# HMC799LP3E

v01.1009

## DC - 700 MHz, 10 kOhm TRANSIMPEDANCE AMPLIFIER

### Typical Applications

The HMC799LP3E is ideal for:

- Laser Sensor
- FDDI Receiver
- CATV FM Analog Receiver
- Wideband Gain Block
- Low Noise RF Applications

### Features

10 kOhm Transimpedance

Very Low Noise: 150nA Input RMS Noise over 700 MHz Bandwidth

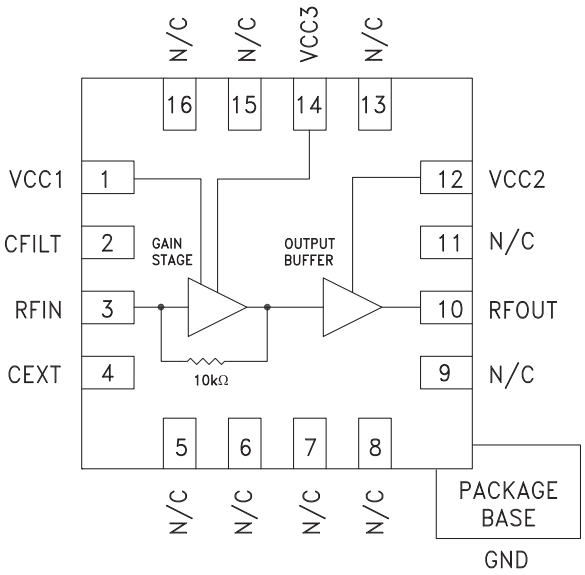
700 MHz Analog Bandwidth

Wide Dynamic Range: +65 dB

Low Power: 70mA from Single +5V Supply

16 Lead 3x3 mm SMT Package: $9mm^2$

### Functional Diagram




### General Description

The HMC799LP3E is DC to 700 MHz Transimpedance amplifier designed for opto-electronic laser sensor applications, FDDI receivers and receiver systems employing optical to electrical conversion. This amplifier provides a single-ended output voltage that is proportional to an applied current at its input port. This current is typically provided by a photodiode. Operating from a single +5V supply, HMC799LP3E features very low input referred noise, and very large electrical input dynamic range exceeding 65 dB. 10 kOhm or 80 dB-Ohms transimpedance gain provides very good sensitivity at higher data rates. The output of HMC799LP3E is internally matched to 50 ohms. External matching is not necessary. The HMC799LP3E exhibits excellent gain and output power stability over temperature, while requiring a minimal number of external bias components.

### Electrical Specifications, $T_A$ = +25° C, Vcc1 = Vcc2 = Vcc3 = +5V

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| **DC Specifications** | | | | | |
| Power Supply Voltage | | 4.5 | 5 | 5.5 | V |
| Power Supply Current | Vcc = 5V | 60 | 70 | 80 | mA |
| Input Impedance | @ 350 MHz | | 175 | | Ohm |
| Input Bias Voltage | | | 2.1 | | V |
| **AC Specifications** | | | | | |
| Transimpedance | @ 100 MHz, RL = 50 Ohm | 7.5 | 10 | 12.5 | k Ohms |
| Transimpedance 3-dB Bandwidth | | 600 | 700 | | MHz |
| Small Signal Gain | S21 | | 42 | | dB |
| Input Referred Current Noise Density | Cpd [1] <1pF, @ 200 MHz | | 4.6 | | pA / √Hz |
| | Cpd [1] = 1pF, @ 200 MHz | | 4.8 | | pA / √Hz |
| | Cpd [1] = 2pF, @ 200 MHz | | 5.2 | | pA / √Hz |
| | Cpd [1] = 3pF, @ 200 MHz | | 5.6 | | pA / √Hz |

[1] Cpd is the total parasitic capacitance value arises from addition of input photo diode. This value includes photo diode parasitic capacitance, PCB trace capacitance and package parasitic capacitance.



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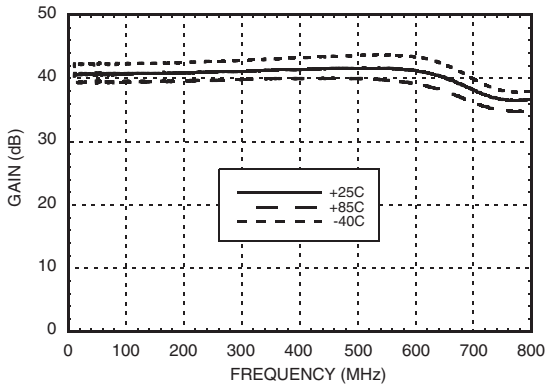
# DC - 700 MHz, 10 kOhm TRANSIMPEDANCE AMPLIFIER

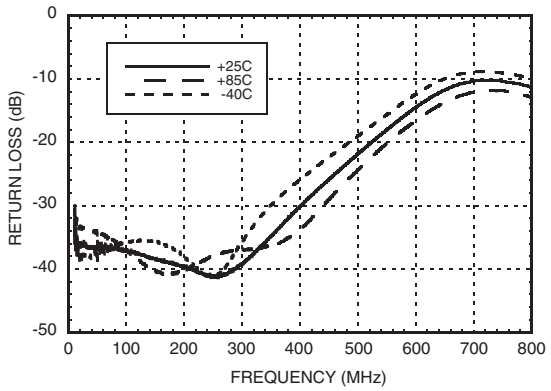
## Electrical Specifications *(Conditions)*

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Input Referred RMS Current Noise | Cpd [1] <1pF, @ 700 MHz BW | | 149 | | nA RMS |
| | Cpd [1] = 1pF, @630 MHz BW | | 164 | | nA RMS |
| | Cpd [1] = 2pF, @ 560 MHz BW | | 174 | | nA RMS |
| | Cpd [1] = 3pF, @ 420 MHz BW | | 132 | | nA RMS |
| Saturated Output Swing | Vin = 50mV p-p | | 1 | | Vp-p |
| Output Power 1-dB Compression | OP1dB @ 200 MHz | | 4 | | dBm |
| Output Third Order Intercept Point | OIP3 @ 200 MHz | | 13 | | dBm |
| Input Overdrive Current | | | 20 | | mA |
| Output Return Loss | @ 500 MHz | 16 | 20 | | dB |

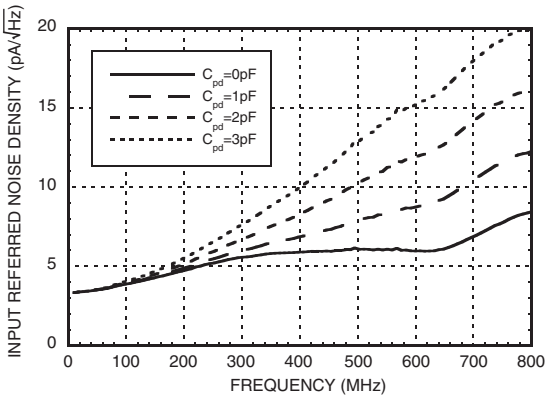
### Gain vs. Temperature



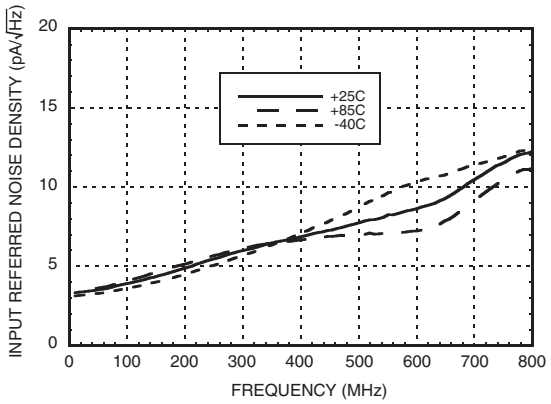

### Output Return Loss vs. Temperature




### Input Referred Noise Density vs. $C_{PD}$ [1]




### Input Referred Noise Density vs. Temperature [2]




[1] Cpd is the total parasitic capacitance value resulting from the addition of the input photo diode. This value includes photo diode parasitic capacitance, PCB trace capacitance and package parasitic capacitance.
[2] Cpd = 1 pF



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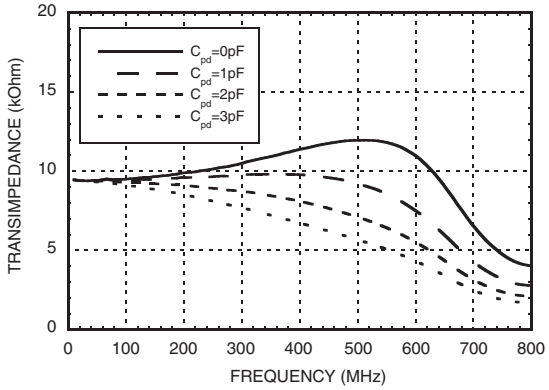
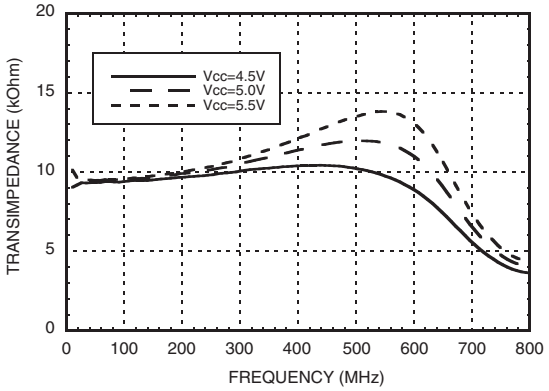
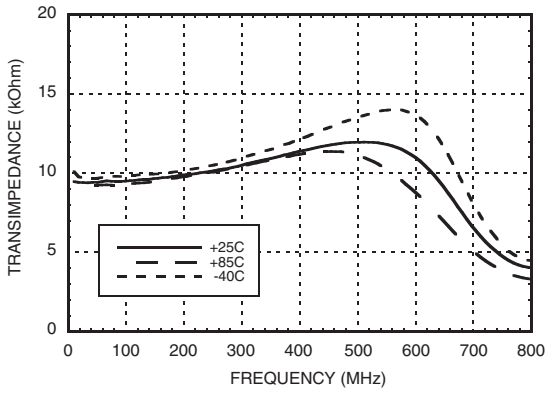
## Transimpedance vs. $C_{PD}$ [1]



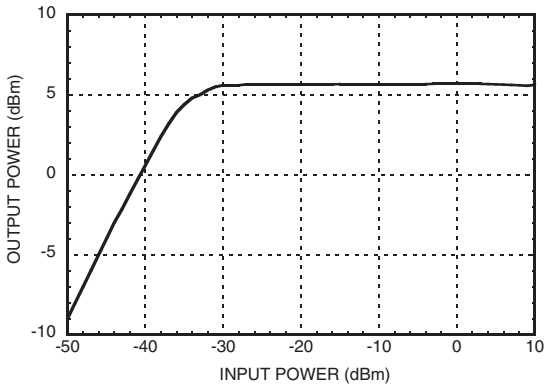

## Transimpedance vs. Supply Voltage (Vcc) [2]




## Transimpedance vs. Temperature [2]




## Output Power vs. Input Power @ 200 MHz [2]




[1] Cpd is the total parasitic capacitance value resulting from the addition of the input photo diode. This value includes photo diode parasitic capacitance, PCB trace capacitance and package parasitic capacitance.
[2] Cpd = 1 pF





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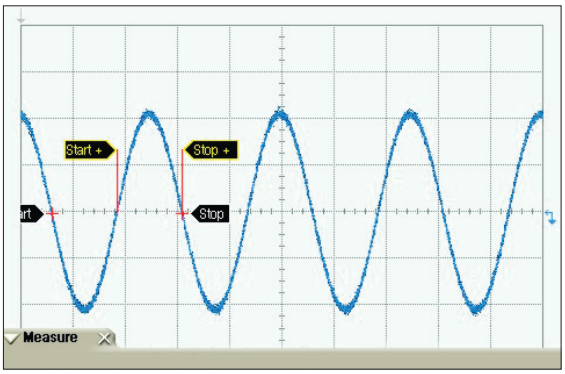
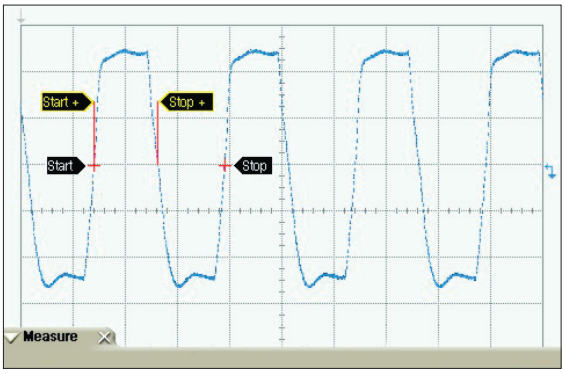
### Output Signal [1]




| | Measurements | | | | | |
|---|---|---|---|---|---|---|
| | Current | Mean | std dev | Min. | Max | Units |
| V amptd | 198.84 | 200.50 | 3.6253 | 184.99 | 212.70 | mV |
| Frequency | 200.8 | 199.9 | 0.631 | 198.0 | 202.1 | MHz |
| Duty Cycle | 50.9 | 49.7 | 0.62 | 47.6 | 51.6 | % |

[1] Input signal current 25 µAp-p, frequency 200 MHz

### Output Signal [2]




| | Measurements | | | | | |
|---|---|---|---|---|---|---|
| | Current | Mean | std dev | Min. | Max | Units |
| V amptd | 959.62 | 960.47 | 3.703 | 953.11 | 972.63 | mV |
| Frequency | 200.1 | 200.0 | 0.117 | 199.5 | 200.4 | MHz |
| Duty Cycle | 49.1 | 49 | 0.08 | 48.7 | 49.2 | % |

[2] Input signal current 20 mAp-p, frequency 200 MHz





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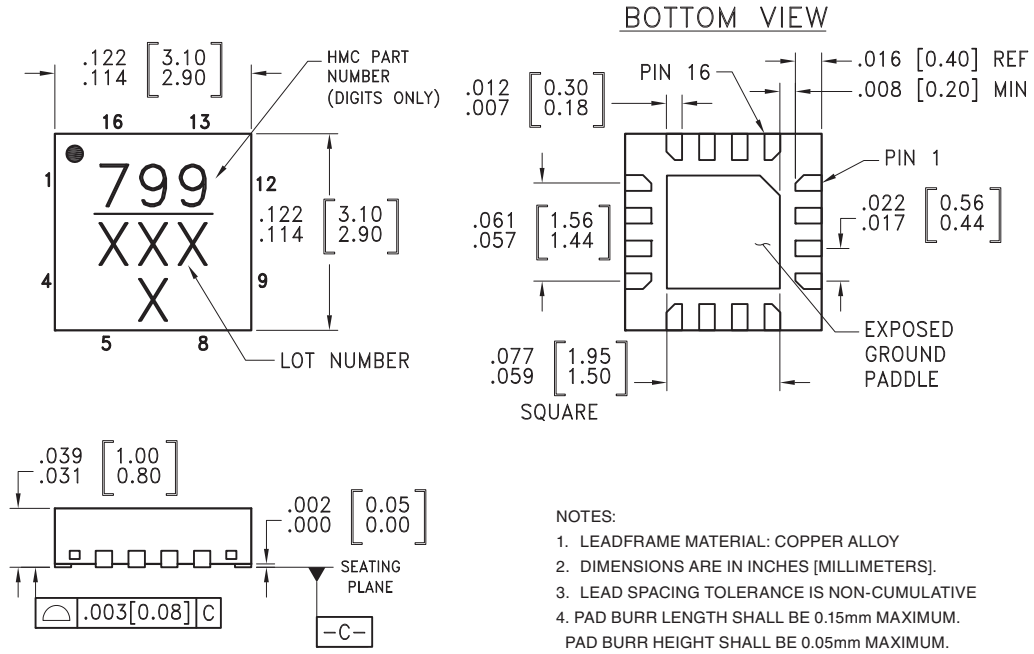
### Absolute Maximum Ratings

| | |
|---|---|
| Power Supply Voltage (Vcc1, Vcc2, Vcc3) | -1V to 8V |
| Input Current | 30 mAp-p |
| Junction Temperature | 125 °C |
| Continuous Pdiss (T=85 °C) (derate 31.82 mW/ °C Above +85 °C | 1.27W |
| Thermal Resistance (Junction to ground paddle) | 31.43 °C/W |
| Storage Temperature | -65 to 125 °C |
| Operating Temperature | -40 to +85 °C |
| ESD Sensitivity (HBM) | Class 1C |

### Outline Drawing




NOTES:

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

### Package Information

| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking [1] |
|---|---|---|---|---|
| HMC799LP3E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 [2] | H799<br>XXXX |

[1] 4-Digit lot number XXXX

[2] Max peak reflow temperature of 260 °C



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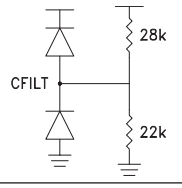
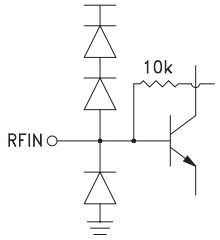
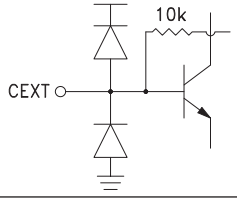
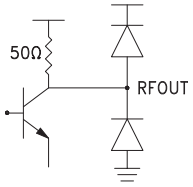
## Pin Descriptions

| Pin Number | Function | Description | Interface Schematic |
|---|---|---|---|
| 1, 12, 14 | VCC1, VCC2, VCC3 | Positive Supply | |
| 2 | CFILT | Overload current filter capacitance pin. |   |
| 3 | RFIN | RF Input |   |
| 4 | CEXT | Reference voltage filter capacitance pin. |   |
| 5 - 9, 11, 13, 15, 16 | N/C | Not connected. | |
| 10 | RFOUT | RF Output |   |
| Package Base | GND | Package base has exposed metal ground paddle which must be connected to ground. |   |





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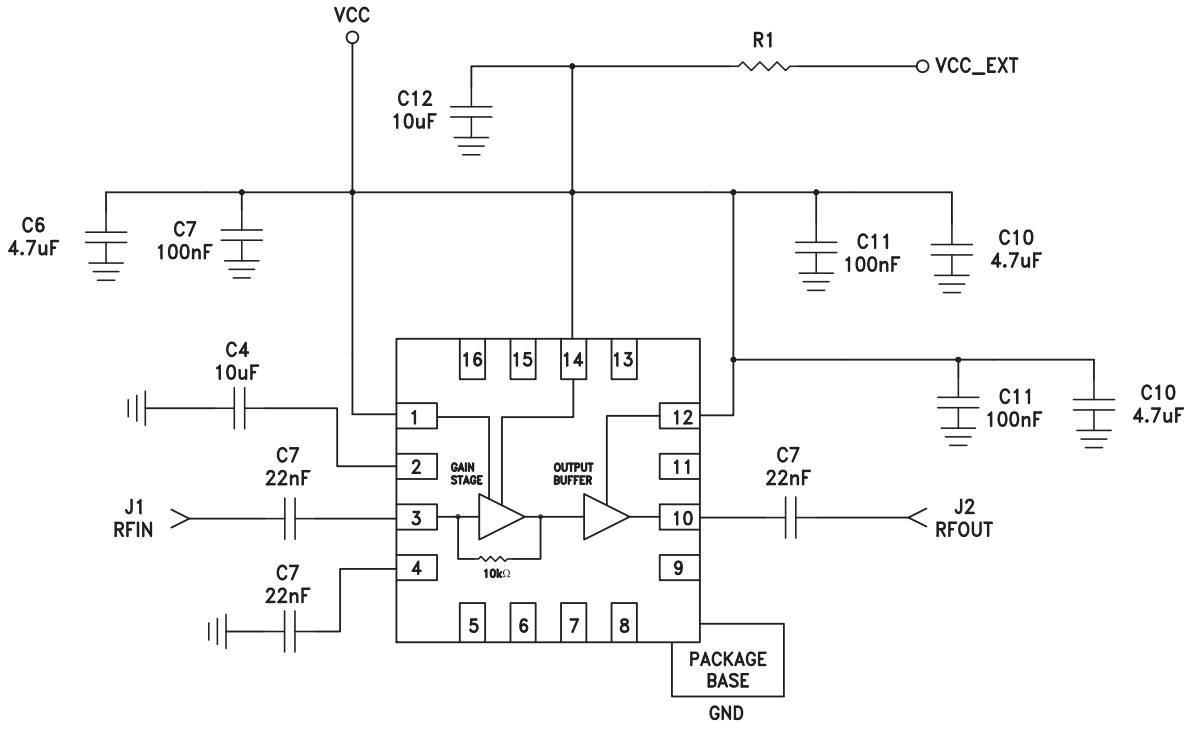
### Application Circuit




Note:

For power supply rejection ratio (PSRR) tests, install 0 Ohm for R1.





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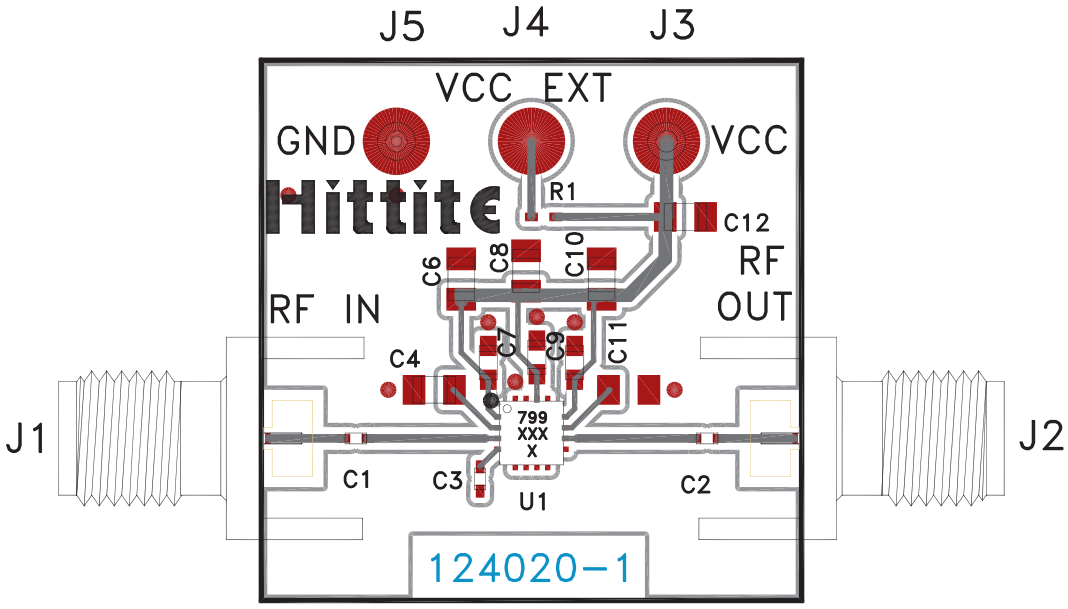
## Evaluation PCB




## List of Materials for Evaluation PCB 124022 [1]

| Item | Description |
|---|---|
| J1 - J2 | PCB Mount SMA Connector |
| J3, J5 | DC Pin |
| C1 - C3 | 22 nF Capacitor, 0402 Pkg. |
| C4, C12 | 10 µF Capacitor, 0805 Pkg. |
| C6, C8, C10 | 4.7 µF Capacitor, 0805 Pkg. |
| C7, C9, C11 | 0.1 µF Capacitor, 0603 Pkg. |
| U1 | HMC799LP3E Transimpedance Amplifier |
| PCB [2] | 124020 Evaluation PCB |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Arlon 25FR or 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.



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