

**MMS006PP3**

**Datasheet**

**DC–20 GHz GaAs MMIC SP2T Non-Reflective Switch**

Released

May 2017



Power Matters.™

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# 1 Revision History

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The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

## 1.1 Revision 1.0

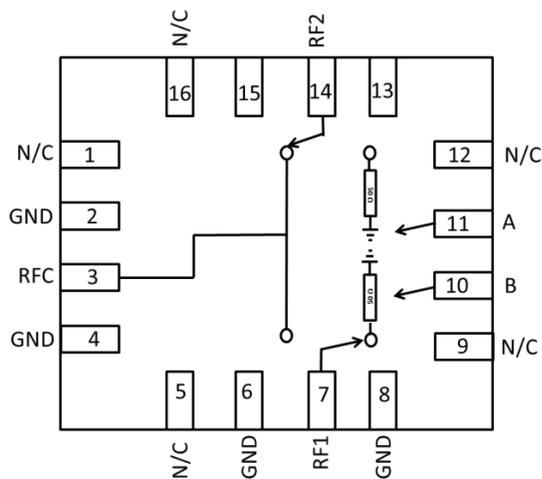
Revision 1.0 was published in May 2017. It was the first publication of this document.

## 2 Product Overview

The MMS006PP3 is a DC-to-20 GHz, non-reflective gallium arsenide (GaAs) pseudomorphic high-electron-mobility transistor (pHEMT) single pole double throw (SPDT) monolithic microwave integrated circuit (MMIC) switch in a plastic leadless 3 mm × 3 mm surface-mount package. The switch delivers over 40 dB of isolation across the DC-to-20 GHz band while maintaining a low insertion loss of less than 2.0 dB. Also available in die form as the MMS006AA, the RF ports are internally matched to 50 Ω, which allows for easy integration into multi-chip modules (MCMs).

The following illustration shows the primary functional diagram of the MMA006PP3 device.

**Figure 1 • Functional Diagram**



### 2.1 Applications

The MMS006PP3 device is designed for the following applications.

- Test instrumentation
- Military radar, radio, EW, and ECM applications
- General purpose microwave applications

### 2.2 Key Features

The following are key features of the MMS006PP3 device:

- Non-reflective topology
- Broadband performance: DC–20 GHz
- Fast switching: 10 ns
- Low insertion loss: 1.2 dB at 10 GHz
- Excellent isolation: 42 dB at 10 GHz
- Compact 16-lead plastic QFN package: 3 mm × 3 mm × 0.85 mm
- High input P1dB: 25 dBm
- High input IP3: 43 dBm

### 3 Electrical Specifications

This section details the electrical specifications of the MMS006PP3 device.

#### 3.1 Absolute Maximum Ratings

The following table lists the absolute maximum ratings of the MMS006PP3 device.

**Table 1 • Absolute Maximum Ratings**

Parameter	Rating
Storage temperature	–65 °C to 150 °C
Operating temperature	–40 °C to 85 °C
Control voltage range (CTLA/CTLB)	0.5 V to –7.5 VDC
RF input power	30 dBm
Hot switching power	7 dBm
Channel temperature	150 °C
Thermal resistance (insertion loss path)	100 °C/W
Thermal resistance (terminated path)	180 °C/W
ESD sensitivity (HBM)	Class 1A

#### 3.2 Specified Electrical Performance

The following table lists the specified electrical performance of the MMS006PP3 device at 25 °C, where  $V_{\text{CONTROL}}$  (CTLA/CTLB) is 0 V, –5 V. The system is 50  $\Omega$ .

**Table 2 • Specified Electrical Performance**

Parameter	Frequency	Min	Typ	Max	Unit
Operational frequency range		DC		20	GHz
Insertion loss (all states)	DC–20 GHz		2.0	2.25	dB
Return loss (on state)	DC–20 GHz		–10		dB
Isolation	DC–20 GHz	35	40		dB
$T_{\text{RISE}}, T_{\text{FALL}}$	DC–20 GHz (10% to 90% and 90% to 10% RF)		10		ns
$T_{\text{ON}}, T_{\text{OFF}}$	DC–20 GHz (50% control to 90% RF and 50% control to 90% RF)		10		ns
Input power for P1 dB	1 GHz–20 GHz		25		dBm
Input third order intercept (IIP3)	2 GHz–20 GHz (two-tone input power, 7 dBm/tone)		43		dBm

#### 3.3 Typical Performance Curves

The following graphs show the typical performance curves of the MMS006PP3 device.

Figure 2 • Insertion Loss vs. Temperature

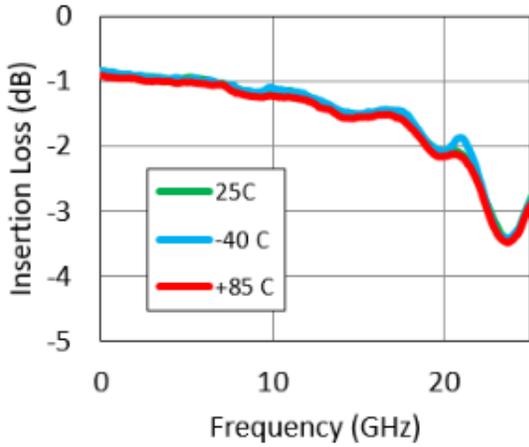


Figure 3 • Isolation

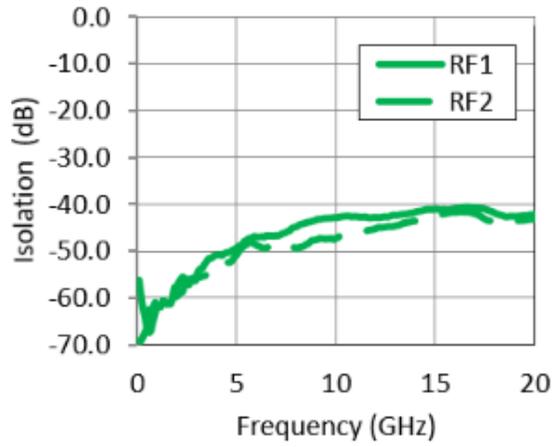


Figure 4 • Return Loss

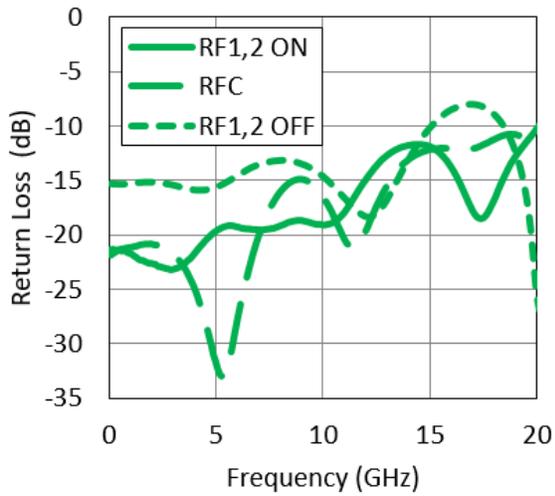


Figure 5 • 0.1 dB and 1 dB Compression Point

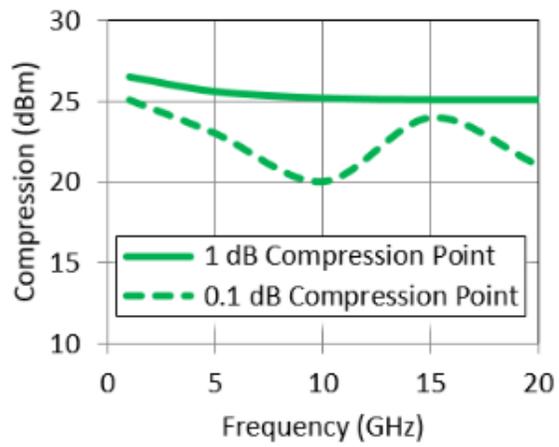
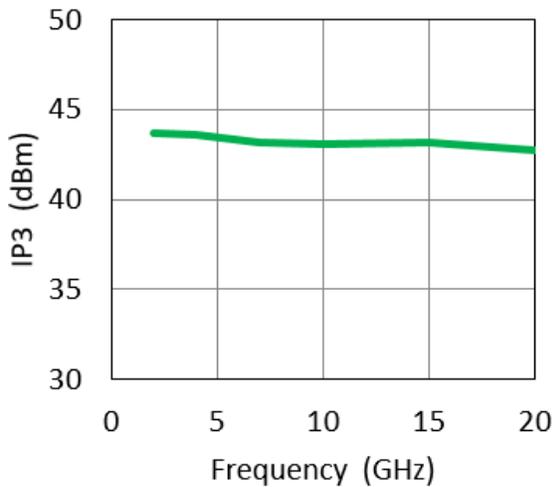


Figure 6 • Input Third Order Intercept Point



### 3.4 Control Voltages

The following tables list the control voltages of the MMS006PP3 device.

**Table 3 • Switch Control Truth Table**

Control Input A	Control Input B	Signal Path Condition: RF Common to RF1	Signal Path Condition: RF Common to RF2
High	Low	On	Off
Low	High	Off	On

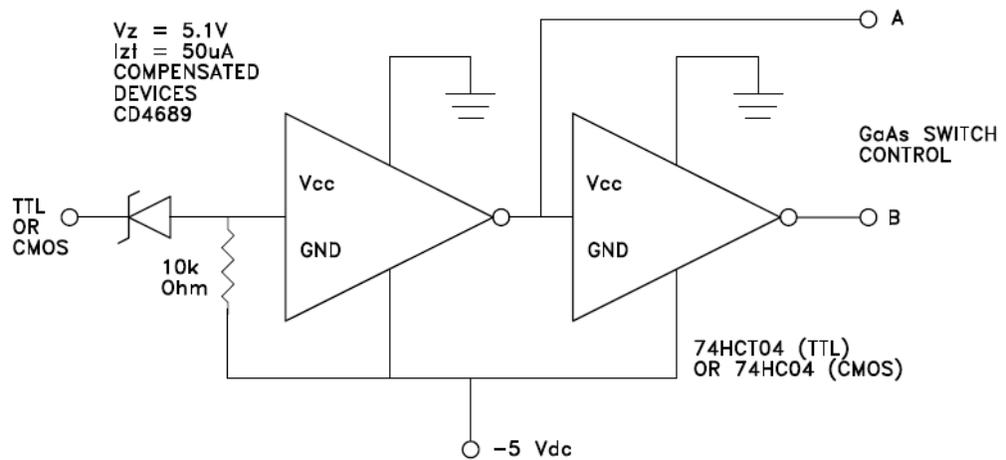
**Table 4 • Digital Control Voltages**

State	Bias Condition
Low	–3 V to 0 V
High	–5.0 V to –4.2 V

### 3.5 Example Driver Circuit

The following illustration shows an example of a possible control voltage driver circuit.

**Figure 7 • Driver Circuit Example**



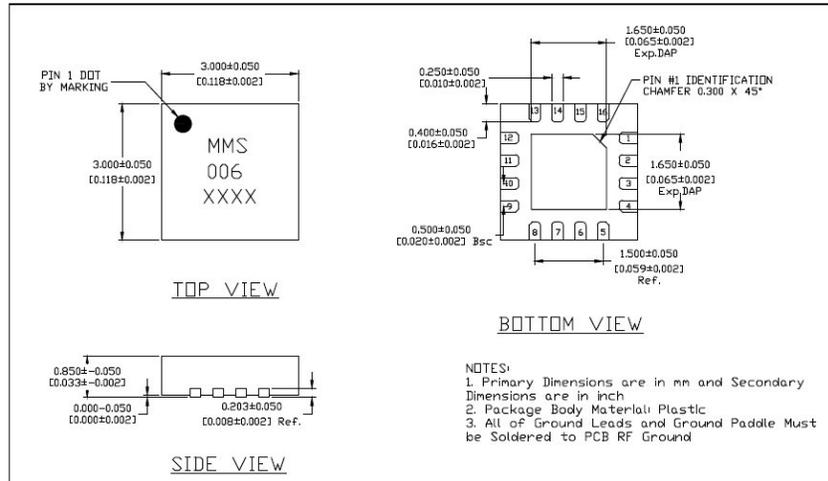
## 4 Package Specification

This section details the package specifications of the MMS006PP3 device.

### 4.1 Package Outline Drawing

The following illustration shows the package outline of the MMS006PP3 device. Dimensions are in millimeters [inches].

Figure 8 • Package Outline



### 4.2 Package Information

The following table lists the package information for the MMS006PP3 device. For additional packaging information, contact your Microsemi sales representative.

Table 5 • Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking
MMS006PP3	Low-stress injection molded plastic	100% matte Sn	TBD	MMS 006 www

### 4.3 Pin Descriptions

The following table describes the pins of the MMS006PP3 device.

Table 6 • Pin Description Information

Pin Number	Pin Name	Description
1, 5, 9, 12, 16	N/C	These pins should be connected to PCB RF ground to maximize isolation.
2, 4, 6, 8, 13, 15	GND	Package bottom has an exposed metal paddle that must be connected to PCB RF ground.
3, 7, 14	RF, RF1, RF2	This pin is DC-coupled and matched to 50 Ω. Blocking capacitors are required if RF line potential is not equal to 0 V.

Pin Number	Pin Name	Description
10	CTLB	For details, see <a href="#">Switch Control Truth Table (see page 5)</a> and <a href="#">Digital Control Voltages (see page 5)</a> .
11	CTLA	For details, see <a href="#">Switch Control Truth Table (see page 5)</a> and <a href="#">Digital Control Voltages (see page 5)</a> .
Backside paddle	RF/DC GND	RF/DC ground.

## 5 Handling Recommendations

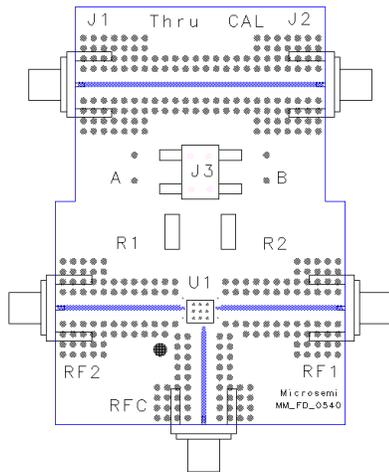
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Gallium arsenide integrated circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. It is recommended to follow all procedures and guidelines outlined in the Microsemi application note [AN01 GaAs MMIC Handling and Die Attach Recommendations](#).

## 6 Evaluation Board Information

The circuit board used in the application should be generated with proper RF circuit design techniques. Signal lines at the RF port should have 50  $\Omega$  impedance and the package ground leads and backside ground paddle should be connected directly to the ground plane as shown (or similar).

**Figure 9 • Evaluation Board**



**Table 7 • Materials for Evaluation PCB MMS006PP3E**

Item	Description
J1, J2, RFC, RF1, RF2	Amphenol end launch SMA RF connector. P/N: 132255RP
J3	Surface mount header pin. P/N: 95278-102-04LF for A, B, GND
R1, R2	100 $\Omega$ resistor, 0603 package
U1	MMS006PP3
PCB <sup>1</sup>	Evaluation PCB: 1.29 inches x 1.55 inches

<sup>1</sup> Circuit board material: Rogers 4350.

## 7 Ordering Information

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The following table lists the ordering information for the MMS006PP3 device.

**Table 8 • Ordering Information**

Part Number	Package
MMS006PP3	3 mm × 3 mm plastic QFN package
MMS006PP3E	Evaluation board for MMS006PP3

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