HEWLETT® PACKARD

High Speed Optocouplers

Technical Data

CNW135A*
CNW136A*
CNW4502A*
CNW4503

Features

- **5000 Vrms/1 Minute Insulation Withstand Capability**
- **Worldwide Safety Approval**
  UL1577 (File No. E55361)
  VDE 0884 Certification
  (V_{IORM} = 1 kV_{RMS})
  BSI according to
  BS 415/7002/EN41003
  FIMKO/SETI-SEMKO-
  NEMKO DEMKO according
  to IEC 65/950/335
  CSA Certified-Component
  Acceptance Notice #5 (File
  CA8832A)
- **High Speed: 1 Mbit/s**
- **TTL Compatible**
- **Performance Guaranteed over Temperature 0°C to 70°C**
- **Pin Compatible with 6N135A/6A and HCPL-4502A/3**
- **Very High Common Mode Rejection for CNW4503**
- **Line Receivers (15 K V/μs Common Mode Transient Immunity and Low Input-Output Capacitance of 0.6 pF)**
- **Analog Signal Ground Isolation (Integrated Photon Detector Provides Improved Linearity over Phototransistor Type)**

*Formerly CNW135, CNW136, CNW4502.

Applications

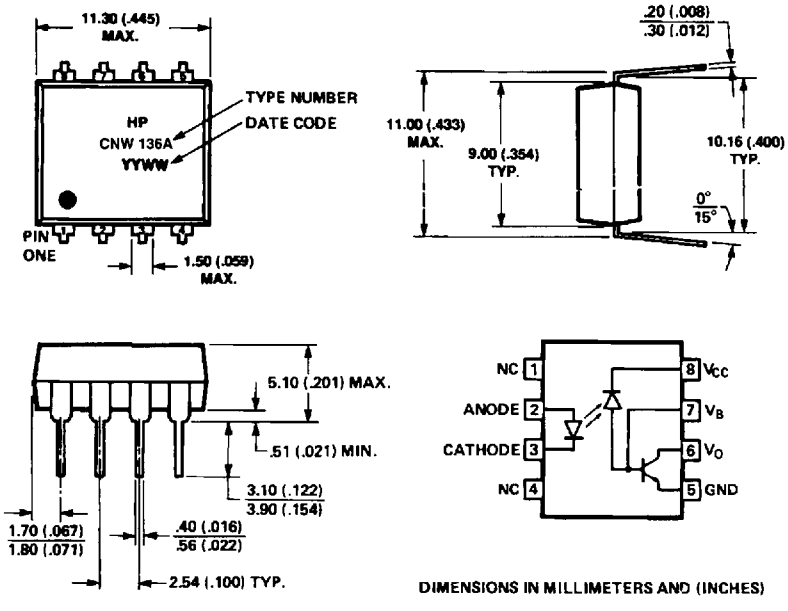
- **High Voltage Insulation**
- **Video Signal Isolation**
- **Feedback Element in Switched Mode Power Supplies**
- **High Speed Logic Ground Isolation – TTL/TTL, TTL/CMOS, TTL/LSTTL**
- **Power Transistors Isolation in Motor Drives**
- **Replaces Pulse Transformers**
- **Replaces Slow Photo-Transistor Isolators (Pins 2-7 of the CNW135A/6A**

Conforms to Pins 1-6 of 6 Pin Phototransistor Couplers. Pin 8 can be Tied to any Available Bias Voltage of 1.5 V to 30 V for High Speed Operation)

Description

These devices are high voltage and fast switching optocouplers consisting of an AlGaAs LED and a silicon photodetector. A wide body encapsulation is used to provide creepage and clearance dimensions suitable for safety approval by regulatory agencies worldwide.

Package Outline



DIMENSIONS IN MILLIMETERS AND (INCHES)

The CNW135A is for use in TTL/CMOS, TTL/LSTTL or wide bandwidth analog applications.

Current transfer ratio (CTR) for the CNW135A is 7% minimum at I_F = 16 mA.

The CNW136A is designed for high speed TTL/TTL applications. A standard 16 mA TTL sink current through the input LED will provide enough output current for 1 TTL load and a 5.6K pullup resistor. CTR of the CNW136A is 19% minimum at I_F = 16 mA. Selection for higher CTR is available.

The CNW4502A/3 provides the electrical and switching performance of the CNW136A, increased ESD protection and increased transient immunity.

Regulatory Information

These products feature a wide body 8 PIN DIP. This package was specifically designed to meet regulatory requirements worldwide. The CNW135A/6A and CNW4502A/3 have been approved by the following organizations:

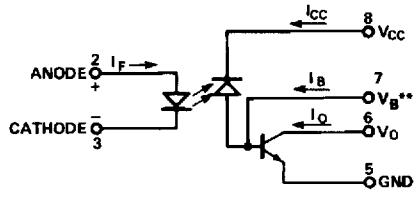
UL – Covered under UL component recognition FILE E55361
VDE – Approved according to VDE 0884 (June 1992)
NORDIC – Tested for applications (reinforced insulation) – Class II applications for plugable apparatus in normal tight execution.
FIMKO/SETI-SEMKO-NEMKO-DEMKO-According to IEC 65-IEC950-IEC335
BSI – Certification according to BS415:1990, BS7002:1992 and EN41003:1993 for class II applications.
CSA – Certified according to Component Acceptance Notice #5 (File CA 88324)

Absolute Maximum Ratings

Storage Temperature ..... -55°C to +125°C
Operating Temperature ..... -55°C to 85°C
Lead Solder Temperature ..... 260°C for 10s (up to seating plane)
Average Input Current – I_F ..... 25 mA
Peak Transient Input Current – I_F ..... 100 mA (≤1 µs pulse width, 300 Hz)
Reverse Input Voltage – V_R (Pin 3-2) ..... 3 V
Input Power Dissipation ..... 40 mW*
Average Output Current – I_O (Pin 6) ..... 8 mA
Emitter-Base Reverse Voltage (Pin 5-7) ..... 5 V
Output Voltage – V_O (Pin 6-5) ..... -0.5 V to 20 V
Supply Voltage – V_{CC} (Pin 8-5) ..... -0.5 V to 30 V
Base Current – I_B (Pin 7, except CNW4502A /3) ..... 5 mA
Output Power Dissipation ..... 100 mW

*Derate at 5.0 mW/°C for operating temperatures above 70°C.

Schematic



**Note: For CNW4502A/3, Pin 7 is not connected.

CAUTION: The small junction sizes inherent to the design of this bipolar component increases the component's susceptibility to damage from electrostatic discharge (ESD). It is advised that normal static precautions be taken in handling and assemby of this component to prevent damage and/or degradation which may be induced by ESD.

VDE 0884 Insulation Characteristics

Description	Symbol	Characteristic	Unit
Installation classification per DIN VDE 0110/01.89, Table 1 for rated mains voltage ≤ 600 V_{RMS} for rated mains voltage ≤ 1000 V_{RMS}		 I-IV I-III	
Climatic Classification		55/85/21	
Pollution Degree (DIN VDE 0110/01.89)		2	
Maximum Working Insulation Voltage	V_{IORM}	1414	V_{PEAK}
	V_{IOWM}	1000	V_{RMS}
Input to Output Test Voltage, Method b* V_{PR} = 1.875 x V_{IORM}, 100% Production Test with tp = 1 sec, Partial Discharge < 5 pC	V_{PR}	2652	V_{PEAK}
		1875	V_{RMS}
Input to Output Test Voltage, Method a* V_{PR} = 1.5 x V_{IORM}, Type and sample test, tp = 60 sec, Partial Discharge < 5 pC	V_{PR}	2121	V_{PEAK}
		1500	V_{RMS}
Highest Allowable Overvoltage* (Transient Overvoltage, t_{TR} = 10 sec)	V_{IOTM}	8000	V_{PEAK}
Safety-Limiting Values (Maximum values allowed in the event of a failure, also see Figure 9) Case Temperature Current (Input Current I_F, P_{SI} = 0) Output Power (obtained by setting pin 8 = 5.5 V, pins 7, 6, 5 = ground)	 T_{SI} I_{SI} $P_{SI, OUTPUT}$	 150 400 700	 °C mA mW
Insulation Resistance at T_{SI}, V_{IO} = 500 V V_{IO} = 500 V	R_{IO}	≥ 10^9	Ω

*Refer to the front of the optocoupler section of the HP Optoelectronics Designer's Catalog, under Product Safety Regulations Section, (VDE 0884) for a detailed description.

Note: Isolation characteristics are guaranteed only within the safety maximum ratings which must be ensured by protective circuits in the application.

Insulation Related Specifications

Parameter	Symbol	Value	Units	Conditions
Min. External Clearance (External Air Gap)	L(IO1)	9.6	mm	Measured from input terminals to output terminals, through air, shortest distance.
Min. External Creepage (External Tracking Path)	L(IO2)	10.0	mm	Measured from input terminals to output terminals, along body of optocoupler, shortest distance.
Min. Internal Clearance (Internal Plastic Gap)		1.0	mm	Through insulation distance conductor to conductor, emitter to detector.
Min. Internal Creepage (Internal Tracking Path)		4.0	mm	Measured from emitter to detector, along internal cavity wall.
Comparative Tracking Index	CTI	200	volts	DIN IEC 112/VDE 0303 PART 1
Isolation Group		IIIa		Material group (DIN VDE 0110)

*Refer to the front of the optocoupler section of the HP Optoelectronics Designer's Catalog, under Product Safety Regulations Section, (VDE 0884) for a detailed description.

Electrical Specifications

Over Recommended Temperature (T_A = 0°C to 70°C) unless otherwise specified. (See note 8.)

Parameter	Symbol	Device	Min.	Typ.*	Max.	Units	Test Conditions	Fig.	Note
Current Transfer Ratio	CTR	CNW135A	7	18	150	%	T_A = 25°C, V_O = 0.4 V; I_F = 16 mA, V_{CC} = 4.5 V	1, 2, 4	1
			5				V_O = 0.5 V; I_F = 16 mA, V_{CC} = 4.5 V		
		CNW136A CNW4502A CNW4503	19	30	150	%	T_A = 25°C, V_O = 0.4 V; I_F = 16 mA, V_{CC} = 4.5 V		
			15				V_O = 0.5 V; I_F = 16 mA, V_{CC} = 4.5 V		
Logic Low Output Voltage	V_{OL}	CNW135A		0.1	0.4	V	T_A = 25°C, I_O = 1.1 mA; I_F = 16 mA, V_{CC} = 4.5 V		
					0.5		I_O = 0.8 mA; I_F = 16 mA, V_{CC} = 4.5 V		
		CNW136A CNW4502A CNW4503		0.1	0.4	V	T_A = 25°C, I_O = 3.0 mA; I_F = 16 mA, V_{CC} = 4.5 V		
					0.5		I_O = 2.4 mA; I_F = 16 mA, V_{CC} = 4.5 V		
Logic High Output Current	I_{OH}			0.002	0.5	µA	T_A = 25°C, V_O = V_{CC} = 5.5 V; I_F = 0 mA	6	
					1		T_A = 25°C, V_O = V_{CC} = 15 V; I_F = 0 mA		
					50				
Logic Low Supply Current	I_{CCL}			55	200	µA	I_F = 16 mA, V_O = Open, V_{CC} = 15 V		
Logic High Supply Current	I_{CCH}				1	µA	T_A = 25°C; I_F = 0 mA, V_O = Open, V_{CC} = 15 V		
					2				
Input Forward Voltage	V_F		1.45	1.68	1.85	V	T_A = 25°C; I_F = 16 mA	3	
			1.35		1.95				
Input Reverse Breakdown Voltage	BV_R		3			V	I_R = 100 µA, T_A = 25°C		
Temperature Coefficient of Forward Voltage	$\frac{\Delta V_F}{\Delta T_A}$			1.9		mV/°C	I_F = 16 mA		
Input Capacitance	C_{IN}			90		pF	f = 1 MHz, V_F = 0 V		
Input-Output Insulation Voltage	V_{ISO}		5000			V_{RMS}	RH ≤ 50%, t = 1 min., T_A = 25°C		2, 7
Resistance (Input-Output)	R_{I-O}		10^{12}	10^{13}		Ω	T_A = 25°C, V_{I-O} = 500 VDC		2
			10^{11}				T_A = 100°C, V_{I-O} = 500 VDC		
Capacitance (Input-Output)	C_{I-O}			0.5	0.6	pF	f = 1 MHz		2
Transistor DC Current Gain	h_{FE}			180			V_O = 5 V, I_O = 3 mA		
				160			V_O = 0.4 V, I_B = 40 µA		

*All typicals at T_A = 25°C.

Switching Specifications

Over Recommended Temperature (T_A = 0°C to 70°C), V_{CC} = 5 V, I_F = 16 mA, unless otherwise specified.

Parameter	Sym.	Device	Min.	Typ.*	Max.	Units	Test Conditions	Fig.	Note
Propagation Delay Time to Logic Low at Output	t_{PHL}	CNW135A		0.2	1.5	µs	T_A = 25°C, R_L = 4.1 kΩ	5, 8, 11	4, 5
					2.0				
		CNW136A CNW4502A		0.2	0.8		T_A = 25°C, R_L = 1.9 kΩ		
					1.0				
Propagation Delay Time to Logic High at Output	t_{PLH}	CNW135A		0.6	1.5	µs	T_A = 25°C, R_L = 4.1 kΩ	5, 8, 11	4, 5
					2.0				
		CNW136A CNW4502A		0.35	0.8		T_A = 25°C, R_L = 1.9 kΩ		
					1.0				
Common Mode Transient Immunity at Logic High Level Output	$\|CM_H\|$	CNW135A	1,000			V/µs	R_L = 4.1 kΩ, I_F = 0 mA, T_A = 25°C, V_{CM} = 10 V	12	3, 4, 5
		CNW136A	1,000				R_L = 1.9 kΩ		
		CNW4502A	1,000	≥10,000			V_{CM} = 10 V, I_F = 0 mA, T_A = 25°C, R_L = 1.9 kΩ	12	3, 4
		CNW4503	15,000	30,000			V_{CM} = 1500 V		
Common Mode Transient Immunity at Logic Low Level Output	$\|CM_L\|$	CNW135A	1,000			V/µs	R_L = 4.1 kΩ, I_F = 16 mA, T_A = 25°C, V_{CM} = 10 V	12	3, 4, 5
		CNW136A	1,000				R_L = 1.9 kΩ		
		CNW4502A	1,000	10,000			V_{CM} = 10 V, I_F = 16 mA, T_A = 25°C, R_L = 1.9 kΩ	12	3, 4
		CNW4503	15,000	30,000			V_{CM} = 1500 V		
Bandwidth	BW	CNW135A CNW136A		11		MHz	See Test Circuit	7, 10	6

*All typicals are at T_A = 25°C.

Notes:

1. CURRENT TRANSFER RATIO in percent is defined as the ratio of output collector current, I_O, to the forward LED input current, I_F, times 100.
2. Device considered a two-terminal device: Pins 1, 2, 3, and 4 shorted together and Pins 5, 6, 7, and 8 shorted together.
3. 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 output will remain in a Logic Low state (i.e. V_O > 0.8 V).
4. The 1.9 kΩ load represents 1 TTL unit load of 1.6 mA and the 5.6 kΩ pull-up resistor.
5. The 4.1 kΩ load represents 1 LSTTL unit load of 0.36 mA and 6.1 kΩ pull-up resistor.
6. The frequency at which the ac output voltage is 3 dB below the low frequency asymptote.
7. In accordance with UL 1577, each optocoupler is proof tested by applying an insulation test voltage of ≥ 6000 Vrms for one second (leakage detection current limit, I_{I-O} ≤ 5 µA). This test is performed before the 100% Production test shown in the VDE 0884 Insulation Characteristics Table.
8. Use of a 0.1 µf bypass capacitor connected between pins 5 and 8 is recommended for operation.

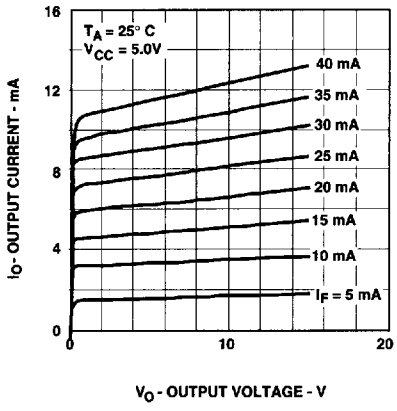


Figure 1. DC and Pulsed Transfer Characteristics.

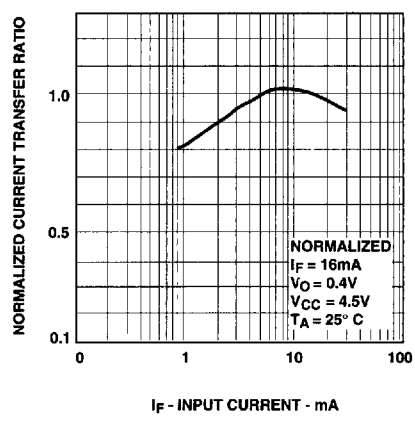


Figure 2. Current Transfer Ratio vs. Input Current

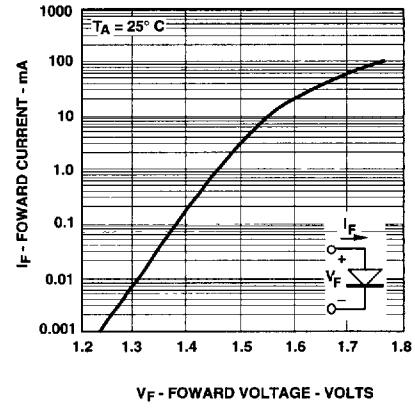


Figure 3. Input Current vs. Forward Voltage.

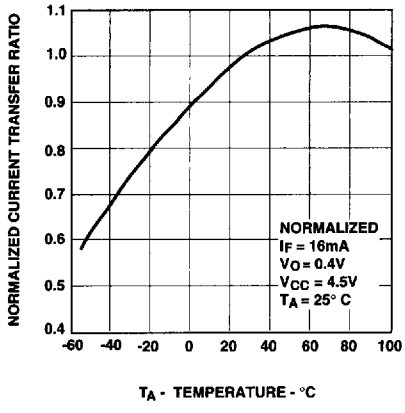


Figure 4. Current Transfer Ratio vs. Temperature.

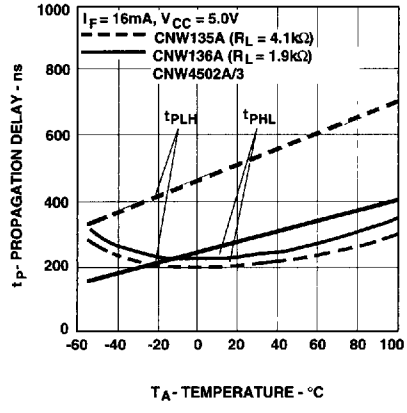


Figure 5. Propagation Delay vs. Temperature.

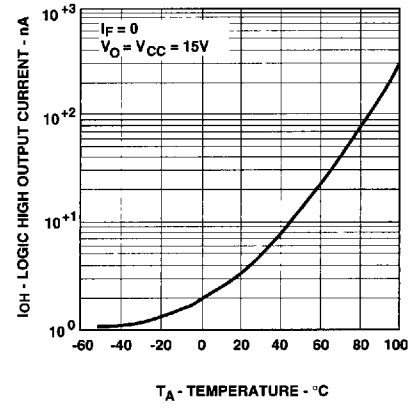


Figure 6. Logic High Output Current vs. Temperature.

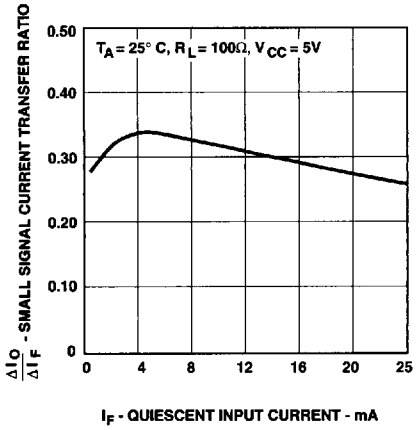


Figure 7. Small-Signal Current Transfer Ratio vs. Quiescent Input Current.

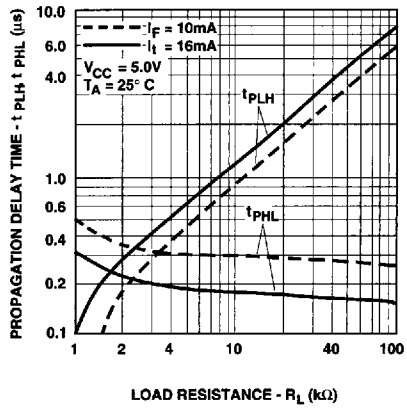


Figure 8. Propagation Delay Time vs. Load Resistance.

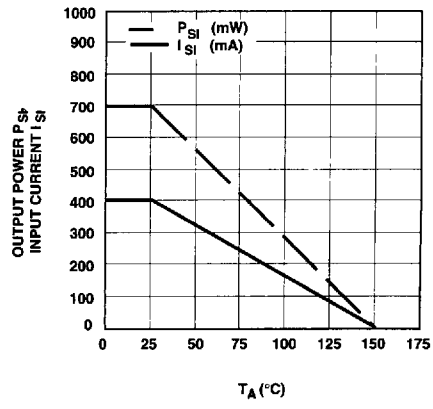


Figure 9. Dependence of Safety Maximum Ratings with Ambient Temperature.

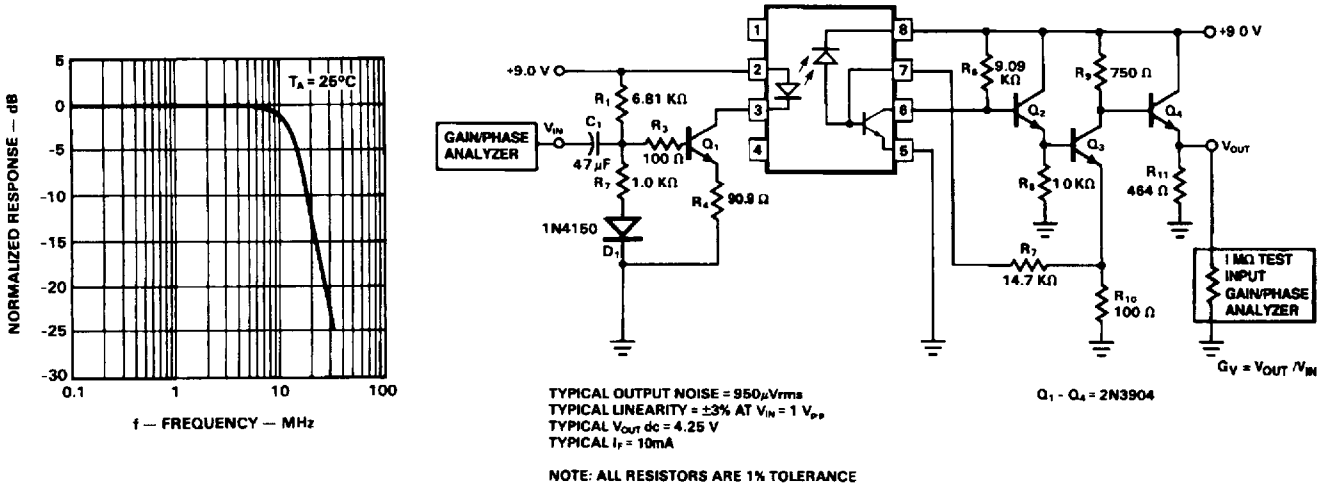


Figure 10. Frequency Response. (CNW135A/6A)

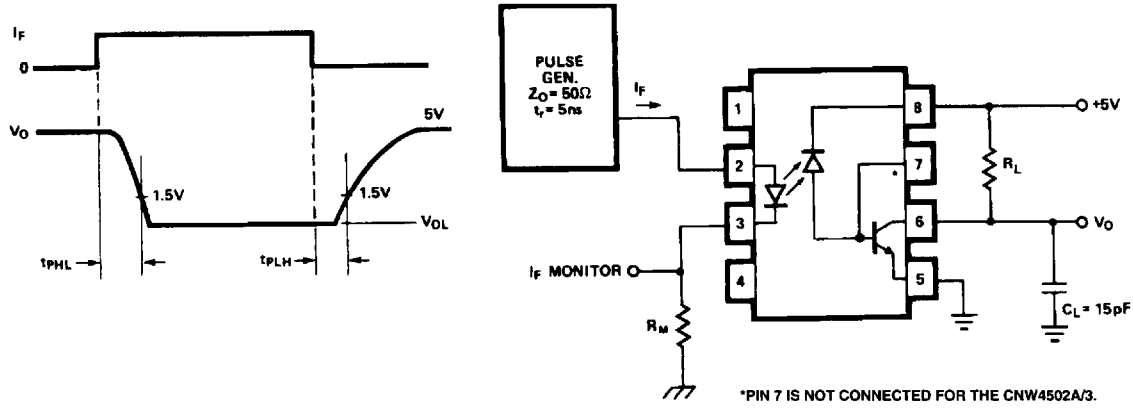


Figure 11. Switching Test Circuit.

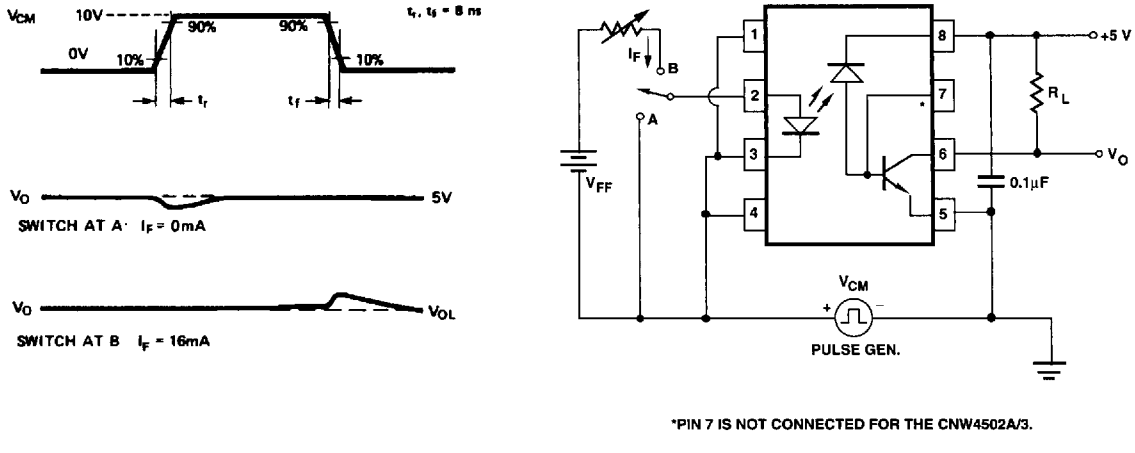


Figure 12. Test Circuit for Transient Immunity and Typical Waveforms.