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PRODUCTS

Electromechanical Relays
Miniature Signal Relays

Electronic Components
KEMET CHARGED.

Why Choose KEMET

KEMET Electronics Corporation is a leading global supplier of electronic components. We offer our customers the broadest selection of capacitor technologies in the industry, along with an expanding range of electromechanical devices, electromagnetic compatibility solutions and supercapacitors. Our vision is to be the preferred supplier of electronic component solutions for customers demanding the highest standards of quality, delivery and service.

Features & Benefits

- Compact, lightweight, ultra-low profile with high density
- Low power consumption
- Extremely durable plastic sealing
- High withstanding voltage
- Complete line of surface mount devices available

Product Checklist

- What is the load condition? (resistance, motor, lamp, etc.)
- What are the expected operation times for relay?
- What is the ambient temperature?
- How many pairs of contacts are required?
- What is the size and dimension?
- Do you need THD or SMD type?
- Do you need non-latch (current holding) or latch (single or double coil) type?
- What is the rated voltage?
- What is the input power consumption?
- What is the withstand and surge withstand contact voltage?
- What is insulation capability?
- Are any certifications required? (UL, CSA)
- Are there any special requests or environmental conditions?

For more information, samples and engineering kits, please visit us at www.kemet.com or call 1.877.myKEMET.

Applications

- Communications and telecom equipment
  - Switching systems
  - xDSL access modules
  - IP/ADSL modems
- Wired and wireless transmission equipment
- Measurement instruments
  - Semiconductor testers
  - Smart meters
- Household appliances and audio visual systems
  - High-end audio equipment
  - HDTV/PCs
  - Blue-Ray recorders
  - Display exchanges
  - PC sound and video boards
- Medical equipment
  - Ultrasonography
- Office machines
  - Printers
  - IP telephones
- Security systems
  - Network cameras
  - Home fire detection and alarms
- Automotive
  - Hands-free
  - Car audio and navigation
  - Vehicle drive recorders
- Power saving equipment
  - IP servers
  - Office LED lighting
  - Stand-by power

Electrical/Physical Characteristics

Series		UA2	UB2	UC2	UD2	EA2	EB2	EC2	EE2
Appearance									
Height (mm)		8.3	8.8	5.6	5.45	5.4	7.5	9.4	10.0
Implementation (mm)		10.6 x 5.7	10.6 x 7.4	10.9 x 6.5	10.9 x 8.4	14.2 x 9.2	14.3 x 11.5	15 x 7.5	15 x 9.5
Features		Ultra-compact, slim, high withstand voltage		Ultra-small, low-profile, high withstand voltage		Small, low-profile		Small, slim, high withstand voltage	
		THD	SMD	THD	SMD	THD	SMD	THD	SMD
Contact Form		2C							
Contact	CAPACITY (W)	30 W / 37.5 VA				30 W / 62.5 VA			
	VOLTAGE (VDC)	220 VDC / 250 VAC							
	CURRENT (A)	1				2		2	
Coil	POWER (MW) CONSUMPTION	100 – 230		100 – 140		100 – 200		100 – 230	
	RATED VOLTAGE (VDC)	3, 4.5, 5, 12, 24		3, 4.5, 5, 12		3, 4.5, 5, 12, 24		3, 4.5, 5, 12, 24	
Options (Default is non-latch)		1 coil; latch type, low power consumption		1 coil; latch type, low power consumption		1 coil & 2 coil; latch type		1 coil & 2 coil; latch type, high isolation type	

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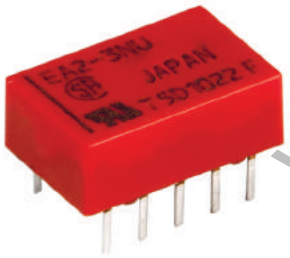
Ordering Information

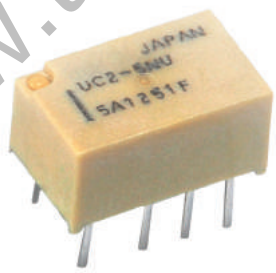
Series			Nominal Coil Voltage	Latch Type	Option		Packaging Code
EB2			– 3	S	NU		–L
Type	THD	SMD	1.5 = 1.5 V 3 = 3 V 4.5 = 4.5 V 5 = 5 V 12 = 12 V 24 = 24 V	Blank = Non-latch S = Single coil latch T = Double coil latch	THD	SMD	Blank = Tube (default packaging for THDs) L = Embossed carrying tape (L type)
Flat	EA2	EB2			NU = Standard NE = Low power consumption	NU = Standard NUN/NUH = Minimum footprint NE = Low power consumption NEN = Low power consumption with minimum footprint NUX = High solder joint reliability	
Ultra-Mini Flat	UC2	UD2					
Slim	EC2	EE2					
Ultra-Mini Slim	UA2	UB2					

Note: Some options may not be available. Please refer to detailed product information.

Through-Hole Type



Surface Mount Type



EC2/EE2 Series

Overview

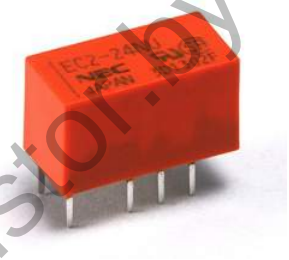
The KEMET EC2/EE2 miniature signal relays offer a compact case size in a slim package. Minimal board space is consumed with either a through-hole or surface mount configuration. These relays are recognized by UL and CSA, while also being compliant with Part 68 of the FCC's 1,500 V surge capacity.

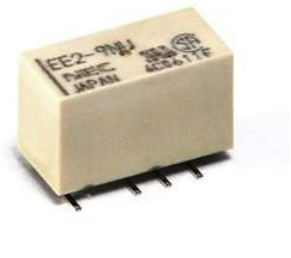
Applications

- Electronic switching systems
- PBX
- Terminal equipment
- Telephone systems

Benefits

- Low power consumption (< 200 mW)
- Compact and lightweight
- Low magnetic interference
- Tube or embossed tape and reel packaging
- UL recognized (E73266) and CSA certified (LR46266)
- Surface mount and through-hole options
- High Insulation (ND) type conforms to TUV EN60950 supplementary insulation class standards
- High Breakdown Voltage (NKX) type can withstand 1.5 kVAC at open contacts





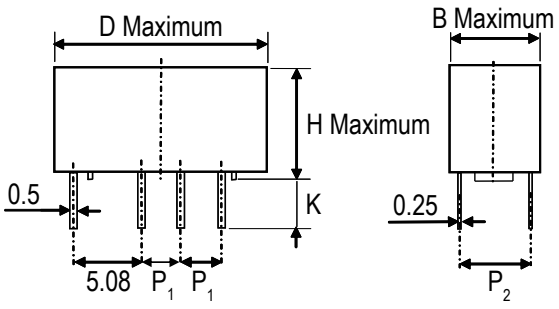
Part Number System

EE2-	3	S	NU	-L
Series	Coil Voltage	Latch Type	Lead Type	Packaging
EC2- = Through-hole mount EE2- = Surface mount	3 = 3 VDC 4.5 = 4.5 VDC 5 = 5 VDC 9 = 9 VDC 12 = 12 VDC 24 = 24 VDC	Blank = Non-latch type S = Single coil latch type T = Double coil latch type	NU = Standard NJ = Trimmed ND = High insulation NUH = Minimum footprint NUX = High solder joint reliability NKX = High breakdown voltage and high solder joint reliability	Blank = Tube -L = Embossed tape on reel

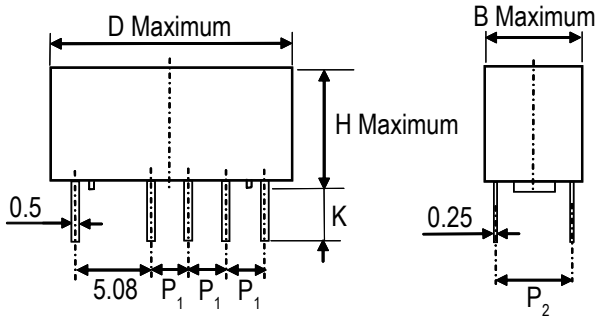
Dimensions – Millimeters

EC2 Series

Non-latch type and single coil latch type

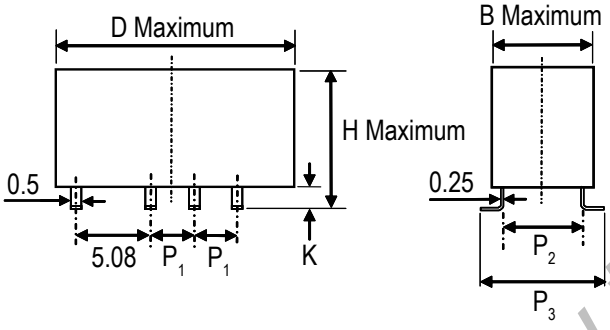


Double coil latch type

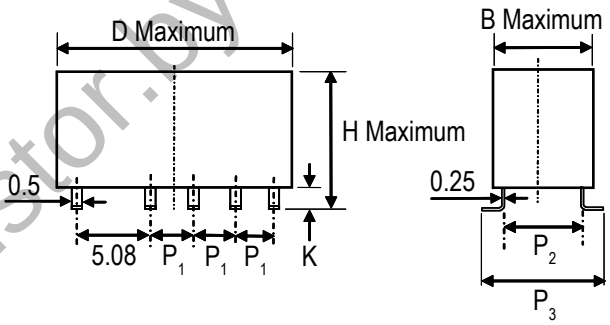


EE2 Series

Non-latch type and single coil latch type



Double coil latch type

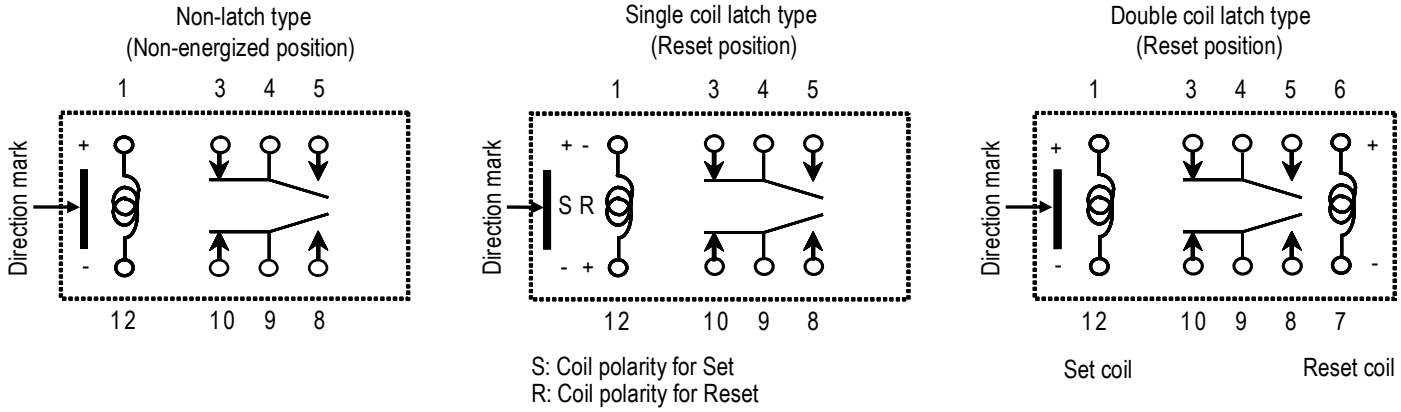


Series	D	H	B	P_1	P_2	P_3	K
EC2 (NU, ND)	15.0	9.4	7.5	2.54	5.08	—	3.2
EC2 (NJ)	15.0	9.4	7.5	2.54	5.08	—	2.8
EE2 (NU, ND)	15.0	10.0	7.5	2.54	5.08	9.5	1.0
EE2 (NUH)	15.0	10.0	7.5	2.54	5.08	7.5	1.0
EE2 (NUX, NKX)	15.0	10.35	7.5	2.54	5.08	9.0	1.35

General tolerance: ±0.2

Pin Configurations

Bottom view



Safety Standards and Ratings

Certification Body	Mark	Specification	File Number	Rating
UL		UL Recognized (UL508)[1]	E73266	30 VDC, 2 A (resistive) 110 VDC, 0.3 A (resistive) 125 VAC, 0.5 A (resistive)
CSA		CSA Certified (CSA 22.2 #14)	LR46266	

[1] *Spacing: UL114, UL478*

Certification Body	Mark	Lead Type	Specification	File Number	Class	Rating
TUV		ND (Non-latch and Single coil)	TUV Certified (IEC61810 / EN61810)	R 9750561	Supplementary insulation	Creepage and clearance of coil to contact is more than 2 mm (According to EN60950)
		NU, NJ, NUH, NUX (Non-latch and Single coil)	TUV Certified (EN61810)	R 9751153	Basic insulation	

Environmental Compliance

All KEMET relays are RoHS Compliant.

RoHS Compliant

Table 1 – Ratings & Part Number Reference

Part Number	Nominal Coil Voltage (VDC)	Lead Type	Packaging
EC2-3(1)NU	3	Radial	Tube
EC2-4.5(1)NU	4.5	Radial	Tube
EC2-5(1)NU	5	Radial	Tube
EC2-9(1)NU	9	Radial	Tube
EC2-12(1)NU	12	Radial	Tube
EC2-24(1)NU	24	Radial	Tube
EC2-3(1)NJ	3	Trimmed Radial	Tube
EC2-4.5(1)NJ	4.5	Trimmed Radial	Tube
EC2-5(1)NJ	5	Trimmed Radial	Tube
EC2-9(1)NJ	9	Trimmed Radial	Tube
EC2-12(1)NJ	12	Trimmed Radial	Tube
EC2-24(1)NJ	24	Trimmed Radial	Tube
EC2-3(1)ND[1]	3	Radial, High insulation	Tube
EC2-4.5(1)ND[1]	4.5	Radial, High insulation	Tube
EC2-5(1)ND[1]	5	Radial, High insulation	Tube
EC2-9(1)ND[1]	9	Radial, High insulation	Tube
EC2-12(1)ND[1]	12	Radial, High insulation	Tube
EC2-24(1)ND[1]	24	Radial, High insulation	Tube
EE2-3(1)NU	3	Surface mount	Tube
EE2-4.5(1)NU	4.5	Surface mount	Tube
EE2-5(1)NU	5	Surface mount	Tube
EE2-9(1)NU	9	Surface mount	Tube
EE2-12(1)NU	12	Surface mount	Tube
EE2-24(1)NU	24	Surface mount	Tube
EE2-3(1)NU-L	3	Surface mount	Tape on Reel
EE2-4.5(1)NU-L	4.5	Surface mount	Tape on Reel
EE2-5(1)NU-L	5	Surface mount	Tape on Reel
EE2-9(1)NU-L	9	Surface mount	Tape on Reel
EE2-12(1)NU-L	12	Surface mount	Tape on Reel
EE2-24(1)NU-L	24	Surface mount	Tape on Reel
EE2-3(1)NUH	3	Surface mount, Minimum footprint	Tube
EE2-4.5(1)NUH	4.5	Surface mount, Minimum footprint	Tube
EE2-5(1)NUH	5	Surface mount, Minimum footprint	Tube
EE2-9(1)NUH	9	Surface mount, Minimum footprint	Tube
EE2-12(1)NUH	12	Surface mount, Minimum footprint	Tube
EE2-24(1)NUH	24	Surface mount, Minimum footprint	Tube
EE2-3(1)NUH-L	3	Surface mount, Minimum footprint	Tape on Reel
EE2-4.5(1)NUH-L	4.5	Surface mount, Minimum footprint	Tape on Reel
EE2-5(1)NUH-L	5	Surface mount, Minimum footprint	Tape on Reel
EE2-9(1)NUH-L	9	Surface mount, Minimum footprint	Tape on Reel
EE2-12(1)NUH-L	12	Surface mount, Minimum footprint	Tape on Reel
EE2-24(1)NUH-L	24	Surface mount, Minimum footprint	Tape on Reel
EE2-3(1)NUX	3	Surface mount, High solder joint reliability	Tube
EE2-4.5(1)NUX	4.5	Surface mount, High solder joint reliability	Tube
EE2-5(1)NUX	5	Surface mount, High solder joint reliability	Tube
EE2-9(1)NUX	9	Surface mount, High solder joint reliability	Tube
EE2-12(1)NUX	12	Surface mount, High solder joint reliability	Tube
EE2-24(1)NUX	24	Surface mount, High solder joint reliability	Tube
EE2-3(1)NUX-L	3	Surface mount, High solder joint reliability	Tape on Reel
EE2-4.5(1)NUX-L	4.5	Surface mount, High solder joint reliability	Tape on Reel
EE2-5(1)NUX-L	5	Surface mount, High solder joint reliability	Tape on Reel
EE2-9(1)NUX-L	9	Surface mount, High solder joint reliability	Tape on Reel
EE2-12(1)NUX-L	12	Surface mount, High solder joint reliability	Tape on Reel
EE2-24(1)NUX-L	24	Surface mount, High solder joint reliability	Tape on Reel
EE2-3(1)ND[1]	3	Surface mount, High insulation	Tube
EE2-4.5(1)ND[1]	4.5	Surface mount, High insulation	Tube
EE2-5(1)ND[1]	5	Surface mount, High insulation	Tube
EE2-9(1)ND[1]	9	Surface mount, High insulation	Tube
EE2-12(1)ND[1]	12	Surface mount, High insulation	Tube
EE2-24(1)ND[1]	24	Surface mount, High insulation	Tube

(1) To complete KEMET part number, leave blank for Non-latch, insert S for Single coil, or T for Double coil. Designates latch type.

[1] ND type only available as Non-latch and Single coil.

[2] NKX type only available as Non-latch. Non-standard part, please contact KEMET to special order.

Table 1 – Ratings & Part Number Reference cont'd

Part Number	Nominal Coil Voltage (VDC)	Lead Type	Packaging
EE2-3(1)ND-L[1]	3	Surface mount, High insulation	Tape on Reel
EE2-4.5(1)ND-L[1]	4.5	Surface mount, High insulation	Tape on Reel
EE2-5(1)ND-L[1]	5	Surface mount, High insulation	Tape on Reel
EE2-9(1)ND-L[1]	9	Surface mount, High insulation	Tape on Reel
EE2-12(1)ND-L[1]	12	Surface mount, High insulation	Tape on Reel
EE2-24(1)ND-L[1]	24	Surface mount, High insulation	Tape on Reel
EE2-3NKX[2]	3	Surface mount, High breakdown voltage, High solder joint reliability	Tube
EE2-4.5NKX[2]	4.5	Surface mount, High breakdown voltage, High solder joint reliability	Tube
EE2-12NKX[2]	12	Surface mount, High breakdown voltage, High solder joint reliability	Tube
EE2-3NKX-L[2]	3	Surface mount, High breakdown voltage, High solder joint reliability	Tape on Reel
EE2-4.5NKX-L[2]	4.5	Surface mount, High breakdown voltage, High solder joint reliability	Tape on Reel
EE2-12NKX-L[2]	12	Surface mount, High breakdown voltage, High solder joint reliability	Tape on Reel

(1) To complete KEMET part number, leave blank for Non-latch, insert S for Single coil, or T for Double coil. Designates latch type.

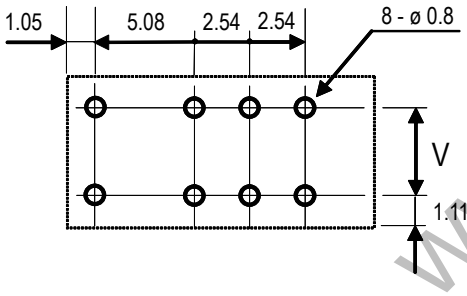
[1] ND type only available as Non-latch and Single coil.

[2] NKX type only available as Non-latch. Non-standard part, please contact KEMET to special order.

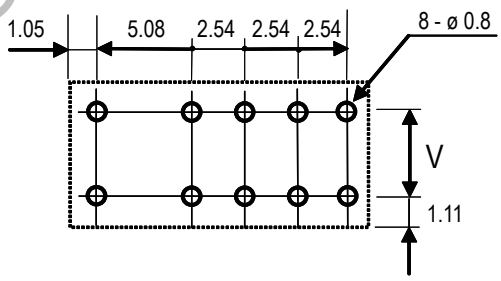
Land Pattern – Millimeters

EC2 Series (bottom view)

Non-latch type and single coil latch type

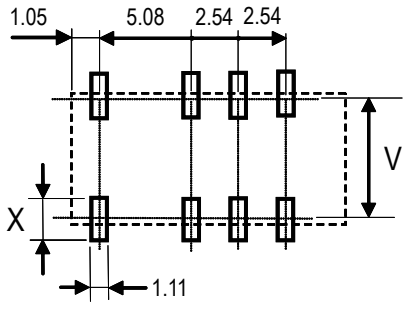


Double coil latch type

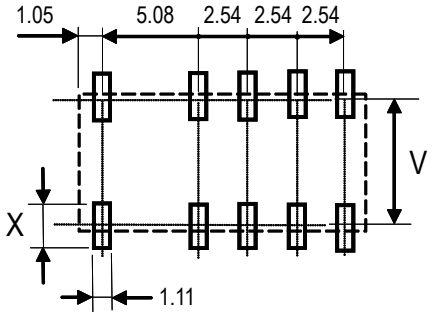


EE2 Series (top view)

Non-latch type and single coil latch type



Double coil latch type



Series	V	X
EC2	5.08	—
EE2 (NU, ND)	7.29	3.0
EE2 (NUH)	6.29	2.0
EE2 (NUX, NKX)	7.02	2.73

Soldering Process

EC2 – Through-hole Mounting

Automatic Soldering

Preheating: 110–120°C / 110 seconds (maximum)

Solder temperature: 260°C maximum

Solder time: 5 seconds maximum

Note: KEMET recommends cooling down a printed circuit board to less than 110°C within 40 seconds after soldering.

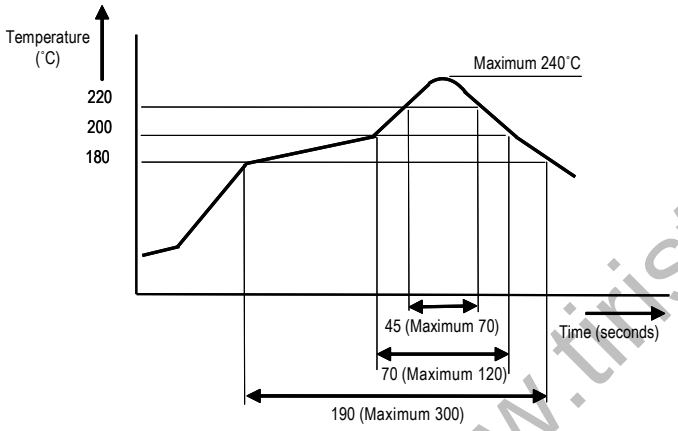
Manual Soldering

Solder temperature: 350°C maximum

Solder time: 3 seconds maximum

EE2 – Surface Mounting

IRS Method



Note:

Temperature profile shows printed circuit board surface temperature on the relay terminal portion.

Please consult KEMET if you wish to use a temperature profile other than above.

Contact Specifications

Item		EC2/EE2
Contact Form		2 Form C
Contact Material		Silver alloy with gold alloy overlay
Contact Ratings	Maximum Switching Power	60 W, 125 VA
	Maximum Switching Voltage	220 VDC, 250 VAC
	Maximum Switching Current	2 A
	Maximum Carrying Current	2 A
Minimum Contact Ratings		10 mVDC, 10 µA[*1]
Initial Contact Resistance		75 mΩ maximum (initial)
Operating Time (excluding bounce)		Approximately 2 milliseconds
Release Time (excluding bounce)		Approximately 1 millisecond
Insulation Resistance		1,000 MΩ @ 500 VDC
Withstand Voltage	Between Open Contacts	NU, NJ, ND, NUH, NUX: 1,000 VAC (for one minute), 1,500 V surge (10 x 160 µs)[*2]
		NKX: Make contact: 1,500 VAC (for one minute), 2,500 V surge (2 x 10 µs)[*3] Break contact: 1,000 VAC (for one minute), 1,500 V surge (10 x 160 µs)[*2]
	Between Adjacent Contacts	1,000 VAC (for one minute), 1,500 V surge (10 x 160 µs)[*2]
	Between Coil and Contacts	Non-latch and single coil latch type: 1,500 VAC (for one minute), 2,500 V surge (2 x 10 µs)[*3]
		Double coil latch type: 1,000 VAC (for one minute), 1,500 V surge (10 x 160 µs)[*2]
Shock Resistance		735 m/s^2 (75 G) – misoperation 980 m/s^2 (100 G) – destructive failure
Vibration Resistance		10 to 55 Hz, double amplitude 3 mm (20 G) – misoperation 10 to 55 Hz, double amplitude 5 mm (30 G) – destructive failure
Ambient Temperature		-40 to +85°C
Coil Temperature Rise		18°C at nominal coil voltage (140 mW)
Running Specifications	Non-load	1 x 10^8 operations (Non-latch type)[*4] 1 x 10^7 operations (Latch type)
	Load	50 VDC 0.1 A (resistive), 1 x 10^6 operations @ 85°C, 5 Hz 10 VDC 10 mA (resistive), 1 x 10^6 operations @ 85°C, 2 Hz
Weight		Approximately 1.9 g

*[*1] This value is a reference value in the resistance load. Minimum capacity changes depending on the switching frequency, environment temperature, and load.*
*[*2] Rise time: 10 µs; decay time to half crest: 160 µs.*
*[*3] Rise time: 2 µs; decay time to half crest: 10 µs.*
*[*4] This shows the number of operations with fatal defects. Stable characteristics are maintained for 1 x 10^7 operations.*

Coil Specifications

Non-latch Type (@ 20°C)				
Nominal Coil Voltage (VDC)	Coil Resistance (Ω) ±10%	Operating Voltage[1] (VDC)	Release Voltage[1] (VDC)	Nominal Operating Power (mW)
3	64.3	2.25	0.3	140
4.5	145	3.38	0.45	140
5	178	3.75	0.5	140
9	579	6.75	0.9	140
12	1028	9.0	1.2	140
24	2880	18.0	2.4	200

[1] *Test by pulse voltage.*

Single Coil Latch Type (@ 20°C)[2]				
Nominal Coil Voltage (VDC)	Coil Resistance (Ω) ±10%	Set Voltage[1] (VDC)	Reset Voltage[1] (VDC)	Nominal Operating Power (mW)
3	90	2.25	2.25	100
4.5	202.5	3.38	3.38	100
5	250	3.75	3.75	100
9	810	6.75	6.75	100
12	1440	9.0	9.0	100
24	3840	18.0	18.0	150

[1] *Test by pulse voltage.*

[2] *Latch type relays should be initialized to a known position before using. Only the specified polarity should be used to energize the coil.*

Double Coil Latch Type (@ 20°C)[2,3]					
Nominal Coil Voltage (VDC)	Coil Resistance (Ω) ±10%		Set Voltage[4] (VDC)	Release Voltage[4] (VDC)	Nominal Operating Power (mW)
3	S	64.3	2.25	–	140
	R	64.3	–	2.25	
4.5	S	145	3.38	–	140
	R	145	–	3.38	
5	S	178	3.75	–	140
	R	178	–	3.75	
9	S	579	6.75	–	140
	R	579	–	6.75	
12	S	1028	9.0	–	140
	R	1028	–	9.0	
24	S	2880	18.0	–	200
	R	2880	–	18.0	

[2] *Latch type relays should be initialized to a known position before using. Only the specified polarity should be used to energize the coil.*

[3] *Can not be driven by reverse polarity for reverse operation.*

[4] *S = Set coil [pin #1 (+), pin #12 (-)], R = Reset coil [pin #6 (+), pin #7 (-)].*

Coil Specifications cont'd

Non-latch, High Insulation (ND) Type (@ 20°C)				
Nominal Coil Voltage (VDC)	Coil Resistance (Ω) ±10%	Operating Voltage[1] (VDC)	Release Voltage[1] (VDC)	Nominal Operating Power (mW)
3	45	2.25	0.3	200
4.5	101	3.38	0.45	200
5	125	3.75	0.5	200
9	405	6.75	0.9	200
12	720	9.0	1.2	200
24	2504	18.0	2.4	230

[1] Test by pulse voltage.

Single Coil Latch, High Insulation (ND) Type (@ 20°C)[2]				
Nominal Coil Voltage (VDC)	Coil Resistance (Ω) ±10%	Set Voltage[1] (VDC)	Reset Voltage[1] (VDC)	Nominal Operating Power (mW)
3	90	2.25	2.25	100
4.5	203	3.38	3.38	100
5	250	3.75	3.75	100
9	810	6.75	6.75	100
12	960	9.0	9.0	150
24	3388	18.0	18.0	170

[1] Test by pulse voltage.

[2] Latch type relays should be initialized to a known position before using. Only the specified polarity should be used to energize the coil.

Non-latch, High Breakdown Voltage (NKX) Type (@ 20°C)				
Nominal Coil Voltage (VDC)	Coil Resistance (Ω) ±10%	Operating Voltage[1] (VDC)	Release Voltage[1] (VDC)	Nominal Operating Power (mW)
3	39.1	2.25	0.3	230
4.5	88.0	3.38	0.45	230
12	626.0	9.0	1.2	230

[1] Test by pulse voltage.

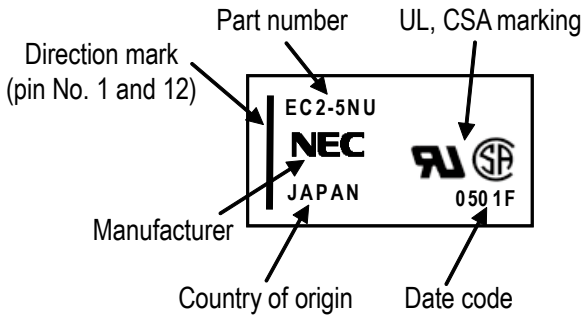
Recommended Relay Drive Conditions

Coil Type	Rating	Ambient Temperature
Non-latch	Voltage: ≤ ±5% of nominal voltage	-40 to +85°C
Single Coil Double Coil	Square pulse (rise and fall time is rapid) Pulse height: ≤ ±5% of nominal voltage Pulse Width: > 10 ms	

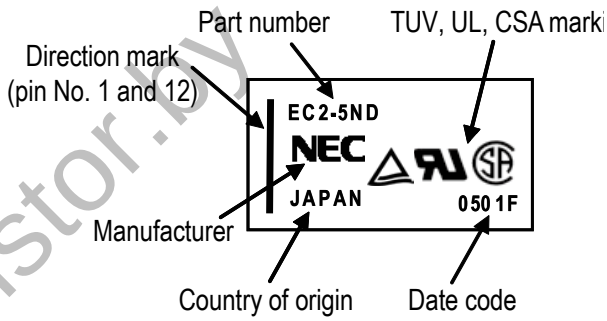
Marking

Top view

All except ND type:



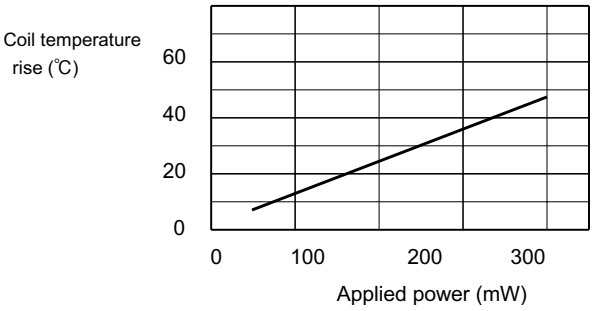
ND (High Insulation) type:

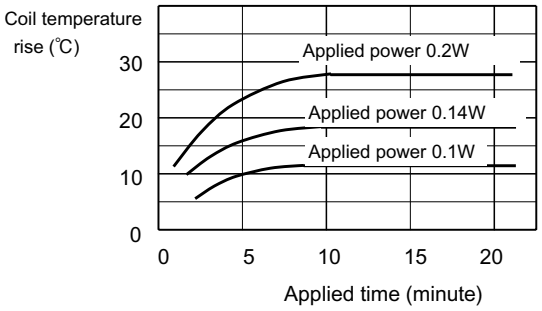


Performance Data

Coil Temperature Rise

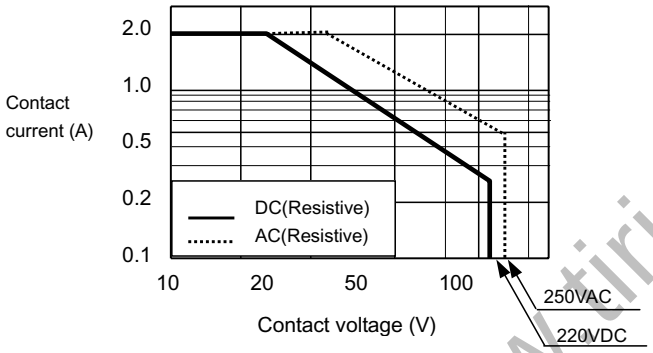
Temperature is measured by coil resistance





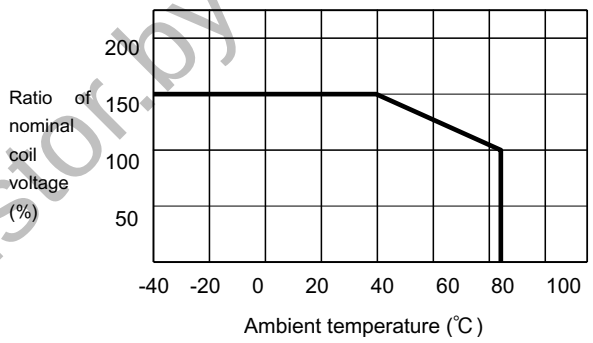
Switching Capacity

Maximum Values



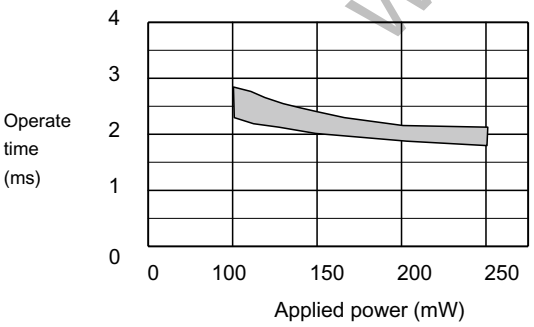
Maximum Coil Voltage

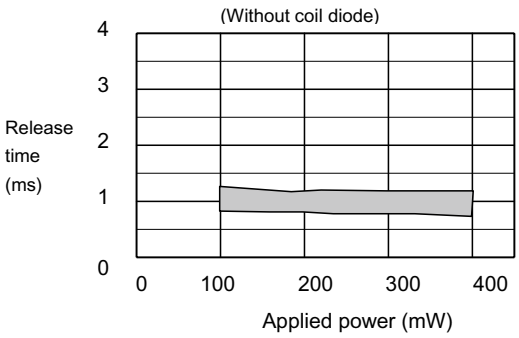
Maximum value of permissible alteration



Applied Voltage vs. Timing

(Sample: EE2-5NU)

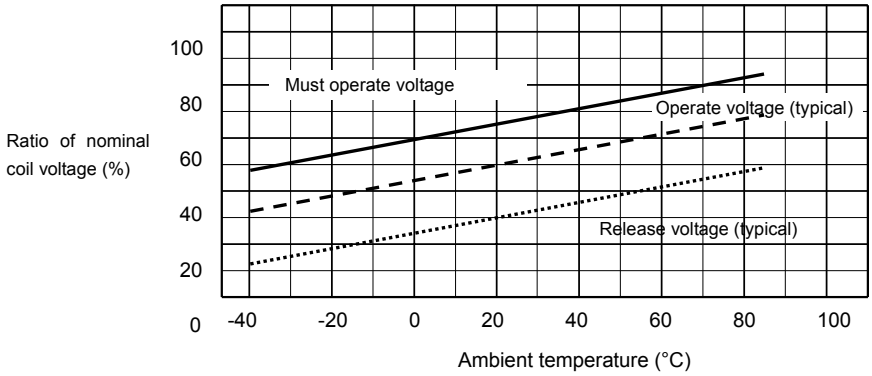




Performance Data cont'd

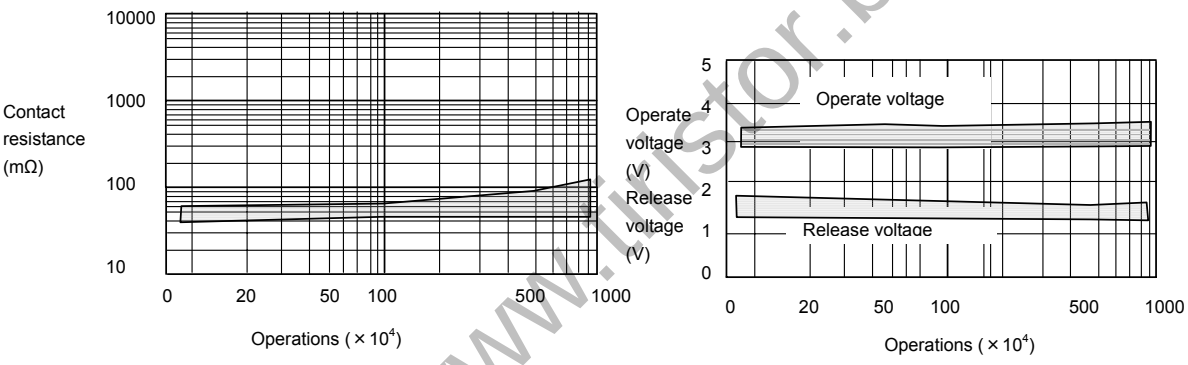
Operate and Release Voltage vs. Ambient Temperature

This shows a typical change of operate (release) voltage. The value of must operate is estimated, so coil voltage must be applied higher than this value for safe operation. For hot start operation, please inquire with KEMET.



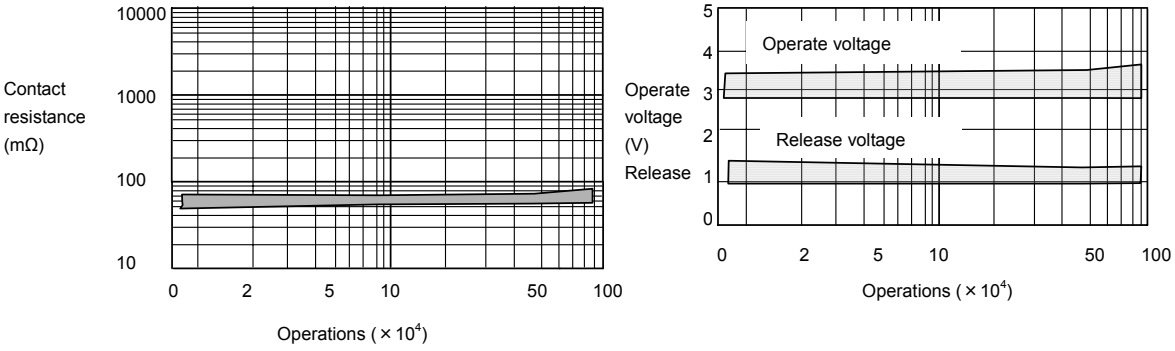
Running Test (Non-load)

(Load: none; Drive: 5 VDC, 50 Hz, 50% duty; Ambient Temperature: room temperature; Sample: EE2-5NU, 20 pieces)



Running Test (Load)

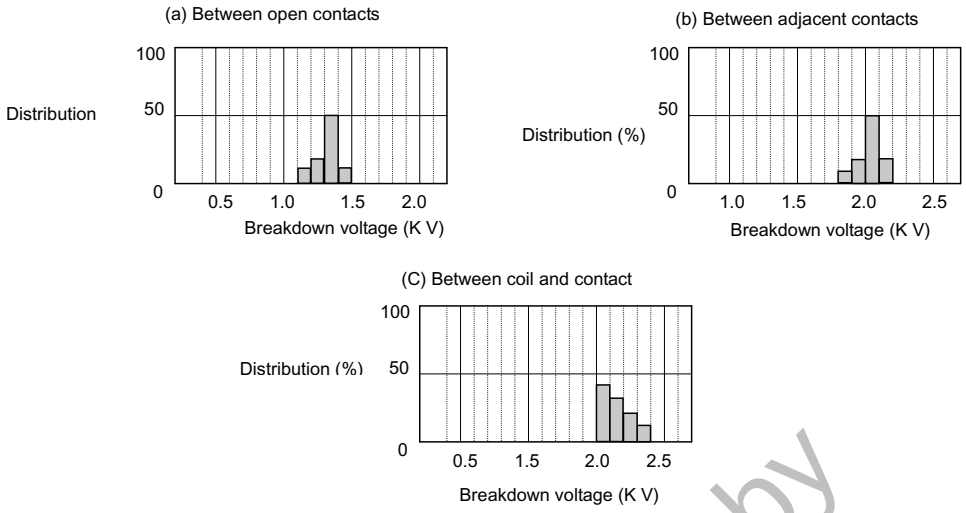
(Load: 50 VDC, 0.1 A resistive; Drive: 5 VDC, 5 Hz, 50% duty; Ambient Temperature: 85°C; Sample: EE2-5NU, 10 pieces)



Performance Data cont'd

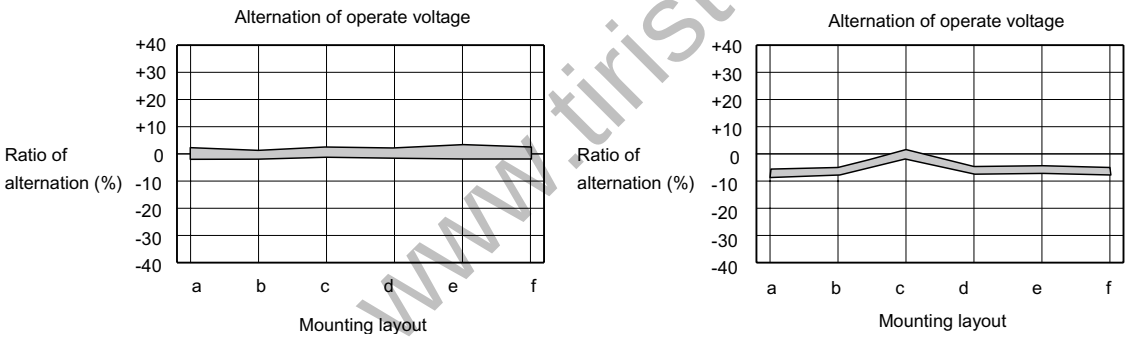
Breakdown Voltage

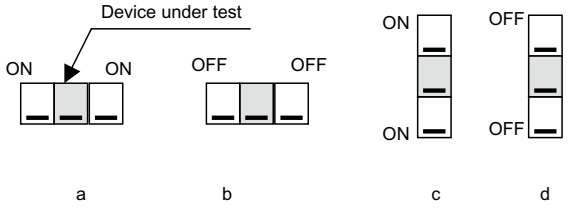
(Sample: EE2-5NU, 10 pieces)

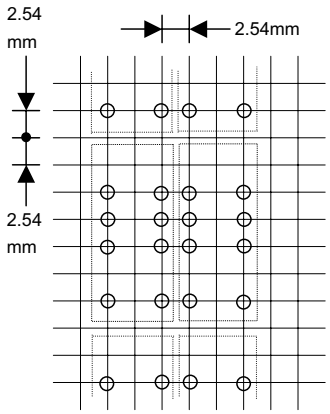


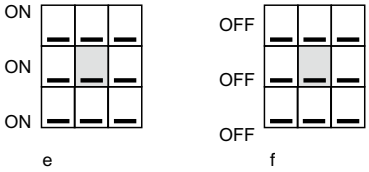
Alteration of Voltage in Dense Mounting

(magnetic interference)

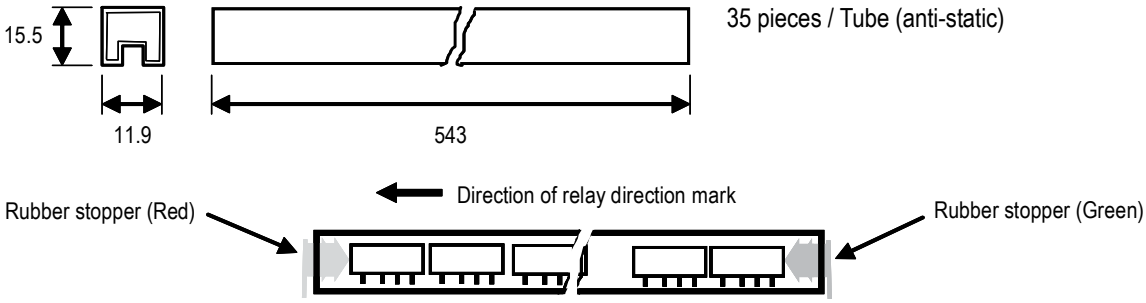






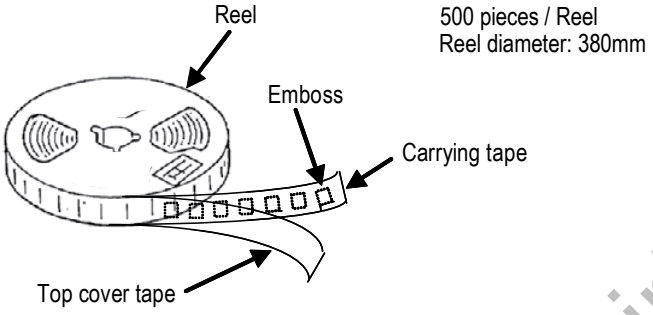


Tube Packing – Millimeters

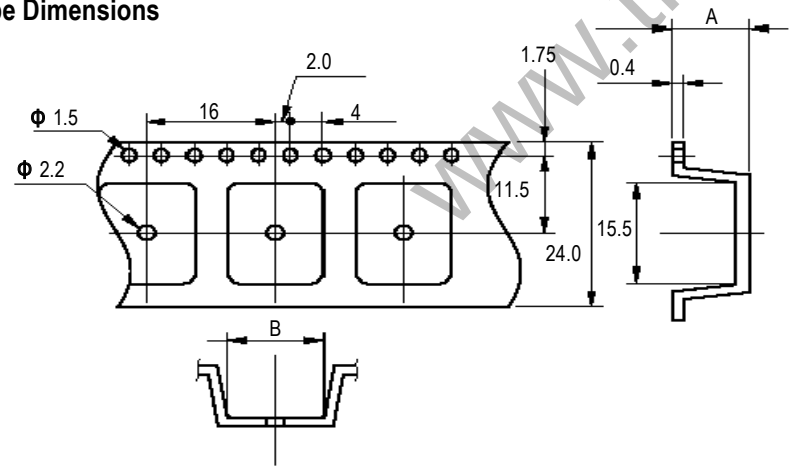


Tape & Reel Packaging Information (EE2 only) – Millimeters

Appearance

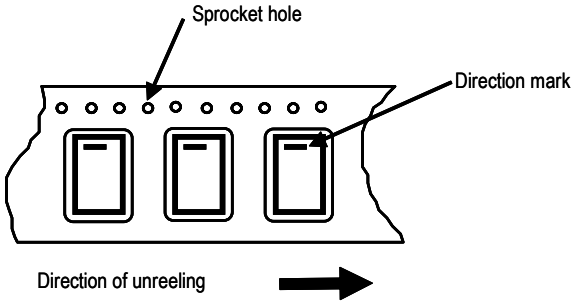


Tape Dimensions



Series	A	B
NU-L, ND-L, NUX-L, NKX-L	Maximum 10.9	10.0
NUH-L	Maximum 11.1	8.0

Relay Direction Mark and Tape Carrying Direction



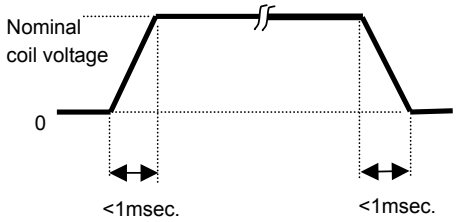
Notes on Using Relays

1. Contact Load

Make sure that the contact load is within the specified range; otherwise, the lifetime of the contacts will be shortened considerably. Note that the running performance shown is an example, and that it varies depending on parameters such as the type of load, switching frequency, driver circuit, and ambient temperature under the actual operating conditions.

2. Driving Relays

- If the internal connection diagram of a relay shows + and - symbols on the coil, apply the rated voltage to the relay in the specified direction. If a rippled DC current source is used, abnormalities such as heat at the coil may occur.
- The maximum voltage that can be applied to the coil of the relay varies depending on the ambient temperature. Generally, the higher the voltage applied to the coil, the shorter the operating time. Note, however, that high voltage also increases the bounce of the contacts and the contact opening and closing frequency, which may shorten the lifetime of the contacts.
- For consistent operation, the driving voltage should have rise and fall times of less than 1 ms.



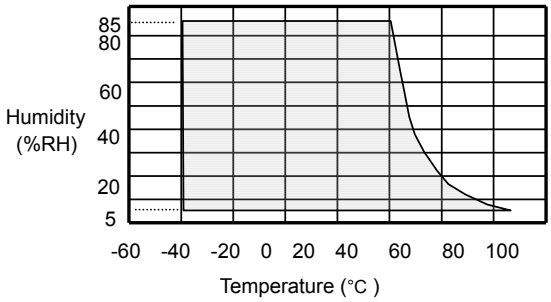
- For a latching relay, apply a voltage to the coil according to the polarity specified in the internal connection diagram of the relay.
- If a current is applied to the coil over a long period of time, the coil temperature rises, promoting generation of organic gas inside the relay, which may result in faulty contacts. In this case, use of a latching relay is recommended.
- The operating time and release time indicate the time required for each contact to close after the voltage has been applied to or removed from the coil. However, because the relay has a mechanical structure, a bounce state exists at the end of the operating and release times. Furthermore, because additional time is required until the contact stabilizes after being in a high-resistance state, care must be taken when using the relay at high speeds.

3. Operating Environment

- Make sure that the relay mounted in the application set is used within the specified temperature range. Use of a relay at a temperature outside this range may adversely affect insulation or contact performance.
- If the relay is used for a long period of time in highly humid (RH 85% or higher) environment, moisture may be absorbed into the relay. This moisture may react with the NOx and SOx generated by glow discharges that occur when the contacts are opened or closed, producing nitric or sulfuric acid. If this happens, the acid produced may corrode the metallic parts of the relay, causing operational malfunction.
- If any material containing silicon (silicon rubber, silicon oil, and silicon based coating material) is used in the neighborhood of relay, there is some possibility that these materials will emit silicon gas that will penetrate the relay. In this case, the switching contact may generate silicon compounds on the surface of contacts. This silicon compound may result in contact failure. Avoid use of relay in such an environment.

Notes on Using Relays cont'd

- Because the operating temperature range varies depending on the humidity, use the relay in the temperature range illustrated in the figure below. Prevent the relay from being frozen and avoid the generation of condensation.



- The relay maintains constant sealability under normal atmospheric pressure (810 to 1,200 hpa). Its sealability may be degraded or the relay may be deformed and malfunction if it is used under barometric conditions exceeding the specified range.
- The same applies when the relay is stored or transported. Keep the upper-limit value of the temperature to which the relay is exposed after it is removed from the carton box to within 50°C.
- Permanent magnets are used in polarized relays. For this reason, when magnets, transformers, or speakers are located nearby the relay characteristics may change and faulty operations may result.
- If excessive vibration or shock is applied to the relay, it may malfunction and the contacts remain closed. Vibration or shock applied to the relay during operation may cause considerable damage to or wearing of the contacts. Note that operation of a snap switch mounted close to the relay or shock due to the operation of magnetic solenoid may also cause malfunctioning.

4. Mounting

- When mounting a relay onto a PC board using an automatic chip mounter, if excessive force is applied to the cover of the relay when the relay is chucked or inserted, the cover may be damaged or the characteristics of the relay degraded. Keep the force applied to the relay to within 1 kg.
- Avoid bending the pins to temporarily secure the relay to the PC board. Bending the pins may degrade sealability or adversely affect the internal mechanism.
- Ventilation immediately after soldering is recommended. Avoid immersing the relay in cleaning solvent immediately after soldering due to the danger of thermal shock being applied to the relay.
- Use an alcohol-based or water-based cleaning solvent. Never use thinner and benzene because they may damage the relay housing.
- Do not use ultrasonic cleaning because the vibration energy generated by the ultrasonic waves may cause the contacts to remain closed.

5. Handling and Storage

- Relays are packaged in magazine cases for shipment. If a space is created in the case after some relays have been removed, be sure to insert a stopper to secure the remaining relays in the case. If relays are not well secured, vibration during transportation may cause malfunctioning of the contacts.
- Exercise care in handling the relay so as to avoid dropping it or allowing it to fall. Do not use a relay that has been dropped. If a relay drops from a workbench to the floor, a shock of 9,800 m/s^2 (1,000 G) or more is applied to the relay, possibly damaging its functions. Even if a light shock has been applied to the relay, thoroughly evaluate its operation before using it.

Notes on Using Relays cont'd

- Latching relays are factory-set to reset state for shipment. A latching relay may be set, however, by vibration or shock applied while being transported. Be sure to forcibly reset the relay before using it in the application set. Also note that the relay may be set by unexpected vibration or shock when it is used in a portable set.
- The sealability of a surface mount (SMT) relay may be lost if the relay absorbs and is then heated during soldering. When storing relays, therefore, observe the following points:

1. For standard packing, please use relays within 12 months after delivery (storage conditions: 30°C / 60% RH). If the relays have moisture absorption, dehumidify as follows:
   – Tape Packaging: 50 ±5°C, 200–300 hours.
   – Simple Relay: 85 ±5°C, 48 hours.
2. For MBB packing, please use relays within 2 years after delivery (storage conditions: 30°C / 60% RH). After opening MBB packing, please use within 3 months (storage conditions: 30°C / 60% RH).

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Shanghai, China
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Although KEMET designs and manufactures its products to the most stringent quality and safety standards, given the current state of the art, isolated component failures may still occur. Accordingly, customer applications which require a high degree of reliability or safety should employ suitable designs or other safeguards (such as installation of protective circuitry or redundancies) in order to ensure that the failure of an electrical component does not result in a risk of personal injury or property damage.

Although all product–related warnings, cautions and notes must be observed, the customer should not assume that all safety measures are indicted or that other measures may not be required.

Devices thru Material Innovation

NEC/TOKIN

Vol.04

Reed Switches Applications

⚠

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PRECAUTIONS TO BE TAKEN WHEN USING REED SWITCHES AND APPLICATIONS
(Please read these precautions before using our products)

1. Befor using our products or designing asystem using our products, please read the “Precautions To Be Taken When Using Our Products” section in this catalogue and the section entitled “Equipment with which our products are used” (such as a level of quality) on the last page of the catalog.
2. The main failures with reed switches and applications are open-circuit, short-circuit, and faulty operation. For details, please refer the section entitled “Precautions To Be Taken When Using Our Products” in the catalogue.

   When using the products, systems should be carefully designed to ensure redundancy and to prevent faulty operation, allowing for the occurrence of failures.
3. Use the products after checking the working conditions and rated performance of each of the reed switches and applications

ISO 9001 QS 9000	ISO 14001
NEC TOKIN CERAMICS CORP. REGISTERED TO QS-9000 & ISO 9001 CERTIFICATE NO.A13033	JQA JQA-E-90094

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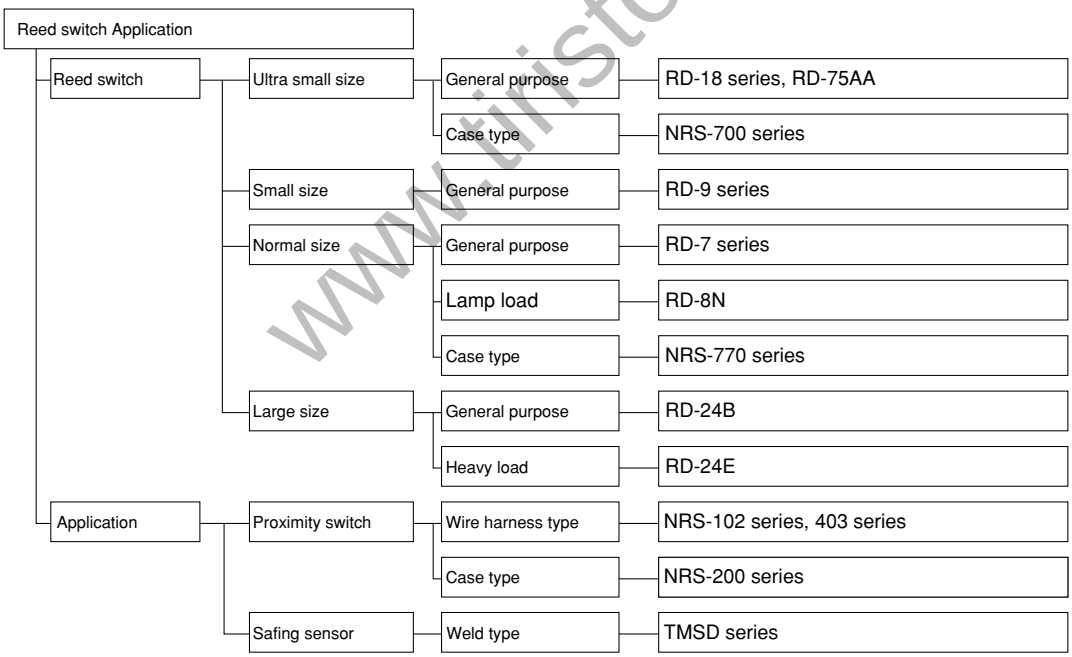

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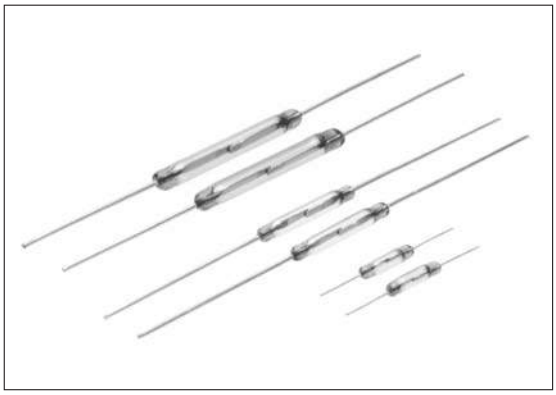
Reed Switches



Outline

NEC TOKIN provides a wide range of reed switches for minute-load to high-power switching purposes. The reed switches are available in two types, i.e., a reed switch having ruthenium-plated contacts and a reed switch having rhodium-plated contacts.
Please choose the optimum reed switch best-suited to your intended applications from a wide selection of reed switches.

Features

- Compact and Lightweight
  The reed switches are suitable for use as a compact and lightweight magnetically responsive switch, thereby rendering equipment smaller.

- Ambient Resistance
  Contacts of the reed switch are encapsulated in a glass tube together with inert gas (nitrogen gas), which protects the reed switch from the effects of the exterior environment, for example, gas, dust, or moisture in the atmosphere.

- Relatively stable characteristics are ensured from low to high temperatures. The reed switches are usable over a wide variety of temperatures.

- High Reliability
  Considerably high reliability is assured as a result of the adoption of NEC TOKIN's unique contact processing technique.

- High-speed Operation
  Since the reed switch operates at high speed, it is easy to interface with a transistor or an IC.

- Long Life
  A long-life reed switch without mechanical friction is implemented as a result of its simple structure.

- Extensive Applications
  When used in combination with a permanent magnet, the reed switch finds extensive application in switching and sensing.

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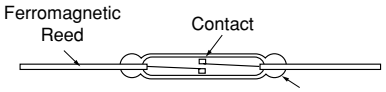
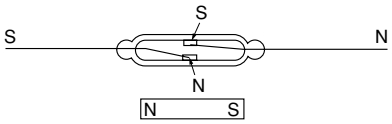
Structure and Principle of Operation

A reed switch encapsulated in a glass tube has two ferromagnetic reeds which face each other with a given contact clearance between them, as shown in diagrams on the right. The glass tube is filled with nitrogen gas to prevent the activation of the contacts, thus providing improved reliability and extended life.
Upon receipt of a magnetic field from the outside in the axial direction of the reed switch, the reeds of the reed switch are magnetized. The free opposite ends of the reeds attract each other and come into contact with each other, to close the circuit. When the magnetic field is removed, the circuit opens by means of the resiliency of the reeds.



● Operating Principle of Reed Switch



Contact Material

● Ruthenium (Ru) plated contact
Ruthenium-plated contacts developed by NEC TOKIN's unique technique are made of a very hard material having with a high melting point. The contacts are resistant to mechanical friction and heat generation, and they have excellent anti-sticking performance.

● Rhodium (Rh) plated contact
Power reed switches what are susceptible to relatively large consumption employ Rh-plated contacts, which results in extended life of the reed switches (compensating for contact consumption).

Characteristics of Contact Material

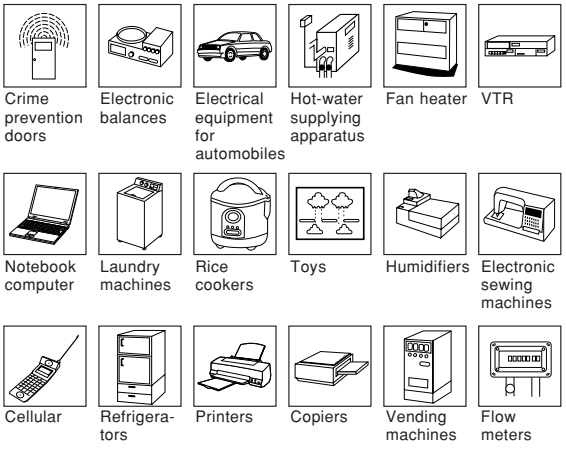
Items	Ru (Ruthenium)	Rh (Rhodium)	Au (Gold)
Atomic Weight	101	103	197
Melting Point (K)	2,523	2,233	1,338
Boiling Point (K)	4,173	4,000	2,983
Density (g/cm^3)	12.1	12.4	19.3
Specific Heat (J/g•K) 0°C	0.234	0.238	0.128
Hardness (HV)	220	100	25
Tensile Strength	50.0	54.9	13.5
(kgf/mm^2) (N/m^2)	490×10^6	538×10^6	132×10^6

Types and Applications

When used in combination with a permanent magnet, the reed switch finds extensive applications in which it provides switching and sensing capabilities.

● Construction of Reed Switch

Type	Part No.	Applications
General purpose	RD-7AA/ 7B/24B NRS-771	For general control purposes (about 10W)
High power	RD-24E	Heavy load (50W)
Lamp load	RD-8N	Direct switching of a 3.4W lamp (for surge current use)
Compact	RD-9A/9B	For general control purposes (about 5W)
Ultra compact	RD-18A/18B /75AA NRS-701	Light load



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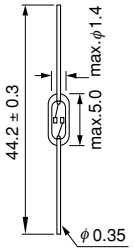
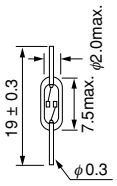
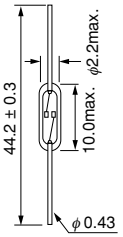
Reed Switches

(The switches are arranged in ascending order of glass tube length.)

Items \ Types			RD-75AA	RD-18A	RD-18B	RD-9A	RD-9B
Outer Dimensions (mm)							
Pick up Ampereturns (A)			10 to 20	15 to 30	10 to 30	10 to 30	10 to 30
Drop-out Ampereturns (A) min.			1	5	5	35% of Pick up	3
Operating Time (ms) max.			0.5	0.5	0.5	1	0.5
Release Time (ms) max.			0.05	0.05	0.05	0.05	0.05
Bounce Time (ms) max.			0.5	0.5	0.5	0.5	0.5
Contact Rating	Maximum Switching Power (W)		3	1	1	5	5
	Maximum Switching Voltage (VDC)		20	30	30	100	100
	Maximum Switching Current (A)		0.2	0.1	0.1	0.5	0.3
	Maximum Carrying Current (A)		0.3	0.3	0.3	0.7	0.5
Contact Resistance (mΩ)			200	200	250	150	200
Withstand Voltage (VDC)			100	200	200	200	200
Insulation Resistance (Ω)			10^9 (at an application of 100VDC)				
Shock and Vibration Resistance (m/s^2)			Fracture 294	Faulty Operation 98 (Fracture 490)			
Operating Temperature Range (°C)			–40 to +125				
Reed Resonant Frequency (kHz)			13.7	10	10	7.2	7.2
Life Expectancy (operations)	Mechanical Life Expectancy		1×10^8				
	Electrical Life Expectancy	5VDC, 10mA, and Resistive Load	1×10^7	1×10^7	1×10^7	5×10^7	5×10^7
		Others					
Contact Material			Rh (Rhodium)	Rh (Rhodium)	Ru (Ruthenium)	Rh (Rhodium)	Ru (Ruthenium)
Characteristics and Applications			Ultra-compact light load			Compact, and general control purposes	
NEC TOKIN's Standard Coil			N-104			N-103	
UL File No.			–	–	–	–	–

*Pre-soldering on terminals are lead-free (Sn100%)

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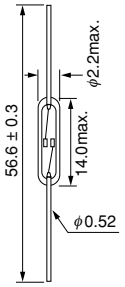
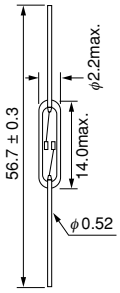
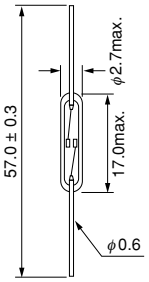
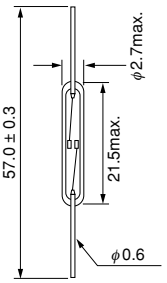
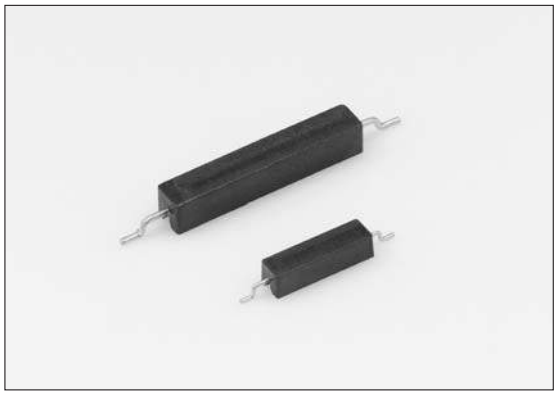
RD-7AA	RD-7B	RD-8N	RD-24B	RD-24E	Remarks
					Terminal dimension is measured before it is pro-cessed (soldered).
10 to 40	10 to 40	30 to 50	20 to 60	20 to 60	
5	5	10	8	8	
0.5	0.5	1.0	1.0	1.0	With use of NEC TOKIN's standard coil
0.05	0.05	0.05	0.1	0.05	
0.5	0.5	0.5	0.5	0.5	
10	10	10 (rush current 30)	15	50	
100	100	100	100	125V.AC 200V.DC	
0.5	0.5	Rush current of 3A	0.5	1.0	
1.0	1.0	2.0	1.0	2.0	
150	150	150	150	150	With use of four-terminalfall-of-potential method
200	200	250	300	300	Leakage current of less than 1mA
10^9 (at an application of 100V.DC)					
Faulty operation 98 (fracture 490)					
−40 to +125					
4.8	4.9	4.3	2.2	2.2	
1×10^8					
5×10^7					
		5×10^4 12V.DC, 3.4W Lamp load		1×10^6 50V. DC 0.1A Resistive load	
Rh (Rhodium)	Ru (Ruthenium)	Rh (Rhodium)	Ru (Ruthenium)	Rh (Rhodium)	
Compact, and general-purpose use	Compact, and general-purpose use	Lamp load use	Long life (light load)	High power	
N-103			N-102		
–	–	–	–	–	

Numbering System

RD-7B-1020 F

- Series
- Pick up Ampereturn: 10 to 20A
- Lead free

Surface Mounting Type Reed Switches



Outline

These reed switches are Surface-mounting type and Suited for automatic mounting.

Applications

When used in combination with a magnet, the reed switch finds extensive applications in which it provides switching and sensing capabilities.

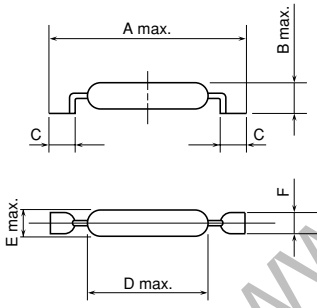
- Cellular phones
- Car electronics
- OA electronics
- Home electronics

Features

- Suited for automatic mounting
- Can be soldered using reflow
- With the NRS-700series, its glass tube is covered with a case, making it easy to handle.

Shapes and Dimensions

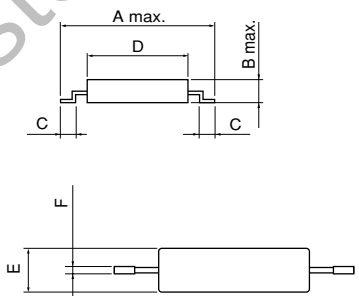
● RD Series



(mm)

Model	A	B	C	D	E	F
RD-18B-S003	12.5	2.3	1.4	7.5	2.0	1.2
RD- 7B-S002	19.9	2.5	(1.8)	14.0	2.2	1.6

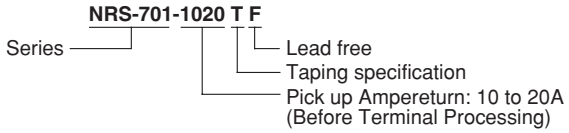
● NRS Series



(mm)

Model	A	B	C	D	E	F
NRS-701	13.0	2.2	1.2	8.3	2.4	0.4
NRS-771	24.0	3.0	1.6	17.0	3.0	0.6

Numbering System



*Pre-soldering on terminals are lead-free (Sn100%)

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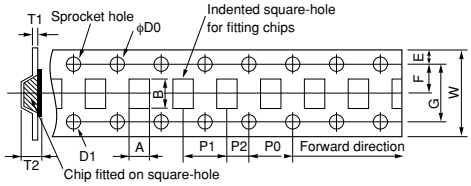
Specifications

Items			RD-18B	RD-7B	NRS-701	NRS-771
Maximum Switching Power	(W)		1	10	1	10
Maximum Switching voltage	(VDC)		30	100	30	100
Maximum Switching Current	(A)		0.1	0.5	0.1	0.5
Maximum Carrying Current	(A)		0.3	1.0	0.3	1.0
Contact Resistance	(mΩ)		250	150	300	200
Operating Time	(ms)	max.	0.5	0.5	1.0	1.0
Release Time	(ms)	max.	0.05	0.05	0.1	0.1
Withstand Voltage	(V.DC)		200	200	200	200
Insulation Resistance	(Ω)		10^9 (at 100VDC)		10^7 (at 100VDC)	
Life Expectancy	5VDC. 10mA and Resistive Load		1×10^7	5×10^7	1×10^7	5×10^7
Operating Temperature Range (°C)			-40~+125		-40~+85	
Weight	(mg)	max.	40	90	80	250

Reel Tape Dimensions

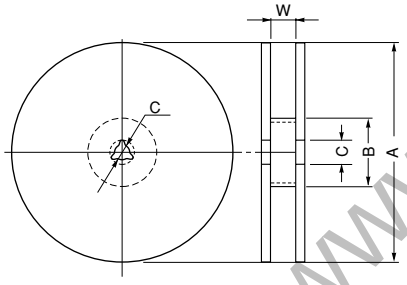
Tape Dimensions



(mm)

Type	RD-18B	RD-7B	NRS-701	NRS-771
A	2.0	4.0	2.7	3.3
B	13.2	20.3	16.0	32.0
W	24.0	32.0	24.0	44.0
F	11.5	14.2	11.5	20.2
E	1.75	1.75	1.75	1.75
G	–	28.4	–	40.4
P1	8.0	8.0	8.0	8.0
P2	2.0	2.0	2.0	2.0
P0	4.0	4.0	4.0	4.0
D0	1.55	1.55	1.55	1.55
D1	–	1.55×1.75	–	1.55×1.75
T1	0.3	0.3	0.4	0.4
T2	(3.0)	(3.0)	(3.2)	(4.2)

Reel Dimensions

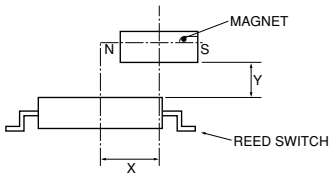


(mm)

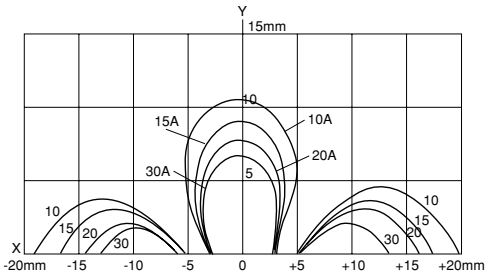
A	250	330	330	382
B	100	80	80	80
C	13.0	13.0	13.0	13.0
W	24.5	33.5	24.5	45.5

Standard number of Packages (piece/reel)	
RD-18B	1,000
RD-7B NRS-701, 771	2,000

Example for operation characteristics



Driving Area by Means of Ferrite Magnet 5×5×7 (NRS-701)
Values in the graph indicates reed switch's pick up ampereturns.



Proximity Switch NRS Series

Outline

With a built-in reeed switch, NEC TOKIN's prosimity switches sre compact, lightweight and highly reliable while realizing high economy. Used in combination with permanent magnets, these switches find wide use in switching, sensing and other applications.

Features

- Compact and Lightweight
  The proximity switches are suitable for use as a compact and lightweight magnetically responsive switch, thereby rendering equipment smaller.

- Ambient Resistance
  Contacts of the proximity switch are encapsulated in a glass tube together with insert gas(nitrogen gas),which protects the proximity switch from the effects of the exterior enviroment, for example, gas, dust, or moisture in the atmosphere.

- Simple Circuit for design
  The proximity switches are usable for progress of the reliability, durability and maintenance in the electronic machine.

Applications

- Position detection(door switches, float, etc)
- Rotation detection

Performance (NRS-102/NRS-403 Series)

Items	Types	Performance
Contact form		1 Form A
Maximum Switching Power	(W)	10
Maximum Switching Current	(A)	0.5
Maximum Switching Voltage	(V.DC)	100
Withstand Voltage	(V.DC)	200
Ambient Temperature	(˚C)	-20~+80
Contact Resistance	(mΩ)max.	500
Electrical Life Expectancy		12V.DC, 5mA resistive load... more than 10 million operations

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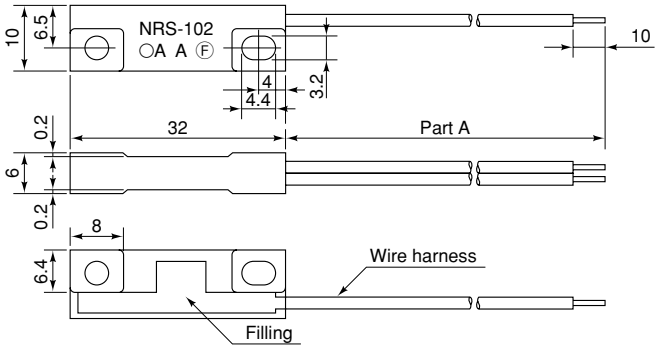
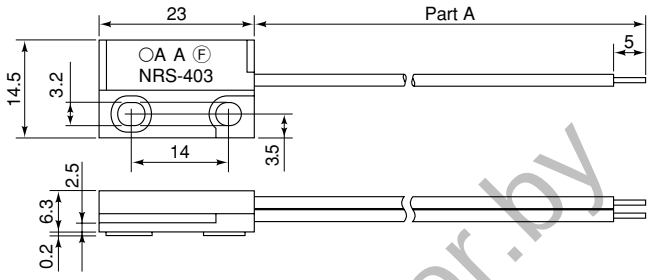
Shapes and Dimensions

● NRS-102Series



● NRS-403Series



(mm)

Numbering System

NRS-102-10 F

Series — Lead free

Wire Length

∗Lead-free (Sn100%)

Number

Number	Contact Resistance (included conductor resistance)	*Wire Length (Part A) [cm]
NRS-102-∗∗	500(mΩ)max.	10,20,30,40,50,60,70,80,90,100
NRS-403-∗∗	500(mΩ)max.	10,20,30,40,50,60,70,80,90,100

*We append the designated connector on demand.

**M4 thread fastening NRS-103 series also available.

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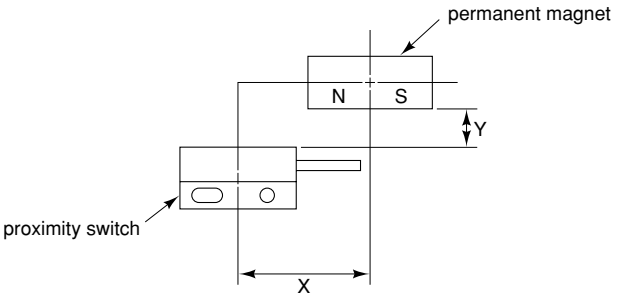
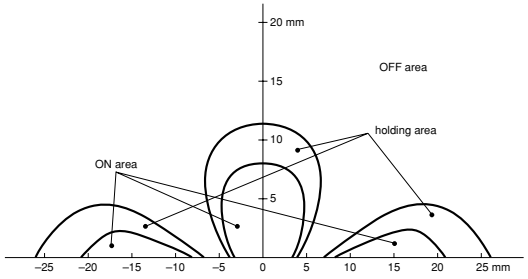
Operation range

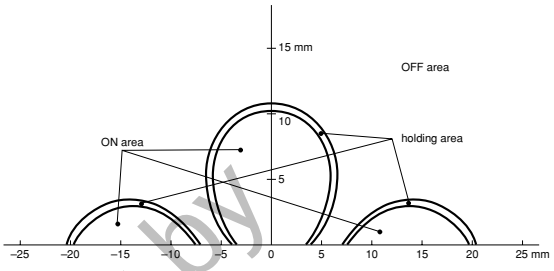
Operation ranges of the proximity switch driven by the ferrite magnet are shown below. In the measurement, Y denotes a distance between the side planes of the proximity switch and the permanent magnet, and X denotes a distance of parallel displacement of the permanent magnet while keeping the distance Y.



Operation range by Ferrite Magnet 5×5×7 of NRS-102



Operation range by Ferrite Magnet 5×5×7 of NRS-403



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Precautions to be Taken when Using Reed Switches/Proximity Switches

Processing of Terminal

The size of the product on which the reed switch is mounted determines the installation method and positioning. (See Figure 1 for example.)

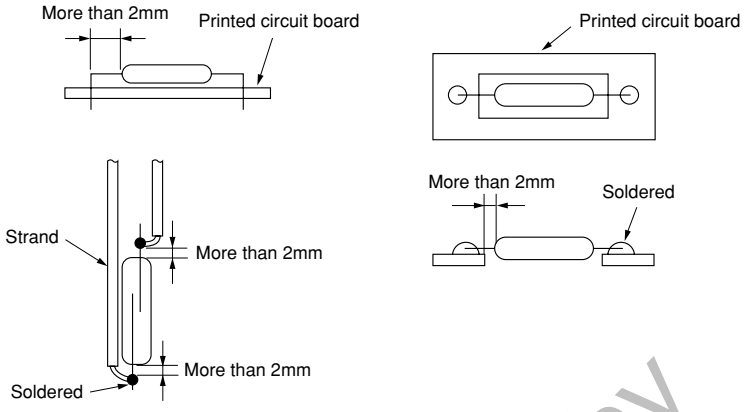

Fig. 1 Example of Mounting of Reed Switch

Notes 1) The relative position between a reed switch contact and a magnet becomes important when the reed switch is acutually used. Naturally, a method which makes it easy to accurately position contacts of the reed switch is preferable.
2) Position the reed switch with respect to the end face of the reed switch terminal. A glass tube that has a poor axial accuracy can not be used for reference.
3) When bending or cutting the terminals of the reed switch, please bend or cut the terminals after having fixed them using pads so as to prevent force from being exerted on the sealed portion, as shown in Fig. 2.
4) To protect a sealed portion of the glass tube, the glass tube should be spaced more than 2mm apart from an area where the terminals are bent or cut (Fig. 2).
5) The terminals of the reed switch form a part of a magnetic circuit. If the terminals are cut, the pick up and the drop-out value increase, as shown in Fig. 3. Please note that similar results will be expected even if the terminals are bent.

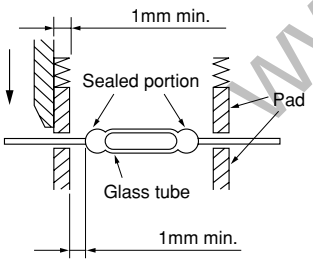

Fig. 2 Example of cutting of terminal

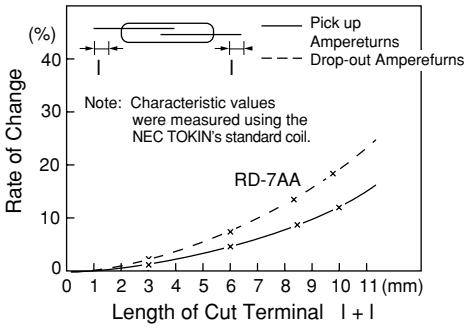

Fig. 3 Example of variations in pick-up and drop-out values resulting from cutting of terminal

6) To protect sealed portions of the glass tube, the terminals should be soldered while being spaced at least 1mm or more, preferably 2mm or more, away from the glass tube.

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Fixing of Terminal

● When the terminals of the reed switch are fixed to a printed wiring board, it is recommended that a clearance of more than 2mm be ensured between the sealed portion and an area of the terminal to be fixed, in order to protect the glass tube from mechanical force, as shown in Fig. 4. Further, please do not bring solder into direct contact with the sealed portions of the glass tube, in order to prevent cracks or gas leakage from the sealed portions. It is also recommended that soldering of the terminals be carried out at a temperature of less than 250°C and be completed within 3 sec.

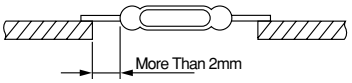

Fig. 4 Reference for terminal mounting

(1) When the terminals of the reed switch are welded, one terminal may become lifted off in relation to the other terminal, as shown in Fig. 5, thereby exerting force on the sealed portions of the glass tube. To prevent this problem, please weld the terminals under appropriate conditions (e.g., welding voltage and current, and applied pressure).
Further, it is expected that a magnetic field developed as a result of the welding current will cause the contacts to become close, which in turn permits the flow of the welding current into the contacts of the reed switch. The circulation of the welding current to the contacts must be prevented.

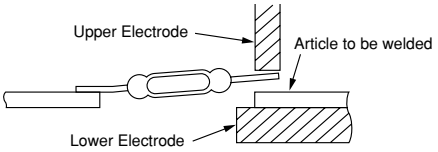

Fig. 5 Precautions to be taken when welding terminals

(2) When the reed switch is mounted on a printed circuit board, the printed circuit board should be made of a material which is less prone to deformation (resulting from, for example, thermal expansion or moisture absorption) so as to prevent bending stress, which is caused by warping the printed circuit board, from acting on the sealed portions of the glass tube.
If deformation of the printed circuit board is expected, a reed switch with angular terminals should be used to alleviate the warpage of the printed circuit board.

(3) When the reed switch is mounted on the printed circuit board while the glass tube remains in direct contact with the printed circuit board, the glass tube may crack if the printed circuit board has large warpage. To prevent cracking, the reed switch is mounted so as to be lifted off from the surface of the printed circuit board, or the reed switch is mounted such that the terminals cross over a depression or a cutout formed in the printed circuit board, as shown in Fig. 6.

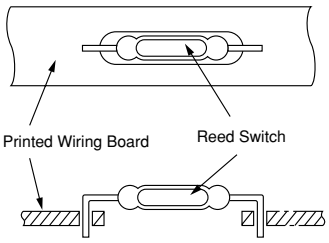

Fig. 6 Example of mounting of reed Sswitch on warped printed wiring board

(4) When the reed switch is mounted so as to be aligned with a cutout formed in the printed wiring board, attention must be paid to the shape of the printed wiring board and mounting work so as to prevent the glass tube from running onto the printed circuit board.
See Fig. 7.

Fig. 7 Precautions to be taken when mounting reed switch on printed wiring board

(5) The cutting of the lead terminals soldered to the printed circuit board by a diamond cutter must be avoided. Otherwise the sensitivity (a clearance between the contacts) of the reed switch will change.

Fixing of Glass Tube

(1) If the glass tube of the reed switch is fixed using resin, the glass tube will be subject to stress resulting from contraction and expansion of the resin when the resin sets, which may result in cracks in the glass tube. Please reduce the number of points and the area of the glass tube to be fixed. (It is recommended to use fixing resin or adhesive which is flexible, and causes only a small amount of shrinkage when it sets.)

(2) If a unit incorporating a reed switch is mounted, the unit must be prevented from warping as a result of protrusion of a filler or other foregin substances interposed between the unit and a board.

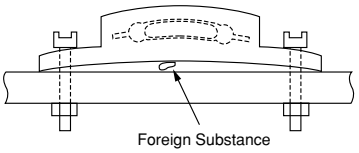

Fig. 8 Warpage in unit having built-in reed switch resulting from foreign substance between unit and board

Physical Shock

(1) If a reed switch or a unit incorporating a reed switch is dropped from a height of more than 30cm, the characteristics (particularly the sensitivity) of the reed switch may change. Avoid physical shock.

(2) If a large printed circuit board on which a plenty of reed switches and proximity switches are mounted is divided into several pieces by separating the circuit board along its perforations, the sensitivity of the reed switches and proximity switches may change as a result of the physical shock caused by cutting. (It is recommended to reduce the remaining perforation to as small an area as possible, and also to use a resulting unit after having checked whether or not the sensitivity of the reed switches remains unchanged).

Pick up Ampereturns

(1) The pick-up ampere represent the sensitivity of the reed switch. These pick-up ampere have expressed in ampere (A) which is the product of the number of turns (T) and the current (A) amperes necessary for turning the contacts on (ON) when NEC TOKIN's standard coil is energized. The smaller pick-up ampere have better sensitivity.

(2) A number "1020" in a part number such as "RD-7B-1020F" in the part No. a preset pick-up ampere when it was classified. A guaranteed value has a tolerance of ±2A, and consequently the reed switch with this designation pick-up ampere between 08A and 22A.

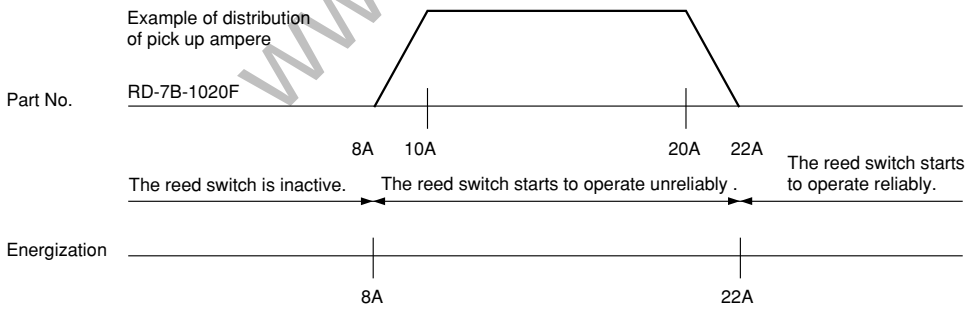

Fig. 9 Example of sensitivity distribution of reed switch

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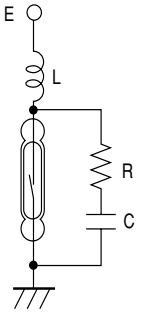
Contact point protection circuit

To improve reliability of the reed switch and proximity switch, use the contact point protection circuit shown below for use with an inductive load or with a load applied with surge current.

(1) Inductive Load

When an inductance (e.g., a coil, an electromagnetic relay, or a motor) is used as load, a back electromotive force of several hundred volts (energy stored in the inductance) arises when the contacts are opened, which results in considerable decrease in contact life (the same result arises even when a resistive load is used with a high voltage or a large current). Fig. 10 shows circuits for protecting the reed switch from the back electromotive force.

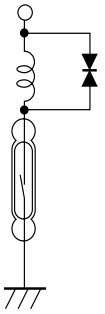
● Contact Protecting Circuit Using CR



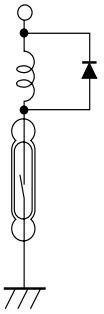
• $C = I^2/10$ (μF)

• $R = \text{Approx.} \dfrac{E}{10 \times I^{(I+50/E)}}$ (Ω)

● Contact Protecting Circuit Using Varistor



● Contact Protecting Circuit Using Diode



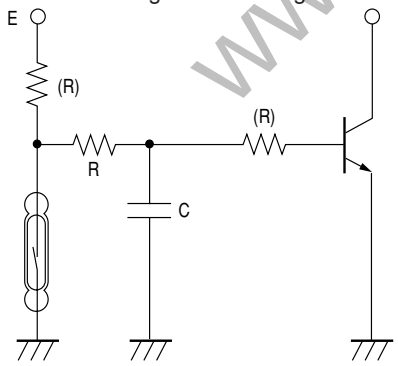
• Diode has a withstand voltage of more than EV.
• Forward-direction current
Approximately 5E/load coil resistance (A)

Fig. 10

(2) Capacitive Load

When a capacitor is used as load, a rush current flows as a result of the charging and discharging action of the capacitor when the contacts are closed, thereby making it impossible for the contacts to open. Fig. 11 shows a circuit for protecting the reed switch from the rush current.

● Contact Protecting Circuit Using R



R : The value at which a rush current becomes smaller than the maximum current for opening/closing a reed switch

Fig. 11

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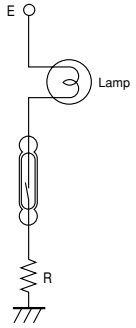
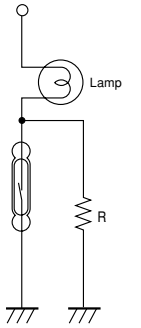
(3) Lamp Load

Tungsten is commonly used for a lamp filament. The tungsten lamp is characterized in that the resistance of the lamp, which is small when the lamp initially lights up, progressively increases and becomes stable at a stationary electric current. If the tungsten lamp is actuated using the reed switch, a rush current (5 to 10 times as large as stationary electric current) flows into the lamp immediately after the lamp has lit up, which may cause the contacts to be fused or stuck to each other. Fig. 12 shows a circuit with a protecting resistor R for preventing the reed switch contacts from being fused or stuck to each other. If the use of the protecting resistor is not desired, please use the RD-8N reed switch.

● Contact Protecting Circuit Using R



● Contact Protecting Circuit Using R



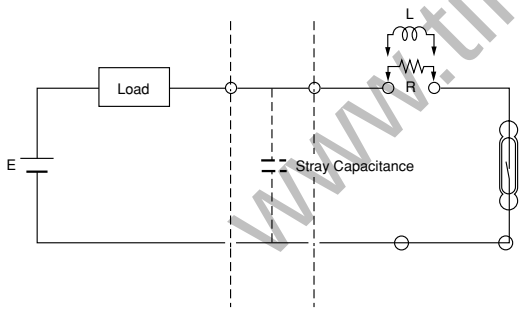
R : The value at which a rush current becomes smaller than the maximum current for opening/closing a reed switch

Fig. 12

(4) Wiring Capacitive Load

If the contacts and load are connected together through a long wire or cable, a rush current flows by means of stray capacitance of the wire or cable when the contacts are closed, which significantly influences contact life. Fig. 13 shows a circuit with resistance or inductance for preventing the flow of the rush current.

● Contact Protecting Circuit Using R or L



R : The value at which a surge current generally becomes smaller than the maximum current for opening and closing a reed switch
L : Inductance of around 1 to 10μH

Fig. 13

Concerning Ultrasonic

(1) Ultrasonic Cleaning

Avoid, in principle, ultrasonic cleaning of the reed switch and proximity switch per se or after mounted on a printed wiring board, since ultrasonic wave may degrade the sensitivity (the distance of the contact point) or cause cracks in the sealing portion of the glass tube.

(2) Ultrasonic Welding

Avoid, in principle, also ultrasonic welding of the reed switch and proximity switch similarly to the ultrasonic cleaning, since ultrasonic wave may degrade their performances.

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Twin Reed Switch Type Safing Sensor High Stand Type : TMSD-H**51D

Outline

NEC TOKIN has produced two-element compact and high-performance reed switch type safing sensors responding to current needs in which special emphasis is placed on safety.

Features

- High density mounting on board
- High water-proof
- High resistance to G-noise to (except G-detection)

Applications

- SRS air bag systyem
- Seat belt pre-tensioner

Markings

TMSD-H2251D

Starting G (started at 2.2 G)

Specifications

Electrical operating characteristics and mechanical characteristics

Item	Standard	Remarks
Intercontact withstand voltage	min. 200V	——
Switching voltage	max. 40V	——
Switching current	max. 7A	——
Carry current	max. 20A	——
Contact resistance	max. 150mΩ	When 100mA is applied
Insulation resistance	min. 10MΩ	Applied voltage of 100VDC
Operating time	max. 16.0ms	7.2G-20ms (Half sine wave)
ON-holding time	min. 26.5ms	7.2G-20ms (Half sine wave)
Retention temperature	-40~+100˚C	——
Operating temperature	-30~+80˚C	——

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When using our products, the following precautions should be taken.

(1) Safety designing of an apparatus or a system allowing for failures of electronic components used in the system

In general, failures will occur in electronic components at a certain probability. NEC TOKIN makes every effort to improve the quality and reliability of electronic component products. However, it is impossible to completely eliminate the probability of failures. Therefore, when using NEC TOKIN's electronic component products, systems should be carefully designed to ensure redundancy in the event of an accident which would result in injury or death, fire, or social damage, to ensure the prevention of the spread of fire, and the prevention of faulty operation. (For details about failure mode, see "Precautions for Use".)

(2) Quality level of various kinds of parts, and equipment in which the parts can be utilized
Electronic components have a standard quality level unless otherwise specified.

NEC TOKIN classifies the level of quality of electronic component products into three levels, in order from a lower level, a standard quality level, a special quality level, and a custom quality level in which a customer individually specifies a quality assurance program. Each of the quality levels has recommended applications.
If a user wants to use the electronic parts having a standard quality level in applications other than the applications specified for the standard quality level, they should always consult a member of our company's sales staff before using the electronic parts.

Standard quality level :	Computers, office automation equipment, communications equipment, measuring instruments, AV equipment, household electrical appliances, machine tools, personal equipment, industrial robots
Special quality level :	Transportation equipment (automobiles, railways, shipping, or the like), traffic signals, disaster prevention/crime prevention systems, a variety of safety devices, and medical equipment which is not directly intended for life-support purposes
Custom quality level :	Equipment for airplanes, aerospace equipment, nuclear power control systems, and medical equipment, apparatus or system for life-support purposes

Unless otherwise shown, the quality level of NEC TOKIN's electronic component products included in documents such as catalogues, data sheets or data books is the standard quality level.

(3) This manual is subject to change without notice.

The contents of this manual are based on data which is correct as of July 2007, and they may be changed without notice. If our products are used for mass-production design, please enquire cousult with a member of our company's sales staff by way of precaution.

(4) Reprinting and copying of this manual without prior written permission fromf NEC TOKIN Corporation are not permitted.

(5) Industrial property problems

In the event any problems associated with industrial property of a third party arising as a result of the use of our products, NEC TOKIN assumes no responsibility for problems other than problems directly associated with the constitution and manufacturing method of the products.

(6) Export Control
For customers outside Japan
NEC-TOKIN products should not be used or sold for use in the development, production, stockpiling or utilization of any conventional weapons or mass-destructive weapons (nuclear weapons, chemical or biological weapons, or missiles), or any other weapons.

For customers in Japan
For products which are controlled items subject to the' Foreign Exchange and Foreign Trade Law' of Japan, the export license specified by the law is required for export.

⚠

●All specifications in this catalog and production status of products are subject to change without notice. Prior to the purchase, please contact NEC TOKIN for updated product data.
●Please request for a specification sheet for detailed product data prior to the purchase.
●Before using the product in this catalog, please read "Precautions" and other safety precautions listed in the printed version catalog.

DATA SHEET

NEC/TOKIN

AUTOMOTIVE RELAYS
EX2/EX1 SERIES

DESCRIPTION

The new NEC EX2/EX1 series is PC-board mount type and the most suitable for various motor and heater controls in the automobiles which require high quality and high performance.

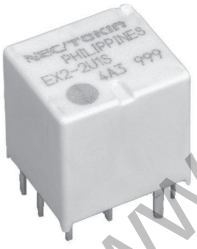
The EX2 series is succeeding in about 60% of miniaturization in comparison with the ET2 series. The EX1 series is succeeding in about 50% of miniaturization in comparison with the ET1 series.

FEATURES

- PC-board mounting
- Lead free solder is used
- Approx. 75% relay volume of ET2
- Approx. 65% relay volume of ET1
- Approx. 60% relay space of ET2
- Approx. 50% relay space of ET1
- Approx. 88% relay weight of ET2
- Approx. 78% relay weight of ET1

APPLICATIONS

- Motor control
- Solenoid control



EX2 SERIES

EX1 SERIES

For Proper Use of Miniature Relays

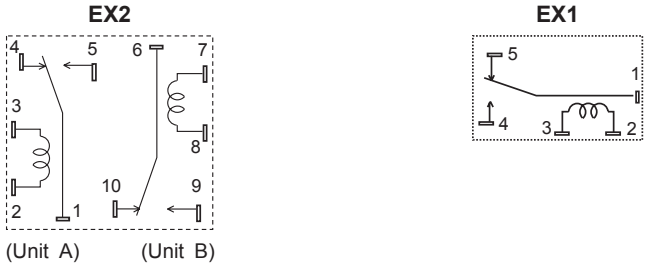
DO NOT EXCEED MAXIMUM RATING

Do not use relay under excessive conditions such as over ambient temperature, over voltage and over current. Incorrect use could result in abnormal heating and damage to the relay or other parts.

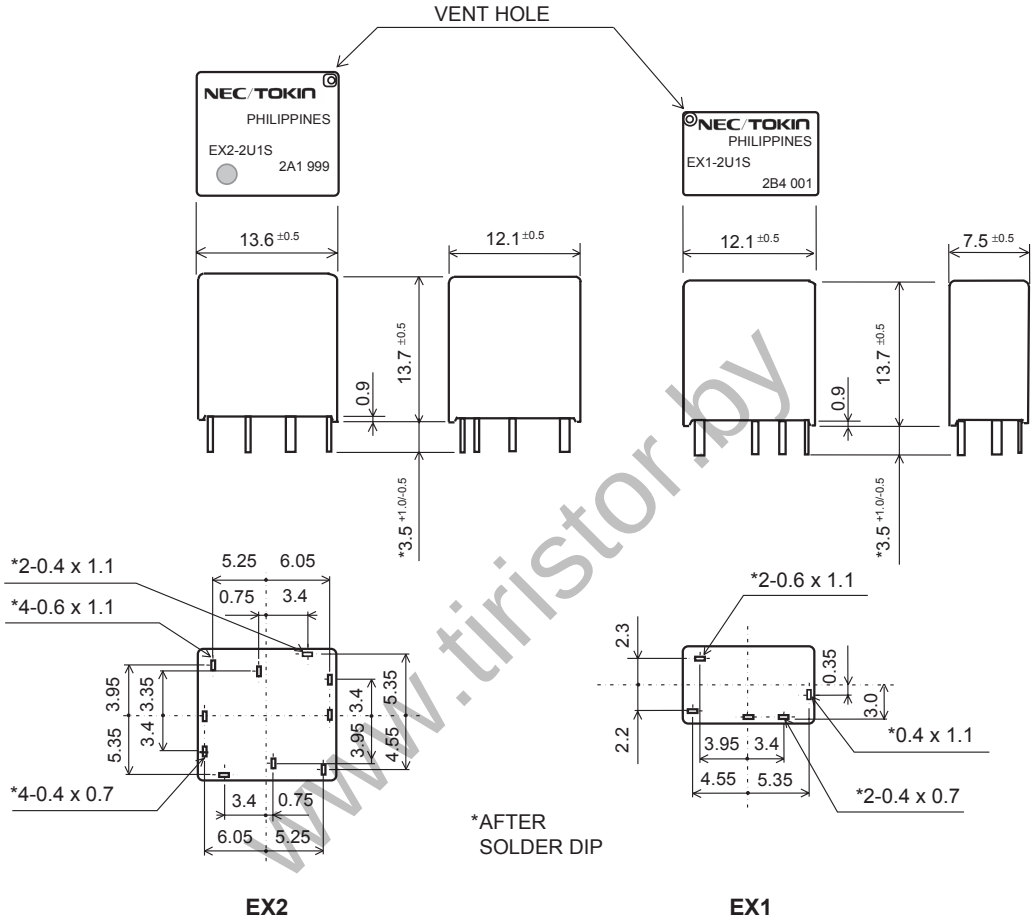
READ CAUTIONS IN THE SELECTION GUIDE

Read the cautions described in NEC's "Miniature Relays" (ER0046EJ*) before dose designing your relay applications.

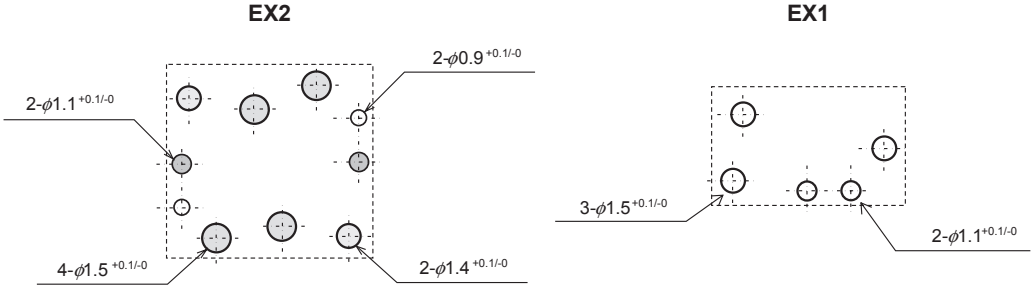
SCHEMATIC (BOTTOM VIEW)



DIMENSIONS [mm]



PCB PAD LAYOUT [mm] (BOTTOM VIEW)



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SPECIFICATION

(at 20 °C)

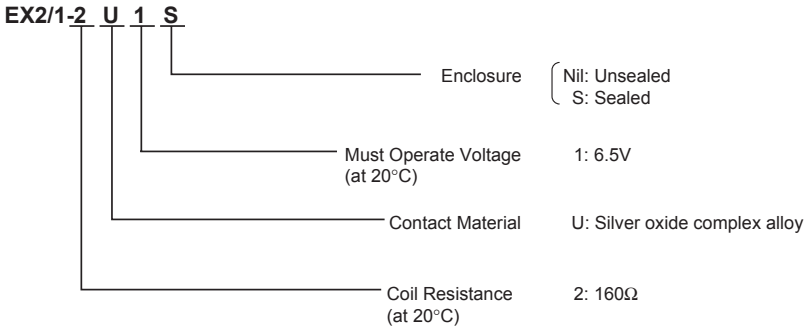
Items			Specifications	
			EX2	EX1
Contact Form			1c x 2 (Separate)	1c
Contact Rating	Max. Switching Voltage		16Vdc	
	Max. Switching Current		30A (at16Vdc)	
	Min. Switching Current		1A (5Vdc)	
	Max. Carrying Current		35A (2minutes max. 12Vdc at 25°C) 30A (2minutes max. 12Vdc at 85°C) 20A (2minutes max. 12Vdc at 125°C)	
	Contact Resistance		4mΩ typical (measured at 7A) initial	
Contact Material			Silver oxide complex alloy	
Operate Time (Excluding Bounce)			2.5ms typical (at nominal voltage)	
Release Time (Excluding Bounce)			3ms typical (at nominal voltage with diode)	
Nominal Operate Power			900mW	
Insulation Resistance			100MΩ at 500Vdc	
Withstand Voltage	Between Open Contact		500Vac min. (for 1minute)	
	Between Contact and Coil		500Vac min. (for 1minute)	
Shock Resistance	Misoperation		98m/s^2	
	Destructive Failure		980m/s^2	
Vibration Resistance	Misoperation		10 to 300Hz, 43m/s^2	
	Destructive Failure		10 to 500Hz 43m/s^2, 200hour	
Ambient Temperature			-40 to +125 °C	
Coil Temperature Rise			70°C / W (without contact carrying current)	
Life Expectancy	Mechanical		1 x 10^6 operations	
	Electrical	P/W motor lock (14Vdc, 25A)	100x10^3 operations	
		P/W motor free (14Vdc, 25A/7A)	100x10^3 operations	
Weight			Approx. 6.4g	Approx. 3.5g

COIL RATING

(at 20 °C)

Part Numbers	Nominal Voltage (Vdc)	Coil Resistance (Ω)+/-10%	Must Operate Voltage (Vdc)	Must Release Voltage (Vdc)
EX2/1-2U1S (Sealed type)	12	160	6.5	0.9
EX2/1-2U1 (Unsealed type)	12	160	6.5	0.9

NUMBERING SYSTEM



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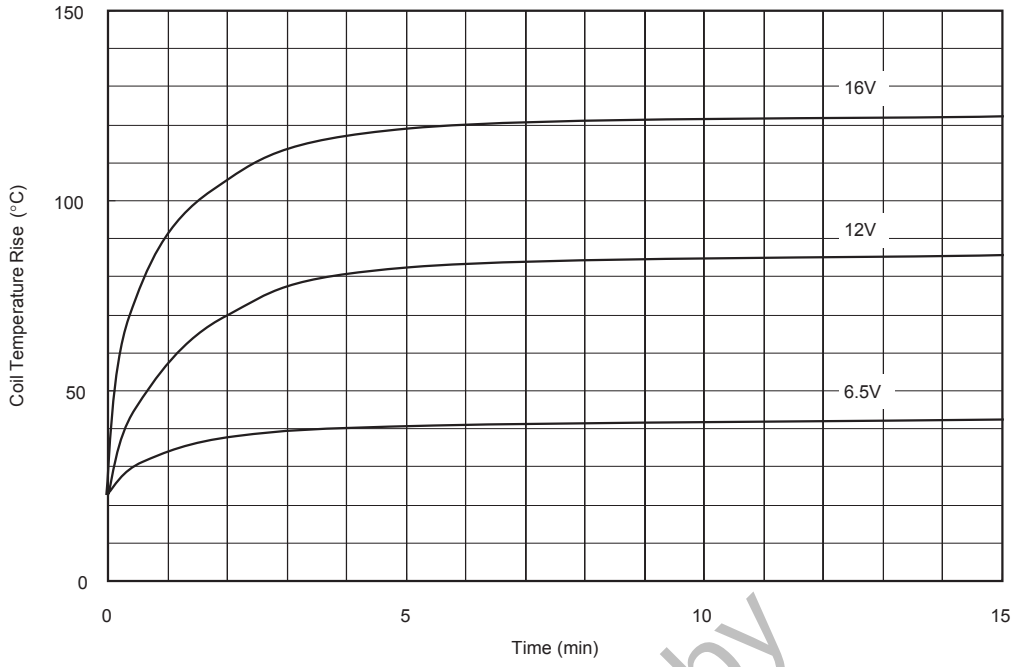
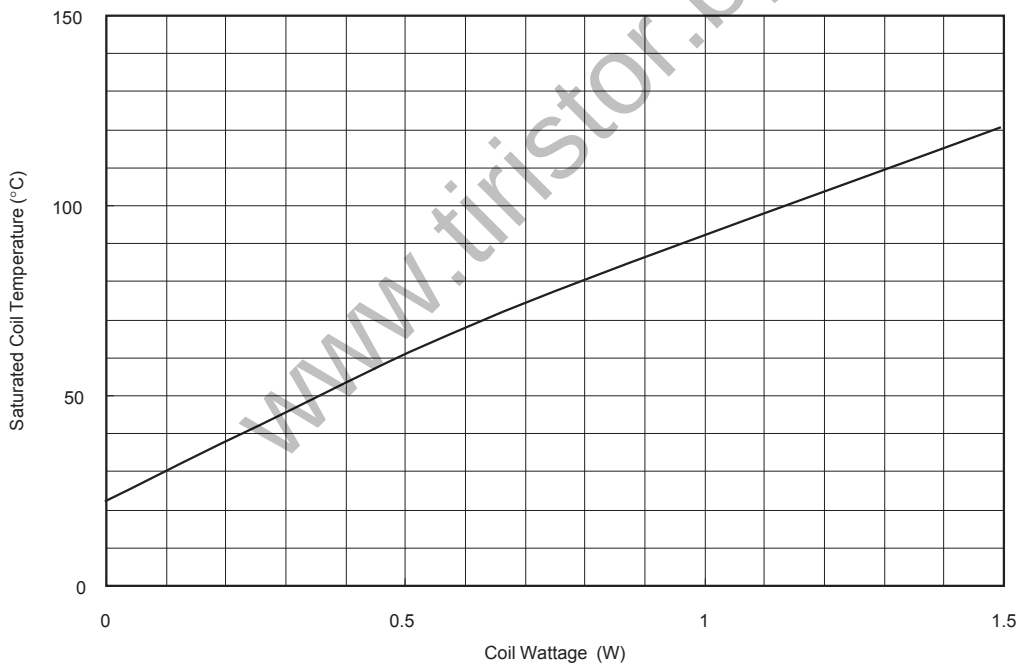
TECHNICAL DATA

Coil Temperature Rise





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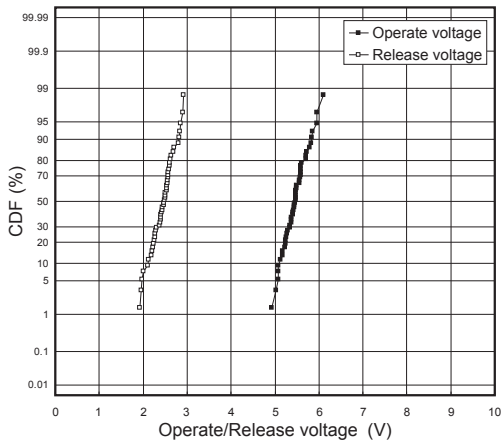
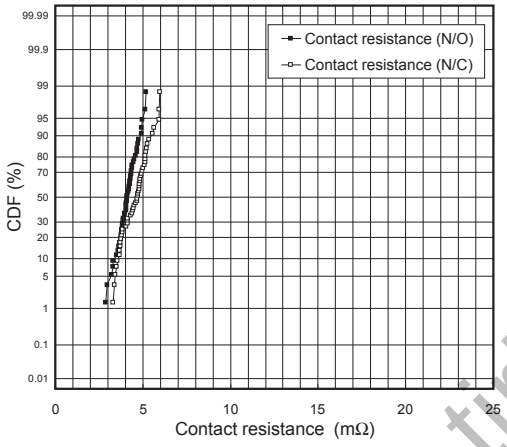
RELAY CHARACTERISTICS DISTRIBUTION (INITIAL, n = 25 pcs., at 20°C)

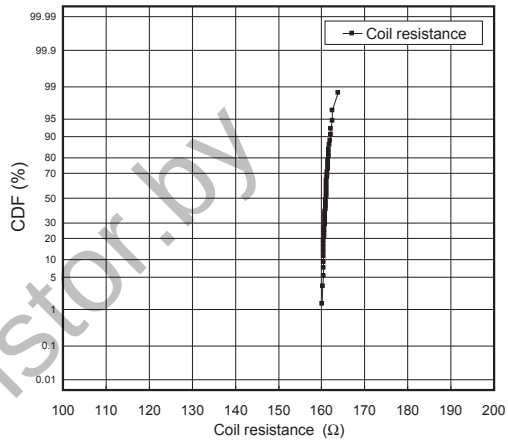
Operate/Release Voltage



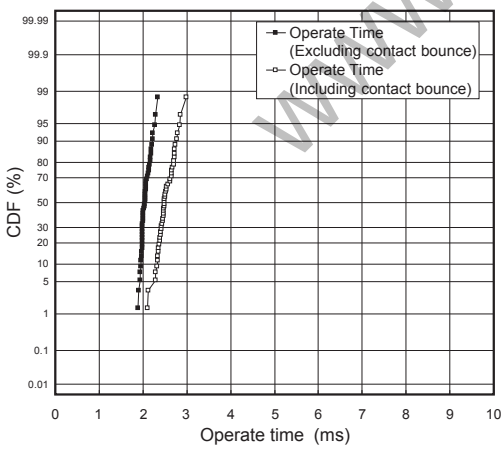
Contact Resistance



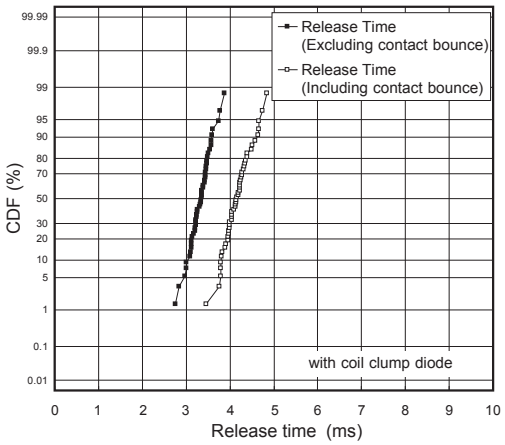
Coil Resistance



Operate Time

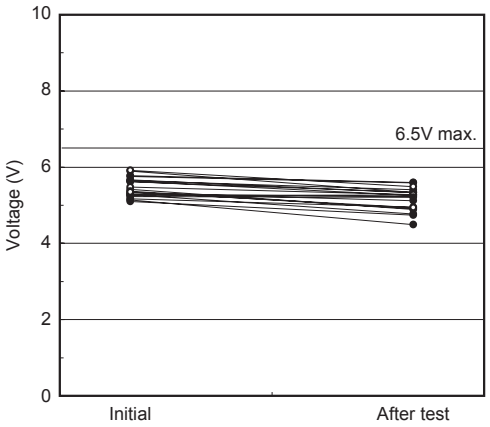


Release Time

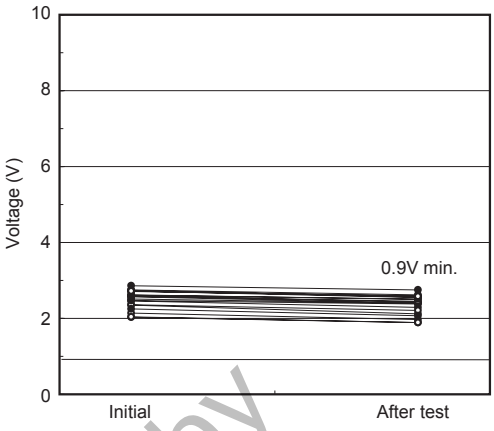


ELECTRICAL LIFE TEST (14Vdc-25A, P/W motor, Lock)

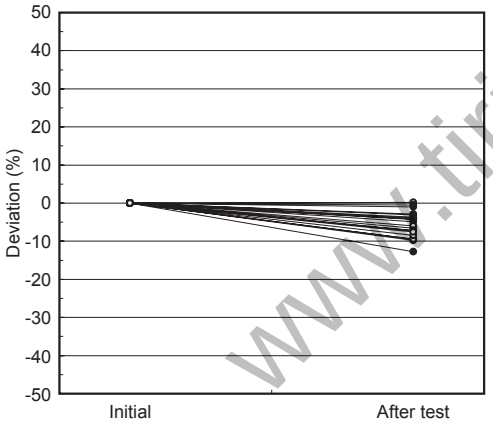
Test items	Test conditions	Samples
1. Operate voltage 2. Release voltage 3. Contact resistance 4. Coil resistance 5. Operate time 6. Release time (with coil clump diode)	Temperature :20°C Frequency :0.2s ON, 9.8s OFF, 0.1Hz Contact load :14Vdc-25A, P/W motor, Lock Number of operations :100 x 10^3	EX2-2U1S 10 pcs



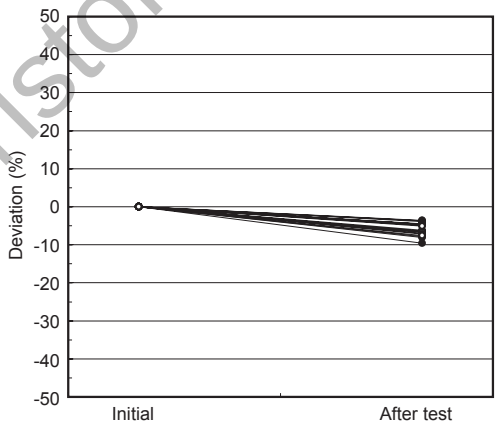
Operate voltage



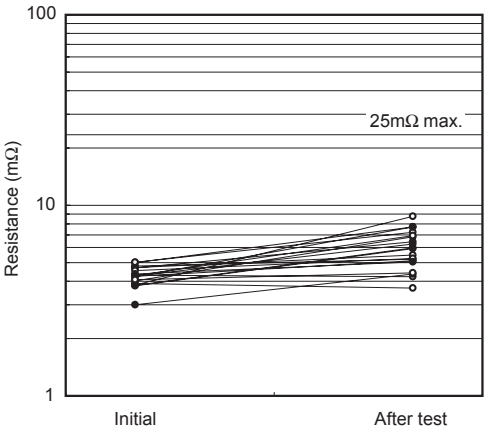
Release voltage



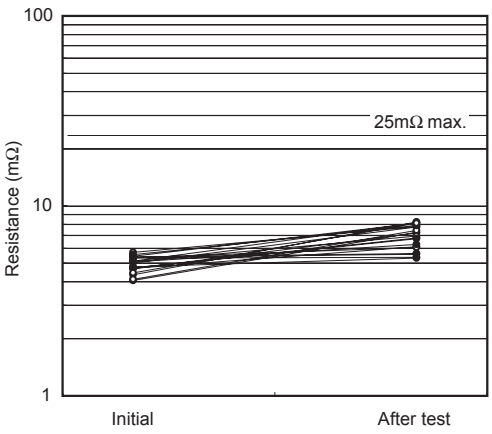
Operate voltage



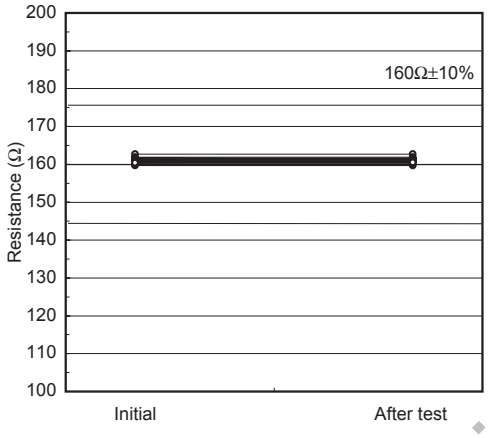
Release voltage



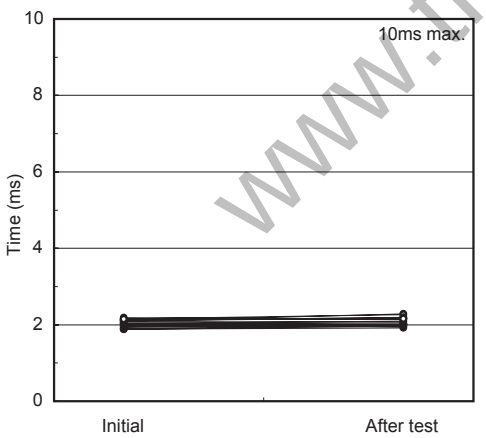
Contact resistance (N/O)



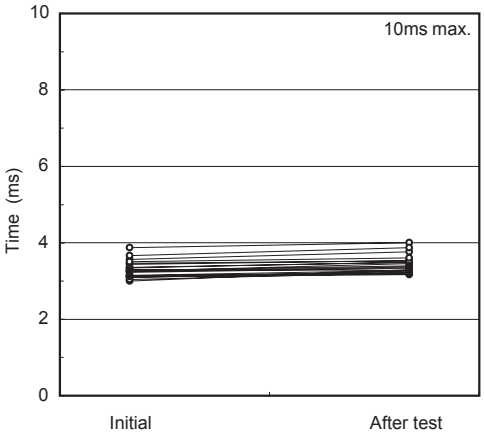
Contact resistance (N/C)



Coil resistance



Operate time



Release time

2006.03.24 P0691EMDD03VOL02E

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

NEC-Tokin KEMET:

EX1-2U1S

DATA SHEET

NEC/TOKIN

RoHS Compliant

MINIATURE SIGNAL RELAY

EC2/EE2 SERIES

COMPACT SIZE, SLIM-PACKAGE

DESCRIPTION

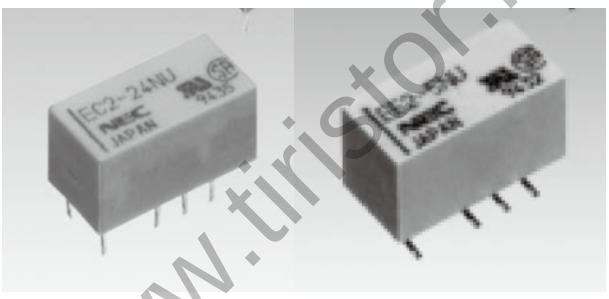
NEC TOKIN EC2/EE2 relay is a standard miniature signal relay, compact and slim.

FEATURES

- ☐ Compact and light weight
- ☐ FCC (1500 V) and Telcordia (2500 V) surge capacity
- ☐ UL recognized and CSA certified.
- ☐ Low power consumption (100-200 mW)
- ☐ ND type (High insulation) conform to supplement insulation for EN60950
- ☐ NKX type (High breakdown voltage) can withstand 1.5KVAC at open contacts

APPLICATIONS

Electronic switching systems, PBX, Terminal equipment, Telephone system



For Right Use of Miniature Relays

DO NOT EXCEED MAXIMUM RATINGS.
Do not use relays under exceeding conditions such as over ambient temperature, over voltage and over current. Incorrect use could result in abnormal heating, damage to related parts or cause burning.

READ CAUTIONS IN THE SELECTION GUIDE.
Read the cautions described in NEC TOKIN's "Miniature Relays" when you choose relays for your application.

The information in this document is subject to change without notice.

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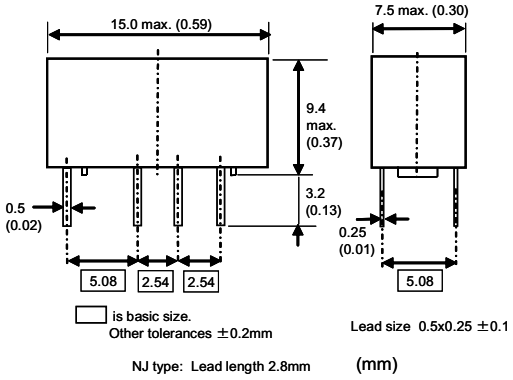
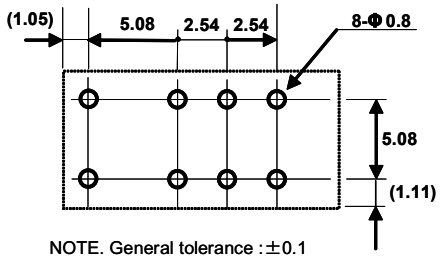
2012.09.12 9600SD2VOL02E1209H0

DIMENSIONS AND PAD LAYOUTS Unit: mm (inch)

EC2 SERIES

Non-latch type, Single coil latch type

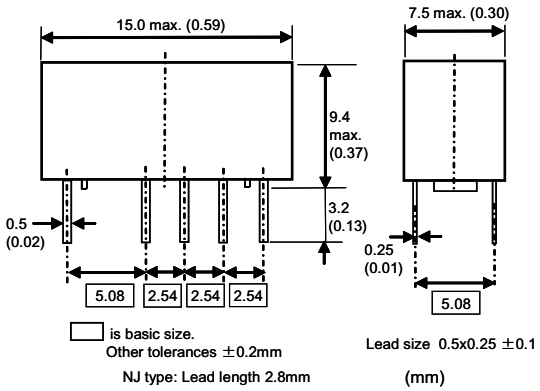


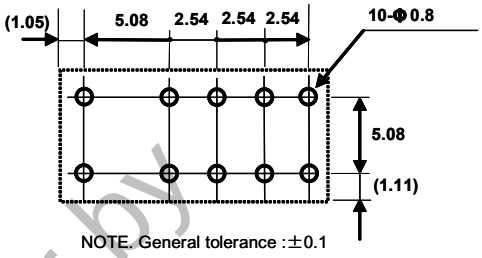


NOTE. General tolerance :±0.1

(Bottom view)

Double coil latch type



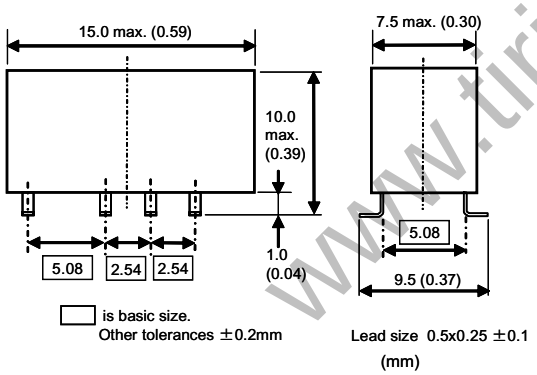


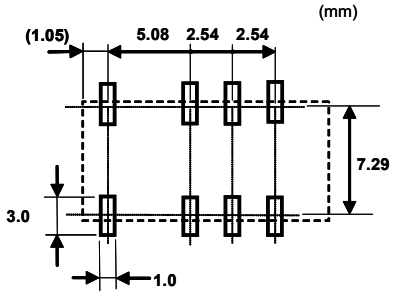
NOTE. General tolerance :±0.1

(Bottom view)

EE2 SERIES

Standard/ Non-latch type, Single coil latch type

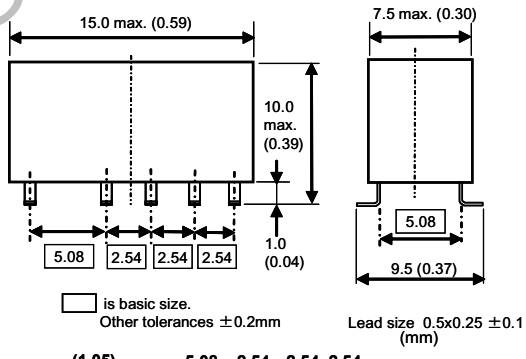


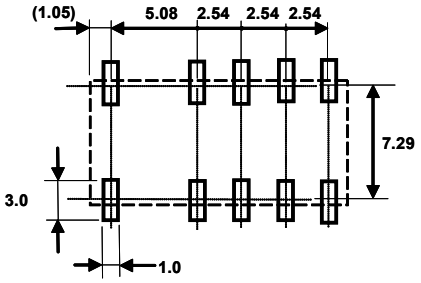


NOTE. General tolerance :±0.1

(Top view)

Standard/ Double coil latch type





NOTE. General tolerance :±0.1

(Top view)

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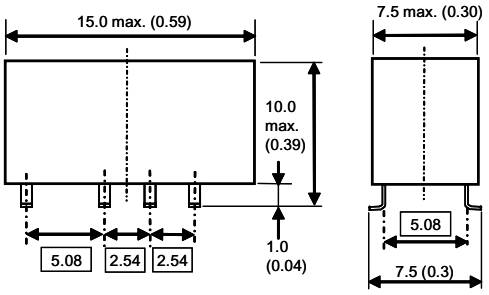
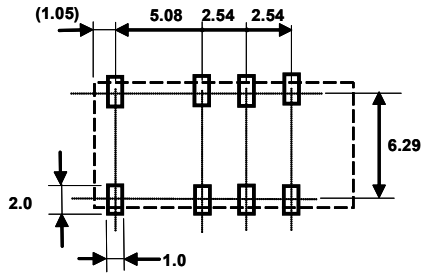
Minimum footprint / Non-latch type, Single coil latch type



is basic size.
Other tolerances ±0.2mm

Lead size 0.5x0.25 ±0.1

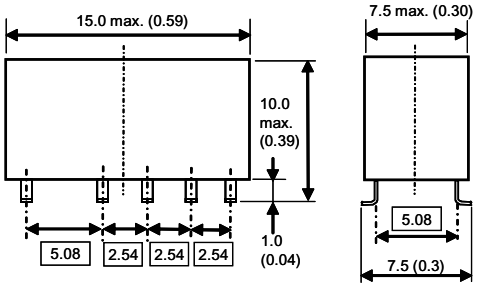
(mm)



NOTE. General tolerance :±0.1

(Top view)

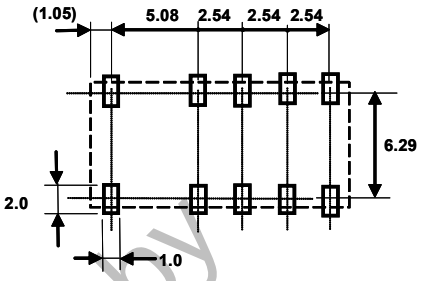
Minimum footprint/ Double coil latch type



is basic size.
Other tolerances ±0.2mm

Lead size 0.5x0.25 ±0.1

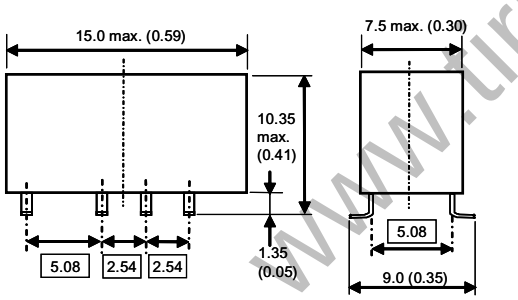
(mm)



NOTE. General tolerance :±0.1

(Top view)

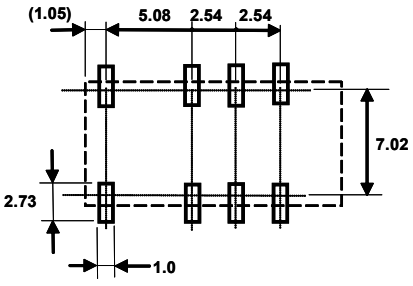
High solder joint reliability/
Non-latch type, Single coil latch type



is basic size.
Other tolerances ±0.2mm

Lead size 0.5x0.25 ±0.1

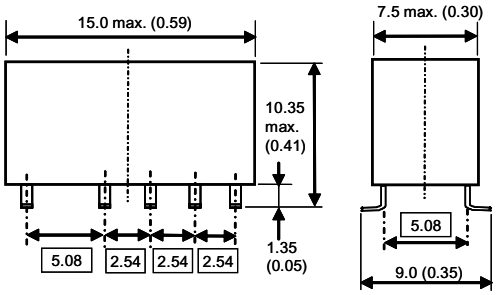
(mm)



NOTE. General tolerance :±0.1

(Top view)

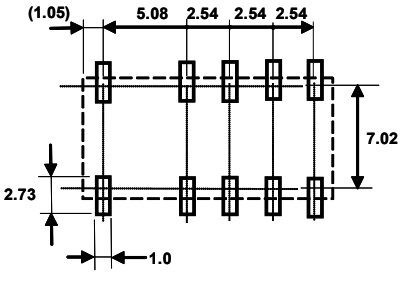
High solder joint reliability /
Double coil latch type



is basic size.
Other tolerances ±0.2mm

Lead size 0.5x0.25 ±0.1

(mm)

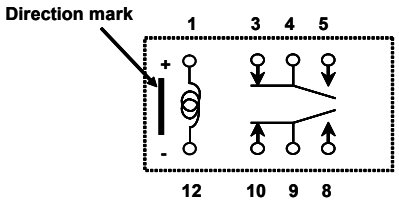


NOTE. General tolerance :±0.1

(Top view)

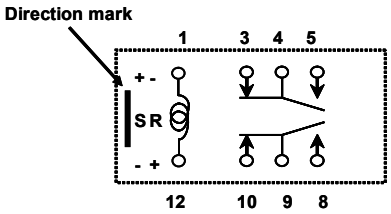
PIN CONFIGURATIONS (Bottom view)

Non-latch type



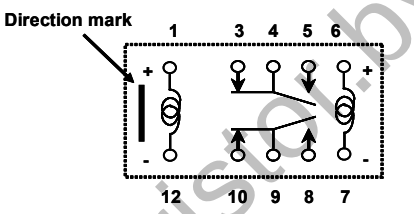
Non-latch type
(Not energized position)

Single coil latch type



S: Coil polarity for Set
R: Coil polarity for Reset
Single coil latch type
(Reset position)

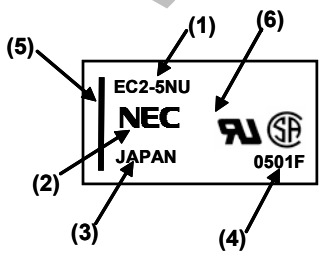
Double coil latch type



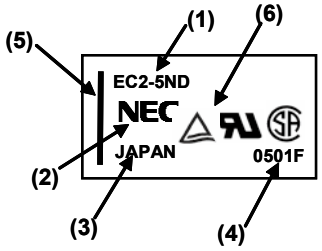
Double coil latch type
(Reset position)

MARKINGS (top view)

Except ND type



ND type (High insulation)



(1) Part number
(2) Manufacturer
(3) Country of origin
(4) Date code
(5) Direction mark (pin No. 1 and 12)
(6) UL,CSA marking (TUV added for ND type)

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GENERAL SPECIFICATIONS

Contact Form		2 Form C
Contact Material		Silver alloy with gold alloy overlay
Contact Ratings	Maximum Switching Power	60 W, 125 VA
	Maximum Switching Voltage	220 VDC, 250 VAC
	Maximum Switching Current	2 A
	Maximum Carrying Current	2 A
Minimum Contact Ratings		10 m VDC, 10μA ***1**
Initial Contact Resistance		75 m Ω max. (initial)
Operate Time (Excluding bounce)		Approx. 2 ms
Release Time (Excluding bounce)		Approx. 1 ms
Insulation Resistance		1000 M Ω at 500 VDC
Withstanding Voltage	Between open contacts	1000 VAC (for one minute) 1500 V surge (10x160 μs ***2**)
		[High breakdown voltage (NKX) type] Make contact: 1500 VAC (for one minute) 2500 V surge (2x10 μs ***3**) Break contact: 1000 VAC (for one minute) 1500 V surge (10x160 μs ***2**)
	Between adjacent contacts	1000 VAC (for one minute) 1500 V surge (10x160 μs ***2**)
	Between coil and contacts	1500 VAC (for one minute) , 2500 V surge (2x10 μs ***3**)
		[Double coil latch type] 1000 VAC (for one minute) 1500 V surge (10x160 μs ***2**)
Shock Resistance		735 m/s^2 (75G) (misoperation) 980 m/s^2 (100G) (destructive failure)
Vibration Resistance		10 to 55 Hz, double amplitude 3 mm(20G) (misoperation) 10 to 55 Hz, double amplitude 5 mm(30G) (destructive failure)
Ambient Temperature		－40 to ＋85℃
Coil Temperature Rise		18℃ at nominal coil voltage (140mW)
Running Specifications	Nonload	$1x10^8$ operations (Non-latch type) ***4** $1x10^7$ operations (latch type)
	Load	50 VDC 0.1A (resistive), $1x10^6$ operations at 85℃ ,5Hz
		10 VDC 10mA (resistive), $1x10^6$ operations at 85℃ ,2Hz
Weight		Approx. 1.9 g

***1** This value is a reference value in the resistance load.
Minimum capacity changes depending on switching frequency and environment temperature and the load.

***2** rise time: 10 μs, decay time to half crest: 160 μs

***3** rise time: 2 μs, decay time to half crest: 10 μs

***4** This shows the number of operations with fatal defects. Stable characteristics are maintained for 1×10^7 operations.

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COIL SPECIFICATIONS

Non-latch Type at 20℃

Nominal Coil Voltage (VDC)	Coil Resistance (Ω) ± 10%	Must Operate Voltage* (VDC)	Must Release Voltage* (VDC)	Nominal Operating Power (mW)
3	64.3	2.25	0.3	140
4.5	145	3.38	0.45	140
5	178	3.75	0.5	140
9	579	6.75	0.9	140
12	1028	9.0	1.2	140
24	2880	18.0	2.4	200

Single Coil Latch Type at 20℃

Nominal Coil Voltage (VDC)	Coil Resistance (Ω) ± 10%	Set Voltage* (VDC)	Reset Voltage* (VDC)	Nominal Operating Power (mW)
3	90	2.25	2.25	100
4.5	202.5	3.38	3.38	100
5	250	3.75	3.75	100
9	810	6.75	6.75	100
12	1440	9.0	9.0	100
24	5760	18.0	18.0	100

Double Coil Latch Type (Can not be driven by reverse polarity for reverse operation) at 20℃

Nominal Coil Voltage (VDC)	Coil Resistance (Ω) ± 10%		Set Voltage** (VDC)	Reset Voltage** (VDC)	Nominal Operating Power (mW)
3	S	64.3	2.25	-	140
	R	64.3	-	2.25	
4.5	S	145	3.38	-	140
	R	145	-	3.38	
5	S	178	3.75	-	140
	R	178	-	3.75	
9	S	579	6.75	-	140
	R	579	-	6.75	
12	S	1028	9.0	-	140
	R	1028	-	9.0	
24	S	4114	18.0	-	140
	R	4114	-	18.0	

Non-latch High Insulation (ND) Type at 20℃

Nominal Coil Voltage (VDC)	Coil Resistance (Ω) ± 10%	Must Operate Voltage* (VDC)	Must Release Voltage* (VDC)	Nominal Operating Power (mW)
3	45	2.25	0.3	200
4.5	101	3.38	0.45	200
5	125	3.75	0.5	200
9	405	6.75	0.9	200
12	720	9.0	1.2	200
24	2504	18.0	2.4	230

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Single Coil Latch High Insulation (ND) Type at 20℃

Nominal Coil Voltage (VDC)	Coil Resistance (Ω) ± 10%	Set Voltage* (VDC)	Reset Voltage* (VDC)	Nominal Operating Power (mW)
3	90	2.25	2.25	100
4.5	203	3.38	3.38	100
5	250	3.75	3.75	100
9	810	6.75	6.75	100
12	960	9.0	9.0	150
24	3388	18.0	18.0	170

Non-latch High Breakdown Voltage (NKX) Type at 20℃

Nominal Coil Voltage (VDC)	Coil Resistance (Ω) ± 10%	Must Operate Voltage* (VDC)	Must Release Voltage* (VDC)	Nominal Operating Power (mW)
3	39.1	2.25	0.3	230
4.5	88.0	3.38	0.45	230
12	626	9.0	1.2	230

Note * Test by pulse voltage

** S : Set coil (pin No.1 ... (+) , pin No.12 ...(-)) R : Reset coil (pin No.6...(+) , pin No.7...(-))
The latch type relays should be initialized at appointed position before using, and should be energized to specific polarity by above polarity to avoid wrong operation.
Any special coil requirement, please contact NEC TOKIN for availability.

SAFETY STANDARD AND RATING

UL Recognized (UL508)* File No E73266	CSA Certificated (CSA C22.2 No14) File No LR46266
30 VDC, 2 A (Resistive) 110 VDC, 0.3 A (Resistive) 125 VAC, 0.5 A (Resistive)	

* Spacing: UL114, UL478

TUV Certificate	
(IEC61810/ EN61810)	(EN61810)
No. R 9750561	No. R 9751153
ND Type (Non-latch and Single coillatch)	NU,NJ,NUH,NUX Type (Non-latch and Single coillatch)
Creepage and clearance of coil to contact is more than 2 mm. (According to EN60950)	
Supplementary insulation class	Basic insulation class

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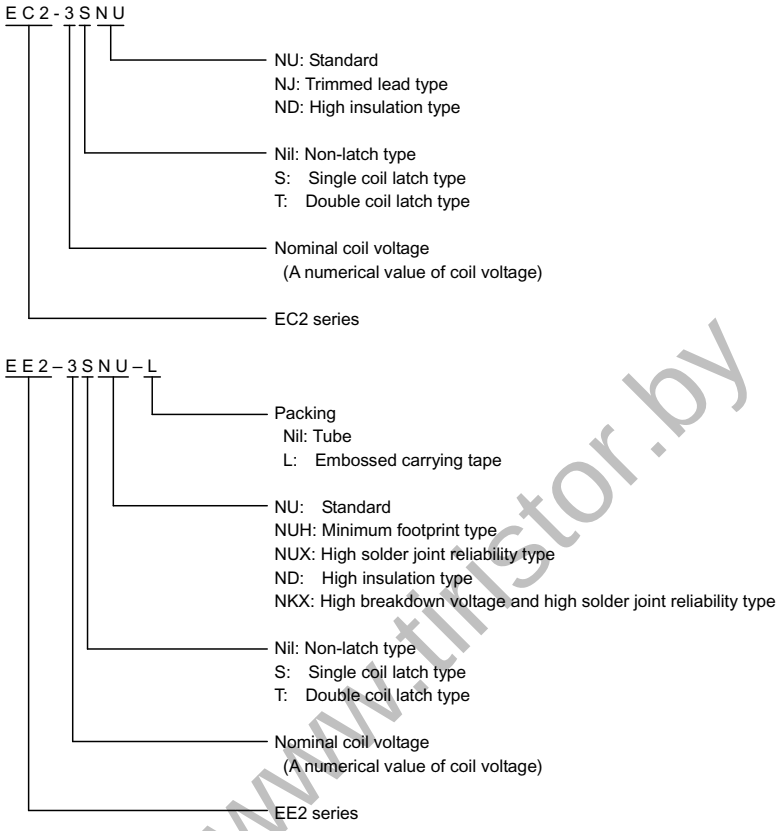
RECOMMENDED RELAY DRIVE CONDITIONS

Drive under conditions. If it is impossible, please inquire to NEC TOKIN.

Non-latch type	Voltage: within ±5% of nominal voltage	Ambient temperature −40 to +85℃
Single coil latch type Double coil latch type	Square pulse (rise and fall time is rapid) Pulse height : within ±5% of nominal voltage Pulse width : More than 10 ms	

PART NUMBER SYSTEM



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ORDERING PART NUMBERS

☐ **EC2 series**

Option		Nominal Coil Voltage (VDC)	Coil Type		
Terminal	Packing		Non-latch	Single Coil Latch	Double Coil Latch
Standard	Tube	3	EC2-3NU	EC2-3SNU	EC2-3TNU
		4.5	EC2-4.5NU	EC2-4.5SNU	EC2-4.5TNU
		5	EC2-5NU	EC2-5SNU	EC2-5TNU
		9	EC2-9NU	EC2-9SNU	EC2-9TNU
		12	EC2-12NU	EC2-12SNU	EC2-12TNU
		24	EC2-24NU	EC2-24SNU	EC2-24TNU
Trimmed lead		3	EC2-3NJ	EC2-3SNJ	EC2-3TNJ
		4.5	EC2-4.5NJ	EC2-4.5SNJ	EC2-4.5TNJ
		5	EC2-5NJ	EC2-5SNJ	EC2-5TNJ
		9	EC2-9NJ	EC2-9SNJ	EC2-9TNJ
		12	EC2-12NJ	EC2-12SNJ	EC2-12TNJ
		24	EC2-24NJ	EC2-24SNJ	EC2-24TNJ

☐ **EC2 series High Insulation Type (ND Type)**

Option		Nominal Coil Voltage (VDC)	Coil Type	
Terminal	Packing		Non-latch	Single Coil Latch
Standard	Tube	3	EC2-3ND	EC2-3SND
		4.5	EC2-4.5ND	EC2-4.5SND
		5	EC2-5ND	EC2-5SND
		9	EC2-9ND	EC2-9SND
		12	EC2-12ND	EC2-12SND
		24	EC2-24ND	EC2-24SND

☐ **EE2 series**

Option		Nominal Coil Voltage (VDC)	Coil Type		
Terminal	Packing		Non-latch	Single Coil Latch	Double Coil Latch
Standard	Tube	3	EE2-3NU	EE2-3SNU	EE2-3TNU
		4.5	EE2-4.5NU	EE2-4.5SNU	EE2-4.5TNU
		5	EE2-5NU	EE2-5SNU	EE2-5TNU
		9	EE2-9NU	EE2-9SNU	EE2-9TNU
		12	EE2-12NU	EE2-12SNU	EE2-12TNU
		24	EE2-24NU	EE2-24SNU	EE2-24TNU
	Taping	3	EE2-3NU-L	EE2-3SNU-L	EE2-3TNU-L
		4.5	EE2-4.5NU-L	EE2-4.5SNU-L	EE2-4.5TNU-L
		5	EE2-5NU-L	EE2-5SNU-L	EE2-5TNU-L
		9	EE2-9NU-L	EE2-9SNU-L	EE2-9TNU-L
		12	EE2-12NU-L	EE2-12SNU-L	EE2-12TNU-L
		24	EE2-24NU-L	EE2-24SNU-L	EE2-24TNU-L
Minimum footprint	Tube	3	EE2-3NUH	EE2-3SNUH	EE2-3TNUH
		4.5	EE2-4.5NUH	EE2-4.5SNUH	EE2-4.5TNUH
		5	EE2-5NUH	EE2-5SNUH	EE2-5TNUH
		9	EE2-9NUH	EE2-9SNUH	EE2-9TNUH
		12	EE2-12NUH	EE2-12SNUH	EE2-12TNUH
		24	EE2-24NUH	EE2-24SNUH	EE2-24TNUH

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Minimum footprint	Taping	3	EE2-3NUH-L	EE2-3SNUH-L	EE2-3TNUH-L
		4.5	EE2-4.5NUH-L	EE2-4.5SNUH-L	EE2-4.5TNUH-L
		5	EE2-5NUH-L	EE2-5SNUH-L	EE2-5TNUH-L
		9	EE2-9NUH-L	EE2-9SNUH-L	EE2-9TNUH-L
		12	EE2-12NUH-L	EE2-12SNUH-L	EE2-12TNUH-L
		24	EE2-24NUH-L	EE2-24SNUH-L	EE2-24TNUH-L
High solder joint reliability	Tube	3	EE2-3NUX	EE2-3SNUX	EE2-3TNUX
		4.5	EE2-4.5NUX	EE2-4.5SNUX	EE2-4.5TNUX
		5	EE2-5NUX	EE2-5SNUX	EE2-5TNUX
		9	EE2-9NUX	EE2-9SNUX	EE2-9TNUX
		12	EE2-12NUX	EE2-12SNUX	EE2-12TNUX
		24	EE2-24NUX	EE2-24SNUX	EE2-24TNUX
	Taping	3	EE2-3NUX-L	EE2-3SNUX-L	EE2-3TNUX-L
		4.5	EE2-4.5NUX-L	EE2-4.5SNUX-L	EE2-4.5TNUX-L
		5	EE2-5NUX-L	EE2-5SNUX-L	EE2-5TNUX-L
		9	EE2-9NUX-L	EE2-9SNUX-L	EE2-9TNUX-L
		12	EE2-12NUX-L	EE2-12SNUX-L	EE2-12TNUX-L
		24	EE2-24NUX-L	EE2-24SNUX-L	EE2-24TNUX-L

□ EE2 series High Insulation Type (ND Type)

Option		Nominal Coil Voltage (VDC)	Coil Type	
Terminal	Packing		Non-latch	Single Coil Latch
Standard	Tube	3	EE2-3ND	EE2-3SND
		4.5	EE2-4.5ND	EE2-4.5SND
		5	EE2-5ND	EE2-5SND
		9	EE2-9ND	EE2-9SND
		12	EE2-12ND	EE2-12SND
		24	EE2-24ND	EE2-24SND
	Taping	3	EE2-3ND-L	EE2-3SND-L
		4.5	EE2-4.5ND-L	EE2-4.5SND-L
		5	EE2-5ND-L	EE2-5SND-L
		9	EE2-9ND-L	EE2-9SND-L
		12	EE2-12ND-L	EE2-12SND-L
		24	EE2-24ND-L	EE2-24SND-L

□ EE2 series High Breakdown Voltage Type (NKX Type)

Option		Nominal Coil Voltage (VDC)	Coil Type
Terminal	Packing		Non-latch
High solder joint reliability	Tube	3	EE2-3NKX
		4.5	EE2-4.5NKX
		12	EE2-12NKX
	Taping	3	EE2-3NKX-L
		4.5	EE2-4.5NKX-L
		12	EE2-12NKX-L

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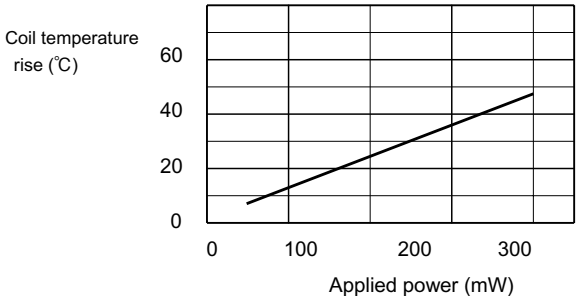
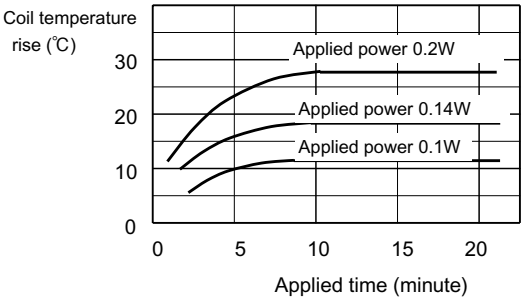
PERFORMANCE DATA

☐ COIL TEMPERATURE RISE

Temperature is measured by coil resistance

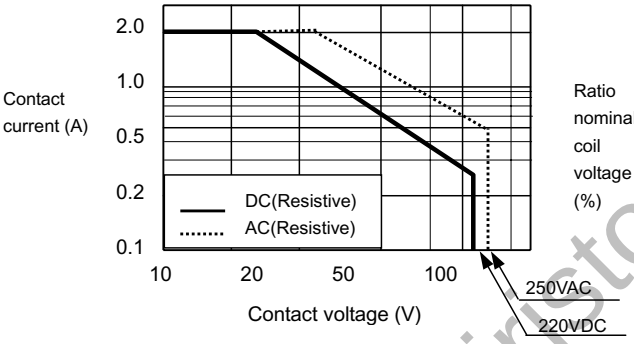




☐ SWITCHING CAPACITY

These are maximum value.

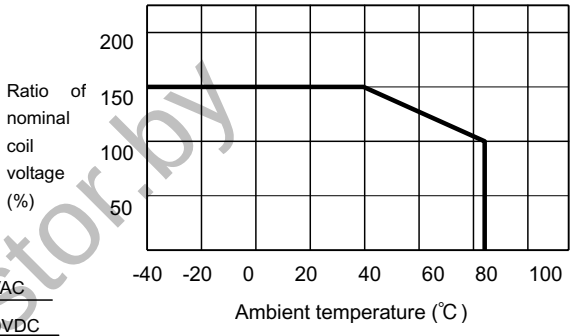
Inquire with NEC TOKIN for maximum values under continuous



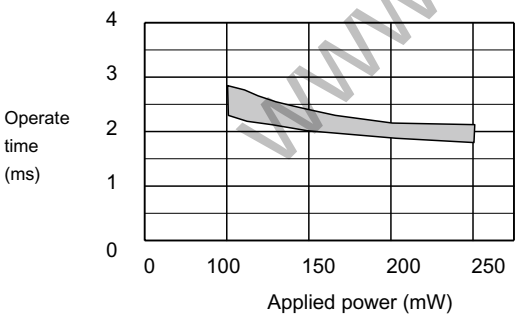
☐ MAXIMUM COIL VOLTAGE

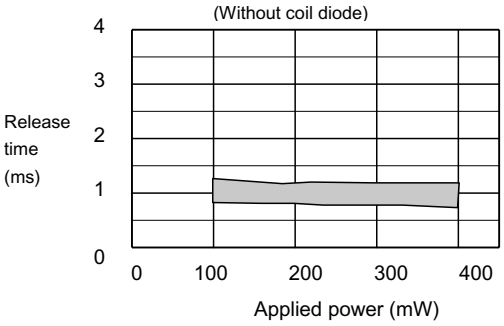
This is a maximum value of permissible alteration.

Inquire with NEC TOKIN under continuous use.



☐ APPLIED VOLTAGE VS. TIMING (Sample:EE2-5NU)





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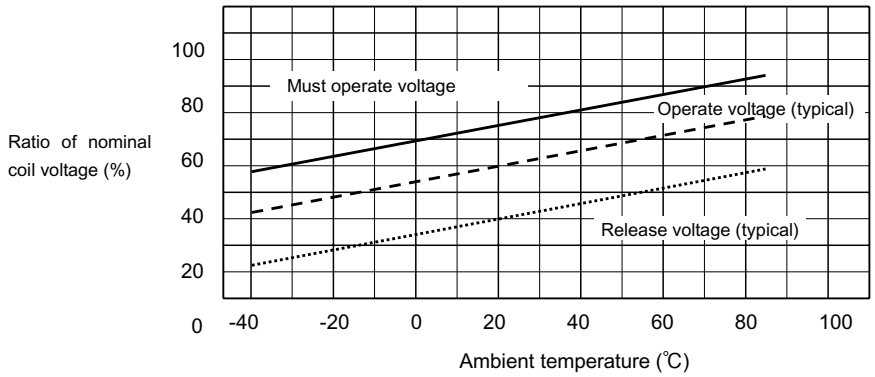
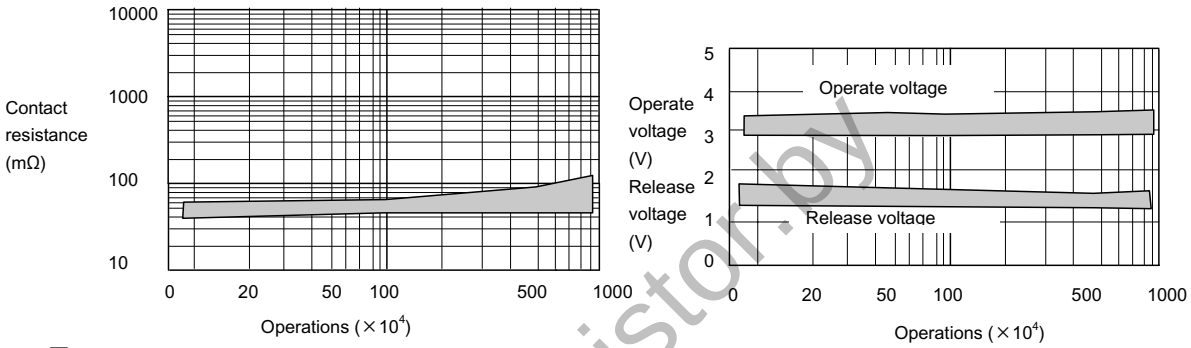
□ OPERATE AND RELEASE VOLTAGE VS.AMBIENT TEMPERATURE

This shows a typical change of operate (release) voltage. The value of must operate is estimated, so coil voltage must be applied more than this value for safety operation. For hot start operation, please inquire with NEC TOKIN.



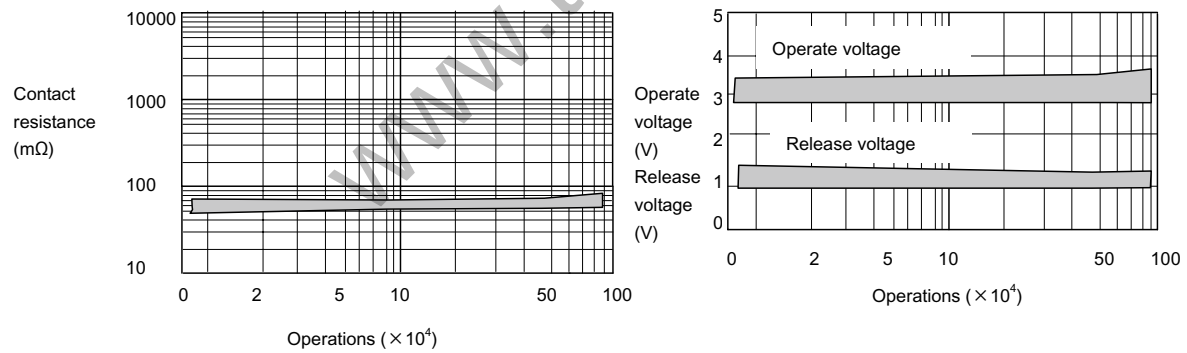
□ RUNNING TEST (Non load)

(Load: none, Drive:5VDC, 50Hz, 50%duty, Ambient temperature :room temperature, Sample:EE2-5NU ,20pieces)



□ RUNNING TEST(Load)

(Load:50VDC 0.1A resistive,Drive:5VDC,5Hz,50%duty,Ambient temperature:85℃, Sample:EE2-5NU ,10pieces)



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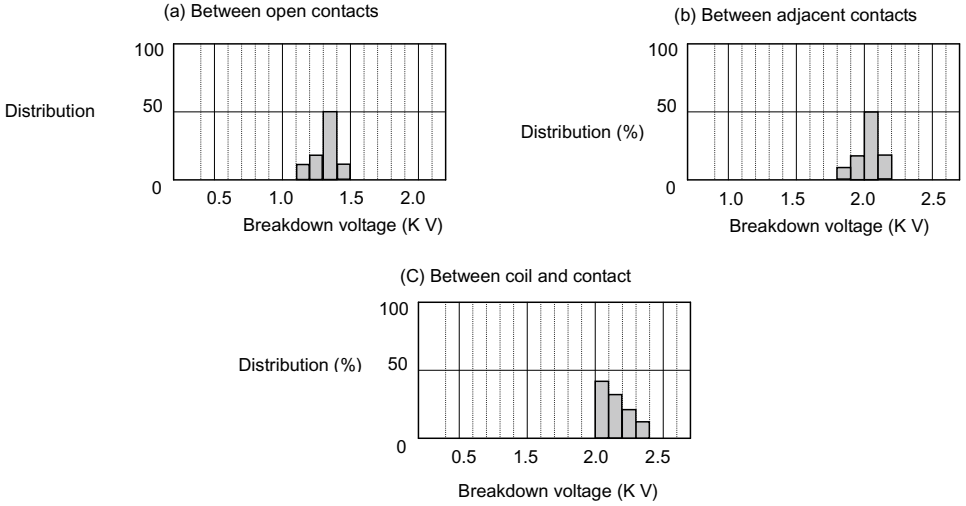
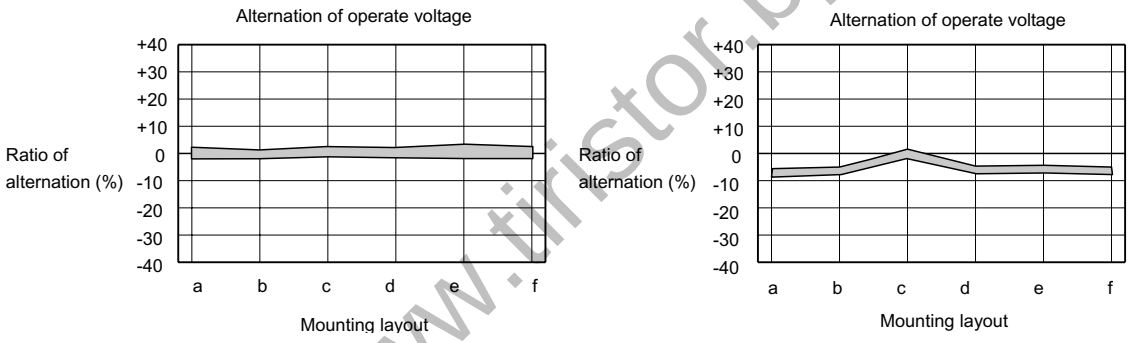
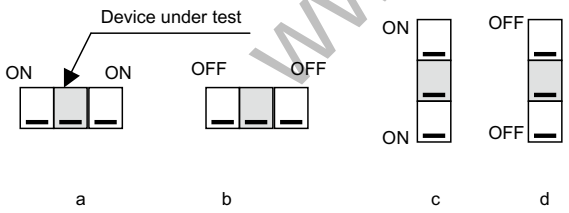
□ BREAKDOWN VOLTAGE

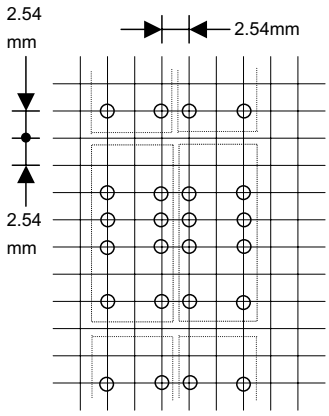
Sample: EC2-5NU 10peices

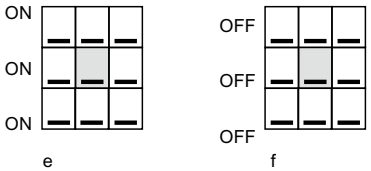


□ ALTERNATION OF VOLTAGE IN DENSE MOUNTING (Magnetic interference)









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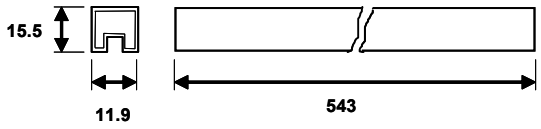
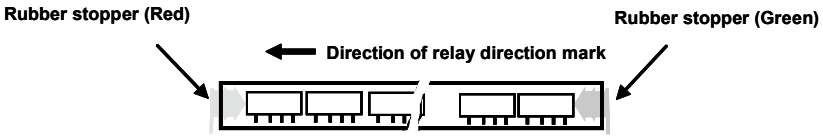
PACKING DIMENSION (Unit: mm)

TUBE PACKING (EC2/EE2)



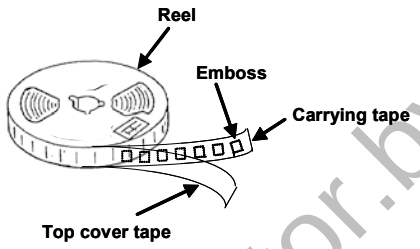
35 pieces / Tube (anti-static)



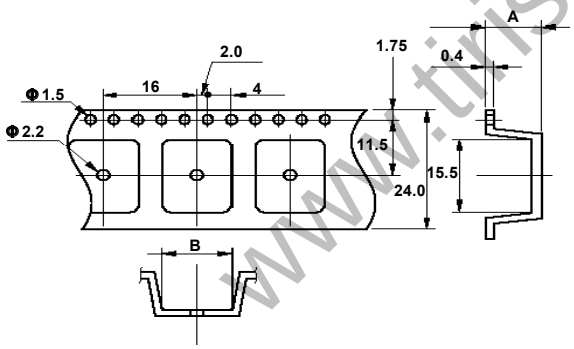
TAPE PACKING (EE2)

APPEARANCE

Number of storage: 500 pieces / Reel
Reel diameter: 380mm

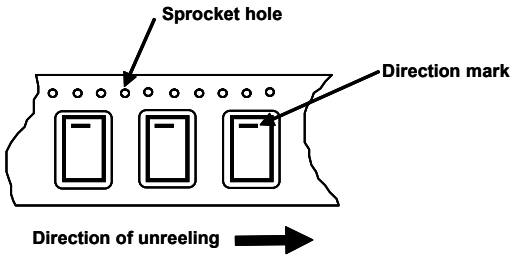


TAPE DIMENSIONS



	A	B
EE2-xxNU-L EE2-xxND-L EE2-xxNUX-L EE2-xxNKX-L	Max.10.9	10.0
EE2-xxNUH-L	Max.11.1	8.0

RELAY DIRECTION MARK AND TAPE CARRYING DIRECTION



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SOLDERING TEMPERATURE CONDITION

THROUGH-HOLE MOUNTING (EC2)

1. Automatic soldering

Preheating: 110~ 120℃ /110 sec. (max.)
Solder temperature: 260℃ max.
Solder time: 5 seconds max.

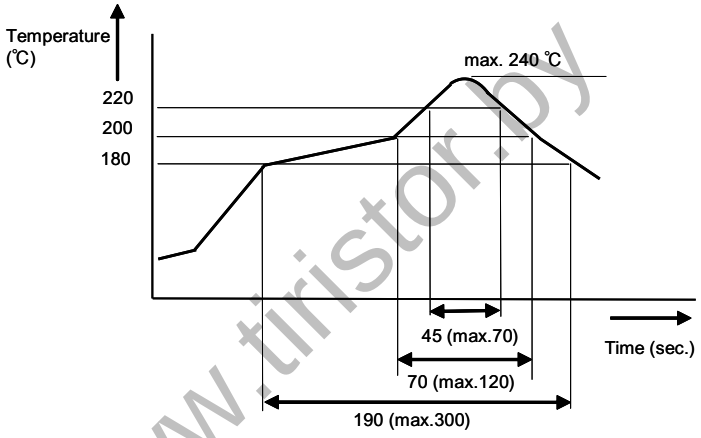
Note: NEC TOKIN recommends cooling down a printed circuit board less than 110℃ within 40 seconds after soldering.

2. Manual soldering

Solder temperature: 350℃ max.
Solder time: 3 seconds max.

SURFACE-MOUNTING TYPE (EE2)

IRS Method



Note:
1. Temperature profile shows printed circuit board surface temperature on the relay terminal portion.
2. Check the actual soldering condition to use other method except above mentioned temperature profiles.

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NOTE ON CORRECT USE

1. Notes on contact load

Make sure that the contact load is within the specified range; otherwise, the lifetime of the contacts will be shortened considerably.

Note that the running performance shown is an example, and that it varies depending on parameters such as the type of load, switching frequency, driver circuit, and ambient temperature under the actual operating conditions.

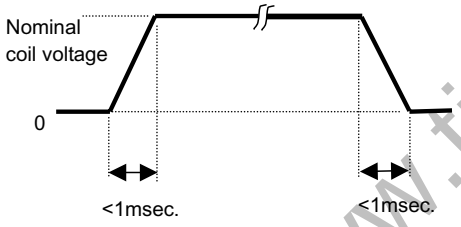
Evaluate the performance by using the actual circuit before using the relay.

2. Driving relays

- If the internal connection diagram of a relay shows + and - symbols on the coil, apply the rated voltage to the relay in the specified direction. If a rippled DC current source is used, abnormalities such as beat at the coil may occur.
- The maximum voltage that can be applied to the coil of the relay varies depending on the ambient temperature.

Generally, the higher the voltage applied to the coil, the shorter the operating time. Note, however, that a high voltage also increases the bounce of the contacts and the contact opening and closing frequency, which may shorten the lifetime of the contacts.

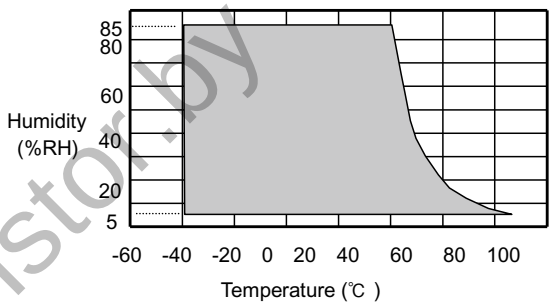
- If the driving voltage waveform of the relay coil rises and falls gradually, the inherent performance of the relay may not be fully realized. Make sure that the voltage waveform instantaneously rises and falls as a pulse.



- For a latching relay, apply a voltage to the coil according to the polarity specified in the internal connection diagram of the relay.
- If a current is applied to the coil over a long period of time, the coil temperature rises, promoting generation of organic gas inside the relay, which may result in faulty contacts. In this case, use of a latching relay is recommended.
- The operating time and release time indicate the time required for each contact to close after the voltage has been applied to or removed from the coil. However, because the relay has a mechanical structure, a bounce state exists at the end of the operating and release times. Furthermore, because additional time is required until the contact stabilizes after being in a high-resistance state, care must be taken when using the relay at high speeds.

3. Operating environment

- Make sure that the relay mounted in the application set is used within the specified temperature range. Use of a relay at a temperature outside this range may adversely affect insulation or contact performance.
- If the relay is used for a long period of time in highly humid (RH 85% or higher) environment, moisture may be absorbed into the relay. This moisture may react with the NOx and SOx generated by glow discharges that occur when the contacts are opened or closed, producing nitric or sulfuric acid. If this happens, the acid produced may corrode the metallic parts of the relay, causing operational malfunction.
- If any material containing silicon (silicon rubber, silicon oil, and silicon based coating material) is used in the neighborhood of relay, there is some possibility that these materials will emit silicon gas that will penetrate the relay. In this case, the switching contact may generate silicon compounds on the surface of contacts. This silicon compound may result in contact failure. Avoid use of relay in such an environment.
- Because the operating temperature range varies depending on the humidity, use the relay in the temperature range illustrated in the figure below. Prevent the relay from being frozen and avoid the generation of condensation.



- The relay maintains constant sealability under normal atmospheric pressure (810 to 1,200 hpa). Its sealability may be degraded or the relay may be deformed and malfunction if it is used under barometric conditions exceeding the specified range.
- The same applies when the relay is stored or transported. Keep the upper-limit value of the temperature to which the relay is exposed after it is removed from the carton box to within 50℃ .
- Permanent magnets are used in polarized relays. For this reason, when magnets, transformers, or speakers are located nearby the relay characteristics may change and faulty operations may result.
- If excessive vibration or shock is applied to the relay, it may malfunction and the contacts remain closed. Vibration or shock applied to the relay during operation may cause considerable damage to or wearing of the contacts. Note that operation of a snap switch mounted close to the relay or shock due to the operation of magnetic solenoid may also cause malfunctioning.

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4. Notes on mounting relays

- When mounting a relay onto a PC board using an automatic chip mounter, if excessive force is applied to the cover of the relay when the relay is chucked or inserted, the cover may be damaged or the characteristics of the relay degraded. Keep the force applied to the relay to within 1 kg.
- Avoid bending the pins to temporarily secure the relay to the PC board. Bending the pins may degrade sealability or adversely affect the internal mechanism.
- It is recommended to solder the relay onto a PC board under the following conditions:

<1> Reflow soldering

Refer to the recommended soldering temperature profile.

<2> Flow soldering

Solder temperature: 260℃ max., Time: 5 seconds max.

Preheating: 110~ 120℃ /110 sec. (max.)

<3> Manual soldering

Solder temperature: 350℃ , Time: 2~3 seconds

- Ventilation immediately after soldering is recommended. Avoid immersing the relay in cleaning solvent immediately after soldering due to the danger of thermal shock being applied to the relay.
- Use an alcohol-based or water-based cleaning solvent. Never use thinner and benzene because they may damage the relay housing.
- Do not use ultrasonic cleaning because the vibration energy generated by the ultrasonic waves may cause the contacts to remain closed.

5. Handling

- Relays are packaged in magazine cases for shipment. If a space is created in the case after some relays have been removed, be sure to insert a stopper to secure the remaining relays in the case. If relays are not well secured, vibration during transportation may cause malfunctioning of the contacts.
- Exercise care in handling the relay so as to avoid dropping it or allowing it to fall. Do not use a relay that has been dropped. If a relay drops from a workbench to the floor, a shock of 9,800 m/s2 (1,000 G) or more is applied to the relay, possibly damaging its functions. Even if a light shock has been applied to the relay, thoroughly evaluate its operation before using it.
- Latching relays are factory-set to the reset state for shipment. A latching relay may be set, however, by vibration or shock applied while being transported. Be sure to forcibly reset the relay before using it in the application set. Also note that the relay may be set by unexpected vibration or shock when it is used in a portable set.
- The sealability of a surface-mount (SMT) relay may be lost if the relay absorbs moisture and is then heated during soldering. When storing relays, therefore, observe the following points:

<1> For standard packing, please use relays within 12 months after delivery. (Storage conditions: 30℃ / 60% RH)

If the relays have moisture absorption, dehumidify as follows.

Tape packing: 50 ± 5℃ , 200~300 hours.

Simple relay: 85 ± 5℃ , 48 hours.

<2> For MBB packing, please use relays within 2 years after delivery.

(Storage conditions: 30℃ / 60% RH)

After open MBB packing, please use within 3 months.

(Storage conditions: 30℃ / 60% RH)

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Devices thru Material Innovation

NEC/TOKIN

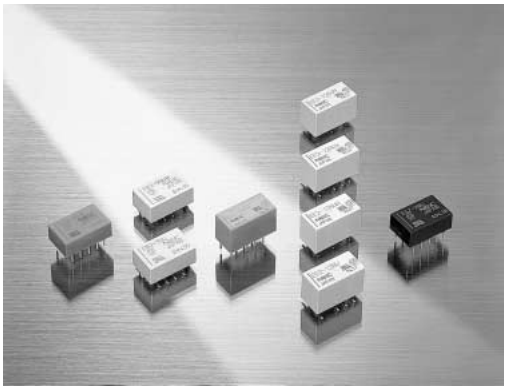
Miniature Relays

2nd edition

Introduction to NEC TOKIN E.M. Devices

Since NEC industrialized telephone relays in Japan more than a half century ago, many technological innovations have taken place in its electromechanical devices (E.M. devices).
NEC's relays were designed and manufactured always on the basis of the newest technology that the company develops. Their high reliability and advanced features assure the high reliability and high performance of your products.
NEC divided and transferred its business of manufacturing and sale of relays to Tokin, as of April 1, 2002. Then Tokin Corporation changed its corporate name to "NEC TOKIN Corporation," which has charge of electronic components business within the NEC Group.

Miniature Relay



Miniature Signal Relay

Miniature Power Relay

Introduction of NEC TOKIN's miniature relays

NEC TOKIN's miniature relays can be classified into two types. Signal relays that are mainly used by communication equipment manufacturers in the world, and power relays that satisfy the needs of automobile electronic systems and household electronic appliances.

Feature

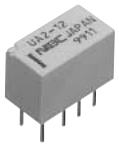
Miniature signal relay

- Compact and lightweight for dense mounting
- Low power consumption
- Plastic-sealed package
- High withstand voltage
- Surface mounting product lineup

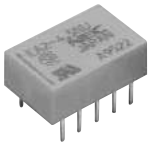
Miniature power relay

- High power switching capability
- Compact and lightweight with twin relay structure
- Flux tight housing
- Washable with plastic-sealed package
- Semicustom-made-product available for various application

Selector Chart

•Group		Miniature Relay-Signal			
•Type of Relay		**UA2** 	**UB2** 	**UC2** 	**UD2** 
•Features		•super-compact size •dual-inline leads (small mounting space) •2500V surge (2 x 10 μs*) •latching type available •Low power consumption type available	•super-compact size •surface mount (small mounting space) •2500V surge (2 x 10 μs*) •latching type available •Low power consumption type available	•super-compact size •dual-inline leads (low profile type) •2500V surge (2 x 10 μs*) •latching type available	•super-compact size •surface mount (low profile type) •2500V surge (2 x 10 μs*) •latching type available
•Contact Arrangement		2c			
•Contact Material (standard)		silver alloy with gold alloy overlay			
•Contact Rating (resistive) (switching)	3A 2A 1A	30W/37.5 VA 1.0A			
•Coil Voltage		1.5,3,4.5,5,6,9,12,24 Vdc			
•Nominal Operate Power		100 to 230mW (latch type 100 to 120 mW)			
•Must Operate Voltage		75%			
•Must Release Voltage		10%			
•Operate Time (typ.) (Excluding bounce)		2ms			
•Release Time (typ.) (Excluding bounce Without Diode)		1ms			
•Running Specifications	Load	1×10^5 (30 Vdc, 1 A at 20°C) 1×10^5 (125 Vac, 0.3A at 20°C)			
	Nonload	10 $\times10^6$			
•Withstand Voltage	Between open contacts	1000Vac			
	Between adjacent contacts	1000Vac			
	Between contacts and coil	1500Vac			
•Surge Withstand Voltage		1500V(FCC), 2500 V***(2x10 μs, coil to contacts)			
•Safety Standard		UL, CSA, TUV			
•Option		latching type			
•Height (mm)		8.3	8.8	5.6	5.45
•Mounting Space (mm^2)		6.0 × 10.9	7.4 × 10.9	6.8 × 10.9	8.4 × 10.9
•Page		10 to 11 , 15	12 to 15	16 to 17, 21	18 to 20, 21

Selector Chart

Miniature Relay-Signal				• Group
EA2 	**EB2** 	**EC2** 	**EE2** 	• Type of Relay
•Low power consumption •Low magnetic interference •1500V FCC surge 1000Vac FCC •compact, light weight •latching type available	•surface mount •Low power consumption •Low magnetic interference •1500V FCC surge 1000Vac FCC •compact, light weight •latching type available •ultra-low profile type is line up.	•Low power consumption •dual-inline leads (small mounting space) •2500 V surge (2 x 10 μs*) coil to contacts •latching type available •high-insulation type is line up.	•Low power consumption •surface mount (reduced mounting space) •2500 V surge (2 x 10 μs*) coil to contacts •latching type available •high-insulation type is line up.	• Features
2c				• Contact Arrangement
silver alloy with gold alloy overlay				• Contact Material (standard)
30W/62.5 VA		60W/125 VA (UL/CSA Rating)		• Contact Rating (resistive) (switching)
1.0A		2.0A		3A / 2A / 1A
3,4.5,5,6,9,12,24 Vdc				• Coil Voltage
140mW (latch type 100 ~ 200 mW)				• Nominal Operate Power
75%				• Must Operate Voltage
10%				• Must Release Voltage
2ms				• Operate Time (typ.) (Excluding bounce)
1ms				• Release Time (typ.) (Excluding bounce Without Diode)
1× 10^6 (50 Vdc, 0.1 A at 85°C,5Hz) 1× 10^6 (10 Vdc, 10 mA at 85°C,2Hz)				Load — • Running Specifi-cations
10 x10^6				Nonload — • Running Specifi-cations
1000Vac				Between open contacts — • With-stand Voltage
1000Vac				Between adjacent contacts — • With-stand Voltage
1000Vac		1500 Vac or 1000Vac**		Between contacts and coil — • With-stand Voltage
1500V FCC		1500V (FCC), 2500 V***(2x10ms, coil to contacts)		• Surge Withstand Voltage
UL, CSA				• Safety Standard
latching type				• Option
5.4	7.5	9.4	10.0	• Height (mm)
9.2 × 14.2	9.3 × 14.3	7.5 × 15.0	9.5 × 15.0	• Mounting Space (mm^2)
22 to 23, 28	24 to 28	29 to 31, 36	32 to 36	• Page

* 2 μs of rise time and 10 μs of decay time to half crest. ★ For individual correspondence at Nonlatch type only
** for double coil latch type
*** 1500V for double coil latch type

Selector Chart

• Group		Miniature Relay-Signal				
• Type of Relay		**ED2** 	**EF2** 	**MR62** 	**MR62-K -Y -KY** 	**MR82** 
• Features		•ultra-low power consumption •dual-inline leads (small mounting space) •2500 V surge (2 x 10 μs*) coil to contacts •latching type available	•ultra-low power consumption •surface mount (reduced mounting space) •2500V surge (2 x 10 μs*) coil to contacts •latching type available	•DIP terminal •sealed package for flow soldering •stable contact resistance at high temperature •1500V FCC surge #	•DIP terminal •sealed package for flow soldering •stable contact resistance at high temperature •1500V FCC surge #	• DIP terminal • sealed package • lower power comsumption (200mW) • stable contact resistance at high temperature • 1500V FCC surge # coil and contacts
• Contact Arrangement		2c				
• Contact Material (standard)		silver alloy with gold alloy overlay				
• Contact Rating (resistive) (switching)	3A 2A 1A	30W/62.5 VA 1.0A		60W/125 VA 2.0A		
• Coil Voltage		1.5,3,4.5,5,6,9,12,24 Vdc		5,6,9,12,24,48 Vdc		4.5,5,6,9,12,24 Vdc
• Nominal Operate Power		30 to 70mW		550mW	400mW or 550mW	200mW
• Must Operate Voltage		80% (75%*)		62 to 72 %	70 % 48 %...80 %	70 %
• Must Release Voltage		10%		5%		
• Operate Time (typ.) (Excluding bounce)		3ms		2.5ms	2.5ms (K type 3.5ms)	5.5ms
• Release Time (typ.) (Excluding bounce Without Diode)		2ms				
• Running Specifications	Load	1×10^6 (50 Vdc, 0.1 A at 70°C,5Hz) 1×10^6 (10 Vdc, 10 mA at 70°C,2Hz)		1×10^6 (50 Vdc, 0.1 A at 85°C,5Hz) 1×10^6 (10 Vdc, 10 mA at 85°C,2Hz)		
	Nonload	10×10^6				
• Withstand Voltage	Between open contacts	1000Vac		500Vac	1000Vac or 500Vac	500Vac
	Between adjacent contacts	1000Vac				
	Between contacts and coil	1500Vac or 1000Vac**		1000Vac		
• Surge Withstand Voltage		1500V(FCC), 2500 V***(2x10 μs, coil to contacts)		1500V FCC#		
• Safety Standard		UL, CSA				
• Option		latching type		—		
• Height (mm)		9.4	10.0	11.4		
• Mounting Space (mm^2)		7.5 × 15.0	9.5 × 15.0	9.8 × 20.2		
• Page		37 to 38 , 42	39 to 41, 42	43, 46	44, 46	45, 46

#FCC surge between coi and contacts and between adjacent contacts

Selector Chart

Miniature Relay-Power			• Group
EN2 	***EP2*** 	***EP1*** 	• Type of Relay
•motor reversible control •30% less relay space than 2 MR301 relays •symmetrical structure •flux tight housing	•motor reversible control •50% less relay space than 2 MR301 relays •symmetrical structure •flux tight housing	•motor reversible control •65% relay volume than MR301 •62% relay weight than MR301 •flux tight housing	• Features
1c × 2	1c × 2	1c	• Contact Arrangement
silver oxide complex alloy			• Contact Material (standard)
35A (16Vdc)	30A(16Vdc)	30A (16Vdc)	30A 25A 20A 15A 10A 5A 1A • Contact Rating (DC motor load) (switching)
12 Vdc			• Coil Voltage
640mW / 800mW / 1150mW	480mW / 640mW		• Nominal Operate Power
6.5 to 8.5Vdc			• Must Operate Voltage
0.6 or 0.9 Vdc	0.9 Vdc		• Must Release Voltage
Approx. 5ms			• Operate Time (typ.) (Excluding bounce)
Approx. 7ms			• Release Time (typ.) (Excluding bounce With Diode)
100×10^3 motor load 14Vdc, 30A / 7A	100×10^3 motor load 14Vdc, 25A / 3A		Load — • Running Specifications
1×10^6			Nonload — • Running Specifications
500Vac			Between open contacts — • Withstand Voltage
500Vac		—	Between adjacent contacts — • Withstand Voltage
500Vac			Between contacts and coil — • Withstand Voltage
—			• Surge Withstand Voltage
—			• Safety Standard
Separate type		—	• Option
17.0	16.5	16.5	• Height (mm)
16.5 × 33.5	16.7 × 24.3	16.7 × 15.1	• Mounting Space (mm^2)
47 to 49	50 to 52	53 to 55	• Page

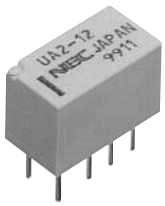
Selector Chart

• Group		Miniature Relay-Power					
		EQ1-31000	***EQ1-11040***	***EQ1-11111***	***EQ1-22111***	***ET 1***	***ET 2***
• Type of Relay							
• Features		•same pin-layout as MR301 •for general purpose •small size & light weight •flux tight housing	•same pin-layout as MR301 •for jump start •small size & light weight •flux tight housing	•same pin-layout as MR301 •for lamp & LCR circuit control •small size & light weight •flux tight housing		•motor heater and solenoid control •45% less relay volume than EP1 •56% less relay weight than EP1 •flux tight housing	•motor reversible control •50% less relay volume than EP2 •50% less relay weight than EP2 •flux tight housing
• Contact Arrangement		1c		1a		1c	1c × 2
• Contact Material (standard)		silver oxide complex alloy				silver oxide complex alloy	
• Contact Rating (DC motor load) (switching)	30A 25A 20A 15A 10A 5A 1A	30A(16Vdc)				25A(16Vdc)	
• Coil Voltage		12 Vdc					
• Nominal Operate Power		640mW	1000mW		800mW	640mW	
• Must Operate Voltage		6.5Vdc			7.2Vdc	6.5Vdc	
• Must Release Voltage		0.9 Vdc	0.6Vdc		0.7Vdc	0.9 Vdc	
• Operate Time (typ.) (Excluding bounce)		Approx. 3ms				Approx. 2.5ms	
• Release Time (typ.) (Excluding bounce With Diode)		Approx. 4ms				Approx. 3ms	
• Running Specifications	Load	100×10^3 motor load, 25A / 3A		100×10^3 lamp load or LCR circuit (peak current 70A)		100×10^3 motor load	
	Nonload	1×10^6					
• Withstand Voltage	Between open contacts	500Vac					
	Between adjacent contacts	—					
	Between contacts and coil	500Vac					
• Surge Withstand Voltage		—					
• Safety Standard		—					
• Option		—					
• Height (mm)		15.4				11.0	
• Mounting Space (mm^2)		15.0 × 21.8				13.3 × 14.5	13.3 × 22.5
• Page		56 to 57				58 to 61	

Selector Chart

Miniature Relay-Power			• Group	
MR301	***MR301-H***	***MR301-E***		
			• Type of Relay	
• low profile • specialty for automotive • flux tight	• low profile • high power switching • flux tight	• low profile • high power switching • flux tight • specialty for automotive	• Features	
1c			• Contact Arrangement	
silver nickel alloy	silver oxide complex alloy		• Contact Material (standard)	
150W/600 VA (resistive load) 5A	300W/1200 VA (resistive load) 10A	240W (DC motor load) 15A (16Vdc)	15A 10A 5A 1A 0.1A	• Contact Rating (switching)
3,5,6,9,12,24 Vdc		9,12 Vdc	• Coil Voltage	
360mW			• Nominal Operate Power	
70%			• Must Operate Voltage	
10%			• Must Release Voltage	
Approx. 5ms			• Operate Time (typ.) (Excluding bounce)	
Approx. 6ms (with diode)			• Release Time (typ.) (Excluding bounce Without Diode)	
100×10^3 14Vdc, 5A	100×10^3 14Vdc, 10A	100×10^3 (DC motor load) 14Vdc, 15A	Load	• Running Specifications
10×10^6			Nonload	
750Vac			Between open contacts	• Withstand Voltage
—			Between adjacent contacts	
1500Vac			Between contacts and coil	
—			• Surge Withstand Voltage	
UL, CSA			• Safety Standard	
—			• Option	
17.0			• Height (mm)	
16.5 × 22.5			• Mounting Space (mm^2)	
62 to 63			• Page	

UA2 Series

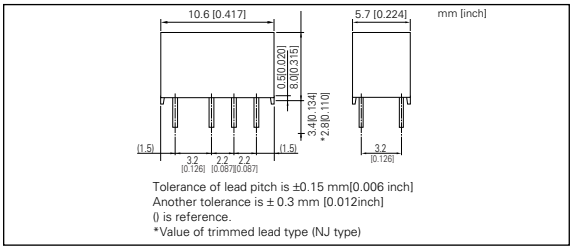


NECTOKIN's UA2 relay is a new generation Miniature Singnal Relay of super-compact size and slim-package.

■ FEATURES

- small mounting size of slim package for dence mounting.
- Bellcore (2500 V) and FCC (1500 V) surge capability.
- IEC950 / UL1950 / EN60950 spacing and high breakdown voltage. (Basic insulation class on 200 V working voltage)
- Power consumption 140mW, Low power consumption 100mW type is available
- UL recognized (E73266), CSA certified (LR46266)

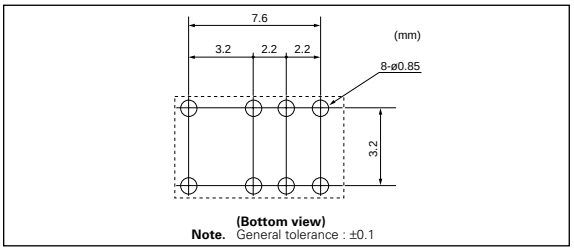
■ DIMENSIONS mm(inch)



Tolerance of lead pitch is ±0.15 mm[0.006 inch]
Another tolerance is ± 0.3 mm [0.012inch]
() is reference.
*Value of trimmed lead type (NJ type)

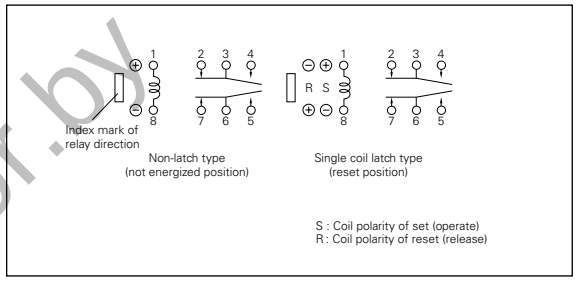
■ RECOMMENDED PAD LAYOUT

(bottom view)mm(inch)



(Bottom view)
Note. General tolerance : ±0.1

■ SCHEMATICS (bottom view)



S : Coil polarity of set (operate)
R : Coil polarity of reset (release)

■ SPECIFICATIONS

Contact Form		2 Form c	
Contact Material		Silver alloy with gold alloy overlay	
Contact Ratings	Maximum Switching Power	30 W, 37.5 VA	
	Maximum Switching Voltage	220 Vdc, 250 Vac	
	Maximum Switching Current	1 A	
	Maximum Carrying Current	1 A	
Minimum Contact Ratings		10 mVdc, 10 μA*1	
Initial Contact Resistance		100 mΩ max.(Initial)	
Nominal Operating Power	Nonlatch type	140 mW (1.5 to 12 V), 230 mW (24 V)	100 mW (low power consumption type)
	Single coil latch type	100 mW (1.5 to 12 V), 120 mW (24 V)	
Operate Time (Excluding bounce)		Approx. 2 ms	
Release Time (Excluding bounce)		Approx. 1 ms	
Insulation Resistance		1000 MΩ at 500 Vdc	
Withstand Voltage	Between open contacts	1000 Vac (for one minute) 1500 V surge (10 × 160 μs*2)	
	Between adjacent contacts		
	Between coil to contacts	1500 Vac (for one minute) 2500 V surge (2 × 10 μs*3)	
Shock Resistance		735 m/s² (misoperation) 980 m/s² (destructive failure)	
Vibration Resistance		10 to 55 Hz, double amplitude 3 mm (misoperating) 10 to 55 Hz, double amplitude 5 mm (destructive failure)	
Ambient Temperature		-40 to + 85°C	
Coil Temperature Rise		18 degrees at nominal coil voltage (140 mW)	
Running Specifications	Nonload	5 × 10⁷ *4 operations(Non-latch type)	
	Load	30 Vdc, 1 A (resistive), 1 × 10⁵ operations at 20°C	
		125 Vac, 0.3 A (resistive), 1 × 10⁵ operations at 20°C	
Weight		Approx. 1 g	

* 1 This value is a reference value in the resistance load.
Minimum capacity changes depending on switching frequency and environment temperature and the load.
* 2 rise time : 10 μs, decay time to half crest : 160 μs
* 3 rise time : 2 μs, decay time to half crest : 10 μs
* 4 This shows a number of operation where it can be running by which a fatal defect is not caused, and a number of operation by which a steady characteristic is maintained is 1×10⁷ times.

■ PART NUMBER SYSTEM

UA2-3SNU

- Option
  - NU : Standard
  - NR : Silver-nickel alloy contact (with gold alloy overlay)
  - NJ : Trimmed lead type
  - NRJ : Trimmed lead type of Silver-nickel alloy contact
  - NE : Low power consumption type
  - NEJ : Low power consumption type with trimmed lead
- Latch type
  - Nil : Nonlatch type
  - S : Single coil latch type
- Nominal coil voltage
  A numerical value of coil voltage
  (See part numbers)
- Series name

■ SAFETY STANDARD AND RATING

UL Recognized (UL508)* File No. E73266	CSA Certified (CSA C22.2 No14)+ File No. LR46266
30 Vdc, 1 A (Resistive) 110 Vdc, 0.3 A (Resistive) 125 Vac, 0.3 A (Resistive)	

* Spacing : UL840
+ Spacing : CSA std950

TUV Certified (EN61810)
No. R 2050596
Creepage and clearance of coil to contact is over than 2 mm (According EN60950)
Basic insulation class

■ PART NUMBERS

• Nonlatch Type

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
UA2-1.5NU	1.5	16	1.13	0.15
UA2-3NU	3	64.3	2.25	0.3
UA2-4.5NU	4.5	145	3.38	0.45
UA2-5NU	5	178	3.75	0.5
UA2-6NU	6	257	4.5	0.6
UA2-9NU	9	579	6.75	0.9
UA2-12NU	12	1028	9.0	1.2
UA2-24NU	24	2504	18.0	2.4

• Single Coil Latch Type

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
UA2-1.5SNU	1.5	22.5	1.13	1.13
UA2-3SNU	3	90	2.25	2.25
UA2-4.5SNU	4.5	202.5	3.38	3.38
UA2-5SNU	5	250	3.75	3.75
UA2-6SNU	6	360	4.5	4.5
UA2-9SNU	9	810	6.75	6.75
UA2-12SNU	12	1440	9.0	9.0
UA2-24SNU	24	4800	18.0	18.0

• Nonlatch NE Type (Low power consumption)

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
UA2-3NE	3	90	2.25	0.3
UA2-4.5NE	4.5	202.5	3.38	0.45
UA2-5NE	5	250	3.75	0.5

Note * Test by pulse voltage
The latch type relays should be initialized at appointed position before using, and should be enegized to specific polarity by above polarity to avoid wrong operation.
Any special coil requirement, Please contact NEC TOKIN for availability.

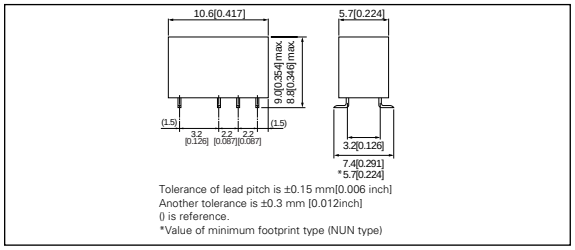
UB2 Series

NEC TOKN's UB2 relay is a new generation Miniature Singnal Relay of super-compact size and slim-package for surface mounting.

■ FEATURES

- Small mounting size of slim package for dence mounting.
- Bellcore (2500 V) and FCC (1500 V) surge capability.
- IEC950 / UL1950 / EN60950 spacing and high breakdown voltage. (Basic insulation class on 200 V working voltage)
- Power consumption 140 mW, Low power consumption 100 mW type is available.
- UL recognized (E73266), CSA certified (LR46266)
- Tube or embossed tape packaging.

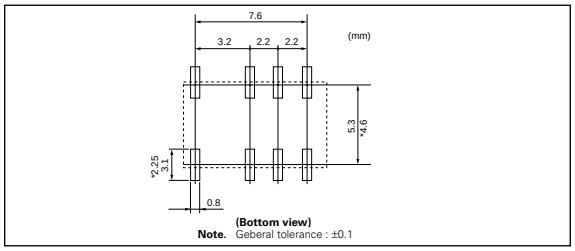
■ DIMENSIONS mm(inch)



Tolerance of lead pitch is ±0.15 mm[0.006 inch]
Another tolerance is ±0.3 mm [0.012inch]
() is reference.
*Value of minimum footprint type (NUN type)

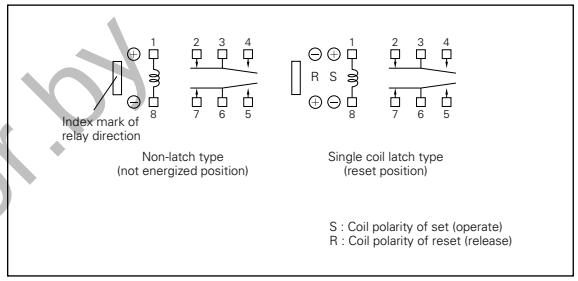
■ RECOMMENDED PAD LAYOUT

(bottom view)mm(inch)



(Bottom view)
Note. Geberal tolerance : ±0.1

■ SCHEMATICS (bottom view)



Non-latch type (not energized position)

Single coil latch type (reset position)

S : Coil polarity of set (operate)
R : Coil polarity of reset (release)

■ SPECIFICATIONS

Contact Form		2 Form c
Contact Material		Silver alloy with gold alloy overlay
Contact Ratings	Maximum Switching Power	30 W, 37.5 VA
	Maximum Switching Voltage	220 Vdc, 250 Vac
	Maximum Switching Current	1 A
	Maximum Carrying Current	1 A
Minimum Contact Ratings		10 mVdc, 10 μA*1
Initial Contact Resistance		100 mΩ max.(Initial)
Nominal Operating Power	Nonlatch type	140 mW (1.5 to 12 V), 230 mW (24 V) | 100 mW (low power consumption type)
	Single coil latch type	100 mW (1.5 to 12 V), 120 mW (24 V)
Operate Time (Excluding bounce)		Approx. 2 ms
Release Time (Excluding bounce)		Approx. 1 ms
Insulation Resistance		1000 MΩ at 500 Vdc
Withstand Voltage	Between open contacts	1000 Vac (for one minute) 1500 V surge (10 × 160 μs*2)
	Between adjacent contacts	
	Between coil to contacts	1500 Vac (for one minute) 2500 V surge (2 × 10 μs*3)
Shock Resistance		735 m/s² (misoperation) 980 m/s² (destructive failure)
Vibration Resistance		10 to 55 Hz, double amplitude 3 mm (misoperation) 10 to 55 Hz, double amplitude 5 mm (destructive failure)
Ambient Temperature		-40 to + 85°C
Coil Temperature Rise		18 degrees at nominal coil voltage (140 mW)
Running Specifications	Nonload	5 × 10⁷ *4 operations(Nonlatch type)
	Load	30 Vdc, 1 A (resistive), 1 × 10⁵ operations at 20°C
		125 Vac, 0.3 A (resistive), 1 × 10⁵ operations at 20°C
Weight		Approx. 1 g

* 1 This value is a reference value in the resistance load.
Minimum capacity changes depending on switching frequency and environment temperature and the load.
* 2 rise time : 10 μs, decay time to half crest : 160 μs
* 3 rise time : 2 μs, decay time to half crest : 10 μs
* 4 This shows a number of operation where it can be running by which a fatal defect is not caused, and a number of operation by which a steady characteristic is maintained is 1×10⁷ times.

■ PART NUMBER SYSTEM

UB2-3SNU - L1

- Package
  - Nil : Tube
  - L : Embossed carrying tape of L type
  - R : Embossed carrying tape of R type
- Option
  - NU : Standard
  - NR : Silver-nickel alloy contact (with gold alloy overlay)
  - NUN : Minimum footprint type
  - NRN : Minimum footprint type of Silver-nickel alloy contact
  - NE : Low power consumption type
  - NEN : Low power consumption type with trimmed lead
- Latch type
  - Nil : Nonlatch type
  - S : Single coil latch type
- Nominal coil voltage
  A numerical value of coil voltage
  (See part numbers)
- Series name

■ SAFETY STANDARD AND RATING

UL Recognized (UL508)* File No. E73266	CSA Certificated (CSA C22.2 No14)+ File No. LR46266
30 Vdc, 1 A (Resistive) 110 Vdc, 0.3 A (Resistive) 125 Vac, 0.3 A (Resistive)	

* Spacing : UL840
+ Spacing : CSA std950

TUV Certified (EN61810)
No. R 2050596
Creepage and clearance of coil to contact is over than 2 mm (According EN60950)
Basic insulation class

■ PART NUMBERS

• Nonlatch Type

at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
UB2-1.5NU	1.5	16	1.13	0.15
UB2-3NU	3	64.3	2.25	0.3
UB2-4.5NU	4.5	145	3.38	0.45
UB2-5NU	5	178	3.75	0.5
UB2-6NU	6	257	4.5	0.6
UB2-9NU	9	579	6.75	0.9
UB2-12NU	12	1028	9.0	1.2
UB2-24NU	24	2504	18.0	2.4

• Single Coil Latch Type

at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
UB2-1.5SNU	1.5	22.5	1.13	1.13
UB2-3SNU	3	90	2.25	2.25
UB2-4.5SNU	4.5	202.5	3.38	3.38
UB2-5SNU	5	250	3.75	3.75
UB2-6SNU	6	360	4.5	4.5
UB2-9SNU	9	810	6.75	6.75
UB2-12SNU	12	1440	9.0	9.0
UB2-24SNU	24	4800	18.0	18.0

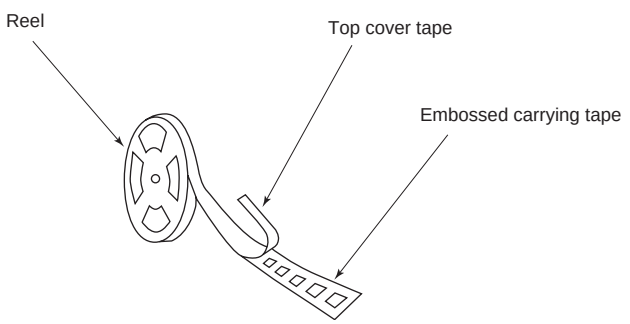
• Nonlatch NE Type (Low power consumption)

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
UB2-3NE	3	90	2.25	0.3
UB2-4.5NE	4.5	202.5	3.38	0.45
UB2-5NE	5	250	3.75	0.5

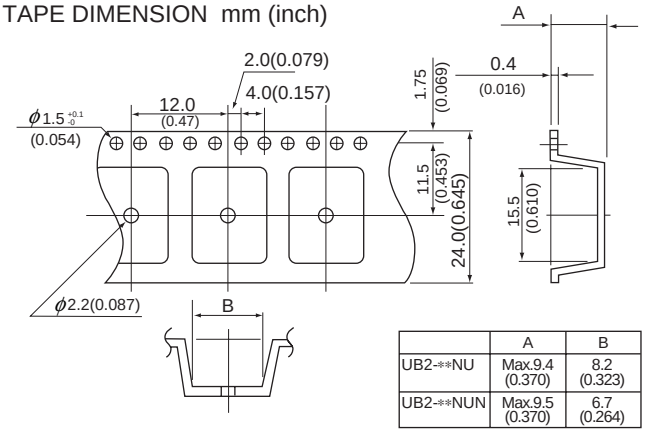
Note * Test by pulse voltage
The latch type relays should be initialized at appointed position before using, and should be enegized to specific polarity by above polarity to avoid wrong operation.
Any special coil requirement, Please contact NEC TOKIN for availability.

■ TAPE PACKAGE (OPTION)

APPEARANCE

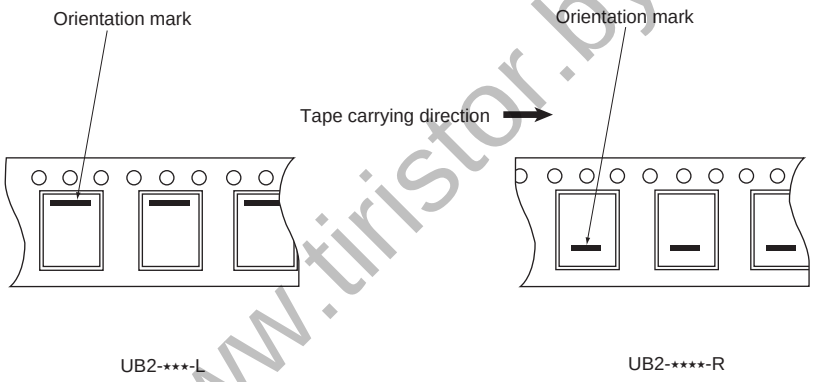


TAPE DIMENSION mm (inch)



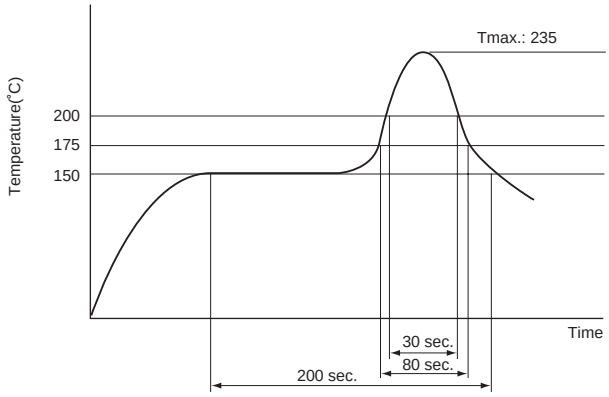
	A	B
UB2-**NU	Max.9.4 (0.370)	8.2 (0.323)
UB2-**NUN	Max.9.5 (0.370)	6.7 (0.264)

Relay orientation mark and tape carrying direction.



■ SOLDERING CONDITION

IRS Method



Note

1. Temperature profile shows printed circuit board surface temperature on the relay terminal portion.
2. Check the actual soldering condition to use other method except above mentioned temperature profiles.

■ Recommended relay drive conditions

Drive under conditions. If it is impossible, please inquire to NEC TOKIN.

Nonlatch type	Voltage:within ±5% at nominal voltage	
Single coil latch type Double coil latch type	Square pulse (rise and fall time is rapidly) Pulse height: within ±5% at nominal voltage Pulse width: more than 10 ms	Ambient temperature -40~+85˚C

■ Technical document

Please confirm technical document before use.
It is able to receive a document at NEC TOKIN's World-wide-web site.
(http://www.nec-tokin.com)

ITEM	TITLE
Data sheet	UA2/UB2 series
	UA2/UB2 series NE type
Information	UA2/UB2 series technical data
User's manual	Function and note on correct use
Application note	Application circuit of miniature signal relay

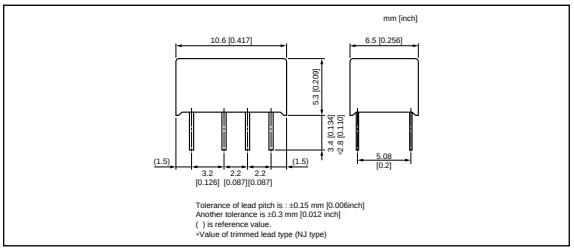
UC2 Series

NEC TOKIN's UC2 relay is a new generation Miniature Singnal Relay of super-compact size and flat-package.

■ FEATURES

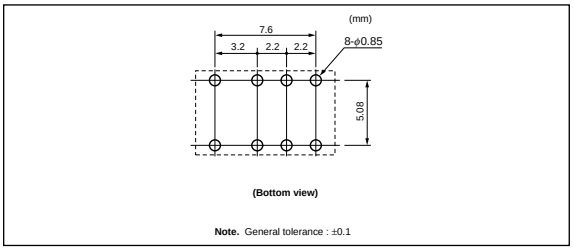
- small mounting size of flat package for dence mounting.
- Bellcore (2500 V) and FCC (1500 V) surge capability.
- IEC950 / UL1950 / EN60950 spacing and high breakdown voltage. (Basic insulation class on 200 V working voltage)
- Low power consumption 140mW
- UL recognized (E73266), CSA certified (LR46266)

■ DIMENSIONS mm(inch)

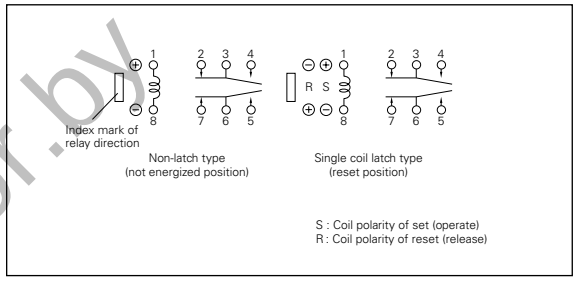


■ RECOMMENDED PAD LAYOUT

(bottom view)mm(inch)



■ SCHEMATICS (bottom view)

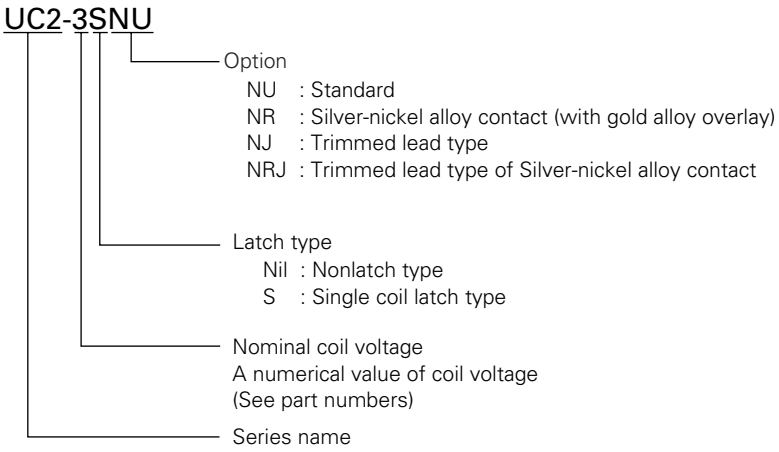


■ SPECIFICATIONS

Contact Form		2 Form c
Contact Material		Silver alloy with gold alloy overlay
Contact Ratings	Maximum Switching Power	30 W, 37.5 VA
	Maximum Switching Voltage	220 Vdc, 250 Vac
	Maximum Switching Current	1 A
	Maximum Carrying Current	1 A
Minimum Contact Ratings		10 mVdc, 10 μA*1
Initial Contact Resistance		100 mΩ max.(Initial)
Nominal Operating Power	Nonlatch type	140 mW (1.5 to 12 V), 230 mW (24 V)
	Single coil latch type	100 mW (1.5 to 12 V), 120 mW (24 V)
Operate Time (Excluding bounce)		Approx. 2 ms
Release Time (Excluding bounce)		Approx. 1 ms
Insulation Resistance		1000 MΩ at 500 Vdc
Withstand Voltage	Between open contacts	1000 Vac (for one minute) 1500 V surge (10 × 160 μs*2)
	Between adjacent contacts	
	Between coil to contacts	1500 Vac (for one minute) 2500 V surge (2 × 10 μs*3)
Shock Resistance		735 m/s² (misoperation) 980 m/s² (destructive failure)
Vibration Resistance		10 to 55 Hz, double amplitude 3 mm (misoperating) 10 to 55 Hz, double amplitude 5 mm (destructive failure)
Ambient Temperature		-40 to + 85°C
Coil Temperature Rise		18 degrees at nominal coil voltage (140 mW)
Running Specifications	Nonload	5 × 10⁷ *4 operations(Non-latch type)
	Load	30 Vdc, 1 A (resistive), 1 × 10⁵ operations at 20°C
		125 Vac, 0.3 A (resistive), 1 × 10⁵ operations at 20°C
Weight		Approx. 0.8 g

* 1 This value is a reference value in the resistance load.
Minimum capacity changes depending on switching frequency and environment temperature and the load.
* 2 rise time : 10 μs, decay time to half crest : 160 μs
* 3 rise time : 2 μs, decay time to half crest : 10 μs
* 4 This shows a number of operation where it can be running by which a fatal defect is not caused, and a number of operation by which a steady characteristic is maintained is 1×10⁷ times.

■ PART NUMBER SYSTEM



■ SAFETY STANDARD AND RATING

UL Recognized (UL508)* File No. E73266	CSA Certified (CSA C22.2 No14)+ File No. LR46266
30 Vdc, 1 A (Resistive) 110 Vdc, 0.3 A (Resistive) 125 Vac, 0.5 A (Resistive)	

* Spacing : UL840
\+ Spacing : CSA std950

TUV Certified (EN61810)
No. R 2050596
Creepage and clearance of coil to contact is over than 2 mm (According EN60950)
Basic insulation class

■ PART NUMBERS

• Nonlatch Type

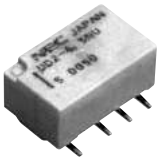
Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
UC2-1.5NU	1.5	16	1.13	0.15
UC2-3NU	3	64.3	2.25	0.3
UC2-4.5NU	4.5	145	3.38	0.45
UC2-5NU	5	178	3.75	0.5
UC2-6NU	6	257	4.5	0.6
UC2-9NU	9	579	6.75	0.9
UC2-12NU	12	1028	9.0	1.2
UC2-24NU	24	2504	18.0	2.4

• Single Coil Latch Type

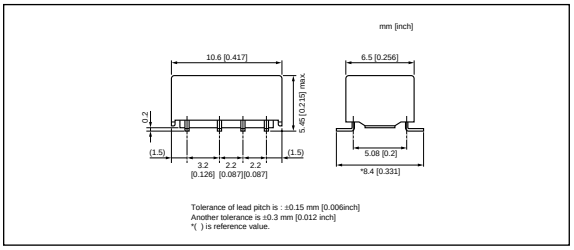
Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
UC2-1.5SNU	1.5	22.5	1.13	1.13
UC2-3SNU	3	90	2.25	2.25
UC2-4.5SNU	4.5	202.5	3.38	3.38
UC2-5SNU	5	250	3.75	3.75
UC2-6SNU	6	360	4.5	4.5
UC2-9SNU	9	810	6.75	6.75
UC2-12SNU	12	1440	9.0	9.0
UC2-24SNU	24	4800	18.0	18.0

Note * Test by pulse voltage
The latch type relays should be initialized at appointed position before using, and should be enegized to specific polarity by above polarity to avoid wrong operation.
Any special coil requirement, Please contact NEC TOKIN for availability.

UD2 Series

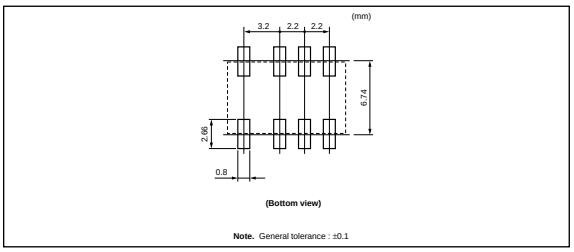


■ DIMENSIONS mm(inch)



■ RECOMMENDED PAD LAYOUT

(bottom view)mm(inch)

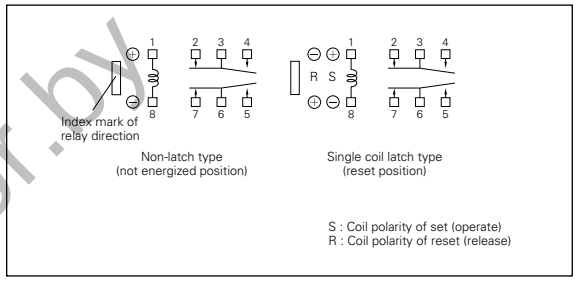


NEC TOKIN's UD2 relay is a new generation Miniature Singnal Relay of super-compact size and flat-package for surface mounting. But , the latching type production is going to start after June 2000.

■ FEATURES

- Small mounting size of flat package for dence mounting.
- Bellcore (2500 V) and FCC (1500 V) surge capability.
- IEC950 / UL1950 / EN60950 spacing and high breakdown voltage. (Basic insulation class on 200 V working voltage)
- Low power consumption 140 mW
- UL recognized (E73266), CSA certified (LR46266)
- Tube or embossed tape packaging.

■ SCHEMATICS (bottom view)



■ SPECIFICATIONS

Contact Form		2 Form c
Contact Material		Silver alloy with gold alloy overlay
Contact Ratings	Maximum Switching Power	30 W, 37.5 VA
	Maximum Switching Voltage	220 Vdc, 250 Vac
	Maximum Switching Current	1 A
	Maximum Carrying Current	1 A
Minimum Contact Ratings		10 mVdc, 10 μA*1
Initial Contact Resistance		100 mΩ max.(Initial)
Nominal Operating Power	Nonlatch type	140 mW (1.5 to 12 V), 230 mW (24 V)
	Single coil latch type	100 mW (1.5 to 12 V), 120 mW (24 V)
Operate Time (Excluding bounce)		Approx. 2 ms
Release Time (Excluding bounce)		Approx. 1 ms
Insulation Resistance		1000 MΩ at 500 Vdc
Withstand Voltage	Between open contacts	1000 Vac (for one minute) 1500 V surge (10 × 160 μs*2)
	Between adjacent contacts	
	Between coil to contacts	1500 Vac (for one minute) 2500 V surge (2 × 10 μs*3)
Shock Resistance		735 m/s² (misoperation) 980 m/s² (destructive failure)
Vibration Resistance		10 to 55 Hz, double amplitude 3 mm (misoperation) 10 to 55 Hz, double amplitude 5 mm (destructive failure)
Ambient Temperature		-40 to + 85°C
Coil Temperature Rise		18 degrees at nominal coil voltage (140 mW)
Running Specifications	Nonload	5 × 10⁷ *4 operations(Nonlatch type)
	Load	30 Vdc, 1 A (resistive), 1 × 10⁵ operations at 20°C
		125 Vac, 0.3 A (resistive), 1 × 10⁵ operations at 20°C
Weight		Approx. 0.8 g

* 1 This value is a reference value in the resistance load.
Minimum capacity changes depending on switching frequency and environment temperature and the load.
* 2 rise time : 10 μs, decay time to half crest : 160 μs
* 3 rise time : 2 μs, decay time to half crest : 10 μs
* 4 This shows a number of operation where it can be running by which a fatal defect is not caused, and a number of operation by which a steady characteristic is maintained is 1×10⁷ times.

■ PART NUMBER SYSTEM

UD2-3SNU - L1

- Package
  - Nil : Tube
  - L : Embossed carrying tape of L type
  - R : Embossed carrying tape of R type
- Option
  - NU : Standard
  - NR : Silver-nickel alloy contact (with gold alloy overlay)
  - NUN : Minimum footprint type
  - NRN : Minimum footprint type of Silver-nickel alloy contact
- Latch type
  - Nil : Nonlatch type
  - S : Single coil latch type
- Nominal coil voltage
  A numerical value of coil voltage
  (See part numbers)
- Series name

■ SAFETY STANDARD AND RATING

UL Recognized (UL508)* File No. E73266	CSA Certificated (CSA C22.2 No14)+ File No. LR46266
30 Vdc, 1 A (Resistive) 110 Vdc, 0.3 A (Resistive) 125 Vac, 0.5 A (Resistive)	

* Spacing : UL508
+ Spacing : CSA std950

TUV Certified (EN61810)
No. R 2050596
Creepage and clearance of coil to contact is over than 2 mm (According EN60950)
Basic insulation class

■ PART NUMBERS

• Nonlatch Type

at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
UD2-1.5NU	1.5	16	1.13	0.15
UD2-3NU	3	64.3	2.25	0.3
UD2-4.5NU	4.5	145	3.38	0.45
UD2-5NU	5	178	3.75	0.5
UD2-6NU	6	257	4.5	0.6
UD2-9NU	9	579	6.75	0.9
UD2-12NU	12	1028	9.0	1.2
UD2-24NU	24	2504	18.0	2.4

• Single Coil Latch Type

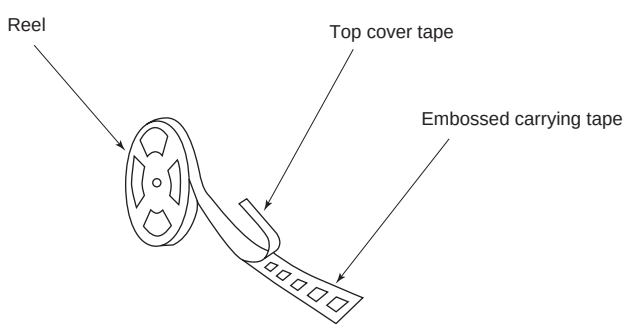
at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
UD2-1.5SNU	1.5	22.5	1.13	1.13
UD2-3SNU	3	90	2.25	2.25
UD2-4.5SNU	4.5	202.5	3.38	3.38
UD2-5SNU	5	250	3.75	3.75
UD2-6SNU	6	360	4.5	4.5
UD2-9SNU	9	810	6.75	6.75
UD2-12SNU	12	1440	9.0	9.0
UD2-24SNU	24	4800	18.0	18.0

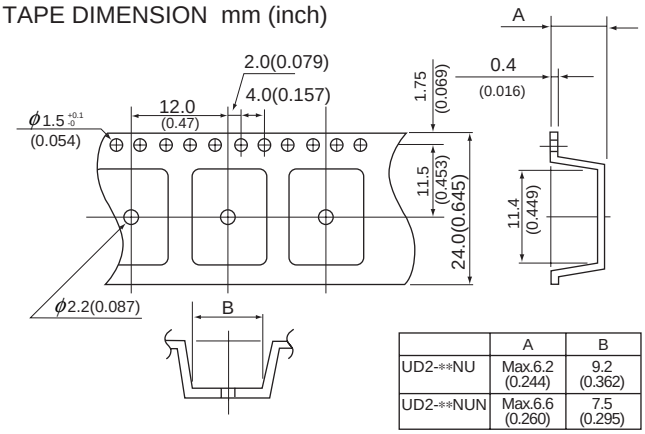
Note * Test by pulse voltage
The latch type relays should be initialized at appointed position before using, and should be enegized to specific polarity by above polarity to avoid wrong operation.
Any special coil requirement, Please contact NEC TOKIN for availability.

■ TAPE PACKAGE (OPTION)

APPEARANCE

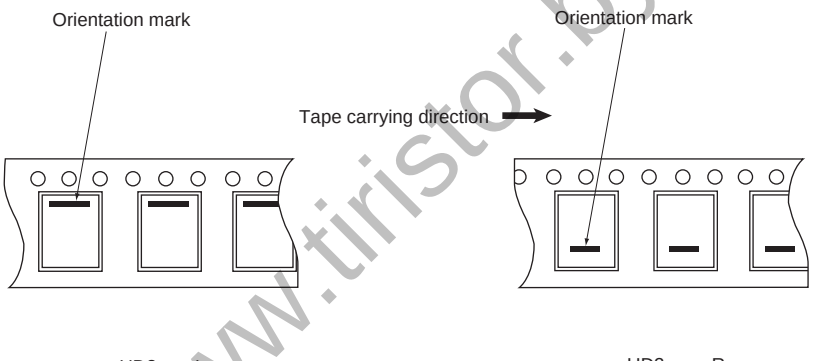


TAPE DIMENSION mm (inch)



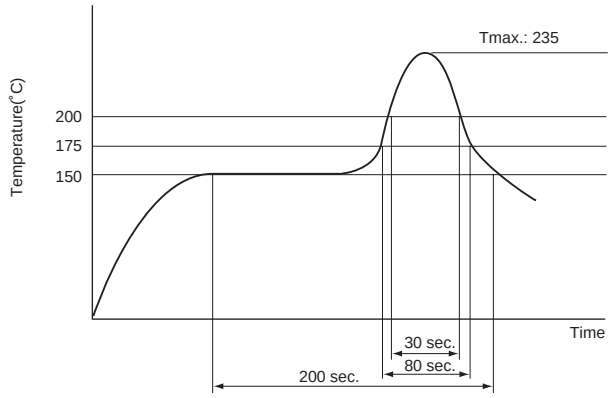
	A	B
UD2-**NU	Max.6.2 (0.244)	9.2 (0.362)
UD2-**NUN	Max.6.6 (0.260)	7.5 (0.295)

Relay orientation mark and tape carrying direction.



■ SOLDERING CONDITION

IRS Method



Note

1. Temperature profile shows printed circuit board surface temperature on the relay terminal portion.
2. Check the actual soldering condition to use other method except above mentioned temperature profiles.

■ Recommended relay drive conditions

Drive under conditions. If it is impossible, please inquire to NEC TOKN.

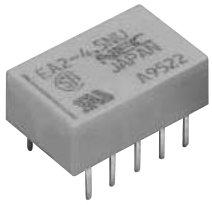
Nonlatch type	Voltage:within ±5% at nominal voltage	
Single coil latch type Double coil latch type	Square pulse (rise and fall time is rapidly) Pulse height: within ±5% at nominal voltage Pulse width: more than 10 ms	Ambient temperature -40~+85˚C

■ Technical document

Please confirm technical document before use.
It is able to receive a document at NEC TOKIN's World-wide-web site.
(http://www.nec-tokin.com)

ITEM	TITLE
Data sheet	UC2/UD2 series
Information	UC2/UD2 series technical data
User's manual	Function and note on correct use
Application note	Application circuit of miniature signal relay

EA2 Series

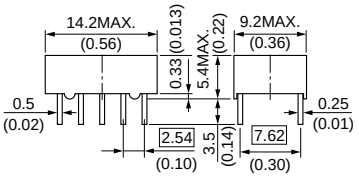


The EA2 series has reduced package size and power consumption compared to other NEC TOKIN conventional relays. Furthermore, it complies with 1500 V surge-voltage requirement of FCC Part 68 by the unique structure and the efficient magnetic circuit.

■ FEATURES

- Low power consumption
- Compact and light weight
- 2 form c contact arrangement
- Low magnetic interference
- Breakdown voltage : 1000 Vac (surge voltage 1500 V), FCC Part 68 compliant
- Tube packaging
- UL recognized (E73266), CSA certified (LR46266)

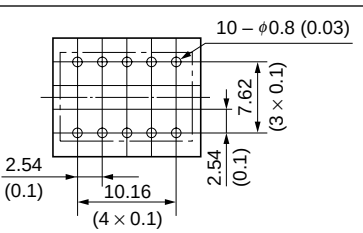
■ DIMENSIONS mm(inch)



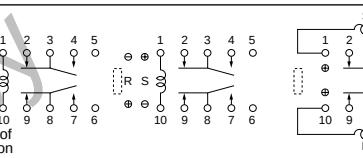
Note: Tolerance ±0.2 unless otherwise specified
NJ: Cover hight — 6.3mm, Lead —2.8mm

■ RECOMMENDED PAD LAYOUT

(bottom view)mm(inch)



■ SCHEMATICS (bottom view)



■ SPECIFICATIONS

Contact Form		2 Form c
Contact Material		Silver alloy with gold alloy overlay
Contact Ratings	Maximum Switching Power	30 W, 62.5 VA
	Maximum Switching Voltage	220 Vdc, 250 Vac
	Maximum Switching Current	1 A
	Maximum Carrying Current	2 A
Minimum Contact Ratings		10 mVdc, 10 μA*1
Initial Contact Resistance		50 mΩtyp.(Initial)
Nominal Operating Power	Nonlatch type	140 mW (3 to 12 V), 200 mW (24 V)
	Single coil latch type	100 mW (3 to 12 V), 150 mW (24 V)
	Double coil latch type	140 mW (3 to 12 V), 200 mW (24 V)
Operate Time (Excluding bounce)		Approx. 2 ms
Release Time (Excluding bounce)		Approx. 1 ms without diode
Insulation Resistance		1000 MΩ at 500 Vdc
Withstand Voltage	Between open contacts	1000 Vac (for one minute) 1500 V surge (10 × 160 μs*2)
	Between adjacent contacts	
	Between coil to contacts	1000 Vac (for one minute) 1500 V surge (10 × 160 μs*2)
Shock Resistance		735 m/s² (misoperating) 980 m/s² (destructive failure)
Vibration Resistance		10 to 55 Hz, double amplitude 3 mm (misoperating) 10 to 55 Hz, double amplitude 5 mm (destructive failure)
Ambient Temperature		-40 to + 85°C
Coil Temperature Rise		18 degrees at nominal coil voltage (140 mW)
Running Specifications	Nonload	1×10^8 *3 operations(Non-latch type) 1×10^7 operations(latch type)
	Load	50 Vdc, 0.1 A (resistive) 1×10^6 operations at 85°C, 5 Hz
		10 Vdc, 10 mA (resistive) 1×10^6 operations at 85°C, 2 Hz
Weight		Approx. 1.5 g

* 1 This value is a reference value in the resistance load.
Minimum capacity changes depending on switching frequency and environment temperature and the load.
* 2 rise time : 10 μs, decay time to half crest : 160 μs
* 3 This shows a number of operation where it can be running by which a fatal defect is not caused, and a number of operation by which a steady characteristic is maintained is 1×10^7 times.

■ PART NUMBER SYSTEM

EA2-3SNU

- NU : Standard type
- NJ : Trimmed leads type
- NP : Silver-palladium alloy contact (with gold alloy overlay)

Latch type
- Nil : Nonlatch type (standard)
- S : Single coil latch type
- T : Double coil latch type

Nominal coil voltage (See part numbers)

■ SAFETY STANDARD AND RATING

UL Recognized (UL508)* File No. E73266	CSA Certificated (CSA C22.2 No14) File No. LR46266
30 Vdc, 1A (Resistive) 110 Vdc, 0.3A (Resistive) 125 Vac, 0.5A (Resistive)	

* Spacing : UL114, UL478

■ PART NUMBERS

• Nonlatch Type at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
EA2-3	3	64.3	2.25	0.3
EA2-4.5	4.5	145	3.38	0.45
EA2-5	5	178	3.75	0.5
EA2-6	6	257	4.5	0.6
EA2-9	9	579	6.75	0.9
EA2-12	12	1028	9.0	1.2
EA2-24	24	2880	18.0	2.4

• Single Coil Latch Type at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
EA2-3S	3	90	2.25	2.25
EA2-4.5S	4.5	202.5	3.38	3.38
EA2-5S	5	250	3.75	3.75
EA2-6S	6	360	4.5	4.5
EA2-9S	9	810	6.75	6.75
EA2-12S	12	1440	9.0	9.0
EA2-24S	24	3840	18.0	18.0

• Double Coil Latch Type** (Can not be driven by reverse polarity for reverse operation) at 20 °C

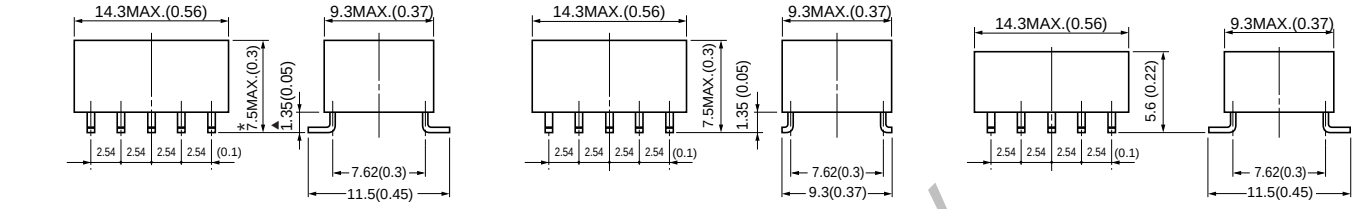
Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
EA2-3T	3	S 64.3 R 64.3	2.25 –	– 2.25
EA2-4.5T	4.5	S 145 R 145	3.38 –	– 3.38
EA2-5T	5	S 178 R 178	3.75 –	– 3.75
EA2-6T	6	S 257 R 257	4.5 –	– 4.5
EA2-9T	9	S 579 R 579	6.75 –	– 6.75
EA2-12T	12	S 1028 R 1028	9.0 –	– 9.0
EA2-24T	24	S 2880 R 2880	18.0 –	– 18.0

Note * Test by pulse voltage
** S : Set coil (pin No.1··· ⊕ , pin No.5··· ⊖) R : Reset coil (pin No.10··· ⊕ , pin No.6··· ⊖)
The latch type relays should be initialized at appointed position before using, and should be enegized to specific polarity by above polarity to avoid wrong operation.
Any special coil requirement, Please contact NEC TOKIN for availability.

EB2 Series

The EB2 series has adapted IRS, VPS surface mounting technique, and sustained the high-performance of EA2 series.

■ DIMENSIONS mm(inch)



*NUE TYPE
6.5 mm MAX.
(0.26)

EB-..
EB-..NU
EB-..NUE

▲NUE TYPE
0.8 mm MAX.
(0.03)

EB-..NUH

EB2-..NUL

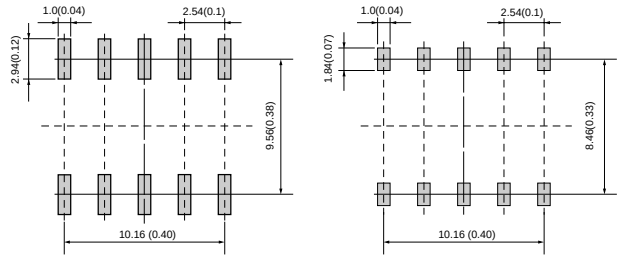
Note : Tolerance ±0.2 mm unless otherwise specified

■ FEATURES

- Compact and light weight
- 2 form c contact arrangement
- Low power consumption
- Low magnetic interference
- Breakdown voltage : 1000 Vac (surge voltage 1500 V), FCC Part 68 compliant
- Tube or Embossed tape packaging
- UL recognized (E73266), CSA certified (LR46266)

■ RECOMMENDED PAD LAYOUT

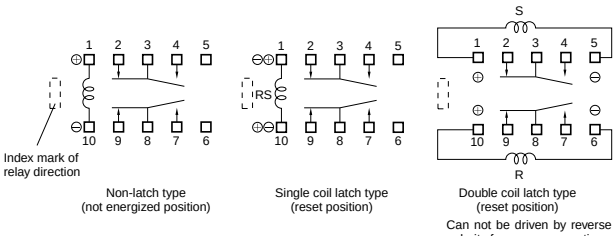
(bottom view)mm(inch)



EB2-..
EB2-..NU,EB2-..NUL
EB2-..NUE

EB2-..NUH

■ SCHEMATICS (bottom view)



Non-latch type
(not energized position)

Single coil latch type
(reset position)

Double coil latch type
(reset position)

Can not be driven by reverse polarity for reverse operation.

*Not use
No. 5, 6 pins

S : Coil polarity of set (operate)
R : Coil polarity of reset (release)

■ SPECIFICATIONS

Contact Form		2 Form c
Contact Material		Silver alloy with gold alloy overlay
Contact Ratings	Maximum Switching Power	30 W, 62.5 VA
	Maximum Switching Voltage	220 Vdc, 250 Vac
	Maximum Switching Current	1 A
	Maximum Carrying Current	2 A
Minimum Contact Ratings		10 mVdc, 10 μA*1
Initial Contact Resistance		50 mΩtyp.(Initial)
Nominal Operating Power	Nonlatch type	140 mW (3 to 12 V), 200 mW (24 V)
	Single coil latch type	100 mW (3 to 12 V), 150 mW (24 V)
	Double coil latch type	140 mW (3 to 12 V), 200 mW (24 V)
Operate Time (Excluding bounce)		Approx. 2 ms
Release Time (Excluding bounce)		Approx. 1 ms without diode
Insulation Resistance		1000 MΩ at 500 Vdc
Withstand Voltage	Between open contacts	1000 Vac (for one minute) 1500 V surge (10 × 160 μs*2)
	Between adjacent contacts	
	Between coil to contacts	1000 Vac (for one minute) 1500 V surge (10 × 160 μs*2)
Shock Resistance		735 m/s² (misoperating) 980 m/s² (destructive failure)
Vibration Resistance		10 to 55 Hz, double amplitude 3 mm (misoperating) 10 to 55 Hz, double amplitude 5 mm (destructive failure)
Ambient Temperature		-40 to + 85°C
Coil Temperature Rise		18 degrees at nominal coil voltage (140 mW)
Running Specifications	Nonload	1×10^8 *3 operations(Non-latch type) 1×10^7 operations(latch type)
	Load	50 Vdc, 0.1 A (resistive) 1×10^6 operations at 85°C, 5 Hz
		10 Vdc, 10 mA (resistive) 1×10^6 operations at 85°C, 2 Hz
Weight		Approx. 1.5 g

* 1 This value is a reference value in the resistance load.
  Minimum capacity changes depending on switching frequency and environment temperature and the load.
* 2 rise time : 10 μs, decay time to half crest : 160 μs
* 3 This shows a number of operation where it can be running by which a fatal defect is not caused, and a number of operation by which a steady characteristic is maintained is 1×10^7 times.

■ PART NUMBER SYSTEM

EB2-3SNU-L

- Packaging code
  - Nil: Tube
  - L:Embossed carrying tape (L type)
  - R:Embossedcarryingtape(Rtype)
- NU: Standard type
  NUH: Minimum footprint type
  NUE: Low profile type (h =6.5 mm)
  NUL: Ultra-low profile type (h= 5.6 mm)
- Latch type
  - Nil: Nonlatch type (standard)
  - S: Single coil latch type
  - T: Double coil latch type
- Nominal coil voltage (See part numbers)

■ SAFETY STANDARD AND RATING

UL Recognized (UL508)* File No. E73266	CSA Certificated (CSA C22.2 No14) File No. LR46266
30 Vdc, 1 A (Resistive) 110 Vdc, 0.3 A (Resistive) 125 Vac, 0.5 A (Resistive)	

* Spacing : UL114, UL478

■ PART NUMBERS

• Nonlatch Type at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
EB2-3	3	64.3	2.25	0.3
EB2-4.5	4.5	145	3.38	0.45
EB2-5	5	178	3.75	0.5
EB2-6	6	257	4.5	0.6
EB2-9	9	579	6.75	0.9
EB2-12	12	1028	9	1.2
EB2-24	24	2880	18	2.4

• Single Coil Latch Type at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
EB2-3S	3	90	2.25	2.25
EB2-4.5S	4.5	202.5	3.38	3.38
EB2-5S	5	250	3.75	3.75
EB2-6S	6	360	4.5	4.5
EB2-9S	9	810	6.75	6.75
EB2-12S	12	1440	9.0	9.0
EB2-24S	24	3840	18.0	18.0

• Double Coil Latch Type** (Can not be driven by reverse polarity for reverse operation) at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
EB2-3T	3	S 64.3 R 64.3	2.25 –	– 2.25
EB2-4.5T	4.5	S 145 R 145	3.38 –	– 3.38
EB2-5T	5	S 178 R 178	3.75 –	– 3.75
EB2-6T	6	S 257 R 257	4.5 –	– 4.5
EB2-9T	9	S 579 R 579	6.75 –	– 6.75
EB2-12T	12	S 1028 R 1028	9.0 –	– 9.0
EB2-24T	24	S 2880 R 2880	18.0 –	– 18.0

Note * Test by pulse voltage

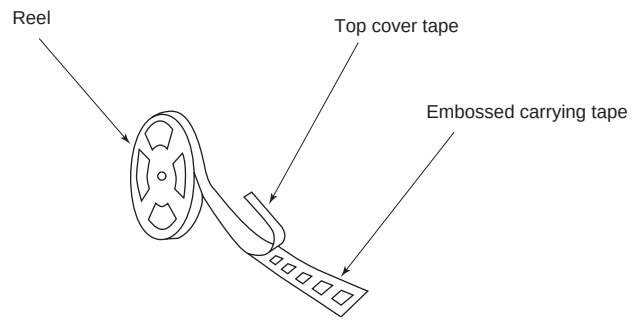
** S : Set coil (pin No.1⋯⊕ , pin No.5⋯⊖) R : Reset coil (pin No.10⋯⊕ , pin No.6⋯⊖)

The latch type relays should be initialized at appointed position before using, and should be enegized to specific polarity by above polarity to avoid wrong operation.

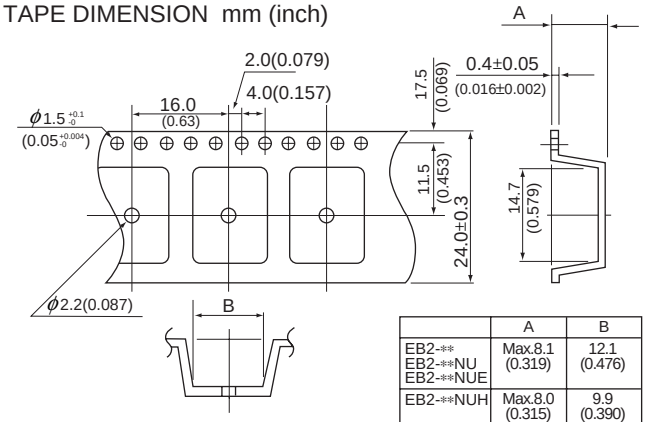
Any special coil requirement, Please contact NEC TOKIN for availability.

■ TAPE PACKAGE (OPTION)

APPEARANCE

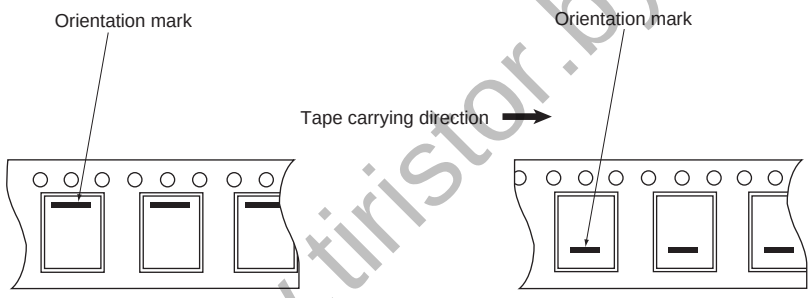


TAPE DIMENSION mm (inch)



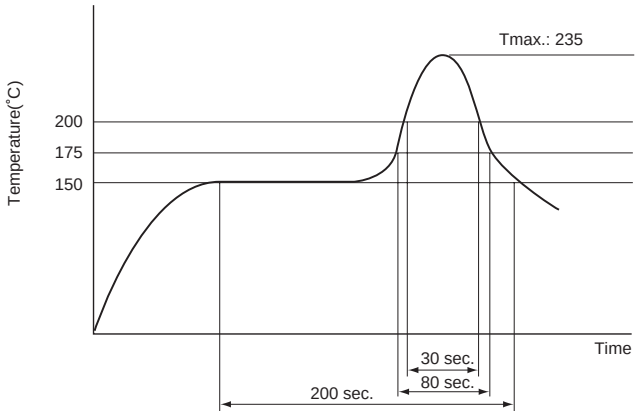
	A	B
EB2-** EB2-**NU EB2-**NUE	Max.8.1 (0.319)	12.1 (0.476)
EB2-**NUH	Max.8.0 (0.315)	9.9 (0.390)
EB2-**NUL	Max.6.5 (0.256)	12.1 (0.476)

Relay orientation mark and tape carrying direction.

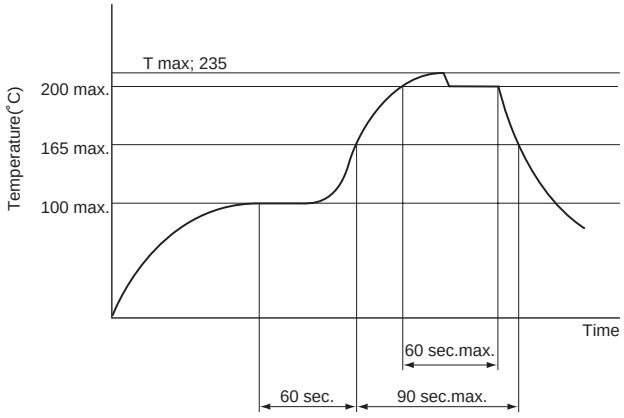


■ SOLDERING CONDITION

IRS Method



VPS Method



Note

1. Temperature profile shows printed circuit board surface temperature on the relay terminal portion.
2. Please check the actual soldering condition to use other method except above mentioned temperature profiles.

■ Recommended relay drive conditions

Drive under conditions. If it is impossible, please inquire to NEC TOKIN.

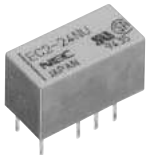
Nonlatch type	Voltage:within ±5% at nominal voltage	
Single coil latch type Double coil latch type	Square pulse (rise and fall time is rapidly) Pulse height: within ±5% at nominal voltage Pulse width: more than 10 ms	Ambient temperature -40~+85˚C

■ Technical document

Please confirm technical document before use.
It is able to receive a document at NEC TOKIN's World-wide-web site.
(http://www.nec-tokin.com)

ITEM	TITLE
Data sheet	EA2 series
	EB2 series
Information	EA2 series technical data
	EB2 series technical data
User's manual	Function and note on correct use
Application note	Application circuit of miniature signal relay

EC2 Series

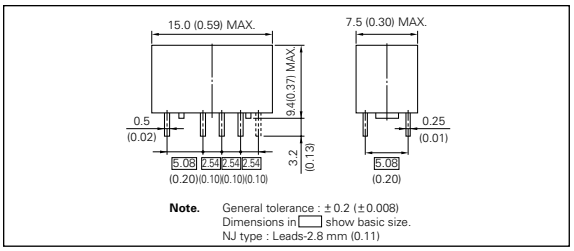


The EC2 series has reduced mounting space but sustained high- performance of NEC EA2 series. Furthermore, it complies with 2500 V surge-voltage requirement of Bellcore specifications.

■ FEATURES

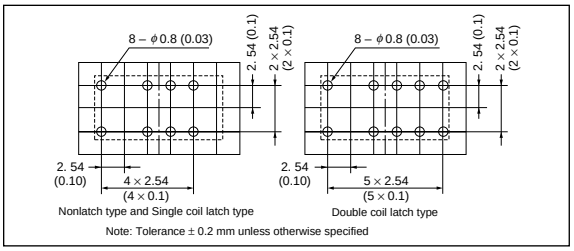
- Compact and light weight
- 2 form c contact arrangement
- Low power consumption
- Reduced mounting space: 15 mm × 7.5 mm
- High-breakdown voltage of coil to contacts: 1500 Vac, 2500 V, (2 × 10 μs*3)
- Capable of High-power switching: 700 Vac, 4.2A, 4 times in case of accident
- UL recognized (E73266), CSA certified (LR46266)
- ND type (High-insulation type) conform to supplemetary insulation for EN60950 (TUV certified)

■ DIMENSIONS mm(inch)

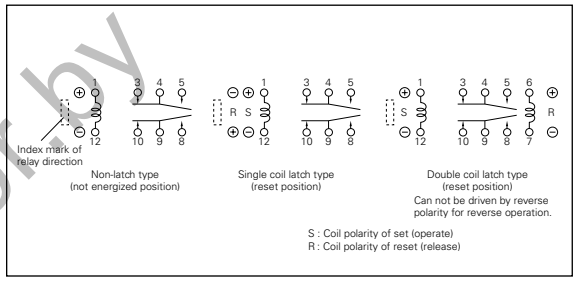


■ RECOMMENDED PAD LAYOUT

(bottom view)mm(inch)



■ SCHEMATICS (bottom view)



■ SPECIFICATIONS

Contact Form		2 Form c	
Contact Material		Silver alloy with gold alloy overlay	
Contact Ratings (UL/CSA Rating)	Maximum Switching Power	60 W, 125 VA	
	Maximum Switching Voltage	220 Vdc, 250 Vac	
	Maximum Switching Current	2A	
	Maximum Carrying Current	2A	
Minimum Contact Ratings		10 mVdc, 10 μA*1	
Initial Contact Resistance		50 mΩ typ.(Initial)	
Nominal Operating Power	Nonlatch type	140 mW (3 to 12 V), 200 mW (24 V)	ND type 200 to 230 mW
	Single coil latch type	100 mW	ND type 100 to 170 mW
	Double coil latch type	140 mW	
Operate Time (Excluding bounce)		Approx. 2 ms	
Release Time (Excluding bounce)		Approx. 1 ms without diode	
Insulation Resistance		1000 MΩ at 500 Vdc	
Withstand Voltage	Between open contacts	1000 Vac (for one minute) 1500 V surge (10 × 160 μs*2)	
	Between adjacent contacts		
	Between coil to contacts	1500 Vac (for one minute) 2500 V surge (2 × 10 μs*3)	Double Coil 1000 Vac (for one miniute) Latch type 1500 V surge (10 × 160 μs*3)
Shock Resistance		735 m/s² (misoperating) 980 m/s² (destructive failure)	
Vibration Resistance		10 to 55 Hz, double amplitude 3 mm (misoperating) 10 to 55 Hz, double amplitude 5 mm (destructive failure)	
Ambient Temperature		-40 to + 85°C	
Coil Temperature Rise		18 degrees at nominal coil voltage (140 mW)	
Running Specifications	Nonload	1 × 10⁸ *4 operations(Non-latch type) 1 × 10⁷ operations(latch type)	
	Load	50 Vdc, 0.1 A (resistive) 1 × 10⁶ operations at 85°C, 5 Hz	
		10 Vdc, 10 mA (resistive) 1 × 10⁶ operations at 85°C, 2 Hz	
Weight		Approx. 1.9 g	

* 1 This value is a reference value in the resistance load.
Minimum capacity changes depending on switching frequency and environment temperature and the load.
* 2 rise time : 10 μs, decay time to half crest : 160 μs
* 3 rise time : 2 μs, decay time to half crest : 10 μs
* 4 This shows a number of operation where it can be running by which a fatal defect is not caused, and a number of operation by which a steady characteristic is maintained is 1×10⁷ times.

■ PART NUMBER SYSTEM

EC2-3SNU

- NU : Standard type
- NJ : Trimmed leads type
- NP : Silver-palladium alloy contact (with gold alloy overlay)
- ND : High insulation type (TUV certified)

Latch type

- Nil : Nonlatch type (standard)
- S : Single coil latch type
- T : Double coil latch type

Nominal coil voltage (See part numbers)

■ SAFETY STANDARD AND RATING

UL Recognized (UL508)* File No. E73266	CSA Certificated (CSA C22.2 No14) File No. LR46266
30 Vdc, 2 A (Resistive) 110 Vdc, 0.3 A (Resistive) 125 Vac, 0.5 A (Resistive)	

* Spacing : UL114, UL478

TUV Certified (EN60255 / IEC60255)	
No. R 9750561	No. R 9751153
"ND" Type (Nonlatch and Single-coil-latch)	Except ND Type (Nonlatch and Single-coil-latch)
Creepage and clearance of coil to contact is over than 2 mm (According EN60950)	
Supplementary insulation class	Basic insulation class

■ PART NUMBERS

• Nonlatch Type

at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
EC2-3	3	64.3	2.25	0.3
EC2-4.5	4.5	145	3.38	0.45
EC2-5	5	178	3.75	0.5
EC2-6	6	257	4.5	0.6
EC2-9	9	579	6.75	0.9
EC2-12	12	1028	9.0	1.2
EC2-24	24	2880	18.0	2.4

• Single Coil Latch Type

at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
EC2-3S	3	90	2.25	2.25
EC2-4.5S	4.5	202.5	3.38	3.38
EC2-5S	5	250	3.75	3.75
EC2-6S	6	360	4.5	4.5
EC2-9S	9	810	6.75	6.75
EC2-12S	12	1440	9.0	9
EC2-24S	24	5760	18.0	18

Note * Test by pulse voltage

** S : Set coil (pin No.1··· ⊕ , pin No.12··· ⊖) R : Reset coil (pin No.6··· ⊕ , pin No.7··· ⊖)

The latch type relays should be initialized at appointed position before using, and should be enegized to specific polarity by above polarity to avoid wrong operation.

Any special coil requirement, Please contact NEC TOKIN for availability.

• Double Coil Latch Type** (Can not be driven by reverse polarity for reverse operation) at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
EC2-3T	3	S 64.3 R 64.3	2.25 –	– 2.25
EC2-4.5T	4.5	S 145 R 145	3.38 –	– 3.38
EC2-5T	5	S 178 R 178	3.75 –	– 3.75
EC2-6T	6	S 257 R 257	4.5 –	– 4.5
EC2-9T	9	S 579 R 579	6.75 –	– 6.75
EC2-12T	12	S 1028 R 1028	9.0 –	– 9.0
EC2-24T	24	S 4114 R 4114	18.0 –	– 18.0

• Nonlatch ND Type at 20 °C

Part Number	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
EC2-3ND	3	45	2.25	0.3
EC2-4.5ND	4.5	101	3.38	0.45
EC2-5ND	5	125	3.75	0.5
EC2-6ND	6	180	4.5	0.6
EC2-9ND	9	405	6.75	0.9
EC2-12ND	12	720	9.0	1.2
EC2-24ND	24	2504	18.0	2.4

• Single Coil Latch ND Type at 20 °C

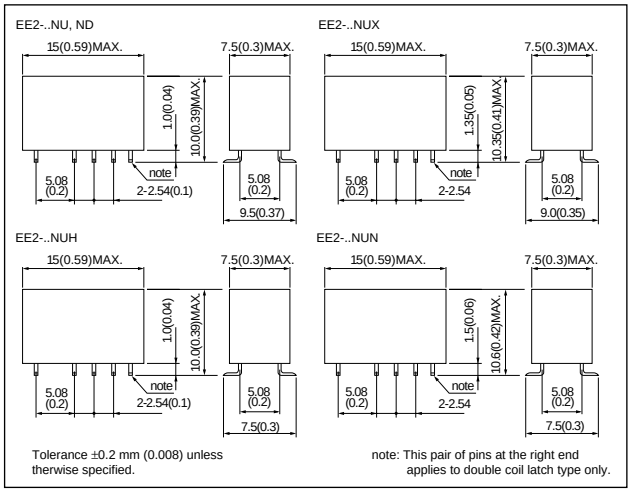
Part Number	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
EC2-3SND	3	90	2.25	2.25
EC2-4.5SND	4.5	203	3.38	3.38
EC2-5SND	5	250	3.75	3.75
EC2-6SND	6	360	4.5	4.5
EC2-9SND	9	810	6.75	6.75
EC2-12SND	12	960	9.0	9
EC2-24SND	24	3388	18.0	18

Note * Test by pulse voltage
** S : Set coil (pin No.1⋯⊕ , pin No.12⋯⊖) R : Reset coil (pin No.6⋯⊕ , pin No.7⋯⊖)
The latch type relays should be initialized at appointed position before using, and should be enegized to specific polarity by above polarity to avoid wrong operation.
Any special coil requirement, Please contact NEC TOKIN for availability.

EE2 Series

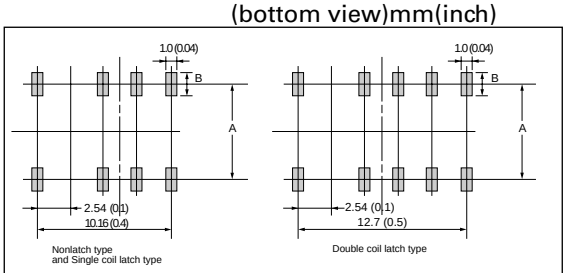
The EE2 series is surface-mounting type sustaining high-performance of NECTOKIN EC2 series.

■ DIMENSIONS mm(inch)



■ RECOMMENDED PAD LAYOUT

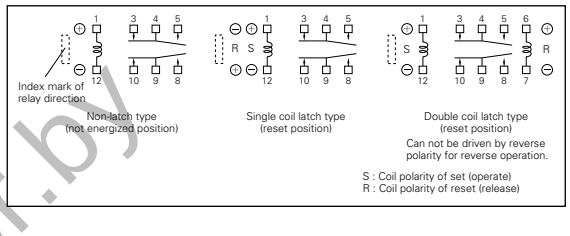
(bottom view)mm(inch)



TYPE	A	B
EE2-..NU,ND	7.3 (0.287)	3.0 (0.118)
EE2-..NUX	7.02 (0.276)	2.73 (0.107)
EE2-..NUH	6.29 (0.248)	2.0 (0.079)
EE2-..NUN	6.29 (0.248)	2.0 (0.079)

Tolerance ± 0.1 mm (0.004) unless otherwise specified.

■ SCHEMATICS (bottom view)



■ FEATURES

- Compact and light weight
- 2 form c contact arrangement
- Low power consumption
- Reduced mounting space: 15 mm × 9.5 mm
- High-breakdown voltage of coil to contacts: 1500 Vac, 2500 V, (2 × 10μs*3)
- Capable of High-power switching : 700 Vac, 4.2 A ,4 times in case of accident
- UL recognized (E73266), CSA certified (LR46266)
- ND type (High-insulation type) conform to supplementary insulation for EN60950 (TUV certified)

■ SPECIFICATIONS

Contact Form		2 Form c	
Contact Material		Silver alloy with gold alloy overlay	
Contact Ratings (UL / CSA Rating)	Maximum Switching Power	60 W, 125 VA	
	Maximum Switching Voltage	220 Vdc, 250 Vac	
	Maximum Switching Current	2 A	
	Maximum Carrying Current	2 A	
Minimum Contact Ratings		10 mVdc, 10 μA*1	
Initial Contact Resistance		50 mΩ typ.(Initial)	
Nominal Operating Power	Nonlatch type	140 mW (3 to 12 V), 200mW (24 V)	ND type 200 to 230 mW
	Single coil latch type	100 mW	ND type 100 to 170 mW
	Double coil latch type	140 mW	
Operate Time (Excluding bounce)		Approx. 2 ms	
Release Time (Excluding bounce)		Approx. 1 ms without diode	
Insulation Resistance		1000 MΩ at 500 Vdc	
Withstand Voltage	Between open contacts	1000 Vac (for one minute) 1500 V surge (10 × 160 μs*2)	
	Between adjacent contacts		
	Between coil to contacts	1500 Vac (for one minute) 2500 V surge (2 × 10 μs*3)	Double Coil 1000 Vac (for one miniute) Latch type 1500 V surge (10 × 160 μs*2)
Shock Resistance		735 m/s² (misoperating) 980 m/s² (destructive failure)	
Vibration Resistance		10 to 55 Hz, double amplitude 3 mm (misoperating) 10 to 55 Hz, double amplitude 5 mm (destructive failure)	
Ambient Temperature		-40 to + 85°C	
Coil Temperature Rise		18 degrees at nominal coil voltage (140 mW)	
Running Specifications	Nonload	1 × 10⁸ *4 operations(Non-latch type) 1 × 10⁷ operations(latch type)	
	Load	50 Vdc, 0.1 A (resistive) 1 × 10⁶ operations at 85°C, 5 Hz	
		10 Vdc, 10 mA (resistive) 1 × 10⁶ operations at 85°C, 2 Hz	
Weight		Approx. 1.9 g	

* 1 This value is a reference value in the resistance load.
  Minimum capacity changes depending on switching frequency and environment temperature and the load.
* 2 rise time : 10 μs, decay time to half crest : 160 μs
* 3 rise time : 2 μs, decay time to half crest : 10 μs
* 4 This shows a number of operation where it can be running by which a fatal defect is not caused, and a number of operation by which a steady characteristic is maintained is 1×10⁷ times.

■ PART NUMBER SYSTEM

EE2-3SNU-L

- Packaging code
  - Nil: Tube
  - L: Embossed carrying tape (L type)
  - R: Embossed carrying tape (R type)
- NU: Standard type
  NUH: Minimum footprint type
  NUX: High solder joint reliability type
  NUN: High solder joint reliability with Minimum footprint type
  ND: High-insulation type (TUV certified)
- Latch type
  - Nil: Nonlatch type (standard)
  - S: Single coil latch type
  - T: Double coil latch type
- Nominal coil voltage (See part numbers)

■ SAFETY STANDARD AND RATING

UL Recognized (UL508)* File No. E73266	CSA Certificated (CSA C22.2 No14) File No. LR46266
30 Vdc, 2 A (Resistive) 110 Vdc, 0.3 A (Resistive) 125 Vac, 0.5 A (Resistive)	

* Spacing : UL114, UL478

TUV Certified (EN60255 / IEC60255)	
No. R 9750561	No. R 9751153
"ND" Type (Nonlatch and Single-coil-latch)	Except ND Type (Nonlatch and Single-coil-latch)
Creepage and clearance of coil to contact is over than 2 mm (According EN60950)	
Supplementary insulation class	Basic insulation class

■ PART NUMBERS

• Nonlatch Type

at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
EE2-3	3	64.3	2.25	0.3
EE2-4.5	4.5	145	3.38	0.45
EE2-5	5	178	3.75	0.5
EE2-6	6	257	4.5	0.6
EE2-9	9	579	6.75	0.9
EE2-12	12	1028	9.0	1.2
EE2-24	24	2880	18.0	2.4

• Single Coil Latch Type

at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
EE2-3S	3	90	2.25	2.25
EC2-4.5S	4.5	202.5	3.38	3.38
EE2-5S	5	250	3.75	3.75
EE2-6S	6	360	4.5	4.5
EE2-9S	9	810	6.75	6.75
EE2-12S	12	1440	9.0	9.0
EE2-24S	24	5760	18.0	18.0

Note * Test by pulse voltage

** S : Set coil (pin No.1··· ⊕ , pin No.12···⊖) R : Reset coil (pin No.6···⊕ , pin No.7···⊖)

The latch type relays should be initialized at appointed position before using, and should be enegized to specific polarity by above polarity to avoid wrong operation.

Any special coil requirement, Please contact NEC TOKIN for availability.

• **Double Coil Latch Type**** (Can not be driven by reverse polarity for reverse operation) at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
EE2-3T	3	S 64.3 R 64.3	2.25 –	– 2.25
EE2-4.5T	4.5	S 145 R 145	3.38 –	– 3.38
EE2-5T	5	S 178 R 178	3.75 –	– 3.75
EE2-6T	6	S 257 R 257	4.5 –	– 4.5
EE2-9T	9	S 579 R 579	6.75 –	– 6.75
EE2-12T	12	S 1028 R 1028	9.0 –	– 9.0
EE2-24T	24	S 4114 R 4114	18.0 –	– 18.0

• **Nonlatch ND Type** at 20 °C

Part Number	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
EE2-3ND	3	45	2.25	0.3
EE2-4.5ND	4.5	101	3.38	0.45
EE2-5ND	5	125	3.75	0.5
EE2-6ND	6	180	4.5	0.6
EE2-9ND	9	405	6.75	0.9
EE2-12ND	12	720	9.0	1.2
EE2-24ND	24	2504	18.0	2.4

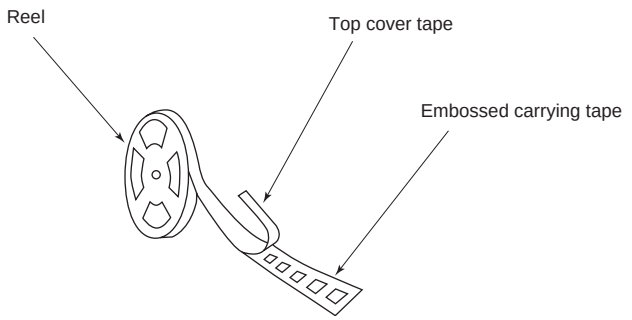
• **Single Coil Latch ND Type** at 20 °C

Part Number	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
EE2-3SND	3	90	2.25	2.25
EE2-4.5SND	4.5	203	3.38	3.38
EE2-5SND	5	250	3.75	3.75
EE2-6SND	6	360	4.5	4.5
EE2-9SND	9	810	6.75	6.75
EE2-12SND	12	960	9.0	9.0
EE2-24SND	24	3388	18.0	18.0

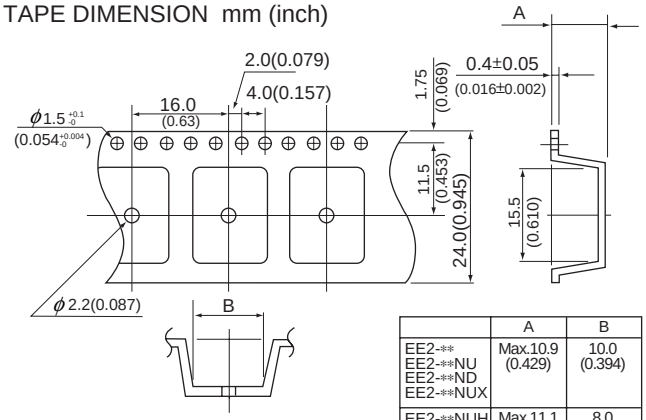
Note * Test by pulse voltage
** S : Set coil (pin No.1··· ⊕ , pin No.12···⊖) R : Reset coil (pin No.6···⊕ , pin No.7··· ⊖)
The latch type relays should be initialized at appointed position before using, and should be enegized to specific polarity by above polarity to avoid wrong operation.
Any special coil requirement, Please contact NEC TOKIN for availability.

■ TAPE PACKAGE (OPTION)

APPEARANCE

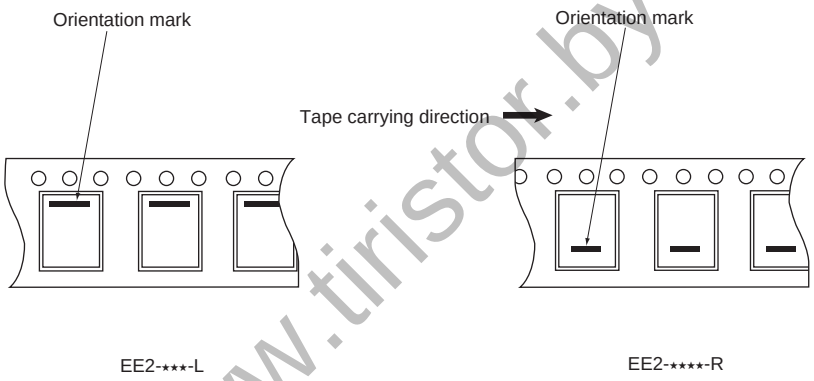


TAPE DIMENSION mm (inch)



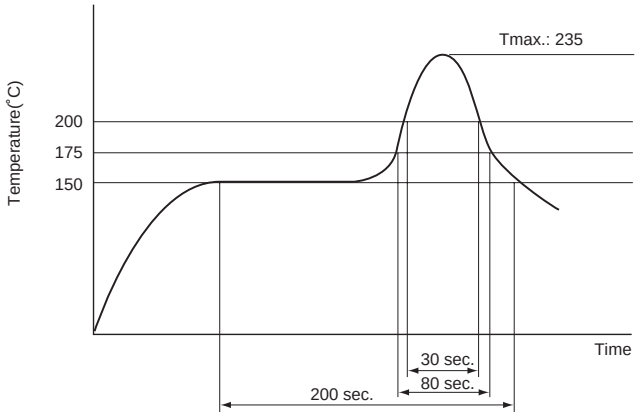
	A	B
EE2-** EE2-**NU EE2-**ND EE2-**NUX	Max.10.9 (0.429)	10.0 (0.394)
EE2-**NUH EE2-**NUN	Max.11.1 (0.437)	8.0 (0.315)

Relay orientation mark and tape carrying direction.

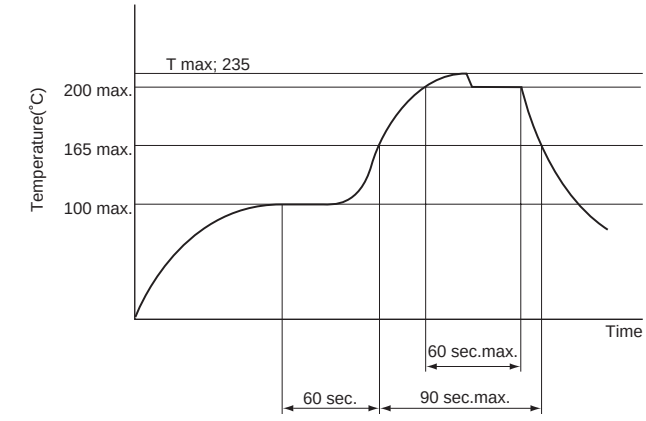


■ SOLDERING CONDITION

IRS Method



VPS Method



Note

1. Temperature profile shows printed circuit board surface temperature on the relay terminal portion.
2. Please check the actual soldering condition to use other method except above mentioned temperature profiles.

■ Recommended relay drive conditions

Drive under conditions. If it is impossible, please inquire to NEC TOKIN.

Nonlatch type	Voltage:within ±5% at nominal voltage	
Single coil latch type Double coil latch type	Square pulse (rise and fall time is rapidly) Pulse height: within ±5% at nominal voltage Pulse width: more than 10 ms	Ambient temperature -40~+85˚C

■ Technical document

Please confirm technical document before use.
It is able to receive a document at NEC TOKIN's World-wide-web site.
(http://www.nec-tokin.com)

ITEM	TITLE
Data sheet	EC2 series EE2 series EC2(ND)/EE2(ND) series
Information	EC2/EE2 series technical data
User's manual	Function and note on correct use
Application note	Application circuit of miniature signal relay

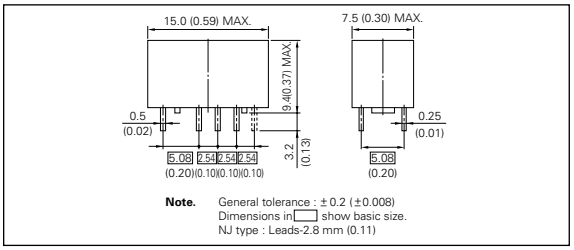
ED2 Series

The ED2 series has reduced coil power consumption but sustained high-performance of NECTOKIN SIGNAL RELAYS. Furthermore, it complies with 2500V surge-voltage requirement of Bellcore specifications.

■ FEATURES

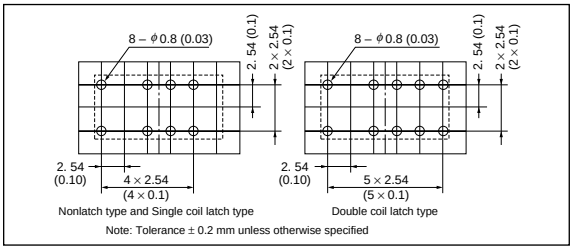
- Low power consumption (30 to 70 mW)
- Compact and light weight
- 2 form c contact arrangement
- Reduced mounting space: 15 mm × 7.5 mm
- High-breakdown voltage of coil to contacts: 1500 Vac, 2500 V (2 × 10 μs*3)
- UL recognized (E73266), CSA certified (LR46266)

■ DIMENSIONS mm(inch)

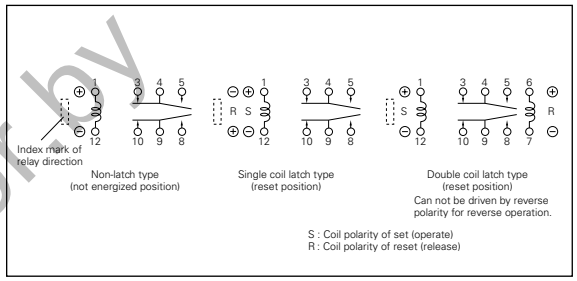


■ RECOMMENDED PAD LAYOUT

(bottom view)mm(inch)



■ SCHEMATICS (bottom view)



■ SPECIFICATIONS

Contact Form		2 Form c	
Contact Material		Silver alloy with gold alloy overlay	
Contact Ratings	Maximum Switching Power	30 W, 62.5VA	
	Maximum Switching Voltage	220 Vdc, 250 Vac	
	Maximum Switching Current	1 A	
	Maximum Carrying Current	2 A	
Minimum Contact Ratings		10 mVdc, 10 μA*1	
Initial Contact Resistance		50 mΩtyp.(Initial)	
Nominal Operating Power	Nonlatch type	50 mW (1.5 to 9 V), 55 mW (9 V), 60 mW (12 V), 70 mW (24 V)	
	Single coil latch type	30 mW	
	Double coil latch type	50 mW	
Operate Time (Excluding bounce)		Approx. 3 ms	
Release Time (Excluding bounce)		Approx. 2 ms without diode	
Insulation Resistance		1000 MΩ at 500 Vdc	
Withstand Voltage	Between open contacts	1000 Vac (for one minute) 1500 V surge (10 × 160 μs*2)	
	Between adjacent contacts		
	Between coil to contacts	1500 Vac (for one minute) 2500 V surge (2 × 10 μs*3)	Double Coil 1000 Vac (for one miniute) Latch type 1500 V surge (10 × 160 μs*2)
Shock Resistance		735 m/s² (misoperating), 980 m/s² (destructive failure)	
Vibration Resistance		10 to 55 Hz, double amplitude 3 mm (misoperating) 10 to 55 Hz, double amplitude 5 mm (destructive failure)	
Ambient Temperature		-40 to + 70°C*4	
Coil Temperature Rise		7 degrees at nominal coil voltage (50 mW)	
Running Specifications	Nonload	1 × 10⁸ *5 operations(Non-latch type) 1 × 10⁷ operations(latch type)	
	Load	50 Vdc, 0.1 A (resistive) 1 × 10⁶ operations at 70°C, 5 Hz 10 Vdc, 10 mA (resistive) 1 × 10⁶ operations at 70°C, 2 Hz	
Weight		Approx. 2.2 g	

* 1 This value is a reference value in the resistance load.
  Minimum capacity changes depending on switching frequency and environment temperature and the load.
* 2 rise time : 10 μs, decay time to half crest : 160 μs
* 3 rise time : 2 μs, decay time to half crest : 10 μs
* 4 Up to 85°C (75% operation of rated voltage at Nonlatch type only),it is possible to respond to a customer's requirement individually.
* 5 This shows a number of operation where it can be running by which a fatal defect is not caused, and a number of operation by which a steady characteristic is maintained is 1×10⁷ times.

ED2 Series

■ PART NUMBER SYSTEM

ED2-3SNU

- Nil: Standard type
- NU: UL recognized CSA certified type
- NJ: Trimmed leads type (UL recognized CSA certified type)

Latch type
- Nil: Nonlatch type (standard)
- S: Single coil latch type
- T: Double coil latch type

Nominal coil voltage (See part numbers)

■ SAFETY STANDARD AND RATING

UL Recognized (UL508)* File No. E73266	CSA Certificated (CSA C22.2 No14) File No. LR46266
30 Vdc, 1 A (Resistive) 110 Vdc, 0.3 A (Resistive) 125 Vac, 0.5 A (Resistive)	

* Spacing : UL114, UL478

TUV Certified (EN60255 / IEC60255)
No. R9950557
Nonlatch and Single-coil-latch
Creepage and clearance of coil to contact is over than 2 mm (According EN60950)
Basic insulation class

■ PART NUMBERS

• Nonlatch Type

at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage** (Vdc)	Must Release Voltage* (Vdc)
ED2-1.5	1.5	45	1.2	0.15
ED2-3	3	180	2.4	0.3
ED2-4.5	4.5	405	3.6	0.45
ED2-5	5	500	4.0	0.5
ED2-6	6	720	4.8	0.6
ED2-9	9	1473	7.2	0.9
ED2-12	12	2400	9.6	1.2
ED2-24	24	8229	19.2	2.4

• Single Coil Latch Type

at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
ED2-1.5S	1.5	75	1.2	1.2
ED2-3S	3	300	2.4	2.4
ED2-4.5S	4.5	675	3.6	3.6
ED2-5S	5	833	4.0	4
ED2-6S	6	1200	4.8	4.8
ED2-9S	9	2700	7.2	7.2
ED2-12S	12	4800	9.6	9.6

• Double Coil Latch Type** (Can not be driven by reverse polarity for reverse operation)

at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
ED2-1.5T	1.5	S 45 R 45	1.2 –	– 1.2
ED2-3T	3	S 180 R 180	2.4 –	– 2.4
ED2-4.5T	4.5	S 405 R 405	3.6 –	– 3.6
ED2-5T	5	S 500 R 500	4.0 –	– 4
ED2-6T	6	S 720 R 720	4.8 –	– 4.8
ED2-9T	9	S 1620 R 1620	7.2 –	– 7.2
ED2-12T	12	S 2880 R 2880	9.6 –	– 9.6

Note * Test by pulse voltage

** S : Set coil (pin No.1⋯⊕ , pin No.12⋯⊖) R : Reset coil (pin No.6⋯⊕ , pin No.7⋯⊖)

The latch type relays should be initialized at appointed position before using, and should be enegized to specific polarity by above polarity to avoid wrong operation.

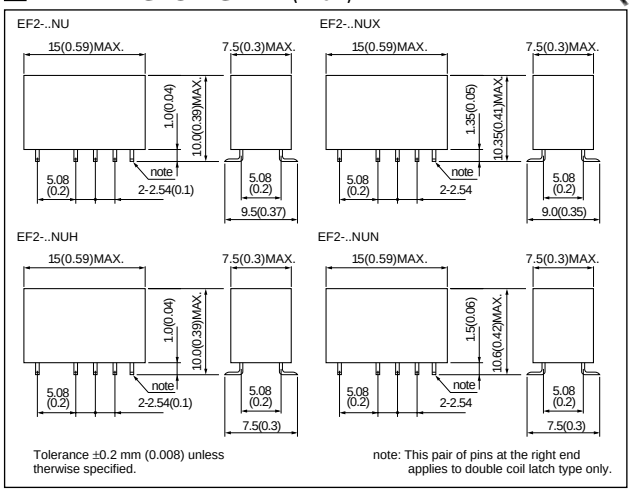
Any special coil requirement, Please contact NECTOKIN for availability.

★75%operation of rated voltage (at +70˚C to +85˚C) is possible individually. Please contact NECTOKIN for availability.

EF2 Series

The EF2 series is surface-mounting type sustaining high-performance of NEC TOKIN ED2 series.

■ DIMENSIONS mm(inch)

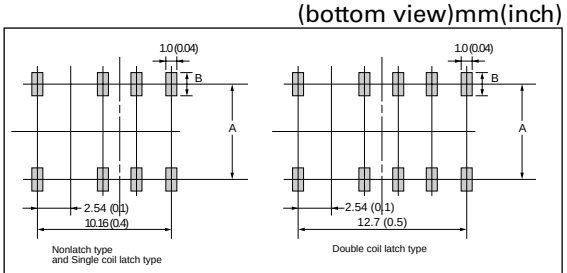


Tolerance ±0.2 mm (0.008) unless therwise specified.

note: This pair of pins at the right end applies to double coil latch type only.

■ RECOMMENDED PAD LAYOUT

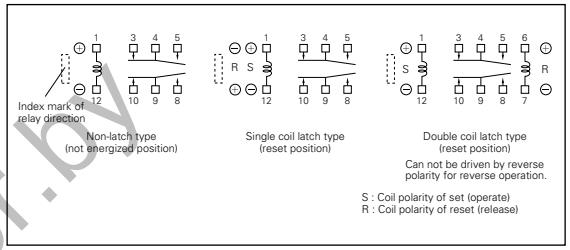
(bottom view)mm(inch)



TYPE	A	B
EF2-..NU	7.3 (0.287)	3.0 (0.118)
EF2-..NUX	7.02 (0.276)	2.73 (0.107)
EF2-..NUH	6.29 (0.248)	2.0 (0.079)
EF2-..NUN	6.29 (0.248)	2.0 (0.079)

Tolerance ± 0.1 mm (0.004) unless otherwise specified.

■ SCHEMATICS (bottom view)



■ FEATURES

- Low power consumption(30 to 70 mW)
- Compact and light weight
- 2 form c contact arrangement
- Reduced mounting space: 15 mm × 9.5 mm
- High-breakdown voltage of coil to contacts: 1500 Vac, 2500 V, (2 × 10 μs*3)
- UL recognized (E73266), CSA certified (LR46266)

■ SPECIFICATIONS

Contact Form		2 Form c
Contact Material		Silver alloy with gold alloy overlay
Contact Ratings	Maximum Switching Power	30 W, 62.5 VA
	Maximum Switching Voltage	220 Vdc, 250 Vac
	Maximum Switching Current	1 A
	Maximum Carrying Current	2 A
Minimum Contact Ratings		10 mVdc, 10 μA*1
Initial Contact Resistance		50 mΩ typ.(Initial)
Nominal Operating Power	Nonlatch type	50 mW (1.5 to 9 V), 55 mW (9 V), 60 mW (12 V), 70 mW (24 V)
	Single coil latch type	30 mW
	Double coil latch type	50 mW
Operate Time (Excluding bounce)		Approx. 2 ms
Release Time (Excluding bounce)		Approx. 1 ms without diode
Insulation Resistance		1000 MΩ at 500 Vdc
Withstand Voltage	Between open contacts	1000 Vac (for one minute)
	Between adjacent contacts	1500 V surge (10 × 160 μs*2)
	Between coil to contacts	1500 Vac (for one minute) / 2500 V surge (2 × 10 μs*3) — Double Coil 1000 Vac (for one miniute) / Latch type 1500 V surge (10 × 160 μs*2)
Shock Resistance		735 m/s² (misoperating), 980 m/s² (destructive failure)
Vibration Resistance		10 to 55 Hz, double amplitude 3 mm (misoperating) 10 to 55 Hz, double amplitude 5 mm (destructive failure)
Ambient Temperature		-40 to + 70°C*4
Coil Temperature Rise		7 degrees at nominal coil voltage (50 mW)
Running Specifications	Nonload	1 × 10⁸ *5 operations(Non-latch type) 1 × 10⁷ operations(latch type)
	Load	50 Vdc, 0.1 A (resistive) 1 × 10⁶ operations at 70°C, 5 Hz 10 Vdc, 10 mA (resistive) 1 × 10⁶ operations at 70°C, 2 Hz
Weight		Approx. 2.2 g

* 1 This value is a reference value in the resistance load.
  Minimum capacity changes depending on switching frequency and environment temperature and the load.
* 2 rise time : 10 μs, decay time to half crest : 160 μs
* 3 rise time : 2 μs, decay time to half crest : 10 μs
* 4 Up to 85°C (75% operation of rated voltage at Nonlatch type only),it is possible to respond to a customer's requirement individually.
* 5 This shows a number of operation where it can be running by which a fatal defect is not caused, and a number of operation by which a steady characteristic is maintained is 1×10⁷ times.

EF2 Series

■ PART NUMBER SYSTEM

EF 2-3SNU-L

- Packaging code
  - Nil: Tube
  - L: Embossed carrying tape (L type)
  - R: Embossed carrying tape (R type)
- Nil: Standard type
  - NU: UL recognized CSA certified type
  - NUH: Minimum footprint type(UL recognized CSA certified type)
  - NUX: High solder joint reliability type (UL recognized CSA certified type)
  - NUN: High solder joint reliability with Minimum footprint type (UL recognized CSA certified type)
- Latch type
  - Nil: Nonlatch type (standard)
  - S: Single coil latch type
  - T: Double coil latch type
- Nominal coil voltage (See part numbers)

■ SAFETY STANDARD AND RATING

UL Recognized (UL508)* File No. E73266	CSA Certificated (CSA C22.2 No14) File No. LR46266
30 Vdc, 1 A (Resistive) 110 Vdc, 0.3 A (Resistive) 125 Vac, 0.5 A (Resistive)	

* Spacing : UL114, UL478

TUV Certified (EN60255 / IEC60255)
No. R9950557
Nonlatch and Single-coil-latch
Creepage and clearance of coil to contact is over than 2 mm (According EN60950)
Basic insulation class

■ PART NUMBERS

• Nonlatch Type at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage** (Vdc)	Must Release Voltage* (Vdc)
EF2-1.5	1.5	45	1.2	0.15
EF2-3	3	180	2.4	0.3
EF2-4.5	4.5	405	3.6	0.45
EF2-5	5	500	4.0	0.5
EF2-6	6	720	4.8	0.6
EF2-9	9	1473	7.2	0.9
EF2-12	12	2400	9.6	1.2
EF2-24	24	8229	19.2	2.4

• Single Coil Latch Type at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
EF2-1.5S	1.5	75	1.2	1.2
EF2-3S	3	300	2.4	2.4
EF2-4.5S	4.5	675	3.6	3.6
EF2-5S	5	833	4.0	4
EF2-6S	6	1200	4.8	4.8
EF2-9S	9	2700	7.2	7.2
EF2-12S	12	4800	9.6	9.6

• Double Coil Latch Type** (Can not be driven by reverse polarity for reverse operation) at 20 °C

Part Number (Standard)	Nominal Coil Voltage (Vdc)	Coil Resistance (Ω) ±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
EF2-1.5T	1.5	S 45 R 45	1.2 –	– 1.2
EF2-3T	3	S 180 R 180	2.4 –	– 2.4
EF2-4.5T	4.5	S 405 R 405	3.6 –	– 3.6
EF2-5T	5	S 500 R 500	4.0 –	– 4
EF2-6T	6	S 720 R 720	4.8 –	– 4.8
EF2-9T	9	S 1620 R 1620	7.2 –	– 7.2
EF2-12T	12	S 2880 R 2880	9.6 –	– 9.6

Note * Test by pulse voltage

** S : Set coil (pin No.1···⊕ , pin No.12···⊖) R : Reset coil (pin No.6···⊕ , pin No.7···⊖)

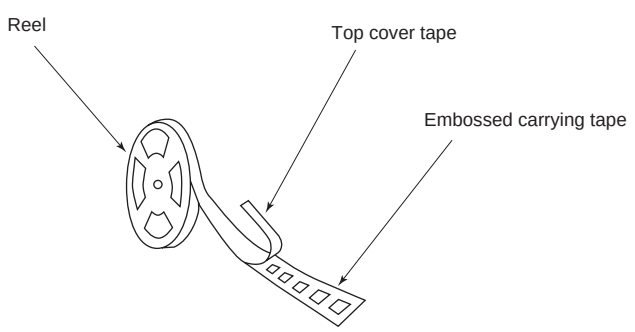
The latch type relays should be initialized at appointed position before using, and should be enegized to specific polarity by above polarity to avoid wrong operation.

Any special coil requirement, Please contact NEC TOKIN for availability.

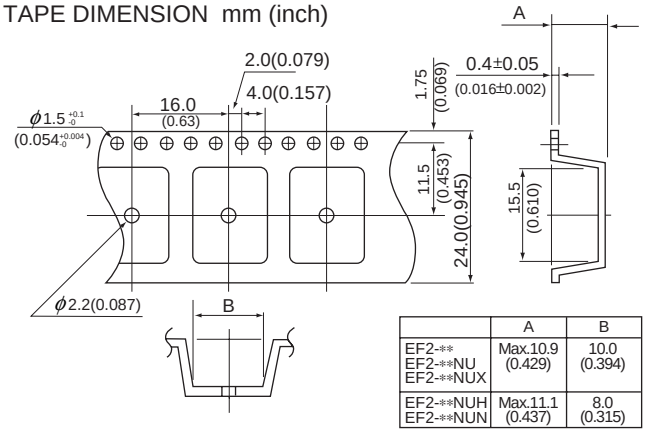
★75%operation of rated voltage (at +70˚C to +85˚C) is possible individually. Please contact NEC TOKIN for availability.

■ TAPE PACKAGE (OPTION)

APPEARANCE

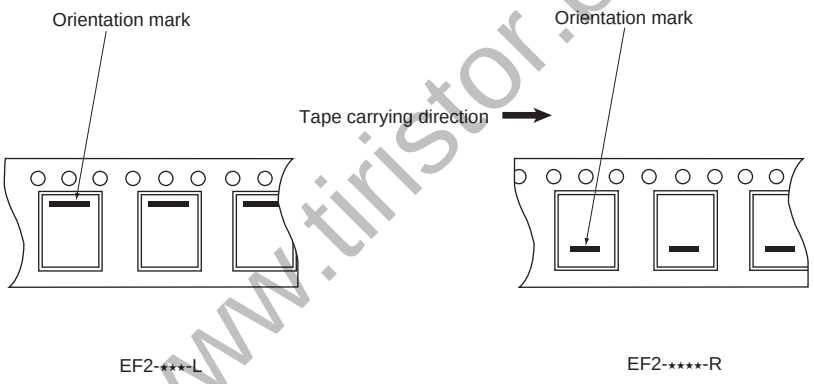


TAPE DIMENSION mm (inch)



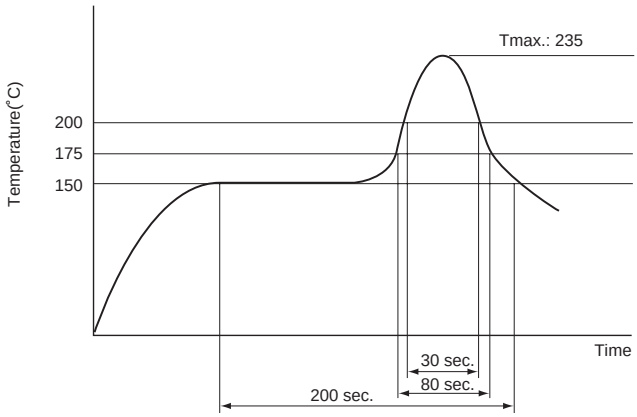
	A	B
EF2-** EF2-**NU EF2-**NUX	Max.10.9 (0.429)	10.0 (0.394)
EF2-**NUH EF2-**NUN	Max.11.1 (0.437)	8.0 (0.315)

Relay orientation mark and tape carrying direction.

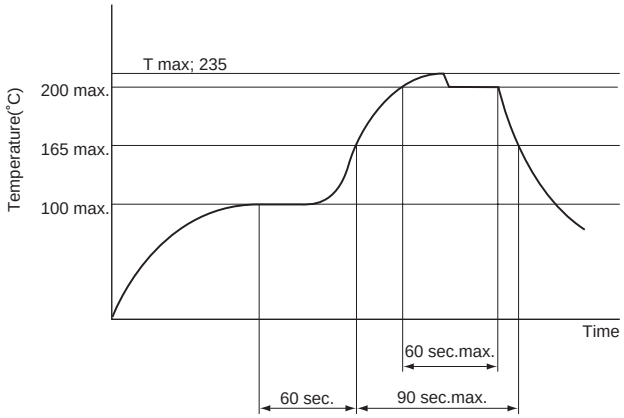


■ SOLDERING CONDITION

IRS Method



VPS Method



Note

1. Temperature profile shows printed circuit board surface temperature on the relay terminal portion.
2. Please check the actual soldering condition to use other method except above mentioned temperature profiles.

■ Recommended relay drive conditions

Drive under conditions. If it is impossible, please inquire to NEC TOKIN.

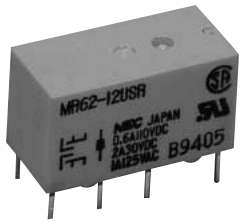
Nonlatch type	Voltage:within ±5% at nominal voltage	Ambient temperature -40~+70˚C(80% operate type) Ambient temperature -40~+85˚C(75% operate type)
Single coil latch type Double coil latch type	Square pulse (rise and fall time is rapidly) Pulse height: within ±5% at nominal voltage Pulse width: more than 10 ms	Ambient temperature -40~+70˚C

■ Technical document

Please confirm technical document before use.
It is able to receive a document at NEC TOKIN's World-wide-web site.
(http://www.nec-tokin.com)

ITEM	TITLE
Data sheet	ED2/EF2 series
Information	ED2/EF22 series technical data
User's manual	Function and note on correct use
Application note	Application circuit of miniature signal relay

MR62 Series Standard Type

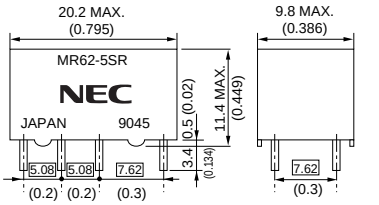


The MR62 series is a plastic sealed miniature relay designed to offer completely dust-and-water-proof package with bifurcated and crossbar contacts for assuring high reliability.

■ FEATURES

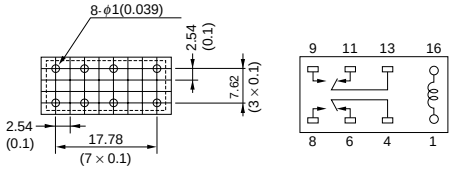
- DIP terminal
- 2 Form c Bifurcated-Crossbar contacts
- Plastic sealed package for flow-soldering process
- Super reliability at signal level
- UL recognized (E73266), C SA certified (LR46266)
- 1500V FCC surge between coil and contacts and between adjacent contacts.

■ DIMENSIONS mm(inch)



Tolerance ± 0.2 mm (0.008)

■ RECOMMENDED PCB PAD LAYOUT and SCHEMATICS mm(inch)



Tolerance ± 0.1 mm

(BOTTOM VIEW)
Approx. 5g (0.17 oz)
Not energized position

■ SAFETY STANDARD AND RATING

UL Recognized (UL508)* File No E73266	CSA Certificated (CSA C22.2 No14) File No LR46266
30 Vdc, 2 A (Resistive) 110 Vdc, 0.6 A (Resistive) 125 Vac, 1 A (Resistive)	

* Spacing : UL114, UL478

■ SPECIFICATIONS

Contact Form		2 Form c
Contact Material		Silver alloy with gold alloy overlay
Contact Ratings	Maximum Switching Power	60 W, 125 VA
	Maximum Switching Voltage	220 Vdc, 250 Vac
	Maximum Switching Current	2 A
	Maximum Carrying Current	2 A
Minimum Contact Ratings		100 mVdc, 100 μA
Initial Contact Resistance		50 mΩ typ.(Initial)
Nominal Operating Power		Approx. 550 mW
Operate Time (Excluding bounce)		Approx. 2.5 ms
Release Time (Excluding bounce)		Approx. 2 ms without diode
Insulation Resistance		1000 MΩ at 500 Vdc
Withstand Voltage	Between open contacts	500 Vac (for one minute)
	Between adjacent contacts	1000 Vac (for one minute) 1500 V surge (10 × 160 μs*1)
	Between coil to contacts	
Shock Resistance		294 m/s² (misoperating) 980 m/s² (destructive failure)
Vibration Resistance		10 to 55 Hz, double amplitude 1.5 mm (misoperating) 10 to 55 Hz, double amplitude 5 mm (destructive failure)
Ambient Temperature		-40 to + 85°C
Coil Temperature Rise		40 degrees at nominal coil voltage (550 mW)
Running Specifications	Nonload	10 × 10⁶ operations
	Load	50 Vdc, 0.1 A (resistive), 1 × 10⁶ operations at 85°C 5Hz
		10 Vdc, 10m A (resistive), 1 × 10⁶ operations at 85°C 2Hz
Weight		Approx. 5 g

* 1 rise time : 10 μs, decay time to half crest : 160 μs

■ STANDARD PART NUMBERS

at 20 °C

Part Number	Nominal Voltage (Vdc)	Coil Resistance (Ω)±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
MR62- 5SR	5	42	3.1	0.25
MR62- 6SR	6	66	3.9	0.33
MR62- 9SR	9	140	5.7	0.45
MR62-12SR	12	280	8.1	0.68
MR62-24SR	24	1,050	15.8	1.3
MR62-48SR	48	4,200	34.4	2.6

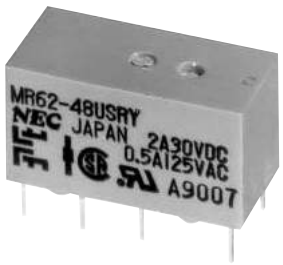
* Test by pulse voltage

■ PART NUMBER SYSTEM

MR62-5USR

- Contact material
  - Nil : Silver-palladium alloy with gold alloy overlay
  - R : Silver-nickel alloy with gold alloy overlay
- Sealed type (Washable)
- Safety standard
  - Nil : Standard type
  - U : UL recognized CSA certified type
- Nominal coil voltage (See part numbers)

MR62 Series-K, Y, KY Type



■ FEATURES

- 1500V FCC surge between open contacts (K, KY type)
- 1500V FCC surge between coil and contacts and between adjacent contacts
- 400mW nominal operate power. (Y, KY type)

■ SPECIFICATIONS

Types		MR62-**K**	MR62-****Y	MR62-**K*Y
Contact Form		2 Form c		
Contact Material		Silver alloy with gold alloy overlay		
Contact Ratings	Maximum Switching Power	60 W, 125 VA		
	Maximum Switching Voltage	220 Vdc, 250 Vac		
	Maximum Switching Current	2 A		
	Maximum Carrying Current	2 A		
Minimum Contact Ratings		100 mVdc, 100 μA		
Initial Contact Resistance		50 mΩtyp.(Initial)		
Nominal Operating Power		Approx. 550 mW	Approx. 400 mW	
Operate Time (Excluding bounce)		Approx. 3.5 ms	Approx. 2.5 ms	
Release Time (Excluding bounce without diode)			Approx. 2 ms	
Insulation Resistance		100 MΩ at 500 Vdc		
Withstand Voltage	Between open contacts	1000 Vac*1 1500 V surge*2	500 Vac*1	1000 Vac*1 1500 V surge*2
	Between adjacent contacts	1000 Vac*1		
	Between coil to contacts	1500 V surge*2		
Shock Resistance		294 m/s² (misoperating) 980 m/s² (destructive failure)		
Vibration Resistance		10 to 55 Hz, double amplitude 1.5 mm (misoperating) 10 to 55 Hz, double amplitude 5 mm (destructive failure)		
Ambient Temperature		-40 ~ + 85℃		
Coil Temperature Rise		40℃ (550 mW)	35℃ (400 mW)	
Running Specifications	Nonload	10 × 10⁶ operations		
	Load	50 Vdc, 0.1 A (resistive) 1 × 10⁶ operations at 85℃, 5 Hz		
		10 Vdc, 10 mA (resistive) 1 × 10⁶ operations at 85℃, 2 Hz		
Weight		Approx. 5 g		

* 1 for one minute
* 2 rise time : 10 μs, decay time to half crest : 160 μs

■ STANDARD PART NUMBERS

at 20°C

Part Number	Nominal Voltage (Vdc)	Coil Resistance (Ω)±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
MR62- 5SRY	5	62.5	3.5	0.25
MR62- 6SRY	6	90	4.2	0.33
MR62- 9SRY	9	202.5	6.3	0.45
MR62-12SRY	12	360	8.4	0.68
MR62-24SRY	24	1,440	16.8	1.3
MR62-48SRY	48	5,760	33.6	2.6
MR62- 5KSR	5	42	3.5	0.25
MR62- 6KSR	6	66	4.2	0.33
MR62- 9KSR	9	140	6.3	0.45
MR62-12KSR	12	280	8.4	0.68
MR62-24KSR	24	1,050	16.8	1.3
MR62-48KSR	48	4,200	38.4	2.6
MR62- 5KSRY	5	62.5	3.5	0.25
MR62- 6KSRY	6	90	4.2	0.33
MR62- 9KSRY	9	202.5	6.3	0.45
MR62-12KSRY	12	360	8.4	0.68
MR62-24KSRY	24	1,440	16.8	1.3
MR62-48KSRY	48	5,360	38.4	2.6

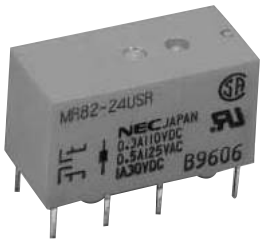
* Test by pulse voltage

■ PART NUMBER SYSTEM

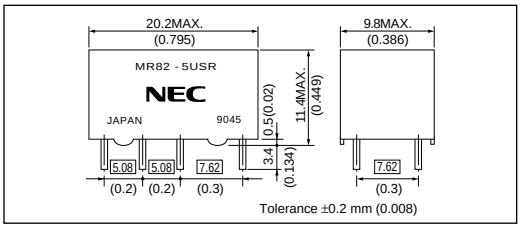
MR62-5UKSRY

- Nominal operate power
  - Nil :550 mW
  - Y :400 mW
- Contact material
  - Nil :Silver-palladium alloy with gold alloy overlay
  - R :Silver-nickel alloy with gold alloy overlay
- Sealed type (Washable)
- Breakdown voltage between open contacts
  - Nil :500 Vac
  - K :1000 Vac
- Safety standard
  - Nil :Standard type
  - U :UL recognized CSA certified type
- Nominal coil voltage (See part numbers)

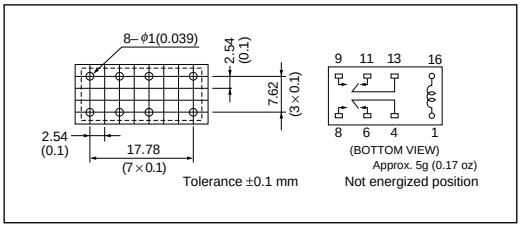
MR82 Series



■ DIMENSIONS mm (inch)



■ RECOMMENDED PCB PAD LAYOUT and SCHEMATICS mm (inch)



■ FEATURES

- 200mW nominal operate power
- 1500V FCC surge strength between coil to contacts, and between adjacent contacts

■ SPECIFICATIONS

Contact Form		2 Form c
Contact Material		Silver alloy with gold alloy overlay
Contact Ratings	Maximum Switching Power	60 W, 125 VA
	Maximum Switching Voltage	220 Vdc, 250 Vac
	Maximum Switching Current	2 A
	Maximum Carrying Current	2 A
Minimum Contact Ratings		100 mVdc, 100 μA
Initial Contact Resistance		50 mΩ typ.(Initial)
Nominal Operating Power		200 mW
Operate Time (Excluding bounce)		Approx. 5.5 ms
Release Time (Excluding bounce)		Approx. 2 ms without diode
Insulation Resistance		1000 MΩ at 500 Vdc
Withstand Voltage	Between open contacts	500 Vac (for one minute)
	Between adjacent contacts	1000 Vac (for one minute)
	Between coil to contacts	1500 V surge (10 × 160 μs*1)
Shock Resistance		294 m/s² (misoperating) 980 m/s² (destructive failure)
Vibration Resistance		10 to 55 Hz, double amplitude 1.5 mm (misoperating) 10 to 55 Hz, double amplitude 5 mm (destructive failure)
Ambient Temperature		-40 ~ +85℃
Coil Temperature Rise		Approx. 22 degrees at nominal coil voltage (200 mW)
Running Specifications	Nonload	10 × 10⁶ operations
	Load	50 Vdc, 0.1 A (resistive) 1 × 10⁶ operations at 85℃, 5 Hz
		10 Vdc, 10 mA (resistive) 1 × 10⁶ operations at 85˚C, 2 Hz
Weight		Approx. 5 g

* 1 rise time : 10 μs, decay time to half crest : 160 μs

■ STANDARD PART NUMBERS

at 20°C

Part Number	Nominal Voltage (Vdc)	Coil Resistance (Ω)±10%	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
MR82- 4.5USR	4.5	101	3.15	0.23
MR82- 5USR	5	125	3.5	0.25
MR82- 6USR	6	180	4.2	0.33
MR82-9USR	9	405	6.3	0.45
MR82-12USR	12	720	8.4	0.68
MR82-24USR	24	2880	16.8	1.2

* Test by pulse voltage

■ PART NUMBER SYSTEM

MR82-5USR

Nominal coil voltage (See part numbers)

■ SAFETY STANDARD AND RATING

UL Recognized (UL508)* File No. E73266	CSA Certificated (CSA C22.2 No14) File No. LR46266
30 Vdc, 1 A (Resistive) 110 Vdc, 0.3 A (Resistive) 125 Vac, 0.5 A (Resistive)	

* Spacing : UL114, UL478

■ Recommended relay drive conditions

Drive under conditions. If it is impossible, please inquire to NEC TOKIN.

Nominal coil voltage = < 24 V	Voltage : within±5% at nominal voltage	Ambient temperature -40~+85℃
Nominal coil voltage = 48 V		Ambient temperature -40~+70℃

■ Technical document

Please confirm technical document before use.
It is able to receive a document at NEC TOKIN's World-wide-web site.
(http://www.nec-tokin.com)

ITEM	TITLE
Data sheet	MR82 Series
Information	MR82 Series technical data
User's manual	Function and note on correct use
Application note	Application circuit of miniature signal relay

EN2 Series

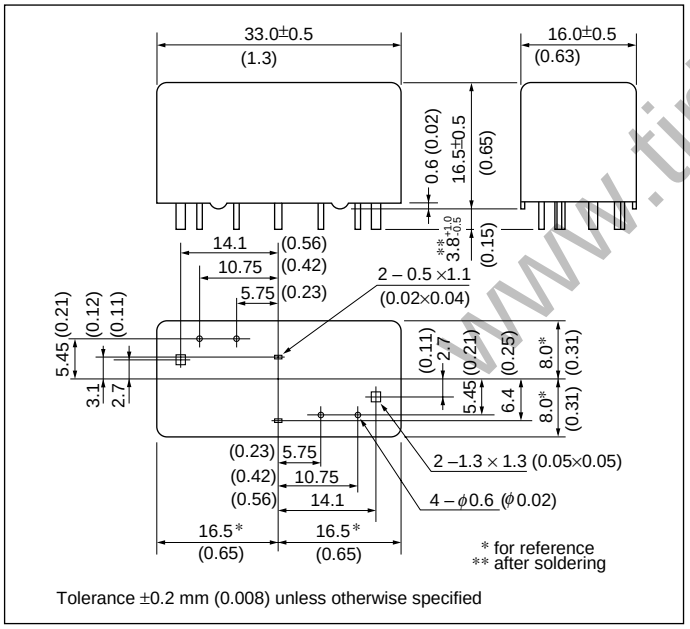
Automotive twin relay EN2 series is printed circuit board mount type and the most suitable for various motor controls in the automotive which require high-quality and high-performance.
EN2 series has two types for different applications. One is H bridge type which is desigined for forword and reverse control of the motor. The other is separate type which contains two separated relays in one package.

■ FEATURES

- Twin relay for motor reversible control
- 30% less relay space than 2 conventional relays
- High performance & productivity by unique symmetrical structure
- Flux tight housing

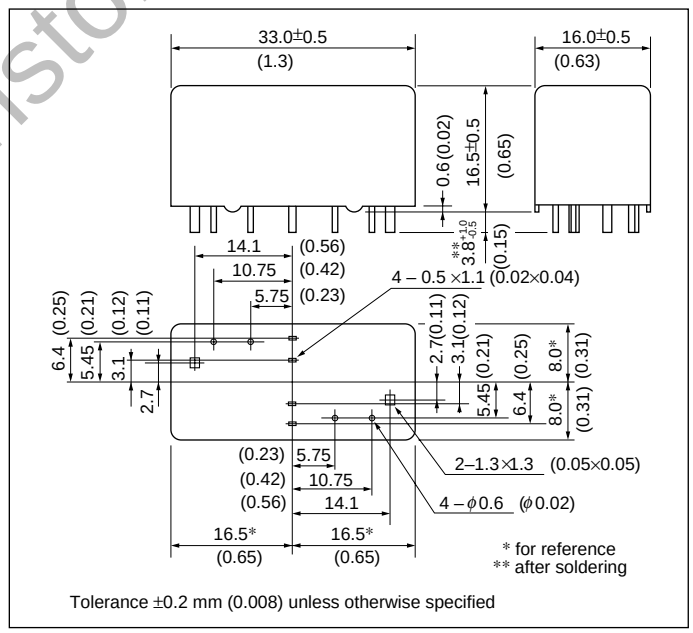
■ DIMENSIONS mm (inch)

[H Bridge Type]



Tolerance ±0.2 mm (0.008) unless otherwise specified

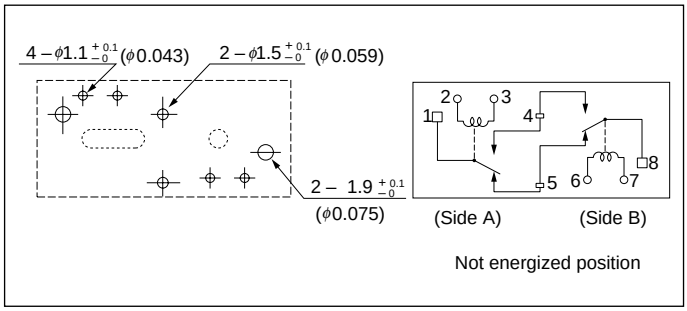
[Separate (T) Type]



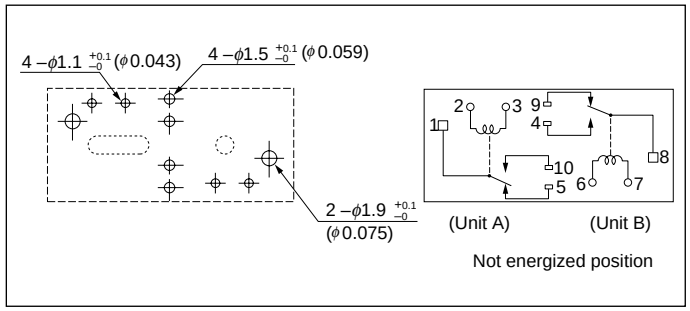
Tolerance ±0.2 mm (0.008) unless otherwise specified

■ RECOMMENDED PCB PAD LAYOUT and SCHEMATICS (bottom view) mm (inch)

[H Bridge Type]



[Separate (T) Type]



EN2 Series

■ SPECIFICATIONS

at 20 °C

Items \ Types (Contact Rating)		EN2 (Standard)	EN2-B (High Current)
Contact Form		1 Form c × 2 (H Bridge Type or Separate Type)	
Contact Material		Silver oxide complex alloy	
Initial Contact Resistance * figure 1.		H Bridge (route A) : 8.1 mΩ typ. H Bridge (route B) : 7.8 mΩ typ. Separate (N/C) : 3.9 mΩ typ. Separate (N/O) : 3.9 mΩ typ. (measured by voltage drop at 6 Vdc, 7A)	H Bridge (route A) : 4.9 mΩ typ. H Bridge (route B) : 4.6 mΩ typ. Separate (N/C) : 2.3 mΩ typ. Separate (N/O) : 2.3 mΩ typ. (measured by voltage drop at 6 Vdc, 7A)
Contact Switching Voltage		16 Vdc	
Contact Switching Current		35 A Max. (at 16 Vdc)	
Contact Carrying Current		25 A Max. (1 hour Max.) 30 A Max. (2 minutes Max.) at 12 Vdc	35 A Max. (1 hour Max.) 40 A Max. (2 minutes Max.) at 12 Vdc
Operate Time (Excluding bounce)		Approx. 5 ms (at Nominal Voltage)	
Release Time (Excluding bounce)		Approx. 2 ms (at Nominal Voltage, without diode) initial	
Nominal Operate Power		0.64 W/ 0.8 W / 1.15 W (at 12 Vdc)	
Insulation Resistance		100 MΩ at 500Vdc, initial	
Withstand Voltage		500 Vac (for 1 minute), initial	
Shock Resistance		98 m/s² (misoperating), 980 m/s² (destructive failure)	
Vibration Resistance		10 to 300 Hz, 43 m/s² (misoperating), 10 to 500 Hz, 43 m/s², 200 hours (destructive failure)	
Ambient Temperature		-40 to +85˚C (-40 to + 185˚F)	
Coil Temperature Rise		50˚C / W (122 ˚F / W)	
Running Specifications	Nonload	10×10^6 operations	
	Load	100×10^3 operations (at 14 Vdc, Motor Load 30 A/7 A)	
Weight		Approx. 18 g (0.63 oz)	

■ COIL RATING

at 20 °C

Part Numbers		Nominal Voltage (Vdc)	Coil Resistance (Ω) ±10 %	Must Operate Voltage * (Vdc)	Must Release Voltage * (Vdc)	Nominal Operate Power (W)
H Bridge Type	Separate Type					
EN2-1N1	EN2-1N1T	12	125	6.5	0.6	1.15
EN2-1N2	EN2-1N2T	12	125	7.0	0.6	1.15
EN2-1N3	EN2-1N3T	12	125	7.5	0.6	1.15
EN2-2N3	EN2-2N3T	12	180	7.5	0.6	0.8
EN2-2N4	EN2-2N4T	12	180	8.0	0.6	0.8
EN2-2N5	EN2-2N5T	12	180	8.5	0.6	0.8
EN2-3N5	EN2-3N5T	12	225	8.5	0.9	0.64

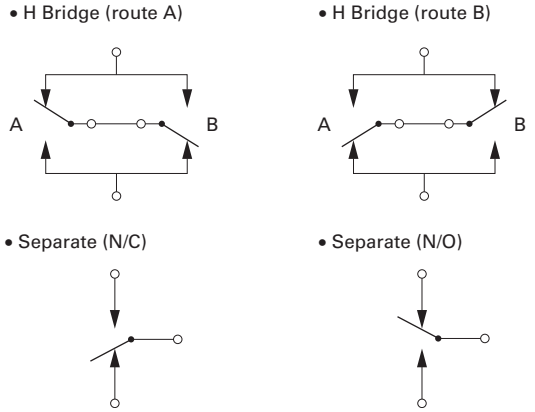
* Test by pulse voltage

■ PART NUMBER SYSTEM

EN2-B1N1 ST

- Wiring: Nil : H bridge type; T : Separate type
- Enclosure: Nil : Unsealed; S : Sealed
- Must Operate Voltage (at 20°C): 1 : 6.5 V; 2 : 7.0 V; 3 : 7.5 V; 4 : 8.0 V; 5 : 8.5 V
- Contact Material: N : Silver oxide complex alloy type I; G : Silver oxide complex alloy type II
- Coil Resistance (at 20°C): 1 : 125 Ω ± 10 %; 2 : 180 Ω ± 10 %; 3 : 225 Ω ± 10 %
- Carrying Current Capacity: Nil : Standard type; B : High current type
- Type

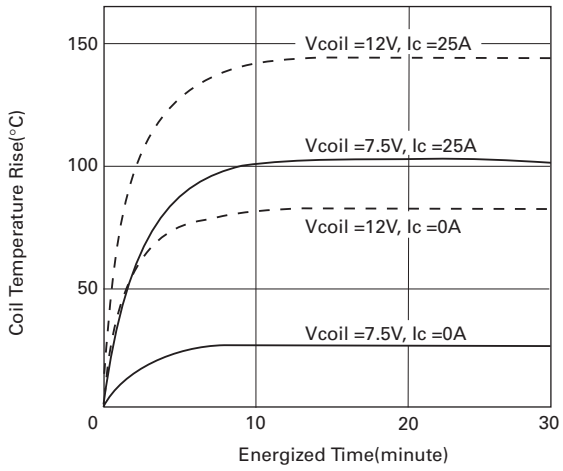
★ Contact Resistance (figure 1)

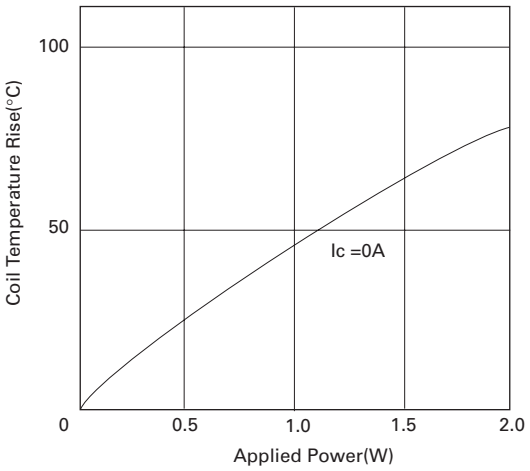


■ DATA

● Coil Temperature Rise

(Sample: EN2-1N2)

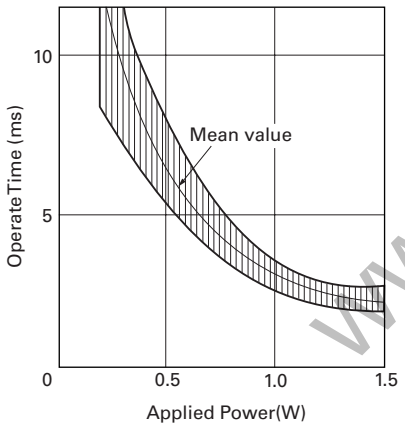




Vcoil: Energized Coil Voltage
Ic: Contact current

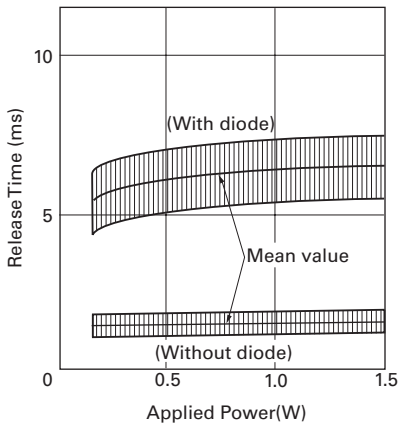
● Operate Time

(Sample: EN2-2N4)



● Release Time

(Sample: EN2-2N4)



EP2 Series

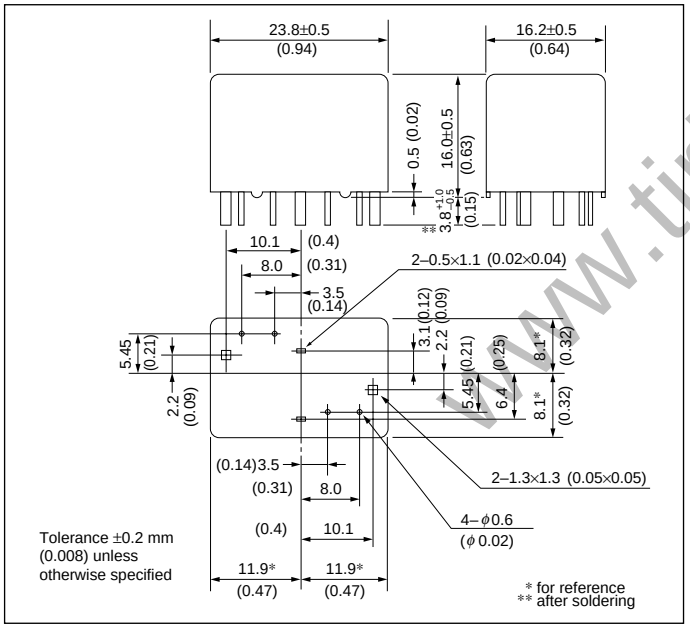
Automotive twin relay EP2 series is printed circuit board mount type and the most suitable for various motor controls in the automotive which require high-quality and high-performance.
EP2 series has two types for different applications. One is H bridge type which is desigined for forword and reverse control of the motor. The other is separate type which contains two separated relays in one package.

■ FEATURES

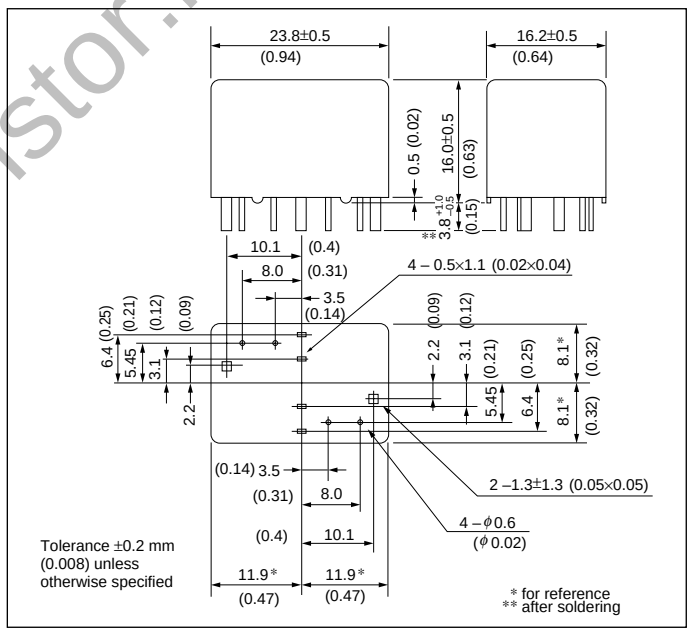
- Twin relay for motor reversible control
- 50% less relay space than 2 conventional relays
- High performance & productivity by unique symmetrical structure
- Flux tight housing

■ DIMENSIONS mm (inch)

[H Bridge Type]

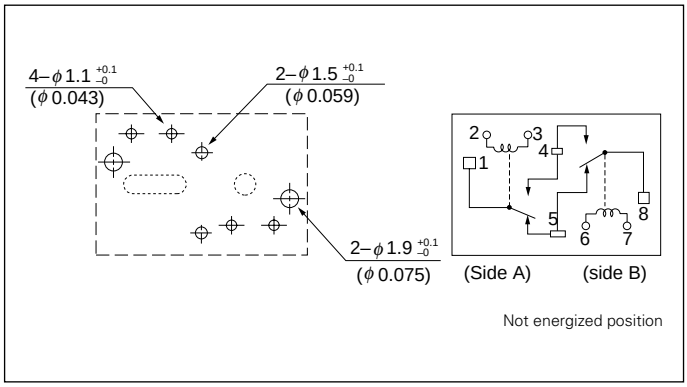


[Separate (T) Type]

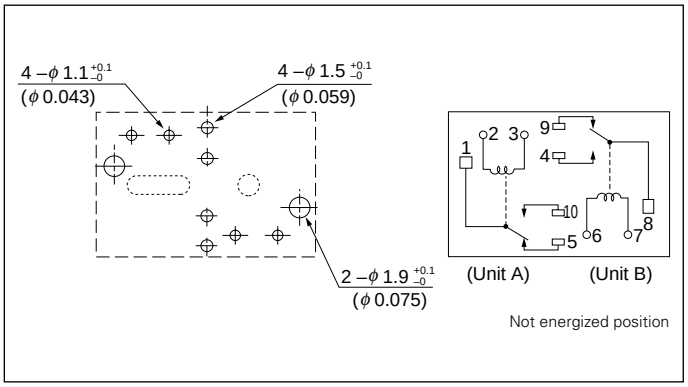


■ RECOMMENDED PCB PAD LAYOUT and SCHEMATICS (bottom view) mm (inch)

[H Bridge Type]



[Separate (T) Type]



■ SPECIFICATIONS

at 20 °C

Items \ Types (Contact Rating)		EP2 (Standard)	EP2-B (High Current)
Contact Form		1 Form c × 2 (H Bridge Type or Separate Type)	
Contact Material		Silver oxide complex alloy (Special type available)	
Initial Contact Resistance * figure 1.		H Bridge (route A) : 10.7 mΩ typ. H Bridge (route B) : 10.4 mΩ typ. Separate (N/C) : 5.2 mΩ typ. Separate (N/O) : 5.2 mΩ typ. (measured by voltage drop at 6 Vdc, 7 A)	H Bridge (route A) : 6.7 mΩ typ. H Bridge (route B) : 6.4 mΩ typ. Separate (N/C) : 3.2 mΩ typ. Separate (N/O) : 3.2 mΩ typ. (measured by voltage drop at 6 Vdc, 7 A)
Contact Switching Voltage		16 Vdc	
Contact Switching Current		30 A Max. (at 16 Vdc)	
Contact Carrying Current		20 A Max. (1 hour Max.) 25 A Max. (2 minutes Max.) at 12 Vdc	25 A Max. (1 hour Max.) 30 A Max. (2 minutes Max.) at 12 Vdc
Operate Time (Excluding bounce)		Approx. 5 ms (at Nominal Voltage)	
Release Time (Excluding bounce)		Approx. 2 ms (at Nominal Voltage), without diode	
Nominal Operate Power		0.48 W/ 0.64 W (at 12 Vdc)	
Insulation Resistance		100 MΩ at 500 Vdc, initial	
Withstand Voltage		500 Vac (for 1 minute), initial	
Shock Resistance		98 m/s² (misoperating), 980 m/s² (destructive failure)	
Vibration Resistance		10 to 300 Hz, 43 m/s² (misoperating), 10 to 500 Hz, 43 m/s², 200 hours (destructive failure)	
Ambient Temperature		-40 to + 85˚C (-40 to +185˚F)	
Coil Temperature Rise		50˚C / W (122 ˚F/W) (Contact Carrying Current : 0 A)	
Running Specifications	Nonload	1 × 10⁶ operations	
	Load	100 × 10³ operations (at 14 Vdc, Motor Load 25 A/5 A)	
Weight		Approx. 15 g (0.53 oz)	

■ COIL RATING

at 20 °C

Part Numbers		Nominal Voltage (Vdc)	Coil Resistance (Ω) ±10 %	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)	Nominal Operate Power (W)
H Bridge Type	Separate Type					
EP2-3N1	EP2-3N1T	12	225	6.5	0.9	0.64
EP2-3N2	EP2-3N2T	12	225	7.0	0.9	0.64
EP2-3N3	EP2-3N3T	12	225	7.5	0.9	0.64
EP2-4N3	EP2-4N3T	12	300	7.5	0.9	0.48
EP2-4N4	EP2-4N4T	12	300	8.0	0.9	0.48
EP2-4N5	EP2-4N5T	12	300	8.5	0.9	0.48

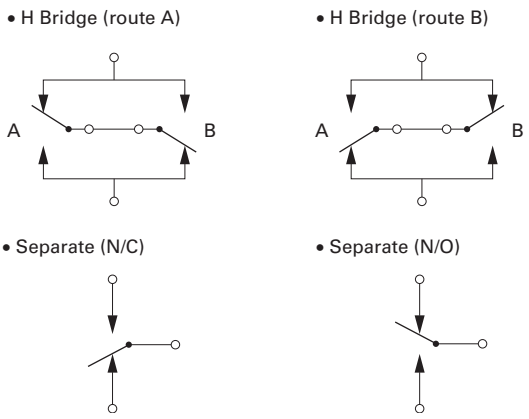
* Test by pulse voltage

■ PART NUMBER SYSTEM

EP2-B3L1 ST

- Wiring: Nil : H bridge type; T : Separate type
- Enclosure: Nil : Unsealed; S : Sealed
- Must Operate Voltage (at 20°C): 1 : 6.5 V; 2 : 7.0 V; 3 : 7.5 V; 4 : 8.0 V; 5 : 8.5 V
- Contact Material: L : Silver oxide complex alloy type I; N : Silver oxide complex alloy type II; G : Silver oxide complex alloy type III
- Coil Resistance (at 20°C): 3 : 225 Ω ± 10 %; 4 : 300 Ω ± 10 %
- Carrying Current Capacity: Nil : Standard type; B : High current type
- Type

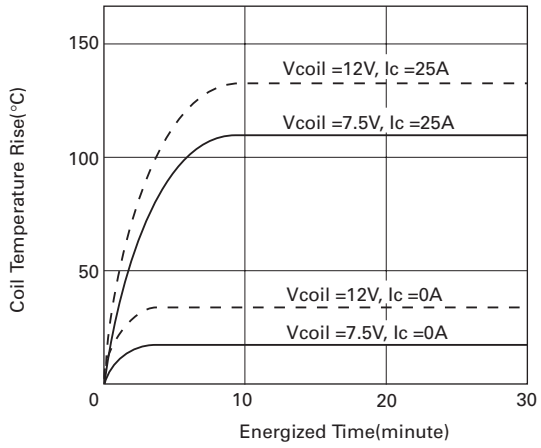
★ Contact Resistance (figure 1)

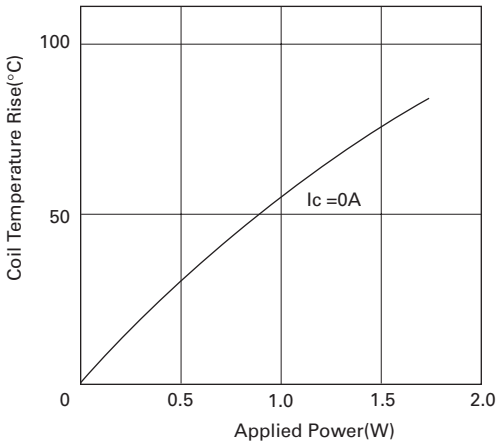


■ DATA

● Coil Temperature Rise

(Sample: EP2-3L1)

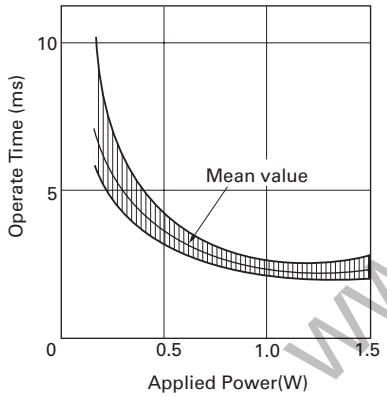




Vcoil: Energized Coil Voltage
Ic: Contact current

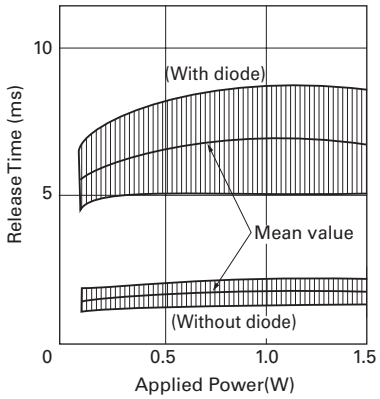
● Operate Time

(Sample: EP2-3L1)



● Release Time

(Sample: EP2-3L1)



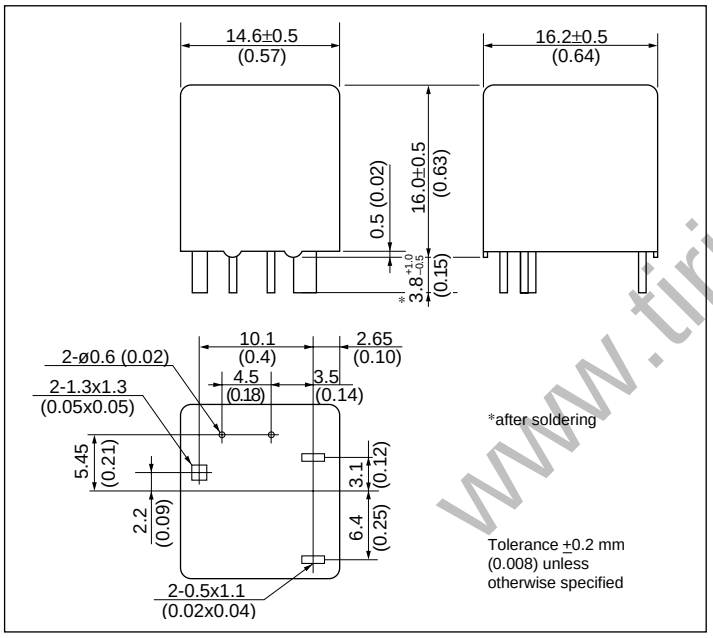
EP1 Series

The automotive relay EP1 Series is printed-circuit-board-mount-type and the most suitable for various motor controls in automotive applications pursuing quality and performance.

■ FEATURES

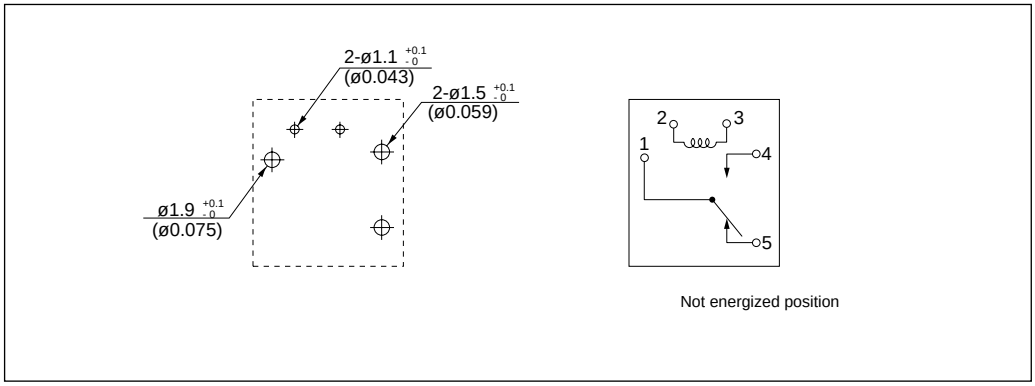
- Flux tight housing
- Low profile
- Two types of contact according to switching current.
  (Standard type: 25 A Max, High current type: 30 A Max.)

■ DIMENSIONS mm (inch)



■ RECOMMENDED PCB PAD LAYOUT and SCHEMATICS

(bottom view) mm (inch)



EP1 Series

■ SPECIFICATIONS

at 20 °C

Items \ Types (Contact Rating)		EP1 (Standard)	EP1-B (High Current)
Contact Form		1 Form c	
Contact Material		Silver oxide complex alloy (Special type available)	
Initial Contact Resistance		5.2 mΩ typ.(measured by voltage drop at 6 Vdc, 7A)	
Contact Switching Voltage		16 Vdc, Max.	
Contact Switching Current		30 A Max. (at 16 Vdc)	
Contact Carrying Current		25 A Max. (1 hour Max.) 30 A Max. (2 minutes Max.) at 12 Vdc	30 A Max. (1 hour Max.) 35 A Max. (2 minutes Max.) at 12 Vdc
Operate Time (Excluding bounce)		Approx. 5 ms (at Nominal Voltage)	
Release Time (Excluding bounce)		Approx. 2 ms (at Nominal Voltage, without diode) initial	
Nominal Operate Power		0.48 W/ 0.64 W (at 12 Vdc)	
Insulation Resistance		100 MΩ at 500 Vdc, initial	
Withstand Voltage		500 Vac (for 1 minute), initial	
Shock Resistance		98 m/s² (misoperating), 980 m/s² (destructive failure)	
Vibration Resistance		10 to 300 Hz, 43 m/s² (misoperating), 10 to 500 Hz, 43 m/s² , 200 hours (destructive failure)	
Ambient Temperature		-40 to + 85˚C (-40 to + 185˚F)	
Coil Temperature Rise		50˚C / W (122 ˚F/W)(Contact Carrying Current: 0A)	
Running Specifications	Nonload	1×10^6 operations	
	Load	100×10^3 operations (at 14 Vdc, Motor Load 25 A/5 A)	
Weight		Approx. 8 g (0.28 oz)	

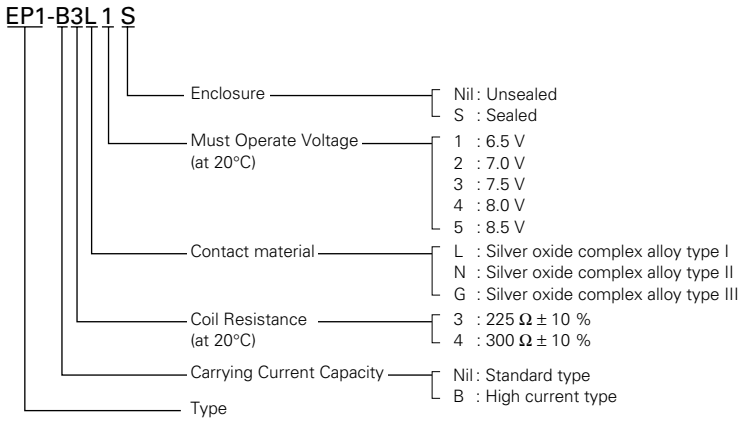
■ COIL RATING

at 20 °C

Part Numbers		Nominal Voltage (Vdc)	Coil Resistance (Ω) ±10 %	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)	Nominal Operate Power (W)
Standard Type	High Current Type					
EP1-3L1	EP1-B3G1	12	225	6.5	0.9	0.64
EP1-3L2	EP1-B3G2	12	225	7.0	0.9	0.64
EP1-3L3	EP1-B3G3	12	225	7.5	0.9	0.64
EP1-4L3	EP1-B4G3	12	300	7.5	0.9	0.48
EP1-4L4	EP1-B4G4	12	300	8.0	0.9	0.48
EP1-4L5	EP1-B4G5	12	300	8.5	0.9	0.48

* Test by pulse voltage

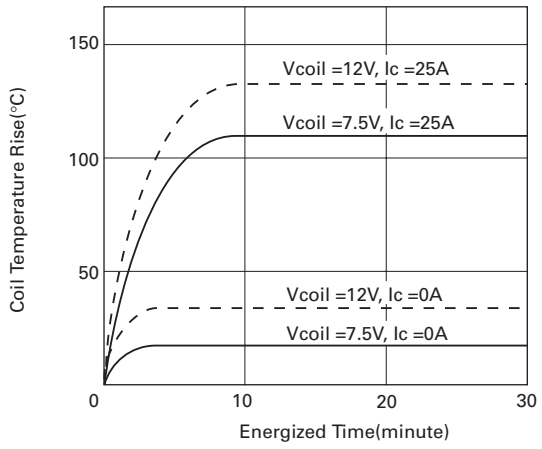
■ PART NUMBER SYSTEM

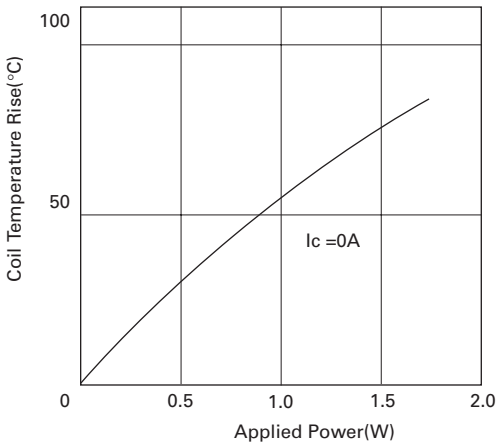


■ DATA

● Coil Temperature Rise

(Sample: EP1-3L1)

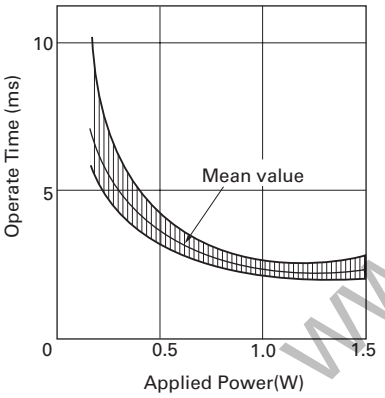




Vcoil: Energized Coil Voltage
Ic: Contact current

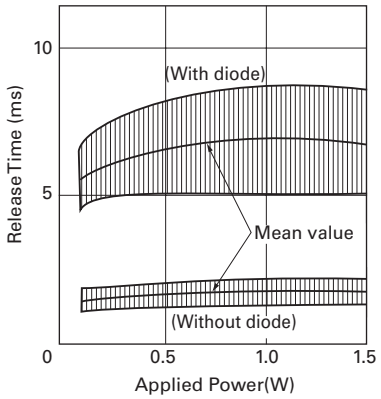
● Operate Time

(Sample: EP1-3L1)



● Release Time

(Sample: EP1-3L1)



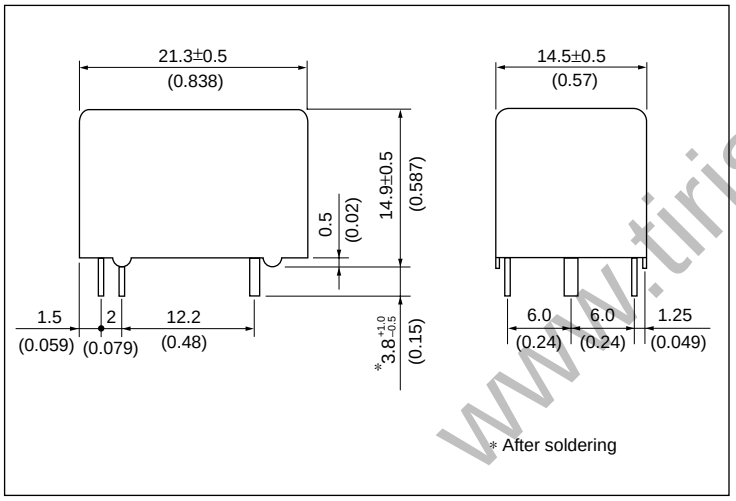
EQ1 Series

The new NECTOKIN EQ1 Series automotive relays are designed for motor and lamp control applications that require a high level of quality and performance. The EQ1 has a unique two-piece design for the magnetic circuit, which result in small size, and high peoductivity.

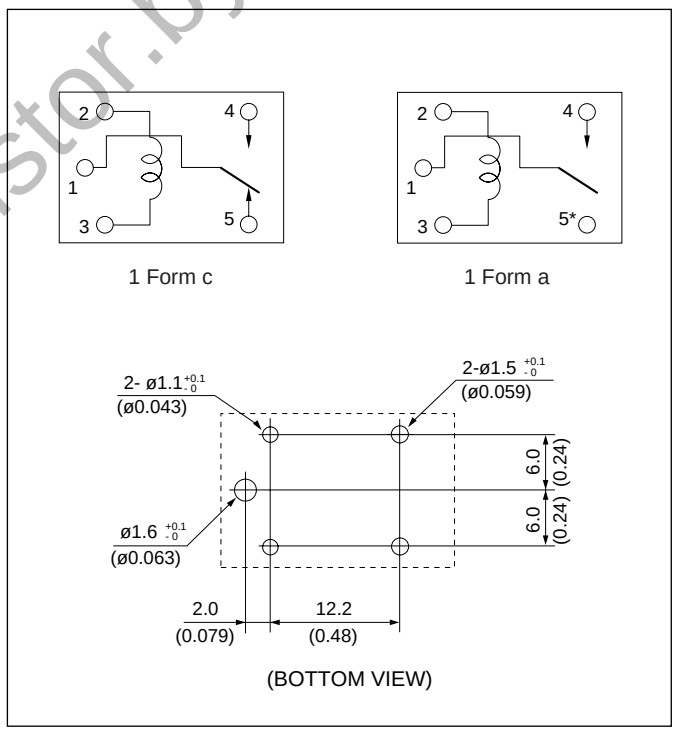
■ FEATURES

- PC board mounting
- Same pin-layout as MR301
- Approx, 70% relay volume of MR301
- Approx, 80% relay space of MR301
- Approx, 90% relay height of MR301
- Approx, 60% relay weight of MR301

■ DIMENSIONS mm (inch)



■ RECOMMENDED PCB PAD LAYOUT and SCHEMATICS (bottom view)mm (inch)



* Dummy terminal

■ PART NUMBER SYSTEM

EQ1-3 1 000 S

- Enclosure: Nil : Unsealed; S : Sealed
- Specific Code: 000 to 999
- Must Operate Voltage (at 20°C): 1 : 6.5 V; 2 : 7.2 V
- Coil Resistance (at 20°C): 1 : 144 Ω ± 10 %; 2 : 180 Ω ± 10 %; 3 : 225 Ω ± 10 %
- Type

■ SPECIFICATIONS

Items		For motor control		For lamp and LCR circuit control	
		EQ1-31000S	EQ1-11040S	EQ1-11111S	EQ1-22111S
Contact Form		1 Form c		1 Form a	
Contact Ratings	Maximum Switching Voltage	16 Vdc			
	Maximum Switching Current	35 A (at 16 Vdc)			
	Contact Resistance	Typical 5 mΩ (measureed at 7 A) initial			
Contact Material		Silver oxide complex alloy			
Operate Time (Excluding bounce)		Typical 3 ms (at Nominal Voltage)			
Release Time (Excluding bounce)		Typical 4 ms (at Nominal Voltage, with diode) initial			
Nominal Operating Power		640 mW	1000 mW		800 mW
Insulation Resistance		100 MΩ at 500 Vdc			
Withstand Voltage	Between open contacts	500 Vac min. (for 1 minute)			
	Between adjacent contacts	500 Vac min. (for 1 minute)			
Shock Resistance	Misoperation	98 m/s^2			
	Destructive Failure	980 m/s^2			
Vibration Resistance	Misoperation	10 to 300 Hz, 43 m/s^2			
	Destructive Failure	10 to 500 Hz, 43 m/s^2, 200 hour			
Ambient Temperature		-40 to +85˚C (-40 to + 185˚F)			
Coil Temperature Rise		60 ˚C/W (108 ˚F / W)			
Life Expectancy	Mechanical	1×10^6 operations			
	Motor : 25 A lock	100×10^3 operations		——	
	Lamp : 108 W Tungsten	——		100×10^3 operations	
	Lamp : 120 W Halogen	——		100×10^3 operations	
	LCR circuit : 70 A peak	——		100×10^3 operations	
Weight		Approx. 9 g (0.32 oz)			

■ COIL RATING

● SEALED TYPE

at 20 °C

Applications \ Items		Part Numbers	Nominal Voltage (Vdc)	Coil Resistance (Ω) ±10 %	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
Motor Control	General Purpose	EQ1-31000S	12	225	6.5	0.9
	For Jump Start	EQ1-11040S		144	6.5	0.6
Lamp and LCR circuit Control		EQ1-22111S		180	7.2	0.7
		EQ1-11111S		144	6.5	0.6

* Test by pulse voltage

● UNSEALED TYPE

at 20 °C

Applications \ Items		Part Numbers	Nominal Voltage (Vdc)	Coil Resistance (Ω) ±10 %	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
Motor Control	General Purpose	EQ1-31000	12	225	6.5	0.9
	For Jump Start	EQ1-11040		144	6.5	0.6
Lamp and LCR circuit Control		EQ1-22111		180	7.2	0.7
		EQ1-11111		144	6.5	0.6

* Test by pulse voltage

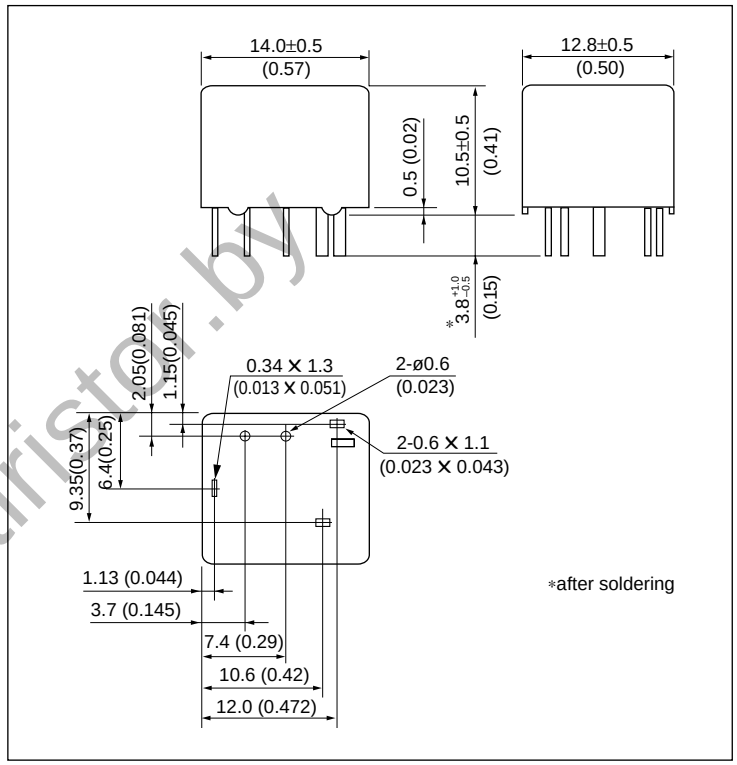
ET1 Series

The new NEC TOKIN EP1 Series are PC-board mount automotive relay suitable for various motor and heater control application that require a high quality and performance. The ET1 series are succeeding ina about 50% of miniaturization in comparison with the EP1 series.

■ FEATURES

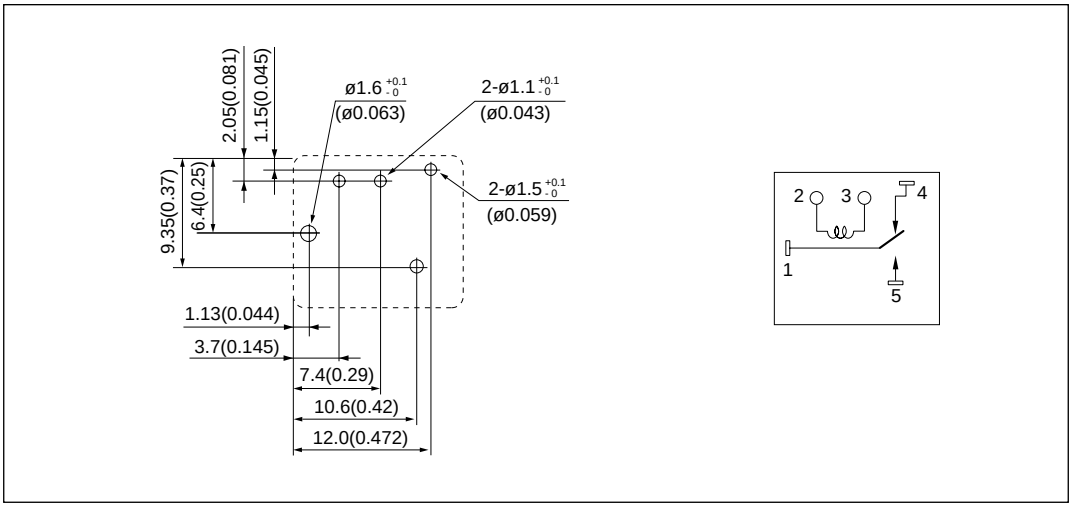
- Flux tight housing
- Approx, 50% relay volume of EP1
- Approx, 76% relay space of EP1
- Approx, 67% relay height of EP1
- Approx, 56% relay weight of EP1

■ DIMENSIONS mm (inch)



■ RECOMMENDED PCB PAD LAYOUT and SCHEMATICS

(bottom view) mm (inch)



■ SPECIFICATIONS

Items			Specifications
Contact Form			1 Form c
Contact Ratings		Maximum Switching Voltage	16 Vdc
		Maximum Switching Current	25 A (at 16 Vdc, inductive loard : 1 mH)
		Contact Resistance	4 mΩ typical (measureed at 7 A) initial
Contact Material			Silver oxide complex alloy
Operate Time (Excluding bounce)			2.5 ms typical (at Nominal Voltage)
Release Time (Excluding bounce)			2.5 ms typical (at Nominal Voltage, with diode) initial
Nominal Operating Power			640 mW
Insulation Resistance			100 MΩ at 500 Vdc
Withstand Voltage		Between open contacts	500 Vac min. (for 1 minute)
		Between adjacent contacts	500 Vac min. (for 1 minute)
Shock Resistance		Misoperation	98 m/s² (10 G)
		Destructive Failure	980 m/s² (100 G)
Vibration Resistance		Misoperation	10 to 300 Hz, 43 m/s²
		Destructive Failure	10 to 500 Hz, 43 m/s² , 200 hour
Ambient Temperature			-40 to + 85˚C
Coil Temperature Rise			70 ˚C/W
Life Expectancy	Mechanical		1×10^6 operations
	Electrical	Power Window Motor (14 V, 20 A, Locked)	100×10^3 operations
		Power Window Motor (14 V, 20 A/3 A, Unlocked)	100×10^3 operations
Weight			Approx. 4.5 g (0.16 oz)

■ COIL RATING

● SEALED TYPE

at 20 °C

Part Numbers	Nominal Voltage (Vdc)	Coil Resistance (Ω) ±10 %	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
ET1-B3M1S	12	225	6.5	0.9

*Test by pulse voltage

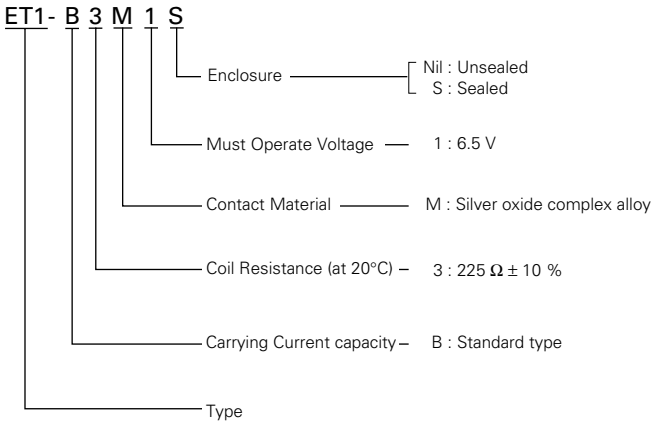
● UNSEALED TYPE

at 20 °C

Part Numbers	Nominal Voltage (Vdc)	Coil Resistance (Ω) ±10 %	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
ET1-B3M1	12	225	6.5	0.9

*Test by pulse voltage

■ PART NUMBER SYSTEM



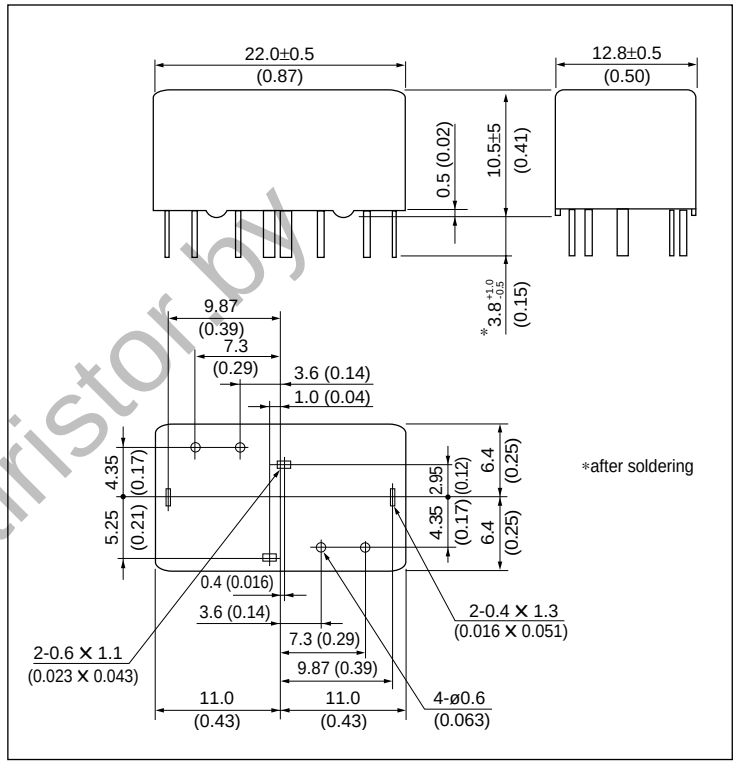
ET2 Series

The new NEC TOKIN ET2 Series are PC-board mount automotive relay suitable for various motor control application that require a high quality and performance. The ET2 series are succeeding ina about 50% of miniaturization in comparison with the EP2 series.

■ FEATURES

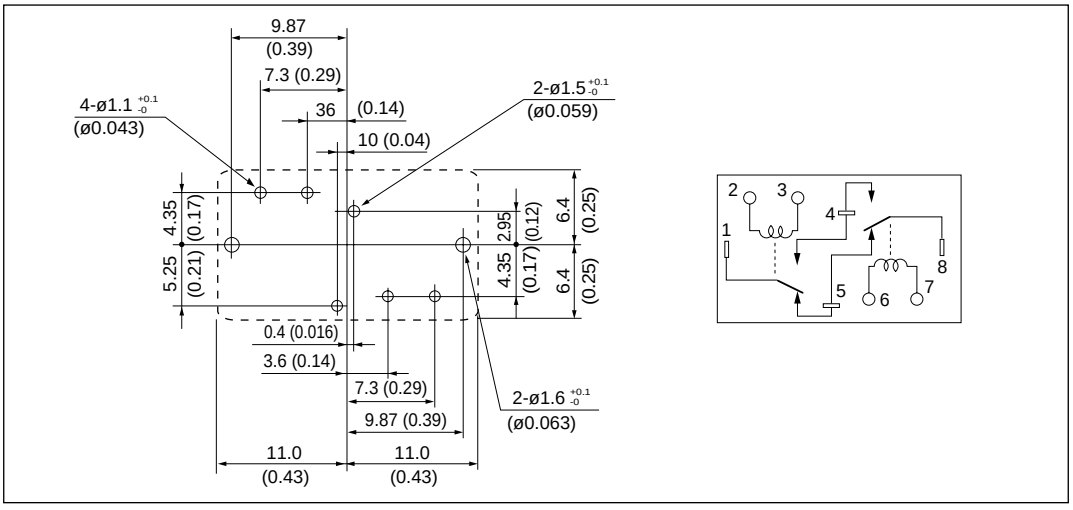
- Flux tight housing
- Approx, 50% relay volume of EP2
- Approx, 74% relay space of EP2
- Approx, 67% relay height of EP2
- Approx, 50% relay weight of EP2

■ DIMENSIONS mm (inch)



■ RECOMMENDED PCB PAD LAYOUT and SCHEMATICS

(bottom view) mm (inch)



■ SPECIFICATIONS

Items			Specifications
Contact Form			1 Form c X 2
Contact Ratings		Maximum Switching Voltage	16 Vdc
		Maximum Switching Current	25 A (at 16 Vdc, inductive loard : 1 mH)
		Contact Resistance	4 mΩ typical (measured at 7 A) initial
Contact Material			Silver oxide complex alloy
Operate Time (Excluding bounce)			2.5 ms typical (at Nominal Voltage)
Release Time (Excluding bounce)			2.5 ms typical (at Nominal Voltage, with diode) initial
Nominal Operating Power			640 mW
Insulation Resistance			100 MΩ at 500 Vdc
Withstand Voltage		Between open contacts	500 Vac min. (for 1 minute)
		Between adjacent contacts	500 Vac min. (for 1 minute)
Shock Resistance		Misoperation	98 m/s^2
		Destructive Failure	980 m/s^2
Vibration Resistance		Misoperation	10 to 300 Hz, 43 m/s^2
		Destructive Failure	10 to 500 Hz, 43 m/s^2, 200 hour
Ambient Temperature			-40 to + 85˚C
Coil Temperature Rise			70 ˚C / W
Life Expectancy	Mechanical		1 × 10^6 operations
	Electrical	Power Window Motor (14 V, 20 A, Locked)	100 × 10^3 operations
		Power Window Motor (14 V, 20 A/3 A, Unlocked)	100 × 10^3 operations
Weight			Approx. 7.5 g (0.26 oz)

■ COIL RATING

● SEALED TYPE

at 20 °C

Part Numbers	Nominal Voltage (Vdc)	Coil Resistance (Ω) ±10 %	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
ET2-B3M1S	12	225	6.5	0.9

*Test by pulse voltage

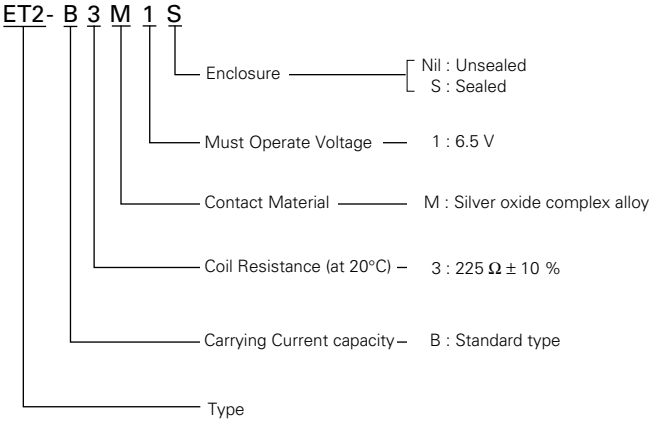
● UNSEALED TYPE

at 20 °C

Part Numbers	Nominal Voltage (Vdc)	Coil Resistance (Ω) ±10 %	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
ET2-B3M1	12	225	6.5	0.9

*Test by pulse voltage

■ PART NUMBER SYSTEM



MR301 Series

The MR301 series, which has a low profile package and light weight, is suited for various kinds of consumer equipments, industrial machines and automobiles.

■ FEATURES

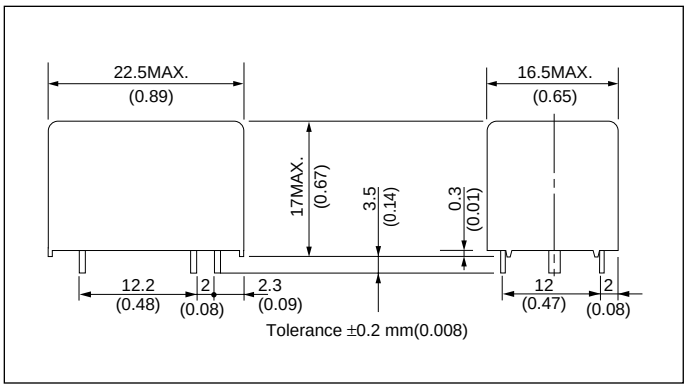
- Low profile, light weight.
- Two types of contact
  (General type: 5A switching, High power type; 10A switching)
- Fluxtight or washable package is available.
- UL recognized (E 73266), CSA certified (LR46266)

■ SAFETY STANDARD AND RATING

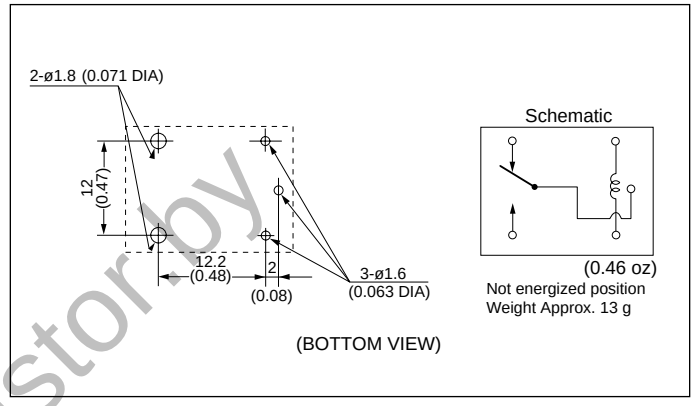
ULRecognized (UL508)* File No. E73266	CSA Certificated (CSA C22.2 No.14) File No. LR46266
MR301-**HU 1/2HP 240VAC 1/4HP 125VAC 30VDC, 7 A (Resistive) 60VDC, 1.0 A (Resistive) 277VDC, 5 A (Resistive) 120VDC, 10 A (Resistive) 360 W, 120VAC Tungsten 120VAC, 2 A Ballast TV-2, 120VAC	MR301- **HU 1/2HP 240VAC 1/4HP 125VAC 30VDC, 7 A (Resistive) 60VDC, 1.0 A (Resistive) 277VDC, 5 A (Resistive) 120VDC, 10 A (Resistive) 360 W, 120VAC Tungsten 120VAC, 2 A Ballast
MR301- **U 1/4HP 240VAC 1/8HP 125VAC 30VDC, 5 A (Resistive) 277VDC, 2.5 A (Resistive) 120VDC, 5 A (Resistive) 130 W, 120VAC Tungsten 120VAC, 2 A Ballast	

* Spacing : UL114, UL478

■ DIMENSIONS mm (inch)



■ RECOMMENDED PCB PAD LAYOUT and SCHEMATICS mm (inch)



■ PART NUMBER SYSTEM

MR301-3HUSL

- 3 — Nominal coil voltage 3,5,6,9,12,24 Vdc
- H — Nil : General type (5A); H : High power type (10A); E : High power type (15A) for automotive
- U — Nil : Standard type; U : UL recognized, CSA certified type
- S — Nil : Unsealed; S : Sealed
- L — Nil : 0.3 mm Standoff; L : 0.8 mm Standoff

■ SPECIFICATIONS

Items \ Types (Contact Rating)			MR301(5A)	MR301-H(10A)	MR301-E(15A)
Contact Form			1 Form c		
Contact Ratings	Maximum Switching Power (Resistive Load)		150 W, 600 VA	300 W, 1200 VA	240 W
	Maximum Switching Voltage (Resistive Load)		250 Vac, 30 Vdc		16Vdc
	Maximum Switching Current (Resistive Load)		5A	10A	15A
	Maximum Switching Voltage & Current		5 Vdc, 0.1 A	5 Vdc, 1 A	
	Initial Contact Resistance		8.8 mΩ typ. (measured by voltage drop at 5 Vdc, 0.5A)	8.8 mΩ typ. (measured by voltage drop at 5 Vdc, 2A)	
Contact Material			Silver nickel alloy	Silver oxide complex alloy	
Operate Time (Excluding bounce)			Approx. 5 ms(at nominal voltage)		
Release Time (Excluding bounce)			Approx. 6 ms(at nominal voltage) without diode		
Nominal Operate Power			360 mW		
Insulation Resistance			1000 MΩ at 500 Vdc		
Withstand Voltage		Between open contacts	750 Vac (for one minute)		
		Between contacts and coil	1500 Vac (for one minute)		
Electrostatic Copacitance		Between open contacts	Approx. 1 pF		
		Between contacts and coil	Approx. 10 pF		
Shock Resistance			98 m/s^2 (misoperating), 980 m/s^2 (destructive failure)		
Withstand Resistance			10 to 300 Hz, 43 m/s^2 (misoperating), 10 to 500 Hz, 43 m/s^2, 200 hours (destructive failure)		
Ambient Temperature			-40 to + 85˚C (-40 to + 185˚F)		
Coil Temperature Rise			50˚C/W (125˚F/W)		
Running Specifications		Nonload	10×10^6 operations		
		Load	100×10^3 operations		
Weight			Approx. 13 g(0.46 oz)		

■ COIL RATING

at 20°C

Nominal Voltage		Coil Resistance ( )± 10 %	Must Operate Voltage* (Vdc)	Must Release Voltage* (Vdc)
Vdc	3	25	2.1	0.3
	5	70	3.5	0.5
	6	100	4.2	0.6
	9	225	6.3	0.9
	12	400	8.4	1.2
	24	1600	16.8	2.4

* Test by pulse voltage

This section provides notes on correctly using the miniature relay. Be sure to read this before using the relay.

Proper functioning of the miniature relay requires appropriate circuit design, mounting and evaluation according to the purpose of use.
Note that the responsibility for accidents caused by improper circuit design, mounting or evaluation falls on you and we cannot be responsible for them.

1. GENERAL

(1) Never allow the contact load to exceed the maximum ratings; otherwise, the lifetime of the relay will be dramatically shortened.
The lifetime specified in the catalog is for certain load conditions, and other factors must be taken into consideration in actual circuits. Therefore, an accurate lifetime must be measured in the actual circuit.
The two tables below show load current range guidelines.

[Signal relay]

Current range	100 mA to 1 mA	1 mA to 0.5 A	0.5 A to 2 A
	GOOD	VERY GOOD	NOT SO GOOD for some cases
Application	• Contacts may be unstable. • Thermal electromotive force and contact noise should be taken into consideration.	• Contacts are stable and highly reliable.	• Infrequent operation poses no problem, but frequent operation deteriorates contact stability. • Use of a power relay is preferred for 1 A or higher.

[Power relay]

Current range	to 100 mA	100 mA to 1 A	A to 35 A
	NOT SO GOOD for some cases	GOOD	VERY GOOD
Application	• Only for applications in which an increase in contact resistance poses no functional problems. • Use of a high capacitance type is not possible.	• It seldom has wear on contacts or dislocation and can be used without problems.	• Since differ-ent contact phenomena occur depending on the contact load, it is necessary to check the contact load and select the correct contacts.

(2) When using the relay with a high current or high capacitance load, an inrush current may cause contact dislocation or deposition; therefore check the feasibility of use in the actual circuit.

(3) Be sure to use the relay at an ambient temperature within the maximum ratings; otherwise, the life of the relay will be radically shortened. If use outside the specified temperature range in unavoidable, consult NEC TOKIN.

(4) With a relay whose coil polarity is specified in its internal circuit diagram, apply the polarity of the rated voltage as specified. Note that when a rippled DC power source is used, abnormalities such as beat in the coil may occur.

(5) Exercise care when handling the relay so as not to apply shock to it or drop it.

(6) The flow soldering conditions are for 5 to 10 seconds at 250 °C.

(7) When cleaning, use alcohol, or a water-based solvent. Avoid using ultrasonic cleaning.

2. NOTES ON CONTACT LOAD

(1) Minimum load

Use the relay at a voltage and current higher than the minimum load; otherwise, the contact resistance will increase and the signal cannot be correctly transmitted. This is because stabilization of the contact surface (electrically and mechanically eliminating minute substances generated on the contact surface) by opening/closing the contacts with the minimum load probably will not occur.

In addition, even if the load is within the maximum ratings, care is required to ensure that the current does not drop below the minimum load after opening/closing the contacts.

(2) Contact protection circuit

By providing a protection circuit that suppresses transient current and voltage applied to the contacts when the contacts are opened or closed, the switching life of a relay can be improved.

It is important to select a correct protection circuit suited to the load.

① General notes

(a) It is necessary to place the protection circuit close to the contacts. In principle, place it on the same printed circuit board as that for the contacts (within a distance of several tens of centimeters).

(b) It is important to confirm the effectiveness of the protection circuit in the actual circuit. In some cases, it is also necessary to conduct lifetime tests using an appropriate equivalent circuit.

② Examples of contact protection circuits

(a) Inductive load

With an inductive load, when the contacts are opened to break the circuit, a counter electromotive force as shown in Fig. 1 is generated, causing an electric discharge between the contacts. This discharge energy accelerates metal dislocation and wear on the contact surface. A protection circuit is therefore necessary to absorb this counter electromotive force. Table 1 shows guideline circuit examples and circuit constants. Never use a connection with a capacitor only as shown in Table 2.

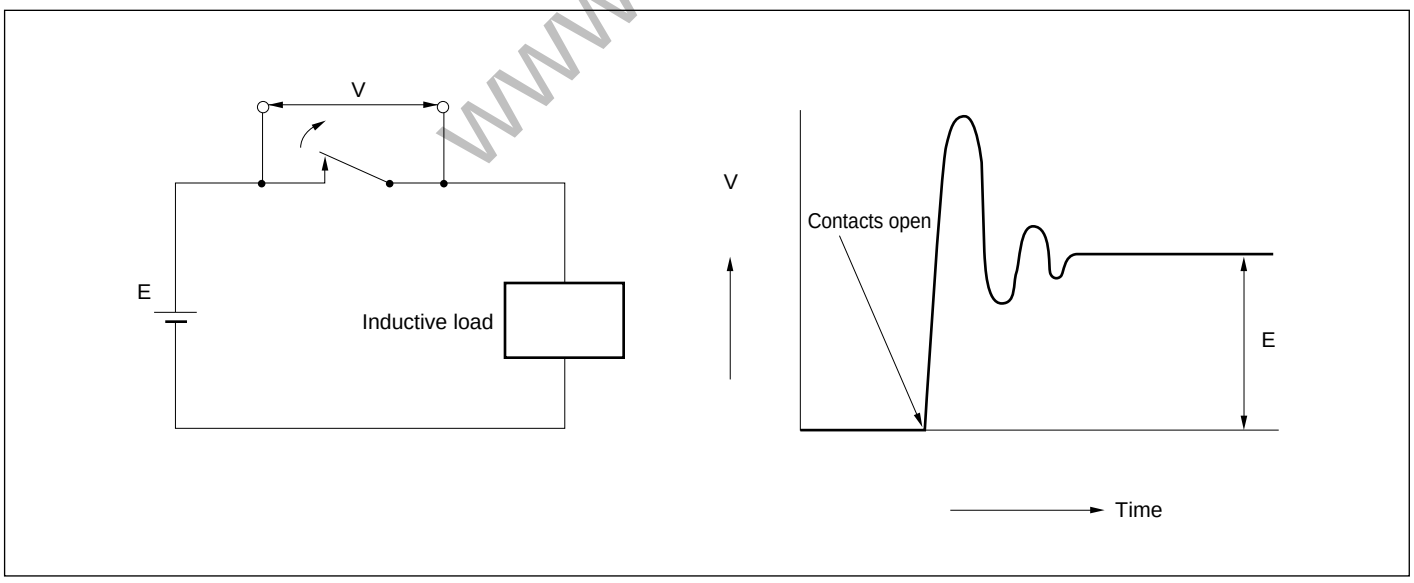


Fig.1 Inductive Load Circuit

Table 1 Inductive Load Contact Protection Circuits

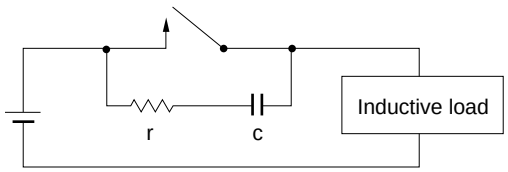
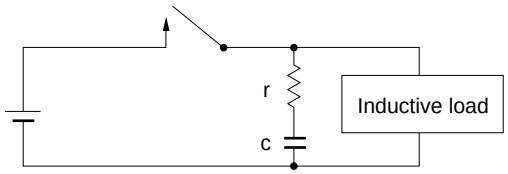
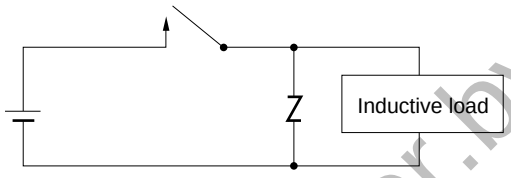
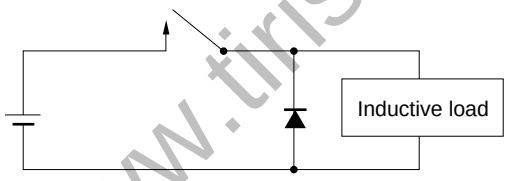
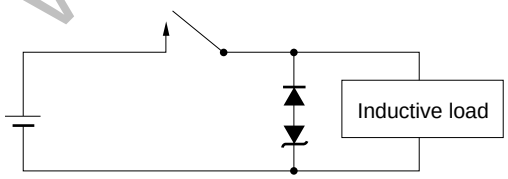
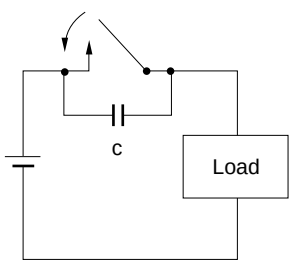
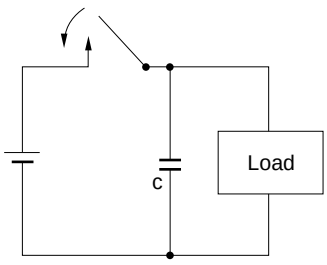
Protection element	Circuit example	Remarks
Capacitor + resistor (CR circuit)		$r\ (\Omega) = \frac{\text{contact voltage (V)}}{0.5 \text{ to } 1}$ C (μF) = (0.5 to 1) × contact current (A) The withstand voltage of a non-polar capacitor should be 300 V or higher.
		
Varistor		High voltage is suppressed by using the voltage characteristics of the varistor.
Diode		Pay attention to the reverse withstand voltage of the diode.
Diode + Zener diode		The ON time of the diode is controlled by using the Zener voltage characteristic and the recovery time of the relay can be shortened.

Table 2 Examples of Wrong Circuits Using Capacitors

WRONG 	This circuit is effective for arc suppression when the contacts are opened, but when the contacts are closed a capacitor short-circuit current flows, making the contacts more susceptible to metal deposition.	**WRONG** 	This circuit is effective for arc suppression when the contacts are opened, but when the contacts are closed a capacitor charging current flows, making the contacts more susceptible to metal deposition.

(b) Lamp loads (inrush current), etc.

Some loads, such as halogen lamps, have a low initial resistance so that an inrush current 10 times as high as the steady-state current may flow through the relay on power application. A high inrush current may also flow when the relay is used to switch loads such as motors and capacitors. In these cases, a current-limiting resistor is connected to the contacts in series in order to keep the inrush current to within the maximum rated value (refer to Fig. 2).

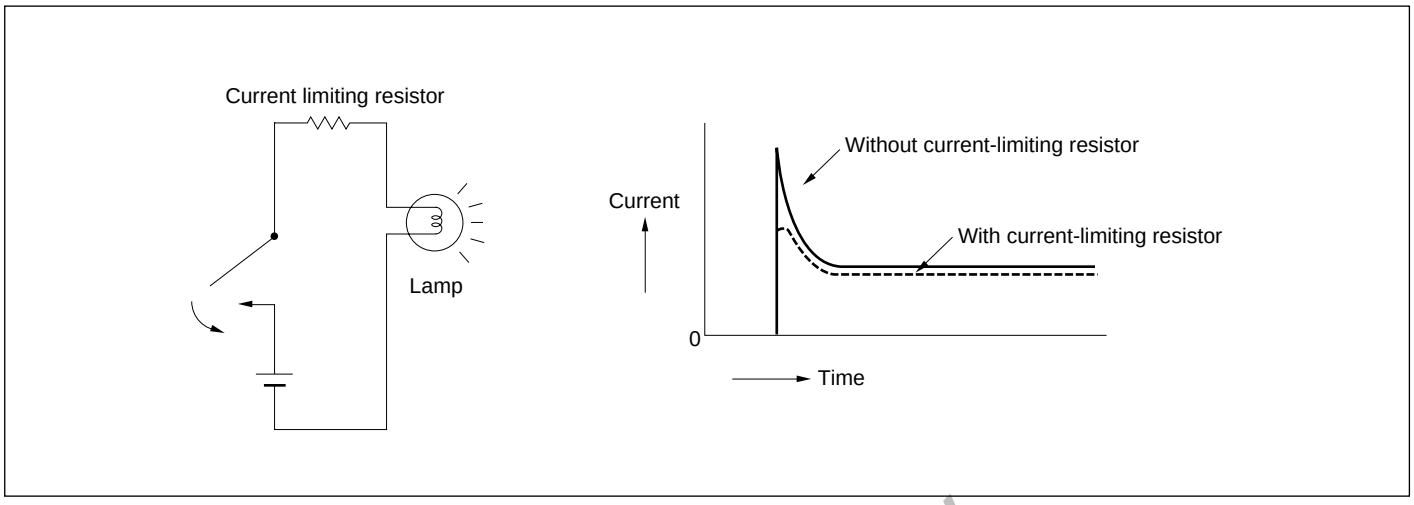


Fig.2 Example of Current-Limiting Resistor in Lamp Load Circuit

(c) Stray line capacitance

When the stray line capacitance is large, the inrush current that is generated due to the stray line capacitance poses a problem. As shown in Fig.3, the electric charge on the line capacitance is discharged directly through the contacts when the contacts are closed. The smaller the wiring cable characteristic impedance and the longer the cable, the greater wear on the contacts.

It is necessary to connect a current-limiting resistor or surge suppresser in series with the contacts as a protection circuit to suppress the inrush current.

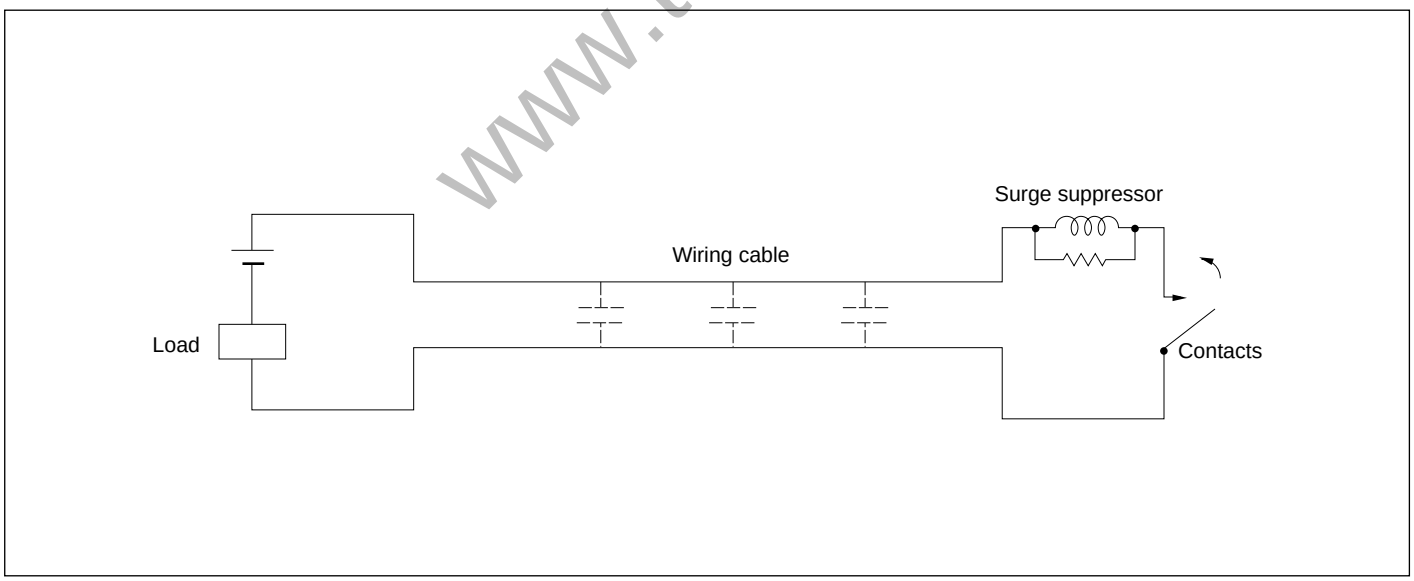


Fig.3 Example of Surge Suppression Circuit with Surge Suppressor

3. NOTES ON DRIVING RELAYS

(1) Temperature characteristics

If the relay is used at an ambient temperature exceeding the operating temperature range, the performance of the relay may be degraded and the life may be dramatically shortened.

① It is possible to use the relay at the rated coil voltage within the operating temperature range. Note, however, that at the upper limit of the operating temperature range the permissible voltage on the coil may be restricted, and must be confirmed before the relay is used.

② The must operate voltage, must release voltage, operate time and release time change with the ambient temperature. Refer to Technical Documents to confirm that the relay operates normally at a particular operating temperature.Fig.4 shows an example of the temperature characteristics of the relay.

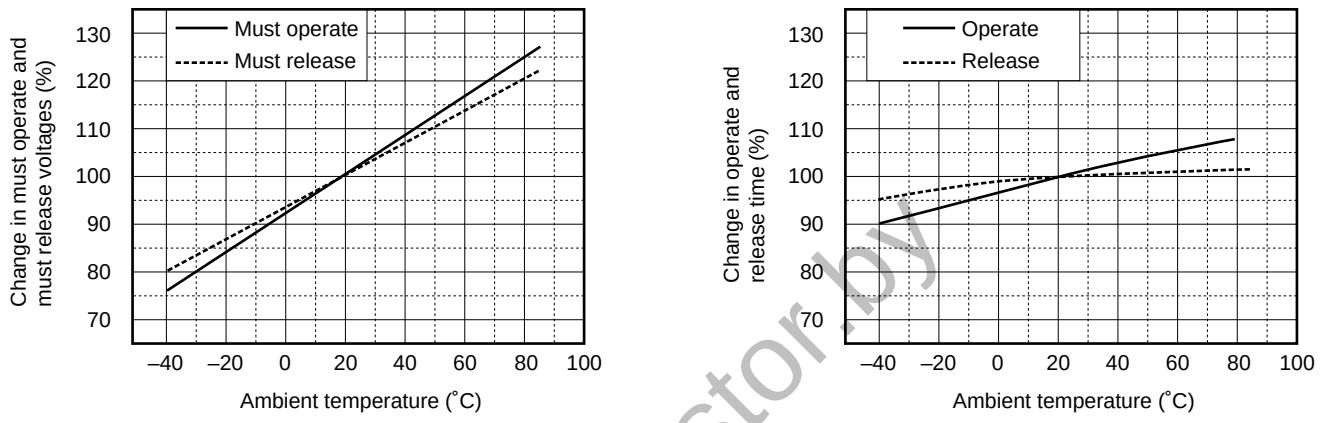


Fig.4 Temperature Characteristics of Relay (Example)

(2) Maximum applied voltage

The maximum applied voltage of the relay coil changes with the ambient temperature. The difference between the permissible temperature specified by relay design and the operating temperature is the permissible temperature rise (the self-heat temperature, i.e., the applied-voltage-dependent portion).

Refer to the coil voltage vs. temperature derating characteristics in the Technical Documents for this value. Fig. 5 shows an example.

The permissible temperature of the relay is determined mainly by the coil wire materials and the permissible temperature of the plastic materials used. In the case of the NEC TOKIN miniature signal relay, it is set at 120 °C in the standard specification.

The larger the coil applied voltage, the shorter the operate time becomes. Note, however, that bounces in the make contacts also become larger, increasing the contact opening/closing frequency, which may affect the life of the contacts.

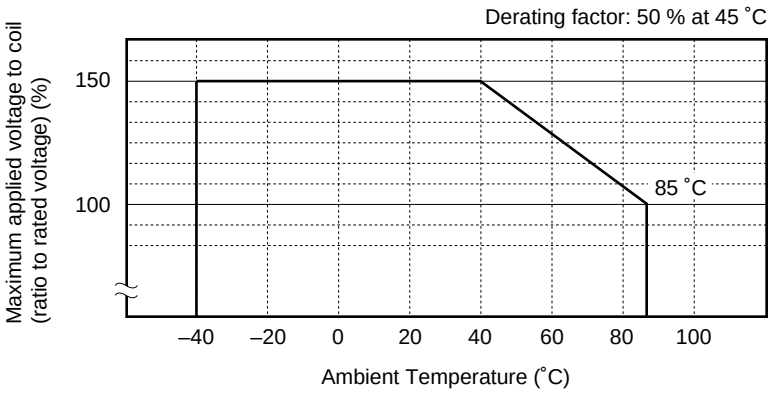


Fig.5 Coil Voltage vs. Ambient Temperature Derating Characteristics (Example)

(3) Hot start

When the temperature of the relay has risen due to heat generated by the voltage applied to the coil, the relay may not operate even if the coil is energized again immediately after it has been once deenergized. This is because an increase in the coil resistance due to heat in the relay causes the current to fall even though the applied voltage remains constant. This reenergizing state is called a hot start. This problem occurs especially when the operating temperature is high and a voltage lower than the relay rated voltage is applied. It is necessary to refer to Technical Documents to know in advance the must operate voltage at the time of a hot start in order to prevent this malfunction.

(4) Non-must operate and holding voltages

In some circuits, the relay must not operate at a certain voltage or release at a certain voltage. In such cases, contact NEC TOKIN because a special specification product with non-must operate and holding voltages specified can be provided.

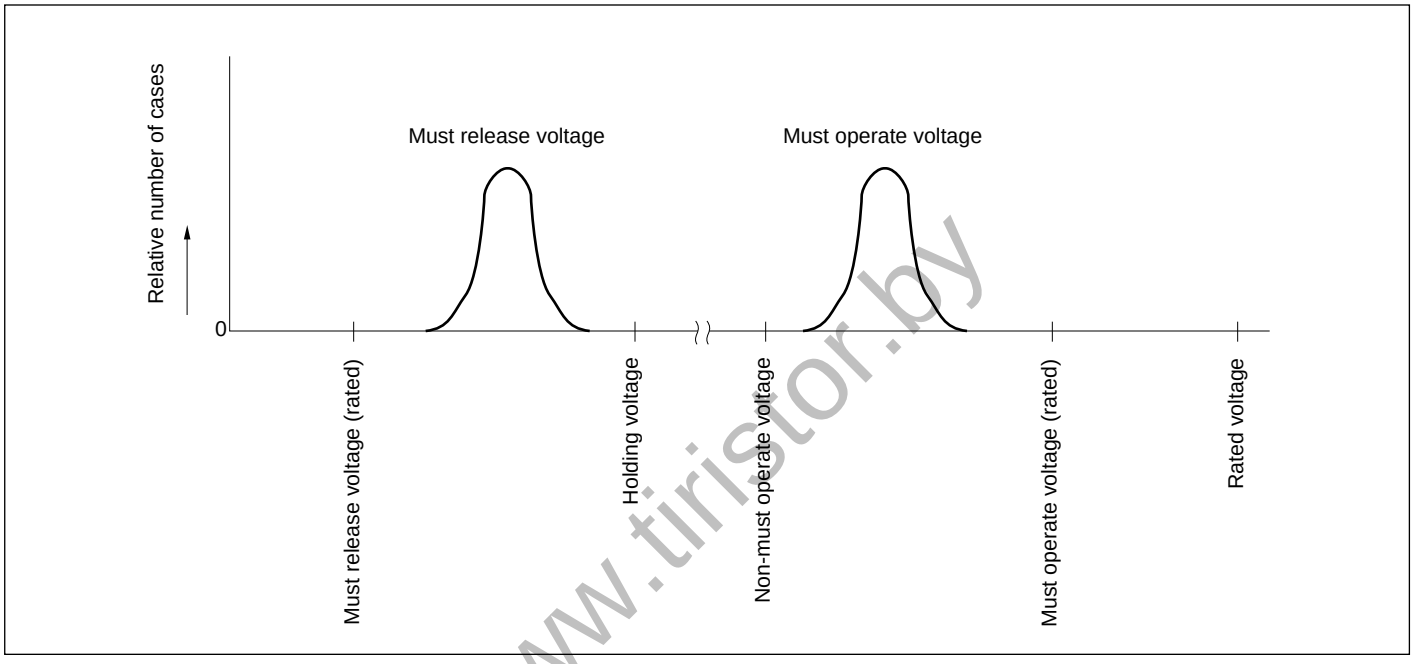


Fig.6 Example of Distribution of Relay Must Operate Voltage and Must Release Voltage

(5) Drive waveform

If the waveform of the relay coil drive voltage gradually increases and decreases, the relay may not be able to deliver its inherent performance. The voltage must instantaneously rise and fall as a pulse.

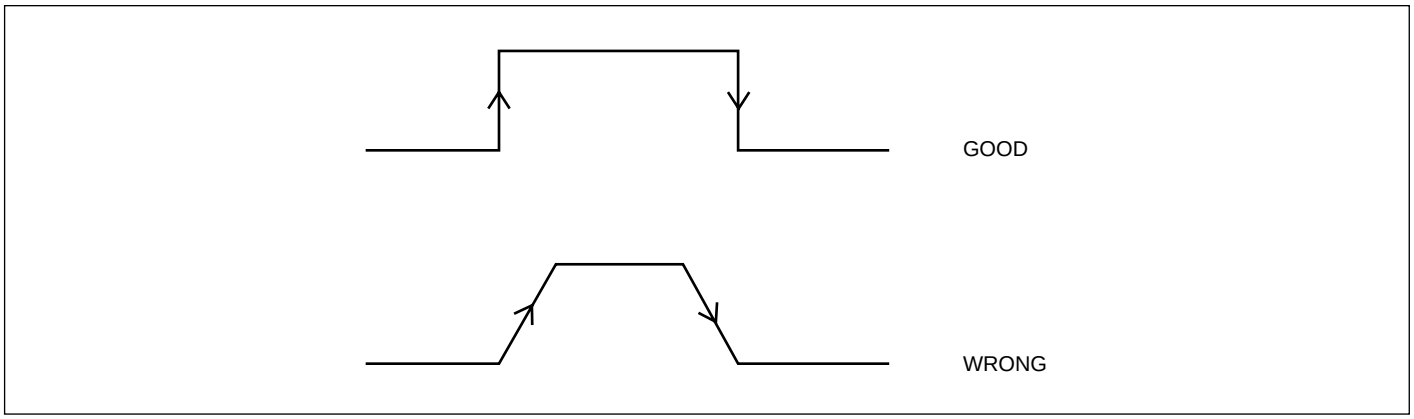


Fig.7 Relay Drive Waveform

(6) Latching relay drive circuit

① Since the relay coil has an inductive impedance, a counter electromotive force is generated when the circuit is opened. This voltage may damage the relay driver transistor, and therefore a diode is connected in parallel with each coil. With a single coil latching type relay, however, a diode cannot be used because the current direction of the coil is inverted. Therefore, when a single coil latching type relay is used, select a transistor with sufficient reverse breakdown voltage.

② A latching relay is driven by a pulsating coil voltage. The pulse width of this drive voltage must be 10 ms or wider. If the pulse is too short, the relay may not operate.

③ Apply a voltage to the coil in the polarity specified by the internal connection diagram of the relay. With a double coil latching type relay, do not apply voltage in a manner that both the set and reset coils are energized at the same time. (Refer to Fig. 8.)

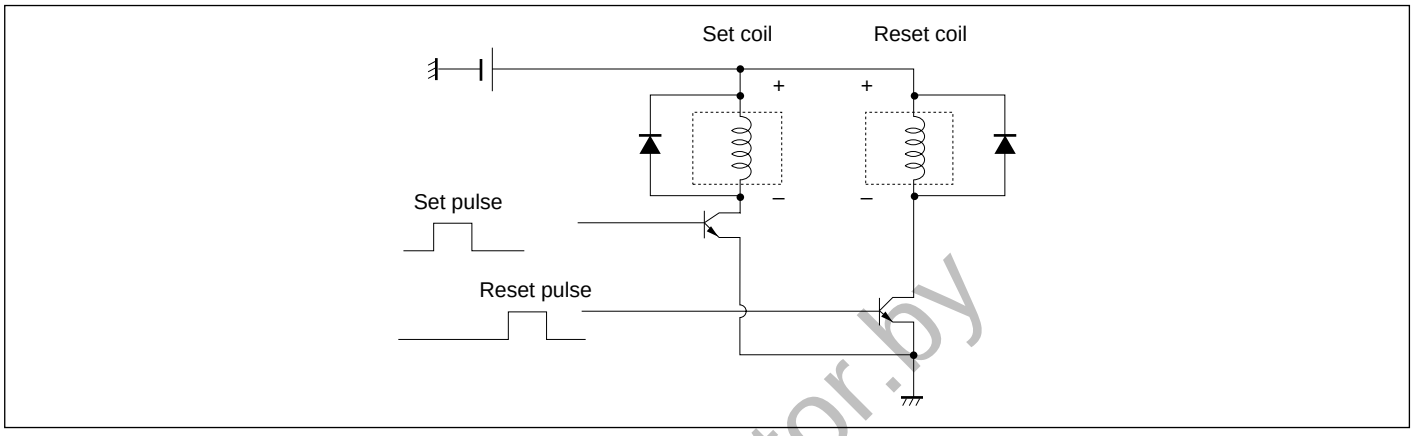


Fig.8 Drive Circuit of Latching Relay (Example of Double Coil Latching Type)

④ A latching relay is factory-set to the reset state for shipment. However, it may be set while being transported due to vibration or shock. Make sure that the relay is reset when its application system starts operating. When the relay is employed in a portable system, the circuit must be designed so that the relay is reset at the beginning of operation of the system because the relay may be set by unexpected vibration or shock.

⑤ When configuring a self-holding circuit that uses the self-break contacts of the relay, note that the coil drive circuit is disconnected by the self-contacts, causing troubles such as self-oscillation.

(7) Connection of coil diode

In the case of loads, such as solenoid and electromagnetic clutches, that produce large discharge energy when the contacts are opened, connect a Zener diode with the drive transistor.
Particularly when the diode is connected in parallel with the coil, the current in the coil diminishes gradually when the relay is released, and thus may slow down opening of the contacts, intensifying wear on the contacts.

(8) Opening/closing frequency

If the contacts are opened/closed frequently with a high current load, repeated electric discharges may cause contact metal deposition or damage to the contact spring. When using the relay with a high current load with frequent opening/closing of the contacts, consult NEC TOKIN.

(9) Long continuous energizing of coil

If the coil is energized continuously for a long time, the coil temperature may rise, promoting generation of organic gas inside the relay, which is likely to cause trouble in the contacts. When using a circuit requiring constant operation, consider the possibility of using a latching relay that does not need continuous energizing of the coil.

(10)Instantaneous voltage drop of circuit

When the same power source is used for the relay drive circuit and the load circuit in a circuit such as a lamp load circuit where an inrush current flows, the moment the contacts are closed the source voltage may drop if the power source capacitance is small. In this case, the relay may be released or an oscillation phenomenon where the relay repeatedly releases and operates may occur.
Add power source capacitance or a smoothing circuit to prevent this phenomenon.

4. NOTES ON OPERATING ENVIRONMENTS

(1) Ambient temperature

Ensure that the ambient temperature of the relay mounted on the device is within the “operating temperature range” in the catalog. Use of the relay at a temperature outside this range may adversely affect insulation or contact performance. For the relationship between the ambient temperature and relay drive conditions, refer to **3. Notes on Driving Relays**.

(2) Humidity

Use of a sealed type relay in a high humidity (RH85 % or higher) environment for a long time may introduce moisture inside the relay. This moisture may combine with NOx or SOx generated by glow discharges to produce nitric acid or sulfuric acid. In this case, the acid produced may corrode the metal that forms the relay, causing operation troubles in the relay. If use of the relay in such a high humidity environment is unavoidable, consult NEC TOKIN in advance.

(3) Atmosphere

Use of a relay in an atmosphere with a high concentration of sulfur gases (H_2S, SO_2), nitric acid gas (HNO_3), ammonia (NH_3), silicon vaporization gas, etc., may cause imperfect contacts and other functional trouble. Avoid use of the relay in such an atmosphere. If it is unavoidable, use a sealed type relay.

(4) Atmospheric pressure

A sealed type relay maintains constant sealability under normal pressures (810 to 1200 hpa). However, if it is used under other pressure conditions, its sealability may be destroyed or the relay may be deformed, causing functional trouble. Be sure to use the relay under normal pressure conditions.

(5) Vibration and shock

The vibration resistance and shock resistance of a relay are as shown in the catalog and use of the relay under conditions other than those specified may cause malfunctions or damage.
Be sure to use the relay within those vibration and shock conditions.
Even before the relay is used, repeated excessive vibration or shock load may cause malfunctioning of the relay, by causing metal deposition on the contacts and other functional trouble. Malfunctions due to vibration or shock during operation may cause considerable damage or wear of the contacts.
Note that operation of a snap switch mounted close to the relay or shock by operation of an electromagnet may cause malfunctioning.

(6) Influence of magnetic fields

The magnetic circuit of an NEC TOKIN miniature signal relay is constructed so that the relay does not easily malfunction due to influence of external magnetic fields. However, under the influence of magnetic flux leaking from a transformer, speaker, or magnet placed in the vicinity of the relay, the must operate voltage, must release voltage, operate time, release time and other dynamic characteristics may change.
In applications where these characteristics changes pose problems, it is necessary to take measures such as magnetic shielding. Also, when many make them miniature signal relays are closely located, the magnetic flux leaking from those relays may make them interfere with each other, causing changes in the must operate voltage, must release voltage, operate time, release time and other dynamic characteristics. Fig. 9 shows examples of the mounting, magnetization, and change in the must operate voltage of signal relays in the EA2 series. In applications where these characteristics changes pose a problem, it is necessary to reduce the mounting density.

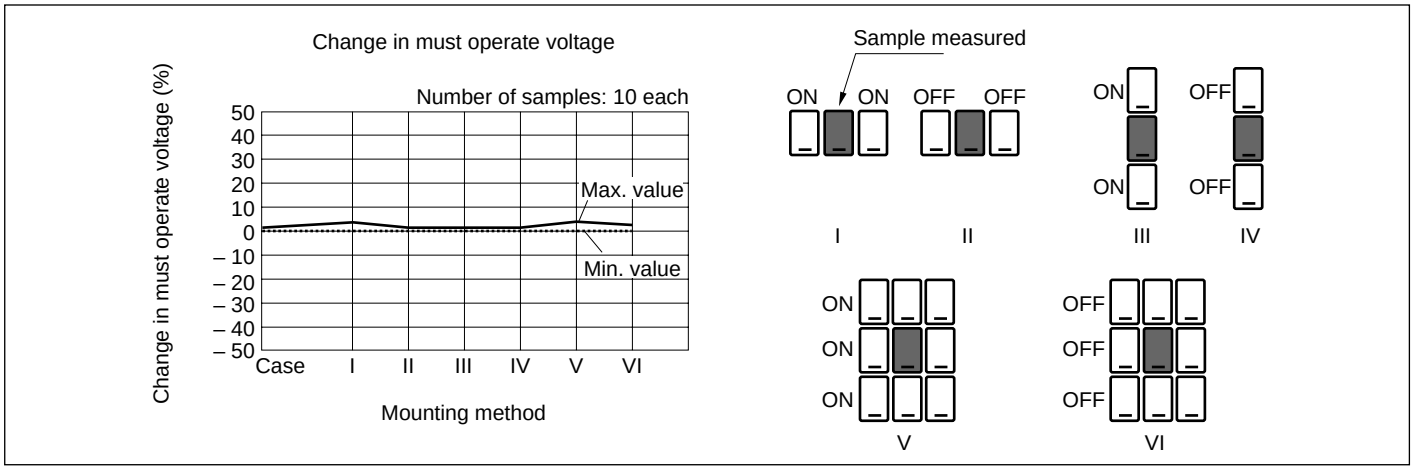


Fig.9 Change in Must Operate Voltage in Dense Mounting

5. INFLUENCE OF RELAY OPERATION ON SURROUNDINGS

(1) Electromagnetic noise

Switching the relay coil generates a high electromotive force due to induction. In general, a surge suppression circuit is connected in parallel with the relay coil to suppress generation of this electromotive force. However, if this suppression circuit is not appropriate, electronic circuits such as microcontrollers may malfunction due to the surge generated. Add an appropriate absorption circuit to prevent electronic circuits from malfunctioning due to the surge generated.

(2) Arc discharge

Connecting/disconnecting a high current at the relay contacts generates an arc discharge. This discharge may cause electronic circuits such as microcontrollers to malfunction and therefore it is necessary to take appropriate measures.

(3) Generation of leakage magnetic flux

Leakage magnetic flux exists in the vicinity of the relay in the magnetized state. Mounting a magnetic sensor, etc. close to the relay may cause malfunctioning.

6. NOTES ON MOUNTING

(1) Design of printed circuit boards

① If an electronic circuit such as a microcontroller is placed close to a relay, noise generated by the relay may cause malfunctioning.

② When designing patterns keep to the shortest possible distance in wiring.

③ For the printed circuit board on which a relay is mounted, use a board of 1 mm or more in thickness. If the printed circuit board is not thick enough, it may be subject to warpage which will add tension to the relay, causing variations in the relay characteristics. Because a flexible printed circuit board is particularly thin, it is necessary to solder near the root of the relay pins. Since preliminary soldering of the pin root part is often insufficient, its solder is likely to become loose.

④

If a thermal cycle is applied to the soldered part, cracks may be generated in it. Special care is required for the relay location, base material and through hole shape.

(2) Relay mounting position

The vibration resistance and shock resistance of a relay are greatly affected by its mounting position. It is particularly important to select the mounting position to prevent the break contacts from being instantaneously cut due to vibration and shock. The vibration resistance and shock resistance are at a minimum when the direction of vibration and shock applied to the relay matches the operation direction of the armature (mobile iron piece) and contacts. Therefore, if it is possible to anticipate the direction of vibration or shocks, mount the relay so that the direction in which vibration or shocks are applied is perpendicular to the direction of the relay armature operation. Fig. 10 shows the direction of relay armature operation.

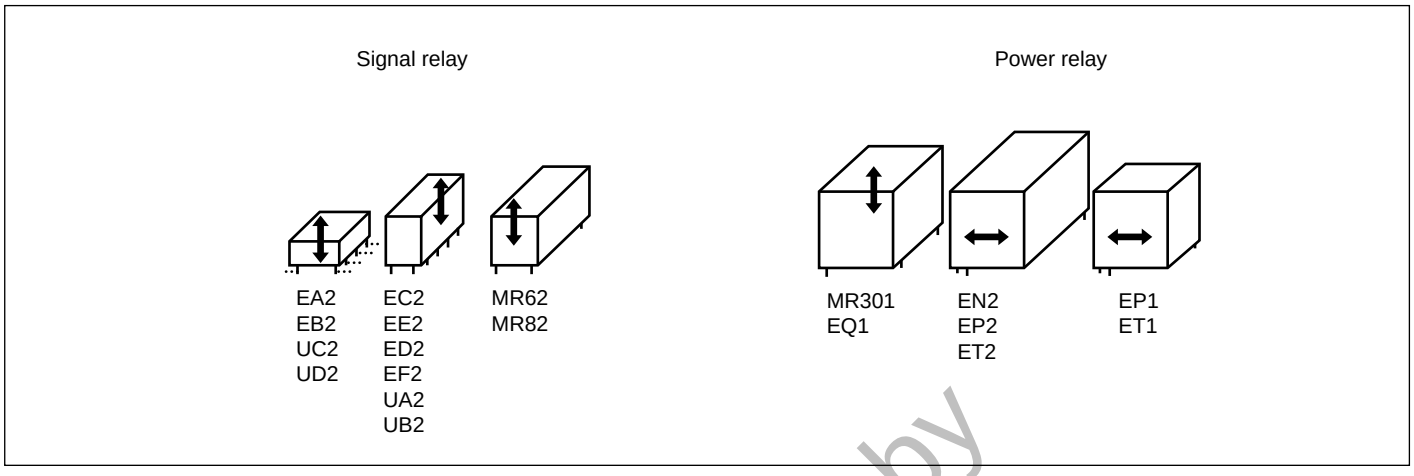


Fig.10 Direction of Armature Operation

(3) Notes on mounting

① Chucking

When a relay is mounted using an automatic machine, note that application of an excessive external force to the cover at the time of chucking or insertion of the relay may damage or change the characteristics of the cover.

② Temporary securing to printed circuit board

Avoid bending the pins to temporarily secure the relay to the printed circuit board. (Refer to Fig. 11.) Bending the pins may degrade sealability or adversely influence the internal mechanism. Pin bending may be allowed under certain conditions in the case of miniature signal relays. Contact NEC TOKIN for details.

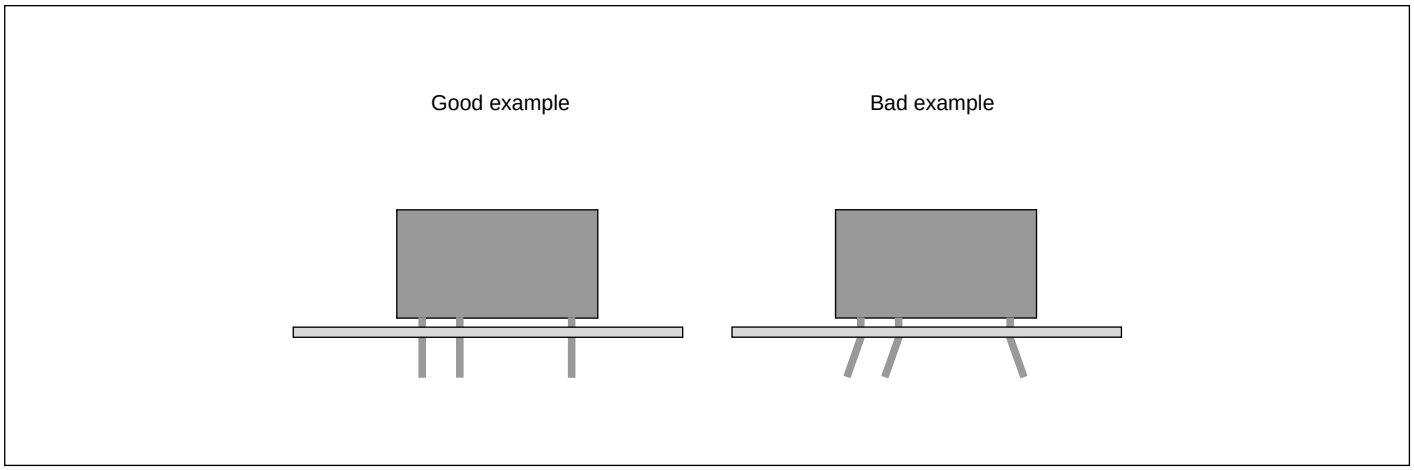


Fig.11 Bending Relay Pins

③ Application of soldering flux

For an unsealed type relay, do not directly apply soldering flux to the relay.

④ Soldering work

The following conditions are recommended for soldering a relay onto a printed circuit board.

(a) Automatic soldering: Flow solder is recommended.
<Recommended conditions> *Preheating: 100 °C max. 1 min. max.
*Solder temperature: 250 °C max.
*Solder time: 5 to 10 seconds

(b) Manual soldering (by soldering iron):
<Recommended conditions>
*Solder temperature: 350 °C max.
*Solder time: 2 to 3 seconds

Ventilation immediately after soldering is completed is recommended.
Avoid immersing the board in cleaning solvent immediately after soldering; otherwise thermal shock may be applied to it.

⑤ Pin cutting after soldering

Do not cut the pins of the relay with a revolving blade or an ultrasonic cutter, because vibration that is applied to the relay during the cutting may change the relay characteristics.

7. NOTES ON CLEANING

(1) Cleaning solvent

Use of alcohol or water-based cleaning solvents is recommended. Never use thinner or benzene because these solvents may damage the relay housing. A sealed type relay can be immerse-cleaned because solvent does not penetrate inside the relay.

(2) Avoid ultrasonic cleaning.

Ultrasonic cleaning may cause a break in the coil wire or sticking of the contacts due to the energy of vibration.

8. NOTES ON HANDLING RELAYS

(1) Use of magazine case stoppers

Relays are packaged in magazine cases for shipment.
When some relays are taken out from the case and space is freed inside the case, be sure to secure the relays in the case with a stopper. If the relays are not well secured, vibration during transportation may cause contact problems.

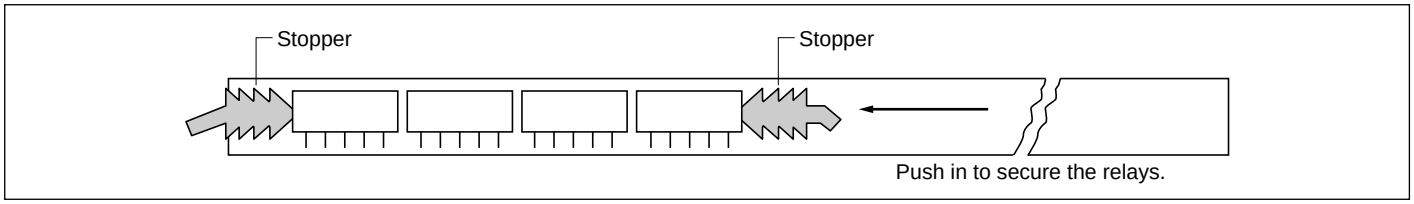


Fig.12 Storage in Magazine Case

(2) Do not use relays that have been dropped.

If an individual relay product falls from the work table, etc. a shock of 1000 G or more is applied to the relay and its functions may be destroyed. Even if the shock is apparently weak, confirm that there is no abnormality before using the relay.

9. NOTES ON USING SMT RELAYS

(1) Mounting pads

Determine the dimensions of the mounting pads on the printed circuit board taking into consideration such factors as solderability and insulation in order to accommodate the mounting accuracy of the automatic mounter. Use the dimensions of the mounting pads in the catalog.

(2) Solder reflow

The SMT relay is highly resistant to heat. However, solder the relay under the correct temperature conditions so that the full performance of the relay can be realized. The IRS (infrared ray reflow soldering) and VPS (vapor phase soldering: reflow by using latent heat of organic solvent) methods are recommended.
In addition, air reflow soldering may also be used. Whichever soldering method is used, be sure to confirm the temperature conditions for soldering and the influence of soldering on the relay in advance before setting work standards.

(3) Storage

The sealability of a surface-mount relay may be lost if the relay absorbs moisture and is then heated during soldering .
When storage relays, therefore,observe the following points:
<1> The storage humidity must be no more than 70% RH. The recommended storage period is 3 months maximum.
<2> When the relay is stored 3 months or longer, please keep the strage humidity to within 50% RH and mount relay in 6 months maximum.

[MEMO]

[MEMO]

[MEMO]

The information in this document is based on documents issued in July, 2002 at the latest.
The information is subject to change without notice. For actual design-in refer to the latest publications of data sheets, etc., for the most up-date specifications of the device.
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Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control system, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

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Precautions

- The names of the products and the specifications in this catalog are subject to change without notice for the sake of improvement. The manufacturer also reserves the right to discontinue any of these products. At the time of delivery, please ask for specifications sheets to check the contents before use.
- Descriptions in this catalog regarding product characteris-tics and quality are based solely on discrete components. When using these components, be sure to check the specifications with the component in question mounted on the products.
- The manufacturer's warranty will not cover any disadvan-tage or damage caused by improper use of the products that deviates from the characteristics, specifications, or conditions for use described in this catalog.
- The products in this catalog are intended for use in ordinary electronic products. If any of these products are to be used in special applications requiring extremely high reliability, where product defects might pose a safety risk, please consult your NEC TOKIN sales representatives.
- Though the manufacturer has taken all possible precau-tions to ensure the quality and reliability of its products, improper use of products may result in bodily injury, fire, or similar accident. If you have any questions regarding the use of the products in question, please consult your NEC TOKIN sales representatives.
- Please be advised that the manufacturer accepts no responsibility for any infraction by users of the manufacturer's products on third party patents or indus-trial copyrights. The manufacturer is responsible only when such infractions are attributable to the structural design of the product and its manufacturing process.
- Should any of these products be considered as strategic goods, and thereby governed by foreign exchange or foreign trade regulations, the Government of Japan will require an export license before said products can be exported outside Japan.
- This catalog is current as of March 2002.

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