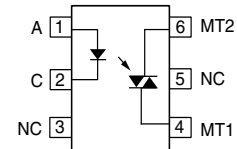
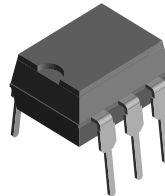


## Optocoupler, Phototriac Output, High dV/dt, Very Low Input Current

### Features

- High Input Sensitivity  $I_{FT} = 1.3 \text{ mA}$
- 300 mA On-State Current
- High Static dV/dt 10,000 V/ $\mu\text{sec.}$ , typical
- Inverse Parallel SCRs Provide Commutating dV/dt > 10 kV/ $\mu\text{sec}$
- Very Low Leakage < 10  $\mu\text{A}$
- Isolation Test Voltage 5300  $V_{RMS}$
- Lead-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



1179041

### Agency Approvals

- UL1577, File No. E52744 System Code J
- CSA 93751
- DIN EN 60747-5-2 (VDE0884)  
DIN EN 60747-5-5 pending  
Available with Option 1
- BABT/ BSI IEC60950 IEC60065

### Applications

Solid-state relays  
Industrial controls  
Office equipment  
Consumer appliances.

### Description

The IL4216/ IL4217/ IL4218 consists of an AlGaAs IRLED optically coupled to a pair of photosensitive non-zero crossing SCR chips and are connected inversely parallel to form a TRIAC. These three semiconductors are assembled in a six pin 0.3 inch dual in-line package.

High input sensitivity is achieved by using an emitter follower phototransistor and a cascaded SCR pre-driver resulting in an LED trigger current of less than 1.3 mA (DC).

The IL4216/ IL4217/ IL4218 uses two discrete SCRs resulting in a commutating dV/dt of greater than 10 kV/ $\mu\text{s}$ . The use of a proprietary dV/dt clamp results in a static dV/dt of greater than 10 kV/ $\mu\text{s}$ . This clamp

circuit has a MOSFET that is enhanced when high dV/dt spikes occur between MT1 and MT2 of the TRIAC. The FET clamps the base of the phototransistor when conducting, disabling the internal SCR predriver.

The blocking voltage of up to 800 V permits control of off-line voltages up to 240 VAC, with a safety factor more than two, and is sufficient for as much as 380 VAC. Current handling capability is up to 300 mA RMS, continuous at 25 °C.

The IL4216/ IL4217/ IL4218 isolates low-voltage logic from 120, 240, and 380 VAC lines to control resistive inductive, or capacitive loads including motors solenoids, high current thyristors or TRIAC and relays.

### Order Information

| Part        | Remarks                                    |
|-------------|--|
| IL4216      | 600 V $V_{DRM}$ , DIP-6                    |
| IL4217      | 700 V $V_{DRM}$ , DIP-6                    |
| IL4218      | 800 V $V_{DRM}$ , DIP-6                    |
| IL4216-X006 | 600 V $V_{DRM}$ , DIP-6 400 mil (option 6) |
| IL4216-X009 | 600 V $V_{DRM}$ , SMD-6 (option 9)         |
| IL4217-X007 | 700 V $V_{DRM}$ , SMD-6 (option 7)         |
| IL4217-X009 | 700 V $V_{DRM}$ , SMD-6 (option 9)         |
| IL4218-X006 | 800 V $V_{DRM}$ , DIP-6 400 mil (option 6) |
| IL4218-X007 | 800 V $V_{DRM}$ , SMD-6 (option 7)         |
| IL4218-X009 | 800 V $V_{DRM}$ , 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              |                | $I_{FSM}$  | 2.5   | A     |
| Power dissipation          |                | $P_{diss}$ | 100   | mW    |
| Derate linearly from 25 °C |                |            | 1.33  | mW/°C |
| Thermal resistance         |                | $R_{th}$   | 750   | °C/W  |

### Output

| Parameter                  | Test condition | Part   | Symbol     | Value | Unit  |
|----------------------------|----------------|--------|------------|-------|-------|
| Peak off-state voltage     |                | IL4216 | $V_{DRM}$  | 600   | V     |
|                            |                | IL4217 | $V_{DRM}$  | 700   | V     |
|                            |                | IL4218 | $V_{DRM}$  | 800   | V     |
| RMS on-state current       |                |        | $I_{DRM}$  | 300   | mA    |
| Single cycle surge         |                |        | $I_{TSM}$  | 3.0   | A     |
| Power dissipation          |                |        | $P_{diss}$ | 500   | mW    |
| Derate linearly from 25 °C |                |        |            | 6.6   | mW/°C |
| Thermal resistance         |                |        | $R_{th}$   | 150   | °C/W  |

### Coupler

| Parameter                  | Test condition   | Symbol     | Value          | Unit      |
|----------------------------|--|------------|----------------|-----------|
| Lead soldering temperature | 5.0 sec.   | $T_{slid}$ | 260            | °C        |
| Creepage distance          |  |            | $\geq 7.0$     | mm        |
| Clearance                  |  |            | $\geq 7.0$     | mm        |
| Storage temperature        |  | $T_{stg}$  | - 55 to + 150  | °C        |
| Ambient temperature        |  | $T_{amb}$  | - 55 to + 100  | °C        |
| Isolation test voltage     |  | $V_{ISO}$  | 5300           | $V_{RMS}$ |
| Isolation resistance       | $V_{IO} = 500\text{ V}, T_{amb} = 25\text{ }^{\circ}\text{C}$  | $R_{IO}$   | $\geq 10^{12}$ | $\Omega$  |
|                            | $V_{IO} = 500\text{ V}, T_{amb} = 100\text{ }^{\circ}\text{C}$ | $R_{IO}$   | $\geq 10^{11}$ | $\Omega$  |



## 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                      | $I_F = 20\text{ mA}$                      | $V_F$      |     | 1.3  | 1.5 | V                    |
| Breakdown voltage                    | $I_R = 10\text{ }\mu\text{A}$             | $V_{BR}$   | 6.0 | 30   |     | V                    |
| Reverse current                      | $V_R = 6.0\text{ V}$                      | $I_R$      |     | 0.1  | 10  | $\mu\text{A}$        |
| Input capacitance                    | $V_F = 0\text{ V}$ , $f = 1.0\text{ MHz}$ | $C_{IN}$   |     | 40   |     | pF                   |
| Thermal resistance, junction to lead |   | $R_{thjl}$ |     | 750  |     | $^{\circ}\text{C/W}$ |

### Output

| Parameter   | Test condition  | Part   | Symbol        | Min   | Typ. | Max | Unit                 |
|---|---|--------|---------------|-------|------|-----|----------------------|
| Repetitive peak off-state voltage                       | $I_{DRM} = 100\text{ }\mu\text{A}$  | IL4216 | $V_{DRM}$     | 600   | 650  |     | V                    |
|   |   | IL4217 | $V_{DRM}$     | 700   | 750  |     | V                    |
|   |   | IL4218 | $V_{DRM}$     | 800   | 850  |     | V                    |
| Off-state voltage                                       | $I_{D(RMS)} = 70\text{ }\mu\text{A}$  | IL4216 | $V_{D(RMS)}$  | 424   | 460  |     | V                    |
|   |   | IL4217 | $V_{D(RMS)}$  | 484   | 536  |     | V                    |
|   |   | IL4218 | $V_{D(RMS)}$  | 565   | 613  |     | V                    |
| Off-state current                                       | $V_D = 600$ , $T_{amb} = 100\text{ }^{\circ}\text{C}$   |        | $I_{D(RMS)}$  |       | 10   | 100 | $\mu\text{A}$        |
| Reverse current   | $V_R = 600\text{ V}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$   |        | $I_{RMS}$     |       | 10   | 100 | V                    |
| On-state voltage  | $I_T = 300\text{ mA}$   |        | $V_{TM}$      |       | 1.7  | 3.0 | V                    |
| On-state current  | $PF = 1.0$ , $V_{T(RMS)} = 1.7\text{ V}$  |        | $I_{TM}$      |       |      | 300 | mA                   |
| Surge (non-repetitive, on-state current)                | $f = 50\text{ Hz}$  |        | $I_{TSM}$     |       |      | 3.0 | A                    |
| Holding current   | $V_T = 3.0\text{ V}$  |        | $I_H$         |       | 65   | 200 | $\mu\text{A}$        |
| Latching current  | $V_T = 2.2\text{ V}$  |        | $I_L$         |       | 5.0  |     | mA                   |
| LED trigger current                                     | $V_{AK} = 5.0\text{ V}$   |        | $I_{FT}$      |       | 0.7  | 1.3 | mA                   |
| Critical state of rise of off-state voltage             | $V_D = 0.67 V_{DRM}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$   |        | $dV/dt_{cr}$  | 10000 |      |     | V/ $\mu\text{s}$     |
|   | $V_D = 0.67 V_{DRM}$ , $T_{amb} = 80\text{ }^{\circ}\text{C}$   |        | $dV/dt_{cr}$  | 5000  |      |     | V/ $\mu\text{s}$     |
| Critical rate of rise of voltage at current commutation | $V_D = 0.67 V_{DRM}$ ,<br>$di/dt_{crq} \leq 15\text{ A/ms}$ ,<br>$T_{amb} = 25\text{ }^{\circ}\text{C}$ |        | $dV/dt_{crq}$ | 10000 |      |     | V/ $\mu\text{s}$     |
|   | $V_D = 0.67 V_{DRM}$ ,<br>$di/dt_{crq} \leq 15\text{ A/ms}$ ,<br>$T_{amb} = 80\text{ }^{\circ}\text{C}$ |        | $dV/dt_{crq}$ | 5000  |      |     | V/ $\mu\text{s}$     |
| Off-state current                                       | $I_T = 300\text{ mA}$   |        | $di/dt$       |       | 100  |     | A/ms                 |
| Thermal resistance, junction to lead                    |   |        | $R_{THJL}$    |       | 150  |     | $^{\circ}\text{C/W}$ |

### Coupler

| Parameter   | Test condition                                 | Symbol         | Min  | Typ. | Max | Unit             |
|---|--|----------------|------|------|-----|------------------|
| Capacitance (input-output)                            | $f = 1.0\text{ MHz}$ , $V_{IO} = 0\text{ V}$   | $C_{IO}$       |      | 0.8  |     | pF               |
| Critical rate of rise of coupled input-output voltage | $I_T = 0$ , $V_{RM} = V_{DM} = 300\text{ VAC}$ | $dV_{(IO)}/dt$ | 5000 |      |     | V/ $\mu\text{s}$ |

## Power Factor Considerations

A snubber isn't needed to eliminate false operation of the TRIAC driver because of the IL4216/ IL4217/ IL4218 high static and commutating dV/dt with loads between 1 and 0.8 power factors. When inductive loads with power factors less than 0.8 are being driven, include a RC snubber or a single capacitor directly across the device to damp the peak commutating dV/dt spike. Normally a commutating dV/dt causes a turning-off device to stay on due to the stored energy remaining in the turning-off device.

But in the case of a zero voltage crossing optotriac, the commutating dV/dt spikes can inhibit one half of the TRIAC from turning on. If the spike potential exceeds the inhibit voltage of the zero cross detection circuit, half of the TRIAC will be held-off and not turn-on. This hold-off condition can be eliminated by using a snubber or capacitor placed directly across the optotriac as shown in Figure 7. Note that the value of the capacitor increases as a function of the load current.

The hold-off condition also can be eliminated by providing a higher level of LED drive current. The higher LED drive provides a larger photocurrent which causes the phototransistor to turn-on before the commutating spike has activated the zero cross network. Figure 8 shows the relationship of the LED drive for power factors of less than 1.0. The curve shows that if a device requires 1.5 mA for a resistive load, then 1.8 times (2.7 mA) that amount would be required to control an inductive load whose power factor is less than 0.3.

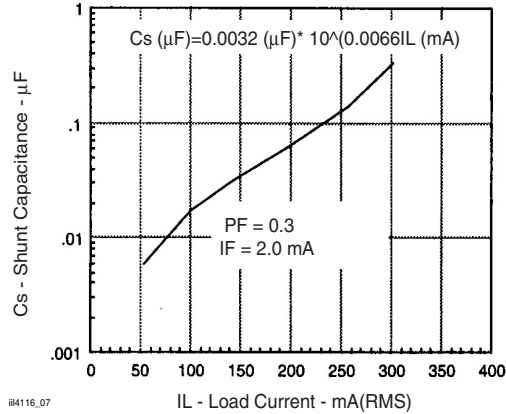


Figure 1. Shunt Capacitance vs. Load Current vs. Power Factor

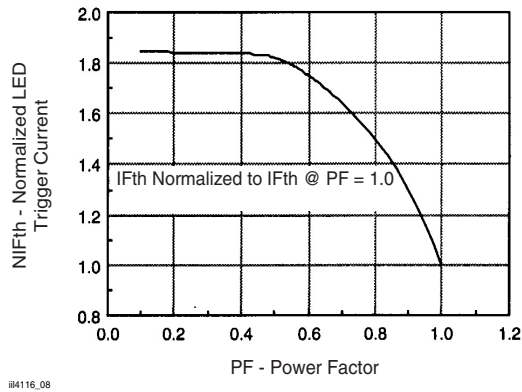


Figure 2. Normalized LED Trigger Current

## Typical Characteristics (Tamb = 25 °C unless otherwise specified)

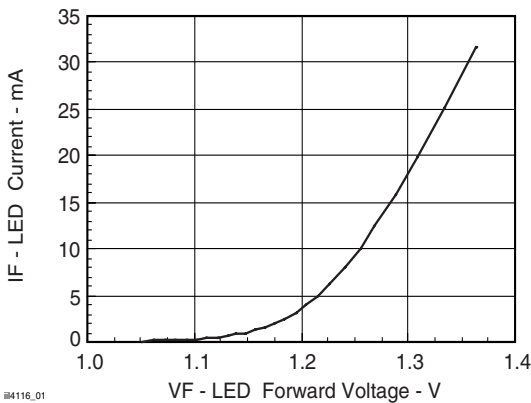


Figure 3. LED Forward Current vs. Forward Voltage

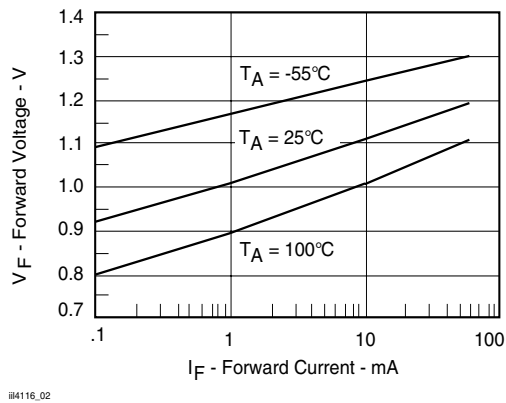
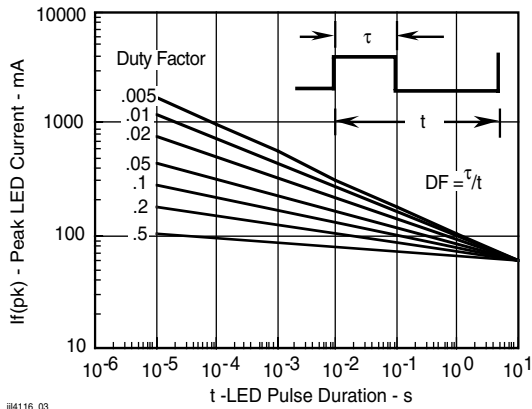
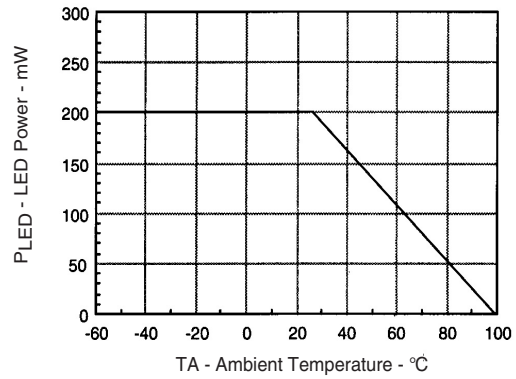


Figure 4. Forward Voltage vs. Forward Current



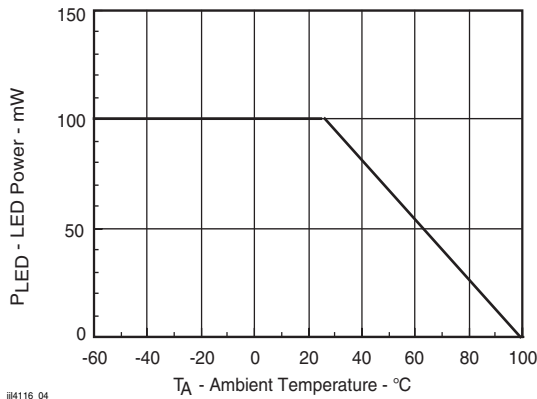
#4116\_03

Figure 5. Peak LED Current vs. Duty Factor, Tau



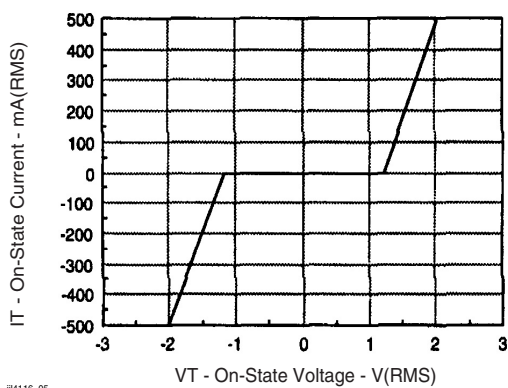
#4116\_06

Figure 8. Maximum Output Power Dissipation



#4116\_04

Figure 6. Maximum LED Power Dissipation



#4116\_05

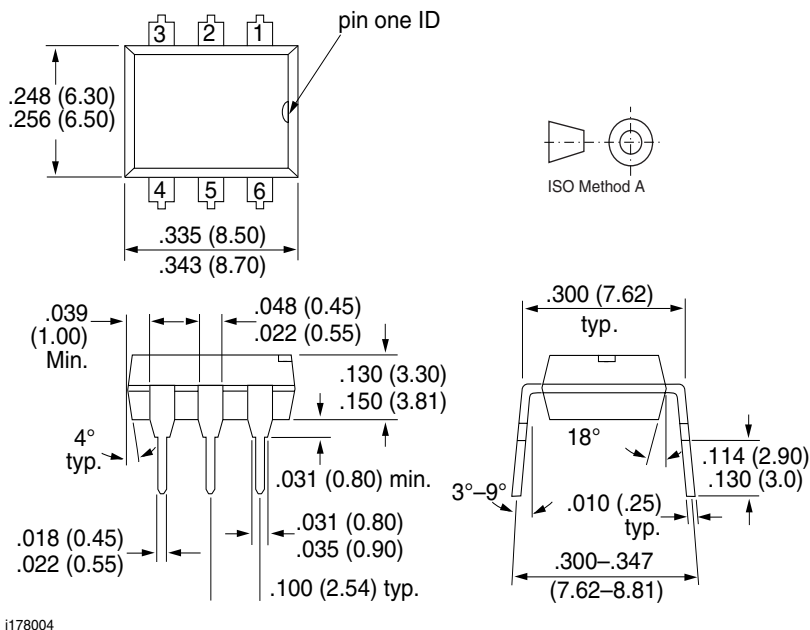
Figure 7. On-State Terminal Voltage vs. Terminal Current

# IL4216/ IL4217/ IL4218

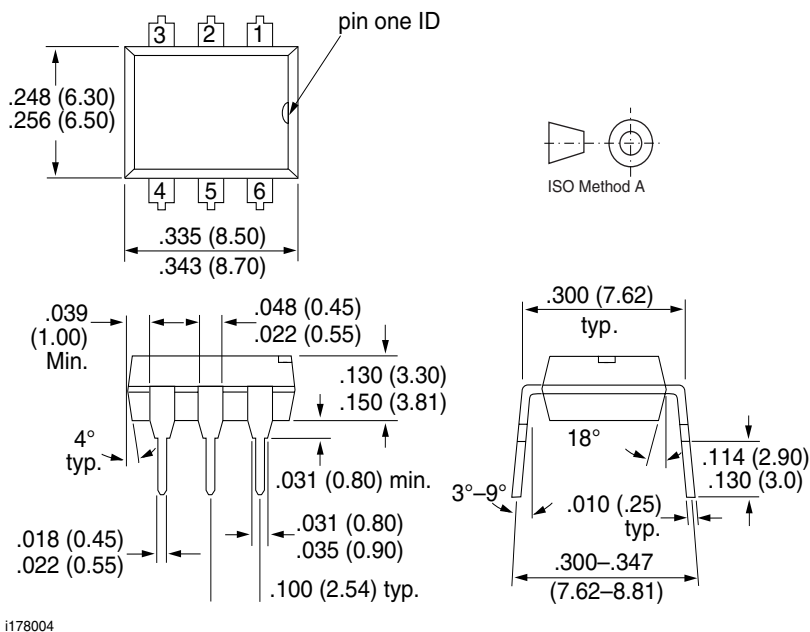


Vishay Semiconductors

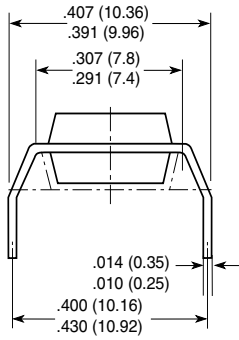
## Package Dimensions in Inches (mm)



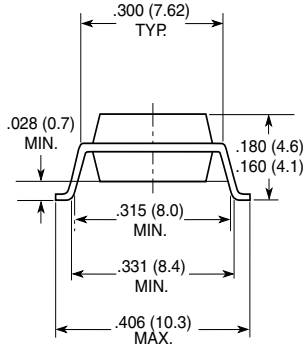
## Package Dimensions in Inches (mm)



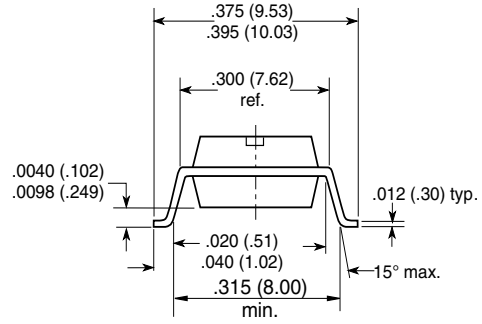
**Option 6**



**Option 7**



**Option 9**



18450

### 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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