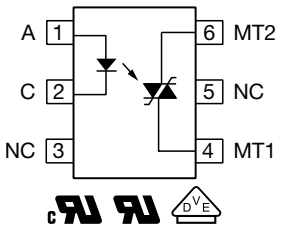
# Optocoupler, Phototriac Output, High dV/dt, Low Input Current




## FEATURES

- Low trigger current $I_{FT}$ = 1 mA (typ.)
- $I_{TRMS}$ = 300 mA
- High static dV/dt ≥ 10 000 V/µs
- Load voltage up to 800 V
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

## LINKS TO ADDITIONAL RESOURCES

3D Models | Design Tools | Related Documents | SPICE Models | Footprints | Schematics

## APPLICATIONS

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

## AGENCY APPROVALS

- UL 1577
- cUL
- DIN EN 60747-5-5 (VDE 0884-5), available with option 1
- FIMKO

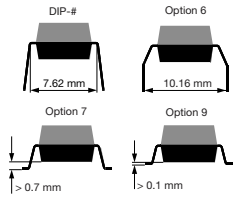
## DESCRIPTION

The IL420 and IL4208 consists of an optically coupled GaAs IRLED to a photosensitive thyristor system with integrated noise suppression and non-zero crossing functionality. The thyristor system enables low trigger currents of 1 mA and features a dV/dt ratio of greater than 10 kV/µs and load voltages up to 800 V.

The IL420 and IL4208 are a perfect microcontroller friendly solution to isolate low-voltage logic from high voltage 120 $V_{AC}$, 240 $V_{AC}$, and 380 $V_{AC}$ lines and to control resistive, inductive, or capacitive AC loads like motors, solenoids, high power thyristors, or TRIACs and solid-state relays.

## ORDERING INFORMATION

| I | L | 4 | 2 | 0 | # | - | X | 0 | # | # | T |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PART NUMBER | | | | | | | PACKAGE OPTION | | | | TAPE AND REEL |




| AGENCY CERTIFIED / PACKAGE | PEAK OFF-STATE VOLTAGE $V_{DRM}$ (V) | |
|---|---|---|
| **UL, cUL, CQC** | **600** | **800** |
| DIP-6 | IL420 | IL4208 |
| DIP-6, 400 mil, option 6 | IL420-X006 | - |
| SMD-6, option 7 | IL420-X007T (1) | IL4208-X007T (1) |
| SMD-6, option 9 | IL420-X009T (1) | IL4208-X009T (1) |
| **VDE, UL, cUL, CQC** | **600** | **800** |
| DIP-6 | IL420-X001 | - |
| DIP-6, 400 mil, option 6 | IL420-X016 | - |
| SMD-6, option 7 | IL420-X017T (1) | IL4208-X017T |

**Notes**

(1) Also available in tubes, do not put T on the end

- Additional options may be possible, please contact sales office

| **ABSOLUTE MAXIMUM RATINGS** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | |
|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **VALUE** | **UNIT** |
| **INPUT** | | | | | |
| 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 |
| **OUTPUT** | | | | | |
| 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 |
| **COUPLER** | | | | | |
| Storage temperature range | | | $T_{stg}$ | -55 to +150 | °C |
| Ambient temperature range | | | $T_{amb}$ | -55 to +100 | °C |
| Soldering temperature | max. ≤ 10 s dip soldering<br>≥ 0.5 mm from case bottom | | $T_{sld}$ | 260 | °C |

**Note**

- 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.

| **ELECTRICAL CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **INPUT** | | | | | | |
| Forward voltage | $I_F$ = 10 mA | $V_F$ | - | 1.16 | 1.35 | V |
| Reverse current | $V_R$ = 6 V | $I_R$ | - | 0.1 | 10 | µA |
| Input capacitance | $V_F$ = 0 V, f = 1 MHz | $C_{IN}$ | - | 40 | - | pF |
| Thermal resistance, junction to ambient | | $R_{thja}$ | - | 750 | - | °C/W |
| **OUTPUT** | | | | | | |
| Off-state current | $V_D = V_{DRM}$, $T_{amb}$ = 100 °C | $I_{DRM}$ | - | 10 | 100 | µA |
| On-state voltage | $I_T$ = 300 mA | $V_{TM}$ | - | 1.7 | 3 | V |
| Surge (non-repetitive), on-state current | f = 50 Hz | $I_{TSM}$ | - | - | 3 | A |
| Holding current | | $I_H$ | - | 65 | 500 | µA |
| Latching current | $V_T$ = 2.2 V | $I_L$ | - | | 500 | µA |
| LED trigger current | $V_D$ = 5 V | $I_{FT}$ | - | 1 | 2 | mA |
| Trigger current temperature gradient | | $\Delta I_{FT}/\Delta T_j$ | - | 7 | 14 | µA/°C |
| Critical rate of rise off-state voltage | $V_D$ = 0.67 $V_{DRM}$, $T_j$ = 25 °C | $dV/dt_{cr}$ | 10 000 | - | - | V/µs |
| | $V_D$ = 0.67 $V_{DRM}$, $T_j$ = 80 °C | $dV/dt_{cr}$ | 5000 | - | - | V/µs |
| Critical rate of rise of voltage at current commutation | $V_D$ = 230 $V_{RMS}$, $I_D$ = 300 $mA_{RMS}$, $T_J$ = 25 °C | $dV/dt_{crq}$ | - | 8 | - | V/µs |
| | $V_D$ = 230 $V_{RMS}$, $I_D$ = 300 $mA_{RMS}$, $T_J$ = 85 °C | $dV/dt_{crq}$ | - | 7 | - | V/µs |
| 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 |

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

| **SWITCHING CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Turn-on time | $V_{RM} = V_{DM} = V_{DRM}$ | $t_{on}$ | - | 35 | - | µs |

| **SAFETY AND INSULATION RATINGS** | | | | |
|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **VALUE** | **UNIT** |
| Climatic classification | According to IEC 68 part 1 | | 55 / 100 / 21 | |
| Comparative tracking index | | CTI | 175 | |
| Maximum rated withstanding isolation voltage | t = 1 min | $V_{ISO}$ | 4420 | $V_{RMS}$ |
| Maximum transient isolation voltage | | $V_{IOTM}$ | 8000 | $V_{peak}$ |
| Maximum repetitive peak isolation voltage | | $V_{IORM}$ | 890 | $V_{peak}$ |
| Isolation resistance | $V_{IO}$ = 500 V, $T_{amb}$ = 25 °C | $R_{IO}$ | $\geq 10^{12}$ | Ω |
| | $V_{IO}$ = 500 V, $T_{amb}$ = 100 °C | $R_{IO}$ | $\geq 10^{11}$ | Ω |
| Output safety power | | $P_{SO}$ | 500 | mW |
| Input safety current | | $I_{SI}$ | 250 | mA |
| Safety temperature | | $T_S$ | 175 | °C |
| Creepage distance | DIP-6; SMD-6, option 7; SMD-6 option 9 | | ≥ 7 | mm |
| Clearance distance | | | ≥ 7 | mm |
| Creepage distance | DIP-6, option 6 | | ≥ 8 | mm |
| Clearance distance | | | ≥ 8 | mm |
| Insulation thickness | | DTI | ≥ 0.4 | mm |

**Note**

- As per IEC 60747-5-5, § 7.4.3.8.2, 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 °C, unless otherwise specified)

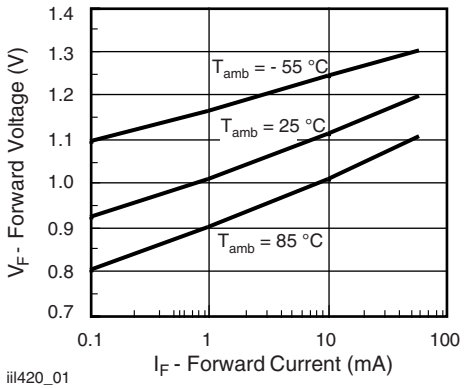



Fig. 1 - Forward Voltage vs. Forward Current

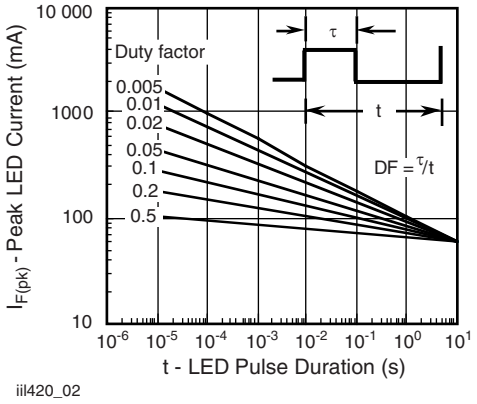



Fig. 2 - Peak LED Current vs. Duty Factor, τ

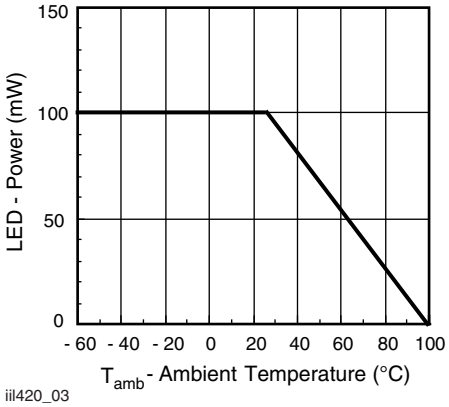



Fig. 3 - Maximum LED Power Dissipation

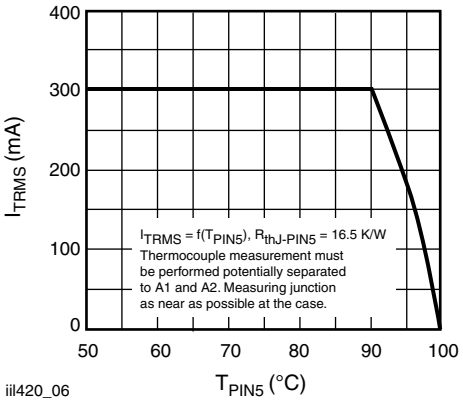



Fig. 6 - Current Reduction

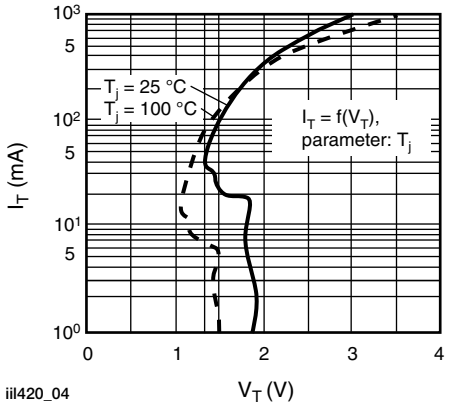



Fig. 4 - Typical Output Characteristics

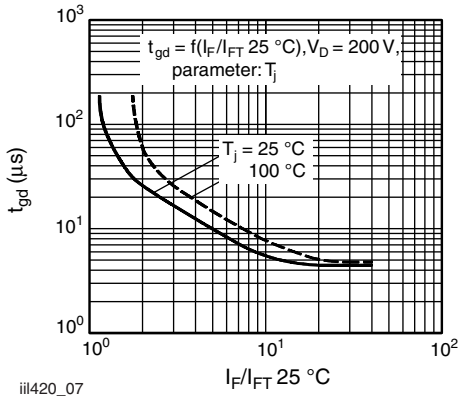



Fig. 7 - Typical Trigger Delay Time

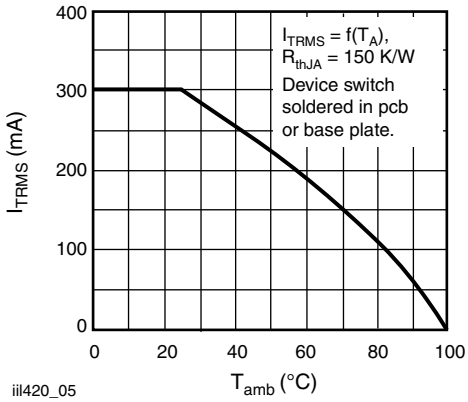



Fig. 5 - Current Reduction

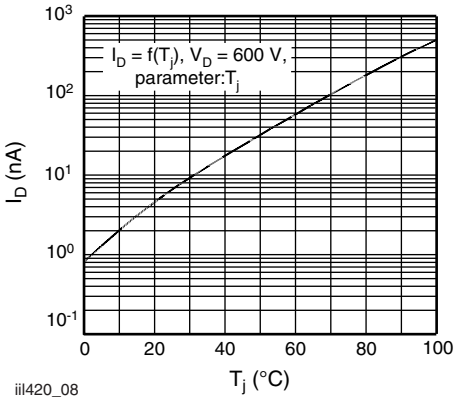



Fig. 8 - Typical Off-State Current

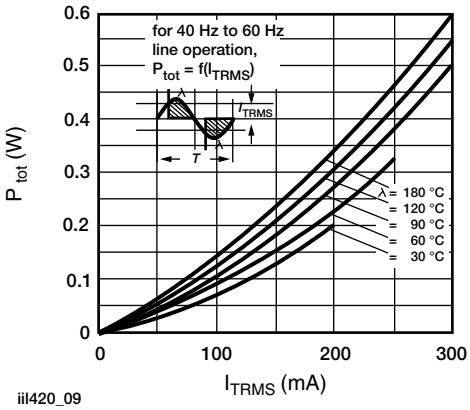



Fig. 9 - Power Dissipation

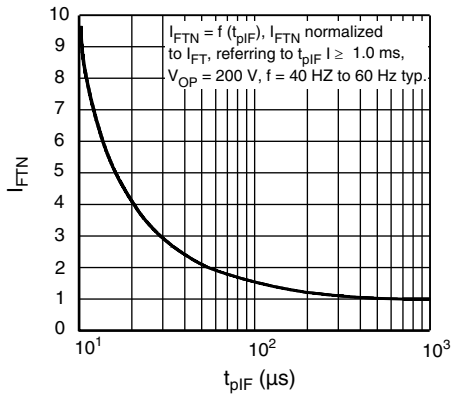
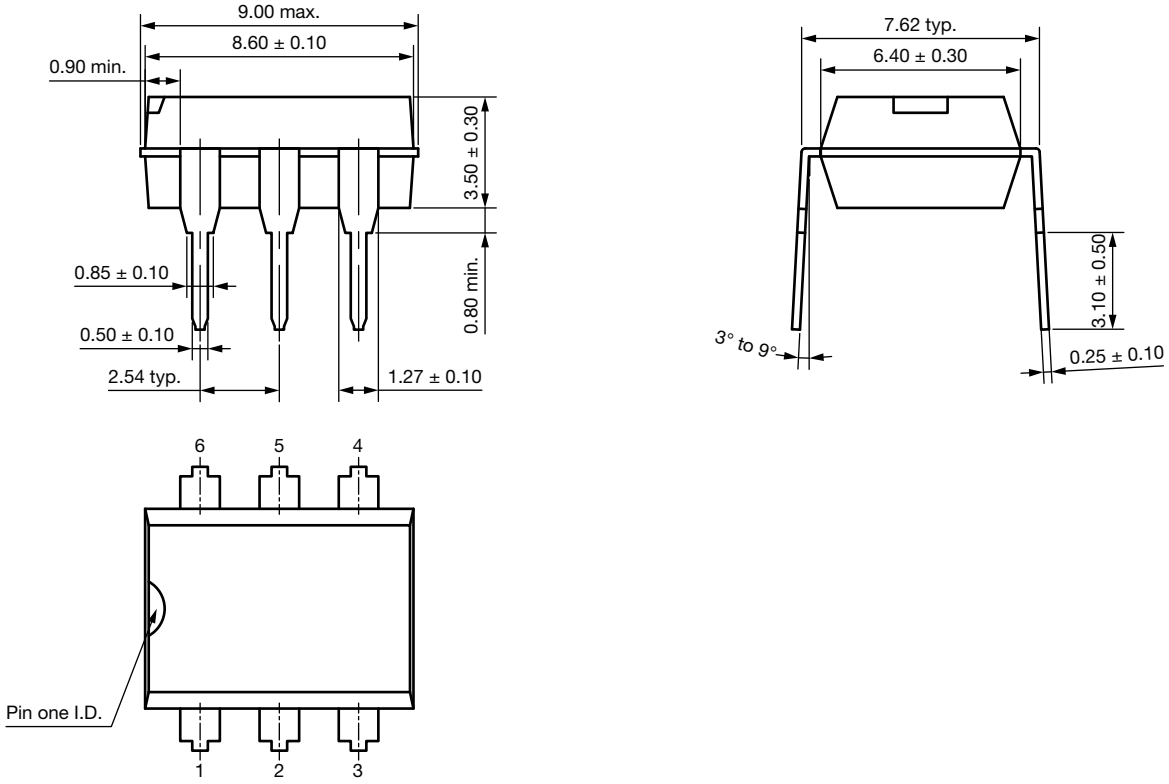


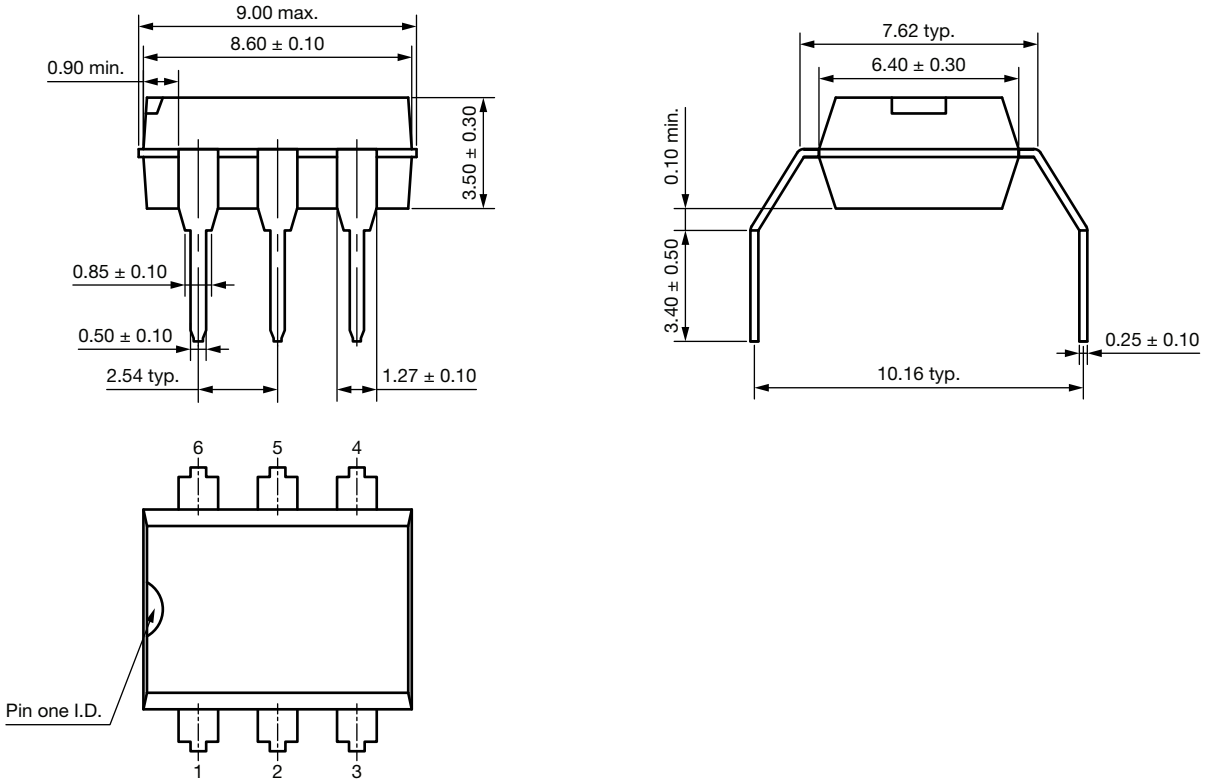

Fig. 10 - Pulse Trigger Current

## **PACKAGE DIMENSIONS** in millimeters

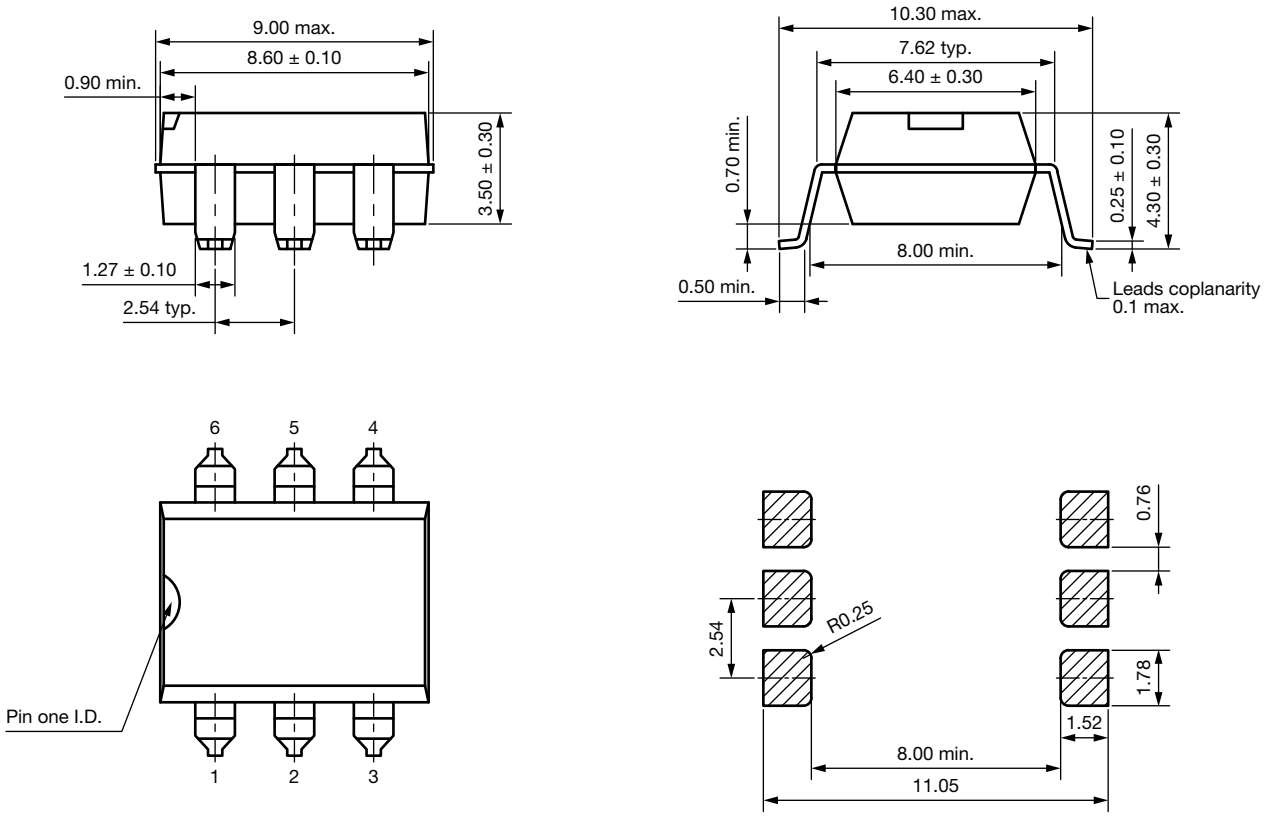
### DIP-6



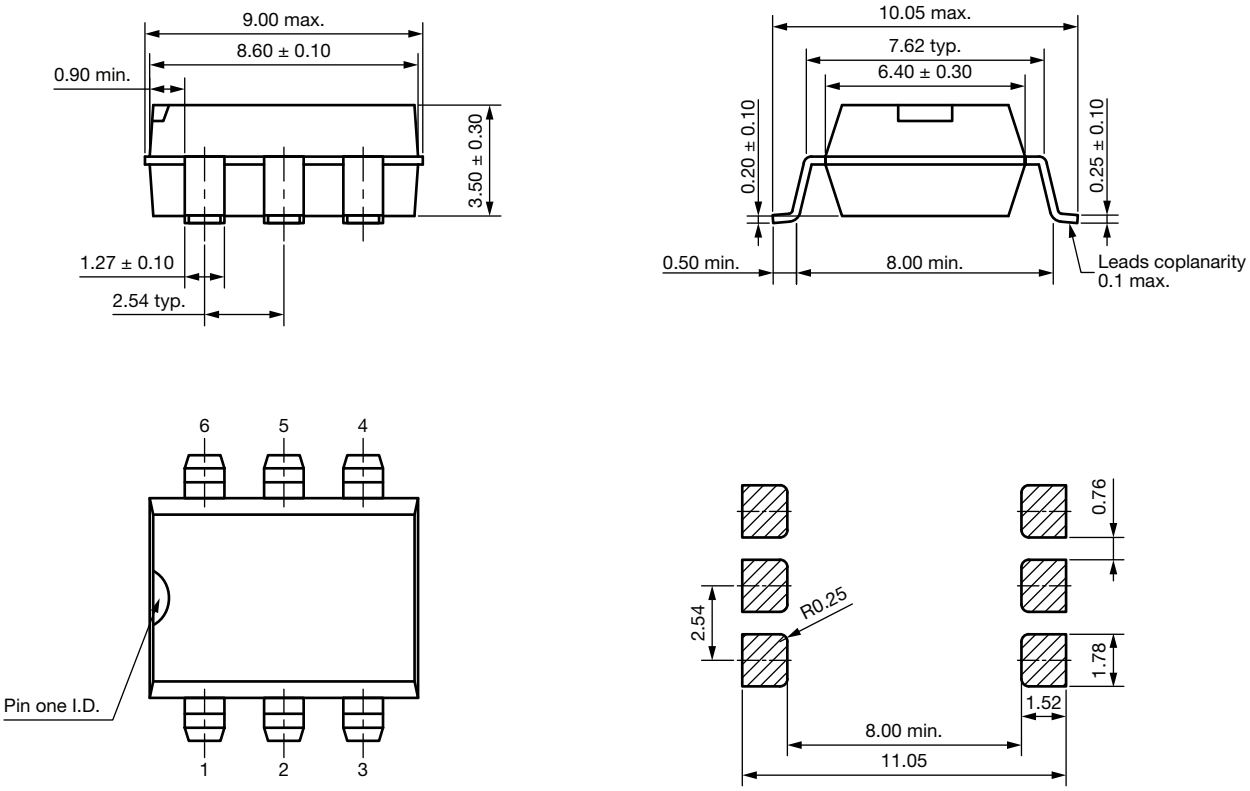
**DIP-6, 400 mil (option 6)**




**SMD-6 (option 7)**



**SMD-6 (option 9)**




## **PACKAGE MARKING** (example)

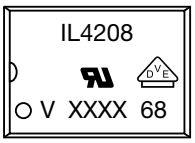



Fig. 11 - Example of IL4208-X017T

**Notes**

- XXXX = LMC (lot marking code)
- VDE logo is only marked on option 1 parts
- Tape and reel suffix (T) is not part of the package marking

## SOLDER PROFILES

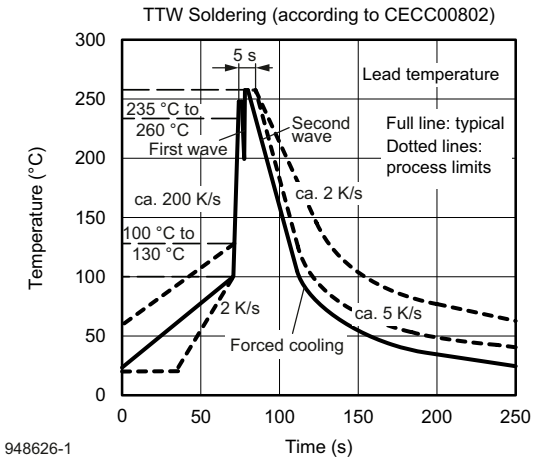



Fig. 12 - Wave Soldering Double Wave Profile
According to J-STD-020 for DIP Devices

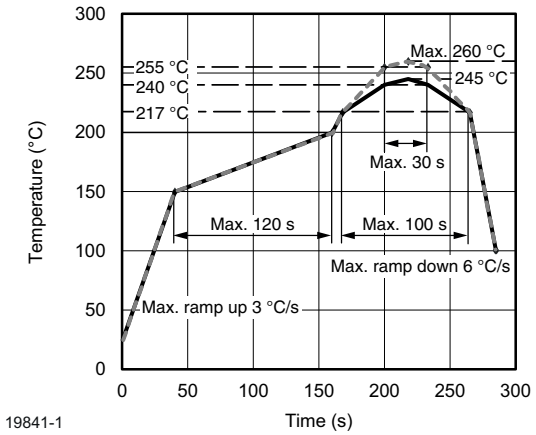



Fig. 13 - Lead (Pb)-free Reflow Solder Profile
According to J-STD-020 for SMD Devices

## HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: unlimited

Conditions: $T_{amb}$ < 30 °C, RH < 85 %

Moisture sensitivity level 1, according to J-STD-020

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