Introduction

The MLS78 series is a group of three terminal positive voltage linear regulators with multiple fixed output voltages. In the case of good heat dissipation, it can provide an output current of 1.5A, and has internal short-circuit protection and thermal shutdown protection, which makes it not affected by overload. In addition to being used as fixed voltage regulators, these devices can also be used with external components to obtain adjustable output voltage and current, and can also be used as power transmission elements in precision regulators.

Features

- Available Output Voltage:
  5.0V, 6.0V, 8.0V, 9.0V and 12V
- Maximum Output Current:
  Exceed 1.5A
- Line Regulation:

4.0 ~ 12mV (Typ.) at T_J = 25° C

- Load Regulation:

9.0 ~ 14mV (Typ.) at T_J = 25° C

- Output Tolerances:

±3% at T_J = 25℃

±5% over the Operating T_J

- Thermal Shutdown Protection
- Short Circuit Protection

Available Packages

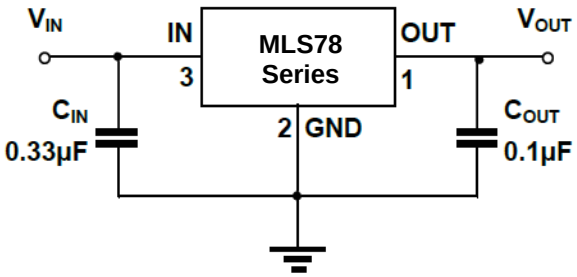
PART NUMBER	PACKAGES
MLS78 Series	TO-252
	TO-220F
	TO-220
	TO-263

Note: For more detailed packaging information, see the part Pin Configuration and Function and the part Mechanical Information.

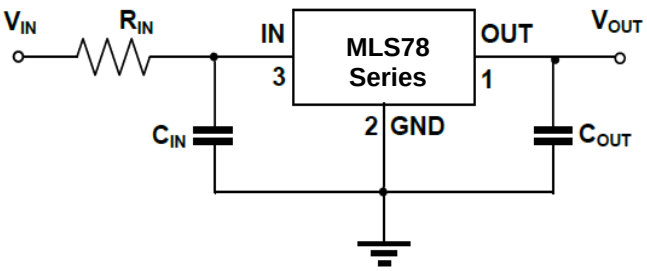
Applications

- AC Inventors
- DC Motor Drivers
- Household Electric Appliances
- HVAC Systems
- Industrial Power Supplies
- SMPS Post Regulation
- Solar Energy String Inventors
- Test and Measurement Equipment

Pb-Free RoHS Halogen-Free



(1) Conventional Circuit



(2) Resistance are used at IN

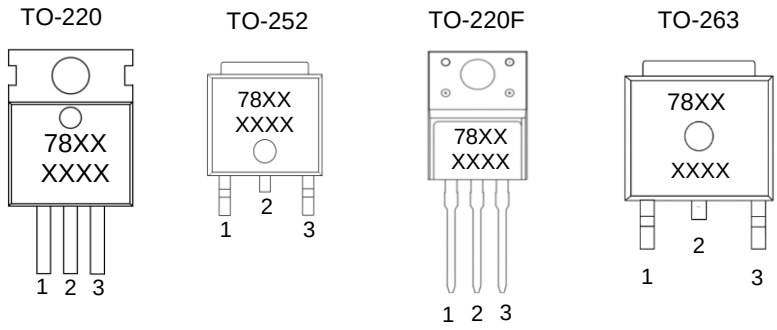
Typical Application Circuit

Pin Configuration and Marking Information

Model	Device	Package	Minimum Package(pcs)	Inner Box Quantity(pcs)	Outer Carton Quantity(pcs)	Delivery Mode
MLS78XX	MLS78XX	TO-252	2,500	5,000	35,000	13"reel
MLS78XX	MLS78XX	TO-263	800	800	4,000	13"reel
MLS78XX	MLS78XX	TO-220F	50	1,000	5,000	/
MLS78XX	MLS78XX	TO-220	50	1,000	5,000	/

Pin Configuration and Marking Information

Pin Configuration and Function



Package Top View

Pin Name	MLS78 Series				I / O	Description
	TO-252	TO-220F	TO-263	TO-220		
IN	1	1	1	1	I	Input to the device.
GND	2	2	2	2	-	Regulator ground.
OUT	3	3	3	3	O	Output of the regulator.

78XX : Product number, the "XX" in the "78XX" represents the output voltage, for example, if V_{OUT} = 5.0V, "XX" is "05".
XXXX : Code

Specifications

Absolute Maximum Ratings(1)

Characteristic		Symbol	Value	Unit
Maximum input voltage(2)		V_{IN}	35	V
Maximum power dissipation	TO-252	$P_{D\ Max}$	Internally Limited(3)	W
	TO-220F			
	TO-263			
	TO-220			
Maximum junction temperature		$T_{J\ Max}$	150	°C
Storage temperature		T_{stg}	- 65 ~ 150	°C
Soldering temperature & time		T_{solder}	260°C, 10s	-

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

(2) All voltages are with respect to network ground terminal.

(3) Refer to Thermal Information for details.

Recommended Operating Conditions(4)

Parameter	Symbol	Min.	Nom.	Max.	Unit
Operating junction temperature	Tj	-40	-	125	˚C
Operating ambient temperature	Ta	-	- (5)	-	˚C

(4) Recommends that users should not exceed the rated value in the Recommended Operating Conditions for the application conditions of the equipment, so as to ensure the stability of normal operation and reliability of long-term operation of the equipment. Operation beyond the recommended rated conditions does not mean that the product will fail.The consumers need to evaluate the risks that may be caused by the operation of the product beyond the recommended ratedconditions.

(5) It is necessary to ensure that the operating junction temperature of the equipment does not exceed the rated value of the recommended operating conditions when using the device for design.

ESD Ratings

ESD Ratings		Symbol	Value	Unit
Electrostatic discharge(6)	Human body model	$V_{ESD\text{-}HBM}$	2000	V
	Machine model	$V_{ESD\text{-}MM}$	200	

(6) ESD testing is conducted in accordance with the relevant specifications formulated by the Joint Electronic Equipment Engineering Commission (JEDEC). The human body mode (HBM) electrostatic discharge test is based on the JESD22-114D test standard, using a 100pF capacitor and discharging to each pin of the device through a resistance of 1.5kΩ. The electrostatic discharge test in mechanical mode (MM) is based on the JESD22-115-A test standard and uses a 200pF capacitor to discharge directly to each pin of the device.

Thermal Information

Thermal Metric(7)	Symbol	MLS78 Series				Unit
Junction-to-ambient thermal resistance	$R_{\theta JA}$	TO-220	TO-220F	TO-252	TO-263	℃/W
		64.3	62.5	78	60.5	
Junction-to-case thermal resistance	$R_{\theta JC}$	TO-220	TO-220F	TO-252	TO-263	℃/W
		5.5	5.2	5.4	5.1	
Reference maximum power dissipation for continuous operation	$P_{D\,Ref}$	TO-220	TO-220F	TO-252	TO-263	W
		1.5	1.55	1.25	1.6	

(6) T_A = 25℃, all numbers are typical, and apply for packages soldered directly onto a PCB board in still air without extra heat dissipation pads.

Electrical Characteristics

MLS7805 (V_{OUT} = 5.0V, V_{IN} = 10V, I_{OUT} = 500mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = 25℃, unless otherwise specified)

Characteristic	Symbol	Test Ccnditions(8)	Min	Typ(9)	Max	Uuit
Output voltage(10)	V_{OUT}	-	4.85	5.0	5.15	V
		V_{IN} = 7 to 20V, I_{OUT} = 5mA to 1A	4.75	5.0	5.25	V
Line regulation	ΔV_{LINE}	V_{IN} = 7 to 25V	-	-	100	mV
		V_{IN} = 8 to 12V	-	-	50	mV
Load regulation	ΔV_{LOAD}	I_{OUT} = 5mA to 1.5A	-	-	100	mV
		I_{OUT} = 250 to 750mA	-	-	50	mV
Quiescent current	I_Q	-	-	-	8	mA
Quiescent current change	ΔI_Q	I_{OUT} = 5mA to 1.0A	-	-	0.5	mA
		V_{IN} = 7 to 25V	-	-	1.3	mA
Output voltage drift	$\Delta V_{OUT}/\Delta T$	I_{OUT} = 5mA	-	-1.1	-	mV/℃
Output noise voltage	V_N	f = 10 to 100kHz	-	42	-	μV
Ripple rejection	RR	V_{IN} = 8 to 18V, f = 120Hz	62	73	-	dB
Dropout voltage(11)	V_{DO}	I_{OUT} = 1A	-	2	-	V
Output resistance	R_{OUT}	f = 1KHz	-	10	-	mΩ
Short circuit current	I_{SC}	-	-	230	-	mA
Peak current	I_{Peak}	-	-	0.5	-	A

MLS7806 (V_{OUT} = 6.0V, V_{IN} = 11V, I_{OUT} = 500mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = 25℃, unless otherwise specified)

Characteristic	Symbol	Test Ccnditions(8)	Min	Typ(9)	Max	Uuit
Output voltage(10)	V_{OUT}	-	5.82	6.0	6.18	V
		V_{IN} = 8 to 21V, I_{OUT} = 5mA to 1A	5.70	6.0	6.30	V
Line regulation	ΔV_{LINE}	V_{IN} = 8 to 25V	-	-	120	mV
		V_{IN} = 9 to 13V	-	-	60	mV
Load regulation	ΔV_{LOAD}	I_{OUT} = 5mA to 1.5A	-	-	120	mV
		I_{OUT} = 250 to 750mA	-	-	60	mV
Quiescent current	I_Q	-	-	-	8	mA
Quiescent current change	ΔI_Q	I_{OUT} = 5mA to 1A	-	-	0.5	mA
		V_{IN} = 8 to 25V	-	-	1.3	mA
Output voltage drift	$\Delta V_{OUT}/\Delta T$	I_{OUT} = 5mA	-	-0.8	-	mV/℃
Output noise voltage	V_N	f = 10 to 100kHz	-	45	200	μV
Ripple rejection	RR	V_{IN} = 9 to 19V, f = 120Hz	59	75	-	dB
Dropout voltage(11)	V_{DO}	I_{OUT} = 1A	-	2	-	V
Output resistance	R_{OUT}	f = 1KHz	-	10	-	mΩ
Short circuit current	I_{SC}	-	-	550	-	mA
Peak current	I_{Peak}	-	-	2.1	-	A

MLS7808 (V_{OUT} = 8.0V, V_{IN} = 14V, I_{OUT} = 500mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = 25℃, unless otherwise specified)

Characteristic	Symbol	Test Ccnditions[8]	Min	Typ[9]	Max	Uuit
Output voltage[10]	V_{OUT}	-	7.76	8.0	8.24	V
		V_{IN} = 10.5 to 23V, I_{OUT} = 5mA to 1A	7.60	8.0	8.40	V
Line regulation	ΔV_{LINE}	V_{IN} = 10.5 to 25V	-	-	160	mV
		V_{IN} = 11 to 17V	-	-	80	mV
Load regulation	ΔV_{LOAD}	I_{OUT} = 5mA to 1.5A	-	-	160	mV
		I_{OUT} = 250 to 750mA	-	-	80	mV
Quiescent current	I_Q	-	-	-	8	mA
Quiescent current change	ΔI_Q	I_{OUT} = 5mA to 1A	-	-	0.5	mA
		V_{IN} = 10.5 to 25V	-	-	1	mA
Output voltage drift	$\Delta V_{OUT}/\Delta T$	I_{OUT} = 5mA	-	-0.8	-	mV/℃
Output noise voltage	V_N	f = 10 to 100kHz	-	52	-	μV
Ripple rejection	RR	V_{IN} = 11.5 to 21.5V, f = 120Hz	55	72	-	dB
Dropout voltage[11]	V_{DO}	I_{OUT} = 1A	-	2	-	V
Output resistance	R_{OUT}	f = 1KHz	-	10	-	mΩ
Short circuit current	I_{SC}	-	-	450	-	mA
Peak current	I_{Peak}	-	-	2.2	-	A

MLS7809 (V_{OUT} = 9.0V, V_{IN} = 16V, I_{OUT} = 500mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = 25℃, unless otherwise specified)

Characteristic	Symbol	Test Ccnditions[8]	Min	Typ[9]	Max	Uuit
Output voltage[10]	V_{OUT}	-	8.73	9.0	9.27	V
		V_{IN} = 11.5 to 24V, I_{OUT} = 5mA to 1A	8.55	9.0	9.45	V
Line regulation	ΔV_{LINE}	V_{IN} = 11.5 to 26V	-	-	180	mV
		V_{IN} = 11.5 to 17V	-	-	90	mV
Load regulation	ΔV_{LOAD}	I_{OUT} = 5mA to 1.5A	-	-	180	mV
		I_{OUT} = 250 to 750mA	-	-	90	mV
Quiescent current	I_Q	-	-	-	8	mA
Quiescent current change	ΔI_Q	I_{OUT} = 5mA to 1A	-	-	0.5	mA
		V_{IN} = 11.5 to 28V	-	-	1	mA
Output voltage drift	$\Delta V_{OUT}/\Delta T$	I_{OUT} = 5mA	-	-1	-	mV/℃
Output noise voltage	V_N	f = 10 to 100kHz	-	60	-	μV
Ripple rejection	RR	V_{IN} = 12 to 22V, f = 120Hz	55	70	-	dB
Dropout voltage[11]	V_{DO}	I_{OUT} = 1A	-	2	-	V
Output resistance	R_{OUT}	f = 1KHz	-	18	-	mΩ
Short circuit current	I_{SC}	-	-	400	-	mA
Peak current	I_{Peak}	-	-	2.2	-	A

MLS7812 (V_{OUT} = 12.0V, V_{IN} = 19V, I_{OUT} = 500mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = 25℃, unless otherwise specified)

Characteristic	Symbol	Test Ccnditions[8]	Min	Typ[9]	Max	Uuit
Output voltage[10]	V_{OUT}	-	11.64	12.0	12.36	V
		V_{IN} = 14.5 to 27V, I_{OUT} = 5mA to 1A	11.40	12.0	12.60	V
Line regulation	ΔV_{LINE}	V_{IN} = 14.5 to 30V	-	-	240	mV
		V_{IN} = 16 to 22V	-	-	120	mV
Load regulation	ΔV_{LOAD}	I_{OUT} = 5mA to 1.5A	-	-	240	mV
		I_{OUT} = 250 to 750mA	-	-	120	mV
Quiescent current	I_Q	-	-	-	8	mA
Quiescent current change	ΔI_Q	I_{OUT} = 5mA to 1A	-	-	0.5	mA
		V_{IN} = 14.5 to 30V	-	-	1	mA
Output voltage drift	$\Delta V_{OUT}/\Delta T$	I_{OUT} = 5mA	-	-1	-	mV/℃
Output noise voltage	V_N	f = 10 to 100kHz	-	75	-	μV
Ripple rejection	RR	V_{IN} = 15 to 25V, f = 120Hz	55	71	-	dB
Dropout voltage[11]	V_{DO}	I_{OUT} = 1A	-	2	-	V
Output resistance	R_{OUT}	f = 1KHz	-	18	-	mΩ
Short circuit current	I_{SC}	-	-	350	-	mA
Peak current	I_{Peak}	-	-	2.2	-	A

Note:

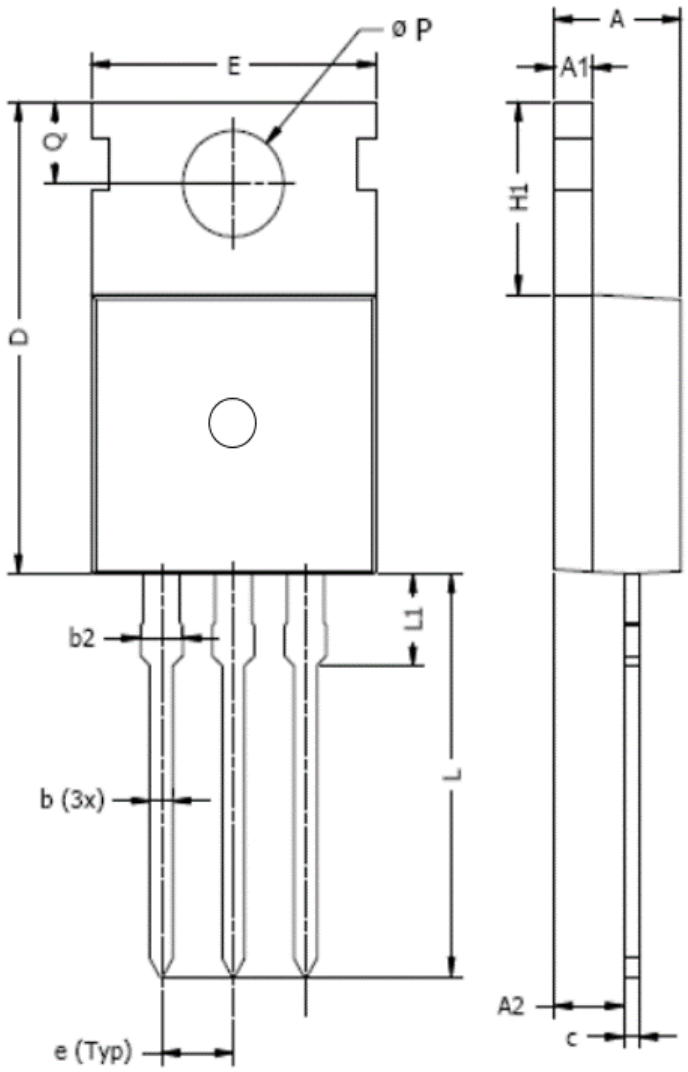
(8) Pulse test technology is used to make T_J as close to TA as possible. Thermal effects must be considered separately.

(9) Typical numbers are at 25℃ (T_J) and represent the most likely norm.

(10) This specification only applies to the DC power consumption allowed by the absolute maximum rating.

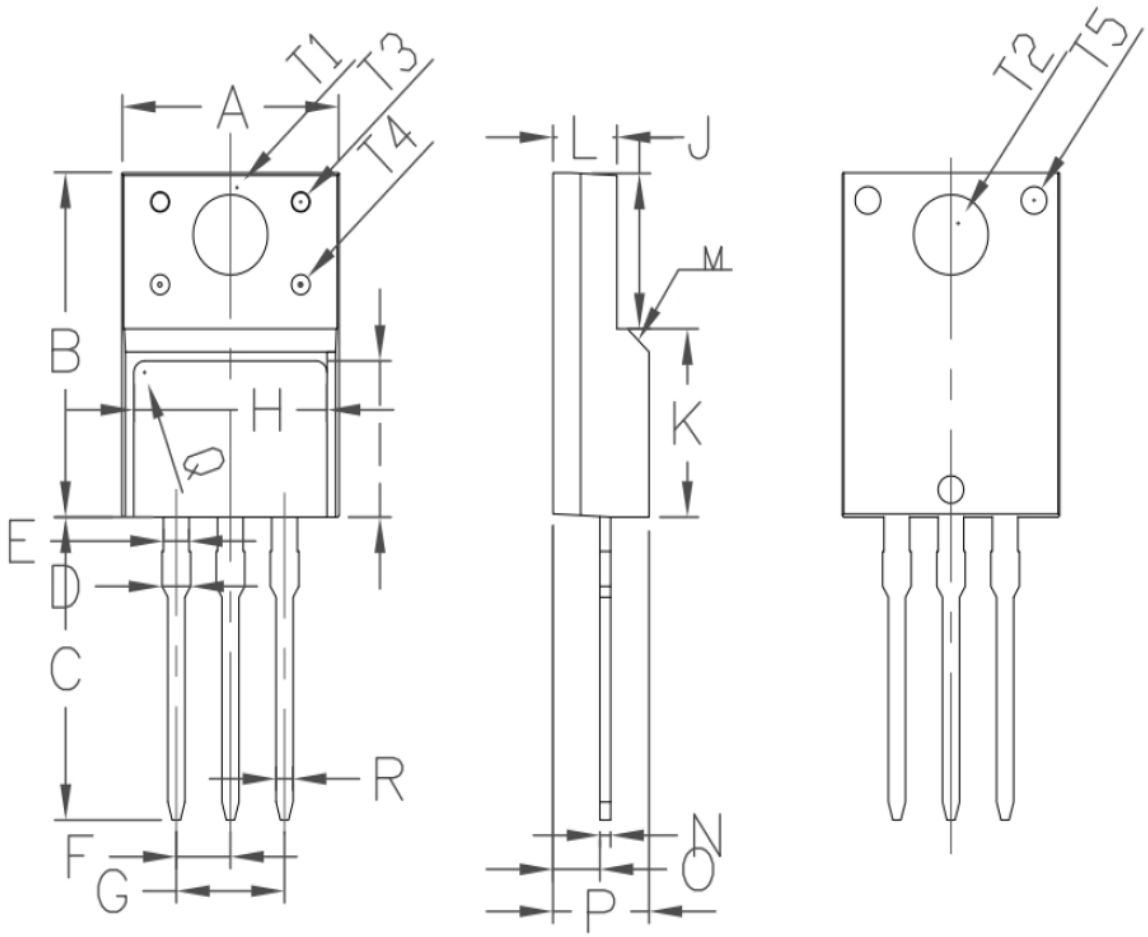
(11) The difference of output voltage and input voltage when input voltage is decreased gradually till output voltage equals to 95% of V_{OUT}.

TO-220 Package information



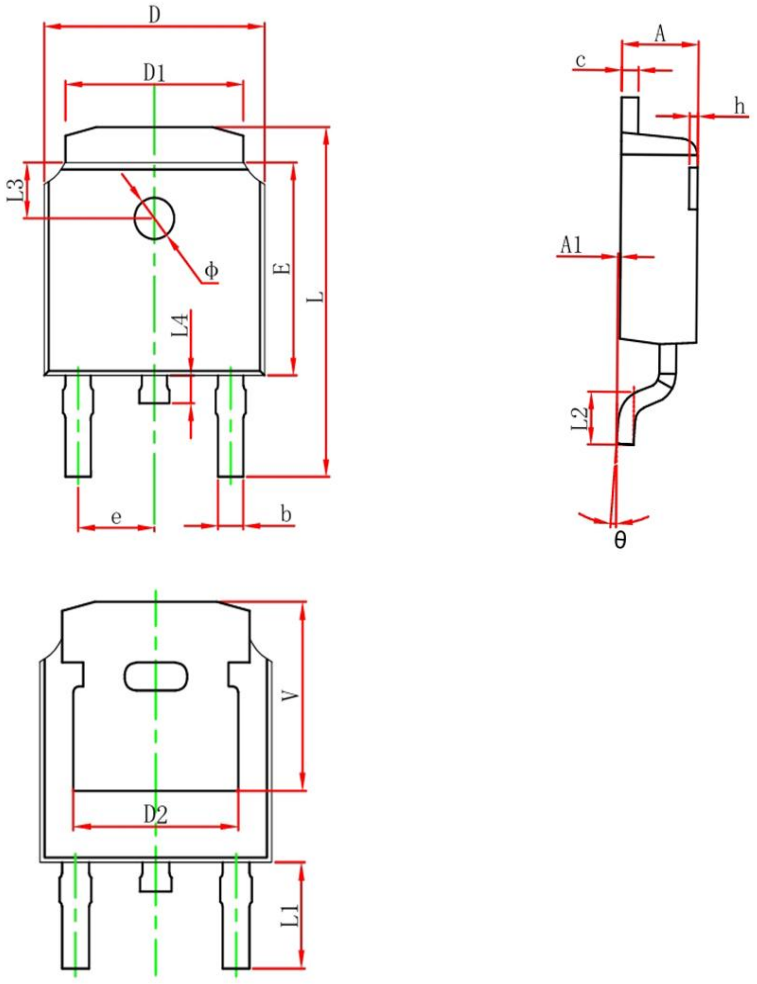
Symbol	Dimensions in Millimeters(mm)		Dimensions In Inches	
	Min	Max	Min	Max
A	3.600	4.800	0.142	0.189
A1	1.200	1.400	0.047	0.055
A2	2.030	2.900	0.080	0.114
b	0.400	1.000	0.016	0.039
b2	1.200	1.780	0.047	0.070
c	0.360	0.600	0.014	0.024
D	14.220	16.500	0.561	0.651
e	2.340	2.740	0.092	0.108
E	9.700	10.600	0.383	0.418
H1	5.840	6.850	0.230	0.270
L	12.700	14.700	0.501	0.580
L1	2.700	3.300	0.106	0.130
ØP	3.500	4.000	0.138	0.158
Q	2.540	3.400	0.100	0.134

TO-220F Package information



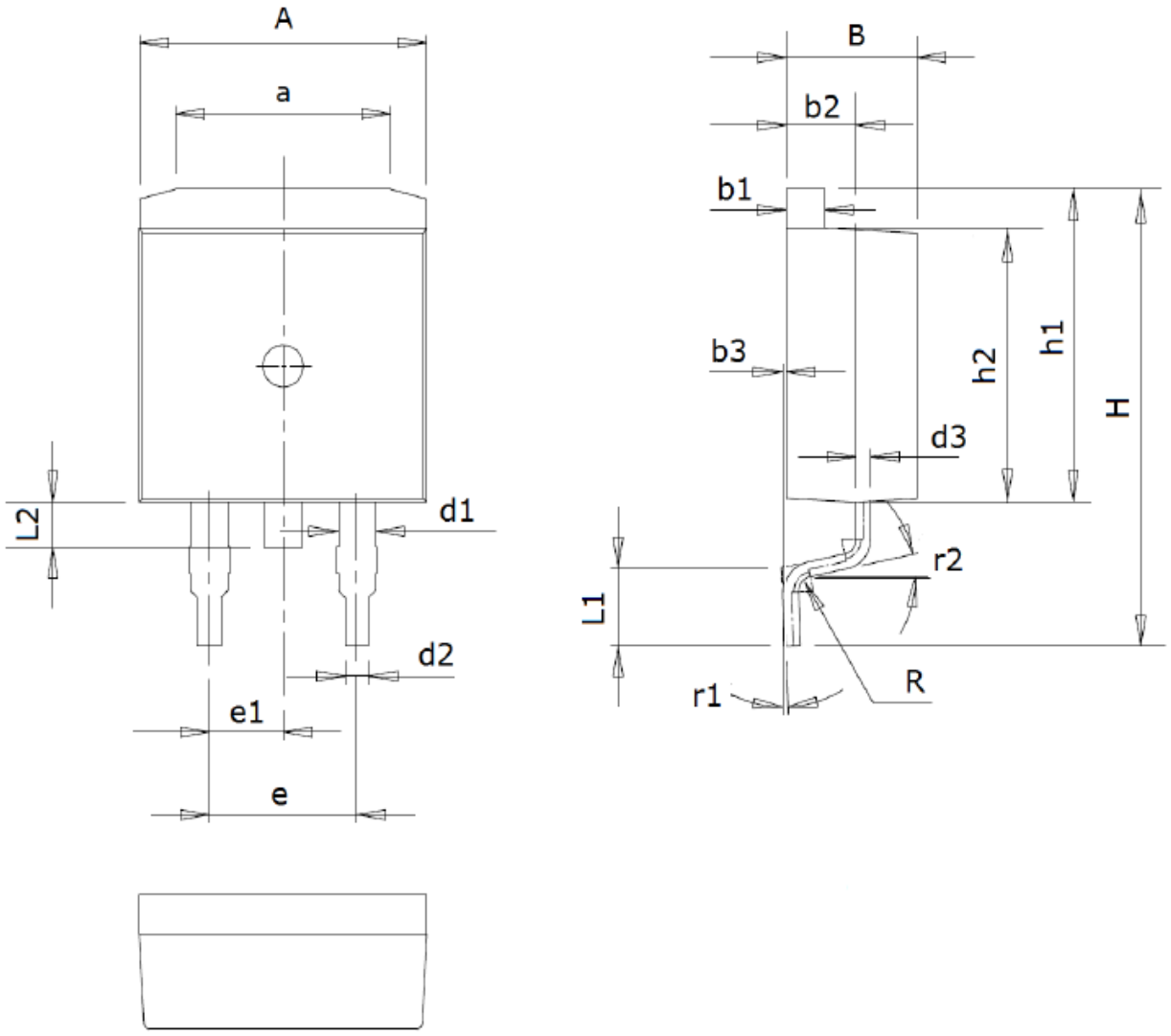
Symbol	Dimensions in Millimeters(mm)		Dimensions In Inches	
	Min	Max	Min	Max
A	9.960	10.360	0.392	0.407
B	15.670	16.070	0.616	0.632
C	13.140	13.540	0.517	0.533
D	1.200	1.400	0.047	0.055
E	1.200TYP		0.047TYP	
F	2.540TYP		0.100TYP	
G	5.080TYP		0.200TYP	
H	7.600	8.000	0.299	0.314
I	7.100	7.500	0.279	0.295
J	6.480	6.880	0.255	0.270
K	8.990	9.390	0.353	0.369
L	2.340	2.740	0.092	0.107
M	45°TYP		45°TYP	
N	0.490	0.520	0.019	0.020
O	2.150	2.550	0.084	0.100
P	4.500	4.900	0.177	0.192
Q	0.500TYP		0.019TYP	
S	4.5°TYP		4.5°TYP	
T1	3.450TYP		0.135TYP	
T2	3.180TYP		0.125TYP	
T3	1.500TYP		0.059TYP	
T4	1.200TYP		0.047TYP	
T5	1.500TYP		0.059TYP	
R	0.770	0.830	0.030	0.032

TO-252 Package information



Symbol	Dimensions in Millimeters(mm)		Dimensions In Inches	
	Min	Max	Min	Max
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.635	0.770	0.025	0.030
c	0.450	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	4.830 REF.		0.190 REF.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.712	10.312	0.386	0.406
L1	2.900 REF.		0.114 REF.	
L2	1.400	1.700	0.055	0.067
L3	1.600 REF.		0.063 REF.	
L4	0.600	1.000	0.024	0.039
Φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.250 REF.		0.207 REF.	

TO-263 Package information



Symbol	Dimensions in Millimeters(mm)		Symbol	Dimensions in Millimeters(mm)	
	Min	Max		Min	Max
A	9.700	10.300	e1	2.54TYP	
a	7.000	7.800	H	14.800	15.600
B	4.300	4.700	h1	10.200	10.700
b1	1.250	1.350	h2	8.900	9.400
b2	2.200	2.600	L1	2.400	2.900
b3	0.000	0.200	L2	1.300	1.800
d1	1.200	1.400	R	0.5TYP	
d2	0.700	0.900	r1	0°	8°
d3	0.400	0.600	r2	12°TYP	
e	5.08TYP				