78LXX 100-mA Fixed Qutput Linear Regulator

1. General Description

1.1 Description

The 78LXX series of three terminal positive regulators is available with several fixed output voltages, making them useful in a wide range of applications. Used as a Zener-diode and resistor combination replacement, the 78LXX usually provides an effective output impedance improvement of two orders of magnitude and lower quiescent current. These regulators can provide local, on-card regulation, elimination distribution problems associated with single-point regulation. The available voltages allow the 78LXX to be used in logic systems, instrumentation, HiFi, and other solid-state electronic equipment.

With adequate heat sinking, the regulator can deliver 100-mA output current. Current limiting is included to limit the peak output current to a safe value. Safe area protection for the output transistors is provided to limit internal power dissipation. If internal power dissipation is too high for the heat sinking provided, the thermal shutdown circuit prevents the IC from overheating.

1.2 Features

- Input voltage up to 36 V
- Available output voltages: 5 V, 6V, 8 V, 9 V, 10 V,12 V and 15 V
- Output current of 100 mA
- Internal thermal overload protection
- Internal short-circuit current limit

1.3 Device Information

PART NUMBER	PACKAGE
78LXX	SOT89
	SOT23
	TO
	SOP

2. Connection Diagrams and Pin Description

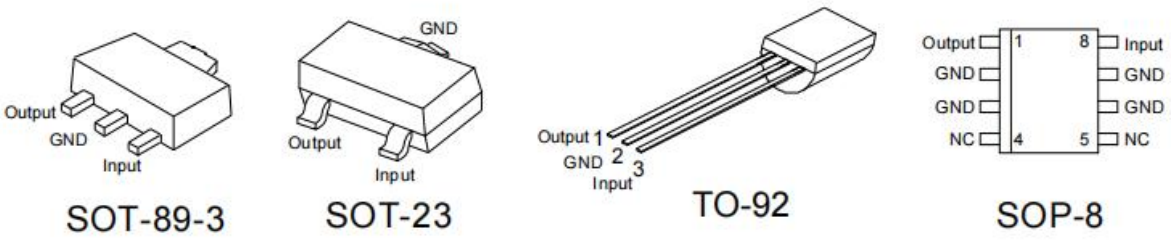


Figure 2.1 Top View

PIN					I/O	FUNCTION
NAME	No.					
	SOT89	SOT23	TO	SOP		
GND	2	2	2	2,3,6,7	-	Ground
INPUT	3	3	3	8	I	INPUT
OUTPUT	1	1	1	1	O	OUTPUT
NC				4,5	-	No connection

3. System Diagram

3.1 Block Diagram

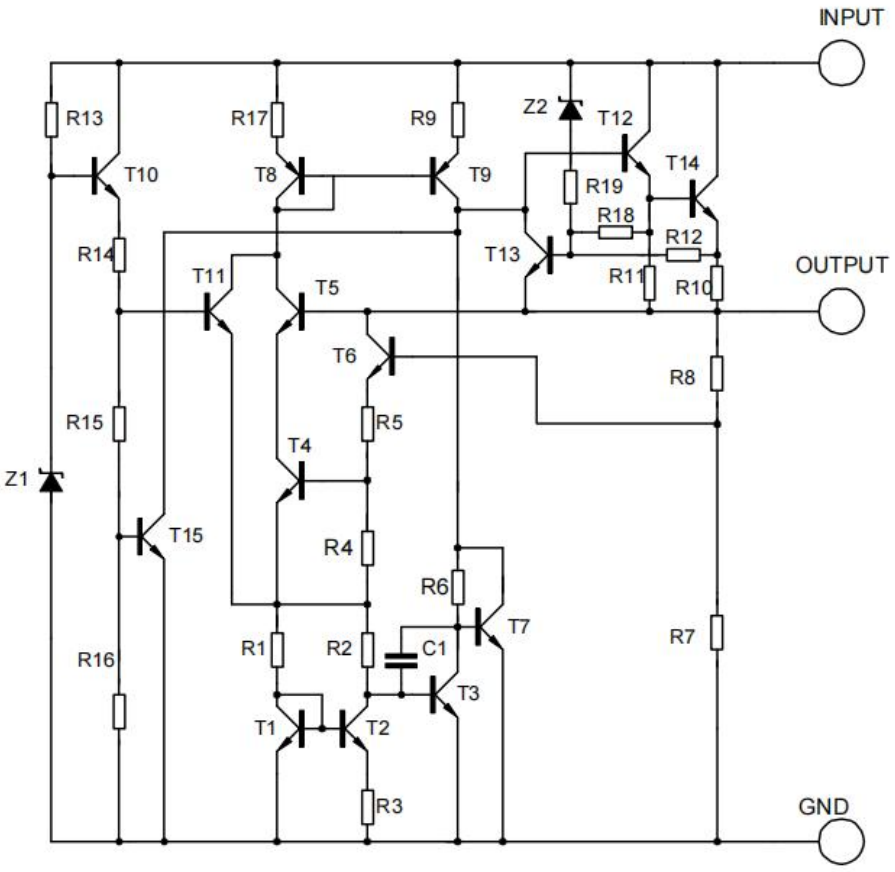


Figure 3.1: Block Diagram

4. Specifications

4.1 Absolute Maximum Ratings

Symbol	Parameter	MIN	MAX	Unit
V_{CC}	Supply Voltage	-	38	V
PD	Power dissipation	Internally limited		
Tstg	Storage temperature	-65	150	℃
T_J	Operating Junction Temperature	-40	85	℃

Absolute maximum ratings are those values beyond which the device could be permanently damaged,These are stress ratings only,which do not imply functional operation of the device at these or any other conditions beyond those indicated under normal operating conditions.

4.2 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

Symbol	Parameter	MIN	MAX	Unit
VI	Input voltage		36	V
VO	Continuous Output current		0.1	A

4.3 Electrical Characteristics

4.3.1 DC Specifications (78L05)

VIN = 10 V, I_O=40mA, CIN = 0.33 μF, CO = 0.1 μF, TJ = 25°C (unless otherwise noted).

Symbol	Parameter	Test Condition	MIN	TYP	MAX	Unit
Vo	Output voltage		4.8	5	5.2	V
		8.5 V ≤ VIN ≤ 20 V, 1mA ≤ I_O≤ 40 mA	4.75	5	5.25	V
		1mA ≤ I_O≤ 70 mA	4.75	5	5.25	V
I_{PK}	Peak output current		-	150	-	mA
VRLINE	Line regulation	8.5 V ≤ VIN ≤ 20 V	-	-	75	mV
VRLOAD	Load regulation	1mA ≤ I_O≤ 100 mA	-	-	60	mV
		1mA ≤ I_O≤ 40 mA	-	-	30	mV
IQ	Quiescent current		-	3	5.5	mA
ΔIQ	Quiescent current change	1mA ≤ I_O≤ 40 mA	-	-	0.1	mA
		8.5 V ≤ VIN ≤ 20 V, I_O=0mA	-	-	1.5	mA
ΔVIN / ΔVo	Ripple rejection	f = 120 Hz， 8.5 V ≤ VIN ≤ 16 V	-	50	-	dB
VIN(min)	Minimum value of input voltage required to maintain line regulation		-	8	--	V
ΔVO/ΔT	Average output voltage temperaturecoefficient	–40°C ≤ TJ ≤ 85°C, I_O=5mA	-	±0.5	-	mV/℃

4.3.2 DC Specifications (78L06)

VIN = 12 V, I_O=40mA, CIN = 0.33 μF, CO = 0.1 μF, TJ = 25°C (unless otherwise noted).

Symbol	Parameter	Test Condition	MIN	TYP	MAX	Unit
Vo	Output voltage		5.75	6	6.25	V
		8.5 V ≤ VIN ≤ 20 V, 1mA ≤ I_O≤ 40 mA	5.7	6	6.3	V
		1mA ≤ I_O≤ 70 mA	5.7	6	6.3	V
I_{PK}	Peak output current		-	150	-	mA
VRLINE	Line regulation	9V ≤ VIN ≤ 20 V	-	-	120	mV
VRLOAD	Load regulation	1mA ≤ I_O≤ 100 mA	-	-	80	mV
		1mA ≤ I_O≤ 40 mA	-	-	40	mV
IQ	Quiescent current		-	3	5.5	mA
ΔIQ	Quiescent current change	1mA ≤ I_O≤ 40 mA	-	-	0.1	mA
		9 V ≤ VIN ≤ 20V, I_O=0mA	-	-	1.5	mA
ΔVIN / ΔVo	Ripple rejection	f = 120 Hz，10 V ≤ VIN ≤ 20V	-	50	-	dB
VIN(min)	Minimum value of input voltage required to maintain line regulation		-	8.5	--	V
ΔVO/ΔT	Average output voltage temperaturecoefficient	–40°C ≤ TJ ≤ 85°C, I_O=5mA	-	±0.6	-	mV/℃

4.3.3 DC Specifications (78L08)

VIN = 14 V, I_O=40mA, CIN = 0.33 μF, CO = 0.1 μF, TJ = 25°C (unless otherwise noted).

Symbol	Parameter	Test Condition	MIN	TYP	MAX	Unit
Vo	Output voltage		7.7	8	8.3	V
		10.5 V ≤ VIN ≤ 23 V, 1mA ≤ I_O≤ 40 mA	7.6	8	8.4	V
		1mA ≤ I_O≤ 70 mA	7.6	8	8.4	V
I_{PK}	Peak output current		-	150	-	mA
VRLINE	Line regulation	10.5V ≤ VIN ≤ 23 V	-	-	150	mV
VRLOAD	Load regulation	1mA ≤ I_O≤ 100 mA	-	-	80	mV
		1mA ≤ I_O≤ 40 mA	-	-	40	mV
IQ	Quiescent current		-	3	5.5	mA
ΔIQ	Quiescent current change	1mA ≤ I_O≤ 40 mA	-	-	0.1	mA
		11V ≤ VIN ≤ 23 V, I_O=0mA	-	-	1.5	mA
ΔVIN / ΔVo	Ripple rejection	f = 120 Hz，11 V ≤ VIN ≤ 23 V	-	50	-	dB
VIN(min)	Minimum value of input voltage required to maintain line regulation		-	10	--	V
ΔVO/ΔT	Average output voltage temperaturecoefficient	–40°C ≤ TJ ≤ 85°C, I_O=5mA	-	±0.75	-	mV/℃

4.3.4 DC Specifications (78L09)

VIN = 15 V, I_O=40mA, CIN = 0.33 μF, CO = 0.1 μF, TJ = 25°C (unless otherwise noted).

Symbol	Parameter	Test Condition	MIN	TYP	MAX	Unit
Vo	Output voltage		8.64	9	9.36	V
		11.5 V ≤ VIN ≤ 24 V, 1mA ≤ I_O≤ 40 mA	8.55	9	9.45	V
		1mA ≤ I_O≤ 70 mA	8.55	9	9.45	V
I_{PK}	Peak output current		-	150	-	mA
VRLINE	Line regulation	11.5V ≤ VIN ≤ 24V	-	-	200	mV
VRLOAD	Load regulation	1mA ≤ I_O≤ 100 mA	-	-	90	mV
		1mA ≤ I_O≤ 40 mA	-	-	45	mV
IQ	Quiescent current		-	3	5.5	mA
ΔIQ	Quiescent current change	1mA ≤ I_O≤ 40 mA	-	-	0.1	mA
		11.5V ≤ VIN ≤ 24 V, I_O=0mA	-	-	1.5	mA
ΔVIN / ΔVo	Ripple rejection	f = 120 Hz，13 V ≤ VIN ≤ 24 V	-	50	-	dB
VIN(min)	Minimum value of input voltage required to maintain line regulation		-	11	--	V
ΔVO/ΔT	Average output voltage temperaturecoefficient	–40°C ≤ TJ ≤ 85°C, I_O=5mA	-	±0.8	-	mV/℃

4.3.5 DC Specifications (78L10)

VIN = 15 V, I_O=40mA, CIN = 0.33 μF, CO = 0.1 μF, TJ = 25°C (unless otherwise noted).

Symbol	Parameter	Test Condition	MIN	TYP	MAX	Unit
Vo	Output voltage		9.6	10	10.4	V
		12.5 V ≤ VIN ≤ 24 V, 1mA ≤ I_O≤ 40 mA	9.55	10	10.45	V
		1mA ≤ I_O≤ 70 mA	9.55	10	10.45	V
I_{PK}	Peak output current		-	150	-	mA
VRLINE	Line regulation	12.5V ≤ VIN ≤ 24V	-	-	200	mV
VRLOAD	Load regulation	1mA ≤ I_O≤ 100 mA	-	-	90	mV
		1mA ≤ I_O≤ 40 mA	-	-	45	mV
IQ	Quiescent current		-	3	5.5	mA
ΔIQ	Quiescent current change	1mA ≤ I_O≤ 40 mA	-	-	0.1	mA
		13V ≤ VIN ≤ 24 V, I_O=0mA	-	-	1.5	mA
ΔVIN / ΔVo	Ripple rejection	f = 120 Hz，14 V ≤ VIN ≤ 24 V	-	50	-	dB
VIN(min)	Minimum value of input voltage required to maintain line regulation		-	12	--	V
ΔVO/ΔT	Average output voltage temperaturecoefficient	–40°C ≤ TJ ≤ 85°C, I_O=5mA	-	±0.9	-	mV/℃

4.3.6 DC Specifications (78L12)

VIN = 19 V, I_O=40mA, CIN = 0.33 μF, CO = 0.1 μF, TJ = 25°C (unless otherwise noted).

Symbol	Parameter	Test Condition	MIN	TYP	MAX	Unit
Vo	Output voltage		11.5	12	12.5	V
		14.5 V ≤ VIN ≤ 27 V, 1mA ≤ I_O≤ 40 mA	11.4	12	12.6	V
		1mA ≤ I_O≤ 70 mA	11.4	12	12.6	V
I_{PK}	Peak output current		-	150	-	mA
VRLINE	Line regulation	14.5V ≤ VIN ≤ 27V	-	-	200	mV
VRLOAD	Load regulation	1mA ≤ I_O≤ 100 mA	-	-	100	mV
		1mA ≤ I_O≤ 40 mA	-	-	50	mV
IQ	Quiescent current		-	3	5.5	mA
ΔIQ	Quiescent current change	1mA ≤ I_O≤ 40 mA	-	-	0.1	mA
		16V ≤ VIN ≤ 27 V, I_O=0mA	-	-	1.5	mA
ΔVIN / ΔVo	Ripple rejection	f = 120 Hz， 15 V ≤ VIN ≤ 25 V	-	50	-	dB
VIN(min)	Minimum value of input voltage required to maintain line regulation		-	14	--	V
ΔVO/ΔT	Average output voltage temperaturecoefficient	–40°C ≤ TJ ≤ 85°C, I_O=5mA	-	±1	-	mV/℃

4.3.7 DC Specifications (78L15)

VIN = 23 V, I_O=40mA, CIN = 0.33 μF, CO = 0.1 μF, TJ = 25°C (unless otherwise noted).

Symbol	Parameter	Test Condition	MIN	TYP	MAX	Unit
Vo	Output voltage		14.4	15	15.6	V
		17.5 V ≤ VIN ≤ 30 V, 1mA ≤ I_O≤ 40 mA	14.25	15	15.75	V
		1mA ≤ I_O≤ 70 mA	14.25	15	15.75	V
I_{PK}	Peak output current		-	150	-	mA
VRLINE	Line regulation	17.5V ≤ VIN ≤ 30V	-	-	250	mV
VRLOAD	Load regulation	1mA ≤ I_O≤ 100 mA	-	-	150	mV
		1mA ≤ I_O≤ 40 mA	-	-	75	mV
IQ	Quiescent current		-	3	5.5	mA
ΔIQ	Quiescent current change	1mA ≤ I_O≤ 40 mA	-	-	0.1	mA
		20V ≤ VIN ≤ 30 V, I_O=0mA	-	-	1.5	mA
ΔVIN / ΔVo	Ripple rejection	f = 120 Hz, 18.5 V ≤ VIN ≤ 28.5 V	-	50	-	dB
VIN(min)	Minimum value of input voltage required to maintain line regulation		-	17	--	V
ΔVO/ΔT	Average output voltage temperaturecoefficient	–40°C ≤ TJ ≤ 85°C, I_O=5mA	-	±1.3	-	mV/℃

5. Application Information

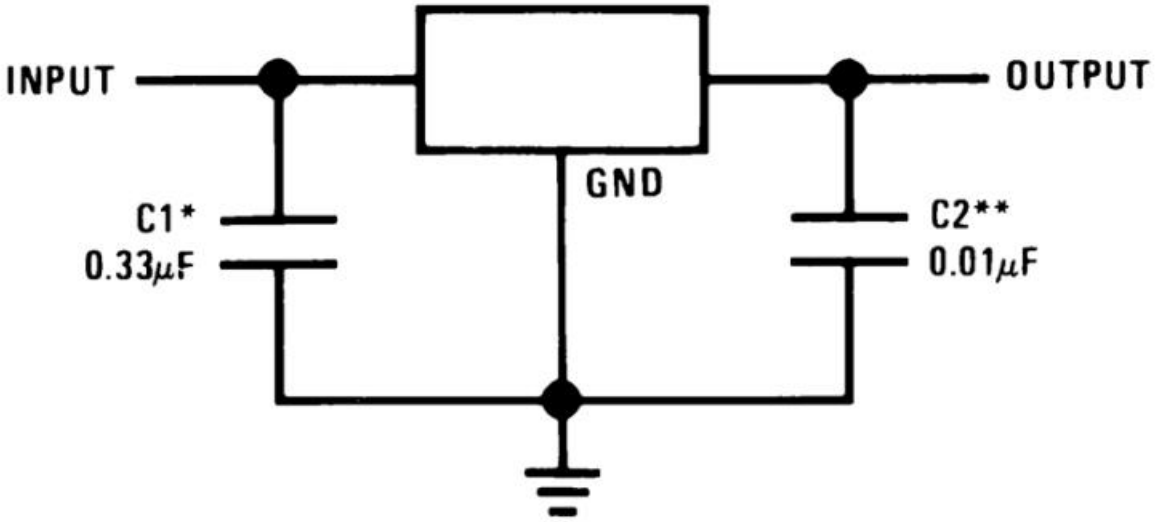


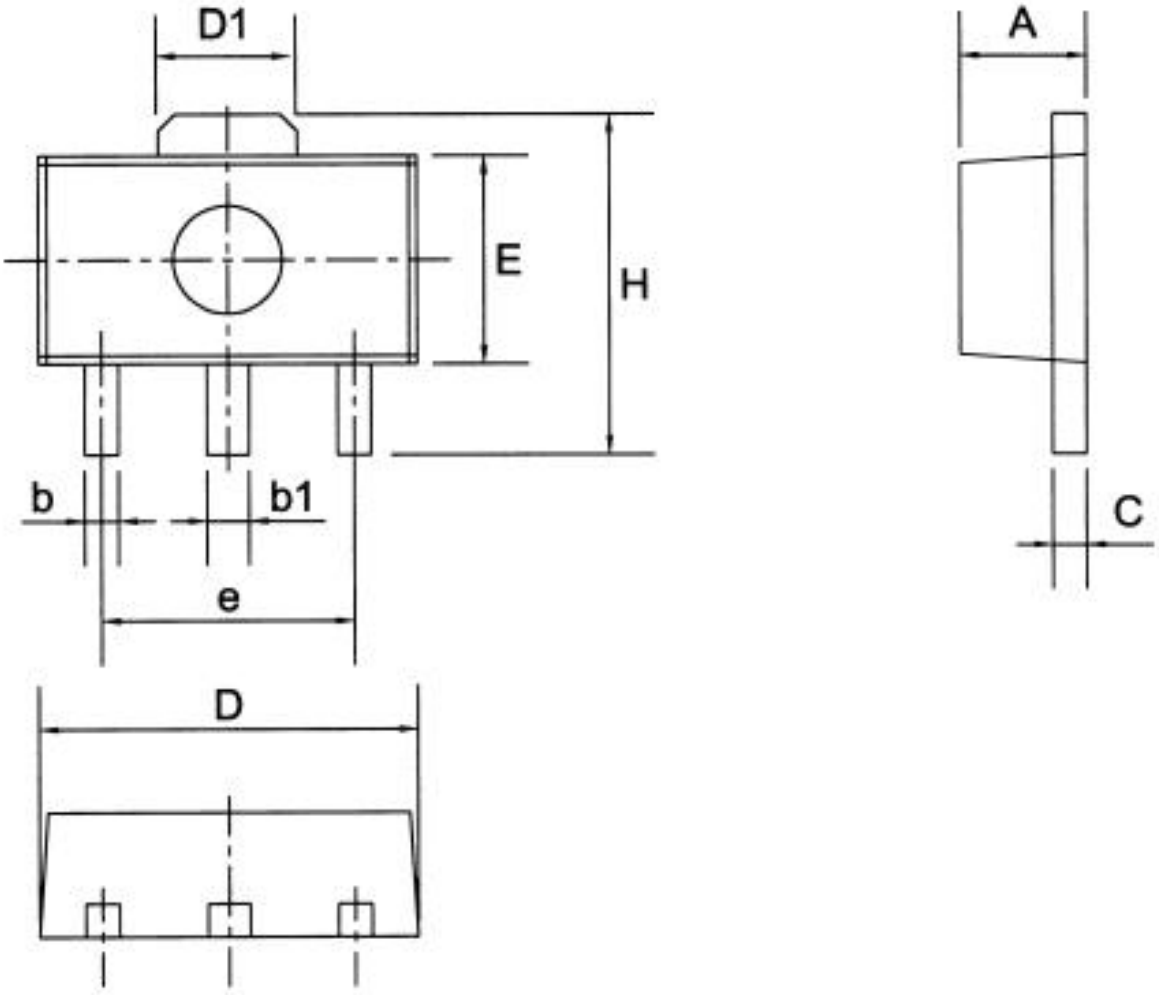
Figure 5.1：Application Circuit

6. Ordering Information

Orderable Device	Package Type	Pins	Packing	Package Qty
78LXXGT03ARAQ	SOT89	3	Tape & Reel	1000
78LXXST03ARCQ	SOT23	3	Tape & Reel	3000
78LXXKW03ABAQ	TO92	3	Bag	1000
78LXXNS08ARDQ	SOP	8	Tape & Reel	4000

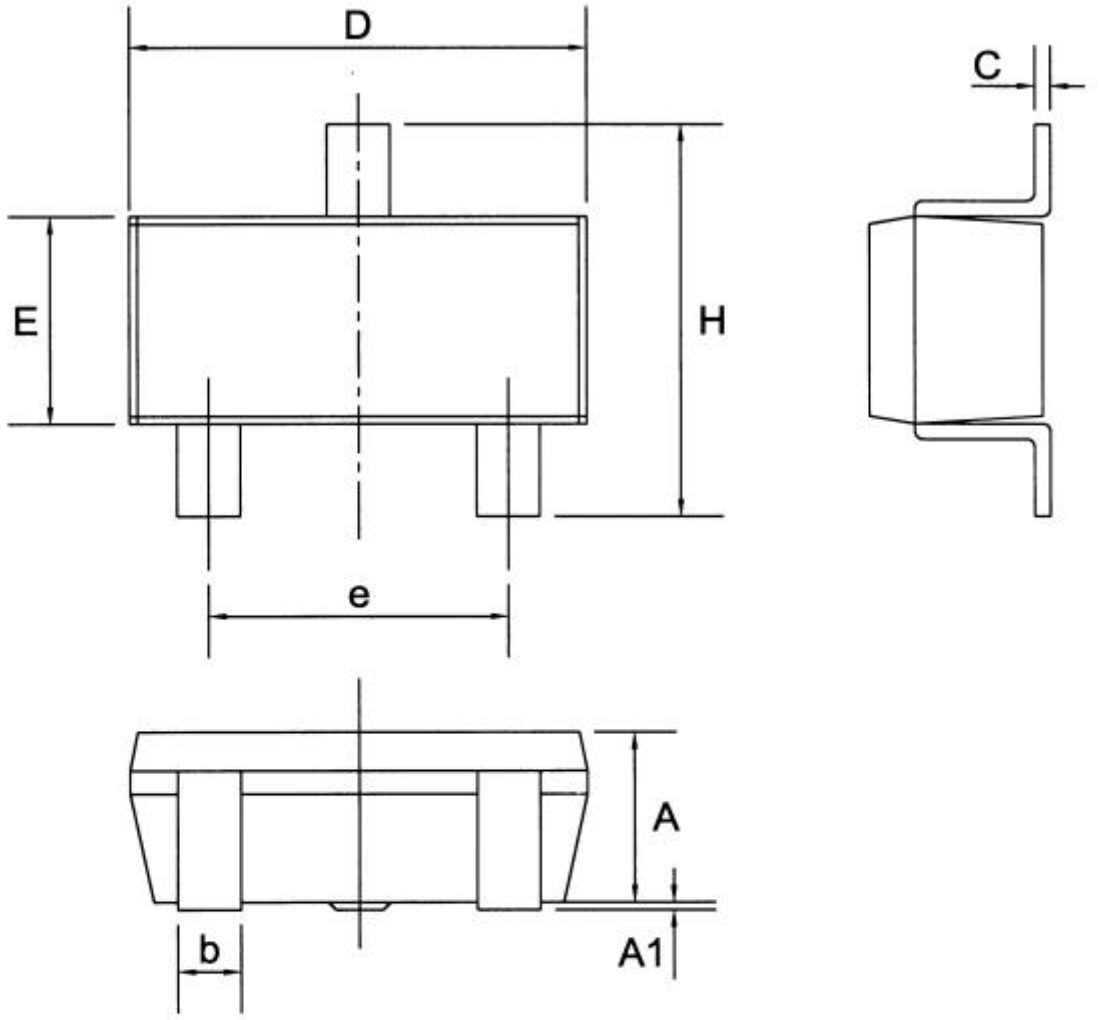
7. Package Information

7.1 SOT89-3



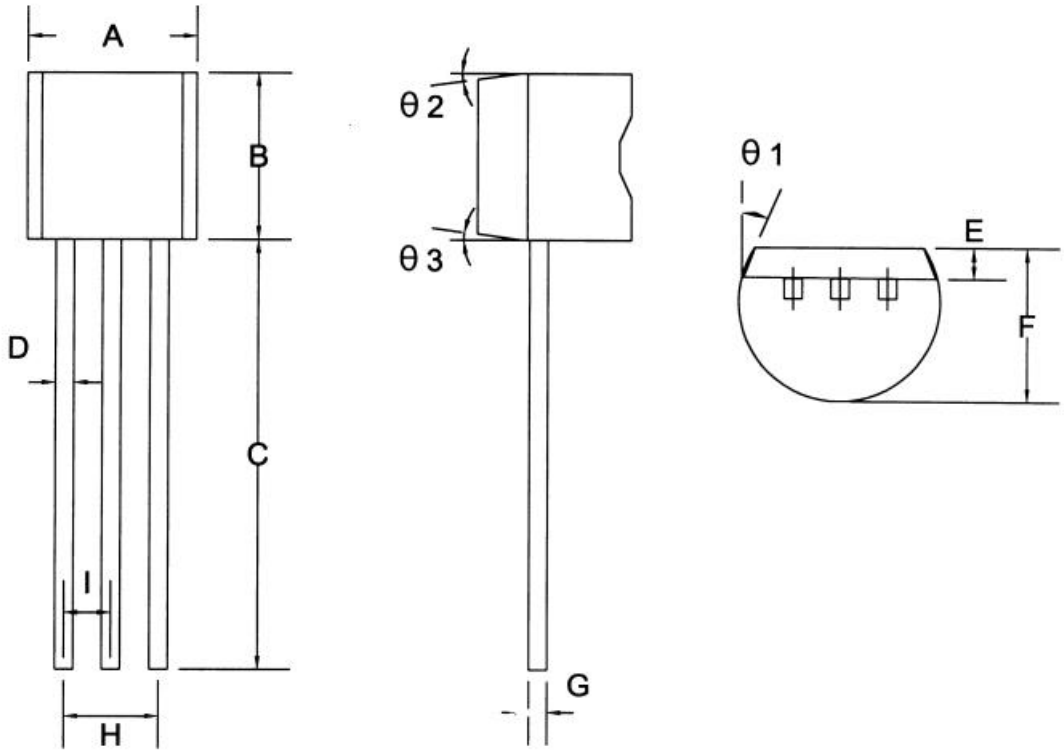
Symbol	Dimensions In Millmeters			Dimensions In Inches		
	Min	Nom	Max	Min	Nom	Max
A	1.30	1.50	1.70	0.051	0.059	0.067
b	0.25	0.40	0.55	0.010	0.016	0.022
b1	0.40	0.50	0.60	0.016	0.020	0.024
C	0.30	0.40	0.50	0.012	0.016	0.020
D	4.30	4.50	4.70	0.169	0.177	0.185
D1	1.45	1.65	1.85	0.057	0.065	0.073
E	2.30	2.50	2.70	0.091	0.098	0.106
e	2.90	3.00	3.10	0.114	0.118	0.122
H	3.90	4.10	4.30	0.154	0.161	0.169

7.2 SOT23-3



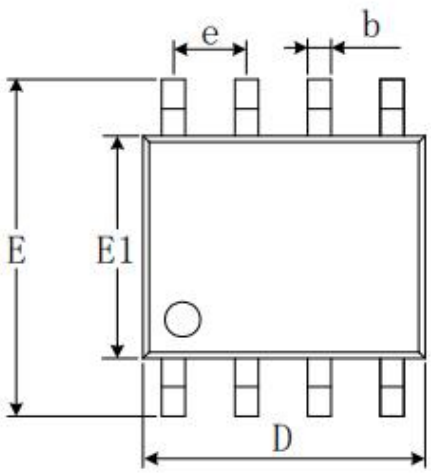
Symbol	Dimensions In Millmeters			Dimensions In Inches		
	Min	Nom	Max	Min	Nom	Max
A	1.05	1.15	1.35	0.041	0.045	0.053
A1	—	0.05	0.10	—	0.002	0.004
b	0.35	0.40	0.55	0.014	0.016	0.022
C	0.08	0.10	0.20	0.003	0.004	0.008
D	2.70	2.90	3.10	0.106	0.114	0.122
E	1.20	1.35	1.50	0.047	0.053	0.059
e	1.70	1.90	2.10	0.067	0.075	0.083
H	2.35	2.55	2.75	0.093	0.100	0.108

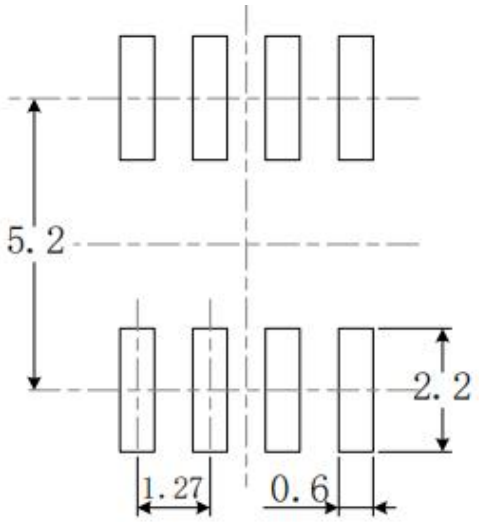
7.3 TO92



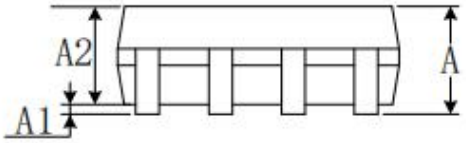
Symbol	Dimensions In Millmeters			Dimensions In Inches		
	Min	Nom	Max	Min	Nom	Max
A	4.33	4.58	4.83	0.170	0.180	0.190
B	4.33	4.58	4.83	0.170	0.180	0.190
C	14.07	14.47	14.87	0.554	0.570	0.585
D	0.34	0.44	0.54	0.013	0.017	0.021
E	0.92	1.02	1.12	0.036	0.040	0.044
F	3.36	3.56	3.76	0.132	0.140	0.148
G	0.34	0.44	0.54	0.013	0.017	0.021
H	2.42	2.54	2.66	0.095	0.100	0.105
I	1.15	1.27	1.39	0.045	0.050	0.055
θ1	—	5°	—	—	5°	—
θ2	—	2°	—	—	2°	—
θ3	—	2°	—	—	2°	—

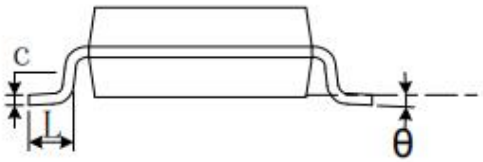
7.4 SOP8





RECOMMENDED LAND PATTERN (Unit: mm)





Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.800	5.000	0.189	0.197
e	1.270(BSC)		0.050(BSC)	
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°