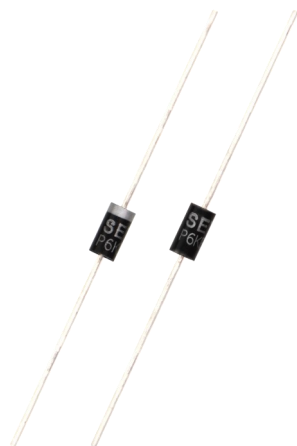


瞬态抑制二极管 TVS Diodes

Transient Voltage Suppression Diodes

P6KE Series



描述 Description

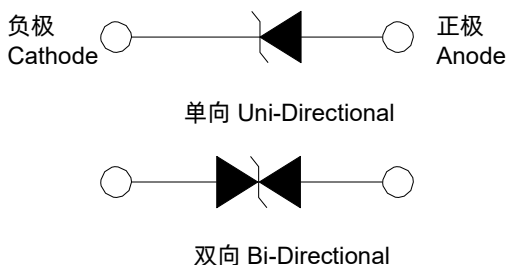
P6KE系列是专为保护敏感电子设备免受雷电和其他瞬变电压事件引起的电压瞬变。

The P6KE Series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

应用 Applications

- | | |
|---------|------------------------------|
| ● 通信设备 | Communication Equipment |
| ● 安防 | Security & Protection |
| ● 工控设备 | Industrial Control Equipment |
| ● 电源 | Power Supply |
| ● 汽车电子 | Automotive Electronics |
| ● 新能源设备 | New Energy |
| ● 防雷保护 | Lightning Protection |

功能图 Functional Diagram



特性 Features

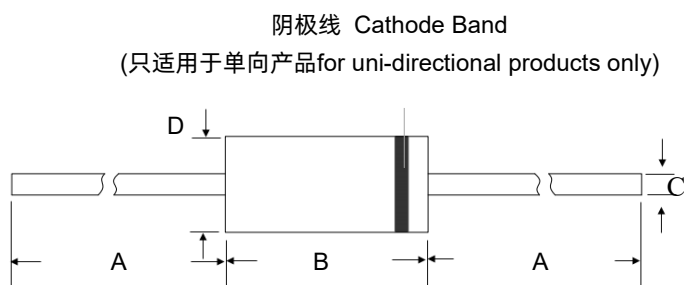
- 重复率0.01% 的10/1000 μ S 波形对应峰值脉冲功率600 W
- DO-15 封装内置玻璃钝化保护或平面芯片(< 10 V)
- 快速响应时间：从0 V到击穿电压时间小于1.0 PS
- 优异的箝位性能
- 典型的故障模式为电压或电流超过额定而导致的短路
- 锡须测试依据JEDEC JESD201A表4a和4c进行
- IEC 61000-4-2 ESD 30 kV (空气), 30 kV (接触)
- 数据线EFT保护符合IEC 61000-4-4
- 低浪涌电阻
- 12.6 V以上电压规格对应漏电典型值低于1.0 μ A
- 回流焊高温保证:260 °C/30 s
- 温度系数典型值0.1%
- UL 认可的化合物符合可燃性等级 V-0
- 引脚镀雾锡
- 无卤素，符合RoHS要求
- 无铅E3：二级互连引线无铅，端子镀锡(Sn) (IPC/JEDEC J-STD-609A.01)
- 600 W peak pulse capability at 10/1000 μ S waveform, repetition rate (duty cycles):0.01%
- Glass passivated chip junction or Planar chip (< 10 V) in DO-15 Package
- Fast response time: typically less than 1.0 PS from 0 Volts to BV min
- Excellent clamping capability
- Typical failure mode is short from over-specified voltage or current
- Whisker test is conducted per Table 4a/4c of JEDEC JESD201A
- IEC 61000-4-2 ESD 30 kV (Air), 30 kV (Contact)
- EFT protection of data lines in accordance with IEC 61000 -4-4
- Low incremental surge resistance
- Typical $I_{R\leq 1 \mu A}$ for $V_{BR \min} > 12.6 V$
- Compatible with high temperature reflow soldering (260 °C/30 s)
- $V_{BR} @ T_J = V_{BR@25^\circ C} \times (1 + \alpha_T \times (T_J - 25))$
(α_T : Temperature Coefficient, typical value is 0.1%)
- UL Recognized compound meeting flammability rating V-0
- Matte tin lead-free plated
- Halogen free and RoHS compliant
- Pb-free E3 means 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/ JEDEC J-STD-609A.01)

瞬态抑制二极管 TVS Diodes

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封装尺寸 Package Outline Dimensions (DO-204AC/DO-15)



DO-204AC (DO-15)

符号 Symbol	公制(毫米) Millimeters		英制(英寸) Inches	
	Min.	Max.	Min.	Max.
A	25.40	-	1.000	-
B	5.80	7.60	0.230	0.300
C	0.71	0.86	0.028	0.034
D	2.60	3.60	0.104	0.140

额定参数与特性 Maximum Ratings and Characteristics

(除另有注释, 默认 $T_A=25^\circ\text{C}$ Ratings at 25°C ambient temperature unless otherwise specified.)

参数 Parameter	符号 Symbol	值 Value	单位 Unit
10/1000 uS脉冲波形下(图4), 峰值脉冲功率 ⁽¹⁾ (图2)-单芯片 Peak Pulse Power Dissipation(Fig.2) by 10/1000 uS Test Waveform(Fig.4) (Note 1) - Single Die Parts	P_{PPM}	600	W
10/1000 uS 脉冲波形下(图4), 峰值脉冲功率 ⁽¹⁾ (图2)-叠层芯片 ⁽⁴⁾ Peak Pulse Power Dissipation(Fig.2) by 10/1000 uS Test Waveform(Fig.4) (Note 1) - Stacked Die Parts (Note 4)	P_{PPM}	800	W
峰值功耗, 无限散热, $T_L=75^\circ\text{C}$ Steady State Power Dissipation on Infinite Heat Sink at $T_L=75^\circ\text{C}$	P_D	5.0	W
正向脉冲电流峰值 ⁽²⁾ , 额定负载叠加8.3 ms 单半正弦波测得(JEDEC方法) Peak Forward Surge Current, 8.3 ms Single Half Sine Wave Unidirectional Only (Note 2)	I_{FSM}	100	A
正向瞬态电压峰值 ⁽³⁾ , 单向50 A Maximum Instantaneous Forward Voltage at 50 A for Unidirectional Only (Note 3)	V_F	3.5/5.0	V
工作和存储温度范围 Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 175	$^\circ\text{C}$
典型热阻(结至引线) Typical Thermal Resistance Junction to Lead	$R_{\theta JL}$	20	$^\circ\text{C/W}$
典型热阻(结至环境) Typical Thermal Resistance Junction to Ambient	$R_{\theta JA}$	75	$^\circ\text{C/W}$

注释 Notes

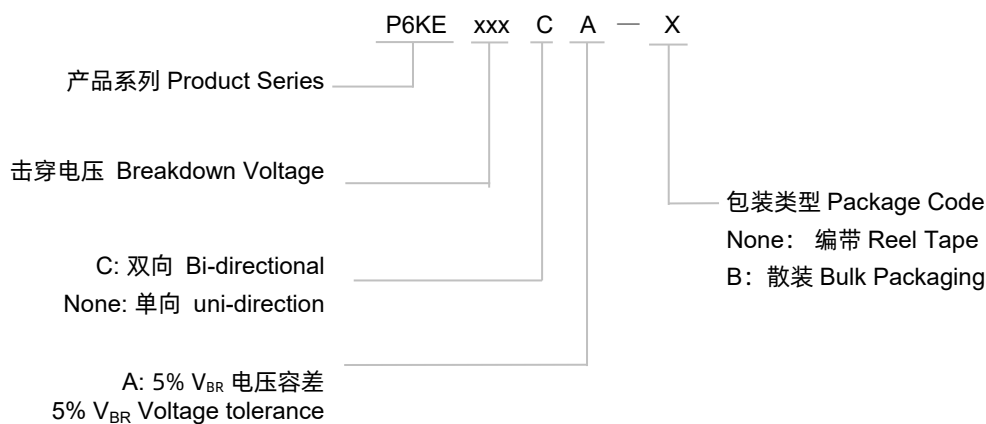
- 参照图4非重复性脉冲电流波形, 初始结温 25°C 以图3所示曲线降额(环境温度 $T_A=25^\circ\text{C}$)。
Non-repetitive current pulse, per Fig. 4 and derated above $T_J(\text{initial})=25^\circ\text{C}$ per Fig. 3.
- 叠加波形为8.3 ms 单半周期正弦波或等幅方波, 最长周期4次/min。
Measured of 8.3 ms single half sine-wave or equivalent square wave, duty cycle=4 pulses per minute maximum.
- 单芯片 $V_F < 3.5\text{ V}$, 叠层芯片 $V_F < 5.0\text{ V}$ 。
 $V_F < 3.5\text{ V}$ for single die parts and $V_F < 5.0\text{ V}$ for stacked-die parts.
- 叠层芯片元件的详细信息, 请参阅电气特性中标有*的规格编号。
For stacked die component details, please refer to models marked with * in electrical characteristics table.

瞬态抑制二极管 TVS Diodes

Transient Voltage Suppression Diodes

P6KE Series

型号规则 Part Numbering System



标记 Marking



瞬态抑制二极管 TVS Diodes

Transient Voltage Suppression Diodes

P6KE Series

术语 Glossary

项目 Item	描述 Description
V_C	箝位电压 Clamping Voltage TVS在低差阻区域内的电压，用于限制设备两端的电压。 Voltage across TVS in a region of low differential resistance that serves to limit the voltage across the device terminals.
V_R	反向关断电压 Reverse Stand-off Voltage TVS 在没有导通状态下最高电压。 Maximum voltage that can be applied to the TVS without operation. 注：也用 V_{WM} （最高直流工作电压）表示，也称为截止电压(V_{so})。 NOTE : It is also shown as V_{WM} (maximum working voltage (maximum d.c. voltage)) and known as rated stand-off voltage (V_{so}).
I_R	反向漏电流 Reverse Leakage Current 量测 V_R 的电流。 Current measured at V_R . 注：也用 I_D 待机电流表示。 NOTE : Also shown as I_D for stand-by current.
V_{BR}	击穿电压 Breakdown Voltage 在击穿区以指定电流 I_T (测试电流)通过TVS的电压。 Voltage across TVS at a specified current I_T (test current) in the breakdown region.
I_{PPM}	额定随机重复峰值脉冲电流 Rated Random Recurring Peak Impulse Current 施加在设备上的随机重复峰值脉冲电流的最大额定值。 Maximum-rated value of random recurring peak impulse current that may be applied to a device.
$P_{M(AV)}$	额定平均功率 Rated Average Power Dissipation 所有电源(包括瞬态电流和待机电流)在短时间内平均产生的最大额定功耗。 Maximum-rated value of power dissipation resulting from all sources, including transients and standby current, averaged over a short period of time.
P_{PPM}	额定随机重复峰值脉冲功率 Rated Random Recurring Peak Impulse Power Dissipation 额定随机重复峰值脉冲电流(I_{PPM}) 和规定的最大箝位电压(V_C)乘积的最大额定值。 Maximum-rated value of the product of rated random recurring peak impulse current (I_{PPM}) multiplies by specified maximum clamping voltage (V_C).
C_J	电容 Capacitance 在规定的频率和电压下所测量的TVS电容。 Capacitance across the TVS measured at a specified frequencyx and voltage.

—(GB-T 18802.321 / IEC 61643-321 / JESD210A)

瞬态抑制二极管 TVS Diodes

Transient Voltage Suppression Diodes

P6KE Series

项目 Item	描述 Description
V_{FS}	正向浪涌峰值电压 Peak Forward Surge Voltage 在指定的正向浪涌电流(I_{FS})和持续时间下, 通过TVS的峰值电压。 Peak voltage across TVS for a specified forward surge current (I_{FS}) and time duration. 注: 也用 V_F 表示。 NOTE : Also shown as V_F .
I_{FS}	正向浪涌电流 Forward Surge Current 在正向导通区域通过TVS的脉冲电流。 Pulsed current through TVS in the forward conducting region. 注: 也用 I_F 表示。 NOTE : Also shown as I_F .
$\alpha_{V(BR)}$	击穿电压温度系数 Temperature Coefficient of Breakdown Voltage 击穿电压的变化与温度变化的比值。 The change of breakdown voltage divided by the change of temperature.
I_{PP}	峰值脉冲电流 Peak pulse Current 施加在TVS上的峰值脉冲电流, 以确定箝位电压 V_C 的特定波形。 Peak pulse current value applied across the TVS to determine the clamping voltage V_C for a specified wave shape.
I_T	脉冲直流测试电流 Pulsed D.C. Test Current 测量击穿电压 V_{BR} 的测试电流。该电流值由制造商确定, 通常以脉冲持续时间小于40 ms的毫安级电流给出。 Test current for measurement of the breakdown voltage V_{BR} . This is defined by the manufacturer and usually given in milliamperes with a pulse duration of less than 40 ms. 注: 也用 I_{BR} 表示。 NOTE : Also shown as I_{BR} .

—(GB-T 18802.321 / IEC 61643-321 / JESD210A)

瞬态抑制二极管 TVS Diodes

Transient Voltage Suppression Diodes

P6KE Series

电气特性 (除另有注释, 默认 $T_A=25^{\circ}\text{C}$)

Electrical Characteristics ($T_A = 25^{\circ}\text{C}$ unless otherwise noted) Table 1

型号 Part Number		击穿电压 Breakdown Voltage $V_{BR}@I_T$		测试电流 Test Current I_T	反向关断 电压 Reverse Stand-off Voltage V_R	最大反向 漏电流 Max. Reverse Leakage $I_R@V_R$	最大峰值 脉冲电流 Max. Peak Pulse Current I_{PPM}	最大箝位 电压 Max. Clamping Voltage $V_C@I_{PPM}$
		Min	Max					
Uni	Bi	(V)		(mA)	(V)	(μA)	(A)	(V)
P6KE6.8A	P6KE6.8CA	6.45	7.14	10	5.80	1000	58.1	10.5
P6KE7.5A	P6KE7.5CA	7.13	7.88	10	6.40	500	54.0	11.3
P6KE8.2A	P6KE8.2CA	7.79	8.61	10	7.02	200	50.4	12.1
P6KE9.1A	P6KE9.1CA	8.65	9.55	1	7.78	50	45.5	13.4
P6KE10A	P6KE10CA	9.50	10.50	1	8.55	10	42.1	14.5
P6KE11A	P6KE11CA	10.50	11.60	1	9.40	5	39.1	15.6
P6KE12A	P6KE12CA	11.40	12.60	1	10.20	5	36.5	16.7
P6KE13A	P6KE13CA	12.40	13.70	1	11.10	1	33.5	18.2
P6KE15A	P6KE15CA	14.30	15.80	1	12.80	1	28.8	21.2
P6KE16A	P6KE16CA	15.20	16.80	1	13.60	1	27.1	22.5
P6KE18A	P6KE18CA	17.10	18.90	1	15.30	1	24.2	25.2
P6KE20A	P6KE20CA	19.00	21.00	1	17.10	1	22.0	27.7
P6KE22A	P6KE22CA	20.90	23.10	1	18.80	1	19.9	30.6
P6KE24A	P6KE24CA	22.80	25.20	1	20.50	1	18.4	33.2
P6KE27A	P6KE27CA	25.70	28.40	1	23.10	1	16.3	37.5
P6KE30A	P6KE30CA	28.50	31.50	1	25.60	1	14.7	41.4
P6KE33A	P6KE33CA	31.40	34.70	1	28.20	1	13.3	45.7
P6KE36A	P6KE36CA	34.20	37.80	1	30.80	1	12.2	49.9
P6KE39A	P6KE39CA	37.10	41.00	1	33.30	1	11.3	53.9
P6KE43A	P6KE43CA	40.90	45.20	1	36.80	1	10.3	59.3
P6KE47A	P6KE47CA	44.70	49.40	1	40.20	1	9.4	64.8
P6KE51A	P6KE51CA	48.50	53.60	1	43.60	1	8.7	70.1
P6KE56A	P6KE56CA	53.20	58.80	1	47.80	1	7.9	77.0
P6KE62A	P6KE62CA	58.90	65.10	1	53.00	1	7.2	85.0
P6KE68A	P6KE68CA	64.60	71.40	1	58.10	1	6.6	92.0
P6KE75A	P6KE75CA	71.30	78.80	1	64.10	1	5.9	103.0
P6KE82A	P6KE82CA	77.90	86.10	1	70.10	1	5.4	113.0
P6KE91A	P6KE91CA	86.50	95.50	1	77.80	1	4.9	125.0

瞬态抑制二极管 TVS Diodes

Transient Voltage Suppression Diodes

P6KE Series

型号 Part Number		击穿电压 Breakdown Voltage $V_{BR@I_T}$		测试电流 Test Current I_T	反向关断 电压 Reverse Stand-off Voltage V_R	最大反向 漏电流 Max. Reverse Leakage $I_R@V_R$	最大峰值 脉冲电流 Max. Peak Pulse Current I_{PPM}	最大箝位 电压 Max. Clamping Voltage $V_C@I_{PPM}$
		Min	Max					
Uni	Bi	(V)		(mA)	(V)	(μA)	(A)	(V)
P6KE100A	P6KE100CA	95.00	105.00	1	85.50	1	4.5	137.0
P6KE110A	P6KE110CA	105.00	116.00	1	94.00	1	4.0	152.0
P6KE120A	P6KE120CA	114.00	126.00	1	102.00	1	3.7	165.0
P6KE130A	P6KE130CA	124.00	137.00	1	111.00	1	3.4	179.0
P6KE150A	P6KE150CA	143.00	158.00	1	128.00	1	2.9	207.0
P6KE160A	P6KE160CA	152.00	168.00	1	136.00	1	2.8	219.0
P6KE170A	P6KE170CA	162.00	179.00	1	145.00	1	2.6	234.0
P6KE180A	P6KE180CA	171.00	189.00	1	154.00	1	2.5	246.0
P6KE200A	P6KE200CA	190.00	210.00	1	171.00	1	2.2	274.0
P6KE220A	P6KE220CA	209.00	231.00	1	185.00	1	1.9	328.0
P6KE250A	-	237.00	263.00	1	214.00	1	1.8	344.0
-	P6KE250CA*	237.00	263.00	1	214.00	1	2.4	344.0
P6KE300A	-	285.00	315.00	1	256.00	1	1.5	414.0
-	P6KE300CA*	285.00	315.00	1	256.00	1	2.0	414.0
P6KE350A*	P6KE350CA*	332.00	368.00	1	300.00	1	1.7	482.0
P6KE400A*	P6KE400CA*	380.00	420.00	1	342.00	1	1.5	548.0
P6KE440A*	P6KE440CA*	418.00	462.00	1	376.00	1	1.4	602.0
P6KE480A*	P6KE480CA*	456.00	504.00	1	408.00	1	1.3	658.0
P6KE510A*	P6KE510CA*	485.00	535.00	1	434.00	1	1.2	698.0
P6KE530A*	P6KE530CA*	503.50	556.50	1	451.00	1	1.2	725.0
P6KE540A*	P6KE540CA*	513.00	567.00	1	460.00	1	1.1	740.0
P6KE550A*	P6KE550CA*	522.50	577.50	1	468.00	1	1.1	760.0
P6KE600A*	P6KE600CA*	570.00	630.00	1	512.00	1	1.0	828.0

注释 Notes:

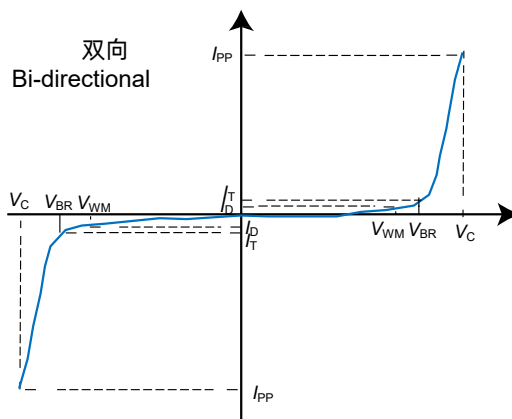
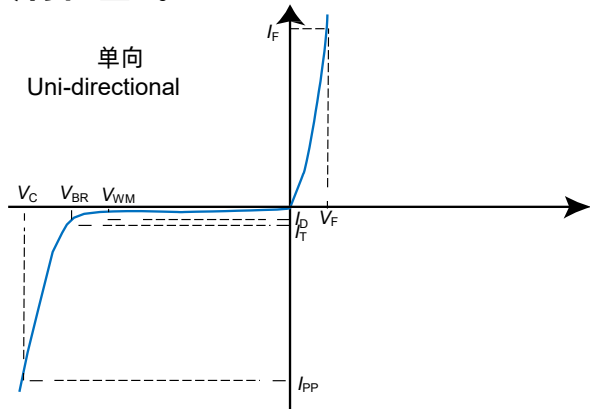
- 叠加波形为8.3 ms单个半周期正弦波或等幅方波，最长周期4次/min。
Measured of 8.3 ms single half sine-wave or equivalent square wave, duty cycle=4 pulses per minute maximum.
- $V_F < 3.5 V$ 为单芯片产品， $V_F < 5.0 V$ 为双芯片产品。
 $V_F < 3.5 V$ for single die parts and $V_F < 5.0 V$ for stacked-die parts.
- 双芯片产品的详细信息，请参阅电气特性中以*标示的部件编号。
For stacked die component details, please refer to models marked with * in electrical characteristics table.
- 对于 V_R 为10 V及更低的双向产品， I_R 值需乘以两倍。
For bidirectional type having V_R of 10 volts and less, the I_R should be doubled.

瞬态抑制二极管 TVS Diodes

Transient Voltage Suppression Diodes

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伏安特性曲线 I-V Curve Characteristics



参考性能曲线(除有另外注释, 默认 $T_A=25^\circ\text{C}$)

Performance Curve for Reference($T_A=25^\circ\text{C}$ unless otherwise noted)

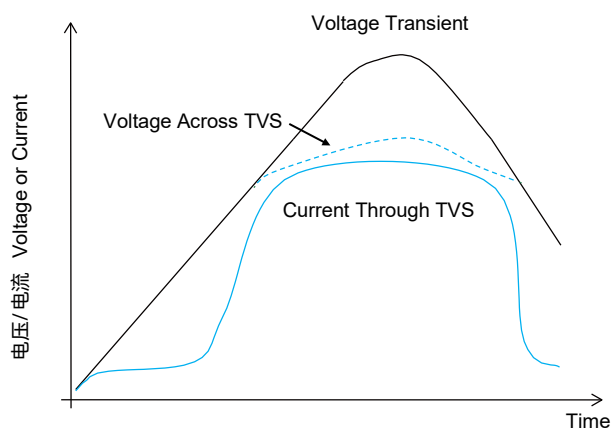


FIGURE 1 TVS瞬态钳位波形
TVS Transients Clamping Waveform

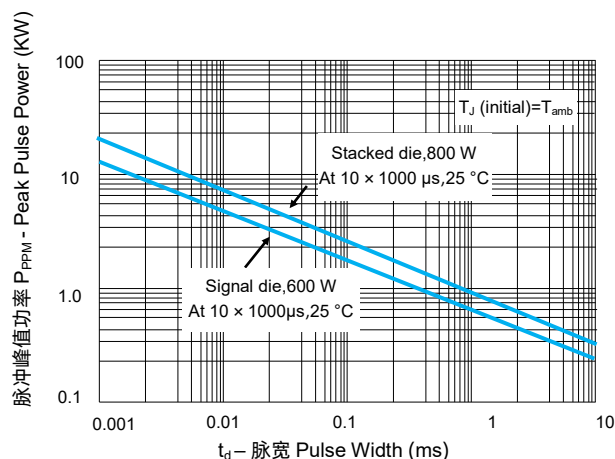


FIGURE 2 峰值脉冲功率额定曲线
Peak Pulse Power Rating Curve

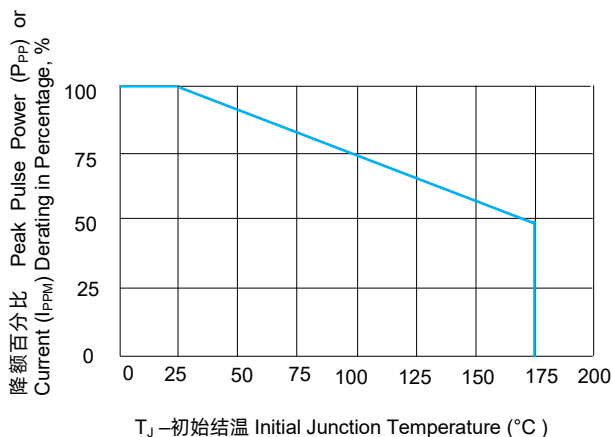


FIGURE 3 峰值脉冲功率降额曲线
Peak Pulse Power Derating Curve

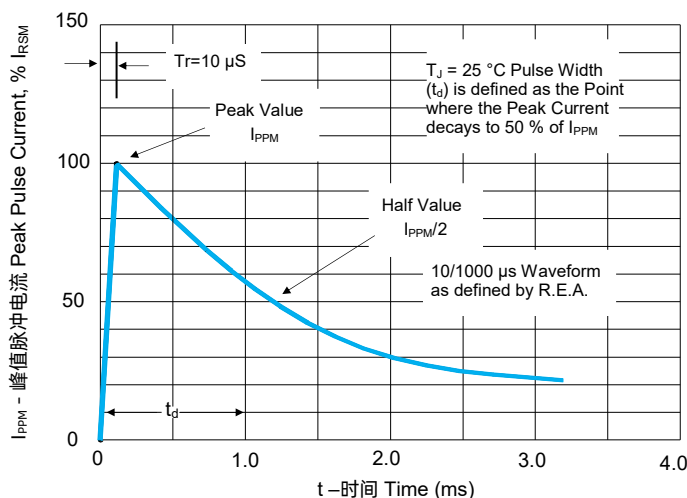


FIGURE 4 脉冲波形
Pulse Waveform

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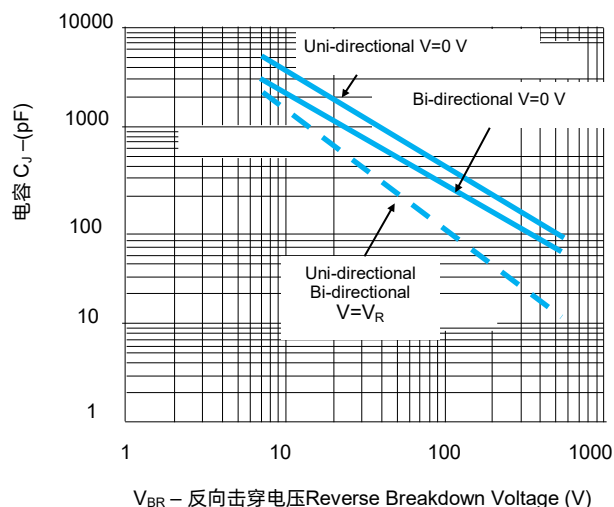


FIGURE 5 典型结电容 Typical Junction Capacitance

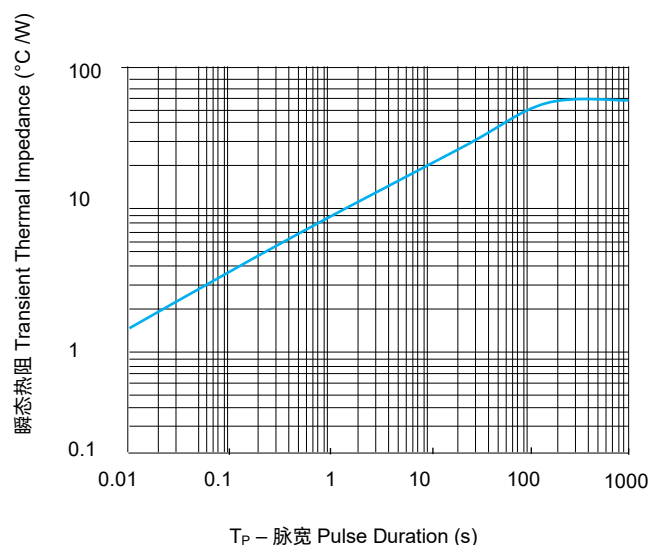


FIGURE 6 典型瞬态热阻 Typical Transient Thermal Impedance

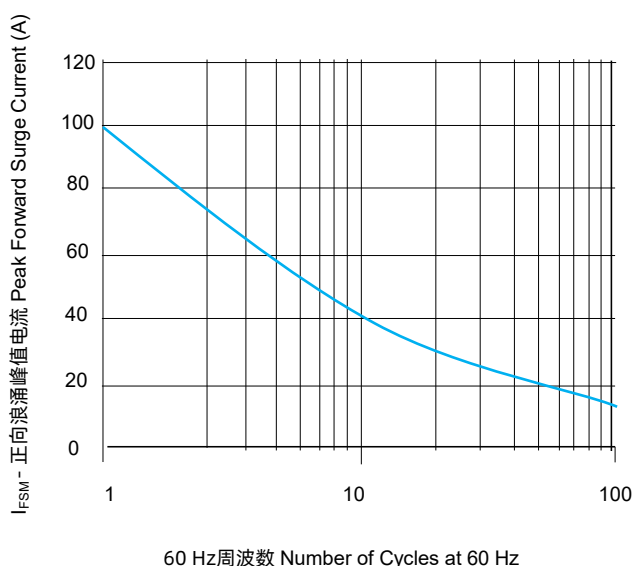


FIGURE 7 最大非重复正向浪涌电流(单向型)
Maximum Non-Repetitive Forward Surge Current
Uni-Directional only

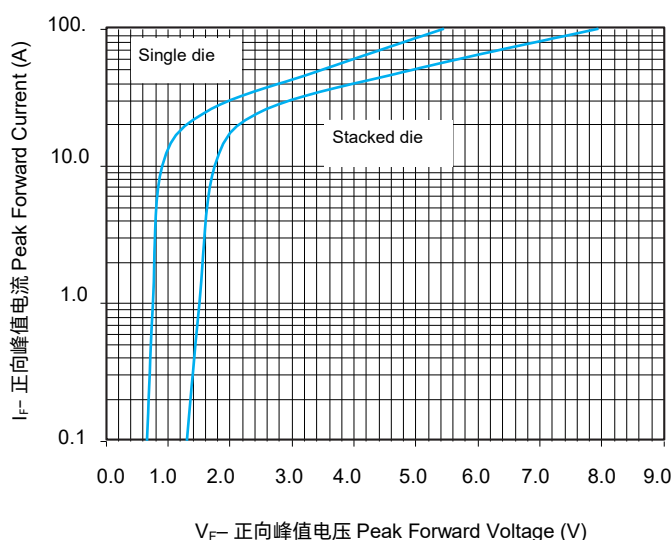


FIGURE 8 峰值正向电压及电流(典型值)
Peak Forward Drop vs Peak Forward Current (Typical
Values)

环境特性 Environmental Specifications

高温存储 High Temp. Storage	JESD22-A103
高温反偏 HTRB	JESD22-A108
温度循环 Temperature Cycling	JESD22-A104
高温高湿反偏 H3TRB	JESD22-A101
耐焊接热 RSH	JESD22-B106

物理特性 Physical Specifications

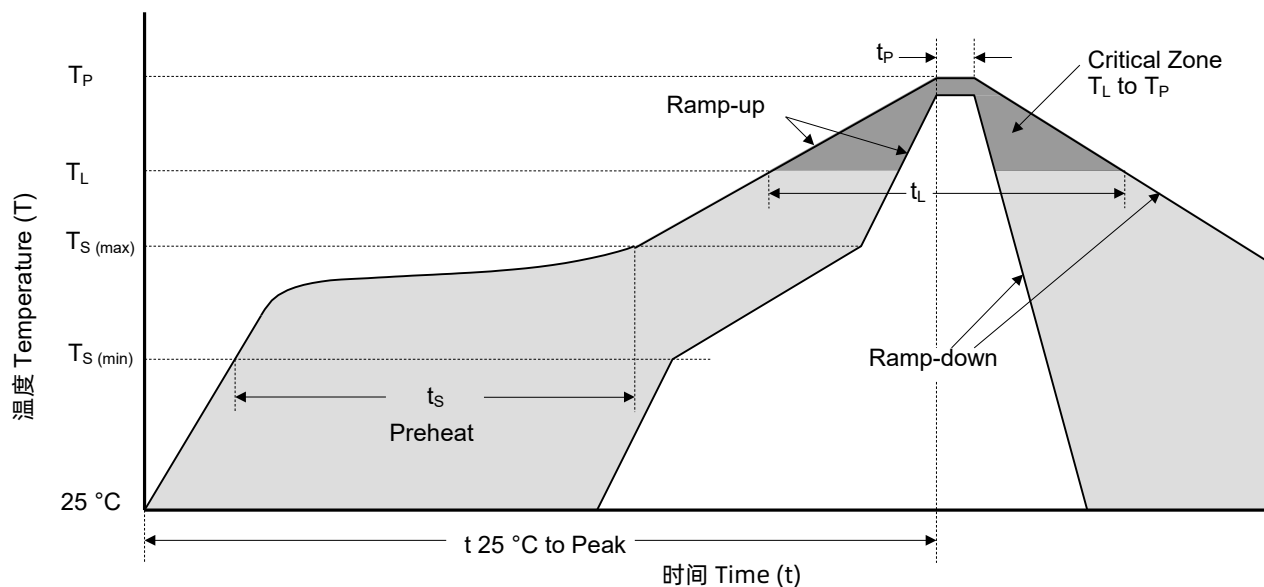
重量 Weight	0.015 oz., 0.4 g
封装 Case	JEDEC DO-204AC (DO-15) molded plastic body over passivated junction.
极性 Polarity	Color band denotes the cathode except Bipolar.
端子 Terminal	Matte Tin axial leads, solderable per JESD22-B102.

瞬态抑制二极管 TVS Diodes

Transient Voltage Suppression Diodes

P6KE Series

焊接参数 Soldering Parameters



回流焊接参数 Reflow Soldering Parameters		无铅组装 Lead-Free Assembly
预热 Pre-heat	最低温($T_{S(min)}$) Temperature Min ($T_{S(min)}$)	150 °C
	最高温($T_{S(max)}$) Temperature Max ($T_{S(max)}$)	200 °C
	升温时长(t_s) Time (min to max) (t_s)	60 ~ 120 seconds
平均升温速率(液相温度(T_L)至峰值温度(T_P)) Average Ramp-up Rate (Liquidus Temp (T_L) to Peak Temp (T_P))		3 °C / second max.
$T_{S(max)}$ 到 T_L 升温速率 $T_{S(max)}$ to T_L Ramp-up Rate		3 °C / second max.
回流 Reflow	温度 Temperature (T_L) (Liquidus)	217 °C
	时长 Time (min to max) (t_L)	60 ~ 150 seconds
峰值温度 Peak Temperature (T_P)		260 ^{+0/-5} °C
实际峰值温度 (t_P) 5 °C 以内的时间 Time of within 5 °C of Actual Peak Temperature (t_P)		20 ~ 40 seconds
降温速率 Ramp-down Rate		6 °C / second max.
25 °C 至峰值温度时长 Time from 25 °C to Peak Temperature		8 Minutes max.
极限温度 Do Not Exceed		260 °C

波峰焊(浸焊) Flow/Wave Soldering (Solder Dipping)

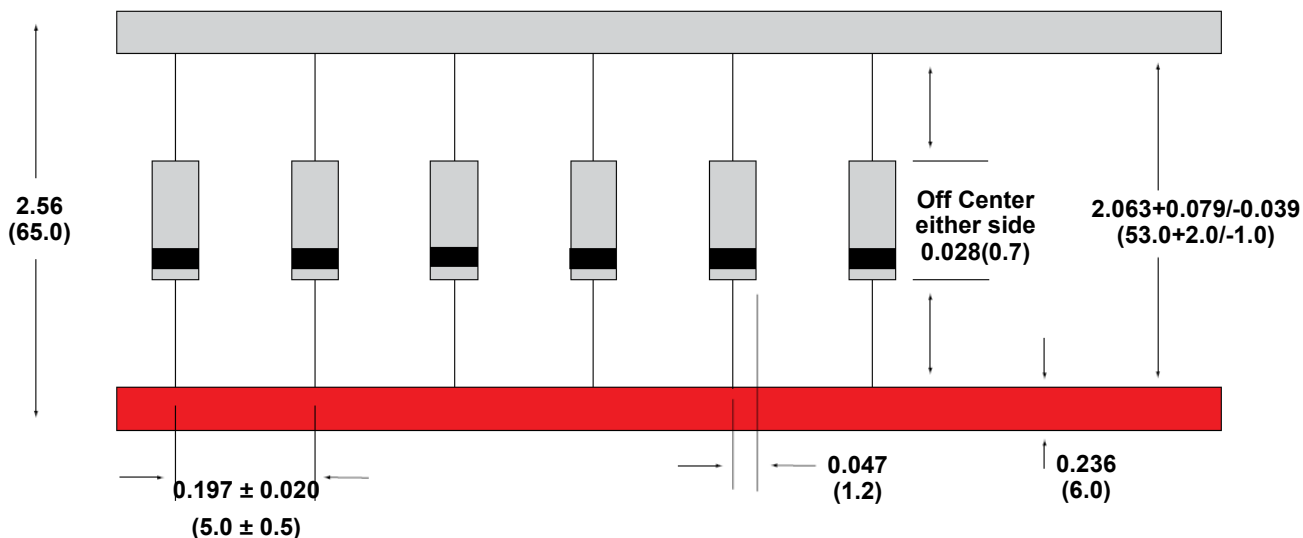
峰值温度 Peak Temperature	260 °C+0 /- 5 °C
浸焊时间 Dipping Time	10 seconds
焊接次数 Soldering Number	1 time

瞬态抑制二极管 TVS Diodes

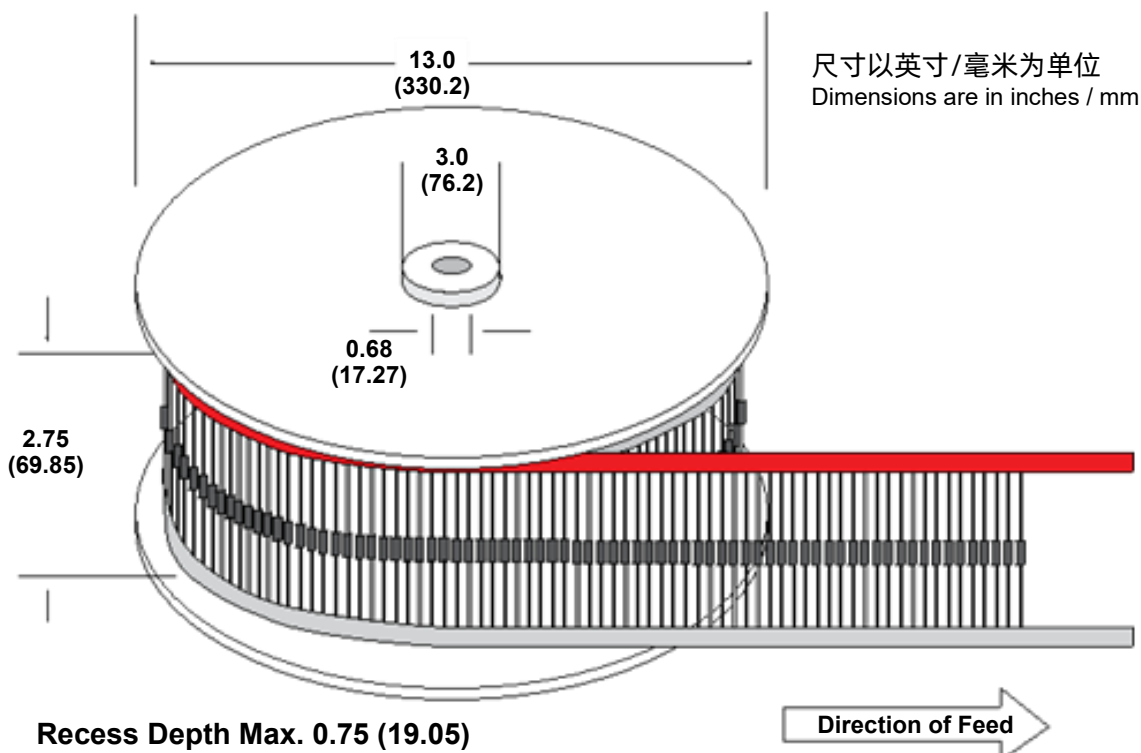
Transient Voltage Suppression Diodes

P6KE Series

包装信息 Packaging Information



包装信息 Packaging Information



型号 Part Number	封装 Package	数量 QTY's (Reel)	包装选项 Packaging Option	包装规格 Packaging Specification
P6KExxxXX	DO-204AC	4000 PCS	Tape & Reel	EIA STD RS-296
P6KExxxXX-TB	DO-204AC	3000 PCS	TB	/
P6KExxxXX-B	DO-204AC	1000 PCS	Bulk	SETsafe SETfuse Spec



注意

ATTENTION

使用方法 Usage

1. 请在规定的温度范围内使用TVS。
TVS must be operated in the specified ambient temp.
2. 请勿使用强极性溶剂清洗TVS以免破坏封装层。
Do not clean the TVS with strong polar solvent such as ketone, esters, benzene and halogenated hydrocarbon, to avoid damaging the encapsulating layer.
3. 请勿对TVS施加剧烈的振动，冲击或压力，以避免元件开裂。
Please do not apply severe vibration, shock or pressure to TVS, to avoid element cracking.

更换 Replacement

1. 若TVS出现可视化损伤，请将其更换。
If TVS is visually damaged, please replace it.
2. TVS为非修理型产品，安全起见，请更换同等规格的TVS。
TVS is a non-repairable product. For safety sake, please use equivalent TVS for replacement.

存储 Storage

1. 存储温度范围。
Storage Temp. Range: (-55 to 150) °C.
2. 请勿将TVS存放于高温高湿或腐蚀性气体环境中，已避免影响引脚的焊接性能，请于收货后一年内进行使用。
Do not store the TVS at the high temp., high humidity or corrosive gas environment, to avoid influencing the solder-ability of the lead wires. The product shall be used up within 1 year after receiving the goods.

瞬态抑制二极管 TVS Diodes

Transient Voltage Suppression Diodes

P6KE Series

环境条件 Environmental Conditions

1. 请勿暴露于室外阳光直射环境。
TVS should not be exposed to the open air, nor direct sunshine.
2. 请避免雨水，水汽等高温高湿环境。
TVS should avoid rain, water vapor or other condition of high temp. and high humidity.
3. 请避免沙尘，盐雾等有害环境。
TVS should avoid sand dust, salt mist, or other harmful gases.

TVS最大典型结电容 Max. Typical Capacitance of TVS

高频线路应用中请参照规格书中所给出的典型电容曲线。

The typical capacitance of TVS is listed in the specifications. Designers may refer to it when designing TVS in high frequency circuit.

安装机械应力 Installation Mechanical Stress

1. 安装TVS时请避免敲击，防止物理损伤。
Do not knock TVS when installing, to avoid mechanical damage.
2. 请不要对 TVS 施加剧烈的振动、冲击或压力，以免表面树脂或元件破裂。
Please do not apply severe vibration, shock or pressure to TVS, to avoid surface resin or element cracking.

TVS

TVS