WINSOURCE ELECTRONICS

# THE DATASHEET OF

HMC-C583

# 0.1 GHz to 40 GHz, SPST Switch

Data Sheet **HMC-C583**

## 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

## FUNCTIONAL BLOCK DIAGRAM

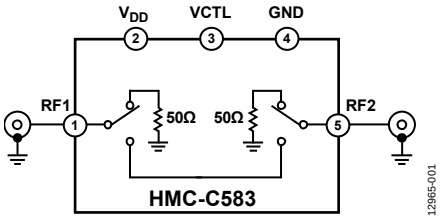



*Figure 1.*

## 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.

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 V, VCTL = 0 V or 5 V, $T_A$ = 25°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 | | | | | | Includes insertion loss |
| | | 40 | 50 | | dB | 0.1 GHz to 40 GHz |
| INPUT POWER FOR 0.1 dB COMPRESSION | P0.1dB | | | | | |
| | | | 5 | | dBm | 0.1 GHz to 0.5 GHz |
| | | | 21 | | dBm | 0.5 GHz to 40 GHz |
| INPUT THIRD-ORDER INTERCEPT | IP3 | | | | | |
| | | | 20 | | dBm | 0.1 GHz to 2 GHz |
| | | | 40 | | dBm | 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 | $I_{IN}$ | | ±20 | | µA | $V_{IN}$ = 0 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% VCTL to 10%/90% RF |

# ABSOLUTE MAXIMUM RATINGS

**Table 2.**

| Parameter | Rating |
|---|---|
| Supply Input ($V_{DD}$) | 5.8 V |
| Control Voltage (VCTL) | $V_{DD}$ ± 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°C to +85°C |
| Storage Temperature Range | −65°C to +150°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

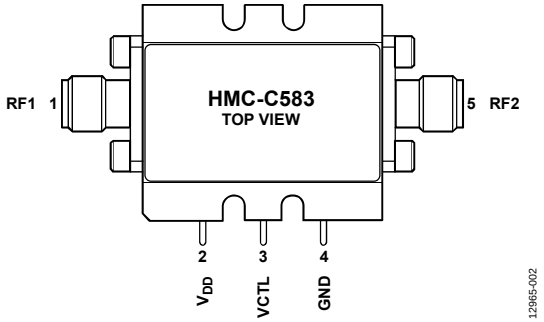



*Figure 2. Pin Configuration*

**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 | $V_{DD}$ | 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

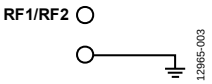



*Figure 3. RF1/RF2 Interface Schematic*




*Figure 4. GND Interface Schematic*

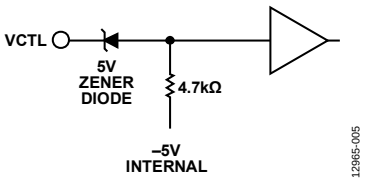



*Figure 5. VCTL Interface Schematic*

# TYPICAL PERFORMANCE CHARACTERISTICS

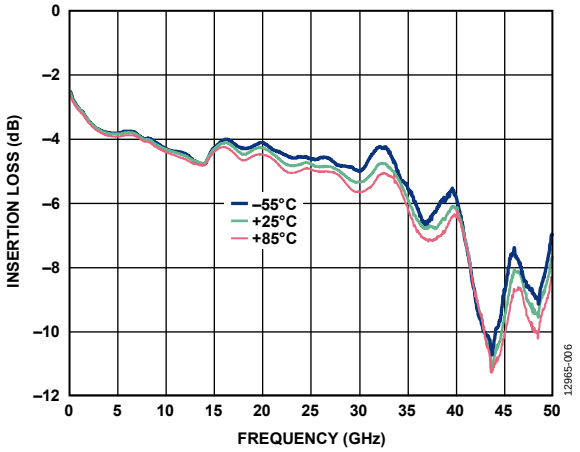



Figure 6. Insertion Loss vs. Frequency at Various Temperatures

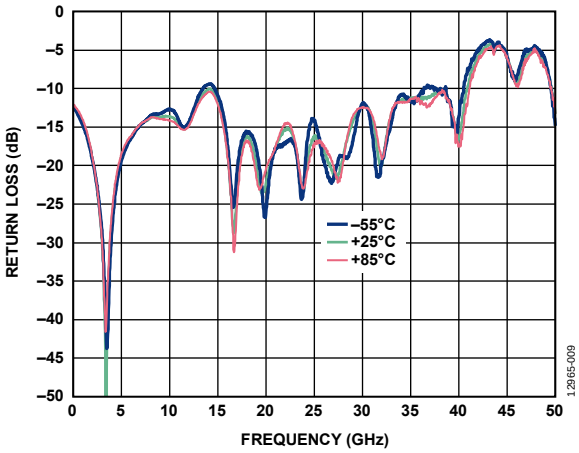



Figure 9. Return Loss vs. Frequency at Various Temperatures for RF1, RF2

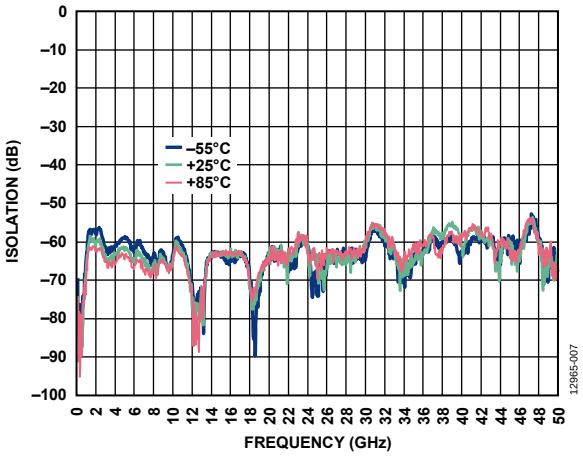



Figure 7. Isolation vs. Frequency at Various Temperatures

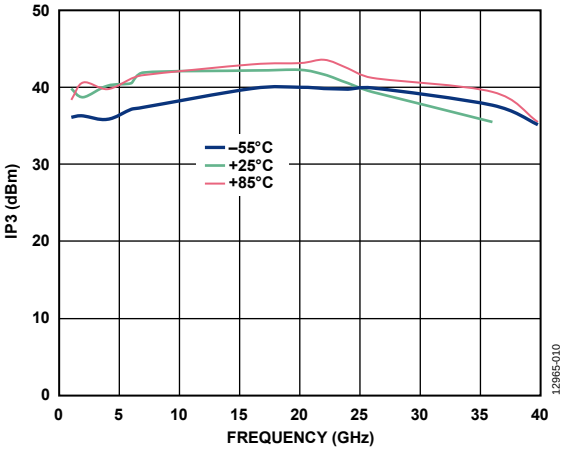



Figure 10. IP3 vs. Frequency at Various Temperatures

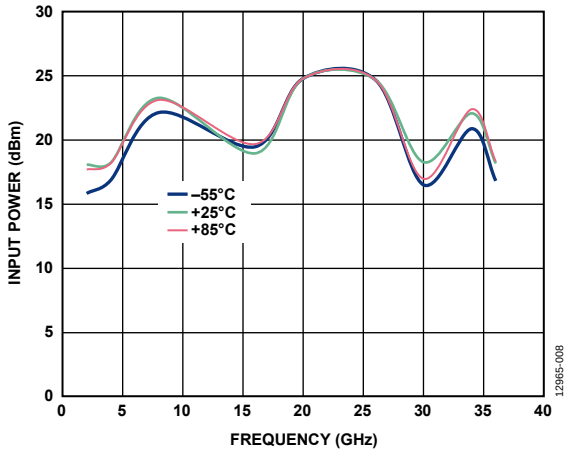



Figure 8. Input 0.1 dB Compression (Low Frequency)

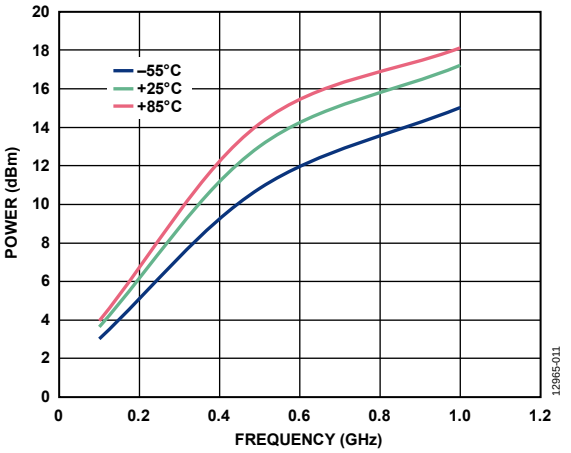



Figure 11. Input 0.1 dB Compression (High Frequency)

# 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 Ω.

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.

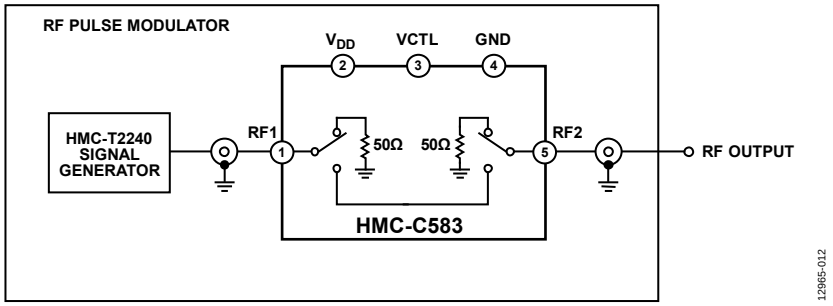
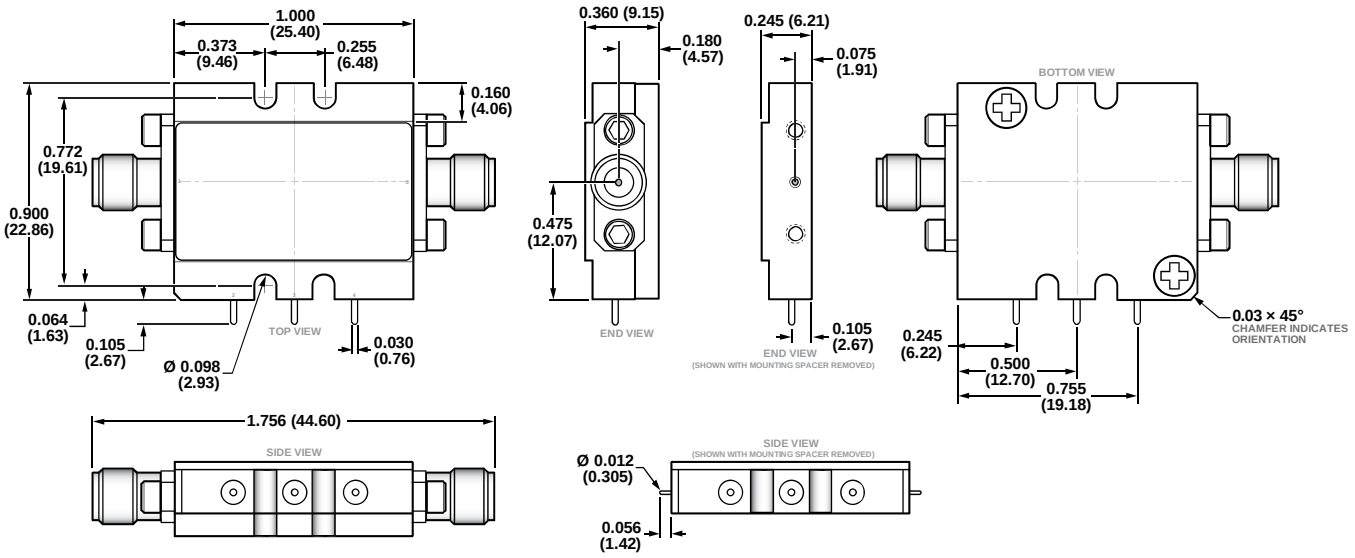



*Figure 12. Typical Application Circuit*

# OUTLINE DIMENSIONS




PKG-001093

**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.**

09-28-2015-A

*Figure 13. 5-Lead Module with Connector Interface [MODULE]*
*(ML-5-1)*
*Dimensions shown in inches and (millimeters)*

## ORDERING GUIDE

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

[1] This is an RoHS compliant part.

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