

300mA Ultra-low Noise Ultra-Fast CMOS LDO Regulators

General Description

The LN1193 is designed for portable RF and wireless applications with demanding performance and space requirements. The LN1193 performance is optimized for battery-powered systems to deliver ultra low noise and low quiescent current. A noise bypass pin is available for further reduction of output noise. Regulator ground current increases only slightly in dropout, further prolonging the battery life. The LN1193 also works with low-ESR ceramic capacitors, reducing the amount of board space necessary for power applications, critical in hand-held wireless devices. The LN1193 consumes less than 0.01A in shutdown mode and has fast turn-on time less than 50s. The other features include ultra low dropout voltage, high output accuracy, current limiting protection, short-load protection, and high ripple rejection ratio.

Features

- Ultra-Low-Noise for RF Application
- Ultra-Fast Response in Line/Load Transient
- Quick Start-Up (Typically 50μs)
- < 0.01μA Standby Current When Shutdown
- Low Dropout : 300mV @ 100mA

Ordering Information

LN1193 ①②③④⑤⑥

Designator	Symbol	Description	Designator	Symbol	Description
①		CE Pin Logic :	⑤		Package Type :
	A	Active 'High' (pull-down resistor built in)		M	SOT-23-5L
	B	Active 'High' (no pull-down resistor built in)		K	SOT-353/SC70-5
	C	Active 'Low' (pull-up resistor built in)		D	DFN2×2-6L
	D	Active 'Low' (no pull-up resistor built in)	⑥		Device Orientation :
②③	10-60	Output Voltage: e.g. ②=3, ③=0 ⇒ 3.0V			Embossed Tape : Standard Feed
④	2	Output Voltage : 100mV increments e.g. ②=3, ③=8, ④=2 ⇒ 3.8V		R	Embossed Tape : Reverse Feed
	A	Output Voltage : 50mV increments e.g. ②=3, ③=8, ④=A ⇒ 3.85V		L	

- Output Voltage Range :1.0V to 5.0V (selectable in100mV steps)
- TTL-Logic-Controlled Shutdown Input
- Low Temperature Coefficient
- Current Limiting Protection
- Thermal Shutdown Protection
- Only 1μF Output Capacitor Required for Stability
- High Power Supply Rejection Ratio: 70dB (1 kHz)
- Custom Voltage Available

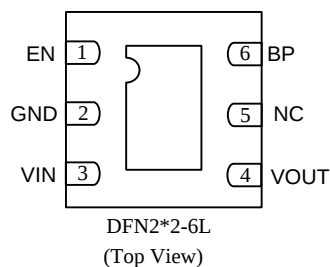
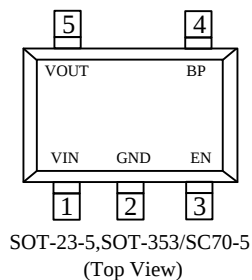
Applications

- CDMA/GSM Cellular Handsets
- Battery-Powered Equipment
- Laptop, Palmtops, Notebook Computers
- Hand-Held Instruments
- PCMCIA Cards

Package

- SOT-23-5L
- SOT-353/ SC-70-5
- DFN2×2-6L

Pin Configuration

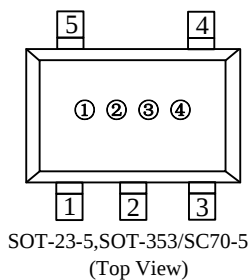


Pin Assignment

Pin Number		Pin Name	Function
SOT-23-5L/ SC70-5/SOT-353	WDFN-6L 2X2		
1	3	VIN	SUPPLY POWER
2	2	GND	GROUND
3	1	EN	ENABLE PIN
4	6	BP	BYPASS
5	4	VOUT	VOLTAGE OUTPUT
-	5	NC	No Connect

Marking Rule

- SOT-23-5L, SOT-353/SC-70



- ① Represents the product name

Symbol	Product Name
4	LN1193◆◆◆◆◆◆◆◆

- ② Represents the type of regulator

Voltage(V)	1.0~3.0	3.1~6.0	1.05~3.05	3.15~6.05		
Symbol	V	A	E	M	Product Name	LN1193A◆◆◆◆◆◆◆◆
	X	B	F	N		LN1193B◆◆◆◆◆◆◆◆
	Y	C	H	P		LN1193C◆◆◆◆◆◆◆◆
	Z	D	L	R		LN1193D◆◆◆◆◆◆◆◆

③ Represents the Output Voltage

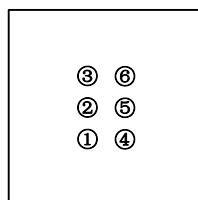
Symbol	Output Voltage (V)			
0		3.1		3.15
1		3.2		3.25
2		3.3		3.35
3		3.4		3.45
4		3.5		3.55
5		3.6		3.65
6		3.7		3.75
7		3.8		3.85
8		3.9		3.95
9	1.0	4.0	1.05	4.05
A	1.1	4.1	1.15	4.15
B	1.2	4.2	1.25	4.25
C	1.3	4.3	1.35	4.35
D	1.4	4.4	1.45	4.45
E	1.5	4.5	1.55	4.55

Symbol	Output Voltage (V)			
F	1.6	4.6	1.65	4.65
H	1.7	4.7	1.75	4.75
K	1.8	4.8	1.85	4.85
L	1.9	4.9	1.95	4.95
M	2.0	5.0	2.05	5.05
N	2.1		2.15	
P	2.2		2.25	
R	2.3		2.35	
S	2.4		2.45	
T	2.5		2.55	
U	2.6		2.65	
V	2.7		2.75	
X	2.8		2.85	
Y	2.9		2.95	
Z	3.0		3.05	

④ Represents the assembly lot no.

0~9, A~Z repeated (G, I, J, O, Q, W excepted)

- DFNWB2×2-6L (Top View)



DFN2*2-6L
(Top View)

① ② Represents the product name

Symbol		Product Name
①	②	
9	3	LN1193xxxxDx

③ Represents the type of regulator

Symbol	Type	Product Name
A	Active 'High' (pull-down resistor built in)	LN1193AxxxDx
B	Active 'High' (no pull-down resistor built in)	LN1193BxxxDx
C	Active 'Low' (pull-up resistor built in)	LN1193CxxxDx
D	Active 'Low' (no pull-up resistor built in)	LN1193DxxxDx

④ Represents the integers of Output Voltage

Example: 3 represents 3.x, 5 represents 5.x

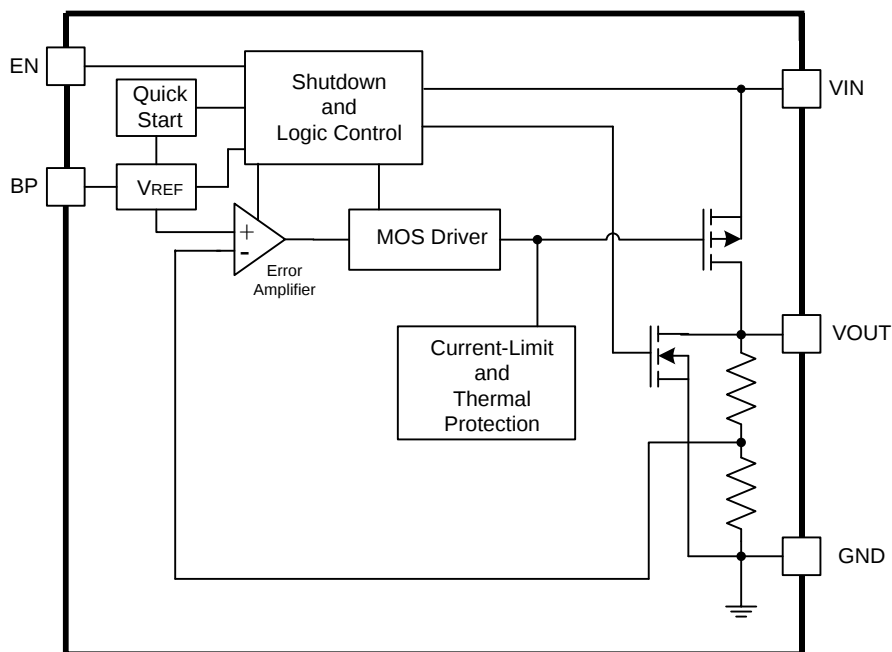
⑤ Represents the decimals of Output Voltage

Symbol	Voltage (V)	Product Name	Symbol	Voltage (V)	Product Name
0	X.0	LN1193XX0XDX	A	X.05	LN1193XXAXDX
1	X.1	LN1193XX1XDX	B	X.15	LN1193XXBXDX
2	X.2	LN1193XX2XDX	C	X.25	LN1193XXCXDX
3	X.3	LN1193XX3XDX	D	X.35	LN1193XXDXDX
4	X.4	LN1193XX4XDX	E	X.45	LN1193XXEXDX
5	X.5	LN1193XX5XDX	F	X.55	LN1193XXFXDX
6	X.6	LN1193XX6XDX	H	X.65	LN1193XXHXDX
7	X.7	LN1193XX7XDX	K	X.75	LN1193XXKXDX
8	X.8	LN1193XX8XDX	L	X.85	LN1193XXLXDX
9	X.9	LN1193XX9XDX	M	X.95	LN1193XXMXDX

⑥ Represents the assembly lot No.

0~9, A~Z repeated (G, I, J, O, Q, W excepted)

■ Function Block Diagram

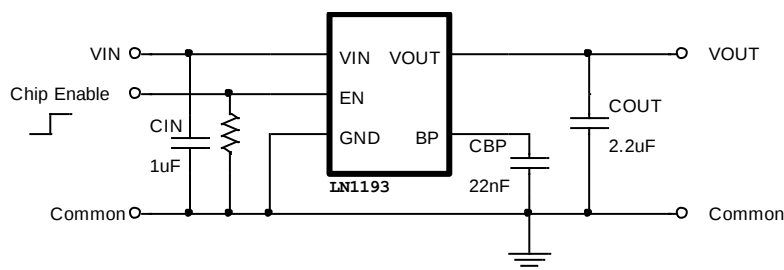


Absolute Maximum Ratings

Parameter	Symbol	Maximum Rating		Unit
Input Voltage	V _{IN}	V _{SS} -0.3~V _{SS} +8		V
	V _{ON/OFF}	V _{SS} -0.3~V _{IN} +0.3		
Output Current	V _{OUT}	V _{SS} -0.3~V _{IN} +0.3		
Power Dissipation	P _D	SOT-23-5,SOT-353/SC70-5	400	mW
		DFN2×2-6L	600	
Operating Ambient Temperature	Topr	-40~+85		°C
Storage Temperature	Tstg	-40~+125		

Caution: The absolute maximum ratings are rated values exceeding which the product could suffer physical damage. These values must therefore not be exceeded under any conditions.

Typical Application Circuit



Caution: The above connection diagram and constant will not guarantee successful operation. Perform thorough evaluation using the actual application to set the constant.

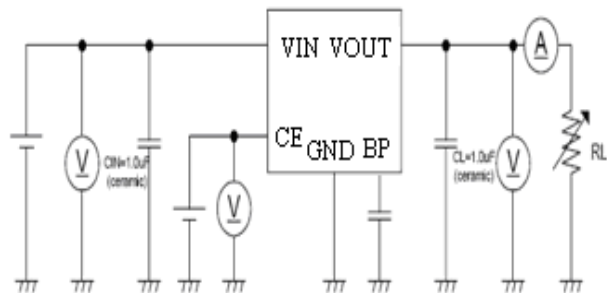
Application Conditions

Input capacitor (CIN): 1.0μF or more

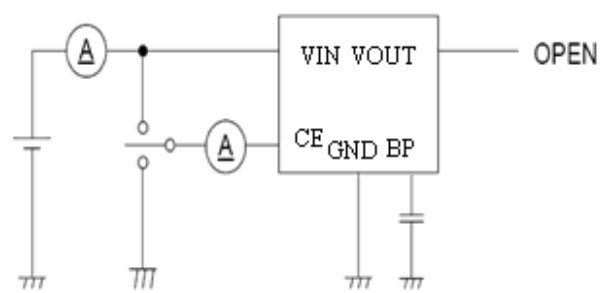
Output capacitor (CL): 2.2μF or more (tantalum capacitor)

Caution A general series regulator may oscillate, depending on the external components selected. Check that no oscillation occurs with the application using the above capacitor.

Test Circuits



Circuit 1



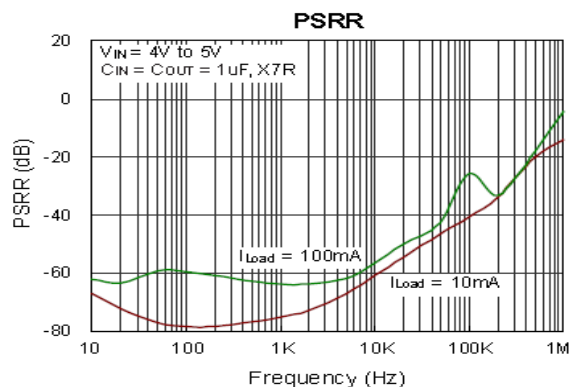
Circuit 2

Electrical Characteristics

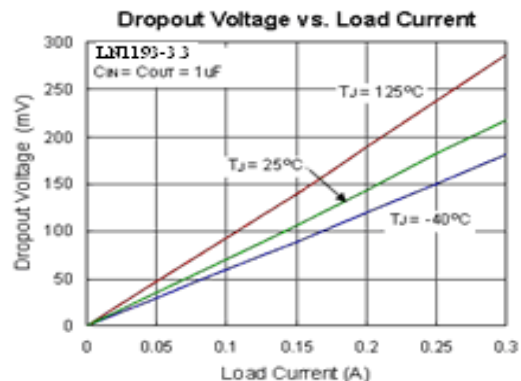
Parameter	Symbol	Condition	Min	Typ	Max	Unit	Circuit
Output Voltage	$V_{OUT(E)}$	$V_{IN} = V_{OUT(S)} + 1.0 \text{ V}$, $I_{OUT} = 30 \text{ mA}$	$V_{OUT(S)} \times 0.98$	$V_{OUT(S)}$	$V_{OUT(S)} \times 1.02$	V	1
Output Current	I_{OUT}	$V_{IN} \geq V_{OUT(S)} + 1.0 \text{ V}$	300	-	-	mA	1
Dropout Voltage	V_{drop}	$I_{OUT} = 50 \text{ mA}$	-	0.10	0.16	V	1
		$I_{OUT} = 100 \text{ mA}$	-	0.20	0.3		
Line Regulations	$\frac{\Delta V_{OUT1}}{\Delta V_{IN} \cdot V_{OUT}}$	$V_{OUT(S)} + 0.5 \text{ V} \leq V_{IN} \leq 6 \text{ V}$ $I_{OUT} = 30 \text{ mA}$	-	0.10	0.3	%/V	
Load Regulation	ΔV_{OUT2}	$V_{IN} = V_{OUT(S)} + 1.0 \text{ V}$ $1.0 \text{ mA} \leq I_{OUT} \leq 100 \text{ mA}$	-	50	100	mV	
Output Voltage Temperature Characteristics	$\frac{\Delta V_{OUT}}{\Delta T_a \cdot V_{OUT}}$	$V_{IN} = V_{OUT(S)} + 1.0 \text{ V}$, $I_{OUT} = 10 \text{ mA}$ $-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$	-	± 100	-	ppm/ $^\circ\text{C}$	
Supply Current	I_{SS1}	$V_{IN} = V_{OUT(S)} + 1.0 \text{ V}$	-	70	-	μA	2
Input Voltage	V_{IN}	-	2.0	-	6	V	-
Ripple-Rejection	PSRR	$V_{IN} = V_{OUT(S)} + 1.0 \text{ V}$, $f = 10\text{KHz}$ $V_{rip} = 0.5 \text{ Vrms}$, $I_{OUT} = 50 \text{ mA}$	-	50	-	dB	1
		$V_{IN} = V_{OUT(S)} + 1.0 \text{ V}$, $f = 100\text{Hz}$ $V_{rip} = 0.5 \text{ Vrms}$, $I_{OUT} = 50 \text{ mA}$	-	70	-		
Short-circuit Current	I_{short}	$V_{IN} = V_{OUT(S)} + 1.0 \text{ V}$, V_{CE} on $V_{OUT} = \text{gnd}$	-	40	-	mA	1
CE "High" Voltage	V_{CEH}	-	1.3	-	V_{IN}	V	1
CE "Low" Voltage	V_{CEL}	-	-	-	0.4	V	1
CE "High" Current	I_{CEH}	$V_{IN} = V_{CE} = V_{OUT(T)} + 1.0\text{V}$	-0.1	-	0.1	μA	2
CE "Low" Current	I_{CEL}	$V_{IN} = V_{OUT(T)} + 1.0\text{V}$, $V_{CE} = V_{SS}$	-0.1	-	0.1	μA	2

Typical Performance Characteristics (3.0V output)

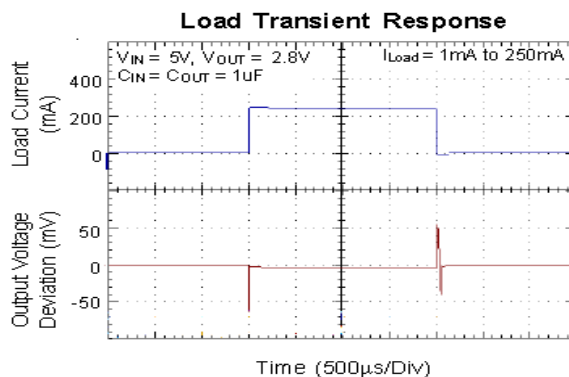
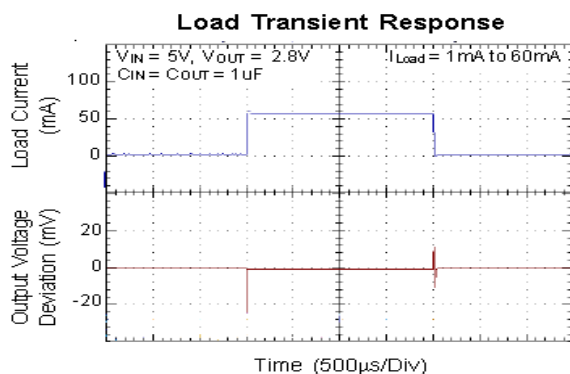
1、PSRR vs. Frequency



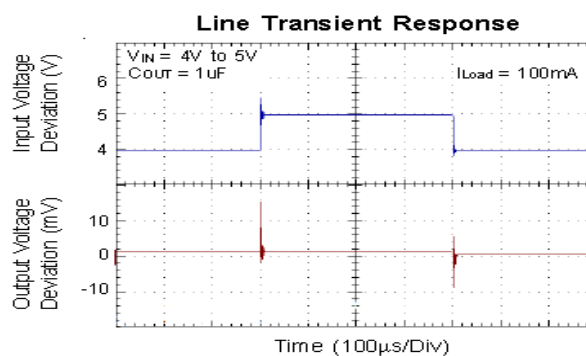
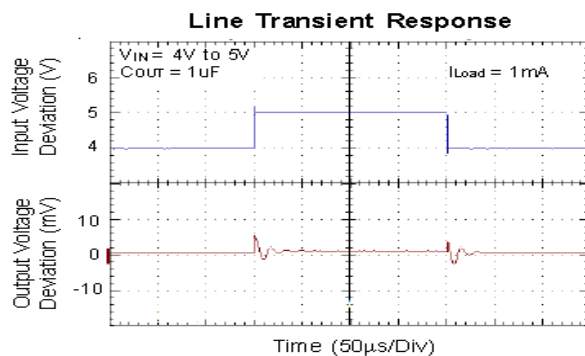
2、Dropout Voltage vs. Load Current



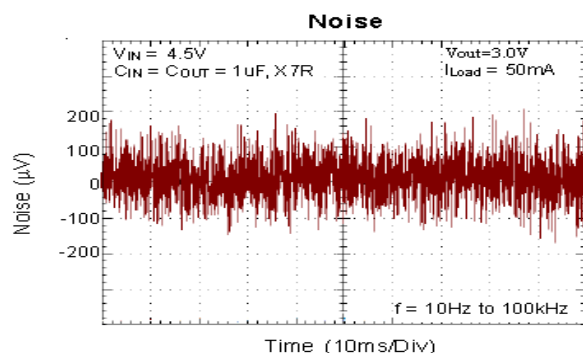
3、Load Transient Response



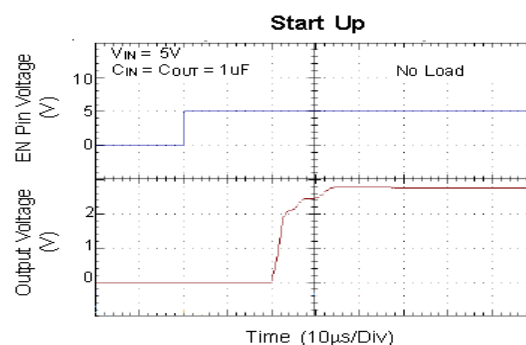
4、line transient response



5、Noise

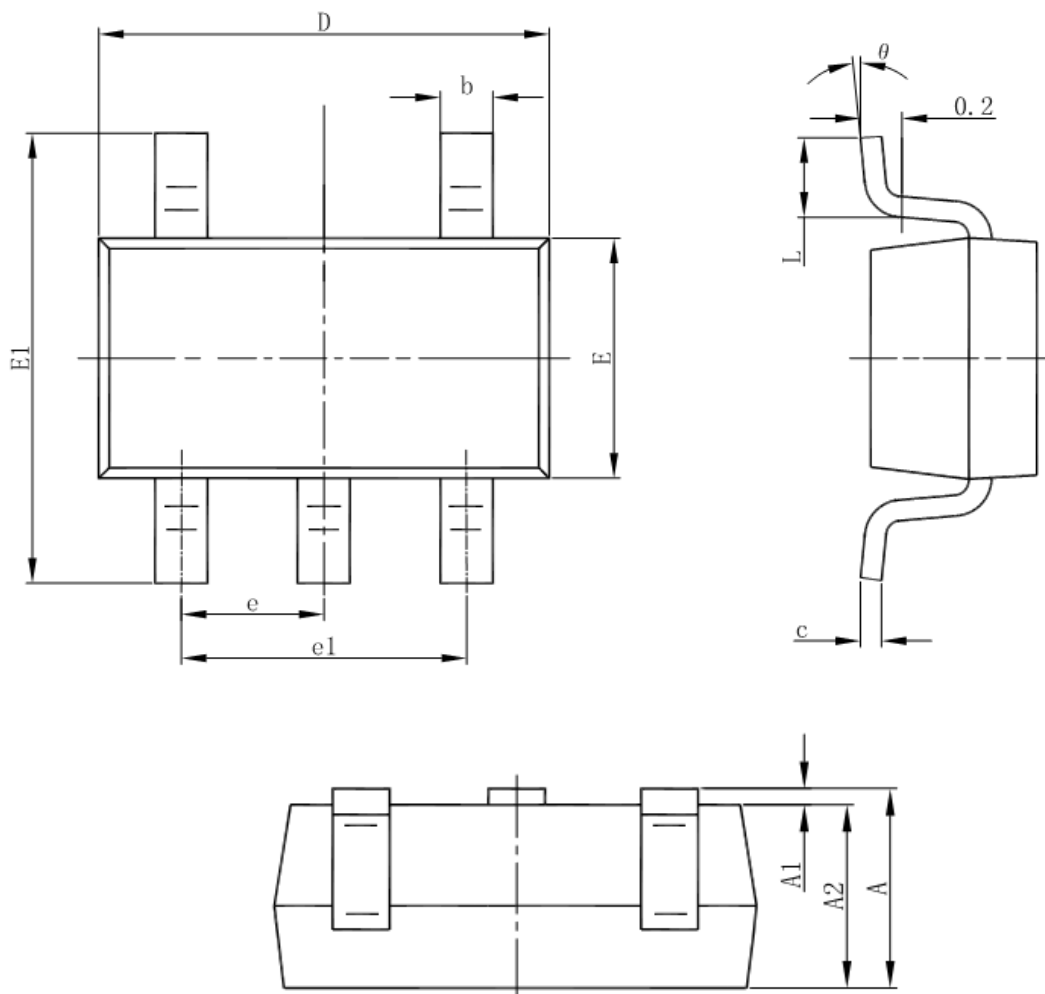


6、start up



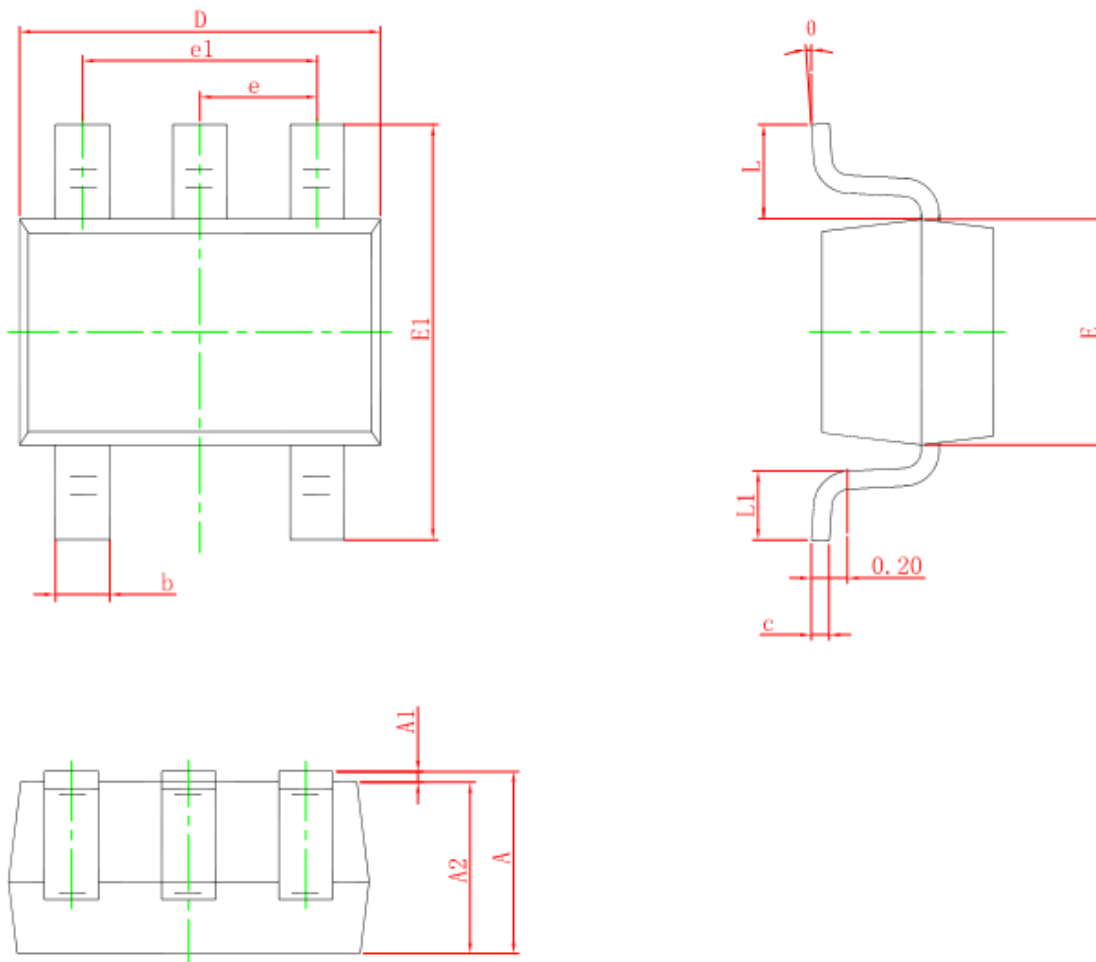
■ Package Information

● SOT-23-5L



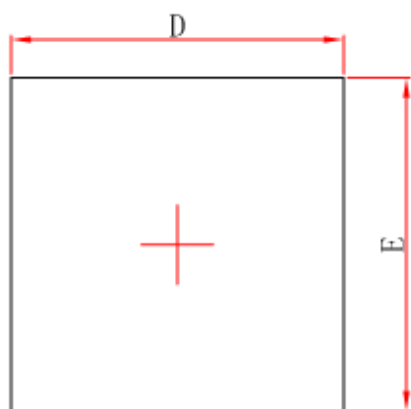
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)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

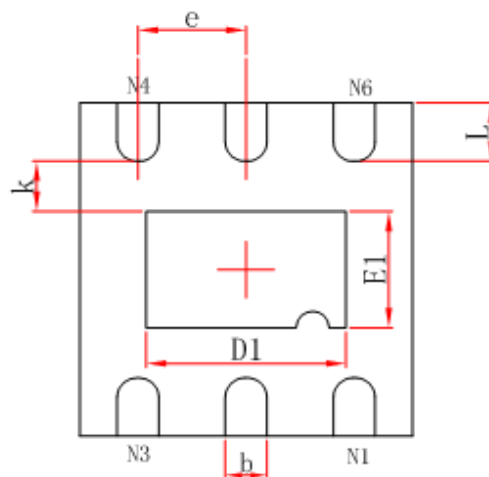


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650 TYP		0.026 TYP	
e1	1.200	1.400	0.047	0.055
L	0.525 REF		0.021 REF	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

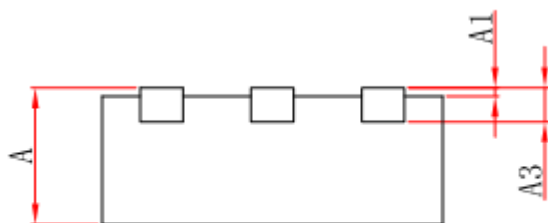
● DFN2×2-6L



Top View



Bottom View



Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	1.900	2.100	0.075	0.083
E	1.900	2.100	0.075	0.083
D1	1.100	1.300	0.043	0.051
E1	0.600	0.800	0.024	0.031
k	0.200MIN.		0.008MIN.	
b	0.180	0.300	0.007	0.012
e	0.650TYP.		0.026TYP.	
L	0.250	0.450	0.010	0.018