

1. Description

The HCPL-3120 is a gate driven optocoupler with an output current of 2.5 A, 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/ μ s minimum Common Mode Rejection
- 2.5A maximum peak output current
- 2A minimum peak output current
- Wide operating V_{CC} Range: 15V~30V
- 400ns maximum propagation delay

2. Applications

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

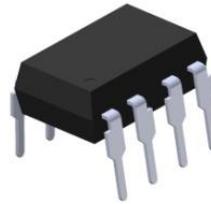
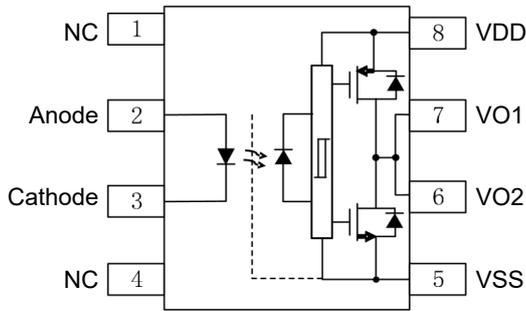
- 100ns of pulse width distortion
- Under Voltage Lock-Out protection (UVLO) with hysteresis
- Operating temperature range: -40°C~ +110°C

4. Truth Table

LED	$V_{CC}-V_{SS}$ “ POSITIVE GOING” (TURN-ON)	$V_{CC}-V_{SS}$ “ NEGATIVE GOING” (TURN-OFF)	VO
OFF	0~30V	0~30V	LOW
ON	0~11.5V	0~10V	LOW
ON	11.5~13.5V	10~12V	TRANSITION
ON	13.5~30V	12~30V	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 ⁽¹⁾	I_F	25	mA
	Reverse Voltage	V_R	5	V
Output	Peak Output Current ⁽²⁾	$I_{O(\text{PEAK})}$	2.5	A
	Supply Voltage	$V_{DD}-V_{SS}$	0 to 35	V
	Output Voltage	V_O	0 to V_{DD}	V
Isolation Voltage		V_{ISO}	5000	V_{rms}
Total Power Dissipation ⁽³⁾		P_T	295	mW
Output Power Dissipation ⁽⁴⁾		P_O	250	mW
Lead Solder Temperature		260°C for 10 sec., 1.6 mm below seating plane		
Operating Temperature		T_{opr}	-40 to 110	°C
Storage Temperature		T_{stg}	-55 to 125	°C
Soldering Temperature		T_{sol}	260	°C

1. Derate linearly above 70°C free-air temperature at a rate of 0.3 mA/°C.
2. 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 = 2.0 A. See Applications section for additional details on limiting I_{OH} peak.
3. Derate linearly above 70°C free-air temperature at a rate of 5.4 mW/°C. The maximum LED junction temperature should not exceed 125°C.
4. Derate linearly above 70°C free-air temperature at a rate of 4.8 mW/°C.

8. Recommended Operating Conditions

Parameter	Symbol	Min	Max	Units
Power Supply Voltage	$V_{CC}-V_{SS}$	15	30	V
Input Current (ON)	$I_{F(\text{ON})}$	7	16	mA
Input Voltage (OFF)	$V_{F(\text{OFF})}$	-3.6	0.8	V
Operating Temperature	T_A	-40	110	°C



9. Electro-optical Characteristics (T_A=25°C)

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

All typical values are at T_A=25°C, V_{DD}=30V, and V_{SS}=GND.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Forward Voltage	V _F	I _F =10mA	1.2	1.5	1.8	V
Reverse Current	I _R	V _R =5V			10	μA
High Level Output Current ⁽¹⁾⁽²⁾	I _{OH}	V _O =V _{DD} -3V	1	2		A
		V _O =V _{DD} -6V	2			A
Low Level Output Current ⁽¹⁾⁽²⁾	I _{OL}	V _O =V _{SS} +3V	1	2		A
		V _O =V _{SS} +6V	2			A
High Level Output Voltage ⁽³⁾⁽⁴⁾	V _{OH}	I _O =-2.5A	V _{DD} -6.25V	V _{DD} -2.5V		V
		I _O =-100mA	V _{DD} -0.3V	V _{DD} -0.1V		V
Low Level Output Voltage	V _{OL}	I _O =2.5A		V _{SS} +2.5V	V _{SS} +6.25V	V
		I _O =100mA		V _{SS} +0.1V	V _{SS} +0.3V	V
High Level Power Supply Current	I _{ccH}	V _O =Open, I _F =7 to 16mA		1.8	3.8	mA
Low Level Power Supply Current	I _{ccL}	V _O =Open, V _F =0 to 0.8V		2.1	3.8	mA
Input The Turn On Current	I _{FLH}	I _O =0mA, V _O >5V		2.8	5	mA
Input The Turn Off Voltage	V _{FHL}	I _O =0mA, V _O <5V	0.8			V
UVLO Threshold	V _{UVLO+}	I _F =10mA, V _O >5V	11.5	12.7	13.5	V
	V _{UVLO-}	I _F =10mA, V _O <5V	10	11.2	12	V
UVLO Hysteresis	UVLO _{HYS}			1.5		V
Isolation Resistance	R _{ISO}	V _{I-O} =500V, 40~60%R.H.		10 ¹¹		Ω
Isolation Capacitance	C _{ISO}	V _{I-O} =0V, Freq=1MHZ		1		pF
Propagation Delay Time to Low Output Level ⁽⁵⁾	T _{PHL}	I _F =7mA to 16mA		100	300	ns
Propagation Delay Time to High Output Level ⁽⁵⁾	T _{PLH}	R _g =10Ω C _g =10nF		100	300	ns
Pulse Width Distortion ⁽⁶⁾	PWD	F=10KHZ		3	100	ns
Propagation Delay Difference Between Any Two Parts ⁽⁷⁾	P _{DD}	Duty Cycle=50%	-250		250	ns



Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Rise Time (10% To 90%)	T_R	$I_F=7mA$ to $16mA, R_g=10\Omega, C_g=10NF$		80		ns
Output Drop Time(90%~10%)	T_F	$F=10KHZ, Duty\ Cycle=50\%$		80		ns
UVLO Turn On Delay	$T_{UVLO\ ON}$	$I_F=10mA, V_O>5V$		1.6		μs
UVLO Turn Off Delay	$T_{UVLO\ OFF}$	$I_F=10mA, V_O<5V$		0.4		μs
Output High Level Common Mode Transient Immunity ⁽⁸⁾⁽⁹⁾	$ CM_H $	$T_A=25^\circ C, V_{DD}=30V$ $V_{CM}=2000V, I_F=7\sim 16mA, V_F=0V$	35	50		$KV/\mu s$
Output Low Level Common Mode Transient Immunity ⁽⁸⁾⁽¹⁰⁾	$ CM_L $	$T_A=25^\circ C, V_{DD}=30V$ $V_{CM}=2000V, I_F=7\sim 16mA, V_F=0V$	35	50		$KV/\mu s$

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 = 2.0 A. See Applications section for additional details on limiting I_{OH} 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 loads V_{OH} will approach V_{CC} as I_{OH} approaches zero amps.
4. Maximum pulse width = 1 ms, maximum duty cycle = 20%.
5. This load condition approximates the gate load of a 1200 V/75A IGBT.
6. Pulse Width Distortion (PWD) is defined as $|t_{PHL}-t_{PLH}|$ for any given device.
7. The difference between t_{PHL} and t_{PLH} between any two HCPL-3120 parts under the same test condition.
8. Pins 1 and 4 need to be connected to LED common.
9. 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., $V_O>15.0V$).
10. 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., $V_O<1.0V$).

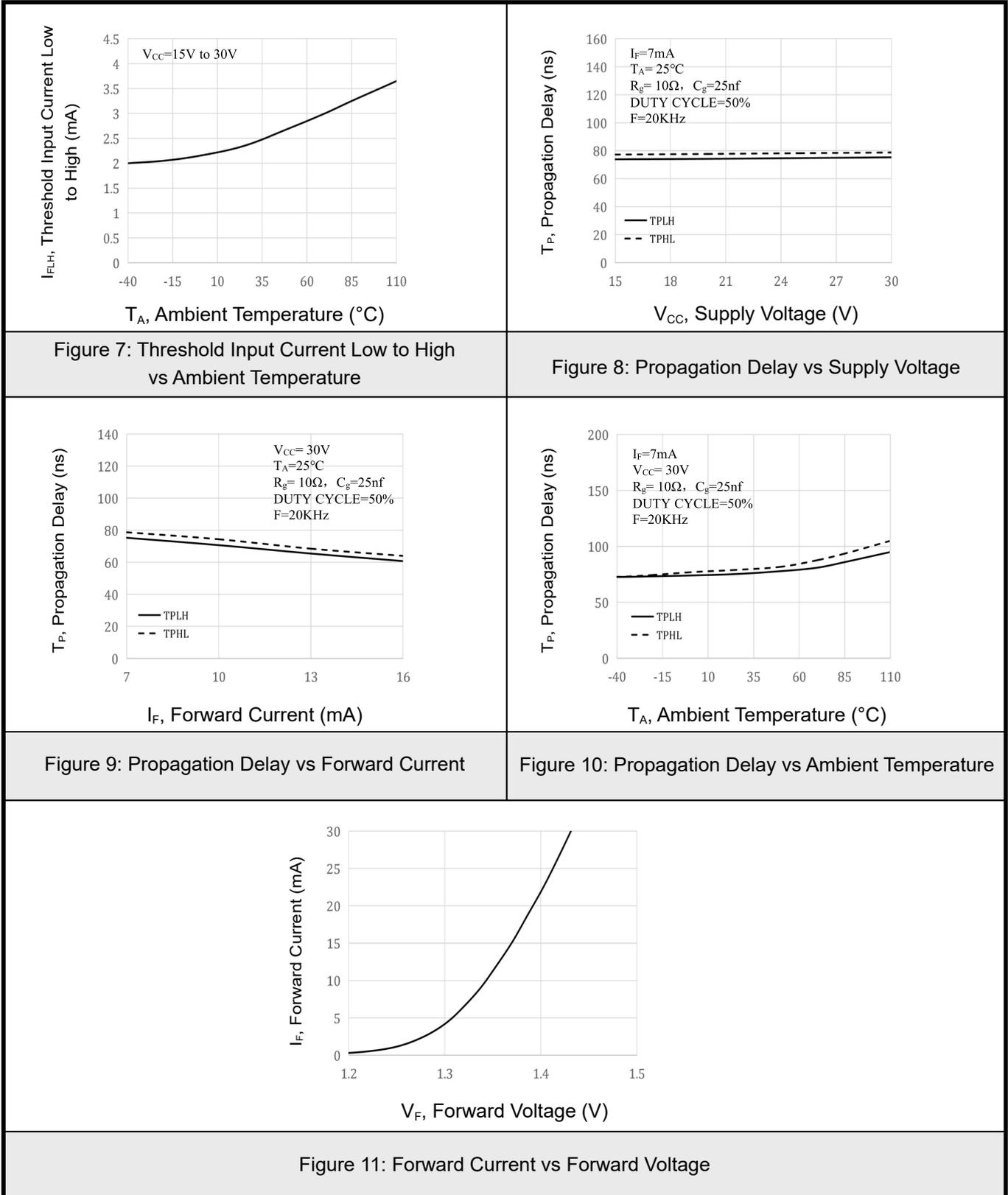


10.1 Typical Characteristic

<p>High Output Rail Voltage (V)</p> <p>$I_F=10\text{mA}$ $I_O=0\text{mA}$ $V_{CC}=30\text{V}$</p> <p>T_A, Ambient Temperature ($^{\circ}\text{C}$)</p>	<p>$V_{OH}-V_{CC}$, High Level Output Voltage (V)</p> <p>$I_F=7\text{ to }16\text{mA}$ $I_O=-100\text{mA}$ $V_{CC}=15\text{V to }30\text{V}$</p> <p>$T_A$, Ambient Temperature ($^{\circ}\text{C}$)</p>
<p>Figure 1: High Output Rail Voltage vs Ambient Temperature</p>	<p>Figure 2: High Level Output Voltage vs Ambient Temperature</p>
<p>V_{OL}, Low Level Output Voltage (V)</p> <p>$V_{F(OFF)}=0\text{V}$ $I_O=100\text{mA}$ $V_{CC}=15\text{V to }30\text{V}$</p> <p>$T_A$, Ambient Temperature ($^{\circ}\text{C}$)</p>	<p>I_{CC}, Supply Current (mA)</p> <p>$I_F=10\text{ mA for }I_{CCH}$ $V_F=0\text{ V for }I_{CCL}$ $V_{CC}=30\text{V}$</p> <p>T_A, Ambient Temperature ($^{\circ}\text{C}$)</p>
<p>Figure 3: Low Level Output Voltage vs Ambient Temperature</p>	<p>Figure 4: Supply Current vs Ambient Temperature</p>
<p>I_{CC}, Supply Current (mA)</p> <p>$I_F=10\text{mA for }I_{CCH}$ $V_F=0\text{ V for }I_{CCL}$ $T_A=25^{\circ}\text{C}$</p> <p>V_{CC}, Supply Voltage (V)</p>	<p>V_O, Output Voltage (V)</p> <p>$T_A=25^{\circ}\text{C}$ $V_{CC}=30\text{V}$</p> <p>I_{FLH}, Threshold Input Current Low to High (mA)</p>
<p>Figure 5: Supply Current vs supply Voltage</p>	<p>Figure 6: Output Voltage vs Threshold input Current Low to High</p>



10.2 Typical Characteristic





11. Test Circuits Diagrams

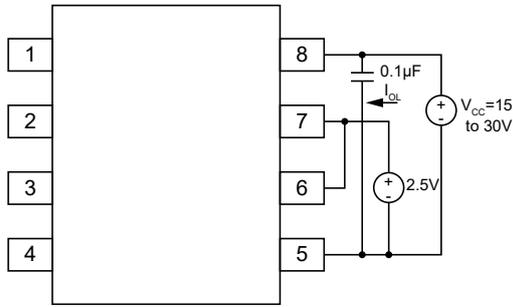


Figure.12 I_{OL} Pulsed Test Circuit

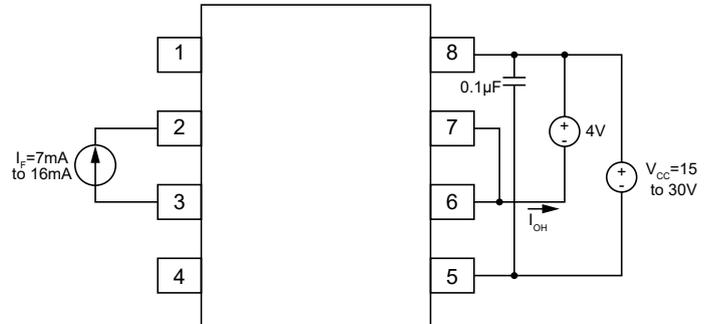


Figure.13 I_{OH} Pulsed Test Circuit

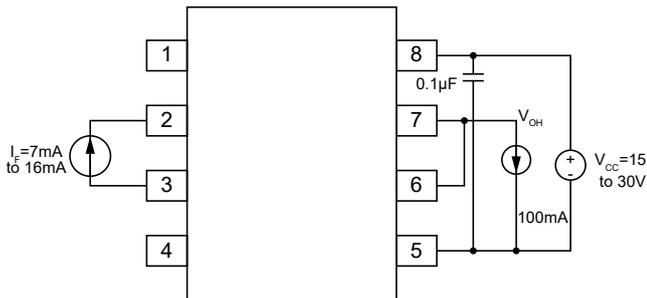


Figure.14 V_{OH} Pulsed Test Circuit

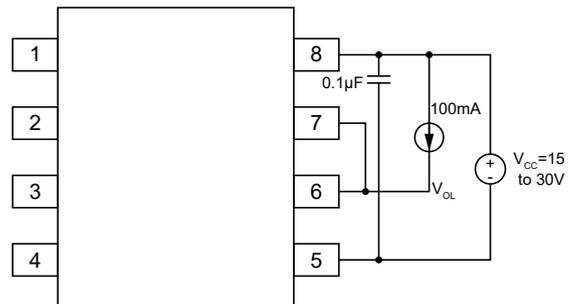


Figure.15 V_{OL} Pulsed Test Circuit

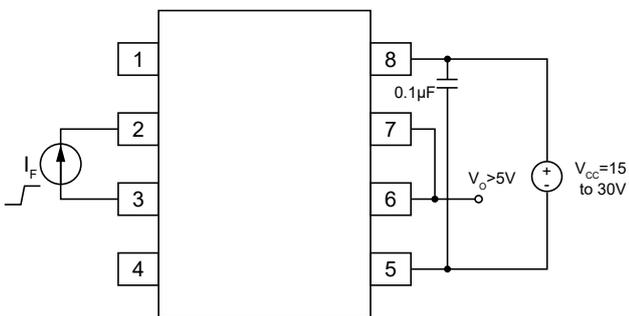


Figure.16 I_{FLH} Test Circuit

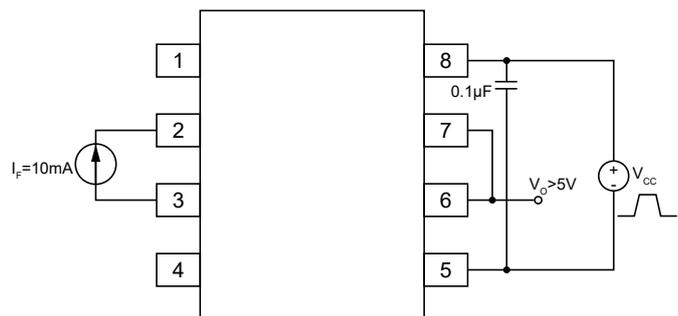


Figure.17 UVLO Test Circuit

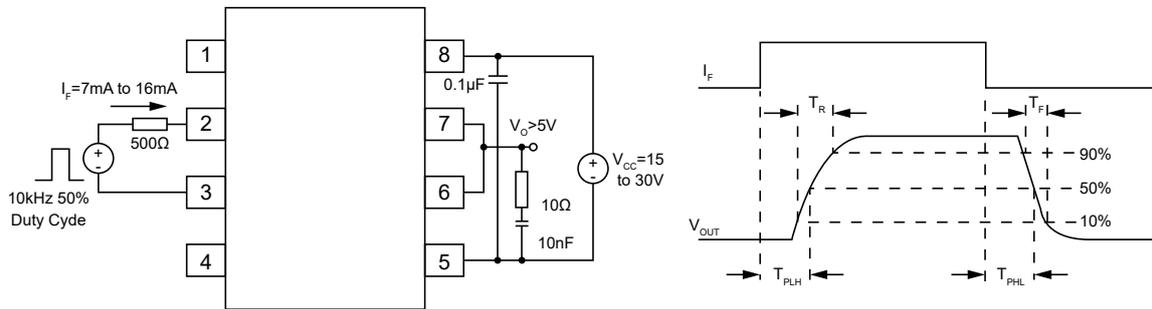


Figure.18 T_{PHL} , T_{PLH} , T_R , T_F Test Circuit

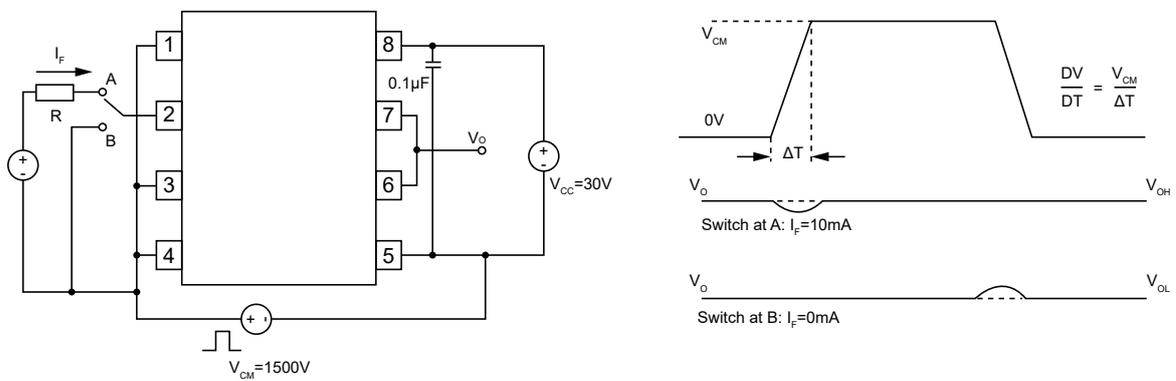
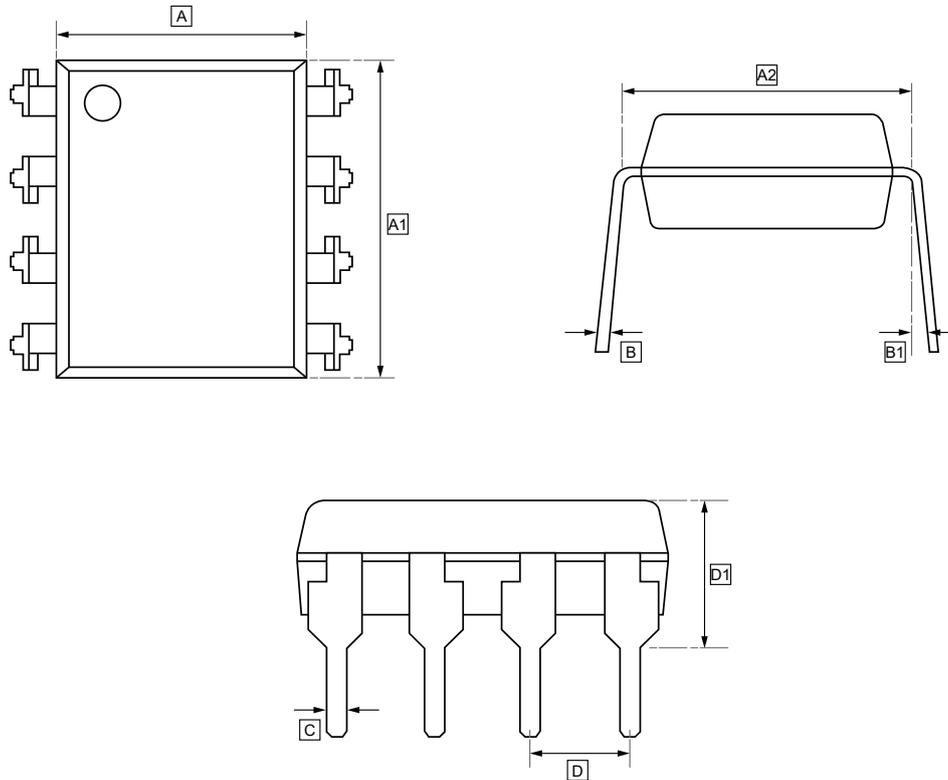


Figure.19 CMR Test Circuit



12.1 DIP-8 Package Outline Dimensions

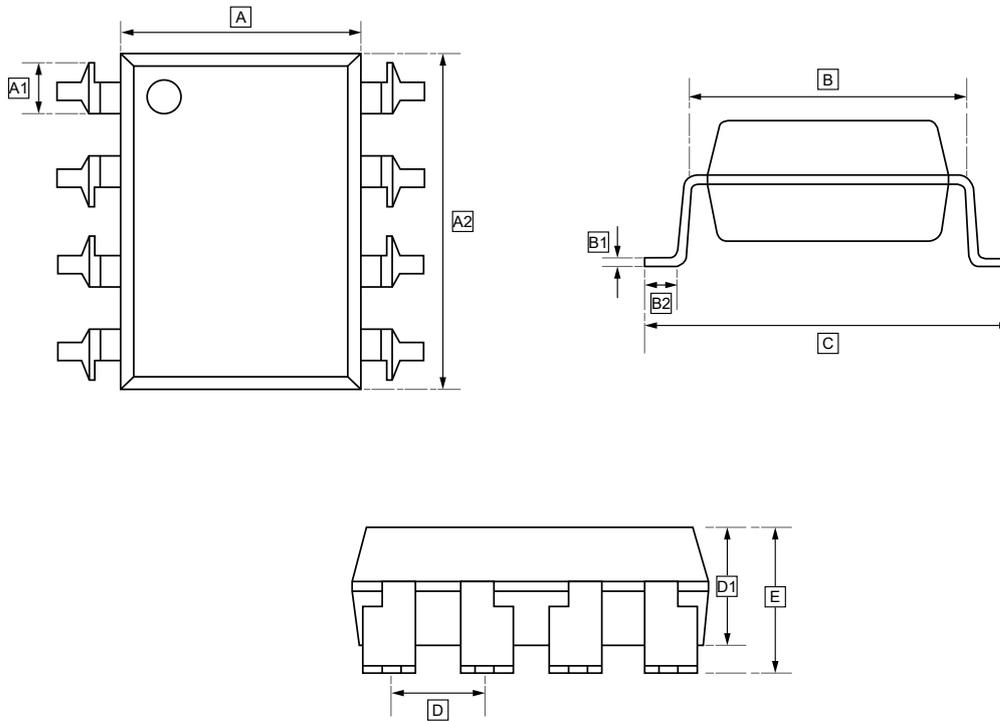


DIMENSIONS (mm are the original dimensions)

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

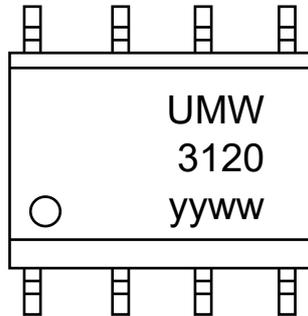


DIMENSIONS (mm are the original dimensions)

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			



13. Ordering Information



yy: Year Code
ww: Week Code

Order Code	Marking	Package	Base QTY	Delivery Mode
UMW HCPL-3120-000E	3120	DIP-8	2250	Tube and box
UMW HCPL-3120-500E	3120	SOP-8	1000	Tape and reel



14.Disclaimer

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