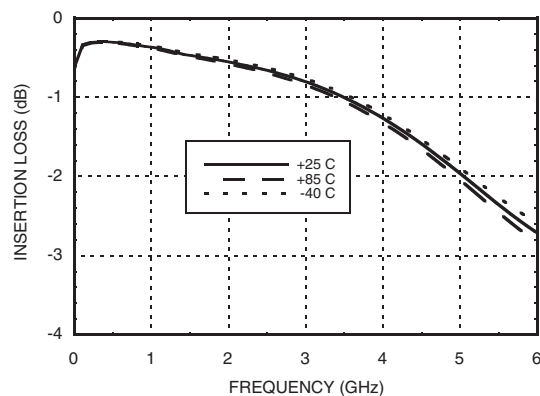
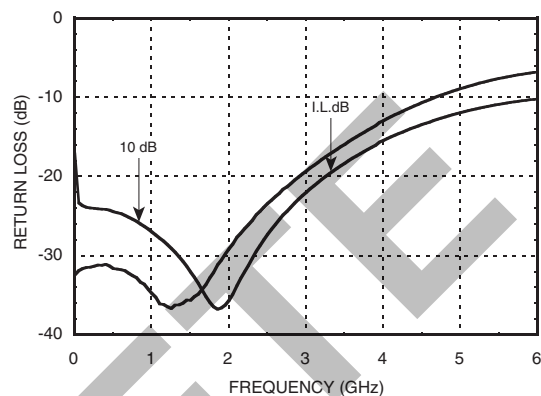


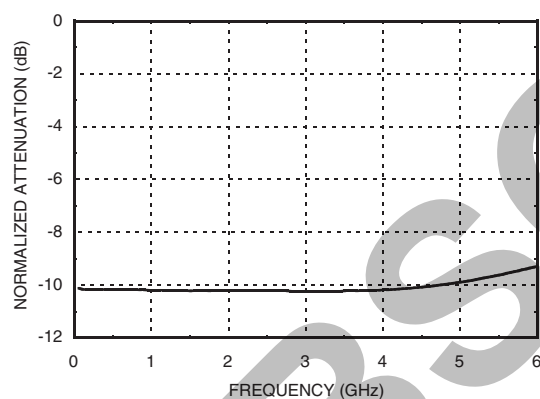
**Insertion Loss**



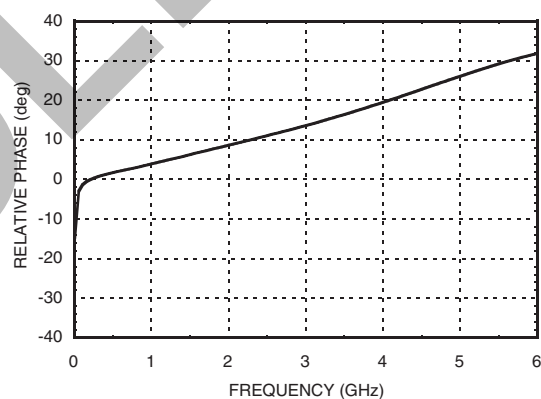
**Return Loss RF1, RF2**



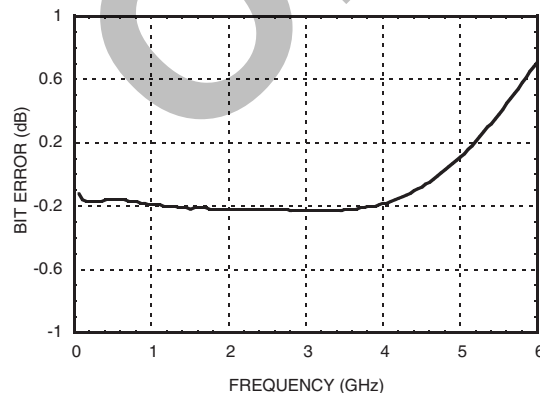
**Normalized Attenuation**



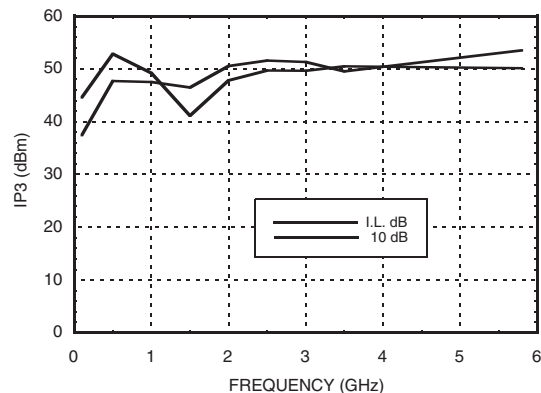
**Relative Phase vs. Frequency**



**Bit Error vs. Frequency**



**Input IP3 vs. Frequency**





v01.1005

# HMC541LP3 / 541LP3E

**10 dB GaAs MMIC 1-BIT DIGITAL  
POSITIVE CONTROL ATTENUATOR, DC - 5 GHz**

## Bias Voltage & Current

| Vdd = +5.0 Vdc $\pm$ 10% |                 |
|--------------------------|-----------------|
| Vdd (VDC)                | Idd (Typ.) (mA) |
| +4.5                     | 1.3             |
| +5.0                     | 1.5             |
| +5.5                     | 1.7             |

## Control Voltage

| State           | Bias Condition                      |
|-----------------|-------------------------------------|
| Low             | 0 to +0.8V @ -5 $\mu$ A Typ.        |
| High            | +2.0 to + 5.0 Vdc @ 40 $\mu$ A Typ. |
| Note: Vdd = +5V |                                     |

## Truth Table

| Control Voltage Input | Attenuation State<br>RF1 - RF2 |
|-----------------------|--------------------------------|
| V1<br>10 dB           |                                |
| High                  | Reference I.L.                 |
| Low                   | 10 dB                          |

OBSOLETE

For price, delivery, and to place orders, please contact Hittite Microwave Corporation:  
20 Alpha Road, Chelmsford, MA 01824 Phone: 978-250-3343 Fax: 978-250-3373  
Order On-line at [www.hittite.com](http://www.hittite.com)

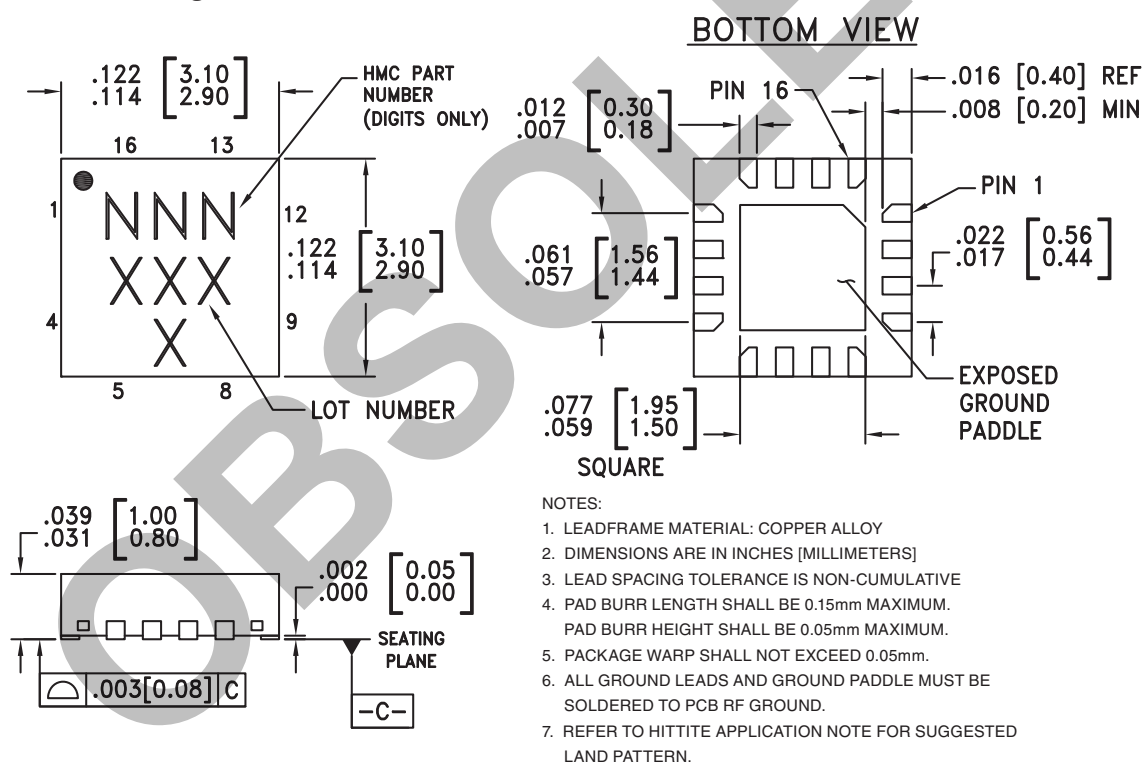
### Absolute Maximum Ratings

|                                                                             |                      |
|-----------------------------------------------------------------------------|----------------------|
| RF Input Power (DC - 5 GHz)                                                 | +27 dBm (T = +85 °C) |
| Control Voltage Range (V1)                                                  | -1V to Vdd +1V       |
| Bias Voltage (Vdd)                                                          | +7.0 Vdc             |
| Channel Temperature                                                         | 150 °C               |
| Continuous P <sub>diss</sub> (T = 85 °C)<br>(derate 14.7 mW/°C above 85 °C) | 0.96 W               |
| Thermal Resistance                                                          | 68 °C/W              |
| Storage Temperature                                                         | -65 to +150 °C       |
| Operating Temperature                                                       | -40 to +85 °C        |
| ESD Sensitivity (HBM)                                                       | Class 1B             |



ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS

### Outline Drawing



### Package Information

| Part Number | Package Body Material                              | Lead Finish   | MSL Rating          | Package Marking <sup>[3]</sup> |
|-------------|----------------------------------------------------|---------------|---------------------|--------------------------------|
| HMC541LP3   | Low Stress Injection Molded Plastic                | Sn/Pb Solder  | MSL1 <sup>[1]</sup> | 541<br>XXXX                    |
| HMC541LP3E  | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | 541<br>XXXX                    |

[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C

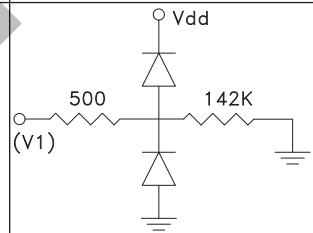
[3] 4-Digit lot number XXXX

For price, delivery, and to place orders, please contact Hittite Microwave Corporation:  
20 Alpha Road, Chelmsford, MA 01824 Phone: 978-250-3343 Fax: 978-250-3373  
Order On-line at [www.hittite.com](http://www.hittite.com)

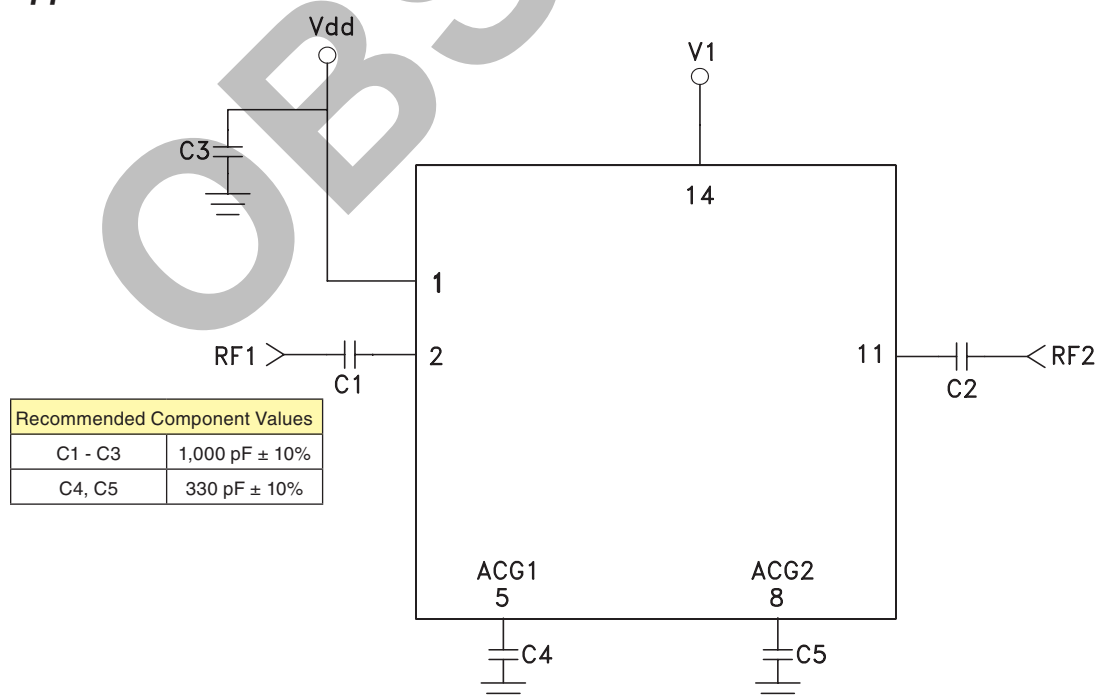
# HMC541LP3 / 541LP3E

## 10 dB GaAs MMIC 1-BIT DIGITAL POSITIVE CONTROL ATTENUATOR, DC - 5 GHz

### Pin Descriptions

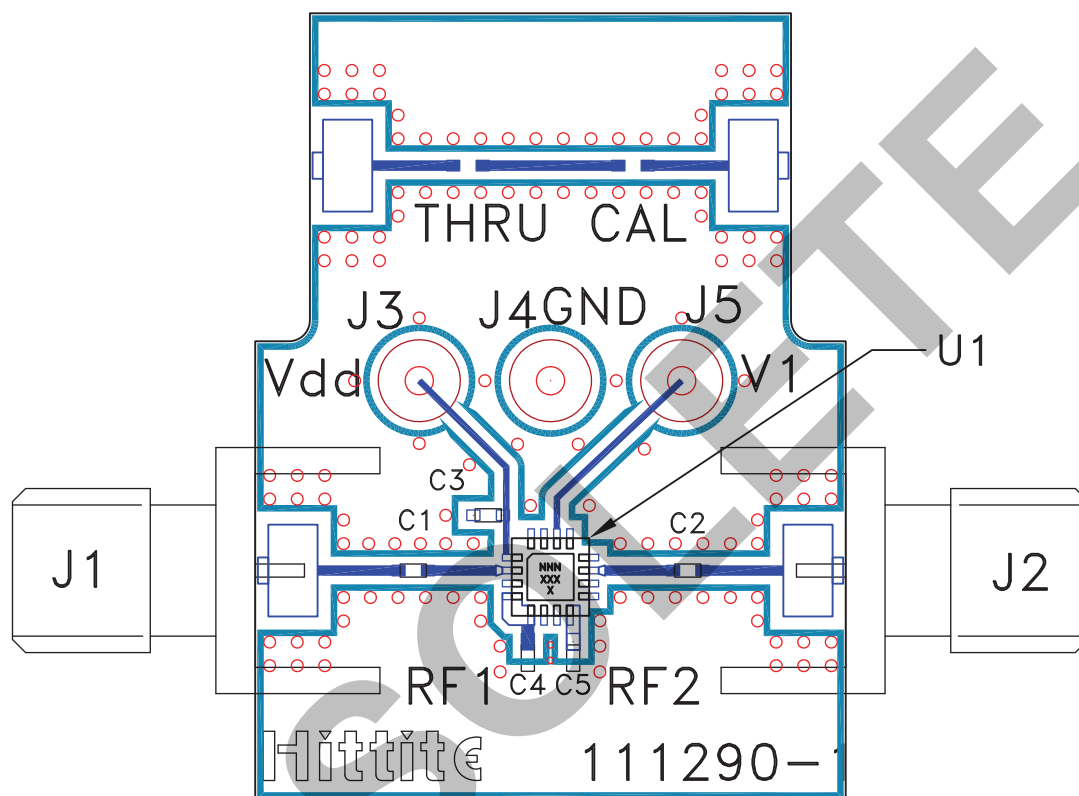
| Pin Number                        | Function   | Description                                                                                                                             | Interface Schematic                                                                   |
|-----------------------------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1                                 | Vdd        | Supply Voltage.                                                                                                                         |                                                                                       |
| 2, 11                             | RF1, RF2   | This pin is DC coupled and matched to 50 Ohm. Blocking capacitors are required. Select value based on lowest frequency of operation.    |    |
| 3, 4, 6, 7, 9, 10, 12, 13, 15, 16 | N/C        | These pins should be connected to PCB RF ground to maximize performance.                                                                |                                                                                       |
| 5, 8                              | ACG1, ACG2 | External capacitor to ground is required. Select value for lowest frequency of operation. Place capacitor as close to pins as possible. |                                                                                       |
| 14                                | V1         | See truth table and control voltage table.                                                                                              |   |
|                                   | GND        | Package bottom has an exposed metal paddle that must be connected to RF Ground.                                                         |  |

### Application Circuit



For price, delivery, and to place orders, please contact Hittite Microwave Corporation:  
 20 Alpha Road, Chelmsford, MA 01824 Phone: 978-250-3343 Fax: 978-250-3373  
 Order On-line at [www.hittite.com](http://www.hittite.com)

**Evaluation PCB**



**List of Material for Evaluation PCB 111317 [1]**

| Item    | Description                               |
|---------|-------------------------------------------|
| J1 - J2 | PCB Mount SMA Connector                   |
| J3 - J5 | DC Connector                              |
| C1 - C3 | 1000 pF Capacitor, 0402 Pkg.              |
| C4 - C5 | 330 pF Capacitor, 0402 Pkg.               |
| U1      | HMC541LP3 / HMC541LP3E Digital Attenuator |
| PCB [2] | 111290 Evaluation PCB                     |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the final application should use RF circuit design techniques. Signal lines should have 50 ohm impedance while the package ground leads and exposed paddle should be connected directly to the ground plane similar to that shown. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation circuit board shown is available from Hittite upon request.