



78LXX 100-mA Fixed Output 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

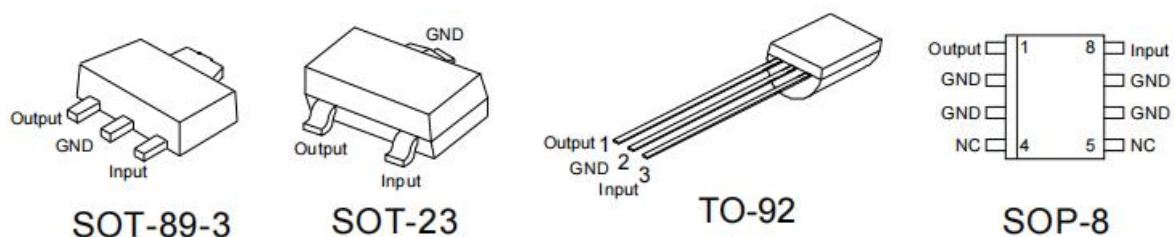


Figure 2.1 Top View



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

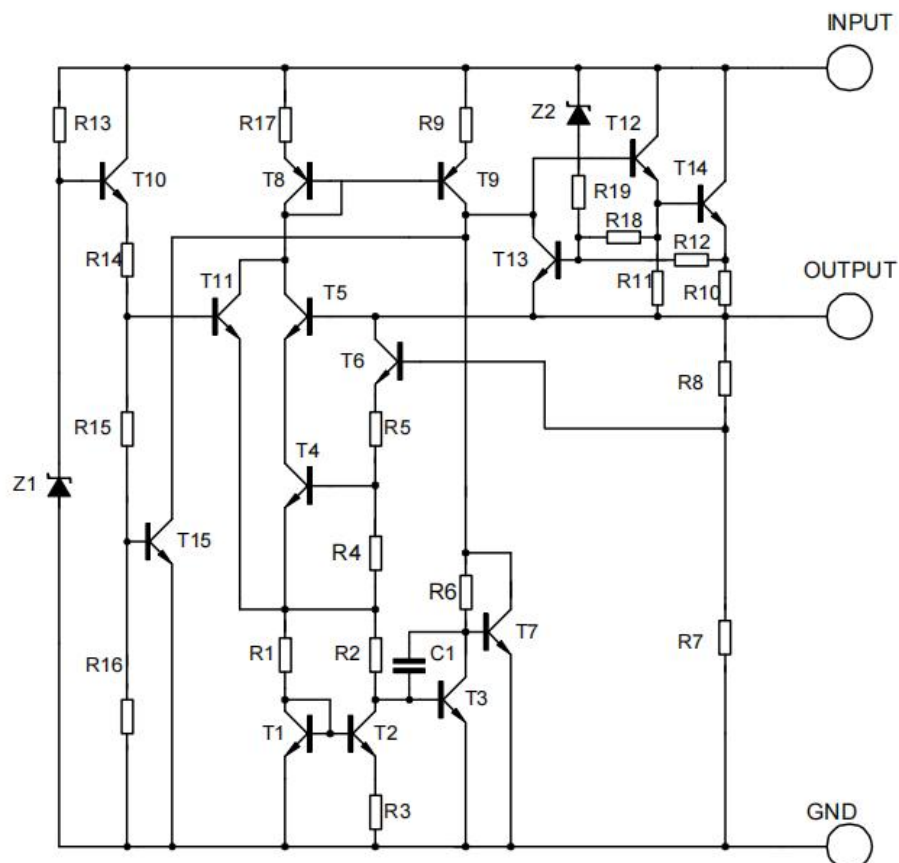


Figure 3.1: Block Diagram



4. Specifications

4.1 Absolute Maximum Ratings

Symbol	Parameter		MIN	MAX	Unit
V _{CC}	Supply Voltage		-	38	V
PD	Power dissipation	SOT89	-	350	mW
		SOT23	-	200	mW
		TO92	-	625	mW
		SOP8	-	300	mW
T _{stg}	Storage temperature		-65	150	°C
T _J	Junction Temperature		-	125	°C
T _{OP}	Operating Temperature		-40	85	°C

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
V _I	Input voltage	-	36	V
V _O	Continuous Output current	-	0.1	A

4.3 Electrical Characteristics

4.3.1 DC Specifications (78L05)

V_{IN} = 10 V, I_O = 40 mA, C_{IN} = 0.33 μF, C_O = 0.1 μF, T_J = 25°C (unless otherwise noted).

Symbol	Parameter	Test Condition	MIN	TYP	MAX	Unit
V _O	Output voltage		4.8	5	5.2	V
		8V ≤ V _{IN} ≤ 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
V _{RLINE}	Line regulation	8V ≤ V _{IN} ≤ 20 V	-	-	75	mV
V _{RLOAD}	Load regulation	1mA ≤ I _O ≤ 100 mA	-	-	60	mV
		1mA ≤ I _O ≤ 40 mA	-	-	30	mV
I _Q	Quiescent current		-	3	5.5	mA
ΔI _Q	Quiescent current change	1mA ≤ I _O ≤ 40 mA	-	-	0.1	mA
		8 V ≤ V _{IN} ≤ 20 V, I _O = 0 mA	-	-	1.5	mA
ΔV _{IN} / ΔV _O	Ripple rejection	f = 120 Hz, 8V ≤ V _{IN} ≤ 16 V	-	60	-	dB
V _d	Dropout voltage		-	1.7	--	V
ΔV _O /ΔT	Average output voltage temperature coefficient	-40°C ≤ T _J ≤ 85°C, I _O = 5 mA	-	±0.7	-	mV/°C



4.3.2 DC Specifications (78L06)

$V_{IN} = 12\text{ V}$, $I_O = 40\text{ mA}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$, $T_J = 25^\circ\text{C}$ (unless otherwise noted).

Symbol	Parameter	Test Condition	MIN	TYP	MAX	Unit
Vo	Output voltage		5.75	6	6.25	V
		$8.5\text{ V} \leq V_{IN} \leq 20\text{ V}$, $1\text{ mA} \leq I_O \leq 40\text{ mA}$	5.7	6	6.3	V
		$1\text{ mA} \leq I_O \leq 70\text{ mA}$	5.7	6	6.3	V
IPK	Peak output current		-	150	-	mA
VRLINE	Line regulation	$8.5\text{ V} \leq V_{IN} \leq 20\text{ V}$	-	-	120	mV
VRLOAD	Load regulation	$1\text{ mA} \leq I_O \leq 100\text{ mA}$	-	-	80	mV
		$1\text{ mA} \leq I_O \leq 40\text{ mA}$	-	-	40	mV
IQ	Quiescent current		-	3	5.5	mA
ΔI_Q	Quiescent current change	$1\text{ mA} \leq I_O \leq 40\text{ mA}$	-	-	0.1	mA
		$9\text{ V} \leq V_{IN} \leq 20\text{ V}$, $I_O = 0\text{ mA}$	-	-	1.5	mA
$\Delta V_{IN} / \Delta V_O$	Ripple rejection	$f = 120\text{ Hz}$, $10\text{ V} \leq V_{IN} \leq 20\text{ V}$	-	60	-	dB
Vd	Dropout voltage		-	1.7	--	V
$\Delta V_O / \Delta T$	Average output voltage temperature coefficient	$-40^\circ\text{C} \leq T_J \leq 85^\circ\text{C}$, $I_O = 5\text{ mA}$	-	± 0.75	-	mV/ $^\circ\text{C}$

4.3.3 DC Specifications (78L08)

$V_{IN} = 14\text{ V}$, $I_O = 40\text{ mA}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$, $T_J = 25^\circ\text{C}$ (unless otherwise noted).

Symbol	Parameter	Test Condition	MIN	TYP	MAX	Unit
Vo	Output voltage		7.7	8	8.3	V
		$10.5\text{ V} \leq V_{IN} \leq 23\text{ V}$, $1\text{ mA} \leq I_O \leq 40\text{ mA}$	7.6	8	8.4	V
		$1\text{ mA} \leq I_O \leq 70\text{ mA}$	7.6	8	8.4	V
IPK	Peak output current		-	150	-	mA
VRLINE	Line regulation	$10.5\text{ V} \leq V_{IN} \leq 23\text{ V}$	-	-	150	mV
VRLOAD	Load regulation	$1\text{ mA} \leq I_O \leq 100\text{ mA}$	-	-	80	mV
		$1\text{ mA} \leq I_O \leq 40\text{ mA}$	-	-	40	mV
IQ	Quiescent current		-	3	5.5	mA
ΔI_Q	Quiescent current change	$1\text{ mA} \leq I_O \leq 40\text{ mA}$	-	-	0.1	mA
		$11\text{ V} \leq V_{IN} \leq 23\text{ V}$, $I_O = 0\text{ mA}$	-	-	1.5	mA
$\Delta V_{IN} / \Delta V_O$	Ripple rejection	$f = 120\text{ Hz}$, $11\text{ V} \leq V_{IN} \leq 23\text{ V}$	-	60	-	dB
Vd	Dropout voltage		-	1.7	--	V
$\Delta V_O / \Delta T$	Average output voltage temperature coefficient	$-40^\circ\text{C} \leq T_J \leq 85^\circ\text{C}$, $I_O = 5\text{ mA}$	-	± 0.8	-	mV/ $^\circ\text{C}$



4.3.4 DC Specifications (78L09)

VIN = 15 V, IO=40mA, CIN = 0.33 μ F, CO = 0.1 μ F, 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 $\leq$ VIN $\leq$ 24 V, 1mA $\leq$ IO $\leq$ 40 mA	8.55	9	9.45	V
		1mA $\leq$ IO $\leq$ 70 mA	8.55	9	9.45	V
IPK	Peak output current		-	150	-	mA
VRLINE	Line regulation	11.5V $\leq$ VIN $\leq$ 24V	-	-	200	mV
VRLOAD	Load regulation	1mA $\leq$ IO $\leq$ 100 mA	-	-	90	mV
		1mA $\leq$ IO $\leq$ 40 mA	-	-	45	mV
IQ	Quiescent current		-	3	5.5	mA
Δ IQ	Quiescent current change	1mA $\leq$ IO $\leq$ 40 mA	-	-	0.1	mA
		11.5V $\leq$ VIN $\leq$ 24 V, IO=0mA	-	-	1.5	mA
Δ VIN / Δ Vo	Ripple rejection	f = 120 Hz, 13 V $\leq$ VIN $\leq$ 24 V	-	60	-	dB
Vd	Dropout voltage		-	1.7	--	V
Δ VO/ Δ T	Average output voltage temperaturecoefficient	-40°C $\leq$ TJ $\leq$ 85°C, IO=5mA	-	$\pm$ 0.9	-	mV/°C

4.3.5 DC Specifications (78L10)

VIN = 15 V, IO=40mA, CIN = 0.33 μ F, CO = 0.1 μ F, 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 $\leq$ VIN $\leq$ 24 V, 1mA $\leq$ IO $\leq$ 40 mA	9.55	10	10.45	V
		1mA $\leq$ IO $\leq$ 70 mA	9.55	10	10.45	V
IPK	Peak output current		-	150	-	mA
VRLINE	Line regulation	12.5V $\leq$ VIN $\leq$ 24V	-	-	200	mV
VRLOAD	Load regulation	1mA $\leq$ IO $\leq$ 100 mA	-	-	90	mV
		1mA $\leq$ IO $\leq$ 40 mA	-	-	45	mV
IQ	Quiescent current		-	3	5.5	mA
Δ IQ	Quiescent current change	1mA $\leq$ IO $\leq$ 40 mA	-	-	0.1	mA
		13V $\leq$ VIN $\leq$ 24 V, IO=0mA	-	-	1.5	mA
Δ VIN / Δ Vo	Ripple rejection	f = 120 Hz, 14 V $\leq$ VIN $\leq$ 24 V	-	60	-	dB
Vd	Dropout voltage		-	1.7	--	V
Δ VO/ Δ T	Average output voltage temperaturecoefficient	-40°C $\leq$ TJ $\leq$ 85°C, IO=5mA	-	$\pm$ 1	-	mV/°C



4.3.6 DC Specifications (78L12)

$V_{IN} = 19\text{ V}$, $I_O = 40\text{ mA}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$, $T_J = 25^\circ\text{C}$ (unless otherwise noted).

Symbol	Parameter	Test Condition	MIN	TYP	MAX	Unit
V_O	Output voltage		11.5	12	12.5	V
		$14.5\text{ V} \leq V_{IN} \leq 27\text{ V}$, $1\text{ mA} \leq I_O \leq 40\text{ mA}$	11.4	12	12.6	V
		$1\text{ mA} \leq I_O \leq 70\text{ mA}$	11.4	12	12.6	V
I_{PK}	Peak output current		-	150	-	mA
VRLINE	Line regulation	$14.5\text{ V} \leq V_{IN} \leq 27\text{ V}$	-	-	250	mV
VRLOAD	Load regulation	$1\text{ mA} \leq I_O \leq 100\text{ mA}$	-	-	100	mV
		$1\text{ mA} \leq I_O \leq 40\text{ mA}$	-	-	50	mV
I_Q	Quiescent current		-	3	5.5	mA
ΔI_Q	Quiescent current change	$1\text{ mA} \leq I_O \leq 40\text{ mA}$	-	-	0.1	mA
		$16\text{ V} \leq V_{IN} \leq 27\text{ V}$, $I_O = 0\text{ mA}$	-	-	1.5	mA
$\Delta V_{IN} / \Delta V_O$	Ripple rejection	$f = 120\text{ Hz}$, $15\text{ V} \leq V_{IN} \leq 25\text{ V}$	-	50	-	dB
V_d	Dropout voltage		-	1.7	--	V
$\Delta V_O / \Delta T$	Average output voltage temperature coefficient	$-40^\circ\text{C} \leq T_J \leq 85^\circ\text{C}$, $I_O = 5\text{ mA}$	-	± 1.1	-	mV/ $^\circ\text{C}$

4.3.7 DC Specifications (78L15)

$V_{IN} = 23\text{ V}$, $I_O = 40\text{ mA}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$, $T_J = 25^\circ\text{C}$ (unless otherwise noted).

Symbol	Parameter	Test Condition	MIN	TYP	MAX	Unit
V_O	Output voltage		14.4	15	15.6	V
		$17.5\text{ V} \leq V_{IN} \leq 30\text{ V}$, $1\text{ mA} \leq I_O \leq 40\text{ mA}$	14.25	15	15.75	V
		$1\text{ mA} \leq I_O \leq 70\text{ mA}$	14.25	15	15.75	V
I_{PK}	Peak output current		-	150	-	mA
VRLINE	Line regulation	$17.5\text{ V} \leq V_{IN} \leq 30\text{ V}$	-	-	250	mV
VRLOAD	Load regulation	$1\text{ mA} \leq I_O \leq 100\text{ mA}$	-	-	150	mV
		$1\text{ mA} \leq I_O \leq 40\text{ mA}$	-	-	75	mV
I_Q	Quiescent current		-	3	5.5	mA
ΔI_Q	Quiescent current change	$1\text{ mA} \leq I_O \leq 40\text{ mA}$	-	-	0.1	mA
		$20\text{ V} \leq V_{IN} \leq 30\text{ V}$, $I_O = 0\text{ mA}$	-	-	1.5	mA
$\Delta V_{IN} / \Delta V_O$	Ripple rejection	$f = 120\text{ Hz}$, $18.5\text{ V} \leq V_{IN} \leq 28.5\text{ V}$	-	50	-	dB
V_d	Dropout voltage		-	1.7	--	V
$\Delta V_O / \Delta T$	Average output voltage temperature coefficient	$-40^\circ\text{C} \leq T_J \leq 85^\circ\text{C}$, $I_O = 5\text{ mA}$	-	± 1.4	-	mV/ $^\circ\text{C}$



4.4 Typical Characteristics

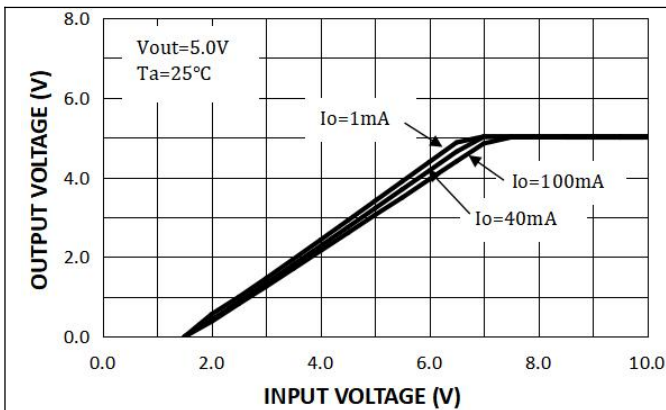


Fig1. Dropout Characteristics

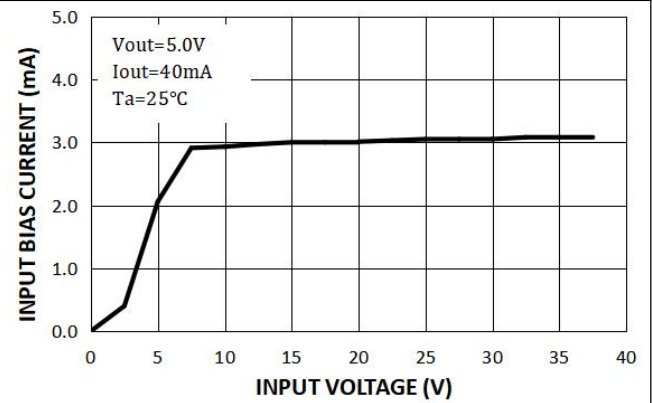


Fig2. Input Bias Current vs Input Voltage

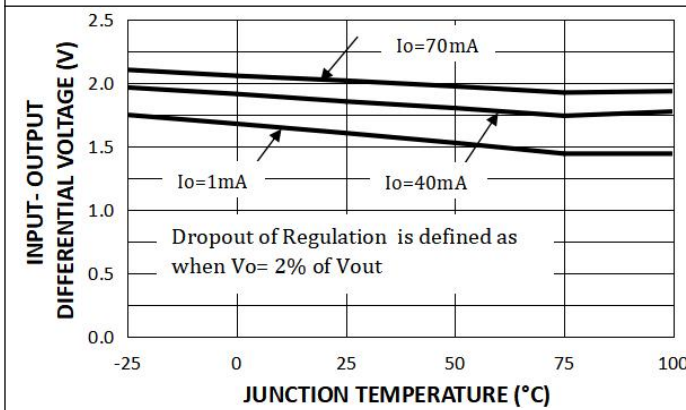


Fig3. Dropout Voltage vs Junction Temperature

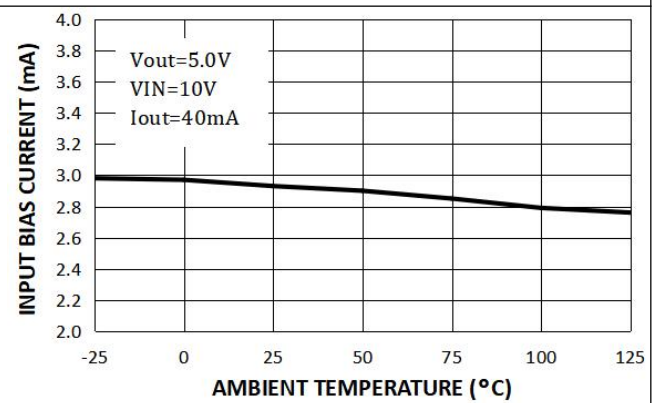


Fig4. Input Bias Current vs Ambient Temperature



5.Application Information

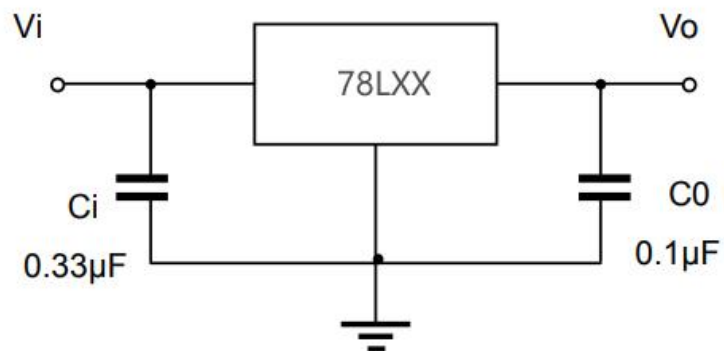


Figure 5.1: Application Circuit



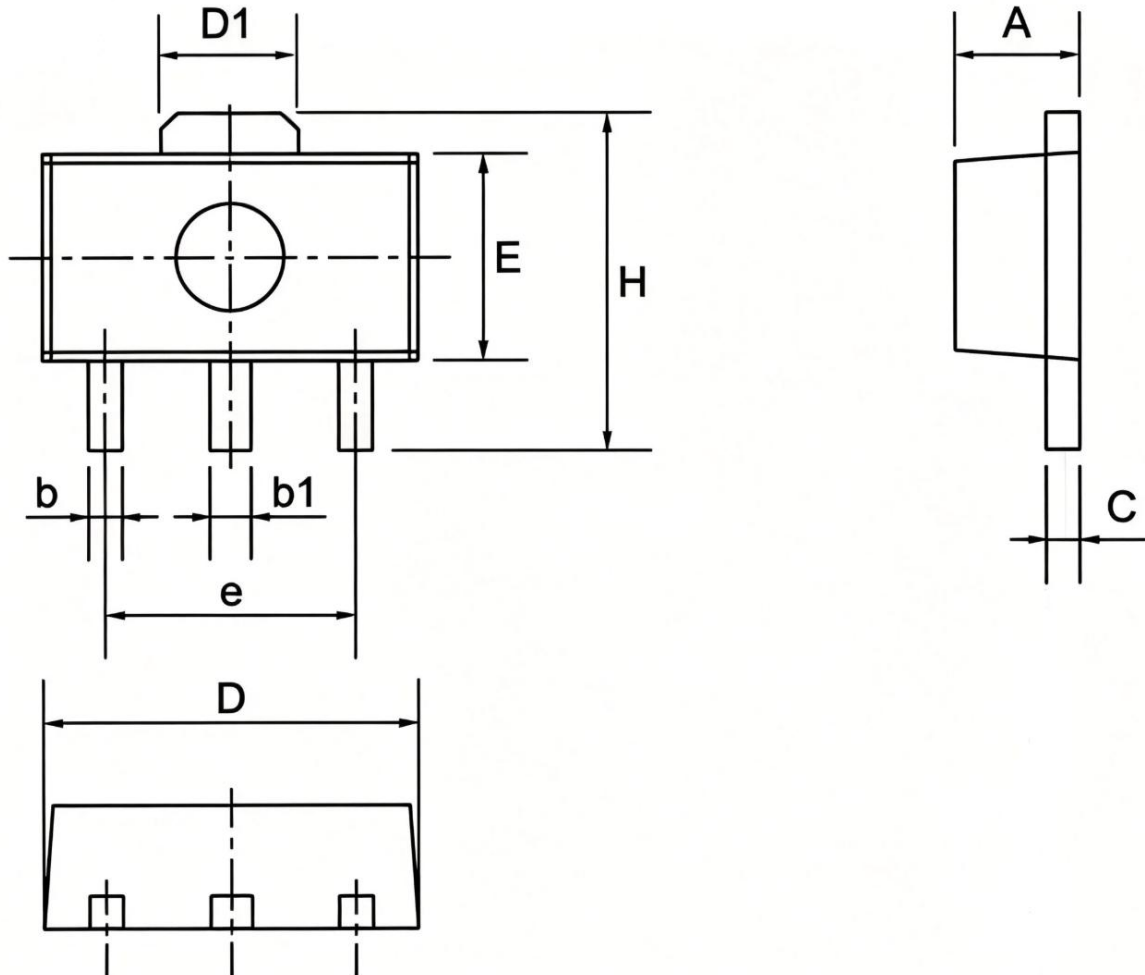
6. Ordering Information

Orderable Device	Package Type	Pins	Packing	Package Qty
78LXXGT03ABRAQ	SOT89	3	Tape & Reel	1000
78LXXS	SOT23	3	Tape & Reel	3000
78LXXKW03ABBAQ	TO92	3	Bag	1000
78LXXNS08ABRDQ	SOP	8	Tape & Reel	4000



7.Package Information

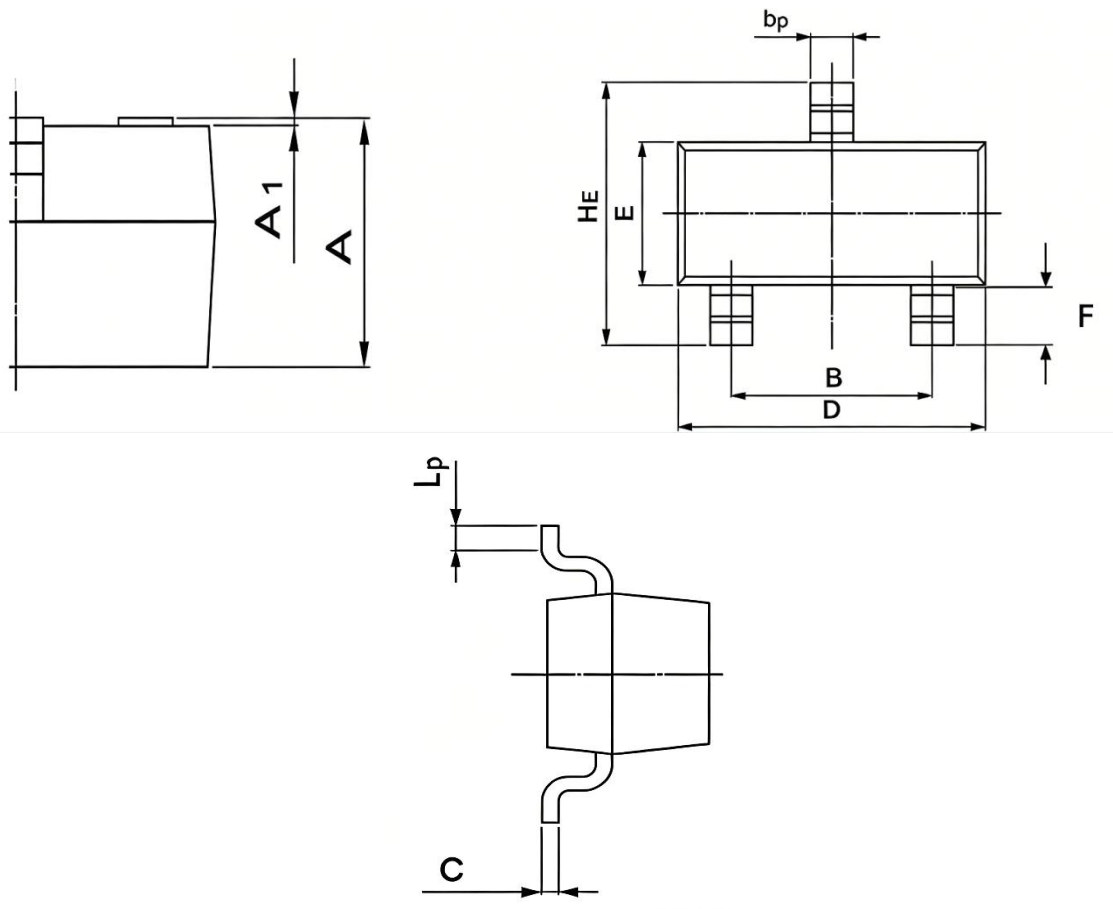
7.1 SOT89-3



Symbol	Dimensions In Millimeters		
	Min	Nom	Max
A	1.30	1.50	1.70
b	0.25	0.40	0.55
b1	0.40	0.50	0.60
C	0.30	0.40	0.50
D	4.30	4.50	4.70
D1	1.45	1.65	1.85
E	2.30	2.50	2.70
e	2.90	3.00	3.10
H	3.90	4.20	4.40



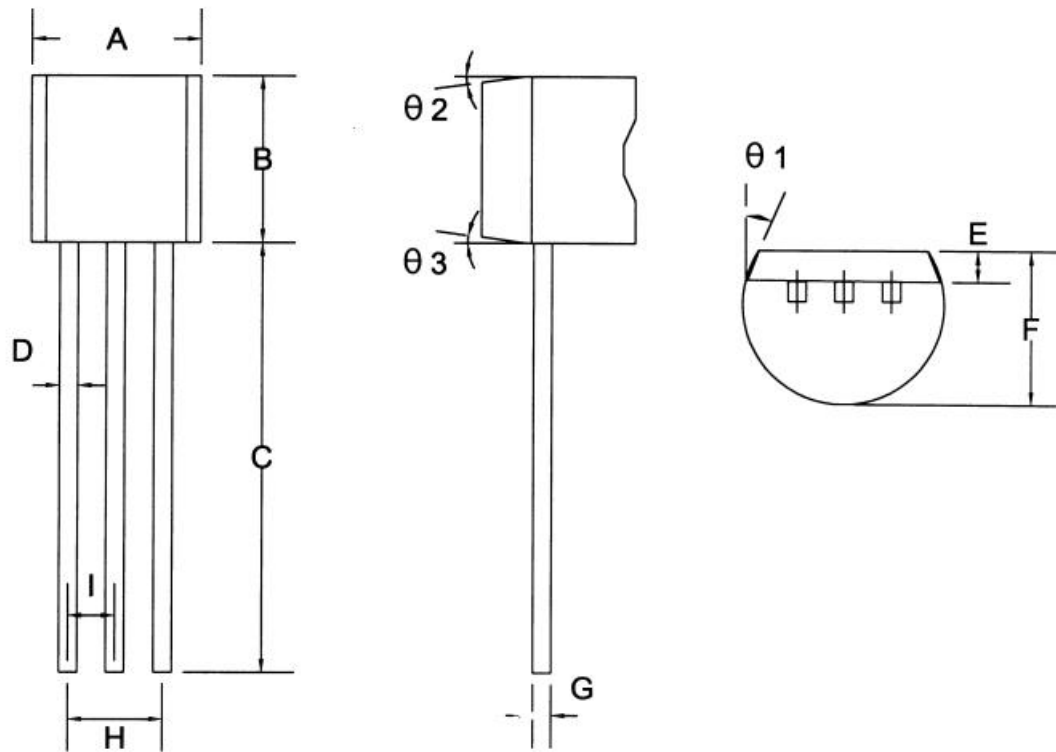
7.2 SOT23-3



Symbol	Dimensions In Millimeters		
	Min	Nom	Max
A	0.90	1.05	1.40
A1	--	0.05	0.10
B	1.70	1.90	2.10
C	0.08	0.13	0.20
D	2.70	2.90	3.10
E	1.20	1.40	1.65
HE	2.20	2.50	2.80
bp	0.35	0.45	0.55
Lp	0.20	0.35	0.50
F	0.50	0.59	0.68



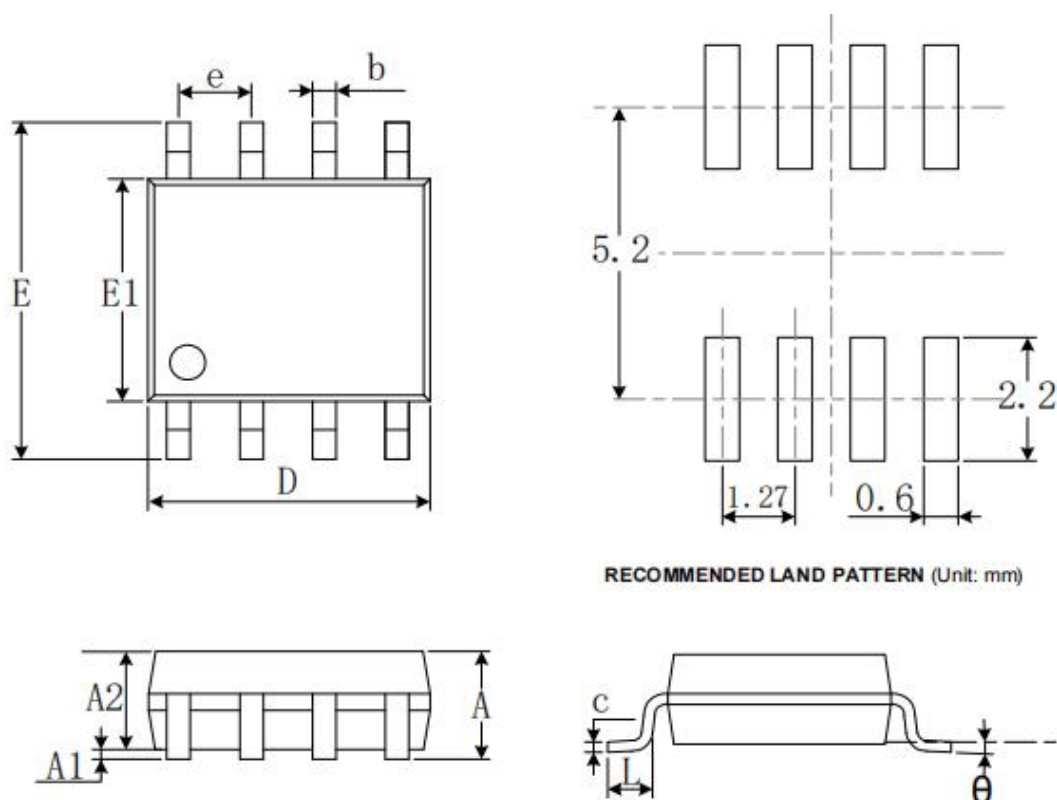
7.3 TO92



Symbol	Dimensions In Millimeters			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
θ 1	—	5°	—	—	5°	—
θ 2	—	2°	—	—	2°	—
θ 3	—	2°	—	—	2°	—



7.4 SOP8



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°