

H11N1M, H11N2M, H11N3M 6-Pin DIP High Speed Logic Optocouplers

Features

- High data rate, 5MHz typical (NRZ)
- Free from latch up and oscillation throughout voltage and temperature ranges.
- Microprocessor compatible drive
- Logic compatible output sinks 16mA at 0.5V maximum
- Guaranteed on/off threshold hysteresis
- Wide supply voltage capability, compatible with all popular logic systems
- High common mode transient immunity, 2000V/μs minimum
- Fast switching $t_r = 7.5\text{ns}$ typical, $t_f = 12\text{ns}$ typical
- Underwriter Laboratory (UL) recognized—file #E90700
- VDE recognized—File#102497 – Add option V (e.g., H11N1VM)

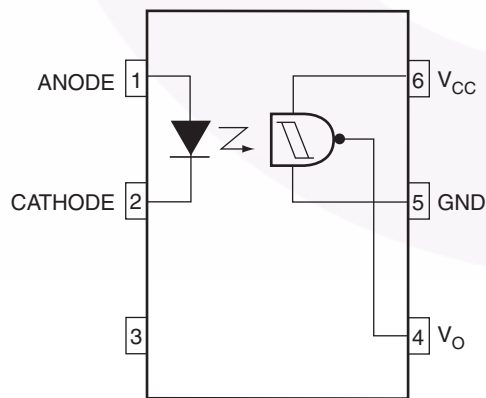
Applications

- Logic to logic isolator
- Programmable current level sensor
- Line receiver—eliminate noise and transient problems
- A.C. to TTL conversion—square wave shaping
- Interfaces computers with peripherals
- Isolated power MOS driver for power supplies

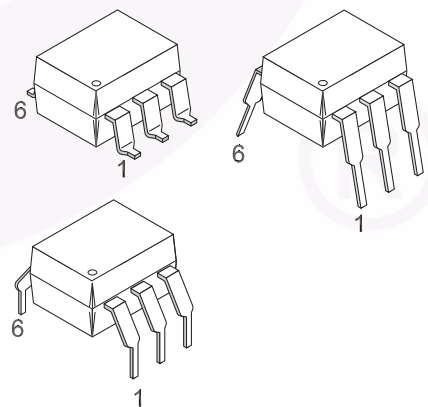
Description

The H11NXM series has a high speed integrated circuit detector optically coupled to an AlGaAs infrared emitting diode. The output incorporates a Schmitt trigger, which provides hysteresis for noise immunity and pulse shaping. The detector circuit is optimized for simplicity of operation and utilizes an open collector output for maximum application flexibility.

Schematic



Package Outlines



Truth Table

| Input | Output |
|-------|--------|
| H | L |
| L | H |

Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$ unless otherwise specified.)

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol | Parameters | Value | Units |
|---------------------|---|----------------|----------------------------|
| TOTAL DEVICE | | | |
| T_{STG} | Storage Temperature | -40 to +150 | $^\circ\text{C}$ |
| T_{OPR} | Operating Temperature | -40 to +85 | $^\circ\text{C}$ |
| T_{SOL} | Lead Solder Temperature | 260 for 10 sec | $^\circ\text{C}$ |
| P_D | Total Device Power Dissipation @ 25°C Derate Above 25°C | 250 | mW |
| | | 2.94 | $\text{mW}/^\circ\text{C}$ |
| EMITTER | | | |
| I_F | Continuous Forward Current | 30 | mA |
| V_R | Reverse Voltage | 6 | V |
| $I_{F(pk)}$ | Forward Current – Peak (1 μs pulse, 300 pps) | 1.0 | A |
| P_D | LED Power Dissipation 25°C Ambient Derate Linearly From 25°C | 120 | mW |
| | | 1.41 | $\text{mW}/^\circ\text{C}$ |
| DETECTOR | | | |
| P_D | Detector Power Dissipation @ 25°C Derate Linearly from 25°C | 150 | mW |
| | | 1.76 | $\text{mW}/^\circ\text{C}$ |
| V_O | V_{45} Allowed Range | 0 to 16 | V |
| V_{CC} | V_{65} Allowed Range | 0 to 16 | V |
| I_O | I_4 Output Current | 50 | mA |

Electrical Characteristics ($T_A = 25^\circ\text{C}$ unless otherwise specified.)**Individual Component Characteristics**

| Symbol | Parameters | Test Conditions | Device | Min. | Typ.* | Max. | Units |
|----------------------|-------------------------|---|--------|------|-------|------|---------------|
| EMITTER | | | | | | | |
| V_F | Input Forward Voltage | $I_F = 10\text{mA}$ | All | | 1.4 | 2 | V |
| | | $I_F = 0.3\text{mA}$ | | 0.75 | 1.25 | | |
| I_R | Reverse Current | $V_R = 5\text{V}$ | All | | | 10 | μA |
| C_J | Capacitance | $V = 0, f = 1.0\text{MHz}$ | All | | | 100 | pF |
| DETECTOR | | | | | | | |
| V_{CC} | Operating Voltage Range | | All | 4 | | 15 | V |
| $I_{CC(\text{off})}$ | Supply Current | $I_F = 0, V_{CC} = 5\text{V}$ | All | | 6 | 10 | mA |
| I_{OH} | Output Current, High | $I_F = 0.3\text{mA}, V_{CC} = V_O = 15\text{V}$ | All | | | 100 | μA |

Transfer Characteristics

| Symbol | DC Characteristics | Test Conditions | Device | Min. | Typ.* | Max. | Units |
|--|----------------------------|--|--------|------|-------|------|-------|
| $I_{CC(\text{on})}$ | Supply Current | $I_F = 10\text{mA}, V_{CC} = 5\text{V}$ | All | | 6.5 | 10 | mA |
| V_{OL} | Output Voltage, Low | $R_L = 270\Omega, V_{CC} = 5\text{V}, I_F = I_{F(\text{on})} \text{ max.}$ | All | | | 0.5 | V |
| $I_{F(\text{on})}$ | Turn-On Threshold Current | $R_L = 270\Omega, V_{CC} = 5\text{V}^{(1)}$ | H11N1M | 0.8 | | 3.2 | mA |
| | | | H11N2M | 2.3 | | 5 | |
| | | | H11N3M | 4.1 | | 10 | |
| $I_{F(\text{off})}$ | Turn-Off Threshold Current | $R_L = 270\Omega, V_{CC} = 5\text{V}$ | All | 0.3 | | | mA |
| $I_{F(\text{off})} / I_{F(\text{on})}$ | Hysteresis Ratio | $R_L = 270\Omega, V_{CC} = 5\text{V}$ | All | 0.65 | | 0.95 | |

Switching Speed

| Symbol | AC Characteristics | Test Conditions | Device | Min. | Typ.* | Max. | Units |
|-----------|------------------------------------|---|--------|------|-------|------|-------|
| t_{PHL} | Propagation Delay Time HIGH-to-LOW | $C = 120\text{pF}, t_p = 1\mu\text{s}, R_E = ^{(2)}, \text{Figure 1}$ | All | | 100 | 330 | ns |
| t_r | Rise Time | $C = 120\text{pF}, t_p = 1\mu\text{s}, R_E = ^{(2)}, \text{Figure 1}$ | All | | 7.5 | | ns |
| t_{PLH} | Propagation Delay Time LOW-to-HIGH | $C = 120\text{pF}, t_p = 1\mu\text{s}, R_E = ^{(2)}, \text{Figure 1}$ | All | | 150 | 330 | ns |
| t_f | Fall Time | $C = 120\text{pF}, t_p = 1\mu\text{s}, R_E = ^{(2)}, \text{Figure 1}$ | All | | 12 | | ns |
| | Data Rate | | All | | 5 | | MHz |

Isolation Characteristics

| Symbol | Parameters | Test Conditions | Min. | Typ.* | Max. | Units |
|-----------|--------------------------------|---|-----------|-------|------|------------|
| V_{ISO} | Input-Output Isolation Voltage | $f = 60\text{ Hz}, t = 1\text{ sec.}$ | 7500 | | | V_{PEAK} |
| C_{ISO} | Isolation Capacitance | $V_{I-O} = 0\text{V}, f = 1\text{ MHz}$ | | 0.4 | 0.6 | pF |
| R_{ISO} | Isolation Resistance | $V_{I-O} = \pm 500\text{ VDC}$ | 10^{11} | | | Ω |

*Typical values at $T_A = 25^\circ\text{C}$ **Notes:**

- Maximum $I_{F(\text{ON})}$ is the maximum current required to trigger the output. For example, a 3.2mA maximum trigger current would require the LED to be driven at a current greater than 3.2mA to guarantee the device will turn on. A 10% guard band is recommended to account for degradation of the LED over its lifetime. The maximum allowable LED drive current is 30mA.
- H11N1: $R_E = 910\Omega$, H11N2: $R_E = 560\Omega$, H11N3: $R_E = 240\Omega$

Safety and Insulation Ratings

As per IEC 60747-5-2, this optocoupler is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings shall be ensured by means of protective circuits.

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|------------|---|--------|-----------|------|------------|
| | Installation Classifications per DIN VDE 0110/1.89 Table 1 | | | | |
| | For Rated Main Voltage < 150Vrms | | I-IV | | |
| | For Rated Main voltage < 300Vrms | | I-IV | | |
| | Climatic Classification | | 55/100/21 | | |
| | Pollution Degree (DIN VDE 0110/1.89) | | 2 | | |
| CTI | Comparative Tracking Index | 175 | | | |
| V_{PR} | Input to Output Test Voltage, Method b, $V_{IORM} \times 1.875 = V_{PR}$, 100% Production Test with $t_m = 1$ sec, Partial Discharge < 5pC | 1594 | | | V_{peak} |
| | Input to Output Test Voltage, Method a, $V_{IORM} \times 1.5 = V_{PR}$, Type and Sample Test with $t_m = 60$ sec, Partial Discharge < 5pC | 1275 | | | V_{peak} |
| V_{IORM} | Max. Working Insulation Voltage | 850 | | | V_{peak} |
| V_{IOTM} | Highest Allowable Over Voltage | 6000 | | | V_{peak} |
| | External Creepage | 7 | | | mm |
| | External Clearance | 7 | | | mm |
| | Insulation Thickness | 0.5 | | | mm |
| RIO | Insulation Resistance at T_s , $V_{IO} = 500V$ | 10^9 | | | Ω |

Typical Performance Curves

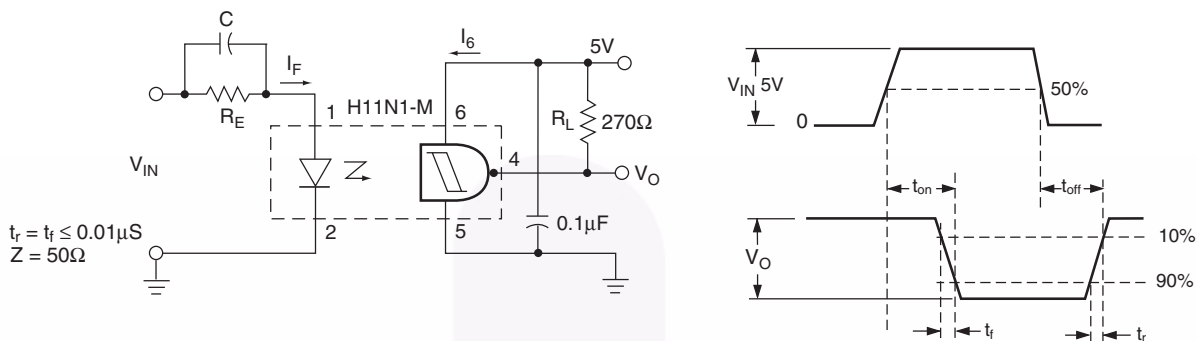


Figure 1. Switching Test Circuit and Waveforms

Figure 2. Transfer Characteristics

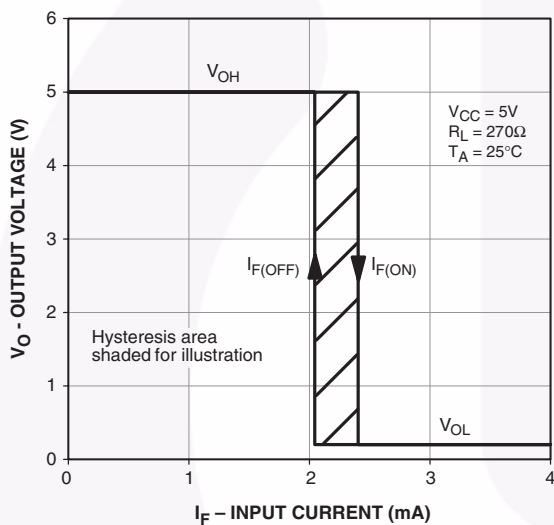


Figure 3. Threshold Current vs. Supply Voltage

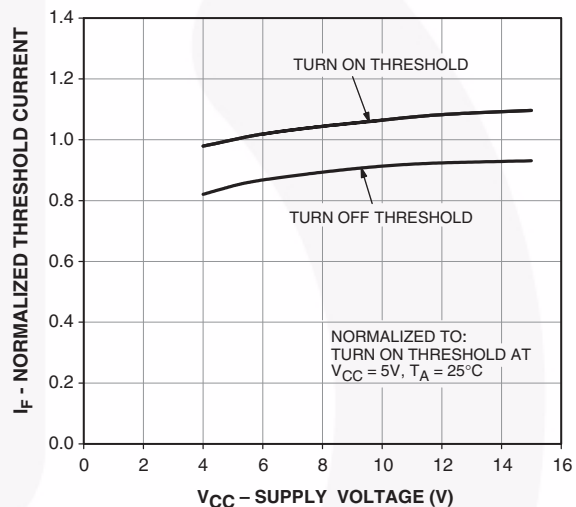


Figure 4. Threshold Current vs. Temperature

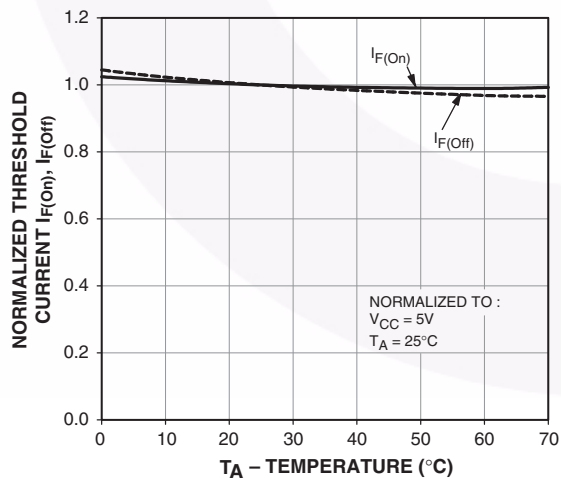
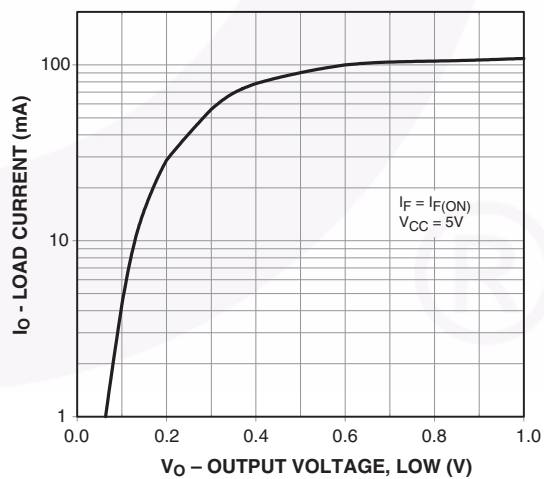


Figure 5. Load Current vs. Output Voltage



Typical Performance Curves (Continued)

Figure 6. Supply Current vs. Supply Voltage

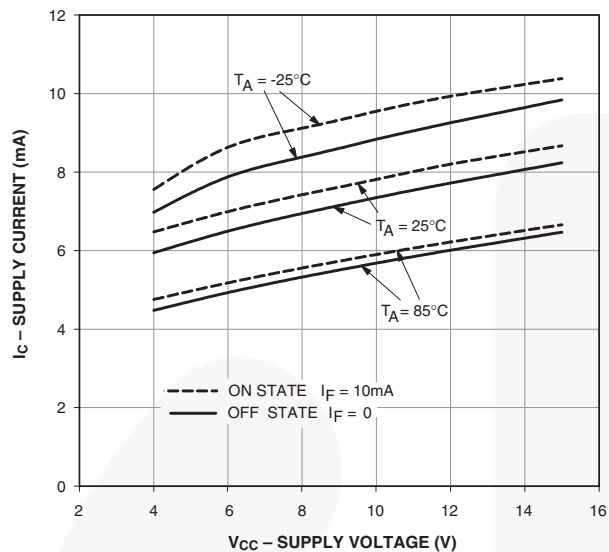
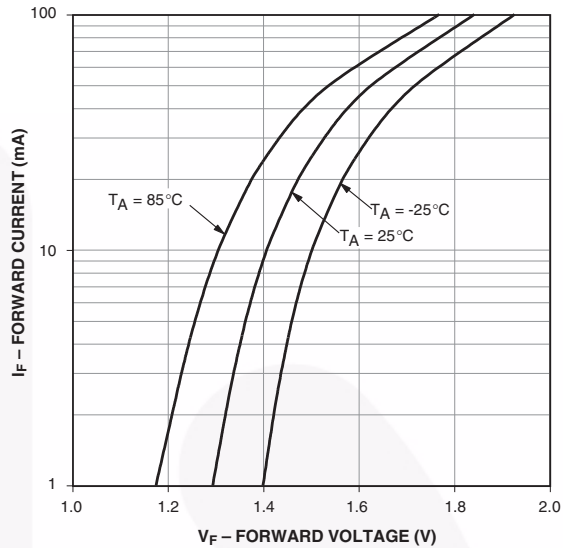
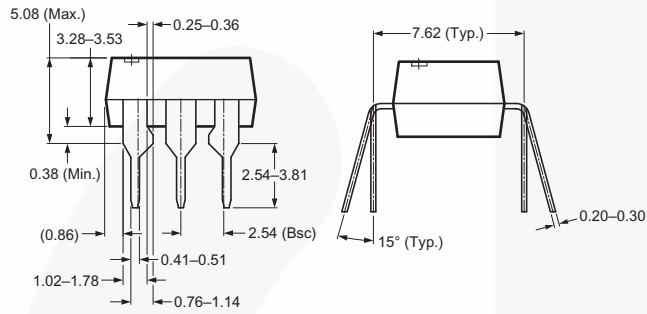
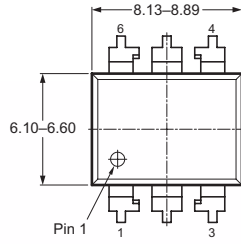


Figure 7. LED Forward Voltage vs. Forward Current

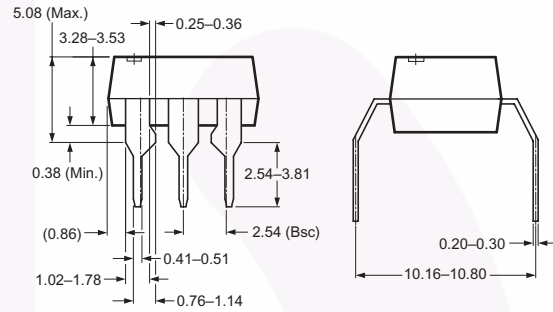
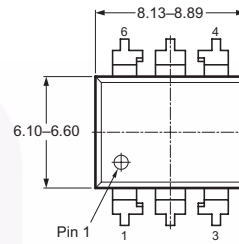


Package Dimensions

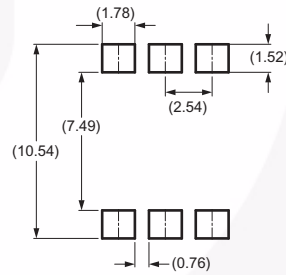
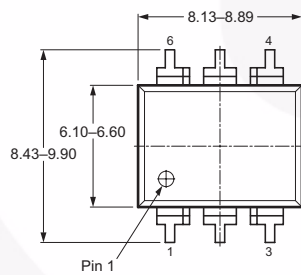
Through Hole



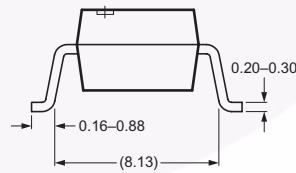
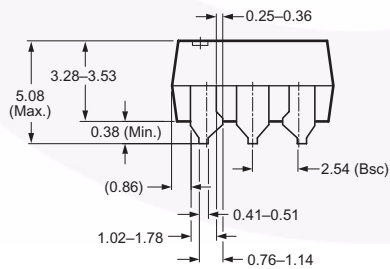
0.4" Lead Spacing



Surface Mount



Recommended Pad Layout

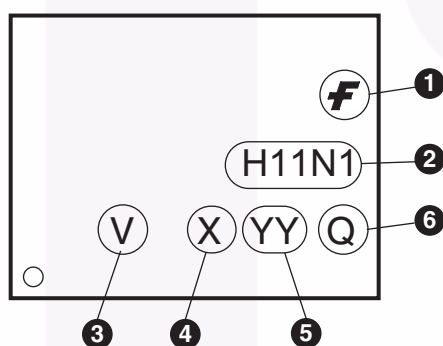


Note:
All dimensions in mm.

Ordering Information

| Option | Order Entry Identifier (Example) | Description |
|-----------|----------------------------------|--|
| No option | H11N1M | Standard Through Hole Device |
| S | H11N1SM | Surface Mount Lead Bend |
| SR2 | H11N1SR2M | Surface Mount; Tape and Reel |
| T | H11N1TM | 0.4" Lead Spacing |
| V | H11N1VM | VDE 0884 |
| TV | H11N1TVM | VDE 0884, 0.4" Lead Spacing |
| SV | H11N1SVM | VDE 0884, Surface Mount |
| SR2V | H11N1SR2VM | VDE 0884, Surface Mount, Tape and Reel |

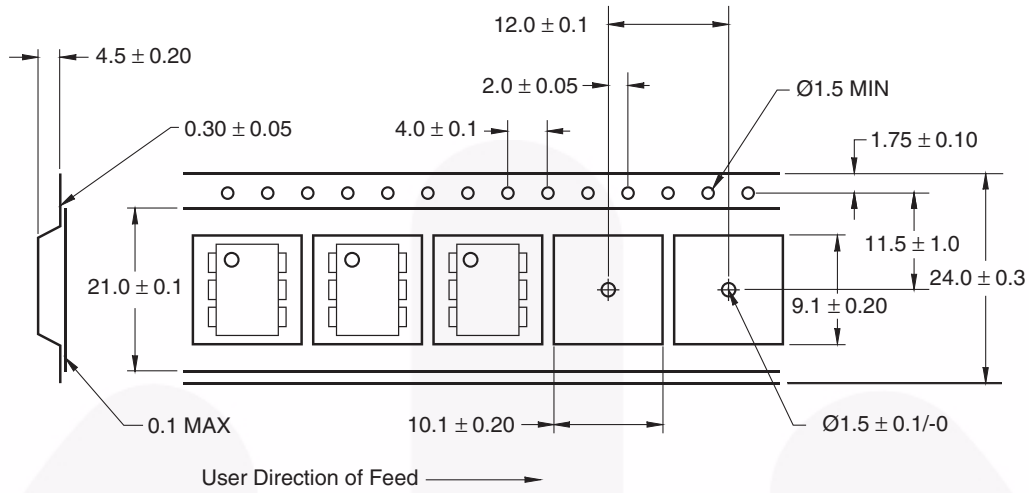
Marking Information



| Definitions | |
|-------------|--|
| 1 | Fairchild logo |
| 2 | Device number |
| 3 | VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table) |
| 4 | One digit year code, e.g., '3' |
| 5 | Two digit work week ranging from '01' to '53' |
| 6 | Assembly package code |

*Note – Parts that do not have the 'V' option (see definition 3 above) that are marked with date code '325' or earlier are marked in portrait format.

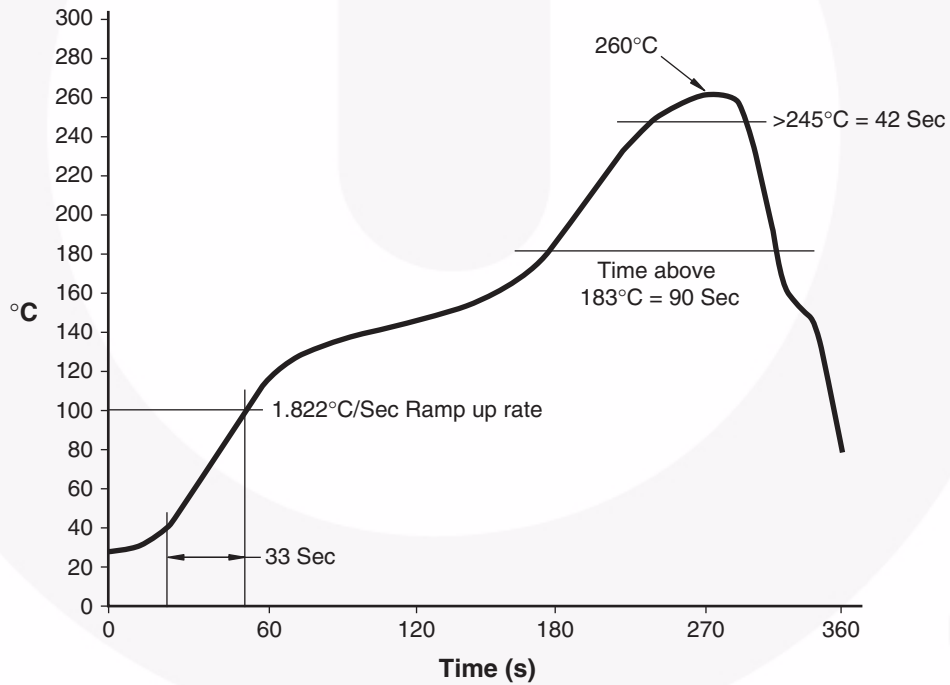
Tape Dimensions



Note:

All dimensions are in millimeters.





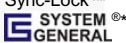
Reflow Soldering Profile





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|--------------------------|-----------------------|---|
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