

FAIRCHILD
SEMICONDUCTOR™

HIGH VOLTAGE PHOTOTRANSISTOR OPTOCOUPLEDERS

DESCRIPTION

The H11DX and 4N38 are phototransistor-type optically coupled optoisolators. An infrared emitting diode manufactured from specially grown gallium arsenide is selectively coupled with a high voltage NPN silicon phototransistor. The device is supplied in a standard plastic six-pin dual-in-line package.

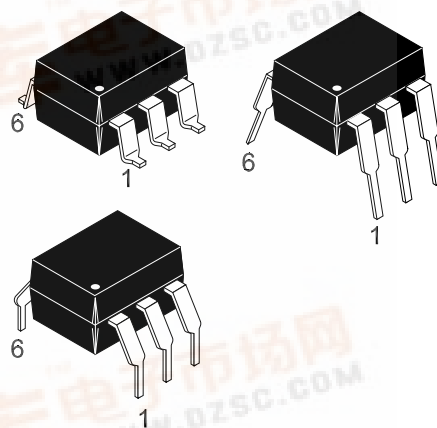
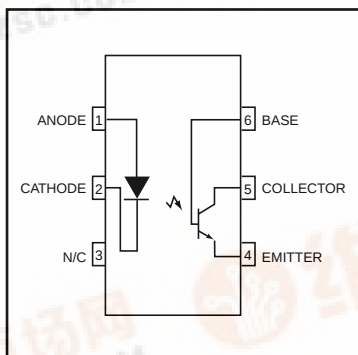
H11D1
H11D2
H11D3
H11D4
4N38

FEATURES

- High Voltage
 - H11D1, H11D2, $BV_{CER} = 300\text{ V}$
 - H11D3, H11D4, $BV_{CER} = 200\text{ V}$
- High isolation voltage
 - 5300 VAC RMS - 1 minute
 - 7500 VAC PEAK - 1 minute
- Underwriters Laboratory (UL) recognized File# E90700

APPLICATIONS

- Power supply regulators
- Digital logic inputs
- Microprocessor inputs
- Appliance sensor systems
- Industrial controls



ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Value	Units
TOTAL DEVICE			
Storage Temperature	T _{STG}	-55 to +150	°C
Operating Temperature	T _{OPR}	-55 to +100	°C
Lead Solder Temperature	T _{SOL}	260 for 10 sec	°C
Total Device Power Dissipation @ T _A = 25°C	P _D	260	mW
Derate above 25°C		3.5	mW/°C
EMITTER			
*Forward DC Current	I _F	80	mA
*Reverse Input Voltage	V _R	6.0	V
*Forward Current - Peak (1μs pulse, 300pps)	I _{F(pk)}	3.0	A
*LED Power Dissipation @ T _A = 25°C	P _D	150	mW
Derate above 25°C		1.41	mW/°C

H11D1, H11D2, H11D3, H11D4, 4N38

ABSOLUTE MAXIMUM RATINGS (Cont.)

Parameter	Symbol	Value	Units
DETECTOR			
*Power Dissipation @ $T_A = 25^\circ\text{C}$	P_D	300	mW
Derate linearly above 25°C		4.0	mW/ $^\circ\text{C}$
*Collector to Emitter Voltage	V_{CER}	H11D1 - H11D2 300	V
		H11D3 - H11D4 200	
		4N38 80	
*Collector Base Voltage	V_{CBO}	H11D1 - H11D2 300	
		H11D3 - H11D4 200	
		4N38 80	
*Emitter to Collector Voltage	V_{ECO}	H11D1 - H11D2 7	
		H11D3 - H11D4 7	
Collector Current (Continuous)		100	mA

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ Unless otherwise specified.)

INDIVIDUAL COMPONENT CHARACTERISTICS

Characteristic	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
EMITTER							
*Forward Voltage	($I_F = 10\text{ mA}$)	V_F	ALL		1.15	1.5	V
Forward Voltage Temp. Coefficient		$\frac{\Delta V_F}{\Delta T_A}$	ALL		-1.8		mV/ $^\circ\text{C}$
Reverse Breakdown Voltage	($I_R = 10\text{ }\mu\text{A}$)	BV_R	ALL	6	25		V
Junction Capacitance	($V_F = 0\text{ V}$, $f = 1\text{ MHz}$)	C_J	ALL		50		pF
	($V_F = 1\text{ V}$, $f = 1\text{ MHz}$)		ALL		65		pF
*Reverse Leakage Current	($V_R = 6\text{ V}$)	I_R	ALL		0.05	10	μA
DETECTOR	($R_{BE} = 1\text{ M}\Omega$)						
*Breakdown Voltage Collector to Emitter	($I_C = 1.0\text{ mA}$, $I_F = 0$)	BV_{CER}	H11D1/2	300			V
	(No R_{BE}) ($I_C = 1.0\text{ mA}$)		H11D3/4	200			
			4N38	80			
*Collector to Base	($I_C = 100\text{ }\mu\text{A}$, $I_F = 0$)	BV_{CBO}	H11D1/2	300			
			H11D3/4	200			
			4N38	80			
Emitter to Base	($I_E = 100\text{ }\mu\text{A}$, $I_F = 0$)	BV_{EBO}	4N38	7			
Emitter to Collector		BV_{ECO}	ALL	7	10		
*Leakage Current Collector to Emitter ($R_{BE} = 1\text{ M}\Omega$)	($V_{CE} = 200\text{ V}$, $I_F = 0$, $T_A = 25^\circ\text{C}$)	I_{CER}	H11D1/2			100	nA
	($V_{CE} = 200\text{ V}$, $I_F = 0$, $T_A = 100^\circ\text{C}$)					250	μA
	($V_{CE} = 100\text{ V}$, $I_F = 0$, $T_A = 25^\circ\text{C}$)		H11D3/4			100	nA
	($V_{CE} = 100\text{ V}$, $I_F = 0$, $T_A = 100^\circ\text{C}$)					250	μA
	(No R_{BE}) ($V_{CE} = 60\text{ V}$, $I_F = 0$, $T_A = 25^\circ\text{C}$)	I_{CEO}	4N38			50	nA

Notes

* Parameters meet or exceed JEDEC registered data (for 4N38 only)

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

H11D1, H11D2, H11D3, H11D4, 4N38

TRANSFER CHARACTERISTICS

DC Characteristic	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
EMITTER	Current Transfer Ratio Collector to Emitter	CTR	H11D1	2 (20)			mA (%)
			H11D2				
			H11D3	1 (10)			
			H11D4				
			4N38	2 (20)			
*Saturation Voltage	(I _F = 10 mA, V _{CE} = 10 V) (R _{BE} = 1 MΩ)	V _{CE (SAT)}	H11D1/2/3/4		0.1	0.40	V
	(I _F = 10 mA, I _C = 0.5 mA) (R _{BE} = 1 MΩ)		4N38			1.0	
	(I _F = 20 mA, I _C = 4 mA)						

TRANSFER CHARACTERISTICS

Characteristic	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
SWITCHING TIMES Non-Saturated Turn-on Time	(V _{CE} = 10 V, I _{CE} = 2 mA)	t _{on}	ALL		5		μs
		t _{off}	ALL		5		

ISOLATION CHARACTERISTICS

Characteristic	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
Isolation Voltage	(I _{I-O} ≤ 1 μA, 1 min.)	V _{ISO}	ALL	5300			(V _{AC RMS})
				7500			(V _{AC PEAK})
Isolation Resistance	(V _{I-O} = 500 VDC)	R _{ISO}	ALL	10 ¹¹			Ω
Isolation Capacitance	(f = 1 MHz)	C _{ISO}	ALL		0.5		pF

Notes

* Parameters meet or exceed JEDEC registered data (for 4N38 only)

** All typical values at T_A = 25°C

Fig.1 LED Forward Voltage vs. Forward Current

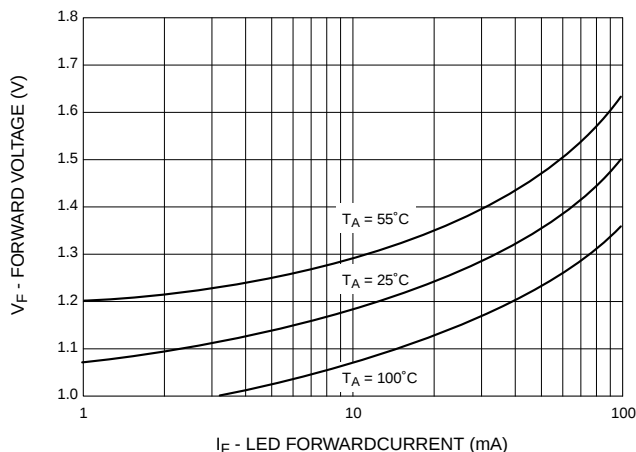
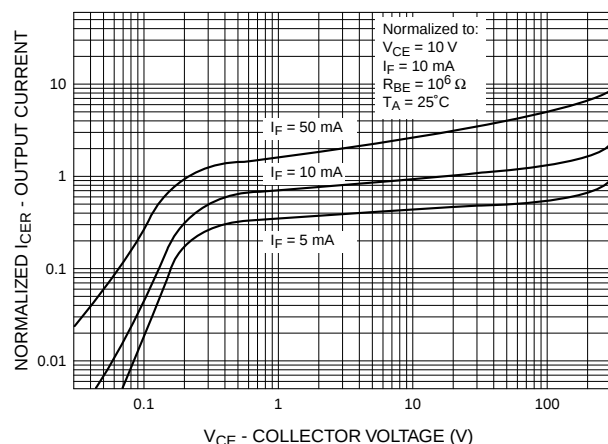


Fig.2 Normalized Output Characteristics



H11D1, H11D2, H11D3, H11D4, 4N38

Fig.3 Normalized Output Current vs. LED Input Current

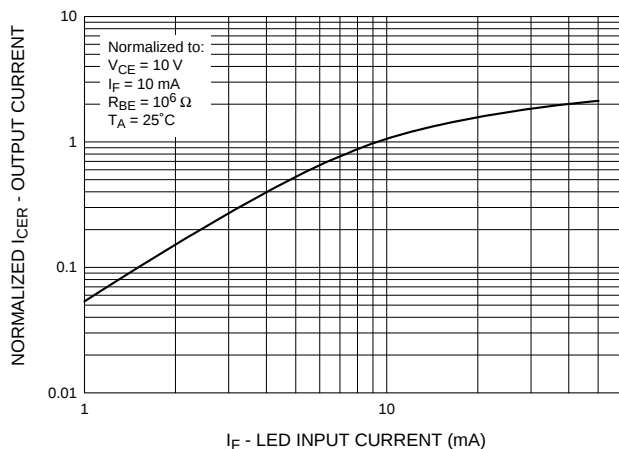


Fig.4 Normalized Output Current vs. Temperature

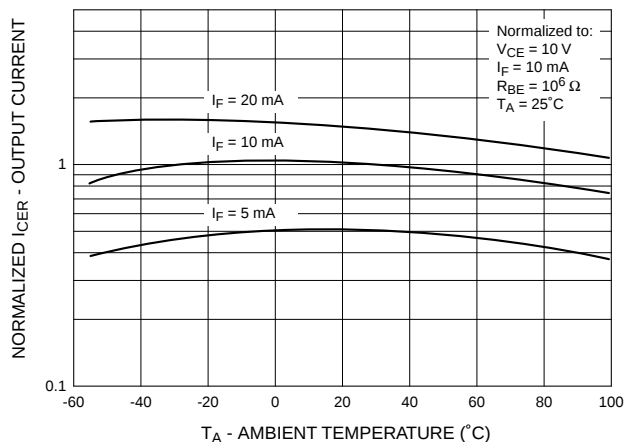
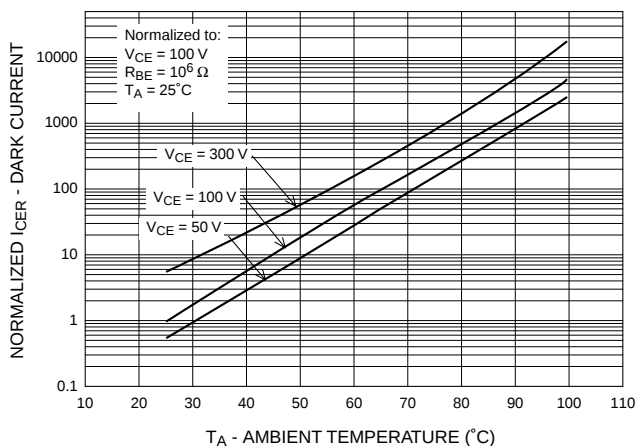
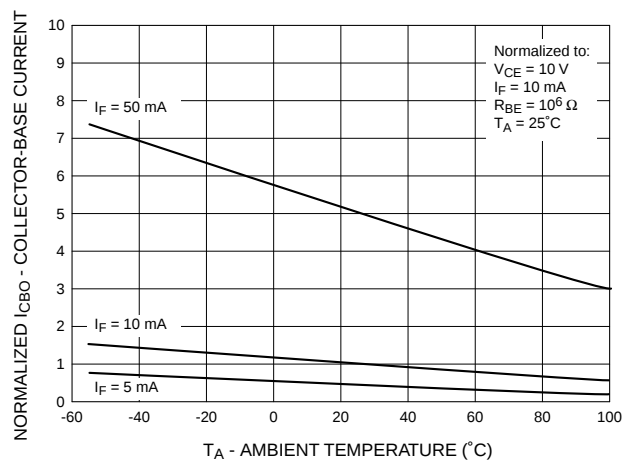


Fig.5 Normalized Dark Current vs. Ambient Temperature

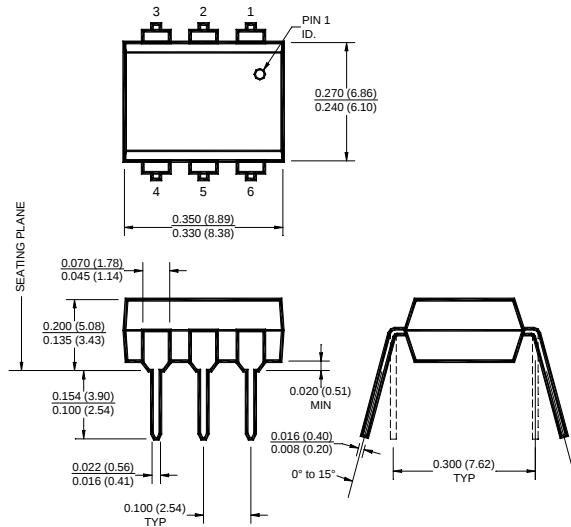


Normalized Collector-Base Current vs. Temperature

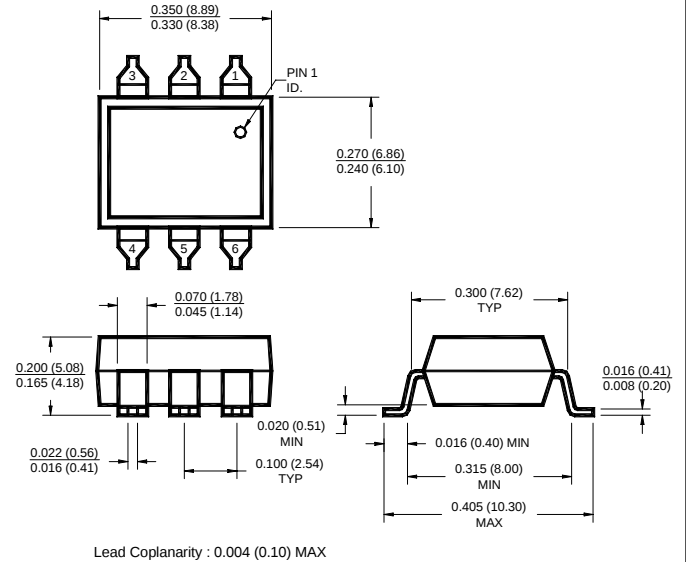


H11D1, H11D2, H11D3, H11D4, 4N38

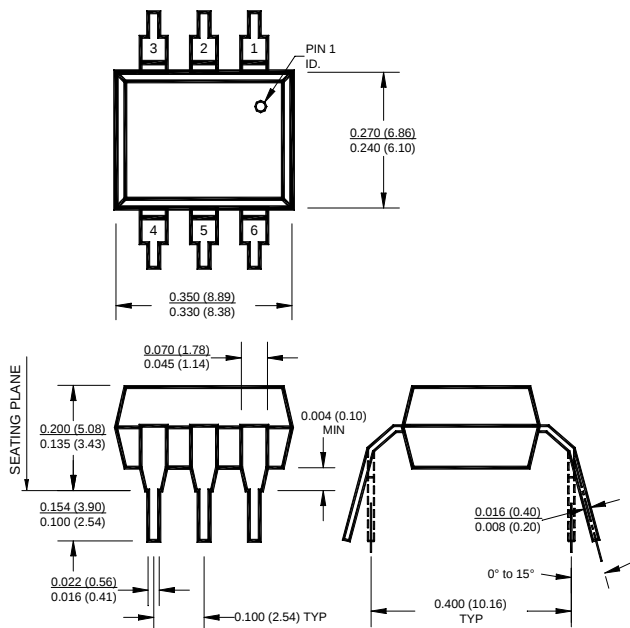
Package Dimensions (Through Hole)



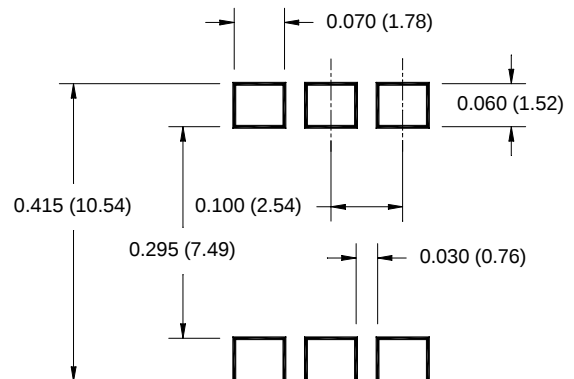
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



Recommended Pad Layout for Surface Mount Leadform



NOTE

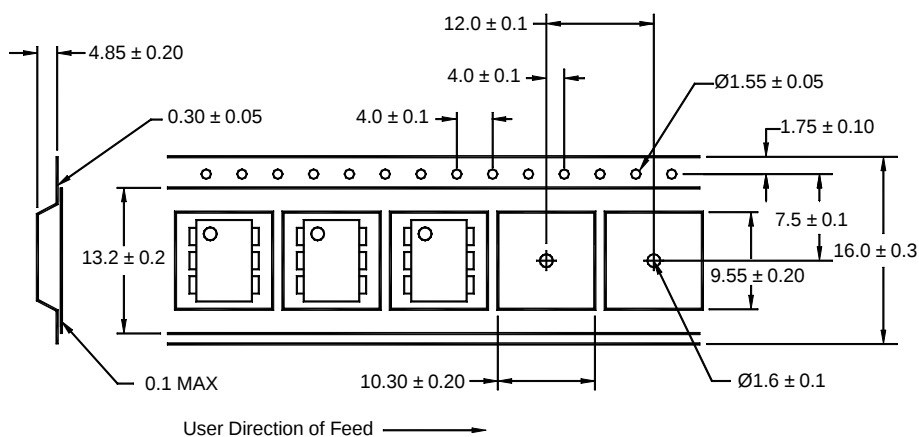
All dimensions are in inches (millimeters)

H11D1, H11D2, H11D3, H11D4, 4N38

ORDERING INFORMATION

Option	Order Entry Identifier	Description
S	.S	Surface Mount Lead Bend
SD	.SD	Surface Mount; Tape and reel
W	.W	0.4" Lead Spacing
300	.300	VDE 0884
300W	.300W	VDE 0884, 0.4" Lead Spacing
3S	.3S	VDE 0884, Surface Mount
3SD	.3SD	VDE 0884, Surface Mount, Tape & Reel

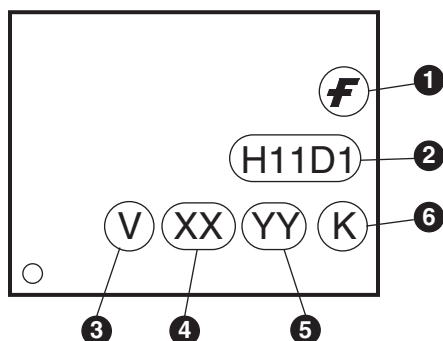
QT Carrier Tape Specifications ("D" Taping Orientation)



NOTE

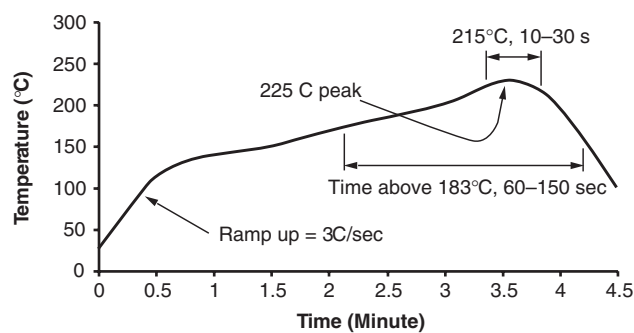
All dimensions are in millimeters

MARKING INFORMATION



Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	Two digit year code, e.g., '03'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

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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PRODUCT STATUS DEFINITIONS

Definition of Terms

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Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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