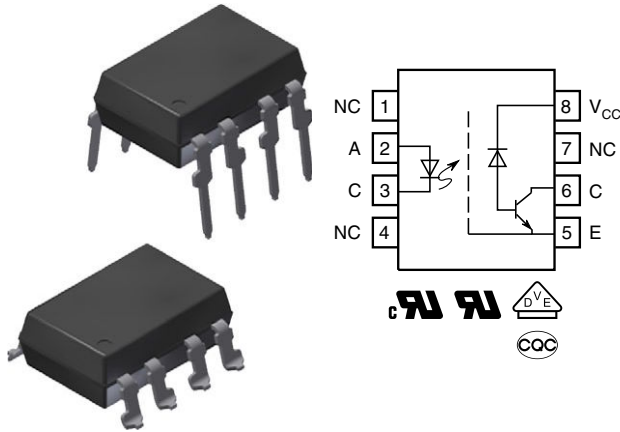


Analog High Speed Coupler, High Noise Immunity, 1 MBd, 15 kV/μs



DESCRIPTION

The SFH6345 is an optocoupler with a GaAlAs infrared emitting diode, optically coupled to an integrated photo detector consisting of a photo diode and a high speed transistor in a DIP-8 plastic package. The device is similar to the 6N135 but has an additional Faraday shield on the detector which enhances the input-output dV/dt immunity. Signals can be transmitted between two electrically separated circuits up to frequencies of 2 MHz. This is an ideal solution for industrial communication bus isolation, as well as isolated drive circuit applications such as IPM (intelligent power module) drivers.

FEATURES

- High-speed optocoupler without base connection
- Isolation test voltage: 5300 V_{RMS}
- GaAlAs emitter
- Integrated detector with photo diode and transistor
- High data transmission rate: 1 MBit/s
- TTL compatible
- Open collector output
- Good CTR linearity relative to forward current
- Field effect stable
- Low coupling capacitance
- Very high common mode transient immunity dV/dt: ≥ 15 kV/μs at V_{CM} = 1500 V
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



APPLICATIONS

- Data communications
- IGBT drivers
- Programmable controllers
- IPM (intelligent power module) drivers

AGENCY APPROVALS

- UL1577 file no. E52744, double protection
- DIN EN 60747-5-5 (VDE0884-5) available with option 1
- cUL components acceptance service no. 5A
- CQC GB8898-2001, GB4943.1-2011

| ORDERING INFORMATION | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <div style="border: 1px solid black; padding: 2px 5px;">S</div> <div style="border: 1px solid black; padding: 2px 5px;">F</div> <div style="border: 1px solid black; padding: 2px 5px;">H</div> <div style="border: 1px solid black; padding: 2px 5px;">6</div> <div style="border: 1px solid black; padding: 2px 5px;">3</div> <div style="border: 1px solid black; padding: 2px 5px;">4</div> <div style="border: 1px solid black; padding: 2px 5px;">5</div> <div style="border: 1px solid black; padding: 2px 5px;">-</div> <div style="border: 1px solid black; padding: 2px 5px;">X</div> <div style="border: 1px solid black; padding: 2px 5px;">0</div> <div style="border: 1px solid black; padding: 2px 5px;">#</div> <div style="border: 1px solid black; padding: 2px 5px;">#</div> <div style="border: 1px solid black; padding: 2px 5px;">T</div> </div> <div style="margin-left: 20px;"> <p style="text-align: center;">PART NUMBER</p> <p style="text-align: center;">PACKAGE OPTION</p> <p style="text-align: center;">TAPE AND REEL</p> </div> <div style="margin-left: 20px;"> </div> </div> | |
| AGENCY CERTIFIED/PACKAGE | CMR (kV/μs) |
| UL, cUL, CQC | ≥ 15 |
| DIP-8 | SFH6345 |
| SMD-8, option 7 | SFH6345-X007T ⁽¹⁾ |
| SMD-8, option 9 | SFH6345-X009T ⁽¹⁾ |
| VDE, UL, cUL, CQC | |
| DIP-8 | SFH6345-X001 |
| DIP-8, 400 mil, option 6 | SFH6345-X016 |
| SMD-8, option 7 | SFH6345-X017T |
| SMD-8, option 9 | SFH6345-X019T ⁽¹⁾ |

Note

⁽¹⁾ Also available in tubes; do not add T to 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 | 3 | V |
| DC forward current | | I_F | 25 | mA |
| Surge forward current | $t_p = 1\text{ }\mu\text{s}$, 300 pulses/s | I_{FSM} | 1 | A |
| Power dissipation | | P_{diss} | 45 | mW |
| OUTPUT | | | | |
| Supply voltage | | V_S | -0.5 to 30 | V |
| Output voltage | | V_O | -0.5 to 25 | V |
| Output current | | I_O | 8 | mA |
| Power dissipation | | P_{diss} | 100 | mW |
| COUPLER | | | | |
| 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 | 125 | $^{\circ}\text{C}$ |
| Soldering temperature | max. 10 s, max. dip soldering: distance to seating plane $\geq 1.5\text{ mm}$ | T_{sld} | 260 | $^{\circ}\text{C}$ |

Note

- 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

| ELECTRICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified) | | | | | | |
|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-----------------|------|-------|------|---------------|
| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| INPUT | | | | | | |
| Forward voltage | $I_F = 16\text{ mA}$ | V_F | - | 1.33 | 1.9 | V |
| Reverse current | $V_R = 3\text{ V}$ | I_R | - | 0.5 | 10 | μA |
| Capacitance | $V_R = 0\text{ V}$, $f = 1\text{ MHz}$ | C_O | - | 30 | - | pF |
| Thermal resistance | | R_{thja} | - | 700 | - | K/W |
| OUTPUT | | | | | | |
| Supply current, logic high | $I_F = 0\text{ V}$, $V_O = \text{open}$, $V_{CC} = 15\text{ V}$ | I_{CCH} | - | 0.01 | 1 | μA |
| | | $I_{CCH}^{(1)}$ | - | 0.01 | 2 | μA |
| Output current, output high | $I_F = 0\text{ V}$, $V_O = V_{CC} = 5.5\text{ V}$ | I_{OH} | - | 0.003 | 0.5 | μA |
| | | I_{OH} | - | 0.01 | 1 | μA |
| | $I_F = 0\text{ V}$, $V_O = V_{CC} = 15\text{ V}$ | $I_{OH}^{(1)}$ | - | - | 50 | μA |
| Collector emitter capacitance | $V_{CE} = 5\text{ V}$, $f = 1\text{ MHz}$ | C_{CE} | - | 3 | - | pF |
| Thermal resistance | | R_{thja} | - | 300 | - | K/W |
| COUPLER | | | | | | |
| Coupling capacitance | | C_C | - | 0.6 | - | pF |
| Collector emitter saturation voltage | $I_F = 16\text{ mA}$, $I_O = 2.4\text{ mA}$, $V_{CC} = 4.5\text{ V}$ | V_{OL} | - | 0.1 | 0.4 | V |
| Logic low supply current | $I_F = 16\text{ mA}$, $V_O = \text{open}$, $V_{CC} = 15\text{ V}$ | I_{CCL} | - | 80 | 200 | μA |

Notes

- 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

⁽¹⁾ $T_{amb} = 0\text{ }^{\circ}\text{C}$ to $70\text{ }^{\circ}\text{C}$, unless otherwise specified, typical values $T_{amb} = 25\text{ }^{\circ}\text{C}$

| CURRENT TRANSFER RATIO ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified) | | | | | | |
|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|------|------|------|
| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| Current transfer ratio | $I_F = 16\text{ mA}$, $V_O = 0.4\text{ V}$, $V_{CC} = 4.5\text{ V}$ | CTR | 19 | 30 | - | % |
| | $I_F = 16\text{ mA}$, $V_O = 0.5\text{ V}$, $V_{CC} = 4.5\text{ V}$, $T_{amb} = 0\text{ }^{\circ}\text{C}$ to $70\text{ }^{\circ}\text{C}$ | CTR | 15 | - | - | % |

| SWITCHING CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified) | | | | | | |
|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-----------|------|------|------|---------------|
| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| Propagation delay time (high to low), see fig. 1 | $I_F = 16\text{ mA}$, $V_{CC} = 5\text{ V}$, $R_L = 1.9\text{ k}\Omega$ | t_{PHL} | - | 0.3 | 0.8 | μs |
| Propagation delay time (low to high), see fig. 1 | $I_F = 16\text{ mA}$, $V_{CC} = 5\text{ V}$, $R_L = 1.9\text{ k}\Omega$ | t_{PLH} | - | 0.3 | 0.8 | μs |

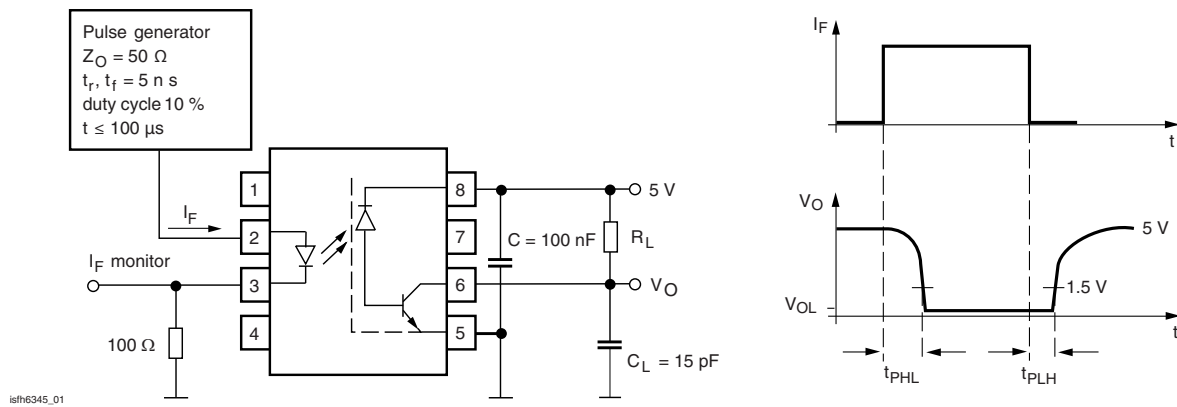


Fig. 1 - Switching Times (Typ.)

| COMMON MODE TRANSIENT IMMUNITY ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified) | | | | | | |
|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|----------|--------|--------|------|------------------------|
| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| Common mode transient immunity (high), see fig. 2 | $I_O = 0\text{ mA}$, $V_{CM} = 1500\text{ V}_{P-P}$, $R_L = 1.9\text{ k}\Omega$, $V_{CC} = 5\text{ V}$ | $ CM_H $ | 15 000 | 30 000 | - | $\text{V}/\mu\text{s}$ |
| Common mode transient immunity (low), see fig. 2 | $I_O = 16\text{ mA}$, $V_{CM} = 1500\text{ V}_{P-P}$, $R_L = 1.9\text{ k}\Omega$, $V_{CC} = 5\text{ V}$ | $ CM_L $ | 15 000 | 30 000 | - | $\text{V}/\mu\text{s}$ |

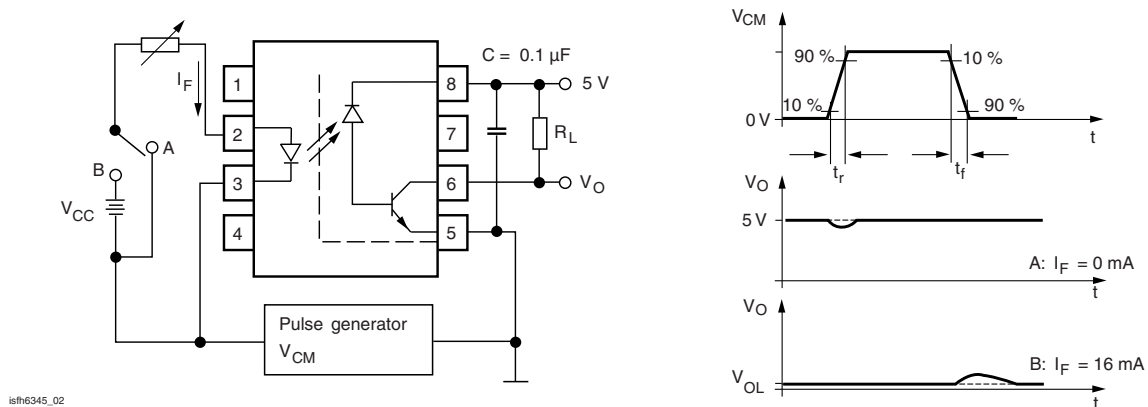


Fig. 2 - Common Mode Transient Immunity

| SAFETY AND INSULATION RATINGS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified) | | | | |
|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|------------|----------------|--------------------|
| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
| Climatic classification | According to IEC 68 part 1 | | 55/100/21 | |
| 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} | 5300 | 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 | $T_{amb} = 25\text{ }^{\circ}\text{C}$, $V_{IO} = 500\text{ V}$ | R_{IO} | $\geq 10^{12}$ | Ω |
| | $T_{amb} = 100\text{ }^{\circ}\text{C}$, $V_{IO} = 500\text{ V}$ | R_{IO} | $\geq 10^{11}$ | Ω |
| Output safety power | | P_{SO} | 500 | mW |
| Input safety current | | I_{SI} | 300 | mA |
| Input safety temperature | | T_S | 175 | $^{\circ}\text{C}$ |
| Creepage distance | DIP-8 | | ≥ 7 | mm |
| Clearance distance | DIP-8 | | ≥ 7 | mm |
| Creepage distance | DIP-8, 400 mil, option 6 | | ≥ 8 | mm |
| Clearance distance | DIP-8, 400 mil, option 6 | | ≥ 8 | mm |
| Creepage distance | SMD-8, option 7 | | ≥ 8 | mm |
| Clearance distance | SMD-8, option 7 | | ≥ 8 | mm |
| Creepage distance | SMD-8, option 9 | | ≥ 8 | mm |
| Clearance distance | SMD-8, option 9 | | ≥ 8 | 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

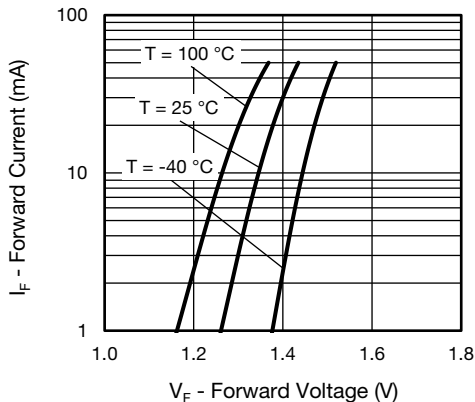
TYPICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)


Fig. 3 - LED Forward Current vs. Forward Voltage

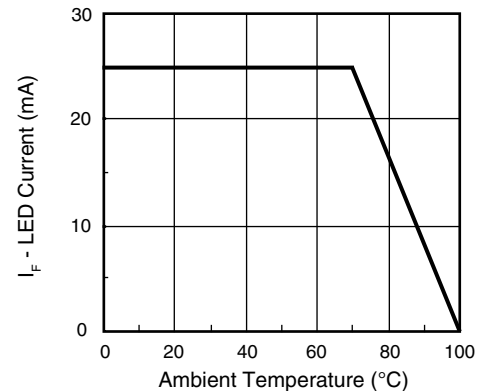


Fig. 4 - Permissible Forward LED Current vs. Temperature

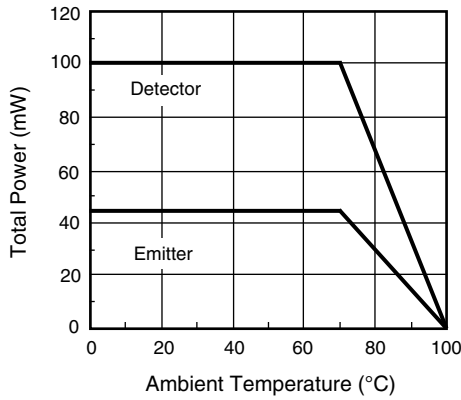


Fig. 5 - Permissible Power Dissipation vs. Temperature

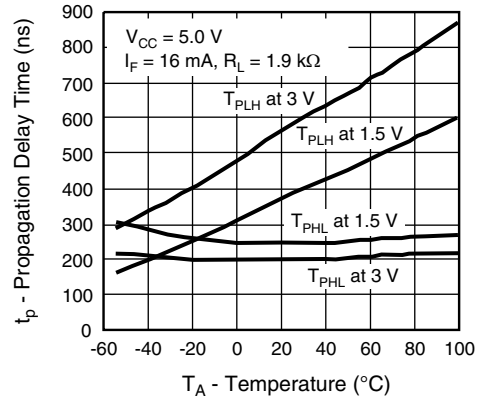


Fig. 8 - Propagation Delay vs. Ambient Temperature

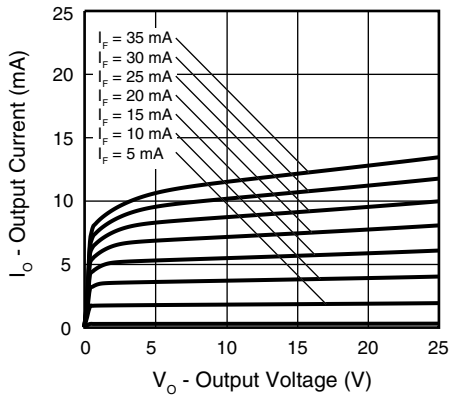


Fig. 6 - Output Current vs. Output Voltage

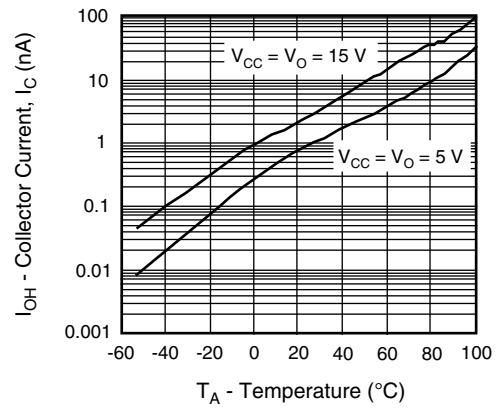


Fig. 9 - Logic High Output Current vs. Temperature

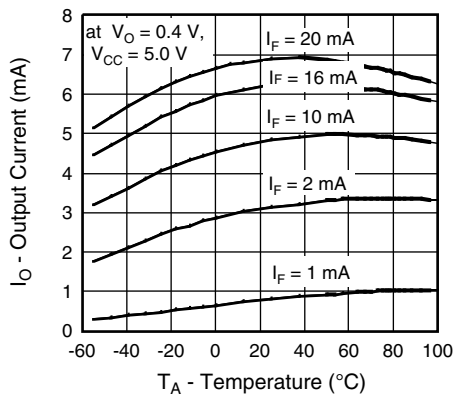


Fig. 7 - Output Current vs. Temperature

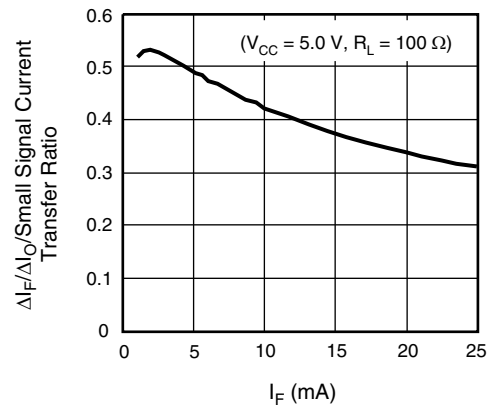
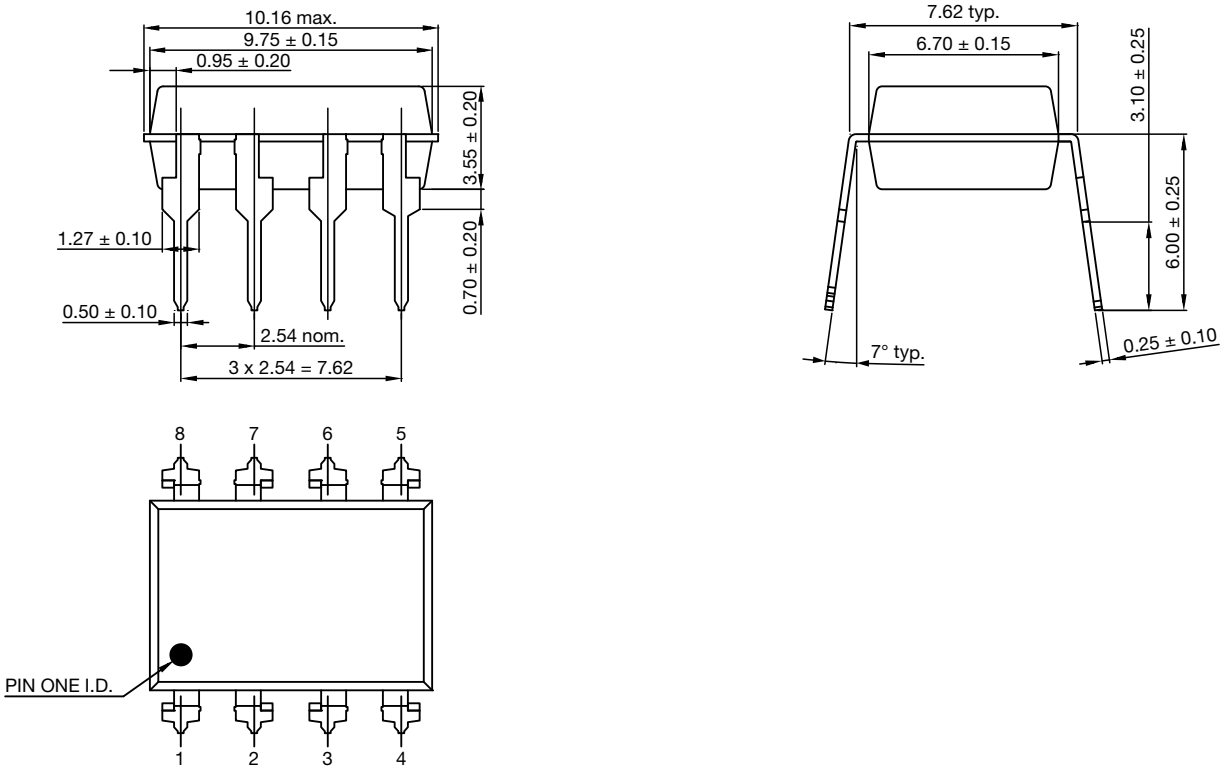


Fig. 10 - Small Signal Current Transfer Ratio vs. Input Current

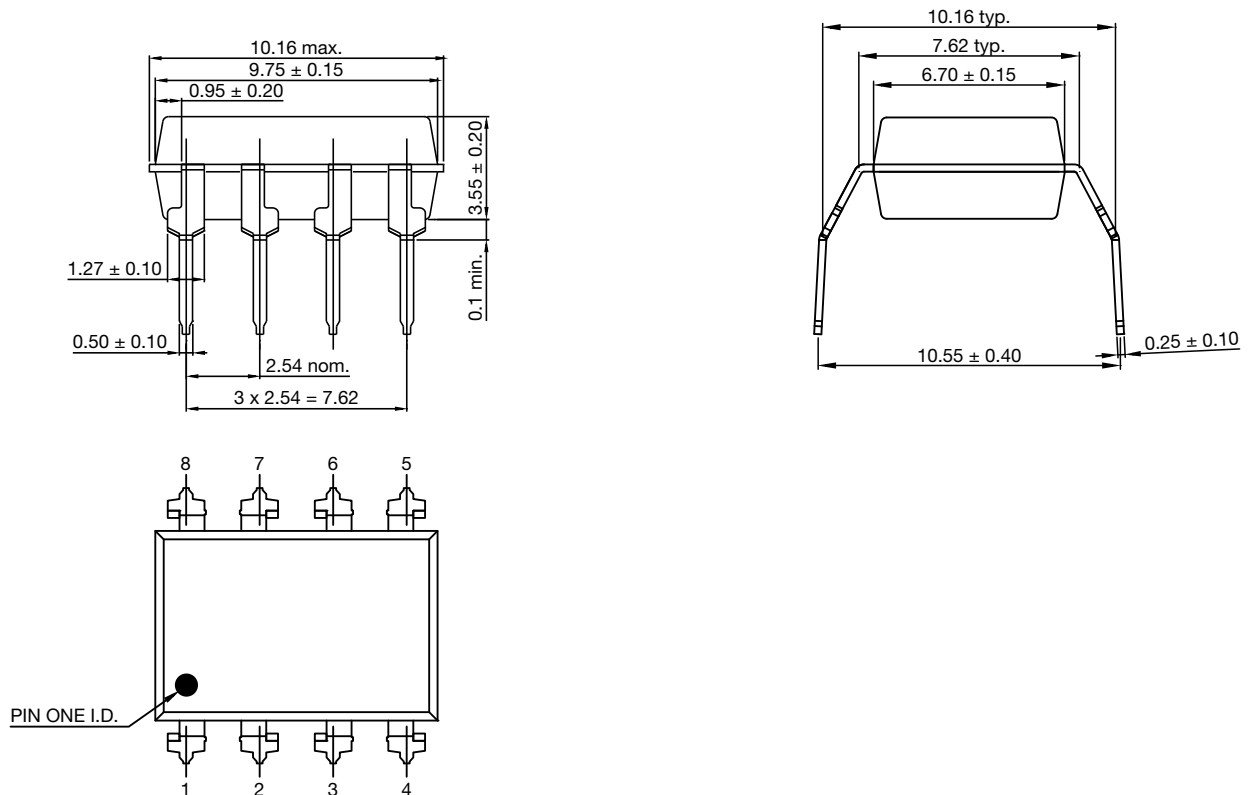


PACKAGE DIMENSIONS (in millimeters)

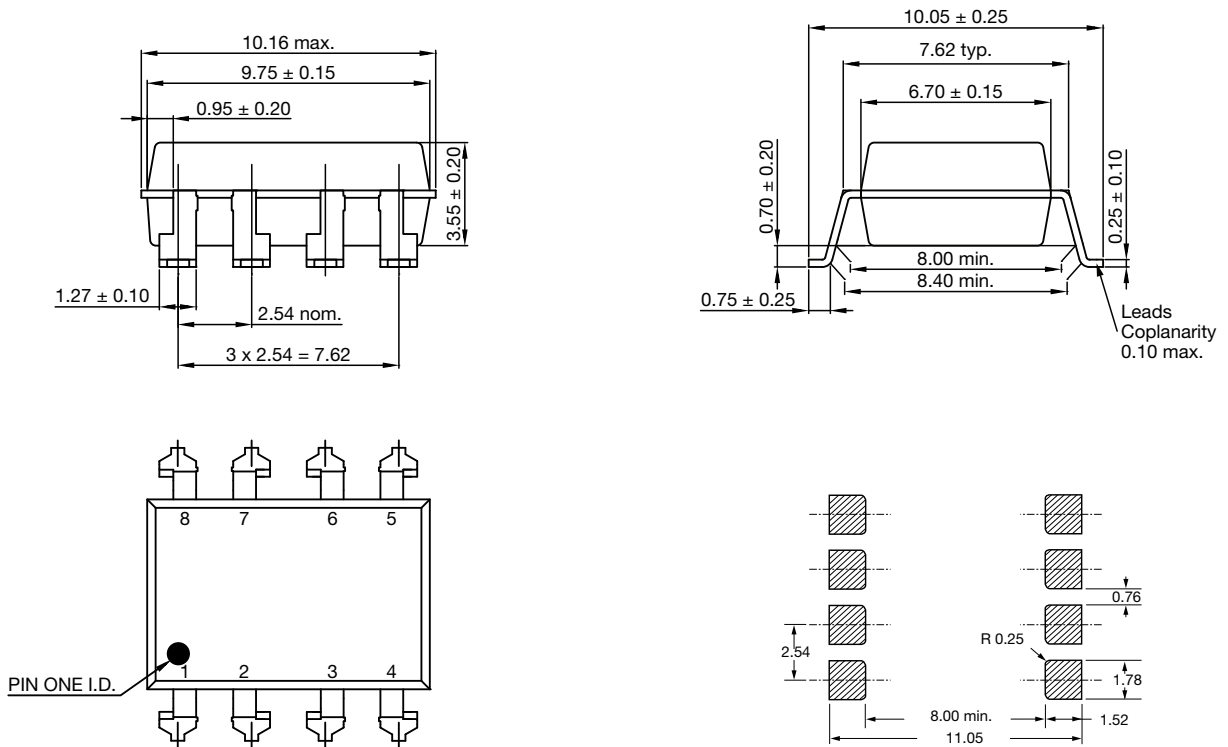
DIP-6



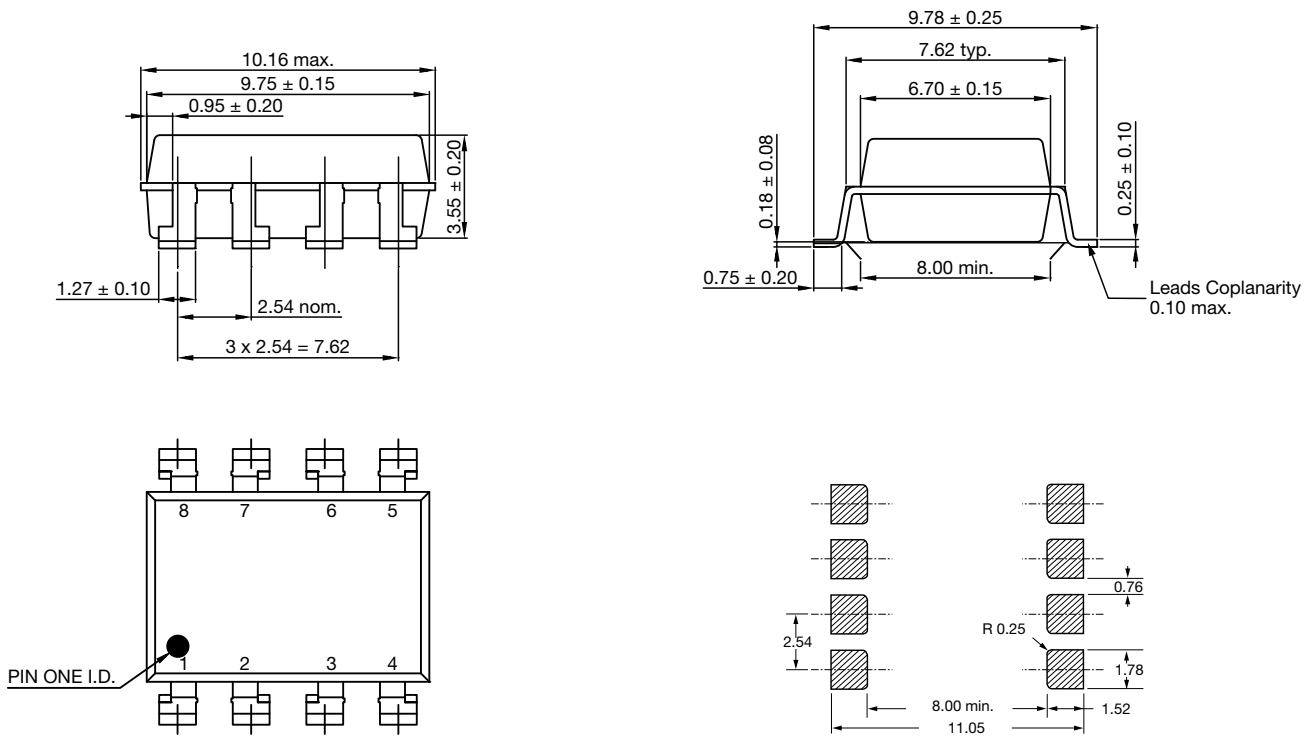
DIP-6, Option 6



SMD-6, Option 7



SMD-6, Option 9



PACKAGE MARKING

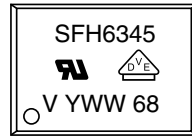
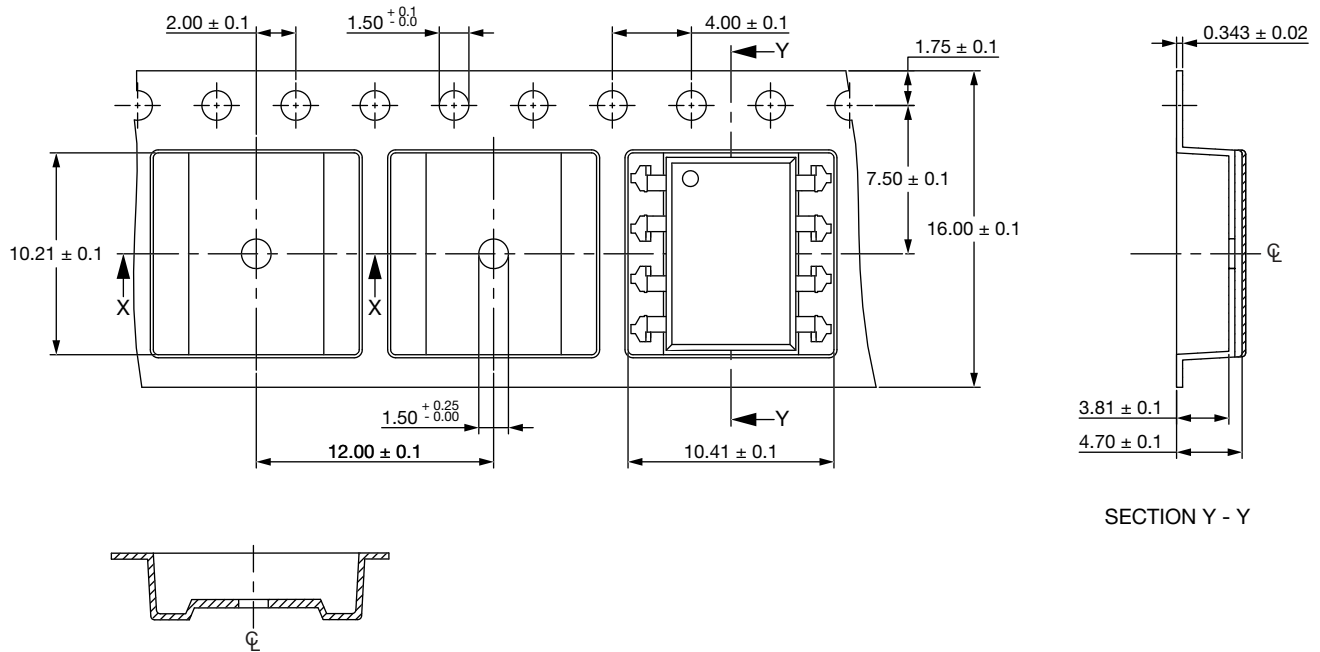


Fig. 11 - SFH6345

Notes

- The VDE logo is only marked on option 1 parts
- Tape and reel suffix (T) is not part of the package marking

PACKAGING INFORMATION (in millimeters)



Note:

- Cumulative tolerance of 10 sprocket holes is ± 0.20

Fig. 12 - Tape and Reel Packing for SMD-8, Option 7 (1000 pieces on reel)

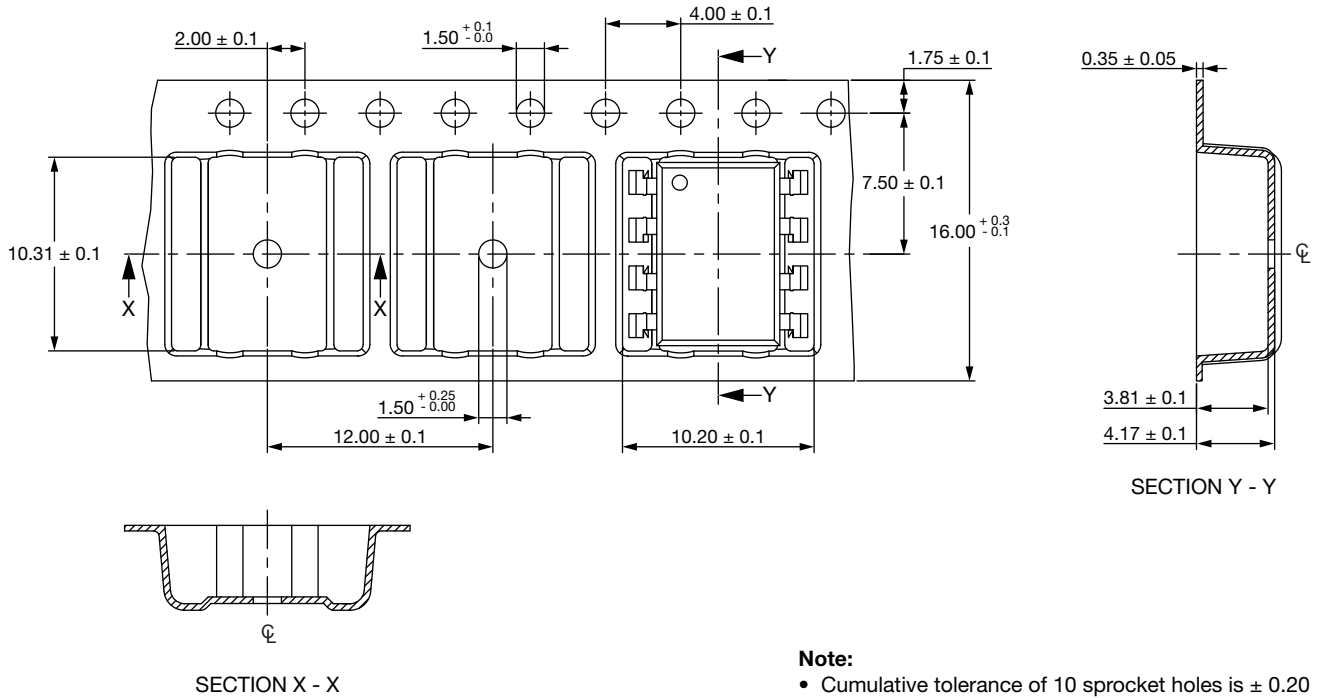
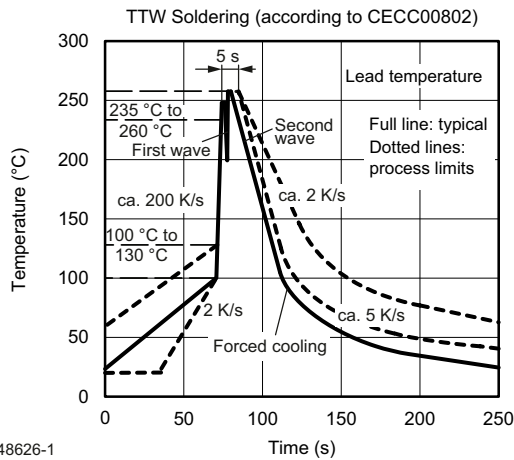


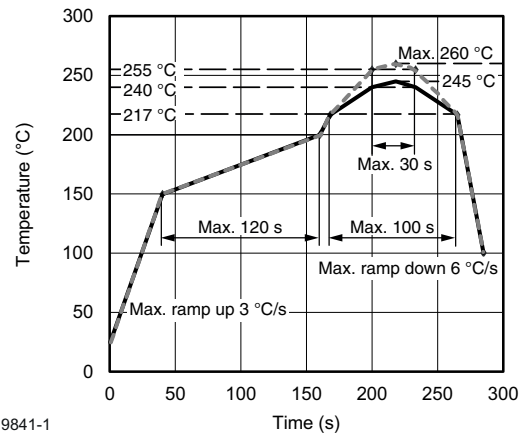
Fig. 13 - Tape and Reel Packing for SMD-8, Option 9 (1000 pieces on reel)

SOLDER PROFILES



948626-1

Fig. 14 - Wave Soldering Double Wave Profile According to J-STD-020 for DIP-8 Devices



19841-1

Fig. 15 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD-8 Devices

HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: unlimited

Conditions: $T_{amb} < 30\text{ °C}$, RH < 85 %

Moisture sensitivity level 1, according to J-STD-020



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