Devices thru Material Innovation

NEC/TOKIN

Vol. 02

NEC TOKIN Sensors

CONTENTS

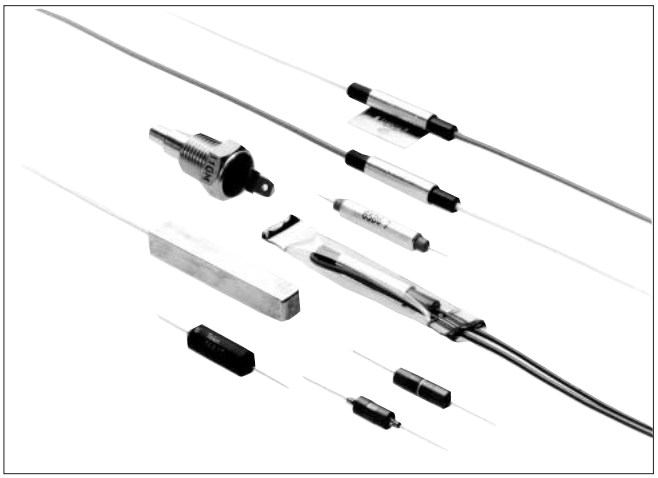
INTRODUCTION

Advances in LSIs, microcomputers and power devices enable ever more efficient use of energy, finer control and greater ease of use. In this way industry is promoting consumer appliances with increasingly sophisticated “intelligent” functions. And with these developments there is a burgeoning need for advanced, highly reliable sensors with capabilities corresponding to the human’ five senses.

NEC TOKIN seeks to commercialize creative products fusing new material technologies with new applications, developing and commercializing a broad range of sensor devices based on outstanding materials technologies covering properties such as magnetism, piezoelectronics and optics.

This catalog introduces different kinds of sensors, including thermosensors, current sensors and magnetic sensors. Besides the items shown here we also offer an extensive line of sensor-related products and are continually developing new sensors, so please feel free to ask us about anything you might need. We look forward to being able to serve you.

Thermal Reed Switch TRS®



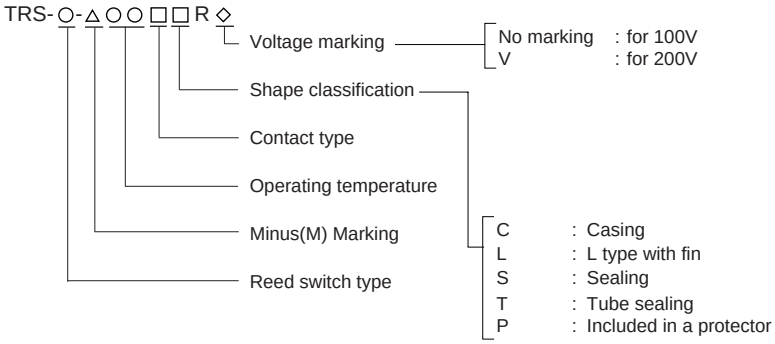
Outline

NEC TOKIN led the world in recognizing and realizing the potential of ferrite's Curie temperature. The result is Thermorite®, a temperature-sensing magnetic material. Ever since the introduction of this product, NEC TOKIN has reigned as the top manufacturer of Curie-temperature-utilizing control devices, developing many products with new functions. Among these, the Thermal Reed Switch (TRS®) is the chief product, with patents in the United States and Japan. Its superiority as a highly reliable, precise temperature-sensitive switch ideal for promoting energy conservation has been attested to by the International Relay Association. There are already more than 300 million in use, and with the addition of TRS® varieties approved by UL, CSA and other safety standards, the lineup just keeps getting better.

Features

- High relaibility (rated life of 5×10^5 times switching when used under appropriate conditions : cumulative fault rate 10%)
- Excellent temperature accuracy (±2.5°C, ±1°C)
- Wide range of operating temperature available (–10°C to +130°C)
- Excellent environmental resistance (contacts are encased in a glass tube)

Markings



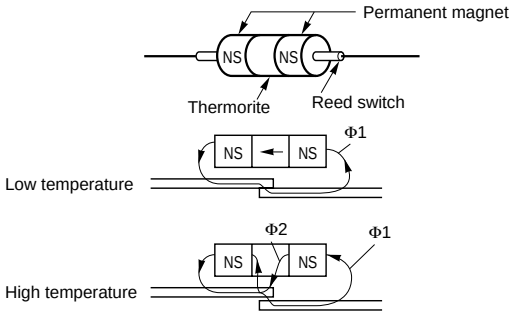
Electrical Ratings (Standard)

Reed switch type	For 100 V				For 200 V	
Reed switch rating	TRS06-	TRS1	TRS3-	TRS5-	TRS5-	TRS1-
Maximum opening/closing voltage (V)	110 AC•DC	140 AC 200 DC	140 AC 200 DC	140 AC 200 DC	264 AC	220 AC
Maximum opening/closing current (A)	0.3 AC•DC	0.5 AC•DC	0.5 AC•DC	0.5 AC•DC	0.275 AC	0.045 AC
Maximum opening/closing power (W)	6 AC•DC	10 AC•DC	35 AC 10 DC	50 AC 10 DC	60.5 AC	10 AC

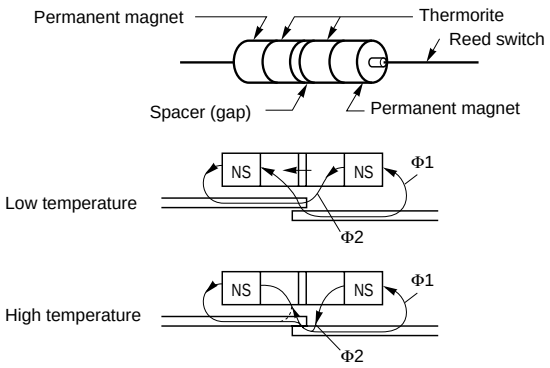
Structures and Principles of Operation

Thermal Reed Switches (TRS®) are temperature-sensing switches composed of a magnet and a temperature-sensing soft ferromagnetic substance called Thermorite®. This material's saturation magnetic flux density decreases as the temperature increases, and it turns into a paramagnetic substance at the Curie temperature.

(a) Normally closed type

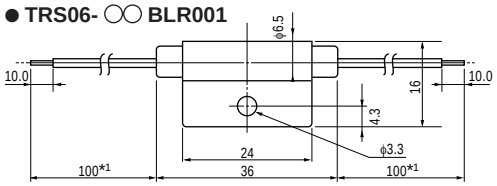
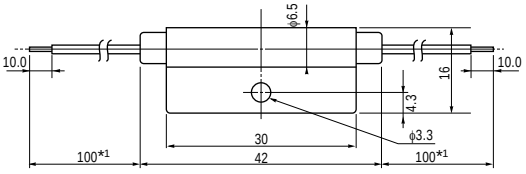
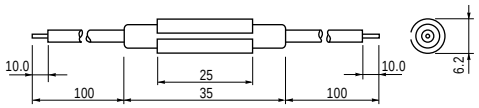
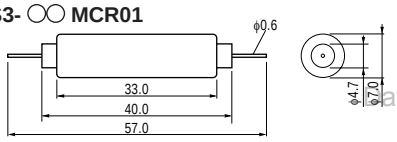
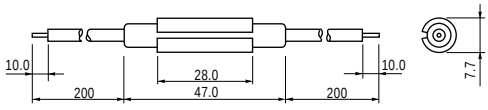
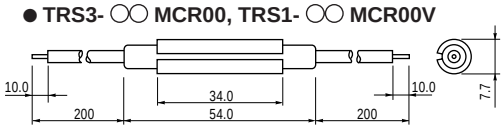
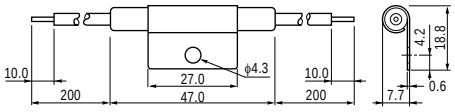
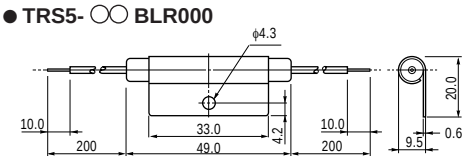


(b)Normally open type

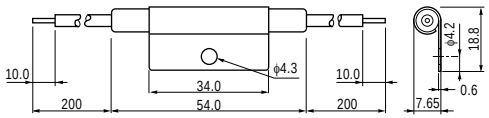
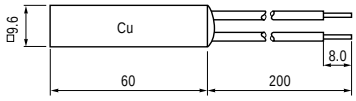
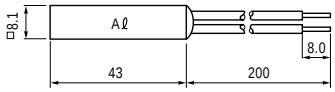
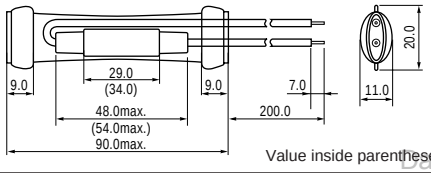
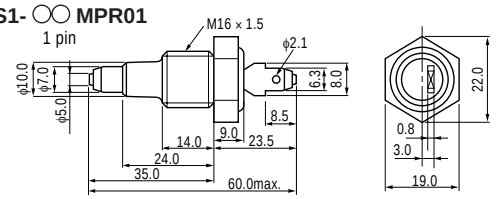
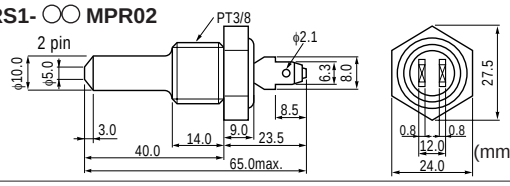
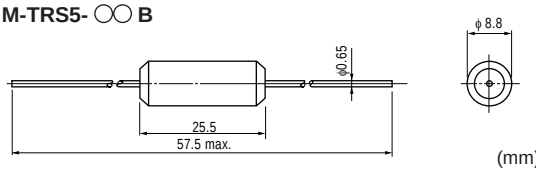
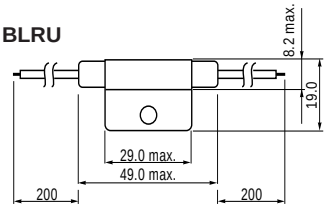


Before Using Thermal Reed Switch (TRS®)

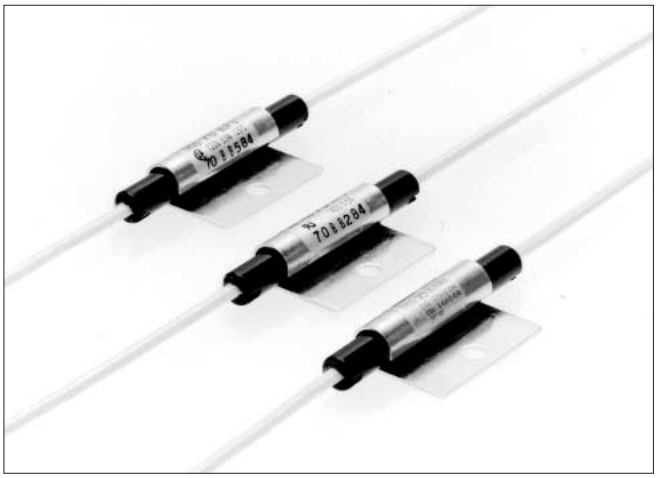
- Do not use in close proximity to strongly magnetized parts.
- Do not use if dropped or strongly shocked.
- Do NOT use with greater load than specified.
  When installing these switches in circuits prone to producing surge voltage (inductive load) or rush current (in lamps and motors), an appropriate switch type should be used, or a contact point protection circuit added.
- Avoid stress (especially torsion) in case of additional processing.
- Each reed switch has a specific resonance frequency. Please contact us when an oscillation is added.
- Please contact us before deciding your specifications.

	Part Number / Shape / Dimensions	Operating temperature range*1	Temperature tolerance	DIEF Temperature	Application(s)	Features
Compact Type	● **TRS06- ○○ BLR001**  ● **TRS06- ○○ MLR001**  ● **TRS06- ○○ BCR001**  (mm)	30°C to 130°C	±5°C	10°C max.	Power supplies Recharge temperature detection	Compact
C Type	● **TRS5- ○○ BCR01** ● **TRS5- ○○ BCR01V** ● **TRS1- ○○ MCR01, 01V** ● **TRS3- ○○ MCR01**  ● **TRS5- ○○ BCR00, 00V**  ● **TRS3- ○○ MCR00, TRS1- ○○ MCR00V**  (mm)	0°C to 120°C	±2.5°C		Rice cookers Yogurt makers Hot water heaters Photocopiers	General-purpose
L Type (Break Type)	● **TRS5- ○○ BLR00** ● **TRS5- ○○ BLR00V**  (mm)	0°C to 130°C	±2.5°C		Rice cookers Hot water heaters Thermos-type hot water heaters	General-purpose
High-Precision Type	● **TRS5- ○○ BLR000**  (mm)	40°C to 100°C	±1°C			High-precision

*1 Please consult us before you determine specifications.

L Type (Make Type)	● **TRS3- ○○ MLR00, TRS1- ○○ MLR00V**  (mm)	0°C to 130°C	±2.5°C	10°C max.	Power supplies Computers & peripherals	General-purpose
S Type	● **TRS5- ○○ BSR00, 00V** ● **TRS3- ○○ MSR00, TRS1- ○○ MSR00V**  ● **TRS5- ○○ BSR01E, 01EV** ● **TRS3- ○○ MSR01E, TRS1- ○○ MSR01EV**  (mm)	–10°C to 100°C	±2.5°C		Air-conditioners Freezers Vending machines Refrigerators Anti-freeze heaters	Humidity-and moisture-resistant
T Type	● **TRS5- ○○ BTR01, 01V** ● **TRS3- ○○ MTR01, TRS1- ○○ MTR01V**  (mm) Value inside parentheses ( ) is MTR	–10°C to 60°C	±2.5°C			
P Type	● **TRS1- ○○ BPR01** ● **TRS1- ○○ MPR01**  ● **TRS1- ○○ BPR02** ● **TRS1- ○○ MPR02**  (mm)	30°C to 110°C	±3°C		Automobile engine compart-ments Hot water heaters Boilers	Shielded for automotive use
Mold TRS Type	● **M-TRS5- ○○ B**  (mm)	–10°C to 130°C	±2.5°C		Anti-freeze heaters Aquarium heaters	Molded plastic
Approved by UL, CS	● **TRS5- ○○ BLRU**  (mm)	0°C to 130°C	±2.5°C		Photocopiers Rice cookers	Satisfies overseas safety standards-UL, CSA

TRS Series Approved by UL,CSA,and VDE



Specifications

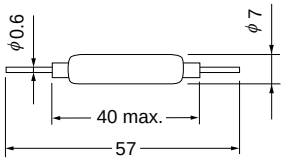
Recog-nized by:	Model	Max.Make/Break Current	Max.Make/Break Voltage	Max.Make/Break Power	Shape No.	Set Operating Temperature Range (˚C)	Tolerances for Operating Temperature (˚C)	Temperature Differential (deg.)*1
®	BLR Series TRS5-○○○BCR01U	0.5A	140V AC	50W AC	A	0~120	±2.5	10 max.
®	TRS5-○○○BCR01VU	0.275A	264V AC	60.5W AC				
®	BLR Series TRS5-○○○BLR U	0.5A	140V AC	50W AC	B	0~130	±2.5	10 max.
®	TRS5-○○○BLR VU	0.275A	264V AC	60.5W AC				
®	BLR Series TRS5-○○○BLR U	0.5A	120V AC	50W AC	B	0~129	±2.5	10 max.
®	TRS5-○○○BLR XU	0.25A	240V AC	60W AC				

UL : File No.E67648
CSA : File No.LR50414-2

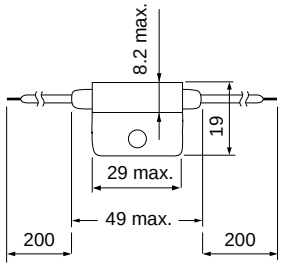
*1.No values specified in the international safety standard.
*○○○indicates the operating temperature

Shape and Dimensions

● A

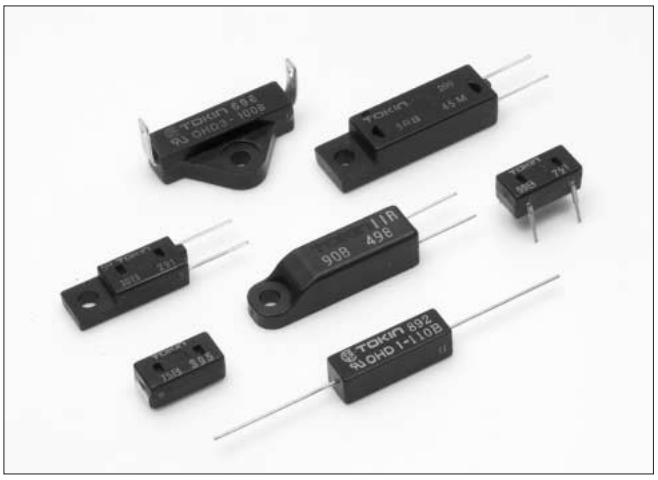


● B



[mm]

Thermal Guard OHD®



Outline

In addition to the thermal guards (OHD®) favorably accepted as overheat sensors, radial type (OHD5R) is adopted.

Features

- Extremely simple circuit design (as no adjustment needed).
- Reliable ON-OFF operation (special temperature-sensitive materials and highly-reliable switches give reproducible, reliable ON-OFF action).
- Usable with extremely low (0.1 mW or lower) signals to high power (6 W) levels, making them ideal as built-in overheating detectors in electronic circuits. (OHD5S-○○B, OHD5R- ○○B have a maximum rating of 1 W.)
- High-speed response (three times higher than previous NEC TOKIN products).
- Compact, light and easy to handle.
- Dust-proof, explosion-proof, and corrosion-proof.
- Wide range of operating temperatures available (in 5 °C increments from 30 to 130 °C)

Applications

- Monitoring overheating of power transistors and power modules in power supplies, OA equipment and other electronic appliances.
- Atmospheric temperature detection and overheating monitoring in room heaters, gas hot water heaters, PPCs, amplifiers, motors, HDDs, FDDs and other general appliances.

Specifications

Product name		Features	Contact shape	Contact capacity	Set operating temperature range*2	Operating temperature precision	DiFF
OHD1- ○○B ○○M		General-purpase	B:Break M:Make	Maximum opening/closing voltage 110 V AC/DC Maximum opening/closing current 0.3 A AC/DC Maximum opening/closing power 6 W AC/DC Minimum opening/closing current 0.1mA/1V,DC	Fixed in 5°C increments from 30°C to 130°C	±5°C	10°C max.
OHD3- ○○B ○○M							
OHD5S- ○○B*1		Compact SMD type Compact radial type	B:Break	Maximum opening/closing voltage 30 V.DC Maximum opening/closing current 0.1 A DC Maximum opening/closing power 1 W DC Minimum opening/closing current 0.1mA/1V,DC			
OHD5R- ○○B							

UL : E67648
CSA : LR50414
TÜV : OHD1·3 R 9750955
OHD5R R 9750944

*Reel type is also available in OHD5S.
*1,2 Please consult us before you determine specifications.

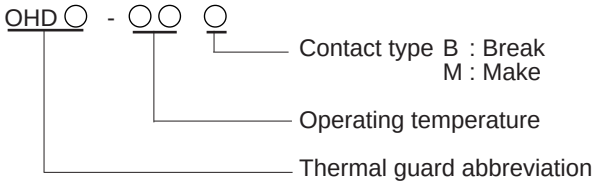
Product name	Contact Resistance	Insulation Withstancl Voltage	Insulation Resistance
OHD1•3•11R	150mΩ Max.	2500VAC/1min. or 3000VAC/1sec (Between terminals and mounting resin surface)	DC500V-100MΩ min. (Between terminals and mounting resin surface)
OHD5S•5R	300mΩ Max.	1500VAC/1min. or 1800VAC/1sec (Between terminals and mounting resin surface)	DC500V-100MΩ min. (Between terminals and mounting resin surface)

Standard Temperature Specifications

Product name	Standard Temperature specification
OHD1-B	60. 80. 90. 100˚C
OHD1-M	70˚C
OHD3-B	60. 70. 80. 85. 90. 100. 105. 110. 120˚C
OHD3-M	80. 85. 90. 95. 100. 105. 110. 115. 120˚C
OHD5R-B	80. 85. 90. 95. 100. 105. 110˚C
OHD5S-B	70. 90˚C
OHD5S-B01	70. 90˚C

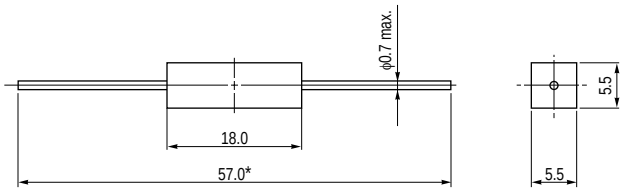
* Please ask separately except standard temperature specification

Markings

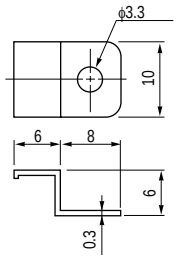


Shape and Dimensions

● OHD1 *This product will be change 45.0 length type after April 2001.

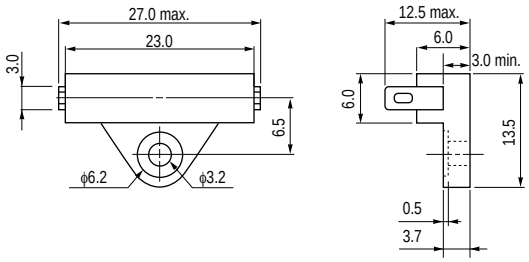


● OHD1 mounting bracket

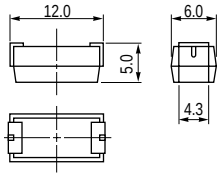


*Mounting brackets exclusively for the OHD1 type are provided optionally (at separate cost).

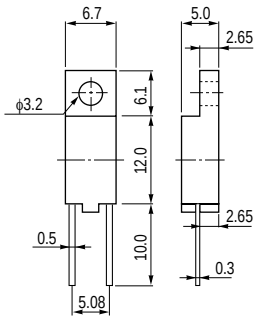
● OHD3



● OHD5S



● OHD5R

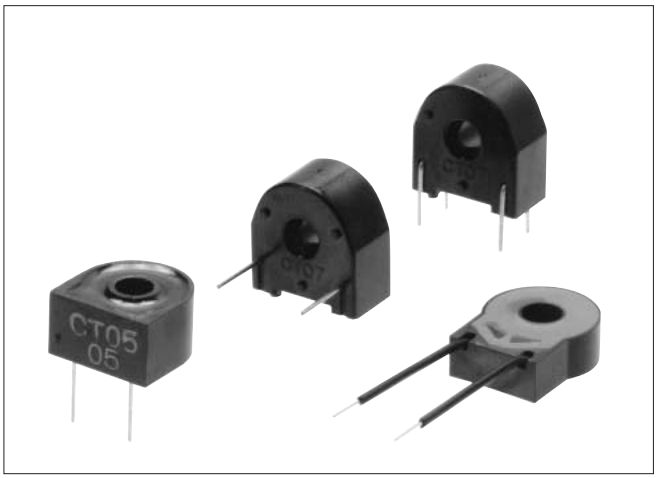


(mm)

Before Using Thermal Guard OHD®

- Do NOT use with greater load than specified.
- Do not affix in close proximity to strongly magnetized parts and avoid using in a magnetic field.
- Do not use if dropped or strongly shocked.
- The OHD1 is designed to be inserted into printed circuit boards. If a wire harness is required, we recommend the OHD3 type.

Current Transformers Low Current Type



Outline

This series of compact current transformers (current sensors) can be used for detecting very low current levels and overcurrent protection in electronic appliances.

Features

- High sensitivity (detection of low current) and high performance.
- Compact, lightweight.
- Mountable on printed circuit boards.

Applications

- Overcurrent detection in microcomputer-controlled equipment.
- Current detection in electric refrigerators, air conditioners and electromagnetic cookers.

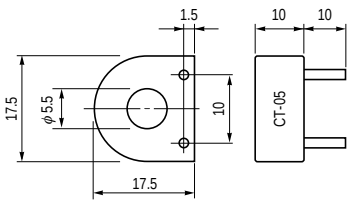
Specifications

Product name	CT-05	CT-06	CT-07
Core	Permalloy (TMB)	Permalloy (TMH)	Permalloy (TMB)
Lead wires	Pin connectors, annealed copper wire ϕ0.6 mm	Polyethylene sheath ϕ0.5 mm single wire	Pin connectors, solder-plated hard-drawn copper wire ϕ0.8 mm
Materials	Phenolic resin case. epoxy-filled	Phenolic resin case, silicon-filled	Phenolic resin case, epoxy-filled

Notes:)(1) In the standard lineup there are three types of CT-06, depending on differences in secondary windings.
(2) The CT-05 has 500^{T} as standard.

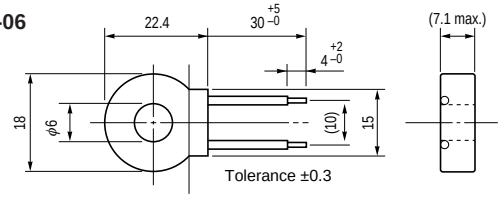
Shape and Dimensions

● **CT-05**



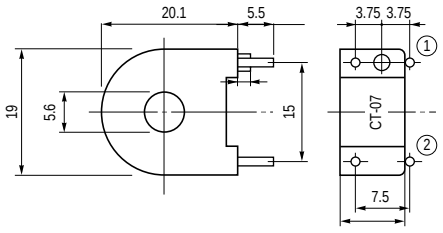
(mm)

● **CT-06**



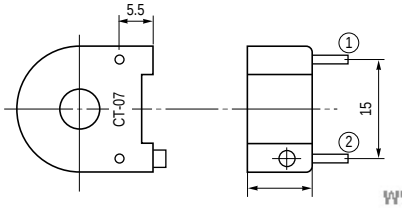
(mm)

● **CT-07V (vertical type)**



(mm)

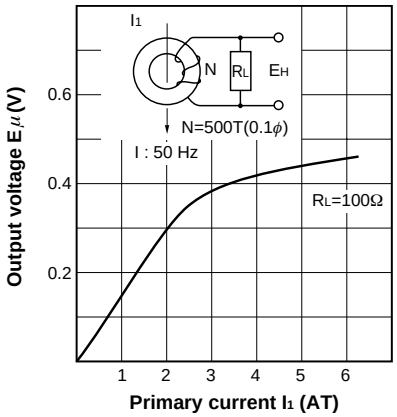
● **CT-07H (horizontal type)**



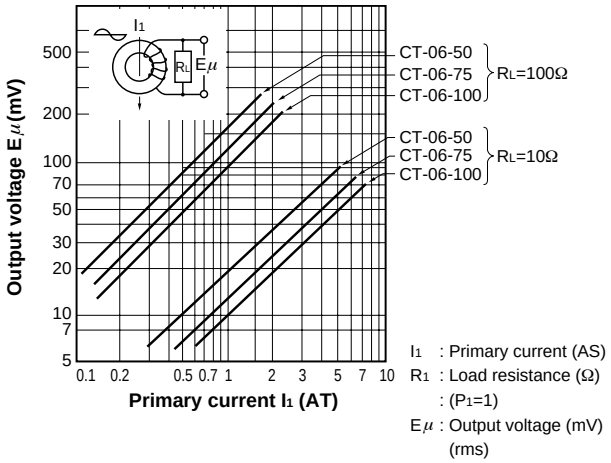
(mm)

Output Characteristics

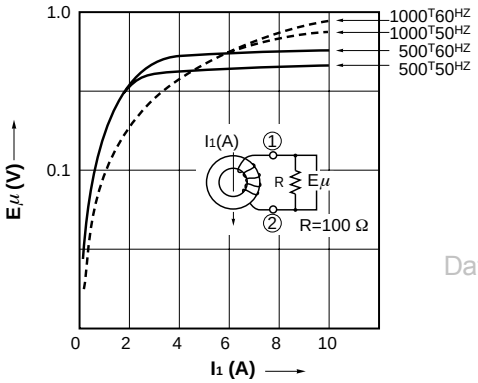
- **CT-05 AC output characteristics (example)**



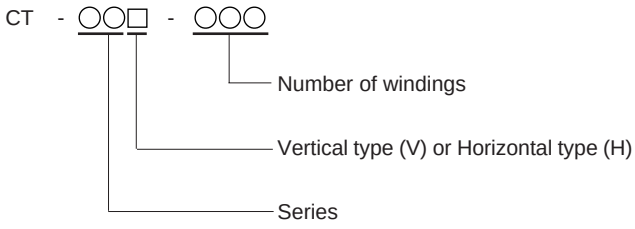
- **CT-06 AC output characteristics (example)**



- **CT-07 AC output characteristics (example)**



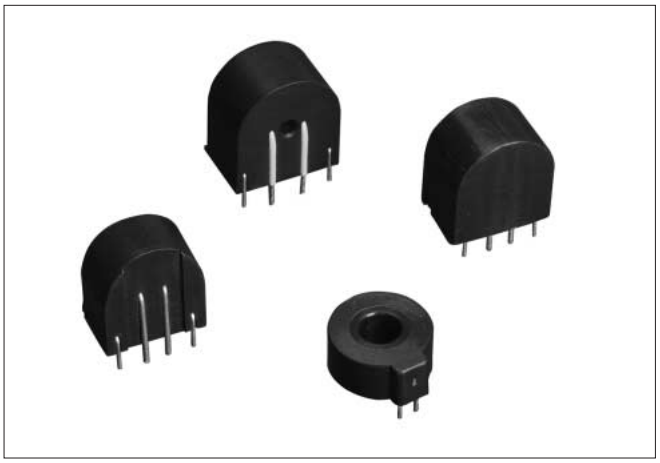
Markings



Before Using Current Transformers Low Current Type

- The core may be damaged if applied with a strong impact. Carefully avoid dropping or applying any other strong impacts.
- Preliminary study is needed with regard to heating by current conduction.

Zero-Phase Current Transformers ZCT



Outline

The ZCT Series of compact molded-type zero-phase current transformers is ideal for improving the sensitivity, compactness and light weight of electric shock prevention earth leakage breakers.

Features

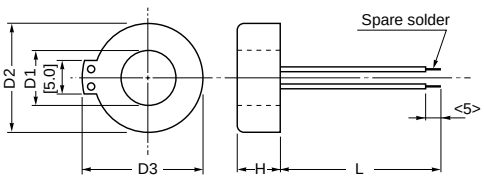
- High sensitivity.
- Compact and light weight.
- Laminated iron core type.

Applications

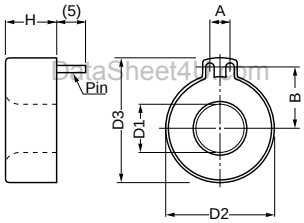
- Electric shock prevention earth leakage breakers.
- Short circuit relays.

Shape and Dimensions

● MR-1,2,3,4



● MR-1-P3,P5



Product name	Each part's dimensions (mm)						
	D1 (±0.3)	D2 (±0.3)	D3 (±0.4)	H	L (±3.0)	A (±0.3)	B (±0.3)
MR-1	7.5	19.0	22.0	8.0±0.3	40.0	—	—
MR-2	9.2	21.5	24.3	8.0±0.3	80.0	—	—
MR-3	12.0	27.0	30.0	10.0±0.3	67.0	—	—
MR-4	17.0	31.3	33.7	10.5±0.3	67.0	—	—
MR-1-P3	7.7	19.0	21.0	8.5 max.	—	3.0	10.0
MR-1-P5	7.7	19.0	21.5	8.5 max.	—	5.0	10.5

Pin : 0.8ϕ solder-plated wire

Specifications

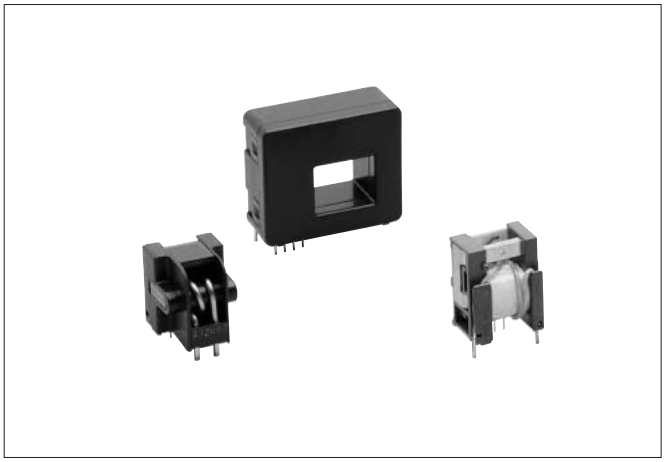
Product name	Rated current (A)	Output voltage (mV) min.	Overload characteristics (–20°C to 80°C) (%) max.	Temperature characteristics (rated load) (%) max.	Unbalance characteristics (%) max.	Measurement conditions
MR-1	30	8	10	±10	13	R=0.3 kΩ Io=22.5 mA
MR-2	30					
MR-3	60					
MR-4	125					
MR-1-P3	30					
MR-1-P5	30					

Note:)We can accommodate other specifications as well, so please ask if required. R : Output load, Io = Io : Detection current

Before Using Zero-Phase Current Transformers ZCT

- Strong shocks such as from being dropped may change the characteristics. Take care to avoid any subjecting the transformers to physical shocks.

Magnetic Direct Current Sensor MDCS



Outline

Magnetic direct current sensors (MDCS) use a magnetic substance and hole device for magnetic detection of direct current. They detect all currents (DC, AC and pulse), and the output voltage varies in proportion to the strength of the current measured.

Features

- Detection of both direct currents and alternating currents (including pulse currents)
- Fluctuations in output from changes in the power supply voltage and the ambient temperature are small.
- Excellent linearity of measured current and the converted power output
- The measured current and the secondary output side are insulated.

Applications

- Inverter-based home appliances (Air-conditioners etc.)
- General-purpose inverters
- AC variable-speed drive and servo drive
- Industrial machines • UPS • DC motor control
- FAX and other multifunction telephone series (THS Series)

Item		Marking	Rated value and conditions (Ta=25˚C)											
			Amplifier built-in type											
			Single power supply operating type (Magnetic proportion system)				Double power supply operating type (Magnetic balance system)							
Model			LA12				JB15							
			20V21	30V21	40V21	50V21	05V41	10V41	15V41	20V41	25V41	30V41	40V41	50V41
Rated current	(A)	IcL1	±20	±30	±40	±50	±5	±10	±15	±20	±25	±30	±40	±50
Primary side windings	(Turn)	–	3	2	2	2	6	3	2	1	1	1	–	–
Scope of measurement	–	–	0 to 100% of rated current (IcL1)				0 to 250% of rated current (IcL1)						0 to 150% of rated current (IcL1)	
Power supply voltage	(V)	Vcc	+12±5%				+15±5%							
		Vee	–				–15±5%							
Consumption current	(mA) max.	–	40				50							
Output voltage	(V)	Vh	±2.000±0.060 (at IcL1, RL=10Ω)				±4.000±0.060 (at IcL1, RL=18kΩ)							
Remaining voltage	(V)	Voff	+2.500±0.060 (at 0A, RL=10kΩ)				±0.050 (at 0A, RL=18kΩ)							
Hysteresis	(mV) max.	Vhys	60				30						60	
Power supply voltage variation	(mV) max.	–	30 (Vcc=+12V±5%)				30 (Vcc=+15V±5%, Vee=–15V±5%)							
Vh temperature characteristics	(%/˚C)	–	±0.15				±0.04							
Voff temperature characteristics	(mV/˚C)	–	±4				±1.5							
Pulse response	(μs) max.	Tp	20 (di/dt=100AT/μs)				3 (di/dt=100AT/μs)							
Linearity	(%) max.	γ	±2				±0.5							
insulation withsand voltage	–	–	AC2000V/1min. (Between wire and terminals)											
Insulation resistance	–	–	500MΩ/DC500V (Between wire and terminals)											
Operating temperature range	(˚C)	Ta	–10 to +75											
Storage temperature range	(˚C)	Ts	–15 to+80											

* Besides the standard windings, any other windings within the rated current are possible.
* The rated current unit A is designated as the primary side current (A) × number of turns (Turn).

● **THS56,56F,65,63F**

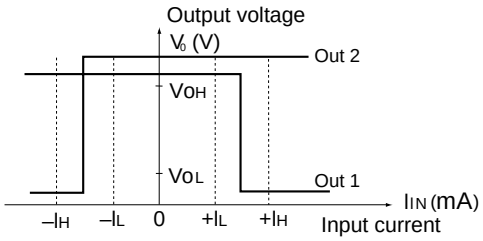
Electrical Characteristics (Ta=25°C, Vcc=+5V)

Item		Marking	Conditions	Rating min.	Rating typ.	Rating max.	Comments
Sensitivity current (mA)	56,65	I_L	Ta=+5°C~+45°C	2			
		I_H				15	
	56F,63F	I_L		5			
		I_H				10	
Primary side input current (mA)	56,56F,63F,65	Iin		-120		120	
Input direct current resistance (Ω)	56	Rin	Ta=–10°C~+70°C	2.5	3.5	4.5	
	56F,63F,65			2.5	3.9	5.0	
Input inductance (mH)	56	Lin	Ta=–10°C~+70°C	0.8	1.0	1.2	-10°C ~ +70°C
	56F,63F,65			0.8	1.1	1.4	
Output voltage (V)		V_{OH}	RL=10kΩ	3.5			
		V_{OL}			0.1	0.8	
Response (μS)		ton-off	RL=∞		60		
Power supply voltage (V)		Vcc		+4.5		+5.5	
Consumption current (mA)	56,56F,65	Icc			10		
	63F				12		
Effect of external magnetic field (mA)	56,56F,63F,65	Iin offset	Iin=0 $B=1\times10^{-3}T$		3		
"Analog" out put Loss (dB)	56,65		Iin=0~120mA 1kHz,60Ω	30	34	38	
	56F			30	33	36	
	63F			-2	0	2	
S/N (dB)	56,56F,65		Input level(Vin) –45~+20dBm	15			
	63F		Input level(Vin) –45~0dBm				

Maximum Rating

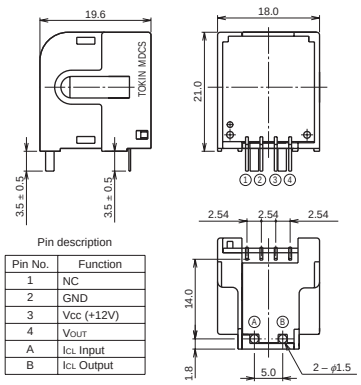
Item		Marking	Rating	Comments
Power supply voltage (V)		V_{CC}	7.0	
Primary side input current (A)	56,56F,63F,65	Iin	0.5	10sec. max.
Withstand voltage between primary and secondary (kVAC) min.			2.2	60sec. 50Hz RH=65±5%
Operating temperature range (°C)		Topt.	–10 ~ +70	
Storage temperature range (°C)		Tstg.	–20 ~ +80	

Input Current - Output Voltage Characteristics



Shape and Dimensions

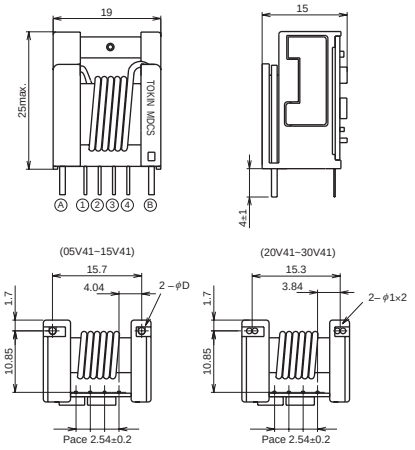
● **LA12-○○V21**



Pin description

Pin No.	Function
1	NC
2	GND
3	Vcc (+12V)
4	VOUT
A	ICL Input
B	ICL Output

● **JB15-05V41~30V41**



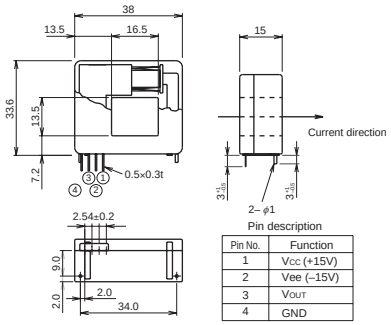
Pin description

Pin No.	Function
1	VOUT
2	Vcc (+15V)
3	GND
4	(–15V)
A	ICL Input
B	ICL Output

Model/Wire size

Model	φ D
05V41	φ 0.8
10~15V41	φ 1.0
20~30V41	φ 1.0×2

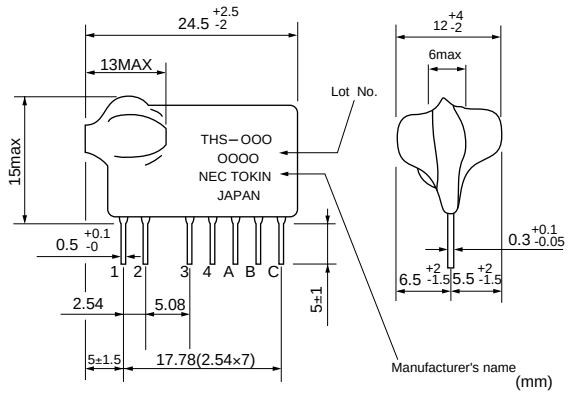
● **JB15-40V41/50V41**



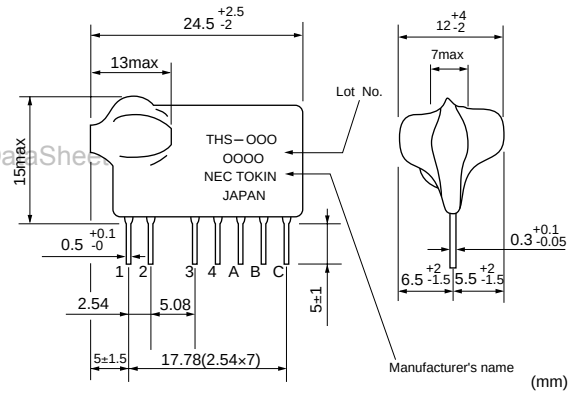
Pin description

Pin No.	Function
1	VCC (+15V)
2	Vee (–15V)
3	VOUT
4	GND

● **THS-56,56F,65**



● **THS-63F**



Pin number	LA12	JB15-05V41~30V41	JB15-40V41/50V41	THS56,56F,65,63F
1	NC	Vout (Output voltage pin)	Vcc (+15V)	(Coil input)
2	GND (Ground pin)	Vcc (+15V)	Vee (-15V)	(Coil input)
3	Vcc (+12V)	GND (Ground pin)	Vout (Output voltage pin)	GND (Ground pin)
4	Vout (Output voltage pin)	Vee (-15V)	GND (Ground pin)	"Analog" output
A	(Measured current ⊕pin)	(Measured current ⊕pin)	—	OUT2
B	(Measured current ⊖ pin)	(Measured current ⊖ pin)	—	OUT1
C	—	—	—	Vcc (+5V)

Before Using Magnetic Direct Current Sensor MDCS

- Strong physical shocks could damage cores. Be careful not to drop or apply other strong impact.
- These products are heat resistant up to 260°C for 10 seconds. Be careful not to exceed this amount when soldering. Use a low-corrosion type flux when soldering.
- Because the circuit uses ICs, application of strong static electricity could cause damage. Take static electricity precautions when handling.
- Because these products are magnetic current detectors, application of strong external magnetic fields could cause their characteristics to change. Limit ambient magnetic fields to 50e or less.

Twin Reed Switch Type Safing Sensor NRS-603W

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

- Allows the control of driver and passenger seats using one sensor, because two reed switches are included in the sensor
- Has about 55% the volume of conventional NRS-602 reed switch type safing sensors containing one element, thereby enabling substantially compact reed switch type safing sensors
- Use of a built-in reed switch ensures energizing currents (20A) twice as large as a conventional reed switch type safing sensor

Applications

- SRS air bag systyem
- Seat belt pre-tensioner

Specifications

Item				Standard	Remarks
Electrical operating characteristics, mechanical characteristics	Intercontact withstand voltage	(V)	min.	200	–
	Switching voltage	(V)	max.	40	–
	Switching current	(A)	max.	7	–
	Carry current	(A)	max.	20	–
	Contact resistance	(mΩ)	max.	150	When 100mA is applied
	Insulation resistance	(Ω)	min.	10^8	Applied voltage of 100VDC
	Operating time	(ms)	max.	24.2	7.2G-20ms (Half sine wave)
	ON-holding time	(ms)	min.	14	7.2G-20ms (Half sine wave)
	Retention temperature	(˚C)		-40~+100	–
	Operating temperature	(˚C)		-30~+80	–

Before Using Twin Reed Switch Type Safing Sensor NRS-603W

- Characteristics are subject to change when installed in the vicinity of magnetic fields or strong magnetic substances.
- Do NOT use sensors which have been dropped or subjected to a strong shock.
- For current running conditions, please contact us.
- Be sure to consult with us before deciding on your specifications.

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.

Applications

- SRS air bag systyem
- Seat belt pre-tensioner

Features

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

Makings

TMSD • H2251D
└ Starting G (started at 2.2G)

Specifications

Item	Standard	Remarks
Inter contact withstand voltage	min. 200V	–
Switching voltage	max. 40V	–
Switching current	max. 7A	–
Carry current	max. 20A	–
Contact resistance	max. 150Ω	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	–

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

- Characteristics are subject to change when installed in the vicinity of magnetic fields or strong magnetic substances.
- Do NOT use sensors which have been dropped or subjected to a strong shock.
- For current running conditions, please contact us.
- Be sure to consult with us before deciding on your specifications.

Ceramic Gyro

Outline

Ceramic Gyro is a miniature angular rate sensor having a very simple construction that is made up of a single piezoelectric ceramic column printed with electrodes.

Features

- Miniature size
- High-speed response
- Magnetic field proof

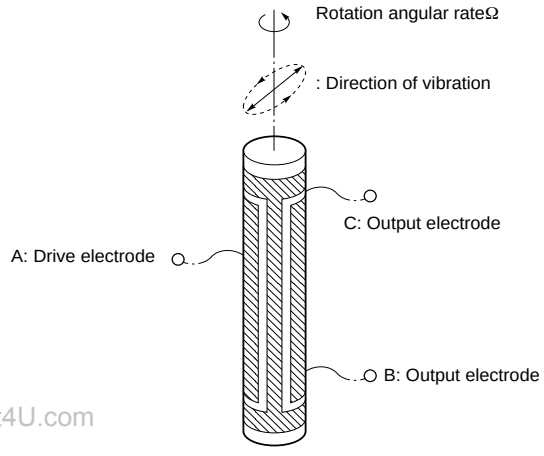
Applications

- Image stabilizing system on camcorder, camera and binocular
- Stability control of radio-controlled helicopter
- Input equipment (mouse etc.)

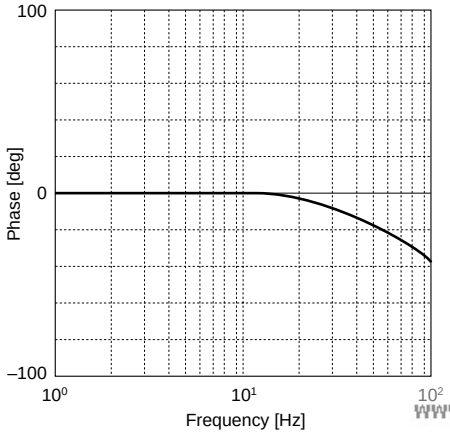
Specifications

Model			CG -16D	CG - L43
Item		Condition	Specifications	Specifications
Supply voltage	(V)		+5	+3
Reference voltage output	(V)		+2.4	+1.3
Current consumption	(mA) max.		7	4
Maximum detectable angular rate	(deg/sec)	25˚C	±90	±90
Sensitivity	(mV/deg/sec)	25˚C	1.1 ±20%	0.66 ±20%
Output voltage at zero angular rate	(mV) max.	25˚C	±300	±300
		Any temperature	±800	±500
Temperature characteristics of sensitivity	(%)		±15	±15
Frequency response	(Hz) min.	-90deg	100	100
Operating temperature range	(˚C)		-5 ~ 75	-5 ~ 75
Storage temperature range	(˚C)		-40 ~ 80	-40 ~ 80
Dimensions	(mm)		8 X 20 X 8	8 X 16 X 5

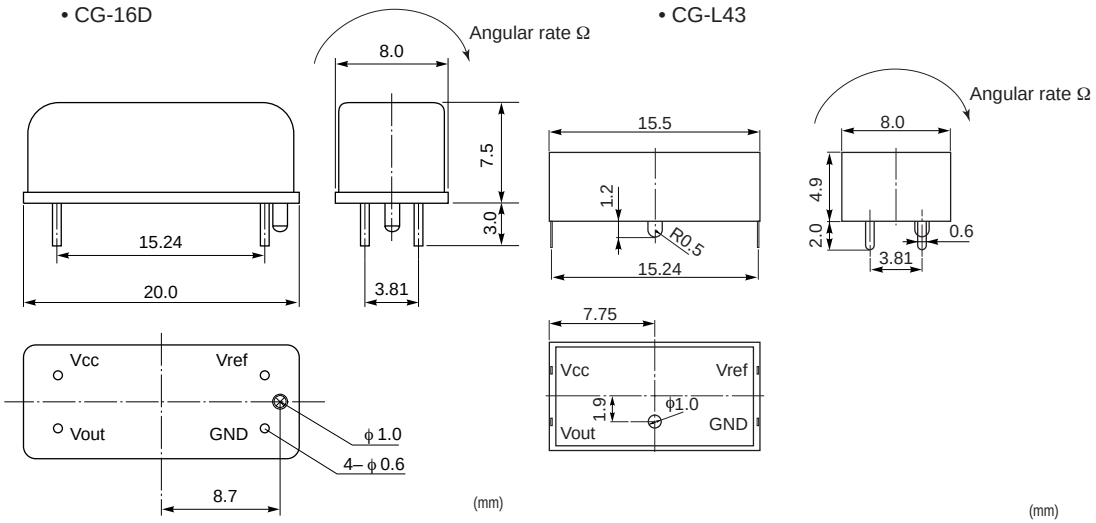
Vibrating Element Structure



Frequency - Phase Characteristics



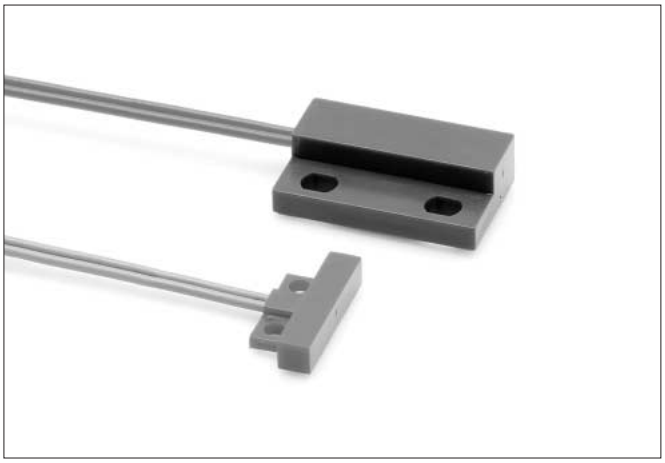
Shape and Dimensions



Before Using Ceramic Gyro

- When transporting or handling a sensor, be careful not to drop it or subject it to any other physical shock. Failure to do so may lead to internal damage or deterioration of its characteristics.
- Avoid applying mounting voltages higher than the rating to the sensors pins. This will lead to overheating or damage to the sensors.
- As sensors are not water resistant, cleaning should be avoided.
- When handling sensors, anti-electrostatic precautions must be taken.

Magnetic Type Proximity Switches TMRS Series



Outline

NEC TOKIN's highly reliable magnetic non-contact switches are the result of combining reed switches and magnets, made possible by the contact technology, magnetic circuit technology and plastic molding technology developed through the production of 300 million temperature switches (TMRS Series).

Applications

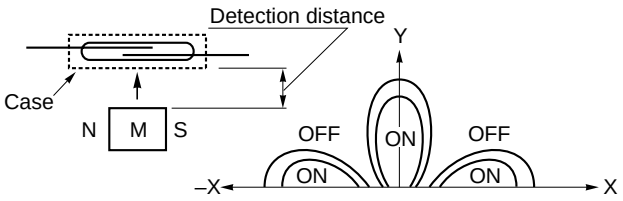
- Position detection (air cylinders, automatic doors, etc.)
- Rotation detection

Features

- Sealed resin-molded structure makes for easy handling and mechanical strength.
- The contacts are encased in glass for excellent resistance to dust and corrosion.

Operation Characteristics

● Normally open type



When drive magnet M approaches, the reed switch contacts close and the circuit comes on.

Specifications

	Product name	Features	Contact capacity	Life time
TMRS Series	TMRS-3	Compact wire harness	Maximum switching voltage 110V AC/DC Maximum switching current 0.5V AC/DC Maximum switching power 10W AC/DC	12VDC 5mA (R) 10^7 times
	TMRS-4	General wire harness		

Markings

● Switch

TMRS-○○○○

- Classification number
- 0 : Normally open
  1 : Normally closed
- Shape

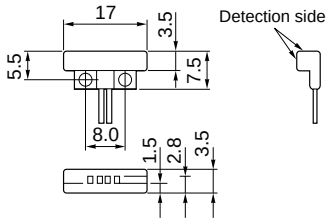
● Drive magnet

MG-○○○○

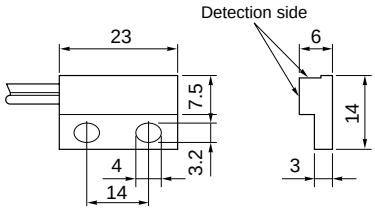
- Classification number
- Material 1. Ferrite (non-isotropic)
  2. Ferrite (isotropic)
  3. Rare earth compound
- Shape

Shape and Dimensions

● TMRS-3



● TMRS-4



(mm)

Operating Characteristics

Switch / Magnet		TMRS -3.4
		Detection distance
Specifications	Dimensions (mm)	Normally open (N.O.) 5 10 15 20 (mm)
MG-1101	5X4X30	10
MG-1103	15X4X30	20
MG-2201	8X4X10	4
MG-2203	10X3.5X16	9
MG-3101	5X5X7	6
MG-3102	7X7X7	10
MG-4301	ϕ6X20	20

• Detection distance: The distance between the detection side and the surface of the magnet at which the unit operates.

Proximity Switch NRS Series

Specifications

Item	Types	Performance
Contact from		1 From A
Maximum Swiching Power	(W)	10
Maximum Swiching Current	(A)	0.5
Maximum Swiching 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 10million opetarions

Outline

With a built-in reed switch, NEC TOKIN's proximity switches are 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

Numbering System

NRS-102-10

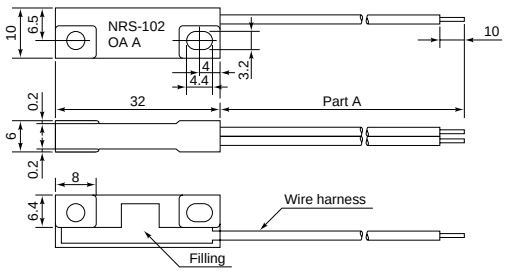
Series — Wire Length

Number	Contact Resistance (inculuded 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.

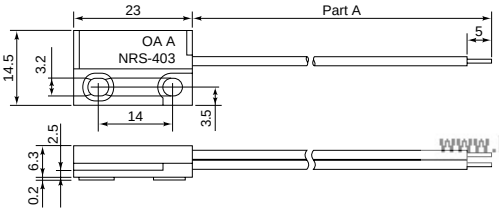
Shape and Dimensions

● NRS-102 Series



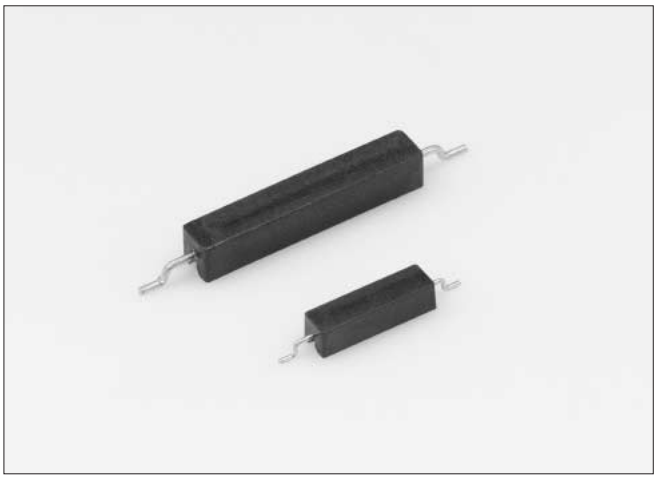
(mm)

● NRS-403 Series



(mm)

Magnetic Type Proximity Switches Case Type:NRS-700 Series



Outline

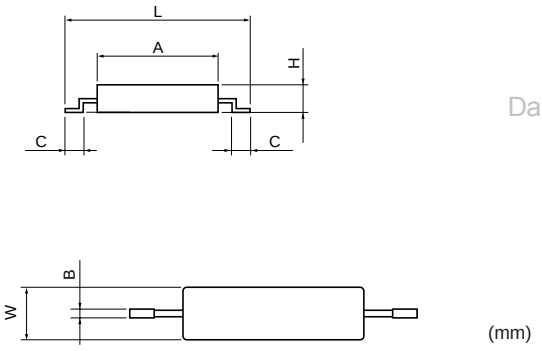
These reed switches are Surface-mounting type and Suited for automatic mounting.

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

Shapes and Dimensions



(mm)

(mm)

Model	L max.	W max.	H max.	A	B	C
NRS-701A	13.0	2.4	2.2	8.3	0.4	1.2
NRS-771	24.0	3.0	3.0	17.0	0.6	1.6

Features

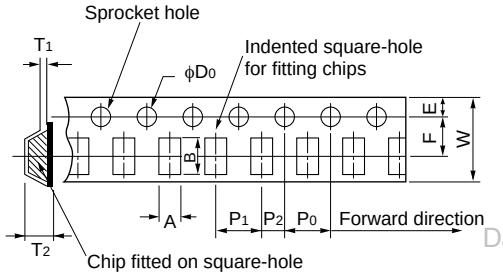
- Suited for automatic mounting
- Can be soldered using reflow
- With the NRS-700 series, its glass tube is covered with a case, making it easy to handle.

Specifications

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

Reel Tape Dimensions

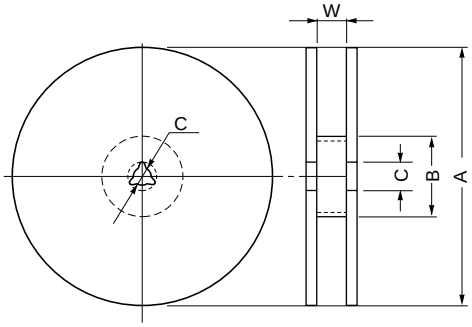
Tape Dimensions



(mm)

Type	NRS-701A	NRS-771
A	2.7	3.3
B	16.0	32.0
W	24.0	44.0
F	11.5	20.2
E	1.75	1.75
P1	8.0	8.0
P2	2.0	2.0
P0	4.0	4.0
D0	1.55	1.55
T1	0.4	0.4
T2	(3.4)	(4.2)

Reel Dimensions

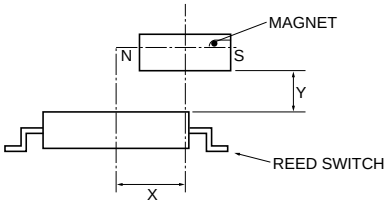


(mm)

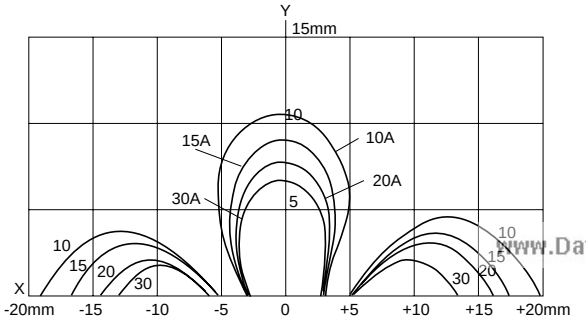
A	330	382
B	80	80
C	13.0	13.0
W	24.5	45.5

Standard number of Packages (piece/reel)
2,000

Example for operation characteristics



Driving Area by Means of FM5/5/7 (NRS-701)
Figures in the graph denote operation values before processing the terminal.



Before Using Proximity Switch Series

Fixing the Proximity Switch

When fixing a proximity switch, avoid warping as shown in Figure 1 caused by rise of filler or an obstacle left on the mounting surface. Also, do not pull a reed wire.

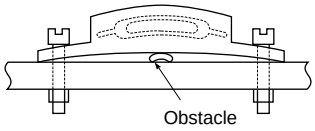


Figure 1 Warping caused by an obstacle left between the proximity switch and the mounting surface.

Cautions for Shock

(1) As the characteristics of the proximity switch (especially sensitive) may deteriorate when the switch falls from above 30cm height, caution must be taken.

(2) If many proximity switches are mounted on a large print board, caution must be taken when cutting the print board along the perforated line, because the shock of cutting may change the sensitivity of the switch. (Along with an effort such as leaving the least part to reduce the shock, we recommend that you confirm that the sensitivity has not changed before use.)

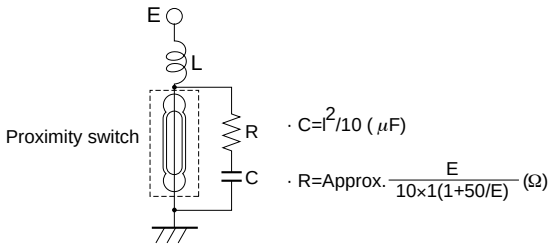
Contact Protection Circuit

For improving the reliability of the proximity switch, insert one of the following contact protection circuits when using the switch at a load which causes a surge current.

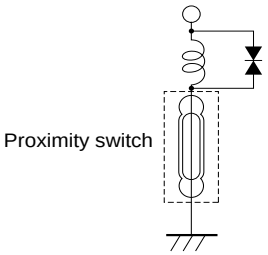
- Inductive load

  If an inductance (coil, electromagnetic relay, motor, etc.) is used as a load, hundred of volts of counter electromotive force (the energy stored in the inductance) will occur to shorten the lifetime of the contact (for the resistance load, that is also true when an inductance is used at a high voltage or a large current). For protection circuits, refer to Figure 2.

Protection circuit with CR



Protection circuit with varistor



Protection circuit with diode

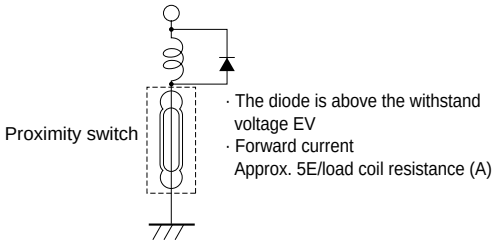


Figure 2

- Capacity load

  If a condenser is used as a load, charge/discharge at the capacitance will cause a rush current when the switch is closed, which may make switch opening impossible. In this case, as shown in Figure 3, the method in which a protection resistance R is inserted can be used.

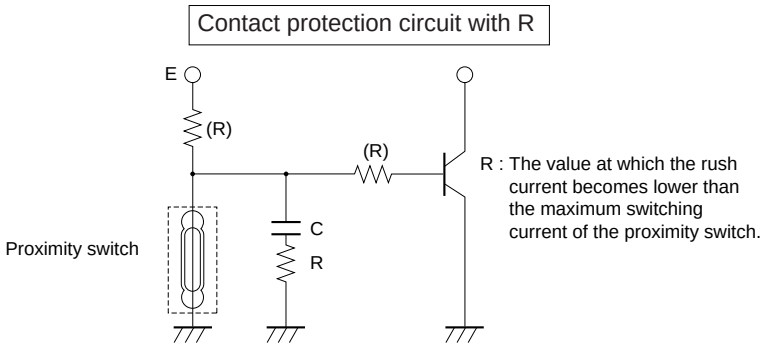


Figure 3

- Lamp load

  In general, the filament of the lamp is made of tungsten. With the tungsten filament, the resistance is low when the lamp is turned on and becomes higher as it reaches the stationary current. When this lamp is used with a proximity switch, a rush current (at five to ten times the stationary current) will be caused immediately after lighting, which may result in welding or adhering of the contact. In this case, as shown in Figure 4, a protection resistor R can be inserted .

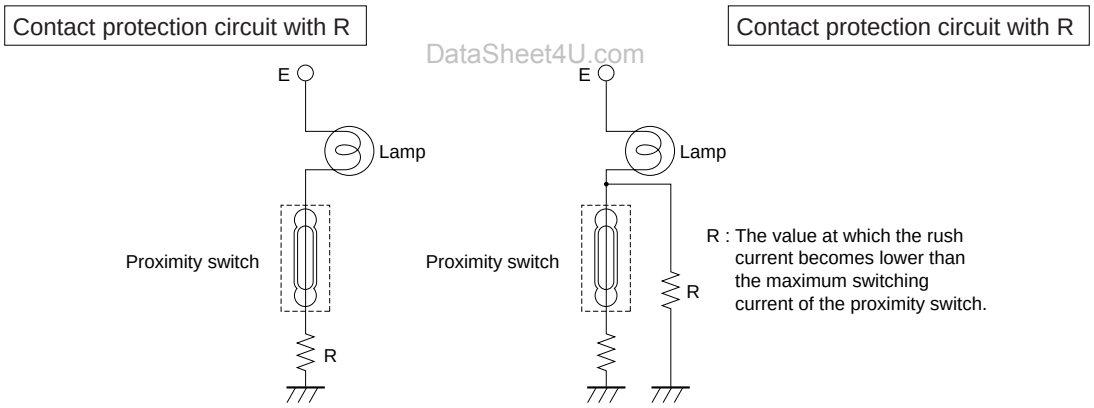


Figure 4

- Wiring capacity load

  If a contact and a load are combined by long wires or cable, the floating capacity will cause a rush current when the contact is closed, which largely affects the lifetime of the contact. In this case, as shown in Figure 5, a protection circuit in which a resistance or inductance is added can be used.

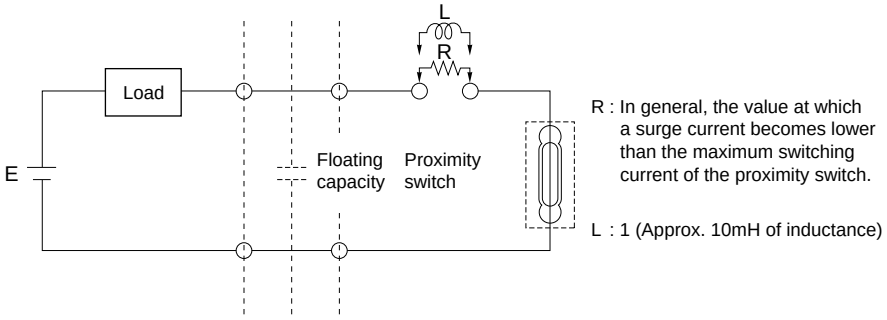
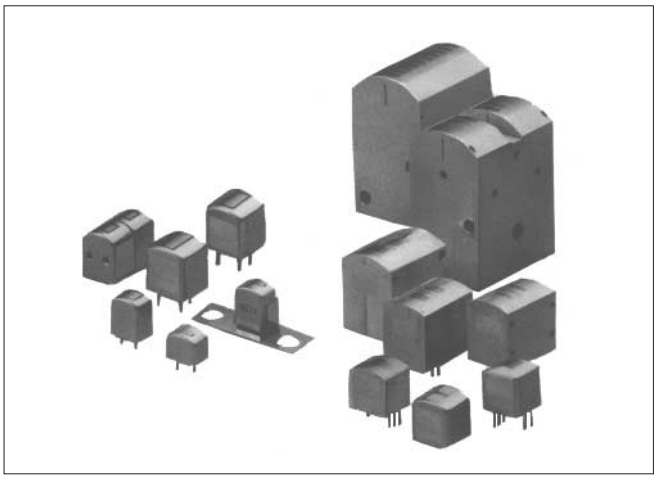


Figure 5

Cautions for Ultrasonic

- Ultrasonic cleaning
  After mounting a proximity switch on a printed circuit board or the like, avoid ultrasonic cleaning because ultrasonic cleaning may change the sensitivity of the switch or crack the seal of the glass tube.
- Ultrasonic welding
  Also, avoid ultrasonic welding because, by the same reason as ultrasonic cleaning, the performance of the proximity switch may deteriorate.

Industrial Magnetic Head



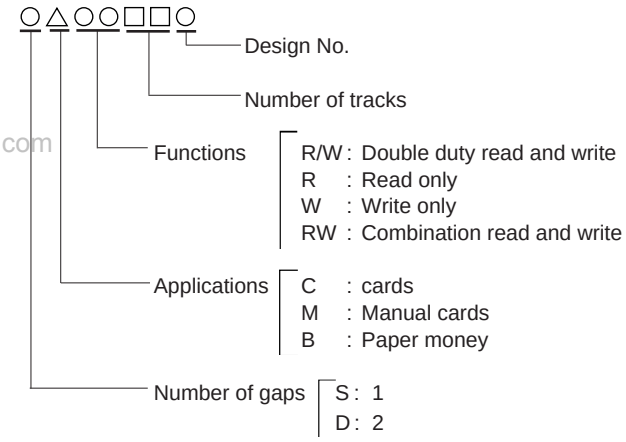
Outline

NEC TOKIN's outstanding magnetic heads represent a further fruition of the Company's formidable technology and know-how accrued through independently developing and producing magnetic core materials, magnetic recording media and magnetic card reader/writers. These industrial-use magnetic heads are suitable for use in many advanced devices in the limelight recently, such as prepaid card systems, computer magnetic media I/O, automated ticket wickets and paper money recognition devices. NEC TOKIN's originally-developed high performance metal magnetic material Sendust"' is used as the core material, for high reliability proven in extensive deliveries over the years.

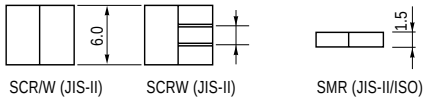
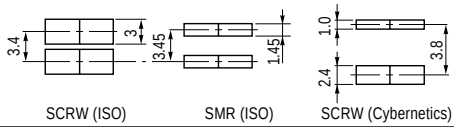
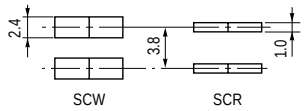
Features

- The core material uses Sendust®, which NEC TOKIN lead the world in developing and commercializing.
- Outstanding sliding characteristics and wear resistance
- Excellent environmental resistance makes these ideal as magnetic heads in motor vehicles and outdoor equipment. Because NEC TOKIN is active in all stages of integrated head manufacturing, including original magnetic material development, processing and assembly, we are able to accommodate a wide range of customer requirements.

Markings

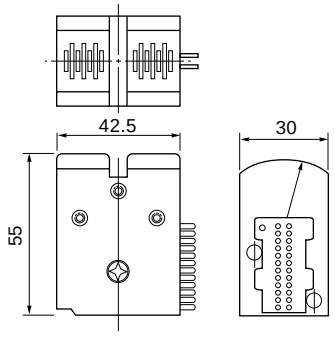


Specifications

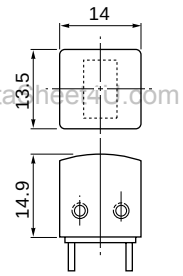
Product name	Applications	Recording density	Track width / track format (mm)
SCRW001-02 SCRW001-01	JIS II / ISO Standard Magnetic card reader / writer	to 210BPI	
SCRW002-01 SMR002-01	ISO Standard Magnetic card reader / writer		
SMR001-02	Manual magnetic card reader		
SCW10-04 SCR10-04 SCRW4-04 SCR8-04	Cybernetics Standard Automated ticket wickets (Passes and tickets)	to 30BPI	
SBR001-07SD SBR001-03SD SBR001-09SD SBR001-08SD	Paper money recognition devices	(DC bias application method)	10 mm 8 mm 4 mm 1.5 mm 

Shape and Dimensions (Example)

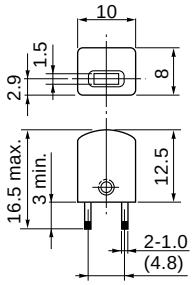
● **SCR8-04 (Cybernetics)**



● **SCRW(JIS-II)**
● **SBR001-03SD,SBR001-07SD**



● **SBR001-08SD**



(mm)

Before Using Industrial Magnetic Head

Note

Before using this product, be sure to read the catalog and the specifications.

Cautions on operating

(1) A flaw or dirt, etc. on the surface with which the card will make contact (the slide face) may bring about a flaw on the card face, so caution must be taken.

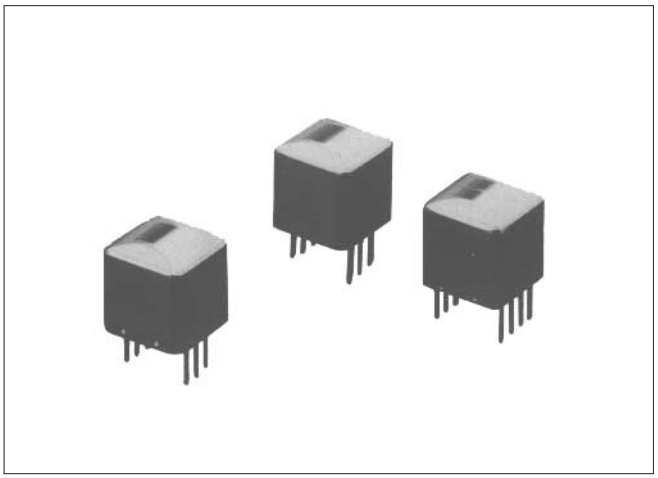
(2) When a current higher than the allowable current is supplied in a winding, breaking of wire or abnormal heating may occur. Refer to the specifications shipped with the product.

(3) A force large enough to change the shape of the product may result in deteriorating the characteristics of the product. For operating conditions, please contact us before use.

(4) An excessive shock around the magnetic gap of the core may damage the core, which results in deteriorating the characteristics of the product. Caution must be taken.

(5) The core and the case of the slide face are made from the metal. If water is left on the surface, rust occurring on the surface may lead to flaws on the card face. Caution mast be taken.

High-Security Card-Reading Magnetic Head



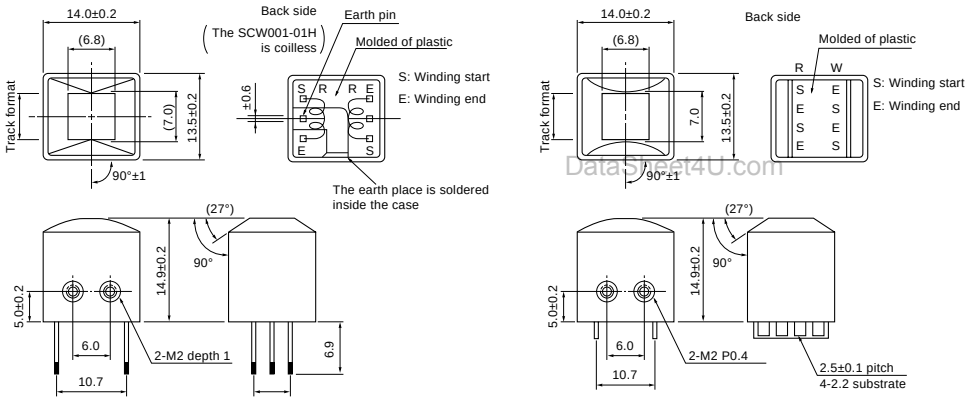
Features

- Enables saturation recording of high security cards
- Excellent resistance to spacing loss during recording
- Excellent wear resistance
- Excellent environmental resistance makes these ideal as magnetic heads in motor vehicles and outdoor equipment.

Applications

- High security magnetic card systems
- High security card issuing machines
- High-speed card reader / writers

Shape and Dimensions



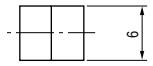
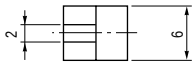
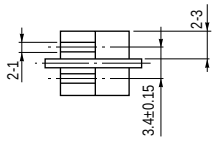
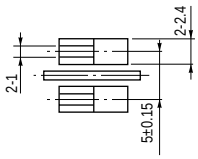
(mm)

Specifications

	SCW001-01H	SCRW001-01H	SCRW002-01H	SCRW002-02H
Effective track widthW (mm)	W : 6.0 ± 0.1	W : 6.0 ± 0.1 R : 2.0 ± 0.1	W : 3.0 ± 0.1 R : 1.0 ± 0.1	W : 2.4 ± 0.1 R : 1.0 ± 0.1
Inductance (1kHz) (mH)	W side 6.0 ± 25%	W side 8.0 ± 25%	W side 1.4 ± 25%	W side 0.6 ± 25%
		R side 194 ± 25%	R side 257 ± 25%	R side 220 ± 25%
Direct current resistance (Ω)		W side 7.0 ± 15%	W side 2.0 ± 15%	W side 2.5 ± 15%
		R side 140 ± 15%	R side 135 ± 15%	R side 142 ± 15%
Insulation resistance (MΩ)	50 or better (DC 500V) between pins and sealed case			
Resolution	105 / 52, 5BPI 85%			
Saturation recording current (mA)	High security card Is = 200 p–p		High security card Is = 430 p–p	
Playback / record voltage (mV)	—	50 p-p	30 p-p	30 p-p
Storage temperature (˚C)	-20 to 75			

Track Format

(mm)

SCW001-01H	SCRW001-01H	SCRW002-01H	SCRW002-02H
			

Before Using High-Security Card-Reading Magnetic Head

Note

Before using this product, be sure to read the catalog and the specifications.

Cautions on operating

(1) A flaw or dirt, etc. on the surface with which the card will make contact (the slide face) may bring about a flaw on the card face, so caution must be taken.

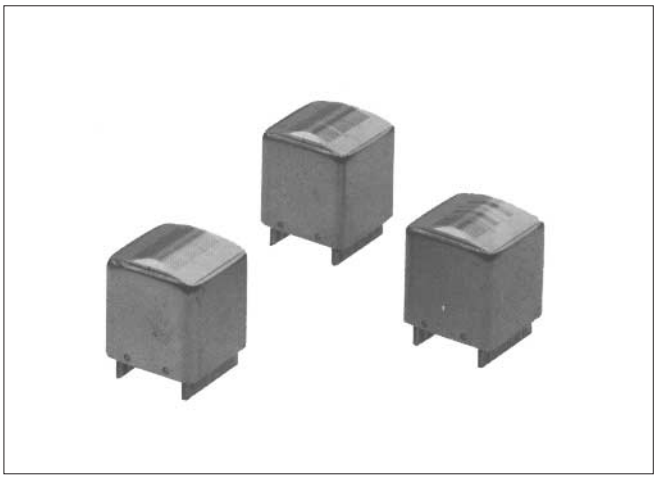
(2) When a current higher than the allowable current is supplied in a winding, breaking of wire or abnormal heating may occur. Refer to the specifications shipped with the product.

(3) A force large enough to change the shape of the product may result in deteriorating the characteristics of the product. For operating conditions, please contact us before use.

(4) An excessive shock around the magnetic gap of the core may damage the core, which results in deteriorating the characteristics of the product. Caution must be taken.

(5) The core and the case of the slide face are made from the metal. If water is left on the surface, rust occurring on the surface may lead to flaws on the card face. Caution mast be taken.

POS System Standard Magnetic Head



Features

- Enables saturation recording
- Excellent resistance to spacing loss during recording
- Excellent wear resistance
- Excellent environmental resistance makes these ideal as magnetic heads in motor vehicles and outdoor equipment.

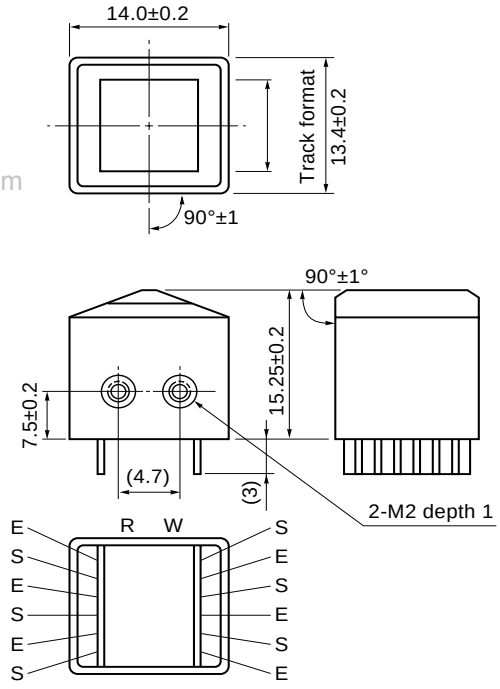
Applications

- POS systems
- Vending machines

Specifications

		SCW003-01H	SCRW003-02H	SCRW003-01H
Effective track width (mm)	1ch - W side	3.0±0.1	3.0±0.1	1.0±0.1
	2ch - W side			
	3ch - W side			3.0±0.1
	1ch - R side	3.0±0.1	1.0±0.1	1.0±0.1
	2ch - R side			
	3ch - R side			
Inductance (1kHz) (mH)	1ch - W side	1.0 ±25%	1.0 ±25%	—
	2ch - W side			
	3ch - W side			1.0 ±25%
	1ch - R side	—	220 ±25%	85.0 ±25%
	2ch - R side			
	3ch - R side			220 ±25%
Direct current resistance (Ω)	1ch - W side	1.2 ±15%	1.2 ±15%	—
	2ch - W side			
	3ch - W side			1.2 ±15%
	1ch - R side	—	175 ±15%	175 ±15%
	2ch - R side			
	3ch - R side			
Insulation resistance (MΩ)		50 or better (500VDC) between pins and sealed case		
Resolution (%) min.		210 / 105 BPI 85		
Saturation recording current (mA)		Is = 430 p-p		
Playback / record voltage (mV)		25 p-p		
Storage temperature (°C)		20 to 75		

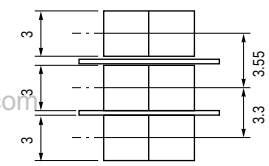
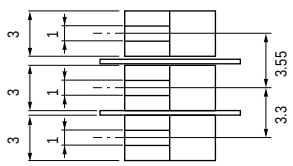
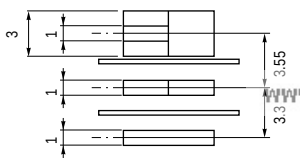
Shape and Dimensions



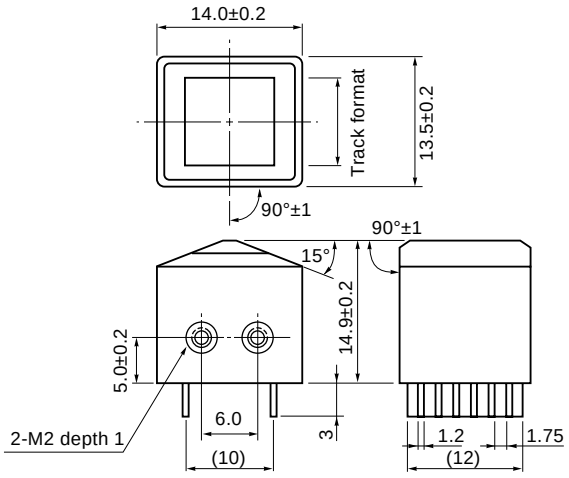
(mm)

Track Format

(mm)

SCW003-01H	SCRW003-02H	SCRW003-01H
		

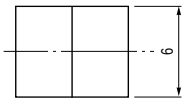
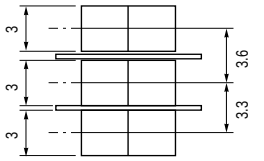
Shape and Dimensions



(mm)

Track Format

(mm)

STW001-01HL	SCW003-01HL
	

Before Using POS System Standard Magnetic Head

Note

Before using this product, be sure to read the catalog and the specifications.

Cautions on operating

(1) A flaw or dirt, etc. on the surface with which the card will make contact (the slide face) may bring about a flaw on the card face, so caution must be taken.

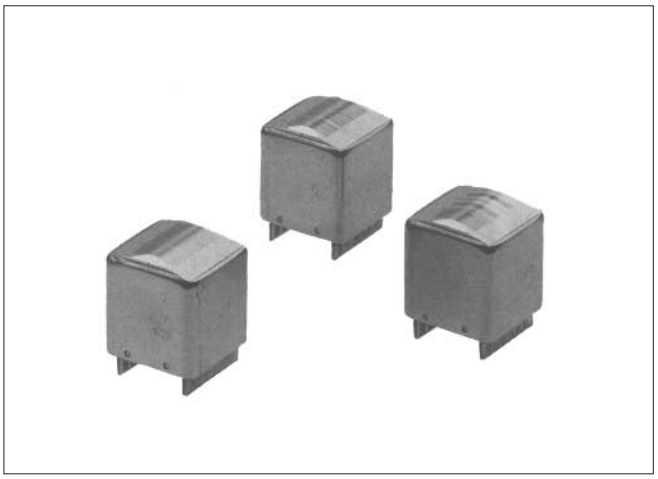
(2) When a current higher than the allowable current is supplied in a winding, breaking of wire or abnormal heating may occur. Refer to the specifications shipped with the product.

(3) A force large enough to change the shape of the product may result in deteriorating the characteristics of the product. For operating conditions, please contact us before use.

(4) An excessive shock around the magnetic gap of the core may damage the core, which results in deteriorating the characteristics of the product. Caution must be taken.

(5) The core and the case of the slide face are made from the metal. If water is left on the surface, rust occurring on the surface may lead to flaws on the card face. Caution mast be taken.

Magnetic Recording Heads For Super High Hc Media



Outline

These products feature newly developed high-performance Hi-B head cores . The high-density recording magnet head with excellent recording ability is also developed for ultra-high coercive media (Hc = 3000 to 4000 Oe) and for high coercive print media that have non-orientation magnetic layers.

Features

- Enables saturation recording of ultra-high magnet coercive cards (3000 to 4000 Oe)
- Enables saturation recording of non-orientation print media (2750 Oe)
- Excellent resistance to spacing loss during recording
- High overwrite characteristics (40 dB or better on 2750 Oe non-orientation print media)
- Excellent wear resistance and environmental resistance

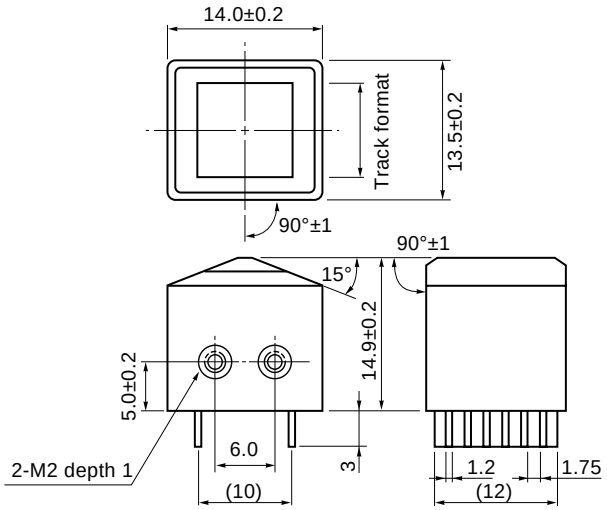
Applications

- High security card systems
- Non-orientation magnetic print card systems
- POS systems
- Vending machines

Specifications

		STW001-01HL	SCW003-01HL
Effective track width	(mm)	6.0±0.1	3.0±0.1
Inductance (1 kHz)	(mH)	1.6±25%	0.33±25%
Direct current resistance	(Ω)	3.3±15%	0.43±15%
Insulation resistance	(M)	50 or better (DC 500 V) between pins and sealed case	
Recording density	(BPI)	210	210
Saturation recording current	I_S (A_{P-P})	1 < 2750 Oe non-orientation print media >	1.35 < 4000 Oe card >
Storage temperature	(˚C)	-20 to 75	

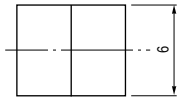
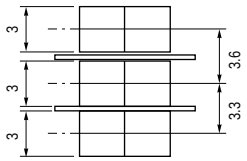
Shape and Dimensions



(mm)

Track Format

(mm)

STW001-01HL	SCW003-01HL
	

Before Using Magnetic Recording Heads For Super High Hc Media

Note

Before using this product, be sure to read the catalog and the specifications.

Cautions on operating

(1) A flaw or dirt, etc. on the surface with which the card will make contact (the slide face) may bring about a flaw on the card face, so caution must be taken.

(2) When a current higher than the allowable current is supplied in a winding, breaking of wire or abnormal heating may occur. Refer to the specifications shipped with the product.

(3) A force large enough to change the shape of the product may result in deteriorating the characteristics of the product. For operating conditions, please contact us before use.

(4) An excessive shock around the magnetic gap of the core may damage the core, which results in deteriorating the characteristics of the product. Caution must be taken.

(5) The core and the case of the slide face are made from the metal. If water is left on the surface, rust occurring on the surface may lead to flaws on the card face. Caution mast be taken.

● For inquiry, please call Sales Promotion Department(JAPAN)

Products	Section	Phone / Fax	Adress
Thermal Reed Switch (TRS®)	For inquiry, Please call Sales Promotion Department(JAPAN)	Phone:81-3-3402-6179 Fax:81-3-3402-6172	5-8,Kita-Aoyama 2-chome,Minato-Ku,Tokyo 107-8620,Japan
TRS Series Approved by UL, CSA, and VDE			
Thermal Guard (OHD®)			
Current Transformer (low current type)			
Zero-Phase Current Transformer ZCT			
Magnetic Direct Current Sensor MDCS			
Twin Reed Switch Type Safing Sensor NRS-603W			
Twin Reed Switch Type Safing Sensor High Stand Type:TMSD-H**51D			
Ceramic Gyro			
Proximity Switches NRS Series			
Magnetic Type Proximity Switch Case Type:NRS-700 Series			
Magnetic type Proximity Switches TMRS Series			
Industrial Magnetic Head			
High-Security Card-Reading Magnetic Head			
POS System Standard Magnetic Head			
Magnetic Recording Heads For Super High Hc Media			

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 in order to use the products properly and safely.
- Descriptions in this catalog regarding product characteristics 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.
- Each sensor in this catalog may malfunction or break down in a particular mode. When designing products, be sure to include a countermeasure for this eventuality.
- The manufacturer's warranty will not cover any disadvantage 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, such as in aviation equipment and nuclear power controllers where product defects might pose a safety risk, please consult your NEC TOKIN sales representatives.
- Though the manufacturer has taken all possible precautions 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 industrial 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 come under the category of strategic goods or services (according to Japan's foreign trade and foreign exchange regulations), the sender must obtain an export license from the Japanese Government before said products can be exported outside Japan.
- This catalog is current as of September 2002.

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