

ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Visit our website - *Click HERE*

TELEDYNE MICROWAVE

Ordering Information

All Teledyne Microwave products can be ordered by contacting an authorized factory representative or directly from Teledyne Microwave (415) 968-2211. Inventory stock is normally delivered within two weeks.

Custom Engineering

Microwave components and subsystems can be built to specification. Contact Teledyne Microwave Marketing with your requirements.

Terms

Net 30 days from date of invoice.

Shipping

All orders are FOB, Mountain View, CA and shipped via UPS surface unless otherwise specified.

Customer Service

1-800-832-6869 (Outside CA)
1-415-960-8613 (Inside CA)

Our dedicated Customer Service Department can be contacted for:

- Delivery status
- Order expediting
- Returns and repairs

Please contact Customer Service prior to returning any material.

Coaxial Switch Part Numbers

CS - 33 S 1 C - T (Example)

Switch (2 or 3 characters)

CR	Coaxial Switch – Reduced Height
CS	Coaxial Switch – Standard Height
CT	Internally Terminated Coaxial Switch
SA	Switch Attenuator
SM	Switch Matrix

Series Type (2 characters)

33	Miniature SPDT DC – 22.0 GHz Designate inboard mount (21 GHz Max) with the letter I (Example: CRI-33)
32	Standard SPDT DC – 12.4 GHz
53	Miniature SPDT DC – 26.5 GHz
35	Miniature DPDT DC – 18.0 GHz
37	Miniature Transfer DC – 18.0 GHz
47	Standard Transfer DC – 12.4 GHz
38	Miniature Multi-Throw DC – 18.0 GHz
18	Standard Multi-Throw DC – 12.4 GHz
58	Miniature Multi-Throw DC – 26.5 GHz
39	Latching Multi-Throw DC – 18.0 GHz

Connector Type

S	SMA Female	**B**	BNC Female	**6**	Mixed Connectors
N	N Female	**T**	TNC Female	**X**	SC Connectors

Actuator Voltage (1 character)

1	28 VDC Failsafe
2	115 VAC Failsafe
5	Special Voltage – Failsafe
6	28 VDC Latching
7	115 VAC Latching
9	Special Voltage – Latching

Actuator Type (1 or 2 characters)

O	No cutoff or indicators
C	Indicator contacts only
D	Self cutoff only
E	Self cutoff and indicators
3-8	Indicates no. of positions on Multi-throw Switches

Dash Number (1 or more characters)

	Number denotes special and additional customer requirements
T	TTL Driver
D	Decoders and TTL Driver

TELEDYNE MICROWAVE • 1290 Terra Bella Ave. • Mountain View, CA 94043 • 415-968-2211 • FAX 415-966-1521

TTL Switch Driver Option

As a special option, on both failsafe and latching type switches, drivers can be provided which are compatible with industry standard low power Schottky TTL circuits.

VCC Input

The V_{cc} may or may not have to be connected to 5 volts as follows:

1. For a low current interface, connect V_{cc} to 5 volts. All units are provided with a 5 volt (V_{cc}) connection and internal pull up resistor (R1). With a 5 volt connection made, the logic input current drain is compatible with two low power Schottky TTL loads. (40 μA, high current)

2. For a high current interface, the V_{cc} connection is optional. If a high level logic input current drive (450 μA @ 2.4 volts) is available, the 5 volt (V_{cc}) connection need not be made.

Multi-Throw

Teledyne Microwave has two options available for TTL compatible drivers on multi-throw switches:

T-Option

This option uses a circuit similar to the SPDT and Transfer circuit. There is one control input for each position.

D-Option

This option includes a decoder. The control input is a 3-bit parallel word that is decoded to internally select the appropriate position.

Performance Parameters vs Frequency

Generally speaking, the performance of coaxial switches degrades with increasing frequency i.e., the VSWR and insertion loss increase and the isolation decreases. All Teledyne Microwave data sheets specify these three parameters as "worst case" at the highest operating frequency, either 12.4 GHz or 18 GHz depending on the type of switch used. If the switch is used only over a band whose upper limit is limited, much better specifications can be achieved. Special applications such as this, should be called out so that better performance can be offered.

Actuator Current vs Temperature

Due to the fact that actuator coil resistance will vary as a function of temperature, there is a resultant inverse relationship between switch operating temperature and actuator drive current. For switches operating at 28 volts D.C., the approximate actuator drive current at temperature, T, can be calculated from the equation:

$$I_T = \frac{28}{\frac{28}{I_A}\,[1 + .00385\,(T - 20)]}$$

Where:

I_T = Actuator current at temperature T

I_A = Room temperature actuator current—see catalog specification page

T = Temperature of interest in degrees celsius

Truth Tables

SPDT Failsafe

Logic Input	RF Path	
1	IN to 1	IN to 2
	Normally Closed	Normally Open
0	On	Off
1	Off	On

SPDT Latching

Logic Input		RF Path	
1	2	IN to 1	IN to 2
0	0	No Change	
1	0	On	Off
0	1	Off	On
1	1	Forbidden	

Transfer Failsafe
CS-37S10-T or CS-47N10-T

Logic Input	RF Path			
1	1-2	3-4	1-3	2-4
0	On	On	Off	Off
1	Off	Off	On	On

Transfer Latching
CS-37S60-T or CS-47N60-T

Logic Input		RF Path			
1	2	1-2	3-4	1-3	2-4
0	0		No Change		
1	0	Off	Off	On	On
0	1	On	On	Off	Off
1	1		Forbidden		

Multithrow
CS-38S16-D

Logic Input			RF Position					
1	2	3	1	2	3	4	5	6
0	0	0	On	Off	Off	Off	Off	Off
1	0	0	Off	On	Off	Off	Off	Off
0	1	0	Off	Off	On	Off	Off	Off
1	1	0	Off	Off	Off	On	Off	Off
0	0	1	Off	Off	Off	Off	On	Off
1	0	1	Off	Off	Off	Off	Off	On

Pin C Common
Pin J Vsw +28 Vdc
Pin 4 & 5 Spares

Multithrow
CS-38S16-T

Logic Input						RF Position					
1	2	3	4	5	6	1	2	3	4	5	6
1	0	0	0	0	0	On	Off	Off	Off	Off	Off
0	1	0	0	0	0	Off	On	Off	Off	Off	Off
0	0	1	0	0	0	Off	Off	On	Off	Off	Off
0	0	0	1	0	0	Off	Off	Off	On	Off	Off
0	0	0	0	1	0	Off	Off	Off	Off	On	Off
0	0	0	0	0	1	Off	Off	Off	Off	Off	On

Pin C Common
Pin J Vsw +28 Vdc
Pin B Vcc +5 Vdb
Pin 7, 8, D, E, F Spares

Applications

The transfer switch, whether it is adapted to coaxial or waveguide transmission lines is basically a modified double-pole-double-throw (DPDT) device. A true DPDT switch is a six port device that contains two completely independent transmission paths. in a transfer switch the two transmission paths are provided but are not totally independent as shown in Fig. 1.



Figure 1

The transfer switch has several interesting applications as follows:

Two Transmitters to Either of Two Antennas

Two microwave transmitters can be connected to either of two alternate antennas as shown in Fig. 2.

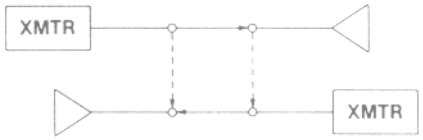


Figure 2

Circuit Insertion

A complete microwave circuit or circuit element can be inserted into a transmission line by using a transfer switch as shown in Fig. 3.

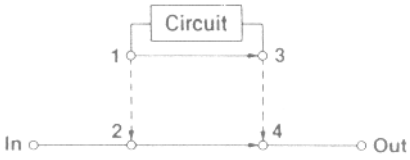
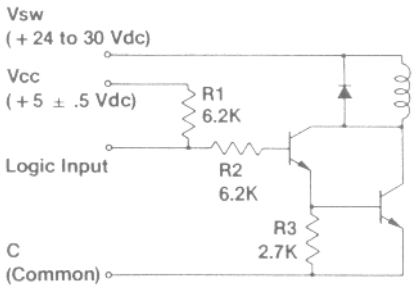


Figure 3

In the event that the 1-3 shorting of the microwave circuit is undesirable, this leg can be left out.

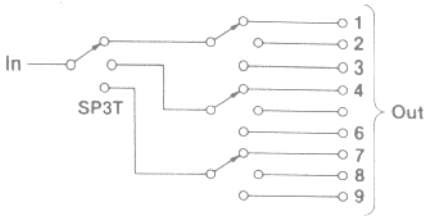
Basic Driver Schematic
SPDT and Transfer Switches



Failsafe uses 1 circuit
Latching uses 2 circuits
(Vsw, Vcc, & C are common to both circuits)

Series Application of Multi-Throw Switches

Many times requirements for greater than six position switches are encountered. Since it is difficult to design a high performance unit that has more than eight throws or positions, one solution is as shown:

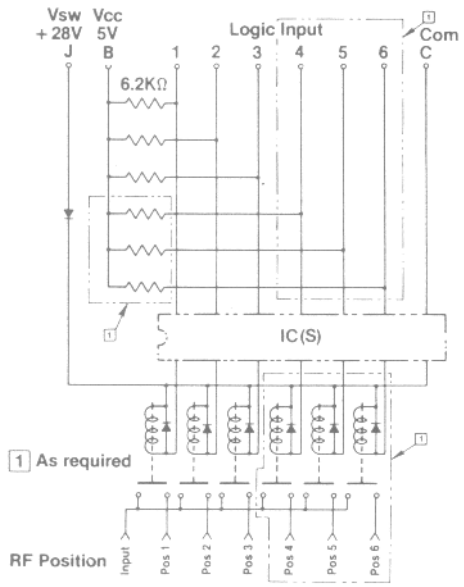


The example shows a single-pole-9-throw unit made up of 4 three-throw switches. The number of throws possible using this technique is essentially unlimited and is equal to the total number of throws available in the output stage. If a 2 stage unit were set up using 6 position switches, the resultant would be a total of 36 outputs or a SP36T switch bank.

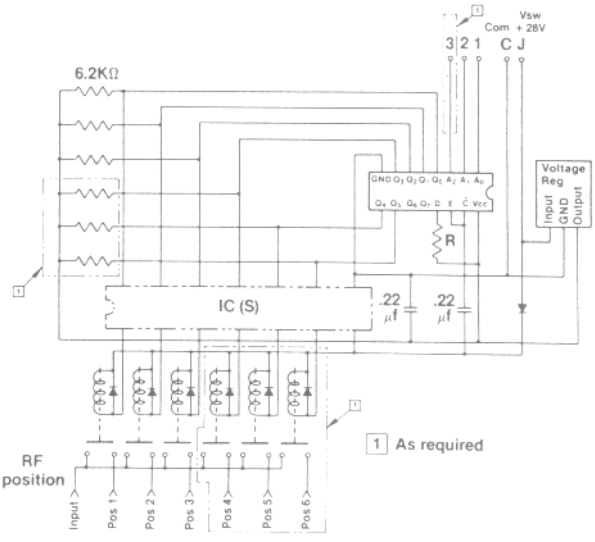
Magnetic Sensitivity

The switch can be sensitive to ferrous materials or external magnetic fields. Neighboring ferrous materials should be no closer than 0.5 inches and external magnetic field should have a flux density less than 5 gauss.

Basic T Schematic



Basic D Schematic



TELEDYNE MICROWAVE • 1290 Terra Bella Ave. • Mountain View, CA 94043 • 415-968-2211 • FAX 415-966-1521

Glossary of Switching Terms

Failsafe

A switch with an actuator that contains a spring return mechanism that provides RF connection to one selected position when no voltage is applied to the power terminals. This type of switch requires continuous voltage to maintain RF connection to any other position. For multi-position switches, the no voltage condition is all RF connections open.

Latching

A switch with an actuator that contains a mechanism, either mechanical or magnetic, that will maintain a chosen RF contact path whether or not voltage is maintained after switching is accomplished.

Self-Deenergizing/Self-Cutoff

Applies to latching switches only. A switch that has the ability to disconnect the actuator drive circuit so that D.C. current will not be consumed after switching has been accomplished. Self-cutoff can be accomplished either by using mechanical contacts or IC drive circuits.

Indicator Contacts

A set of internally mounted D.C. contacts that are mechanically connected to the actuator and transfer in one-to-one correspondence with the RF contacts. These contacts are usually wired to indicator lights to remotely show switch position, but in many cases, can also be used as interlock contacts. Indicator contact rating (max.) is 30 VDC, 50 mA, or 1.5 watts resistive load.

Switching Time

The total amount of time between application of voltage to the actuator terminals and completion of switching including all contact bounce, if any. Total switching time is made up of three parts, namely (1) inductive delay in the actuator coil, (2) transfer time of the RF contacts, and (3) bounce time of the RF contacts.

Actuator

The electromechanical mechanism that transfers the RF contacts from one position to another. Most Teledyne Microwave actuators use either linear or rotary solenoids acting on mechanical linkage to the RF contacts.

SPDT Switch

Single-Pole-Double-Throw. A switch with one input and two output ports.

Multi-Throw Switch

A switch with one input and more than two outputs. Standard Teledyne Microwave switches (CS-38, CS-58, CS-18 and CS-39) provide up to 8 outputs operating from a single input.

Transfer Switch

A four-port switch that provides two independent pairs of RF paths through it. These pairs are actuated simultaneously, such actuation being similar to that of a double-pole-double-throw switch. See application notes as to typical usage.

Isolation

The measure of the power level at the output connector of an unconnected RF channel as referenced to the power at the input connector. Specified in dB below input power level.

Internal Termination

Applies to SPDT and Multi-Throw switches. An unselected input or output port will be connected to an internal 50 ohm termination. Switches without internal termination will open circuit the unselected ports and the VSWR will be infinite.

Attenuator Switch

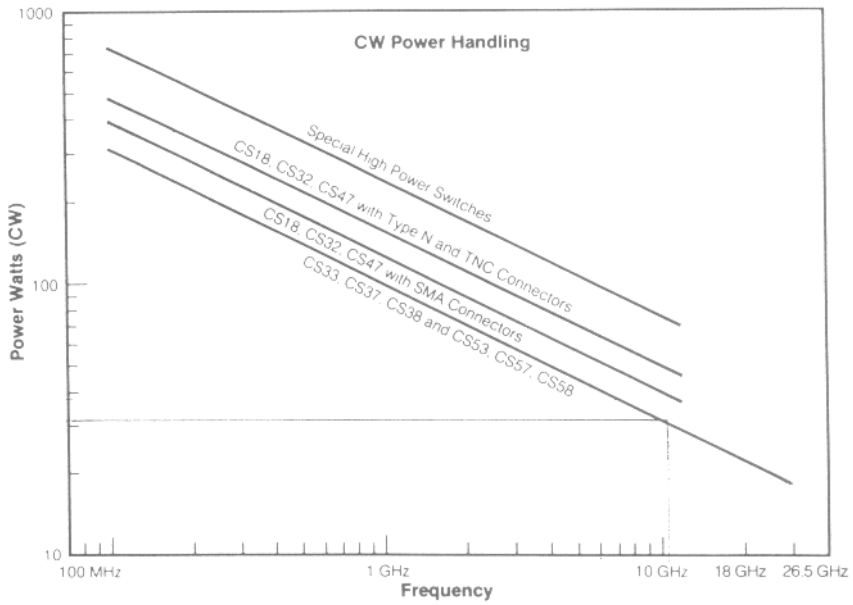
A two state switch that has a low loss and a high loss state. The low loss state insertion loss is typically 0.5 dB or less. The high loss state is precision level of attenuation such as 10, 20, 30 dB.

Arc Suppression Diode

A diode connected in parallel with the coil. The diode will clip the back emf spike to 0.7 volts when the coil is de-energized. The diode cathode is connected to the positive side of the coil and the diode anode is connected to the negative side.

Date Code

Either serial numbers or date codes are marked on the switches. The date code is in accordance with MIL-STD-1285A and consists of four digits. The first two digits are the year, and the last two digits are the week of that year (YYWW). Thus, 8604 will be switches which went through final inspection during the fourth week of 1986.



Power Handling Capability (watts cw)

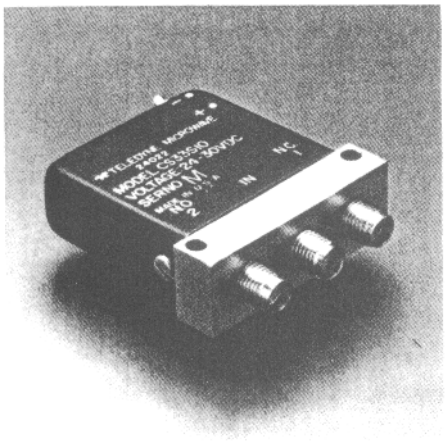
There are several factors which determine the power handling capability of a given switch design. The following graph, however, may be used as a baseline for selecting an appropriate switch model.

Notes:

1. This graph is based on the following reference conditions:
   - A/ Ambient temperature 40°C
   - B/ Sea Level operating
   - C/ 1.2 VSWR load
   - D/ Non Switching

2. For applications calling for low pressure, high altitude or severe temperature requirements, the above power ratings would be derated. Please contact factory for specific information.

Failsafe DC-22 GHz Miniature SPDT Switches



CS-33S10

CS-33 Series

DC-22 GHz*

SMA Connectors

Description

The Type CS-33 Failsafe Switch is a broadband SPDT electro-mechanical switch designed to switch microwave signals from a common input to either of two outputs. Designed for 50 ohm transmission lines, the unit is set up for minimum size compatible with SMA connector spacing. Two different mounting hole configurations are offered: standard and optional inboard mounting.

The failsafe switches on this page are provided with a spring operated actuator which is particularly desirable in applications where the switch is connected to one position (normally closed) most of the time and only periodically is switched to the alternate position. In this type of application, holding power is required only when operating in the alternate position. Also, switching circuitry is simplified, since only one d-c circuit is required.

Specifications

RF Contacts:
Break before make

Actuator Voltage:
24–30 VDC; 12, 15, 20 VDC, and 115 VAC on special order

Actuator Current:
80 mA @ 28 VDC and 20°C

Switching Time:
20 msec.

Weight:
1.65 oz. max.

Temperature Range:
– 54°C to + 85°C

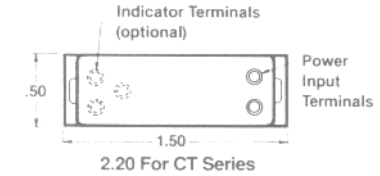
Life:
1 million cycles

RF Power Handling:
See graph in front of brochure

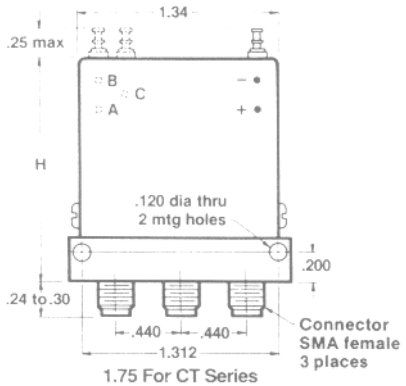
Optional Features

- Indicator Circuits
- Special Actuator Voltages
- TTL Compatible Drivers
- Arc Suppression Diodes
- Power Connectors
- Inboard Mounting

Outboard Mounting



2.20 For CT Series



1.75 For CT Series

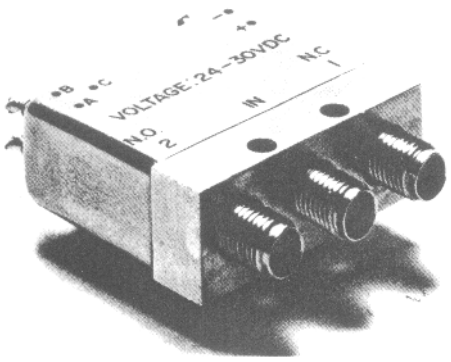
H = 1.20 max CR Model
options may add
height. Consult factory
H = 1.55 max STD Model
H = 2.10 max TTL Model

RF Performance

Frequency	DC–6 GHz	6–12 GHz	12–18 GHz	18–22 GHz*
VSWR (maximum)	1.25:1	1.40:1	1.50:1	1.70:1
Insertion Loss (maximum)	0.2 dB	0.4 dB	0.5 dB	0.8 dB
Isolation (minimum)	70 dB	60 dB	60 dB	50 dB

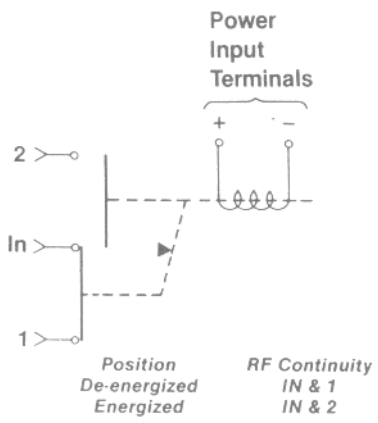
* Outboard Mounts To 22 GHz
Inboard Mounts To 21 GHz

TELEDYNE MICROWAVE • 1290 Terra Bella Ave. • Mountain View, CA 94043 • 415-968-2211 • FAX 415-966-1521

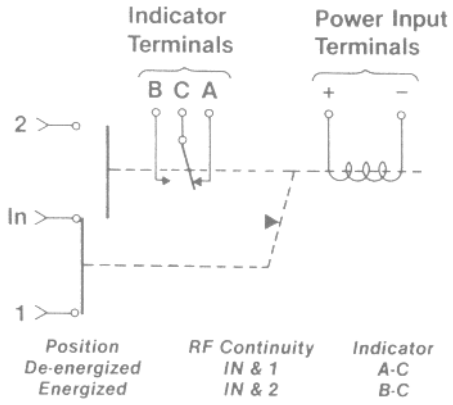


CR33S1C-99

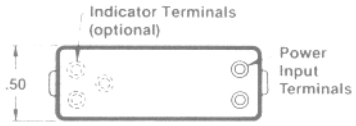
CS-33S10

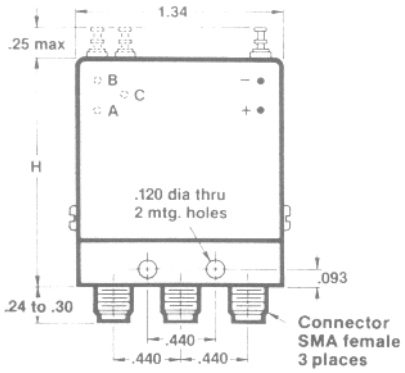


CS-33S1C



Inboard Mounting





H = 1.20 max CR Model
options may add
height. Consult factory
H = 1.55 max STD Model
H = 2.10 max TTL Model

Part Number Table

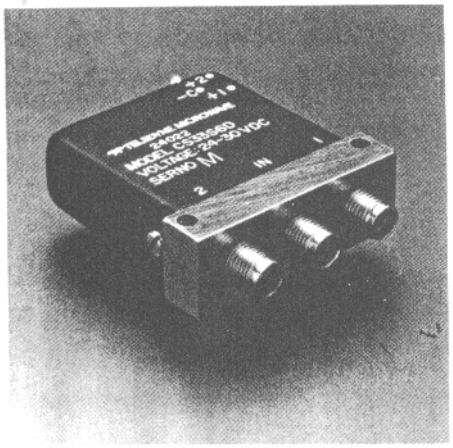
All units have SMA-Female connectors

For TTL Drivers add -T to Part No.

Actuator Type	Without Indicators	With Indicators
Failsafe	CS-33S10	CS-33S1C

TELEDYNE MICROWAVE • 1290 Terra Bella Ave. • Mountain View, CA 94043 • 415-968-2211 • FAX 415-966 1521

Latching DC-22 GHz Miniature SPDT Switches



CS-33S60

CS-33 Series

DC-22 GHz*

SMA Connectors

Description

The Type CS-33 Latching Switch is a broadband SPDT electro-mechanical switch designed to switch microwave signals from a common input to either of two outputs. Designed for 50 ohm transmission lines, the unit is set up for minimum size compatible with SMA connector spacing.

The switches on this page are provided with a magnetic latching actuator which is particularly desirable in applications where actuator power consumption must be kept to an absolute minimum. The latching type actuator requires less switching current than the failsafe type. In the self-cutoff version, power is applied only for the very short duration (approximately 50 msec. max.) of the actuator transfer from one position to the other. This makes this type of actuator especially suitable for space vehicles or portable battery operated systems.

Specifications

RF Contacts:
Break before make

Actuator Voltage:
24–30 VDC; 12, 15, 20 VDC, and 115 VAC on special order

Actuator Current:
60 mA @ 28 VDC and 20°C

Switching Time:
10 msec.

Weight:
1.65 oz.

Temperature Range:
– 54°C to + 85°C

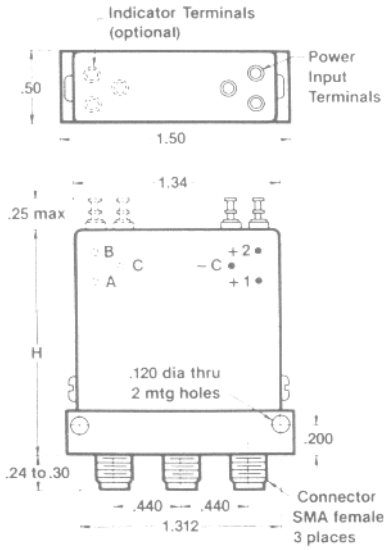
Life:
1 million cycles

RF Power Handling:
See graph in front of brochure

Optional Features

- Indicator Circuits
- Special Actuator Voltages
- TTL Compatible Drivers
- Arc Suppression Diodes
- Power Connectors
- Inboard Mounting

Outboard Mounting



H = 1.20 max CR Model options may add height. Consult factory
H = 1.55 max STD Model
H = 2.10 max TTL Model

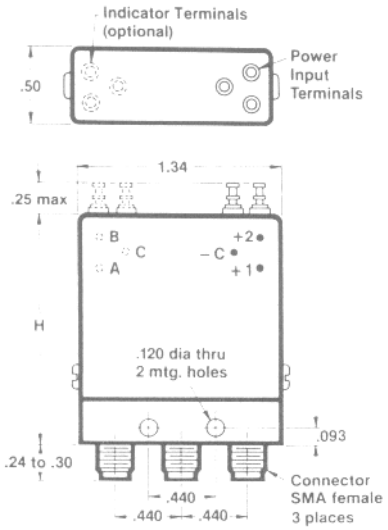
RF Performance

Frequency	DC–6 GHz	6–12 GHz	12–18 GHz	18–22 GHz*
VSWR (maximum)	1.25:1	1.40:1	1.50:1	1.70:1
Insertion Loss (maximum)	0.2 dB	0.4 dB	0.5 dB	0.8 dB
Isolation (minimum)	70 dB	60 dB	60 dB	50 dB

* Outboard Mounts To 22 GHz
Inboard Mounts To 21 GHz

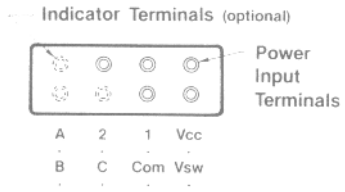
TELEDYNE MICROWAVE • 1290 Terra Bella Ave. • Mountain View, CA 94043 • 415-968-2211 • FAX 415-966-1521

Inboard Mounting



H = 1.20 max CR Model
options may add
height. Consult factory
H = 1.55 max STD Model
H = 2.10 max TTL Model

TTL Option



Part Number Table

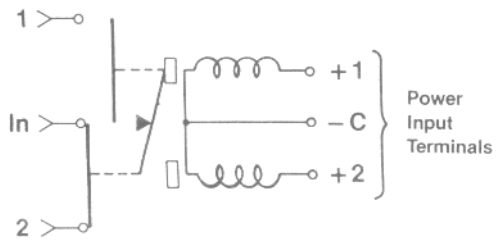
All units have SMA-Female connectors

For TTL Drivers add -T to Part No.

Actuator Type	Without Indicators	With Indicators
Latching without Self-Cutoff	CS-33S60	CS-33S6C
Latching with Self-Cutoff	CS-33S6D	CS-33S6E

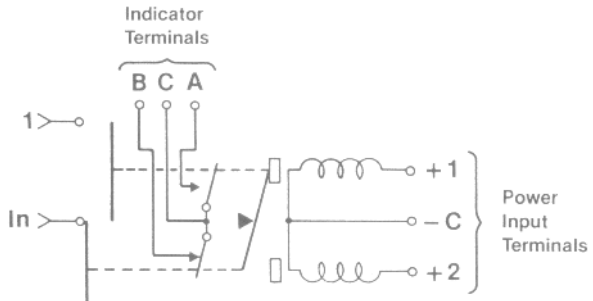
For Models CS-33S60 and CS-33S6C power is applied in a pulse form of sufficient duration (20 msec. min.) to cause switching. For Models CS-33S6D and CS-33S6 steady voltage may be applied continuously, but switch only draws current during the actual switching cycle.

CS-33S60



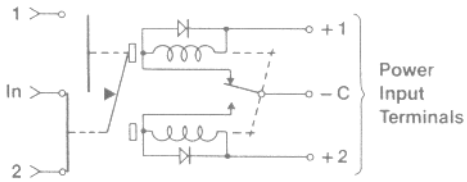
Position	Voltage	RF continuity
1	+1 & –C	IN & 1
2	+2 & –C	IN & 2

CS-33S6C



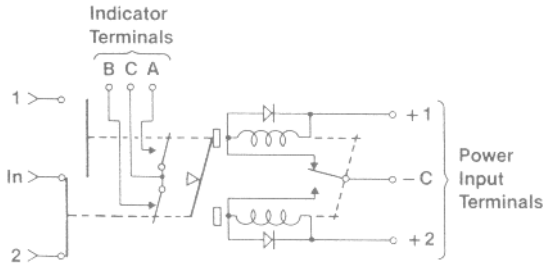
Position	Voltage	RF continuity	Indicator
1	+1 & –C	IN & 1	A & C
2	+2 & –C	IN & 2	B & C

CS-33S6D

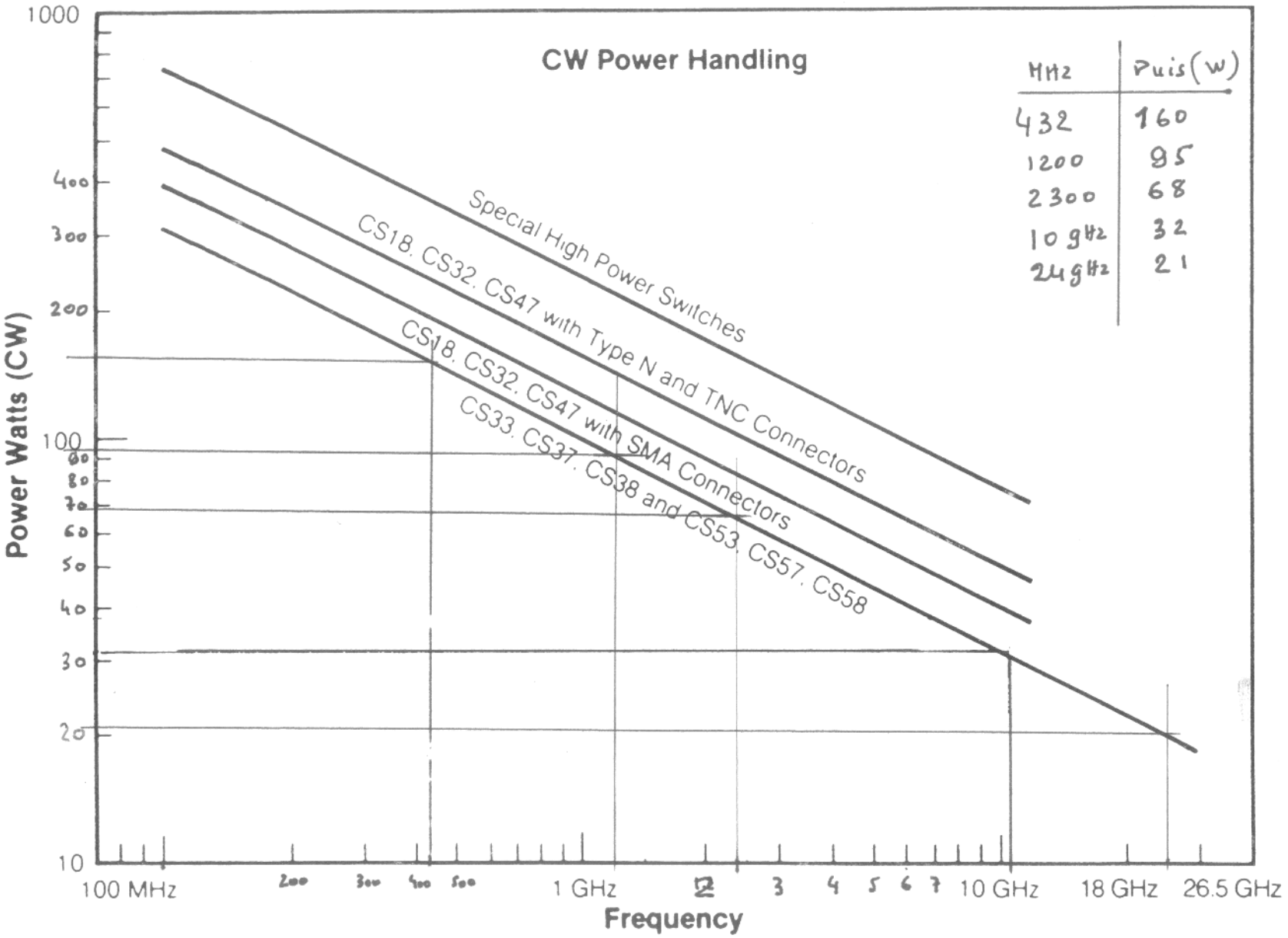


Position	Voltage	RF continuity
1	+1 & –C	IN & 1
2	+2 & –C	IN & 2

CS-33S6E



Position	Voltage	RF continuity	Indicator
1	+1 & –C	IN & 1	A & C
2	+2 & –C	IN & 2	B & C



Notes:

1. This graph is based on the following reference conditions:
   A/ Ambient temperature 40°C
   B/ Sea Level operating

2. For applications calling for low pressure, high altitude or severe temperature requirements, the above power ratings would be derated. Please contact factory for specific

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP