

# ASSR-401C and ASSR-402C

Low C x R, Form A, Solid State Relay (Photo MOSFET)  
(400V/100Ω/15pF)



## Data Sheet



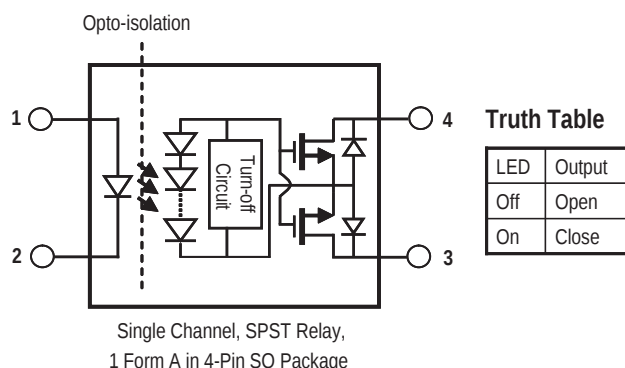
### Description

The ASSR-40xC Series is specifically designed for fast switching applications, commonly found in the test and measurement systems. The low C x R and low output off-state leakage current provide higher system throughput and reduce system errors.

The dual channel configuration of ASSR-402C is equivalent to 2 Form A Electromechanical Relays (EMR). One channel of the relay consists of an AlGaAs infrared light-emitting diode (LED) input stage optically coupled to a high-voltage output detector circuit. The detector consists of a high-speed photovoltaic diode array and driver circuitry to switch on/off two discrete high voltage MOSFETs. The relay turns on (contact closes) with a minimum input current of 1mA through the input LED. The relay turns off (contact opens) with an input voltage of 0.8V or less.

ASSR-401C is available in 4-pin SO package and ASSR-402C is available in 8-pin DIP and Gull Wing Surface Mount packages. Their electrical and switching characteristics are specified over the temperature range of -40°C to +85°C.

### Functional Diagram



### Features

- Compact Solid-State Bi-directional Signal Switch
- Single and Dual Channel Normally-off Single-Pole-Single-Throw (SPST) Relay
- 400V Output Withstand Voltage
- 0.04A Current Rating
- Low Input Current:  $I_F = 1\text{mA}$
- Low C x R: 650pF•Ω typical
- Low Output Off-state Leakage Current: 0.3nA typical
- Fast Speed Switching: 0.08ms (Ton), 0.05ms (Toff) typical
- High Transient Immunity: >1kV/μs
- High Input-to-Output Insulation Voltage (Safety and Regulatory Approvals Pending)
  - 3750 Vrms for 1 min per UL1577
  - CSA Component Acceptance

### Applications

- Automatic Test Equipment
- Data Acquisition System
- Datalogger and Recorder
- Multiplexer
- Measuring Instrument
- EMR / Reed Relay Replacement

**CAUTION:** It is advised that normal static precautions be taken in handling and assembly of this component to prevent damage and/or degradation which may be induced by ESD.

## Ordering Information

ASSR-xxxx is UL Recognized with 3750 Vrms for 1 minute per UL1577 and is approved under CSA Component Acceptance Notice #5.

| Part number | Option         | Package          | Surface Mount | Gull Wing | Tape & Reel | Quantity            |
|-------------|----------------|------------------|---------------|-----------|-------------|---------------------|
|             | RoHS Compliant |                  |               |           |             |                     |
| ASSR-401C   | -003E          | SO-4             | X             |           |             | 100 units per tube  |
|             | -503E          |                  | X             |           | X           | 1500 units per reel |
| ASSR-402C   | -002E          | 300 mil<br>DIP-8 |               |           |             | 50 units per tube   |
|             | -302E          |                  | X             | X         |             | 50 units per tube   |
|             | -502E          |                  | X             | X         | X           | 1000 units per reel |

To order, choose a part number from the part number column and combine with the desired option from the option column to form an order entry.

Example 1:

ASSR-401C-503E to order product of Surface Mount SO-4 package in Tape and Reel packaging and RoHS Compliant.

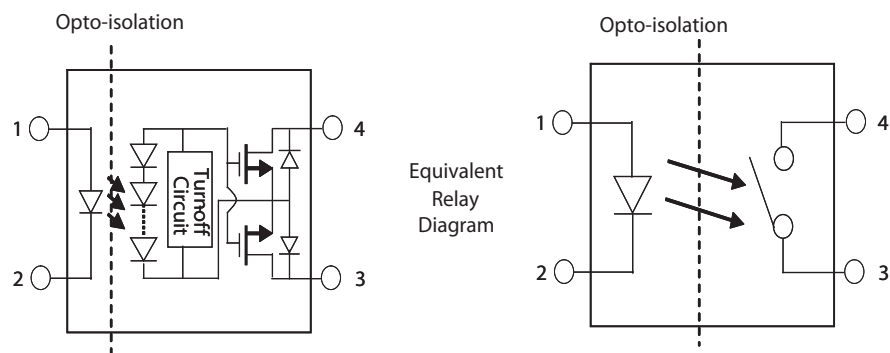
Example 2:

ASSR-402C-002E to order product of 300mil DIP-8 package in tube packaging and RoHS Compliant.

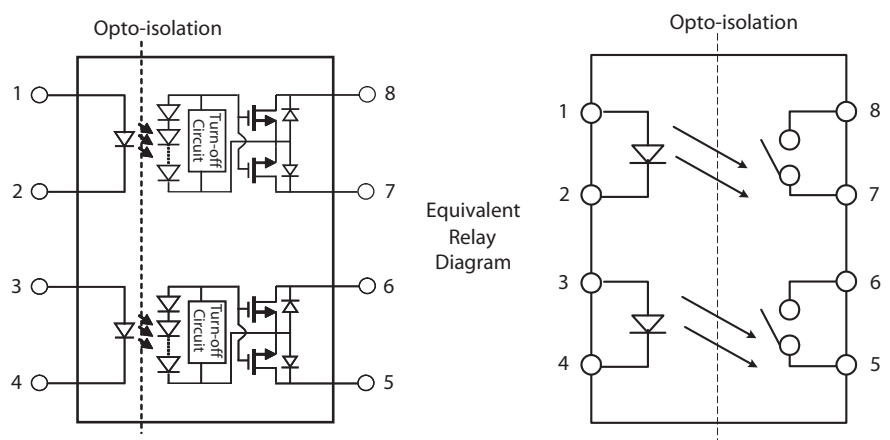
Option datasheets are available. Contact your Avago sales representative or authorized distributor for information.

## Schematic

### ASSR-401C

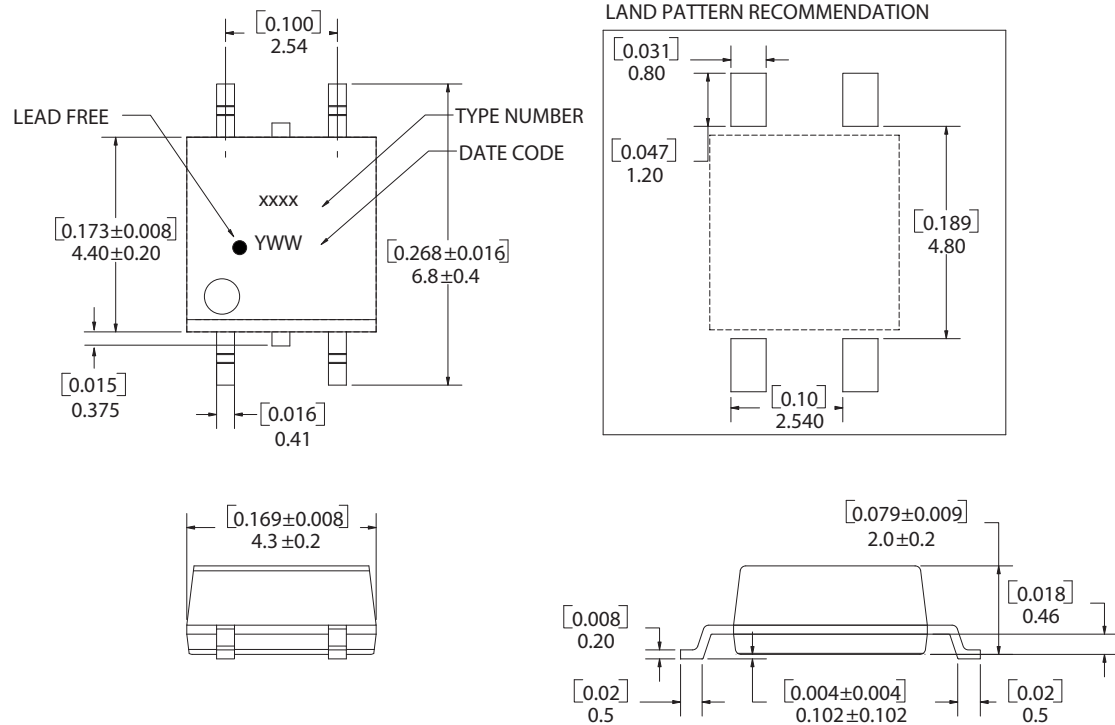


### ASSR-402C



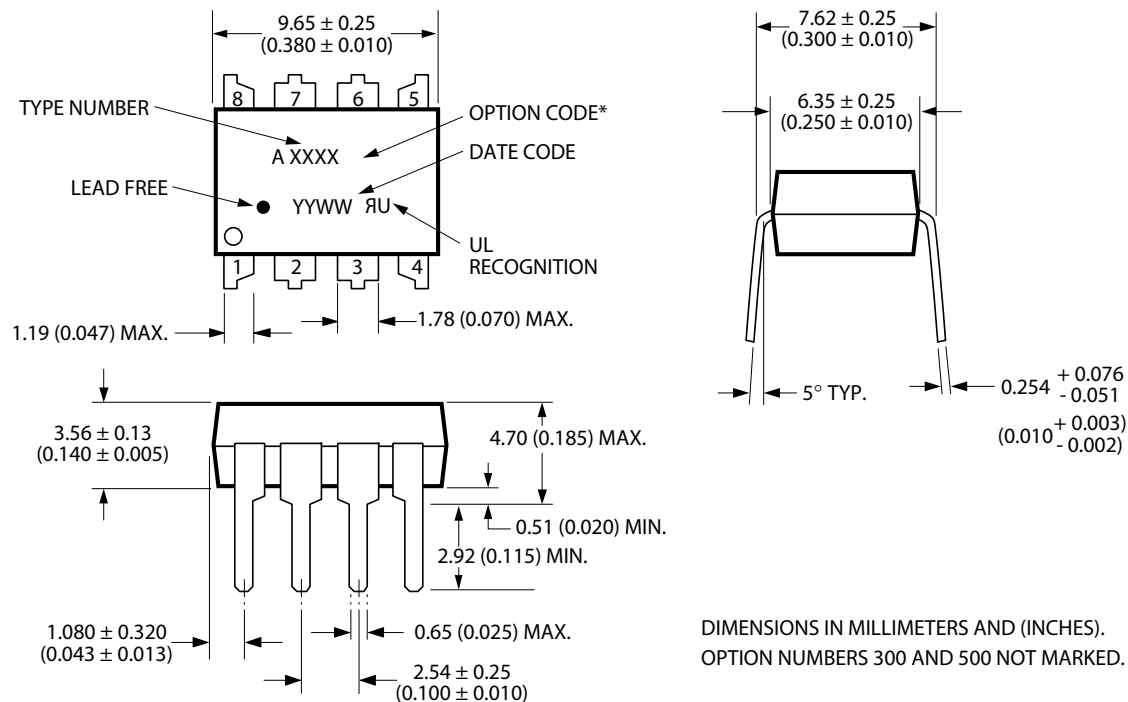
## Package Outline Drawings

### ASSR-401C 4-Pin Small Outline Package



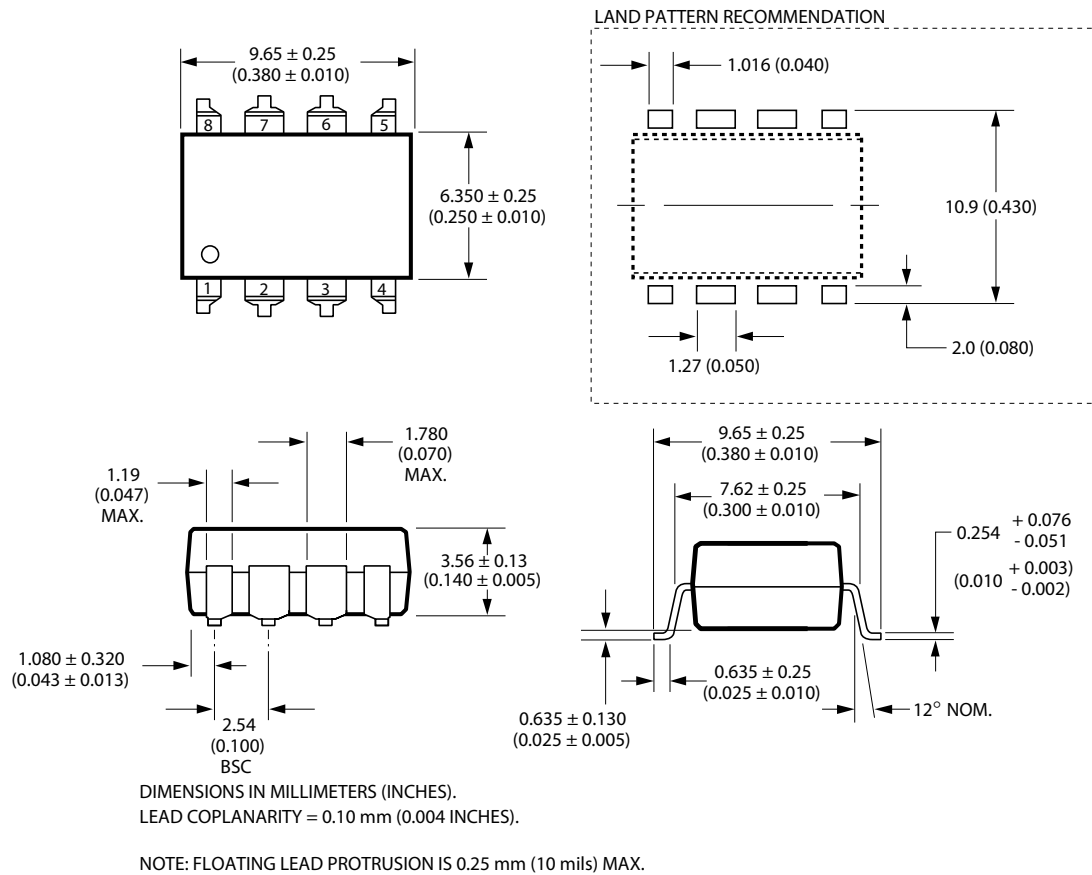
DIMENSIONS IN MILLIMETERS AND [INCHES]  
OPTION NUMBER 500 AND UL RECOGNITION NOT MARKED

### ASSR-402C 8-Pin DIP Package

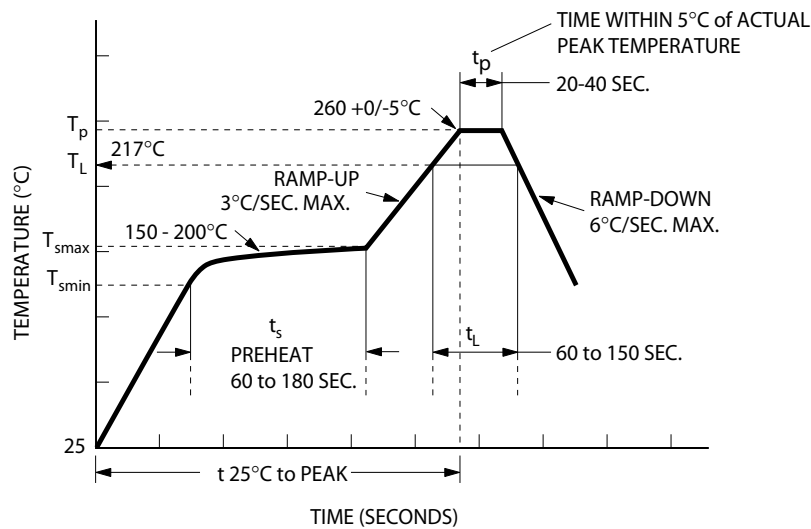


DIMENSIONS IN MILLIMETERS AND (INCHES).  
OPTION NUMBERS 300 AND 500 NOT MARKED.

## ASSR-402C 8-Pin DIP Package with Gull Wing Surface Mount Option 300



## Lead Free IR Profile



NOTES:  
THE TIME FROM 25°C TO PEAK TEMPERATURE = 8 MINUTES MAX.  
 $T_{smax} = 200^\circ\text{C}$ ,  $T_{smin} = 150^\circ\text{C}$

Use of non-chlorine-activated fluxes is highly recommended.

## Regulatory Information

The ASSR-401C and ASSR-402C are approved by the following organizations:

### UL

Approved under UL 1577, component recognition program up to  $V_{ISO} = 3750 V_{RMS}$

### CSA

Approved under CSA Component Acceptance Notice #5.

## Insulation and Safety Related Specifications

| Parameter                                         | Symbol | ASSR-401C | ASSR-402C | Units | Conditions                                                                                                                         |
|---------------------------------------------------|--------|-----------|-----------|-------|------------------------------------------------------------------------------------------------------------------------------------|
| Minimum External Air Gap (Clearance)              | L(101) | 4.9       | 7.1       | mm    | Measured from input terminals to output terminals, shortest distance through air.                                                  |
| Minimum External Tracking (Creepage)              | L(102) | 4.9       | 7.4       | mm    | Measured from input terminals to output terminals, shortest distance path along body.                                              |
| Minimum Internal Plastic Gap (Internal Clearance) |        | 0.08      | 0.08      | mm    | Through insulation distance conductor to conductor, usually the straight line distance thickness between the emitter and detector. |
| Tracking Resistance (Comparative Tracking Index)  | CTI    | 175       | 175       | V     | DIN IEC 112/VDE 0303 Part 1                                                                                                        |
| Isolation Group (DIN VDE0109)                     |        | IIIa      | IIIa      |       | Material Group (DIN VDE0109)                                                                                                       |

## Absolute Maximum Ratings

| Parameter                                                                          | Symbol                        | Min.     | Max.             | Units   | Note |
|------------------------------------------------------------------------------------|-------------------------------|----------|------------------|---------|------|
| Storage Temperature                                                                | $T_S$                         | -55      | 125              | °C      |      |
| Operating Temperature                                                              | $T_A$                         | -40      | 85               | °C      |      |
| Junction Temperature                                                               | $T_J$                         |          | 125              | °C      |      |
| Lead Soldering Cycle                                                               | Temperature<br>Time           |          | 260<br>10        | °C<br>s |      |
| Input Current                                                                      | Average<br>Surge<br>Transient | $I_F$    | 25<br>50<br>1000 | mA      |      |
| Reversed Input Voltage                                                             |                               | $V_R$    | 5                | V       |      |
| Input Power Dissipation                                                            | ASSR-401C<br>ASSR-402C        | $P_{IN}$ | 20<br>40         | mW      |      |
| Output Power Dissipation                                                           | ASSR-401C<br>ASSR-402C        | $P_O$    | 160<br>320       | mW      |      |
| Average Output Current ( $T_A = 25^\circ\text{C}$ , $T_C \leq 100^\circ\text{C}$ ) |                               | $I_O$    | 0.04             | A       |      |
| Output Voltage ( $T_A = 25^\circ\text{C}$ )                                        |                               | $V_O$    | -400<br>400      | V       |      |
| Solder Reflow Temperature Profile                                                  | See Lead Free IR Profile      |          |                  |         |      |

## Recommended Operating Conditions

| Parameter             | Symbol       | Min. | Max. | Units | Note |
|-----------------------|--------------|------|------|-------|------|
| Input Current (ON)    | $I_{F(ON)}$  | 1    | 10   | mA    | 1    |
| Input Voltage (OFF)   | $V_{F(OFF)}$ | 0    | 0.8  | V     |      |
| Operating Temperature | $T_A$        | -40  | +85  | °C    |      |

## Package Characteristics

Unless otherwise specified,  $T_A = 25^\circ\text{C}$ .

| Parameter                                          | Sym.      | Min. | Typ.       | Max. | Units    | Conditions                                         | Note |
|----------------------------------------------------|-----------|------|------------|------|----------|----------------------------------------------------|------|
| Input-Output Momentary Withstand Voltage           | $V_{ISO}$ | 3750 |            |      | Vrms     | $RH \leq 50\%$ ,<br>$t = 1 \text{ min}$            | 2, 3 |
| Input-Output Resistance                            | $R_{I-O}$ |      | $10^{12}$  |      | $\Omega$ | $V_{I-O} = 500 \text{ Vdc}$                        |      |
| Input-Output Capacitance<br>ASSR-401C<br>ASSR-402C | $C_{I-O}$ |      | 0.4<br>0.8 |      | pF       | $f = 1 \text{ MHz}$ ;<br>$V_{I-O} = 0 \text{ Vdc}$ | 2    |

## Electrical Specifications (DC)

Over recommended operating  $T_A = -40^\circ\text{C}$  to  $85^\circ\text{C}$ , unless otherwise specified.

| Parameter                       | Sym.           | Min. | Typ. | Max. | Units         | Conditions                                                                                        | Note |
|---------------------------------|----------------|------|------|------|---------------|---------------------------------------------------------------------------------------------------|------|
| Output Withstand Voltage        | $ V_{O(OFF)} $ | 400  | 440  |      | V             | $V_F = 0.8\text{V}$ , $I_O = 250 \mu\text{A}$ ,<br>$T_A = 25^\circ\text{C}$                       |      |
|                                 |                | 360  |      |      | V             | $V_F = 0.8\text{V}$ , $I_O = 250 \mu\text{A}$                                                     |      |
| Output Leakage Current          | $I_{O(OFF)}$   |      | 0.3  | 10   | nA            | $V_F = 0.8\text{V}$ , $V_O = 400\text{V}$ ,<br>$T_A = 25^\circ\text{C}$                           | 4    |
|                                 |                |      |      | 1    | $\mu\text{A}$ | $V_F = 0.8\text{V}$ , $V_O = 400\text{V}$                                                         | 4    |
| Output Off-Capacitance          | $C_{(OFF)}$    |      | 10   | 15   | pF            | $V_F = 0.8\text{V}$ , $V_O = 0\text{V}$ , Freq=1 MHz                                              |      |
| Output Offset Voltage           | $ V_{(OS)} $   |      | 1    |      | $\mu\text{V}$ | $I_F = 5\text{mA}$ , $I_O = 0\text{mA}$                                                           |      |
| Input Reverse Breakdown Voltage | $V_R$          | 5    |      |      | V             | $I_R = 10 \mu\text{A}$                                                                            |      |
| Input Forward Voltage           | $V_F$          | 1.1  | 1.3  | 1.65 | V             | $I_F = 5\text{mA}$                                                                                |      |
| Output On-resistance            | $R_{(ON)}$     |      | 65   | 100  | $\Omega$      | $I_F = 5\text{mA}$ , $I_O = 40\text{mA}$ ,<br>Pulse $\leq 30\text{ms}$ , $T_A = 25^\circ\text{C}$ | 5    |

## Switching Specifications (AC)

Over recommended operating  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ , unless otherwise specified.

| Parameter                        | Sym.          | Min. | Typ.      | Max. | Units             | Conditions                                                            | Fig. | Note |
|----------------------------------|---------------|------|-----------|------|-------------------|-----------------------------------------------------------------------|------|------|
| Turn On Time                     | $T_{ON}$      |      | 0.08      | 0.2  | ms                | $I_F = 5\text{mA}$ , $I_O = 40\text{mA}$ , $T_A = 25^{\circ}\text{C}$ |      |      |
|                                  |               |      |           | 0.5  | ms                | $I_F = 5\text{mA}$ , $I_O = 40\text{mA}$                              |      |      |
|                                  |               |      | 0.16      | 0.5  | ms                | $I_F = 2\text{mA}$ , $I_O = 40\text{mA}$ , $T_A = 25^{\circ}\text{C}$ |      |      |
|                                  |               |      |           | 0.8  | ms                | $I_F = 2\text{mA}$ , $I_O = 40\text{mA}$                              |      |      |
| Turn Off Time                    | $T_{OFF}$     |      | 0.05      | 0.2  | ms                | $I_F = 5\text{mA}$ , $I_O = 40\text{mA}$ , $T_A = 25^{\circ}\text{C}$ |      |      |
|                                  |               |      |           | 0.5  | ms                | $I_F = 5\text{mA}$ , $I_O = 40\text{mA}$                              |      |      |
|                                  |               |      | 0.05      | 0.2  | ms                | $I_F = 2\text{mA}$ , $I_O = 40\text{mA}$ , $T_A = 25^{\circ}\text{C}$ |      |      |
|                                  |               |      |           | 0.5  | ms                | $I_F = 2\text{mA}$ , $I_O = 40\text{mA}$                              |      |      |
| Output Transient Rejection       | $dV_O/dt$     | 1    | 7         |      | kV/ $\mu\text{s}$ | $\Delta V_O = 400\text{V}$ , $T_A = 25^{\circ}\text{C}$               |      |      |
| Input-Output Transient Rejection | $dV_{I-O}/dt$ | 1    | $\geq 10$ |      | kV/ $\mu\text{s}$ | $\Delta V_{I-O} = 1000\text{V}$ , $T_A = 25^{\circ}\text{C}$          |      |      |

Notes:

1. For qualified device performance over temperature range, it is recommended to operate at  $I_F = 5\text{mA}$ .
2. Device is considered as a two terminal device: pins 1, 2, 3 and 4 shorted together and pins 5, 6, 7 and 8 shorted together.
3. The Input-Output Momentary Withstand Voltage is a dielectric voltage rating that should not be interpreted as an input-output continuous voltage rating. For the continuous voltage rating refer to the IEC/EN/DIN EN 60747-5-2 Insulation Characteristics Table (if applicable), your equipment level safety specification, or Avago Technologies Application Note 1074, "Optocoupler Input-Output Endurance Voltage."
4. The PCB design and environmental conditions are taken into consideration when measuring the  $I_{O(OFF)}$  performance.
5. During the pulsed  $R_{(ON)}$  measurement ( $I_O$  duration  $\leq 30\text{ms}$ ), ambient ( $T_A$ ) and case temperature ( $T_C$ ) are equal.

For product information and a complete list of distributors, please go to our web site:

[www.avagotech.com](http://www.avagotech.com)

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