

48 V, 10 MHz, Low Noise, Precision Operational Amplifiers

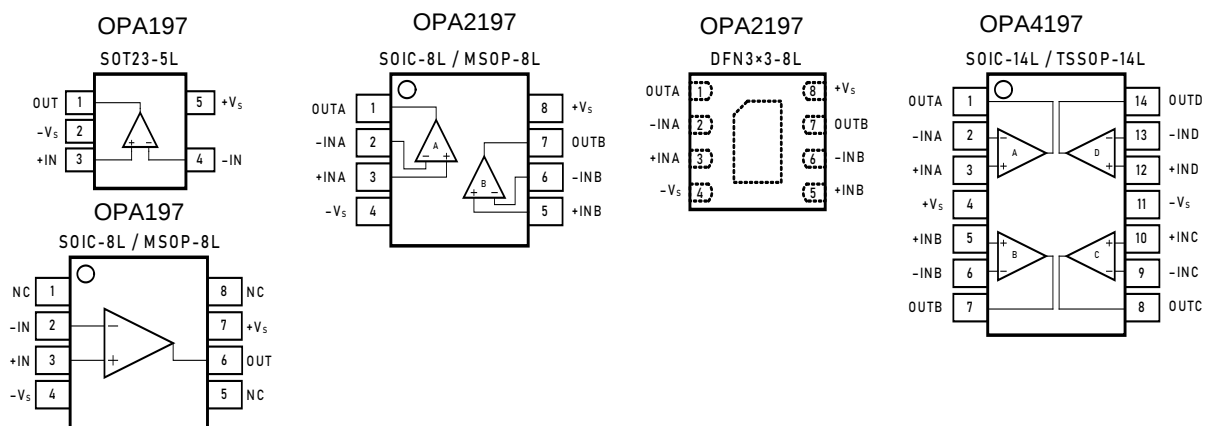
Features and Benefits

- Wide Supply: ± 2.25 V to ± 24 V, 4.5 V to 48 V
- Low Offset Voltage: ± 75 μ V Typically
- Low Offset Voltage Drift: ± 1.5 μ V/ $^{\circ}$ C
- High Common-Mode Rejection: 116 dB
- Gain Bandwidth: 10 MHz
- Slew Rate: 9 V/ μ s
- Low Noise: 8 nV/ $\sqrt{\text{Hz}}$ at 10 kHz
- Low Bias Current: ± 10 pA
- Rail-to-Rail Output

Applications

- Tracking Amplifier in Power Modules
- Merchant Power Supplies
- High-Side and Low-Side Current Sensing
- High Precision Comparator
- 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 $V_{S+} - 1.5$ V.
+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 4.5 V to 48 V. Split supplies are possible as long as the voltage between V_{S+} and V_{S-} is from 4.5 V to 48 V.
-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 4.5 V to 48 V.
OUT	Amplifier output.
NC	No connection

Ordering Information ⁽¹⁾

Type Number	Package Name	Package Quantity	Eco Class ⁽²⁾	Marking Code ⁽³⁾
OPA197IDBVR	SOT23-5L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	OPA197
OPA197IDR	SOIC-8L	Tape and Reel, 4 000	Green (RoHS & no Sb/Br)	OPA197
OPA197IDGKR	MSOP-8L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	OPA197
OPA2197IDR	SOIC-8L	Tape and Reel, 4 000	Green (RoHS & no Sb/Br)	OPA2197
OPA2197IDGKR	MSOP-8L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	OPA2197
OPA2197IDRH	DFN3x3-8L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	OPA2197
OPA4197IDR	SOIC-14L	Tape and Reel, 2 500	Green (RoHS & no Sb/Br)	OPA4197
OPA4197IPWR	TSSOP-14L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	OPA4197

(1) Please contact to your Linearin representative for the latest availability information and product content details.

(2) Eco Class - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & Halogen Free).

(3) There may be multiple device markings, a varied marking character of "x", or additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

Limiting Value – In accordance with the Absolute Maximum Rating System

Parameter	Absolute Maximum Rating
Supply Voltage, V_{S+} to V_{S-}	60 V
Signal Input Terminals: Voltage, Current	$-V_S - 0.3$ V 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 MIL-STD-883J / Method 3015.9 ⁽¹⁾	2 000	V
	Charged device model (CDM), per ESDA/JEDEC JS-002-2014 ⁽²⁾	2 000	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 500-V HBM is possible if necessary precautions are taken.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 250-V CDM is possible if necessary precautions are taken.

Electrical Characteristics

$V_S = 4.5 \text{ V to } 48 \text{ V}$, $T_A = +25 \text{ }^\circ\text{C}$, $V_{CM} = V_{OUT} = V_S/2$, and $R_L = 10 \text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted. Boldface limits apply over the specified temperature range, $T_A = -40 \text{ }^\circ\text{C to } +125 \text{ }^\circ\text{C}$.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
OFFSET VOLTAGE						
Input offset voltage	V _{OS}			±75	±350	μV
Offset voltage drift	V _{OS} TC	T _A = −40 to +125 °C		±1.5		μV/°C
Power supply rejection ratio	PSRR	V _S = 4.5 to 48 V, V _{CM} = 0.1 V		3.5		μV/V
		T _A = −40 to +125 °C		10		
INPUT BIAS CURRENT						
Input bias current	I _B			10		pA
		T _A = +85 °C		150		
		T _A = +125 °C		600		
Input offset current	I _{OS}			5		pA
NOISE						
Input voltage noise	V _n	f = 0.1 to 10 Hz		4		μV _{P-P}
Input voltage noise density	e _n	f = 1 kHz		10		nV/√Hz
		f = 10 kHz		8		
Input current noise density	I _n	f = 1 kHz		5		fA/√Hz
INPUT VOLTAGE						
Common-mode voltage range	V _{CM}		−V _S		+V _S −1.5	V
Common-mode rejection ratio	CMRR	V _S = 40 V, V _{CM} = 0 to 38 V		116		dB
		V _{CM} = 0.1 to 38 V, T _A = −40 to +125 °C		103		
		V _S = 5 V, V _{CM} = 0 to 3.5 V		96		
		V _{CM} = 0.1 to 3 V, T _A = −40 to +125 °C		84		
INPUT IMPEDANCE						
Input capacitance	C _{IN}	Differential		2		pF
		Common mode		3.5		
OPEN-LOOP GAIN						
Open-loop voltage gain	A _{VOL}	V _S = 40 V, V _O = 0.1 to 39.9 V		130		dB
		T _A = −40 to +125 °C		120		
		V _S = 5 V, V _O = 0.1 to 4.9 V		122		
		T _A = −40 to +125 °C		112		
FREQUENCY RESPONSE						
Gain bandwidth product	GBW			10		MHz
Slew rate	SR	V _S = 40 V, G = +1, 10 V step		9		V/μs
Total harmonic distortion + noise	THD+N	G = +1, f = 1 kHz, V _O = 3 V _{RMS}		0.0002		%
Settling time	t _S	To 0.1%, V _S = 40 V, G = +1, 5 V step		1.6		μs
		To 0.01%, V _S = 40 V, G = +1, 5 V step		3.5		
Overload recovery time	t _{OR}	V _{IN} × Gain > V _S		0.6		μs

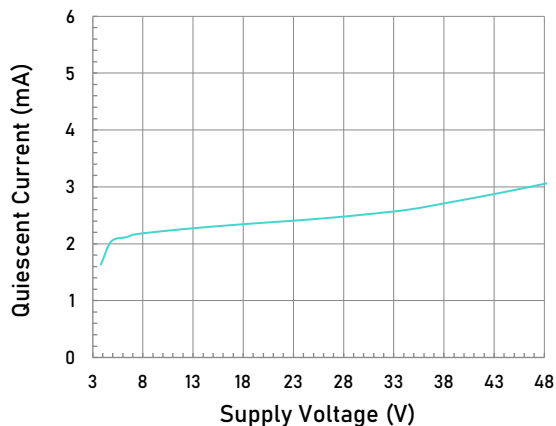
Electrical Characteristics (continued)

$V_S = 4\text{ V to }48\text{ V}$, $T_A = +25\text{ °C}$, $V_{CM} = V_{OUT} = V_S/2$, and $R_L = 10\text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted.
Boldface limits apply over the specified temperature range, $T_A = -40\text{ °C to }+125\text{ °C}$.

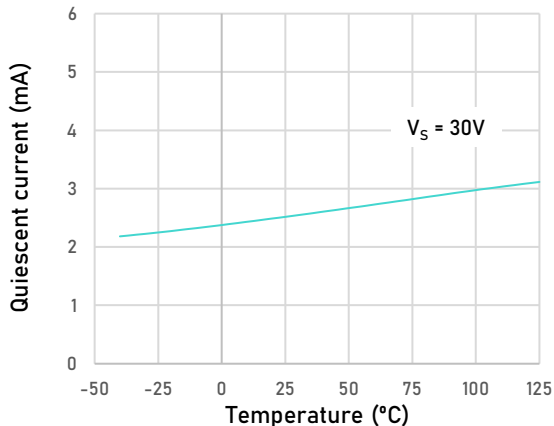
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
OUTPUT						
High output voltage swing	V _{OH}	V _S = ±20 V, R _L = 10 kΩ		+V _S -95		mV
		V _S = ±20 V, R _L = 2 kΩ		+V _S -255		
Low output voltage swing	V _{OL}	V _S = ±20 V, R _L = 10 kΩ		-V _S +60		mV
		V _S = ±20 V, R _L = 2 kΩ		-V _S +240		
Short-circuit current	I _{SC}			±45		mA
POWER SUPPLY						
Operating supply voltage	V _S	T _A = -40 to +125 °C	4.5		48	V
Quiescent current (per amplifier)	I _Q	V _S = 5 V		2.05		mA
		V _S = 40 V		2.75		
THERMAL CHARACTERISTICS						
Operating temperature range	T _A		-40		+125	°C
Package Thermal Resistance	θ _{JA}	SOT23-5L		190		°C/W
		MSOP-8L		201		
		SOIC-8L		125		
		TSSOP-14L		112		
		SOIC-14L		115		

Typical Performance Characteristics

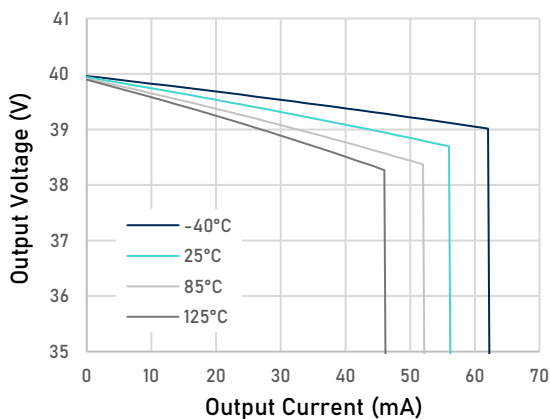
At $T_A = +25^\circ\text{C}$, $V_{CM} = V_S/2$, and $R_L = 10\text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted.



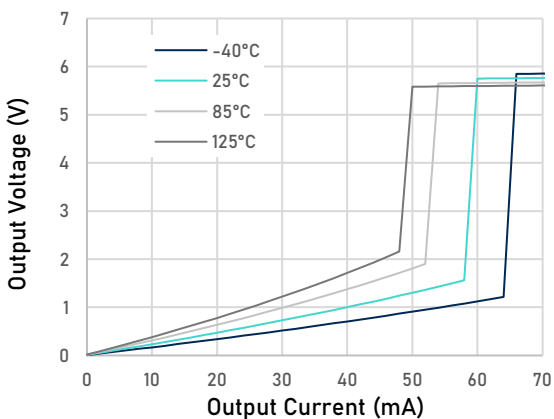
Quiescent Current as a function of Supply Voltage



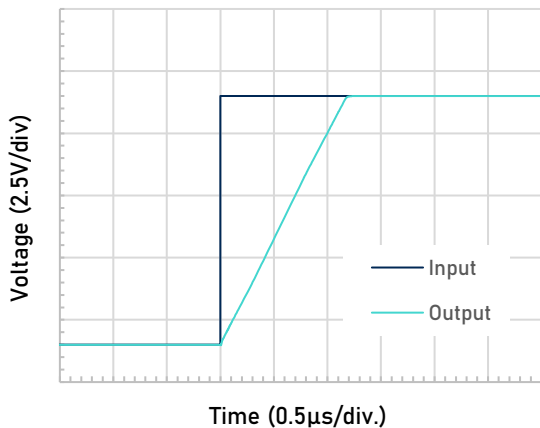
Quiescent Current as a function of Temperature



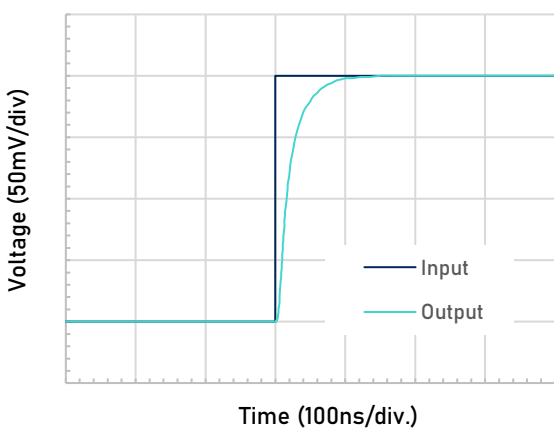
Output Voltage Swing as a function of Output Current (Sourcing, $V_S = 40\text{ V}$)



Output Voltage Swing as a function of Output Current (Sinking, $V_S = 40\text{ V}$)



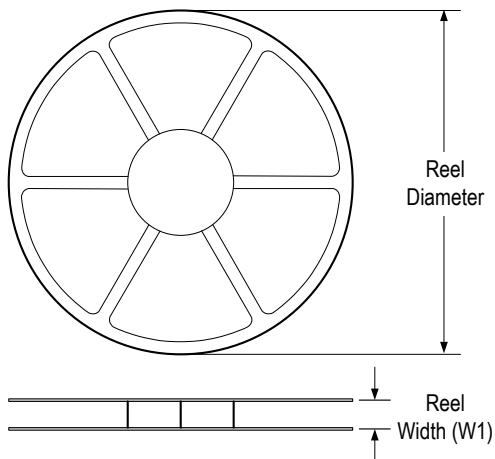
Large-Signal Step Response(Failing)



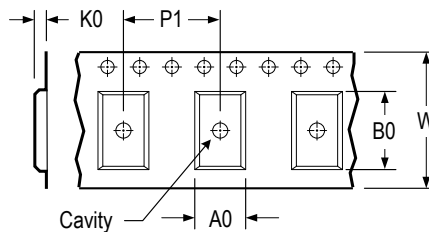
Small-Signal Step Response

Tape and Reel Information

REEL DIMENSIONS

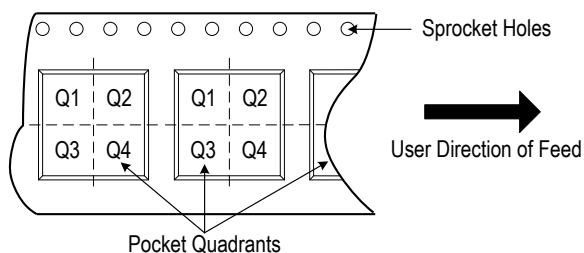


TAPE DIMENSIONS



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

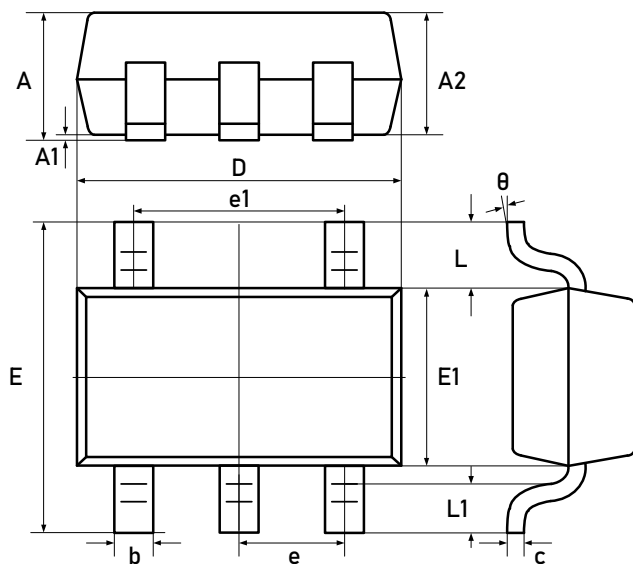


* All dimensions are nominal

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
OPA4197IPWR	SOT23	5	3 000	178	9.0	3.3	3.2	1.5	4.0	8.0	Q3

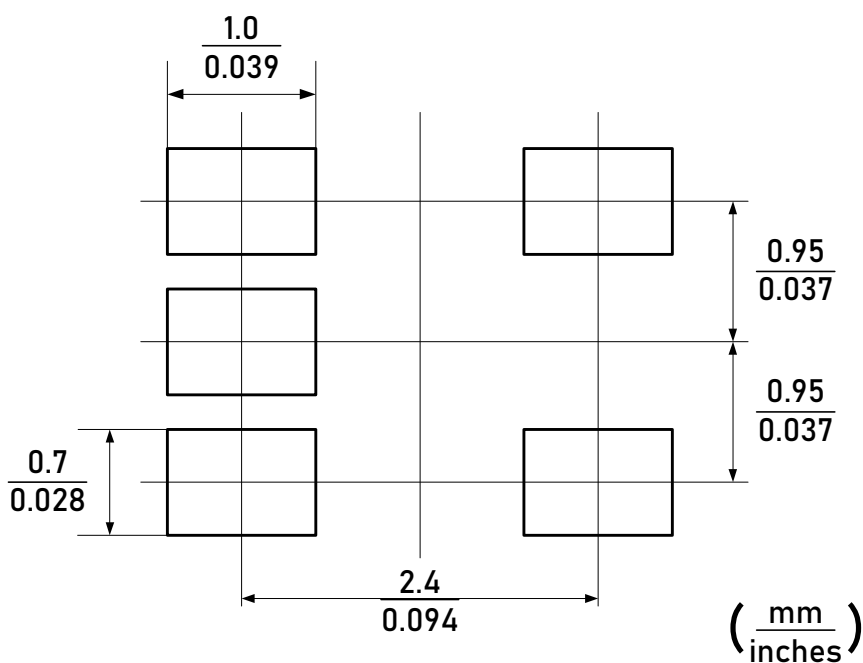
Package Outlines

DIMENSIONS, SOT23-5L



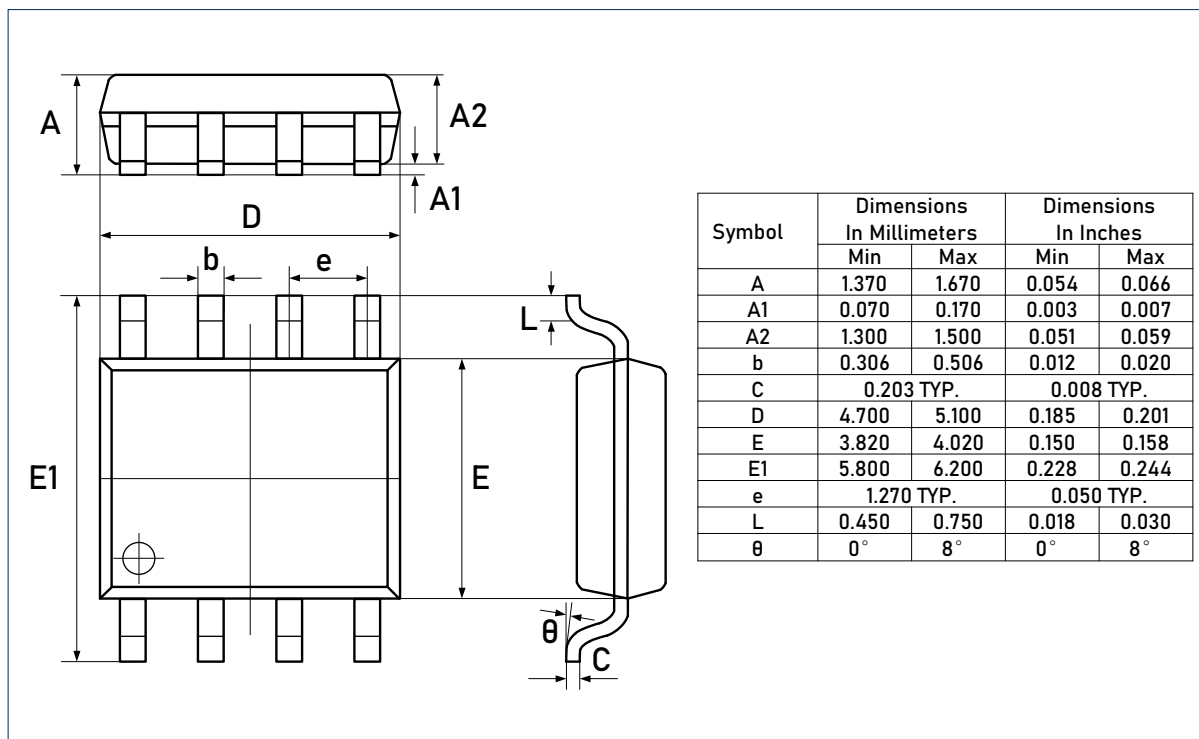
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	-	1.25	-	0.049
A1	0.04	0.10	0.002	0.004
A2	1.00	1.20	0.039	0.047
b	0.33	0.41	0.013	0.016
c	0.15	0.19	0.006	0.007
D	2.820	3.02	0.111	0.119
E1	1.50	1.70	0.059	0.067
E	2.60	3.00	0.102	0.118
e	0.95 BSC		0.037 BSC	
e1	1.90 BSC		0.075 BSC	
L	0.60 REF		0.024 REF	
L1	0.30	0.60	0.012	0.024
θ	0°	8°	0°	8°

RECOMMENDED SOLDERING FOOTPRINT, SOT23-5L

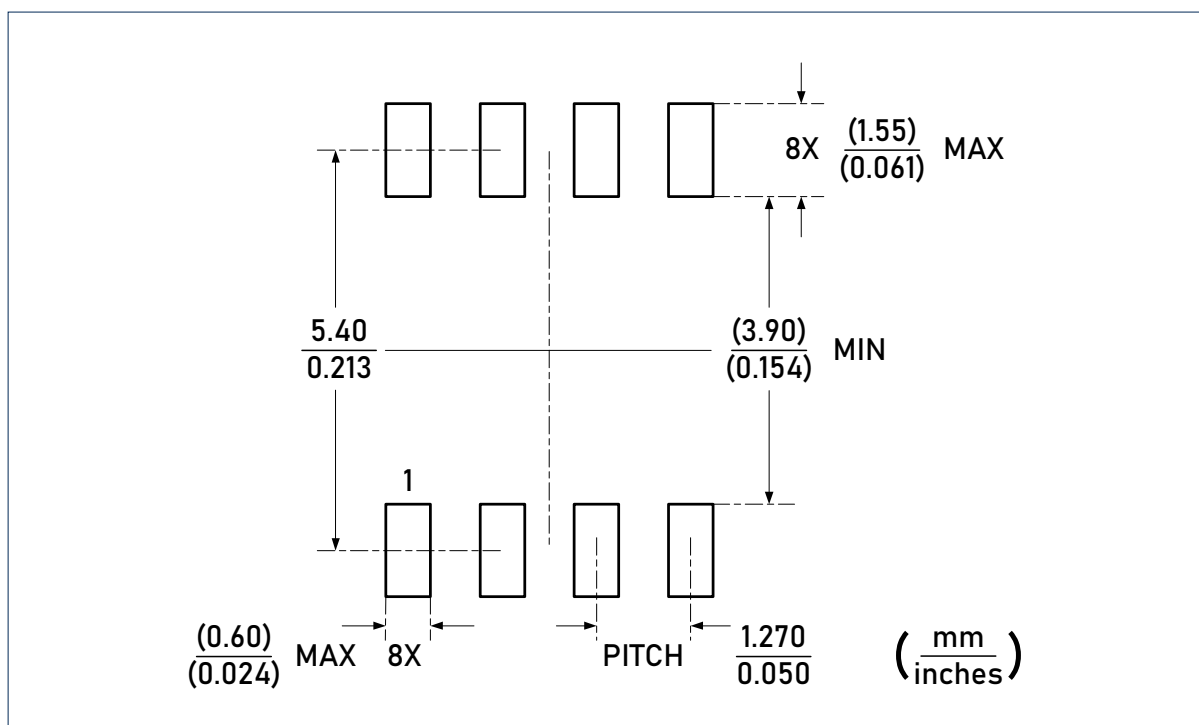


Package Outlines (continued)

DIMENSIONS, SOIC-8L

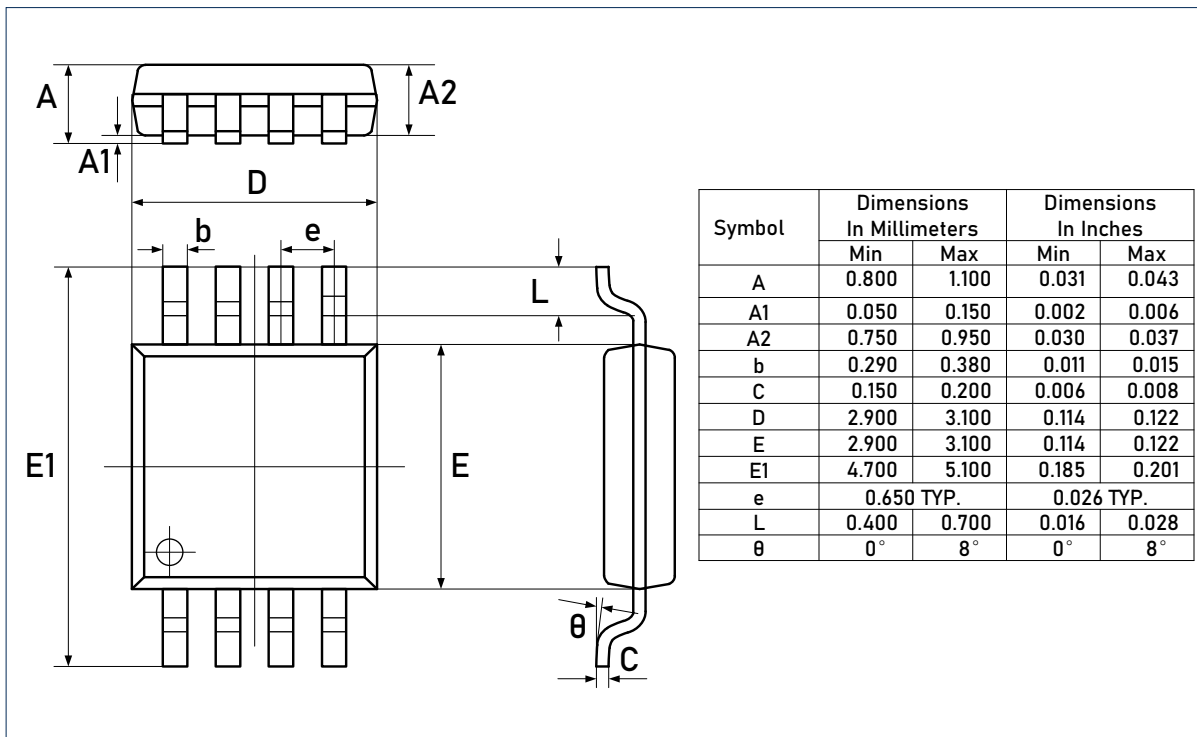


RECOMMENDED SOLDERING FOOTPRINT, SOIC-8L

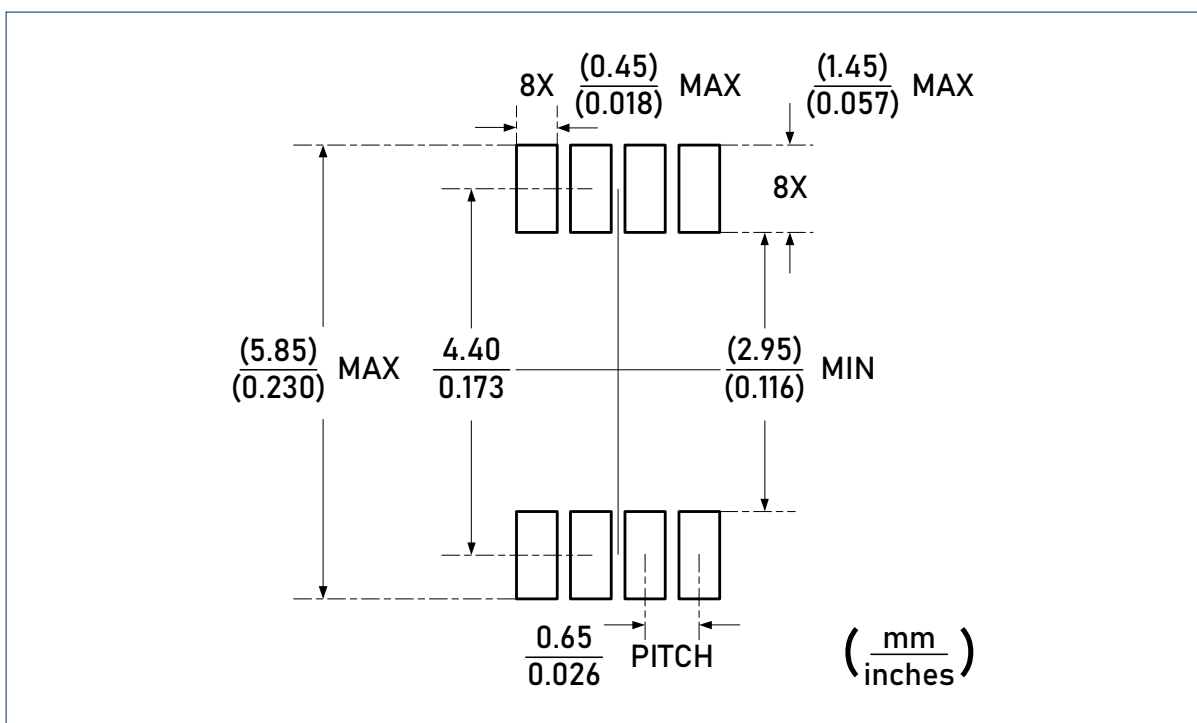


Package Outlines (continued)

DIMENSIONS, MSOP-8L

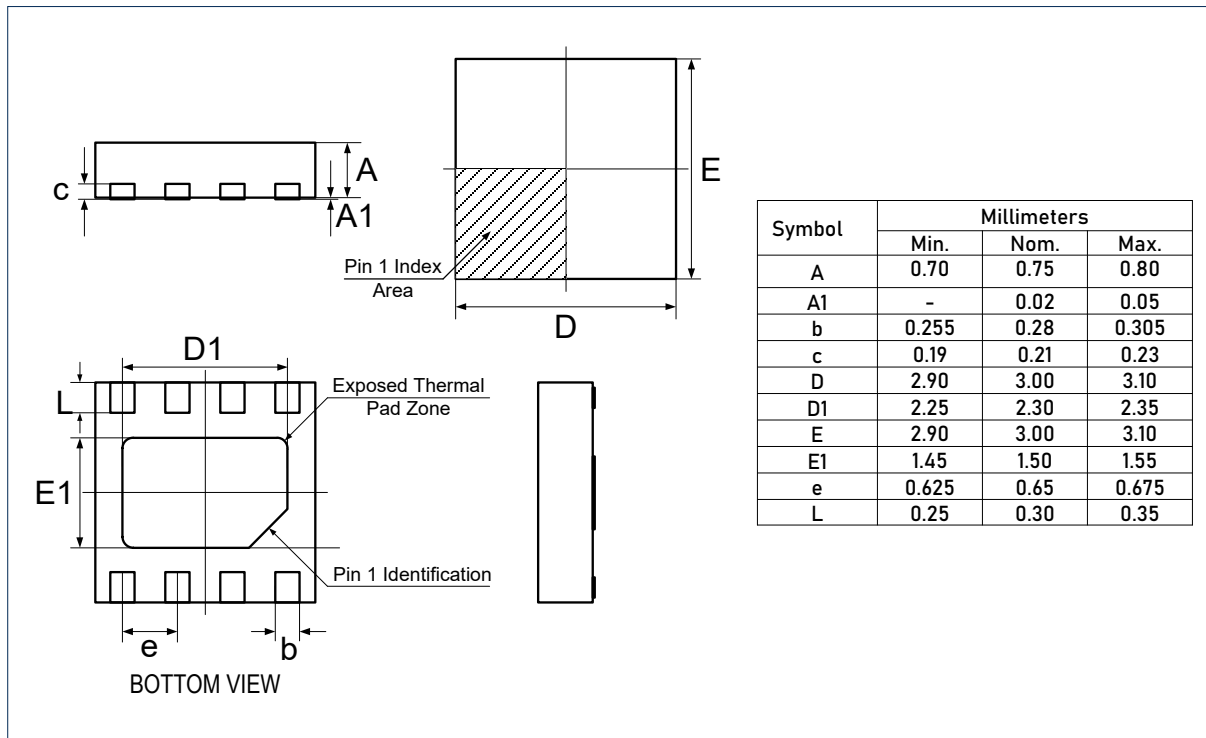


RECOMMENDED SOLDERING FOOTPRINT, MSOP-8L



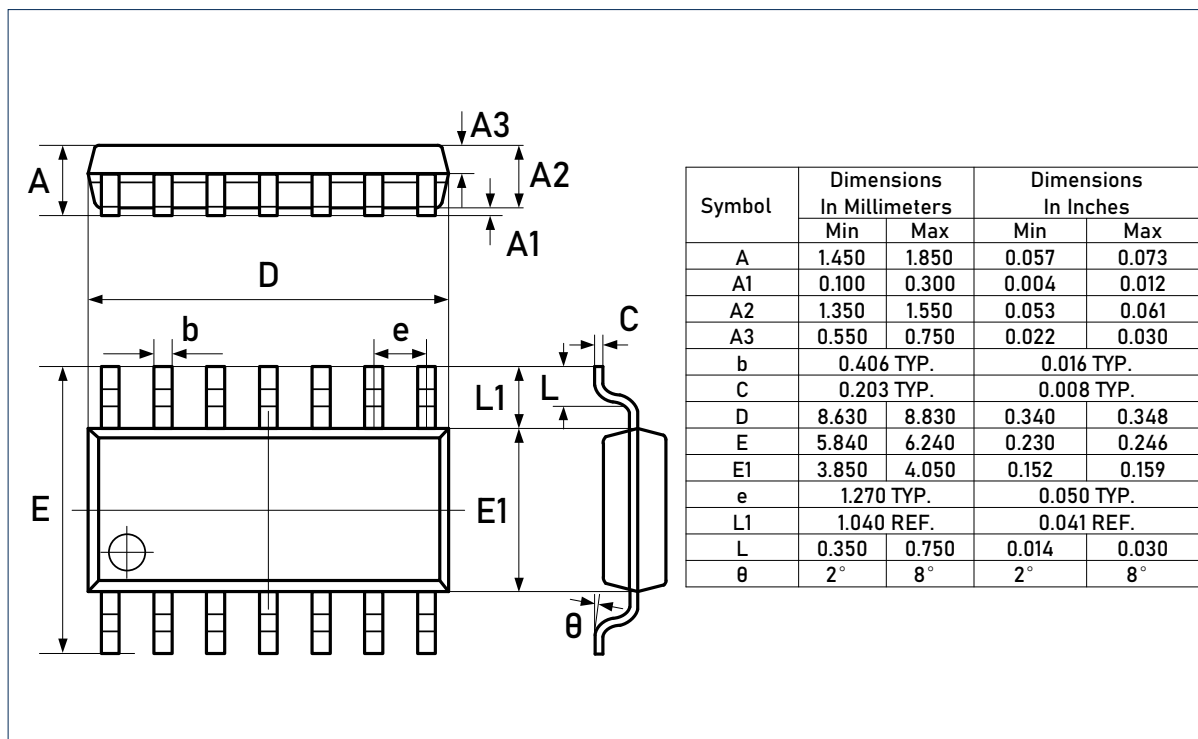
Package Outlines (continued)

DIMENSIONS, DFN3x3-8L

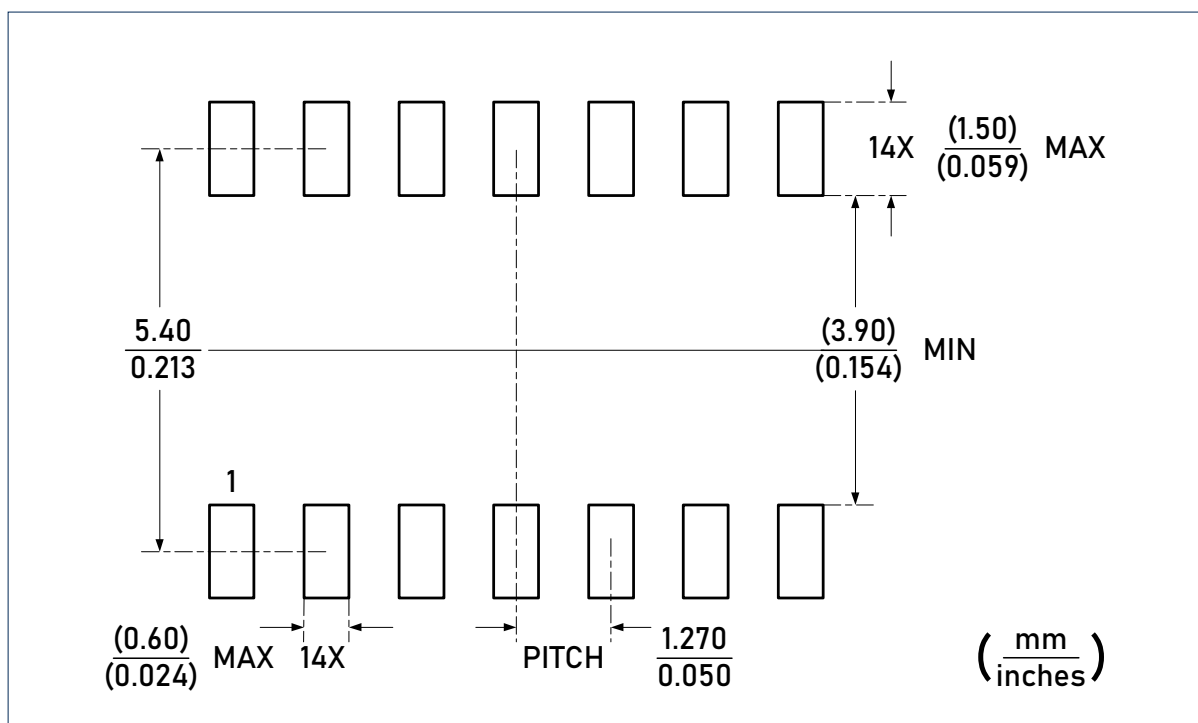


Package Outlines (continued)

DIMENSIONS, SOIC-14L

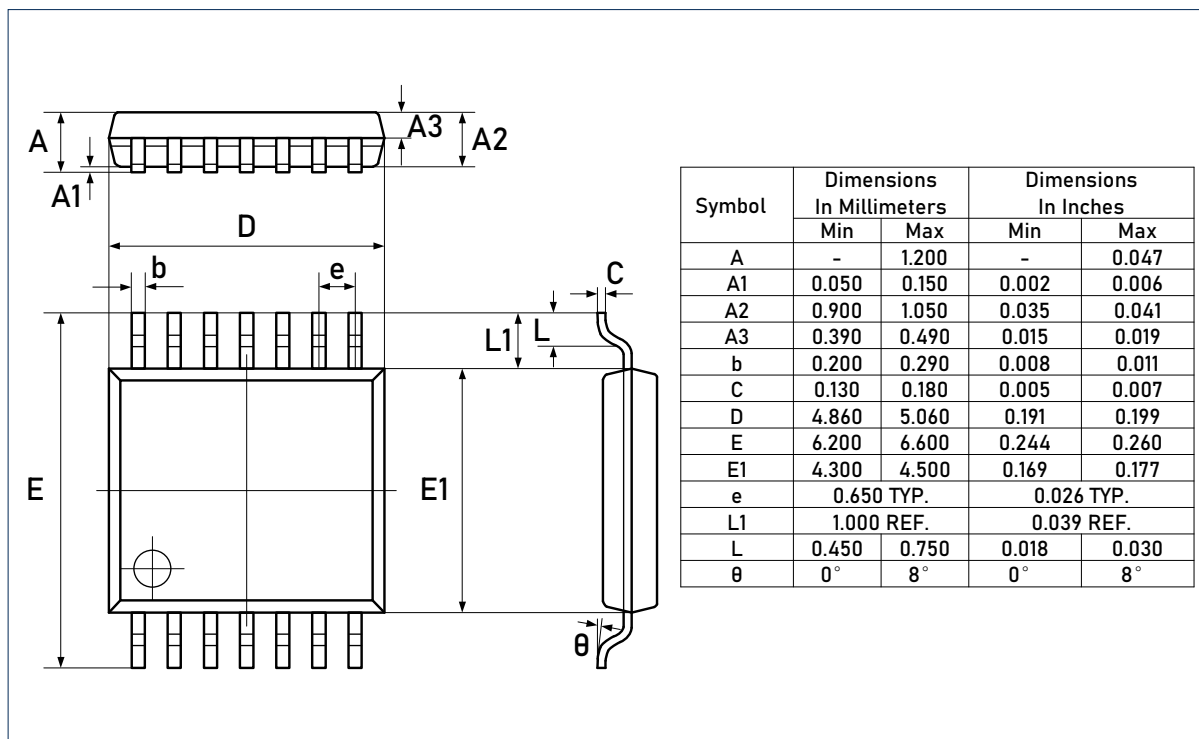


RECOMMENDED SOLDERING FOOTPRINT, SOIC-14L



Package Outlines (continued)

DIMENSIONS, TSSOP-14L



RECOMMENDED SOLDERING FOOTPRINT, SOIC-14L

