

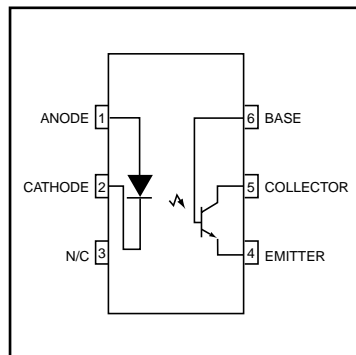
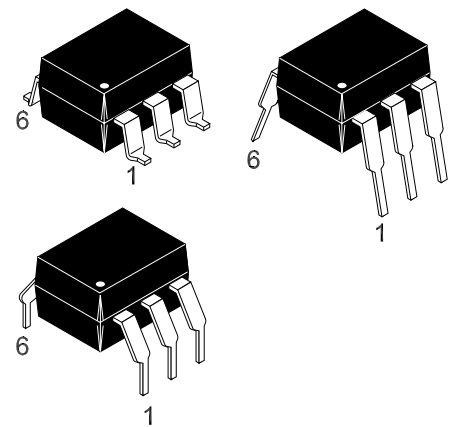
DESCRIPTION

The H11DX and 4N38 are phototransistor-type optically coupled optoisolators. An infrared emitting diode manufactured from specially grown gallium arsenide is selectively coupled with a high voltage NPN silicon phototransistor. The device is supplied in a standard plastic six-pin dual-in-line package.

H11D1
H11D2
H11D3
H11D4
4N38

FEATURES

- High Voltage
 - H11D1, H11D2, $BV_{CER} = 300\text{ V}$
 - H11D3, H11D4, $BV_{CER} = 200\text{ V}$
- High isolation voltage
 - 5300 VAC RMS - 1 minute
 - 7500 VAC PEAK - 1 minute
- Underwriters Laboratory (UL) recognized File# E90700



APPLICATIONS

- Power supply regulators
- Digital logic inputs
- Microprocessor inputs
- Appliance sensor systems
- Industrial controls

ABSOLUTE MAXIMUM RATINGS

| Parameter | Symbol | Value | Units |
|---|-----------|----------------|-------|
| TOTAL DEVICE | | | |
| Storage Temperature | T_{STG} | -55 to +150 | °C |
| Operating Temperature | T_{OPR} | -55 to +100 | °C |
| Lead Solder Temperature | T_{SOL} | 260 for 10 sec | °C |
| Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$ | P_D | 260 | mW |
| Derate above 25°C | | 3.5 | mW/°C |
| EMITTER | | | |
| *Forward DC Current | I_F | 80 | mA |
| *Reverse Input Voltage | V_R | 6.0 | V |
| *Forward Current - Peak (1µs pulse, 300pps) | $I_F(pk)$ | 3.0 | A |
| *LED Power Dissipation @ $T_A = 25^\circ\text{C}$ | P_D | 150 | mW |
| Derate above 25°C | | 1.41 | mW/°C |

H11D1, H11D2, H11D3, H11D4, 4N38

| ABSOLUTE MAXIMUM RATINGS (Cont.) | | | |
|---|-----------|----------------------|----------------------|
| Parameter | Symbol | Value | Units |
| DETECTOR | | | |
| *Power Dissipation @ $T_A = 25^\circ\text{C}$ | P_D | 300 | mW |
| Derate linearly above 25°C | | 4.0 | mW/ $^\circ\text{C}$ |
| *Collector to Emitter Voltage | V_{CER} | H11D1 - H11D2 300 | V |
| | | H11D3 - H11D4 200 | |
| | | 4N38 80 | |
| *Collector Base Voltage | V_{CBO} | H11D1 - H11D2 300 | |
| | | H11D3 - H11D4 200 | |
| | | 4N38 80 | |
| *Emitter to Collector Voltage | V_{ECO} | 7 | |
| Collector Current (Continuous) | | 100 | mA |

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ Unless otherwise specified.)

| INDIVIDUAL COMPONENT CHARACTERISTICS | | | | | | | |
|---|--|---------------------------------|---------|-----------|-------|-----|----------------------|
| Characteristic | Test Conditions | Symbol | Device | Min | Typ** | Max | Unit |
| EMITTER | | | | | | | |
| *Forward Voltage | ($I_F = 10\text{ mA}$) | V_F | ALL | | 1.15 | 1.5 | V |
| Forward Voltage Temp. Coefficient | | $\frac{\Delta V_F}{\Delta T_A}$ | ALL | | -1.8 | | mV/ $^\circ\text{C}$ |
| Reverse Breakdown Voltage | ($I_R = 10\text{ }\mu\text{A}$) | BV_R | ALL | 6 | 25 | | V |
| Junction Capacitance | ($V_F = 0\text{ V}$, $f = 1\text{ MHz}$) | C_J | ALL | | 50 | | pF |
| | ($V_F = 1\text{ V}$, $f = 1\text{ MHz}$) | | ALL | | 65 | | pF |
| *Reverse Leakage Current | ($V_R = 6\text{ V}$) | I_R | ALL | | 0.05 | 10 | μA |
| DETECTOR | | | | | | | |
| *Breakdown Voltage Collector to Emitter | ($R_{BE} = 1\text{ M}\Omega$) | BV_{CER} | H11D1/2 | 300 | | | V |
| | ($I_C = 1.0\text{ mA}$, $I_F = 0$) | | H11D3/4 | 200 | | | |
| | (No R_{BE}) ($I_C = 1.0\text{ mA}$) | BV_{CEO} | 4N38 | 80 | | | |
| *Collector to Base | ($I_C = 100\text{ }\mu\text{A}$, $I_F = 0$) | BV_{CBO} | H11D1/2 | 300 | | | |
| | | | H11D3/4 | 200 | | | |
| | | | 4N38 | 80 | | | |
| Emitter to Base | | BV_{EBO} | 4N38 | 7 | | | |
| Emitter to Collector | ($I_E = 100\text{ }\mu\text{A}$, $I_F = 0$) | BV_{ECO} | ALL | 7 | 10 | | |
| *Leakage Current Collector to Emitter ($R_{BE} = 1\text{ M}\Omega$) | ($V_{CE} = 200\text{ V}$, $I_F = 0$, $T_A = 25^\circ\text{C}$) | I_{CER} | H11D1/2 | | | 100 | nA |
| | ($V_{CE} = 200\text{ V}$, $I_F = 0$, $T_A = 100^\circ\text{C}$) | | | | | 250 | μA |
| | ($V_{CE} = 100\text{ V}$, $I_F = 0$, $T_A = 25^\circ\text{C}$) | | H11D3/4 | | | 100 | nA |
| | ($V_{CE} = 100\text{ V}$, $I_F = 0$, $T_A = 100^\circ\text{C}$) | | | | | 250 | μA |
| | (No R_{BE}) ($V_{CE} = 60\text{ V}$, $I_F = 0$, $T_A = 25^\circ\text{C}$) | | | I_{CEO} | 4N38 | | |

Notes

* Parameters meet or exceed JEDEC registered data (for 4N38 only)

** All typical values at $T_A = 25^\circ\text{C}$

H11D1, H11D2, H11D3, H11D4, 4N38

| TRANSFER CHARACTERISTICS | | | | | | | |
|--|--|---------------|-------------|--------|-------|------|--------|
| DC Characteristic | Test Conditions | Symbol | Device | Min | Typ** | Max | Unit |
| EMITTER | | | | | | | |
| Current Transfer Ratio Collector to Emitter | $(I_F = 10 \text{ mA}, V_{CE} = 10 \text{ V})$ $(R_{BE} = 1 \text{ M}\Omega)$ | CTR | H11D1 | 2 (20) | | | mA (%) |
| | | | H11D2 | | | | |
| | | | H11D3 | | | | |
| | | | H11D4 | 1 (10) | | | |
| | | | 4N38 | 2 (20) | | | |
| *Saturation Voltage | $(I_F = 10 \text{ mA}, I_C = 0.5 \text{ mA})$ $(R_{BE} = 1 \text{ M}\Omega)$ | $V_{CE(SAT)}$ | H11D1/2/3/4 | | 0.1 | 0.40 | V |
| | | | 4N38 | | | 1.0 | |
| | $(I_F = 20 \text{ mA}, I_C = 4 \text{ mA})$ | | | | | | |

| TRANSFER CHARACTERISTICS | | | | | | | |
|----------------------------|--|-----------|--------|-----|-------|-----|---------------|
| Characteristic | Test Conditions | Symbol | Device | Min | Typ** | Max | Unit |
| SWITCHING TIMES | | | | | | | |
| Non-Saturated Turn-on Time | $(V_{CE} = 10 \text{ V}, I_{CE} = 2 \text{ mA})$ | t_{on} | ALL | | 5 | | μs |
| Turn-off Time | $(R_L = 100 \Omega)$ | t_{off} | ALL | | 5 | | |

| ISOLATION CHARACTERISTICS | | | | | | | |
|---------------------------|--|-----------|--------|-----------|-------|-----|----------------|
| Characteristic | Test Conditions | Symbol | Device | Min | Typ** | Max | Unit |
| Isolation Voltage | $(I_{I-O} \leq 1 \mu\text{A}, 1 \text{ min.})$ | V_{ISO} | ALL | 5300 | | | (V_{ACRMS}) |
| | | | | 7500 | | | (V_{ACPEAK}) |
| Isolation Resistance | $(V_{I-O} = 500 \text{ VDC})$ | R_{ISO} | ALL | 10^{11} | | | Ω |
| Isolation Capacitance | $(f = 1 \text{ MHz})$ | C_{ISO} | ALL | | 0.5 | | pF |

Notes
 * Parameters meet or exceed JEDEC registered data (for 4N38 only)
 ** All typical values at $T_A = 25^\circ\text{C}$

Fig.1 LED Forward Voltage vs. Forward Current

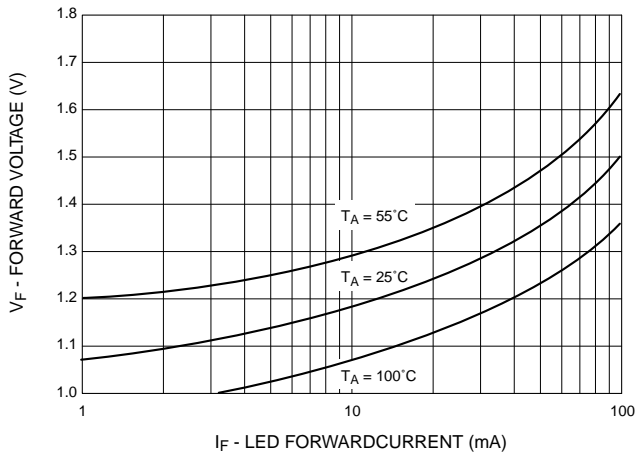
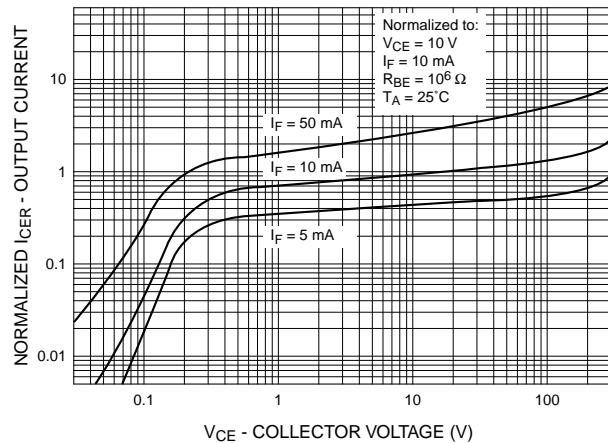


Fig.2 Normalized Output Characteristics



H11D1, H11D2, H11D3, H11D4, 4N38

Fig.3 Normalized Output Current vs. LED Input Current

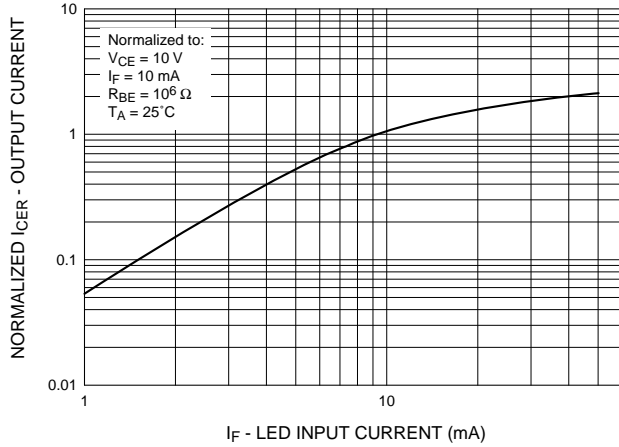


Fig.4 Normalized Output Current vs. Temperature

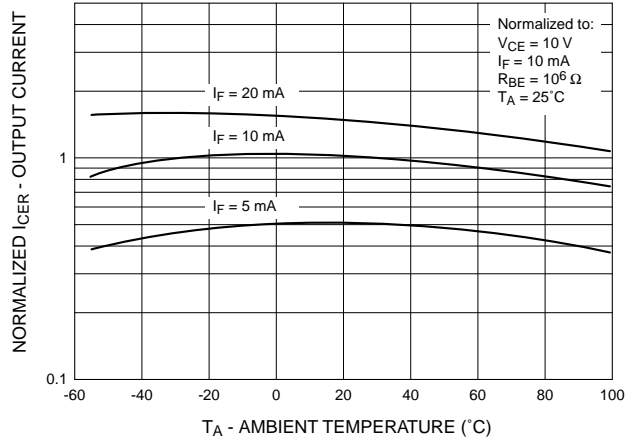
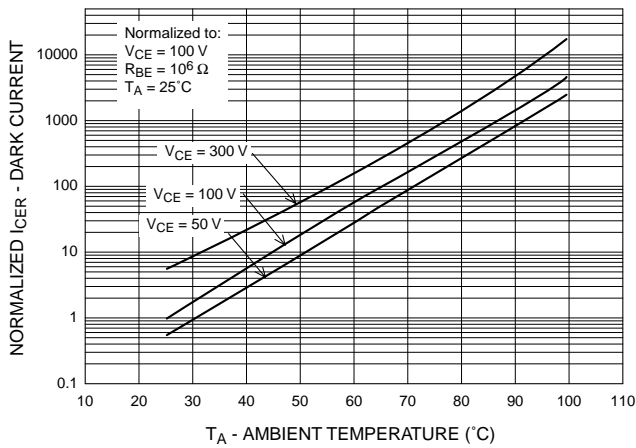
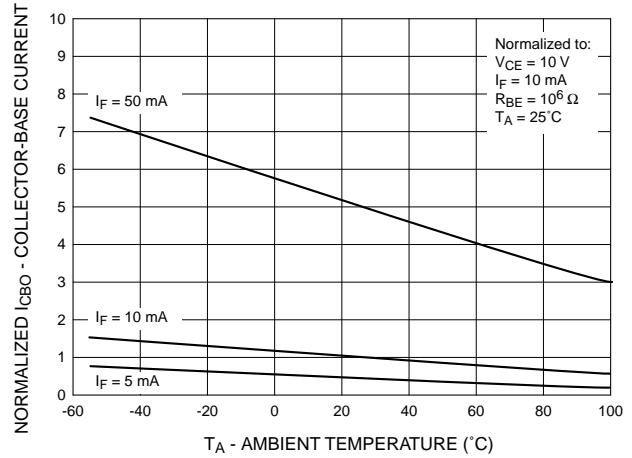


Fig.5 Normalized Dark Current vs. Ambient Temperature

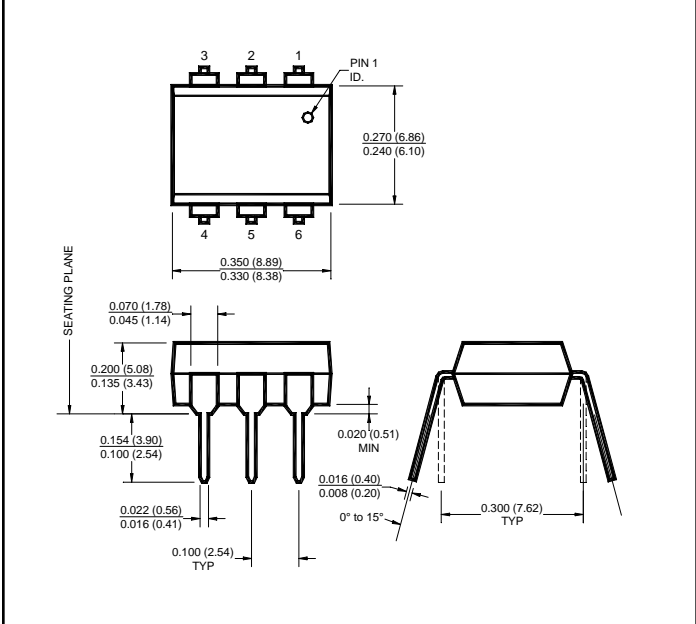


Normalized Collector-Base Current vs. Temperature

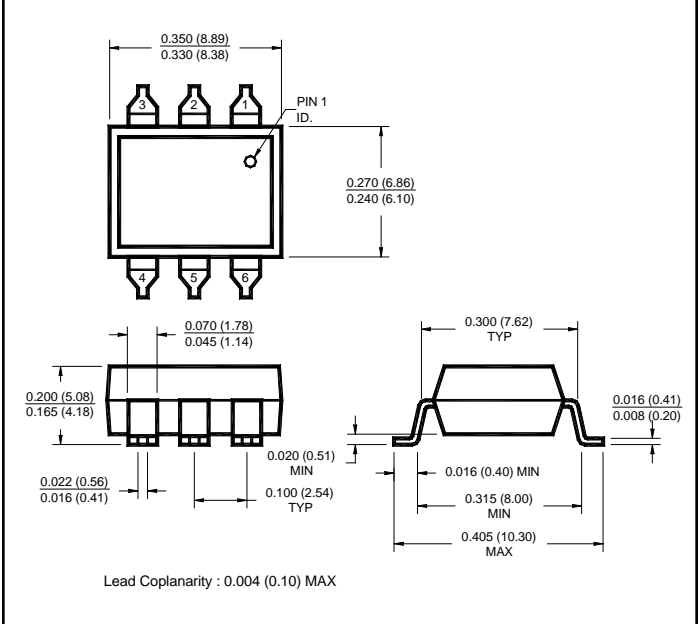


H11D1, H11D2, H11D3, H11D4, 4N38

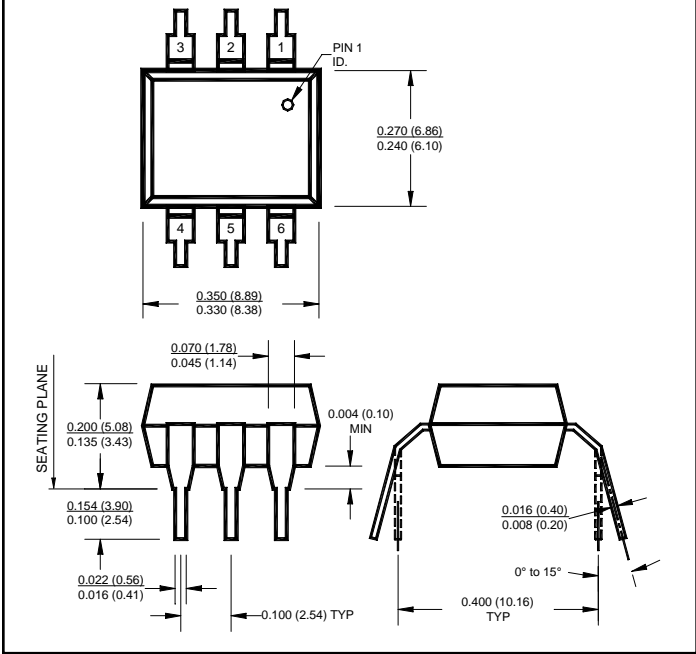
Package Dimensions (Through Hole)



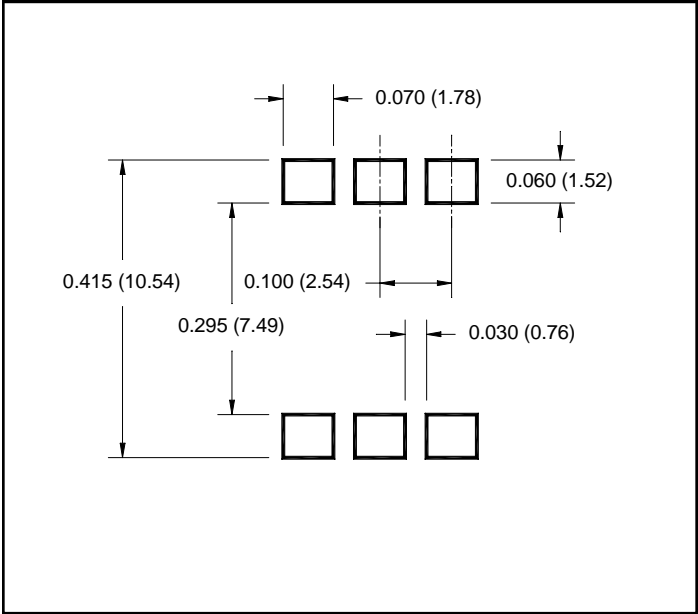
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



Recommended Pad Layout for Surface Mount Leadform



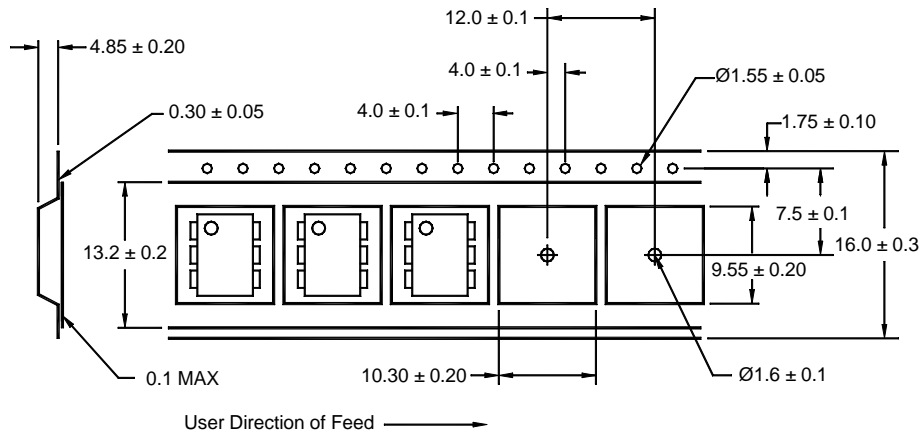
NOTE
All dimensions are in inches (millimeters)

H11D1, H11D2, H11D3, H11D4, 4N38

ORDERING INFORMATION

| Option | Order Entry Identifier | Description |
|--------|------------------------|--------------------------------------|
| S | .S | Surface Mount Lead Bend |
| SD | .SD | Surface Mount; Tape and reel |
| W | .W | 0.4" Lead Spacing |
| 300 | .300 | VDE 0884 |
| 300W | .300W | VDE 0884, 0.4" Lead Spacing |
| 3S | .3S | VDE 0884, Surface Mount |
| 3SD | .3SD | VDE 0884, Surface Mount, Tape & Reel |

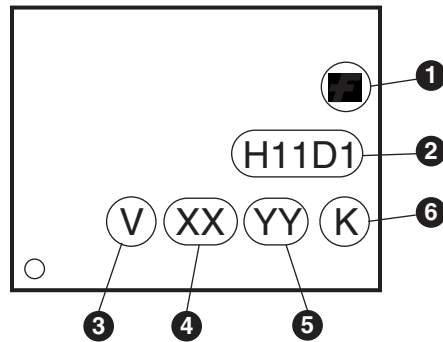
QT Carrier Tape Specifications ("D" Taping Orientation)



NOTE

All dimensions are in millimeters

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 | Two digit year code, e.g., '03' |
| 5 | Two digit work week ranging from '01' to '53' |
| 6 | Assembly package code |

Reflow Profile (Black Package, No Suffix)

