Dual 300mA High Speed Low Dropout CMOS Voltage Regulators

■ General Description

The LN6401 series are highly accurate, Dual, low noise, CMOS LDO voltage regulators. Performance features of the series include low output noise, high ripple rejection ratio, low dropout and very fast turn-on times.

The LN6401 includes a reference voltage source, error amplifiers, driver transistors, current limiters and phase compensators internally. TheLN6401's current limiter's foldback circuit also operates as a short protect for the output current limiter. The output voltage for each regulator is set independently by laser trimming. Voltages are selectable in 50mV steps within a range of 1.3V to 6.0V.The EN function allows the output of each regulator to be turned off independently, resulting in greatly reduced power consumption. The LN6401 series is available in the SOT-26 and DFN package.

■ Features

- Output voltage range : 1.3V to 6.0V (selectable in 50mV steps)
- Highly accurate : ± 2%
- Dropout voltage : 200mV @ 100mA (3.0V type)
- High ripple rejection : 70dB (1 kHz)
- Low power consumption : 120μA (TYP.)
- Maximum output current : 300mA
- Standby current : less than 0.1μA
- Internal protector : current limiter and short protector

■ Applications

- Mobile phones
- Cordless phones and radio communication equipment
- Cameras, Video cameras
- Portable games
- Portable AV equipment
- PDAs

■ Package

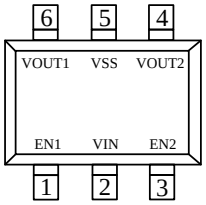
- SOT-23-6L
- DFN2×2-6
- DFN1.8×2-6

■ Ordering Information

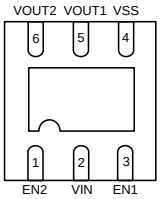
LN6401 ①②③④⑤⑥⑦⑧

Designator	Description	Symbol	Description
①	Regulator1 EN type	E	Active 'High' (pull-down resistor built in)
		F	Active 'High' (no pull-down resistor built in)
		G	Active 'Low' (pull-up resistor built in)
		H	Active 'Low' (no pull-up resistor built in)
②	Regulator2 EN type	E	Active 'High' (pull-down resistor built in)
		F	Active 'High' (no pull-down resistor built in)
		G	Active 'Low' (pull-up resistor built in)
		H	Active 'Low' (no pull-up resistor built in)
③④	Regulator1 Output Voltage	13～50	eg. 30 represents 3.0V
⑤⑥	Regulator2 Output Voltage	13～50	eg. 30 represents 3.0V
⑦	Packaging Types	M	SOT-23-6L
		D	DFN2×2-6/DFN1.8×2-6
⑧	Device Orientation	R	Embossed tape: Standard feed
		L	Embossed tape: Reverse feed

■ Pin Configuration



SOT-23-6L
(Top View)



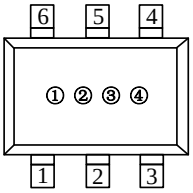
DFN2*2-6/DFN1.8*2-6
(Top View)

■ Pin Assignment

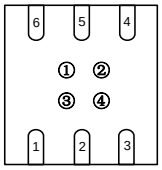
Pin Number		Pin Name	Function
SOT-23-6L	DFN2×2-6/DFN1.8×2-6		
1	3	EN1	ON/OFF Control1
2	2	VIN	Power Input
3	1	EN2	ON/OFF Control2
4	6	VOUT2	Output2
5	4	GND	Ground
6	5	VOUT1	Output 1

■ Marking Rule

- SOT-23-6L、DFN2×2-6、DFN1.8×2-6



SOT-23-6L
(Top View)



DFN2*2-6/DFN1.8*2-6
(Top View)

① Represents the product name

Symbol	Product Name
1	LN6401◆◆◆◆◆◆◆◆

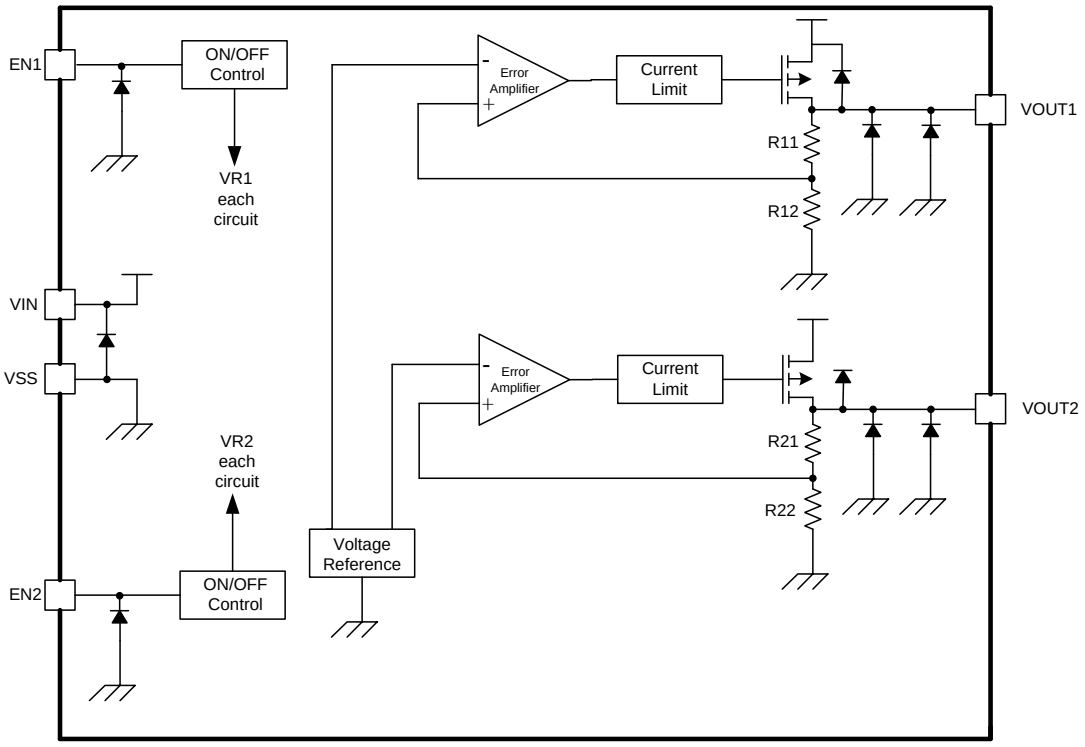
② ③ Represents output voltage

MARK	VOUT1(V)	VOUT2(V)	EN1	EN2
BX	1.2	2.8	High Enable	High Enable
EX	1.5	2.8	High Enable	High Enable
KT	1.8	2.5	High Enable	High Enable
KX	1.8	2.8	High Enable	High Enable
K2	1.8	3.3	High Enable	High Enable
TX	2.5	2.8	High Enable	High Enable
XX	2.8	2.8	High Enable	High Enable
X2	2.8	3.3	High Enable	High Enable
66	3.0	3.0	High Enable	High Enable
Z2	3.0	3.3	High Enable	High Enable

④ Represents the assembly lot no.

0 to 9，A to Z, reversed character of 0 to 9 and A to Z repeated (G,I,J,O,Q W excepted)

■ Function Block Diagram

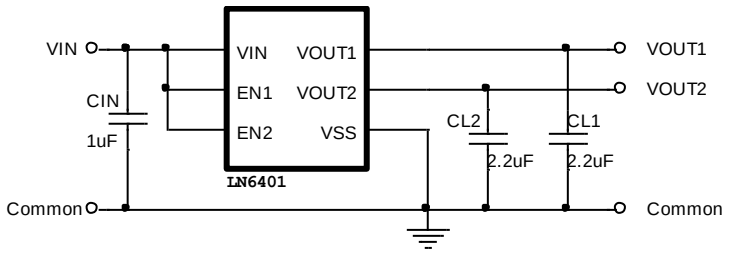


■ Absolute Maximum Ratings

Parameter	Symbol	Maximum Rating		Unit
Input Voltage	V_{IN}	V_{SS}-0.3～V_{SS}+10		V
	V_{EN}	V_{SS}-0.3～V_{IN}+0.3		
Output Voltage	V_{OUT}	V_{SS}-0.3～V_{IN}+0.3		
Output Current	I_{OUT1}+I_{OUT2}	700		mA
Power Dissipation	P_D	SOT-23-6L	250	mW
		DFN2×2-6/DFN1.8×2-6	100	
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

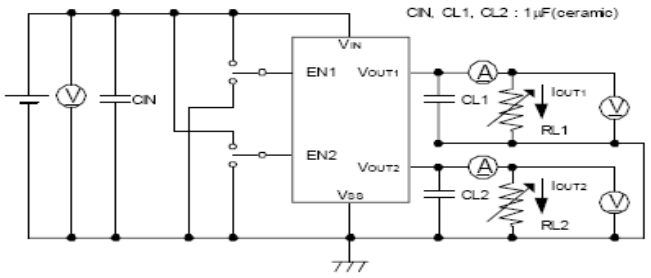
Input capacitor (CIN): 1.0μF or more

Output capacitor (CL): 1.0μF or more (tantalum capacitor)

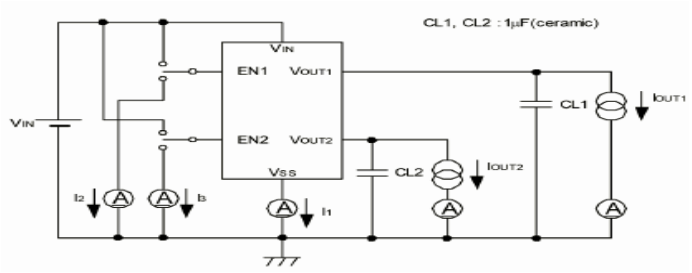
Caution A general series regulator may oscillate, depending on the external components selected. Check that no oscillation occurs with the application using the above capacitor.

■ Test Circuits

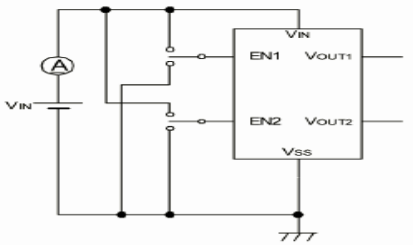
Circuit ①



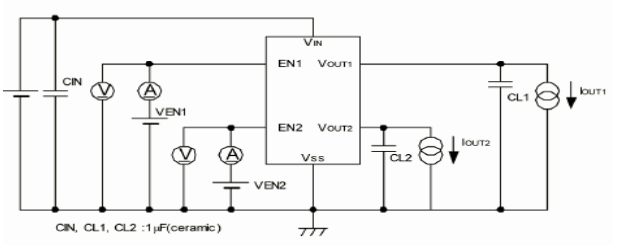
Circuit ②



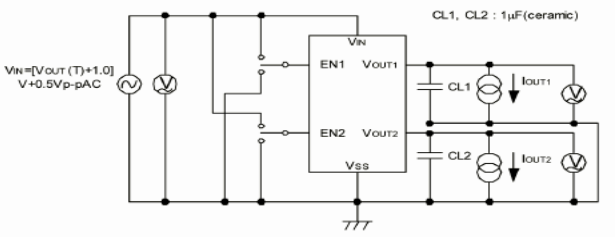
Circuit ③



Circuit ④



Circuit ⑤

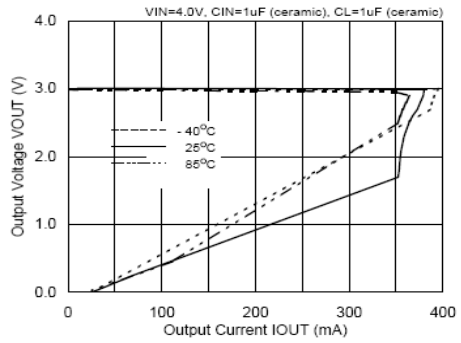


■ Electrical Characteristics

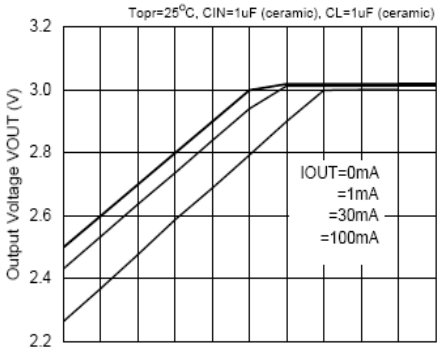
Parameter	Symbol	Condition	Min	Typ	Max	Unit	Circuit
Output Voltage	$V_{OUT(E)}$	V_{IN} =$V_{OUT(S)}$+1.0 V, I_{OUT}=10 mA	$V_{OUT(S)}$ ×0.98	$V_{OUT(S)}$	$V_{OUT(S)}$ ×1.02	V	1
Output Current	I_{OUT}	V_{IN}≥$V_{OUT(S)}$+1.0 V	300	—	—	mA	1
Dropout Voltage	V_{drop}	I_{OUT}=50 mA	—	0.06	0.10	V	1
		I_{OUT}=100 mA	—	0.20	0.30		
Line Regulations	$\frac{\Delta V_{OUT1}}{\Delta V_{IN} \bullet V_{OUT}}$	$V_{OUT(S)}$+0.5 V ≤V_{IN}≤7 V I_{OUT}=10 mA	—	0.01	0.2	%/V	
Load Regulation	ΔV_{OUT2}	V_{IN}=$V_{OUT(S)}$+1.0 V 1.0 mA ≤I_{OUT} ≤100 mA	—	15	50	mV	
Output Voltage Temperature Characteristics	$\frac{\Delta V_{OUT}}{\Delta Ta \bullet V_{OUT}}$	V_{IN}=$V_{OUT(S)}$+1.0 V, I_{OUT}=10 mA -40°C ≤Ta ≤85°C	—	±100	—	ppm/℃	
Supply Current	I_{SS1}	V_{IN}=$V_{OUT(S)}$+1.0 V	—	90	120	μA	2
Standby Current	I_{STB}	V_{IN}=V_{EN}=$V_{OUT(T)}$+1V ， V_{EN}=VSS	—	0.01	0.1	μA	3
Input Voltage	V_{IN}	——	2.0	—	7	V	—
Ripple-Rejection	|PSRR|	V_{IN}=$V_{OUT(S)}$+1.0 V，f=1 kHz Vrip=0.5 Vrms, I_{OUT}=30 mA	—	70	—	dB	5
Short-circuit Current	Ishort	V_{IN}=$V_{OUT(S)}$+1.0 V, V_{IN}=V_{EN}	—	30	—	mA	1
Current limiter	Ilim	V_{IN}=V_{EN}=$V_{OUT(T)}$+1V	—	450	—	mA	1
CE “High” Voltage	V_{CEH}		1.3		VIN	V	2
CE “Low” Voltage	V_{CEL}				0.25	V	2
CE “High” Current	I_{CEH}	V_{IN}=V_{EN}=$V_{OUT(T)}$+1V	-0.1		0.1	uA	2
CE “Low” Current	I_{CEH}	V_{IN}=V_{EN}=$V_{OUT(T)}$+1V ，V_{EN}=V_{SS}	-0.1		0.1	uA	2

■ Typical Performance Characteristics （3.0V output）

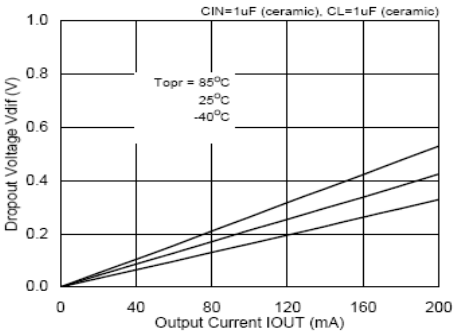
1、Output Voltage vs. Output Current



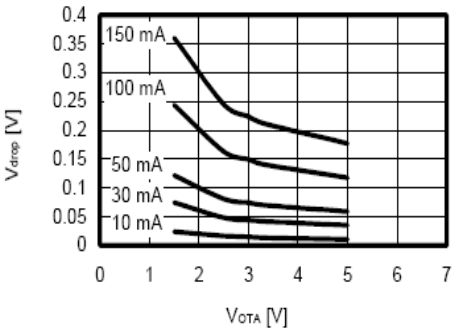
2、Outpout Voltage vs. Input Current (Contd)



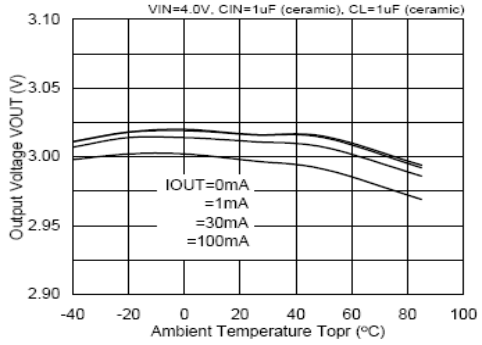
3、Dropout Voltage vs. Output Current



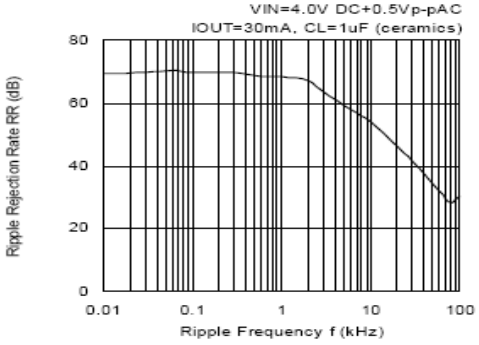
4、Dropout Voltage vs. Output Voltage



5、Output Voltage VS. Ambient Temperature

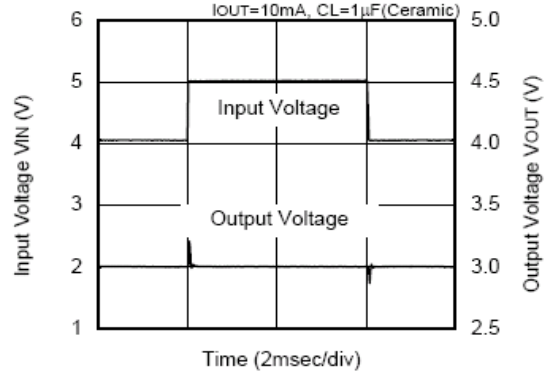


6、Ripple Rejection Rate

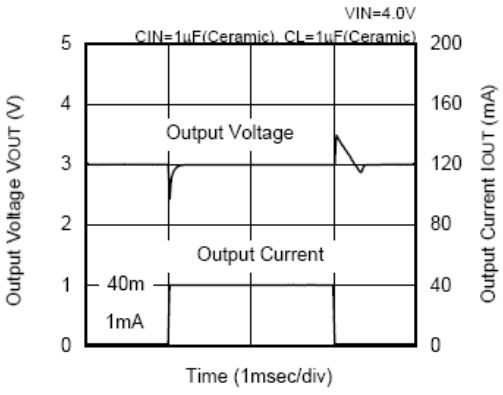


7. Transient Response

Input Transient Response

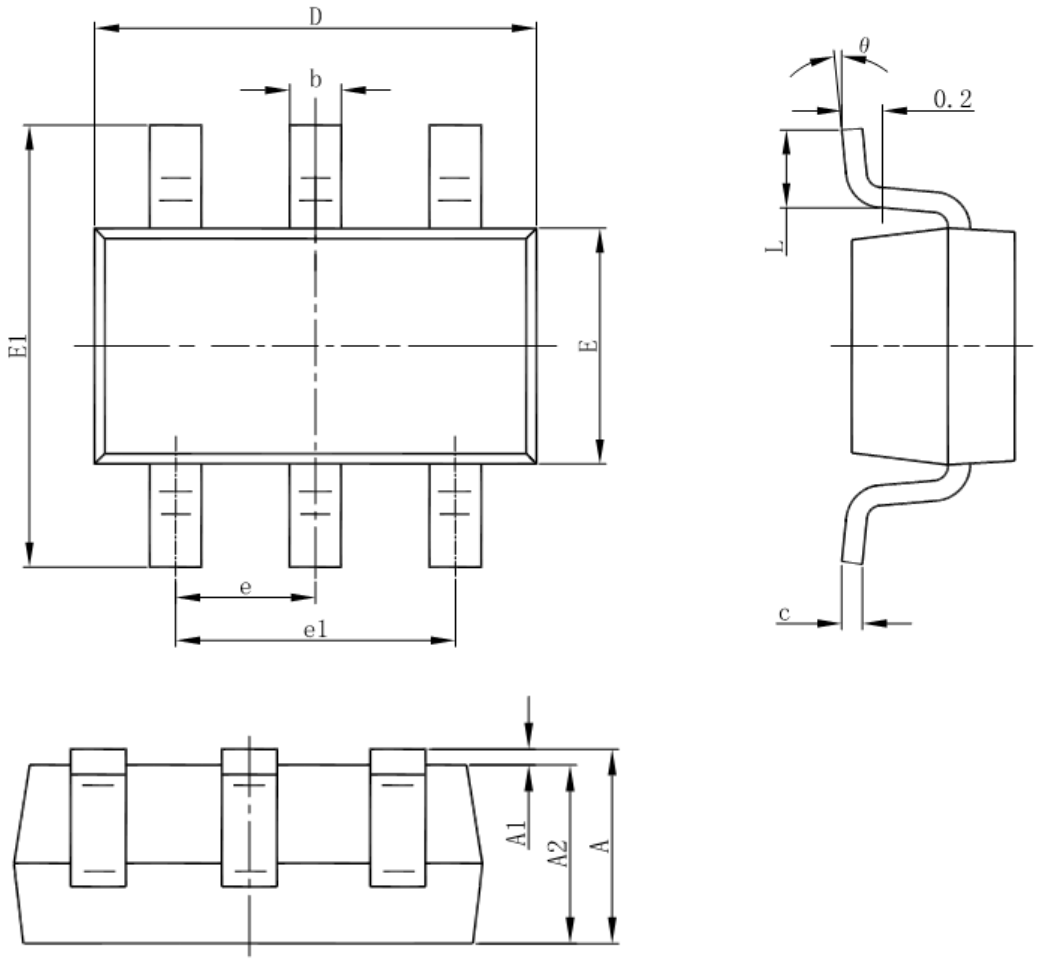


Load Transient Response



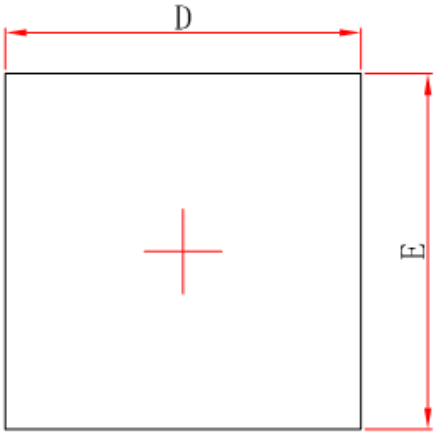
■ Package Information

- **SOT-23-6L**

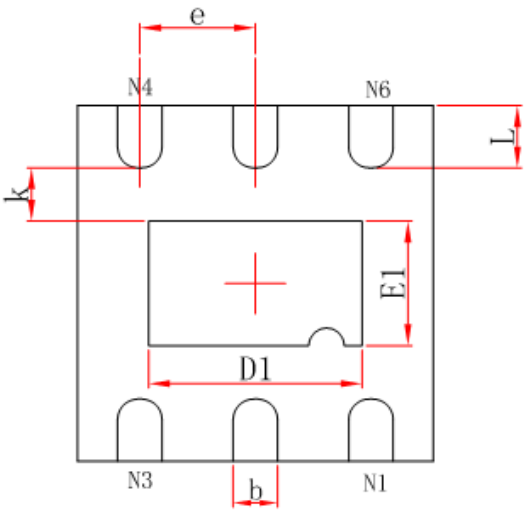


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)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

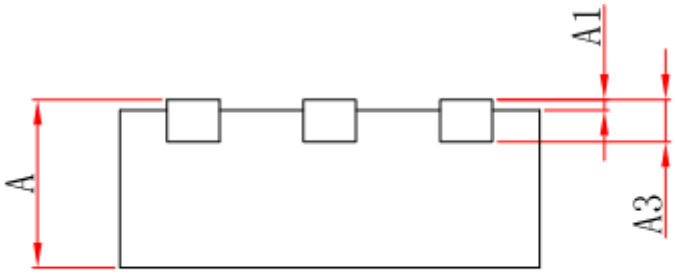
- **DFN2×2-6**



Top View



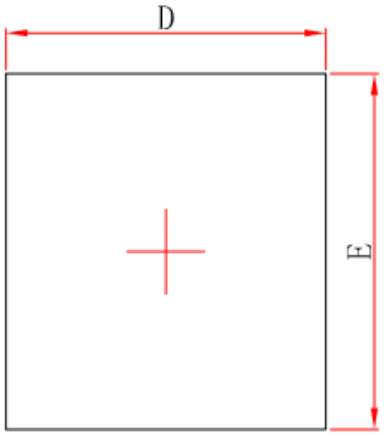
Bottom View



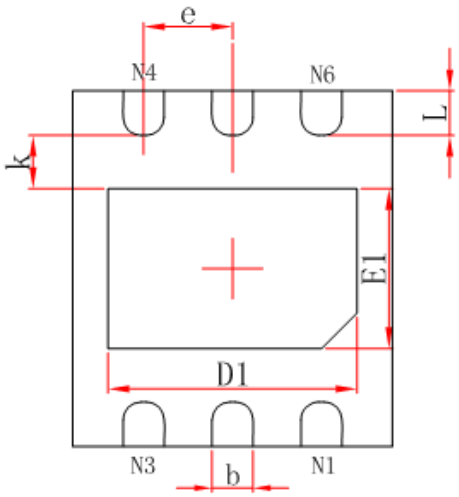
Side View

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

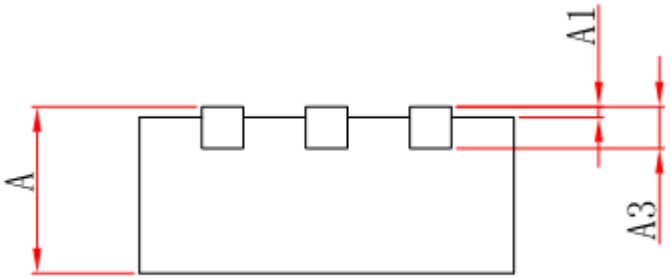
- **DFN1.8×2-6**



Top View



Bottom View



Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.450/0.550	0.550/0.650	0.018/0.022	0.022/0.026
A1	0.000	0.050	0.000	0.002
A3	0.150REF.		0.006REF.	
D	1.724	1.876	0.068	0.074
E	1.924	2.076	0.076	0.082
D1	1.300	1.500	0.051	0.059
E1	0.800	1.000	0.031	0.039
k	0.200MIN.		0.008MIN.	
b	0.180	0.280	0.007	0.011
e	0.500TYP.		0.020TYP.	
L	0.174	0.326	0.007	0.013