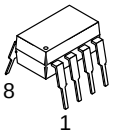
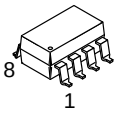
# 3.3 V/5 V High Speed-10 MBit/s Logic Gate Optocouplers

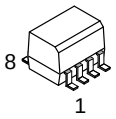
# FOD060L, FOD260L




**PDIP8 9.655x6.6, 2.54P (DIP)**
**CASE 646CQ**




**PDIP8 GW (SMT)**
**CASE 709AC**




**SOIC8 (Small Outline)**
**CASE 751DZ**

## Description

These optocouplers consist of an AlGaAS LED, optically coupled to a very high speed integrated photo-detector logic gate. Devices include a strobable output. This output features an open collector, thereby permitting wired OR outputs. The coupled parameters are guaranteed over the temperature range of −40 °C to +85 °C. A maximum input signal of 5 mA will provide a minimum output sink current of 13 mA (fan out of 8). An internal noise shield provides superior common mode rejection of typically 50 kV/μs at 1,000 V common mode.

## Features

- FOD060L in SO8 and FOD260L in 8-pin DIP
- Very High Speed − 10 MBit/s
- Superior CMR − 50 kV/μs at 1,000 V Peak
- Fan-out of 8 over −40 °C to +85 °C
- Logic Gate Output
- Strobable Output
- Wired OR-open Collector
- Safety and Regulatory Approvals
  - UL1577
  - DIN EN/IEC 60747-5-2

## Applications

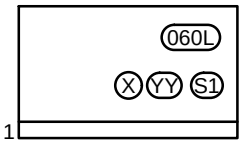
- Ground Loop Elimination
- LSTTL to TTL, LSTTL or 5-volt CMOS
- Line Receiver, Data Transmission
- Data Multiplexing
- Switching Power Supplies
- Pulse Transformer Replacement
- Computer-peripheral Interface

## TRUTH TABLE (POSITIVE LOGIC)

| Input | Enable | Output |
|---|---|---|
| On | H | L |
| Off | H | H |
| On | L | H |
| Off | L | H |
| On* | NC* | L* |
| Off* | NC* | H* |

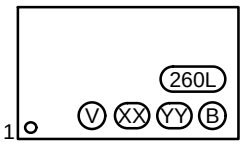
* Devices with pin 7 not connected.
A 0.1 μF bypass capacitor must be connected between pins 5 and 8. (See Note 2)

## MARKING DIAGRAM




SOIC8

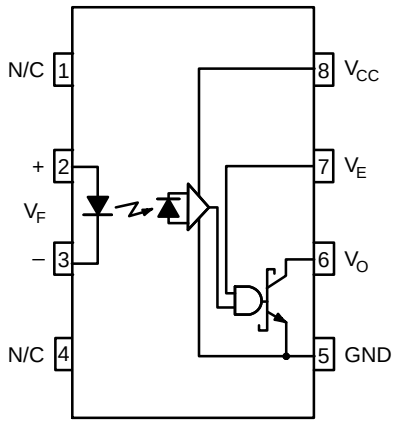
060L = Device number
X = One digit year code, e.g., ‘8’
YY = Two digit work week ranging from ‘01’ to ‘53’
S1 = Assembly package code




PDIP8/PDIP8 GW

260L = Device number
V = VDE mark (Note: Only appears on parts ordered with DIN EN/IEC 60747-5-2 option – See order entry table)
XX = Two digit year code, e.g., ‘11’
YY = Two digit work week ranging from ‘01’ to ‘53’
B = Assembly package code

## BLOCK DIAGRAM




## ORDERING INFORMATION

See detailed ordering and shipping information on page 11 of this data sheet.

**SAFETY AND INSULATION RATINGS** (As per DIN EN/IEC 60747-5-5, this optocoupler is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings shall be ensured by means of protective circuits.)

| Parameter | | Characteristics |
|---|---|---|
| Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage | <150 $V_{RMS}$ | I–IV |
| | <300 $V_{RMS}$ | I–III |
| Climatic Classification | | 55/100/21 |
| Pollution Degree (DIN VDE 0110/1.89) | | 2 |
| Comparative Tracking Index | | 175 |

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{PR}$ | Input-to-Output Test Voltage, Method A, $V_{IORM}$ x 1.6 = $V_{PR}$, Type and Sample Test with $t_m$ = 10 s, Partial Discharge < 5 pC | 904 | $V_{peak}$ |
| | Input-to-Output Test Voltage, Method B, $V_{IORM}$ x 1.875 = $V_{PR}$, 100% Production Test with $t_m$ = 1 s, Partial Discharge < 5 pC | 1060 | $V_{peak}$ |
| $V_{IORM}$ | Maximum Working Insulation Voltage | 565 | $V_{peak}$ |
| $V_{IOTM}$ | Highest Allowable Over-Voltage | 4000 | $V_{peak}$ |
| | External Creepage | ≥4 | mm |
| | External Clearance | ≥4 | mm |
| DTI | Distance Through Insulation (Insulation Thickness) | ≥0.4 | mm |
| $T_S$ | Case Temperature (Note 1) | 150 | °C |
| $I_{S,INPUT}$ | Input Current (Note 1) | 200 | mA |
| $P_{S,OUTPUT}$ | Output Power (Note 1) | 300 | mW |
| $R_{IO}$ | Insulation Resistance at $T_S$, $V_{IO}$ = 500 V (Note 1) | $>10^9$ | Ω |

1. Safety limit values – maximum values allowed in the event of a failure.

**ABSOLUTE MAXIMUM RATINGS** (No derating required up to 85 °C)

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $T_{STG}$ | Storage Temperature | −40 to +125 | °C |
| $T_{OPR}$ | Operating Temperature | −40 to +85 | °C |
| **EMITTER** | | | |
| $I_F$ | DC/Average Forward Input Current | 50 | mA |
| $V_E$ | Enable Input Voltage, not to Exceed $V_{CC}$ by More than 500 mV | $V_{CC}$ + 0.5 V | V |
| $V_R$ | Reverse Input Voltage | 5.0 | V |
| $P_I$ | Power Dissipation | 45 | mW |
| **DETECTOR** | | | |
| $V_{CC}$ (1 minute max) | Supply Voltage | 7.0 | V |
| $I_O$ | Output Current | 50 | mA |
| $V_O$ | Output Voltage | 7.0 | V |
| $P_O$ | Collector Output Power Dissipation | 85 | mW |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected. Operating the device outside its recommended conditions, but still within its maximum rated limits may not cause immediate damage. However, doing so can lead to reduced performance, unpredictable behavior, and potentially shorten the device’s lifespan or reliability.

## RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Max | Unit |
|---|---|---|---|---|
| $I_{FL}$ | Input Current, Low Level | 0 | 250 | μA |
| $I_{FH}$ | Input Current, High Level | *6.3 | 15 | mA |
| $V_{CC}$ | Supply Voltage, Output | 3.0 | 5.5 | V |
| $V_{EL}$ | Enable Voltage, Low Level | 0 | 0.8 | V |
| $V_{EH}$ | Enable Voltage, High Level | 2.0 | $V_{CC}$ | V |
| $T_A$ | Operating Temperature | −40 | +85 | °C |
| N | Fan Out (TTL Load) | | 8 | |
| $R_L$ | Output Pull-up Resistor | 330 | 4K | Ω |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

* 6.3 mA is a guard banded value which allows for at least 20% CTR degradation. Initial input current threshold value is 5.0 mA or less.

## ELECTRICAL CHARACTERISTICS ($T_A$ = −40 °C to +85 °C unless otherwise specified. Typical value is measured at $T_A$ = 25 °C and $V_{CC}$ = 3.3 V)

| Symbol | Parameter | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **INDIVIDUAL COMPONENT CHARACTERISTICS** | | | | | | |
| **EMITTER** | | | | | | |
| $V_F$ | Input Forward Voltage | $I_F$ = 10 mA | | 1.4 | 1.8 | V |
| | | $T_A$ = 25 °C | | | 1.75 | |
| $B_{VR}$ | Input Reverse Breakdown Voltage | $I_R$ = 10 μA | 5.0 | | | V |
| $C_{IN}$ | Input Capacitance | $V_F$ = 0, f = 1 MHz | | 6.0 | | pF |
| ΔVF/ΔTA | Input Diode Temperature Coefficient | $I_F$ = 10 mA | | −1.9 | | mV/°C |
| **DETECTOR** | | | | | | |
| $I_{CCH}$ | High Level Supply Current | $V_E$ = 0.5 V, $I_F$ = 0 mA, $V_{CC}$ = 3.3 V | | 3.5 | 7 | mA |
| $I_{CCL}$ | Low Level Supply Current | $V_E$ = 0.5 V, $I_F$ = 0 mA, $V_{CC}$ = 3.3 V | | 3.2 | 10 | mA |
| $I_{EL}$ | Low Level Enable Current | $V_{CC}$ = 3.3 V, $V_E$ = 0.5 V | | | −1.6 | mA |
| $I_{EH}$ | High Level Enable Current | $V_{CC}$ = 3.3 V, $V_E$ = 2.0 V | | | −1.6 | mA |
| $V_{EH}$ | High Level Enable Voltage | $V_{CC}$ = 3.3 V, $I_F$ = 10 mA | 2.0 | 1.27 | | V |
| $V_{EL}$ | Low Level Enable Voltage | $V_{CC}$ = 3.3 V, $I_F$ = 10 mA (Note 3) | | 1.18 | 0.8 | V |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## SWITCHING CHARACTERISTICS ($T_A$ = −40 °C to +85 °C, $V_{CC}$ = 3.3 V, $I_F$ = 7.5 mA unless otherwise specified. Typical value is measured at $T_A$ = 25 °C and $V_{CC}$ = 3.3 V)

| Symbol | AC Characteristics | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $T_{PLH}$ | Propagation Delay Time to Output High Level | $R_L$ = 350 Ω, $C_L$ = 15 pF (Figure 9) (Note 4) | | 65 | 90 | ns |
| $T_{PHL}$ | Propagation Delay Time to Output Low Level | $R_L$ = 350 Ω, $C_L$ = 15 pF (Figure. 9) (Note 5) | | 43 | 75 | ns |
| $\lvert T_{PHL} - T_{PLH} \rvert$ | Pulse Width Distortion | $R_L$ = 350 Ω, $C_L$ = 15 pF (Figure 9) | | 23 | 25 | ns |
| $t_{PSK}$ | Propagation Delay Skew | $R_L$ = 350 Ω, $C_L$ = 15 pF (Note 6) | | 31 | 40 | ns |
| $t_r$ | Output Rise Time (10−90%) | $R_L$ = 350 Ω, $C_L$ = 15 pF (Figure 9) (Note 7) | | 22 | | ns |
| $t_f$ | Output Fall Time (90−10%) | $R_L$ = 350 Ω, $C_L$ = 15 pF (Figure 9) (Note 8) | | 3 | | ns |
| $t_{ELH}$ | Enable Propagation Delay Time to Output High Level | $V_{EH}$ = 3 V, $R_L$ = 350 Ω, $C_L$ = 15 pF (Figure 10) (Note 9) | | 47 | | ns |

**SWITCHING CHARACTERISTICS** ($T_A$ = −40 °C to +85 °C, $V_{CC}$ = 3.3 V, $I_F$ = 7.5 mA unless otherwise specified. Typical value is measured at $T_A$ = 25 °C and $V_{CC}$ = 3.3 V) (continued)

| Symbol | AC Characteristics | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $t_{EHL}$ | Enable Propagation Delay Time to Output Low Level | $V_{EH}$ = 3 V, $R_L$ = 350 Ω, $C_L$ = 15 pF (Figure 10) (Note 10) | | 27 | | ns |
| $CM_H$ | Common Mode Transient Immunity (at Output High Level) | $R_L$ = 350 Ω, $T_A$ = 25 °C, $I_F$ = 0 mA, $V_{OH}$ (Min.) = 2.0 V, $\|V_{CM}\|$ = 1,000 V (Figure 11) (Note 11) | 25,000 | 50,000 | | V/μs |
| $CM_L$ | Common Mode Transient Immunity (at Output Low Level) | $R_L$ = 350 Ω, $T_A$ = 25 °C, $I_F$ = 7.5 mA, $V_{OL}$ (Max.) = 0.8 V, $\|V_{CM}\|$ = 1,000 V (Figure 11) (Note 12) | 25,000 | 50,000 | | V/μs |

**TRANSFER CHARACTERISTICS** ($T_A$ = −40 °C to +85 °C unless otherwise specified. Typical value is measured at $T_A$ = 25 °C and $V_{CC}$ = 3.3 V)

| Symbol | DC Characteristics | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{OH}$ | High Level Output Current | $I_F$ = 250 μA, $V_{CC}$ = 3.3 V, $V_O$ = 3.3 V, $V_E$ = 2.0 V (Note 3) | | 0.01 | 50 | μA |
| $V_{OL}$ | Low Level Output Voltage | $V_{CC}$ = 3.3 V, $I_F$ = 5 mA, $I_{OL}$ = 13 mA, $V_E$ = 2.0 V (Note 3) | | 0.3 | 0.6 | V |
| $I_{FT}$ | Input Threshold Current | $V_{CC}$ = 3.3 V, $V_O$ = 0.6 V, $I_{OL}$ = 13 mA, $V_E$ = 2.0 V (Note 3) | | 1 | 5 | mA |

**ISOLATION CHARACTERISTICS** ($T_A$ = −40 °C to +85 °C unless otherwise specified. Typical value is measured at $T_A$ = 25 °C and $V_{CC}$ = 3.3 V)

| Symbol | Characteristics | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{I-O}$ | Input-Output Insulation Leakage Current | Relative humidity = 45%, $T_A$ = 25 °C, t = 5 s, $V_{I-O}$ = 3000 VDC (Note 13) | | | 1.0 | μA |
| $V_{ISO}$ | Withstand Insulation Test Voltage | $I_{IO} \le 2$ μA, $R_H$ < 50%, $T_A$ = 25 °C, t = 1 min. (Note 13) | | | | VRMS |
| | FOD060L | | 3750 | | | |
| | FOD260L | | 5000 | | | |
| $R_{I-O}$ | Resistance (Input to Output) | $V_{I-O}$ = 500 V (Note 13) | | $10^{12}$ | | Ω |
| $C_{I-O}$ | Capacitance (Input to Output) | f = 1 MHz (Note 13) | | 0.6 | | pF |

NOTES:

2. The $V_{CC}$ supply to each optoisolator must be bypassed by a 0.1 μF capacitor or larger. This can be either a ceramic or solid tantalum capacitor with good high frequency characteristic and should be connected as close as possible to the package $V_{CC}$ and GND pins of each device.
3. Enable Input – No pull up resistor required as the device has an internal pull up resistor.
4. $t_{PLH}$ – Propagation delay is measured from the 3.75 mA level on the HIGH to LOW transition of the input current pulse to the 1.5 V level on the LOW to HIGH transition of the output voltage pulse.
5. $t_{PHL}$ – Propagation delay is measured from the 3.75 mA level on the LOW to HIGH transition of the input current pulse to the 1.5 V level on the HIGH to LOW transition of the output voltage pulse.
6. $t_{PSK}$ is the worst case difference between $t_{PHL}$ and $t_{PLH}$ for any devices at the stated test conditions.
7. $t_r$ – Rise time is measured from the 90% to the 10% levels on the LOW to HIGH transition of the output pulse.
8. $t_f$ – Fall time is measured from the 10% to the 90% levels on the HIGH to LOW transition of the output pulse.
9. $t_{ELH}$ – Enable input propagation delay is measured from the 1.5 V level on the HIGH to LOW transition of the input voltage pulse to the 1.5 V level on the LOW to HIGH transition of the output voltage pulse.
10. $t_{EHL}$ – Enable input propagation delay is measured from the 1.5 V level on the LOW to HIGH transition of the input voltage pulse to the 1.5 V level on the HIGH to LOW transition of the output voltage pulse.
11. $CM_H$ – The maximum tolerable rate of rise of the common mode voltage to ensure the output will remain in the high state (i.e., $V_{OUT}$ > 2.0 V). Measured in volts per microsecond (V/μs).
12. $CM_L$ – The maximum tolerable rate of fall of the common mode voltage to ensure the output will remain in the low output state (i.e., $V_{OUT}$ < 0.8 V). Measured in volts per microsecond (V/μs).
13. Device considered a two-terminal device: Pins 1, 2, 3 and 4 shorted together, and Pins 5, 6, 7 and 8 shorted together.

## TYPICAL PERFORMANCE CURVES

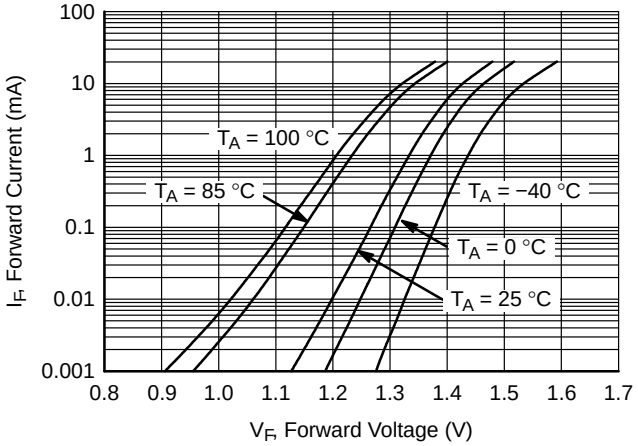



**Figure 1. Input Forward Current vs. Forward Voltage**

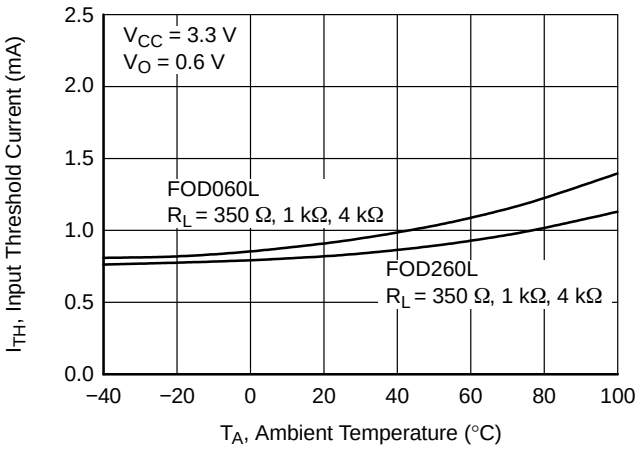



**Figure 2. Input Threshold Current vs. Ambient Temperature**

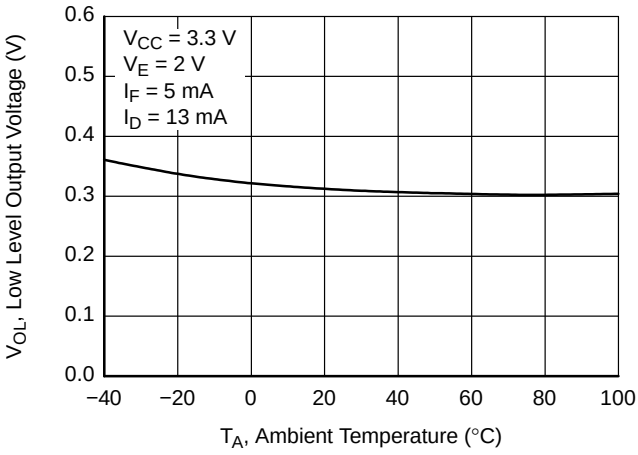



**Figure 3. Low Level Output Voltage vs. Ambient Temperature**

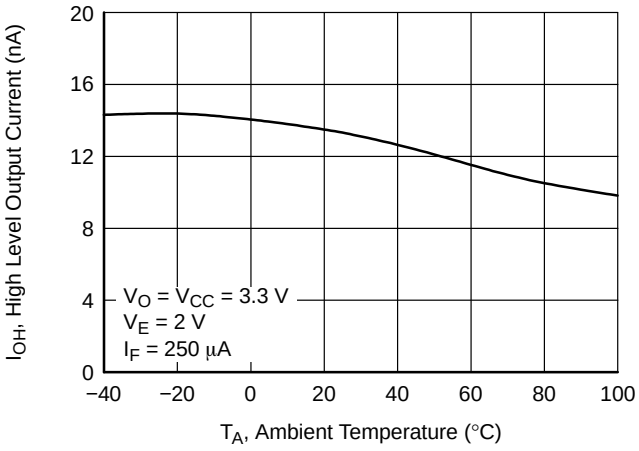



**Figure 4. High Level Output Current vs. Ambient Temperature**

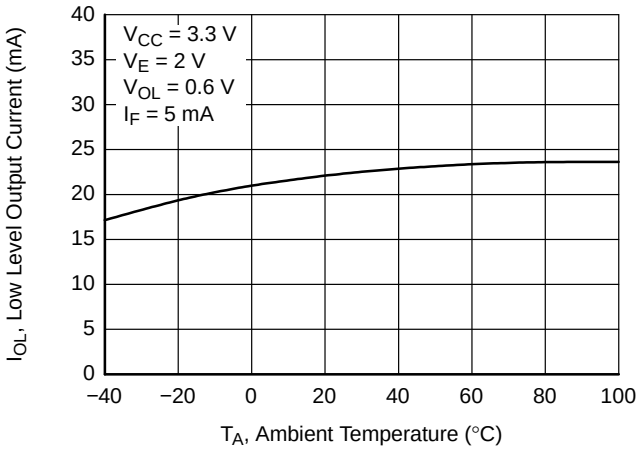



**Figure 5. Low Level Output Current vs. Ambient Temperature**

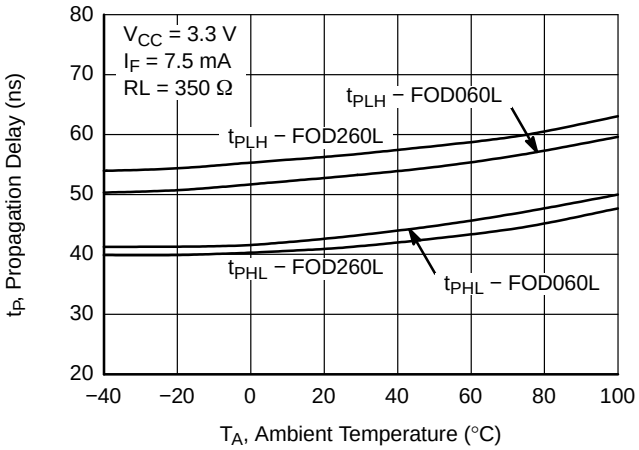



**Figure 6. Propagation Delay vs. Ambient Temperature**

## TYPICAL PERFORMANCE CURVES (CONTINUED)

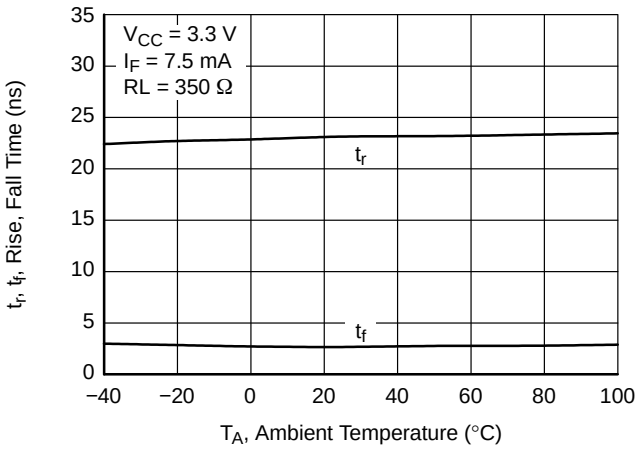



**Figure 7. Rise and Fall Times vs. Ambient Temperature**

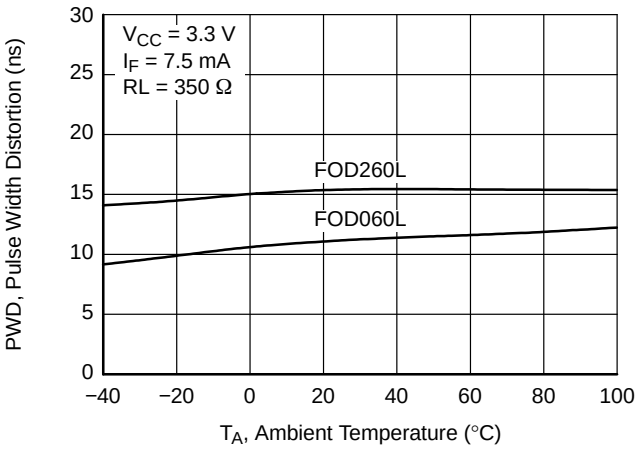



**Figure 8. Pulse Width Distortion vs. Ambient Temperature**

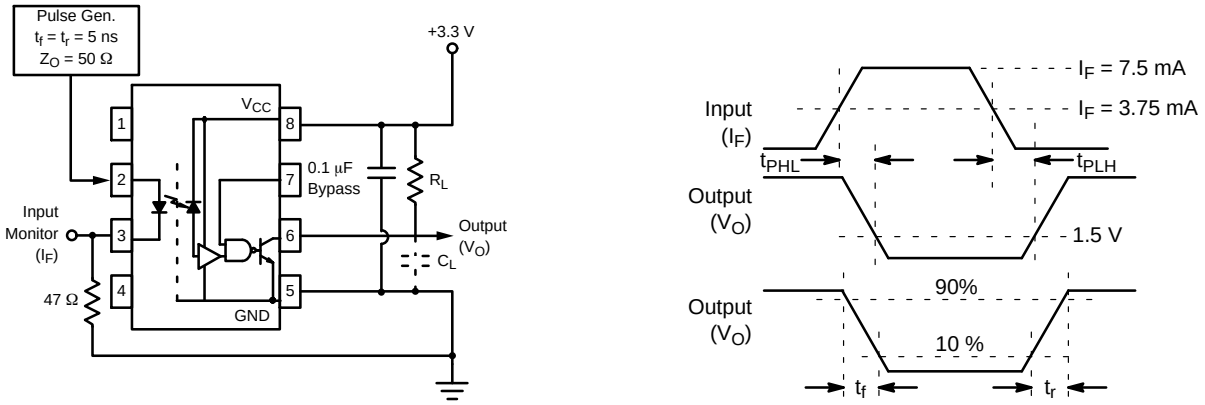



**Figure 9. Test Circuit and Waveforms for $t_{PLH}$, $t_{PHL}$, $t_r$ and $t_f$**

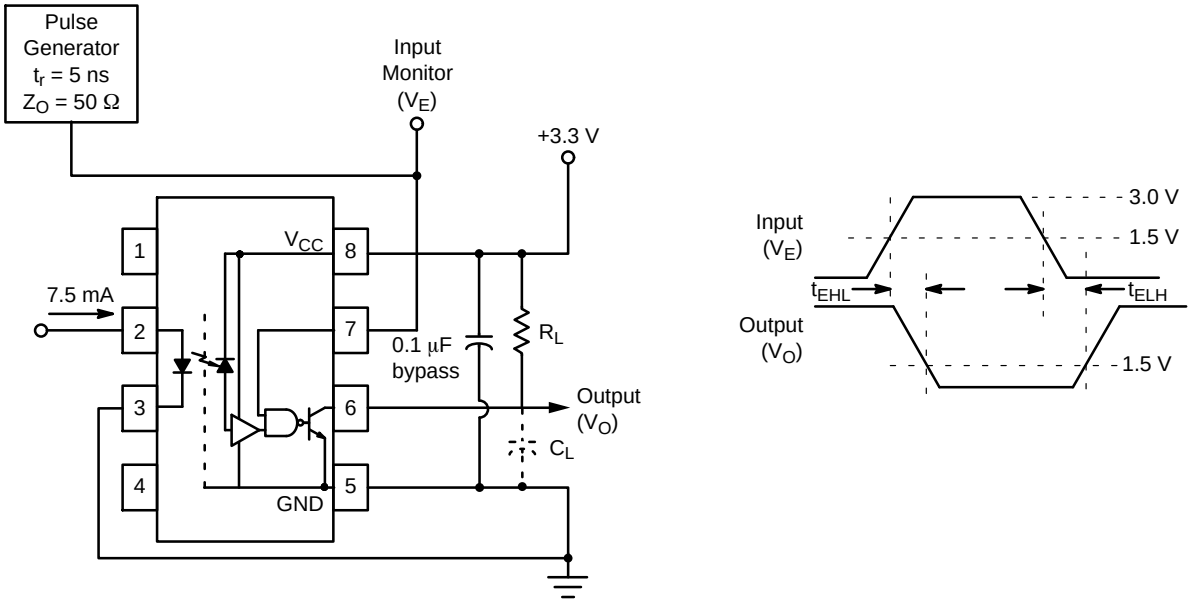



**Figure 10. Test Circuit $t_{EHL}$ and $t_{ELH}$**

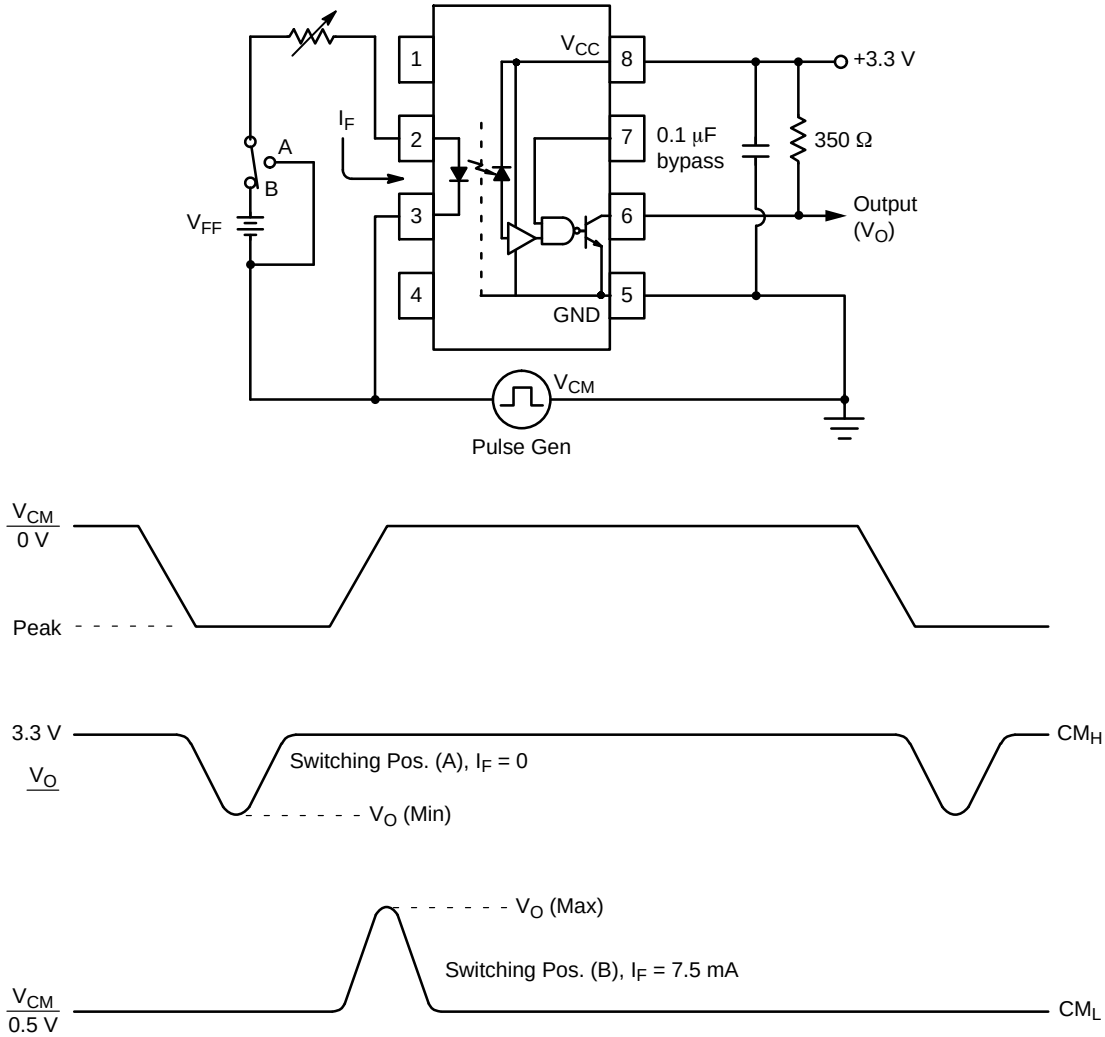



**Figure 11. Test Circuit Common Mode Transient Immunity**

## REFLOW PROFILE

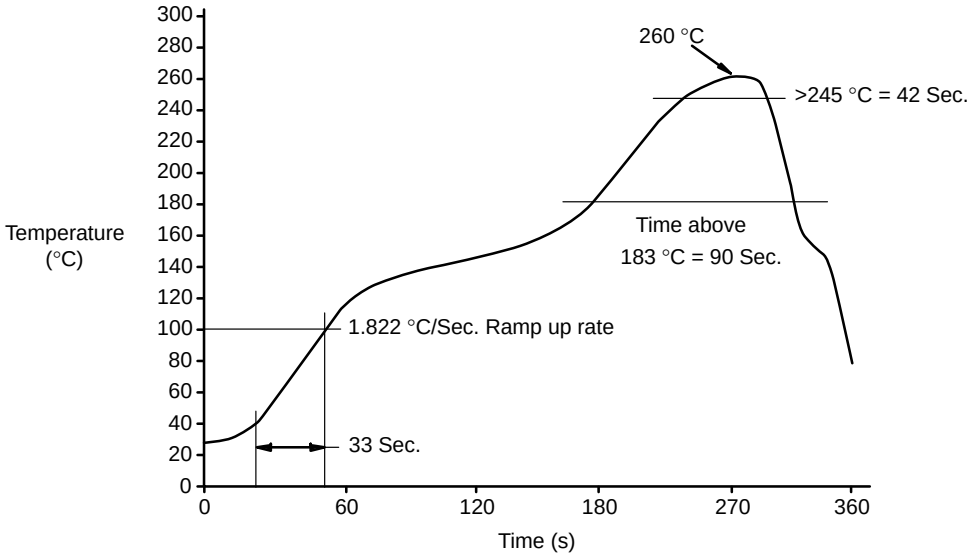



**Figure 12. Small Outline**

## REFLOW PROFILE (CONTINUED)

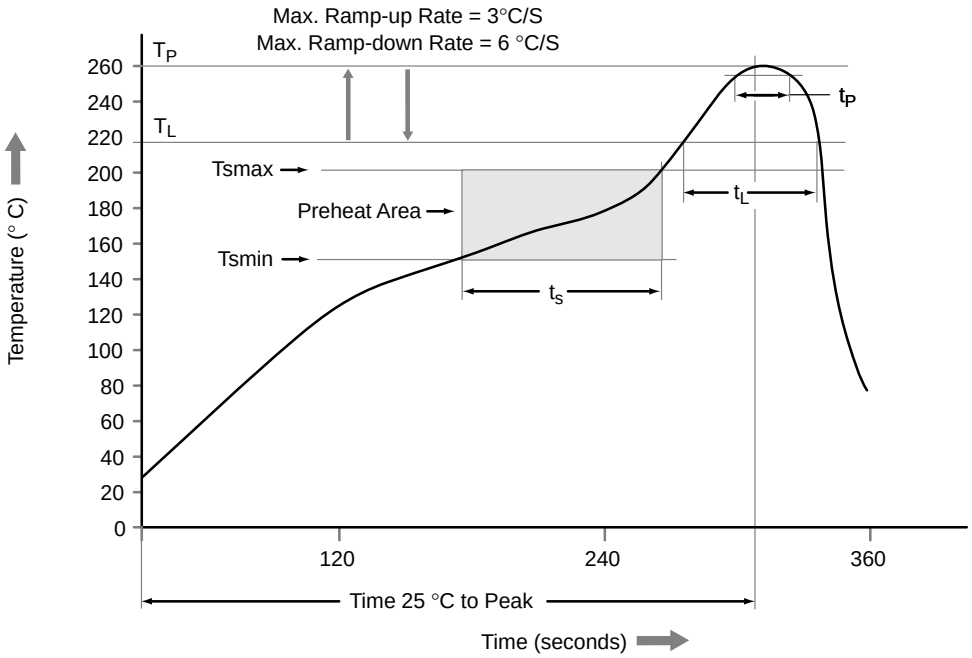



**Figure 13. DIP and SMT**

### REFLOW PROFILE

| Profile Feature | Pb-Free Assembly Profile |
|---|---|
| Temperature Min. (Tsmin) | 150 °C |
| Temperature Max. (Tsmax) | 200 °C |
| Time ($t_S$) from (Tsmin to Tsmax) | 60–120 seconds |
| Ramp-up Rate ($t_L$ to $t_P$) | 3 °C/second max. |
| Liquidous Temperature ($T_L$) | 217 °C |
| Time ($t_L$) Maintained Above ($T_L$) | 60–150 seconds |
| Peak Body Package Temperature | 260 °C +0 °C / –5 °C |
| Time ($t_P$) within 5 °C of 260 °C | 30 seconds |
| Ramp-down Rate ($T_P$ to $T_L$) | 6 °C/second max. |
| Time 25 °C to Peak Temperature | 8 minutes max. |

## ORDERING INFORMATION

| Device Order Number | Specific Device Marking | Shipping† |
|---|---|---|
| FOD060L | Small outline 8-pin | 50 Units / Tube |
| FOD060LR2 | Small outline 8-pin | 2,500 Units / Tape & Reel |
| FOD260L | DIP 8-Pin | 50 Units / Tube |
| FOD260LS | SMT 8-Pin (Lead Bend) | 50 Units / Tube |
| FOD260LSD | SMT 8-Pin (Lead Bend) | 1,000 Units / Tape & Reel |
| FOD260LSV | SMT 8-Pin (Lead Bend), DIN EN/IEC 60747-5-2 option | 50 Units / Tube |
| FOD260LSDV | SMT 8-Pin (Lead Bend), DIN EN/IEC 60747-5-2 option | 1,000 Units / Tape & Reel |

† For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

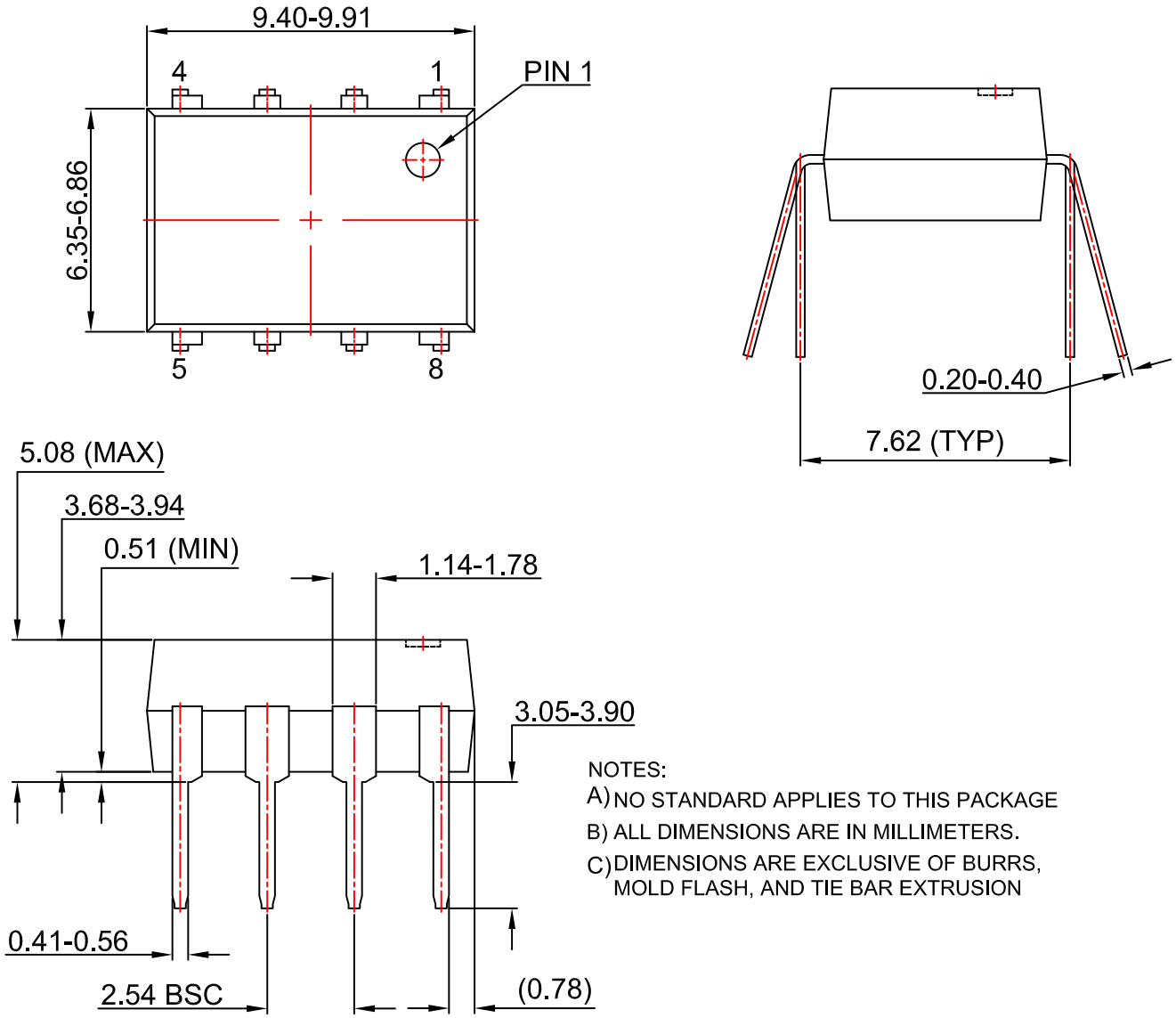
## REVISION HISTORY

| Revision | Description of Changes | Date |
|---|---|---|
| 3 | Converted the document to **onsemi** format. | 5/13/2026 |

This document has undergone updates prior to the inclusion of this revision history table. The changes tracked here only reflect updates made on the noted approval dates.

**PDIP8 9.655x6.6, 2.54P**
CASE 646CQ
ISSUE O

DATE 18 SEP 2017

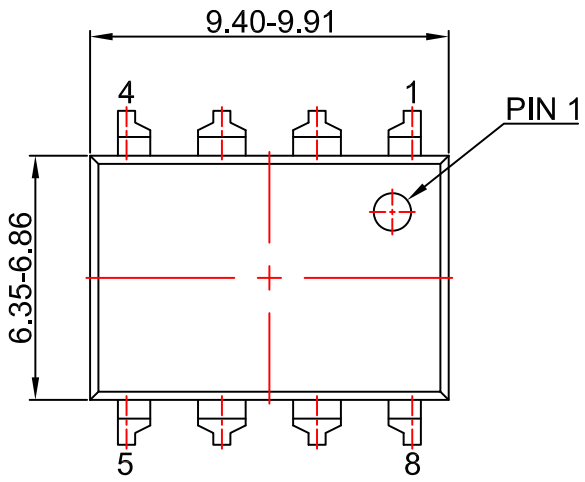


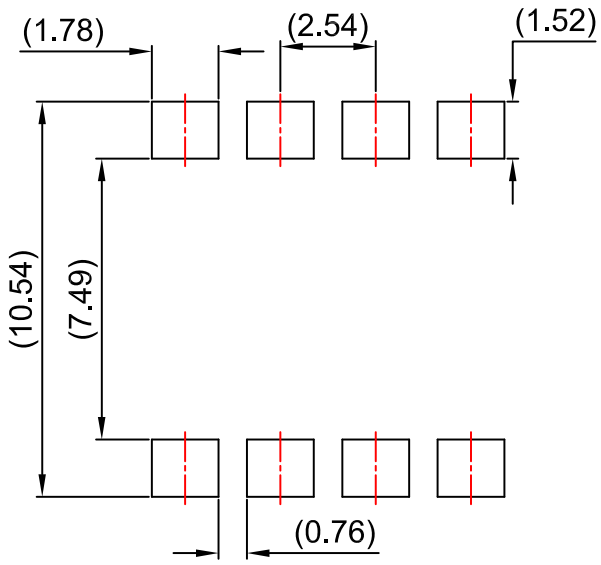

NOTES:
A) NO STANDARD APPLIES TO THIS PACKAGE
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION

| | | | |
|---|---|---|---|
| **DOCUMENT NUMBER:** | **98AON13446G** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. | |
| **DESCRIPTION:** | **PDIP8 9.655X6.6, 2.54P** | | **PAGE 1 OF 1** |

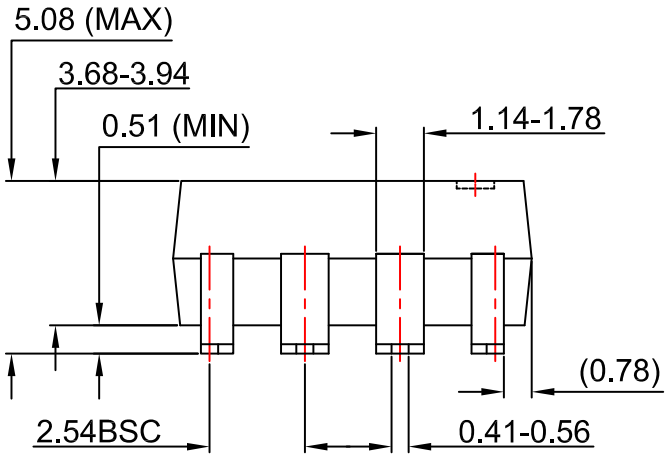
**PDIP8 GW**
CASE 709AC
ISSUE O

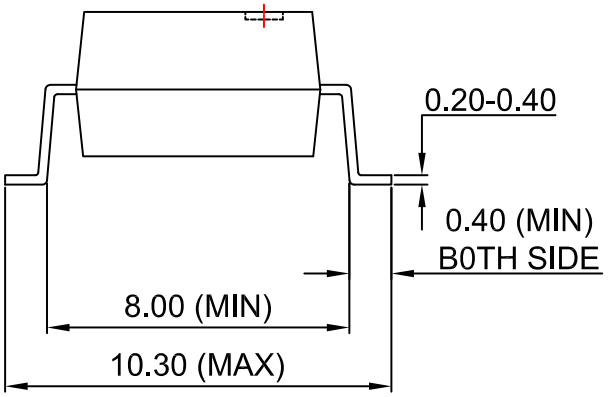
DATE 31 JUL 2016




LAND PATTERN RECOMMENDATION




NOTES:
A) NO STANDARD APPLIES TO THIS PACKAGE
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION

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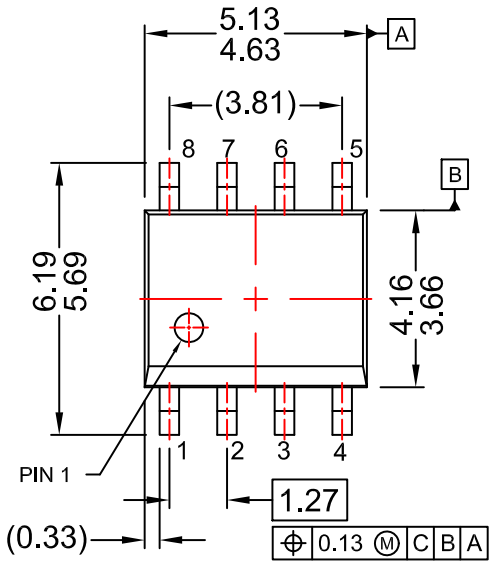
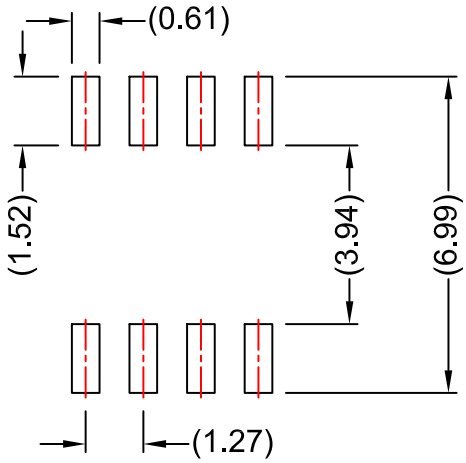
| **DESCRIPTION:** | **PDIP8 GW** | | **PAGE 1 OF 1** |

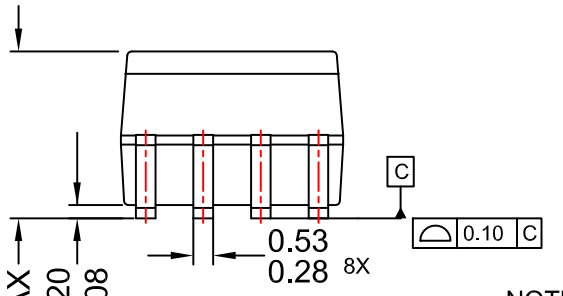
**SOIC8**
CASE 751DZ
ISSUE O

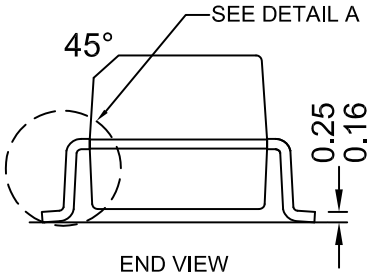
DATE 30 SEP 2016



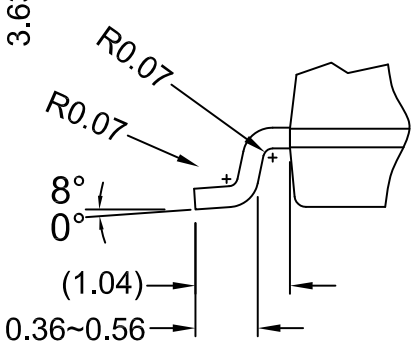




LAND PATTERN RECOMMENDATION




END VIEW




DETAIL A
SCALE: 2:1

NOTES:

A) NO STANDARD APPLIES TO THIS PACKAGE
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
D) LANDPATTERN STANDARD: SOIC127P600X175-8M.

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