

LM79MXX Series

3-Terminal Negative Regulators

General Description

The LM79MXX series of 3-terminal regulators is available with fixed output voltages of $-5V$, $-12V$, and $-15V$. These devices need only one external component—a compensation capacitor at the output. The LM79MXX series is packaged in the TO-220 power package, and is capable of supplying 0.5A of output current.

These regulators employ internal current limiting, safe area protection, and thermal shutdown for protection against virtually all overload conditions.

Low ground pin current of the LM79MXX series allows output voltage to be easily boosted above the preset value with

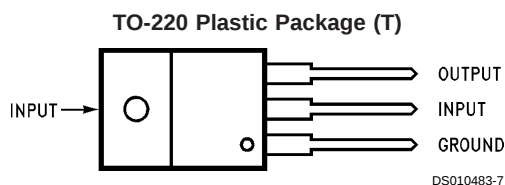
a resistor divider. The low quiescent current of these devices with a specified maximum change with line and load ensures good regulation in the voltage boosted mode.

For output voltage other than $-5V$, $-12V$, and $-15V$ the LM137 series provides an output voltage range from $-1.2V$ to $-57V$.

Features

- Thermal, short circuit and safe area protection
- High ripple rejection
- 0.5A output current
- 4% tolerance on preset output voltage

Connection Diagram



Front View

Order Number LM79M05CT, LM79M12CT or LM79M15CT

See NS Package Number T03B

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Input Voltage

$$V_O = -5V$$

$$-25V$$

$$V_O = -12V, -15V$$

$$-35V$$

Input/Output Differential

$$V_O = -5V$$

$$25V$$

$$V_O = -12V, -15V$$

$$30V$$

Power Dissipation (Note 2)

Internally Limited

Operating Junction
Temperature Range

$$0^{\circ}\text{C to } +125^{\circ}\text{C}$$

Storage Temperature Range

$$-65^{\circ}\text{C to } +150^{\circ}\text{C}$$

Lead Temperature
(Soldering, 10 sec.)

$$230^{\circ}\text{C}$$

ESD Susceptibility

TBD

Electrical Characteristics LM79M05C

Conditions unless otherwise noted: $I_{OUT} = 350\text{mA}$, $C_{IN} = 2.2\mu\text{F}$, $C_{OUT} = 1\mu\text{F}$, $0^{\circ}\text{C} \leq T_J \leq +125^{\circ}\text{C}$

Part Number			LM79M05C			Units
Output Voltage			-5V			
Input Voltage (Unless Otherwise Specified)			-10V			
Symbol	Parameter	Conditions	Min	Typ	Max	
V _O	Output Voltage	T _J = 25°C	-4.8	-5.0	-5.2	V
		5mA ≤ I _{OUT} ≤ 350mA	-4.75		-5.25	V
ΔV _O	Line Regulation	T _J = 25°C (Note 3)	(-25 ≤ V _{IN} ≤ -7)			
			8 50			mV
			(-25 ≤ V _{IN} ≤ -7)			
ΔV _O	Load Regulation	T _J = 25°C, (Note 3) 5mA ≤ I _{OUT} ≤ 0.5A	2 30			mV
			(-18 ≤ V _{IN} ≤ - 8)			
			30 100			mV
I _Q	Quiescent Current	T _J = 25°C	1 2			mA
ΔI _Q	Quiescent Current Change	With Input Voltage	0.4			mA
		With Load, 5mA ≤ I _{OUT} ≤ 350mA	(-25 ≤ V _{IN} ≤ -8) 0.4			mA
V _n	Output Noise Voltage	T _A = 25°C, 10Hz ≤ f ≤ 100Hz	150			μV
	Ripple Rejection	f = 120Hz	54	66	(-18 ≤ V _{IN} ≤ -8)	
	Dropout Voltage	T _J = 25°C, I _{OUT} = 0.5A	1.1			V
I _{OMAX}	Peak Output Current	T _J = 25°C	800			mA
	Average Temperature Coefficient of Output Voltage	I _{OUT} = 5mA, 0°C ≤ T _J ≤ 100°C	-0.4			mV/°C

Electrical Characteristics LM79M12C, LM79M15C

Conditions unless otherwise noted: $I_{OUT} = 350\text{mA}$, $C_{IN} = 2.2\mu\text{F}$, $C_{OUT} = 1\mu\text{F}$, $0^\circ\text{C} \leq T_J \leq +125^\circ\text{C}$

Part Number			LM79M12C			LM79M15C			Units
Output Voltage			-12V			-15V			
Input Voltage (Unless Otherwise Specified)			-19V			-23V			
Symbol	Parameter	Conditions	Min	Typ	Max	Min	Typ	Max	
V _O	Output Voltage	T _J = 25°C	-11.5	-12.0	-12.5	-14.4	-15.0	-15.6	V
		5 mA ≤ I _{OUT} ≤ 350mA	-11.4		-12.6	-14.25		-15.75	V
			(-27 ≤ V _{IN} ≤ -14.5)			(-30 ≤ V _{IN} ≤ -10.5)			
ΔV _O	Line Regulation	T _J = 25°C (Note 3)	5		80	5		80	mV
			(-30 ≤ V _{IN} ≤ -14.5)			(-30 ≤ V _{IN} ≤ -17.5)			
			3		50	3		50	mV
			(-25 ≤ V _{IN} ≤ - 15)			(-28 ≤ V _{IN} ≤ -18)			
ΔV _O	Load Regulation	T _J = 25°C, (Note 3) 5mA ≤ I _{OUT} ≤ 0.5A	30		240	30		240	mV
I _Q	Quiescent Current	T _J = 25°C	1.5		3	1.5		3	mA
ΔI _Q	Quiescent Current Change	With Input Voltage	0.4			0.4			mA
		(-30 ≤ V _{IN} ≤ -14.5)			(-30 ≤ V _{IN} ≤ -27)				

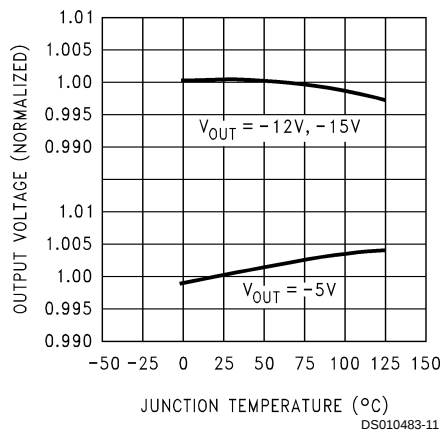
Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics.

Note 2: Refer to Typical Performance Characteristics and Design Considerations for details.

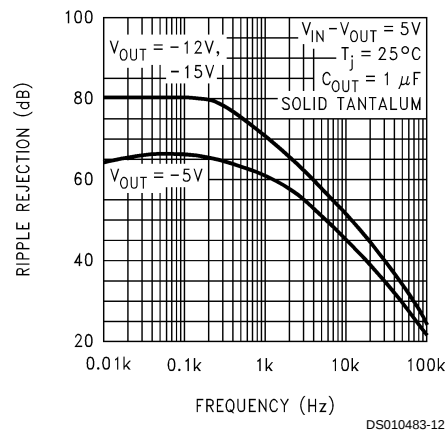
Note 3: Regulation is measured at a constant junction temperature by pulse testing with a low duty cycle. Changes in output voltage due to heating effects must be taken into account.

Typical Performance Characteristics

Output Voltage vs. Temperature

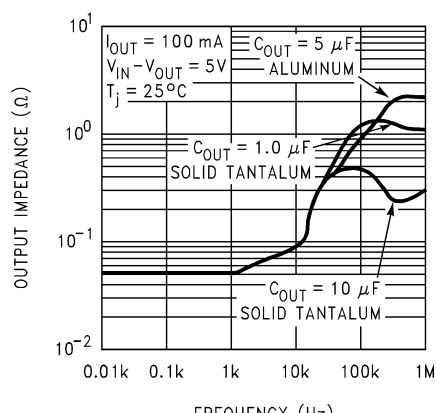


Ripple Rejection



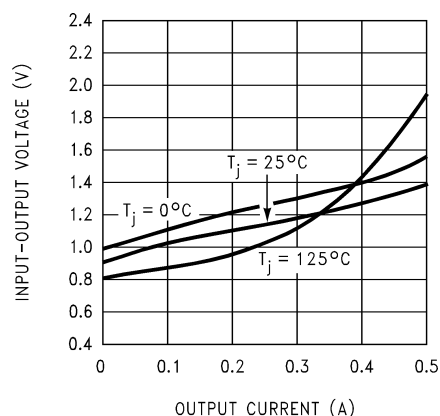
Typical Performance Characteristics (Continued)

Output Impedance



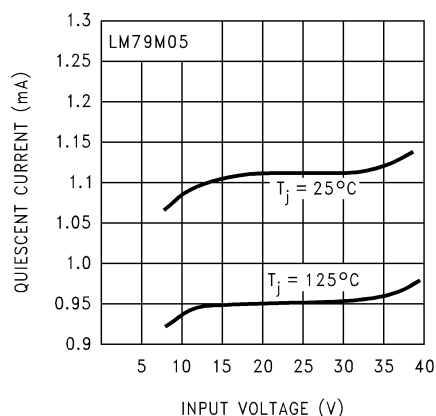
DS010483-13

Minimum Input-Output Differential



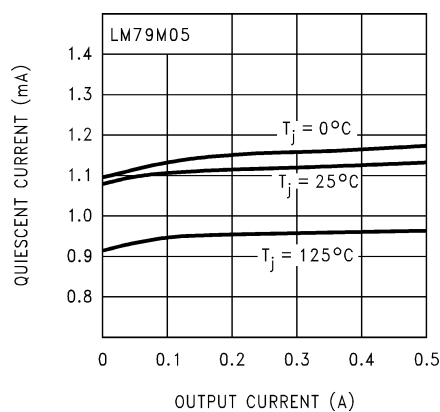
DS010483-14

Quiescent Current vs. Input Voltage



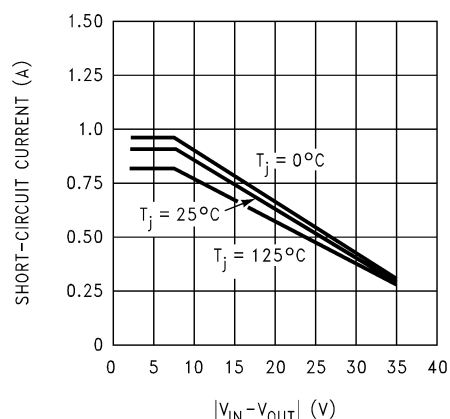
DS010483-15

Quiescent Current vs. Load Current



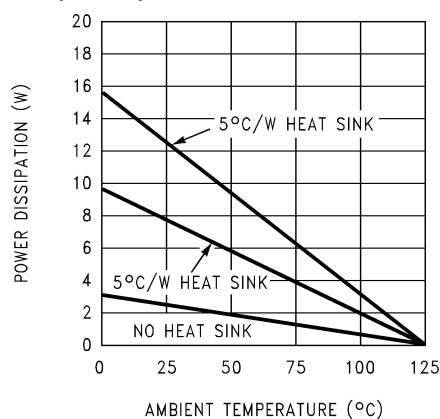
DS010483-16

Short-Circuit Current



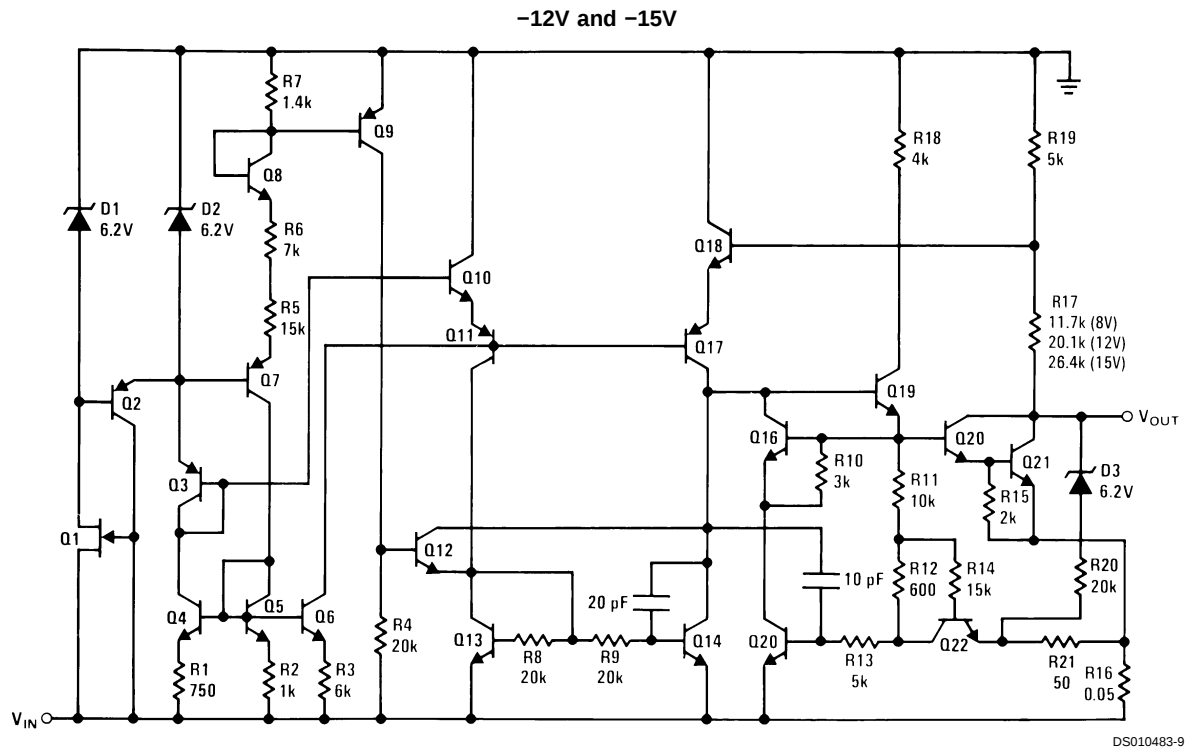
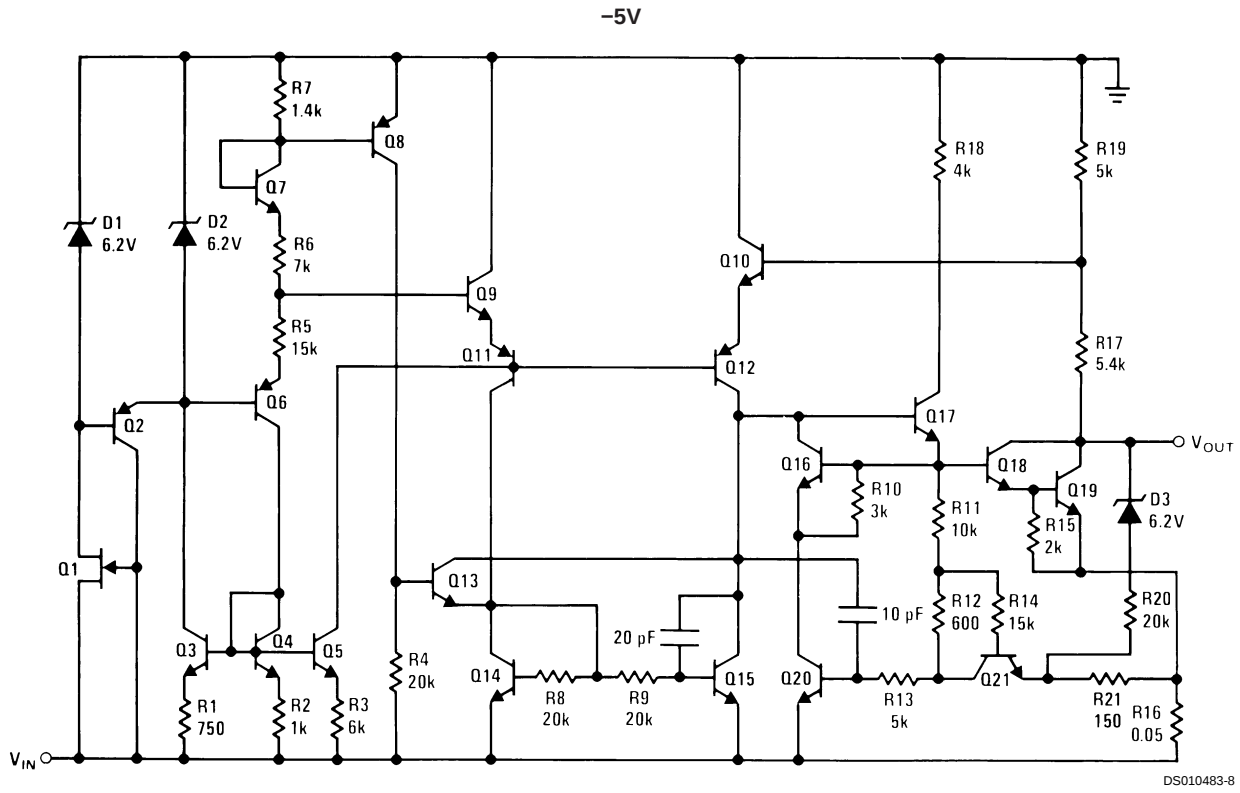
DS010483-17

Maximum Average Power Dissipation (TO-220)



DS010483-18

Schematic Diagrams



Design Considerations

The LM79MXX fixed voltage regulator series have thermal-overload protection from excessive power, internal short-circuit protection which limits the circuit's maximum current, and output transistor safe-area compensation for reducing the output current as the voltage across the pass transistor is increased.

Although the internal power dissipation is limited, the junction temperature must be kept below the maximum specified temperature in order to meet data sheet specifications. To calculate the maximum junction temperature or heat sink required, the following thermal resistance values should be used:

Package	θ_{JC} (°C/W)	θ_{JA} (°C/W)
TO-220	3	40

$$P_{D\text{MAX}} = \frac{T_{J\text{MAX}} - T_A}{\theta_{JC} + \theta_{CA}} \text{ or } \frac{T_{J\text{MAX}} - T_A}{\theta_{JA}} \text{ (Without a Heat Sink)} \quad (1)$$

$$\theta_{CA} = \theta_{CS} + \theta_{SA}$$

Solving for T_J :

$$T_J = T_A + P_D (\theta_{JC} + \theta_{CA}) \text{ or } T_A + P_D \theta_{JA} \text{ (Without a Heat Sink)}$$

Where

T_J = Junction Temperature

T_A = Ambient Temperature

P_D = Power Dissipation

θ_{JC} = Junction-to-Case Thermal Resistance

θ_{CA} = Case-to-Ambient Thermal Resistance

θ_{CS} = Case-to-Heat Sink Thermal Resistance

θ_{SA} = Heat Sink-to-Ambient Thermal Resistance

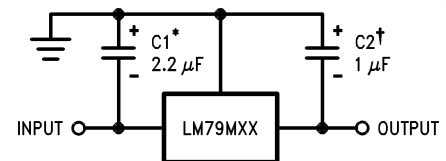
θ_{JA} = Junction-to-Ambient Thermal Resistance

Typical Applications

Bypass capacitors are necessary for stable operation of the LM79MXX series of regulators over the input voltage and output current ranges. Output bypass capacitors will improve the transient response of the regulator.

The bypass capacitors (2.2μF on the input, 1.0μF on the output), should be ceramic or solid tantalum which have good high frequency characteristics. If aluminum electrolytics are used, their values should be 10μF or larger. The bypass capacitors should be mounted with the shortest leads, and if possible, directly across the regulator terminals.

Fixed Regulator



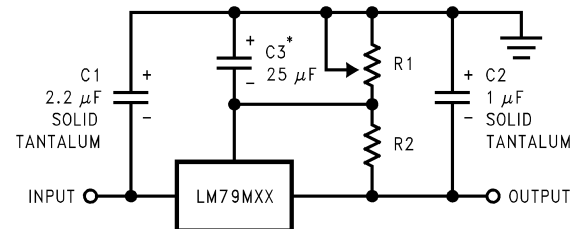
DS010483-2

*Required if regulator is separated from filter capacitor by more than 3". For value given, capacitor must be solid tantalum. 25μF aluminum electrolytic may be substituted.

†Required for stability. For value given, capacitor must be solid tantalum. 25μF aluminum electrolytic may be substituted. Values given may be increased without limit.

For output capacitance in excess of 100μF, a high current diode from input to output (1N4001, etc.) will protect the regulator from momentary input shorts.

Variable Output



DS010483-3

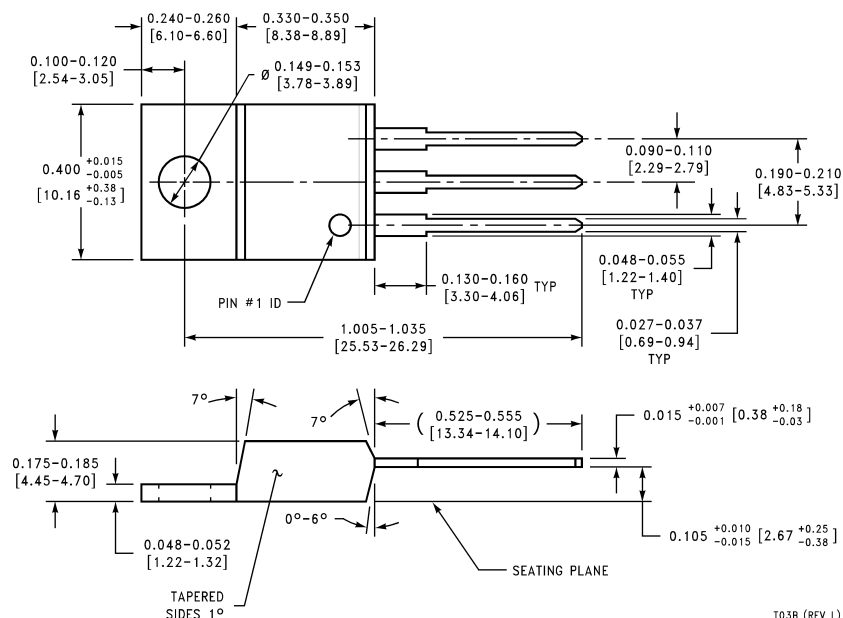
*Improves transient response and ripple rejection. Do not increase beyond 50μF.

$$V_{OUT} = V_{SET} \left(\frac{R1 + R2}{R2} \right)$$

Select R2 as follows:

LM79M05C	300Ω
LM79M12C	750Ω
LM79M15C	1k

Physical Dimensions inches (millimeters) unless otherwise noted



LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT AND GENERAL COUNSEL OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



National Semiconductor Corporation
Americas
Email: support@nsc.com

www.national.com

National Semiconductor Europe

Fax: +49 (0) 180-530 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 69 9508 6208
English Tel: +44 (0) 870 24 0 2171
Français Tel: +33 (0) 1 41 91 8790

National Semiconductor Asia Pacific Customer Response Group

Tel: 65-2544466
Fax: 65-2504466
Email: ap.support@nsc.com

National Semiconductor Japan Ltd.

Tel: 81-3-5639-7560
Fax: 81-3-5639-7507