

## ICPL3120



### DESCRIPTION

The ICPL3120 consists of an Infrared Light Emitting Diode optically coupled to an Integrated Circuit with a Power Driving Output. ICPL3120 is ideally suitable to drive the Power IGBT and MOSFET in Inverters of Motor Controls and in Power Supplies.

The 2.5A peak output current is capable to direct drive IGBT/MOSFET up to ratings of 1200V/100A. For IGBTs with higher ratings, ICPL3120 can be used to drive a discrete power stage which drives the IGBT gate.

### FEATURES

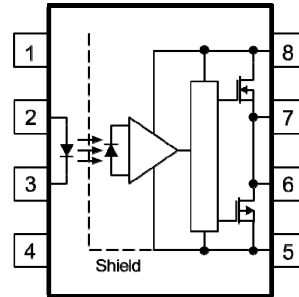
- $\pm 2.5A$  Maximum Peak Output Current
- 35kV/ $\mu s$  Minimum Common Mode Rejection at  $V_{CM}$  1500V
- Maximum Propagation Delay 500ns
- Maximum Propagation Delay Difference 100ns
- Wide Operating Voltage Range  
 $V_{CC}$  15 to 30 V
- Maximum Supply Current  $I_{CC}$  3.5mA
- Under Voltage Lock Out (UVLO) Protection with Hysteresis
- Guaranteed Performance over Temperature Range - 40°C to +105°C
- MSL 1
- Lead Free and RoHS Compliant
- Safety Approvals Pending

### APPLICATIONS

- IGBT/MOSFET Gate Drive
- UPS
- Inverters
- AC Brushless and DC Motor Drives

### ORDER INFORMATION

- Add G after PN for 10mm lead spacing
- Add SM after PN for Surface Mount
- Add SMT&R after PN for Surface Mount Tape & Reel



- |   |                  |
|---|------------------|
| 1 | NC               |
| 2 | Anode            |
| 3 | Cathode          |
| 4 | NC               |
| 5 | GND ( $V_{EE}$ ) |
| 6 | $V_O$            |
| 7 | $V_O$            |
| 8 | $V_{CC}$         |

A 0.1 $\mu F$  bypass Capacitor must be connected between Pins 8 and 5.

### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ C$ )

Stresses exceeding the absolute maximum ratings can cause permanent damage to the device.

Exposure to absolute maximum ratings for long periods of time can adversely affect reliability.

#### Input

Forward Current	20mA
Forward Peak Current	1A
(Pulse Width $\leq 1\mu s$ , 300pps)	
Forward Current Rise / Fall Time	500ns
Reverse Voltage	5V
Power dissipation	45mW

#### Output

Peak Output Current	$\pm 2.5A$
(Exponential waveform, Pulse Width $\leq 0.3\mu s$ , $f \leq 15kHz$ )	
Operating Frequency	50kHz
(Exponential waveform, $I_{O(Peak)} \leq 12.5A$ , Pulse Width $\leq 0.3\mu s$ )	
Supply Voltage ( $V_{CC} - V_{EE}$ )	0V to 35V
Output Voltage	0V to $V_{CC}$
Power Dissipation	250mW

#### Total Package

Isolation Voltage	5000V <sub>RMS</sub>
Total Power Dissipation	295mW
Operating Temperature	-40 to 105 °C
Storage Temperature	-55 to 125 °C
Junction Temperature	125 °C Max
Lead Soldering Temperature (10s)	260°C

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## ICPL3120

### Truth Table

LED	$V_{CC} - V_{EE}$ (Turn ON, +ve going)	$V_{CC} - V_{EE}$ (Turn OFF -ve going)	$V_o$
OFF	0 – 30V	0 – 30V	LOW
ON	0 – 11.0V	0 – 9.5V	LOW
ON	11.0 – 13.5V	9.5 – 12.0V	TRANSITION
ON	13.5 – 30V	12 – 30V	HIGH

### Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Operating Temperature	$T_A$	- 40	105	°C
Supply Voltage	$V_{CC} - V_{EE}$	15	30	V
Input Current (ON)	$I_{F(ON)}$	7	16	mA
Input Voltage (OFF)	$V_{F(OFF)}$	0	0.8	V



**ICPL3120**

**ELECTRICAL CHARACTERISTICS** (Typical Values at  $V_{CC} - V_{EE} = 30V$  and  $T_A = 25^\circ C$ ,  
Minimum and Maximum Values at Recommended Operating Conditions,  
unless otherwise specified)

**INPUT**

Parameter	Symbol	Test Condition	Min	Typ.	Max	Unit
Forward Voltage	$V_F$	$I_F = 10mA$	1.2	1.37	1.8	V
Forward Voltage Temperature Coefficient	$\Delta V_F / \Delta T$	$I_F = 10mA$		-1.237		mV/°C
Reverse Voltage	$V_R$	$I_R = 10\mu A$	5			V
Input Threshold Current (Low to High)	$I_{FLH}$	$V_{CC} = 30V$ $V_O > 5V$		1.8	5	mA
Input Threshold Voltage (High to Low)	$V_{FHL}$	$V_{CC} = 30V$ $V_O < 5V$	0.8			V
Input Capacitance	$C_{IN}$	$V_F = 0V, f = 1MHz$		33		pF

**OUTPUT**

Parameter	Symbol	Test Condition	Min	Typ.	Max	Unit
High Level Supply Current	$I_{CCH}$	$I_F = 10mA, V_{CC} = 30V$ $V_O = \text{Open}$		2.4	3.5	mA
Low Level Supply Current	$I_{CCL}$	$I_F = 0mA, V_{CC} = 30V$ $V_O = \text{Open}$		2.5	3.5	mA
High Level Output Current	$I_{OH}$	Maximum Pulse Width = 50µs $V_O = V_{CC} - 1.5V$  Maximum Pulse Width = 10µs $V_O = V_{CC} - 4V$			-1.0 -2.5	A
Low Level Output Current	$I_{OL}$	Maximum Pulse Width = 50µs $V_O = V_{EE} + 1.5V$  Maximum Pulse Width = 10µs $V_O = V_{EE} + 4V$	1.0 2.5			A
High Level Output Voltage	$V_{OH}$	$I_F = 10mA, I_O = -100mA$	$V_{CC} - 0.3$	$V_{CC} - 0.1$		V
Low Level Output Voltage	$V_{OL}$	$I_F = 0mA, I_O = 100mA$		$V_{EE} + 0.1$	$V_{EE} + 0.25$	V
UVLO Threshold	$V_{UVLO+}$	$V_O > 5V, I_F = 10mA$	11.0	12.7	13.5	V
	$V_{UVLO-}$	$V_O < 5V, I_F = 10mA$	9.5	11.2	12.0	V
UVLO Hysteresis	$UVLO_{HYS}$			1.5		V



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**SWITCHING**

Parameter	Symbol	Test Condition	Min	Typ.	Max	Unit
Propagation Delay Time to High Output Level	$t_{PLH}$	$I_F = 7$ to $16mA$ , $V_{CC} = 15$ to $30V$ , $V_{EE} = 0V$ , $R_g = 10\Omega$ , $C_g = 25nF$ , $f = 10kHz$ , Duty Cycle = 50%	50	130	500	ns
Propagation Delay Time to Low Output Level	$t_{PHL}$		50	130	500	
Pulse Width Distortion $ t_{PHL} - t_{PLH} $ for any given device	PWD			5	70	
Propagation Delay Difference ( $t_{PHL} - t_{PLH}$ ) between any two Devices	PDD		-100		100	
Output Rise Time (10% to 90%)	$t_r$				35	
Output Fall Time (90% to 10%)	$t_f$				35	
UVLO Turn On Delay	$t_{UVLO ON}$	$I_F = 10mA$ , $V_O > 5V$		1.6		$\mu s$
UVLO Turn Off Delay	$t_{UVLO OFF}$	$I_F = 10mA$ , $V_O < 5V$		0.4		$\mu s$
Common Mode Transient Immunity at High Output Level	$CM_H$	$I_F = 10$ to $16mA$ , $V_{CC} = 30V$ , $V_{CM} = 1500V$ , $T_A = 25^\circ C$	35	50		$kV/\mu s$
Common Mode Transient Immunity at Low Output Level	$CM_L$	$V_F = 0V$ , $V_{CC} = 30V$ , $V_{CM} = 1500V$ , $T_A = 25^\circ C$	35	50		$kV/\mu s$

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Minimum and Maximum Values at Recommended Operating Conditions,  
unless otherwise specified)

### ISOLATION

Parameter	Symbol	Test Condition	Min	Typ.	Max	Unit
Insulation Voltage	$V_{ISO}$	R.H. = 40% - 60%, $T_A = 25^\circ C$ $t = 1 \text{ min}$ ,	5000			V
Input - Output Resistance	$R_{I-O}$	$V_{I-O} = 500VDC$		$10^{12}$		$\Omega$
Input - Output Capacitance	$C_{I-O}$	$f = 1MHz$		0.92		pF

**Note :**

1. A 0.1uF or bigger bypass capacitor must be connected across pin 8 and pin 5.
2. PDD is the difference of  $t_{PHL}$  and  $t_{PLH}$  between any two ICPL3120 under same test conditions.
3. Common Mode Transient Immunity in High stage is the maximum tolerable negative  $dV_{CM}/dt$  on the trailing edge of the common mode impulse signal,  $V_{CM}$ , to assure that the output will remain high ( $V_O > 15V$ ).
4. Common Mode Transient Immunity in Low stage is the maximum tolerable positive  $dV_{CM}/dt$  on the leading edge of the common mode impulse signal,  $V_{CM}$ , to assure that the output will remain low ( $V_O < 1V$ ).

## ICPL3120

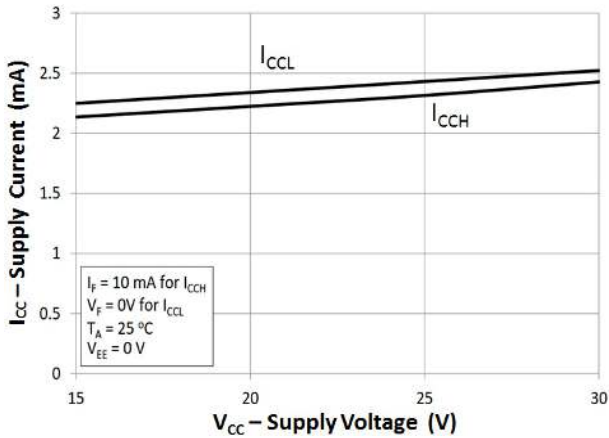


Fig 1 Supply Current vs Supply Voltage

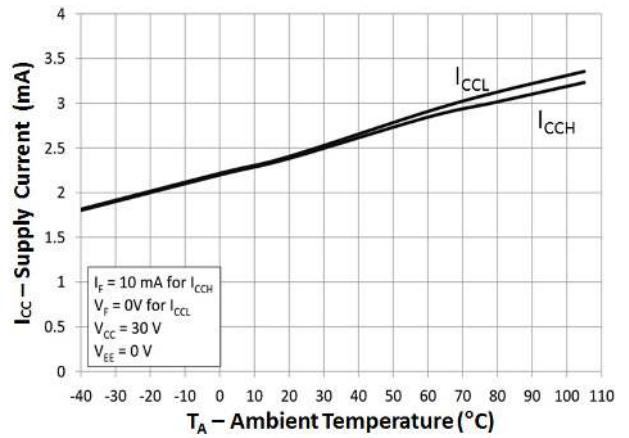


Fig 2 Supply Current vs Ambient Temperature

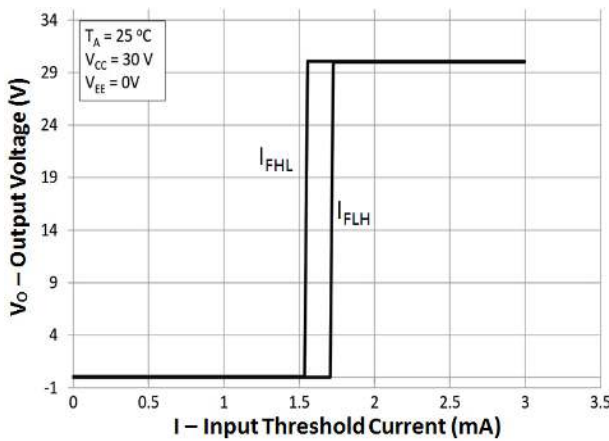


Fig 3 Transfer Characteristics

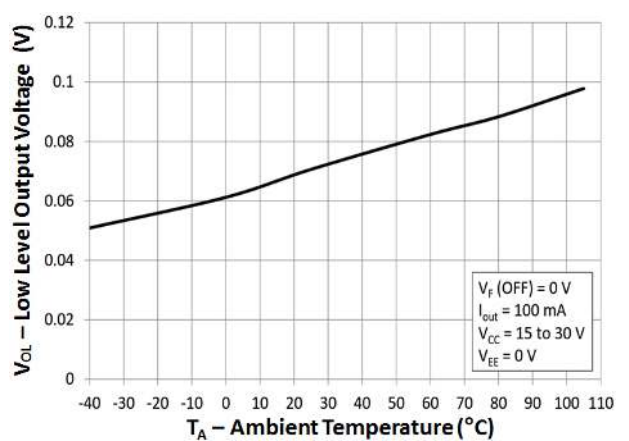


Fig 4 Output Low Voltage vs Ambient Temperature

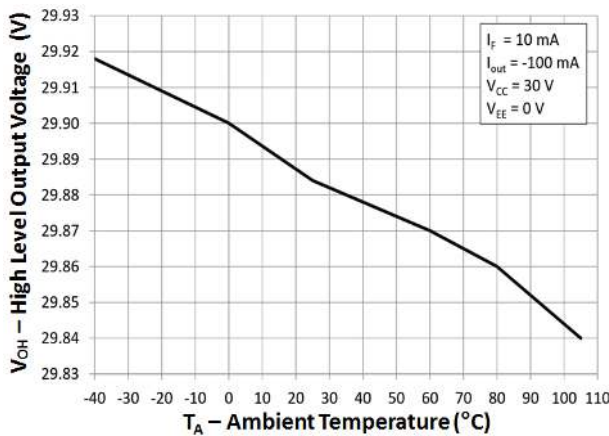


Fig 5 Output High Voltage vs Ambient Temperature

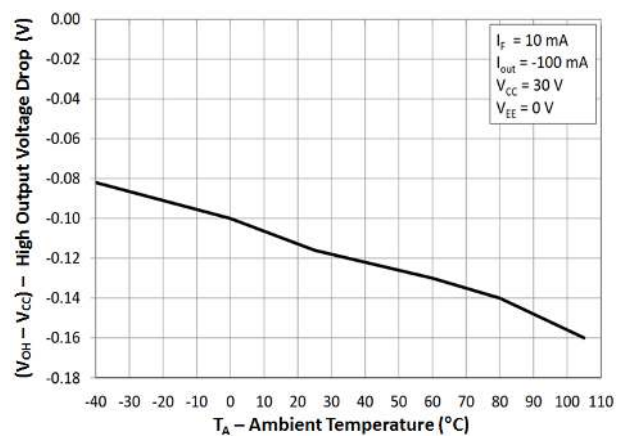
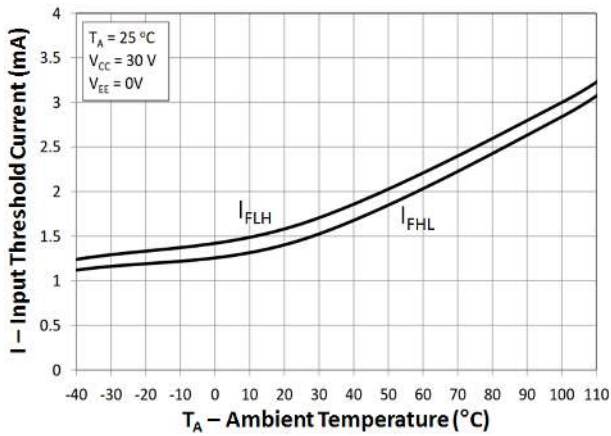
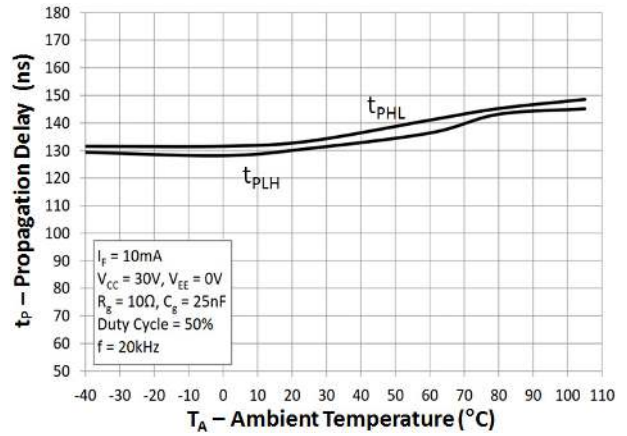


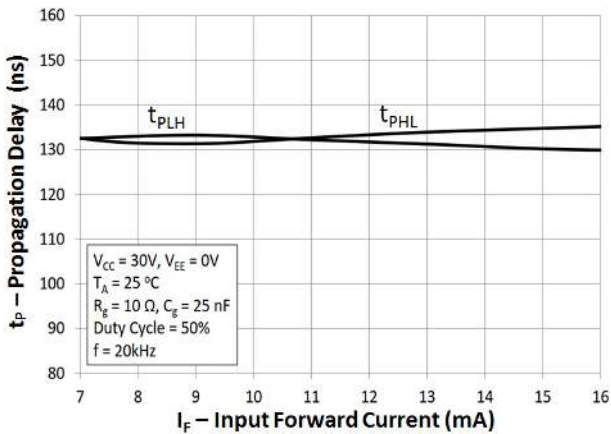
Fig 6 Output High Voltage Drop vs Ambient Temperature



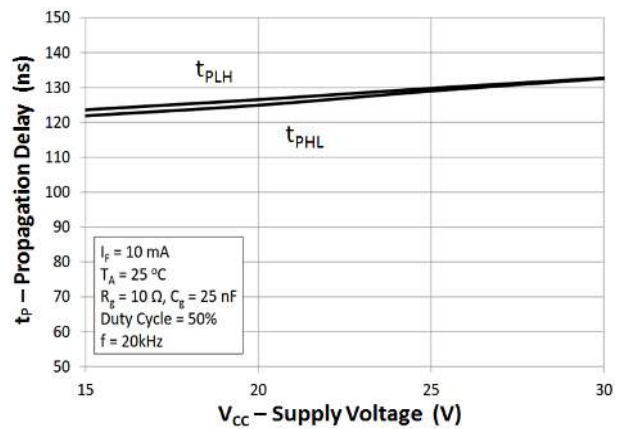
**Fig 7** Input Threshold Current vs Ambient Temperature



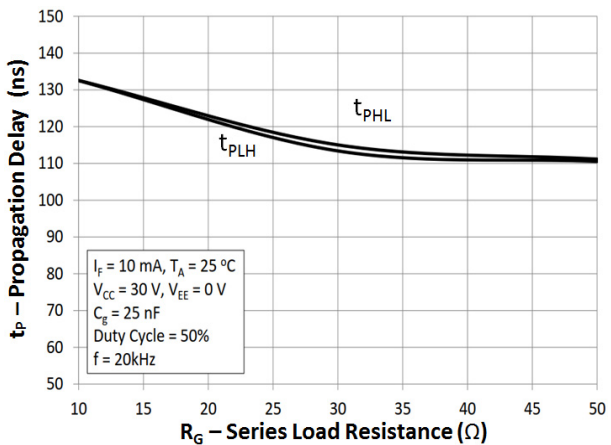
**Fig 8** Propagation Delay vs Ambient Temperature



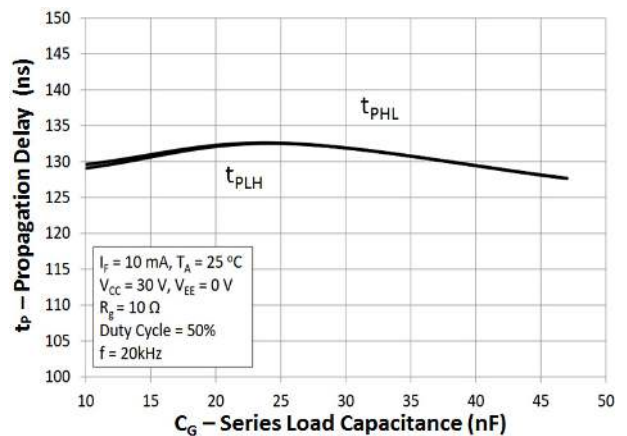
**Fig 9** Propagation Delay vs Forward Current



**Fig 10** Propagation Delay vs Supply Voltage



**Fig 11** Propagation Delay vs Series Load Resistance



**Fig 12** Propagation Delay vs Series Load Capacitance

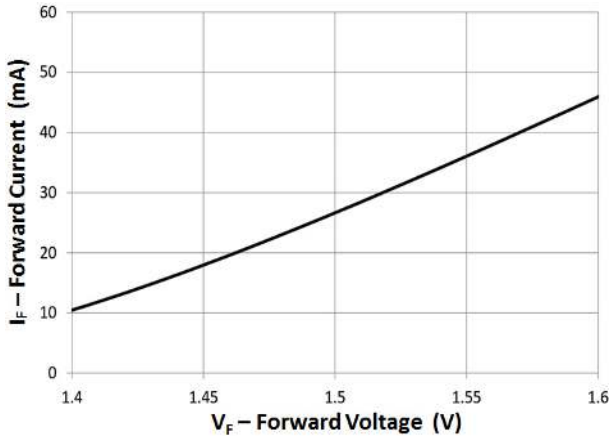
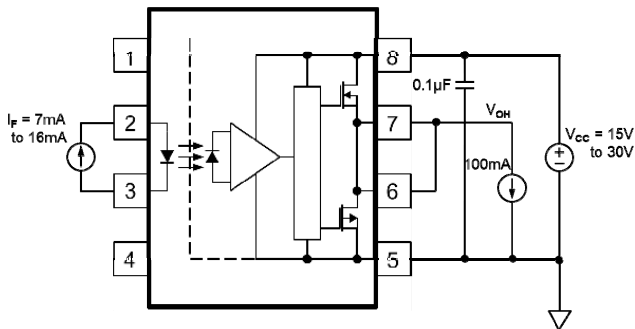
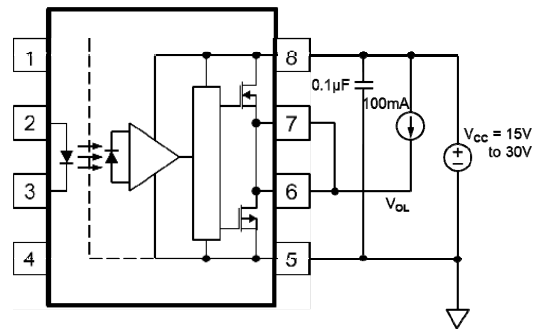


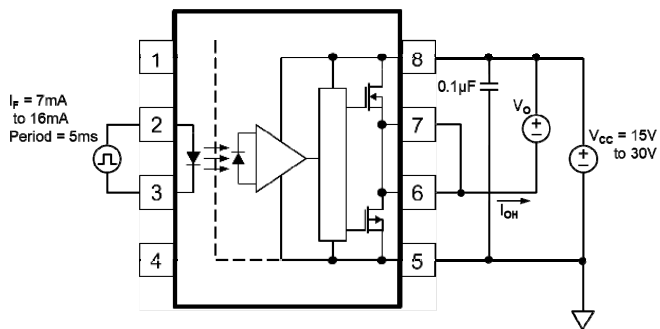
Fig 13 Forward Current vs Forward Voltage



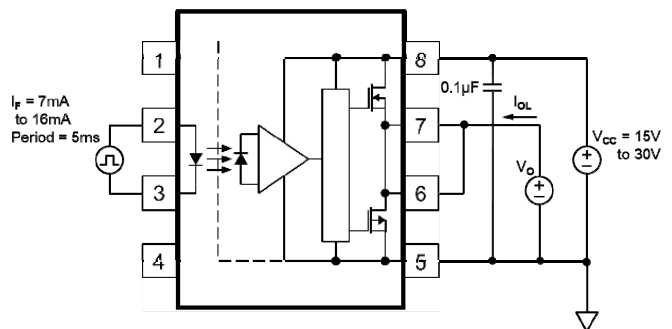
V<sub>OH</sub> Test Circuit



V<sub>OL</sub> Test Circuit



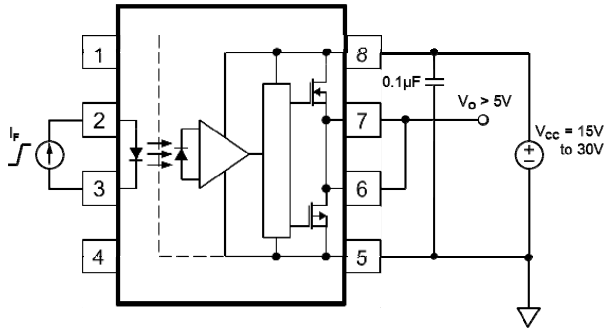
I<sub>OH</sub> Test Circuit



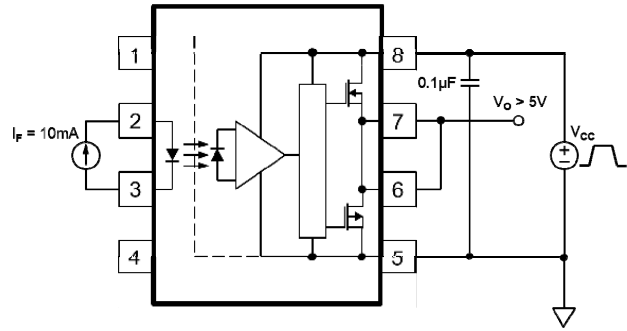
I<sub>OL</sub> Test Circuit



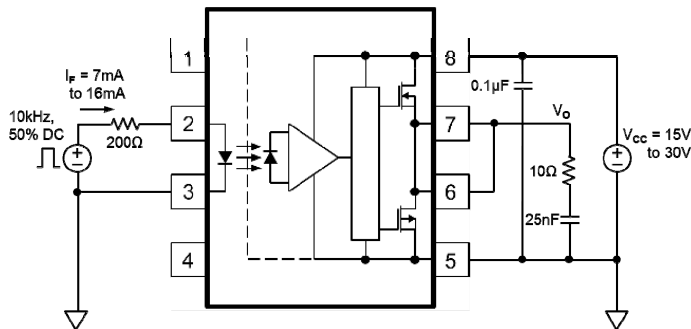
## ICPL3120



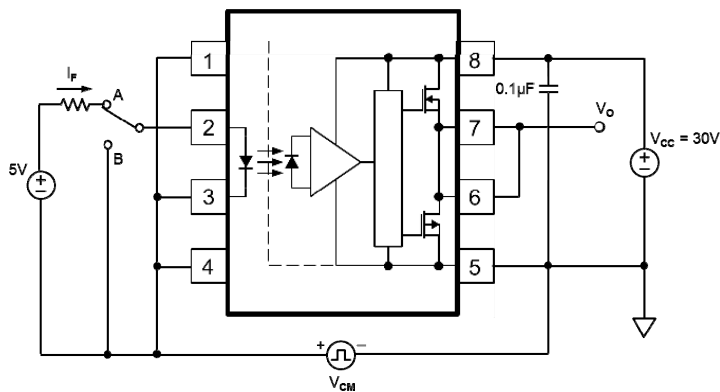
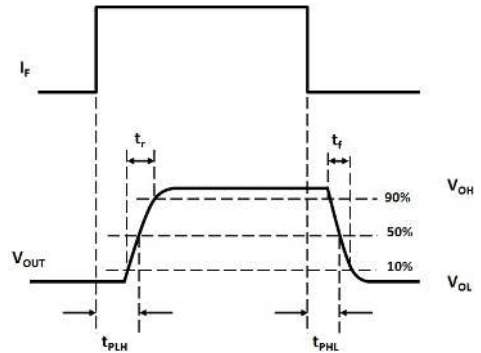
**$I_{FLH}$  Test Circuit**



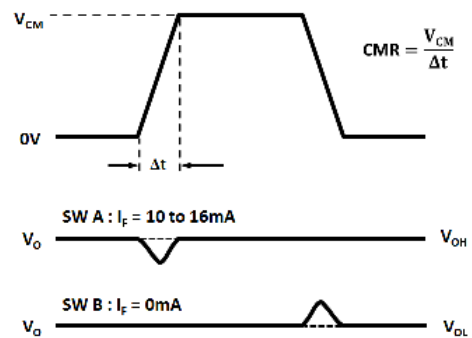
**UVLO Test Circuit**



**$t_r$ ,  $t_f$ ,  $t_{PLH}$  and  $t_{PHL}$  Test Circuit**



**CMR Test Circuit**

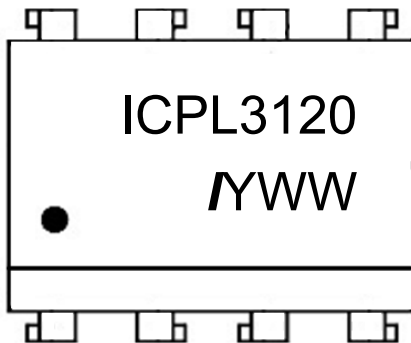


## ICPL3120

### ORDER INFORMATION

ICPL3120			
After PN	PN	Description	Packing quantity
None	ICPL3120	Standard DIP8	50 pcs per tube
G	ICPL3120G	10mm Lead Spacing	50 pcs per tube
SM	ICPL3120SM	Surface Mount	50 pcs per tube
SMT&R	ICPL3120SMT&R	Surface Mount Tape & Reel	1000 pcs per reel

### DEVICE MARKING

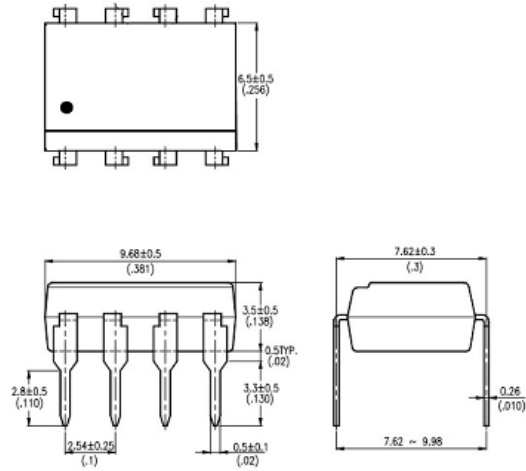


ICPL3120 denotes Device Part Number  
 I denotes Isocom  
 Y denotes 1 digit Year code  
 WW denotes 2 digit Week code

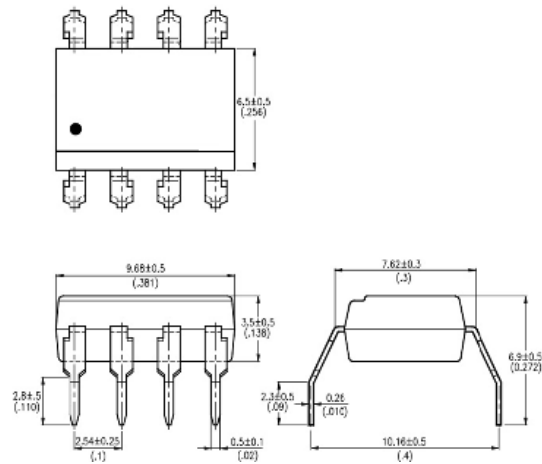
# ICPL3120

## PACKAGE DIMENSIONS in mm (inch)

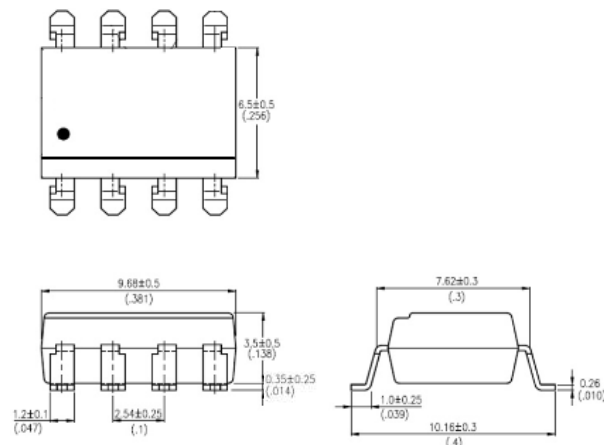
### DIP



### G Form

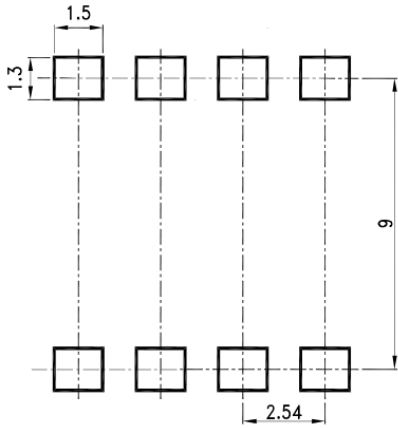


### SMD

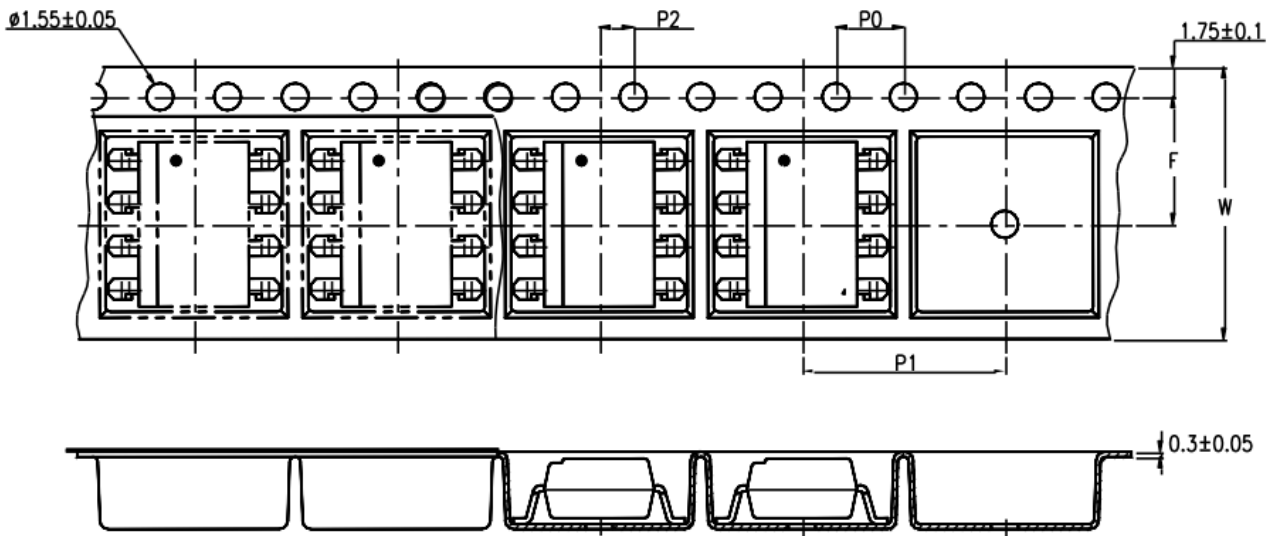


## ICPL3120

### RECOMMENDED SOLDER PAD LAYOUT (mm)

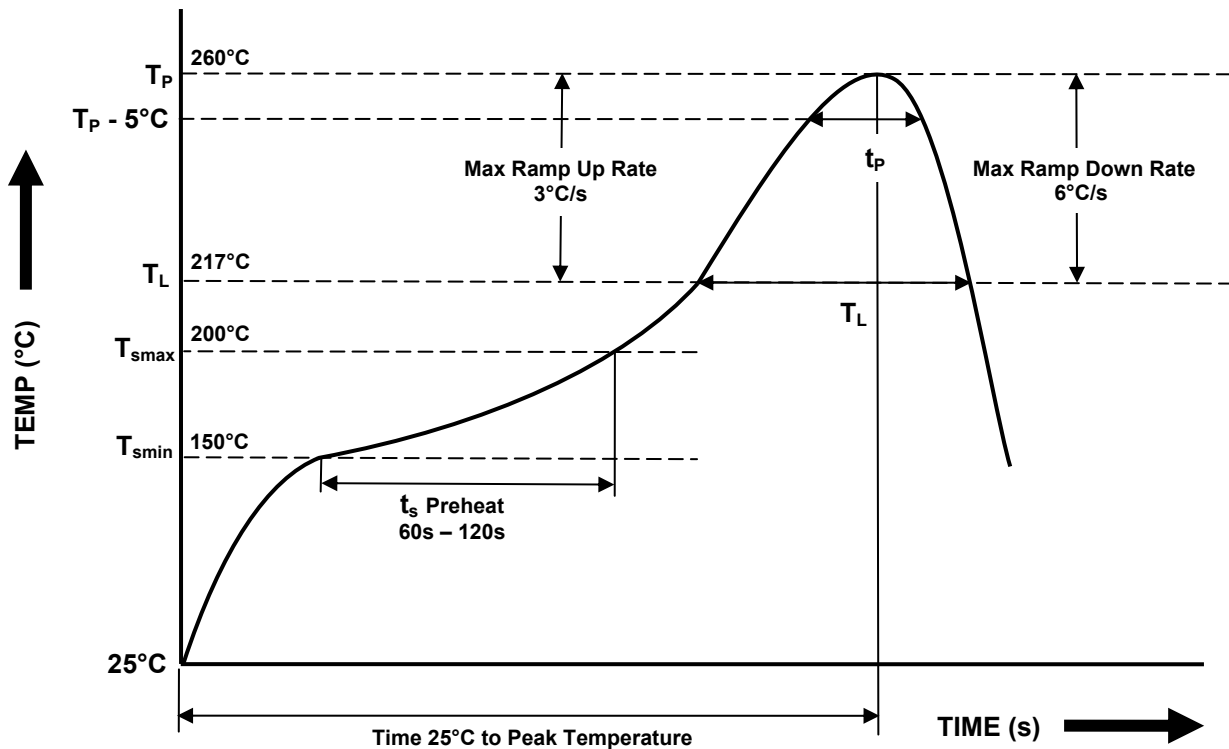


### TAPE AND REEL PACKAGING



Description	Symbol	Dimension mm (inch)
Tape Width	W	16 ± 0.3 (0.63)
Pitch of Sprocket Holes	P <sub>0</sub>	4 ± 0.1 (0.15)
Distance of Compartment to Sprocket Holes	F	7.5 ± 0.1 (0.295)
	P <sub>2</sub>	2 ± 0.1 (0.079)
Distance of Compartment to Compartment	P <sub>1</sub>	12 ± 0.1 (0.47)

**IR REFLOW SOLDERING TEMPERATURE PROFILE**  
**Note : One Time Reflow Soldering is Recommended.**  
**Do Not Immerse Device Body in Solder Paste.**



Profile Details	Conditions
<b>Preheat</b> - Min Temperature (T <sub>SMIN</sub> ) - Max Temperature (T <sub>SMAX</sub> ) - Time T <sub>SMIN</sub> to T <sub>SMAX</sub> (t <sub>s</sub> )	150°C 200°C 60s - 120s
<b>Soldering Zone</b> - Peak Temperature (T <sub>P</sub> ) - Time at Peak Temperature - Liquidous Temperature (T <sub>L</sub> ) - Time within 5°C of Actual Peak Temperature (T <sub>P</sub> - 5°C) - Time maintained above T <sub>L</sub> (t <sub>L</sub> ) - Ramp Up Rate (T <sub>L</sub> to T <sub>P</sub> ) - Ramp Down Rate (T <sub>P</sub> to T <sub>L</sub> )	260°C 10s max 217°C 30s max 60s - 100s 3°C/s max 6°C/s max
Average Ramp Up Rate (T <sub>Smax</sub> to T <sub>P</sub> )	3°C/s max
Time 25°C to Peak Temperature	8 minutes max



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