

HC190N070S1E

700V N-Channel SiC MOSFET

产品特点/Product features

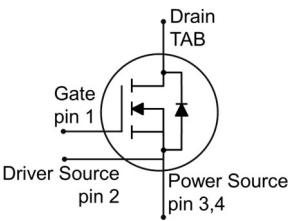
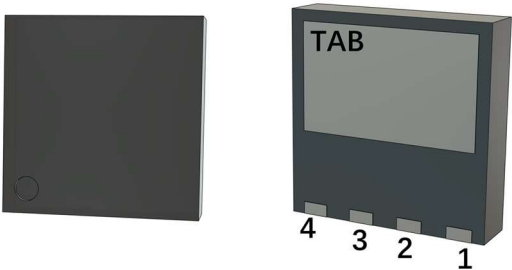
- Kelvin source configuration  
开尔文源极配置
- Low Capacitances with High speed switching  
低电容高速开关
- Low specific on-resistance  
低导通电阻
- Low reverse recovery ( $Q_{rr}$ )  
低反向恢复电荷 $Q_{rr}$
- Reduction of heat sink requirements  
减少散热器需求
- Halogen Free and RoHS Compliant  
无卤素且符合 RoHS 标准

应用领域/Applications

- On-Board Charger  
车载充电器
- Direct Current to Direct Current Converters  
DC-DC 转换器
- Renewable Energy Applications  
可再生能源应用

关键性能参数/Key Performance Parameters

| Parameter        | Value     | Unit |
|------------------|-----------|------|
| $V_{DSS}$        | 700       | V    |
| $R_{DS(on),typ}$ | 190 (@5A) | mΩ   |
| $I_{DM}$         | 26        | A    |



| Type/型号      | Package/封装 | Marking/标识 | Packaging method/包装方式 |
|--------------|------------|------------|-----------------------|
| HC190N070S1E | DFN8080    | HC190N070E | Tape and Reel/卷带包装    |

# 700V N-Channel SiC MOSFET

## HC190N070S1E



### 1. Maximum ratings at $T_j = 25^\circ\text{C}$ , unless otherwise specified.

**最大额定值** 默认  $T_j = 25^\circ\text{C}$  除非另有说明

**Table 1 Maximum ratings/最大额定值**

| Parameter<br>参数                                  | Symbol<br>符号 | Test conditions<br>测试条件                                    | Value<br>值 | Unit<br>单位 |
|--------------------------------------------------|--------------|------------------------------------------------------------|------------|------------|
| Drain-source voltage<br>漏极-源极电压                  | $V_{DS}$     | $T_j \geq 25^\circ\text{C}$                                | 700        | V          |
| Drain current <sup>1</sup><br>连续漏极电流             | $I_D$        | $T_C = 25^\circ\text{C}, V_{GS} = 18\text{V}$              | 19         | A          |
|                                                  |              | $T_C = 100^\circ\text{C}, V_{GS} = 18\text{V}$             | 11         |            |
| Peak drain current <sup>2</sup><br>峰值漏极电流        | $I_{DM}$     | $T_C = 25^\circ\text{C}$                                   | 26         | A          |
| Continuous diode current <sup>1</sup><br>连续二极管电流 | $I_S$        | $T_C = 25^\circ\text{C}, V_{GS} = -4\text{V}$              | 17         | A          |
| Peak diode current <sup>2</sup><br>峰值二极管电流       | $I_{SM}$     | $T_C = 25^\circ\text{C}, V_{GS} = -4\text{V}$              | 26         | A          |
| Maximum gate source voltage<br>栅源最大电压            | $V_{GS,MAX}$ |                                                            | -10~25     | V          |
| Recommend gate source voltage<br>推荐的栅源电压         | $V_{GS,op}$  |                                                            | -4~18      | V          |
| Avalanche energy, single pulse<br>单脉冲雪崩能量        | $E_{AS}$     | $I_{AS} = 12\text{A}, V_{DD} = 50\text{V}, L = 1\text{mH}$ | 110        | mJ         |
| Power dissipation<br>总耗散功率                       | $P_{tot}$    | $T_C = 25^\circ\text{C}$                                   | 54         | W          |
|                                                  |              | $T_C = 100^\circ\text{C}$                                  | 27         |            |

1. Limited by  $T_j(\text{max})$ /受限于最大结温

2. Pulse width  $t_p$  limited by  $T_j(\text{max})$  /脉宽受限于最大结温



2. Thermal characteristics

热特性

Table 2 Thermal characteristics/热特性

| Parameter<br>参数                                    | Symbol<br>符号         | Test conditions<br>测试条件 | Value/值 |      |      | Unit<br>单位 |
|----------------------------------------------------|----------------------|-------------------------|---------|------|------|------------|
|                                                    |                      |                         | Min.    | Typ. | Max. |            |
| Storage Temperature<br>存储温度                        | T <sub>stg</sub>     |                         | -55     |      | 175  | °C         |
| Operating junction Temperature<br>工作结温             | T <sub>j</sub>       |                         | -55     |      | 175  | °C         |
| Thermal resistance, junction-case<br>结-壳热阻         | R <sub>th(j-c)</sub> |                         |         | 2.8  |      | K/W        |
| Thermal resistance, junction-ambient<br>结-环境热阻     | R <sub>th(j-a)</sub> |                         |         | 42   |      | K/W        |
| Soldering temperature, reflow solderin<br>焊接温度，回流焊 | T <sub>sold</sub>    | reflow MSL1             |         |      | 260  | °C         |



### 3. Electrical characteristics at $T_j = 25^\circ\text{C}$ , unless otherwise specified.

电气特性 默认  $T_j = 25^\circ\text{C}$  除非另有说明

Table 3 Static characteristics/静态特性

| Parameter<br>参数                               | Symbol<br>符号  | Test conditions<br>测试条件                    |                           | Value/值 |      |      | Unit<br>单位    |
|-----------------------------------------------|---------------|--------------------------------------------|---------------------------|---------|------|------|---------------|
|                                               |               |                                            |                           | Min.    | Typ. | Max. |               |
| Drain-source breakdown voltage<br>漏源击穿电压      | $V_{(BR)DSS}$ | $I_D = 100\mu\text{A}, V_{GS} = 0\text{V}$ |                           | 700     |      |      | V             |
| Gate threshold voltage<br>门极开启阈值电压            | $V_{GS(th)}$  | $I_D = 2.2\text{mA}, V_{DS} = V_{GS}$      |                           | 2.2     | 3.0  | 3.8  | V             |
| Drain-source on-state resistance<br>漏极-源极导通电阻 | $R_{DS(on)}$  | $I_D = 5\text{A}, V_{GS} = 15\text{V}$     | $T_j = 25^\circ\text{C}$  |         | 240  |      | m $\Omega$    |
|                                               |               |                                            | $T_j = 175^\circ\text{C}$ |         | 249  |      |               |
|                                               |               | $I_D = 5\text{A}, V_{GS} = 18\text{V}$     | $T_j = 25^\circ\text{C}$  |         | 190  | 270  |               |
|                                               |               |                                            | $T_j = 175^\circ\text{C}$ |         | 225  |      |               |
| Zero gate voltage drain current<br>集电极-发射极漏电流 | $I_{DSS}$     | $V_{DS} = 700\text{V}, V_{GS} = 0\text{V}$ |                           |         | 1.0  | 20   | $\mu\text{A}$ |
| Gate to source Leakage current<br>门极-源极漏电流    | $I_{GSS}$     | $V_{DS} = 0\text{V}, V_{GS} = 18\text{V}$  |                           |         |      | 100  | nA            |
| Integrated gate resistor<br>内部门极电阻            | $R_G$         | $f = 1\text{MHz}$                          |                           |         | 3.5  |      | $\Omega$      |

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**Table 4 Dynamic characteristics/动态特性**

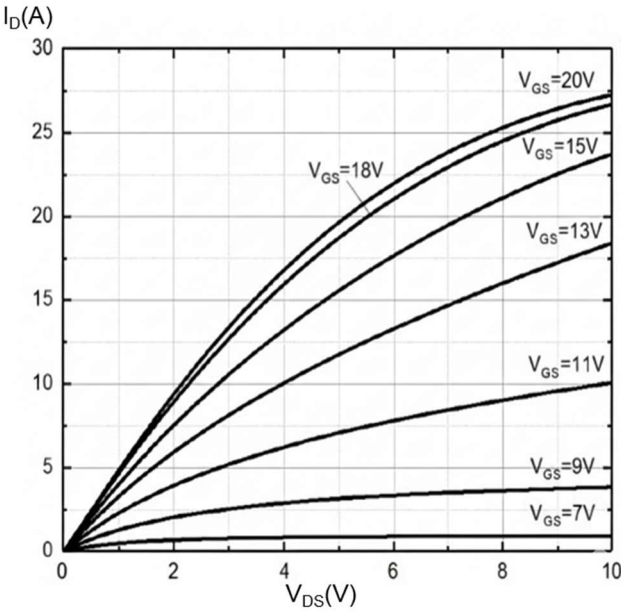
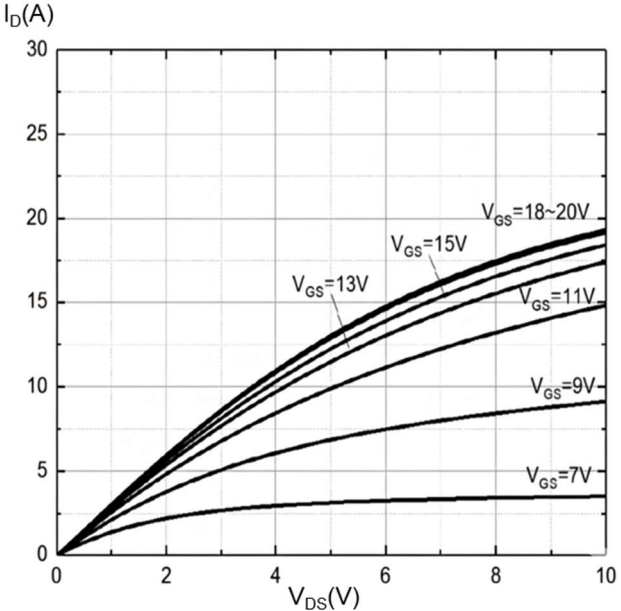
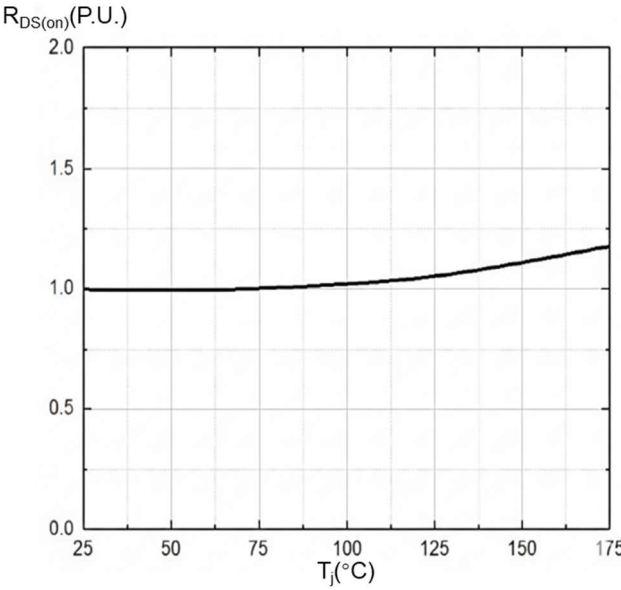
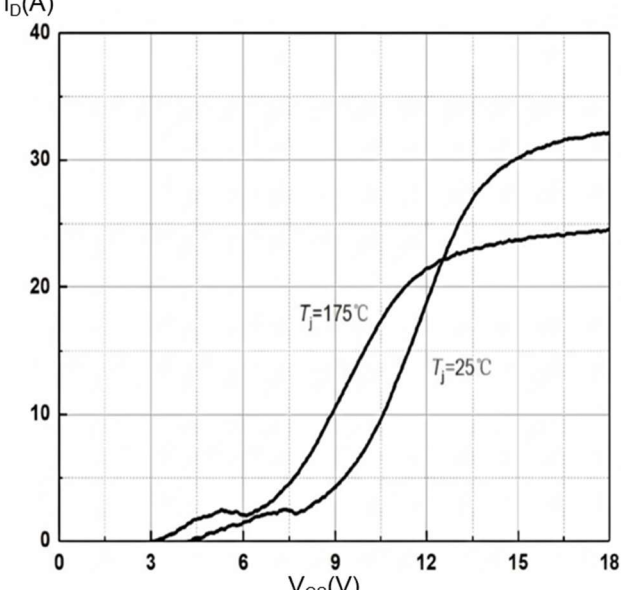
| Parameter<br>参数                        | Symbol<br>符号 | Test conditions<br>测试条件                                                       | Value/值 |      |      | Unit<br>单位 |
|----------------------------------------|--------------|-------------------------------------------------------------------------------|---------|------|------|------------|
|                                        |              |                                                                               | Min.    | Typ. | Max. |            |
| Total gate charge<br>总栅极电荷             | $Q_{G(tot)}$ | $V_{DD}=400V$ ,<br>$I_D=5A$ ,<br>$V_{GS}=-4/18V$                              |         | 17.6 |      | nC         |
| Gate source charge<br>栅-源极电荷           | $Q_{GS}$     |                                                                               |         | 3.7  |      |            |
| Gate-drain charge<br>栅-漏极电荷            | $Q_{GD}$     |                                                                               |         | 7    |      |            |
| Input capacitance<br>输入电容              | $C_{iss}$    | $V_{DS}=600V$ ,<br>$V_{GS}=0V$ ,<br>$f=1MHz$                                  |         | 361  |      | pF         |
| Output capacitance<br>输出电容             | $C_{oss}$    |                                                                               |         | 34   |      |            |
| Reverse transfer capacitance<br>反向传输电容 | $C_{rss}$    |                                                                               |         | 3.5  |      |            |
| Turn-On Delay Time<br>开启延迟时间           | $t_{d(on)}$  | $V_{DD}=400V$ ,<br>$I_D=5A$ ,<br>$V_{GS}=-4/18V$ ,<br>$R_{G(ext)}=20\Omega$ , |         | 2    |      | ns         |
| Rise time<br>上升时间                      | $t_r$        |                                                                               |         | 19   |      |            |
| Turn-Off Delay Time<br>关闭延迟时间          | $t_{d(off)}$ |                                                                               |         | 14   |      |            |
| Turn-Off Fall Time<br>下降时间             | $t_f$        |                                                                               |         | 11   |      |            |
| Turn-on switch loss<br>单次开启损耗          | $E_{on}$     |                                                                               |         | 31   |      | $\mu J$    |
| Turn-off switch loss<br>单次关闭损耗         | $E_{off}$    |                                                                               |         | 13   |      |            |

**Table 5 Reverse diode characteristics/体二极管反向特性**

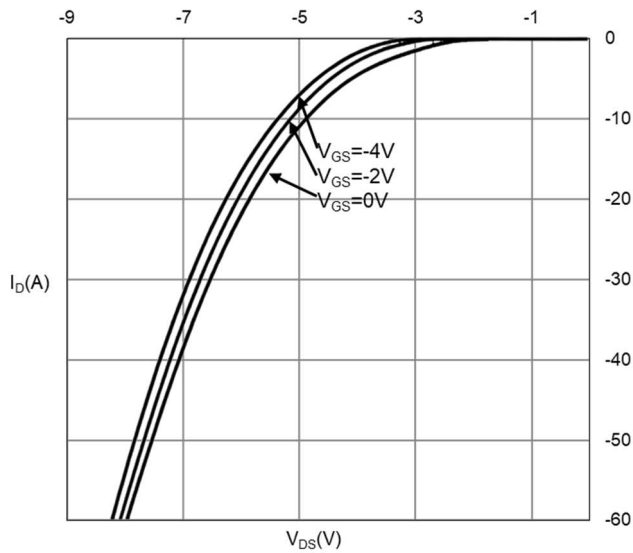
| Parameter<br>参数                                        | Symbol<br>符号 | Test conditions<br>测试条件                               | Value/值 |      |      | Unit<br>单位 |
|--------------------------------------------------------|--------------|-------------------------------------------------------|---------|------|------|------------|
|                                                        |              |                                                       | Min.    | Typ. | Max. |            |
| Drain-source reverse voltage<br>体二极管正向压降               | $V_{SD}$     | $I_S=2.5A, V_{GS}=-4V$                                |         | 4.2  |      | V          |
| MOSFET forward recovery time<br>MOSFET正向恢复时间           | $t_{fr}$     | $V_{DS}=400V$ ,<br>$I_S=5A$ ,<br>$-di/dt=1000A/\mu s$ |         | 28   |      | ns         |
| MOSFET forward recovery charge<br>MOSFET正向恢复电荷         | $Q_{fr}$     |                                                       |         | 38   |      | nC         |
| MOSFET peak forward recovery current<br>MOSFET正向恢复峰值电流 | $I_{frm}$    |                                                       |         | 3.5  |      | A          |



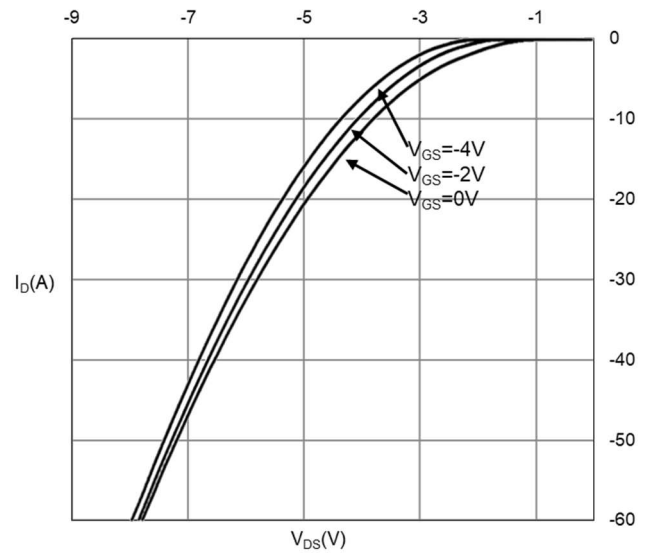
4. Electrical characteristics diagrams  
电气特性图表

|                                                                                                                                                                                                               |                                                                                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Typ.Output characteristic/典型输出特性<br/><math>I_D=f(V_{DS}); T_J=25^{\circ}\text{C}</math></p>                              | <p>Typ.Output characteristic/典型输出特性<br/><math>I_D=f(V_{DS}); T_J=175^{\circ}\text{C}</math></p>                        |
| <p>Typ.Drain-source on-state resistance/典型漏源导通电阻<br/><math>R_{DS(on)}=f(T_J); I_D=5\text{A}, V_{GS}=18\text{V}</math></p>  | <p>Typ.Transfer characteristics/典型传输特性<br/><math>I_D=f(V_{GS}); V_{GS}=18\text{V}, T_J=25^{\circ}\text{C}</math></p>  |

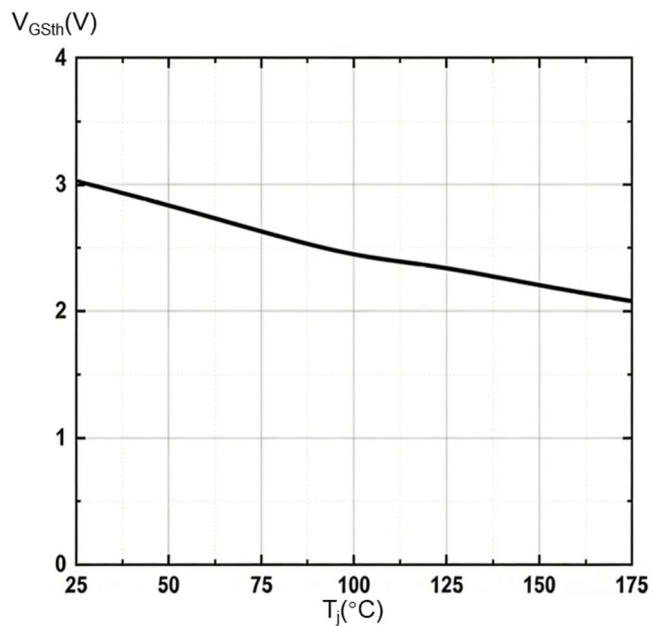
**Typ.Reverse drain current characteristics/典型二极管特性**  
 $I_D=f(V_{DS}); T_J=25^{\circ}\text{C}$



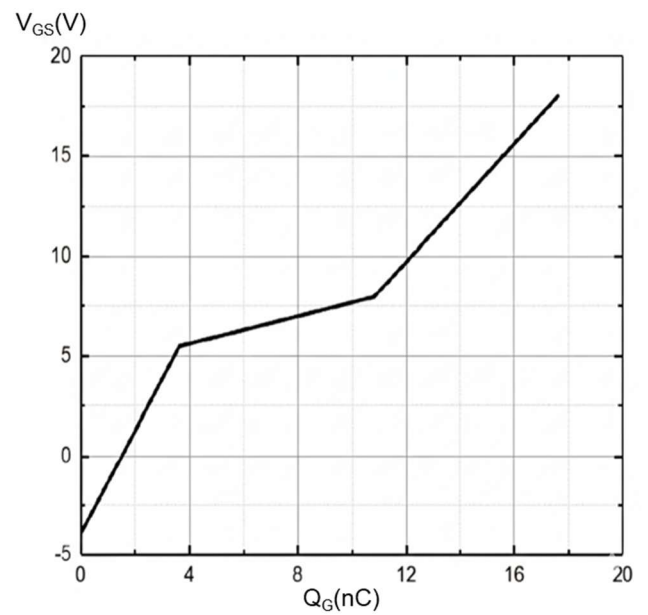
**Typ.Reverse drain current characteristics/典型二极管特性**  
 $I_D=f(V_{DS}); T_J=175^{\circ}\text{C}$



**Typ.Gate threshold voltage/典型门级阈值电压结温特性**  
 $V_{GSth}=f(T_J); I_D=2.2\text{mA}, V_{DS}=V_{GS}$



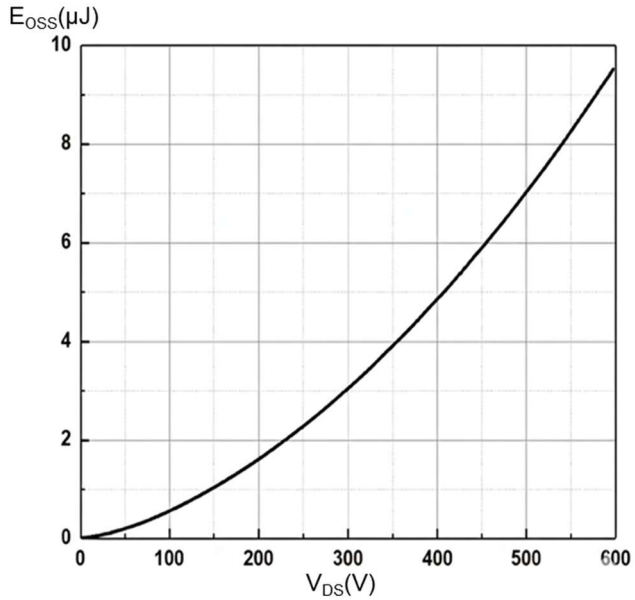
**Typ.Gate charge/典型门级电荷**  
 $V_{GS}=f(Q_G); I_{DS}=5\text{A}, V_{DS}=400\text{V}, T_J=25^{\circ}\text{C}$



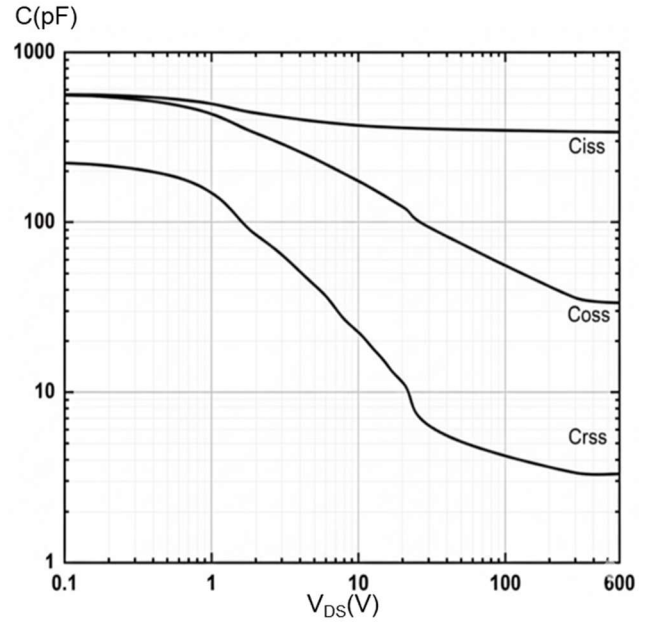
# 700V N-Channel SiC MOSFET HC190N070S1E



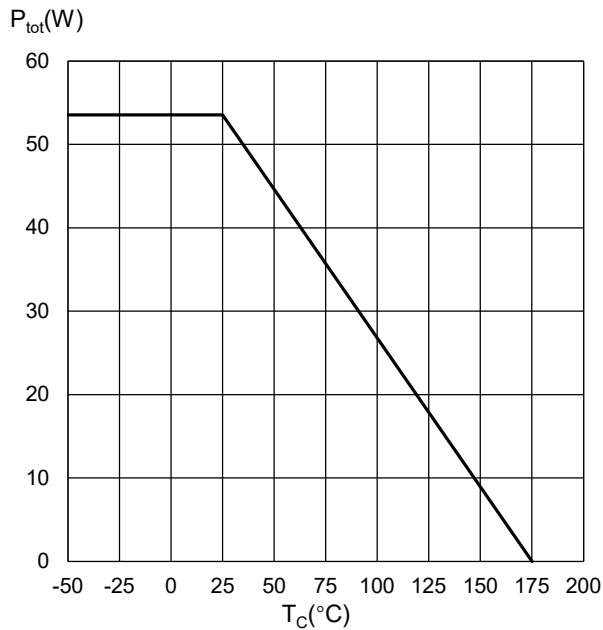
**Typ.Coss stored energy/典型Coss存储能量**  
 $E_{oss}=f(V_{DS}); T_J=25^{\circ}\text{C}$



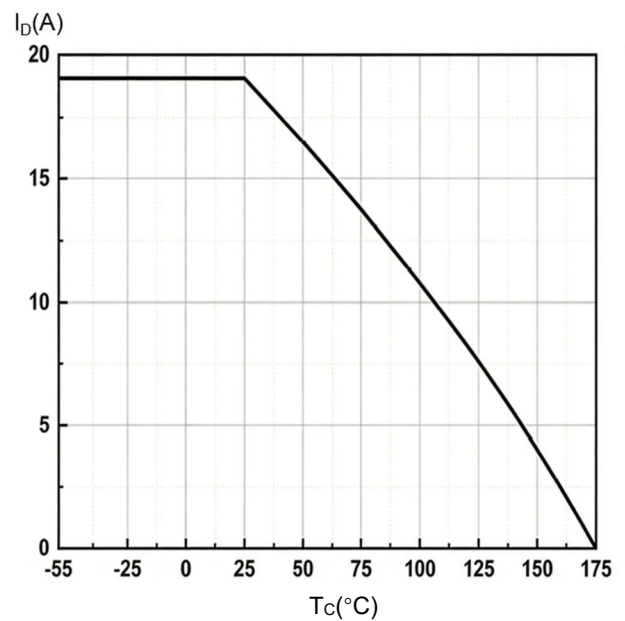
**Typ.Capacitances/典型电容特性**  
 $C=f(V_{DS}); V_{AC}=25\text{mV}, f=1\text{MHz}, T_J=25^{\circ}\text{C}$



**Power dissipation/耗散功率**  
 $P_{tot}=f(T_c); @R_{th(j-c).typ}$



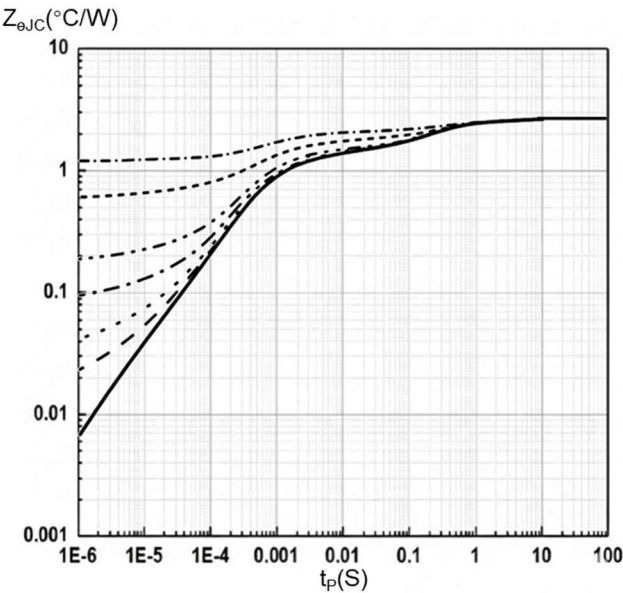
**Continuous Drain Current/连续漏电流与壳温**  
 $I_D=f(T_c); T_J \leq 175^{\circ}\text{C}$



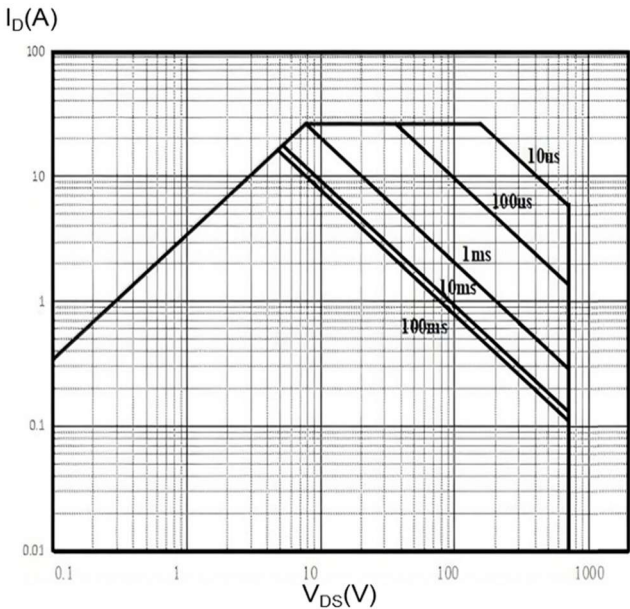




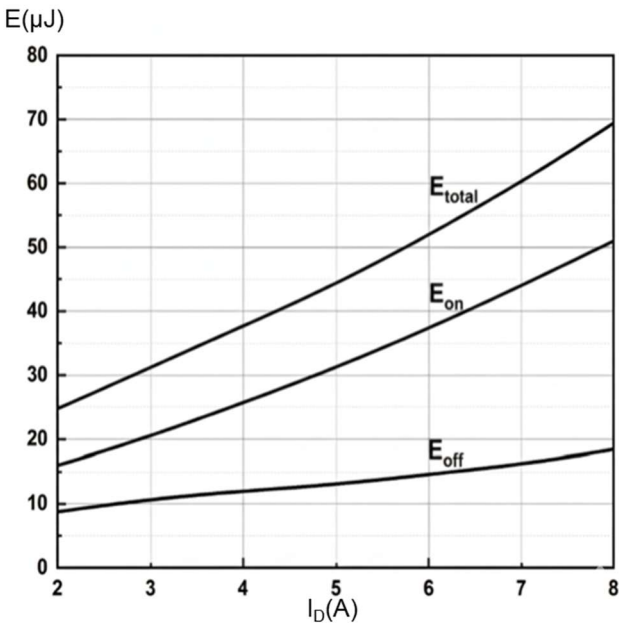
Transient thermal impedance/热阻特性  
 $Z_{\theta JC}=f(t_p)$ ; ( $R_{th(j-c),typ}$ )



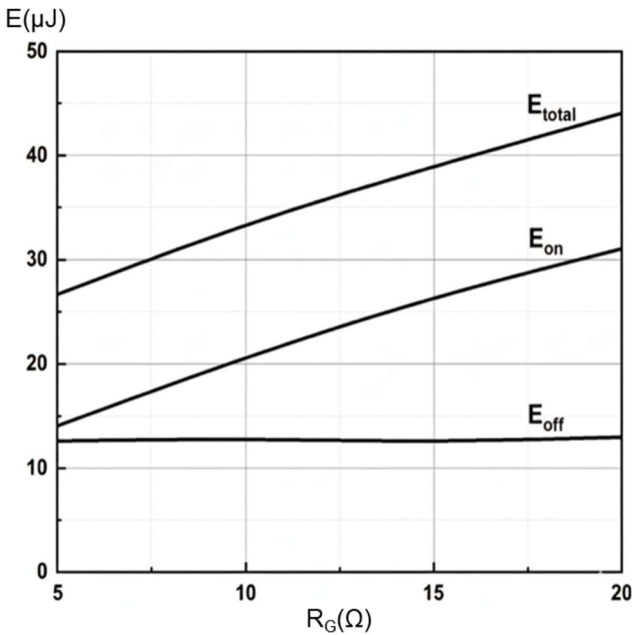
Safe operating area/安全工作区  
 $I_D=f(V_{DS})$



Typ.Switching losses vs current /动态损耗-电流特性  
 $E=f(I_D)$ ;  $V_{GS}=-4/18V, R_G=20\Omega, V_{DD}=400V, T_j=25^\circ C$



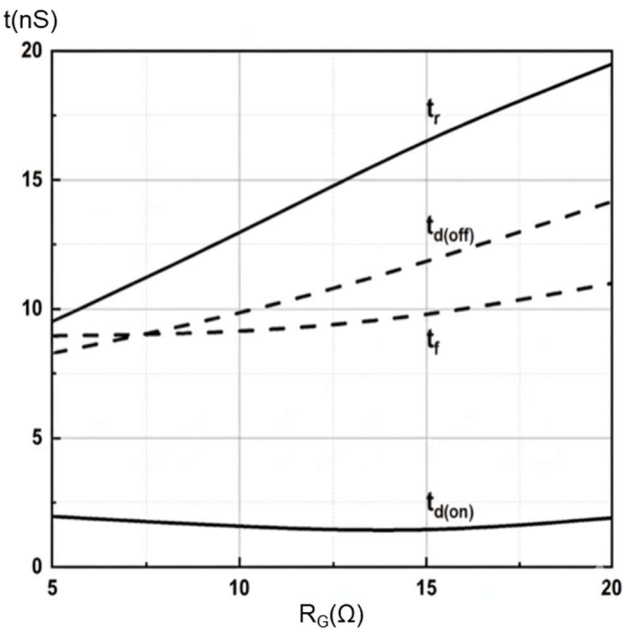
Typ.Switching losses vs resistance/动态损耗-门级电阻特性  
 $E=f(R_G)$ ;  $V_{GS}=-4/18V, V_{DD}=400V, I_D=5A, T_j=25^\circ C$



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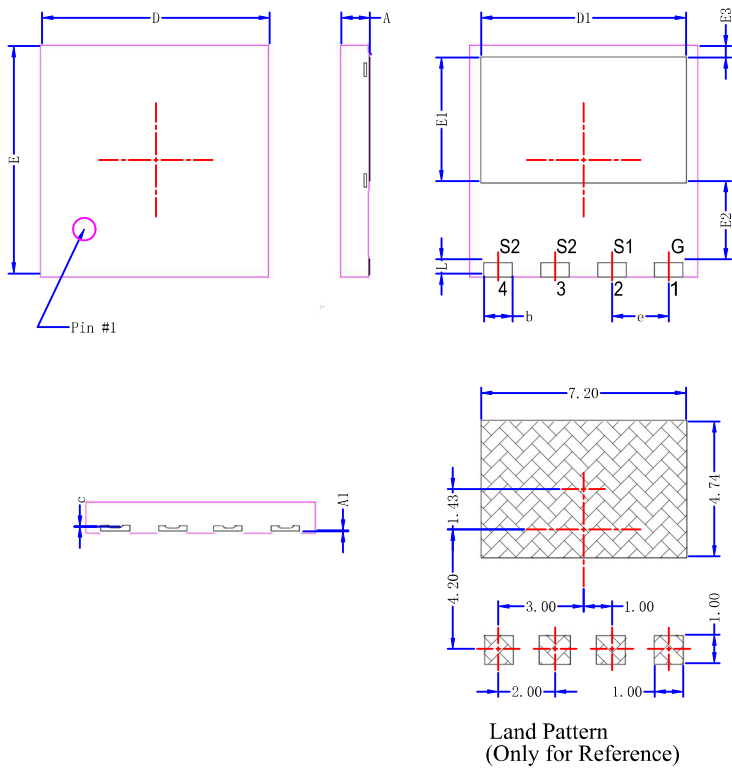
Typ.Switching times vs resistance/开关时间-门级电阻特性  
 $t=f(R_G)$ ;  $V_{GS}=-4/18V$ ,  $V_{DD}=400V$ ,  $I_D=5A$ ,  $T_J=25^{\circ}C$





5. Package outline  
封装外形

Figure 1. Outline DFN8080, dimensions in mm/DFN8080外形尺寸（毫米）



| SYMBOL | DIMENSIONS |      |      |
|--------|------------|------|------|
|        | MIN.       | NOM. | MAX. |
| A      | 0.90       | 1.00 | 1.10 |
| A1     | 0.00       | --   | 0.05 |
| b      | 0.90       | 1.00 | 1.10 |
| c      | 0.10       | 0.20 | 0.30 |
| D      | 7.90       | 8.00 | 8.10 |
| D1     | 7.10       | 7.20 | 7.30 |
| E      | 7.90       | 8.00 | 8.10 |
| E1     | 4.25       | 4.35 | 4.45 |
| E2     | 2.65       | 2.75 | 2.85 |
| E3     | 0.30       | 0.40 | 0.50 |
| e      | 2.00 BSC   |      |      |
| L      | 0.40       | 0.50 | 0.60 |

- NOTES:
- Package body sizes exclude mold flash
- 注:
- 封装本体尺寸不包括模具飞边



6. Revision history

Table 6 Date and version number/日期与版本号

| Date日期     | Revision版本 | Changes更改内容             |
|------------|------------|-------------------------|
| 2025-12-05 | Rev.G1.0   | Target Datasheet（目标规格书） |

7. Matters needing attention

Appendix 1. Important Technical Guidance, Application Policy, and Copyright Notice/重要技术指南、应用规范与版权声明

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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