

SUL62029 400mA Ultra Low Noise, High PSRR LDO for RF Analog Circuits

General Description

The SUL62029 is a LDO with ultra-low noise, high PSRR, low dropout with low quiescent current. It has 400mA output current capability.

The device is designed to work with 1 μ F input and output ceramic capacitor, and can operate in a wide input voltage range from 1.6V to 5.5V. It is very suitable for noise-sensitive, low power consumption requirement and space limited applications.

The SUL62029 features OCP function thermal shutdown mode to protect itself during system abnormal situation.

The SUL62029 is available in WLCSP-4B(0.67mm x 0.67mm), SOT23-5, and DFN1x1-4 package.

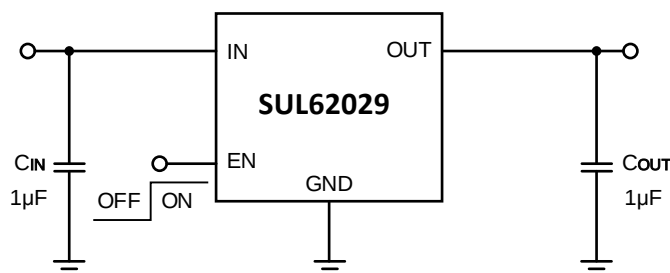
Features

- Input Voltage Range: 1.6V ~ 5.5V
- Fixed Output Voltage: 0.9V ~ 5.0V
- Ultra High PSRR: 93dB@1KHz
- Ultra-Low Noise: 8 μ VRMS
- Low Quiescent Current: 15 μ A
- Low Dropout: 300mV@400mA, when $V_{OUT}=1.8V$
- Over Current protection
- Output Discharge
- Thermal Shutdown
- Integrated Soft-Start Function

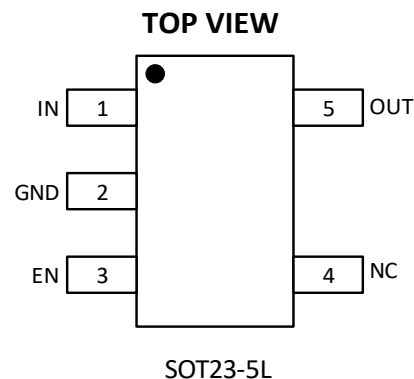
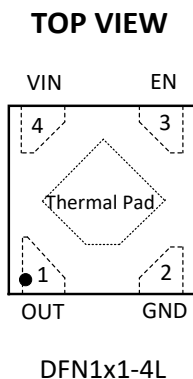
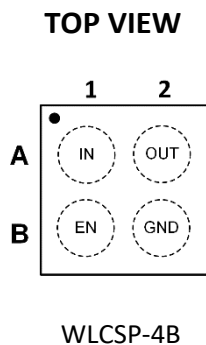
Applications

- Camera Power
- Wireless device Power
- Smartphone, Wearable device
- Noise sensitive device Power

Typical Application Circuit



Pin Configurations



Pin Descriptions

WLCSP-4B	DFN1x1-4	SOT23-5	Name	Description
A1	4	1	IN	Power Input
A2	1	5	OUT	Power Output
B1	3	3	EN	Enable control. Device is active when EN=1
B2	2	2	GND	Ground Connection
-	-	4	NC	Not Connected
-	Thermal Pad	-	NC	Thermal Pad, Connect to GND

Ordering Information

PART NO	Package	V _{OUT} DISCHARGE	TAPE & REEL
SUL62029D4-XX	DFN1x1-4L	Yes	3000/REEL
SUL62029B4-XX	WLCSP-4B	Yes	5000/REEL
SUL62029S5-XX	SOT23-5L	Yes	3000/REEL

Note: "XX" stands for output voltages. For example, 28 means product outputs 2.8V.

SUL62029 devices are Pb-free and RoHS compliant.

Absolute Maximum Ratings (Note 1)

Symbol	Parameter	Min.	Max.	Unit
V _{IN}	IN to GND	-0.3	6	V
V _{OUT}	OUT to GND	-0.3	6	V
V _{EN}	EN to GND	-0.3	6	V
P _D	Total Power Dissipation at T _A = 25°C	SOT23-5	0.5	W
		WLCSP-4B	0.4	W
		DFN1X1-4	0.4	W
T _{STG}	Storage Temperature Range	-65	+150	°C
T _J	Maximum Junction Temperature		+150	°C

Note (1): Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

ESD Ratings

Symbol	Parameter	Value	Unit
ESD	Human Body Model, ANSI/ESDA/JEDEC JS-001-2012	2	kV
	Charged Device Model, JESD22-C101	1	kV

Recommended Operating Conditions (Note 2)

Parameters	Min.	Max.	Unit
Input Voltage: V _{IN}	1.7	5.5	V
Operating Junction Temperature Range	-40	125	°C
Output Current		400	mA

Note (2): The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance.

Electrical Characteristics

$V_{IN} = V_{SET} + 1V$, $I_{OUT} = 1mA$, $T_A = -40^{\circ}C \sim 85^{\circ}C$, unless otherwise noted. Typical value at $T_A = +25^{\circ}C$ and $V_{SET} = 3.3V$, $C_{IN} = C_{OUT} = 1\mu F$.

Parameter	Symbol	Test Conditions		Min.	Typ.	Max.	Unit
Input Voltage Range ^(Note 3)	V_{IN}			1.6		5.5	V
EN Logic Voltage ^(Note 4)	V_{ENH}			1.1		5	V
	V_{ENL}					0.3	
EN Pull Down Resistor	R_{ENPD}	$V_{EN} = 5V$			10		M Ω
Output Discharge Resistor	R_{DIS}				150		Ω
Thermal Shutdown Threshold	T_{SD}				150		$^{\circ}C$
Thermal Hysteresis	T_{HYS}				20		$^{\circ}C$
Output Current	I_{OUT}			400			mA
UVLO Threshold	V_{UVLO}	V_{IN} rising			1.5		V
UVLO Hysteresis	V_{UVLO_HYS}				100		mV
Input Quiescent Current	I_Q	$I_{OUT} = 0$			15	20	μA
Shut Down Current	I_{SHUT}	$EN = 0$, $V_{IN} = 5V$			0.21	1.2	μA
Output Voltage Accuracy	A_{OUT}	$I_{OUT} = 0 \sim 400mA$, All V_{SET}		-2		2	%
Dropout Voltage ^(Note 5)	V_{DO}	$V_{SET} = 1.8V$, $I_{OUT} = 400mA$				300	mV
Line Regulation	LineRe	$V_{IN} = V_{SET} + 1V \sim 5V$, $\Delta V_{IN} = 1V$, $I_{OUT} = 200mA$.			0.02		%/V
Load Regulation	LoadRe	$I_{OUT} = 1mA$ to $400mA$			0.001		%/mA
Output Current Limit	I_{LIM}	$V_{OUT} = 0.9 * V_{SET}$		500	625		mA
Short circuit current	I_{SC}	$V_{OUT} = 0$			70		mA
Power Supply Rejection Ration	PSRR	$I_{OUT} = 20mA$, $V_{SET} = 3.3V$	$f = 1KHz$		93		dB
			$f = 10KHz$		84		
			$f = 100KHz$		65		
			$f = 2MHz$		51		
Output Voltage Noise	V_{NOISE}	BW = 10Hz to 100KHz, $I_{OUT} = 20mA$			8		μV_{RMS}

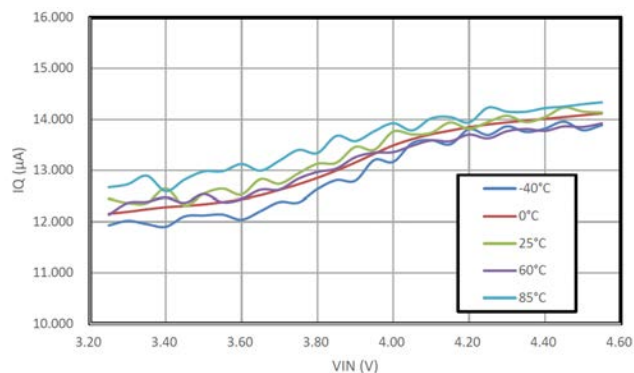
Note (3): Output current capability is 270mA when $1.6V \leq V_{IN} < 1.7V$, is 360mA when $1.7V \leq V_{IN} < 1.75V$. And the device has full function when $V_{IN} \geq 1.75V$

Note (4): If the voltage that applied on EN pin higher than 5V, need add one 2Mohm in series.

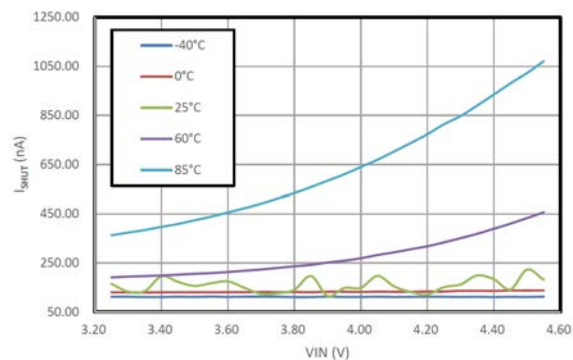
Note (5): Guarantee by design. Not test on ATE.

Typical Performance Characteristics

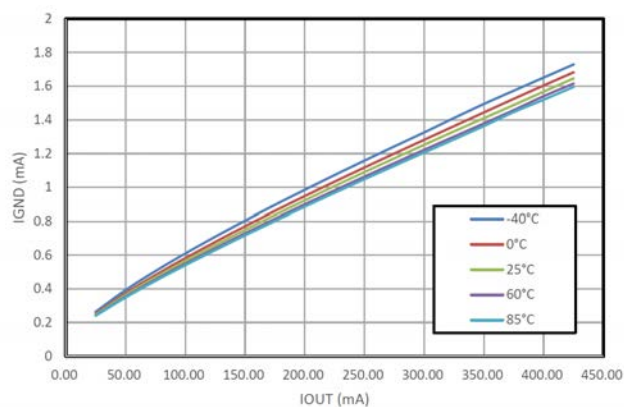
I_Q vs V_{IN} ($V_{SET} = 3.3V$)



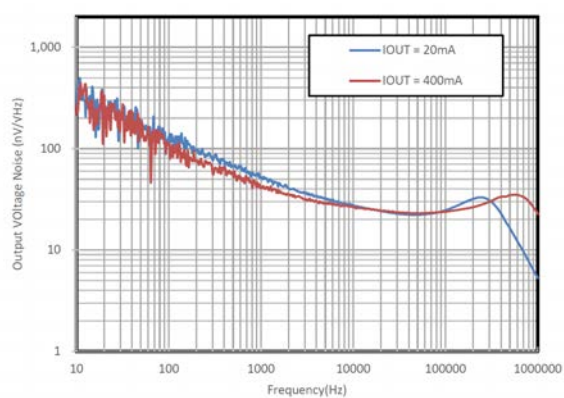
I_{SHUT} vs V_{IN} ($V_{SET} = 3.3V$)



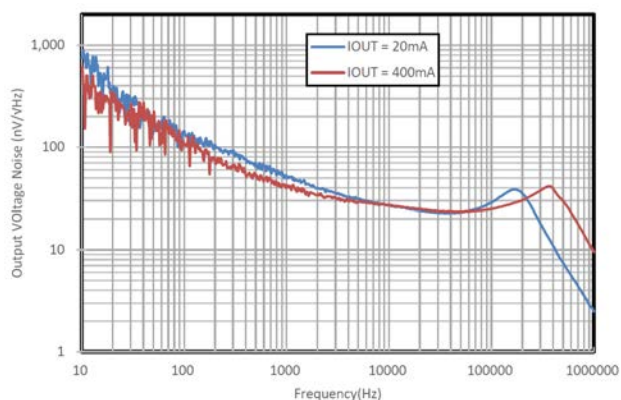
I_{GND} vs I_{OUT}



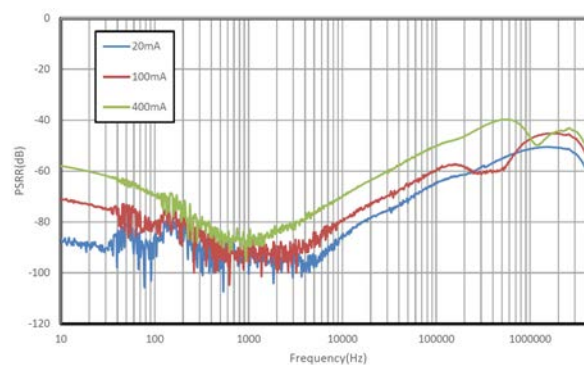
Noise vs Frequency ($C_{OUT} = 1\mu F$)



Noise vs Frequency ($C_{OUT} = 2.2\mu F$)

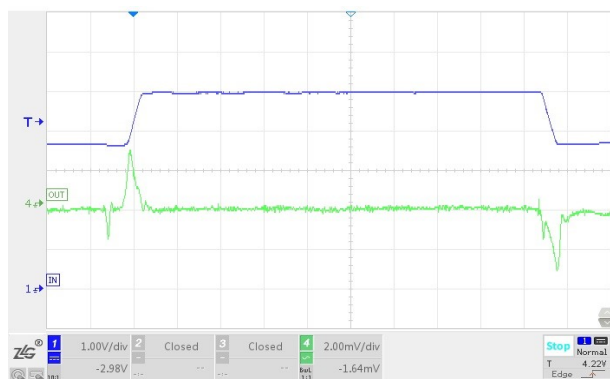


PSRR vs Frequency

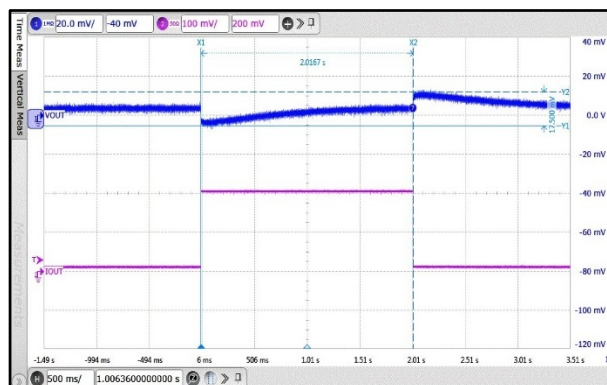


Typical Performance Characteristics (Continued)

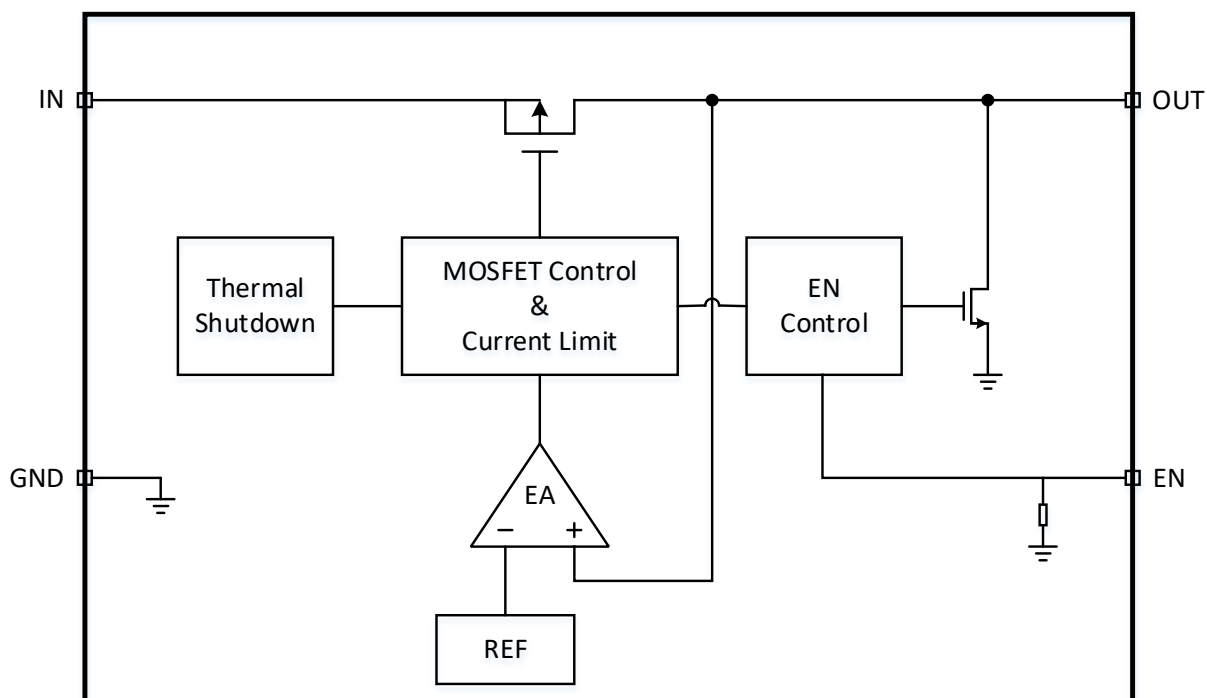
Line Transient ($I_{OUT}=200mA$)



Load Transient ($1\mu s$ rising/falling time)



Functional Block Diagram



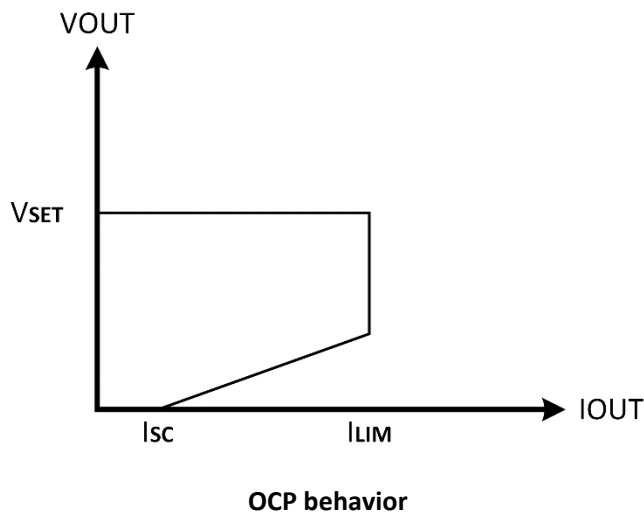
Functional Description

UVLO (Under-Voltage Lockout)

The device has a built-in under-voltage lockout (UVLO) circuit in LDO mode. When V_{IN} is rising, the output remains disconnected from the input until IN voltage is above 1.5V (TYP). This circuit has a 100mV hysteresis to provide noise immunity to transient conditions.

OCP (Over Current Protection)

The device enters foldback mode when the output load hit the over current threshold or in shorting event. The current is clamped. The output voltage drops. When the voltage drops below foldback voltage threshold, foldback current limit is activated and scales back to short circuit current.



The OCP threshold is 625mA (typical).

Thermal Shutdown

The SUL62029 has thermal shutdown function. When the junction temperature exceeds T_{SD} , the device turns off internal MOSFET to protect itself. The device exits thermal shutdown after junction temperature cools down below $T_{SD}-T_{HYS}$. And then the device full works after a soft start period.

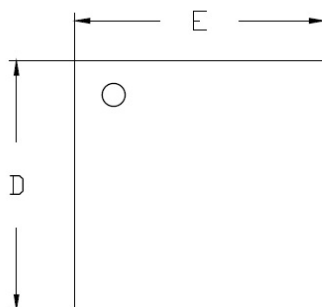
Soft Start function

To avoid high inrush current, SUL62029 integrated soft-start function. When EN status changes from logic 0 to logic 1 or from thermal shutdown mode, SUL62029 will regulate output current for about 1ms and then enter full function status.

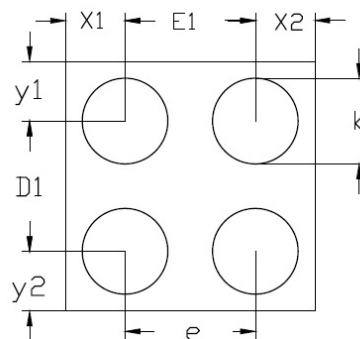
Output discharge

The SUL62029 has output discharge function. The VOUT connects to GND with about 150Ω resistor when EN=0 or shutdown mode for 2ms and then disconnects this resistor.

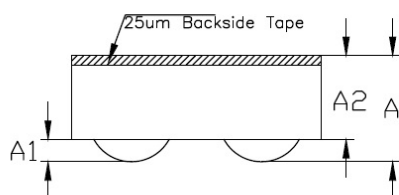
Package Dimensions: WLCSP-4B



TOP VIEW



BOTTOM VIEW

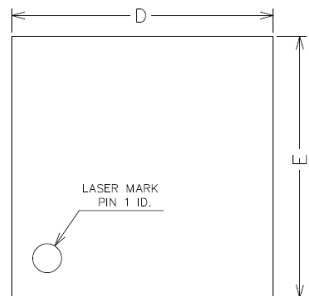


SIDE VIEW

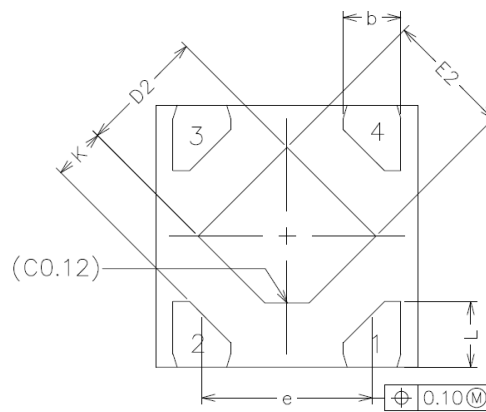
COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.240	0.285	0.330
A1	0.040	0.060	0.080
A2	0.200	0.225	0.250
D	0.650	0.670	0.690
D1	0.350BSC		
E	0.650	0.670	0.690
E1	0.350BSC		
b	0.180	0.200	0.220
e	0.350 BSC		
x1	0.160 REF		
x2	0.160 REF		
y1	0.160 REF		
y2	0.160 REF		

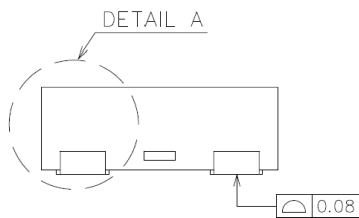
Package Dimensions: DFN1x1-4L



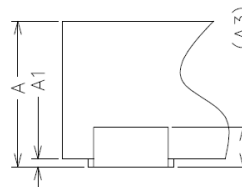
TOP VIEW



BOTTOM VIEW



SIDE VIEW

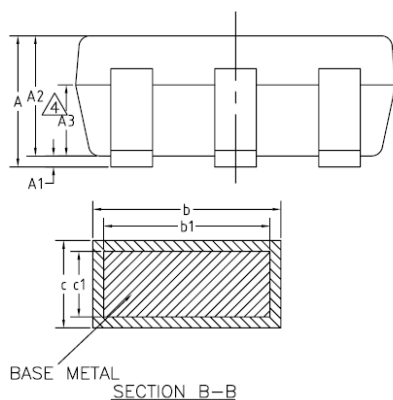
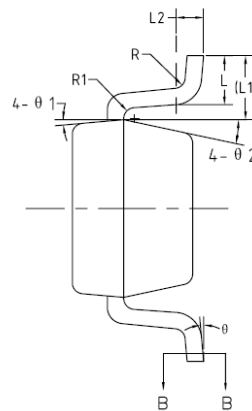
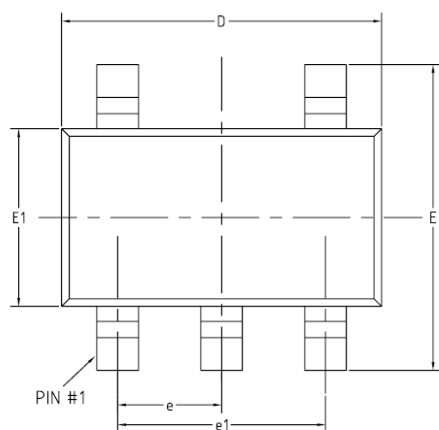


DETAIL A

COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.34	0.37	0.40
A1	0.00	0.02	0.05
A3	0.10REF		
b	0.17	0.22	0.27
D	0.95	1.00	1.05
E	0.95	1.00	1.05
D2	0.43	0.48	0.53
E2	0.43	0.48	0.53
L	0.20	0.25	0.30
e	0.60	0.65	0.70
K	0.15	—	—

Package Dimensions: SOT23-5L



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	—	—	1.25
A1	0	—	0.15
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.36	—	0.50
b1	0.36	0.38	0.45
c	0.14	—	0.20
c1	0.14	0.15	0.16
D	2.826	2.926	3.026
E	2.60	2.80	3.00
E1	1.526	1.626	1.726
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
L	0.35	0.45	0.60
L1	0.59REF		
L2	0.25BSC		
R	0.10	—	—
R1	0.10	—	0.25
θ	0°	—	8°
θ 1	3°	5°	7°
θ 2	6°	—	14°