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September 2016

H11N1M, H11N2M — 6-Pin DIP Schmitt Trigger Output Optocoupler

H11N1M, H11N2M 6-Pin DIP Schmitt Trigger Output Optocoupler

Features

- High Data Rate, 5 MHz Typical (NRZ)
- Free from Latch-up and Oscillation Throughout Voltage and Temperature Ranges
- Microprocessor Compatible Drive
- Logic Compatible Output Sinks 16 mA at 0.5 V Maximum
- Guaranteed On/Off Threshold Hysteresis
- Wide Supply Voltage Capability, Compatible with All Popular Logic Systems
- Safety and Regulatory Approvals:
 - UL1577, 4,170 VAC_{RMS} for 1 Minute
 - DIN-EN/IEC60747-5-5, 850 V Peak Working Insulation Voltage

Description

The H11NXM series has a high-speed integrated circuit detector optically coupled to an aluminium gallium arsenide (AlGaAs) infrared emitting diode. The output incorporates a Schmitt trigger, which provides hysteresis for noise immunity and pulse shaping. The detector circuit is optimized for simplicity of operation and utilizes an open-collector output for maximum application flexibility.

Applications

- Logic-to-Logic Isolator
- Programmable Current Level Sensor
- Line Receiver—Eliminate Noise and Transient Problems
- AC to TTL Conversion—Square Wave Shaping
- Interfaces Computers with Peripherals
- Isolated Power MOS Driver for Power Supplies

Schematic

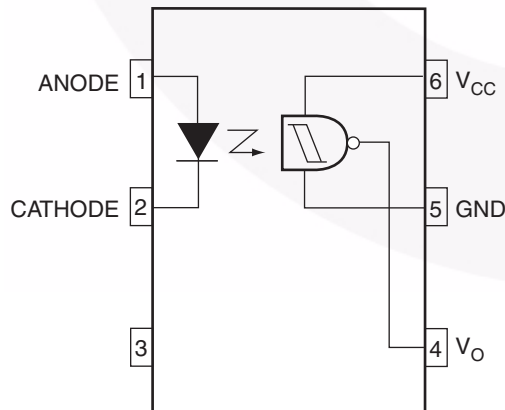


Figure 1. Schematic

Package Outlines



Figure 2. Package Outlines

Truth Table

Input	Output
H	L
L	H

Safety and Insulation Ratings

As per DIN EN/IEC 60747-5-5, this optocoupler is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings shall be ensured by means of protective circuits.

Parameter		Characteristics
Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage	< 150 V _{RMS}	I–IV
	< 300 V _{RMS}	I–IV
Climatic Classification		55/100/21
Pollution Degree (DIN VDE 0110/1.89)		2
Comparative Tracking Index		175

Symbol	Parameter	Value	Unit
V _{PR}	Input-to-Output Test Voltage, Method A, V _{IORM} × 1.6 = V _{PR} , Type and Sample Test with t _m = 10 s, Partial Discharge < 5 pC	1360	V _{peak}
	Input-to-Output Test Voltage, Method B, V _{IORM} × 1.875 = V _{PR} , 100% Production Test with t _m = 1 s, Partial Discharge < 5 pC	1594	V _{peak}
V _{IORM}	Maximum Working Insulation Voltage	850	V _{peak}
V _{IOTM}	Highest Allowable Over-Voltage	6000	V _{peak}
	External Creepage	≥ 7	mm
	External Clearance	≥ 7	mm
	External Clearance (for Option TV, 0.4" Lead Spacing)	≥ 10	mm
DTI	Distance Through Insulation (Insulation Thickness)	≥ 0.5	mm
T _S	Case Temperature ⁽¹⁾	175	°C
I _{S,INPUT}	Input Current ⁽¹⁾	350	mA
P _{S,OUTPUT}	Output Power ⁽¹⁾	800	mW
R _{IO}	Insulation Resistance at T _S , V _{IO} = 500 V ⁽¹⁾	> 10 ⁹	Ω

Note:

1. Safety limit values – maximum values allowed in the event of a failure.

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. $T_A = 25^\circ\text{C}$ unless otherwise specified.

Symbol	Parameters	Value	Units
Total Device			
T_{STG}	Storage Temperature	-40 to +125	$^\circ\text{C}$
T_{OPR}	Operating Temperature	-40 to +85	$^\circ\text{C}$
T_J	Junction Temperature	-40 to +125	$^\circ\text{C}$
T_{SOL}	Lead Solder Temperature	260 for 10 seconds	$^\circ\text{C}$
P_D	Total Device Power Dissipation at 25°C Derate Above 25°C	210	mW
		2.94	mW/ $^\circ\text{C}$
Emitter			
I_F	Continuous Forward Current	30	mA
V_R	Reverse Voltage	6	V
$I_F(\text{pk})$	Forward Current – Peak (1 μs pulse, 300 pps)	100	mA
P_D	LED Power Dissipation	60	mW
Detector			
P_D	Detector Power Dissipation	150	mW
V_O	V_{45} Allowed Range	0 to 16	V
V_{CC}	V_{65} Allowed Range	3 to 16	V
I_O	I_4 Output Current	50	mA

Electrical Characteristics

$T_A = 25^\circ\text{C}$ unless otherwise specified.

Individual Component Characteristics

Symbol	Parameters	Test Conditions	Min.	Typ.	Max.	Units
Emitter						
V_F	Input Forward Voltage	$I_F = 10 \text{ mA}$		1.4	2.0	V
		$I_F = 0.3 \text{ mA}$	0.75	1.25		
I_R	Reverse Current	$V_R = 5 \text{ V}$			10	μA
C_J	Capacitance	$V = 0, f = 1.0 \text{ MHz}$			100	pF
Detector						
V_{CC}	Operating Voltage Range		4		15	V
$I_{\text{CC(off)}}$	Supply Current	$I_F = 0, V_{\text{CC}} = 5 \text{ V}$		6	10	mA
I_{OH}	Output Current, High	$I_F = 0, V_{\text{CC}} = V_O = 15 \text{ V}$			100	μA

Electrical Characteristics (Continued) $T_A = 25^\circ\text{C}$ unless otherwise specified.**Transfer Characteristics**

Symbol	DC Characteristics	Test Conditions	Device	Min.	Typ.	Max.	Units
$I_{CC(on)}$	Supply Current	$I_F = 10\text{ mA}, V_{CC} = 5\text{ V}$	All		6.5	10.0	mA
V_{OL}	Output Voltage, Low	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}, I_F = I_{F(on)}\text{ Maximum}$	All			0.5	V
$I_{F(on)}$	Turn-On Threshold Current	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}^{(2)}$	H11N1M	0.8		3.2	mA
			H11N2M	2.3		5.0	
$I_{F(off)}$	Turn-Off Threshold Current	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}$	All	0.3			mA
$I_{F(off)} / I_{F(on)}$	Hysteresis Ratio	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}$	All	0.65		0.95	

Switching Speed

Symbol	AC Characteristics	Test Conditions	Min.	Typ.	Max.	Units
t_{on}	Turn-On Time	$C = 120\text{ pF}, t_p = 1\ \mu\text{s}, R_E = ^{(3)}$, Figure 9		100	330	ns
t_r	Rise Time	$C = 120\text{ pF}, t_p = 1\ \mu\text{s}, R_E = ^{(3)}$, Figure 9		7.5		ns
t_{off}	Turn-Off Time	$C = 120\text{ pF}, t_p = 1\ \mu\text{s}, R_E = ^{(3)}$, Figure 9		150	330	ns
t_f	Fall Time	$C = 120\text{ pF}, t_p = 1\ \mu\text{s}, R_E = ^{(3)}$, Figure 9		12		ns
	Data Rate			5		MHz

Isolation Characteristics

Symbol	Parameters	Test Conditions	Min.	Typ.	Max.	Units
V_{ISO}	Input-Output Isolation Voltage	$t = 1\text{ Minute}$	4170			$V_{AC_{RMS}}$
C_{ISO}	Isolation Capacitance	$V_{I-O} = 0\text{ V}, f = 1\text{ MHz}$		0.4	0.6	pF
R_{ISO}	Isolation Resistance	$V_{I-O} = \pm 500\text{ VDC}, T_A = 25^\circ\text{C}$	10^{11}			Ω

Notes:

- Maximum $I_{F(on)}$ is the maximum current required to trigger the output. For example, a 3.2 mA maximum trigger current would require the LED to be driven at a current greater than 3.2 mA to guarantee the device will turn on. A 10% guard band is recommended to account for degradation of the LED over its lifetime. The maximum allowable LED drive current is 30 mA.
- H11N1: $R_E = 910\ \Omega$, H11N2: $R_E = 560\ \Omega$

Typical Performance Curves

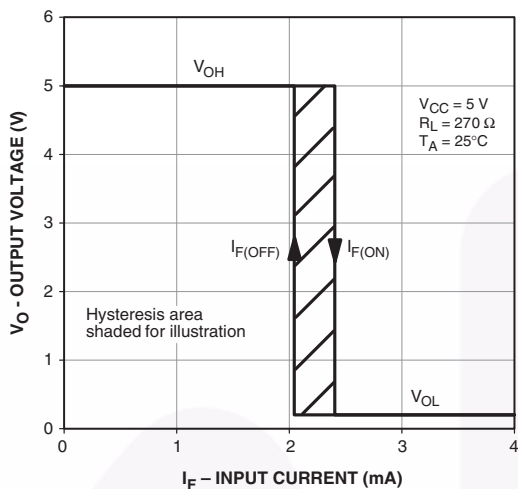


Figure 3. Transfer Characteristics

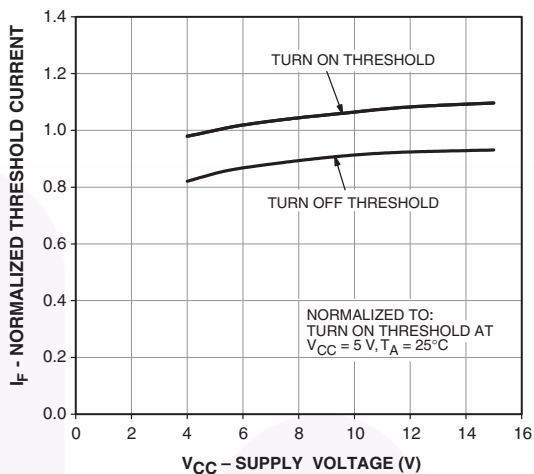


Figure 4. Threshold Current vs. Supply Voltage

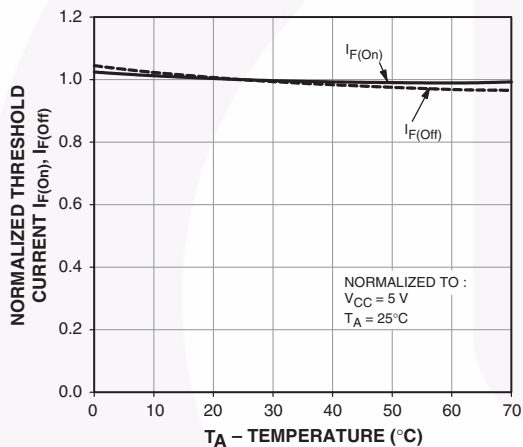


Figure 5. Threshold Current vs. Temperature

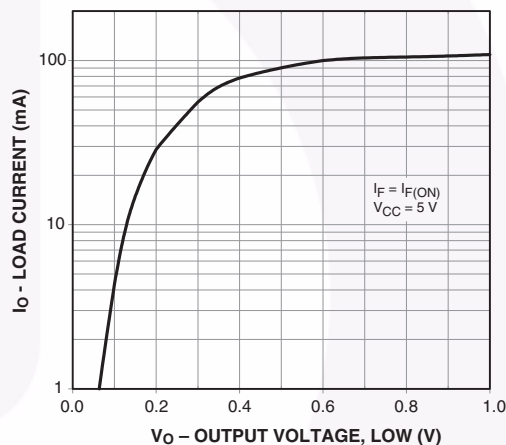


Figure 6. Load Current vs. Output Voltage

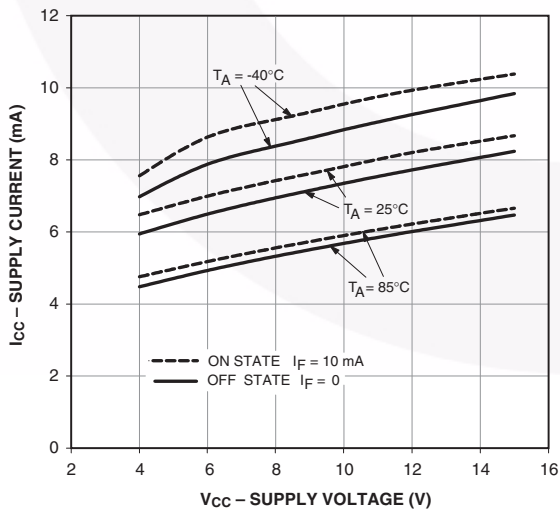


Figure 7. Supply Current vs. Supply Voltage

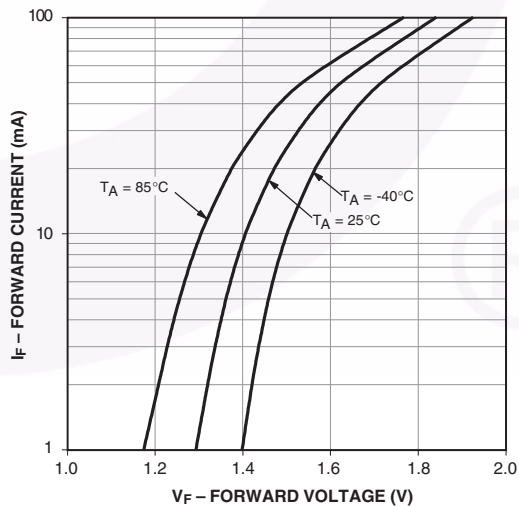


Figure 8. LED Forward Current vs. Forward Voltage

Switching Test Circuit and Waveforms



Figure 9. Switching Test Circuit and Waveforms

Reflow Profile



Figure 10. Reflow Profile

Ordering Information

Part Number	Package	Packing Method
H11N1M	DIP 6-Pin	Tube (50 Units)
H11N1SM	SMT 6-Pin (Lead Bend)	Tube (50 Units)
H11N1SR2M	SMT 6-Pin (Lead Bend)	Tape and Reel (1000 Units)
H11N1VM	DIP 6-Pin, DIN EN/IEC60747-5-5 Option	Tube (50 Units)
H11N1SVM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tube (50 Units)
H11N1SR2VM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tape and Reel (1000 Units)
H11N1TVM	DIP 6-Pin, 0.4" Lead Spacing, DIN EN/IEC60747-5-5 Option	Tube (50 Units)

Note:

4. The product orderable part number system listed in this table also applies to the H11N2M product families.

Marking Information



Figure 11. Top Mark

Table 1. Top Mark Definitions

1	Fairchild Logo
2	Device Number
3	DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)
4	One-Digit Year Code, e.g., "6"
5	Digit Work Week, Ranging from "01" to "53"
6	Assembly Package Code



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