



ESTABLISHED RELIABILITY MILITARY TO-5 RELAYS SPDT



SERIES	RELAY TYPE
411	SPDT basic relay
411D	SPDT relay with internal diode for coil transient suppression
411DD	SPDT relay with polarity reversal protection and coil transient suppression diode
411T	SPDT relay with internal transistor driver and coil transient suppression diode

DESCRIPTION

The TO-5 relay, originally conceived and developed by Teledyne, has become one of the industry standards for low-level switching from dry circuit to 1 ampere. Designed specifically for high-density PC board mounting, its small size and low coil power dissipation make the 411 relay one of the most versatile ultraminiature relays available.

The following unique construction features and manufacturing techniques provide excellent resistance to environmental extremes and overall high reliability.

The 411 feature:

- All welded construction.
- Unique uni-frame design, providing high magnetic efficiency and mechanical rigidity.
- High force/mass ratios for resistance to shock and vibration.
- Advanced cleaning techniques provide maximum assurance of internal cleanliness.
- Precious metal alloy contact material with gold plating assures excellent high current and dry circuit switching capabilities.

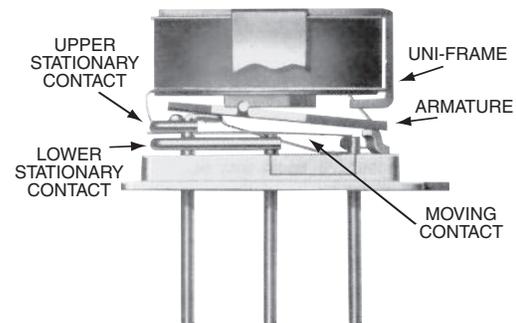
The Series 411D and 411DD relays have internal discrete silicon diodes for coil suppression and polarity reversal protection. The hybrid 411T relay features an internal silicon suppression diode and transistor driver. This hybrid package reduces required PC board floor space by reducing the number of external components needed to drive the relay.

By virtue of its inherently low intercontact capacitance and contact circuit losses, the 411 relay has proven to be an excellent ultraminiature RF switch for frequency ranges well into the UHF spectrum. A typical RF application for the TO-5 relay is in handheld radio transceivers, wherein the combined features of good RF performance, small size, low coil power dissipation and high reliability make it a preferred method of T-R switching

ENVIRONMENTAL AND PHYSICAL SPECIFICATIONS

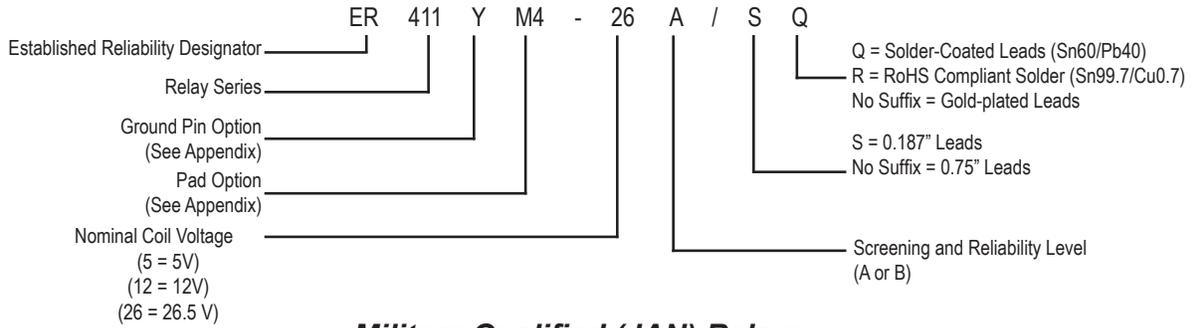
Temperature (Ambient)	-65°C to +125°C
Vibration (Note 1)	30 g's to 500 Hz
Shock (Note 1)	75 g's, 6ms half sine
Acceleration	50 g's
Enclosure	Hermetically sealed
Weight	0.09 oz. (2.55g) max.
Reflow Temperature	260°C max. temp. 1 min. max

INTERNAL CONSTRUCTION

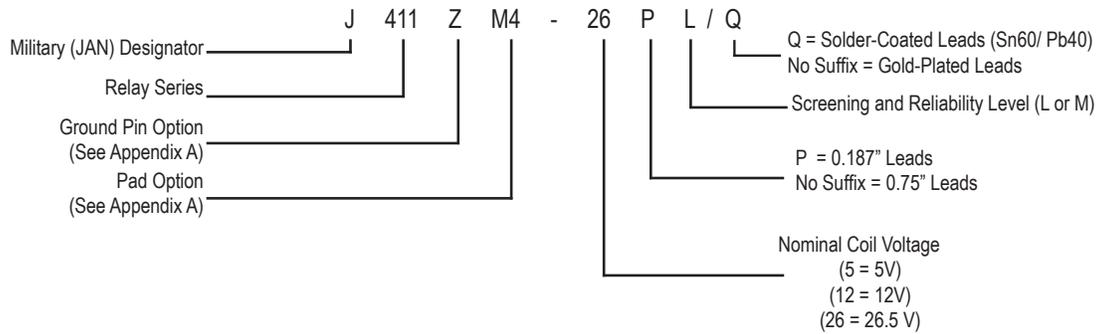


Part Numbering System (Note 5 & 6)

T²R Established Reliability Relays



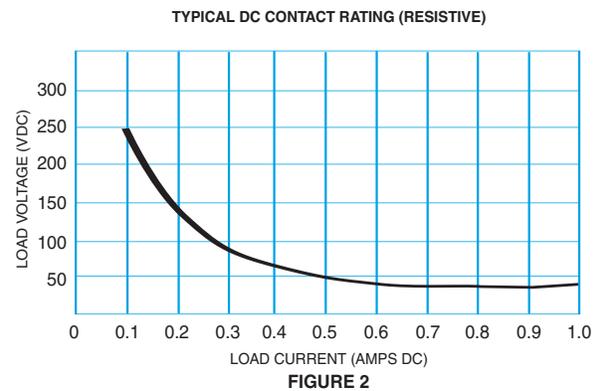
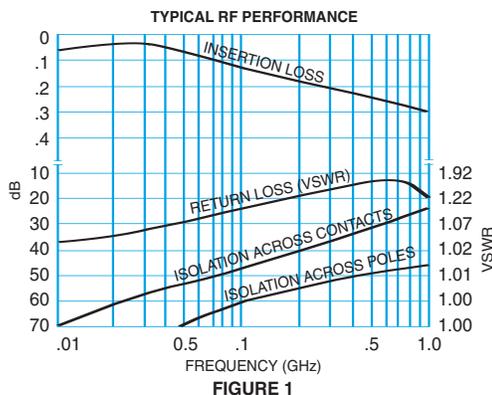
Military Qualified (JAN) Relays



GENERAL ELECTRICAL SPECIFICATIONS (-65 °C to 125 °C unless otherwise noted. See notes 2 & 3.)

Contact Arrangement	1 Form C (SPDT)	
Rated Duty	Continuous	
Contact Resistance	0.1 Ω max.; 0.2 Ω max. afterlife at A / 28 Vdc	
Contact Load Rating (DC)	Resistive: 1 A / 28 Vdc Inductive: 200 mA / 28 Vdc (320mH) Lamp: 100 mA / 28 Vdc (320mH) Low level: 10 to 50 μA @ 10 to 50 mV	
Contact Load Rating (AC)	Resistive: 250 mA / 115Vac, 60 and 400 Hz (Case not grounded) 100 mA / 115 Vac, 60 and 400 Hz (Case grounded)	
Contact Life Ratings	10,000,000 cycles (typical) at low level 1,000,000 cycles (typical) at 0.5 A / 28 Vdc resistive 100,000 cycles min. at all other loads specified above	
Contact Overload Rating	2 A / 28 Vdc Resistive (100 cycles min.)	
Coil Operating Power	300 mW typical at nominal rated voltage	
Contact Carry Rating	Contact Factory	
Operate Time	2.0 msec max. at nominal rated coil voltage	
Release Time	411	1.5 ms max.
	411D	4.0 ms max.
	411DD	
	411T	
Contact Bounce	1.5 ms max.	
Intercontact Capacitance	0.4 pf typical	
Insulation Resistance	10,000 MΩ min. between mutually isolated terminals	
Dielectric Strength ($V_{rms}/60$ Hz)	Atmospheric pressure : 500	70,000 ft : 125
Negative Coil Transient (Vdc)	411D 411DD 411T	1.0 max.
Diode P.I.V (Vdc)	411D 411DD 411T	100 min.
411 Transistor Characteristics	Base Turn Off Voltage (Vdc)	0.3 min
	Emitter-Base breakdown Voltage (BV_{EBO}) (Vdc)	6.0 min
	Collector-Base breakdown Voltage (BV_{CBO}) (Vdc) ($I_c = 100\mu A$)	75 min

PERFORMANCE CURVES (Note 2)



DETAILED ELECTRICAL SPECIFICATIONS (-65 °C to 125 °C unless otherwise noted. See note 3.)

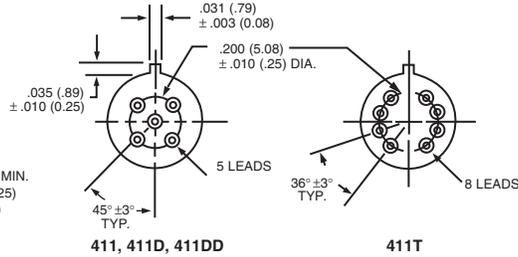
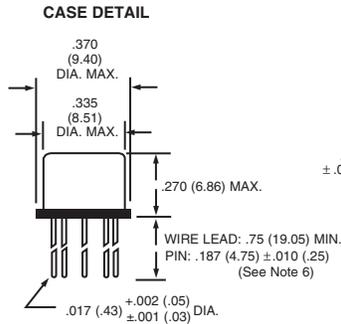
BASE PART NUMBERS (411, 411D, 411DD)		411-5 411D-5 411D-5	411-12 411D-12 411D-12	411-26 411D-26 411D-26
Coil Voltage	Nom.	5.0	12.0	26.5
	Max.	7.5	20.0	40.0
Coil Resistance (Ohms ±10% @25°C)	411 411D	63	500	2000
	411DD (Note 4)	50	500	2000
Coil Current (mA _{dc} @25°C)	411DD	Min	72.7	11.5
		Max	100	14.4
Pick-Up Voltage (V _{dc} , max.)	411 411D	3.7	9.0	18.0
	411DD	4.5	10.0	19.0
Drop-Out Voltage	Min.	0.15	0.4	0.89
	Max.	2.4	5.6	10.4

BASE PART NUMBERS (411T)		411T-5	411T-12	411T-26
Coil Voltage	Nom.	5.0	12.0	26.5
	Max.	7.5	20.0	40.0
Coil Resistance (Ohms ±10% @25°C) (Note 4)		63	500	2000
Coil Current (mA _{dc} @25°C)	Min	66.6	20.9	11.5
	Max	89.6	28.1	15.5
Pick-Up Voltage (V _{dc} , max.)		3.9	10.0	19.0
Turn On Base Current (mA _{dc} , Max.) (Note 7)		2.38	0.8	0.40
Drop-Out Voltage	Min.	0.15	0.4	0.89
	Max.	2.4	5.6	10.4

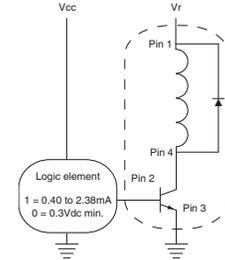
NOTES:

- Relay contacts will exhibit no chatter in excess of 10 μs or transfer in excess of 1 μs.
- "Typical" characteristics are based on available data and are best estimates. No on-going verification tests are performed.
- Unless otherwise specified, parameters are initial values.
- For reference only. Coil resistance not directly measurable at relay terminals due to internal series semiconductor, 411DD and 411T only.
- Unless otherwise specified, relays will be supplied with gold-plated leads.
- The slash and characters appearing after the slash are not marked on the relay.
- Limit Base Emitter current to 15 mA_{dc} max.

**SERIES 411
OUTLINE DIMENSIONS**



TYPICAL LOGIC INTERFACE
(See Note 7)

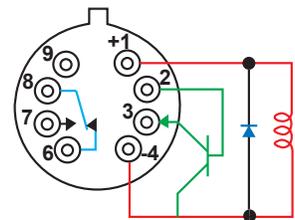
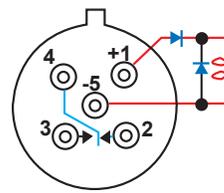
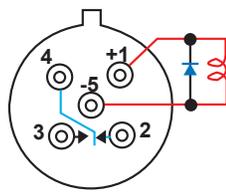
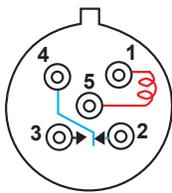


Notes:
Logic 1 activates the relay.
Logic 0 de-activates the relay.
Vcc = logic bias power.
Vr = coil energization voltage.

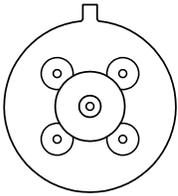
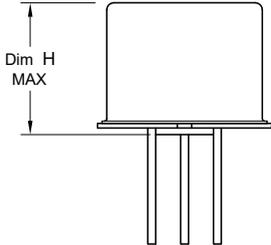
Dimensions: in. (mm)

(Viewed From Terminals)

SCHEMATIC DIAGRAMS

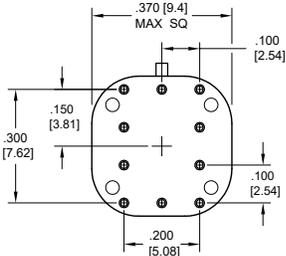
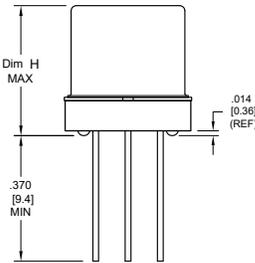


APPENDIX A : Spacer Pads, Spreader Pads, and Ground Pin Positions

Pad designation and bottom view dimensions	Height	For use with the following:	Dim. H Max.
 <p>"M4" Spacer Pad for TO-5</p>		ER411, J411	.295 (7.49)

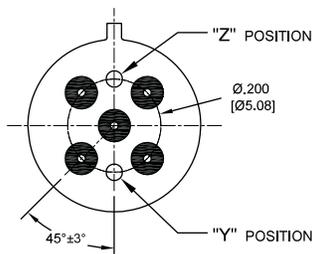
Notes:

1. Spacer pad material: Polyester film.
2. To specify a "M4" spacer pad, refer to the mounting variants portion of the part numbering example in the applicable datasheet.
3. Dimensions are in inches (mm).
4. Unless otherwise specified, tolerance is $\pm .010$ " (.25 mm).
5. Add 10 m Ω to the contact resistance shown in the datasheet.
6. Add 0.01 oz. (0.25 g) to the weight of the relay assembly shown in the datasheet.

Pad designation and bottom view dimensions	Height	For use with the following:	Dim. H Max.
 <p>"M" Spreader Pad <u>5/</u> <u>6/</u></p>		ER411T, ER412, J412	.388 (9.86)

Notes:

1. Spreader pad material: Diallyl Phthalate.
2. To specify a "M" spreader pad, refer to the mounting variants portion of the part number example in the applicable datasheet.
3. Dimensions are in inches (mm).
4. Unless otherwise specified, tolerance is $\pm .010$ " (0.25 mm).
- 5/. Add 25 m Ω to the contact resistance shown in the datasheet.
- 6/. Add .01 oz. (0.25 g) to the weight of the relay assembly shown in the datasheet.



TO-5 Relays:
ER411, RF311, RF331

- Indicates ground pin position
- Indicates glass insulated lead position
- ◎ Indicates ground pin or lead position depending on relay type

NOTES

1. Terminal views shown
2. Dimensions are in inches (mm)
3. Tolerances: $\pm .010$ ($\pm .25$) unless otherwise specified
4. Ground pin positions are within .015 (0.38) dia. of true position
5. Ground pin head dia., 0.035 (0.89) ref: height 0.010 (0.25) ref.
6. Lead dia. 0.017 (0.43) nom.