



## Optocoupler, Phototransistor Output, With Base Connection

### Features

- Interfaces with common logic families
- Input-output coupling capacitance < 0.5 pF
- Industry Standard Dual-in line 6-pin package
- 5300 V<sub>RMS</sub> isolation test voltage

### Agency Approvals

- UL - File No. E52744 System Code H or J
- DIN EN 60747-5-2(VDE0884)  
DIN EN 60747-5-5 pending  
Available with Option 1
- CSA 93751
- BSI IEC60950 IEC60965

### Applications

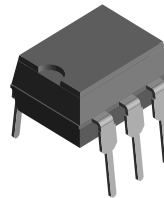
AC mains detection  
Reed relay driving  
Switch mode power supply feedback  
Telephone ring detection  
Logic ground isolation  
Logic coupling with high frequency noise rejection  
For additional design information see Application Note 45

### Description

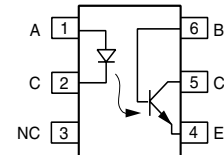
The MCT27x family is an Industry Standard Single Channel Phototransistor Couplers. It includes the MCT270/ 271/ 272/ 273/ 274/ 275/ 276/ 277 couplers. Each optocoupler consists of gallium arsenide infrared LED and a silicon NPN phototransistor.

These couplers are Underwriters Laboratories (UL) listed to comply with a 5300 V<sub>RMS</sub> isolation test voltage.

This isolation performance is accomplished through Vishay double molding isolation manufacturing process. Compliance to DIN EN 60747-5-2(VDE0884)/ DIN EN 60747-5-5 pending partial discharge isolation specification is available by ordering option 1.



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These isolation processes and the Vishay ISO9001 quality program results in the highest isolation performance available for a commercial plastic phototransistor optocoupler.

The devices are available also in lead formed configuration suitable for surface mounting and are available either on tape and reel, or in standard tube shipping containers.

### Order Information

| Part        | Remarks                       |
|-------------|-------------------------------|
| MCT270      | CTR > 50 %, DIP-6             |
| MCT271      | CTR 45 - 90 %, DIP-6          |
| MCT272      | CTR 75 - 150 %, DIP-6         |
| MCT273      | CTR 125 - 250 %, DIP-6        |
| MCT274      | CTR 225 - 400 %, DIP-6        |
| MCT275      | CTR 70 - 210 %, DIP-6         |
| MCT276      | CTR 15 - 60 %, DIP-6          |
| MCT277      | CTR > 100 %, DIP-6            |
| MCT270-X009 | CTR > 50 %, SMD-6 (option 9)  |
| MCT277-X009 | CTR > 100 %, SMD-6 (option 9) |

For additional information on the available options refer to Option Information.

## Absolute Maximum Ratings

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

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 Rating for extended periods of the time can adversely affect reliability.

## Input

| Parameter         | Test condition              | Symbol     | Value | Unit |
|-------------------|-----------------------------|------------|-------|------|
| Reverse voltage   |                             | $V_R$      | 6.0   | V    |
| Forward current   |                             | $I_F$      | 60    | mA   |
| Surge current     | $t < 10\text{ }\mu\text{s}$ | $I_{FSM}$  | 2.5   | A    |
| Power dissipation |                             | $P_{diss}$ | 100   | mW   |

## Output

| Parameter                           | Test condition      | Symbol     | Value | Unit |
|-------------------------------------|---------------------|------------|-------|------|
| Collector-emitter breakdown voltage |                     | $V_{CEO}$  | 70    | V    |
| Emitter-base breakdown voltage      |                     |            | 7.0   | V    |
| Collector current                   |                     | $I_C$      | 50    | mA   |
|                                     | $t < 1.0\text{ ms}$ | $I_C$      | 100   | mA   |
| Power dissipation                   |                     | $P_{diss}$ | 150   | mW   |

## Coupler

| Parameter                                                  | Test condition                                                                | Symbol    | Value         | Unit               |
|------------------------------------------------------------|-------------------------------------------------------------------------------|-----------|---------------|--------------------|
| Isolation test voltage                                     |                                                                               | $V_{ISO}$ | 5300          | $V_{RMS}$          |
| Creepage                                                   |                                                                               |           | $\geq 7.0$    | mm                 |
| Clearance                                                  |                                                                               |           | $\geq 7.0$    | mm                 |
| Isolation thickness between emitter and detector           |                                                                               |           | $\geq 0.4$    | mm                 |
| Comparative tracking index per DIN IEC 112/VDE0303, part 1 |                                                                               |           | 175           |                    |
| Isolation resistance                                       | $V_{IO} = 500\text{ V}, T_{amb} = 25\text{ }^{\circ}\text{C}$                 | $R_{IO}$  | $10^{12}$     | $\Omega$           |
|                                                            | $V_{IO} = 500\text{ V}, T_{amb} = 100\text{ }^{\circ}\text{C}$                | $R_{IO}$  | $10^{11}$     | $\Omega$           |
| Storage temperature                                        |                                                                               | $T_{amb}$ | - 55 to + 150 | $^{\circ}\text{C}$ |
| Operating temperature                                      |                                                                               | $T_{amb}$ | - 55 to + 100 | $^{\circ}\text{C}$ |
| Junction temperature                                       |                                                                               | $T_j$     | 100           | $^{\circ}\text{C}$ |
| Soldering temperature                                      | max. 10 s dip soldering:<br>distance to seating plane<br>$\geq 1.5\text{ mm}$ | $T_{sld}$ | 260           | $^{\circ}\text{C}$ |



## Electrical Characteristics

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

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.

### Input

| Parameter       | Test condition                | Symbol | Min | Typ. | Max | Unit          |
|-----------------|-------------------------------|--------|-----|------|-----|---------------|
| Forward voltage | $I_F = 20\text{ mA}$          | $V_F$  |     |      | 1.5 | V             |
| Reverse current | $V_R = 3.0\text{ V}$          | $I_R$  |     |      | 10  | $\mu\text{A}$ |
| Capacitance     | $V_R = 0, f = 1.0\text{ MHz}$ | $C_O$  |     | 25   |     | pF            |

### Output

| Parameter                           | Test condition                                   | Symbol     | Min | Typ. | Max | Unit |
|-------------------------------------|--------------------------------------------------|------------|-----|------|-----|------|
| Collector-emitter breakdown voltage | $I_C = 10\text{ }\mu\text{A}, I_F = 0\text{ mA}$ | $BV_{CEO}$ | 30  |      |     | V    |
| Emitter-collector breakdown voltage | $I_E = 10\text{ }\mu\text{A}, I_F = 0\text{ mA}$ | $BV_{ECO}$ | 7.0 |      |     | V    |
| Collector-base breakdown voltage    | $I_C = 10\text{ }\mu\text{A}, I_F = 0\text{ mA}$ | $BV_{CBO}$ | 70  |      |     | V    |
| Collector-emitter leakage current   | $V_{CE} = 10\text{ V}, I_F = 0\text{ mA}$        | $I_{CEO}$  |     |      | 50  | nA   |

### Coupler

| Parameter                            | Test condition                               | Symbol      | Min | Typ.      | Max | Unit     |
|--------------------------------------|----------------------------------------------|-------------|-----|-----------|-----|----------|
| Resistance, input to output          | $V_{IO} = 500\text{ VDC}$                    | $R_{IO}$    |     | $10^{12}$ |     | $\Omega$ |
| Capacitance (input-output)           |                                              | $C_{IO}$    |     | 0.5       |     | pF       |
| Collector-emitter saturation voltage | $I_{CE} = 2.0\text{ mA}, I_F = 16\text{ mA}$ | $V_{CEsat}$ |     |           | 0.4 | V        |

### Current Transfer Ratio

| Parameter                                  | Test condition                              | Part   | Symbol     | Min  | Typ. | Max | Unit |
|--------------------------------------------|---------------------------------------------|--------|------------|------|------|-----|------|
| DC Current Transfer Ratio                  | $V_{CE} = 10\text{ V}, I_F = 10\text{ mA}$  | MCT270 | $CTR_{DC}$ | 50   |      |     | %    |
|                                            |                                             | MCT271 | $CTR_{DC}$ | 45   |      | 90  | %    |
|                                            |                                             | MCT272 | $CTR_{DC}$ | 75   |      | 150 | %    |
|                                            |                                             | MCT273 | $CTR_{DC}$ | 125  |      | 250 | %    |
|                                            |                                             | MCT274 | $CTR_{DC}$ | 225  |      | 400 | %    |
|                                            |                                             | MCT275 | $CTR_{DC}$ | 70   |      | 210 | %    |
|                                            |                                             | MCT276 | $CTR_{DC}$ | 15   |      | 60  | %    |
|                                            |                                             | MCT277 | $CTR_{DC}$ | 100  |      |     | %    |
| Current Transfer Ratio (collector-emitter) | $V_{CE} = 0.4\text{ V}, I_F = 16\text{ mA}$ | MCT271 | $CTR_{CE}$ | 12.5 |      |     | %    |
|                                            |                                             | MCT272 | $CTR_{CE}$ | 12.5 |      |     | %    |
|                                            |                                             | MCT273 | $CTR_{CE}$ | 12.5 |      |     | %    |
|                                            |                                             | MCT274 | $CTR_{CE}$ | 12.5 |      |     | %    |
|                                            |                                             | MCT275 | $CTR_{CE}$ | 12.5 |      |     | %    |
|                                            |                                             | MCT276 | $CTR_{CE}$ | 12.5 |      |     | %    |
|                                            |                                             | MCT277 | $CTR_{CE}$ | 40   |      |     | %    |

## Switching Characteristics

| Parameter      | Test condition                                                         | Part   | Symbol               | Min | Typ. | Max | Unit          |
|----------------|------------------------------------------------------------------------|--------|----------------------|-----|------|-----|---------------|
| Switching time | $I_C = 2.0 \text{ mA}$ , $R_L = 100 \Omega$ , $V_{CE} = 5.0 \text{ V}$ | MCT270 | $t_{on}$ , $t_{off}$ |     |      | 10  | $\mu\text{s}$ |
|                |                                                                        | MCT271 | $t_{on}$ , $t_{off}$ |     |      | 7.0 | $\mu\text{s}$ |
|                |                                                                        | MCT272 | $t_{on}$ , $t_{off}$ |     |      | 10  | $\mu\text{s}$ |
|                |                                                                        | MCT273 | $t_{on}$ , $t_{off}$ |     |      | 20  | $\mu\text{s}$ |
|                |                                                                        | MCT274 | $t_{on}$ , $t_{off}$ |     |      | 25  | $\mu\text{s}$ |
|                |                                                                        | MCT275 | $t_{on}$ , $t_{off}$ |     |      | 15  | $\mu\text{s}$ |
|                |                                                                        | MCT277 | $t_{on}$ , $t_{off}$ |     |      | 15  | $\mu\text{s}$ |
|                |                                                                        | MCT276 | $t_{on}$ , $t_{off}$ |     |      | 3.5 | $\mu\text{s}$ |

## Typical Characteristics ( $T_{amb} = 25^\circ\text{C}$ unless otherwise specified)

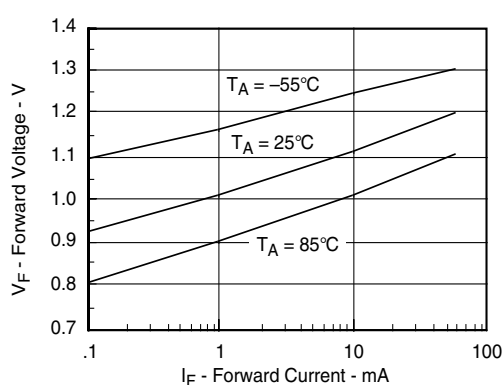


Fig. 1 Forward Voltage vs. Forward Current

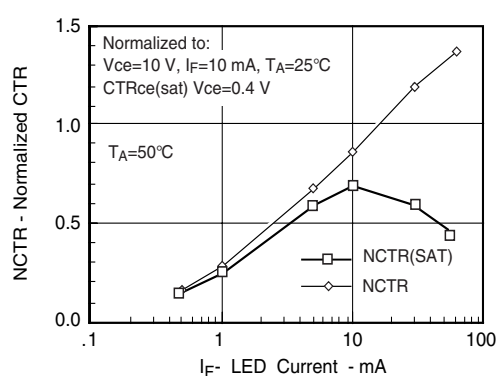


Fig. 3 Normalized Non-saturated and Saturated CTR vs. LED Current

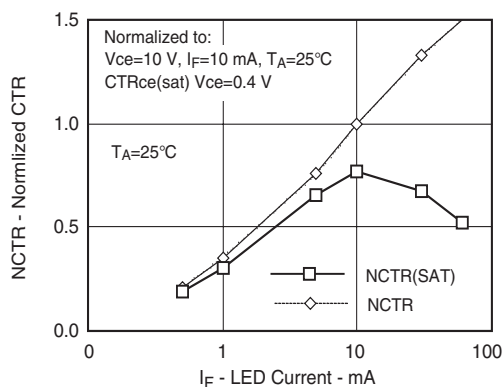


Fig. 2 Normalized Non-Saturated and Saturated CTR vs. LED Current

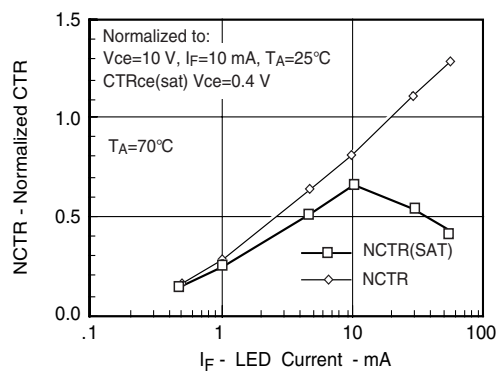
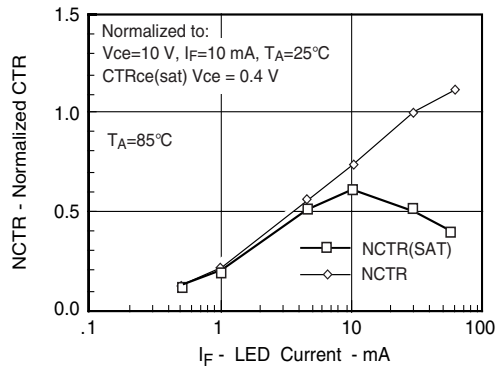
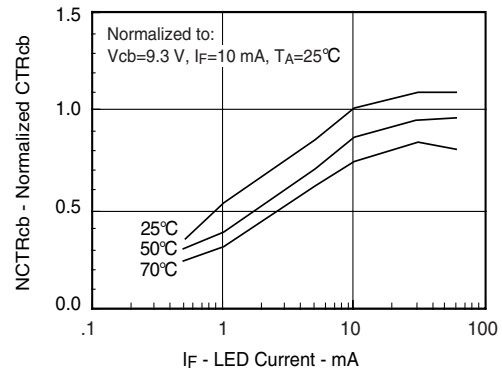


Fig. 4 Normalized Non-saturated and saturated CTR vs. LED Current



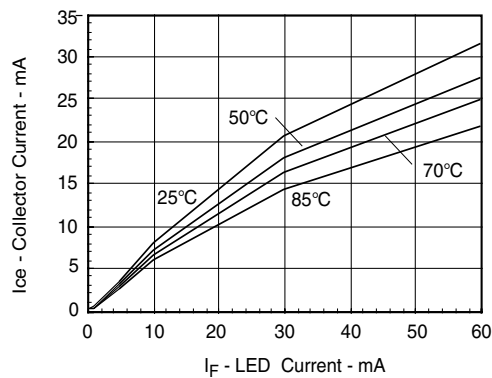
44n25\_05

Fig. 5 Normalized Non-saturated and saturated CTR vs. LED Current



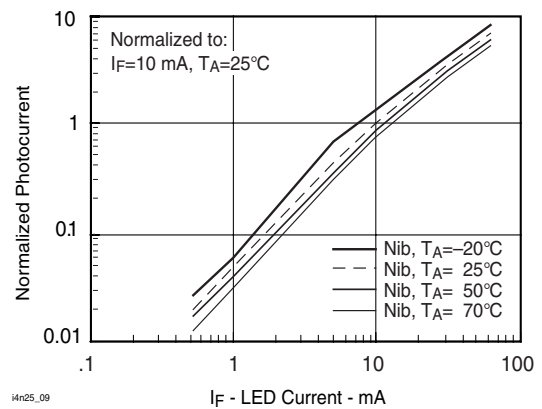
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Fig. 8 Normalized CTRcb vs. LED Current and Temp.



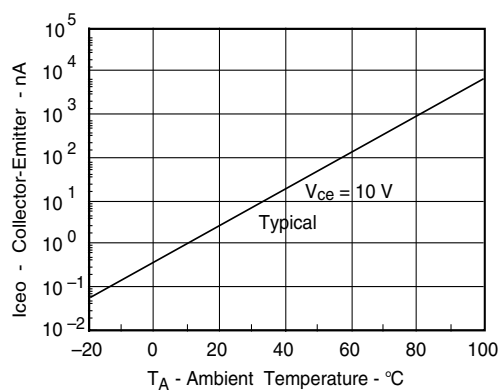
44n25\_06

Fig. 6 Collector-Emitter Current vs. Temperature and LED Current



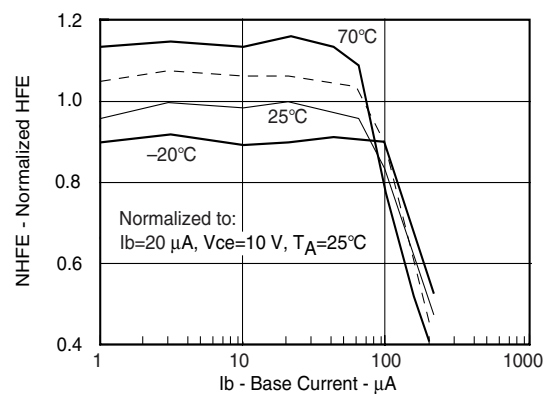
44n25\_09

Fig. 9 Normalized Photocurrent vs.  $I_F$  and Temp.



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Fig. 7 Collector-Emitter Leakage Current vs. Temp.



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Fig. 10 Normalized Non-saturated HFE vs. Base Current and Temperature

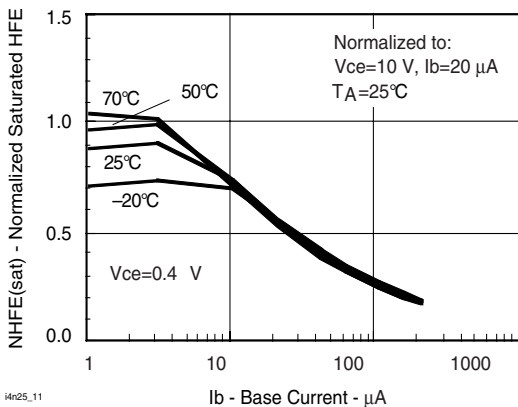


Fig. 11 Normalized HFE vs. Base Current and Temp.

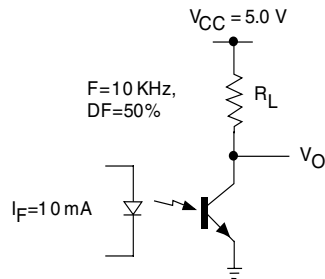


Fig. 14 Switching Schematic

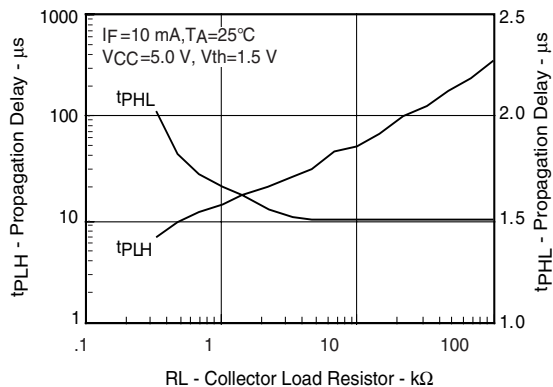


Fig. 12 Propagation Delay vs. Collector Load Resistor

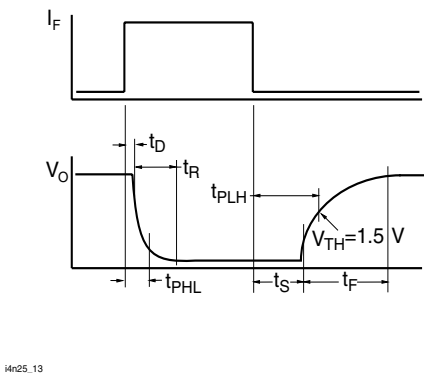
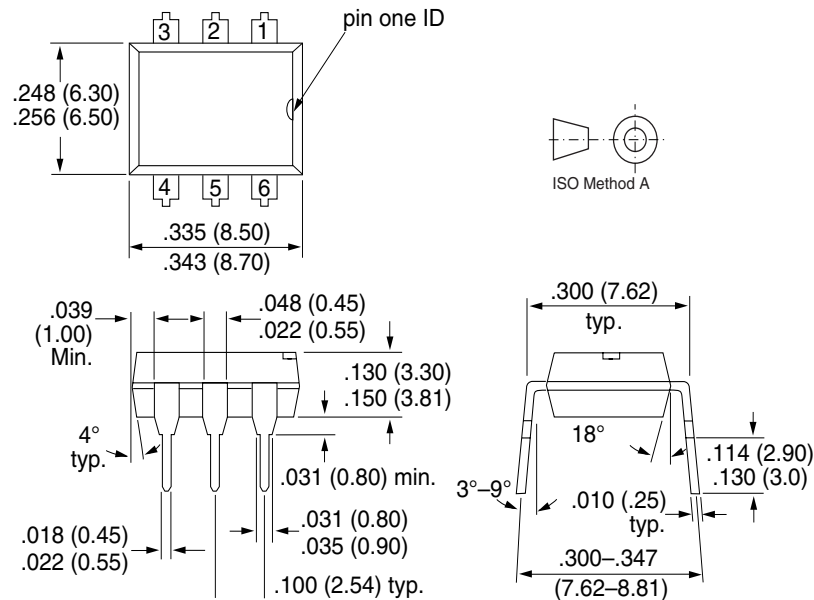


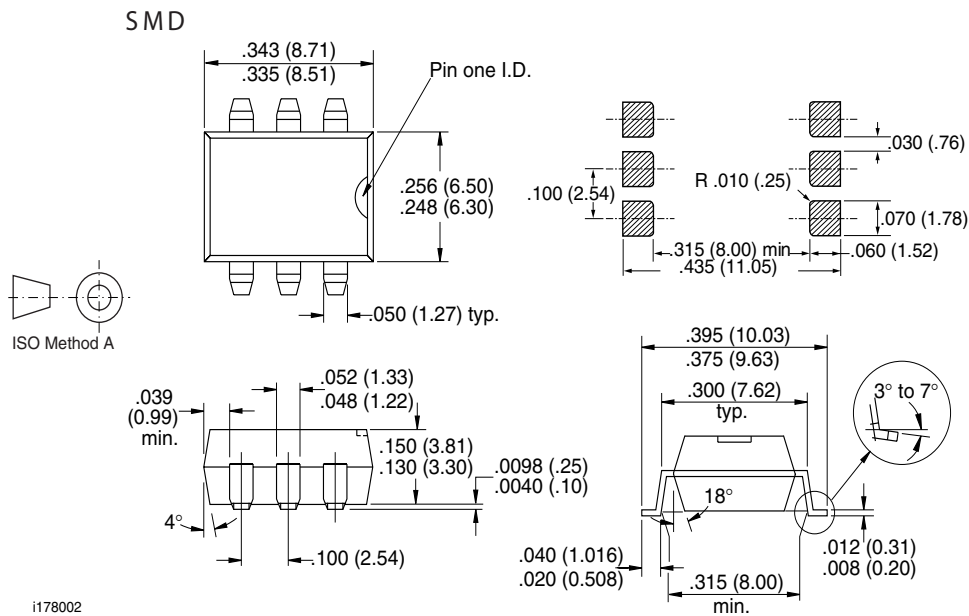
Fig. 13 Switching Timing

## Package Dimensions in Inches (mm)



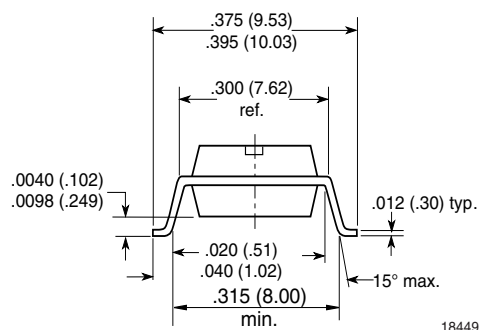
i178004

## Package Dimensions in Inches (mm)



i178002

Option 9



18449





## **Ozone Depleting Substances Policy Statement**

It is the policy of **Vishay Semiconductor GmbH** to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

**Vishay Semiconductor GmbH** has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

**Vishay Semiconductor GmbH** can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

### **We reserve the right to make changes to improve technical design and may do so without further notice.**

Parameters can vary in different applications. All operating parameters must be validated for each customer application by the customer. Should the buyer use Vishay Semiconductors products for any unintended or unauthorized application, the buyer shall indemnify Vishay Semiconductors against all claims, costs, damages, and expenses, arising out of, directly or indirectly, any claim of personal damage, injury or death associated with such unintended or unauthorized use.

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Datasheets for electronics components.