

## LM79MXX Series 3-Terminal Negative Regulators

 Check for Samples: [LM79M05](#), [LM79M12](#), [LM79M15](#)

### FEATURES

- Thermal, Short Circuit and Safe Area Protection
- High Ripple Rejection
- 0.5A Output Current
- 4% Tolerance on Preset Output Voltage

### DESCRIPTION

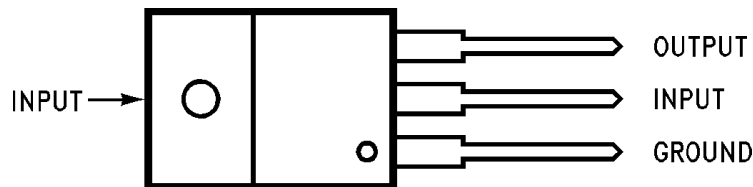
The LM79MXX series of 3-terminal regulators is available with fixed output voltages of  $-5V$ ,  $-12V$ , and  $-15V$ . These devices need only one external component—a compensation capacitor at the output. The LM79MXX series is packaged in the TO-220 power package, and is capable of supplying 0.5A of 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  $-57V$ .

### Connection Diagram



**Figure 1. TO-220 Plastic Package (NDE)  
Front View  
See Package Number NDE0003B**



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These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

### Absolute Maximum Ratings<sup>(1)(2)</sup>

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 <sup>(3)</sup>		Internally Limited
Operating Junction Temperature Range		0°C to +125°C
Storage Temperature Range		-65°C to +150°C
Lead Temperature (Soldering, 10 sec.)		230°C
ESD Susceptibility		TBD

- (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.
- (2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/Distributors for availability and specifications.
- (3) Refer to [Typical Performance Characteristics](#) and [Design Considerations](#) for details.

### Electrical Characteristics LM79M05C

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

Part Number		LM79M05C				Units
Output Voltage		-5V				
Input Voltage (Unless Otherwise Specified)		-10V				
Symbol	Parameter	Conditions	Min	Typ	Max	
$V_O$	Output Voltage	$T_J = 25^\circ C$	-4.8	-5.0	-5.2	V
		$5mA \leq I_{OUT} \leq 350mA$	-4.75		-5.25	V
$\Delta V_O$	Line Regulation	$T_J = 25^\circ C^{(1)}$	$(-25 \leq V_{IN} \leq -7)$			
				8	50	mV
			$(-25 \leq V_{IN} \leq -7)$			
$\Delta V_O$	Load Regulation	$T_J = 25^\circ C,^{(1)}$		2	30	mV
			$(-18 \leq V_{IN} \leq -8)$			
$\Delta V_O$	Load Regulation	$T_J = 25^\circ C,^{(1)}$		30	100	mV
			$5mA \leq I_{OUT} \leq 0.5A$			
$I_Q$	Quiescent Current	$T_J = 25^\circ C$		1	2	mA
$\Delta I_Q$	Quiescent Current Change	With Input Voltage			0.4	mA
			$(-25 \leq V_{IN} \leq -8)$			
		With Load, $5mA \leq I_{OUT} \leq 350mA$			0.4	mA
$V_n$	Output Noise Voltage	$T_A = 25^\circ C,$ $10Hz \leq f \leq 100Hz$		150		$\mu V$
	Ripple Rejection	$f = 120Hz$	54	66		dB
			$(-18 \leq V_{IN} \leq -8)$			
	Dropout Voltage	$T_J = 25^\circ C, I_{OUT} = 0.5A$		1.1		V
$I_{OMAX}$	Peak Output Current	$T_J = 25^\circ C$		800		mA
	Average Temperature Coefficient of Output Voltage	$I_{OUT} = 5mA,$ $0^\circ C \leq T_J \leq 100^\circ C$		-0.4		$mV/^\circ C$

- (1) 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.

**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	$T_J = 25^\circ\text{C}$	-11.5	-12.0	-12.5	-14.4	-15.0	-15.6	V
		$5\text{mA} \leq I_{OUT} \leq 350\text{mA}$	-11.4		-12.6	-14.25		-15.75	V
$\Delta V_O$	Line Regulation	$T_J = 25^\circ\text{C}$ <sup>(1)</sup>	$(-27 \leq V_{IN} \leq -14.5)$			$(-30 \leq V_{IN} \leq -10.5)$			
			5			80			mV
			$(-30 \leq V_{IN} \leq -14.5)$			$(-30 \leq V_{IN} \leq -17.5)$			
			3			50			mV
$\Delta V_O$	Load Regulation	$T_J = 25^\circ\text{C}$ <sup>(1)</sup> $5\text{mA} \leq I_{OUT} \leq 0.5\text{A}$	$(-25 \leq V_{IN} \leq -15)$			$(-28 \leq V_{IN} \leq -18)$			
			30			240			mV
$I_Q$	Quiescent Current	$T_J = 25^\circ\text{C}$		1.5	3		1.5	3	mA
$\Delta I_Q$	Quiescent Current Change	With Input Voltage				0.4			mA
			$(-30 \leq V_{IN} \leq -14.5)$			$(-30 \leq V_{IN} \leq -27)$			
		With Load, $5\text{mA} \leq I_{OUT} \leq 350\text{mA}$				0.4			mA
$V_n$	Output Noise Voltage	$T_A = 25^\circ\text{C}$ , $10\text{Hz} \leq f \leq 100\text{Hz}$	400			400			$\mu\text{V}$
			Ripple Rejection	$f = 120\text{Hz}$	54	70	54	70	
	Dropout Voltage	$T_J = 25^\circ\text{C}$ , $I_{OUT} = 0.5\text{A}$	$(-25 \leq V_{IN} \leq -15)$			$(-30 \leq V_{IN} \leq -17.5)$			
			1.1			1.1			V
$I_{OMAX}$	Peak Output Current	$T_J = 25^\circ\text{C}$	800			800			mA
	Average Temperature Coefficient of Output Voltage	$I_{OUT} = 5\text{mA}$ , $0^\circ\text{C} \leq T_J \leq 100^\circ\text{C}$	-0.8			-1.0			$\text{mV}/^\circ\text{C}$

(1) 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

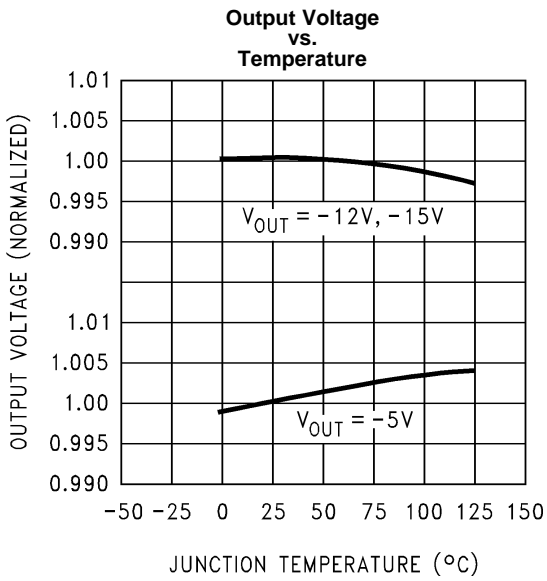


Figure 2.

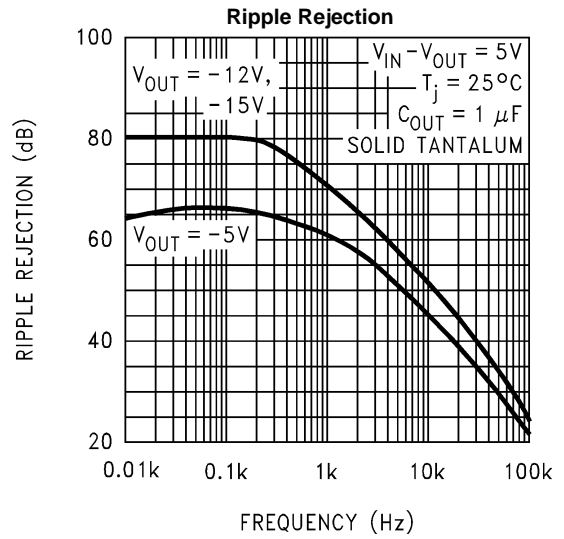


Figure 3.

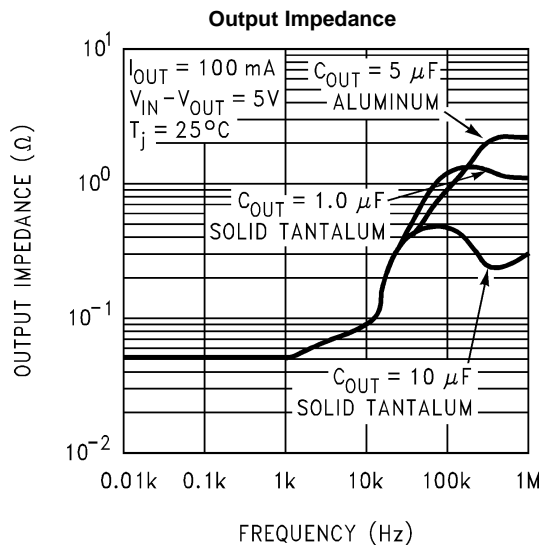


Figure 4.

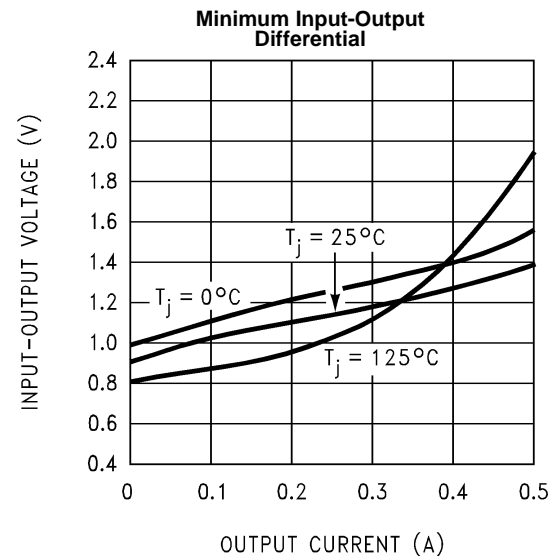


Figure 5.

Typical Performance Characteristics (continued)

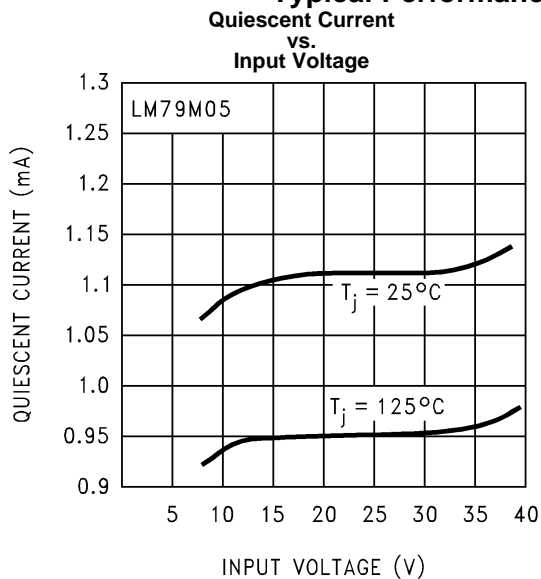


Figure 6.

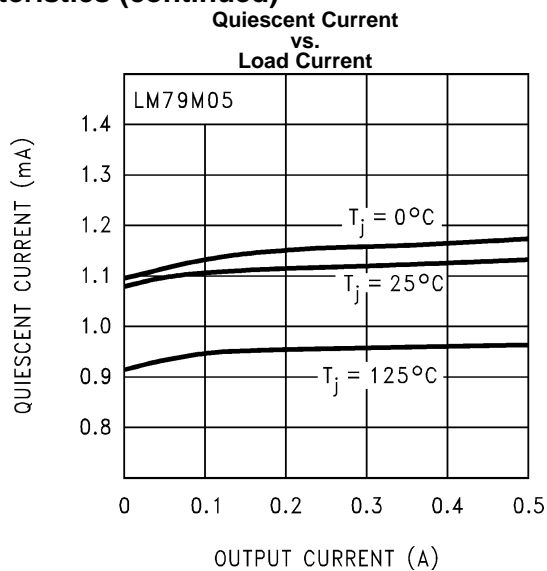


Figure 7.

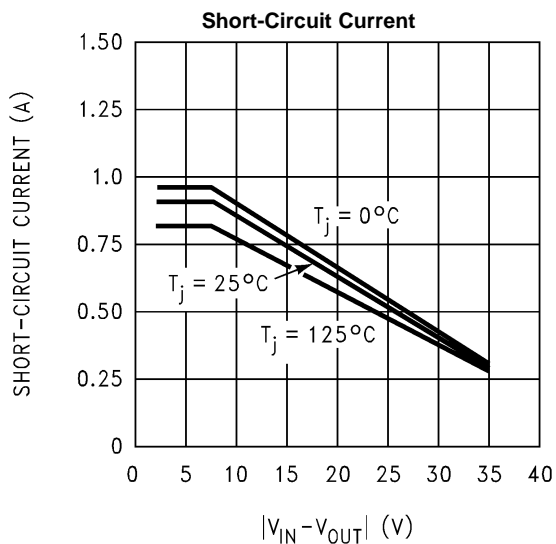


Figure 8.

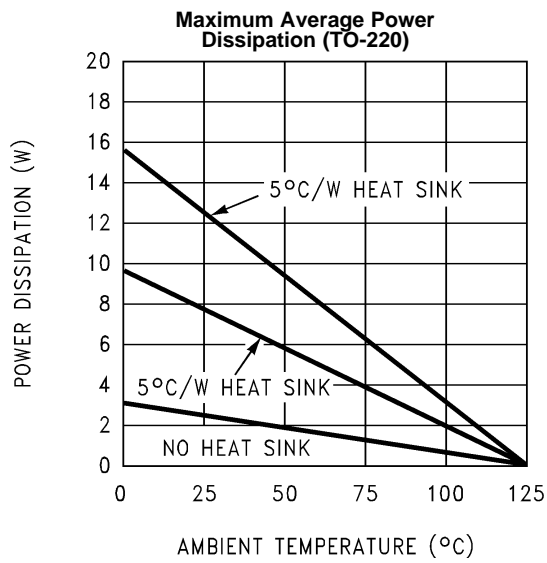


Figure 9.

Schematic Diagrams

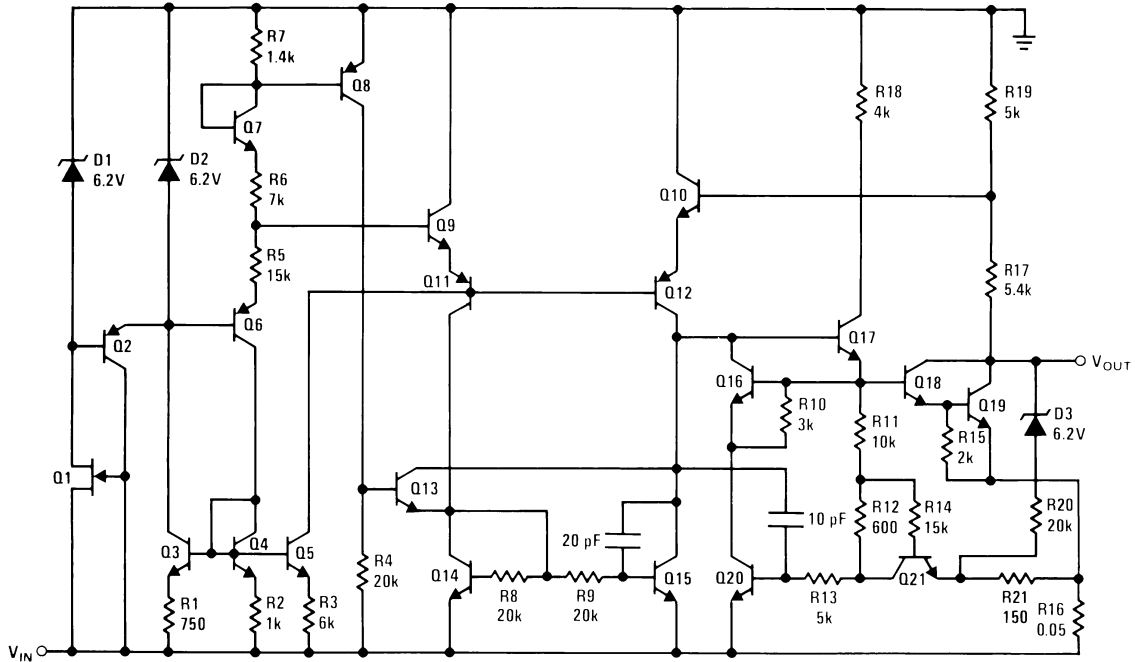


Figure 10. -5V

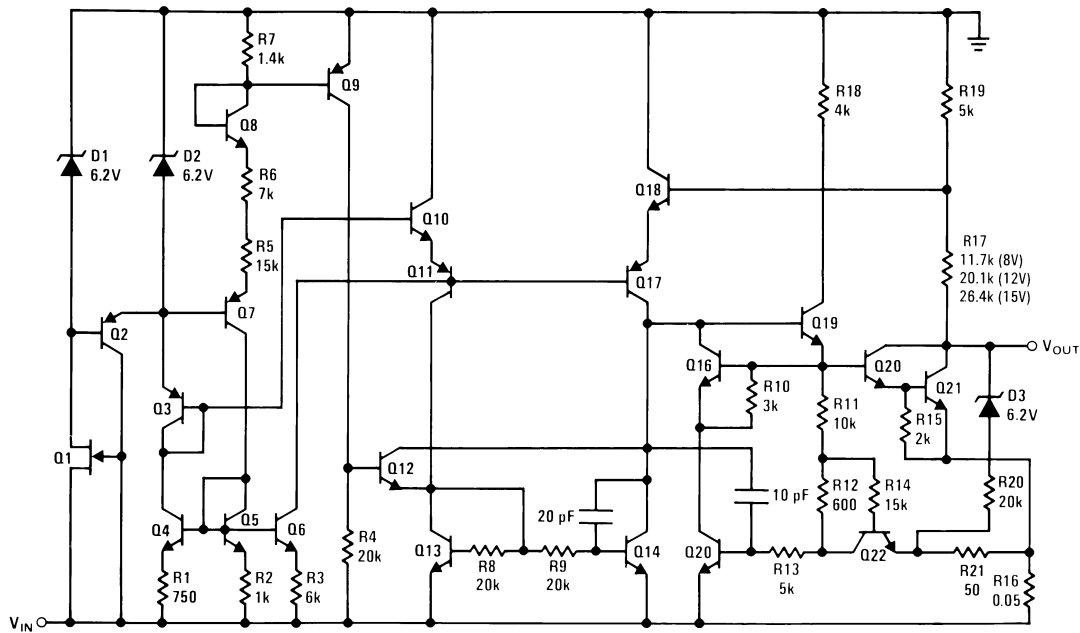


Figure 11. -12V and -15V

## 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	$\theta_{JC}$ (°C/W)	$\theta_{JA}$ (°C/W)
TO-220	3	40

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

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

Solving for  $T_J$ :

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

Where

$T_J$  = Junction Temperature

$T_A$  = Ambient Temperature

$P_D$  = Power Dissipation

$\theta_{JC}$  = Junction-to-Case Thermal Resistance

$\theta_{CA}$  = Case-to-Ambient Thermal Resistance

$\theta_{CS}$  = Case-to-Heat Sink Thermal Resistance

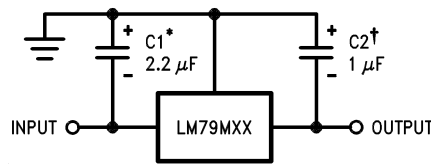
$\theta_{SA}$  = Heat Sink-to-Ambient Thermal Resistance

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

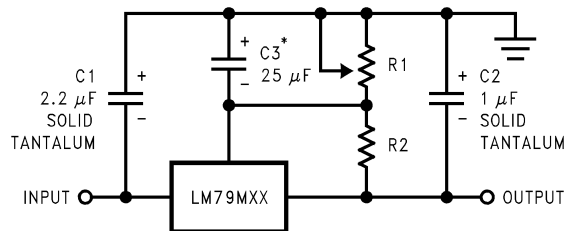


\*Required if regulator is separated from filter capacitor by more than 3". For value given, capacitor must be solid tantalum. 25μF aluminum electrolytic may be substituted.

†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.

Figure 12. Fixed Regulator



\*Improves transient response and ripple rejection.

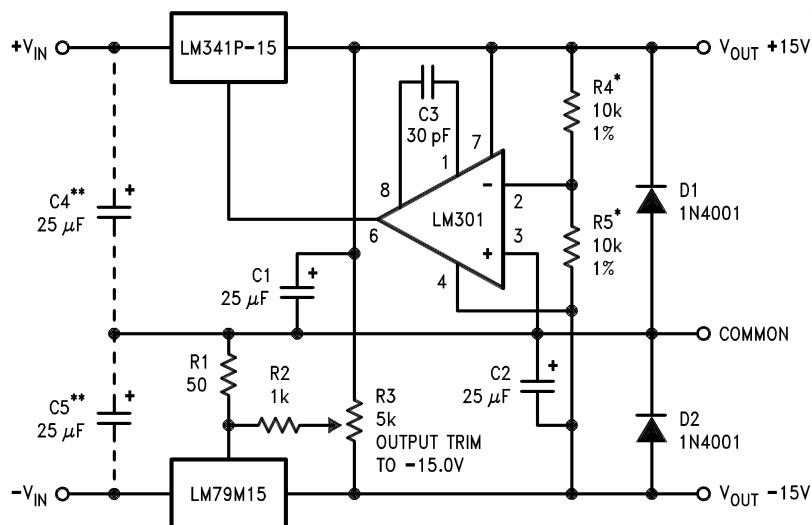
Do not increase beyond 50μF.

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

Select R2 as follows:

LM79M05C	300Ω
LM79M12C	750Ω
LM79M15C	1k

Figure 13. Variable Output



\*Resistor tolerance of R4 and R5 determine matching of (+) and (-) outputs.

\*\*Necessary only if raw supply filter capacitors are more than 3" from regulators.

Figure 14. ±15V, 1 Amp Tracking Regulators



	Performance (Typical)	
	(-15)	(+15)
Load Regulation at 0.5A	40mV	2 mV
Output Ripple, $C_{IN} = 3000\mu\text{F}$ , $I_L = 0.5\text{A}$	100 $\mu\text{Vrms}$	100 $\mu\text{Vrms}$
Temperature Stability	50mV	50mV
Output Noise $10\text{Hz} \leq f \leq 10\text{kHz}$	150 $\mu\text{Vrms}$	150 $\mu\text{Vrms}$

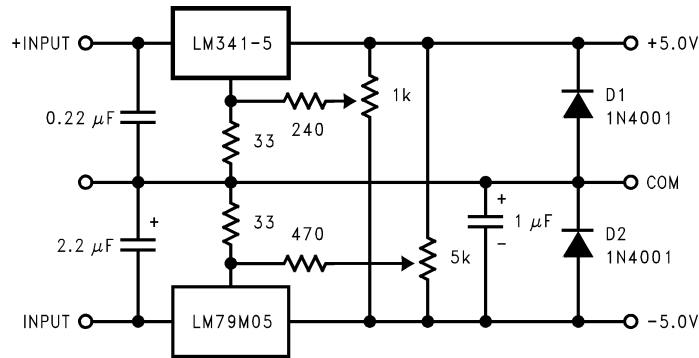


Figure 15. Dual Trimmed Supply

## REVISION HISTORY

Changes from Revision C (April 2013) to Revision D	Page
• Changed layout of National Data Sheet to TI format .....	<a href="#">9</a>

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM79M12CT	NRND	TO-220	NDE	3	45	TBD	Call TI	Call TI	0 to 125	LM79M 12CT	
LM79M12CT/NOPB	ACTIVE	TO-220	NDE	3	45	Green (RoHS & no Sb/Br)	CU SN	Level-1-NA-UNLIM	0 to 125	LM79M 12CT	Samples

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSELETE:** TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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