# P61089A

**硬件可编程过电压保护集成电路**

版本号
202104-A

## 产品概述

P61089A主要用于保护 SLIC 免遭瞬态过电压冲击。正向过载由两个二极管来控制，负向浪涌由两个晶闸管抑制，晶闸管的动作电压与门极电压-$V_{BAT}$ 有关。该器件有非常低的门极触发电流($I_{GT}$) 以减少电路工作时的损耗。器件结构如图 1 所示。“四点”结构保证了高可靠的保护，特别是针对非常快速的瞬间线感应过压(L*di/dt) 图 1 和图 2 分别为器件的等效结构图和外型图。

## 产品特点

- ●双编程瞬态抑制;
- ●负压范围宽： $V_{MGL}$=-167$V_{MAX}$
- ●动态开关电压低： $V_{FP}$和 $V_{DGL}$
- ●门极触发电流低： $I_{GT}$=9m$A_{Max}$
- ●峰值脉冲电流： $I_{PP}$=15A（10/700μs）
- ●维持电流： $I_H$ ≥150mA
- ●符合RoHS要求
- ●湿敏等级 MSL3

## 应用领域

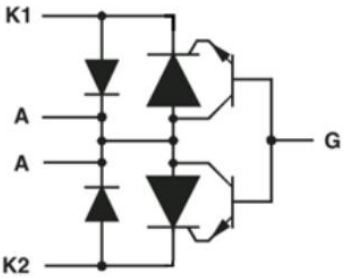
P61089A主要应用于程控交换机等通讯设备的二级过电压防护。

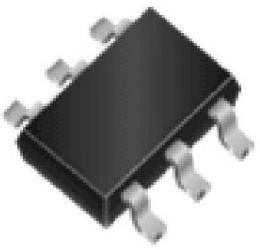
## 特征参数

| 符 号 | 额定值 | 单 位 |
|---|---|---|
| $V_{MGL}$ | - 167 | V |
| $I_{PP}$(10/700) | 15 | A |
| $I_H$ | 150 | mA |

## 封装：SOD-23-6

等效结构图



SOT-23-6

Pic.2 封装尺寸 SOT-23-6

## ■ 满足标准

| 标准类型 | 波形 | | ITSP |
|---|---|---|---|
| ITU-T K.20/21 和 K.45 | 电压 | 10/700μs | 15A |
| | 电流 | 5/310μs | |

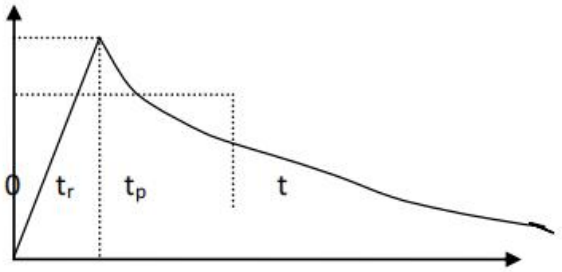
## ■ 电特性

● 极限值　除非另有规定 $T_a$ = 25℃

| 符号 | 参数 | | 数值 | 单位 |
|---|---|---|---|---|
| $V_{PP}/I_{PP}$ | 峰值脉冲电压/电流（注1） | 10/700μs | 600 | V |
| | | 5/310μs | 15 | A |
| $I_{TSM}$ | 非重复性浪涌峰值电流（F=60Hz） | $t_p$=500ms | 6.5 | A |
| | | t=1s | 4.6 | |
| $I_{GSM}$ | 最大门极电流（半正弦波 tp=10ms) | | 2 | A |
| $V_{MLG}$ | 线——地间最大电压 | | -170 | V |
| $V_{MGL}$ | 门极——线间最大电压 | | -167 | V |
| $T_{stg}$ | 存储温度范围 | | -55~150 | ℃ |
| $T_j$ | 最高温度 | | 150 | ℃ |
| $T_L$ | 10 秒内可承受的最高焊锡温度 | | 260 | ℃ |

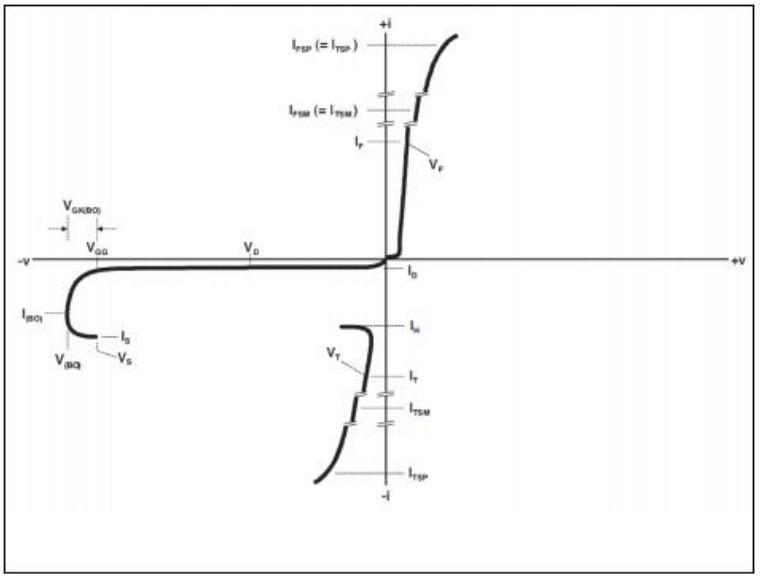
注 1：脉冲波形：

5/310μs $t_r$=5μs $t_p$=310μs　　100%$I_{PP}$




● 伏安特性曲线（$T_a$ = 25℃）

| 符号 | 参数 |
|---|---|
| $I_{GT}$ | 门极触发电流 |
| $I_H$ | 维持电流 |
| $I_{RM}$ | 线-地间反向漏电流 |
| $I_{RG}$ | 门极-线间反向漏电流 |
| $V_{RM}$ | 线-地间反向电压 |
| $V_F$ | 线-地间正向电压 |
| $V_{GT}$ | 门极触发电压 |
| $V_{FP}$ | 线-地间正向峰值电压 |
| $V_{DGL}$ | 门极-线间动态开关电压 |
| $V_{GATE}$ | 门极-地间电压 |
| $V_{LG}$ | 线-地间电压 |
| C | 线-地间断态电容 |
| $I_H$ | 维持电流 |



## ■ 电参数 除非另有规定， Ta= 25℃

● 线地间二极管相关参数

| 符 号 | 测 试 条 件 | 最大值 | 单 位 |
|---|---|---|---|
| $V_F$ | $I_F$=5A， $t_P$=500μs | 3 | V |
| $V_{FP}$ | 10/700μs 1.5kV $R_P$=10Ω (见注释 1) | 5 | V |

注释 1：$V_{FP}$ 见测试电路 2，$R_P$ 是装在线卡上的保护电阻

● 保护晶闸管相关参数(Ta=25℃)

| 符 号 | 测 试 条 件 | 最小值 | 最大值 | 单 位 |
|---|---|---|---|---|
| $I_{GT}$ | $V_{GND}/L_{INE}$=-100V | 0.1 | 9 | mA |
| $I_H$ | $V_{GATE}$=-100V | 150 | | mA |
| $V_{GT}$ | 同 $I_{GT}$ | | 2.5 | V |
| $I_{RG}$ | $T_C$=25℃ $V_{RG}$=-170V | | 5 | μA |
| | $T_C$=70℃ $V_{RG}$=-170V | | 50 | |
| $V_{DGL}$ | $V_{GATE}$=-100V（见注释 3）10/700μs 1.5kV $R_P$=10Ω | | 10 | V |

注释 2：见测试电路 2 功能维持电流($I_H$)；
注释 3：见测试电路 1 关于 $V_{DGL}$，波动时间小于 50ns 不作记录。

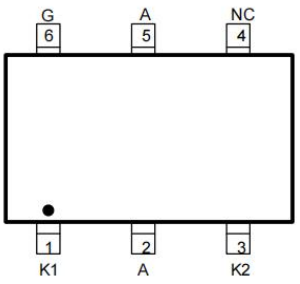
● 保护晶闸管和二极管相关参数

| 符 号 | 测 试 条 件 | 最大值 | 单 位 |
|---|---|---|---|
| $I_{RM}$ | $T_C$=25℃ $V_{GATE/LINE}$=-1V $V_{RM}$=-75 | 5 | μA |
| | $T_C$=70℃ $V_{GATE/LINE}$=-1V $V_{RM}$= -75 | 50 | μA |
| C | $V_R$=-3V F=150KHz | 110 | pF |
| | $V_R$=-48V F=150KHz | 50 | pF |

● 应用注意

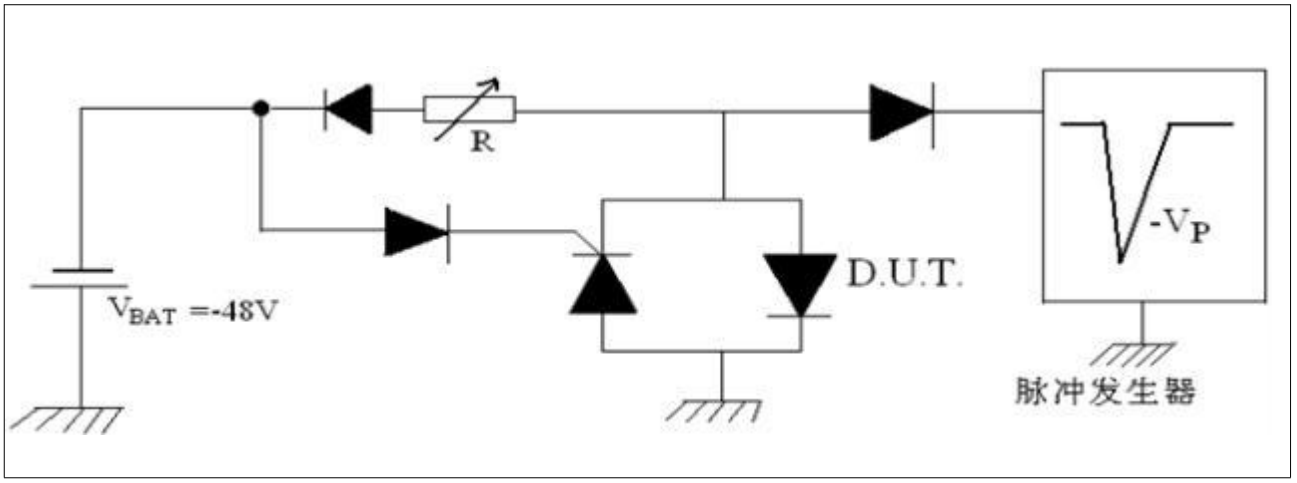
为了更好地发挥“四点”结构的优势， TIP 和 RING 横向穿过器件，这样器件将消除线寄生感应的过压，特别是高速短瞬态。

| Pin # | Pin Name | Description |
|---|---|---|
| 1, 3 | K1, K2 | Connect to subscribe (Tip/Ring) |
| 2, 5 | A | Connect ground |
| 4 | NC | Not connected |
| 6 | G | Connect to battery(Reference Voltage) |



## ■ 测试方法及电路

● 维持电流测试电路(测试电路 1)

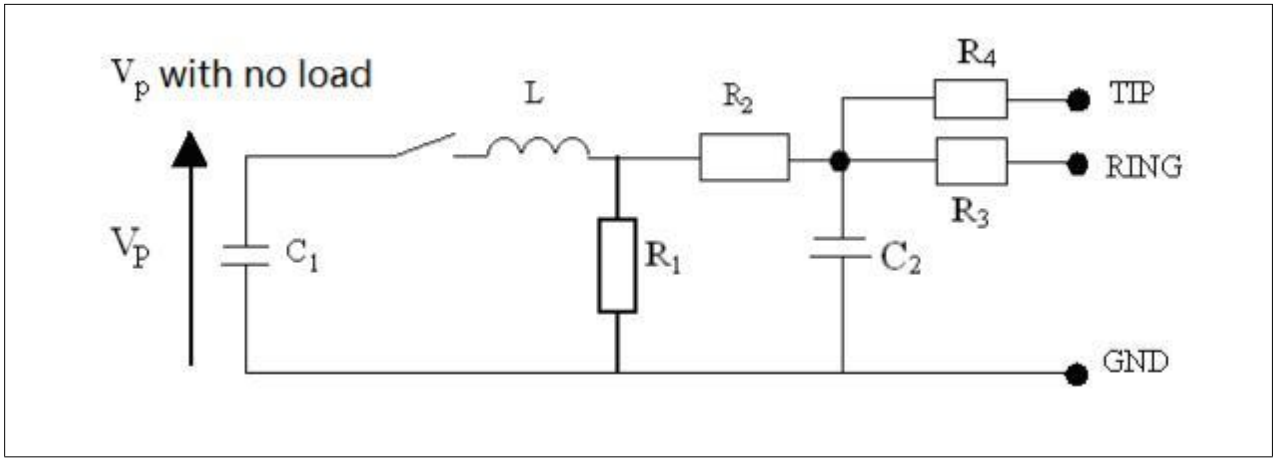



这是一个“导通-截止”测试，该测试电路可以确定维持电流的大小。

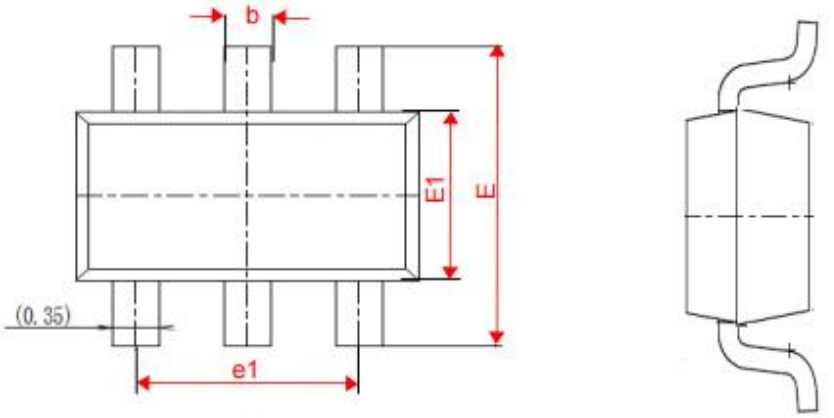
测试方法：

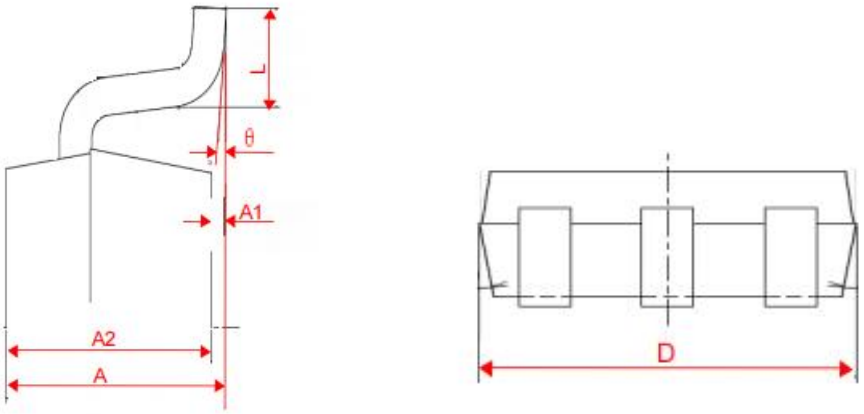
① 短路 DUT，调节电流在 $I_H$ 值范围；
② 用 $I_{PP}$=10A，10/1000μs 的浪涌电流触发 DUT；
③ DUT 最多在 50ms 内必须返回到断态。

● $V_{FP}$ 和 $V_{DGL}$ 参数测试电路 2



# 封装尺寸



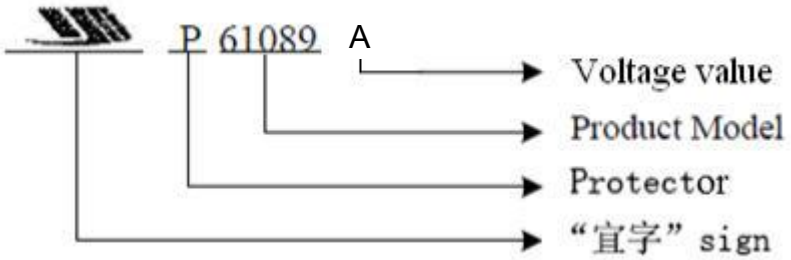




| 名称 | 尺寸 | |
|---|---|---|
| | Min | Max |
| A | 1.05 | 1.25 |
| A1 | 0.03 | 0.13 |
| A2 | 1.05 | 1.15 |
| b | 0.3 | 0.5 |
| D | 2.82 | 3.02 |
| E | 2.8 | 3.0 |
| E1 | 1.5 | 1.7 |
| e1 | 1.8 | 2.0 |
| L | 0.3 | 0.6 |
| θ | 0° | 8° |

# 外观标识

## ■ 打印标示

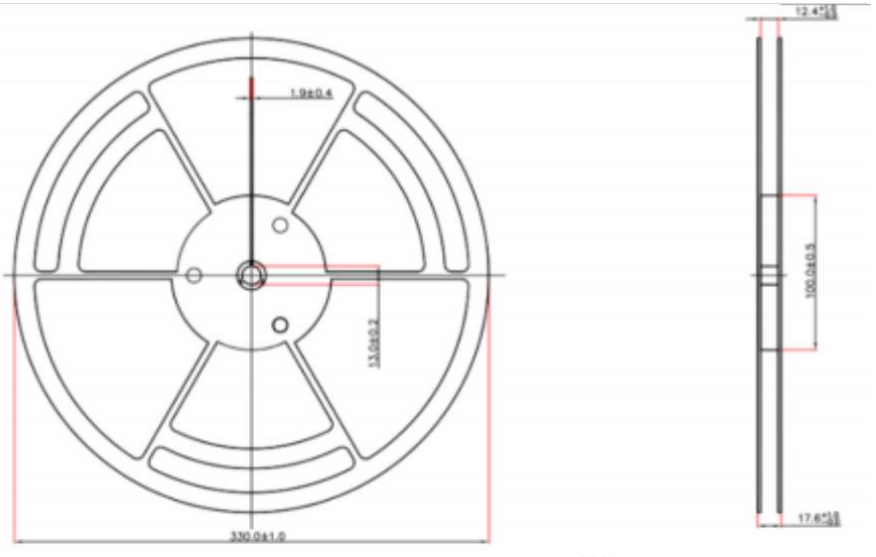

## ■ 命名规则



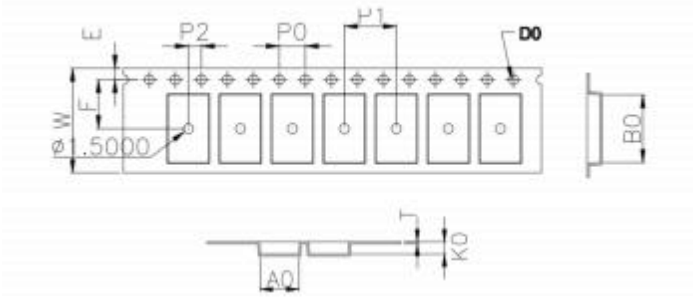

**XXYY:**XX表示年份， YY表示星期。

## ■ 包装

| | SOT-23系列 |
|---|---|
| A0 | 3.25±0.1 |
| B0 | 3.17±0.1 |
| K0 | 1.38±0.1 |
| P0 | 4.0±0.1 |
| P1 | 4.0±0.1 |
| P2 | 2.0±0.1 |
| W | 8.0±0.1 |
| E | 1.75±0.1 |
| F | 3.5±0.1 |
| D0 | 1.5-0 +0.1 |
| D1 | 1.5-0 +0.1 |
| T | |
| 长度 | 1012m |

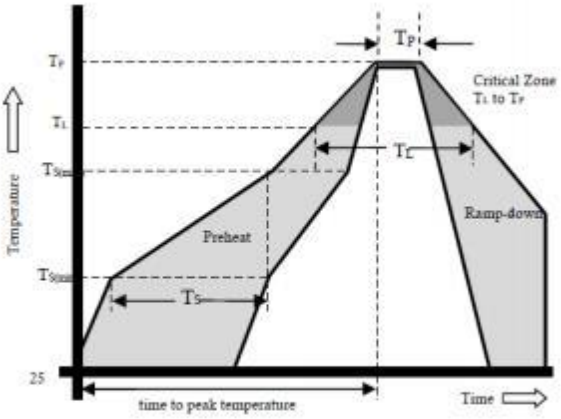


| Package Type | Quantity |
|---|---|
| SOT-23-6 | 3000 |



## ■ 回流焊曲线

| Reflow Condition | | Pb-Free Assembly |
|---|---|---|
| Pre Heat | Temperature Min. | +150°C |
| | Temperature Max. | +200°C |
| | Time(Min to Max) | 60 – 180 seconds |
| Average ramp up rate (Liquidus Temp ($T_L$) to peak) | | 3°C/second max |
| $T_{S(max)}$ to $T_L$ - Ramp-up Rate | | 3°C/second max |
| Reflow | - Temperature ($T_L$) (Liquidus) | 217°C |
| | - Temperature ($T_L$) | 60 – 150 seconds |
| Peak Temp ($T_P$) | | 260+0/-5 °C |
| Time within 5°C of actual Peak Temp ($T_P$) | | 8-15 seconds |
| Ramp-down Rate | | 6°C/s max |
| Time 25°C to peak Temp ($T_P$) | | 8 min max. |
| Do not exceed | | 260°C |



# P61089 A

**Dual Programmable Thyristor Transient Voltage Suppressor**

版本号
201603-A

## Description

This device has been especially designed to protect 2 new high voltage,as well as classical SLICs,against transient overvoltages.Positive overvoltages are clamped by 2 diodes.Negative surges are suppressed by 2 thyristors,their breakdown voltage being referenced to –VBAT through the gate.This component presents a very low gate triggering current in order to reduce the current consumption on printed circuit board the firing phase.This devices are not subject to aging and provide a fail safe mode in short circuit for a better protection.Pic 1 and pic 2 are the device symbol
and the package.

## Features and Benefits

- Dual Voltage-Tracking Protectors ；
- wide negative pressure range： $V_{MGL}$=- 167$V_{MAX}$
- low dynamic switching voltage： $V_{FP}$ and $V_{DGL}$
- low gate triggering current： $I_{GT}$=9m$A_{Max}$
- Peak Pulse Current：$I_{PP}$=15A（10/700μs）
- high Holding current： $I_H$≥150mA
- RoHS compliant
- Moisture sensitivity levels Classifications MSL3

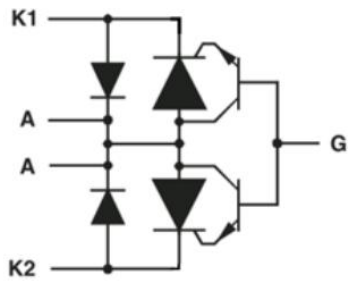
## Application field

P61089 A are designed to protect communication equipment such as SPC exchanger from damaging overvoltage transients in the second level。

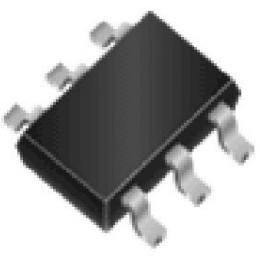
## Characteristic parameters

| symbol | Rated value | unit |
|---|---|---|
| $V_{MGL}$ | - 167 | V |
| $I_{PP}$(10/700μs) | 15 | A |
| $I_H$ | 150 | mA |

**Package： SOT-23-6**




Pic. 1 Device equivalent structure




Pic.2 Device type SOT-23-6

# Electrical Parameters

## ■ Standard

| type | Wave shape | | ITSP |
|---|---|---|---|
| ITU-T K.20/21and K.45 | voltage | 10/700μs | 15A |
| | current | 5/310μs | |

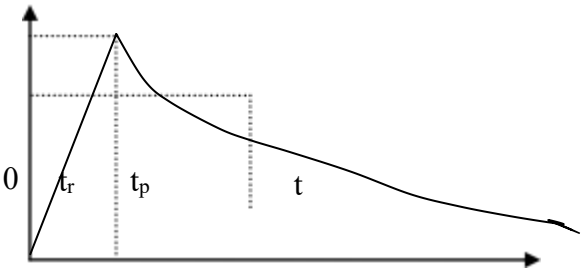
## ■ Electrical characteristics

● Absolute maximum ratings $T_a$ = 25℃ unless otherwise noted

| symbol | parameters | | value | unit |
|---|---|---|---|---|
| VPP/IPP | Peak pulse voltage/vurrent | 10/700uS | 600 | V |
| | | 5/320uS | 15 | A |
| ITSM | Non repetitive peak pulse current (F=60HZ) | tp=500ms | 6.5 | A |
| | | t=1s | 4.6 | |
| IGSM | Maximum gate current（half sinusoidtp=10ms) | | 2 | A |
| VMLG | Line——ground maximum voltae | | -170 | V |
| VMGL | Gate——line maximum voltage | | -167 | V |
| TSTG | Storage Temperature Range | | -55 — 150 | ℃ |
| TJ | maximum temperature | | 150 | ℃ |
| TA | Operating free-air temperature range | | -40 — 85 | ℃ |
| TL | maximum sustainable temperature of solder in 10 seconds | | 260 | ℃ |

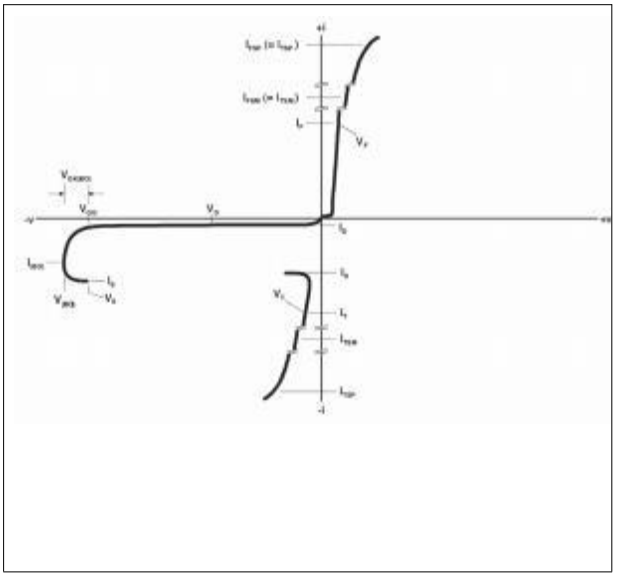
tip. 1： pulse form：

5/310μs $t_r$=5μs $t_P$=310μs 100%$I_{PP}$




● V-I characteristic curve （$T_a$ = 25℃）

| symbol | parameters |
|---|---|
| $I_{GT}$ | Gate trigger current |
| $I_H$ | Holding current |
| $I_{RM}$ | Line-ground reverse leakage current |
| $I_{RG}$ | Gate-line reverse leakage current |
| $V_{RM}$ | Line-ground reverse voltage |
| $V_F$ | Line-ground voltage |
| $V_{GT}$ | gate trigger voltage |
| $V_{FP}$ | Line-ground peak voltage |
| $V_{DGL}$ | Gate-line dynamic switching voltage |
| $V_{GATE}$ | Gate-ground voltage |
| $V_{LG}$ | Line-ground voltage |
| C | Line-ground off state capacitance |



## Electrical Parameters

Absolute maximum ratings $T_a$ = 25℃ unless otherwise noted

### ● Line-ground diode parameters

| symbol | Test conditions | Max. | unit |
|---|---|---|---|
| $V_F$ | $I_F$=5A， $t_P$=500μs | 3 | V |
| $V_{FP}$ | 10/700μs 1.5kV $R_P$=10Ω (tip. 1) | 5 | V |

tip. 1： $V_{FP}$ refers to test circuit 2， $R_P$ is the protective resistance mounted on the card

### ● thyristor parameters （Ta=25℃)

| symbol | Test conditions | Min. | Max. | unit |
|---|---|---|---|---|
| $I_{GT}$ | $V_{GND}/L_{INE}$=- 100V | 0.1 | 9 | mA |
| $I_H$ | $V_{GATE}$=- 100V | 150 | | mA |
| $V_{GT}$ | Same to $I_{GT}$ | | 2.5 | V |
| $I_{RG}$ | $T_C$=25℃ $V_{RG}$=- 170V | | 5 | μA |
| | $T_C$=70℃ $V_{RG}$=- 170V | | 50 | |
| $V_{DGL}$ | $V_{GATE}$=- 100V（TIP.3）10/700μs 1.5kV $R_P$=10Ω | | 10 | V |

Tip.2： see holding current （$I_H$） at test circuit 2；

Tip.3： see $V_{DGL}$ at test circuit 1， Don't make records if fluctuation time is less than 50ns。

● thyristor and diode parameters

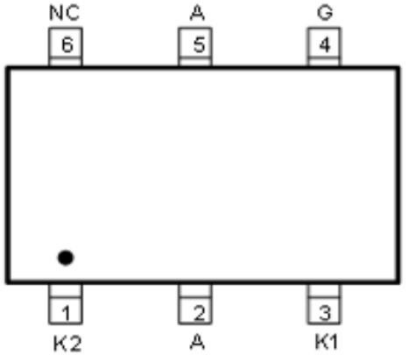
| Symbol | Test conditions | Max. | unit |
|---|---|---|---|
| $I_{RM}$ | $T_C$=25℃ VGATE/LINE=- 1V $V_{RM}$=- 167 | 5 | μA |
| | $T_C$=70℃ VGATE/LINE=- 1V $V_{RM}$= - 167 | 50 | μA |
| C | $V_R$=-3V F=150KHz | 110 | pF |
| | $V_R$=-48V F=150KHz | 50 | pF |

### ● Attention

For eliminate the overvoltage from the line Parasitic induction,especially at the high speed and short moment signal, we make

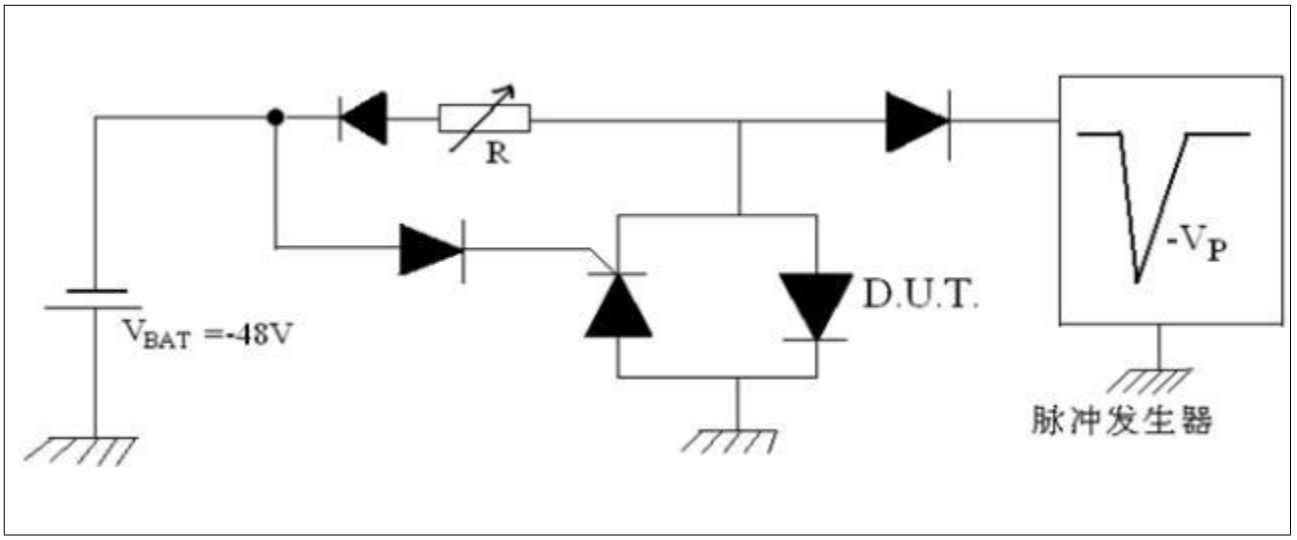
TIP and RING across the device.

| Pin # | Pin Name | Description |
|---|---|---|
| 1, 3 | K1，K2 | Connect to subscribe (Tip/Ring) |
| 4 | G | Connect to battery(Reference Voltage) |
| 2, 5 | A | Connect ground |
| 6 | NC | Not connected |




## ■Test method and circuit

● Holding current test circuit （test circuit1）




This is a “Conducting-cutoff”test.The test circuit can ascertain the size of holding current。

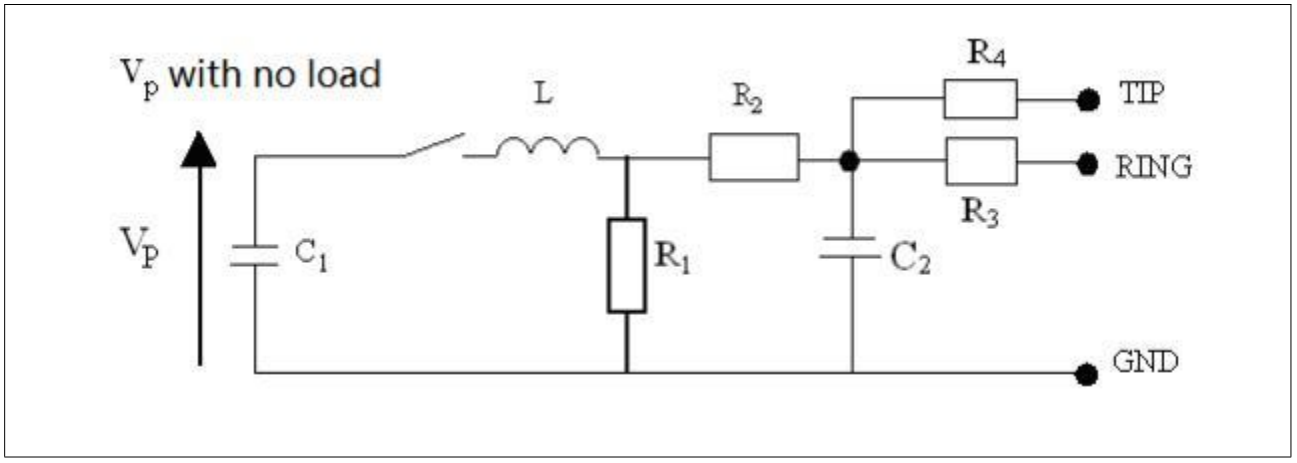
Test method：

① short out DUT， regulating current in $I_H$ range；

②let $I_{PP}$=10A， 10/1000μs surge current triggers DUT；

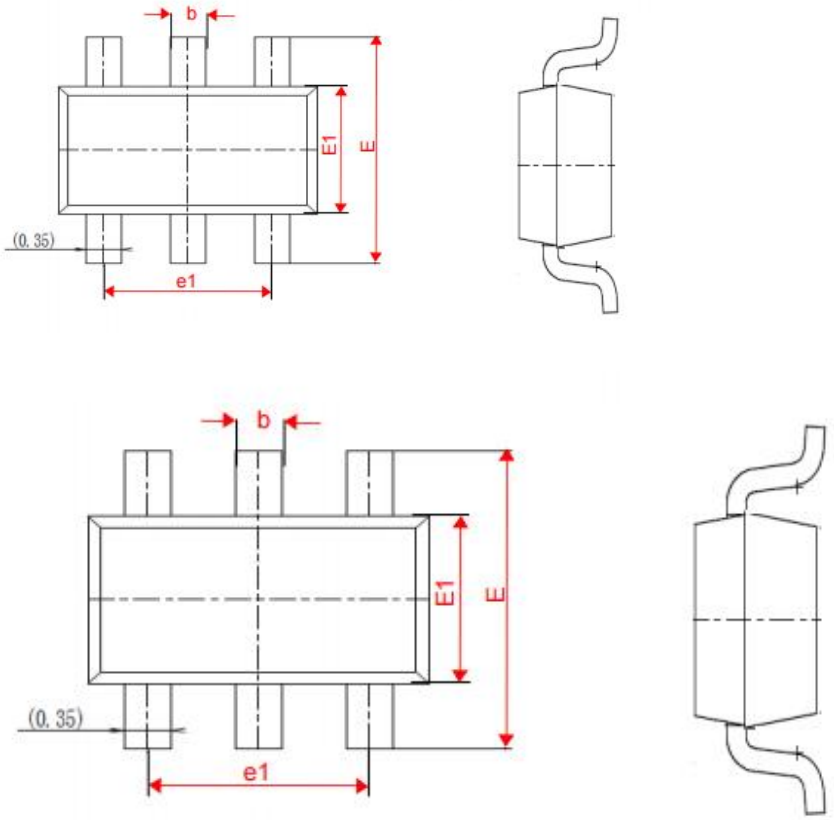
③ DUT must return to the off-state in 50ms.and

● $V_{FP}$ and $V_{DGL}$ test circuit2



## Package size

### ■ Appearance size SOT-23-6

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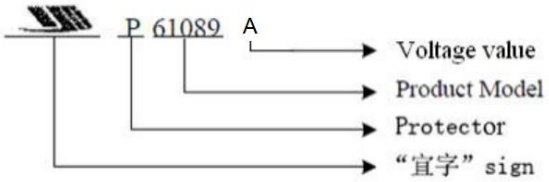
| 名称 | 尺寸 | |
|---|---|---|
| | Min | Max |
| A | 1.05 | 1.25 |
| A1 | 0.03 | 0.13 |
| A2 | 1.05 | 1.15 |
| b | 0.3 | 0.5 |
| D | 2.82 | 3.02 |
| E | 2.8 | 3.0 |
| E1 | 1.5 | 1.7 |
| e1 | 1.8 | 2.0 |
| L | 0.3 | 0.6 |
| θ | 0° | 8° |

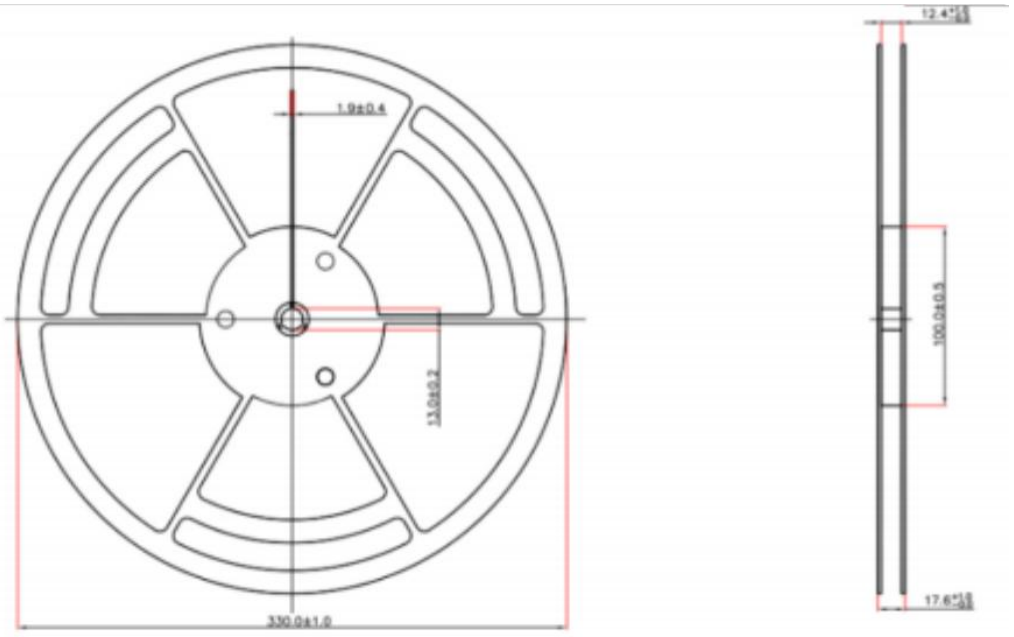
## Marking


## Naming Rule

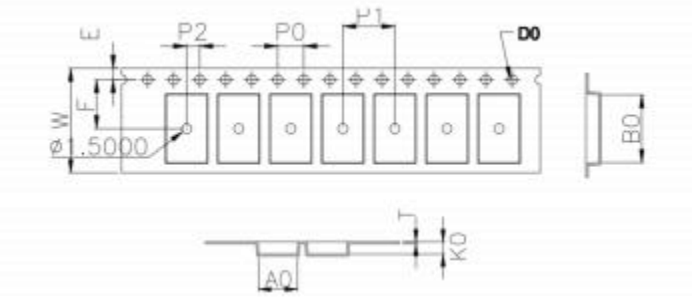



**XXYY:**XX表示年份， YY表示星期。

| | SOT-23系列 |
|---|---|
| A0 | 3.25±0.1 |
| B0 | 3.17±0.1 |
| K0 | 1.38±0.1 |
| P0 | 4.0±0.1 |
| P1 | 4.0±0.1 |
| P2 | 2.0±0.1 |
| W | 8.0±0.1 |
| E | 1.75±0.1 |
| F | 3.5±0.1 |
| D0 | $1.5_{-0}^{+0.1}$ |
| D1 | $1.5_{-0}^{+0.1}$ |
| T | |
| 长度 | 1012m |



| Package Type | Quantity |
|---|---|
| SOT-23-6 | 3000 |



## ■ Reflow Profile

| Reflow Condition | | Pb-Free Assembly |
|---|---|---|
| Pre Heat | Temperature Min. | +150°C |
| | Temperature Max. | +200°C |
| | Time(Min to Max) | 60 – 180 seconds |
| Average ramp up rate (Liquidus Temp ($T_L$) to peak) | | 3°C/second max |
| $T_{S(max)}$ to $T_L$ - Ramp-up Rate | | 3°C/second max |
| Reflow | - Temperature ($T_L$) (Liquidus) | 217°C |
| | - Temperature ($T_L$) | 60 – 150 seconds |
| Peak Temp ($T_P$) | | 260+0/-5 °C |
| Time within 5°C of actual Peak Temp ($T_P$) | | 8-15 seconds |
| Ramp-down Rate | | 6°C/s max |
| Time 25°C to peak Temp ($T_P$) | | 8 min max. |
| Do not exceed | | 260°C |