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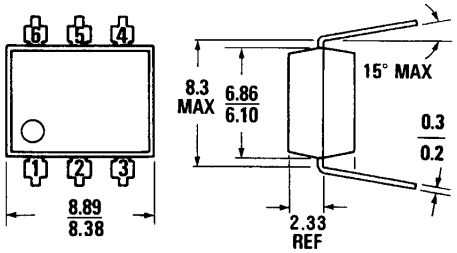
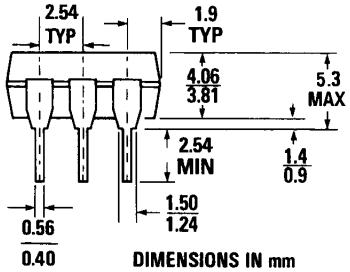
# HIGH-SPEED AlGaAS SCHMITT TRIGGER OPTOCOUPLERS

## H11N1 H11N2 H11N3

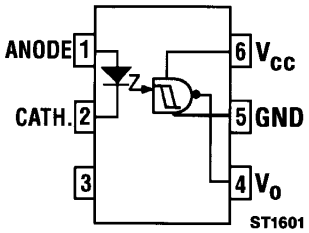
## PACKAGE DIMENSIONS




DIMENSIONS IN mm
PACKAGE CODE K

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°C to 125°C
Operating temperature ..... −25°C to 85°C
Lead solder temperature ..... 260°C for 10 sec

**INPUT DIODE**

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

**DETECTOR**

Power dissipation (at 25°C ambient) ..... 150 mW
Derate linearly (above 25°C ambient) ..... 5 mW/°C
$V_{45}$ allowed range ..... 0 to 16 V
$V_{65}$ allowed range ..... 0 to 16 V
$I_4$ output current ..... 50 mA

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## ELECTRICAL CHARACTERISTICS ($T_A$= 0-70°C Unless Otherwise Specified) Note 1

### INDIVIDUAL COMPONENT CHARACTERISTICS

| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| **INPUT DIODE** | | | | | | |
| Forward voltage | $V_F$ | | 1.6 | 2.0 | V | $I_F$=10 mA |
| | $V_F$ | 0.75 | 1.45 | | V | $I_F$=0.3 mA |
| Reverse current | $I_R$ | | | 10 | μA | $V_R$=5 V, $T_A$=25°C |
| | $I_R$ | | | 100 | μA | $V_R$=5 V, $T_A$=100°C |
| Capacitance | $C_J$ | | | 100 | pF | V=0 V, f=1 MHz |
| **OUTPUT DETECTOR** | | | | | | |
| Operating voltage range | $V_{CC}$ | 4 | | 15 | V | |
| Supply current | $I_{6(off)}$ | | 5.5 | 10 | mA | $I_F$=0, $V_{CC}$=5 V |
| Output current, high | $I_{OH}$ | | | 100 | μA | $I_F$=0.3 mA, $V_{CC}$=$V_O$=15 V |

### TRANSFER CHARACTERISTICS ($T_A$ = 0-70°C) Note 1

| CHARACTERISTIC | | SYMBOL | MIN. | TYP. | MAX. | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|---|
| Supply current | | $I_{6(on)}$ | | 5 | 10 | mA | $I_F$=10 mA, $V_{CC}$=5 V |
| Output voltage, low | | $V_{OL}$ | | 0.3 | 0.5 | V | $R_L$=270 Ω, $V_{CC}$=5 V, $I_F$=$I_{F(on)}$ max. |
| Turn-on threshold current | (H11N1) | $I_{F(on)}$ | 0.8 | | 3.2 | mA | $R_L$=270 Ω, $V_{CC}$=5 V |
| | (H11N2) | $I_{F(on)}$ | 2.3 | | 5.0 | mA | $R_L$=270 Ω, $V_{CC}$=5 V |
| | (H11N3) | $I_{F(on)}$ | 4.1 | | 10.0 | mA | $R_L$=270 Ω, $V_{CC}$=5 V |
| Turn-off threshold current | | $I_{F(off)}$ | 0.3 | 1.5 | | mA | $R_L$=270 Ω, $V_{CC}$=5 V |
| Hysteresis ratio | | $I_{F(off)}/I_{F(on)}$ | 0.65 | 0.8 | 0.95 | | $R_L$=270 Ω, $V_{CC}$=5 V |

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# HIGH-SPEED AlGaAs SCHMITT TRIGGER OPTOCOUPLERS

## DYNAMIC CHARACTERISTICS ($T_A$ = 0-70°C) Note 1

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

## ISOLATION CHARACTERISTICS

| 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 |

## Notes

1. *All measurements are with 100nF bypass capacitor from pin 6 to pin 5.*
2. *Steady overdrive increases $t_{off}$. Use of a large $R_F$ 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 $R_E$ and C are matched to $I_{F(ON)}$ and $V_{CC}$ is between 5 and 15V. With this optimized bias, most units will operate at over 10 MHz, NRZ.*
4. *H11N1: $R_E$ = 910Ω, H11N2: $R_E$ = 560Ω, H11N3: $R_E$ = 240Ω.*

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# OPTOISOLATOR SPECIFICATIONS

## TYPICAL CHARACTERISTICS

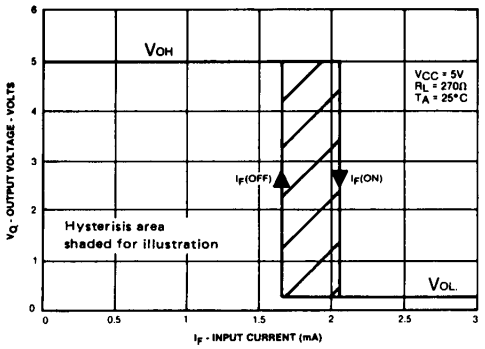



Figure 1. Transfer characteristics ST2022

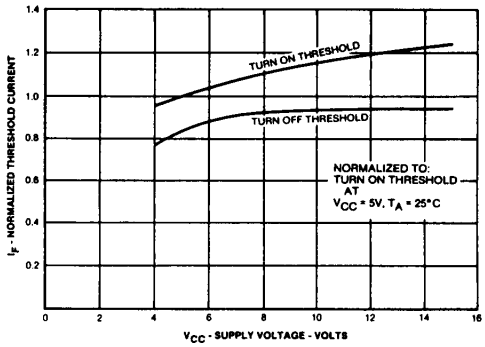



Figure 2. Threshold current vs. supply voltage ST2023

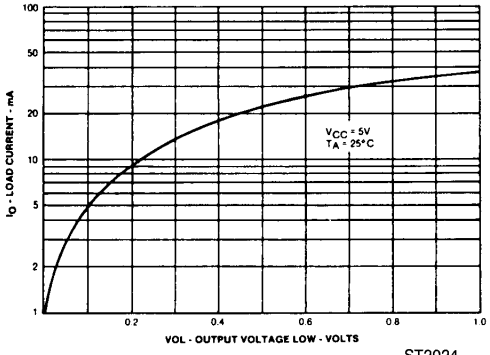



Figure 3. ON voltage vs. current ST2024

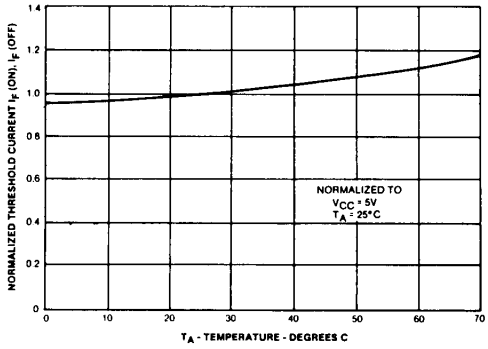



Figure 4. Threshold current vs. temperature ST2025

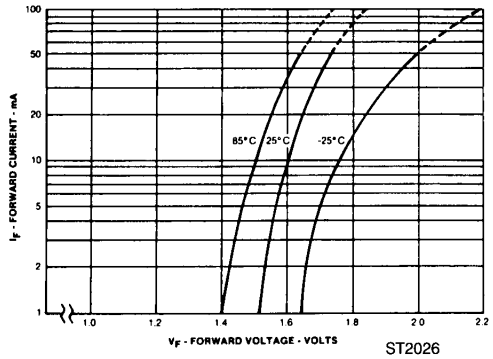



Figure 5. Forward voltage vs. forward current ST2026

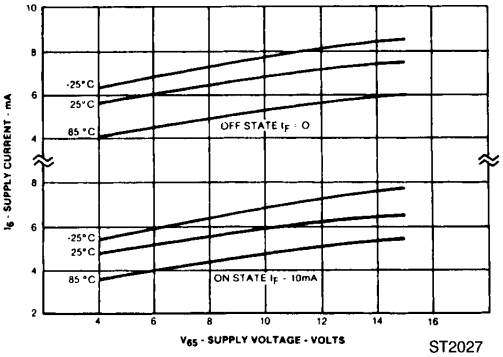
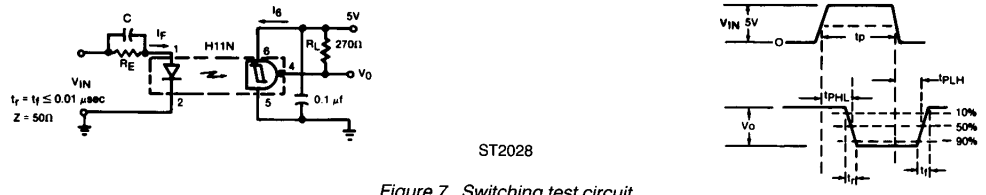


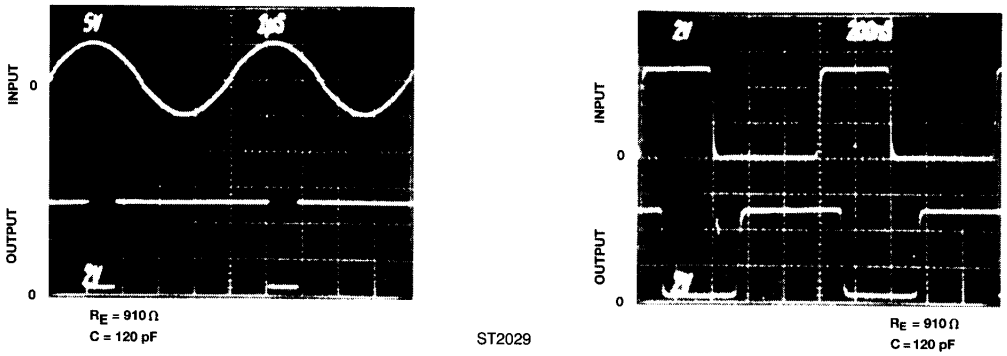

Figure 6. Supply current vs. supply voltage ST2027

## TYPICAL CHARACTERISTICS




ST2028

*Figure 7. Switching test circuit*

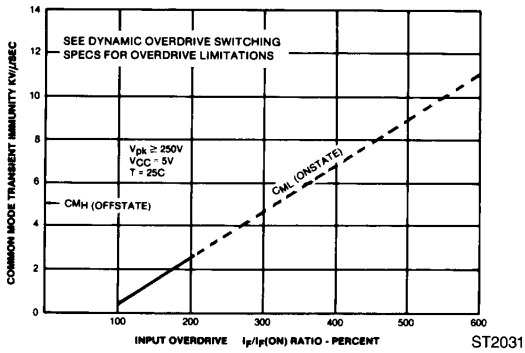



ST2029

*Figure 8. Switching test waveforms*

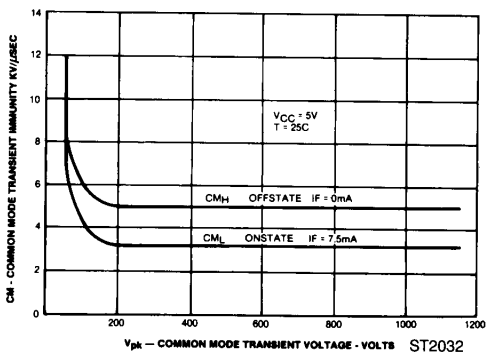

ST2030

*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*

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