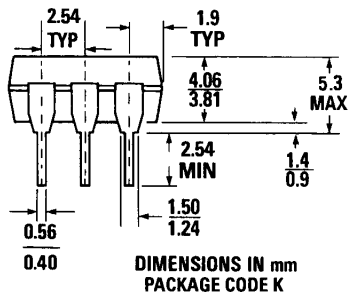
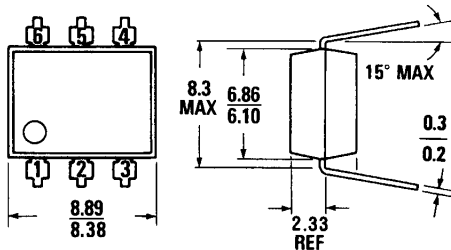




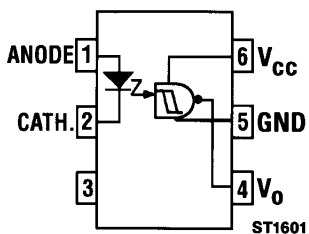
# THE DATASHEET OF H11N1



**PACKAGE DIMENSIONS**



ST1603A



Equivalent Circuit

**DESCRIPTION**

The H11N series has a medium-to-high speed integrated circuit detector optically coupled to a gallium-aluminum-arsenide 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.

**FEATURES & APPLICATIONS**

- 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
- High common mode transient immunity 2000 V/ $\mu$ s minimum
- Fast switching:  $t_r, t_f = 10$  ns typical
- Wide supply voltage capability, compatible with all popular logic systems
- Underwriters Laboratory (UL) recognized — file #E90700
- Logic to logic isolator
- Programmable current level sensor
- Line receiver—eliminates noise and transient problems
- Logic level shifter—couples TTL to CMOS
- A.C. to TTL conversion—square wave shaping
- Isolated power MOS driver for power supplies
- Interfaces computers with peripherals

**ABSOLUTE MAXIMUM RATINGS**

**TOTAL PACKAGE**

Storage temperature . . . . .  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$   
 Operating temperature . . . . .  $-25^{\circ}\text{C}$  to  $85^{\circ}\text{C}$   
 Lead solder temperature . . . . .  $260^{\circ}\text{C}$  for 10 sec

**INPUT DIODE**

Power dissipation ( $25^{\circ}\text{C}$  ambient) . . . . . 50 mW  
 Derate linearly (above  $70^{\circ}\text{C}$ ) . . . . .  $1.67\text{ mW}/^{\circ}\text{C}$   
 Continuous forward current . . . . . 30 mA  
 Peak forward current  
 ( $300\mu\text{s}$  pulse, 2% duty cycle) . . . . . 50 mA  
 Reverse voltage . . . . . 6 V

**DETECTOR**

Power dissipation (at  $25^{\circ}\text{C}$  ambient) . . . . . 150 mW  
 Derate linearly (above  $25^{\circ}\text{C}$  ambient) . . . . .  $5\text{ mW}/^{\circ}\text{C}$   
 $V_{as}$  allowed range . . . . . 0 to 16 V  
 $V_{es}$  allowed range . . . . . 0 to 16 V  
 $I_o$  output current . . . . . 50 mA

**ELECTRICAL CHARACTERISTICS** ( $T_A = 0-70^\circ\text{C}$  Unless Otherwise Specified) Note 1

**INDIVIDUAL COMPONENT CHARACTERISTICS**

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
<b>INPUT DIODE</b>						
Forward voltage	$V_F$		1.6	2.0	V	$I_F = 10\text{ mA}$
	$V_F$	0.75	1.45		V	$I_F = 0.3\text{ mA}$
Reverse current	$I_R$			10	$\mu\text{A}$	$V_R = 5\text{ V}, T_A = 25^\circ\text{C}$
	$I_R$			100	$\mu\text{A}$	$V_R = 5\text{ V}, T_A = 100^\circ\text{C}$
Capacitance	$C_J$			100	pF	$V = 0\text{ V}, f = 1\text{ MHz}$
<b>OUTPUT DETECTOR</b>						
Operating voltage range	$V_{CC}$	4		15	V	
Supply current	$I_{S(off)}$		5.5	10	mA	$I_F = 0, V_{CC} = 5\text{ V}$
Output current, high	$I_{OH}$			100	$\mu\text{A}$	$I_F = 0.3\text{ mA}, V_{CC} = V_O = 15\text{ V}$

**TRANSFER CHARACTERISTICS** ( $T_A = 0-70^\circ\text{C}$ ) Note 1

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Supply current	$I_{S(on)}$		5	10	mA	$I_F = 10\text{ mA}, V_{CC} = 5\text{ V}$
Output voltage, low	$V_{OL}$		0.3	0.5	V	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}, I_F = I_{F(on)}\text{ max.}$
Turn-on threshold current	(H11N1) $I_{F(on)}$	0.8		3.2	mA	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}$
	(H11N2) $I_{F(on)}$	2.3		5.0	mA	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}$
	(H11N3) $I_{F(on)}$	4.1		10.0	mA	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}$
Turn-off threshold current	$I_{F(off)}$	0.3	1.5		mA	$R_L = 270\ \Omega, V_{CC} = 5\text{ V}$
Hysteresis ratio	$I_{F(off)}/I_{F(on)}$	0.65	0.8	0.95		$R_L = 270\ \Omega, V_{CC} = 5\text{ V}$

<b>DYNAMIC CHARACTERISTICS</b> ( $T_A = 0-70^\circ\text{C}$ ) Note 1						
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
<b>SWITCHING SPEED (Figures 7&amp;8)</b>						
Propagation delay, high to low	$t_{PHL}$		150	330	ns	$C=120\text{ pF}$ , $t_p=1\text{ }\mu\text{s}$ , $R_E$ : Note 4
Rise time	$t_r$		10		ns	$C=120\text{ pF}$ , $t_p=1\text{ }\mu\text{s}$ , $R_E$ : Note 4
Propagation delay, low to high	$t_{PLH}$		150	330	ns	$C=120\text{ pF}$ , $t_p=1\text{ }\mu\text{s}$ , $R_E$ : Note 4
Fall time	$t_f$		15		ns	$C=120\text{ pF}$ , $t_p=1\text{ }\mu\text{s}$ , $R_E$ : Note 4
Data rate			5		MHz	Note 3
<b>OVERDRIVE SWITCHING (FIGURES 7&amp;8), NOTE 2</b>						
Turn-off time	$t_{off}$		0.2	0.5	$\mu\text{s}$	$C=0$ , $R_i=270\text{ }\Omega$ , $I_c(\text{MAX})$ H11N1: 5 mA H11N2: 10 mA H11N3: 20 mA
<b>TRANSIENT IMMUNITY (FIGURE 9)</b>						
Common mode transient immunity	$CM_H$	$\pm 2000$	$\pm 10000$		V/ $\mu\text{s}$	$V_{pk}=50\text{ V}$ , $V_{CC}=5\text{ V}$ , $R_i=270\text{ }\Omega$ , $I_F=0$
Common mode transient immunity	$CM_L$	$\pm 2000$	$\pm 10000$		V/ $\mu\text{s}$	$V_{pk}=50\text{ V}$ , $V_{CC}=5\text{ V}$ , $R_i=270\text{ }\Omega$ , $I_F=0$

<b>ISOLATION CHARACTERISTICS</b>						
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Surge isolation voltage	$V_{ISO}$	7500			$V_{PEAK}$	1 Minute
Surge isolation voltage	$V_{ISO}$	5300			$V_{RMS}$	1 Minute

<b>Notes</b>	
1.	All measurements are with 100nF bypass capacitor from pin 6 to pin 5.
2.	Steady overdrive increases $t_{off}$ . Use of a large $R_i$ and a small $C$ as in figure 7 is preferred over overdrive current.
3.	Maximum data rate will vary depending on the bias conditions and is usually highest when $R_i$ and $C$ are matched to $I_{F(OPT)}$ and $V_{CC}$ is between 5 and 15V. With this optimized bias, most units will operate at over 10 MHz, NRZ.
4.	H11N1: $R_E = 910\Omega$ , H11N2: $R_E = 560\Omega$ , H11N3: $R_E = 240\Omega$ .

**TYPICAL CHARACTERISTICS**

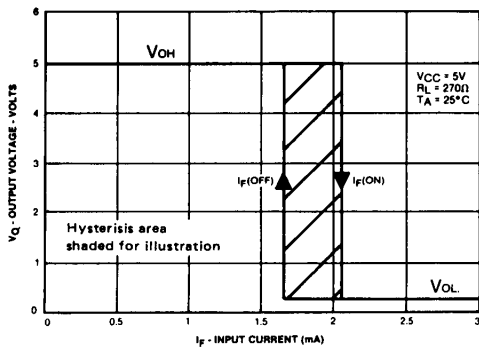


Figure 1. Transfer characteristics ST2022

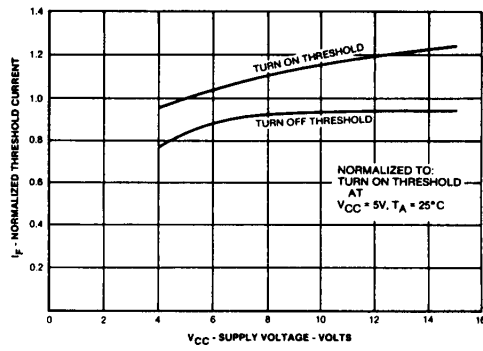


Figure 2. Threshold current vs. supply voltage ST2023

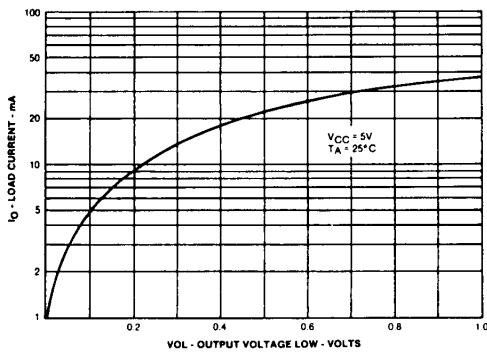


Figure 3. ON voltage vs. current ST2024

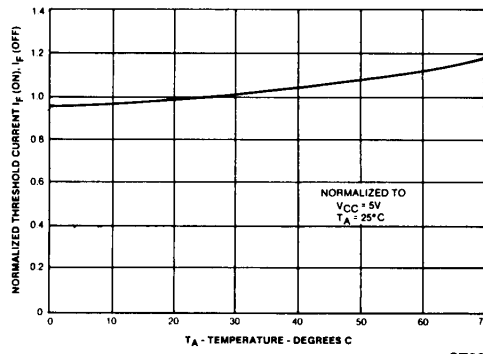


Figure 4. Threshold current vs. temperature ST2025

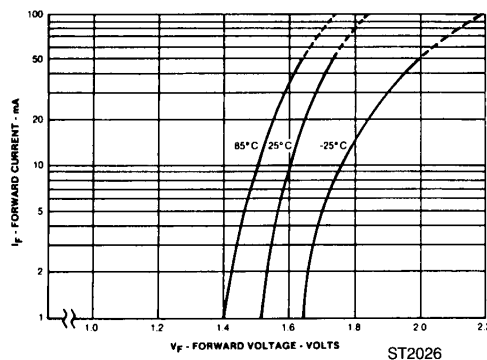


Figure 5. Forward voltage vs. forward current ST2026

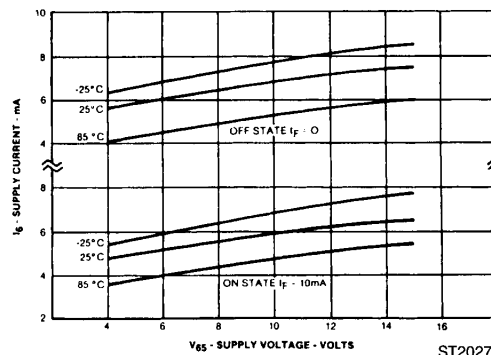
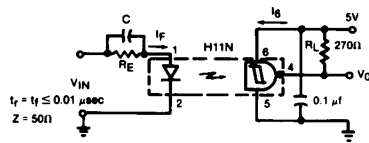


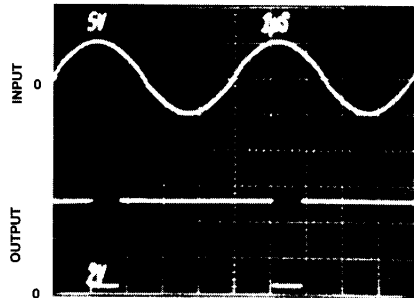
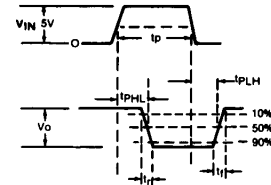
Figure 6. Supply current vs. supply voltage ST2027

**TYPICAL CHARACTERISTICS**



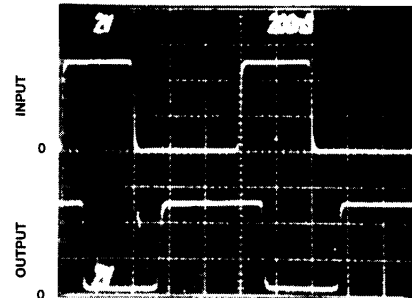
ST2028

Figure 7. Switching test circuit

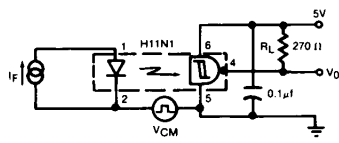


ST2029

Figure 8. Switching test waveforms

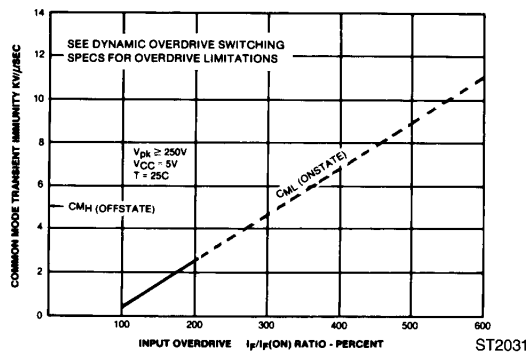
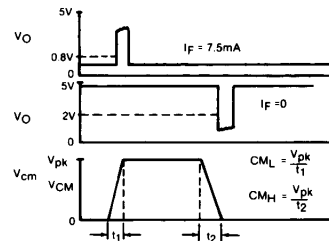


ST2030



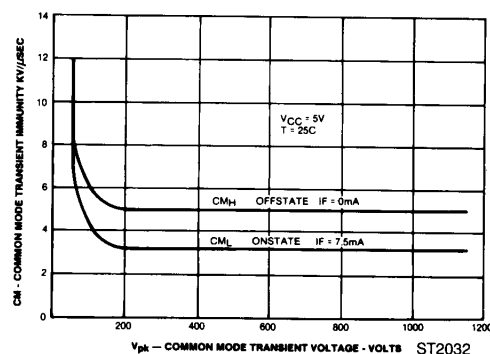
ST2030

Figure 9. Common-mode transient immunity, test circuit and voltage waveforms



ST2031

Figure 10.  $CM_L$  and  $CM_H$  input current



ST2032

Figure 11.  $CM_L$  and  $CM_H$  vs. common-mode transient voltage



## HIGH-SPEED AlGaAs SCHMITT TRIGGER OPTOCOUPLEDERS

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