

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

FEATURES

- **HIGH GAIN BANDWIDTH: 1.1MHz**
- **RAIL-TO-RAIL INPUT AND OUTPUT**
±0.8mV Typical Vos
- **INPUT VOLTAGE RANGE: -0.1V to +5.6V**
with Vs = 5.5V
- **SUPPLY RANGE: +2.2V to +5.5V**
- **SHUTDOWN: RS321S/RS358S**
- **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 RS321, RS358, RS324, RS321S, RS358S 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 RS321S, RS358S 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 RS321, RS358, RS324, RS321S, RS358S 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⁾

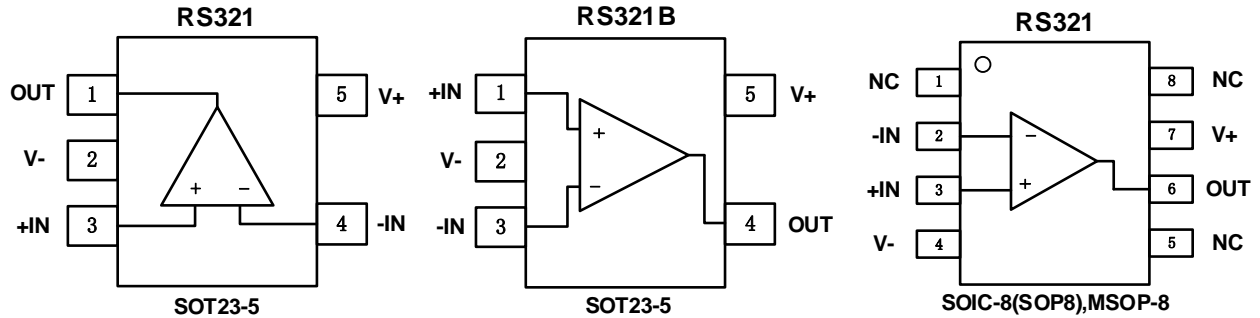
PART NUMBER	PACKAGE	BODY SIZE(NOM)
RS321	SOT23-5	2.90mm×1.60mm
	SOIC-8(SOP8)	4.90mm×3.90mm
	MSOP-8	3.00mm×3.00mm
RS321S	SOT23-6	2.90mm×1.60mm
	SOIC-8(SOP8)	4.90mm×3.90mm
RS358	SOIC-8(SOP8)	4.90mm×3.90mm
	MSOP-8	3.00mm×3.00mm
	DFN2*2-8L	2.00mm×2.00mm
RS358S	MSOP-10	3.00mm×3.00mm
RS324	SOIC-14(SOP14)	8.65mm×3.90mm
	TSSOP-14	5.00mm×4.40mm

Revision History

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

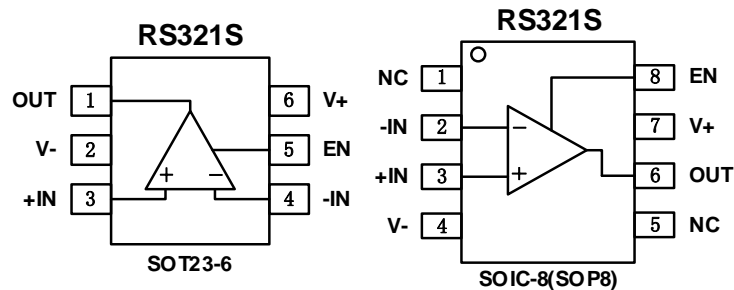
Version	Change Date	Change Item
C.2	2021/6/11	Added the DFN2*2-8L package Added the information of package size

Pin Configuration and Functions (Top View)



Pin Description

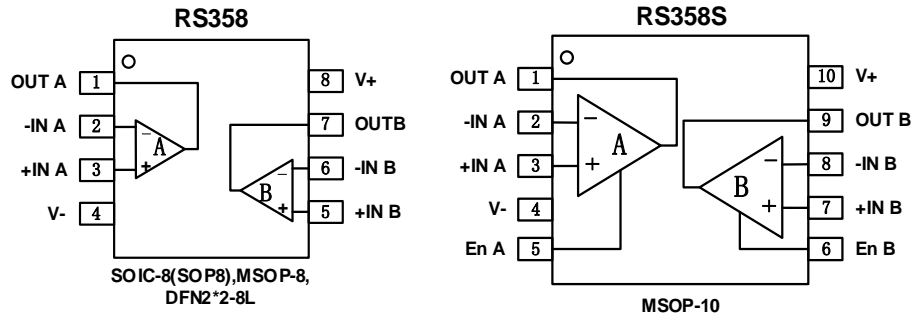
NAME	PIN			I/O	DESCRIPTION
	RS321	RS321B	RS321		
	SOT23-5	SOT23-5	SOIC-8(SOP8)/MSOP8		
-IN	4	3	2	I	Negative (inverting) input
+IN	3	1	3	I	Positive (noninverting) input
NC	-	-	1,5,8	-	No internal connection (can be left floating)
OUT	1	4	6	O	Output
V-	2	2	4	-	Negative (lowest) power supply
V+	5	5	7	-	Positive (highest) power supply



Pin Description

NAME	PIN		I/O	DESCRIPTION
	RS321S			
	SOT23-6	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

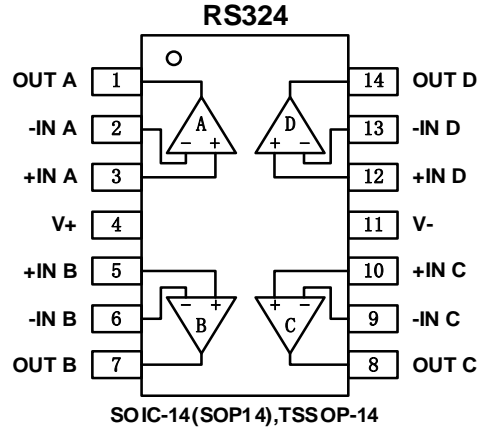
Pin Configuration and Functions (Top View)



Pin Description

NAME	PIN		I/O	DESCRIPTION
	RS358	RS358S		
	SOIC-8(SOP8)/MSOP-8/DFN2*2-8L	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		
-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
V+	4	-	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:RS321

THERMAL METRIC ⁽¹⁾		RS321				UNIT
		5PINS		8PINS		
		SOT23-5	SOT23-6	SOIC-8(SOP8)	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:RS358

THERMAL METRIC ⁽¹⁾		RS358				UNIT
		8PINS				
		SOIC-8 (SOP8)	MSOP8	DFN2*2-8L	MSOP10	
R _{EJA}	Junction-to-ambient thermal resistance	116	165	80.1	169.5	°C/W
R _{EJC(top)}	Junction-to-case(top) thermal resistance	60	53	100	84.1	°C/W
R _{EJB}	Junction-to-board thermal resistance	56	87	45	113	°C/W
Ψ _{JT}	Junction-to-top characterization parameter	12.8	4.9	6.8	15.8	°C/W
Ψ _{JB}	Junction-to-board characterization parameter	98.3	85	45.2	111.6	°C/W
R _{EJC(bot)}	Junction-to-case(bottom) thermal resistance	N/A	N/A	22.7	N/A	°C/W

Thermal Information:RS324

THERMAL METRIC ⁽¹⁾		RS324		UNIT
		14PINS		
		SOIC-14	TSSOP-14	
R _{EJA}	Junction-to-ambient thermal resistance	83.8	120.8	°C/W
R _{EJC(top)}	Junction-to-case(top) thermal resistance	70.7	34.3	°C/W
R _{EJB}	Junction-to-board thermal resistance	59.5	62.8	°C/W
Ψ _{JT}	Junction-to-top characterization parameter	11.6	1	°C/W
Ψ _{JB}	Junction-to-board characterization parameter	37.7	56.5	°C/W
R _{EJC(bot)}	Junction-to-case(bottom) thermal resistance	N/A	N/A	°C/W

PACKAGE/ORDERING INFORMATION

Orderable Device	Package Type	Pin	Channel	Op Temp(°C)	Device Marking ⁽¹⁾	Package Qty
RS321XF	SOT23-5	5	1	-40°C~125°C	321	Tape and Reel,3000
RS321BXF	SOT23-5	5	1	-40°C~125°C	321B	Tape and Reel,3000
RS321XK	SOIC-8(SOP8)	8	1	-40°C~125°C	RS321	Tape and Reel,4000
RS321XM	MSOP-8	8	1	-40°C~125°C	RS321	Tape and Reel,4000
RS321SXK	SOIC-8(SOP8)	8	1	-40°C~125°C	RS321S	Tape and Reel,4000
RS321SXH	SOT23-6	6	1	-40°C~125°C	321S	Tape and Reel,3000
RS358XK	SOIC-8(SOP8)	8	2	-40°C~125°C	RS358	Tape and Reel,4000
RS358XM	MSOP-8	8	2	-40°C~125°C	RS358	Tape and Reel,4000
RS358XTDE8	DFN2*2-8L	8	2	-40°C~125°C	358	Tape and Reel,3000
RS358SXN	MSOP-10	10	2	-40°C~125°C	RS358S	Tape and Reel,4000
RS324XP	SOIC-14 (SOP14)	14	4	-40°C~125°C	RS324	Tape and Reel,4000
RS324XQ	TSSOP-14	14	4	-40°C~125°C	RS324	Tape and Reel,4000

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.

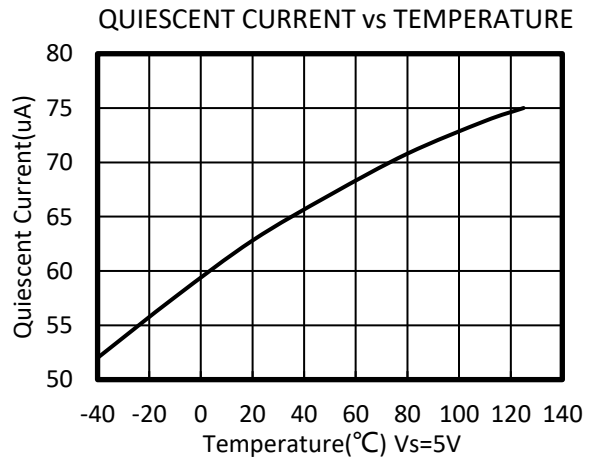
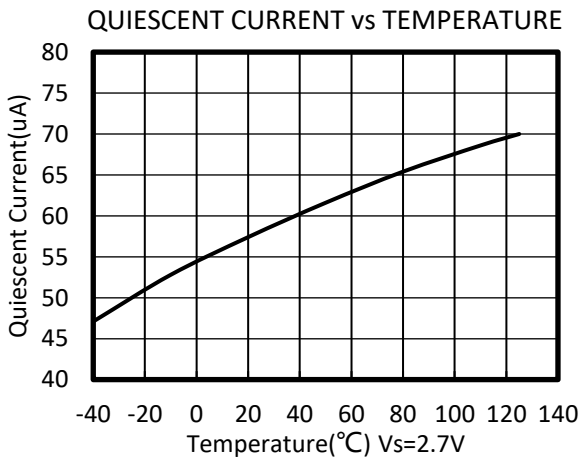
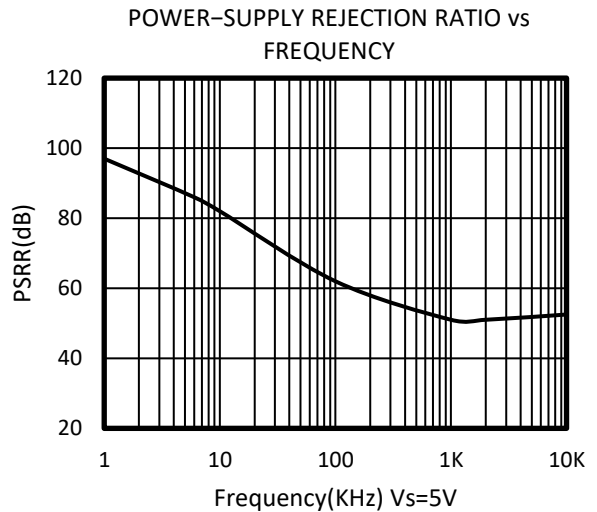
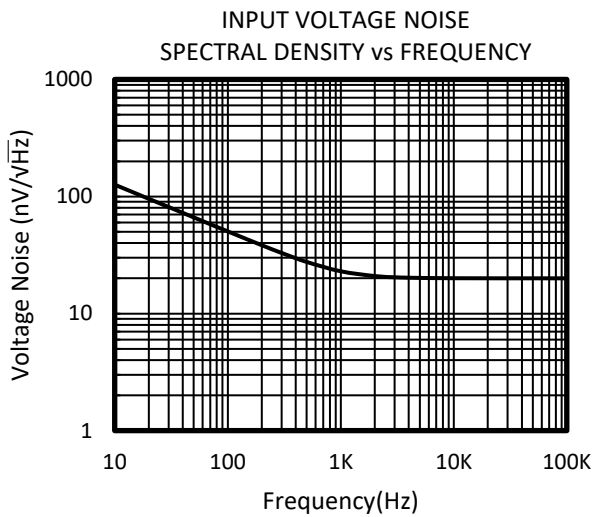
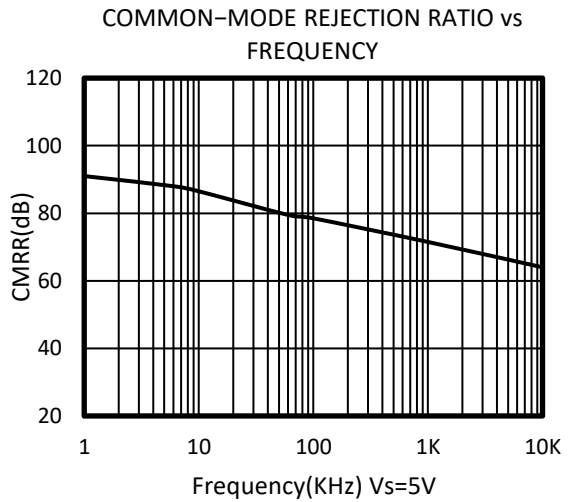
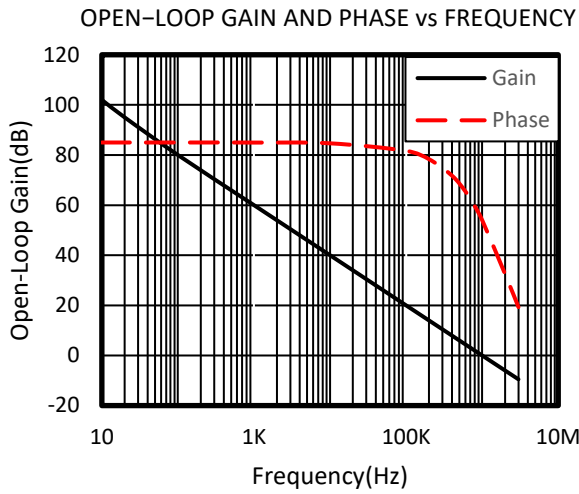
ELECTRICAL CHARACTERISTICS

(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	RS321S, RS358S, RS321, RS358, RS324			
				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		60	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	62	85		dB
			$-40^\circ\text{C to } 125^\circ\text{C}$	58			
INPUT							
V_{os}	Input Offset Voltage		25°C	-4.5	± 0.8	4.5	mV
V_{os} T_C	Input Offset Voltage Average Drift	$-40^\circ\text{C to } 125^\circ\text{C}$			± 2.9		$\mu\text{V}/^\circ\text{C}$
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	65	80		dB
			$-40^\circ\text{C to } 125^\circ\text{C}$	62			
		$V_S = 5.5\text{V}$, $V_{cm} = -0.1\text{V to } 5.6\text{V}$	25°C	57	75		
			$-40^\circ\text{C to } 125^\circ\text{C}$	55			
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	75	95		dB
			$-40^\circ\text{C to } 125^\circ\text{C}$	72			
		$R_L = 10\text{k}\Omega$, $V_o = 0.05\text{V to } 4.95\text{V}$	25°C	85	100		
			$-40^\circ\text{C to } 125^\circ\text{C}$	82			
	Output Swing from Rail	$R_L = 2\text{k}\Omega$	25°C		26		mV
		$R_L = 10\text{k}\Omega$			8		
I_{out}	Output Short-Circuit Current		25°C		54		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		23		$\text{nV}/\sqrt{\text{Hz}}$
		$f = 10\text{KHz}$	25°C		20		$\text{nV}/\sqrt{\text{Hz}}$
ENABLE/SHUTDOWN (RS321S, RS358S)							
$I_{q(OFF)}$	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

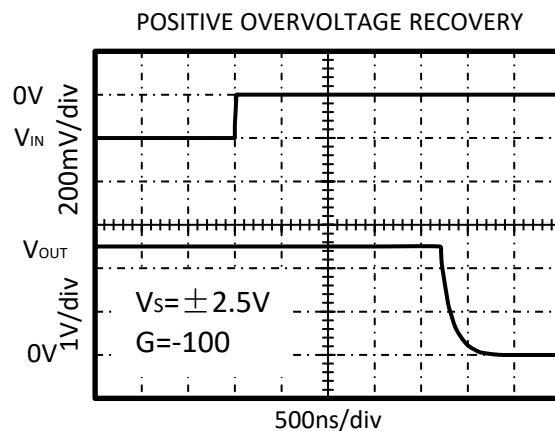
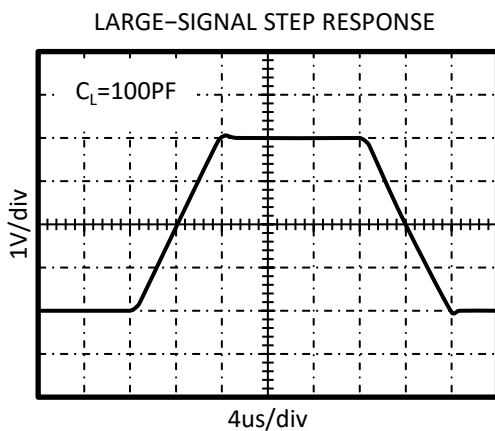
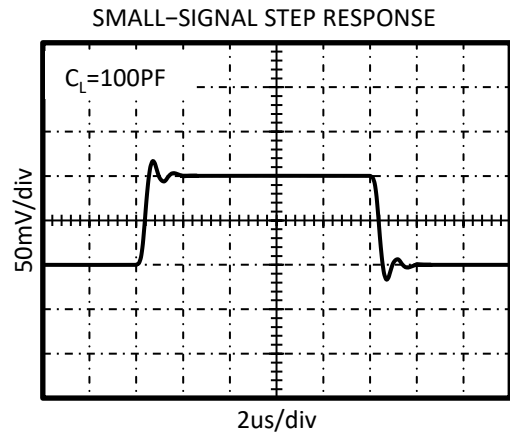
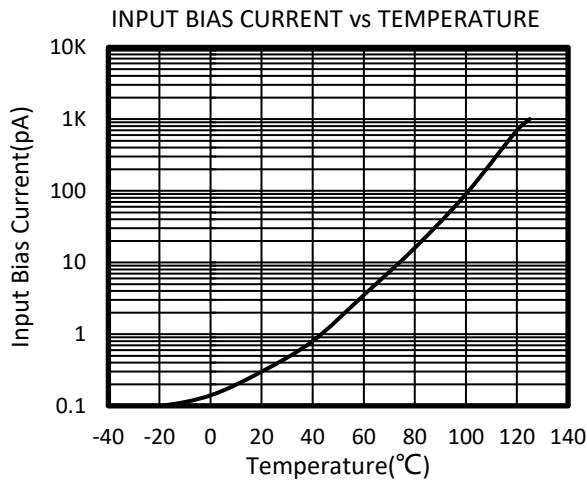
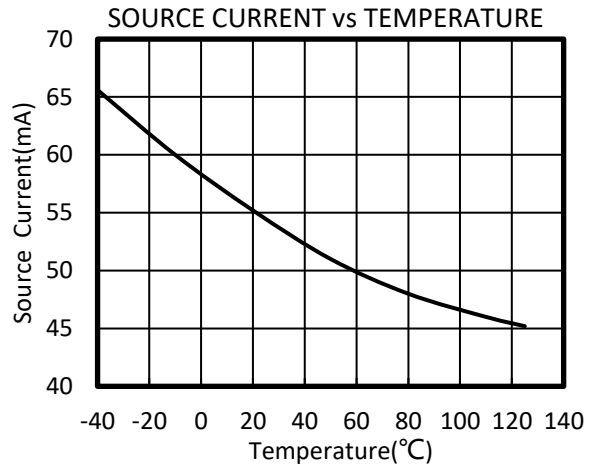
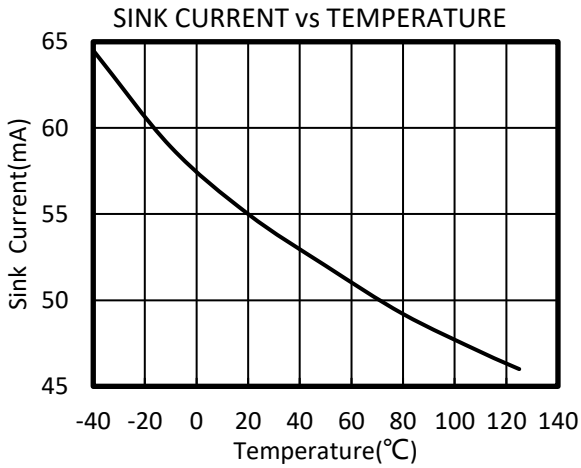
TYPICAL CHARACTERISTICS

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.



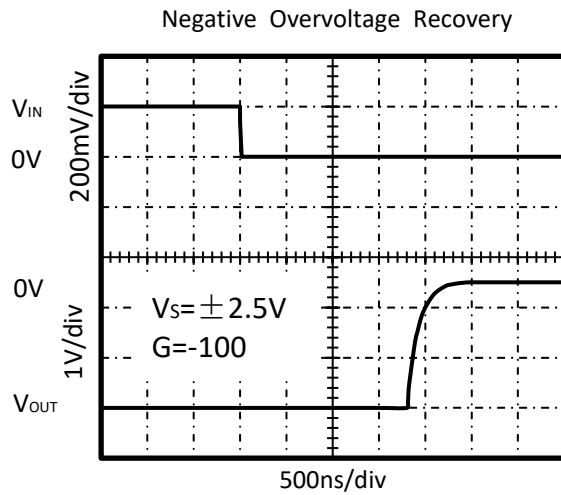
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APPLICATION NOTES

The RS321, RS358, RS324, RS321S, RS358S 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.

RS321S/RS358S ENABLE FUNCTION

The RS321S/RS358S 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 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.

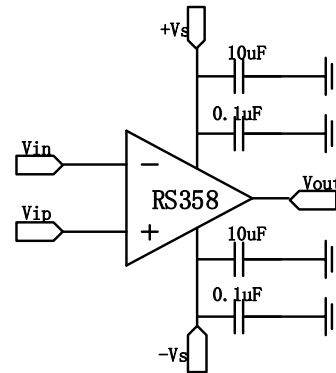


Figure1. Amplifier with Bypass Capacitors

INSTRUMENTATION AMPLIFIER

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

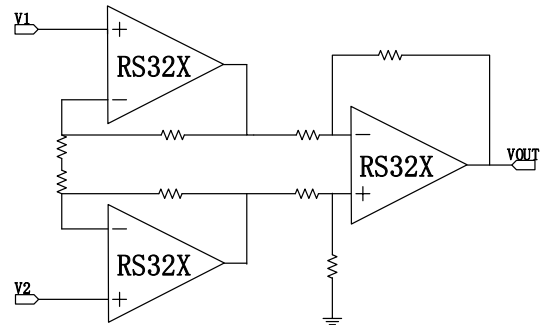
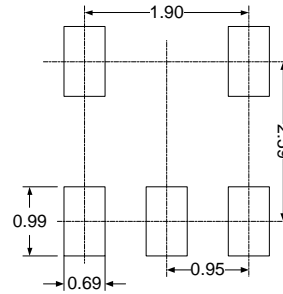
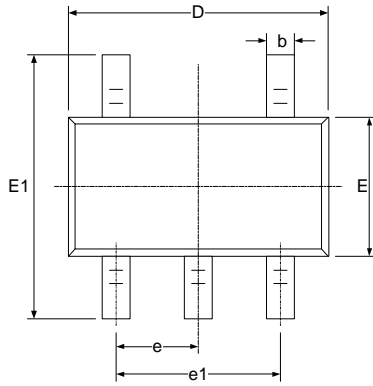
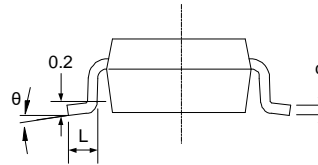
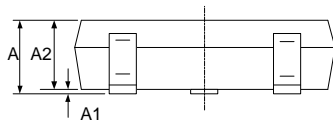


Figure2. Amplifier instrumentation amplifier

PACKAGE OUTLINE DIMENSIONS SOT23-5

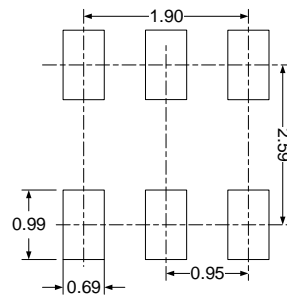
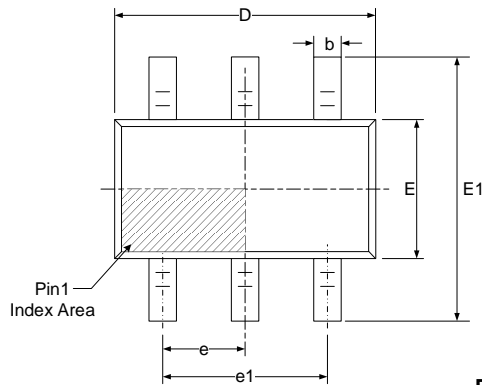


RECOMMENDED LAND PATTERN (Unit: mm)

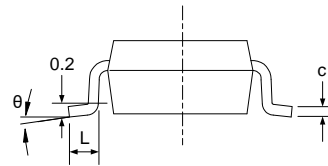
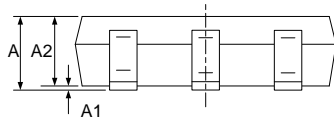


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)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

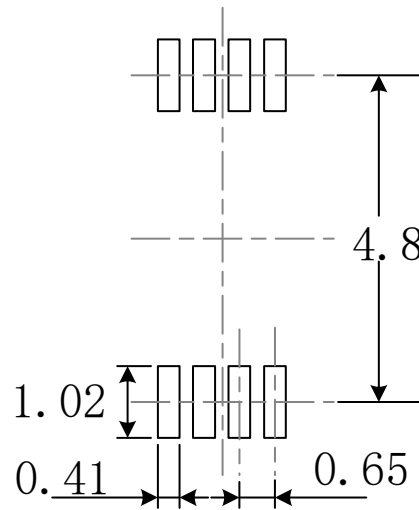
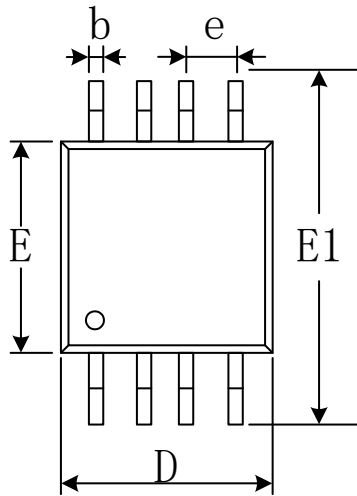


RECOMMENDED LAND PATTERN (Unit: mm)

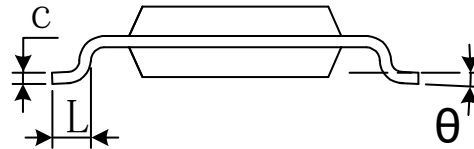
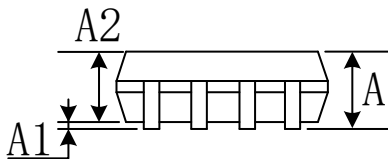


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)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

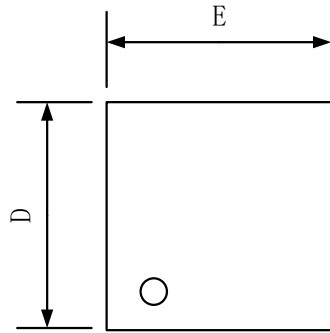


RECOMMENDED LAND PATTERN (Unit: mm)

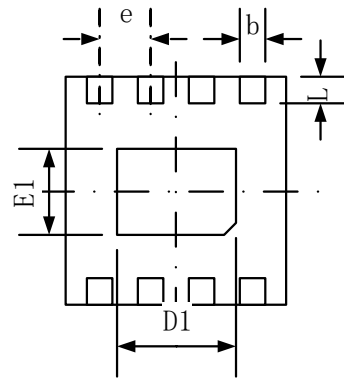


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
e	0.650(BSC)		0.026(BSC)	
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187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

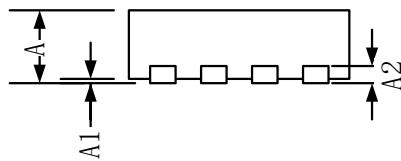
DFN2*2-8L



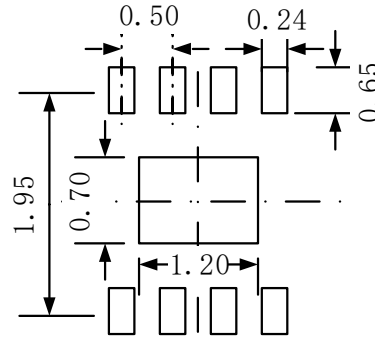
TOP VIEW



BOTTOM VIEW



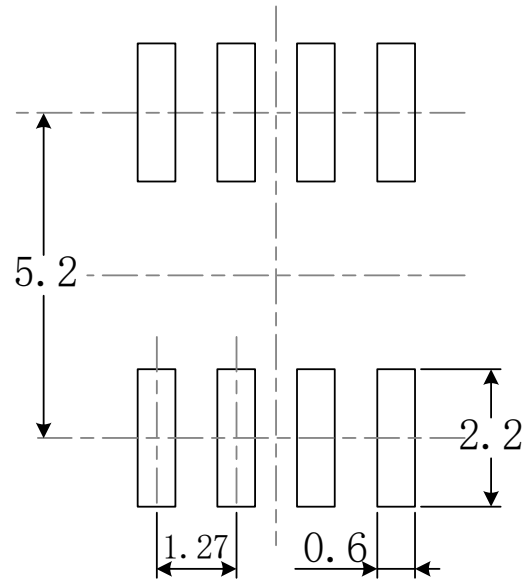
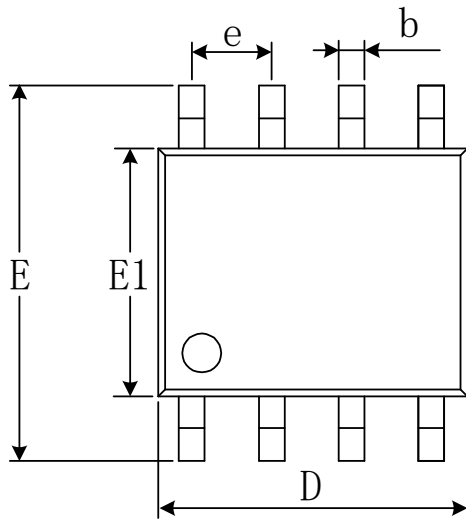
SIDE VIEW



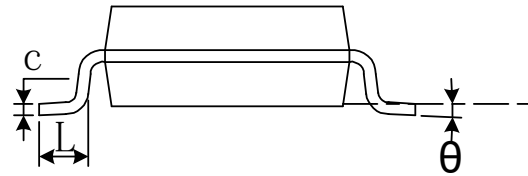
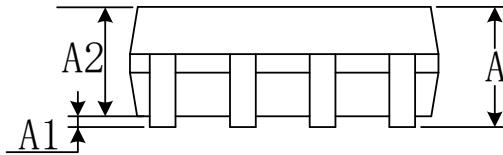
RECOMMENDED LAND
PATTERN (Unit: mm)

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

SOIC-8(SOP8)

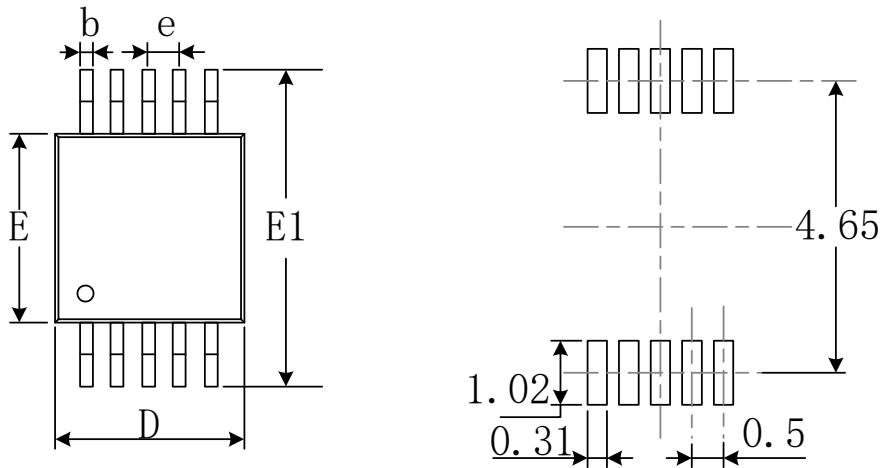


RECOMMENDED LAND PATTERN (Unit: mm)

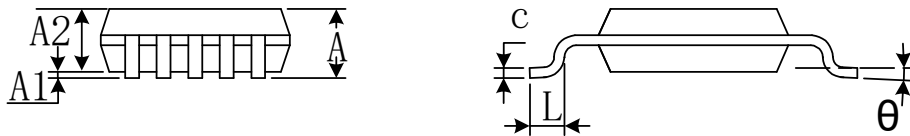


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.800	5.000	0.189	0.197
e	1.270(BSC)		0.050(BSC)	
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150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

MSOP-10

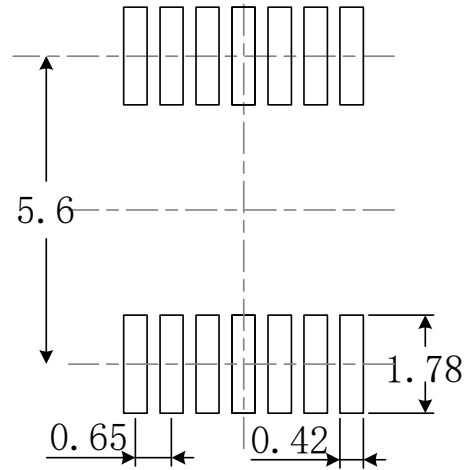
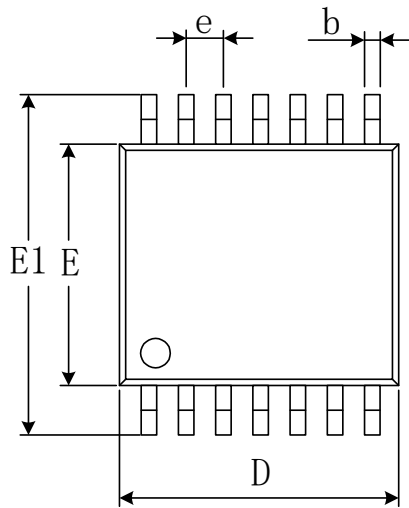


RECOMMENDED LAND PATTERN (Unit: mm)

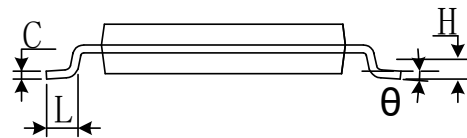
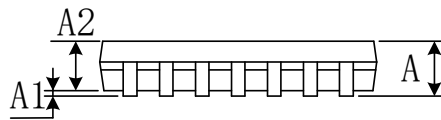


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.180	0.280	0.007	0.011
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
e	0.50(BSC)		0.020(BSC)	
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187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

TSSOP-14

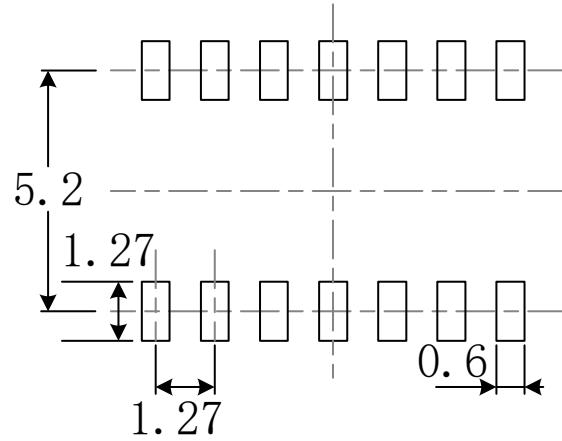
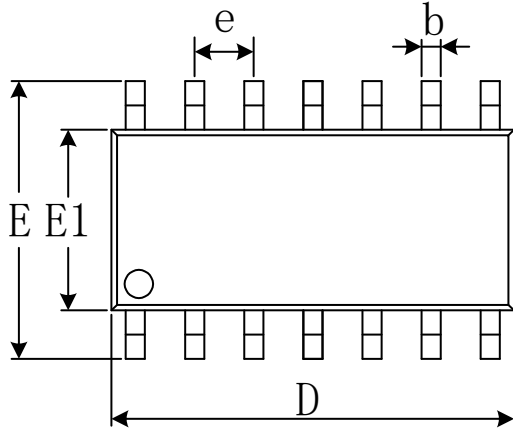


RECOMMENDED LAND PATTERN (Unit: mm)

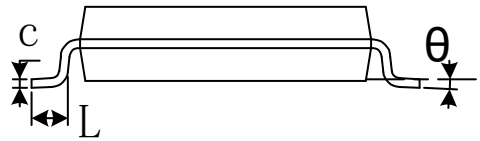
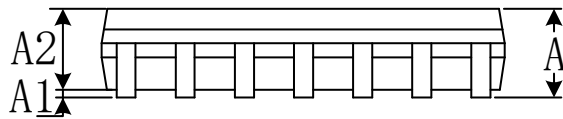


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.860	5.100	0.191	0.201
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650(BSC)		0.026(BSC)	
L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

SOIC-14(SOP14)



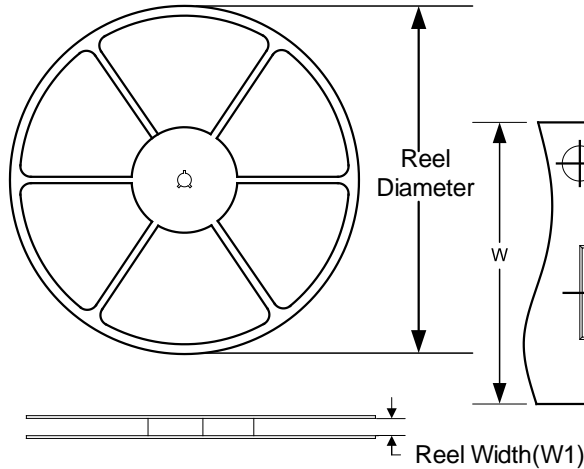
RECOMMENDED LAND PATTERN (Unit: mm)



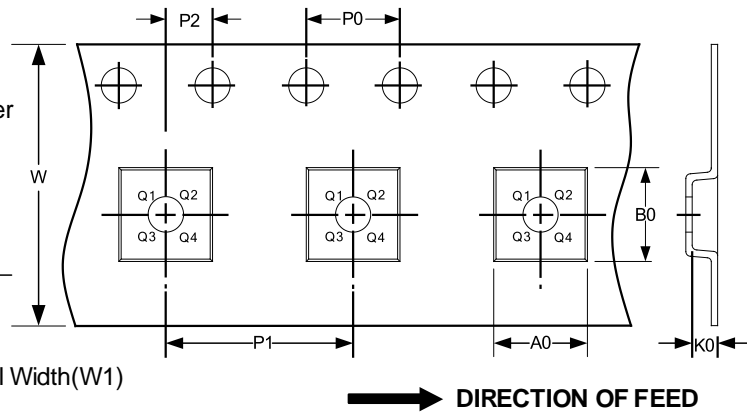
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.310	0.510	0.012	0.020
c	0.100	0.250	0.004	0.010
D	8.450	8.850	0.333	0.348
e	1.270(BSC)		0.050(BSC)	
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150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

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 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOT23-5	7"	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3
SOT23-6	7"	9.5	3.17	3.23	1.37	4.0	4.0	2.0	8.0	Q3
SOIC-8 (SOP8)	13"	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1
MSOP-8	13"	12.4	5.20	3.30	1.50	4.0	8.0	2.0	12.0	Q1
DFN2*2-8L	7"	9.5	2.30	2.30	1.10	4.0	4.0	2.0	8.0	Q2
MSOP-10	13"	12.4	5.20	3.30	1.20	4.0	8.0	2.0	12.0	Q1
SOIC-14 (SOP14)	13"	16.4	6.60	9.30	2.10	4.0	8.0	2.0	16.0	Q1
TSSOP-14	13"	12.4	6.95	5.60	1.20	4.0	8.0	2.0	14.0	Q1