

Low Power, Low Noise, 9MHz, RRIO, CMOS Amplifiers

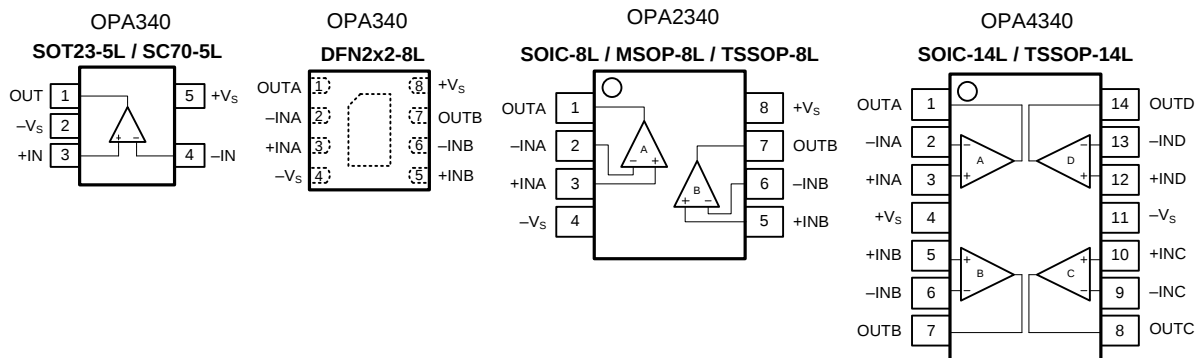
Features and Benefits

- Wide Unity-Gain Bandwidth: 9 MHz
- High Slew Rate: 8.5 V/ μ s
- Fast Settling: 0.3 μ s to 0.1%
- Low Noise: 12 nV/ $\sqrt$ Hz at 1 kHz
- Low Input Offset Voltage: $\pm$ 0.7 mV
- Single 2.0 V to 5.5 V Power Supply Range
- Rail-to-Rail Input and Output
- Internal RF/EMI Filter
- Low Supply Current: 700 μ A at 5V Supply Per Amplifier
- Extended Temperature Range: -40°C to $+125^{\circ}\text{C}$

Applications

- Motor Phase Current Sense
- Audio Outputs
- Photodiode Amplification
- Battery-Powered Instruments:
 - Consumer, Industrial, Medical, Notebooks
- Sensor Signal Conditioning:
 - Sensor Interfaces, Loop-Powered, Active Filters

Pin Configurations (Top View)



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.
-V _S	Negative power supply.
OUT	Amplifier output.

Ordering Information

Type Number	Package Name	Package Quantity	Marking Code ⁽¹⁾
OPA340NA/3K	SOT23-5L	Tape and Reel, 3 000	AH1
OPA340NA	SC70-5L	Tape and Reel, 3 000	AH1
OPA2340UA/2K5	SOIC-8L	Tape and Reel, 4 000	OPA2340
OPA2340UA	DFN2x2-8L	Tape and Reel, 3 000	OPA2340
OPA2340MM/TR	MSOP-8L	Tape and Reel, 3 000	OPA2340
OPA2340EA/2K5	TSSOP-8L	Tape and Reel, 3 000	OPA2340
OPA4340UA/2K5	SOIC-14L	Tape and Reel, 2 500	OPA4340
OPA4340EA/2K5	TSSOP-14L	Tape and Reel, 3 000	OPA4340

(1) 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 (IEC 60134).

Parameter	Absolute Maximum Rating
Supply Voltage, V _{S+} to V _{S-}	10.0 V
Signal Input Terminals: Voltage, Current	V _{S-} - 0.5 V to V _{S+} + 0.5 V, ±10 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 MIL-STD-883J / Method 3015.9 ⁽¹⁾	± 5 000	V
	Charged device model (CDM), per ESDA/JEDEC JS-002-2014 ⁽²⁾	± 2 000	
	Machine model (MM), per JESD22-A115C	± 250	

(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

$V_S = 5.0V$, $T_A = +25^\circ C$, $V_{CM} = V_S/2$, $V_O = V_S/2$, 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			± 0.7	± 3.5	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	90	106		dB
		T _A = −40 to +125 °C	77			
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		4		μV _{P-P}
e _n	Input voltage noise density	f = 1 kHz		12		nV/√Hz
I _n	Input current noise density	f = 1 kHz		5		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 _{CM} = −0.1 to 5.1 V	70	82		dB
		V _{CM} = 0 to 4.9 V, T _A = −40 to +125 °C	67			
		V _S = 2.0 V, V _{CM} = −0.1 to 2.1 V	66	77		
		V _{CM} = 0 to 1.8 V, T _A = −40 to +125 °C	62			
INPUT IMPEDANCE						
C _{IN}	Input capacitance	Differential		2.0		pF
		Common mode		3.5		
OPEN-LOOP GAIN						
A _{VOL}	Open-loop voltage gain	R _L = 10 kΩ, V _O = 0.05 to 3.5 V	93	102		dB
		T _A = −40 to +125 °C	84			
		R _L = 600 Ω, V _O = 0.15 to 3.5 V	78	87		
		T _A = −40 to +125 °C	70			
FREQUENCY RESPONSE						
GBW	Gain bandwidth product			9		MHz
SR	Slew rate	G = +1, C _L = 100 pF, V _O = 1.5 to 3.5 V		8.5		V/μs
THD+N	Total harmonic distortion + noise	G = +1, f = 1 kHz, V _O = 0.5 V _{RMS}		0.0008		%
t _S	Settling time	To 0.1%, G = +1, 1V step		0.3		μs
		To 0.01%, G = +1, 1V step		0.4		
t _{OR}	Overload recovery time	V _{IN} * Gain > V _S		0.3		μs

Electrical Characteristics (continued)

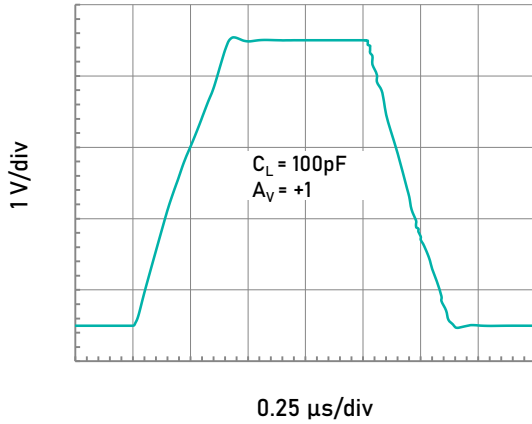
$V_S = 5.0V$, $T_A = +25^{\circ}C$, $V_{CM} = V_S/2$, $V_O = V_S/2$, and $R_L = 10k\Omega$ connected to $V_S/2$, unless otherwise noted.

Boldface limits apply over the specified temperature range, $T_A = -40$ to $+125^{\circ}C$.

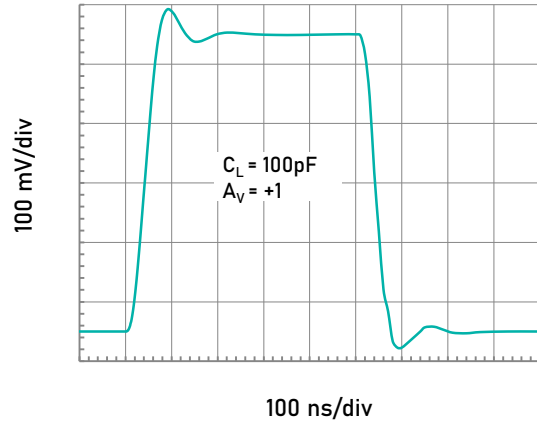
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
OUTPUT						
V _{OH}	High output voltage swing	R _L = 10 kΩ	V _{S+} -14	V _{S+} -10		mV
		R _L = 600 Ω	V _{S+} -200	V _{S+} -140		
V _{OL}	Low output voltage swing	R _L = 10 kΩ		V _{S-} +7	V _{S-} +10	mV
		R _L = 600 Ω		V _{S-} +100	V _{S-} +150	
I _{SC}	Short-circuit current			± 70		mA
POWER SUPPLY						
V _S	Operating supply voltage	T _A = -40 to +125 °C	2.0		5.5	V
I _q	Quiescent current (per amplifier)	V _S = 2.0 V		585	695	μA
		V _S = 5.0 V		700	830	
THERMAL CHARACTERISTICS						
T _A	Operating temperature range		-40		+125	°C
θ _{JA}	Package Thermal Resistance	SC70-5L		333		°C/W
		SOT23-5L		190		
		DFN2x2-8L		94		
		MSOP-8L		201		
		TSSOP-8L		160		
		SOIC-8L		125		
		TSSOP-14L		112		
		SOIC-14L		115		

Typical Performance Characteristics

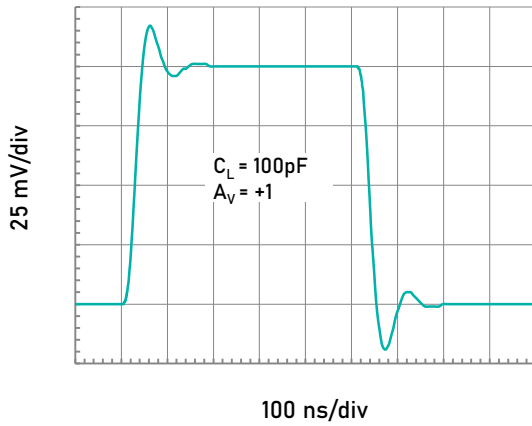
At $T_A = +25^\circ\text{C}$, $V_{CM} = V_S/2$, and $R_L = 10\text{k}\Omega$ connected to $V_S/2$, unless otherwise noted.



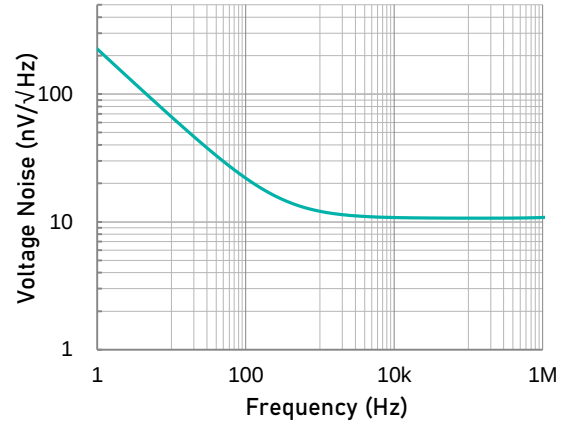
Large Signal Step Response.



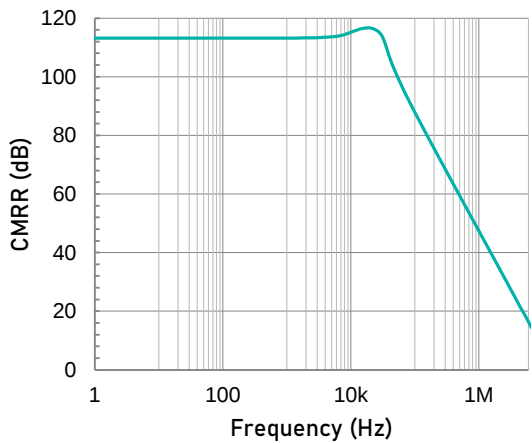
Small Signal Step Response (500 mV).



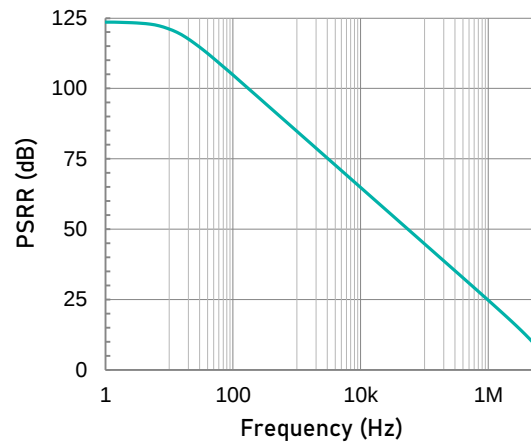
Small Signal Step Response (500 mV).



Input Voltage Noise Spectral Density as a function of Frequency.



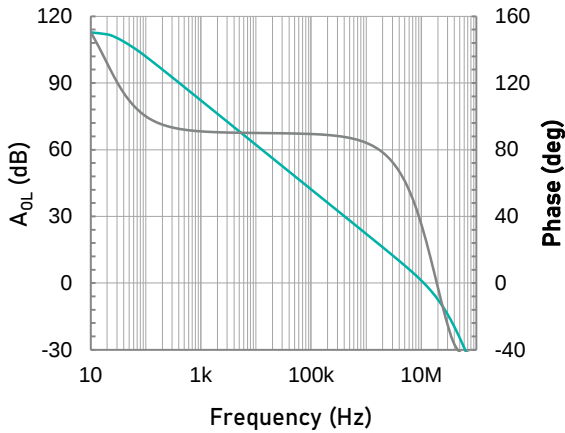
Common-mode Rejection Ratio as a function of Frequency.



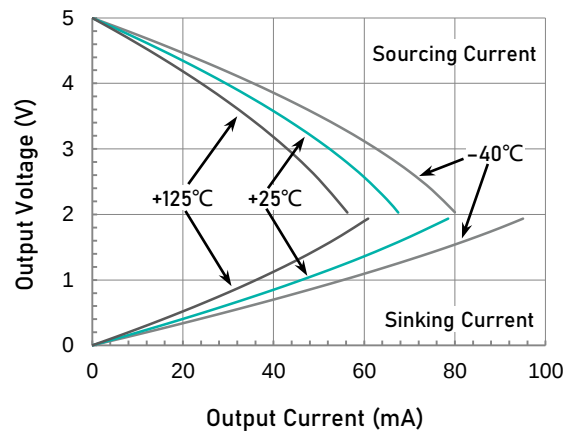
Power Supply Rejection Ratio as a function of Frequency.

Typical Performance Characteristics (continued)

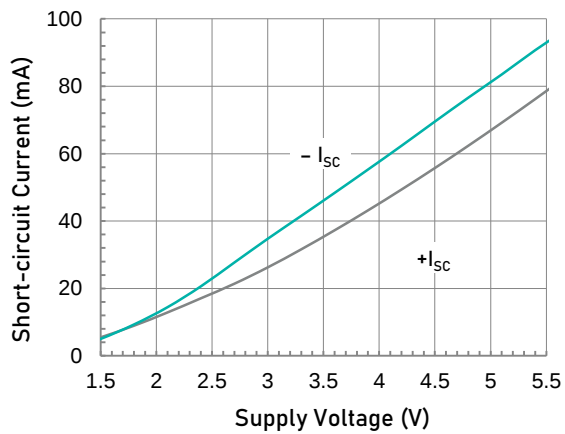
At $T_A = +25^\circ\text{C}$, $V_{CM} = V_S/2$, and $R_L = 10\text{k}\Omega$ connected to $V_S/2$, unless otherwise noted.



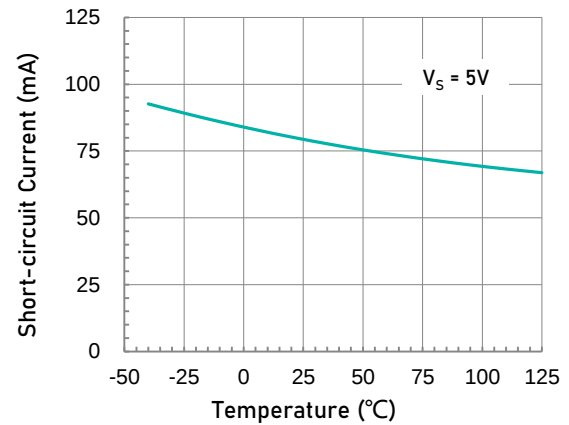
Open-loop Gain and Phase as a function of Frequency.



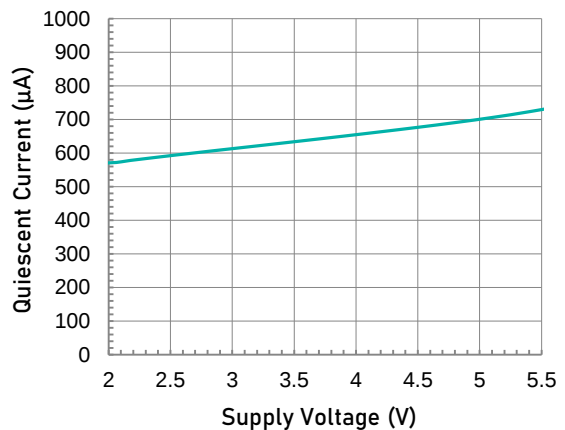
Output Voltage Swing as a function of Output Current.



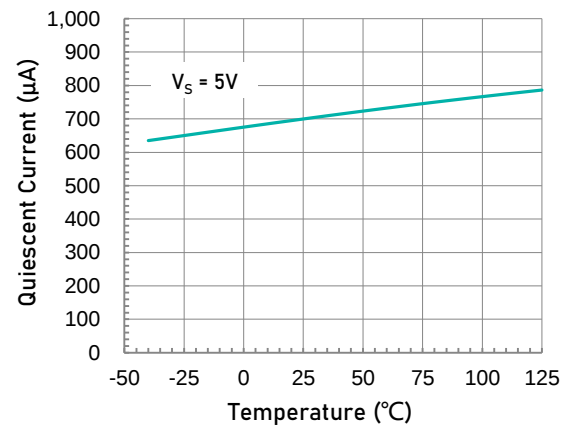
Short-circuit Current as a function of Supply Voltage.



Short-circuit Current as a function of Temperature.



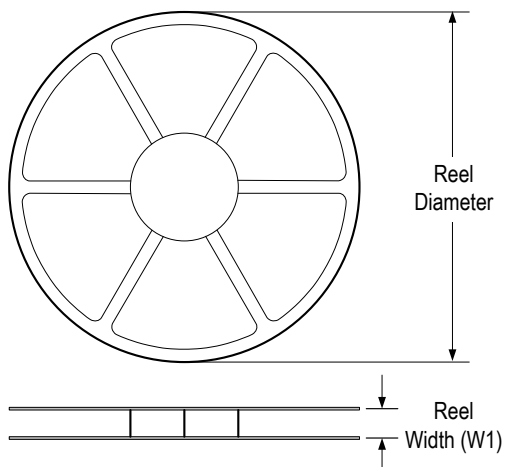
Quiescent Current as a function of Supply Voltage.



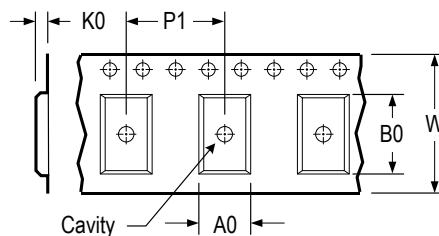
Quiescent Current as a function of Temperature.

Tape and Reel Information

REEL DIMENSIONS

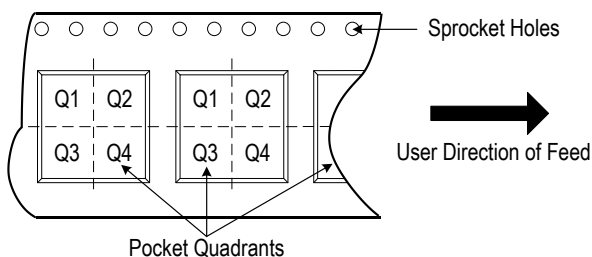


TAPE DIMENSIONS



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

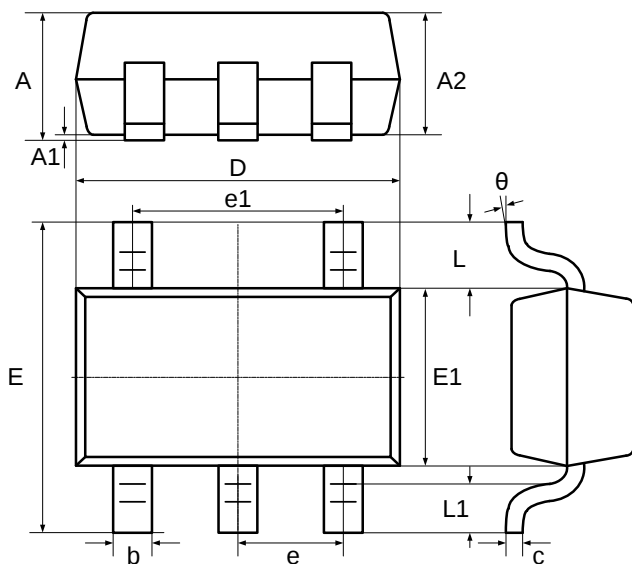


* All dimensions are nominal

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
OPA340NA/3K	SOT23	5	3 000	178	9.0	3.3	3.2	1.5	4.0	8.0	Q3

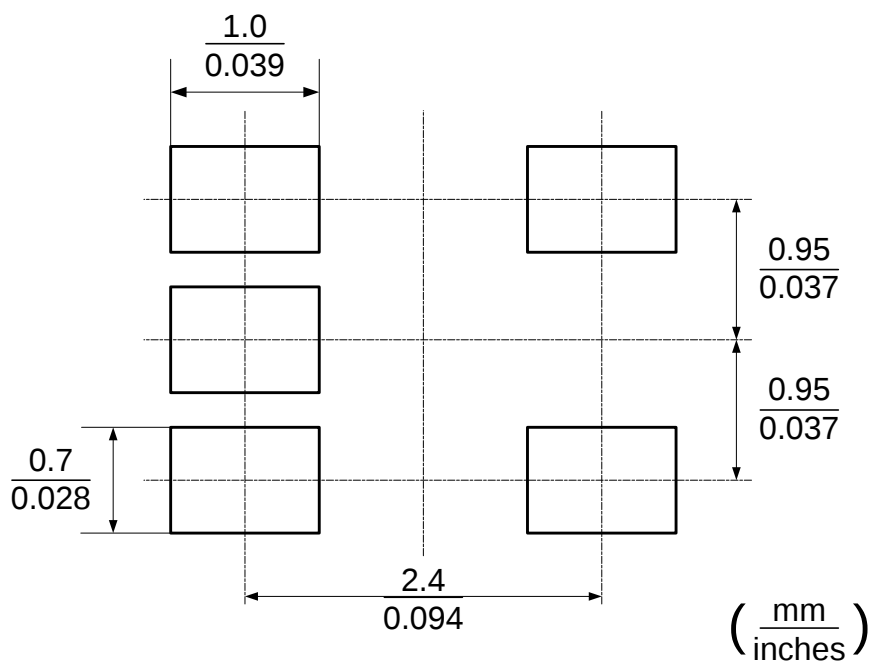
Package Outlines

DIMENSIONS, SOT23-5L



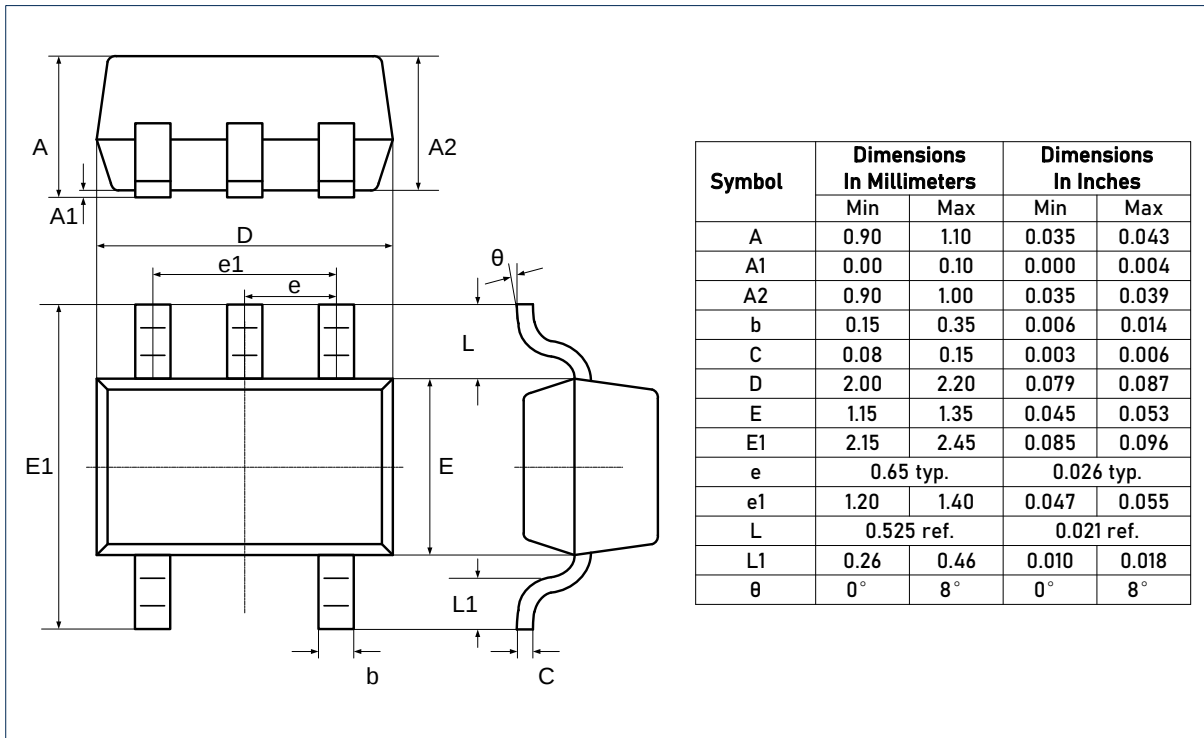
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	-	1.25	-	0.049
A1	0.04	0.10	0.002	0.004
A2	1.00	1.20	0.039	0.047
b	0.33	0.41	0.013	0.016
c	0.15	0.19	0.006	0.007
D	2.820	3.02	0.111	0.119
E1	1.50	1.70	0.059	0.067
E	2.60	3.00	0.102	0.118
e	0.95 BSC		0.037 BSC	
e1	1.90 BSC		0.075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

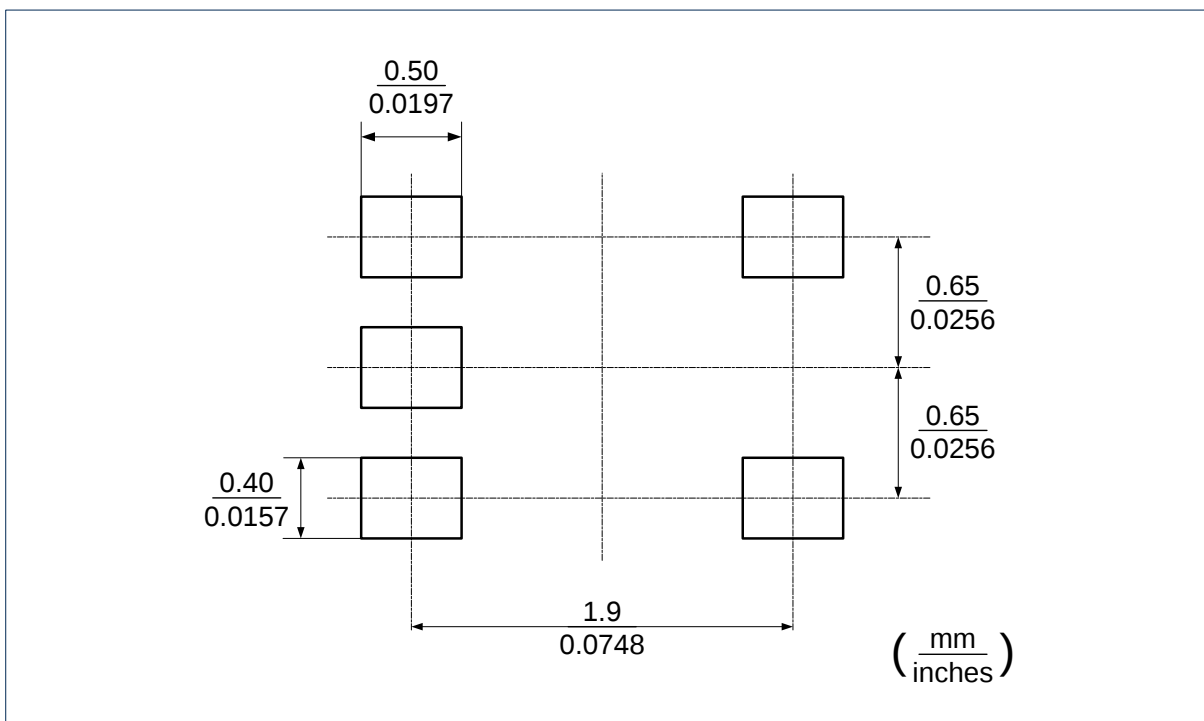


Package Outlines (continued)

DIMENSIONS, SC70-5L (SOT353)

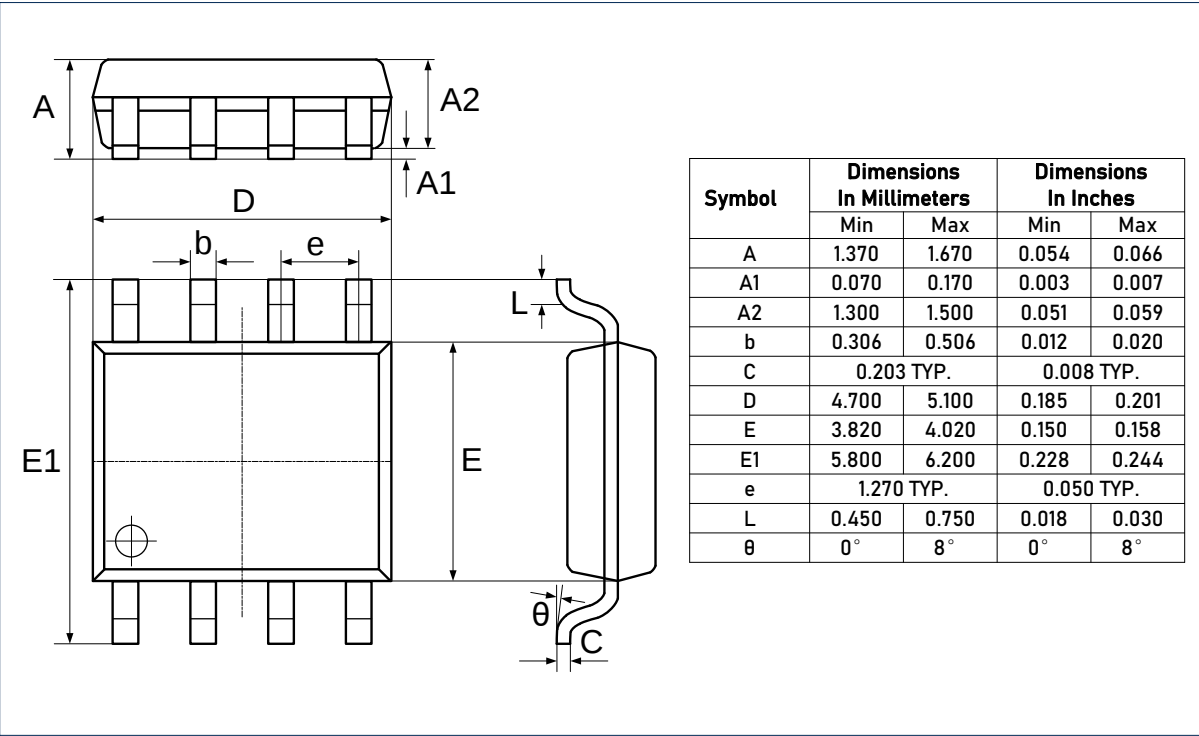


RECOMMENDED SOLDERING FOOTPRINT, SC70-5L (SOT353)

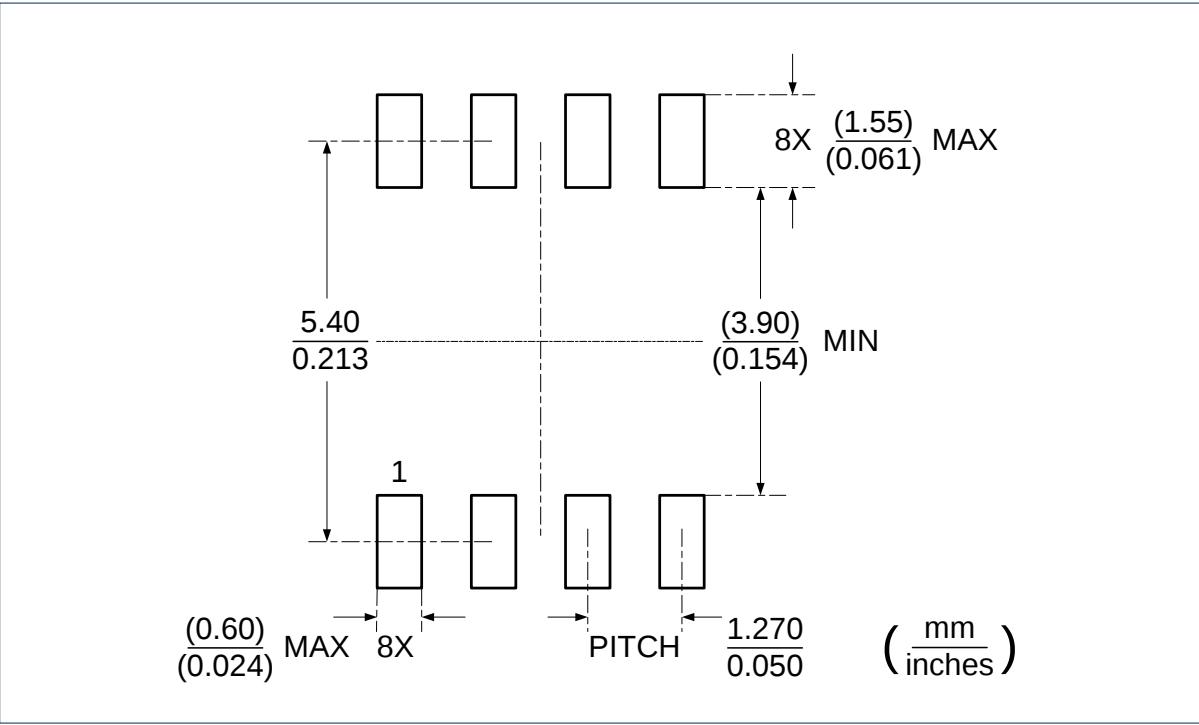


Package Outlines (continued)

DIMENSIONS, SOIC-8L

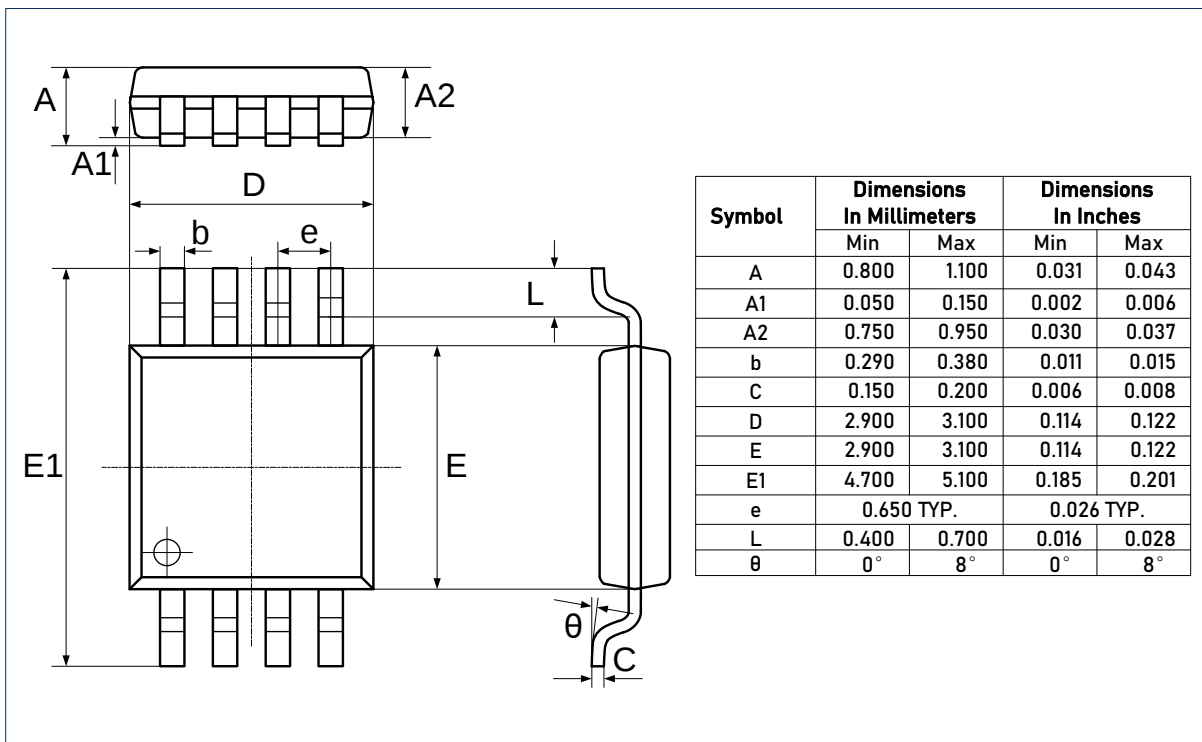


RECOMMENDED SOLDERING FOOTPRINT, SOIC-8L

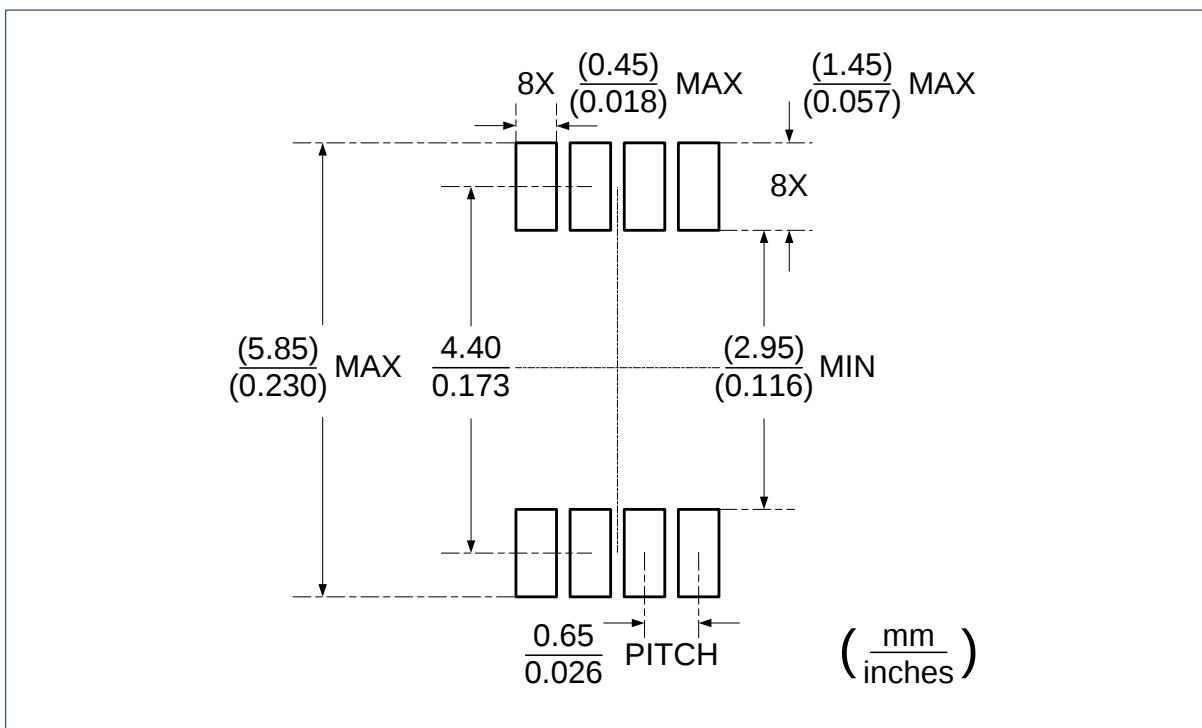


Package Outlines (continued)

DIMENSIONS, MSOP-8L

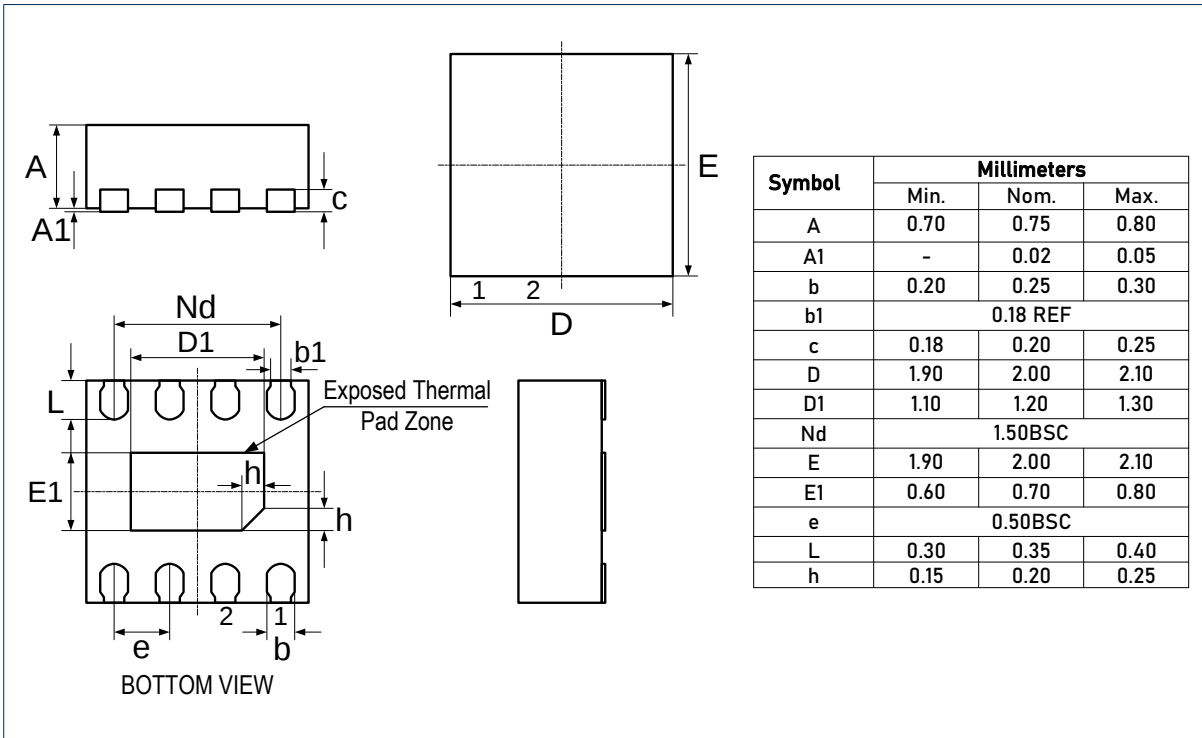


RECOMMENDED SOLDERING FOOTPRINT, MSOP-8L

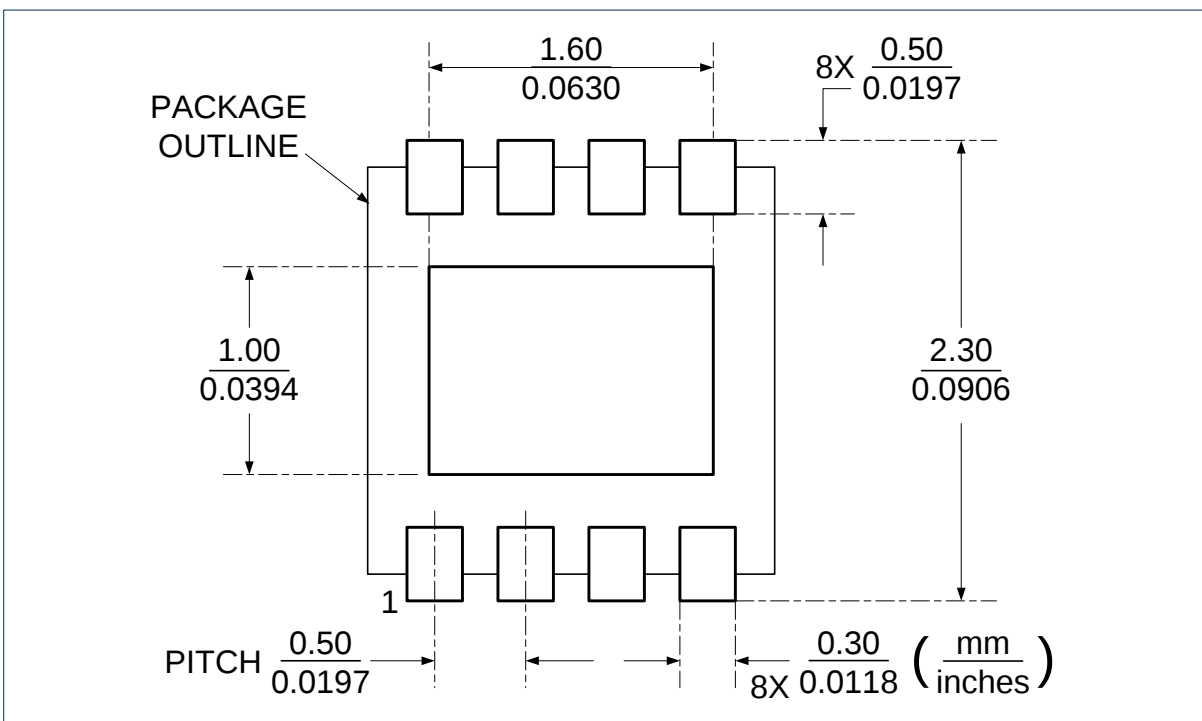


Package Outlines (continued)

DIMENSIONS, DFN2x2-8L

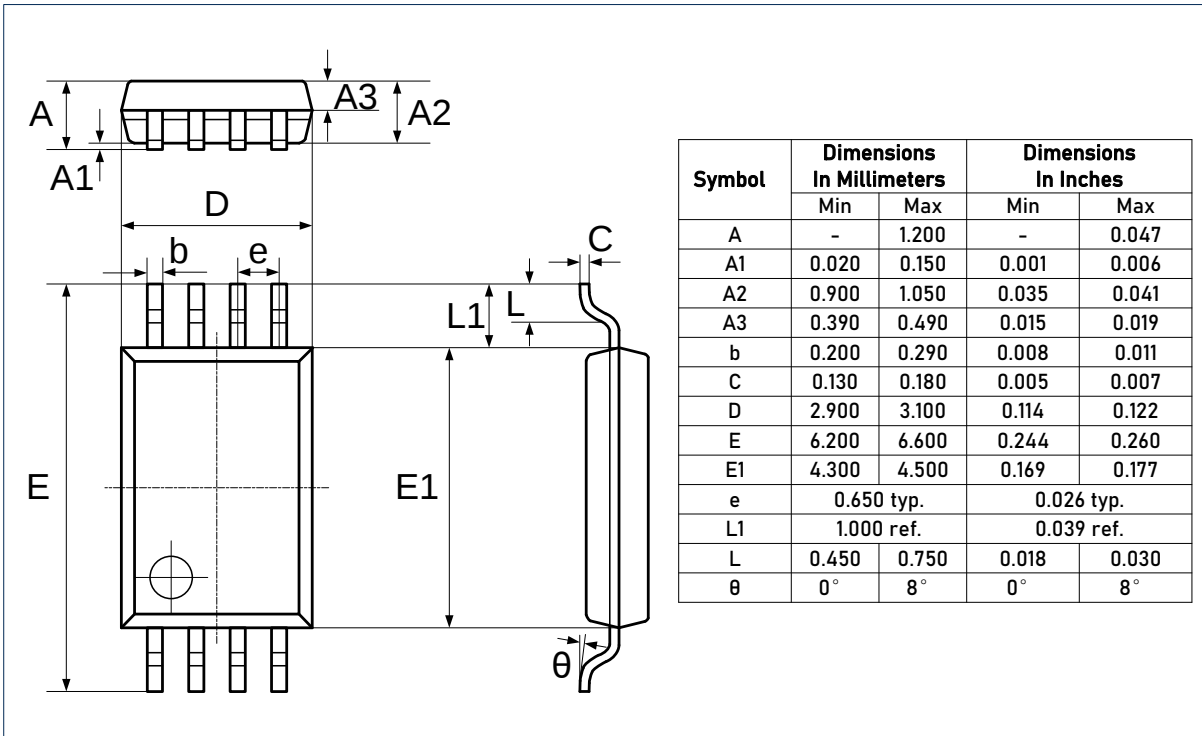


RECOMMENDED SOLDERING FOOTPRINT, DFN2x2-8L

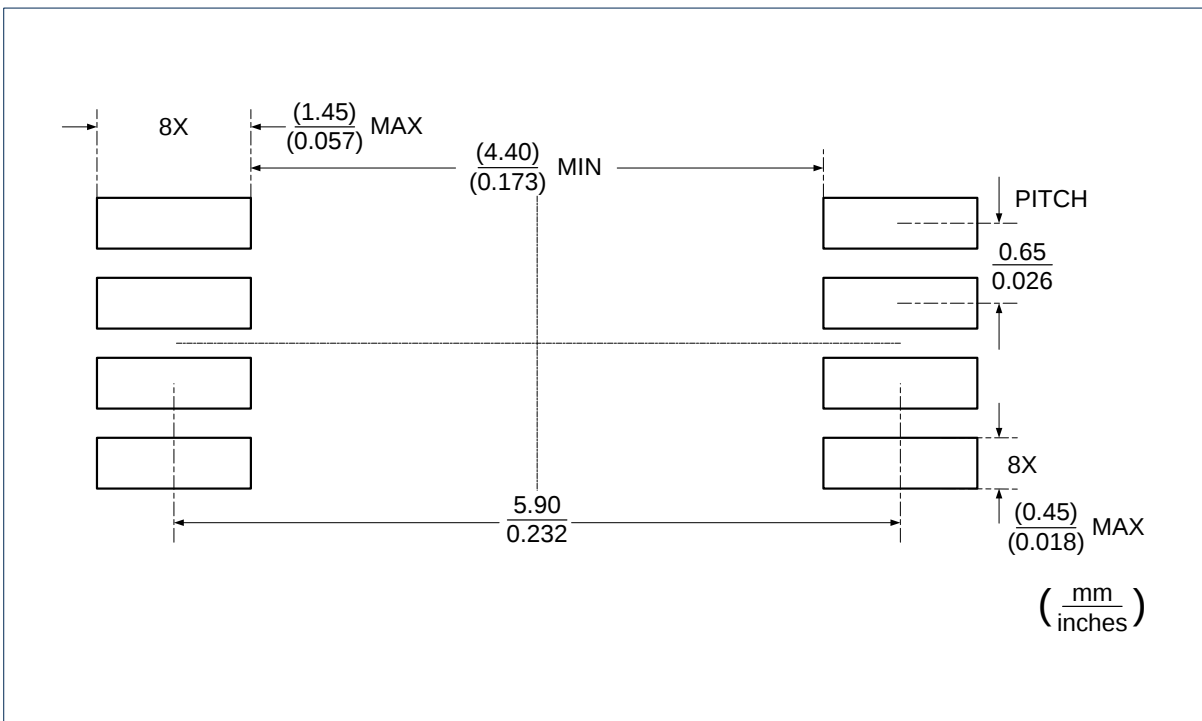


Package Outlines (continued)

DIMENSIONS, TSSOP-8L

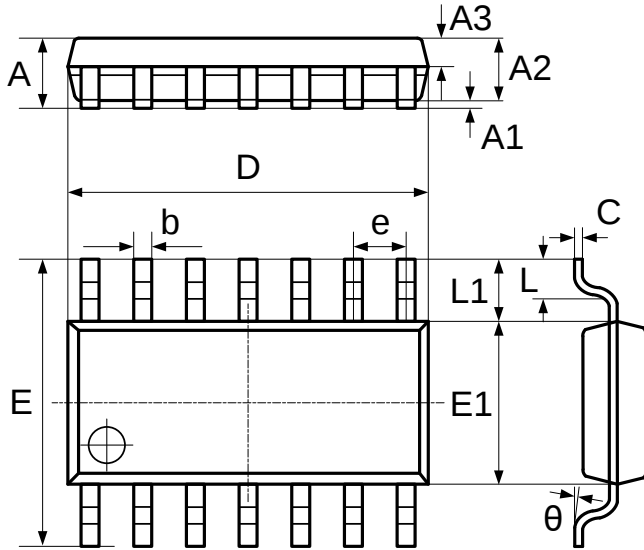


RECOMMENDED SOLDERING FOOTPRINT, TSSOP-8L



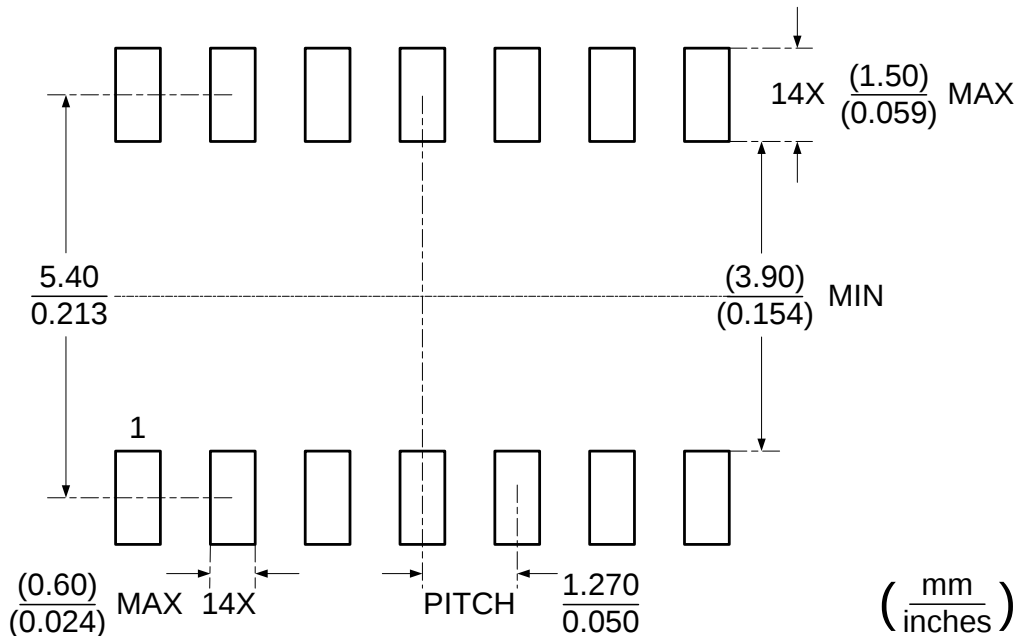
Package Outlines (continued)

DIMENSIONS, SOIC-14L



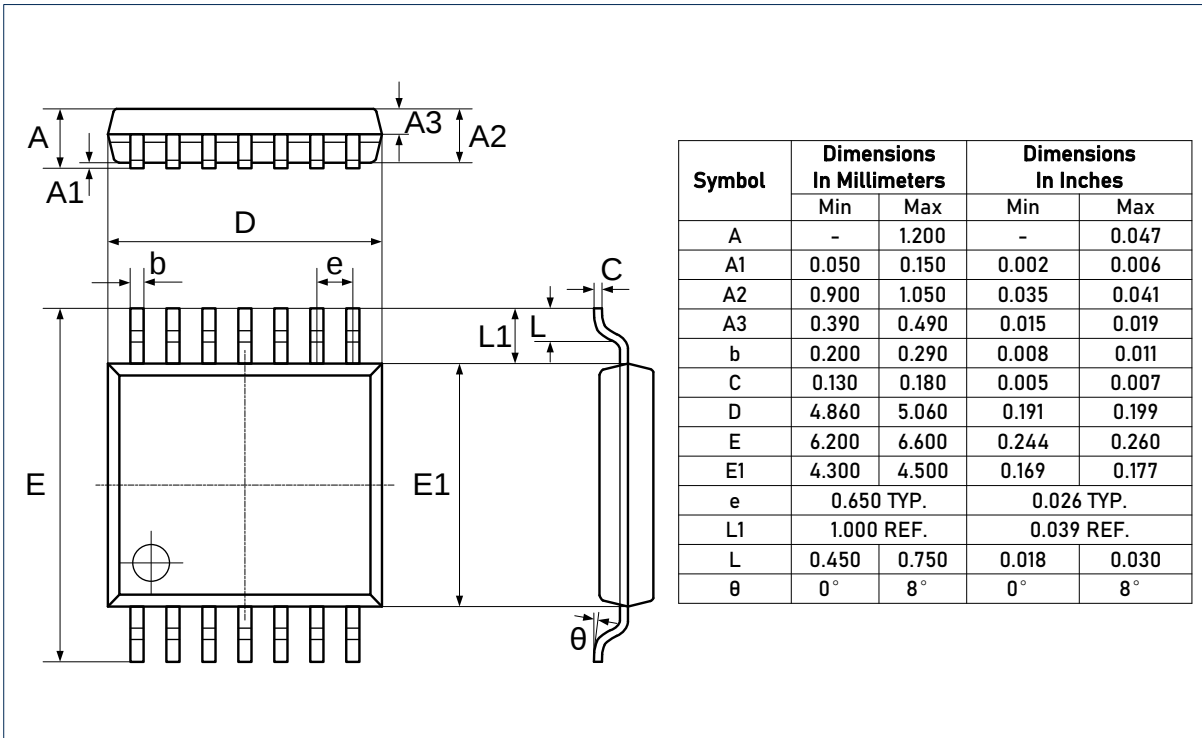
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.450	1.850	0.057	0.073
A1	0.100	0.300	0.004	0.012
A2	1.350	1.550	0.053	0.061
A3	0.550	0.750	0.022	0.030
b	0.406 TYP.		0.016 TYP.	
C	0.203 TYP.		0.008 TYP.	
D	8.630	8.830	0.340	0.348
E	5.840	6.240	0.230	0.246
E1	3.850	4.050	0.152	0.159
e	1.270 TYP.		0.050 TYP.	
L1	1.040 REF.		0.041 REF.	
L	0.350	0.750	0.014	0.030
θ	2° 8°		2° 8°	

RECOMMENDED SOLDERING FOOTPRINT, SOIC-14L



Package Outlines (continued)

DIMENSIONS, TSSOP-14L



RECOMMENDED SOLDERING FOOTPRINT, TSSOP-14L

