

1.Description

HCPL4502 devices each consist of an infrared emitting diode, optically coupled to a high speed photo detector transistor. A separate connection for the photodiode bias and output-transistor collector increase the speed by several orders of magnitude over conventional phototransistor couplers by reducing the base-collector capacitance of the input transistor. The devices are packaged in an 8-pin DIP package and available in wide-lead spacing and SMD option

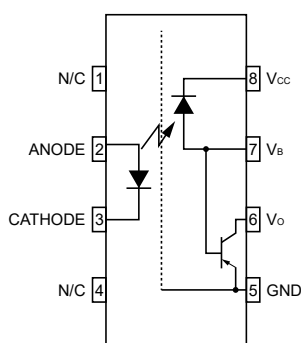
2.Applications

- Line receivers
- Telecommunication equipments
- Power transistor isolation in motor drives
- Replacement for low speed phototransistor photo couplers
- Feedback loop in switch-mode power supplies
- Home appliances
- High speed logic ground isolation

3.Features

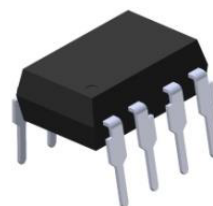
- High speed 1Mbit/s
- High isolation voltage between input and output ($V_{iso}=5000\text{ Vrms}$)
- Guaranteed performance from 0°C to 70°C
- Wide operating temperature range of -55°C to 100°C
- Pb free and RoHS compliant

4.Pinning Information

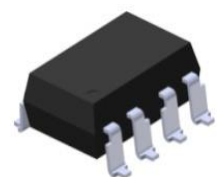


Truth Table

LED	V_o
ON	LOW
OFF	HIGH



DIP-8



SOP- 8



5. Absolute Maximum Ratings $T_A = 25^\circ\text{C}$

Parameter		Symbol	Value	Units
Input	Forward current	I_F	25	mA
	Peak forward current (50% duty, 1ms P.W)	I_{FP}	50	mA
	Peak transient current ($\leq 1\mu\text{s}$ P.W, 300pps)	I_{Ftrans}	1	A
	Reverse voltage	V_R	5	V
	Power dissipation	P_{IN}	45	mW
Output	Power dissipation	P_O	100	mW
	Average Output current	$I_{O(AVG)}$	8	mA
	Peak Output current	$I_{IO(PK)}$	16	mA
	Output voltage	V_O	-0.5 to 20	V
	Supply voltage	V_{CC}	-0.5 to 30	V
Total Power Dissipation		P_{TOT}	145	mW
Isolation Voltage ^{*1}		V_{ISO}	5000	V_{rms}
Operating Temperature		T_{OPR}	-55 to 100	$^\circ\text{C}$
Storage Temperature		T_{STG}	-55 to 125	$^\circ\text{C}$
Soldering Temperature ^{*2}		T_{SOL}	260	$^\circ\text{C}$

*1 AC for 1 minute, R.H.=40 ~ 60% R.H. In this test, pins 1,2,3 & 4 are shorted together, and pins 5,6,7 & 8 are shorted together.

*2 For 10 seconds.



6. Electrical Characteristics ($T_A=0$ to 70°C unless specified otherwise)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Input						
Forward Voltage	V_F	$I_F=16\text{mA}$		1.45	1.7	V
Reverse Voltage	B_{VR}	$I_R=10\mu\text{A}$	5	20		V
Temperature coefficient of forward voltage	$\Delta V_F/\Delta T_A$	$I_F=16\text{mA}$		-1.6		mV/ $^\circ\text{C}$
Output						
Logic High Supply Current	I_{CCH}	$V_{CC}=15\text{V}$, $I_F=0\text{mA}$, $V_O=\text{Open}$			1	μA
		$T_A=0\sim 70^\circ\text{C}$			2	μA
Logic Low Supply Current	I_{CCL}	$V_{CC}=15\text{V}$, $I_F=16\text{mA}$, $V_O=\text{Open}$		50	200	μA
Transfer						
Logic High Output Current	I_{OH}	$I_F=0\text{mA}$, $V_O=V_{CC}=5.5\text{V}$		0.001	0.5	μA
		$I_F=0\text{mA}$, $V_O=V_{CC}=15\text{V}$		0.005	1	μA
		$T_A=0\sim 70^\circ\text{C}$, $V_O=V_{CC}=15\text{V}$			50	μA
Logic Low Output Voltage	VOL	$I_F=16\text{mA}$, $V_{CC}=4.5\text{V}$, $I_O=2.4\text{mA}$		0.1	0.4	V
Current Transfer Ratio	CTR	$I_F=16\text{mA}$, $V_{CC}=4.5\text{V}$, $I_O=0.4\text{V}$	19	26	50	%
Isolation Voltage	V_{ISO}	$RH<50\%$, $T_A=25^\circ\text{C}$, $I_{I-O}\leq 50\mu\text{A}$	5000			V_{RMS}



7.Switching Characteristics

($T_A=0$ to 70°C unless specified otherwise, $I_F=16\text{mA}$, $V_{CC}=5\text{V}$)

Parameter	Symbol	Conditions		Min	Typ	Max	Units
Propagation Delay Time to Logic Low	T_{PLH}	$I_F=16\text{mA}$, $R_L=4.1\text{k}\Omega$			1300	1500	ns
		$I_F=16\text{mA}$, $R_L=1.9\text{k}\Omega$			600	800	ns
Propagation Delay Time to Logic	T_{PHL}	$I_F=16\text{mA}$, $R_L=4.1\text{k}\Omega$			200	1500	ns
		$I_F=16\text{mA}$, $R_L=1.9\text{k}\Omega$			200	800	ns
Common Mode Transient Immunity at Logic High	$ CM_H $	$R_L=4.1\text{k}\Omega$	$T_A=25^{\circ}\text{C}$, $I_F=0\text{mA}$, $C_L=15\text{pF}$ $ V_{CM} =10\text{V(Peak)}$		5000		$\text{V}/\mu\text{s}$
		$R_L=1.9\text{k}\Omega$					
Common Mode Transient Immunity at Logic Low	$ CM_L $	$R_L=4.1\text{k}\Omega$	$T_A=25^{\circ}\text{C}$, $I_F=16\text{mA}$ $C_L=15\text{pF}$		5000		$\text{V}/\mu\text{s}$
		$R_L=1.9\text{k}\Omega$					



8. Typical Characteristic

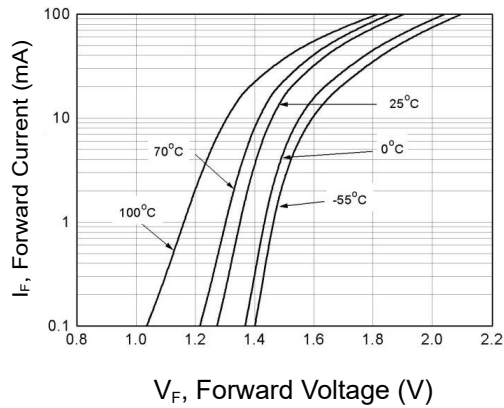


Figure 1: Forward Current vs. Forward Voltage

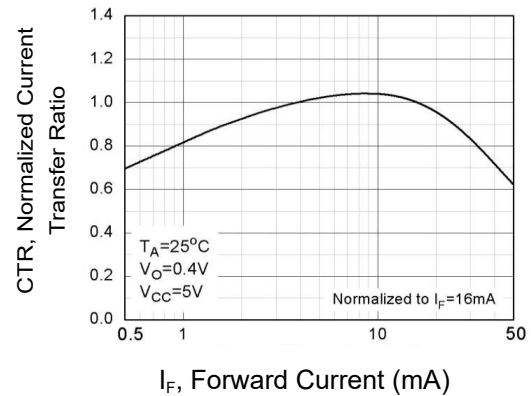


Figure 2: Normalized Current Transfer Ratio vs. Forward Current

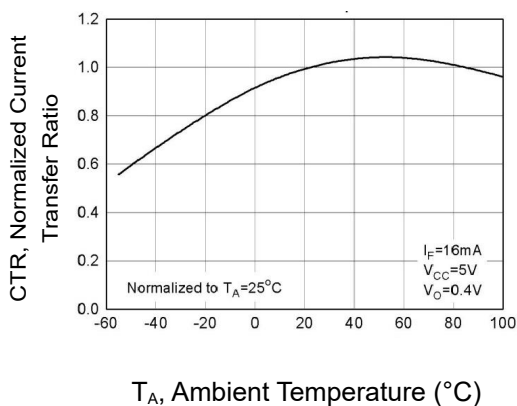


Figure 3: Normalized Current Transfer Ratio vs. Ambient Temperature

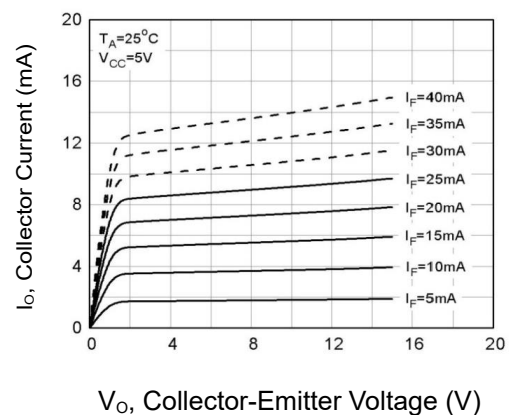


Figure 4: Output Current vs. Output Voltage

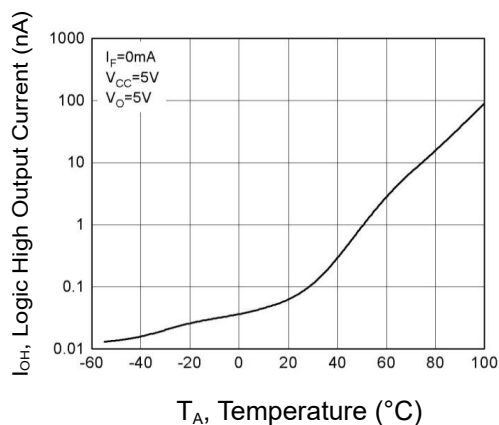


Figure 5: Logic High Output Current vs. Temperature

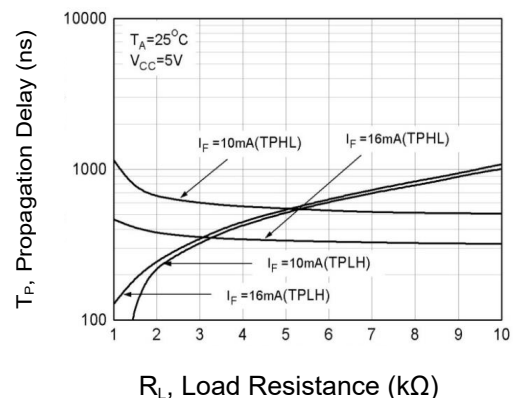


Figure 6: Propagation Delay vs. Load Resistance



9. Switching Time Test Circuit & Waveform

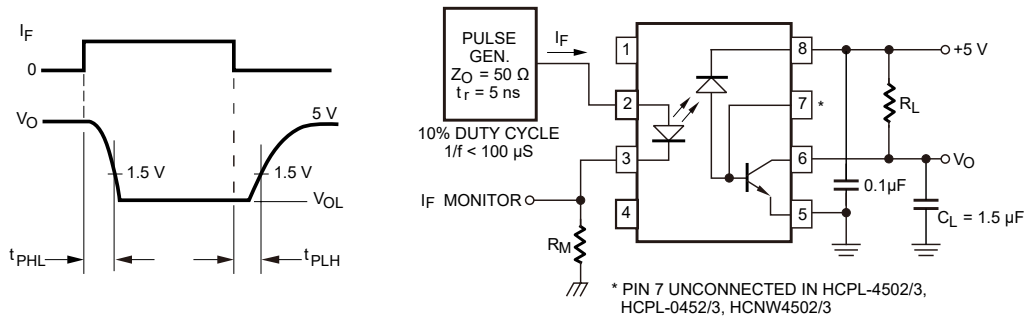


Figure 7. Switching test circuit.

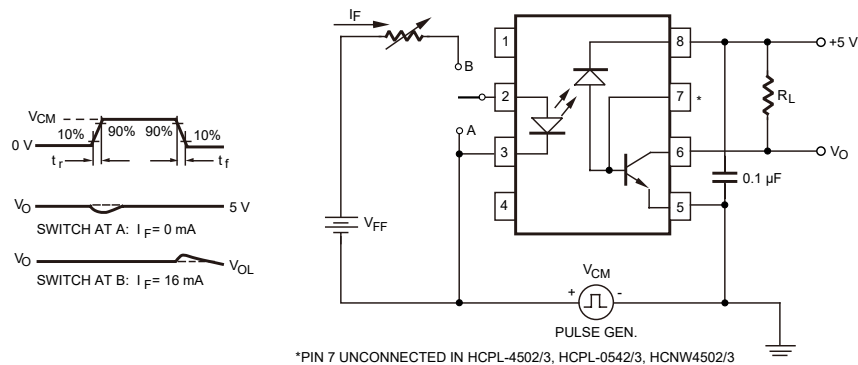
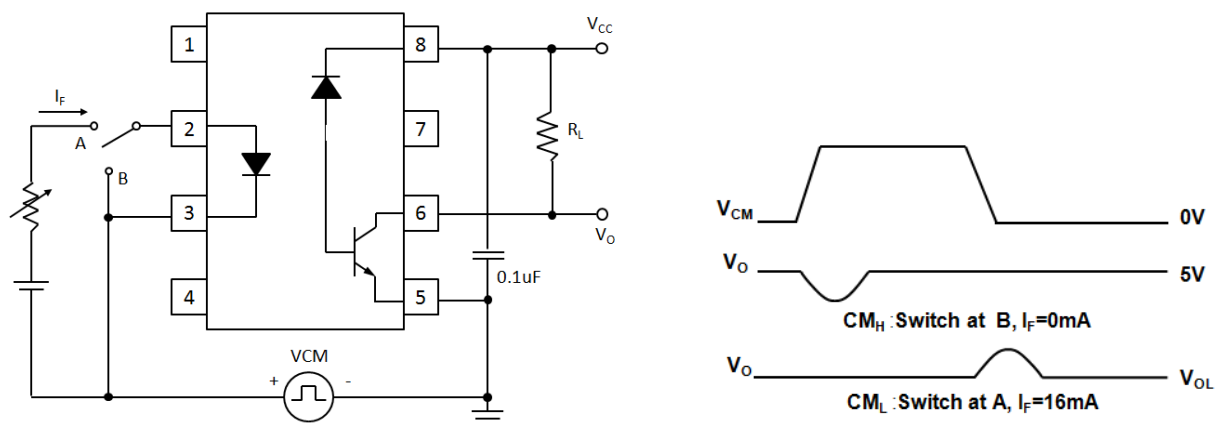


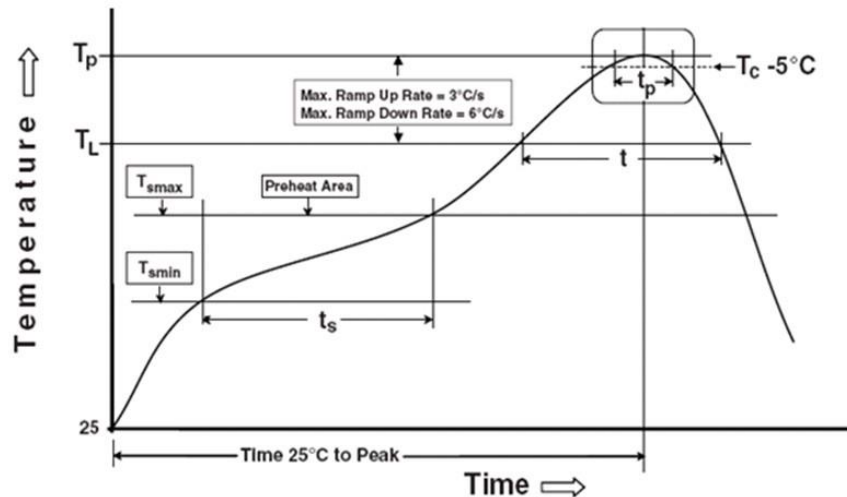
Figure 8. Test circuit for transient immunity and typical waveforms.

10. Transient Immunity Test Circuit & Waveform





11. Precautions for Use



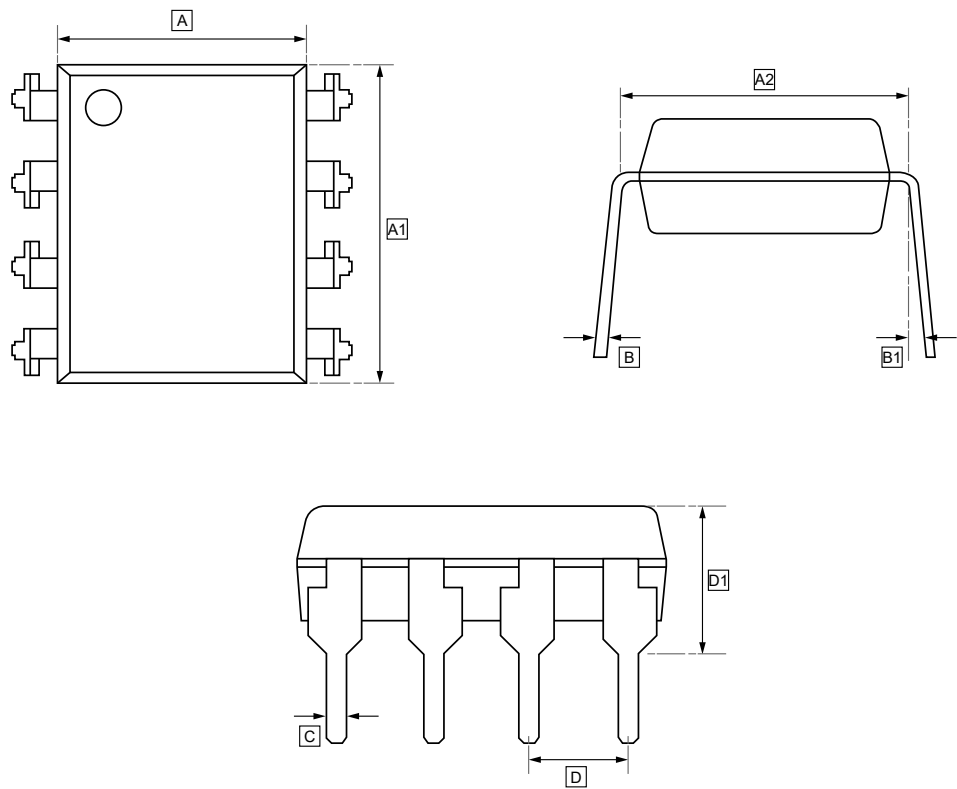
1. Soldering Condition

1.1 (A) Maximum Body Case Temperature Profile for evaluation of Reflow Profile

Preheat	
Temperature min (T_{smin})	150°C
Temperature max (T_{smax})	200°C
Time (T_{smin} to T_{smax}) (t_s)	60-120 seconds
Average ramp-up rate (T_{smax} to T_p)	3°C/second max
Other	
Liquidus Temperature (T_L)	216°C
Time above Liquidus Temperature (t_L)	60-100 sec
Peak Temperature (T_p)	260°C
Time within 5°C of Actual Peak Temperature: $T_p - 5^\circ\text{C}$	30s
Ramp- Down Rate from Peak Temperature	6°C /second max
Time 25°C to peak temperature	8 minutes max
Reflow times	3 times



12.1 DIP-8 Package Outline Dimensions

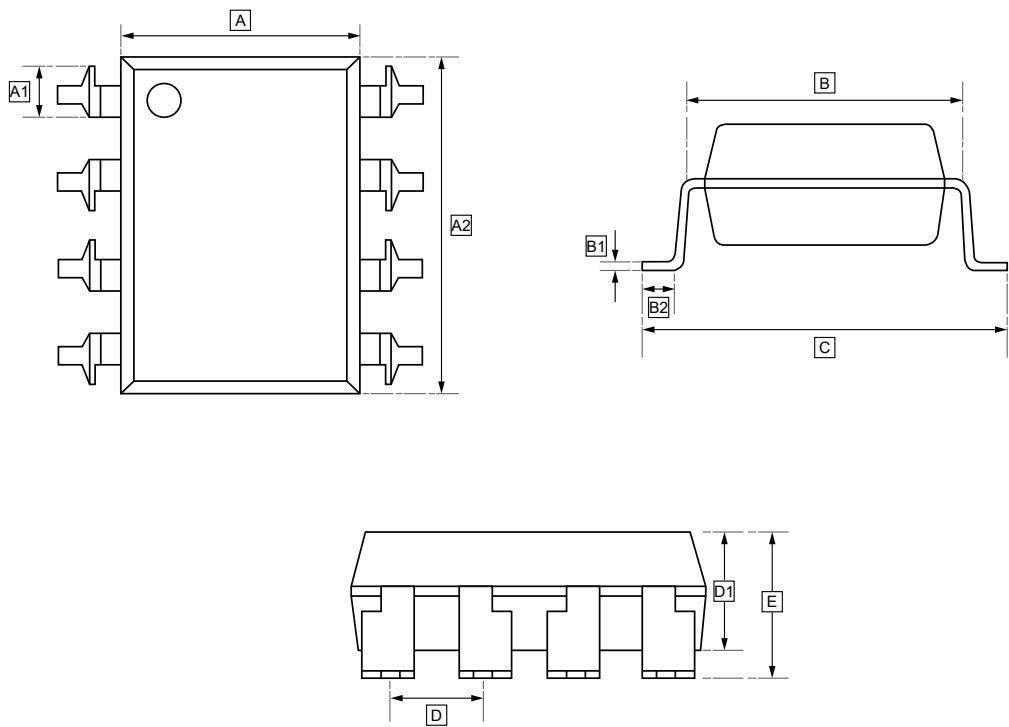


DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	B	B1	C	D	D1
Min	6.30	9.46	7.62	0.25	5°	0.40	2.54	4.20
Max	6.90	10.06	TYP.		15°	0.60	TYP.	4.80



12.2 SOP-8 Package Outline Dimensions

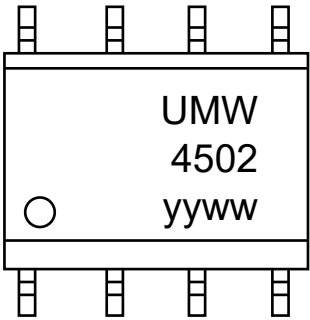


DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	B	B1	B2	C	D	D1	E
Min	6.30	1.45	9.46	7.62	0.25	0.6	-	2.54	3.20	4.00
Max	6.90		10.06	TYP		-	10.3	TYP	3.80	4.60



13.Ordering Information



yy: Year Code
ww: Week Code

Order Code	Marking	Package	Base QTY	Delivery Mode
UMW HCPL-4502-000E	4502	DIP-8	2250	Tube and box
UMW HCPL-4502-500E	4502	SOP-8	1000	Tape and reel



14.Disclaimer

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