150mA, Ultralow Power Consumption, High Voltage CMOS LDO Regulator

1 FEATURES

- **Ultralow Quiescent Current I_Q:**
  2.5µA Typical at Light Loads
  5µA Maximum at Light Loads
- **150mA Nominal Output Current**
- **Low Dropout Voltage**
- **Low Temperature Coefficient**
- **High Input Voltage (up to 36V)**
- **Output Voltage Accuracy:**
  ±2.5% (Max at 25°C)
  ±1.0% (Class A Max at 25°C)
- **Fixed 3.0 V, 3.3 V, 3.6 V and 5.0 V Output Voltage**
- **Operating Temperature Range:**
  -40°C to +85°C
- **Micro Size Packages: SOT23-3, SOT23, SOT89-3, SOT89-3(L-Type) and SOT-223**

2 APPLICATIONS

- **Audio/Video Equipment**
- **Communication Equipment**
- **Battery-Powered Equipment**
- **Automotive Head Unit**
- **Laptop, Palmtops, Notebook Computers**

3 DESCRIPTIONS

The RS3002 series is a set of low power high voltage regulators implemented in CMOS technology. It can operate from 2.5V to 36V. Which can provide 150mA output current. The device allows input voltage as high as 36V.

The RS3002 series is available in several fixed output voltages. CMOS technology ensures low dropout voltage and ultralow quiescent current.

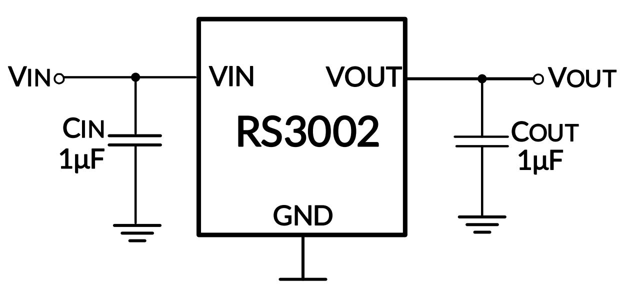
The RS3002 is available in Green SOT23-3, SOT23, SOT89-3, TO-92, SOT23-5 and SOT-223 packages. It operates over an ambient temperature range of -40°C to +85°C.

Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS3002	SOT23-3	1.60mm×2.92mm
	SOT23	1.30mm×2.92mm
	SOT23-5	1.60mm×2.92mm
	SOT89-3	2.45mm×4.50mm
	TO-92	4.60mm×4.60mm
	SOT-223	3.50mm×7.00mm

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

4 TYPICAL APPLICATION SCHEMATIC



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5 REVISION HISTORY

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

VERSION	Change Date	Change Item
A.1	2019/04/13	Initial version completed
A.2	2019/06/08	1) Added 4.36V output voltage 2) Added TO-92 package
A.3	2019/11/01	Added SOT23-5 package
A.4	2020/09/02	Increase the thermal protection temperature to 150°C
B.1	2021/12/10	1) Modify PACKAGE/ORDERING INFORMATION on Page 4 @ A.4 Version. 2) Change SOT23-5, SOT23-3 and SOT89-3 (L-Type) Thermal Information on Page 5 @A.4 Version. 3) Added SOT-223 package
B.2	2022/09/29	Update PACKAGE MARKING on Page 5@RevB.1
B.2.1	2024/03/07	Modify packaging naming
B.3	2024/06/12	1. Add MSL on Page 6@RevB.2.1 2. Add Package thermal impedance on Page 7@RevB.2.1 3. Update PACKAGE note 4. Add RS3002-3.6YF5 ORDERING NUMBER

6 PACKAGE/ORDERING INFORMATION (1)

PRODUCT	ORDERING NUMBER	V_{OUT}(V)	V_{OUT} Accuracy	PACKAGE LEAD	PACKAGE MARKING (2)	MSL (3)	PACKAGE OPTION
RS3002-3.0	RS3002-3.0YF3	3.0	±2.5%	SOT23-3	SD30	MSL3	Tape and Reel, 3000
	RS3002-3.0SYF5	3.0	±2.5%	SOT23-5	SD30S	MSL3	Tape and Reel, 3000
	RS3002-3.0YSF3	3.0	±2.5%	SOT23	SD30	MSL3	Tape and Reel, 3000
	RS3002-3.0YE3	3.0	±2.5%	SOT89-3	SD30	MSL3	Tape and Reel, 1000
	RS3002-3.0YE3L	3.0	±2.5%	SOT89-3 (L-Type)	SD30L	MSL3	Tape and Reel, 1000
RS3002-3.3	RS3002-3.3YF3	3.3	±2.5%	SOT23-3	SD33	MSL3	Tape and Reel, 3000
	RS3002-3.3SYF5	3.3	±2.5%	SOT23-5	SD33S	MSL3	Tape and Reel, 3000
	RS3002-3.3YSF3	3.3	±2.5%	SOT23	SD33	MSL3	Tape and Reel, 3000
	RS3002-3.3YD3	3.3	±2.5%	SOT-223	SD33	MSL3	Tape and Reel, 2500
	RS3002-3.3YE3	3.3	±2.5%	SOT89-3	SD33	MSL3	Tape and Reel, 1000
	RS3002-3.3YE3L	3.3	±2.5%	SOT89-3 (L-Type)	SD33L	MSL3	Tape and Reel, 1000
RS3002-3.6	RS3002-3.6YF3	3.6	±2.5%	SOT23-3	SD36	MSL3	Tape and Reel, 3000
	RS3002-3.6YF5	3.6	±2.5%	SOT23-5	SD36	MSL3	Tape and Reel, 3000
	RS3002-3.6SYF5	3.6	±2.5%	SOT23-5	SD36S	MSL3	Tape and Reel, 3000
	RS3002-3.6YSF3	3.6	±2.5%	SOT23	SD36	MSL3	Tape and Reel, 3000
	RS3002-3.6YE3	3.6	±2.5%	SOT89-3	SD36	MSL3	Tape and Reel, 1000
	RS3002-3.6YE3L	3.6	±2.5%	SOT89-3 (L-Type)	SD36L	MSL3	Tape and Reel, 1000
RS3002-5.0	RS3002-5.0YF3	5.0	±2.5%	SOT23-3	SD50	MSL3	Tape and Reel, 3000
	RS3002-5.0SYF5	5.0	±2.5%	SOT23-5	SD50S	MSL3	Tape and Reel, 3000
	RS3002-5.0YSF3	5.0	±2.5%	SOT23	SD50	MSL3	Tape and Reel, 3000
	RS3002-5.0YE3	5.0	±2.5%	SOT89-3	SD50	MSL3	Tape and Reel, 1000
	RS3002-5.0YE3L	5.0	±2.5%	SOT89-3 (L-Type)	SD50L	MSL3	Tape and Reel, 1000
	RS3002-5.0YD3	5.0	±2.5%	SOT-223	SD50	MSL3	Tape and Reel, 2500
	RS3002-5.0YT3	5.0	±2.5%	TO-92	SD50	MSL3	Tape and Reel, 2000

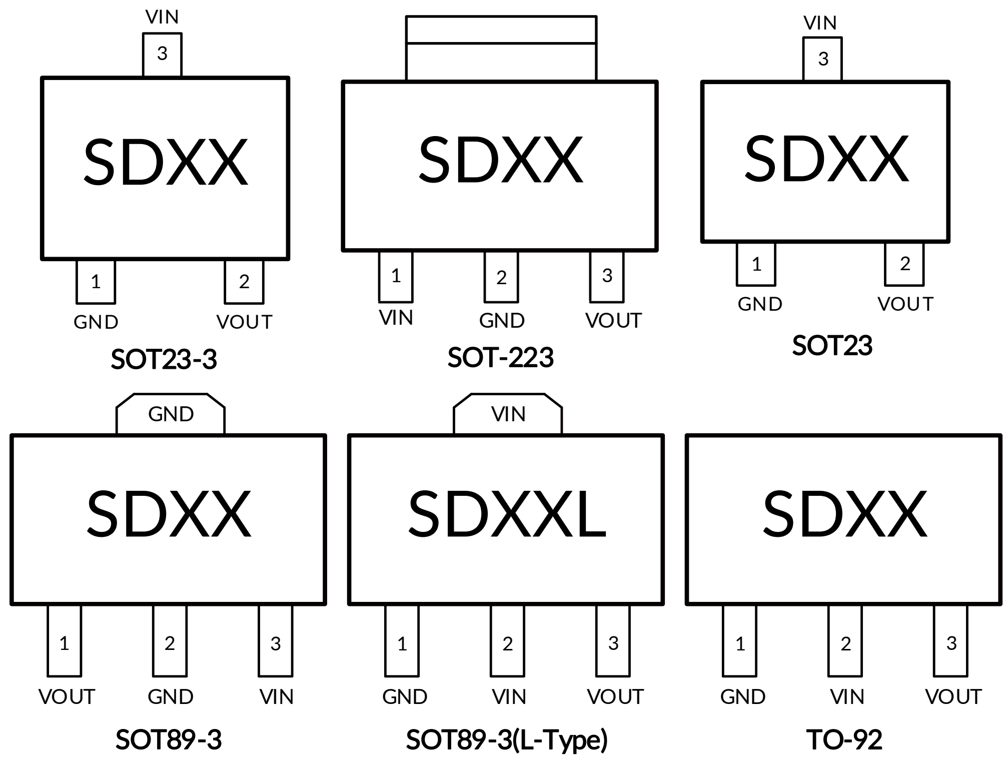
NOTE:

(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) MSL, The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.

7 PIN CONFIGURATION AND FUNCTIONS



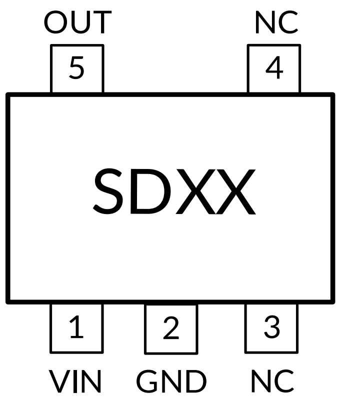
NOTE: XX indicate Output Voltage, xx indicate Date Code
For example: SD33(V_{OUT}=3.3V)

PIN DESCRIPTION

NAME	PIN					FUNCTION
	SOT23-3	SOT23	SOT89-3	SOT89-3 (L-Type)/TO-92	SOT-223	
GND	1	1	2	1	2	Ground.
VOUT	2	2	1	3	3	Regulator Output. Recommended output capacitor range: 1µF to 10µF.
VIN	3	3	3	2	1	Regulator Input. Up to 36V input voltage. At least 1µF supply bypass capacitor is recommended.

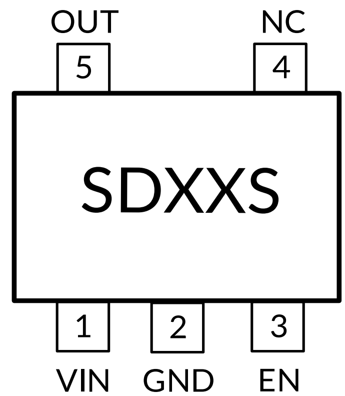
PIN CONFIGURATION AND FUNCTIONS

(TOP VIEW)



SOT23-5

(TOP VIEW)



SOT23-5

PIN DESCRIPTION

SOT23-5			I/O (1)	DESCRIPTION
NAME	**SDXX**	**SDXXS**		
VIN	1	1	I	Regulator Input. Up to 36V input voltage. At least 1µF supply bypass capacitor is recommended.
GND	2	2	G	Ground.
EN	-	3	I	Enable pin. Drive EN greater than V_{EN}(H) to turn on the regulator. Drive EN less than V_{EN}(L) to put the LDO into shutdown mode.
NC	3,4	4	-	Not connect.
OUT	5	5	O	Regulator Output. Recommended output capacitor range: 1µF to 10µF.

(1) I = Input, O = Output, G=Ground.

8 SPECIFICATIONS

8.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) (1) (2)

			MIN	MAX	UNIT
V_{IN}	Input voltage		-0.3	45	V
V_{EN}	Enable input voltage		-0.3	V_{IN}	V
θ_{JA}	Package thermal impedance (3)	SOT23		190	°C/W
		SOT23-3		315	
		SOT23-5		250	
		SOT89-3		75	
		SOT89-3(L-Type)		210	
		SOT-223		85	
		TO-92		145	
T_J	Junction temperature (4)		-40	150	°C
P_D	Continuous power dissipation (5)		Internally Limited		W
T_{stg}	Storage temperature		-65	150	°C

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) All voltages are with respect to the GND pin.
(3) The package thermal impedance is calculated in accordance with JESD-51.
(4) 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.
(5) Internal thermal shutdown circuitry protects the device from permanent damage.

8.2 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), per ANSI/ESDA/JEDEC JS-001 (1)	±1000	V
		Machine Model (MM)	±100	V

(1) JEDEC document JEP155 states that 500 V HBM allows safe manufacturing with a standard ESD control process.

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.

8.3 Recommended Operating Conditions

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

		MIN	MAX	UNIT
V_{IN}	Input supply voltage	2.5	36	V
V_{EN}	Enable voltage	0	36	V
T_A	Operating temperature	-40	+85	°C

(1) All voltages are with respect to the GND pin.

8.4 Electrical Characteristics

(V_{IN} = V_{OUT} + 2V, C_{IN} = C_{OUT} = 1µF, V_{OUT} = 3.3V, Full = -40°C to +85°C, typical values are at T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN (2)	TYP (3)	MAX (2)	UNITS
Input Voltage	V_{IN}	V_{OUT} = 3.3V		+25°C	2.5 (1)		36	V
Output Voltage Accuracy		I_{OUT} = 1mA		+25°C	-2.5	0	2.5	%
		I_{OUT} = 1mA, Class A		+25°C	-1.0	0	1.0	%
Ground Pin Current		No load	V_{IN} = V_{OUT} + 2V	+25°C		2.5	5	µA
			V_{IN} = 36V			5.0	8	
		I_{OUT} = 50mA				2.5		
Maximum Output Current (4)				+25°C	150			mA
Dropout Voltage (5)	V_{DROP}	I_{OUT} = 150mA		+25°C		1200	1800	mV
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	V_{IN} = V_{OUT} + 2V to 36V, I_{OUT} = 1mA		+25°C		0.001	0.012	%/V
Load Regulation	ΔV_{OUT}	V_{IN} =V_{OUT}+2V, I_{OUT} = 1mA to150mA		+25°C		11	20	mV
Power Supply Rejection Ratio	PSRR	V_{OUT} = 3.3V, I_{OUT} = 10mA	f = 217Hz	+25°C		57		dB
			f = 1KHz			54		
Output Voltage Temperature Coefficient (6)	$\frac{\Delta V_{OUT}}{\Delta T_A \times V_{OUT}}$	I_{OUT} = 1mA		FULL		70		ppm/°C
THERMAL PROTECTION								
Thermal Shutdown Temperature	T_{SHDN}					150		°C
SHUTDOWN								
EN Voltage Range	V_{EN}			FULL	-0.3		V_{IN}+0.3	V
EN Input Threshold	V_{IH}	V_{IN} = V_{OUT} + 2V to 36V		FULL	1.1			V
	V_{IL}	V_{IN} = V_{OUT} + 2V to 36V		FULL			0.4	
EN Input Bias Current	I_{BH}	EN=36V		+25°C		0.01	1	µA
	I_{BL}	EN=0V		FULL		0.01	1	
Shutdown Supply Current	$I_{Q(SHDN)}$	EN=0V		FULL		1.0	2	µA
Start-Up Time (7)	t_{STR}	C_{OUT} = 1µF, No Load		+25°C		230		µs

NOTES:
(1) V_{IN} = $V_{OUT\ (NOMINAL)}$ or 2.5V, whichever is greater.
(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) Maximum output current is affected by the PCB layout, size of metal trace, the thermal conduction path between metal layers, ambient temperature and the other environment factors of system. Attention should be paid to the dropout voltage when $V_{IN} < V_{OUT} + V_{DROP}$.
(5) The dropout voltage is defined as V_{IN} - V_{OUT}, when V_{OUT} is 100mV below the value of V_{OUT} for V_{IN} = $V_{OUT\ (NOMINAL)}$ + 2V.
(6) Output voltage temperature coefficient is defined as the worst-case voltage change divided by the total temperature range.
(7) Time needed for V_{OUT} to reach 90% of final value.

Electrical Characteristics

(V_{IN} = V_{OUT} + 2V, C_{IN} = C_{OUT} = 1μF, V_{OUT} = 5.0V, Full = -40°C to +85°C, typical values are at T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN[(2)]	TYP[(3)]	MAX[(2)]	UNITS
Input Voltage	V_{IN}	V_{OUT} = 5.0V	+25°C	2.5[(1)]		36	V
Output Voltage Accuracy		I_{OUT} = 1mA	+25°C	-2.5	0	2.5	%
		I_{OUT} = 1mA, Class A	+25°C	-1.0	0	1.0	%
Ground Pin Current		No load, V_{IN} = V_{OUT} + 2V	+25°C		2.5	5	μA
		No load, V_{IN} = 36V			5.0	8	
		I_{OUT} = 50mA			2.5		
Maximum Output Current [(4)]			+25°C	150			mA
Dropout Voltage [(5)]	V_{DROP}	I_{OUT} = 150mA	+25°C		1000	1600	mV
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	V_{IN} = V_{OUT} + 2V to 36V, I_{OUT} = 1mA	+25°C		0.001	0.012	%/V
Load Regulation	ΔV_{OUT}	V_{IN} =V_{OUT}+2V, I_{OUT} = 1mA to150mA	+25°C		11	20	mV
Power Supply Rejection Ratio	PSRR	V_{OUT} = 5.0V, I_{OUT} = 10mA, f = 217Hz	+25°C		57		dB
		V_{OUT} = 5.0V, I_{OUT} = 10mA, f = 1KHz			54		
Output Voltage Temperature Coefficient [(6)]	$\frac{\Delta V_{OUT}}{\Delta T_A \times V_{OUT}}$	I_{OUT} = 1mA	FULL		70		ppm/°C
THERMAL PROTECTION							
Thermal Shutdown Temperature	T_{SHDN}				150		°C
SHUTDOWN							
EN Voltage Range	V_{EN}		FULL	-0.3		V_{IN}+0.3	V
EN Input Threshold	V_{IH}	V_{IN} = V_{OUT} + 2V to 36V	FULL	1.1			V
	V_{IL}	V_{IN} = V_{OUT} + 2V to 36V	FULL			0.4	
EN Input Bias Current	I_{BH}	EN=36V	+25°C		0.01	1	μA
	I_{BL}	EN=0V	FULL		0.01	1	
Shutdown Supply Current	$I_{Q(SHDN)}$	EN=0V	FULL		1.0	2	μA
Start-Up Time [(7)]	t_{STR}	C_{OUT} = 1μF, No Load	+25°C		230		μs

NOTES:
(1) V_{IN} = $V_{OUT (NOMINAL)}$ or 2.5V, whichever is greater.
(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) Maximum output current is affected by the PCB layout, size of metal trace, the thermal conduction path between metal layers, ambient temperature and the other environment factors of system. Attention should be paid to the dropout voltage when V_{IN} < V_{OUT} + V_{DROP}.
(5) The dropout voltage is defined as V_{IN} - V_{OUT}, when V_{OUT} is 100mV below the value of V_{OUT} for V_{IN} = $V_{OUT (NOMINAL)}$ + 2V.
(6) Output voltage temperature coefficient is defined as the worst-case voltage change divided by the total temperature range.
(7) Time needed for V_{OUT} to reach 90% of final value.

8.5 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.

V_{IN} = 5.3V, V_{OUT} = 3.3V, C_{IN} = C_{OUT} = 1µF, T_A = 25°C unless otherwise noted.

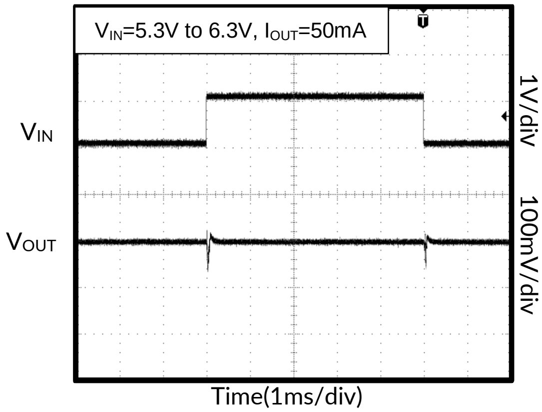


Figure 1. Line-Transient Response

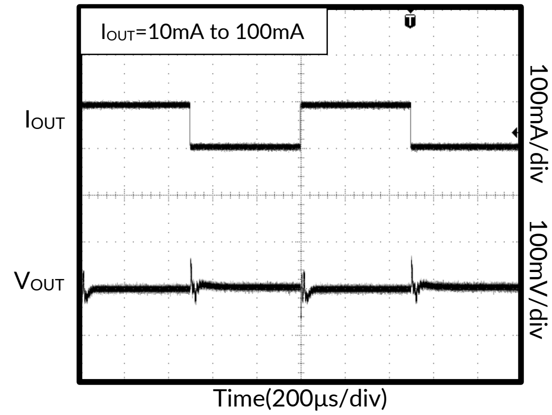


Figure 2. Load-Transient Response

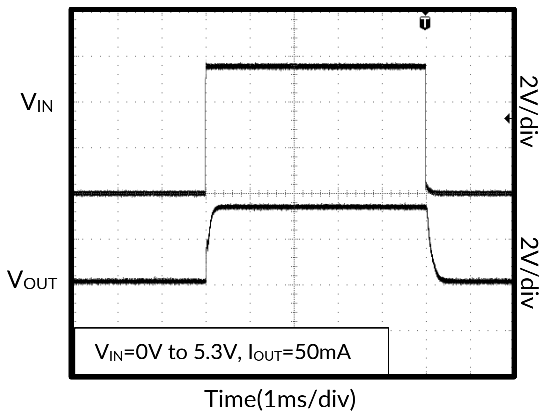


Figure 3. Power-Up/Power-Down Output Waveform

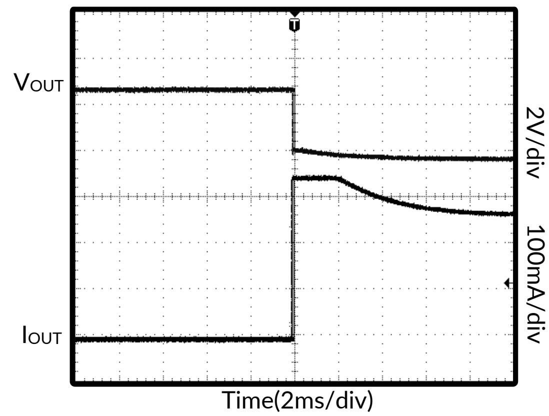


Figure 4. Output Short Waveform

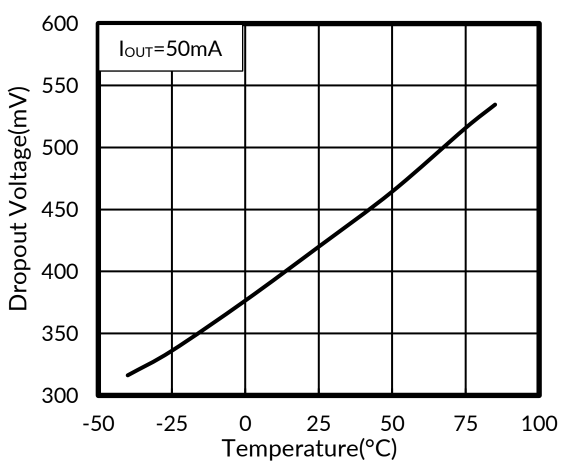


Figure 5. Dropout Voltage vs Temperature

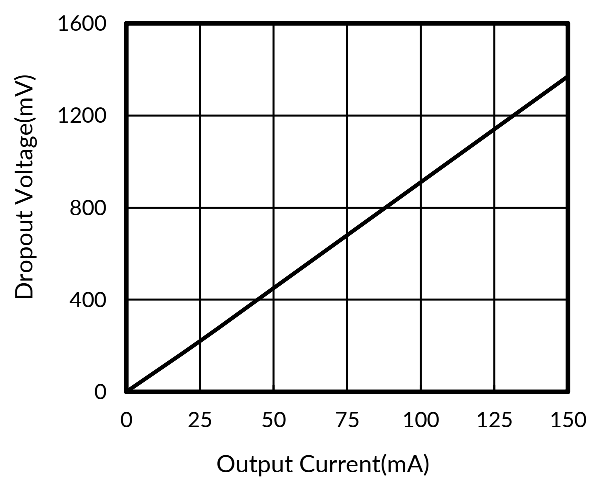


Figure 6. Dropout Voltage vs Output Current

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.

V_{IN} = 5.3V, V_{OUT} = 3.3V, C_{IN} = C_{OUT} = 1µF, T_A = 25°C unless otherwise noted.

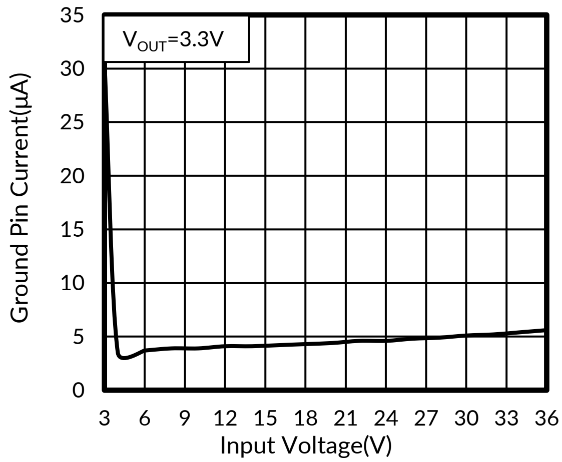


Figure 7. Ground Pin Current vs Input Voltage

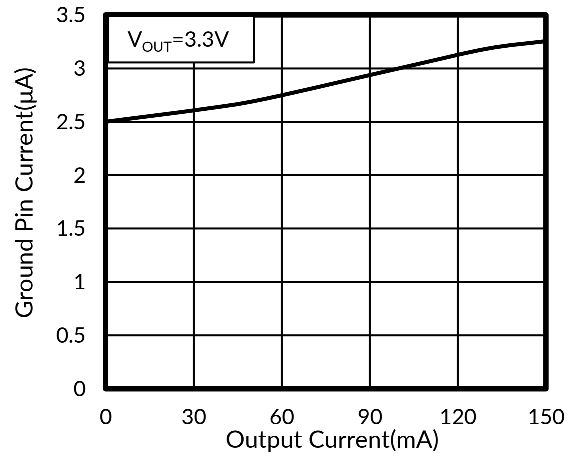


Figure 8. Ground Pin Current vs Load Current

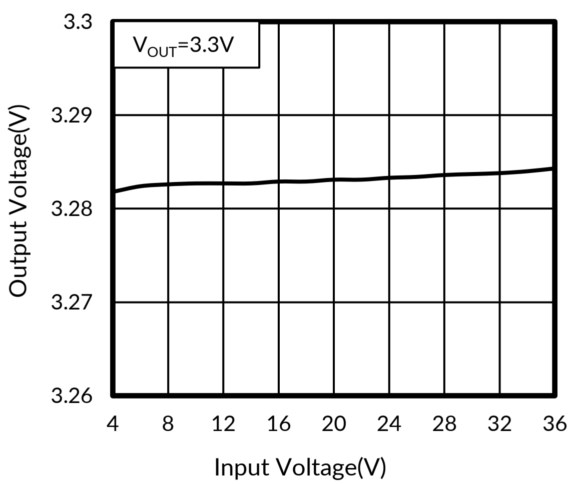


Figure 9. Line Regulation

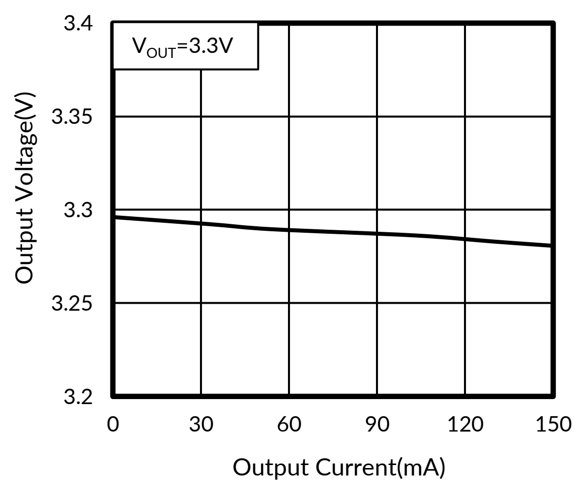


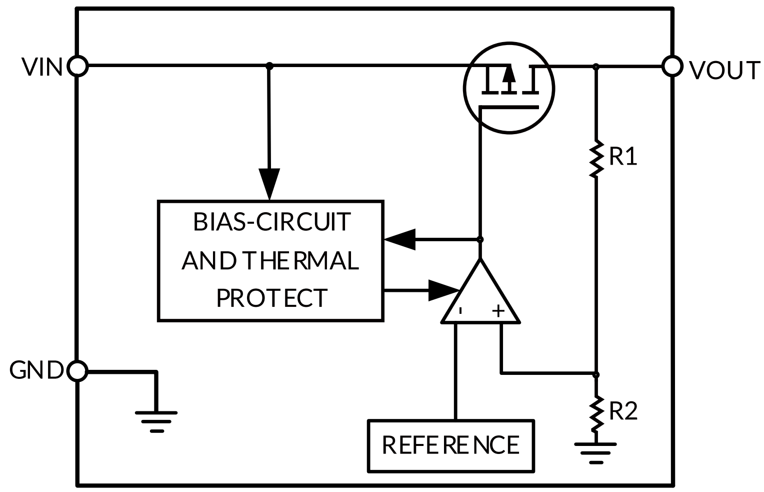
Figure 10. Load Regulation

9 DETAILED DESCRIPTION

9.1 Overview

The RS3002 low-dropout regulators (LDO) consumes only 2.5 µA of quiescent current at light load and delivers excellent line and load transient performance. These characteristics, combined with low noise and good PSRR with low dropout voltage, make this device ideal for portable consumer applications.

9.2 Functional Block Diagram



9.3 Thermal Considerations

When the junction temperature is too high, the thermal protection circuitry sends a signal to the control logic that will shut down the IC. The IC will restart when the temperature has sufficiently cooled down. The maximum power dissipation is dependent on the thermal resistance of the case and the circuit board, the temperature difference between the die junction and the ambient air, and the rate of air flow. The GND pin must be connected to the ground plane for proper dissipation.

9.4 Operation with V_{IN} Lower Than 2.5V

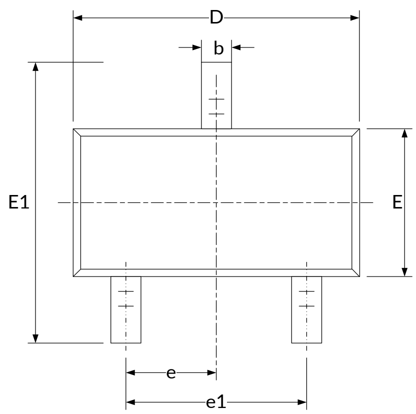
The device normally operates with input voltages above 2.5V. At input voltages below the 2.5V, the device does not operate.

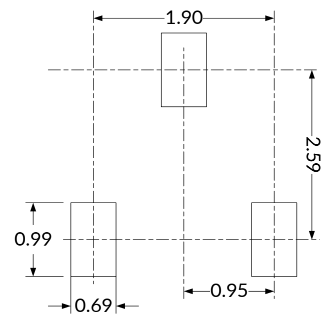
9.5 Operation with V_{IN} Larger Than 2.5V

When V_{IN} is greater than 2.5V, if V_{IN} is also higher than the output set value plus the device dropout voltage, V_{OUT} is equal to the set value. Otherwise, V_{OUT} is equal to V_{IN} minus the dropout voltage.

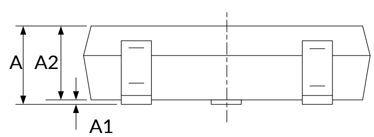
10 PACKAGE OUTLINE DIMENSIONS

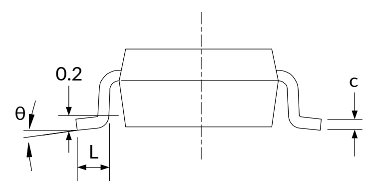
SOT23-3 (3)





RECOMMENDED LAND PATTERN (Unit: mm)

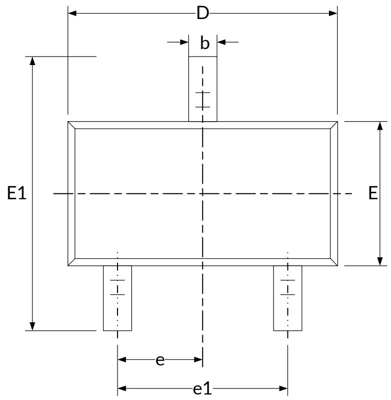


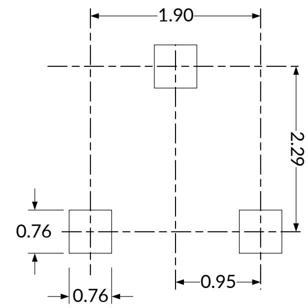


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D (1)	2.820	3.020	0.111	0.119
E (1)	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC) (2)		0.037(BSC) (2)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

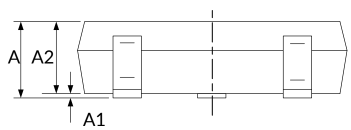
NOTE:
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

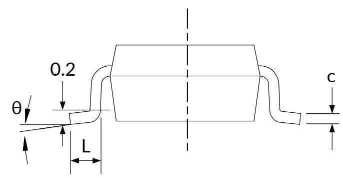
SOT23 (3)





RECOMMENDED LAND PATTERN (Unit: mm)

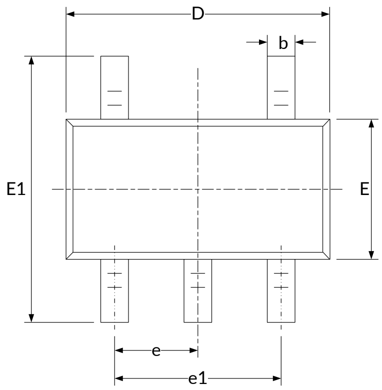


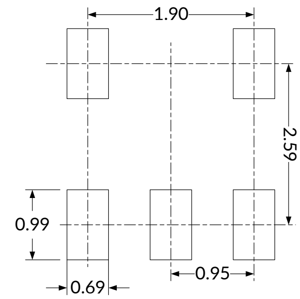


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D (1)	2.800	3.000	0.110	0.118
E (1)	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950(BSC) (2)		0.037(BSC) (2)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°

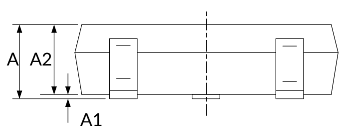
NOTE:
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

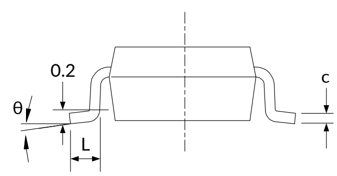
SOT23-5 (3)





RECOMMENDED LAND PATTERN (Unit: mm)



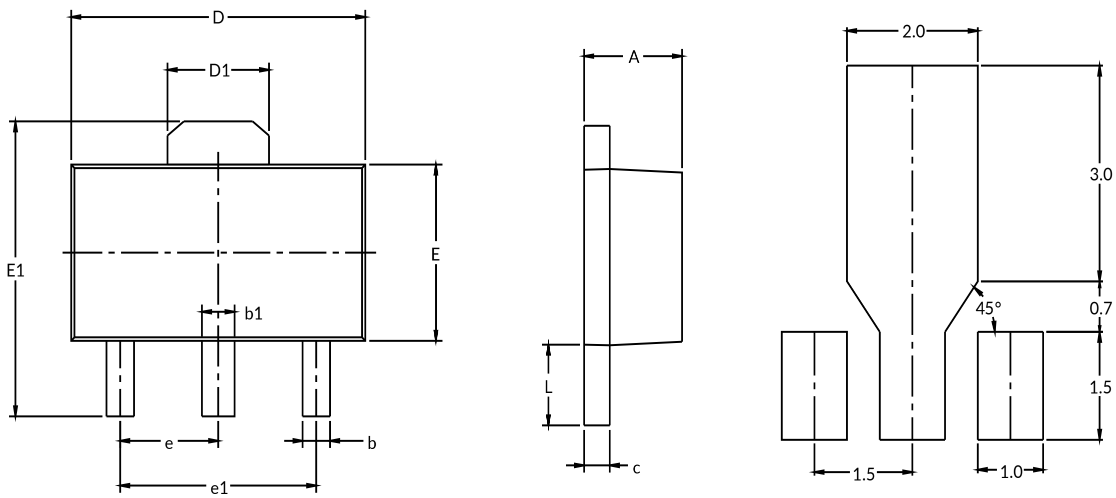


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D (1)	2.820	3.020	0.111	0.119
E (1)	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC) (2)		0.037(BSC) (2)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
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.

SOT89-3 (4)

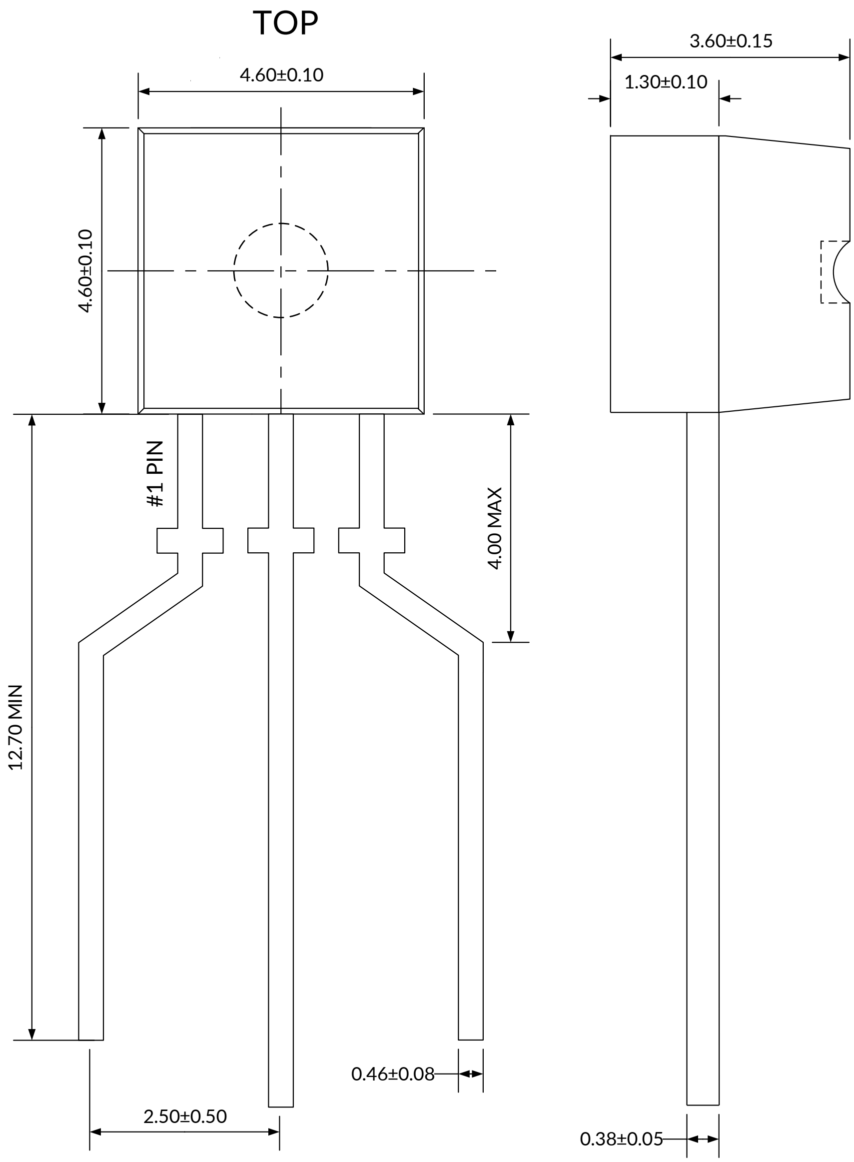


RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D (1)	4.400	4.600	0.173	0.181
D1	1.550 REF (2)		0.061 REF (2)	
E (1)	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 BSC (3)		0.060 BSC (3)	
e1	3.000 BSC (3)		0.118 BSC (3)	
L	0.900	1.200	0.035	0.047

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

TO-92 (1)

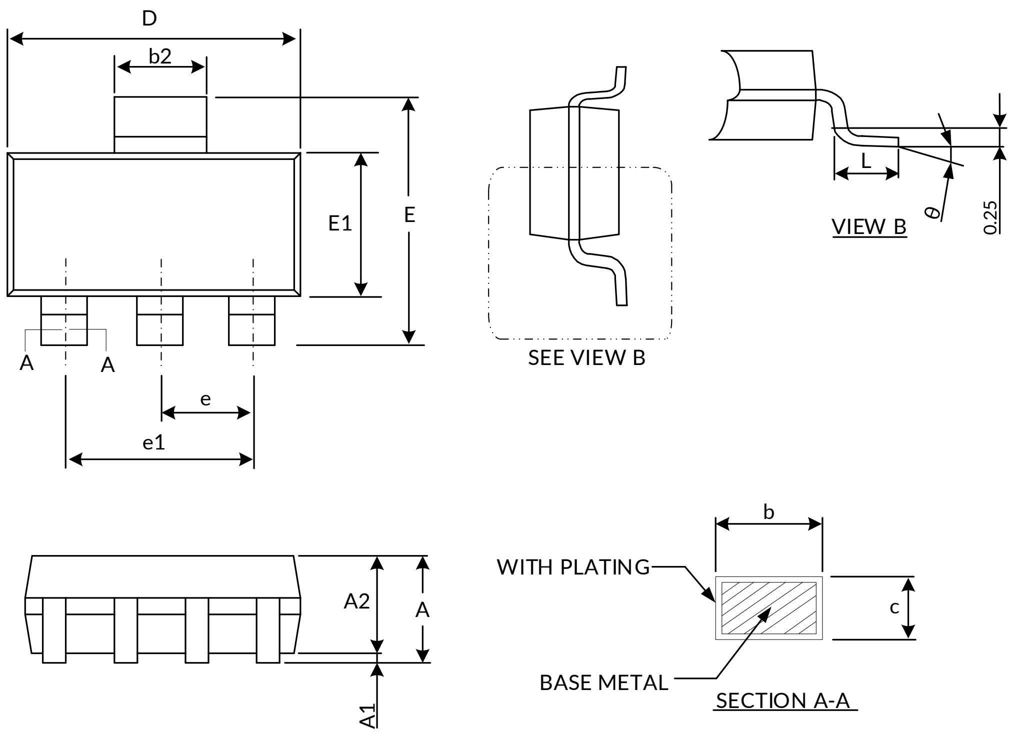


RECOMMENDED LAND PATTERN (Unit: mm)

NOTE:

1. This drawing is subject to change without notice.

SOT-223 (3)

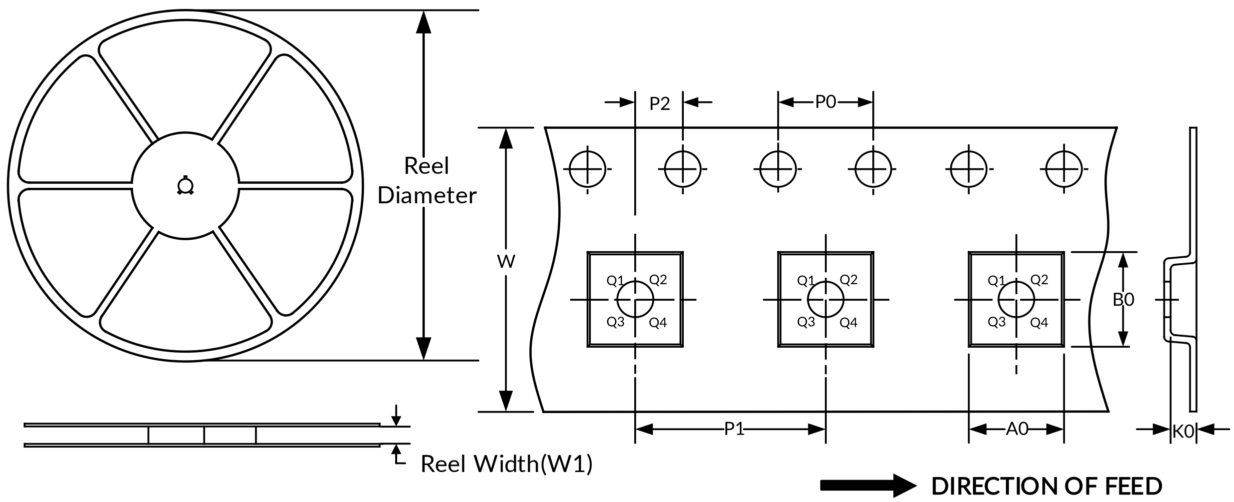


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	-	1.800	-	0.071
A1	0.020	0.100	0.001	0.004
A2	1.550	1.650	0.061	0.065
b	0.660	0.840	0.026	0.033
b2	2.900	3.100	0.114	0.122
c	0.230	0.330	0.009	0.013
D (1)	6.300	6.700	0.248	0.263
E	6.700	7.300	0.263	0.287
E1 (1)	3.300	3.700	0.130	0.145
e	2.300 BSC (2)		0.090 BSC (2)	
e1	4.600 BSC (2)		0.181 BSC (2)	
L	0.900	-	0.035	-

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.

11 TAPE AND REEL INFORMATION

REEL DIMENSIONS   TAPE DIMENSION



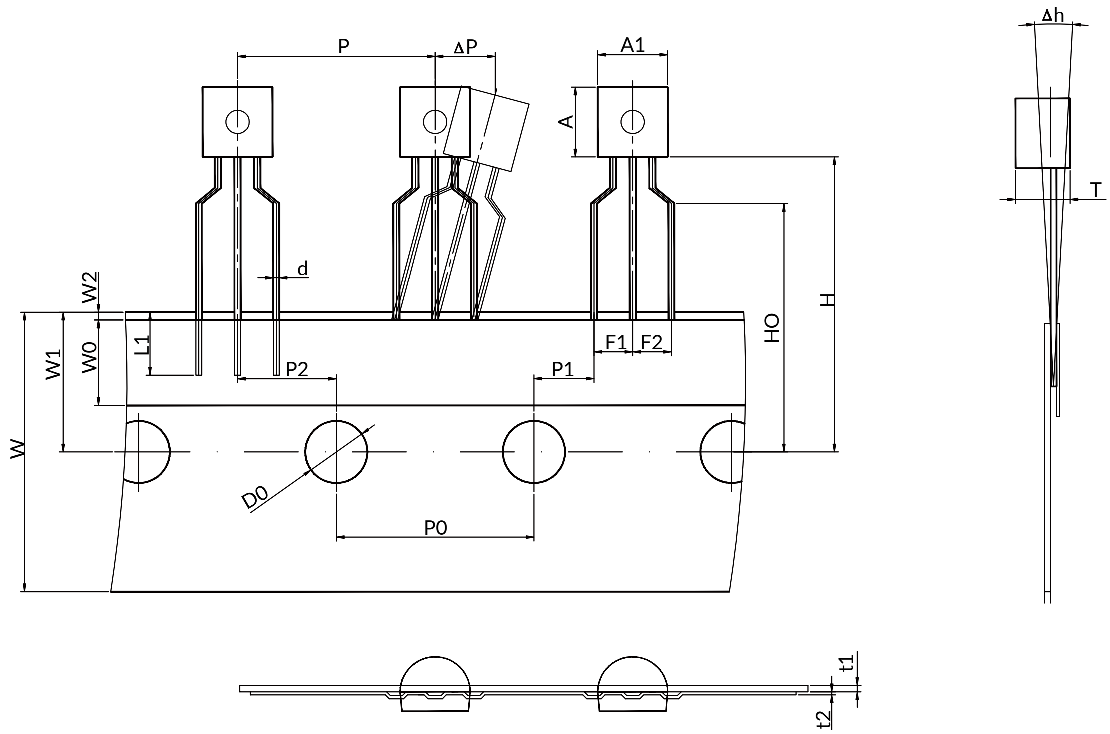
NOTE: The picture is only for reference. Please make the object as the standard.

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
SOT23-3	7"	9.0	3.20	3.30	1.30	4.0	4.0	2.0	8.0	Q3
SOT23	7"	9.5	3.15	2.77	1.22	4.0	4.0	2.0	8.0	Q3
SOT23-5	7"	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3
SOT89-3	7"	13.2	4.85	4.45	1.85	4.0	8.0	2.0	12.0	Q3
SOT-223	13"	12.4	6.765	7.335	1.88	4.0	8.0	2.0	12.0	Q3

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

TAPE AND REEL INFORMATION (Continued)



TO-92

Item	Symbol	Value and Tolerance (Unit: mm)
Body width	A1	4.5 ± 0.2
Body height	A	4.5 ± 0.2
Body thickness	T	3.5 ± 0.1
Lead wire diameter	d	0.46 +0.09, -0.08
Pitch of component	P	12.7 ± 0.3
Feed hole pitch	P0	12.7 ± 0.2
Hole center to component center	P2	6.35 ± 0.3
Lead to lead distance	F1, F2	2.5 ± 0.3
Component alignment, F-R	Δh	0 ± 1.0
Type width	W	18.0 + 1.0, - 0.5
Hole down tape width	W0	6.0 ± 0.5
Hole position	W1	9.0 ± 0.5
Hole down tape position	W2	1.0 MAX
Height of component from tape center	H	19.0+2.0, -1.0
Lead wire clinch height	H0	16.0 ± 0.5
Lead wire (tape portion)	L1	2.5 MIN
Feed hole diameter	D0	4.0 ± 0.2
Carrier Tape Thickness	t1	0.4 ± 0.05
Taped Lead Thickness	t2	0.2 ± 0.05
Position of hole	P1	3.85 ± 0.3
Component alignment	ΔP	0 ± 1.0

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