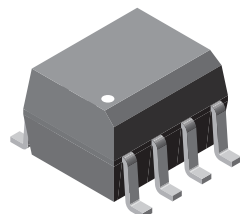
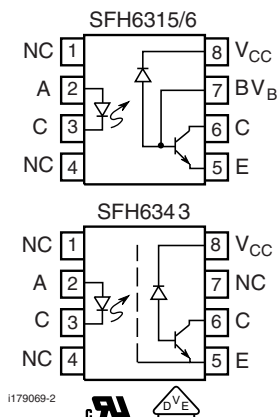




## High Speed Optocoupler, 1 MBd, Transistor Output



i179074

RoHS  
COMPLIANT

## DESCRIPTION

The SFH6315, SFH6316, SFH6343, high speed optocouplers, each consists of a GaAlAs infrared emitting diode, optically coupled with an integrated photo detector and a high speed transistor. The photo detector is junction isolated from the transistor to reduce miller capacitance effects. The open collector output function allows circuit designers to adjust the load conditions when interfacing with different logic systems such as TTL, CMOS, etc.

Because the SFH6343 has a faraday shield on the detector chip, it can also reject and minimize high input to output common mode transient voltages. There is no base connection, further reducing the potential electrical noise entering the package.

The SFH6315, SFH6316, SFH6343 are packaged in industry standard SOIC-8 packages and are suitable for surface mounting.

## FEATURES

- Surface mountable
- Industry standard SOIC-8 footprint
- Compatible with infrared vapor phase reflow and wave soldering processes
- Isolation test voltage, 4000 V<sub>RMS</sub>
- Very high common mode transient immunity: 15000 V/μs at V<sub>CM</sub> = 1500 V guaranteed (SFH6343)
- High speed: 1 MBd
- TTL compatible
- Guaranteed AC and DC performance temperature: 0 °C to 70 °C
- Open collector output
- Pin compatible with agilent (HP) optocouplers
  - SFH6315T - HCPL0500
  - SFH6316T - HCPL0501
  - SFH6343T - HCPL0453
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

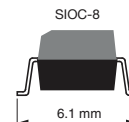
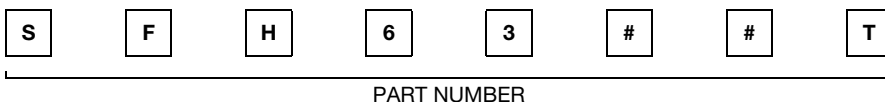
## APPLICATIONS

- Line receivers
- Logic ground isolation
- Analog signal ground isolation
- Replace pulse transformers

## AGENCY APPROVALS

- UL1577, file no. E52744 system code Y
- cUL - file no. E52744, equivalent to CSA bulletin 5A
- DIN EN 60747-5-5 (VDE 0884-5) available with option 1

## ORDERING INFORMATION



| AGENCY CERTIFIED/PACKAGE | CTR (%)                 |                         |                         |
|--------------------------|-------------------------|-------------------------|-------------------------|
| UL, cUL                  | ≥ 5                     | ≥ 15                    | NO BASE CONNECTION      |
| SOIC-8                   | SFH6315T <sup>(1)</sup> | SFH6316T <sup>(1)</sup> | SFH6343T <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                                                                           | $t_p \leq 1\text{ }\mu\text{s}$ , 300 pulses/s                          | $I_{FSM}$  | 1           | A                  |
| Power dissipation                                                                               | $T_{amb} \leq 70\text{ }^{\circ}\text{C}$                               | $P_{diss}$ | 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                                                                               | $T_{amb} \leq 70\text{ }^{\circ}\text{C}$                               | $P_{diss}$ | 100         | mW                 |
| <b>COUPLER</b>                                                                                  |                                                                         |            |             |                    |
| Isolation test voltage between emitter and detector                                             |                                                                         | $V_{ISO}$  | 4000        | $V_{RMS}$          |
| Pollution degree (DIN VDE 0110)                                                                 |                                                                         |            | 2           |                    |
| Comparative tracking index                                                                      | DIN IEC 112/VDE 0303 part 1                                             | CTI        | 175         |                    |
| 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 <sup>(1)</sup>                                                            | max. 10 s, dip soldering distance to seating plane $\geq 1.5\text{ mm}$ |            | 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.

| ELECTRICAL CHARACTERISTICS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                                                                                                       |         |                               |      |       |      |                        |
|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|---------|-------------------------------|------|-------|------|------------------------|
| PARAMETER                                                                                         | TEST CONDITION                                                                                        | PART    | SYMBOL                        | MIN. | TYP.  | MAX. | UNIT                   |
| <b>INPUT</b>                                                                                      |                                                                                                       |         |                               |      |       |      |                        |
| Forward voltage                                                                                   | $I_F = 16\text{ mA}$ , $25\text{ }^{\circ}\text{C}$                                                   |         | $V_F$                         |      | 1.6   | 1.8  | V                      |
|                                                                                                   |                                                                                                       |         | $V_F$                         |      | 1.6   | 1.9  | V                      |
| Reverse current                                                                                   | $V_R = 3\text{ V}$                                                                                    |         | $I_R$                         |      | 0.5   | 10   | $\mu\text{A}$          |
| Capacitance                                                                                       | $f = 1\text{ MHz}$ , $V_F = 0\text{ V}$                                                               |         | $C_{IN}$                      |      | 75    |      | pF                     |
| Temperature coefficient of forward voltage                                                        | $I_F = 16\text{ mA}$                                                                                  |         | $\Delta V_F / \Delta T_{amb}$ |      | -1.7  |      | mW/ $^{\circ}\text{C}$ |
| <b>OUTPUT</b>                                                                                     |                                                                                                       |         |                               |      |       |      |                        |
| Logic low supply current                                                                          | $I_F = 16\text{ mA}$ , $V_O = \text{open}$ , $V_{CC} = 15\text{ V}$                                   |         | $I_{CCL}$                     |      | 200   |      | $\mu\text{A}$          |
| Logic high supply current                                                                         | $I_F = 0\text{ mA}$ , $V_O = \text{open}$ , $V_{CC} = 15\text{ V}$ ; $25\text{ }^{\circ}\text{C}$     |         | $I_{CCH}$                     |      | 0.001 | 1    | $\mu\text{A}$          |
|                                                                                                   |                                                                                                       |         | $I_{CCH}$                     |      | 0.001 | 2    | $\mu\text{A}$          |
| Logic low output voltage                                                                          | $I_F = 16\text{ mA}$ , $V_{CC} = 4.5\text{ V}$ , $I_O = 1.1\text{ mA}$ , $25\text{ }^{\circ}\text{C}$ | SFH6315 | $V_{OL}$                      |      | 0.15  | 0.4  | V                      |
|                                                                                                   | $I_F = 16\text{ mA}$ , $V_{CC} = 4.5\text{ V}$ , $I_O = 0.8\text{ mA}$                                | SFH6315 | $V_{OL}$                      |      | 0.15  | 0.5  | V                      |
|                                                                                                   | $I_F = 16\text{ mA}$ , $V_{CC} = 4.5\text{ V}$ , $I_O = 3\text{ mA}$ , $25\text{ }^{\circ}\text{C}$   | SFH6316 | $V_{OL}$                      |      | 0.15  | 0.4  | V                      |
|                                                                                                   | $I_F = 16\text{ mA}$ , $V_{CC} = 4.5\text{ V}$ , $I_O = 2.4\text{ mA}$                                | SFH6343 | $V_{OL}$                      |      | 0.15  | 0.5  | V                      |
|                                                                                                   | $I_F = 16\text{ mA}$ , $V_{CC} = 4.5\text{ V}$ , $I_O = 2.4\text{ mA}$                                | SFH6316 | $V_{OL}$                      |      | 0.15  | 0.5  | V                      |
|                                                                                                   | $I_F = 16\text{ mA}$ , $V_{CC} = 4.5\text{ V}$ , $I_O = 2.4\text{ mA}$                                | SFH6343 | $V_{OL}$                      |      | 0.15  | 0.5  | V                      |
| Logic high output current                                                                         | $I_F = 0\text{ mA}$ , $V_O = V_{CC} = 5.5\text{ V}$ , $25\text{ }^{\circ}\text{C}$                    |         | $I_{OH}$                      |      | 0.003 | 0.5  | $\mu\text{A}$          |
|                                                                                                   | $I_F = 0\text{ mA}$ , $V_O = V_{CC} = 15\text{ V}$ , $25\text{ }^{\circ}\text{C}$                     |         | $I_{OH}$                      |      | 0.01  | 1    | $\mu\text{A}$          |
|                                                                                                   | $I_F = 0\text{ mA}$ , $V_O = V_{CC} = 15\text{ V}$                                                    |         | $I_{OH}$                      |      |       | 50   | $\mu\text{A}$          |
| <b>COUPLER</b>                                                                                    |                                                                                                       |         |                               |      |       |      |                        |
| Capacitance (input to output) <sup>(1)</sup>                                                      | $f = 1\text{ MHz}$                                                                                    |         | $C_{IO}$                      |      | 0.4   |      | pF                     |

**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> A 0.1  $\mu\text{F}$  bypass capacitor connected between pins 5 and 8 is recommended.

| CURRENT TRANSFER RATIO |                                                                                                |         |        |      |      |      |      |
|------------------------|------------------------------------------------------------------------------------------------|---------|--------|------|------|------|------|
| PARAMETER              | TEST CONDITION                                                                                 | PART    | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| Current transfer ratio | $V_O = 0.4 \text{ V}$ , $I_F = 16 \text{ mA}$ , $V_{CC} = 4.5 \text{ V}$ , $25^\circ \text{C}$ | SFH6315 | CTR    | 7    | 16   | 50   | %    |
|                        | $V_O = 0.5 \text{ V}$ , $I_F = 16 \text{ mA}$ , $V_{CC} = 4.5 \text{ V}$                       | SFH6315 | CTR    | 5    | 17   |      | %    |
|                        | $V_O = 0.4 \text{ V}$ , $I_F = 16 \text{ mA}$ , $V_{CC} = 4.5 \text{ V}$ , $25^\circ \text{C}$ | SFH6316 | CTR    | 19   | 35   | 50   | %    |
|                        | $V_O = 0.4 \text{ V}$ , $I_F = 16 \text{ mA}$ , $V_{CC} = 4.5 \text{ V}$ , $25^\circ \text{C}$ | SFH6343 | CTR    | 19   | 35   | 50   | %    |
|                        | $V_O = 0.5 \text{ V}$ , $I_F = 16 \text{ mA}$ , $V_{CC} = 4.5 \text{ V}$                       | SFH6343 | CTR    | 15   | 36   |      | %    |
|                        | $V_O = 0.5 \text{ V}$ , $I_F = 16 \text{ mA}$ , $V_{CC} = 4.5 \text{ V}$                       | SFH6316 | CTR    | 15   | 36   |      | %    |

**Note**

- Current transfer ratio in percent equals the ratio of output collector current ( $I_O$ ) to the forward LED input current ( $I_F$ ) times 100. A 0.1  $\mu\text{F}$  bypass capacitor connected between pins 5 and 8 is recommended.

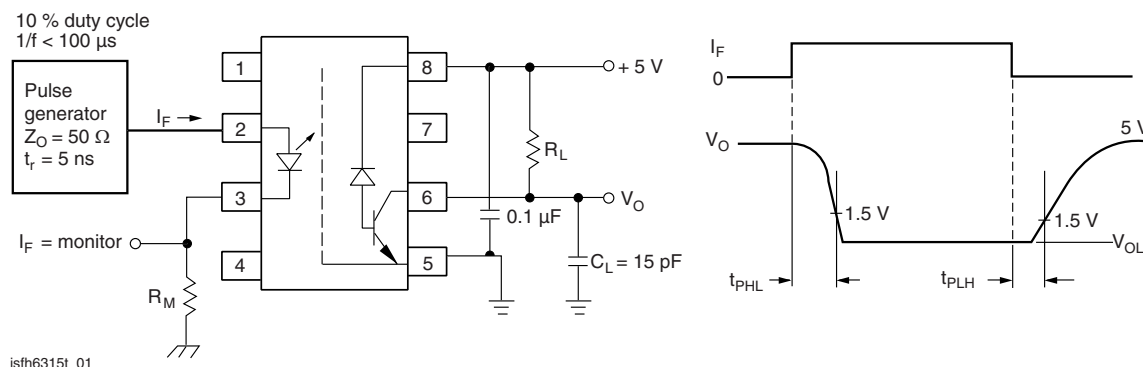


Fig. 1 - Test Circuit for Switching Times

| SWITCHING CHARACTERISTICS                                   |                             |         |                 |      |      |      |               |
|-------------------------------------------------------------|-----------------------------|---------|-----------------|------|------|------|---------------|
| PARAMETER                                                   | TEST CONDITION              | PART    | SYMBOL          | MIN. | TYP. | MAX. | UNIT          |
| Propagation delay time to logic low at output (see fig. 1)  | $R_L = 4.1 \text{ K}\Omega$ | SFH6315 | $t_{PHL}^{(1)}$ |      | 0.5  | 1.5  | $\mu\text{s}$ |
|                                                             |                             | SFH6315 | $t_{PHL}$       |      | 0.5  | 2    | $\mu\text{s}$ |
|                                                             | $R_L = 1.9 \text{ K}\Omega$ | SFH6316 | $t_{PHL}$       |      | 0.25 | 0.8  | $\mu\text{s}$ |
|                                                             |                             | SFH6343 | $t_{PHL}$       |      | 0.25 | 1    | $\mu\text{s}$ |
| Propagation delay time to logic high at output (see fig. 1) | $R_L = 4.1 \text{ K}\Omega$ | SFH6315 | $t_{PLH}^{(1)}$ |      | 0.5  | 1.5  | $\mu\text{s}$ |
|                                                             |                             | SFH6315 | $t_{PLH}$       |      | 0.5  | 2    | $\mu\text{s}$ |
|                                                             | $R_L = 1.9 \text{ K}\Omega$ | SFH6316 | $t_{PLH}$       |      | 0.5  | 0.8  | $\mu\text{s}$ |
|                                                             |                             | SFH6343 | $t_{PLH}$       |      | 0.5  | 1    | $\mu\text{s}$ |

**Notes**

- Over recommended temperature ( $T_{amb} = 0^\circ \text{C}$  to  $70^\circ \text{C}$ ),  $V_{CC} = 5 \text{ V}$ ,  $I_F = 16 \text{ mA}$  unless otherwise specified. The 1.9 kW load represents 1 TTL unit load of 1.6 mA and the 5.6 kW pull-up resistor. The 4.1 kW load represents 1 LSTTL unit load of 0.36 mA and the 6.1 kW pull-up resistor.

<sup>(1)</sup>  $T_{amb} = 25^\circ \text{C}$ , unless otherwise specified.

## COMMON MODE TRANSIENT IMMUNITY

| PARAMETER                                                              | TEST CONDITION                                                                        | PART    | SYMBOL   | MIN. | TYP. | MAX. | UNIT        |
|------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------|----------|------|------|------|-------------|
| Common mode transient immunity at logic high level output (see fig. 2) | $R_L = 4.1\text{ k}\Omega$ , $I_F = 0\text{ mA}$ ,<br>$V_{CM} = 10\text{ V}_{P-P}$    | SFH6315 | $ CM_H $ |      | 1    |      | kV/ $\mu$ s |
|                                                                        | $R_L = 1.9\text{ k}\Omega$ , $I_F = 0\text{ mA}$ ,<br>$V_{CM} = 1500\text{ V}_{P-P}$  | SFH6316 | $ CM_H $ |      | 1    |      | kV/ $\mu$ s |
|                                                                        |                                                                                       | SFH6343 | $ CM_H $ | 15   | 30   |      | kV/ $\mu$ s |
| Common mode transient immunity at logic low level output (see fig. 2)  | $R_L = 4.1\text{ k}\Omega$ , $I_F = 16\text{ mA}$ ,<br>$V_{CM} = 10\text{ V}_{P-P}$   | SFH6315 | $ CM_L $ |      | 1    |      | kV/ $\mu$ s |
|                                                                        | $R_L = 1.9\text{ k}\Omega$ , $I_F = 16\text{ mA}$ ,<br>$V_{CM} = 10\text{ V}_{P-P}$   | SFH6316 | $ CM_L $ |      | 1    |      | kV/ $\mu$ s |
|                                                                        | $R_L = 1.9\text{ k}\Omega$ , $I_F = 16\text{ mA}$ ,<br>$V_{CM} = 1500\text{ V}_{P-P}$ | SFH6343 | $ CM_L $ | 15   | 30   |      | kV/ $\mu$ s |

### Note

- Common mode transient immunity in a logic high level is the maximum tolerable (positive)  $dV_{CM}/dt$  on the leading edge of the common mode pulse ( $V_{CM}$ ) to assure that the output will remain in a logic high state (i.e.,  $V_O > 2$  V). Common mode transient immunity in a logic low level is the maximum tolerable (negative)  $dV_{CM}/dt$  on the trailing edge of the common mode pulse signal ( $V_{CM}$ ) to assure that the output will remain in logic low state, i.e.,  $V_O > 0.8$  V).

The 1.9 k $\Omega$  load represents 1 TTL unit load of 1.6 mA and the 5.6 k $\Omega$  pull-up resistor.

The 4.1 k $\Omega$  load represents 1 LSTTL unit load of 0.36 mA and the 6.1 k $\Omega$  pull-up resistor.

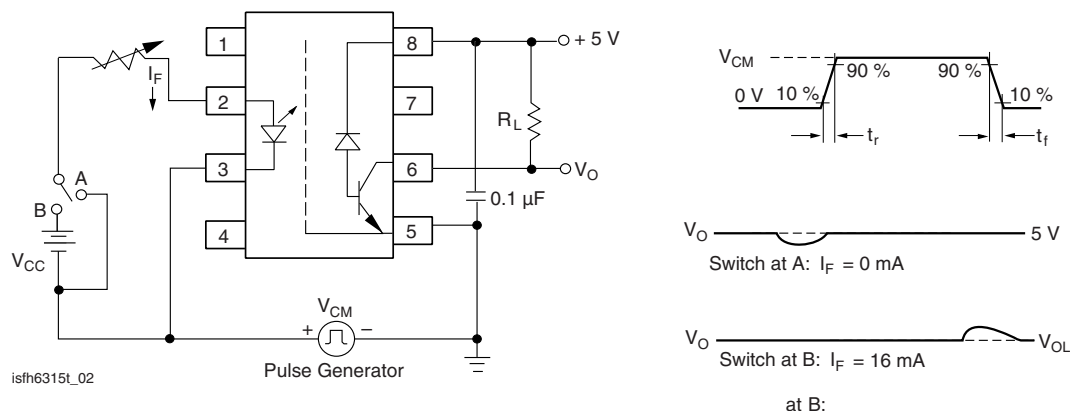


Fig. 2 - Test Circuit for Transient Immunity and Typical Waveforms

## 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  |      |
| Maximum transient isolation voltage       |                                                                                      | V <sub>IOTM</sub> | 6000               |           |      | V    |
| Maximum repetitive peak isolation voltage |                                                                                      | V <sub>IORM</sub> | 560                |           |      | V    |
| Output safety power                       |                                                                                      | P <sub>SO</sub>   |                    |           | 350  | mW   |
| Input safety current                      |                                                                                      | I <sub>SI</sub>   |                    |           | 150  | mA   |
| Input safety temperature                  |                                                                                      | T <sub>SI</sub>   |                    |           | 165  | °C   |
| Creepage distance                         |                                                                                      |                   | ≥ 4                |           |      | mm   |
| Clearance distance                        |                                                                                      |                   | ≥ 4                |           |      | mm   |
| Insulation resistance                     | V <sub>IO</sub> = 500 V, T <sub>amb</sub> = 25 °C, R <sub>ISOL</sub> <sup>(1)</sup>  | R <sub>IO</sub>   | ≥ 10 <sup>12</sup> |           |      | Ω    |
|                                           | V <sub>IO</sub> = 500 V, T <sub>amb</sub> = 100 °C, R <sub>ISOL</sub> <sup>(1)</sup> | R <sub>IO</sub>   | ≥ 10 <sup>11</sup> |           |      | Ω    |
| Insulation thickness                      |                                                                                      |                   | 0.2                |           |      | mm   |

## Notes

- As per IEC 60747-5-5, §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.
- (1) Device considered a two-terminal device: pins 1, 2, 3, and 4 shorted together and pins 5, 6, 7, and 8 shorted together.

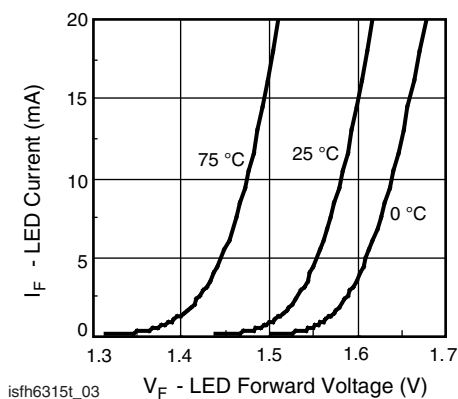
**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)


Fig. 3 - LED Forward Current vs. Forward Voltage

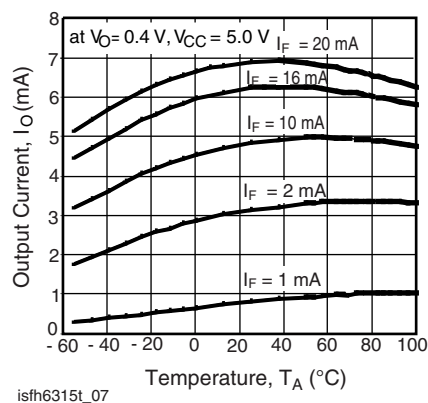


Fig. 6 - Output Current vs. Temperature

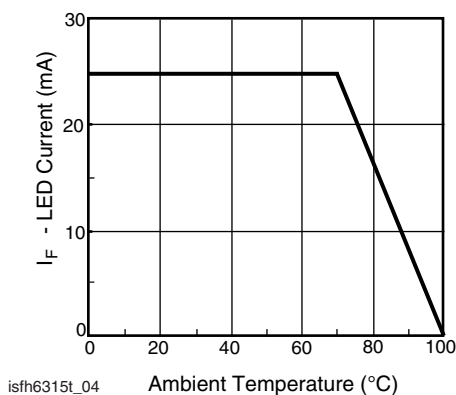


Fig. 4 - Permissible Forward LED Current vs. Temperature

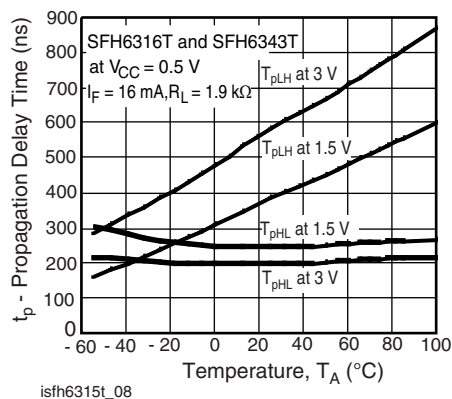


Fig. 7 - Propagation Delay vs. Temperature SFH6316T and SFH6343T

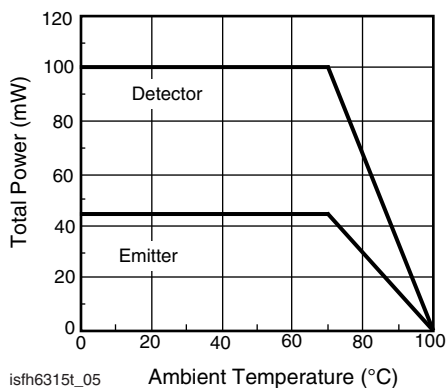


Fig. 5 - Permissible Power Dissipation vs. Temperature

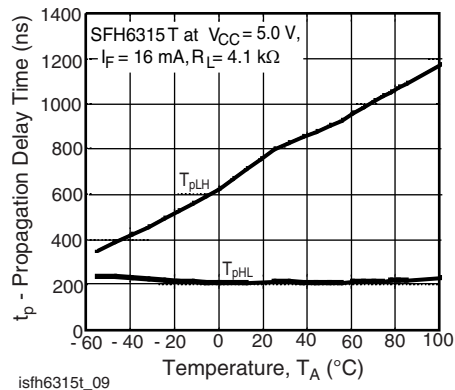


Fig. 8 - Propagation Delay vs. Temperature SFH6315T

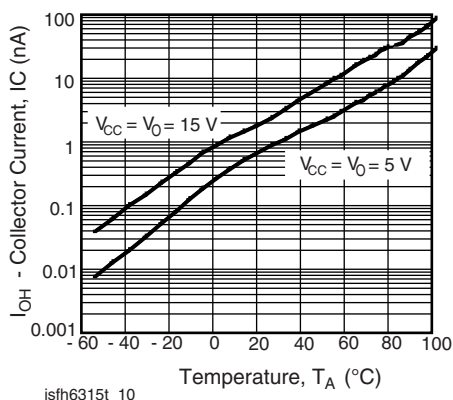


Fig. 9 - Logic High Output Current vs. Temperature

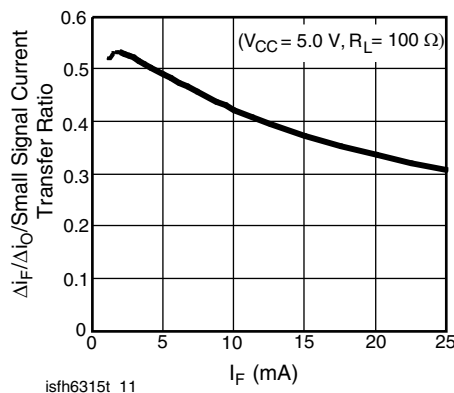
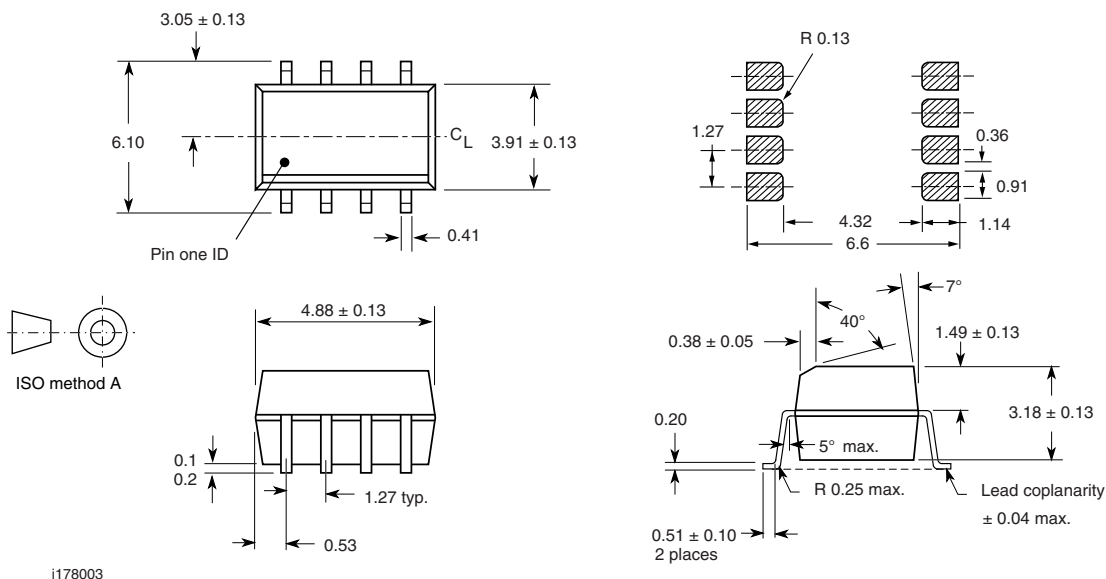
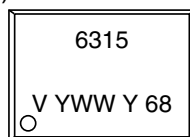


Fig. 10 - Small Signal Current Transfer Ratio vs. Input Current

### PACKAGE DIMENSIONS in millimeters



### PACKAGE MARKING (Example of SFH6315T)



#### Note

- Tape and reel suffix (T) is not part of the package marking.



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