

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

**4N26**  
**H11A1**

**4N27**  
**H11A2**

**4N28**  
**H11A3**

**4N35**  
**H11A4**

**4N36**  
**H11A5**

## 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.

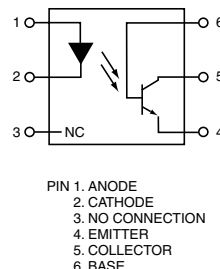
## FEATURES

- 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)
- Also available in white package by specifying -M suffix, eg. 4N25-M except H11A2, H11A4 and H11A5

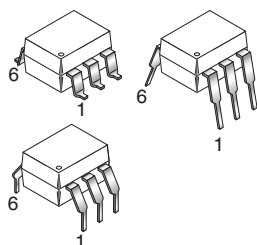
## APPLICATIONS

- Power supply regulators
- Digital logic inputs
- Microprocessor inputs

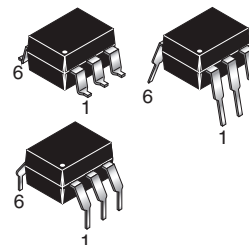
## SCHEMATIC



## WHITE PACKAGE (-M SUFFIX)



## BLACK PACKAGE (NO -M SUFFIX)



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

| Parameter                                              | Symbol              | Value                  | Units |
|--------------------------------------------------------|---------------------|------------------------|-------|
| TOTAL DEVICE                                           |                     |                        |       |
| Storage Temperature                                    | T <sub>STG</sub>    | -55 to +150            | °C    |
| Operating Temperature                                  | T <sub>OPR</sub>    | -55 to +100            | °C    |
| Lead Solder Temperature                                | T <sub>SOL</sub>    | 260 for 10 sec         | °C    |
| Total Device Power Dissipation @ T <sub>A</sub> = 25°C | P <sub>D</sub>      | 250                    | mW    |
| Derate above 25°C                                      |                     | 3.3 (non-M), 2.94 (-M) |       |
| EMITTER                                                |                     |                        |       |
| DC/Average Forward Input Current                       | I <sub>F</sub>      | 100 (non-M), 60 (-M)   | mA    |
| Reverse Input Voltage                                  | V <sub>R</sub>      | 6                      | V     |
| Forward Current - Peak (300μs, 2% Duty Cycle)          | I <sub>F</sub> (pk) | 3                      | A     |
| LED Power Dissipation @ T <sub>A</sub> = 25°C          | P <sub>D</sub>      | 150 (non-M), 120 (-M)  | mW    |
| Derate above 25°C                                      |                     | 2.0 (non-M), 1.41 (-M) | mW/°C |
| DETECTOR                                               |                     |                        |       |
| Collector-Emitter Voltage                              | V <sub>CEO</sub>    | 30                     | V     |
| Collector-Base Voltage                                 | V <sub>CBO</sub>    | 70                     | V     |
| Emitter-Collector Voltage                              | V <sub>ECO</sub>    | 7                      | V     |
| Detector Power Dissipation @ T <sub>A</sub> = 25°C     | P <sub>D</sub>      | 150                    | mW    |
| Derate above 25°C                                      |                     | 2.0 (non-M), 1.76 (-M) | mW/°C |

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**H11A4**

**4N36**  
**H11A5**

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C Unless otherwise specified.)

### INDIVIDUAL COMPONENT CHARACTERISTICS

| Parameter                           | Test Conditions                               | Symbol            | Min | Typ** | Max  | Unit |
|-------------------------------------|-----------------------------------------------|-------------------|-----|-------|------|------|
| <b>EMITTER</b>                      |                                               |                   |     |       |      |      |
| Input Forward Voltage               | (I <sub>F</sub> = 10 mA)                      | V <sub>F</sub>    |     | 1.18  | 1.50 | V    |
| Reverse Leakage Current             | (V <sub>R</sub> = 6.0 V)                      | I <sub>R</sub>    |     | 0.001 | 10   | μA   |
| <b>DETECTOR</b>                     |                                               |                   |     |       |      |      |
| Collector-Emitter Breakdown Voltage | (I <sub>C</sub> = 1.0 mA, I <sub>F</sub> = 0) | BV <sub>CEO</sub> | 30  | 100   |      | V    |
| Collector-Base Breakdown Voltage    | (I <sub>C</sub> = 100 μA, I <sub>F</sub> = 0) | BV <sub>CBO</sub> | 70  | 120   |      | V    |
| Emitter-Collector Breakdown Voltage | (I <sub>E</sub> = 100 μA, I <sub>F</sub> = 0) | BV <sub>ECO</sub> | 7   | 10    |      | V    |
| Collector-Emitter Dark Current      | (V <sub>CE</sub> = 10 V, I <sub>F</sub> = 0)  | I <sub>CEO</sub>  |     | 1     | 50   | nA   |
| Collector-Base Dark Current         | (V <sub>CB</sub> = 10 V)                      | I <sub>CBO</sub>  |     |       | 20   | nA   |
| Capacitance                         | (V <sub>CE</sub> = 0 V, f = 1 MHz)            | C <sub>CE</sub>   |     | 8     |      | pF   |

### ISOLATION CHARACTERISTICS

| Characteristic                 | Test Conditions                                 | Symbol           | Min              | Typ** | Max | Units     |
|--------------------------------|-------------------------------------------------|------------------|------------------|-------|-----|-----------|
| Input-Output Isolation Voltage | (Non-'M', Black Package) (f = 60 Hz, t = 1 min) | V <sub>ISO</sub> | 5300             |       |     | Vac(rms)* |
|                                | ('M', White Package) (f = 60 Hz, t = 1 sec)     |                  | 7500             |       |     | Vac(pk)   |
| Isolation Resistance           | (V <sub>I-O</sub> = 500 VDC)                    | R <sub>ISO</sub> | 10 <sup>11</sup> |       |     | Ω         |
| Isolation Capacitance          | (V <sub>I-O</sub> = ∅, f = 1 MHz)               | C <sub>ISO</sub> |                  | 0.5   |     | pF        |
|                                | ('M' White Package)                             |                  |                  | 0.2   | 2   | pF        |

Note

\* 5300 Vac(rms) for 1 minute equates to approximately 9000 Vac (pk) for 1 second

\*\* Typical values at T<sub>A</sub> = 25°C

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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                    |                              |     |      |
|                                                   | (I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10 V, T <sub>A</sub> = -55°C)            |                                           | 4N35<br>4N36<br>4N37                                                      | 40                    |                              |     |      |
|                                                   | (I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10 V, T <sub>A</sub> = +100°C)           |                                           | 4N35<br>4N36<br>4N37                                                      | 40                    |                              |     |      |
|                                                   | 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 |     |      |
| (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                                 | (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   |

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

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**H11A3**

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**H11A4**

**4N36**  
**H11A5**

## TRANSFER CHARACTERISTICS (Cont.)

| AC Characteristic             | Test Conditions                                                                     | Symbol    | Device                                                                    | Min | Typ** | Max | Unit          |
|-------------------------------|-------------------------------------------------------------------------------------|-----------|---------------------------------------------------------------------------|-----|-------|-----|---------------|
| Non Saturated<br>Turn-on Time | ( $I_C = 2 \text{ mA}$ , $V_{CC} = 10 \text{ V}$ , $R_L = 100\Omega$ )<br>(Fig.20)  | $T_{ON}$  | 4N35<br>4N36<br>4N37                                                      |     | 2     | 10  | $\mu\text{s}$ |
| 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**

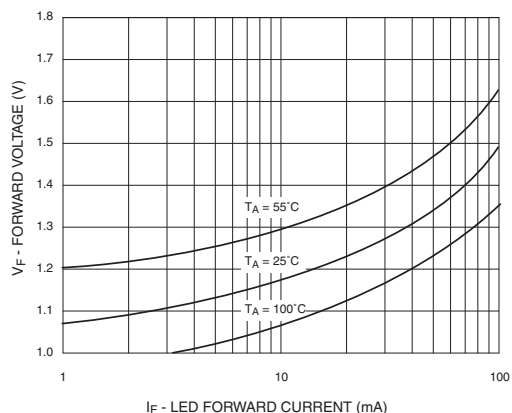
**4N28**  
**H11A3**

**4N35**  
**H11A4**

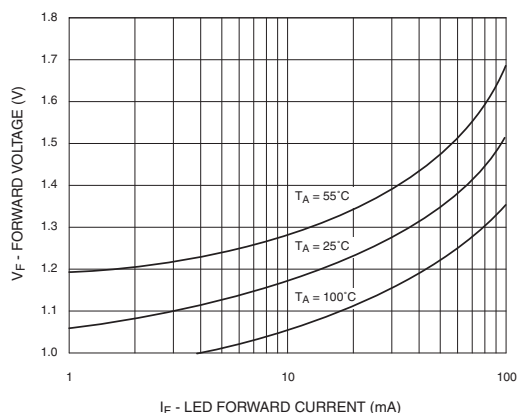
**4N36**  
**H11A5**

## TYPICAL PERFORMANCE CURVES

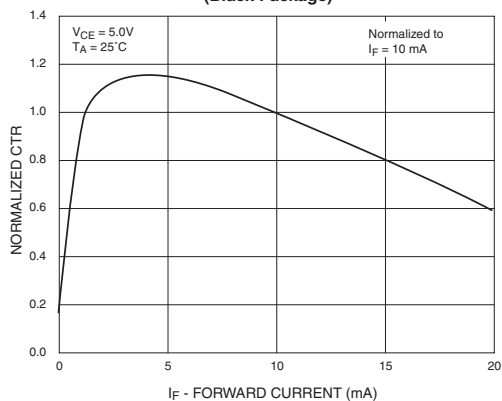
**Fig. 1 LED Forward Voltage vs. Forward Current  
(Black Package)**



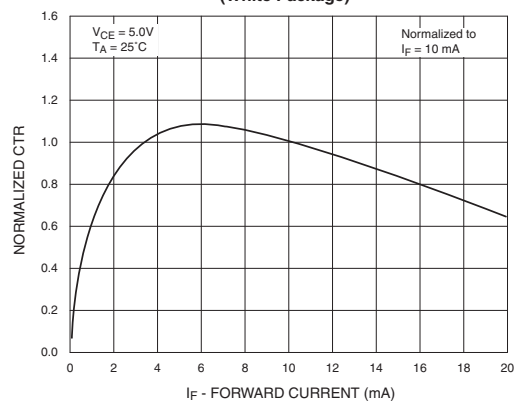
**Fig. 2 LED Forward Voltage vs. Forward Current  
(White Package)**



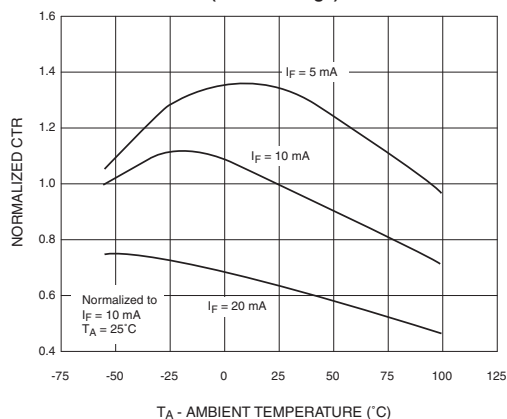
**Fig.3 Normalized CTR vs. Forward Current  
(Black Package)**



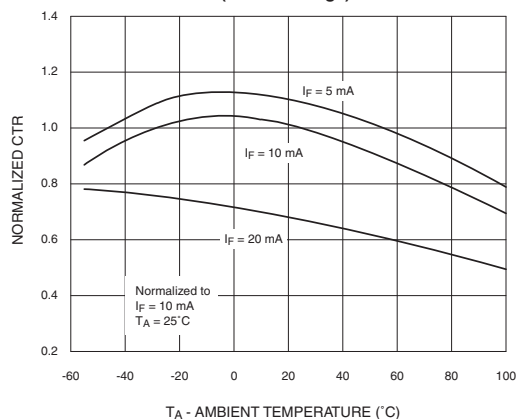
**Fig.4 Normalized CTR vs. Forward Current  
(White Package)**



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



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



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

**4N26**  
**H11A1**

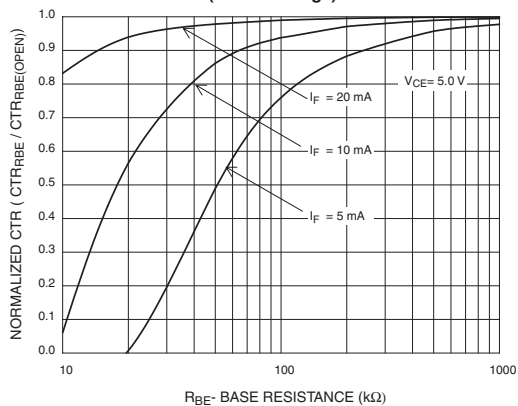
**4N27**  
**H11A2**

**4N28**  
**H11A3**

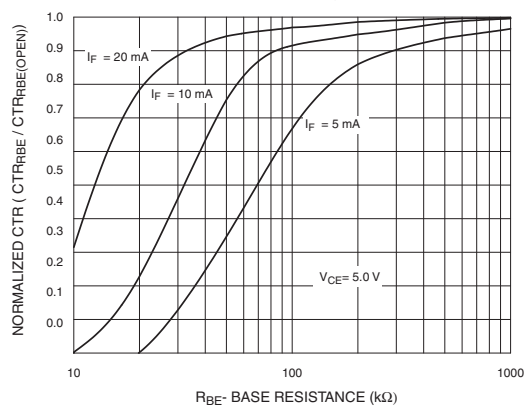
**4N35**  
**H11A4**

**4N36**  
**H11A5**

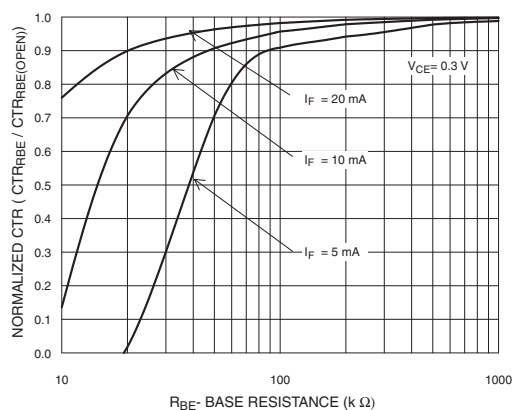
**Fig. 7 CTR vs. RBE (Unsaturated)**  
**(Black Package)**



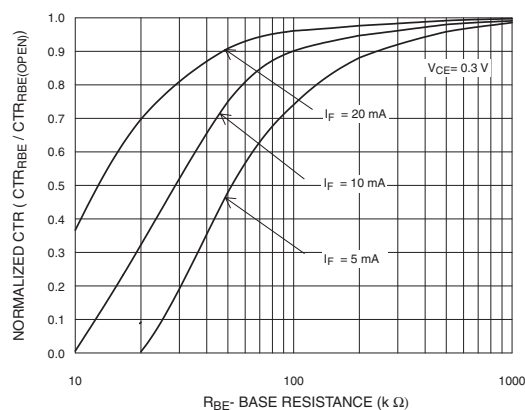
**Fig. 8 CTR vs. RBE (Unsaturated)**  
**(White Package)**



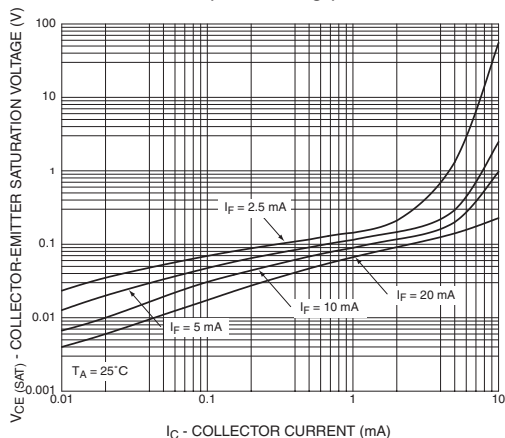
**Fig. 9 CTR vs. RBE (Saturated)**  
**(Black Package)**



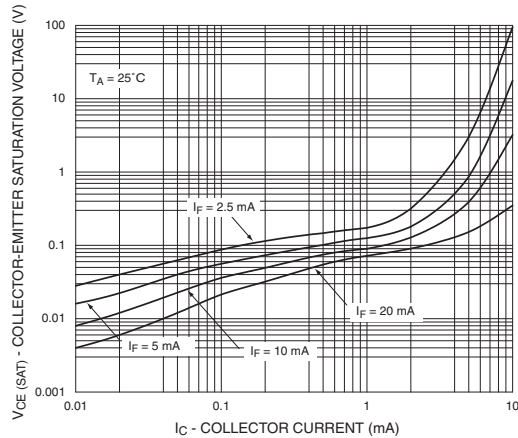
**Fig. 10 CTR vs. RBE (Saturated)**  
**(White Package)**



**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**

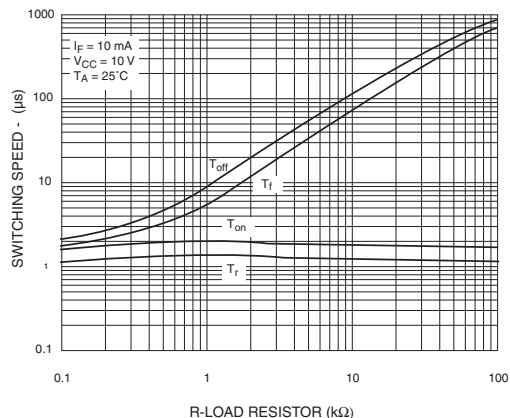
**4N27**  
**H11A2**

**4N28**  
**H11A3**

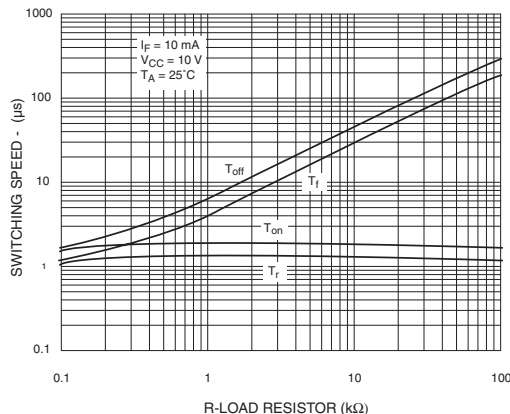
**4N35**  
**H11A4**

**4N36**  
**H11A5**

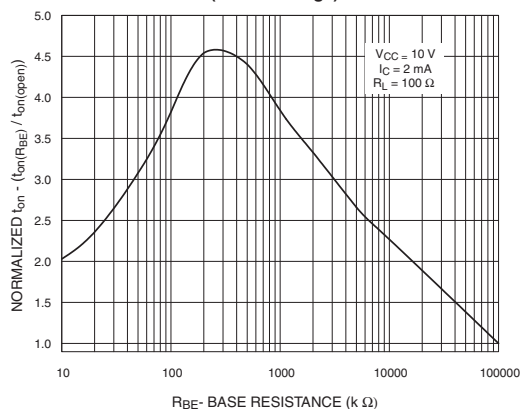
**Fig. 13 Switching Speed vs. Load Resistor**  
(Black Package)



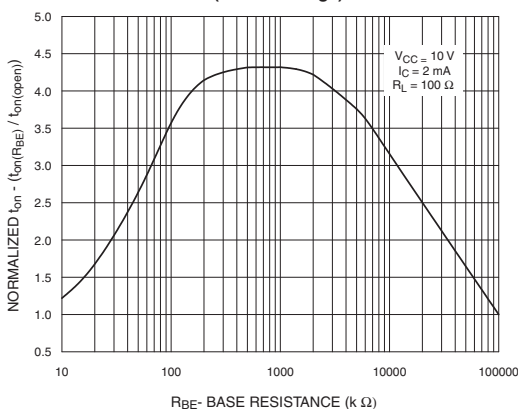
**Fig. 14 Switching Speed vs. Load Resistor**  
(White Package)



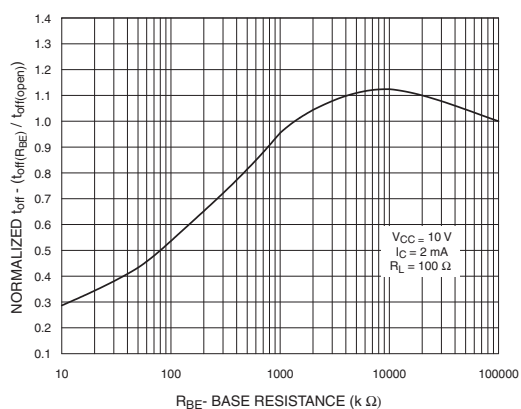
**Fig. 15 Normalized  $t_{on}$  vs.  $R_{BE}$**   
(Black Package)



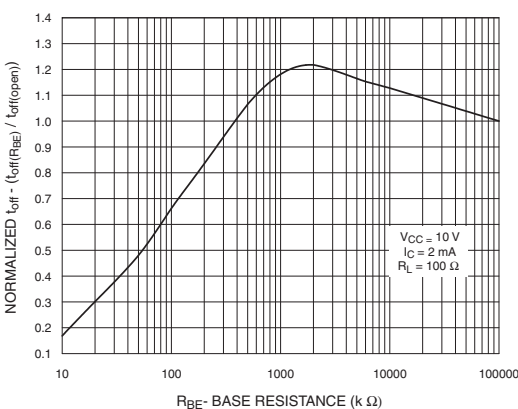
**Fig. 16 Normalized  $t_{on}$  vs.  $R_{BE}$**   
(White Package)



**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

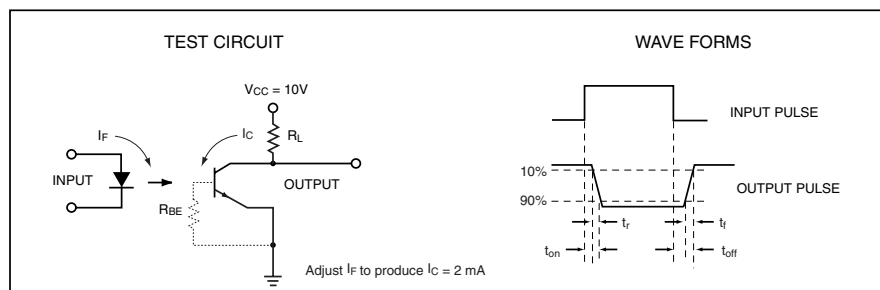
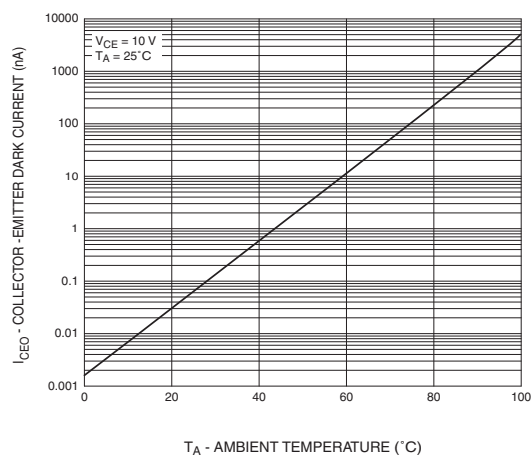


Figure 20. Switching Time Test Circuit and Waveforms



4N25  
4N37

4N26  
H11A1

4N27  
H11A2

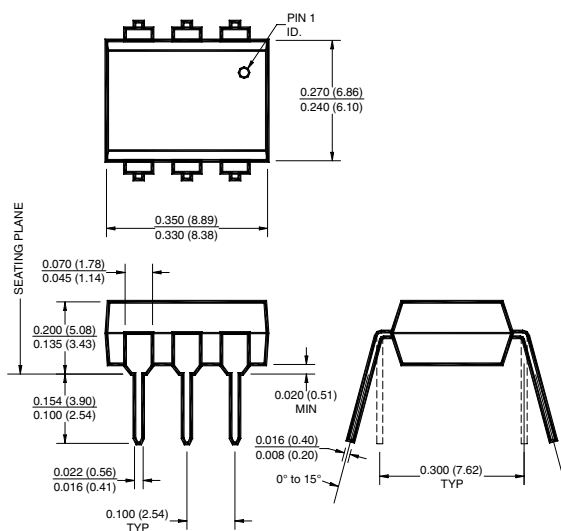
4N28  
H11A3

4N35  
H11A4

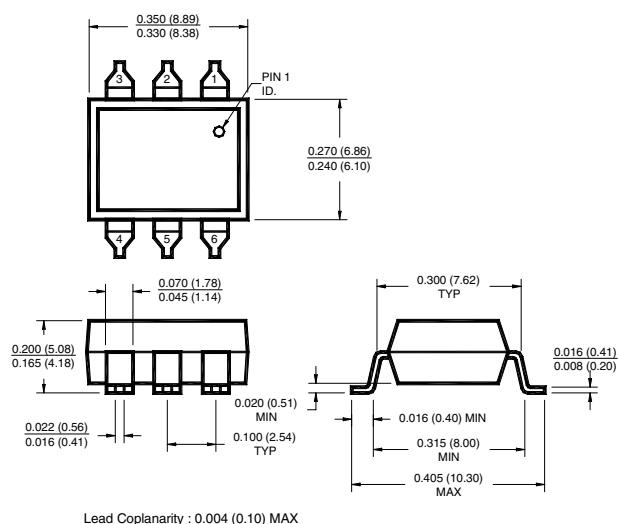
4N36  
H11A5

## Black Package (No -M Suffix)

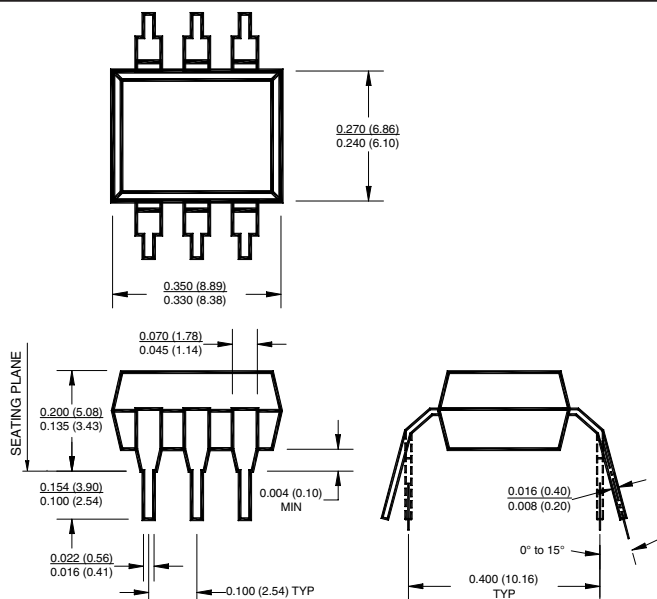
### Package Dimensions (Through Hole)



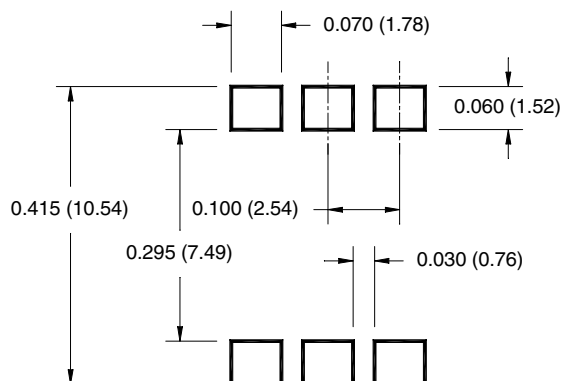
### Package Dimensions (Surface Mount)



### Package Dimensions (0.4" Lead Spacing)



### Recommended Pad Layout for Surface Mount Leadform



#### NOTE

All dimensions are in inches (millimeters)

4N25  
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4N26  
H11A1

4N27  
H11A2

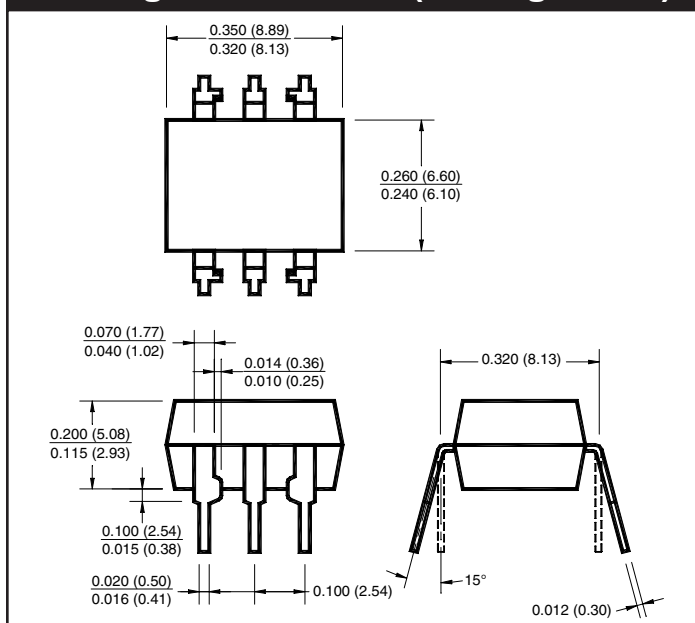
4N28  
H11A3

4N35  
H11A4

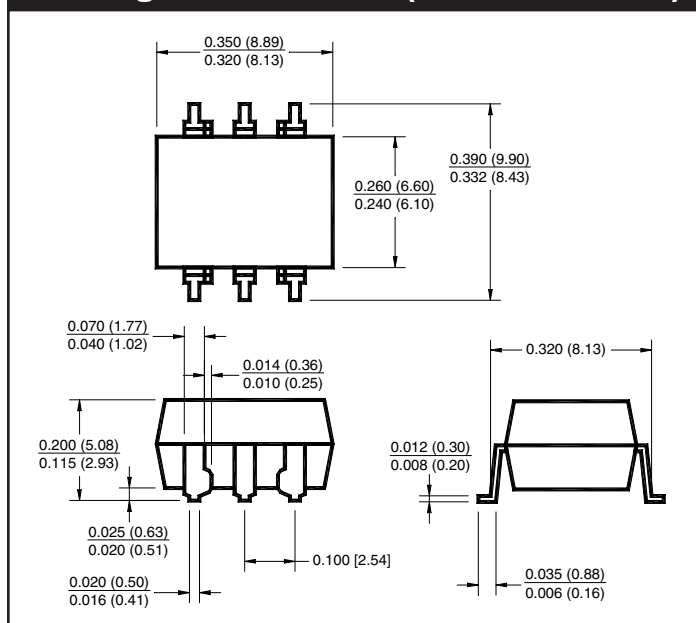
4N36  
H11A5

## White Package (-M Suffix)

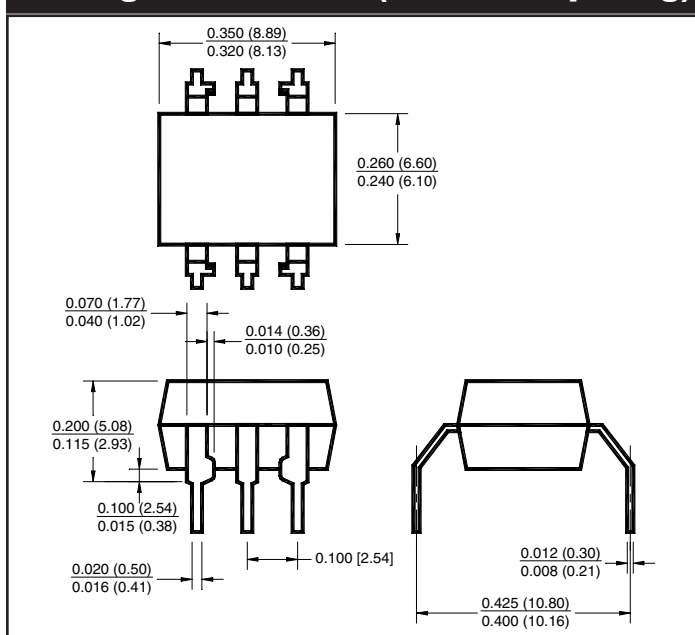
### Package Dimensions (Through Hole)



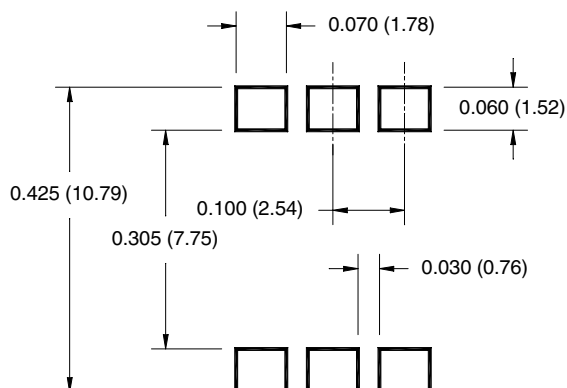
### Package Dimensions (Surface Mount)



### 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**

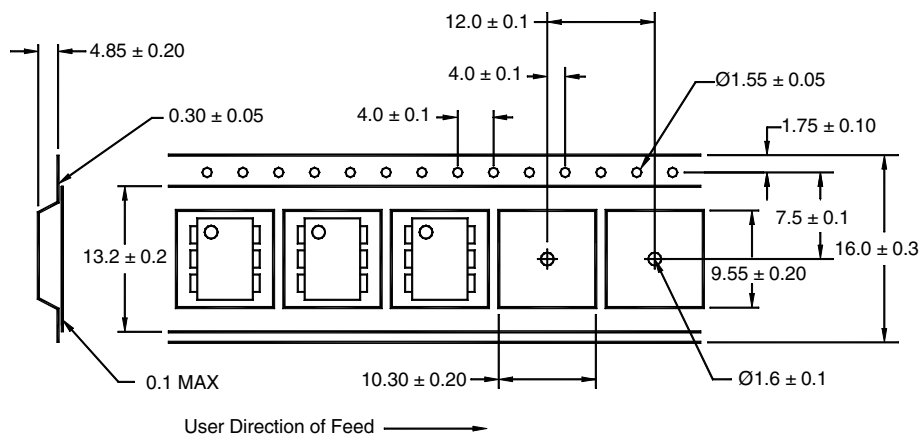
**4N35**  
**H11A4**

**4N36**  
**H11A5**

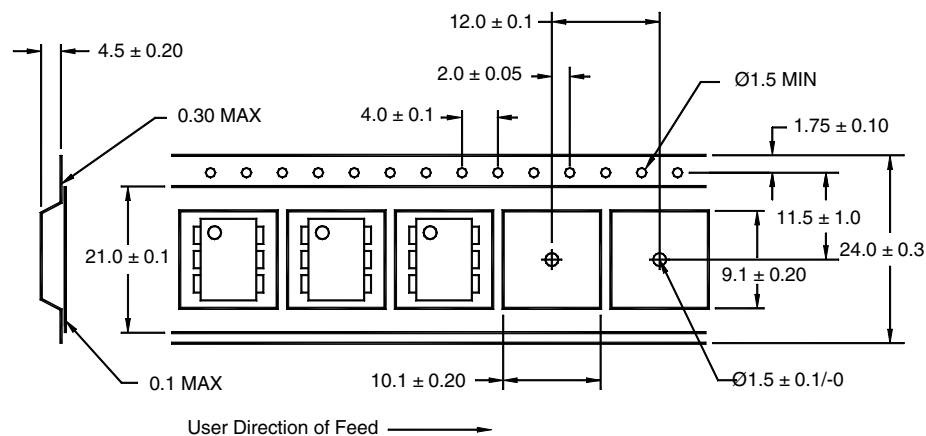
## ORDERING INFORMATION

| Order Entry Identifier       |                              |                                      |
|------------------------------|------------------------------|--------------------------------------|
| Black Package<br>(No Suffix) | White Package<br>(-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 (“D” Taping Orientation) (Black Package, No Suffix)



### QT Carrier Tape Specifications (“D” Taping Orientation) (White Package, -M Suffix)



**4N25**  
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**4N26**  
**H11A1**

**4N27**  
**H11A2**

**4N28**  
**H11A3**

**4N35**  
**H11A4**

**4N36**  
**H11A5**

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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.