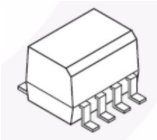
# Dual Channel OptoHiT™ Series, High-Temperature Phototransistor Optocoupler in Small Outline 8-Pin Package

# FOD8802 Series



SOIC8
M SUFFIX
CASE 751DZ

## Description

The FOD8802 dual channel optocoupler is a best−in−class phototransistor, optocoupler utilizing **onsemi**'s leading−edge proprietary process technology to achieve high operating temperature performance, up to 125°C. It consists of two aluminum gallium arsenide (AlGaAs) infrared light emitting diode optically coupled to two phototransistors, in a small outline, 8−pin SOIC package. It delivers consistent current transfer ratio at very low input current over temperature. The AlGaAs light ouput degradation performance is significantly better than the commodity optocoupler products that uses the standard GaAs, extending lifetime and reducing the guardband requirements to compensate for temperature drift. The input−output isolation voltage, Viso, is rated at 2500 $VAC_{RMS}$.

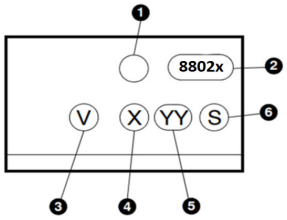
## Features

- Excellent CTR Linearity at High Temperature
- CTR at Very Low Input Current, $I_F$
- High Isolation Voltage Regulated by Safety Agency, UL1577, 2500 $VAC_{RMS}$ for 1 min.
- Applicable to Infrared Ray Reflow, 260°C
- These are Pb−Free Devices

## Typical Applications

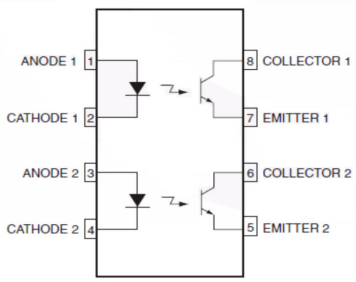
- Primarily Suited for DC−DC Converters
- For Ground Loop Isolation, Signal to Noise Isolation
- Communications – Adapters, Chargers
- Consumer – Appliances, Set Top Boxes
- Industrial – Power Supplies, Motor Control, Programmable Logic Control

## MARKING DIAGRAM




1. ON = Corporate Name
2. 8802x = Device Number
3. V = DIN EN/IEC60747−5−5 Option
4. X = One−Digit Year Code
5. YY = Digit Work Week
6. S = Assembly Package Code

## PIN CONNECTIONS




## ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 9 of this data sheet.

© Semiconductor Components Industries, LLC, 2020

**Table 1. SAFETY AND INSULATION RATINGS**
As per DIN_EN/IEC60747−5−5. 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 | | 40/125/21 |
| Pollution Degree (DIN VDE 0110/1.89) | | 2 |
| Comparative Tracking Index | | 175 |

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| VPR | 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 | Vpeak |
| | 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 | Vpeak |
| VIORM | Maximum Working Insulation Voltage | 565 | Vpeak |
| VIOTM | Highest Allowable Over−Voltage | 4,000 | Vpeak |
| | 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 |
| IS,INPUT | Input Current (Note 1) | 200 | mA |
| PS,OUTPUT | Output Power (Note 1) | 300 | mW |
| RIO | 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.

**Table 2. ABSOLUTE MAXIMUM RATINGS** ($T_A$ = 25°C unless otherwise specified)

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $T_{STG}$ | Storage Temperature | −40 to +150 | °C |
| $T_{OPR}$ | Operating Temperature | −40 to +125 | °C |
| $T_J$ | Junction Temperature | −50 to +150 | °C |
| $T_{SOL}$ | Lead Solder Temperature (Refer to Reflow Temperature Profile) | 260 for 10 sec | °C |
| **EMITTER** | | | |
| $I_{F(average)}$ | Continuous Forward Current | 20 | mA |
| $V_R$ | Reverse Input Voltage | 6 | V |
| $PD_{LED}$ | Power Dissipation (Note 2) | 40 | mW |
| **DETECTOR** | | | |
| $I_{C(average)}$ | Continuous Collector Current | 30 | mA |
| $V_{CEO}$ | Collector−Emitter Voltage | 75 | V |
| $V_{ECO}$ | Emitter−Collector Voltage | 7 | V |
| $PD_C$ | Collector Power Dissipation (Note 2) | 150 | 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.

2. Functional operation under these conditions is not implied. Permanent damage may occur if the device is subjected to conditions outside these ratings.

**Table 3. ELECTRICAL CHARACTERISTICS**

Apply over all recommended conditions ($T_A$ = −40°C to +125°C unless otherwise specified). All typical values are measured at $T_A$ = 25°C.

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $V_F$ | Forward Voltage | $I_F$ = 1 mA | 1.0 | 1.35 | 1.8 | V |
| $\Delta V_F / \Delta T_A$ | Forward Voltage Coefficient | $I_F$ = 1 mA | | −1.6 | | mV/°C |
| $I_R$ | Reverse Current | $V_R$ = 6 V | | | 10 | μA |
| $C_T$ | Terminal Capacitance | V = 0 V, f = 1 MHz | | 30 | | pF |
| $BV_{CEO}$ | Collector−Emitter Breakdown Voltage | $I_C$ = 0.5 mA, $I_F$ = 0 mA | 75 | 130 | | V |
| $BV_{ECO}$ | Emitter−Collector Breakdown Voltage | $I_E$ = 100 μA, $I_F$ = 0 mA | 7 | 12 | | V |
| $I_{CEO}$ | Collector Dark Current | $V_{CE}$ = 75 V, $I_F$ = 0 mA, $T_A$ = 25°C | | | 100 | nA |
| | | $V_{CE}$ = 50 V, $I_F$ = 0 mA | | | 50 | μA |
| | | $V_{CE}$ = 5 V, $I_F$ = 0 mA | | | 30 | μA |
| $C_{CE}$ | Capacitance | $V_{CE}$ = 0 V, f = 1 MHz | | 8 | | pF |

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.

**Table 4. TRANSFER CHARACTERISTICS**

Apply over all recommended conditions ($T_A$ = −40°C to +125°C unless otherwise specified). $T_A$ = 25°C unless otherwise specified.

| Symbol | Parameter | Device | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| $CTR_{CE}$ | Current Transfer Ratio (collector−emiiter) | FOD8802A | $I_F$ = 1.0 mA, $V_{CE}$ = 5 V @ $T_A$ = 25°C | 80 | 120 | 160 | % |
| | | | $I_F$ = 1.0 mA, $V_{CE}$ = 5 V | 35 | 120 | 230 | |
| | | | $I_F$ = 1.6 mA, $V_{CE}$ = 5 V | 40 | 125 | | |
| | | | $I_F$ = 3.0 mA, $V_{CE}$ = 5 V | 45 | 138 | | |
| | | FOD8802B | $I_F$ = 1.0 mA, $V_{CE}$ = 5 V @ $T_A$ = 25°C | 130 | 195 | 260 | |
| | | | $I_F$ = 1.0 mA, $V_{CE}$ = 5 V | 65 | 195 | 360 | |
| | | | $I_F$ = 1.6 mA, $V_{CE}$ = 5 V | 70 | 202 | | |
| | | | $I_F$ = 3.0 mA, $V_{CE}$ = 5 V | 75 | 215 | | |
| | | FOD8802C | $I_F$ = 1.0 mA, $V_{CE}$ = 5 V @ $T_A$ = 25°C | 200 | 300 | 400 | |
| | | | $I_F$ = 1.0 mA, $V_{CE}$ = 5 V | 100 | 300 | 560 | |
| | | | $I_F$ = 1.6 mA, $V_{CE}$ = 5 V | 110 | 312 | | |
| | | | $I_F$ = 3.0 mA, $V_{CE}$ = 5 V | 115 | 330 | | |
| | | FOD8802D | $I_F$ = 1.0 mA, $V_{CE}$ = 5 V @ $T_A$ = 25°C | 100 | | 400 | |
| | | | $I_F$ = 1.0 mA, $V_{CE}$ = 5 V | 45 | | 560 | |
| | | | $I_F$ = 1.6 mA, $V_{CE}$ = 5 V | 50 | | | |
| | | | $I_F$ = 3.0 mA, $V_{CE}$ = 5 V | 55 | | | |
| $CTR_{CE(SAT)}$ | Saturated Current Transfer Ratio (collector−emiiter) | FOD8802A | $I_F$ = 1.0 mA, $V_{CE}$ = 0.4 V @ $T_A$ = 25°C | 65 | 108 | 150 | % |
| | | | $I_F$ = 1.0 mA, $V_{CE}$ = 0.4 V | 30 | 108 | | |
| | | | $I_F$ = 1.6 mA, $V_{CE}$ = 0.4 V | 25 | 104 | | |
| | | | $I_F$ = 3.0 mA, $V_{CE}$ = 0.4 V | 20 | 92 | | |
| | | FOD8802B | $I_F$ = 1.0 mA, $V_{CE}$ = 0.4 V @ $T_A$ = 25°C | 90 | 168 | 245 | |
| | | | $I_F$ = 1.0 mA, $V_{CE}$ = 0.4 V | 45 | 168 | | |
| | | | $I_F$ = 1.6 mA, $V_{CE}$ = 0.4 V | 40 | 155 | | |
| | | | $I_F$ = 3.0 mA, $V_{CE}$ = 0.4 V | 35 | 132 | | |
| | | FOD8802C | $I_F$ = 1.0 mA, $V_{CE}$ = 0.4 V @ $T_A$ = 25°C | 140 | 238 | 380 | |
| | | | $I_F$ = 1.0 mA, $V_{CE}$ = 0.4 V | 75 | 238 | | |
| | | | $I_F$ = 1.6 mA, $V_{CE}$ = 0.4 V | 65 | 215 | | |
| | | | $I_F$ = 3.0 mA, $V_{CE}$ = 0.4 V | 55 | 177 | | |
| | | FOD8802D | $I_F$ = 1.0 mA, $V_{CE}$ = 0.4 V @ $T_A$ = 25°C | 70 | | 380 | |
| | | | $I_F$ = 1.0 mA, $V_{CE}$ = 0.4 V | 35 | | | |
| | | | $I_F$ = 1.6 mA, $V_{CE}$ = 0.4 V | 30 | | | |
| | | | $I_F$ = 3.0 mA, $V_{CE}$ = 0.4 V | 25 | | | |
| $V_{CE(SAT)}$ | Saturation voltage | FOD8802A | $I_F$ = 1.0 mA, $I_C$ = 0.3 mA | | 0.17 | 0.40 | V |
| | | | $I_F$ = 1.6 mA, $I_C$ = 0.4 mA | | 0.16 | 0.40 | |
| | | | $I_F$ = 3.0 mA, $I_C$ = 0.6 mA | | 0.15 | 0.40 | |
| | | FOD8802B | $I_F$ = 1.0 mA, $I_C$ = 0.45 mA | | 0.17 | 0.40 | |
| | | | $I_F$ = 1.6 mA, $I_C$ = 0.6 mA | | 0.16 | 0.40 | |
| | | | $I_F$ = 3.0 mA, $I_C$ = 1.0 mA | | 0.16 | 0.40 | |
| | | FOD8802C | $I_F$ = 1.0 mA, $I_C$ = 0.75 mA | | 0.18 | 0.40 | |
| | | | $I_F$ = 1.6 mA, $I_C$ = 1.0 mA | | 0.17 | 0.40 | |
| | | | $I_F$ = 3.0 mA, $I_C$ = 1.6 mA | | 0.17 | 0.40 | |
| | | FOD8802D | $I_F$ = 1.0 mA, $I_C$ = 0.45 mA | | | 0.40 | |
| | | | $I_F$ = 1.6 mA, $I_C$ = 0.60 mA | | | 0.40 | |
| | | | $I_F$ = 3.0 mA, $I_C$ = 1.00 mA | | | 0.40 | |

**Table 5. SWITCHING CHARACTERISTICS**

Apply over all recommended conditions ($T_A$ = −40°C to +125°C unless otherwise specified). All typical values are measured at $T_A$ = 25°C.

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $t_{ON}$ | Turn On Time | $I_F$ = 1.6 mA, $V_{CC}$ = 5 V, $R_L$ = 0.75 kΩ | 1 | 6 | 20 | μs |
| | | $I_F$ = 1.6 mA, $V_{CC}$ = 5 V, $R_L$ = 4.7 kΩ | | 6 | | μs |
| $t_{OFF}$ | Turn Off Time | $I_F$ = 1.6 mA, $V_{CC}$ = 5 V, $R_L$ = 0.75 kΩ | 1 | 6 | 20 | μs |
| | | $I_F$ = 1.6 mA, $V_{CC}$ = 5 V, $R_L$ = 4.7 kΩ | | 40 | | μs |
| $t_R$ | Output Rise Time (10% −90%) | $I_F$ = 1.6 mA, $V_{CC}$ = 5 V, $R_L$ = 0.75 kΩ | | 6 | | μs |
| $t_F$ | Output Fall Time (90% −10%) | $I_F$ = 1.6 mA, $V_{CC}$ = 5 V, $R_L$ = 0.75 kΩ | | 7 | | μs |
| $CM_H$ | Common Mode Rejection Voltage (Transient Immunity Output High) | $I_F$ = 0 mA, $V_{CC}$ = 5 V, $R_L$ = 4.7kΩ VCM = 500 V (Note 3) | | 10 | | kV/μs |
| $CM_L$ | Common Mode Rejection Voltage (Transient Immunity Output Low) | $I_F$ = 1.6 mA, $V_{CC}$ = 5 V, $R_L$ = 4.7 kΩ VCM = 500 V (Note 3) | | 10 | | kV/μs |

3. Common mode transient immunity at output high is the maximum tolerable positive dVcm/dt on the leading edge of the common mode impulse signal, Vcm, to assure that the output will remain high.

**Table 6. ISOLATION CHARACTERISTICS**

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $V_{ISO}$ | Input−Output Isolation Voltage | Freq = 60 Hz, t = 1.0 min, $I_{I-O} \le$ 10 μA (Notes 4, 5) | 2,500 | | | $VAC_{RMS}$ |
| $R_{ISO}$ | Isolation Resistance | $V_{I-O}$ = 500 V (Note 4) | $10^{11}$ | | | Ω |
| $C_{ISO}$ | Isolation Capacitance | Frequency = 1 MHz | | 0.6 | | pF |

4. Device is considered a two terminal device: Pins 1 and 2 are shorted together and Pins 3 and 4 are shorted together.
5. 2,500 $VAC_{RMS}$ for 1 minute duration is equivalent to 3,000 $VAC_{RMS}$ for 1 second duration.

## TEST CIRCUIT

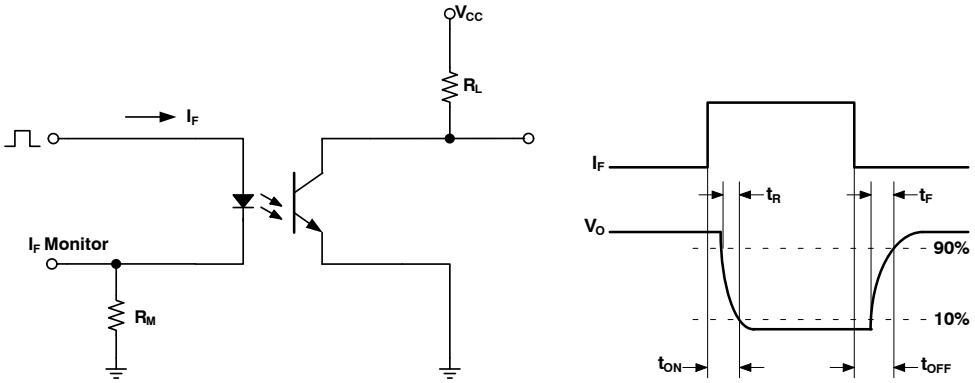



**Figure 1. Switching Test Circuit and Waveform**

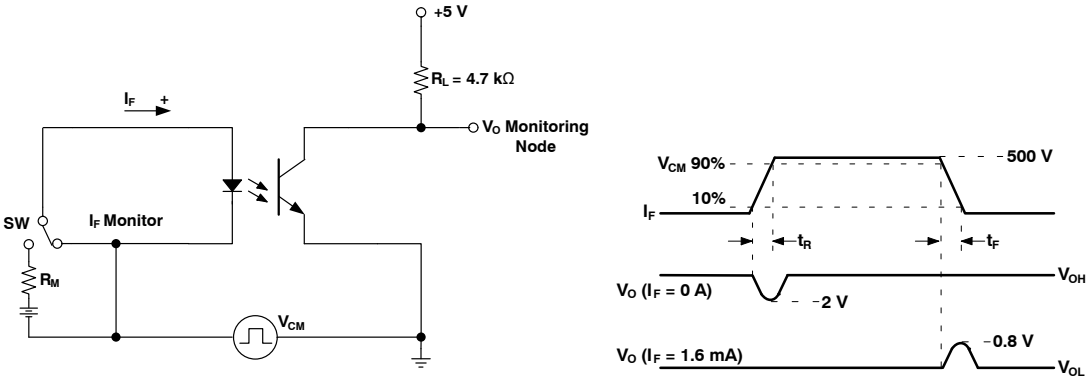



**Figure 2. Test Circuit for Instantaneous Common−Mode Rejection Voltage**

## TYPICAL PERFORMANCE CHARACTERISTICS

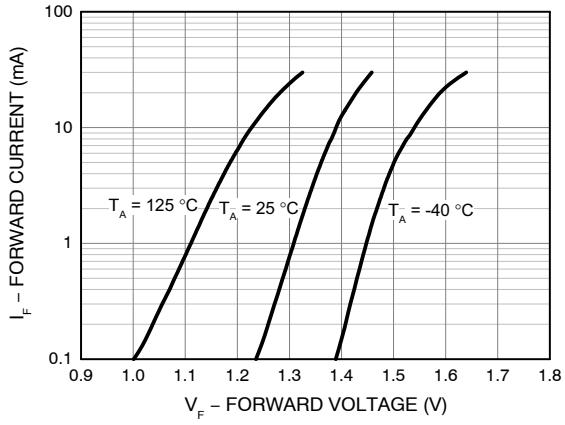



**Figure 3. Forward Current vs. Forward Voltage**

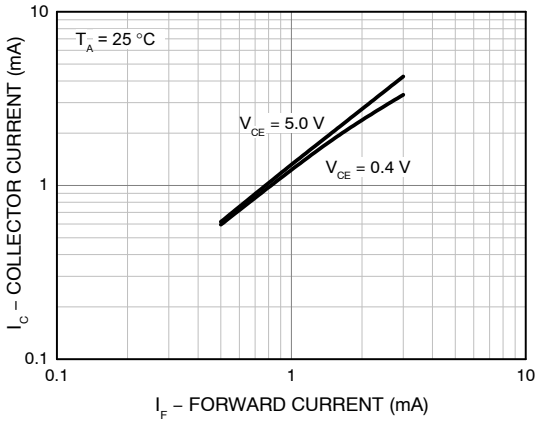



**Figure 4. Collector Current vs. Forward Current**

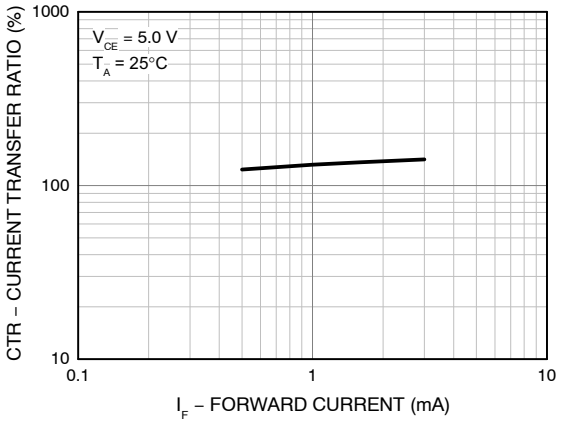



**Figure 5. Current Transfer Ratio vs. Forward Current**

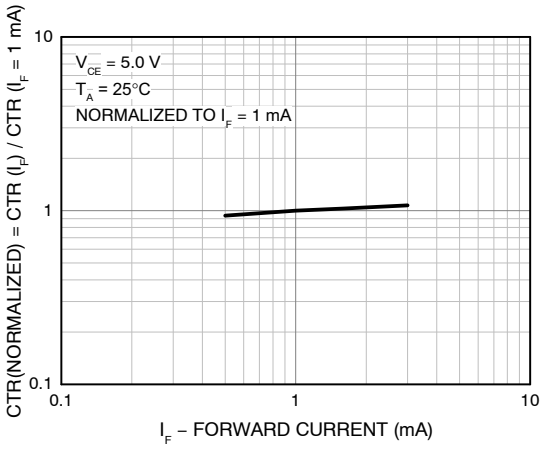



**Figure 6. Normalized CTR vs. Forward Current**

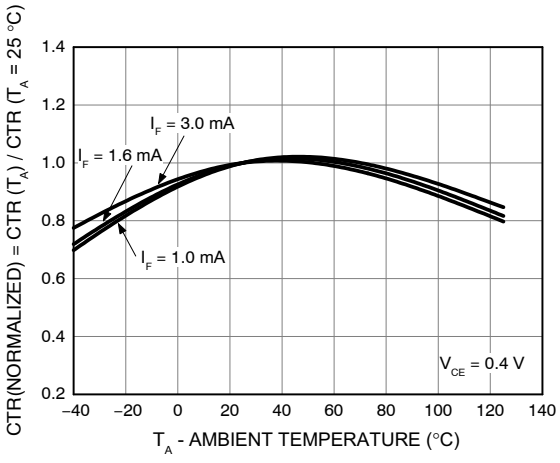



**Figure 7. Normalized CTR vs. Ambient Temperature**

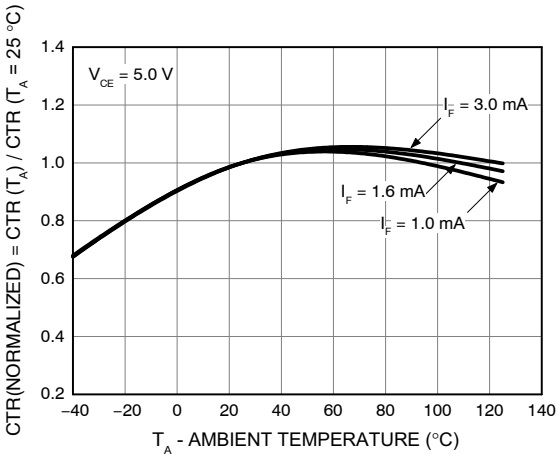



**Figure 8. Normalized CTR vs. Ambient Temperature**

## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

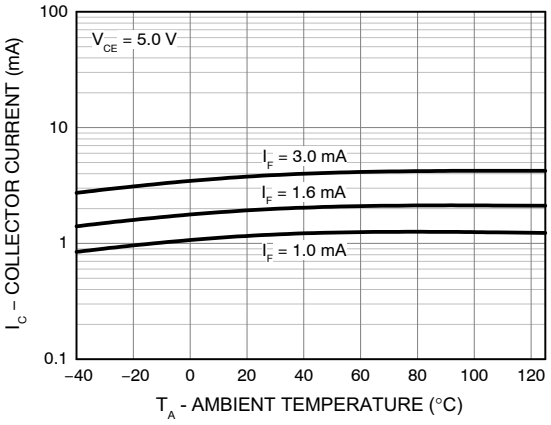



**Figure 9. Collector Current vs. Ambient Temperature**

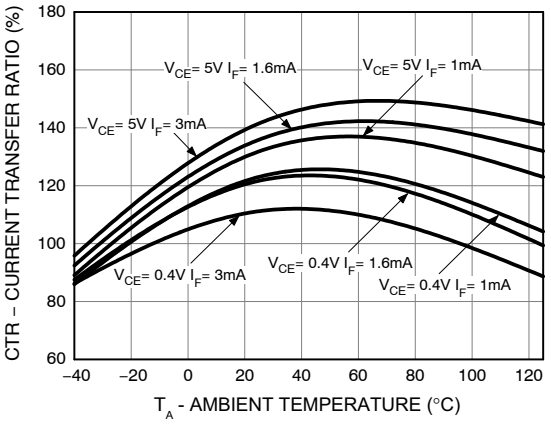



**Figure 10. Current Transfer Ratio vs. Ambient Temperature**

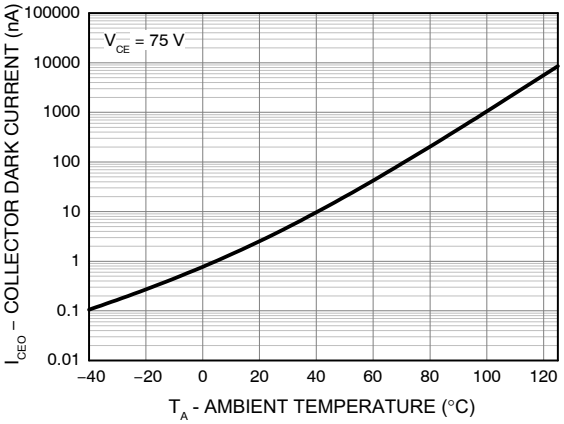



**Figure 11. Collector Dark Current vs. Ambient Temperature**

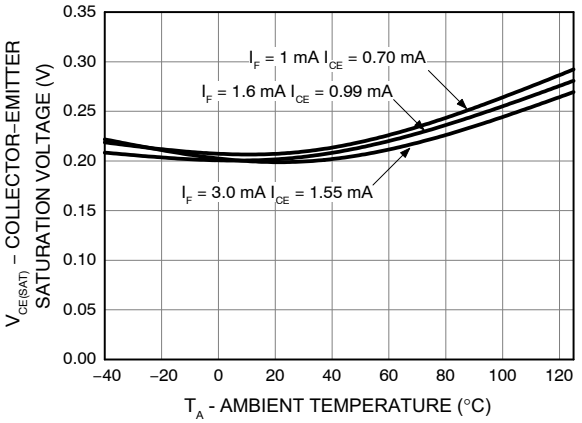



**Figure 12. Collector−Emitter Saturation Voltage vs. Ambient Temperature**

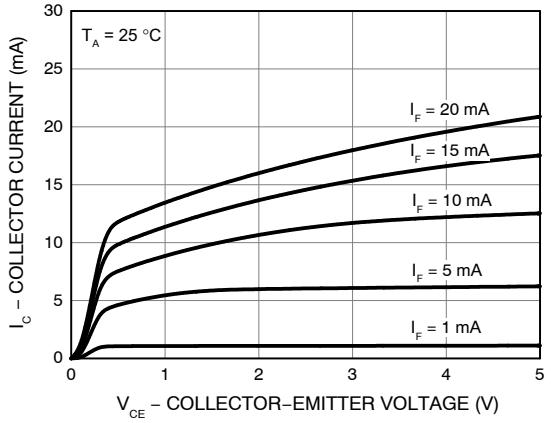



**Figure 13. Collector Current vs. Collector−Emitter Voltage**

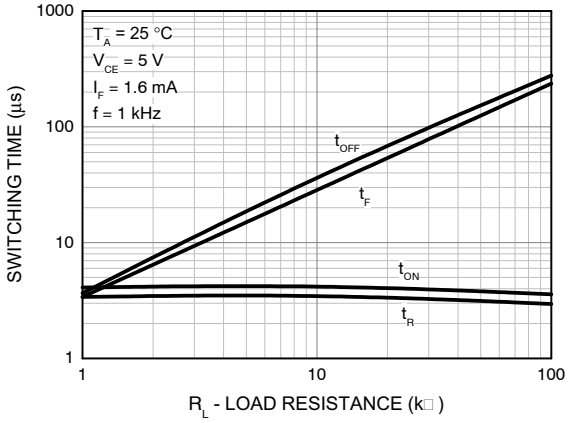



**Figure 14. Switching Time vs. Load Resistance**

## REFLOW PROFILE

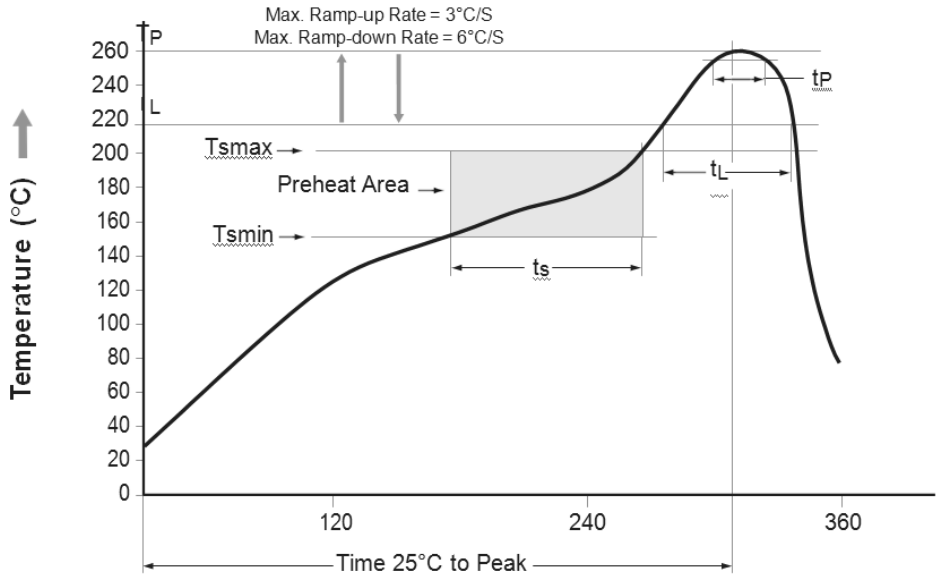



**Figure 15. Reflow Profile**

| 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** (Note 6)

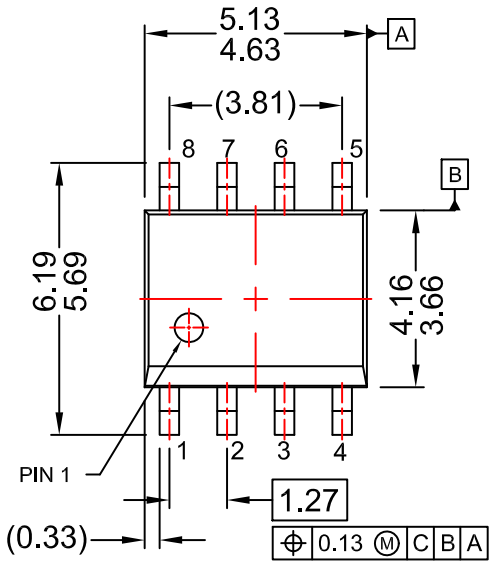
| Part Number | Package | Packing Method |
|---|---|---|
| FOD8802A | Small Outline 8−Pin | Tube (50 units per tube) |
| FOD8802AR2 | Small Outline 8−Pin | Tape and Reel (2,500 units per reel) |
| FOD8802AV | Small Outline 8−Pin<br>DIN EN/IEC60747−5−5 Option (pending approval) | Tube (50 units per tube) |
| FOD8802AR2V | Small Outline 8−Pin<br>DIN EN/ IEC60747−5−5 Option (pending approval) | Tape and Reel (2,500 units per reel) |

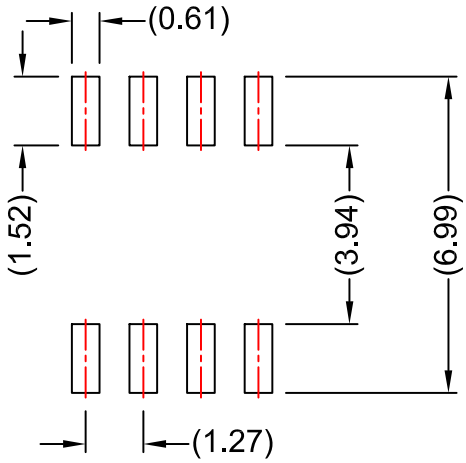
6. The product orderable part number system listed in this table also applies to the FOD8802A, FOD8802B, FOD8802C and FOD8802D products.

OptoHiT is a trademark of Semiconductor Components Industries, LLC (SCILLC) or its subsidiaries in the United States and/or other countries.

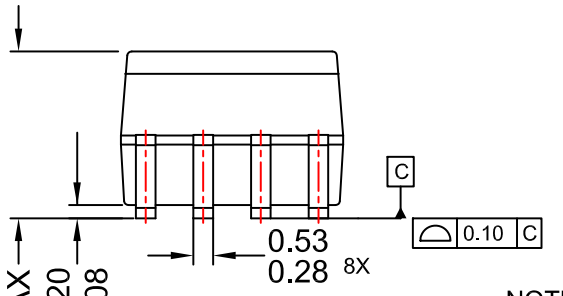
**SOIC8**
CASE 751DZ
ISSUE O

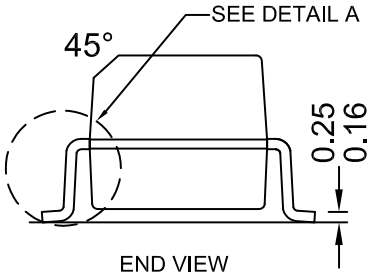
DATE 30 SEP 2016



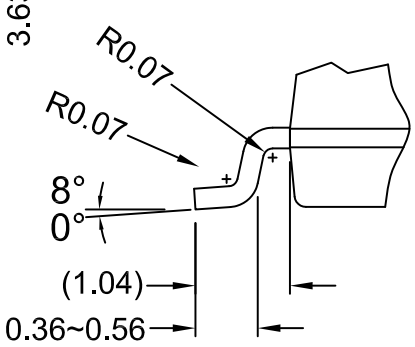




LAND PATTERN RECOMMENDATION




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.

| | | | |
|---|---|---|---|
| **DOCUMENT NUMBER:** | **98AON13733G** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. | |
| **DESCRIPTION:** | **SOIC8** | | **PAGE 1 OF 1** |

**onsemi** and onsemi are trademarks of Semiconductor Components Industries, LLC dba **onsemi** or its subsidiaries in the United States and/or other countries. **onsemi** reserves the right to make changes without further notice to any products herein. **onsemi** makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. **onsemi** does not convey any license under its patent rights nor the rights of others.

**onsemi**, , and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent−Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as−is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## ADDITIONAL INFORMATION

**TECHNICAL PUBLICATIONS**:
**Technical Library:** www.onsemi.com/design/resources/technical−documentation
**onsemi Website:** www.onsemi.com

**ONLINE SUPPORT**: www.onsemi.com/support
**For additional information, please contact your local Sales Representative at** www.onsemi.com/support/sales