

**4N25  
4N37**

**4N26  
H11A1**

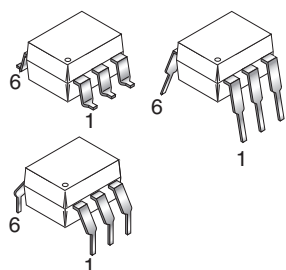
**4N27  
H11A2**

**4N28  
H11A3**

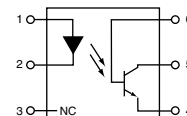
**4N35  
H11A4**

**4N36  
H11A5**

## WHITE PACKAGE (-M SUFFIX)

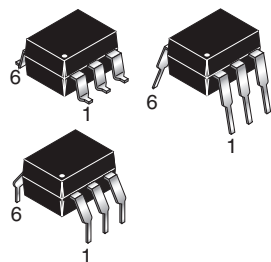


## SCHEMATIC



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

## BLACK PACKAGE (NO -M SUFFIX)



## 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.

## FEATURES

- Also available in white package by specifying -M suffix, eg. 4N25-M
- UL recognized (File # E90700)
- VDE recognized (File # 94766)
  - Add option V for white package (e.g., 4N25V-M)
  - Add option 300 for black package (e.g., 4N25.300)

## APPLICATIONS

- Power supply regulators
- Digital logic inputs
- Microprocessor inputs

**4N25  
4N37**

**4N26  
H11A1**

**4N27  
H11A2**

**4N28  
H11A3**

**4N35  
H11A4**

**4N36  
H11A5**

**ABSOLUTE MAXIMUM RATINGS** ( $T_A = 25^\circ\text{C}$  unless otherwise specified)

| Parameter                                                                                    | Symbol             | Value                                           | Units                      |
|----------------------------------------------------------------------------------------------|--------------------|-------------------------------------------------|----------------------------|
| <b>TOTAL DEVICE</b>                                                                          |                    |                                                 |                            |
| Storage Temperature                                                                          | $T_{\text{STG}}$   | -55 to +150                                     | $^\circ\text{C}$           |
| Operating Temperature                                                                        | $T_{\text{OPR}}$   | -55 to +100                                     | $^\circ\text{C}$           |
| Lead Solder Temperature                                                                      | $T_{\text{SOL}}$   | 260 for 10 sec                                  | $^\circ\text{C}$           |
| Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$              | 250<br>3.3 (non-M), 2.94 (-M)                   | mW                         |
| <b>EMITTER</b>                                                                               |                    |                                                 |                            |
| DC/Average Forward Input Current                                                             | $I_F$              | 100 (non-M), 60 (-M)                            | mA                         |
| Reverse Input Voltage                                                                        | $V_R$              | 6                                               | V                          |
| Forward Current - Peak (300 $\mu\text{s}$ , 2% Duty Cycle)                                   | $I_{F(\text{pk})}$ | 3                                               | A                          |
| LED Power Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$          | $P_D$              | 150 (non-M), 120 (-M)<br>2.0 (non-M), 1.41 (-M) | mW<br>mW/ $^\circ\text{C}$ |
| <b>DETECTOR</b>                                                                              |                    |                                                 |                            |
| Collector-Emitter Voltage                                                                    | $V_{\text{CEO}}$   | 30                                              | V                          |
| Collector-Base Voltage                                                                       | $V_{\text{CBO}}$   | 70                                              | V                          |
| Emitter-Collector Voltage                                                                    | $V_{\text{ECO}}$   | 7                                               | V                          |
| Detector Power Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$     | $P_D$              | 150<br>2.0 (non-M), 1.76 (-M)                   | mW<br>mW/ $^\circ\text{C}$ |

**4N25**  
**4N37**

**4N26**  
**H11A1**

**4N27**  
**H11A2**

**4N28**  
**H11A3**

**4N35**  
**H11A4**

**4N36**  
**H11A5**

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

### INDIVIDUAL COMPONENT CHARACTERISTICS

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

### ISOLATION CHARACTERISTICS

| Characteristic                 | Test Conditions                                                       | Symbol    | Min       | Typ* | Max | Units    |
|--------------------------------|-----------------------------------------------------------------------|-----------|-----------|------|-----|----------|
| Input-Output Isolation Voltage | (Non '-M', Black Package) ( $f = 60\text{ Hz}$ , $t = 1\text{ min}$ ) | $V_{ISO}$ | 5300      |      |     | Vac(rms) |
|                                | ('M', White Package) ( $f = 60\text{ Hz}$ , $t = 1\text{ sec}$ )      |           | 7500      |      |     | Vac(pk)  |
| Isolation Resistance           | ( $V_{I-O} = 500\text{ VDC}$ )                                        | $R_{ISO}$ | $10^{11}$ |      |     | $\Omega$ |
| Isolation Capacitance          | ( $V_{I-O} = \&$ , $f = 1\text{ MHz}$ )                               | $C_{ISO}$ |           | 0.5  |     | pF       |
|                                | ('M' White Package)                                                   |           |           | 0.2  | 2   | pF       |

Note

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

**4N25  
4N37**

**4N26  
H11A1**

**4N27  
H11A2**

**4N28  
H11A3**

**4N35  
H11A4**

**4N36  
H11A5**

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

| DC Characteristic                               | Test Conditions                                                                     | Symbol                | Device                                                                    | Min | Typ* | Max | Unit |
|-------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------|---------------------------------------------------------------------------|-----|------|-----|------|
| Current Transfer Ratio,<br>Collector to Emitter | (I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10 V)                                    | CTR                   | 4N35<br>4N36<br>4N37                                                      | 100 |      |     | %    |
|                                                 |                                                                                     |                       | H11A1                                                                     | 50  |      |     |      |
|                                                 |                                                                                     |                       | H11A5                                                                     | 30  |      |     |      |
|                                                 |                                                                                     |                       | 4N25<br>4N26<br>H11A2<br>H11A3                                            | 20  |      |     |      |
|                                                 | 4N27<br>4N28<br>H11A4                                                               |                       | 10                                                                        |     |      |     |      |
|                                                 | 4N35<br>4N36<br>4N37                                                                |                       | 40                                                                        |     |      |     |      |
|                                                 | 4N35<br>4N36<br>4N37                                                                |                       | 40                                                                        |     |      |     |      |
|                                                 | (I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10 V, T <sub>A</sub> = -55°C)            |                       |                                                                           |     |      |     |      |
|                                                 | (I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10 V, T <sub>A</sub> = +100°C)           |                       |                                                                           |     |      |     |      |
| Collector-Emitter<br>Saturation Voltage         | (I <sub>C</sub> = 2 mA, I <sub>F</sub> = 50 mA)                                     | V <sub>CE (SAT)</sub> | 4N25<br>4N26<br>4N27<br>4N28                                              |     |      | 0.5 | V    |
|                                                 | (I <sub>C</sub> = 0.5 mA, I <sub>F</sub> = 10 mA)                                   |                       | 4N35<br>4N36<br>4N37                                                      |     |      | 0.3 |      |
|                                                 |                                                                                     |                       | H11A1<br>H11A2<br>H11A3<br>H11A4<br>H11A5                                 |     |      | 0.4 |      |
| AC Characteristic                               |                                                                                     |                       |                                                                           |     |      |     |      |
| Non-Saturated<br>Turn-on Time                   | (I <sub>F</sub> = 10 mA, V <sub>CC</sub> = 10 V, R <sub>L</sub> = 100Ω)<br>(Fig.20) | T <sub>ON</sub>       | 4N25<br>4N26<br>4N27<br>4N28<br>H11A1<br>H11A2<br>H11A3<br>H11A4<br>H11A5 |     | 2    |     | μs   |
| Non Saturated<br>Turn-on Time                   | (I <sub>C</sub> = 2 mA, V <sub>CC</sub> = 10 V, R <sub>L</sub> = 100Ω)<br>(Fig.20)  | T <sub>ON</sub>       | 4N35<br>4N36<br>4N37                                                      |     | 2    | 10  | μs   |

**4N25  
4N37**

**4N26  
H11A1**

**4N27  
H11A2**

**4N28  
H11A3**

**4N35  
H11A4**

**4N36  
H11A5**

| <b>TRANSFER CHARACTERISTICS</b> ( $T_A = 25^\circ\text{C}$ Unless otherwise specified.) (Continued) |                                                                                   |           |                                                                           |     |      |     |               |
|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------|---------------------------------------------------------------------------|-----|------|-----|---------------|
| AC Characteristic                                                                                   | Test Conditions                                                                   | Symbol    | Device                                                                    | Min | Typ* | Max | Unit          |
| Turn-off Time                                                                                       | ( $I_F = 10\text{ mA}$ , $V_{CC} = 10\text{ V}$ , $R_L = 100\Omega$ )<br>(Fig.20) | $T_{OFF}$ | 4N25<br>4N26<br>4N27<br>4N28<br>H11A1<br>H11A2<br>H11A3<br>H11A4<br>H11A5 |     | 2    |     | $\mu\text{s}$ |
|                                                                                                     | ( $I_C = 2\text{ mA}$ , $V_{CC} = 10\text{ V}$ , $R_L = 100\Omega$ )<br>(Fig.20)  |           | 4N35<br>4N36<br>4N37                                                      |     | 2    | 10  |               |

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

**4N25  
4N37**

**4N26  
H11A1**

**4N27  
H11A2**

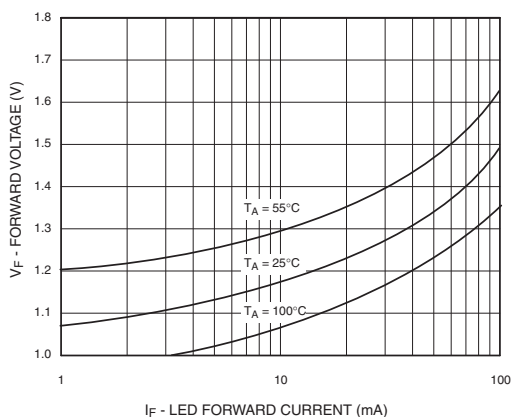
**4N28  
H11A3**

**4N35  
H11A4**

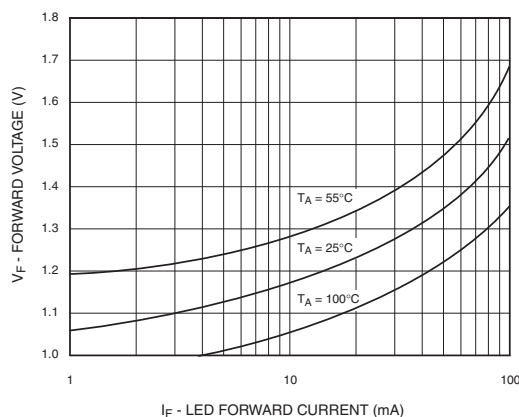
**4N36  
H11A5**

## TYPICAL PERFORMANCE CURVES

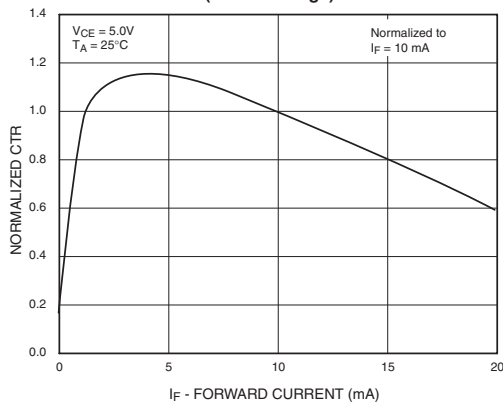
**Fig. 1 LED Forward Voltage vs. Forward Current  
(Black Package)**



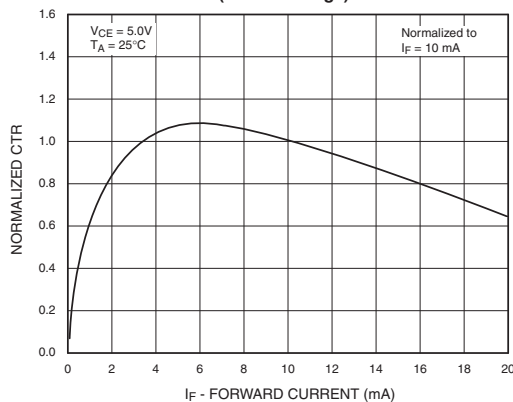
**Fig. 2 LED Forward Voltage vs. Forward Current  
(White Package)**



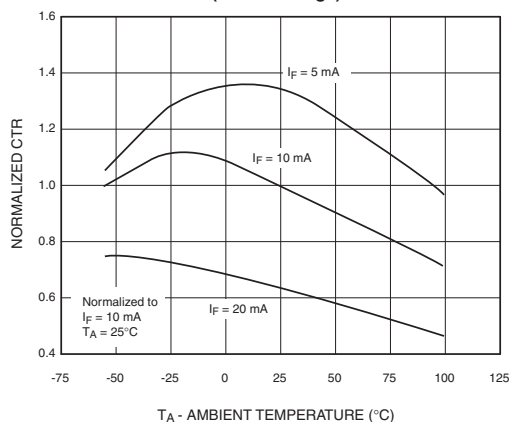
**Fig.3 Normalized CTR vs. Forward Current  
(Black Package)**



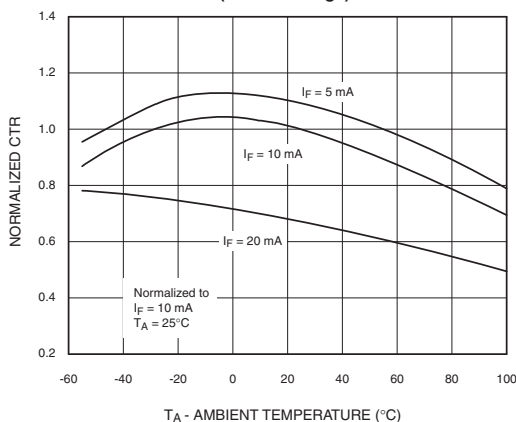
**Fig.4 Normalized CTR vs. Forward Current  
(White Package)**



**Fig. 5 Normalized CTR vs. Ambient Temperature  
(Black Package)**



**Fig. 6 Normalized CTR vs. Ambient Temperature  
(White Package)**



**4N25  
4N37**

**4N26  
H11A1**

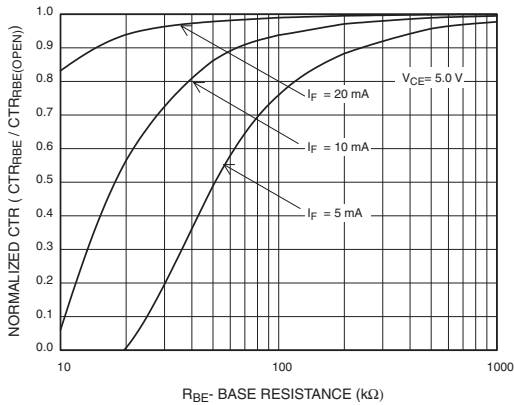
**4N27  
H11A2**

**4N28  
H11A3**

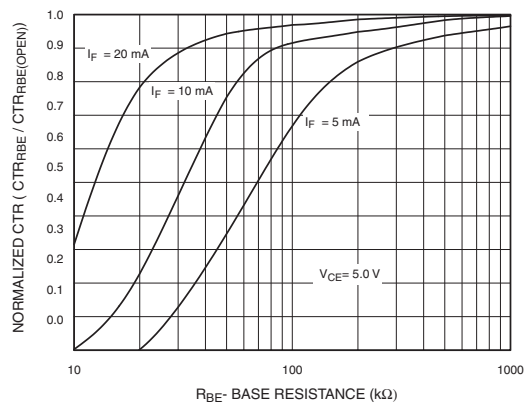
**4N35  
H11A4**

**4N36  
H11A5**

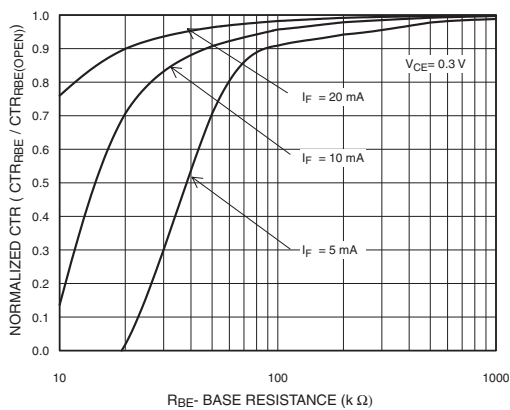
**Fig. 7 CTR vs. RBE (Unsaturated)  
(Black Package)**



**Fig. 8 CTR vs. RBE (Unsaturated)  
(White Package)**



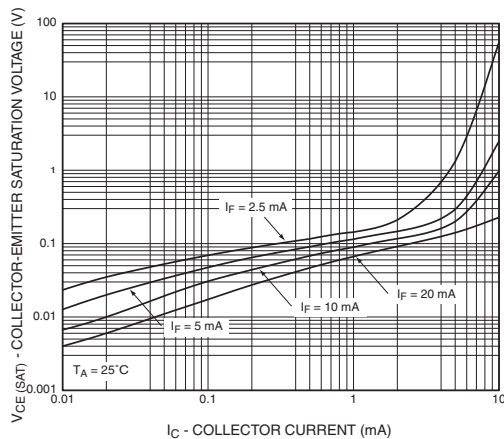
**Fig. 9 CTR vs. RBE (Saturated)  
(Black Package)**



**Fig. 10 CTR vs. RBE (Saturated)  
(White Package)**



**Fig. 11 Collector-Emitter Saturation Voltage vs. Collector Current  
(Black Package)**



**Fig. 12 Collector-Emitter Saturation Voltage vs. Collector Current  
(White Package)**



**4N25**  
**4N37**

**4N26**  
**H11A1**

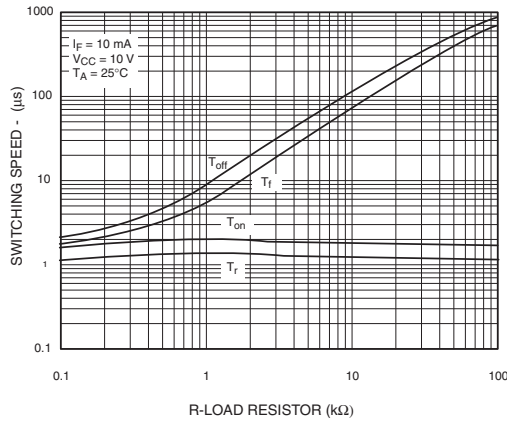
**4N27**  
**H11A2**

**4N28**  
**H11A3**

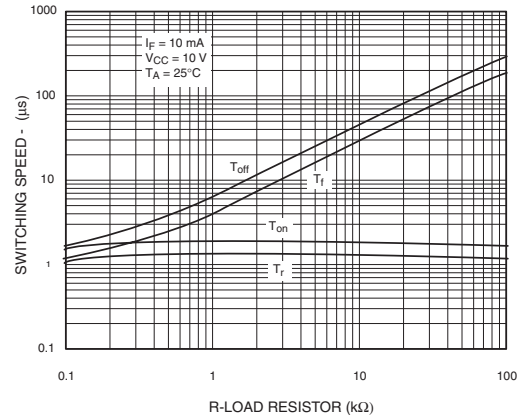
**4N35**  
**H11A4**

**4N36**  
**H11A5**

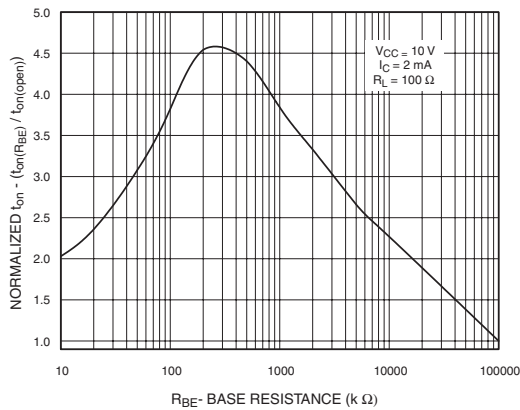
**Fig. 13 Switching Speed vs. Load Resistor  
(Black Package)**



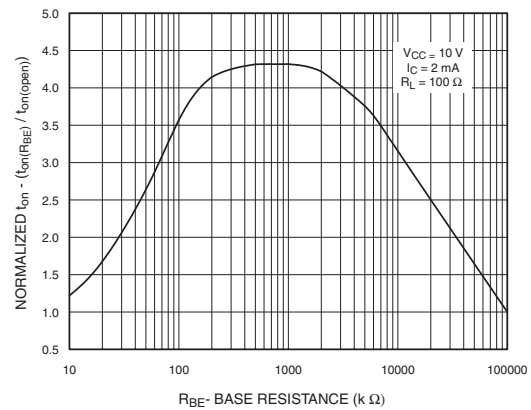
**Fig. 14 Switching Speed vs. Load Resistor  
(White Package)**



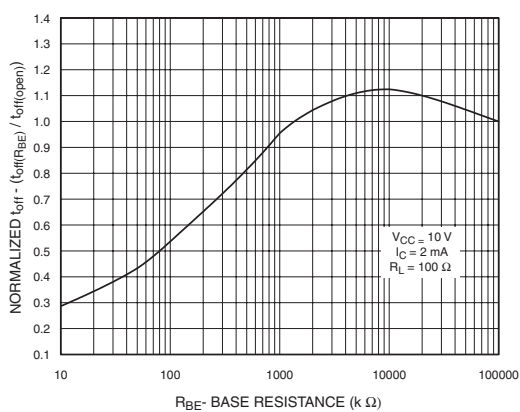
**Fig. 15 Normalized  $t_{on}$  vs.  $R_{BE}$   
(Black Package)**



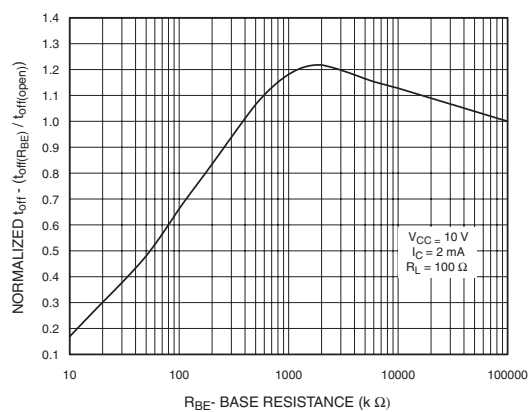
**Fig. 16 Normalized  $t_{on}$  vs.  $R_{BE}$   
(White Package)**



**Fig. 17 Normalized  $t_{off}$  vs.  $R_{BE}$   
(Black Package)**



**Fig. 18 Normalized  $t_{off}$  vs.  $R_{BE}$   
(White Package)**



4N25  
4N37

4N26  
H11A1

4N27  
H11A2

4N28  
H11A3

4N35  
H11A4

4N36  
H11A5

Fig. 19 Dark Current vs. Ambient Temperature



Figure 20. Switching Time Test Circuit and Waveforms

**4N36**  
**H11A5**

## 6/6/02

**4N25  
4N37**

**4N26  
H11A1**

**4N27  
H11A2**

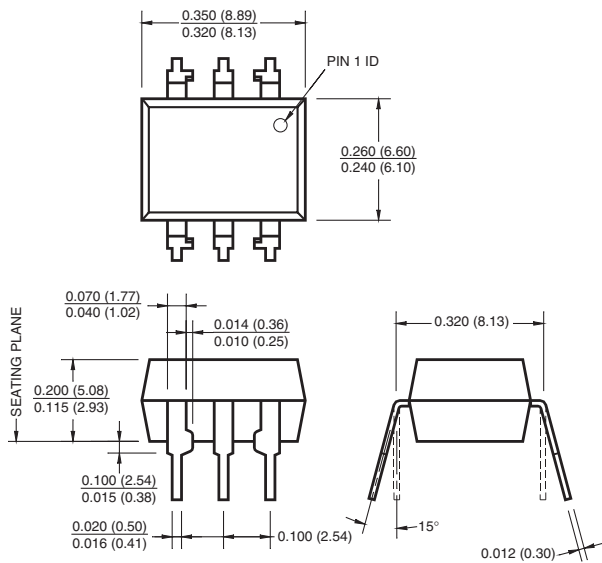
**4N28  
H11A3**

**4N35  
H11A4**

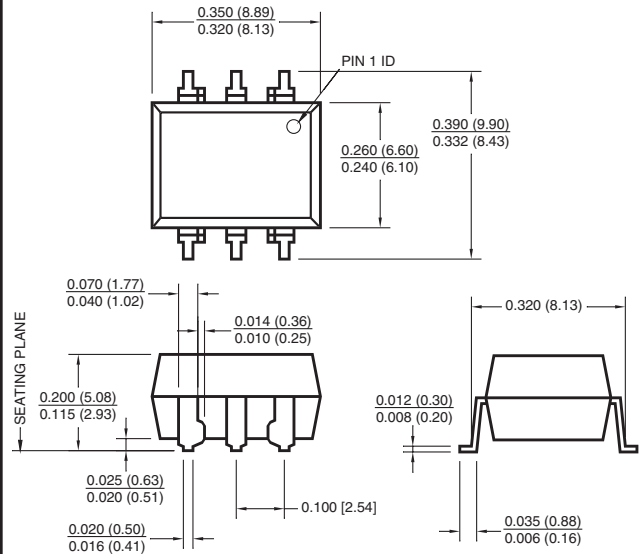
**4N36  
H11A5**

## White Package (-M Suffix)

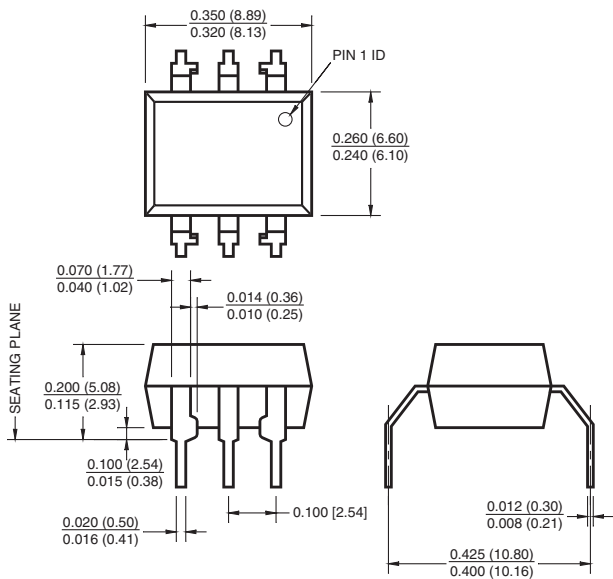
### Package Dimensions (Through Hole)



### Package Dimensions (Surface Mount)



### Package Dimensions (0.4" Lead Spacing)



### Recommended Pad Layout for Surface Mount Leadform



## NOTE

All dimensions are in inches (millimeters)

**4N25**  
**4N37**

**4N26**  
**H11A1**

**4N27**  
**H11A2**

**4N28**  
**H11A3**

**4N35**  
**H11A4**

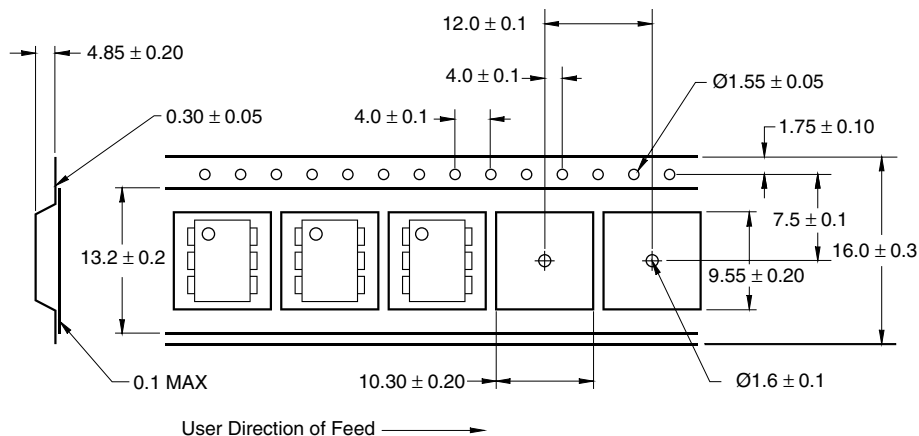
**4N36**  
**H11A5**

## ORDERING INFORMATION

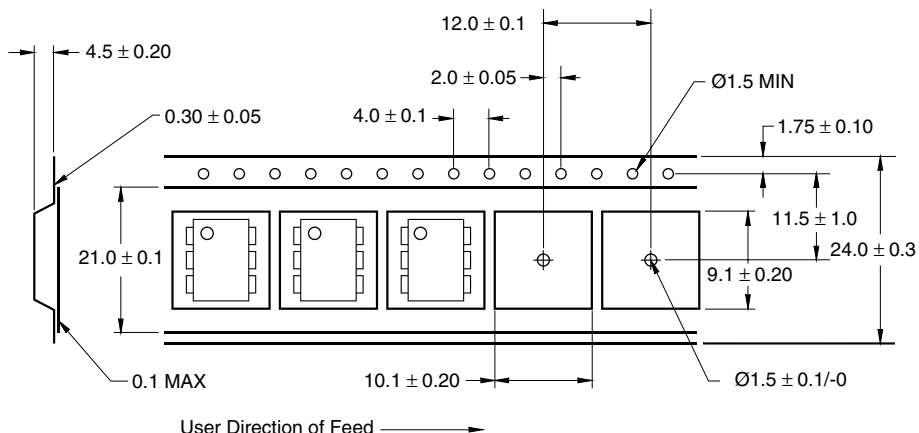
### Order Entry Identifier

| Black Package (No Suffix) | White Package (-M Suffix) | Option                               |
|---------------------------|---------------------------|--------------------------------------|
| .S                        | S                         | Surface Mount Lead Bend              |
| .SD                       | SR2                       | Surface Mount; Tape and reel         |
| .W                        | T                         | 0.4" Lead Spacing                    |
| .300                      | V                         | VDE 0884                             |
| .300W                     | TV                        | VDE 0884, 0.4" Lead Spacing          |
| .3S                       | SV                        | VDE 0884, Surface Mount              |
| .3SD                      | SR2V                      | VDE 0884, Surface Mount, Tape & Reel |

### QT Carrier Tape Specifications (Black Package, No Suffix)



### QT Carrier Tape Specifications (White Package, -M Suffix)



---

**4N25  
4N37**

**4N26  
H11A1**

**4N27  
H11A2**

**4N28  
H11A3**

**4N35  
H11A4**

**4N36  
H11A5**

---

**DISCLAIMER**

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

**LIFE SUPPORT POLICY**

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.