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MICROWAVE CORPORATION

v03.1210



# HMC552LP4 / 552LP4E

## GaAs MMIC MIXER w/ INTEGRATED LO AMPLIFIER, 1.6 - 3.0 GHz

### Typical Applications

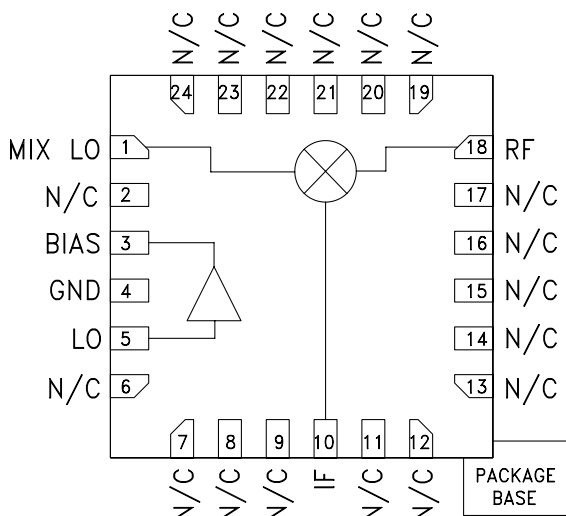
The HMC552LP4 / HMC552LP4E is ideal for Wireless Infrastructure Applications:

- PCS / 3G Infrastructure
- Base Stations & Repeaters
- WiMAX & WiBro
- ISM & Fixed Wireless

### Features

- Input IP3: +25 dBm
- Low Input LO Drive: -4 to +4 dBm
- LO to RF Isolation: 30 dB
- Low Conversion Loss: 8 dB
- Single Positive Supply: +5V @ 62 mA
- Robust 1,000V ESD, Class 1C
- 24 Lead 4x4mm SMT Package: 16mm<sup>2</sup>

### Functional Diagram



### General Description

The HMC552LP4 & HMC552LP4E are high linearity, double-balanced converter ICs that operate from 1.6 to 3.0 GHz and deliver a +25 dBm input third order intercept point. The LO amplifier output and high dynamic range mixer input are positioned so that an external LO filter can be placed in series between them. The converter provides 30 dB of LO to RF isolation and is ideal for upconverter and down-converter applications. The IC operates from a single +5V supply consuming 62 mA of current and accepts a LO drive level of -4 to +4 dBm. The design requires no external baluns and supports IF frequencies between DC and 1 GHz. The HMC552LP4 & HMC552LP4E are pin for pin compatible with the HMC551LP4 & HMC551LP4E, which operate from 0.8 to 1.2 GHz.

### Electrical Specifications, $T_A = +25^\circ \text{C}$ , LO = 0 dBm, Vcc = +5V, R1 = 18 Ohms, IF = 100 MHz\*

| Parameter                      | Min.      | Typ. | Max. | Units |
|--------------------------------|-----------|------|------|-------|
| Frequency Range, RF, LO        | 1.6 - 3.0 |      |      | GHz   |
| Frequency Range, IF            | DC - 1.0  |      |      | GHz   |
| Conversion Loss                |           | 8    | 10   | dB    |
| Noise Figure (SSB)             |           | 8    |      | dB    |
| LO to RF Isolation             | 25        | 30   |      | dB    |
| LO to IF Isolation             | 10        | 20   |      | dB    |
| IP3 (Input)                    |           | 25   |      | dBm   |
| 1 dB Compression (Input)       |           | 16   |      | dBm   |
| LO Drive Input Level (Typical) | -4 to +4  |      |      | dBm   |
| Supply Current (Icc)           |           | 62   |      | mA    |

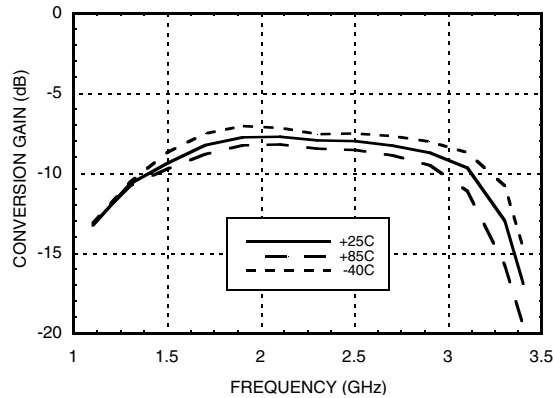
\*Unless otherwise noted, all measurements performed as a downconverter configured as shown in application circuit.

For price, delivery and to place orders: Hittite Microwave Corporation, 20 Alpha Road, Chelmsford, MA 01824

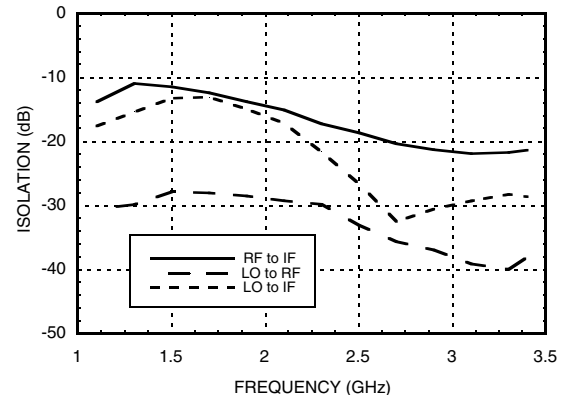
Phone: 978-250-3343 Fax: 978-250-3373 Order On-line at [www.hittite.com](http://www.hittite.com)

Application Support: Phone: 978-250-3343 or [apps@hittite.com](mailto:apps@hittite.com)

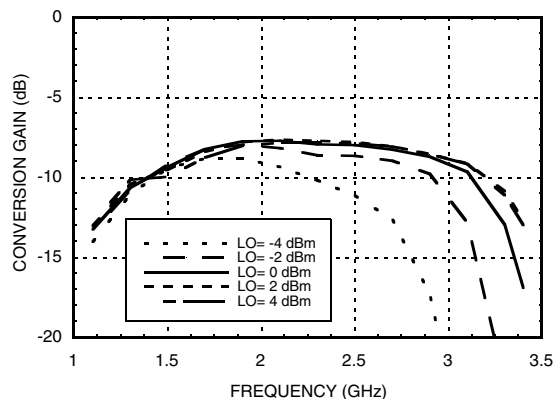
### Conversion Gain vs. Temperature @ LO = 0 dBm



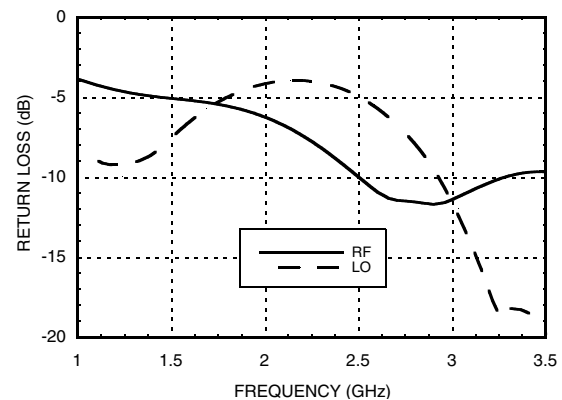
### Isolation @ LO = 0 dBm



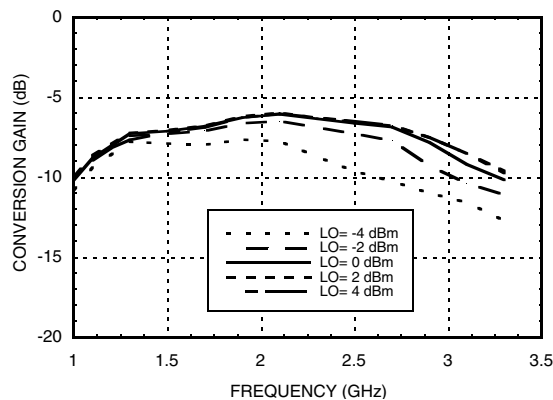
### Conversion Gain vs. LO Drive



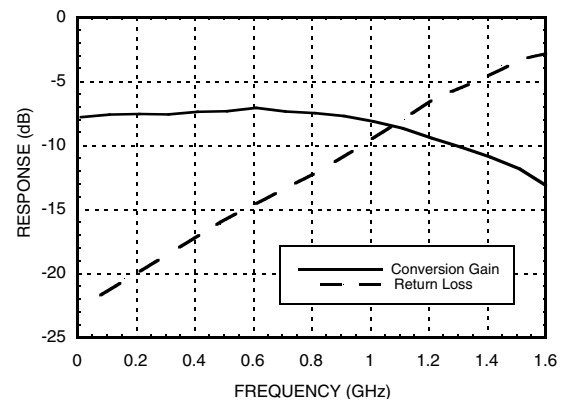
### Return Loss @ LO = 0 dBm



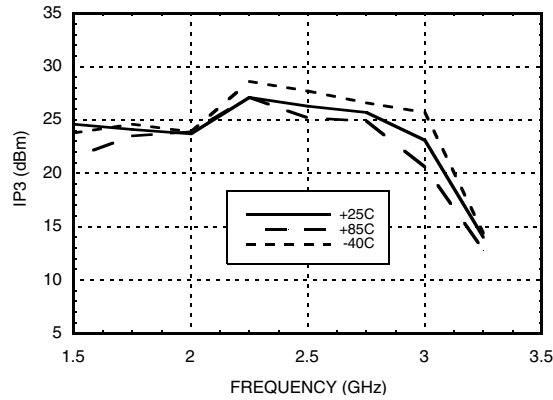
### Upconverter Performance Conversion Gain vs. LO Drive



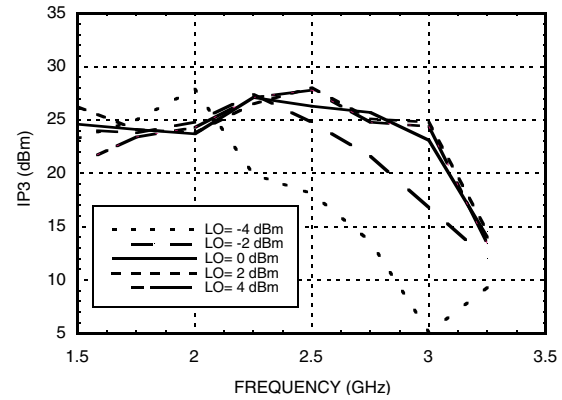
### IF Bandwidth @ LO = 0 dBm



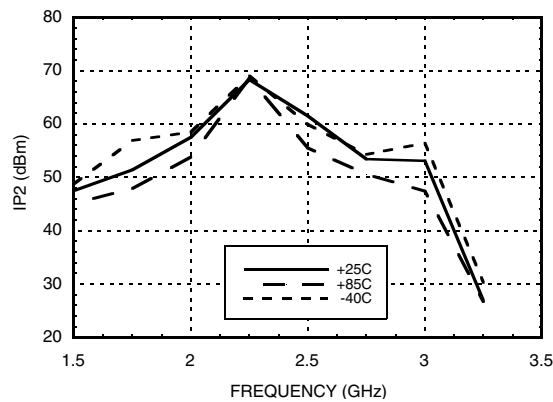
**Input IP3 vs. Temperature @ LO = 0 dBm**



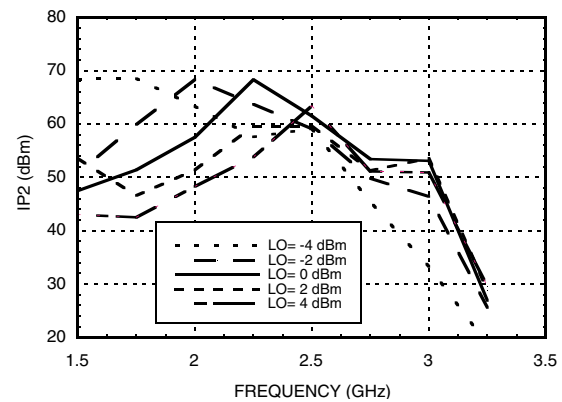
**Input IP3 vs. LO Drive**



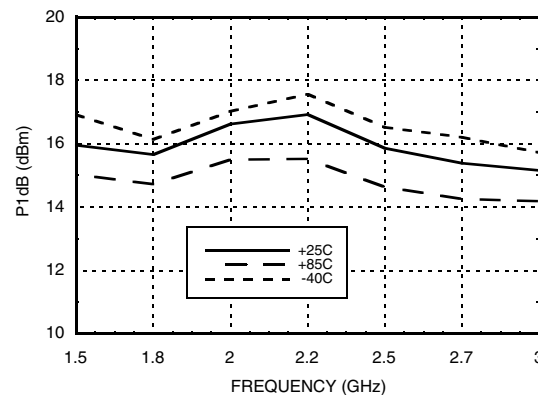
**Input IP2 vs. Temperature @ LO = 0 dBm**



**Input IP2 vs. LO Drive**



**Input P1dB vs. Temperature @ LO = 0 dBm**





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## HMC552LP4 / 552LP4E

### GaAs MMIC MIXER w/ INTEGRATED LO AMPLIFIER, 1.6 - 3.0 GHz

#### MxN Spurious @ IF Port

| mRF | nLO |     |     |     |     |
|-----|-----|-----|-----|-----|-----|
|     | 0   | 1   | 2   | 3   | 4   |
| 0   | xx  | -3  | 16  | 16  | 25  |
| 1   | 7   | 0   | 23  | 44  | 53  |
| 2   | 79  | 66  | 61  | 61  | 98  |
| 3   | 102 | 105 | 93  | 94  | 84  |
| 4   | 103 | 107 | 107 | 102 | 103 |

RF Freq. = 1.9 GHz @ -10 dBm  
LO Freq. = 1.8 GHz @ 0 dBm  
All values in dBc relative to the IF power level.

#### Harmonics of LO

| LO Freq. (GHz) | nLO Spur @ RF Port |    |    |    |
|----------------|--------------------|----|----|----|
|                | 1                  | 2  | 3  | 4  |
| 1.5            | 27                 | 17 | 31 | 32 |
| 1.8            | 28                 | 16 | 40 | 44 |
| 2.1            | 28                 | 18 | 31 | 47 |
| 2.4            | 34                 | 21 | 33 | 41 |
| 2.7            | 36                 | 28 | 42 | 46 |
| 3.0            | 41                 | 27 | 48 | 54 |

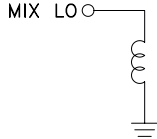
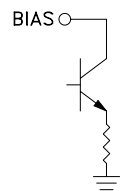
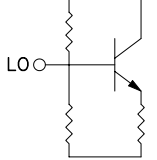
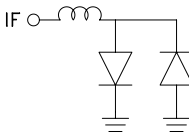
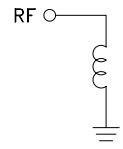
LO = 0 dBm  
All values in dBc below input LO level measured at RF port.

#### Typical Supply Current

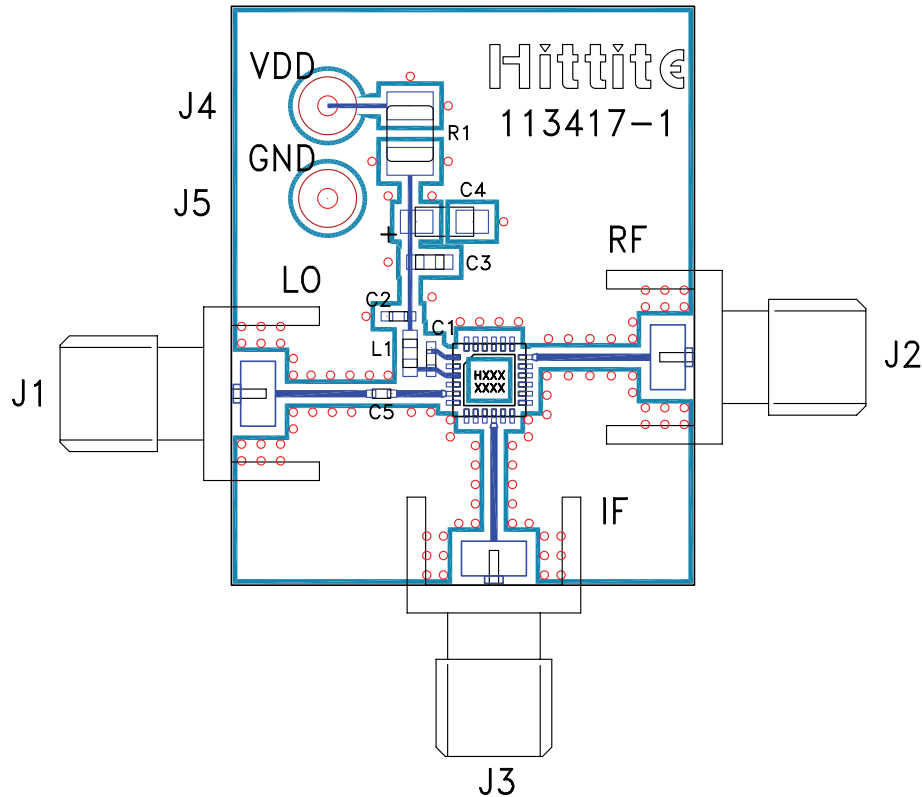
| Vcc  | Icc (mA) |
|------|----------|
| +5.0 | 62 mA    |



### Pin Descriptions

| Pin Number                    | Function | Description                                                                                                                                                                                                                                                                                                                                              | Interface Schematic                                                                   |
|-------------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1                             | MIX LO   | This pin is DC coupled and matched to 50 Ohms. An off chip DC blocking capacitor is required.                                                                                                                                                                                                                                                            |    |
| 2, 6 - 9,<br>11 - 17, 19 - 24 | N/C      | No connection. These pins may be connected to RF ground. Performance will not be affected.                                                                                                                                                                                                                                                               |                                                                                       |
| 3                             | BIAS     | Power supply for the LO amplifier, a Bias resistor is required. Three external bypass capacitors are recommended for optimum performance, as illustrated in the application circuit.                                                                                                                                                                     |    |
| 4                             | GND      | Backside of package has exposed metal ground paddle that must also be connected to ground.                                                                                                                                                                                                                                                               |    |
| 5                             | LO       | This pin is DC coupled and matched to 50 Ohms. An off chip DC blocking capacitor is required.                                                                                                                                                                                                                                                            |   |
| 10                            | IF       | This pin is DC coupled. For applications not requiring operation to DC, this port should be DC blocked externally using a series capacitor whose value has been chosen to pass the necessary IF frequency range. For operation to DC, this pin must not source/sink more than 18 mA of current or die non-function and possible die failure will result. |  |
| 18                            | RF       | This pin is DC coupled and matched to 50 Ohms.                                                                                                                                                                                                                                                                                                           |  |

### Evaluation PCB



### List of Materials for Evaluation PCB 113722 <sup>[1]</sup>

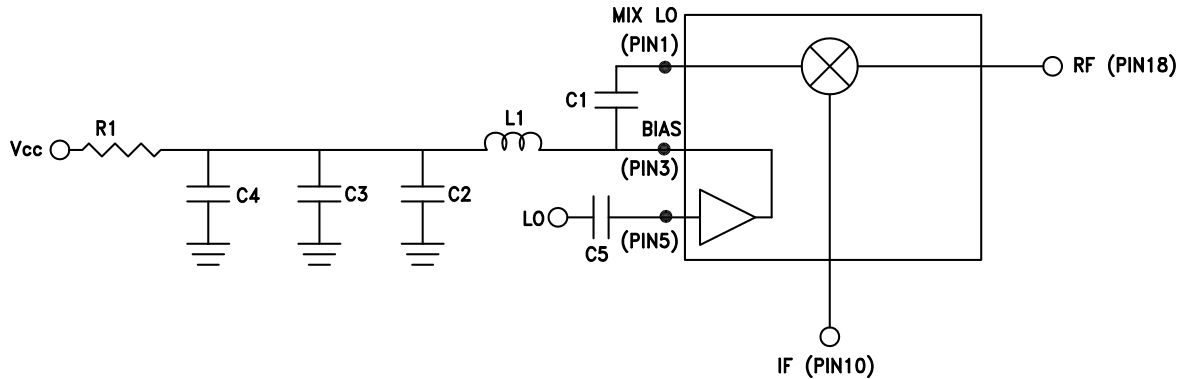
| Item       | Description                         |
|------------|-------------------------------------|
| J1 - J3    | PCB Mount SMA RF Connector          |
| J4, J5     | DC Pin                              |
| C1, C2, C5 | 100 pF Chip Capacitor, 0402 Pkg.    |
| C3         | 1000 pF Chip Capacitor, 0603 Pkg.   |
| C4         | 2.2 $\mu$ F Capacitor, Tantalum     |
| L1         | 18 nH Chip Inductor, 0603 Pkg.      |
| R1         | 18 Ohm Resistor, 1210 1/8 watt Pkg. |
| U1         | HMC552LP4 / HMC552LP4E              |
| PCB [2]    | 113417 Evaluation Board             |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the 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.

### Application Circuit



| Recommended Components Values (IF = DC - 300 MHz) |             |
|---------------------------------------------------|-------------|
| C3                                                | 1000 pF     |
| C4                                                | 2.2 $\mu$ F |
| C1, C2, C5                                        | 100 pF      |
| L1                                                | 18 nH       |
| R1                                                | 18 Ohm      |

#### Note:

Select R1 to achieve Icc by using equation below,  $R1 \geq 18$  Ohms.

$$I_{cc} = (V_s - 3.8) / R1$$