



DATA SHEET

IS013392: Hermetic-Packaged, High-Isolation SP4T Absorptive Switch, DC to 4 GHz

Applications

- Military and space communications
- High-reliability applications
- GSM/CDMA/WCDMA/LTE cellular infrastructure
- Test and measurement systems

Features

- Broadband frequency range: 0.02 GHz to 4.0 GHz
- Low insertion loss: 1.0 dB @ 2 GHz
- Typical isolation: 50 dB @ 2 GHz
- Positive voltage control: 0/3 V to 0/5 V
- Isolated ports are absorptive from 500 MHz to 4 GHz
- Small hermetic QFN (20-pin, 4 x 4 mm) package

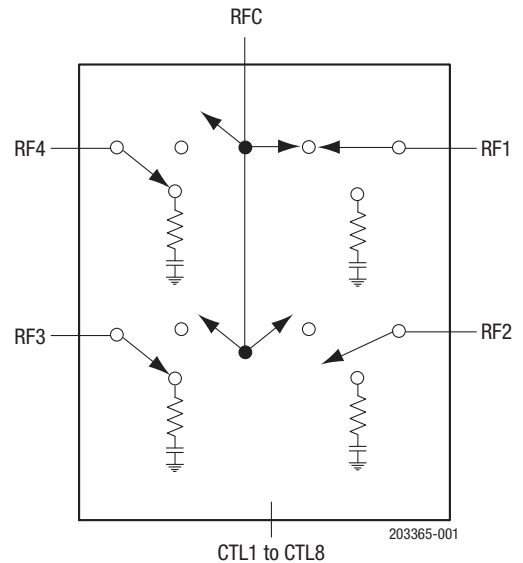


Figure 1. IS013392 Block Diagram

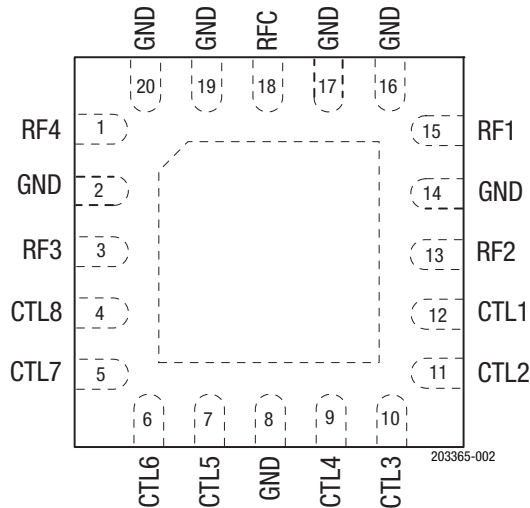


Figure 2. IS013392 Pinout (Top View)

Description

The IS013392 is a symmetrical, single-pole, four-throw (SP4T) switch. The switch is intended for high-reliability (Hi-Rel) space, military, and aerospace applications operating from 20 MHz to 4 GHz. The impedance of the RF ports in isolation is 50 Ω at frequencies above 500 MHz.

The IS013392 SP4T switch is provided in a hermetic ceramic Quad Flat No-Lead (QFN) 4 x 4 mm package. A functional block diagram is shown in Figure 1. The pin configuration and package are shown in Figure 2. Signal pin assignments and functional pin descriptions are provided in Table 1.

Table 1. ISO13392 Signal Descriptions

Pin	Name	Description	Pin	Name	Description
1	RF4	RF output 4. A DC blocking capacitor is required.	11	CTL2	Control signal 2. See Table 4.
2	GND	Ground	12	CTL1	Control signal 1. See Table 4.
3	RF3	RF output 3. A DC blocking capacitor is required.	13	RF2	RF output 2. A DC blocking capacitor is required.
4	CTL8	Control signal 8. See Table 4.	14	GND	Ground
5	CTL7	Control signal 7. See Table 4.	15	RF1	RF output 1. A DC blocking capacitor is required.
6	CTL6	Control signal 6. See Table 4.	16	GND	Ground
7	CTL5	Control signal 5. See Table 4.	17	GND	Ground
8	GND	Ground	18	RFC	RF common port. A DC blocking capacitor is required.
9	CTL4	Control signal 4. See Table 4.	19	GND	Ground
10	CTL3	Control signal 3. See Table 4.	20	GND	Ground

Functional Description

The recommended startup sequence for the ISO 13392 is as follows:

1. Apply VCTL1 through VCTL8.
2. Apply RF input.

The device must be turned off in the reverse order.

Electrical and Mechanical Specifications

The absolute maximum ratings of the ISO13392 are provided in Table 2. Electrical specifications are provided in Table 3.

The state of the ISO13392 is determined by the logic provided in Table 4. Typical performance characteristics are shown in Figures 3 through 9.

Table 2. ISO13392 Absolute Maximum Ratings¹

Parameter	Symbol	Minimum	Maximum	Units
Operating frequency	f	0.02	4.00	GHz
Input power	P _{IN}		+30	dBm
Control voltage (CTL1 to CTL8)	V _{CTL}	0	7.0	V
Operating temperature (case)	T _{OP}	-55	+125	°C
Storage temperature	T _{STG}	-55	+150	°C

¹ Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

ESD HANDLING: *Although this device is designed to be as robust as possible, electrostatic discharge (ESD) can damage this device. This device must be protected at all times from ESD when handling or transporting. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD handling precautions should be used at all times.*

Table 3. ISO13392 Electrical Specifications¹

($V_{DD} = 5\text{ V}$, $V_{C1} = V_{C2} = V_{DD}$, $T_{OP} = +25\text{ }^{\circ}\text{C}$, All Unused RF Ports are Terminated in a $50\ \Omega$ Load, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
RF Specifications						
Insertion loss	IL	0.02 to 1.0 GHz		0.9	1.1	dB
		1.0 to 2.0 GHz		1.0	1.2	dB
		2.0 to 2.7 GHz		1.1	1.3	dB
		2.7 to 4.0 GHz		1.5	1.9	dB
Isolation	ISO	0.02 to 1.0 GHz	45	55		dB
		1.0 to 2.0 GHz	40	50		dB
		2.0 to 2.7 GHz	35	45		dB
		2.7 to 4.0 GHz	33	38		dB
Return loss (insertion loss state) ²	IS11I	0.02 to 2.7 GHz, all RF ports		22		dB
		2.7 to 4.0 GHz		18		dB
Return loss (isolation state)	IS22I	0.5 to 4.0 GHz		8 to 14		dB
1 dB input compression point	P1dB	$V_{DD} = 5\text{ V}$		+30		dBm
Third order input intercept point	IIP3	Two tones, +7 dBm per tone, 1 MHz spacing		+47		dBm
Switching speed	T_{RISE} , T_{FALL} T_{ON} , T_{OFF}	10/90% RF rise/fall time		40		ns
		50 % V_{CTL} to 10/90% on/off time		125		ns
DC/Control Specifications						
Control voltage: High Low	CTL1 through CTL8		3 0		5 0.2	V V

¹ Performance is guaranteed only under the conditions listed in this table.

² Return loss in the insertion loss state is dependent on the value of DC blocking capacitors.

Table 4. ISO13392 Truth Table/Control Voltages

Control Input								Signal Path States RFC to ...			
CTL1	CTL2	CTL3	CTL4	CTL5	CTL6	CTL7	CTL8	RF1	RF2	RF3	RF4
Low	High	High	Low	High	Low	High	Low	On	Off	Off	Off
High	Low	Low	High	High	Low	High	Low	Off	On	Off	Off
High	Low	High	Low	Low	High	High	Low	Off	Off	On	Off
High	Low	High	Low	High	Low	Low	High	Off	Off	Off	On

Typical Performance Characteristics

($V_{DD} = 5\text{ V}$, CTL1 through CTL8 based on Table 4, $T_{OP} = +25\text{ }^{\circ}\text{C}$, $P_{IN} = 0\text{ dBm}$, Blocking Capacitors = 100 pF, Unless Otherwise Noted)

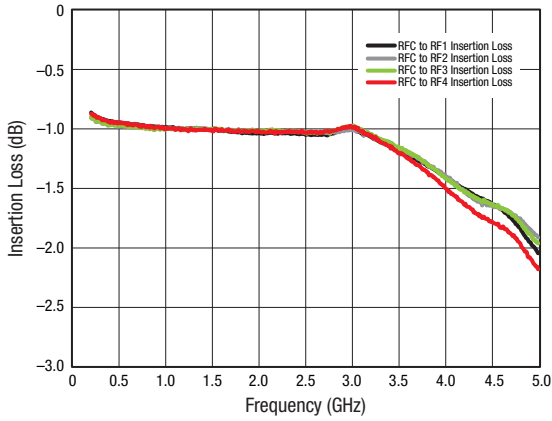


Figure 3. Insertion Loss vs Frequency

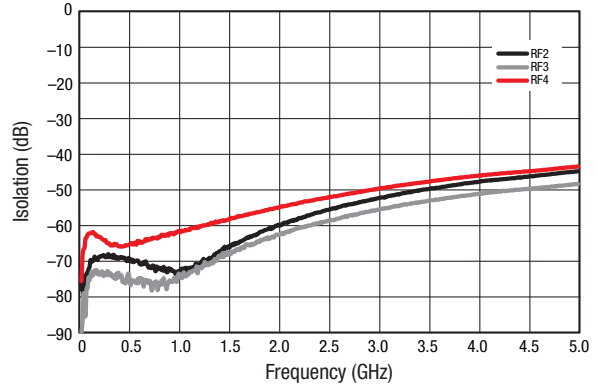


Figure 4. Isolation vs Frequency (RFC to RF1 "On")

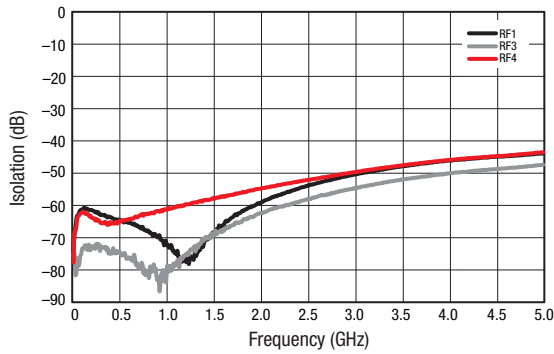


Figure 5. Isolation vs Frequency (RFC to RF2 "On")

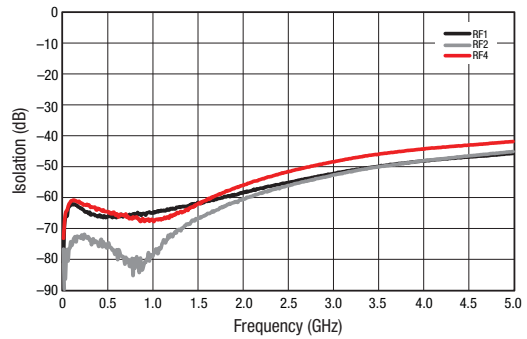


Figure 6. Isolation vs Frequency (RFC to RF3 "On")

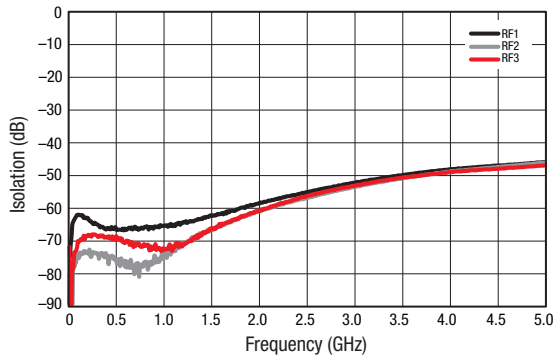


Figure 7. Isolation vs Frequency (RFC to RF4 "On")

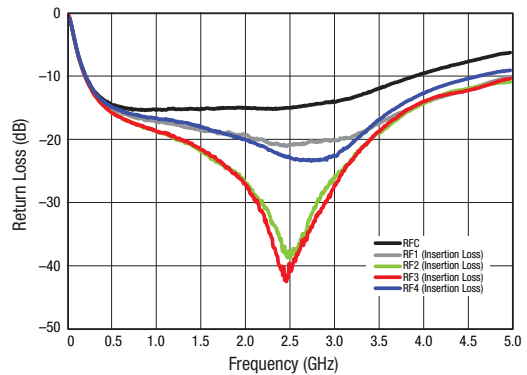


Figure 8. Return Loss vs Frequency (Insertion Loss States)

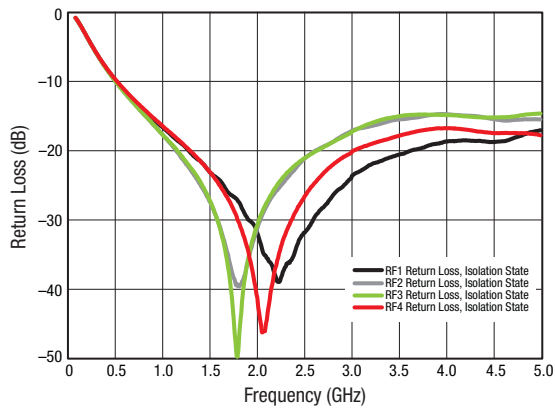


Figure 9. Return Loss vs Frequency (Isolation States)

Evaluation Board Description

The ISO13392 Evaluation Board is used to test the performance of the ISO13392 switch. An Evaluation Board schematic is shown in Figure 10. An assembly drawing for the Evaluation Board is shown in Figure 11. A suggested driver circuit is shown in Figure 12, and a logic driver truth table is provided in Table 5.

Package Dimensions

A typical part marking for the ISO13392 is shown in Figure 13. Package dimensions for the ISO13392 are shown in Figure 14.

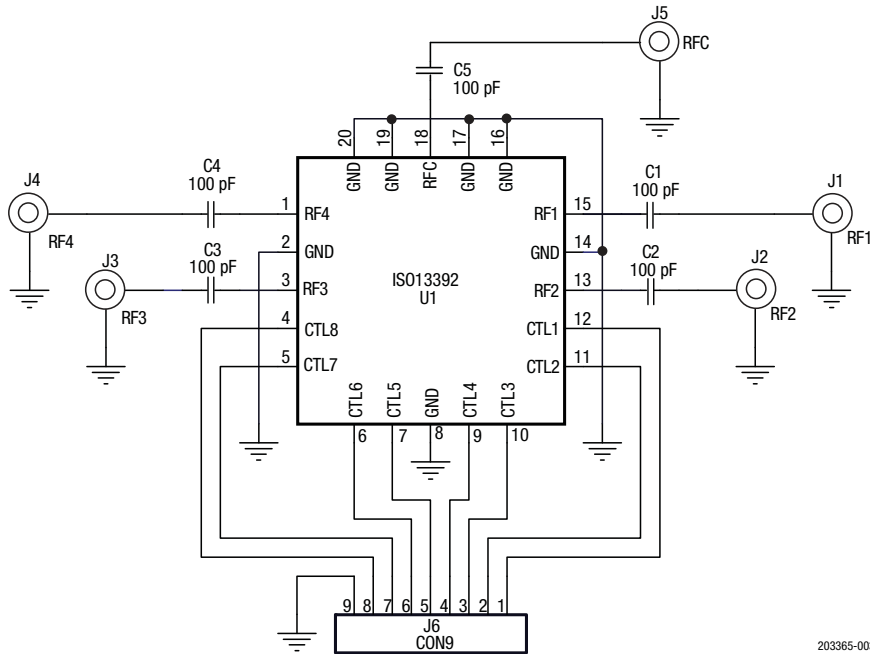


Figure 10. ISO13392 Evaluation Board Schematic

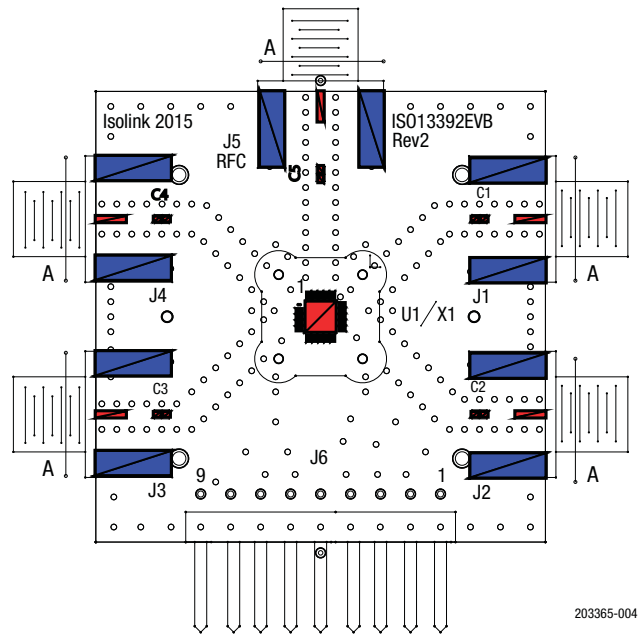


Figure 11. ISO13392 Evaluation Board Assembly Diagram

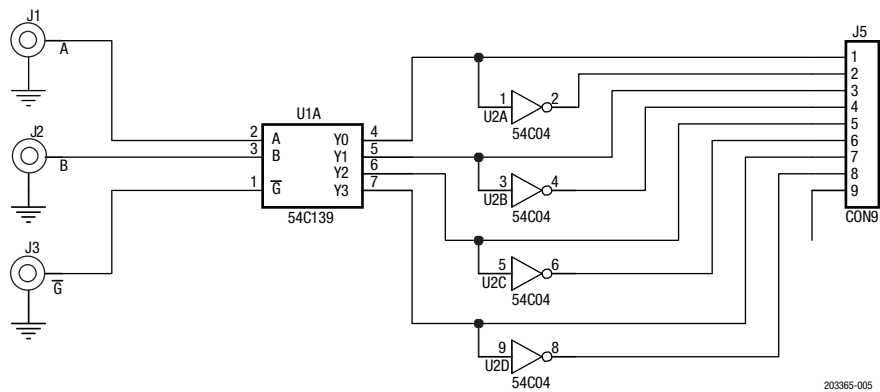


Figure 12. ISO13392 Suggested Driver Circuit

Table 5. ISO13392 Logic Driver Truth Table

\overline{G}	A	B	RF1	RF2	RF3	RF4
Low	Low	Low	On	Off	Off	Off
Low	High	Low	Off	On	Off	Off
Low	Low	High	Off	Off	On	Off
Low	High	High	Off	Off	Off	On
High	-	-	Off	Off	Off	Off

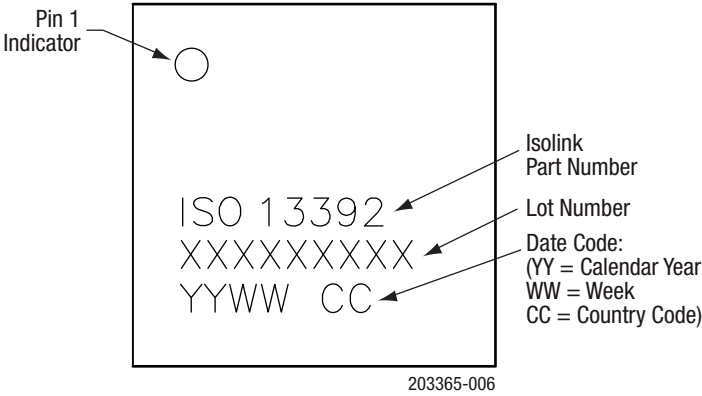


Figure 13. ISO13392 Typical Part Marking

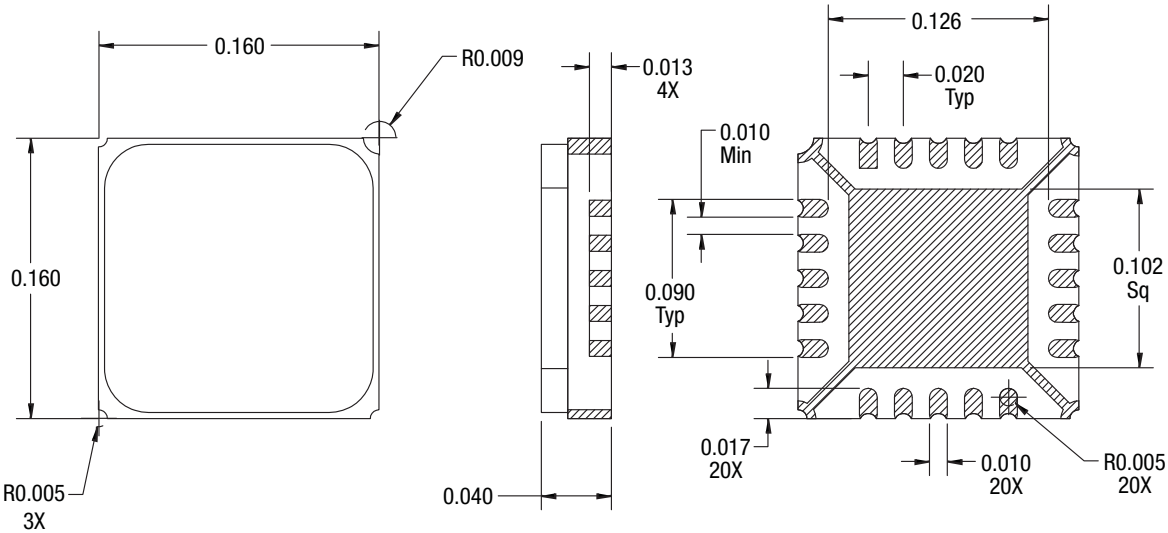


Figure 14. ISO13392 Package Dimensions

Ordering Information

Product Description	Product Part Number	Evaluation Board Part Number
ISO13392: SP4T Switch	ISO13392	ISO13392-EVB

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