# LM140QML Three Terminal Positive Regulators

**Check for Samples: LM140QML**

## FEATURES

- **Complete Specifications at 1.0A and 0.5A Loads**
- **No External Components**
- **Internal Thermal Overload Protection**
- **Internal Short Circuit Current-Limiting**
- **Output Transistor Safe-Area Compensation**

## DESCRIPTION

The monolithic 3-terminal positive voltage regulators employ internal current-limiting, thermal shutdown and safe-area compensation, making them essentially indestructible. If adequate heat sinking is provided, they can deliver over 0.5A output current. They are intended as fixed voltage regulators in a wide range of applications including local (on-card) regulation for elimination of noise and distribution problems associated with single-point regulation. In addition to use as fixed voltage regulators, these devices can be used with external components to obtain adjustable output voltages and currents.

Considerable effort was expended to make the entire series of regulators easy to use and minimize the number of external components. It is not necessary to bypass the output, although this does improve transient response. Input bypassing is needed only if the regulator is located far from the filter capacitor of the power supply.

### Connection Diagram

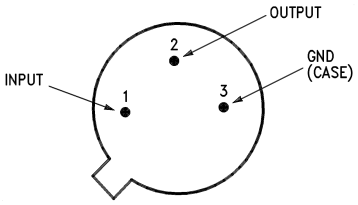


**Figure 1. Steel Metal Can TO-39 Package (NDT)**
**Bottom View**
**See Package Number NDT0003A**

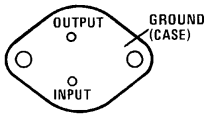


**Figure 2. TO-3 Metal Can (K)**
**Bottom View**
**See Package Number K0002C**

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.

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## Absolute Maximum Ratings(1)

| | | | |
|---|---|---|---|
| DC Input Voltage | | | 35V |
| Internal Power Dissipation(2) | | | Internally Limited |
| Maximum Junction Temperature ($T_{Jmax}$) | | | 150°C |
| Storage Temperature Range | | | -65°C ≤ $T_A$ ≤ +150°C |
| Operating Temperature Range | | | -55°C ≤ $T_A$ ≤ +125°C |
| Lead Temperature (Soldering 10 seconds) | | | 300°C |
| Thermal Resistance | $\theta_{JA}$ | T0−39 (Still Air) | 232°C/W |
| | | T0−39 (500 LF/Min Air Flow) | 77°C/W |
| | | T0−3 (Still Air) | 35°C/W |
| | | T0−3 (500 LF/Min Air Flow) | TBD |
| | $\theta_{JC}$ | T0−39 | 15°C/W |
| | | T0−3 | 4°C/W |
| ESD Susceptibility(3) | | | 2KV |

(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 specify specific performance limits. For ensured specifications and test conditions, see the Electrical Characteristics. The ensured 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, 100pF discharged through 1.5KΩ

## Quality Conformance Inspection

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 |


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## LM140H–5.0 Electrical Characteristics DC Parameters

The following conditions apply, unless otherwise specified.
DC: $V_I$ = 10V, $I_L$ =350mA

| Symbol | Parameter | Conditions | Notes | Min | Max | Unit | Sub-groups |
|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $V_I$ = 35V, $I_L$ = 5mA | | 4.75 | 5.75 | V | 1 |
| | | | | 4.80 | 5.20 | V | 1 |
| | | $V_I$ = 8V | | 4.70 | 5.30 | V | 1, 2, 3 |
| | | $V_I$ = 8V, $I_L$ = 5mA | | 4.70 | 5.30 | V | 1, 2, 3 |
| | | $V_I$ = 20V, $I_L$ = 5mA | | 4.70 | 5.30 | V | 1, 2, 3 |
| | | $V_I$ = 20V | | 4.70 | 5.30 | V | 1, 2, 3 |
| $R_{Line}$ | Line Regulation | 7V ≤ $V_I$ ≤ 25V, $I_L$ = 200mA | | -50 | 50 | mV | 1 |
| | | 8V ≤ $V_I$ ≤ 25V, $I_L$ = 200mA | | -50 | 50 | mV | 2, 3 |
| | | 8V ≤ $V_I$ ≤ 20V, $I_L$ = 200mA | | -25 | 25 | mV | 1 |
| | | | | -40 | 40 | mV | 2, 3 |
| $R_{Load}$ | Load Regulation | 5mA ≤ $I_L$ ≤ 500mA | | -50 | 50 | mV | 1 |
| | | | | -100 | 100 | mV | 2, 3 |
| | | 5mA ≤ $I_L$ ≤ 200mA | | -25 | 25 | mV | 1 |
| | | | | -50 | 50 | mV | 2, 3 |
| $I_Q$ | Quiescent Current | | | | 7.0 | mA | 1, 2, 3 |
| $\Delta I_Q$ | Quiescent Current Change | 8V ≤ $V_I$ ≤ 25V, $I_L$ = 200mA | | -0.8 | 0.8 | mA | 1, 2, 3 |
| | | 5mA ≤ $I_L$ ≤ 350mA | | -0.5 | 0.5 | mA | 1, 2, 3 |
| $I_{Pk}$ | Peak Current | $V_I$ - $V_O$ = 7V | See (1) | 0.4 | 2.0 | A | 1, 2, 3 |
| $V_{DO}$ | Dropout Voltage | | See (2) | | 2.5 | V | 1 |
| $I_{OS}$ | Short Circuit Current | $V_I$ = 35V | | | 1.0 | A | 1, 2, 3 |

(1) $V_O$ is set to 90% $V_{Ref}$
(2) $V_{DO} = V_I - V_O$ when $V_O$ is 95% of $V_{Ref}$.

## LM140H–5.0 Electrical Characteristics AC Parameters

The following conditions apply, unless otherwise specified.
AC: $V_I$ = 10V, $I_L$ =350mA

| Symbol | Parameter | Conditions | Notes | Min | Max | Unit | Sub-groups |
|---|---|---|---|---|---|---|---|
| RR | Ripple Rejection | $I_L$ = 125mA, $e_I$ = 1$V_{RMS}$, $f$ = 2.4KHz, $V_I$ = 10V | | 62 | | dB | 4, 5, 6 |

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## LM140H–12 Electrical Characteristics DC Parameters

The following conditions apply, unless otherwise specified.
DC: $V_I$ = 19V, $I_L$ =350mA

| Symbol | Parameter | Conditions | Notes | Min | Max | Unit | Sub-groups |
|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $V_I$ = 35V, $I_L$ = 5mA | | 11.4 | 12.6 | V | 1 |
| | | | | 11.5 | 12.5 | V | 1 |
| | | $V_I$ = 15.5V | | 11.4 | 12.6 | V | 1, 2, 3 |
| | | $V_I$ = 15.5V, $I_L$ = 5mA | | 11.4 | 12.6 | V | 1, 2, 3 |
| | | $V_I$ = 27V, $I_L$ = 5mA | | 11.4 | 12.6 | V | 1, 2, 3 |
| | | $V_I$ = 27V | | 11.4 | 12.6 | V | 1, 2, 3 |
| $R_{Line}$ | Line Regulation | 14.5V ≤ $V_I$ ≤ 30V, $I_L$ = 200mA | | -60 | 60 | mV | 1 |
| | | 15.0V ≤ $V_I$ ≤ 30V, $I_L$ = 200mA | | -120 | 120 | mV | 2, 3 |
| | | 16V ≤ $V_I$ ≤ 25V, $I_L$ = 200mA | | -30 | 30 | mV | 1 |
| | | | | -60 | 60 | mV | 2, 3 |
| $R_{Load}$ | Load Regulation | 5mA ≤ $I_L$ ≤ 500mA | | -120 | 120 | mV | 1 |
| | | | | -240 | 240 | mV | 2, 3 |
| | | 5mA ≤ $I_L$ ≤ 200mA | | -60 | 60 | mV | 1 |
| | | | | -120 | 120 | mV | 2, 3 |
| $I_Q$ | Quiescent Current | | | | 7.0 | mA | 1, 2, 3 |
| $\Delta I_Q$ | Quiescent Current Change | 14.5V ≤ $V_I$ ≤ 30V, $I_L$ = 200mA | | -0.8 | 0.8 | mA | 1, 2, 3 |
| | | 5mA ≤ $I_L$ ≤ 350mA | | -0.5 | 0.5 | mA | 1, 2, 3 |
| $I_{Pk}$ | Peak Current | $V_I$ - $V_O$ = 7V | See (1) | 0.4 | 2.0 | A | 1, 2, 3 |
| $V_{DO}$ | Dropout Voltage | | See (2) | | 2.5 | V | 1 |
| $I_{OS}$ | Short Circuit Current | $V_I$ = 35V | | | 1.0 | A | 1, 2, 3 |

(1) $V_O$ is set to 90% $V_{Ref}$
(2) $V_{DO} = V_I - V_O$ when $V_O$ is 95% of $V_{Ref}$.

## LM140H–12 Electrical Characteristics AC Parameters

| Symbol | Parameter | Conditions | Notes | Min | Max | Unit | Sub-groups |
|---|---|---|---|---|---|---|---|
| RR | Ripple Rejection | $V_I$ = 17V, $I_L$ = 125mA, $e_I$ = 1$V_{RMS}$, $f$ = 2.4KHz | | 55 | | dB | 4, 5, 6 |


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## LM140H–15 Electrical Characteristics DC Parameters

The following conditions apply, unless otherwise specified.
DC: $V_I$ = 23V, $I_L$ =350mA

| Symbol | Parameter | Conditions | Notes | Min | Max | Unit | Sub-groups |
|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $V_I$ = 35V, $I_L$ = 5mA | | 14.25 | 15.75 | V | 1 |
| | | | | 14.40 | 15.60 | V | 1 |
| | | $V_I$ = 18.5V | | 14.25 | 15.75 | V | 1, 2, 3 |
| | | $V_I$ = 18.5V, $I_L$ = 5mA | | 14.25 | 15.75 | V | 1, 2, 3 |
| | | $V_I$ = 30V, $I_L$ = 5mA | | 14.25 | 15.75 | V | 1, 2, 3 |
| | | $V_I$ = 30V | | 14.25 | 15.75 | V | 1, 2, 3 |
| $R_{Line}$ | Line Regulation | 17.5V ≤ $V_I$ ≤ 30V, $I_L$ = 200mA | | -60 | 60 | mV | 1 |
| | | 18.5V ≤ $V_I$ ≤ 30V, $I_L$ = 200mA | | -120 | 120 | mV | 2, 3 |
| | | 20V ≤ $V_I$ ≤ 30V, $I_L$ = 200mA | | -30 | 30 | mV | 1 |
| | | | | -60 | 60 | mV | 2, 3 |
| $R_{Load}$ | Load Regulation | 5mA ≤ $I_L$ ≤ 500mA | | -150 | 150 | mV | 1 |
| | | | | -300 | 300 | mV | 2, 3 |
| | | 5mA ≤ $I_L$ ≤ 200mA | | -75 | 75 | mV | 1 |
| | | | | -150 | 150 | mV | 2, 3 |
| $I_Q$ | Quiescent Current | | | | 7.0 | mA | 1, 2, 3 |
| $\Delta I_Q$ | Quiescent Current Change | 17.5V ≤ $V_I$ ≤ 30V, $I_L$ = 200mA | | -0.8 | 0.8 | mA | 1, 2, 3 |
| | | 5mA ≤ $I_L$ ≤ 350mA | | -0.5 | 0.5 | mA | 1, 2, 3 |
| $I_{Pk}$ | Peak Current | $V_I$ - $V_O$ = 7V | See (1) | 0.4 | 2.0 | A | 1, 2, 3 |
| $V_{DO}$ | Dropout Voltage | | See (2) | | 2.5 | V | 1 |
| $I_{OS}$ | Short Circuit Current | $V_I$ = 35V | | | 1.0 | A | 1, 2, 3 |

(1) $V_O$ is set to 90% $V_{Ref}$
(2) $V_{DO}$ = $V_I$ − $V_O$ when $V_O$ is 95% of $V_{Ref}$.

## LM140H–15 Electrical Characteristics AC Parameters

The following conditions apply, unless otherwise specified.
AC: $V_I$ = 23V, $I_L$ =350mA

| Symbol | Parameter | Conditions | Notes | Min | Max | Unit | Sub-groups |
|---|---|---|---|---|---|---|---|
| RR | Ripple Rejection | $V_I$=20V, $I_L$=125mA, $e_I$=1$V_{RMS}$, $f$ = 2.4KHz | | 54 | | dB | 4, 5, 6 |

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## LM140K–5.0 Electrical Characteristics DC Parameters

The following conditions apply, unless otherwise specified.
DC: $V_I$ = 10V, $I_L$ = 5mA

| Symbol | Parameter | Conditions | Notes | Min | Max | Unit | Sub-groups |
|---|---|---|---|---|---|---|---|
| $I_Q$ | Quiescent Current | $I_L$ = 1A | | | 6.0 | mA | 1 |
| | | | | | 7.0 | mA | 2, 3 |
| ΔQ | Quiescent Current Change | $I_L$ = 1A, 8V ≤ $V_I$ ≤ 20mA | | -0.8 | 0.8 | mA | 1 |
| | | $I_L$ ≤ 500mA, 8V ≤ $V_I$ ≤ 25V | | -0.8 | 0.8 | mA | 1, 2, 3 |
| | | 5mA, ≤ $I_L$ ≤ 1.0A | | -0.5 | 0.5 | mA | 1, 2, 3 |
| $V_O$ | Output Voltage | | | 4.80 | 5.20 | V | 1 |
| | | $V_I$ = 8V | | 4.75 | 5.25 | V | 1, 2, 3 |
| | | $V_I$ = 8V, $I_L$ = 1A | | 4.75 | 5.25 | V | 1, 2, 3 |
| | | $V_I$ = 20V | | 4.75 | 5.25 | V | 1, 2, 3 |
| | | $V_I$ = 20V, $I_L$ = 1A | | 4.75 | 5.25 | V | 1, 2, 3 |
| $R_{Line}$ | Line Regulation | $I_L$ = 500mA, 7V ≤ $V_I$ ≤ 25V | | -50 | 50 | mV | 1, 2, 3 |
| | | $I_L$ = 1A, 7.3V ≤ $V_I$ ≤ 20V | | -50 | 50 | mV | 1 |
| | | $I_L$ = 1A, 8.0V ≤ $V_I$ ≤ 20V | | -50 | 50 | mV | 2, 3 |
| | | $I_L$ = 1A, 8V ≤ $V_I$ ≤ 12V | | -25 | 25 | mV | 1, 2, 3 |
| $R_{Load}$ | Load Regulation | 5mA ≤ $I_L$ ≤ 1.5A | | -50 | 50 | mV | 1 |
| | | 5mA ≤ $I_L$ ≤ 1.0A | | -50 | 50 | mV | 2, 3 |
| | | 250mA ≤ $I_L$ ≤ 750mA | | -25 | 25 | mV | 1 |
| $I_{OS}$ | Current Limit | | | -4.0 | -0.02 | A | 1 |
| | | $V_I$ = 35V | | -2.0 | -0.02 | A | 1 |

## LM140K–5.0 Electrical Characteristics AC Parameters

The following conditions apply, unless otherwise specified.
AC: $V_I$ = 10V, $I_L$ = 5mA

| Symbol | Parameter | Conditions | Notes | Min | Max | Unit | Sub-groups |
|---|---|---|---|---|---|---|---|
| RR | Ripple Rejection | $f$ = 120Hz, $I_L$ = 350mA, $e_I$ = $1V_{RMS}$ | | 68 | | dB | 4 |


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## LM140K–12 Electrical Characteristics DC Parameters

The following conditions apply, unless otherwise specified.
DC: $V_I$ = 19V, $I_L$ = 5mA

| Symbol | Parameter | Conditions | Notes | Min | Max | Unit | Sub-groups |
|---|---|---|---|---|---|---|---|
| $I_Q$ | Quiescent Current | $I_L$ = 1A | | | 6.0 | mA | 1 |
| | | | | | 7.0 | mA | 2, 3 |
| $\Delta I_Q$ | Quiescent Current Change | $I_L$ = 1A, 15.5V ≤ $V_I$ ≤ 27V | | -0.8 | 0.8 | mA | 1 |
| | | $I_L$ = 500mA 15V ≤ $V_I$ ≤ 30V | | -0.8 | 0.8 | mA | 1, 2, 3 |
| | | 5mA ≤ $I_L$ ≤ 1A | | -0.5 | 0.5 | mA | 1, 2, 3 |
| $V_O$ | Output Voltage | | | 11.5 | 12.5 | V | 1 |
| | | $V_I$ = 15.5V | | 11.4 | 12.6 | V | 1, 2, 3 |
| | | $V_I$ = 15.5V, $I_L$ = 1A | | 11.4 | 12.6 | V | 1, 2, 3 |
| | | $V_I$ = 27V | | 11.4 | 12.6 | V | 1, 2, 3 |
| | | $V_I$ = 27V, $I_L$ = 1A | | 11.4 | 12.6 | V | 1, 2, 3 |
| $R_{Line}$ | Line Regulation | $I_L$ = 500mA, 14.5V ≤ $V_I$ ≤ 25V | | -120 | 120 | mV | 1, 2, 3 |
| | | $I_L$ = 1A, 14.6V ≤ $V_I$ ≤ 27V | | -120 | 120 | mV | 1 |
| | | $I_L$ = 1A, 15.0V ≤ $V_I$ ≤ 27V | | -120 | 120 | mV | 2, 3 |
| | | $I_L$ = 1A, 16V ≤ $V_I$ ≤ 22V | | -60 | 60 | mV | 1, 2, 3 |
| $R_{Load}$ | Load Regulation | 5mA ≤ $I_L$ ≤ 1.5A | | -120 | 120 | mV | 1 |
| | | 5mA ≤ $I_L$ ≤ 1.0A | | -120 | 120 | mV | 2, 3 |
| | | 250mA ≤ $I_L$ ≤ 750mA | | -60 | 60 | mV | 1 |
| $I_{OS}$ | Current Limit | $V_I$ = 17V | | -3.5 | -0.02 | A | 1 |
| | | $V_I$ = 35V | | -2.0 | -0.02 | A | 1 |

## LM140K–12 Electrical Characteristics AC Parameters

The following conditions apply, unless otherwise specified.
AC: $V_I$ = 19V, $I_L$ = 5mA

| Symbol | Parameter | Conditions | Notes | Min | Max | Unit | Sub-groups |
|---|---|---|---|---|---|---|---|
| RR | Ripple Rejection | $f$ = 120Hz, $I_L$ = 350mA, $e_I$ = $1V_{RMS}$ | | 61 | | dB | 4 |

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## LM140K–15 Electrical Characteristics DC Parameters

The following conditions apply, unless otherwise specified.
DC: $V_I$ = 23V, $I_L$ = 5mA

| Symbol | Parameter | Conditions | Notes | Min | Max | Unit | Sub-groups |
|---|---|---|---|---|---|---|---|
| $I_Q$ | Quiescent Current | $I_L$ = 1A | | | 6.0 | mA | 1 |
| | | | | | 7.0 | mA | 2, 3 |
| $\Delta I_Q$ | Quiescent Current Change | $I_L$ = 1A, 18.5V ≤ $V_I$ ≤ 30V | | -0.8 | 0.8 | mA | 1 |
| | | $I_L$ = 500mA, 18.5V ≤ $V_I$ ≤ 30V | | -0.8 | 0.8 | mA | 2, 3 |
| | | 5mA ≤ $I_L$ ≤ 1A | | -0.5 | 0.5 | mA | 1, 2, 3 |
| $V_O$ | Output Voltage | | | 14.4 | 15.6 | V | 1 |
| | | $V_I$ = 18.5V | | 14.25 | 15.75 | V | 1, 2, 3 |
| | | $V_I$ = 18.5V, $I_L$ = 1A | | 14.25 | 15.75 | V | 1, 2, 3 |
| | | $V_I$ = 30V | | 14.25 | 15.75 | V | 1, 2, 3 |
| | | $V_I$ = 30V, $I_L$ = 1A | | 14.25 | 15.75 | V | 1, 2, 3 |
| $R_{Line}$ | Line Regulation | $I_L$ = 500mA, 17.5V ≤ $V_I$ ≤ 30V | | -150 | 150 | mV | 1 |
| | | $I_L$ = 500mA, 18.5V ≤ $V_I$ ≤ 30V | | -150 | 150 | mV | 2, 3 |
| | | $I_L$ = 1A, 17.7V ≤ $V_I$ ≤ 30V | | -75 | 75 | mV | 1 |
| | | $I_L$ = 1A, 20V ≤ $V_I$ ≤ 26V | | -75 | 75 | mV | 1, 2, 3 |
| $R_{Load}$ | Load Regulation | 5mA ≤ $I_L$ ≤ 1.5A | | -150 | 150 | mV | 1 |
| | | 5mA ≤ $I_L$ ≤ 1.0A | | -150 | 150 | mV | 2, 3 |
| | | 250mA ≤ $I_L$ ≤ 750mA | | -75 | 75 | mV | 1 |
| $I_{OS}$ | Current Limit | $V_I$ = 20V | | -3.5 | -0.02 | A | 1 |
| | | $V_I$ =35V | | -2.0 | -0.02 | A | 1 |

## LM140K–15 Electrical Characteristics AC Parameters

The following conditions apply, unless otherwise specified.
AC: $V_I$ = 23V, $I_L$ = 5mA

| Symbol | Parameter | Conditions | Notes | Min | Max | Unit | Sub-groups |
|---|---|---|---|---|---|---|---|
| RR | Ripple Rejection | $f$ = 120Hz, $I_L$ = 350mA, $e_I$ = $1V_{RMS}$ | | 60 | | dB | 4 |


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## REVISION HISTORY SECTION

| Released | Revision | Section | Originator | Changes |
|---|---|---|---|---|
| 02/21/06 | A | New Release, Corporate format | L. Lytle | 6 MDS data sheets converted into one Corp. data sheet format. The drift tables were eliminated from the 883 section since it did not apply. MDS data sheets MNLM140-05H Rev 0B0, MNLM140-05-K Rev. 0C0, MNLM140-12H Rev 0A0, MNLM140-12K Rev 0B0, MNLM140-15H Rev 0A0, and MNLM140-15K Rev 0B0 will be archived. |

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## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LM140H-12/883 | ACTIVE | TO | NDT | 3 | 20 | TBD | Call TI | Call TI | -55 to 125 | LM140H-12/883 Q ACO<br>LM140H-12/883 Q >T | Samples |
| LM140H-15/883 | ACTIVE | TO | NDT | 3 | 20 | TBD | Call TI | Call TI | -55 to 125 | LM140H-15/883 Q ACO<br>LM140H-15/883 Q >T | Samples |
| LM140H-5.0/883 | ACTIVE | TO | NDT | 3 | 20 | TBD | Call TI | Call TI | -55 to 125 | LM140H-5.0/883 Q ACO<br>LM140H-5.0/883 Q >T | Samples |
| LM140K-12/883 | ACTIVE | TO | K | 2 | 50 | TBD | Call TI | Call TI | -55 to 125 | LM140K-12<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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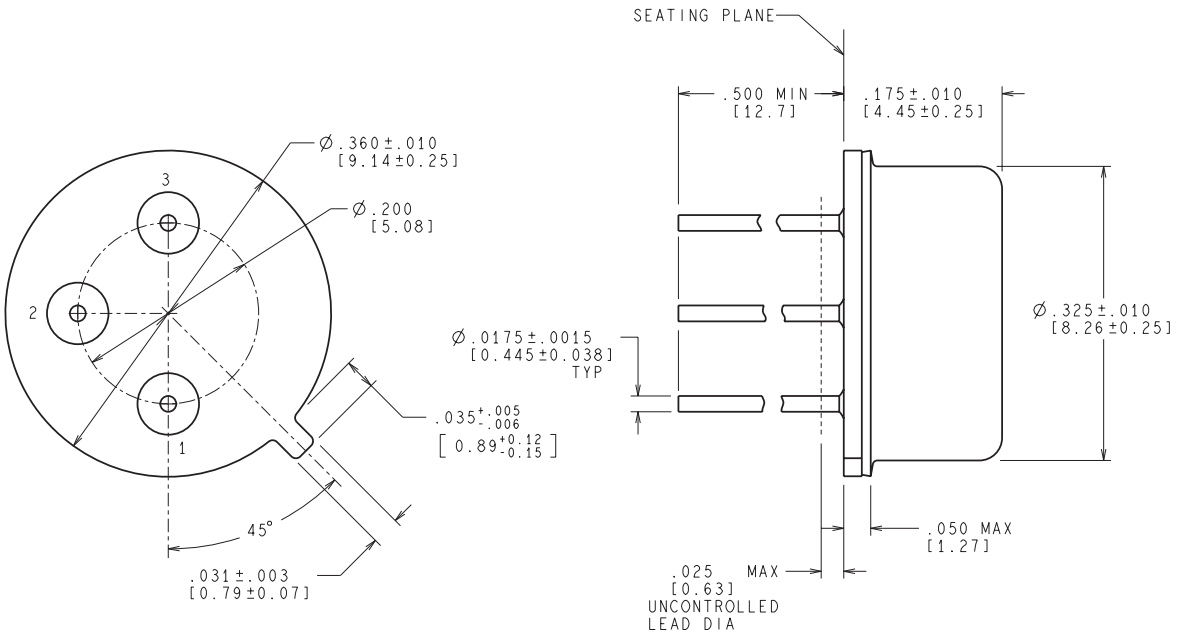
# NDT0003A




CONTROLLING DIMENSION IS INCH
VALUES IN [ ] ARE MILLIMETERS

MIL-PRF-38535
CONFIGURATION CONTROL

H03A (Rev D)

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