# 36V/5A Over Voltage Protection IC

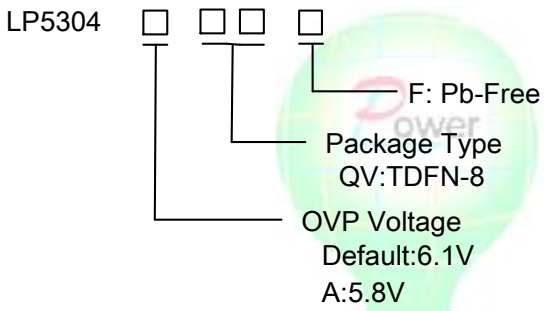
## General Description

The LP5304 is an Over-Voltage-Protection(OVP) device. The device will switch off internal MOSFET to disconnect IN to OUT to protect load when any of input voltage over the threshold. The Over temperature protection (OTP) function monitors chip temperature to protect the device.
The LP5304 is available in DFN-8 package. Standard products are Pb-free and Halogen-free.

## Features

- Input Voltage Range: 3.5V to 36V
- Typical Output Power on Time: 9mS
- OVP Threshold: 6.1V/5.8V
- OVP Threshold Time Less Than 1uS
- Output current:5A
- Low $R_{(DSON)}$ Internal Switches:30mΩ @ 5V
- Output Discharge
- Thermal Fault Protection
- DFN-8 3*3mm Package
- RoHS Compliant and 100% Lead (Pb)-Free

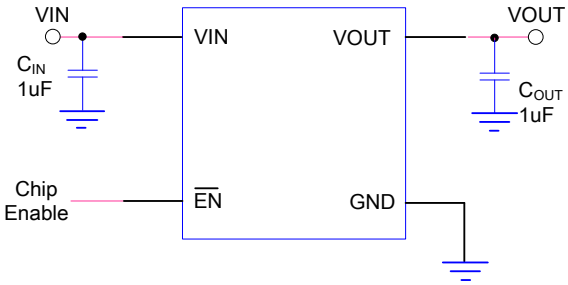
## Order Information




## Applications

- GPS
- PMP
- PAD
- MID
- Digital cameras, Digital Videos

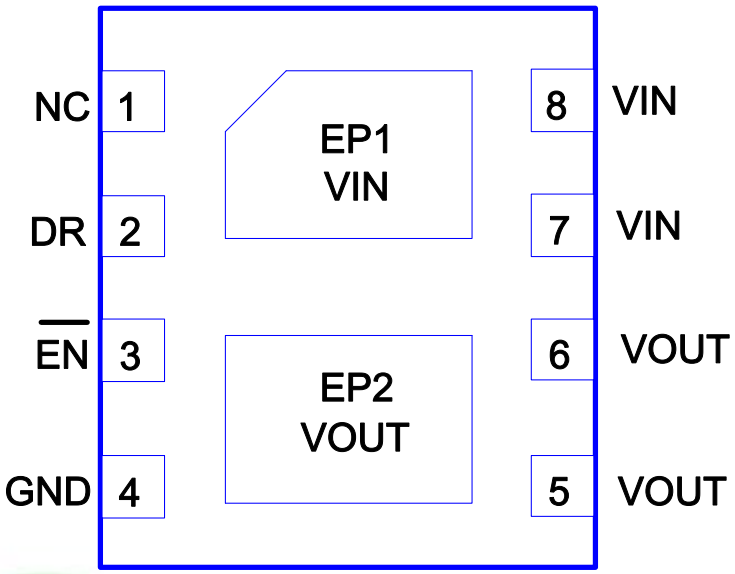
## Typical Application Circuit




## Marking Information

| Device | Marking | Package | Shipping |
|---|---|---|---|
| LP5304QVF | LPS<br>LP5304<br>YWX | DFN-8 | 5K/REEL |
| LP5304AQVF | LPS<br>LP5304A<br>YWX | DFN-8 | 5K/REEL |
| Y: Year code. W: Week code. X: Batch numbers. | | | |

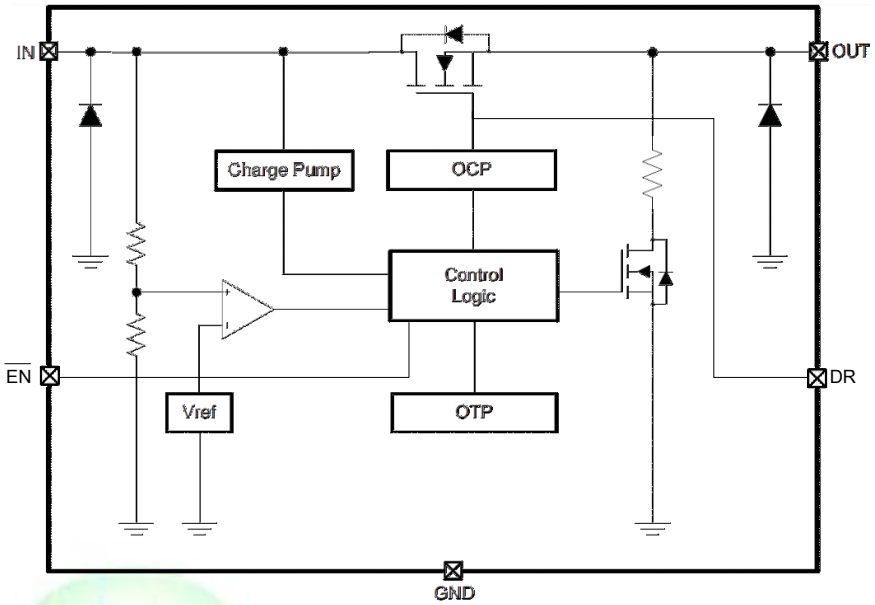
## Functional Pin Description




## Pin Description

| DFN-8 | PIN | DESCRIPTION |
|---|---|---|
| 1 | NC | No connector. |
| 2 | DR | NMOS gate driver. |
| 3 | $\overline{EN}$ | Chip enable pin. Active low. |
| 4 | GND | Ground. |
| 5/6/EP2 | OUT | Output pin. |
| 7/8/EP1 | VIN | Input pin. A 1uF low ESR ceramic capacitor or larger must be connected as close as to this pin. It is recommended to use 50V capacitor or according to application. |

## Function Block Diagram




## Absolute Maximum Ratings Note 1

- ✧ Input to GND ---------- 36V
- ✧ Vout to GND ---------- 6.5V
- ✧ EN Pin to GND ---------- 6.5V
- ✧ DR Pin to GND ---------- 13V
- ✧ Maximum Junction Temperature ---------- 150°C
- ✧ Maximum Soldering Temperature (at leads, 10 sec) ---------- 260°C

**Note 1.** Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## Thermal Information

- ✧ Maximum Power Dissipation (DFN-8, PD,TA=25°C) ---------- 1.5W
- ✧ Thermal Resistance (DFN-8, JA) ---------- 65℃/W

## ESD Susceptibility

- ✧ HBM(Human Body Mode) ---------- 2KV
- ✧ MM(Machine Mode) ---------- 200V

## Recommended Operating Conditions

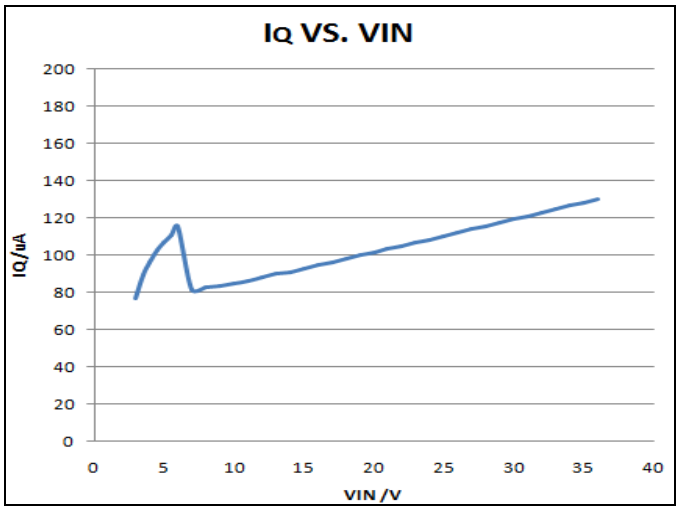
- ✧ Operating Ambient Temperature Range (Ta) ---------- -40℃ to 85°C

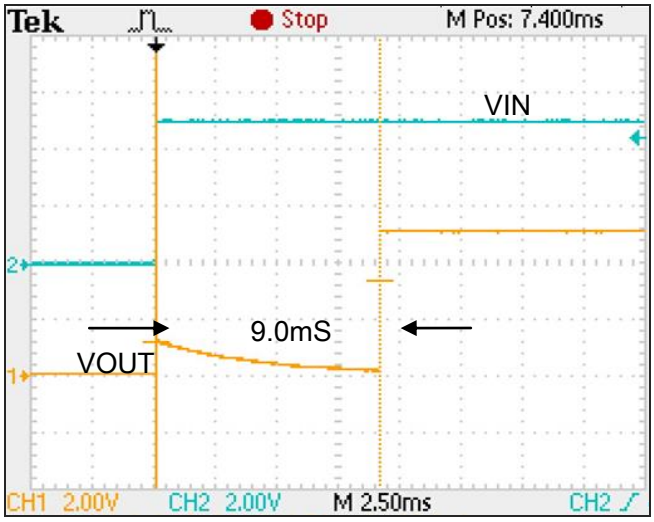
# Electrical Characteristics

(Typical values are TA=25℃ )

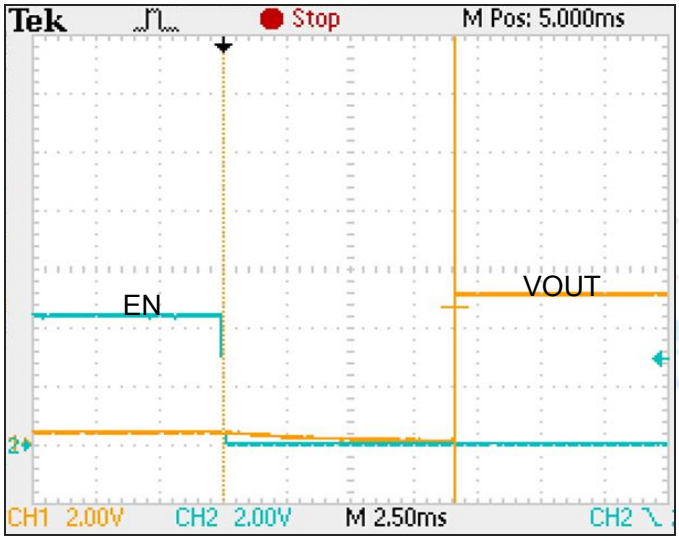
| Symbol | Parameter | Conditions | | LP5304 | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| **DC characteristics and Power-ON-Reset** | | | | | | | |
| VIN | Input Voltage | | | 3.5 | | 36 | V |
| $I_Q$ | Input quiescent current | VIN =5V, EN=LOW, IOUT =0A | | | 110 | | uA |
| $I_{SD}$ | | VIN =5V, EN=HIGH, IOUT =0A | | | | 1 | |
| $R_{ON}$ | IN-to-OUT ON resistance | VIN =5V, IOUT =4A | | | 30 | 35 | mΩ |
| $R_{DISCHARGE}$ | Output discharge resistance | | | | 4.3 | | kΩ |
| $V_{EN(L)}$ | Enable Threshold Low | Chip enable | | | | 0.4 | V |
| $V_{EN(H)}$ | Enable Threshold High | Chip shutdown | | 1.4 | | | V |
| UVLO | Under voltage lock out threshold | VIN increasing from 0~5V | | 2.6 | 2.8 | 3 | V |
| $V_{HYS-UVLO}$ | Under voltage lock out hysteresis | VIN decreasing from 5~0V | | | 500 | | mV |
| $T_{ON}$ | Output power-on time | EN = LOW , | | | 9 | | mS |
| | Turn on through EN | EN = HIGH -> LOW, | | | 9 | | |
| **Input Over-Voltage-Protection (OVP)** | | | | | | | |
| $V_{OVP}$ | OVP threshold | VIN increasing from 5~7V | LP5304QVF | 5.8 | 6.1 | 6.4 | V |
| | | | LP5304AQVF | 5.5 | 5.8 | 6.1 | V |
| $V_{HYS-OVP}$ | OVP hysteresis | VIN decreasing from 7~5V | | | 300 | | mV |
| $T_{OVP}$ | OVP active time | VIN = 5 -> 10V | | | | 1 | uS |
| $T_{ON(OVP)}$ | OVP recovery time | VIN = 10 -> 5V to output ON | | | 9 | | mS |
| $I_{out}$ | Output current limit | | | 5 | | | A |
| **Over-Temperature-Protection (OTP)** | | | | | | | |
| OTP threshold | | | | | 150 | | ℃ |
| OTP hysteresis | | | | | 20 | | ℃ |

## Typical Operating Characteristics

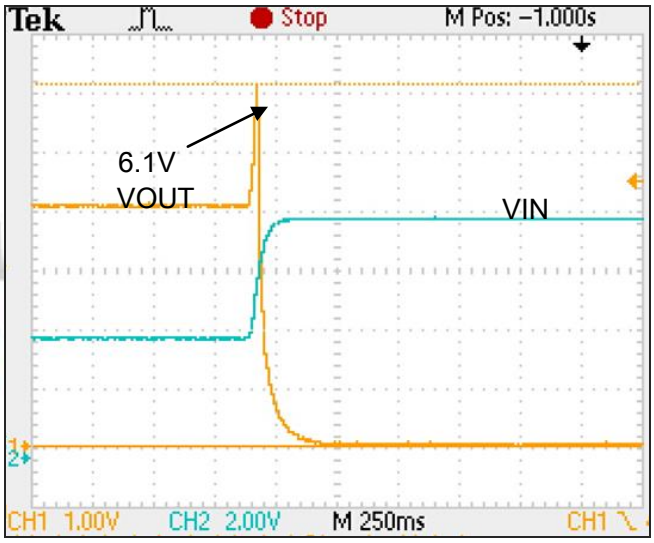


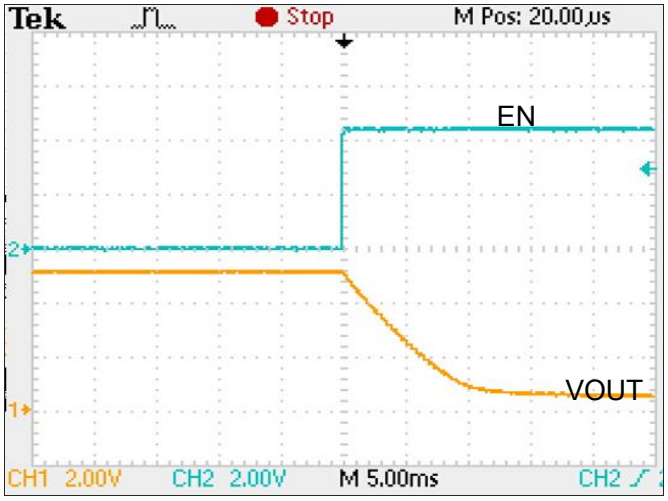

Turn on with EN=0V



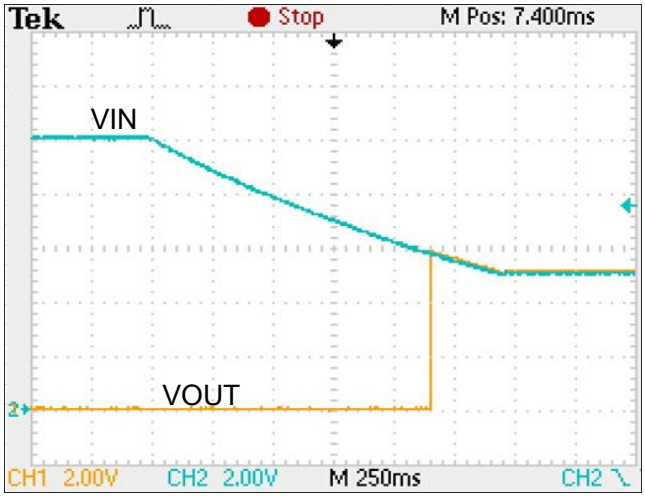

Turn on with VIN=5V




OVP waveform ( LP5304QVF )



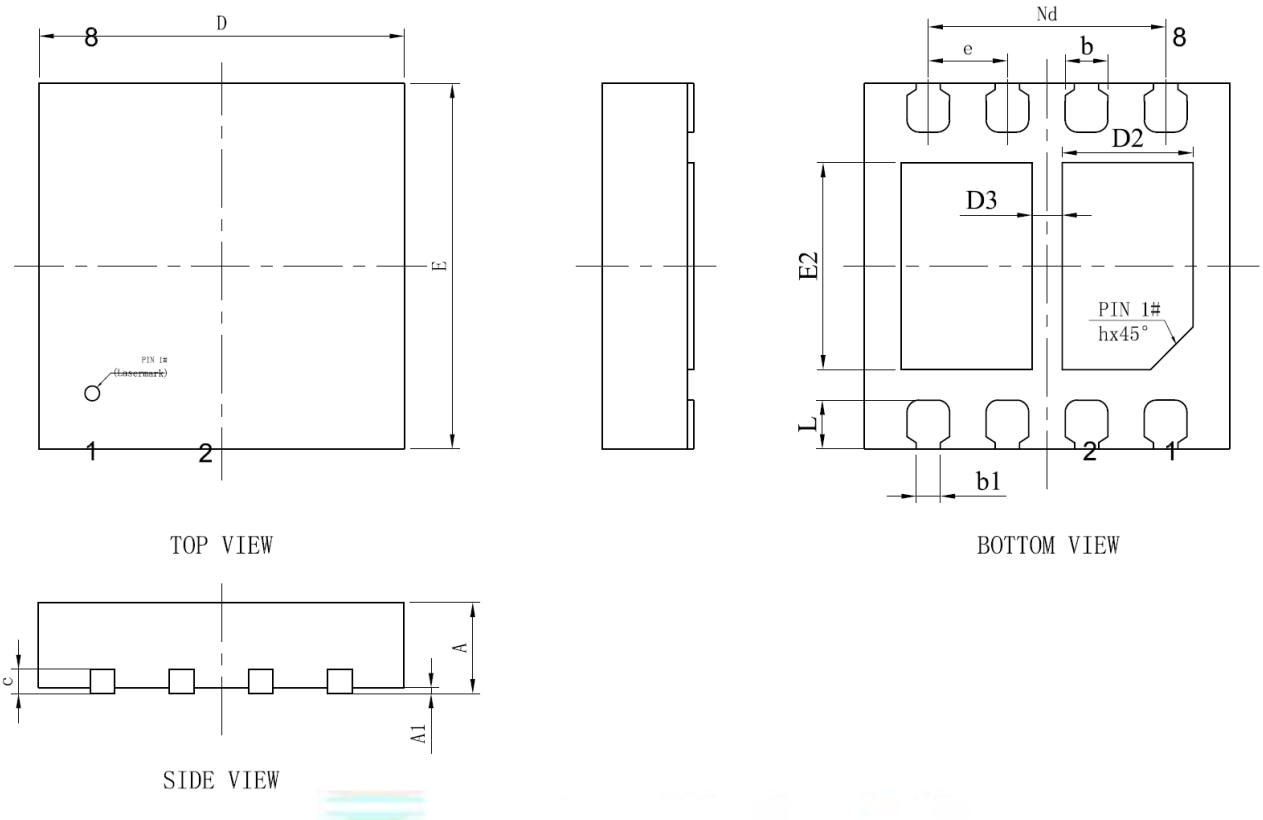

Turn off waveform with Iout=0A




VIN falling waveform

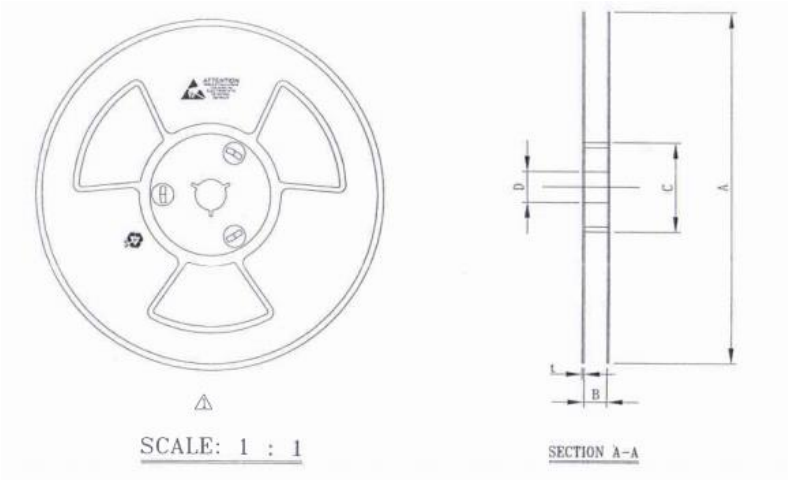
## Packaging Information

DFN-8

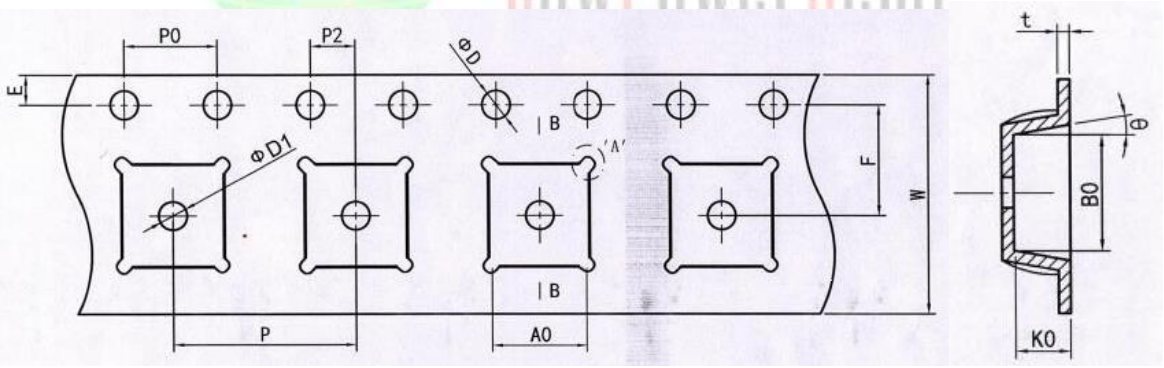



| SYMBOL | MILIMETER | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 0.70 | 0.75 | 0.80 |
| A1 | 0 | 0.02 | 0.05 |
| b | 0.30 | 0.35 | 0.40 |
| b1 | | 0.20REF | |
| c | 0.18 | 0.20 | 0.23 |
| D | 2.90 | 3.00 | 3.10 |
| D2 | 0.975 | 1.075 | 1.175 |
| D3 | 0.25REF | | |
| Nd | 1.90 | 1.95 | 2.00 |
| E | 2.90 | 3.00 | 3.10 |
| E2 | 1.60 | 1.70 | 1.80 |
| e | | 0.65BSC | |
| L | 0.35 | 0.40 | 0.45 |
| h | 0.30 | 0.35 | 0.40 |

## TAPE AND REEL INFORMATION




| SYMBOL | MILIMETER | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 328 | 329 | 330 |
| B | 11.8 | 12.8 | 13.8 |
| C | 99 | 100 | 101 |
| D | 13.0 | 13.3 | 13.6 |
| L | 1.7 | 2.0 | 2.3 |




| SYMBOL | MILIMETER | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A0 | 3.2 | 3.3 | 3.4 |
| B0 | 3.2 | 3.3 | 3.4 |
| D | 1.50 | 1.55 | 1.60 |
| D1 | 1.50 | -- | -- |
| E | 1.65 | 1.75 | 1.85 |
| F | 5.40 | 5.50 | 5.60 |
| P | 7.90 | 8.00 | 8.10 |
| P0 | 3.90 | 4.00 | 4.10 |
| P2 | 1.95 | 2.00 | 2.05 |
| K0 | 1.00 | 1.10 | 1.20 |
| W | 11.70 | 12.00 | 12.30 |
| t | 0.25 | 0.30 | 0.35 |
| θ | -- | 3° | -- |

## Classification of IR Reflow Profile

| Profile Feature | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|---|---|---|
| **Preheat/Soak** | | |
| Temperature Min($T_{SMIN}$) | 100℃ | 150℃ |
| Temperature Max($T_{SMAX}$) | 150℃ | 200℃ |
| Time($T_S$) from ($T_{SMIN}$ to $T_{SMAX}$) | 60~120 seconds | 60~120 seconds |
| Ramp-up rate ($T_L$ to $T_P$) | 3℃/second max | 3℃/second max |
| Liquidous temperature($T_L$) | 183℃ | 217℃ |
| Time($t_L$) maintained above $T_L$ | 60~150 seconds | 60~150 seconds |
| Peak package body temperature ($T_P$) | For users $T_P$ must not exceed theClassification temp in Table 1. For suppliers $T_P$ must equal or exceedthe Classification temp in Table 1. | For users $T_P$ must not exceed theClassification temp in Table 2. For suppliers $T_P$ must equal or exceedthe Classification temp in Table 2. |
| Time($t_P$)* within 5℃ of the specified classification temperature($T_C$), see Figure1 | 20* seconds | 30* seconds |
| Ramp-down rate ($T_P$ to $T_L$) | 6℃/second max | 6℃/second max |
| Time 25℃ to peak temperature | 6 minutes max | 8minutes max |
| * Tolerance for peak profile temperature ($T_P$) is defined as a supplier minimum and a user maximum. | | |

**Table 1Sn-Pb Eutectic Process - Classification Temperatures ($T_C$)**

| Package Thickness | Volume $mm^3$ <350 | Volume $mm^3$ ≥350 |
|---|---|---|
| <2.5mm | 235℃ | 220℃ |
| ≥2.5mm | 220℃ | 220℃ |

**Table 2 Pb-Free Process - Classification Temperatures ($T_C$)**

| Package Thickness | Volume $mm^3$ <350 | Volume $mm^3$ 350~2000 | Volume $mm^3$ ≥350 |
|---|---|---|---|
| <1.6mm | 260℃ | 260℃ | 260℃ |
| 1.6mm~2.5mm | 260℃ | 250℃ | 245℃ |
| >2.5mm | 250℃ | 245℃ | 245℃ |

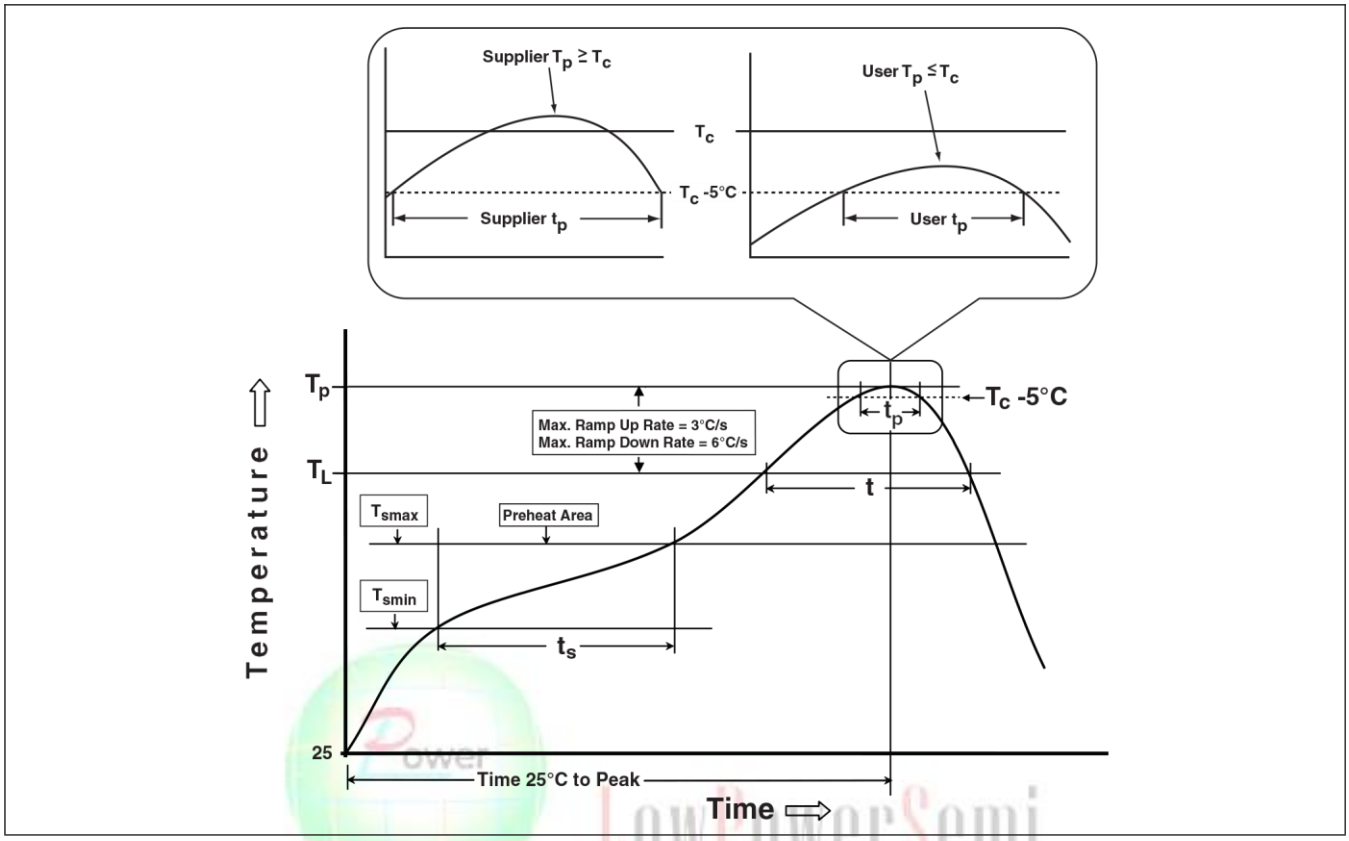



Figure1Classification Profile (Not to scale)

**Products shipped conform to "Rohs" standards;**

**Moisture Sensitivity Level：MSL3（CONDITION：≦30 °C/60%RH、Time control:168 hours）;**