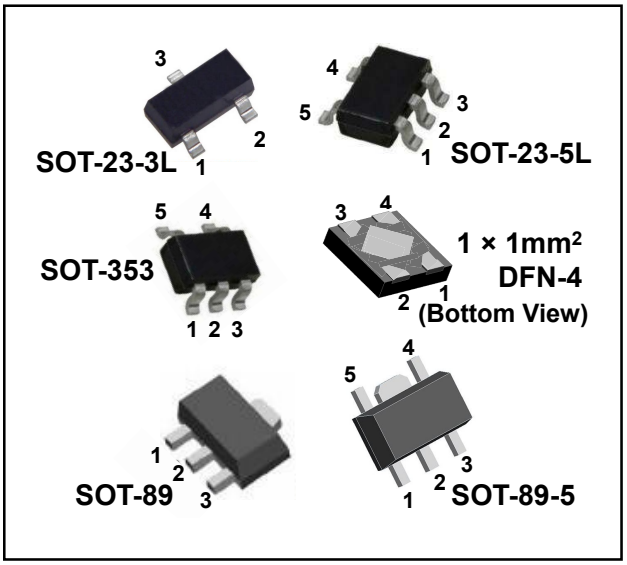
ULTRA FAST, HIGH PSRR, LOW NOISE CMOS VOLTAGE REGULATOR

FEATURES

- Operating Voltage: 2.0V ~ 6.0V
- Output Voltage Range: 1.0V ~ 5.0V (Selectable in 0.1V Steps)
- Low Output Noise: 40μV_{rms} (10 Hz ~ 100 kHz)
- Low Dropout Voltage: 150mV@150mA
- Low Quiescent Current: 50μA
- High Accuracy: ±2% (Typ.)
- Excellent Line and Load Transient Response
- Built-in Current Limiter
- High Ripple Rejection: 75dB@1 kHz
- Built-in Short Circuit Protection
- TTL-Logic-Controlled Shutdown Input



DESCRIPTION

The ***STComponet*** ST6200 series are a group of positive voltage regulators manufactured by CMOS technologies with high ripple rejection, ultra low noise, low power consumption and low dropout voltage, which can prolong battery life in portable electronics. The ST6200 series work with low-ESR ceramic capacitors, reducing the amount of board space necessary for power applications. The ST6200 series consume less than 0.1μA in shutdown mode and have fast turn-on time less than 50μs. The series are very suitable for the battery-powered equipments, such as RF applications and other systems requiring a quiet voltage source.

TYPICAL APPLICATION CIRCUIT

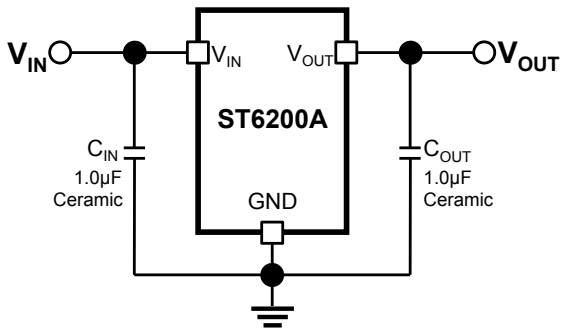


Figure 1: ST6200A Series Application Circuit

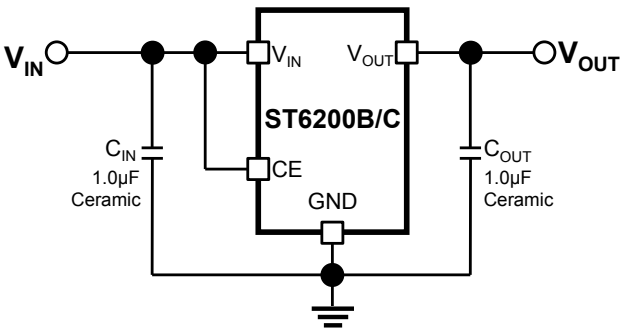


Figure 2: ST6200B/C Series Application Circuit

DEVICE SUMMARY

Ordering Code (1)	Package Material	Pin Configuration (2)					Package Type	Shipping
		V_{IN}	GND	V_{OUT}	CE	NC		
ST6200①②③M	Lead Free	3	1	2	-	-	SOT-23-3L	Taping reel
ST6200①②③MA		3	2	1	-	-		Taping reel
ST6200①②③MC		1	3	2	-	-		Taping reel
ST6200①②③MY		2	3	1	-	-		Taping reel
ST6200①②③MG	Halogen Free	3	1	2	-	-		Taping reel
ST6200①②③MAG		3	2	1	-	-		Taping reel
ST6200①②③MCG		1	3	2	-	-		Taping reel
ST6200①②③MYG		2	3	1	-	-		Taping reel
ST6200①②③P	Lead Free	2	1	3	-	-	SOT-89	Taping reel
ST6200①②③PT		3	2	1	-	-		Taping reel
ST6200①②③PG	Halogen Free	2	1	3	-	-		Taping reel
ST6200①②③PTG		3	2	1	-	-		Taping reel
ST6200①②③FG	Halogen Free	4	2	1	3	-	1 × 1 mm^2 DFN-4	Taping reel
ST6200①②③U	Lead Free	1	2	5	3	4	SOT-353	Taping reel
ST6200①②③UG	Halogen Free	1	2	5	3	4		Taping reel
ST6200①②③M5	Lead Free	1	2	5	3	4	SOT-23-5L	Taping reel
ST6200①②③MF		1	2	5	-	3,4		Taping reel
ST6200①②③ML		5	2	4	1	3		Taping reel
ST6200①②③M5G	Halogen Free	1	2	5	3	4		Taping reel
ST6200①②③MFG		1	2	5	-	3,4		Taping reel
ST6200①②③MLG		5	2	4	1	3		Taping reel
ST6200①②③P5	Lead Free	5	2	1	4	3	SOT-89-5	Taping reel
ST6200①②③P5G	Halogen Free	5	2	1	4	3		Taping reel

Note 1:

①: A ➔ Without CE function, standard voltage regulator, output fast discharge.
B ➔ With CE function at high active and internal built-in pull-down resistor, output fast discharge.
C ➔ With CE function at high active and no internal built-in resistor, output is normal discharge.

②③: Output voltage (e.g. 3.0V = ②: 3 & ③: 0)
The Output Voltage Range can support from 1.2V to 5.0V which selectable in 0.1V per steps.

Note 2: **V_{IN}**: Power Input; **GND**: Ground; **V_{OUT}**: Output Pin; **CE**: Chip Enable; **NC**: Not Connect.

INTERNAL SCHEMATIC DIAGRAM

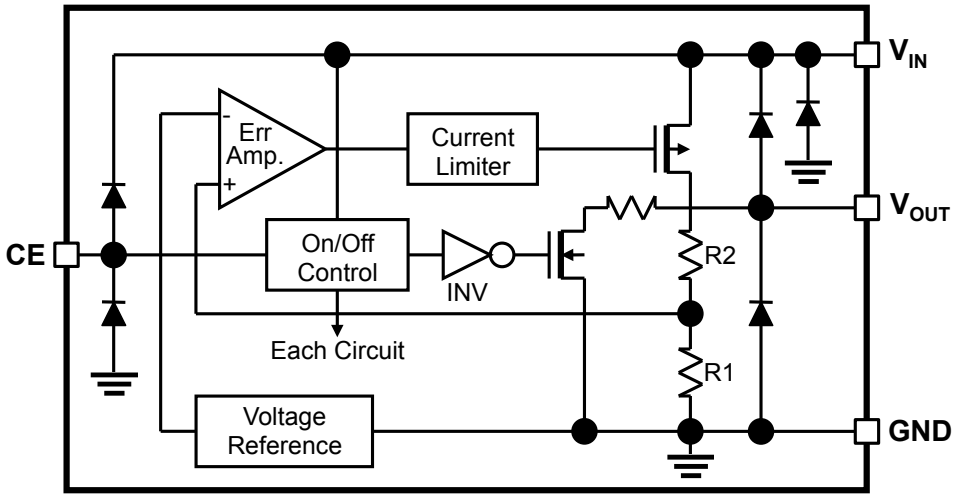


Figure 3: ST6200B Series Block Diagram

ABSOLUTE MAXIMUM RATINGS (3)

T_A = 25°C, All voltage respect to GND unless otherwise specified.

PARAMETER		SYMBOL	RATINGS	UNIT
Supply Input Voltage		V_{IN}	-0.3 ~ +7	V
Output Current		I_{OUT}	600	mA
Output Voltage		V_{OUT}	-0.3 ~ (V_{IN} + 0.3)	V
Operation Junction Temperature Range (4)		T_J	-40 ~ +125	°C
Power Dissipation	SOT-23-3L	P_D	400	mW
	SOT-23-5L		400	mW
	SOT-353		400	mW
	1mm × 1mm DFN-4		400	mW
	SOT-89		600	mW
	SOT-89-5		600	mW
Operating Free Air Temperature Range		T_A	-40 ~ +85	°C
Storage Temperature		T_{stg}	-40 ~ +125	°C
Soldering Temperature & Time		T_{solder}	260°C, 10 sec.	
ESD Rating (5)	Human Body Model	HBM	4	kV
	Machine Model	MM	200	V

Note 3: Absolute Maximum Ratings are those values beyond which the device could be permanently damaged. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Note 4: This IC includes over temperature protection that is intended to protect the device during momentary overload. Junction temperature will exceed 125°C when over temperature protection is active. Continuous operation above the specified maximum operating junction temperature may impair device reliability.

Note 5: ESD testing is performed according to the respective JESD22 JEDEC standard. The human body model is a 100 pF capacitor discharged through a 1.5kΩ resistor into each pin. The machine model is a 200pF capacitor discharged directly into each pin.

RECOMMENDED OPERATING CONDITIONS (6)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Supply Input Voltage	V_{IN}	2		6	V
Operation Junction Temperature Range	T_J	0		125	°C
Operation Free Air Temperature Range	T_A	0		85	°C

Note 6: *Absolute Maximum Ratings* indicate limits beyond which damage to the device may occur. *Recommended Operating Conditions* indicate conditions for which the device is intended to be functional, but specific performance is not ensured.

ELECTRICAL CHARACTERISTICS

T_A = 25°C, V_{IN} = V_{OUT} + 1V, C_{IN} = C_{OUT} = 1μF, All voltage respect to GND unless otherwise noted.

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT(E)}$ (8)	I_{OUT} = 1mA	V_{OUT} × 0.98	V_{OUT} (7)	V_{OUT} × 1.02	V
Supply Current	I_{SS}	No loading.		50	100	μA
Standby Current	I_{STBY}	V_{CE} = GND			0.1	μA
Output Current	I_{OUT}		300			mA
Dropout Voltage (9)	V_{diff}	I_{OUT} = 150mA, V_{OUT} ≥ 2.8V		150		mV
Load Regulation	ΔV_{OUT}	V_{IN} = V_{OUT} + 1V, 1mA ≤ I_{OUT} ≤ 100mA		10		mV
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	I_{OUT} = 10mA, (V_{OUT} + 1V) ≤ V_{IN} ≤ 6V		0.01	0.2	%/V
Output Voltage Temperature Characteristics	$\frac{\Delta V_{OUT}}{\Delta T_A \times V_{OUT}}$	I_{OUT} = 10mA, -40°C ≤ T_A ≤ +85°C		100		ppm/°C
Output Short Current	I_{short}	V_{OUT} = GND		100		mA
Input Voltage	V_{IN}		2.0		6.0	V

T_A = 25°C, V_{IN} = V_{OUT} + 1V, C_{IN} = C_{OUT} = 1μF, All voltage respect to GND unless otherwise noted.

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Power Supply Rejection Rate	f = 217 Hz	PSRR	V_{IN} = (V_{OUT} + 1V) + $1V_{PP}$,		80		dB
	f = 1 kHz		I_{OUT} = 50mA		75		dB
	f = 10 kHz				70		dB
CE "High" Voltage		V_{CEH}		1.5		V_{IN}	V
CE "Low" Voltage		V_{CEL}				0.3	V
C_{OUT} Auto-Discharge Resistance		$R_{dischrg}$	V_{IN} = 5V, V_{OUT} = 3V, V_{CE} = GND		80		Ω

Note 7: V_{OUT}: Specified output voltage.
Note 8: $V_{OUT(E)}$: Effective output voltage. (The output voltage is V_{IN} = (V_{OUT} + 1.0V) and maintain a certain I_{OUT} values.)
Note 9: V_{diff}: The difference of output voltage and input voltage when input voltage is decreased gradually till output voltage equals to 98% of $V_{OUT(E)}$. (refer to the "*Table 1: Dropout Voltage Chart*" for fixed output voltage examples)

Table 1: Dropout Voltage Chart (Dropout Voltage @ I_{OUT} = 150mA)

Setting Output Voltage (V_{OUT})	MIN	TYP	MAX	UNIT
1.2V		380	600	mV
1.5V		270	600	mV
1.8V		230	600	mV
2.5V		180	400	mV
2.8V		160	220	mV
3.0V		155	220	mV
3.3V		150	220	mV

C_{OUT} AUTO-DISCHARGE FUNCTION

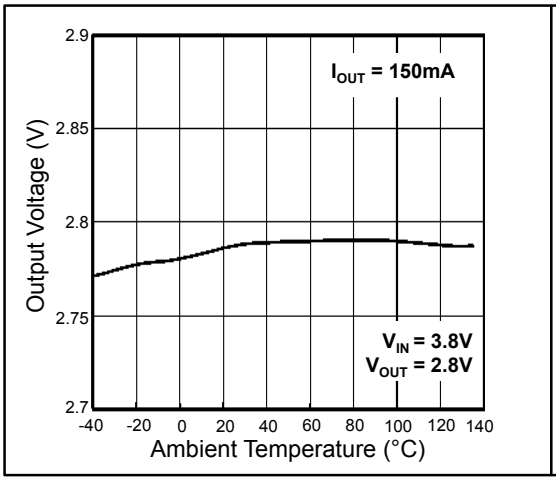
The ***STComponet*** ST6200B series can discharge the electric charge in the output capacitor (C_{OUT}), when a low signal to the CE pin, which enables a whole IC circuit turn off, is inputted via the N-channel transistor located between the V_{OUT} pin and the GND pin (see the INTERNAL SCHEMATIC DIAGRAM).
The C_{OUT} auto-discharge resistance value is set at 80Ω (V_{OUT} = 3.0V @ V_{IN} = 5.0V at typical). The discharge time of the output capacitor (C_{OUT}) is set by the C_{OUT} auto-discharge resistance (R) and the output capacitor (C_{OUT}). By setting the constant of a C_{OUT} auto-discharge resistance value ($R_{dischrg}$) and an output capacitor value (C_{OUT}) as τ (τ = C × $R_{dischrg}$), the output voltage after discharge via the N-channel transistor is calculated by the following formulas.

$$V = V_{OUT(E)} \times e^{-t/\tau} \text{ , or } t = \tau/n\ (V/V_{OUT(E)})$$

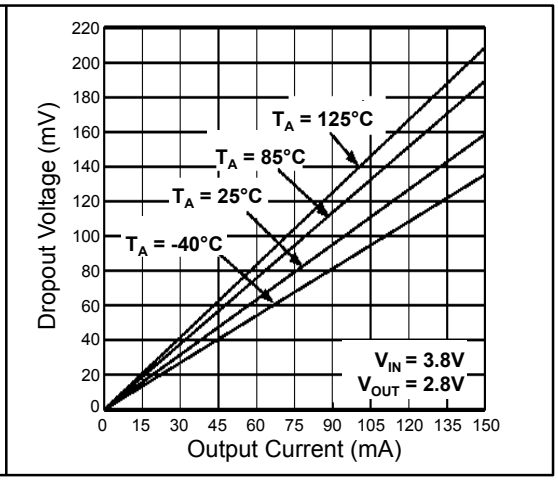
(V: Output voltage after discharge; $V_{OUT(E)}$: Output voltage; *t*: Discharge time; τ: C_{OUT} auto-discharge resistance ($R_{dischrg}$) × output capacitor (C_{OUT}) value C)

ELECTRICAL CHARACTERISTICS CURVES

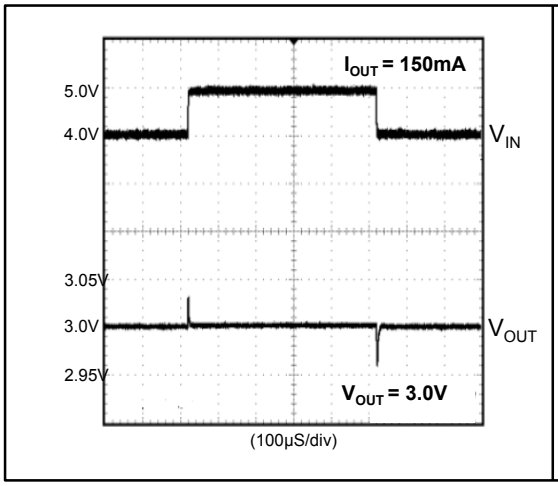
(1) V_{OUT} vs. T_A



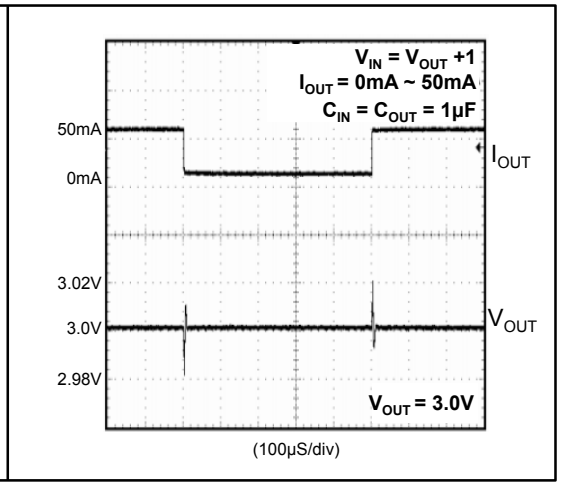
(2) V_{diff} vs. I_{OUT}



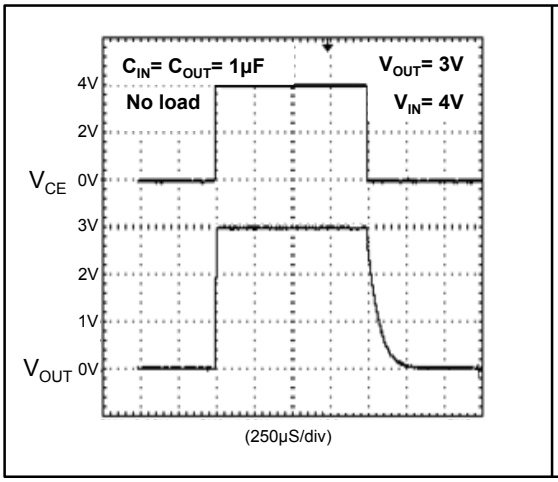
(3) Line Transient Response



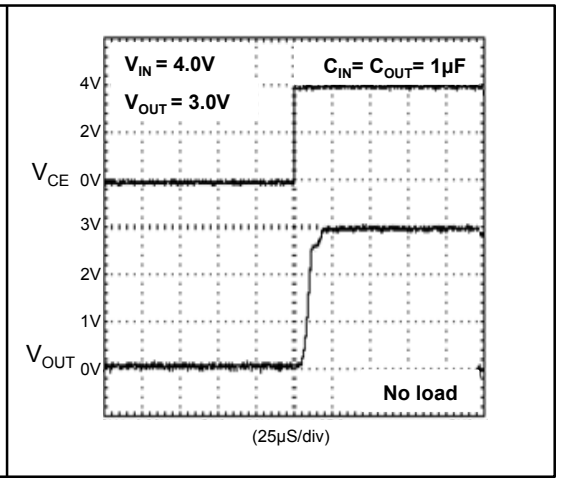
(4) Load Transient Response



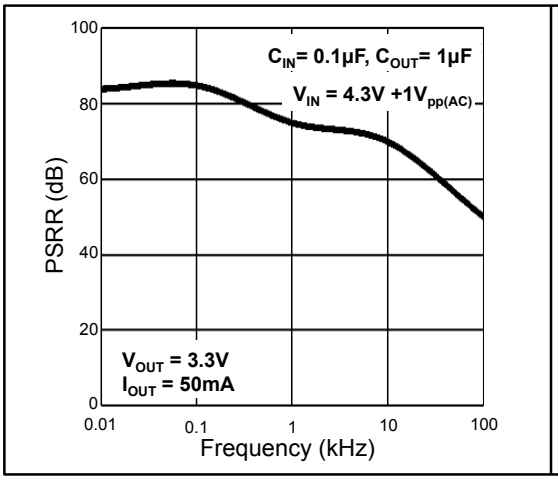
(5) CE Pin Shutdown Response



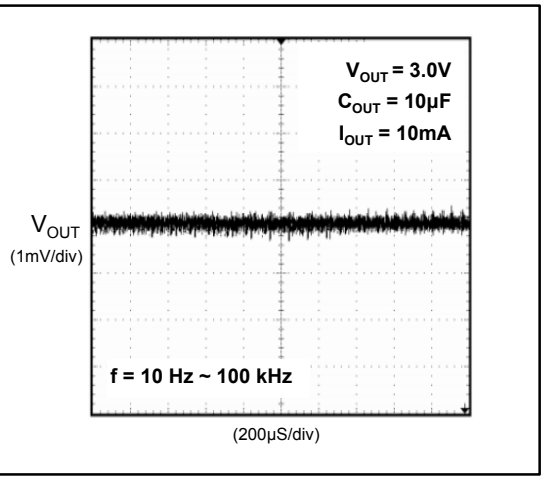
(6) Start Up



(7) PSRR vs. Frequency

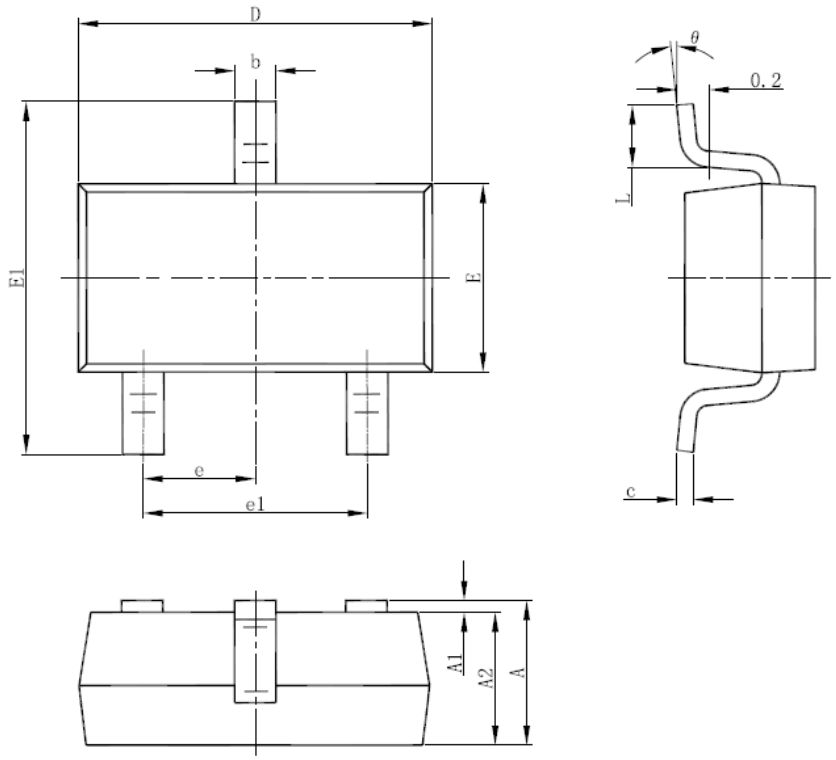


(8) Output Noise



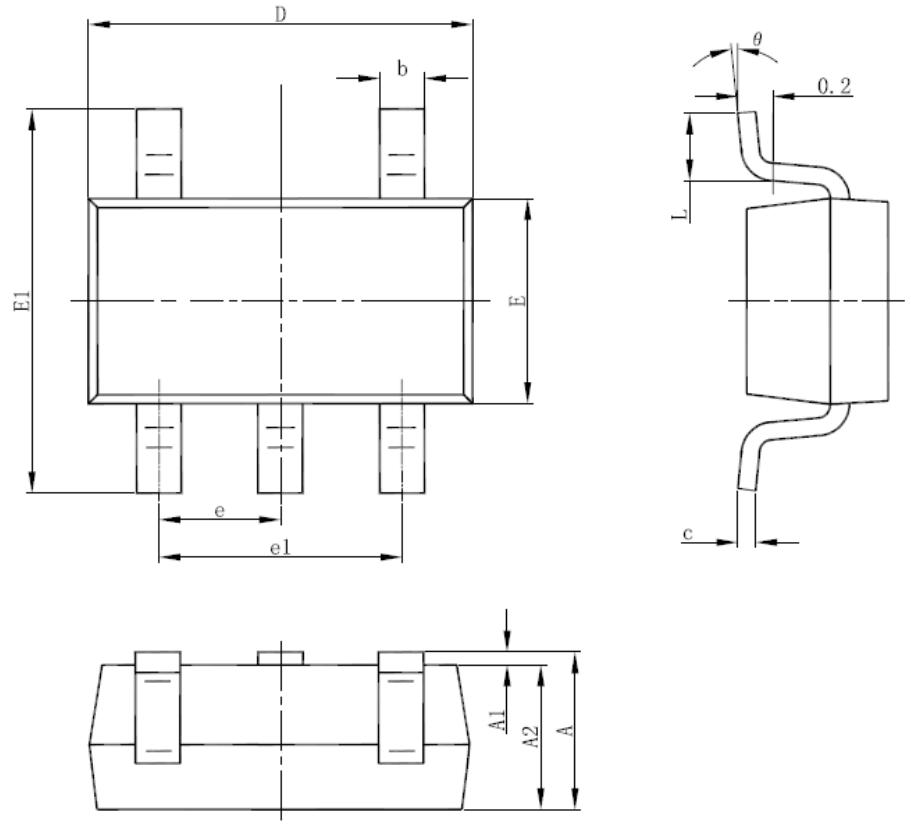
PACKAGE DIMENSION

SOT-23-3L



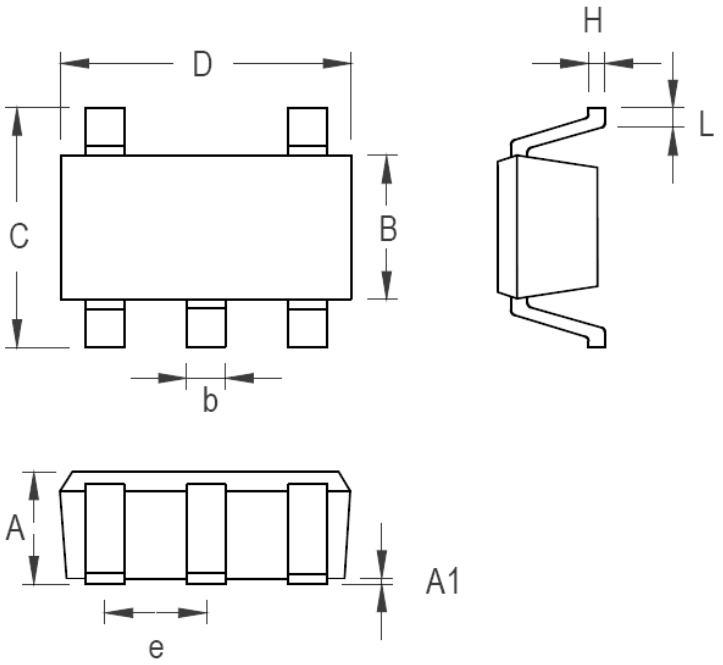
SYMBOL	Dimensions in Millimeters		Dimensions in Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 (BSC)		0.037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

SOT-23-5L



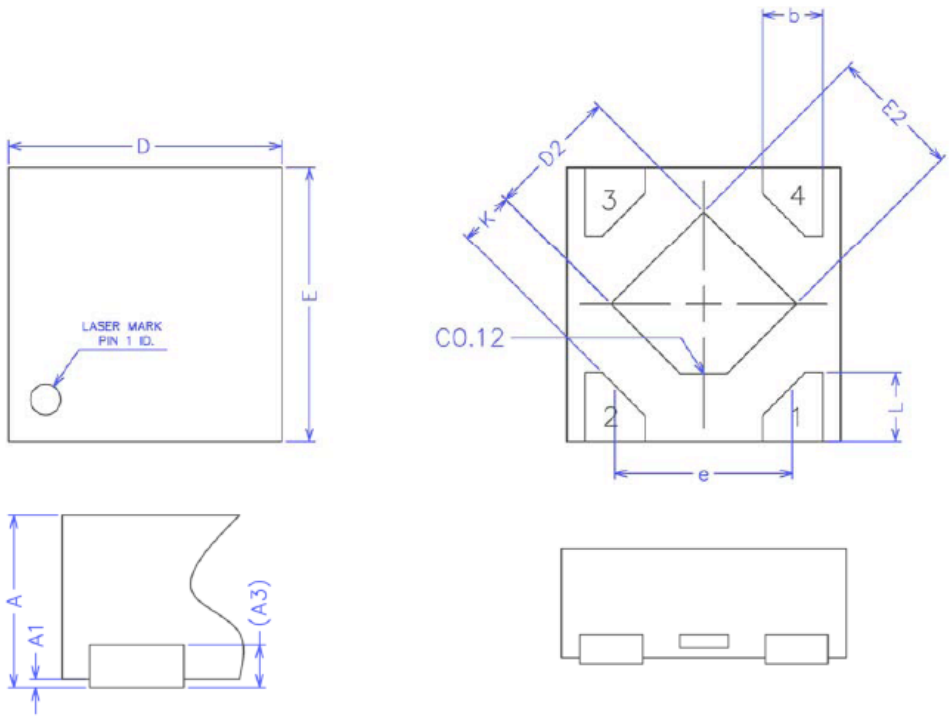
SYMBOL	Dimensions in Millimeters		Dimensions in Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 (BSC)		0.037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

SOT-353



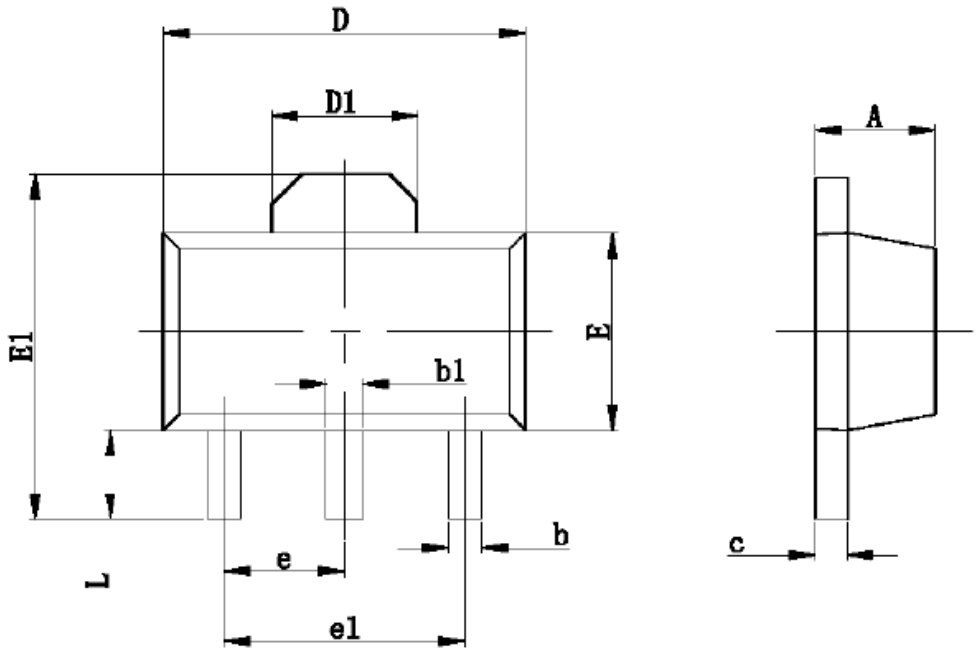
SYMBOL	Dimensions in Millimeters		Dimensions in Inches	
	MIN	MAX	MIN	MAX
A	0.800	1.100	0.031	0.044
A1	0.000	0.100	0.000	0.004
B	1.150	1.350	0.045	0.054
b	0.150	0.400	0.006	0.016
C	1.800	2.450	0.071	0.096
D	1.800	2.250	0.071	0.089
e	0.650		0.026	
H	0.080	0.260	0.003	0.010
L	0.210	0.460	0.008	0.018

1 × 1 mm² DFN-4



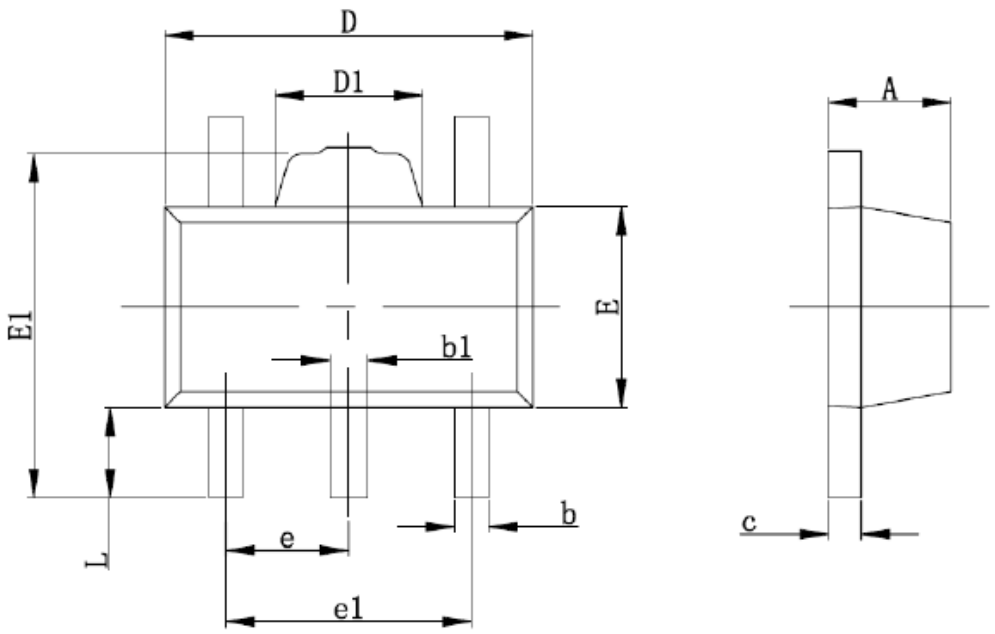
SYMBOL	Dimensions in Millimeters		Dimensions in Inches	
	MIN	MAX	MIN	MAX
A	0.340	0.400	0.013	0.016
A1	0.000	0.050	0.000	0.002
A3	0.100 REF		0.004 REF	
b	0.170	0.270	0.006	0.017
D	0.950	1.050	0.037	0.041
E	0.950	1.050	0.037	0.041
D2	0.430	0.530	0.017	0.021
E2	0.430	0.530	0.017	0.021
L	0.200	0.300	0.008	0.012
e	0.650 (TYP)		0.026 (TYP)	
K	0.150	-	0.006	-

SOT-89



SYMBOL	Dimensions in Millimeters		Dimensions in Inches	
	MIN	MAX	MIN	MAX
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.197
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 (REF)		0.061 (REF)	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 (TYP)		0.060 (TYP)	
e1	3.000 (TYP)		0.118 (TYP)	
L	0.900	1.200	0.035	0.047

SOT-89-5



SYMBOL	Dimensions in Millimeters		Dimensions in Inches	
	MIN	MAX	MIN	MAX
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.360	0.560	0.014	0.022
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.400	1.800	0.055	0.071
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 (TYP)		0.060 (TYP)	
e1	2.900	3.100	0.114	0.122
L	0.900	1.100	0.035	0.043

NOTICE

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