
Ultralow Quiescent, Fast Transient
Low Dropout Regulator

General Description

The MA3053 series is a high voltage , ultralow-power , low dropout voltage regulator. The device can deliver 100mA output current with a dropout voltage of 300mV and allows an input voltage as high as 35V. The typical quiescent current is only 1.6 μ A. The device is available in fixed output voltages of 1.8, 3.3 and 5.0V. The device features integrated short-circuit and thermal shutdown protection.

Although designed primarily as fixed voltage regulators, the device can be used with external components to obtain variable voltages.

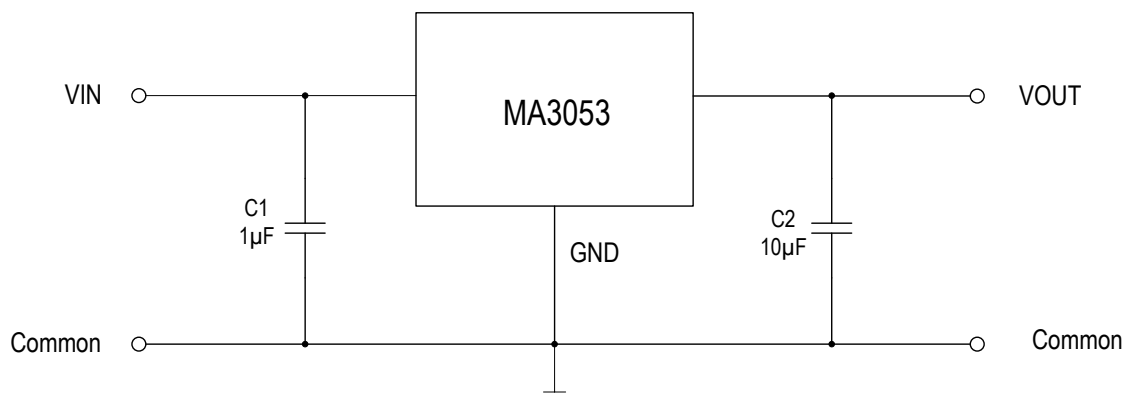
Features

- Low Quiescent Current : 1.6 μ A
- High Input Voltage : Up to 35V
- High Output current : 200mA
- Without Overshoot in Start Up
- Without Overshoot after Short Circuits Removed
- Low Dropout Voltage :
 - 280mV@100mA
 - 580mV@200mA
- Fixed Output Voltages : 1.8, 3.3 and 5.0V.
- High-accuracy Output Voltage : $\pm 2\%$
- Good Transient Response
- Low Temperature Drift : $\pm 100\text{ppm}/^\circ\text{C}$
- Integrated Short-Circuit Protection
- Integrated Thermal Protection
- Available Packages : SOT89-3L/SOT23-3L/SOT23-5L

Applications

- Battery-powered equipment -
- Portable equipment
- Audio/Video equipment

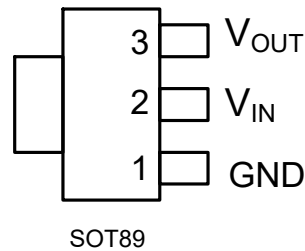
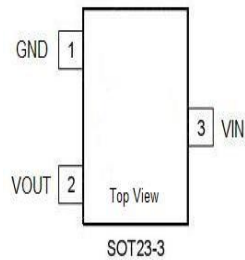
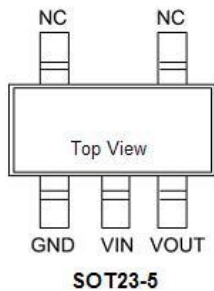
Basic Circuit



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PIN ASSIGNMENT

The pin assignment is given by:



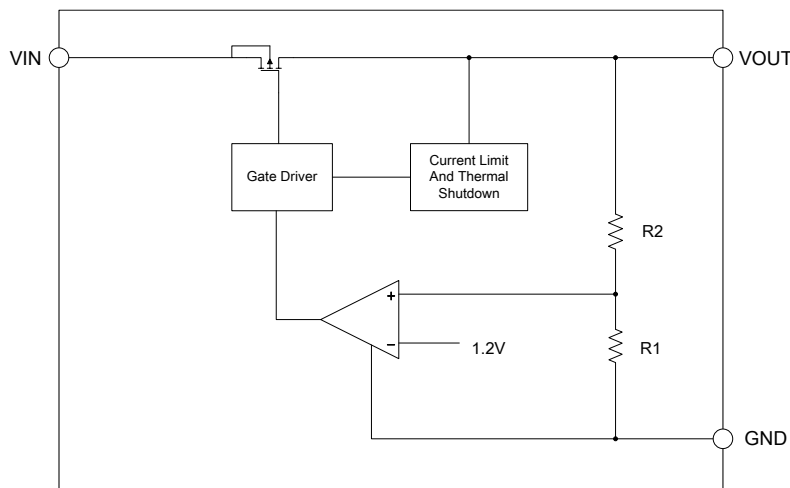
Name	Description
GND	Ground pin
VOUT	Regulator output pin
VIN	Regulator input supply pin

ORDER/MARKING INFORMATION

Order Information	Top Marking (SOT-23-3L/SOT-23-5L A Type)
MA3053 X XX X Package A : SOT-23-3L B : SOT-23-5L F : SOT-89-3L Output Voltage 18 : 1.8V 33: 3.3V 50: 5.0V Packing Blank: Bulk A : Taping	5 3 XX B MA3053 B: Output accuracy $\pm 2\%$ Output Voltage 18: 1.8V 33: 3.3V 50: 5.0V
Top Marking (SOT-89-3L)	
M 5 3 XX B → B: Output accuracy $\pm 2\%$ Y W W X 18: Output Voltage 1.8V 33: Output Voltage 3.3V 50: Output Voltage 5.0V Internal code. Variable. WW: 01~52 Year: 1=2011 2=2012 3=2013 4=2014 ⋮ 9=2019 MA3053	

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BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (at $T_A=25^{\circ}\text{C}$)

Characteristics	Symbol	Rating	Unit
V_{IN} Pin to GND Pin Voltage	V_{IN}	- 0.3 to 35	V
V_{OUT} Pin to GND pin Voltage	V_{OUT}	- 0.3 to 6	V
V_{OUT} Pin to V_{IN} Pin Voltage		- 35 to + 0.3	V
Peak output	Current	Internally limited	
Storage Temperature Range	T_{ST}	-40 to 150	$^{\circ}\text{C}$
Operating virtual junction Temperature		150	$^{\circ}\text{C}$
Thermal Resistance from Junction to ambient	SOT23-5L	θ_{JA}	400 $^{\circ}\text{C/W}$
	SOT89		135 $^{\circ}\text{C/W}$
Power Dissipation	SOT23-5L	PD	0.25 W
	SOT89		0.75 W
Human Body Model (HBM)	Electrostatic		2000 KV
Charged Device Model (MM)	discharge rating		250 V

Note : Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device .Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

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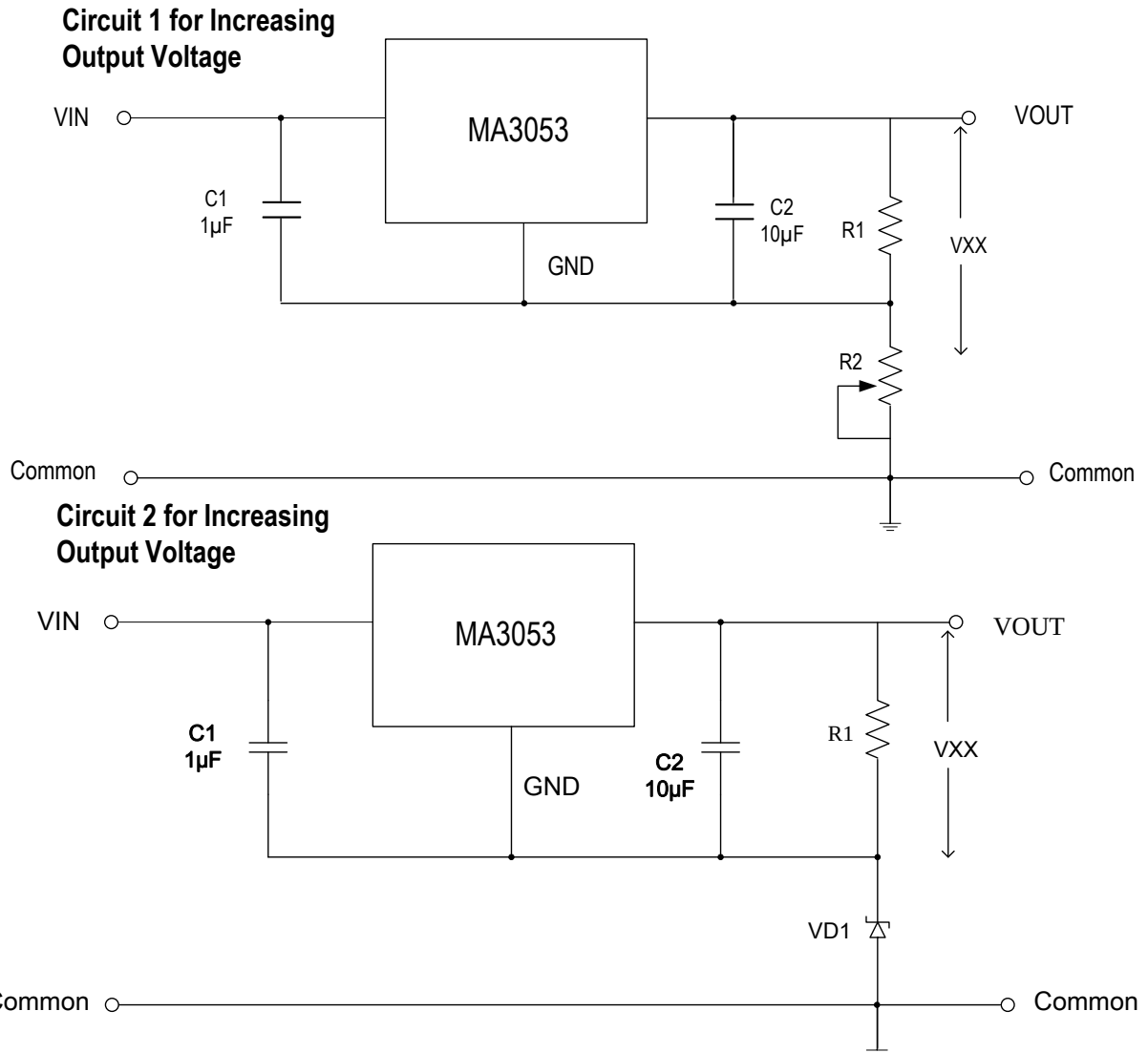
ELECTRICAL CHARACTERISTICS

(At $T_A=25^{\circ}\text{C}$, $C_{IN}=1\mu\text{F}$, $V_{IN}=V_{OUTNOM}+1.0\text{V}$, $C_{OUT}=10\mu\text{F}$, unless otherwise noted)

Characteristics	Symbol	Conditions	Min	Typ	Max	Units
Input Voltage	V_{IN}		-	-	35	V
Quiescent Current	I_{GND}	No load	-	1.6	2.0	μA
Output Voltage	V_{OUT}	$I_{OUT}=10\text{mA}$	$V_{OUTNOM}*0.98$	V_{OUTNOM}	$V_{OUTNOM}*1.02$	V
Output Current	I_{OUT_MAX}		200	250	-	mA
Dropout Voltage*1	V_{DROP}	AX3053-50, $I_{OUT}=100\text{mA}$, $\Delta V_{OUT}=$ $-V_{OUTNOM}*2\%$	-	280	350	mV
		AX3053-50, $I_{OUT}=200\text{mA}$, $\Delta V_{OUT}=$ $-V_{OUTNOM}*2\%$	-	580	700	mV
		AX3053-33, $I_{OUT}=100\text{mA}$, $\Delta V_{OUT}=$ $-V_{OUTNOM}*2\%$	-	300	380	mV
		AX3053-33, $I_{OUT}=200\text{mA}$, $\Delta V_{OUT}=$ $-V_{OUTNOM}*2\%$	-	600	750	mV
Load Regulation	ΔV_{OUT}	$1\text{mA} \leq I_{OUT} \leq 100\text{mA}$	-	20	50	mV
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN}} \times 100\%$	$I_{OUT}=1\text{mA}$, $V_{IN}=(V_{OUTNOM}+1\text{V})$ to 35V	-	-	0.2	%/V
Current Limit	I_{LIMIT}	$V_{IN}=(V_{OUTNOM}+1\text{V})$ to 35V $R_{LOAD}=V_{OUTNOM}/1\text{A}$	-	450	-	mA
Thermal Shutdown Threshold	T_{SHDN}		-	125	-	$^{\circ}\text{C}$

Note : *1 Dropout Voltage is the voltage difference between the input and the output at which the output voltage drops 2% below its nominal value.

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Typical Application Circuit

Application Note:

Note 1: Power Dissipation:

The power dissipated by the p-channel MOSFET

$$PD (MOSFET) = (VIN - VOUT) \cdot I_{OUT}$$

Total Power Dissipation

$$PD(TOTAL) = PD(MOSFET) + VIN \cdot I_{GND}$$

The quiescent current I_{GND} is only 1.6µA, so that $VIN \cdot I_{GND}$ can be ignored. The maximum power dissipation can be estimated by $PD(max) = [VIN(max) - VOUT(min)] \cdot I_{OUT}$

Note 2: Junction Temperature

$$T_J = P_D(max) \cdot \theta_{JA} + T_A$$

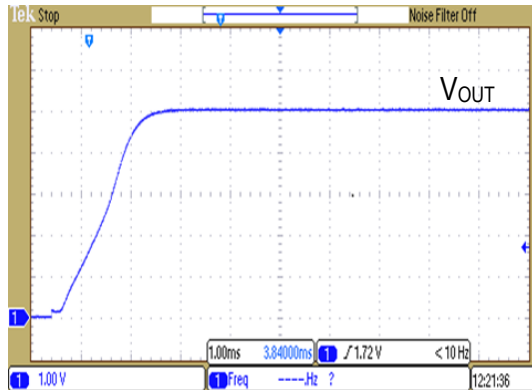
θ_{JA} is thermal resistance of junction to ambient, T_A is the ambient temperature.

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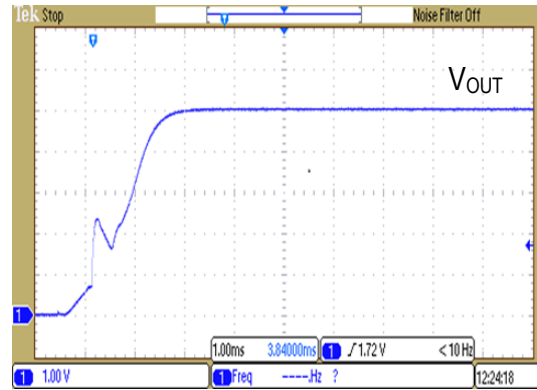
TYPICAL CHARACTERISTICS (CONTINUOUS)

Startup

$V_{IN}=6.0V$, No Load , $C_{OUT}=1\mu F$



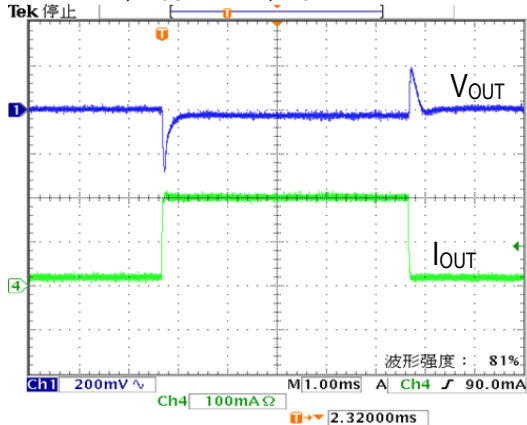
$V_{IN}=6.0V$, $I_{OUT}=30mA$, $C_{OUT}=1\mu F$



Transient Response

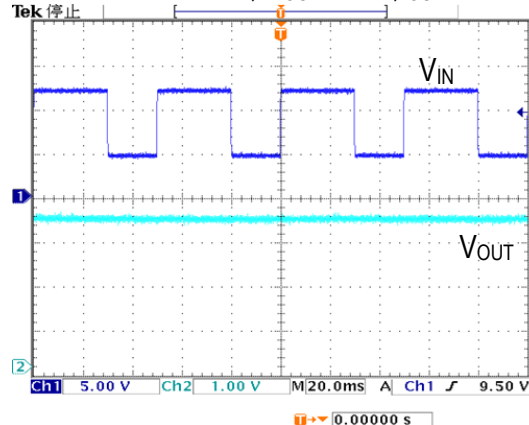
Load Transient

$V_{IN}=12.0V$, $C_{OUT}=10\mu F$, $I_{LOAD}=10mA$ to $200mA$



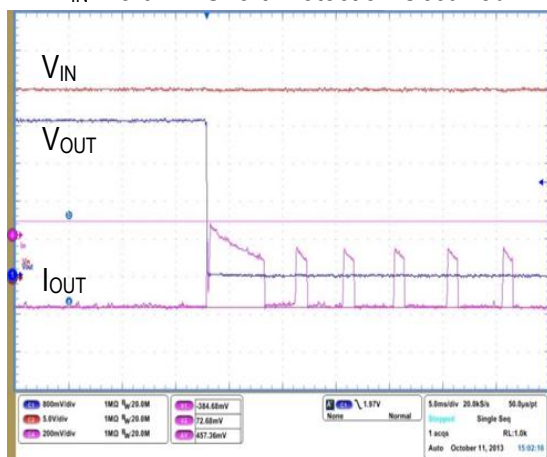
Line Transient

$V_{IN}=5.0V$ to $12.0V$, $C_{OUT}=10\mu F$, $I_{OUT}=1mA$

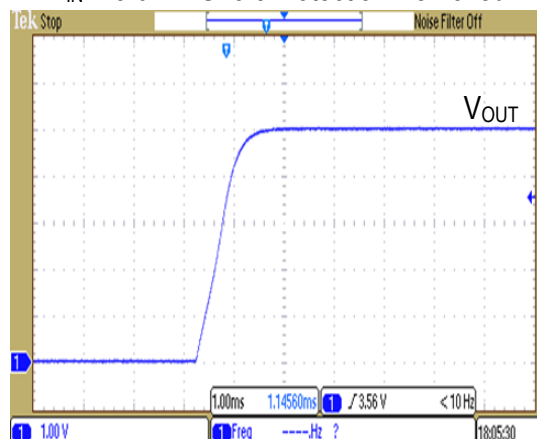


Short Protection

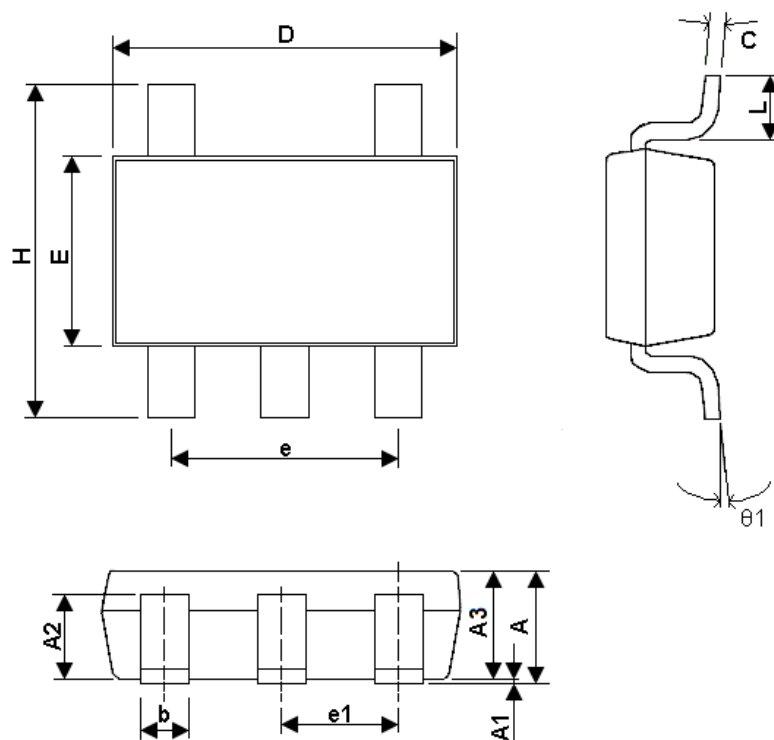
$V_{IN}=25.0V$, Short Protection Occurred



$V_{IN}=25.0V$, Short Protection Removed

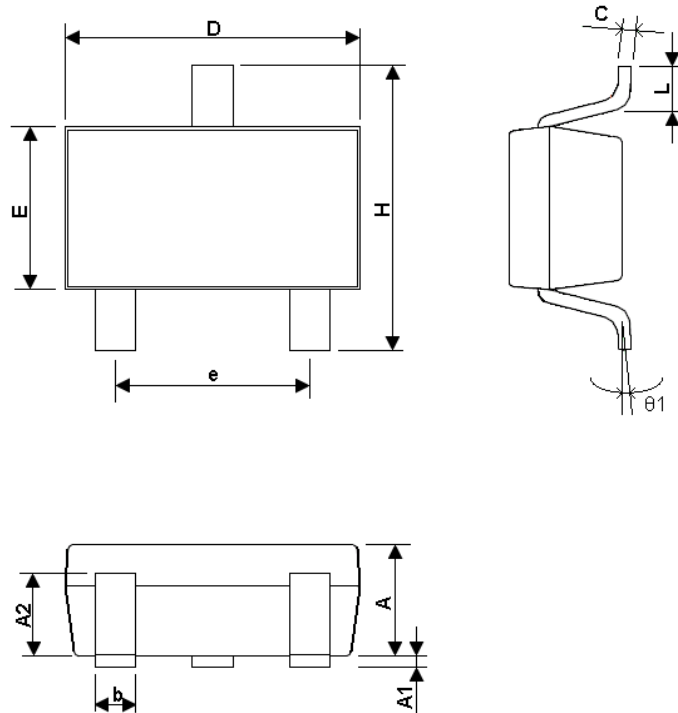


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SOT-23-5


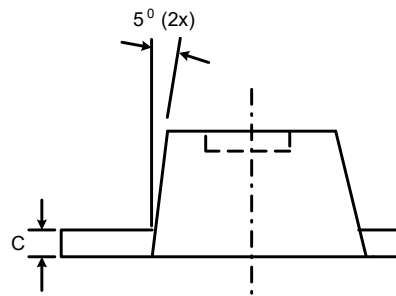
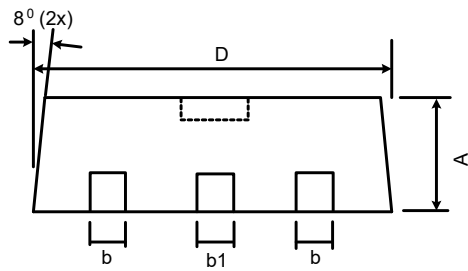
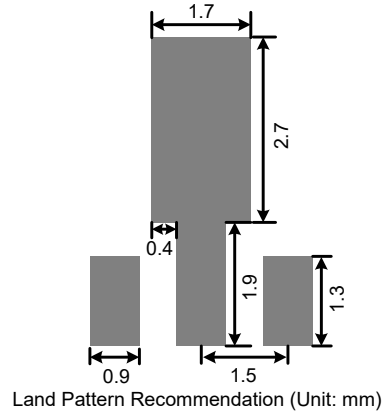
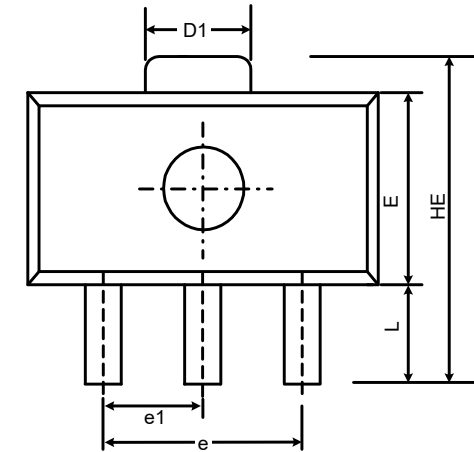
SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	---	---	1.00	---	---	0.039
A1	0.00	---	0.10	0.000	---	0.004
A2	0.58	0.68	0.78	0.023	0.027	0.030
A3	0.84	0.87	0.90	0.033	0.034	0.035
b	0.35	0.40	0.50	0.014	0.016	0.020
C	0.10	0.125	0.15	0.004	0.005	0.006
D	2.70	2.90	3.10	0.106	0.114	0.122
E	1.50	1.60	1.80	0.059	0.063	0.071
e	---	1.90(TYP)	---	---	0.075(TYP)	---
H	2.60	2.80	3.00	0.102	0.110	0.118
L	0.370	---	---	0.015	---	---
Θ1	1°	5°	9°	1°	5°	9°
e1	---	0.95(TYP)	---	---	0.037	---

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SOT-23-3


SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.75	---	0.90	0.030	---	0.035
A1	0.00	---	0.10	0.000	---	0.004
A2	0.70	0.80	0.90	0.027	0.031	0.035
b	0.35	0.40	0.50	0.013	0.016	0.020
C	0.10	0.15	0.25	0.004	0.006	0.001
D	2.70	2.90	3.10	0.106	0.114	0.122
E	1.40	1.60	1.80	0.055	0.063	0.071
e	---	1.90(TYP)	---	---	0.075	---
H	2.60	2.80	3.00	0.102	0.110	0.118
L	0.370	---	---	0.015	---	---
θ1	1°	5°	9°	1°	5°	9°

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(3) SOT-89-3L


Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	1.4	1.5	1.6	0.055	0.059	0.063
b	0.36	0.42	0.48	0.014	0.017	0.019
b1	0.44	0.5	0.56	0.017	0.02	0.022
C	0.35	0.4	0.44	0.014	0.016	0.017
D	4.4	4.5	4.6	0.173	0.177	0.181
D1	1.35	1.59	1.83	0.053	0.063	0.072
e	3.0 BSC			0.118 BSC		
e1	1.5 BSC			0.059 BSC		
E	2.29	2.45	2.6	0.09	0.097	0.102
HE	3.94	4.1	4.25	0.155	0.161	0.167
L	0.8	1	1.2	0.031	0.04	0.047

JEDEC outline: TO-243 AB