

1. Description

The HCPL-3140 is a gate driven optocoupler with an output current of 0.4A, with an AlGaAs LED, which is coupled to a photosensitive integrated circuit through infrared light. This optocoupler can drive most low-power IGBTs and MOSFETs. In the motor control inverter and high-performance power system applications, it is very suitable for fast switching drive power IGBTs and MOSFETs.

3. Features

- 35kV/μs minimum Common Mode Rejection
- 1A maximum peak output current
- 0.4A minimum peak output current
- Wide operating V_{CC} Range: 10V~30V
- 400ns maximum propagation delay

2. Applications

- Uninterrupted Power Supply
- IGBT isolation / power MOSFET gate drive
- Induction heating
- Industrial inverters

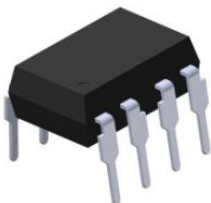
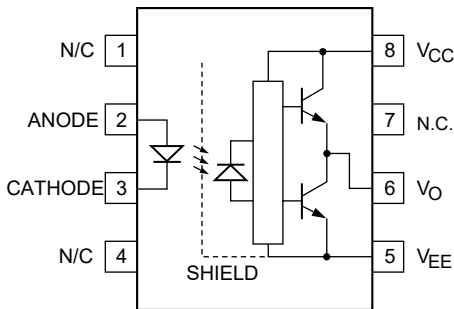
- 100ns of pulse width distortion
- Under Voltage Lock-Out protection (UVLO) with hysteresis
- Operating temperature range: -40°C~ +110°C

4. Truth Table

LED	VO
OFF	LOW
ON	HIGH



5.Pinning Information



DIP-8



SOP- 8

Note: 0.1uF bypass capacitor must be connected between pins 5 and 8.

6.Insulation And Safety Related Specifications

Parameter	Symbol	Note	Value	Unit
Creepage Distance	L	Measured from input terminals to output terminals, shortest distance path along body	≥7	mm
Clearance Distance	L	Measured from input terminals to output terminals, shortest distance through air	≥7	mm
Insulation Thickness	DTI	Insulation thickness between emitter and detector	≥0.4	mm
Peak Isolation Voltage	V_{IORM}	DIN/EN/IEC EN60747-5-5.	1500	V_{peak}
Transient Isolation Voltage	V_{IOTM}	DIN/EN/IEC EN60747-5-5.	7000	V_{peak}
Isolation Voltage	V_{ISO}	For 1 min	5000	V_{rms}



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

Parameter		Symbol	Value	Units
Input	Forward Input Current	I_{FM}	25	mA
	Reverse Voltage	V_R	5	V
Output	Peak Output Current	$I_{O(PEAK)}$	1	A
	Supply Voltage	$V_{CC}-V_{SS}$	-0.5 to 35	V
	Output Voltage	V_O	-0.5 to V_{CC}	V
Isolation Voltage		V_{ISO}	5000	V_{rms}
Output Power Dissipation		P_O	250	mW
Total Power Dissipation		P_T	295	mW
Operating Temperature		T_{opr}	-40 to 110	$^\circ\text{C}$
Storage Temperature		T_{stg}	-55 to 125	$^\circ\text{C}$
Soldering Temperature		T_{sol}	260	$^\circ\text{C}$

8. Recommended Operating Conditions

Parameter	Symbol	Min	Max	Units
Power Supply Voltage	$V_{DD}-V_{SS}$	10	30	V
Input Current (ON)	$I_{F(ON)}$	7	16	mA
Input Voltage (OFF)	$V_{F(OFF)}$	-3.6	0.8	V
Operating Temperature	T_A	-40	110	$^\circ\text{C}$



9. Electro-optical Characteristics ($T_A=25^\circ\text{C}$)

All minimum and maximum specifications are at recommended operating conditions, unless otherwise noted

All typical values are at $T_A=25^\circ\text{C}$, $V_{DD}=30\text{V}$, and $V_{SS}=\text{GND}$.

Parameter	Symbol	Conditions		Min	Typ	Max	Units
Forward Voltage	V_F	$I_F=10\text{mA}$		1.2	1.5	1.8	V
Reverse Current	I_R	$V_R=5\text{V}$				10	μA
High Level Output Current ^{(1) (2)}	I_{OH}	$V_O=V_{CC}-4\text{V}$		0.2			A
		$V_O=V_{CC}-10\text{V}$		0.4	0.5		A
Low Level Output Current ^{(1) (2)}	I_{OL}	$V_O=V_{SS}+2.5\text{V}$		0.1			A
		$V_O=V_{SS}+10\text{V}$		0.4	0.5		A
High Level Output Voltage ^{(3) (4)}	V_{OH}	$I_F=10\text{mA}$	$I_O=-100\text{mA}$	$V_{CC}-4\text{V}$			V
Low Level Output Voltage	V_{OL}	$I_F=0\text{mA}$	$I_O=100\text{mA}$			0.5V	V
High Level Power Supply Current ⁽⁵⁾	I_{cCH}	$V_O=\text{Open}$, $I_F=7$ to 16mA			1.8	3.8	mA
Low Level Power Supply Current ⁽⁵⁾	I_{cCL}	$V_O=\text{Open}$, $I_F=0$ to 0.8V			2.1	3.8	mA
Input The Turn On Current	I_{FLH}	$I_O=0\text{mA}$, $V_O>5\text{V}$			2.8	5	mA
Input The Turn Off Voltage	V_{FHL}	$I_O=0\text{mA}$, $V_O<5\text{V}$		0.8			V
Isolation Resistance	R_{ISO}	$V_{I-O}=500\text{V}$, 40~60%R.H.			10^{11}		Ω
Isolation Capacitance	C_{ISO}	$V_{I-O}=0\text{V}$, Freq=1MHZ			1		pF
Propagation Delay Time to Low Output Level	T_{PHL}	$I_F=7\text{mA}$ to 16mA $R_g=10\Omega$ $C_g=10\text{nF}$ $F=10\text{KHZ}$ Duty Cycle=50%			100	300	ns
Propagation Delay Time to High Output Level ⁽⁵⁾	T_{PLH}				100	300	ns
Pulse Width Distortion	PWD				3	100	ns
Propagation Delay Difference Between Any Two Parts ⁽⁶⁾	P_{DD}			-250		250	ns

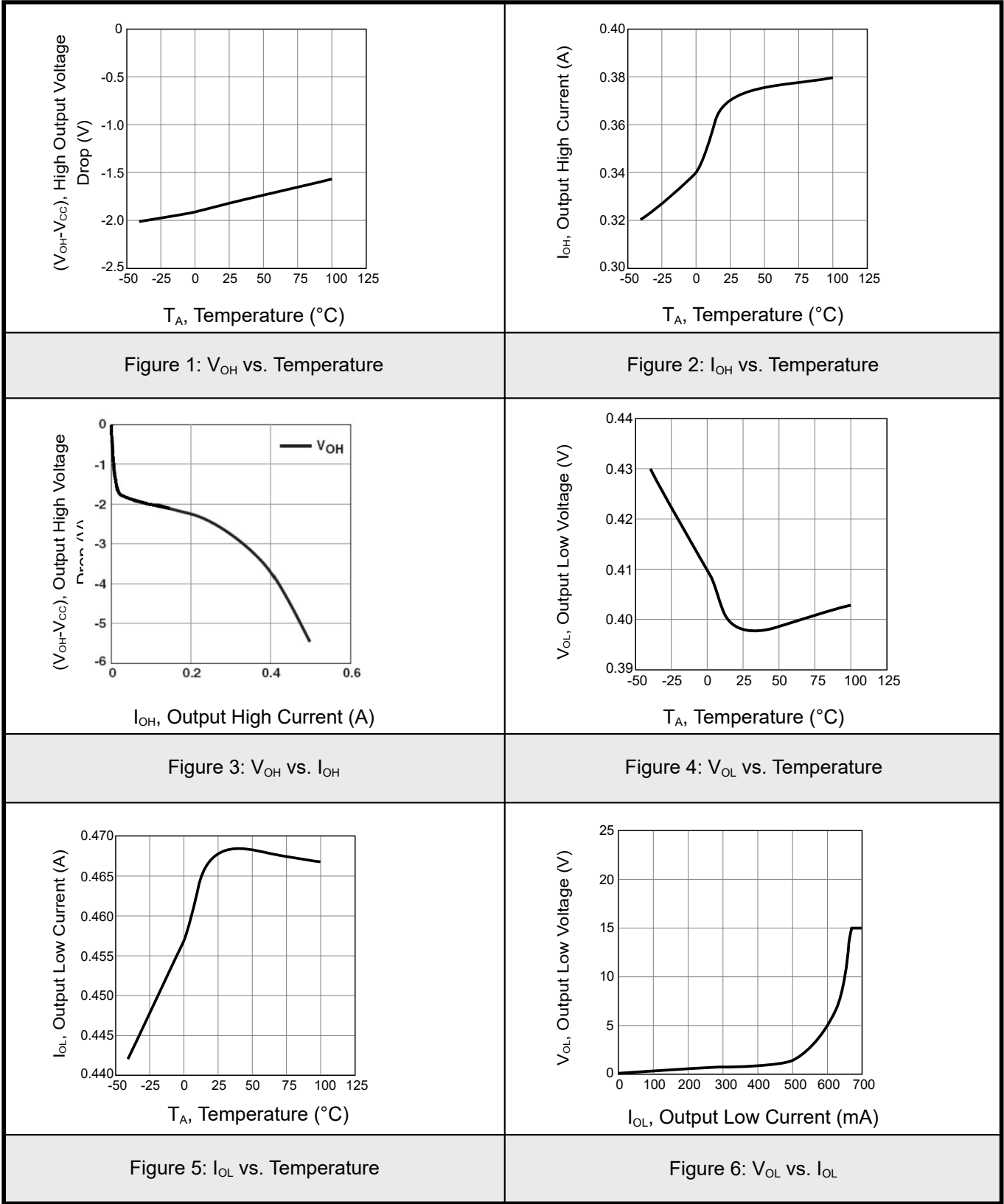


Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Rise Time (10% To 90%)	T_R	$I_F=7\text{mA to }16\text{mA}, R_g=10\Omega, C_g=10\text{NF}$ $F=10\text{KHZ, Duty Cycle}=50\%$		50		ns
Output Drop Time(90%~10%)	T_F			50		ns
UVLO Turn On Delay	$T_{UVLO\ ON}$	$I_F=10\text{mA}, V_O>5\text{V}$		2		μs
UVLO Turn Off Delay	$T_{UVLO\ OFF}$	$I_F=10\text{mA}, V_O<5\text{V}$		0.4		μs
Output High Level Common Mode Transient Immunity ⁽⁷⁾	$ CM_H $	$T_A=25^\circ\text{C}, V_{DD}=30\text{V}$ $V_{CM}=2000\text{V}, I_F=7\sim16\text{mA}, V_F=0\text{V}$	35	50		KV/ μs
Output Low Level Common Mode Transient Immunity ⁽⁸⁾	$ CM_L $	$T_A=25^\circ\text{C}, V_{DD}=30\text{V}$ $V_{CM}=2000\text{V}, I_F=7\sim16\text{mA}, V_F=0\text{V}$	35	50		KV/ μs

1. Maximum pulse width = 10 μs , maximum duty cycle = 0.2%. This value is intended to allow for component tolerances for designs with I_O peak minimum = 0.4 A. See Application section for additional details on limiting I_{OL} peak.
2. Maximum pulse width = 50 μs , maximum duty cycle = 0.5%.
3. In this test, V_{OH} is measured with a DC load current. When driving capacitive load V_{OH} will approach V_{CC} as I_{OH} approaches zero amps.
4. Maximum pulse width = 1 ms, maximum duty cycle = 20%.
5. The power supply current increases when operating frequency and Qg of the driven IGBT increases.
6. PDD is the difference between t_{PHL} and t_{PLH} between any two parts or channels under the same test conditions.
7. Common mode transient immunity in the high state is the maximum tolerable $|dV_{CM}/dt|$ of the common mode pulse V_{CM} to assure that the output will remain in the high state (i.e. $V_O>6.0\text{V}$).
8. Common mode transient immunity in a low state is the maximum tolerable $|dV_{CM}/dt|$ of the common mode pulse, V_{CM} , to assure that the output will remain in a low state (i.e. $V_O<1.0\text{V}$).



10.1 Typical Characteristic





10.2 Typical Characteristic

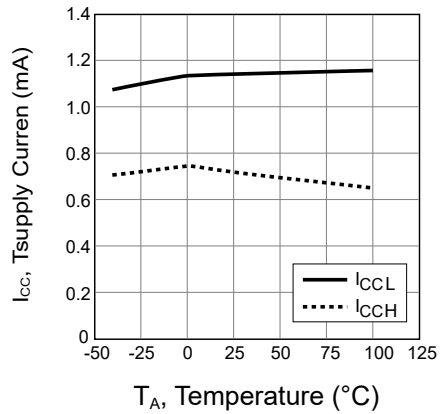
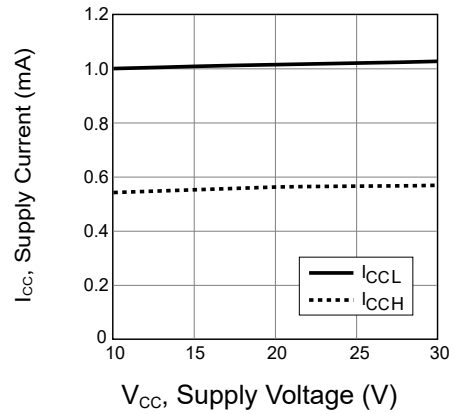
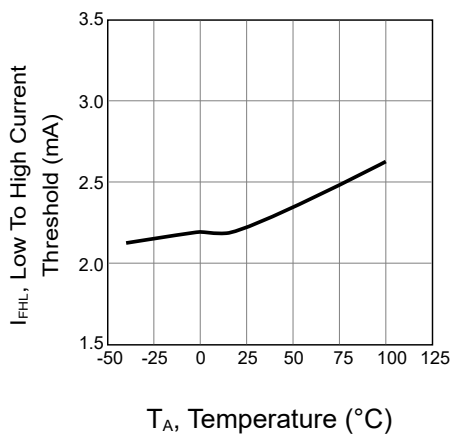
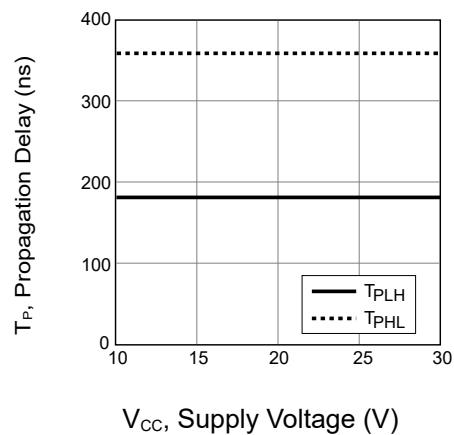
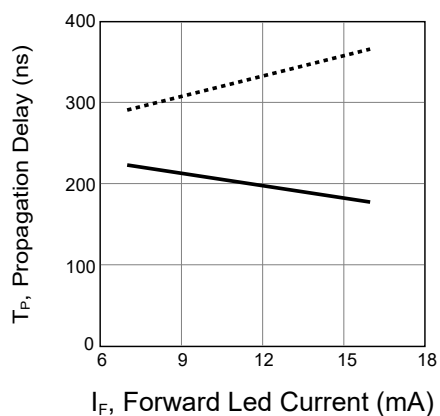
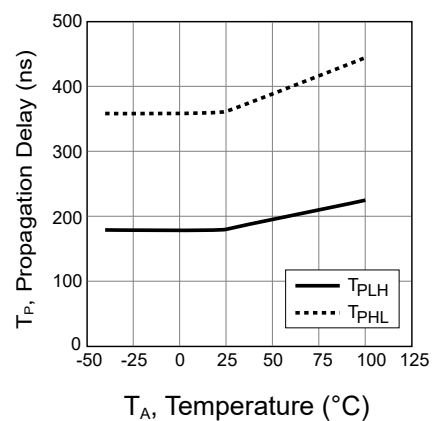
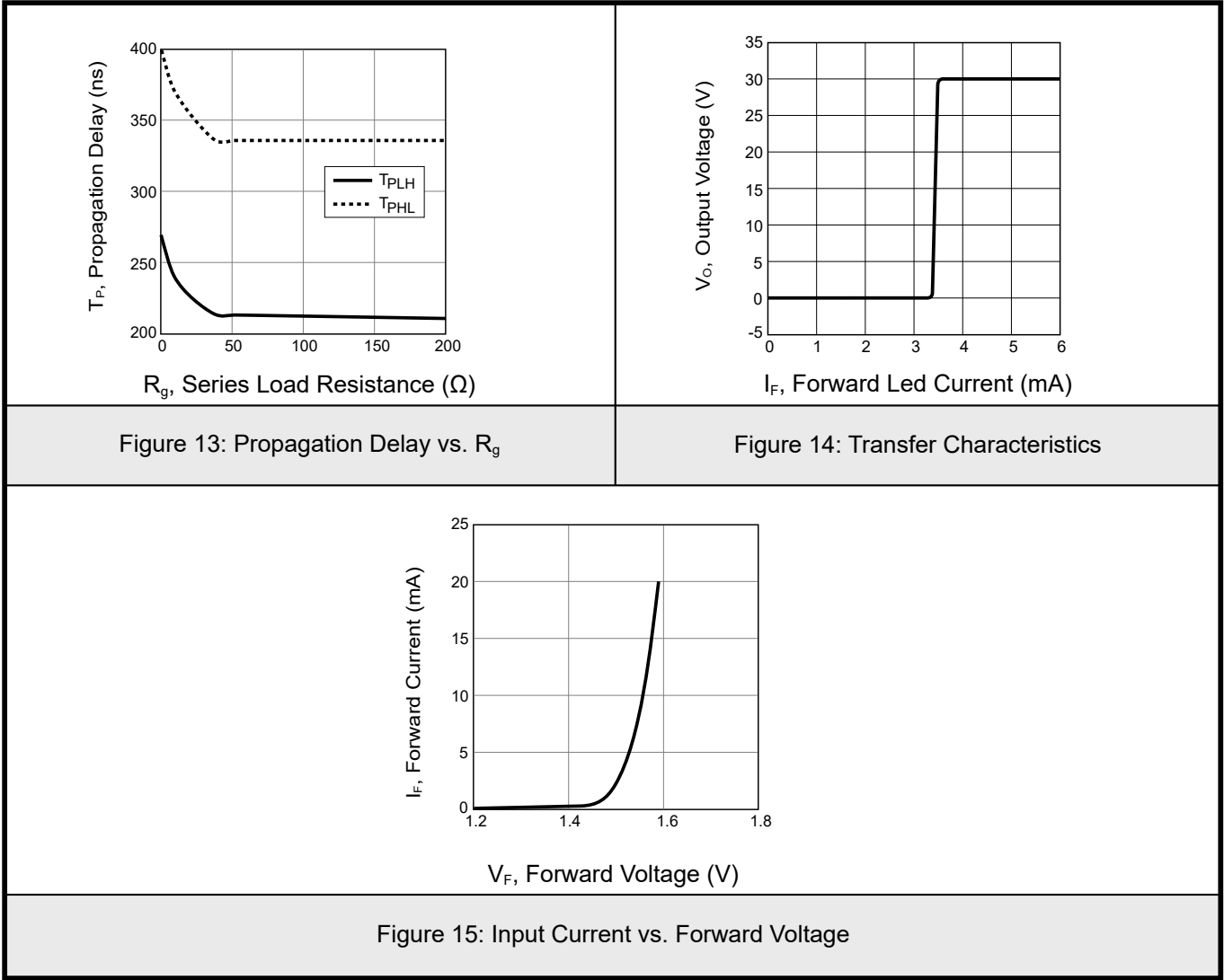
Figure 7: I_{CC} vs. TemperatureFigure 8: I_{CC} vs. V_{CC} Figure 9: I_{FLH} vs. TemperatureFigure 10: Propagation Delay vs. V_{CC} Figure 11: Propagation Delay vs. I_F 

Figure 12: Propagation Delay vs. Temperature



10.3 Typical Characteristic





11. Test Circuits Diagrams

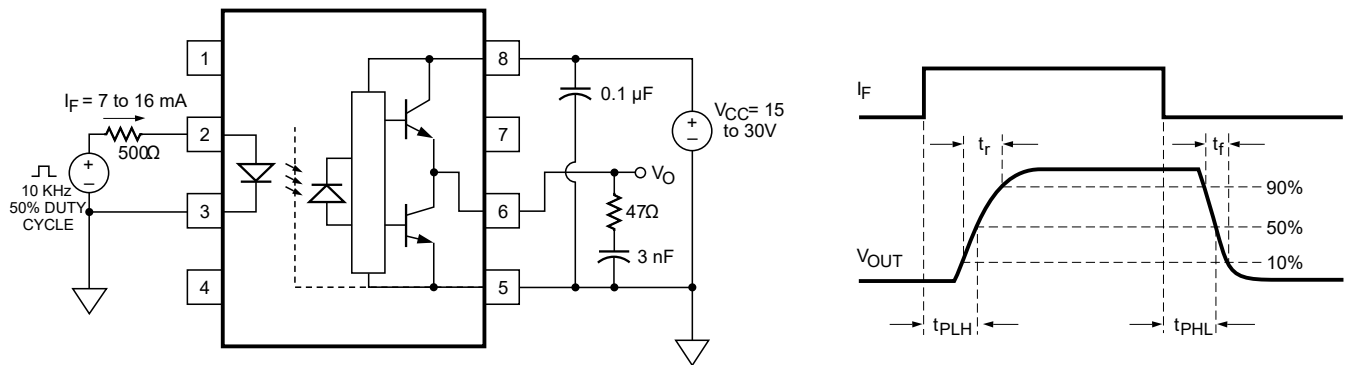


Figure 16: Propagation Delay Test Circuit and Waveforms

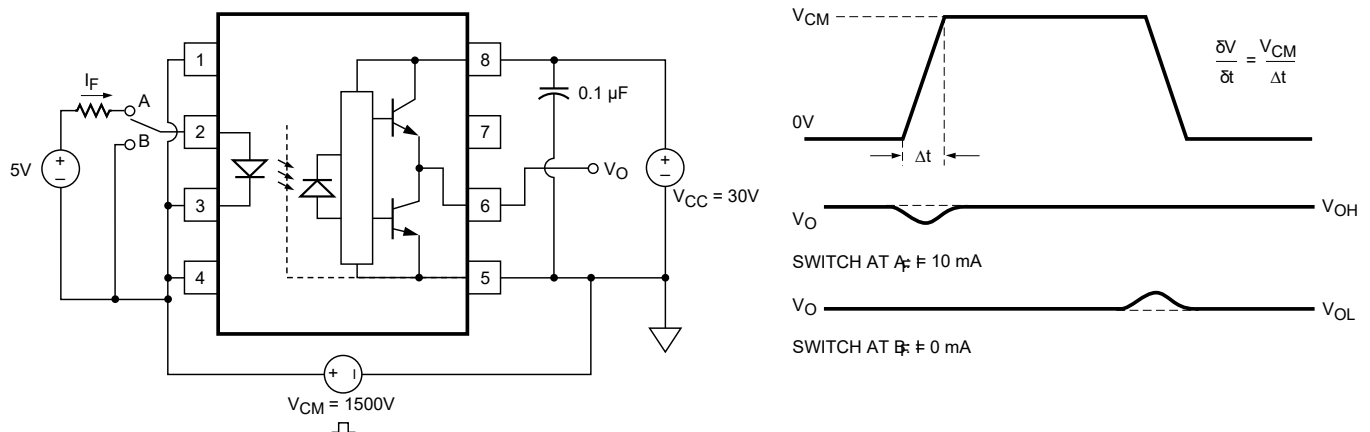
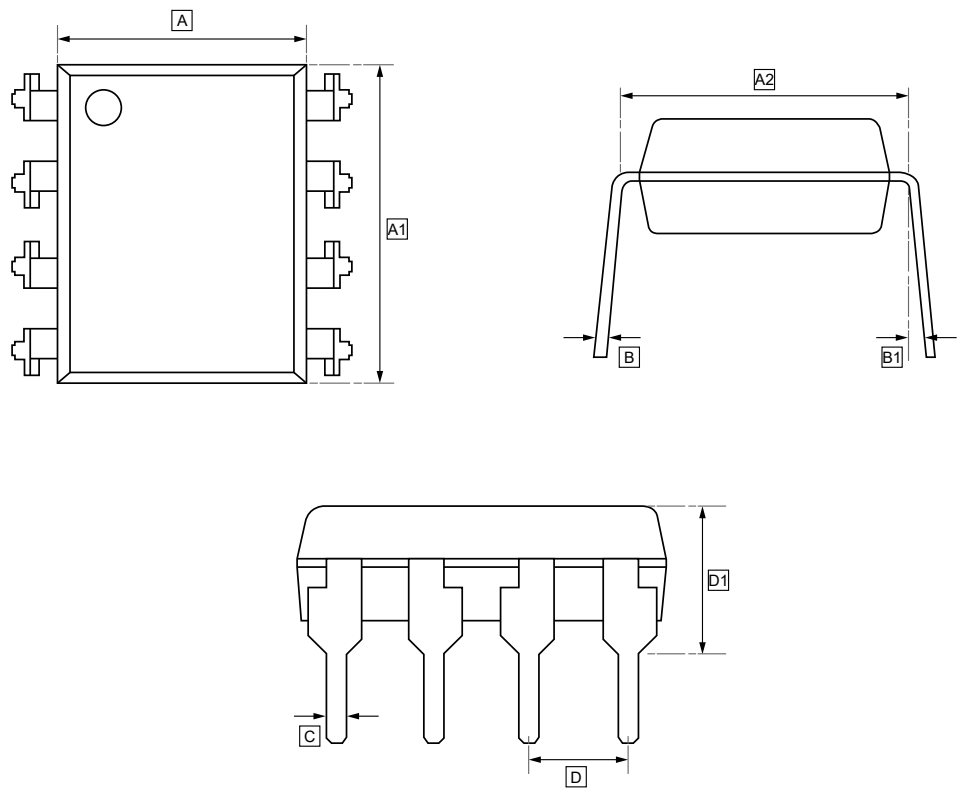


Figure 17: CMR Test Circuit and Waveforms



12.1 DIP-8 Package Outline Dimensions

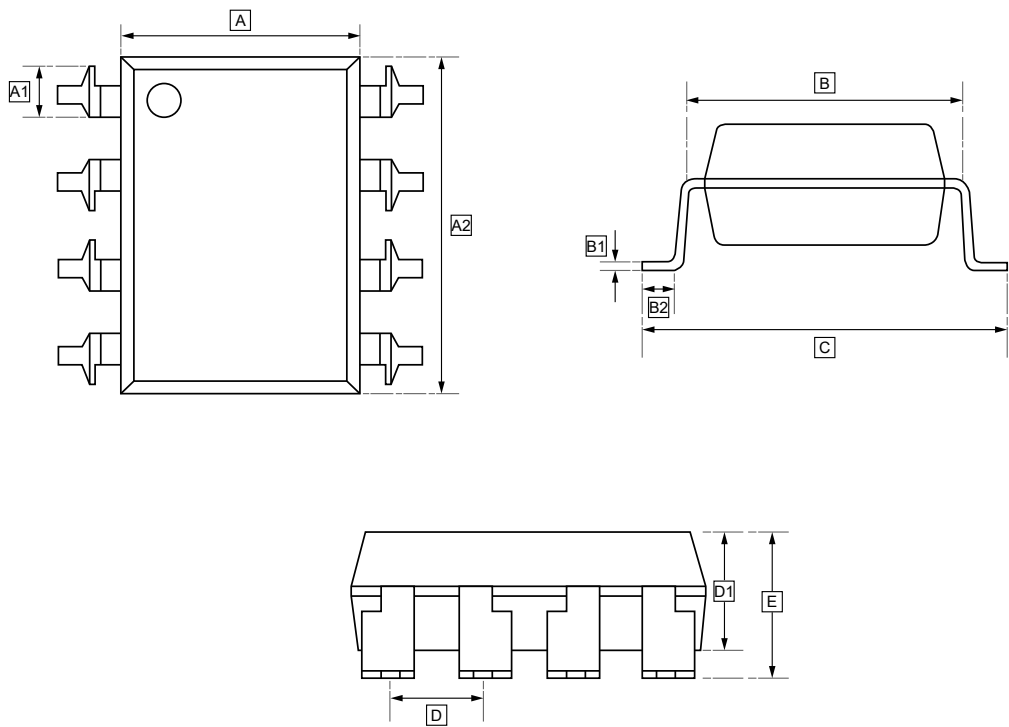


DIMENSIONS (mm are the original dimensions)

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

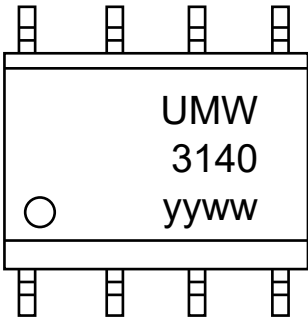


DIMENSIONS (mm are the original dimensions)

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-3140-000E	3140	DIP-8	2250	Tube and box
UMW HCPL-3140-560E	3140	SOP-8	1000	Tape and reel
UMW HCPL-3140-500E	3140	SOP-8	1000	Tape and reel



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