

## LM320L/LM79LXXAC/LM13121 Series 3-Terminal Negative Regulators

### General Description

The LM320L/LM79LXXAC/LM13121 dual marked series of 3-terminal negative voltage regulators features fixed output voltages of  $-5V$ ,  $-12V$ , and  $-15V$  with output current capabilities in excess of 100mA. These devices were designed using the latest computer techniques for optimizing the packaged IC thermal/electrical performance. The LM79LXXAC series, even when combined with a minimum output compensation capacitor of  $0.1\mu F$ , exhibits an excellent transient response, a maximum line regulation of  $0.07\% V_O/V$ , and a maximum load regulation of  $0.01\% V_O/mA$ .

The LM320L/LM79LXXAC/LM13121 series also includes, as self-protection circuitry: safe operating area circuitry for output transistor power dissipation limiting, a temperature independent short circuit current limit for peak output current limiting, and a thermal shutdown circuit to prevent excessive junction temperature. Although designed primarily as fixed voltage regulators, these devices may be combined with simple external circuitry for boosted and/or adjustable voltages and currents. The LM79LXXAC series is available in

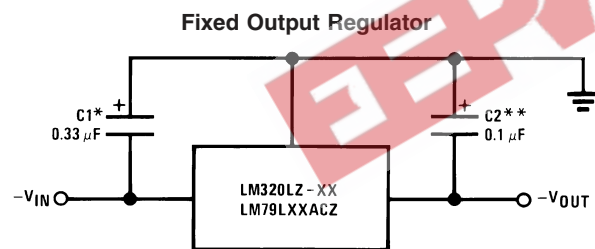
the 3-lead TO-92 package, 8-lead SOIC package, and the 6-Bump micro SMD package. The LM320L series is available in the 3-lead TO-92 package.

For output voltage other than  $-5V$ ,  $-12V$  and  $-15V$ , the LM137L series provides an output voltage range from 1.2V to 47V.

### Features

- Preset output voltage error is less than  $\pm 5\%$  overload, line and temperature
- Specified at an output current of 100mA
- Easily compensated with a small  $0.1\mu F$  output capacitor
- Internal short-circuit, thermal and safe operating area protection
- Easily adjustable to higher output voltages
- Maximum line regulation less than  $0.07\% V_{OUT}/V$
- Maximum load regulation less than  $0.01\% V_{OUT}/mA$
- See AN-1112 for micro SMD considerations

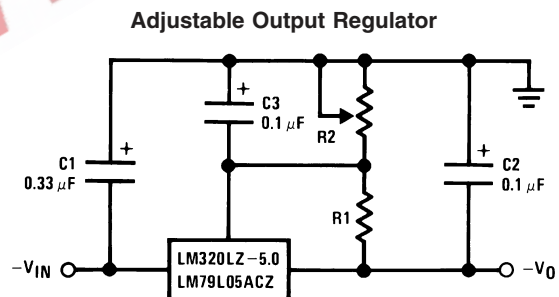
### Typical Applications



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\*Required if the regulator is located far from the power supply filter. A  $1\mu F$  aluminum electrolytic may be substituted.

\*\*Required for stability. A  $1\mu F$  aluminum electrolytic may be substituted.



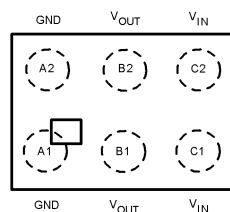
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$$-V_O = -5V - (5V/R_1 + I_Q) \cdot R_2$$

$$5V/R_1 > 3 I_Q$$

### Connection Diagrams

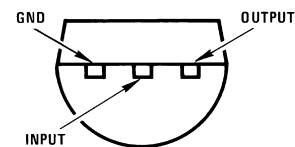
#### 6-Bump micro SMD



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**Bump Side Down**

#### TO-92 Plastic Package (Z)

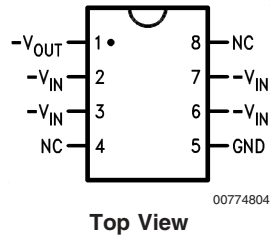


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**Bottom View**

## Connection Diagrams (Continued)

SO-8 Plastic (Narrow Body)



## Ordering Information

| Package             | Part Number  | Package Marking | Transport Media          | NSC Drawing |
|---------------------|--------------|-----------------|--------------------------|-------------|
| 8-Lead SOIC         | LM79L05ACM   | LM79L05ACM      | 95 Units/Rail            | M08A        |
|                     | LM79L05ACMX  |                 | 2.5k Units Tape and Reel |             |
|                     | LM79L13ACM   | LM79L12ACM      | 95 Units/Rail            |             |
|                     | LM79L13ACMX  |                 | 2.5k Units Tape and Reel |             |
|                     | LM79L15ACM   | LM79L15ACM      | 95 Units/Rail            |             |
|                     | LM79L15ACMX  |                 | 2.5k Units Tape and Reel |             |
| 3-Pin TO-92         | LM13121Z-5.0 | 320L79L05       | 1800 Units Per Box       | Z03A        |
|                     | LM13121Z-12  | 320L79L12       | 1800 Units Per Box       |             |
|                     | LM13121Z-15  | 320L79L15       | 1800 Units Per Box       |             |
| 6-Bump<br>micro SMD | LM79L05ACTL  | XTPB            | 250 Units Tape and Reel  | TLA06AMA    |
|                     | LM79L05ACTLX |                 | 3k Units Tape and Reel   |             |

**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

$$V_O = -5V, -12V, -15V \quad -35V$$

Internal Power Dissipation (Note 2) Internally Limited

Operating Temperature Range

0°C to +70°C

Maximum Junction Temperature

+125°C

Storage Temperature Range

-55°C to +150°C

Lead Temperature

(Soldering, 10 sec.)

260°C

**Electrical Characteristics** (Note 3)T<sub>A</sub> = 0°C to +70°C unless otherwise noted.

| Output Voltage                         |  |   | -5V                            |     |       | -12V                            |     |       | -15V                            |     |        | Units   |
|--|--|---|--------------------------------|-----|-------|---------------------------------|-----|-------|---------------------------------|-----|--------|---------|
| Input Voltage (unless otherwise noted) |  |   | -10V                           |     |       | -17V                            |     |       | -20V                            |     |        |         |
| Symbol                                 | Parameter  | Conditions  | Min                            | Typ | Max   | Min                             | Typ | Max   | Min                             | Typ | Max    |         |
| V <sub>O</sub>                         | Output Voltage                                     | T <sub>J</sub> = 25°C, I <sub>O</sub> = 100mA         | -5.2                           | -5  | -4.8  | -12.5                           | -12 | -11.5 | -15.6                           | -15 | -14.4  | V       |
|  |  | 1mA ≤ I <sub>O</sub> ≤ 100mA                          | -5.25                          |     | -4.75 | -12.6                           |     | -11.4 | -15.75                          |     | -14.25 |         |
|  |  | V <sub>MIN</sub> ≤ V <sub>IN</sub> ≤ V <sub>MAX</sub> | (-20 ≤ V <sub>IN</sub> ≤ -7.5) |     |       | (-27 ≤ V <sub>IN</sub> ≤ -14.8) |     |       | (-30 ≤ V <sub>IN</sub> ≤ -18)   |     |        |         |
|  |  | 1mA ≤ I <sub>O</sub> ≤ 40mA                           | -5.25                          |     | -4.75 | -12.6                           |     | -11.4 | -15.75                          |     | -14.25 |         |
|  |  | V <sub>MIN</sub> ≤ V <sub>IN</sub> ≤ V <sub>MAX</sub> | (-20 ≤ V <sub>IN</sub> ≤ -7)   |     |       | (-27 ≤ V <sub>IN</sub> ≤ -14.5) |     |       | (-30 ≤ V <sub>IN</sub> ≤ -17.5) |     |        |         |
| ΔV <sub>O</sub>                        | Line Regulation                                    | T <sub>J</sub> = 25°C, I <sub>O</sub> = 100mA         |                                |     | 60    |                                 |     | 45    |                                 |     | 45     | mV      |
|  |  | V <sub>MIN</sub> ≤ V <sub>IN</sub> ≤ V <sub>MAX</sub> | (-20 ≤ V <sub>IN</sub> ≤ -7.3) |     |       | (-27 ≤ V <sub>IN</sub> ≤ -14.6) |     |       | (-30 ≤ V <sub>IN</sub> ≤ -17.7) |     |        | V       |
|  |  | T <sub>J</sub> = 25°C, I <sub>O</sub> = 40mA          |                                |     | 60    |                                 |     | 45    |                                 |     | 45     | mV      |
|  |  | V <sub>MIN</sub> ≤ V <sub>IN</sub> ≤ V <sub>MAX</sub> | (-20 ≤ V <sub>IN</sub> ≤ -7)   |     |       | (-27 ≤ V <sub>IN</sub> ≤ -14.5) |     |       | (-30 ≤ V <sub>IN</sub> ≤ -17.5) |     |        | V       |
| ΔV <sub>O</sub>                        | Load Regulation                                    | T <sub>J</sub> = 25°C                                 |                                |     | 50    |                                 |     | 100   |                                 |     | 125    | mV      |
|  |  | 1mA ≤ I <sub>O</sub> ≤ 100mA                          |                                |     |       |                                 |     |       |                                 |     |        |         |
| ΔV <sub>O</sub>                        | Long Term Stability                                | I <sub>O</sub> = 100mA                                |                                | 20  |       |                                 | 48  |       |                                 | 60  |        | mV/khrs |
| I <sub>O</sub>                         | Quiescent Current                                  | I <sub>O</sub> = 100mA                                |                                | 2   | 6     |                                 | 2   | 6     |                                 | 2   | 6      | mA      |
| ΔI <sub>O</sub>                        | Quiescent Current Change                           | 1mA ≤ I <sub>O</sub> ≤ 100mA                          |                                |     | 0.3   |                                 |     | 0.3   |                                 |     | 0.3    |         |
|  |  | 1mA ≤ I <sub>O</sub> ≤ 40mA                           |                                |     | 0.1   |                                 |     | 0.1   |                                 |     | 0.1    | mA      |
|  |  | I <sub>O</sub> = 100mA                                |                                |     | 0.25  |                                 |     | 0.25  |                                 |     | 0.25   | mA      |
|  |  | V <sub>MIN</sub> ≤ V <sub>IN</sub> ≤ V <sub>MAX</sub> | (-20 ≤ V <sub>IN</sub> ≤ -7.5) |     |       | (-27 ≤ V <sub>IN</sub> ≤ -14.8) |     |       | (-30 ≤ V <sub>IN</sub> ≤ -18)   |     |        | V       |
| V <sub>n</sub>                         | Output Noise Voltage                               | T <sub>J</sub> = 25°C, I <sub>O</sub> = 100mA         |                                | 40  |       |                                 | 96  |       |                                 | 120 |        | μV      |
|  |  | f = 10Hz – 10kHz                                      |                                |     |       |                                 |     |       |                                 |     |        |         |
| $\frac{\Delta V_{IN}}{\Delta V_O}$     | Ripple Rejection                                   | T <sub>J</sub> = 25°C, I <sub>O</sub> = 100mA         | 50                             |     |       | 52                              |     |       | 50                              |     |        | dB      |
|  |  | f = 120Hz   |                                |     |       |                                 |     |       |                                 |     |        |         |
|  | Input Voltage Required to Maintain Line Regulation | T <sub>J</sub> = 25°C, I <sub>O</sub> = 100mA         |                                |     | -7.3  |                                 |     | -14.6 |                                 |     | -17.7  | V       |
|  |  | I <sub>O</sub> = 40mA                                 |                                |     | -7.0  |                                 |     | -14.5 |                                 |     | -17.5  | V       |

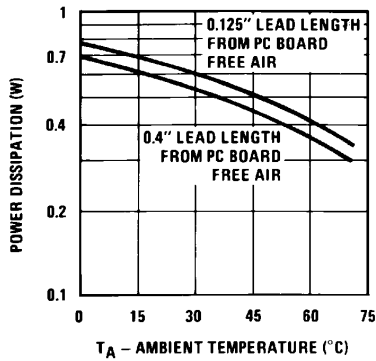
**Note 1:** Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits.

**Note 2:** Thermal resistance of Z package is 60°C/W θ<sub>JC</sub>, 232°C/W θ<sub>JA</sub> at still air, and 88°C/W at 400 ft/min of air. The M package θ<sub>JA</sub> is 180°C/W in still air. The maximum junction temperature shall not exceed 125°C on electrical parameters.

**Note 3:** To ensure constant junction temperature, low duty cycle pulse testing is used.

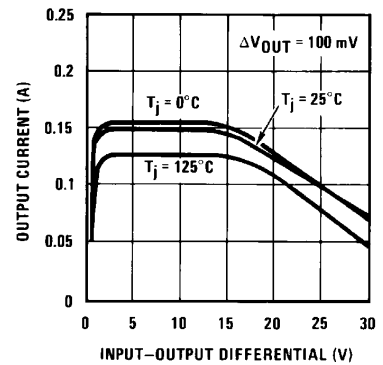
# Typical Performance Characteristics

Maximum Average Power Dissipation (TO-92)



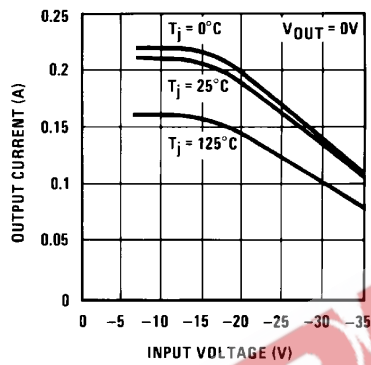
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Peak Output Current



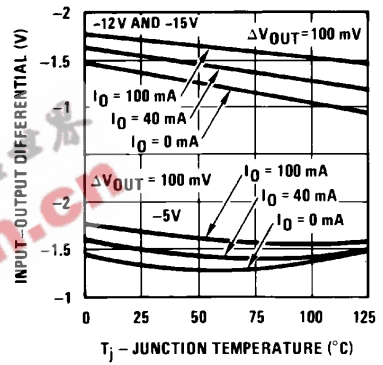
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Short Circuit Output Current



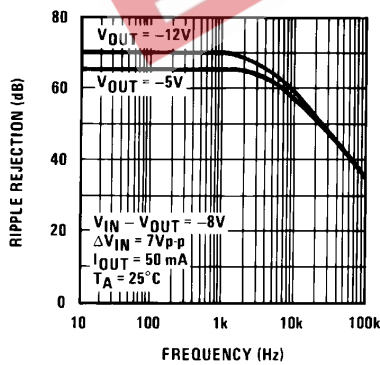
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Dropout Voltage



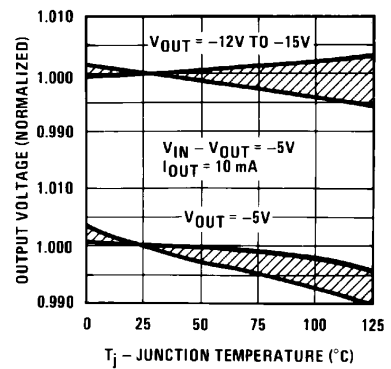
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Ripple Rejection



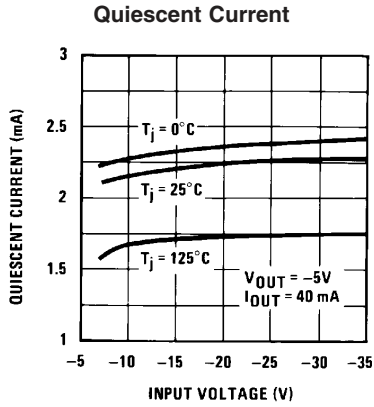
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Output Voltage vs. Temperature (Normalized to 1V @ 25°C)

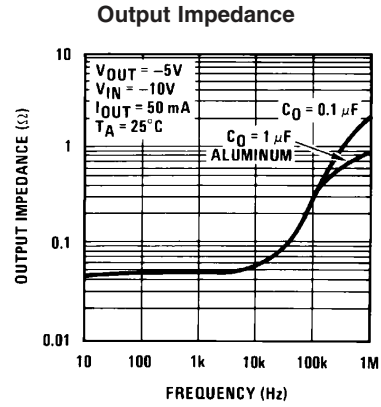


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Typical Performance Characteristics (Continued)

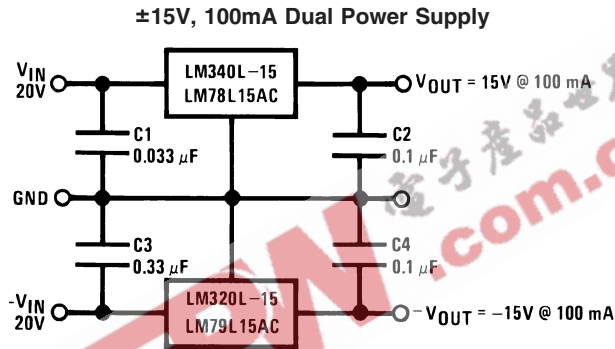


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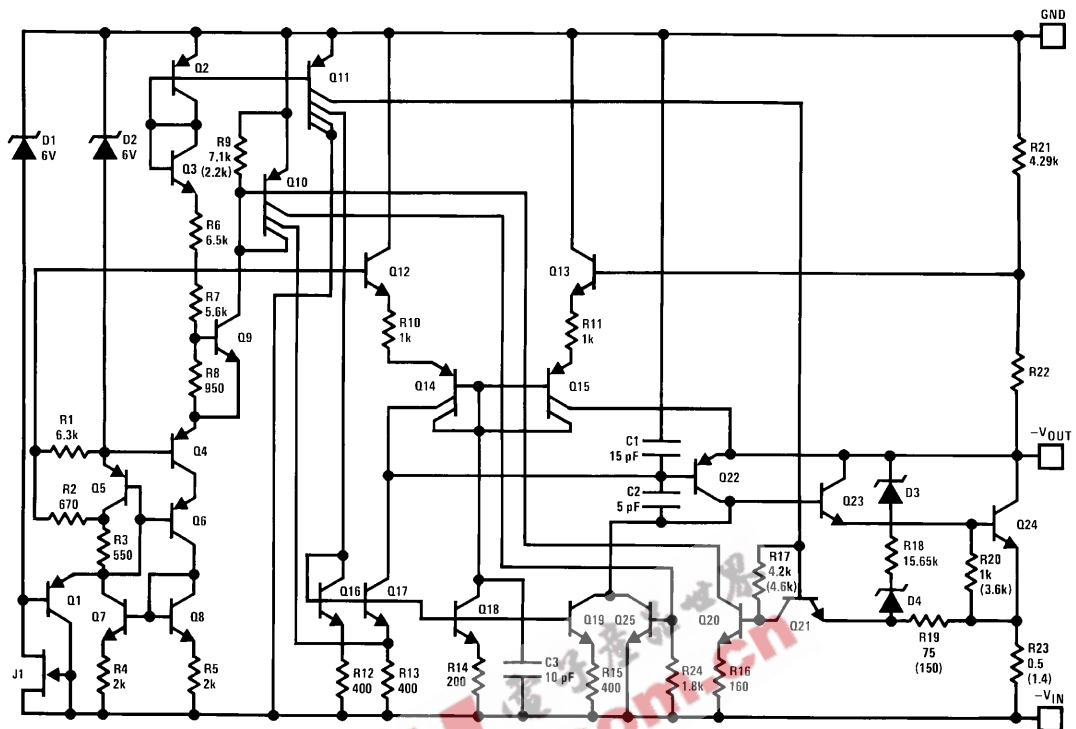
Typical Applications



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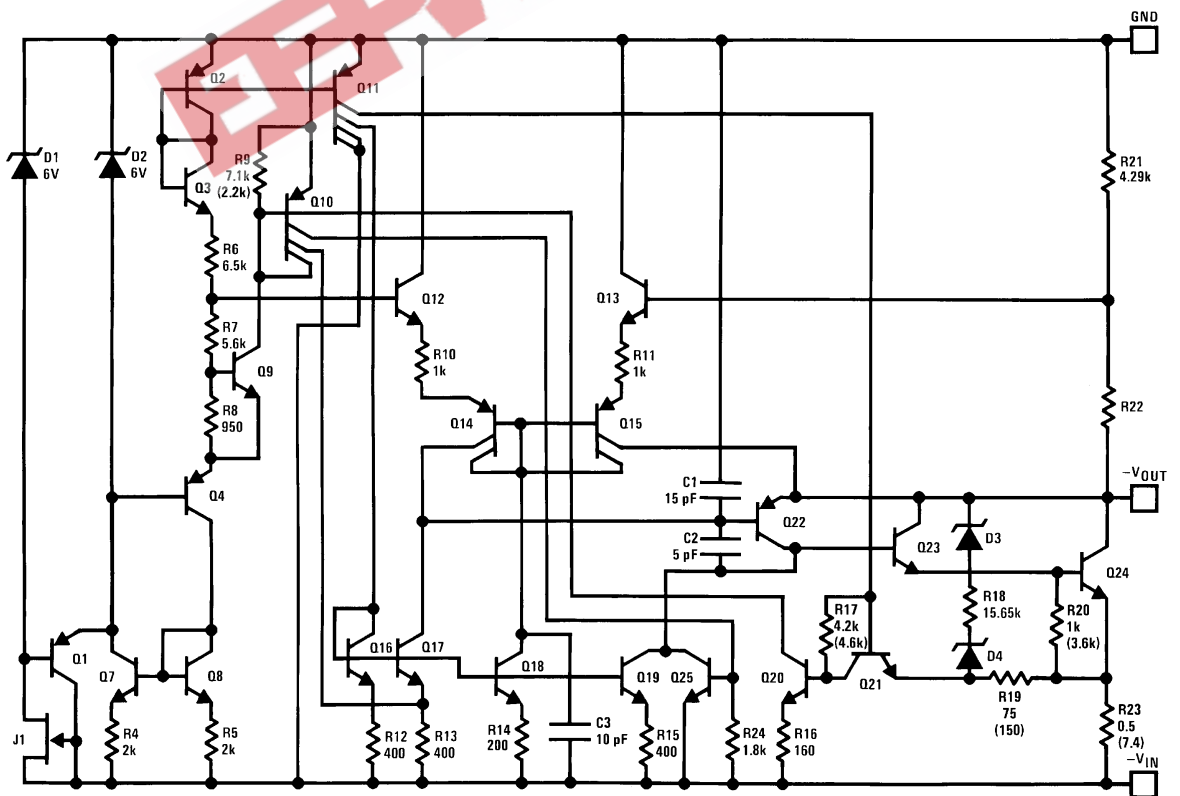
### Schematic Diagrams

-5V



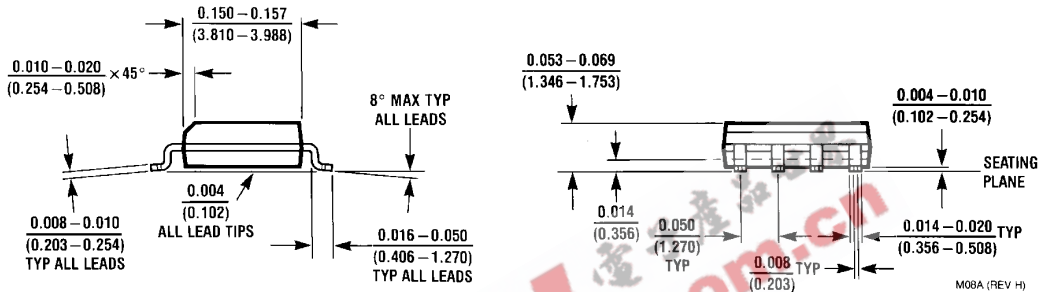
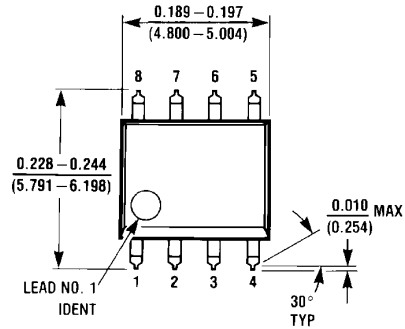
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-12V and -15V

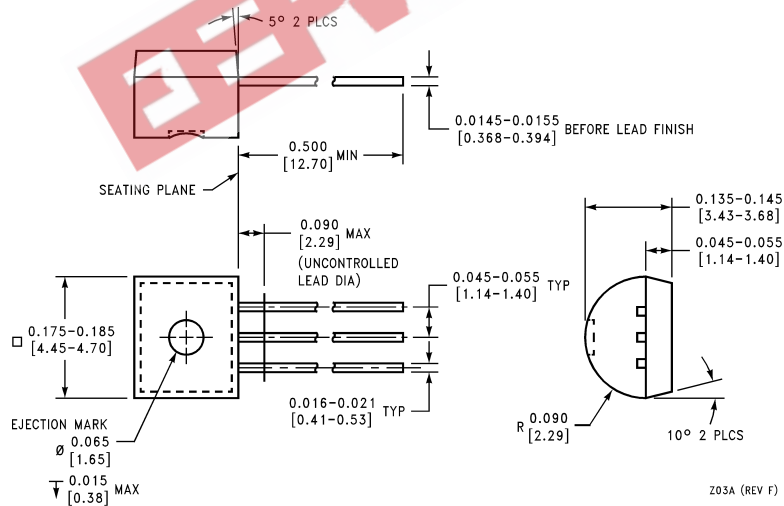


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**Physical Dimensions** inches (millimeters)  
unless otherwise noted

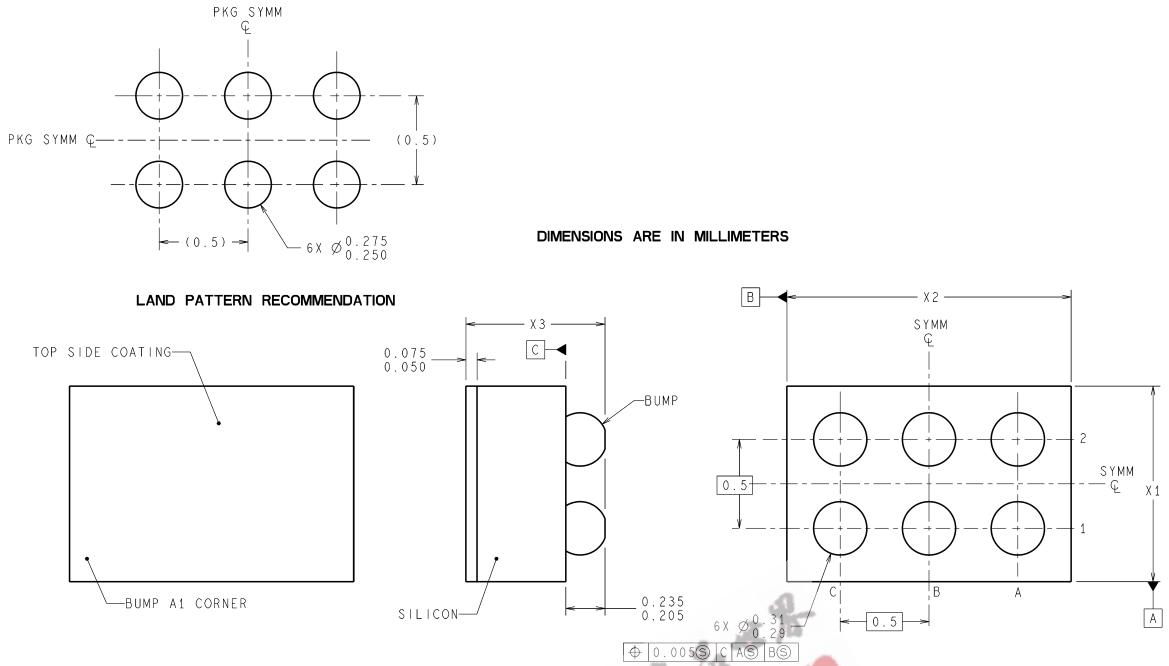


**SOIC Package (M)**  
NS Package Number M08A



**Molded Offset TO-92 (Z)**  
NS Package Number Z03A

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



TLA06XXX (Rev A)

NOTES: UNLESS OTHERWISE SPECIFIED

1. EPOXY COATING.
2. 63Sn/67Pb EUTECTIC BUMP.
3. RECOMMEND NON-SOLDER MASK DEFINED LANDING PAD.
4. PIN A1 ESTABLISHED BY LOWER LEFT CORNER WITH RESPECT TO TEXT ORIENTATION.
5. XXX IN DRAWING NUMBER REPRESENTS PACKAGE SIZE VARIATION WHERE X1 IS PACKAGE WIDTH, X2 IS PACKAGE LENGTH AND X3 IS PACKAGE HEIGHT.
6. REFERENCE JECC REGISTRATION MO-211, VARIATION BC.

**6-Bump micro SMD**  
**NS Package Number TLA06AMA**  
 $X_1 = 1006\mu\text{m}$   $X_2 = 1793\mu\text{m}$   $X_3 = 600\mu\text{m}$

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