32V, 3.8MHz Rail-to-Rail Output CMOS Operational Amplifier

1 FEATURES

- **HIGH GAIN BANDWIDTH: 3.8MHz**
- **INPUT OFFSET VOLTAGE: ±0.8mV (Typical)**
- **QUIESCENT CURRENT: 0.44mA/Amp**
- **Rail to Rail Output**
- **Supply Range: 3V to 32V**
- **SPECIFIED UP TO +125°C**
- **Micro SIZE PACKAGES: SOP8, MSOP8, TSSOP8, SOP14, TSSOP14**

2 APPLICATIONS

- **SENSORS**
- **PHOTODIODE AMPLIFICATION**
- **ACTIVE FILTERS**
- **TEST EQUIPMENT**
- **DRIVING A/D CONVERTERS**

3 DESCRIPTIONS

The RS844X families of products offer high voltage (32V) operation and rail-to-rail output, as well as excellent speed/power consumption ratio, providing an excellent bandwidth (3.8MHz) and slew rate of 15V/us. The op-amps are unity gain stable and feature an ultra-low input bias current.

The input can operate normally within the negative power rail to 1.5V below of the positive power rail. Input signals beyond the supply rails do not cause phase reversal. The RS844X families of operational amplifiers are specified at the full temperature range of −40°C to +125°C under single power supplies of 3V to 32V or dual power supplies of ±1.5V to ±16V.

Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE(NOM)
RS8442	SOP8	4.90mm x 3.90mm
	MSOP8	3.00mm x 3.00mm
	TSSOP8	3.00mm×4.40mm
RS8444	SOP14	8.65mm x 3.90mm
	TSSOP14	5.00mm x 4.40mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

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4 REVISION HISTORY

Note: Page numbers for previous revisions may different from page numbers in the current version.

VERSION	Change Date	Change Item
A.0	2023/10/18	Preliminary version completed
A.0.1	2023/11/29	Update ELECTRICAL CHARACTERISTICS
A.1	2023/12/29	Update ELECTRICAL CHARACTERISTICS and TYPICAL CHARACTERISTICS
A.1.1	2024/03/01	Modify packaging naming
A.2	2024/11/08	1. Add TSSOP8 Package 2. Delete RS8441
A.3	2024/11/22	Update Input Offset Voltage

5 PACKAGE/ORDERING INFORMATION (1)

Orderable Device	Package Type	Pin	Channel	Op Temp(°C)	Device Marking (2)	MSL (3)	Package Qty
RS8442XK	SOP8	8	2	-40°C ~125°C	RS8442	MSL3	Tape and Reel,4000
RS8442XM	MSOP8	8	2	-40°C ~125°C	RS8442	MSL3	Tape and Reel,4000
RS8442XQ	TSSOP8	8	2	-40°C ~125°C	RS8442	MSL3	Tape and Reel,4000
RS8444XP	SOP14	14	4	-40°C ~125°C	RS8444	MSL3	Tape and Reel,4000
RS8444XQ	TSSOP14	14	4	-40°C ~125°C	RS8444	MSL3	Tape and Reel,4000

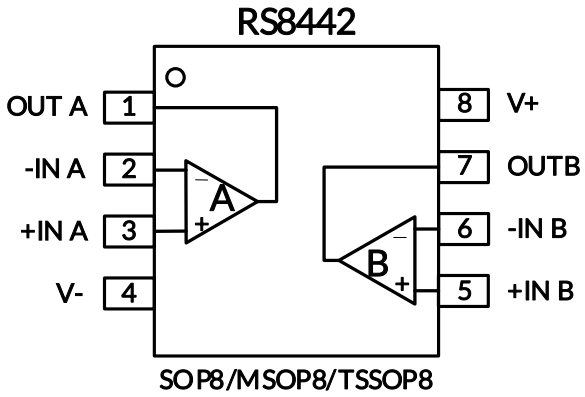
NOTE:

(1) This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the right-hand navigation.

(2) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.

(3) RUNIC classify the MSL level with using the common preconditioning setting in our assembly factory conforming to the JEDEC industrial standard J-STD-20F, Please align with RUNIC if your end application is quite critical to the preconditioning setting or if you have special requirement.

6 PIN CONFIGURATION AND FUNCTIONS (TOP VIEW)

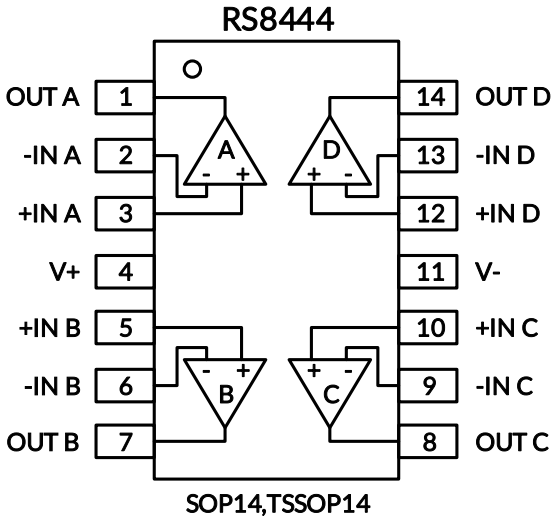


Pin Description

NAME	PIN	I/O (1)	DESCRIPTION
	SOP8/MSOP8/TSSOP8		
-INA	2	I	Inverting input, channel A
+INA	3	I	Noninverting input, channel A
-INB	6	I	Inverting input, channel B
+INB	5	I	Noninverting input, channel B
OUTA	1	O	Output, channel A
OUTB	7	O	Output, channel B
V-	4	-	Negative (lowest) power supply or ground (for single supply operation)
V+	8	-	Positive (highest) power supply

(1) I = Input, O = Output.

PIN CONFIGURATION AND FUNCTIONS (TOP VIEW)



Pin Description

NAME	PIN	I/O (1)	DESCRIPTION
	SOP14/TSSOP14		
-INA	2	I	Inverting input, channel A
+INA	3	I	Noninverting input, channel A
-INB	6	I	Inverting input, channel B
+INB	5	I	Noninverting input, channel B
-INC	9	I	Inverting input, channel C
+INC	10	I	Noninverting input, channel C
-IND	13	I	Inverting input, channel D
+IND	12	I	Noninverting input, channel D
OUTA	1	O	Output, channel A
OUTB	7	O	Output, channel B
OUTC	8	O	Output, channel C
OUTD	14	O	Output, channel D
V-	11	-	Negative (lowest) power supply or ground (for single supply operation)
V+	4	-	Positive (highest) power supply

(1) I = Input, O = Output.

7 SPECIFICATIONS

7.1 Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted) (1)

			MIN	MAX	UNIT
Voltage	Supply, Vs=(V+) - (V-)		-0.7	36	V
	Signal input pin (2)		(V-)-0.2	(V+) +0.2	
	Signal output pin (3)		(V-)-0.2	(V+) +0.2	
Current	Signal input pin (2)		-10	10	mA
	Signal output pin (3)		-100	100	mA
	Output short-circuits (4)		Continuous		
θ_{JA}	Package thermal impedance (5)	SOP8		110	°C/W
		MSOP8		170	
		TSSOP8		240	
		SOP14		105	
		TSSOP14		90	
Temperature	Operating range, T_A		-40	125	°C
	Junction, T_J (6)		-40	150	
	Storage, T_{stg}		-55	150	

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.
(2) Input terminals are diode-clamped to the power-supply rails. Input signals that can swing more than 0.2V beyond the supply rails should be current-limited to 10mA or less.
(3) Output terminals are diode-clamped to the power-supply rails. Output signals that can swing more than 0.2V beyond the supply rails should be current-limited to ±100mA or less.
(4) Short-circuit to ground, one amplifier per package.
(5) The package thermal impedance is calculated in accordance with JESD-51.
(6) The maximum power dissipation is a function of $T_{J(MAX)}$, $R_{\theta JA}$, and T_A. The maximum allowable power dissipation at any ambient temperature is $P_D = (T_{J(MAX)} - T_A) / R_{\theta JA}$. All numbers apply for packages soldered directly onto a PCB.

7.2 ESD Ratings

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM)	±2000	V
		Charged-device model (CDM)	±1500	

ESD SENSITIVITY CAUTION

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

7.3 Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

		MIN	NOM	MAX	UNIT
Supply voltage，Vs= (V+) - (V-)	Single-supply	3		32	V
	Dual-supply	±1.5		±16	

7.4 ELECTRICAL CHARACTERISTICS

(At T_A = +25°C, Vs=3V to 32V, R_L = 10kΩ connected to Vs/2, and V_{OUT} = Vs/2, V_{CM} = Vs/2, Full [9] = -40°C to 125°C, unless otherwise noted.) [1]

PARAMETER		CONDITIONS	T_J	RS844X			UNITS
				MIN[2]	TYP[3]	MAX[2]	
POWER SUPPLY							
Vs	Operating Voltage Range		25°C	3		32	V
I_Q	Quiescent Current Per Amplifier	Vs=±2.5V, Io=0mA	25°C		0.44	0.7	mA
			Full			0.8	
		Vs=±16V, Io=0mA	25°C		0.52	0.8	
			Full			0.9	
PSRR	Power-Supply Rejection Ratio	Vs=5V to 32V	25°C	95	120		dB
			Full	90			
INPUT							
Vos	Input Offset Voltage	V_{CM}= Vs/2	25°C	-1	±0.8	1	mV
			Full		±1.1		
Vos Tc	Input Offset Voltage Average Drift		Full		2		uV/°C
IB	Input Bias Current [4] [5]	V_{CM}=0V	25°C		±10	±25	pA
			Full		±7000		
I_{OS}	Input Offset Current [5]	V_{CM}=0V	25°C		±10		pA
			Full		±7000		
V_{CM}	Common-Mode Voltage Range	Vs= ±16V	25°C	(V-)		(V+)-1.5	V
CMRR	Common-Mode Rejection Ratio	Vs= ±16V, V_{CM}=-16V to 14.5V	25°C	85	120		dB
			Full	80			
OUTPUT							
A_{OL}	Open-Loop Voltage Gain	R_L=10KΩ, Vo=(V-)+0.6V to (V+)-0.6V	25°C	100	120		dB
			Full	85			
V_{OH}	Output Swing	Vs=±16V, R_L=10KΩ	25°C	15.65			V
V_{OL}						-15.65	V
I_{SC}	Short-circuit current [6] [7]	Vs=±5V	25°C	15	43		mA
			Full	10			
FREQUENCY RESPONSE							
SR	Slew Rate [8]	G=+1, C_L=100pF	25°C	9	15		V/us
			Full	6			
GBW	Gain-Bandwidth Product		25°C	2.3	3.8		MHz
			Full	2.1			
ts	Settling Time,0.01%	Vs=±2.5V, G=+1, C_L=100pF, Step=2V	25°C		1.5		us
PM	Phase Margin	Vs = 32V, R_L=10K, C_L=100pF	25°C		60		°
GM	Gain Margin	Vs = 32V, R_L=10K, C_L=100pF	25°C		15		
t_{OR}	Overload Recovery Time	V_{IN}·Gain≥Vs, G=11	25°C		0.5		us
t_{ON}	Turn On Time		25°C		8.5		us
NOISE							
En	Input Voltage Noise	f = 0.1Hz to 10Hz, Vs=±2.5V	25°C		13.5		uVpp

en	Input Voltage Noise Density	f = 1KHz	25°C		30		$nV/\sqrt{Hz}$

NOTE:

(1) Electrical table values apply only for factory testing conditions at the temperature indicated. Factory testing conditions result in very limited self-heating of the device.

(2) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlations using statistical quality control (SQC) method.

(3) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.

(4) Positive current corresponds to current flowing into the device.

(5) This parameter is ensured by design and/or characterization and is not tested in production.

(6) The maximum power dissipation is a function of $T_{J(MAX)}$, $R_{\theta JA}$, and T_A. The maximum allowable power dissipation at any ambient temperature is PD = ($T_{J(MAX)}$ - T_A) / $R_{\theta JA}$. All numbers apply for packages soldered directly onto a PCB.

(7) Short circuit test is a momentary test.

(8) Number specified is the slower of positive and negative slew rates.

(9) Specified by characterization only.

7.5 TYPICAL CHARACTERISTICS

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

At T_A = +25°C, Vs=±16V, R_L = 10kΩ connected to $V_S/2$, V_{OUT} = $V_S/2$, unless otherwise noted.

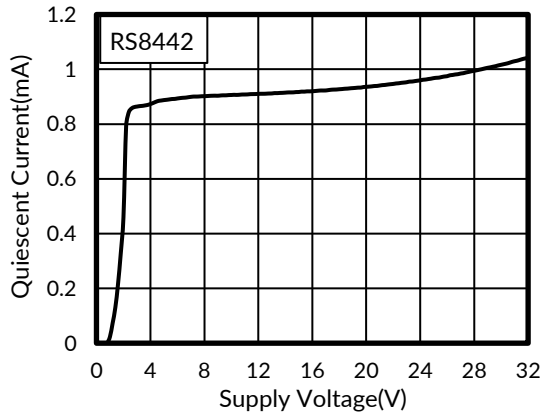


Figure 1. Supply Voltage vs Quiescent Current

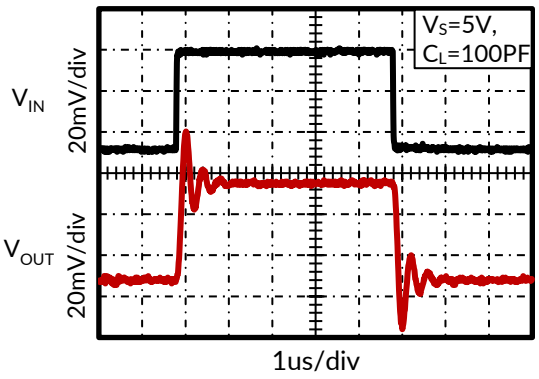


Figure 2. SMALL-SIGNAL STEP RESPONSE

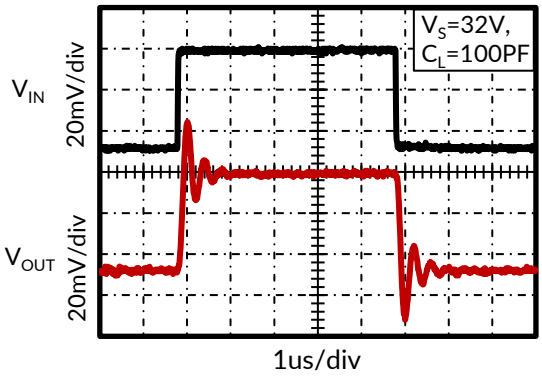


Figure 3. SMALL-SIGNAL STEP RESPONSE

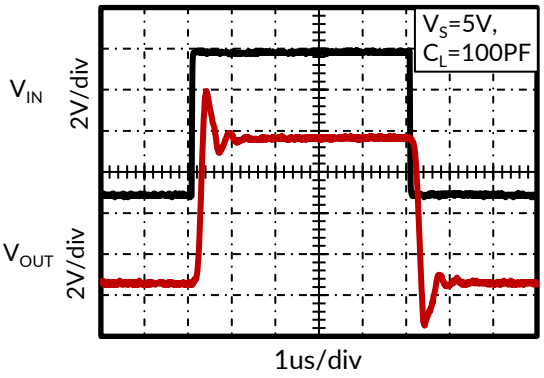


Figure 4. LARGE-SIGNAL STEP RESPONSE

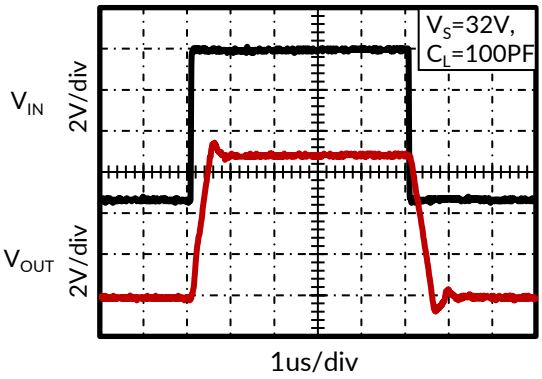


Figure 5. LARGE-SIGNAL STEP RESPONSE

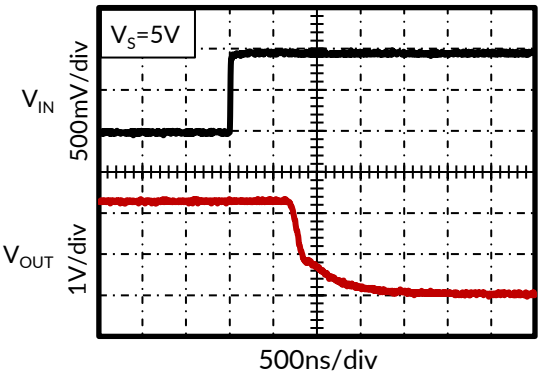


Figure 6. Positive Overload Recovery

TYPICAL CHARACTERISTICS

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.
At T_A = +25°C, Vs=±16V, R_L = 10kΩ connected to $V_S/2$, V_{OUT} = $V_S/2$, unless otherwise noted.

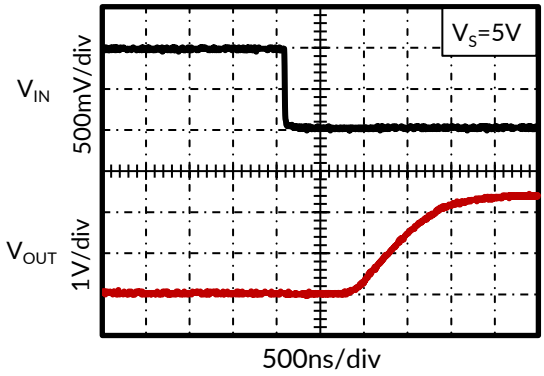


Figure 7. Negative Overload Recovery

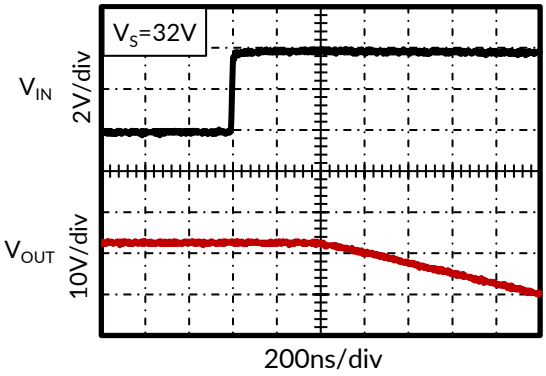


Figure 8. Positive Overload Recovery

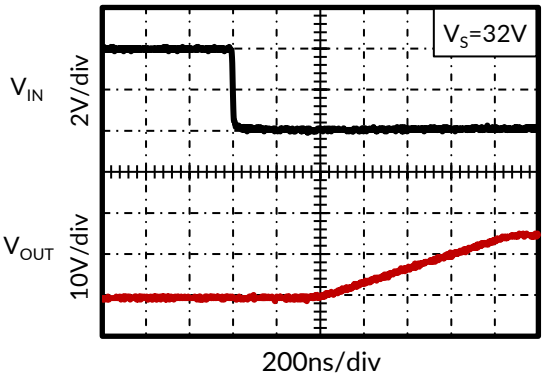
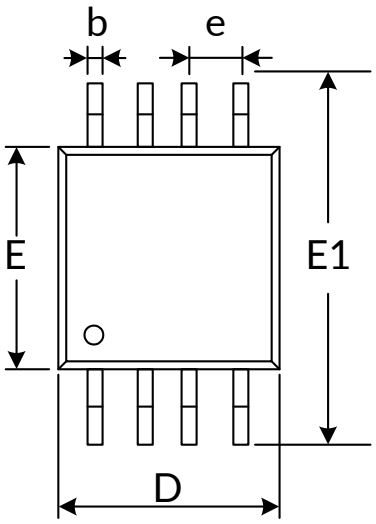
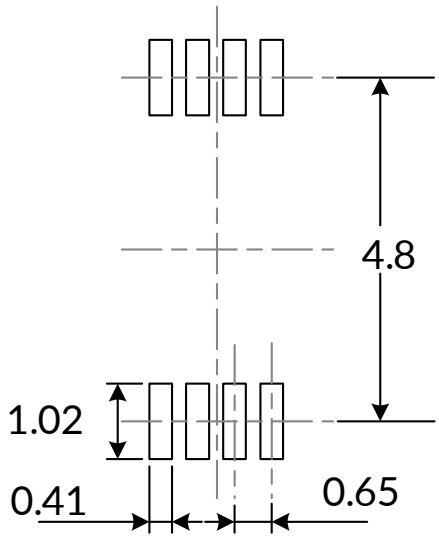


Figure 9. Negative Overload Recovery

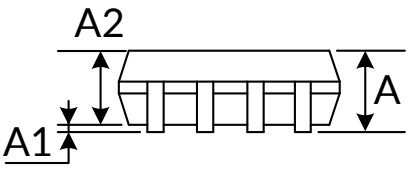
8 PACKAGE OUTLINE DIMENSIONS

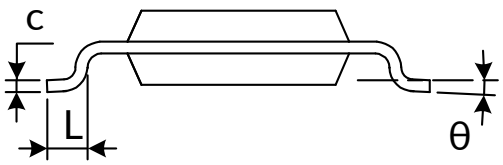
MSOP8 (3)





RECOMMENDED LAND PATTERN (Unit: mm)



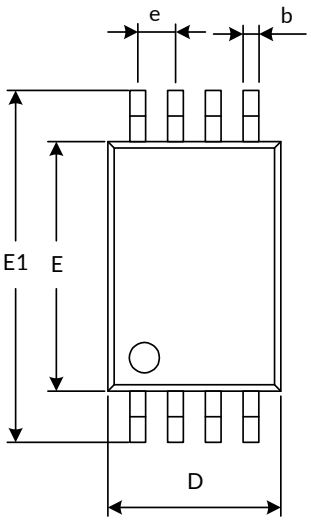


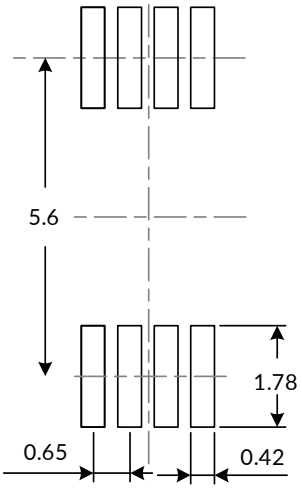
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D (1)	2.900	3.100	0.114	0.122
e	0.650(BSC) (2)		0.026(BSC) (2)	
E (1)	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

NOTE:

1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

TSSOP8 (3)





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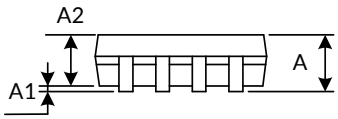
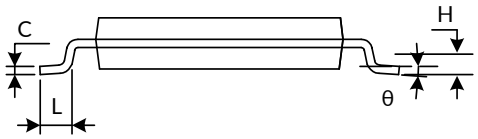


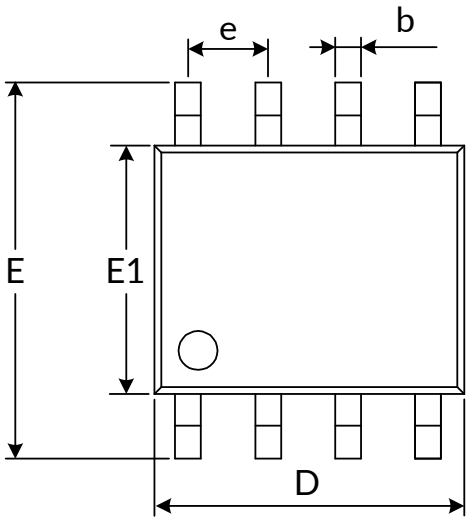


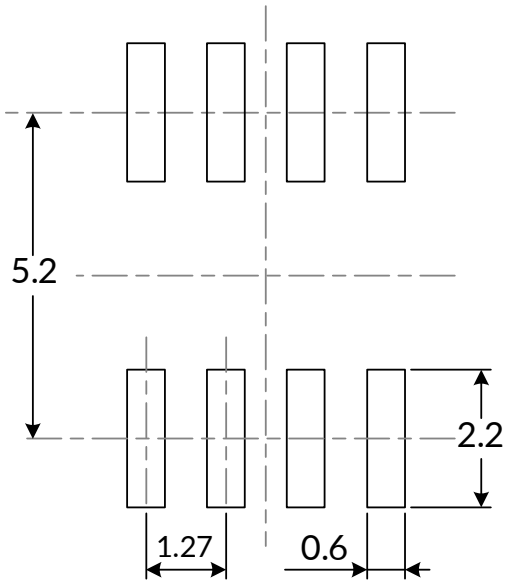
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D (1)	2.900	3.100	0.114	0.122
E (1)	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650(BSC) (2)		0.026(BSC) (2)	
L	0.500	0.700	0.020	0.028
H	0.25(TYP)		0.01(TYP)	
θ	1°	7°	1°	7°

NOTE:

1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

SOP8 (3)





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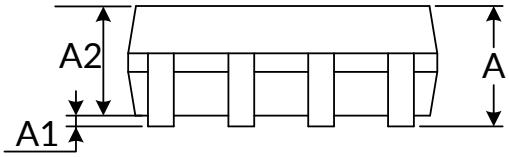
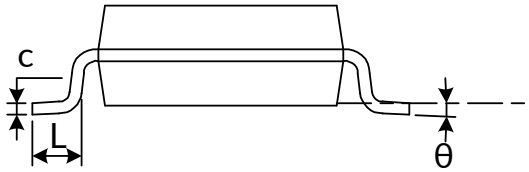


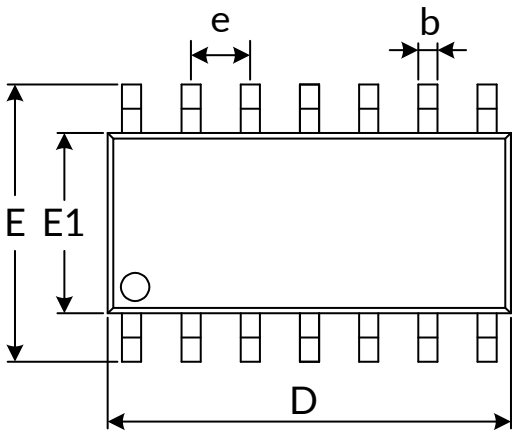


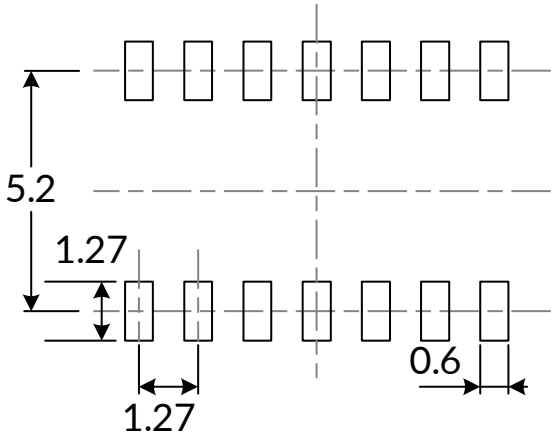
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D (1)	4.800	5.000	0.189	0.197
e	1.270(BSC) (2)		0.050(BSC) (2)	
E	5.800	6.200	0.228	0.244
E1 (1)	3.800	4.000	0.150	0.157
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

NOTE:

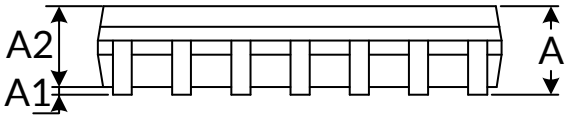
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

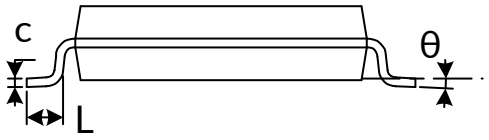
SOP14 (3)





RECOMMENDED LAND PATTERN (Unit: mm)



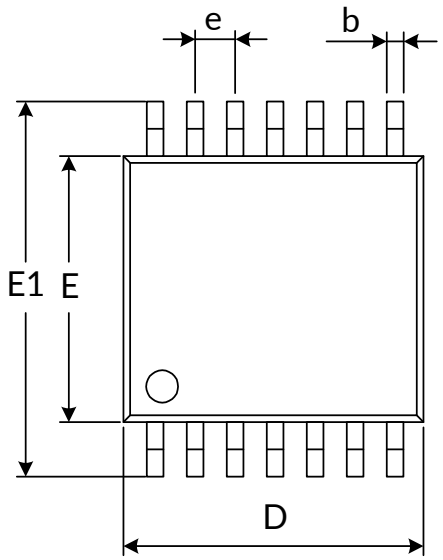


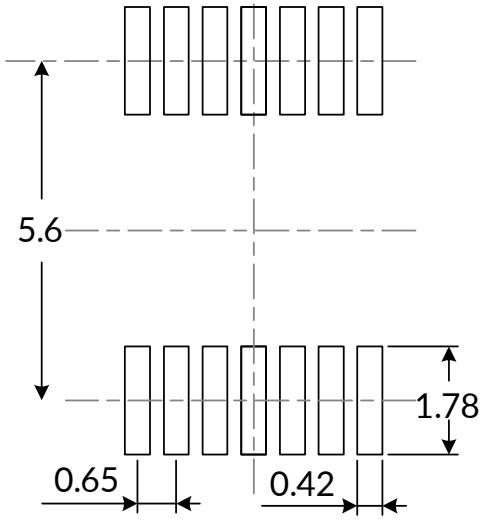
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.310	0.510	0.012	0.020
c	0.100	0.250	0.004	0.010
D (1)	8.450	8.850	0.333	0.348
e	1.270(BSC) (2)		0.050(BSC) (2)	
E	5.800	6.200	0.228	0.244
E1 (1)	3.800	4.000	0.150	0.157
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

NOTE:

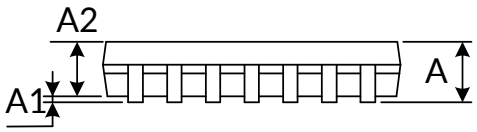
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

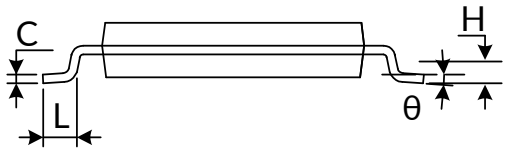
TSSOP14 (3)





RECOMMENDED LAND PATTERN (Unit: mm)





Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D (1)	4.860	5.100	0.191	0.201
E (1)	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650(BSC) (2)		0.026(BSC) (2)	
L	0.500	0.700	0.020	0.028
H	0.25(TYP)		0.01(TYP)	
θ	1°	7°	1°	7°

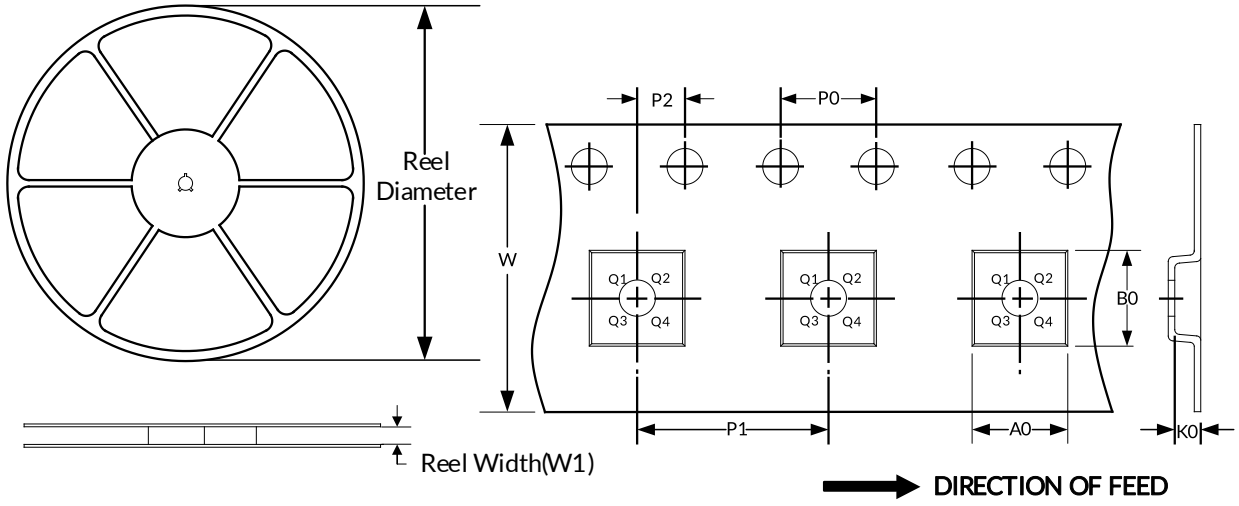
NOTE:

1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

9 TAPE AND REEL INFORMATION

REEL DIMENSIONS

TAPE DIMENSION



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1(mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOP8	13"	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1
MSOP8	13"	12.4	5.20	3.30	1.50	4.0	8.0	2.0	12.0	Q1
TSSOP8	13"	12.4	6.90	3.45	1.65	4.0	8.0	2.0	12.0	Q1
SOP14	13"	16.4	6.60	9.30	2.10	4.0	8.0	2.0	16.0	Q1
TSSOP14	13"	12.4	6.95	5.60	1.20	4.0	8.0	2.0	12.0	Q1

NOTE:
1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.

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