

1.1MHz, Rail-to-Rail I/O CMOS Operational Amplifier

FEATURES

- **HIGH GAIN BANDWIDTH:1.1MHz**
- **RAIL-TO-RAIL INPUT AND OUTPUT**
0.6mV Typical Vos
- **INPUT VOLTAGE RANGE: -0.1V to +5.6V**
with Vs = 5.5V
- **SUPPLY RANGE: +2.2V to +5.5V**
- **SHUTDOWN: RS6331S/RS6332S**
- **SPECIFIED UP TO +125°C**
- **Micro SIZE PACKAGES: SOT23-5, SOT23-6**

APPLICATIONS

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

DESCRIPTION

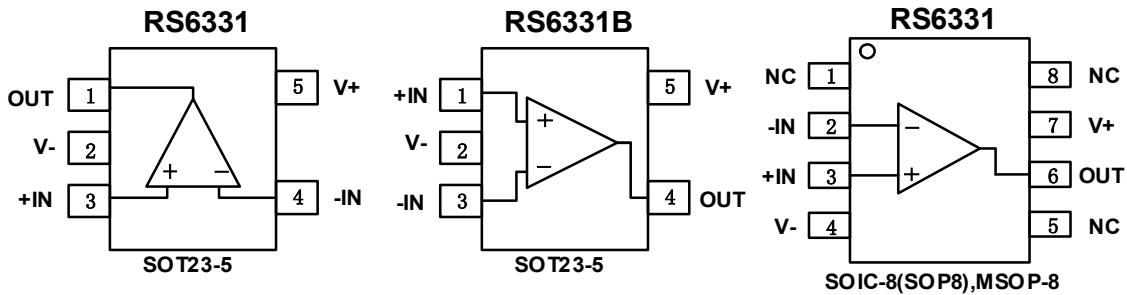
The RS6331, RS6332, RS6334, RS6331S, RS6332S families of products offer low voltage operation and rail-to-rail input and output, as well as excellent speed/power consumption ratio, providing an excellent bandwidth (1.1MHz) and slew rate of 0.5V/us. The op-amps are unity gain stable and feature an ultra-low input bias current.

The devices are ideal for sensor interfaces, active filters, and portable applications. The RS6331S, RS6332S include a shutdown mode. Under logic control, the amplifiers can be switched from normal operation to a standby current that is less than 1uA. The RS6331, RS6332, RS6334, RS6331S, RS6332S families of operational amplifiers are specified at the full temperature range of -40°C to +125°C under single or dual power supplies of 2.2V to 5.5V.

Device Information ⁽¹⁾

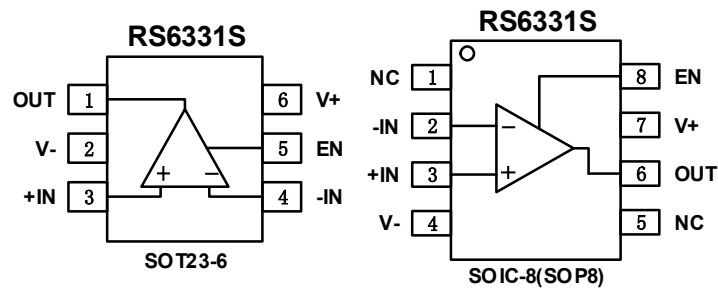
PART NUMBER	PACKAGE	BODY SIZE(NOM)
RS6331	SOT23-5	2.90mm×1.60mm
	SOIC-8(SOP8)	4.90mm×3.90mm
	MSOP-8	3.00mm×3.00mm
RS6331S	SOT23-6	2.90mm×1.60mm
	SOIC-8(SOP8)	4.90mm×3.90mm
RS6332	SOIC-8(SOP8)	4.90mm×3.90mm
	MSOP-8	3.00mm×3.00mm
	TSSOP-8	3.00mm×4.40mm
	TDFN2x2-8L	2.00mm×2.00mm
	TDFN3x3-8L	3.00mm×3.00mm
RS6332S	MSOP-10	3.00mm×3.00mm
RS6334	SOIC-14(SOP14)	8.65mm×3.90mm
	TSSOP-14	5.00mm×4.40mm
	TQFN3x3-16	3.00mm×3.00mm

Pin Configuration and Functions (Top View)



Pin Description

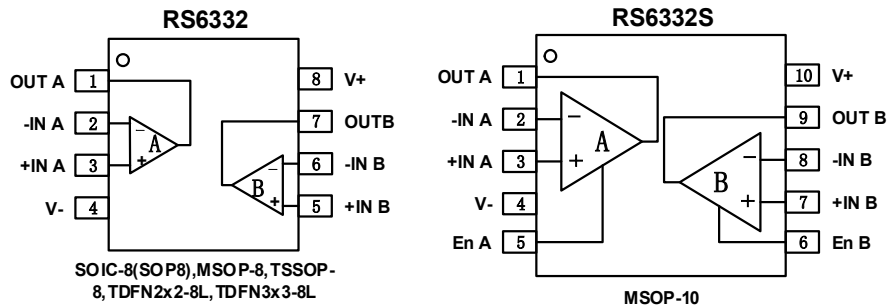
NAME	PIN			I/O	DESCRIPTION
	RS6331 SOT23-5	RS6331B SOT23-5	RS6331 SOIC-8(SOP8)/ MSOP8		
-IN	4	3	2	I	Negative (inverting) input
+IN	3	1	3	I	Positive (noninverting) input
NC	-	-	1,5,8	-	No internal connection (can be left floating)
OUT	1	4	6	O	Output
V-	2	2	4	-	Negative (lowest) power supply
V+	5	5	7	-	Positive (highest) power supply



Pin Description

NAME	PIN		I/O	DESCRIPTION
	RS6331S SOT23-6	RS6331S SOIC-8(SOP8)		
-IN	4	2	I	Inverting input
+IN	3	3	I	Noninverting input
OUT	1	6	O	Output
EN	5	8	I	Enable pin. This pin turns the regulator on or off. Low = disabled, high = normal operation (pin must be driven)
NC	-	1,5	-	No internal connection (can be left floating)
V-	2	4	-	Negative (lowest) power supply
V+	6	7	-	Positive (highest) power supply

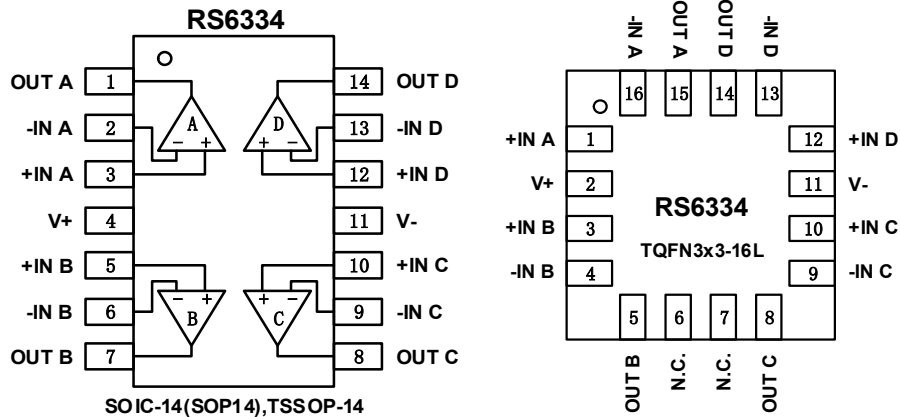
Pin Configuration and Functions (Top View)



Pin Description

NAME	PIN		I/O	DESCRIPTION
	RS6332	RS6332S		
	SOIC-8(SOP8)/MSOP-8/TSSOP-8/TDFN2x2-8L/TDFN3x3-8L	MSOP10		
-INA	2	2	I	Inverting input, channel A
+INA	3	3	I	Noninverting input, channel A
-INB	6	8	I	Inverting input, channel B
+INB	5	7	I	Noninverting input, channel B
OUTA	1	1	O	Output, channel A
OUTB	7	9	O	Output, channel B
EnA	-	5	I	Enable pin, channel A. This pin turns the regulator on or off. Low = disabled, high = normal operation (pin must be driven)
EnB	-	6	I	Enable pin, channel B. This pin turns the regulator on or off. Low = disabled, high = normal operation (pin must be driven)
V-	4	4	-	Negative (lowest) power supply
V+	8	10	-	Positive (highest) power supply

Pin Configuration and Functions (Top View)



Pin Description

NAME	PIN		I/O	DESCRIPTION
	SOIC-14(SOP14)/TSSOP-14	TQFN3x3-16L		
-INA	2	16	I	Inverting input, channel A
+INA	3	1	I	Noninverting input, channel A
-INB	6	4	I	Inverting input, channel B
+INB	5	3	I	Noninverting input, channel B
-INC	9	9	I	Inverting input, channel C
+INC	10	10	I	Noninverting input, channel C
-IND	13	13	I	Inverting input, channel D
+IND	12	12	I	Noninverting input, channel D
OUTA	1	15	O	Output, channel A
OUTB	7	5	O	Output, channel B
OUTC	8	8	O	Output, channel C
OUTD	14	14	O	Output, channel D
V-	11	11	-	Negative (lowest) power supply
V+	4	2	-	Positive (highest) power supply

SPECIFICATIONS

Absolute Maximum Ratings

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

		MIN	MAX	UNIT
Voltage	Supply, $V_s=(V+) - (V-)$		7	V
	Signal input pin ⁽²⁾	(V-)-0.5	(V+) +0.5	
	Signal output pin ⁽³⁾	(V-)-0.5	(V+) +0.5	
Current	Signal input pin ⁽²⁾	-10	10	mA
	Signal output pin ⁽³⁾	-100	100	mA
	Output short-circuit ⁽⁴⁾	Continuous		
Temperature	Operating range, T_A	-40	125	°C
	Junction, T_J		150	
	Storage, T_{stg}	-65	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 0.5V 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 0.5V beyond the supply rails should be current-limited to ± 100 mA or less.

(4) Short-circuit to ground, one amplifier per package.

ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM)	± 5000	V
		Machine Model (MM)	± 400	

Recommended Operating Conditions

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

		MIN	NOM	MAX	UNIT
Supply voltage, $V_s=(V+) - (V-)$	Single-supply	2.2		5.5	V
	Dual-supply	± 1.1		± 2.75	
Specified temperature		-40		125	°C

Thermal Information:RS6331

THERMAL METRIC ⁽¹⁾		RS6331				UNIT
		5PINS	6PINS	8PINS		
		SOT23-5	SOT23-6	SOIC-8	MSOP8	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	273.8	187.3	116	165	°C/W
$R_{\theta JC(top)}$	Junction-to-case(top) thermal resistance	126.8	126.5	60	53	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	85.9	32.6	56	87	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	10.9	24.1	12.8	4.9	°C/W
Ψ_{JB}	Junction-to-board characterization parameter	84.9	32.1	98.3	85	°C/W
$R_{\theta JC(bot)}$	Junction-to-case(bottom) thermal resistance	N/A	N/A	N/A	N/A	°C/W

Thermal Information:RS6332

THERMAL METRIC ⁽¹⁾		RS6332						UNIT
		8PINS						
		SOIC-8	MSOP-8	MSOP-10	TSSOP-8	TDFN2 ×2-8L	TDFN3 ×3-8L	
R _{θJA}	Junction-to-ambient thermal resistance	116	165	169.5	200.8	80.1	66.9	°C/W
R _{θJC(top)}	Junction-to-case(top) thermal resistance	60	53	84.1	95.3	100	54.5	°C/W
R _{θJB}	Junction-to-board thermal resistance	56	87	113	128.5	45	40.4	°C/W
ψ _{JT}	Junction-to-top characterization parameter	12.8	4.9	15.8	26.5	6.8	1.9	°C/W
ψ _{JB}	Junction-to-board characterization parameter	98.3	85	111.6	125.9	45.2	40.4	°C/W
R _{θJC(bot)}	Junction-to-case(bottom) thermal resistance	N/A	N/A	N/A	N/A	22.7	10.8	°C/W

Thermal Information:RS6334

THERMAL METRIC ⁽¹⁾		RS6334			UNIT
		14PINS			
		SOIC-14	TSSOP-14	TQFN3×3-16L	
R _{θJA}	Junction-to-ambient thermal resistance	83.8	120.8	68.5	°C/W
R _{θJC(top)}	Junction-to-case(top) thermal resistance	70.7	34.3	70.4	°C/W
R _{θJB}	Junction-to-board thermal resistance	59.5	62.8	42.6	°C/W
ψ _{JT}	Junction-to-top characterization parameter	11.6	1	5.3	°C/W
ψ _{JB}	Junction-to-board characterization parameter	37.7	56.5	40.9	°C/W
R _{θJC(bot)}	Junction-to-case(bottom) thermal resistance	N/A	N/A	N/A	°C/W

PACKAGE/ORDERING INFORMATION

Orderable Device	Package Type	Pin	Channel	Op Temp(°C)	Device Marking ⁽¹⁾	Package Qty
RS6331XF	SOT23-5	5	1	-40°C~125°C	6331	Tape and Reel,3000
RS6331BXF	SOT23-5	5	1	-40°C~125°C	6331B	Tape and Reel,3000
RS6331XK	SOIC-8(SOP8)	8	1	-40°C~125°C	RS6331	Tape and Reel,4000
RS6331XM	MSOP-8	8	1	-40°C~125°C	RS6331	Tape and Reel,4000
RS6331SXK	SOIC-8(SOP8)	8	1	-40°C~125°C	RS6331S	Tape and Reel,4000
RS6331SXH	SOT23-6	6	1	-40°C~125°C	6331S	Tape and Reel,3000
RS6332XK	SOIC-8(SOP8)	8	2	-40°C~125°C	RS6332	Tape and Reel,4000
RS6332XM	MSOP-8	8	2	-40°C~125°C	RS6332	Tape and Reel,4000
RS6332XTDE8	TDFN2x2-8L	8	2	-40°C~125°C	6332	Tape and Reel,3000
RS6332XTDC8	TDFN3x3-8L	8	2	-40°C~125°C	RS6332	Tape and Reel,5000
RS6332XQ	TSSOP-8	8	2	-40°C~125°C	RS6332	Tape and Reel,4000
RS6332SXN	MSOP-10	10	2	-40°C~125°C	RS6332S	Tape and Reel,4000
RS6334XP	SOIC-14(SOP14)	14	4	-40°C~125°C	RS6334	Tape and Reel,4000
RS6334XQ	TSSOP-14	14	4	-40°C~125°C	RS6334	Tape and Reel,4000
RS6334XTQC16	TQFN3x3-16L	16	4	-40°C~125°C	RS6334	Tape and Reel,5000

NOTE:

- (1) 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.

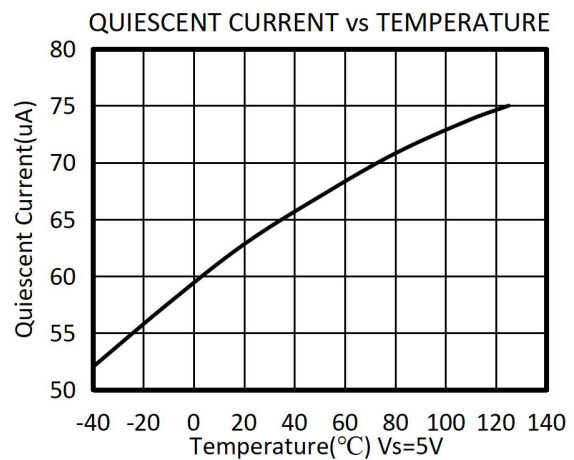
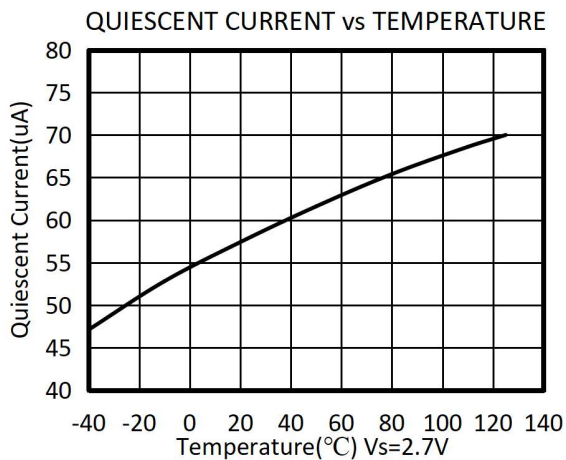
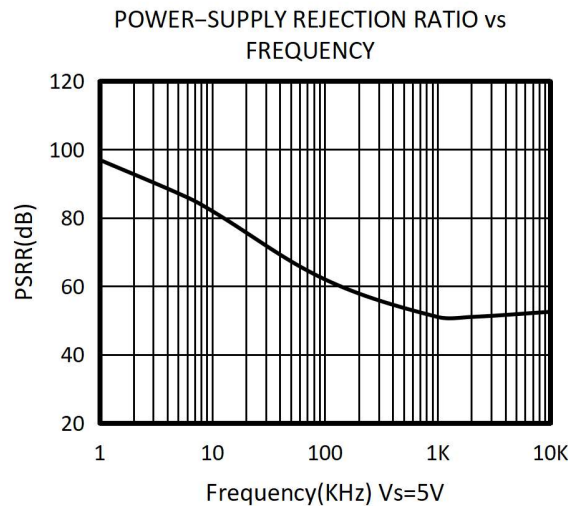
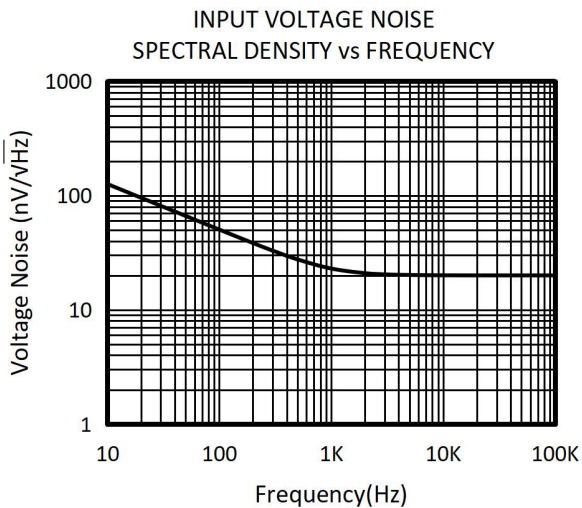
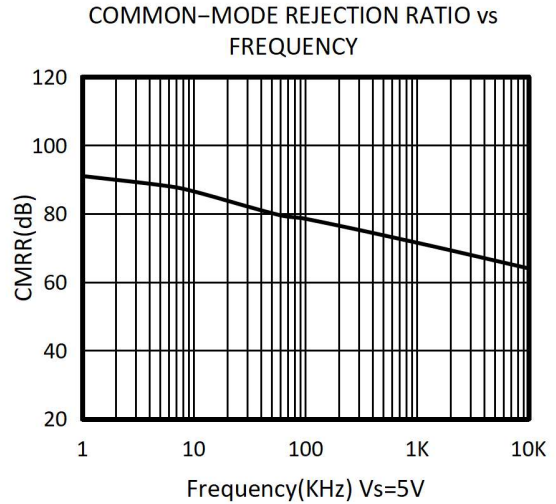
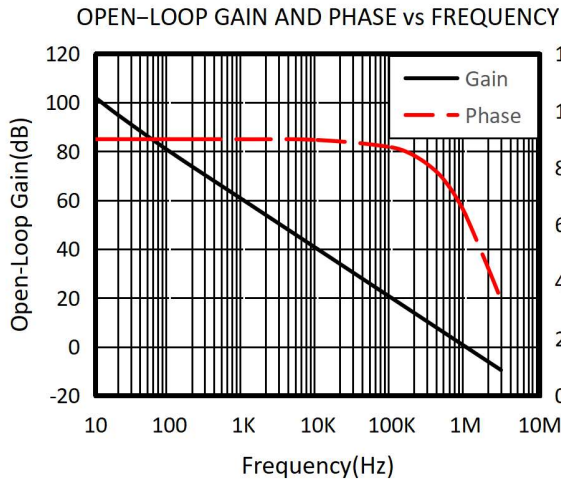
ELECTRICAL CHARACTERISTICS

(At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $R_L = 10\text{k}\Omega$ connected to $V_S/2$, and $V_{OUT} = V_S/2$, unless otherwise noted.)

PARAMETER		CONDITIONS	T_J	RS6331S, RS6332S, RS6331, RS6332, RS6334			
				MIN	TYP	MAX	UNIT
POWER SUPPLY							
V_S	Operating Voltage Range		25°C	2.2		5.5	V
I_Q	Quiescent Current/Amplifier		25°C		58	80	μA
PSRR	Power-Supply Rejection Ratio	$V_S = 2.2\text{V to } 5.5\text{V}$, $V_{cm} = (V-) + 0.5\text{V}$	25°C	72	90		dB
			$-40^\circ\text{C to } 125^\circ\text{C}$	65			
INPUT							
V_{os}	Input Offset Voltage		25°C		0.6	3	mV
$V_{os\ TC}$	Input Offset Voltage Average Drift	$-40^\circ\text{C to } 125^\circ\text{C}$			2		$\mu\text{V}/^\circ\text{C}$
I_B	Input Bias Current		25°C		1	10	pA
I_{os}	Input Offset Current		25°C		1	10	pA
V_{cm}	Common-Mode Voltage Range	$V_S = 5.5\text{V}$	25°C	-0.1		5.6	V
CMRR	Common-Mode Rejection Ratio	$V_S = 5.5\text{V}$, $V_{cm} = -0.1\text{V to } 4\text{V}$	25°C	71	90		dB
			$-40^\circ\text{C to } 125^\circ\text{C}$	68			
		$V_S = 5.5\text{V}$, $V_{cm} = -0.1\text{V to } 5.6\text{V}$	25°C	60	80		
			$-40^\circ\text{C to } 125^\circ\text{C}$	57			
OUTPUT							
AOL	Open-Loop Voltage Gain	$R_L = 2\text{K}\Omega$, $V_o = 0.15\text{V to } 4.85\text{V}$	25°C	94	105		dB
			$-40^\circ\text{C to } 125^\circ\text{C}$	85			
		$R_L = 10\text{K}\Omega$, $V_o = 0.05\text{V to } 4.95\text{V}$	25°C	100	110		
			$-40^\circ\text{C to } 125^\circ\text{C}$	90			
	Output Swing From Rail	$R_L = 2\text{K}\Omega$	25°C		25		mV
		$R_L = 10\text{K}\Omega$			8		
I_{out}	Output Short-Circuit Current		25°C		55		mA
FREQUENCY RESPONSE							
SR	Slew Rate		25°C		0.5		V/ μs
GBP	Gain-Bandwidth Product		25°C		1.1		MHz
PM	Phase Margin		25°C		64		$^\circ$
t_s	Setting Time, 0.1%				1.3		μs
	Overload Recovery Time	$V_{IN} \cdot \text{Gain} \geq V_S$			2.3		μs
NOISE							
e_n	Input Voltage Noise Density	$f = 1\text{KHz}$	25°C		22		nV/ $\sqrt{\text{Hz}}$
		$f = 10\text{KHz}$	25°C		20		nV/ $\sqrt{\text{Hz}}$
ENABLE/SHUTDOWN(RS6331S,RS6332S)							
$I_{Q(OFF)}$	Supply Current in Shutdown		25°C		<1		μA
t_{OFF}			25°C		3		μs
t_{ON}			25°C		20		μs
V_L	Shut Down		25°C	V-		(V-) + 0.8	V
V_H	Amplifier Is Active		25°C	(V-) + 2		V+	V

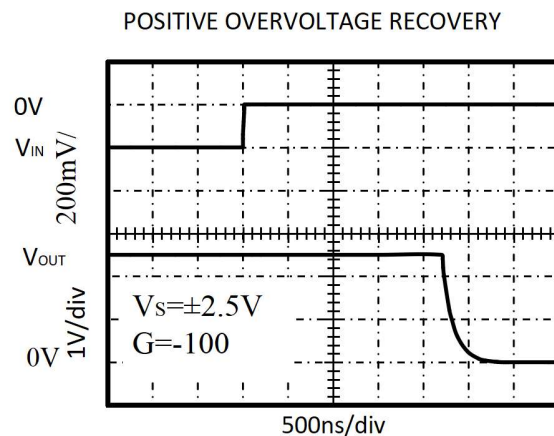
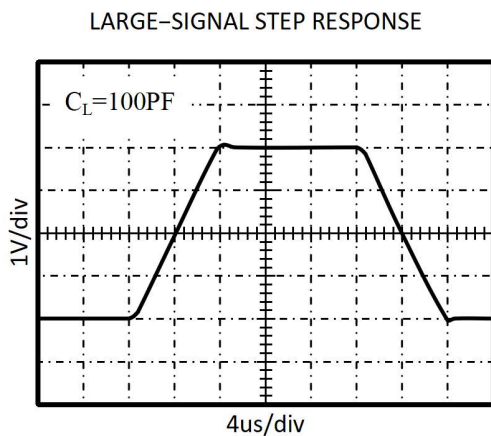
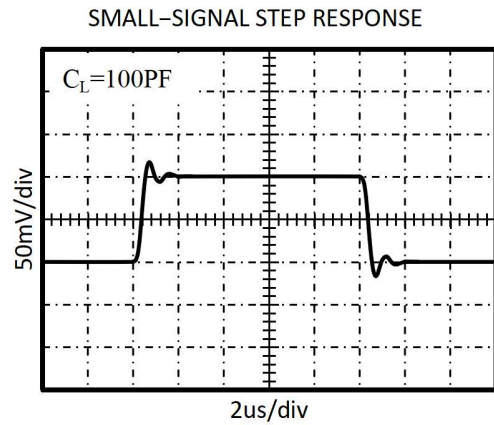
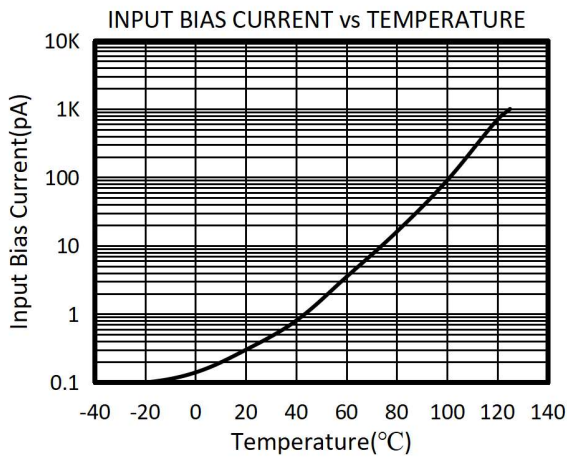
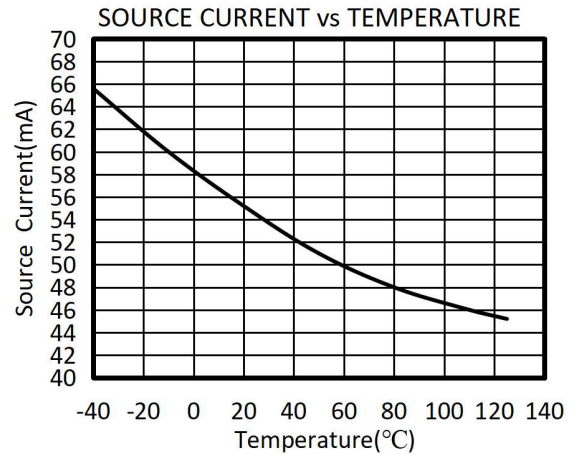
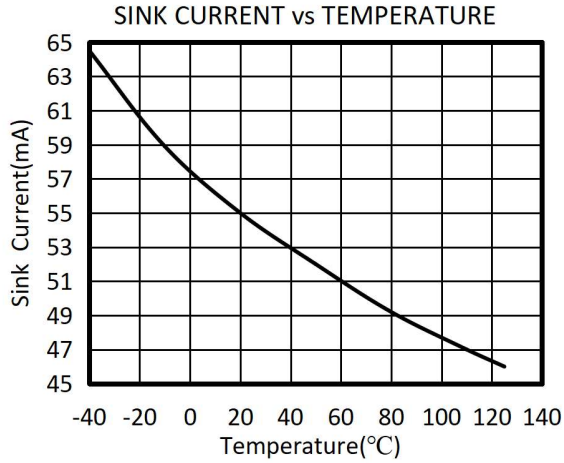
TYPICAL CHARACTERISTICS

At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $R_L = 10\text{k}\Omega$ connected to $V_S/2$, $V_{OUT} = V_S/2$, unless otherwise noted.



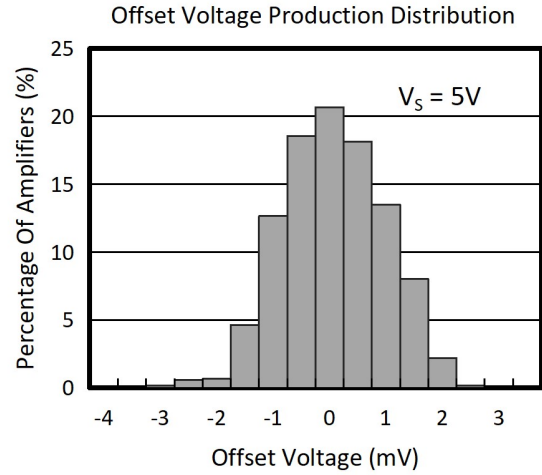
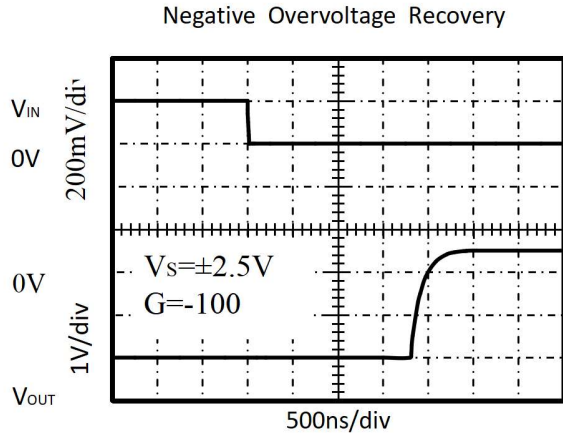
TYPICAL CHARACTERISTICS

At $T_A = +25^\circ\text{C}$, $V_s = 5\text{V}$, $R_i = 10\text{k}\Omega$ connected to $V_s/2$, $V_{\text{OUT}} = V_s/2$, unless otherwise noted.



TYPICAL CHARACTERISTICS

At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $R_L = 10\text{k}\Omega$ connected to $V_S/2$, $V_{OUT} = V_S/2$, unless otherwise noted.



APPLICATION NOTES

The RS6331, RS6332, RS6334, RS6331S, RS6332S are high precision, rail-to-rail operational amplifiers that can be run from a single-supply voltage 2.2V to 5.5V ($\pm 1.1V$ to $\pm 2.75V$). Supply voltages higher than 7V (absolute maximum) can permanently damage the amplifier.

Rail-to-rail input and output swing significantly increases dynamic range, especially in low-supply applications.

Good layout practice mandates use of a 0.1uF capacitor place closely across the supply pins.

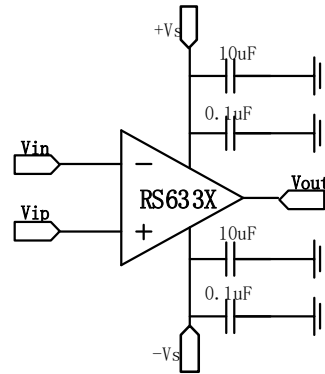


Figure1. Amplifier with Bypass Capacitors

RS6331S/RS6332S ENABLE FUNCTION

The RS6331S/RS6332S includes a shutdown mode. Under logic control, the amplifiers can be switched from normal mode to a standby current of 1uA. When the Enable pin is connected to high, the amplifier is active. Connecting Enable low disables the amplifier, and places the amplifier, and place the output in a high-impedance state.

LAYOUT GUIDELINS

Attention to good layout practices is always recommended. Keep traces short. When possible, use a PCB ground plane with surface-mount components placed as close to the device pins as possible. Place a 0.1uF capacitor closely across the supply pins.

These guidelines should be applied throughout the analog circuit to improve performance and provide benefits such as reducing the EMI susceptibility.

INSTRUMENTATION AMPLIFIER

In the three-op amp, instrumentation amplifier configuration shown in Figure2,

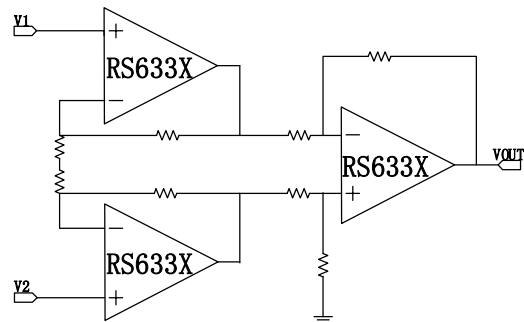
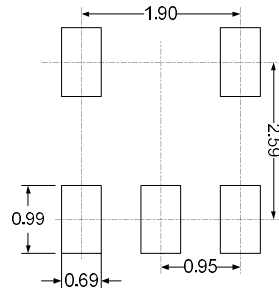
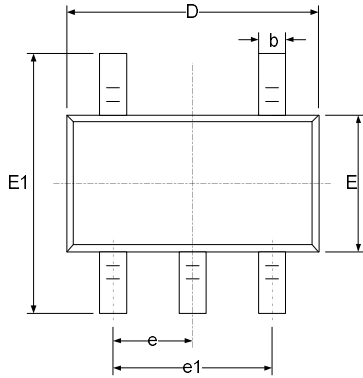
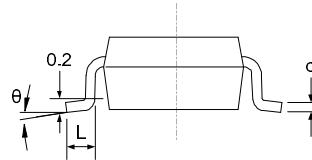
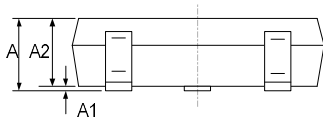


Figure2. Amplifier instrumentation amplifier

PACKAGE OUTLINE DIMENSIONS SOT23-5

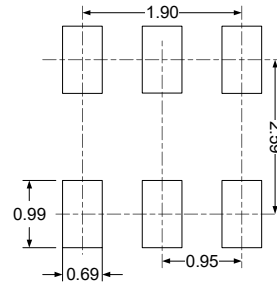
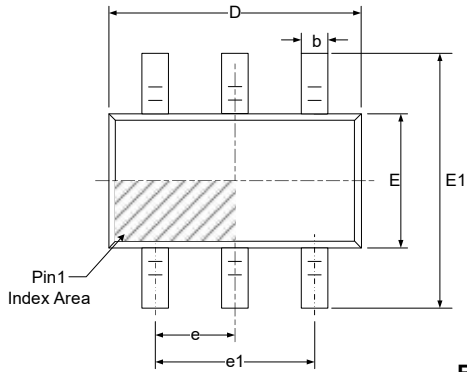


RECOMMENDED LAND PATTERN (Unit: mm)

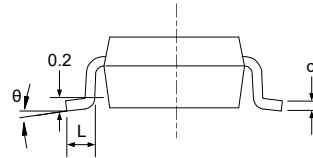
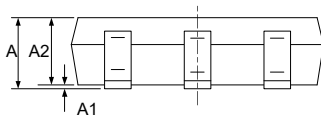


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

SOT23-6

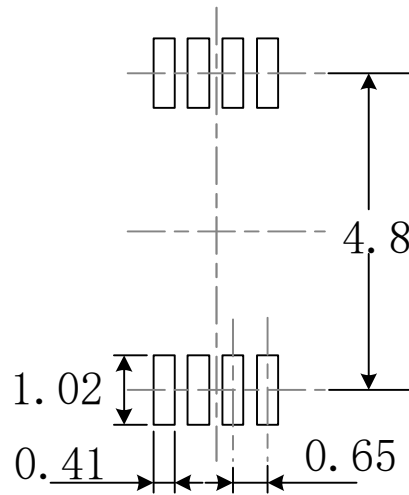
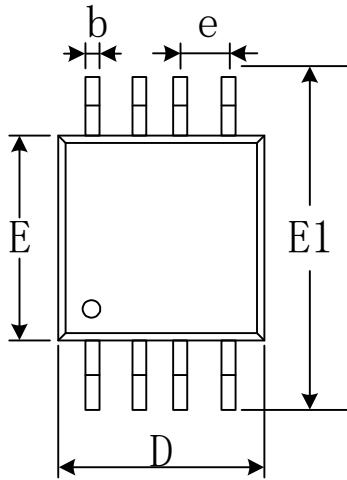


RECOMMENDED LAND PATTERN (Unit: mm)

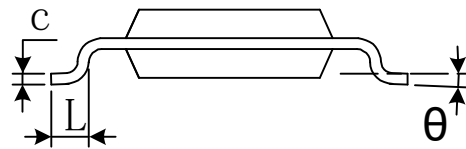
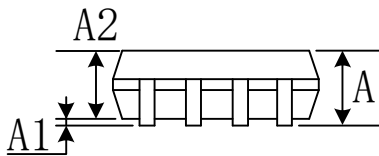


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

MSOP-8

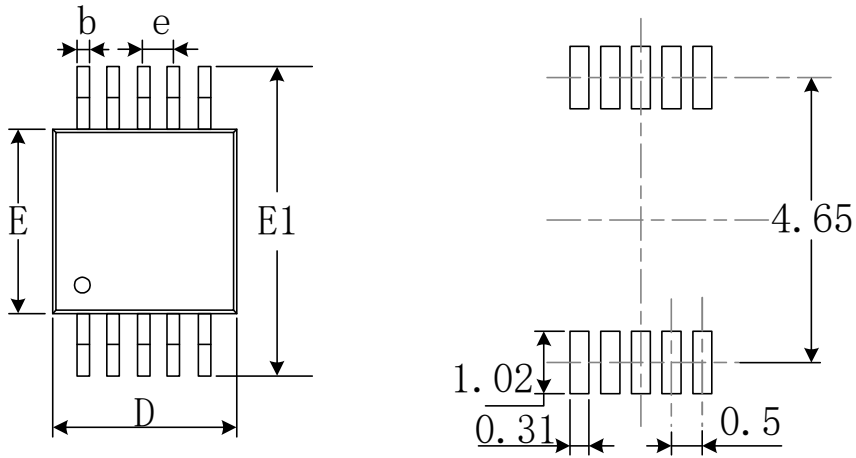


RECOMMENDED LAND PATTERN (Unit: mm)

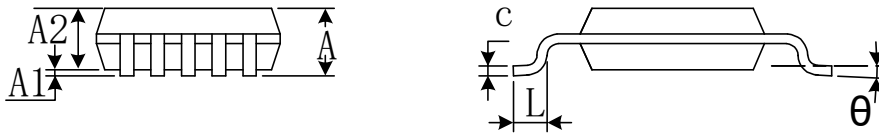


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
e	0.650(BSC)		0.026(BSC)	
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187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

MSOP-10

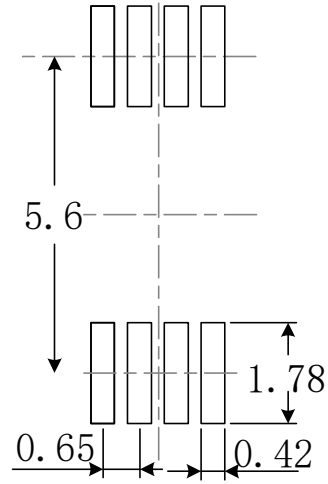
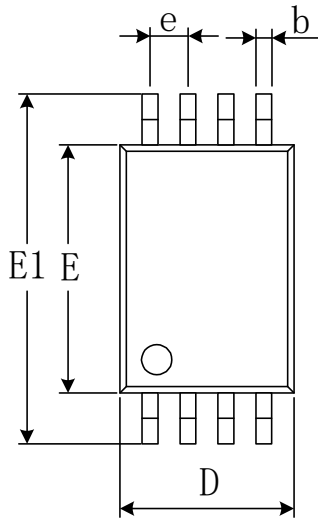


RECOMMENDED LAND PATTERN (Unit: mm)

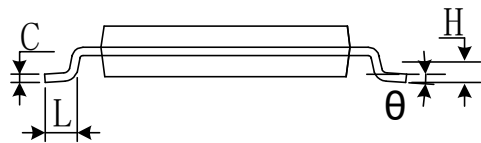
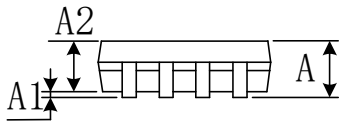


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.180	0.280	0.007	0.011
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
e	0.50(BSC)		0.020(BSC)	
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

TSSOP-8

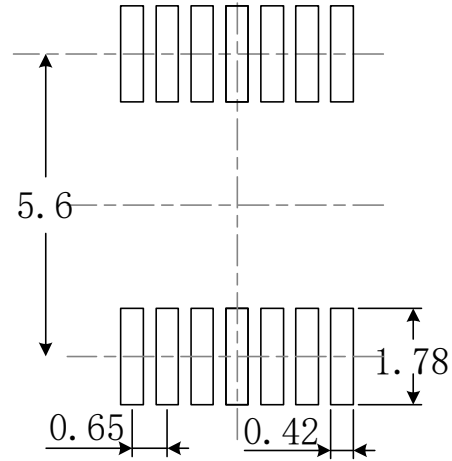
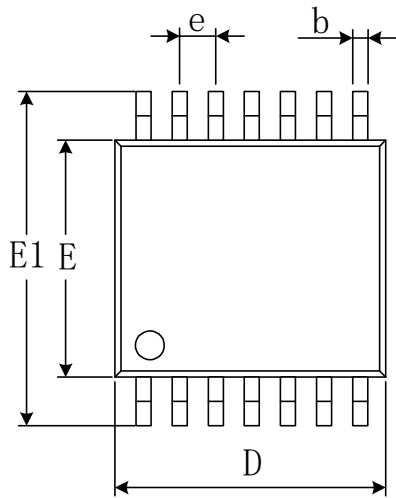


RECOMMENDED LAND PATTERN (Unit: mm)

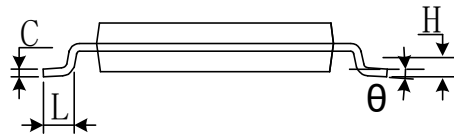
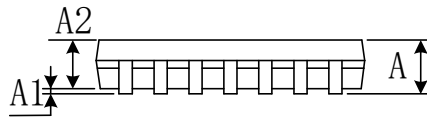


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	2.900	3.100	0.114	0.122
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650(BSC)		0.026(BSC)	
L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

TSSOP-14

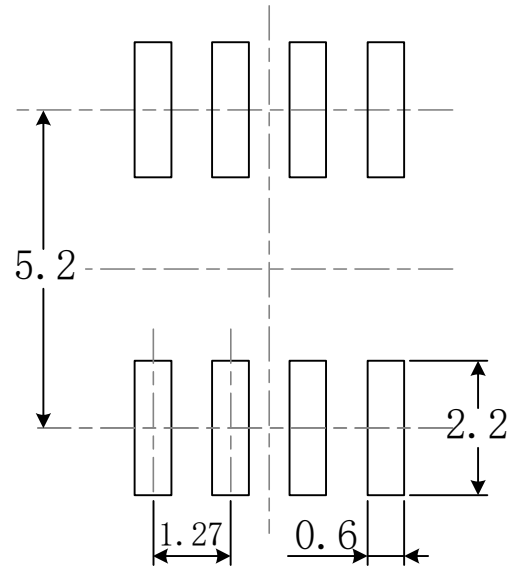
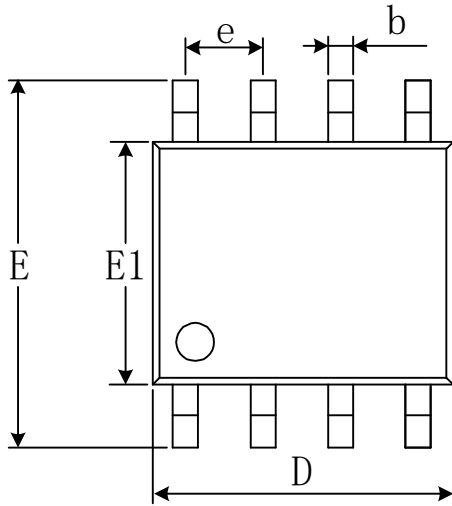


RECOMMENDED LAND PATTERN (Unit: mm)

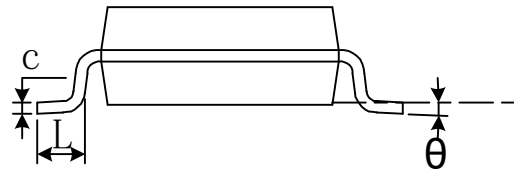
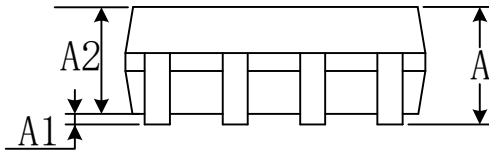


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.860	5.100	0.191	0.201
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650(BSC)		0.026(BSC)	
L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

SOIC-8(SOP8)

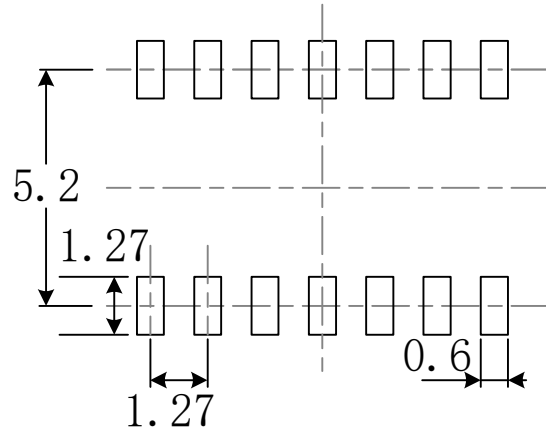
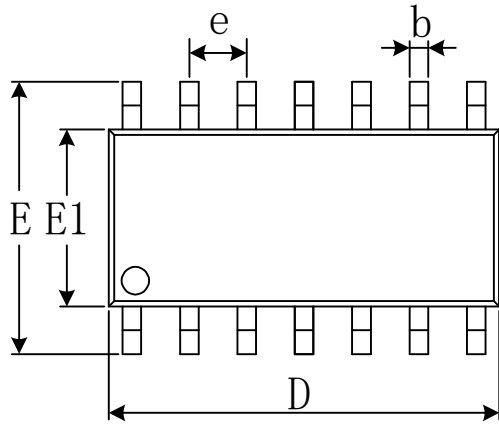


RECOMMENDED LAND PATTERN (Unit: mm)

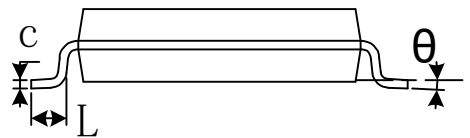
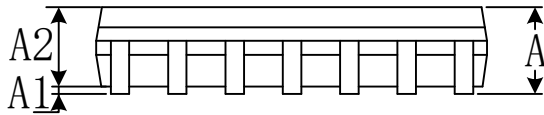


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.800	5.000	0.189	0.197
e	1.270(BSC)		0.050(BSC)	
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150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

SOIC-14(SOP14)

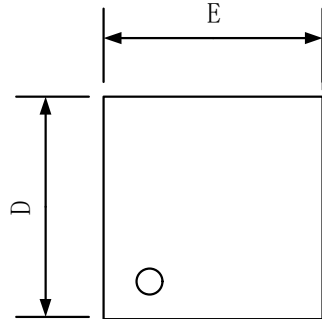


RECOMMENDED LAND PATTERN (Unit: mm)

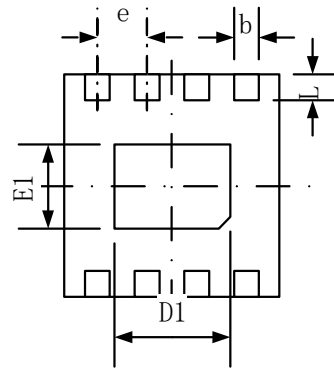


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.310	0.510	0.012	0.020
c	0.100	0.250	0.004	0.010
D	8.450	8.850	0.333	0.348
e	1.270(BSC)		0.050(BSC)	
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150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

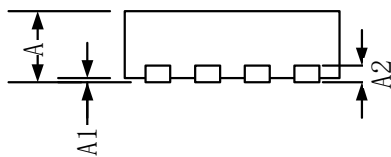
TDFN-2x2-8L



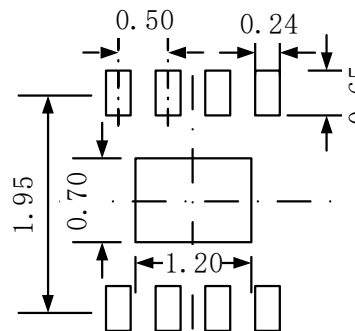
TOP VIEW



BOTTOM VIEW



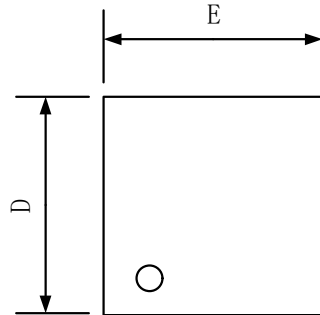
SIDE VIEW



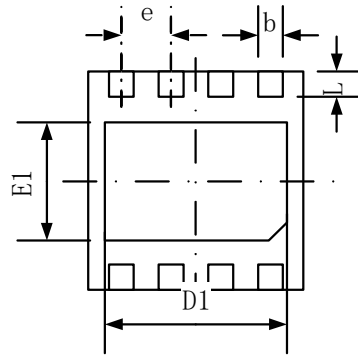
RECOMMENDED LAND
PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203(TYP)		0.008(TYP)	
b	0.180	0.300	0.007	0.012
D	1.900	2.100	0.075	0.083
D1	1.100	1.300	0.043	0.051
E	1.900	2.100	0.075	0.083
E1	0.600	0.800	0.024	0.031
e	0.500(TYP)		0.020(TYP)	
L	0.250	0.450	0.010	0.018

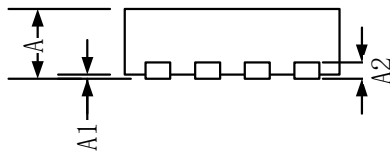
TDFN-3x3-8L



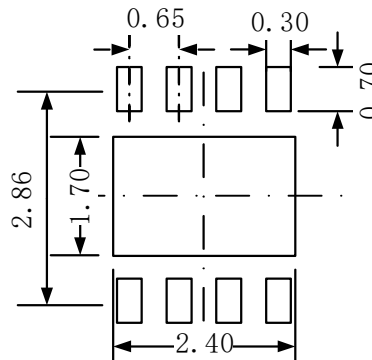
TOP VIEW



BOTTOM VIEW



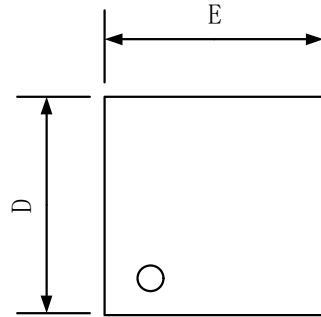
SIDE VIEW



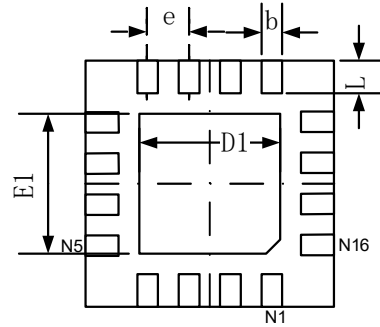
RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203		0.008	
b	0.250	0.350	0.010	0.014
D	2.900	3.100	0.114	0.122
D1	2.350	2.450	0.093	0.096
E	2.900	3.100	0.114	0.122
E1	1.650	1.750	0.065	0.069
e	0.650 TYP		0.026 TYP	
L	0.370	0.470	0.015	0.019

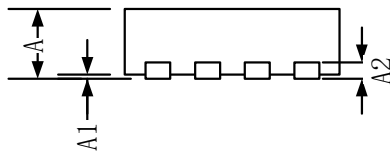
TQFN-3x3-16L



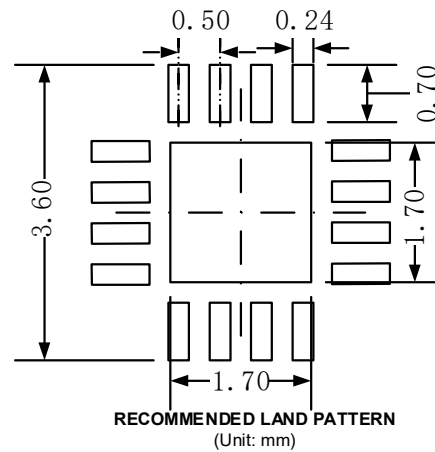
TOP VIEW



BOTTOM VIEW



SIDE VIEW



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203		0.008	
b	0.180	0.300	0.007	0.012
D	2.900	3.100	0.114	0.122
D1	1.600	1.800	0.063	0.071
E	2.900	3.100	0.114	0.122
E1	1.600	1.800	0.063	0.071
e	0.500 TYP		0.020 TYP	
L	0.300	0.500	0.012	0.020