

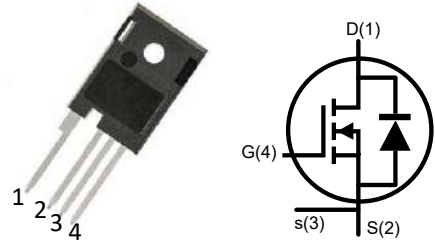
## HCM32S12T4K2

1200V 32mΩ 碳化硅功率MOSFET, TO-247-4L

1200V 32mΩ Silicon Carbide Power MOSFET, TO-247-4L

### 特点 Features

- 高阻断电压，低导通电阻  
High Blocking Voltage with Low On-Resistance
- 高开关速度，低寄生电容  
High Speed Switching with Low Capacitances
- 易于并联，驱动简单  
Easy to Parallel and Simple to Drive
- 抗门锁效应  
Resistant to Latch-Up
- 无卤素添加，符合RoHS标准  
Halogen Free, RoHS Compliant



### 应用 Applications

- 太阳能逆变器  
Solar Inverters
- 开关电源  
Switch Mode Power Supplies
- 高压DC/DC  
High Voltage DC/DC Converters
- 电动汽车电机驱动  
EV Motor Drives

### 碳化硅功率MOSFET/ SiC Power MOSFET

最大额定值/ Maximum Rated Values ( $T_{vj}=25^{\circ}\text{C}$  unless otherwise noted)

| 参数<br>Parameter                     | 符号<br>Symbol   | 条件<br>Condition                                           | 数值<br>Value | 单位<br>Unit         |
|-------------------------------------|----------------|-----------------------------------------------------------|-------------|--------------------|
| 漏极-源极电压 Drain-source voltage        | $V_{DS\ max}$  | $V_{GS}=0V, I_D=100\mu A$                                 | 1200        | V                  |
| 栅极-源极电压 Gate-source voltage         | $V_{GS\ max}$  | Absolute maximum values                                   | -8/+19      | V                  |
|                                     | $V_{GS\ op}$   | Recommended operational values                            | -4/+15      | V                  |
| 连续漏极电流<br>Continuous drain current  | $I_D$          | $V_{GS}=15V, T_c=25^{\circ}\text{C}$                      | 92          | A                  |
|                                     |                | $V_{GS}=15V, T_c=100^{\circ}\text{C}$                     | 65          |                    |
| 漏极脉冲电流 Pulsed drain current         | $I_{D\ pulse}$ | Pulse width $t_p$ limited by $T_{vj\ max}$                | 276         | A                  |
| 耗散功率 Power dissipation              | $P_D$          | $T_c=25^{\circ}\text{C}, T_{vj\ max}=175^{\circ}\text{C}$ | 417         | W                  |
| 工作结温 Operating junction temperature | $T_{vj\ op}$   |                                                           | -55~175     | $^{\circ}\text{C}$ |
| 存储温度范围 Storage temperature range    | $T_{stg}$      |                                                           | -55~175     | $^{\circ}\text{C}$ |

# 电特性 Electrical Characteristics ( $T_{vj}=25^{\circ}\text{C}$ unless otherwise noted)

| 参数<br>Parameter                               | 符号<br>Symbol        | 条件<br>Condition                                                                                                                                                          |                        | 数值 Value |      |      | 单位<br>Unit |
|-----------------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------|------|------|------------|
|                                               |                     |                                                                                                                                                                          |                        | Min.     | Typ. | Max. |            |
| 漏极-源极阻断电压<br>Drain-source breakdown voltage   | V <sub>DSS BR</sub> | V <sub>GS</sub> =0V, I <sub>D</sub> =100μA                                                                                                                               |                        | 1200     |      |      | V          |
| 栅极阈值电压<br>Gate threshold voltage              | V <sub>GS th</sub>  | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =11.5mA                                                                                                                | T <sub>vj</sub> =25°C  | 2.0      | 2.6  | 4.0  | V          |
|                                               |                     |                                                                                                                                                                          | T <sub>vj</sub> =175°C |          | 1.9  |      |            |
| 零栅压漏极电流<br>Zero gate voltage drain current    | I <sub>DSS</sub>    | V <sub>DS</sub> =1200V, V <sub>GS</sub> =0V                                                                                                                              |                        |          | 1    | 100  | μA         |
| 栅极-源极漏电流<br>Gate-source leakage current       | I <sub>GSS</sub>    | V <sub>GS</sub> =15V, V <sub>DS</sub> =0V                                                                                                                                |                        |          | 1    | 100  | nA         |
| 漏极-源极导通电阻<br>Drain-source on-state resistance | R <sub>DS on</sub>  | V <sub>GS</sub> =15V, I <sub>D</sub> =40A                                                                                                                                | T <sub>vj</sub> =25°C  |          | 32   | 50   | mΩ         |
|                                               |                     |                                                                                                                                                                          | T <sub>vj</sub> =175°C |          | 49   |      |            |
| 跨导<br>Transconductance                        | g <sub>fs</sub>     | V <sub>DS</sub> =20V, I <sub>D</sub> =40A                                                                                                                                | T <sub>vj</sub> =25°C  |          | 28   |      | S          |
|                                               |                     |                                                                                                                                                                          | T <sub>vj</sub> =175°C |          | 29   |      |            |
| 输入电容<br>Input capacitance                     | C <sub>iss</sub>    | V <sub>GS</sub> =0V<br>V <sub>DS</sub> =1000V<br>f=100kHz<br>V <sub>AC</sub> =25mV                                                                                       |                        |          | 2536 |      | pF         |
| 输出电容<br>Output capacitance                    | C <sub>oss</sub>    |                                                                                                                                                                          |                        |          | 134  |      |            |
| 反向传输电容<br>Reverse transfer capacitance        | C <sub>rss</sub>    |                                                                                                                                                                          |                        |          | 11   |      |            |
| 输出电容存储能量<br>C <sub>oss</sub> stored energy    | E <sub>oss</sub>    |                                                                                                                                                                          |                        |          | 136  |      |            |
| 开通能量<br>Turn-on switching energy              | E <sub>on</sub>     | V <sub>DS</sub> =800V, V <sub>GS</sub> =-4/15V<br>I <sub>D</sub> =40A, R <sub>G ext</sub> =2.5Ω,<br>L=250μH                                                              | T <sub>vj</sub> =25°C  |          | 420  |      | μJ         |
| 关断能量<br>Turn-off switching energy             | E <sub>off</sub>    |                                                                                                                                                                          | T <sub>vj</sub> =175°C |          | 812  |      |            |
|                                               |                     |                                                                                                                                                                          | T <sub>vj</sub> =25°C  |          | 95   |      |            |
|                                               |                     |                                                                                                                                                                          | T <sub>vj</sub> =175°C |          | 118  |      |            |
| 开通延迟时间<br>Turn-on delay time                  | t <sub>d on</sub>   | V <sub>DS</sub> =800V, V <sub>GS</sub> =-4/15V<br>I <sub>D</sub> =40A, R <sub>G ext</sub> =2.5Ω,<br>T <sub>vj</sub> =25°C, L=250μH<br>Timing relative to V <sub>DS</sub> |                        |          | 16   |      | ns         |
| 上升时间<br>Rise time                             | t <sub>r</sub>      |                                                                                                                                                                          |                        |          | 17   |      |            |
| 关断延迟时间<br>Turn-off delay time                 | t <sub>d off</sub>  |                                                                                                                                                                          |                        |          | 30   |      |            |
| 下降时间<br>Fall time                             | t <sub>f</sub>      |                                                                                                                                                                          |                        |          | 11   |      |            |
| 栅极内阻<br>Internal gate resistance              | R <sub>G int</sub>  | f=1MHz, V <sub>AC</sub> =25mV                                                                                                                                            |                        |          | 1.2  |      | Ω          |
| 栅源电荷<br>Gate to source charge                 | Q <sub>GS</sub>     | V <sub>DS</sub> =800V, V <sub>GS</sub> =-4/15V<br>I <sub>D</sub> =40A                                                                                                    |                        |          | 27   |      | nC         |
| 栅漏电荷<br>Gate to drain charge                  | Q <sub>GD</sub>     |                                                                                                                                                                          |                        |          | 57   |      |            |
| 栅极总电荷<br>Total gate charge                    | Q <sub>G</sub>      |                                                                                                                                                                          |                        |          | 113  |      |            |

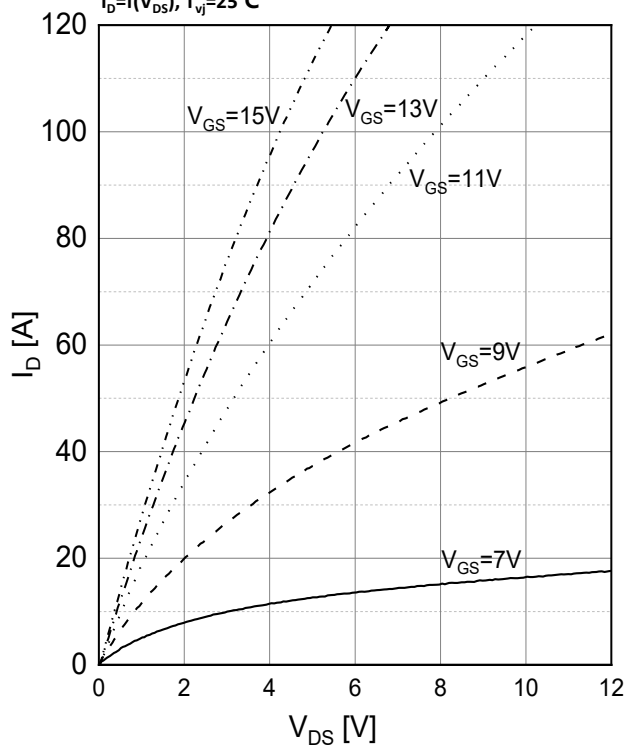
体二极管特性 Body Diode Characteristics (T<sub>vj</sub>=25°C unless otherwise noted)

| 参数<br>Parameter                               | 符号<br>Symbol         | 条件<br>Condition                                                                                                           |                        | 数值 Value |      |      | 单位<br>Unit |
|-----------------------------------------------|----------------------|---------------------------------------------------------------------------------------------------------------------------|------------------------|----------|------|------|------------|
|                                               |                      |                                                                                                                           |                        | Min.     | Typ. | Max. |            |
| 二极管正向电压<br>Diode forward voltage              | V <sub>SD</sub>      | V <sub>GS</sub> =-4V, I <sub>S</sub> =20A                                                                                 | T <sub>vj</sub> =25°C  |          | 4.4  |      | V          |
|                                               |                      |                                                                                                                           | T <sub>vj</sub> =175°C |          | 4.2  |      |            |
| 二极管连续正向电流<br>Continuous diode forward current | I <sub>S</sub>       | V <sub>GS</sub> =-4V, T <sub>C</sub> =25°C                                                                                |                        |          |      | 73   | A          |
| 二极管脉冲电流<br>Diode pulse current                | I <sub>S pulse</sub> | V <sub>GS</sub> =-4V, Pulse width t <sub>p</sub> limited by T <sub>vj max</sub>                                           |                        |          |      | 276  | A          |
| 反向恢复时间<br>Reverse recovery time               | t <sub>rr</sub>      | V <sub>GS</sub> =-4V<br>I <sub>S</sub> =40A<br>R <sub>G ext</sub> =2.5Ω<br>T <sub>vj</sub> =175°C<br>V <sub>R</sub> =800V |                        |          | 22   |      | ns         |
| 反向恢复电荷<br>Reverse recovery charge             | Q <sub>rr</sub>      |                                                                                                                           |                        |          | 480  |      | nC         |
| 反向恢复峰值电流<br>Peak reverse recovery current     | I <sub>RRM</sub>     |                                                                                                                           |                        |          | 30   |      | A          |

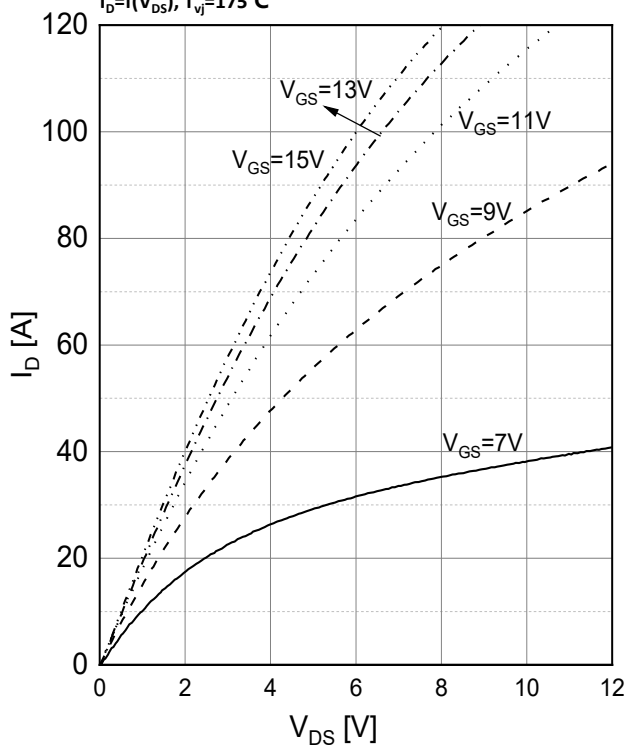
热特性 Thermal Characteristics

| 参数<br>Parameter                               | 符号<br>Symbol       | 条件<br>Condition | 数值 Value |      |      | 单位<br>Unit |
|-----------------------------------------------|--------------------|-----------------|----------|------|------|------------|
|                                               |                    |                 | Min.     | Typ. | Max. |            |
| 结-壳热阻<br>Thermal resistance: junction to case | R <sub>th JC</sub> |                 |          | 0.36 |      | K/W        |

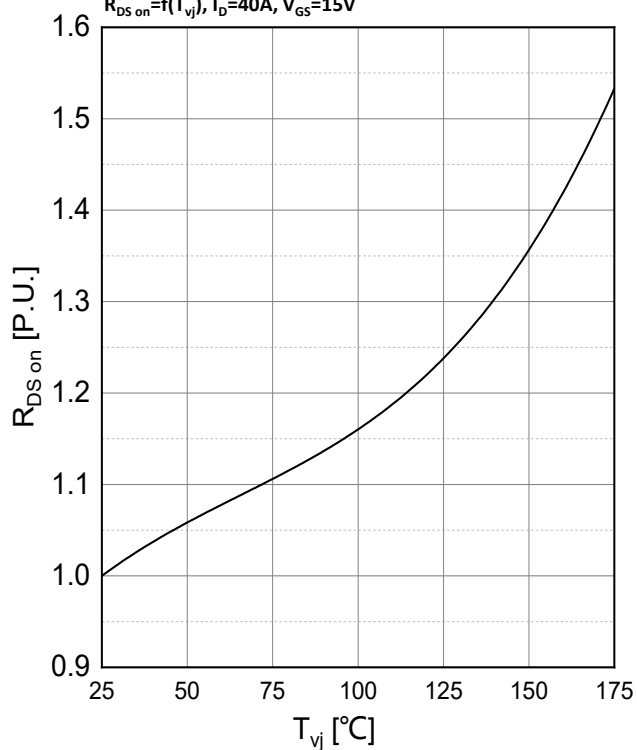
输出特性  
Output Characteristics  
 $I_D = f(V_{DS}), T_{vj} = 25^\circ\text{C}$



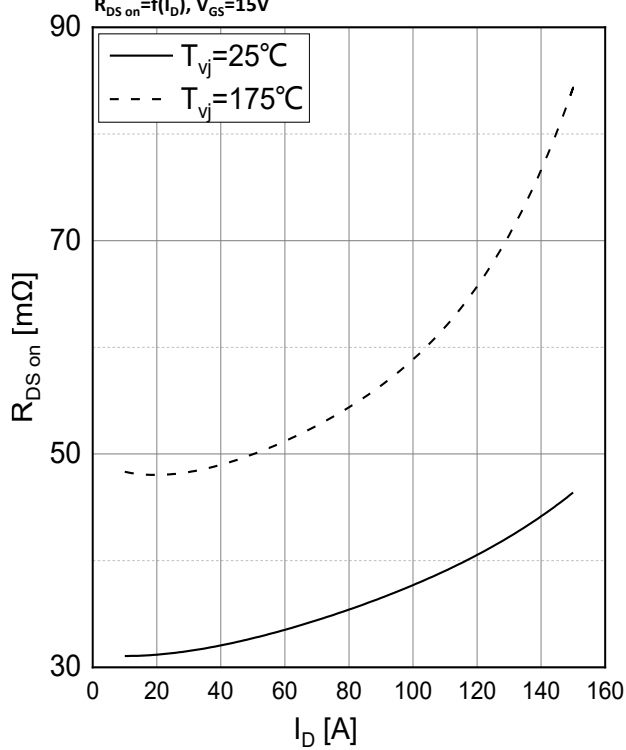
输出特性  
Output Characteristics  
 $I_D = f(V_{DS}), T_{vj} = 175^\circ\text{C}$



标准化导通电阻  
Normalized On-Resistance  
 $R_{DS\ on} = f(T_{vj}), I_D = 40A, V_{GS} = 15V$



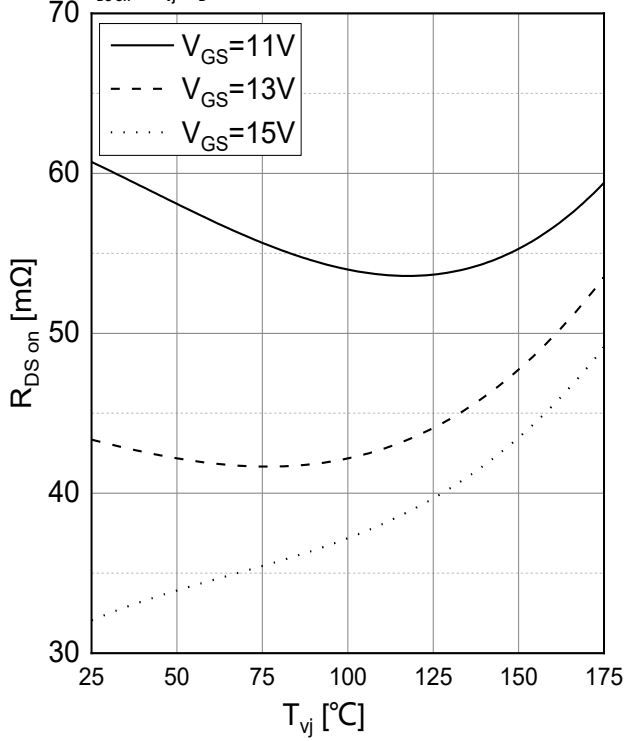
导通电阻  
On-Resistance  
 $R_{DS\ on} = f(I_D), V_{GS} = 15V$



## 导通电阻

### On-Resistance

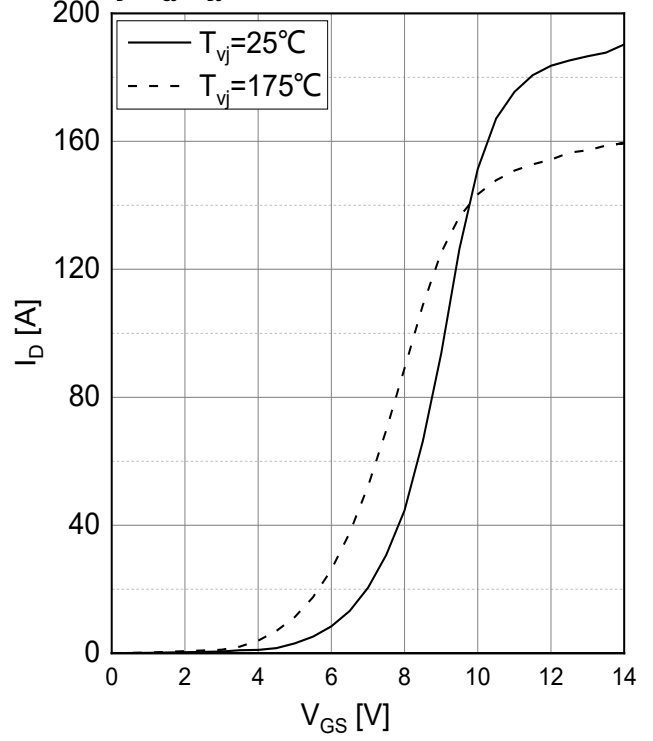
$$R_{DS\ on}=f(T_{vj}), I_D=40A$$



## 转移特性

### Transfer Characteristics

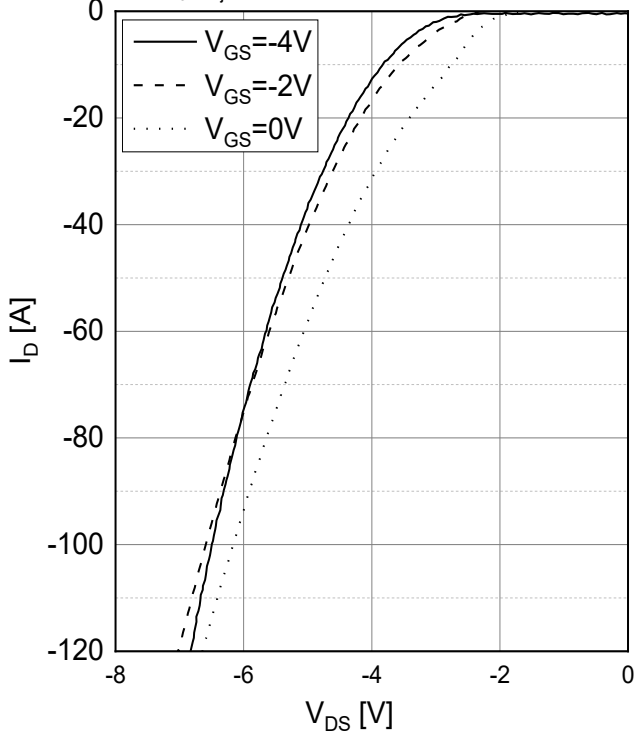
$$I_D=f(V_{GS}), V_{DS}=20V$$



## 体二极管特性

### Body Diode Characteristics

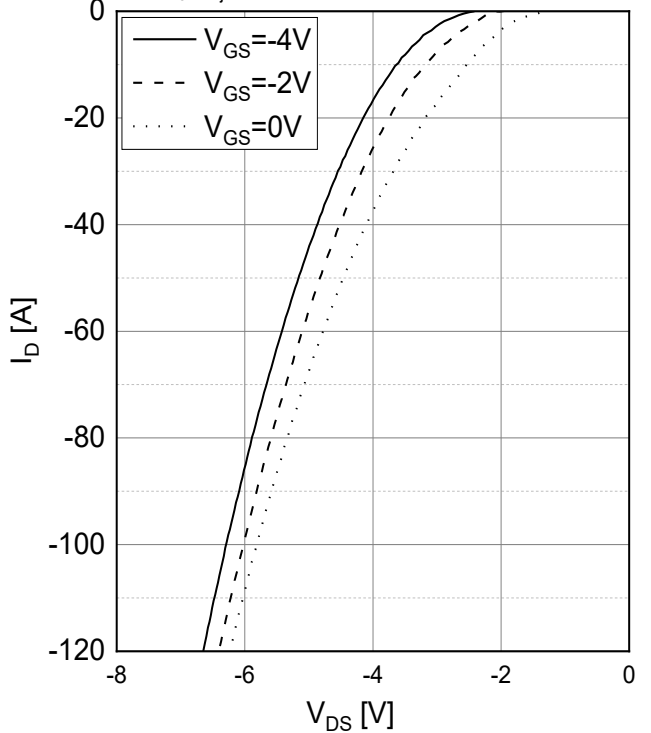
$$I_D=f(V_{DS}), T_{vj}=25^{\circ}C$$



## 体二极管特性

### Body Diode Characteristics

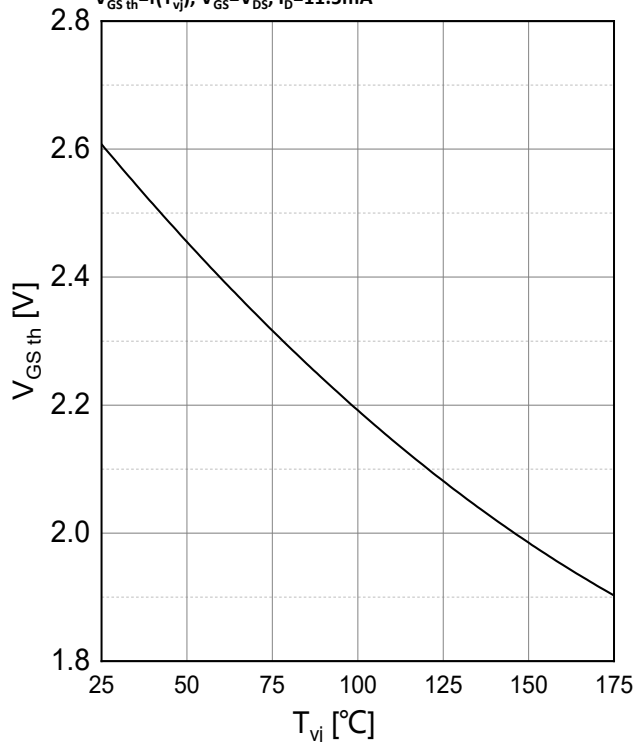
$$I_D=f(V_{DS}), T_{vj}=175^{\circ}C$$



## 阈值电压

### Threshold Voltage

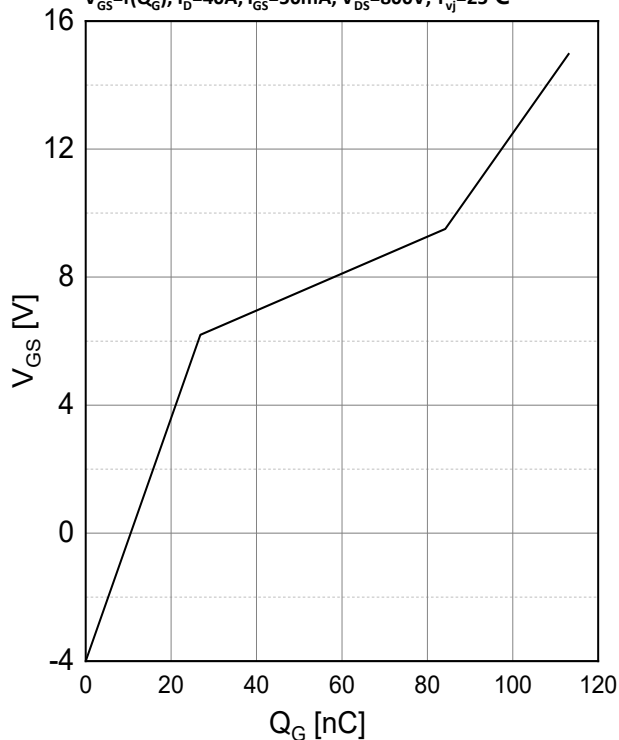
$V_{GS\ th}=f(T_{vj})$ ,  $V_{GS}=V_{DS}$ ,  $I_D=11.5mA$



## 栅极电荷特性

### Gate Charge Characteristics

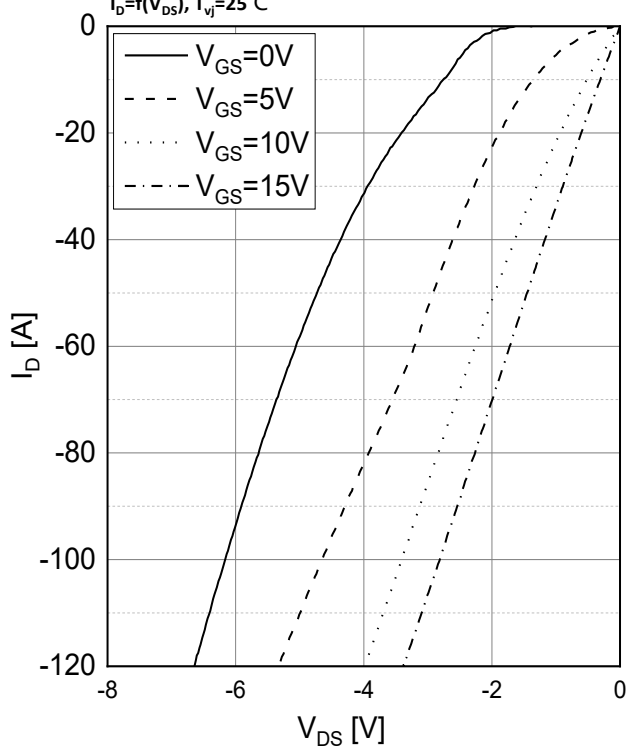
$V_{GS}=f(Q_G)$ ,  $I_D=40A$ ,  $I_{GS}=50mA$ ,  $V_{DS}=800V$ ,  $T_{vj}=25^\circ C$



## 第三象限特性

### 3rd Quadrant Characteristics

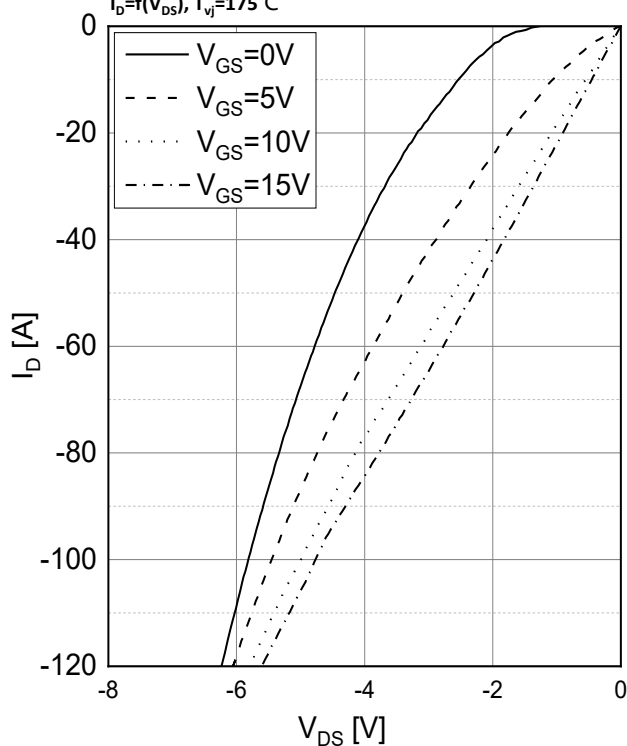
$I_D=f(V_{DS})$ ,  $T_{vj}=25^\circ C$



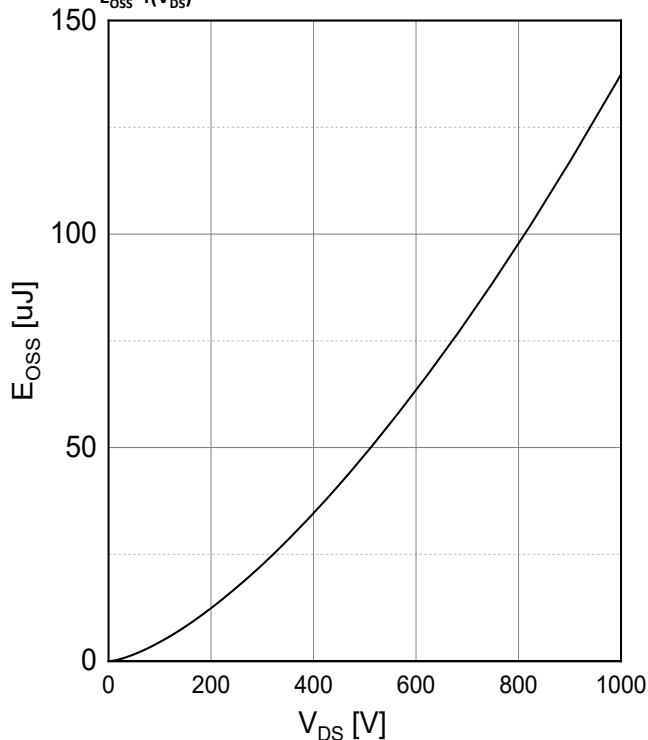
## 第三象限特性

### 3rd Quadrant Characteristics

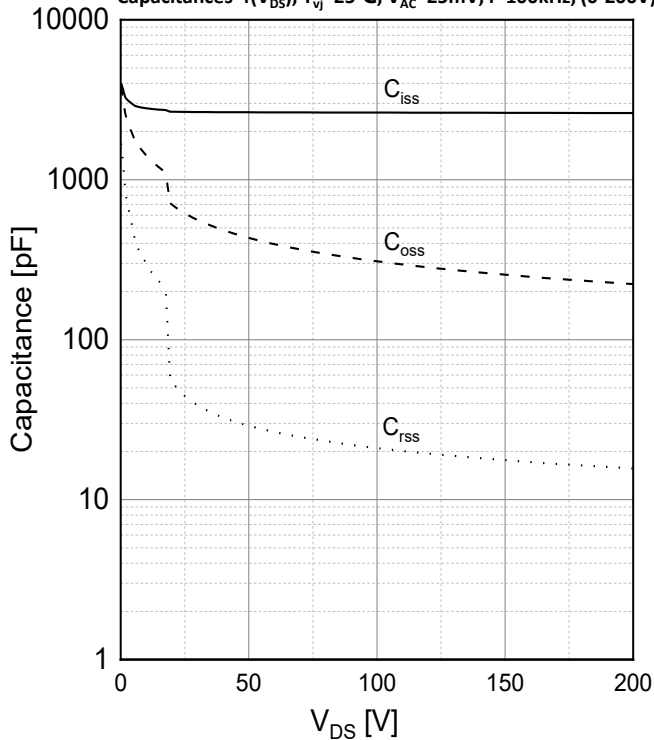
$I_D=f(V_{DS})$ ,  $T_{vj}=175^\circ C$



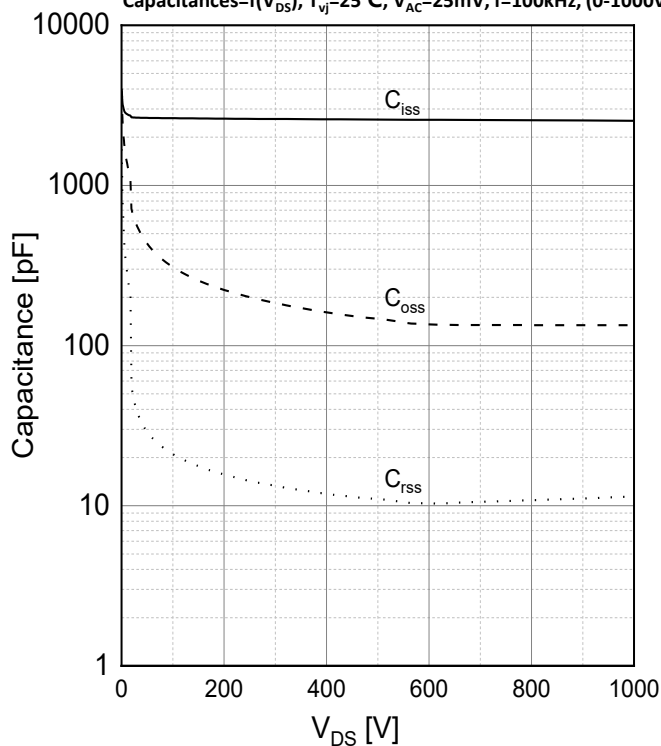
输出电容存储能量  
Output Capacitor Stored Energy  
 $E_{OSS}=f(V_{DS})$



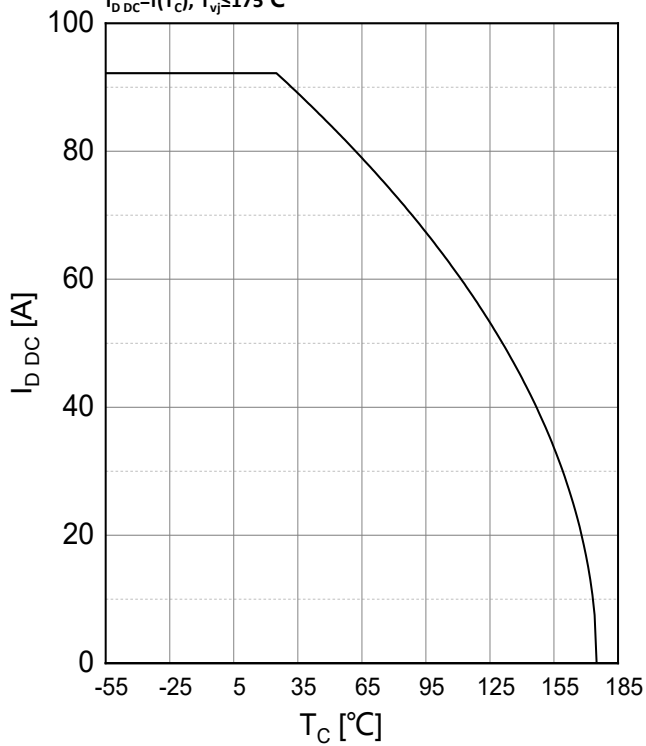
电容  
Capacitances  
Capacitances= $f(V_{DS})$ ,  $T_{vj}=25^{\circ}C$ ,  $V_{AC}=25mV$ ,  $f=100kHz$ , (0-200V)



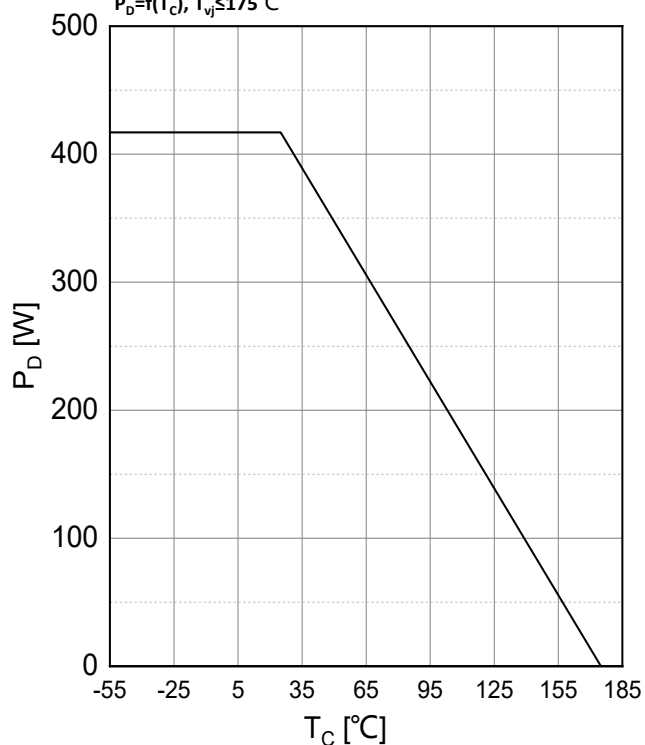
电容  
Capacitances  
Capacitances= $f(V_{DS})$ ,  $T_{vj}=25^{\circ}C$ ,  $V_{AC}=25mV$ ,  $f=100kHz$ , (0-1000V)



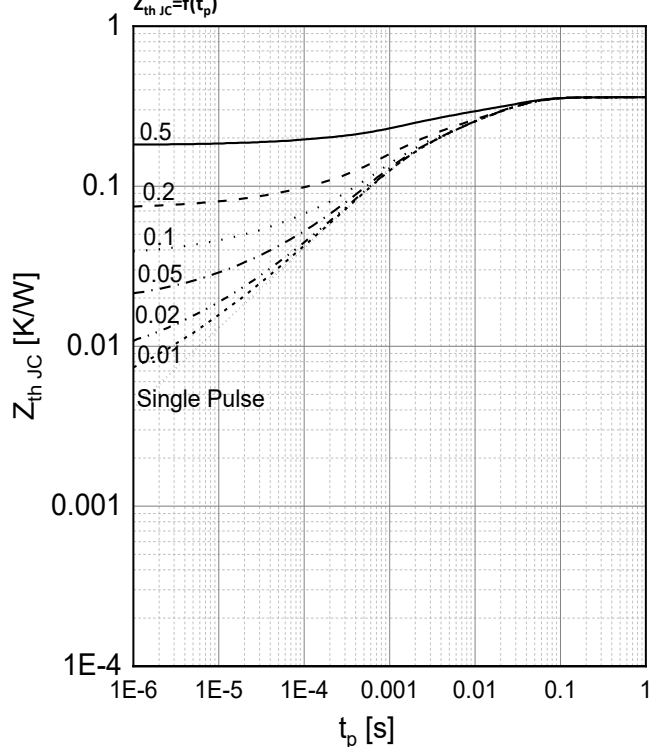
连续漏极电流衰减  
Continuous Drain Current Derating  
 $I_{D DC}=f(T_C)$ ,  $T_{vj}\leq 175^{\circ}C$



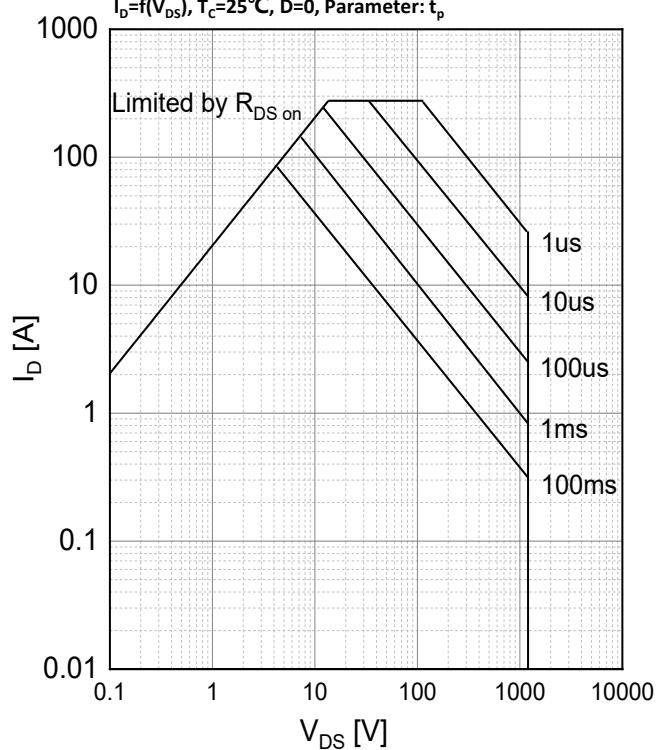
最大功耗衰减  
Maximum Power Dissipation Derating  
 $P_D = f(T_C), T_{vj} \leq 175^\circ\text{C}$



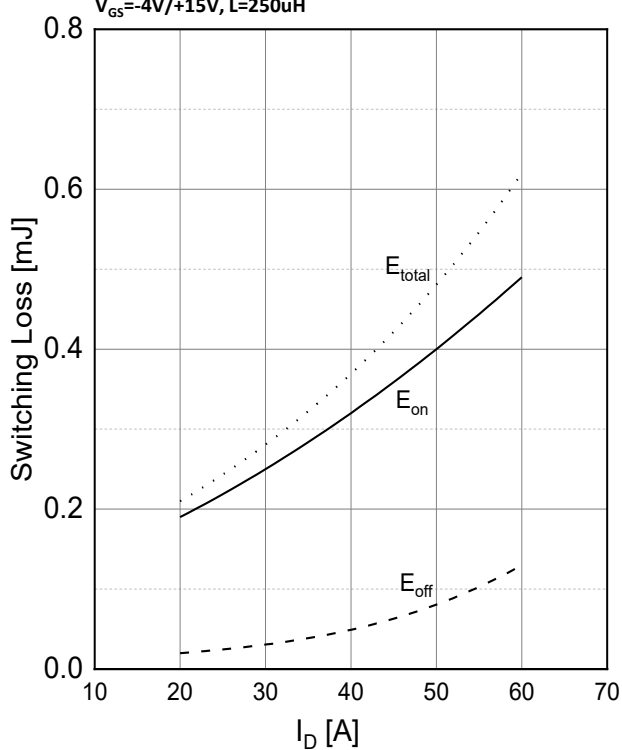
瞬态热阻 (结-壳)  
Transient Thermal Impedance (Junction-Case)  
 $Z_{th JC} = f(t_p)$



安全工作区  
Safe Operating Area  
 $I_D = f(V_{DS}), T_C = 25^\circ\text{C}, D = 0$ , Parameter:  $t_p$



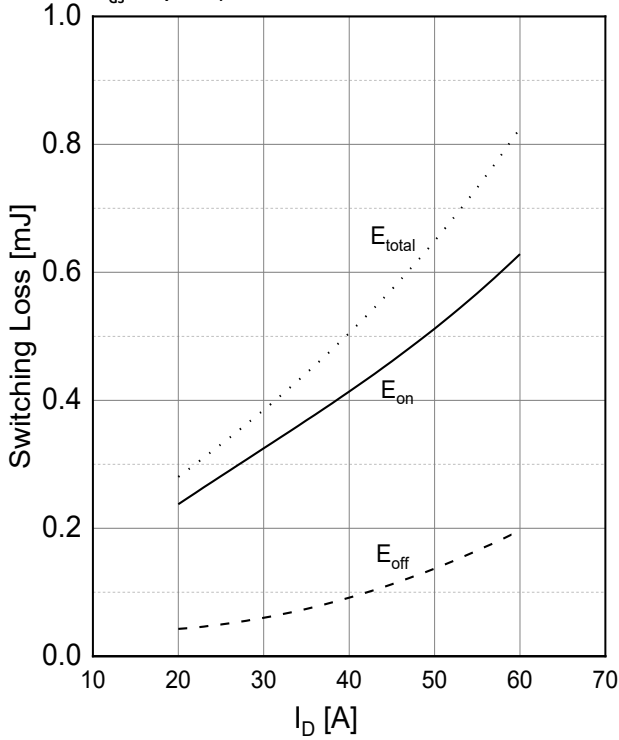
开关能量  
Switching Energy  
Switching Loss =  $f(I_D), T_{vj} = 25^\circ\text{C}, V_{DS} = 600\text{V}, R_{G ext} = 2.5\Omega, V_{GS} = -4\text{V}/+15\text{V}, L = 250\mu\text{H}$



## 开关能量

### Switching Energy

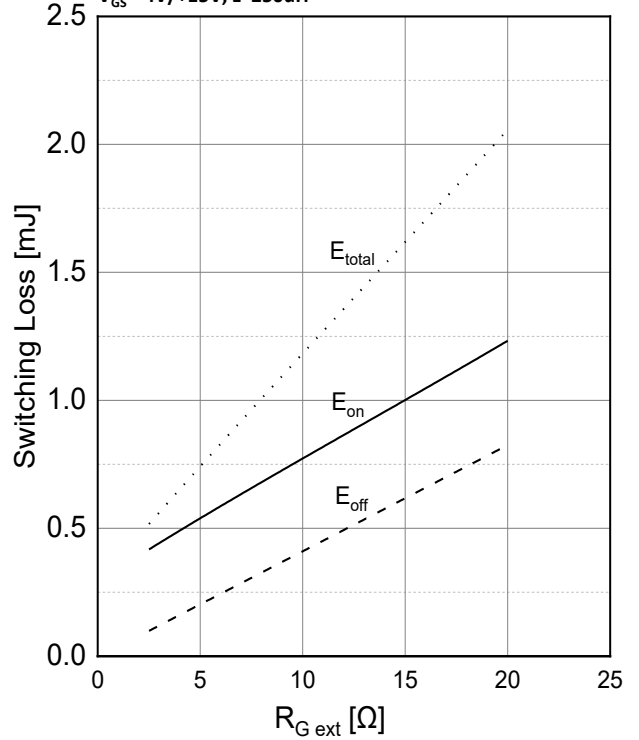
Switching Loss=f( $I_D$ ),  $T_{vj}=25^\circ\text{C}$ ,  $V_{DS}=800\text{V}$ ,  $R_{G\text{ ext}}=2.5\Omega$ ,  
 $V_{GS}=-4\text{V}/+15\text{V}$ ,  $L=250\mu\text{H}$



## 开关能量

### Switching Energy

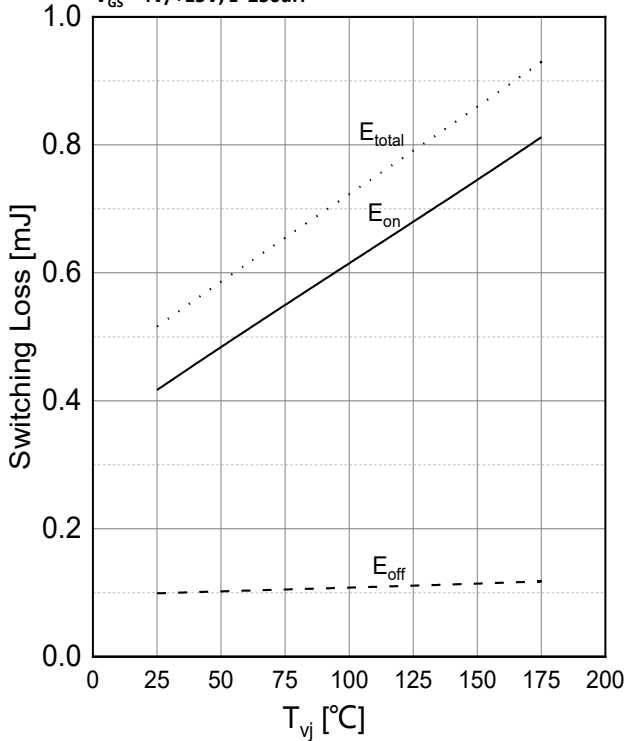
Switching Loss=f( $R_{G\text{ ext}}$ ),  $T_{vj}=25^\circ\text{C}$ ,  $V_{DS}=800\text{V}$ ,  $I_D=40\text{A}$ ,  
 $V_{GS}=-4\text{V}/+15\text{V}$ ,  $L=250\mu\text{H}$



## 开关能量

### Switching Energy

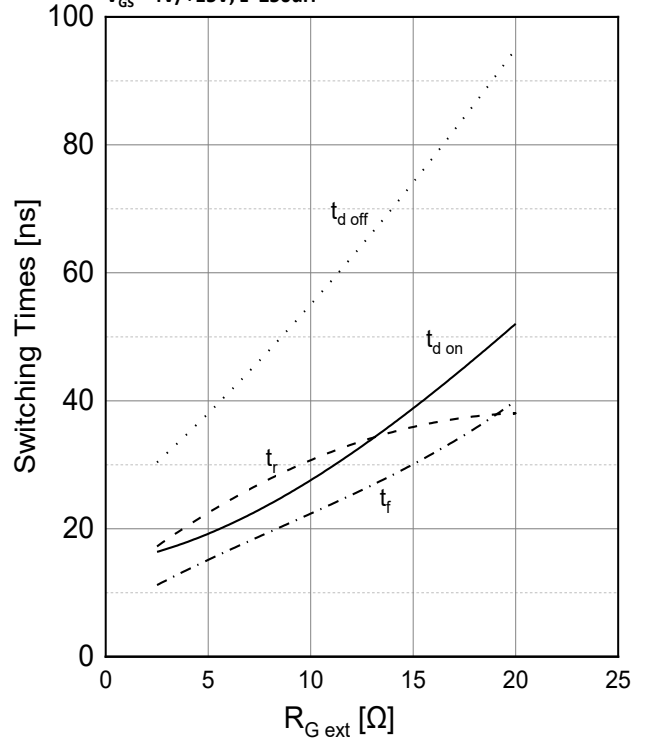
Switching Loss=f( $T_{vj}$ ),  $V_{DS}=800\text{V}$ ,  $I_D=40\text{A}$ ,  $R_{G\text{ ext}}=2.5\Omega$ ,  
 $V_{GS}=-4\text{V}/+15\text{V}$ ,  $L=250\mu\text{H}$



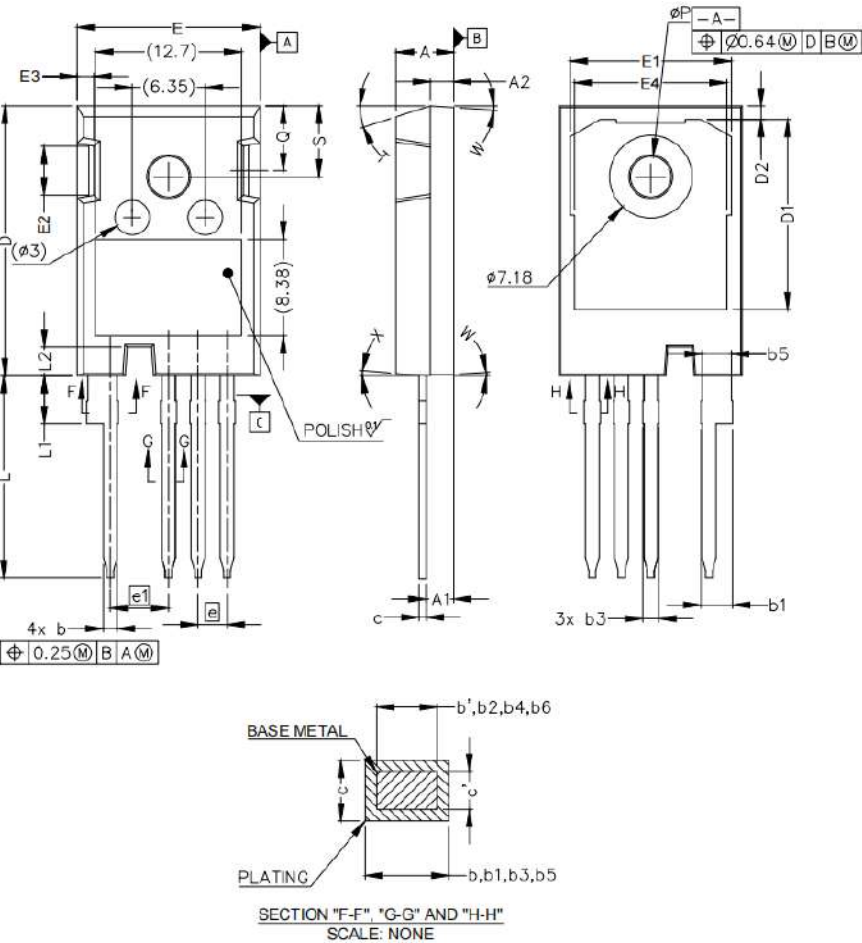
## 开关时间

### Switching Times

Switching Times=f( $R_{G\text{ ext}}$ ),  $T_{vj}=25^\circ\text{C}$ ,  $V_{DS}=800\text{V}$ ,  $I_D=40\text{A}$ ,  
 $V_{GS}=-4\text{V}/+15\text{V}$ ,  $L=250\mu\text{H}$



外形尺寸 Outline Drawing



| SYMBOL | MILLIMETERS |       |
|--------|-------------|-------|
|        | MIN         | MAX   |
| A      | 4.83        | 5.21  |
| A1     | 2.29        | 2.54  |
| A2     | 1.91        | 2.16  |
| b'     | 1.07        | 1.28  |
| b      | 1.07        | 1.33  |
| b1     | 2.39        | 2.94  |
| b2     | 2.39        | 2.84  |
| b3     | 1.07        | 1.60  |
| b4     | 1.07        | 1.50  |
| b5     | 2.39        | 2.69  |
| b6     | 2.39        | 2.64  |
| c'     | 0.55        | 0.65  |
| c      | 0.55        | 0.68  |
| D      | 23.30       | 23.60 |
| D1     | 16.25       | 17.65 |
| D2     | 0.95        | 1.25  |
| E      | 15.75       | 16.13 |
| E1     | 13.10       | 14.15 |
| E2     | 3.68        | 5.10  |
| E3     | 1.00        | 1.90  |
| E4     | 12.38       | 13.43 |
| e      | 2.54 BSC    |       |
| e1     | 5.08 BSC    |       |
| N      | 4           |       |
| L      | 17.31       | 17.82 |
| L1     | 3.97        | 4.37  |
| L2     | 2.35        | 2.65  |
| øP     | 3.51        | 3.65  |
| Q      | 5.49        | 6.00  |
| S      | 6.04        | 6.30  |
| T      | 17.5° REF.  |       |
| W      | 3.5 ° REF.  |       |
| X      | 4° REF.     |       |

|            |                |
|------------|----------------|
| 日期 Date    | 描述 Description |
| 2024-11-13 | 正式版            |

## 声明与使用条件/ Notices and conditions of use

### 1. HIITIO 保留手册的更改权；

HIITIO reserves the right to change the manual;

### 2. 本手册中提供的数据一部分为产品的典型值，实际出厂测试的数据与典型值略有差异，但我司保证这些差异不会影响产品的正常使用，如果产品信息发生变更，我司会及时更新手册，请随时关注；

Part of the data provided in this manual is the typical value of the product, the actual factory test data and the typical value are slightly different, but our company guarantees that these differences will not affect the normal use of the product, if the product information changes, our company will update the manual in time, please pay attention at any time;

### 3. 在应用我司产品时请不要超过产品的最大额定值，否则我司无法保证产品应用的可靠性；

When applying our products, please do not exceed the maximum rating of the product, otherwise our company can not guarantee the reliability of the product application;

### 4. 产品在使用时，严禁触碰，断电后确认无残余电荷且产品已完全冷却后，才可以在有静电防护措施下触碰产品；

When the product is in use, it is strictly forbidden to touch the product. After power off, it is confirmed that there is no residual charge and the product has been completely cooled, and it can only be touched under electrostatic protection measures;

### 5. 购买产品时请认准我司商标，如有疑问请与本司联系。

Please look for our trademark when purchasing products. If you have any questions, please contact us.