

SUL62025 200mA Ultra-Low I_Q LDO

GENERAL DESCRIPTION

The SUL62025 is a tiny LDO with very low I_Q. It has 200mA output current capability and only 50nA working power consumption when I_{OUT} = 0. The device is designed to work with 1μF input and output ceramic capacitor. It is very suitable for battery powered device with ultra-long standby time.

The SUL62025 has over current protection and thermal shutdown functions to protect system and itself when the application in abnormal situation.

The SUL62025 is available in DFN1x1-4 and SOT23-5 packages.

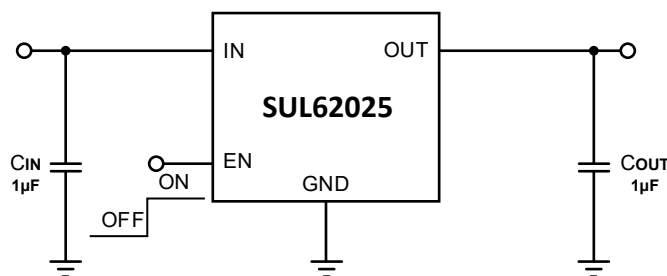
FEATURES

- Input voltage range: 1.7V ~ 5.5V
- Fixed output voltage range: 1.2V~4V
- Low Quiescent current: 50nA
- Maximum Output Current: 200mA
- Over Current protection
- Output Discharge
- Thermal Shutdown
- Robust ESD immunity capability
 - HBM > ±5KV
 - CDM > ±2KV

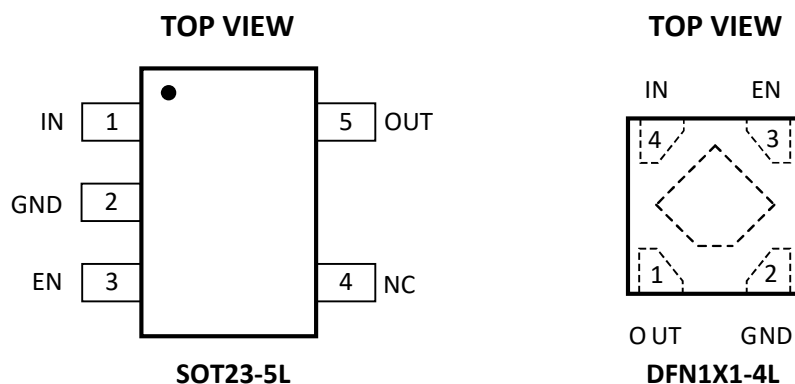
APPLICATIONS

- IOT device
- Portable device
- Wearable medical device
- Battery power device

TYPICAL APPLICATION CIRCUIT



PIN CONFIGURATION



PIN DESCRIPTION

PIN NO		SYMBOL	I/O	DESCRIPTION
SOT23-5L	DFN1x1-4L			
1	4	IN	Power	Power Input
2	2	GND	Ground	Ground Connection
3	3	EN	I	Enable (active high, do not float)
4	-	NC	/	Not connected
5	1	OUT	O	Power Output

ORDERING INFORMATION

Part Number	PACKAGE	TEMPERATURE	TAPE & REEL
SUL62025S5-XX	SOT23-5L	-40 ~ +85°C	3000/REEL
SUL62025D4-XX	DFN1x1-4L	-40 ~ +85°C	3000/REEL

Note: XX indicates 1.2V~4.0V by 0.05V step. For example, 28 means product outputs 2.8V. The SUL62025 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
I_{IN}	Input Current (Continuous)			500	mA
I_{OUT}	Output Current			500	mA
T_{STG}	Storage Temperature Range		-65	+150	°C
T_J	Maximum Junction Temperature			+150	°C
ESD	Human Body Model, ANSI/ESDA/JEDEC JS-001-2012	All Pins	5		KV
	Charged Device Model, JESD22-C101	All Pins	2		

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.

RECOMMENDED OPERATING RANGE (Note 2)

Parameters	Min.	Max.	Unit
Input Voltage: V_{IN}	1.7	5.5	V
Enable Voltage: V_{EN}	0	5.5	V
Output Voltage: V_{OUT}	1.2	4	V
Operating Temperature Range	-40	85	°C

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

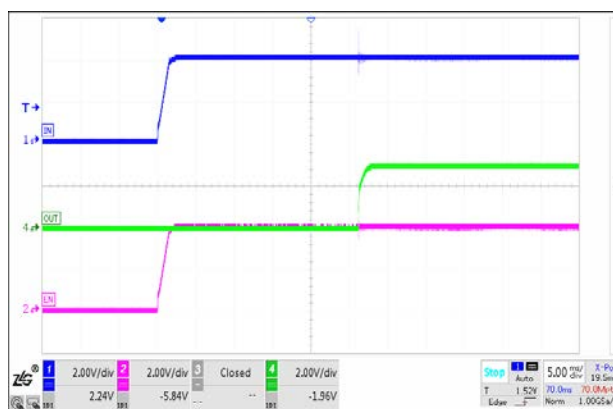
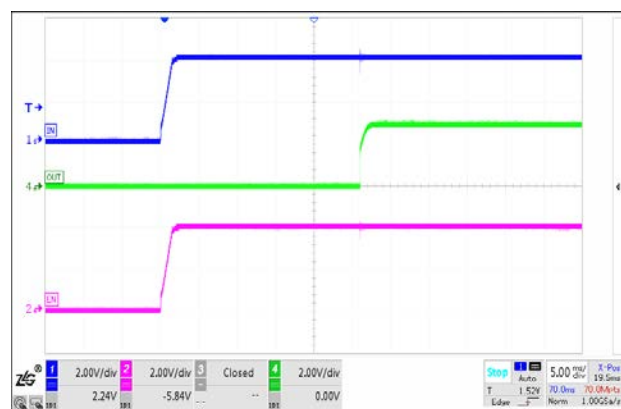
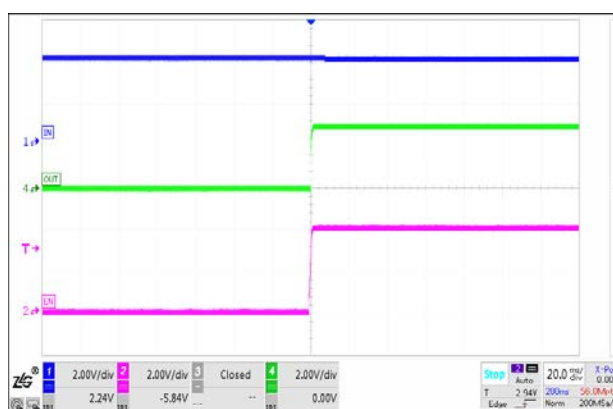
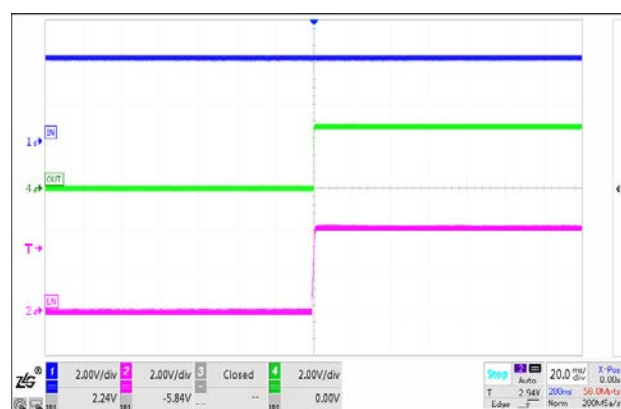
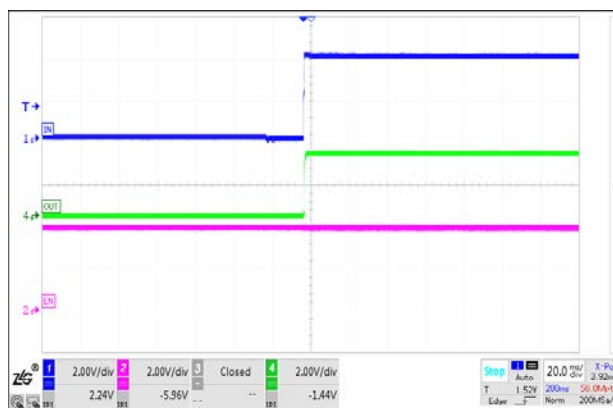
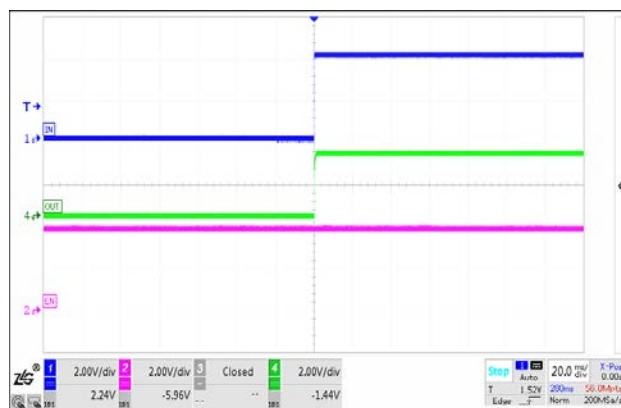
$V_{IN} = V_{SET} + 1V$, $I_{OUT} = 1mA$, $T_A = -40^{\circ}C \sim 85^{\circ}C$, unless otherwise noted.

Typical value at $T_A = +25^{\circ}C$ and $V_{SET} = 3V$, $C_{IN} = C_{OUT} = 1\mu F$.

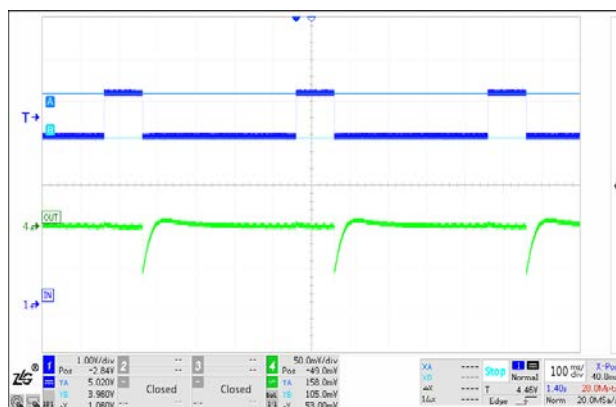
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Input Voltage Range	V_{IN}		1.7		5.5	V
EN Logic Voltage	V_{ENH}		1.1			V
	V_{ENL}				0.28	
EN Pin Leakage Current	I_{EN}	$V_{EN} = V_{IN}$, $1.7V \leq V_{IN} \leq 5.5V$		1		nA
Output Discharge Resistor	R_{DIS}			150		Ω
Thermal Shutdown Threshold	T_{SD}			150		$^{\circ}C$
Thermal Hysteresis	T_{HYS}			20		$^{\circ}C$
Output Current	I_{OUT}			200		mA
UVLO Threshold	V_{UVLO}	V_{IN} rising		1.6		V
UVLO Hysteresis	V_{UVLO_HYS}			100		mV
Input Quiescent Current	I_Q	$I_{OUT} = 0$, $T_A = 25^{\circ}C$		50		nA
Shutdown Current	I_{SHUT}	$EN = 0$, $V_{IN} = 5V$, $T_A = 25^{\circ}C$		9		nA
GND Current Ratio	$I_{GND/IOUT}$	$3\mu A < I_{OUT} < 5mA$		2		%
		$5mA < I_{OUT} < 50mA$		0.5		
		$I_{OUT} > 50mA$		0.25		
Output Voltage Accuracy	A_{OUT}	$I_{OUT} = 0 \sim 200mA$, All V_{SET} , $T_A = 25^{\circ}C$	-2		2	%
Dropout Voltage ⁽³⁾	V_{DO}	$V_{SET} = 3V$, $I_{OUT} = 200mA$			300	mV
GND Current at Dropout	I_{GNDDR}	$I_{OUT} = 0mA$, $V_{OUT} = 0.95 \times V_{SET}$		50		nA
Line Regulation	LineRe	$V_{IN} = V_{SET} + 1V \sim 5V$, $\Delta V_{IN} = 1V$. $I_{OUT} = 200mA$.		0.1		%/V
Load Regulation	LoadRe	$I_{OUT} = 1mA$ to $200mA$		0.008		%/mA
Output Current Limit	I_{Lim}	$V_{OUT} = 0.9 \times V_{SET}$	280			mA
Short circuit current	I_{SC}	$V_{OUT} = 0$		60		mA
Power Supply Rejection Ration	PSRR	$I_{OUT} = 20mA$, $V_{SET} = 3V$, $f = 1KHz$		55		dB
Output Voltage Noise	V_{NOISE}	$BW = 10Hz$ to $100KHz$, $I_{OUT} = 20mA$		60		μV_{RMS}

Note (3): Dropout Voltage is defined as $(V_{IN} - V_{OUT})$ when $V_{OUT} = V_{SET} \times 95\%$.

TYPICAL CHARACTERISTICS

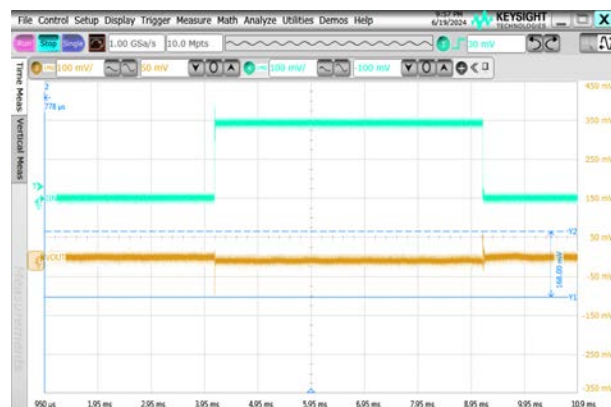


TYPICAL CHARACTERISTICS (Continued)



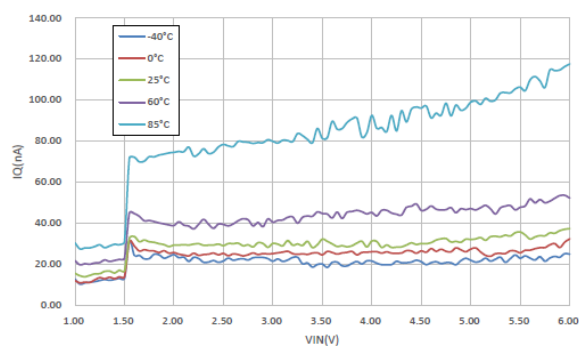
(4V~5V with $5\mu\text{s}$ t_R/t_F @ $I_{OUT}=100\text{mA}$)

Line Transient

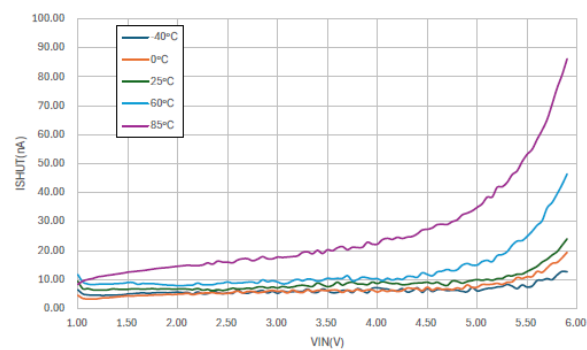


(1mA~200mA with $5\mu\text{s}$ t_R/t_F time)

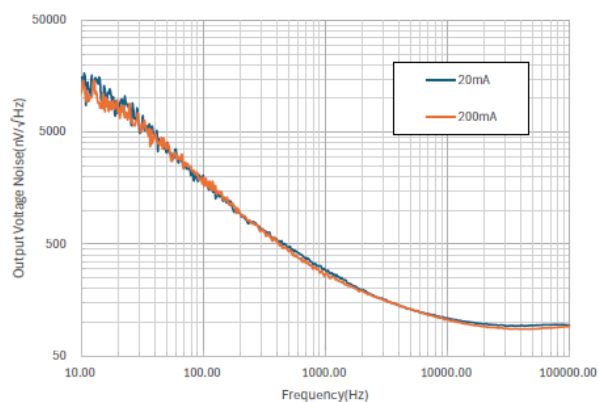
Load Transient



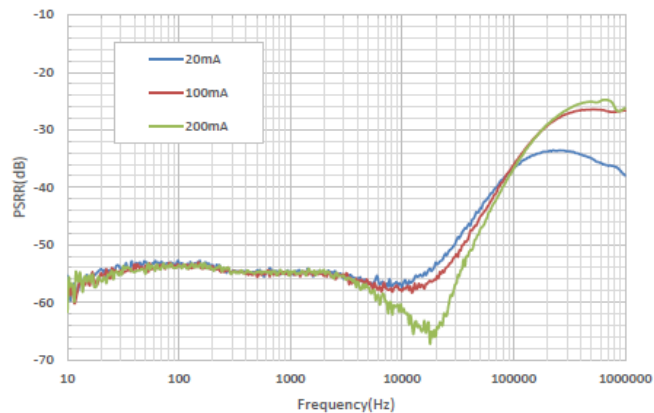
I_Q vs V_{IN} ($V_{SET}=1.2V$)



I_{SHUT} vs V_{IN} ($V_{SET}=1.2V$)

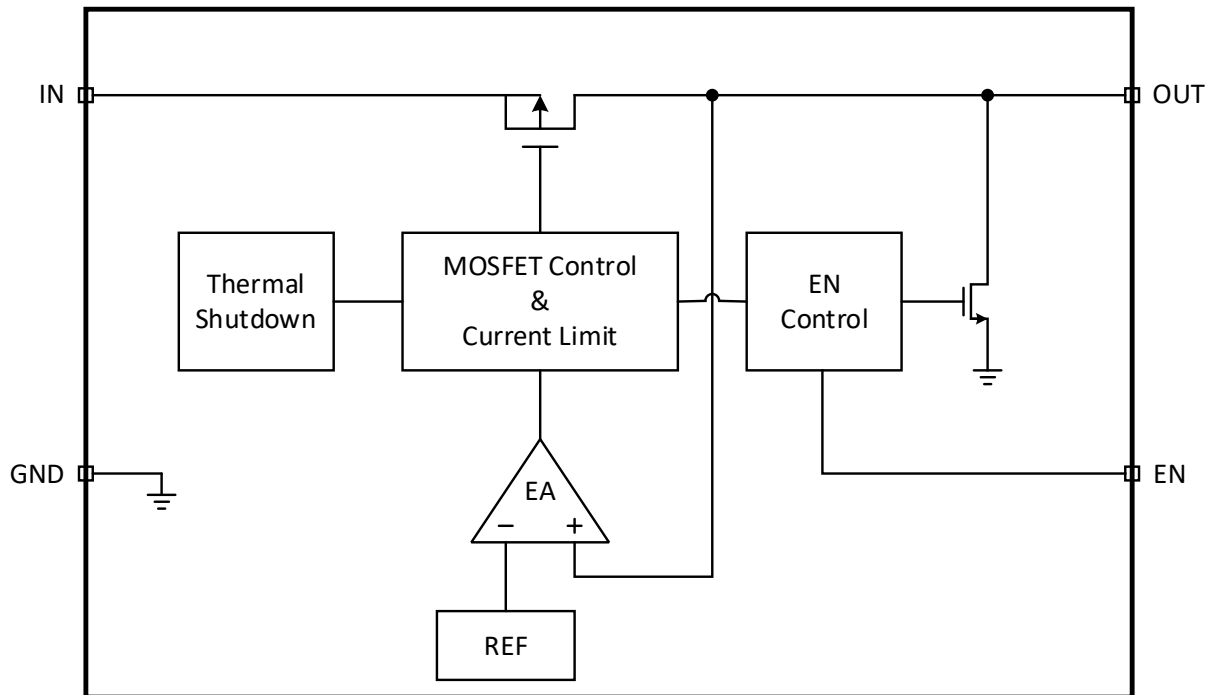


Output Voltage Noise



PSRR

BLOCK DIAGRAM



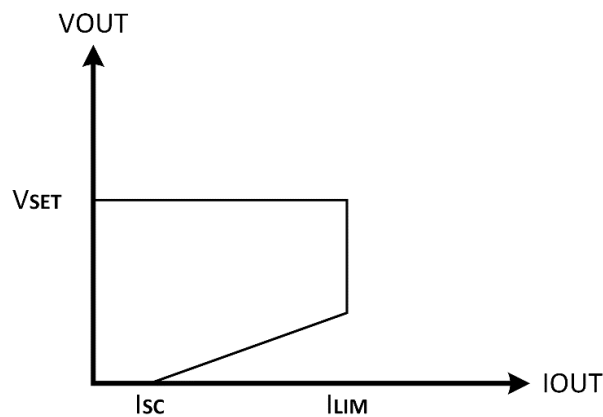
FUNCTIONAL DESCRIPTION

UVLO (Under-Voltage Lockout)

The device has a built-in under-voltage lockout (UVLO) circuit. When V_{IN} is rising, the output remains disconnected from the input until V_{IN} is above 1.6V (TYP). The UVLO has a 100mV hysteresis to provide noise immunity to transient conditions.

OCP (Over Current Protection)

The device has OCP circuit which works in foldback scheme. The device regulates output current to I_{LIM} when the OCP limitation is triggered. The output voltage drops if the R_{LOAD} keep decreasing but output current almost keeps same. When output voltage drops below short protection voltage, the regulated output current will scale down to I_{SC} . The device will turn back when the heavy load removed.



Thermal Shutdown

The device 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.

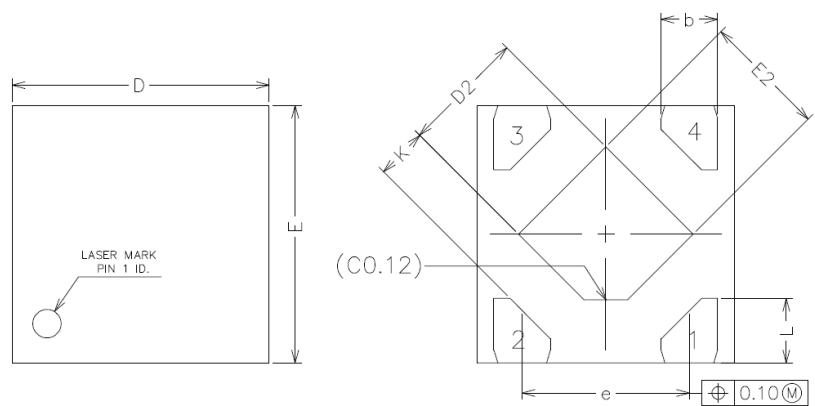
SS function

To avoid high inrush current, SUL62025 integrated soft-start function. When EN status changes from logic 0 to logic 1 or from thermal shutdown mode, SUL62025 will slowly pump to target voltage in 1ms.

Output discharge

The device has output discharge function. The V_{OUT} connects to GND with about 150 Ω resistor when EN=0 shutdown mode.

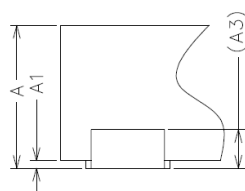
PACKAGE DIMENSIONS: DFN1X1-4L



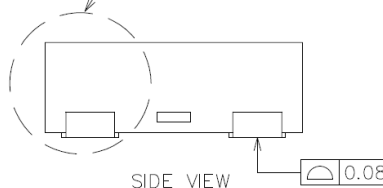
TOP VIEW

BOTTOM VIEW

DETAIL A



DETAIL A



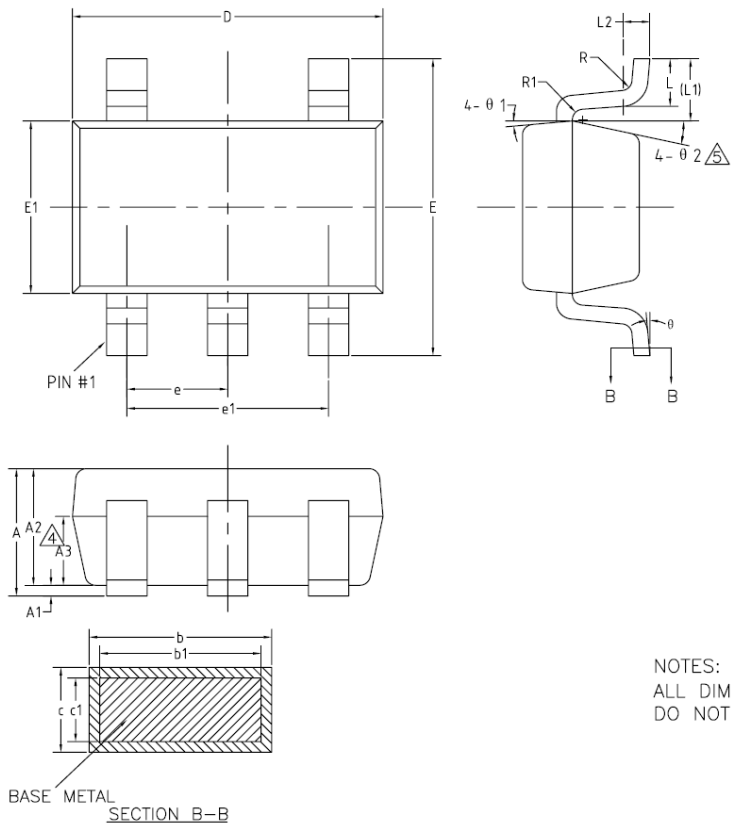
SIDE VIEW

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	—	—

NOTES:
ALL DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSION.

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°

NOTES:
ALL DIMENSIONS REFER TO JEDEC STANDARD MO-178 AA
DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.