## Features

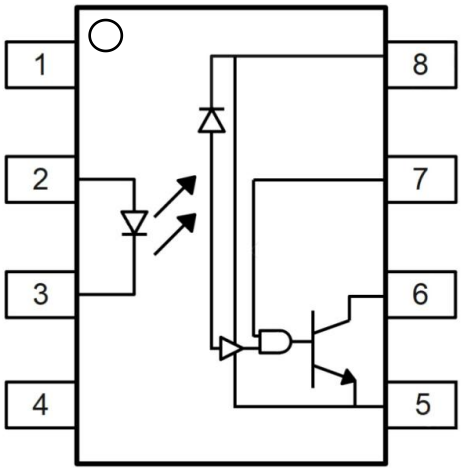
- High isolation 3750 $V_{RMS}$
- DC input with logic gate output
- Operating temperature range - 40 °C to 100 °C
- REACH compliance
- Halogen free (Optional)
- MSL class 1
- Regulatory Approvals (Pending Approved)
  - UL - UL1577
  - VDE - EN60747-5-5(VDE0884-5)
  - CQC - GB4943.1

## Applications

- Ground loop elimination
- LSTTL to TTL, LSTTL or CMOS
- Line receiver, data transmission
- Data multiplexing
- Switching power supply
- Pulse transformer replacement

## Description

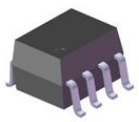
The ICPL-060X series combine an AlGaAs infrared emitting diode as the emitter which is optically coupled to a silicon high speed integrated photo-detector logic gate with a strobable output in a plastic SO8 package with different lead forming options.




### TRUTH TABLE

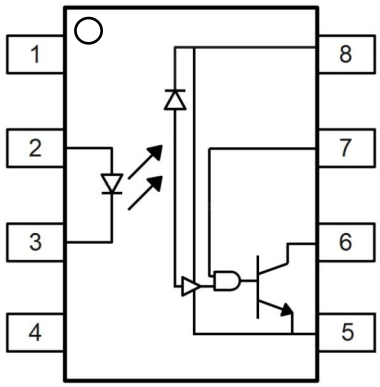
| LED | ENABLE | OUTPUT |
|---|---|---|
| ON | H | L |
| OFF | H | H |
| ON | L | H |
| OFF | L | H |
| ON | NC | L |
| OFF | NC | H |

## ORDERING INFORMATION

| Outline | Part Number | Package | Marking | Packing | Packing Size | Quantity |
|---|---|---|---|---|---|---|
|  | ICPL-0600-500E | SOP8 | ICPL 060X /YYWW B | Reel | 13 " | 2000 |
| | ICPL-0601-500E | | | | | |

## CONTENTS

## PIN CONFIGURATION AND FUNCTIONS




| Pin | Name |
|---|---|
| 1 | NC |
| 2 | Anode |
| 3 | Cathode |
| 4 | NC |
| 5 | GND |
| 6 | $V_O$ |
| 7 | $V_E$ |
| 8 | $V_{CC}$ |

## ABSOLUTE MAXIMUM RATINGS

| Parameter | Symbol | Value | Unit | Note |
|---|---|---|---|---|
| INPUT | | | | |
| Forward Current | $I_F$ | 25 | mA | |
| Peak Forward Current | $I_{FP}$ | 50 | mA | 1 |
| Peak Transient Current | $I_{F(trans)}$ | 1 | A | 2 |
| Reverse Voltage | $V_R$ | 5 | V | |
| Enable Voltage | $V_E$ | $V_{CC}$+0.5 | V | |
| Input Power Dissipation | $P_I$ | 100 | mW | |
| OUTPUT | | | | |
| Supply Voltage | $V_{CC}$ | 7 | V | |
| Output Voltage | $V_O$ | 7 | V | |
| Output Current | $I_O$ | 50 | mA | |
| Output Power Dissipation | $P_O$ | 85 | mW | |
| COMMON | | | | |
| Total Power Dissipation | $P_{tot}$ | 200 | mW | |
| Isolation Voltage | $V_{iso}$ | 5000 | Vrms | 3 |
| Operating Temperature | $T_{opr}$ | -40~100 | °C | |
| Storage Temperature | $T_{stg}$ | -55~125 | °C | |
| Soldering Temperature | $T_{sol}$ | 260 | °C | 4 |

Note 1. 50% duty, 1ms P.W
Note 2. ≤1μs P.W,300pps
Note 3. AC For 1 Minute, R.H. = 40 ~ 60%
Note 4. For 10 seconds

## RECOMMENDED OPERATION CONDITIONS

| Parameter | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|
| Operating Temperature | $T_a$ | -40 | 100 | °C |
| Supply Voltage | $V_{CC}$ | 4.5 | 5.5 | V |
| Low Level Input Current | $I_{FL}$ | 0 | 250 | μA |
| High Level Input Current | $I_{FH}$ | 5 | 15 | mA |
| Low Level Enable Voltage | $V_{EL}$ | 0 | 0.8 | V |
| High Level Enable Voltage | $V_{EH}$ | 2 | $V_{CC}$ | V |
| Output Pull-up Resistor | $R_L$ | 330 | 4k | Ω |
| Fan Out (at RL=1kΩ per channel) | N | - | 8 | TTL Loads |

## ELECTRICAL OPTICAL CHARACTERISTICS($T_a$=25°C)

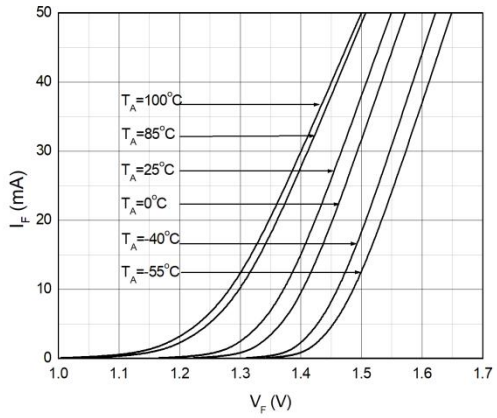
| Parameter | Symbol | Min. | Typ. | Max. | Unit | Test Condition |
|---|---|---|---|---|---|---|
| INPUT | | | | | | |
| Forward Voltage | $V_F$ | - | 1.38 | 1.8 | V | $I_F$=10mA |
| Reverse Current | $I_R$ | - | - | 10 | μA | $V_R$=5V |
| Input Capacitance | $C_{in}$ | - | 60 | - | pF | V=0, f=1MHz |
| OUTPUT | | | | | | |
| High Level Supply Current | $I_{CCH}$ | - | 6.5 | 8 | mA | $I_F$=0mA, $V_E$=0.5V,$V_{CC}$=5.5V |
| Low Level Supply Current | $I_{CCL}$ | - | 9.0 | 10 | mA | $I_F$=10mA, $V_{CC}$=5.5V |
| High Level Enable Current | $I_{EH}$ | - | -0.6 | -1.6 | mA | $V_E$=2.0V, $V_{CC}$=5.5V |
| Low Level Enable Current | $I_{EL}$ | - | -0.8 | -1.6 | mA | $V_E$=0.5V, $V_{CC}$=5.5V |
| High Level Enable Voltage | $V_{EH}$ | 2.0 | - | - | V | $I_F$=10mA, $V_{CC}$=5.5V |
| Low Level Enable Voltage | $V_{EL}$ | - | - | 0.8 | V | $I_F$=10mA, $V_{CC}$=5.5V |
| TRANSFER CHARACTERISTICS ($T_a$=-40 to 85°C) | | | | | | |
| High Level Output Current | $I_{OH}$ | - | 1.6 | 100 | μA | $V_{CC}$=5.5V, $V_O$=5.5V, $I_F$=250μA, $V_E$=2.0V |
| Low Level Output Voltage | $V_{OL}$ | - | 0.35 | 0.6 | V | $V_{CC}$=5.5V, $I_F$=5mA, $V_E$=2.0V, $I_{CL}$=13mA |
| Input Threshold Current | $I_{FT}$ | - | 3 | 5 | mA | $V_{CC}$=5.5V, $V_O$=0.6V, $V_E$=2.0V, $I_{OL}$=13mA |
| Isolation Resistance | $R_{iso}$ | 10^12 | 10^14 | - | Ω | DC500V, 40 ~ 60% R.H. |
| Floating Capacitance | $C_{IO}$ | - | 1.0 | - | pF | V=0, f=1MHz |

## ELECTRICAL OPTICAL CHARACTERISTICS

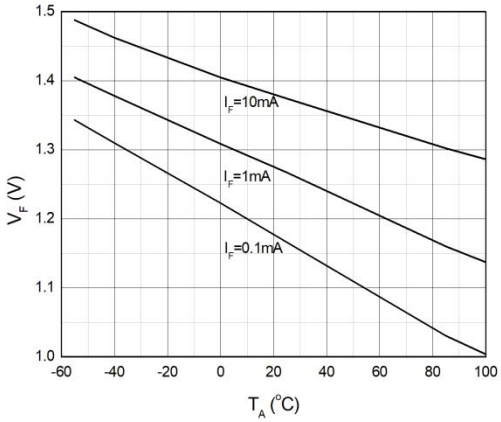
| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Test Condition |
|---|---|---|---|---|---|---|---|
| SWITCHING CHARACTERISTICS ($T_a$=-40 to 85°C, $V_{CC}$=5V, $I_F$=7.5mA unless specified otherwise) | | | | | | | |
| Propagation Delay Time to Output Low Level | | $t_{PHL}$ | - | 45 | 75 | ns | $C_L$=15pF, $R_L$=350Ω, $T_a$=25°C |
| Propagation Delay Time to Output High Level | | $t_{PLH}$ | - | 45 | 75 | ns | $C_L$=15pF, $R_L$=350Ω, $T_a$=25°C |
| Pulse Width Distortion | | $\|t_{PHL}-t_{PLH}\|$ | - | 5 | 35 | ns | $C_L$=15pF, $R_L$=350Ω |
| Rise Time | | $t_r$ | - | 30 | - | ns | $C_L$=15pF, $R_L$=350Ω |
| Fall Time | | $t_f$ | - | 10 | - | ns | $C_L$=15pF, $R_L$=350Ω |
| Enable Propagation Delay Time to Output Low Level | | $t_{EHL}$ | - | 40 | - | ns | $I_F$=7.5mA, $V_{EH}$=3.5V, $C_L$=15pF, $R_L$=350Ω |
| Enable Propagation Delay Time to Output High Level | | $t_{ELH}$ | - | 15 | - | ns | $I_F$=7.5mA, $V_{EH}$=3.5V, $C_L$=15pF, $R_L$=350Ω |
| Common Mode Transient Immunity at Logic High | ICPL-0600 | $CM_H$ | 5000 | - | - | V/μs | $I_F$=7.5mA , $V_{OH}$=2.0V, $R_L$=350Ω, $T_a$=25°C $V_{CM}$=50Vp-p |
| | ICPL-0601 | | 10000 | - | - | | $I_F$=7.5mA , $V_{OH}$=2.0V, $R_L$=350Ω, $T_a$=25°C $V_{CM}$=400Vp-p |
| Common Mode Transient Immunity at Logic Low | ICPL-0600 | $CM_L$ | 5000 | - | - | V/μs | $I_F$=0mA , $V_{OH}$=0.8V, $R_L$=350Ω, $T_a$=25°C $V_{CM}$=50Vp-p |
| | ICPL-0601 | | 10000 | - | - | | $I_F$=0mA , $V_{OH}$=0.8V, $R_L$=350Ω, $T_a$=25°C $V_{CM}$=400Vp-p |

## CHARACTERISTIC CURVES

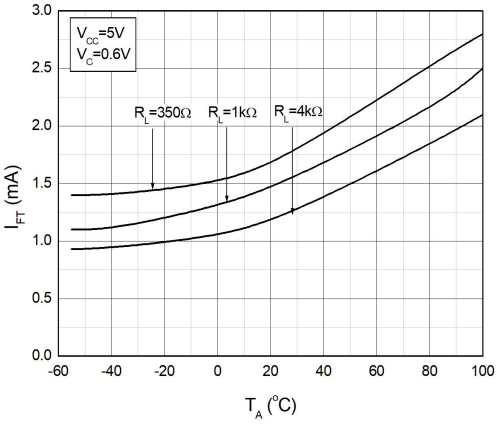
### Fig.1 Forward Current vs. Forward Voltage



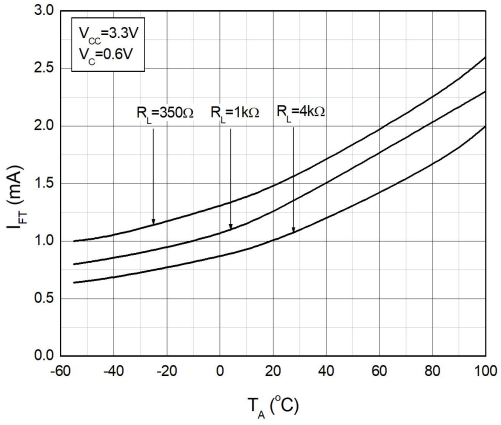

### Fig.2 Forward Voltage vs. Ambient Temperature



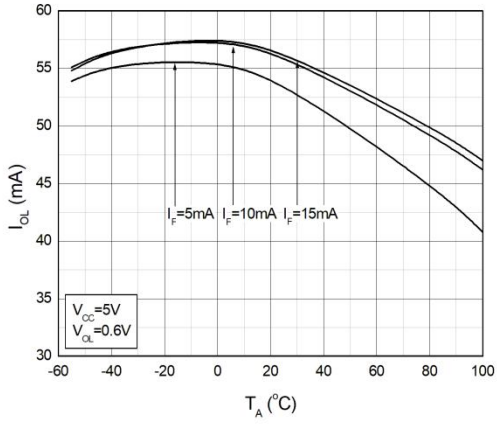

### Fig.3 Input Threshold Current vs. Ambient Temperature




### Fig.4 Input Threshold Current vs. Ambient Temperature




### Fig.5 Low Level Output Current vs. Ambient Temperature




### Fig.6 Low Level Output Current vs. Ambient Temperature

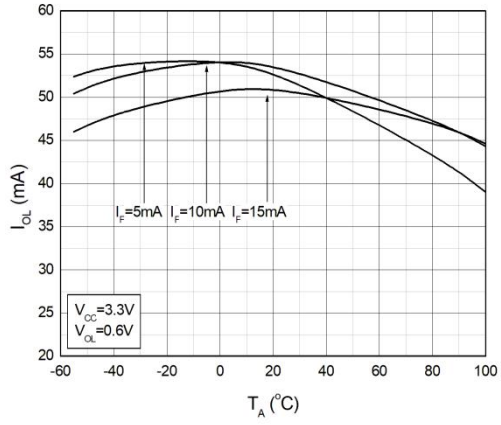


**Fig.7 Low Level Output Voltage vs. Ambient Temperature**

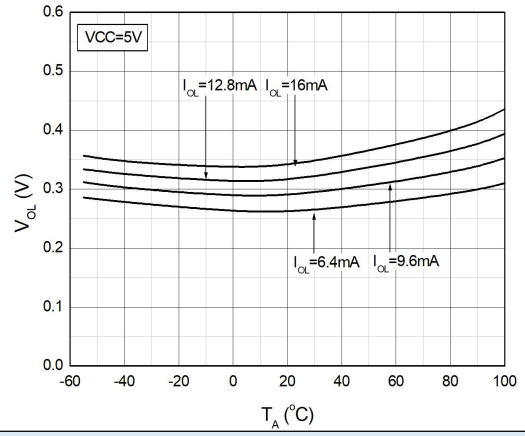



**Fig.8 Low Level Output Voltage vs. Ambient Temperature**

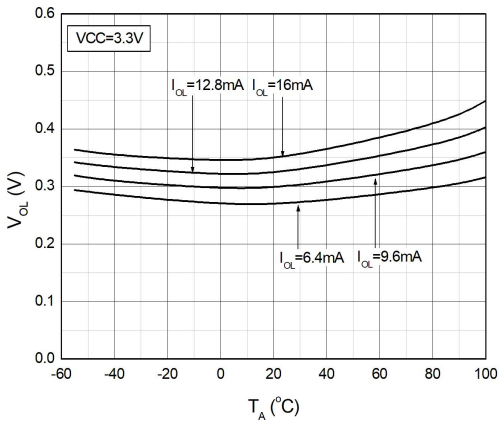



**Fig.9 High Level Output Current vs. Ambient Temperature**

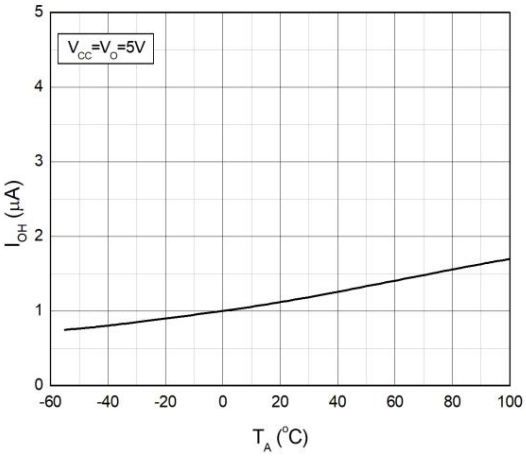



**Fig.10 High Level Output Current vs. Ambient Temperature**

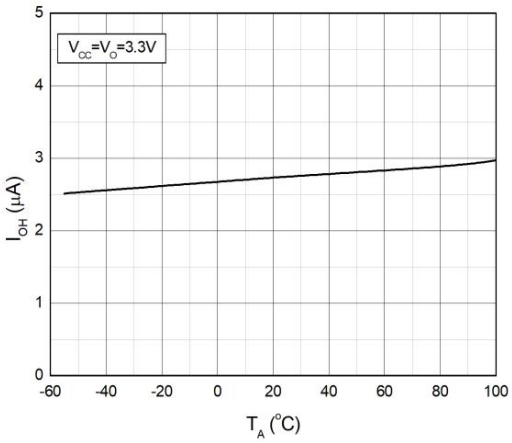



**Fig.11 Output Voltage vs. Forward Current**

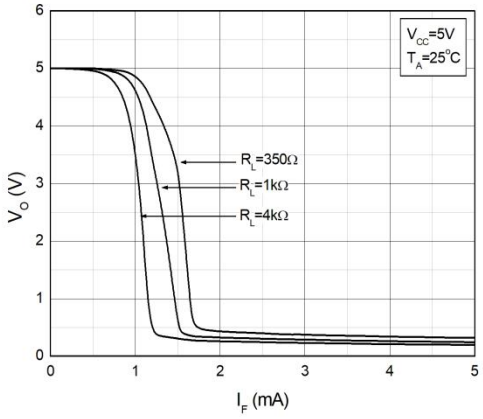
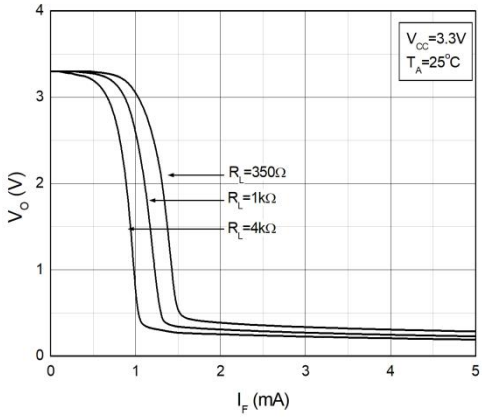
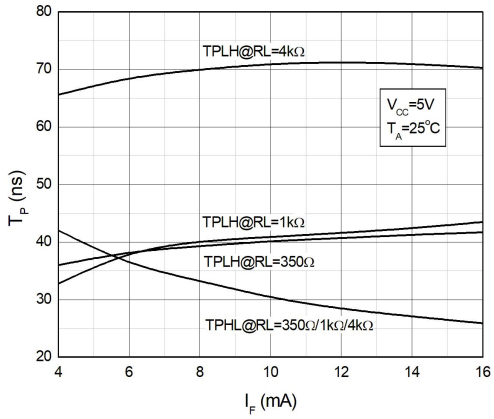


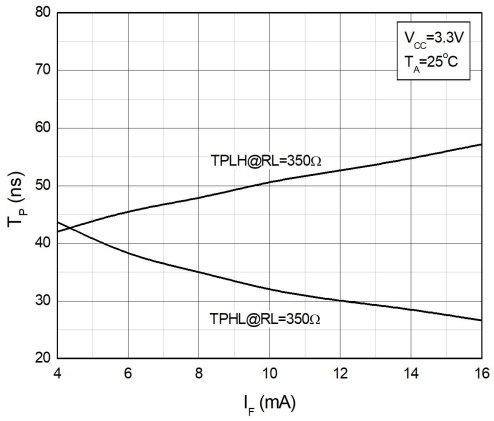

**Fig.12 Output Voltage vs. Forward Current**



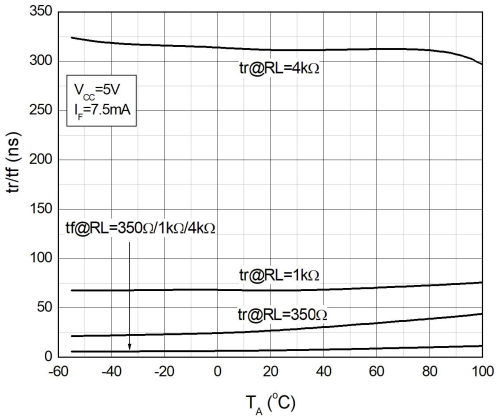
## Fig.13 Propagation Delay vs. Forward Current



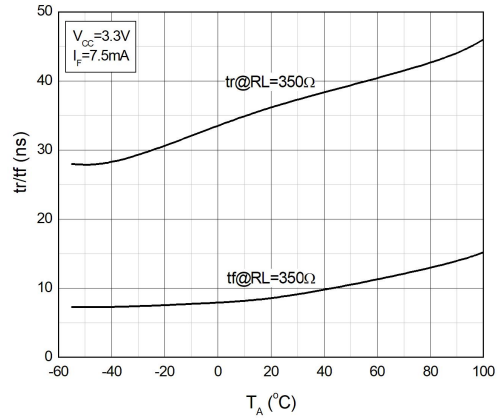

## Fig.14 Propagation Delay vs. Forward Current



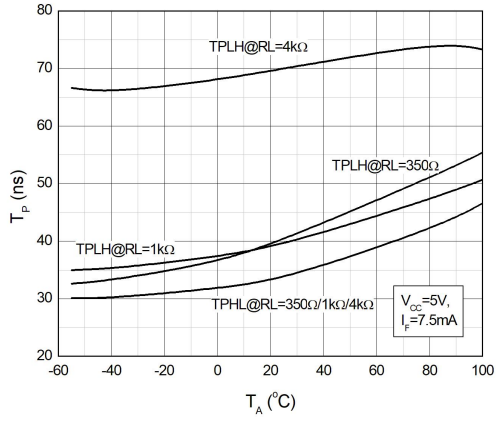

## Fig.15 Rise and Fall Time vs. Ambient Temperature




## Fig.16 Rise and Fall Time vs. Ambient Temperature




## Fig.17 Propagation Delay vs. Ambient Temperature




## Fig.18 Propagation Delay vs. Ambient Temperature

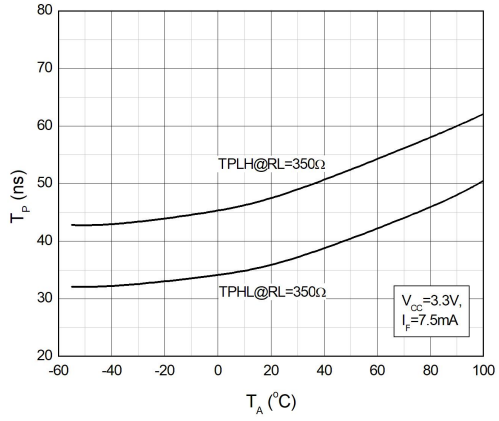


**Fig.19 Pulse Width Distortion vs. Ambient Temperature**

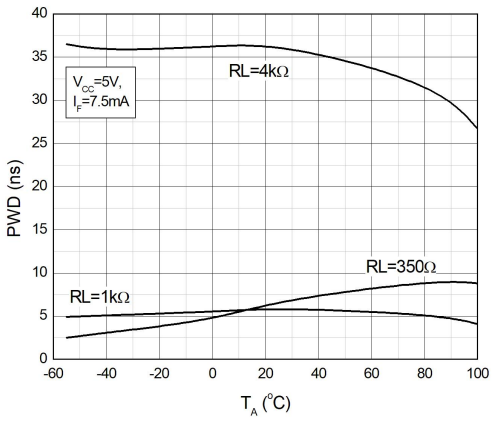



**Fig.20 Pulse Width Distortion vs. Ambient Temperature**

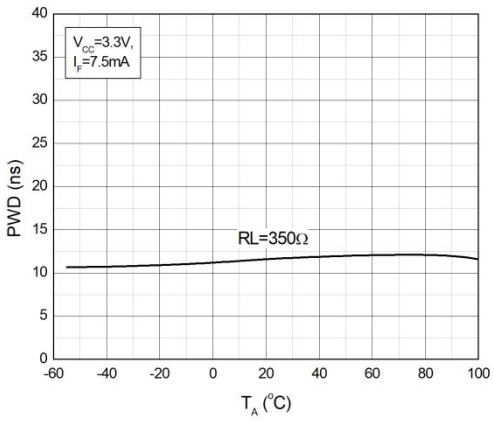



**Fig.21 Enable Propagation Delay vs. Ambient Temperature**

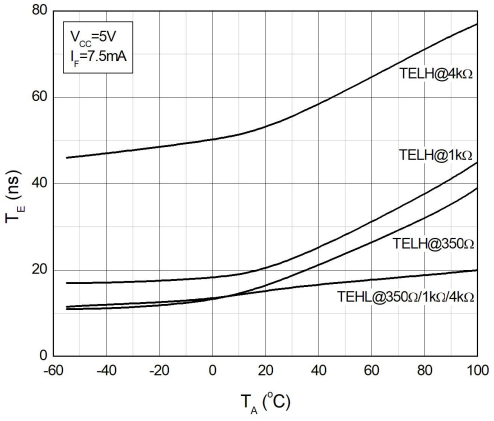
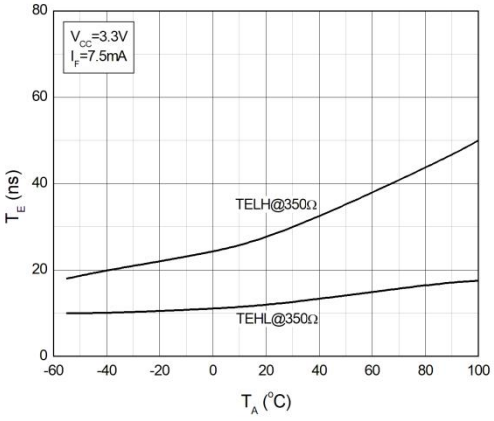



**Fig.22 Enable Propagation Delay vs. Ambient Temperature**



## TEST CIRCUITS

**Fig.23 Test Circuits for $t_{PHL}$, $t_{PLH}$, $t_r$, $t_f$**

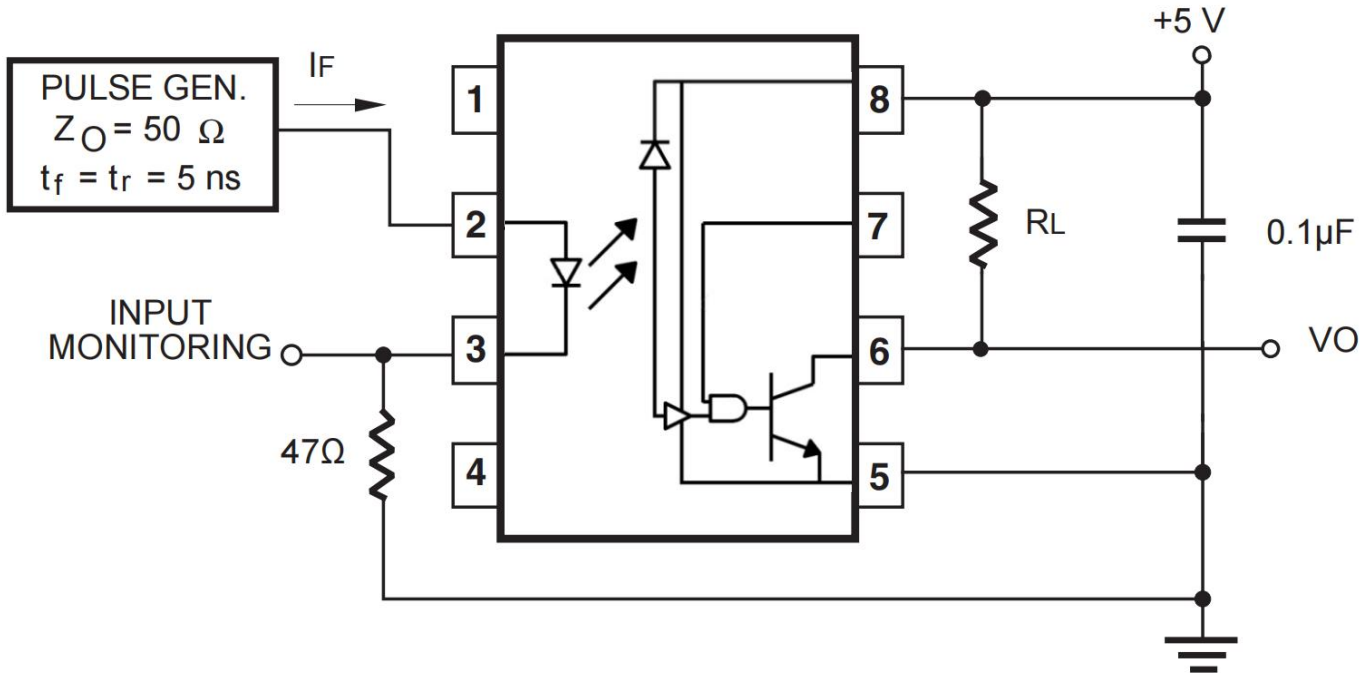
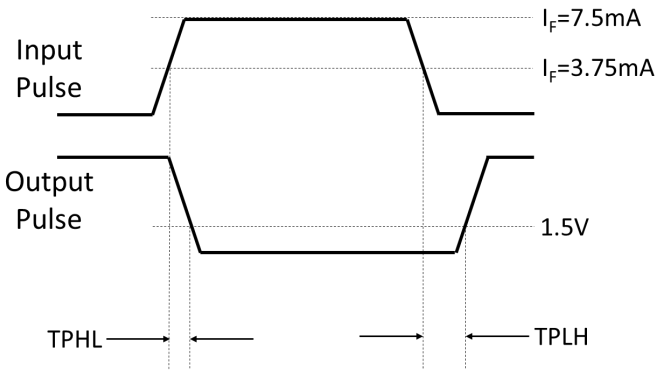
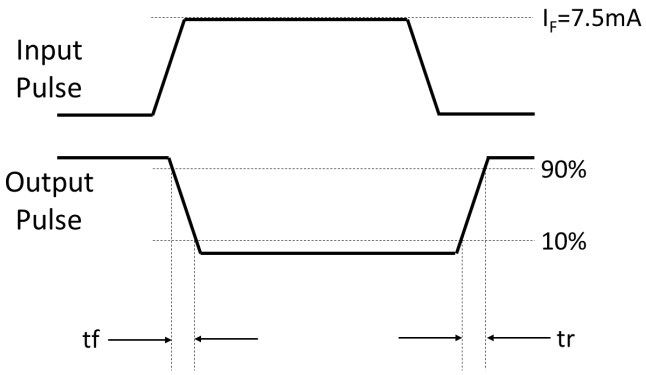



**Fig.24 Waveforms of $t_{PHL}$, $t_{PLH}$, $t_r$, $t_f$**



## TEST CIRCUITS

**Fig.25 Test Circuits for $t_{EHL}$, $t_{ELH}$**

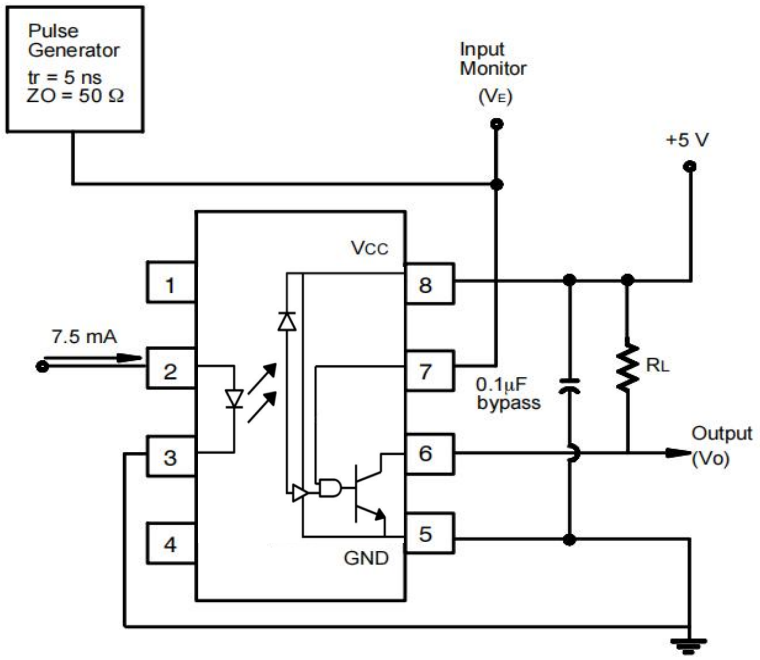
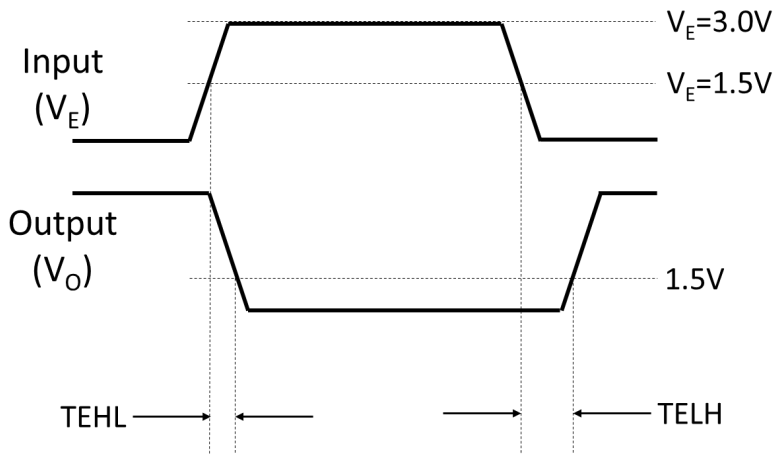



**Fig.26 Waveforms of $t_{EHL}$, $t_{ELH}$**



## TEST CIRCUITS

**Fig.27 Test Circuits for Common Mode Transient Immunity**

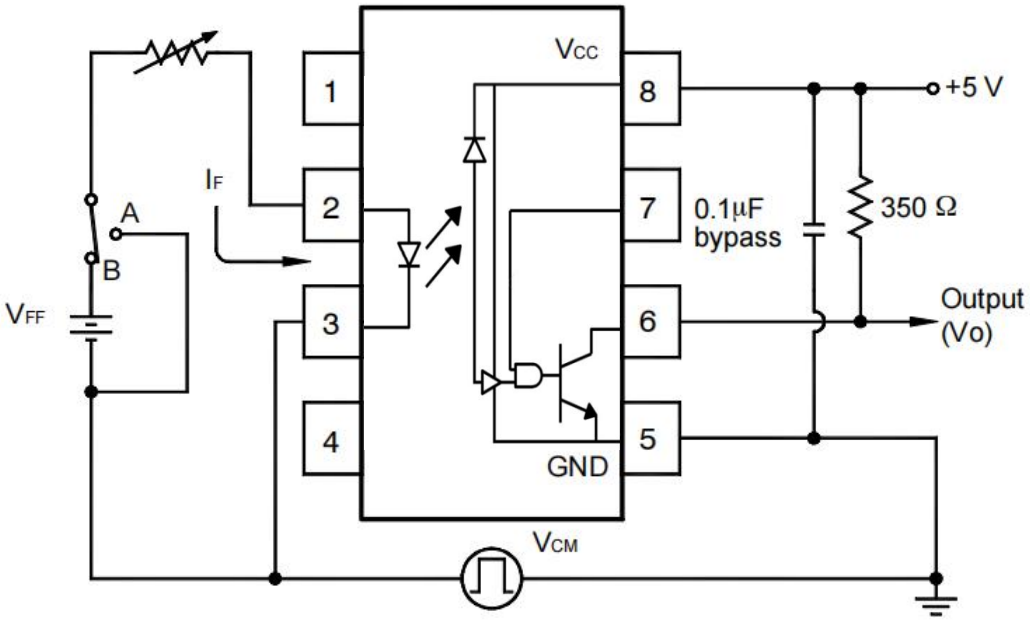
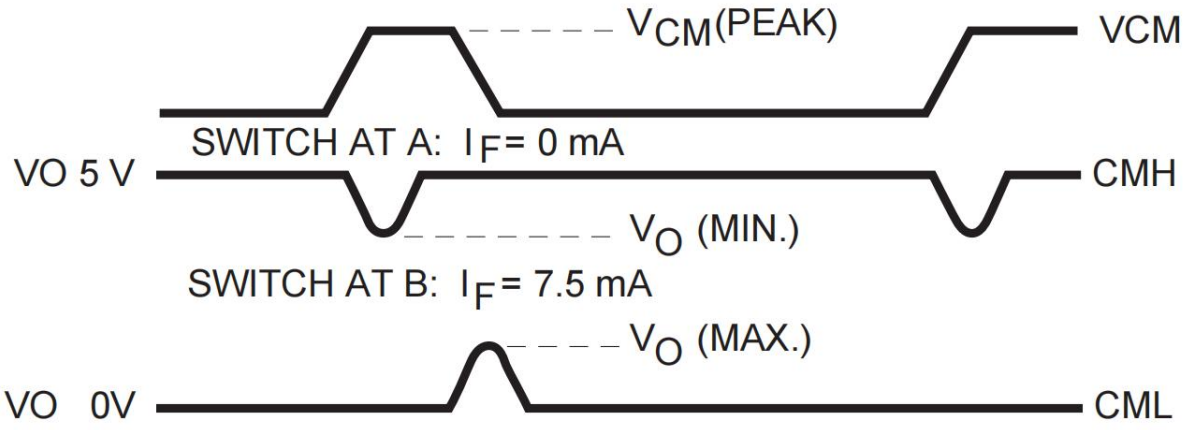
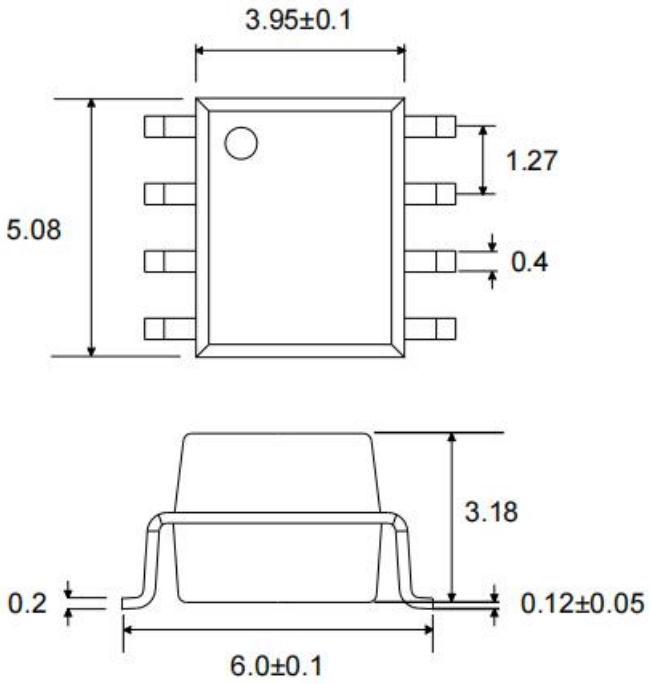



**Fig.28 Waveforms of Common Mode Transient Immunity**



## PACKAGE DIMENSIONS

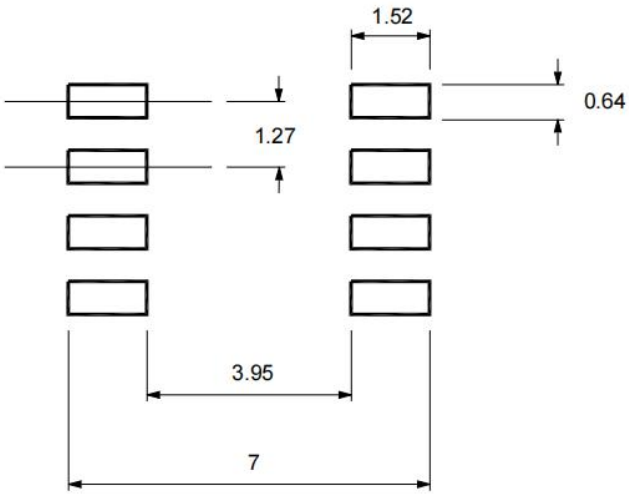
**Surface Mount (Low Profile) Lead Forming (SOP8)**




- **Dimensions in mm unless otherwise stated**

## RECOMMENDED SOLDER MASK

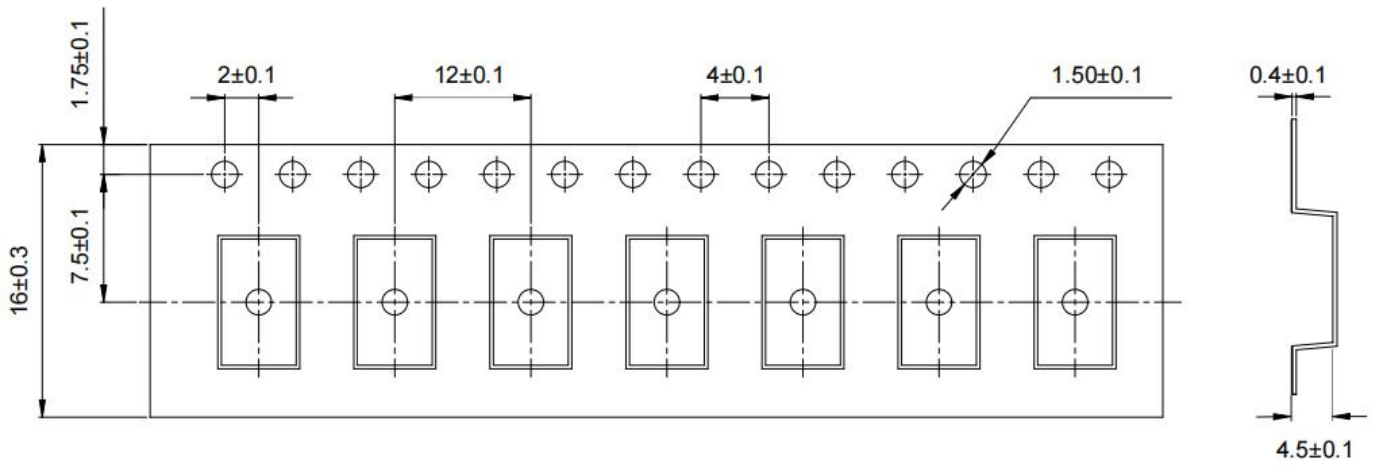
**Surface Mount (Low Profile) Lead Forming**

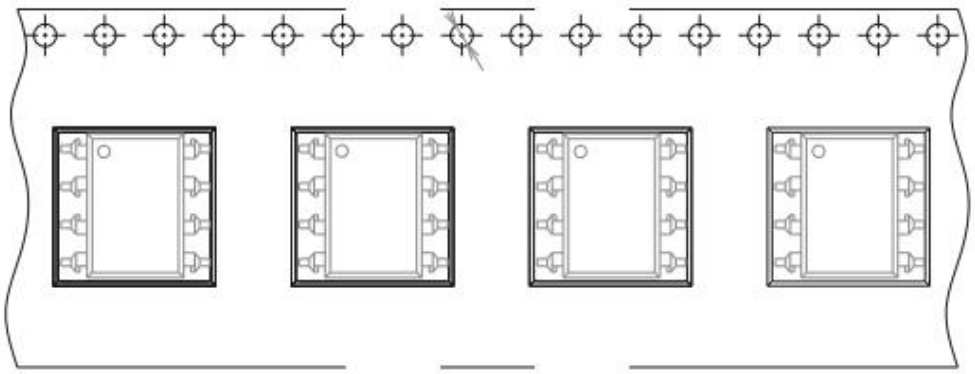



- **Dimensions in mm unless otherwise stated**

## TAPING DIMENSIONS

**Option SOP8**

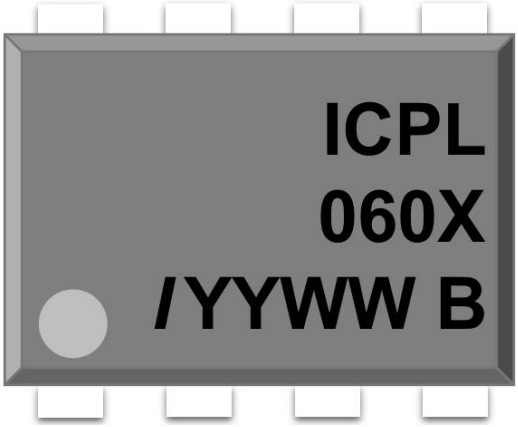


- **Dimensions in mm unless otherwise stated**

# ORDERING AND MARKING INFORMATION

## Marking Information




| | | |
|---|---|---|
| ICPL | : | Company Abbr. |
| 060X | : | Part Number |
| / | : | ISOMICRON |
| YY | : | Fiscal Year |
| WW | : | Work Week |
| B | : | Manufacturing Code |

## Order Code

**ICPL – 060X - 5 0 0 E**

**Company Abbr.**

**Part Number**

**Lead Forming**
5: SM-SL

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

**CTR Rank:** None

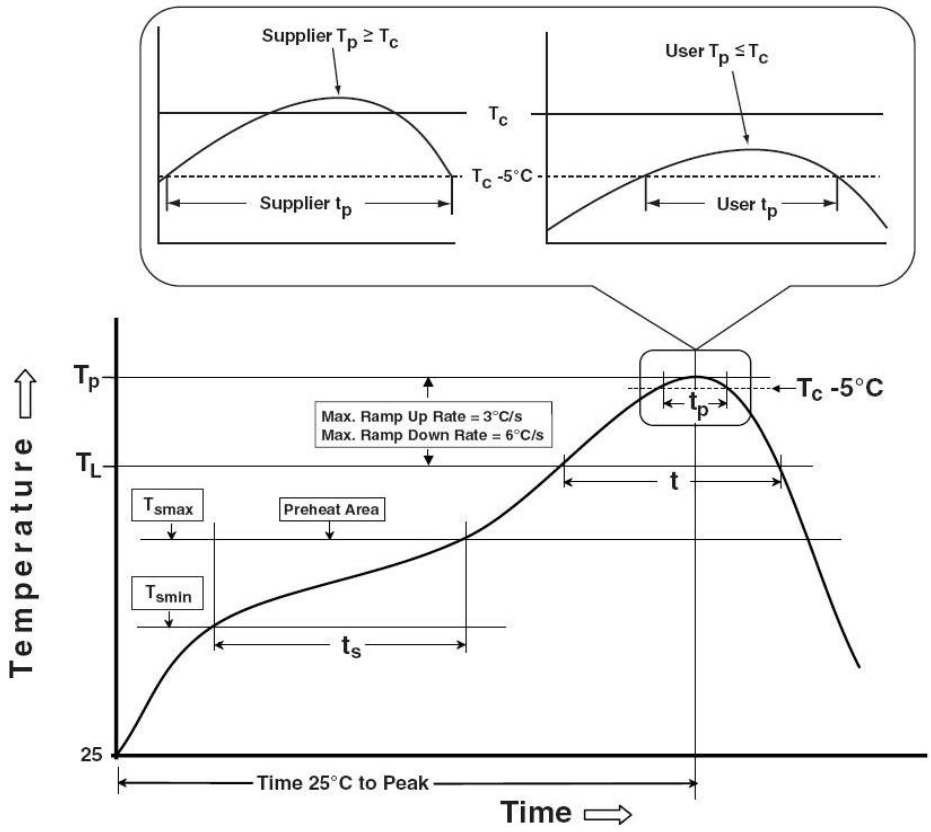
**Performance:**
0: Normal
1: Enhanced
2: Industrial level
3: Auto level
4: Military level

## Packing Quantity

| Option | Quantity | Quantity – Inner box | Quantity – Outer box |
|---|---|---|---|
| SM-SL | 2000 Units/Reel | 2 Reels/Inner box | 5 Inner box/Outer box = 20k Units |

# REFLOW INFORMATION

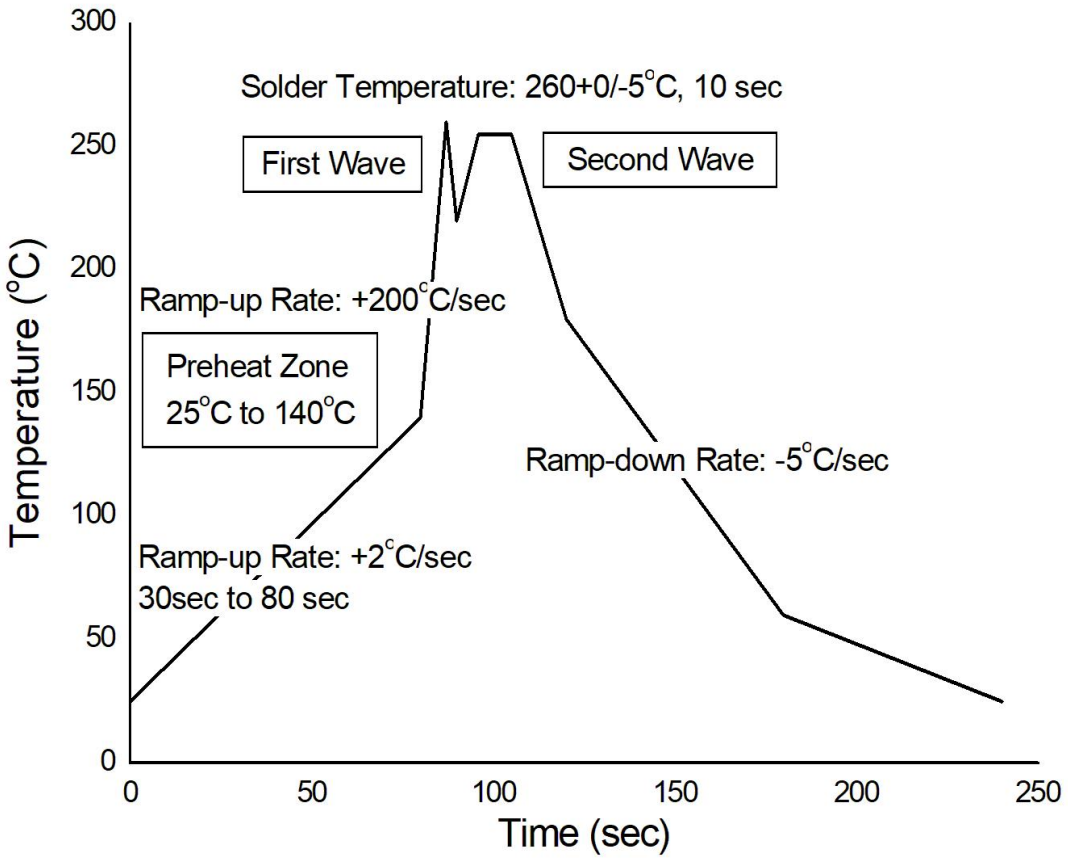
## Reflow Profile




| 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.
- ISOMICRON makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, ISOMICRON disclaims (a) any and all liability arising out of the application or use of any product, (b) any and all liability, including without limitation special, consequential or incidental damages, and (c) any and all implied warranties, including warranties of fitness for particular
- 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, automotive, 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.