

## Features

Output Current up to 1A

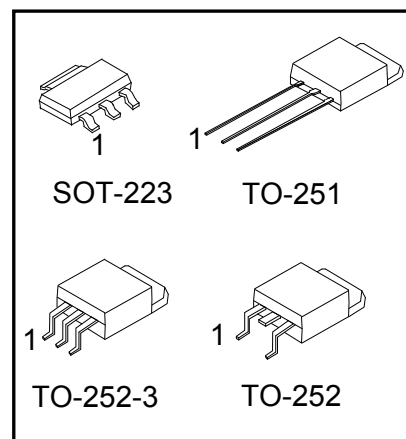
Output Voltages of 5, 6, 8, 9, 12, 15, 18, 24V

Thermal Overload Protection Short Circuit Protection

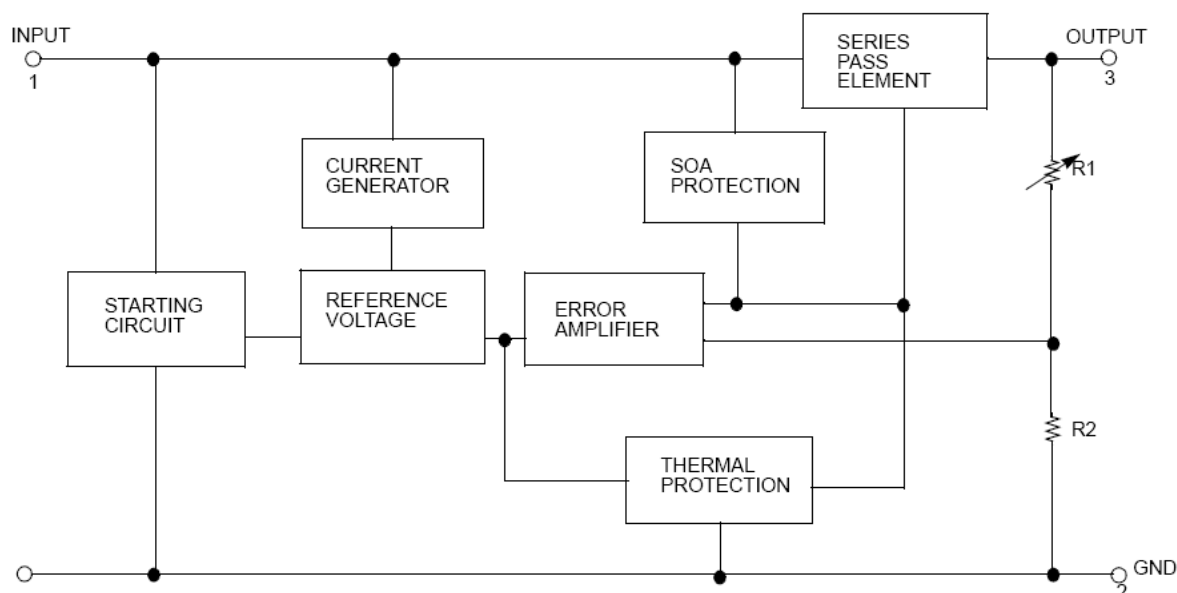
Output Transistor Safe Operating area (SOA)Protection

## Description

The 78MXX three-terminal positive regulators are available in the TO-252 package with several fixed output voltages making it useful in a wide range of applications.



## Internal Block Diagram



## Absolute Maximum Ratings

PARAMETER		SYMBOL	RATINGS	UNIT
Input Voltage		V <sub>IN</sub>	35	V
Output Current		I <sub>OUT</sub>	1	A
Power Dissipation (T <sub>C</sub> =25°C)	SOT-223	P <sub>D</sub>	1	W
	TO-251/TO-252		2	
	TO-252-3			
Operating Junction Temperature		T <sub>J</sub>	-20 ~ 85	
Storage Temperature		T <sub>STG</sub>	-55 ~ +150	

**Thermal Data**

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Case	SOT-223	$\theta_{JC}$	15	°C/W
	TO-251/TO-252		12.5	
	TO-252-3			

**Electrical Characteristics (78M05)**

(Refer to the test circuits,  $0 < T_J < +125^{\circ}\text{C}$ ,  $I_O=350\text{mA}$ ,  $V_I=10\text{V}$ , unless otherwise specified,  $C_I = 0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ )

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Output Voltage	$V_O$	$I_O = 5\text{mA} \sim 350\text{mA}$ $V_I = 7 \sim 20\text{V}$	4.75	5	5.25	V
Line Regulation(Note)	$\Delta V_O$	$I_O = 200\text{mA}$ $T_J = 25^{\circ}\text{C}$	$V_I = 7\text{V} \sim 25\text{V}$		100	mV
			$V_I = 8\text{V} \sim 25\text{V}$		50	
Load Regulation(Note)	$\Delta V_O$	$T_J = 25^{\circ}\text{C}$	$I_O = 5\text{mA} \sim 500\text{mA}$		100	mV
			$I_O = 5\text{mA} \sim 200\text{mA}$		50	
Quiescent Current	$I_Q$	$T_J = 25^{\circ}\text{C}$			6.0	mA
Quiescent Current Change	$\Delta I_Q$	$I_O = 5\text{mA} \sim 350\text{mA}$			0.5	mA
		$I_O = 200\text{mA}$ , $V_I = 8 \sim 25\text{V}$			0.8	
Output Voltage Drift	$\Delta V / \Delta T$	$I_O = 5\text{mA}$ , $T_J = 0 \sim 125^{\circ}\text{C}$		-0.5		mV/°C
Output Noise Voltage	$V_N$	$f = 10\text{Hz} \sim 100\text{KHz}$		40		$\mu\text{V}$
Ripple Rejection	RR	$f = 120\text{Hz}$ , $V_I = 8 \sim 18\text{V}$		80		dB
Dropout Voltage	$V_D$	$T_J = 25^{\circ}\text{C}$ , $I_O = 500\text{mA}$		2		V
Short Circuit Current	$I_{SC}$	$T_J = 25^{\circ}\text{C}$ , $V_I = 35\text{V}$		800		mA
Peak Current	$I_{PK}$	$T_J = 25^{\circ}\text{C}$		900		mA

**Notes:**

Load and line regulation are specified at constant junction temperature. Change in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.

## Electrical Characteristics (78M06)

(Refer to the test circuits,  $0 < T_J < +125^{\circ}\text{C}$ ,  $I_O=350\text{mA}$ ,  $V_I=11\text{V}$ , unless otherwise specified,  $C_I = 0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ )

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Output Voltage	$V_O$	$I_O = 5\text{mA} \sim 350\text{mA}$ $V_I = 8 \sim 21\text{V}$	5.7	6	6.3	V
Line Regulation(Note)	$\Delta V_O$	$I_O = 200\text{mA}$ $T_J = 25^{\circ}\text{C}$ $V_I = 8\text{V} \sim 25\text{V}$			100	mV
		$V_I = 9\text{V} \sim 25\text{V}$			50	
Load Regulation(Note)	$\Delta V_O$	$T_J = 25^{\circ}\text{C}$ $I_O = 5\text{mA} \sim 500\text{mA}$			120	mV
		$I_O = 5\text{mA} \sim 200\text{mA}$			60	
Quiescent Current	$I_Q$	$T_J = 25^{\circ}\text{C}$			6.0	mA
Quiescent Current Change	$\Delta I_Q$	$I_O = 5\text{mA} \sim 350\text{mA}$			0.5	mA
		$I_O = 200\text{mA}$ , $V_I = 9 \sim 25\text{V}$			0.8	
Output Voltage Drift	$\Delta V / \Delta T$	$I_O = 5\text{mA}$ , $T_J = 0 \sim 125^{\circ}\text{C}$		-0.5		mV/ $^{\circ}\text{C}$
Output Noise Voltage	$V_N$	$f = 10\text{Hz} \sim 100\text{KHz}$		45		$\mu\text{V}$
Ripple Rejection	RR	$f = 120\text{Hz}$ , $V_I = 9 \sim 19\text{V}$		80		dB
Dropout Voltage	$V_D$	$T_J = 25^{\circ}\text{C}$ , $I_O = 500\text{mA}$		2		V
Short Circuit Current	$I_{SC}$	$T_J = 25^{\circ}\text{C}$ , $V_I = 35\text{V}$		800		mA
Peak Current	$I_{PK}$	$T_J = 25^{\circ}\text{C}$		900		mA

### Notes:

Load and line regulation are specified at constant junction temperature. Change in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.

## Electrical Characteristics (78M08)

(Refer to the test circuits,  $0 < T_j < +125^{\circ}\text{C}$ ,  $I_o=350\text{mA}$ ,  $V_i=14\text{V}$ , unless otherwise specified,  $C_i = 0.33\mu\text{F}$ ,  $C_o=0.1\mu\text{F}$ )

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Output Voltage	$V_o$	$I_o = 5\text{mA} \sim 350\text{mA}$ $V_i = 10.5 \sim 23\text{V}$	7.6	8	8.4	V
Line Regulation(Note)	$\Delta V_o$	$I_o = 200\text{mA}$ $T_j = 25^{\circ}\text{C}$ $V_i = 10.5\text{V} \sim 25\text{V}$			100	mV
		$V_i = 11\text{V} \sim 25\text{V}$			50	
Load Regulation(Note)	$\Delta V_o$	$T_j = 25^{\circ}\text{C}$ $I_o = 5\text{mA} \sim 500\text{mA}$			160	mV
		$I_o = 5\text{mA} \sim 200\text{mA}$			80	
Quiescent Current	$I_Q$	$T_j = 25^{\circ}\text{C}$			6.0	mA
Quiescent Current Change	$\Delta I_Q$	$I_o=5\text{mA} \sim 350\text{mA}$			0.5	mA
		$I_o = 200\text{mA}$ , $V_i = 10.5 \sim 25\text{V}$			0.8	
Output Voltage Drift	$\Delta V / \Delta T$	$I_o = 5\text{mA}$ , $T_j = 0 \sim 125^{\circ}\text{C}$		-0.8		mV/ $^{\circ}\text{C}$
Output Noise Voltage	$V_N$	$f = 10\text{Hz} \sim 100\text{KHz}$		52		$\mu\text{V}$
Ripple Rejection	RR	$f = 120\text{Hz}$ , $V_i = 11.5 \sim 21.5\text{V}$		80		dB
Dropout Voltage	$V_D$	$T_j = 25^{\circ}\text{C}$ , $I_o = 500\text{mA}$		2		V
Short Circuit Current	$I_{SC}$	$T_j = 25^{\circ}\text{C}$ , $V_i = 35\text{V}$		800		mA
Peak Current	$I_{PK}$	$T_j = 25^{\circ}\text{C}$		900		mA

### Notes:

Load and line regulation are specified at constant junction temperature. Change in  $V_o$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.

## Electrical Characteristics (78M09)

(Refer to the test circuits,  $0 < T_j < +125^{\circ}\text{C}$ ,  $I_o=350\text{mA}$ ,  $V_i=15\text{V}$ , unless otherwise specified,  $C_i = 0.33\mu\text{F}$ ,  $C_o=0.1\mu\text{F}$ )

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Output Voltage	$V_o$	$I_o = 5\text{mA} \sim 350\text{mA}$ $V_i = 11.5 \sim 24\text{V}$	8.45	9	9.55	V
Line Regulation(Note)	$\Delta V_o$	$I_o = 200\text{mA}$ $T_j = 25^{\circ}\text{C}$	$V_i = 11.5\text{V} \sim 25\text{V}$		100	mV
			$V_i = 12\text{V} \sim 25\text{V}$		50	
Load Regulation(Note)	$\Delta V_o$	$T_j = 25^{\circ}\text{C}$	$I_o = 5\text{mA} \sim 500\text{mA}$		180	mV
			$I_o = 5\text{mA} \sim 200\text{mA}$		90	
Quiescent Current	$I_Q$	$T_j = 25^{\circ}\text{C}$			6.0	mA
Quiescent Current Change	$\Delta I_Q$	$I_o=5\text{mA} \sim 350\text{mA}$			0.5	mA
		$I_o = 200\text{mA}$ , $V_i = 11.5 \sim 25\text{V}$			0.8	
Output Voltage Drift	$\Delta V / \Delta T$	$I_o = 5\text{mA}$ , $T_j = 0 \sim 125^{\circ}\text{C}$		-0.8		mV/ $^{\circ}\text{C}$
Output Noise Voltage	$V_N$	$f = 10\text{Hz} \sim 100\text{KHz}$		52		$\mu\text{V}$
Ripple Rejection	RR	$f = 120\text{Hz}$ , $V_i = 12.5 \sim 22.5\text{V}$		80		dB
Dropout Voltage	$V_D$	$T_j = 25^{\circ}\text{C}$ , $I_o = 500\text{mA}$		2		V
Short Circuit Current	$I_{SC}$	$T_j = 25^{\circ}\text{C}$ , $V_i = 35\text{V}$		800		mA
Peak Current	$I_{PK}$	$T_j = 25^{\circ}\text{C}$		900		mA

### Notes:

Load and line regulation are specified at constant junction temperature. Change in  $V_o$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.

## Electrical Characteristics (78M12)

(Refer to the test circuits,  $0 < T_J < +125^{\circ}\text{C}$ ,  $I_O=350\text{mA}$ ,  $V_I=19\text{V}$ , unless otherwise specified,  $C_I = 0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ )

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Output Voltage	$V_O$	$I_O = 5\text{mA} \sim 350\text{mA}$ $V_I = 14.5 \sim 27\text{V}$	11.4	12	12.6	V
Line Regulation(Note)	$\Delta V_O$	$I_O = 200\text{mA}$ $T_J = 25^{\circ}\text{C}$ $V_I = 14.5\text{V} \sim 30\text{V}$			100	mV
		$V_I = 16\text{V} \sim 30\text{V}$			50	
Load Regulation(Note)	$\Delta V_O$	$T_J = 25^{\circ}\text{C}$ $I_O = 5\text{mA} \sim 500\text{mA}$			240	mV
		$I_O = 5\text{mA} \sim 200\text{mA}$			120	
Quiescent Current	$I_Q$	$T_J = 25^{\circ}\text{C}$			6.0	mA
Quiescent Current Change	$\Delta I_Q$	$I_O = 5\text{mA} \sim 350\text{mA}$			0.5	mA
		$I_O = 200\text{mA}$ , $V_I = 14.5 \sim 30\text{V}$			0.8	
Output Voltage Drift	$\Delta V / \Delta T$	$I_O = 5\text{mA}$ , $T_J = 0 \sim 125^{\circ}\text{C}$		-0.8		mV/ $^{\circ}\text{C}$
Output Noise Voltage	$V_N$	$f = 10\text{Hz} \sim 100\text{KHz}$		75		$\mu\text{V}$
Ripple Rejection	RR	$f = 120\text{Hz}$ , $V_I = 15 \sim 25\text{V}$		80		dB
Dropout Voltage	$V_D$	$T_J = 25^{\circ}\text{C}$ , $I_O = 500\text{mA}$		2		V
Short Circuit Current	$I_{SC}$	$T_J = 25^{\circ}\text{C}$ , $V_I = 35\text{V}$		800		mA
Peak Current	$I_{PK}$	$T_J = 25^{\circ}\text{C}$		900		mA

### Notes:

Load and line regulation are specified at constant junction temperature. Change in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.

## Electrical Characteristics (78M15)

(Refer to the test circuits,  $0 < T_J < +125^{\circ}\text{C}$ ,  $I_O=350\text{mA}$ ,  $V_I=23\text{V}$ , unless otherwise specified,  $C_I = 0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ )

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Output Voltage	$V_O$	$I_O = 5\text{mA} \sim 350\text{mA}$ $V_I = 17.5 \sim 30\text{V}$	14.25	15	15.75	V
Line Regulation(Note)	$\Delta V_O$	$I_O = 200\text{mA}$ $T_J = 25^{\circ}\text{C}$ $V_I = 17.5\text{V} \sim 30\text{V}$			100	mV
		$V_I = 20\text{V} \sim 30\text{V}$			50	
Load Regulation(Note)	$\Delta V_O$	$T_J = 25^{\circ}\text{C}$ $I_O = 5\text{mA} \sim 500\text{mA}$			300	mV
		$I_O = 5\text{mA} \sim 200\text{mA}$			150	
Quiescent Current	$I_Q$	$T_J = 25^{\circ}\text{C}$			6.0	mA
Quiescent Current Change	$\Delta I_Q$	$I_O = 5\text{mA} \sim 350\text{mA}$			0.5	mA
		$I_O = 200\text{mA}$ , $V_I = 17.5 \sim 30\text{V}$			0.8	
Output Voltage Drift	$\Delta V / \Delta T$	$I_O = 5\text{mA}$ , $T_J = 0 \sim 125^{\circ}\text{C}$		-1.0		mV/ $^{\circ}\text{C}$
Output Noise Voltage	$V_N$	$f = 10\text{Hz} \sim 100\text{KHz}$		100		$\mu\text{V}$
Ripple Rejection	RR	$f = 120\text{Hz}$ , $V_I = 18.5 \sim 28.5\text{V}$		70		dB
Dropout Voltage	$V_D$	$T_J = 25^{\circ}\text{C}$ , $I_O = 500\text{mA}$		2		V
Short Circuit Current	$I_{SC}$	$T_J = 25^{\circ}\text{C}$ , $V_I = 35\text{V}$		800		mA
Peak Current	$I_{PK}$	$T_J = 25^{\circ}\text{C}$		900		mA

### Notes:

Load and line regulation are specified at constant junction temperature. Change in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.

## Electrical Characteristics (78M18)

(Refer to the test circuits,  $0 < T_J < +125^{\circ}\text{C}$ ,  $I_O=350\text{mA}$ ,  $V_I=26\text{V}$ , unless otherwise specified,  $C_I = 0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ )

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Output Voltage	$V_O$	$I_O = 5\text{mA} \sim 350\text{mA}$ $V_I = 20.5 \sim 33\text{V}$	17.1	18	18.9	V
Line Regulation(Note)	$\Delta V_O$	$I_O = 200\text{mA}$ $T_J = 25^{\circ}\text{C}$			100	mV
		$V_I = 21\text{V} \sim 33\text{V}$ $V_I = 24\text{V} \sim 33\text{V}$			50	
Load Regulation(Note)	$\Delta V_O$	$T_J = 25^{\circ}\text{C}$			360	mV
		$I_O = 5\text{mA} \sim 500\text{mA}$ $I_O = 5\text{mA} \sim 200\text{mA}$			180	
Quiescent Current	$I_Q$	$T_J = 25^{\circ}\text{C}$			6.0	mA
Quiescent Current Change	$\Delta I_Q$	$I_O=5\text{mA} \sim 350\text{mA}$			0.5	mA
		$I_O = 200\text{mA}$ , $V_I = 21 \sim 33\text{V}$			0.8	
Output Voltage Drift	$\Delta V / \Delta T$	$I_O = 5\text{mA}$ , $T_J = 0 \sim 125^{\circ}\text{C}$		-1.2		mV/ $^{\circ}\text{C}$
Output Noise Voltage	$V_N$	$f = 10\text{Hz} \sim 100\text{KHz}$		100		$\mu\text{V}$
Ripple Rejection	RR	$f = 120\text{Hz}$ , $V_I = 22 \sim 32\text{V}$		70		dB
Dropout Voltage	$V_D$	$T_J = 25^{\circ}\text{C}$ , $I_O = 500\text{mA}$		2		V
Short Circuit Current	$I_{SC}$	$T_J = 25^{\circ}\text{C}$ , $V_I = 35\text{V}$		800		mA
Peak Current	$I_{PK}$	$T_J = 25^{\circ}\text{C}$		900		mA

### Notes:

Load and line regulation are specified at constant junction temperature. Change in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.



## Electrical Characteristics (78M24)

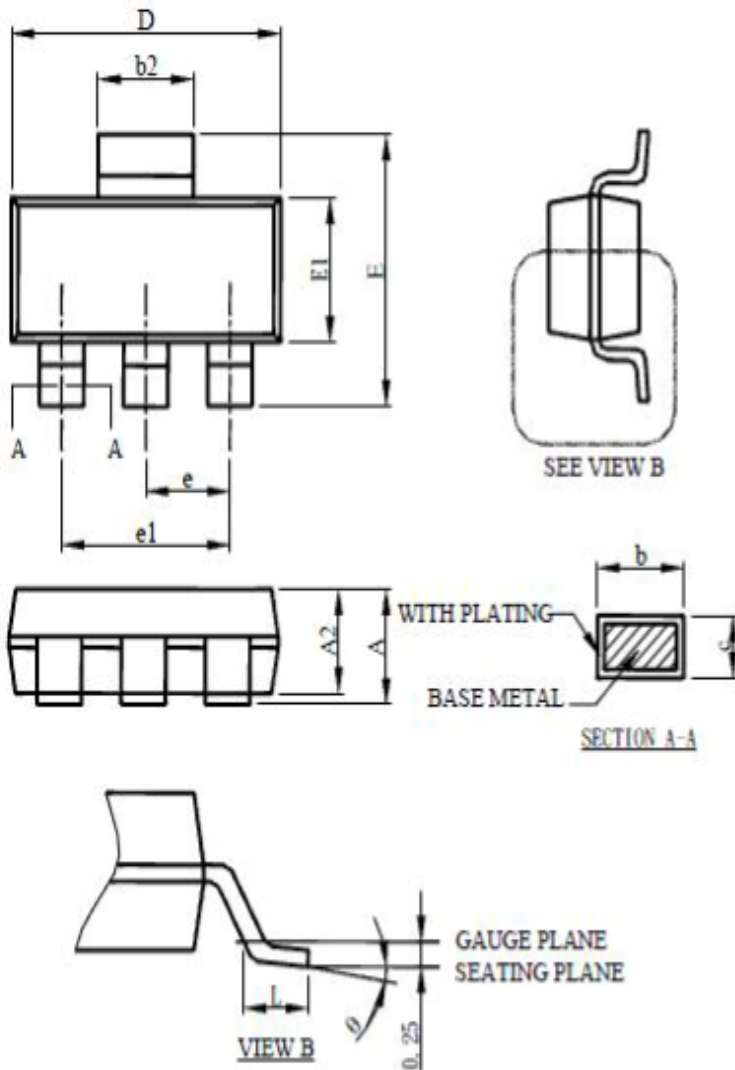
(Refer to the test circuits,  $0 < T_J < +125^{\circ}\text{C}$ ,  $I_O=350\text{mA}$ ,  $V_I=33\text{V}$ , unless otherwise specified,  $C_I = 0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ )

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Output Voltage	$V_O$	$I_O = 5\text{mA} \sim 350\text{mA}$ $V_I = 27 \sim 38\text{V}$	22.8	24	25.2	V
Line Regulation(Note)	$\Delta V_O$	$I_O = 200\text{mA}$ $T_J = 25^{\circ}\text{C}$			100	mV
		$V_I = 27\text{V} \sim 38\text{V}$ $V_I = 28\text{V} \sim 38\text{V}$			50	
Load Regulation(Note)	$\Delta V_O$	$T_J = 25^{\circ}\text{C}$			480	mV
		$I_O = 5\text{mA} \sim 500\text{mA}$ $I_O = 5\text{mA} \sim 200\text{mA}$			240	
Quiescent Current	$I_Q$	$T_J = 25^{\circ}\text{C}$			6.0	mA
Quiescent Current Change	$\Delta I_Q$	$I_O=5\text{mA} \sim 350\text{mA}$			0.5	mA
		$I_O = 200\text{mA}$ , $V_I = 27 \sim 38\text{V}$			0.8	
Output Voltage Drift	$\Delta V / \Delta T$	$I_O = 5\text{mA}$ , $T_J = 0 \sim 125^{\circ}\text{C}$		-1.2		mV/ $^{\circ}\text{C}$
Output Noise Voltage	$V_N$	$f = 10\text{Hz} \sim 100\text{KHz}$		170		$\mu\text{V}$
Ripple Rejection	RR	$f = 120\text{Hz}$ , $V_I = 28 \sim 38\text{V}$		70		dB
Dropout Voltage	$V_D$	$T_J = 25^{\circ}\text{C}$ , $I_O = 500\text{mA}$		2		V
Short Circuit Current	$I_{SC}$	$T_J = 25^{\circ}\text{C}$ , $V_I = 35\text{V}$		800		mA
Peak Current	$I_{PK}$	$T_J = 25^{\circ}\text{C}$		900		mA

### Notes:

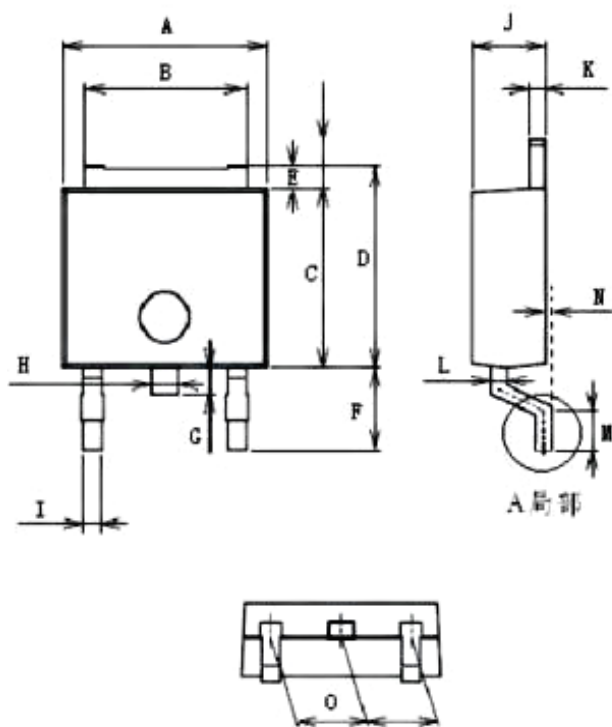
Load and line regulation are specified at constant junction temperature. Change in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.

## SOT-223 Package Information



SYMBOL	SOT-223	
	MILLIMETERS	
	MIN.	MAX.
A		1.80
A1	0.02	0.10
A2	1.55	1.65
b	0.66	0.84
b2	2.90	3.10
c	0.23	0.33
D	6.30	6.70
E	6.70	7.30
E1	3.30	3.70
e	2.30 BSC	
e1	4.60 BSC	
L	0.90	
$\theta$	0°	8°

## TO-252 Package Information



Unit: mm

Item	Min	Max
A	6.40	6.70
B	5.20	5.40
C	6.00	6.30
D	6.55	6.85
E	0.45	0.60
F	3.07	3.35
G	0.85	1.05
H	0.75	0.95
I	0.55	0.75
J	2.20	2.40
K	0.43	0.58
L	0.43	0.58
M	0.90	1.10
N	0.90	1.10
O	2.20	2.40