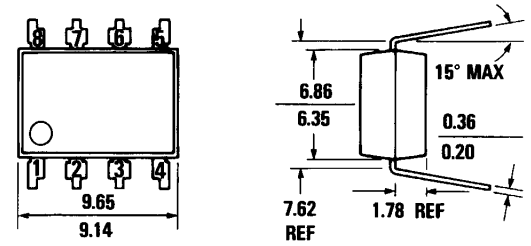
QT OPTOELECTRONICS

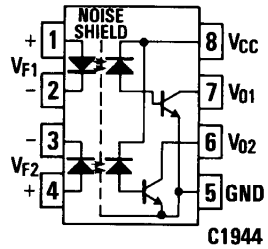
DUAL HIGH-SPEED TRANSISTOR OPTOCOUPLERS

HCPL-2530 HCPL-2531

PACKAGE DIMENSIONS



DIMENSIONS IN mm
PACKAGE CODE D



Equivalent Circuit

DESCRIPTION

The HCPL-2530/31 dual optocouplers contain two completely separated 700 nm GaAsP LED emitters each optically coupled to a high speed photodetector transistor.

A separate pin for the bias of the photodiodes improves the speed by several orders of magnitude by reducing the base-collector capacitance.

An internal noise shield provides superior common mode rejection of 10 kV/μs. An improved package allows superior insulation permitting a 480 V working voltage compared to industry standard of 220 V.

FEATURES

- High speed 1 MBit/s
- Superior CMR—10 kV/μs
- Double working voltage—480 V RMS
- CTR guaranteed 0-70°C
- U.L. recognized (File #E50151)

APPLICATIONS

- Line receivers
- Pulse transformer replacement
- Output interface to CMOS-LSTTL-TTL
- Wide bandwidth analog coupling

ABSOLUTE MAXIMUM RATINGS

TOTAL PACKAGE

Storage temperature ..... −55°C to 125°C
Operating temperature ..... −55°C to 100°C
Lead solder temperature ..... 260°C for 10s

INPUT DIODE

Average forward input current (each channel) ..... 25 mA (1)
Peak forward input current (each channel) ..... 50 mA (2) (50% duty cycle, 1 ms pulse width)
Peak transient input current—I_F (each channel) (≤1μs P.W., 300 ..... 1.0 A
Reverse input voltage (each channel) ..... 5 V
Input power dissipation (each channel) ..... 45 mW (3)

OUTPUT TRANSISTOR

Average output current (each channel) ..... 8 mA
Peak output current (each channel) ..... 16 mA
Supply voltage - V_{CC} (Pin 8-5) ..... −0.5 V to 30 V
Output voltage - V_O (Pin 7, 6-5) ..... −0.5 V to 20 V
Output power dissipation (each channel) ..... 35 mW (4)

ELECTRICAL CHARACTERISTICS (T_A=0°C to 70°C Unless Otherwise Specified)

INDIVIDUAL COMPONENT CHARACTERISTICS

PARAMETER	SYM.	DEVICE HCPL	MIN.	TYP.*	MAX.	UNITS	TEST CONDITIONS	FIG.	NOTE
DIODE Input forward Voltage	V_F			1.5	1.7	V	I_F=16 mA, T_A=25°C	3	5
Input reverse breakdown volt.	B_{VR}		5			V	I_R=10 μA		5
Temp. coefficient of forward volt.	$\frac{\Delta V_F}{\Delta T_A}$			−1.6		mV/°C	I_F=16 mA		5
DETECTOR Logic high output current	I_{OH}			.02	500	nA	$I_{F1}=I_{F2}$=0 mA, T_A=25°C $V_{O1}=V_{O2}=V_{CC}$=5.5 V	6	5
					10	μA	$I_{F1}=I_{F2}$=0 mA $V_{O1}=V_{O2}=V_{CC}$=15 V		5
Logic low supply current	I_{CCL}			80		μA	$I_{F1}=I_{F2}$=16 mA, V_{CC}=15 V $V_{O1}=V_{O2}$=Open		
Logic high supply current	I_{CCH}			.01	4	μA	$I_{F1}=I_{F2}$=0 mA, V_{CC}=15 V $V_{O1}=V_{O2}$=Open		

TRANSFER CHARACTERISTICS

DC CHARACTERISTICS	SYM.	DEVICE HCPL	MIN.	TYP.*	MAX.	UNITS	TEST CONDITIONS	FIG.	NOTE
Current transfer ratio	CTR	2530	7	18		%	I_F=16 mA T_A=25°C, V_O=0.5 V, V_{CC}=4.5 V	1,2	5,6
		2531	19						
		2530	5	21			I_F=16 mA, V_O=0.5 V, V_{CC}=4.5 V	1,2	5,6
		2531	15						
Logic low output voltage	V_{OL}	2530		.1	0.5	v	I_F=16 mA I_O=1.1 mA, V_{CC}=4.5 V T_A=25°C		5
		2531		.1	0.5	V	I_F=16 mA I_O=2.4 mA, V_{CC}=4.5 V T_A=25°C		

SWITCHING CHARACTERISTICS (T_A=25°C V_{CC}=5.0 V)

PARAMETER	SYM.	DEVICE HCPL	MIN.	TYP.*	MAX.	UNITS	TEST CONDITIONS	FIG.	NOTE
Propagation delay time (For output low level)	t_{PLH}	2530		0.5	1.5	μs	I_F=16 mA, R_L=4.1 kΩ	5,11	10,11
		2531		0.3	0.8	μs	I_F=16 mA, R_L=1.9 kΩ		
Propagation delay time (For output high level)	t_{PHL}	2530		0.2	1.5	μs	I_F=16 mA, R_L=4.1 kΩ	5,11	10,11
		2531		0.1	0.8	μs	I_F=16 mA, R_L=1.9 kΩ		
Common mode transient immunity at logic high level output	CM_H	2530	1000	10000		V/μs	R_L=4.1 kΩ R_L=1.9 kΩ	I_F=0 mA, V_{CM}=10 V_{p-p}	10	9,10,11
		2531	1000	10000						
Common mode transient immunity at logic low level output	CM_L	2530	−1000	−10000		V/μs	R_L=4.1 kΩ R_L=1.9 kΩ	I_F=16 mA, V_{CM}=10 V_{p-p}	10	9,10,11
		2531	−1000	−10000						
Bandwidth	BW			3		MHz	R_L=100 Ω		9	12

**All typicals at T_A=25°C*

ISOLATION CHARACTERISTICS

CHARACTERISTICS	SYM.	DEVICE HCPL	MIN.	TYP.*	MAX.	UNITS	TEST CONDITIONS	FIG.	NOTE
Input capacitance	C_{IN}			60		pF	V_F=0 V, f=1 MHz		5
Withstand Insulation test voltage	V_{ISO}		2500			V_{RMS}	RH≤50% T_A=25°C, t=1 min		7,13
Resistance (input-output)	R_{I-O}			10^{12}		Ω	V_{I-O}=500 VDC		7
Capacitance (input-output)	C_{I-O}			0.6		pF	f=1 MHz		7
Input-Input insulation leakage current	I_{I-I}			0.005		μA	RH≤50% V_{I-I}=500 VDC t=5 s		8
Resistance (input-input)	R_{I-I}			10^{11}		Ω	V_{I-I}=500 VDC		8
Capacitance (input-input)	C_{I-I}			0.25		pF	f=1 MHz		8

**All typicals at T_A=25°C*

NOTES

1. *Derate linearly above 70°C free-air temperature at a rate of 0.8 mA/°C.*
2. *Derate linearly above 70°C free-air temperature at a rate of 1.6 mA/°C.*
3. *Derate linearly above 70°C free-air temperature at a rate of 0.9 mW/°C.*
4. *Derate linearly above 70°C free-air temperature at a rate of 1.0 mW/°C.*
5. *Each channel.*
6. *CURRENT TRANSFER RATIO is defined as the ratio of output collector current, I_O, to the forward LED input current, I_F, times 100%.*
7. *Device considered a two-terminal device: Pins 1, 2, 3, and 4 shorted together and Pins 5, 6, 7, and 8 shorted together.*
8. *Measured between pins 1 and 2 shorted together, and pins 3 and 4 shorted together.*
9. *Common mode transient immunity in Logic High level is the maximum tolerable (positive) dV_{CM}/dt on the leading edge of the common mode pulse V_{CM}, to assure that the output will remain in a logic High State (i.e., V_O) 2.0 V). Common mode transient immunity in Logic Low level is the maximum tolerable (negative) dV_{CM}/dt on the trailing edge of the common mode pulse signal, V_{CM} to assure that the ouput will remain in a Logic Low state (i.e., V_O (0.8 V).*
10. *The 1.9 KΩ load represents 1 TTL unit load of 1.6 mA and the 5.6 KΩ pull-up resistor.*
11. *The 4.1 KΩ load represents 1 LSTTL unit load of 0.36 mA and 6.1 KΩ pull-up resistor.*
12. *The frequency at which the ac output voltage is 3dB below the low frequency asymptote.*
13. *The 2500 V_{RMS}/1 min capability is validated by a factory 3.1 kV_{RMS}/1 sec dielectric voltage withstand test.*

TYPICAL ELECTRO-OPTICAL CHARACTERISTICS (T_A=25° Unless Otherwise Specified)

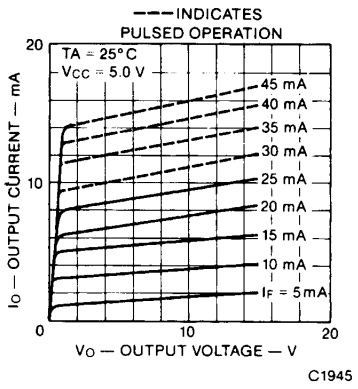


Fig. 1. DC and Pulsed Transfer Characteristics

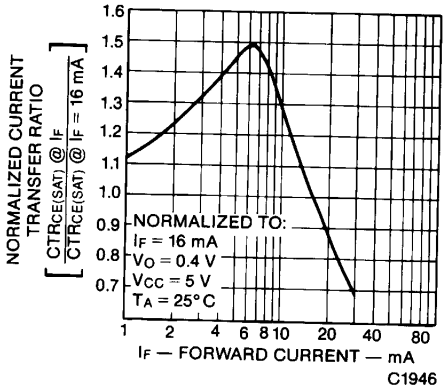


Fig. 2. Normalized Current Transfer Ratio vs. Forward Current

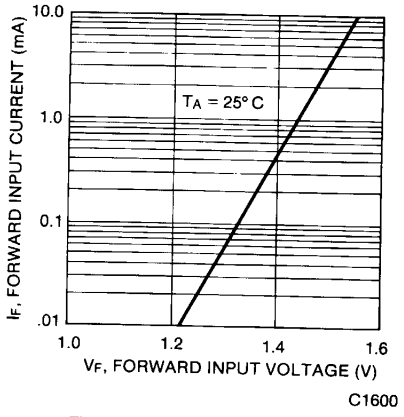


Fig. 3. Forward Input Current vs. Forward Input Voltage

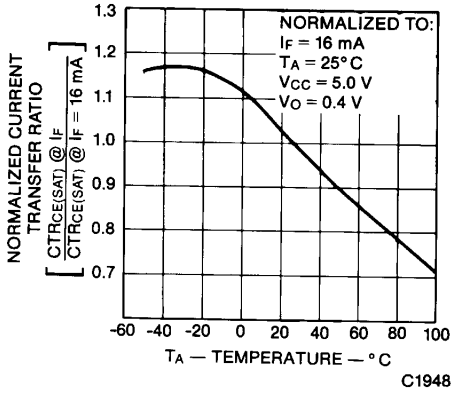


Fig. 4. Normalized Current Transfer Ratio vs. Temperature

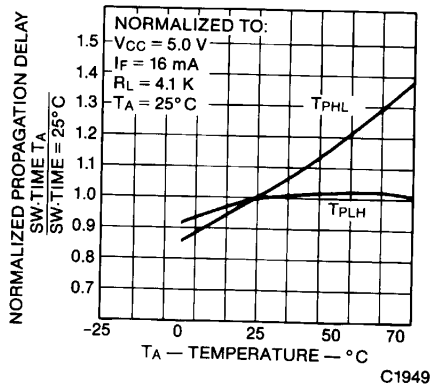


Fig. 5. Normalized Propagation Delay vs. Temperature

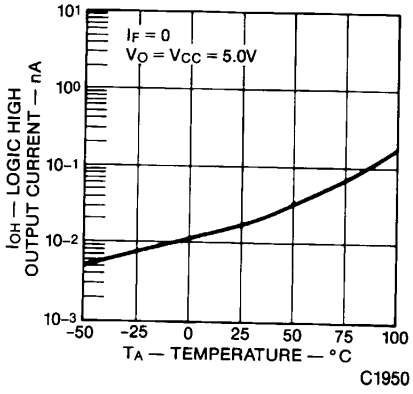


Fig. 6. Logic High Output Current vs. Temperature

TYPICAL ELECTRO-OPTICAL CHARACTERISTICS
(T_A=25° Unless Otherwise Specified) (Cont'd)

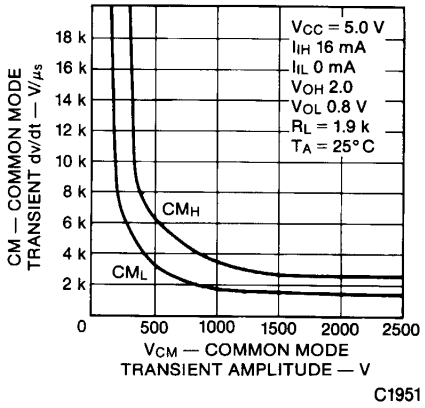


Fig. 7. Common Mode Transient Immunity vs. Common Mode Transient Amplitude

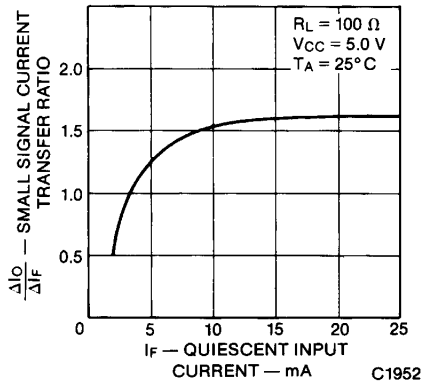
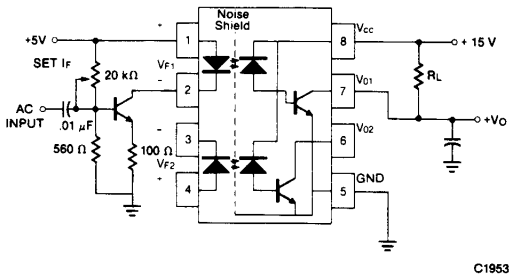


Fig. 8. Small Signal Transfer Ratio vs. Quiescent Input Current



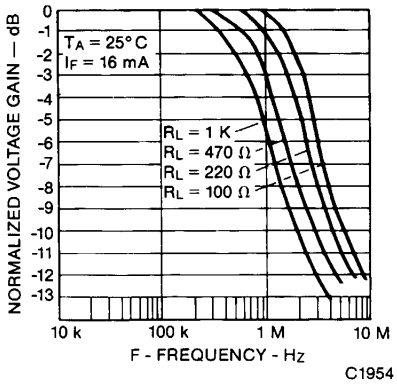
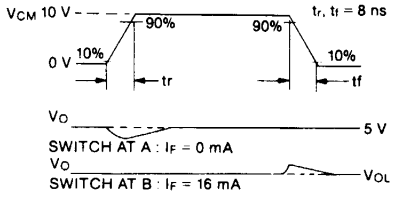


Fig. 9. Frequency Response



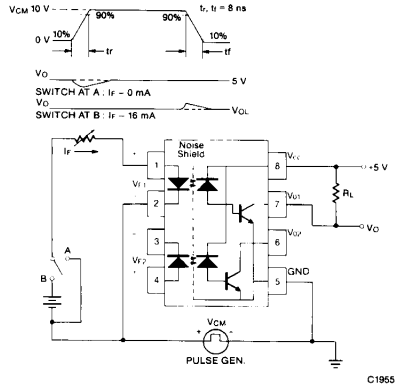
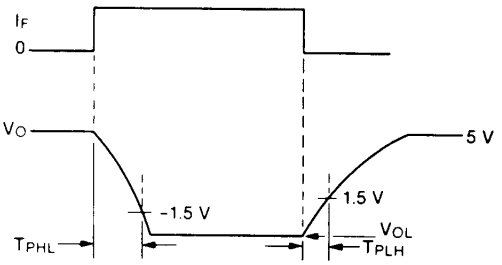


Fig. 10. Test Circuit for Transient Immunity and Typical Waveforms

TYPICAL ELECTRO-OPTICAL CHARACTERISTICS
(T_A=25° Unless Otherwise Specified) (Cont'd)



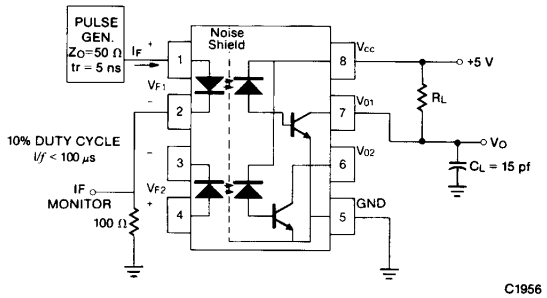


Fig. 11. Switching Test Circuit