



# Delay Lines for High-Speed Clock Distribution Systems

MAX3620

## General Description

The MAX3620 series is a family of high-performance passive delay lines for use in QDR/QDRII synchronous memory systems. These delay lines support high-speed transceiver logic (HSTL) source terminated transmission with an unterminated load at the receiver, and deliver accurate delays of 0.75ns, 1.00ns, 1.25ns, and 1.50ns for the generation of the quarter clock phase. The MAX3620 is offered in a small 3mm x 3mm package which contains two delay lines of equal length that can be driven either differentially or single-endedly.

## Features

- ◆ Supports HSTL Source Terminated Lines
- ◆ All-Passive Design
- ◆ Compatible with 100Ω Differential and 50Ω Single-Ended Transmission Lines
- ◆ Small 3mm x 3mm Package

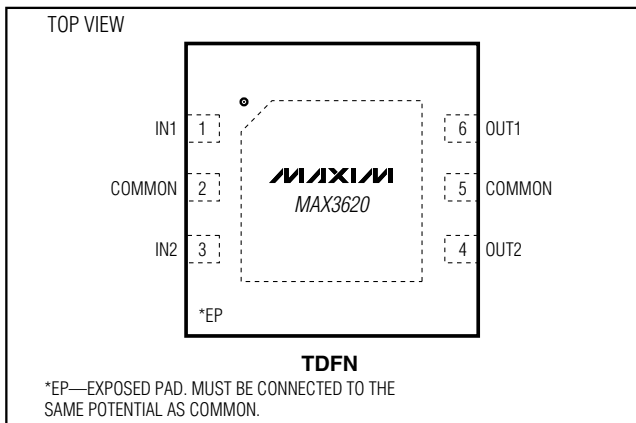
## Applications

QDR/QDRII Memory Systems  
Multiphase Clock Generation

## Ordering Information

| PART        | TEMP RANGE     | PIN-PACKAGE |
|-------------|----------------|-------------|
| MAX3620AETT | -40°C to +85°C | 6 TDFN      |
| MAX3620BETT | -40°C to +85°C | 6 TDFN      |
| MAX3620CETT | -40°C to +85°C | 6 TDFN      |
| MAX3620DETT | -40°C to +85°C | 6 TDFN      |

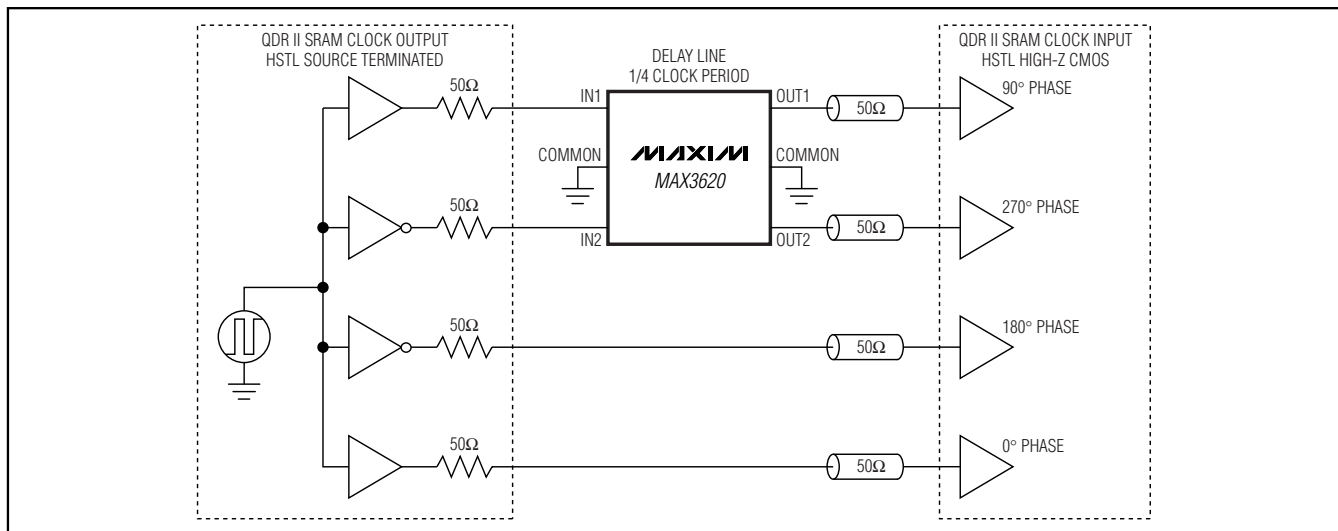
## Pin Configuration



## Selector Guide

| PART        | PKG CODE | TOP MARK |
|-------------|----------|----------|
| MAX3620AETT | T633-2   | AJX      |
| MAX3620BETT | T633-2   | AIY      |
| MAX3620CETT | T633-2   | AIZ      |
| MAX3620DETT | T633-2   | AJA      |

## Typical Application Circuit



**For pricing, delivery, and ordering information, please contact Maxim/Dallas Direct! at 1-888-629-4642, or visit Maxim's website at [www.maxim-ic.com](http://www.maxim-ic.com).**

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## ABSOLUTE MAXIMUM RATINGS

Maximum DC Voltage between COMMON and IOs (IN1, IN2, OUT1, OUT2).....±2.0V

Operating Temperature Range .....-45°C to +85°C  
Storage Temperature Range .....-55°C to +150°C

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## ELECTRICAL CHARACTERISTICS

(Typical ambient temperature is +25°C. See Table 1 for more information.)

| PARAMETER                                       | SYMBOL | CONDITIONS   | MIN      | TYP  | MAX  | UNITS    |     |  |
|---|--------|--|----------|------|------|----------|-----|--|
| Characteristic Impedance                        | $Z_0$  | See Table 1 clock frequency  |          | 50   |      | $\Omega$ |     |  |
| Delay Values                                    |        | $Z_{LOAD} = Z_{SOURCE}$<br>(Note 1)                                    | MAX3620A | 0.65 | 0.75 | 0.85     | ns  |  |
|   |        |  | MAX3620B | 0.90 | 1.00 | 1.10     |     |  |
|   |        |  | MAX3620C | 1.15 | 1.25 | 1.35     |     |  |
|   |        |  | MAX3620D | 1.40 | 1.50 | 1.60     |     |  |
| Delay Matching                                  |        | IN2-to-OUT2 relative to IN1-to-OUT1,<br>$Z_{LOAD} = Z_{SOURCE}$        | -20      |      | +20  | ps       |     |  |
| Insertion Loss                                  |        | $Z_{LOAD} = Z_{SOURCE}$<br>(Notes 1, 2, 4)                             | MAX3620A |      | 2.5  |          | dB  |  |
|   |        |  | MAX3620B |      | 2.1  |          |     |  |
|   |        |  | MAX3620C |      | 2.3  |          |     |  |
|   |        |  | MAX3620D |      | 2.2  |          |     |  |
|   |        | $Z_{LOAD} \gg Z_{SOURCE}$ ,<br>source termination only<br>(Notes 5, 6) | MAX3620A |      | 4.6  |          |     |  |
|   |        |  | MAX3620B |      | 3.8  |          |     |  |
|   |        |  | MAX3620C |      | 3.1  |          |     |  |
|   |        |  | MAX3620D |      | 3.4  |          |     |  |
| Cutoff Frequency,<br>3dB Loss Relative to 10MHz |        | $Z_{LOAD} = Z_{SOURCE}$<br>(Note 3)                                    | MAX3620A |      | 450  |          | MHz |  |
|   |        |  | MAX3620B |      | 370  |          |     |  |
|   |        |  | MAX3620C |      | 320  |          |     |  |
|   |        |  | MAX3620D |      | 300  |          |     |  |
| Input Return Loss                               |        | $Z_{LOAD} = Z_{SOURCE}$ , 50MHz to 1GHz<br>(Note 3)                    | 12       |      |      | dB       |     |  |
| Output Return Loss                              |        | $Z_{LOAD} = Z_{SOURCE}$ , 50MHz to 1GHz<br>(Note 3)                    | 15       |      |      | dB       |     |  |
| Input Leakage at ±1.5V                          |        | IN1 or IN2 to grounded COMMON  | -10      |      | +10  | $\mu A$  |     |  |
| Output Leakage at ±1.5V                         |        | OUT1 or OUT2 to grounded COMMON  | -10      |      | +10  | $\mu A$  |     |  |
| Output Transition Time<br>(20% to 80%)          |        | $Z_{LOAD} = Z_{SOURCE}$<br>(Notes 1, 2)                                | MAX3620A |      | 540  |          | ps  |  |
|   |        |  | MAX3620B |      | 620  |          |     |  |
|   |        |  | MAX3620C |      | 700  |          |     |  |
|   |        |  | MAX3620D |      | 760  |          |     |  |
|   |        | $Z_{LOAD} \gg Z_{SOURCE}$ ,<br>source termination only<br>(Note 5)     | MAX3620A |      | 590  |          |     |  |
|   |        |  | MAX3620B |      | 720  |          |     |  |
|   |        |  | MAX3620C |      | 810  |          |     |  |
|   |        |  | MAX3620D |      | 890  |          |     |  |

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MAX3620

## ELECTRICAL CHARACTERISTICS (continued)

(Typical ambient temperature is +25°C. See Table 1 for more information.)

**Note 1:** Load and source resistance =  $50\Omega \pm 1\%$ , capacitance  $\leq 1\text{pF}$ . Input transition time (20% to 80%) = 300ps.

**Note 2:** The clock frequency is the maximum operational clock frequency listed in Table 1.

**Note 3:** Load and source resistance =  $50\Omega \pm 1\%$ , capacitance  $\leq 1\text{pF}$ .

**Note 4:** Insertion loss is relative to a lossless  $50\Omega$  transmission line. Ideally, an insertion loss of 0dB will result in 0.5 times the open-circuit transmitter output.

**Note 5:** Source termination only (no-load termination), 5pF and 20k $\Omega$  at load, 300ps input transition time (20% to 80%). Load capacitance dominates performance.

**Note 6:** Insertion loss is relative to an ideal open 20k $\Omega$  load. Ideally, an insertion loss of 0dB will result in 0.998 times the open-circuit transmitter output.

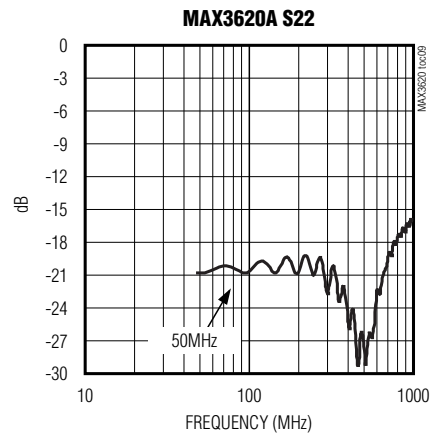
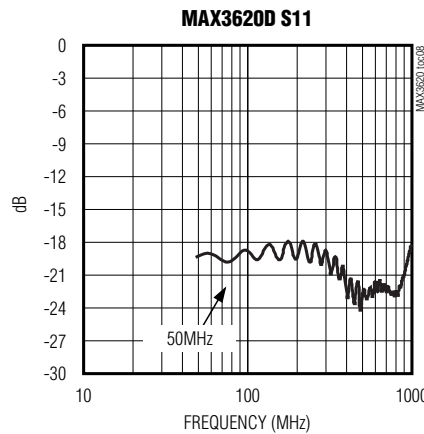
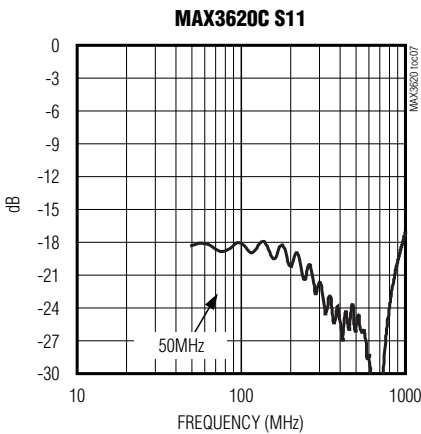
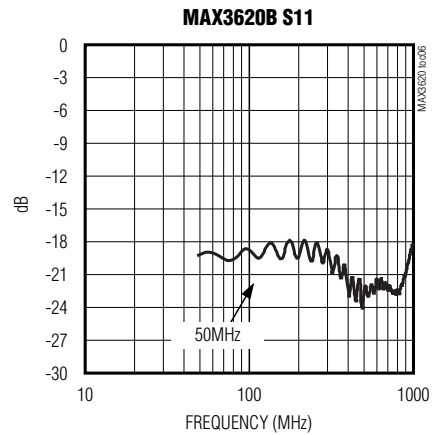
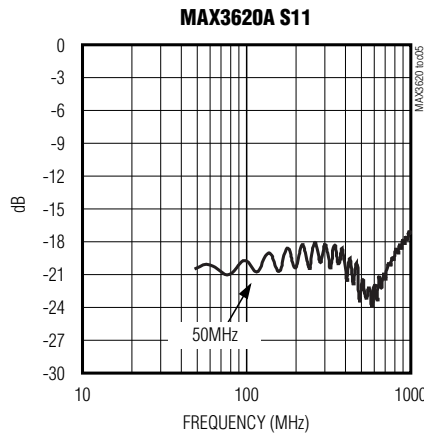
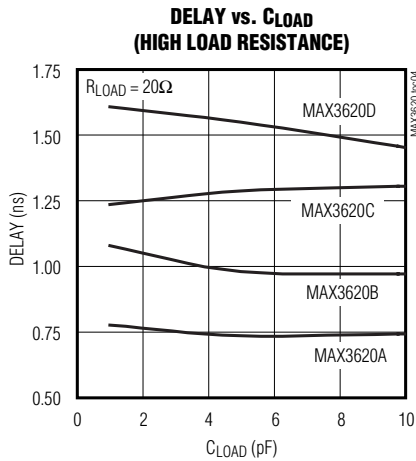
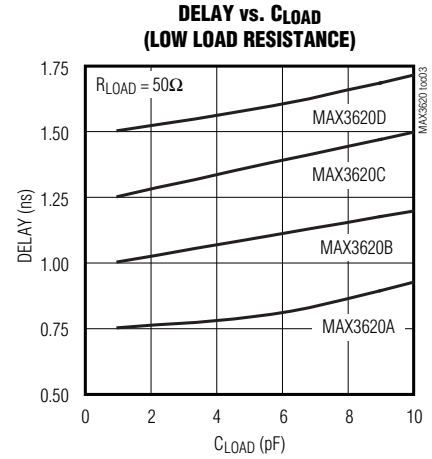
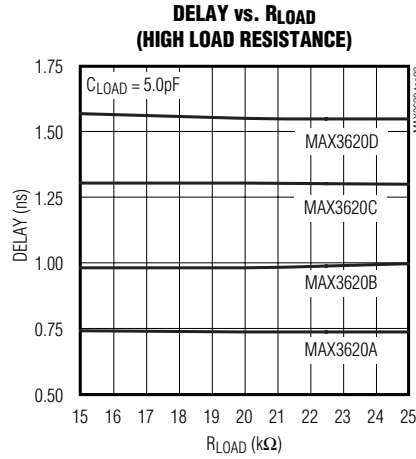
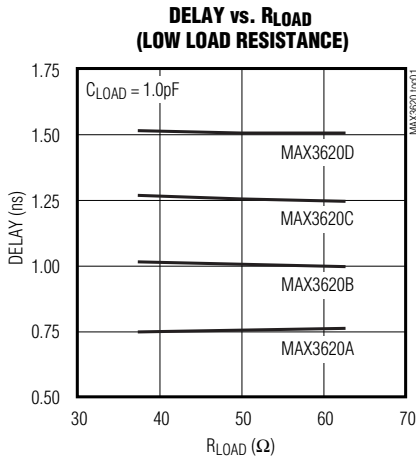
**Table 1. Recommended Operating Conditions**

| PARAMETER                     | CONDITIONS   | MIN  | TYP | MAX  | UNITS            |
|-------------------------------|--|------|-----|------|------------------|
| Operating Ambient Temperature |  | -40  | +25 | +85  | °C               |
| Recommended Load Capacitance  | $Z_{\text{LOAD}} \gg 50\Omega$ , source termination only |      | 5   |      | pF               |
| Recommended Load Resistance   | $Z_{\text{LOAD}} \gg 50\Omega$ , source termination only |      | 20  |      | k $\Omega$       |
| Clock Frequency               | MAX3620A   | 250  |     | 333  | MHz              |
|                               | MAX3620B   | 190  |     | 250  |                  |
|                               | MAX3620C   | 150  |     | 200  |                  |
|                               | MAX3620D   | 125  |     | 167  |                  |
| Input Amplitude               |  |      |     | 1.5  | V <sub>P-P</sub> |
| Input Voltage Range           |  | -1.5 |     | +1.5 | V                |

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## Typical Operating Characteristics

( $T_A = +25^\circ\text{C}$ , unless otherwise noted.)

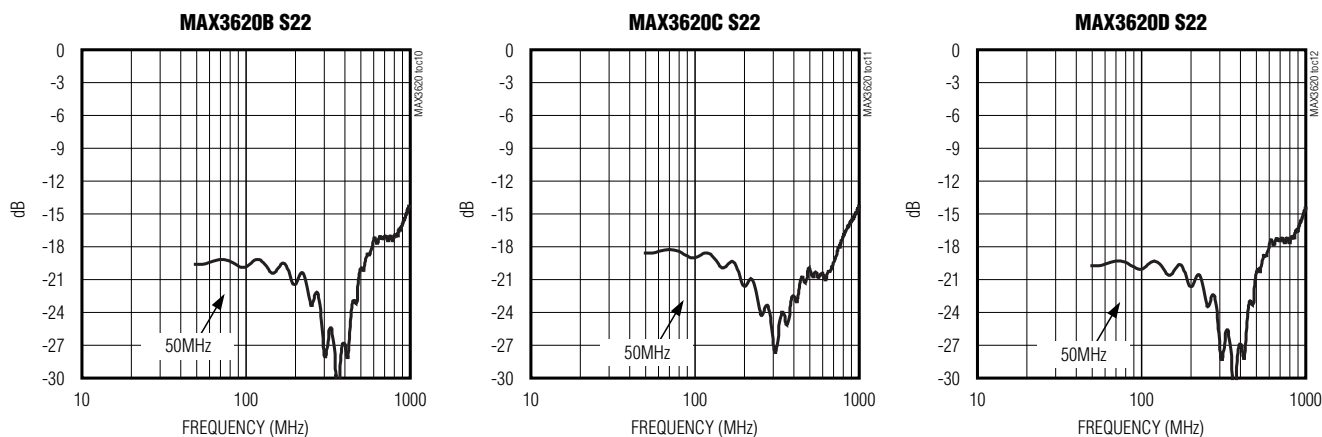


# Delay Lines for High-Speed Clock Distribution Systems

**MAX3620**

## Typical Operating Characteristics (continued)

(T<sub>A</sub> = +25°C, unless otherwise noted.)



### Pin Description

| PIN | NAME        | FUNCTION                            |
|-----|-------------|-------------------------------------|
| 1   | IN1         | Single-Ended Input 1                |
| 2   | COMMON      | Common                              |
| 3   | IN2         | Single-Ended Input 2                |
| 4   | OUT2        | Single-Ended Output 2               |
| 5   | COMMON      | Common                              |
| 6   | OUT1        | Single-Ended Output 1               |
| —   | Exposed Pad | Connect to same potential as COMMON |

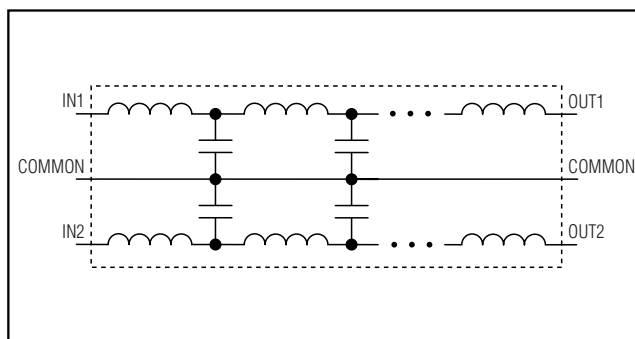


Figure 1. Functional Diagram

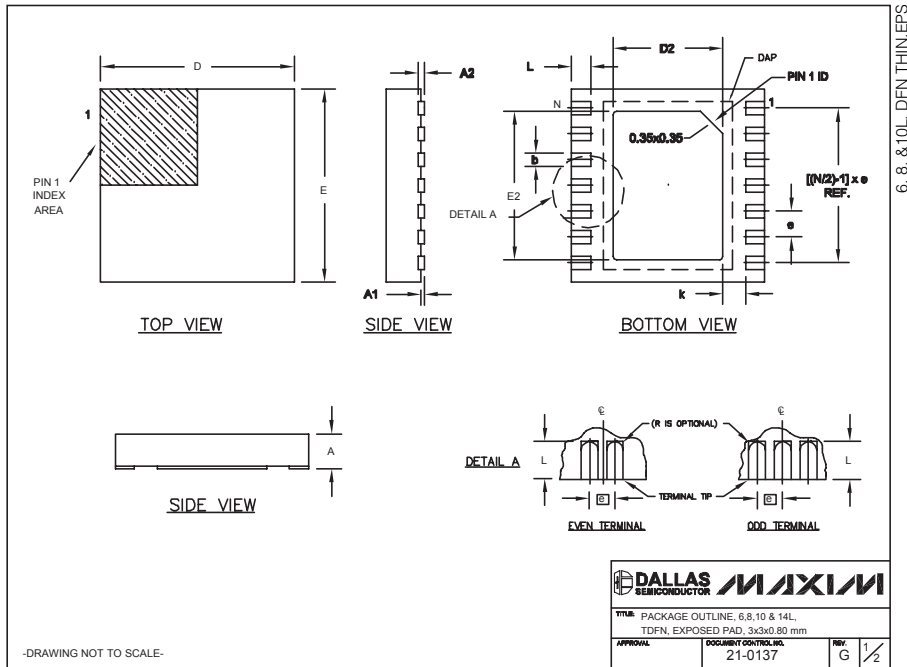
### Detailed Description

The MAX3620 delay lines are transmission lines constructed with a series of L-C sections. Figure 1 is a functional diagram of the MAX3620. The distributed architecture of the MAX3620 allows for symmetrical impedance looking into each terminal. When the MAX3620 is used in single-ended operation, leave unused input/output open.

# Delay Lines for High-Speed Clock Distribution Systems

## Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to [www.maxim-ic.com/packages](http://www.maxim-ic.com/packages).)



| COMMON DIMENSIONS |      |           |  |
|-------------------|------|-----------|--|
| SYMBOL            | MIN. | MAX.      |  |
| A                 | 0.70 | 0.80      |  |
| D                 | 2.90 | 3.10      |  |
| E                 | 2.90 | 3.10      |  |
| A1                | 0.00 | 0.05      |  |
| L                 | 0.20 | 0.40      |  |
| k                 |      | 0.25 MIN. |  |
| A2                |      | 0.20 REF. |  |

| PACKAGE VARIATIONS |    |           |           |          |                |           |               |                   |
|--------------------|----|-----------|-----------|----------|----------------|-----------|---------------|-------------------|
| PKG. CODE          | N  | D2        | E2        | e        | JEDEC SPEC     | b         | [(N/2)-1] x e | DOWNBONDS ALLOWED |
| T633-1             | 6  | 1.50±0.10 | 2.30±0.10 | 0.95 BSC | MO229 / WEEA   | 0.40±0.05 | 1.90 REF      | NO                |
| T633-2             | 6  | 1.50±0.10 | 2.30±0.10 | 0.95 BSC | MO229 / WEEA   | 0.40±0.05 | 1.90 REF      | NO                |
| T833-1             | 8  | 1.50±0.10 | 2.30±0.10 | 0.65 BSC | MO229 / WEEC   | 0.30±0.05 | 1.95 REF      | NO                |
| T833-2             | 8  | 1.50±0.10 | 2.30±0.10 | 0.65 BSC | MO229 / WEEC   | 0.30±0.05 | 1.95 REF      | NO                |
| T833-3             | 8  | 1.50±0.10 | 2.30±0.10 | 0.65 BSC | MO229 / WEEC   | 0.30±0.05 | 1.95 REF      | YES               |
| T1033-1            | 10 | 1.50±0.10 | 2.30±0.10 | 0.50 BSC | MO229 / WEED-3 | 0.25±0.05 | 2.00 REF      | NO                |
| T1433-1            | 14 | 1.70±0.10 | 2.30±0.10 | 0.40 BSC | ----           | 0.20±0.05 | 2.40 REF      | YES               |
| T1433-2            | 14 | 1.70±0.10 | 2.30±0.10 | 0.40 BSC | ----           | 0.20±0.05 | 2.40 REF      | NO                |

NOTES:  
 1. ALL DIMENSIONS ARE IN mm. ANGLES IN DEGREES.  
 2. COPLANARITY SHALL NOT EXCEED 0.08 mm.  
 3. WARPAGE SHALL NOT EXCEED 0.10 mm.  
 4. PACKAGE LENGTH/PACKAGE WIDTH ARE CONSIDERED AS SPECIAL CHARACTERISTIC(S).  
 5. DRAWING CONFORMS TO JEDEC MO229, EXCEPT DIMENSIONS "D2" AND "E2", AND T1433-1 & T1433-2.  
 6. "N" IS THE TOTAL NUMBER OF LEADS.  
 7. NUMBER OF LEADS SHOWN ARE FOR REFERENCE ONLY.

-DRAWING NOT TO SCALE-

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