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FAIRCHILD SEMICONDUCTOR®

May 2011

# FAN256 — Dual Low Voltage Comparator

## Features

- Low Supply Current: $I_{DD}$=7µA (Typical)
- Single Power Supply Operation
- Wide Common-Mode Input Voltage Range: Rail-to-Rail
- Push-Pull Output Circuit
- Low Input Bias Current
- Internal Hysteresis
- Packaged in MicroPak™ 8 (1.6mm x 1.6mm)

## Applications

- Mobile Phones
- Alarm and Security Systems
- Personal Digital Assistants

## Description

The FAN256 is a low-power, dual comparator that typically consumes less than 10µA supply current per comparator. Guaranteed to operate at a low voltage of 1.6V and fully operational up to 5.5V, it is convenient for use in 1.8, 3.0V, and 5.0V systems.

The FAN256 has a complementary push-pull P- and N-channel output stage capabile of driving a rail-to-rail output swing with a load ranging up to 5.0mA.

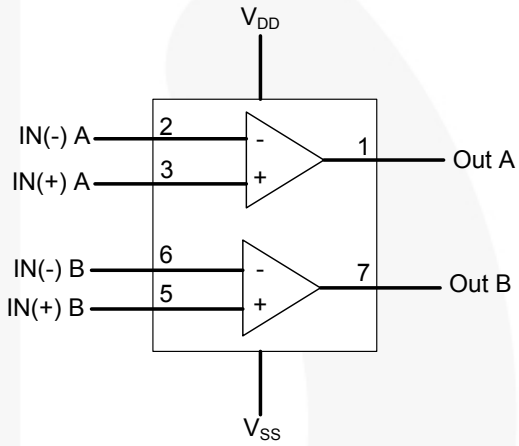


**Figure 1. Functional Diagram**

## Ordering Information

| Part Number | Top Mark | Operating Temperature Range | Package | Packing Method |
|---|---|---|---|---|
| FAN256L8X | CP | -40 to 85°C | 8-Lead, MicroPak™ 1.6mm x 1.6mm Package | 5000 Units on Tape and Reel |

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## Pin Configuration

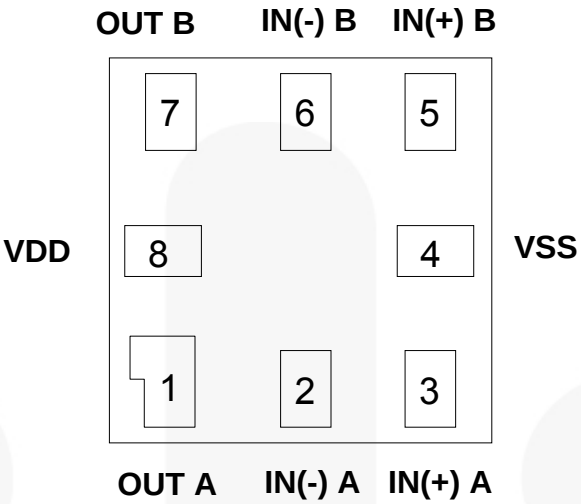


**Figure 2. Pin Configuration (Top Through View)**

## Pin Definitions

| Pin # | Name | Description |
|---|---|---|
| 1 | OUT A | Comparator A Output |
| 2 | IN(-) A | Inverting Input of Comparator A |
| 3 | IN(+) A | Non-Inverting Input of Comparator A |
| 4 | VSS | Negative Supply Voltage |
| 5 | IN(+) B | Non-Inverting Input of Comparator B |
| 6 | IN(-) B | Inverting Input of Comparator B |
| 7 | OUT B | Comparator B Output |
| 8 | VDD | Positive Supply Voltage |

## Function Table

| Inputs | Outputs |
|---|---|
| IN(-) > IN(+) | Output LOW |
| IN(+) > IN(-) | Output HIGH |

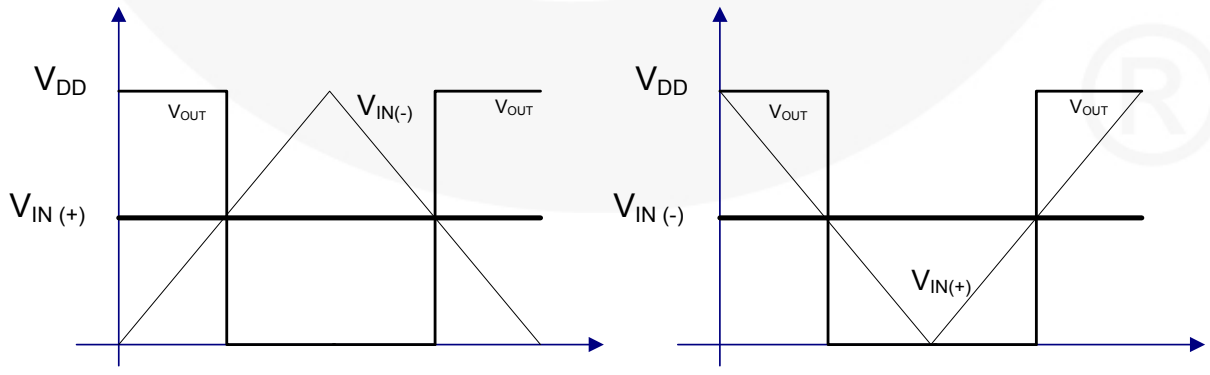


**Figure 3. $V_{IN}$ vs. $V_{OUT}$**

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## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol | Parameter | Condition | Min. | Max. | Unit |
|---|---|---|---|---|---|
| $V_{DD}$ to $V_{SS}$ | Supply Voltage | | -3.0 | +3.0 | V |
| | | | 0 | 6.0 | |
| $DV_{IN}$ | Differential Input Voltage | | | ±6 | |
| $V_{IN}$ | Input Voltage | | | $V_{SS}$ to $V_{DD}$ | V |
| $t_s$ | Output Short Circuit Duration(1) | | | Indefinite | S |
| $T_J$ | Junction Temperature | | | +150 | °C |
| $T_{STG}$ | Storage Temperature Range | | -65 | +150 | °C |
| $P_D$ | Power Dissipation | | | 226 | mW |
| $\Theta_{JA}$ | Thermal Resistance | | | 287 | °C/W |
| ESD | IEC 61000-4-2 System ESD | Air Gap | | 15 | kV |
| | | Contact | | 8 | |
| | JEDEC JESD22-A114, Human Body Model | All Pins | | 8 | |
| | | Pin to Pin: IN(-), IN(+) to $V_{DD}$ or $V_{SS}$ | | 12 | |
| | JEDEC JESD22-C101, Charged Device Model | All Pins | | 2 | |

**Note:**
1. The maximum total power dissipation must not be exceeded.

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

| Symbol | Parameter | Condition | Min. | Max. | Unit |
|---|---|---|---|---|---|
| $V_{DD}$ to $V_{SS}$ | Power Supply | | -2.75 | +2.75 | V |
| | | | 0 | 5.5 | |
| $V_{DD}$ | Power Supply | $V_{SS}$=0V | 1.6 | 5.5 | V |
| $V_{IN}$ | Input Voltage | | | $V_{SS}$ to $V_{DD}$ | V |
| $I_{OH}/I_{OL}$ | Output Sink/Source Current | $V_{DD}$=5.0V | | 5 | mA |
| | | $V_{DD}$=3.0V | | 3 | |
| | | $V_{DD}$=1.6V | | 1 | |
| $T_A$ | Operating Temperature, Free Air | | -40 | +85 | °C |

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## Electrical Characteristics

| Symbol | Parameter | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **$V_{DD}$=5.5V, $V_{SS}$=GND, and $T_A$=+25°C** | | | | | | |
| $V_{HYS}$ | Input Hysteresis | $V_{CM}$=0.5$V_{DD}$ | | 4 | | mV |
| $V_{IO}$ | Input Offset Voltage[2] | $V_{CM}$=0.5$V_{DD}$ | -15 | ±1 | +15 | mV |
| $I_{IO}$ | Input Offset Current | | | 10 | | pA |
| $I_I$ | Input Bias Current | | | 10 | | pA |
| $V_{CM}$ | Common Mode Input Voltage | | $V_{SS}$ | | $V_{DD}$ | V |
| CMRR | Common Mode Rejection Ratio[3] | $V_{CM}$=$V_{DD}$ | | 68 | | dB |
| $I_{DD}$ | Supply Current - Per Comparator | | | 7 | 17 | µA |
| PSRR | Power Supply Rejection Ratio[3] | $\Delta V_{DD}$=0.5V | 45 | 80 | | dB |
| $I_{OS}$ | Output Short Circuit Current | $V_O$=$V_{DD}$ | | 60 | | mA |
| | | $V_O$=$V_{SS}$ | | 90 | | |
| $V_{OL}$ | Low-Level Output Voltage | $I_{SINK}$=5.0mA | | 0.1 | 0.3 | V |
| $V_{OH}$ | High-Level Output Voltage | $I_{SOURCE}$=5.0mA | 5.2 | 5.4 | | V |
| $t_{PLH}$ | Propagation Delay (Turn-On) | Overdrive=20mV, $C_L$=15pF | | 0.40 | | µs |
| $t_{PHL}$ | Propagation Delay (Turn-Off) | Overdrive=20mV, $C_L$=15pF | | 0.42 | | µs |
| $t_{TLH}$ | Response Time, Output Rise/Fall[4] | $C_L$=50pF | | 4.0 | | ns |
| $t_{THL}$ | | | | 5.4 | | |
| **$V_{DD}$=3V, $V_{SS}$=GND, and $T_A$=+25°C** | | | | | | |
| $V_{HYS}$ | Input Hysteresis | $V_{CM}$=0.5$V_{DD}$ | | 4 | | mV |
| $V_{IO}$ | Input Offset Voltage[2] | $V_{CM}$=0.5$V_{DD}$ | -15 | ±1 | +15 | mV |
| $I_{IO}$ | Input Offset Current | | | 10 | | pA |
| $I_I$ | Input Bias Current | | | 10 | | pA |
| $V_{CM}$ | Common Mode Input Voltage | | $V_{SS}$ | | $V_{DD}$ | V |
| CMRR | Common Mode Rejection Ratio[3] | $V_{CM}$=$V_{DD}$ | | 60 | | dB |
| $I_{DD}$ | Supply Current(x) Per Comparator | | | 6 | 15 | µA |
| PSRR | Power Supply Rejection Ratio[3] | $\Delta V_{DD}$=0.5V | 45 | 70 | | dB |
| $I_{OS}$ | Output Short Circuit Current | $V_O$=$V_{DD}$ | | 27 | | mA |
| | | $V_O$=$V_{SS}$ | | 35 | | |
| $V_{OL}$ | Low-Level Output Voltage | $I_{SINK}$=3.0mA | | 0.15 | 0.35 | V |
| $V_{OH}$ | High-Level Output Voltage | $I_{SOURCE}$=3.0mA | 2.65 | 2.85 | | V |
| $t_{PLH}$ | Propagation Delay (Turn-On) | Overdrive=20mV, $C_L$=15pF | | 0.45 | | µs |
| $t_{PHL}$ | Propagation Delay (Turn-Off) | Overdrive=20mV, $C_L$=15pF | | 0.47 | | µs |
| $t_{TLH}$ | Response Time, Output Rise/Fall[4] | $C_L$=50pF | | 6.1 | | ns |
| $t_{THL}$ | | | | 6.2 | | |

*Continued on the following page…*

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## Electrical Characteristics

| Symbol | Parameter | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **$V_{DD}$=1.6V, $V_{SS}$=GND, and $T_A$=+25°C** | | | | | | |
| $V_{HYS}$ | Input Hysteresis | $V_{CM}$=0.5$V_{DD}$ | | 3.5 | | mV |
| $V_{IO}$ | Input Offset Voltage(2) | $V_{CM}$=0.5$V_{DD}$ | -15 | ±1 | +15 | mV |
| $I_{IO}$ | Input Offset Current | | | 10 | | pA |
| $I_I$ | Input Bias Current | | | 10 | | pA |
| $V_{CM}$ | Common Mode Input Voltage | | $V_{SS}$ | | $V_{DD}$ | V |
| CMRR | Common Mode Rejection Ratio(3) | $V_{CM}$=$V_{DD}$ | | 56 | | dB |
| $I_{DD}$ | Supply Current(x) Per Comparator | | | 5 | 13 | µA |
| PSRR | Power Supply Rejection Ratio(3) | $\Delta V_{DD}$=0.5V | 45 | 70 | | dB |
| $I_{OS}$ | Output Short Circuit Current | $V_O$=$V_{DD}$ | | 5.5 | | mA |
| | | $V_O$=$V_{SS}$ | | 7.5 | | |
| $V_{OL}$ | Low-Level Output Voltage | $I_{SINK}$=1.0mA | | 0.15 | 0.25 | V |
| $V_{OH}$ | High-Level Output Voltage | $I_{SOURCE}$=1.0mA | 1.35 | 1.50 | | V |
| $t_{PLH}$ | Propagation Delay (Turn-On) | Overdrive=20mV, $C_L$=15pF | | 0.52 | | µs |
| $t_{PHL}$ | Propagation Delay (Turn-Off) | Overdrive=20mV, $C_L$=15pF | | 0.54 | | µs |
| $t_{TLH}$ | Response Time, Output Rise/Fall(4) | $C_L$=50pF | | 16.5 | | ns |
| $t_{THL}$ | | | | 13.0 | | |

**Notes:**
2. Differential input switching level is guaranteed at the minimum or maximum offset voltage, minus or plus half the maximum hysteresis voltage.
3. Guaranteed by design and characterization data
4. Input signal: 1kHz, square-wave signal with 10ns edge rate.

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## Typical Performance Characteristics

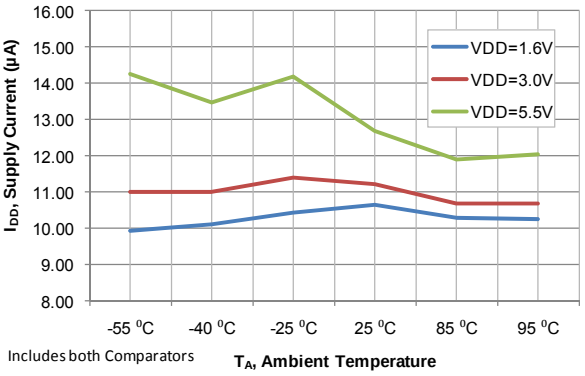



**Figure 4. Supply Current vs. Temperature**

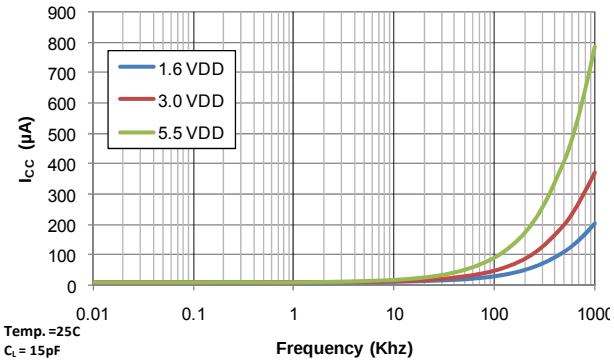



**Figure 5. Supply Current vs. Output Transition Frequency**

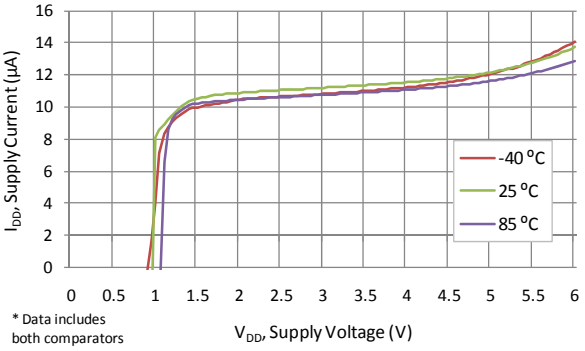



**Figure 6. Supply Current vs. Supply Voltage**

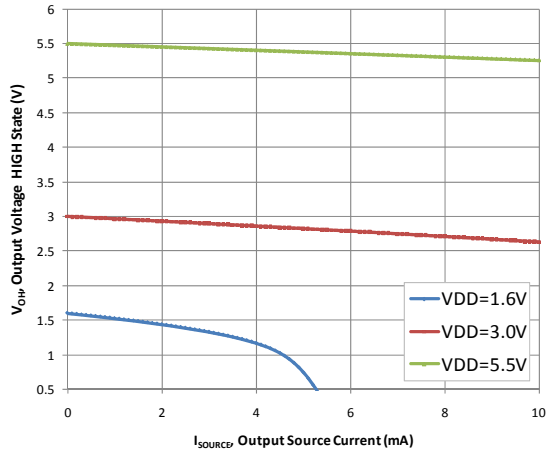



**Figure 7. Output HIGH vs. Output Drive Current**

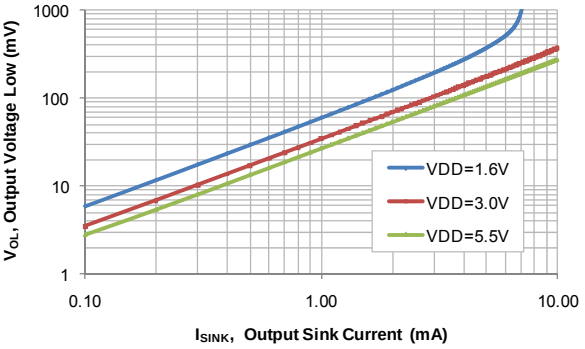



**Figure 8. Output LOW vs. Output Drive Current**

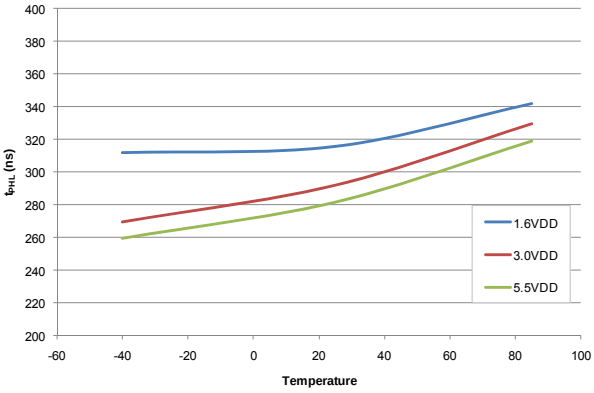



**Figure 9. Propagation Delay ($t_{PHL}$) vs. Temperature**

## Typical Performance Characteristics (Continued)

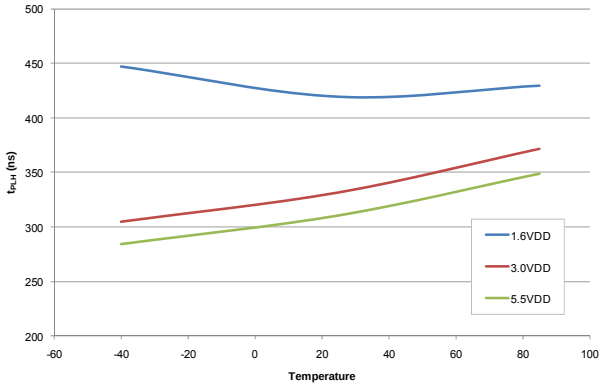



**Figure 10. Propagation Delay ($t_{PLH}$) vs. Temperature**

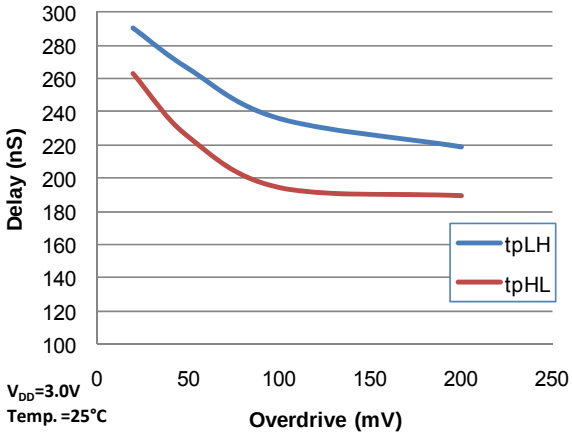



**Figure 11. Propagation Delay vs. Input Overdrive**

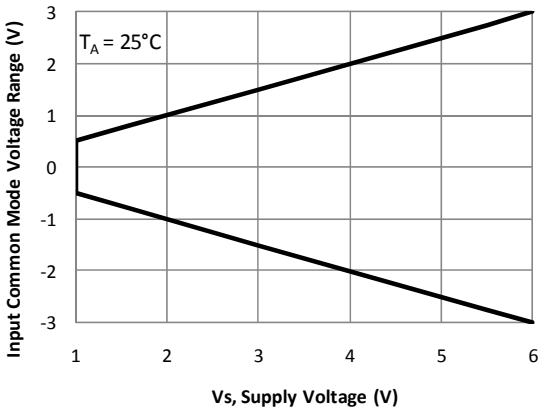



**Figure 12. Input Common Mode Voltage Range vs. Supply Voltage**

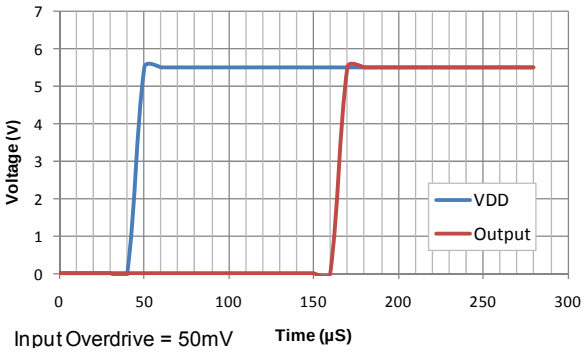
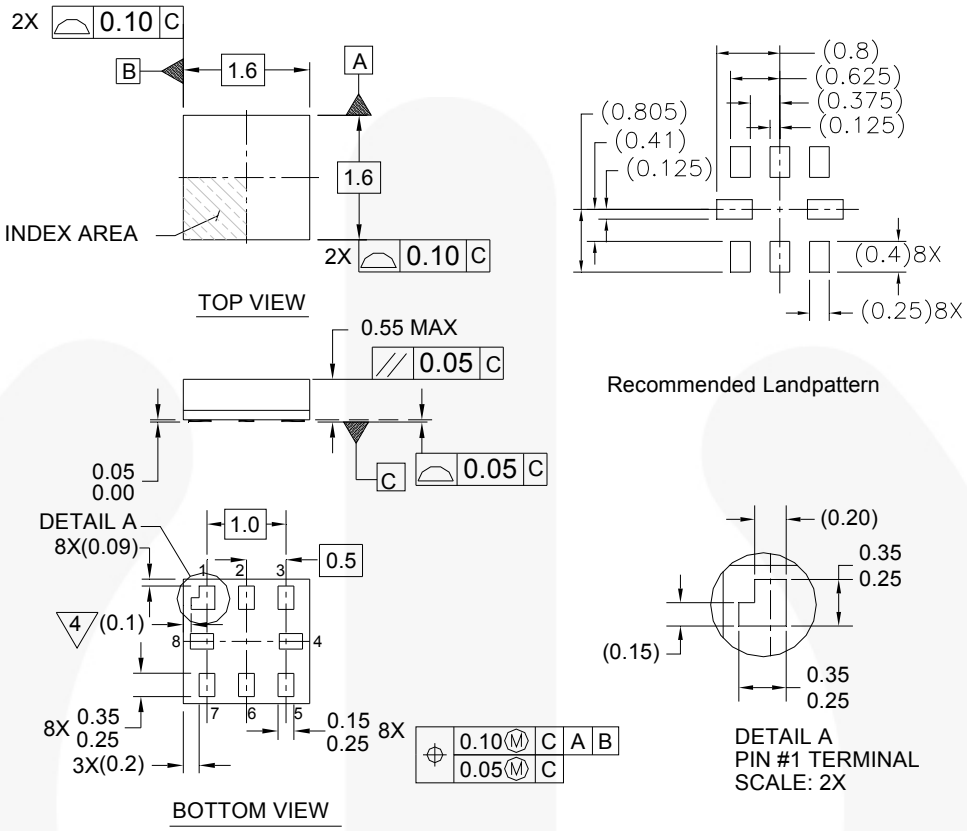



**Figure 13. Power-Up Delay**

## Physical Dimensions




Notes:

1. PACKAGE CONFORMS TO JEDEC MO-255 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y.14M-1994
4. PIN 1 FLAG, END OF PACKAGE OFFSET
5. DRAWING FILE NAME: MKT-MAC08AREV4

MAC08AREV4

**Figure 14. 8-Lead, MicroPak™ 1.6mm Wide**

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