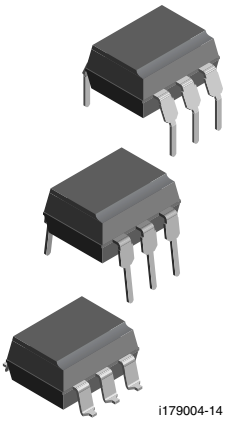
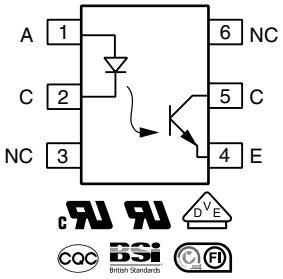
# Optocoupler, Phototransistor Output, no Base Connection, 110 °C Rated



i179004-14




## FEATURES

- Operating temperature from -55 °C to +110 °C
- No base terminal connection for improved common mode interface immunity
- Long term stability
- Industry standard dual-in-line package
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

## APPLICATIONS

- AC adapter
- SMPS
- PLC
- Factory automation
- Game consoles

## DESCRIPTION

The CNY117F is a 110 °C rated optocoupler consisting of a gallium arsenide infrared emitting diode optically coupled to a silicon planar phototransistor detector in a plastic plug-in DIP-6 package.

The coupling device is suitable for signal transmission between two electrically separated circuits. The potential difference between the circuits to be coupled is not allowed to exceed the maximum permissible reference voltages.

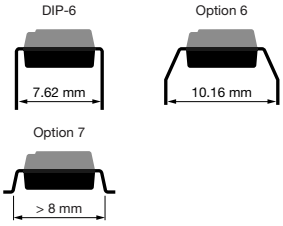
In contrast to the CNY117 series, the base terminal of the F type is not connected, resulting in a substantially improved common-mode interference immunity.

## AGENCY APPROVALS

- UL file no. E52744
- cUL tested to CSA 22.2 bulletin 5A
- DIN EN 60747-5-5 (VDE 0884-5), available with option 1
- BSI: EN 60065, EN 60950-1
- FIMKO EN60950
- CQC GB8898-2011

## ORDERING INFORMATION

| C | N | Y | 1 | 1 | 7 | F | - | # | X | 0 | # | # | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PART NUMBER | | | | | | | | CTR BIN | PACKAGE OPTION | | | | TAPE AND REEL |




| AGENCY CERTIFIED/PACKAGE | CTR (%) | | | |
|---|---|---|---|---|
| **UL, cUL, BSI** | **40 to 80** | **63 to 125** | **100 to 200** | **160 to 320** |
| DIP-6 | CNY117F-1 | CNY117F-2 | CNY117F-3 | CNY117F-4 |
| DIP-6, 400 mil, option 6 | CNY117F-1X006 | CNY117F-2X006 | CNY117F-3X006 | CNY117F-4X006 |
| SMD-6, option 7 | CNY117F-1X007T | CNY117F-2X007T | CNY117F-3X007T | CNY117F-4X007T |
| **VDE, UL, cUL, BSI** | **40 to 80** | **63 to 125** | **100 to 200** | **160 to 320** |
| DIP-6 | CNY117F-1X001 | CNY117F-2X001 | CNY117F-3X001 | CNY117F-4X001 |
| DIP-6, 400 mil, option 6 | CNY117F-1X016 | CNY117F-2X016 | CNY117F-3X016 | CNY117F-4X016 |
| SMD-6, option 7 | CNY117F-1X017T | CNY117F-2X017T | CNY117F-3X017T | CNY117F-4X017T |

**Note**

- Additional options may be possible, please contact sales office.



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| **ABSOLUTE MAXIMUM RATINGS** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | |
|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **VALUE** | **UNIT** |
| **INPUT** | | | | |
| Reverse voltage | | $V_R$ | 6.0 | V |
| DC forward current | | $I_F$ | 60 | mA |
| Surge forward current | t ≤ 10 µs | $I_{FSM}$ | 2.5 | A |
| Power dissipation | | $P_{diss}$ | 100 | mW |
| **OUTPUT** | | | | |
| Collector emitter breakdown voltage | | $BV_{CEO}$ | 70 | V |
| Collector current | | $I_C$ | 50 | mA |
| Collector peak current | $t_p/T$ = 0.5, $t_p$ ≤ 10 ms | $I_{CM}$ | 100 | mA |
| Output power dissipation | | $P_{diss}$ | 150 | mW |
| **COUPLER** | | | | |
| Isolation test voltage between emitter and detector | t = 1 min | $V_{ISO}$ | 5000 | $V_{RMS}$ |
| Storage temperature range | | $T_{stg}$ | -55 to +150 | °C |
| Ambient temperature range | | $T_{amb}$ | -55 to +110 | °C |
| Soldering temperature [1] | 2 mm from case, ≤ 10 s | $T_{sld}$ | 260 | °C |
| Total power dissipation | | $P_{diss}$ | 250 | mW |

**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.

(1) Refer to reflow profile for soldering conditions for surface mounted devices (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP).

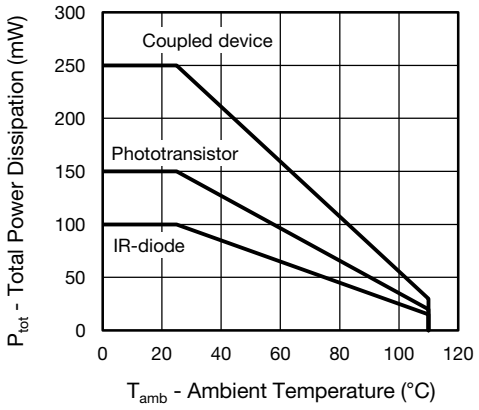



Fig. 1 - Total Power Dissipation vs. Ambient Temperature

| **ELECTRICAL CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **INPUT** | | | | | | | |
| Forward voltage | $I_F$ = 60 mA | | $V_F$ | | 1.39 | 1.65 | V |
| Breakdown voltage | $I_R$ = 10 µA | | $V_{BR}$ | 6.0 | | | V |
| Reverse current | $V_R$ = 6.0 V | | $I_R$ | | 0.01 | 10 | µA |
| Capacitance | $V_R$ = 0 V, f = 1.0 MHz | | $C_O$ | | 25 | | pF |
| **OUTPUT** | | | | | | | |
| Collector emitter capacitance | $V_{CE}$ = 5.0 V, f = 1.0 MHz | | $C_{CE}$ | | 5.2 | | pF |
| Base collector capacitance | $V_{CE}$ = 5.0 V, f = 1.0 MHz | | $C_{BC}$ | | 6.5 | | pF |
| Emitter base capacitance | $V_{CE}$ = 5.0 V, f = 1.0 MHz | | $C_{EB}$ | | 7.5 | | pF |


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| **ELECTRICAL CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **COUPLER** | | | | | | | |
| Collector emitter, saturation voltage | $I_F$ = 10 mA, $I_C$ = 2.5 mA | | $V_{CEsat}$ | | 0.25 | 0.4 | V |
| Coupling capacitance | | | $C_C$ | | 0.6 | | pF |
| Collector emitter, leakage current | $V_{CE}$ = 10 V | CNY117F-1 | $I_{CEO}$ | | 2.0 | 50 | nA |
| | | CNY117F-2 | $I_{CEO}$ | | 2.0 | 50 | nA |
| | | CNY117F-3 | $I_{CEO}$ | | 5.0 | 100 | nA |
| | | CNY117F-4 | $I_{CEO}$ | | 5.0 | 100 | nA |

**Note**

- Minimum and maximum values were tested requierements. Typical values are characteristics of the device and are the result of engineering evaluations. Typical values are for information only and are not part of the testing requirements.

| **CURRENT TRANSFER RATIO** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Current transfer ratio | $I_F$ = 10 mA | CNY117F-1 | CTR | 40 | | 80 | % |
| | | CNY117F-2 | CTR | 63 | | 125 | % |
| | | CNY117F-3 | CTR | 100 | | 200 | % |
| | | CNY117F-4 | CTR | 160 | | 320 | % |
| | $I_F$ = 1.0 mA | CNY117F-1 | CTR | 13 | 30 | | % |
| | | CNY117F-2 | CTR | 22 | 45 | | % |
| | | CNY117F-3 | CTR | 34 | 70 | | % |
| | | CNY117F-4 | CTR | 56 | 90 | | % |

**Note**

- Current transfer ratio $I_C/I_F$ at $V_{CE}$ = 5.0 V, 25 °C and collector emitter leakage current by dash number.

| **SWITCHING CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **PART** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **LINEAR OPERATION** (without saturation) | | | | | | | |
| Turn-on time | $I_F$ = 10 mA, $V_{CC}$ = 5.0 V, $R_L$ = 75 Ω | | $t_{on}$ | | 3.0 | | µs |
| Rise time | $I_F$ = 10 mA, $V_{CC}$ = 5.0 V, $R_L$ = 75 Ω | | $t_r$ | | 2.0 | | µs |
| Turn-off time | $I_F$ = 10 mA, $V_{CC}$ = 5.0 V, $R_L$ = 75 Ω | | $t_{off}$ | | 2.3 | | µs |
| Fall time | $I_F$ = 10 mA, $V_{CC}$ = 5.0 V, $R_L$ = 75 Ω | | $t_f$ | | 2.0 | | µs |
| Cut-off frequency | $I_F$ = 10 mA, $V_{CC}$ = 5.0 V, $R_L$ = 75 Ω | | $f_{CO}$ | | 110 | | kHz |
| **SWITCHING OPERATION** (with saturation) | | | | | | | |
| Turn-on time | $I_F$ = 20 mA | CNY117F-1 | $t_{on}$ | | 3.0 | | µs |
| | $I_F$ = 10 mA | CNY117F-2 | $t_{on}$ | | 4.2 | | µs |
| | | CNY117F-3 | $t_{on}$ | | 4.2 | | µs |
| | $I_F$ = 5.0 mA | CNY117F-4 | $t_{on}$ | | 6.0 | | µs |
| Rise time | $I_F$ = 20 mA | CNY117F-1 | $t_r$ | | 2.0 | | µs |
| | $I_F$ = 10 mA | CNY117F-2 | $t_r$ | | 3.0 | | µs |
| | | CNY117F-3 | $t_r$ | | 3.0 | | µs |
| | $I_F$ = 5.0 mA | CNY117F-4 | $t_r$ | | 4.6 | | µs |
| Turn-off time | $I_F$ = 20 mA | CNY117F-1 | $t_{off}$ | | 18 | | µs |
| | $I_F$ = 10 mA | CNY117F-2 | $t_{off}$ | | 23 | | µs |
| | | CNY117F-3 | $t_{off}$ | | 23 | | µs |
| | $I_F$ = 5.0 mA | CNY117F-4 | $t_{off}$ | | 25 | | µs |
| Fall time | $I_F$ = 20 mA | CNY117F-1 | $t_f$ | | 11 | | µs |
| | $I_F$ = 10 mA | CNY117F-2 | $t_f$ | | 14 | | µs |
| | | CNY117F-3 | $t_f$ | | 14 | | µs |
| | $I_F$ = 5.0 mA | CNY117F-4 | $t_f$ | | 15 | | µs |


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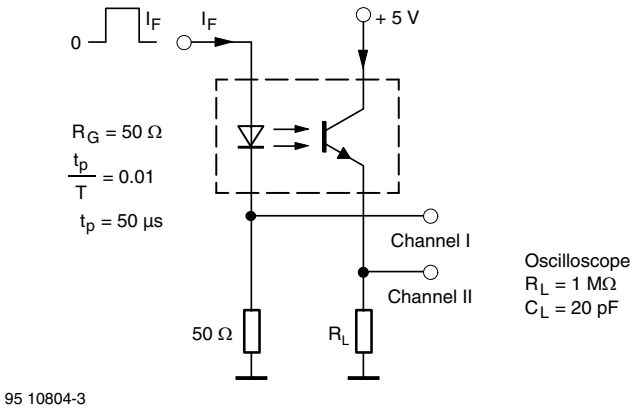



Fig. 2 - Test Circuit, Non-Saturated Operation

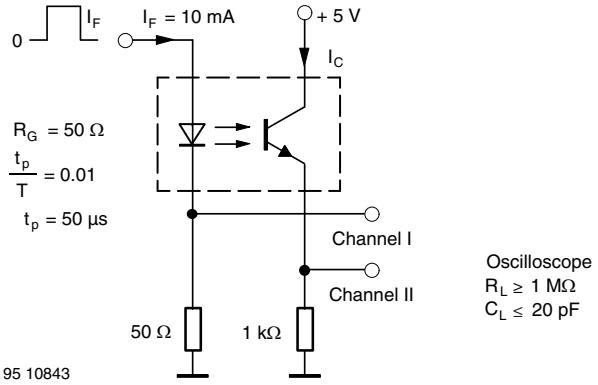



Fig. 3 - Test Circuit, Saturated Operation

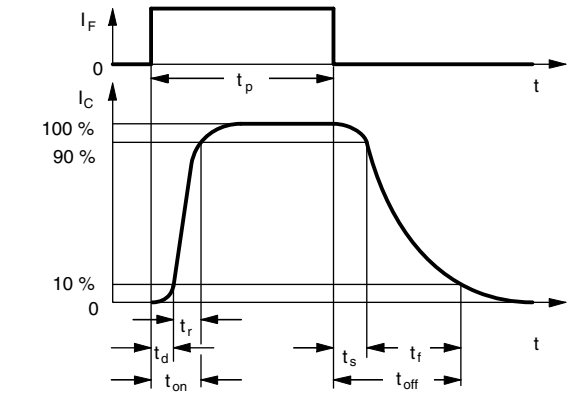



Fig. 4 - Switching Times

| SAFETY AND INSULATION RATINGS | | | | |
|---|---|---|---|---|
| **PARAMETER** | | **SYMBOL** | **VALUE** | **UNIT** |
| **MAXIMUM SAFETY RATINGS** | | | | |
| Output safety power | | $P_{SO}$ | 700 | mW |
| Input safety current | | $I_{SI}$ | 400 | mA |
| Safety temperature | | $T_{SI}$ | 175 | °C |
| Comparative tracking index | | CTI | 175 | |
| **INSULATION RATED PARAMETERS** | | | | |
| Maximum withstanding isolation voltage | | $V_{ISO}$ | 5000 | $V_{RMS}$ |
| Maximum transient isolation voltage | | $V_{IOTM}$ | 8000 | $V_{peak}$ |
| Maximum repetitive peak isolation voltage | | $V_{IORM}$ | 890 | $V_{peak}$ |
| Insulation resistance | $T_{amb}$ = 25 °C, $V_{DC}$ = 500 V | $R_{IO}$ | $\geq 10^{12}$ | Ω |
| Isolation resistance | $T_{amb}$ = 100 °C, $V_{DC}$ = 500 V | $R_{IO}$ | $\geq 10^{11}$ | Ω |
| Climatic classification (according to IEC 68 part 1) | | | 55/115/21 | |
| Environment (pollution degree in accordance to DIN VDE 0109) | | | 2 | |
| Creepage distance | Standard DIP-4 | | ≥ 7 | mm |
| | SMD | | ≥ 7 | mm |
| Clearance distance | Standard DIP-4 | | ≥ 8 | mm |
| | SMD | | ≥ 8 | mm |
| Insulation thickness | | DTI | ≥ 0.4 | mm |

**Note**

- As per DIN EN 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.


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**TYPICAL CHARACTERISTICS** ($T_{amb}$ = 25 °C, unless otherwise specified)

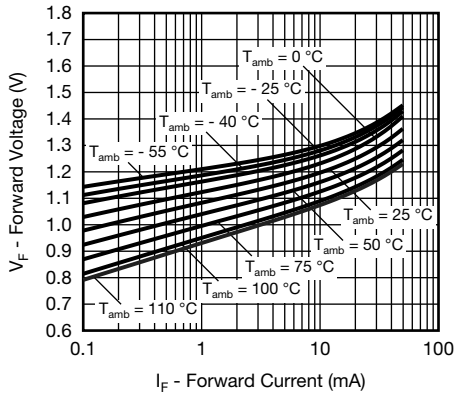



Fig. 5 - Forward Voltage vs. Forward Current

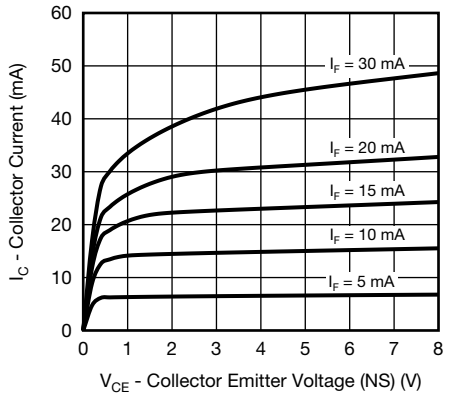



Fig. 6 - Collector Current vs. Collector Emitter Voltage (NS)

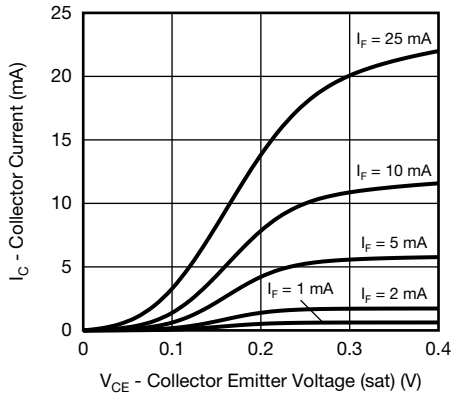



Fig. 7 - Collector Current vs. Collector Emitter Voltage (sat)

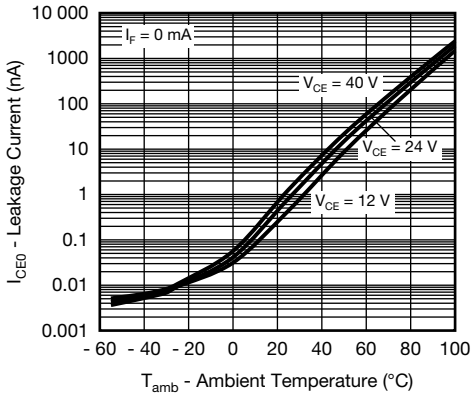



Fig. 8 - Leakage Current vs. Ambient Temperature

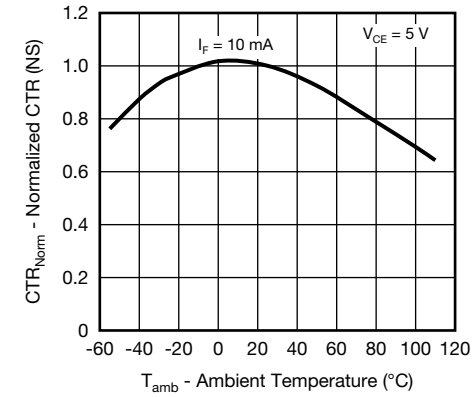



Fig. 9 - Normalized CTR (NS) vs. Ambient Temperature

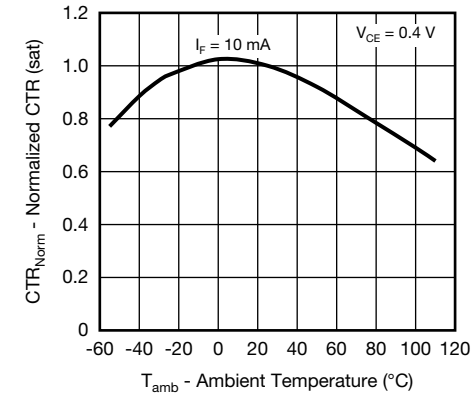



Fig. 10 - Normalized CTR (sat) vs. Ambient Temperature


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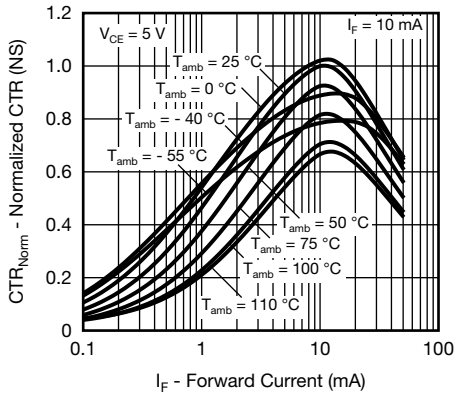



Fig. 11 - Normalized CTR (NS) vs. Forward Current

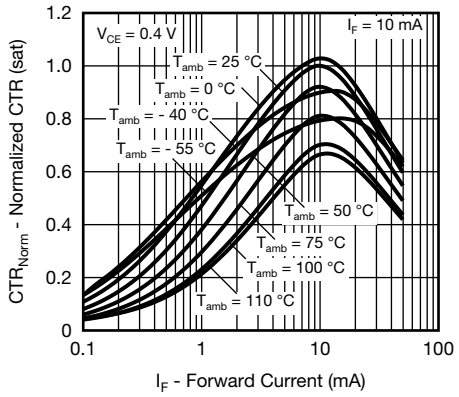



Fig. 12 - Normalized CTR (sat) vs. Forward Current

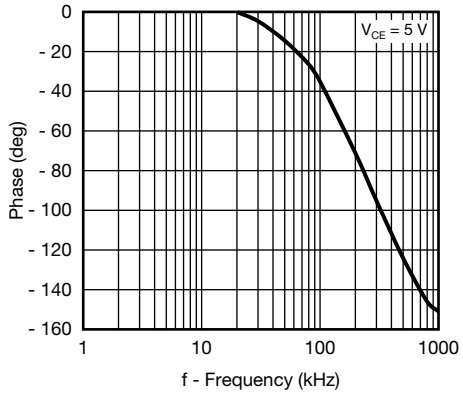



Fig. 13 - CTR Frequency vs. Phase Angle

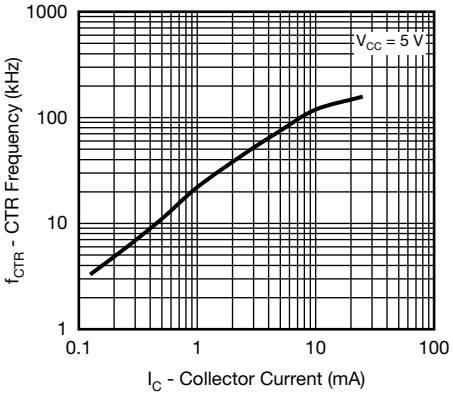



Fig. 14 - CTR -3 dB Frequency vs. Collector Current

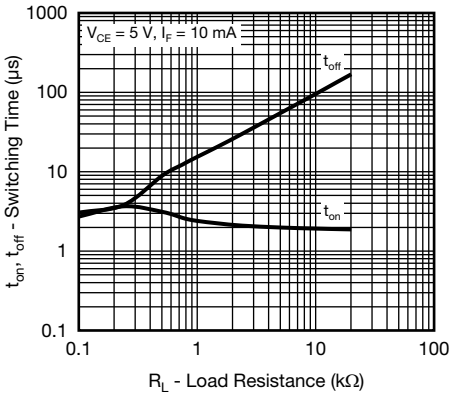
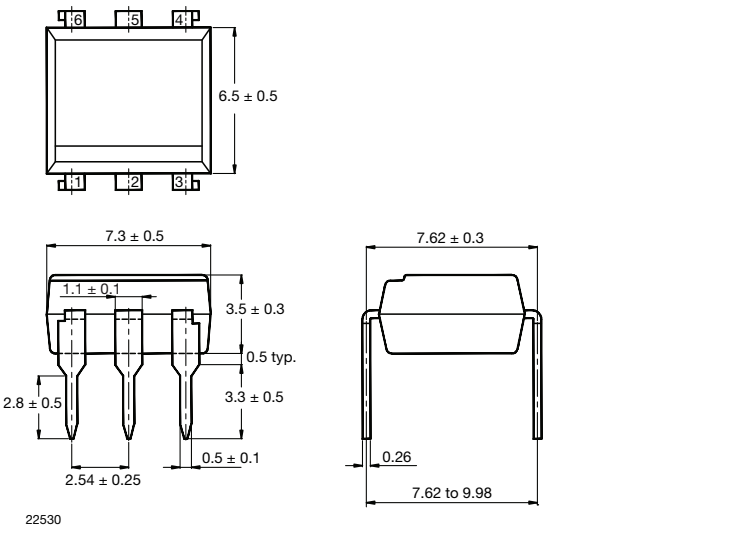


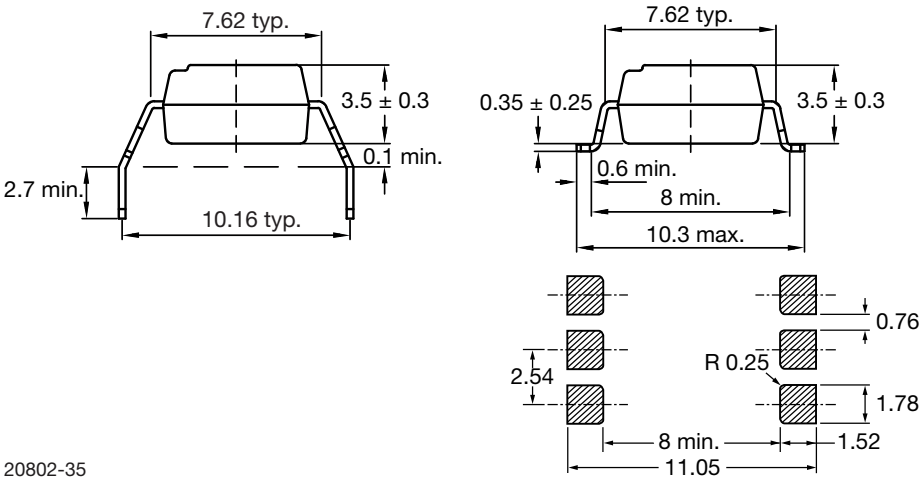

Fig. 15 - Switching Time vs. Load Resistance


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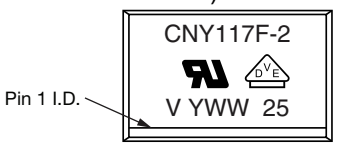
**PACKAGE DIMENSIONS** in millimeters




**Option 6** **Option 7**




**PACKAGE MARKING** (Example of CNY117F-2X017T)




**Notes**

- VDE logo is only marked on option 1 parts. Option information is not marked on the part.
- Tape and reel suffix (T) is not part of the package marking.


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## TUBE AND TAPE INFORMATION

| DEVICES PER TUBE | | | |
|---|---|---|---|
| **TYPE** | **UNITS/TUBE** | **TUBES/BOX** | **UNITS/BOX** |
| DIP-6 | 50 | 40 | 2000 |

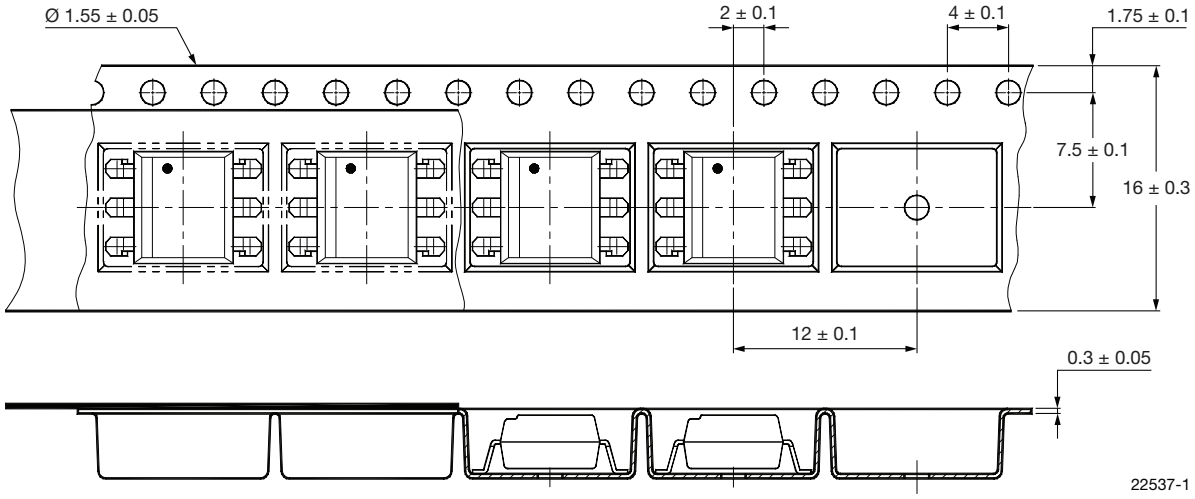



Fig. 16 - Tape and Reel Drawing, 1000 Units per Reel


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