



### Typical Applications

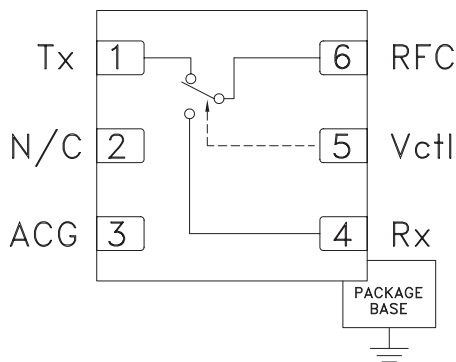
The HMC646LP2(E) is ideal for:

- LNA Protection & T/R Switching
- TD-SCDMA / 3G Infrastructure
- Satellite Subscriber Terminals
- Private Mobile Radio & Public Safety Handsets
- Automotive Telematics

### Features

- High Input P0.1dB: +46 dBm Tx
- Low Insertion Loss: 0.4 dB
- High IIP3: +74 dBm
- Single Positive Control: 0/+3V to 0/+8V
- Failsafe operation; Tx 'On' when unpowered
- 2x2mm DFN SMT Package

### Functional Diagram



### General Description

The HMC646LP2(E) is an SPDT switch in a leadless DFN surface mount plastic package for use in transmit / receive and LNA protection applications which require very low distortion and high power handling of up to 40 watts with less than 10% duty cycle. This robust switch can control signals from 100 - 2100 MHz\* and is ideal for TD-SCDMA / 3G repeaters, PMR, automotive telematics, and satellite subscriber terminal applications. The design provides exceptional P0.1dB of +46 dBm and +74 dBm IIP3 on the Transmit (Tx) port. The failsafe topology provides a low loss path from Tx to RFC, when no DC power is available.

### Electrical Specifications, $T_A = +25^\circ\text{C}$ , $V_{dd} = 5\text{V}$ , $V_{ctl} = 0/+5\text{Vdc}$ , 50 Ohm System\*

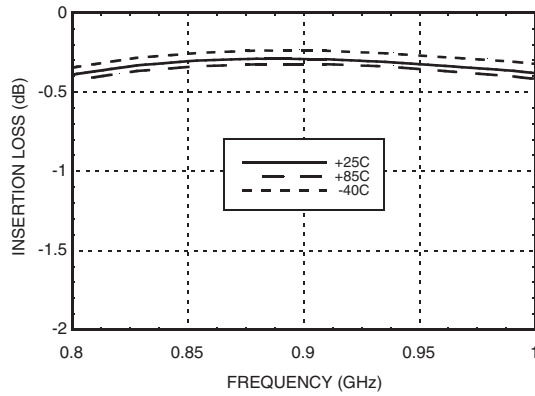
| Parameter  | Min.                     | Typ. | Max. | Min.        | Typ. | Max. | Min.        | Typ. | Max. | Units |
|--|--------------------------|------|------|-------------|------|------|-------------|------|------|-------|
| Frequency Range  | 869 - 960                |      |      | 1525 - 1661 |      |      | 2010 - 2025 |      |      | MHz   |
| Insertion Loss   | Tx - RFC                 | 0.3  | 0.6  |             | 0.6  | 0.9  |             | 0.7  | 1.0  | dB    |
|  | RFC - Rx                 |      | 0.4  | 0.7         |      | 0.8  | 1.1         | 1.3  | 1.7  | dB    |
| Isolation  | Tx - RFC                 | 20   | 27   |             | 15   | 22   |             | 12   | 17   | dB    |
|  | RFC - Rx                 | 28   | 38   |             | 20   | 30   |             | 25   | 32   | dB    |
| Return Loss  | Tx - RFC                 |      | 17   |             |      | 27   |             | 25   |      | dB    |
|  | RFC - Rx                 |      | 25   |             |      | 20   |             | 12   |      | dB    |
| Input Power for 0.1 dB Compression                                     | Tx - RFC                 |      | 44   |             |      | 46   |             | 46   |      | dBm   |
|  | RFC - Rx                 |      | 20   |             |      | 20   |             | 20   |      | dBm   |
| Input Third Order Intercept (Two-tone input power = +17 dBm each tone) | Tx - RFC                 |      | 71   |             |      | 74   |             | 74   |      | dBm   |
|  | RFC - Rx                 |      | 41   |             |      | 42   |             | 34   |      | dBm   |
| Switching Characteristics  | tRISE, tFALL (10/90% RF) |      | 100  |             |      | 100  |             | 100  |      | ns    |
|  | tON, (50% CTL to 90% RF) |      | 320  |             |      | 320  |             | 320  |      | ns    |
|  | tOFF (50% CTL to 10% RF) |      | 320  |             |      | 320  |             | 320  |      | ns    |

\* Specifications and data reflect HMC646LP2(E) measured using the respective application circuits for each designated frequency band found herein

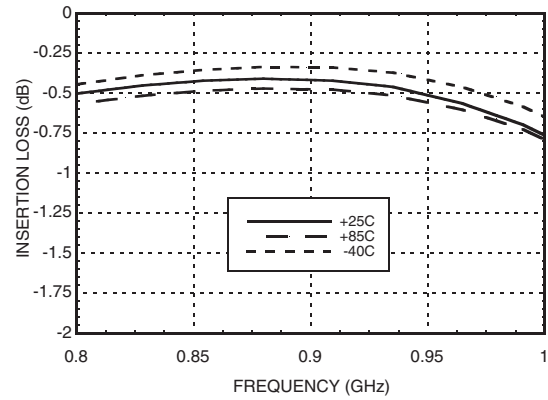


**GaAs MMIC 40W FAILSAFE SWITCH, 0.1 - 2.1 GHz**

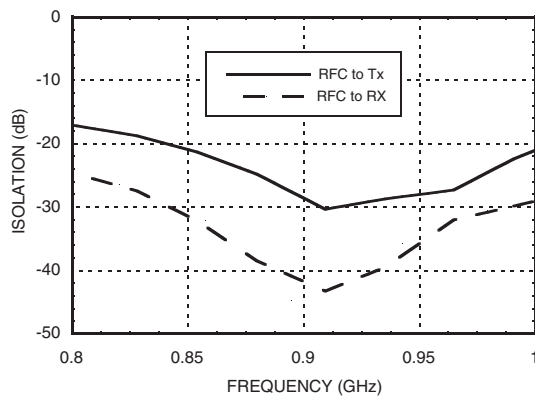
**Insertion Loss vs. Temperature, Tx with 915 MHz Tuning**



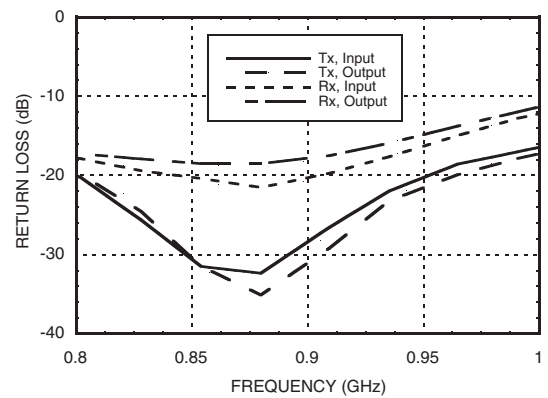
**Insertion Loss vs. Temperature, Rx with 915 MHz Tuning**



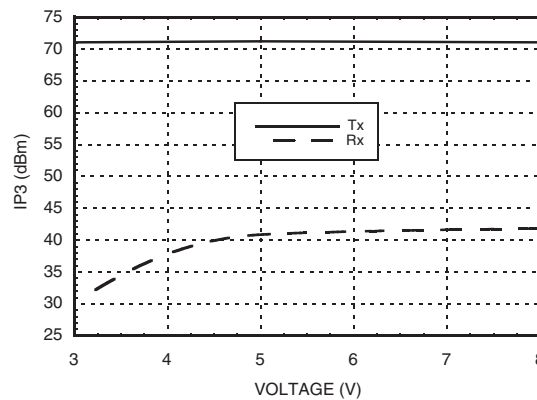
**Isolation with 915 MHz Tuning**



**Return Loss with 915 MHz Tuning**



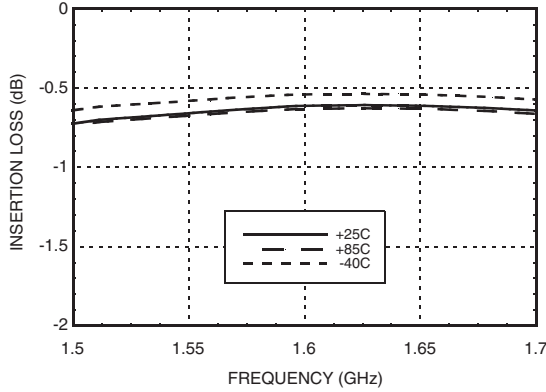
**Input IP3 vs. Voltage with 915 MHz Tuning**



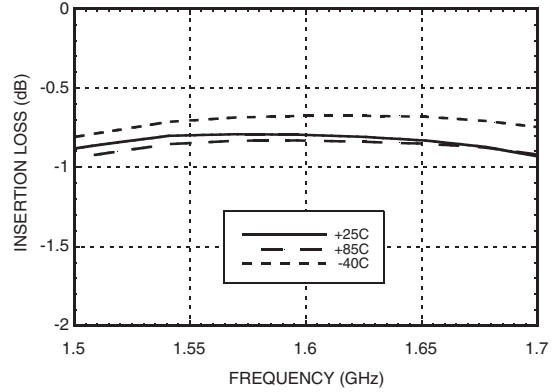


**GaAs MMIC 40W FAILSAFE SWITCH, 0.1 - 2.1 GHz**

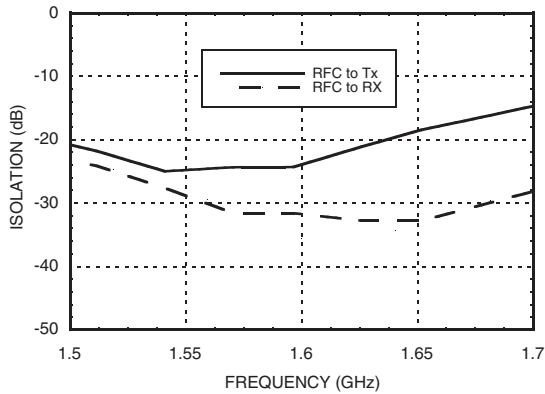
**Insertion Loss vs. Temperature, Tx with 1600 MHz Tuning**



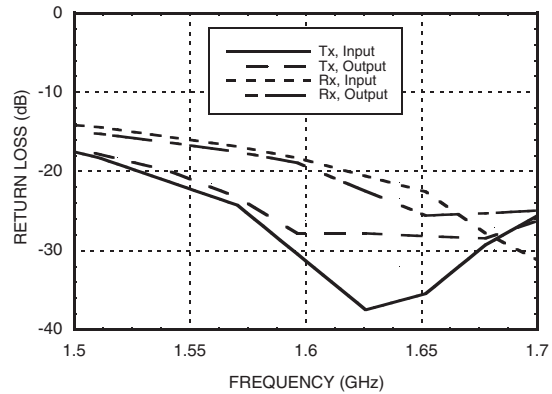
**Insertion Loss vs. Temperature, Rx with 1600 MHz Tuning**



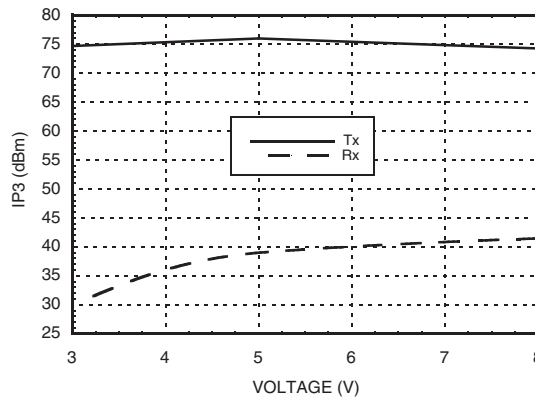
**Isolation with 1600 MHz Tuning**



**Return Loss with 1600 MHz Tuning**



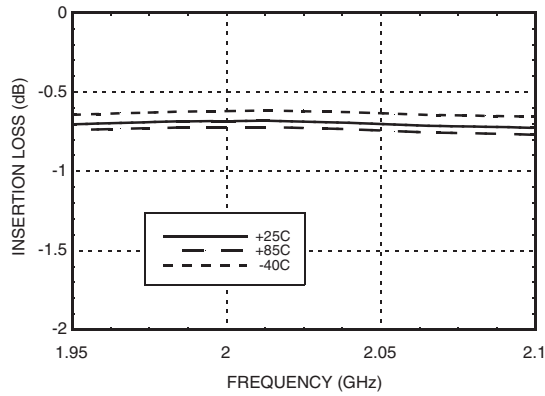
**Input IP3 vs. Voltage with 1600 MHz Tuning**



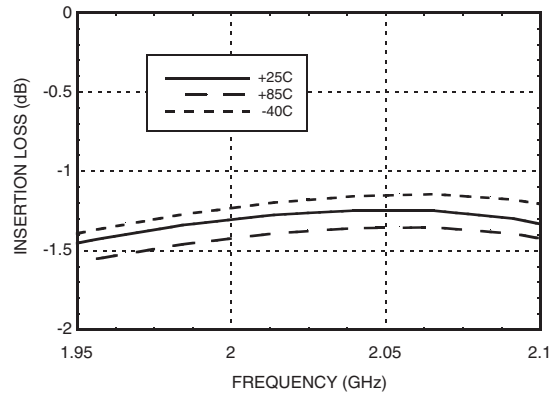


**GaAs MMIC 40W FAILSAFE SWITCH, 0.1 - 2.1 GHz**

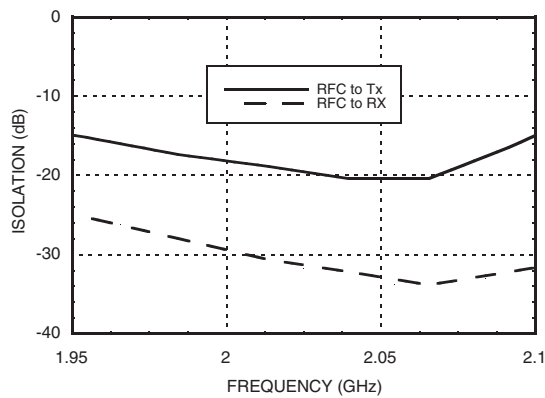
**Insertion Loss vs. Temperature, Tx with 2015 MHz Tuning**



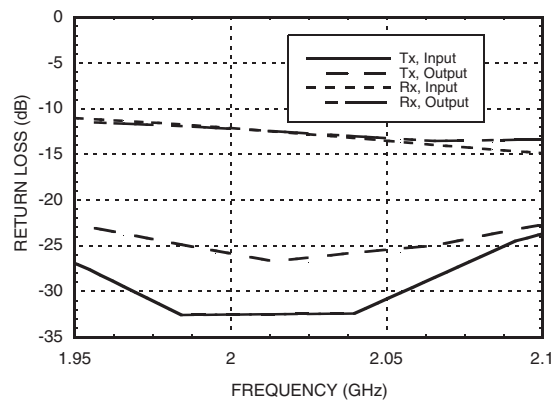
**Insertion Loss vs. Temperature, Rx with 2015 MHz Tuning**



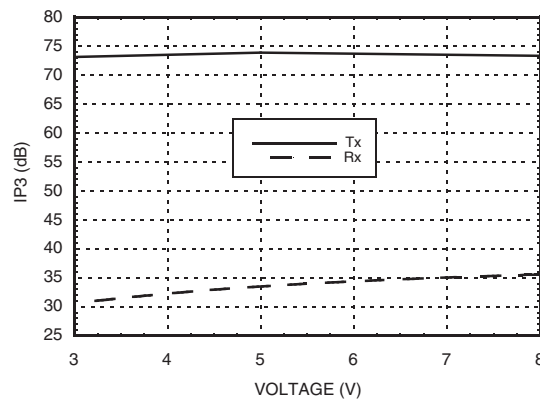
**Isolation with 2015 MHz Tuning**



**Return Loss with 2015 MHz Tuning**



**Input IP3 vs. Voltage with 2015 MHz Tuning**



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## GaAs MMIC 40W FAILSAFE SWITCH, 0.1 - 2.1 GHz



### Absolute Maximum Ratings

|                              |         | Vdd = 5V              |
|------------------------------|---------|-----------------------|
| Max. CW Input Power          | Tx Port | +44.00 dBm            |
|                              | Rx Port | +36.75 dBm            |
| Max Channel Temp.            |         | 150 °C                |
| Thermal Resistance           | Tx Port | 14.75 °C/W            |
|                              | Rx Port | 14.75 °C/W            |
| Continuous Dissipated Power  | Tx Port | 4.4 W                 |
|                              | Rx Port | 4.4 W                 |
| Supply Voltage (Vdd)         |         | +10V Vdc              |
| Control Voltage Range (Vctl) |         | -0.2 to Vdd + 1.0 Vdc |
| Storage Temperature          |         | -65 to +150 °C        |
| Operating Temperature        |         | -40 to +85 °C         |

### Truth Table

| Control Input |     | Signal Path State |           |
|---------------|-----|-------------------|-----------|
| Vctl          | Vdd | RFC To Tx         | RFC to Rx |
| 0.0           | 0.0 | ON                | OFF       |
| 0.0           | Vdd | OFF               | ON        |
| Vdd           | Vdd | ON                | OFF       |

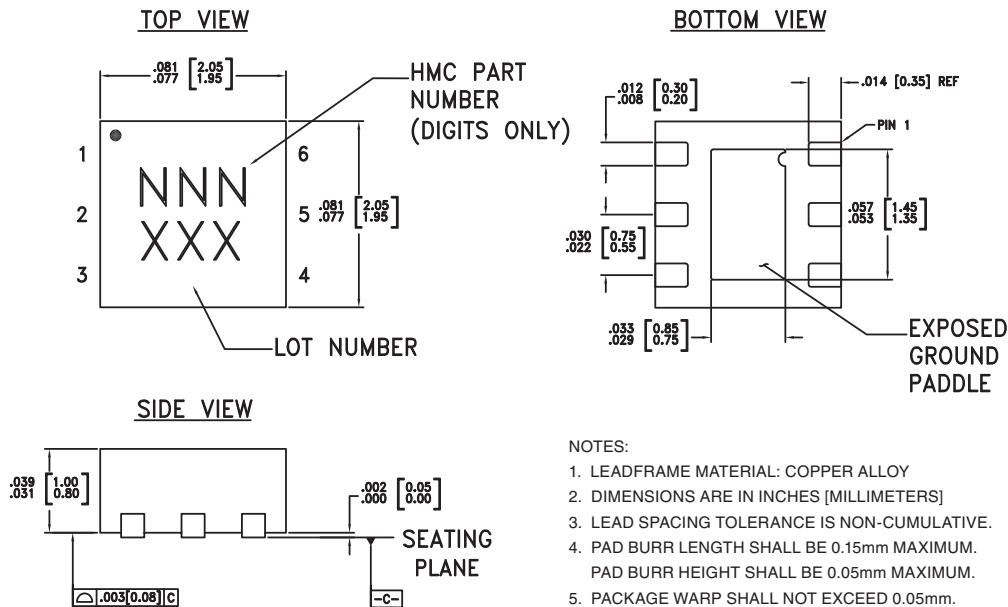
Vdd = +3V to +8V  
Control Input Voltage Tolerances are ± 0.2 Vdc.

DC blocking capacitors are required at ports RFC, Tx and Rx.



**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**

### Outline Drawing



**NOTES:**

- LEADFRAME MATERIAL: COPPER ALLOY
- DIMENSIONS ARE IN INCHES [MILLIMETERS]
- LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
- PAD BURR LENGTH SHALL BE 0.15mm MAXIMUM.  
PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
- PACKAGE WARP SHALL NOT EXCEED 0.05mm.
- ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
- REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED LAND PATTERN.

### Package Information

| Part Number | Package Body Material                              | Lead Finish   | MSL Rating          | Package Marking <sup>[3]</sup> |
|-------------|--|---------------|---------------------|--------------------------------|
| HMC646LP2   | Low Stress Injection Molded Plastic                | Sn/Pb Solder  | MSL1 <sup>[1]</sup> | 646<br>XXX                     |
| HMC646LP2E  | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | 646<br>XXX                     |

[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C

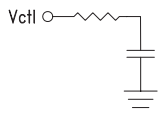

[3] 3-Digit lot number XXX

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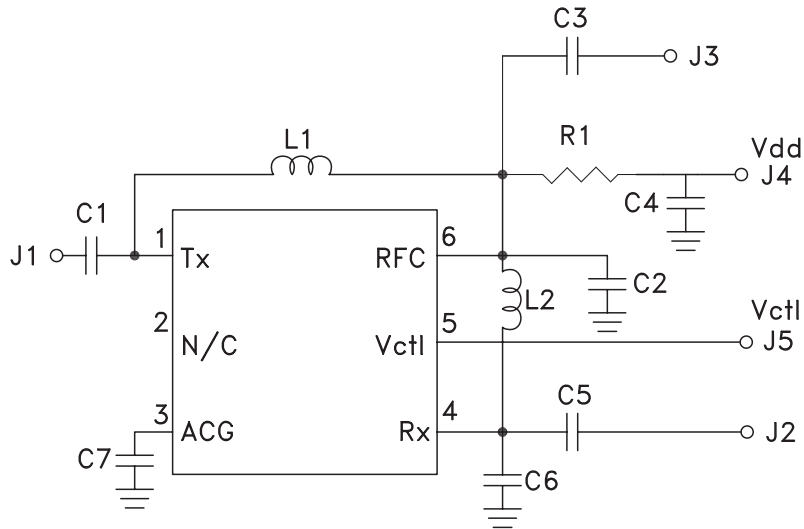


### Pin Descriptions

| Pin Number | Function | Description   | Interface Schematic  |
|------------|----------|---|--|
| 1          | Tx       | This pin is DC coupled and matched to 50 Ohms.                                      |  |
| 2          | N/C      | Not Connected   |  |
| 3          | ACG      | External capacitor to ground is required.<br>See application circuit herein.        |  |
| 4          | Rx       | This pin is DC coupled and matched to 50 Ohms.                                      |  |
| 5          | Vctl     | See truth table.  |   |
| 6          | RFC      | This pin is DC coupled and matched to 50 Ohms.                                      |  |
|            | GND      | Package bottom has exposed metal paddle<br>that must be connected to PCB RF ground. |  |



**Application Circuit**



**Components for Selected Frequencies**

| Tuned Frequency       | 915 MHz | 1600 MHz | 2015 MHz |
|-----------------------|---------|----------|----------|
| Evaluation PCB Number | 118098  | 118099   | 118100   |
| C1, C3, C5 [1]        | 1000 pF | 330 pF   | 330 pF   |
| C2                    | 2.7 pF  | 1.5 pF   | 1.1 pF   |
| C4                    | 1000 pF | 100 pF   | 100 pF   |
| C6                    | 1.8 pF  | 0.5 pF   | 0.5 pF   |
| C7                    | 15 pF   | 4.7 pF   | 2.7 pF   |
| L1                    | 15 nH   | 3.9 nH   | 1.8 nH   |
| L2                    | 9 nH    | 4.3 nH   | 3.3 nH   |
| R1                    | 10 k    | 10 k     | 10 k     |

[1] DC blocking capacitors