

**4N25  
4N37**

**4N26  
H11A1**

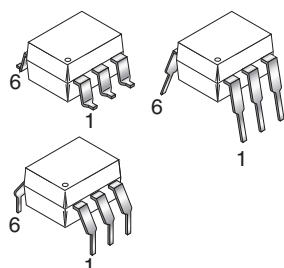
**4N27  
H11A2**

**4N28  
H11A3**

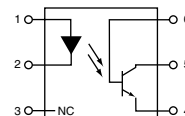
**4N35  
H11A4**

**4N36  
H11A5**

## WHITE PACKAGE (-M SUFFIX)

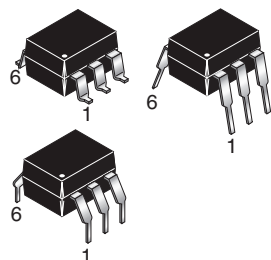


## SCHEMATIC



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

# GENERAL PURPOSE 6-PIN PHOTOTRANSISTOR OPTOCOUPLEDERS

**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                                     | $^\circ\text{C}$           |
| Wave solder temperature (see page 14 for reflow solder profiles)                             | $T_{\text{SOL}}$   | 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**

| TRANSFER CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ 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**

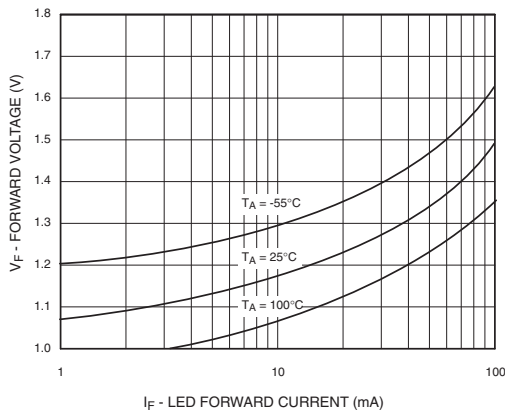
**4N28  
H11A3**

**4N35  
H11A4**

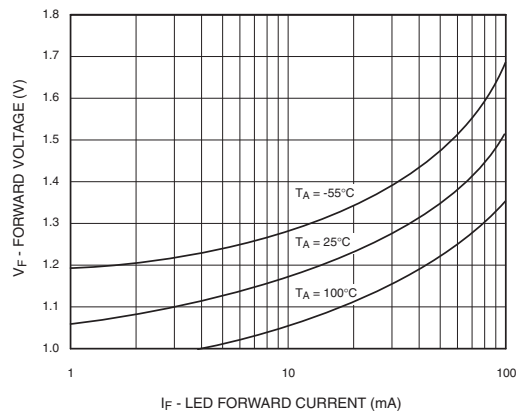
**4N36  
H11A5**

## TYPICAL PERFORMANCE CURVES

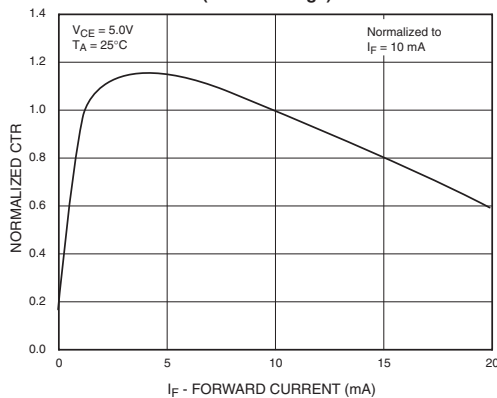
**Fig. 1 LED Forward Voltage vs. Forward Current  
(Black Package)**



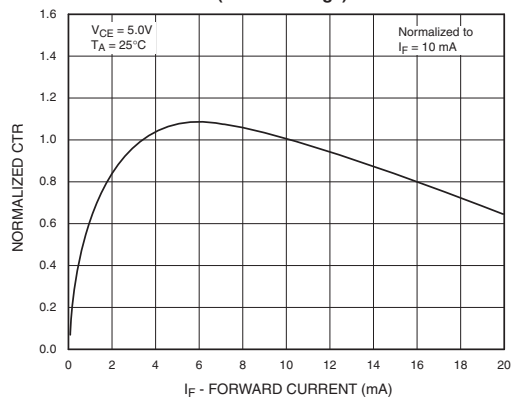
**Fig. 2 LED Forward Voltage vs. Forward Current  
(White Package)**



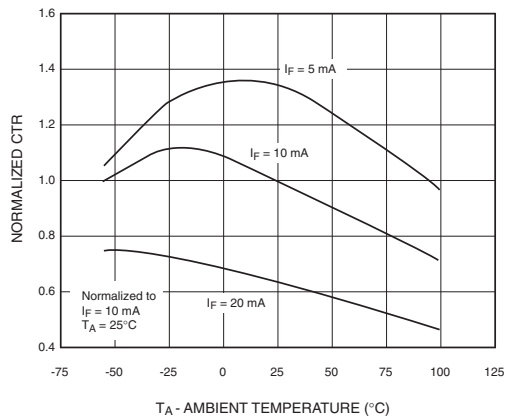
**Fig.3 Normalized CTR vs. Forward Current  
(Black Package)**



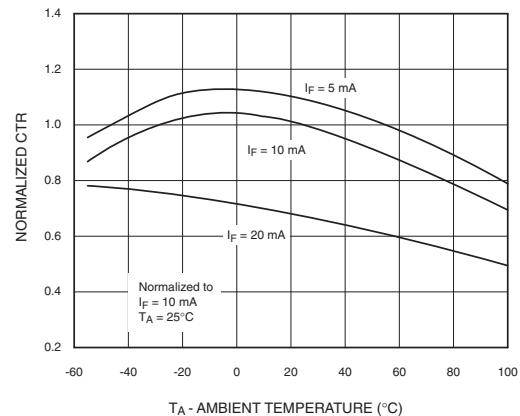
**Fig.4 Normalized CTR vs. Forward Current  
(White Package)**



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



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



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

**4N26**  
**H11A1**

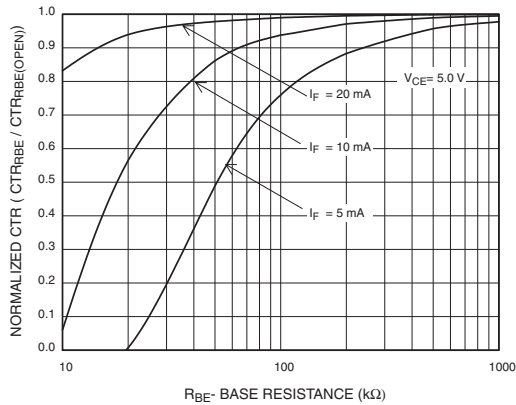
**4N27**  
**H11A2**

**4N28**  
**H11A3**

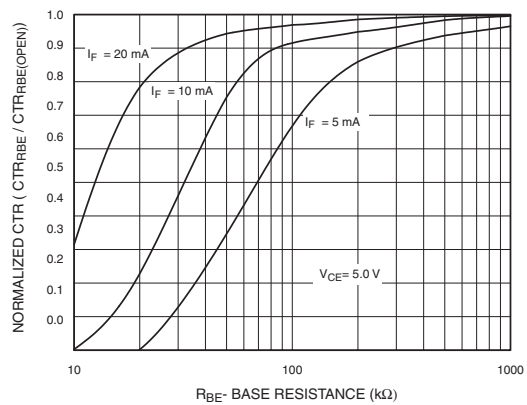
**4N35**  
**H11A4**

**4N36**  
**H11A5**

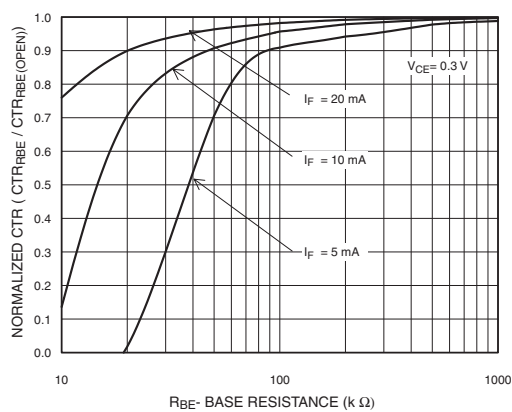
**Fig. 7 CTR vs. RBE (Unsaturated)**  
(Black Package)



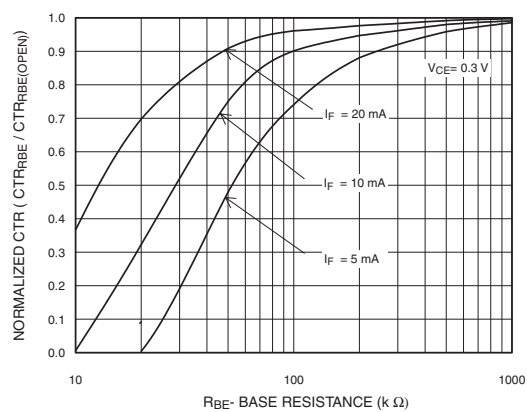
**Fig. 8 CTR vs. RBE (Unsaturated)**  
(White Package)



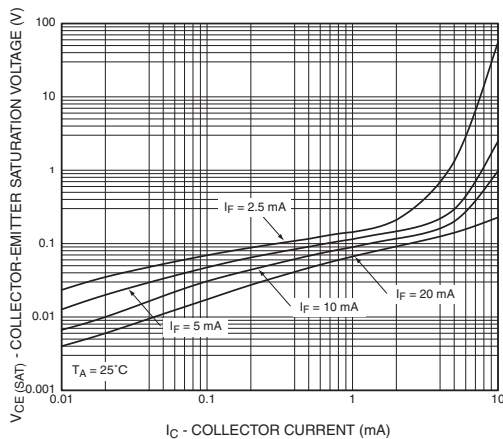
**Fig. 9 CTR vs. RBE (Saturated)**  
(Black Package)



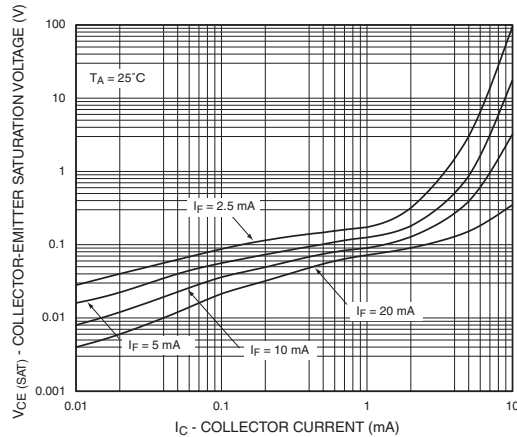
**Fig. 10 CTR vs. RBE (Saturated)**  
(White Package)



**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**

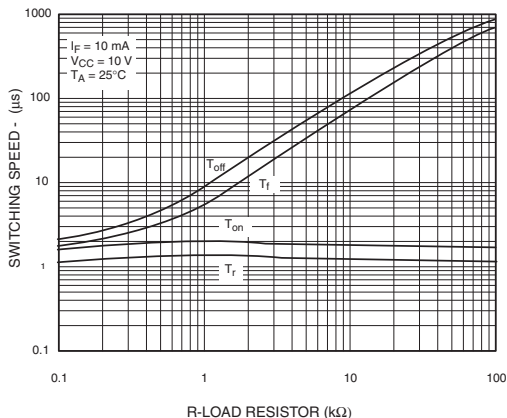
**4N27**  
**H11A2**

**4N28**  
**H11A3**

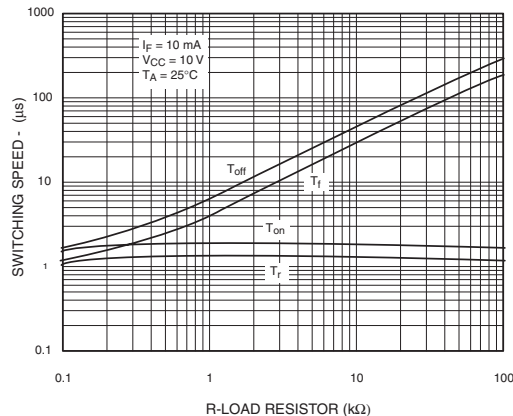
**4N35**  
**H11A4**

**4N36**  
**H11A5**

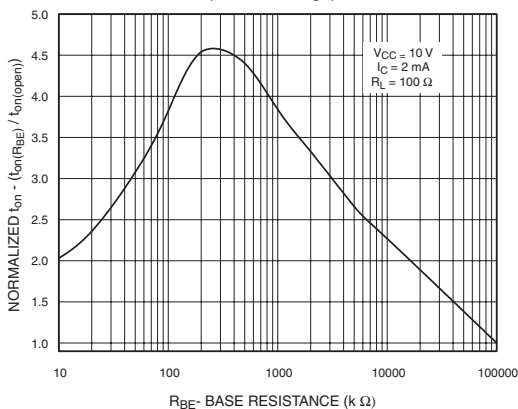
**Fig. 13 Switching Speed vs. Load Resistor  
(Black Package)**



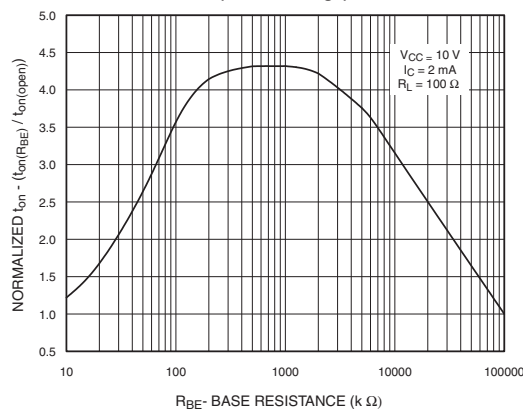
**Fig. 14 Switching Speed vs. Load Resistor  
(White Package)**



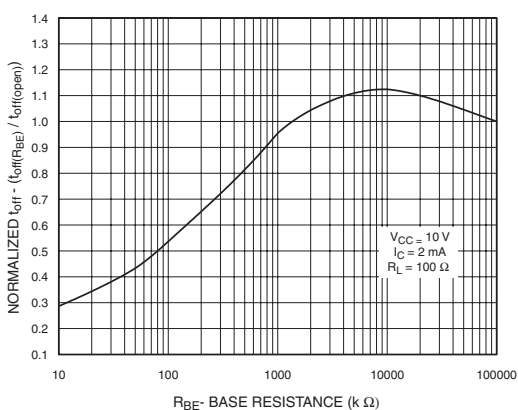
**Fig. 15 Normalized  $t_{on}$  vs.  $R_{BE}$   
(Black Package)**



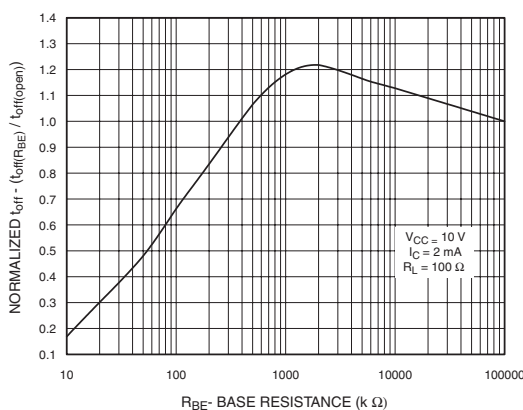
**Fig. 16 Normalized  $t_{on}$  vs.  $R_{BE}$   
(White Package)**



**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

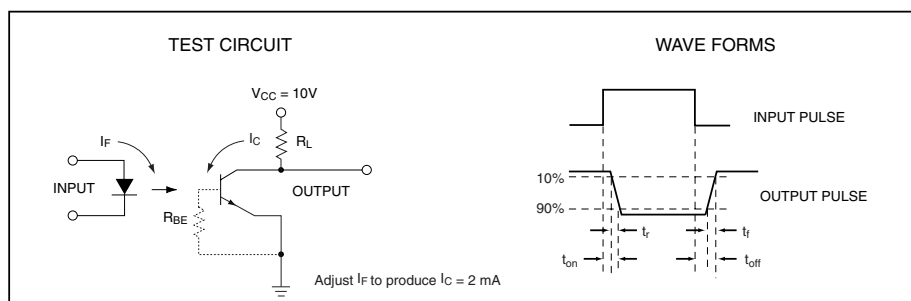
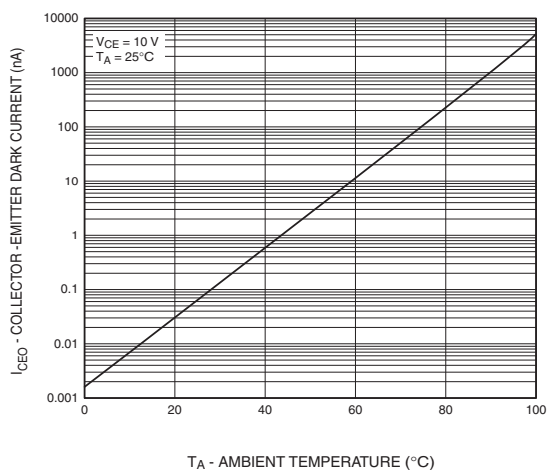


Figure 20. Switching Time Test Circuit and Waveforms

**4N25  
4N37**

**4N26  
H11A1**

**4N27  
H11A2**

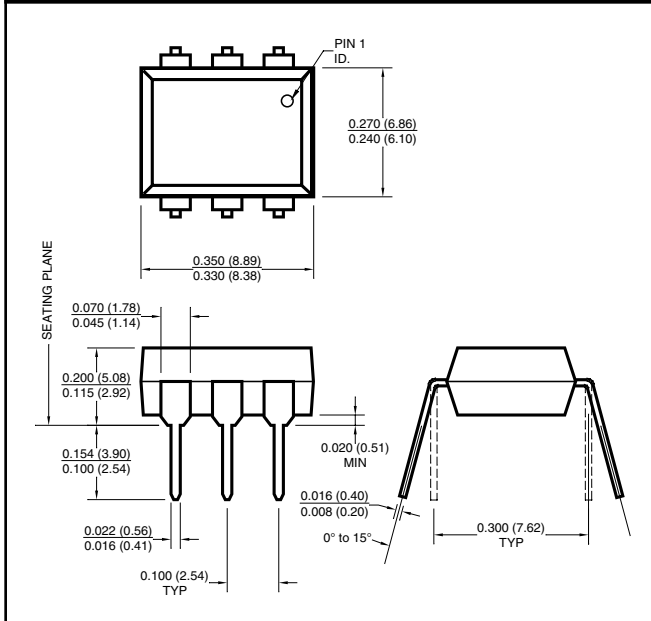
**4N28  
H11A3**

**4N35  
H11A4**

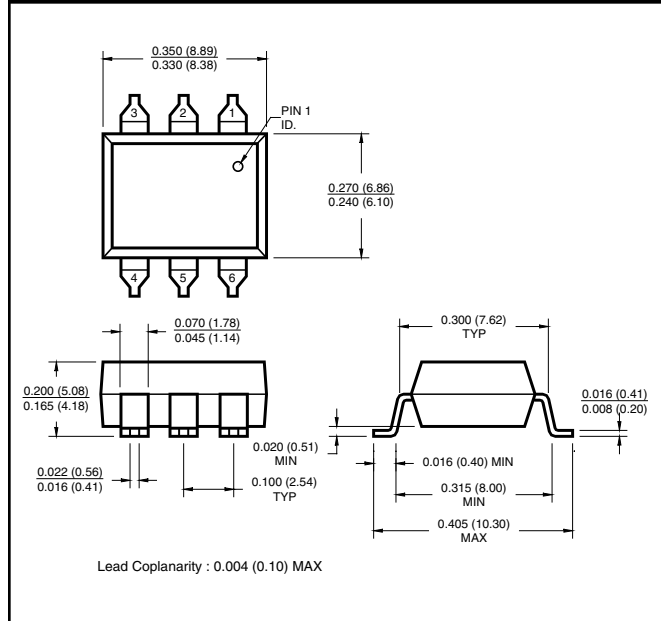
**4N36  
H11A5**

## Black Package (No -M Suffix)

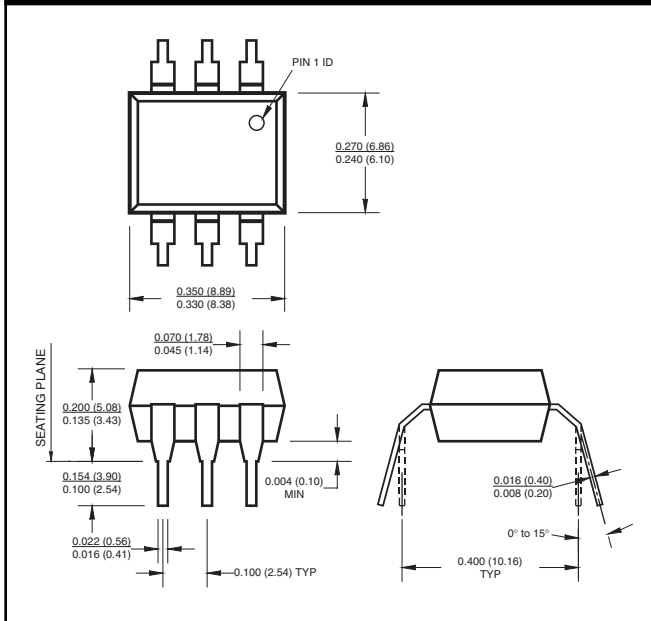
### Package Dimensions (Through Hole)



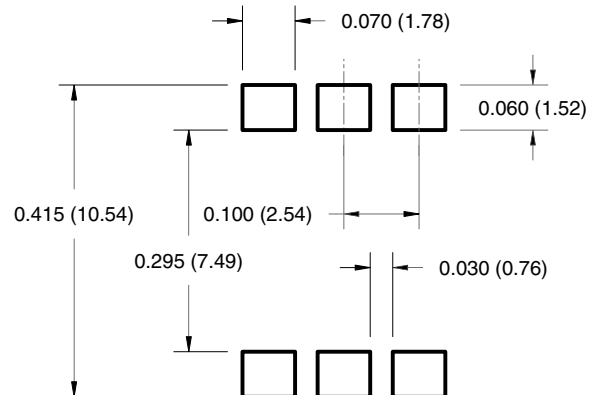
### Package Dimensions (Surface Mount)



### 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**

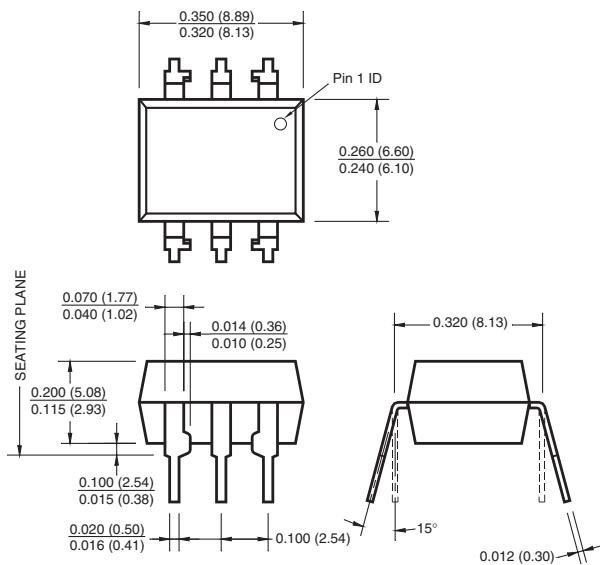
**4N28  
H11A3**

**4N35  
H11A4**

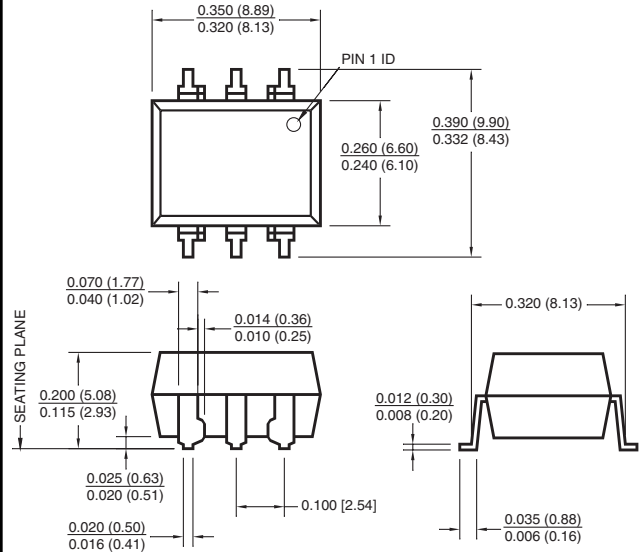
**4N36  
H11A5**

## White Package (-M Suffix)

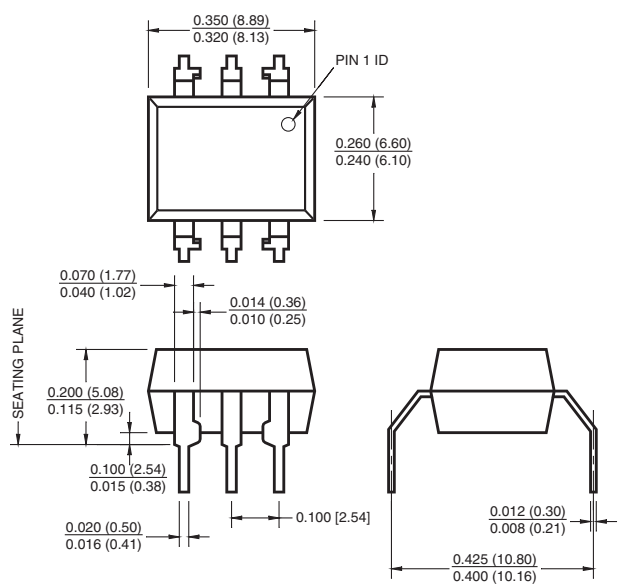
### Package Dimensions (Through Hole)



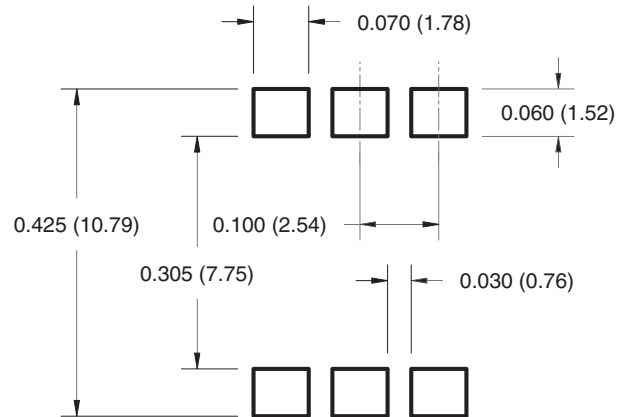
### Package Dimensions (Surface Mount)



### 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**

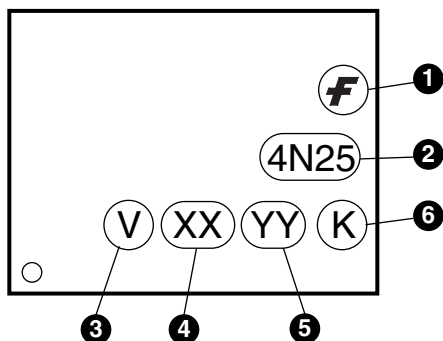
**4N35  
H11A4**

**4N36  
H11A5**

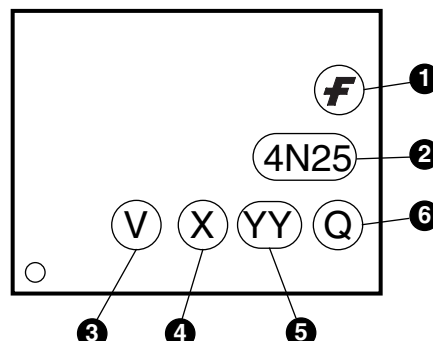
## ORDERING INFORMATION

| 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 |

## MARKING INFORMATION



**Black Package, No Suffix**



**White Package, -M Suffix**

| 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 or two digit year code <ul style="list-style-type: none"> <li>Two digits for black package parts, e.g., '03'</li> <li>One digit for white package parts, e.g., '3'</li> </ul> |
| 5           | Two digit work week ranging from '01' to '53'                                                                                                                                     |
| 6           | Assembly package code                                                                                                                                                             |

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

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

**4N26**  
**H11A1**

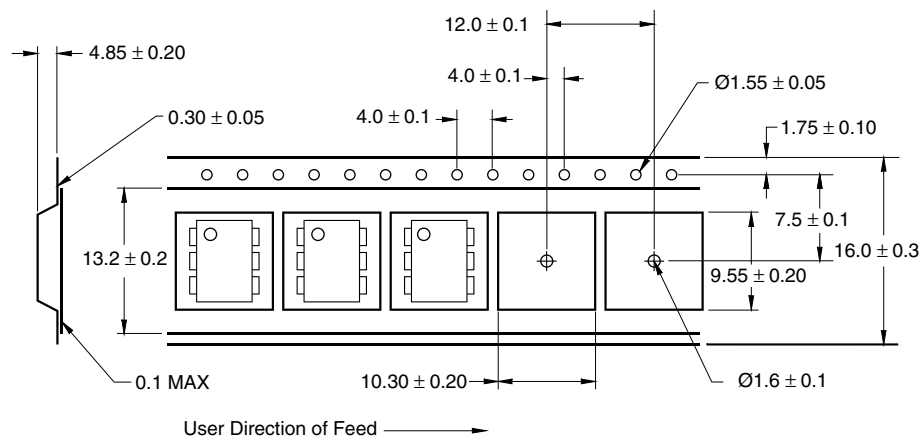
**4N27**  
**H11A2**

**4N28**  
**H11A3**

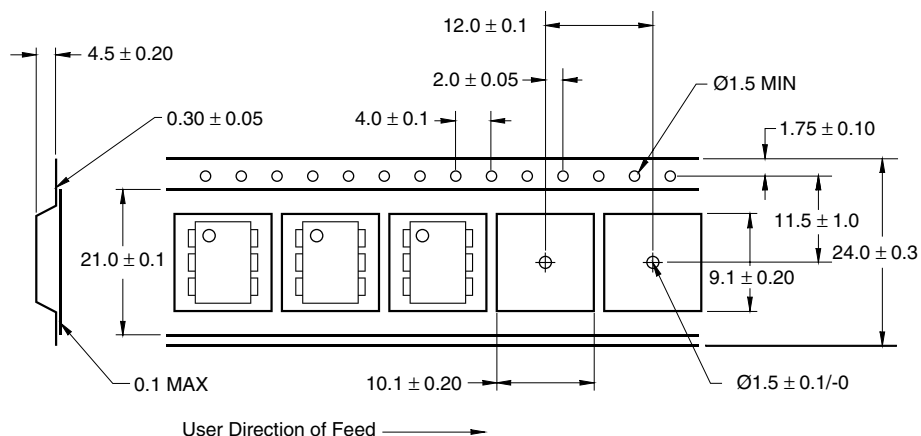
**4N35**  
**H11A4**

**4N36**  
**H11A5**

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



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



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

**4N26**  
**H11A1**

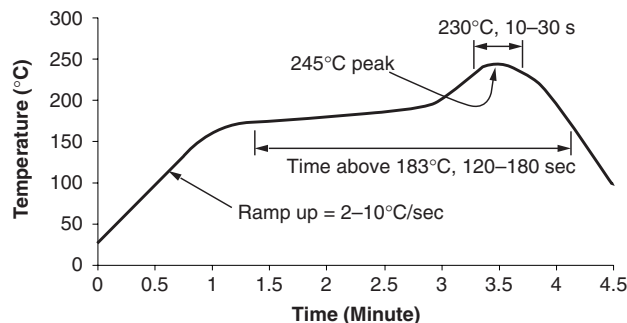
**4N27**  
**H11A2**

**4N28**  
**H11A3**

**4N35**  
**H11A4**

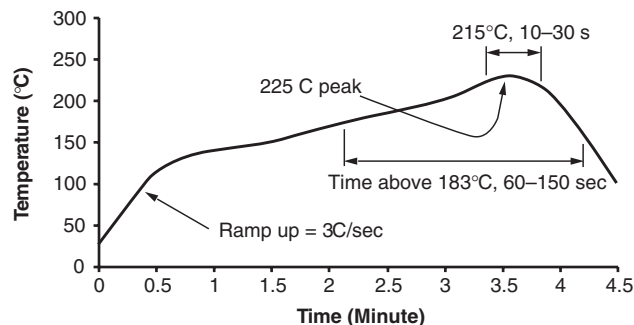
**4N36**  
**H11A5**

## Reflow Profile (White Package, -M Suffix)



- Peak reflow temperature: 245°C (package surface temperature)
- Time of temperature higher than 183°C for 120-180 seconds
- One time soldering reflow is recommended

## 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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**4N25  
4N37**

**4N26  
H11A1**

**4N27  
H11A2**

**4N28  
H11A3**

**4N35  
H11A4**

**4N36  
H11A5**

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