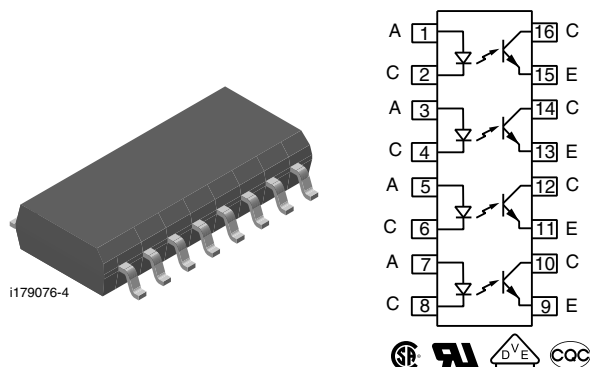


# Optocoupler, Phototransistor Output, Quad Channel, SOP-16, Half Pitch Mini-Flat Package



## FEATURES

- SOP (small outline package)
- Isolation test voltage, 3750 V<sub>RMS</sub> (1.0 s)
- High collector emitter voltage, V<sub>CEO</sub> = 70 V
- Low saturation voltage
- Fast switching times
- Temperature stable
- Low coupling capacitance
- End stackable, 0.050" (1.27 mm) spacing
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



## DESCRIPTION

The SFH6916 has a GaAs infrared emitter, which is optically coupled to a silicon planar phototransistor detector, and is incorporated in a 16 pin 50 mil lead pitch miniflat package. It features a high current transfer ratio, low coupling capacitance, and high isolation voltage.

The coupling devices are designed for signal transmission between two electrically separated circuits.

## AGENCY APPROVALS

- UL1577, file no. E52744 system code U
- CSA 22.2 bulletin 5A, double protection
- DIN EN 60747-5-5 (VDE 0884)
- CQC GB4943.1-2011 (suitable for installation altitude below 2000 m)

## ORDERING INFORMATION

|             |   |   |   |   |   |   |
|-------------|---|---|---|---|---|---|
| S           | F | H | 6 | 9 | 1 | 6 |
| PART NUMBER |   |   |   |   |   |   |



| AGENCY CERTIFIED/PACKAGE | CTR (%)   |
|--------------------------|-----------|
| UL, cUL                  | 50 to 300 |
| SOP-16, quad channel     | SFH6916   |

## ABSOLUTE MAXIMUM RATINGS (T<sub>amb</sub> = 25 °C, unless otherwise specified)

| PARAMETER                           | TEST CONDITION          | SYMBOL            | VALUE | UNIT |
|-------------------------------------|-------------------------|-------------------|-------|------|
| <b>INPUT</b>                        |                         |                   |       |      |
| Reverse voltage                     |                         | V <sub>R</sub>    | 6     | V    |
| DC forward current                  |                         | I <sub>F</sub>    | 50    | mA   |
| Surge forward current               | t <sub>p</sub> ≤ 10 μs  | I <sub>FSM</sub>  | 2.5   | A    |
| Total power dissipation             |                         | P <sub>diss</sub> | 80    | mW   |
| <b>OUTPUT</b>                       |                         |                   |       |      |
| Collector emitter voltage           |                         | V <sub>CE</sub>   | 70    | V    |
| Emitter collector voltage           |                         | V <sub>EC</sub>   | 7     | V    |
| Collector current                   |                         | I <sub>C</sub>    | 50    | mA   |
|                                     | t <sub>p</sub> = 1.0 ms | I <sub>C</sub>    | 100   | mA   |
| Total power dissipation per channel |                         | P <sub>diss</sub> | 150   | mW   |

**ABSOLUTE MAXIMUM RATINGS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

| PARAMETER                                           | TEST CONDITION                                                         | SYMBOL    | VALUE          | UNIT               |
|-----------------------------------------------------|------------------------------------------------------------------------|-----------|----------------|--------------------|
| <b>COUPLER</b>                                      |                                                                        |           |                |                    |
| Isolation test voltage between emitter and detector | $t = 1.0\text{ s}$                                                     | $V_{ISO}$ | 3750           | $V_{RMS}$          |
| Isolation resistance                                | $V_{IO} = 500\text{ V}, T_{amb} = 25\text{ }^{\circ}\text{C}$          | $R_{IO}$  | $\geq 10^{12}$ | $\Omega$           |
|                                                     | $V_{IO} = 500\text{ V}, T_{amb} = 100\text{ }^{\circ}\text{C}$         | $R_{IO}$  | $\geq 10^{11}$ | $\Omega$           |
| Storage temperature range                           |                                                                        | $T_{stg}$ | - 55 to + 125  | $^{\circ}\text{C}$ |
| Ambient temperature range                           |                                                                        | $T_{amb}$ | - 55 to + 100  | $^{\circ}\text{C}$ |
| Junction temperature                                |                                                                        | $T_j$     | 100            | $^{\circ}\text{C}$ |
| Soldering temperature <sup>(1)</sup>                | max. 10 s dip soldering distance to seating plane $\geq 1.5\text{ mm}$ |           | 260            | $^{\circ}\text{C}$ |
| Total power dissipation                             |                                                                        | $P_{tot}$ | 700            | mW                 |

**Notes**

- Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute maximum ratings for extended periods of the time can adversely affect reliability.

<sup>(1)</sup> Refer to reflow profile for soldering conditions for surface mounted devices.

**ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

| PARAMETER                            | TEST CONDITION                          | SYMBOL      | MIN. | TYP. | MAX. | UNIT          |
|--------------------------------------|-----------------------------------------|-------------|------|------|------|---------------|
| <b>INPUT</b>                         |                                         |             |      |      |      |               |
| Forward voltage                      | $I_F = 5\text{ mA}$                     | $V_F$       |      | 1.15 | 1.4  | V             |
| Reverse current                      | $V_R = 6\text{ V}$                      | $I_R$       |      | 0.01 | 10   | $\mu\text{A}$ |
| Capacitance                          | $C_O$                                   | $C_O$       |      | 14   |      | pF            |
| Thermal resistance                   |                                         | $R_{thja}$  |      | 1000 |      | K/W           |
| <b>OUTPUT</b>                        |                                         |             |      |      |      |               |
| Collector emitter leakage current    | $V_{CE} = 20\text{ V}$                  | $I_{CEO}$   |      |      | 100  | nA            |
| Collector emitter capacitance        | $V_{CE} = 5\text{ V}, f = 1\text{ MHz}$ | $C_{CE}$    |      | 2.8  |      | pF            |
| Thermal resistance                   |                                         | $R_{thja}$  |      | 500  |      | K/W           |
| <b>COUPLER</b>                       |                                         |             |      |      |      |               |
| Collector emitter saturation voltage | $I_F = 20\text{ mA}, I_C = 1\text{ mA}$ | $V_{CEsat}$ |      | 0.1  | 0.4  | V             |
| Coupling capacitance                 | $f = 1\text{ MHz}$                      | $C_C$       |      | 1    |      | pF            |

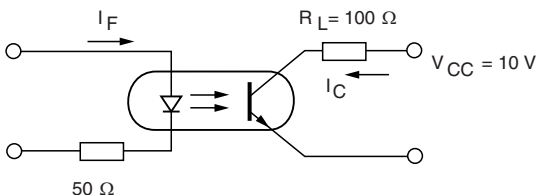
**Note**

- Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements.

**CURRENT TRANSFER RATIO** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

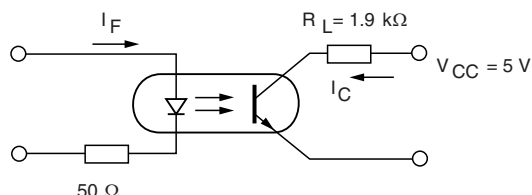
| PARAMETER              | TEST CONDITION                           | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|------------------------|------------------------------------------|--------|------|------|------|------|
| Current transfer ratio | $I_F = 5\text{ mA}, V_{CC} = 5\text{ V}$ | CTR    | 50   |      | 300  | %    |

| <b>SWITCHING CHARACTERISTICS</b> ( $T_{amb} = 25^{\circ}\text{C}$ , unless otherwise specified) |                                                                           |           |      |      |      |               |
|-------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-----------|------|------|------|---------------|
| PARAMETER                                                                                       | TEST CONDITION                                                            | SYMBOL    | MIN. | TYP. | MAX. | UNIT          |
| <b>NON-SATURATED</b>                                                                            |                                                                           |           |      |      |      |               |
| Rise time                                                                                       | $I_C = 2\text{ mA}$ , $V_{CC} = 10\text{ V}$ , $R_L = 100\ \Omega$        | $t_r$     |      | 4    |      | $\mu\text{s}$ |
| Fall time                                                                                       | $I_C = 2\text{ mA}$ , $V_{CC} = 10\text{ V}$ , $R_L = 100\ \Omega$        | $t_f$     |      | 3    |      | $\mu\text{s}$ |
| Turn-on time                                                                                    | $I_C = 2\text{ mA}$ , $V_{CC} = 10\text{ V}$ , $R_L = 100\ \Omega$        | $t_{on}$  |      | 5    |      | $\mu\text{s}$ |
| Turn-off time                                                                                   | $I_C = 2\text{ mA}$ , $V_{CC} = 10\text{ V}$ , $R_L = 100\ \Omega$        | $t_{off}$ |      | 4    |      | $\mu\text{s}$ |
| <b>SATURATED</b>                                                                                |                                                                           |           |      |      |      |               |
| Rise time                                                                                       | $I_F = 16\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 1.9\text{ k}\Omega$ | $t_r$     |      | 15   |      | $\mu\text{s}$ |
| Fall time                                                                                       | $I_F = 16\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 1.9\text{ k}\Omega$ | $t_f$     |      | 0.5  |      | $\mu\text{s}$ |
| Turn-on time                                                                                    | $I_F = 16\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 1.9\text{ k}\Omega$ | $t_{on}$  |      | 1    |      | $\mu\text{s}$ |
| Turn-off time                                                                                   | $I_F = 16\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $R_L = 1.9\text{ k}\Omega$ | $t_{off}$ |      | 30   |      | $\mu\text{s}$ |



isth6916\_01

Fig. 1 - Switching Operation (without Saturation)



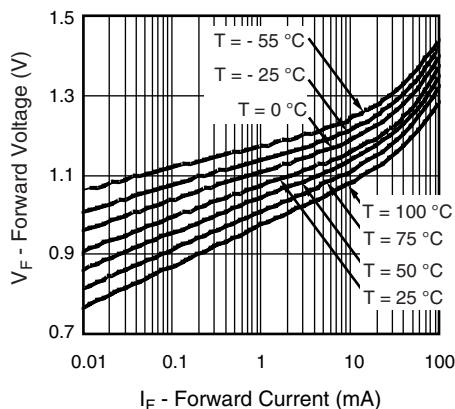
isth6916\_02

Fig. 2 - Switching Operation (with Saturation)

| <b>SAFETY AND INSULATION RATINGS</b>                 |                |            |      |           |      |                    |
|------------------------------------------------------|----------------|------------|------|-----------|------|--------------------|
| PARAMETER                                            | TEST CONDITION | SYMBOL     | MIN. | TYP.      | MAX. | UNIT               |
| Climatic classification (according to IEC 68 part 1) |                |            |      | 55/100/21 |      |                    |
| Comparative tracking index                           |                | CTI        | 175  |           | 399  |                    |
| Peak transient overvoltage                           |                | $V_{IOTM}$ | 6000 |           |      | V                  |
| Peak insulation voltage                              |                | $V_{IORM}$ | 707  |           |      | V                  |
| Safety rating - power output                         |                | $P_{SO}$   |      |           | 350  | mW                 |
| Safety rating - input current                        |                | $I_{SI}$   |      |           | 150  | mA                 |
| Safety rating - temperature                          |                | $T_{SI}$   |      |           | 175  | $^{\circ}\text{C}$ |
| Creepage distance                                    |                |            | 5    |           |      | mm                 |
| Clearance distance                                   |                |            | 5    |           |      | mm                 |

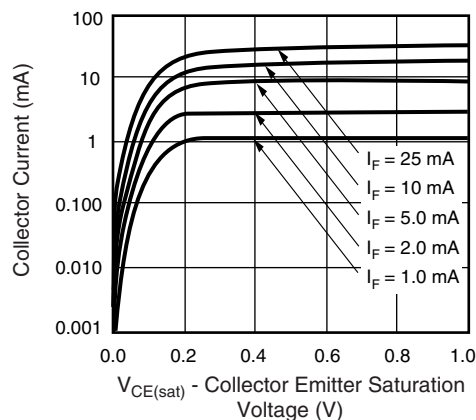
**Note**

- As per IEC 60747-5-2, § 7.4.3.8.1, this optocoupler is suitable for “safe electrical insulation” only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits.

**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)


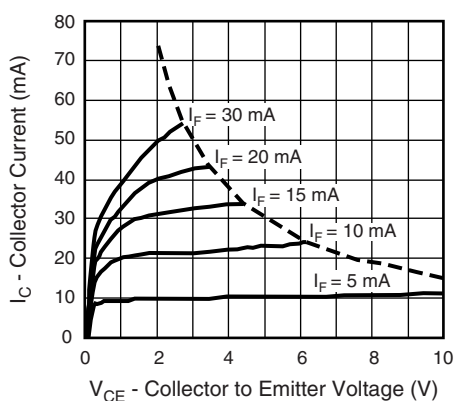
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Fig. 3 - Diode Forward Voltage vs. Forward Current



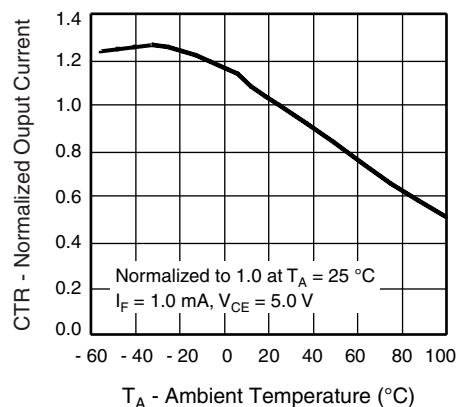
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Fig. 6 - Collector Current vs. Collector Emitter Saturation Voltage



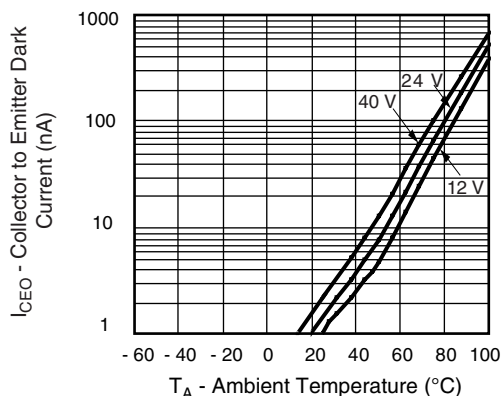
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Fig. 4 - Collector Current vs. Collector Emitter Voltage



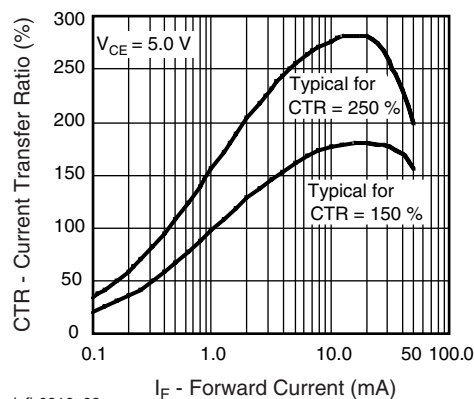
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Fig. 7 - Normalized Output Current vs. Ambient Temperature



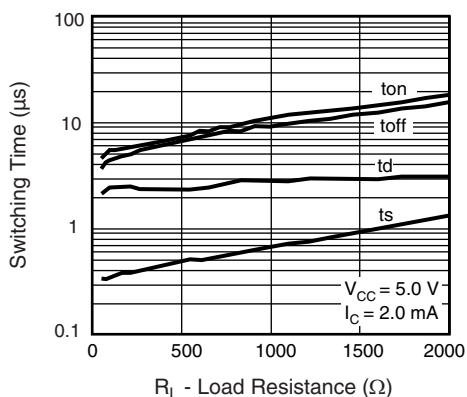
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Fig. 5 - Collector to Emitter Dark Current vs. Ambient Temperature



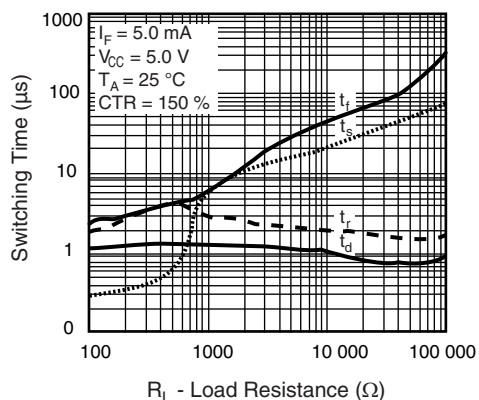
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Fig. 8 - Current Transfer Ratio vs. Forward Current



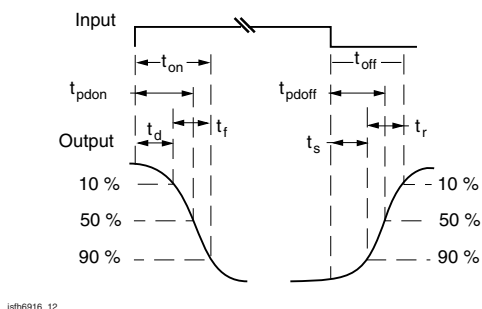
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Fig. 9 - Switching Time vs. Load Resistance



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Fig. 10 - Switching Time vs. Load Resistance

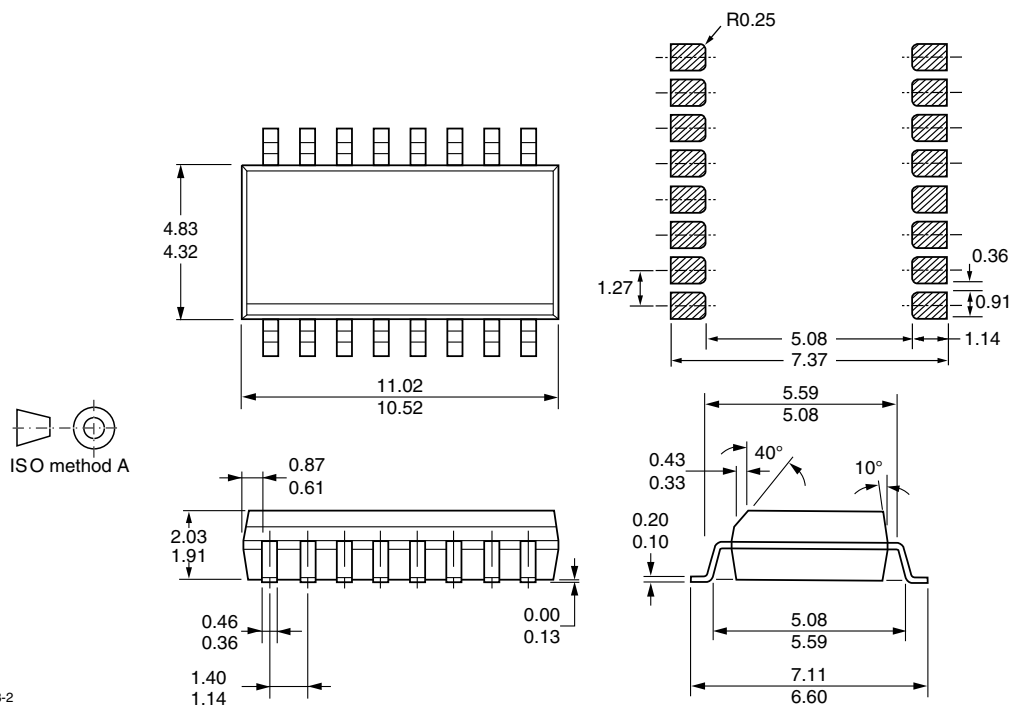


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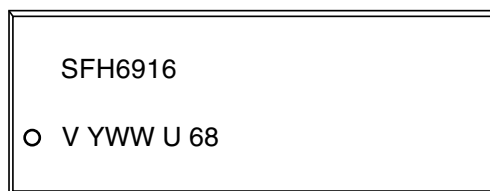
Fig. 11 - Switching Time Measurement



**PACKAGE DIMENSIONS** in millimeters



**PACKAGE MARKING**





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