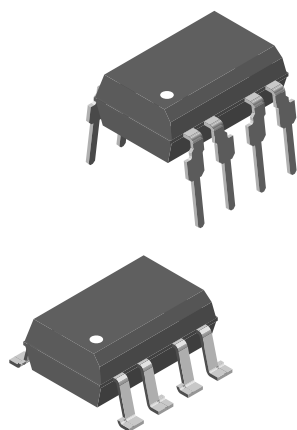
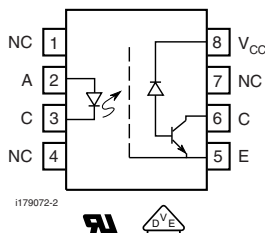


# Analog High Speed Coupler, High Noise Immunity, 1 MBd, 15 kV/μs



22644



## FEATURES

- Direct replacement for HCPL 4503
- High-speed optocoupler without base connection
- Isolation test voltage: 5300 V<sub>RMS</sub>
- 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<sub>CM</sub> = 1500 V
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

## 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.

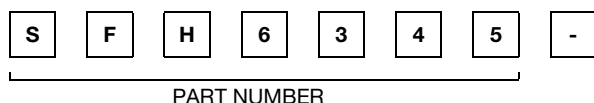
## APPLICATIONS

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

## AGENCY APPROVALS

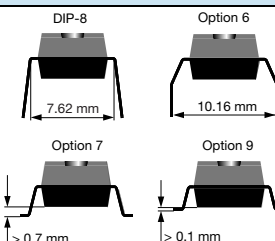
- UL1577, file no. E52744 system code H double protection
- DIN EN 60747-5-2 (VDE0884)/DIN EN 60747-5-5 (pending), available with option 1

## ORDERING INFORMATION



PART NUMBER

PACKAGE OPTION

TAPE  
AND  
REEL


| AGENCY CERTIFIED/PACKAGE | CMR (kV/μs)                  |
|--------------------------|------------------------------|
| UL                       | ≥ 15                         |
| DIP-8                    | SFH6345                      |
| SMD-8, option 7          | SFH6345-X007T <sup>(1)</sup> |
| SMD-8, option 9          | SFH6345-X009T <sup>(1)</sup> |
| VDE, UL                  |                              |
| DIP-8                    | SFH6345-X001                 |
| DIP-8, 400 mil, option 6 | SFH6345-X016                 |
| SMD-8, option 7          | SFH6345-X017T <sup>(1)</sup> |
| SMD-8, option 9          | SFH6345-X019T <sup>(1)</sup> |

### Note

<sup>(1)</sup> 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               |
| <b>INPUT</b>                                                                                    |                                                                                  |            |                |                    |
| 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                 |
| <b>OUTPUT</b>                                                                                   |                                                                                  |            |                |                    |
| 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                 |
| <b>COUPLER</b>                                                                                  |                                                                                  |            |                |                    |
| Isolation test voltage between emitter and detector                                             |                                                                                  | $V_{ISO}$  | 5300           | $V_{RMS}$          |
| 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 + 150  | $^{\circ}\text{C}$ |
| Ambient temperature range                                                                       |                                                                                  | $T_{amb}$  | - 55 to + 125  | $^{\circ}\text{C}$ |
| Junction temperature                                                                            |                                                                                  | $T_j$      | 100            | $^{\circ}\text{C}$ |
| Soldering temperature <sup>(1)</sup>                                                            | max. 10 s, max. dip soldering:<br>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.

<sup>(1)</sup> 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                                                            | SYMBOL     | MIN. | TYP.  | MAX. | UNIT          |
| <b>INPUT <sup>(1)</sup></b>                                                                       |                                                                           |            |      |       |      |               |
| 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   | $\mu\text{A}$ |
| Capacitance                                                                                       | $V_R = 0\text{ V}$ , $f = 1\text{ MHz}$                                   | $C_O$      |      | 30    |      | pF            |
| Thermal resistance                                                                                |                                                                           | $R_{thja}$ |      | 700   |      | K/W           |
| <b>OUTPUT</b>                                                                                     |                                                                           |            |      |       |      |               |
| Supply current, logic high                                                                        | $I_F = 0\text{ V}$ , $V_O = \text{open}$ , $V_{CC} = 15\text{ V}$         | $I_{CCH}$  |      | 0.01  | 1    | $\mu\text{A}$ |
|                                                                                                   |                                                                           | $I_{CCH}$  |      | 0.01  | 2    | $\mu\text{A}$ |
| Output current, output high                                                                       | $I_F = 0\text{ V}$ , $V_O = V_{CC} = 5.5\text{ V}$                        | $I_{OH}$   |      | 0.003 | 0.5  | $\mu\text{A}$ |
|                                                                                                   | $I_F = 0\text{ V}$ , $V_O = V_{CC} = 15\text{ V}$                         | $I_{OH}$   |      | 0.01  | 1    | $\mu\text{A}$ |
|                                                                                                   |                                                                           | $I_{OH}$   |      |       | 50   | $\mu\text{A}$ |
| Collector emitter capacitance                                                                     | $V_{CE} = 5\text{ V}$ , $f = 1\text{ MHz}$                                | $C_{CE}$   |      | 3     |      | pF            |
| Thermal resistance                                                                                |                                                                           | $R_{thja}$ |      | 300   |      | K/W           |
| <b>COUPLER</b>                                                                                    |                                                                           |            |      |       |      |               |
| Coupling capacitance                                                                              |                                                                           | $C_C$      |      | 0.6   |      | pF            |
| Collector emitter saturation voltage                                                              | $I_F = 16\text{ mA}$ , $I_O = 2.4\text{ mA}$ ,<br>$V_{CC} = 4.5\text{ V}$ | $V_{OL}$   |      | 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  | $\mu\text{A}$ |

**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.

<sup>(1)</sup>  $T_{amb} = 0\text{ }^{\circ}\text{C}$  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 | $I_F = 16\text{ mA}$ , $V_O = 0.4\text{ V}$ , $V_{CC} = 4.5\text{ V}$                                                                            | $I_C/I_F$ | 19   | 30   |      | %    |
|                        | $I_F = 16\text{ mA}$ , $V_O = 0.5\text{ V}$ , $V_{CC} = 4.5\text{ V}$ ,<br>$T_{amb} = 0\text{ }^{\circ}\text{C}$ to $70\text{ }^{\circ}\text{C}$ | $I_C/I_F$ | 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  | $\mu\text{s}$ |
| 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  | $\mu\text{s}$ |

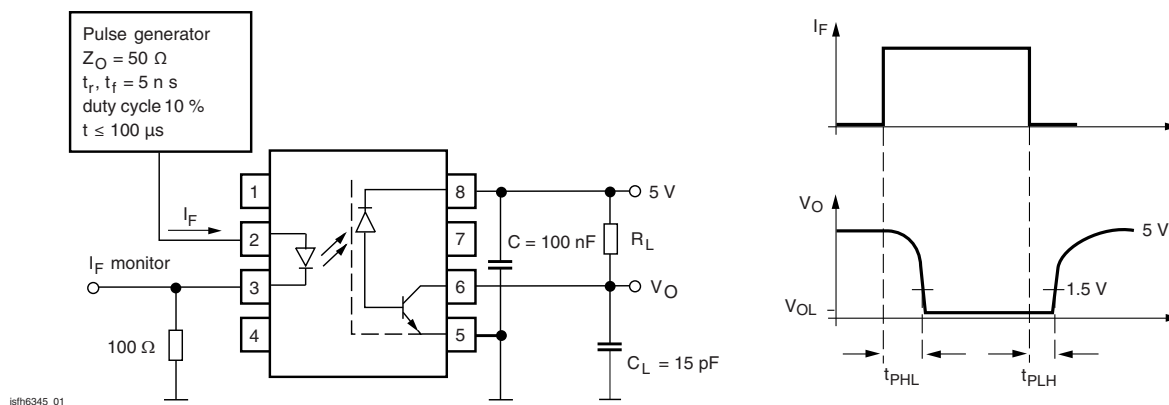


Fig. 1 - Switching Times (Typ.)

**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 | $I_O = 0\text{ mA}$ , $V_{CM} = 1500\text{ V}_{P-P}$ ,<br>$R_L = 1.9\text{ k}\Omega$ , $V_{CC} = 5\text{ V}$  | $ CM_H $ | 15   | 30   |      | $\text{kV}/\mu\text{s}$ |
| Common mode transient immunity (low), see fig. 2  | $I_O = 16\text{ mA}$ , $V_{CM} = 1500\text{ V}_{P-P}$ ,<br>$R_L = 1.9\text{ k}\Omega$ , $V_{CC} = 5\text{ V}$ | $ CM_L $ | 15   | 30   |      | $\text{kV}/\mu\text{s}$ |

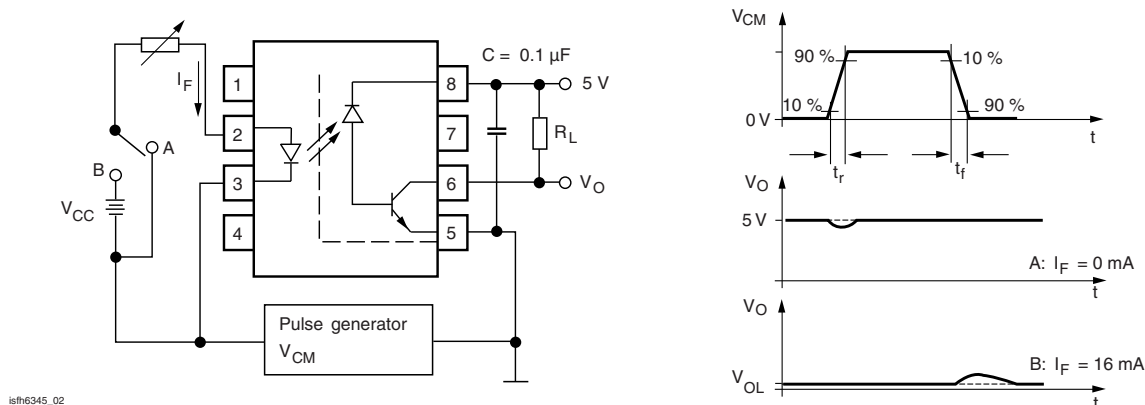


Fig. 2 - Common Mode Transient Immunity

**SAFETY AND INSULATION RATINGS**

| PARAMETER                  | TEST CONDITION | SYMBOL | MIN. | TYP.      | MAX. | UNIT |
|----------------------------|----------------|--------|------|-----------|------|------|
| Climatic classification    | IEC 68 part 1  |        |      | 55/100/21 |      |      |
| Comparative tracking index |                | CTI    | 175  |           | 399  |      |
| $V_{IOTM}$                 |                |        | 8000 |           |      | V    |
| $V_{IORM}$                 |                |        | 890  |           |      | V    |
| $P_{SO}$                   |                |        |      |           | 500  | mW   |
| $I_{SI}$                   |                |        |      |           | 300  | mA   |
| $T_{SI}$                   |                |        |      |           | 175  | °C   |
| Creepage distance          | Standard DIP-8 |        | 7    |           |      | mm   |
| Clearance distance         | Standard DIP-8 |        | 7    |           |      | mm   |
| Creepage distance          | 400 mil DIP-8  |        | 8    |           |      | mm   |
| Clearance distance         | 400 mil DIP-8  |        | 8    |           |      | mm   |

**Note**

- According to DIN EN 60747-5-2 (VDE 0884), 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.

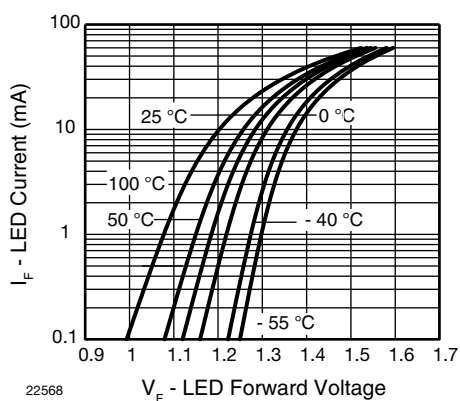
**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ °C}$ , unless otherwise specified)


Fig. 3 - LED Forward Current vs. Forward Voltage

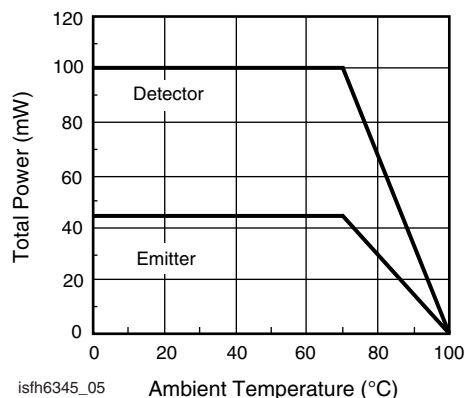


Fig. 5 - Permissible Power Dissipation vs. Temperature

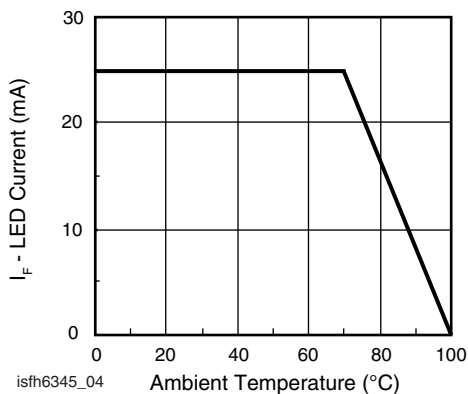


Fig. 4 - Permissible Forward LED Current vs. Temperature

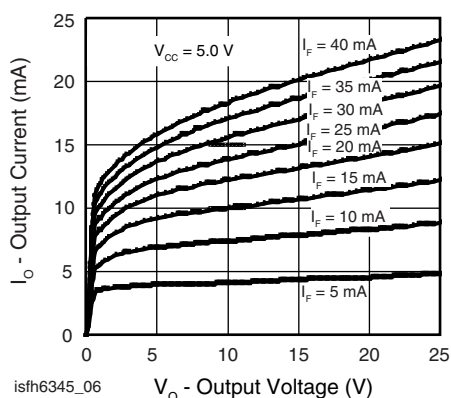


Fig. 6 - Output Current vs. Output Voltage

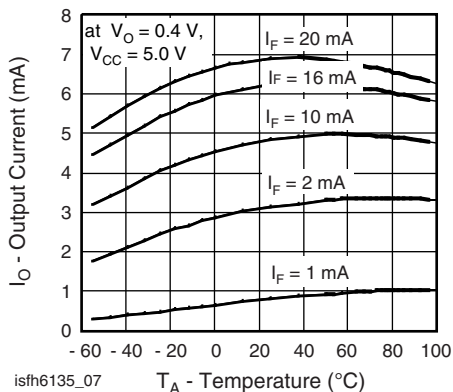


Fig. 7 - Output Current vs. Temperature

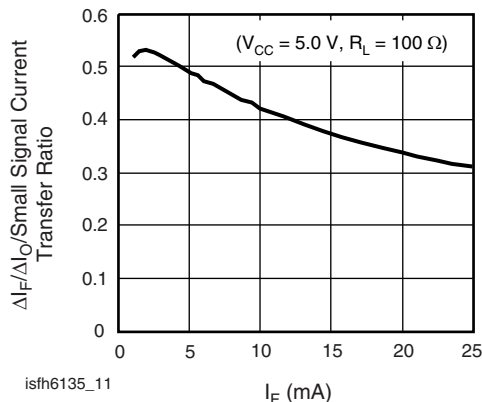


Fig. 10 - Small Signal Current Transfer Ratio vs. Input Current

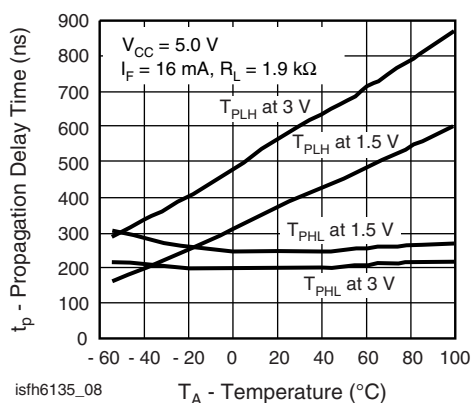


Fig. 8 - Propagation Delay vs. Ambient Temperature

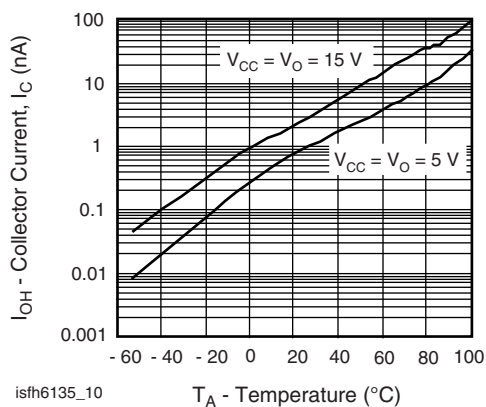
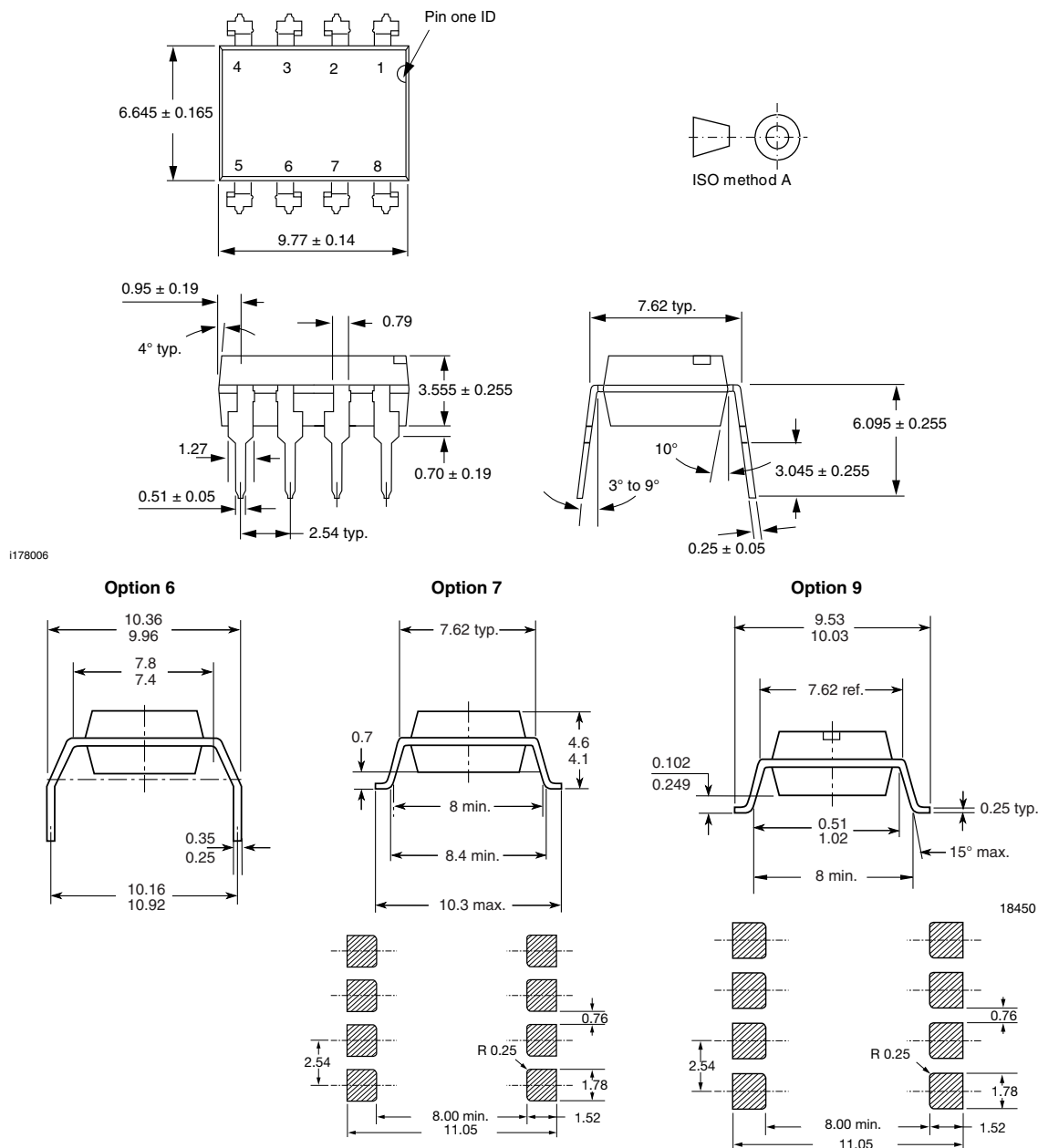
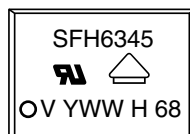


Fig. 9 - Logic High Output Current vs. Temperature

**PACKAGE DIMENSIONS** in millimeters

**PACKAGE MARKING**

**Notes**

- Only options 1, and 7 are reflected in the package marking.
- The VDE logo is only marked on option 1 parts.
- Tape and reel suffix (T) is not part of the package marking.



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Электрон  
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