



**THE DATASHEET OF
FOD3182TSV**



3 A Output Current, High Speed MOSFET Gate Driver Optocoupler

FOD3182

Description

The FOD3182 is a 3 A Output Current, High Speed MOSFET Gate Drive Optocoupler. It consists of a aluminium gallium arsenide (AlGaAs) light emitting diode optically coupled to a CMOS detector with PMOS and NMOS output power transistors integrated circuit power stage. It is ideally suited for high frequency driving of power MOSFETS used in Plasma Display Panels (PDPs), motor control inverter applications and high performance DC/DC converters.

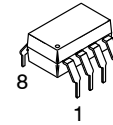
The device is packaged in an 8-pin dual in-line housing compatible with 260°C reflow processes for lead free solder compliance.

Features

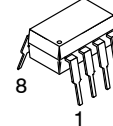
- High Noise Immunity Characterized by 50 kV/μs (Typ.) Common Mode Rejection @ $V_{CM} = 2,000\text{ V}$
 - Guaranteed Operating Temperature Range of -40°C to $+100^{\circ}\text{C}$
 - 3 A Peak Output Current
 - Fast Switching Speed
 - ◆ 210 ns Max. Propagation Delay
 - ◆ 65 ns Max. Pulse Width Distortion
 - Fast Output Rise/Fall Time
 - Offers Lower Dynamic Power Dissipation
 - 250 kHz Maximum Switching Speed
 - Wide V_{DD} operating Range: 10 V to 30 V
 - Use of P-Channel MOSFETs at Output Stage Enables Output Voltage Swing Close to the Supply Rail (Rail-to-Rail Output)
 - 5000 Vrms, 1 Minute Isolation
 - Under Voltage Lockout Protection (UVLO) with Hysteresis – Optimized for Driving MOSFETs
 - Minimum Creepage Distance of 8.0 mm
 - Minimum Clearance Distance of 10 mm to 16 mm (Option TV or TSV)
 - Minimum Insulation Thickness of 0.5 mm
 - UL and VDE*
 - 1,414 Peak Working Insulation Voltage (V_{IORM})
- *Requires “V” Ordering Option

Applications

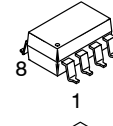
- Plasma Display Panel
- High Performance DC/DC Converter
- High Performance Switch Mode Power Supply
- High Performance Uninterruptible Power Supply
- Isolated Power MOSFET Gate Drive



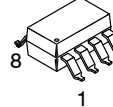
PDIP8 6.6x3.81, 2.54P
CASE 646BW



PDIP8 9.655x6.61, 2.54P
CASE 646CQ

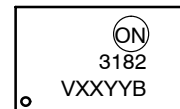


PDIP8 GW
CASE 709AC



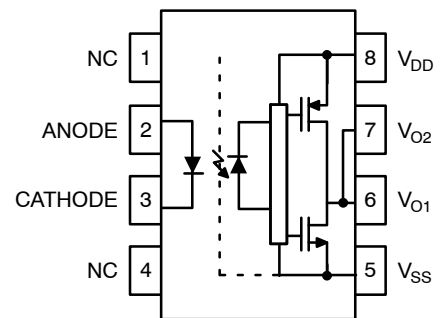
PDIP8 GW
CASE 709AD

MARKING DIAGRAM



3182 = Device Number
V = VDE Mark (Note: Only appears on parts ordered with DIN EN/IEC 60747-5-2 option – See ordering table)
XX = Two Digit Year Code, e.g., “11”
YY = Digit Work Week Ranging from “01” to “53”
B = Assembly Package Code

FUNCTIONAL BLOCK DIAGRAM



NOTE: A 0.1 μF bypass capacitor must be connected between pins 5 and 8.

ORDERING INFORMATION

See detailed ordering and shipping information on page 16 of this data sheet.

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TRUTH TABLE

| LED | V _{DD} – V _{SS} “Positive Going” (Turn-on) | V _{DD} – V _{SS} “Negative Going” (Turn-off) | V _O |
|-----|--------------------------------------------------------------|---------------------------------------------------------------|----------------|
| Off | 0 V to 30 V | 0 V to 30 V | Low |
| On | 0 V to 7.4 V | 0 V to 7 V | Low |
| On | 7.4 V to 9 V | 7 V to 8.5 V | Transition |
| On | 9 V to 30 V | 8.5 V to 30 V | High |

PIN DEFINITIONS

| Pin No. | Name | Description |
|---------|-----------------|-------------------------------------------------------------|
| 1 | NC | Not Connected |
| 2 | Anode | LED Anode |
| 3 | Cathode | LED Cathode |
| 4 | NC | Not Connected |
| 5 | V _{SS} | Negative Supply Voltage |
| 6 | V _{O2} | Output Voltage 2 (internally connected to V _{O1}) |
| 7 | V _{O1} | Output Voltage 1 |
| 8 | V _{DD} | Positive Supply Voltage |

SAFETY AND INSULATION RATINGS (As per DIN EN/IEC 60747–5–2. 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.)

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------|------|-------------------|
| | Installation Classifications per DIN VDE 0110/1.89 Table 1 | – | I–IV | – | |
| | For Rated Mains Voltage < 150 Vrms | | | | |
| | For Rated Mains Voltage < 300 Vrms | | | | |
| | For Rated Mains Voltage < 450 Vrms | | | | |
| | For Rated Mains Voltage < 600 Vrms | | | | |
| | For Rated Mains Voltage < 1000 Vrms (Option T, TS) | – | I–III | – | |
| | Climatic Classification | – | 40/100/21 | – | |
| | Pollution Degree (DIN VDE 0110/1.89) | – | 2 | – | |
| CTI | Comparative Tracking Index | 175 | – | – | |
| V _{PR} | Input to Output Test Voltage, Method b, V _{IORM} × 1.875 = V _{PR} , 100% Production Test with t _m = 1 second, Partial Discharge < 5 pC | 2651 | – | – | |
| | Input to Output Test Voltage, Method a, V _{IORM} × 1.5 = V _{PR} , Type and Sample Test with t _m = 60 seconds, Partial Discharge < 5 pC | 2121 | – | – | |
| V _{IORM} | Max Working Insulation Voltage | 1,414 | – | – | V _{peak} |
| V _{IOTM} | Highest Allowable Over Voltage | 6000 | – | – | V _{peak} |
| | External Creepage | 8 | – | – | mm |
| | External Clearance | 7.4 | – | – | mm |
| | External Clearance (for Option T or TS – 0.4” Lead Spacing) | 10.16 | – | – | mm |
| | Insulation Thickness | 0.5 | – | – | mm |
| T _{Case} | Safety Limit Values – Maximum Values Allowed in the Event of a Failure Case Temperature | 150 | – | – | °C |
| I _{S,INPUT} | Input Current | 25 | – | – | mA |
| P _{S,OUTPUT} | Output Power (Duty Factor ≤ 2.7%) | 250 | – | – | mW |
| R _{IO} | Insulation Resistance at T _S , V _{IO} = 500 V | 10 ⁹ | – | – | Ω |

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ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise specified)

| Symbol | Parameter | Value | Unit |
|-----------------------------------|--------------------------------------------------------------------------------------|----------------------|------|
| T _{STG} | Storage Temperature | -40 to +125 | °C |
| T _{OPR} | Operating Temperature | -40 to +100 | °C |
| T _J | Junction Temperature | -40 to +125 | °C |
| T _{SOL} | Lead Solder Temperature – Wave Solder (Refer to Reflow Temperature Profile, page 15) | 260 for 10 seconds | °C |
| I _{F(AVG)} | Average Input Current (Note 1) | 25 | mA |
| I _{F(tr, tf)} | LED Current Minimum Rate of Rise/Fall | 250 | ns |
| V _R | Reverse Input Voltage | 5 | V |
| I _{OH(PEAK)} | “High” Peak Output Current (Note 2) | 3 | A |
| I _{OL(PEAK)} | “Low” Peak Output Current (Note 2) | 3 | A |
| V _{DD} – V _{SS} | Supply Voltage | -0.5 to 35 | V |
| V _{O(PEAK)} | Output Voltage | 0 to V _{DD} | V |
| P _O | Output Power Dissipation (Note 3) | 250 | mW |
| P _D | Total Power Dissipation (Note 4) | 295 | 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.

1. Derate linearly above +79°C free air temperature at a rate of 0.37mA/°C.
2. Maximum pulse width = 10 μs, maximum duty cycle = 11%.
3. Derate linearly above +79°C, free air temperature at the rate of 5.73 mW/°C.
4. No derating required across operating temperature range.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Value | Unit |
|-----------------------------------|---------------------|-------------|------|
| V _{DD} – V _{SS} | Power Supply | 10 to 30 | V |
| I _{F(ON)} | Input Current (ON) | 10 to 16 | mA |
| V _{F(OFF)} | Input Voltage (OFF) | -3.0 to 0.8 | V |

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.

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ELECTRICAL–OPTICAL CHARACTERISTICS (DC) (Apply over all recommended conditions, typical value is measured at $V_{DD} = 30\text{ V}$, $V_{SS} = 0\text{ V}$, $T_A = 25^\circ\text{C}$, unless otherwise specified.)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|--------------------|--------------------------------------------|--------------------------------------------------|----------------|------|----------------|----------------------|
| I_{OH} | High Level Output Current | $V_{OH} = (V_{DD} - V_{SS} - 1\text{ V})$ | 0.5 | 0.9 | – | A |
| | | $V_{OH} = (V_{DD} - V_{SS} - 6\text{ V})$ | 2.5 | – | – | |
| I_{OL} | Low Level Output Current | $V_{OL} = (V_{DD} - V_{SS} + 1\text{ V})$ | 0.5 | 1 | – | A |
| | | $V_{OL} = (V_{DD} - V_{SS} + 6\text{ V})$ | 2.5 | – | – | |
| V_{OH} | High Level Output Voltage (Note 5, 6) | $I_O = -100\text{ mA}$ | $V_{DD} - 0.5$ | – | – | V |
| V_{OL} | Low Level Output Voltage (Note 5, 6) | $I_O = 100\text{ mA}$ | – | – | $V_{SS} + 0.5$ | V |
| I_{DDH} | High Level Supply Current | Output Open, $I_F = 10\text{ to }16\text{ mA}$ | – | 2.6 | 4.0 | mA |
| I_{DDL} | Low Level Supply Current | Output Open, $V_F = -3.0\text{ to }0.8\text{ V}$ | – | 2.5 | 4.0 | mA |
| I_{FLH} | Threshold Input Current Low to High | $I_O = 0\text{ mA}$, $V_O > 5\text{ V}$ | – | 3.0 | 7.5 | mA |
| V_{FHL} | Threshold Input Voltage High to Low | $I_O = 0\text{ mA}$, $V_O < 5\text{ V}$ | 0.8 | – | – | V |
| V_F | Input Forward Voltage | $I_F = 10\text{ mA}$ | 1.1 | 1.43 | 1.8 | V |
| $\Delta V_F / T_A$ | Temperature Coefficient of Forward Voltage | $I_F = 10\text{ mA}$ | – | –1.5 | – | mV/ $^\circ\text{C}$ |
| V_{UVLO+} | UVLO Threshold | $V_O > 5\text{ V}$, $I_F = 10\text{ mA}$ | 7 | 8.3 | 9 | V |
| V_{UVLO-} | | $V_O < 5\text{ V}$, $I_F = 10\text{ mA}$ | 6.5 | 7.7 | 8.5 | V |
| $UVLO_{HYST}$ | UVLO Hysteresis | | – | 0.6 | – | V |
| BV_R | Input Reverse Breakdown Voltage | $I_R = 10\text{ }\mu\text{A}$ | 5 | – | – | V |
| C_{IN} | Input Capacitance | $f = 1\text{ MHz}$, $V_F = 0\text{ V}$ | – | 25 | – | pF |

5. In this test, V_{OH} is measured with a dc load current of 100 mA. When driving capacitive load V_{OH} will approach V_{DD} as I_{OH} approaches zero amps.
6. Maximum pulse width = 1 ms, maximum duty cycle = 20%.

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SWITCHING CHARACTERISTICS (Apply over all recommended conditions, typical value is measured at $V_{DD} = 30\text{ V}$, $V_{SS} = 0\text{ V}$, $T_A = 25^\circ\text{C}$, unless otherwise specified.)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|-------------------------------------|----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-------------------------|
| t_{PLH} | Propagation Delay Time to High Output Level (Note 7) | $I_F = 10\text{ mA}$, $R_g = 10\ \Omega$, $f = 250\text{ kHz}$, Duty Cycle = 50%, $C_g = 10\text{ nF}$ | 50 | 120 | 210 | ns |
| t_{PHL} | Propagation Delay Time to Low Output Level (Note 7) | | 50 | 145 | 210 | ns |
| P_{WD} | Pulse Width Distortion (Note 8) | | – | 35 | 65 | ns |
| P_{DD} ($t_{PHL} - t_{PLH}$) | Propagation Delay Difference Between Any Two Parts (Note 9) | | –90 | – | 90 | ns |
| t_r | Rise Time | $C_L = 10\text{ nF}$, $R_g = 10\ \Omega$ | – | 38 | – | ns |
| t_f | Fall Time | | – | 24 | – | ns |
| $t_{UVLO\ ON}$ | UVLO Turn On Delay | | – | 2.0 | – | μs |
| $t_{UVLO\ OFF}$ | UVLO Turn Off Delay | | – | 0.3 | – | μs |
| $ CM_H $ | Output High Level Common Mode Transient Immunity (Note 10, 11) | $T_A = +25^\circ\text{C}$, $I_f = 7\text{ mA}$ to 16 mA , $V_{CM} = 2\text{ kV}$, $V_{DD} = 30\text{ V}$ | 35 | 50 | – | $\text{kV}/\mu\text{s}$ |
| $ CM_L $ | Output Low Level Common Mode Transient Immunity (Note 10, 12) | $T_A = +25^\circ\text{C}$, $V_f = 0\text{ V}$, $V_{CM} = 2\text{ kV}$, $V_{DD} = 30\text{ V}$ | 35 | 50 | – | $\text{kV}/\mu\text{s}$ |

7. t_{PHL} propagation delay is measured from the 50% level on the falling edge of the input pulse to the 50% level of the falling edge of the V_O signal. t_{PLH} propagation delay is measured from the 50% level on the rising edge of the input pulse to the 50% level of the rising edge of the V_O signal.
8. PWD is defined as $|t_{PHL} - t_{PLH}|$ for any given device.
9. The difference between t_{PHL} and t_{PLH} between any two FOD3182 parts under same operating conditions, with equal loads.
10. Pin 1 and 4 need to be connected to LED common.
11. Common mode transient immunity in the high state is the maximum tolerable dV_{CM}/dt of the common mode pulse V_{CM} to assure that the output will remain in the high state (i.e. $V_O > 15\text{ V}$).
12. Common mode transient immunity in a low state is the maximum tolerable dV_{CM}/dt of the common mode pulse, V_{CM} , to assure that the output will remain in a low state (i.e. $V_O < 1.0\text{ V}$).

INSULATION CHARACTERISTICS

| Symbol | Parameter | Test Conditions | Min | Typ* | Max | Unit |
|-----------|-------------------------------------------|--------------------------------------------------------------------------------------------------|------|-----------|-----|-----------|
| V_{ISO} | Withstand Isolation Voltage (Note 13, 14) | $T_A = 25^\circ\text{C}$, R.H. < 50%, $t = 1\text{ minute}$, $I_{I-O} \leq 10\ \mu\text{A}$ | 5000 | – | – | V_{rms} |
| R_{I-O} | Resistance (Input to Output) (Note 14) | $V_{I-O} = 500\text{ V}$ | – | 10^{11} | – | Ω |
| C_{I-O} | Capacitance (Input to Output) | Freq. = 1 MHz | – | 1 | – | pF |

*Typical values at $T_A = 25^\circ\text{C}$

13. In accordance with UL 1577, each optocoupler is proof tested by applying an insulation test voltage $> 6000\text{ V}_{rms}$, 60 Hz for 1 second (leakage detection current limit $I_{I-O} < 10\ \mu\text{A}$).
14. Device considered a two-terminal device: pins on input side shorted together and pins on output side shorted together.

TYPICAL PERFORMANCE CURVES

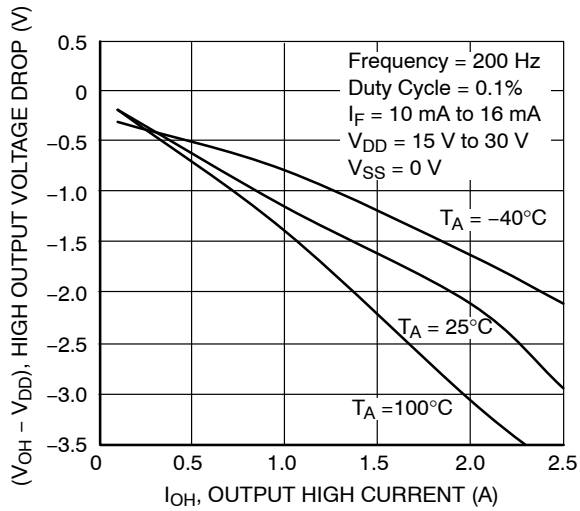


Figure 1. Output High Voltage Drop vs. Output High Current

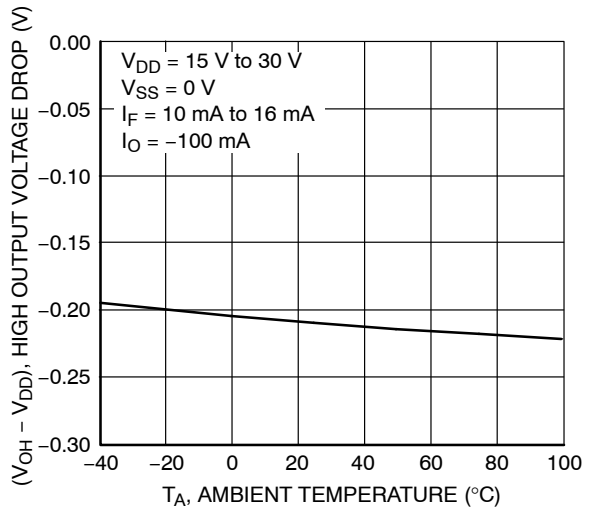


Figure 2. Output High Voltage Drop vs. Ambient Temperature

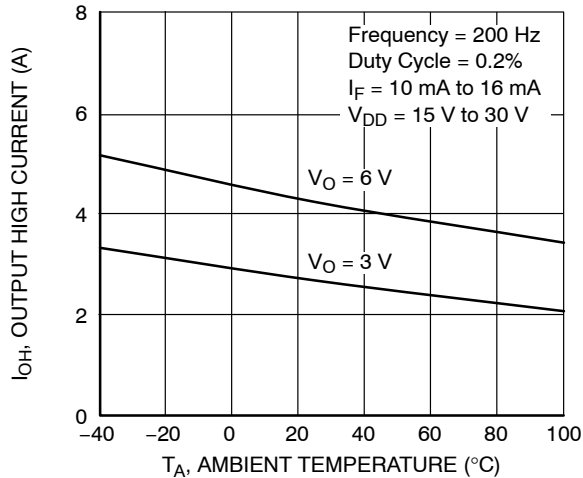


Figure 3. Output High Current vs. Ambient Temperature

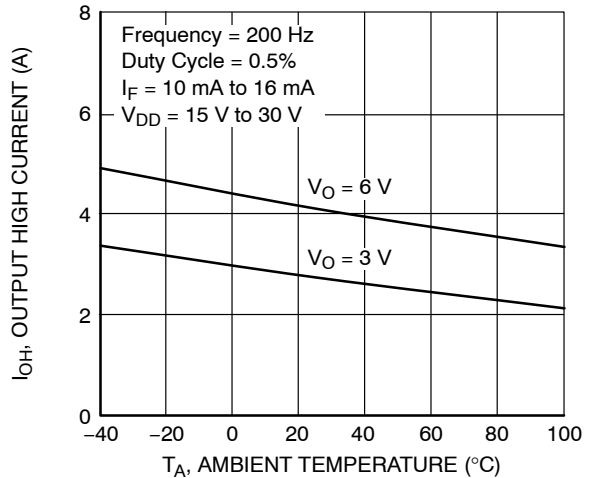


Figure 4. Output High Current vs. Ambient Temperature

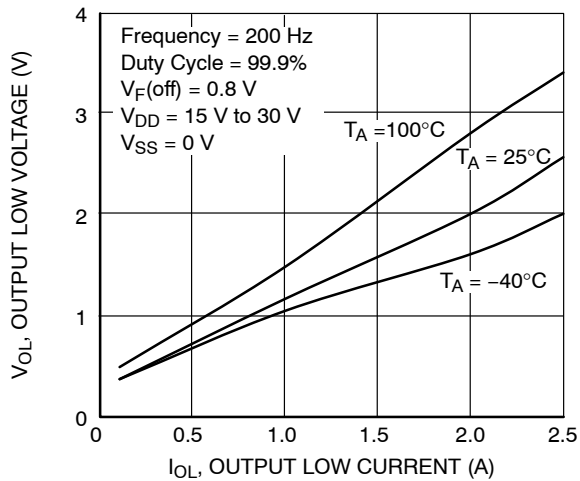


Figure 5. Output Low Voltage vs. Output Low Current

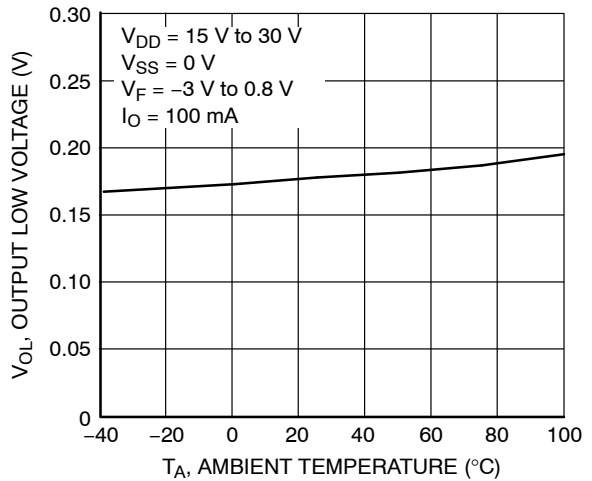


Figure 6. Output Low Voltage vs. Ambient Temperature

TYPICAL PERFORMANCE CURVES (Continued)

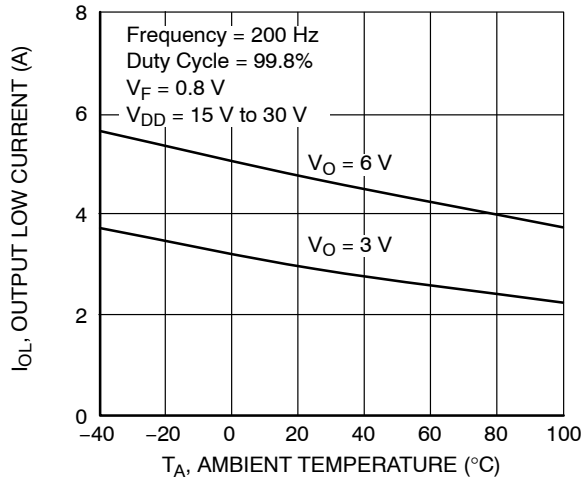


Figure 7. Output Low Current vs. Ambient Temperature

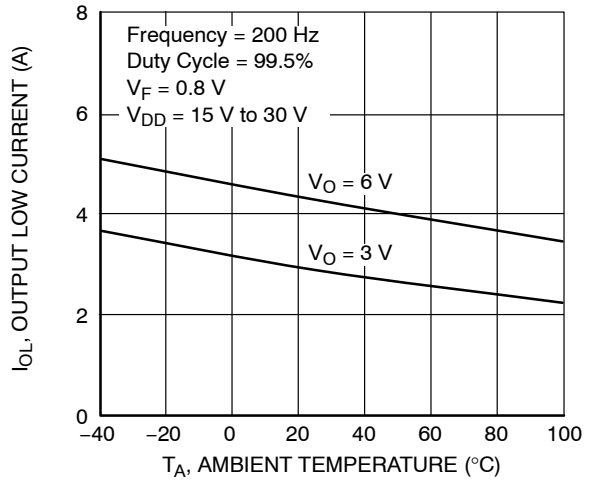


Figure 8. Output Low Current vs. Ambient Temperature

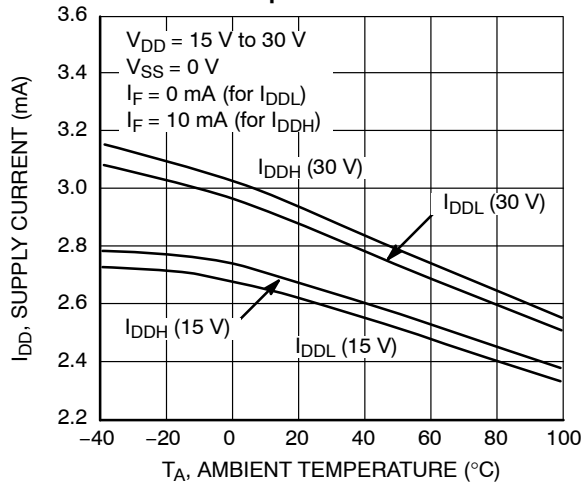


Figure 9. Supply Current vs. Ambient Temperature

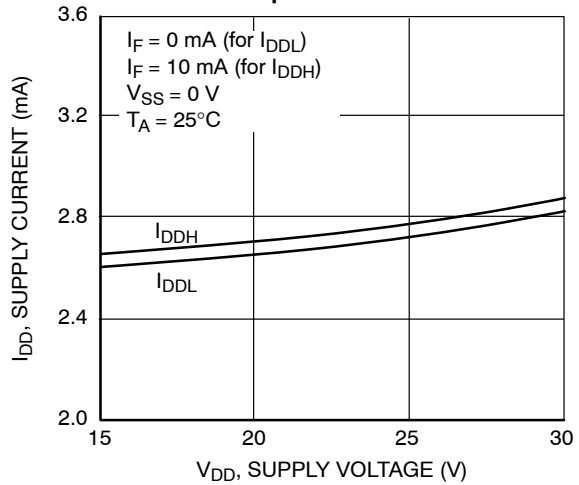


Figure 10. Supply Current vs. Supply Voltage

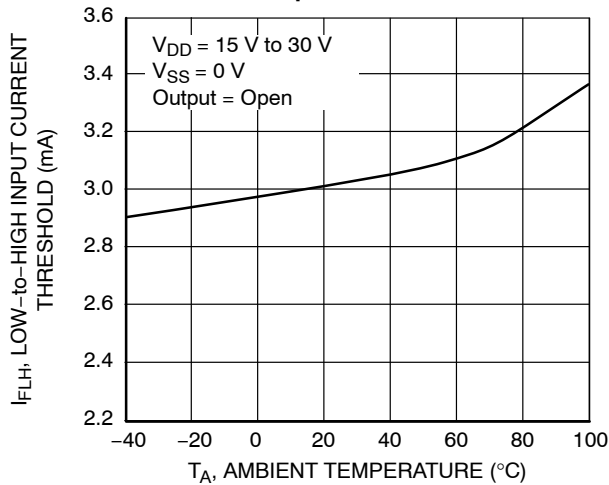


Figure 11. Low-to-High Input Current Threshold vs. Ambient Temperature

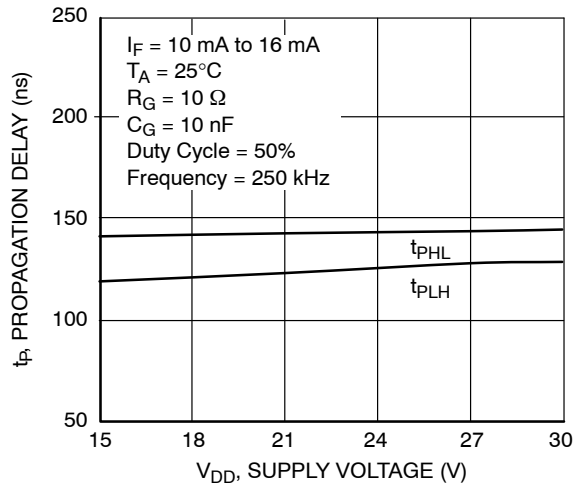


Figure 12. Propagation Delay vs. Supply Voltage

TYPICAL PERFORMANCE CURVES (Continued)

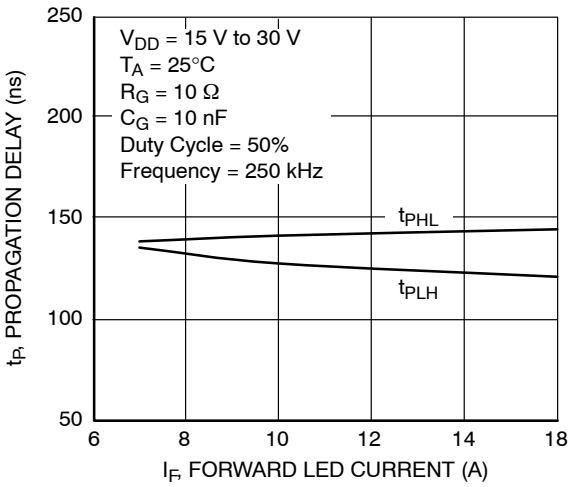


Figure 13. Propagation Delay vs. LED Forward Current

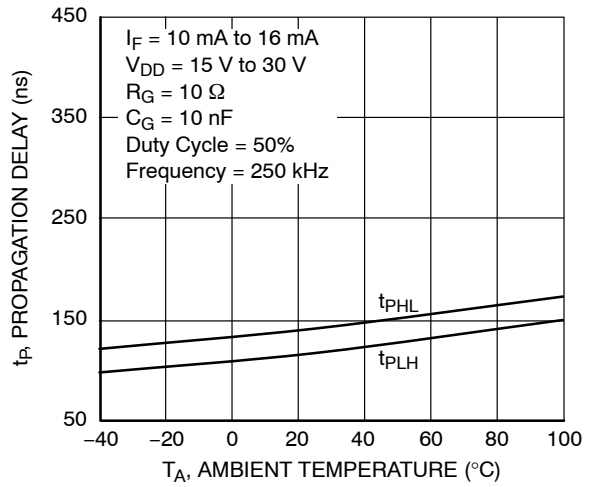


Figure 14. Propagation Delay vs. Ambient Temperature

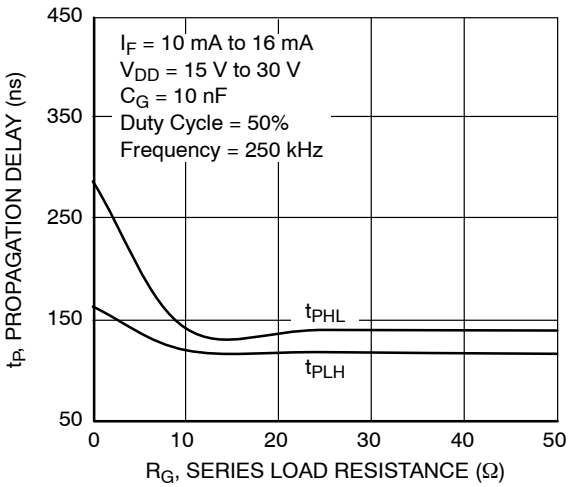


Figure 15. Propagation Delay vs. Series Load Resistance

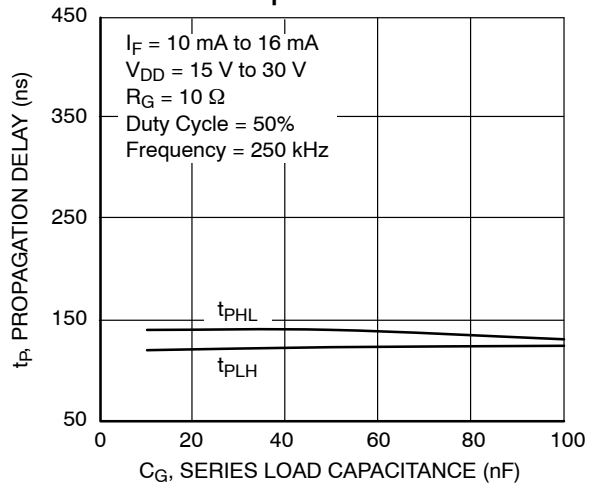


Figure 16. Propagation Delay vs. Series Load Capacitance

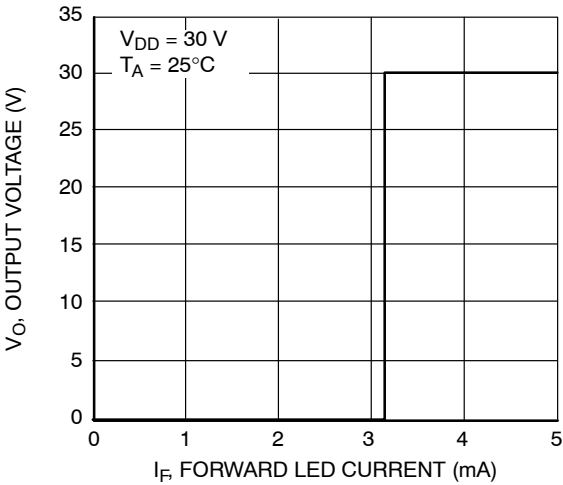


Figure 17. Transfer Characteristics

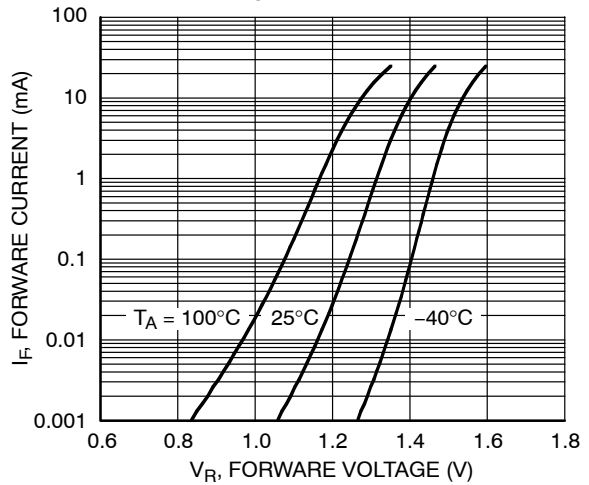


Figure 18. Input Forward Current vs. Forward Voltage

TYPICAL PERFORMANCE CURVES (Continued)

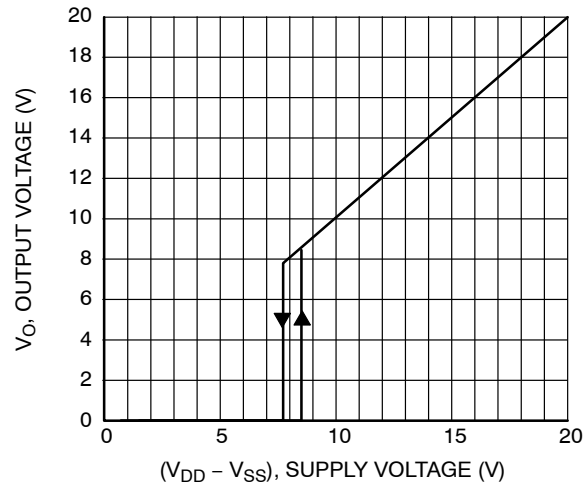


Figure 19. Under Voltage Lockout

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TEST CIRCUIT

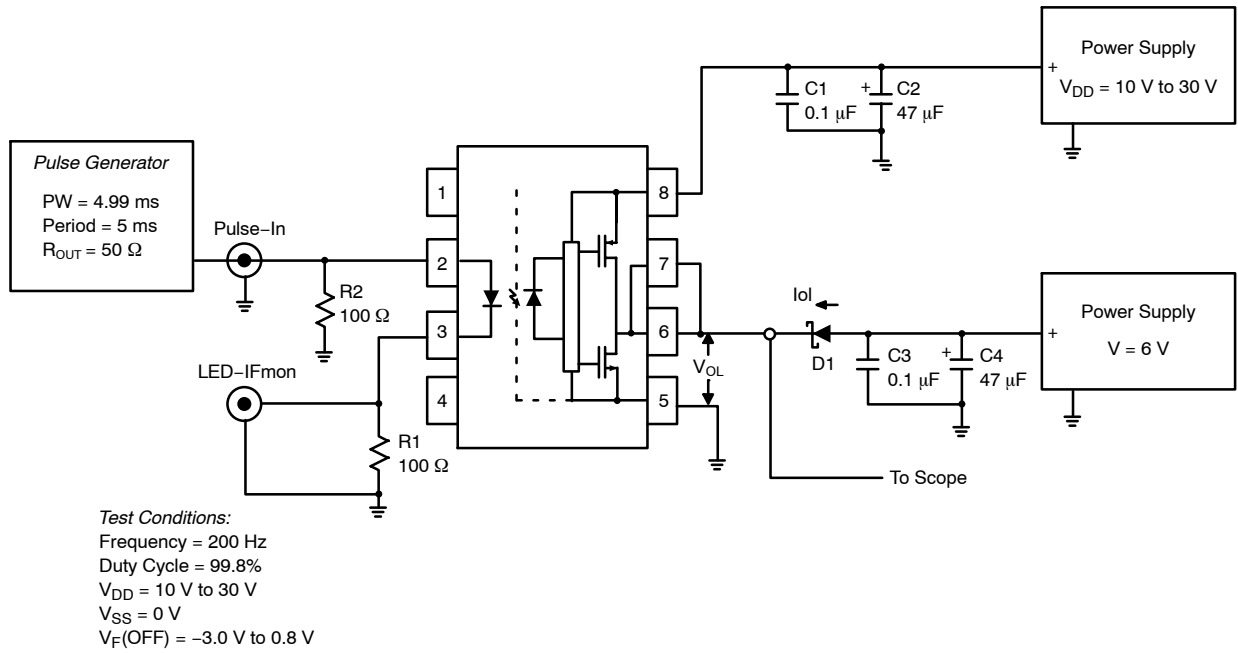


Figure 20. I_{OL} Test Circuit

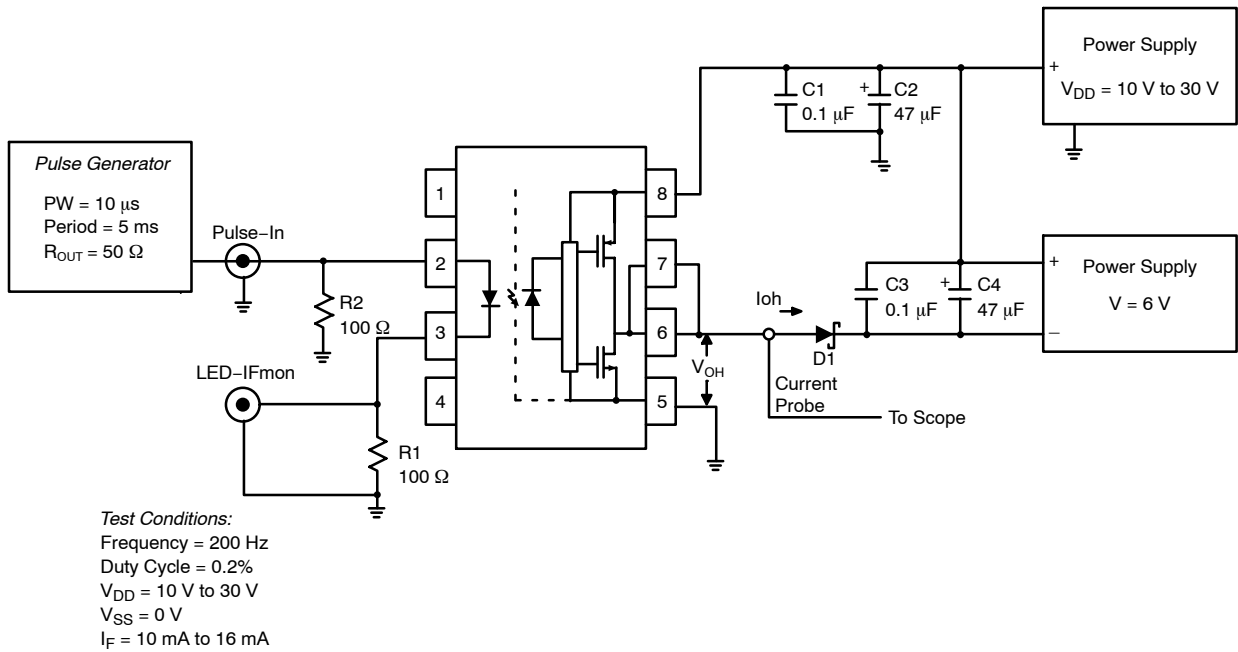


Figure 21. I_{OH} Test Circuit

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TEST CIRCUIT (Continued)

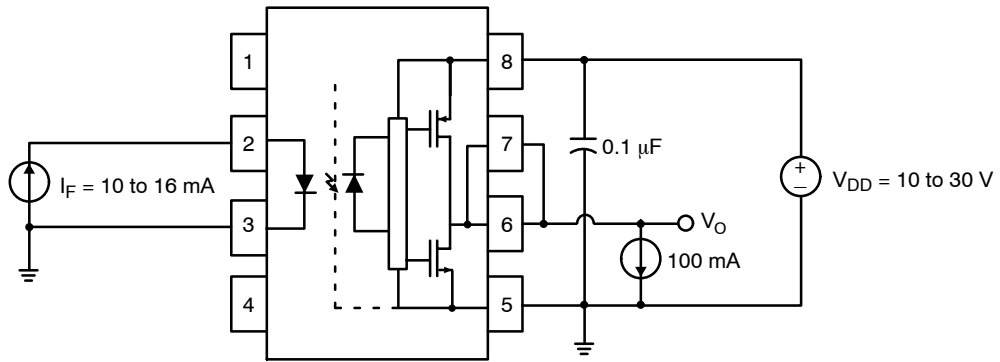


Figure 22. V_{OH} Test Circuit

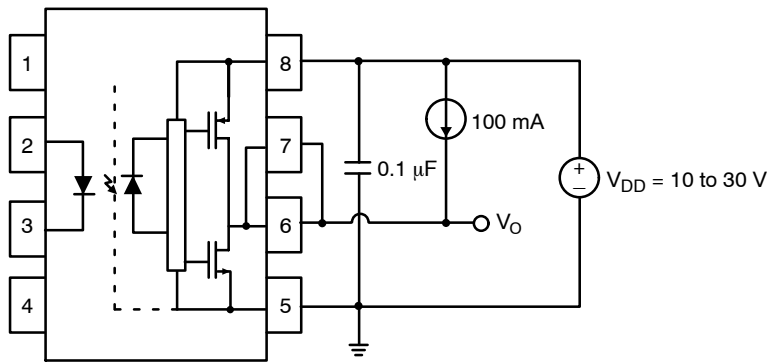


Figure 23. V_{OL} Test Circuit

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TEST CIRCUIT (Continued)

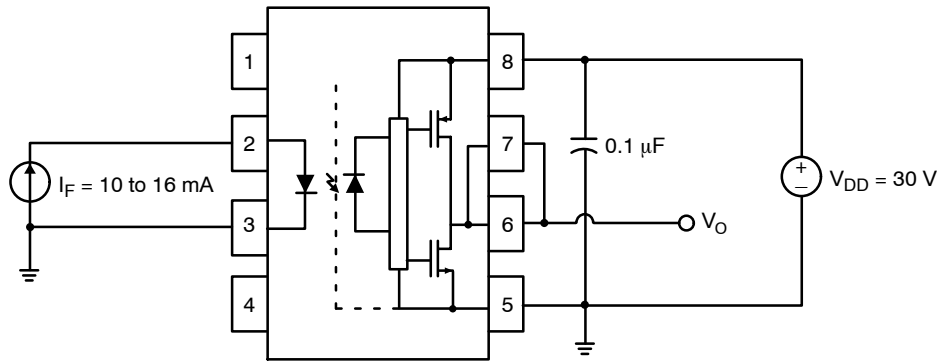


Figure 24. I_{DDH} Test Circuit

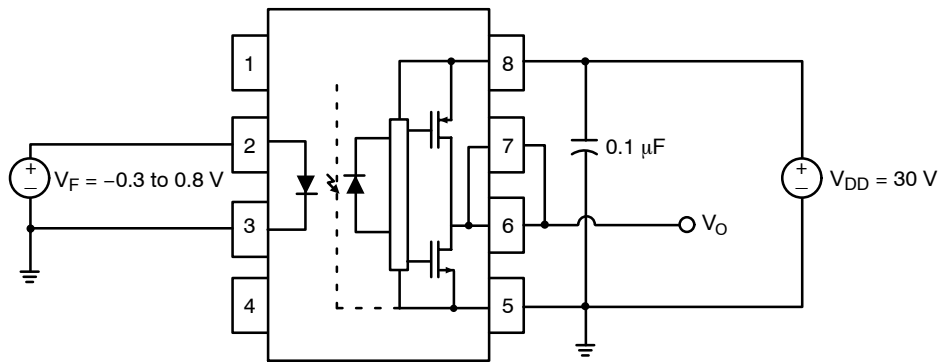


Figure 25. I_{DDL} Test Circuit

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TEST CIRCUIT (Continued)

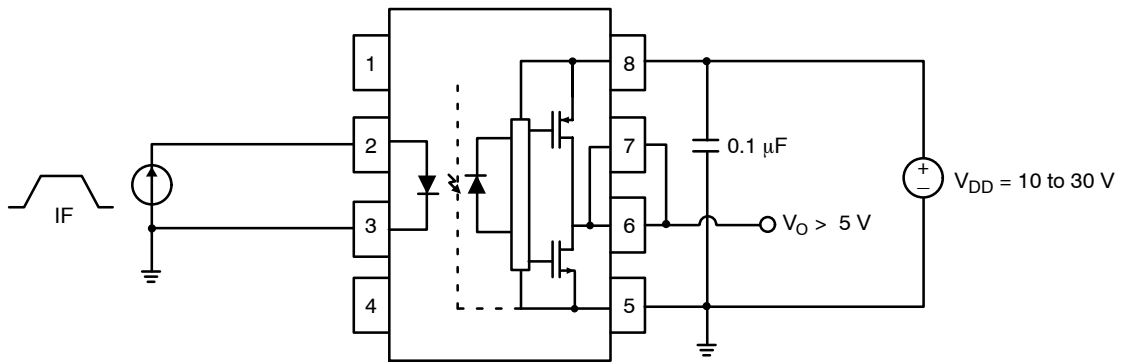


Figure 26. I_{FLH} Test Circuit

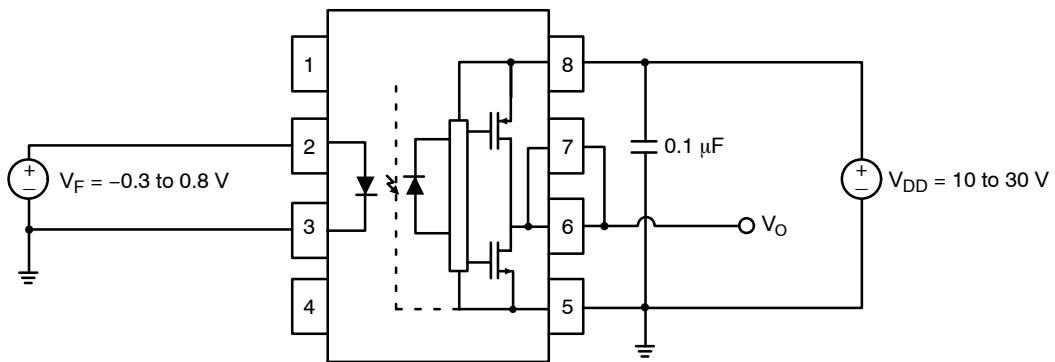


Figure 27. I_{FHL} Test Circuit

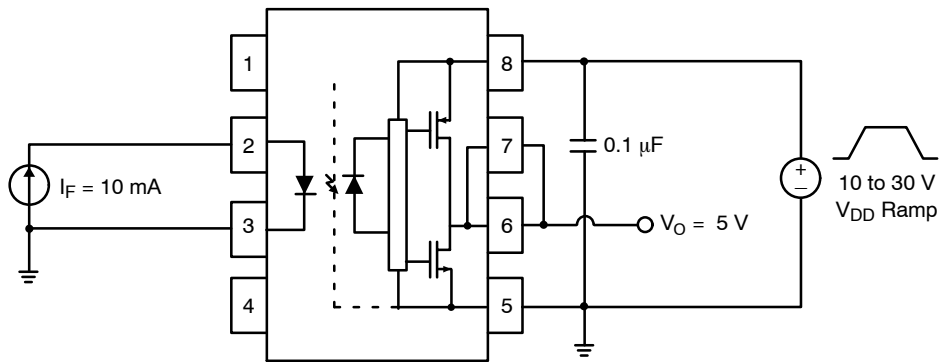


Figure 28. UVLO Test Circuit

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TEST CIRCUIT (Continued)

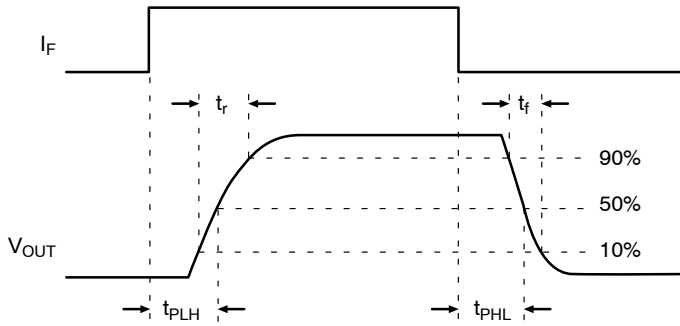
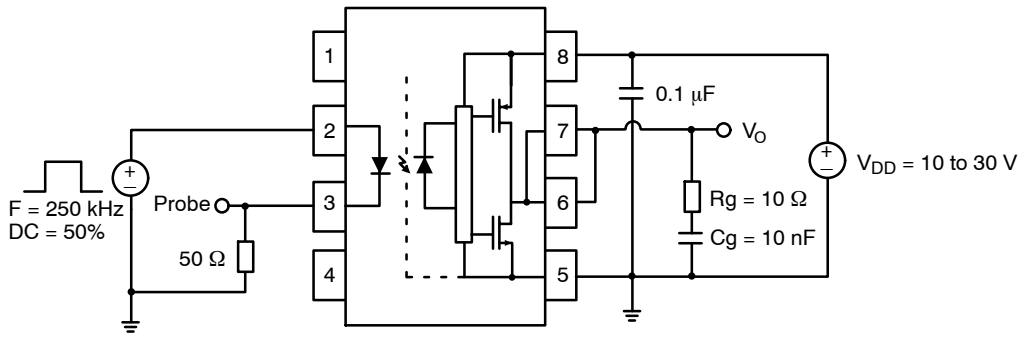


Figure 29. t_{PHL} , t_{PLH} , t_r and t_f Test Circuit and Waveforms

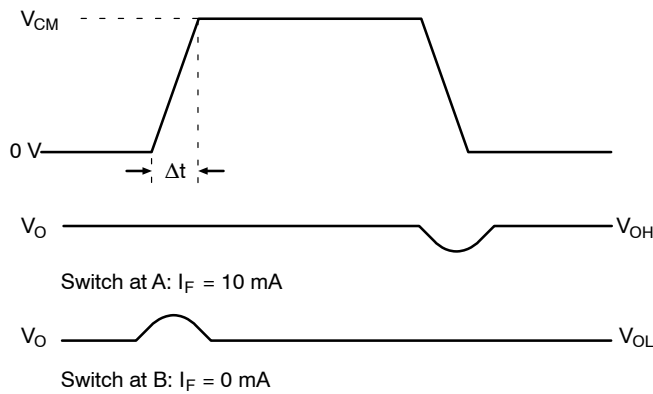
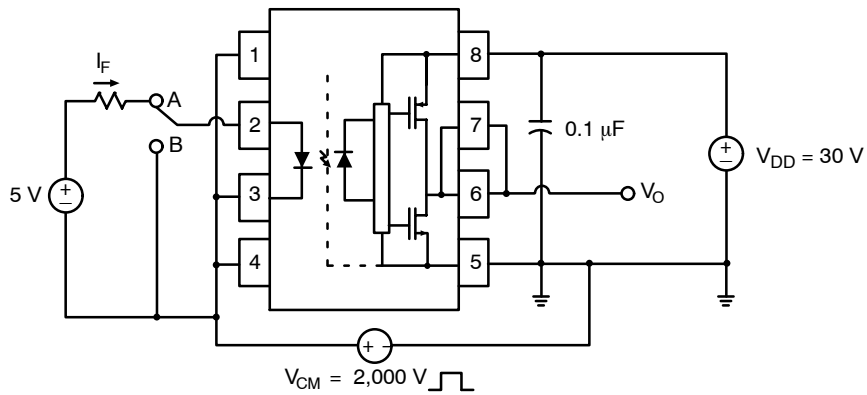


Figure 30. CMR Test Circuit and Waveforms

REFLOW PROFILE

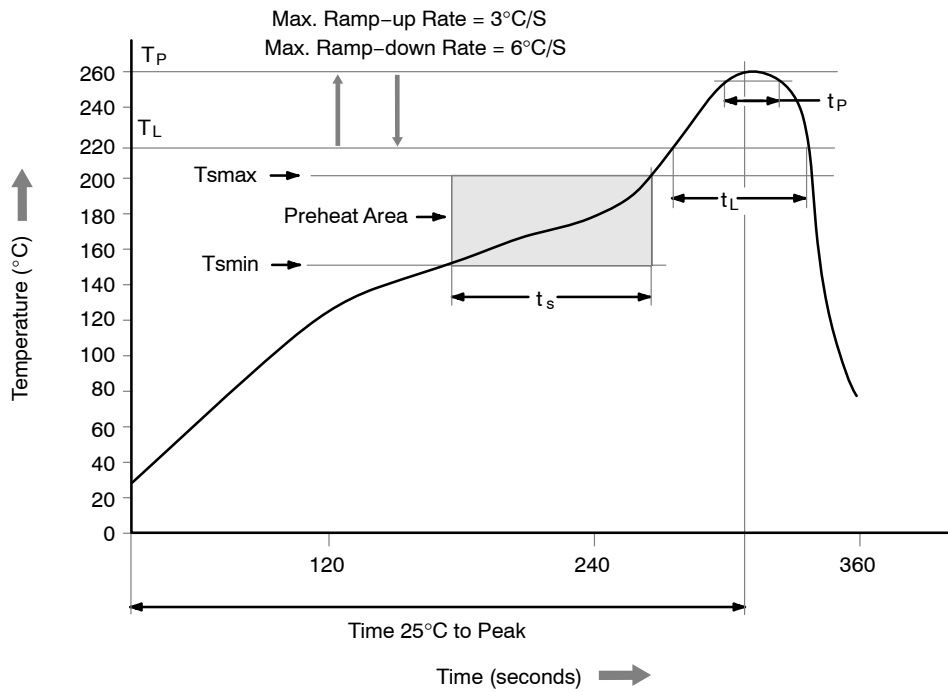


Figure 31. Reflow Profile

Table 1.

| Profile Feature | Pb-Free Assembly Profile |
|-----------------------------------|--------------------------|
| Temperature Min. (Tsmmin) | 150°C |
| Temperature Max. (Tsmmax) | 200°C |
| Time (ts) from (Tsmmin to Tsmmax) | 60–120 seconds |
| Ramp-up Rate (tL to tp) | 3°C/second max. |
| Liquidous Temperature (TL) | 217°C |
| Time (tL) Maintained Above (TL) | 60–150 seconds |
| Peak Body Package Temperature | 260°C +0°C / -5°C |
| Time (tp) within 5°C of 260°C | 30 seconds |
| Ramp-down Rate (TP to TL) | 6°C/second max. |
| Time 25°C to Peak Temperature | 8 minutes max. |

FOD3182

ORDERING INFORMATION

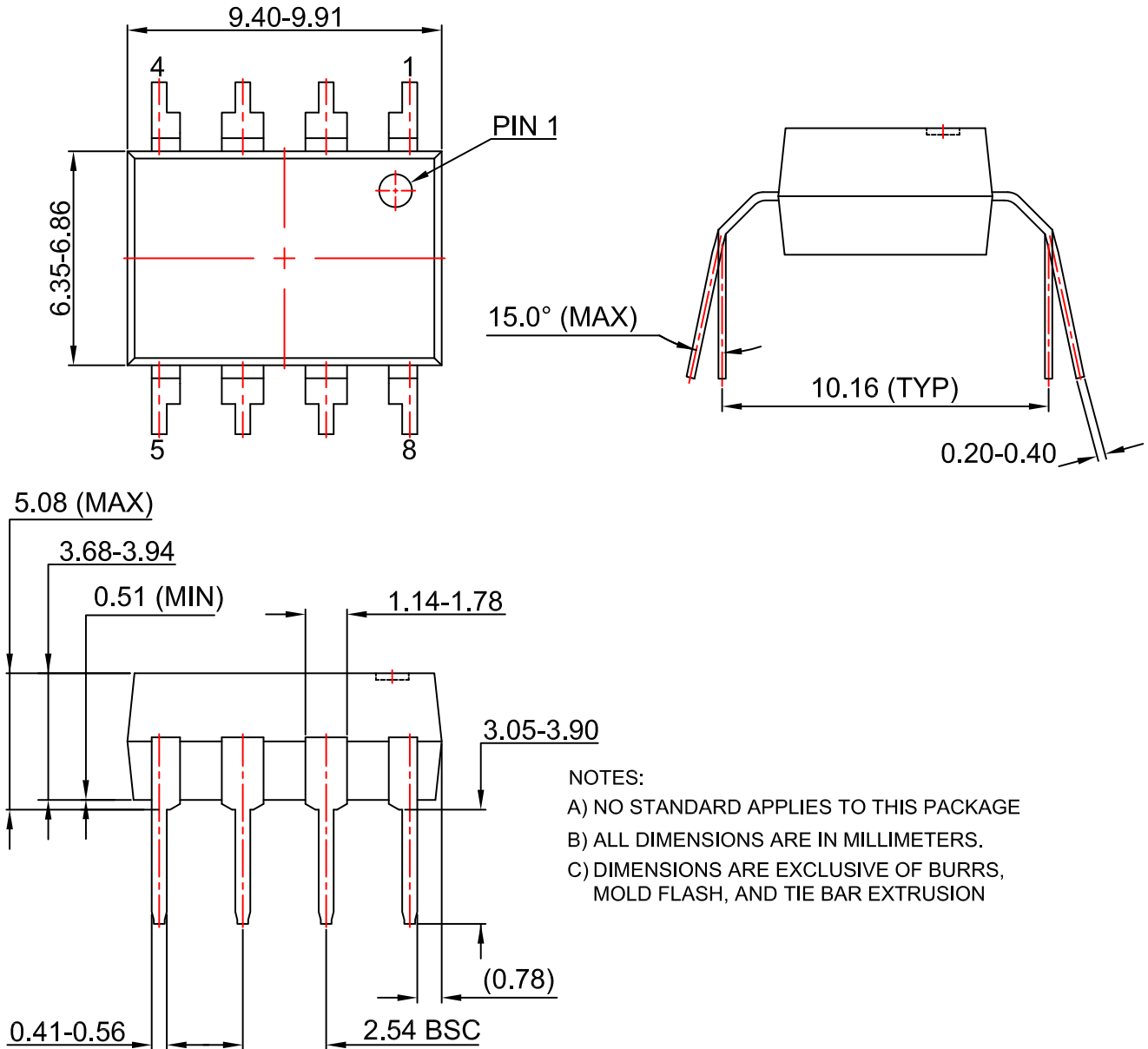
| Part Number | Package | Shipping [†] |
|--------------|------------------------------------------------------------------------------------|-----------------------|
| FOD3182 | PDIP8 9.655x6.61, 2.54P DIP 8-Pin | 50 Units / Tube |
| FOD3182S | PDIP8 GW SMT 8-Pin (Lead Bend) | 50 Units / Tube |
| FOD3182SD | PDIP8 GW SMT 8-Pin (Lead Bend) | 1,000 / Tape and Reel |
| FOD3182V | PDIP8 9.655x6.61, 2.54P DIP 8-Pin, IEC60747-5-2 option | 50 Units / Tube |
| FOD3182SV | PDIP8 GW SMT 8-Pin (Lead Bend), DIN EN/IEC 60747-5-2 option | 50 Units / Tube |
| FOD3182SDV | PDIP8 GW SMT 8-Pin (Lead Bend), DIN EN/IEC 60747-5-2 option | 1,000 / Tape and Reel |
| FOD3182TV | PDIP8 6.6x3.81, 2.54P DIP 8-Pin, 0.4" Lead Spacing, DIN EN/IEC 60747-5-2 option | 50 Units / Tube |
| FOD3182TSV | PDIP8 GW SMT 8-Pin, 0.4" Lead Spacing, DIN EN/IEC 60747-5-2 option | 50 Units / Tube |
| FOD3182TSR2 | PDIP8 GW SMT 8-Pin, 0.4" Lead Spacing | 700 / Tape and Reel |
| FOD3182TSR2V | PDIP8 GW SMT 8-Pin, 0.4" Lead Spacing, DIN EN/IEC 60747-5-2 option | 700 / Tape and 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.

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

PDIP8 6.6x3.81, 2.54P
CASE 646BW
ISSUE O

DATE 31 JUL 2016



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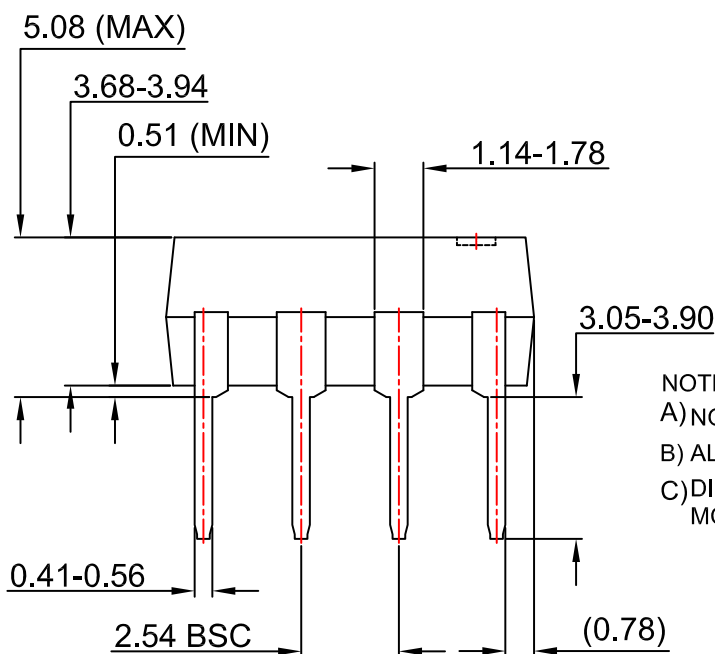
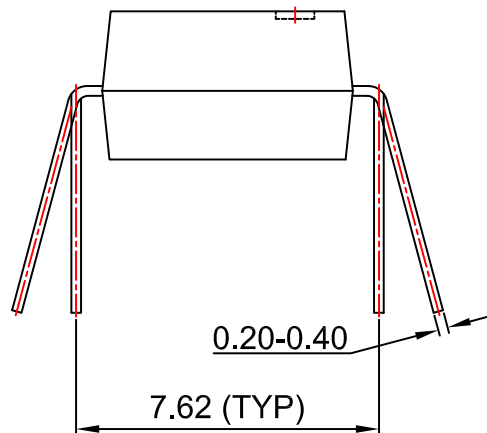
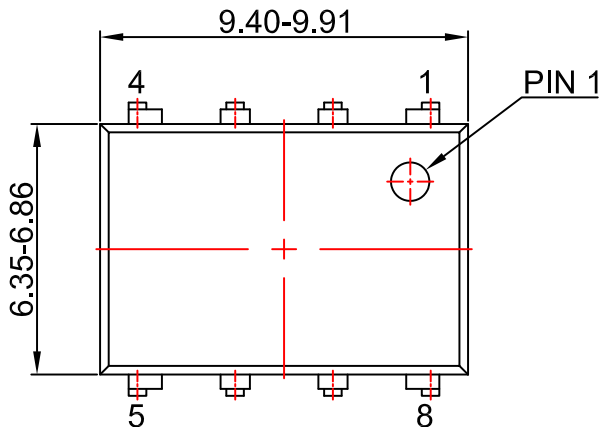
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PDIP8 9.655x6.6, 2.54P
CASE 646CQ
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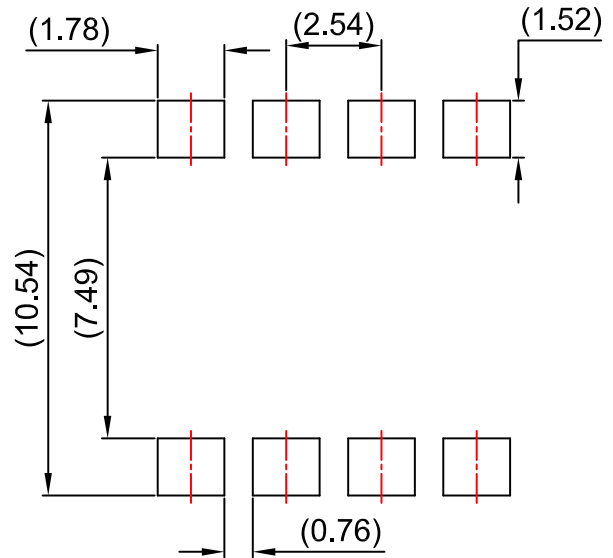
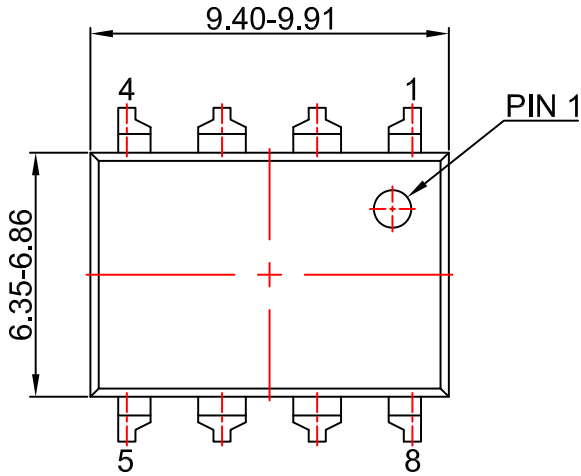
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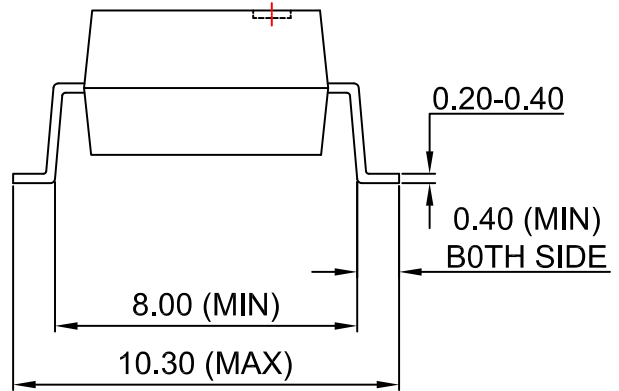
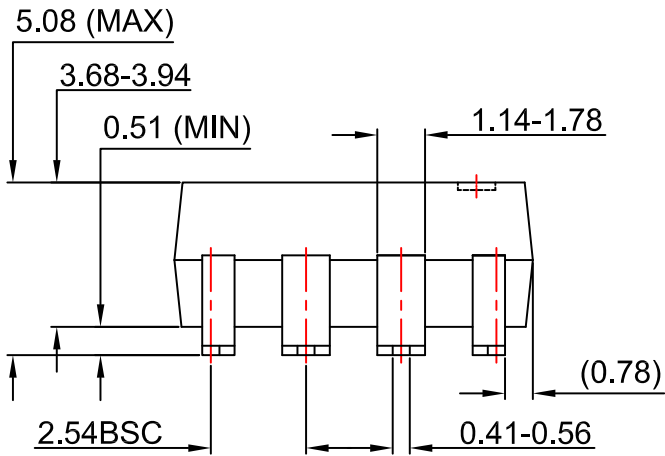


PDIP8 GW
CASE 709AC
ISSUE O

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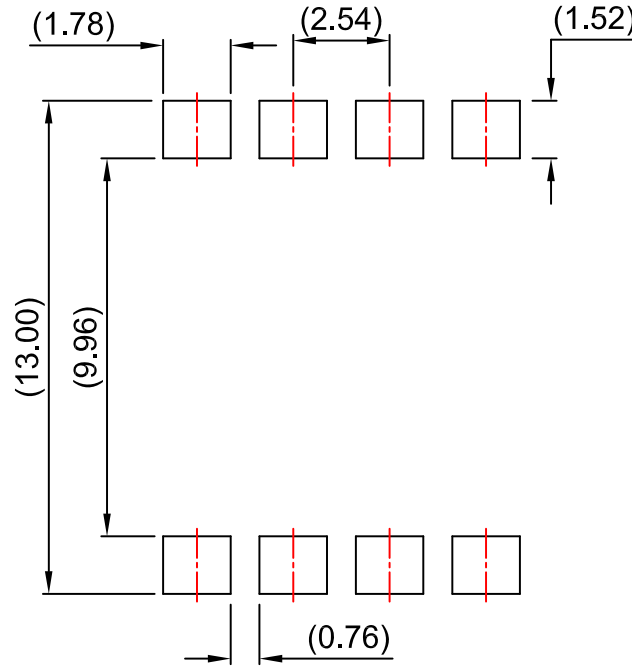
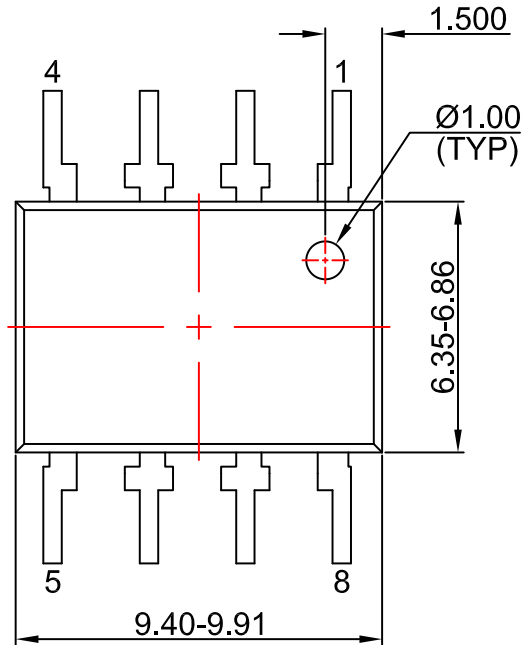
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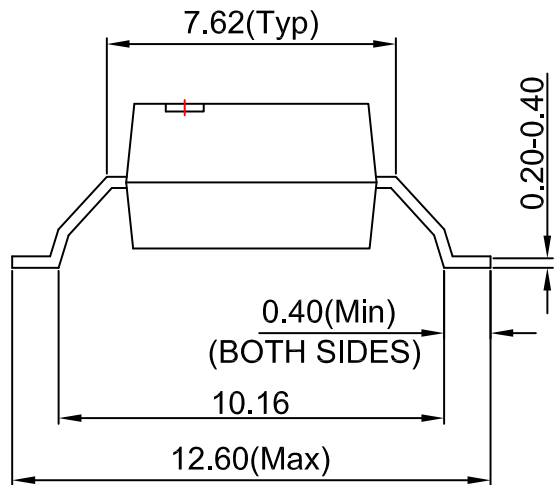
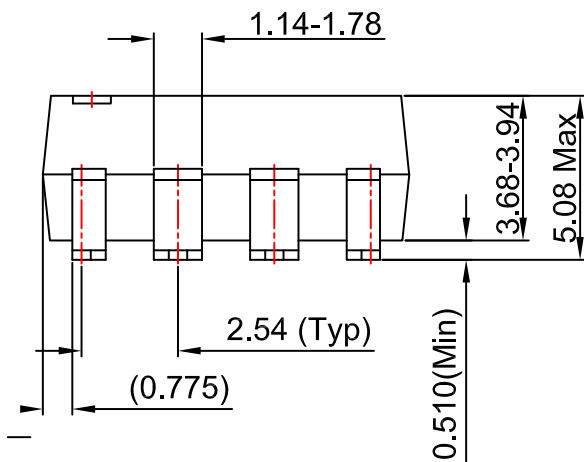


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CASE 709AD
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