



MAGNETIC-LATCHING TO-5 RELAYS ESTABLISHED RELIABILITY MILITARY SPDT



SERIES	RELAY TYPE
421	DPDT basic relay
421D	DPDT relay with internal diode for coil transient suppression
421DD	DPDT relay with polarity reversal protection and coil transient suppression diode

DESCRIPTION

The magnetic-latching TO-5 relay, originally conceived and developed by Teledyne, has become one of the industry standards for low-level switching from dry circuit to 0.5 ampere. Designed for high-density PC board mounting, its small size and low coil power dissipation make the 421 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 421 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 contacts material with gold plating assures excellent high current and dry circuit switching capabilities.

The Series 421D and 421DD utilize discrete silicon diodes for coil suppression and polarity reversal protection.

By virtue of its inherently low intercontact capacitance and contact circuit losses, the 421 relay has proven to be an excellent ultraminiature RF switch for frequency ranges well into the UHF spectrum. A typical RF application for this 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 transmit-receive switching (see Figure 1).

The Series 421 magnetic-latching relays are ideally suited for applications where coil power dissipation must be minimized. The relays can be operated with a short duration pulse. After the contacts have transferred, no external holding power is required.

The magnetic latching feature of the Series 421 provides a "memory" capability, since the relays will not reset upon removal of coil power.

Principle of Operation:

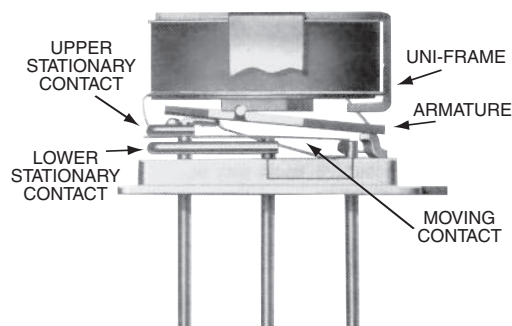
Energizing Coil B produces a magnetic field opposing the magnetic field of the permanent magnet in Circuit A. As the net holding force decreases, the attractive force in the air gap of Circuit A, which also results from the magnetic field of the permanent magnet, becomes great enough to break the armature free of Core B, and snap it into a closed position against Core A. The armature remains in this position upon removal of power from Coil B, but will snap back into position B upon energizing Coil A. Since operation depends upon cancellation of a magnetic field, it is necessary to apply the correct polarity to the relay coils as indicated on the relay schematic.

When latching relays are installed in equipment, the latch and reset coils should not be pulsed simultaneously. Coils should not be pulsed with less than rated coil voltage and the pulse width should be a minimum of three times the specified operate time of the relay. If these conditions are not followed, it is possible for the relay to be in the magnetic neutral position. Should this happen, however, pulsing one coil or the other, as prescribed, will bring the relay back into proper operating condition.

ENVIRONMENTAL AND PHYSICAL SPECIFICATIONS

Temperature (Ambient)	-65°C to +125°C
Vibration (General Note I)	30 g's to 3000 Hz
Shock (General Note I)	75 g's, 6ms half sine
Acceleration	50 g's
Enclosure	Hermetically sealed
Weight	0.159 oz. (4.5g) max.

INTERNAL CONSTRUCTION



SERIES 421
GENERAL ELECTRICAL SPECIFICATIONS (-65°C to +125°C unless otherwise noted) (Notes 2 & 3)

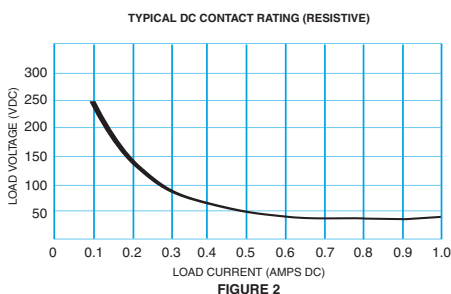
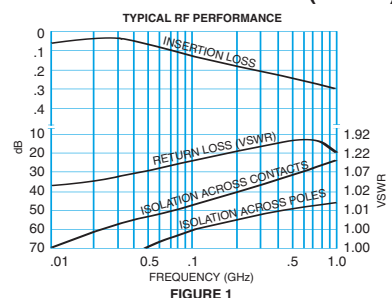
Contact Arrangement	1 Form C (SPDT)
Rated Duty	Continuous
Contact Resistance	0.125 ohm max. before life; 0.225 ohm max. after life at 1A/28Vdc (measured 1/8" from header)
Contact Load Rating (DC)	Resistive: 0.5 A / 28 Vdc Inductive: 200 mA / 28 Vdc (320mH) Lamp: 100 mA / 28 Vdc (320mH) Low level: 10 to 50 μ A @ 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	1 A / 28 Vdc Resistive (100 cycles min.)
Coil Operating Power	290 mW typical at nominal rated voltage
Contact Carry Rating	Contact Factory
Operate Time	1.5 ms max. at nominal rated coil voltage
Minimum Operate Pulse	4.5 ms width @ rated voltage
Contact Bounce	1.5 ms max
Intercontact Capacitance	0.4 pf typical
Insulation Resistance	10,000 M Ω min. between mutually isolated terminals
Dielectric Strength	500 Vrms / 60 Hz @ atmospheric pressure 125 Vrms / 60 Hz @ 70,000 ft
Negative Coil Transient (Vdc) 421D, 421DD	1.0 Vdc Max.
Diode P.I.V. (Vdc) 421D, 421DD	100 Vdc Min.

421 Series

DETAILED ELECTRICAL SPECIFICATIONS (-65°C to +125°C unless otherwise noted) (Notes 3)

BASE PART NUMBERS (421, 421D, 421DD)		421-5 421D-5 421DD-5	421-12 421D-12 421DD-12	421-26 421D-26 421DD-26
Coil Voltage	Nom.	5.0	12.0	26.5
	Max.	6.0	16.0	32.0
Coil Resistance (Ohms $\pm 10\%$ @25°C)	421, 421D	61	500	2000
	421DD (Note 4)	48	500	2000
Coil Current (421DD) (mA dc @25°C)	Min.	78.0	19.6	11.2
	Max.	111.8	26.7	15.2
Set & Reset Voltage (Vdc, Max)	421	3.5	9.0	18.0
	421D	3.7	9.0	18.0
	421DD	4.5	10.0	19.0

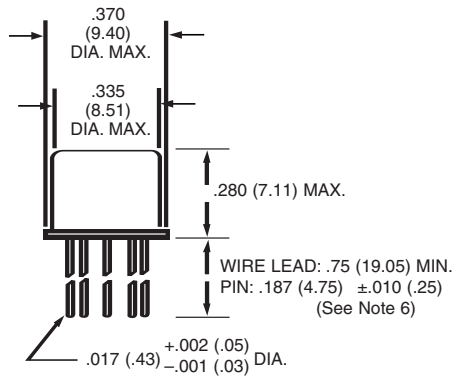
PERFORMANCE CURVES (Note 2)



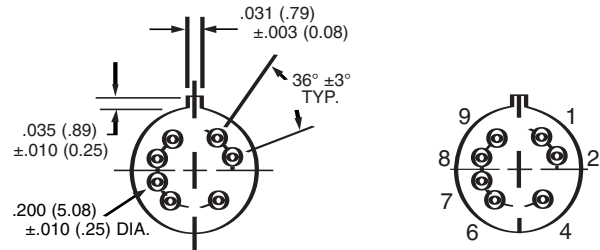
GENERAL NOTES

1. Relay contacts will exhibit no chatter in excess of 10 μ sec or transfer in excess of 1 μ sec.
2. "Typical" characteristics are based on available data and are best estimates. No on-going verification tests are performed.
3. Unless otherwise specified, parameters are initial values.
4. Relays can be supplied with a spacer pad. See appendix.

SERIES 421 OUTLINE DIMENSIONS

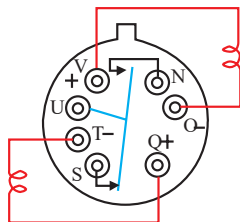


TERMINAL LOCATIONS AND PIN NUMBERING (REF. ONLY) (Viewed from Terminals)

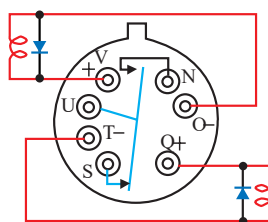


DIMENSIONS ARE SHOWN IN INCHES (MILLIMETERS)

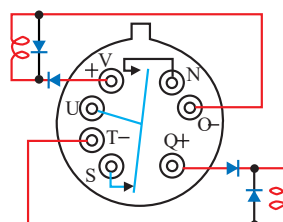
SCHEMATIC DIAGRAMS



421

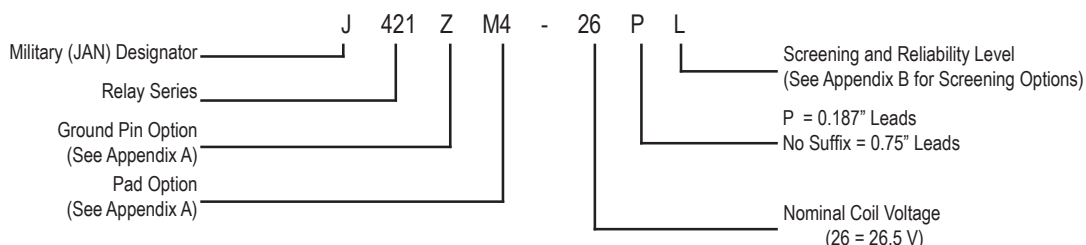
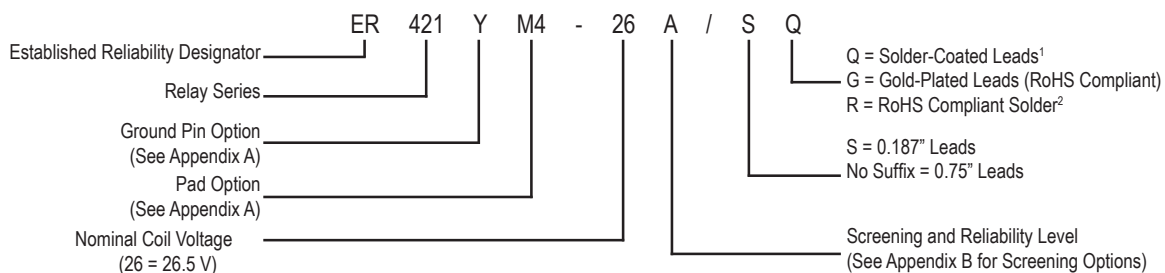


421D



421D

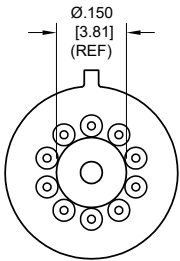
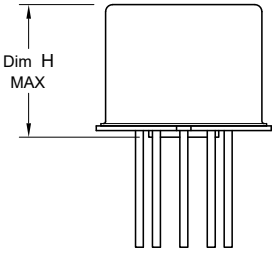
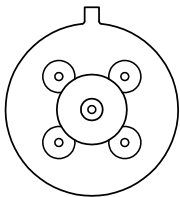
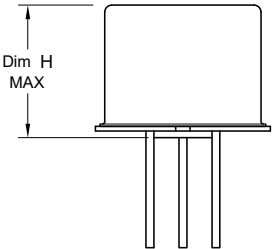
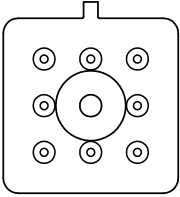
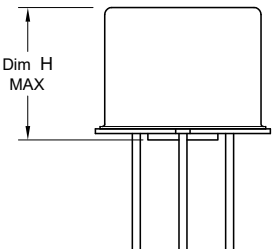
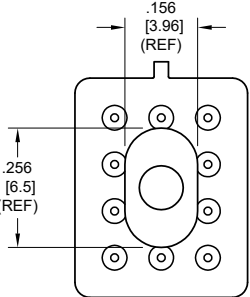
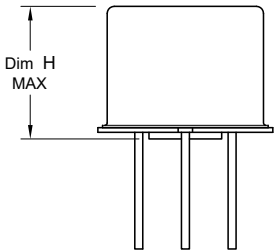
SERIES 421 PART NUMBERING SYSTEM



NOTES:

1. RELAY CONTACTS WILL EXHIBIT NO CHATTER IN EXCESS OF 10 MSEC OR TRANSFER IN EXCESS OF 1 MSEC.
2. "TYPICAL" CHARACTERISTICS ARE BASED ON AVAILABLE DATA AND ARE BEST ESTIMATES. NO ON-GOING VERIFICATION TESTS ARE PERFORMED.
3. UNLESS OTHERWISE SPECIFIED, PARAMETERS ARE INITIAL VALUES.
4. FOR REFERENCE ONLY. COIL RESISTANCE NOT DIRECTLY MEASURABLE AT RELAY TERMINALS DUE TO INTERNAL SERIES DIODE, 421DD ONLY.
5. UNLESS OTHERWISE SPECIFIED, RELAYS WILL BE SUPPLIED WITH EITHER GOLD-PLATED OR SOLDERCOATED LEADS.
6. THE SLASH AND CHARACTERS APPEARING AFTER THE SLASH ARE NOT MARKED ON THE RELAY.
7. SCREENED HI-REL VERSIONS AVAILABLE. CONTACT FACTORY.

APPENDIX A : Spacer Pads

Pad designation and bottom view dimensions	Height	For use with the following:	Dim. H Max.
 "M4" Spacer Pad for TO-5		ER412	.295 (7.49)
		712, RF300, RF, RF700, RF703	.300 (7.62)
		ER422, 722	.305 (7.75)
		ER432	.400 (10.16)
		732, RF303	.410 (10.41)
		RF312	.350 (8.89)
 "M4"Spacer Pad for TO-5		ER411	.295 (7.49)
		RF311	.300 (7.62)
		RF331	.410 (10.41)
 "M4" Spacer Pad for Centigrid®		172	.305 (7.75)
		ER114, J114	.300 (7.62)
		ER134, J134	.400 (10.16)
		RF100	.315 (8.00)
		RF103	.420 (10.67)
 "M9"Spacer Pad for Centigrid®		122C, A152	.320 (8.13)
		ER116C, J116C	.300 (7.62)
		ER136C, J136C	.400 (10.16)
		RF180	.325 (8.25)
		A150	.305 (7.75)

Notes:

1. Spacer pad material: Polyester film.
2. To specify an "M4" or "M9" 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 mΩ 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.

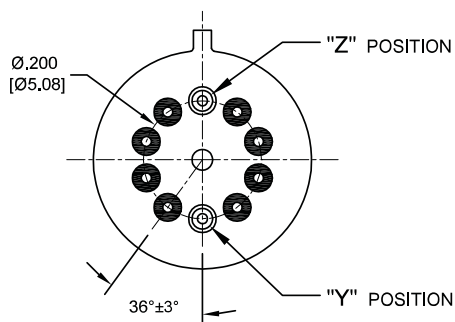
APPENDIX A : Spreader Pads

Pad designation and bottom view dimensions	Height	For use with the following:	Dim. H Max.
"M" Spreader Pad <u>5</u>/<u>6</u>/		ER411T, ER412, J412	.388 (9.86)
		712	.393 (9.99)
		ER432, J432	.493 (12.52)
		732	.503 (12.78)
		J421, J422, ER422, 722	.398 (10.11)

Notes:

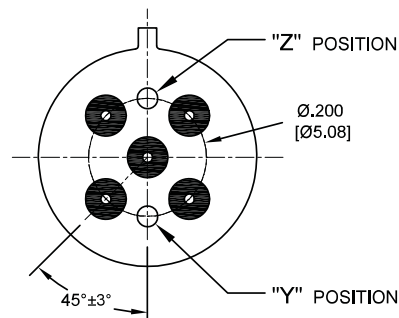
1. Spreader pad material: Diallyl Phthalate.
2. To specify an "M", "M2" or "M3" spreader pad, refer to the mounting variants portion of the part number example in the applicable datasheet.
3. Dimensions are in inches (mm).
4. Unless otherwise specified, tolerance is $\pm .010$ (0.25 mm).
- 5/. Add 25 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.
- 7/. Add 50 m Ω to the contact resistance shown in the datasheet.
- 8/. Add 0.025 oz (0.71 g) to the weight of the relay assembly shown in the datasheet.
- 9/. M3 pad to be used only when the relay has a center pin (e.g. ER411M3-12A, 722XM3-26.)

APPENDIX A : Ground Pin Positions



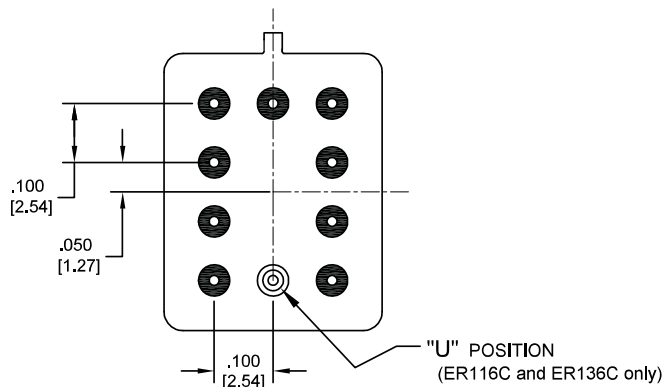
TO-5 Relays:

ER412, ER412T, ER422, ER432, ER432T, 712, 712TN, 400H, 400K, 400V, RF300, RF303, RF341, RF312, RF332, RF310, RF313, RF320, RF323, SI800, SI803, RF700, RF703



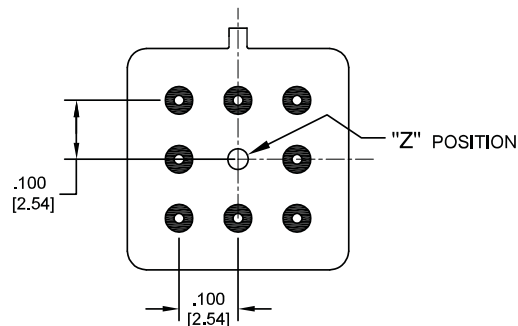
TO-5 Relays:

ER411, RF311, RF331



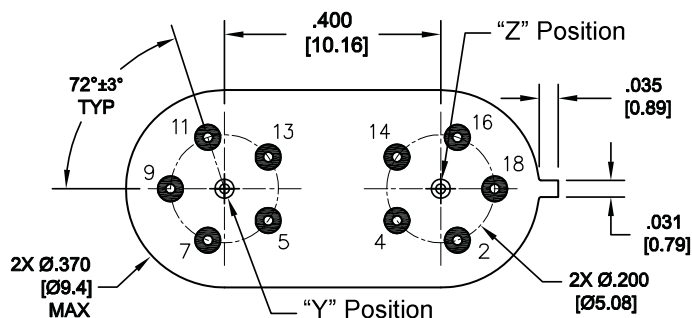
Centigrid® Relays:

RF180, ER116C, 122C, ER136C



Centigrid® Relays:

RF100, RF103, ER114, ER134, 172



Loopback Relays:

LB363

NOTES

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

1. Terminal views shown
2. Dimensions are in inches (mm)
3. Tolerances: ± .010 (±.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.