

# 4N25M, 4N26M, 4N27M, 4N28M, 4N35M, 4N36M, 4N37M, H11A1M, H11A2M, H11A3M, H11A4M, H11A5M General Purpose 6-Pin Phototransistor Optocouplers

## Features

- UL recognized (File # E90700, Volume 2)
- VDE recognized (File # 102497)
  - Add option V (e.g., 4N25VM)

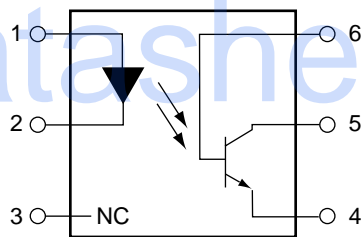
## Applications

- Power supply regulators
- Digital logic inputs
- Microprocessor inputs

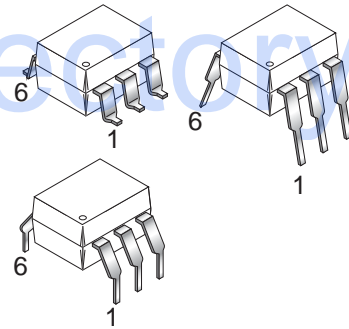
## Description

The general purpose optocouplers consist of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a 6-pin dual in-line package.

## Functional Block Diagram



- PIN 1. ANODE  
2. CATHODE  
3. NO CONNECTION  
4. EMITTER  
5. COLLECTOR  
6. BASE



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

| Symbol              | Parameter  | Value          | Units                |
|---------------------|--|----------------|----------------------|
| <b>TOTAL DEVICE</b> |  |                |                      |
| $T_{STG}$           | Storage Temperature  | -55 to +150    | $^\circ\text{C}$     |
| $T_{OPR}$           | Operating Temperature  | -55 to +100    | $^\circ\text{C}$     |
| $T_{SOL}$           | Wave solder temperature (see page 8 for reflow solder profile)                               | 260 for 10 sec | $^\circ\text{C}$     |
| $P_D$               | Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | 250            | mW                   |
|                     |  | 2.94           |                      |
| <b>EMITTER</b>      |  |                |                      |
| $I_F$               | DC/Average Forward Input Current   | 60             | mA                   |
| $V_R$               | Reverse Input Voltage  | 6              | V                    |
| $I_F(\text{pk})$    | Forward Current – Peak (300 $\mu\text{s}$ , 2% Duty Cycle)                                   | 3              | A                    |
| $P_D$               | LED Power Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$          | 120            | mW                   |
|                     |  | 1.41           | mW/ $^\circ\text{C}$ |
| <b>DETECTOR</b>     |  |                |                      |
| $V_{CEO}$           | Collector-Emitter Voltage  | 30             | V                    |
| $V_{CBO}$           | Collector-Base Voltage   | 70             | V                    |
| $V_{ECO}$           | Emitter-Collector Voltage  | 7              | V                    |
| $P_D$               | Detector Power Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$     | 150            | mW                   |
|                     |  | 1.76           | mW/ $^\circ\text{C}$ |

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

| Symbol          | Parameter                           | Test Conditions                          | Min. | Typ.* | Max. | Unit          |
|-----------------|-------------------------------------|--|------|-------|------|---------------|
| <b>EMITTER</b>  |                                     |  |      |       |      |               |
| $V_F$           | Input Forward Voltage               | $I_F = 10\text{mA}$                      |      | 1.18  | 1.50 | V             |
| $I_R$           | Reverse Leakage Current             | $V_R = 6.0\text{V}$                      |      | 0.001 | 10   | $\mu\text{A}$ |
| <b>DETECTOR</b> |                                     |  |      |       |      |               |
| $BV_{CEO}$      | Collector-Emitter Breakdown Voltage | $I_C = 1.0\text{mA}$ , $I_F = 0$         | 30   | 100   |      | V             |
| $BV_{CBO}$      | Collector-Base Breakdown Voltage    | $I_C = 100\mu\text{A}$ , $I_F = 0$       | 70   | 120   |      | V             |
| $BV_{ECO}$      | Emitter-Collector Breakdown Voltage | $I_E = 100\mu\text{A}$ , $I_F = 0$       | 7    | 10    |      | V             |
| $I_{CEO}$       | Collector-Emitter Dark Current      | $V_{CE} = 10\text{V}$ , $I_F = 0$        |      | 1     | 50   | nA            |
| $I_{CBO}$       | Collector-Base Dark Current         | $V_{CB} = 10\text{V}$                    |      |       | 20   | nA            |
| $C_{CE}$        | Capacitance                         | $V_{CE} = 0\text{V}$ , $f = 1\text{MHz}$ |      | 8     |      | pF            |

**Isolation Characteristics**

| Symbol    | Characteristic                 | Test Conditions                       | Min.      | Typ.* | Max. | Units    |
|-----------|--------------------------------|---------------------------------------|-----------|-------|------|----------|
| $V_{ISO}$ | Input-Output Isolation Voltage | $f = 60\text{Hz}$ , $t = 1\text{sec}$ | 7500      |       |      | Vac(pk)  |
| $R_{ISO}$ | Isolation Resistance           | $V_{I-O} = 500\text{VDC}$             | $10^{11}$ |       |      | $\Omega$ |
| $C_{ISO}$ | Isolation Capacitance          | $V_{I-O} = \&$ , $f = 1\text{MHz}$    |           | 0.2   | 2    | pF       |

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

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

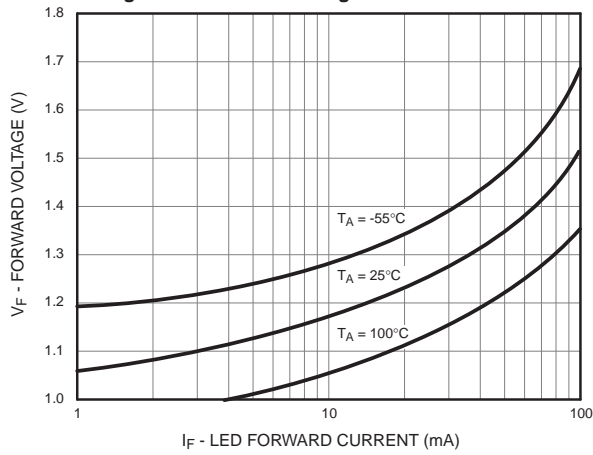
**Transfer Characteristics**

| Symbol                    | Parameter                                    | Test Conditions  | Device   | Min. | Typ.* | Max. | Unit          |
|---------------------------|--|--|--|------|-------|------|---------------|
| <b>DC CHARACTERISTICS</b> |  |  |  |      |       |      |               |
| CTR                       | Current Transfer Ratio, Collector to Emitter | $I_F = 10\text{mA}$ , $V_{CE} = 10\text{V}$                                  | 4N35M, 4N36M, 4N37M  | 100  |       |      | %             |
|                           |  |  | H11A1M   | 50   |       |      |               |
|                           |  |  | H11A5M   | 30   |       |      |               |
|                           |  |  | 4N25M, 4N26M<br>H11A2M, H11A3M                                     | 20   |       |      |               |
|                           |  |  | 4N27M, 4N28M<br>H11A4M   | 10   |       |      |               |
|                           |  | $I_F = 10\text{mA}$ , $V_{CE} = 10\text{V}$ ,<br>$T_A = -55^\circ\text{C}$   | 4N35M, 4N36M, 4N37M  | 40   |       |      |               |
|                           |  | $I_F = 10\text{mA}$ , $V_{CE} = 10\text{V}$ ,<br>$T_A = +100^\circ\text{C}$  | 4N35M, 4N36M, 4N37M  | 40   |       |      |               |
| $V_{CE(SAT)}$             | Collector-Emitter Saturation Voltage         | $I_C = 2\text{mA}$ , $I_F = 50\text{mA}$                                     | 4N25M, 4N26M, 4N27M, 4N28M,  |      |       | 0.5  | V             |
|                           |  | $I_C = 0.5\text{mA}$ , $I_F = 10\text{mA}$                                   | 4N35M, 4N36M, 4N37M  |      |       | 0.3  |               |
|                           |  |  | H11A1M, H11A2M, H11A3M, H11A4M, H11A5M                             |      |       | 0.4  |               |
| <b>AC CHARACTERISTICS</b> |  |  |  |      |       |      |               |
| $T_{ON}$                  | Non-Saturated Turn-on Time                   | $I_F = 10\text{mA}$ , $V_{CC} = 10\text{V}$ ,<br>$R_L = 100\Omega$ (Fig. 11) | 4N25M, 4N26M, 4N27M, 4N28M, H11A1M, H11A2M, H11A3M, H11A4, H11A5M  |      | 2     |      | $\mu\text{s}$ |
|                           |  | $I_C = 2\text{mA}$ , $V_{CC} = 10\text{V}$ ,<br>$R_L = 100\Omega$ (Fig. 11)  | 4N35M, 4N36M, 4N37M  |      | 2     | 10   | $\mu\text{s}$ |
| $T_{OFF}$                 | Turn-off Time                                | $I_F = 10\text{mA}$ , $V_{CC} = 10\text{V}$ ,<br>$R_L = 100\Omega$ (Fig. 11) | 4N25M, 4N26M, 4N27M, 4N28M, H11A1M, H11A2M, H11A3M, H11A4M, H11A5M |      | 2     |      | $\mu\text{s}$ |
|                           |  | $I_C = 2\text{mA}$ , $V_{CC} = 10\text{V}$ ,<br>$R_L = 100\Omega$ (Fig. 11)  | 4N35M, 4N36M, 4N37M  |      | 2     | 10   |               |

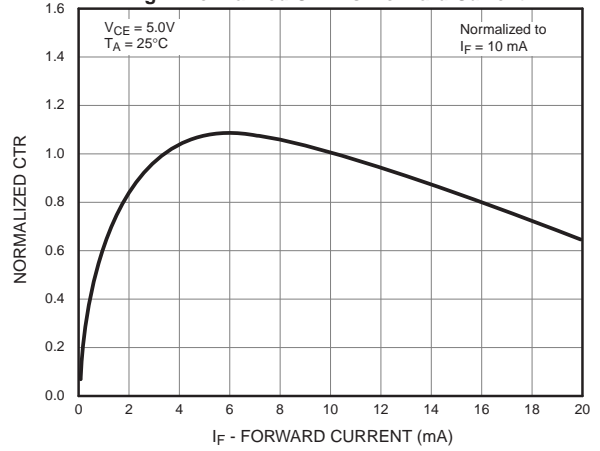
\* Typical values at  $T_A = 25^\circ\text{C}$

## Typical Performance Curves

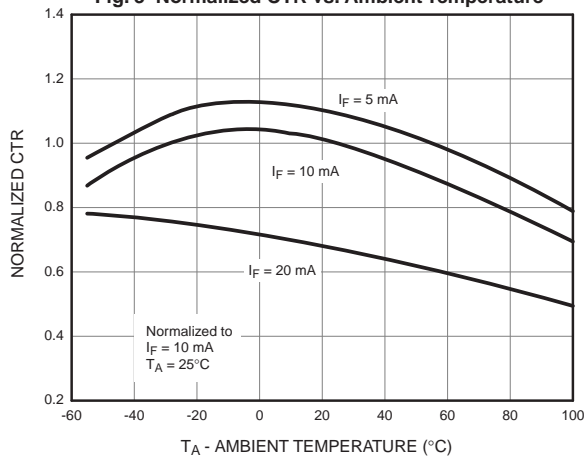
**Fig. 1 LED Forward Voltage vs. Forward Current**



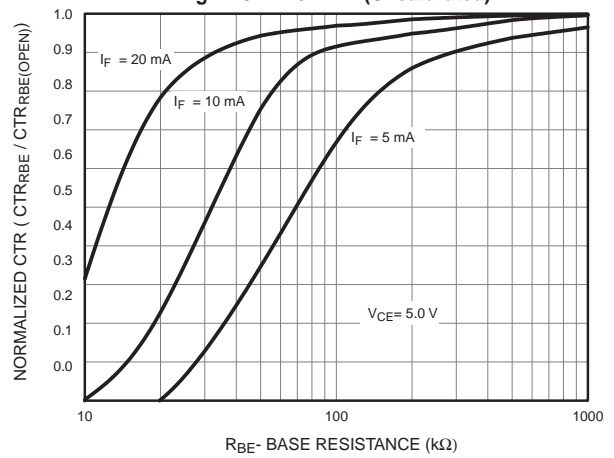
**Fig.2 Normalized CTR vs. Forward Current**



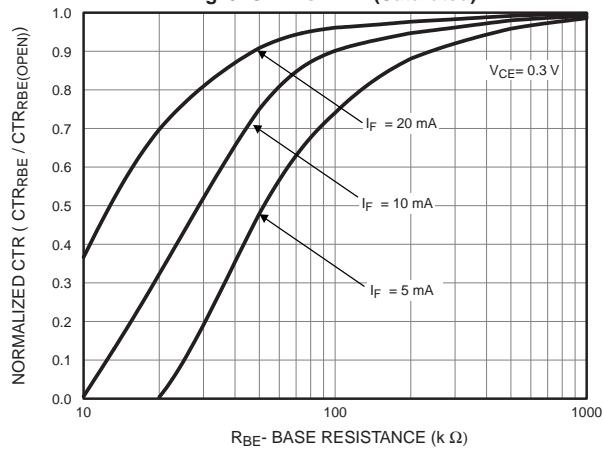
**Fig. 3 Normalized CTR vs. Ambient Temperature**



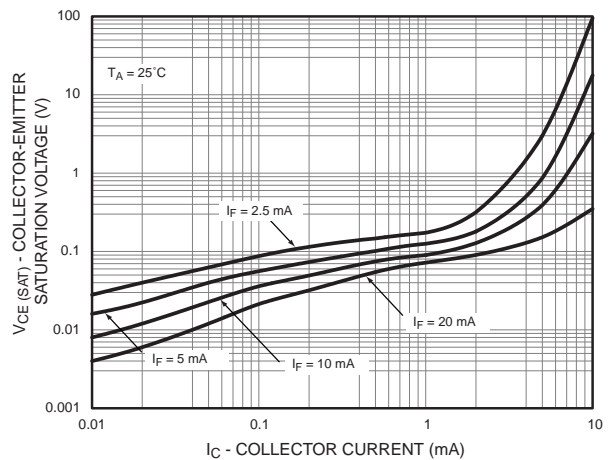
**Fig. 4 CTR vs. R<sub>BE</sub> (Unsaturated)**

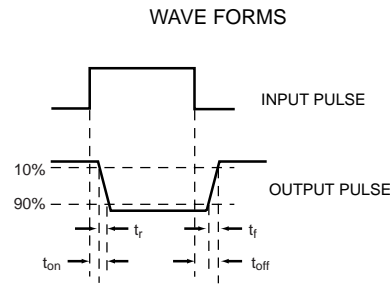
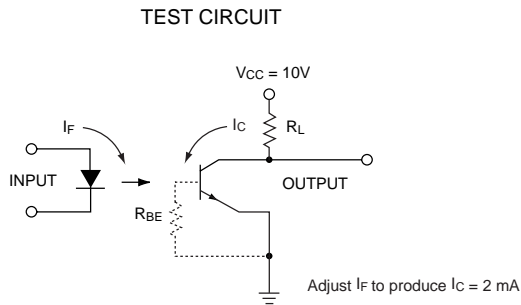
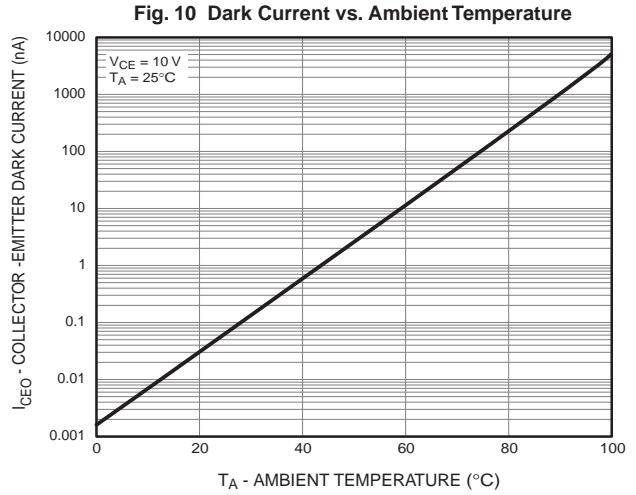
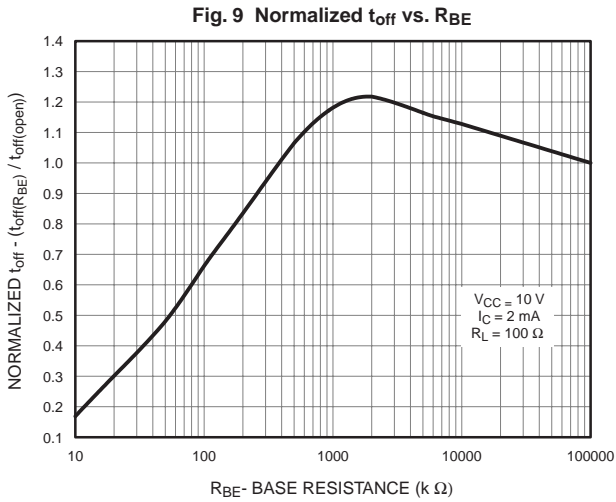
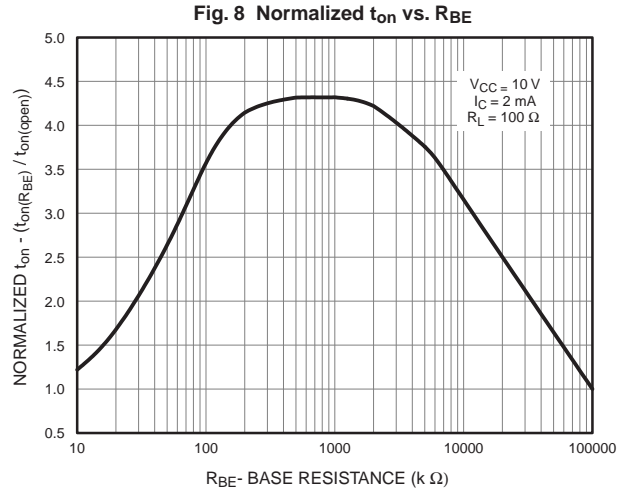
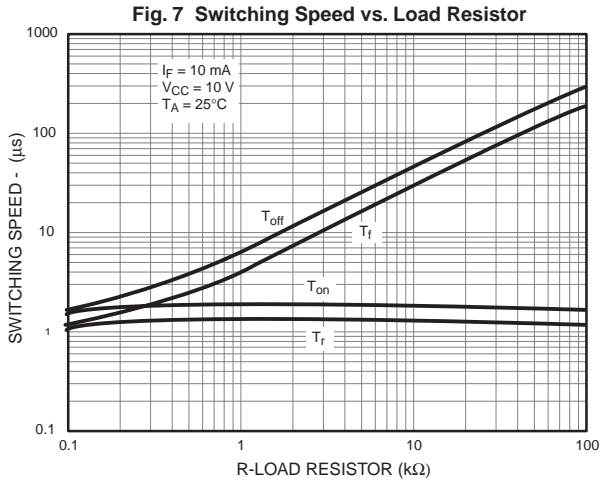


**Fig. 5 CTR vs. R<sub>BE</sub> (Saturated)**



**Fig. 6 Collector-Emitter Saturation Voltage vs. Collector Current**

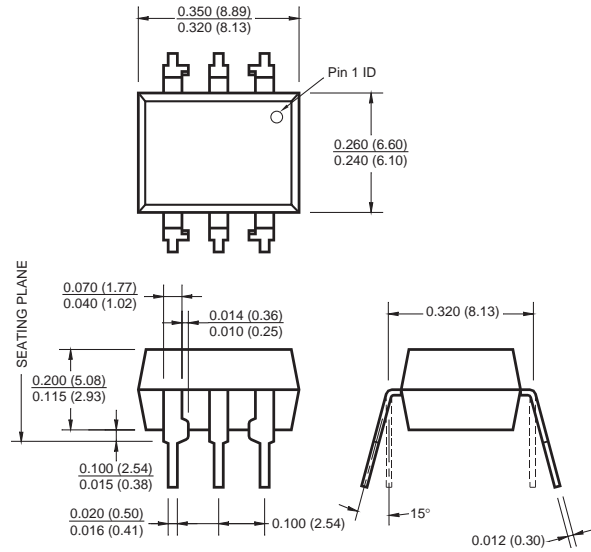




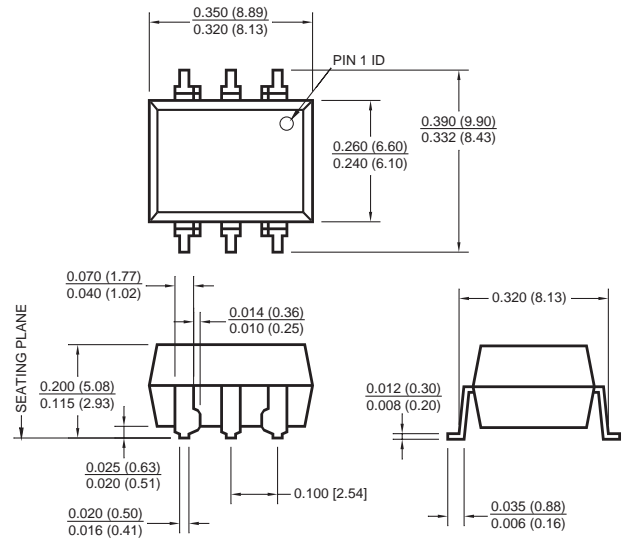
**Figure 11. Switching Time Test Circuit and Waveforms**

## Package Dimensions

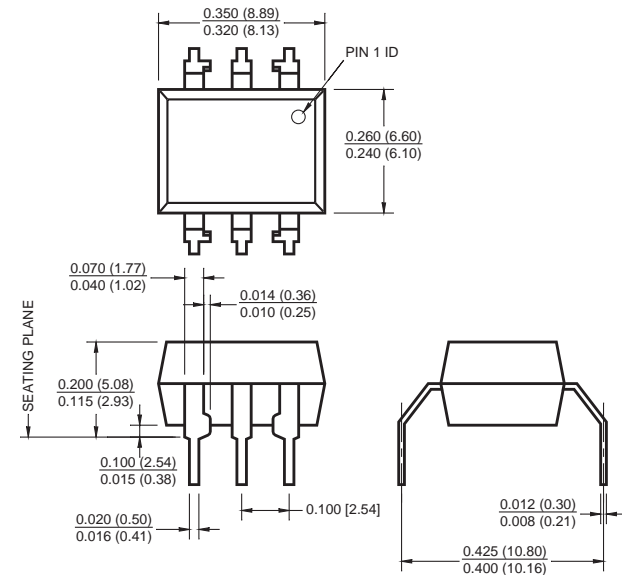
### Through Hole



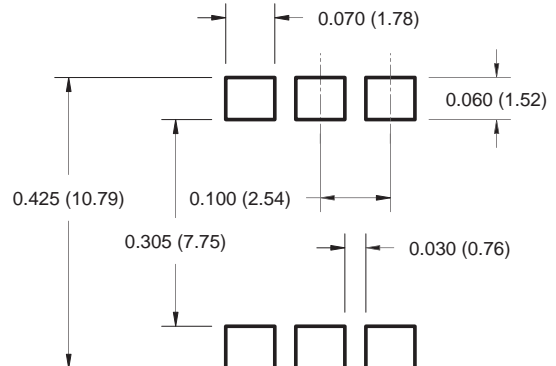
### Surface Mount



### 0.4" Lead Spacing



### Recommended Pad Layout for Surface Mount Leadform



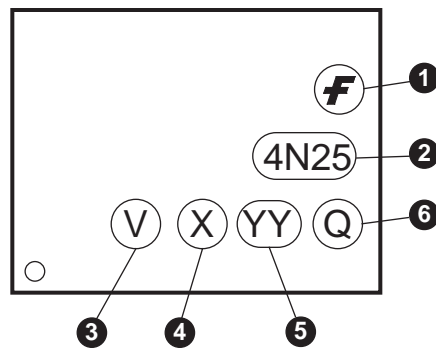
### Note:

All dimensions are in inches (millimeters)

## Ordering Information

| Option    | Order Entry Identifier (Example) | Description                            |
|-----------|----------------------------------|--|
| No option | 4N25M                            | Standard Through Hole Device           |
| S         | 4N25SM                           | Surface Mount Lead Bend                |
| SR2       | 4N25SR2M                         | Surface Mount; Tape and Reel           |
| T         | 4N25TM                           | 0.4" Lead Spacing                      |
| V         | 4N25VM                           | VDE 0884                               |
| TV        | 4N25TVM                          | VDE 0884, 0.4" Lead Spacing            |
| SV        | 4N25SVM                          | VDE 0884, Surface Mount                |
| SR2V      | 4N25SR2VM                        | VDE 0884, Surface Mount, Tape and Reel |

## Marking Information

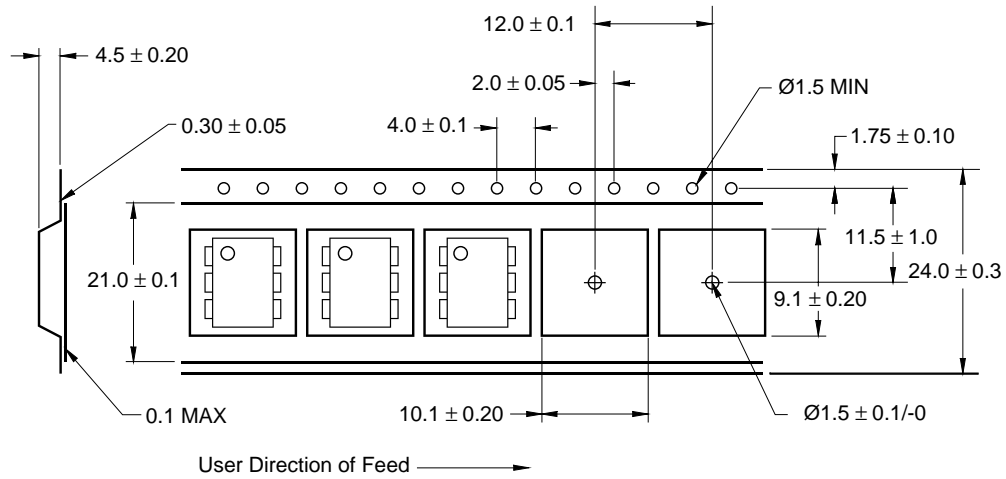


### Definitions

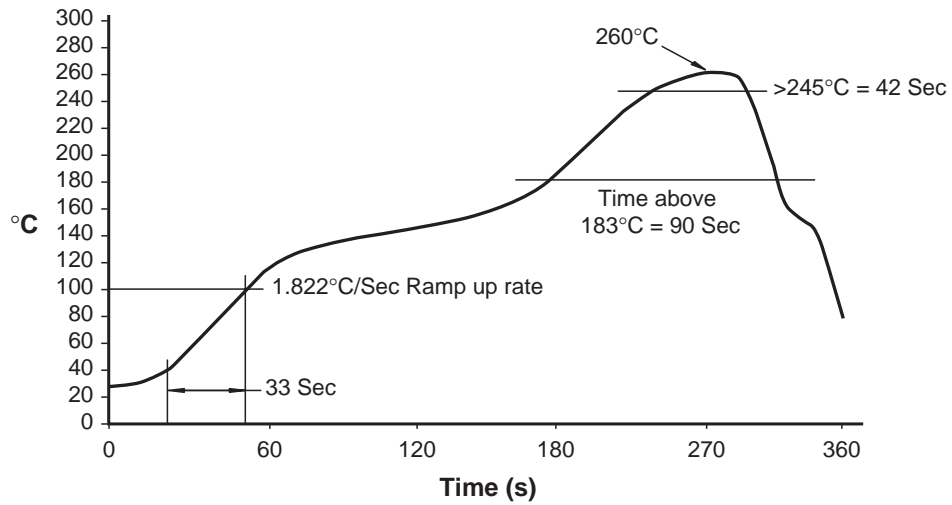
|   |  |
|---|--|
| 1 | Fairchild logo   |
| 2 | Device number  |
| 3 | VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table) |
| 4 | One digit year code, e.g., '7'   |
| 5 | Two digit work week ranging from '01' to '53'  |
| 6 | Assembly package code  |

\*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.

### Carrier Tape Specification



### Reflow Profile








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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; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice 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 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.                                      |

Rev. I24

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## H11A3-M

6-Pin DIP Package Phototransistor Output Optocoupler

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- [Features](#)
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- [Product status/pricing/packaging](#)
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### General description

The general purpose optocouplers consist of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a 6-pin dual-in-line package.

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### Features

- UL recognized (File #E90700, Volume 2)
- VDE recognized (File #102497)
  - Add option V (e.g. 4N25VM)

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### Applications

- Power supply regulators
- Digital logic inputs
- Microprocessor inputs

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| Product    | Product status  | Pb-free Status   | Pricing* | Package type | Leads | Packing method |
|------------|-----------------|--|----------|--------------|-------|----------------|
| H11A3FM    | Lifetime Buy    |                     | N/A      | DIP-W        | 6     | BULK           |
| H11A3FR2M  | Lifetime Buy    |                     | N/A      | SMDIP-W      | 6     | TAPE REEL      |
| H11A3FR2VM | Lifetime Buy    |                     | N/A      | SMDIP-W      | 6     | TAPE REEL      |
| H11A3FVM   | Lifetime Buy    |                     | N/A      | DIP-W        | 6     | BULK           |
| H11A3M     | Full Production | <br>Full Production | \$0.229  | DIP-W        | 6     | BULK           |
| H11A3SM    | Full Production | <br>Full Production | \$0.165  | SMDIP-W      | 6     | BULK           |
| H11A3SR2M  | Full Production | <br>Full Production | \$0.206  | SMDIP-W      | 6     | TAPE REEL      |
| H11A3SR2VM | Full Production | <br>Full Production | \$0.206  | SMDIP-W      | 6     | TAPE REEL      |
| H11A3SVM   | Full Production | <br>Full Production | \$0.165  | SMDIP-W      | 6     | BULK           |
| H11A3TM    | Full Production | <br>Full Production | \$0.165  | DIP-W        | 6     | BULK           |
| H11A3TVM   | Full Production | <br>Full Production | \$0.165  | DIP-W        | 6     | BULK           |
| H11A3VM    | Full Production | <br>Full Production | \$0.165  | DIP-W        | 6     | BULK           |

\* Fairchild 1,000 piece Budgetary Pricing

\*\* A sample button will appear if the part is available through Fairchild's on-line samples program. If there is no sample button, please contact a [Fairchild distributor](#) to obtain samples



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

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### Qualification Support

Click on a product for detailed qualification data

| Product                    |
|----------------------------|
| <a href="#">H11A3FM</a>    |
| <a href="#">H11A3FR2M</a>  |
| <a href="#">H11A3FR2VM</a> |
| <a href="#">H11A3FVM</a>   |
| <a href="#">H11A3M</a>     |
| <a href="#">H11A3SM</a>    |
| <a href="#">H11A3SR2M</a>  |
| <a href="#">H11A3SR2VM</a> |
| <a href="#">H11A3SVM</a>   |
| <a href="#">H11A3TM</a>    |
| <a href="#">H11A3TVM</a>   |
| <a href="#">H11A3VM</a>    |

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