

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

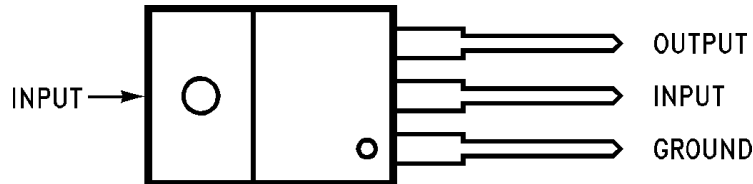


Figure 1. TO-220 Plastic Package (NDE)
Front View
See Package Number NDE0003B



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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⁽¹⁾⁽²⁾

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 ⁽³⁾		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
ΔV_O	Line Regulation	$T_J = 25^\circ C$ ⁽¹⁾	$(-25 \leq V_{IN} \leq -7)$			
				8	50	mV
			$(-25 \leq V_{IN} \leq -7)$			
ΔV_O	Load Regulation	$T_J = 25^\circ C$ ⁽¹⁾		2	30	mV
			$(-18 \leq V_{IN} \leq -8)$			
ΔV_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
ΔI_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		μV
	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/°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
ΔV_O	Line Regulation	$T_J = 25^\circ\text{C}$ ⁽¹⁾	$(-27 \leq V_{IN} \leq -14.5)$			$(-30 \leq V_{IN} \leq -10.5)$			
			5			80			mV
			$(-30 \leq V_{IN} \leq -14.5)$			$(-30 \leq V_{IN} \leq -17.5)$			
			3			50			mV
ΔV_O	Load Regulation	$T_J = 25^\circ\text{C}$ ⁽¹⁾ $5\text{mA} \leq I_{OUT} \leq 0.5\text{A}$	$(-25 \leq V_{IN} \leq -15)$			$(-28 \leq V_{IN} \leq -18)$			
			30			240			mV
I_Q	Quiescent Current	$T_J = 25^\circ\text{C}$		1.5	3		1.5	3	mA
ΔI_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			μV
			Ripple Rejection	$f = 120\text{Hz}$	54	70	54	70	
			$(-25 \leq V_{IN} \leq -15)$			$(-30 \leq V_{IN} \leq -17.5)$			
	Dropout Voltage	$T_J = 25^\circ\text{C}$, $I_{OUT} = 0.5\text{A}$	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

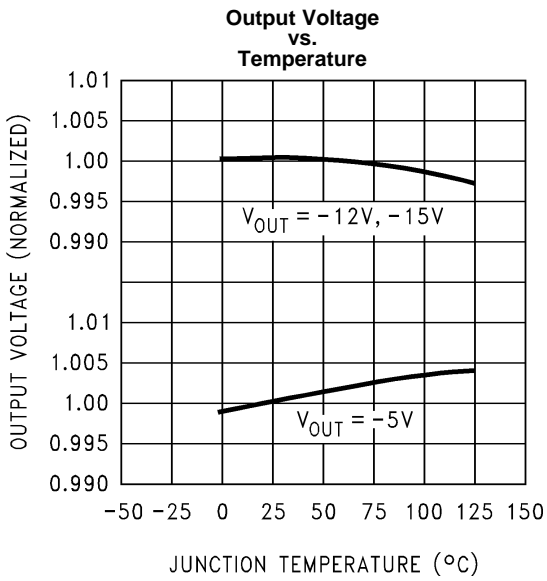


Figure 2.

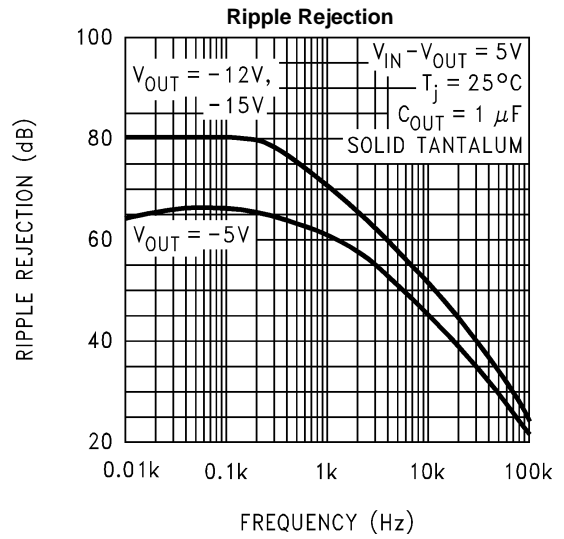


Figure 3.

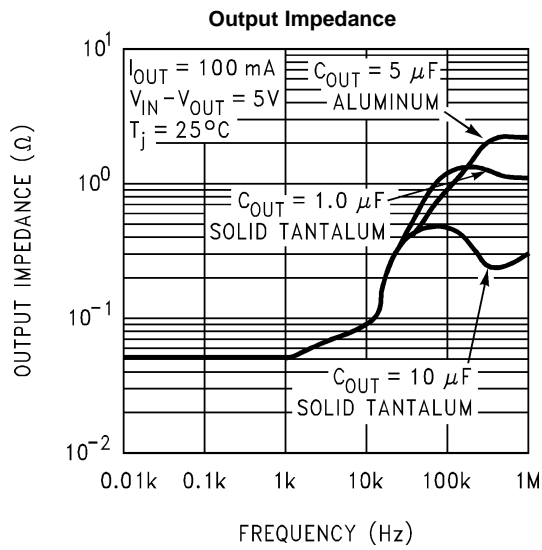


Figure 4.

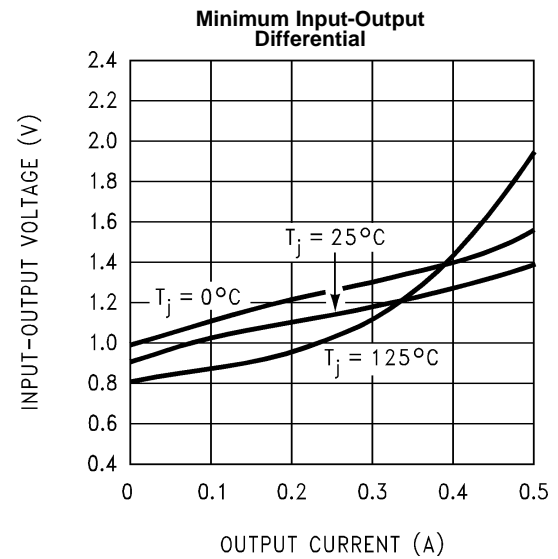
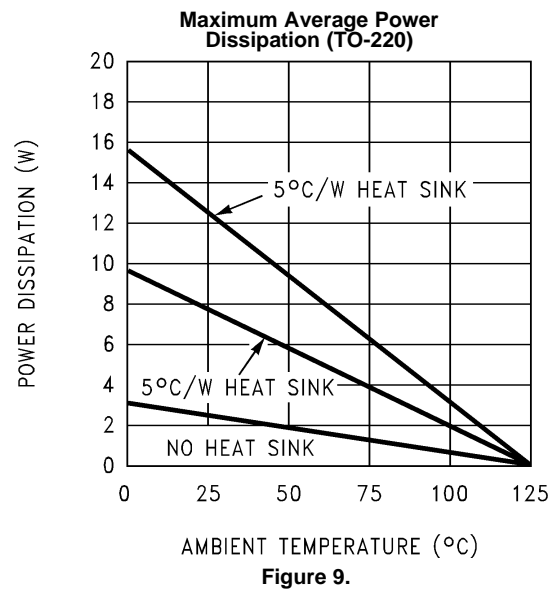
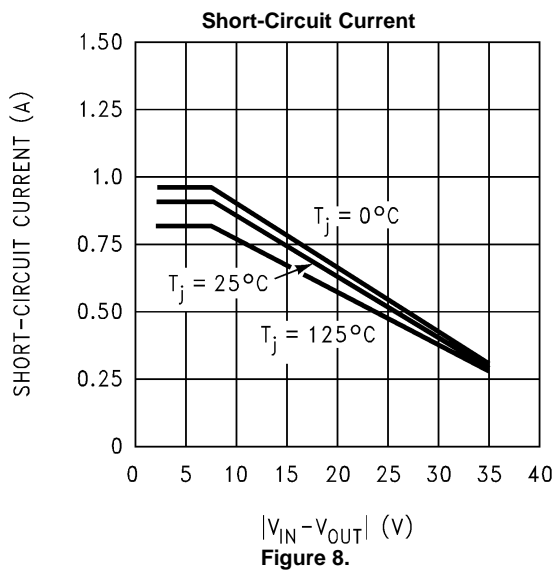
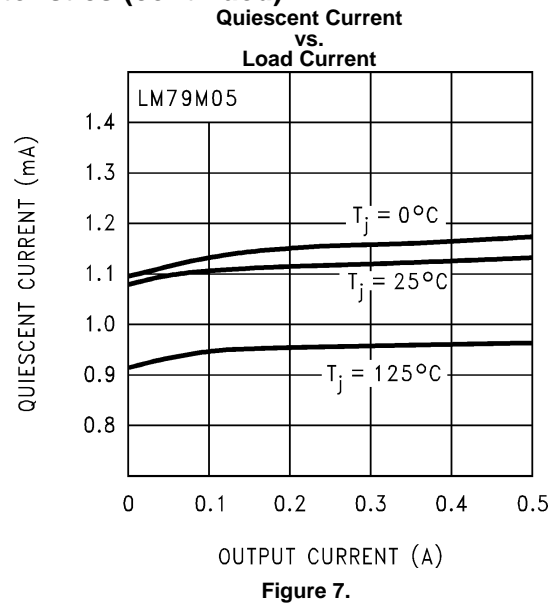
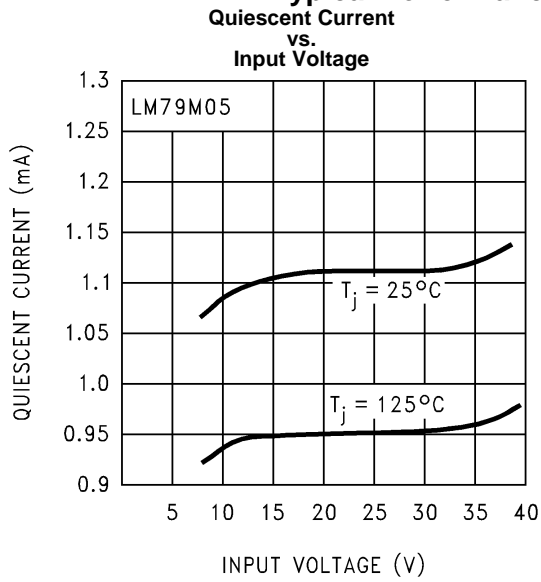


Figure 5.

Typical Performance Characteristics (continued)



Schematic Diagrams

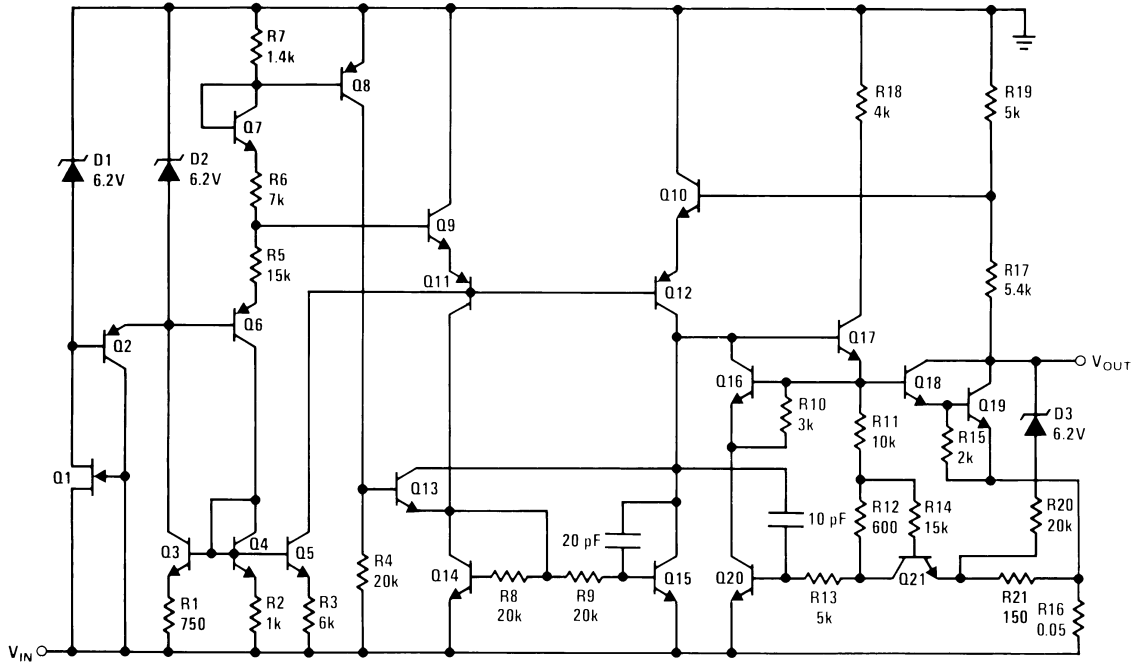


Figure 10. -5V

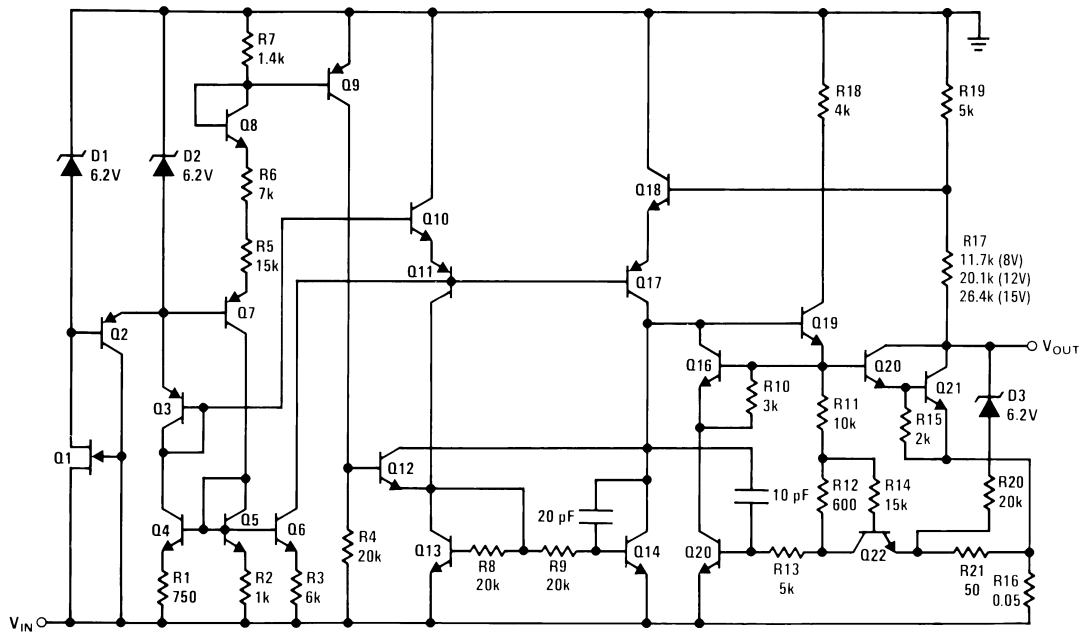


Figure 11. -12V and -15V

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	θ_{JC} (°C/W)	θ_{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

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

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

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

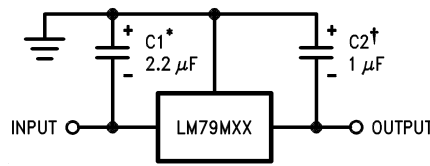
θ_{SA} = Heat Sink-to-Ambient Thermal Resistance

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 (2.2 μ F on the input, 1.0 μ 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 μ F or larger. The bypass capacitors should be mounted with the shortest leads, and if possible, directly across the regulator terminals.

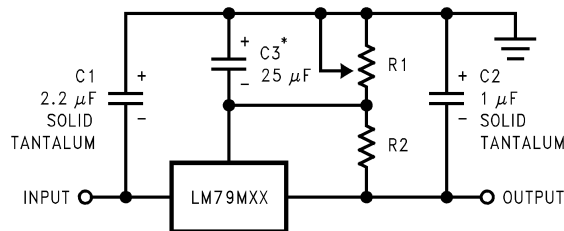


*Required if regulator is separated from filter capacitor by more than 3". For value given, capacitor must be solid tantalum. 25μF aluminum electrolytic may be substituted.

†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.

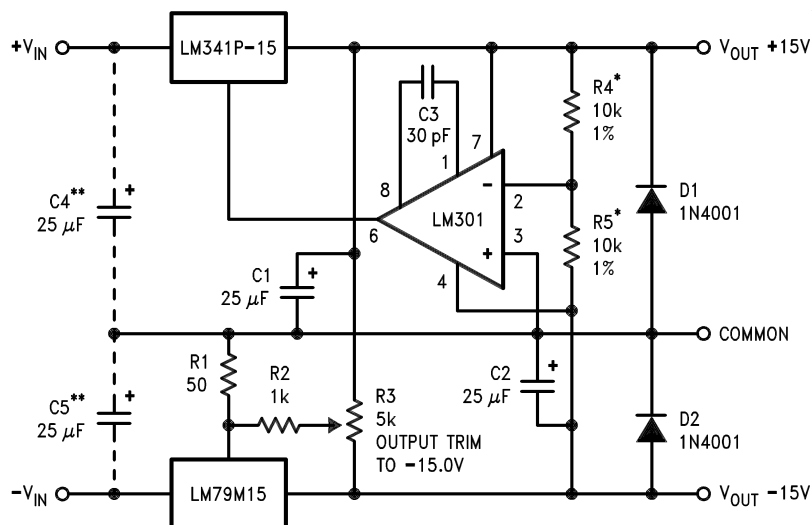
Do not increase beyond 50μF.

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

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 μVrms	100 μVrms
Temperature Stability	50mV	50mV
Output Noise $10\text{Hz} \leq f \leq 10\text{kHz}$	150 μVrms	150 μVrms

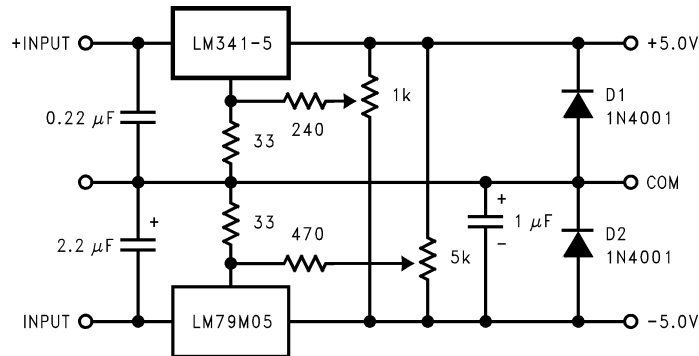


Figure 15. Dual Trimmed Supply

REVISION HISTORY

Changes from Revision C (April 2013) to Revision D	Page
• Changed layout of National Data Sheet to TI format	9

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