TELEDYNE
COAX SWITCHES
Everywhereyoulook™

Series H-28S
T-Switch DC-22 GHz
Latching Coaxial Switch

PART NUMBER	DESCRIPTION
H-28S	Latching T-Switch

The H-28S Series T-Switch is a latching random mode switch. It is a four-port device that features SMA connector interfaces and is capable of switching broadband RF signals from DC-22 GHz from multiple input sources to multiple output devices.

The switch is designed with a characteristic impedance of 50 Ohms. Its magnetic latching drive mechanism, high reliability RF system, small size and light weight characteristics make this switch suitable for space and other Hi-Rel applications.

H-28 HIREL SERIES OVERVIEW
Design Based on Teledyne's HIREL Commercial Off The Shelf (COTS) program
Proven Space Flight Heritage
Fully Defined Pre-Seal Internal Screening Plan
Fully Defined Post-Seal Standard Acceptance Test Plan and Procedure (ATP)
ANSI-J-STD-006 Requirements for Electric Grade Solder Alloys and Fluxed and Non-Fluxed Sold Solders for Electronic Soldering Applications

STANDARD HIREL SCREENING (SEE DETAILED SUMMARY OF STANDARD SCREENING ON PAGE 4-9)	
Pre-Seal - Standard Internal Screening Plan	Operational Test at Temperature
Thermal Shock	Physical and Mechanical Inspection
Initial Functional	QA/CSI Sign-off
Run-In at Room Ambient	Final Functional
Vibration	

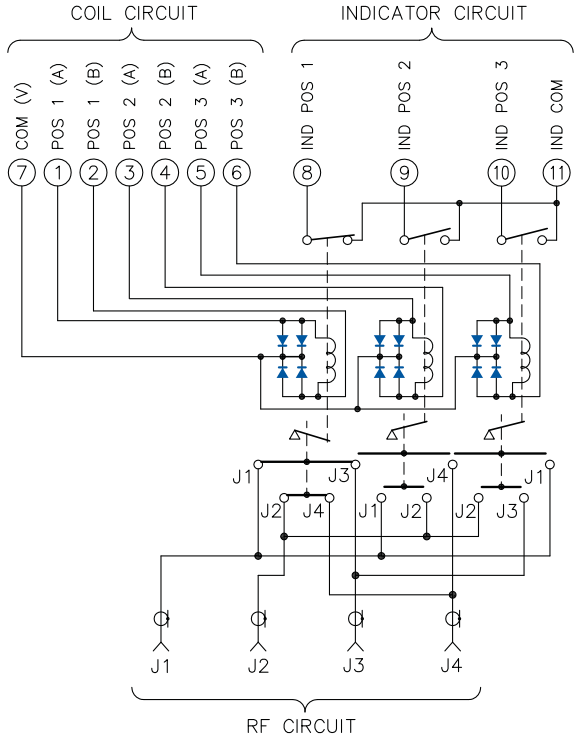
ENVIRONMENTAL AND PHYSICAL CHARACTERISTICS	
Operating Temperature:	–55°C to +85°C
Sine Vibration (Non-operating)	20 G_{peak}
Random Vibration (Non-operating)	21.5 Grms
Shock (Non-operating)	800G / 300 µs (1/2 Sine Pulses)
Typical Contact Life	1,000,000 cycles
Connector Type	SMA
Weight	4.10 oz. (116 g) max.

ELECTRICAL CHARACTERISTICS	
Form Factor	Break before make
Frequency Range	DC–22 GHz
Characteristic Impedance	50 Ohms
Switching Time (Set)	20 ms max.
Switching Time (Reset)	10 ms max.
Coil Resistance	265 Ohms nom.
RF Contact Resistance	250 mOhms max.
Indicator Contact Resistance	500 mOhms max.
Insulation Resistance	100 MOhms min.
Actuation Voltage	28Vdc nom., 32Vdc max.
Actuation Current (Per Coil)	135 mA max.@ 28Vdc and 20°C

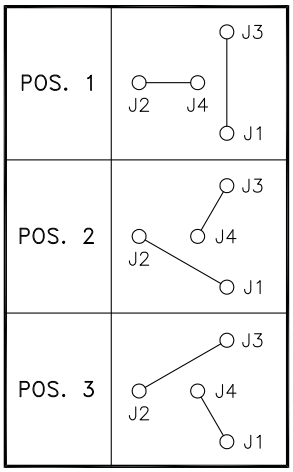
PERFORMANCE CHARACTERISTICS (SEE PAGES: 4-6)						
Parameter	F2 (L-BAND) DC–2 GHz	F4 (S-BAND) 2–4 GHz	F8 (C-BAND) 4–8 GHz	F12 (X-BAND) 8–12 GHz	F18 (KU-BAND) 12-18 GHz	F22 (K-BAND) 18-22 GHz
Insertion Loss, dB (Max.)	0.12	0.15	0.3	0.35	0.55	0.65
VSWR (Max.)	1.15:1	1.2:1	1.35:1	1.4:1	1.6:1	1.65:1
Isolation, dB (Min.)	70	70	60	60	60	60

PART NUMBER	DEFAULT CONFIGURATION
H-28S6C-F2	SMA Female Connections
H-28S6C-F4	Transient Suppresion
H-28S6C-F8	9-PIN D-Sub Connector
H-28S6C-F12	Indicator Contacts
H-28S6C-F18	Venting Screen
H-28S6C-F22	

SCHEMATIC DIAGRAM



SCHEMATIC (SHOWN IN POS 1)



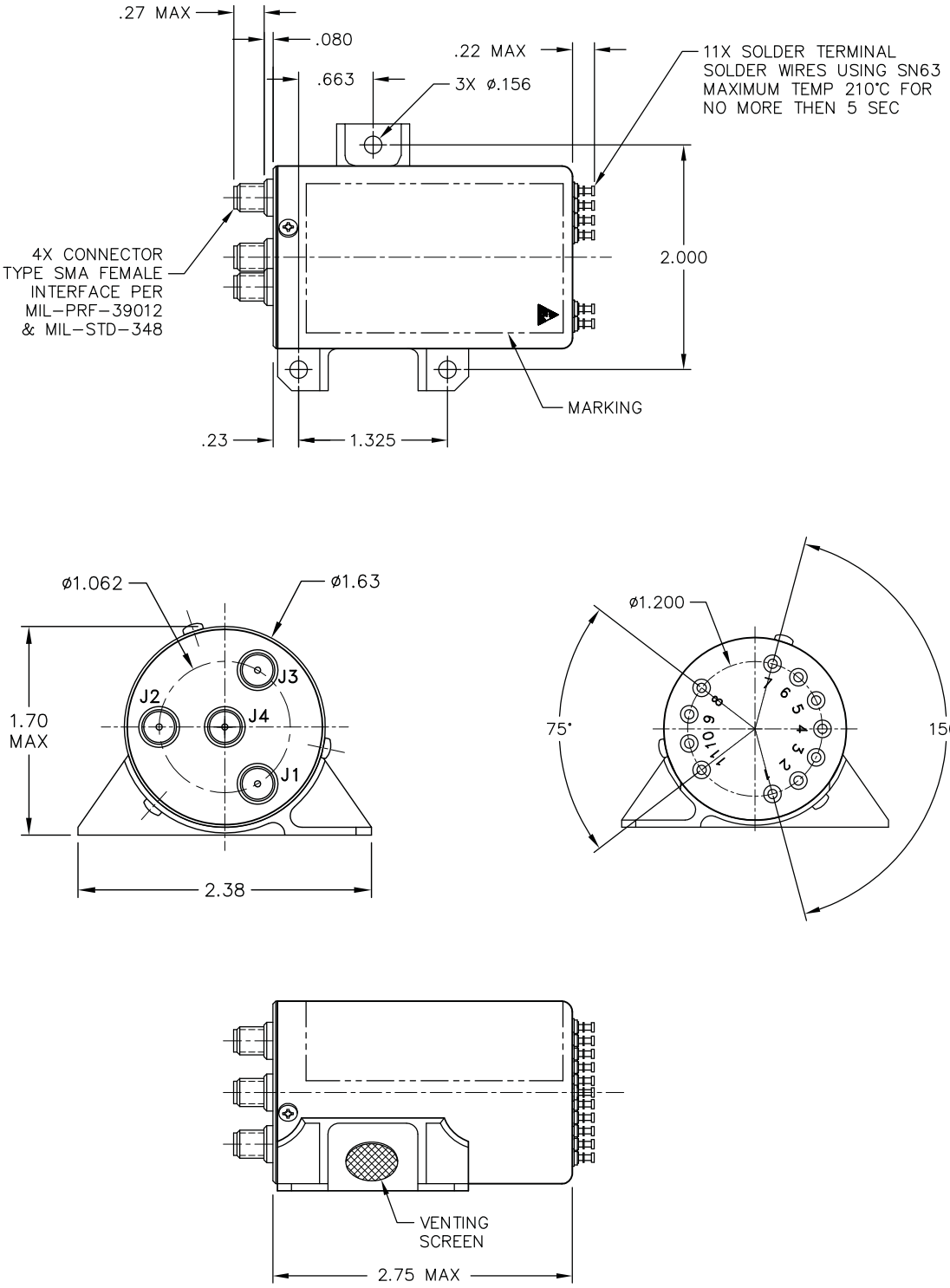
(TERMINAL VIEW)

INDICATOR TRUTH TABLE Failsafe
H-28S6C-TBD

Postion	Coil Voltage Terminals 1	2	3	4	5	6	7	RF Paths	Indicator
1 SET	+	-					+	J1 - J3 J2 - J4	8 - 11
1 RESET	-	+					+	Open	Open
2 SET			+	-			+	J1 - J2 J3 - J4	9 - 11
2 RESET			-	+			+	Open	Open
3 SET					+	-	+	J1 - J4 J2 - J3	10 - 11
3 RESET					-	+	+	Open	Open

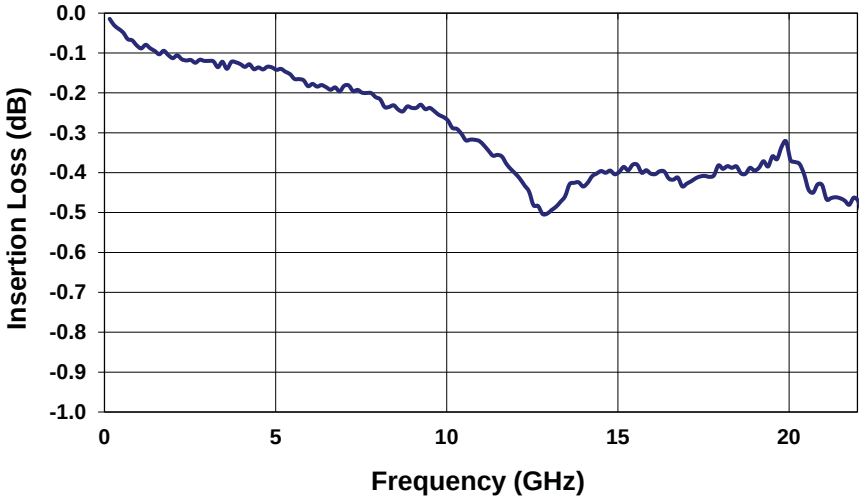
Pin 7 is for Coil Transient Suppression Only

MECHANICAL OUTLINE



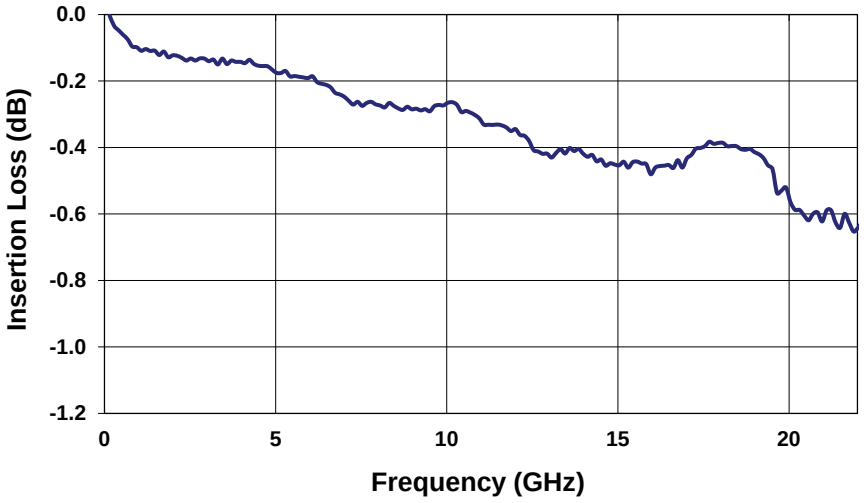
TYPICAL NARROWBAND RF INSERTION LOSS PERFORMANCE CURVES

Insertion Loss (DC-22 GHz)



COMMON (J4) PORT TO ANY PORT

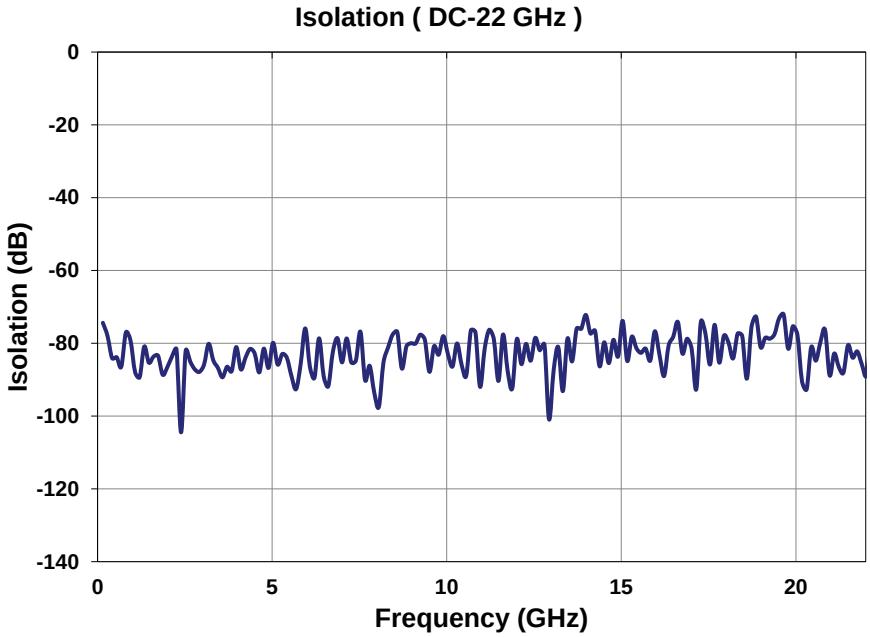
Insertion Loss (DC-22 GHz)



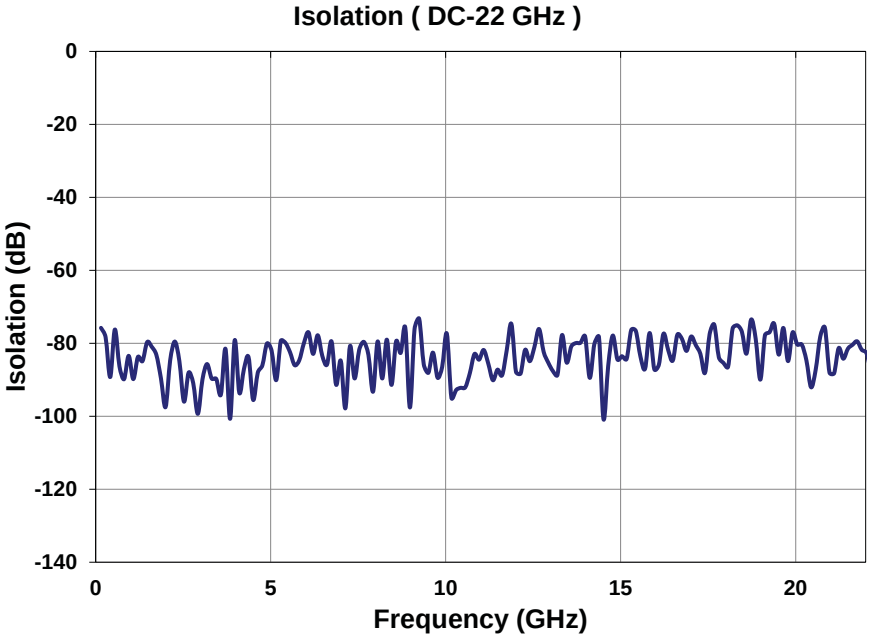
RF NOTES

PORT TO PORT

TYPICAL NARROWBAND RF ISOLATION PERFORMANCE CURVES



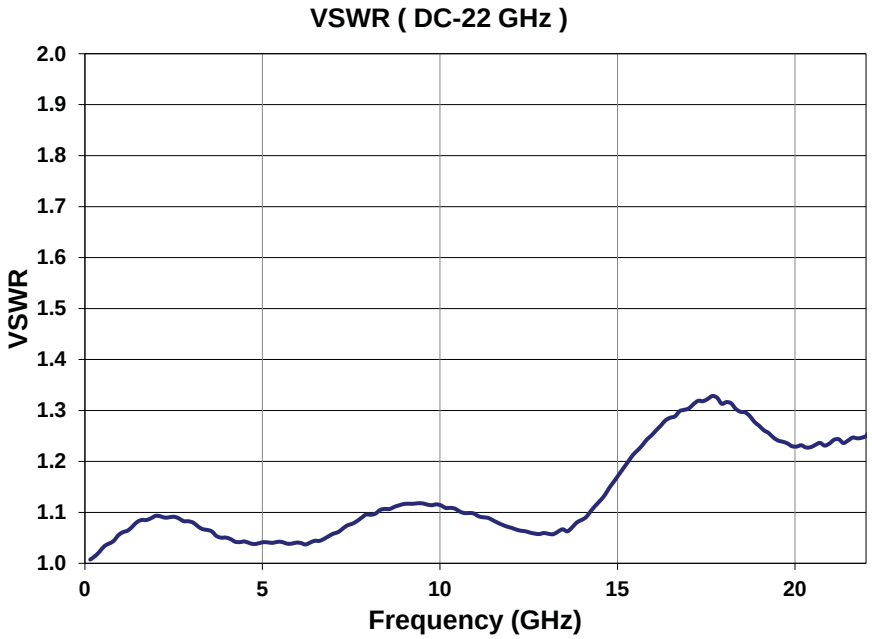
COMMON (J4) PORT TO ANY PORT



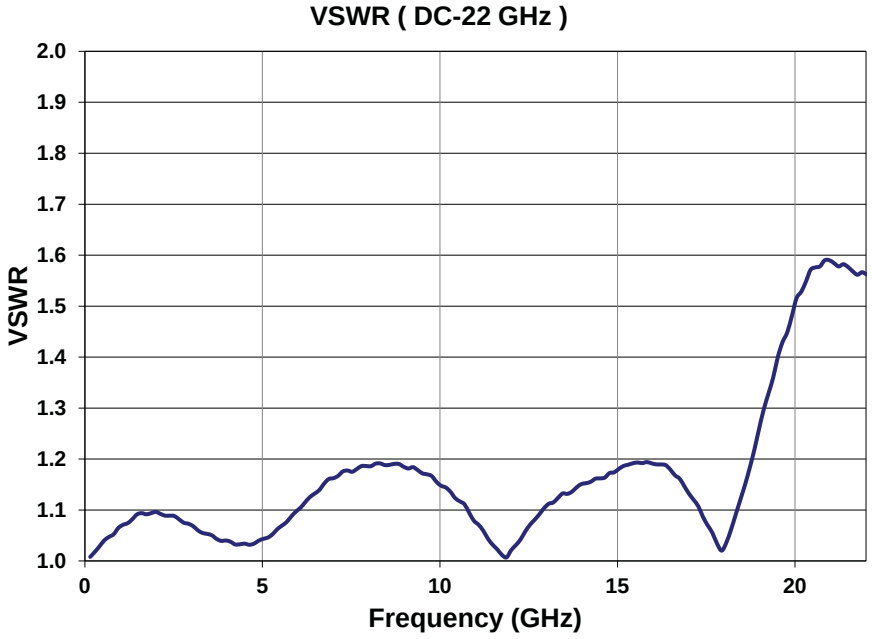
PORT TO PORT

RF NOTES

TYPICAL NARROWBAND RF VSWR PERFORMANCE CURVES



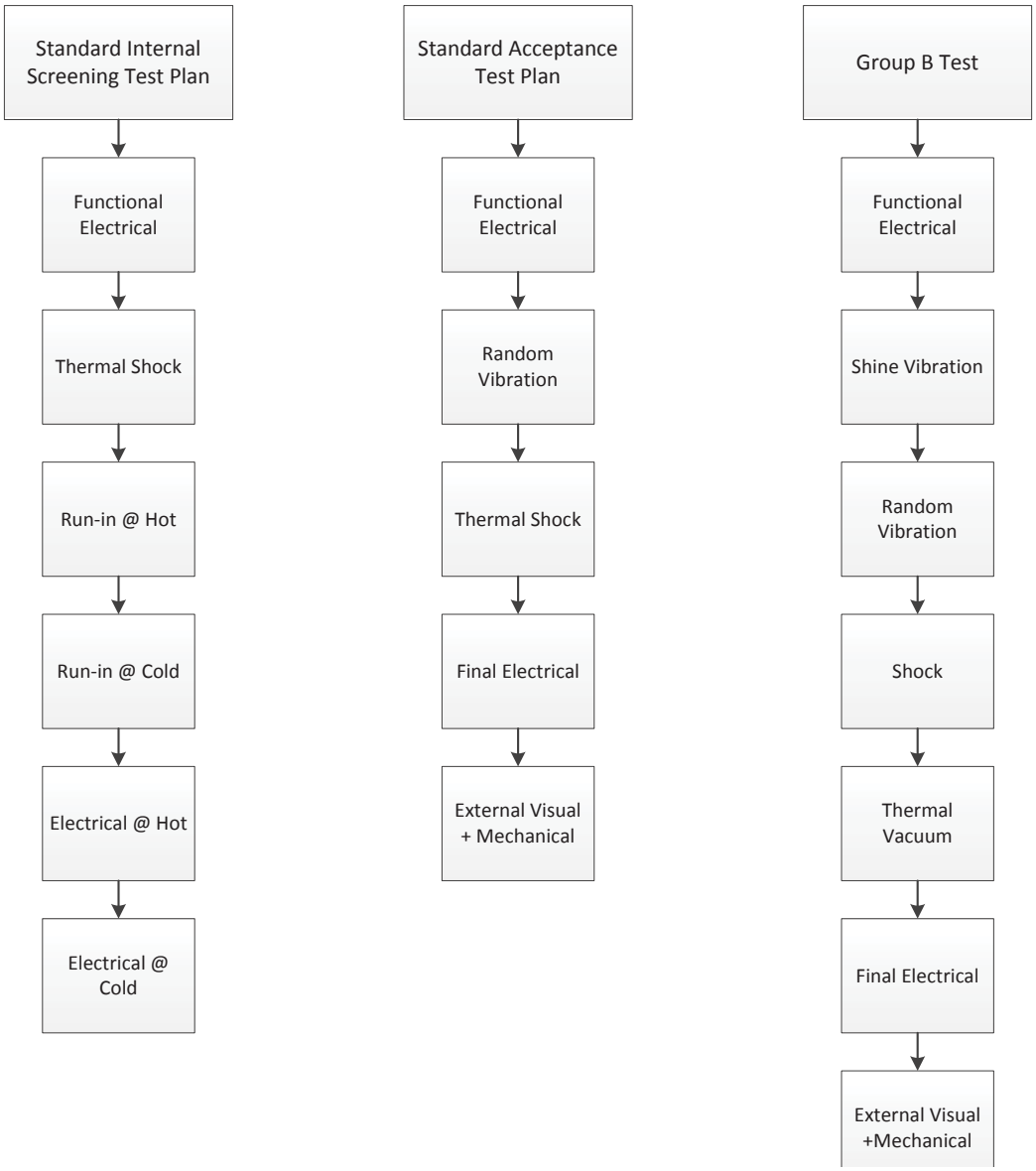
COMMON (J4) PORT TO ANY PORT



PORT TO PORT

RF NOTES

ATP COAX Test Flow



DETAILED SUMMARY OF STANDARD SCREENING	
Pre-Seal - Inspection	100% Visual Inspection
Electrical Test at Room Ambient	VSWR Insertion Loss Isolation, Minimum Operating Voltage Switching Time Coil Resistance
Thermal Shock	5 cycles 1-hour dwell at each temperature -55°C and +85°C
Run In at Room Temperature Extremes	Temperature, per Teledyne standard or customer's requirement 500 actuations at each temperature extreme 250 actuation, non-monitor 250 actuation, contact-resistance monitor
Electrical Test at Temperatures	VSWR Insertion Loss Isolation Minimum Operation Voltage Switching Time Coil Resistance Contact Resistance
Vibration, Random	
Post-vibration Functional	VSWR Insertion Loss Minimum Operating Voltage Minimum Switching Time RF Contact Resistance Indicator Contact Resistance (if applicable)
Final Functional at Room Ambient	VSWR Insertion Loss Isolation Minimum Operating Voltage Minimum Switching Time RF Contact Resistance Indicator Contact Resistance Coil Resistance
Physical and Mechanical Inspection	
QA/CSI Sign-off	
In addition to the standard environmental tests, upon customer request, the following tests may be performed at any time during acceptance test:	□Mechanical Shock □Thermal Vacuum □RF Leakage □RF Susceptibility □Run-in Cycling □Switching Life Test □X-ray

GLOSSARY

Actuator
An actuator is the electromechanical mechanism that transfers the RF contacts from one position to another upon DC command.

Arc Suppression Diode
A diode is connected in parallel with the coil. This diode limits the "reverse EMF spike" generated when the coil de-energizes to 0.7 volts. The diode cathode is connected to the positive side of the coil and the anode is connected to the negative side.

Date Code
All switches are marked with either a unique serial number or a date code. Date codes are in accordance with MIL-STD-1285 Paragraph 5.2.5 and consist of four digits. The first two digits define the year and the last two digits define the week of the year (YYWW). Thus, 1032 identifies switches that passed through final inspection during the 32nd week of 2010.

Latching
A latching switch remains in the selected position whether or not voltage is maintained. This can be accomplished with either a magnetic or mechanical latching mechanism.

Indicator
Indicators tell the system which position the switch is in. Other names for indicators are telemetry contacts or tellback circuit. Indicators are usually a set of internally mounted DC contacts linked to the actuator. They can be wired to digital input lines, status lights, or interlocks. Unless otherwise specified, the maximum indicator contact rating is 30 Vdc, 50 mA, or 1.5 Watts into a resistive load.

Isolation
Isolation is the measure of the power level at the output connector of an unconnected RF channel as referenced to the power at the input connector. It is specified in dB below the input power level.

Switching Time
Switching time is the total interval beginning with the arrival of the leading edge of the command pulse at the switch DC input and ending with the completion of the switch transfer, including contact bounce. It consists of three parts: (1) inductive delay in the coil, (2) transfer time of the physical movement of the contacts, and (3) the bounce time of the RF contacts.

Performance Parameters vs Frequency
Generally speaking, the RF performance of coaxial switches is frequency dependent. With increasing frequency, VSWR and insertion loss increase while isolation decreases. All data sheets specify these three parameters as "worst case" at the highest operating frequency. If the switch is to be used over a narrow frequency band, better performance can be achieved.

Actuator Current vs Temperature
The resistance of the actuator coil varies as a function of temperature. There is an inverse relationship between the operating temperature of the switch and the actuator drive current. For switches operating at 28 VDC, the approximate actuator drive current at temperature, T, can be calculated using the equation:

$$I_T = \frac{I_A}{[1 + .00385\ (T-20)]}$$

Where:

I_T = Actuator current at temperature, T

I_A = Room temperature actuator current – see data sheet

T = Temperature of interest in °C

Magnetic Sensitivity
An electro-mechanical switch can be sensitive to ferrous materials and external magnetic fields. Neighboring ferrous materials should be permitted no closer than 0.5 inches and adjacent external magnetic fields should be limited to a flux density of less than 5 Gauss.