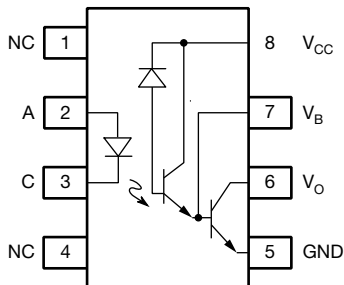


High Speed Optocoupler, 100 kBd, Low Input Current, Photodiode Darlington Output



DESCRIPTION

High common mode transient immunity and very high current ratio are achieved by coupling an LED with an integrated high gain photo detector in an eight pin dual-in-line package. Separate pins for the photo diode and output stage enable TTL compatible saturation voltages with high speed operation.

Access to the base terminal allows adjustment to the gain bandwidth.

The 6N139 is suited for low power logic applications involving CMOS and low power TTL applications. A 400 % current transfer ratio with only 0.5 mA of LED current is guaranteed.

FEATURES

- 400 % (min) high current transfer ratio
- 0.5 mA low input drive current
- Enhanced CTI of 275
- 10 kV/ μ s (typ.) high common mode transient immunity
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT

APPLICATIONS

- Microprocessor system interface
- PLC, ATE input / output isolation
- RS232, SPI, I2C bus systems
- TTL, CMOS voltage level translation
- Multiplexed data transmission
- Ground loop and electrical noise elimination

AGENCY APPROVALS

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

LINKS TO ADDITIONAL RESOURCES





| ORDERING INFORMATION | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px;">6</div> <div style="border: 1px solid black; padding: 2px 5px;">N</div> <div style="border: 1px solid black; padding: 2px 5px;">1</div> <div style="border: 1px solid black; padding: 2px 5px;">3</div> <div style="border: 1px solid black; padding: 2px 5px;">#</div> <div style="border: 1px solid black; padding: 2px 5px;">-</div> <div style="border: 1px solid black; padding: 2px 5px;">X</div> <div style="border: 1px solid black; padding: 2px 5px;">0</div> <div style="border: 1px solid black; padding: 2px 5px;">#</div> <div style="border: 1px solid black; padding: 2px 5px;">#</div> <div style="border: 1px solid black; padding: 2px 5px;">T</div> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> PART NUMBER PACKAGE OPTION TAPE AND REEL </div> | |
| AGENCY CERTIFIED / PACKAGE | CTR (%) |
| | 1.6 mA |
| UL, cUL | > 500 |
| DIP-8 | 6N139 |
| SMD-8, option 7 | 6N139-X007T |
| UL, cUL, VDE (option 1) | > 500 |
| DIP-8 | 6N139-X001 |
| SMD-8, option 7 | 6N139-X017T |

| ABSOLUTE MAXIMUM RATINGS (T _{amb} = 25 °C, unless otherwise specified) | | | | |
|---------------------------------------------------------------------------------|----------------|-------------------|-------------|------|
| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
| INPUT | | | | |
| Reverse voltage | | V _R | 5 | V |
| Average forward input current | | I _F | 20 | mA |
| Input power dissipation | | P _{diss} | 35 | mW |
| OUTPUT | | | | |
| Supply voltage | | V _{CC} | 18 | V |
| Output voltage | | V _O | 18 | V |
| Output current | | I _O | 50 | mA |
| Output power dissipation | | P _{diss} | 100 | mW |
| COUPLER | | | | |
| Storage temperature | | T _{stg} | -55 to +150 | °C |
| Operating temperature | | T _{amb} | -40 to +100 | °C |
| Lead soldering temperature | t = 10 s | T _{slid} | 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} = -40 °C to +85 °C, V _{CC} = 4.5 V to 5.5 V, I _F = 7.5 mA; typical values are at T _{amb} = 25 °C) | | | | | | |
| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| INPUT | | | | | | |
| Input forward voltage | I _F = 1.6 mA, T _{amb} = 25 °C | V _F | - | 1.1 | 1.7 | V |
| Input reverse breakdown voltage | I _R = 10 μA, T _{amb} = 25 °C | B _{VR} | 5 | - | - | V |
| Input capacitance | f = 1 MHz, V _F = 0 | C _{IN} | - | 60 | - | pF |
| Temperature coefficient of forward voltage | I _F = 1.6 mA | | - | -1.9 | - | mV/°C |
| OUTPUT | | | | | | |
| Logic low, output voltage ⁽¹⁾ | I _F = 1.6 mA, I _O = 8 mA, V _{CC} = 4.5 V | V _{OL} | - | 0.1 | 0.4 | V |
| | I _F = 5 mA, I _O = 15 mA, V _{CC} = 4.5 V | V _{OL} | - | 0.1 | 0.4 | V |
| | I _F = 12 mA, I _O = 24 mA, V _{CC} = 4.5 V | V _{OL} | - | 0.2 | 0.4 | V |
| Logic high, output current ⁽¹⁾ | I _F = 0 mA, V _O = 18 V, V _{CC} = 18 V, T _{amb} = 25 °C | I _{OH} | - | 0.1 | 100 | μA |
| Logic low supply current ⁽¹⁾ | I _F = 1.6 mA, V _O = open, V _{CC} = 18 V | I _{CCL} | - | 0.4 | 1.5 | mA |
| Logic high supply current ⁽¹⁾ | I _F = 0 mA, V _O = open, V _{CC} = 18 V, T _{amb} = 25 °C | I _{CCH} | - | 0.01 | 10 | μA |
| COUPLER | | | | | | |
| Coupling capacitance | f = 1 MHz | C _{IO} | - | 25 | - | pF |

Notes

- 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.

⁽¹⁾ Pin 7 open

| CURRENT TRANSFER RATIO | | | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|--------|------|------|------|------|
| (T _{amb} = -40 °C to +85 °C, V _{CC} = 4.5 V to 5.5 V, I _F = 7.5 mA; typical values are at T _{amb} = 25 °C) | | | | | | |
| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| Current transfer ratio ⁽¹⁾ | I _F = 0.5 mA, V _O = 0.4 V, V _{CC} = 4.5 V | CTR | 400 | 2000 | 5000 | % |
| | I _F = 1.6 mA, V _O = 0.4 V, V _{CC} = 4.5 V | CTR | 500 | 1600 | 2600 | % |

Notes

⁽¹⁾ Pin 7 open

| SAFETY AND INSULATION RATINGS (T _{amb} = 25 °C, unless otherwise specified) | | | | |
|---------------------------------------------------------------------------------------------|----------------------------------------------------|-------------------|--------------------|-------------------|
| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
| Climatic classification | According to IEC 68 part 1 | | 55 / 110 / 21 | |
| Comparative tracking index | Insulation group IIIa | CTI | 275 | |
| Maximum rated withstanding isolation voltage | According to UL 1577, t = 1 min | V _{ISO} | 5000 | V _{RMS} |
| Maximum transient isolation voltage | According to DIN EN 60747-5-5 | V _{IOTM} | 6000 | V _{peak} |
| Maximum repetitive peak isolation voltage | According to DIN EN 60747-5-5 | V _{IORM} | 630 | V _{peak} |
| Isolation resistance | T _{amb} = 25 °C, V _{IO} = 500 V | R _{IO} | ≥ 10 ¹² | Ω |
| | T _{amb} = 100 °C, V _{IO} = 500 V | R _{IO} | ≥ 10 ¹¹ | Ω |
| Output safety power | | P _{SO} | 600 | mW |
| Input safety current | | I _{SI} | 230 | mA |
| Input safety temperature | | T _S | 175 | °C |
| Creepage distance | DIP-8, SMD-8, option 7 | | ≥ 7 | mm |
| Clearance distance | | | ≥ 7 | 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.

| SWITCHING CHARACTERISTICS | | | | | | |
|------------------------------------------------|---------------------------------------------------|-----------|------|------|------|---------------|
| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| Propagation delay time to logic low at output | $I_F = 0.5 \text{ mA}, R_L = 4.7 \text{ k}\Omega$ | t_{PHL} | - | 5 | 25 | μs |
| | $I_F = 12 \text{ mA}, R_L = 270 \Omega$ | t_{PHL} | - | 0.1 | 1 | μs |
| Propagation delay time to logic high at output | $I_F = 0.5 \text{ mA}, R_L = 4.7 \text{ k}\Omega$ | t_{PLH} | - | 18 | 60 | μs |
| | $I_F = 12 \text{ mA}, R_L = 270 \Omega$ | t_{PLH} | - | 2 | 7 | μs |

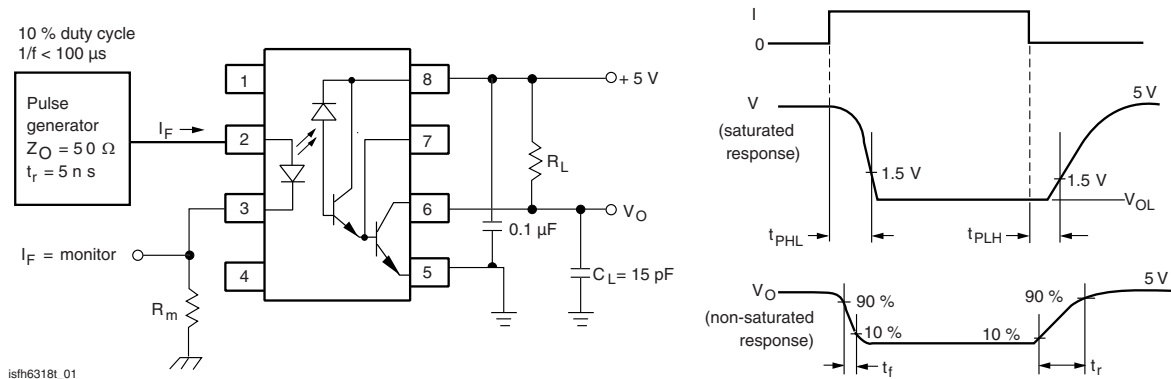


Fig. 1 - Switching Test Circuit

| COMMON MODE TRANSIENT IMMUNITY | | | | | | |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------|----------|------|------|------|-------------------------|
| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| Common mode transient immunity, logic high level output | $I_F = 0 \text{ mA}, R_L = 2.2 \text{ k}\Omega, R_{CC} = 0, V_{CM} = 10 \text{ V}_{P-P}$ | $ CM_H $ | 1 | 10 | - | $\text{kV}/\mu\text{s}$ |
| Common mode transient immunity, logic low level output | $I_F = 1.6 \text{ mA}, R_L = 2.2 \text{ k}\Omega, R_{CC} = 0, V_{CM} = 10 \text{ V}_{P-P}$ | $ CM_L $ | 1 | 10 | - | $\text{kV}/\mu\text{s}$ |

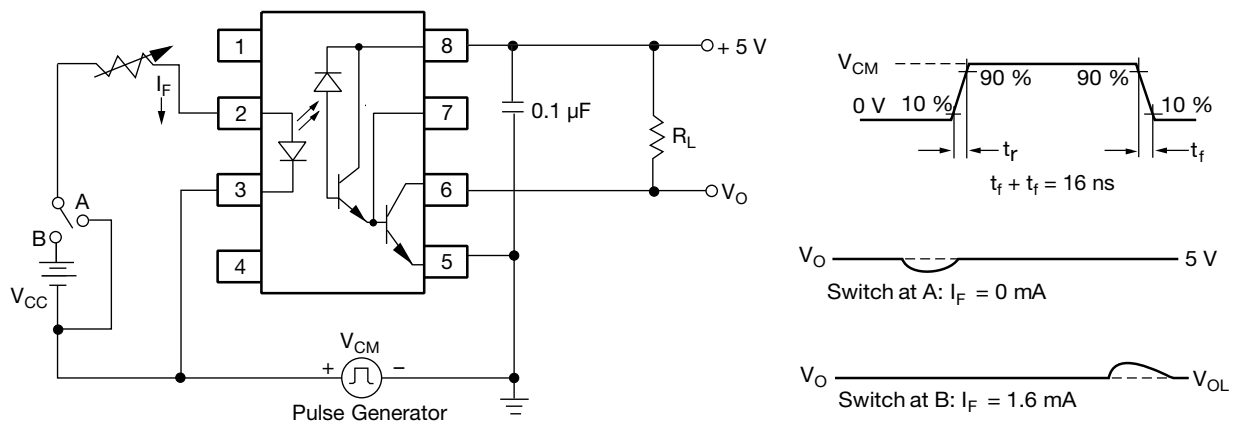


Fig. 2 - Test Circuit for Transient Immunity and Typical Waveforms

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

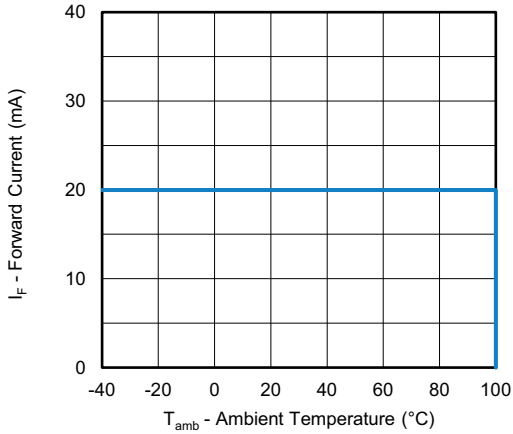


Fig. 3 - Forward Current vs. Ambient Temperature

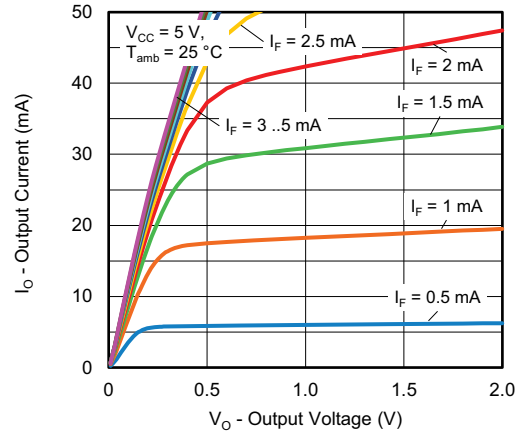


Fig. 6 - Output Current vs. Output Voltage

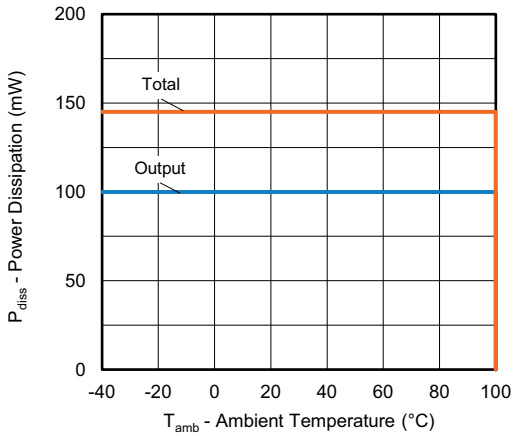


Fig. 4 - Power Dissipation vs. Ambient Temperature

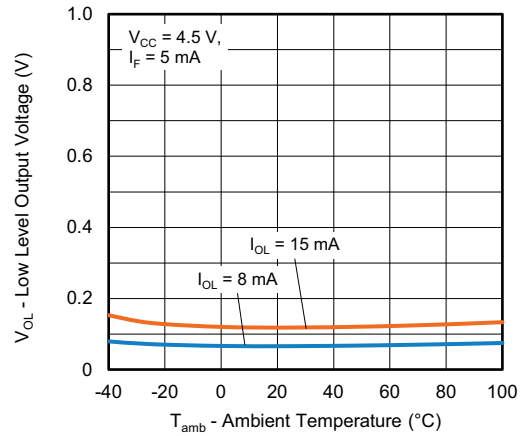


Fig. 7 - Low Level Output Voltage vs. Ambient Temperature

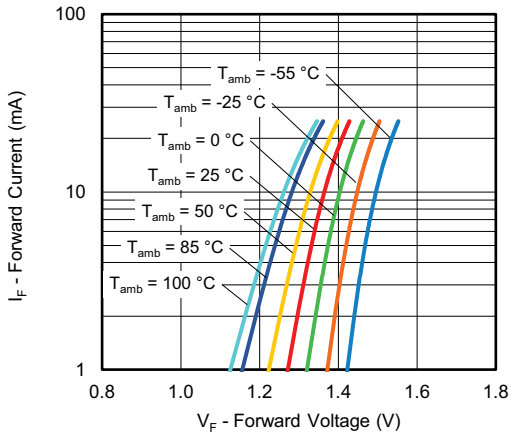


Fig. 5 - Forward Current vs. Forward Voltage

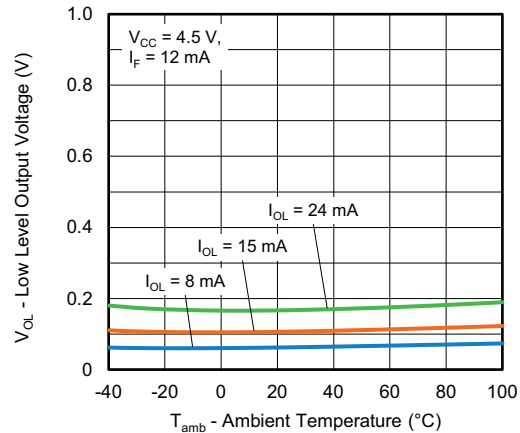


Fig. 8 - Low Level Output Voltage vs. Ambient Temperature

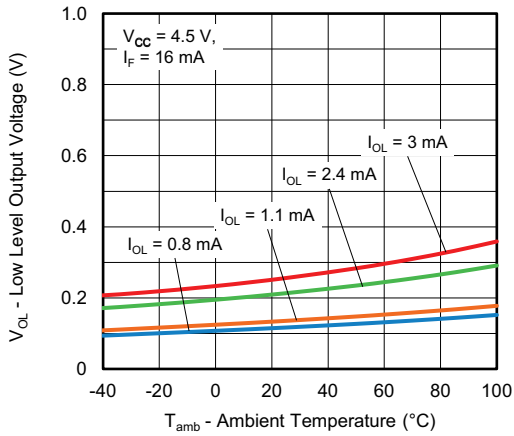


Fig. 9 - Low Level Output Voltage vs. Ambient Temperature

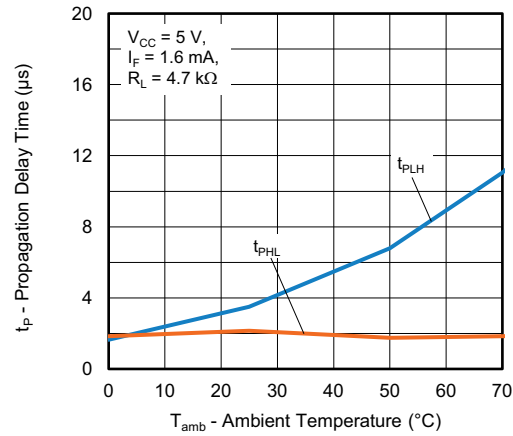


Fig. 12 - Propagation Delay Time vs. Ambient Temperature

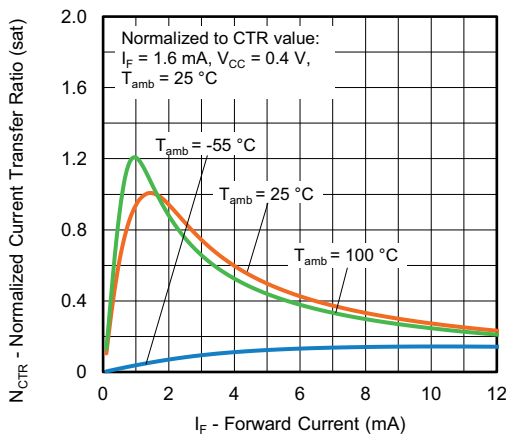


Fig. 10 - Normalized Current Transfer Ratio (saturated) vs. Forward Current

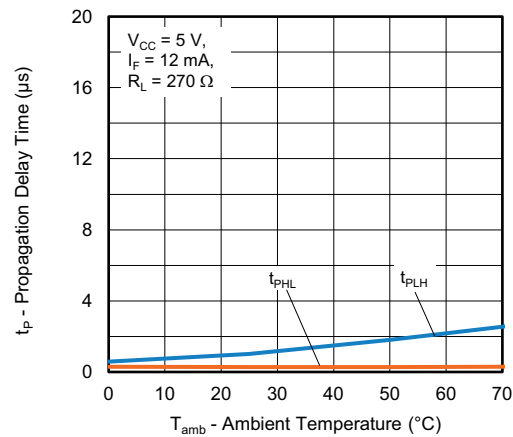


Fig. 13 - Propagation Delay Time vs. Ambient Temperature

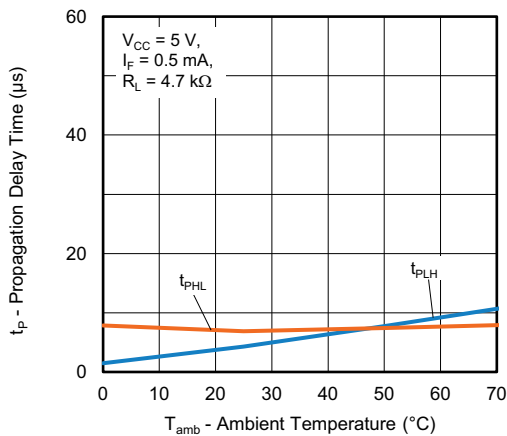


Fig. 11 - Propagation Delay Time vs. Ambient Temperature

PACKAGE DIMENSIONS (in millimeters)

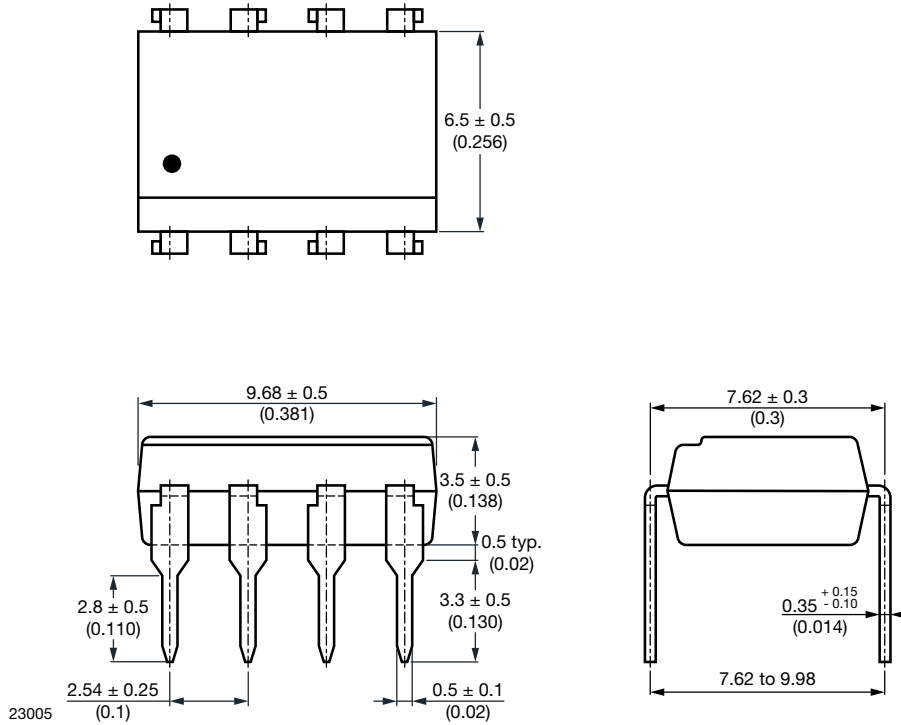
DIP-8


Fig. 14

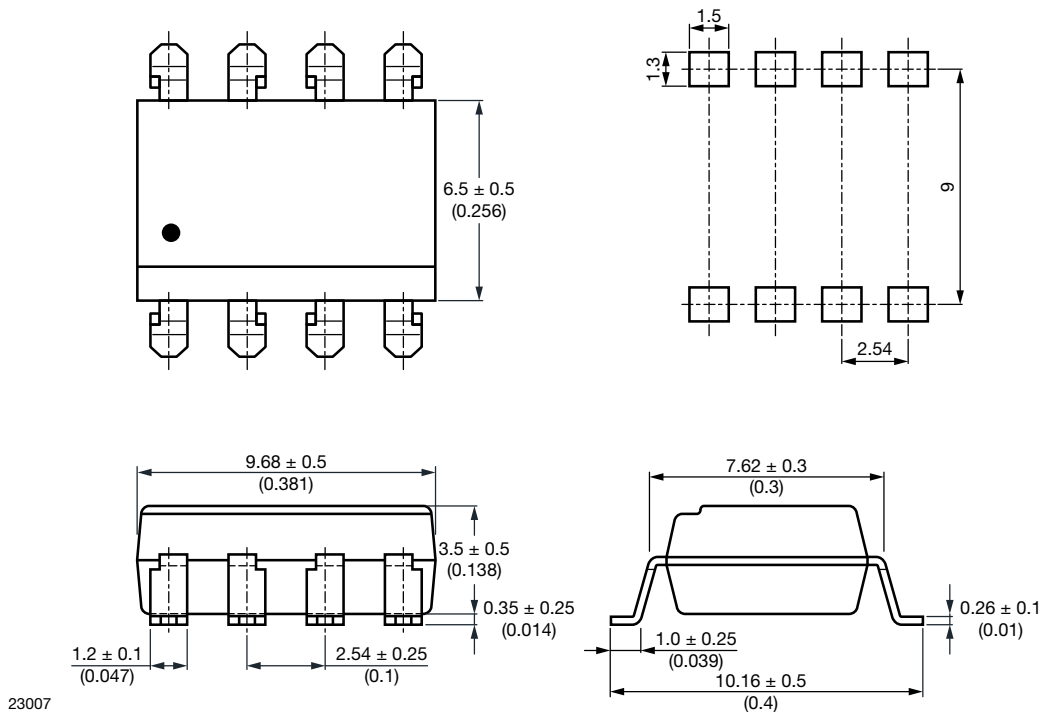
SMD-8, Option 7


Fig. 15

PACKAGE MARKING


Fig. 16 - Example of 6N139

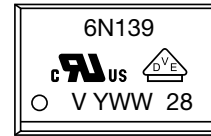


Fig. 17 - Example of 6N139-X017T

Notes

- “YWW” is the date code marking (Y = year code, WW = week code)
- VDE logo is only marked on VDE option parts
- Tape and reel suffix (T) is not part of the package marking

PACKAGING INFORMATION (in millimeters)

| DEVICES PER TUBES | | | |
|-------------------|------------|-----------|-----------|
| TYPE | UNITS/TUBE | TUBES/BOX | UNITS/BOX |
| DIP-8 | 50 | 40 | 2000 |

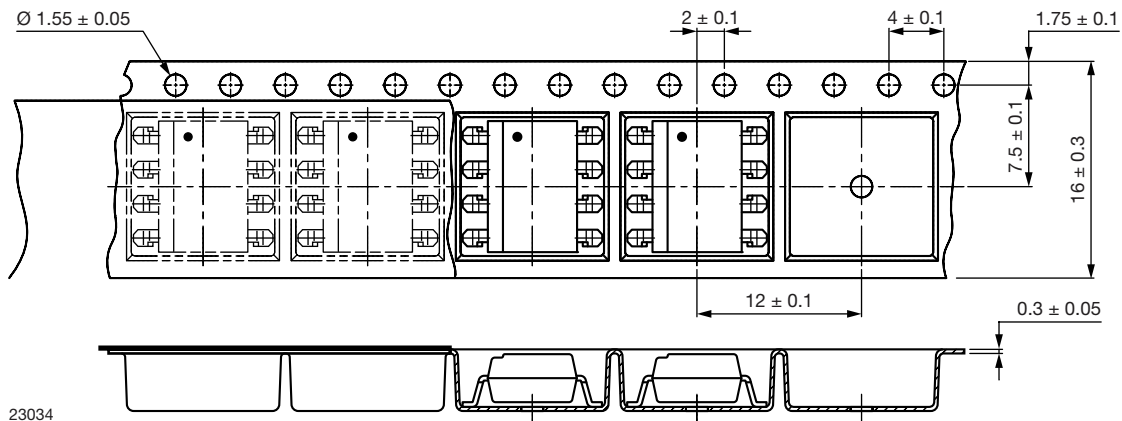
SMD-8 Tape


Fig. 18 - Tape and Reel Packaging (1000 pieces on reel)

Reel


Fig. 19 - Tape and Reel Shipping Medium

SOLDER PROFILES
IR Reflow Soldering (JEDEC® J-STD-020C compliant)

One time soldering reflow is recommended within the condition of temperature and time profile shown below. Do not solder more than three times.

| PROFILE ITEM | CONDITIONS |
|------------------------------------------------|------------------|
| Preheat | |
| - Temperature minimum ($T_{S \text{ min.}}$) | 150 °C |
| - Temperature maximum ($T_{S \text{ max.}}$) | 200 °C |
| - Time (min. to max.) (t_S) | 90 s ± 30 s |
| Soldering zone | |
| - Temperature (T_L) | 217 °C |
| - Time (t_L) | 60 s |
| Peak temperature (T_p) | 260 °C |
| Ramp-up rate | 3 °C/s max. |
| Ramp-down rate | 3 °C/s to 6 °C/s |

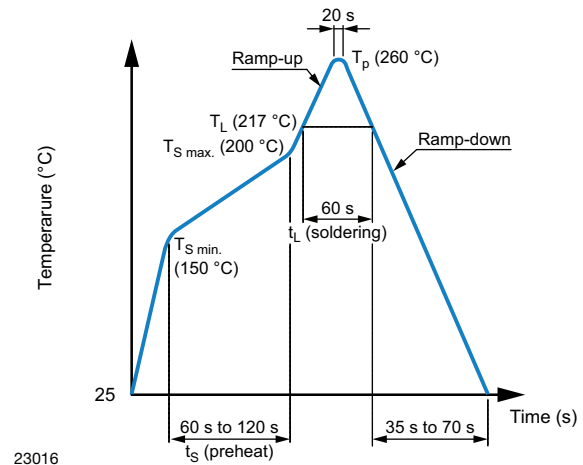


Fig. 20

Wave Soldering (JEDEC JESD22-A111 compliant)

One time soldering is recommended within the condition of temperature.

Temperature: 260 °C + 0 °C / - 5 °C

Time: 10 s

Preheat temperature: 25 °C to 140 °C

Preheat time: 30 s to 80 s

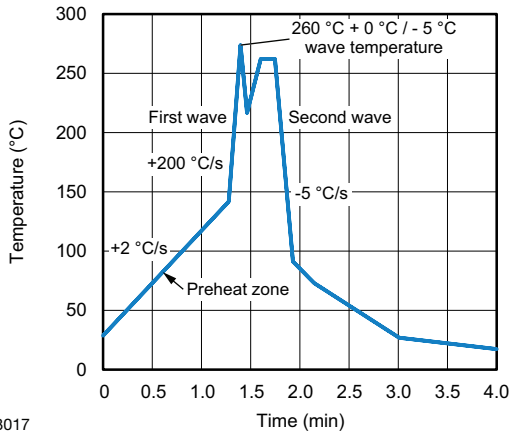
HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: unlimited

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

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



23017

Fig. 21

Hand Soldering by Soldering Iron

Allow single lead soldering in every single process. One time soldering is recommended.

Temperature: 380 °C + 0 °C / - 5 °C

Time: 3 s max.



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