CMD196

DC - 28 GHz SPDT Non-reflective Switch

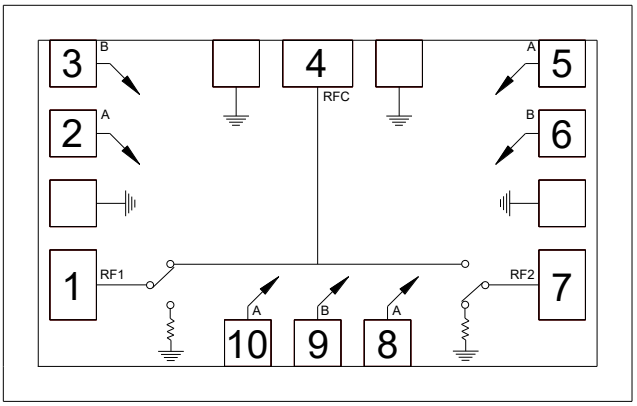
Product Overview

The CMD196 is a general-purpose broadband high isolation non-reflective MMIC SPDT switch in die form. Covering DC to 28 GHz, the CMD196 features a low insertion loss of 1.75 dB and high isolation of 46 dB at 14 GHz. The CMD196 operates using complementary control voltage logic lines of 0/-5 V and requires no bias supply.

Key Features

- Low Loss Broadband Performance
- High Isolation
- Fast Switching Speed
- Non-Reflective Design
- Small Die Size: 1350 um x 850 um

Functional Block Diagram



Ordering Information

Part No.	Description
CMD196	DC-28 GHz SPDT Non-reflective Switch, 100 Piece WP Sample

Electrical Performance (V_{ctl} = 0/-5 V, T_A = 25 °C, F = 14 GHz)

Parameter	Min	Typ.	Max	Units
Frequency Range		DC - 28		GHz
Insertion Loss		1.75		dB
Isolation		46		dB
Return Loss - On State		15		dB
Return Loss RF1, RF2 - Off State		25		dB
Input P1dB		23		dBm
Switching Characteristics tRISE, tFALL (10/90% RF) tON, tOFF (50% CTL to 10/90% RF)		 1.8 11/4		 ns ns

Absolute Maximum Ratings

Parameter	Rating
RF Input Power	+27 dBm
Control Voltage Range (A, B)	+0.5V to -7.5V
Channel Temperature, Tch	150 °C
Operating Temperature	-55 to 85 °C
Storage Temperature	-55 to 150 °C
Thermal Resistance, θ_{JC} (insertion loss path)	103 °C/W
Thermal Resistance, θ_{JC} (terminated path)	258 °C/W
Terminated Power Level (V_{ctl} = -5 V, CW)	+24 dBm

Exceeding any one or combination of the maximum ratings may cause permanent damage to the device.

Control Voltages

State	Bias Condition
Low	0 to -0.5V @ 1 uA Typ
High	-3V @ 1 uA Typ to -7V @ 6 uA Typ

Truth Table

Control Input		Signal Path State	
A	B	RFC to RF1	RFC to RF2
High	Low	On	Off
Low	High	Off	On

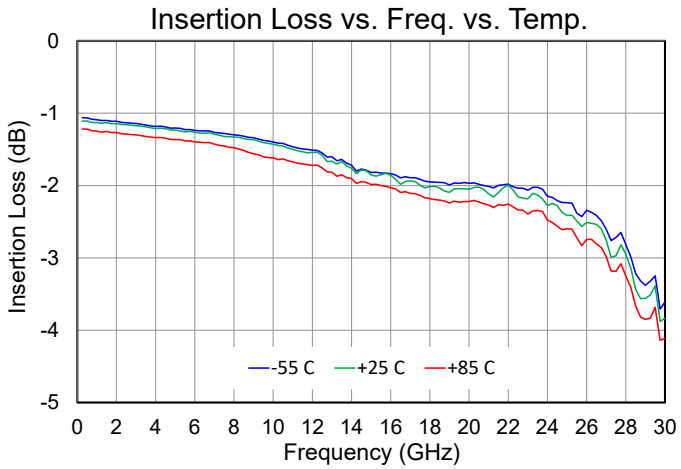
Electrical Specifications

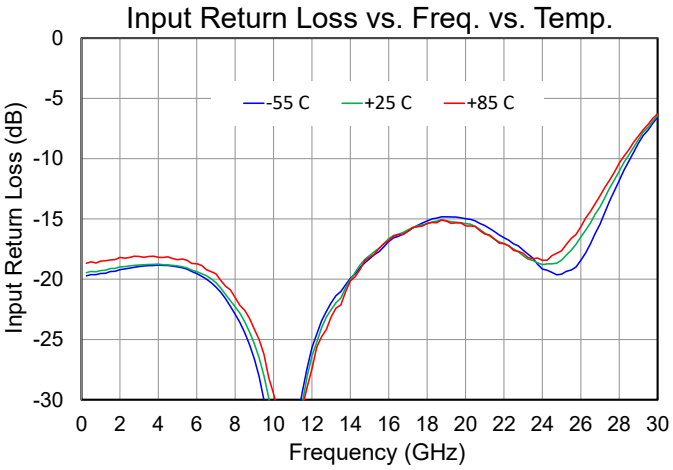
Test conditions unless otherwise noted: 50 Ω, 25 °C, V_{ctl} = 0/-5 V.

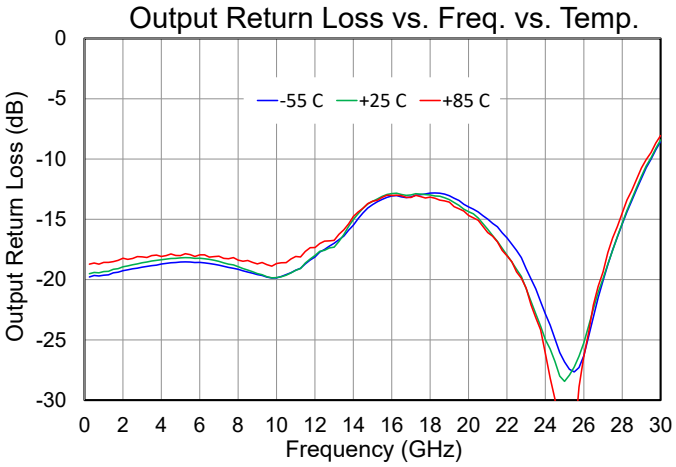
Parameter		Test conditions	Min	Typ.	Max	Units
Frequency Range			DC	-	28	GHz
Insertion Loss		Frequency: 2 GHz	-	1.1	1.9	dB
		Frequency: 8.5 GHz	-	1.3	2.2	
		Frequency: 15 GHz	-	1.9	2.8	
		Frequency: 21.5 GHz	-	2.3	3.2	
		Frequency: 24 GHz	-	2.8	3.8	
		Frequency: 26 GHz	-	3.1	4.5	
		Frequency: 28 GHz	-	4.3	5.0	
Isolation		Frequency: 2 GHz	45	63	-	dB
		Frequency: 8.5 GHz	37	48	-	
		Frequency: 15 GHz	30	33	-	
		Frequency: 21.5 GHz	30	38	-	
		Frequency: 24 GHz	30	35	-	
		Frequency: 26 GHz	30	36	-	
		Frequency: 28 GHz	30	42	-	
Return Loss – On State		Frequency: DC – 8 GHz	-	18	-	dB
		Frequency: 8 – 20 GHz	-	12	-	
		Frequency: 20 – 28 GHz	-	18	-	
Return Loss RF1, RF2 – OFF State		Frequency: DC – 8 GHz	-	17	-	dB
		Frequency: 8 – 20 GHz	-	25	-	
		Frequency: 20 – 28 GHz	-	15	-	
Input P1dB		Frequency: DC – 8 GHz	-	23	-	dBm
		Frequency: 8 – 20 GHz	-	23	-	
		Frequency: 20 – 28 GHz	-	23	-	
Input IP3		Frequency: DC – 8 GHz	-	37	-	dBm
		Frequency: 8 – 20 GHz	-	37	-	
		Frequency: 20 – 28 GHz	-	38	-	
Switching Characteristic	tRISE, tFALL (10/90% RF)	Frequency: DC – 8 GHz	-	1.8	-	ns
		Frequency: 8 – 20 GHz	-	1.8	-	
		Frequency: 20 – 28 GHz	-	1.8	-	
	tON, tOFF (50% CTL to 10/90% RF)	Frequency: DC – 8 GHz	-	11/4	-	ns
		Frequency: 8 – 20 GHz	-	11/4	-	
		Frequency: 20 – 28 GHz	-	11/4	-	

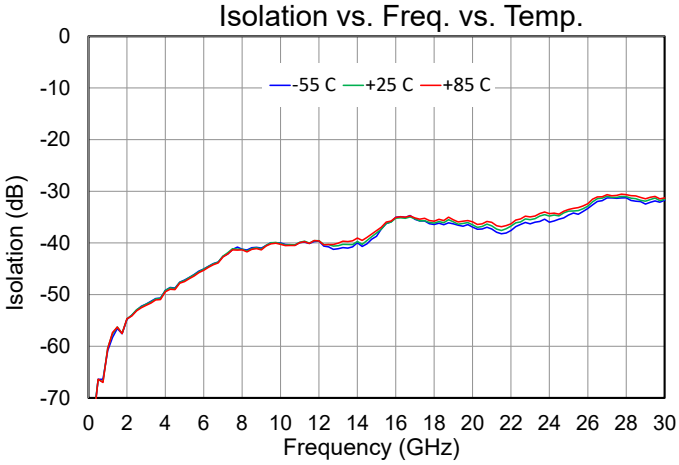
Performance Plots – Small Signal

Test conditions unless otherwise noted: 50 Ω, V_{CTL} = 0/-5 V, 25 °C



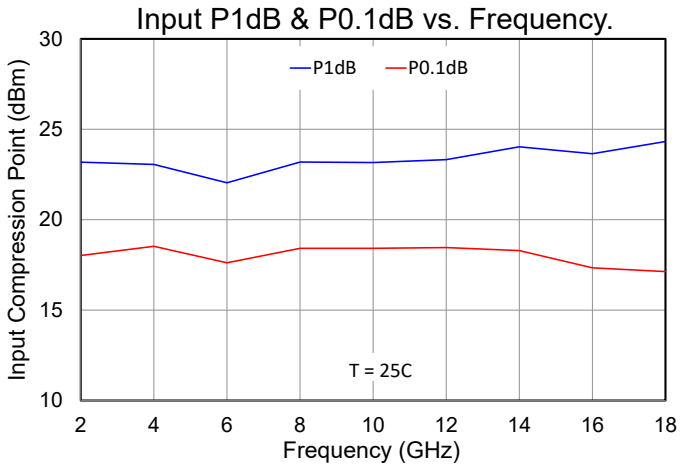


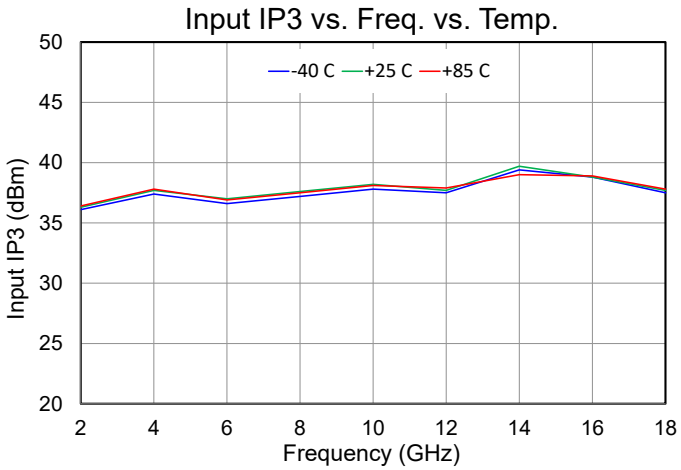




Performance Plots – Large Signal & Linearity

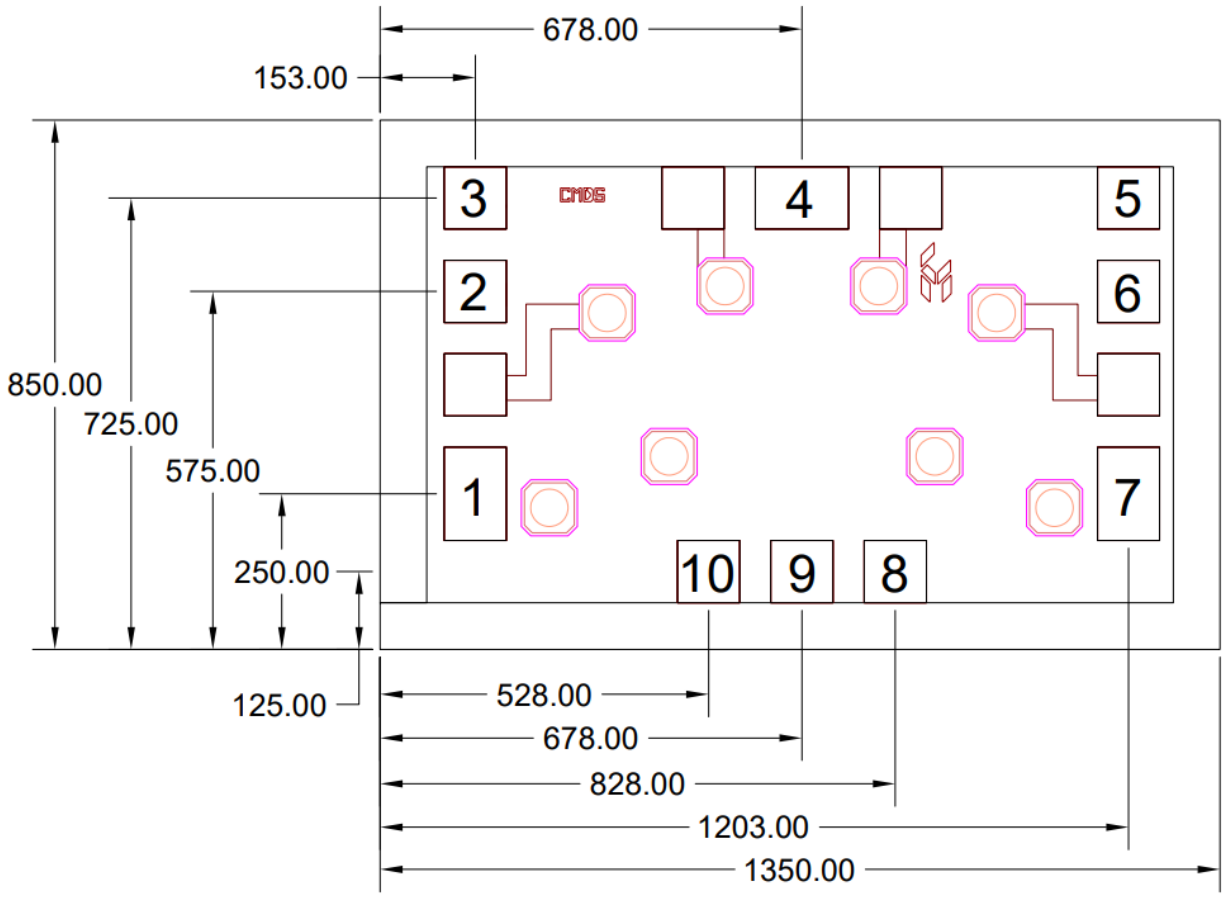
Test conditions unless otherwise noted: 50 Ω, V_{CTL} = 0/-5 V, 25 °C





Mechanical Information

Die Outline (all dimensions in microns)

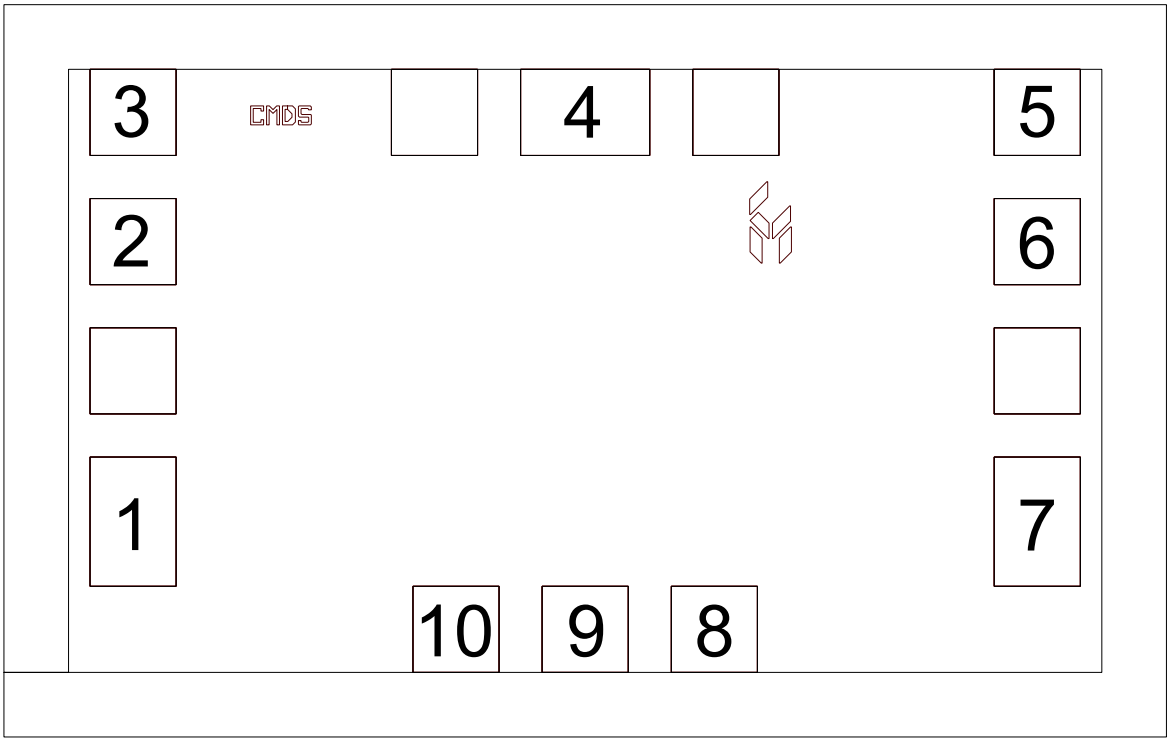


Notes:

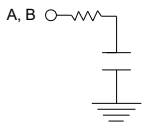
1. No connection required for unlabeled pads
2. Backside is RF and DC ground
3. Backside and bond pad metal: Gold
4. Die is 85 microns thick
5. DC bond pads (2, 3, 5, 6, 8, 9, 10) are 100 x 100 microns
6. RF bond pads (1, 4, 7) are 100 x 150 microns

Pad Description

Pad Diagram

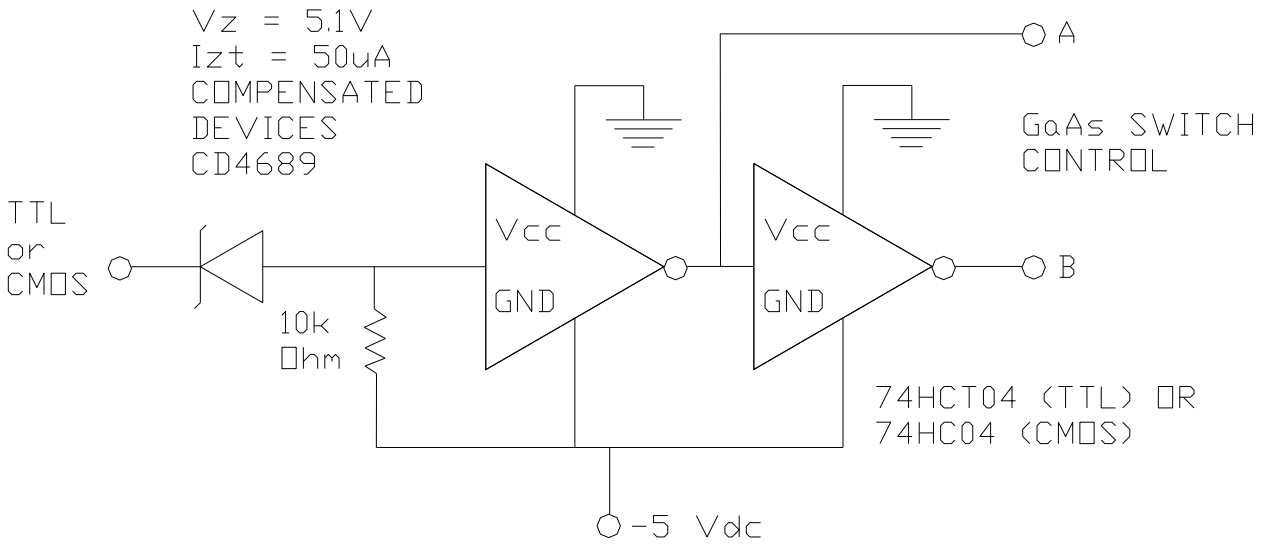


Functional Description

Pin	Function	Description	Schematic
1, 4, 7	RF1, RFC, RF2	These pins are DC coupled and matched to 50 ohm Blocking capacitors are required if RF line potential is not equal to 0 V	
2, 5, 8, 10	CTRLA	See truth table and control voltage table	
3, 6, 9	CTRLB	See truth table and control voltage table	
Backside	Ground	Connect to RF / DC ground	

Applications Information

Suggested Driver Circuit



GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.

Applications Information

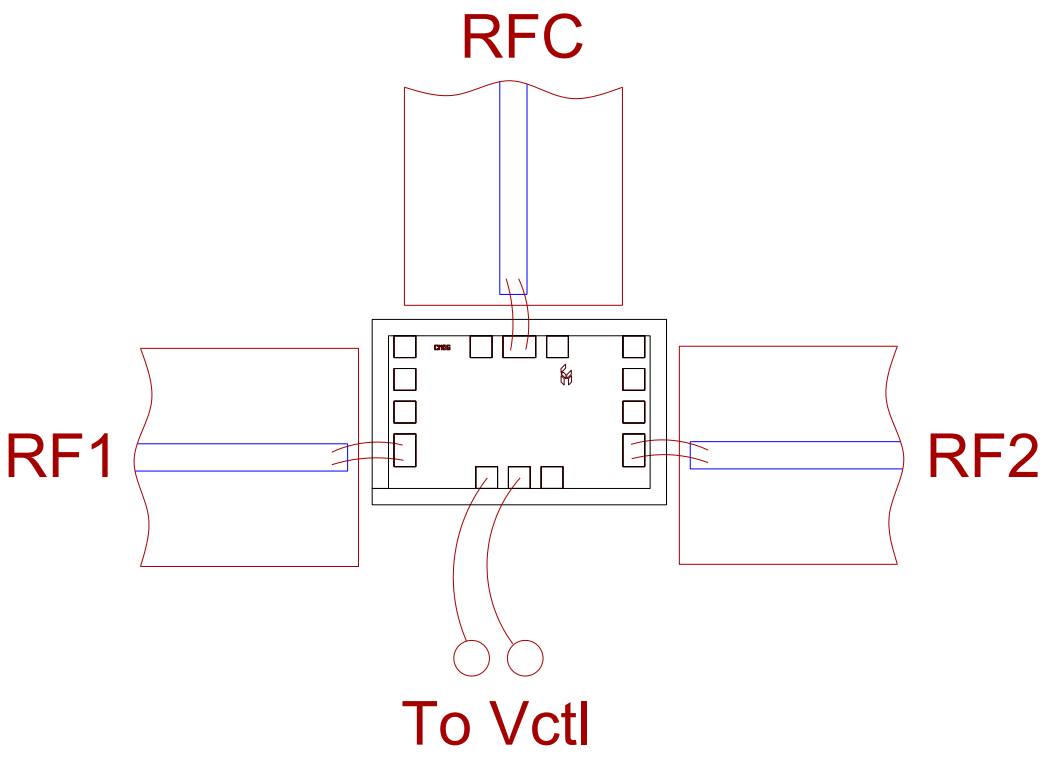
Assembly Guidelines

The backside of the CMD196 is RF ground. Die attach should be accomplished with electrically and thermally conductive epoxy only. Eutectic attach is not recommended. Standard assembly procedures should be followed for high frequency devices. The top surface of the semiconductor should be made planar to the adjacent RF transmission lines, and the RF decoupling capacitors placed in close proximity to the DC connections on chip.

RF connections should be made as short as possible to reduce the inductive effect of the bond wire. Use of a 0.8 mil thermosonic wedge bonding is highly recommended as the loop height will be minimized. The RF inputs and outputs require a double bond wire as shown.

The semiconductor is 85 um thick and should be handled by the sides of the die or with a custom collet. Do not make contact directly with the die surface as this will damage the monolithic circuitry. Handle with care.

Assembly Diagram



Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 1A	ESDA / JEDEC JS-001-2012

Caution!
ESD-Sensitive Device

RoHS Compliance

This part is compliant with 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead Free
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_4O_2$) Free
- SVHC Free
- Halogen Free
- PFOS Free

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

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