HL7612 Series
1A CMOS Voltage Regulator
High Voltage Low Power Consumption LDO

HL7612 Series is a high voltage (up to 40V) low power low dropout voltage regulator (LDO) manufactured in CMOS processes. It can deliver up to 1A of current while consuming only 1.6uA of quiescent current. It consists of a reference voltage generator, an error amplifier, a current foldback circuit, and a phase compensation circuit plus a driver transistor.

■ Features

- Ultra-low Quiescent Current: 1.6uA
- Maximum Input Voltage: 40V
- Output Voltage Highly Accurate: ±2%
- Maximum Output Current: 1A
- Dropout Voltage: 10mV@I_{OUT}=10mA
- Temperature Stability: ±45ppm/℃
- ON/OFF Logic = Enable High
- Protections Circuits: Current Limiter, Foldback, Over Temperature Protection
- Output Capacitor: Low ESR Ceramic Capacitor Compatible

■ Applications

- Active SCSI Terminators
- Portable/ Plan Top/ Notebook Computers
- High Efficiency Linear Regulators
- SMPS Post Regulators
- Mother B/D Clock Supplies
- Disk Drives
- Battery Chargers

■ Product Selections

Product Name	V_{OUT} (V)	Package	Ordering Name	Marking	Package Information
HL7612E30	3.0V	SOT23-3L	HL7612E30QA3	7612E30	Tape and Reel, 3000pcs
HL7612E33	3.3V	SOT23-3L	HL7612E33QA3	7612E33	
HL7612E36	3.6V	SOT23-3L	HL7612E36QA3	7612E36	
HL7612E50	5.0V	SOT23-3L	HL7612E50QA3	7612E50	
HL7612A33	3.3V	SOT89-3L	HL7612A33PA1	7612A33	Tape and Reel, 1000pcs
HL7612A36	3.6V	SOT89-3L	HL7612A36PA1	7612A36	
HL7612A40	4.0V	SOT89-3L	HL7612A40PA1	7612A40	
HL7612A50	5.0V	SOT89-3L	HL7612A50PA1	7612A50	
HL7612AC0	12.0V	SOT89-3L	HL7612AC0PA1	7612AC0	
HL7612E33	3.3V	SOT89-3L	HL7612E33PA1	7612E33	Tape and Reel, 1000pcs
HL7612E36	3.6V	SOT89-3L	HL7612E36PA1	7612E36	
HL7612E40	4.0V	SOT89-3L	HL7612E40PA1	7612E40	
HL7612E50	5.0V	SOT89-3L	HL7612E50PA1	7612E50	
HL7612EC0	12.0V	SOT89-3L	HL7612EC0PA1	7612EC0	

HL7612E33	3.3V	SOT89-5L	HL7612E33PC1	7612E33	Tape and Reel, 1000pcs
HL7612E36	3.6V	SOT89-5L	HL7612E36PC1	7612E36	
HL7612E40	4.0V	SOT89-5L	HL7612E40PC1	7612E40	
HL7612E50	5.0V	SOT89-5L	HL7612E50PC1	7612E50	
HL7612EC0	12.0V	SOT89-5L	HL7612EC0PC1	7612EC0	
HL7612F33	3.3V	SOT89-5L	HL7612F33PC1	7612F33	Tape and Reel, 1000pcs
HL7612F36	3.6V	SOT89-5L	HL7612F36PC1	7612F36	
HL7612F40	4.0V	SOT89-5L	HL7612F40PC1	7612F40	
HL7612F50	5.0V	SOT89-5L	HL7612F50PC1	7612F50	
HL7612FC0	12.0V	SOT89-5L	HL7612FC0PC1	7612FC0	
HL7612C33	3.3V	SOT223-3L	HL7612C33YA2	7612C33	Tape and Reel, 2500pcs
HL7612C36	3.6V	SOT223-3L	HL7612C36YA2	7612C36	
HL7612C40	4.0V	SOT223-3L	HL7612C40YA2	7612C40	
HL7612C50	5.0V	SOT223-3L	HL7612C50YA2	7612C50	
HL7612CC0	12.0V	SOT223-3L	HL7612CC0YA2	7612CC0	
HL7612F33	3.3V	SOT223-3L	HL7612F33YA2	7612F33	Tape and Reel, 2500pcs
HL7612F36	3.6V	SOT223-3L	HL7612F36YA2	7612F36	
HL7612F40	4.0V	SOT223-3L	HL7612F40YA2	7612F40	
HL7612F50	5.0V	SOT223-3L	HL7612F50YA2	7612F50	
HL7612F80	8.0V	SOT223-3L	HL7612F80YA2	7612F80	
HL7612FC0	12.0V	SOT223-3L	HL7612FC0YA2	7612FC0	
HL7612D33	3.3V	TO252-2L	HL7612D33UA2	7612D33	Tape and Reel, 2500pcs
HL7612D36	3.6V	TO252-2L	HL7612D36UA2	7612D36	
HL7612D40	4.0V	TO252-2L	HL7612D40UA2	7612D40	
HL7612D50	5.0V	TO252-2L	HL7612D50UA2	7612D50	
HL7612DA0	10.0V	TO252-2L	HL7612DA0UA2	7612DA0	
HL7612DC0	12.0V	TO252-2L	HL7612DC0UA2	7612DC0	
HL7612E33	3.3V	TO252-4L	HL7612E33UB2	7612E33	Tape and Reel, 2500pcs
HL7612E50	5.0V	TO252-4L	HL7612E50UB2	7612E50	
HL7612EA0	10.0V	TO252-4L	HL7612EA0UB2	7612EA0	
HL7612EC0	12.0V	TO252-4L	HL7612EC0UB2	7612EC0	

Notes:

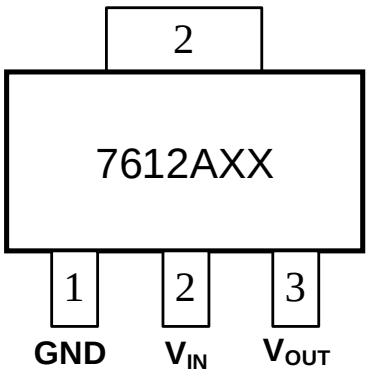
1* Customer can request to customize the output voltage ranged from 1.2V to 15V if desired voltage is not found in the selections.

2* Customer can request customization of package choice.

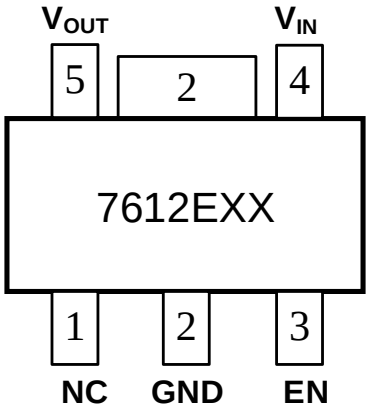
3* Please pay attention to the MARKING of the product package type.

■ Pin Configuration and Functions

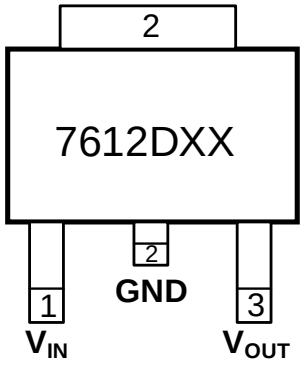
SOT89-3L(A_Type)
TOP View



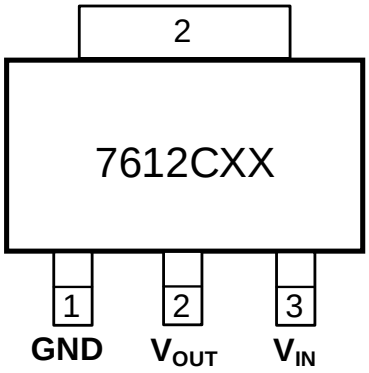
SOT89-5L(E_Type)
TOP View



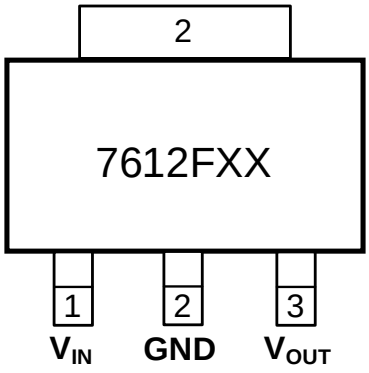
TO252-2L(D_Type)
TOP View



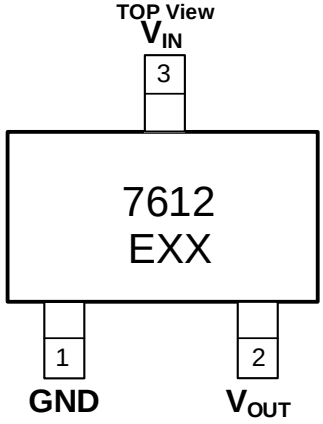
SOT223-3L(C_Type)
TOP View



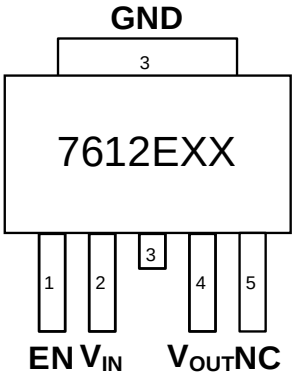
SOT223-3L(F_Type)
TOP View



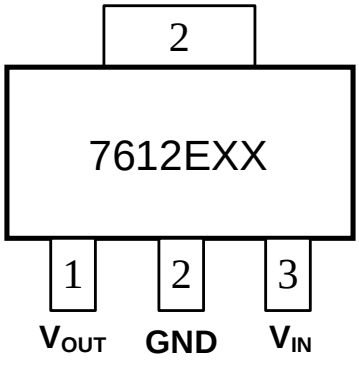
SOT23-3L
TOP View



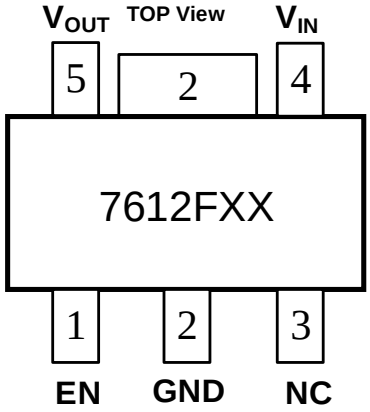
TO252-4L
TOP View



SOT89-3L(E_Type)
TOP View



SOT89-5L(F_Type)
TOP View



Pin Functions

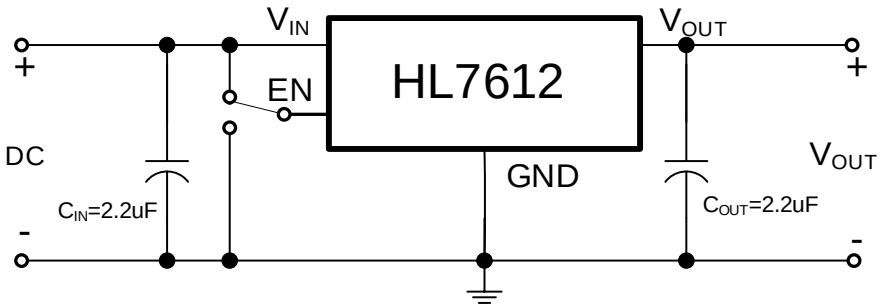
Name	Description
V_{IN}	Power Input Pin.
EN	Enable pin. Drive this pin high to enable the device. Drive this pin low to put the device into low current shutdown.
V_{OUT}	Regulated output voltage pin
GND	Ground

■ Absolute Maximum Ratings (Unless otherwise indicated: T_a=25℃)

Parameter	Symbol	Ratings	Units
Input Voltage	V_{IN}	-0.3 ~ 45	V
Output Voltage	V_{OUT}	Vss-0.3 ~ VIN+0.3V	
Power Dissipation	P_D	SOT23-3L 250 SOT89-3L 1000 SOT89-5L 1000 SOT223-3L 1500 TO252-2L 1800 TO252-4L 1800	mW
Thermal Resistance	$R_{\theta JA}$	SOT23-3L 200 SOT89-3L 100 SOT89-5L 100 SOT223-3L 66 TO252-2L 55 TO252-4L 55	℃/W
Operating Ambient Temperature	T_{opr}	-40 ~ +85	℃
Storage Temperature	T_{stg}	-40 ~ +125	
ESD Protection	ESD HBM	6000	V
Humidity sensitive level	MSL	3	

Note: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device.

■ Typical Applications



■ Notes on Use

Input Capacitor (C_{IN}): 2.2μF above

Output Capacitor (C_{OUT}): 2.2μF above

Normally, if the input voltage (Vin) increases, it is better to increase the output capacitance (Cout)

■ Electrical Characteristics

HL7612 Series (Unless otherwise indicated：T_a=25℃)

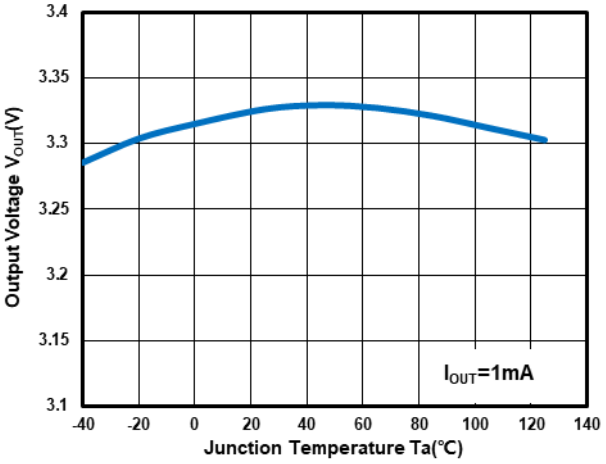
PARAMETER	SYMBOL	CONDITIONS		MIN.	TYP.	MAX.	UNIT
Output Voltage*1	$V_{OUT(S)}$	V_{IN}= $V_{OUT(S)}$+2V，I_{OUT}=10mA		$V_{OUT(S)}$× 0.98	$V_{OUT(S)}$	$V_{OUT(S)}$× 1.02	V
Dropout Voltage*2	V_{DROP}	I_{OUT}=10mA			10	20	mV
		I_{OUT}=1A			1000	1800	
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \bullet V_{OUT(s)}}$	$V_{OUT(S)}$+2V≤V_{IN}≤40V I_{OUT} =1mA			0.01	0.02	%/V
Load Regulation	ΔV_{OUT2}	V_{IN}=$V_{OUT(S)}$+2V 1mA≤I_{OUT}≤300mA	$V_{OUT(S)}$≤5.3V		20	40	mV
			$V_{OUT(S)}$＞5.3		40	80	
Temperature Stability	$\frac{\Delta V_{OUT}}{\Delta T_a \bullet V_{OUT(s)}}$	V_{IN} = $V_{OUT(S)}$+2V，I_{OUT}=10mA -40℃≤T_a≤85℃			±45		ppm/℃
GND Current	I_{GND}	No load	$V_{OUT(S)}$<3.0V	0.8	1.2	2	uA
			3.0≤$V_{OUT(S)}$≤5.3	0.8	1.6	2.5	
			$V_{OUT(S)}$>5.3V	1.5	2.5	3	
		I_{OUT}=100mA			480		
Shutdown Current*3	I_{SHUT}	V_{IN}=40V，V_{EN}=0V			0.1	1	
Input Voltage	V_{IN}	---		2.2		40	V
Maximum Output Current	I_{OUTMAX}			1			A
Current Limit*4	I_{LIM}	V_{IN}= $V_{OUT(S)}$+2V, V_{OUT} = 0.9 ×$V_{OUT(S)}$			1.6		
Short Circuit Current*5	I_{SHORT}	V_{IN}=V_{EN}=$V_{OUT(S)}$+2V V_{OUT}=0V			230		mA
Power Supply Rejection Ratio	PSRR	f=10Hz, $V_{OUT(S)}$=3.6V			72		dB
		f=100Hz,$V_{OUT(S)}$=3.6V			70		
		f=1kHz, $V_{OUT(S)}$=3.6V			65		
EN 'H'Level Voltage*3	V_{ENH}			1.6		40.0	V
EN 'L' Level Voltage*3	V_{ENL}			0		0.5	
EN 'H'Level Current*3	I_{ENH}	V_{IN}=40V, V_{EN}=V_{IN}		-0.1		0.1	uA
EN 'L' Level Voltage*3	I_{ENL}	V_{IN}=40V, V_{EN}=0		-0.1		0.1	
Over Temperature Protection	OTP	I_{OUT}=10mA			155		℃

Notes:

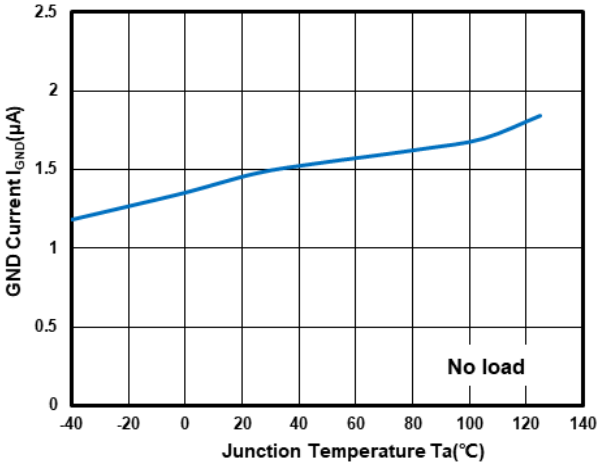
1. $V_{OUT(S)}$: Output voltage when V_{IN}=V_{OUT}+2V, I_{OUT}=1 mA.
2. V_{DROP}=V_{IN1} -（$V_{OUT(S)}$× 0.98）where V_{IN1} is the input voltage when V_{OUT} = $V_{OUT(S)}$× 0.98.
3. Parameters with EN pin.
4. I_{LIM} : Output current when V_{IN}=$V_{OUT(S)}$+2V and V_{OUT} = 0.95*$V_{OUT(S)}$.
5. VOUT pin should be shorted to GND pin, and the impedance between them is less than 0.1 ohm.

■ Typical Performance Characteristics (Continued)

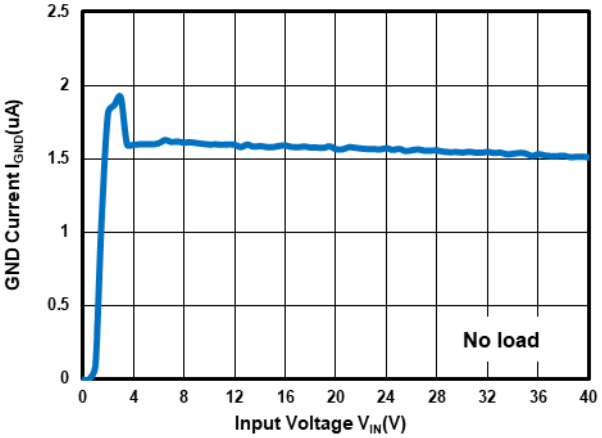
Test Conditions: V_{IN}=V_{OUT}+2.0V, C_{IN}=2.2uF, C_{OUT}=2.2uF, unless otherwise indicated.



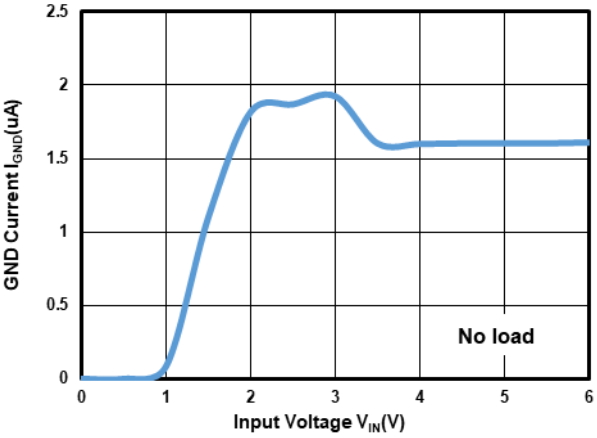
Output Voltage vs Temperature at V_{OUT}=3.3V



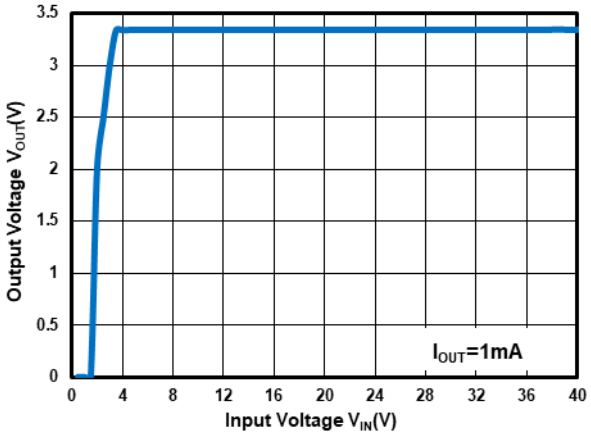
GND Current vs Temperature at V_{OUT}=3.3V



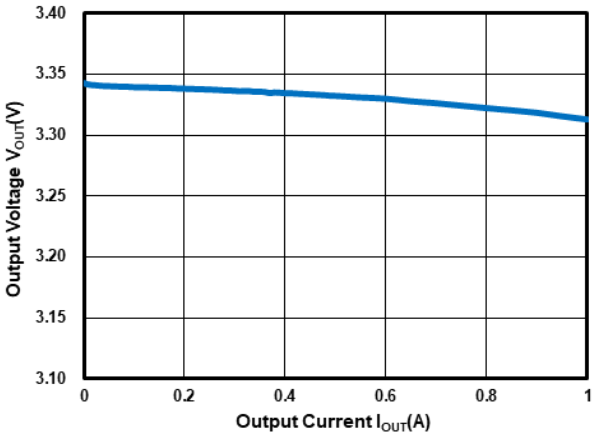
GND Current vs Input Voltage at V_{OUT}=3.3V



GND Current vs Input Voltage at V_{OUT}=3.3V



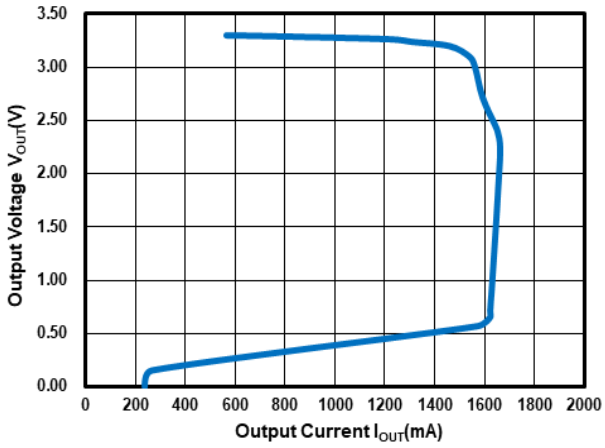
Output Voltage vs Input Voltage at V_{OUT}=3.3V



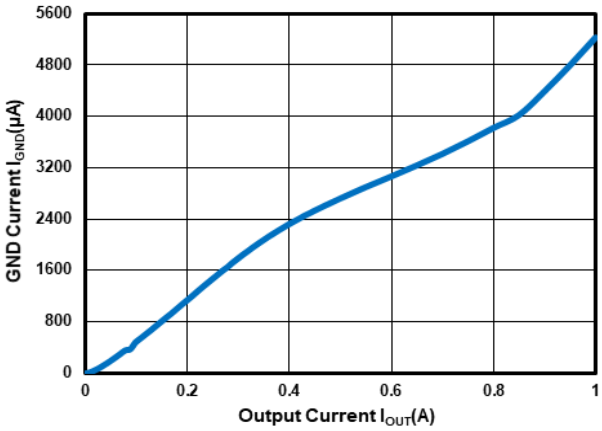
Output Voltage vs Output Current at V_{OUT}=3.3V

■ Typical Performance Characteristics (Continued)

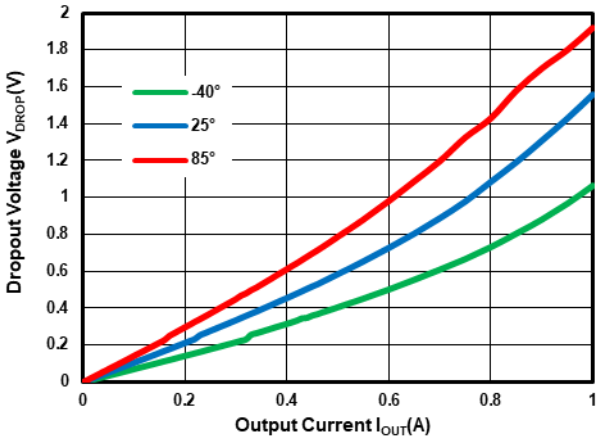
Test Conditions: V_{IN}=V_{OUT}+2.0V, C_{IN}=2.2uF, C_{OUT}=2.2uF, unless otherwise indicated.



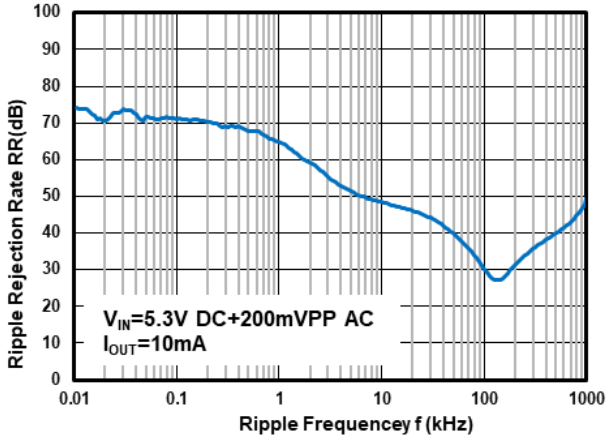
Output Current Fold-back at V_{OUT}=3.3V



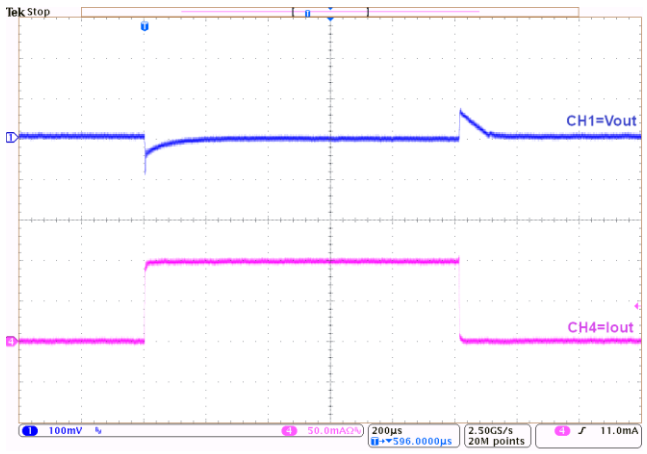
GND Current vs Output Current at V_{OUT}=3.3V



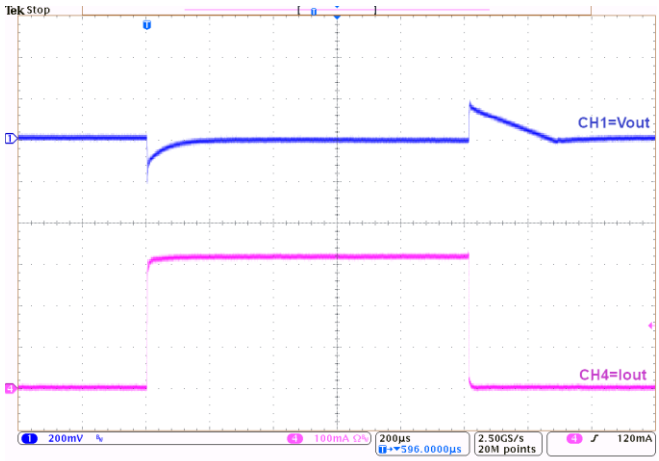
Dropout Voltage vs Temperature at V_{OUT}=3.3V



Power Supply Rejection Ratio at V_{OUT}=3.3V



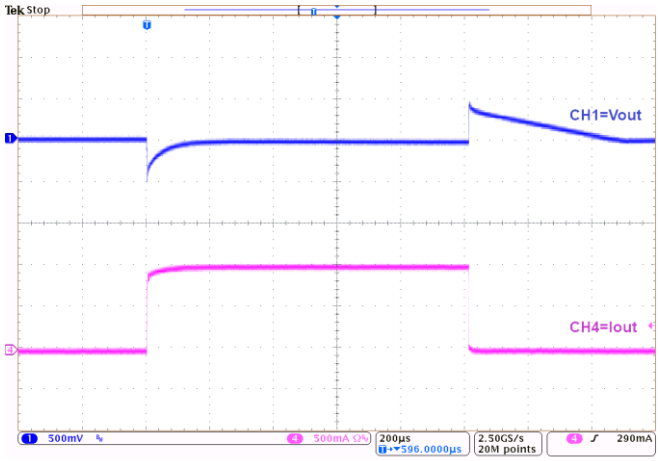
Load Transient at V_{OUT}=3.3V
(I_{OUT}=1mA~100mA~1mA)



Load Transient at V_{OUT}=3.3V
(I_{OUT}=1mA~300mA~1mA)

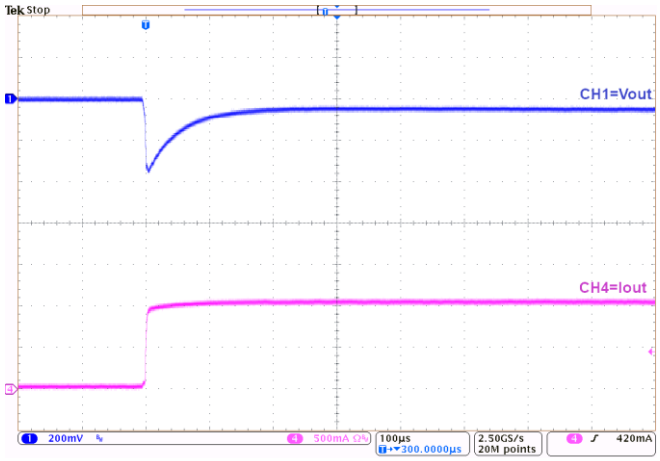
■ Typical Performance Characteristics (Continued)

Test Conditions: V_{IN}=V_{OUT}+2.0V, C_{IN}=2.2uF, C_{OUT}=2.2uF, unless otherwise indicated.



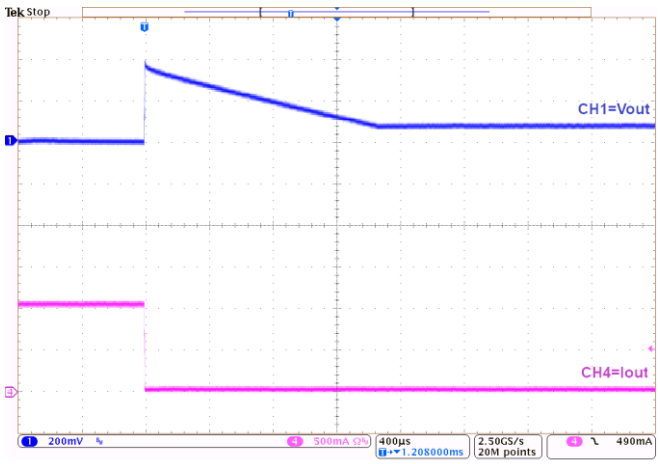
Load Transient at V_{OUT}=3.3V

(I_{OUT}=1mA~1A~1mA)



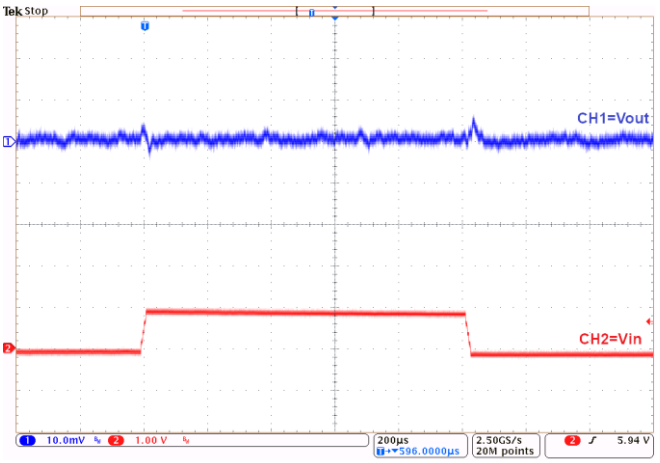
Load Transient at V_{OUT}=3.3V

(I_{OUT}=0mA~1A)



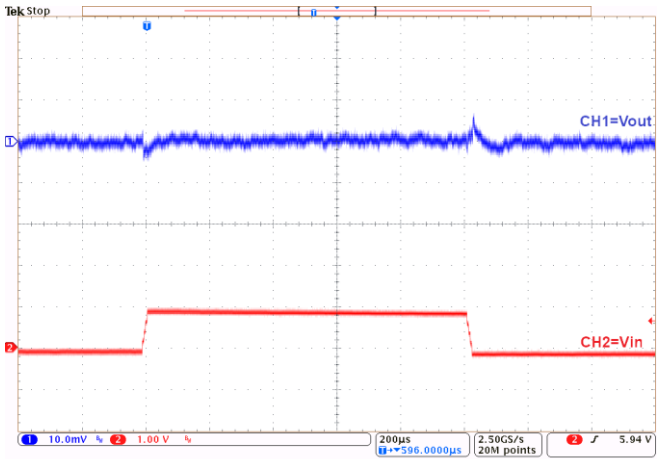
Load Transient at V_{OUT}=3.3V

(I_{OUT}=1A~0mA)



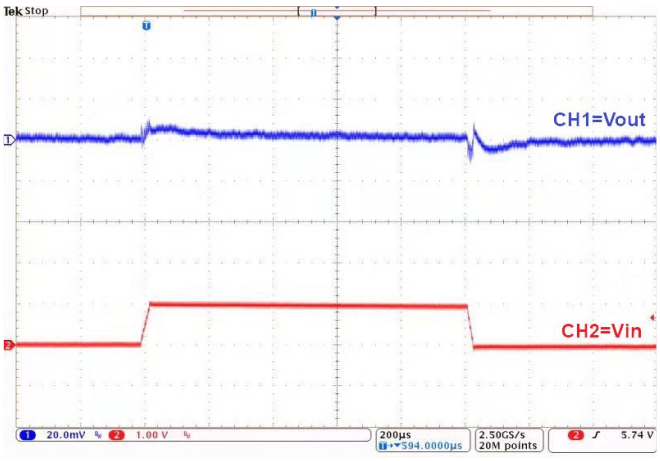
Line Transient at V_{OUT}=3.3V

(I_{OUT}=1mA)



Line Transient at V_{OUT}=3.3V

(I_{OUT}=10mA)

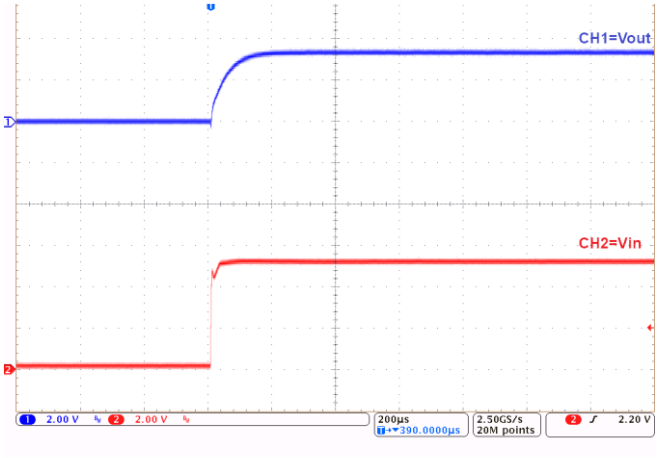


Line Transient at V_{OUT}=3.3V

(I_{OUT}=300mA)

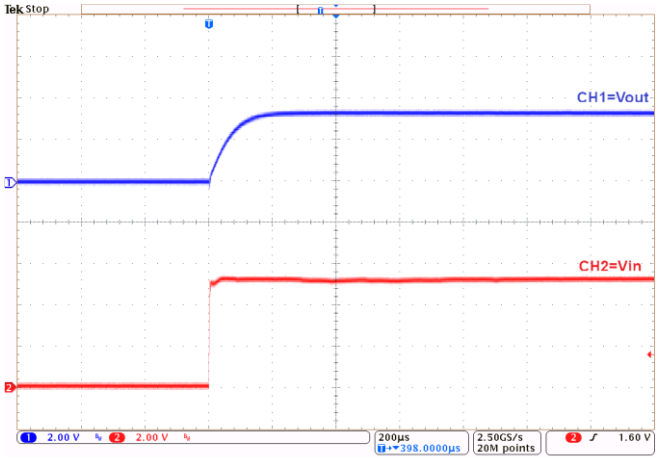
■ Typical Performance Characteristics (Continued)

Test Conditions: V_{IN}=V_{OUT}+2.0V, C_{IN}=2.2uF, C_{OUT}=2.2uF, unless otherwise indicated.



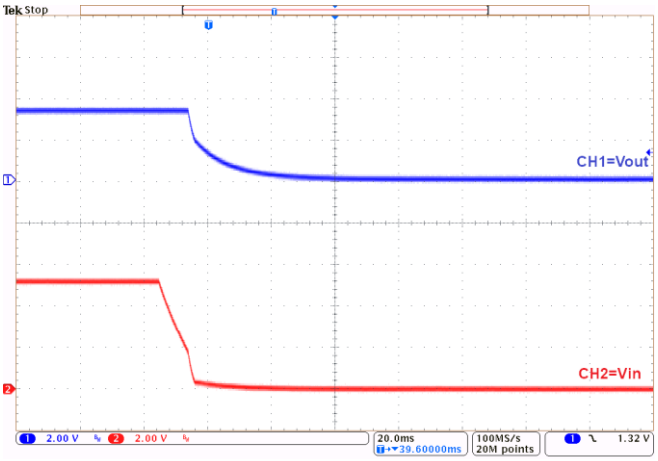
Power-Up at V_{OUT}=3.3V

(I_{OUT}=1mA))



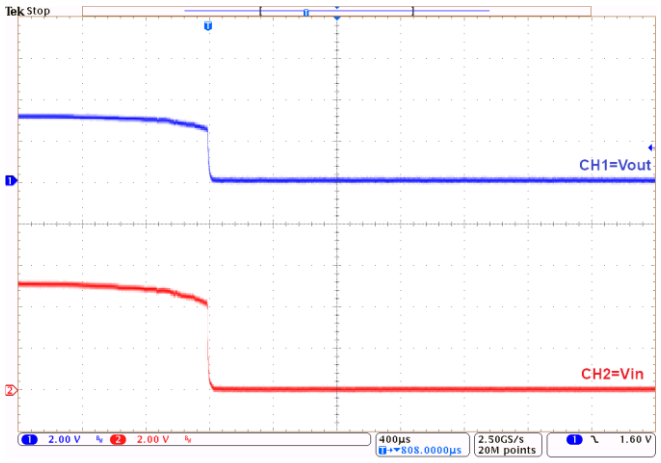
Power-Up at V_{OUT}=3.3V

(I_{OUT}=1A)



Power-Down at V_{OUT}=3.3V

(I_{OUT}=1mA)



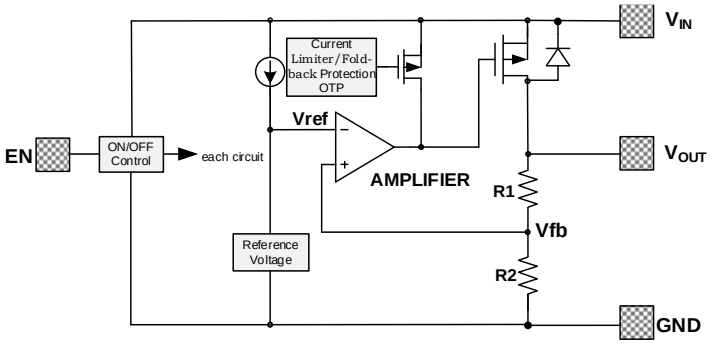
Power-Down at V_{OUT}=3.3V

(I_{OUT}=1A)

■ Operational Explanation

1. Output voltage control

The voltage divided by resistors R1 and R2 is compared with the internal reference voltage by the error amplifier. The amplifier output then drives the P-channel MOSFET connected to the V_{OUT} pin. The output voltage at the V_{OUT} pin is regulated by this negative feedback system. The current limit circuit and short protect circuit operate in relation to output current level. Further, the IC's internal circuitry can be in operation or shutdown modes controlled by the CE pin's signal.



2. Pass transistor

The pass transistor with low turn-on resistance used in HL7612 is a P-channel MOSFET. If the potential on V_{OUT} pin is higher than VIN, it is possible that IC will be destroyed due to reverse current which is caused by parasitic diodes between V_{IN} and V_{OUT}. Therefore, the V_{OUT} pin potential exceeds V_{IN}+0.3V is not allowed.

3. Current foldback and over temperature protection

The HL7612 series includes a combination of a fixed current limiter circuit and a foldback circuit, which aid the operations of the current limiter and circuit protection. When the load current reaches the current limit level, the fixed current limiter circuit operates and output voltage drops. As a result of this drop in output voltage, the foldback circuit operates, output voltage drops further and output current decreases. This design can prevent the chip be damaged due to over temperature, moreover, the heat dissipation is limited by the package type.

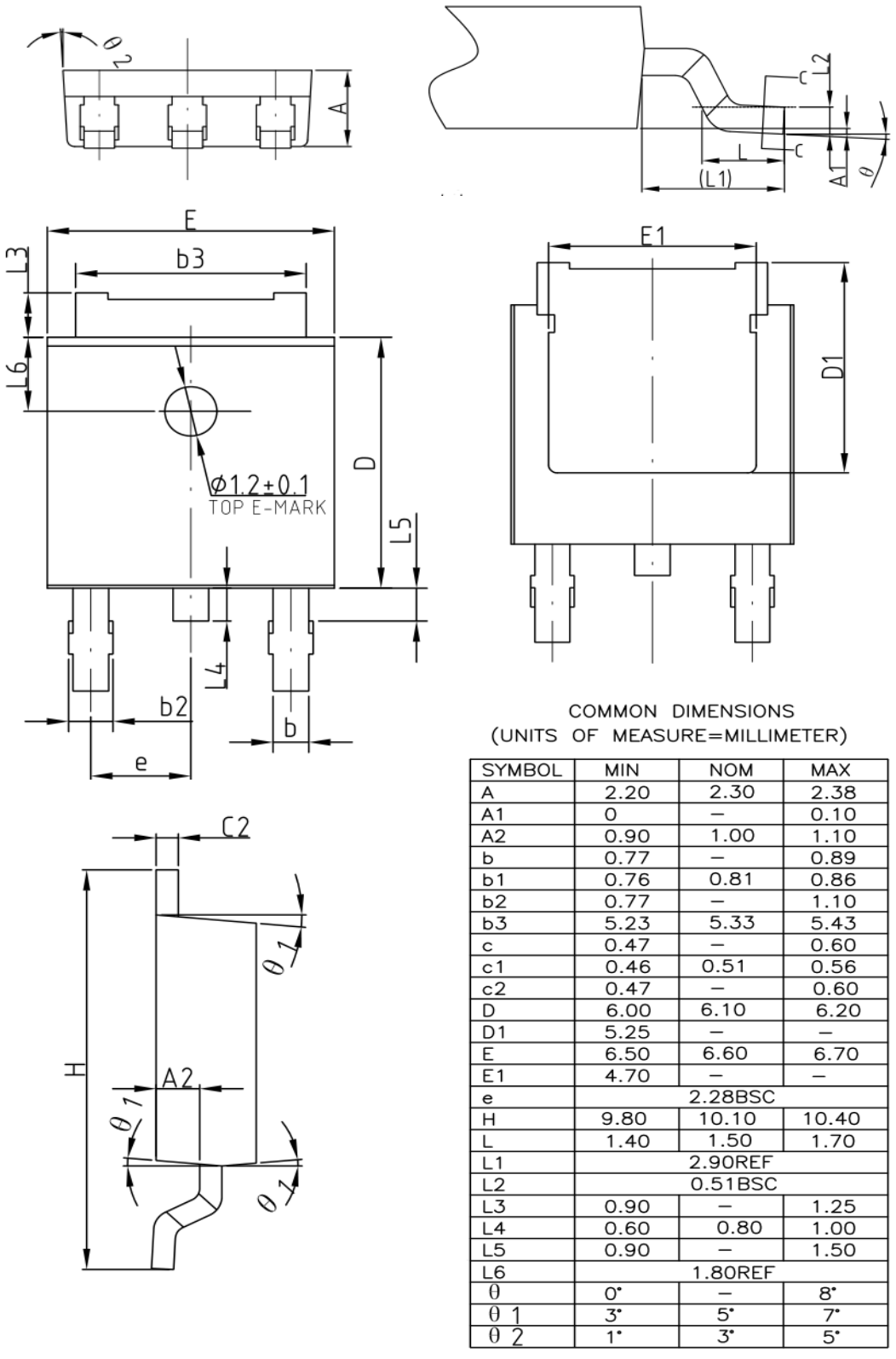
Special attention should be paid to that the product of the dropout voltage on the chip and the output current must be smaller than the heat dissipation. If power consumption on the chip is more than the heat dissipation, OTP will protect the chip from damaging due to over temperature.

■ Notes:

1. The input and output capacitors should be placed as close as possible to the IC.
2. If the impedance of the power supply is high, which is caused by forgetting installing input capacitor or installing too small value capacitor, the oscillation may occur.
3. Pay attention to the operation conditions of input and output voltage and load current, such that the power consumption in the IC should not exceed the allowable power consumption of the package even though the chip has short circuit protection.
4. IC has a built-in anti-static protection (ESD) circuit, but please do not add excessive stress to the IC.

■ Packaging Information

TO252-2L PACKGE OUTLINE DIMENSIONS

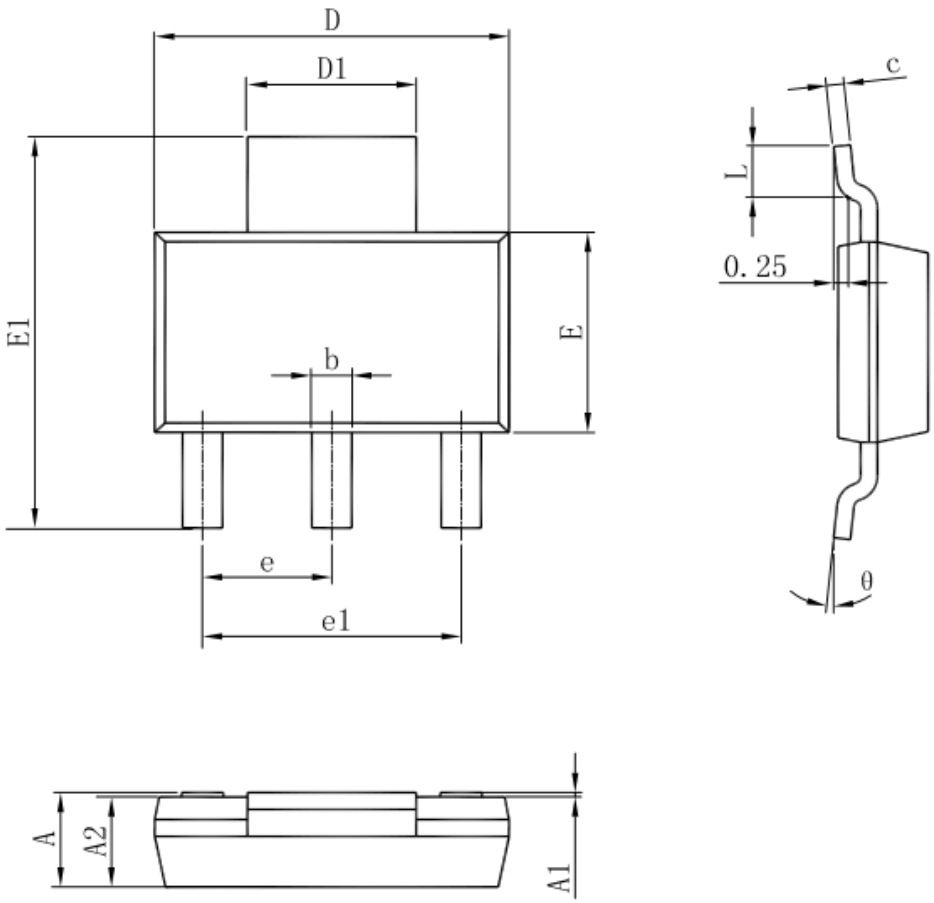


COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.38
A1	0	–	0.10
A2	0.90	1.00	1.10
b	0.77	–	0.89
b1	0.76	0.81	0.86
b2	0.77	–	1.10
b3	5.23	5.33	5.43
c	0.47	–	0.60
c1	0.46	0.51	0.56
c2	0.47	–	0.60
D	6.00	6.10	6.20
D1	5.25	–	–
E	6.50	6.60	6.70
E1	4.70	–	–
e	2.28BSC		
H	9.80	10.10	10.40
L	1.40	1.50	1.70
L1	2.90REF		
L2	0.51BSC		
L3	0.90	–	1.25
L4	0.60	0.80	1.00
L5	0.90	–	1.50
L6	1.80REF		
θ	0°	–	8°
θ 1	3°	5°	7°
θ 2	1°	3°	5°

■ Packaging Information (Continued)

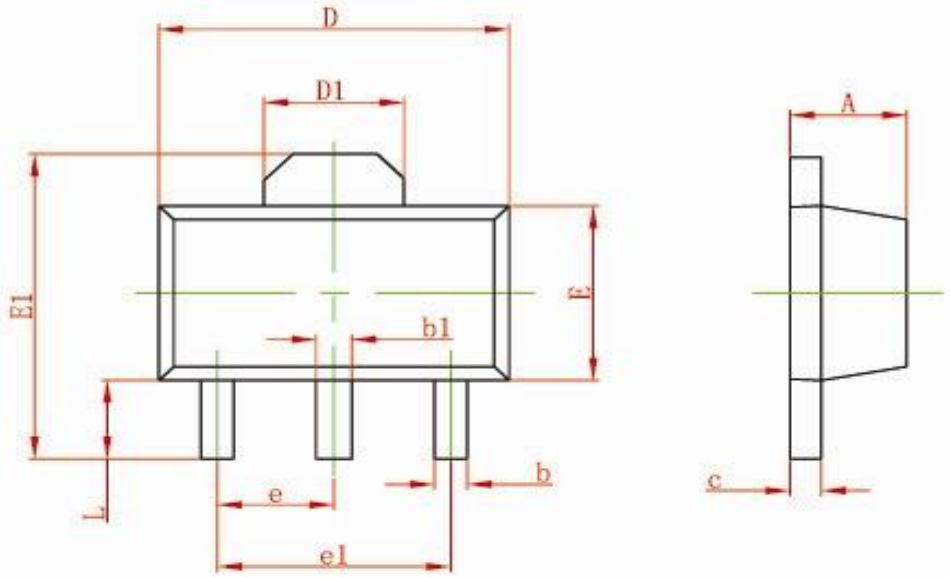
SOT-223 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.520	1.800	0.060	0.071
A1	0.000	0.100	0.000	0.004
A2	1.500	1.700	0.059	0.067
b	0.660	0.820	0.026	0.032
c	0.250	0.350	0.010	0.014
D	6.200	6.400	0.244	0.252
D1	2.900	3.100	0.114	0.122
E	3.300	3.700	0.130	0.146
E1	6.830	7.070	0.269	0.278
e	2.300(BSC)		0.091(BSC)	
e1	4.500	4.700	0.177	0.185
L	0.900	1.150	0.035	0.045
θ	0°	10°	0°	10°

■ Packaging Information (Continued)

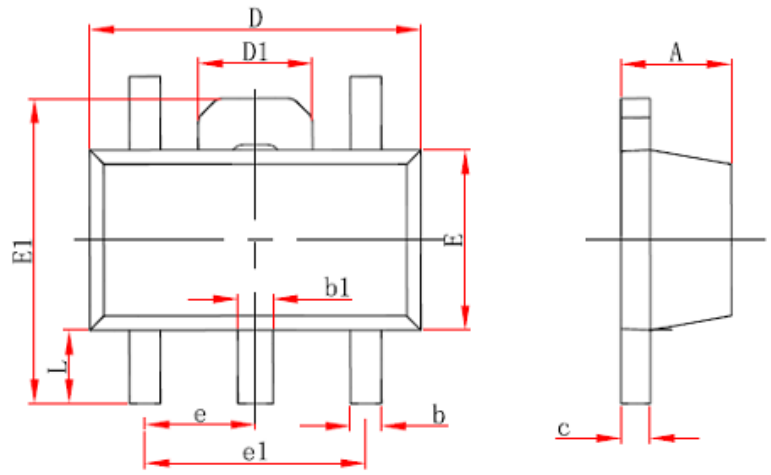
SOT-89-3L PACKAGE OUTLINE DIMENSIONS



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		0.060TYP	
e1	3.000 TYP		0.118TYP	
L	0.900	1.200	0.035	0.047

■ Packaging Information (Continued)

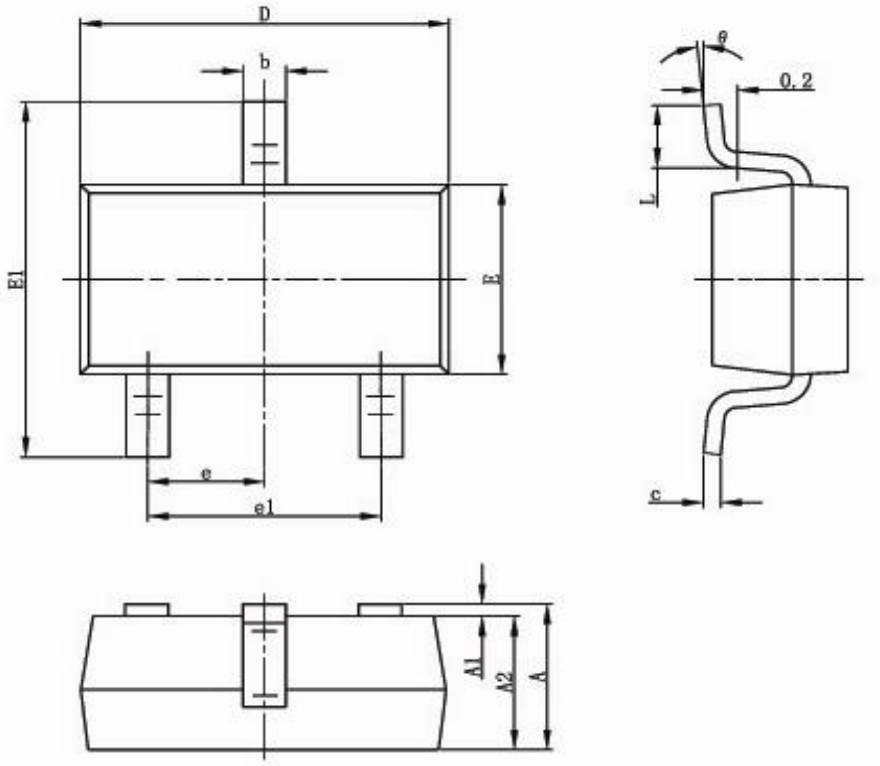
SOT-89-5L PACKAGE OUTLINE DIMENSIONS



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.	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP.		0.060TYP.	
e1	3.000 TYP.		0.118 TYP.	
L	0.900	1.200	0.035	0.047

■ Packaging Information (Continued)

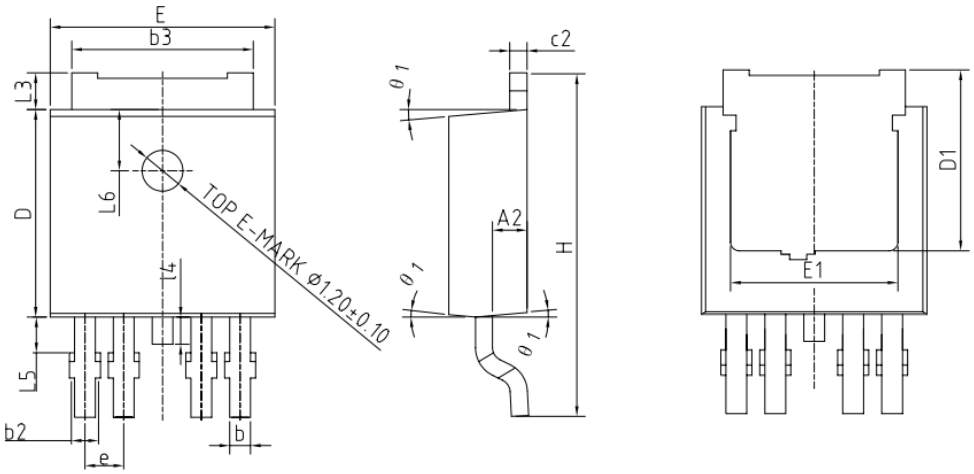
SOT-23-3L PACKAGE OUTLINE DIMENSIONS

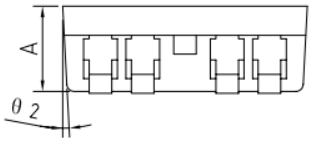


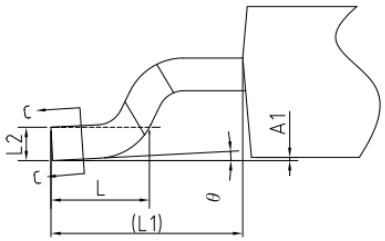
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)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

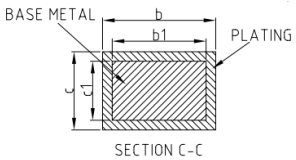
■ Packaging Information (Continued)

TO252-4L PACKAGE OUTLINE DIMENSIONS









COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.38
A1	0	–	0.10
A2	0.90	1.00	1.10
b	0.57	–	0.70
b1	0.56	0.61	0.66
b2	0.57	–	0.86
b3	5.23	5.33	5.44
c	0.50	–	0.56
c1	0.50	0.51	0.52
c2	0.50	–	0.56
D	6.00	6.10	6.20
D1	5.00	–	–
E	6.50	6.60	6.70
E1	4.70	–	–
e		1.14BSC	
H	9.80	10.10	10.40
L	1.40	1.50	1.70
L1		2.90REF	
L2		0.51BSC	
L3	0.90	–	1.25
L4	0.60	0.80	1.00
L5	0.90	–	1.50
L6		1.80REF	
θ	0°	–	8°
θ1	3°	5°	7°
θ2	1°	3°	5°