

## Optocoupler, Phototransistor Output, SOT223/10, Quad Channel

### Features

- Transistor Optocoupler in SOT223/10 Package
- End Stackable, 1.27 mm Spacing
- Low Current Input
- Very High CTR, 150 % Typical at  $I_F = 1 \text{ mA}$ ,  $V_{CE} = 5 \text{ V}$
- Good CTR Linearity Versus Forward Current
- Minor CTR Degradation
- High Collector-Emitter Voltage,  $V_{CEO} = 70 \text{ V}$
- Low Coupling Capacitance
- High Common Mode Transient Immunity
- Isolation Test Voltage: 1768  $V_{RMS}$

### Agency Approvals

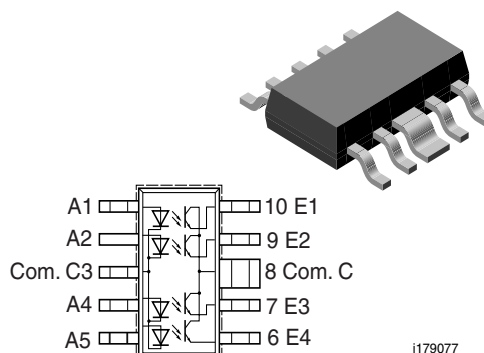
- UL File #E76222 System Code V
- CSA 93751

### Applications

Telecommunication  
SMT  
PCMCIA  
Instrumentation

### Description

The SFH6943 is a four channel mini-optocoupler suitable for high density packaged PCB application. It has a minimum of 1768  $V_{RMS}$  isolation from input to



output. The device consists of four phototransistors as detectors. Each channel is individually controlled. The optocoupler is housed in a SOT223/10 package. All the cathodes of the input LEDs and all the collectors of the output transistors are common enabling a pin count reduction from 16 pins to 10 pins-a significant space savings as compared to four channels that are electrically isolated individually.

### Order Information

| Part      | Remarks                 |
|-----------|-------------------------|
| SFH6943-2 | CTR 63 - 200 %, SMD-10  |
| SFH6943-3 | CTR 100 - 320 %, SMD-10 |
| SFH6943-4 | CTR 160 - 500 %, SMD-10 |

For additional information on the available options refer to Option Information.

### Absolute Maximum Ratings

$T_{amb} = 25^\circ\text{C}$ , unless otherwise specified

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 Rating for extended periods of the time can adversely affect reliability.

### Input

| Parameter               | Test condition            | Symbol     | Value | Unit |
|-------------------------|---------------------------|------------|-------|------|
| Reverse voltage         |                           | $V_R$      | 3     | V    |
| DC forward current      |                           | $I_F$      | 5     | mA   |
| Surge forward current   | $t_p \leq 10 \mu\text{s}$ | $I_{FSM}$  | 100   | mA   |
| Total power dissipation |                           | $P_{diss}$ | 10    | mW   |

## Output

| Parameter                 | Test condition       | Symbol     | Value | Unit |
|---------------------------|----------------------|------------|-------|------|
| Collector-emitter voltage |                      | $V_{CE}$   | 70    | V    |
| Emitter-collector voltage |                      | $V_{EC}$   | 7     | V    |
| Collector current         |                      | $I_C$      | 10    | mA   |
| Surge collector current   | $t_P < 1 \text{ ms}$ | $I_{FSM}$  | 20    | mA   |
| Total power dissipation   |                      | $P_{diss}$ | 20    | mW   |

## Coupler

| Parameter                                                                                          | Test condition                                        | Symbol    | Value          | Unit             |
|----------------------------------------------------------------------------------------------------|-------------------------------------------------------|-----------|----------------|------------------|
| Isolation test voltage (between emitter and detector, refer to climate DIN 40046, part 2, Nov. 74) | $t = 1 \text{ sec.}$                                  | $V_{ISO}$ | 1768           | $V_{RMS}$        |
| Creepage                                                                                           |                                                       |           | $\geq 4$       | mm               |
| Clearance                                                                                          |                                                       |           | $\geq 4$       | mm               |
| Comparative tracking index per DIN IEC 112/VDE0303, part 1                                         |                                                       |           | 175            |                  |
| Isolation resistance                                                                               | $V_{IO} = 100 \text{ V}, T_{amb} = 25^\circ\text{C}$  | $R_{IO}$  | $\geq 10^{11}$ | $\Omega$         |
|                                                                                                    | $V_{IO} = 100 \text{ V}, T_{amb} = 100^\circ\text{C}$ | $R_{IO}$  | $\geq 10^{12}$ | $\Omega$         |
| Storage temperature range                                                                          |                                                       | $T_{stg}$ | - 55 to + 150  | $^\circ\text{C}$ |
| Ambient temperature range                                                                          |                                                       | $T_{amb}$ | - 55 to + 100  | $^\circ\text{C}$ |
| Junction temperature                                                                               |                                                       | $T_J$     | 100            | $^\circ\text{C}$ |
| Soldering temperature, Dip soldering plus reflow soldering processes                               | $t = 10 \text{ sec. max}$                             | $T_{sld}$ | 260            | $^\circ\text{C}$ |

## Electrical Characteristics

$T_{amb} = 25^\circ\text{C}$ , unless otherwise specified

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.

## Input

| Parameter          | Test condition                         | Symbol     | Min | Typ. | Max | Unit          |
|--------------------|----------------------------------------|------------|-----|------|-----|---------------|
| Forward voltage    | $I_F = 5 \text{ mA}$                   | $V_F$      |     | 1.25 |     | V             |
| Reverse current    | $V_R = 3 \text{ V}$                    | $I_R$      |     | 0.01 | 10  | $\mu\text{A}$ |
| Capacitance        | $V_R = 0 \text{ V}, f = 1 \text{ MHz}$ | $C_O$      |     | 5    |     | pF            |
| Thermal resistance |                                        | $R_{thja}$ |     | 1000 |     | K/W           |

## Output

| Parameter                         | Test condition                            | Symbol     | Min | Typ. | Max | Unit |
|-----------------------------------|-------------------------------------------|------------|-----|------|-----|------|
| Collector-emitter voltage         | $I_{CE} = 10 \mu\text{A}$                 | $V_{CEO}$  | 70  |      |     | V    |
| Emitter-collector voltage         | $I_{EC} = 10 \mu\text{A}$                 | $V_{ECO}$  | 7   |      |     | V    |
| Collector-emitter capacitance     | $V_{CE} = 5 \text{ V}, f = 1 \text{ MHz}$ | $C_{CE}$   |     | 6    |     | pF   |
| Thermal resistance                |                                           | $R_{thja}$ |     | 500  |     | K/W  |
| Collector-emitter leakage current | $V_{CE} = 10 \text{ V}$                   | $I_{CEO}$  |     | 50   |     | nA   |

## Coupler

| Parameter            | Test condition | Symbol | Min | Typ. | Max | Unit |
|----------------------|----------------|--------|-----|------|-----|------|
| Coupling capacitance |                | $C_C$  |     | 1    |     | pF   |

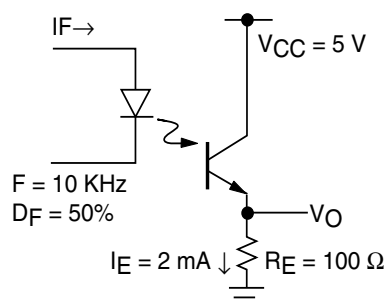
## Current Transfer Ratio

| Parameter               | Test condition                                  | Part      | Symbol    | Min | Typ. | Max | Unit |
|-------------------------|-------------------------------------------------|-----------|-----------|-----|------|-----|------|
| Coupling Transfer Ratio | $I_F = 1 \text{ mA}$ , $V_{CE} = 1.5 \text{ V}$ | SFH6943-2 | $I_E/I_F$ | 63  |      | 200 | %    |
|                         |                                                 | SFH6943-3 | $I_E/I_F$ | 100 |      | 320 | %    |
|                         |                                                 | SFH6943-4 | $I_E/I_F$ | 160 |      | 500 | %    |
|                         | $I_F = 0.5 \text{ mA}$ , $V_{CC} = 5 \text{ V}$ | SFH6943-2 | $I_E/I_F$ | 32  | 100  |     | %    |
|                         |                                                 | SFH6943-3 | $I_E/I_F$ | 50  | 160  |     | %    |
|                         |                                                 | SFH6943-4 | $I_E/I_F$ | 80  | 250  |     | %    |

## Switching Characteristics

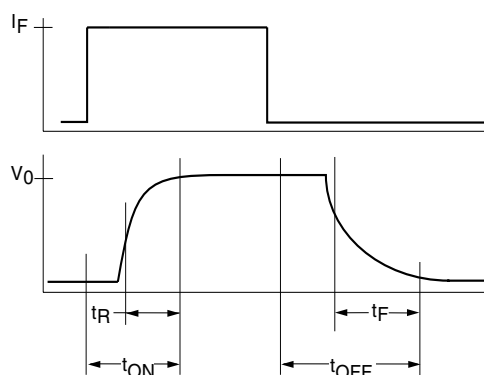
| Parameter     | Test condition                                                     | Symbol    | Min | Typ. | Max | Unit          |
|---------------|--------------------------------------------------------------------|-----------|-----|------|-----|---------------|
| Turn-on time  | $I_E = 2 \text{ mA}$ , $R_E = 100 \Omega$ , $V_{CC} = 5 \text{ V}$ | $t_{on}$  |     | 3    |     | $\mu\text{s}$ |
| Rise time     | $I_E = 2 \text{ mA}$ , $R_E = 100 \Omega$ , $V_{CC} = 5 \text{ V}$ | $t_r$     |     | 2.6  |     | $\mu\text{s}$ |
| Turn-off time | $I_E = 2 \text{ mA}$ , $R_E = 100 \Omega$ , $V_{CC} = 5 \text{ V}$ | $t_{off}$ |     | 3.1  |     | $\mu\text{s}$ |
| Fall time     | $I_E = 2 \text{ mA}$ , $R_E = 100 \Omega$ , $V_{CC} = 5 \text{ V}$ | $t_f$     |     | 2.8  |     | $\mu\text{s}$ |

## Typical Characteristics ( $T_{amb} = 25^\circ\text{C}$ unless otherwise specified)



isth6943\_01

Fig. 1 Switching times (typ.)



isth6943\_02

Fig. 2 Switching Waveform

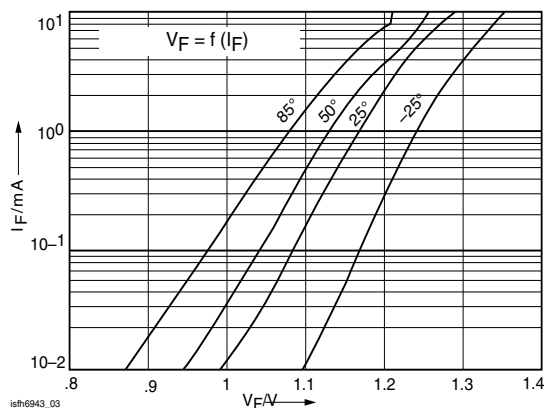


Fig. 3 LED Current vs. LED Voltage

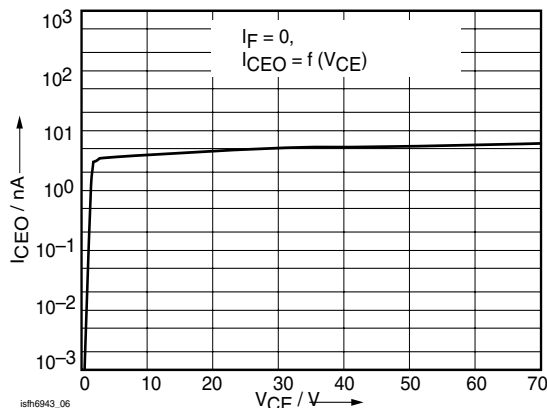


Fig. 6 Collector-Emitter Leakage Current (typ.)

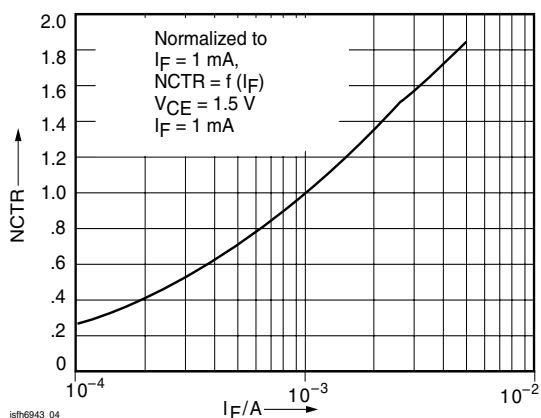


Fig. 4 Non-Saturated Current Transfer

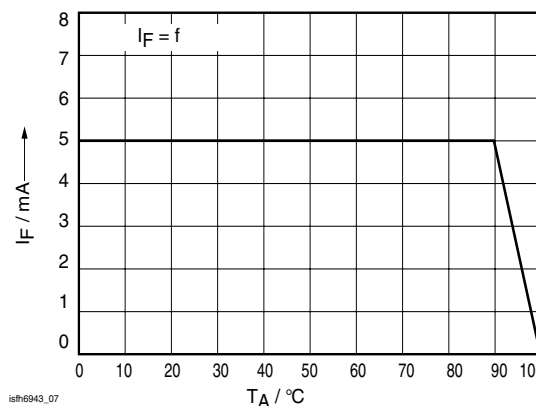


Fig. 7 Permissible Forward Current Diode

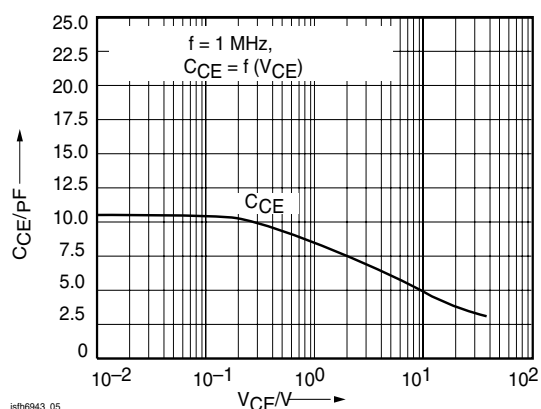


Fig. 5 Transistor Capacitances (typ.)

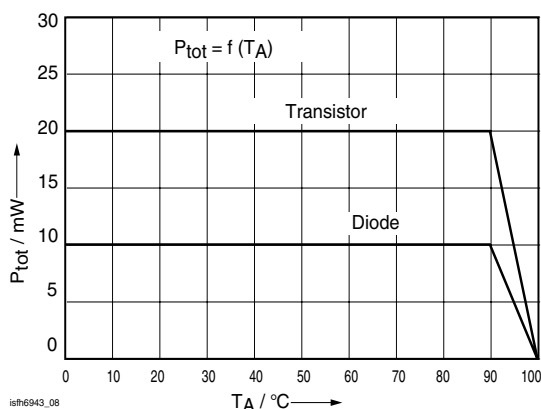


Fig. 8 Permissible Power Dissipation

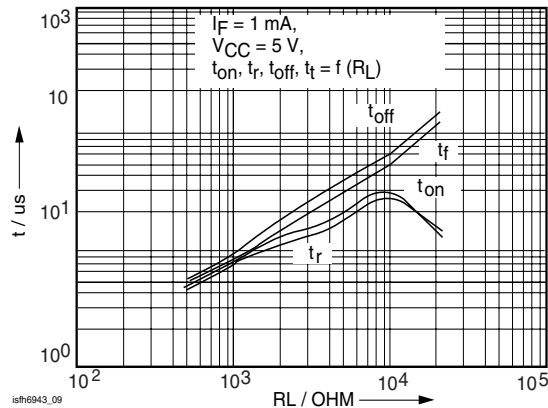


Fig. 9

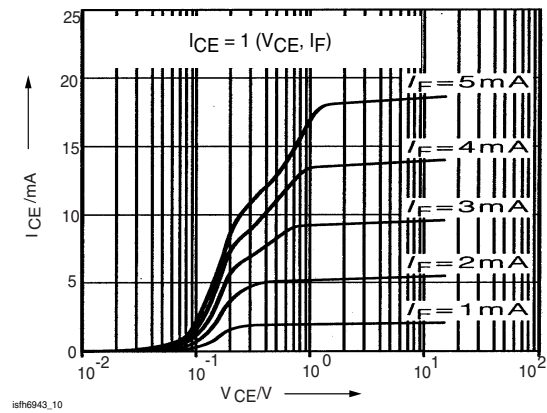
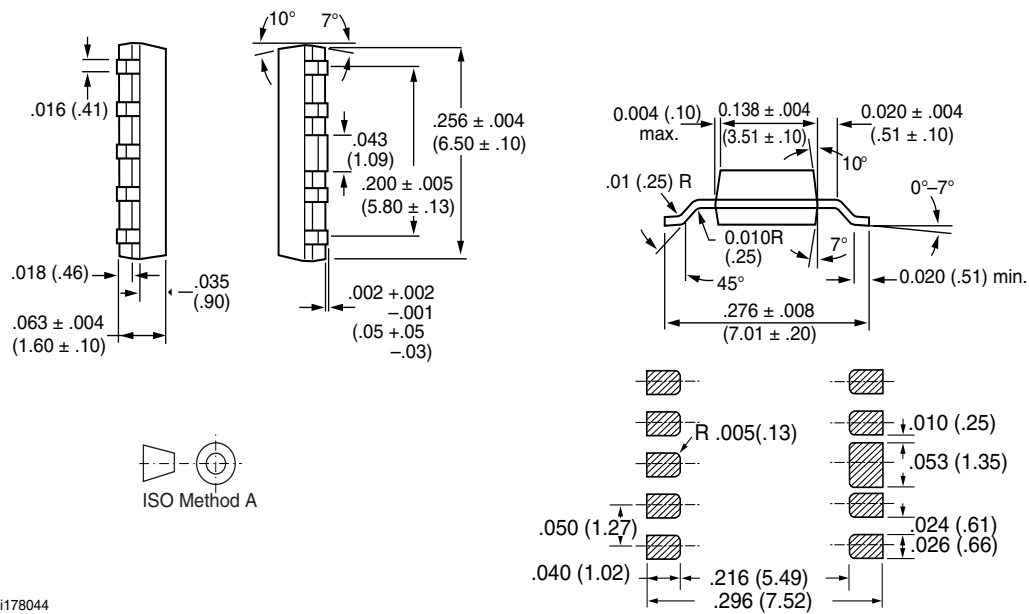


Fig. 10 Transistor Output Characteristics

## Package Dimensions in Inches (mm)



## Ozone Depleting Substances Policy Statement

It is the policy of **Vishay Semiconductor GmbH** to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

**Vishay Semiconductor GmbH** has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

**Vishay Semiconductor GmbH** can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

**We reserve the right to make changes to improve technical design  
and may do so without further notice.**

Parameters can vary in different applications. All operating parameters must be validated for each customer application by the customer. Should the buyer use Vishay Semiconductors products for any unintended or unauthorized application, the buyer shall indemnify Vishay Semiconductors against all claims, costs, damages, and expenses, arising out of, directly or indirectly, any claim of personal damage, injury or death associated with such unintended or unauthorized use.

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