CUSTOM

MSSR

ISSR

Product Overview

EMR

COAX

TELEDYNE RELAYS
TELEDYNE COAX SWITCHES
Everywhereyoulook™

SPACE

MATRIX

InP

Switching Solutions

Teledyne Relays is the world's innovative leader in manufacturing ultra-miniature hermetically sealed switching products, with more than 50 years heritage in military programs. Our comprehensive product line meets wide-ranging requirements for the defense and aerospace markets, covering frequencies from DC to 52GHz with our Coaxial products, and DC-18GHz with signal integrity up to 40Gbps with our High-Frequency electro-mechanical relays. We also offer high-performance solutions for industrial, telecom, commercial, and medical switching applications.

Business Focus

- QPL & COTS Electromechanical Relays
- QPL & COTS Solid-State Relays
- Industrial Solid-State Relays
- High-Frequency Relays and Coaxial Switches
- Space (Hi-Rel) Relays & Coaxial Switches
- COTS & Custom RF Switch Matrices
- Military and Space Grade Optocouplers
- Hybrid Solutions, SSPC, DC-DC Converters

Markets We Serve

- Commercial & Military Aviation
- Defense & Aerospace
- Telecom/Communications (Wireless)
- Instrumentation & Test
- Industrial Power & Motion Control
- Medical Applications
- IC Semiconductor Test
- Oil & Gas

Product Assurance & Technical Service

intertek
Total Quality. Assured.

CERTIFICATE OF REGISTRATION

This is to certify that the management system of:

Teledyne Relays

Main Site: 12525 Daphne Avenue, Hawthorne, California, 90250-3308, USA
Additional Site: NORTH AMERICAN PRODUCTION SHARING OF MEXICO, S.A. DE C.V., Teledyne Relays Division, Blvd. Diaz Ordaz #1131, Tijuana, 92143, Mexico

Has been audited and registered by Intertek as meeting the requirements of the standards:

AS9100:D and ISO 9001:2015

The management system is applicable to:

Multiple Site Structure

Main Site Scope: The Design, Manufacture and Distribution of Relays.
Additional Site Scope: The Manufacture of Electromechanical Relays.

Certificate Number
95-469-11
Initial Certification Date
16 November 1995
Certificate Issue Date
27 March 2020
Certificate Reissue Date
Certificate Expiry Date
26 March 2023

Intertek
ANAB ACCREDITED
MANAGEMENT SYSTEMS CERTIFICATION BODY

Calin Moldovean
President, Business Assurance

Intertek Testing Services NA, Inc. dba Intertek
4700 Broadmoor Avenue S.E.,
Kentwood, MI, USA

The assessment was performed in accordance with the requirements of AS9104/1-2012-01. Intertek is accredited under the Aerospace Registrar Management Program and IAQG ICOP scheme. In the issuance of this certificate, Intertek assumes no liability to any party other than to the Client, and then only in accordance with the agreed upon Certification Agreement. This certificate's validity is subject to the organization maintaining their system in accordance with Intertek's requirements for systems certification. Validity may be confirmed via email at certificate.validation@intertek.com or by scanning the code to the right with a smartphone. The certificate remains the property of Intertek, to whom it must be returned upon request.
CT-AS9100_2009-AS9104_1-ANAB-EN-LT-P-01.jul.17

Under an aggressive Total Quality Management (TQM) program, Teledyne Relays has embraced a "continuous improvement" culture. With recognized certifications such as AS/EN/JISQ9100:2009 (REV D), ISO 9001/2015, DSCC MIL-STD-790 and Boeing D6-82479, Teledyne Relays has become a primary supplier of switching solutions with the highest quality and reliability to industry leaders around the world.

Teledyne Relays provides easy access to technical service and customer support. An innovative, integrated website makes it easy to find technical information, buy relays and even get e-mail responses within 24 hours. Design engineers who need switching solutions for their electronic systems can find them available on our website.

RoHS or Non-RoHS: Your Choice!

High Performance Switches For Your High-Frequency Application

- 33-75GHz — Satellite Communications, High Band 5G, Q/V Band
- 26.5-40GHz — LDMS, HTS Sat-Comm Ka Band
- 8-18GHz — Radar, Ku Band
- 10.9-12.75GHz — Satellite Communications
- 12.2-12.7GHz — DBS (Direct Broadcast Satellite)
- 11.7-12.2GHz — TV Transmission, X Band
- 5.7-8.0GHz — ISM Radio, C Band, X Band
- 3.7-4.2GHz — Fixed Satellite
- 2.7-3.7GHz — Radio Location, Radio Navigation
- 2.5-2.7GHz — MMDS (Multi Channel, MultiPoint Distribution System)
- 2.4-2.6GHz — ISM (Industrial, Scientific, Medical) Bluetooth
- 1.85-1.99GHz — PCS
- 1.2-1.6GHz — GPS, L Band
- 930-931MHz — Narrow Band GPS
- 824-894MHz — Cellular
- 806-866MHz — SMR (Special Molbile Radio)
- 54-806MHz — Braodcast/Cable TV

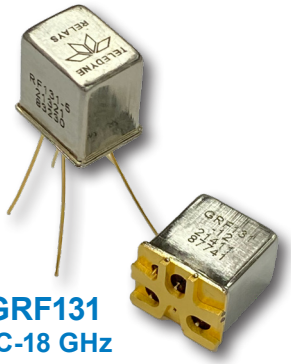
SPECIFICATIONS ARE SUBJECT TO CHANGE

EMR

Teledyne Relays offers low signal, hermetic, electromechanical relays for high-reliability applications across multiple markets.

RF RELAYS

- Signal Integrity up to 40Gbps
- DC - 18GHz
- SPDT Non Latch & Latching
- Hermetically Sealed
- 3 Million Cycle Life

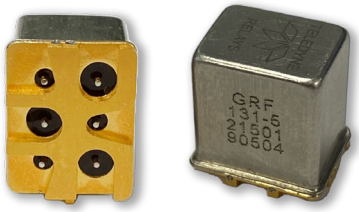


GRF131
DC-18 GHz
40 Gbps

RF Performance			
Frequency (GHz)	VSWR	Isolation (dB)	Insertion Loss (dB)
DC-4	1.20:1	65	0.12
4-8	1.25:1	50	0.15
8-12	1.28:1	45	0.20
12-16	1.75:1	40	0.50
16-18	1.95:1	30	0.85

Link to datasheet

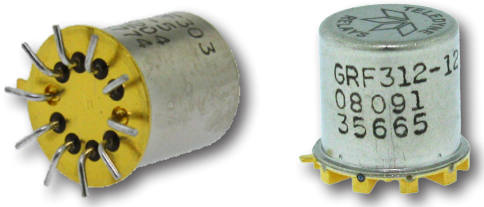
SPDT



GRF121
DC-18 GHz
40 Gbps

GRF131
DC-18 GHz
40 Gbps

DPDT



SRF303
DC-6 GHZ
18 Gbps

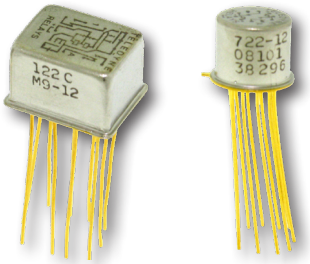
SGRF312
DC-8 GHZ
20 Gbps

LOOPBACK

SGLB363
DC - 6 GHz
16Gbps

COMMERCIAL RELAYS

LATCHING

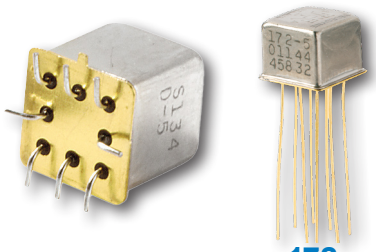


122C

722

- Economical Switching Solutions
- Short Lead Times
- Hermetically Sealed
- 10 Million Cycle Life
- 1A/28Vdc Resistive Load Rating
- Transistor and CMOS driver options

NON-LATCHING



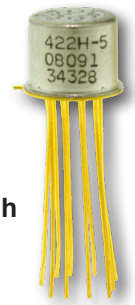
S134

172

HIGH PERFORMANCE RELAYS

HIGH TEMPERATURE

- -65°C to +200°C
- DPDT
- Non-latching
- Latching
- Sensitive non-latch
- 412H, 422H, 432H



422H

HIGH SHOCK

- Shock up to 4,000 g's
- -65°C to +125°C
- DPDT
- Latching & Non-latch
- 412K, 422K

412K

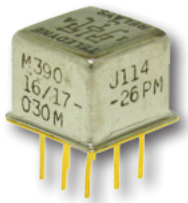
HIGH VIBRATION

- Vibration up to 380 g's
- 10M Life Cycle
- DPDT, non-latching
- Internal Diode option
- 412V, 412DV

412DV

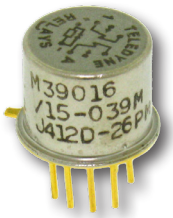
MILITARY GRADE JAN RELAYS

QPL Qualified Parts



J114

- MIL-PRF-39016
- MIL-PRF-28776
- SPDT, DPDT
- Latching & Non-latch
- TO-5, .100 Centigrid
- CMOS Transistor Driver
- TVS & Polarity Diodes

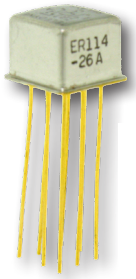


J412D

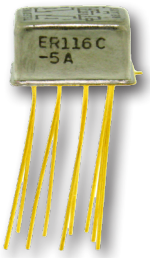
- DPDT 1/2 Crystal Can
- Resistive: 2A/28Vdc
- MIL-PRF-39016/45 Qualified
- Hermetically Sealed
- 1 Million Cycle Life

J255

ESTABLISHED RELIABILITY RELAYS



ER114



ER116C

- A & B Level Screening
- More Spacer/spreader pad options
- Added Ground Pin Option
- Reduced Cost
- Reduced Leadtime

ER420

ER432

EMR SCREENING LEVELS

INSPECTION	Screening Levels			
	A Level 1.5%/10K Cycles	B Level .75%/10K Cycles	JAN L Level 3%/10K Cycles	JAN M Level 1%/10K Cycles
Subgroup 1				
Screening, Internal Moisture AQL[1]	✓	✓	✓	✓
Vibration (Sinusoidal) AQL[1]			✓	
Vibration (Sinusoidal) 100%		✓		✓
Screening, Burn-In (Hybrids only)			✓	✓
Screening, Run-In (Room Temperature)	✓			
Screening, Run-In (+125°C and –65°C)		✓	✓	✓
Subgroup 2				
Coil Resistance or Coil Current	✓	✓	✓	✓
Insulation Resistance	✓	✓	✓	✓
Dielectric Withstanding Voltage	✓	✓	✓	✓
Static Contact Resistance	✓	✓	✓	✓
Pickup and Dropout or Set and Reset Voltage	✓	✓	✓	✓
Operate and Release or Set and Reset Time	✓	✓	✓	✓
Hold Voltage			✓	✓
Turn-On and Turn-Off Time (Hybrids only)	✓	✓	✓	✓
Contact Bounce Time	✓		✓	
Contact Stabilization Time		✓		✓
Turn-On Current (T Hybrids only)	✓	✓	✓	✓
Turn-On Voltage (C Hybrids only)	✓	✓	✓	✓
Turn-Off Voltage (Hybrids only)	✓	✓	✓	✓
Coil Transient Suppression (D, DD and Hybrids only)	✓	✓	✓	✓
Diode Blocking Integrity (DD only)	✓	✓	✓	✓
Zener Voltage (C Hybrid only)	✓	✓	✓	✓
Neutral Screen (Latching Relays only)	✓	✓	✓	✓
Break Before Make Verification			✓	✓
Contact Simultaneity			✓	✓
Subgroup 3				
Solderability 2 Samples per Daily Solderability Inspection Lot	✓	✓	✓	✓
Leak Test	✓	✓	✓	✓
External Visual and Mechanical Inspection 2/Lot for Dimension and Weight Check	✓	✓	✓	✓

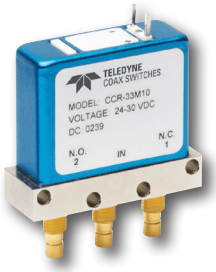
COAX

Teledyne Coax Switches offers a large portfolio of coaxial switches with a wide frequency range from DC to 53GHz.

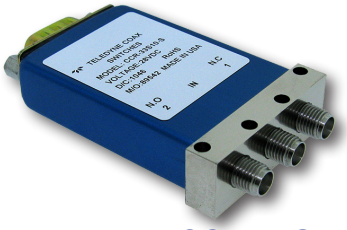
SPDT SWITCHES

- Operating Frequency from **DC - 53GHz**
- Excellent Insertion Loss Repeatability
- Characterized at 5 million cycles
- Compact design with High performance

CR-50U
DC-53GHz



CCR-33M
DC-3GHz



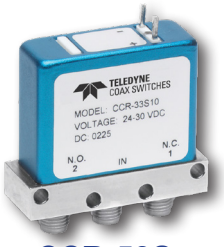
CCR-33S
DC-18GHz

CRT-33S
DC-22GHz

CCS-32N
DC-12GHz

OPTIONS

- **Failsafe or Latching**
- **Internal 50 Ω Termination**
- **12, 15, 24, or 28Vdc Actuation**
- **SMA, TNC, N, 2.92mm & 2.4mm**
- **Indicators, Self Cutoff (Latching Only)**
- **TTL, Diodes, Moisture Seal, D-Sub**



CCR-53S
DC-26.5GHz

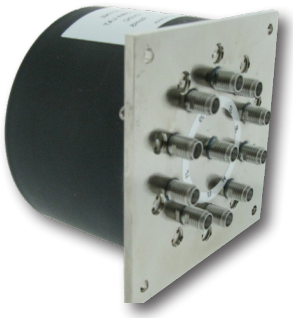
MULTI-THROW SWITCHES

- DC - 52GHz
- Internal 50Ω Termination
- SMA, 2.92mm, TNC, N, & U
- SP3T - SP12T
- 5 Million Cycles
- Normally Open & Latching

CR-39U
DC-52GHz

CCT-58S SP12T
DC-18GHz

CCS-18
DC-12GHz



CCR-39S SP10T
DC-18GHz

CCR-58S
DC-26.5GHz

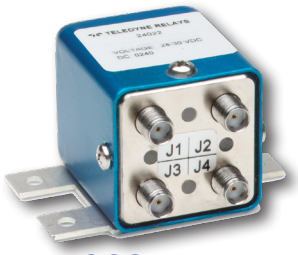
CCR-48K
DC-40GHz

TRANSFER & 2P3T SWITCHES

CR-37U
DC-52GHz

- Operating Frequency from **DC - 52GHz**
- SMA, 2.92mm, TNC, N, & U
- 5 Million Cycles
- High Power N & TNC
- Failsafe & Latching

CCS-47N
DC-12GHz

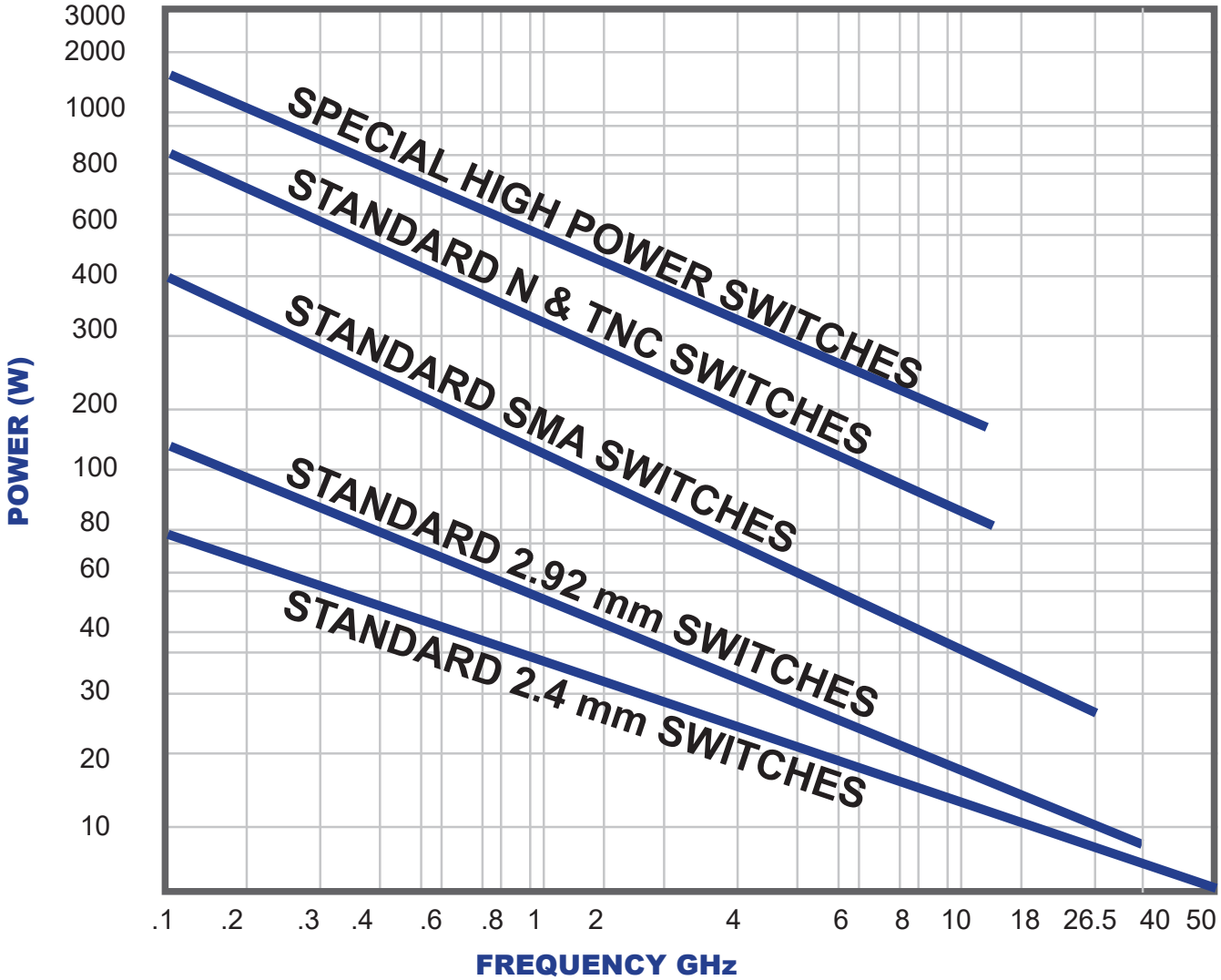


CCS-37K
DC-40GHz

CCRS-33S
DC-18GHz

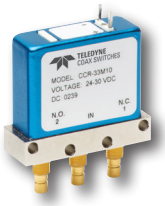
CCS-37S
DC-26.5GHz

POWER VS FREQUENCY



MATRIX

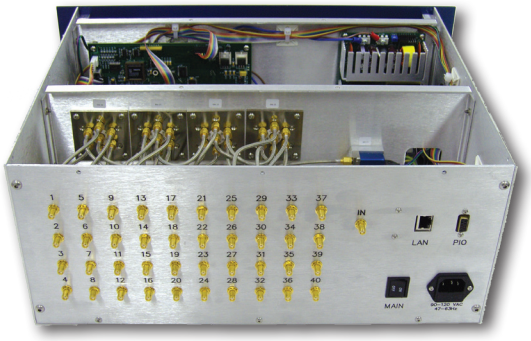
Teledyne, the world's innovative leader in manufacturing electromechanical and solid-state switching products for more than 50 years, offers a modular approach to matrix assembly switching. Incorporating highly repeatable and long-cycle-life relays and switches, Teledyne's matrices cover the spectrum from DC to 53GHz. Teledyne's modular approach to building matrices allows assembly of a vast array of customized matrix assemblies with the same standard sub-assemblies. The internal components of the assembly and main module utilize Teledyne's proven relays and switches. Teledyne has developed a standard programmable microcontroller that can be used for nearly any matrix configuration. The universal power supply allows the matrix assembly to be used worldwide. Teledyne is highly vertically integrated, which reduces development time, qualification time, cost and lead time, while ensuring high quality and cost-effective production.



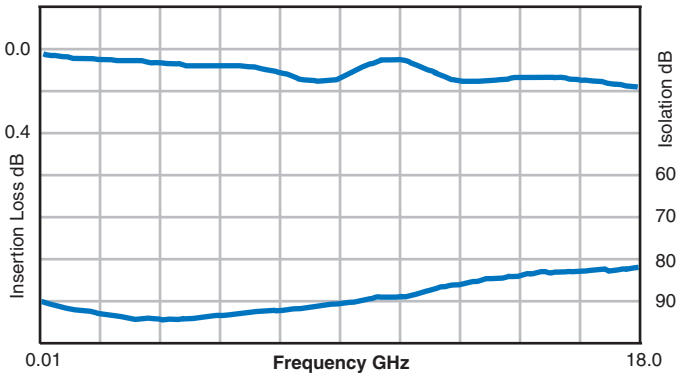
To learn more, call us or visit us online today. And see what Teledyne Coaxial Switches can do for you.

FEATURES

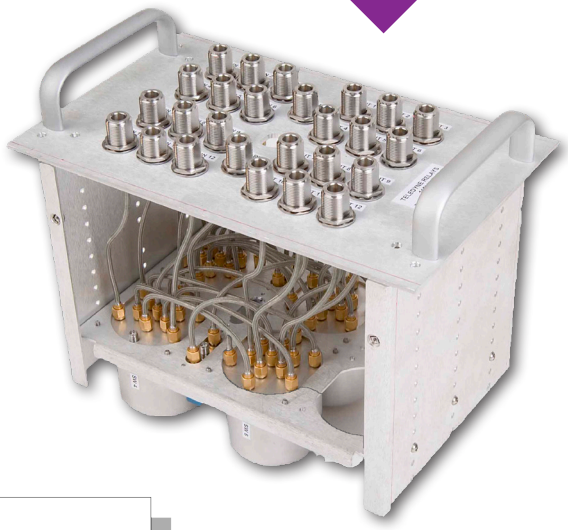
- **Fully customized switching configurations**
- **Universal Power Supply**
- **Visual Display – LED**
- **Standard and custom racks available**
- **Manual/direct and/or remote control**
- **Multiple interface configurations:**
  RF ports – SMA, 2.92mm, N, SMB, TNC, etc.
  Control – RS-232, Ethernet, USB, Keypad, etc.
- **50 and 75 ohm impedances**

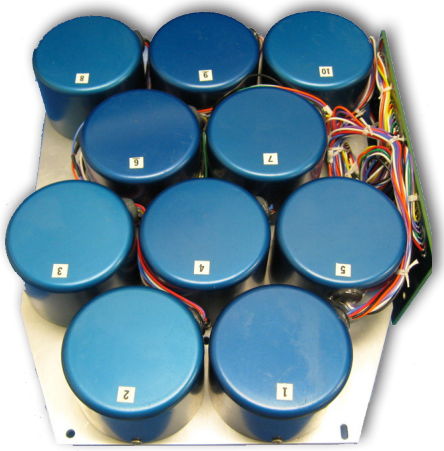


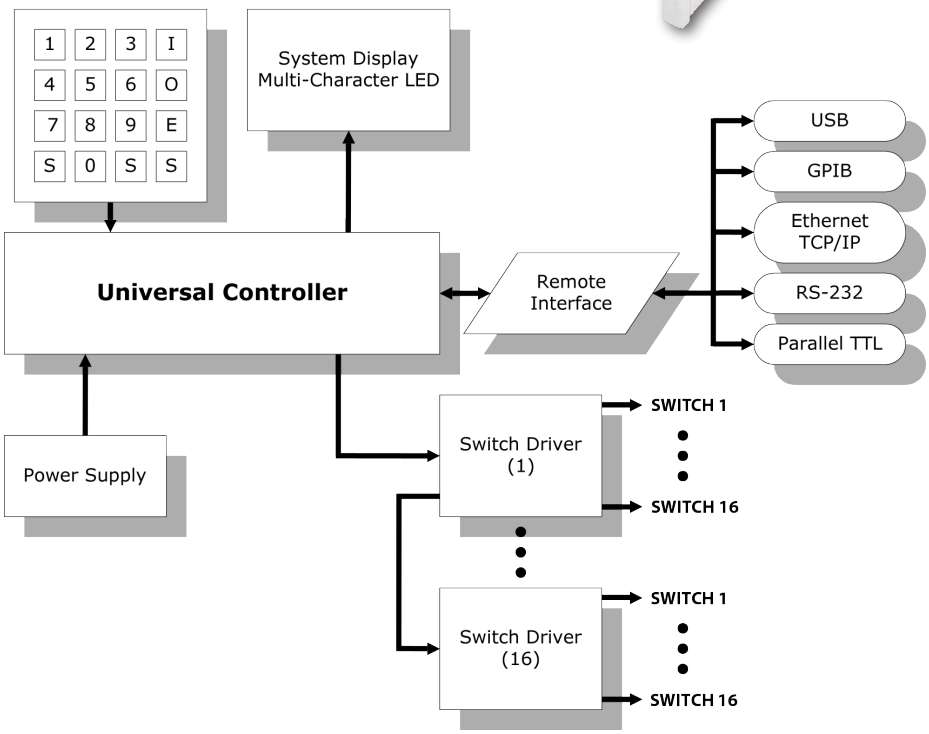
TYPICAL INSERTION LOSS / ISOLATION**



MATRIX



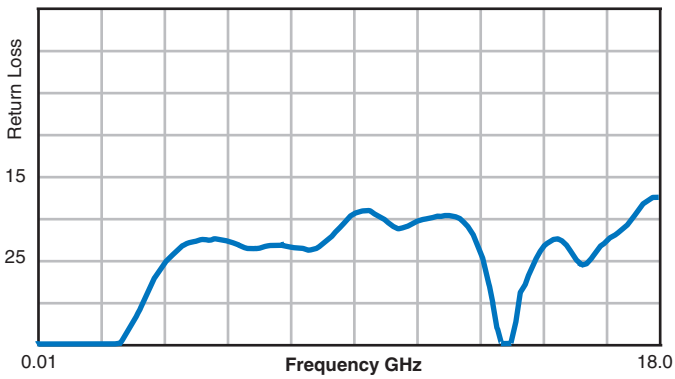


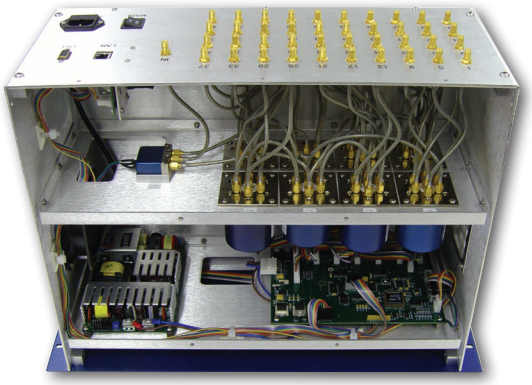


ADDITIONAL FEATURES

- Monitor cycle count
- System health/system status
- LEDs: Visual status
- In-circuit programming

TYPICAL RETURN LOSS**





**Sample measurement from a 1x40 switch matrix.
For reference only, contact factory for additional details

MATRIX

Mini Matrix

The MMA, MMB & MMC series are an ideal solution that incorporate Teledyne Coax Switches with remote control via USB and/or TCP/IP (Ethernet). Remote operation is accomplished via Windows GUI or ASCII (command set provided).

TYPICAL RF CHARACTERISTICS

Frequency	DC-6 GHz	6-12 GHz	12-18 GHz	18-26.5 GHz	26.5-34 GHz	34-40 GHz	40-52 GHz
Insertion Loss	0.20 dB	0.40 dB	0.50 dB	0.90 dB	1.00 dB	1.20 dB	1.40 dB
Isolation	80 dB	80 dB	80 dB	70 dB	65 dB	60 dB	60 dB
VSWR	1.25:1	1.40:1	1.50:1	1.60:1	1.70:1	1.80:1	2.00:1

Mini Matrix App Form!

- Off the Shelf design
- Open Port (Labview & C++ Compatible)
- Controller supports 2 x 8 output channels @ 24V
- Discrete control
- Controlled through USB/Ethernet
- Windows GUI & API provided

CONFIGURATIONS AVAILABLE

Series	Frequency	Connector Type	Quantity	Cycle Life
SPDT	18, 26.5, 40 GHz	SMA, 2.92mm	Up to 4 SPDT	5M Cycles
Transfer	18, 26.5 GHz	SMA, 2.92mm	Up to 4 Transfer	5M Cycles
Multi-Throw	18, 26.5, 40 GHz	SMA, 2.92mm	Up to 2 SP8T	5M Cycles

Airworthy Custom Matrix Boxes

Program Oriented Design Review

- Compliance Matrix
- Mechanical Layout
- Thermal Analysis
- Cascade Analysis with Tolerances
- Power Analysis

TESTING CAPABILITIES:

- Shock
- Ballistic Shock
- Crash Load
- Random Vibration
- Acoustic Noise
- Temperature
- Sinusoidal Vibration
- Altitude
- Humidity

TELEDYNE
COAX SWITCHES
Everywhereyoulook™

SPACE

For over fifty years Teledyne Relays has been supplying high reliability switching solutions intended for space flight applications. As the inventor of the ultra-miniature T0-5 electromechanical relay Teledyne Relays has been involved with all facets of the modern space age. From the earliest NASA missions Teledyne Relays has supplied T0-5 relays and RF Coax Switches for use in all type of space craft: manned, unmanned, deep space and robotic exploration.

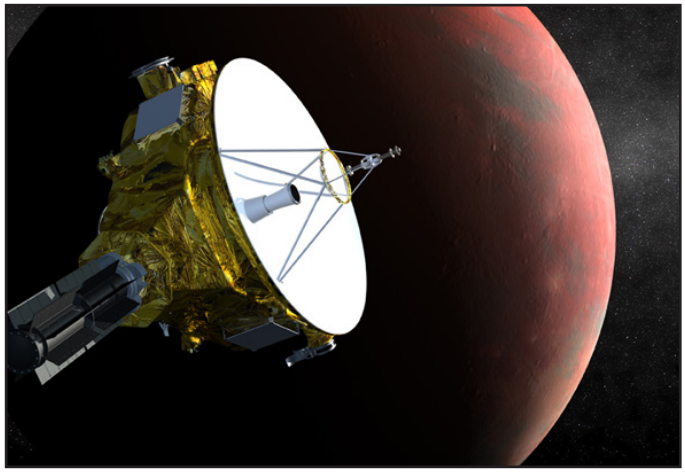
Ariane V Launch Vehicle

Space Market Segments Served:

- Deep-space Probes
- Manned Programs
- Communications Satellites
- Launch Vehicles
- Earth Observatory / Weather Satellites
- Commercial/Military Satellites

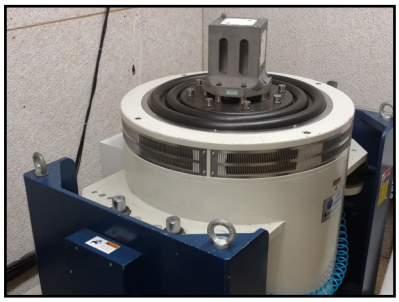
Capabilities:

- Logistic Infrastructure
- Chemical Analysis Lab
- Scanning Electro Microscope (SEM)
- In-house Plating Shop
- Environmental Test Lab
- Field Technical Support



New Horizons Spacecraft

SPACE STANDARDS



Specifications

- NASA/GSFC S-311-P-754
- NASA EEE-INST-002
- ESA/SCC 3601
- ESA/SCC 3602
- TR-HIREL-1

Certifications

- MIL-PRF-39016
- MIL-PRF-28776
- MIL-STD-790
- BOEING D1-9000
- ISO 9001:2008
- NASA/JEDEC Solder Requirements

Required Tests

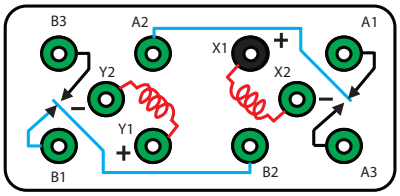
- 100% Pre-Cap
- Small Particle Inspection (Millipore Inspection)
- Sinusoidal Vibration
- Resonant Beam Test
- P.I.N.D. Test
- Internal Moisture
- Temperature Condition, High and Low Temperature Miss Test
- Electrical Measurements
- Leak Test
- Radiographic Inspection (X-Ray)
- Visual Inspection

ELECTROMECHANICAL RELAYS

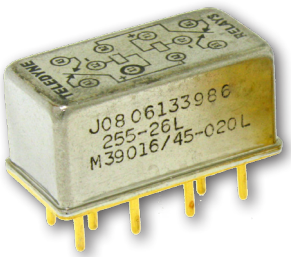
Contact Load and Life Ratings

LOAD LEVEL	CONTACT LOAD
Low level/Mechanical	10-50µA at 10-50 mVdc or Peak AC
Intermediate Current	100mA at 28Vdc
High Level, Resistive	2.0A at 28Vdc
High Level, Inductive	750 mA at 28Vdc, with 0.20H inductance
High Level, Lamp	160mA at 28Vdc
Overload, Resistive	4.0A at 28Vdc

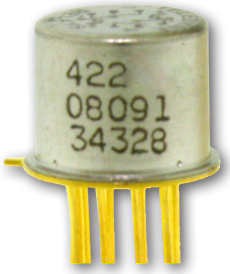
Form Factor	2 Form C (DPDT)	**Operating Temperature**	–65°C to +125°C
Frequency Range	DC-3 GHz	**Vibration (Sinusoidal)**	30 g's 10 to 2500 Hz
Lead Finish	Gold Plated or Solder Coated	**Shock (Specific Pulse)**	100 g's, 6ms half sine
Hermetic Seal	1 x 10^{-8} atm-cm^3/s	**Weight**	0.10 oz. (2.84) max.



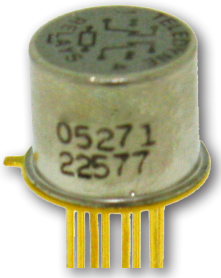
HR255 SHECMATIC



HR255



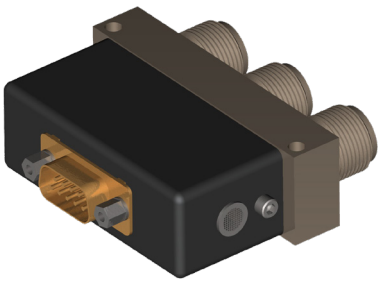
HR422 / HRS422



HR412 / HRS412

Form Factor	2 Form C (DPDT)	**Operating Temperature**	–65°C to +125°C
Frequency Range	DC-3 GHz	**Vibration (Sinusoidal)**	30 g's 10 to 2500 Hz
Lead Finish	Gold Plated or Solder Coated	**Shock (Specific Pulse)**	100 g's, 6ms half sine
Hermetic Seal	1 x 10^{-6} atm-cm^3/s	**Weight**	0.10 oz. (2.84) max.

COAXIAL SPDT SWITCH

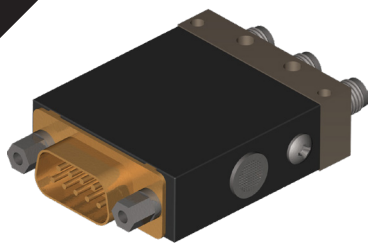


H-32N

Form Factor	SPDT, break before make
Frequency Range	L, S, C, X
RF Leakage	-95 dBc, 10dBm, @300 MHz
Characteristic Impedance	50 Ohms
Operating Temperature	–55°C to +85°C
Vibration, 10 ~ 2000 Hz, 300 s (MIL-STD-202 Method 214, Condition C)	10 G peak
Shock, Half-Sine Pulse (MIL-STD-202 Method 213, Condition D)	500 G peak

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 (max)	0.2 dB	0.3 dB	0.4 dB	0.55 dB
Isolation (min)	70 dB	70 dB	70 dB	60 dB
VSWR (max)	1.2:1	1.3:1	1.3:1	1.6:1

SPACE



H-33S

Form Factor	SPDT, break before make
Frequency Range	L, S, C, X, KU, K
RF Leakage	-95 dBc @ 300 MHz
Characteristic Impedance	50 Ohms
Operating Temperature	–55°C to +85°C
Vibration, 10 ~ 2000 Hz, 300 s **MIL-STD-202 Method 214, Condition C**	10 G peak
Shock, Half-Sine Pulse **MIL-STD-202 Method 213, Condition D**	500 G peak

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**	**F18 (KU-BAND) 12-18 GHz**	**F26 (K-BAND) 18-26 GHz**
Insertion Loss (max)	0.15 dB	0.25 dB	0.35 dB	0.35 dB	0.40 dB	0.65 dB
Isolation (min)	80 dB	70 dB	70 dB	70 dB	60 dB	55 dB
VSWR (max)	1.5:1	1.25:1	1.30:1	1.35:1	1.40:1	1.65:1

TRANSFER SWITCH

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 (max)	0.2 dB	0.3 dB	0.4 dB	0.6 dB
Isolation (min)	70 dB	70 dB	60 dB	60 dB
VSWR (max)	1.20:1	1.30:1	1.40:1	1.65:1

H-47N

Form Factor	Transfer, break before make
Frequency Range **H-37N** **H-37S**	 L, S, C, X L, S, C, X, KU, K
RF Leakage **H-37N** **H-37S**	 -95 dBc, 10dBm, @300 MHz -95 dBc @ 300 MHz
Characteristic Impedance	50 Ohms
Operating Temperature	–55°C to +85°C
Vibration, 10 ~ 2000 Hz, 300 s **MIL-STD-202 Method 214, Condition C**	10 G peak
Shock, Half-Sine Pulse **MIL-STD-202 Method 213, Condition D**	500 G peak

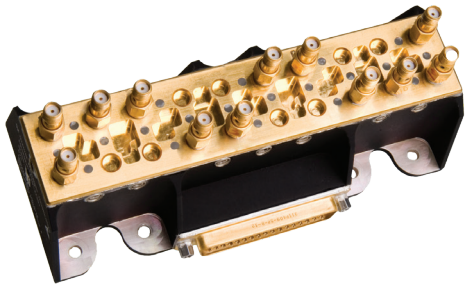
H-37S

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**	**F18 (KU-BAND) 12-18 GHz**
Insertion Loss (max)	0.15 dB	0.25 dB	0.35 dB	0.50 dB	0.65 dB
Isolation (min)	80 dB	70 dB	70 dB	70 dB	60 dB
VSWR (max)	1.15:1	1.30:1	1.35:1	1.40:1	1.60:1

SWITCH BLOCK

What is a switch block?

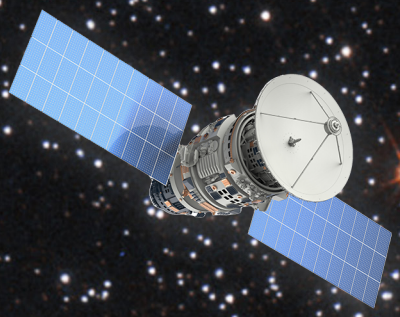
A switch block is a system composed of multiple individual space qualified switches connected to achieve multi-input and multi-output configurations, allowing you to reduce space. A switch block can consist of SPDT and Transfer switches to achieve customized switching configurations.



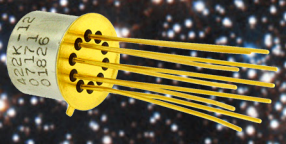
Teledyne Switch Blocks Feature:

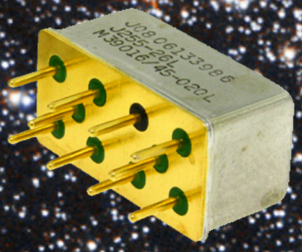
- D-Connectors
- Custom Mounting
- Venting (Pressure Control)
- Custom switching patterns
- Transient Suppression (Diode Protection)
- Custom Telemetry Interfaces/ Connections

SPECIFICATIONS ARE SUBJECT TO CHANGE



Switching Solutions for Diverse Industries





TELEDYNE RELAYS

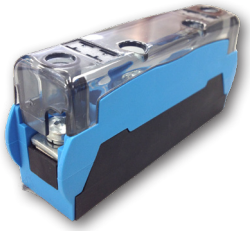
TELEDYNE COAX SWITCHES

Everywhereyoulook™

INDUSTRIAL SOLID STATE RELAYS (AC)

SH Series
Single Phase AC
Output to 125A, 690Vac
SSR w/ Touch-proof Flaps

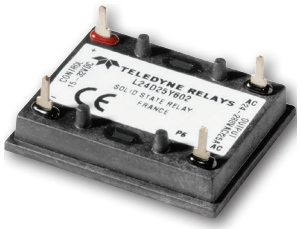
S Series
Single Phase AC
Up to 125A, 660Vac
Hockey Puck SSR



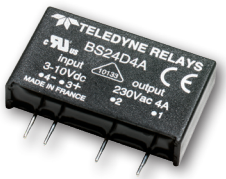
DH Series
Single Phase AC
Up to 50A, 600Vac SSR

SD Series
Up to 50A 600Vac Hockey
Puck Dual SSR

FS Series
Single Phase AC
Up to 20A, 280Vac
Miniature SSR



L Series
Single Phase AC
25A, 280Vac Ultraminiature SSR



BS Series
Single Phase AC
4A, 600Vac SIP

			CURRENT								
											≤ 125A
										≤ 95A	
									≤ 75A		
								≤ 50A			
							≤ 35A				
						≤ 25A					
					≤ 12A						
				≤ 9A							
			≤ 4A								
AC	LINE VOLTAGE	240Vac (≤ 280Vac)	AS4			SH	SH	SH	SH	SH	SH
			BS		STH	STH	STH	STH			
					S	S	DRS	SHP			
					ST	ST					
								SD			
					FS	FS					
						DH					
						L					
						LS					
						C3P					
						SQ					
		480Vac (≤ 520Vac)	AS4		G	DR3P	SH	SH	SH	SH	SH
					S3P						
						S		S	S	S	S
							DH				
								SD			
							XV	E3P2G	E3P2G		
					E3PT			E3PT			
		600Vac (≤ 690Vac)	AS4			LS	LS	SH	SH	SH	SH
			BS				STH	STH	STH		
								S	S	S	S
					ST	ST		ST	ST		
								SD			
								E3PT	SD		
					E3P2G	E3P2G		E3P2G	E3P2G		

E3P2G Series
Three Phase SSR
Up to 75A, 600Vac

SQ Series
Quad Output SSR
25A, 280Vac each

TS Series
Single Phase AC
2A, 275Vac PCB SSR

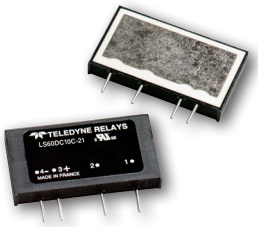
INDUSTRIAL SOLID STATE RELAYS (DC)

			CURRENT									
												≤ 150A
											≤ 125A	
										≤ 95A		
									≤ 75A			
								≤ 50A				
							≤ 35A					
						≤ 25A						
					≤ 12A							
				≤ 9A								
			≤ 4A									
DC	Voltage	≤ 36Vdc			LS10							
		≤ 60Vdc	DX					SHDC				S75
			DS									
		≤ 130Vdc					S20	SHDC			S20	
		≤ 220Vdc	DX									
			DS									
		≤ 350Vdc						S60			SI	

SI Series
DC SSR
Output up to 100A, 500Vdc

S60DC40 Series
DC SSR w/ status LED
Output 40A, 350Vdc

DX Series
Up to 3A, 60Vdc
DIN Rail SSR
Optional LED



LS10 Series
DC SSR
10A, 60Vdc PCB mount

S75DC150 Series
DC SSR w/ status LED
Output 150A, 42Vdc

SHDC Series
Output up to 40A, 100Vdc
Over-voltage protection
IP20 touch-proof flaps

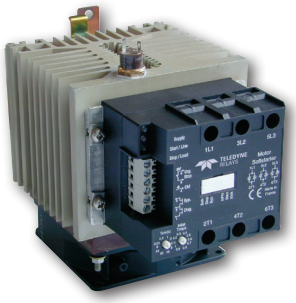
MOTOR CONTROLLERS

EMCRT Series

Part Number	Motor Current	Main Voltage	Peak Voltage	Switch Type	Control Voltage	I^2T
EMCRT48D50	8.5A	24-520 Vac	1600 Vpk	Zero Cross	12-30 Vdc	1500A²S
EMCRT48D75	16A	24-550 Vac	1600 Vpk	Zero Cross	12-30 Vdc	5000A²S

- Up to 10hp motors
- Controls and reverses 3-Phase motors without direct third leg (two legs)
- IP20 touch-proof housing
- Built-in snubber and MOV
- Very high immunity components, 1600Vpeak
- Forward/Reverse display LED

- Reduce high in-rush currents
- Reduce mechanical stress on load
- Heat Sink and Fan integrated
- Diagnostic feedback
- Soft-Start Motor Controller, designed for up to 25kW motors



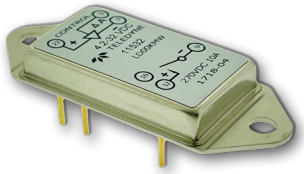
EMCRT Series

Max. Motor Power @40°C				IAC53a @40°C		Phase to Phase Voltage	Mains Frequency	Input	Status Output	In/Out/ Case Isolation	Operating Temp
Star (Y)		Delta (D)		Max.	EN60947-4-2						
400Vac	230Vac	400Vac	230Vac								
15kW	8.6kW	26kW	15kW	30A	22.5A	200 to 480Vac	40 to 65Hz	10 to 24Vdc	24V/1A AC/DC	4kV	–40°C to +100°C

MSSR

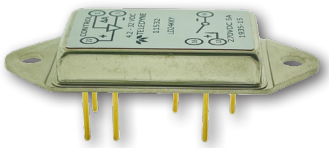
Military Solid-State Relays; for applications where more robust and highly qualified parts are required. Teledyne Relays offers high-performance products designed to comply with MIL-PRF-28750.

SILICON CARBIDE TECHNOLOGY

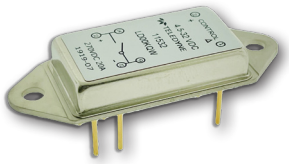


LD00KM
10A, 270Vdc Load
4.2-32Vdc Control

- Meets MIL-STD-704
- Tested Per MIL-PRF-28750
- Low ON resistance
- Low Profile
- Hermetic Package
- Silicon Carbide MOSFET

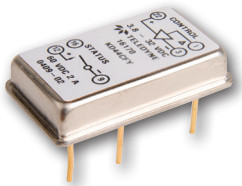


LD24KK
5A, 270Vdc Load
4.2-16Vdc Control
Short Circuit Protection & Trip Status



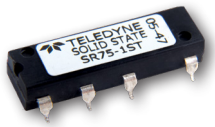
LD00KQ
20A, 270Vdc Load
4.2-18Vdc Control

DC SOLID STATE RELAYS

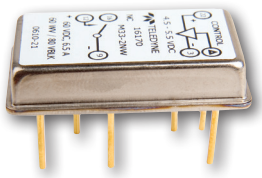


KD44CF
2A, 60Vdc Load
Direct, TTL or CMOS control

- Screened to MIL-PRF-28750
- Chassis & PCB Mount.
- Short-Circuit Protection
- Optical & Transformer Isolation
- Plastic & Hermetically Sealed

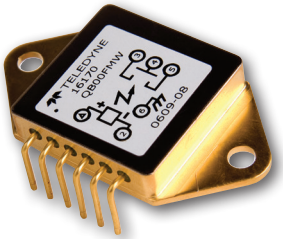


SR75-1ST
1.5A, 60Vdc Load
Surface Mount

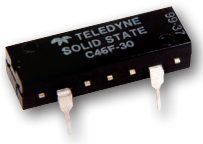


M33-2NW
7A, 60Vdc Load
Up to 100 Amp pulse load

BI-DIRECTIONAL / AC SOLID STATE RELAYS



QB00FM
7.5A, 150Vdc Load
±4.3A, ±150Vac Load

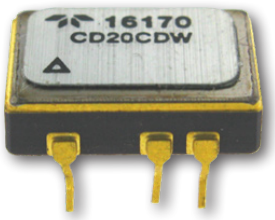


C46F Series
Bi-directional

- Meet MIL-PRF-28750
- Tested Per MIL-STD-704
- Up to 250Vac, 25A
- Chassis & PCB Mount
- Short-Circuit Protection
- Plastic & Hermetically Sealed

652
25A, 250Vrms Load
Zero-Cross

MILITARY QUALIFIED SOLID STATE RELAYS



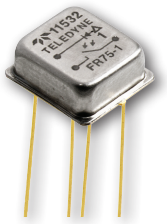
CD20CDY
DESC# 90091-004

List of QPL & DESC
Qualified Part Numbers

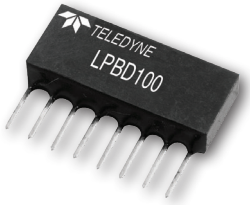
HD22CFY
DESC# 88062-002

COMMERCIAL

- Up to 250Vac, 10A
- Short-Circuit Protection
- Chassis and PCB Mount
- Zero-Cross & Random Switching
- Low Off-State Leakage Current



FR75-1



LPBD100

C60

SCREENING LEVELS

Inspection	S²R Level "W"	S²R Level "T"	MIL-PRF-28750 Level "Y"
Destructive Wirebond Pull Test (Sample test) MIL-STD-883 Method 2011	✓	✓	✓
Internal Visual MIL-STD-883 Method 2017	✓	✓	✓
Constant Acceleration MIL-STD-883 Method 2001, 5000 Gs, Y1 axis			✓
Temperature Cycling MIL-STD-883 Method 1010, 10 cycles	✓ Specified temp range	✓ Specified temp range	✓ –55° to +125°C
Load Conditioning 3 hours at rated input and load 90% duty cycle, 1 to 30 operations per second (latching fault indication for drop out)	✓	✓	✓
Pre Burn-In (optional)			✓
Burn-in Test MIL-STD-883 Method 1015, 160 hours at specified temperature and rated load (latching fault indication on failure)		✓ (48 hours of same testing for plastic-packaged relays)	✓
Dielectric Withstanding Voltage MIL-STD-202 Method 301	✓	✓	✓
Insulation Resistance MIL-STD-883 Method 1003	✓	✓	✓
Electrical Characteristics at –55°C		✓	✓
Electrical Characteristics at +25°C	✓	✓	✓
Electrical Characteristics at +125°C (or as specified)		✓	✓
Seal MIL-STD-202 Method 112 (Gross) MIL-STD-883 Method 1014 (Fine)	✓ (N/A for plastic-packaged relays)	✓ (N/A for plastic-packaged relays)	✓
Visual/Mechanical (Sample test)	✓	✓	✓
Solderability (2 Samples) MIL-STD-202 Method 208		✓	✓

InP

Teledyne's New line of SPDT Indium Phosphide Active RF Switches provide low insertion loss and high linearity, with bandwidths from DC up to 60GHz

Active RF Switches

DESCRIPTION

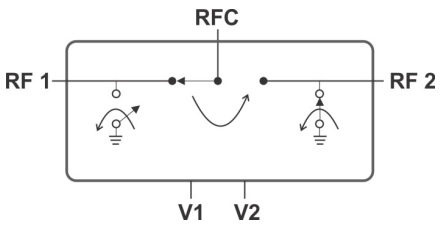
The InP1012-60 is a highly compact, reflective SPDT Active RF switch, manufactured using Teledyne's high-speed, low-loss InP HEMT process. The switch die is packaged in a low-loss, surface mount package, with a small form factor: 3mm (L) × 3mm (W) × 1mm (H). It supports a wide frequency range from DC to 60 GHz, and delivers low insertion loss, fast switching time, and good isolation—making this switch ideal for test and measurement, microwave communications, and radar applications. The InP1012-60 can also tolerate up to 100krads of radiation, allowing it to be used in space applications.

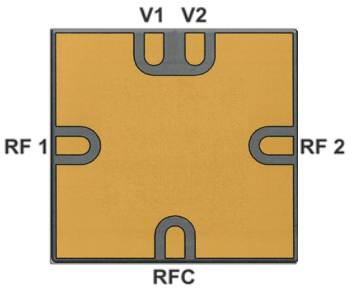
The following unique construction features and manufacturing techniques provide excellent robustness to environmental extremes and overall high reliability:

- Monolithic solid-state switch with no mechanical wear
- Flip-chip packaging provides shock & vibration resistance
- ENEPIG surface finish for solder bonding
- Low loss package with organic overmold
- Test board with K-connector can be provided

The InP1012-60 features:

- High digital bandwidth, greater than 40 Gbps
- Broad frequency bandwidth, DC - 60 GHz
- Small form factor, 3mm X 3mm X 1mm
- Low insertion loss
- Very High linearity
- Wide operating temperature
- Radiation tolerant up to 100krads
- Very fast switching time of less than 100ns





ENVIRONMENTAL AND PHYSICAL SPECIFICATIONS		
Temperature (Ambient)	**Storage**	–65°C to +125°C
	Operating	–65°C to +125°C
Enclosure		Low-Loss Surface Mount Package
ESD Sensitivity (HBM)		Class 1
MSL Sensitivity		TBD
Radiation Tolerance		100krads

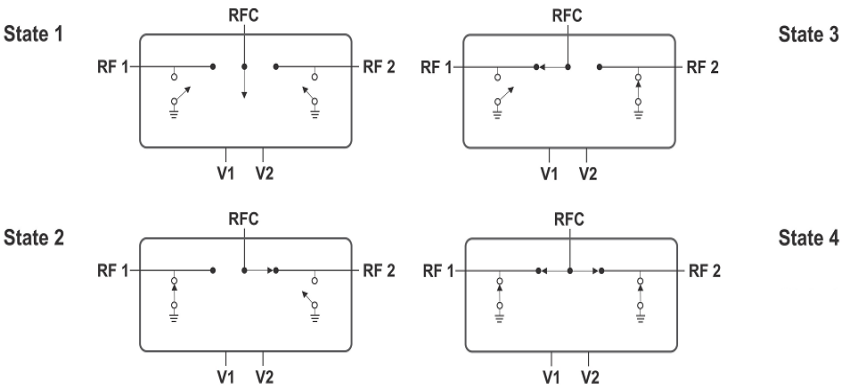
RECOMMENDED OPERATING CONDITIONS

Parameter	MIN	TYP.	MAX	UNIT
Control ON (V1,V2)	-0.3	0	+0.3	V
Control OFF (V1,V2)	-2.0	-2.5	-3.0	V
Control Current		200	700	µA

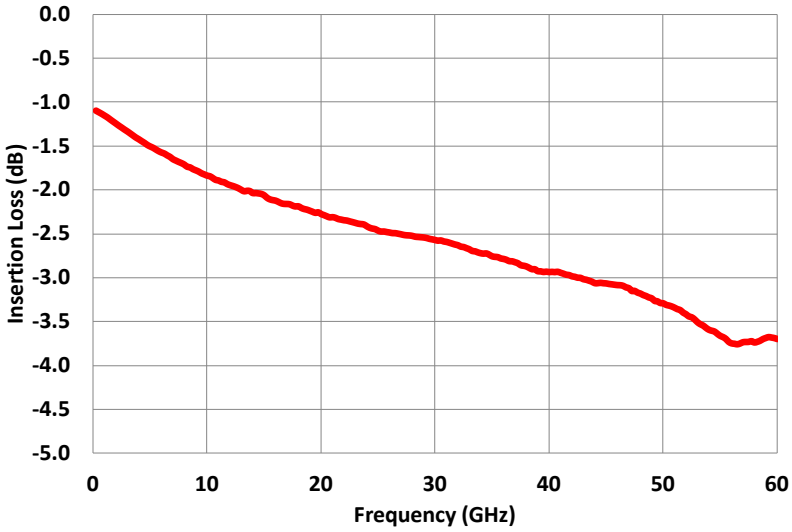
SWITCH STATES

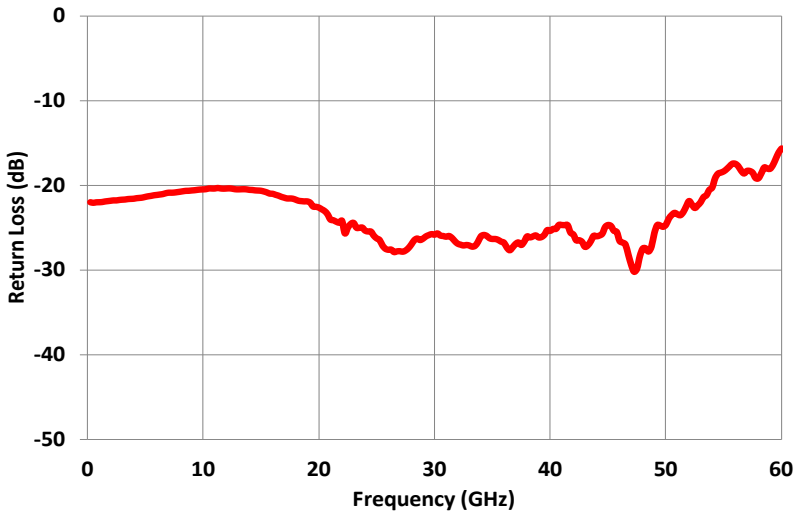
V1	V2	RF1	RF2	STATE
-2.5V	-2.5V	OFF	OFF	1
-2.5V	0V	OFF	ON	2
0V	-2.5V	ON	OFF	3
0V	0V	ON	ON	4

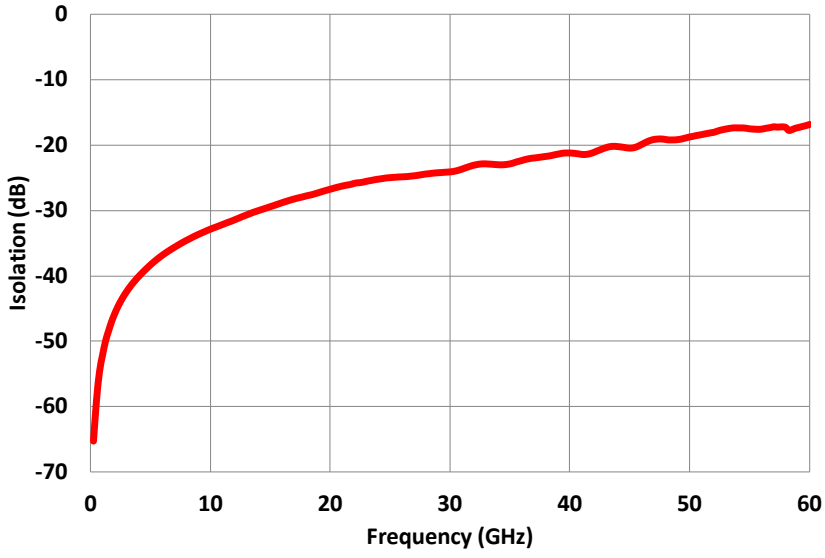
Note: Operation between -0.3V and -2.0V is not recommended.



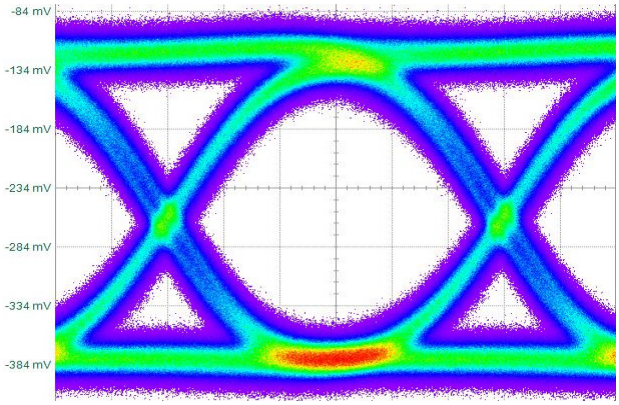
Insertion Loss and Isolation Plots



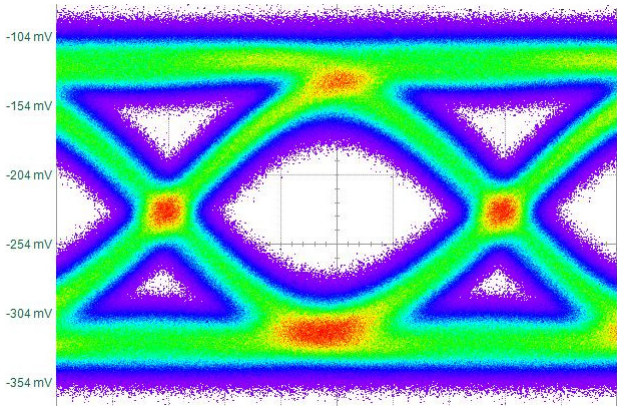




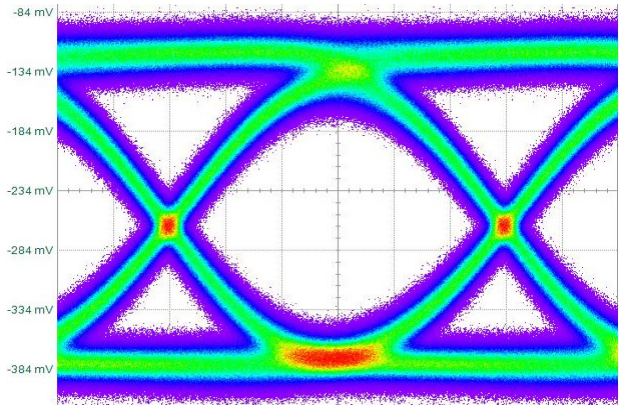
Typical Signal Integrity Plots at 40 Gbps



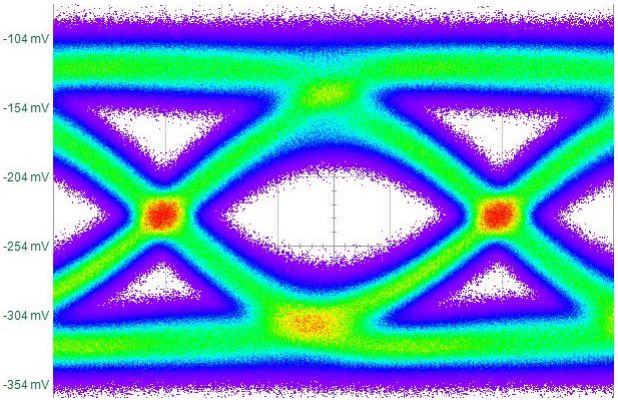
Reference @ 40 Gbps



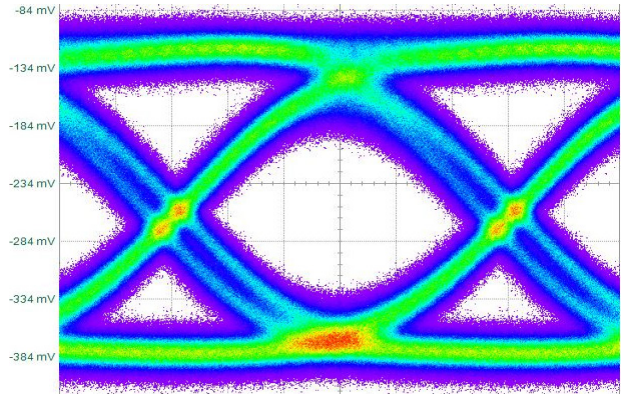
InP1012-60 @ 40 Gbps



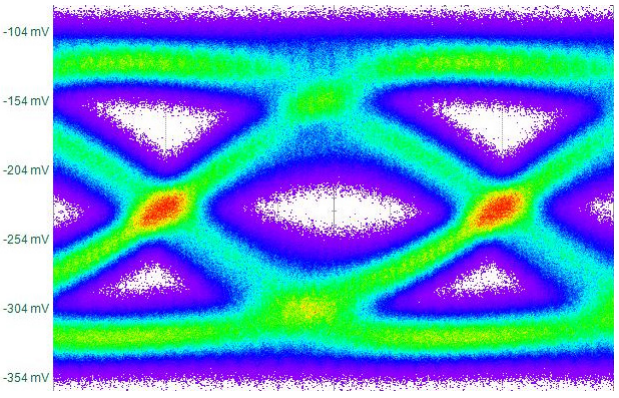
Reference @ 48 Gbps



InP1012-60 @ 48 Gbps



Reference @ 56 Gbps



InP1012-60 @ 56 Gbps

MEASUREMENTS NOTES
DUT measurements were made using an oscilloscope.
The relay was mounted on an evaluation board.

Pattern Generator Settings
- $2^{31}-1$ PRBS signal
- 40Gbps data rate
- Data amplitude of 500mVpp

Electrical Specifications

GENERAL ELECTRICAL SPECIFICATIONS (@25°C)

Contact Arrangement	1 Form C (SPDT)
Rated Duty	Continuous
Operating Power	1-2 mW
Switching Time	60-100 ns

TYPICAL ELECTRICAL SPECIFICATIONS

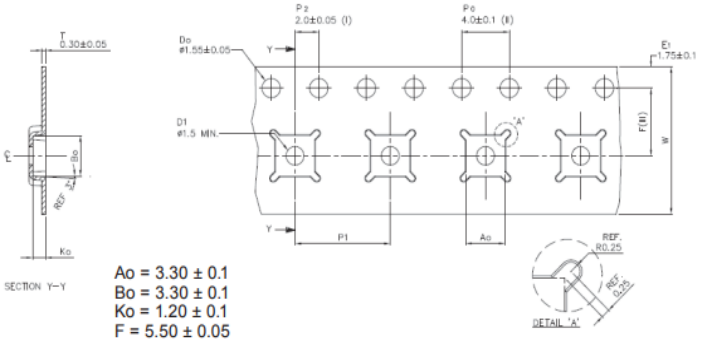
(@25°C, V1 = ON, V2 = OFF OR V1 = OFF, V2 = ON, Z_S =Z_L = 50 Ω)
OPERATING FREQUENCY: DC - 60GHz

Parameter/Condition	Path	Condition	Typical	Unit
Insertion Loss	**RFC-RFX**	DC (20mV - 200mV) * 10 kHz 100 MHz 6 GHz 14 GHz 20 GHz 30 GHz 40 GHz 50 GHz 60 GHz	2.0 0.9 1.2 1.6 2.0 2.3 2.6 2.9 3.3 3.7	dB dB dB dB dB dB dB dB dB dB
Isolation	**RFC-RFX**	10 kHz 100 MHz 6 GHz 14 GHz 20 GHz 30 GHz 40 GHz 50 GHz 60 GHz	67 60 37 30 27 24 21 19 17	dB dB dB dB dB dB dB dB dB
Isolation	**RF1-RF2**	100 MHz 100 MHz - 26.5 GHz 26.5-40 GHz 45- 60 GHz	69 32 27 17	dB dB dB dB
Return Loss (active port)	**RFC-RFX**	100 MHz 6 GHz 14 GHz 20 GHz 30 GHz 40 GHz 50 GHz 60 GHz	23 21 21 23 26 25 25 16	dB dB dB dB dB dB dB dB
Input 0.1dB compression point		100 MHz 6 GHz 18 GHz	3.1 15.7 14.9	dBm dBm dBm
Input 1dB compression point		100 MHz 6 GHz 18 GHz	8.6 21.1 21.8	dBm dBm dBm
Input 3rd Order Intercept (IIP3)		10GHz	37.5	dBm

DIE INFORMATION

PARAMETER	MIN	TYP	MAX	UNIT
Die Size, Singulated (x,y)	**820 x 950**	**830 x 960**	**840 x 970**	**µm**
Wafer Thickness	**615**	**625**	**635**	**µm**
Bump Pitch	**150**			**µm**
Bump Height	**50**	**60**	**70**	**µm**
Bump Diameter		**79**		**µm**
UBM Diameter	**65**	**69**	**74**	**µm**

TAPE AND REEL PACKAGING



Ao = 3.30 ± 0.1
Bo = 3.30 ± 0.1
Ko = 1.20 ± 0.1
F = 5.50 ± 0.05
P1 = 8.00 ± 0.1
W = 12.00 ± 0.3

CUSTOM SOLUTIONS

Teledyne has over 50 years of experience in developing a wide spectrum of custom solutions.

HYBRID SOLUTIONS

Experienced in Custom Hybrid Solutions

Teledyne Relays is a leading manufacturer with the capability of providing build-to-print solutions on hybrid microcircuits devices. Our current products portfolio includes solid state power controllers, DC/DC converters, high current drivers, digital-analog converters, activator control hybrids, deflection amplifiers, base drivers, custom designed multi-layers thick-film/thin film substrates and many more...

With over 50 years of heritage in serving the space, aerospace, and defense markets, Teledyne continues to uphold the same standards and commitment to excellence. Our optimized solutions are supported by teams of engineers and manufacturing personnel with wide ranging experiences in developing products deployed in highly demanding applications, such as electrical power systems, radar receivers, and stores management solutions, for ground or aerial defense platforms.

Teledyne is accredited by Defense Logistics Agency (DLA) in accordance with MIL-PRF-38534, Class H and Class G Qualified Manufacturers List (QML). Since 2014 Teledyne has successfully launched over twenty hybrids into production for our customers. We welcome opportunities to partner with our customers to provide customized solutions to your hybrid needs. Our typical custom solution development cycle is as follows:

Submit an Inquiry Here!

HYBRID MICROCIRCUITS

General Hybrids Assembly

While there are different approaches in hybrid manufacturing, a standard hybrid involves the integration of active and passive chips into a substrate using eutectic and/or epoxy attach processes, substrate attachment to metal enclosure, clean, wire bonding, trim (as required) and test, and hermetic sealing. In essence chip-and-wire is the core technology of hybrid assembly utilizing different tightly controlled and repeatable processes to assemble products with precision, consistency and reliability. Such products will be subjected to the environmental stress screening (ESS) testing in accordance with the MIL-PRF-38534 unless otherwise specified by special customer requirements.

Hybrid Microcircuits vs Printed Circuit Assembly

There are substantial advantages in using hybrid microcircuits when compared to printed circuit assembly (PCA):

- **Miniaturization** - Hybrids utilize unpackaged dies which are significantly lower in size and weight than the packaged devices used on PCA. Although they may not be more economical to produce then PCA are, when the mass of PCA are considered in the overall cost hybrids become comparable in application where size and weight matters.

- **Hermetic Protection** - Hybrids are microcircuits contained within a hermetically sealed and corrosion resistance enclosure. All components are protected from moisture ingress or other adverse environmental changes.

- **Wider Operating Temperature Range** – Since materials used in hybrids microcircuits generally are capable of handling higher temperature than PCA materials can, hybrids microcircuit are designed into critical applications where wider temperature ranges are needed.

- **Better Thermal Management** – Commonly used PCB materials inherently has poor thermal conductivity creating hotspots which may affect life of the components mounted nearby. Hybrids use higher thermally conductive Alumina, Aluminum Nitride or Beryllium Oxide (BeO) substrates to help dissipate heat more uniformly over the surface and increase components lifespan in general.

- **Higher Reliability** – Hybrids use significantly fewer solder joints than PCA do which increase the fundamental reliability of the circuits. Since it is hermetically sealed, circuits interconnections are contained within the hybrid shielded from the adverse influence of the environment in which the application may be exposed to.

- **Recognized Qualification** – When required, hybrid microcircuit may be qualified in accordance with the MIL-PRF-38534 as a standalone item for Class G, Class H or Class K as applicable to demonstrate performance and reliability of such design. Standard hybrids are subjected to burn-in and MIL-PRF-38534 Group A screening requirements to assure high quality is maintained.

CUSTOM SOLUTIONS

Teledyne Relays has developed extensive experience and strong capabilities in the following areas:

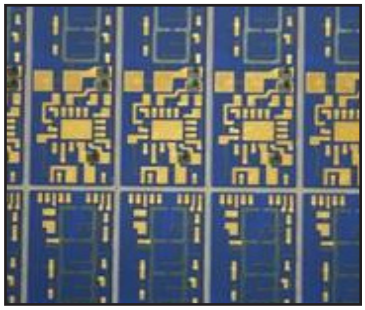
THICK & THIN FILM SUBSTRATES

Thin Film Substrates

- Ti-W, Au, Ni, NiCr, TaN on Al2O3, BeO, AlN
- Thermal Evaporation & Sputter Deposition
- Additive Process
- Etch-back Process

Thick Film Substrates

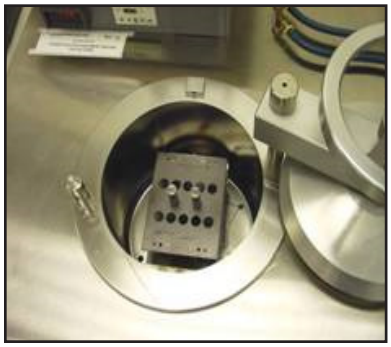
- Au/Ag on Al203, BeO, AlN
- Diffusion Patterning™
- Resistor Network
- Multiple Layers

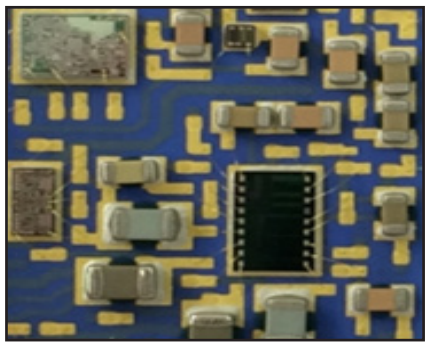


COMPONENT & SUBSTRATE ATTACHMENT

Component Attachment

- Au/Ag on Al203, BeO, AlN
- Void-free Eutectic Die Attach
- Fully Automatic Pick and Place



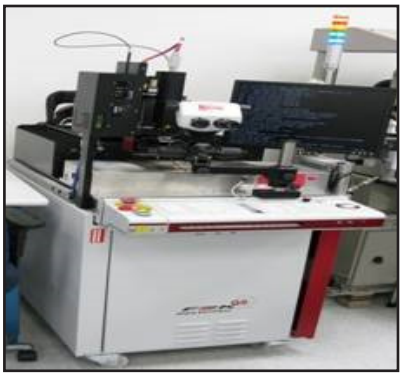


Substrate Attachment

- Au/Ag on Al203, BeO, AlN
- DAP Vacuum Assisted Soldering Attach

WIRE BONDING

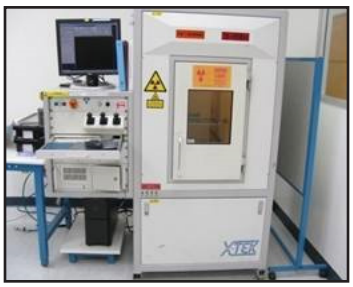
Automatic Wire bonding
- Hughes/Palomar
- Delvotec
- Orthodyne



Manual Wire bonding
- K&S
- High Bond
- Orthodyne

CLEANING & INSPECTION

Cleaning
- DL Aqueous
- Plasma
- Solvent



Inspection & Qualification
- XRF Scan
- Real Time X-ray
- Mechanical Shock
- Vibration (Random & Sine)
- Salt Atmosphere

ENVIRONMENTAL SCREENING & TESTING

Trim and Test

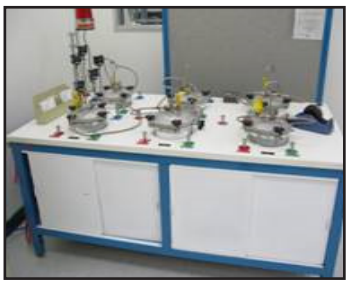
- Active Laser Trim
- Electrical Testing
- Fully Automated Test Systems




Hermetic Sealing & Burn-In

- Projection Weld & Seam Seal
- Pre-programmed Burn-in Cycling

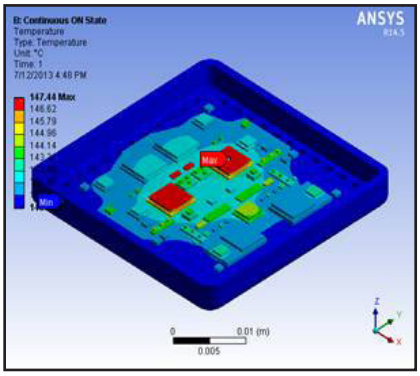




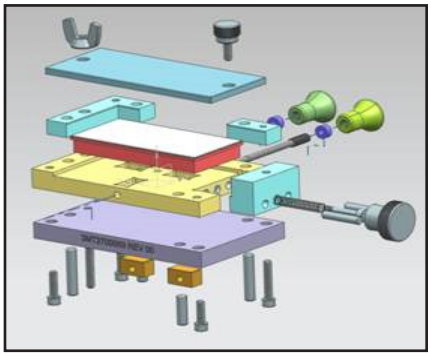

Environmental Stress Screening

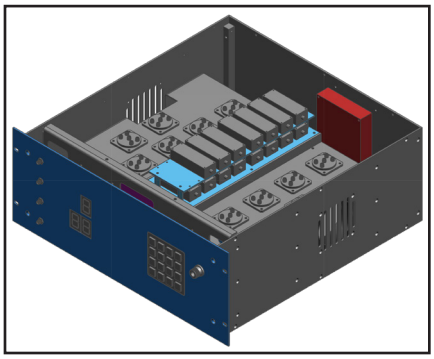
- Temperature Cycle
- Centrifuge/Acceleration
- Particle Impact Noise Detection
- Fine & Gross Leak Test


ENGINEERING SERVICES



- Circuit Design to Functional Specification
- Proof-of-Concept Design Verification
- ANSYS Thermal and Mechanical Stress
- Substrate Layout
- Test Fixture and Test Systems Design
- Assembly and Validation
- Burn-In Boards Design and Fabrication
- LabVIEW/TestStand Programming
- Element Evaluation
- SEM Analysis





HYBRID MICROCIRCUIT CERTIFICATION

Class H: Standard Military Quality Level

Class G: QML listing in accordance with 4.5.2.2

MIL-PRF-38534
HYBRID MICROCIRCUIT CERTIFICATION
FOR
CLASS H
IS HEREBY AWARDED TO

Teledyne Relays
12525 Daphne Avenue
Hawthorne, CA 90250

THIS CERTIFICATION IS VALID UNTIL TERMINATED BY WRITTEN NOTIFICATION FROM DLA LAND AND MARITIME. REFERENCE DLA LAND AND MARITIME LETTER VQ (VQH-21-035802) FOR DETAILS PERTAINING TO THIS CERTIFICATION.

WILLIAMS.EUGENE.1180650748
Digitally signed by WILLIAMS.EUGENE.1180650748
Date: 2021.01.15 14:42:24 -05'00'

EUGENE WILLIAMS JR.
Director Engineering & Technical Support Directorate (V)
DLA, Land & Maritime

RoHS and REACH CERTIFICATE OF COMPLIANCE

RoHS

It is hereby stated and certified that Teledyne Relays complies with the Restrictions on Hazardous Substances, RoHS 3 Directive (2015/863/EU) Directives to the extent herein:

Teledyne Relays does not use any of the Restricted Substances specified by the RoHS Directives (listed below) as components in our Electromechanical Relay, Coax Switch, and Industrial Solid-State Relay products. None of these substances are employed during any manufacturing process:

- **Lead**
- **Mercury**
- **Cadmium**
- **Hexavalent Chromium**
- **Polybrominated Biphenyls (PBB's)**
- **Polybrominated Diphenyl Ethers (PBDE's)**
- **2-ethylhexyl) phthalate (DEHP)**
- **Butyl benzyl phthalate (BBP)**
- **Dibutyl phthalate (DBP)**
- **Diisobutyl phthalate (DIBP)**

However, upon request from the Customer, relay leads may be coated with lead solder, which contains 60% tin and 40% lead.

REACH

It is hereby stated and certified that Teledyne Relays complies with the Registration Evaluation Authorization and Restriction of Chemicals (REACH) Directives to the extent stated herein:

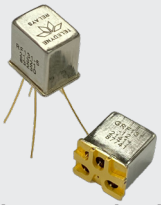
Teledyne Relays is a manufacturer of articles. Teledyne Relays has taken the initiative to review the (224) substances that are under consideration for treatment as Substances of Very High Concern (SVHC) candidates. Teledyne Relays confirmed that our relays do not contain any of the listed substances in concentration >0.1% weight per supplied article, substance or preparation weight.

RoHS or Non-RoHS:
Your Choice!

TELEDYNE RELAYS
Everywhereyoulook™

For Additional Information please E-Mail us at: relays@teledyne.com

About Us

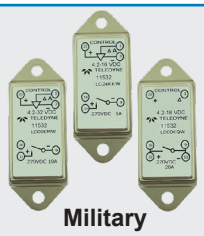


Electromechanical Relays

Coaxial Switches

Custom Matrix

Industrial Solid-State Relays



Military Solid-State Relays

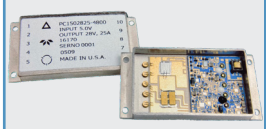
Vertically Integrated

50+ Years

Space Mission Heritage

Mini Matrix

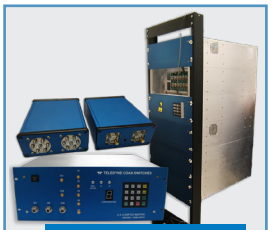
US Facility



Hybrid Micro-circuit Devices

MIL-PRF 39016 & MIL-PRF-28776

Environmental Test Lab



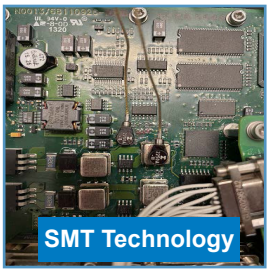
Value Added

7
Different Product Lines

10K+
Part Number Configurations

MIL-PRF-38534

Class H & K



SMT Technology

1000+

Defense Platforms Served

Missiles

Test & Instrumentation

HI-REL Space

Defense

Electronic Warfare

Communications

Aerospace

Radar

Teledyne Relays
12525 Daphne Avenue, Hawthorne, CA 90250
Phone: (323) 777-0077
E-mail: relays@teledyne.com

HEADQUARTERS
12525 Daphne Ave.
Hawthorne, CA 90250
Phone: (323) 777-0077 or (800) 284-7007
Fax: (323) 241-1287

EUROPE
9-13 Napier Road
Wardpark North
Cumbernauld G68 OEF
Scotland UK
Phone: +44 (0) 1236 453 124
Fax: +44 (0) 1236 780 651

E-mail: relays@teledyne.com

www.teledynedefenseelectronics.com

TELEDYNE RELAYS
TELEDYNE COAX SWITCHES
Everywhereyoulook™

PRINTED IN U.S.A.

TR0822