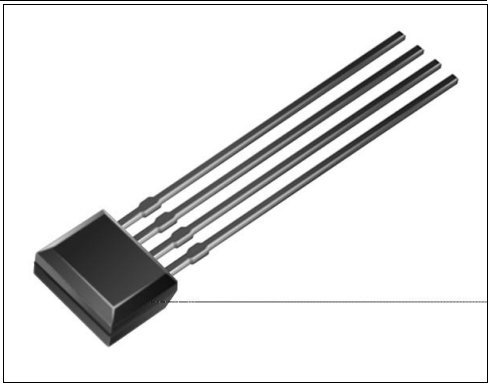
HLC2701

Encoder Detector

FEATURES

- Side-looking plastic package
- TTL/LSTTL/CMOS compatible
- Inverting logic output
- Linear or rotary encoder applications
- Resolution to 0.009 in.(.229 mm)
- Sensitivity versus temperature compensation
- Mechanically and spectrally matched to SEP8506 and SEP8706 infrared emitting diodes



INFRA-74.TIF

DESCRIPTION

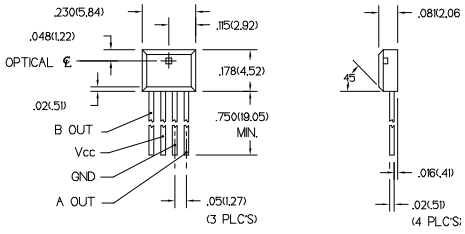
The HLC2701 detector is designed to sense speed and direction of mechanical motion. Applications include rotary and linear encoders; the device is especially well suited for the encoding function in an optical mouse. The detector is a monolithic IC, consisting of two narrow adjacent photodiodes, amplifiers, and Schmitt trigger output stages. The outputs are NPN collectors with internal 10 kΩ (nominal) pull- up resistors to V_{CC} which can directly drive TTL loads. It incorporates circuitry to compensate the sensitivity for the output power versus temperature characteristics of an IRED. The IC is encapsulated in a molded, unlensed black plastic package which is transmissive to IR energy, yet provides shielding from visible light.

In a typical application, the HLC2701 is used in conjunction with an IRED and an encoder disk or linear encoder strip attached to an element for which speed and direction of movement is to be sensed. As the interruptive pattern moves, the sensor provides two phase shifted output signals (active low) which can be processed to provide the speed and direction information.

The sensing areas of the IC are each 0.008 in.(.203 mm) in width and in .015in.(.381 mm) in height with a 0.001 in.(.0254 mm) separation, for center- to- center spacing of 0.009 in.(.203 mm), and outside edge to edge distance of 0.017 in.(.432 mm).

OUTLINE DIMENSIONS in inches (mm)

Tolerance	3 plc decimals	±0.005(0.12)
	2 plc decimals	±0.020(0.51)



DIM_030.cdr

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HLC2701

Encoder Detector

ELECTRICAL CHARACTERISTICS (-40°C to +85°C unless otherwise noted)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Operating Supply Voltage	V_{CC}	4.5		5.5	V	
Turn-on Threshold Irradiance [2]	$E_{eT(+)}$				mW/cm²	V_{CC}=5 V
HLC2701-001		0.05		2.0		T_A=25°C
Hysteresis [3]	HYST		28		%	
Supply Current	I_{CC}			7.0	mA	V_{CC}=5.25 V
High Level Output Voltage (A and B)	V_{OH}	2.4			V	V_{CC}=5 V I_{OH}=0, Ee=0
Low Level Output Voltage (A and B)	V_{OL}			0.4	V	V_{CC}=5 V, I_{OL}=1.6 mA Ee=2.0 mW/cm²
Internal Pull-Up Resistor	R_{INT}	5.0	10.0	20.0	kΩ	
Operate Point Temperature Coefficient	O_{PTC}		-0.76		%/°C	Emitter @ Constant Temperature
Output Rise Time, Output Fall Time	t_r, t_f		100		ns	V_{CC}=5 V R_L=1 kΩ T_A=25°C
Propagation Delay, Low-High, High-Low	t_{PLH}, t_{PHL}		5.0		µs	V_{CE}=5 V R_L=1 kΩ T_A=25°C

Notes
1. It is recommended that a bypass capacitor, 0.1 µF typical, be added between V_{CC} and GND near the device in order to stabilize power supply line.
2. The radiation source is an IRED with a peak wavelength of 880 nm.
3. Hysteresis is defined as the difference between the operating and release threshold intensities, expressed as a percentage of the operate threshold intensity.

ABSOLUTE MAXIMUM RATINGS

(25°C Free-Air Temperature unless otherwise noted)

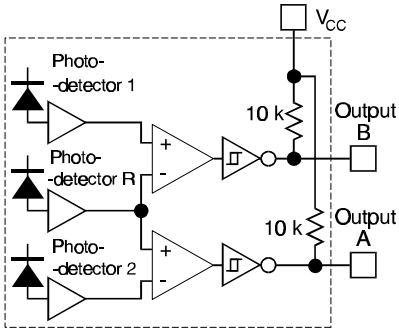
Duration of Output	
Short to V_{CC} or Ground	1.0 sec.
Operating Temperature Range	-40°C to 85°C
Storage Temperature Range	-40°C to 85°C
Soldering Temperature (5 sec)	240°C

HLC2701

Encoder Detector

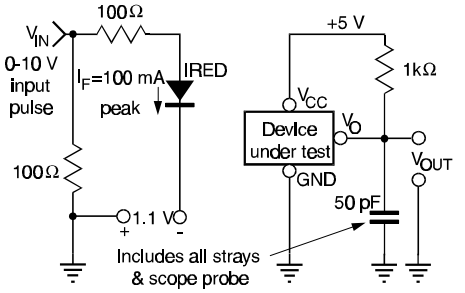
FUNCTIONAL BLOCK DIAGRAM

SCH_045.cdr



SWITCHING TIME TEST CIRCUIT

cir_014.cdr



SWITCHING WAVEFORM

cir_011.cdr

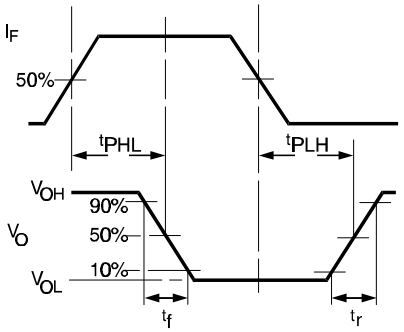


Fig. 1 Responsivity vs Angular Displacement

gra_066.ds4

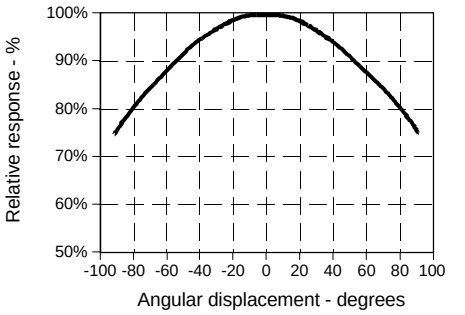


Fig. 2 Threshold Irradiance vs Temperature

gra_060.ds4

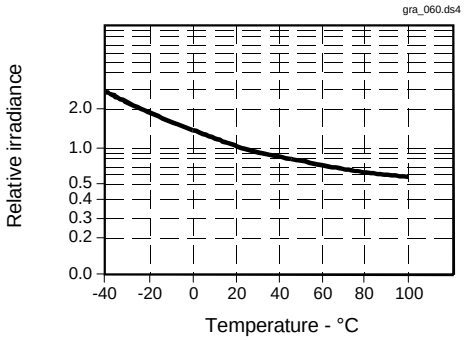
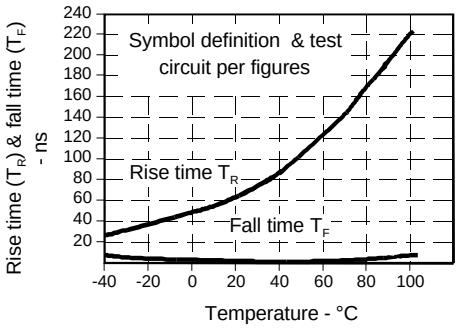


Fig. 3 Output Rise Time (t_r) and Output Fall Time (t_f) vs Temperature

gra_061.ds4



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HLC2701
Encoder Detector

Fig. 4 Delay Time vs Temperature

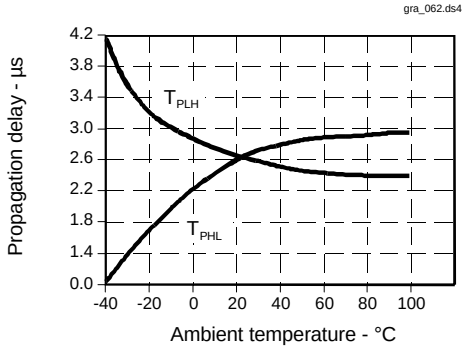
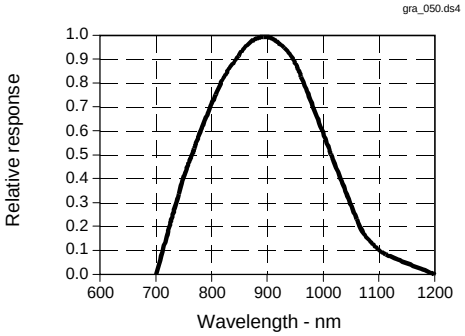


Fig. 5 Spectral Responsivity



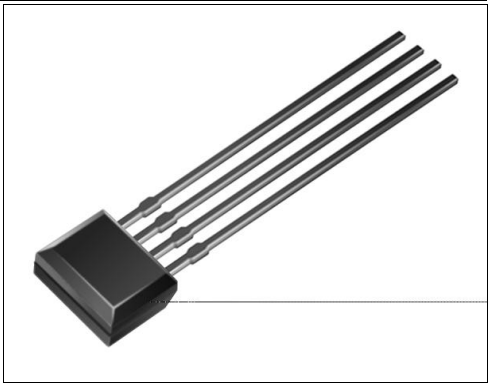
All Performance Curves Show Typical Values

HLC2705

Encoder Detector

FEATURES

- Side-looking plastic package
- TTL/LSTTL/CMOS compatible
- On-chip quadrature logic which provides tach and direction outputs
- Linear or rotary encoder applications
- Resolution to 0.018 in.(.457)
- Sensitivity versus temperature compensation
- Mechanically and spectrally matched to SEP8506 and SEP8706 infrared emitting diodes



INFRA-74.TIF

DESCRIPTION

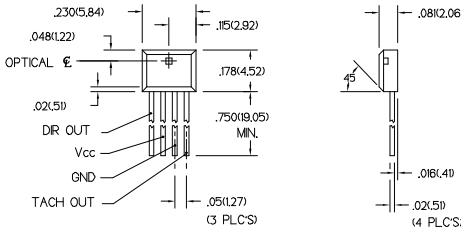
The HLC2705 detector is designed to sense speed and direction of mechanical motion. Applications include rotary and linear encoders; the device is especially well suited for the encoding function in an optical mouse. The detector is a monolithic IC, consisting of two narrow adjacent photodiodes, amplifier stages, and quadrature logic which provides two outputs. One is a fixed duration, low level active tachometer (counting) pulse. It is generated whenever the "A" channel illumination passes through the threshold level. The second is a direction output which is set to a logic high or a logic low depending upon which channel is illuminated first. The sensor also has sensitivity compensation circuitry for the output power versus temperature characteristic of an IRED. The IC is encapsulated in a molded, unlensed black plastic package which is transmissive to IR energy, yet provides shielding from visible light.

The tachometer output is an NPN collector, internally connected to V_{CC} through a 10 kΩ (nominal) resistor. The direction output is a totem-pole configuration. Both are capable of directly driving TTL loads.

The tachometer pulse is generated at both the increasing and decreasing illumination thresholds of the "A" channel, resulting in two tachometer pulses for each mechanical period of the interrupter. The HLC2705 is designed to work with a mechanical period as small as 0.036 in.(0.914 mm), providing resolution to 0.018 in.(0.457 mm).

OUTLINE DIMENSIONS in inches (mm)

Tolerance	3 plc decimals	±0.005(0.12)
	2 plc decimals	±0.020(0.51)



DIM_031.cdr

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HLC2705

Encoder Detector

ELECTRICAL CHARACTERISTICS (-40°C to +85°C unless otherwise noted)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Operating Supply Voltage	V_{CC}	4.5		5.5	V	
Turn-on Threshold Irradiance HLC2705-001	$E_{eT(+)}$	0.05		2.0	mW/cm²	V_{CC}=5 V, T_A=25°C (1)
Supply Current	I_{CC}			12.0	mA	V_{CC}=5.25 V
Tach Output, inactive	$V_{OL,TACH}$	4.5			V	V_{CC}=5 V, I_{OH}=0
Tach Pulse Level, active				0.4	V	V_{CC}=5 V, I_{OL}=1.6 mA
Direction Output, B leads A	$V_{OH,DIR}$	2.4			V	V_{CC}=5 V, I_{OH}=10 µA
Direction Output, A leads B	$V_{OL,DIR}$			0.4	V	V_{CC}=5 V, I_{OL}=1.6 mA
Tach Pulse Width	T_{PW}	3.0		20	µs	V_{CC}=5 V, I_{OL}=1.6 mA
Operate Point Temperature Coefficient	O_{PTC}		-0.76		%/°C	Emitter @ Constant Temperature

Notes
1. The radiation source is an IRED with a peak wavelength of 880 nm.

ABSOLUTE MAXIMUM RATINGS

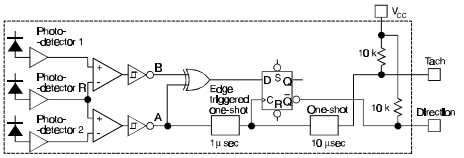
(25°C Free-Air Temperature unless otherwise noted)

Duration of Output	
Short to V_{CC} or Ground	1.0 sec.
Operating Temperature Range	-40°C to 85°C
Storage Temperature Range	-40°C to 85°C
Soldering Temperature (5 sec)	240°C

HLC2705
Encoder Detector

FUNCTIONAL BLOCK DIAGRAM

SCH_046.cdr



OUTPUT TIMING DIAGRAM

cir_012.cdr

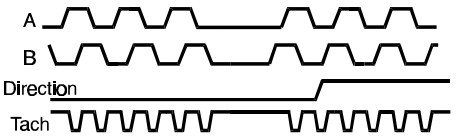


Fig. 1 Responsivity vs Angular Displacement

gra_066.ds4

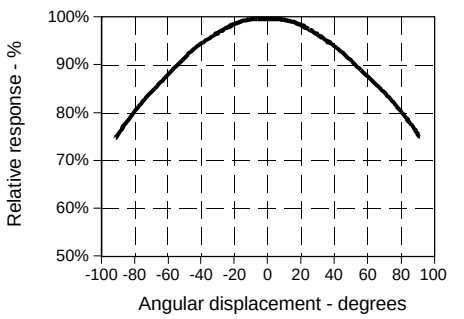
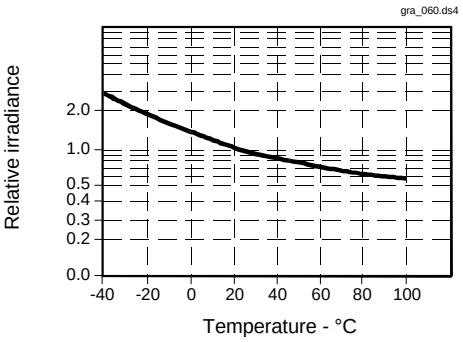


Fig. 2 Threshold Irradiance vs Temperature

gra_060.ds4



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