

General Description

The LTA6324A is a micro-power, 36 V wide supply voltage, rail-to-rail output operational amplifiers capable of operating on supplies ranging from +3.15 V to +36 V. LTA6324A offers outstanding dc precision and ac performance, including low offset (± 0.5 mV typically), low offset drift (± 5 μ V/ $^{\circ}$ C typically), 1.1 MHz bandwidth, Unique features such as differential input-voltage range to the negative supply rail, short-circuit current (± 35 mA), high capacitive load drive of up to 1 nF and high slew rate (0.8 V/ μ s) make the LTA6324A high-performance operational amplifiers for high-voltage industrial applications.

The robust design of the LTA6324A provides ease-of-use to the circuit designer: integrated RF/EMI rejection filter, no phase reversal in overdrive conditions and high electro-static discharge (ESD) protection. The LTA6324A is optimized for operation at voltages from +3.15V (± 1.575 V) to +36 V (± 18 V) over the extended temperature range of -40° C to $+125^{\circ}$ C.

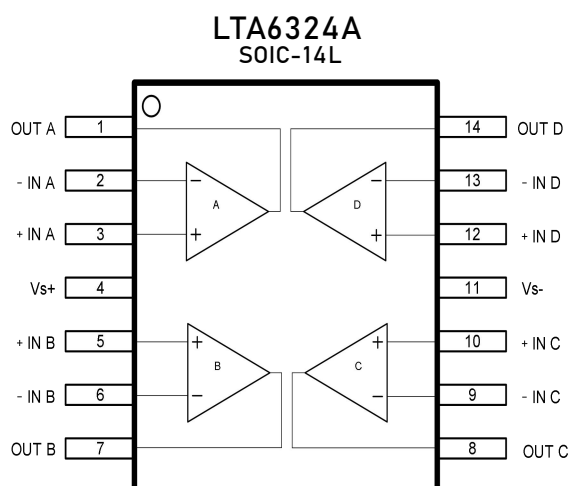
Features and Benefits

- Wide Supply: ± 1.575 V to ± 18 V, 3.15V to 36 V
- Low Offset Voltage: ± 0.5 mV typically
- Low Offset Voltage Drift: ± 5 μ V/ $^{\circ}$ C
- High Common-Mode Rejection: 110 dB
- Gain Bandwidth: 1.1 MHz
- Slew Rate: 0.8 V/ μ s
- Low Noise: 30 nV/ $\sqrt{\text{Hz}}$ at 1 kHz
- Rail-to-Rail Output

Applications

- Tracking Amplifier in Power Modules
- Power Delivery: UPS, Server and Merchant Network Power
- High-Side and Low-Side Current Sensing
- Transducer Amplifiers
- Battery-Powered Instruments
- Test and Measurement Equipment
- Multiplexed Data-Acquisition Systems
- Programmable Logic Controllers

Pin Configuration (Top View)



Pin Description

Symbol	Description
-IN	Inverting input of the amplifier. The voltage range is from V_{S-} to $V_{S+} - 1.5V$.
+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 3.15V to 36V. Split supplies are possible as long as the voltage between V_{S+} and V_{S-} is from 3.15V to 36V.
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 3.15V to 36V.
OUT	Amplifier output.
NC	No connection

Ordering Information

Type Number	Package Name	Package Quantity	Eco Class	Marking Code
LTA6324AXS14/R5	SOIC-14L	Tape and Reel, 2 500	Green (RoHS & no Sb/Br)	F6324, FRAL

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

Parameter	Absolute Maximum Rating
Supply Voltage, V_{S+} to V_{S-}	40 V
Signal Input Terminals: Voltage, Current	$V_{S-} - 0.3$ to $V_{S+} + 0.3$ V, ± 10 mA
Output Short-Circuit	Continuous
Storage Temperature Range, T_{stg}	-65 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	$\pm 2\ 000$	V
	Charged device model (CDM), per ANSI/ESDA/JEDEC JS-002	$\pm 2\ 000$	

Electrical Characteristics

$V_S = 3.15\text{ V}$ to 36 V , $T_A = +25\text{ }^{\circ}\text{C}$, $V_{CM} = V_{OUT} = V_S/2$, and $R_L = 10\text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted. Boldface limits apply over the specified temperature range, $T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
OFFSET VOLTAGE						
V _{OS}	Input offset voltage			±0.5	± 1	mV
V _{OS} TC	Offset voltage drift	T _A = -40 to +125 °C		±5		µV/°C
PSRR	Power supply rejection ratio	V _S = 3.65 to 36 V, V _{CM} = 0.1 V		106		dB
		T _A = -40 to +125 °C		105		
INPUT BIAS CURRENT						
I _B	Input bias current	T _A = +25°C		10		pA
		T _A = +85 °C		150		
		T _A = +125 °C		600		
I _{OS}	Input offset current			5		pA
NOISE						
V _n	Input voltage noise	f = 0.1 to 10 Hz		13		µV _{P-P}
e _n	Input voltage noise density	f = 1 kHz		30		nV/√ Hz
I _n	Input current noise density	f = 1 kHz		5		fA/√ Hz
INPUT VOLTAGE						
V _{CM}	Common-mode voltage range		V _{S-}		V _{S+} -1.5	V
CMRR	Common-mode rejection ratio	V _S = 36 V, V _{CM} = 0 to 34.5 V		110		dB
		V _{CM} = 0.1 to 34 V, T _A = -40 to +125 °C		95		
		V _S = 5.0 V, V _{CM} = 0 to 3.5 V		90		
		V _{CM} = 0.1 to 3 V, T _A = -40 to +125 °C		85		
INPUT IMPEDANCE						
C _{IN}	Input capacitance	Differential		2.0		pF
		Common mode		3.5		
OPEN-LOOP GAIN						
A _{VOL}	Open-loop voltage gain	V _S = 3.15 V, V _O = 0.1 to 2.65 V		100		dB
		V _S = 36 V, V _O = 0.1 to 34.5 V		115		
		V _O = 0.1 to 34.5 V, T _A = -40 to +125 °C		110		
		V _S = 5 V, V _O = 0.1 to 4.5 V		100		
		V _O = 0.1 to 4.5 V, T _A = -40 to +125 °C		95		
FREQUENCY RESPONSE						
GBW	Gain bandwidth product			1.1		MHz
SR	Slew rate	V _S = 36 V, G = +1, 10 V step		0.8		V/µs
THD+N	Total harmonic distortion + noise	G = +1, f = 1 kHz, V _O = 3 V _{RMS}		0.0002		%
t _s	Settling time	To 0.1%, V _S = 36 V, G = +1, 5 V step		16		µs
		To 0.01%, V _S = 36 V, G = +1, 5 V step		22		

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

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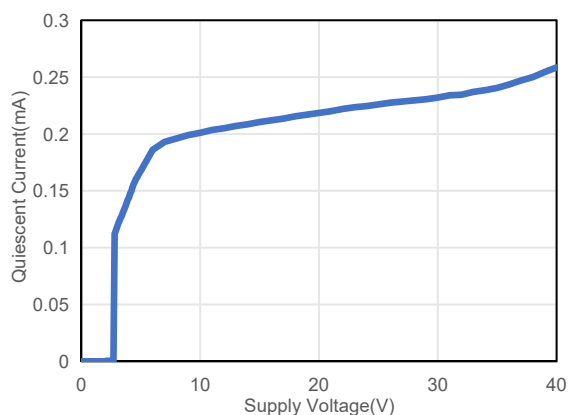
Electrical Characteristics (continued)

$V_S = 3.15\text{ V}$ to 36 V , $T_A = +25^\circ\text{C}$, $V_{CM} = V_{OUT} = V_S/2$, and $R_L = 10\text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted. Boldface limits apply over the specified temperature range, $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$.

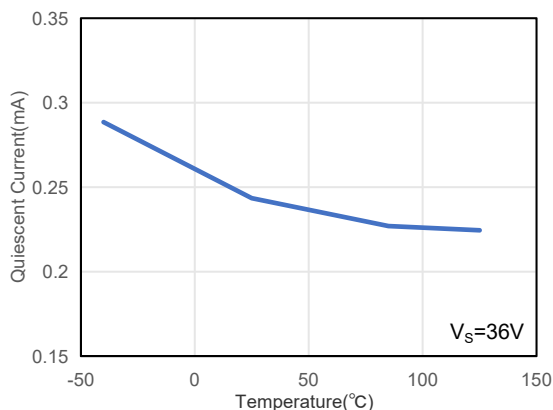
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
t _{OR}	Overload recovery time	V _{IN} × Gain > V _S		2		μs
OUTPUT						
V _{OH}	Output Swing from Positive Rail	V _S = ±18 V, R _L = 10 kΩ		215		mV
		V _S = ±18 V, R _L = 2 kΩ		1050		
V _{OL}	Output Swing from Negative Rail	V _S = ±18 V, R _L = 10 kΩ		150		mV
		V _S = ±18 V, R _L = 2 kΩ		650		
I _{SC}	Short-circuit current			±35		mA
POWER SUPPLY						
V _S	Operating supply voltage	T _A = -40 to +125 °C	3.15		36	V
I _Q	Quiescent current (per amplifier)	V _S = 3.15 V		98		μA
		V _S = 5 V		180		
		V _S = 36 V		260		
THERMAL CHARACTERISTICS						
T _A	Operating temperature range		-40		+125	°C
θ _{JA}	Package Thermal Resistance	SOIC-14L		115		°C/W

Typical Performance Characteristics

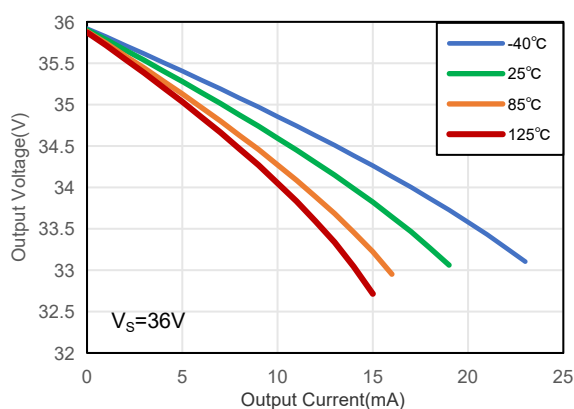
At $T_A = +25^\circ\text{C}$, $V_{CM} = V_S/2$, and $R_L = 10\text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted.



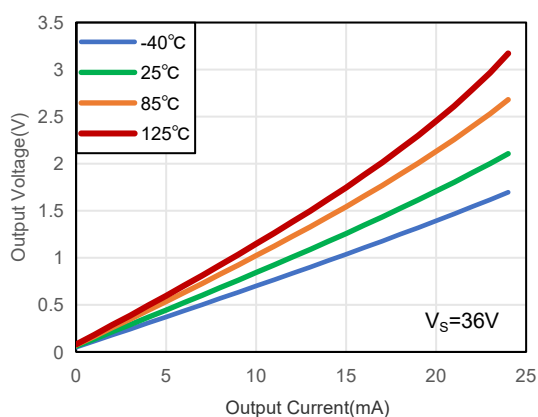
Quiescent Current as a function of Supply Voltage



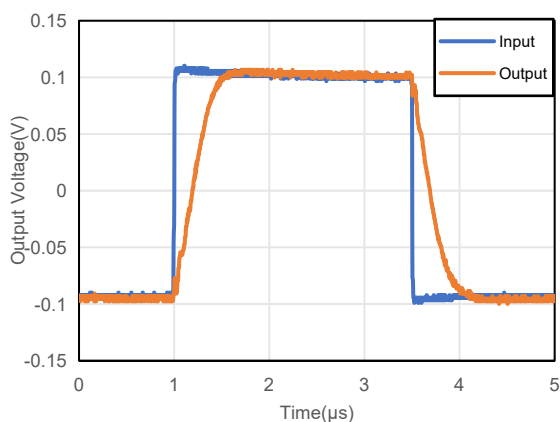
Quiescent Current as a function of Temperature



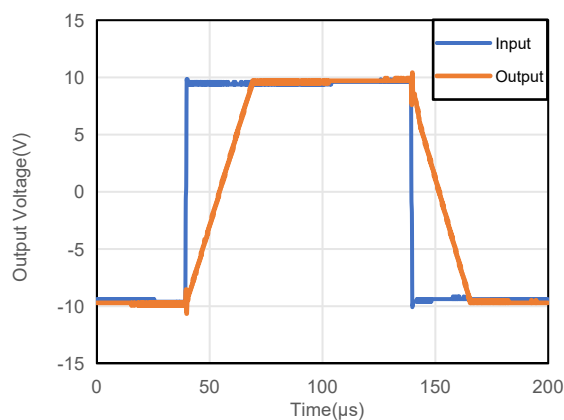
Output Voltage Swing as a function of Output Current (Sourcing, $V_S = 36\text{ V}$)



Output Voltage Swing as a function of Output Current (Sinking, $V_S = 36\text{ V}$)



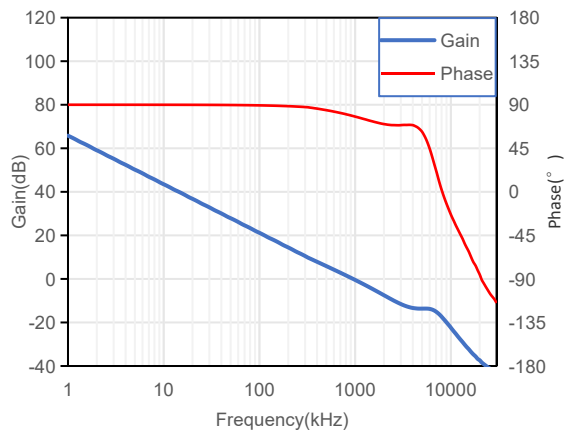
Small-Signal Step Response



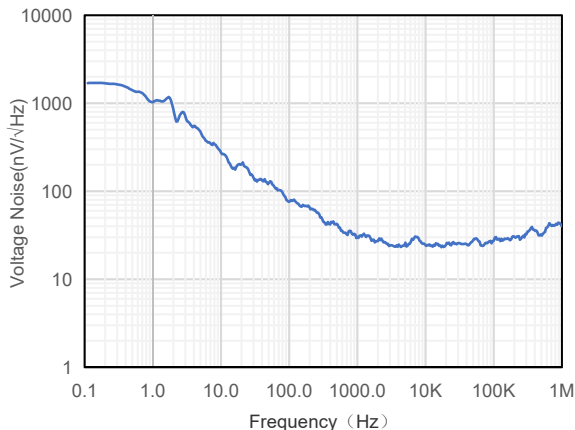
Large-Signal Step Response

Typical Performance Characteristics (continued)

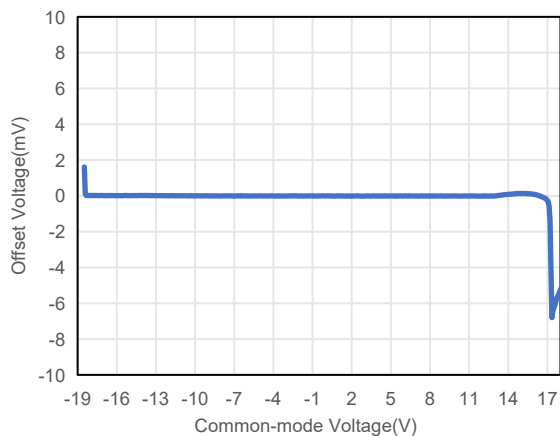
At $T_A = +25^\circ\text{C}$, $V_{CM} = V_S/2$, and $R_L = 10\text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted.



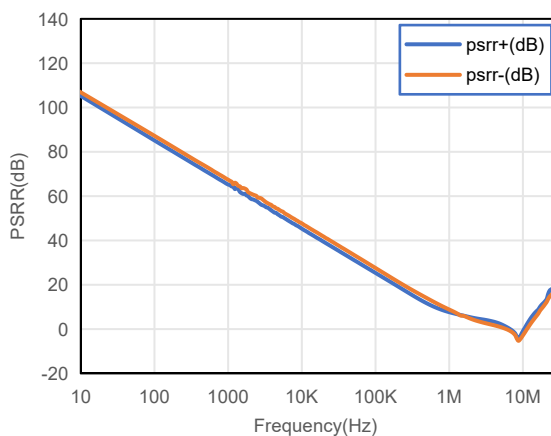
Open-Loop Gain and Phase vs. Frequency



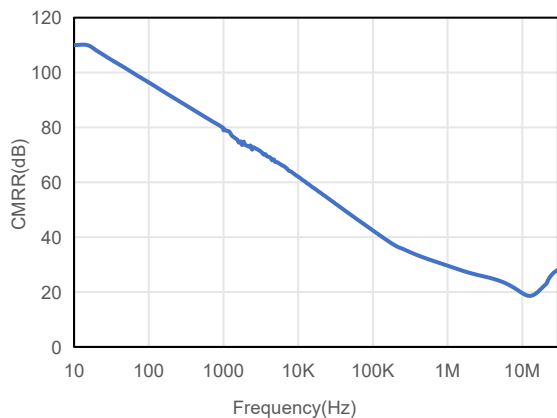
Voltage Noise Density vs. Frequency



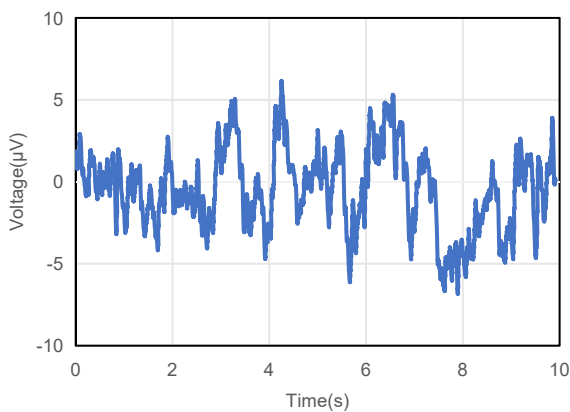
Offset Voltage vs Common-mode Voltage ($V_S = 36\text{ V}$)



PSRR vs Frequency ($V_S = 36\text{ V}$)



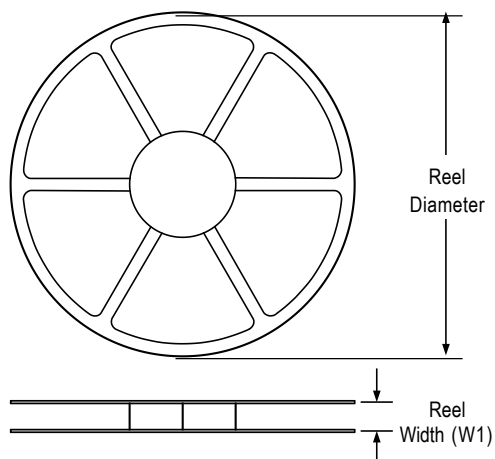
CMRR vs Frequency ($V_S = 36\text{ V}$)



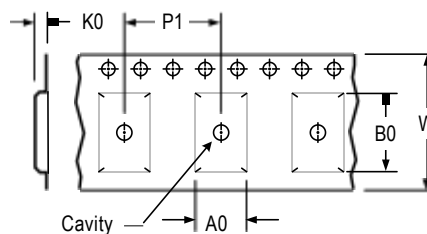
0.1Hz to 10Hz Input Voltage Noise

Tape and Reel Information

REEL DIMENSIONS

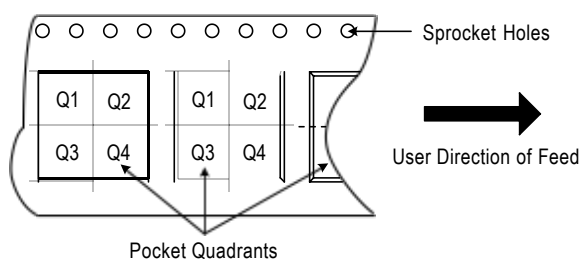


TAPE DIMENSIONS



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

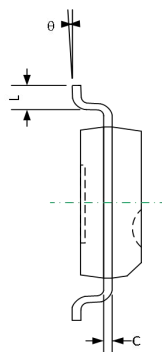
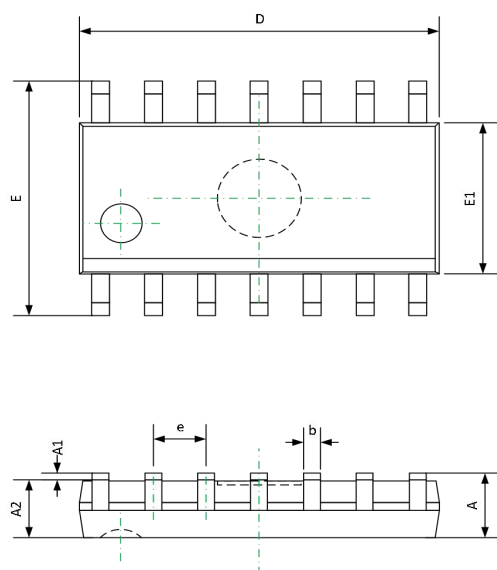


* All dimensions are nominal.

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
LTA6324AXS14/R5	SOIC	14	2 500	330	16.5	6.5	9.5	2.0	8.0	16.0	Q1

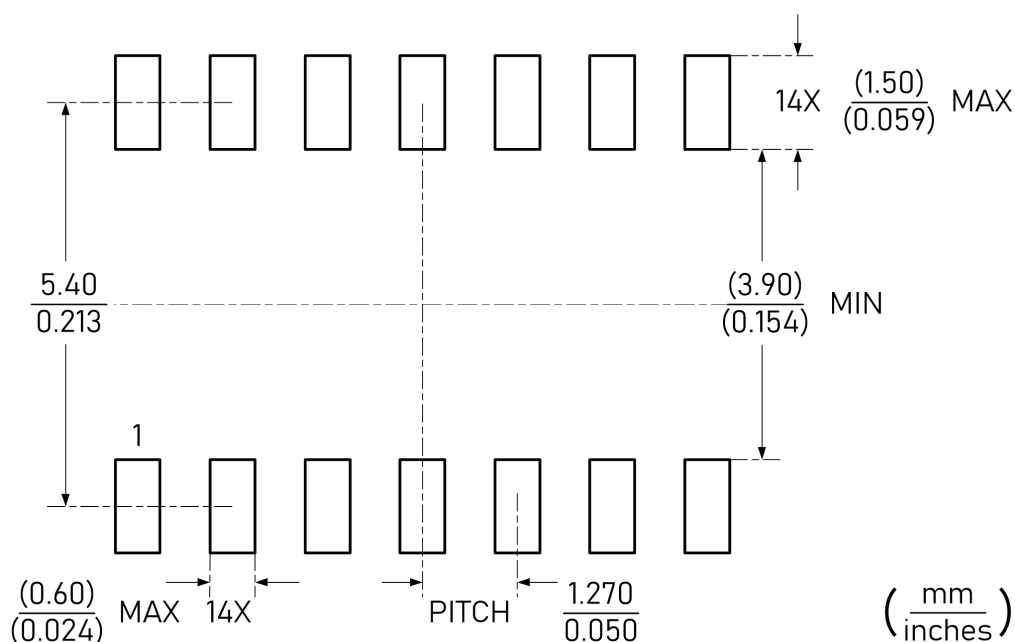
Package Outlines

DIMENSIONS, SOIC-14L



Symbol	Dimensions in Millimeters		Dimensions in inches	
	Min.	Max.	Min.	Max.
A	1.450	1.850	0.057	0.073
A1	0.100	0.300	0.004	0.012
A2	1.350	1.550	0.053	0.061
b	0.406TYP.		0.016TYP.	
C	0.203TYP.		0.008TYP.	
D	8.630	8.830	0.340	0.336
E	5.840	6.240	0.230	0.246
E1	3.850	4.050	0.152	0.159
e	1.270(TYP)		0.050(TYP)	
L	0.350	0.750	0.014	0.030
θ	2°	8°	2°	8°

RECOMMENDED SOLDERING FOOTPRINT, SOIC-14L



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, intelligent industrial & smart factory (industrie 4.0), and automotives. 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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