

**FEATURES**

**7 dB typical insertion loss**  
**Single positive control line**  
**50 dB typical isolation**  
**Input third-order intercept (IP3): 40 dBm**  
**CMOS-compatible control**  
**Nonreflective topology**  
**Hermetically sealed module**  
**Field replaceable K-type connectors**  
**Operating temperature: -55°C to +85°C**

**APPLICATIONS**

**Base station infrastructure**  
**Fiber optics and broadband telecommunications**  
**Microwave radios and VSATs**  
**Military radios, radars, and electronic counter measures (ECM)**  
**Test instrumentation**

**GENERAL DESCRIPTION**

The **HMC-C583** is a 0.1 GHz to 40 GHz, gallium arsenide (GaAs), pseudomorphic high electron mobility transfer (pHEMT), IC single-pole, single-throw (SPST) switch housed in a miniature hermetic module. This wideband switch features 7 dB typical insertion loss, 50 dB typical isolation, and 40 dBm input IP3.

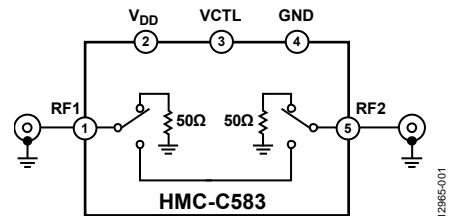
**FUNCTIONAL BLOCK DIAGRAM**

Figure 1.

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The switching on/off time is 10 ns typical. A single control voltage input, toggled between 0 V and 5 V, selects the switch state. Removable K-type connectors can be detached to allow direct connection of the input/output pins of the module to a microstrip or coplanar circuit.

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**REVISION HISTORY**

9/2016—Revision 0: Initial Version

## SPECIFICATIONS

$V_{DD} = 5\text{ V}$ ,  $V_{CTL} = 0\text{ V}$  or  $5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ , unless otherwise noted.

Table 1.

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions/Comments
INSERTION LOSS			7	10	dB	0.1 GHz to 40 GHz
ISOLATION		40	50		dB	Includes insertion loss 0.1 GHz to 40 GHz
INPUT POWER FOR 0.1 dB COMPRESSION	P0.1dB		5 21		dBm dBm	0.1 GHz to 0.5 GHz 0.5 GHz to 40 GHz
INPUT THIRD-ORDER INTERCEPT	IP3		20 40		dBm dBm	0.1 GHz to 2 GHz 2 GHz to 40 GHz
RETURN LOSS			10		dB	0.1 GHz to 40 GHz
SUPPLY INPUT	$V_{DD}$	4.5	5	5.5	V	
CONTROL INPUTS						
Input Voltage						
High	$V_{INH}$		3.5 to $V_{DD}$		V	
Low	$V_{INL}$		0 to 1.5		V	
Input Current	$I_{IN}$		$\pm 20$		$\mu\text{A}$	$V_{IN} = 0\text{ V}$ or $V_{DD}$
SWITCHING CHARACTERISTICS						
Rise Time/Fall Time	$t_{RISE}/t_{FALL}$		1		ns	10%/90% radio frequency (RF)
On Time/Off Time	$t_{ON}/t_{OFF}$		10		ns	50% $V_{CTL}$ to 10%/90% RF

## ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameter	Rating
Supply Input ( $V_{DD}$ )	5.8 V
Control Voltage (VCTL)	$V_{DD} \pm 0.5$ V
RF Input Power	
0.1 GHz to 0.5 GHz	5 dBm
0.5 GHz to 2 GHz	18 dBm
2 GHz to 40 GHz	25 dBm
Hot Switch Power Level	
0.1 GHz to 0.5 GHz	3 dBm
0.5 GHz to 2 GHz	16 dBm
2 GHz to 40 GHz	23 dBm
Operating Temperature Range	$-55^{\circ}\text{C}$ to $+85^{\circ}\text{C}$
Storage Temperature Range	$-65^{\circ}\text{C}$ to $+150^{\circ}\text{C}$
ESD Rating, Human Body Model (HBM)	Class 1A (>250 V)

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

### ESD CAUTION



**ESD (electrostatic discharge) sensitive device.** Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

# PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

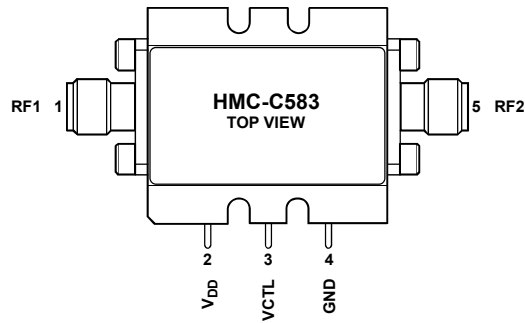


Figure 2. Pin Configuration

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Table 3. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	RF1	RF Input/Output 1. This pin is dc-coupled and matched to 50 Ω. Blocking capacitors are required if the RF line potential is not equal to 0 V dc.
2	V <sub>DD</sub>	Positive Supply Voltage, 5 V DC.
3	VCTL	Control Pin.
4	GND	Power Supply Ground.
5	RF2	RF Input/Output 2. This pin is dc-coupled and matched to 50 Ω. Blocking capacitors are required if the RF line potential is not equal to 0 V dc.

## INTERFACE SCHEMATICS

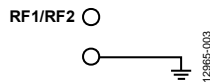


Figure 3. RF1/RF2 Interface Schematic



Figure 4. GND Interface Schematic

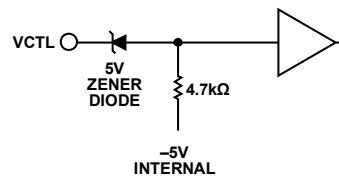


Figure 5. VCTL Interface Schematic

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TYPICAL PERFORMANCE CHARACTERISTICS

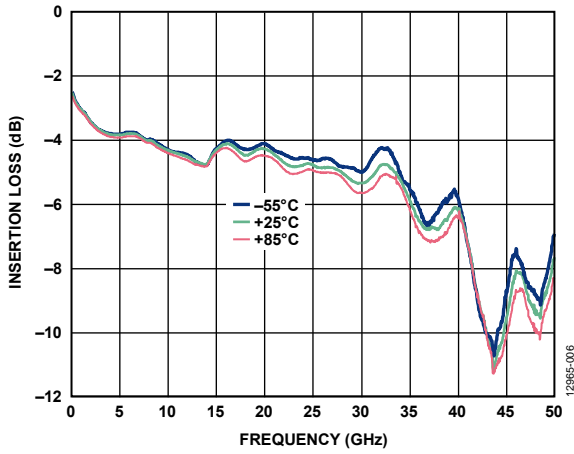


Figure 6. Insertion Loss vs. Frequency at Various Temperatures

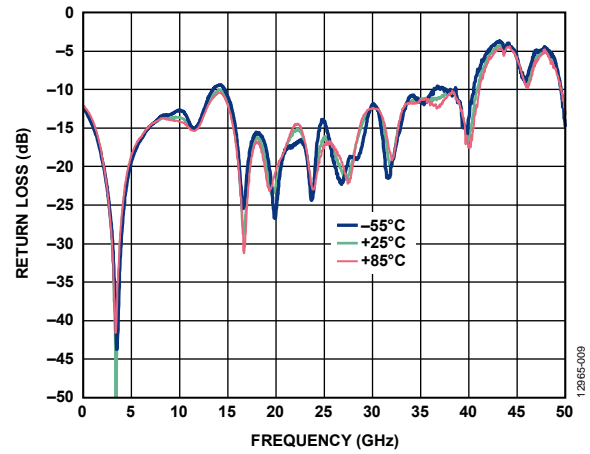


Figure 9. Return Loss vs. Frequency at Various Temperatures for RF1, RF2

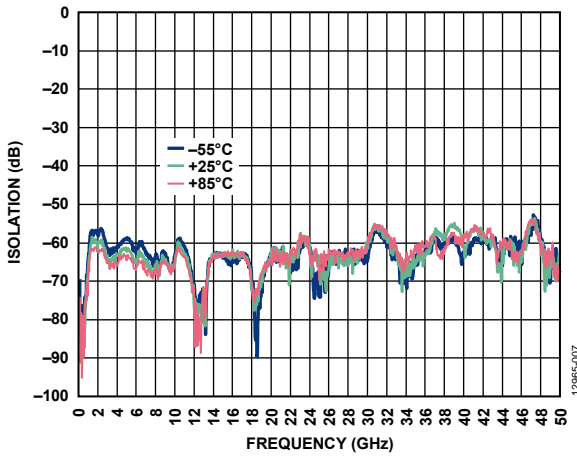


Figure 7. Isolation vs. Frequency at Various Temperatures

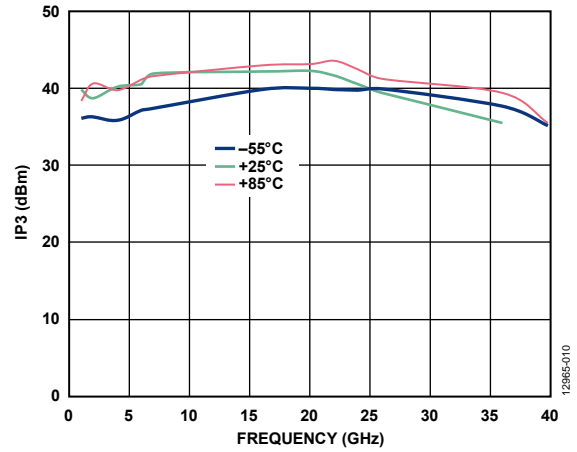


Figure 10. IP3 vs. Frequency at Various Temperatures

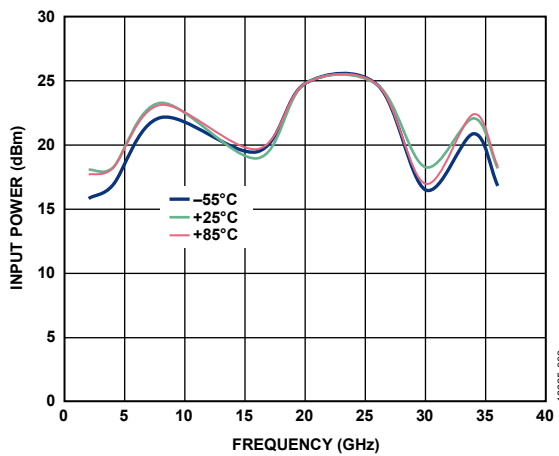


Figure 8. Input 0.1 dB Compression (Low Frequency)

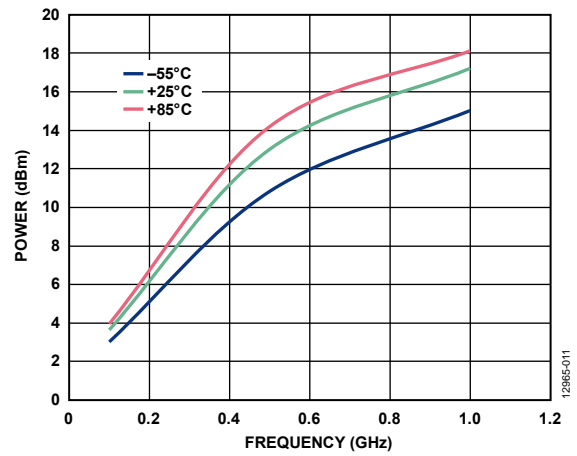


Figure 11. Input 0.1 dB Compression (High Frequency)

## THEORY OF OPERATION

Applying a TTL-level voltage to the VCTL pin provides an insertion loss between the RF1 and RF2 connectors from 7 dB typical to 10 dB typical. When the [HMC-C583](#) is in a high insertion loss state, both the RF1 and RF2 pins are internally terminated to 50  $\Omega$ .

The low state level is a voltage between 0 V and 1.5 V, and the high state level is a voltage between 3.5 V and  $V_{DD}$ .

**Table 4.**

VCTL Level	Typical Insertion Loss Level (dB)
Low	7
High	50

### APPLICATIONS INFORMATION

In Figure 12, the [HMC-C583](#) makes an RF pulse modulator. In this application circuit, the [HMC-C583](#) modulates the amplitude of the output of the synthesized RF signal generator.

This type of circuit can create modulated RF signals for various applications, which is only one of the many applications of the [HMC-C583](#).

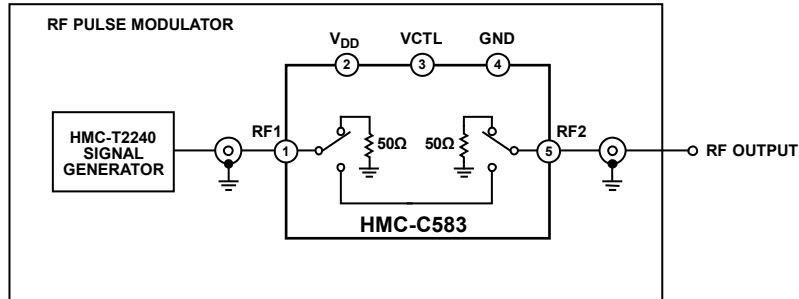
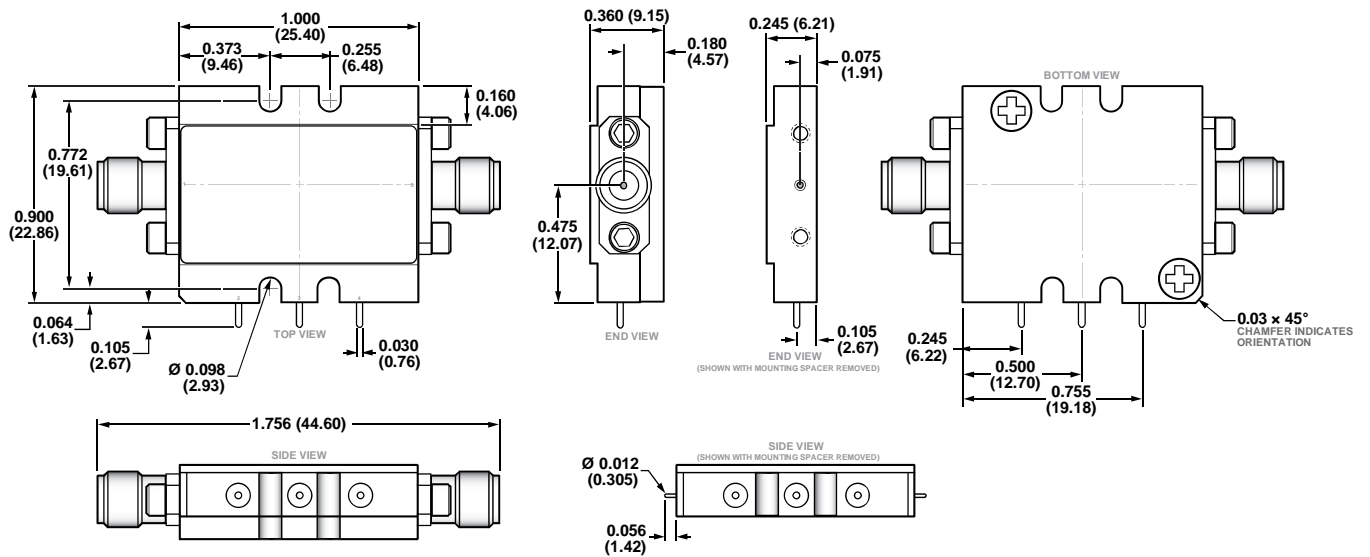


Figure 12. Typical Application Circuit

12285-012



# OUTLINE DIMENSIONS



CONTROLLING DIMENSIONS ARE IN INCHES; MILLIMETER DIMENSIONS (IN PARENTHESES) ARE ROUNDED-OFF INCH EQUIVALENTS FOR REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN.

Figure 13. 5-Lead Module with Connector Interface [MODULE] (ML-5-1)

Dimensions shown in inches and (millimeters)

## ORDERING GUIDE

Model <sup>1</sup>	Temperature Range	Package Description	Package Option
HMC-C583	-55°C to +85°C	5-Lead Module with Connector Interface [MODULE]	ML-5-1

<sup>1</sup> This is an RoHS compliant part.