Features

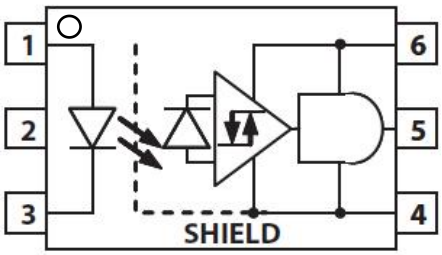
- Positive output type (totem pole output)
- Truth Table Guaranteed: VCC from 4.5V to 30V
- Performance Specified for Common IPM Applications Over Industrial Temperature Range.
- Short Maximum Propagation Delays
- Minimized Pulse Width Distortion (PWD)
- Very High Common Mode Rejection (CMR)
- Hysteresis
- Regulatory Approvals
  - UL - UL1577
  - VDE - EN60747-5-5(VDE0884-5)
  - CQC - GB4943.1

Applications

- IPM Interface Isolation
- Isolated IGBT/MOSFET Gate Drive
- AC and Brushless DC Motor Drives
- Industrial Inverters
- General Digital Isolation

Description

The ICPL-480 series fast speed photocoupler contains a LED and photo detector with built-in Schmitt trigger to provide logic-compatible waveforms, eliminating the need for additional wave shaping. The totem pole output eliminates the need for a pull up resistor and allows for direct drive Intelligent Power Module or gate drive. Minimized propagation delay difference between devices makes these optocouplers excellent solutions for improving inverter efficiency through reduced switching dead time.



TRUTH TABLE

LED	OUT
ON	H
OFF	L

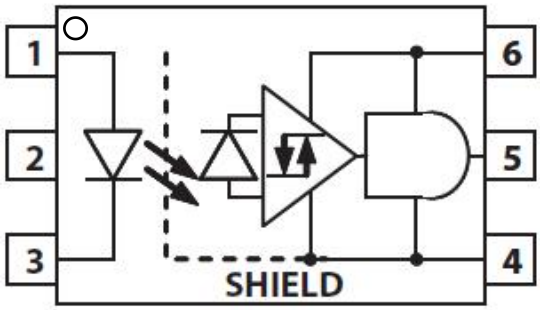
Note: A 0.1μF bypass capacitor must be connected between Pin 4 and 6.

ORDERING INFORMATION

Outline	Part Number	Package	Marking	Packing	Packing Size	Quantity
	ICPL-480P-500E	LSOP6	480P/W /YYWW	Reel	13 "	3000
	ICPL-480W-500E	LSOP6		Reel	13 "	3000

CONTENTS

PIN CONFIGURATION AND FUNCTIONS



Pin	Name
1	Anode
2	NC
3	Cathode
4	GND
5	V_O
6	V_{DD}

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit	Note
Storage Temperature	T_{stg}	-55	125	°C	-
Operating Temperature	T_{opr}	-40	110	°C	-
Output IC Junction Temperature	T_J	-	125	°C	-
Average Forward Input Current	I_F	-	20	mA	-
Reverse Input Voltage	V_R	-	5	V	-
Output Collector Current	I_O		50	mA	
Supply Voltage	V_{CC}	0	35	V	
Output Collector Voltage	V_O	-0.5	Vcc	V	-
Total Package Power Dissipation	P_T	-	145	mW	-
Lead Solder Temperature	T_{sol}	-	260	°C	-

Note: A ceramic capacitor (0.1μF) should be connected between pin 6 and pin 4 to stabilize the operation of a high gain linear amplifier. Otherwise, this Photocoupler may not switch properly. The bypass capacitor should be placed within 1 cm of each pin.

RECOMMENDED OPERATION CONDITIONS

Parameter	Symbol	Min.	Max.	Unit
Operating Temperature	T_a	-40	110	°C
Supply Voltage[1]	V_{CC}	4.5	30	V
Input Current (ON)[2]	$I_{F(ON)}$	1.6	5	mA
Input Voltage (OFF)	$V_{F(OFF)}$		0.8	V

Note 1: Detector requires a V_{CC} of 4.5V or higher for stable operation as output might be unstable if V_{CC} is lower than 4.5V. Be sure to check the power ON/OFF operation other than the supply current.
Note 2: The initial switching threshold is 1.6 mA or less. It is recommended that 2.2mA be used to permit at least a 20% LED degradation guard band.

ISOLATION CHARACTERISTIC

Parameter	Symbo	Device	Min.	Typ.	Max.	Unit	Test Condition	Note
Withstand Insulation Test Voltage	V_{ISO}	ICPL-480P	5000	-	-	V	40% ≤ RH ≤ 60%, t = 1min, T_a = 25°C	1,2
		ICPL-480W						
Input-Output Resistance	R_{I-O}	-	-	10^{12}	-	Ω	V_{I-O} = 500V DC	1

All Typical values at T_a = 25°C
Note 1: Device is considered a two terminal device: pins 1, 2, 3 are shorted together and pins 4, 5, 6 are shorted together.
Note 2: According to UL1577, each photocoupler is tested by applying an insulation test voltage 6000VRMS for one second.

ELECTRICAL OPTICAL CHARACTERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition	Note
INPUT CHARACTERISTICS							
Input Forward Voltage	V_F	1.6	2.0	2.4	V	I_F=10mA	-
Input Forward Voltage Temperature Coefficient	$\Delta V_F/ \Delta T$	-	-1.237	-	mV/°C	I_F=10mA	-
Input Reverse Voltage	BV_R	5	-	-	V	I_R=10μA	-
Input Threshold Current (Low to High)	I_{FLH}	-	0.2	1.5	mA	V_{CC}=30V, V_O>5V	-
Input Threshold Voltage (High to Low)	V_{FHL}	0.8	-	-	V	V_{CC}=30V, V_O<5V	-
Input Capacitance	C_{IN}	-	60	-	pF	f =1MHz, V_F=0V	2
OUTPUT CHARACTERISTICS							
High Level Supply Current	I_{CCH}	-	-	3.0	mA	V_{CC}=5.5V, I_F=5mA, I_O=0mA	-
			1.9	3.0	mA	V_{CC}=30V, I_F=5mA, I_O=0mA	
Low Level Supply Current	I_{CCL}	-	-	3.0	mA	V_{CC}=5.5V, V_F=0V, I_O=0mA	-
			2.0	3.0	mA	V_{CC}=30V, V_F=0V, I_O=0mA	
High level output current	I_{OH}	-	-	-160	mA	V_{CC}=5.5V, I_F=5mA, V_O=GND	1
		-	-	-200		V_{CC}=20V, I_F=5mA, V_O=GND	
Low level output current	I_{OL}	160	-	-	mA	V_O=V_{CC}=5.5V, V_F=0V	1
		200	-	-		V_O=V_{CC}=20V, V_F=0V	
High level output voltage	V_{OH}	V_{CC}-0.5	V_{CC}-0.04	-	V	I_{OL}=-6.5mA	-
Low level output voltage	V_{OL}	-	0.09	0.5	V	I_{OL}=6.5mA	-

Specified over recommended temperature (T_a = -40°C to +110°C, +4.5V ≤ V_{CC} ≤ 30V), $I_{F(ON)}$ = 1.6mA to 5mA, $V_{F(OFF)}$ = 0V to 0.8V, unless otherwise specified. All typicals at T_a = 25°C.
Note 1: Duration of output short circuit time should not exceed 500 μs.
Note 2: Input capacitance is measured between pin 1 and pin 3.

SWITCHING SPECIFICATION

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition	Note
SWITCHING CHARACTERISTICS							
Propagation Delay Time to Output Low Level	t_{PHL}	-	110	220	ns	f = 10kHz, Duty Cycle = 50% I_F = 2mA, V_{CC} = 30V	1
Propagation Delay Time to Output High Level	t_{PLH}	-	90	220	ns		1
Pulse Width Distortion	PWD	-	20	120	ns		2
Propagation Delay Difference Between Any Two Parts	PDD (t_{PHL} - t_{PLH})	-200	-	+200	ns		3
Rise Time	t_r	-	6	-	ns		
Fall Time	t_f	-	7	-	ns		
Common Mode Transient Immunity at Logic High	CM_H	20	-	-	kV/μs	I_F=4.0mA,V_{CC}= 5V, T_a= 25 °C, V_{CM}= 1.5KV	4
Common Mode Transient Immunity at Logic Low	CM_L	20	-	-	kV/μs	I_F=0mA,V_{CC}= 5V, T_a= 25°C, V_{CM}= 1.5KV	4

Over recommended operating conditions T_a = -40° C to 105° C, V_{CC} = +4.5 V to 30 V, $I_{F(ON)}$ = 1.6 mA to 5 mA, $V_{F(OFF)}$ = 0 V to 0.8 V,unless otherwise specified. All typicals at T_a = 25°C.
Note 1: The t_{PLH} propagation delay is measured from the 50% point on the leading edge of the input pulse to the 1.3 V point on the leading edge of the output pulse. The t_{PHL} propagation delay is measured from the 50% point on the trailing edge of the input pulse to the 1.3 V point on the trailing edge of the output pulse.
Note 2: Pulse Width Distortion (PWD) is defined as | t_{PHL} - t_{PLH} | for any given device.
Note 3: The difference of t_{PLH} and t_{PHL} between any two devices under the same test condition.
Note 4: CM_H is the maximum slew rate of the common mode voltage that can be sustained with the output voltage in the logic high state, V_O > 2.0 V. CM_L is the maximum slew rate of the common mode voltage that can be sustained with the output voltage in the logic low state, V_O < 0.8 V. Note: Equal value split resistors (Rin/2) must be used at both ends of the LED.

TYPICAL PERFORMANCE CURVES

Fig.1 V_{OL} vs. Temperature

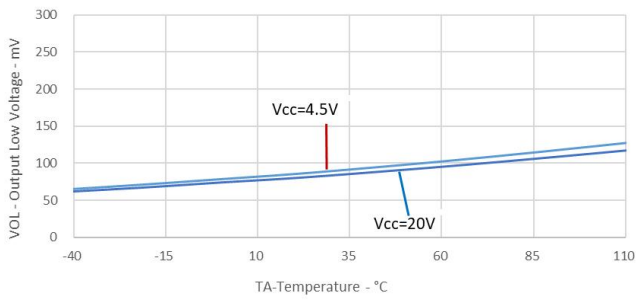


Fig.2 V_{OH} vs. Temperature

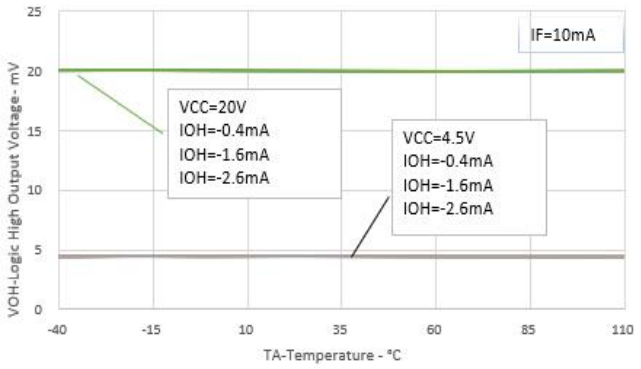


Fig.3 I_{FLH} Hysteresis

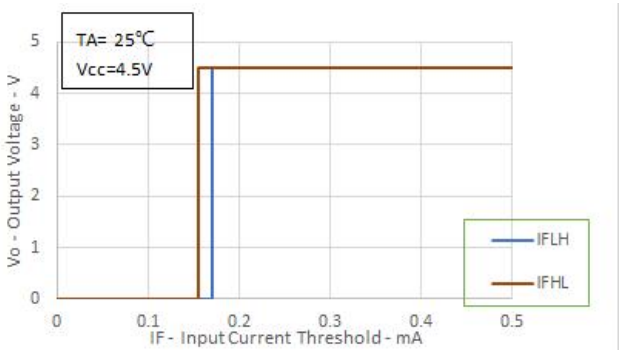


Fig.4 I_{FLH} vs. Temperature

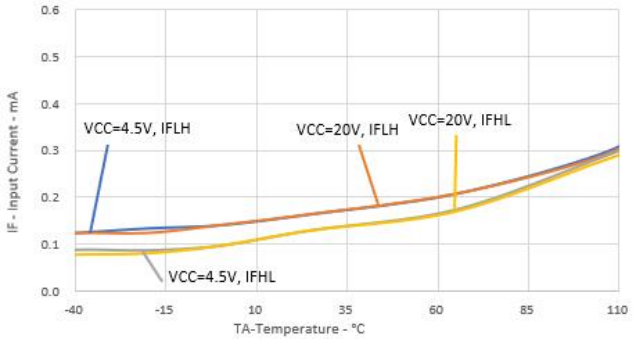


Fig.5 Input Current vs. Voltage

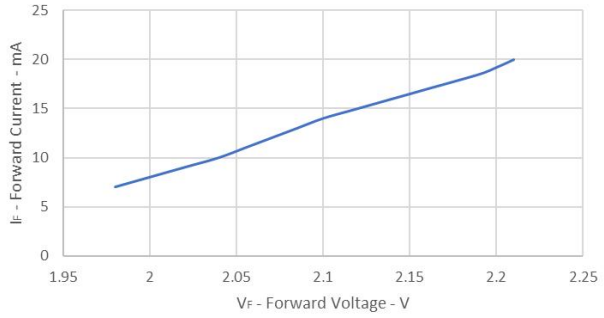


Fig. 6 Supply Voltage vs. Output Voltage

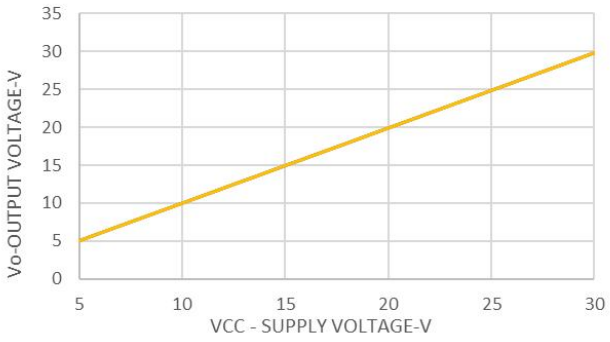


Fig.7 Propagation Delays vs. Temperature

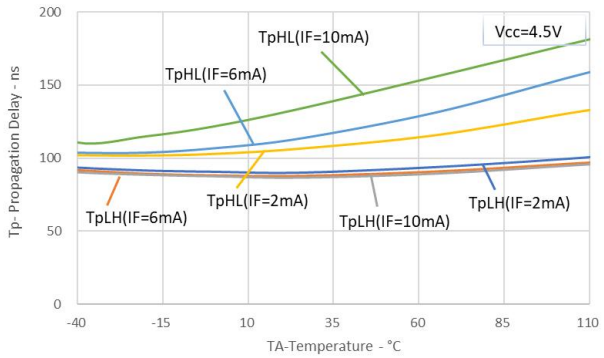


Fig.8 Propagation Delays vs. Temperature

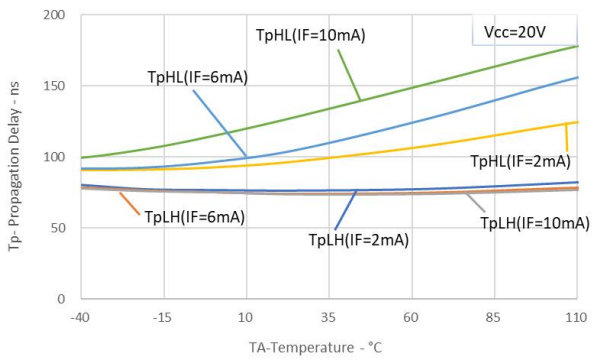
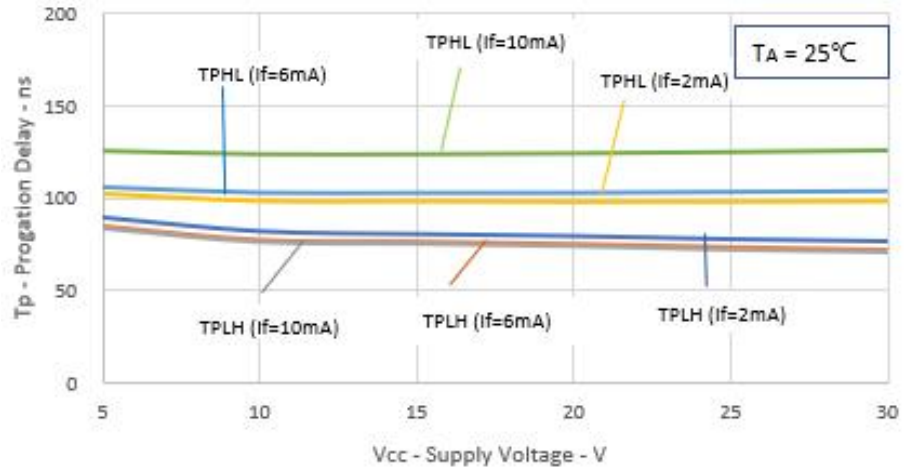


Fig.9 Propagation Delays vs. V_{CC}



TEST CIRCUITS

Fig.10 Test Circuit for t_{PLH}、t_{PHL}、t_r and t_f

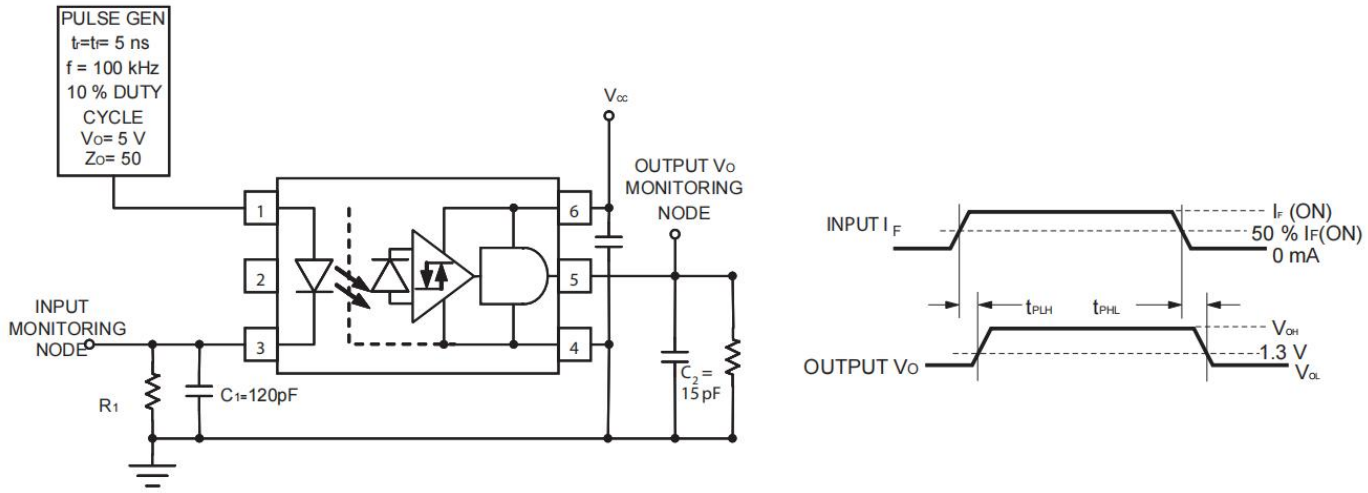
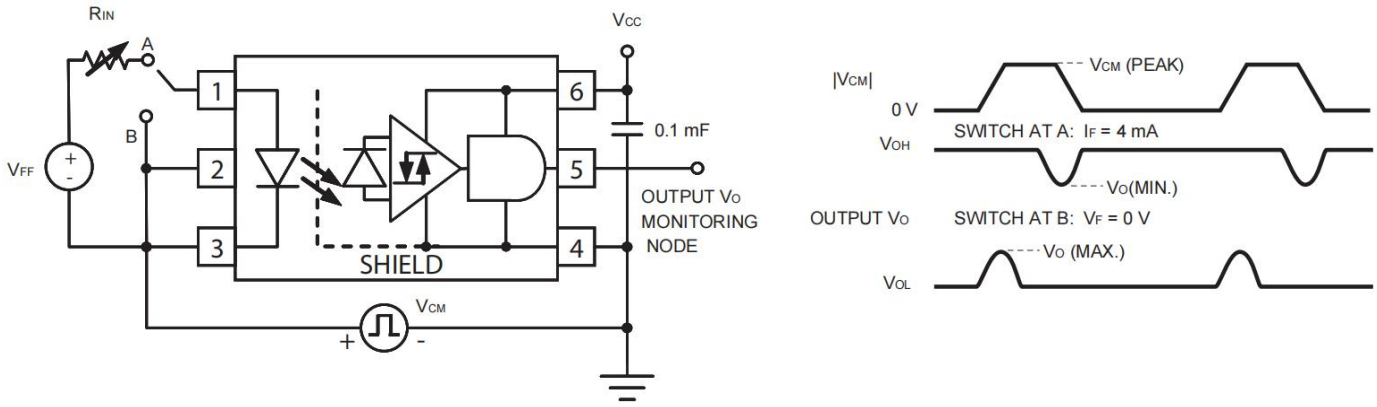
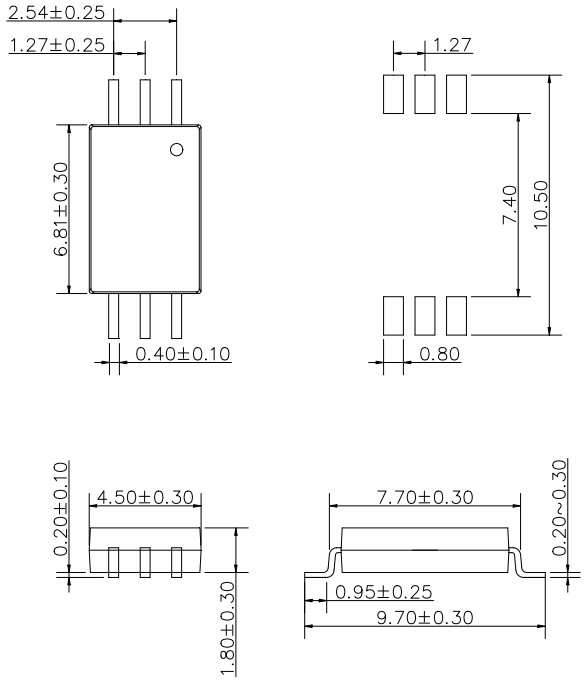


Fig.11 Common Mode Transient Immunity Test Circuit and Typical Waveforms

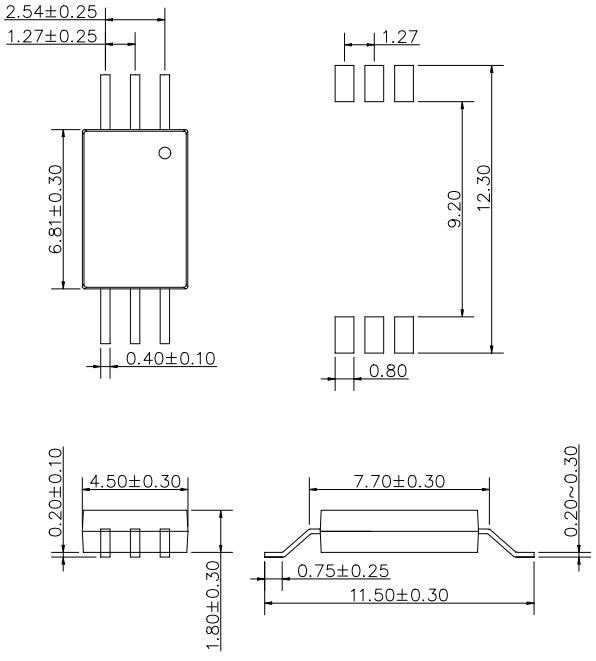


PACKAGE DIMENSIONS

Surface Mount Lead Forming (P type)



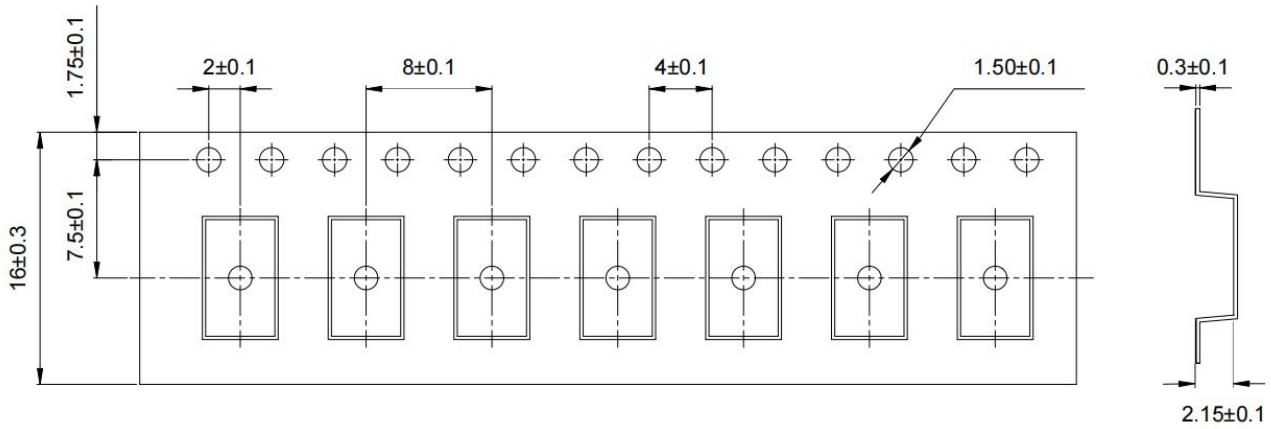
Surface Mount Lead Forming (W type)



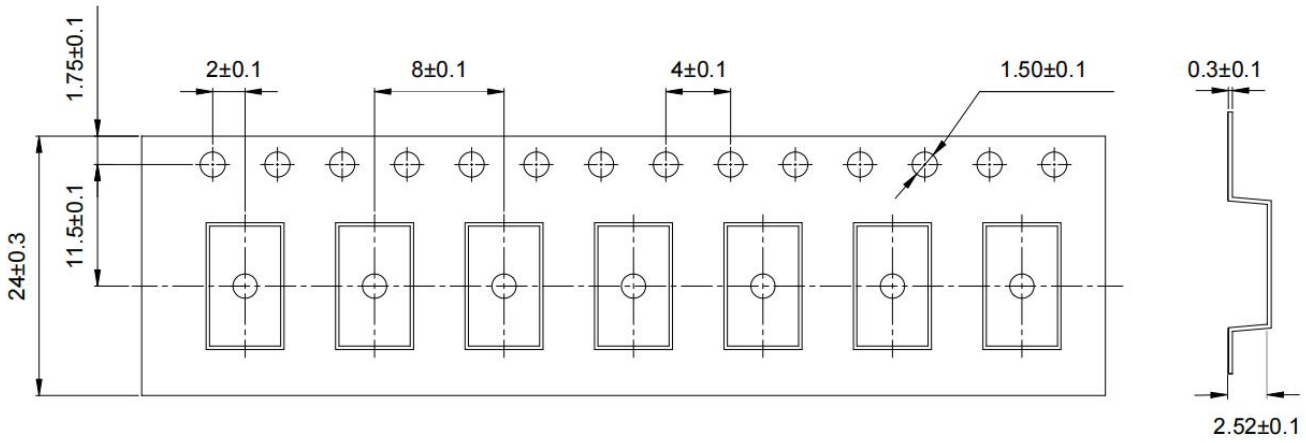
- **Dimensions in mm unless otherwise stated**

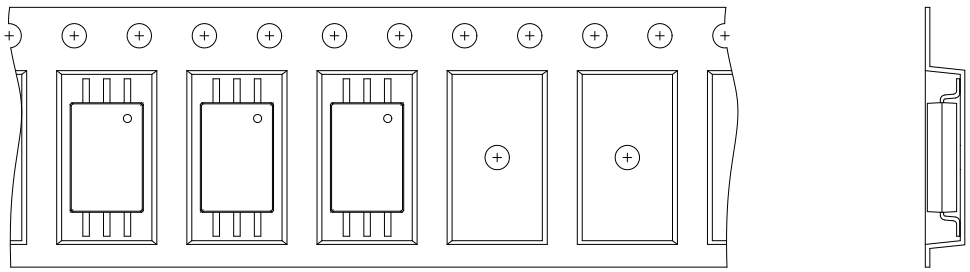
TAPING DIMENSIONS

Option LSOP6-P



Option LSOP6-W





- **Dimensions in mm unless otherwise stated**

ORDERING AND MARKING INFORMATION

Marking Information

480	:	Part Number
P/W	:	Lead Form Option（P/W）
/	:	ISOMICRON
YY	:	Fiscal Year
WW	:	Work Week

Order Code

ICPL – 480 X - 5 0 0 E

Company Abbr.

Part Number

Lead Form Option
P - 9mm Clearance
W- 11mm Clearance

Lead Forming
5: SM-SL

Halogen Free:
E: Halogen-free,Lead-free
Z: Halogen, Lead-free

None

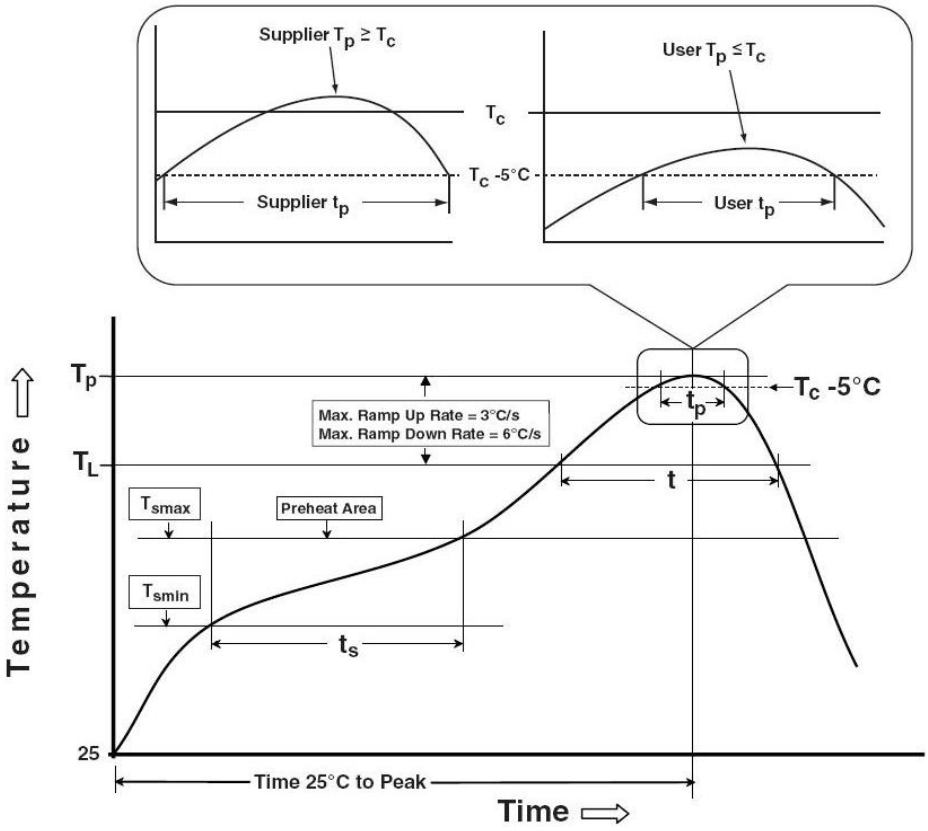
Performance
0: Normal
1: Enhanced
2: Industrial level
3: Auto level
4: Military level

Packing Quantity

Option	Quantity	Quantity – Inner box	Quantity – Outer box
480W	3000Units/Reel	2 Reels/Inner box	5 Inner box/Outer box = 30k Units
480P	3000Units/Reel	3 Reels/Inner box	5 Inner box/Outer box = 45k Units

REFLOW INFORMATION

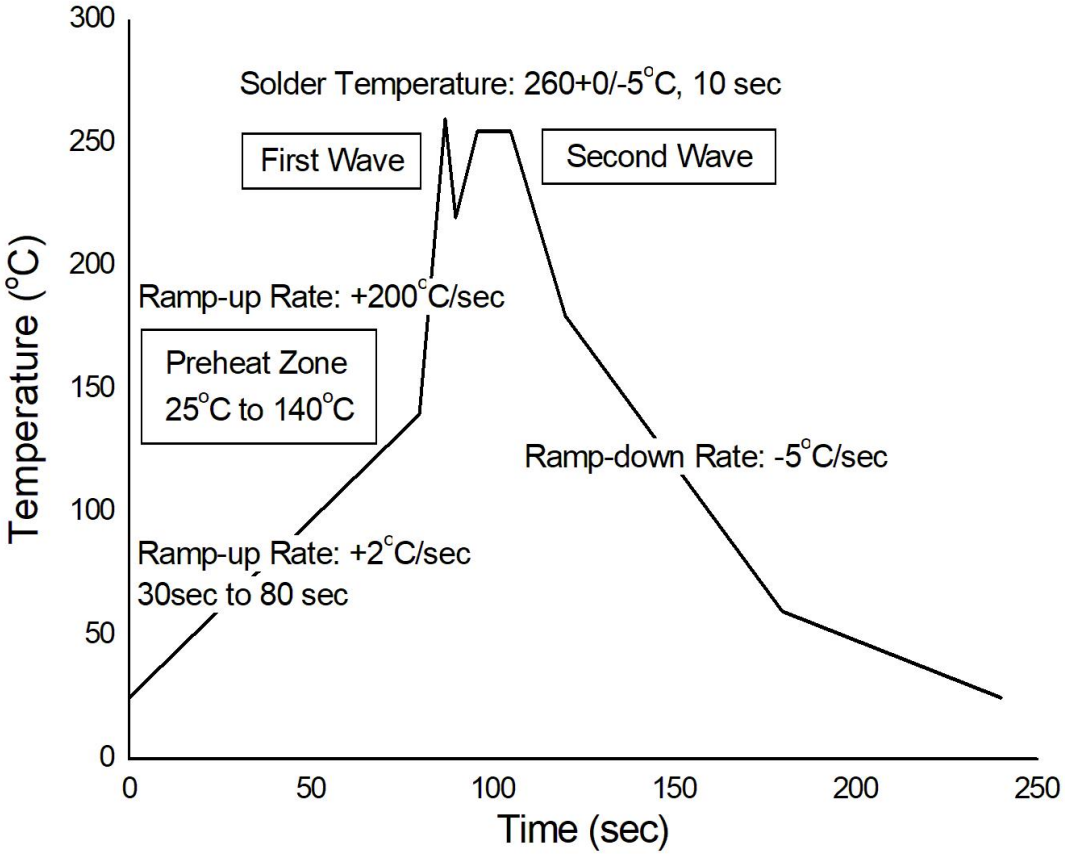
Reflow Profile



Profile Feature	Sn-Pb Assembly Profile	Pb-Free Assembly Profile
Temperature Min. (Tsmin)	100	150°C
Temperature Max. (Tsmax)	150	200°C
Time (ts) from (Tsmin to Tsmax)	60-120 seconds	60-120 seconds
Ramp-up Rate (tL to tP)	3°C/second max.	3°C/second max.
Liquidous Temperature (TL)	183°C	217°C
Time (tL) Maintained Above (TL)	60 – 150 seconds	60 – 150 seconds
Peak Body Package Temperature	235°C +0°C / -5°C	260°C +0°C / -5°C
Time (tP) within 5°C of 260°C	20 seconds	30 seconds
Ramp-down Rate (TP to TL)	6°C/second max	6°C/second max
Time 25°C to Peak Temperature	6 minutes max.	8 minutes max.

TEMPERATURE PROFILE OF SOLDERING

Wave Soldering (JESD22-A111 Compliant)



Hand Soldering By Soldering Iron	
Soldering Temperature	380+0/-5°C
Soldering Time	3 sec max.

- **One time soldering is recommended for all soldering method.**
- **Do not solder more than three times for IR reflow soldering.**

DISCLAIMER

- ISOMICRON is continually improving the quality, reliability, function and design. ISOMICRON reserves the right to make changes without further notices.
- The characteristic curves shown in this datasheet are representing typical performance which are not guaranteed.
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- This product is not intended to be used for military, aircraft, medical, life sustaining or lifesaving applications or any other application which can result in human injury or death.
- Please contact ISOMICRON sales agent for special application request.
- Immerge unit's body in solder paste is not recommended.
- Parameters provided in datasheets may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated in each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify ISOMICRON's terms and conditions of purchase, including but not limited to the warranty expressed therein.
- Discoloration might be occurred on the package surface after soldering, reflow or long-time use. It neither impacts the performance nor reliability.