# LM123QML 3-Amp, 5-Volt Positive Regulator

**Check for Samples: LM123QML**

## FEATURES

- **3 Amp Output Current**
- **Internal Current and Thermal Limiting**
- **0.01Ω Typical Output Impedance**
- **7.5V Minimum Input Voltage**
- **30W Power Dissipation**

## DESCRIPTION

The LM123 is a three-terminal positive regulator with a preset 5V output and a load driving capability of 3 amps. New circuit design and processing techniques are used to provide the high output current without sacrificing the regulation characteristics of lower current devices.

The 3 amp regulator is virtually blowout proof. Current limiting, power limiting, and thermal shutdown provide the same high level of reliability obtained with these techniques in the LM109 1 amp regulator.

No external components are required for operation of the LM123. If the device is more than 4 inches from the filter capacitor, however, a 1 µF solid tantalum capacitor should be used on the input. A 0.1 µF or larger capacitor may be used on the output to reduce load transient spikes created by fast switching digital logic, or to swamp out stray load capacitance.

An overall worst case specification for the combined effects of input voltage, load currents, ambient temperature, and power dissipation ensure that the LM123 will perform satisfactorily as a system element.

For applications requiring other voltages, see LM150 series adjustable regulator data sheet.

### Connection Diagram

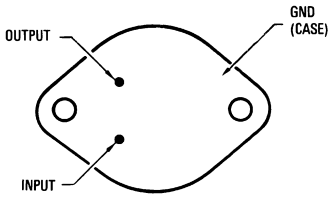
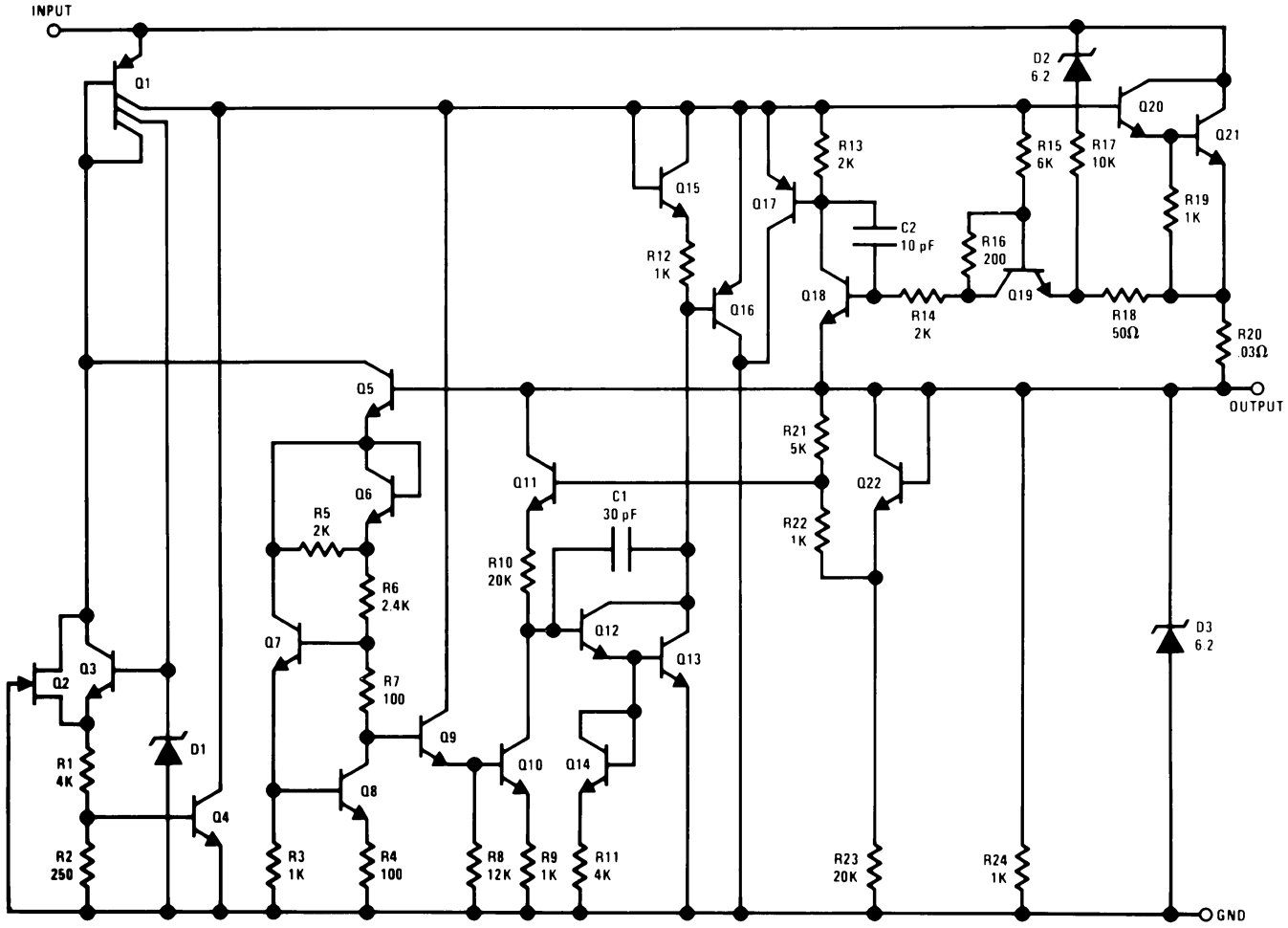



**Figure 1. TO Package**
**See Package Number K0002C**

## Schematic Diagram




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]

| | |
|---|---|
| Input Voltage | 20V |
| Power Dissipation[2] | Internally Limited |
| Operating Junction Temperature Range | −55°C ≤ $T_J$ ≤ +150°C |
| Storage Temperature Range | −65°C ≤ $T_J$ ≤ +150°C |
| Lead Temperature (Soldering, 10 sec.) | 300°C |
| ESD Tolerance[3] | 2000V |

(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 ensure specific performance limits. For ensured specifications and test conditions, see the Electrical Characteristics. The specified specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.

(2) The maximum power dissipation must be derated at elevated temperatures and is dictated by $T_{Jmax}$ (maximum junction temperature), $\theta_{JA}$ (package junction to ambient thermal resistance), and $T_A$ (ambient temperature). The maximum allowable power dissipation at any temperature is $P_{Dmax} = (T_{Jmax} - T_A)/\theta_{JA}$ or the number given in the Absolute Maximum Ratings, whichever is lower.

(3) Human body model, 1.5 kΩ in series with 100 pF.

## Quality Conformance Inspection

**Table 1. Mil-Std-883, Method 5005 - Group A**

| Subgroup | Description | Temp (°C) |
|---|---|---|
| 1 | Static tests at | +25 |
| 2 | Static tests at | +125 |
| 3 | Static tests at | -55 |
| 4 | Dynamic tests at | +25 |
| 5 | Dynamic tests at | +125 |
| 6 | Dynamic tests at | -55 |
| 7 | Functional tests at | +25 |
| 8A | Functional tests at | +125 |
| 8B | Functional tests at | -55 |
| 9 | Switching tests at | +25 |
| 10 | Switching tests at | +125 |
| 11 | Switching tests at | -55 |
| 12 | Settling time at | +25 |
| 13 | Settling time at | +125 |
| 14 | Settling time at | -55 |

## DC Parameters

| Parameter | | Test Conditions | Notes | Min | Max | Units | Sub-groups |
|---|---|---|---|---|---|---|---|
| $V_{OUT}$ | Output Voltage | $V_{IN}$ = 7.5V, $I_O$ = 0A | | 4.7 | 5.3 | V | 1 |
| | | 7.5V ≤ $V_{IN}$ ≤ 15V, 0 ≤ $I_O$ ≤ 3A, P ≤ 30W | | 4.6 | 5.4 | V | 1, 2, 3 |
| $V_{RLine}$ | Line Regulation | 7.5V ≤ $V_{IN}$ ≤ 15V, $I_O$ = 0A | | -25 | 25 | mV | 1 |
| $V_{RLoad}$ | Load Regulation | $V_{IN}$ = 7.5V, 0 ≤ $I_O$ ≤ 3A | | -100 | 100 | mV | 1 |
| $I_Q$ | Quiescent Current | $V_{IN}$ = 15V, 0 ≤ $I_O$ ≤ 3A | | | 20 | mA | 1, 2, 3 |
| | | $V_{IN}$ = 7.5V, 0 ≤ $I_O$ ≤ 3A | | | 20 | mA | 1, 2, 3 |
| $I_{SC}$ | Short Circuit Current | $V_{IN}$ = 15V | | | 4.5 | A | 1 |
| | | $V_{IN}$ =7.5V | | | 5.0 | A | 1 |
| $\Delta V_O / \Delta T$ | Long Term Stability | | See (1) | | 35 | mV | 1 |

(1) Specified parameter not tested.

## Typical Performance Characteristics

Maximum Average Power Dissipation for LM123

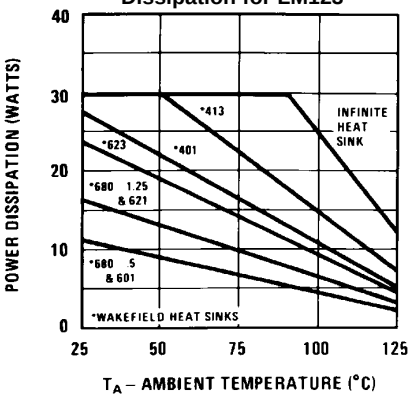



Figure 2.

Output Impedance

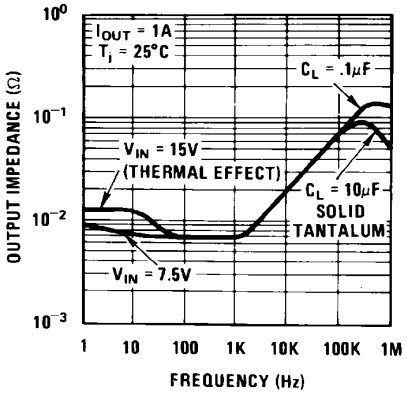



Figure 3.

Peak Available Output Current

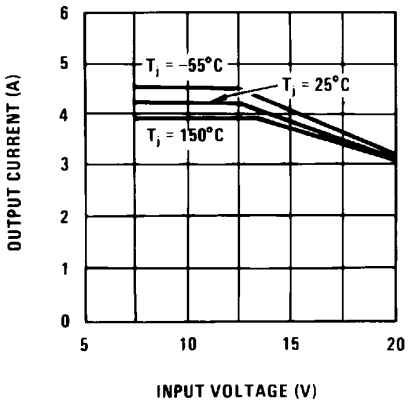



Figure 4.

Short Circuit Current

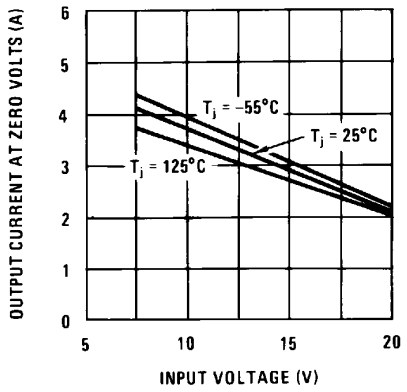



Figure 5.

Ripple Rejection

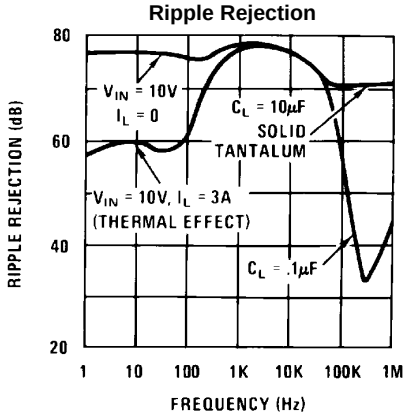



Figure 6.

Dropout Voltage

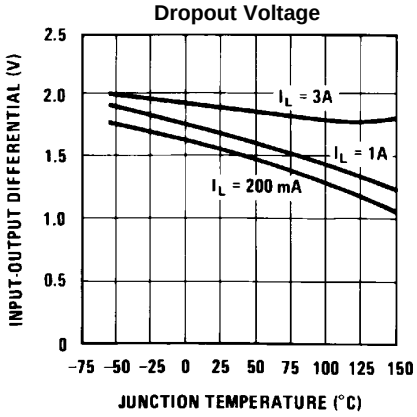



Figure 7.

## Typical Performance Characteristics (continued)

**Line Transient Response**

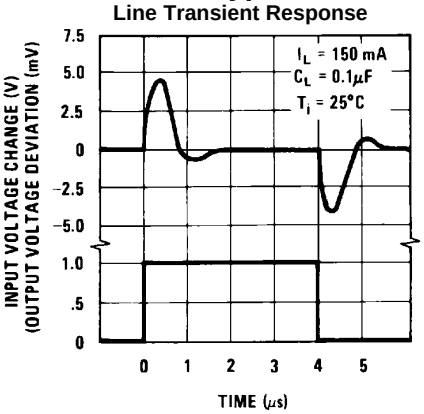



Figure 8.

**Output Voltage**

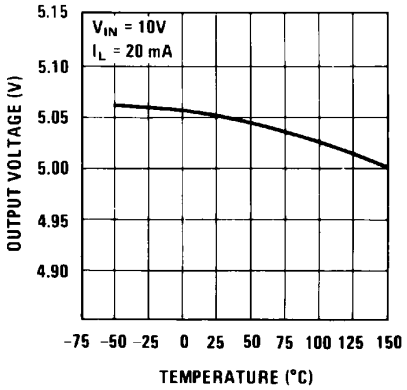



Figure 9.

**Quiescent Current**

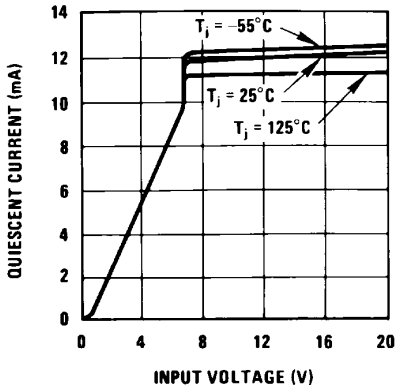



Figure 10.

**Load Transient Response**

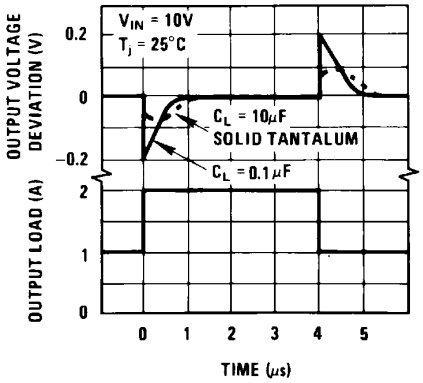



Figure 11.

**Output Noise Voltage**

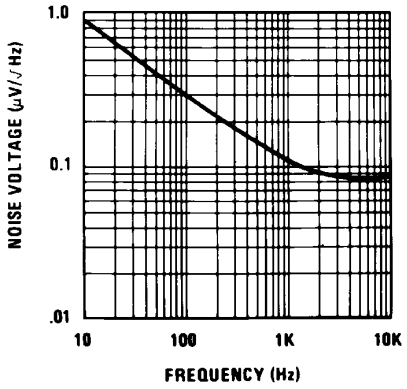
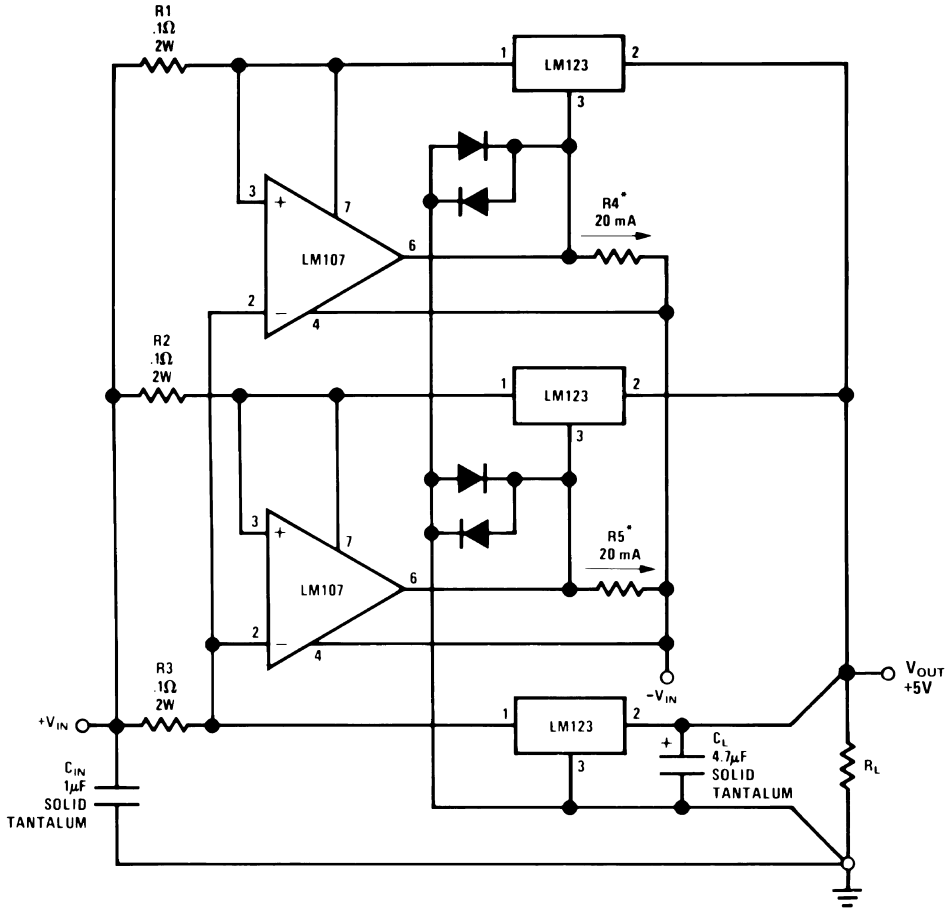


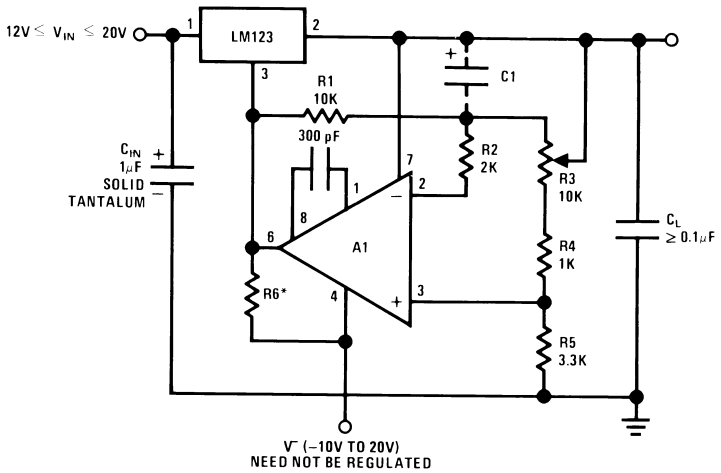

Figure 12.

## TYPICAL APPLICATIONS




*Select for 20 mA Current from Unregulated Negative Supply

**Figure 13. 10 Amp Regulator with Complete Overload Protection**




$$*R6 = \frac{V^-}{12\ mA}$$

$A_1$—LM101A

$C_1$—2 µF Optional—Improves Ripple Rejection, Noise, and Transient Response

**Figure 14. Adjustable Regulator 0V−10V at 3A**

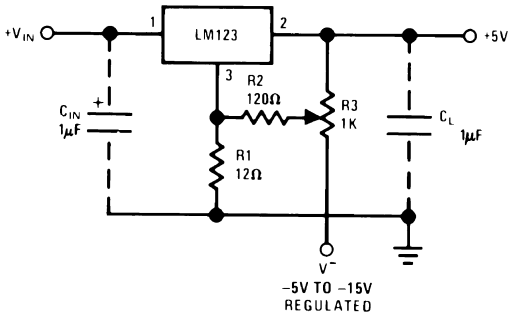
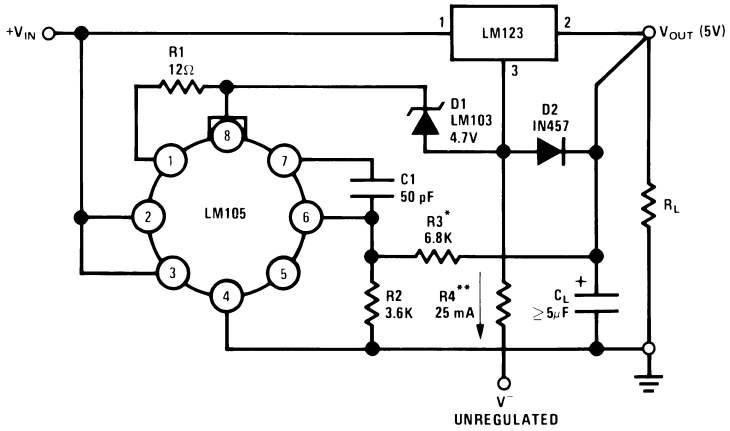
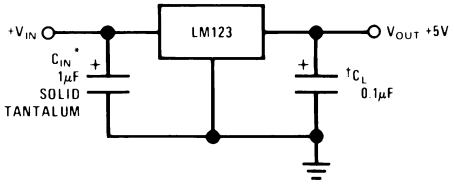



**Figure 15. Trimming Output to 5V**




*Select to Set Output Voltage
**Select to Draw 25 mA from $V^-$

**Figure 16. Adjustable Output 5V−10V 0.1% Regulation**




*Required if LM123 is more than 4″ from filter capacitor.
†Regulator is stable with no load capacitor into resistive loads.

**Figure 17. Basic 3 Amp Regulator**

## REVISION HISTORY SECTION

| Released | Revision | Section | Changes |
|---|---|---|---|
| 12/16/2010 | A | New Release, Corporate format | 1 MDS data sheet converted into one Corp. data sheet format. The drift table was eliminated from the 883 section since it did not apply; MNLM123-X Rev 0BL will be archived. |

## PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish | MSL Peak Temp (3) | Op Temp (°C) | Top-Side Markings (4) | Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LM123K/883 | ACTIVE | TO | K | 2 | 50 | TBD | POST-PLATE | Level-1-NA-UNLIM | -55 to 150 | LM123K<br>/883 Q ACO<br>/883 Q >T | 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.
**OBSOLETE:** 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) Only one of markings shown within the brackets will appear on the physical device.

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