National Semiconductor

Voltage Regulators

LM78MXX Series 3-Terminal Positive Regulators

General Description

The LM78MXX series of three terminal regulators is available with several fixed output voltages making them useful in a wide range of applications. One of these is local on card regulation, eliminating the distribution problems associated with single point regulation. The voltages available allow these regulators to be used in logic systems, instrumentation, HiFi, and other solid state electronic equipment. Although designed primarily as fixed voltage regulators these devices can be used with external components to obtain adjustable voltages and currents.

The LM78MXX series is available in the plastic TO-202 package. This package allows these regulators to deliver over 0.5A if adequate heat sinking is provided. Current limiting is included to limit the peak output current to a safe value. Safe area protection for the output transistor is provided to limit internal power dissipation. If internal power dissipation becomes too high for the heat sinking provided, the thermal shutdown circuit takes over preventing the IC from overheating.

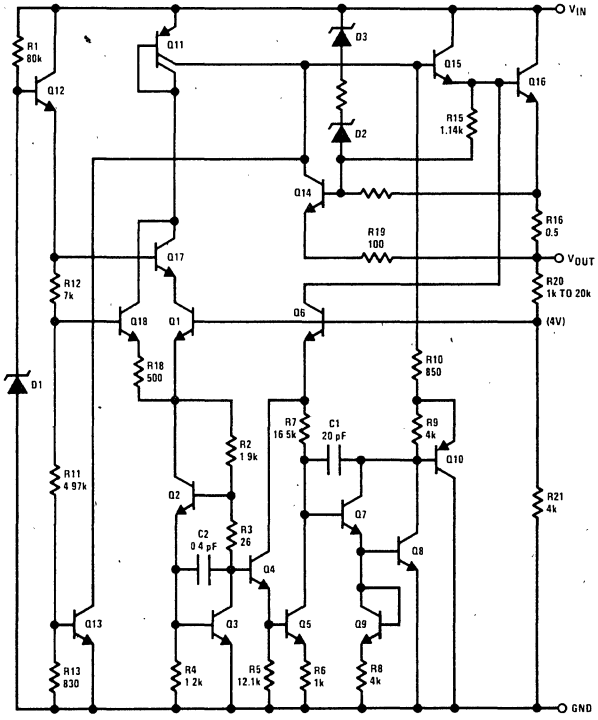
Considerable effort was expended to make the LM78MXX series of regulators easy to use and minimize the number of external components. It is not necessary to bypass the output, although this does improve transient response. Input bypassing is needed only if the regulator is located far from the filter capacitor of the power supply.

For applications requiring other voltages, see LM117 data sheet.

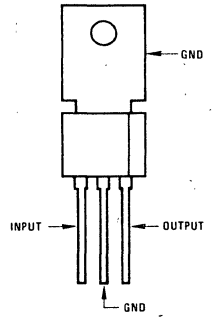
Features

- Output current in excess of 0.5A
- Internal thermal overload protection
- No external components required
- Output transistor safe area protection
- Internal short circuit current limit
- Available in plastic TO-202 package
- Special circuitry allows start-up even if output is pulled to negative voltage (± supplies)

Schematic and Connection Diagrams



Plastic Package



FRONT VIEW

Order Numbers:

LM78M05CP
LM78M12CP
LM78M15CP
See NS Package P03A

For Tab Bend TO-202 Order Numbers:

LM78M05CP TB
LM78M12CP TB
LM78M15CP TB
See NS Package P03E

Absolute Maximum Ratings

Input Voltage (V_O = 5V, 12V and 15V)	35V
Internal Power Dissipation (Note 1)	Internally Limited
Operating Temperature Range	0°C to +70°C
Maximum Junction Temperature	+125°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 10 seconds)	+230°C

Electrical Characteristics

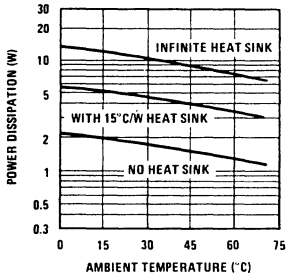
T_A = 0°C to 70°C, I_O = 500 mA, unless otherwise noted.

OUTPUT VOLTAGE			5V			12V			15V			UNITS
INPUT VOLTAGE (unless otherwise noted)			10V			19V			23V			
PARAMETER		CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V_O	Output Voltage	T_J = 25°C	4.8	5	5.2	11.5	12	12.5	14.4	15	15.6	V
		$P_D \leq$ 7.5W, 5 mA $\leq I_O \leq$ 500 mA	4.75		5.25	11.4		12.6	14.25		15.75	V
		and $V_{MIN} \leq V_{IN} \leq V_{MAX}$	(7.5 $\leq V_{IN} \leq$ 20)			(14.8 $\leq V_{IN} \leq$ 27)			(18 $\leq V_{IN} \leq$ 30)			V
ΔV_O	Line Regulation	T_J = 25°C, I_O = 100 mA			50			120			150	mV
		T_J = 25°C, I_O = 500 mA			100			240			300	mV
			(7.2 $\leq V_{IN} \leq$ 25)			(14.5 $\leq V_{IN} \leq$ 30)			(17.6 $\leq V_{IN} \leq$ 30)			V
ΔV_O	Load Regulation	T_J = 25°C, 5 mA $\leq I_O \leq$ 500 mA			100			240			300	mV
ΔV_O	Long Term Stability				20			48			60	mV/1000 hrs
I_O	Quiescent Current	T_J = 25°C		4	10		4	10		4	10	mA
ΔI_O	Quiescent Current Change	T_J = 25°C			0.5			0.5			0.5	mA
		5 mA $\leq I_O \leq$ 500 mA										
		T_J = 25°C			1			1			1	mA
		$V_{MIN} \leq V_{IN} \leq V_{MAX}$	(7.5 $\leq V_{IN} \leq$ 25)			(14.8 $\leq V_{IN} \leq$ 30)			(18 $\leq V_{IN} \leq$ 30)			V
V_n	Output Noise Voltage	T_J = 25°C, f = 10 Hz − 100 kHz		40			75			90		μV
$\frac{\Delta V_{IN}}{\Delta V_{OUT}}$	Ripple Rejection	f = 120 Hz		78			71			69		dB
	Input Voltage Required to Maintain Line Regulation	T_J = 25°C, I_O = 500 mA	7.2			14.5			17.6			V

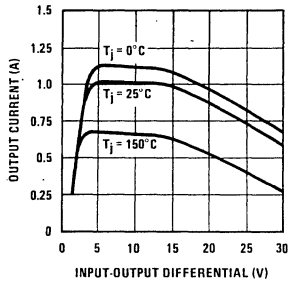
Note 1: Thermal resistance without a heat sink for junction to case temperature is 12°C/W for the TO-202 package. Thermal resistance for case to ambient temperature is 70°C/W for the TO-202 package.

Typical Performance Characteristics

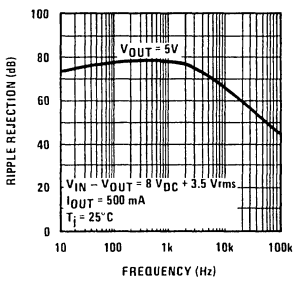
Maximum Average Power Dissipation



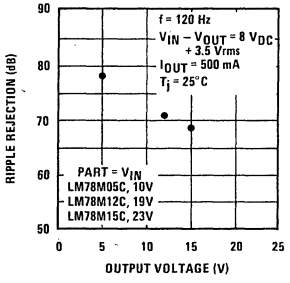
Peak Output Current



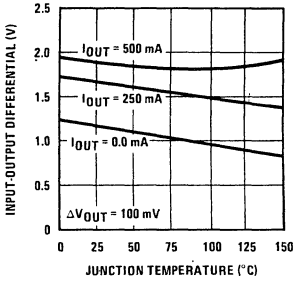
Ripple Rejection



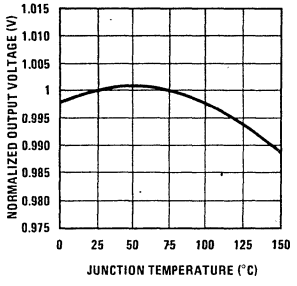
Ripple Rejection



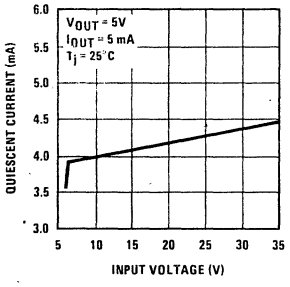
Dropout Voltage



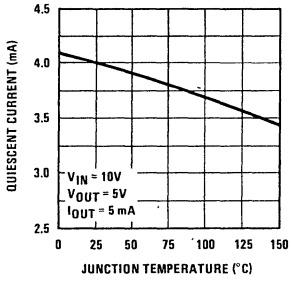
Output Voltage (Normalized to 1V at T_J = 25° C)



Quiescent Current



Quiescent Current



Output Impedance