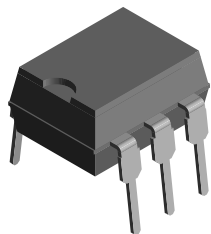
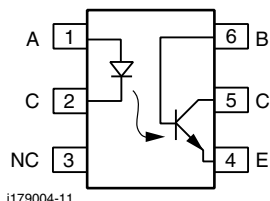




Optocoupler, Phototransistor Output, with Base Connection



i179004-3



i179004-11


RoHS
COMPLIANT

FEATURES

- Isolation test voltage (1.0 s), 5300 V_{RMS}
- V_{CEsat} 0.25 (≤ 0.4) V, I_F = 10 mA, I_C = 2.5 mA
- Built to conform to VDE requirements
- Highest quality premium device
- Long term stability
- Storage temperature, - 55 ° to + 150 °C
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

DESCRIPTION

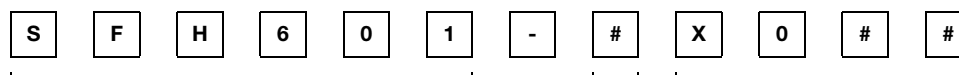
The SFH601 is an optocoupler with a gallium arsenide LED emitter which is optically coupled with a silicon planar phototransistor detector. The component is packaged in a plastic plug-in case 20 AB DIN 41866.

The coupler transmits signals between two electrically isolated circuits.

AGENCY APPROVALS

- UL1577, file no. E52744 system code H or J, double protection
- DIN EN 60747-5-5 (VDE 0884-5) available with option 1
- CSA 93751
- BSI IEC 60950; IEC 60065

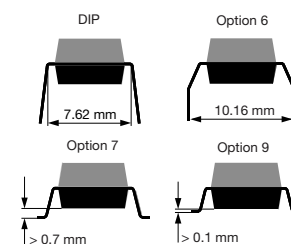
ORDERING INFORMATION



PART NUMBER

CTR
BIN

PACKAGE OPTION



| AGENCY CERTIFIED/PACKAGE | CTR (%) | | | |
|--------------------------|---------------|-----------------|-----------------|-----------------|
| | 40 to 80 | 63 to 125 | 100 to 200 | 160 to 320 |
| UL, BSI, CSA | | | | |
| DIP-6 | SFH601-1 | SFH601-2 | SFH601-3 | SFH601-4 |
| DIP-6, 400 mil, option 6 | SFH601-1X006 | SFH601-2X006 | SFH601-3X006 | SFH601-4X006 |
| SMD-6, option 7 | SFH601-1X007 | SFH601-2X007T | SFH601-3X007(T) | SFH601-4X007(T) |
| SMD-6, option 9 | SFH601-1X009T | SFH601-2X009 | SFH601-3X009 | SFH601-4X009(T) |
| VDE, cUL, UL, BSI | | | | |
| DIP-6, option 1 | SFH601-1X001 | SFH601-2X001 | - | SFH601-4X001 |
| DIP-6, 400 mil, option 6 | SFH601-1X016 | - | SFH601-3X016 | SFH601-4X016 |
| SMD-6, option 7 | SFH601-1X017 | SFH601-2X017(T) | SFH601-3X017(T) | - |
| SMD-6, option 9 | - | - | SFH601-3X019(T) | - |

Note

- For additional information on the available options refer to option information.

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
|-------------------------|----------------|-------------------|-------|------|
| INPUT | | | | |
| Reverse voltage | | V _R | 6 | V |
| DC forward current | | I _F | 60 | mA |
| Surge forward current | t = 10 μs | I _{FSM} | 2.5 | A |
| Total power dissipation | | P _{diss} | 100 | mW |



| ABSOLUTE MAXIMUM RATINGS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified) | | | | |
|--|---|------------|----------------|--------------------|
| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
| OUTPUT | | | | |
| Collector emitter voltage | | V_{CEO} | 100 | V |
| Emitter base voltage | | V_{EBO} | 7 | V |
| Collector current | | I_C | 50 | mA |
| | $t = 1.0\text{ ms}$ | I_C | 100 | mA |
| Power dissipation | | P_{diss} | 150 | mW |
| COUPLER | | | | |
| Isolation test voltage between emitter and detector | $t = 1.0\text{ s}$ | V_{ISO} | 5300 | V_{RMS} |
| Isolation resistance | $V_{IO} = 500\text{ V}$, $T_{amb} = 25\text{ }^{\circ}\text{C}$ | R_{IO} | $\geq 10^{12}$ | Ω |
| | $V_{IO} = 500\text{ V}$, $T_{amb} = 100\text{ }^{\circ}\text{C}$ | R_{IO} | $\geq 10^{11}$ | Ω |
| 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 ⁽¹⁾ | max. 10 s, dip soldering: distance to seating plane $\geq 1.5\text{ mm}$ | T_{sld} | 260 | $^{\circ}\text{C}$ |

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.

⁽¹⁾ Refer to reflow profile for soldering conditions for surface mounted devices (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP).

| ELECTRICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified) | | | | | | | |
|--|--|----------|-------------|------|------|------|---------------|
| PARAMETER | TEST CONDITION | PART | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| INPUT | | | | | | | |
| Forward voltage | $I_F = 60\text{ mA}$ | | V_F | | 1.25 | 1.65 | V |
| Breakdown voltage | $I_R = 10\text{ }\mu\text{A}$ | | V_{BR} | 6 | | | V |
| Reverse current | $V_R = 6\text{ V}$ | | I_R | | 0.01 | 10 | μA |
| Capacitance | $V_F = 0\text{ V}$, $f = 1\text{ MHz}$ | | C_O | | 25 | | pF |
| Thermal resistance | | | R_{thja} | | 750 | | K/W |
| OUTPUT | | | | | | | |
| Collector emitter capacitance | $f = 1\text{ MHz}$, $V_{CE} = 5\text{ V}$ | | C_{CE} | | 6.8 | | pF |
| Collector base capacitance | $f = 1\text{ MHz}$, $V_{CB} = 5\text{ V}$ | | C_{CB} | | 8.5 | | pF |
| Emitter base capacitance | $f = 1\text{ MHz}$, $V_{EB} = 5\text{ V}$ | | C_{EB} | | 11 | | pF |
| Thermal resistance | | | R_{thja} | | 500 | | K/W |
| Collector emitter leakage current | $V_{CE} = 10\text{ V}$ | SFH601-1 | I_{CEO} | | 2 | 50 | nA |
| | | SFH601-2 | I_{CEO} | | 2 | 50 | nA |
| | | SFH601-3 | I_{CEO} | | 5 | 100 | nA |
| | | SFH601-4 | I_{CEO} | | 5 | 100 | nA |
| COUPLER | | | | | | | |
| Saturation voltage collector emitter | $I_F = 10\text{ mA}$, $I_C = 2.5\text{ mA}$ | | V_{CEsat} | | 0.25 | 0.4 | V |
| Capacitance (input to output) | $V_{I-O} = 0$, $f = 1\text{ MHz}$ | | C_{IO} | | 0.6 | | 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.

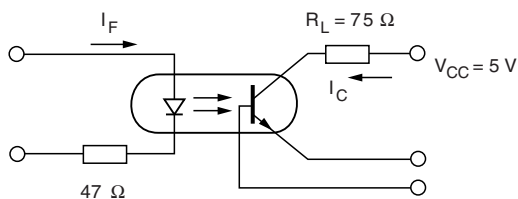


| CURRENT TRANSFER RATIO | | | | | | | |
|--------------------------------------|----------------------|----------|--------|------|------|------|------|
| PARAMETER | TEST CONDITION | PART | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| I_C/I_F at $V_{CE} = 5.0\text{ V}$ | $I_F = 10\text{ mA}$ | SFH601-1 | CTR | 40 | | 80 | % |
| | | SFH601-2 | CTR | 63 | | 125 | % |
| | | SFH601-3 | CTR | 100 | | 200 | % |
| | | SFH601-4 | CTR | 160 | | 320 | % |
| | $I_F = 1\text{ mA}$ | SFH601-1 | CTR | 13 | 30 | | % |
| | | SFH601-2 | CTR | 22 | 45 | | % |
| | | SFH601-3 | CTR | 34 | 70 | | % |
| | | SFH601-4 | CTR | 56 | 90 | | % |

Note

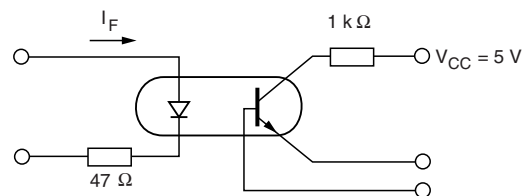
- Current transfer ratio and collector emitter leakage current by dash number.

| SWITCHING CHARACTERISTICS | | | | | | | |
|---------------------------|---|----------|-----------|------|------|------|---------------|
| PARAMETER | TEST CONDITION | PART | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| NON-SATURATED | | | | | | | |
| Current | $V_{CC} = 5\text{ V}, R_L = 75\ \Omega$ | | I_F | | 10 | | mA |
| Rise time | $V_{CC} = 5\text{ V}, R_L = 75\ \Omega$ | | t_r | | 2 | | μs |
| Fall time | $V_{CC} = 5\text{ V}, R_L = 75\ \Omega$ | | t_f | | 2 | | μs |
| Turn-on time | $V_{CC} = 5\text{ V}, R_L = 75\ \Omega$ | | t_{on} | | 3 | | μs |
| Turn-off time | $V_{CC} = 5\text{ V}, R_L = 75\ \Omega$ | | t_{off} | | 2.3 | | μs |
| SATURATED | | | | | | | |
| Current | | SFH601-1 | I_F | | 20 | | mA |
| | | SFH601-2 | I_F | | 10 | | mA |
| | | SFH601-3 | I_F | | 10 | | mA |
| | | SFH601-4 | I_F | | 0.5 | | mA |
| Rise time | | SFH601-1 | t_r | | 2 | | μs |
| | | SFH601-2 | t_r | | 3 | | μs |
| | | SFH601-3 | t_r | | 3 | | μs |
| | | SFH601-4 | t_r | | 4.6 | | μs |
| Fall time | | SFH601-1 | t_f | | 11 | | μs |
| | | SFH601-2 | t_f | | 14 | | μs |
| | | SFH601-3 | t_f | | 14 | | μs |
| | | SFH601-4 | t_f | | 15 | | μs |
| Turn-on time | | SFH601-1 | t_{on} | | 3 | | μs |
| | | SFH601-2 | t_{on} | | 4.2 | | μs |
| | | SFH601-3 | t_{on} | | 4.2 | | μs |
| | | SFH601-4 | t_{on} | | 6 | | μs |
| Turn-off time | | SFH601-1 | t_{off} | | 18 | | μs |
| | | SFH601-2 | t_{off} | | 23 | | μs |
| | | SFH601-3 | t_{off} | | 23 | | μs |
| | | SFH601-4 | t_{off} | | 25 | | μs |



isth601_01

Fig. 1 - Linear Operation (without Saturation)



isth601_02

Fig. 2 - Switching Operation (with Saturation)



| SAFETY AND INSULATION RATINGS | | | | | | |
|--|----------------------------|--------|------|-----------|------|------|
| 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 | |
| V_{IOTM} | | | 8000 | | | V |
| V_{IORM} | | | 890 | | | V |
| P_{SO} | | | | | 700 | mW |
| I_{SI} | | | | | 400 | mA |
| T_{SI} | | | | | 175 | °C |
| Creepage distance | standard DIP-6 | | 7 | | | mm |
| Clearance distance | standard DIP-6 | | 7 | | | mm |
| Creepage distance | 400 mil DIP-6 | | 8 | | | mm |
| Clearance distance | 400 mil DIP-6 | | 8 | | | mm |
| Insulation thickness, reinforced rated | per IEC 60950 2.10.5.1 | | 0.4 | | | 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 ($T_{amb} = 25\text{ °C}$, unless otherwise specified)

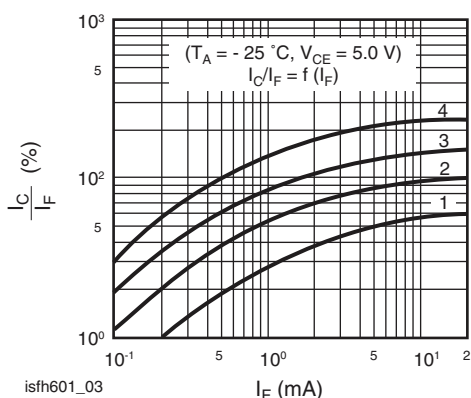


Fig. 3 - Current Transfer Ratio vs. Diode Current

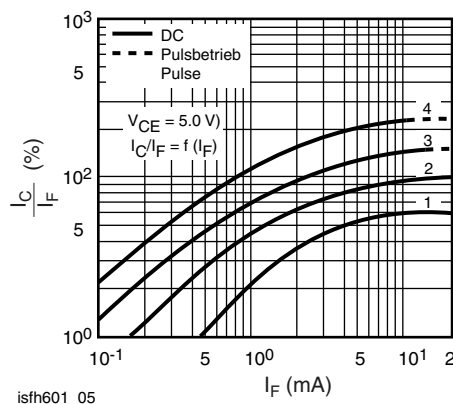


Fig. 5 - Current Transfer Ratio vs. Diode Current

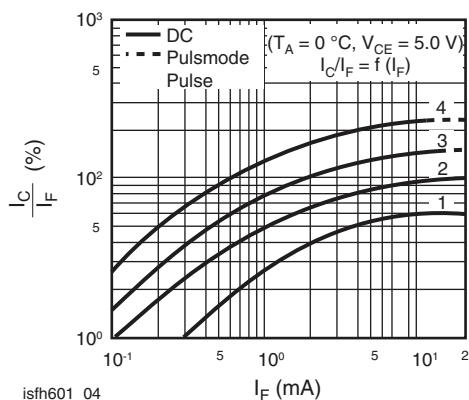


Fig. 4 - Current Transfer Ratio vs. Diode Current

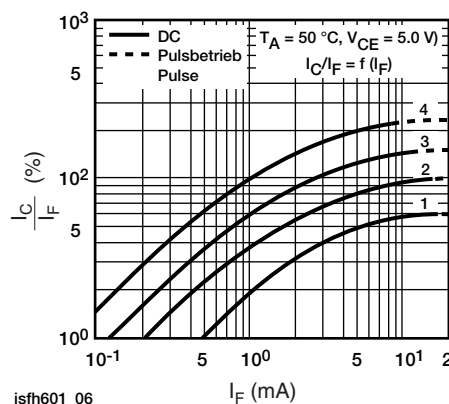


Fig. 6 - Current Transfer Ratio vs. Diode Current

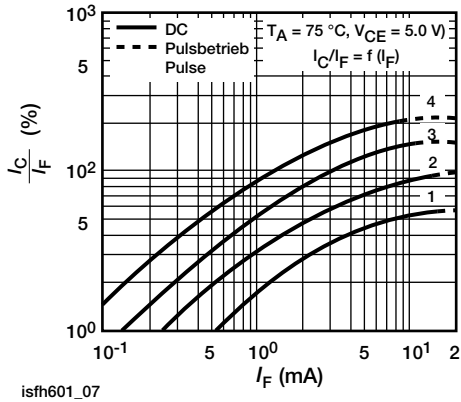


Fig. 7 - Current Transfer Ratio vs. Diode Current

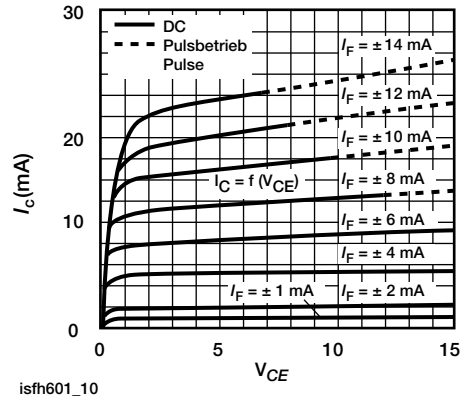


Fig. 10 - Output Characteristics

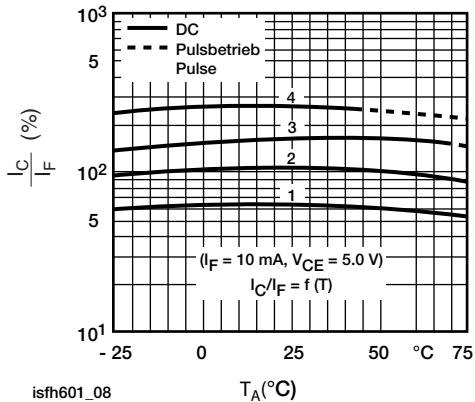


Fig. 8 - Current Transfer Ratio vs. Diode Current

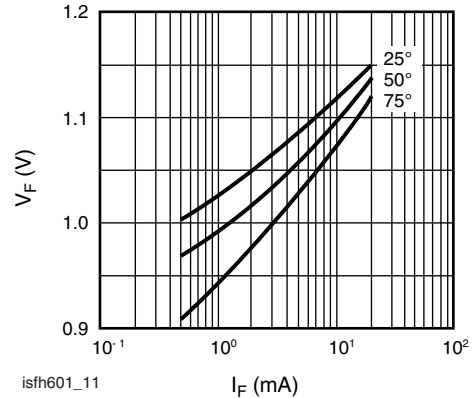


Fig. 11 - Forward Voltage

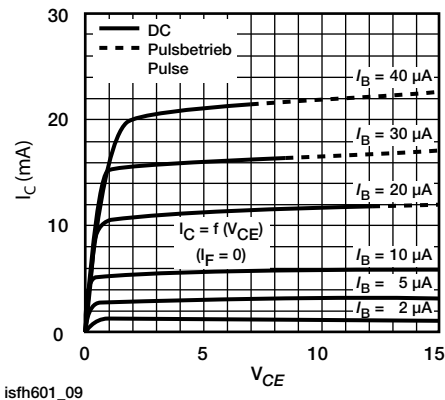


Fig. 9 - Transistor Characteristics

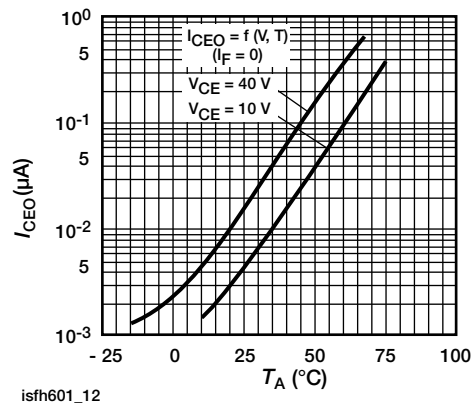


Fig. 12 - Collector Emitter Off-state Current

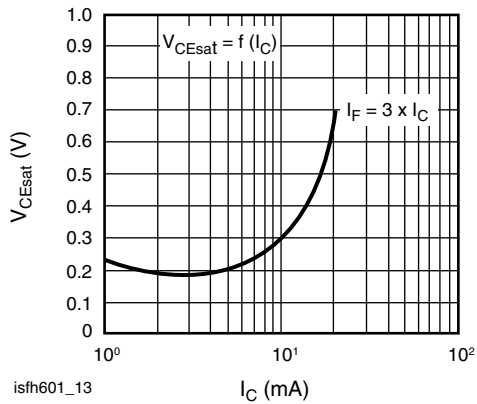


Fig. 13 - Saturation Voltage vs. Collector Current and Modulation Depth SFH601-1

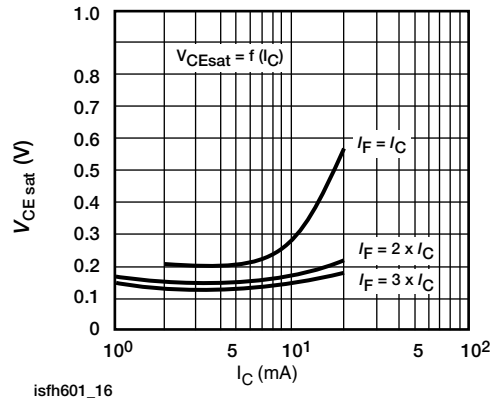


Fig. 16 - Saturation Voltage vs. Collector Current and Modulation Depth SFH601-4

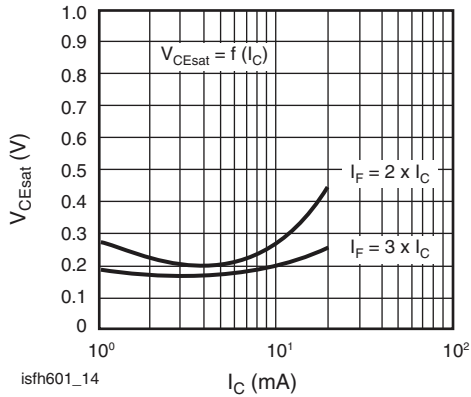


Fig. 14 - Saturation Voltage vs. Collector Current and Modulation Depth SFH601-2

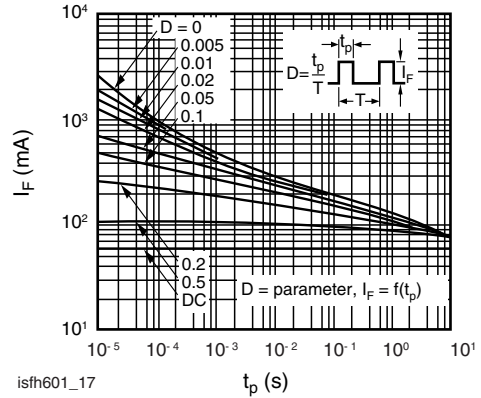


Fig. 17 - Permissible Pulse Load

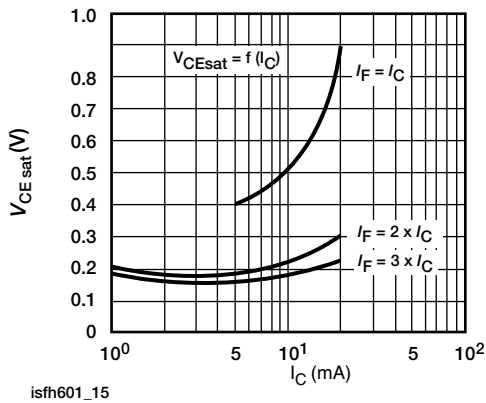


Fig. 15 - Saturation Voltage vs. Collector Current and Modulation Depth SFH601-3

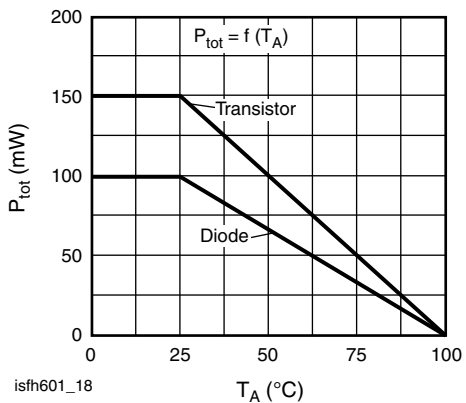
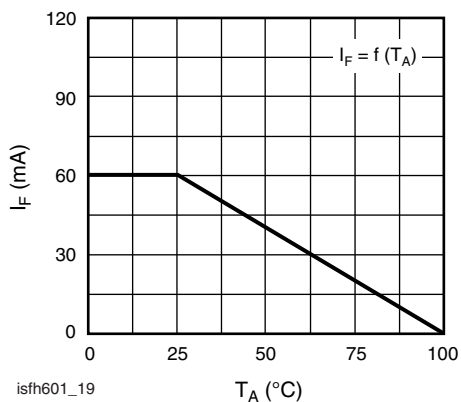
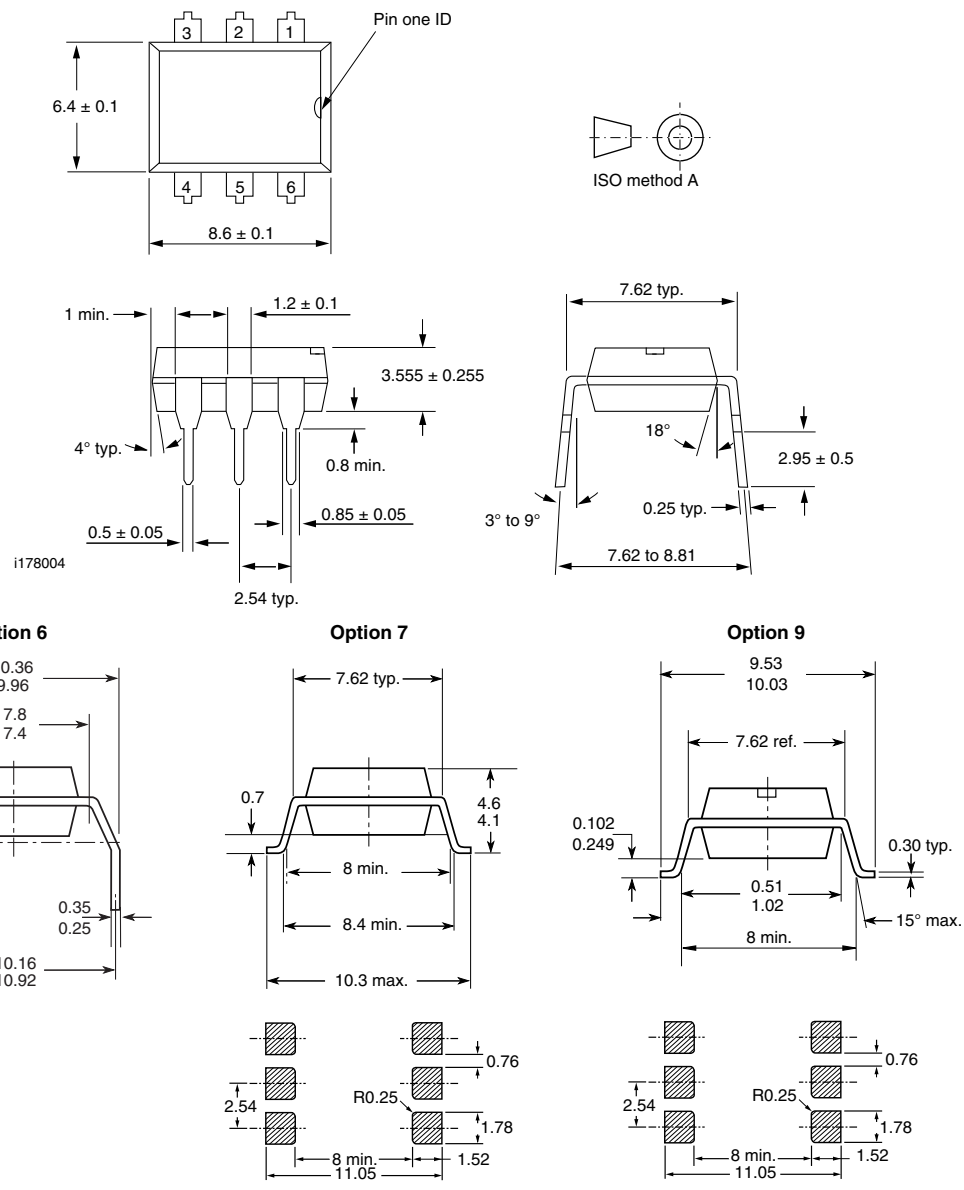


Fig. 18 - Permissible Power Dissipation for Transistor and Diode



isfh601_19
Fig. 19 - Permissible Forward Current Diode

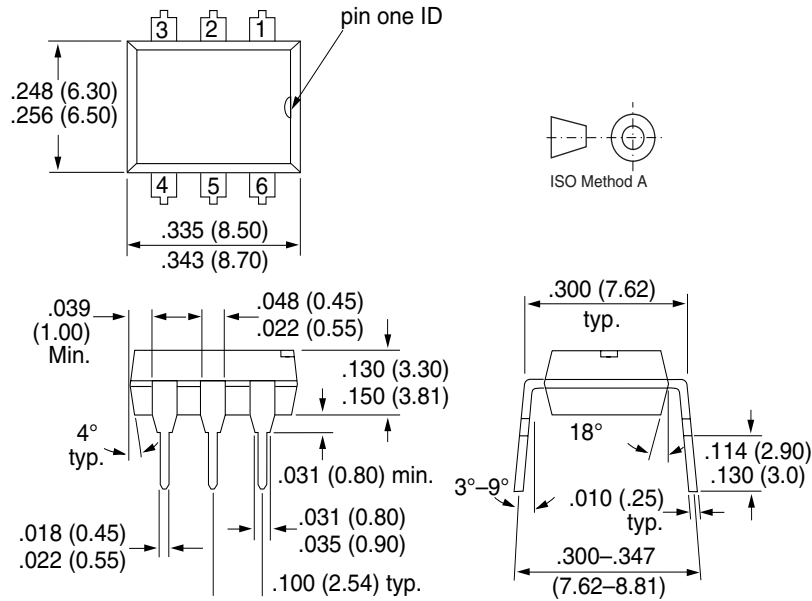
PACKAGE DIMENSIONS in inches (millimeters)





DIP-6A

Package Dimensions in Inches (mm)



i178004

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.

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and may do so without further notice.**

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Telephone: 49 (0)7131 67 2831, Fax number: 49 (0)7131 67 2423



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