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Understanding Embedded - FPGAs (Field Programmable Gate Array)

Embedded - FPGAs, or Field Programmable Gate Arrays, are advanced integrated circuits that offer unparalleled flexibility and performance for digital systems. Unlike traditional fixed-function logic devices, FPGAs can be programmed and reprogrammed to execute a wide array of logical operations, enabling customized functionality tailored to specific applications. This reprogrammability allows developers to iterate designs quickly and implement complex functions without the need for custom hardware.

Applications of Embedded - FPGAs

The versatility of Embedded - FPGAs makes them indispensable in numerous fields. In telecommunications.

Details

| | |
|--------------------------------|---|
| Product Status | Obsolete |
| Number of LABs/CLBs | 1536 |
| Number of Logic Elements/Cells | 13824 |
| Total RAM Bits | 884736 |
| Number of I/O | 320 |
| Number of Gates | - |
| Voltage - Supply | 1.14V ~ 1.26V |
| Mounting Type | Surface Mount |
| Operating Temperature | 0°C ~ 85°C (TJ) |
| Package / Case | 676-BBGA, FCBGA |
| Supplier Device Package | 676-FCBGA (27x27) |
| Purchase URL | https://www.e-xfl.com/product-detail/xilinx/xc4vlx15-11ffg676c |



300MHz, Low-Power, High-Output-Current, Differential Line Driver

MAX4147

General Description

The MAX4147 differential line driver offers high-speed performance while consuming only 100mW of power. Its amplifier has fully symmetrical inputs and outputs and uses laser-trimmed, matched, thin-film resistors to deliver 70dB CMR at 10MHz. Using current-feedback techniques, the MAX4147 achieves a 300MHz bandwidth and a 2000V/ μ s slew rate.

Optimized for differential, high-output-current applications such as transformer drivers, the MAX4147 drives $\pm 2.6V$ into a 26.5Ω load (single-ended) or $\pm 5.6V$ into a 53Ω load (differential). This device is preset for a closed-loop gain of 2V/V. Its ultra-low 0.008%/0.03° differential gain/phase allow for a variety of video and RF signal-processing applications.

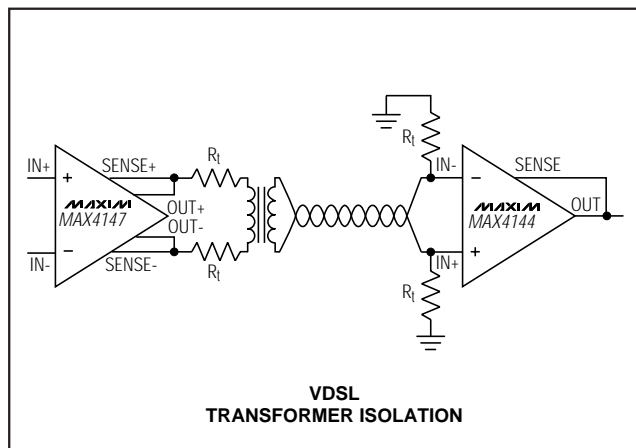
For power-sensitive applications, the MAX4147 has a shutdown function that reduces supply current to less than 1mA. In addition, superior SFDR (-82dBc at 10kHz, $R_L = 33\Omega$) makes it ideal as a transformer driver for HDSL applications.

For a complete differential transmission link, use the MAX4147 with the MAX4144 line receiver (see the MAX4144 data sheet for more information).

Applications

VDSL, ADSL, HDSL
Video Twisted-Pair Driver
Differential Pulse Amplifier
Differential ADC Driver

Typical Application Circuit



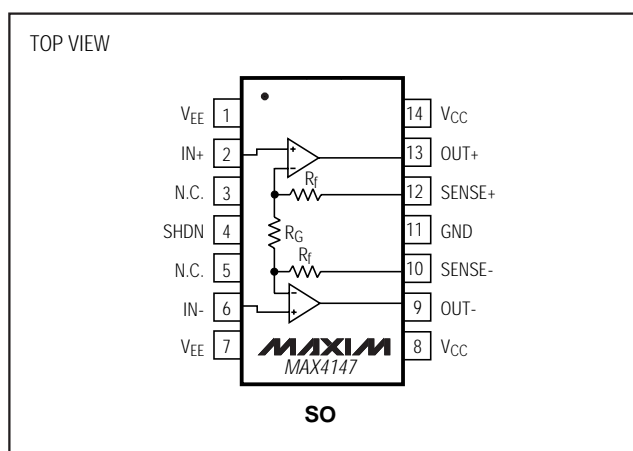
Features

- ♦ 2V/V Fixed Gain
- ♦ 300MHz -3dB Bandwidth
- ♦ 2000V/ μ s Slew Rate
- ♦ 82dBc SFDR at 10kHz
- ♦ 70dB CMR at 10MHz
- ♦ Low Differential Gain/Phase: 0.008%/0.03°
- ♦ High Output Drive: $\pm 5.6V$ into 53Ω
- ♦ Low Power: 100mW

Ordering Information

| PART | TEMP. RANGE | PIN-PACKAGE |
|------------|----------------|-------------|
| MAX4147ESD | -40°C to +85°C | 14 SO |

Pin Configuration



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ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC} to V_{EE})12V
 Voltage on Any Input to Ground($V_{CC} + 0.3V$) to ($V_{EE} - 0.3V$)
 Continuous Power Dissipation ($T_A = +70^\circ\text{C}$)
 SO (derate 8.33mW/ $^\circ\text{C}$ above $+70^\circ\text{C}$)667mW
 Short-Circuit Duration10sec

Operating Temperature Range
 MAX4147ESD-40 $^\circ\text{C}$ to $+85^\circ\text{C}$
 Storage Temperature Range-65 $^\circ\text{C}$ to $+160^\circ\text{C}$
 Lead Temperature (soldering, 10sec)+300 $^\circ\text{C}$

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

($V_{CC} = +5V$, $V_{EE} = -5V$, $T_A = T_{MIN}$ to T_{MAX} , unless otherwise noted. Typical values are at $T_A = +25^\circ\text{C}$.)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|----------------------------------|-------------|--|------|------|-----|------------------------|
| DC SPECIFICATIONS | | | | | | |
| Input Offset Voltage | V_{OS} | $V_{OUT} = 0V$, $R_L = \infty$ | | 0.5 | 6 | mV |
| Input Offset Voltage Drift | TCV_{OS} | $V_{OUT} = 0V$, $R_L = \infty$ | | 30 | | $\mu V/^\circ\text{C}$ |
| Input Bias Current | I_B | $V_{OUT} = 0V$, $R_L = \infty$, $V_{IN} = -V_{OS}$ | | 9 | 20 | μA |
| Input Offset Current | I_{OS} | $V_{OUT} = 0V$, $R_L = \infty$, $V_{IN} = -V_{OS}$ | | 0.03 | 2 | μA |
| Input Voltage Noise | e_n | $f = 10\text{kHz}$ | | 8 | | $nV/\sqrt{\text{Hz}}$ |
| | | $f = 1\text{MHz to } 100\text{MHz}$ | | 80 | | μV_{RMS} |
| Input Current Noise | i_n | $f = 10\text{kHz}$ | | 1.7 | | $pA/\sqrt{\text{Hz}}$ |
| | | $f = 1\text{MHz to } 100\text{MHz}$ | | 17 | | nA_{RMS} |
| Input Capacitance | C_{IN} | | | 1 | | pF |
| Differential Input Resistance | | | | 1 | | $M\Omega$ |
| Differential Input Voltage Range | | $R_L = \infty$ | -3.6 | | 3.6 | V |
| Common-Mode Input Voltage Range | V_{CM} | $R_L = \infty$ | -2.8 | | 2.8 | V |
| Gain | A_V | $-1V \leq V_{OUT} \leq +1V$, $R_L = 53\Omega$ | | 2 | | V/V |
| Gain Error | | $-1V \leq V_{OUT} \leq +1V$, $R_L = 53\Omega$ | | 0.3 | 1 | % |
| Common-Mode Rejection | CMR | $V_{CM} = \pm 2.8V$ | 70 | 100 | | dB |
| Power-Supply Rejection | PSR | $V_S = \pm 4.5V$ to $\pm 5.5V$ | 70 | 100 | | dB |
| Quiescent Supply Current | I_{SY} | $V_{IN} = 0$, $R_L = \infty$ | | 10 | 13 | mA |
| Shutdown Supply Current | I_{SHDN} | $V_{IN} = 0$, $R_L = \infty$ | | 0.6 | 1 | mA |
| Output Voltage Swing | $ V_{OUT} $ | Single-ended, $R_L = \infty$ | 3.2 | 3.8 | | V |
| | | Differential, $R_L = \infty$ | 7.2 | 7.8 | | |
| | | Single-ended, $R_L = 26.5\Omega$ | 2.2 | 2.6 | | |
| | | Differential, $R_L = 53\Omega$ | 5.0 | 5.6 | | |
| Output Current Drive | I_{OUT} | $V_{OUT} = \pm 2.2V$ | 110 | 160 | | mA |
| SHDN High Threshold | V_{IH} | | | | 2.0 | V |
| SHDN Low Threshold | V_{IL} | | 0.8 | | | V |
| SHDN Input Current | I_{SHDN} | $V_{SHDN} \leq 0.8V$ | | 75 | 150 | μA |
| | | $V_{SHDN} \geq 2V$ | | 10 | | nA |

300MHz, Low-Power, High-Output-Current, Differential Line Driver

ELECTRICAL CHARACTERISTICS (continued)

($V_{CC} = +5V$, $V_{EE} = -5V$, $T_A = T_{MIN}$ to T_{MAX} , unless otherwise noted. Typical values are at $T_A = +25^{\circ}C$.)

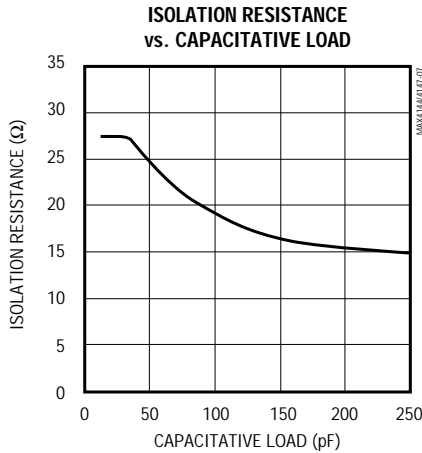
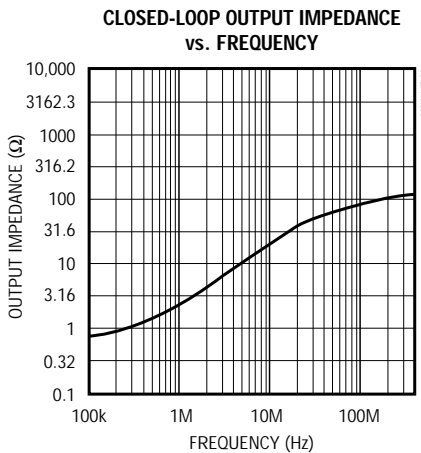
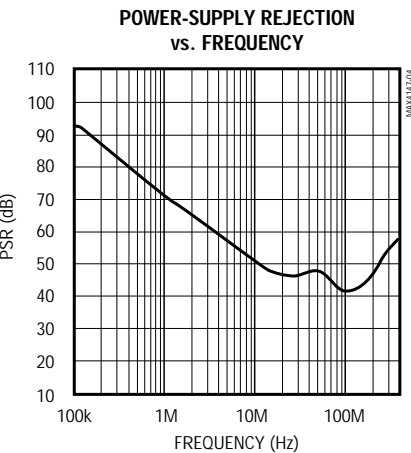
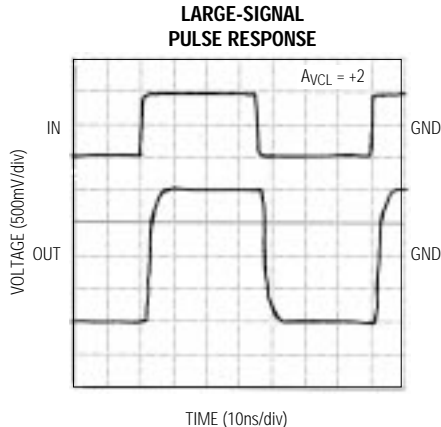
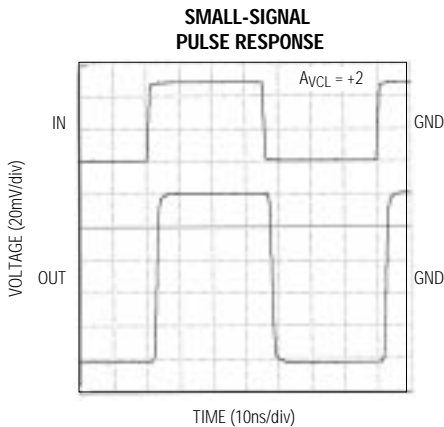
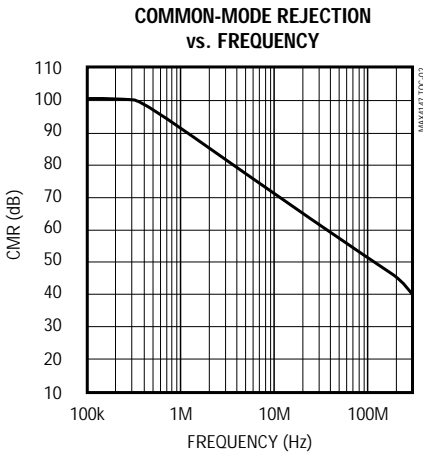
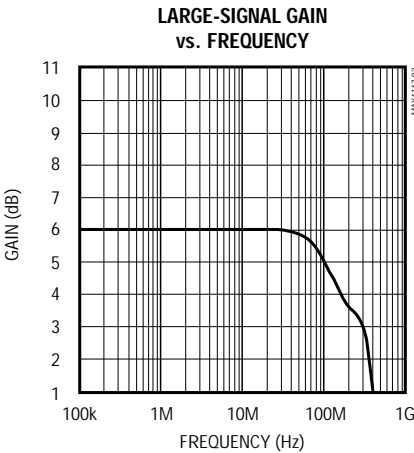
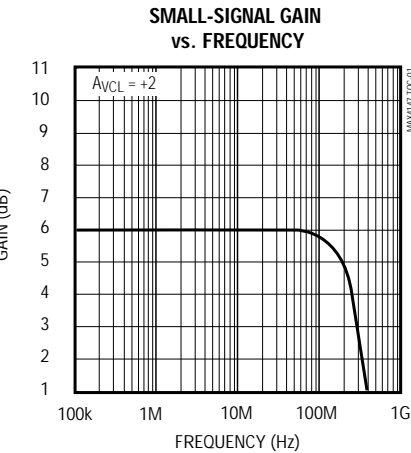
| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|-----------------------------|-----------|---|----------|-------|-----|------------|
| AC SPECIFICATIONS | | | | | | |
| -3dB Bandwidth | BW(-3dB) | $V_{OUT} \leq 0.1V_{RMS}$ | | 300 | | MHz |
| Full-Power Bandwidth | FPBW | $V_{OUT} = 2V_{p-p}$ | | 250 | | MHz |
| 0.1dB Bandwidth | BW(0.1dB) | $V_{OUT} \leq 0.1V_{RMS}$ | | 70 | | MHz |
| Common-Mode Rejection | CMR | $f = 10MHz$ | | 70 | | dB |
| Slew Rate | SR | Differential, $-2V \leq V_{OUT} \leq +2V$ | | 2000 | | V/ μs |
| Settling Time | t_s | $1V \leq V_{OUT} \leq +1V$, $R_L = 150\Omega$, $AV_{CL} = +2$ | to 0.1% | 10 | | ns |
| | | | to 0.01% | 30 | | |
| Differential Gain | DG | $f = 3.58MHz$, $R_L = 150\Omega$ | | 0.008 | | % |
| Differential Phase | DP | $f = 3.58MHz$, $R_L = 150\Omega$ | | 0.03 | | degrees |
| Spurious-Free Dynamic Range | SFDR | $f_C = 10kHz$, $V_{OUT} = 4.0V_{p-p}$, $R_L = 33\Omega$ single-ended, $R_S = 50\Omega$, Figure 1 | | -82 | | dBc |
| | | $f_C = 5MHz$, $V_{OUT} = 2V_{p-p}$, $R_L = 150\Omega$ differential, Figure 2 | | -75 | | |

MAX4147

300MHz, Low-Power, High-Output-Current, Differential Line Driver

Typical Operating Characteristics

($V_{CC} = +5V$, $V_{EE} = -5V$, $R_L = 150\Omega$, $T_A = +25^\circ C$, unless otherwise noted.)

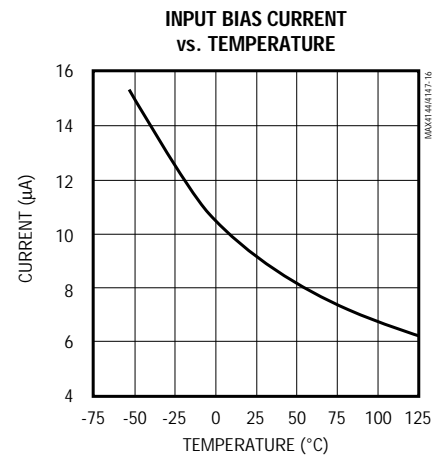
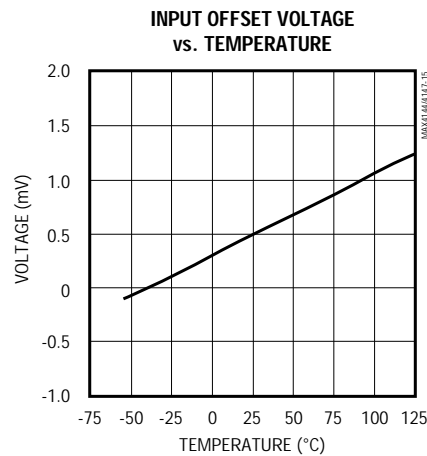
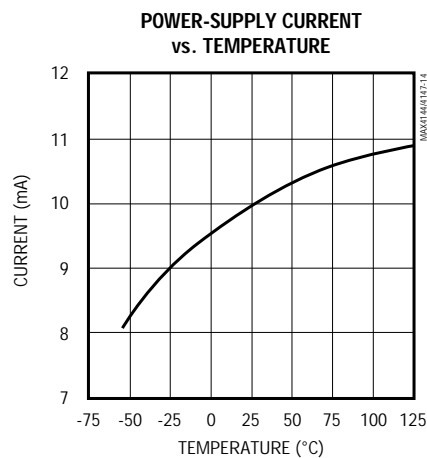
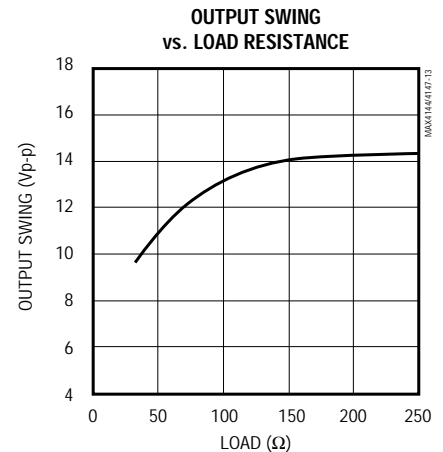
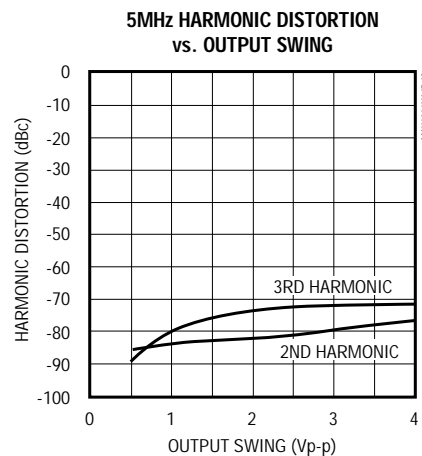
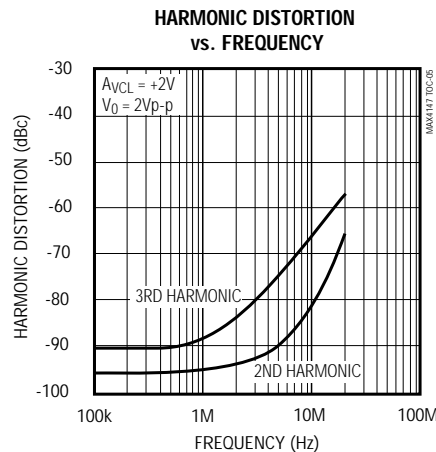
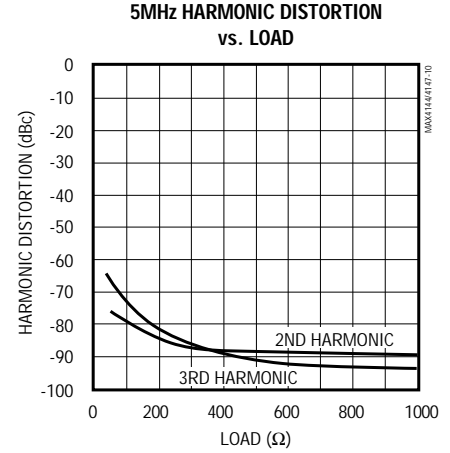
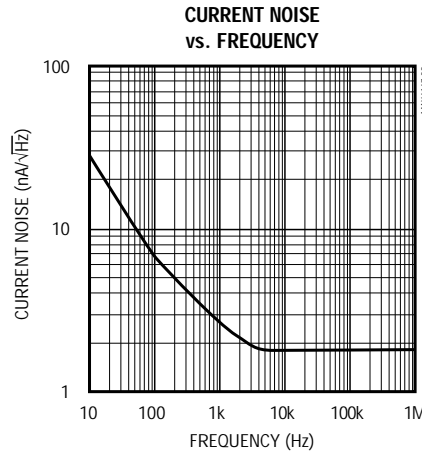
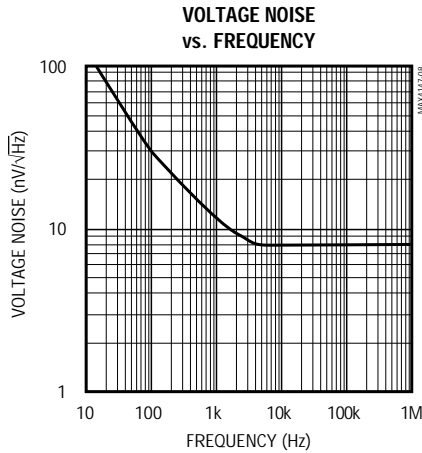


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MAX4147

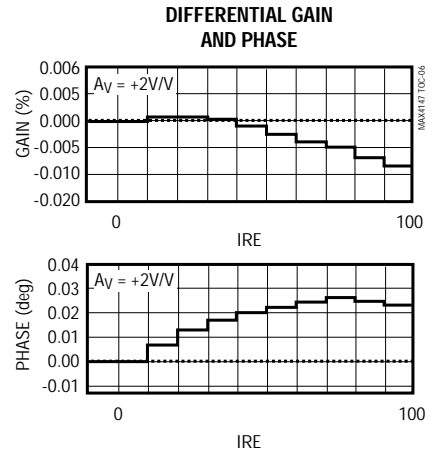
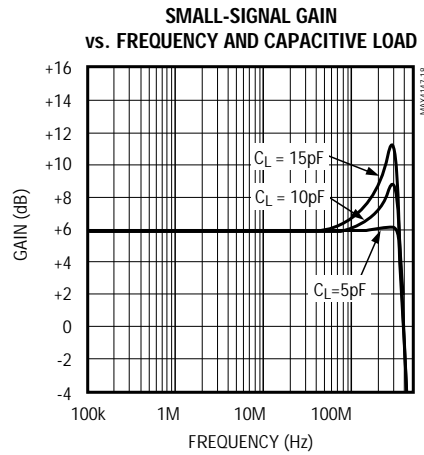
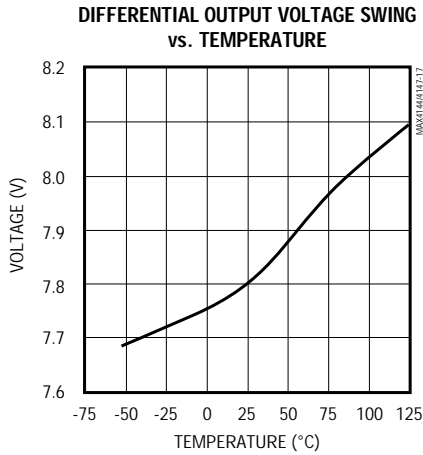
Typical Operating Characteristics (continued)

($V_{CC} = +5V$, $V_{EE} = -5V$, $R_L = 150\Omega$, $T_A = +25^\circ C$, unless otherwise noted.)



300MHz, Low-Power, High-Output-Current, Differential Line Driver

Typical Operating Characteristics (continued)
($V_{CC} = +5V$, $V_{EE} = -5V$, $R_L = 150\Omega$, $T_A = +25^\circ C$, unless otherwise noted.)



Pin Description

| PIN | NAME | FUNCTION |
|-------|----------|--|
| 1, 7 | V_{EE} | Negative Power Supply. Connect to -5V. |
| 2 | IN+ | Noninverting Input |
| 3, 5 | N.C. | No Connect. Not internally connected. |
| 4 | SHDN | Logic Input for Shutdown Circuitry. A logic low enables the amplifier. A logic high disables the amplifier. The amplifier outputs are high impedance in shutdown mode; thus the impedances seen at OUT+ and OUT- are that of the feedback resistors and the protection circuitry (Figure 3). |
| 6 | IN- | Inverting Input |
| 8, 14 | V_{CC} | Positive Power Supply |
| 9 | OUT- | Inverting Output |
| 10 | SENSE- | Sense Line for the Inverting Output. Connect to OUT-, close to the pin. |
| 11 | GND | Ground |
| 12 | SENSE+ | Sense Line for the Noninverting Output. Connect to OUT+, close to the pin. |
| 13 | OUT+ | Noninverting Output |

300MHz, Low-Power, High-Output-Current, Differential Line Driver

MAX4147

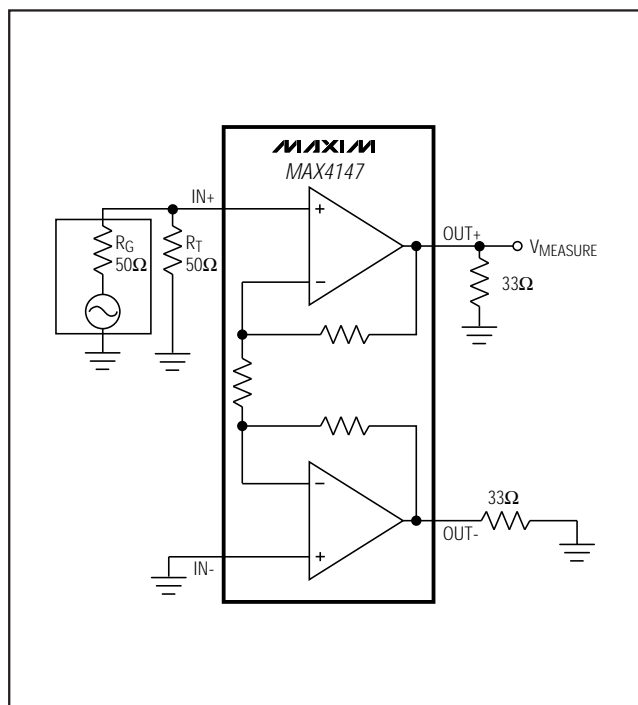


Figure 1. Single-Ended Distortion Setup

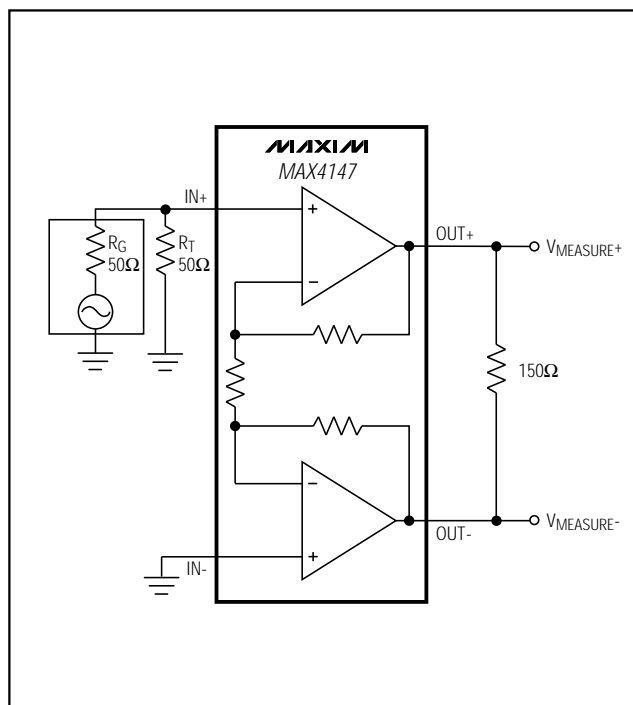


Figure 2. Differential Distortion Setup

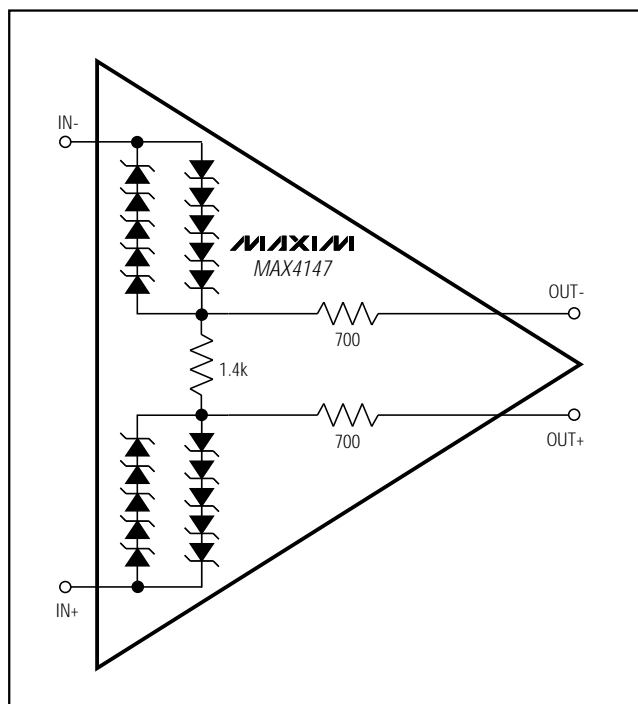
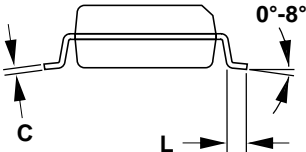
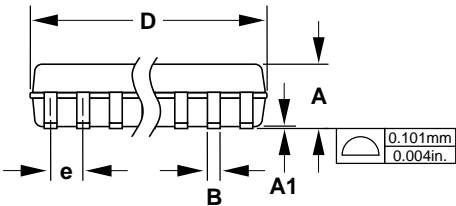


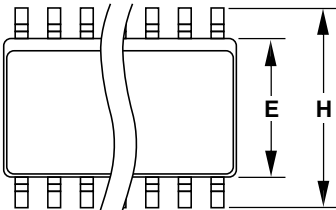
Figure 3. MAX4147 Shutdown Equivalent Circuit

300MHz, Low-Power, High-Output-Current, Differential Line Driver

Package Information



| DIM | INCHES | | MILLIMETERS | |
|-----|--------|-------|-------------|------|
| | MIN | MAX | MIN | MAX |
| A | 0.053 | 0.069 | 1.35 | 1.75 |
| A1 | 0.004 | 0.010 | 0.10 | 0.25 |
| B | 0.014 | 0.019 | 0.35 | 0.49 |
| C | 0.007 | 0.010 | 0.19 | 0.25 |
| E | 0.150 | 0.157 | 3.80 | 4.00 |
| e | 0.050 | | 1.27 | |
| H | 0.228 | 0.244 | 5.80 | 6.20 |
| L | 0.016 | 0.050 | 0.40 | 1.27 |



**Narrow SO
SMALL-OUTLINE
PACKAGE
(0.150 in.)**

| DIM | PINS | INCHES | | MILLIMETERS | |
|-----|------|--------|-------|-------------|-------|
| | | MIN | MAX | MIN | MAX |
| D | 8 | 0.189 | 0.197 | 4.80 | 5.00 |
| D | 14 | 0.337 | 0.344 | 8.55 | 8.75 |
| D | 16 | 0.386 | 0.394 | 9.80 | 10.00 |

21-0041A

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