GENERAL DESCRIPTION

The LW82XX Series is a group of voltage regulators with high accuracy, high speed, low drop-out, reverse current protection, high ripple rejection and fast discharge function.

The series consists of a voltage reference, an error amplifier, a driver transistor, a current limiter, a thermal protection circuit, a reverse current protection circuit and a phase compensation circuit.

Output voltage is selectable from 0.8V to 5.0V which fixed by laser trimming technologies, Step=100mV.

The LW82XX Series is available in SOT23-5L, DFN2x2-6L, DFN3x3-8L and SOT89-5L packages.

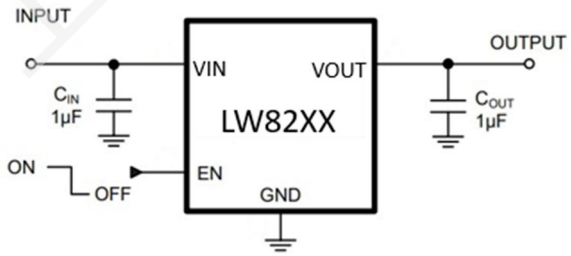
FEATURES

- Output Accuracy: ±1.0%
- Low Quiescent Current: 28uA
- Low Dropout Voltage: 310mV@1000mA/3.3V
- High PSRR: 78dB@1KHz, 10mA
- Output Current: 1000mA
- Excellent Line and Load Transient Response
- Operating Voltage Range: from 1.8V to 7.0V
- Output Voltage Range: from 0.8V to 5.0V
- Over-Temperature Protection
- Current Limiting Protection
- Output Short-Circuit Protection
- Reverse Current Protection Function
- Available in SOT23-5L, DFN2x2-6L, DFN3x3-8L and SOT89-5L Packages

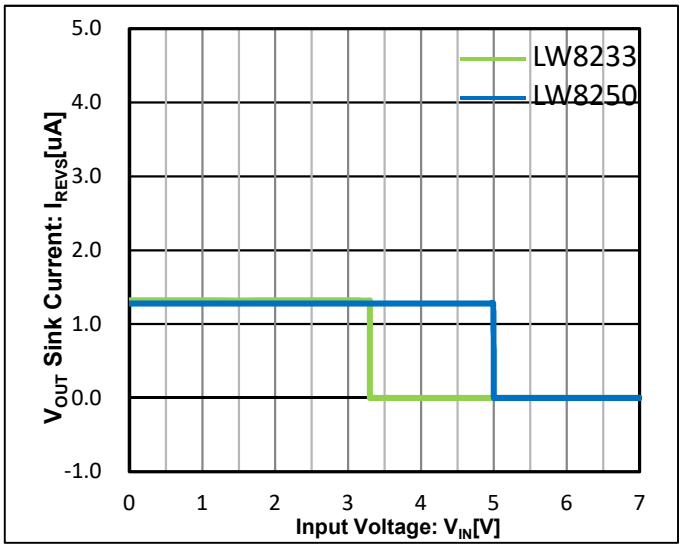
APPLICATIONS

- Battery-Powered Devices
- Reference Voltage Sources
- USB products and HDMI Equipments
- Other Low Voltage Power Suppliers

TYPICAL APPLICATION CIRCUIT



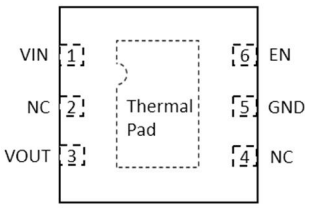
TYPICAL PERFORMANCE CHARACTERISTICS



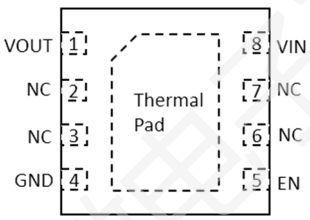
PIN DESCRIPTION:

PIN No				SYMBOL	DESCRIPTTION
DFN2x2-6L (Type-A)	DFN3x3-8L	SOT23-5L (Type-A)	SOT89-5L		
1	8	1	4	VIN	Power Supply Input
5	4	2	2	GND	Ground
6	5	3	1	EN	Chip Enable
2,4	2,3,6,7	4	3	NC	Not Connected
3	1	5	5	VOUT	Output
Thermal pad		--	--	Pad	Connect the thermal pad to a large area GND plane

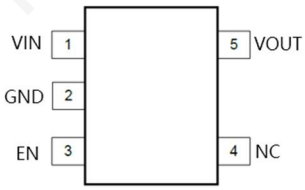
PIN ASSIGNMENT



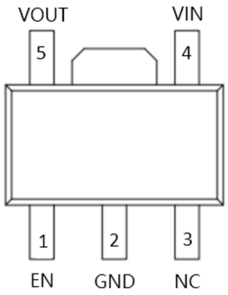
DFN2x2-6L(Type-A)



DFN3x3-8L



SOT23-5L(Type-A)



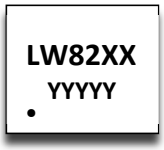
SOT89-5L

MARK INFORMATION:

DFN2x2-6L/DFN3x3-8L

XX: VOLTAGE

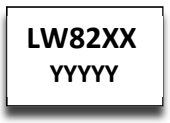
YY: DATE CODE



SOT23-5L

XX: VOLTAGE

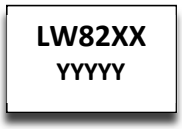
YY: DATE CODE



SOT89-5L

X: VOLTAGE

YY: DATE CODE



ABSOLUTE MAXIMUM RATINGS (1):

(T_A =25℃, unless otherwise specified.)

SYMBOL	ITEM		RATING	UNIT
V_{IN}	Supply Voltage		-0.3~8.0	V
V_{EN}	EN Pin Voltage		-0.3~8.0	V
V_{OUT}	VOUT pin Voltage		-0.3~ (V_{IN}+0.3)	V
$V_{(ESD)}$	ESD Susceptibility, HBM(2)		±4000	V
P_D	Maximum Power Dissipation(3)	DFN2x2-6L	1.56	W
		DFN3x3-8L	2.4	
		SOT23-5L	0.59	
		SOT89-5L	1.64	
$R_{\theta JA}$	Junction-to-ambient Thermal Resistance (3)	DFN2x2-6L	80	℃/W
		DFN3x3-8L	52	
		SOT23-5L	210	
		SOT89-5L	76	
T_J	Junction Temperature Range		-40~150	℃
T_{STG}	Storage Temperature Range		-40~150	℃
T_{SOLDER}	Lead Temperature (Soldering)		260℃, 10s	

Note:

1. Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability

2. per ANSI/ESDA/JEDEC JS-001

3. Device mounted on FR-4 PCB

RECOMMANDED OPERATING RANGE:

SYMBOL	ITEM	VALUE	UNIT
V_{IN}	VIN Supply Voltage	1.8~7.0	V
V_{EN}	EN Pin Voltage	0~7.0	V
V_{OUT}	V_{OUT} Pin Voltage	0.8~5.0	V
I_{OUT}	Output Current	0~1.0	A
T_J	Junction Temperature Range	-40~125	℃

ELECTRICAL CHARACTERISTICS:

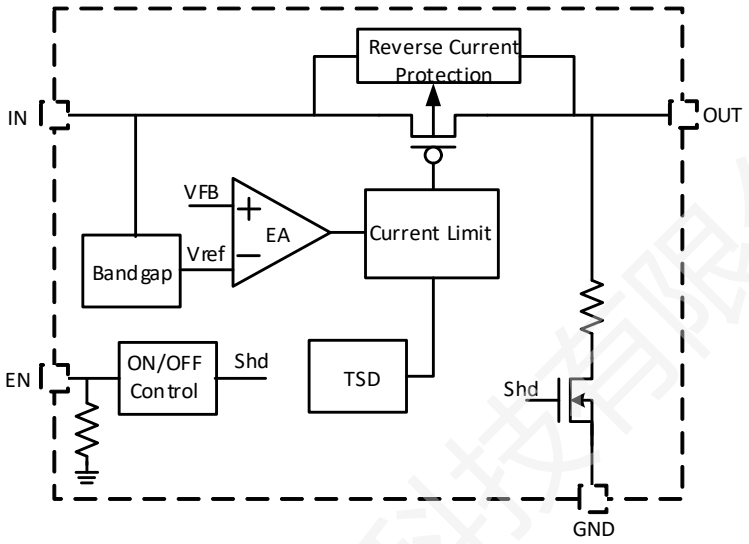
(V_{IN}=V_{OUT}+1V, V_{OUT}=3.3V, C_{IN}= C_{OUT}=1uF, T_A =25℃, unless otherwise specified.)

Symbol	Parameter	Conditions		MIN	TYP	MAX	Units
V_{IN}	Input Voltage			1.8		7.0	V
V_{OUT}	Output Accuracy	I_{OUT}= 1mA		-1.0		+1.0	%
I_{LIM}	Current Limit(1)	V_{IN}=4.3V, V_{OUT} =3.3V		1.1	1.45		A
I_Q	Quiescent Current	V_{IN}=V_{EN}=V_{OUT}+1V, No Load			28	45	μA
I_{SHD}	Shutdown Current	V_{IN}=7.0V, V_{EN}=0V				0.1	μA
V_{DROP}	Dropout Voltage(2)	I_{OUT}=300mA			84		mV
		I_{OUT}=500mA			143		
		I_{OUT}=1000mA			310		
S_{LINE}	Line Regulation	V_{IN}= V_{OUT} +1V to 7.0V, I_{OUT}=1mA			0.05	0.1	%/V
S_{LOAD}	Load Regulation	1mA≤I_{OUT}≤1000mA			0.001	0.01	%/mA
I_{SHORT}	Short Current	V_{OUT}=0V			70		mA
V_{ENH}	EN High Voltage	V_{IN}=1.8V to 7.0V, I_{OUT}=1mA		1.5			V
V_{ENL}	EN Low Voltage					0.5	V
T_{STR}	Startup Time	From V_{EN} 'L'→'H' to 95%*V_{OUT}, C_{OUT}=1uF, No Load			50		μs
PSRR	Power Supply Rejection Ratio	C_{IN} =None, V_{OUT}=3.3V, I_{OUT}=10mA	f=217Hz		79		dB
			f=1KHz		78		
			f=10KHz		72		
I_{REV}	Reverse Current(3)	V_{IN}=0V, V_{OUT}=7.0V			0.01	0.5	μA
I_{REVS}	VOUT Pin Sink Current(4)	V_{IN}=6.0V, V_{OUT}=7.0V			1.5	2.5	μA
T_{SD}	Thermal Shut Down	Temperature rising			160		℃
△T_{SD}	TSD Hysteresis	Temperature falling			20		℃
$R_{DISCHRG}$	R_{ON} of Discharge MOSFET	V_{EN}=0V			80		Ω

NOTES:

1. Guaranteed by design
2. The dropout voltage is defined as V_{IN} - V_{OUT}, when V_{OUT} =95%*$V_{OUT(NOM)}$
3. Reverse Current (I_{REV}) flows from V_{OUT} to V_{IN}
4. V_{OUT} Pin Sink Current (I_{REVS}) flows from V_{OUT} to GND

SIMPLIFIED BLOCK DIAGRAM:



DETAIL OPERATION DESCRIPTION:

The LW82XX Series is a low noise, high PSRR, low drop-out voltage regulator. It consists of a current limiter circuit, a driver transistor, a precision voltage reference, a thermal protection circuit, a reverse current protection circuit and an error correction circuit, and is compatible with low ESR ceramic capacitors. The current limiter's fold-back circuit operates as a short circuit protection as well as the output current limiter.

Reverse Current Protection

The LW82XX series includes reverse current protection to prevent the damage as a result of current flow from VOUT pin to the VIN pin when the power supply is connected to the VOUT pin. When VIN is smaller than VOUT, the reverse current protection works and suppress the reverse current to 0.5μA (MAX.). When VIN is smaller than VOUT, the VOUT pin sink current flowing from the VOUT pin to the GND pin is 1.5μA (TYP.) as the IC operation current. Please also note when an external power supply is connected to the VOUT pin, please use it within 7.0V.

Current Limiting and Short-Circuit Protection

The current limit circuitry prevents damage to the MOSFET switch and the hub downstream port but can deliver load current up to the current limit threshold through the switch. When a heavy load or short circuit is applied to an enabled switch, a large transient current may flow until the current limit circuitry responds. Once this current limit threshold is exceeded the device enters constant current mode until the thermal shutdown occurs or the fault is removed.

Thermal Shutdown

When the junction temperature of the built-in driver transistor reaches the temperature limit level (160℃ TYP.), the thermal shutdown circuit operates and the driver transistor will be turned OFF. The IC resumes its operation when the thermal shutdown function is released and the IC's operation is automatically restored because the junction temperature drops to the level of 140℃ (TYP.) as the thermal shutdown release threshold.

Chip Enable

The LW82XX series can be turned off via the EN pin signal. In shutdown mode, output at the VOUT pin will be pulled down to the GND.

The LW82XX series has a pull-down resistor in order to operate normally even the EN pin is floating.

If the EN pin voltage is set with the specified voltage range, the logic is fixed and the IC will operate normally.

TYPICAL OPERATING CHARACTERISTICS:

（*Tested under* T_A *=25*°C, unless otherwise specified）

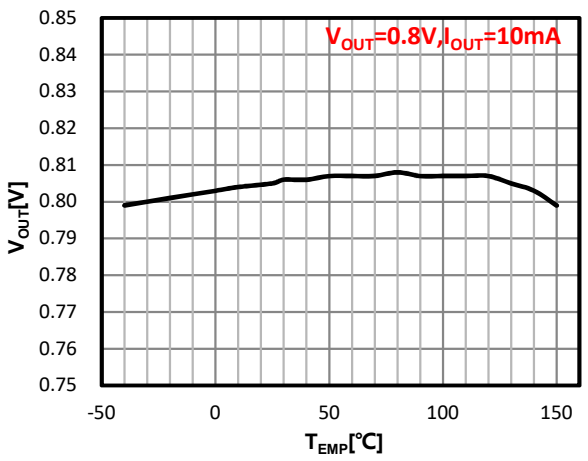


Figure 1. V_{OUT} vs Temperature

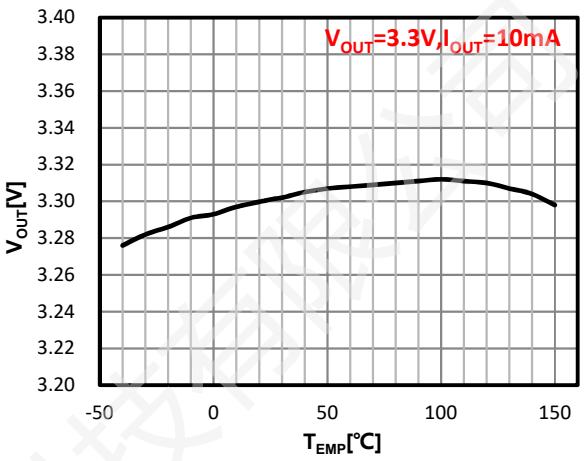


Figure 2. V_{OUT} vs Temperature

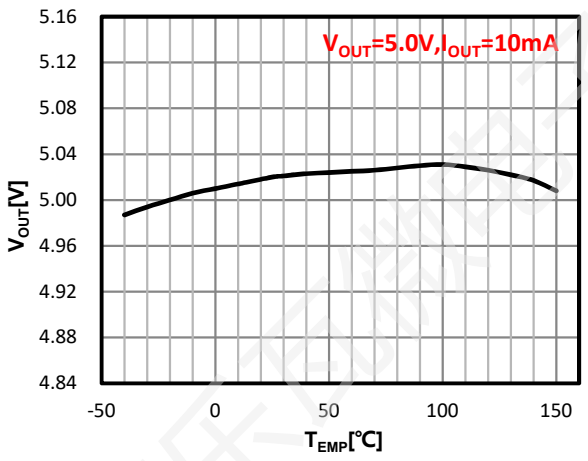


Figure 3. V_{OUT} vs Temperature

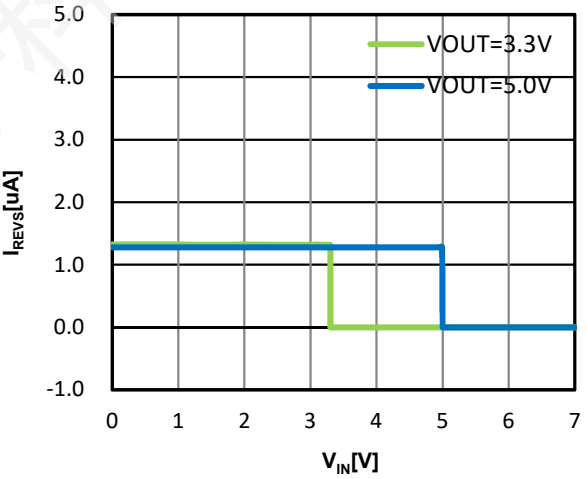


Figure 4. V_{OUT} Sink Current VS Input Voltage

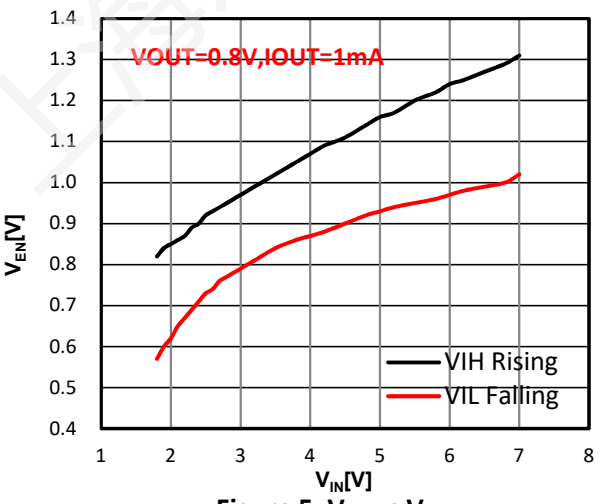


Figure 5. V_{EN} vs V_{IN}

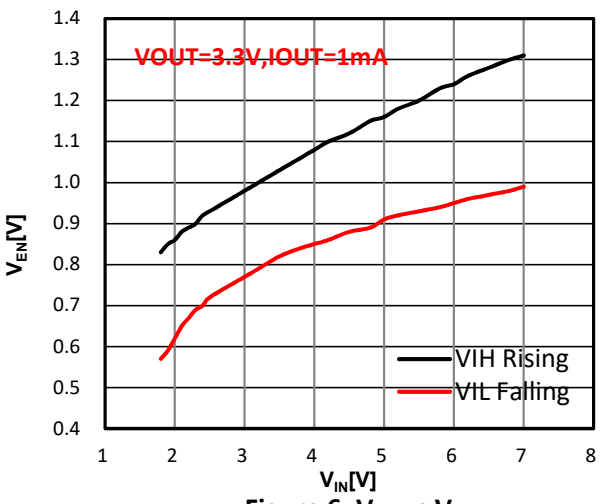


Figure 6. V_{EN} vs V_{IN}

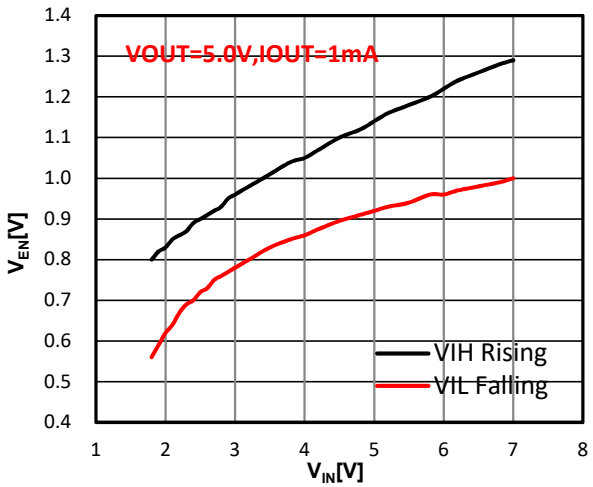


Figure 7. V_{EN} vs V_{IN}

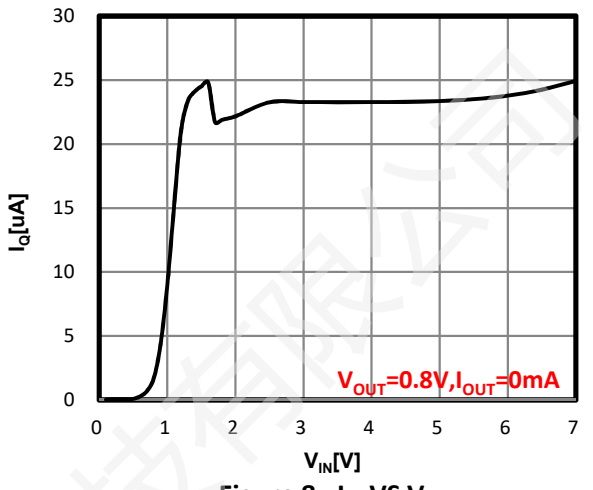


Figure 8. I_Q VS V_{IN}

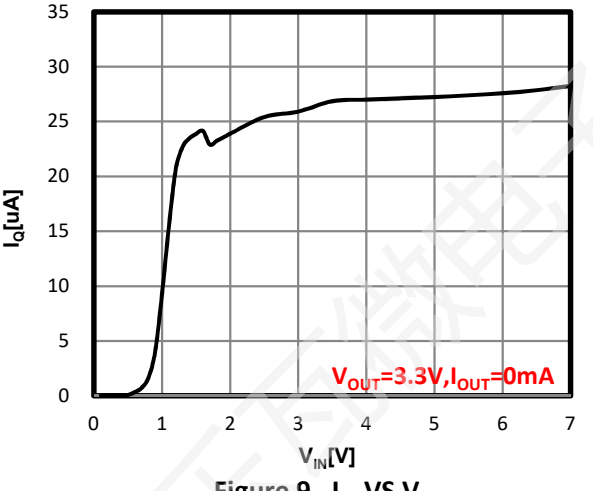


Figure 9. I_Q VS V_{IN}

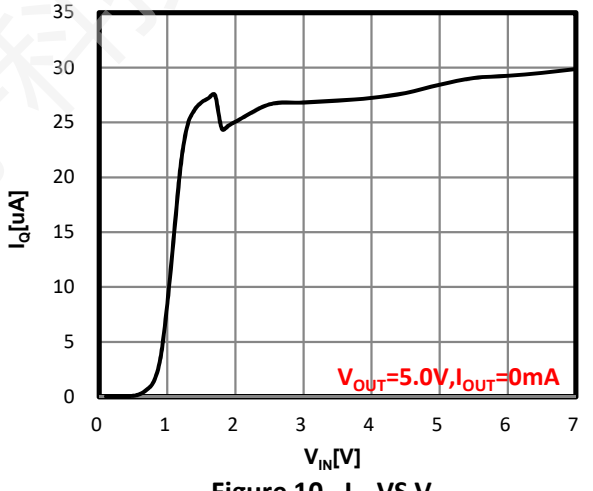


Figure 10. I_Q VS V_{IN}

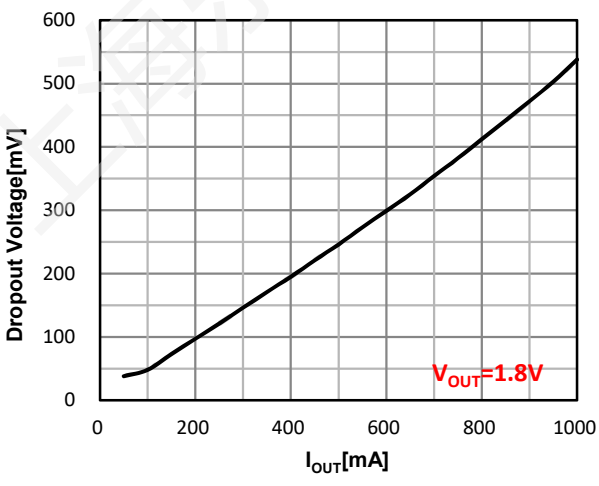


Figure 11. Dropout Voltage VS I_{OUT}

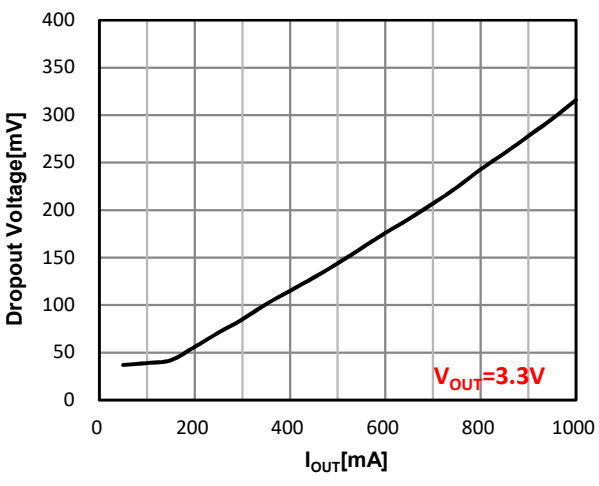


Figure 12. Dropout Voltage VS I_{OUT}

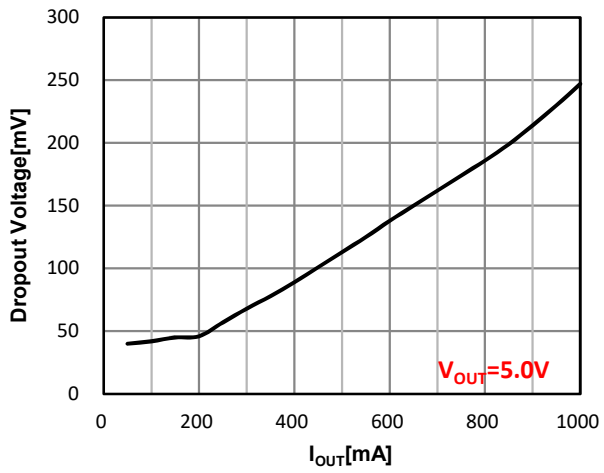


Figure 13. Dropout Voltage VS I_{OUT}

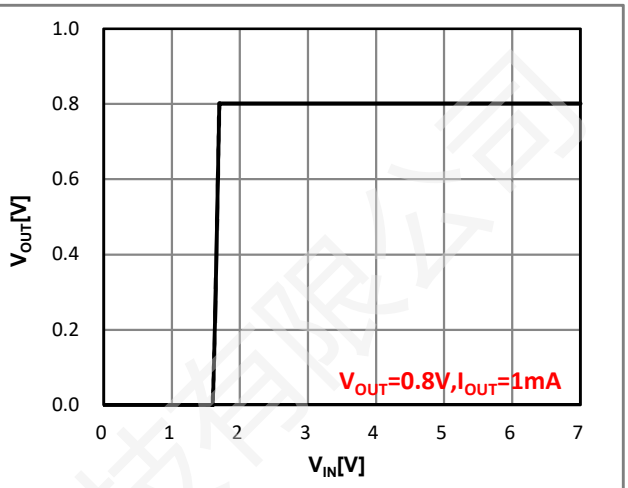


Figure 14. V_{OUT} VS V_{IN}

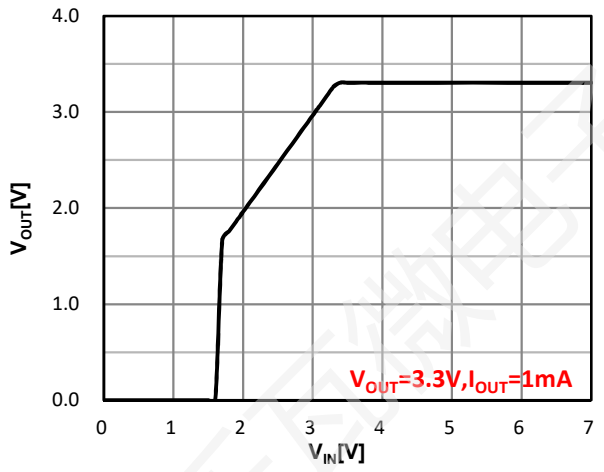


Figure 15. V_{OUT} VS V_{IN}

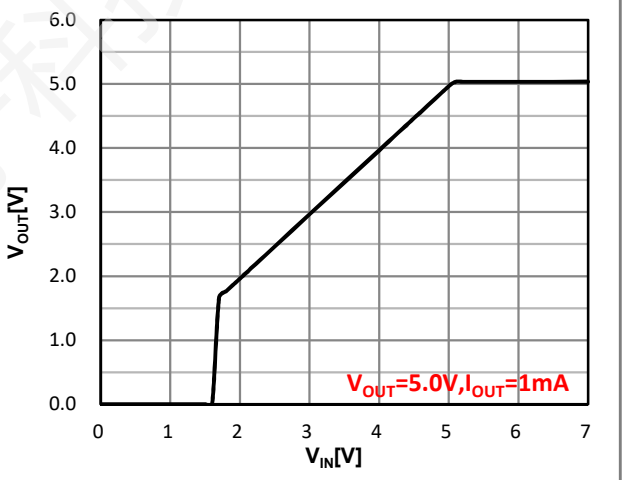
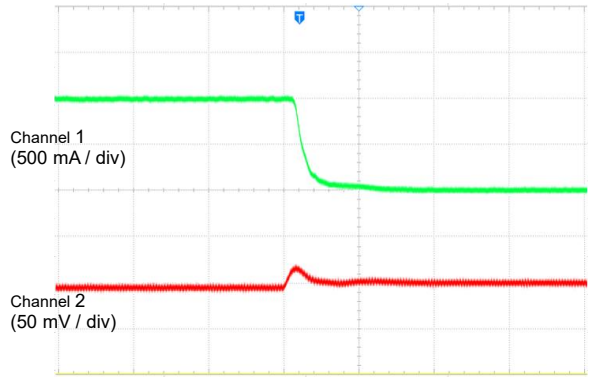


Figure 16. V_{OUT} VS V_{IN}

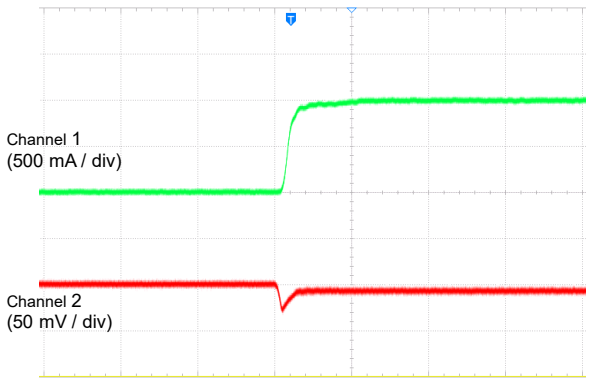
Channel 1 = I_{OUT}, channel 2 =V_{OUT}, V_{IN}=1.8V, V_{OUT}=0.8V

Figure 17. Load Transient (1 mA to 1000 mA)



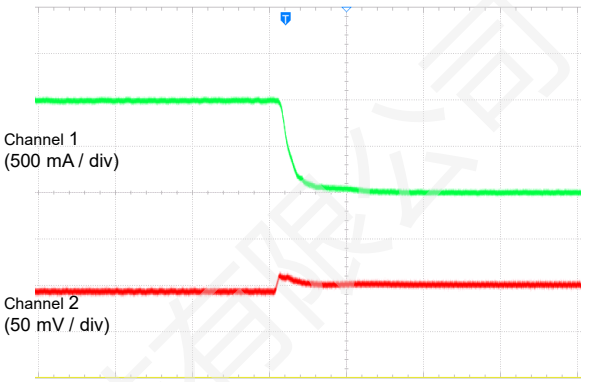
Channel 1 = I_{OUT}, channel 2 =V_{OUT}, V_{IN}=1.8V, V_{OUT}=0.8V

Figure 18. Load Transient (1000 mA to 1 mA)



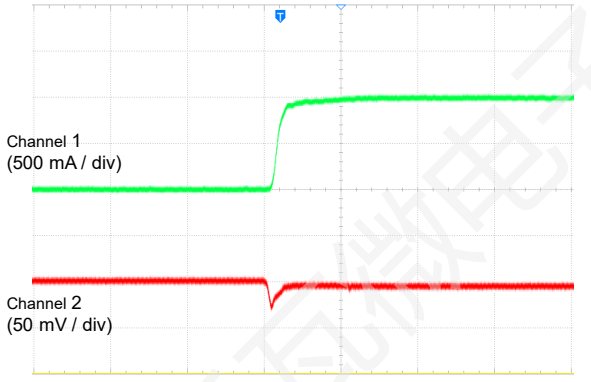
Channel 1 = I_{OUT}, channel 2 =V_{OUT}, V_{IN}=4.3V, V_{OUT}=3.3V

Figure 19. Load Transient (1 mA to 1000 mA)



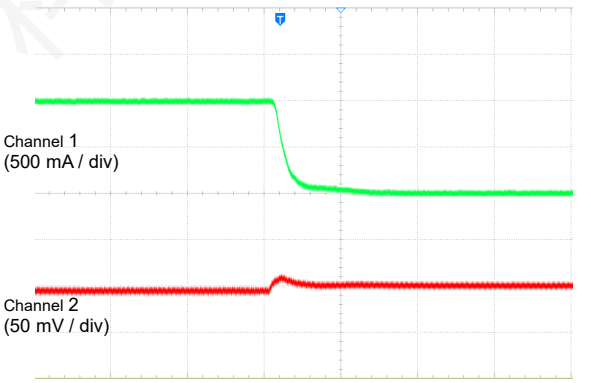
Channel 1 = I_{OUT}, channel 2 =V_{OUT}, V_{IN}=4.3V, V_{OUT}=3.3V

Figure 20. Load Transient (1000 mA to 1 mA)



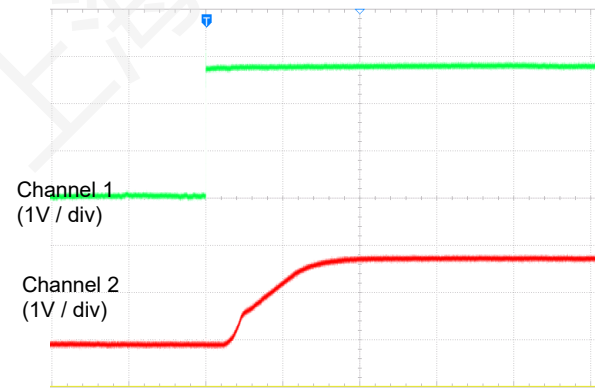
Channel 1 = I_{OUT}, channel 2 =V_{OUT}, V_{IN}=6.0V, V_{OUT}=5.0V

Figure 21. Load Transient (1 mA to 1000 mA)



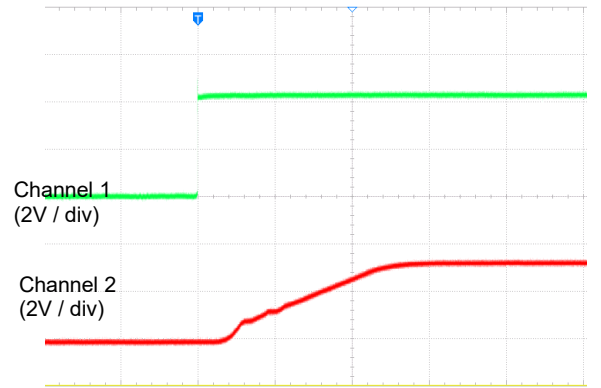
Channel 1 = I_{OUT}, channel 2 =V_{OUT}, V_{IN}=6.0V, V_{OUT}=5.0V

Figure 22. Load Transient (1000 mA to 1 mA)



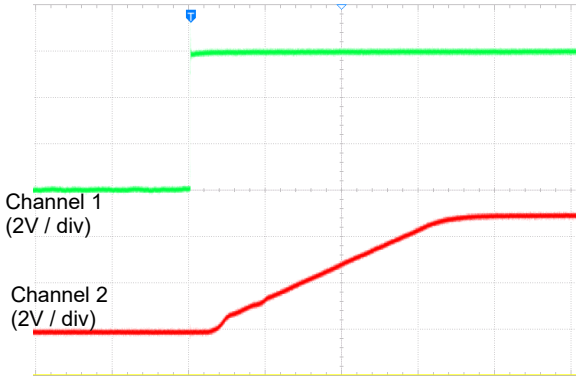
Channel 1 = En, channel 2 =V_{OUT}, V_{OUT}=1.8V, No Load

Figure 23. Power-Up with Enable



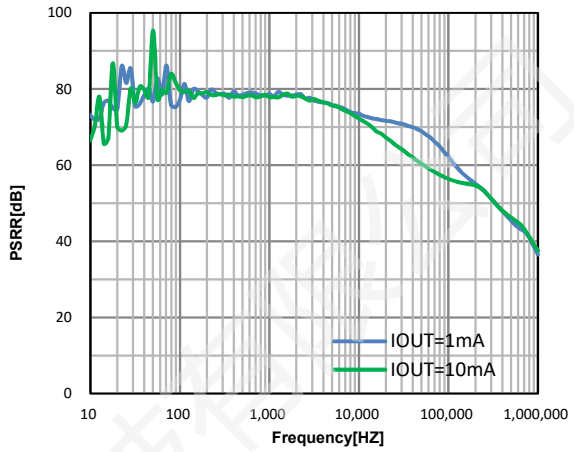
Channel 1 = En, channel 2 =V_{OUT}, V_{OUT}=3.3V, No Load

Figure 24. Power-Up with Enable



Channel 1 = En, channel 2 =V_{OUT}, V_{OUT}=5.0V, No Load

Figure 25. Power-Up with Enable



V_{OUT}=3.3V, V_{IN}=4.3V, V_{PP}=0.2V,C_{IN}=non, C_{OUT}=1uF

Figure 26. PSRR vs Frequency

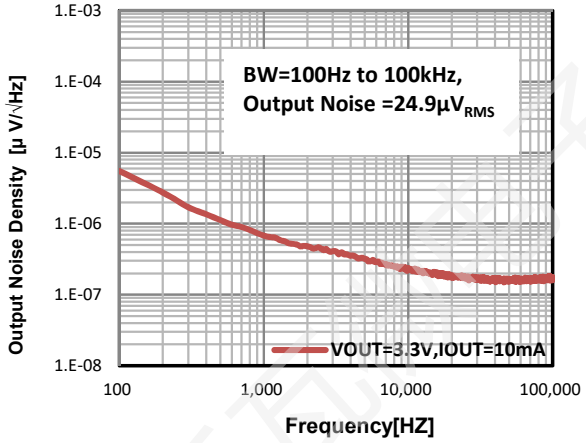


Figure 27. Output Noise Density vs Frequency

APPLICATION INFORMATION:

- **Input Capacitor Selection**

Like any low-dropout regulator, the external capacitors used with the LW82XX Series must be carefully selected for regulator stability and performance. Using a capacitor whose value is >=1μF on the LW82XX Series input and the amount of capacitance can be increased without limit. An at least 10uF input capacitor is needed if input ripple voltage V_{PP}>1V. The input capacitor must be located a distance less than 0.5 inch from the input pin of the IC and returned to a clean analog ground. Any good quality ceramic or tantalum can be used for this capacitor. The capacitor with larger value and lower ESR (equivalent series resistance) provides better PSRR and line-transient response.

- **Output Capacitor Selection**

The output capacitor must meet both requirements for minimum amount of capacitance and ESR in all LDOs application. The LW82XX Series is designed specifically to work with low ESR ceramic output capacitor in space-saving and performance consideration. Using a ceramic capacitor whose value is at least 1μF on the LW82XX Series output ensures stability. An appropriate output capacitor can reduce noise and improve load transient response and PSRR. The output capacitor should be located not more than 0.5 inch from the VOUT pin of the LW82XX Series and returned to a clean analog ground.

- **Layout considerations**

To improve ac performance such as PSRR, output noise, and transient response, it is recommended that the PCB be designed with separate ground planes for VIN and VOUT, with each ground plane connected only at the GND pin of the device.

ORDER INFORMATION:

LW82①②③④⑤⑥

Designator	Item	Symbol	Description
①②	Output Voltage	08~50	e.g.1.2V→①=1,②=2
③④⑤⑥	Packages	A22G	DFN2x2-6L(Type-A)
		AD3H	DFN3x3-8L
		A23E	SOT23-5L(Type-A)
		A89E	SOT89-5L

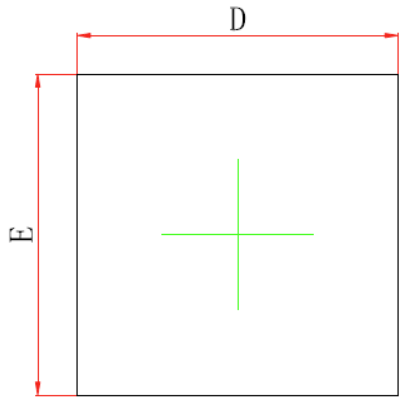
Part #	Output Voltage	Package	Shipping
LW8208A22G	0.8V	DFN2x2-6L(Type-A)	3000 Pcs/ Tape & Reel
LW8212A22G	1.2V		
LW8215A22G	1.5V		
LW8218A22G	1.8V		
LW8228A22G	2.8V		
LW8230A22G	3.0V		
LW8233A22G	3.3V		
LW8236A22G	3.6V		
LW8242A22G	4.2V		
LW8250A22G	5.0V		
LW8208AD3H	0.8V	DFN3x3-8L	5000 Pcs / Tape & Reel
LW8212AD3H	1.2V		
LW8215AD3H	1.5V		
LW8218AD3H	1.8V		
LW8228AD3H	2.8V		
LW8230AD3H	3.0V		
LW8233AD3H	3.3V		
LW8236AD3H	3.6V		
LW8242AD3H	4.2V		
LW8250AD3H	5.0V		

Part #	Output Voltage	Package	Shipping
LW8208A23E	0.8V	SOT23-5L(Type-A)	3000 Pcs/ Tape & Reel
LW8212A23E	1.2V		
LW8215A23E	1.5V		
LW8218A23E	1.8V		
LW8228A23E	2.8V		
LW8230A23E	3.0V		
LW8233A23E	3.3V		
LW8236A23E	3.6V		
LW8242A23E	4.2V		
LW8250A23E	5.0V		
LW8208A89E	0.8V	SOT89-5L	1000 Pcs/ Tape & Reel
LW8212A89E	1.2V		
LW8215A89E	1.5V		
LW8218A89E	1.8V		
LW8228A89E	2.8V		
LW8230A89E	3.0V		
LW8233A89E	3.3V		
LW8236A89E	3.6V		
LW8242A89E	4.2V		
LW8250A89E	5.0V		

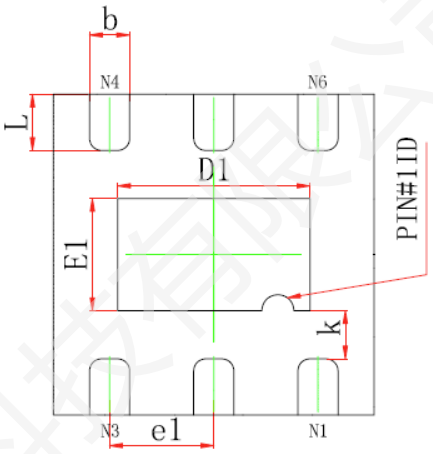
If customers have special output voltage requirements, please contact us.

PACKAGE OUTLINE:

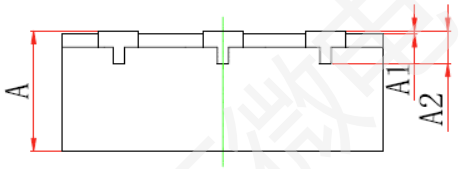
DFN2x2-6L Package



TOP VIEW
[顶视图]



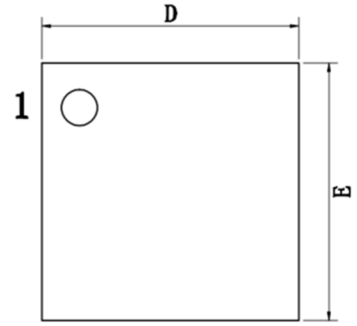
BOTTOM VIEW
[背视图]



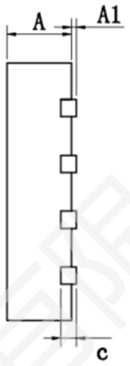
SIDE VIEW
[侧视图]

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203REF.		0.008REF.	
D	1.924	2.076	0.076	0.082
E	1.924	2.076	0.076	0.082
D1	1.150	1.250	0.045	0.049
E1	0.650	0.750	0.026	0.030
b	0.200	0.300	0.008	0.012
e1	0.650TYP.		0.026TYP.	
k	0.200MIN.		0.008MIN.	
L	0.300	0.400	0.012	0.016

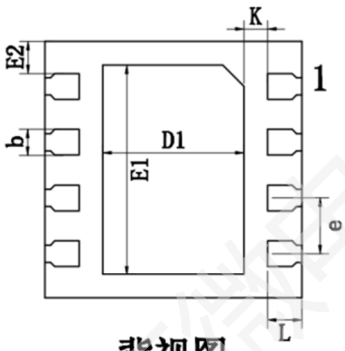
DFN3x3-8L Package



俯视图



侧视图

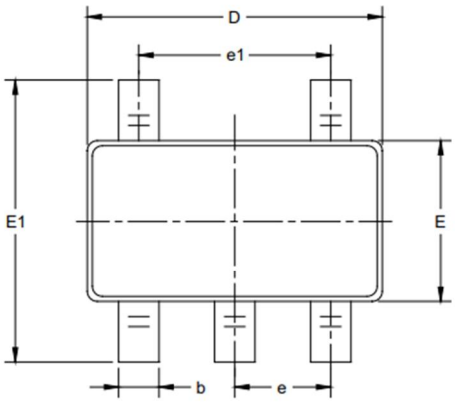


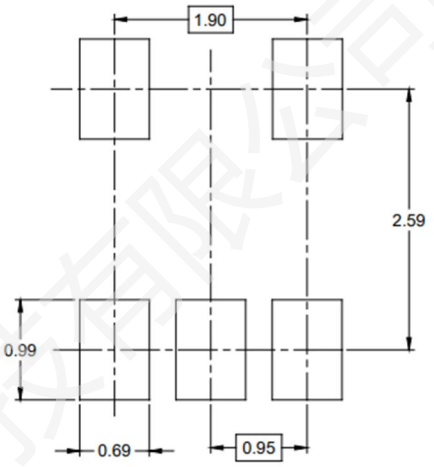
背视图

SYMBOL	MILLMETER		
	MIN	NOM	MAX
* A	0.50	0.55	0.60
	0.70	0.75	0.80
A1	0.00	—	0.05
b	0.25	0.30	0.35
c	0.203 TYP		
D	2.95	3.00	3.05
D1	1.55	1.65	1.75
E	2.95	3.00	3.05
E1	2.35	2.45	2.55
E2	0.375 REF		
e	0.65 BSC		
K	0.275 REF		
L	0.35	0.40	0.45

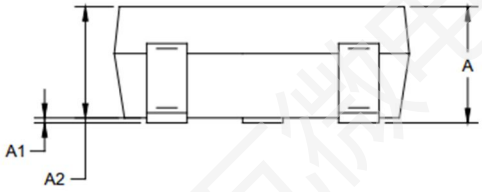
注：* A值为可选择封装厚度值，
封装厚度以焊线图定义为准

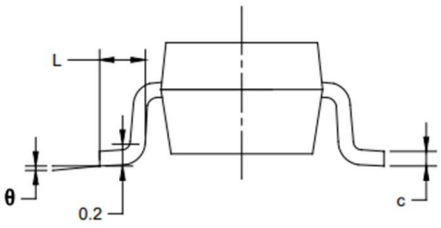
SOT23-5L Package





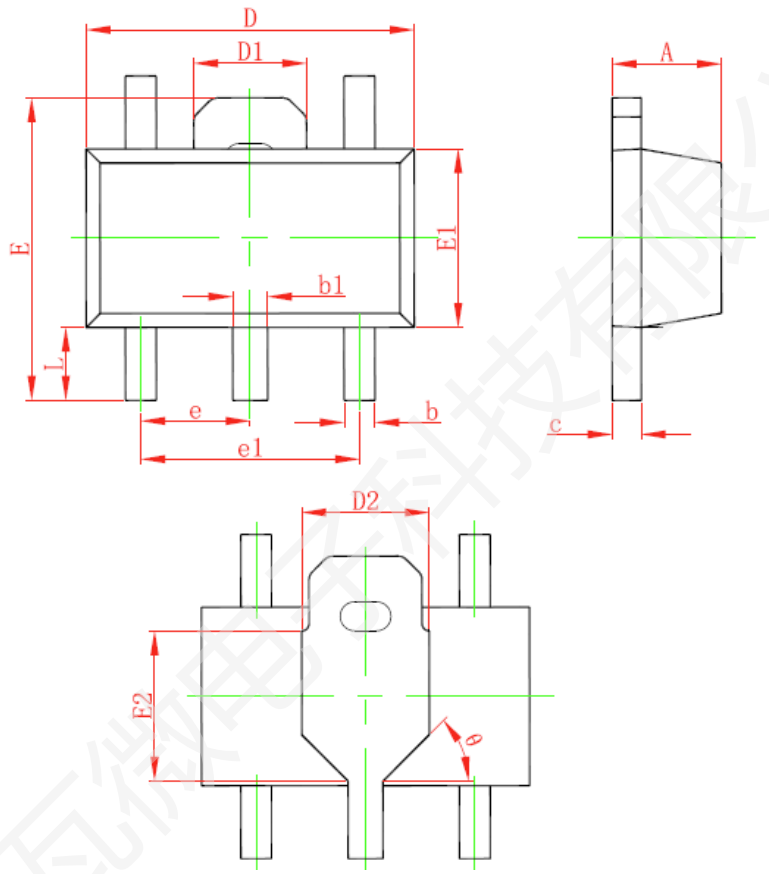
RECOMMENDED LAND PATTERN (Unit: mm)





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	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

SOT89-5L Package



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	0.380	0.580	0.015	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.	
D2	1.750 REF.		0.069 REF.	
E	3.940	4.250	0.155	0.167
E1	2.300	2.600	0.091	0.102
E2	1.900REF.		0.075REF.	
e	1.500 TYP.		0.060TYP.	
e1	3.000 TYP.		0.118 TYP.	
L	0.900	1.200	0.035	0.047
θ	45°		45°	

Revision History:

Revision	Date	Descriptions
Rev 0.1	Sep.2023	Initial Version
Rev 1.0	Nov.2023	Formal Version

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