

GENERAL PURPOSE 6-PIN PHOTOTRANSISTOR OPTOCOUPLEDERS

**4N25
4N37**

**4N26
H11A1**

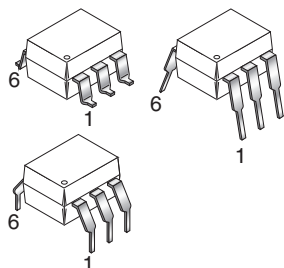
**4N27
H11A2**

**4N28
H11A3**

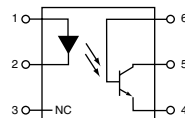
**4N35
H11A4**

**4N36
H11A5**

WHITE PACKAGE (-M SUFFIX)

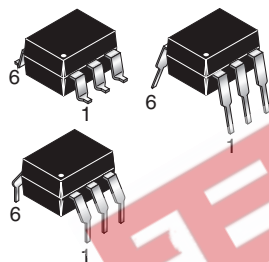


SCHEMATIC



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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**4N36
H11A5**

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	$^\circ\text{C}$
Wave solder temperature (see page 14 for reflow solder profiles)	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)	$I_F(pk)$	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	($I_C = 100\text{ }\mu\text{A}$, $I_F = 0$)	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}			Ω
Isolation Capacitance	($V_{I-O} = 8\text{ V}$, $f = 1\text{ MHz}$)	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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H11A1**

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H11A2**

**4N28
H11A3**

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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, Collector to Emitter	(I _F = 10 mA, V _{CE} = 10 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 mA, V _{CE} = 10 V, T _A = -55°C)						
	(I _F = 10 mA, V _{CE} = 10 V, T _A = +100°C)						
	Collector-Emitter Saturation Voltage		(I _C = 2 mA, I _F = 50 mA)	V _{CE (SAT)}	4N25 4N26 4N27 4N28		
(I _C = 0.5 mA, I _F = 10 mA)		4N35 4N36 4N37				0.3	
		H11A1 H11A2 H11A3 H11A4 H11A5				0.4	
		AC Characteristic	(I _F = 10 mA, V _{CC} = 10 V, R _L = 100Ω) (Fig.20)		T _{ON}	4N25 4N26 4N27 4N28 H11A1 H11A2 H11A3 H11A4 H11A5	
4N35 4N36 4N37				2		10	μs
Non Saturated Turn-on Time	(I _C = 2 mA, V _{CC} = 10 V, R _L = 100Ω) (Fig.20)	T _{ON}	4N35 4N36 4N37		2	10	μs

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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	($I_F = 10\text{ mA}$, $V_{CC} = 10\text{ V}$, $R_L = 100\Omega$) (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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4N27
H11A2

4N28
H11A3

4N35
H11A4

4N36
H11A5

TYPICAL PERFORMANCE CURVES

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

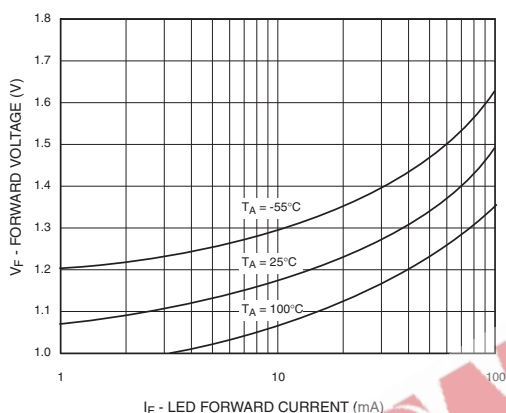


Fig. 2 LED Forward Voltage vs. Forward Current
(White Package)

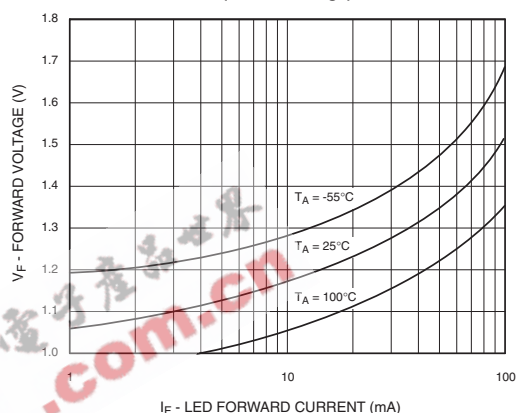


Fig.3 Normalized CTR vs. Forward Current
(Black Package)

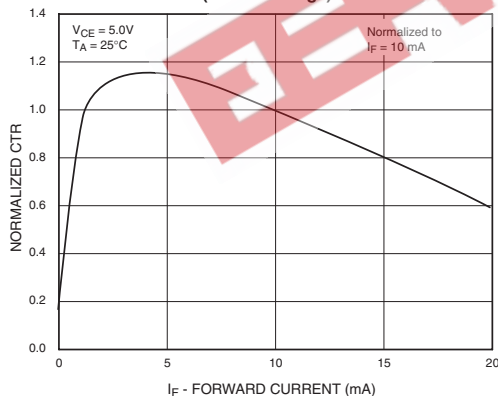


Fig.4 Normalized CTR vs. Forward Current
(White Package)

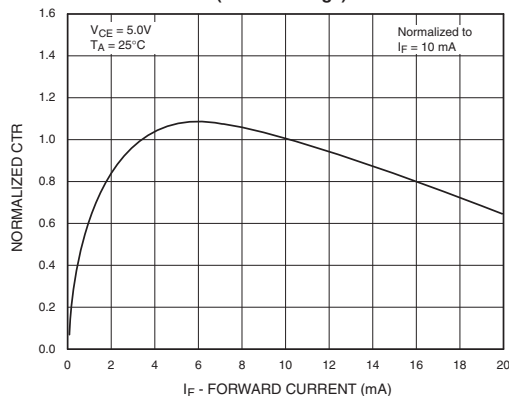


Fig. 5 Normalized CTR vs. Ambient Temperature
(Black Package)

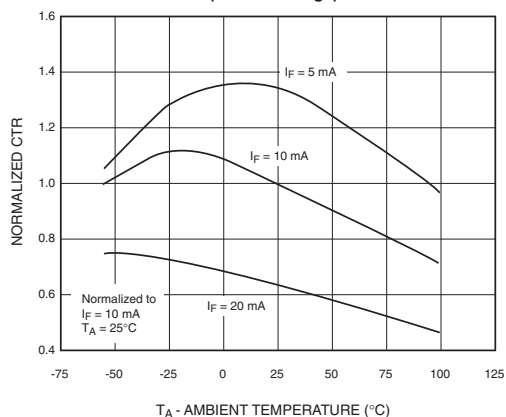
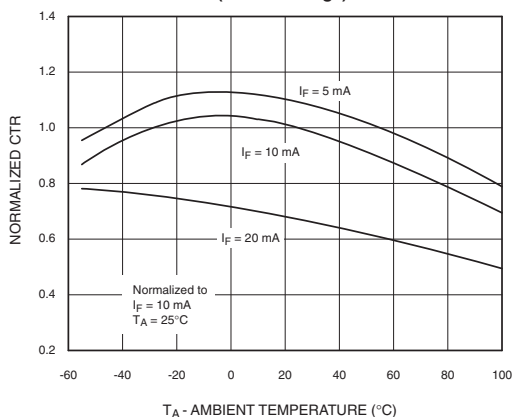


Fig. 6 Normalized CTR vs. Ambient Temperature
(White Package)



4N25
4N37

4N26
H11A1

4N27
H11A2

4N28
H11A3

4N35
H11A4

4N36
H11A5

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

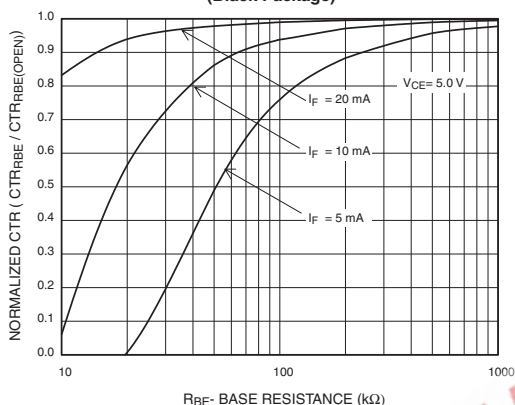


Fig. 8 CTR vs. RBE (Unsaturated)
(White Package)

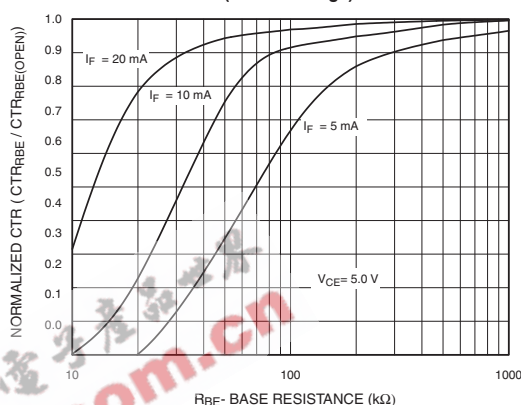


Fig. 9 CTR vs. RBE (Saturated)
(Black Package)

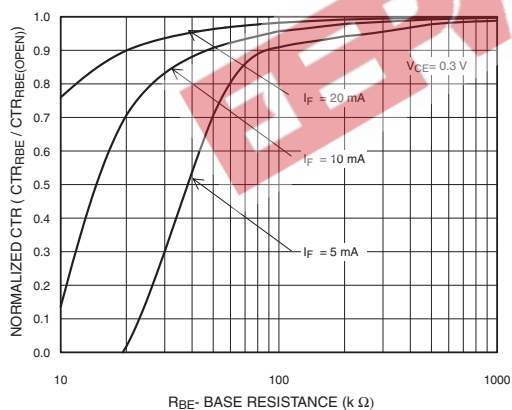


Fig. 10 CTR vs. RBE (Saturated)
(White Package)

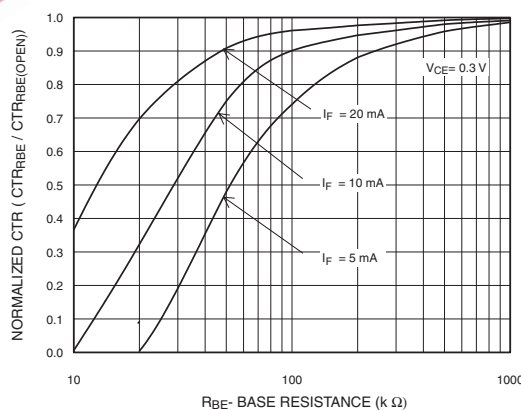


Fig. 11 Collector-Emitter Saturation Voltage vs. Collector Current
(Black Package)

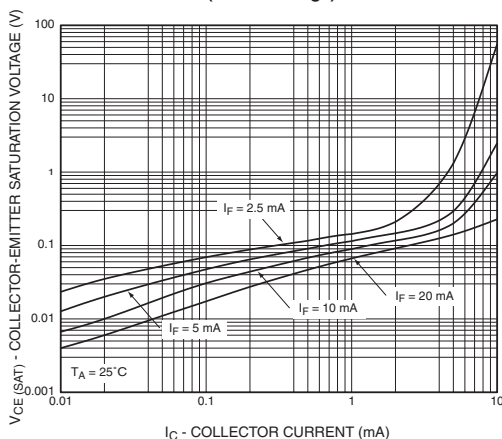
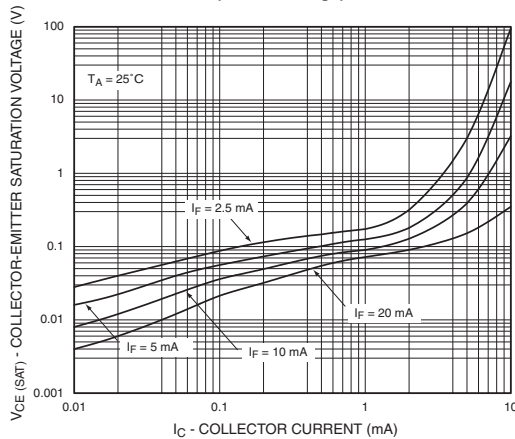


Fig. 12 Collector-Emitter Saturation Voltage vs. Collector Current
(White Package)



4N25
4N37

4N26
H11A1

4N27
H11A2

4N28
H11A3

4N35
H11A4

4N36
H11A5

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

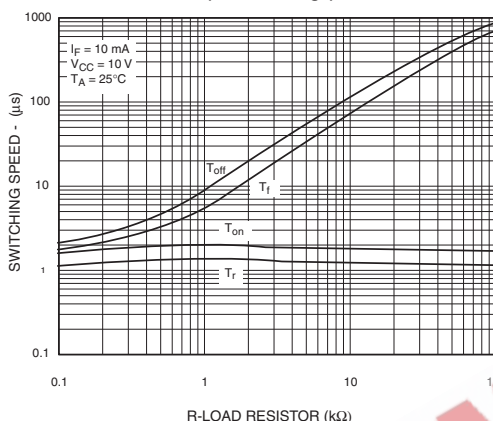


Fig. 14 Switching Speed vs. Load Resistor
(White Package)

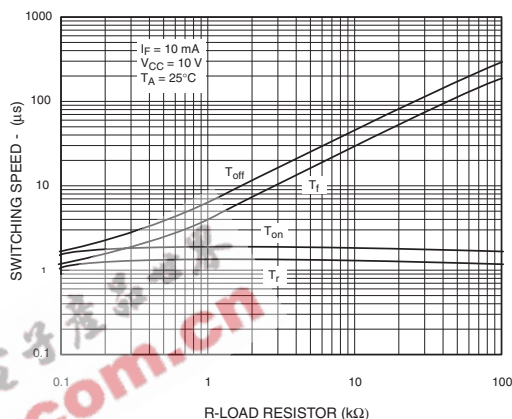


Fig. 15 Normalized t_{on} vs. R_{BE}
(Black Package)

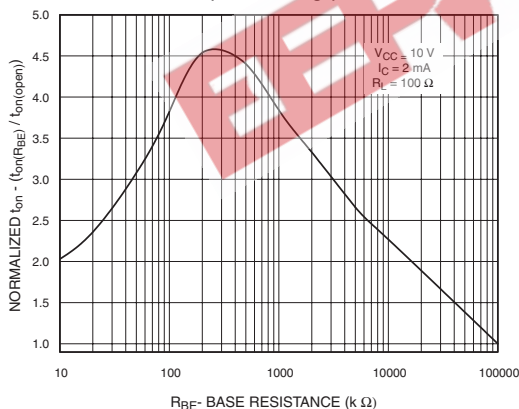


Fig. 16 Normalized t_{on} vs. R_{BE}
(White Package)

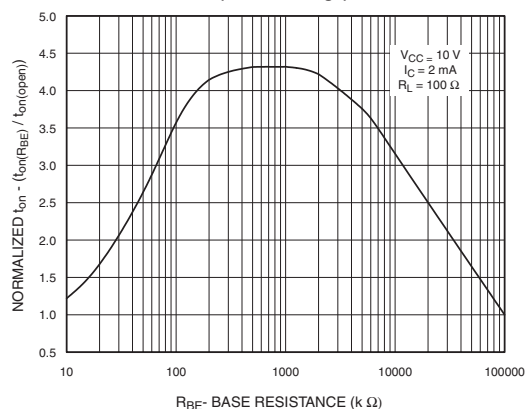


Fig. 17 Normalized t_{off} vs. R_{BE}
(Black Package)

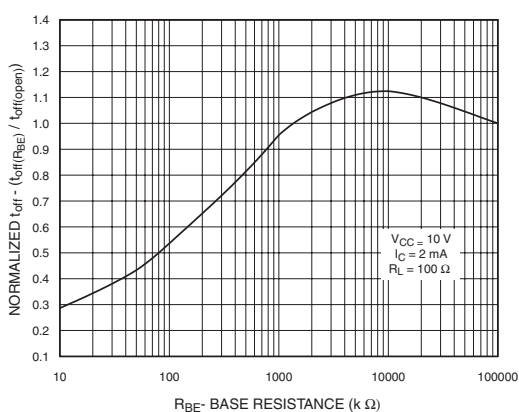
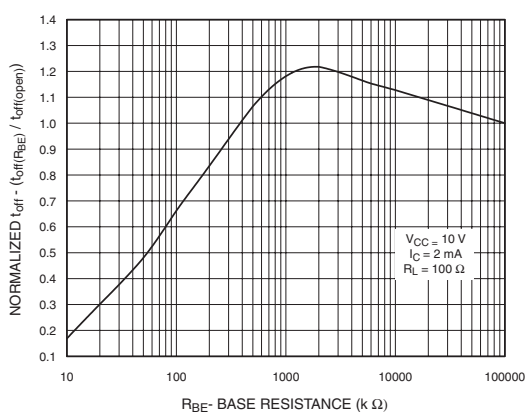


Fig. 18 Normalized t_{off} vs. R_{BE}
(White Package)



4N25
4N37

4N26
H11A1

4N27
H11A2

4N28
H11A3

4N35
H11A4

4N36
H11A5

Fig. 19 Dark Current vs. Ambient Temperature

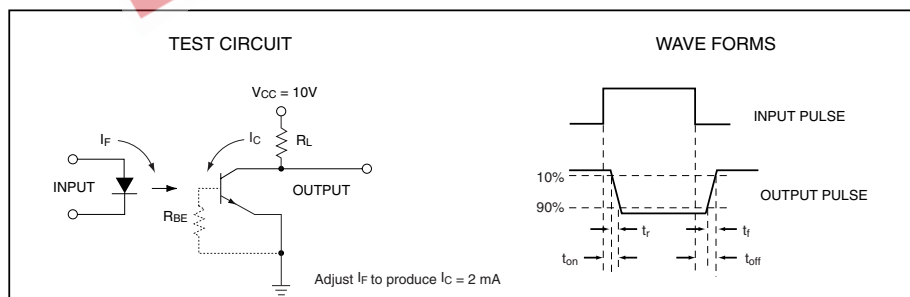
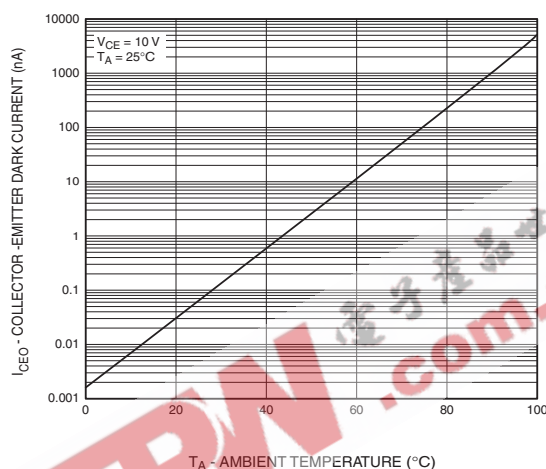


Figure 20. Switching Time Test Circuit and Waveforms

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H11A2**

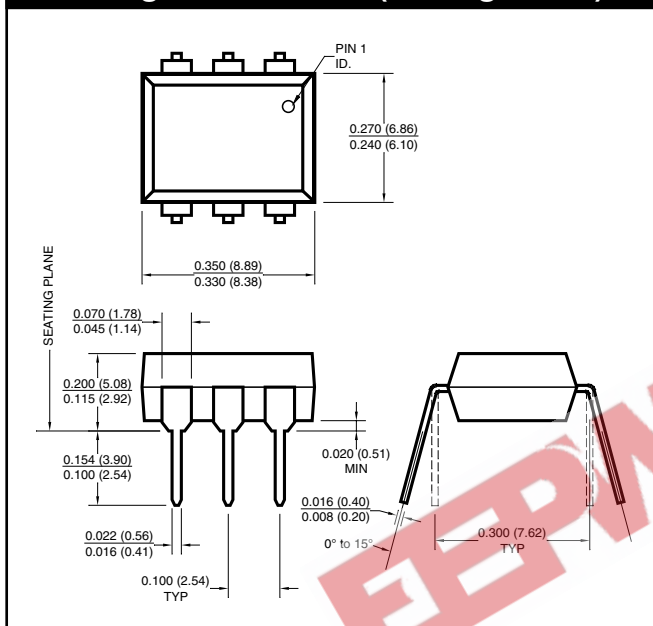
**4N28
H11A3**

**4N35
H11A4**

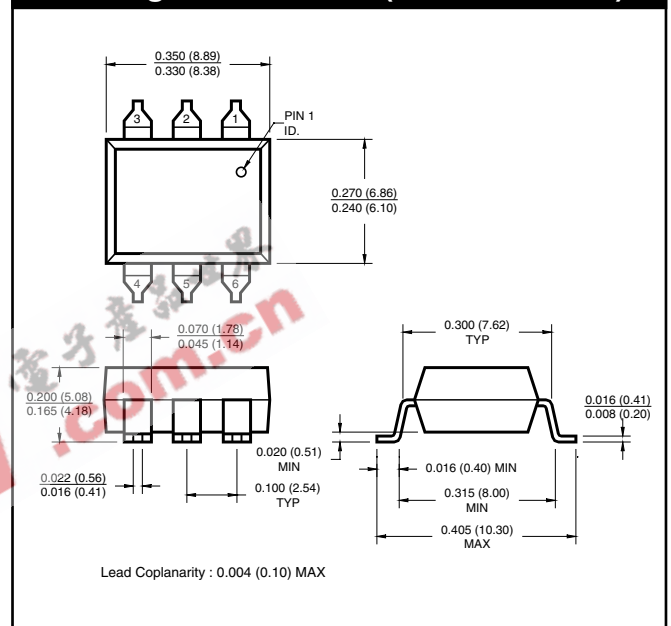
**4N36
H11A5**

Black Package (No -M Suffix)

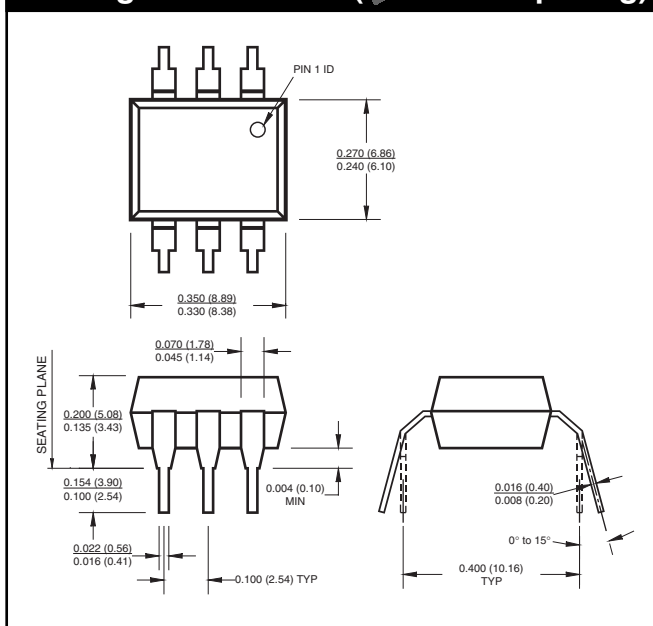
Package Dimensions (Through Hole)



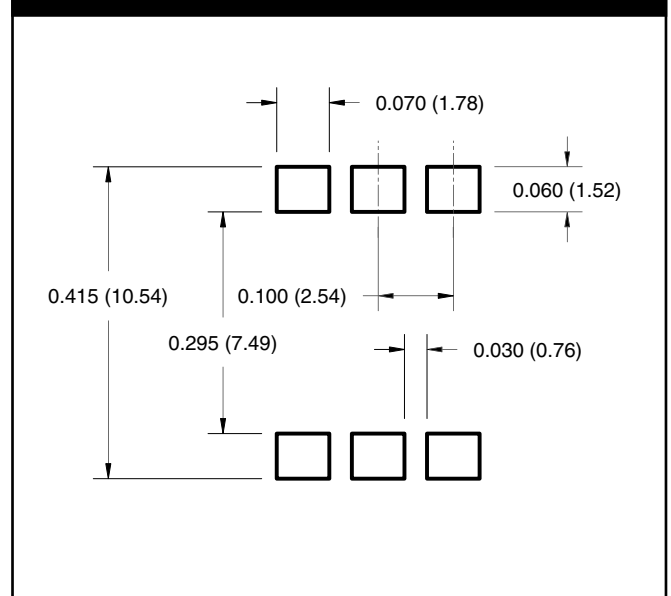
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



Recommended Pad Layout for Surface Mount Leadform



NOTE

All dimensions are in inches (millimeters)

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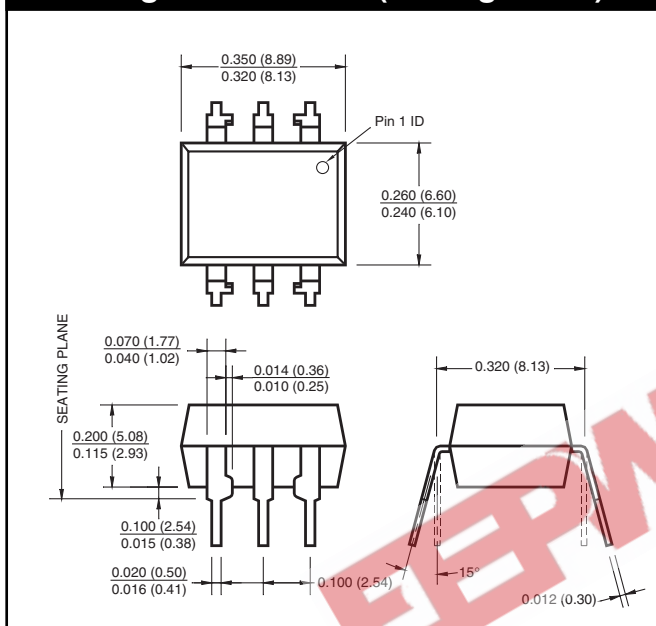
**4N28
H11A3**

**4N35
H11A4**

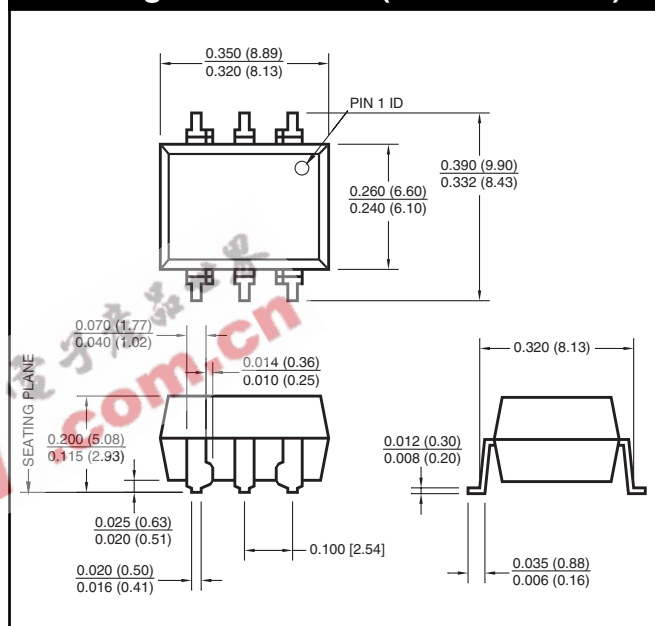
**4N36
H11A5**

White Package (-M Suffix)

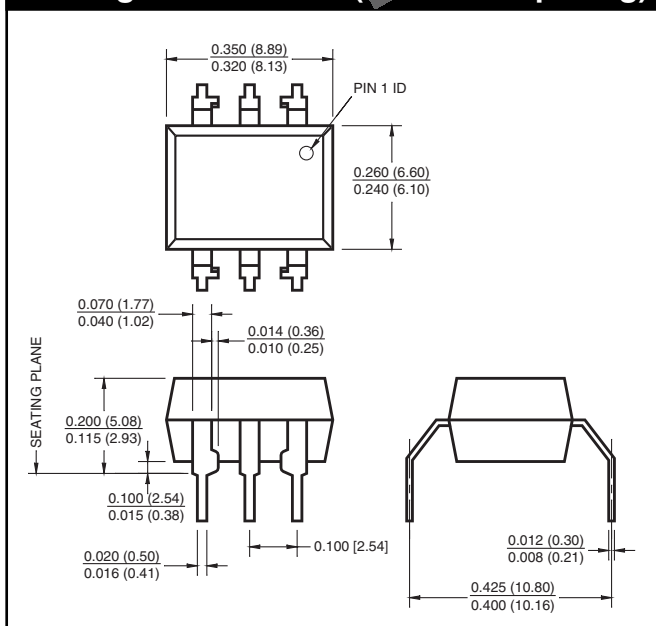
Package Dimensions (Through Hole)



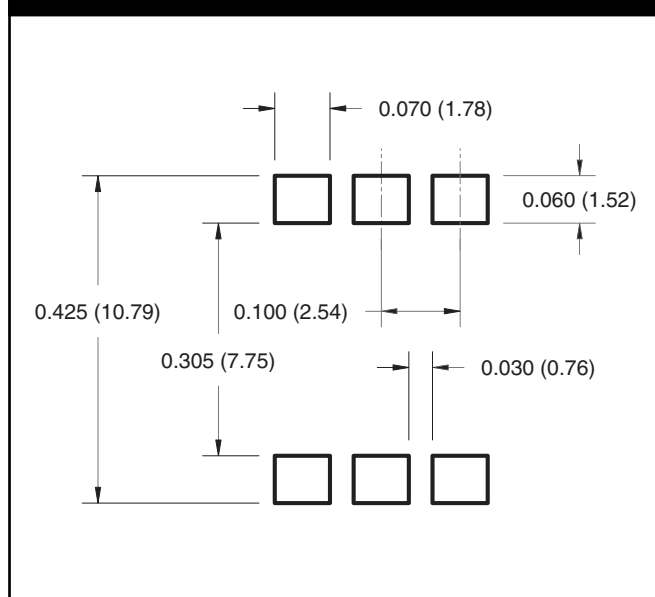
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



Recommended Pad Layout for Surface Mount Leadform



NOTE

All dimensions are in inches (millimeters)

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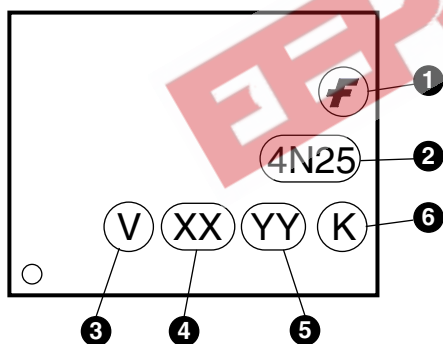
4N35
H11A4

4N36
H11A5

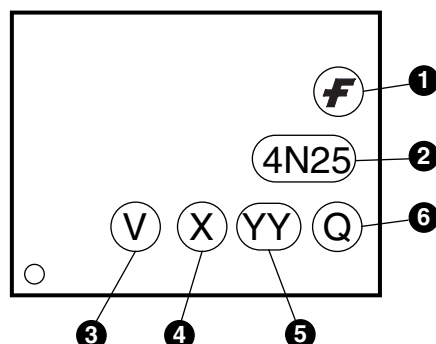
ORDERING INFORMATION

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 • Two digits for black package parts, e.g., '03' • One digit for white package parts, e.g., '3'
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.

4N36
H11A5

Technical drawing of a 5-hole punch card. The drawing shows the card with five rectangular punch holes. Dimensions are given in millimeters (mm) with tolerances. Key dimensions include:

- Overall width: 10.30 ± 0.20
- Overall height: 16.0 ± 0.3
- Distance from left edge to first hole center: 4.85 ± 0.20
- Distance between hole centers: 4.0 ± 0.1
- Distance from last hole center to right edge: 4.0 ± 0.1
- Distance from top edge to hole row: 7.5 ± 0.1
- Distance from bottom edge to hole row: 9.55 ± 0.20
- Hole diameter: $\varnothing 1.55 \pm 0.05$
- Card thickness: 0.1 MAX
- Distance from left edge to first hole row: 0.30 ± 0.05
- Distance from last hole row to right edge: 1.75 ± 0.10

User Direction of Feed is indicated by an arrow pointing right.

Technical drawing of a 5-axis lathe tool holder. The drawing shows a side view of the tool holder with various dimensions in millimeters (mm). The dimensions are as follows:

- Overall length: 12.0 ± 0.1
- Distance from front face to first hole: 4.5 ± 0.20
- Distance between holes: 2.0 ± 0.05
- Distance from front face to first hole (alternative): 0.30 ± 0.05
- Distance between holes (alternative): 4.0 ± 0.1
- Hole diameter: $\varnothing 1.5 \text{ MIN}$
- Distance from front face to last hole: 1.75 ± 0.10
- Distance from front face to last hole (alternative): 11.5 ± 1.0
- Distance from front face to last hole (alternative): 24.0 ± 0.3
- Distance from front face to last hole (alternative): 9.1 ± 0.20
- Distance from front face to last hole (alternative): 0.1 MAX
- Distance from front face to last hole (alternative): 10.1 ± 0.20
- Distance from front face to last hole (alternative): $\varnothing 1.5 \pm 0.1/-0$

User Direction of Feed →

**4N25
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**4N26
H11A1**

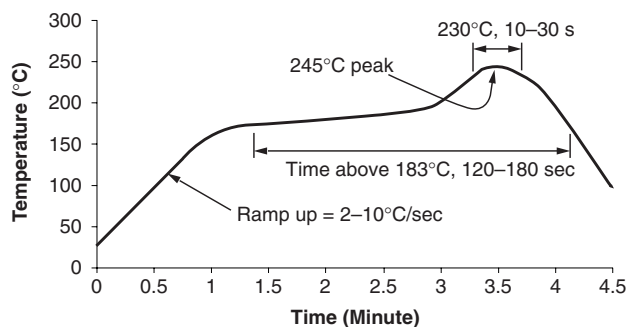
**4N27
H11A2**

**4N28
H11A3**

**4N35
H11A4**

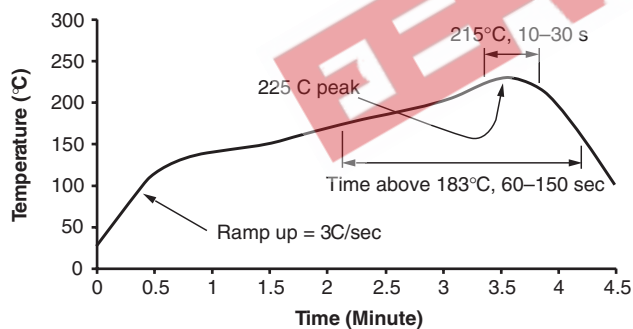
**4N36
H11A5**

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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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.

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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.