

General Description

The LTC8844 of quad-channel amplifiers provides input offset voltage correction for low offset (maximum +3.0mV) and drift ($\pm 2\mu\text{V}/^\circ\text{C}$) through the use of proprietary techniques. Featuring rail-to-rail input and output swings, and low quiescent current (typical 85 μA per amplifier) combined with a wide bandwidth of 1.5MHz and low noise (25nV/ $\sqrt{\text{Hz}}$ at 1kHz) makes it very attractive for a variety of battery-powered applications such as handsets, tablets, notebooks, and portable medical devices. The low input bias current supports these amplifiers to be used in applications with mega-ohm source impedances. The robust design of the LTC8844 devices provides ease-of-use to the circuit designer: unity-gain stability with capacitive loads of up to 500pF, integrated RF/EMI rejection filter, no phase reversal in overdrive conditions, and high electro-static discharge (ESD) protection (4-kV HBM). The LTC8844 is optimized for operation at voltages as low as +1.8V ($\pm 0.9\text{V}$) and up to +5.5V ($\pm 2.75\text{V}$) at the temperature range of 0 $^\circ\text{C}$ to 70 $^\circ\text{C}$, and operation at voltages from +2.0V ($\pm 1.0\text{V}$) to +5.5V ($\pm 2.75\text{V}$) over the extended temperature range of -40 $^\circ\text{C}$ to +125 $^\circ\text{C}$. The LTC8844 devices are offered in QFN3x3-16L packages.

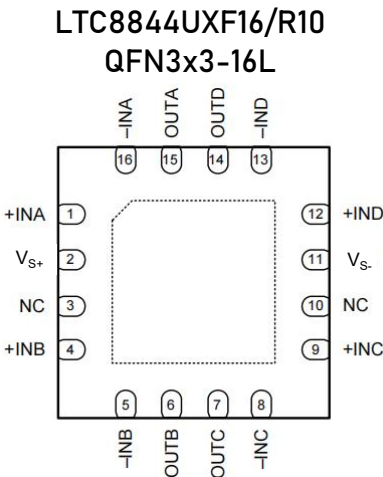
Features and Benefits

- Precision: +3.0 mV Maximum Input Offset Voltage
- Low Noise: 25 nV/ $\sqrt{\text{Hz}}$ at 1 kHz
- 1.5 MHz GBW for Unity-Gain Stable
- Micro-Power: 85 μA Supply Current Per Amplifier
- Single 1.8 V to 5.5 V Supply Voltage Range at 0 $^\circ\text{C}$ to 70 $^\circ\text{C}$
- Rail-to-Rail Input and Output
- Internal RF/EMI Filter
- Extended Temperature Range: -40 $^\circ\text{C}$ to +125 $^\circ\text{C}$

Applications

- Battery-Powered Instruments:
 - Consumer, Industrial, Medical, Notebooks
- Wireless Chargers
- Audio Outputs
- Sensor Signal Conditioning:
 - Sensor Interfaces, Loop-Powered, Active Filters
- Wireless Sensors:
 - Home Security, Remote Sensing, Wireless Metering

Pin Configurations (Top View)



CAUTION: These devices are sensitive to electrostatic discharge; follow proper IC Handling Procedures.
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Pin Description

Symbol	Description
-IN	Inverting input of the amplifier. The voltage range is from (V _{S-} -0.1V) to (V _{S+} +0.1V).
+IN	Non-inverting input of the amplifier. This pin has the same voltage range as -IN.
V _{S+}	Positive power supply. The voltage is from 2.0V to 5.5V. Split supplies are possible as long as the voltage between V _{S+} and V _{S-} is from 2.0V to 5.5V.
V _{S-}	Negative power supply. It is normally tied to ground. It can also be tied to a voltage other than ground as long as the voltage between V _{S+} and V _{S-} is from 2.0V to 5.5V.
OUT	Amplifier output.
NC	No connection.

Ordering Information

Type Number	Package Name	Package Quantity	Eco Class	Marking Code
LTC8844UXF16/R10	QFN3x3-16L	Tape and Reel,5 000	Green (RoHS& no Sb/Br)	AG 4X

Limiting Value

In accordance with the Absolute Maximum Rating System (IEC 60134).

Parameter	Absolute Maximum Rating
Supply Voltage, V _{S+} to V _{S-}	10V
Signal Input Terminals: Voltage, Current	V _{S-} -0.3 V to V _{S+} + 0.3 V, ±20 mA
Output Short-Circuit	Continuous
Storage Temperature Range, T _{stg}	-65 °C to +150 °C
Junction Temperature, T _j	150 °C
Lead Temperature Range (Soldering 10 sec)	260 °C

ESD Rating

Parameter	Item	Value	Unit
Electrostatic Discharge Voltage	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001	±4 000	V
	Charged device model (CDM), per ANSI/ESDA/JEDEC JS-002	±2 000	

Electrical Characteristics

$V_S=5.0V$, $T_A=+25^{\circ}C$, $V_{CM}=V_S/2$, $V_O=V_S/2$, and $R_L=10k\Omega$ connected to $V_S/2$, unless otherwise noted. Boldface limits apply over the specified temperature range, $T_A=-40$ to $+125^{\circ}C$.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
OFFSET VOLTAGE						
V _{OS}	Input offset voltage		-3.0		+3.0	mV
V _{OS} TC	Offset voltage drift	T _A = -40 to +125 °C		± 2		μV/°C
PSRR	Power supply rejection ratio	V _S = 2.0 to 5.5 V, V _{CM} < V _{S+} -2V	80	112		dB
		T _A = -40 to +125 °C	75			
INPUT BIAS CURRENT						
I _B	Input bias current			1		pA
		T _A = +85 °C		150		
		T _A = +125 °C		500		
I _{OS}	Input offset current			1		pA
NOISE						
V _n	Input voltage noise	f = 0.1 to 10 Hz		5.6		μV _{P-P}
e _n	Input voltage noise density	f = 10 kHz		22		nV/√Hz
		f = 1 kHz		25		
I _n	Input current noise density	f = 1 kHz		3		fA/√Hz
INPUT VOLTAGE						
V _{CM}	Common-mode voltage range		V _{S-} -0.1		V _{S+} +0.1	V
CMRR	Common-mode rejection ratio	V _S = 5.5 V,V _{CM} = -0.1 to 5.6 V	80	96		dB
		V _{CM} = 0 to 5.3 V, T _A = -40 to +125 °C	75			
		V _S = 2.0 V,V _{CM} = -0.1 to 2.1 V	78	90		
		V _{CM} = 0 to 1.8 V, T _A = -40 to +125 °C	72			
INPUT IMPEDANCE						
C _{IN}	Input capacitance	Differential		2.0		pF
		Common mode		3.5		
OPEN-LOOPGAIN						
A _{VOL}	Open-loop voltage gain	R _L = 10 kΩ, V _O = 0.05 to 3.5 V	90	105		dB
		T _A = -40 to +125 °C	85			
		R _L = 600 Ω, V _O = 0.15 to 3.5 V	85	100		
		T _A = -40 to +125 °C	80			
FREQUENCY RESPONSE						
GBW	Gain bandwidth product			1.5		MHz
SR	Slew rate	G = +1, C _L = 100 pF, V _O = 1.5 to 3.5 V		1.2		V/μs

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Electrical Characteristics (Cont.)

$V_S=5.0V$, $T_A=+25^{\circ}C$, $V_{CM}=V_S/2$, $V_O=V_S/2$, and $R_L=10k\Omega$ connected to $V_S/2$, unless otherwise noted. Boldface limits apply over the specified temperature range, $T_A=-40$ to $+125^{\circ}C$.

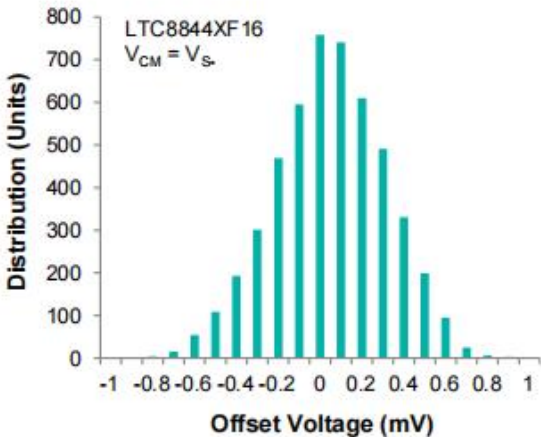
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
THD+N	Total harmonic distortion + noise	G = +1, f = 1 kHz, V _O = 1 V _{RMS}		0.0015		%
t _S	Settling time	To 0.1%, G = +1, 1V step		1.2		μs
		To 0.01%, G = +1, 1V step		1.5		
t _{OR}	Overload recovery time	To 0.1%, V _{IN} * Gain > V _S		2		μs
OUTPUT						
V _{OH}	High output voltage swing	R _L = 10 kΩ	V _{S+} -19	V _{S+} -11		mV
		R _L = 600 Ω	V _{S+} -275	V _{S+} -200		
V _{OL}	Low output voltage swing	R _L = 10 kΩ		V _{S-} +8	V _{S-} +14	mV
		R _L = 600 Ω		V _{S-} +135	V _{S-} +185	
I _{SC}	Short-circuit current	Source current through 10Ω		45		mA
		Sink current through 10Ω		55		
POWER SUPPLY						
V _S	Operating supply voltage	T _A = 0 to +70 °C	1.8		5.5	V
		T _A = -40 to +125 °C	2.0		5.5	
I _Q	Quiescent current (per amplifier)			85	135	μA
		T _A = -40 to +125 °C			170	
THERMAL CHARACTERISTICS						
T _A	Operating temperature range		-40		+125	°C
θ _{JA}	Package Thermal Resistance	QFN3x3-16L		45		°C/W

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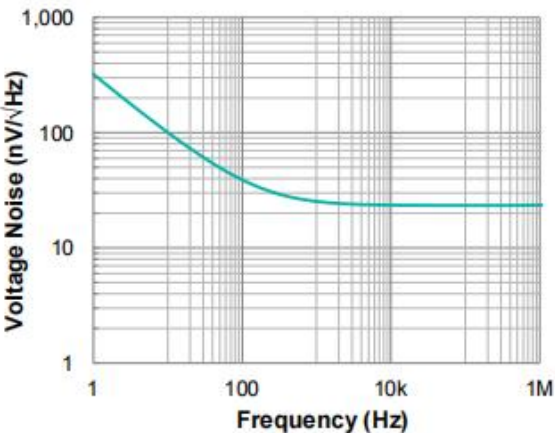


Typical Performance Characteristics

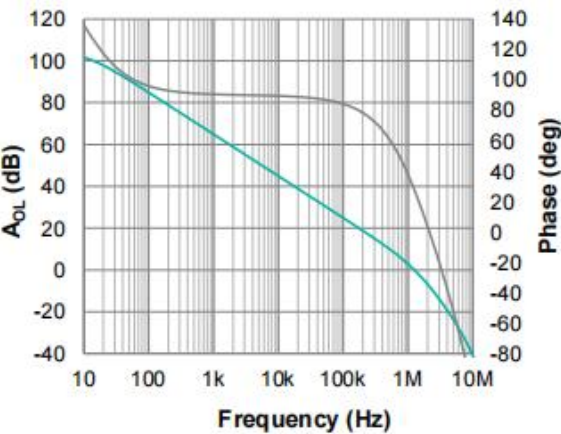
At $T_A = +25^{\circ}\text{C}$, $V_{CM} = V_S/2$, and $R_L = 10\text{k}\Omega$ connected to $V_S/2$, unless other wise noted.



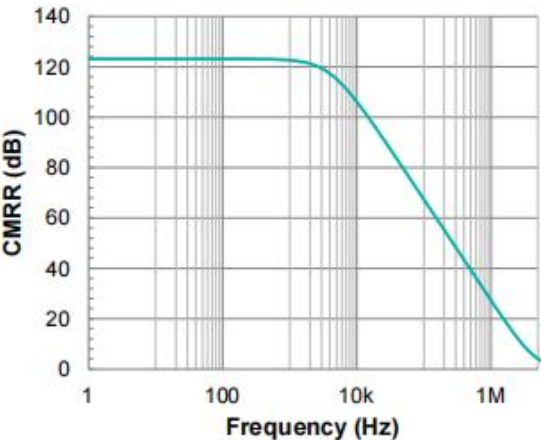
Offset Voltage Production Distribution



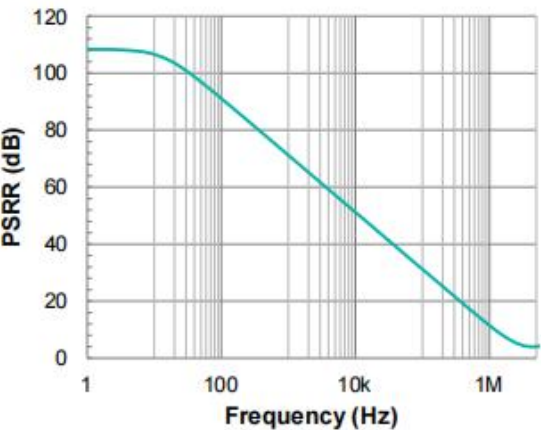
Input Voltage Noise Spectral Density as a function of Frequency.



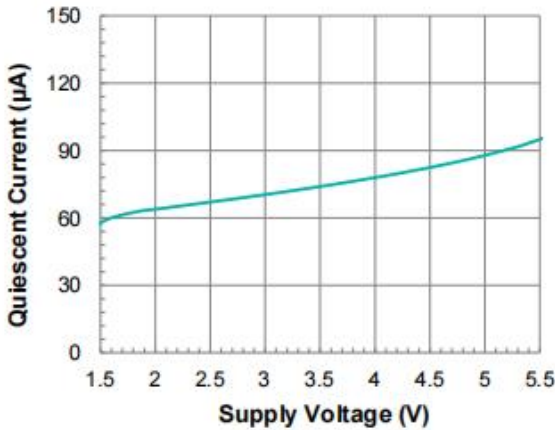
Open-loop Gain and Phase as a function of Frequency.



Common-mode Rejection Ratio as a function of Frequency.



Power Supply Rejection Ratio as a function of Frequency.



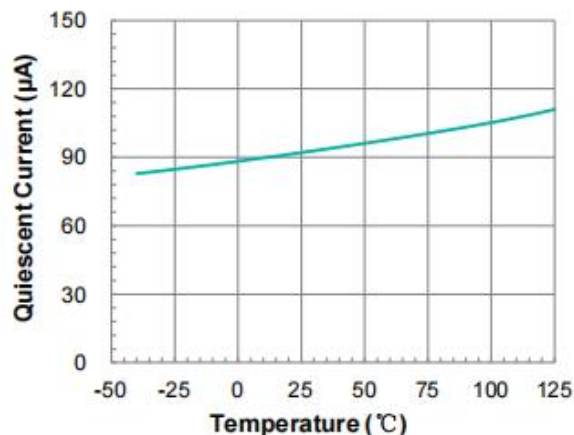
Quiescent Current as a function of Supply Voltage.

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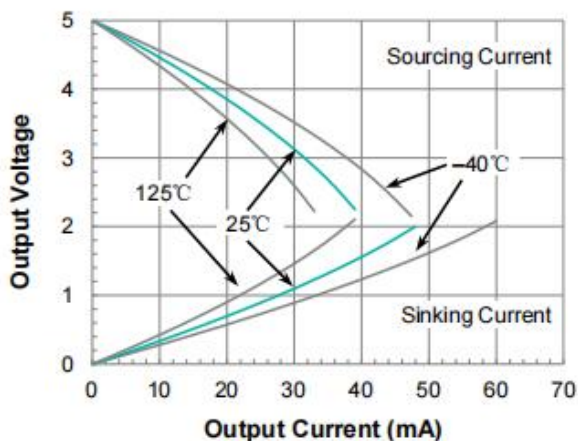


Typical Performance Characteristics (Cont.)

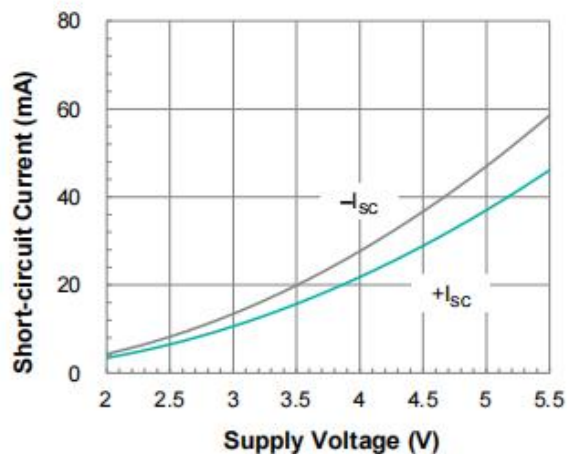
At $T_A = +25^\circ\text{C}$, $V_{CM} = V_S/2$, and $R_L = 10\text{k}\Omega$ connected to $V_S/2$, unless otherwise noted.



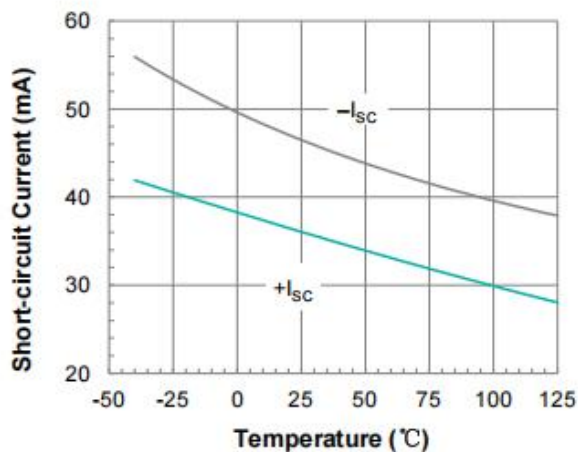
Quiescent Current as a function of Temperature.



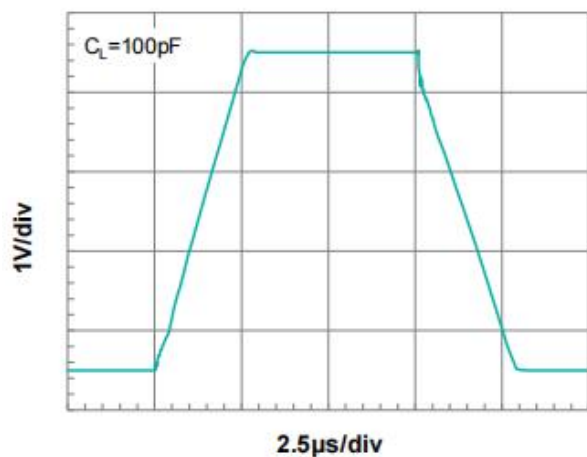
Output Voltage Swing as a function of Output Current.



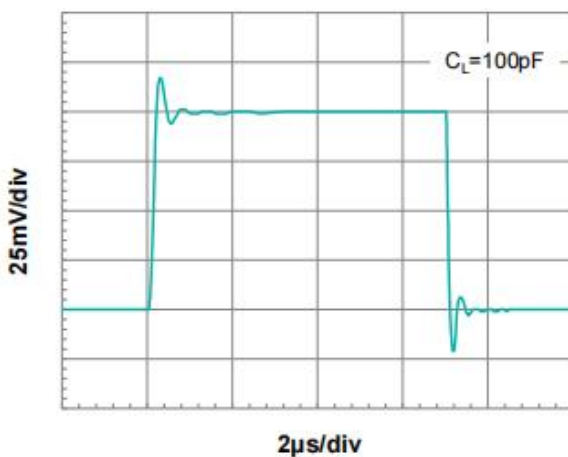
Short-circuit Current as a function of Supply Voltage.



Short-circuit Current as a function of Temperature.



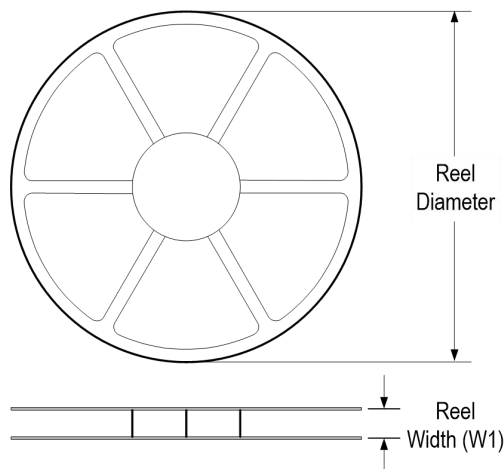
Large Signal Step Response.



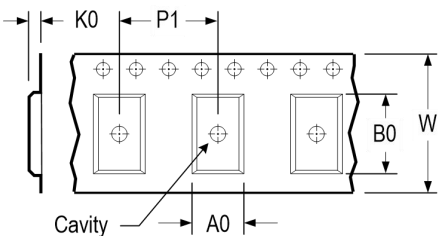
Small Signal Step Response.

Tape and Reel Information

REEL DIMENSIONS

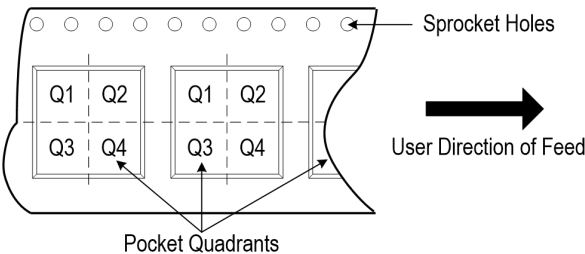


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

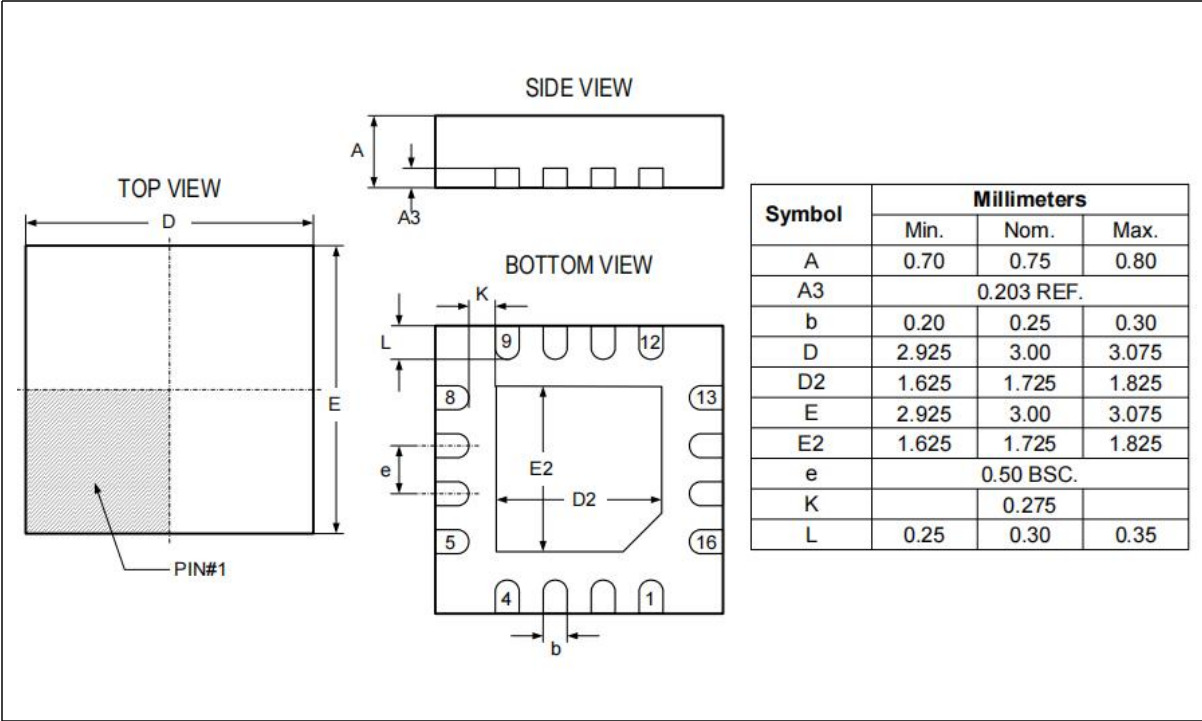


* All dimensions are nominal.

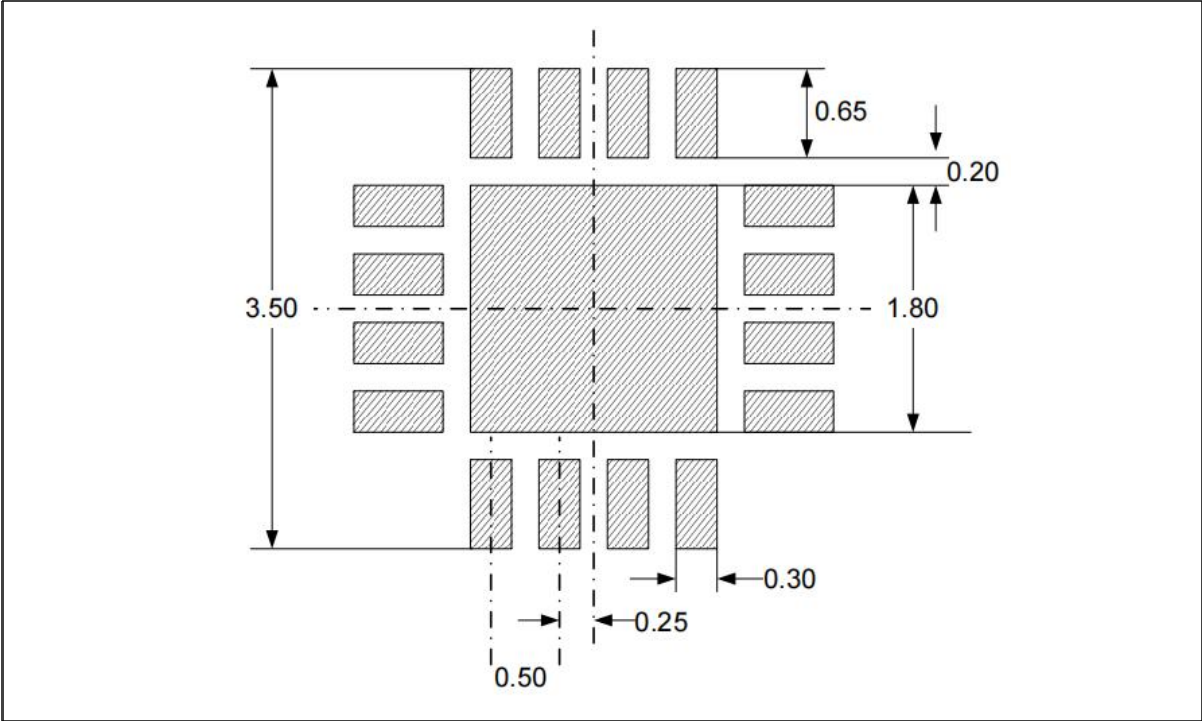
Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin 1 Quadrant
LTC8844UXF16/R10	QFN3x3	16	5 000	330	12.5	3.5	3.5	1.2	8.0	12.0	Q1

Package Outlines

DIMENSIONS, QFN3x3-16L



RECOMMENDED SOLDERING FOOTPRINT, QFN3x3-16L



Important Notice

Linearin is a global fabless semiconductor company specializing in advanced high-performance high-quality analog/mixed-signal IC products and sensor solutions. The company is devoted to the innovation of high performance, analog-intensive sensor front-end products and modular sensor solutions, applied in multi-market of medical & wearable devices, smart home, sensing of IoT, and intelligent industrial & smart factory (industrie 4.0). Linearin's product families include widely-used standard catalog products, solution-based application specific standard products (ASSPs) and sensor modules that help customers achieve faster time-to-market products. Go to <http://www.linearin.com> for a complete list of Linearin product families.

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