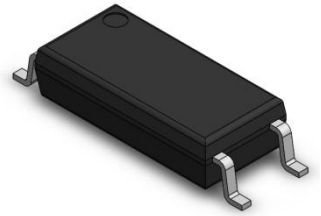
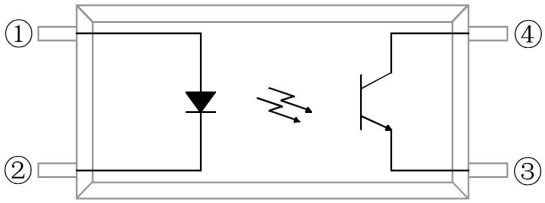
# DC Input 4-Pin Long Creepage Phototransistor Optocoupler



## Description

The PC101x series devices consist of a Gallium Arsenide infrared emitting diode, optically coupled to a Silicon NPN phototransistor detector. They are packaged in a 4-pin long small outline package (SOP-4) and are available in tape and reel packaging format.




## Features

- Current transfer ratio
  (CTR: 50~600% at IF=5mA,VCE=5V)
- High input-output isolation voltage
  (Viso=5000Vrms)
- Creepage distance >8.00mm
- Operating temperature up to +110℃
- RoHS REACH compliance
- Compliance Halogen Free
- MSL Level 1

PIN Configuration

① Anode

② Cathode

③ Emitter

④ Collecter

## Applications

- Programmable controllers
- System appliances, measuring instruments
- Telecommunication equipments
- Home appliances, such as fan, heaters, etc

## Absolute Maximum Ratings *(Ta=25°C)*

| Parameter | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Input | Forward Current | $I_F$ | 60 | mA |
| | Peak Forward Current*1 | $I_{FP}$ | 1 | A |
| | Reverse Voltage | $V_R$ | 6 | V |
| | Power Dissipation<br>No Derating Required Up to $T_a$ = 100°C | $P_D$ | 100 | mW |
| Output | Power Dissipation<br>Derating Factor (above $T_a$ = 80°C) | $P_C$ | 150 | mW |
| | Collector Current | $I_C$ | 50 | mA |
| | Collector-Emitter Voltage | $V_{CEO}$ | 80 | V |
| | Emitter-Collector Voltage | $V_{ECO}$ | 7 | V |
| Total Power Dissipation | | $P_{TOT}$ | 250 | mW |
| Isolation Voltage*2 | | $V_{ISO}$ | 5000 | Vrms |
| Peak Isolation Voltage | | VIORM | 1140 | Vpeak |
| Transient Isolation Voltage | | VIOTM | 5000 | Vpeak |
| Operating Temperature | | $T_{OPR}$ | -55~110 | ℃ |
| Storage Temperature | | $T_{STG}$ | -55~125 | ℃ |
| Soldering Temperature | | $T_{SOL}$ | 260 | ℃ |

**1 100μs pulse, 100Hz frequency*

**2 AC for 1 minute, R.H.= 40 ~ 60% R.H. In this test, pins 1, 2 are shorted together, and pins 3, 4 are shorted together.*

## Electro-Optical Characteristics *(Ta=25°C)*

### Input

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| Forward Voltage | $V_F$ | --- | 1.20 | 1.4 | V | $I_F$=10mA |
| Reverse Current | $I_R$ | --- | --- | 10 | uA | $V_R$=6V |
| Input Capacitance | $C_{in}$ | --- | 10 | 100 | pF | V=0，f=1kHz |

### Output

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| Collector-Emitter Dark Current | $I_{CEO}$ | --- | --- | 100 | nA | $V_{CE}$ = 20V, $I_F$ = 0mA |
| Collector-Emitter Breakdown Voltage | $BV_{CEO}$ | 80 | --- | --- | V | $I_C$=0.1mA |
| Emitter-Collector Breakdown Voltage | $BV_{ECO}$ | 7 | --- | --- | V | $I_E$=0.1mA |

### Transfer Characteristics

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | --- | 0.1 | 0.2 | V | $I_F$=20mA,$I_C$=1mA |
| Isolation Resistance | $R_{IO}$ | $5\times10^{10}$ | --- | --- | Ω | $V_{IO}$=500Vdc, 40~60% R.H. |
| Floating Capacitance | $C_{IO}$ | --- | 0.6 | 1.0 | pF | $V_{IO}$=0,f=1MHz |
| Cut-Off Frequency*3 | $F_C$ | --- | 80 | --- | kHz | $V_{CE}$=2V, $I_C$=2mA, RL=100Ω,-3dB |
| Rise Time*4 | Tr | --- | 5 | 18 | us | $V_{CE}$=2V, $I_C$=2mA, $R_L$=100Ω |
| Fall Time*4 | Tf | --- | 6 | 18 | us | |

**3 Fig.14*

**4 Fig.12&13*

## Current Transfer Ratio Binning

| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|---|
| Current Transfer ratio | PC1010 | CTR | 50 | --- | 600 | % | $I_F$=5mA, $V_{CE}$=5V |
| | PC1015 | | 50 | --- | 150 | | |
| | PC1016 | | 100 | --- | 300 | | |
| | PC1017 | | 80 | --- | 160 | | |
| | PC1018 | | 130 | --- | 260 | | |
| | PC1019 | | 200 | --- | 400 | | |
| | PC1020 | | 300 | --- | 450 | | |
| | PC1011 | CTR | 60 | --- | 300 | % | $I_F$=10mA, $V_{CE}$=5V |
| | PC1012 | | 63 | --- | 125 | | |
| | PC1013 | | 100 | --- | 200 | | |
| | PC1014 | | 160 | --- | 320 | | |
| | PC1012 | CTR | 22 | --- | --- | % | $I_F$=1mA, $V_{CE}$=5V |
| | PC1013 | | 34 | --- | --- | | |
| | PC1014 | | 56 | --- | --- | | |

** Typical values at Ta = 25°C*

## Typical Electro-Optical Characteristics Curves

Fig.1 Forward Current vs. Ambient Temperature

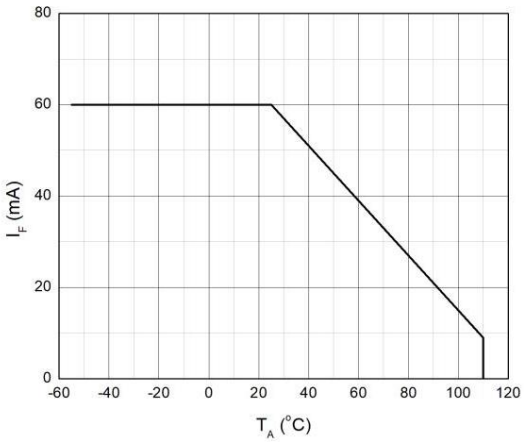



Fig. 2 Collector Power Dissipation Vs.Ambient Temperature

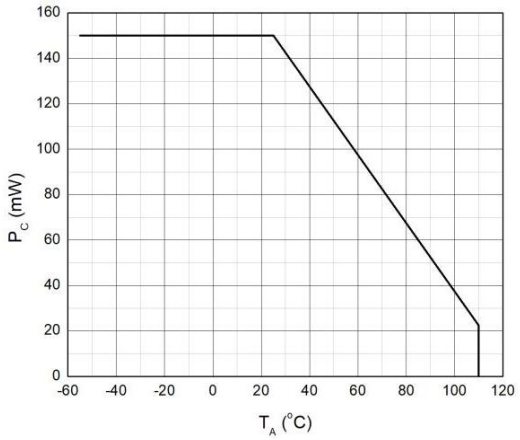



Fig.3 Forward Current vs.Forward Voltage

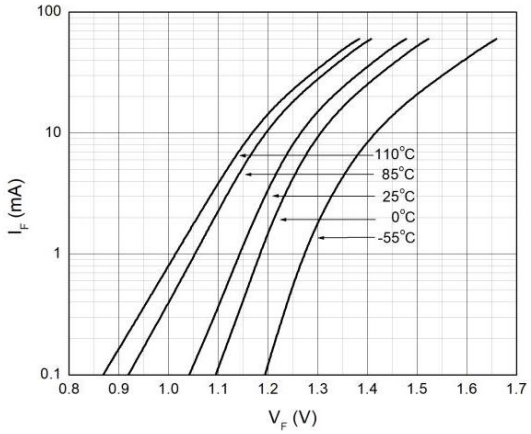



Fig. 4 Collector Dark Current vs.Ambient Temperature

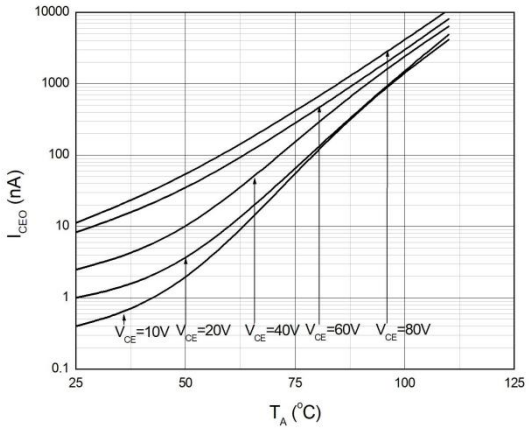



Fig.5 Collector Current vs.Collector-emitter Voltage

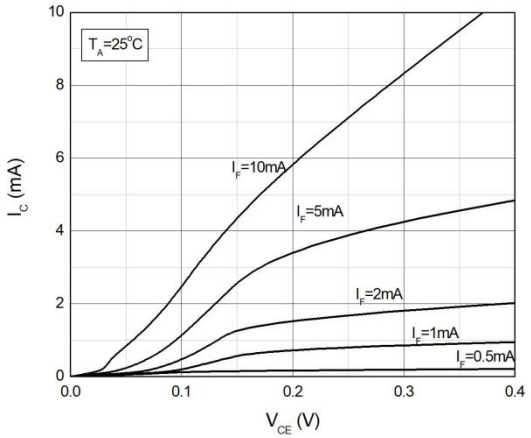
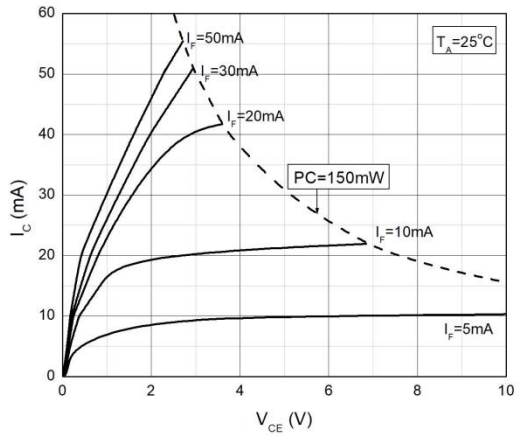



Fig.6 Collector Current vs.Collector-emitter Voltage



## Typical Electro-Optical Characteristics Curves

Fig.7 Normalized Current Transfer Ratio vs. Forward Current

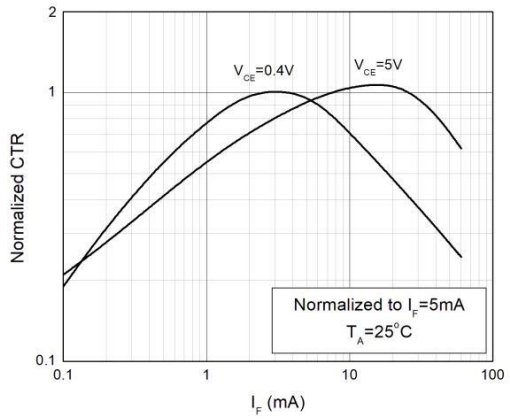



Fig.8 Normalized Current Transfer Ratio vs. Ambient Temperature

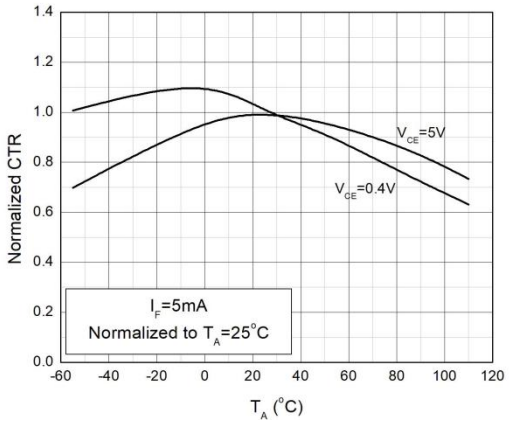



Fig.9 Collector-emitter Saturation Voltage vs. Ambient Temperature

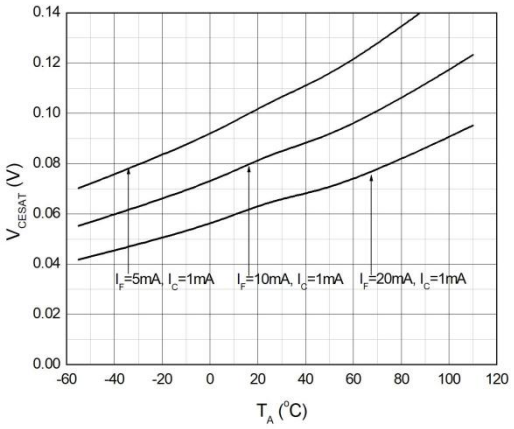



Fig.10 switching Time vs. Load Resistance

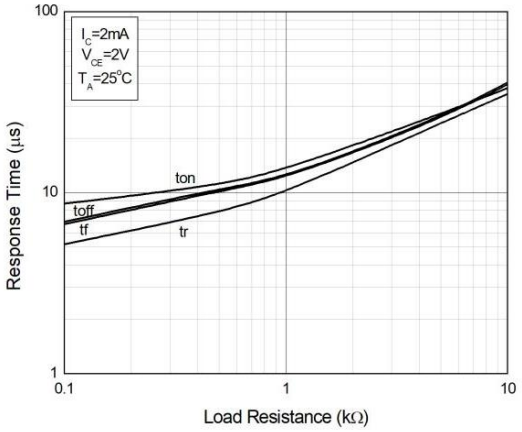



Fig.11 Frequency Response

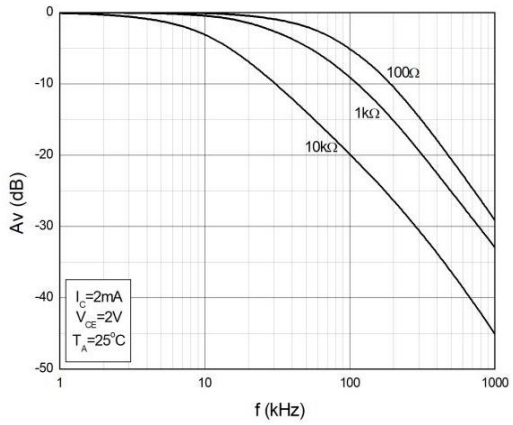
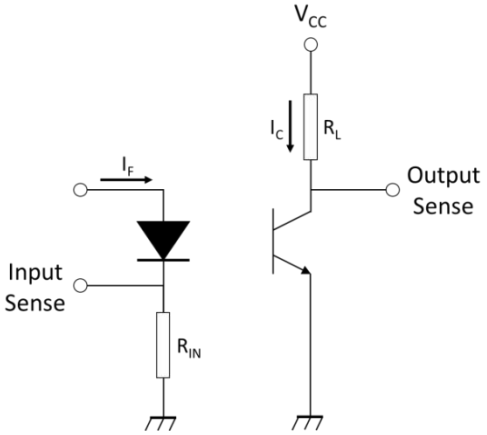



Fig.12 Test Circuits of Response Time



## Typical Electro-Optical Characteristics Curves

Fig.13 Curves of Response Time

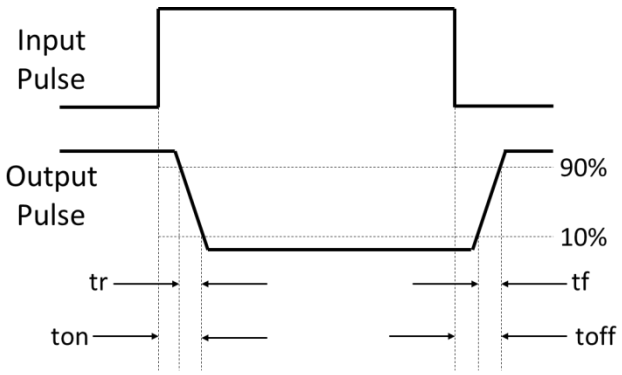
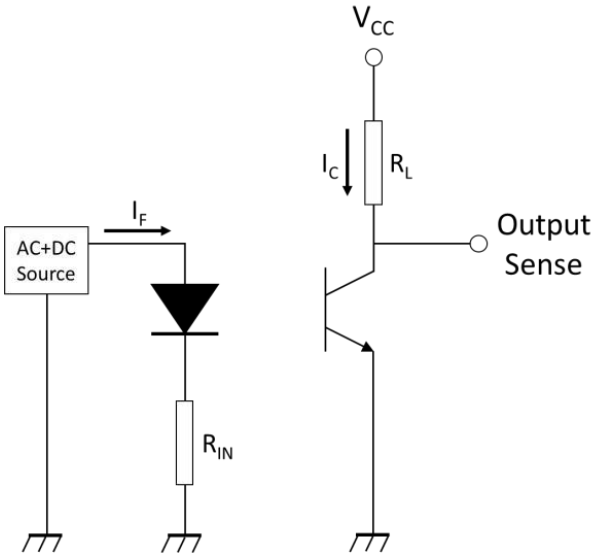
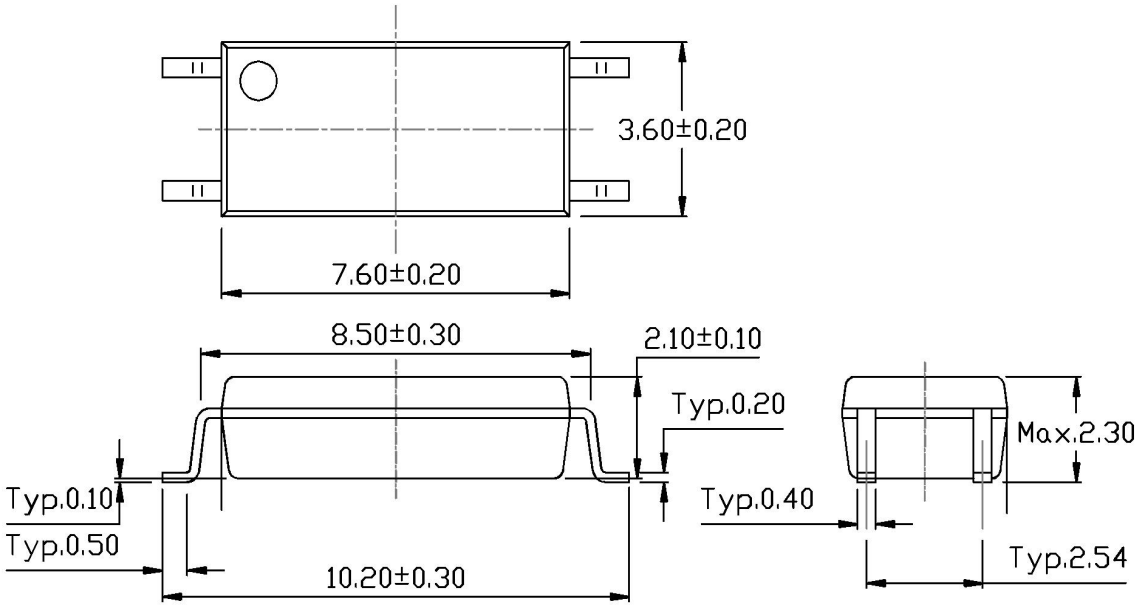



Fig.14 Test Circuits of Frequency Response



## Package Dimension *(Unit：mm)*

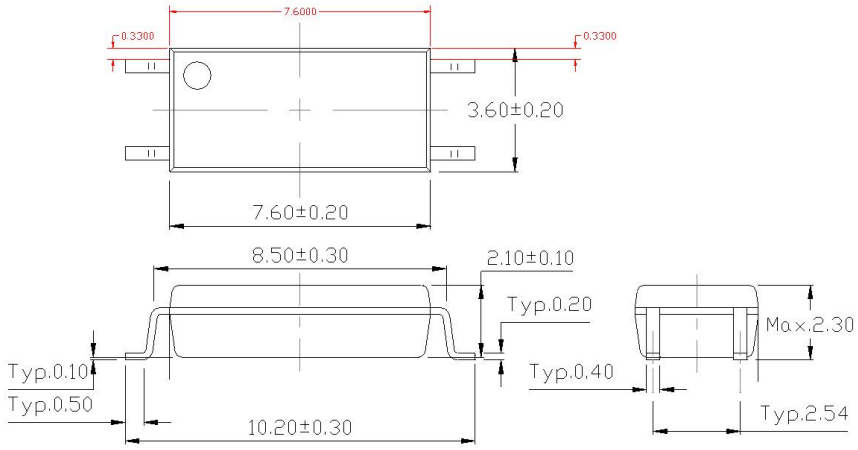



Notes:

*1. All dimensions are in millimeters.*

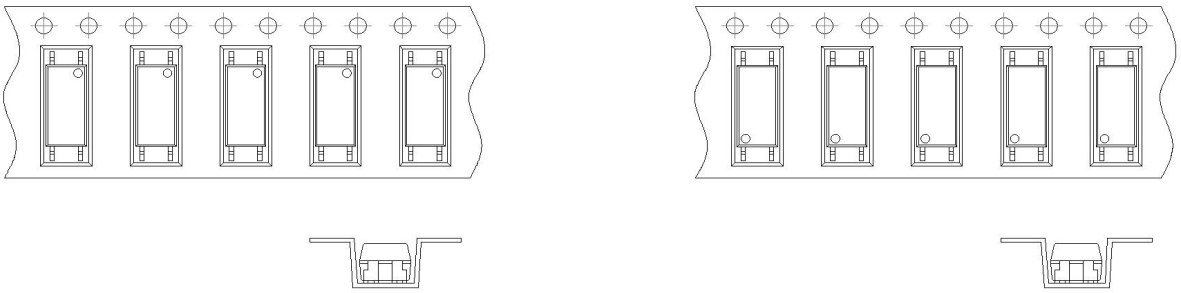
*2. Tolerances dimensions ±0.3mm unless otherwise specified.*

## Creepage Distance

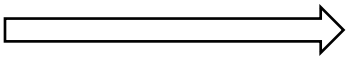


## Packing Specification Tape & Reel Packing Specifications

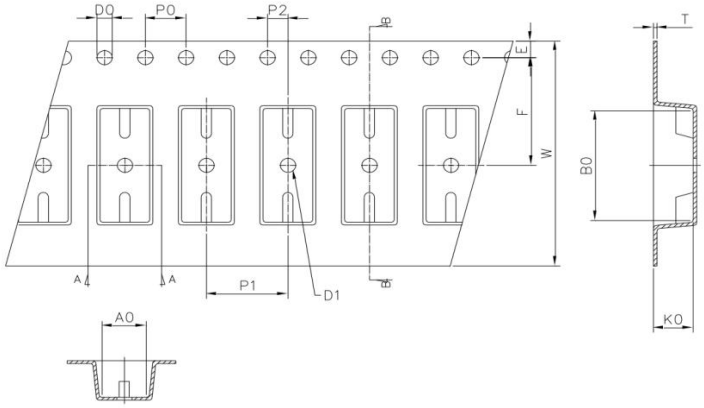
**T1** **T2**



**Direction of feed from reel**

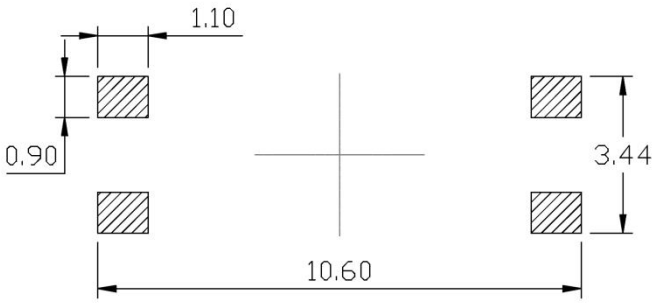


## Carrier Tape Dimensions:Loaded Quantity 3000 pcs Per Reel




| Dimension No. | A0 | B0 | D0 | D1 | E | F |
|---|---|---|---|---|---|---|
| Dimension | 3.80±0.10 | 10.60±0.10 | 1.5±0.10 | 1.50+0.10 | 1.75±0.10 | 7.50±0.10 |
| Dimension No. | P0 | P1 | P2 | t | W | K0 |
| Dimension | 4.00±0.10 | 8.00±0.10 | 2.00±0.10 | 0.30±0.05 | 16.00±0.30 | 2.50±0.10 |

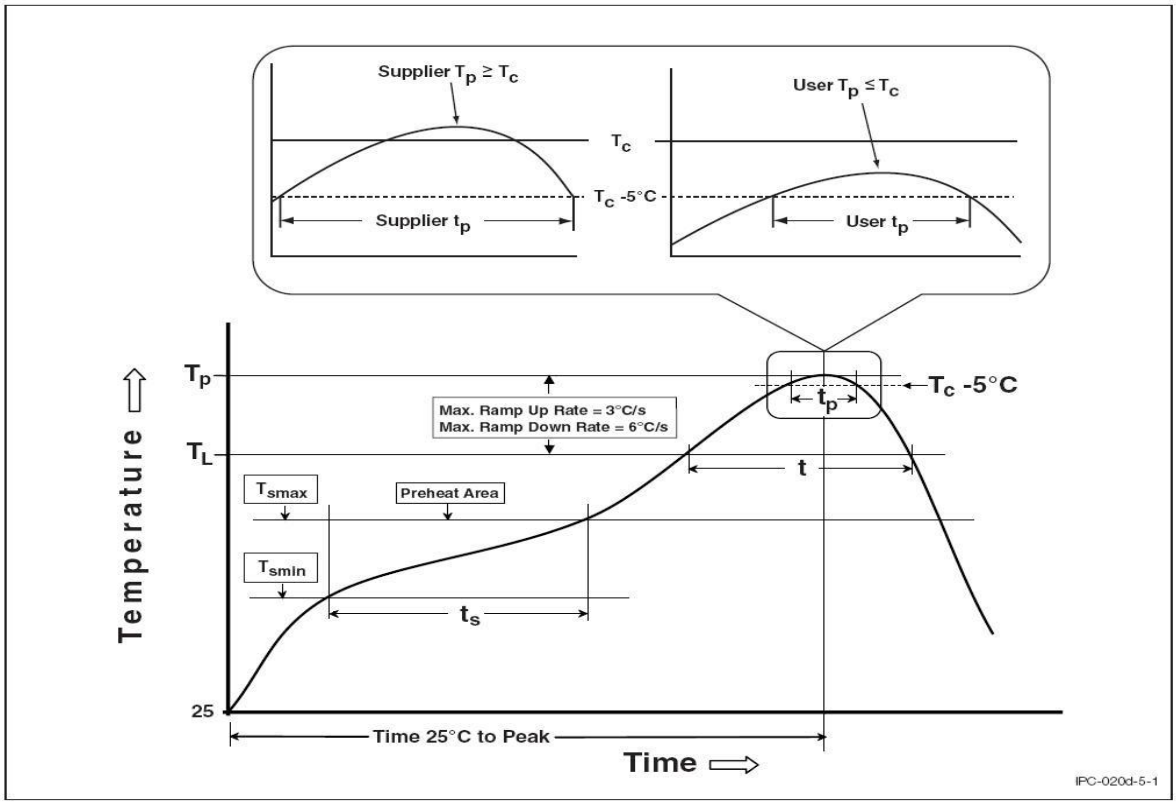
## Recommended Foot Print for Surface Mount Device *(Unit：mm)*




## Precautions for Use

1. Soldering Condition

   Maximum Body Case Temperature Profile For Evaluation of Reflow Profile



**1.** Soldering Condition (cont.)

| **Preheat** | Condition |
|---|---|
| Temperature min ($T_{smin}$) | 150 °C |
| Temperature max ($T_{smax}$) | 200°C |
| Time ($T_{smin}$ to $T_{smax}$) ($t_s$) | 60-120 sec |
| Average Ramp-Up Rate ($T_{smax}$ to $T_p$) | 3 °C/sec max |
| **Other** | Condition |
| Liquidus Temperature ($T_L$) | 217 °C |
| Time Above Liquidus Temperature ($T_L$) | 60-100 sec |
| Peak Temperature ($T_P$) | 260°C |
| Time within 5 °C of Actual Peak Temperature: $T_P$ - 5°C / Tc | 30 sec |
| Ramp- Down Rate From Peak Temperature | 6°C /sec max |
| Time 25°C to Peak Temperature | 8 minutes max |
| Max. Reflow Times | 3 times |