

## 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

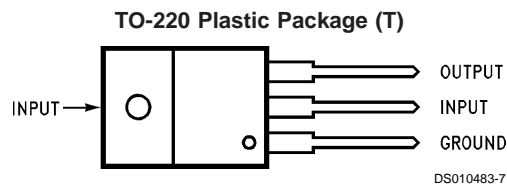
a resistor divider. The low quiescent current of these devices with a specified maximum change with line and load ensures good regulation in the voltage boosted mode.

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°C to +125°C      |
| Storage Temperature Range             | -65°C to +150°C    |
| Lead Temperature (Soldering, 10 sec.) | 230°C              |
| ESD Susceptibility                    | TBD                |

**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                                   | $T_J = 25^\circ C$ (Note 3)                                   |       |                             |                             |         |
|  |   |   |       | 8                           | 50                          | mV      |
|  |   |   |       | $(-25 \leq V_{IN} \leq -7)$ |                             |         |
| $\Delta V_O$                               | Load Regulation                                   | $T_J = 25^\circ C$ , (Note 3)<br>$5mA \leq I_{OUT} \leq 0.5A$ |       |                             |                             |         |
|  |   |   |       | 2                           | 30                          | mV      |
|  |   |   |       | $(-18 \leq V_{IN} \leq -8)$ |                             |         |
| $\Delta V_O$                               | Load Regulation                                   | $T_J = 25^\circ C$ , (Note 3)<br>$5mA \leq I_{OUT} \leq 0.5A$ |       | 30                          | 100                         | mV      |
| $I_Q$                                      | Quiescent Current                                 | $T_J = 25^\circ C$  |       | 1                           | 2                           | mA      |
| $\Delta I_Q$                               | Quiescent Current Change                          | With Input Voltage  |       |                             | 0.4                         | mA      |
|  |   | With Load,<br>$5mA \leq I_{OUT} \leq 350mA$                   |       |                             | 0.4                         | mA      |
| $V_n$                                      | Output Noise Voltage                              | $T_A = 25^\circ C$ ,<br>$10Hz \leq f \leq 100Hz$              |       | 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 | $I_{OUT} = 5mA$ ,<br>$0^\circ C \leq T_J \leq 100^\circ C$    |       | -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                                    | $T_J = 25^\circ\text{C}$  | -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                                   | $T_J = 25^\circ\text{C}$ (Note 3)   |          | 5     | 80    |          | 5     | 80     | mV                         |    |
|  |   |   |          |       |       |          |       |        |                            | mV |
|  |   |   |          |       |       |          |       |        |                            | mV |
| $\Delta V_O$                               | Load Regulation                                   | $T_J = 25^\circ\text{C}$ , (Note 3)<br>$5\text{mA} \leq I_{OUT} \leq 0.5\text{A}$ |          | 30    | 240   |          | 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   |          |       | 0.4    | mA                         |    |
|  |   | With Load,<br>$5\text{mA} \leq I_{OUT} \leq 350\text{mA}$                         |          |       | 0.4   |          |       | 0.4    | mA                         |    |
| $V_n$                                      | Output Noise Voltage                              | $T_A = 25^\circ\text{C}$ ,<br>$10\text{Hz} \leq f \leq 100\text{Hz}$              |          | 400   |       |          | 400   |        | $\mu\text{V}$              |    |
|  | Ripple Rejection                                  | $f = 120\text{Hz}$  | 54       | 70    |       | 54       | 70    |        | dB                         |    |
|  | 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 | $I_{OUT} = 5\text{mA}$ ,<br>$0^\circ\text{C} \leq T_J \leq 100^\circ\text{C}$     |          | -0.8  |       |          | -1.0  |        | $\text{mV}/^\circ\text{C}$ |    |

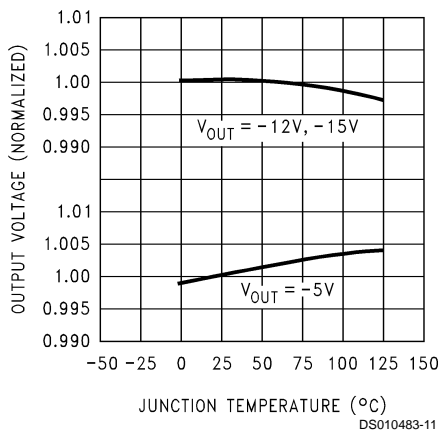
**Note 1:** Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical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

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

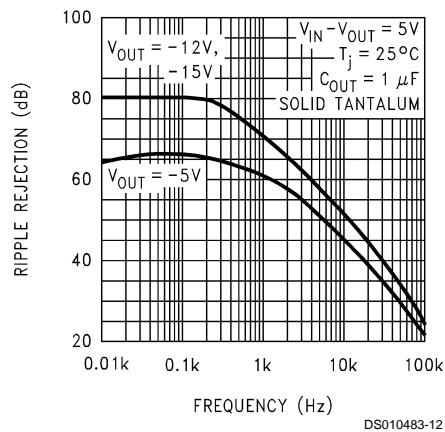
**Note 3:** Regulation is measured at a constant junction temperature by pulse testing with a low duty cycle. Changes in output voltage due to heating effects must be taken into account.

## Typical Performance Characteristics

Output Voltage vs. Temperature

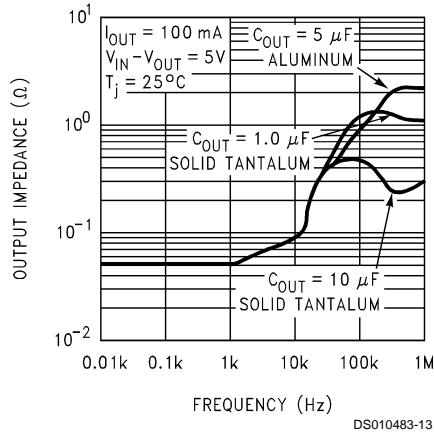


Ripple Rejection

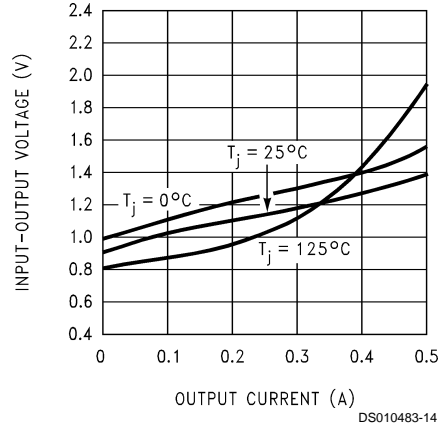


# Typical Performance Characteristics (Continued)

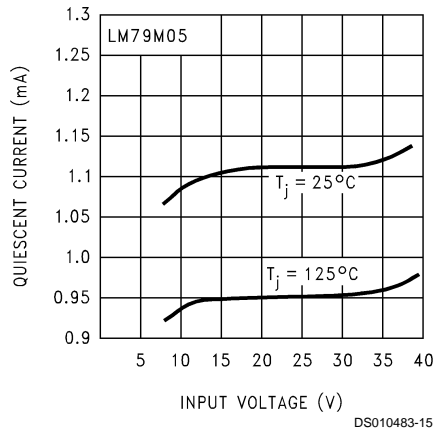
**Output Impedance**



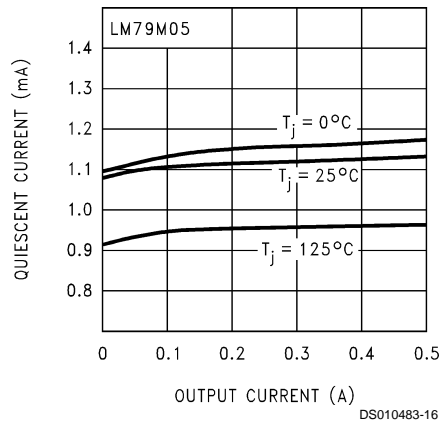
**Minimum Input-Output Differential**



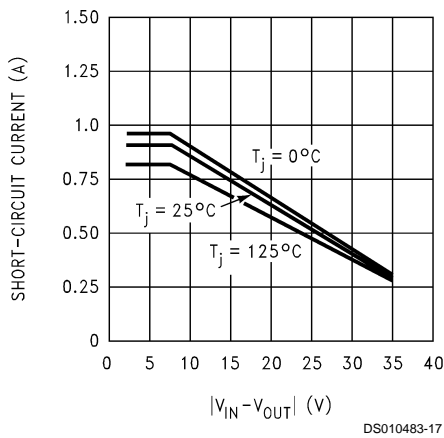
**Quiescent Current vs. Input Voltage**



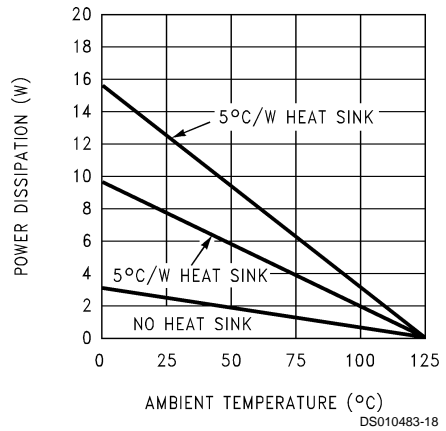
**Quiescent Current vs. Load Current**



**Short-Circuit Current**

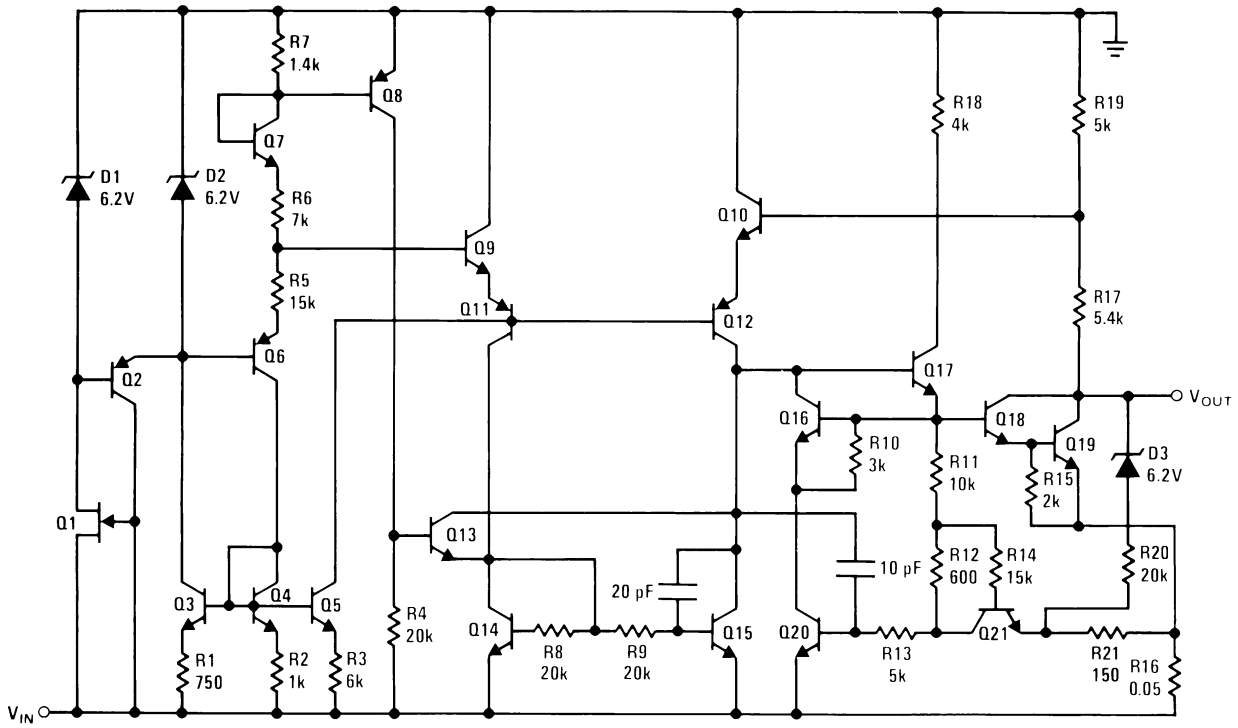


**Maximum Average Power Dissipation (TO-220)**

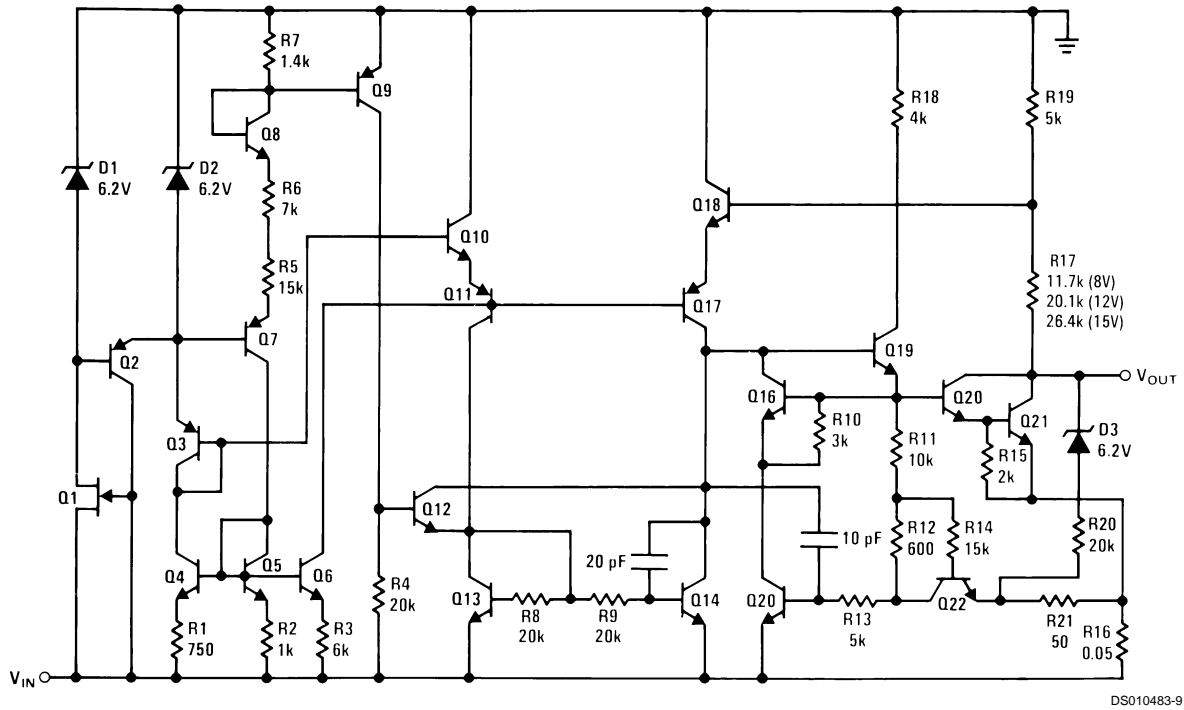


Schematic Diagrams

-5V



-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 | $\theta_{JC}$<br>(°C/W) | $\theta_{JA}$<br>(°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

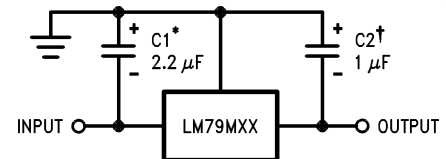
- $T_J$  = Junction Temperature
- $T_A$  = Ambient Temperature
- $P_D$  = Power Dissipation
- $\theta_{JC}$  = Junction-to-Case Thermal Resistance
- $\theta_{CA}$  = Case-to-Ambient Thermal Resistance
- $\theta_{CS}$  = Case-to-Heat Sink Thermal Resistance
- $\theta_{SA}$  = Heat Sink-to-Ambient Thermal 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.

### Fixed Regulator



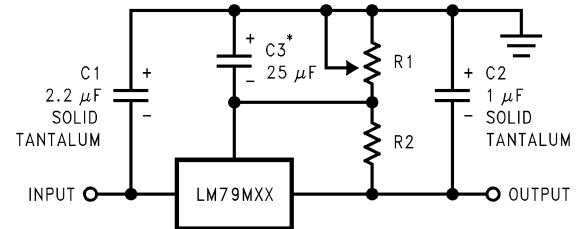
DS010483-2

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

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

For output capacitance in excess of 100 $\mu$ F, 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 50 $\mu$ F.

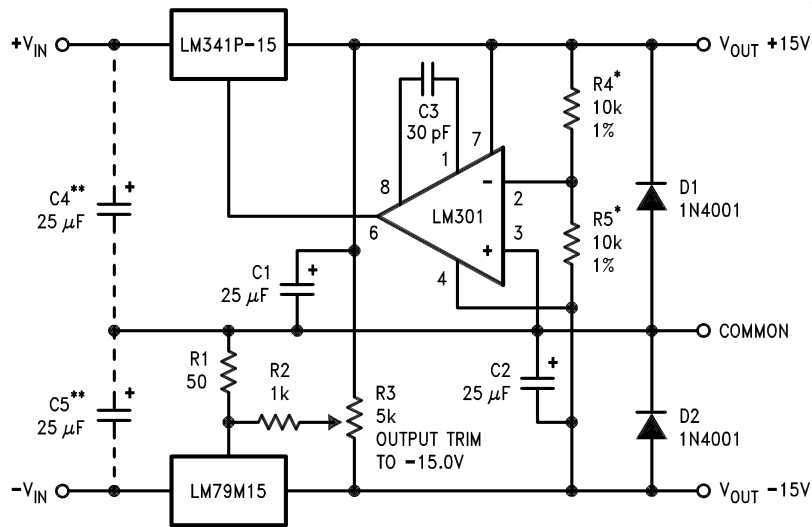
$$V_{OUT} = V_{SET} \left( \frac{R1 + R2}{R2} \right)$$

Select R2 as follows:

|          |              |
|----------|--------------|
| LM79M05C | 300 $\Omega$ |
| LM79M12C | 750 $\Omega$ |
| LM79M15C | 1k           |

## Typical Applications (Continued)

**±15V, 1 Amp Tracking Regulators**



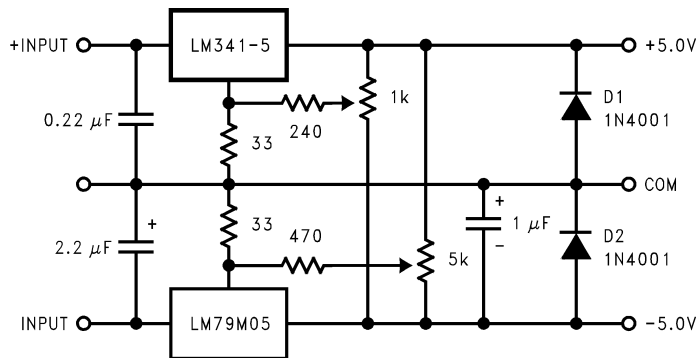
DS010483-1

\*Resistor tolerance of R4 and R5 determine matching of (+) and (-) outputs.  
 \*\*Necessary only if raw supply filter capacitors are more than 3" from regulators.

**Performance (Typical)**

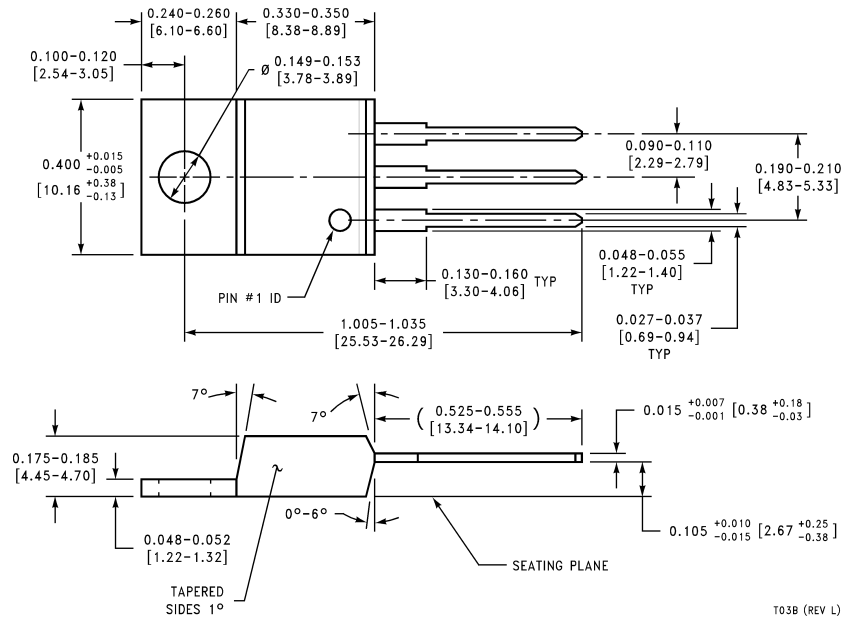
|  | (-15)             | (+15)             |
|--|-------------------|-------------------|
| Load Regulation at 0.5A                            | 40mV              | 2 mV              |
| Output Ripple, $C_{IN} = 3000\mu F$ , $I_L = 0.5A$ | 100 $\mu V_{rms}$ | 100 $\mu V_{rms}$ |
| Temperature Stability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

**Dual Trimmed Supply**



DS010483-4

**Physical Dimensions** inches (millimeters) unless otherwise noted



**TO-220 Plastic Package (T)**  
**Order Number LM79M05CT, LM79M12CT or LM79M15CT**  
**NS Package Number T03B**

T03B (REV L)

**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



Find price and stock options from leading distributors for LM79M05 on Findchips.com:

<https://findchips.com/search/LM79M05>

Find CAD models and details for this part:

<https://findchips.com/detail/lm79m05/National-Semiconductor-Corporation>