



# MPCS-456 Series

LSOP6, DC Input, IPM and Gate Drive Interface Photo Coupler

## Description

The MPCS-456 series Photocoupler contain a LED optically coupled to an integrated high-gain photo detector. Minimized propagation delay difference between devices make these optocouplers excellent solutions for improving inverter efficiency through reduced switching dead time. Specifications and performance plots are given for typical IPM applications.

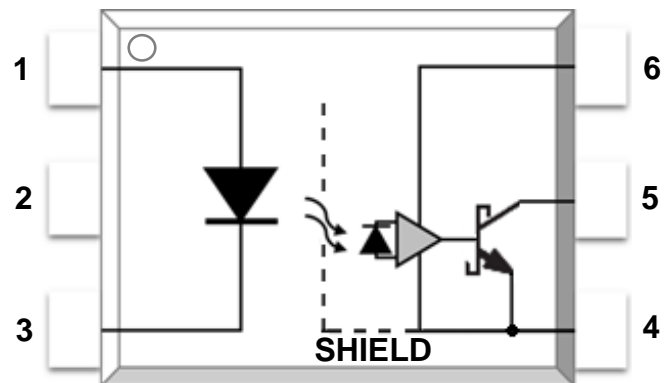
## Features

- 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)
- High CTR
- Regulatory Approvals
  - UL - UL1577
  - VDE - EN60747-5-5(VDE0884-5)
  - CQC – GB4943.1, GB8898

## Applications

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

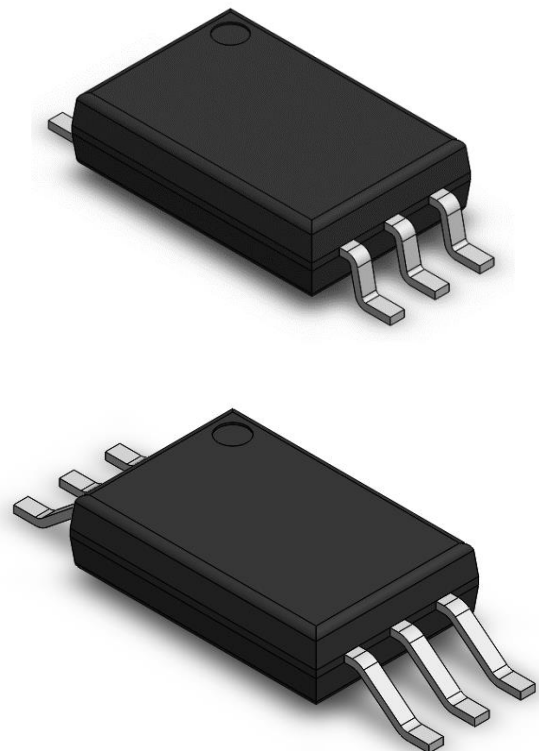
## SCHEMATIC



## PIN DEFINITION

1. Anode	6. V <sub>CC</sub>
2. NC	5. V <sub>O</sub>
3. Cathode	4. GND

## PACKAGE OUTLINE





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### ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN.	MAX.	UNIT	NOTE
Storage Temperature	T <sub>s</sub>	-55	125	°C	-
Operating Temperature	T <sub>A</sub>	-40	110	°C	-
Average Forward Input Current	I <sub>F(AVG)</sub>	-	20	mA	-
Reverse Input Voltage	V <sub>R</sub>	-	5	V	-
Average Output Current	I <sub>O(AVG)</sub>	-	25	mA	-
Output Voltage	V <sub>O</sub>	-0.5	30	V	-
Supply Voltage	V <sub>CC</sub>	-0.5	30	V	-
Output Power Dissipation	P <sub>O</sub>	-	150	mW	-
Total Power Dissipation	P <sub>T</sub>	-	210	mW	-
Lead Solder Temperature	T <sub>sol</sub>	-	260	°C	-

Note: Ambient temperature = 25°C, unless otherwise specified. 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.

### RECOMMENDED OPERATION CONDITIONS

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Operating Temperature	T <sub>A</sub>	-40	110	°C
Supply Voltage	V <sub>CC</sub>	4.5	30	V
Output Voltage	V <sub>O</sub>	0	30	V
Input Current (ON)	I <sub>F(ON)</sub>	5	15	mA
Input Voltage (OFF)	V <sub>F(OFF)</sub>	-3.0	0.8	V



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### ELECTRICAL OPTICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
Current Transfer Ratio	CTR	44	200	-	%	$I_F = 10 \text{ mA}$ , $V_O = 0.6\text{V}$	1
Low Level Output Current	IOL	4.4	20	-	mA	$I_F = 10 \text{ mA}$ , $V_O = 0.6\text{V}$	-
Low Level Output Voltage	VOL	-	0.05	0.6	V	$I_O = 2.4 \text{ mA}$	-
Input Threshold Current	ITH	-	0.15	5.0	mA	$V_O = 0.8\text{V}$ , $I_O = 0.75 \text{ mA}$	2
High Level Output Current	IOH	-	0.1	50	$\mu\text{A}$	$V_F = 0.8\text{V}$	-
High Level Supply Current	ICCH	-	0.8	1.3	mA	$V_F = 0.8\text{V}$ , $V_O = \text{Open}$	2
Low Level Supply Current	ICCL	-	0.85	1.3	mA	$I_F = 10 \text{ mA}$ , $V_O = \text{Open}$	2
Input Forward Voltage	V <sub>F</sub>	-	2.0	2.4	V	$I_F = 10 \text{ mA}$	-
Input Reverse Breakdown Voltage	B <sub>VR</sub>	5	-	-	V	$I_R = 10 \mu\text{A}$	-
Input Capacitance	C <sub>IN</sub>	-	60	-	pF	$f = 1 \text{ MHz}$ , $V_F = 0\text{V}$	-

Note 1. Current Transfer Ratio in percent is defined as the ratio of output collector current ( $I_O$ ) to the forward LED input current ( $I_F$ ) times 100.

Note 2. Use of a 0.1  $\mu\text{F}$  bypass capacitor connected between pins 4 and 6 can improve performance by filtering power supply line noise.

### SWITCHING SPECIFICATION

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
Propagation Delay Time to Output Low Level	t <sub>PHL</sub>	-	140	400	ns	$I_{F(\text{ON})} = 10\text{mA}$ , $V_{F(\text{OFF})} = 0.8\text{V}$ , $V_{CC} = 15.0\text{V}$ , $V_{\text{THLH}} = 2.0\text{V}$ , $V_{\text{THHL}} = 1.5$	-
Propagation Delay Time to Output High Level	t <sub>PLH</sub>	-	490	600	ns		-
Pulse Width Distortion	P <sub>WD</sub>	-	350	500	ns		-
Propagation Delay Difference Between Any Two Parts	P <sub>DD</sub> (t <sub>PHL</sub> - t <sub>PLH</sub> )	-200	-	500	ns		-
Common Mode Transient Immunity at Logic High	CM <sub>H</sub>	15	30	-	kV/ $\mu\text{s}$	$V_{CC} = 15.0\text{V}$ , $C_L = 100\text{pF}$ , $V_{CM} = 1500\text{V}$	-
Common Mode Transient Immunity at Logic Low	CM <sub>L</sub>	15	30	-	kV/ $\mu\text{s}$	$V_{CC} = 15.0\text{V}$ , $C_L = 100\text{pF}$ , $V_{CM} = 1500\text{V}$	-



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## ISOLATION CHARACTERISTIC

PARAMETER	SYMBOL	DEVICE	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
Withstand Insulation Test Voltage	V <sub>iso</sub>	MPCS-456P	5000	-	-	V	RH ≤ 40%-60%, t = 1min, T <sub>A</sub> = 25 °C	1,2
		MPCS-456W						
Input-Output Resistance	R <sub>i-o</sub>	-	-	10 <sup>12</sup>	-	Ω	V <sub>I-O</sub> = 500V DC	1

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. This test is performed before the 100% production test for partial discharge.

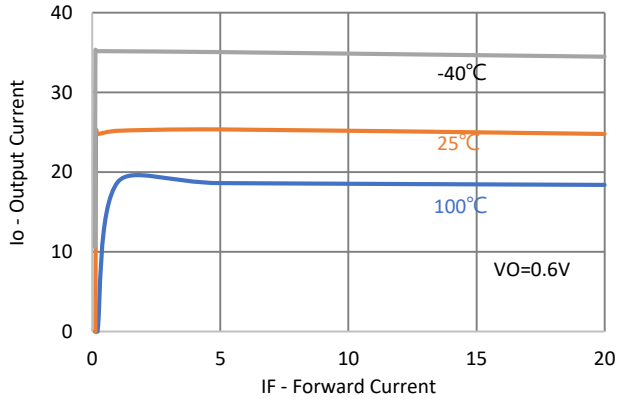


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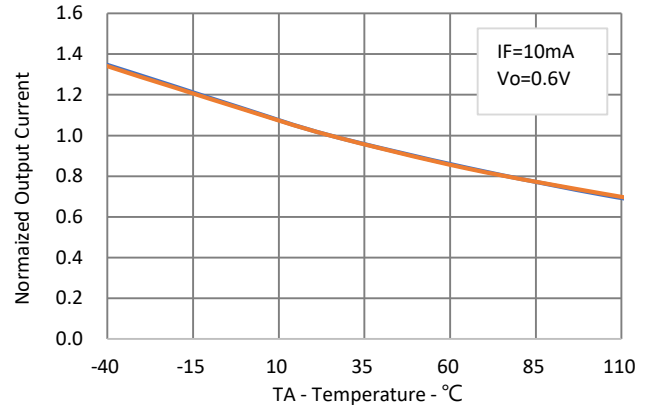
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## TYPICAL PERFORMANCE CURVES & TEST CIRCUITS

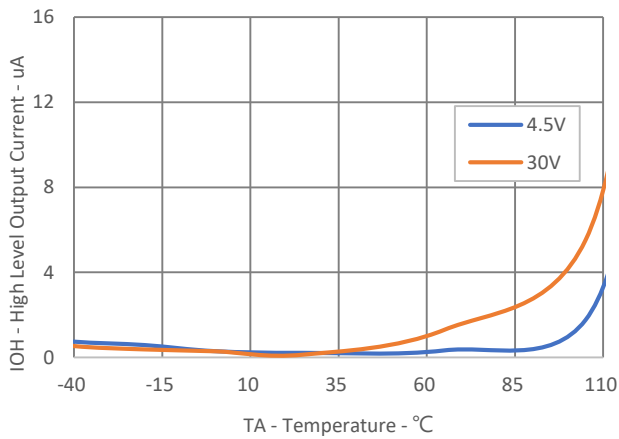
**Fig.1 Typical Transfer Characteristics**



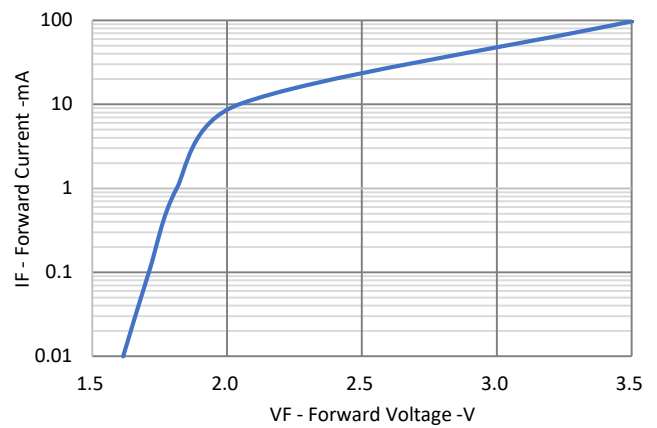
**Fig.2 Normalized Output Current vs. Temperature**



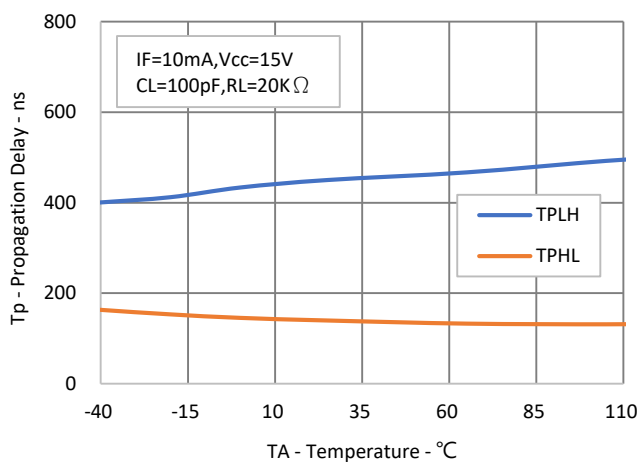
**Fig.3 High Level Output Current vs. Temperature**



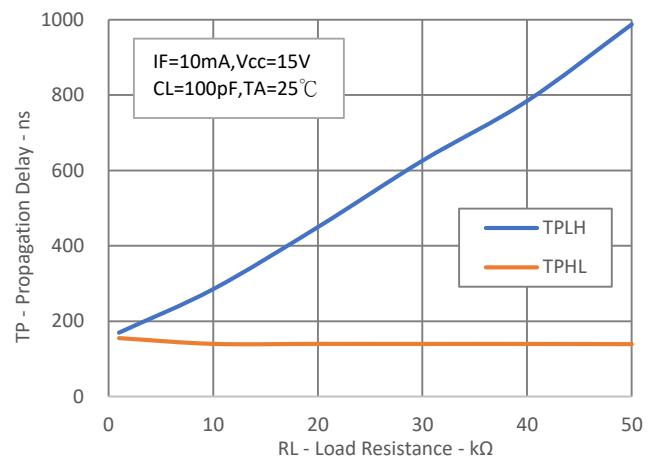
**Fig.4 Input Current vs. Forward Voltage**



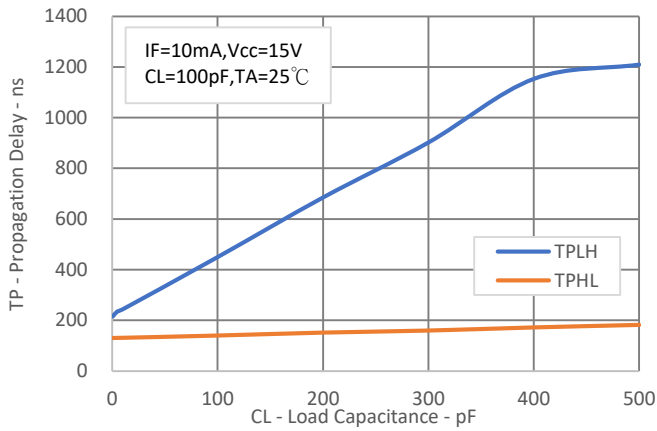
**Fig.5 Propagation Delay with RL vs. Temp**



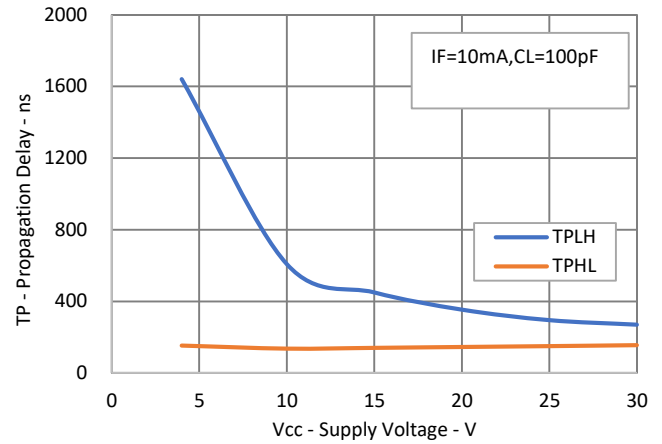
**Fig.6 Propagation Delay vs. Load Resistance**



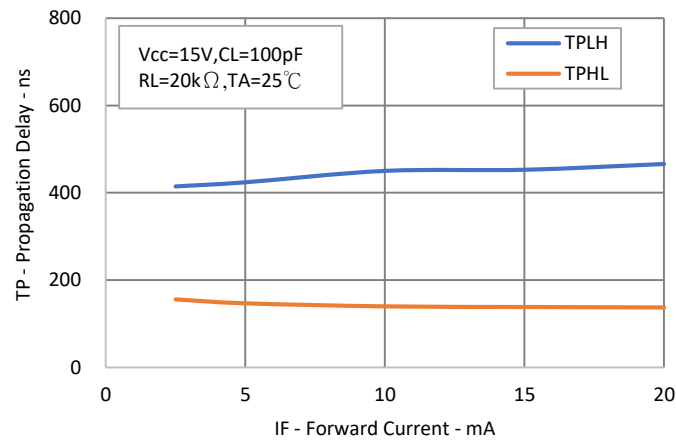
**Fig.7 Propagation Delay vs. Load Capacitance**



**Fig.8 Propagation Delay vs. Supply Voltage**



**Fig.9 Propagation Delays vs. IF**



**Fig.10 Propagation Delay Test Circuit**

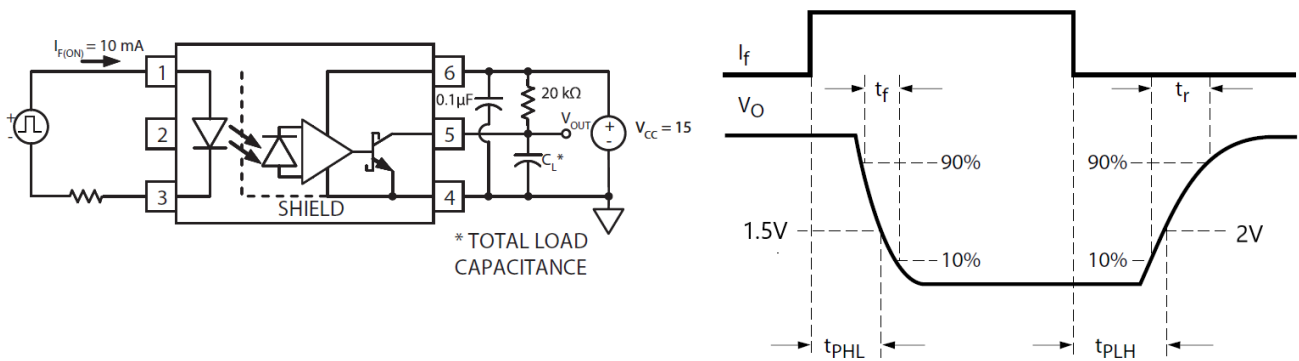
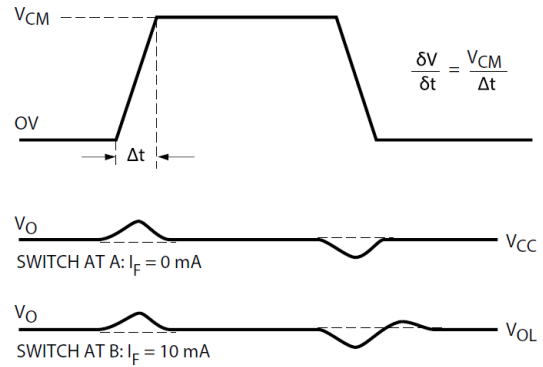
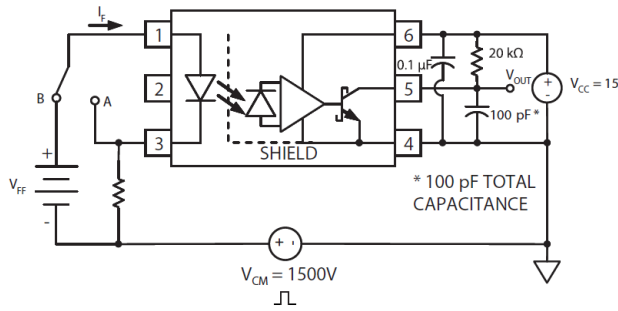


Fig.11 CMR Test Circuit and Waveforms



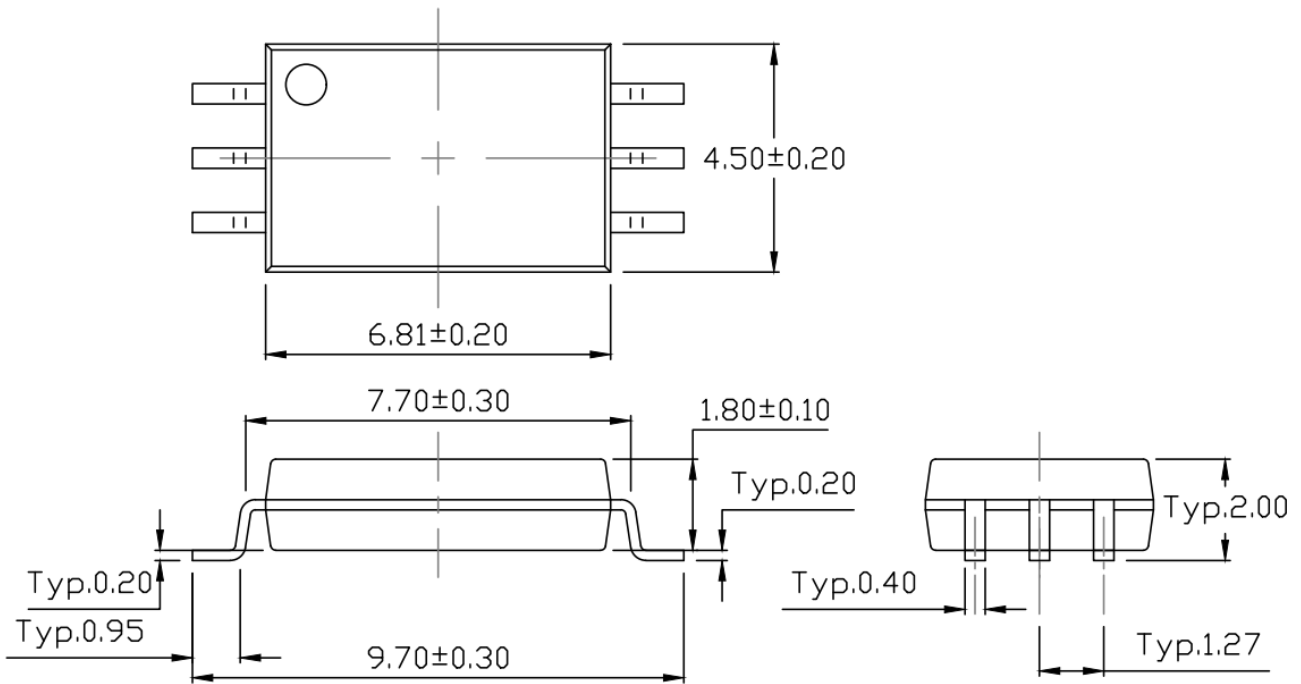


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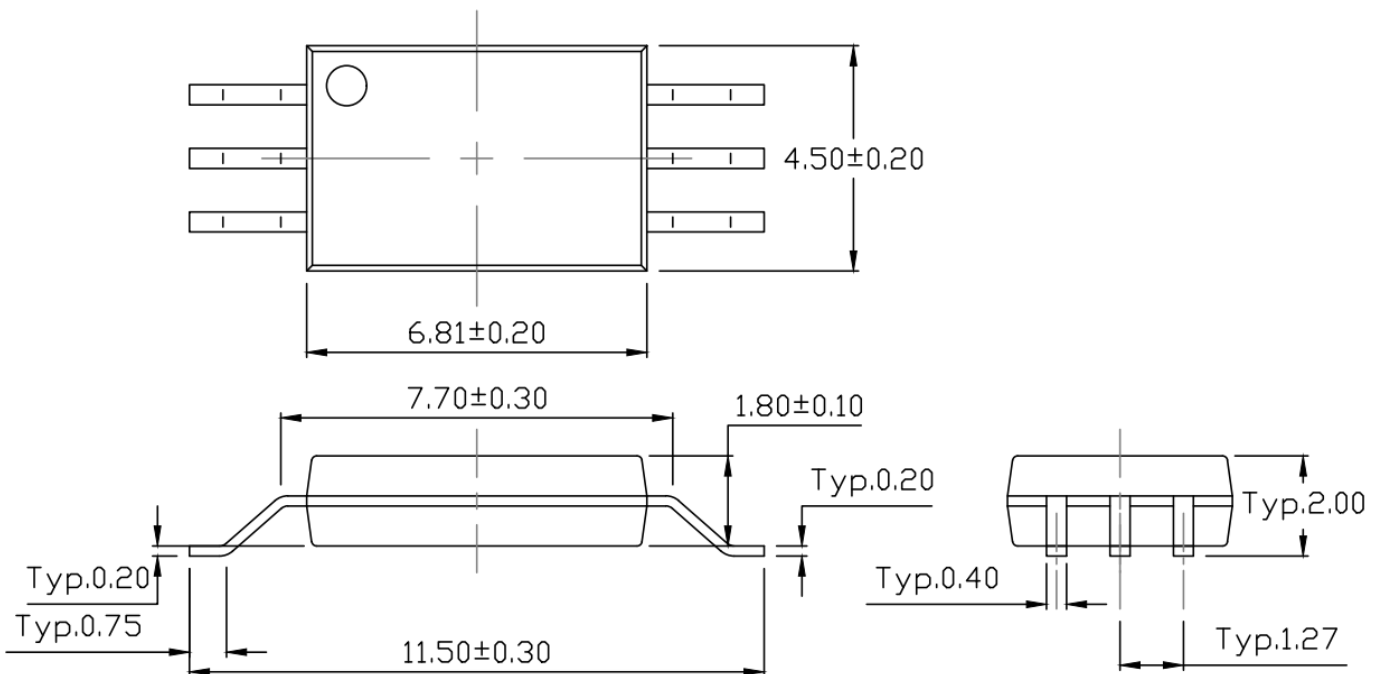
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## PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)

### Surface Mount Lead Forming (P Type)



### Surface Mount (Gullwing) Lead Forming (W Type)



Rev: 2.0

Release Date: 2024/6/19



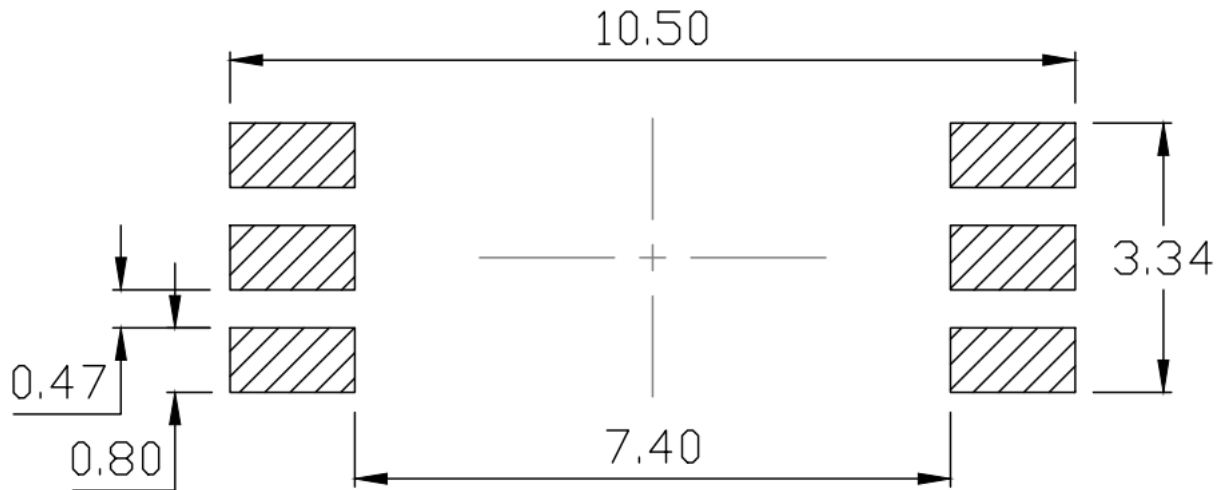


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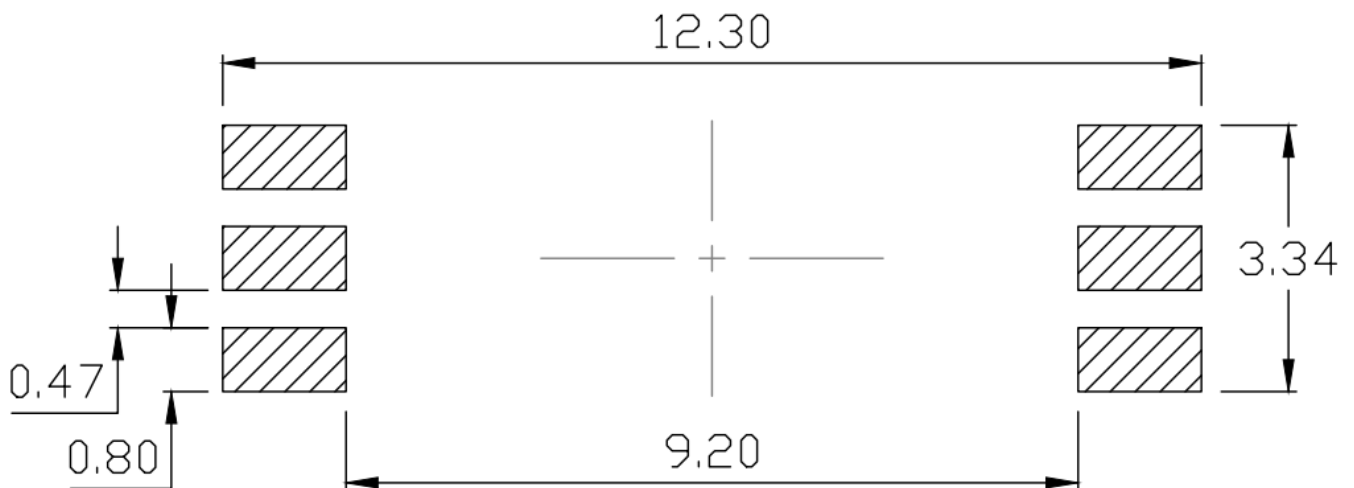
LSOP6, DC Input, IPM and Gate Drive Interface Photo Coupler

## RECOMMENDED SOLDER MASK (Dimensions in mm unless otherwise stated)

### Surface Mount Lead Forming (P Type)



### Surface Mount (Gullwing) Lead Forming (W Type)



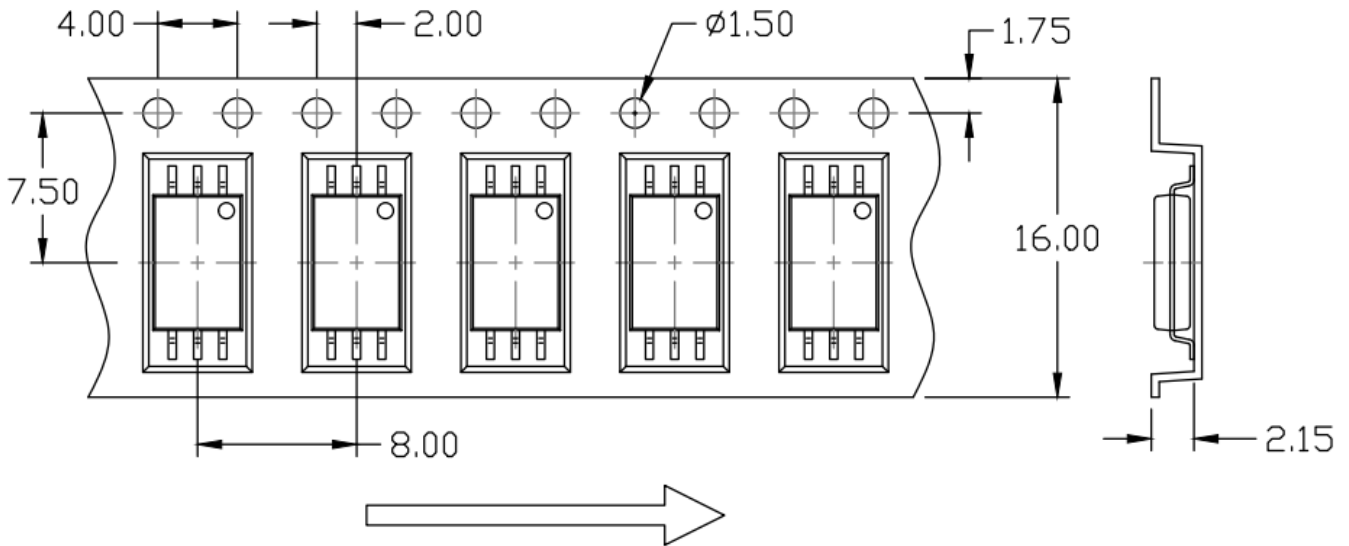


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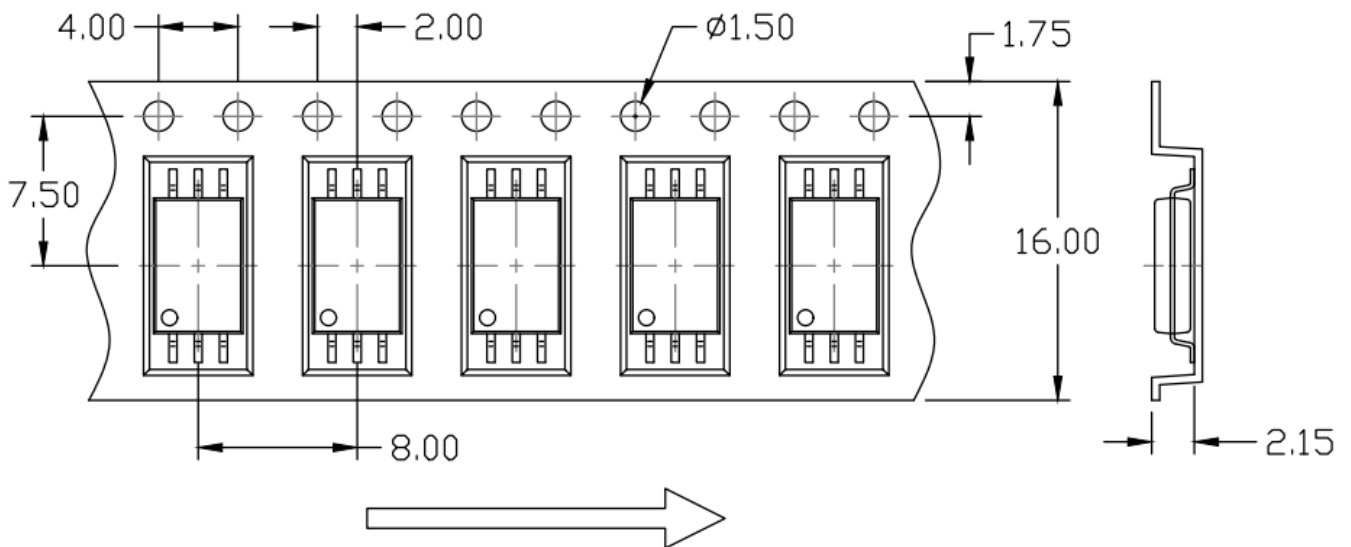
LSOP6, DC Input, IPM and Gate Drive Interface Photo Coupler

## CARRIER TAPE SPECIFICATIONS (Dimensions in mm unless otherwise stated)

### Surface Mount Lead Forming (P Type) Option T1



### Surface Mount Lead Forming (P Type) Option T2



Rev: 2.0

Release Date: 2024/6/19

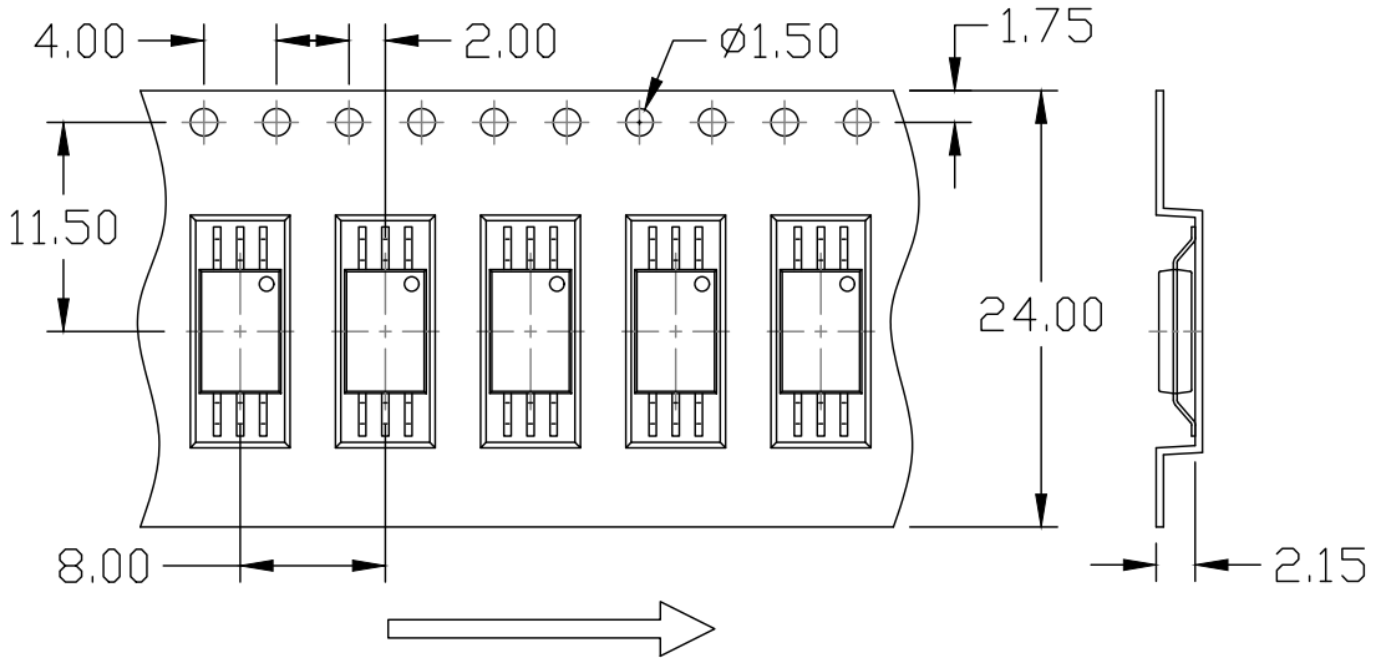


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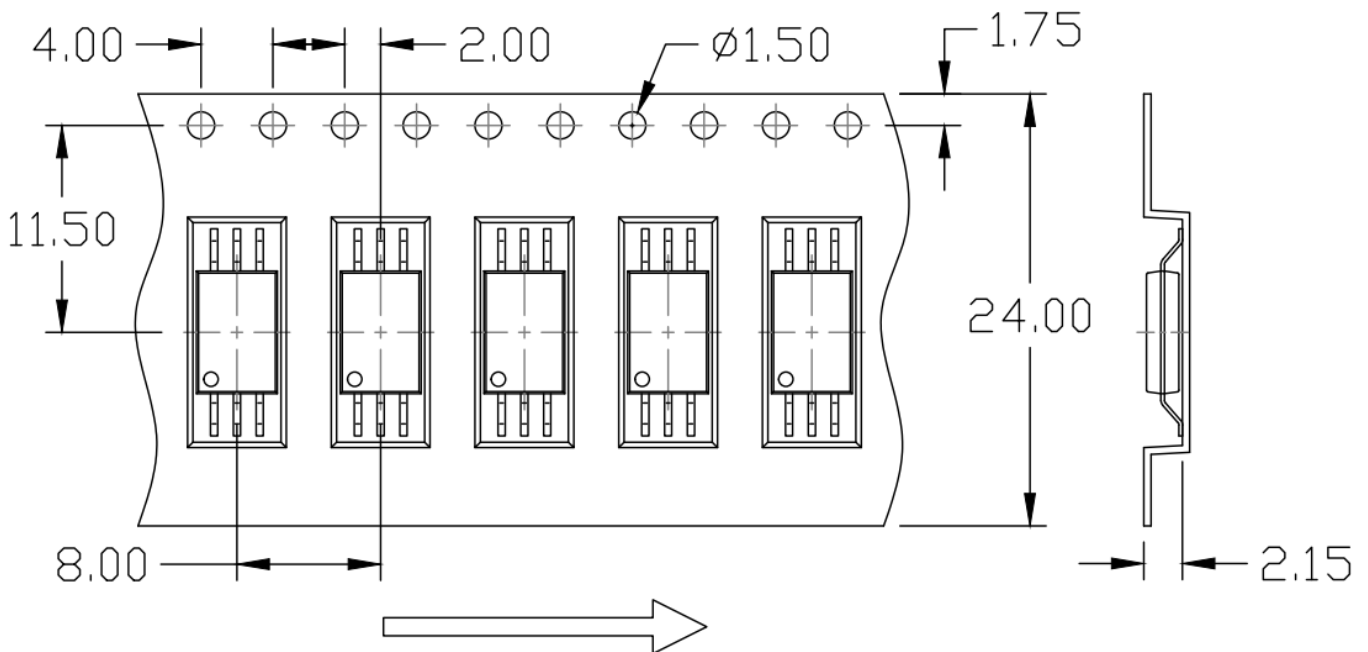
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## CARRIER TAPE SPECIFICATIONS (Dimensions in mm unless otherwise stated)

### Surface Mount (Gullwing) Lead Forming (W Type) Option T1



### Surface Mount (Gullwing) Lead Forming (W Type) Option T2



Rev: 2.0

Release Date: 2024/6/19

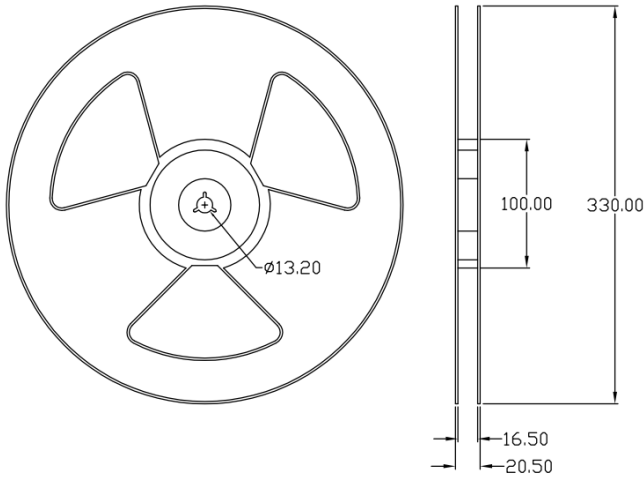


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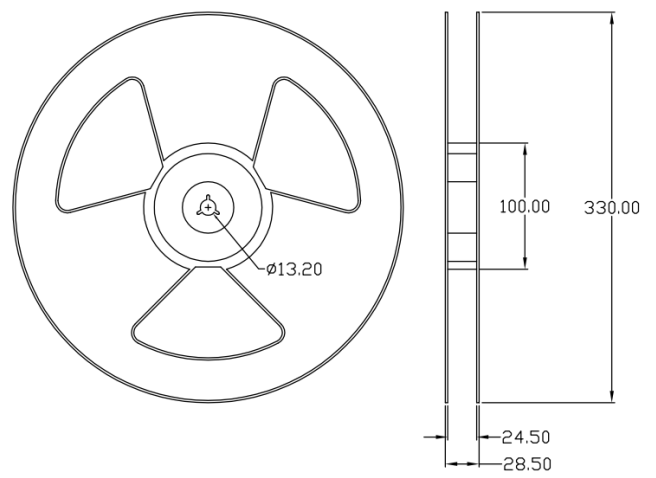
LSOP6, DC Input, IPM and Gate Drive Interface Photo Coupler

## REEL SPECIFICATIONS (Dimensions in mm unless otherwise stated)

Surface Mount Lead Forming (P Type)

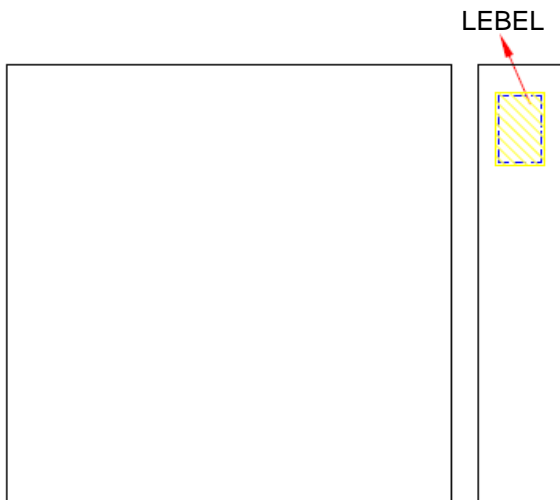


Surface Mount (Gullwing) Lead Forming (W Type)



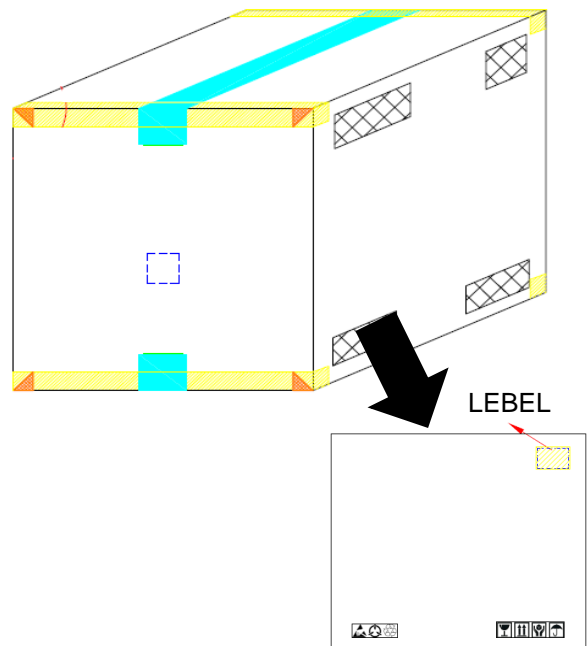
## BOX SPECIFICATIONS (Reel Type)

INNER BOX



L x W x H = 36cm x 36cm x 6.9cm

OUTER BOX



L x W x H = 45cm x 38cm x 38cm



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## ORDERING AND MARKING INFORMATION

### MARKING INFORMATION



M : Company Abbr.  
 YY : Year date code  
 WW : 2-digit work week  
 456 : Part Number  
 T or H : Factory identification mark  
 V : VDE Identification(Optional)

### ORDERING INFORMATION

## MPCS-456(P/W)-ZV

MPC – Company Abbr.  
 S – Stack  
 456 – Part Number  
 P/W – Lead Form Option  
 (P-9mm Clearance or W-11mm Clearance)  
 Z – Tape and Reel Option (T1/T2)  
 V –VDE Option (V or None)

### LABEL INFORMATION

MEMCHIP 喆光照明光電股份有限公司  
 WISELITE Optronics Co., Ltd

Part No : XXXXXXXXXXXXXXXX Bin Code : X

Lot No : XXXXXXXXXXXX

Date Code : XXXX

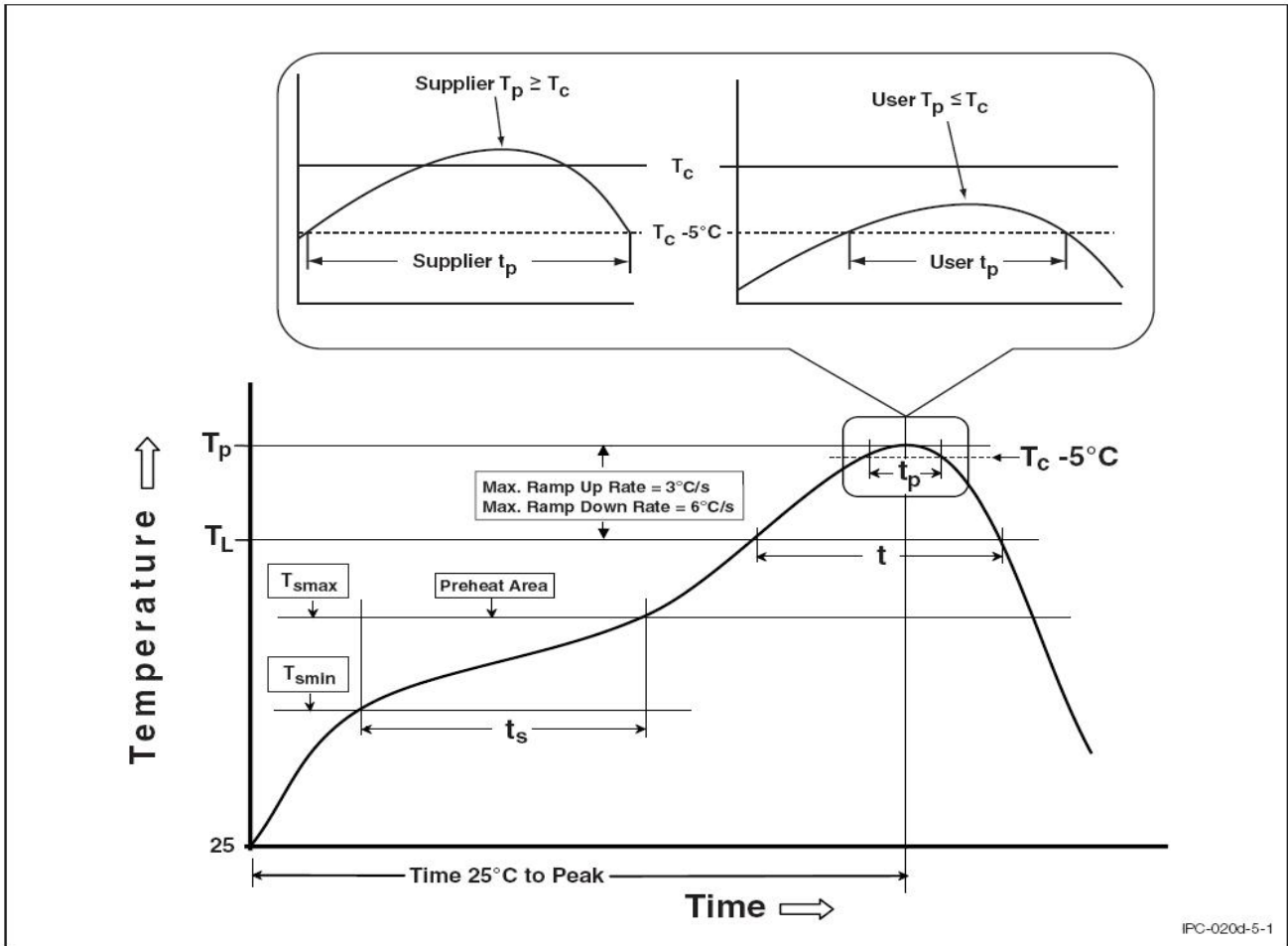
Q'ty : XXXX pcs

### PACKING QUANTITY

Option	Quantity	Quantity – Inner box	Quantity – Outer box
Option P T1/T2	3000 Units/Reel	3 Reels/Inner box	5 Inner box/Outer box = 45k Units
Option W T1/T2	3000 Units/Reel	2 Reels/Inner box	5 Inner box/Outer box = 30k Units

### REFLOW INFORMATION

#### REFLOW PROFILE



Profile Feature	Sn-Pb Assembly Profile	Pb-Free Assembly Profile
Temperature Min. ( $T_{smin}$ )	$100^\circ\text{C}$	$150^\circ\text{C}$
Temperature Max. ( $T_{smax}$ )	$150^\circ\text{C}$	$200^\circ\text{C}$
Time ( $t_s$ ) from ( $T_{smin}$ to $T_{smax}$ )	60-120 seconds	60-120 seconds
Ramp-up Rate ( $t_L$ to $t_P$ )	$3^\circ\text{C/second max.}$	$3^\circ\text{C/second max.}$
Liquidous Temperature ( $T_L$ )	$183^\circ\text{C}$	$217^\circ\text{C}$
Time ( $t_L$ ) Maintained Above ( $T_L$ )	60 – 150 seconds	60 – 150 seconds
Peak Body Package Temperature	$235^\circ\text{C} +0^\circ\text{C} / -5^\circ\text{C}$	$260^\circ\text{C} +0^\circ\text{C} / -5^\circ\text{C}$
Time ( $t_P$ ) within $5^\circ\text{C}$ of $260^\circ\text{C}$	20 seconds	30 seconds
Ramp-down Rate ( $T_P$ to $T_L$ )	$6^\circ\text{C/second max}$	$6^\circ\text{C/second max}$
Time $25^\circ\text{C}$ to Peak Temperature	6 minutes max.	8 minutes max.

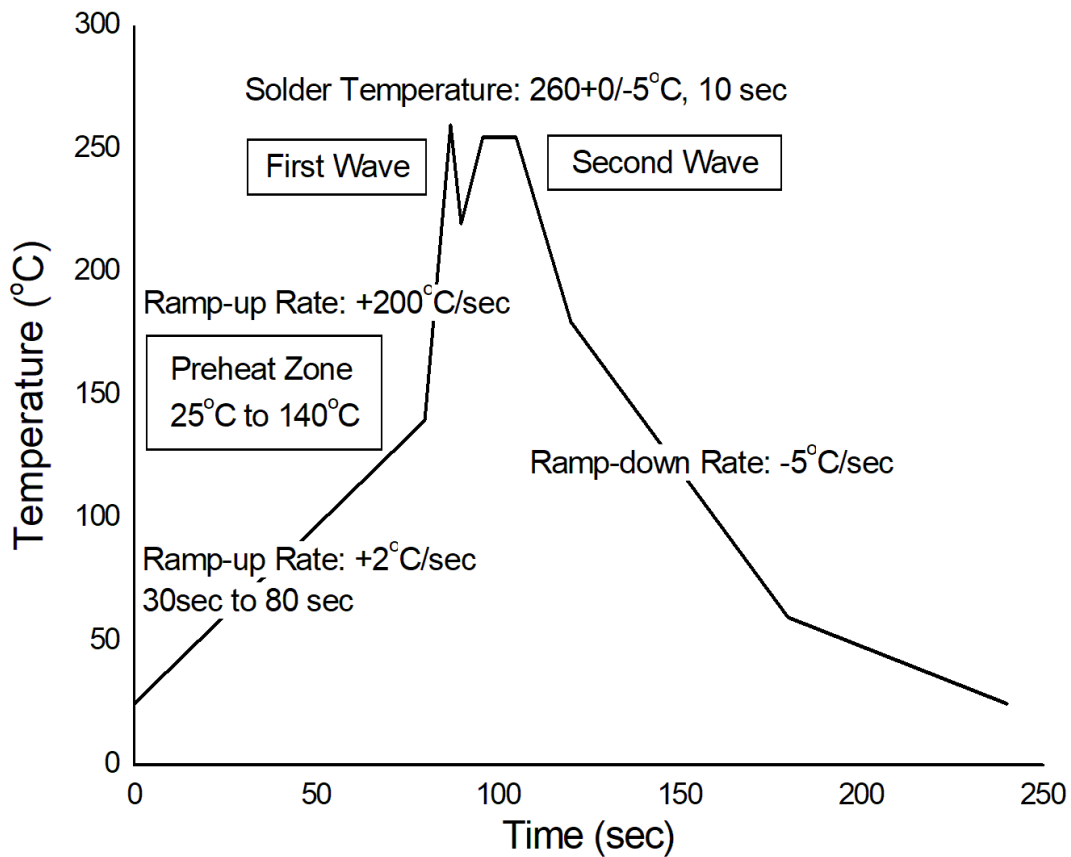


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## TEMPERATURE PROFILE OF SOLDERING

### WAVE SOLDERING (JESD22-A111 COMPLIANT)



### HAND SOLDERING BY SOLDERING IRON

Soldering Temperature	380+0/-5°C
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Soldering Time	3 sec max.
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One time soldering is recommended for all soldering method.

Do not solder more than three times for IR reflow soldering.



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- The characteristic curves shown in this datasheet are representing typical performance which are not guaranteed.
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- The products shown in this publication are designed for the general use in electronic applications such as office automation, equipment, communications devices, audio/visual equipment, electrical application and instrumentation purpose, non-infringement and merchantability.
- 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 WISELITE 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 WISELITE'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.



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