

# GENERAL PURPOSE 6-PIN PHOTOTRANSISTOR OPTOCOUPLERS

4N25  
4N37

4N26  
H11A1

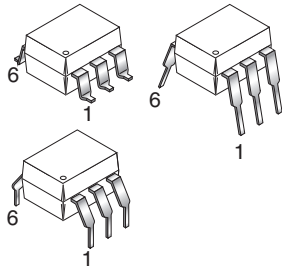
4N27  
H11A2

4N28  
H11A3

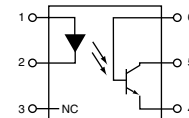
4N35  
H11A4

4N36  
H11A5

## WHITE PACKAGE (-M SUFFIX)

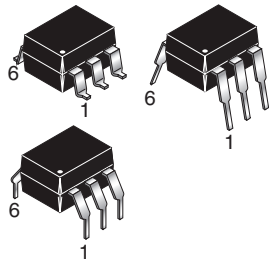


## SCHEMATIC



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

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H11A5**

<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_A = 25^\circ\text{C}$ unless otherwise specified)			
<b>Parameter</b>	<b>Symbol</b>	<b>Value</b>	<b>Units</b>
<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 @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	250 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 @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	150 (non-M), 120 (-M) 2.0 (non-M), 1.41 (-M)	mW 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 @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	150 2.0 (non-M), 1.76 (-M)	mW mW/ $^\circ\text{C}$

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## 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	( $I_C = 100\ \mu\text{A}$ , $I_F = 0$ )	$BV_{CBO}$	70	120		V
Emitter-Collector Breakdown Voltage	( $I_E = 100\ \mu\text{A}$ , $I_F = 0$ )	$BV_{ECO}$	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  $T_A = 25^\circ\text{C}$

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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, Collector to Emitter	$(I_F = 10 \text{ mA}, V_{CE} = 10 \text{ V})$	CTR	4N35 4N36 4N37	100			%
			H11A1	50			
			H11A5	30			
	4N25 4N26 H11A2 H11A3		20				
	4N27 4N28 H11A4		10				
	4N35 4N36 4N37		40				
	$(I_F = 10 \text{ mA}, V_{CE} = 10 \text{ V}, T_A = -55^\circ\text{C})$		40				
	$(I_F = 10 \text{ mA}, V_{CE} = 10 \text{ V}, T_A = +100^\circ\text{C})$		40				
Collector-Emitter Saturation Voltage	$(I_C = 2 \text{ mA}, I_F = 50 \text{ mA})$	$V_{CE(SAT)}$	4N25 4N26 4N27 4N28			0.5	V
	$(I_C = 0.5 \text{ mA}, I_F = 10 \text{ mA})$		4N35 4N36 4N37			0.3	
			H11A1 H11A2 H11A3 H11A4 H11A5			0.4	
AC Characteristic							
Non-Saturated Turn-on Time	$(I_F = 10 \text{ mA}, V_{CC} = 10 \text{ V}, R_L = 100\Omega)$ (Fig.20)	$T_{ON}$	4N25 4N26 4N27 4N28 H11A1 H11A2 H11A3 H11A4 H11A5		2		$\mu\text{s}$
Non Saturated Turn-on Time	$(I_C = 2 \text{ mA}, V_{CC} = 10 \text{ V}, R_L = 100\Omega)$ (Fig.20)	$T_{ON}$	4N35 4N36 4N37		2	10	$\mu\text{s}$

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**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	( $I_F = 10 \text{ mA}$ , $V_{CC} = 10 \text{ V}$ , $R_L = 100\Omega$ ) (Fig.20)	$T_{OFF}$	4N25 4N26 4N27 4N28 H11A1 H11A2 H11A3 H11A4 H11A5		2		$\mu\text{s}$
	( $I_C = 2 \text{ mA}$ , $V_{CC} = 10 \text{ V}$ , $R_L = 100\Omega$ ) (Fig.20)		4N35 4N36 4N37		2	10	

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

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H11A3

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4N36  
H11A5

## TYPICAL PERFORMANCE CURVES

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

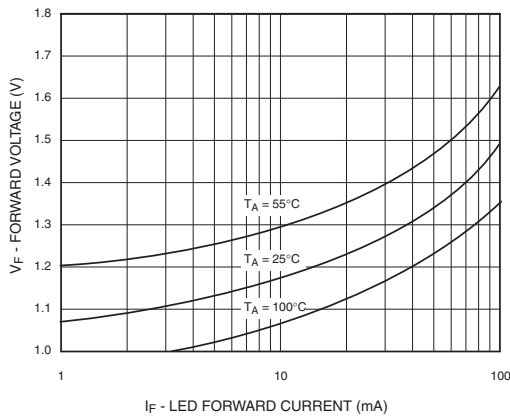


Fig. 2 LED Forward Voltage vs. Forward Current  
(White Package)

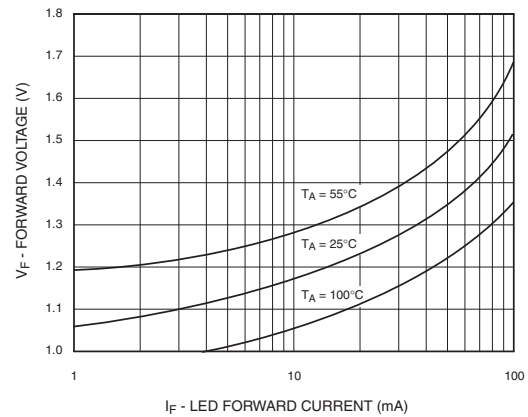


Fig.3 Normalized CTR vs. Forward Current  
(Black Package)

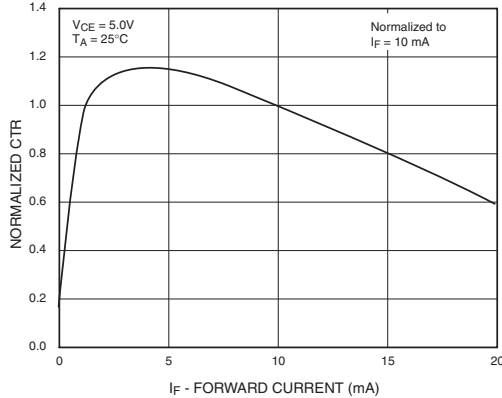


Fig.4 Normalized CTR vs. Forward Current  
(White Package)

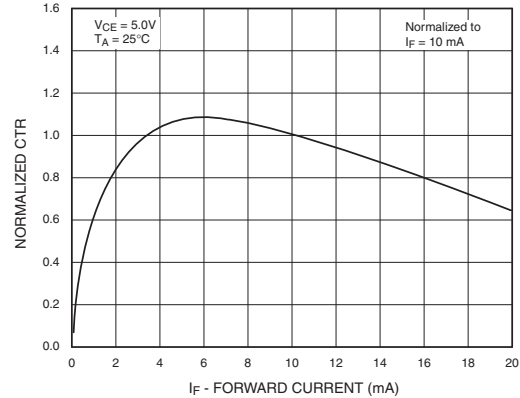


Fig. 5 Normalized CTR vs. Ambient Temperature  
(Black Package)

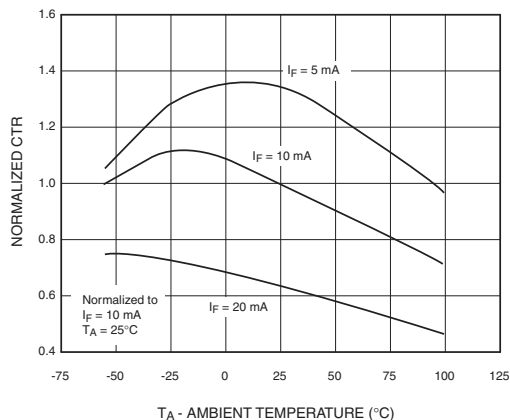
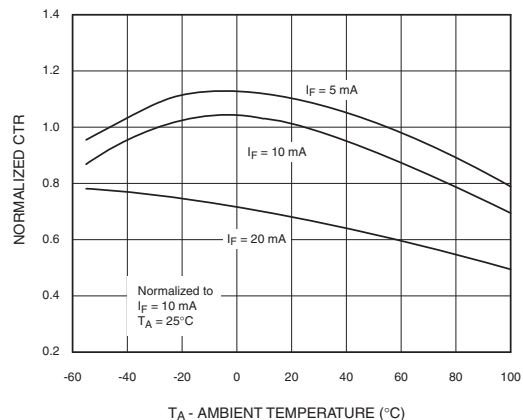


Fig. 6 Normalized CTR vs. Ambient Temperature  
(White Package)



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H11A4

4N36  
H11A5

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

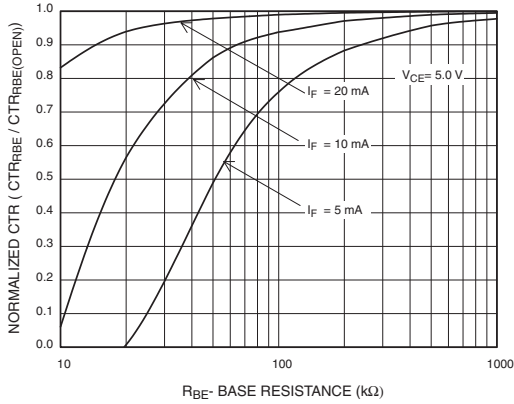


Fig. 8 CTR vs. RBE (Unsaturated)  
(White Package)

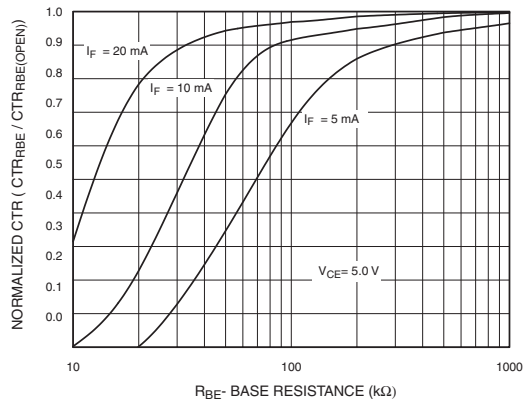


Fig. 9 CTR vs. RBE (Saturated)  
(Black Package)

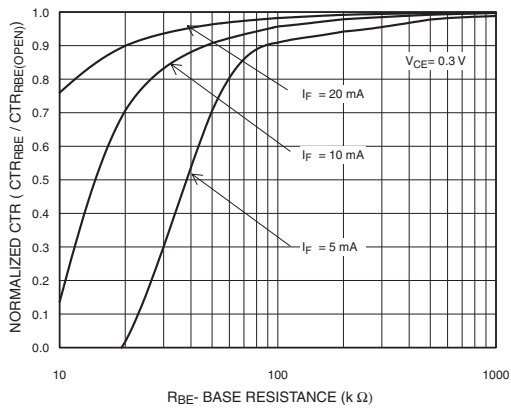


Fig. 10 CTR vs. RBE (Saturated)  
(White Package)

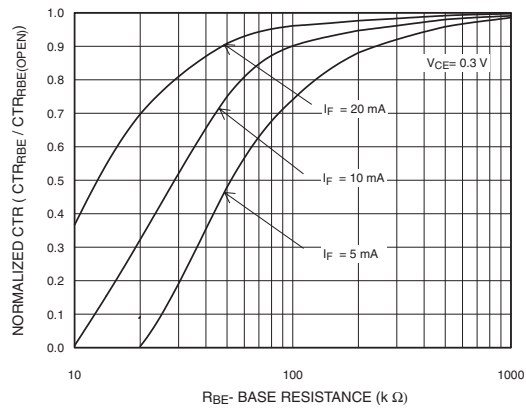


Fig. 11 Collector-Emitter Saturation Voltage vs. Collector Current  
(Black Package)

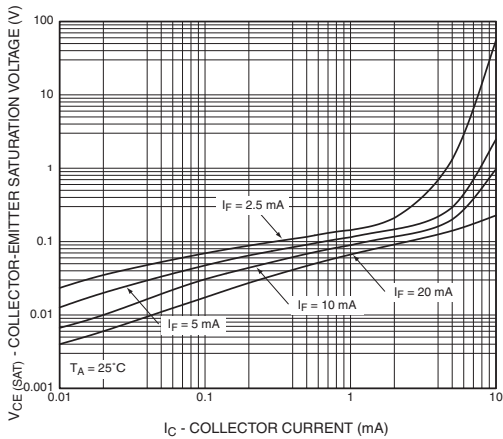
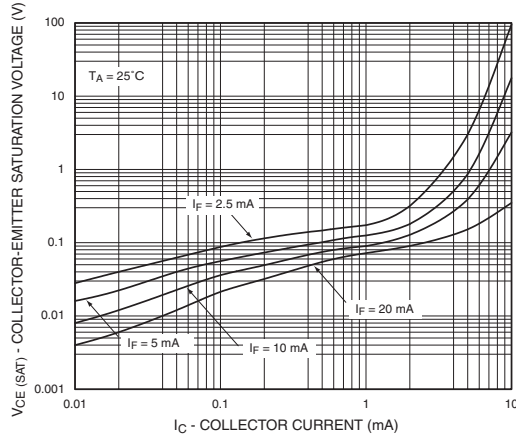


Fig. 12 Collector-Emitter Saturation Voltage vs. Collector Current  
(White Package)



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H11A3

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H11A4

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H11A5

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

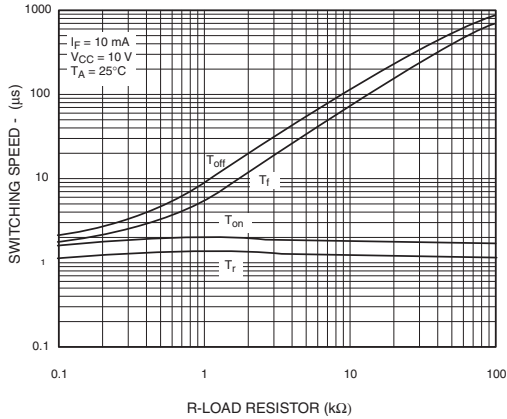


Fig. 14 Switching Speed vs. Load Resistor  
(White Package)

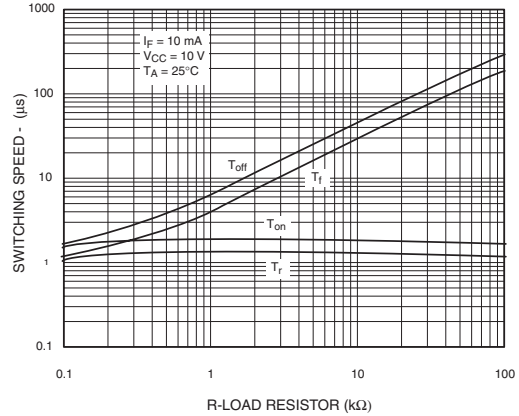


Fig. 15 Normalized  $t_{on}$  vs.  $R_{BE}$   
(Black Package)

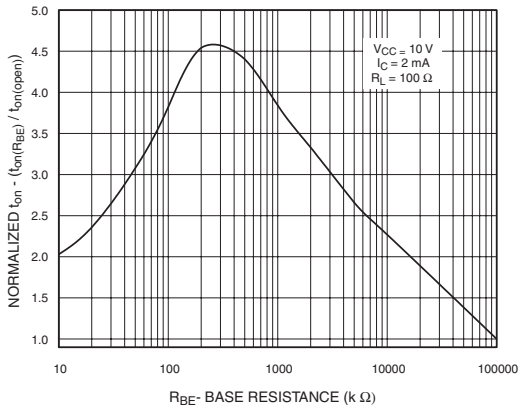


Fig. 16 Normalized  $t_{on}$  vs.  $R_{BE}$   
(White Package)

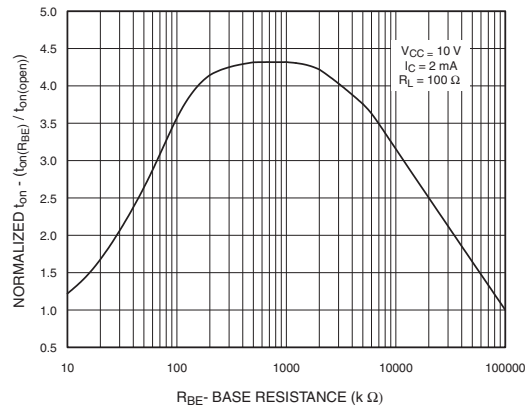


Fig. 17 Normalized  $t_{off}$  vs.  $R_{BE}$   
(Black Package)

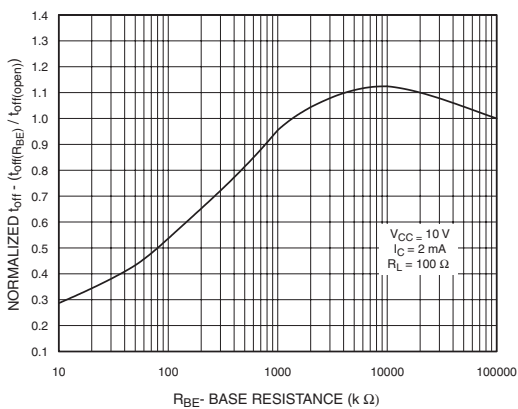
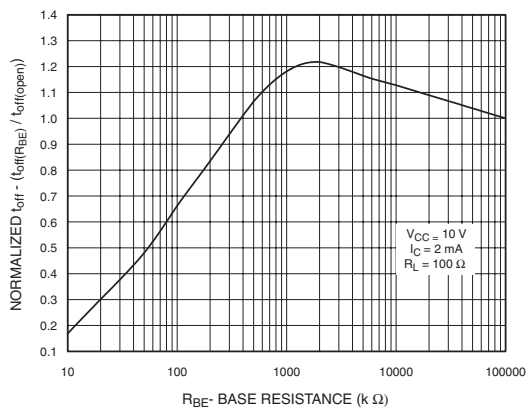


Fig. 18 Normalized  $t_{off}$  vs.  $R_{BE}$   
(White Package)





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4N35  
H11A4

4N36  
H11A5

Fig. 19 Dark Current vs. Ambient Temperature

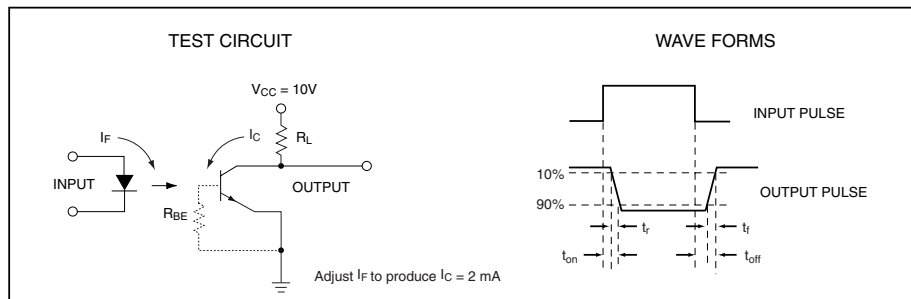
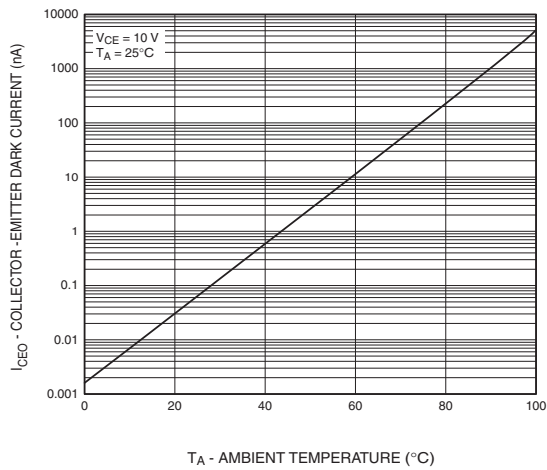


Figure 20. Switching Time Test Circuit and Waveforms

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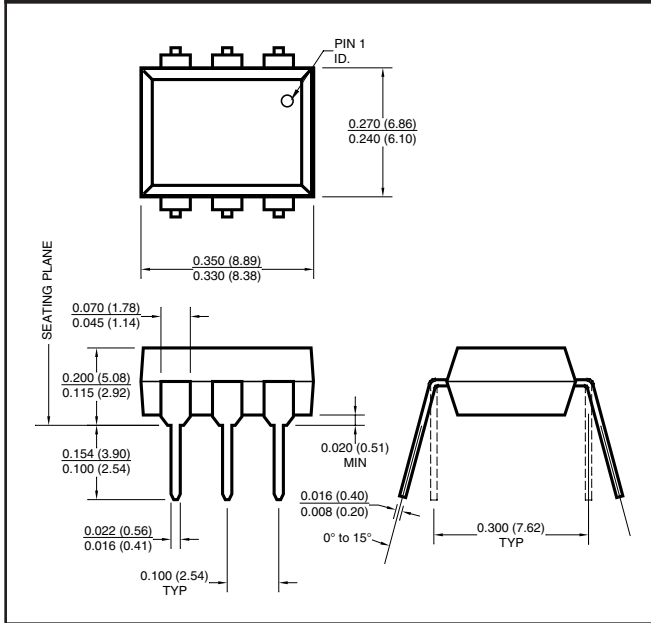
4N28  
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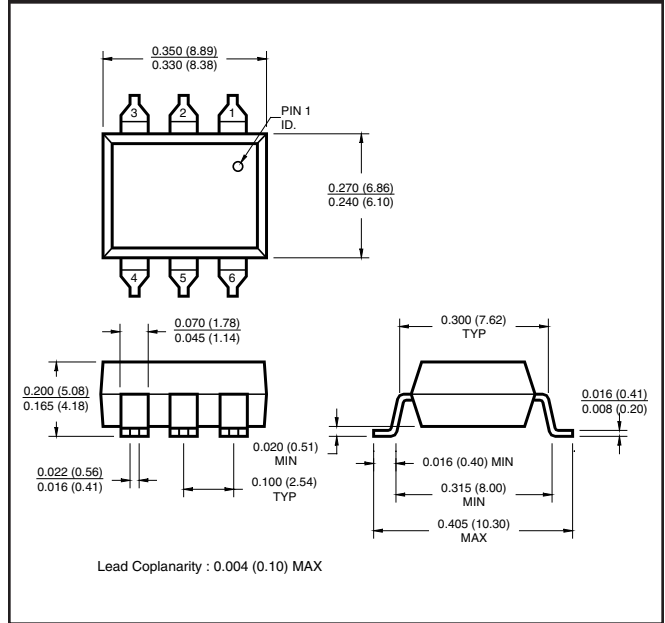
4N36  
H11A5

## Black Package (No -M Suffix)

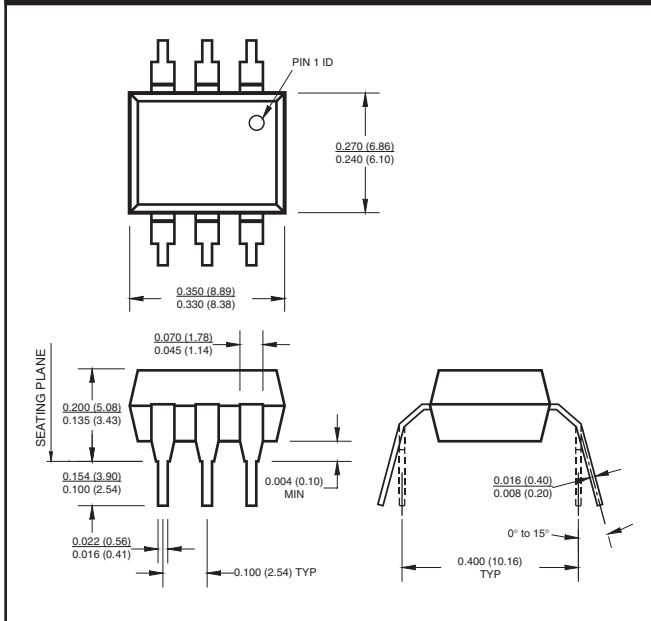
### Package Dimensions (Through Hole)



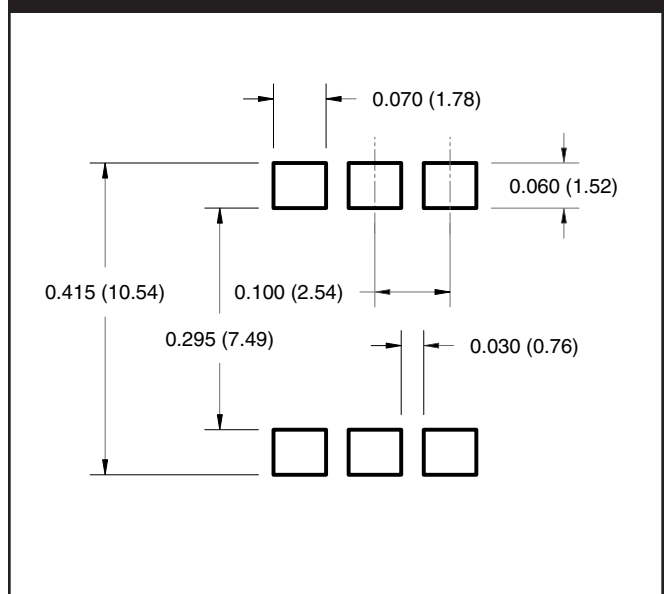
### Package Dimensions (Surface Mount)



### Package Dimensions (0.4" Lead Spacing)



### Recommended Pad Layout for Surface Mount Leadform



## NOTE

All dimensions are in inches (millimeters)

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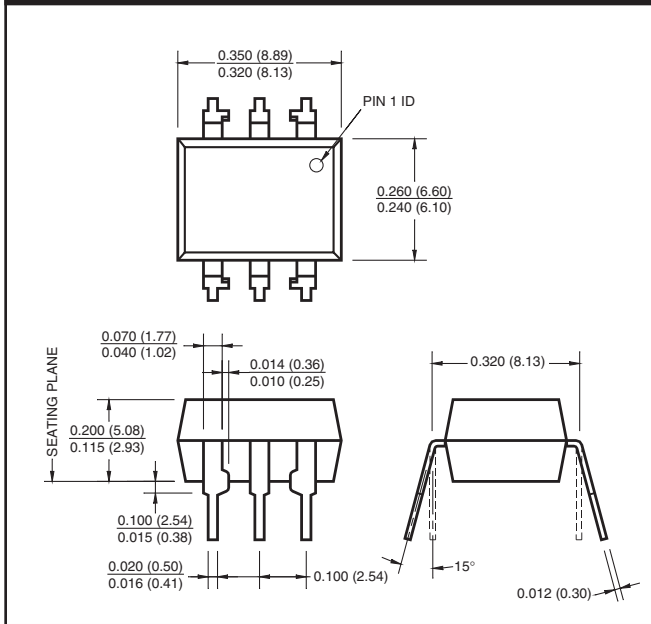
4N28  
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4N35  
H11A4

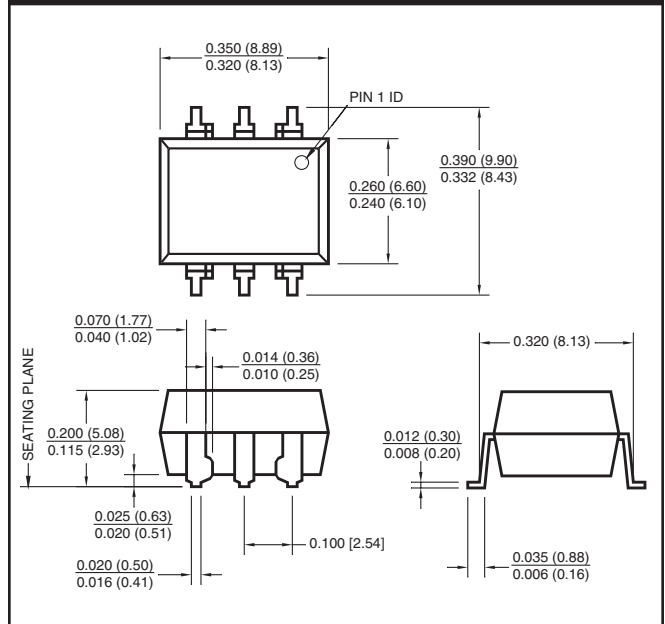
4N36  
H11A5

## White Package (-M Suffix)

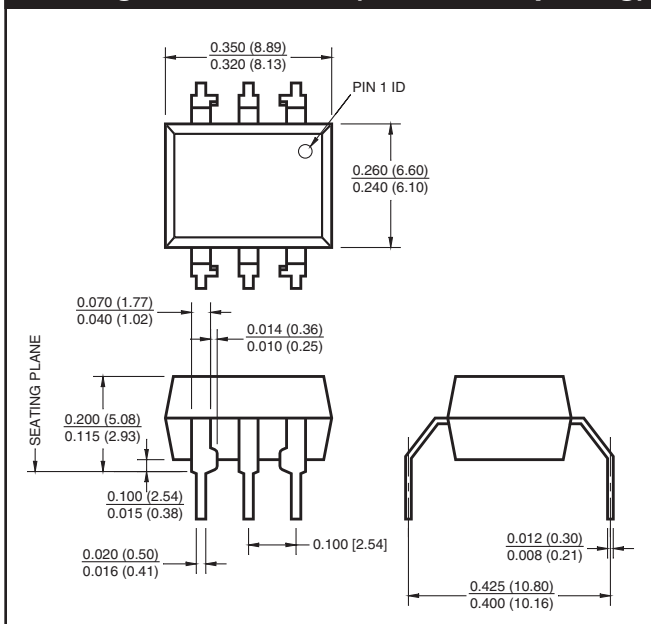
### Package Dimensions (Through Hole)



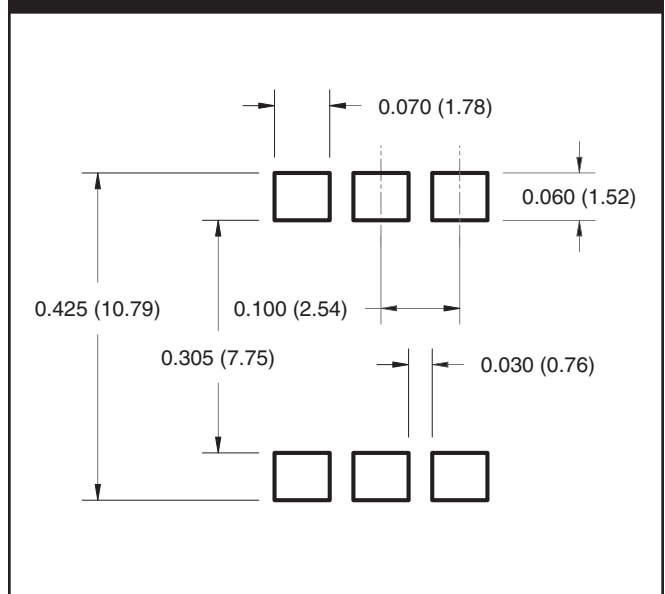
### Package Dimensions (Surface Mount)



### Package Dimensions (0.4" Lead Spacing)



### Recommended Pad Layout for Surface Mount Leadform



## NOTE

All dimensions are in inches (millimeters)

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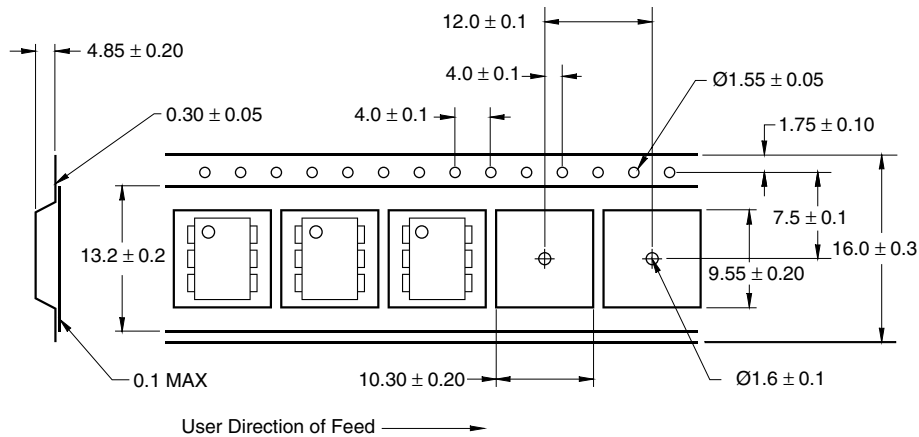
**4N36**  
**H11A5**

## 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)

