SYC SEMICONDUCTORES Y COMPONENTES

HIGH VOLTAGE PHOTOTRANSISTOR OPTOCOUPLERS

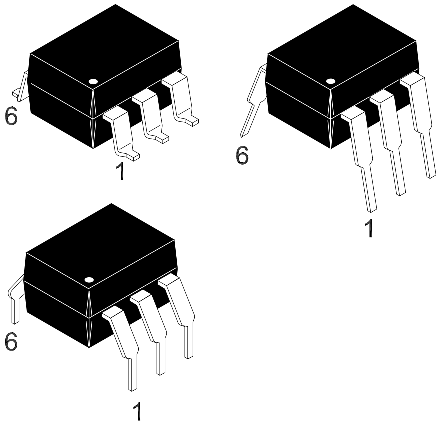
H11D1
H11D2
H11D3
H11D4
4N38

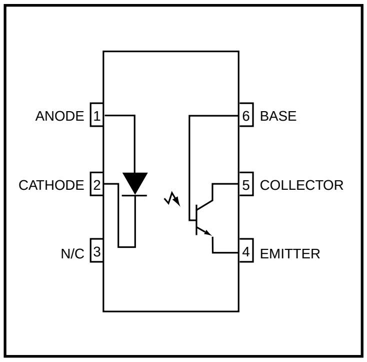
DESCRIPTION

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.

FEATURES

- High Voltage
  - H11D1, H11D2, BV_{CER} = 300 V
  - H11D3, H11D4, BV_{CER} = 200 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

ABSOLUTE MAXIMUM RATINGS (Cont.)

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

ELECTRICAL CHARACTERISTICS (T_A = 25°C Unless otherwise specified.)

INDIVIDUAL COMPONENT CHARACTERISTICS

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

Notes

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

** All typical values at T_A = 25°C

TRANSFER CHARACTERISTICS

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

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
Turn-off Time	(R_L = 100 Ω)	t_{off}	ALL		5		

ISOLATION CHARACTERISTICS

Characteristic	Test Conditions	Symbol	Device	Min	Typ**	Max	Unit
Isolation Voltage	($I_{I\text{-}O}$ ≤ 1 µA, 1 min.)	V_{ISO}	ALL	5300			(V_{AC}RMS)
				7500			(V_{AC}PEAK)
Isolation Resistance	($V_{I\text{-}O}$ = 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

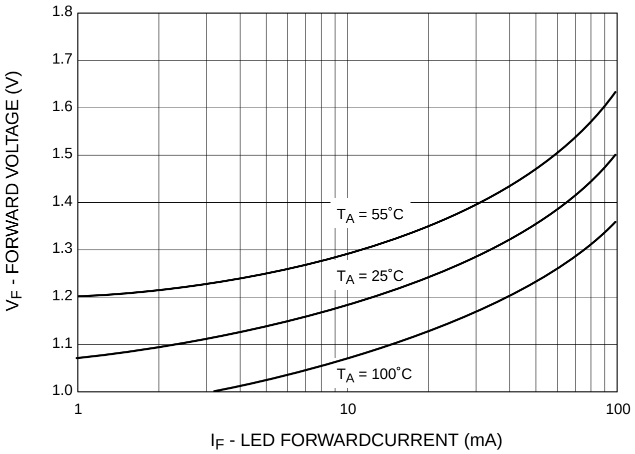


Fig.2 Normalized Output Characteristics

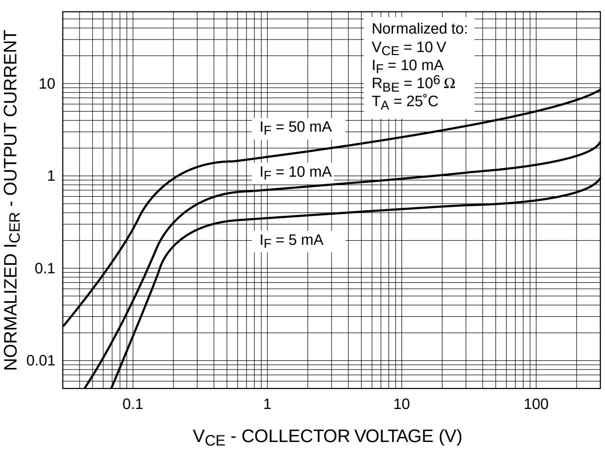


Fig.3 Normalized Output Current vs. LED Input Current

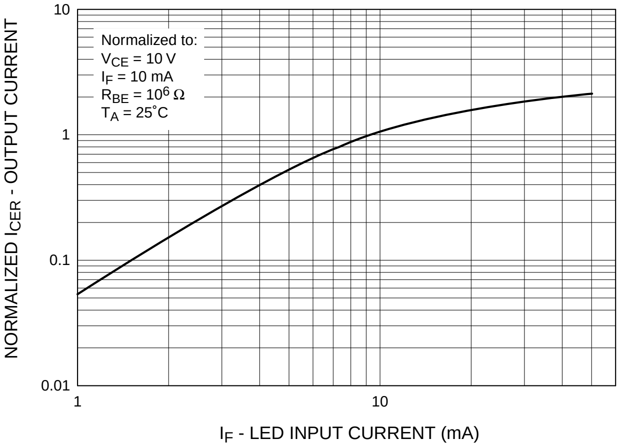


Fig.4 Normalized Output Current vs. Temperature

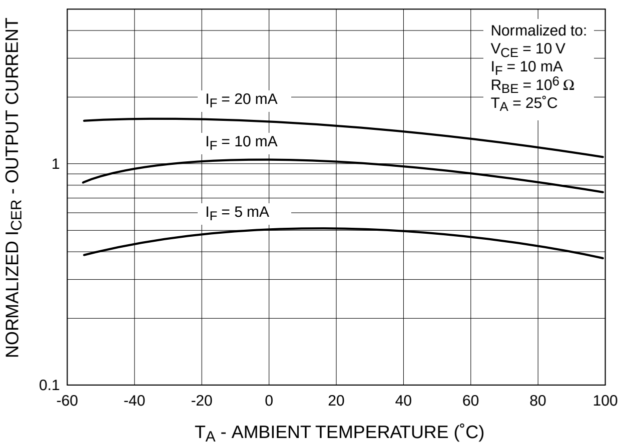
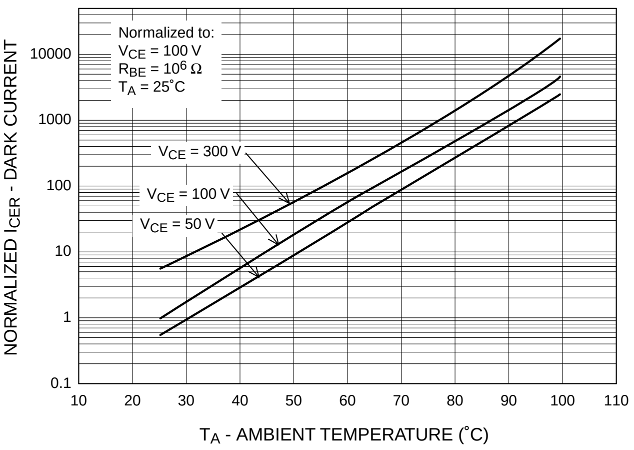
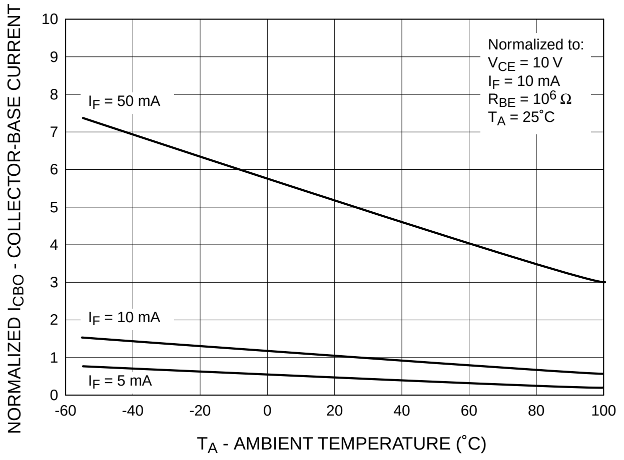


Fig.5 Normalized Dark Current vs. Ambient Temperature



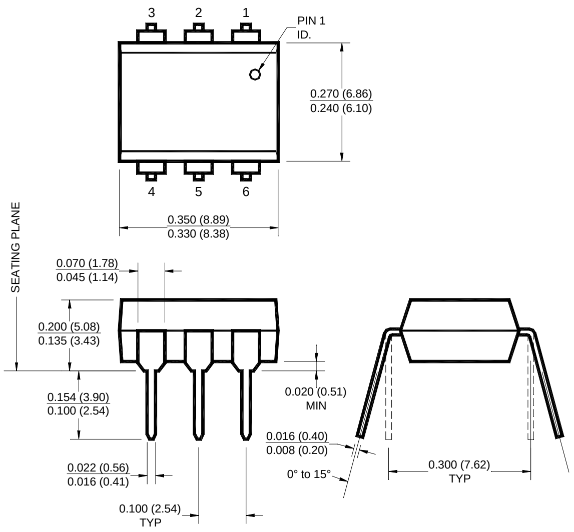
Normalized Collector-Base Current vs. Temperature



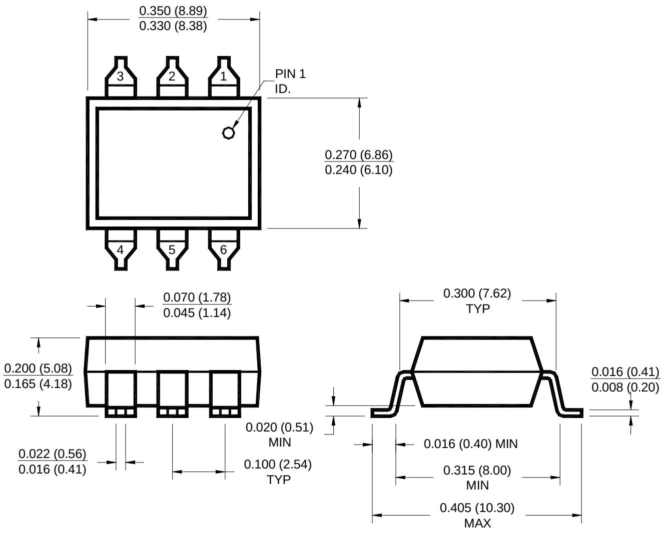
HIGH VOLTAGE PHOTOTRANSISTOR OPTOCOUPLERS

H11D1, H11D2, H11D3, H11D4, 4N38

Package Dimensions (Through Hole)

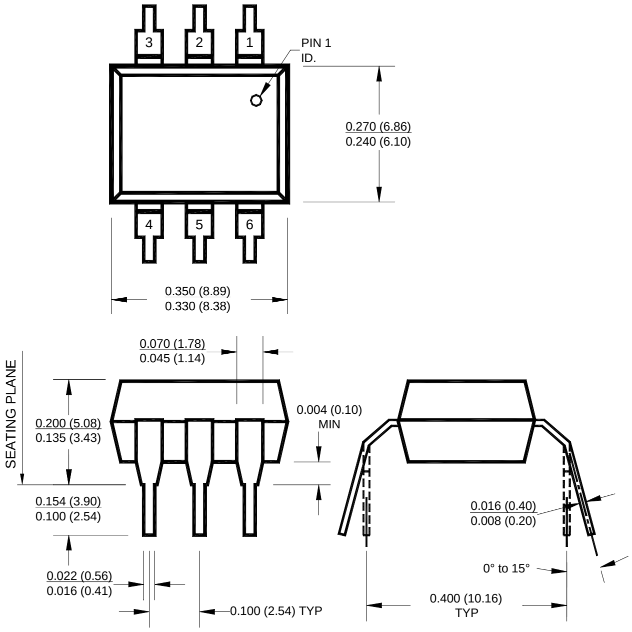


Package Dimensions (Surface Mount)

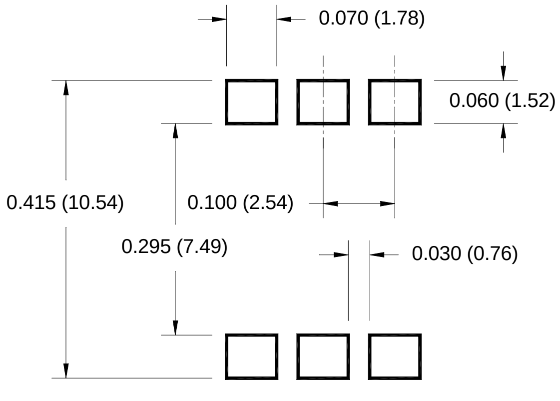


Lead Coplanarity : 0.004 (0.10) MAX

Package Dimensions (0.4”Lead Spacing)



Recommended Pad Layout for Surface Mount Leadform



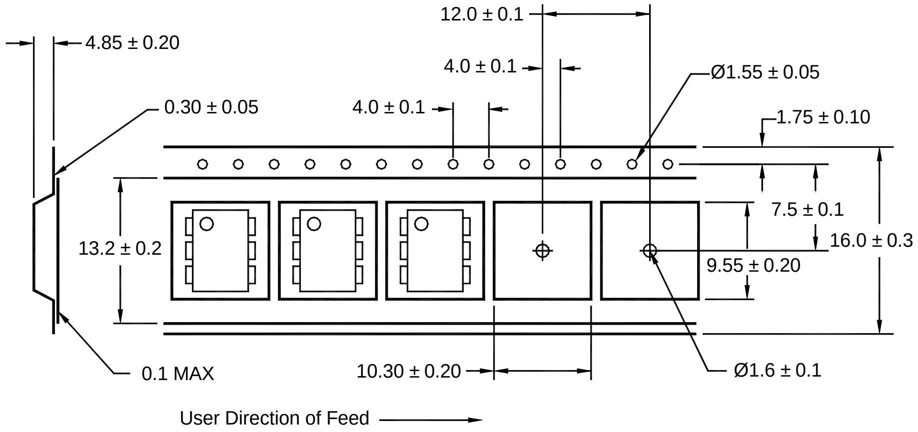
NOTE

All dimensions are in inches (millimeters)

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