**KWBW40N120S2E1**

**1200V 40A** 沟槽栅场截止型**IGBT**


# 特征

#### 饱和压降为正温度系数，易于并联使用

内置快恢复二极管

高可靠性及热稳定性，良好的参数一致性

极低的关断损耗

应用领域

逆变焊机

最大额定值1

**TO-247**

**C E G**



|  |  |  |  |
| --- | --- | --- | --- |
| 参数 | 符号 | 额定值 | 单位 |
| 集电极-发射极电压 | *V* CE | 1200 | V |
| 集电极电流*T* C=25℃*T* C=100℃ | *I* C | 60240 | A |
| 集电极脉冲电流 | *I* Cpuls | 120\*3 |
| RBSOA电流VCE<1200V,Tj<150℃ | *I* Cpeak | 80\* |
| 二极管正向电流*T* C=25℃*T* C=100℃ | *I* F | 302302 |
| 二极管脉冲电流 | *I* Fpuls | 80\* |
| 栅极-发射极电压 | *V* GE | ±20 | V |
| 短路承受时间4*V* GE=15V, *V* CC=600V, *T* j=25°C | *t* SC | 3 | μs |
| 耗散功率*T* C=25℃*T* C=100℃ | *P* tot | 431172 | W |
| 工作结温 | *T* j | -55~150 | ℃ |
| 储存温度 | *T* stg | -55~150 |

##### 1测试标准参考JESD-022

2受限于邦定线

3加\*表示估计值，下同

4允许短路次数:<1000;短路时间间隔:>1s

热学特性

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| 参数 | 符号 | 封装形式 | 最小值 | 典型值 | 最大值 | 单位 |
| IGBT结壳热阻 | *R* thJC | TO-247 | - | - | 0.29 |  |
| 二极管结壳热阻 | *R* thJCD | TO-247 | - | - | 1.2 |
| 结-环境热阻 | *R* thJA | TO-247 | - | - | 30 |

电学特性（未特殊说明时，*T* j=25℃）

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| 参数 | 符号 | 测试条件 | 最小值 | 典型值 | 最大值 | 单位 |
| 静态特性 |
| 击穿电压 | *V* (BR)CES | *V* GE=0V,*I* C=0.5mA | 1200 | - | - | V |
| IGBT导通压降 | *V* CE(sat) | *V* GE=15V,*I* C=40A | - | 2.2 | 2.6 |
| *T* j=25℃ |
| *T* j=150℃ | - | 3.1 | - |
| 二极管正向压降 | *V* F | *V* GE=0V,*I* F=40A | 2.1 | 2.3 | 2.5 |
| *T* j=25℃ |
| *T* j=150℃ | - | 2.1 | - |
| 阈值电压 | *V* GE(th) | *I* C=1.5mA,*V* CE=*V* GE | 5 | 5.9 | 6.5 |
| 集电极-发射极漏电流 | *I* CES | *V* CE=1200V,*V* GE=0V | - | - | 0.4 | mA |
| *T* j=25℃ |
| *T* j=150℃ | - | - | 4 |
| 栅极-发射极漏电流 | *I* GES | *V* CE=0V,*V* GE=20V | - | - | 200 | nA |
| 跨导 | *g* FS | *V* CE=20V,*I* C=40A | - | 43 | - | S |
| 动态特性 |
| 输入电容 | *C* iss | *V* CE=25V*V* GE=0V*f* =1MHz | - | 6800 | - | pF |
| 输出电容 | *C* oss | - | 200 | - |
| 反馈电容 | *C* rss | - | 60 | - |
| 栅电荷 | *Q* G | *V* CC=600V,*I* C=40A, VGE=15V | - | 240 | - | nC |



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| 参数 | 符号 | 测试条件 | 最小值 | 典型值 | 最大值 | 单位 |
| **IGBT**开关特性（感性负载） |
| 开通延迟时间 | *t* d(on) | *T* j=25℃*V* CC=600V,*I* C=40A*V* GE=15/0V*R* G=12Ω*L* load=500μH | - | 73 | - | ns |
| 上升时间 | *t* r | - | 81 | - |
| 关断延迟时间 | *t* d(off) | - | 284 | - |
| 下降时间 | *t* f | - | 47 | - |
| 开通损耗 | *E* on | - | 2.5 | - | mJ |
| 关断损耗 | *E* off | - | 1.4 | - |
| 开关损耗 | *E* ts | - | 3.9 | - |
| 开通延迟时间 | *t* d(on) | *T* j=150℃*V* CC=600V,*I* C=40A*V* GE=15/0V*R* G=12Ω*L* load=500μH | - | 65 | - | ns |
| 上升时间 | *t* r | - | 75 | - |
| 关断延迟时间 | *t* d(off) | - | 316 | - |
| 下降时间 | *t* f | - | 75 | - |
| 开通损耗 | *E* on | - | 2.4 | - | mJ |
| 关断损耗 | *E* off | - | 1.8 | - |
| 开关损耗 | *E* ts | - | 4.2 | - |
| 二极管开关特性 |
| 反向恢复时间 | *t* rr | *T* j=25℃*V* R=600V,*I* F=40A*di* F/dt=500A/μs | - | 140 | - | ns |
| 反向恢复电荷 | *Q* rr | - | 2.2 | - | μC |
| 反 向 恢 复 峰 值电流 | *I* rrm | - | 29 | - | A |
| 反向恢复时间 | *t* rr | *T* j=150℃*V* R=600V,*I* F=40A*di* F/dt=500A/μs | - | 180 | - | ns |
| 反向恢复电荷 | *Q* rr | - | 3.6 | - | μC |
| 反 向 恢 复 峰 值电流 | *I* rrm | - | 35 | - | A |

###### 输出特性 IGBT 输出特性 IGBT

**output characteristic IGBT output characteristic IGBT**

IC = f (VCE), Tj = 25°C IC = f (VCE), Tj = 150°C

180

160

###### V = 19V

140

120

###### V = 19V

140

120

100

I [A]

80

C

**GE**

###### 17V

**15V**

**13V**

**11V**

**9V**

**7V**

100

80

I [A]

60

C

**GE**

###### 17V

**15V**

**13V**

**11V**

**9V**

**7V**

60

40

40

20

20

0

0 1 2 3 4 5 6

0

0 1 2 3 4 5 6

V

CE

##### V [V]

CE

[V]

传输**特性 IGBT** 开关损**耗 IGBT**

###### transfer characteristic IGBT switching losses IGBT

IC = f (VGE), VCE = 20 V Eon = f (IC), Eoff = f (IC), Ets = f (IC)

VGE = 15/0 V, RG = 12Ω, VCE = 600 V

240

200

14

Tj=25℃ Tj=150℃

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|  | E ，T =150℃on jE ，T =150℃off jE ，T =150℃ts j |
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12

10

160

8

E[mJ]

120

I [A]

C

6

80

4

40 2

0

6 7 8 9 10 11 12 13

0

0 10 20 30 40 50 60 70 80 90

C

##### [V]

V

GE

I [A]

开关损**耗 IGBT 反偏安全工作**区 **IGBT**

###### switching losses IGBT reverse bias safe operating area IGBT

Eon = f (RG), Eoff = f (RG) IC = f (VCE)

VGE = 15/0 V, IC = 25 A, VCE = 600 V VGE = 15/0 V, RGoff = 12 W, Tj = 150°C

8 100

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|  | E ，T =150℃on jE ，T =150℃off jE ，T =150℃ts j |
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7 90

80

6

70

5 60

4 50

E[mJ]

I [A]

C

3 40

30

2

20

1 10

0

0 5 10 15 20 25 30 35 40 45

CE

0

0 200 400 600 800 1000 1200 1400

V

##### R [Ω]

G

[V]

电**容特性 IGBT 正向偏**压特性 **二极管**

###### capacitance characteristic of IGBT forward characteristic of Diode

C = f (VCE), VGE=0V, f=1MHz IF = f (VF)

10000



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140

120

Tj=25℃ Tj=150℃

100

1000

80

60

C[pF]

I [A]

F

100 40

20

10

0 10 20 30 40 50

0

0 1 2 3 4

F

##### [V]

V

CE

V [V]

恢复电荷 **二极管** 恢复电荷 **二极管**

###### recovered charge of Diode recovered charge of Diode

Qrr = f (IF), RG = 10 Ω, VCE= 600 V Qrr = f (RG), IF = 25 A, VCE = 600 V

6000

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|  | Q , T =150℃ |
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| Q ，T =150℃ |
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5000

rr j

4000

rr j

4000

3000

Q [nC]

rr

3500

2000

Qrr[nC]

3000

1000

0

0 10 20 30 40 50 60

##### I [A]

F

2500

0 10 20 30 40 50 60 70 80

##### R [Ω]

G

*VGE*

90% *VGE*

10% *VGE*

*VCE*

*IC*

10% *IC*

90% *IC*

90% *VCE*

90% *IC*

10% *IC*

*td* *on* 

 *tr*

 *t f*

*td* *off* 

#### Figure A. Definition of switching times

*VGE*

90% *VCE*

10% *VGE*

*VCE*

*t*2 *t*4

*Eon* *Vce* *Ic* *dt*

*t*1

*I* 0% *IC*

*C t t*2

1

*Eoff*

10% *VCE*

*Vce* *Ic* *dt*

*t*3

10% *VCE*

*t*3

0% *IC*

*t*4

#### Figure B. Definition of switching losses

D.U.T

(Diode)

 U

*RG*

L

D.U.T

(IGBT)

Figure C. Definition of diodes switching characteristics Figure D. Dynamic test circuit

**TO-247**