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MC78XX/LM78XX/MC78XXA

3-Terminal 1A Positive Voltage Regulator

Features

- Output Current up to 1A
- Output Voltages of 5, 6, 8, 9, 10, 12, 15, 18, 24V
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area Protection

Description

The MC78XX/LM78XX/MC78XXA series of three terminal positive regulators are available in the TO-220/D-PAK package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

TO-220

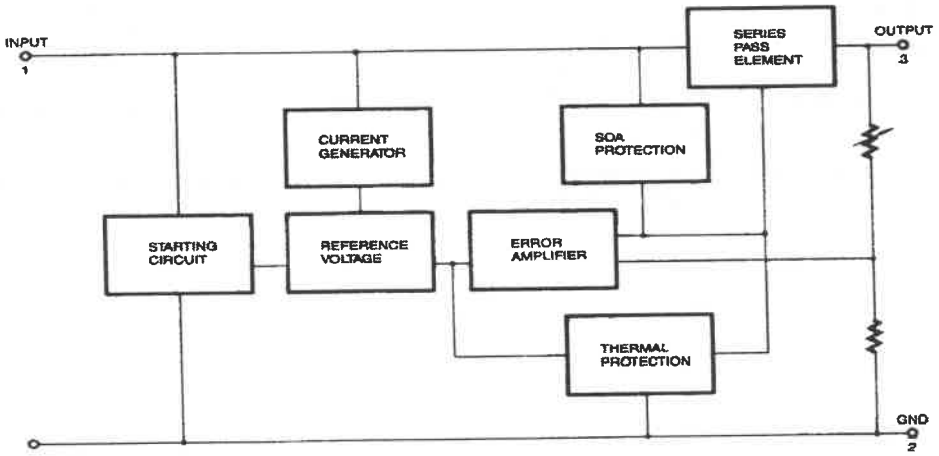
1

D-PAK

1

1. Input 2. GND 3. Output

Internal Block Digram



Rev. 1.0.1

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Input Voltage (for V_O = 5V to 18V) (for V_O = 24V)	V_I V_I	35 40	V V
Thermal Resistance Junction-Cases (TO-220)	$R_{\theta JC}$	5	°C/W
Thermal Resistance Junction-Air (TO-220)	$R_{\theta JA}$	65	°C/W
Operating Temperature Range	T_{OPR}	0 ~ +125	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C

Electrical Characteristics (MC7805/LM7805)

(Refer to test circuit ,0°C < T_J < 125°C, I_O = 500mA, V_I = 10V, C_I= 0.33µF, C_O= 0.1µF, unless otherwise specified)

Parameter	Symbol	Conditions		MC7805/LM7805			Unit
				Min.	Typ.	Max.	
Output Voltage	V_O	T_J =+25 °C		4.8	5.0	5.2	V
		5.0mA ≤ I_O ≤ 1.0A, P_O ≤ 15W V_I = 7V to 20V		4.75	5.0	5.25	
Line Regulation (Note1)	Regline	T_J=+25 °C	V_O = 7V to 25V	-	4.0	100	mV
			V_I = 8V to 12V	-	1.6	50	
Load Regulation (Note1)	Regload	T_J=+25 °C	I_O = 5.0mA to1.5A	-	9	100	mV
			I_O =250mA to 750mA	-	4	50	
Quiescent Current	I_Q	T_J =+25 °C		-	5.0	8.0	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1.0A		-	0.03	0.5	mA
		V_I= 7V to 25V		-	0.3	1.3	
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O= 5mA		-	-0.8	-	mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A=+25 °C		-	42	-	µV/Vo
Ripple Rejection	RR	f = 120Hz V_O = 8V to 18V		62	73	-	dB
Dropout Voltage	V_{Drop}	I_O = 1A, T_J =+25 °C		-	2	-	V
Output Resistance	r_O	f = 1KHz		-	15	-	mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A =+25 °C		-	230	-	mA
Peak Current	I_{PK}	T_J =+25 °C		-	2.2	-	A

Note:

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

Electrical Characteristics (MC7815)

(Refer to test circuit ,0°C < T_J < 125°C, I_O = 500mA, V_I =23V, C_I= 0.33µF, C_O=0.1µF, unless otherwise specified)

Parameter	Symbol	Conditions		MC7815			Unit
				Min.	Typ.	Max.	
Output Voltage	V_O	T_J =+25 °C		14.4	15	15.6	V
		5.0mA ≤ I_O ≤ 1.0A, P_O ≤ 15W V_I = 17.5V to 30V		14.25	15	15.75	
Line Regulation (Note1)	Regline	T_J =+25 °C	V_I = 17.5V to 30V	-	11	300	mV
			V_I = 20V to 26V	-	3	150	
Load Regulation (Note1)	Regload	T_J =+25 °C	I_O = 5mA to 1.5A	-	12	300	mV
			I_O = 250mA to 750mA	-	4	150	
Quiescent Current	I_Q	T_J =+25 °C		-	5.2	8.0	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1.0A		-	-	0.5	mA
		V_I = 17.5V to 30V		-	-	1.0	
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O = 5mA		-	-1	-	mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A =+25 °C		-	90	-	µV/Vo
Ripple Rejection	RR	f = 120Hz V_I = 18.5V to 28.5V		54	70	-	dB
Dropout Voltage	V_{Drop}	I_O = 1A, T_J=+25 °C		-	2	-	V
Output Resistance	r_O	f = 1KHz		-	19	-	mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A=+25 °C		-	250	-	mA
Peak Current	I_{PK}	T_J =+25 °C		-	2.2	-	A

Note:

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

Electrical Characteristics (MC7815A)

(Refer to the test circuits. 0°C < T_J < 125°C, I_O =1A, V_I =23V, C_I=0.33μF, C_O=0.1μF, unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Output Voltage	V_O	T_J =+25 °C		14.7	15	15.3	V
		I_O = 5mA to 1A, P_O ≤15W V_I = 17.7V to 30V		14.4	15	15.6	
Line Regulation (Note1)	Regline	V_I= 17.9V to 30V I_O = 500mA		-	10	150	mV
		V_I= 20V to 26V		-	5	150	
		T_J =+25°C	V_I= 17.5V to 30V	-	11	150	
			V_I= 20V to 26V	-	3	75	
Load Regulation (Note1)	Regload	T_J =+25 °C I_O = 5mA to 1.5A		-	12	100	mV
		I_O = 5mA to 1.0A		-	12	100	
		I_O = 250mA to 750mA		-	5	50	
Quiescent Current	I_Q	T_J =+25 °C		-	5.2	6.0	mA
Quiescent Current Change	ΔI_Q	V_I = 17.5V to 30V, T_J =+25 °C		-	-	0.8	mA
		V_I = 17.5V to 30V, I_O = 500mA		-	-	0.8	
		I_O = 5mA to 1.0A		-	-	0.5	
Output Voltage Drift	$\Delta V/\Delta T$	I_O = 5mA		-	-1.0	-	mV/°C
Output Noise Voltage	V_N	f = 10Hz to 100KHz T_A =+25 °C		-	10	-	μV/Vo
Ripple Rejection	RR	f = 120Hz, I_O = 500mA V_I = 18.5V to 28.5V		-	58	-	dB
Dropout Voltage	V_{Drop}	I_O = 1A, T_J =+25 °C		-	2.0	-	V
Output Resistance	r_O	f = 1KHz		-	19	-	mΩ
Short Circuit Current	I_{SC}	V_I= 35V, T_A =+25 °C		-	250	-	mA
Peak Current	I_{PK}	T_J=+25°C		-	2.2	-	A

Note:

1. 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.

Typical Perfomance Characteristics

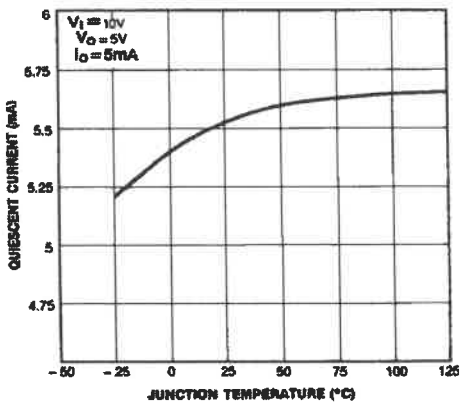


Figure 1. Quiescent Current

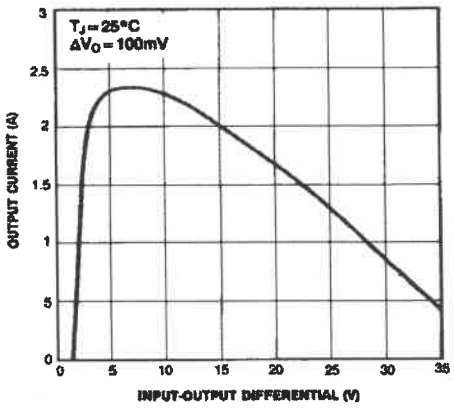


Figure 2. Peak Output Current

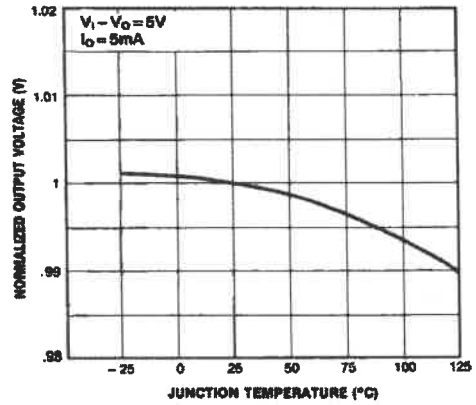


Figure 3. Output Voltage

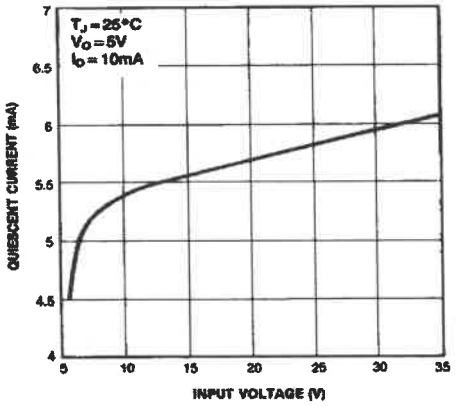


Figure 4. Quiescent Current

Typical Applications

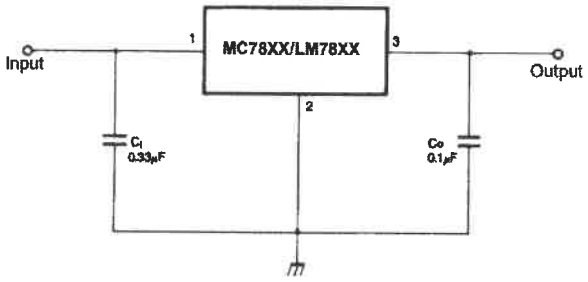


Figure 5. DC Parameters

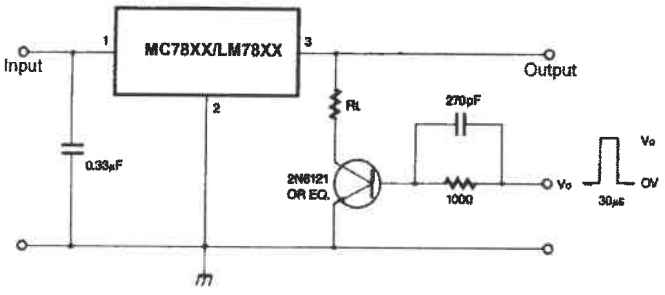


Figure 6. Load Regulation

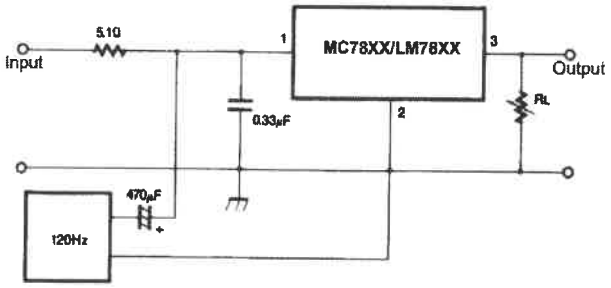


Figure 7. Ripple Rejection

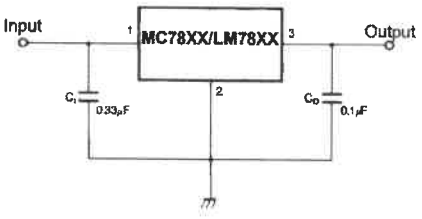
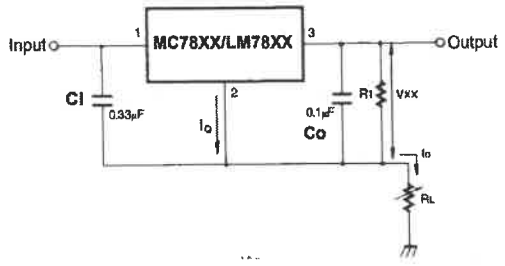


Figure 8. Fixed Output Regulator



$$I_O = \frac{V_{XX}}{R_1} + I_Q$$

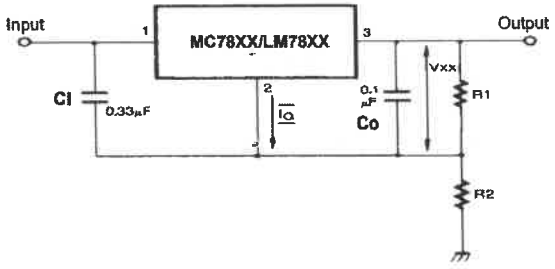
Figure 9. Constant Current Regulator

Notes:

(1) To specify an output voltage. substitute voltage value for "XX." A common ground is required between the input and the Output voltage. The input voltage must remain typically 2.0V above the output voltage even during the low point on the input ripple voltage.

(2) C_I is required if regulator is located an appreciable distance from power Supply filter.

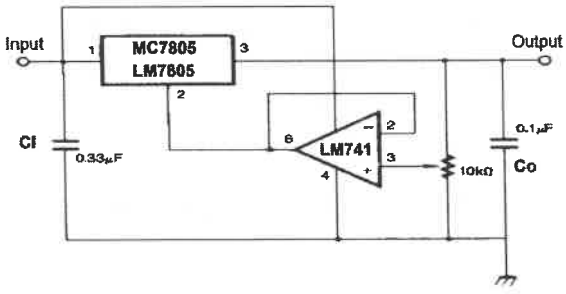
(3) C_O improves stability and transient response.



$$I_{R1} \geq 5IQ$$

$$V_O = V_{XX}(1+R_2/R_1)+I_QR_2$$

Figure 10. Circuit for Increasing Output Voltage



$$I_{R1} \geq 5\ I_Q$$

$$V_O = V_{XX}(1+R_2/R_1)+I_QR_2$$

Figure 11. Adjustable Output Regulator (7 to 30V)

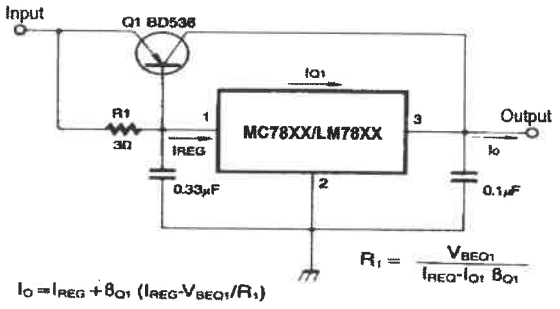


Figure 12. High Current Voltage Regulator

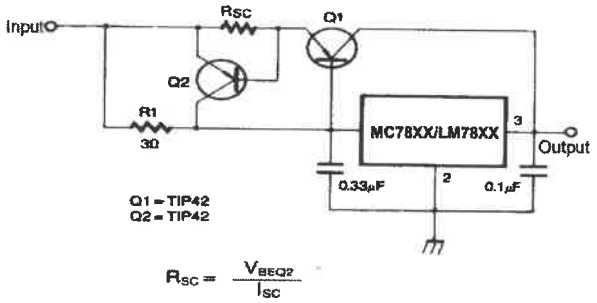


Figure 13. High Output Current with Short Circuit Protection

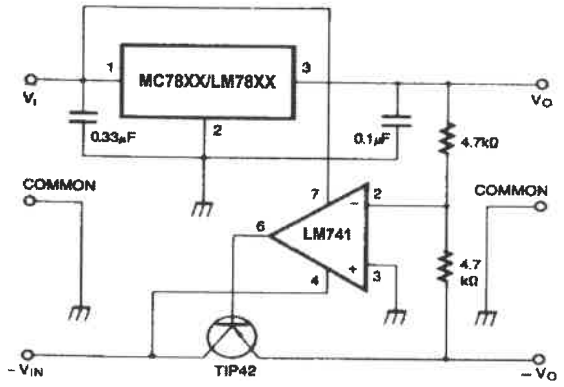


Figure 14. Tracking Voltage Regulator

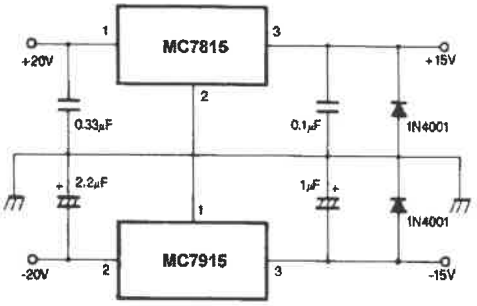


Figure 15. Split Power Supply (±15V-1A)

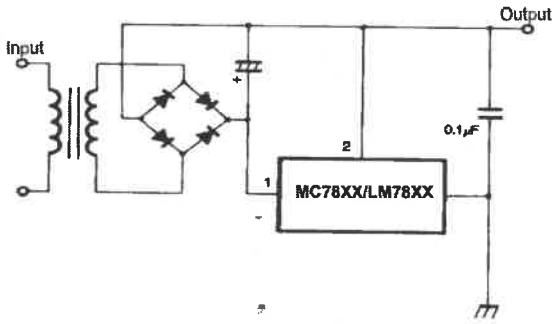


Figure 16. Negative Output Voltage Circuit

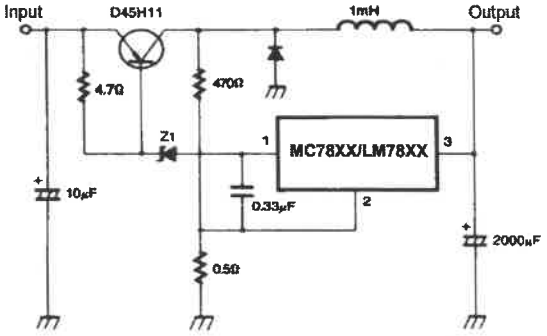
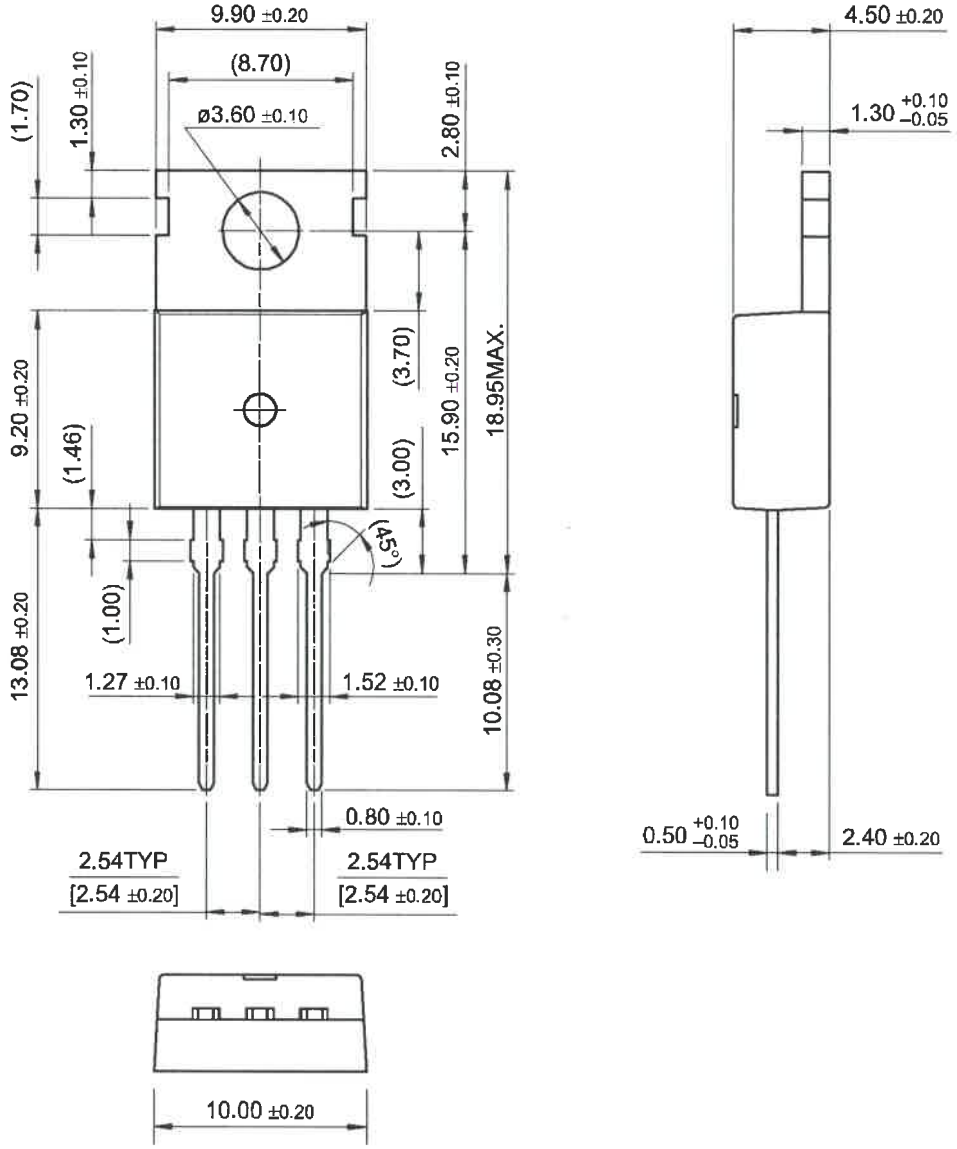


Figure 17. Switching Regulator

Mechanical Dimensions

Package

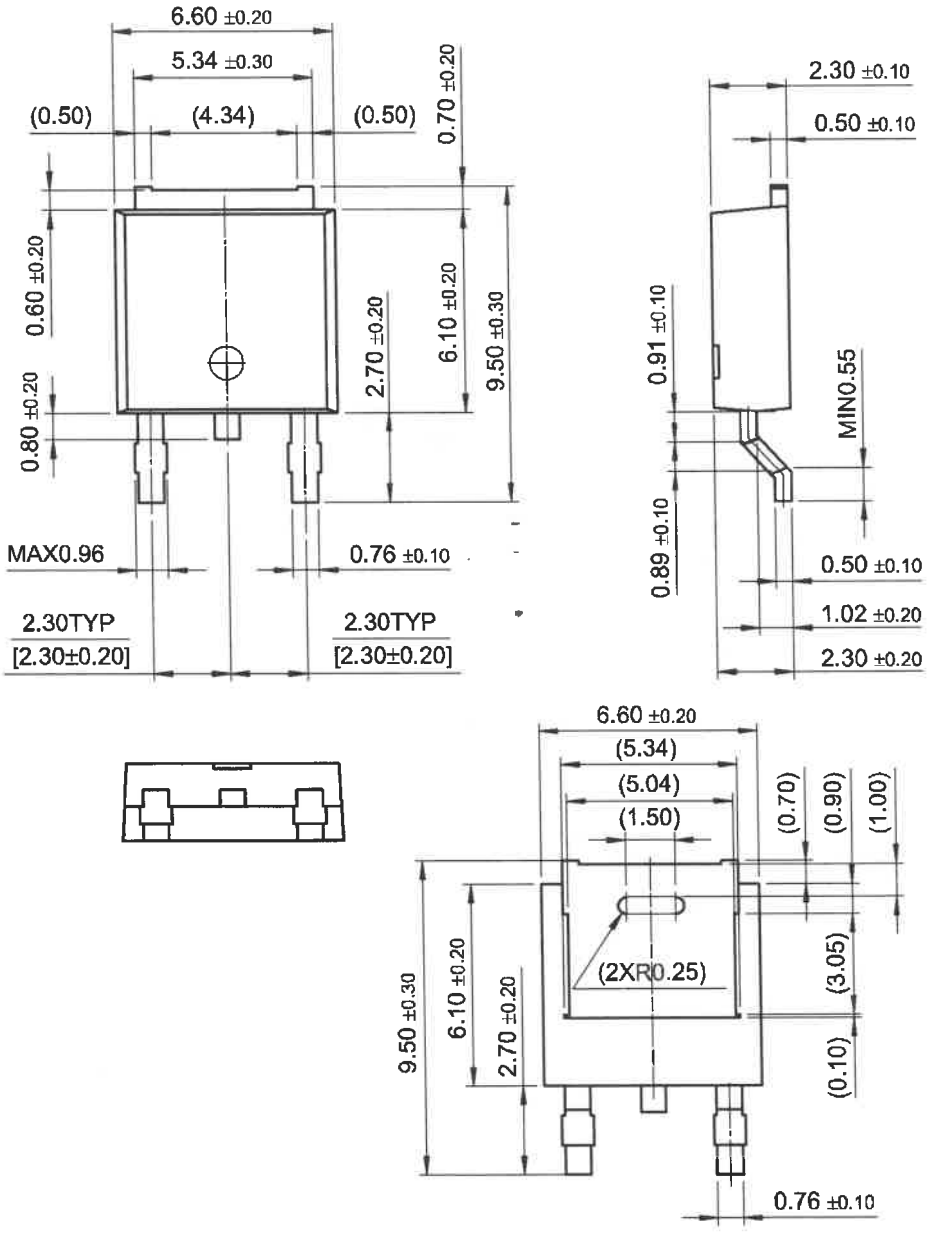
TO-220



Mechancal Dimensions (Continued)

Package

D-PAK



Ordering Information

Product Number	Output Voltage Tolerance	Package	Operating Temperature
LM7805CT	±4%	TO-220	0 ~ + 125°C

Product Number	Output Voltage Tolerance	Package	Operating Temperature
MC7805CT	±4%	TO-220	0 ~ + 125°C
MC7806CT			
MC7808CT			
MC7809CT			
MC7810CT			
MC7812CT			
MC7815CT			
MC7818CT			
MC7824CT			
MC7805CDT		D-PAK	
MC7806CDT			
MC7808CDT			
MC7809CDT			
MC7810CDT			
MC7812CDT			
MC7805ACT	±2%	TO-220	
MC7806ACT			
MC7808ACT			
MC7809ACT			
MC7810ACT			
MC7812ACT			
MC7815ACT			
MC7818ACT			
MC7824ACT			