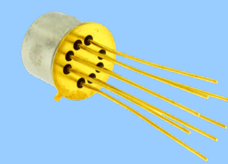
# Series 412K / 422K

Non-Latching, TO-5
High Shock, High Performance

## HIGH-SHOCK, HIGH-PERFORMANCE TO-5 RELAY DPDT



| SERIES | RELAY TYPE |
|---|---|
| 412K | DPDT High-Shock, Non-Latching Relay |
| 422K | DPDT High-Shock, Magnetic-Latching Relay |

### 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 for highdensity PC board mounting, its small size and low coil power dissipation make the TO-5 relay one of the most versatile subminiature relays available.

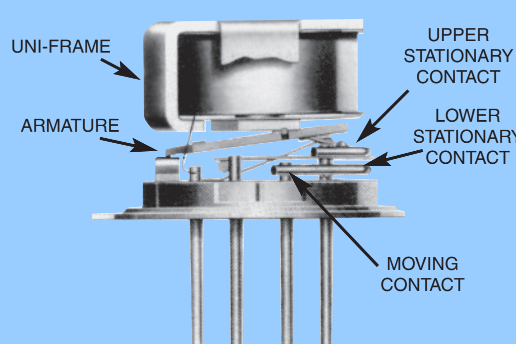
The K Series high-shock TO-5 relays are designed to withstand shock levels up to 4000 g's, .5 millisecond duration. Special material selection and construction details provide assurance that critical elements of the relay structure and mechanism will not be permanently displaced or damaged as a result of extremely high g level shocks.

Typical applications:

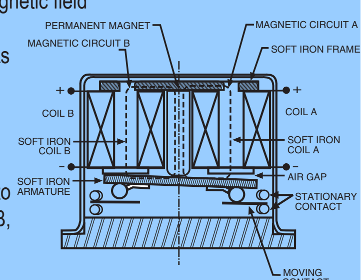
- Commercial avionics aircraft control
- Commercial aircraft control systems
- Transportation systems (rail/truck)

By virtue of their inherently low intercontact capacitance and contact circuit losses, the K Series relays have proven to be excellent subminiature RF switches for applications with 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 TR switching.

### INTERNAL CONSTRUCTION OF 412K




### PRINCIPLE OF OPERATION 422K




Energizing Coil B produces a magnetic field opposing the holding flux of the permanent magnet in Circuit B. As this net holding force decreases, the attractive force in the air gap of circuit A, which also results from the flux 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 then remains in this position upon removal of power from Coil B, but will snap back to 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 magnetically neutral position.

## ENVIRONMENTAL AND PHYSICAL SPECIFICATIONS

| 412K | | |
|---|---|---|
| Temperature (Ambient) | | –65°C to +125°C |
| Vibration (Note 1) | | 30 g's 10 to 3000 Hz |
| Shock | Operating (Note 1) | 75 g's, 6ms half sine |
| | Survival Only | 4000 g's, 0.5 msec. axial plane, half-sine 1000 g's, 0.5 ms side planes, half-sine |
| Acceleration | | 50 g's |
| Enclosure | | Hermetically sealed |
| Weight | | 0.09 oz. (2.55g) max. |

| 422K | | |
|---|---|---|
| Temperature (Ambient) | | –65°C to +125°C |
| Vibration (Note 1) | | 30 g's 10 to 3000 Hz |
| Shock | Operating (Note 1) | 100 g's, 6ms half sine |
| | Survival Only | 2100 g's, 0.5 msec. axial plane, half-sine<br>750 g's, 0.5 msec side planes, half-sine |
| Acceleration | | 50 g's |
| Enclosure | | Hermetically sealed |
| Weight | | 0.09 oz. (2.55g) max. |

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

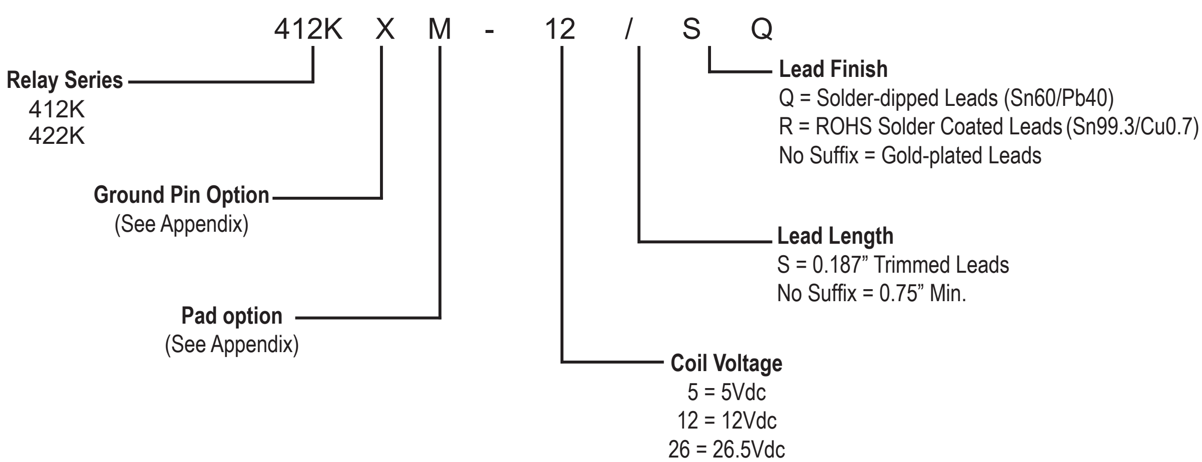
| | | |
|---|---|---|
| Contact Arrangement | | 2 Form C (DPDT) |
| Contact Resistance<br>Measured 1/8" below header | 412K | High Level: 0.1Ω maximum before life; 0.2Ω max. after life at 1A/28Vdc |
| | 422K | 0.125Ω maximum before life; 0.225Ω max. after life at 1A/28Vdc |
| Contact Load Rating (DC)<br>(See Fig. 2 for other DC resistive voltage/current ratings) | | Resistive: 1A/28Vdc<br>Inductive: 200mA/28Vdc (320 mH)<br>Lamp: 100mA/28Vdc<br>Low Level: 10 to 50µA/10 to 50mV |
| Contact Load Rating (AC) | | Resistive: 250mA/115Vac, 60 and 400 Hz (Case not grounded)<br>100mA/115Vac, 60 and 400 Hz (Case grounded) |
| Contact Bounce | | 3.0 ms maximum |
| Contact Life Ratings | | 10,000,000 cycles (typical) at low level<br>1,000,000 cycles at 0.5A/28Vdc resistive<br>100,000 cycles min. at all other loads specified above |
| Contact Overload Rating | | 2A/28Vdc Resistive (100 cycles min.) |
| Contact Carry Rating | | Contact Factory |
| Coil Operating Power | 412K | 500mW typ. @ 25°C |
| | 422K | 290mW typ. @ 25°C |
| Operate Time | 412K | 2.0 ms max. |
| | 422K | 1.5 ms max. |
| Release Time | | 1.5 ms max. |
| Intercontact Capacitance | | 0.4 pf typical |
| Insulation Resistance | | 10,000 MΩ minimum, between mutually isolated terminals |
| Dielectric Strength | | Atmospheric pressure: 500 (Vrms/60Hz)<br>70,000 ft.: 125 (Vrms/60Hz) |
| Minimum Operate Pulse | 422K | 4.5ms width @ rated voltage |

 SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE 

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

| BASE PART NUMBERS (See full P/N example) | | | 412K-5 | 412K-12 | 412K-26 |
|---|---|---|---|---|---|
| Coil Voltage, Nominal (Vdc) | Nom.<br>Max. | | 5.0<br>5.8 | 12.0<br>16.0 | 26.5<br>32.0 |
| 412K Coil Resistance (Ohms ±10%, 25°C) | 412K | | 50 | 300 | 1350 |
| 422K Coil Resistance (Ohms ±10%, 25°C) | 422K | | 61 | 500 | 2000 |
| Pick-up Voltage (Vdc, Max.) | 412K | | 4.3 | 10.0 | 21.0 |
| Drop-out Voltage (Vdc) | 412K | Min. | 0.14 | 0.41 | 0.89 |
| Set & Reset Voltage (Vdc) | 422K | Max | 3.5 | 9.0 | 18.0 |

## Part Numbering System (Notes 4 & 5)




### Notes

1. Relay contacts will exhibit no chatter in excess of 10 µsec or transfer in excess of 1 µsec.
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. Unless otherwise specified, relays will be supplied with gold-plated leads.
5. The slash and characters appearing after the slash are not marked on the relay.
6. Screened HI-REL versions available. Contact factory.

TELEDYNE RELAYS
Everywhereyoulook™

## PERFORMANCE CURVES (Note 2)

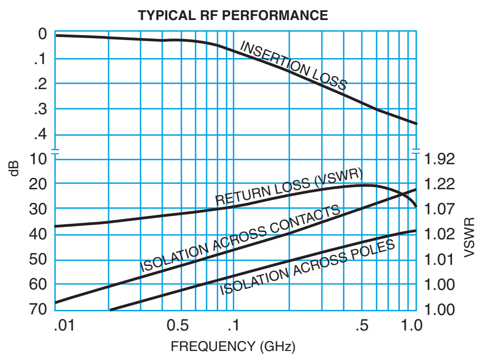



Figure 1

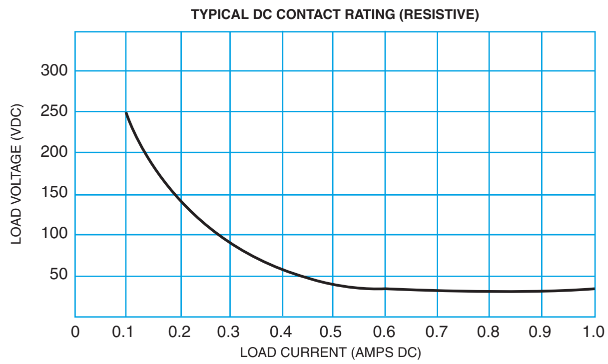
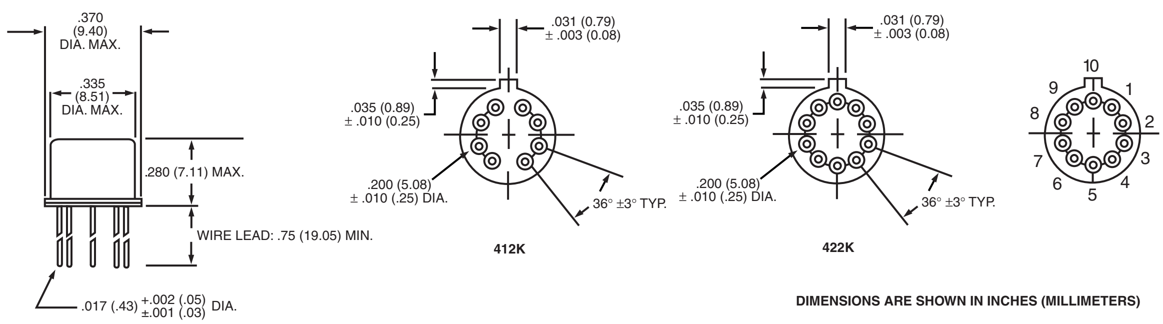



Figure 2

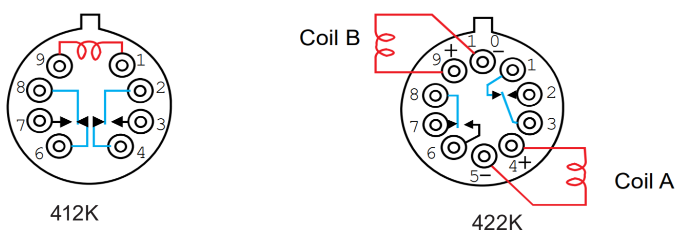
## OUTLINE DIMENSIONS

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




DIMENSIONS ARE SHOWN IN INCHES (MILLIMETERS)

## SCHEMATIC DIAGRAMS

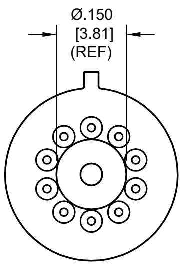
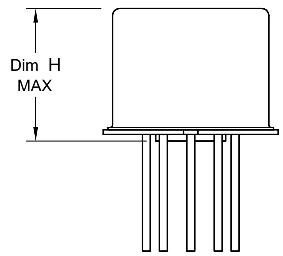



SCHEMATICS ARE VIEWED FROM TERMINALS

 SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE 

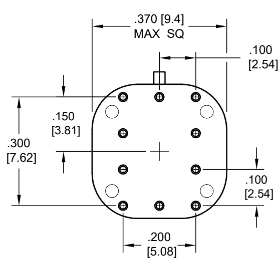
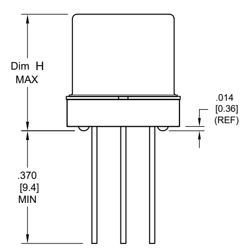
412K422K\082021

# APPENDIX: Spacer Pads

| Pad designation and bottom view dimensions | Height | For use with the following: | Dim. H Max. |
|---|---|---|---|
|   "M4" Pad for TO-5 |   | 412K | .295 (7.49) |
| | | 422K | .305 (7.75) |

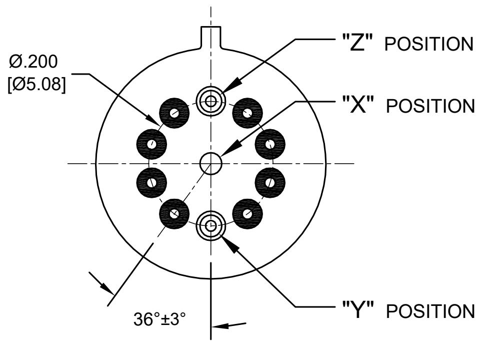
Notes:
1. Spacer pad material: Polyester film.
2. To specify an "M4" spacer pad, refer to the mounting variants portion of the part numbering example in the applicable datasheet.
3. Dimensions are in inches (mm).
4. Unless otherwise specified, tolerance is ± .010" (.25 mm).
5. Add 10 mΩ to the contact 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: Spreader Pads

| Pad designation and bottom view dimensions | Height | For use with the following: | Dim. H Max. |
|---|---|---|---|
|   "M" Pad 5/ 6/ |   | 412K | .388 (9.86) |
| | | 422K | .398 (10.11) |

Notes:
1. Spreader pad material: Diallyl Phthalate.
2. To specify an "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 ± .010" (0.25 mm).

# APPENDIX: Ground Pin Positions




Indicates ground pin position

Indicates glass insulated lead position

Indicates ground pin or lead position depending on relay type

TO-5 Relays:
ER411T, ER412, ER412T, ER420, ER421, ER422, ER431T, ER432, ER432T, 712, 712TN, 400H, 400K, 400V, RF300, RF303, RF341, RF312, RF332, RF310, RF313, RF320, RF323, SI800, SI803, RF700, RF703

NOTES
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.


SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE