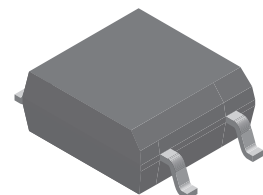
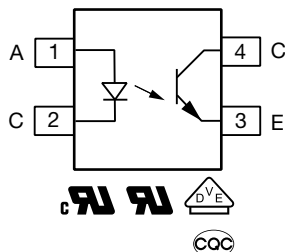




## Optocoupler Phototransistor Output, SOP-4, 100 mil Pitch, Mini-Flat Package



i179066



### 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)



### LINKS TO ADDITIONAL RESOURCES


[Product Page](#)

### 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

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

### ORDERING INFORMATION

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PART NUMBER

CTR BIN

PACKAGE OPTION

TAPE AND REEL

SOP-4

| AGENCY CERTIFIED / PACKAGE               | CTR (%)   |                                        |                                        |               |               |
|------------------------------------------|-----------|----------------------------------------|----------------------------------------|---------------|---------------|
| UL, cUL, BSI, FIMKO, CQC                 | 50 to 300 | 50 to 150                              | 100 to 300                             | 100 to 200    | 200 to 400    |
| SOP-4, 100 mil pitch                     | SFH690ABT | SFH690AT3 <sup>(1)</sup> ,<br>SFH690AT | SFH690BT3 <sup>(1)</sup> ,<br>SFH690BT | SFH690CT      | SFH690DT      |
| UL, cUL, BSI, FIMKO, CQC, VDE (option 1) | 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 |

#### Note

<sup>(1)</sup> Product is rotated 180° in tape and reel cavity



| ABSOLUTE MAXIMUM RATINGS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                                                                        |            |                |                    |
|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|------------|----------------|--------------------|
| PARAMETER                                                                                       | TEST CONDITION                                                         | SYMBOL     | VALUE          | UNIT               |
| <b>INPUT</b>                                                                                    |                                                                        |            |                |                    |
| Reverse voltage                                                                                 |                                                                        | $V_R$      | 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 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>(1)</sup> Refer to reflow profile for soldering conditions for surface mounted devices.

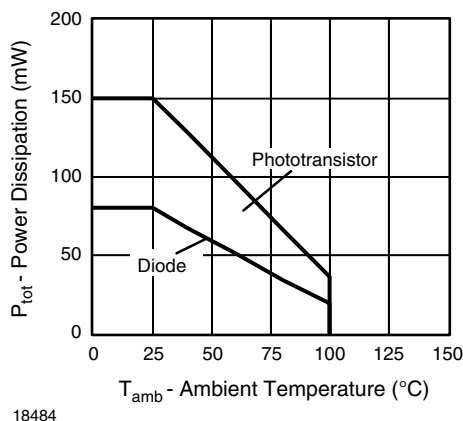


Fig. 1 - Permissible Power Dissipation vs. Ambient Temperature



| ELECTRICAL CHARACTERISTICS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                                            |             |      |      |      |               |
|---------------------------------------------------------------------------------------------------|--------------------------------------------|-------------|------|------|------|---------------|
| PARAMETER                                                                                         | TEST CONDITION                             | SYMBOL      | MIN. | TYP. | MAX. | UNIT          |
| INPUT                                                                                             |                                            |             |      |      |      |               |
| Forward voltage                                                                                   | $I_F = 5\text{ mA}$                        | $V_F$       | -    | 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           |
| OUTPUT                                                                                            |                                            |             |      |      |      |               |
| 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           |
| COUPLER                                                                                           |                                            |             |      |      |      |               |
| 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.

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

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

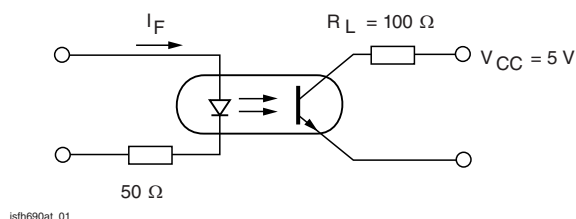


Fig. 2 - Switching Operation (without saturation)

| SAFETY AND INSULATION RATINGS                           |                                                  |            |                |            |
|---------------------------------------------------------|--------------------------------------------------|------------|----------------|------------|
| PARAMETER                                               | CONDITION                                        | SYMBOL     | VALUE          | UNIT       |
| Climatic classification                                 | According to IEC 68 part 1                       |            | 55 / 100 / 21  |            |
| Partial discharge test voltage - lot test (sample test) | $t_{Tr} = 60$ s, $t_{test} = 10$ s, (see Fig. 2) | $V_{IOTM}$ | 6000           | $V_{peak}$ |
| Isolation test voltage (RMS)                            |                                                  | $V_{ISO}$  | 3750           | $V_{RMS}$  |
| Isolation resistance                                    | $V_{IO} = 500$ V, $T_{amb} = 25$ °C              | $R_{IO}$   | $\geq 10^{12}$ | $\Omega$   |
|                                                         | $V_{IO} = 500$ V, $T_{amb} = 100$ °C             | $R_{IO}$   | $\geq 10^{11}$ | $\Omega$   |
| Forward current                                         |                                                  | $I_{si}$   | 150            | mA         |
| Power dissipation                                       |                                                  | $P_{so}$   | 350            | mW         |
| Safety temperature                                      |                                                  | $T_{si}$   | 175            | °C         |
| Comparative tracking index                              |                                                  | CTI        | 175            |            |
| Clearance distance                                      |                                                  |            | 5.0            | mm         |
| Creepage distance                                       |                                                  |            | 5.0            | mm         |
| Insulation distance (internal)                          |                                                  |            | 0.4            | mm         |

## Note

- According to DIN EN 60747-5-2 (VDE 0884) (see fig. 2). This optocoupler is suitable for safe electrical isolation only within the safety ratings. Compliance with the safety ratings shall be ensured by means of suitable protective circuits.

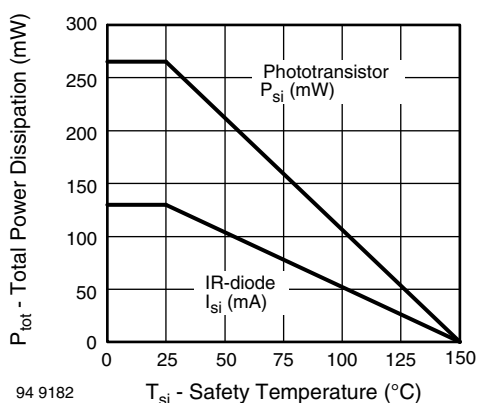


Fig. 3 - Derating Diagram

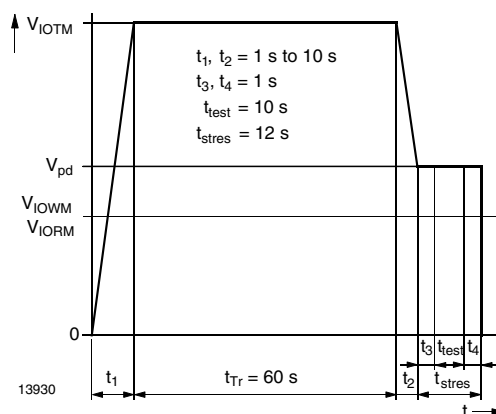


Fig. 4 - Test Pulse Diagram for Sample Test according to DIN EN 60747-5-2 (VDE 0884); IEC60747-5-5



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

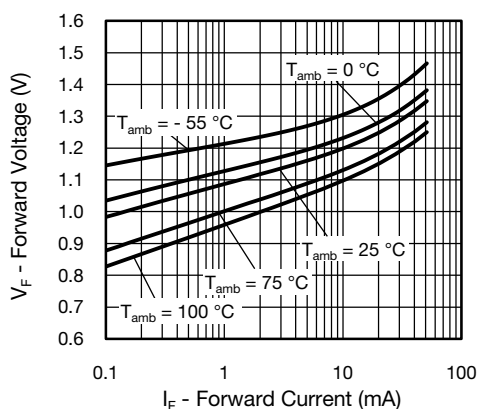


Fig. 5 - Forward Voltage vs. Forward Current

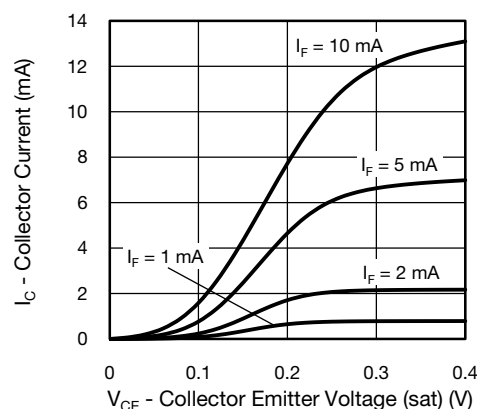


Fig. 8 - Collector Current vs. Collector Emitter Voltage (saturated)

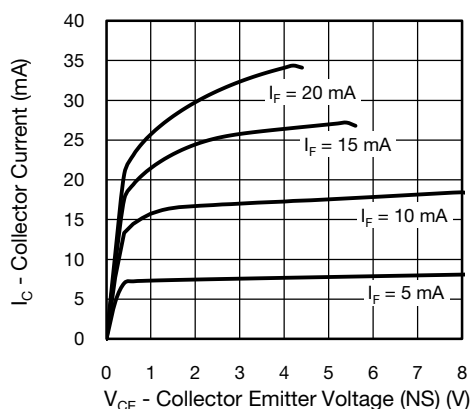


Fig. 6 - Collector Current vs. Collector Emitter Voltage (non-saturated)

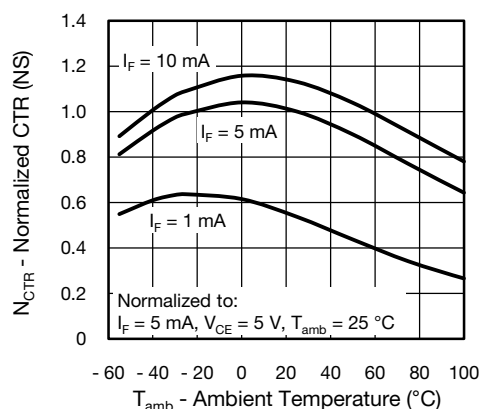


Fig. 9 - Normalized Current Transfer Ratio vs. Ambient Temperature

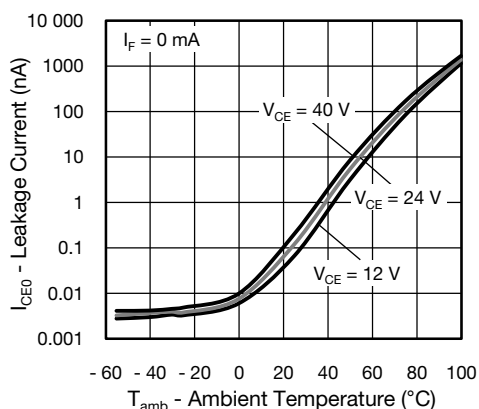


Fig. 7 - Leakage Current vs. Ambient Temperature

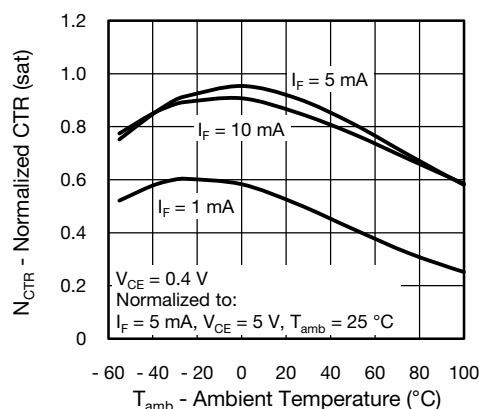


Fig. 10 - Normalized Current Transfer Ratio (saturated) vs. Ambient Temperature

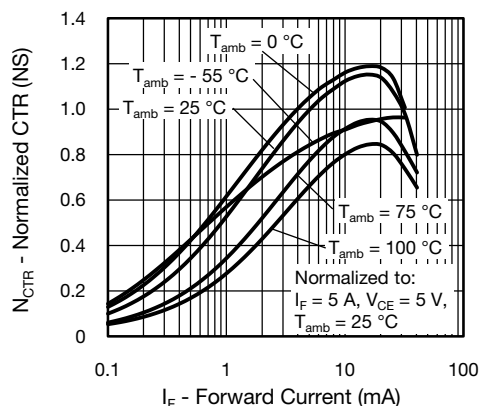


Fig. 11 - Normalized CTR (non-saturated) vs. Forward Current

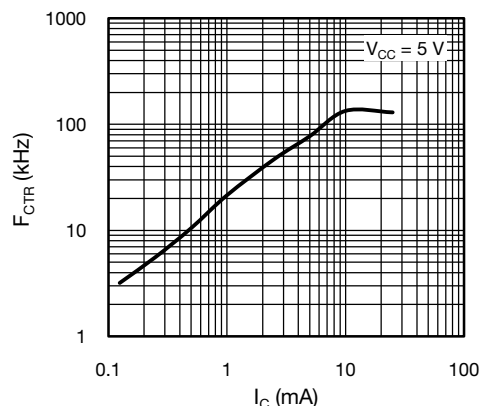
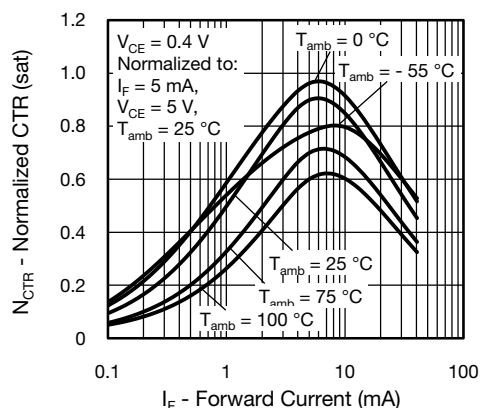

Fig. 14 -  $F_{CTR}$  vs. Collector Current


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

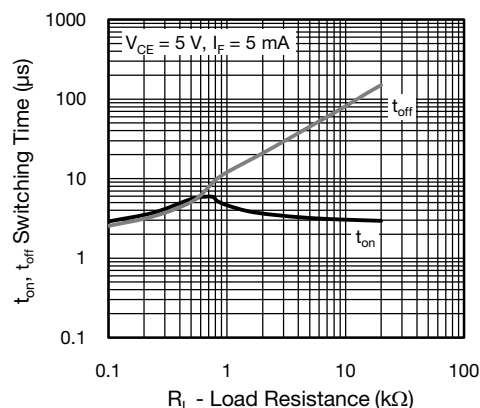
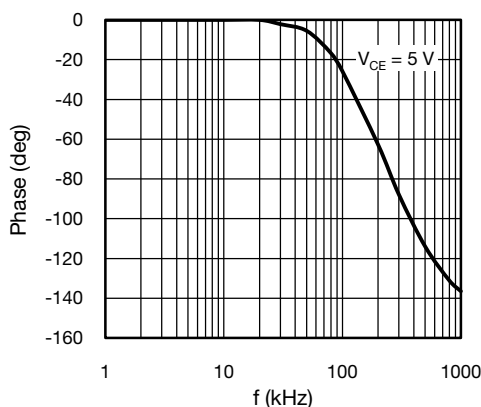
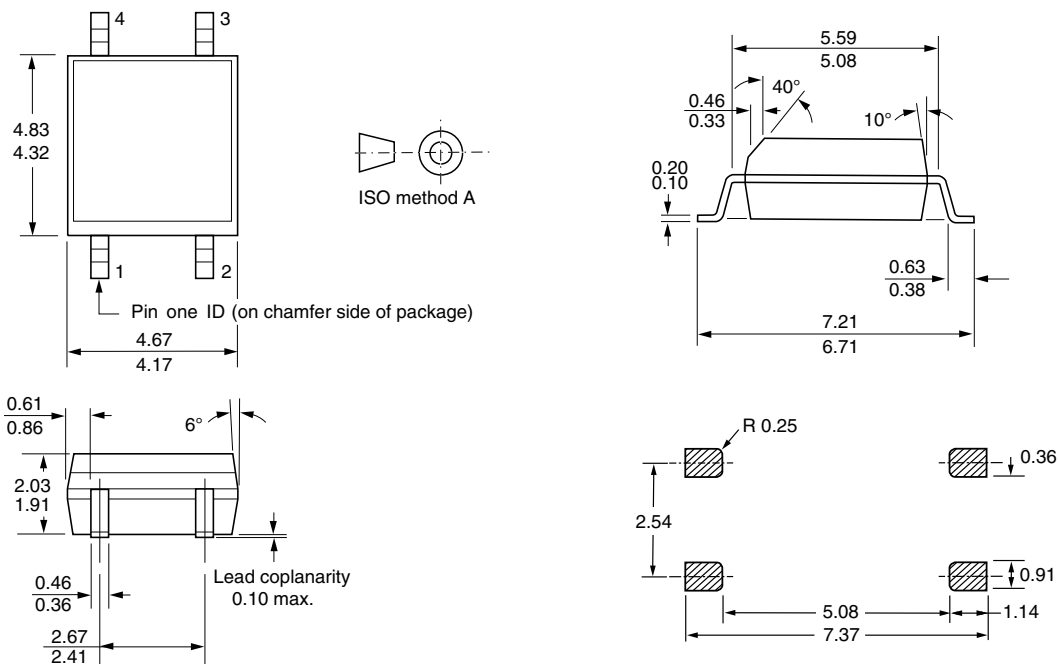


Fig. 15 - Switching Time vs. Load Resistance


Fig. 13 -  $F_{CTR}$  vs. Phase Angle

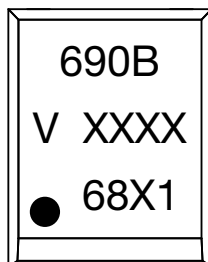


## PACKAGE DIMENSIONS (in millimeters)



i178037

## PACKAGE MARKING (example of SFH690B-X001T)



### Notes

- XXXX = LMC (lot marking code)
- 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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