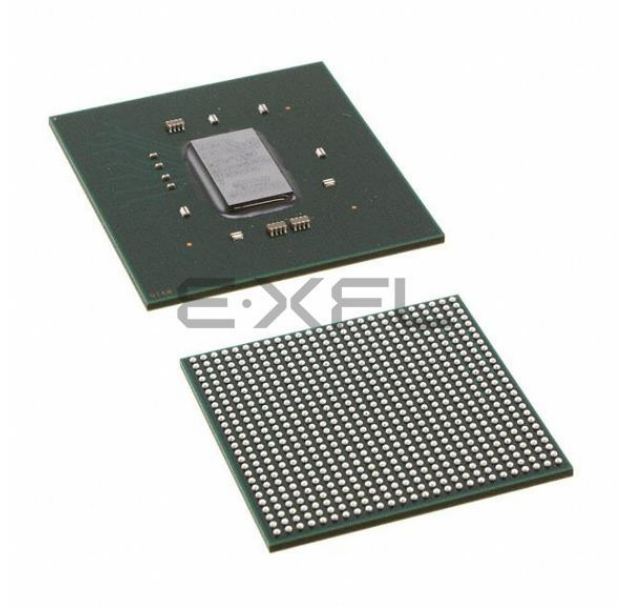

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Understanding Embedded - FPGAs (Field Programmable Gate Array)

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	-40°C ~ 100°C (TJ)
Package / Case	676-BBGA, FCBGA
Supplier Device Package	676-FCBGA (27x27)
Purchase URL	https://www.e-xfl.com/product-detail/xilinx/xc4vlx15-10ffg676i

19-1106; Rev 1; 11/96

EVALUATION KIT AVAILABLE

MAXIM

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

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/µs slew rate.

Optimized for differential, high-output-current applications such as transformer drivers, the MAX4147 drives ±2.6V into a 26.5Ω load (single-ended) or ±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 = 33Ω) 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

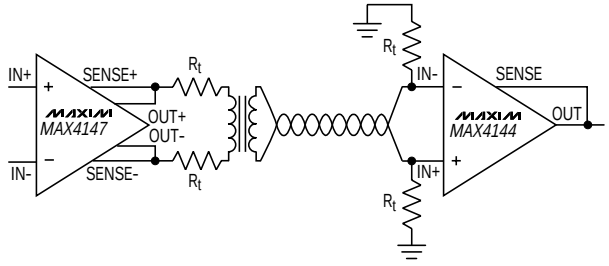
VDSL, ADSL, HDSL

Video Twisted-Pair Driver

Differential Pulse Amplifier

Differential ADC Driver

Typical Application Circuit



VDSL TRANSFORMER ISOLATION

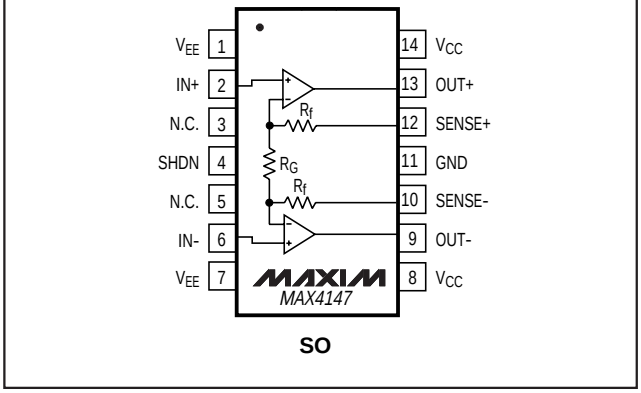
Features

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

Ordering Information

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

Pin Configuration



SO

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

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°C)
SO (derate 8.33mW/°C above +70°C) 667mW
Short-Circuit Duration 10sec

Operating Temperature Range
MAX4147ESD ..... -40°C to +85°C
Storage Temperature Range ..... -65°C to +160°C
Lead Temperature (soldering, 10sec) ..... +300°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°C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC SPECIFICATIONS						
Input Offset Voltage	V_{OS}	V_{OUT} = 0V, R_L = ∞		0.5	6	mV
Input Offset Voltage Drift	TCV_{OS}	V_{OUT} = 0V, R_L = ∞		30		µV/°C
Input Bias Current	I_B	V_{OUT} = 0V, R_L = ∞, V_{IN} = $-V_{OS}$		9	20	µA
Input Offset Current	I_{OS}	V_{OUT} = 0V, R_L = ∞, V_{IN} = $-V_{OS}$		0.03	2	µA
Input Voltage Noise	e_n	f = 10kHz		8		$nV/\sqrt{Hz}$
		f = 1MHz to 100MHz		80		$µV_{RMS}$
Input Current Noise	I_n	f = 10kHz		1.7		$pA/\sqrt{Hz}$
		f = 1MHz to 100MHz		17		nA_{RMS}
Input Capacitance	C_{IN}			1		pF
Differential Input Resistance				1		MΩ
Differential Input Voltage Range		R_L = ∞	-3.6		3.6	V
Common-Mode Input Voltage Range	V_{CM}	R_L = ∞	-2.8		2.8	V
Gain	A_V	-1V ≤ V_{OUT} ≤ +1V, R_L = 53Ω		2		V/V
Gain Error		-1V ≤ V_{OUT} ≤ +1V, R_L = 53Ω		0.3	1	%
Common-Mode Rejection	CMR	V_{CM} = ±2.8V	70	100		dB
Power-Supply Rejection	PSR	V_S = ±4.5V to ±5.5V	70	100		dB
Quiescent Supply Current	I_{SY}	V_{IN} = 0, R_L = ∞		10	13	mA
Shutdown Supply Current	I_{SHDN}	V_{IN} = 0, R_L = ∞		0.6	1	mA
Output Voltage Swing	$\lvert V_{OUT} \rvert$	Single-ended, R_L = ∞	3.2	3.8		V
		Differential, R_L = ∞	7.2	7.8		
		Single-ended, R_L = 26.5Ω	2.2	2.6		
		Differential, R_L = 53Ω	5.0	5.6		
Output Current Drive	I_{OUT}	V_{OUT} = ±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} ≤ 0.8V		75	150	µA
		V_{SHDN} ≥ 2V		10		nA

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°C.)

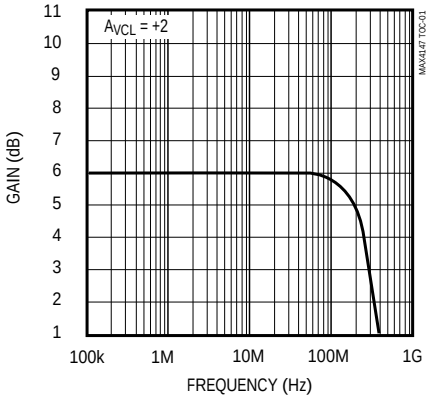
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
AC SPECIFICATIONS							
-3dB Bandwidth	$BW_{(-3dB)}$	$V_{OUT} \le 0.1V_{RMS}$			300		MHz
Full-Power Bandwidth	FPBW	V_{OUT} = 2Vp-p			250		MHz
0.1dB Bandwidth	$BW_{(0.1dB)}$	$V_{OUT} \le 0.1V_{RMS}$			70		MHz
Common-Mode Rejection	CMR	f = 10MHz			70		dB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

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

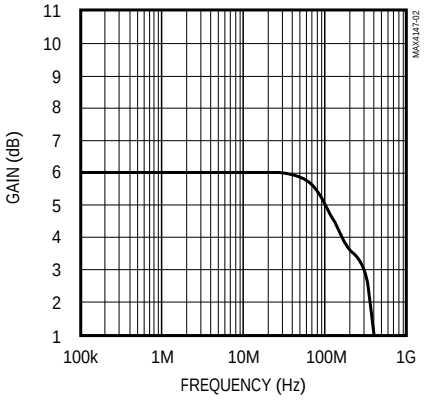
Typical Operating Characteristics

(V_{CC} = +5V, V_{EE} = -5V, R_L = 150Ω, T_A = +25°C, unless otherwise noted.)

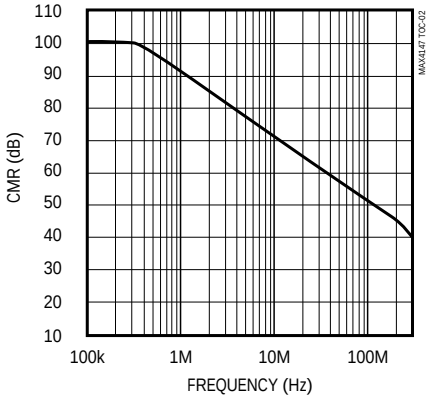
SMALL-SIGNAL GAIN vs. FREQUENCY



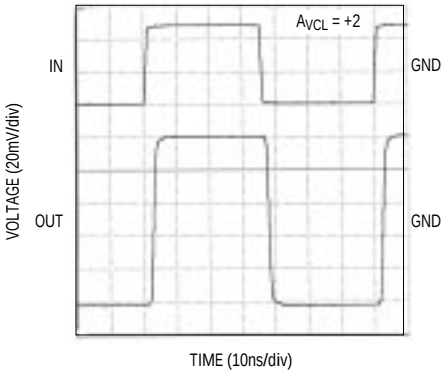
LARGE-SIGNAL GAIN vs. FREQUENCY



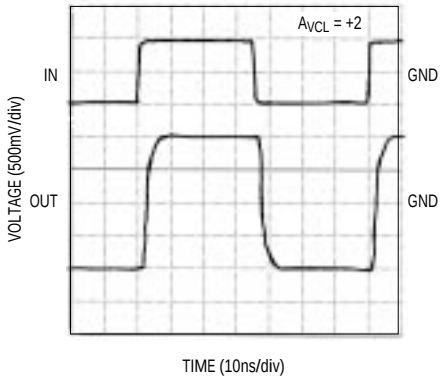
COMMON-MODE REJECTION vs. FREQUENCY



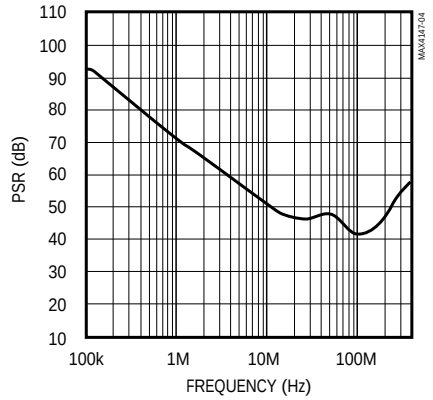
SMALL-SIGNAL PULSE RESPONSE



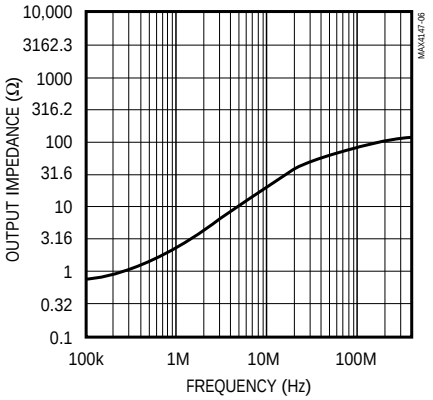
LARGE-SIGNAL PULSE RESPONSE



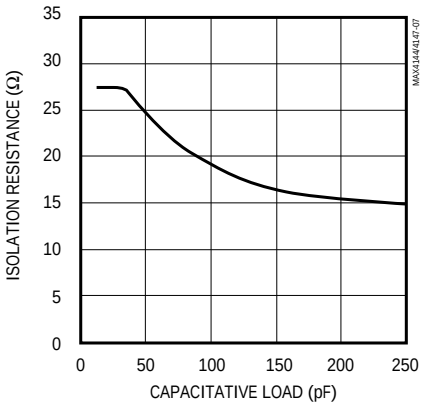
POWER-SUPPLY REJECTION vs. FREQUENCY



CLOSED-LOOP OUTPUT IMPEDANCE vs. FREQUENCY



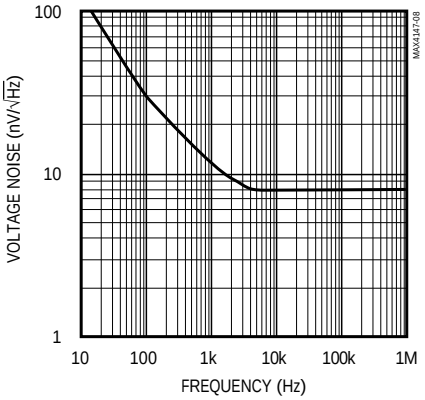
ISOLATION RESISTANCE vs. CAPACITATIVE LOAD



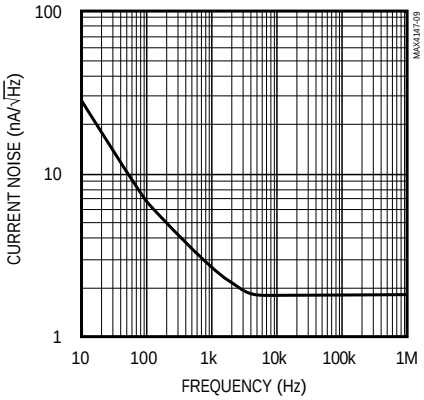
Typical Operating Characteristics (continued)

(V_{CC} = +5V, V_{EE} = -5V, R_L = 150Ω, T_A = +25°C, unless otherwise noted.)

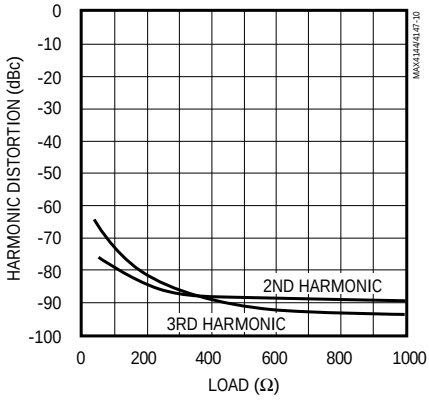
VOLTAGE NOISE vs. FREQUENCY



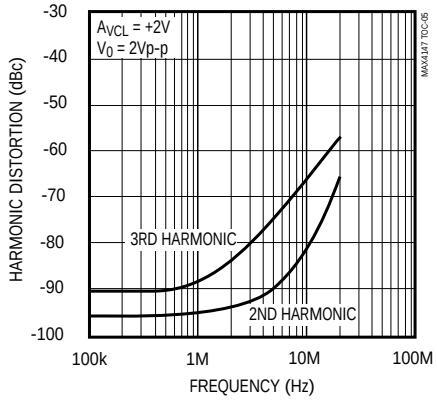
CURRENT NOISE vs. FREQUENCY



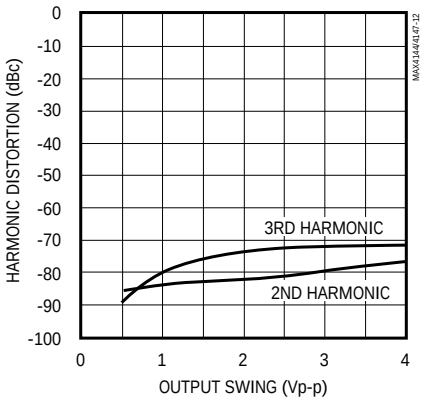
5MHz HARMONIC DISTORTION vs. LOAD



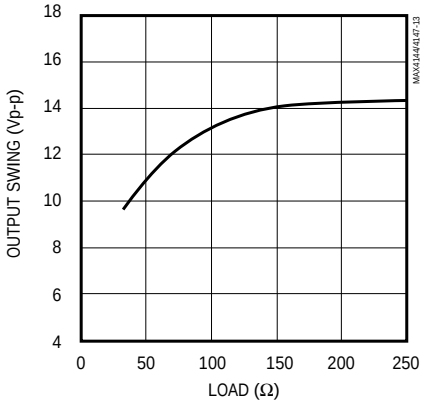
HARMONIC DISTORTION vs. FREQUENCY



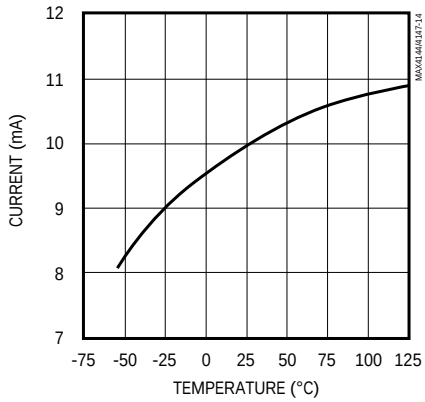
5MHz HARMONIC DISTORTION vs. OUTPUT SWING



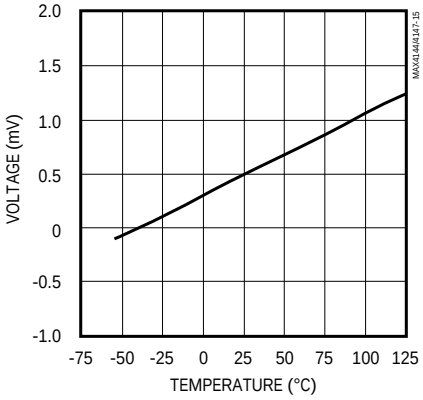
OUTPUT SWING vs. LOAD RESISTANCE



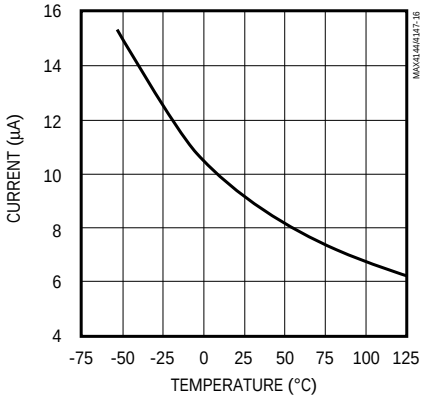
POWER-SUPPLY CURRENT vs. TEMPERATURE



INPUT OFFSET VOLTAGE vs. TEMPERATURE



INPUT BIAS CURRENT vs. TEMPERATURE

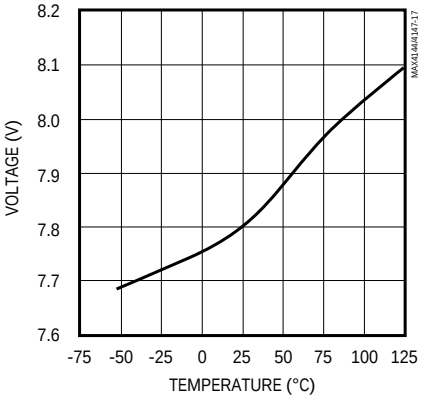


300MHz, Low-Power, High-Output-Current, Differential Line Driver

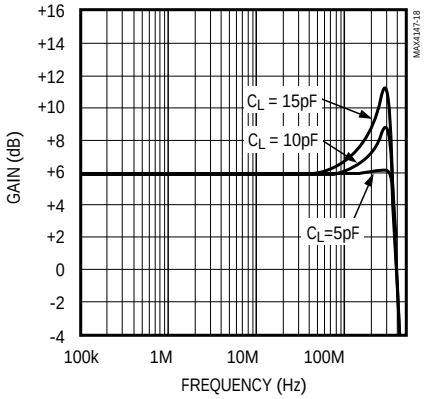
Typical Operating Characteristics (continued)

(V_{CC} = +5V, V_{EE} = -5V, R_L = 150Ω, T_A = +25°C, unless otherwise noted.)

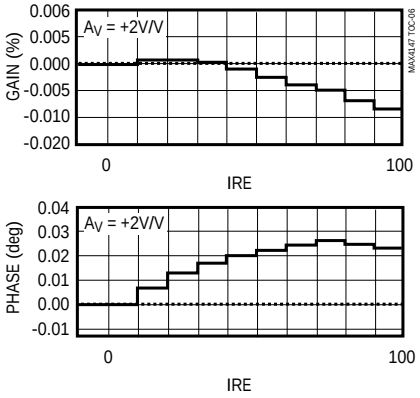
DIFFERENTIAL OUTPUT VOLTAGE SWING vs. TEMPERATURE



SMALL-SIGNAL GAIN vs. FREQUENCY AND CAPACITIVE LOAD



DIFFERENTIAL GAIN AND PHASE



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

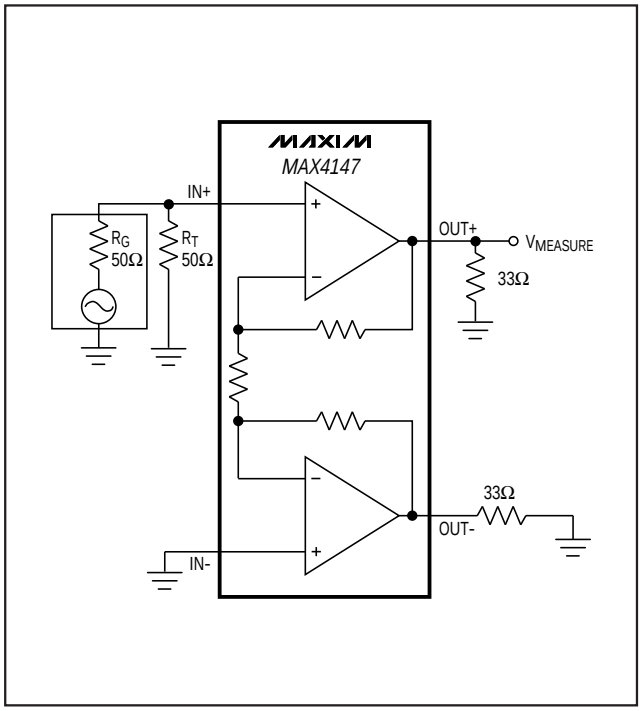


Figure 1. Single-Ended Distortion Setup

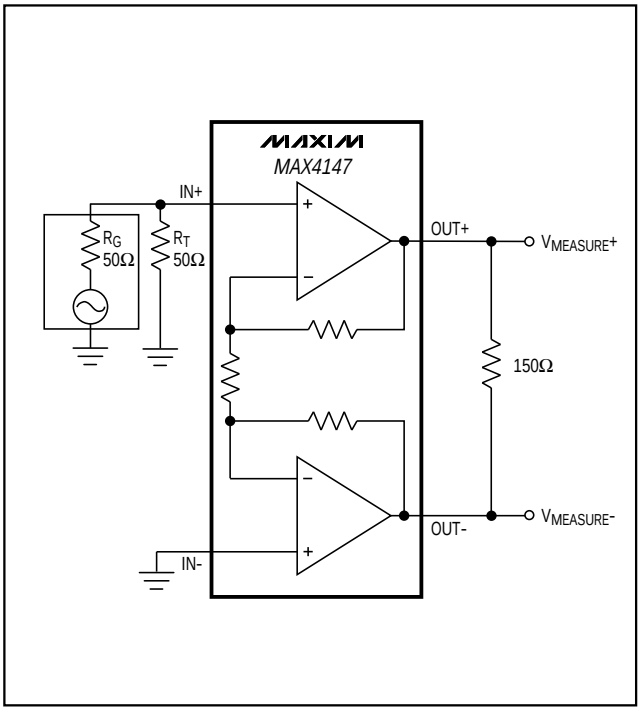


Figure 2. Differential Distortion Setup

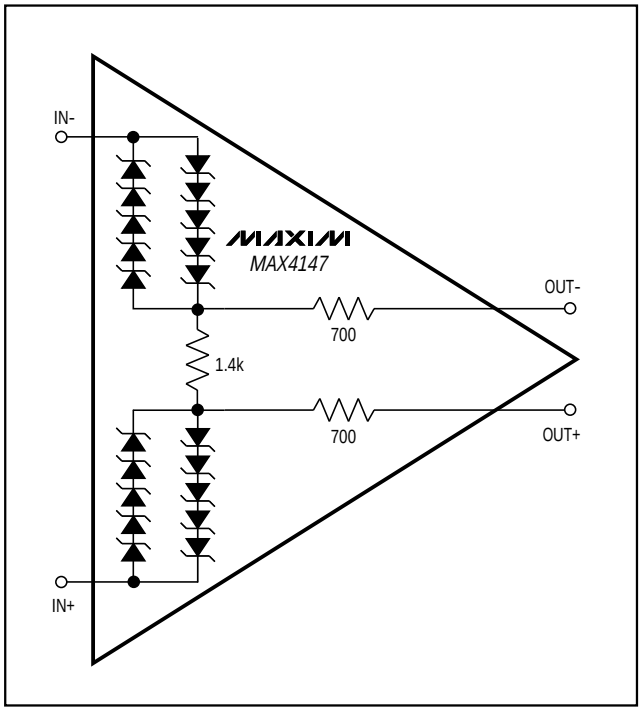
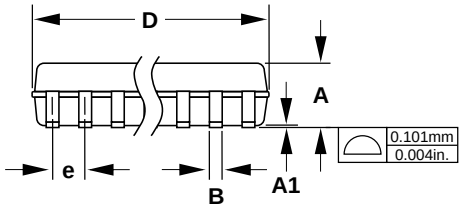
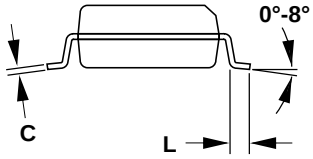


Figure 3. MAX4147 Shutdown Equivalent Circuit

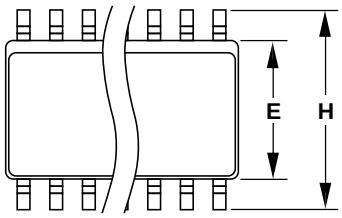
300MHz, Low-Power, High-Output-Current, Differential Line Driver

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