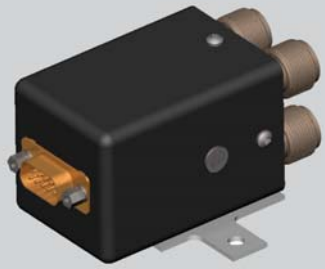
TELEDYNE
COAX SWITCHES
Everywhereyoulook™

Series H-47N
DC up to 12 GHz
Latching Transfer Space Grade Coaxial Switch

PART NUMBER	DESCRIPTION
H-47N	Space Grade Latching Transfer, DC up to 12GHz

Teledyne Coax Switches' "H-47N Series" RF Coaxial Switch is a Commercial Off-The Shelf (COTS) product suitable for high reliability space flight applications. When purchased in accordance with Teledyne Coax Switches' standard Hi-Rel Acceptance Test Procedure (ATP), Document No. 0-43-058, the switches will meet the basic requirements for space flight applications. The "H-47N Series" has become the premier selection for space flight applications requiring RF switching capability. Teledyne Relays' 50 year history of supplying high reliability products to the space craft manufacturing community has supported 95% of all satellite programs worldwide. The RF Coax Switches may be supplied in accordance with the standard requirements of the Hi-Rel ATP or as specified by customer source control drawings. In addition to enhanced test and inspection at the relay level the individual piece parts are inspected to higher standards. The switches may be supplied with standard Type N connector or as specified by customer requirements. All Hi-Rel RF Coaxial Switches are supplied with full data packages in either hard copy or electronic format. Customer Source Inspection (CSI) may be performed during critical manufacturing and test points. Test Readiness Review (TRR) and Document Review Board (DRB) meeting will be supported as required and Qualification Test Programs and Procedures can be customized as necessary.



H-47N 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 Solid 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	

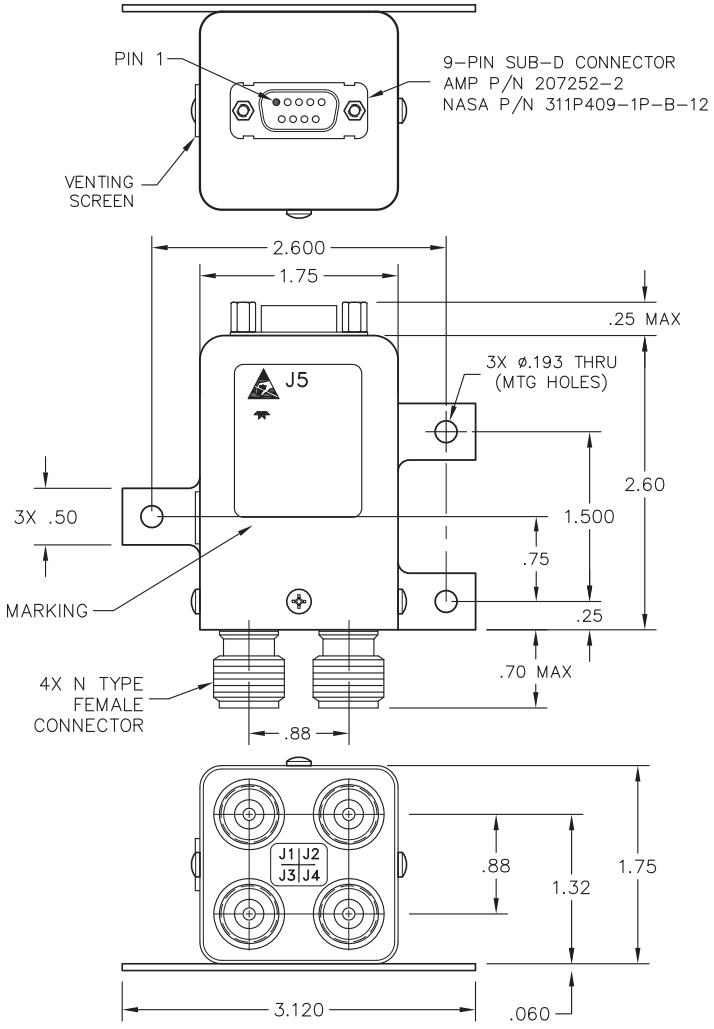
ENVIRONMENTAL AND PHYSICAL CHARACTERISTICS	
Operating Temperature	–55°C to +85°C
Vibration (MIL-STD-202 Method 214, Condition D, non-operating)	10 g's RMS
Shock (MIL-STD-202 Method 213, Condition D, non-operating)	500 g's
Finish	Electroless Nickel Plate
Life Cycle, minimum	100,000 cycles
Connector Type	Type N
Weight	6.5 oz. (184.27g) (max.)

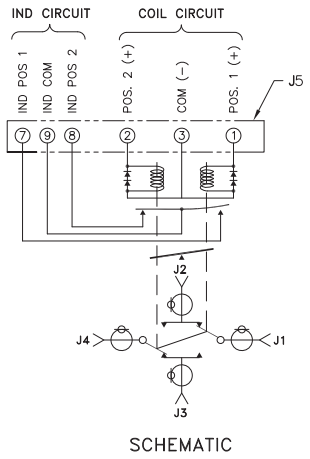
ELECTRICAL CHARACTERISTICS	
Form Factor	Transfer, break before make
Frequency Range	L, S, C, X
Characteristic Impedance	50 Ohms
RF Leakage	-70 dB 4GHz
Operate Time	10 ms (max.)
Release Time	10 ms (max.)
Actuation Voltage Available	28 V
Actuation Current, max. @ ambient	90 mA

PERFORMANCE CHARACTERISTICS				
Frequency Option	F2 (L-BAND) DC–2 GHz	F4 (S-BAND) 2–4 GHz	F8 (C-BAND) 4–8 GHz	F12 (X-BAND) 8–12 GHz
Insertion Loss, dB, max.	0.2	0.3	0.4	0.6
Isolation, dB, min.	70	70	60	60
VSWR , max.	1.3:1	1.3:1	1.4:1	1.65:1

PART NUMBER	DEFAULT CONFIGURATION
H-47N6C-F2	N Female Connections
H-47N6C-F4	Transient Suppression
H-47N6C-F8	9-PIN D-Sub Connector
H-47N6C-F12	Indicator Contacts
	Venting Screen

MECHANICAL OUTLINE

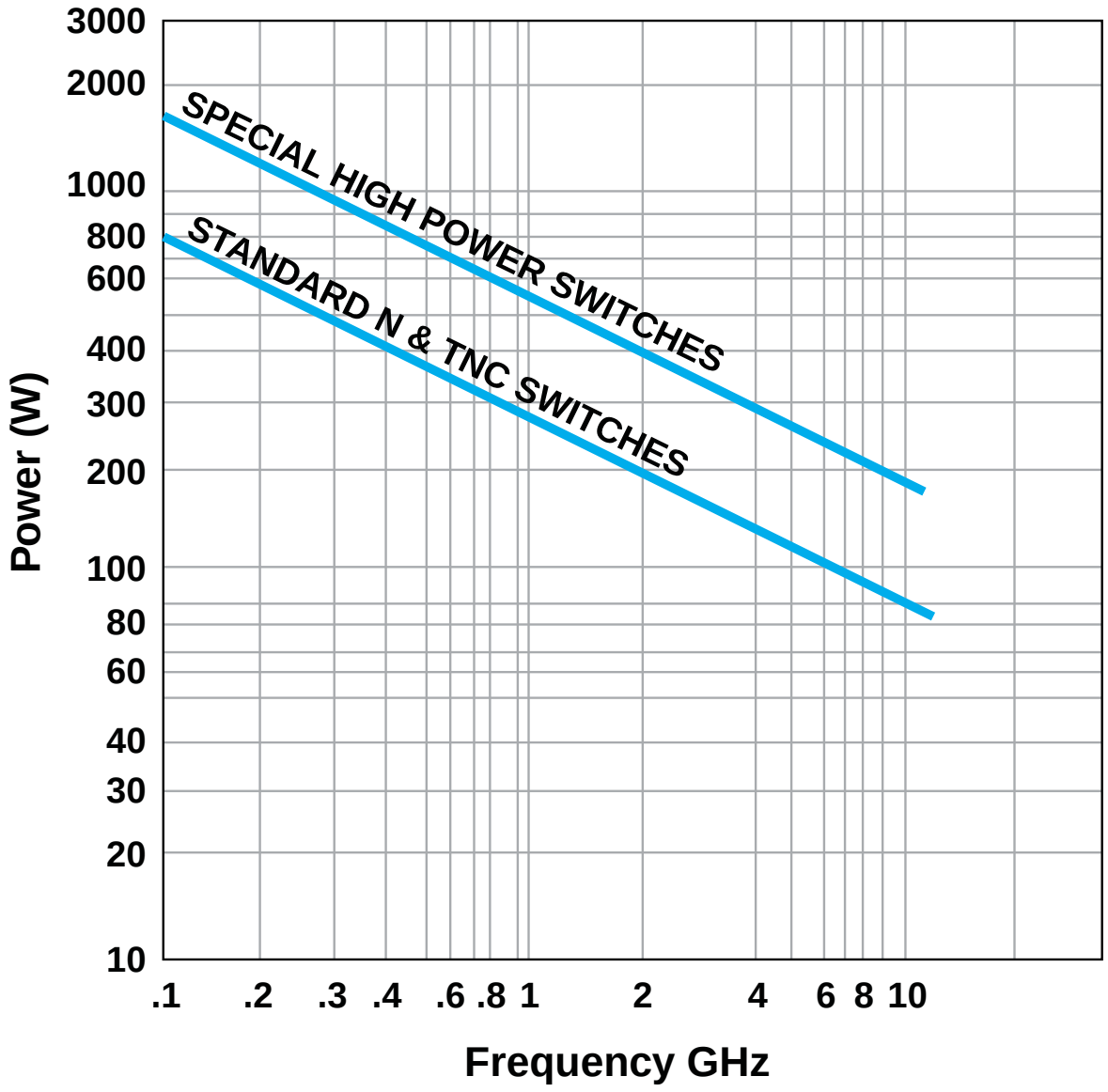




SCHEMATIC

TYPICAL POWER PERFORMANCE CURVE

Power Handling vs. Frequency

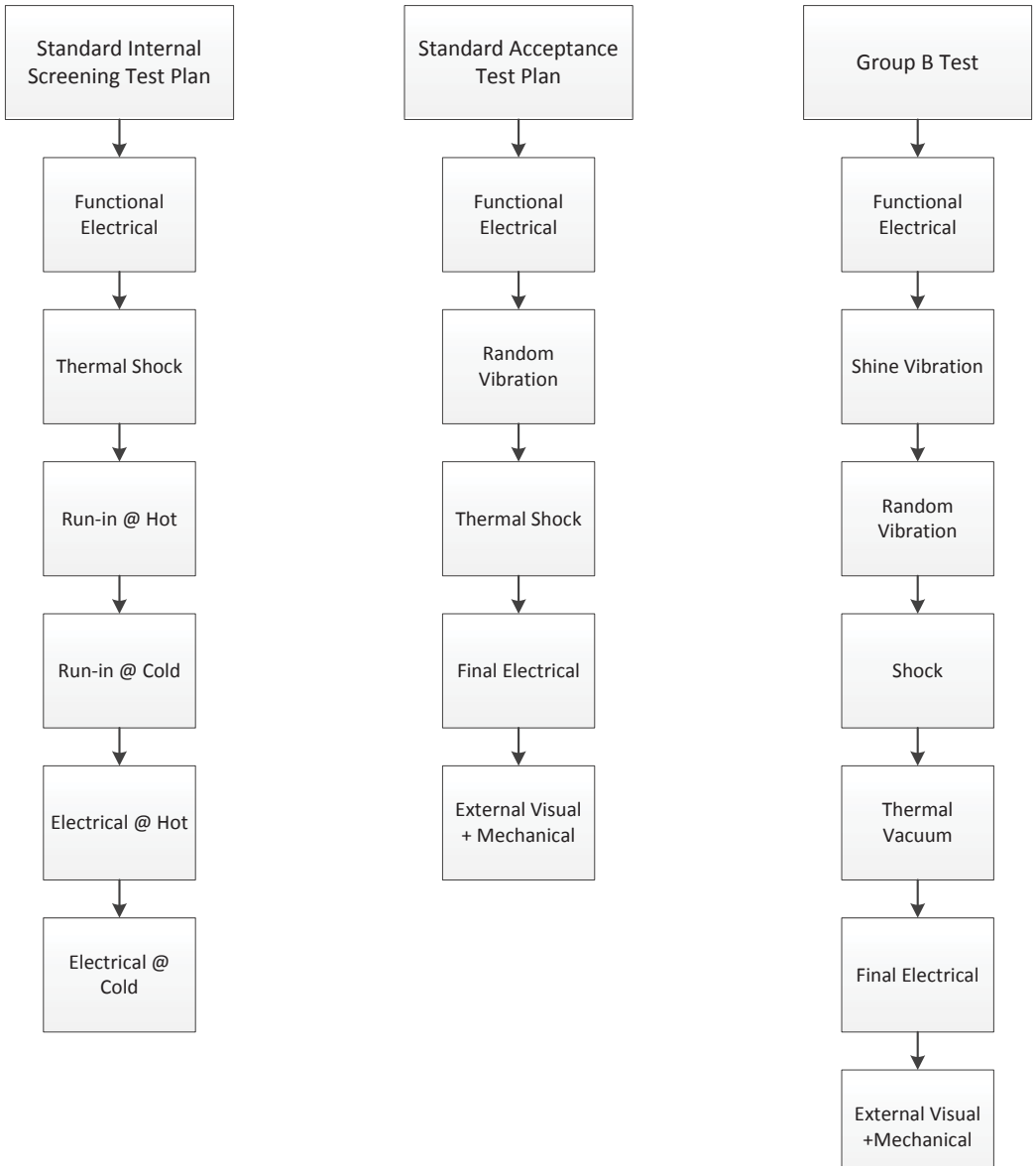


Estimates based on the following reference conditions:

- Ambient temperature of 40°C or less
- Sea level operation
- Load VSWR of 1.20:1 maximum
- No high-power (hot) switching

Please contact Teledyne Coax Switches for derating factors when applications do not meet the foregoing reference conditions.

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.

Transfer Switch
A four-port switch consisting of two independent pairs of RF paths. These pairs are actuated simultaneously. This actuation is similar to that of a double-pole double-throw switch. See application notes for typical usage.

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

Where:

I_T = Actuator current at temperature, T

I_A = Room temperature actuator current – see data sheet

T = Temperature of interest in °C

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:

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.