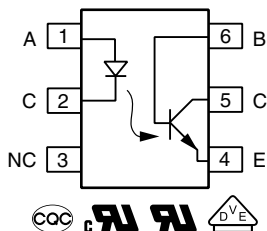


Optocoupler, Phototransistor Output, With Base Connection, 300 V BV_{CEO}



23109



FEATURES

- Phototransistor optocoupler in a 6 pin DIP package with base connection
- Very high collector emitter breakdown voltage, $BV_{CEO} = 300\text{ V}$
- Isolation rated voltage: 5000 V_{RMS}
- Low coupling capacitance
- High common mode transient immunity
- Material categorization:
for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE
GREEN
(5-2008)

LINKS TO ADDITIONAL RESOURCES



3D Models



Design Tools



Related Documents



SPICE Models



Footprints



Schematics

DESCRIPTION

The SFH640 has a GaAs infrared emitting diode emitter, which is optically coupled to a silicon planar phototransistor detector, and is incorporated in a plastic DIP-6 package.

It features a high current transfer ratio, low coupling capacitance, and high isolation voltage.

The coupling device is designed for signal transmission between two electrically separated circuits.

APPLICATIONS

- Telecom
- Industrial controls
- Battery powered equipment
- Office machines
- Programmable controllers

AGENCY APPROVALS

- [UL](#)
- [cUL](#)
- [DIN EN 60747-5-5 \(VDE 0884-5\)](#) available with option 1
- [CQC GB4943.1-2011](#)
- [CQC GB8898-2011](#)

ORDERING INFORMATION

| | | | | | | | | | | | | | | | | | |
|----------------------------|--|--------------|--|--|--|--|--|------------------------------|--|--|--|--|---------|----------------|--|--|---------------|
| PART NUMBER | | | | | | | | | | | | | CTR BIN | PACKAGE OPTION | | | TAPE AND REEL |
| AGENCY CERTIFIED / PACKAGE | | CTR (%) | | | | | | | | | | | | | | | |
| | | 10 mA | | | | | | | | | | | | | | | |
| UL, cUL | | 63 to 125 | | | | | | 100 to 200 | | | | | | | | | |
| DIP-6 | | SFH640-2 | | | | | | SFH640-3 | | | | | | | | | |
| SMD-6, option 7 | | SFH640-2X007 | | | | | | SFH640-3X007T ⁽¹⁾ | | | | | | | | | |
| VDE, UL, cUL | | 63 to 125 | | | | | | 100 to 200 | | | | | | | | | |
| SMD-6, option 9 | | - | | | | | | SFH640-3X019T | | | | | | | | | |

Notes

- Additional options may be possible, please contact sales office
- ⁽¹⁾ Also available in tubes, do not put T on the end

| ABSOLUTE MAXIMUM RATINGS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified) | | | | |
|--|-------------------|------------|-------------|--------------------|
| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
| INPUT | | | | |
| Reverse voltage | | V_R | 6 | V |
| Forward current | | I_F | 60 | mA |
| Power dissipation | | P_{diss} | 100 | mW |
| OUTPUT | | | | |
| Power dissipation | | P_{diss} | 150 | mW |
| Collector emitter voltage | | V_{CEO} | 300 | V |
| Collector base voltage | | V_{CBO} | 300 | V |
| Emitter base voltage | | V_{EBO} | 7 | V |
| Collector current | | I_C | 50 | mA |
| Power dissipation | | P_{diss} | 150 | mW |
| COUPLER | | | | |
| Storage temperature range | | T_{stg} | -55 to +150 | $^{\circ}\text{C}$ |
| Operating temperature range | | T_{amb} | -55 to +115 | $^{\circ}\text{C}$ |
| Soldering temperature | $t = 10\text{ s}$ | 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

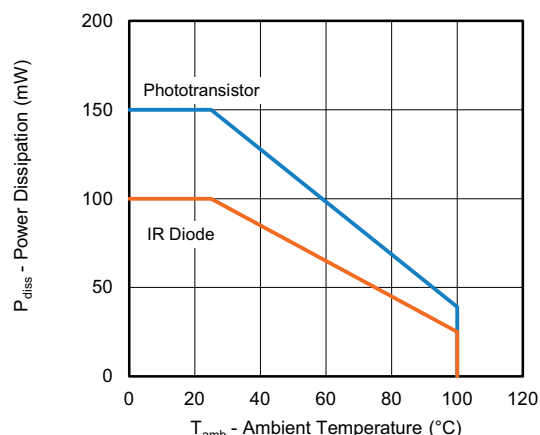


Fig. 1 - Power Dissipation vs. Ambient Temperature

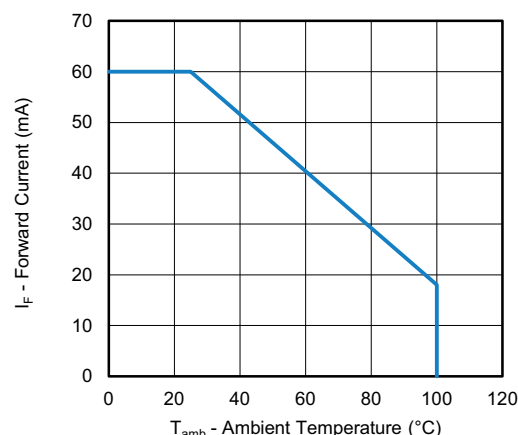


Fig. 2 - Maximum Forward Current vs. Ambient Temperature

| ELECTRICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified) | | | | | | |
|--|--|------------|------|------|------|---------------|
| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| INPUT | | | | | | |
| Forward voltage | $I_F = 10\text{ mA}$ | V_F | - | 1.2 | 1.5 | V |
| Reverse voltage | $I_R = 10\text{ }\mu\text{A}$ | V_R | 6 | - | - | V |
| Reverse current | $V_R = 6\text{ V}$ | I_R | - | 0.01 | 10 | μA |
| Capacitance | $V_F = 0\text{ V}$, $f = 1\text{ kHz}$ | C_i | - | 30 | - | pF |
| OUTPUT | | | | | | |
| Collector emitter breakdown voltage | $I_{CE} = 1\text{ mA}$, $R_{BE} = 1\text{ M}\Omega$ | BV_{CEO} | 300 | - | - | V |
| Voltage emitter base | $I_{EB} = 10\text{ }\mu\text{A}$ | BV_{EBO} | 7 | - | - | V |

| ELECTRICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified) | | | | | | |
|--|---|-------------|------|------|------|------|
| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| COUPLER | | | | | | |
| Coupling capacitance | $V = 0\text{ V}$, $f = 1\text{ MHz}$ | C_{IO} | - | 0.6 | - | pF |
| Collector emitter saturation voltage | $I_F = 10\text{ mA}$, $I_C = 3.2\text{ mA}$ | V_{CEsat} | - | 0.25 | 0.4 | V |
| Collector emitter leakage current | $V_{CE} = 200\text{ V}$, $R_{BE} = 1\text{ M}\Omega$ | I_{CEO} | - | 1 | 100 | nA |

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 | PART | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| I_C/I_F | $I_F = 10\text{ mA}$, $V_{CE} = 10\text{ V}$ | SFH640-2 | CTR | 63 | - | 125 | % |
| | $I_F = 1\text{ mA}$, $V_{CE} = 10\text{ V}$ | SFH640-2 | CTR | 22 | 45 | - | % |
| | $I_F = 10\text{ mA}$, $V_{CE} = 10\text{ V}$ | SFH640-3 | CTR | 100 | - | 200 | % |
| | $I_F = 1\text{ mA}$, $V_{CE} = 10\text{ V}$ | SFH640-3 | CTR | 34 | 70 | - | % |

| SWITCHING CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified) | | | | | | |
|---|---|-----------|------|------|------|---------------|
| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| Turn-on time | $I_C = 2\text{ mA}$, $R_L = 100\text{ }\Omega$, $V_{CC} = 5\text{ V}$ | t_{on} | - | 4 | - | μs |
| Turn-off time | $I_C = 2\text{ mA}$, $R_L = 100\text{ }\Omega$, $V_{CC} = 5\text{ V}$ | t_{off} | - | 5 | - | μs |

| SAFETY AND INSULATION RATINGS | | | | |
|--|---|------------|----------------|--------------------|
| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
| Climatic classification | According to IEC 68 part 1 | | 55 / 115 / 21 | |
| Pollution degree | According to DIN VDE 0109 | | 2 | |
| Comparative tracking index | Insulation group IIIa | CTI | 175 | |
| Maximum rated withstanding isolation voltage | According to UL1577, $t = 1\text{ min}$ | V_{ISO} | 5000 | V_{RMS} |
| Maximum transient isolation voltage | According to DIN EN 60747-5-5 | V_{IOTM} | 8000 | V_{peak} |
| Maximum repetitive peak isolation voltage | According to DIN EN 60747-5-5 | V_{IORM} | 890 | V_{peak} |
| 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 |
| Output safety power | | P_{SO} | 700 | mW |
| Input safety current | | I_{SI} | 400 | mA |
| Input safety temperature | | T_S | 175 | $^{\circ}\text{C}$ |
| Creepage distance | DIP-6, SMD-6 | | ≥ 7 | mm |
| Clearance distance | | | ≥ 7 | mm |
| Insulation thickness | | DTI | ≥ 0.4 | mm |

Note

- As per IEC 60747-5-5, § 7.4.3.8.2, 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

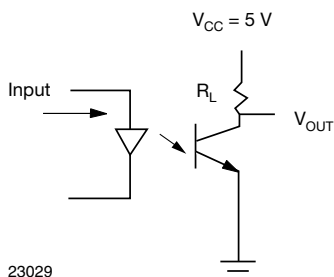
TYPICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)


Fig. 3 - Test Circuit for Switching Characteristics

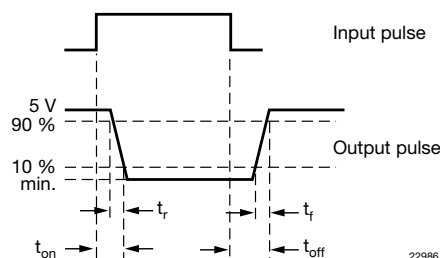


Fig. 4 - Parameter and Limit Definition

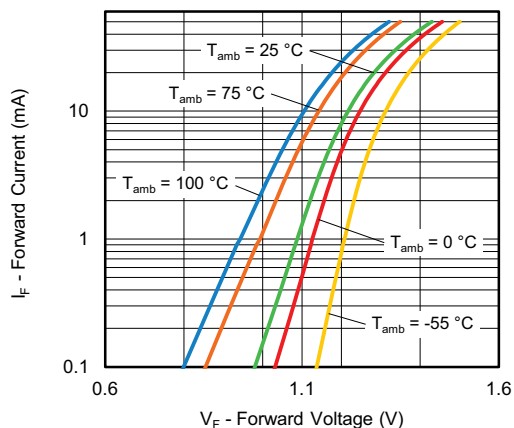


Fig. 5 - Forward Current vs. Forward Voltage

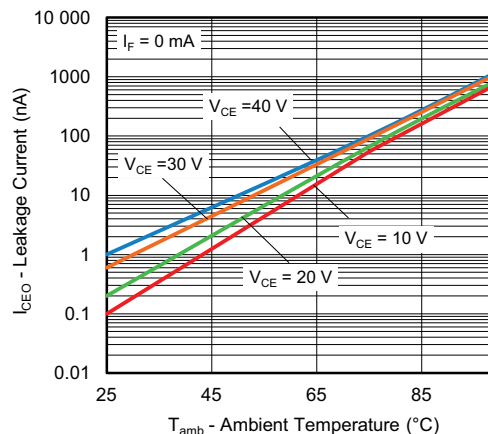


Fig. 8 - Leakage Current vs. Ambient Temperature

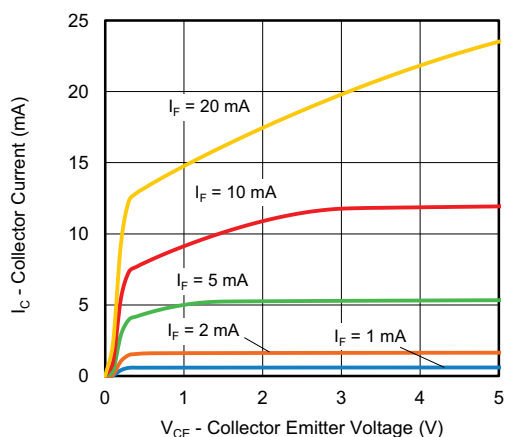


Fig. 6 - Collector Current vs. Collector Emitter Voltage (non-saturated)

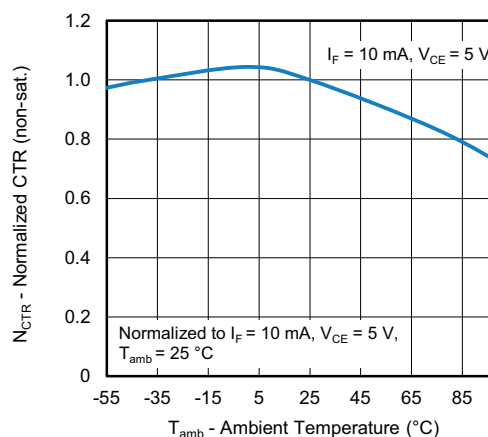


Fig. 9 - Normalized CTR vs. Ambient Temperature (non-saturated)

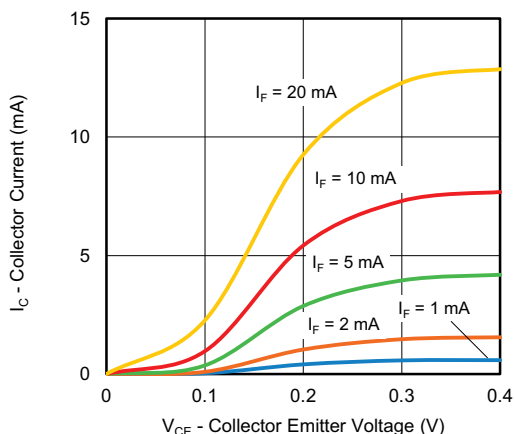


Fig. 7 - Collector Current vs. Collector Emitter Voltage (saturated)

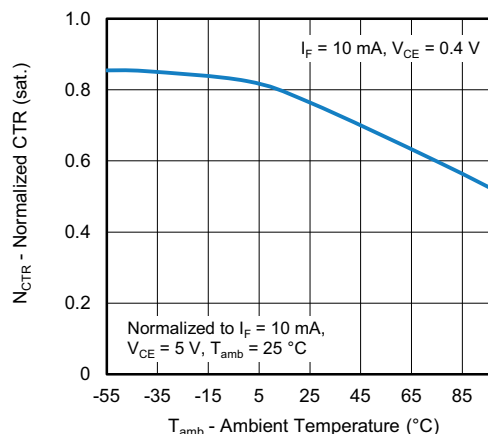


Fig. 10 - Normalized CTR vs. Ambient Temperature (saturated)

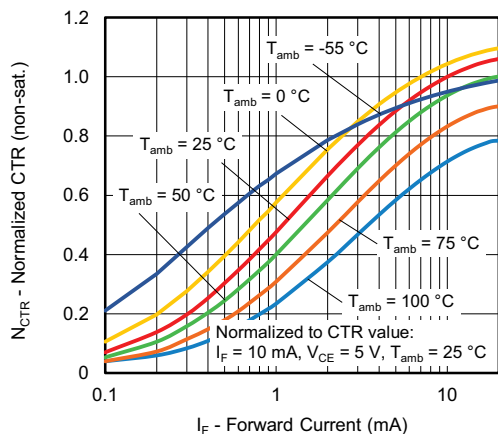


Fig. 11 - Normalized CTR (non-saturated) vs. Forward Current

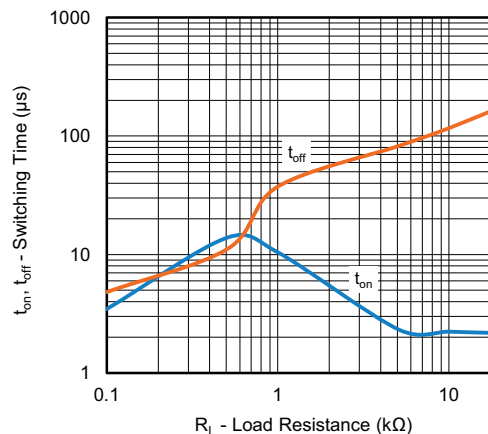


Fig. 13 - Switching Time vs. Load Resistance

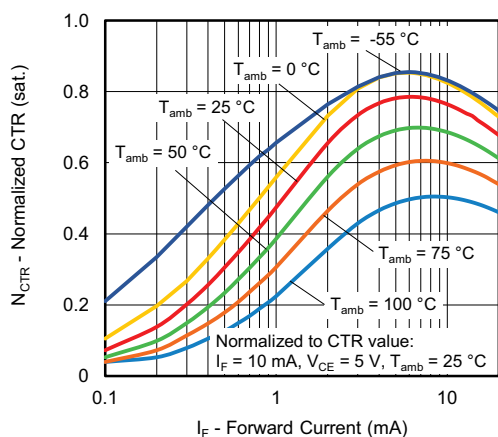


Fig. 12 - Normalized CTR (saturated) vs. Forward Current

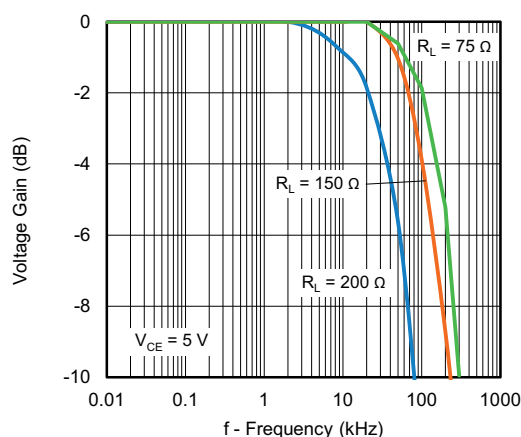


Fig. 14 - Voltage Gain vs. Frequency

PACKAGE DIMENSIONS in millimeters

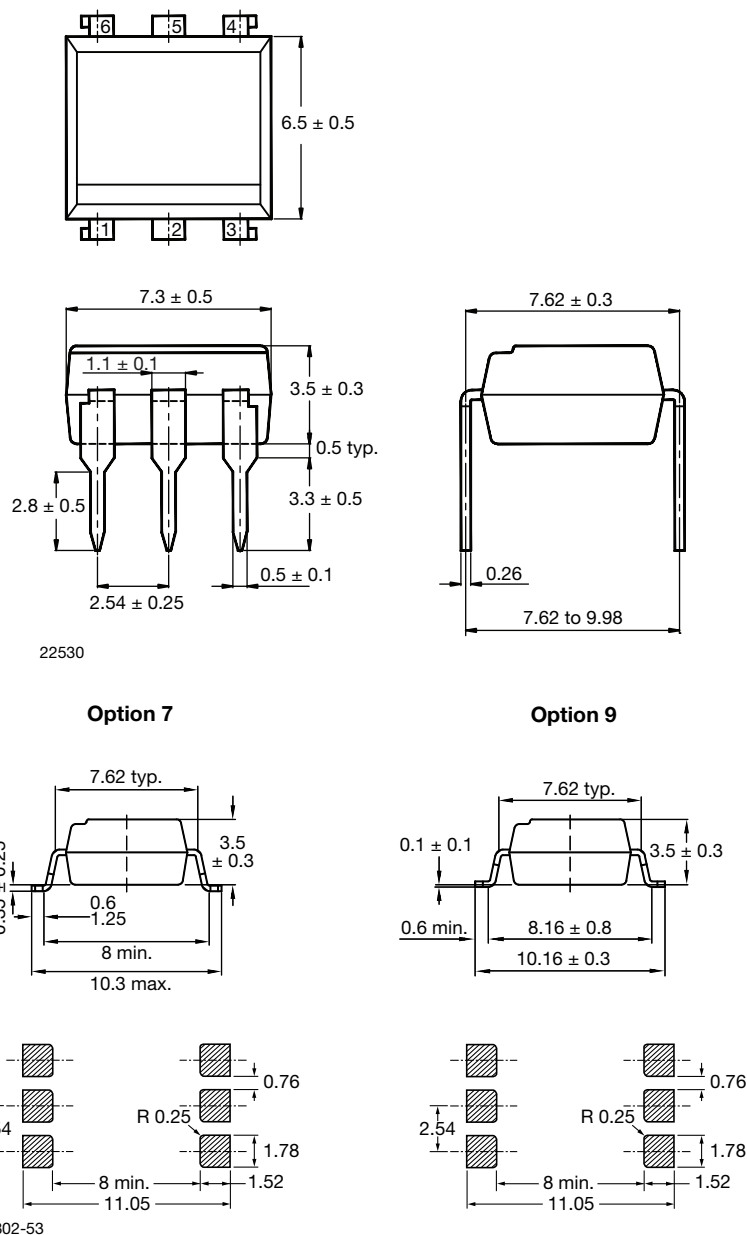
6 Pin Package

PACKAGE MARKING

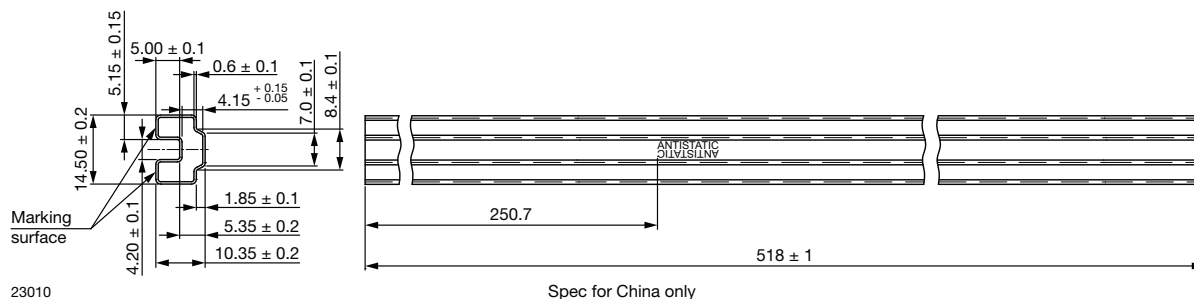
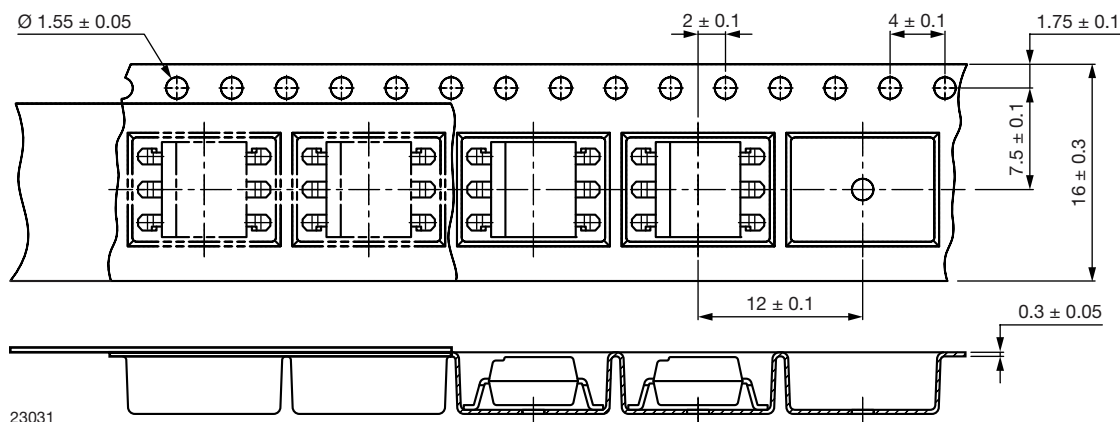

Fig. 15 - Example of SFH640

Notes

- "YWW" is the date code marking (Y = year code, WW = week code)
- VDE logo is only marked on VDE option parts
- Tape and reel suffix (T) is not part of the package marking

PACKAGING INFORMATION

| DEVICES PER TUBE | | | |
|------------------|------------|-----------|-----------|
| TYPE | UNITS/TUBE | TUBES/BOX | UNITS/BOX |
| DIP-6 | 50 | 40 | 2000 |
| SMD-6 | 50 | 40 | 2000 |

DIP-6

SMD-6


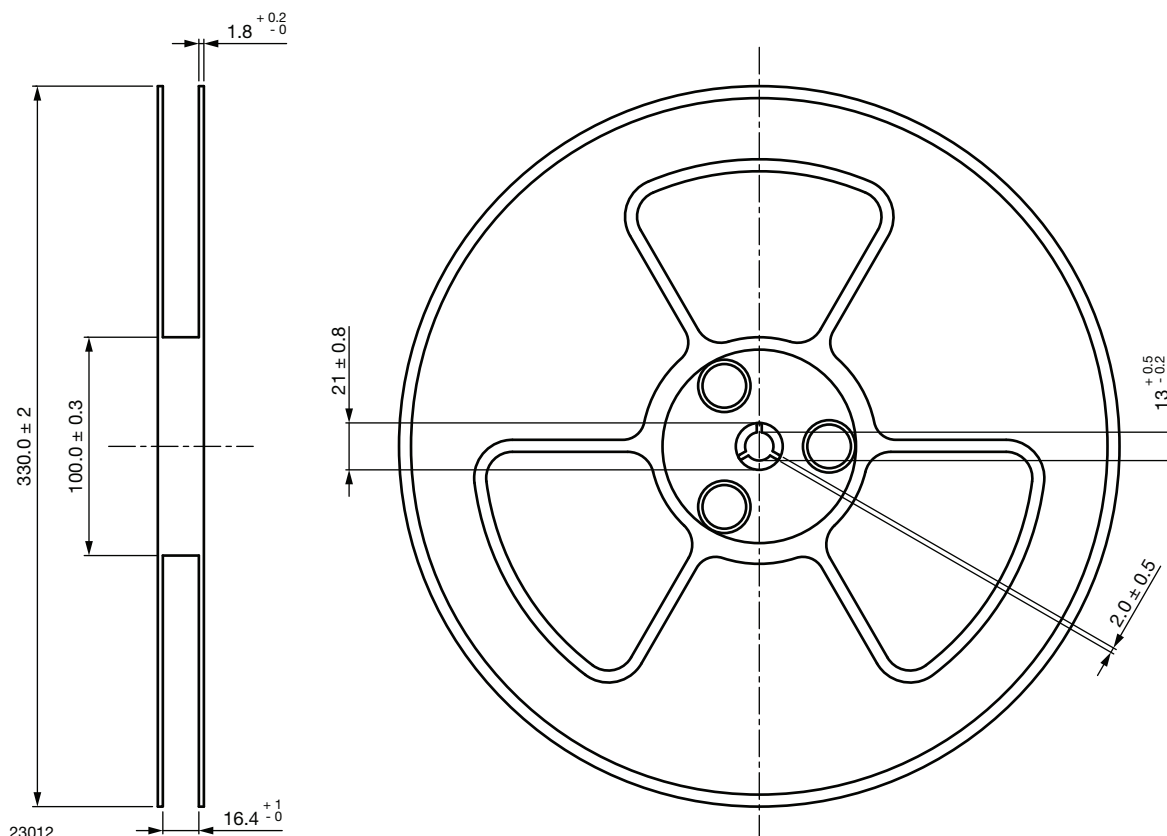
Reel


Fig. 18 - Tape and Reel Shipping Medium

SOLDER PROFILES
IR Reflow Soldering (JEDEC® J-STD-020C compliant)

One time soldering reflow is recommended within the condition of temperature and time profile shown below. Do not solder more than three times.

| PROFILE ITEM | CONDITIONS |
|--|------------------|
| Preheat | |
| - Temperature minimum ($T_{S \text{ min.}}$) | 150 °C |
| - Temperature maximum ($T_{S \text{ max.}}$) | 200 °C |
| - Time (min. to max.) (t_s) | 90 s ± 30 s |
| Soldering zone | |
| - Temperature (T_L) | 217 °C |
| - Time (t_L) | 60 s |
| Peak temperature (T_p) | 260 °C |
| Ramp-up rate | 3 °C/s max. |
| Ramp-down rate | 3 °C/s to 6 °C/s |

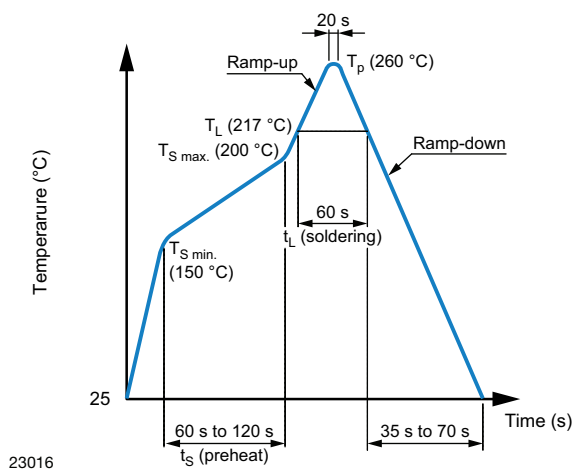


Fig. 19



Wave Soldering (JEDEC JESD22-A111 compliant)

One time soldering is recommended within the condition of temperature.

Temperature: $260\text{ }^{\circ}\text{C} + 0\text{ }^{\circ}\text{C} / - 5\text{ }^{\circ}\text{C}$

Time: 10 s

Preheat temperature: $25\text{ }^{\circ}\text{C}$ to $140\text{ }^{\circ}\text{C}$

Preheat time: 30 s to 80 s

Hand Soldering by Soldering Iron

Allow single lead soldering in every single process. One time soldering is recommended.

Temperature: $380\text{ }^{\circ}\text{C} + 0\text{ }^{\circ}\text{C} / - 5\text{ }^{\circ}\text{C}$

Time: 3 s max.

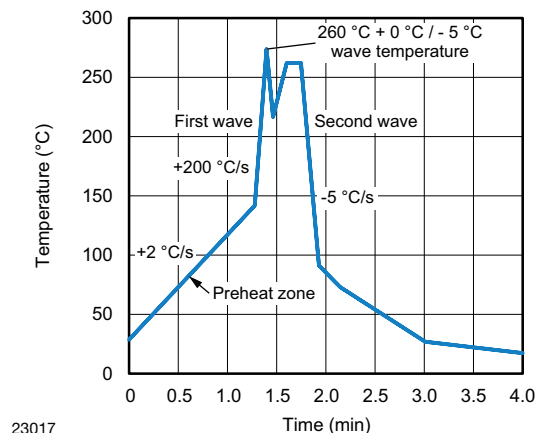


Fig. 20



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