

GENERAL PURPOSE 6-PIN PHOTOTRANSISTOR OPTOCOUPLEDERS

4N25
4N37

4N26
H11A1

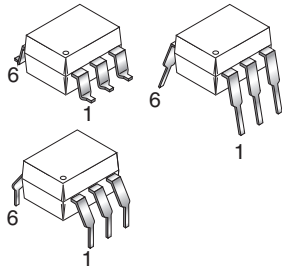
4N27
H11A2

4N28
H11A3

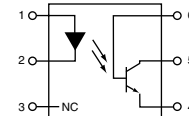
4N35
H11A4

4N36
H11A5

WHITE PACKAGE (-M SUFFIX)

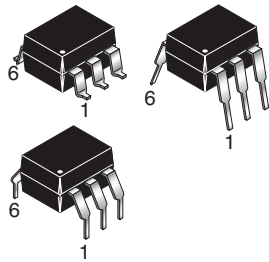


SCHEMATIC



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

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H11A4

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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		μs
	($I_C = 2 \text{ mA}$, $V_{CC} = 10 \text{ V}$, $R_L = 100\Omega$) (Fig.20)		4N35 4N36 4N37		2	10	

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

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TYPICAL PERFORMANCE CURVES

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

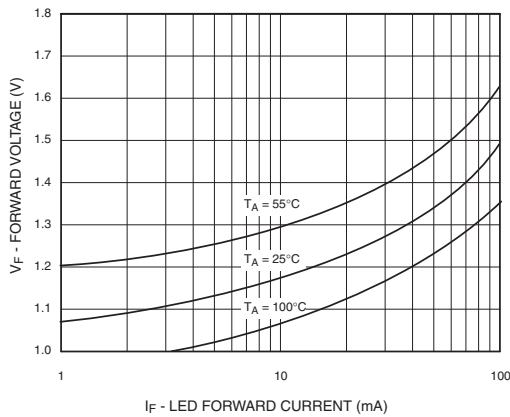


Fig. 2 LED Forward Voltage vs. Forward Current
(White Package)

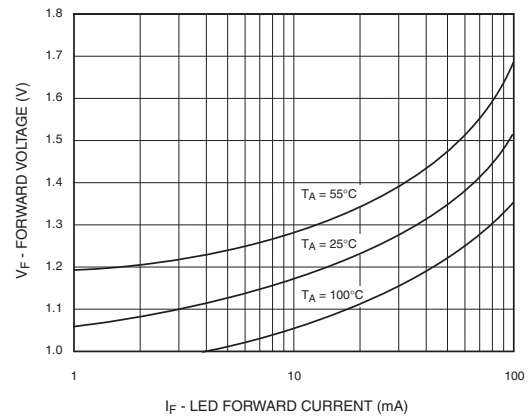


Fig.3 Normalized CTR vs. Forward Current
(Black Package)

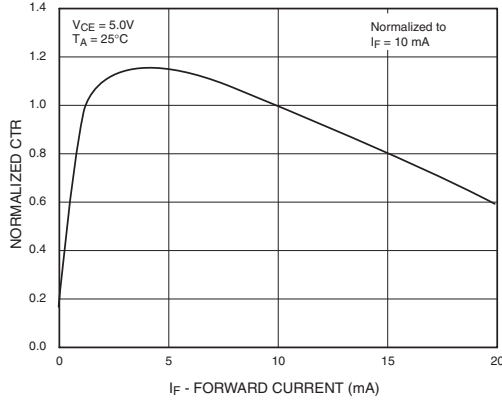


Fig.4 Normalized CTR vs. Forward Current
(White Package)

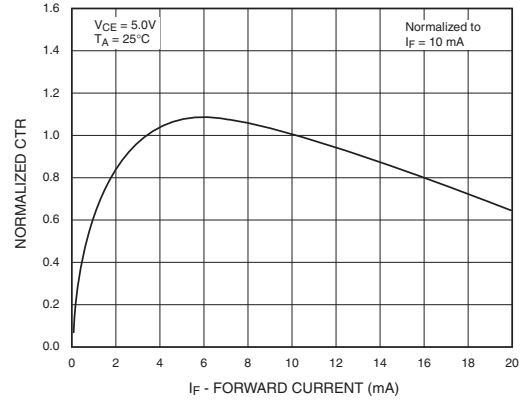


Fig. 5 Normalized CTR vs. Ambient Temperature
(Black Package)

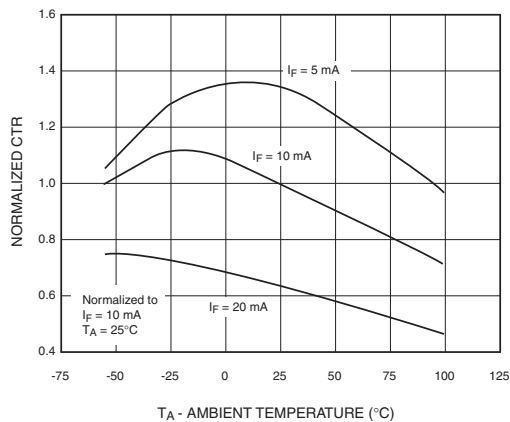
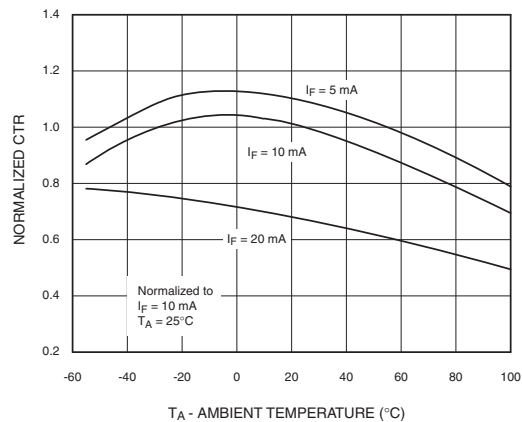


Fig. 6 Normalized CTR vs. Ambient Temperature
(White Package)



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H11A4

4N36
H11A5

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

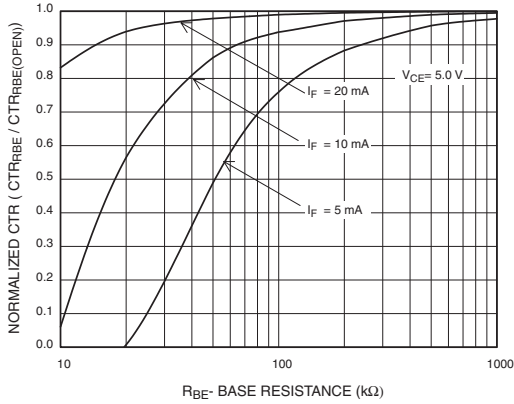


Fig. 8 CTR vs. RBE (Unsaturated)
(White Package)

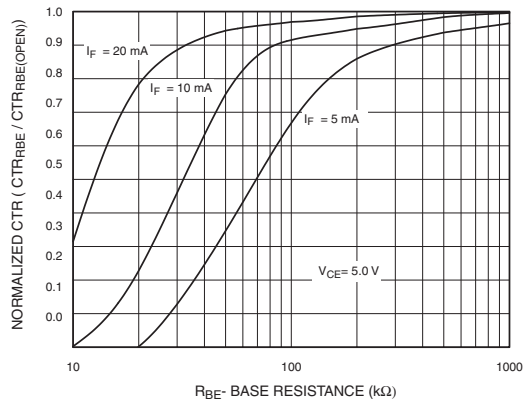


Fig. 9 CTR vs. RBE (Saturated)
(Black Package)

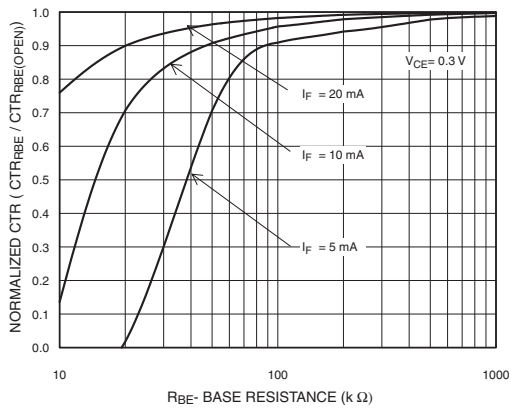


Fig. 10 CTR vs. RBE (Saturated)
(White Package)

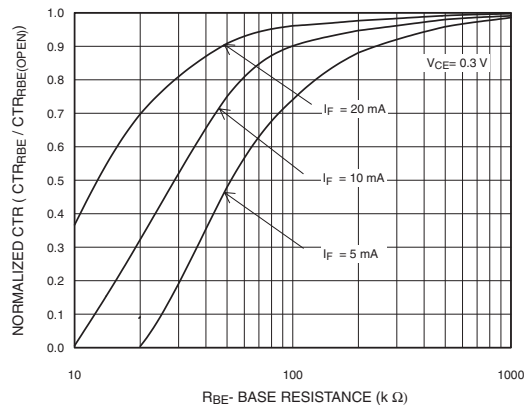


Fig. 11 Collector-Emitter Saturation Voltage vs. Collector Current
(Black Package)

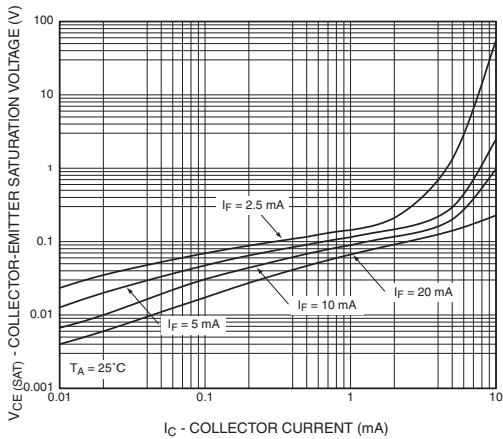
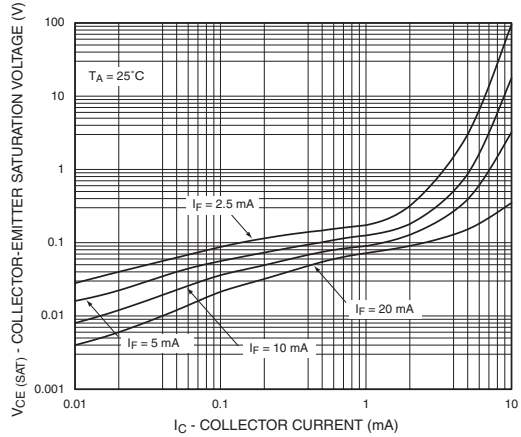


Fig. 12 Collector-Emitter Saturation Voltage vs. Collector Current
(White Package)



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H11A4

4N36
H11A5

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

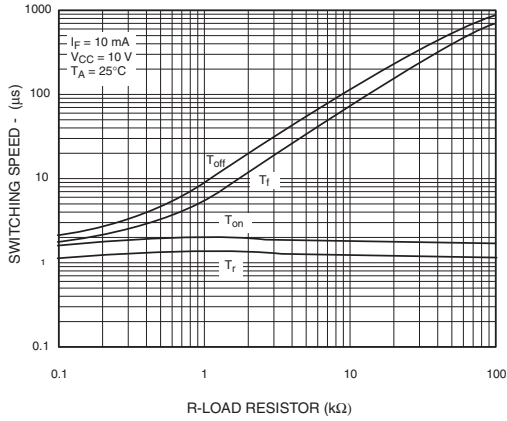


Fig. 14 Switching Speed vs. Load Resistor
(White Package)

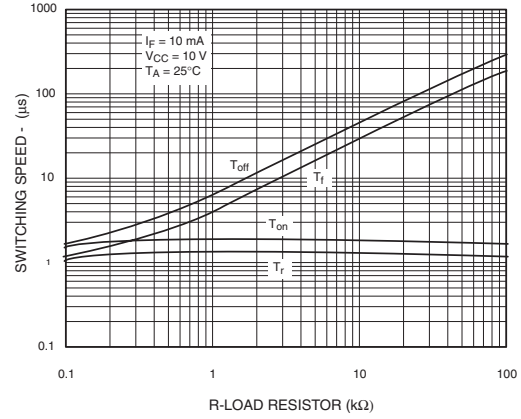


Fig. 15 Normalized t_{on} vs. R_{BE}
(Black Package)

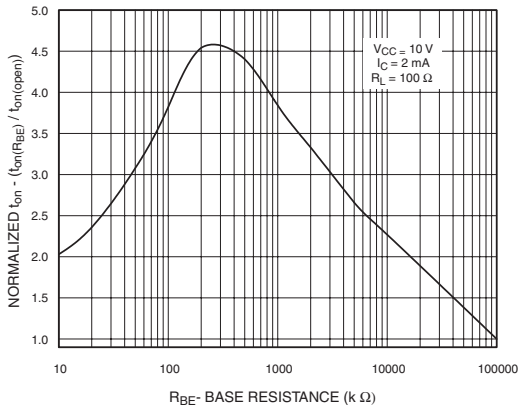


Fig. 16 Normalized t_{on} vs. R_{BE}
(White Package)

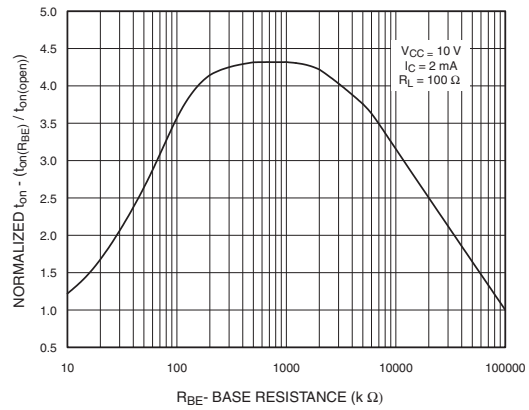


Fig. 17 Normalized t_{off} vs. R_{BE}
(Black Package)

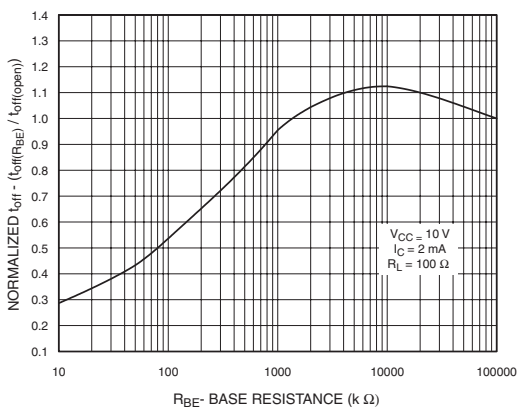
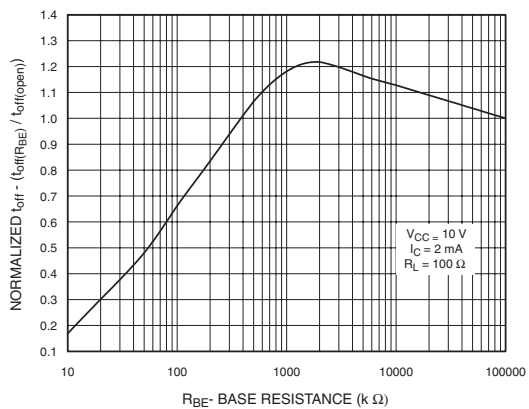


Fig. 18 Normalized t_{off} vs. R_{BE}
(White Package)



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4N27
H11A2

4N28
H11A3

4N35
H11A4

4N36
H11A5

Fig. 19 Dark Current vs. Ambient Temperature

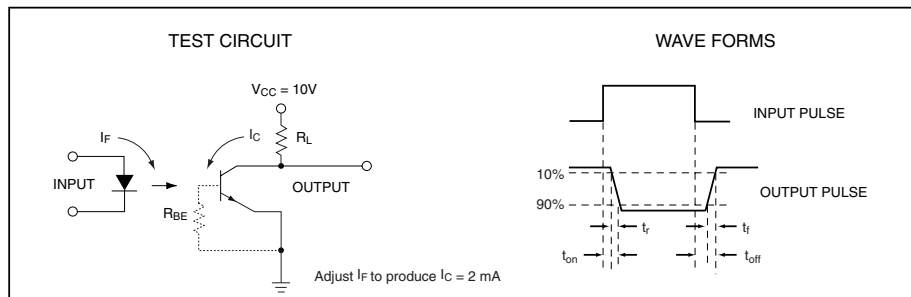
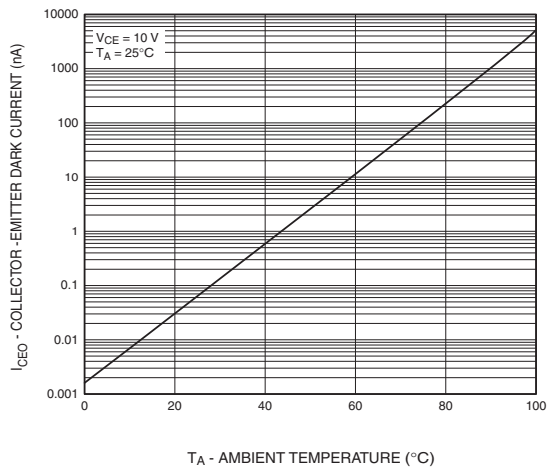


Figure 20. Switching Time Test Circuit and Waveforms

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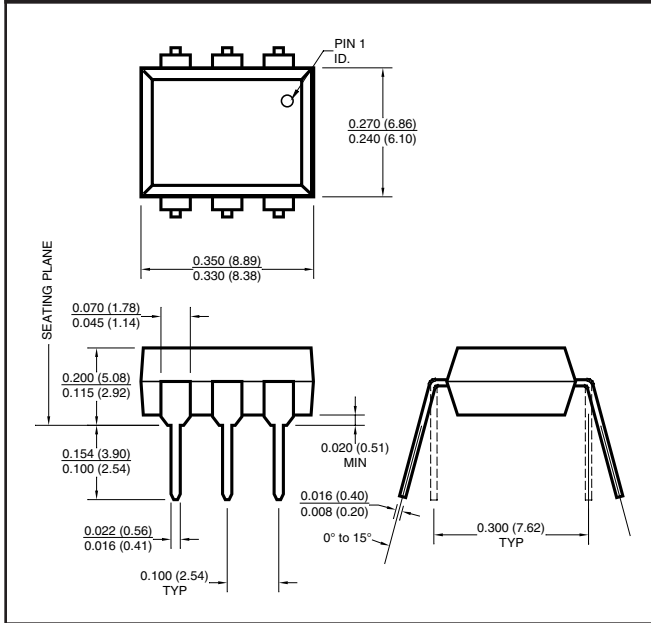
4N28
H11A3

4N35
H11A4

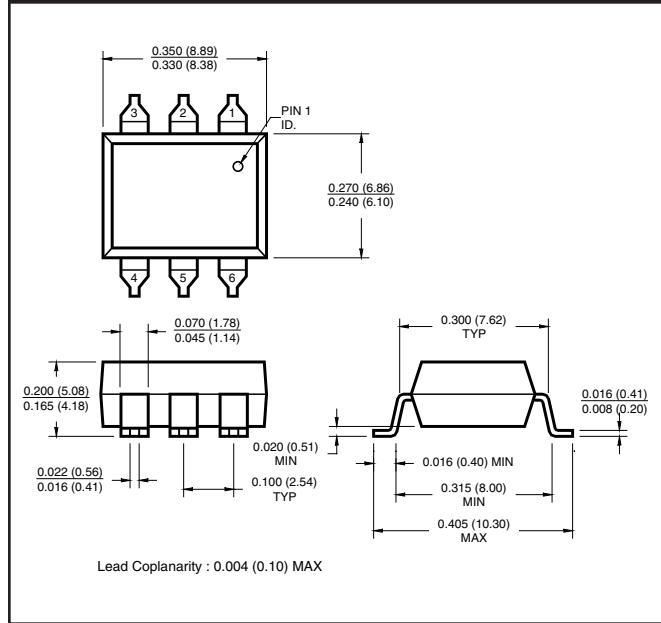
4N36
H11A5

Black Package (No -M Suffix)

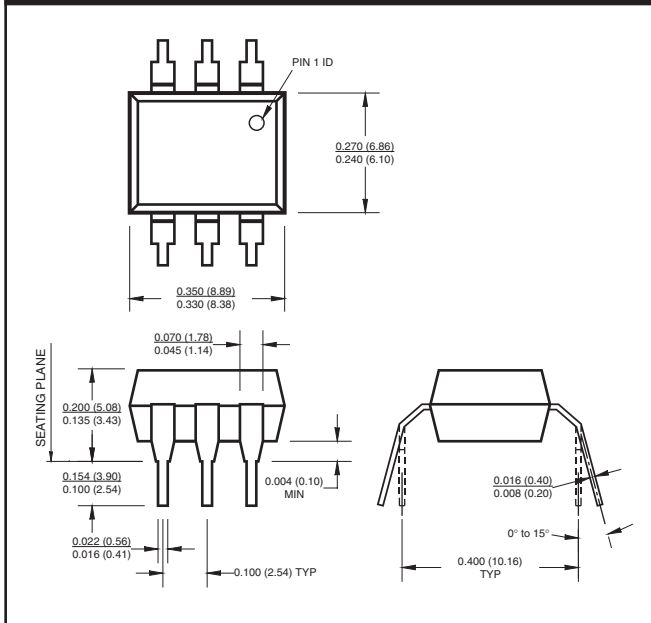
Package Dimensions (Through Hole)



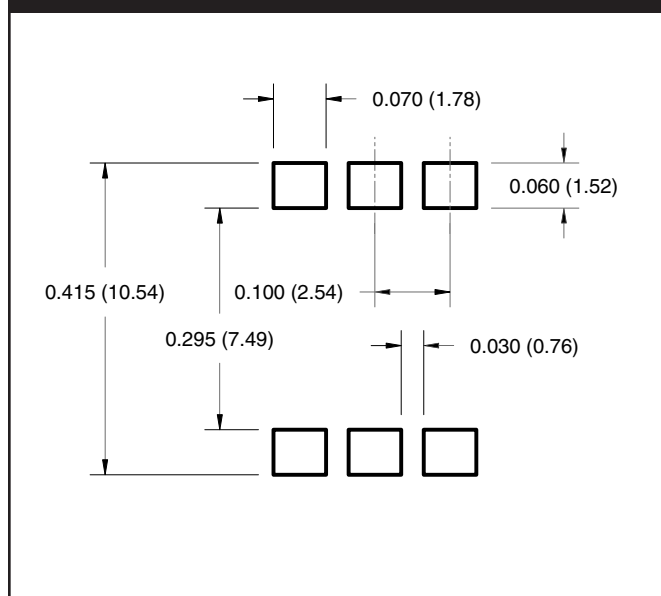
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



Recommended Pad Layout for Surface Mount Leadform



NOTE

All dimensions are in inches (millimeters)

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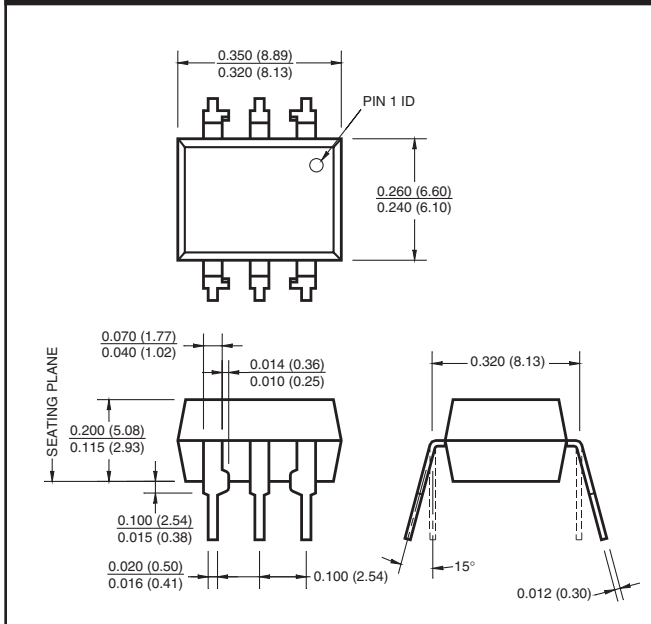
4N28
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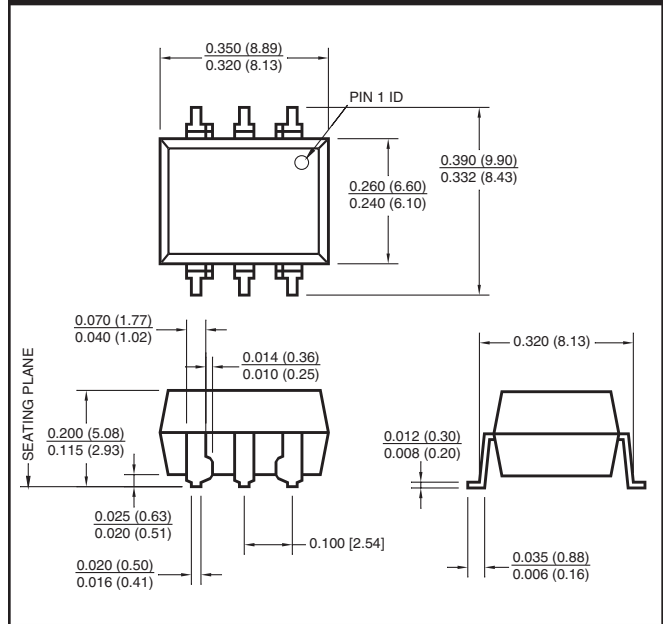
4N36
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White Package (-M Suffix)

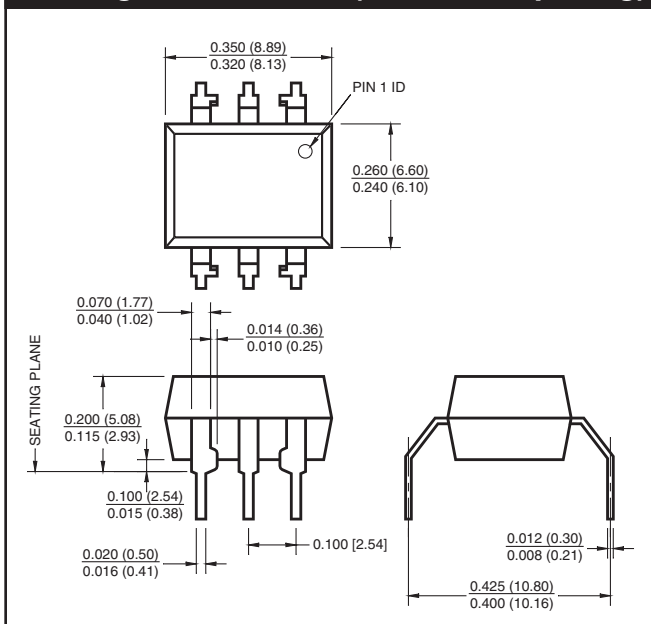
Package Dimensions (Through Hole)



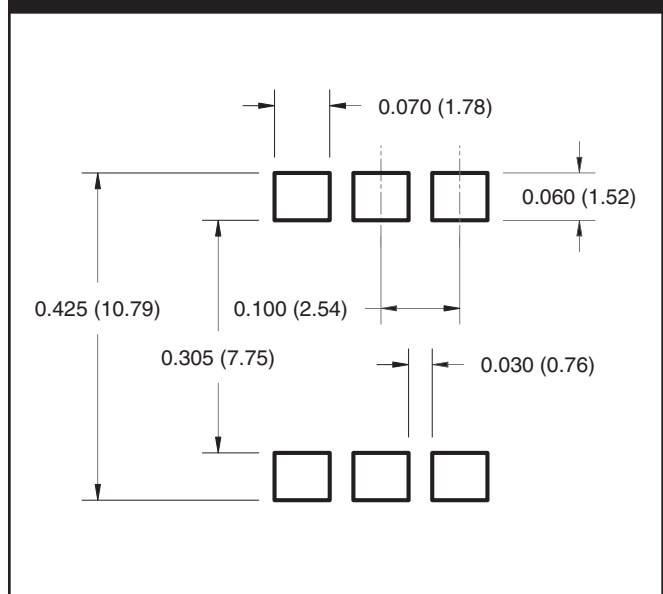
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



Recommended Pad Layout for Surface Mount Leadform



NOTE

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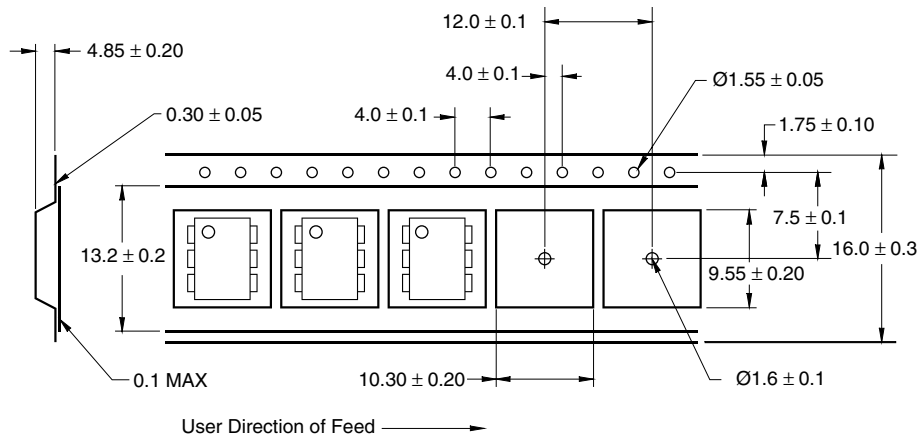
4N36
H11A5

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)

