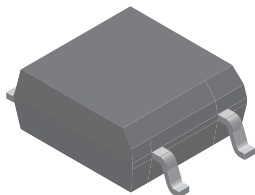
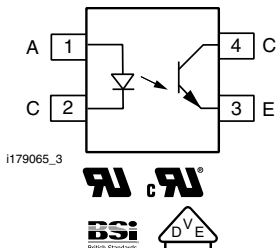




## Optocoupler Phototransistor Output, SOP-4, 100 mil Pitch, Mini-Flat Package



1179066



### FEATURES

- SOP (small outline package)
- Isolation test voltage, 3750 V<sub>RMS</sub> (1 s)
- High collector emitter breakdown voltage, V<sub>CEO</sub> = 70 V
- Low saturation voltage
- Fast switching times
- Temperature stable
- Low coupling capacitance
- End-stackable, 0.100" (2.54 mm) spacing
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



### DESCRIPTION

The SFH690ABT, SFH690AT, SFH690BT, SFH690CT, SFH690DT family has a GaAs infrared emitting diode emitter, which is optically coupled to a silicon planar phototransistor detector, and is incorporated in a 4 pin 100 mil lead pitch miniflat package. It features a high current transfer ratio, low coupling capacitance, and high isolation voltage.

The coupling devices are designed for signal transmission between two electrically separated circuits. The SFH690 series is available only on tape and reel. There are 2000 parts per reel. Marking for SFH690AT is 690A; SFH690BT is 690B; SFH690CT is 690C; SFH690DT is 690D; SFH690ABT will be marked as 690A or 690B.

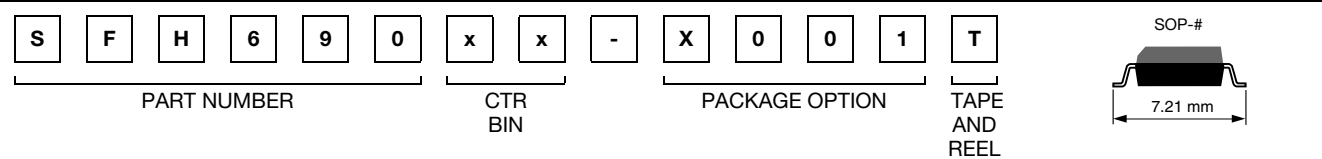
### APPLICATIONS

- High density mounting or space sensitive PCBs
- PLCs
- Telecommunication

### AGENCY APPROVALS

- UL1577, file no. E52744 system code U
- cUL tested to CSA 22.2 bulletin 5A
- BSI IEC 60950; IEC 60065
- DIN EN 60747-5-2 (VDE 0884) available with option 1

### ORDERING INFORMATION



| AGENCY CERTIFIED/PACKAGE | CTR (%)   |                                                   |                                                   |               |               |
|--------------------------|-----------|---------------------------------------------------|---------------------------------------------------|---------------|---------------|
| UL, cUL, BSI             | 50 to 300 | 50 to 150                                         | 100 to 300                                        | 100 to 200    | 200 to 400    |
| SOP-4, 100 mil pitch     | SFH690ABT | SFH690AT <sup>(1)</sup> , SFH690AT <sup>(2)</sup> | SFH690BT <sup>(1)</sup> , SFH690BT <sup>(2)</sup> | SFH690CT      | SFH690DT      |
| VDE, UL, cUL, BSI        | 50 to 300 | 50 to 150                                         | 100 to 300                                        | 100 to 200    | 200 to 400    |
| SOP-4, 100 mil pitch     | -         | -                                                 | SFH690B-X001T                                     | SFH690C-X001T | SFH690D-X001T |

### Notes

- (1) Product is rotated 180° in tape and reel cavity
- (2) Also available in tubes, do not put "T" to the end



| <b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                                                                        |            |                |                    |
|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|------------|----------------|--------------------|
| PARAMETER                                                                                              | TEST CONDITION                                                         | SYMBOL     | VALUE          | UNIT               |
| <b>INPUT</b>                                                                                           |                                                                        |            |                |                    |
| Reverse voltage                                                                                        |                                                                        | $V_R$      | 6              | V                  |
| DC forward current                                                                                     |                                                                        | $I_F$      | 50             | mA                 |
| Surge forward current                                                                                  | $t_p \leq 10\text{ }\mu\text{s}$                                       | $I_{FSM}$  | 2.5            | A                  |
| Power dissipation                                                                                      |                                                                        | $P_{diss}$ | 80             | mW                 |
| <b>OUTPUT</b>                                                                                          |                                                                        |            |                |                    |
| Collector emitter voltage                                                                              |                                                                        | $V_{CEO}$  | 70             | V                  |
| Emitter collector voltage                                                                              |                                                                        | $V_{ECO}$  | 7              | V                  |
| Collector current                                                                                      |                                                                        | $I_C$      | 50             | mA                 |
|                                                                                                        | $t_p \leq 1\text{ ms}$                                                 | $I_C$      | 100            | mA                 |
| Power dissipation                                                                                      |                                                                        | $P_{diss}$ | 150            | mW                 |
| <b>COUPLER</b>                                                                                         |                                                                        |            |                |                    |
| Isolation test voltage between emitter and detector (1 s)                                              |                                                                        | $V_{ISO}$  | 3750           | $V_{RMS}$          |
| 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 + 100  | $^{\circ}\text{C}$ |
| Soldering temperature <sup>(1)</sup>                                                                   | 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.
- <sup>(3)</sup> Refer to reflow profile for soldering conditions for surface mounted devices.

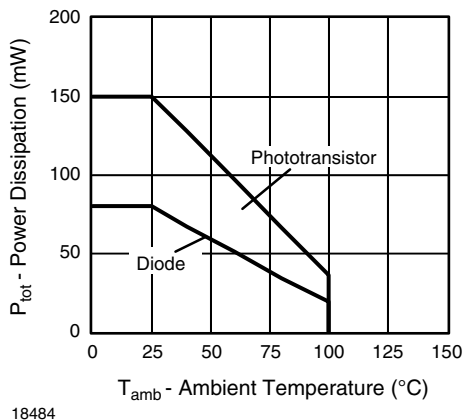


Fig. 1 - Permissible Power Dissipation vs. Ambient Temperature



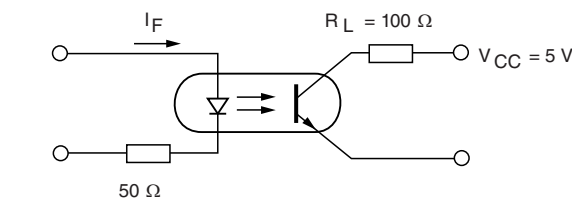
| <b>ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                                         |             |      |      |      |               |
|----------------------------------------------------------------------------------------------------------|-----------------------------------------|-------------|------|------|------|---------------|
| PARAMETER                                                                                                | TEST CONDITION                          | SYMBOL      | MIN. | TYP. | MAX. | UNIT          |
| <b>INPUT</b>                                                                                             |                                         |             |      |      |      |               |
| Forward voltage                                                                                          | $I_F = 5\text{ mA}$                     | $V_F$       |      | 1.15 | 1.4  | V             |
| Reverse current                                                                                          | $V_R = 6\text{ V}$                      | $I_R$       |      | 0.01 | 10   | $\mu\text{A}$ |
| Capacitance                                                                                              | $V_R = 0\text{ V}, f = 1\text{ MHz}$    | $C_O$       |      | 14   |      | pF            |
| Thermal resistance                                                                                       |                                         | $R_{thJA}$  |      | 750  |      | K/W           |
| <b>OUTPUT</b>                                                                                            |                                         |             |      |      |      |               |
| Collector emitter leakage current                                                                        | $V_{CE} = 20\text{ V}$                  | $I_{CEO}$   |      |      | 100  | nA            |
| Collector emitter capacitance                                                                            | $V_{CE} = 5\text{ V}, f = 1\text{ MHz}$ | $C_{CE}$    |      | 2.8  |      | pF            |
| Thermal resistance                                                                                       |                                         | $R_{thJA}$  |      | 500  |      | K/W           |
| <b>COUPLER</b>                                                                                           |                                         |             |      |      |      |               |
| Collector emitter saturation voltage                                                                     | $I_F = 10\text{ mA}, I_C = 2\text{ mA}$ | $V_{CEsat}$ |      | 0.1  | 0.3  | V             |
| Coupling capacitance                                                                                     | $f = 1\text{ MHz}$                      | $C_C$       |      | 0.3  |      | 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.

| <b>CURRENT TRANSFER RATIO</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                                          |           |        |      |      |      |      |
|------------------------------------------------------------------------------------------------------|------------------------------------------|-----------|--------|------|------|------|------|
| PARAMETER                                                                                            | TEST CONDITION                           | PART      | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| $I_C/I_F$                                                                                            | $I_F = 5\text{ mA}, V_{CE} = 5\text{ V}$ | SFH690ABT | CTR    | 50   |      | 300  | %    |
|                                                                                                      |                                          | SFH690AT  | CTR    | 50   |      | 150  | %    |
|                                                                                                      |                                          | SFH690BT  | CTR    | 100  |      | 300  | %    |
|                                                                                                      |                                          | SFH690CT  | CTR    | 100  |      | 200  | %    |
|                                                                                                      |                                          | SFH690DT  | CTR    | 200  |      | 400  | %    |

| <b>SWITCHING CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                                                             |           |      |      |      |               |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|-----------|------|------|------|---------------|
| PARAMETER                                                                                               | TEST CONDITION                                              | SYMBOL    | MIN. | TYP. | MAX. | UNIT          |
| Rise time                                                                                               | $I_C = 2\text{ mA}, V_{CC} = 5\text{ V}, R_L = 100\ \Omega$ | $t_r$     |      | 3    |      | $\mu\text{s}$ |
| Fall time                                                                                               | $I_C = 2\text{ mA}, V_{CC} = 5\text{ V}, R_L = 100\ \Omega$ | $t_f$     |      | 4    |      | $\mu\text{s}$ |
| Turn-on time                                                                                            | $I_C = 2\text{ mA}, V_{CC} = 5\text{ V}, R_L = 100\ \Omega$ | $t_{on}$  |      | 5    |      | $\mu\text{s}$ |
| Turn-off time                                                                                           | $I_C = 2\text{ mA}, V_{CC} = 5\text{ V}, R_L = 100\ \Omega$ | $t_{off}$ |      | 3    |      | $\mu\text{s}$ |



isfh690at\_01

Fig. 2 - Switching Operation (without 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  |      |
| $V_{IOTM}$                                           |                |        | 6000 |           |      | V    |
| $V_{IORM}$                                           |                |        | 707  |           |      | V    |
| $P_{SO}$                                             |                |        |      |           | 350  | mW   |
| $I_{SI}$                                             |                |        |      |           | 150  | mA   |
| $T_{SI}$                                             |                |        |      |           | 175  | °C   |
| Creepage distance                                    |                |        | 5    |           |      | mm   |
| Clearance distance                                   |                |        | 5    |           |      | mm   |
| Insulation thickness                                 |                |        | 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)

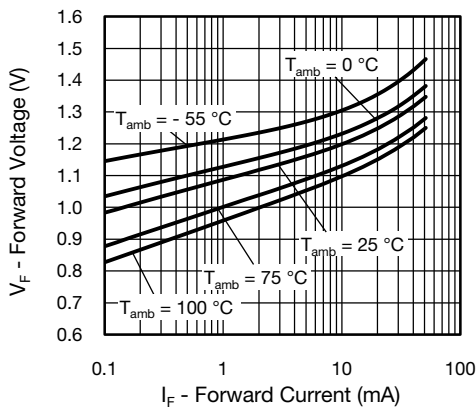


Fig. 3 - Forward Voltage vs. Forward Current

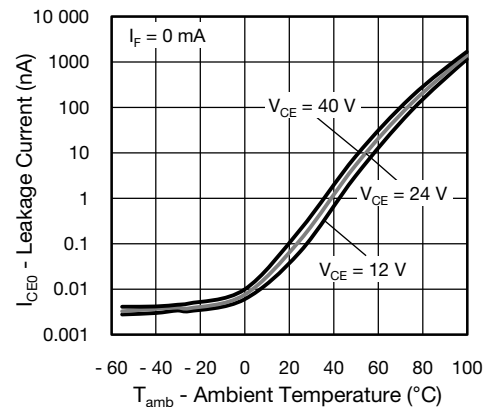


Fig. 5 - Leakage Current vs. Ambient Temperature

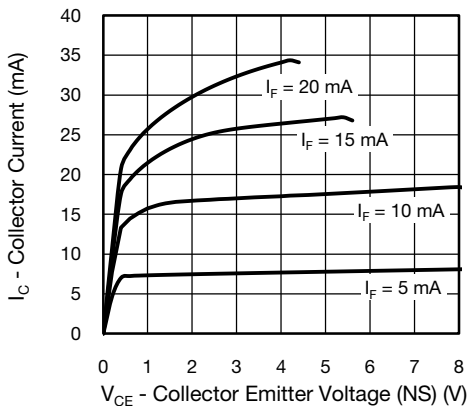


Fig. 4 - Collector Current vs. Collector Emitter Voltage (NS)

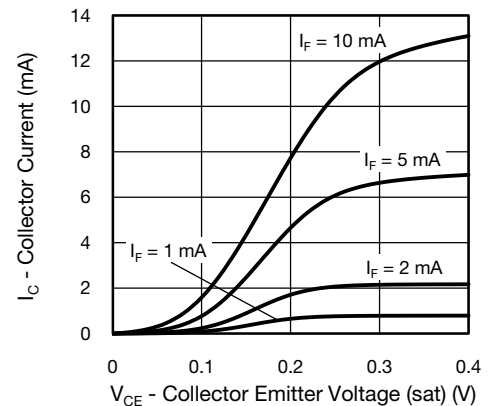


Fig. 6 - Collector Current vs. Collector Emitter Voltage (sat)

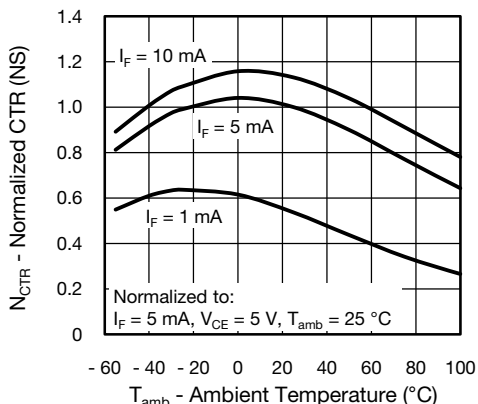


Fig. 7 - Normalized Current Transfer Ratio (sat) vs. Ambient Temperature

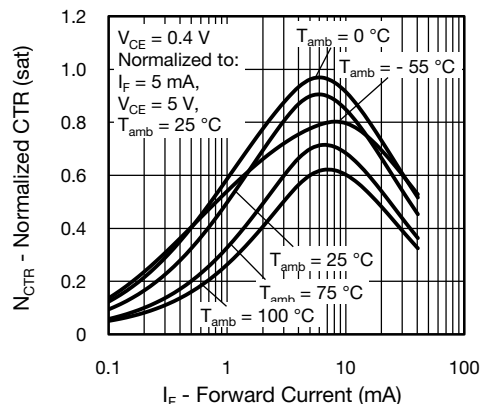


Fig. 10 - Normalized CTR (sat) vs. Forward Current

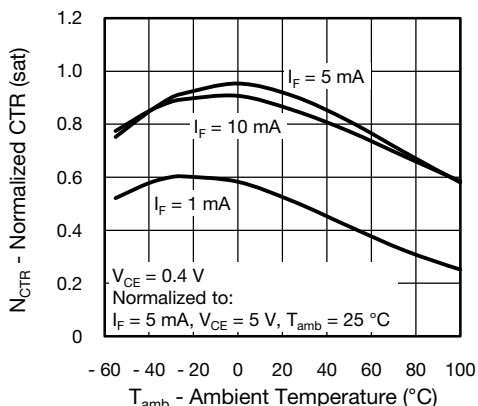


Fig. 8 - Normalized Current Transfer Ratio (NS) vs. Ambient Temperature

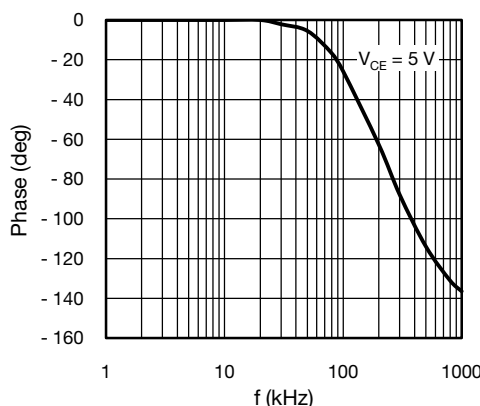


Fig. 11 -  $F_{CTR}$  vs. Phase Angle

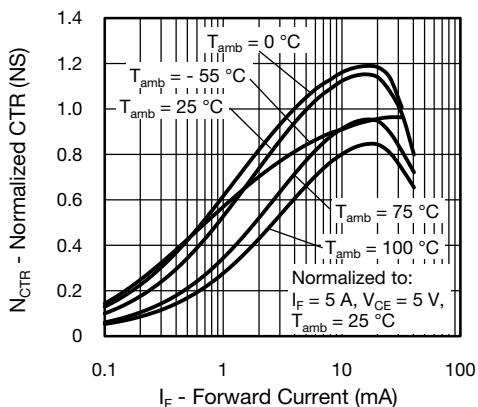


Fig. 9 - Normalized CTR (NS) vs. Forward Current

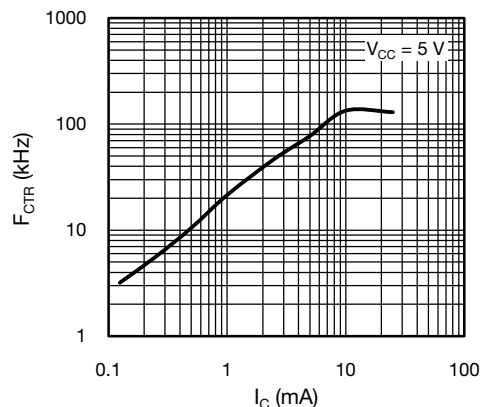


Fig. 12 -  $F_{CTR}$  vs. Collector Current

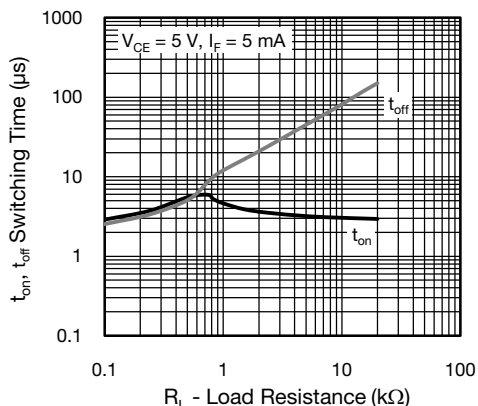
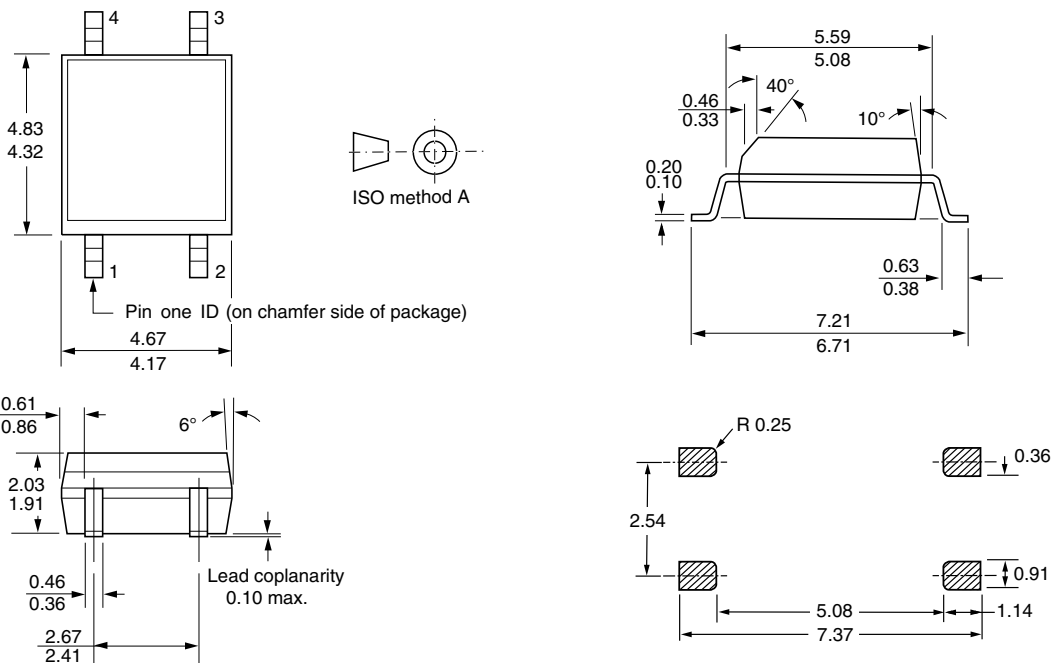


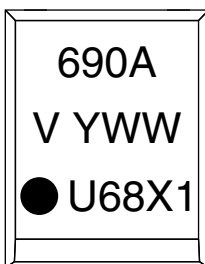
Fig. 13 - Switching Time vs. Load Resistance

**PACKAGE DIMENSIONS** in millimeters



i178037

**PACKAGE MARKING** (example of SFH690AT)



**Notes**

- Only option 1 is reflected in the package marking with the characters "X1"
- Tape and reel suffix (T) is not part of the package marking



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