STEK

ET- 78Mxx

# Positive-Voltage Regulator

◆ Description

The 78Mxx series are fixed-voltage monolithic integrated circuit voltage regulators are designed for a wide range of applications. These applications include on-card regulation for elimination of noise and distribution problems associated with single-point regulation. In addition, they can be used with power-pass elements to make high-current voltage regulators. Each of these regulators can deliver up to 500mA of output current.

◆ Features

➢ Three Terminal Regulators.
➢ Output Current up to 500mA
➢ No External Components.
➢ Internal Thermal Overload Protection.
➢ Internal Short-Circuit Limiting.

◆ Typical Application

V_{IN} 78Mxx V_{OUT}
C_{IN} C_{OUT}
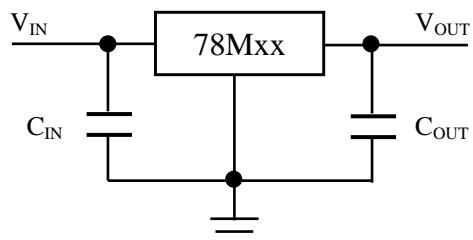
◆ Applications

➢ Linear Regulator
➢ Microprocessor Power Supply
➢ Graphic Card
➢ Mother Board

◆ Pin Description

1   2   3
IN GND OUT

TO-252 (Top View)

1   2   3
IN GND OUT

TO-251 (Top View)

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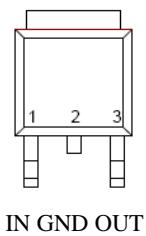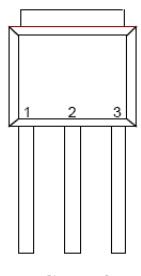
◆ Ordering Information

Part Number	Temperature Range	Package	Pin Assignment			Packing
			Input	GND	Output	
78M05UI	-40 °C ~ +125 °C	TO-252	1	2	3	Tape & Reel
78M05UBI		TO-251	1	2	3	Tube
78M06UI	-40 °C ~ +125 °C	TO-252	1	2	3	Tape & Reel
78M06UBI		TO-251	1	2	3	Tube
78M08UI	-40 °C ~ +125 °C	TO-252	1	2	3	Tape & Reel
78M08UBI		TO-251	1	2	3	Tube
78M09UI	-40 °C ~ +125 °C	TO-252	1	2	3	Tape & Reel
78M09UBI		TO-251	1	2	3	Tube
78M10UI	-40 °C ~ +125 °C	TO-252	1	2	3	Tape & Reel
78M10UBI		TO-251	1	2	3	Tube
78M12UI	-40 °C ~ +125 °C	TO-252	1	2	3	Tape & Reel
78M12UBI		TO-251	1	2	3	Tube
78M15UI	-40 °C ~ +125 °C	TO-252	1	2	3	Tape & Reel
78M15UBI		TO-251	1	2	3	Tube
78M18UI	-40 °C ~ +125 °C	TO-252	1	2	3	Tape & Reel
78M18UBI		TO-251	1	2	3	Tube
78M20UI	-40 °C ~ +125 °C	TO-252	1	2	3	Tape & Reel
78M20UBI		TO-251	1	2	3	Tube
78M24UI	-40 °C ~ +125 °C	TO-252	1	2	3	Tape & Reel
78M24UBI		TO-251	1	2	3	Tube

◆ Absolute Maximum Ratings

Symbol	Parameter	Value		Unit
		78M05~78M18	78M20~78M24	
V_{IN}	Input voltage	35	40	V
I_{OUT}	Output current	0.5		A
T_A	Operating ambient temperature	-40 ~ +125		°C
T_J	Operating junction temperature	0 ~ +150		°C
T_{STG}	Storage temperature	-65 ~ +150		°C
T_{LEAD}	Lead temperature 1.6mm from case for 10 seconds	260		°C

◆ Thermal Characteristics

Symbol	Parameter	Package	Typical Value	Unit
θ_{JA}	Thermal Resistance From Junction to Ambient in Free Air. (Measured with the component mounted on a high effective thermal conductivity test board in free air.)	TO-252	62.5	°C/W
		TO-251	100	

◆ Recommended Operating Conditions

Symbol	Parameter		Min.	Max.	Unit
V_{IN}	Input voltage	78M05	7	25	V
		78M06	8	25	
		78M08	10.5	25	
		78M09	11.5	27	
		78M10	12.5	28	
		78M12	14.5	30	
		78M15	17.5	30	
		78M18	21	33	
		78M20	23	36	
		78M24	27	38	
I_{OUT}	Output current		-	0.5	A
T_J	Operating virtual junction temperature		-	125	^oC

◆ 78M05 Electrical Characteristics (T_A=25^oC, V_{IN}=10V, I_{OUT}=350mA, unless otherwise noted .)

Symbol	Parameter	Test Conditions*		Min.	Typ.	Max.	Unit
V_{OUT}**	Output voltage			4.8	5.0	5.2	V
		I_O=5mA to 350mA V_{IN}=7V to 20V	0 to 125^oC	4.75	5.00	5.25	
Reg_{line}	Line regulation	V_{IN}=7V to 25V	I_O=200mA	-	-	100	mV
		V_{IN}=8V to 25V		-	-	50	
Reg_{load}	Load regulation	I_O=5mA to 200mA		-	-	50	mV
		I_O=5mA to 500mA		-	-	100	
PSRR	Ripple rejection	V_{IN}=8V to 18V, f=120Hz		62	80	-	dB
V_n	Output noise voltage	F=10Hz~100Hz		-	40	-	uV
$V_{DROPOUT}$	Dropout voltage			-	2.0	-	V
I_Q	Bias current			-	4.8	8.0	mA
			125^oC	-	-	7.5	
$\triangle I_Q$	Bias current change	V_{IN}=7V to 25V	0 to 125^oC	-	-	1.0	mA
		I_O=5mA to 350mA		-	-	0.5	

ET- 78Mxx

◆ 78M06 Electrical Characteristics (T_A=25°C, V_{IN}=11V, I_{OUT}=350mA, unless otherwise noted .)

Symbol	Parameter	Test Conditions*		Min.	Typ.	Max.	Unit
V_{OUT}**	Output voltage			5.75	6.00	6.25	V
		I_O=5mA to 350mA V_{IN}=8V to 21V	0 to 125°C	5.7	6.0	6.3	
Reg_{line}	Line regulation	V_{IN}=8V to 25V	I_O=200mA	-	-	100	mV
		V_{IN}=9V to 25V		-	-	50	
Reg_{load}	Load regulation	I_O=5mA to 200mA		-	-	60	mV
		I_O=5mA to 500mA		-	-	120	
PSRR	Ripple rejection	V_{IN}=9V to 19V, f=120Hz		62	80	-	dB
V_n	Output noise voltage	F=10Hz~100Hz		-	45	-	uV
$V_{DROPOUT}$	Dropout voltage			-	2.0	-	V
I_Q	Bias current			-	4.8	8.0	mA
			125°C	-	-	7.5	
$\triangle I_Q$	Bias current change	V_{IN}=8V to 25V	0 to 125°C	-	-	1.0	mA
		I_O=5mA to 350mA		-	-	0.5	

◆ 78M08 Electrical Characteristics (T_A=25°C, V_{IN}=14V, I_{OUT}=350mA, unless otherwise noted .)

Symbol	Parameter	Test Conditions*		Min.	Typ.	Max.	Unit
V_{OUT}**	Output voltage			7.7	8.0	8.3	V
		I_O=5mA to 350mA V_{IN}=10.5V to 23V	0 to 125°C	7.6	8.0	8.4	
Reg_{line}	Line regulation	V_{IN}=10.5V to 25V	I_O=200mA	-	-	150	mV
		V_{IN}=11V to 25V		-	-	75	
Reg_{load}	Load regulation	I_O=5mA to 200mA		-	-	80	mV
		I_O=5mA to 500mA		-	-	160	
PSRR	Ripple rejection	V_{IN}=11.5V to 21.5V, f=120Hz		62	80		dB
V_n	Output noise voltage	F=10Hz~100Hz		-	52		uV
$V_{DROPOUT}$	Dropout voltage			-	2.0		V
I_Q	Bias current			-	4.8	8.0	mA
			125°C	-	-	7.5	
$\triangle I_Q$	Bias current change	V_{IN}=10.5V to 25V	0 to 125°C	-	-	1.0	mA
		I_O=5mA to 350mA		-	-	0.5	

◆ 78M09 Electrical Characteristics (T$_A$=25°C, V$_{IN}$=16.5V, I$_{OUT}$=350mA, unless otherwise noted .)

Symbol	Parameter	Test Conditions*		Min.	Typ.	Max.	Unit
V$_{OUT}$**	Output voltage			8.64	9.00	9.36	V
		I$_O$=5mA to 350mA V$_{IN}$=11.5V to 25V	0 to 125°C	8.55	9.00	9.45	
Reg$_{line}$	Line regulation	V$_{IN}$=11V to 27V	I$_O$=200mA	-	-	150	mV
		V$_{IN}$=11.5V to 27V		-	-	75	
Reg$_{load}$	Load regulation	I$_O$=5mA to 200mA		-	-	90	mV
		I$_O$=5mA to 500mA		-	-	180	
PSRR	Ripple rejection	V$_{IN}$=12V to 23.5V, f=120Hz		62	80		dB
V$_n$	Output noise voltage	F=10Hz~100Hz		-	58		uV
V$_{DROPOUT}$	Dropout voltage			-	2.0		V
I$_Q$	Bias current			-	4.8	8.0	mA
			125°C	-	-	7.5	
△I$_Q$	Bias current change	V$_{IN}$=11V to 27V	0 to 125°C	-	-	1.0	mA
		I$_O$=5mA to 350mA		-	-	0.5	

◆ 78M10 Electrical Characteristics (T$_A$=25°C, V$_{IN}$=15.5V, I$_{OUT}$=350mA, unless otherwise noted .)

Symbol	Parameter	Test Conditions*		Min.	Typ.	Max.	Unit
V$_{OUT}$**	Output voltage			9.6	10	10.4	V
		I$_O$=5mA to 350mA V$_{IN}$=12.5V to 26V	0 to 125°C	9.5	10	10.5	
Reg$_{line}$	Line regulation	V$_{IN}$=12V to 28V	I$_O$=200mA	-	-	150	mV
		V$_{IN}$=12.5V to 28V		-	-	75	
Reg$_{load}$	Load regulation	I$_O$=5mA to 200mA		-	-	90	mV
		I$_O$=5mA to 500mA		-	-	200	
PSRR	Ripple rejection	V$_{IN}$=13V to 23.5V, f=120Hz		62	80	-	dB
V$_n$	Output noise voltage	F=10Hz~100Hz		-	62	-	uV
V$_{DROPOUT}$	Dropout voltage			-	2.0	-	V
I$_Q$	Bias current			-	4.8	8.0	mA
			125°C	-	-	7.5	
△I$_Q$	Bias current change	V$_{IN}$=12V to 28V	0 to 125°C	-	-	1.0	mA
		I$_O$=5mA to 350mA		-	-	0.5	

◆ 78M12 Electrical Characteristics (T_A=25°C, V_{IN}=19V, I_{OUT}=350mA, unless otherwise noted .)

Symbol	Parameter	Test Conditions*		Min.	Typ.	Max.	Unit
V_{OUT}**	Output voltage			11.5	12.0	12.5	V
		I_O=5mA to 350mA V_{IN}=14.5V to 27V	0 to 125°C	11.4	12.0	12.6	
Reg_{line}	Line regulation	V_{IN}=14.5V to 30V	I_O=200mA	-	-	150	mV
		V_{IN}=16V to 30V		-	-	75	
Reg_{load}	Load regulation	I_O=5mA to 200mA		-	-	120	mV
		I_O=5mA to 500mA		-	-	240	
PSRR	Ripple rejection	V_{IN}=15V to 25V, f=120Hz		62	80	-	dB
V_n	Output noise voltage	F=10Hz~100Hz		-	75	-	uV
$V_{DROPOUT}$	Dropout voltage			-	2.0	-	V
I_Q	Bias current			-	4.8	8.0	mA
			125°C	-	-	7.5	
$\triangle I_Q$	Bias current change	V_{IN}=14.5V to 30V	0 to 125°C	-	-	1.0	mA
		I_O=5mA to 350mA		-	-	0.5	

◆ 78M15 Electrical Characteristics (T_A=25°C, V_{IN}=23V, I_{OUT}=350mA, unless otherwise noted .)

Symbol	Parameter	Test Conditions*		Min.	Typ.	Max.	Unit
V_{OUT}**	Output voltage			14.4	15.0	15.6	V
		I_O=5mA to 350mA V_{IN}=17.5V to 30V	0 to 125°C	14.25	15.0	15.75	
Reg_{line}	Line regulation	V_{IN}=17.5V to 30V	I_O=200mA	-	-	150	mV
		V_{IN}=20V to 30V		-	-	75	
Reg_{load}	Load regulation	I_O=5mA to 200mA		-	-	150	mV
		I_O=5mA to 500mA		-	-	300	
PSRR	Ripple rejection	V_{IN}=18.5V to 28.5V, f=120Hz		60	70	-	dB
V_n	Output noise voltage	F=10Hz~100Hz		-	100	-	uV
$V_{DROPOUT}$	Dropout voltage			-	2.0	-	V
I_Q	Bias current			-	4.9	8.0	mA
			125°C	-	-	7.5	
$\triangle I_Q$	Bias current change	V_{IN}=17.5V to 30V	0 to 125°C	-	-	1.0	mA
		I_O=5mA to 350mA		-	-	0.5	

◆ 78M18 Electrical Characteristics $(T_A=25^oC, V_{IN}=26V, I_{OUT}=350mA,$ unless otherwise noted .)

Symbol	Parameter	Test Conditions*		Min.	Typ.	Max.	Unit
V_{OUT}**	Output voltage			17.3	18.0	18.7	V
		I_O=5mA to 350mA V_{IN}=21V to 33V	0 to 125°C	17.1	18.0	18.9	
Reg_{line}	Line regulation	V_{IN}=21.5V to 33V	I_O=200mA	-	-	150	mV
		V_{IN}=24.5V to 33V		-	-	75	
Reg_{load}	Load regulation	I_O=5mA to 200mA		-	-	180	mV
		I_O=5mA to 500mA		-	-	360	
PSRR	Ripple rejection	V_{IN}=22.5V to 32V, f=120Hz		60	70	-	dB
V_n	Output noise voltage	F=10Hz~100Hz		-	100	-	uV
$V_{DROPOUT}$	Dropout voltage			-	2.0	-	V
I_Q	Bias current			-	5.7	8.0	mA
			125°C	-	-	7.5	
$\triangle I_Q$	Bias current change	V_{IN}=21.5V to 33V	0 to 125°C	-	-	1.0	mA
		I_O=5mA to 350mA		-	-	0.5	

◆ 78M20 Electrical Characteristics $(T_A=25^oC, V_{IN}=28V, I_{OUT}=350mA,$ unless otherwise noted .)

Symbol	Parameter	Test Conditions*		Min.	Typ.	Max.	Unit
V_{OUT}**	Output voltage			19.2	20.0	20.8	V
		I_O=5mA to 350mA V_{IN}=23V to 36V	0 to 125°C	19.0	20.0	21.0	
Reg_{line}	Line regulation	V_{IN}=23.5V to 36V	I_O=200mA	-	-	150	mV
		V_{IN}=26.5V to 36V		-	-	75	
Reg_{load}	Load regulation	I_O=5mA to 200mA		-	-	200	mV
		I_O=5mA to 500mA		-	-	400	
PSRR	Ripple rejection	V_{IN}=24.5V to 35V, f=120Hz		55	65	-	dB
V_n	Output noise voltage	F=10Hz~100Hz		-	120	-	uV
$V_{DROPOUT}$	Dropout voltage			-	2.0	-	V
I_Q	Bias current			-	4.9	8.0	mA
			125°C	-	-	7.5	
$\triangle I_Q$	Bias current change	V_{IN}=23.5V to 36V	0 to 125°C	-	-	1.0	mA
		I_O=5mA to 350mA		-	-	0.5	

◆ 78M24 Electrical Characteristics (T_A=25°C, V_{IN}=31V, I_{OUT}=350mA, unless otherwise noted .)

Symbol	Parameter	Test Conditions*		Min.	Typ.	Max.	Unit
V_{OUT}**	Output voltage			23.04	24.00	24.96	V
		I_O=5mA to 350mA V_{IN}=27V to 35V	0 to 125°C	22.80	24.00	25.20	
Reg_{line}	Line regulation	V_{IN}=27.5V to 38V	I_O=200mA	-	-	150	mV
		V_{IN}=30V to 38V		-	-	75	
Reg_{load}	Load regulation	I_O=5mA to 200mA		-	-	240	mV
		I_O=5mA to 500mA		-	-	480	
PSRR	Ripple rejection	V_{IN}=28.5V to 37V, f=120Hz		55	65	-	dB
V_n	Output noise voltage	F=10Hz~100Hz		-	140	-	uV
$V_{DROPOUT}$	Dropout voltage			-	2.0	-	V
I_Q	Bias current			-	4.9	8.0	mA
			125°C	-	-	7.5	
$\triangle I_Q$	Bias current change	V_{IN}=27.5V to 38V	0 to 125°C	-	-	1.0	mA
		I_O=5mA to 350mA		-	-	0.5	

Note:

* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33uF capacitor across the input and a 0.1uF capacitor across the output.

** The specification applies only for DC power dissipation permitted by absolute maximum rating.

◆ Typical Application Circuits

**Dropout Voltage vs Junction Temperature**

Quiescent Current vs Input Voltage (78M05)

Output Voltage Deviation vs Junction Temperature

Peak Output Current vs Input to Output Voltage Differential

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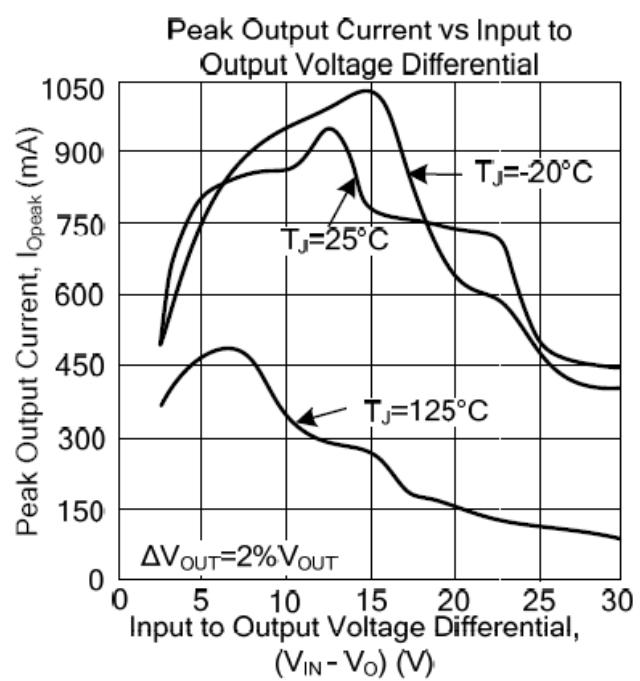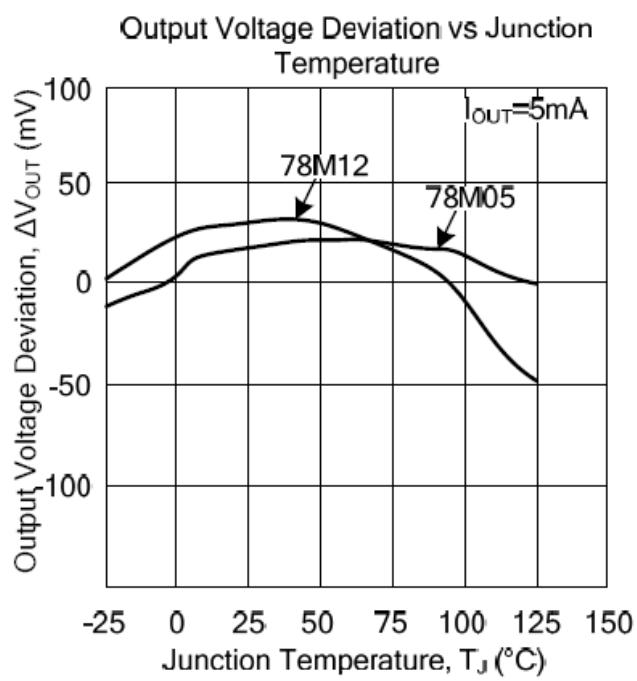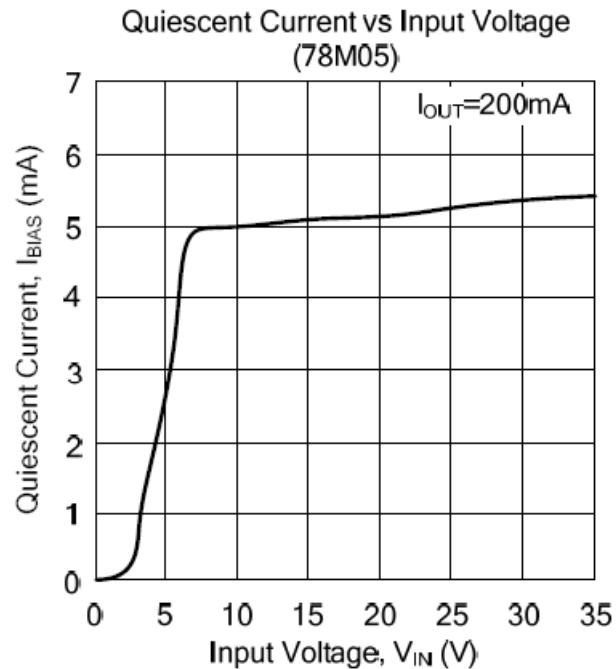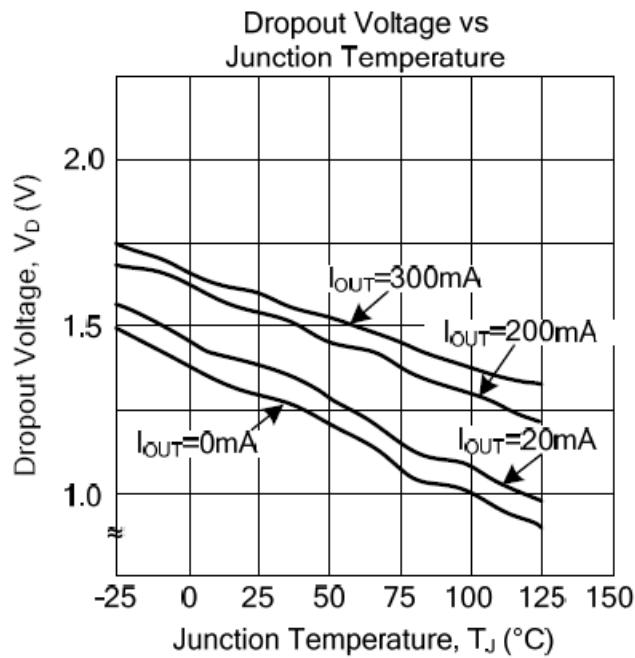
◆ Package Information
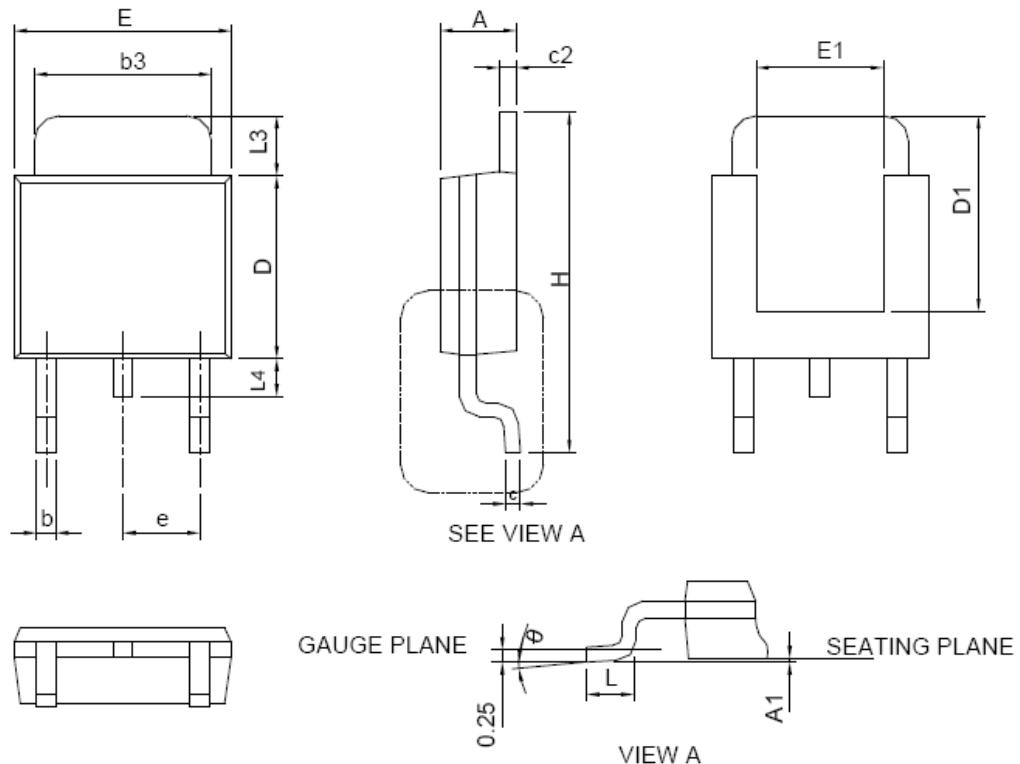
TO-252

SYMBOL	TO-252			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	2.18	2.39	0.086	0.094
A1		0.13		0.005
b	0.50	0.89	0.020	0.035
b3	4.95	5.46	0.195	0.215
c	0.46	0.61	0.018	0.024
c2	0.46	0.89	0.018	0.035
D	5.33	6.22	0.210	0.245
D1	4.57	6.00	0.180	0.236
E	6.35	6.73	0.250	0.265
E1	3.81	6.00	0.150	0.236
e	2.29 BSC		0.090 BSC	
H	9.40	10.41	0.370	0.410
L	0.90	1.78	0.035	0.070
L3	0.89	2.03	0.035	0.080
L4		1.02		0.040
θ	0°	8°	0°	8°

10

◆   Package Information

TO-251
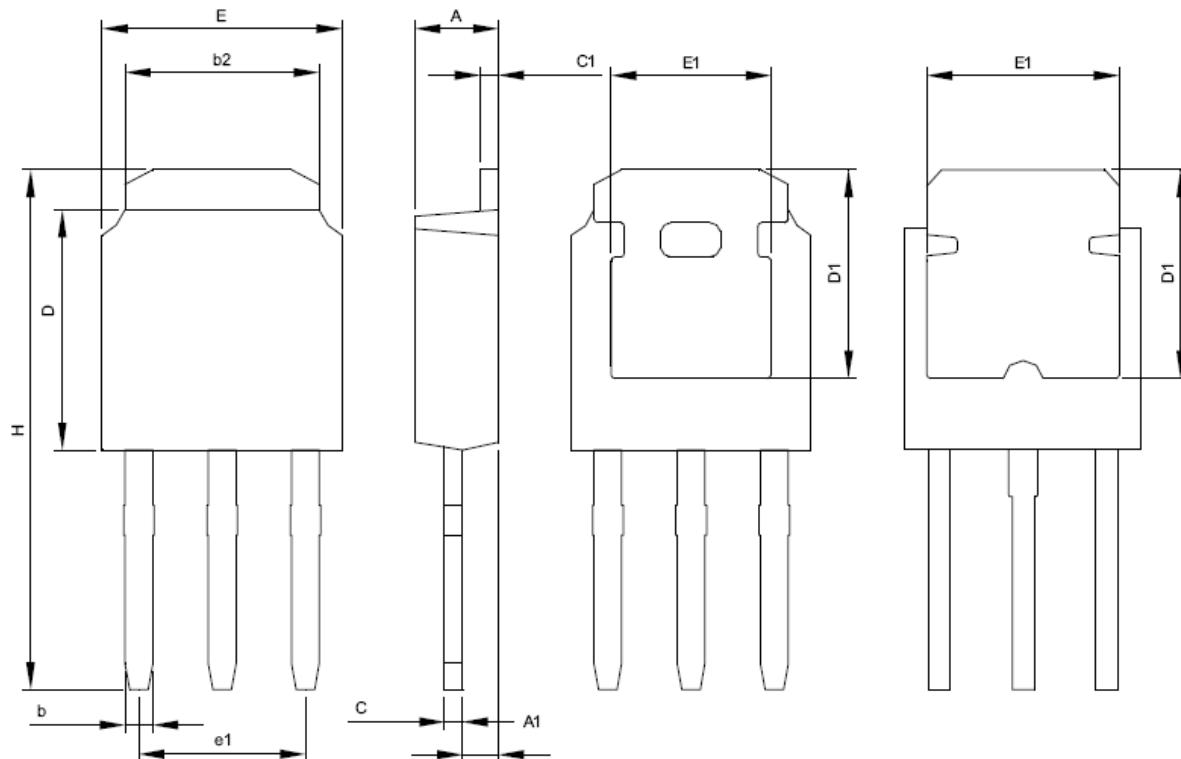
Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	2.20	2.40	0.087	0.094
A1	1.02	1.27	0.040	0.050
b	0.50	0.88	0.020	0.035
b2	5.20	5.46	0.205	0.215
C	0.40	0.60	0.016	0.024
C1	0.40	0.60	0.016	0.024
D	5.40	6.20	0.213	0.244
D1	5.30	--	0.209	--
E	6.35	6.70	0.250	0.264
E1	4.40	5.40	0.173	0.213
e1	4.50	4.70	0.177	0.185
H	12.90	15.25	0.508	0.600