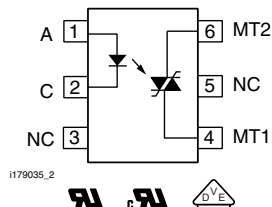
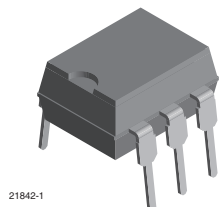




# Optocoupler, Phototriac Output, High dV/dt, Low Input Current



## FEATURES

- High input sensitivity  $I_{FT} = 2 \text{ mA}$
- 600 V, 800 V blocking voltage
- 300 mA on-state current
- High static dV/dt  $10 \text{ kV}/\mu\text{s}$
- Very low leakage  $< 10 \mu\text{A}$
- Isolation test voltage  $5300 \text{ V}_{\text{RMS}}$
- Small 6-pin DIP package
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?999912](http://www.vishay.com/doc?999912)

RoHS  
COMPLIANT

## DESCRIPTION

The IL420 and IL4208 consists of a GaAs IRLED optically coupled to a photosensitive non-zero crossing TRIAC network. The TRIAC consists of two inverse parallel connected monolithic SCRs. These three semiconductors are assembled in a six pin dual in-line package.

High input sensitivity is achieved by using an emitter follower phototransistor and a cascaded SCR predriver resulting in an LED trigger current of less than 2 mA (DC).

The use of a proprietary dV/dt clam results in a static dV/dt of greater than  $10 \text{ kV}/\mu\text{s}$ . This clamp circuit has a MOSFET that is enhanced when high dV/dt spikes occur between MT1 and MT2 of the TRIAC. When conducting, the FET clamps the base of the phototransistors, disabling the first stage SCR predriver.

The 600 V, 800 V blocking voltage permits control of offline voltages up to 240 VAC, with a safety factor of more than two, and is sufficient for as much as  $380 \text{ V}_{\text{AC}}$ .

The IL420, IL4208 isolates low-voltage logic from  $120 \text{ V}_{\text{AC}}$ ,  $240 \text{ V}_{\text{AC}}$ , and  $380 \text{ V}_{\text{AC}}$  lines to control resistive, inductive, or capacitive loads including motors, solenoids, high current thyristors or TRIAC and relays.

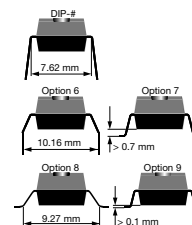
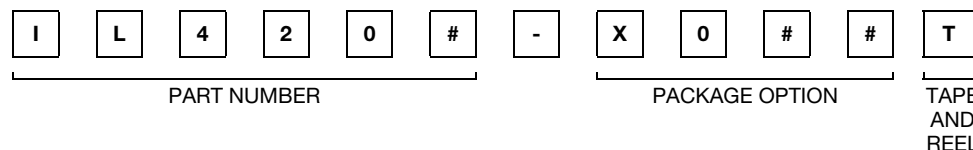
## APPLICATIONS

- Solid state relays
- Industrial controls
- Office equipment
- Consumer appliances

## AGENCY APPROVALS

- UL1577, file no. E52744 system code H, double protection
- CSA 93751
- DIN EN 60747-5-5 (VDE 0884), available with option 1
- CQC: GB8898-2001

## ORDERING INFORMATION



| AGENCY CERTIFIED/PACKAGE | BLOCKING VOLTAGE $V_{\text{DRM}}$ (V) |                             |
|--------------------------|---------------------------------------|-----------------------------|
|                          | 600                                   | 800                         |
| UL, cUL, CQC             |                                       |                             |
| DIP-6                    | IL420                                 | IL4208                      |
| DIP-6, 400 mil, option 6 | IL420-X006                            | -                           |
| SMD-6, option 7          | IL420-X007T <sup>(1)</sup>            | IL4208-X007T <sup>(1)</sup> |
| SMD-6, option 8          | IL420-X008T                           | -                           |
| SMD-6, option 9          | IL420-X009T <sup>(1)</sup>            | IL4208-X009T <sup>(1)</sup> |
| VDE, UL, cUL, CQC        | 600                                   | 800                         |
| DIP-6                    | IL420-X001                            | -                           |
| DIP-6, 400 mil, option 6 | IL420-X016                            | -                           |
| SMD-6, option 7          | IL420-X017T <sup>(1)</sup>            | IL4208-X017T                |

### Note

<sup>(1)</sup> Also available in tubes, do not put T on the end.



| <b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                                                                                |        |            |                |           |
|--------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------|------------|----------------|-----------|
| PARAMETER                                                                                              | TEST CONDITION                                                                 | PART   | SYMBOL     | VALUE          | UNIT      |
| <b>INPUT</b>                                                                                           |                                                                                |        |            |                |           |
| Reverse voltage                                                                                        |                                                                                |        | $V_R$      | 6              | V         |
| Forward current                                                                                        |                                                                                |        | $I_F$      | 60             | mA        |
| Surge current                                                                                          |                                                                                |        | $I_{FSM}$  | 2.5            | A         |
| Power dissipation                                                                                      |                                                                                |        | $P_{diss}$ | 100            | mW        |
| Derate from 25 °C                                                                                      |                                                                                |        |            | 1.33           | mW/°C     |
| <b>OUTPUT</b>                                                                                          |                                                                                |        |            |                |           |
| Peak off-state voltage                                                                                 |                                                                                | IL420  | $V_{DRM}$  | 600            | V         |
|                                                                                                        |                                                                                | IL4208 | $V_{DRM}$  | 800            | V         |
| RMS on-state current                                                                                   |                                                                                |        | $I_{TM}$   | 300            | mA        |
| Single cycle surge current                                                                             |                                                                                |        | $I_{TSM}$  | 3              | A         |
| Power dissipation                                                                                      |                                                                                |        | $P_{diss}$ | 500            | mW        |
| Derate from 25 °C                                                                                      |                                                                                |        |            | 6.6            | mW/°C     |
| <b>COUPLER</b>                                                                                         |                                                                                |        |            |                |           |
| Isolation test voltage between emitter and detector                                                    | $t = 1\text{ s}$                                                               |        | $V_{ISO}$  | 5300           | $V_{RMS}$ |
| Isolation resistance                                                                                   | $V_{IO} = 500\text{ V}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$               |        | $R_{IO}$   | $\geq 10^{12}$ | $\Omega$  |
|                                                                                                        | $V_{IO} = 500\text{ V}$ , $T_{amb} = 100\text{ }^{\circ}\text{C}$              |        | $R_{IO}$   | $\geq 10^{11}$ | $\Omega$  |
| Storage temperature range                                                                              |                                                                                |        | $T_{stg}$  | - 55 to + 150  | °C        |
| Ambient temperature range                                                                              |                                                                                |        | $T_{amb}$  | - 55 to + 100  | °C        |
| Soldering temperature <sup>(1)</sup>                                                                   | max. $\leq 10\text{ s}$ dip soldering<br>$\geq 0.5\text{ mm}$ from case bottom |        | $T_{sld}$  | 260            | °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 (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP).

| <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                                                                                          | $I_F = 10\text{ mA}$                                                                   | $V_F$                      |        | 1.16 | 1.35 | V                              |
| Reverse current                                                                                          | $V_R = 6\text{ V}$                                                                     | $I_R$                      |        | 0.1  | 10   | $\mu\text{A}$                  |
| Input capacitance                                                                                        | $V_F = 0\text{ V}$ , $f = 1\text{ MHz}$                                                | $C_{IN}$                   |        | 40   |      | pF                             |
| Thermal resistance, junction to ambient                                                                  |                                                                                        | $R_{thja}$                 |        | 750  |      | °C/W                           |
| <b>OUTPUT</b>                                                                                            |                                                                                        |                            |        |      |      |                                |
| Off-state current                                                                                        | $V_D = V_{DRM}$ , $T_{amb} = 100\text{ }^{\circ}\text{C}$                              | $I_{DRM}$                  |        | 10   | 100  | $\mu\text{A}$                  |
| On-state voltage                                                                                         | $I_T = 300\text{ mA}$                                                                  | $V_{TM}$                   |        | 1.7  | 3    | V                              |
| Surge (non-repetitive), on-state current                                                                 | $f = 50\text{ Hz}$                                                                     | $I_{TSM}$                  |        |      | 3    | A                              |
| Holding current                                                                                          |                                                                                        | $I_H$                      |        | 65   | 500  | $\mu\text{A}$                  |
| Latching current                                                                                         | $V_T = 2.2\text{ V}$                                                                   | $I_L$                      |        |      | 500  | $\mu\text{A}$                  |
| LED trigger current                                                                                      | $V_D = 5\text{ V}$                                                                     | $I_{FT}$                   |        | 1    | 2    | mA                             |
| Trigger current temperature gradient                                                                     |                                                                                        | $\Delta I_{FT}/\Delta T_j$ |        | 7    | 14   | $\mu\text{A}/^{\circ}\text{C}$ |
| Critical rate of rise off-state voltage                                                                  | $V_D = 0.67 V_{DRM}$ , $T_j = 25\text{ }^{\circ}\text{C}$                              | $dV/dt_{cr}$               | 10 000 |      |      | V/ $\mu\text{s}$               |
|                                                                                                          | $V_D = 0.67 V_{DRM}$ , $T_j = 80\text{ }^{\circ}\text{C}$                              | $dV/dt_{cr}$               | 5000   |      |      | V/ $\mu\text{s}$               |
| Critical rate of rise of voltage at current commutation                                                  | $V_D = 230 V_{RMS}$ , $I_D = 300\text{ mA}_{RMS}$ , $T_j = 25\text{ }^{\circ}\text{C}$ | $dV/dt_{crq}$              |        | 8    |      | V/ $\mu\text{s}$               |
|                                                                                                          | $V_D = 230 V_{RMS}$ , $I_D = 300\text{ mA}_{RMS}$ , $T_j = 85\text{ }^{\circ}\text{C}$ | $dV/dt_{crq}$              |        | 7    |      | V/ $\mu\text{s}$               |
| Critical rate of rise of on-state current commutation                                                    |                                                                                        | $dI/dt_{crq}$              |        | 12   |      | A/ms                           |
| Thermal resistance, junction to ambient                                                                  |                                                                                        | $R_{thja}$                 |        | 150  |      | °C/W                           |

| <b>ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                                                  |          |      |      |      |                 |
|----------------------------------------------------------------------------------------------------------|--------------------------------------------------|----------|------|------|------|-----------------|
| PARAMETER                                                                                                | TEST CONDITION                                   | SYMBOL   | MIN. | TYP. | MAX. | UNIT            |
| <b>COUPLER</b>                                                                                           |                                                  |          |      |      |      |                 |
| Critical rate of rise of coupled input/output voltage                                                    | $I_T = 0\text{ A}$ , $V_{RM} = V_{DM} = V_{DRM}$ | $dV/dt$  |      | 5000 |      | $V/\mu\text{s}$ |
| Capacitance (input to output)                                                                            | $f = 1\text{ MHz}$ , $V_{IO} = 0\text{ V}$       | $C_{IO}$ |      | 0.8  |      | $\text{pF}$     |

**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>SWITCHING CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                             |          |      |      |      |               |
|---------------------------------------------------------------------------------------------------------|-----------------------------|----------|------|------|------|---------------|
| PARAMETER                                                                                               | TEST CONDITION              | SYMBOL   | MIN. | TYP. | MAX. | UNIT          |
| Turn-on time                                                                                            | $V_{RM} = V_{DM} = V_{DRM}$ | $t_{on}$ |      | 35   |      | $\mu\text{s}$ |

| <b>SAFETY AND INSULATION RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                 |        |      |           |      |                    |
|-------------------------------------------------------------------------------------------------------------|-----------------|--------|------|-----------|------|--------------------|
| PARAMETER                                                                                                   | TEST CONDITION  | SYMBOL | MIN. | TYP.      | MAX. | UNIT               |
| Climatic classification (according to IEC68 part 1)                                                         |                 |        |      | 55/100/21 |      |                    |
| Comparative tracking index                                                                                  |                 | CTI    | 175  |           | 399  |                    |
| $V_{IOTM}$                                                                                                  |                 |        | 8000 |           |      | $\text{V}$         |
| $V_{IORM}$                                                                                                  |                 |        | 630  |           |      | $\text{V}$         |
| $P_{SO}$                                                                                                    |                 |        |      |           | 500  | $\text{mW}$        |
| $I_{SI}$                                                                                                    |                 |        |      |           | 250  | $\text{mA}$        |
| $T_{SI}$                                                                                                    |                 |        |      |           | 175  | $^{\circ}\text{C}$ |
| Creepage distance                                                                                           | Standard DIP-8  |        | 7    |           |      | $\text{mm}$        |
| Clearance distance                                                                                          | Standard DIP-8  |        | 7    |           |      | $\text{mm}$        |
| Creepage distance                                                                                           | 400 mil DIP-8   |        | 8    |           |      | $\text{mm}$        |
| Clearance distance                                                                                          | 400 mil DIP-8   |        | 8    |           |      | $\text{mm}$        |
| Insulation thickness                                                                                        | For IL4208 only |        | 0.4  |           |      | $\text{mm}$        |

**Note**

- As per IEC60747-5-2, § 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.

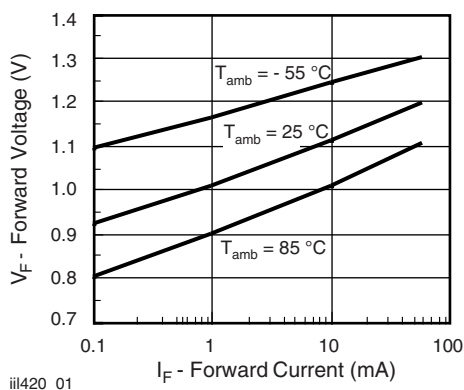
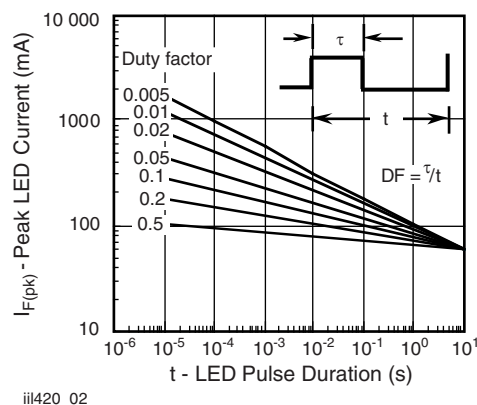
**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)


Fig. 1 - Forward Voltage vs. Forward Current


Fig. 2 - Peak LED Current vs. Duty Factor,  $\tau$

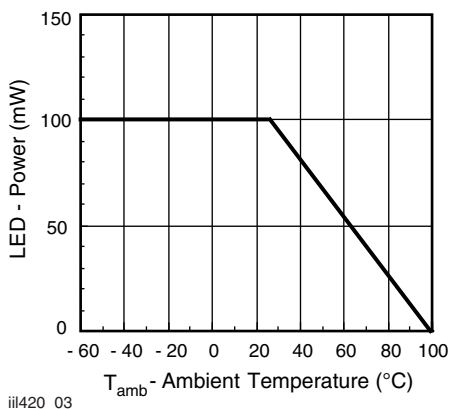


Fig. 3 - Maximum LED Power Dissipation

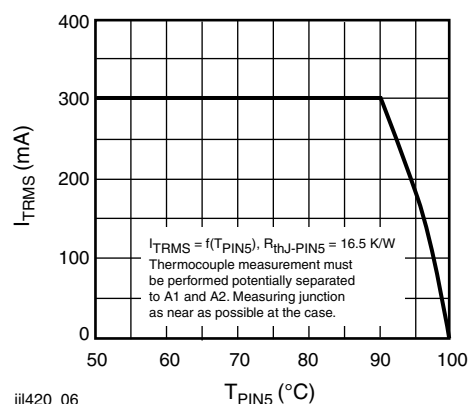


Fig. 6 - Current Reduction

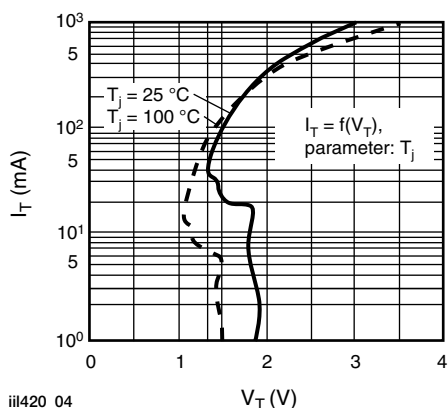


Fig. 4 - Typical Output Characteristics

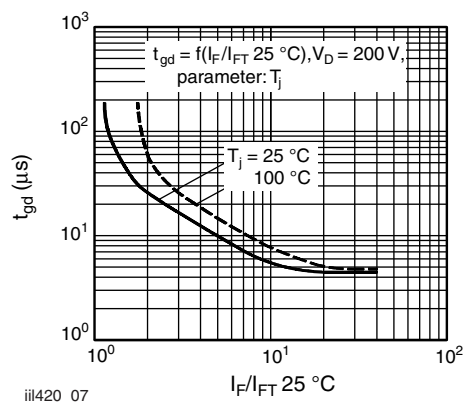


Fig. 7 - Typical Trigger Delay Time

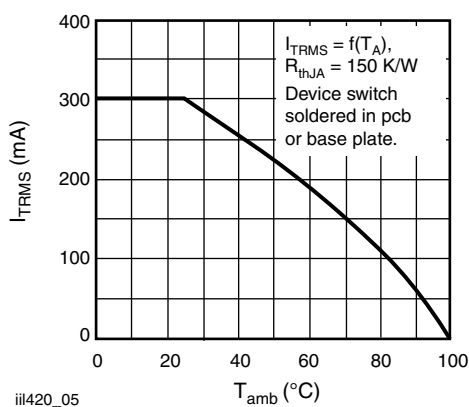


Fig. 5 - Current Reduction

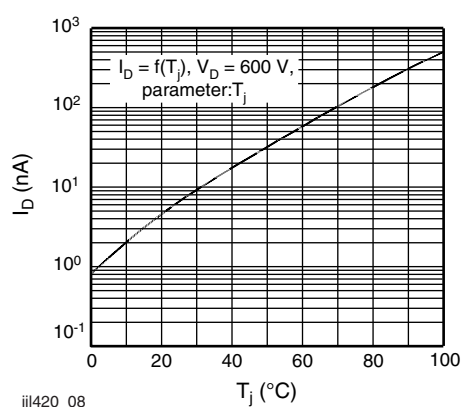


Fig. 8 - Typical Off-State Current

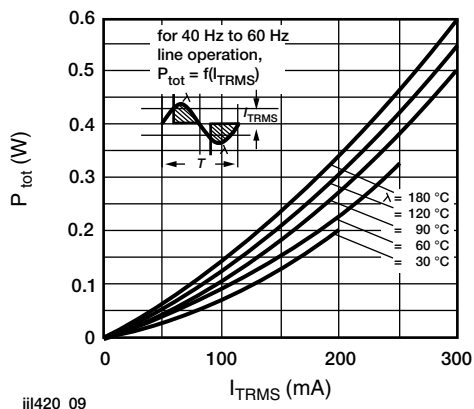


Fig. 9 - Power Dissipation

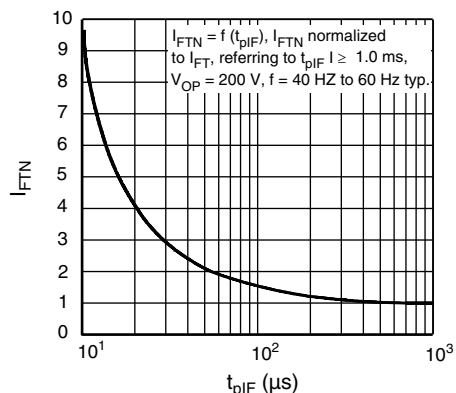
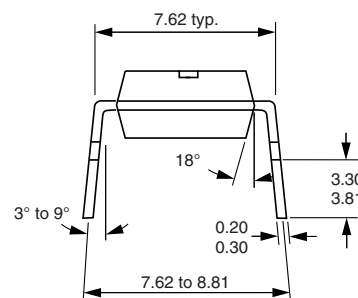
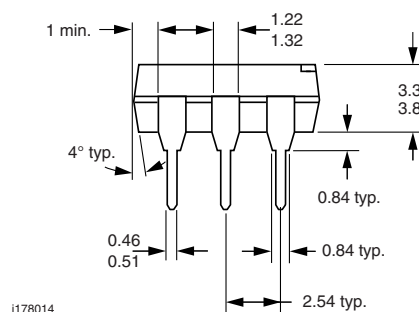
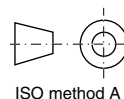
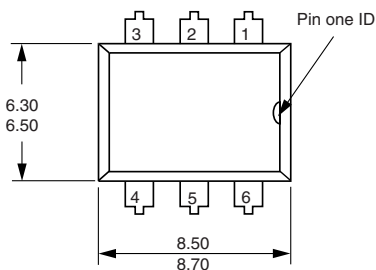
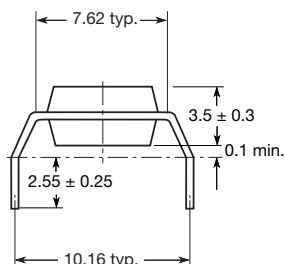
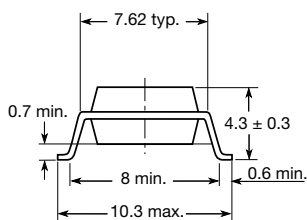
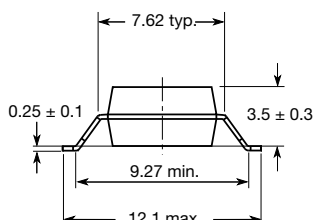
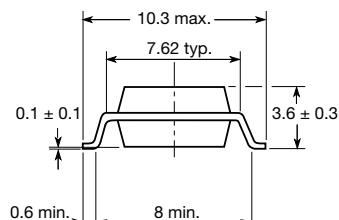
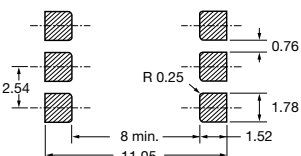
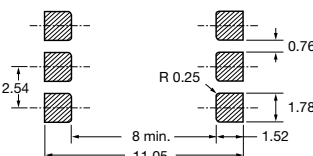
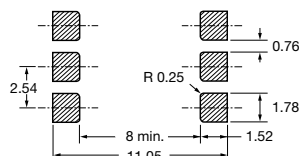


Fig. 10 - Pulse Trigger Current

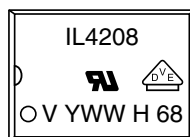
**PACKAGE DIMENSIONS** in millimeters

**Option 6**

**Option 7**

**Option 8**

**Option 9**


20802-25





## PACKAGE MARKING (example)



### Notes

- Only options 1, 7, and 8 are reflected in the package marking.
- The VDE Logo is only marked on option 1 parts.
- Tape and reel suffix (T) is not part of the package marking.



## Disclaimer

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