

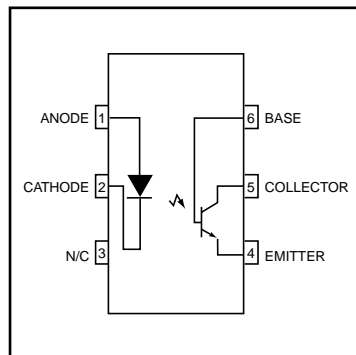
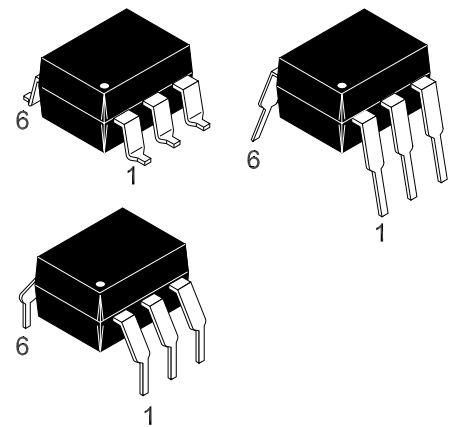
## DESCRIPTION

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 |
|---|-----------|----------------|-------|
| <b>TOTAL DEVICE</b>                                       |           |                |       |
| 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 |
| <b>EMITTER</b>  |           |                |       |
| *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**

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

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

| <b>INDIVIDUAL COMPONENT CHARACTERISTICS</b>                                 |  |                                 |         |           |       |     |                      |
|---|--|---------------------------------|---------|-----------|-------|-----|----------------------|
| Characteristic  | Test Conditions  | Symbol                          | Device  | Min       | Typ** | Max | Unit                 |
| <b>EMITTER</b>  |  |                                 |         |           |       |     |                      |
| *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  | $\mu\text{A}$        |
| <b>DETECTOR</b>   |  |                                 |         |           |       |     |                      |
| *Breakdown Voltage<br>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<br>Collector to Emitter<br>( $R_{BE} = 1\text{ M}\Omega$ ) | ( $V_{CE} = 200\text{ V}$ , $I_F = 0$ , $T_A = 25^\circ\text{C}$ )               | $I_{CER}$                       | H11D1/2 |           |       | 100 | nA                   |
|   | ( $V_{CE} = 200\text{ V}$ , $I_F = 0$ , $T_A = 100^\circ\text{C}$ )              |                                 |         |           |       | 250 | $\mu\text{A}$        |
|   | ( $V_{CE} = 100\text{ V}$ , $I_F = 0$ , $T_A = 25^\circ\text{C}$ )               |                                 | H11D3/4 |           |       | 100 | nA                   |
|   | ( $V_{CE} = 100\text{ V}$ , $I_F = 0$ , $T_A = 100^\circ\text{C}$ )              |                                 |         |           |       | 250 | $\mu\text{A}$        |
|   | (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<br>Current Transfer Ratio<br>Collector to Emitter | $(I_F = 10 \text{ mA}, V_{CE} = 10 \text{ V})$<br>$(R_{BE} = 1 \text{ M}\Omega)$ | CTR           | H11D1       | 2 (20) |       |      | mA (%) |
|   |  |               | H11D2       |        |       |      |        |
|   | H11D3  |               | 1 (10)      |        |       |      |        |
|   | H11D4  |               |             |        |       |      |        |
|   | $(I_F = 10 \text{ mA}, V_{CE} = 10 \text{ V})$                                   | 4N38          | 2 (20)      |        |       |      |        |
| *Saturation Voltage                                       | $(I_F = 10 \text{ mA}, I_C = 0.5 \text{ mA})$<br>$(R_{BE} = 1 \text{ M}\Omega)$  | $V_{CE(SAT)}$ | 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<br>Non-Saturated Turn-on Time | $(V_{CE} = 10 \text{ V}, I_{CE} = 2 \text{ mA})$ | $t_{on}$ | ALL    |     | 5     |     | $\mu\text{s}$ |
|   |  |          |        |     |       |     |               |

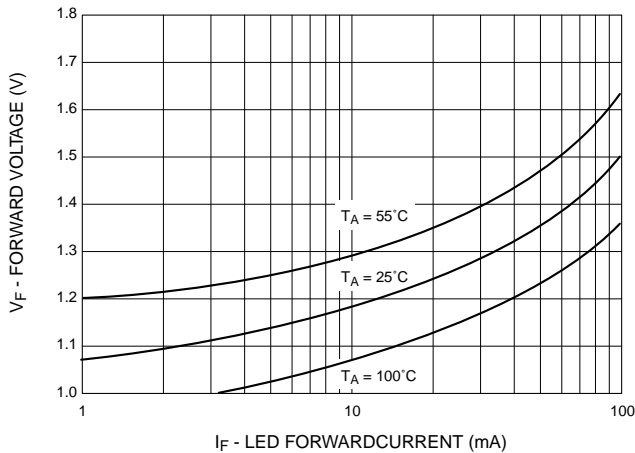
### ISOLATION CHARACTERISTICS

| 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    | $10^{11}$ |       |     | $\Omega$       |
| Isolation Capacitance | $(f = 1 \text{ MHz})$                          | $C_{ISO}$ | ALL    |           | 0.5   |     | pF             |

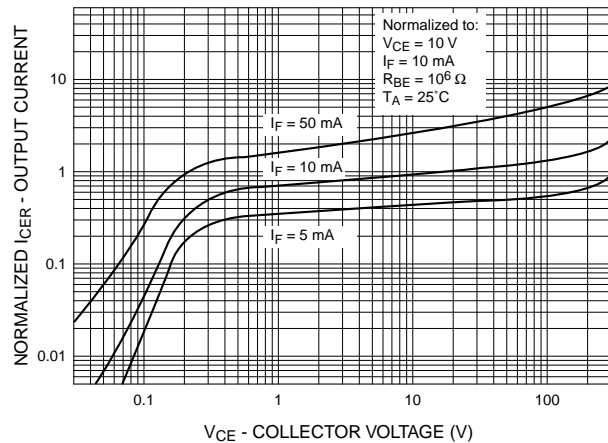
Notes

- \* 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**

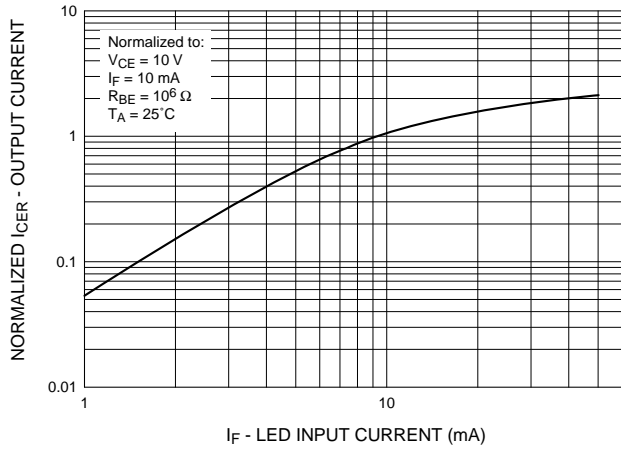


**Fig.2 Normalized Output Characteristics**

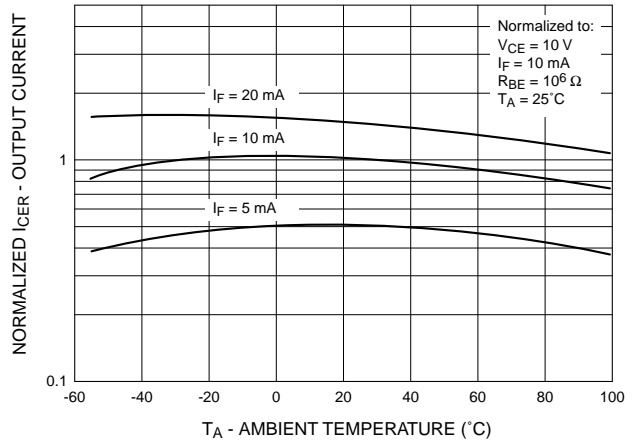


**H11D1, H11D2, H11D3, H11D4, 4N38**

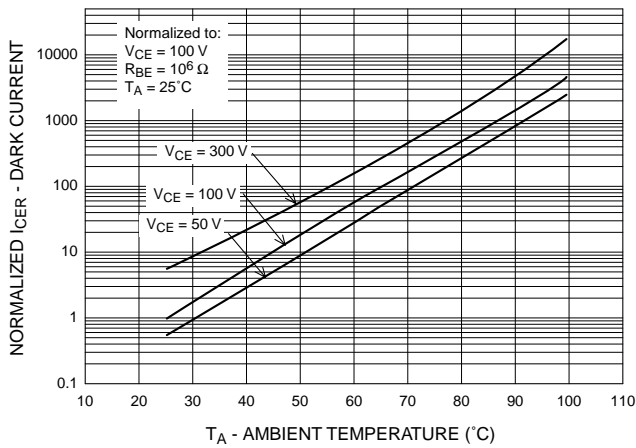
**Fig.3 Normalized Output Current vs. LED Input Current**



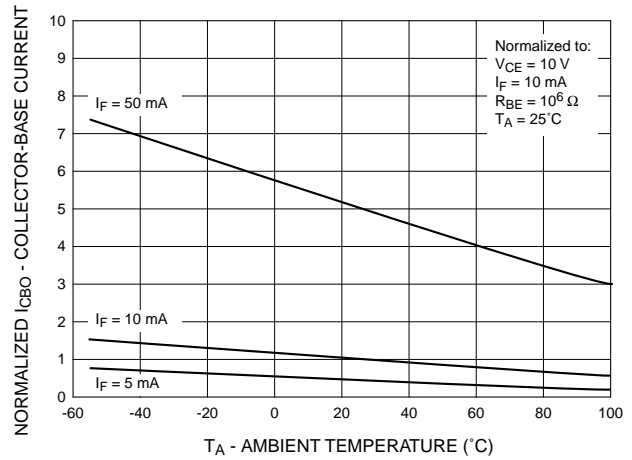
**Fig.4 Normalized Output Current vs. Temperature**



**Fig.5 Normalized Dark Current vs. Ambient Temperature**

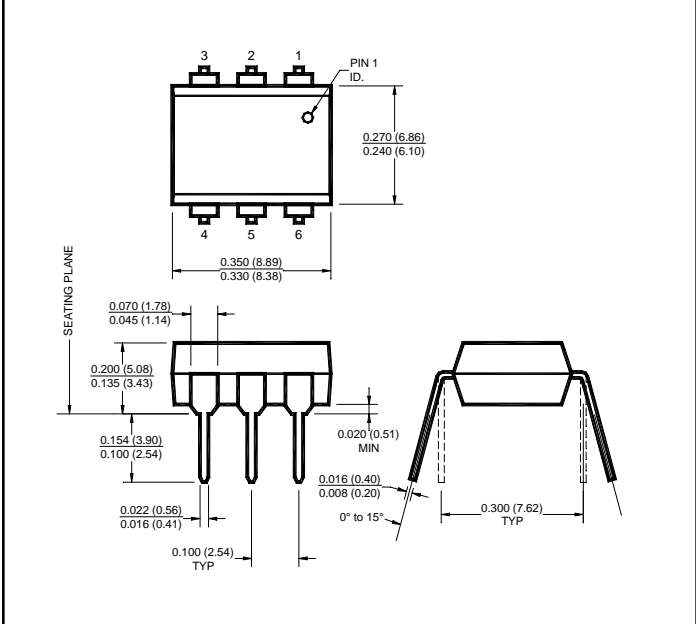


**Normalized Collector-Base Current vs. Temperature**

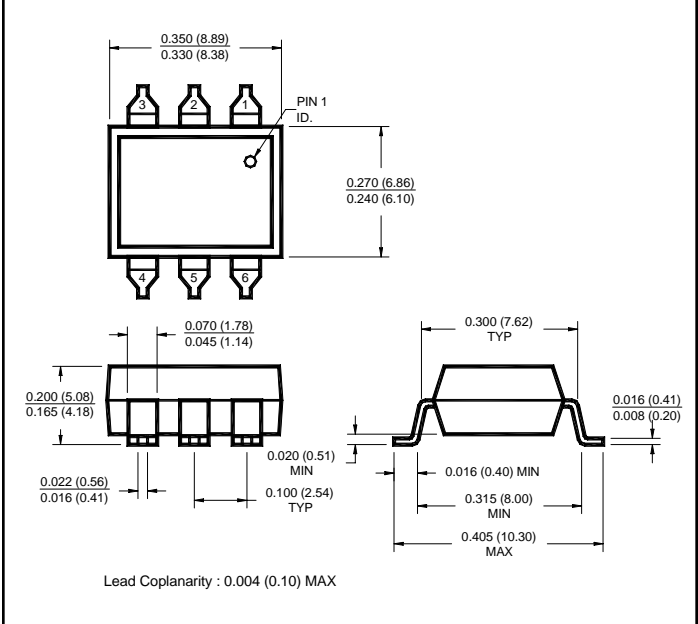


**H11D1, H11D2, H11D3, H11D4, 4N38**

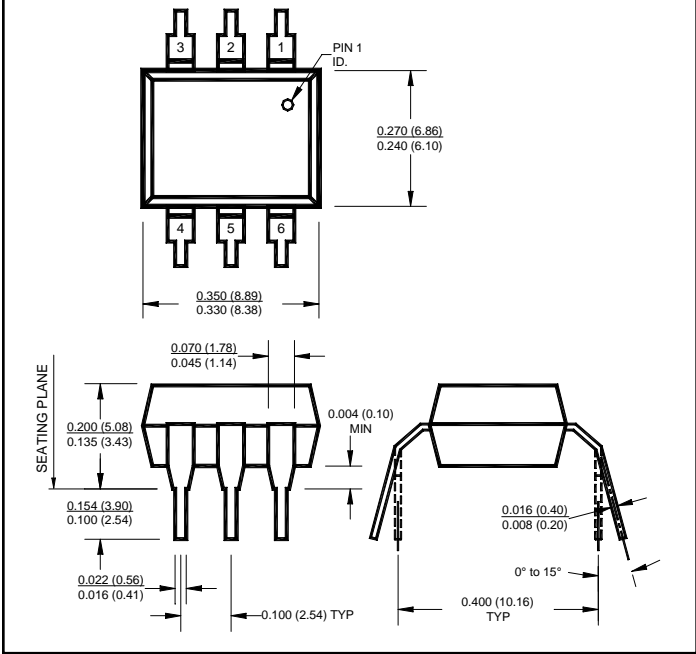
**Package Dimensions (Through Hole)**



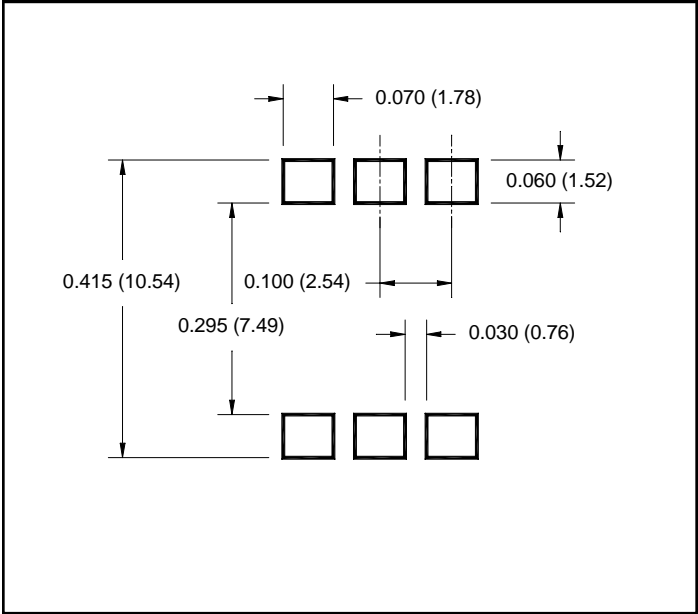
**Package Dimensions (Surface Mount)**



**Package Dimensions (0.4" Lead Spacing)**



**Recommended Pad Layout for Surface Mount Leadform**



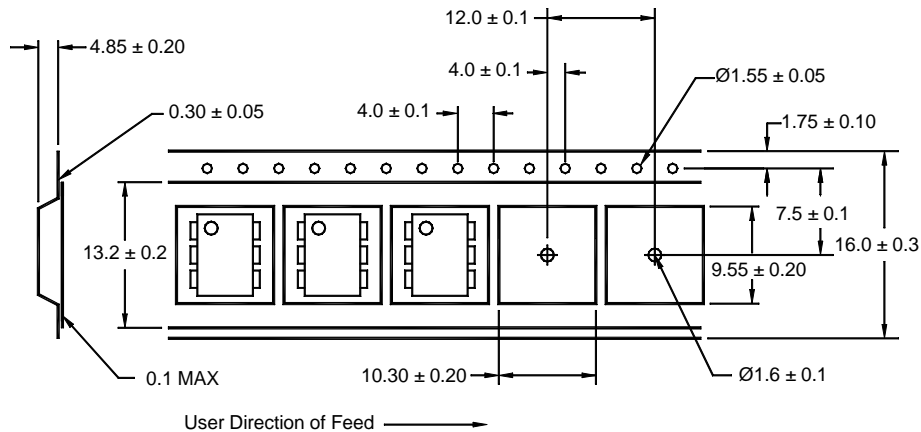
**NOTE**  
All dimensions are in inches (millimeters)

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 |

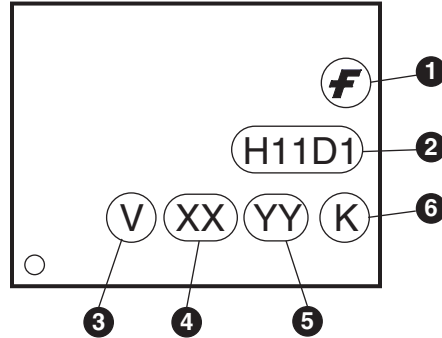
## QT Carrier Tape Specifications ("D" Taping Orientation)



### NOTE

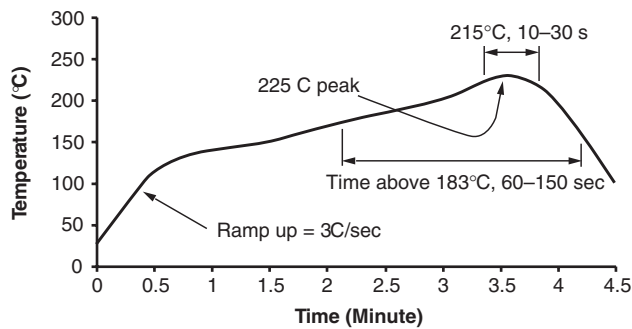
All dimensions are in millimeters

**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)**



- Peak reflow temperature: 225°C (package surface temperature)
- Time of temperature higher than 183°C for 60–150 seconds
- One time soldering reflow is recommended

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|--------------------------------------|---------------------|---------------|---------------------|-----------------|
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| ActiveArray™                         | FASTr™              | LittleFET™    | PowerEdge™          | SuperFET™       |
| Bottomless™                          | FPST™               | MICROCOUPLER™ | PowerSaver™         | SuperSOT™-3     |
| CoolFET™                             | FRFET™              | MicroFET™     | PowerTrench®        | SuperSOT™-6     |
| CROSSVOLT™                           | GlobalOptoisolator™ | MicroPak™     | QFET®               | SuperSOT™-8     |
| DOMET™                               | GTO™                | MICROWIRE™    | QS™                 | SyncFET™        |
| EcoSPARK™                            | HiSeC™              | MSX™          | QT Optoelectronics™ | TinyLogic®      |
| E <sup>2</sup> CMOS™                 | μC™                 | MSXPro™       | Quiet Series™       | TINYOPTO™       |
| EnSigna™                             | i-Lo™               | OCX™          | RapidConfigure™     | TruTranslation™ |
| FACT™                                | ImpliedDisconnect™  | OCXPro™       | RapidConnect™       | UHC™            |
| FACT Quiet Series™                   |                     | OPTOLOGIC®    | μSerDes™            | UltraFET®       |
| Across the board. Around the world.™ |                     | OPTOPLANAR™   | SILENT SWITCHER®    | VCX™            |
| The Power Franchise®                 |                     | PACMAN™       | SMART START™        |                 |
| Programmable Active Droop™           |                     | POP™          | SPM™                |                 |

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## PRODUCT STATUS DEFINITIONS

### Definition of Terms

| Datasheet Identification | Product Status         | Definition  |
|--------------------------|------------------------|---|
| Advance Information      | Formative or In Design | This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.  |
| Preliminary              | First Production       | This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design. |
| No Identification Needed | Full Production        | This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.   |
| Obsolete                 | Not In Production      | This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.   |



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## H11D2

6-pin DIP High Voltage Phototransistor Output Optocoupler

### Contents

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- [Features](#)
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- [Ordering information](#)
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- [Safety agency certificates](#)
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### General 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.

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### Features

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

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### Applications

- Power supply regulators
- Digital logic inputs

BUY

### Datasheet

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- Microprocessor inputs
- Appliance sensor systems
- Industrial controls

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### Ordering information








The following options can be ordered with this part:


| 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 and Reel |


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### Product status/pricing/packaging

**BUY**

| Product   | Product status | Pb-free Status  | Package type | Leads | Packing method |
|-----------|----------------|---|--------------|-------|----------------|
| H11D2     | Lifetime Buy   |   | DIP-B        | 6     | BULK           |
| H11D2300  | Lifetime Buy   |  | DIP-B        | 6     | BULK           |
| H11D2300W | Lifetime Buy   |  | DIP-B        | 6     | BULK           |
| H11D23S   | Lifetime Buy   |  | SMDIP-B      | 6     | BULK           |
| H11D23SD  | Lifetime Buy   |  | SMDIP-B      | 6     | TAPE REEL      |
| H11D2S    | Lifetime Buy   |  | SMDIP-B      | 6     | BULK           |
| H11D2SD   | Lifetime Buy   |  | SMDIP-B      | 6     | TAPE REEL      |

|        |              |   |       |   |      |
|--------|--------------|---|-------|---|------|
| H11D2W | Lifetime Buy |  | DIP-B | 6 | BULK |
|--------|--------------|---|-------|---|------|

 Indicates product with Pb-free second-level interconnect. For more information [click here](#).

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### Safety agency certificates

| Certificate                            | Agency    |                                      |
|--|-----------|--------------------------------------|
| <a href="#">E90700, Vol. 1</a> (936 K) | UL (1577) | Underwriters Laboratories Inc.       |
| <a href="#">E90700, Vol. 1</a> (936 K) | C-UL      | Underwriters Laboratories Inc.       |
| <a href="#">0122085</a> (677 K)        | SEMKO     | SEMKO                                |
| <a href="#">P01101067</a> (1638 K)     | NEMKO     | NEMKO                                |
| <a href="#">FI 16812</a> (964 K)       | FIMKO     | FIMKO                                |
| <a href="#">310684-02</a> (623 K)      | DEMKO     | DEMKO Testing & Certification        |
| <a href="#">1027742</a> (2305 K)       | CSA       | Canadian Standards Association       |
| <a href="#">94766</a> (1673 K)         | VDE       | VDE Pruf-und Zertifizierungsinstitut |

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### Qualification Support

Click on a product for detailed qualification data

| Product                   |
|---------------------------|
| <a href="#">H11D2</a>     |
| <a href="#">H11D2300</a>  |
| <a href="#">H11D2300W</a> |
| <a href="#">H11D23S</a>   |
| <a href="#">H11D23SD</a>  |
| <a href="#">H11D2S</a>    |
| <a href="#">H11D2SD</a>   |
| <a href="#">H11D2W</a>    |

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