

## 英飞凌碳化硅 MOSFET

### 英飞凌CoolSiC™ MOSFET 750 V G2

750 V CoolSiC™ MOSFET 采用英飞凌强大的第 2 代碳化硅沟槽技术，提供无与伦比的性能、卓越的可靠性和极佳的易用性。它能够实现经济高效且简化的设计，满足不断增长的系统和市场需求。

#### 特性

- 高度稳健的 750 V 技术，100% 经过雪崩测试
- 同类最佳的  $R_{DS(on)} \times Q_{fr}$
- 出色的  $R_{DS(on)} \times Q_{oss}$  和  $R_{DS(on)} \times Q_G$
- 低  $C_{rss}/C_{iss}$  和高  $V_{GS(th)}$  的独特组合
- 英飞凌专有芯片贴装技术
- 驱动器源引脚可用

#### 优点

- 增强了 500 V 以上总线电压的稳健性和可靠性
- 硬开关效率卓越
- 软开关拓扑中的开关频率更高
- 单极栅极驱动的抗寄生导通稳健性
- 一流的散热性能
- 通过改进栅极控制减少开关损耗

#### 潜在应用

- 电动汽车充电基础设施
- 太阳能光伏逆变器和不间断电源
- 储能和电池化成
- 通信和服务器 SMPS
- 固态继电器和断路器

#### 产品验证

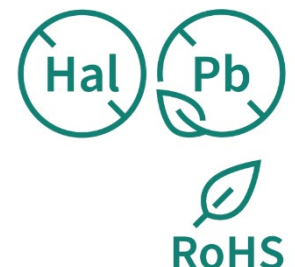
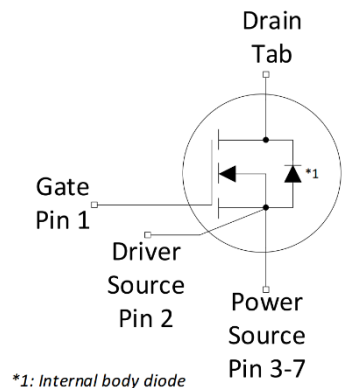
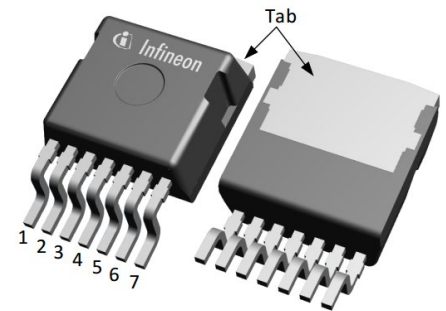
通过 JEDEC 相关测试。

请注意：源引脚和驱动器源引脚不可互换。交换可能会导致故障。对于并联 MOSFET 器件，通常建议将栅极电阻串联在驱动源而非栅极上。

表 1 主要性能参数

| Parameter                         | Value | Unit |
|-----------------------------------|-------|------|
| $V_{DSS}$ over full $T_{j,range}$ | 750   | V    |
| $R_{DS(on),typ}$                  | 11.0  | mΩ   |
| $R_{DS(on),max}$                  | 13.8  | mΩ   |
| $Q_{G,typ}$                       | 106   | nC   |
| $I_{D,pulse}$                     | 533   | A    |
| $Q_{oss,typ} @ 500 V$             | 226   | nC   |
| $E_{oss,typ} @ 500 V$             | 39    | μJ   |

PG-TO263-7



| Part number   | Package    | Marking  | Related links  |
|---------------|------------|----------|----------------|
| IMBG75R011M2H | PG-TO263-7 | 75R011M2 | see Appendix A |

本数据手册的原文使用英文撰写。为方便起见，英飞凌提供了译文；由于翻译过程中可能使用了自动化工具，英飞凌不保证译文的准确性。为确认准确性，请务必访问 [infineon.com](https://www.infineon.com) 参考最新的英文版本（控制文档）。

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## 1 最大额定值

除非另有规定， $T_j = 25^\circ\text{C}$ 。

注：为了获得最佳的使用寿命和可靠性，英飞凌建议运行条件不超过本数据手册中所述最大额定值的 80%。不建议采用“线性模式”运行。如需评估潜在的“线性模式”运行，请联系英飞凌销售办事处。

表 2 最大额定值

| Parameter                                             | Symbol           | Values |      |      | Unit             | Note / Test condition                                                |
|-------------------------------------------------------|------------------|--------|------|------|------------------|----------------------------------------------------------------------|
|                                                       |                  | Min.   | Typ. | Max. |                  |                                                                      |
| Drain-source voltage                                  | $V_{\text{DSS}}$ | -      | -    | 750  | V                | static, $T_j = -55^\circ\text{C}$ to $175^\circ\text{C}$             |
| Continuous DC drain current <sup>1)</sup>             | $I_{\text{DDC}}$ | -      | -    | 129  | A                | $T_c = 25^\circ\text{C}$                                             |
|                                                       |                  |        |      | 91   |                  | $T_c = 100^\circ\text{C}$                                            |
| Peak drain current <sup>2)</sup>                      | $I_{\text{DM}}$  | -      | -    | 533  | A                | $T_c = 25^\circ\text{C}$ , $V_{\text{GS}} = 18\text{ V}$             |
| Avalanche energy, single pulse                        | $E_{\text{AS}}$  | -      | -    | 507  | mJ               | $I_D = 19.0\text{ A}$ , $V_{\text{DD}} = 50\text{ V}$ ; see table 11 |
| Avalanche energy, repetitive                          | $E_{\text{AR}}$  |        |      | 2.62 |                  |                                                                      |
| Avalanche current, single pulse                       | $I_{\text{AS}}$  | -      | -    | 19.0 | A                | -                                                                    |
| MOSFET $dv/dt$ ruggedness                             | $dv/dt$          | -      | -    | 200  | V/ns             | $V_{\text{DS}} = 0 \dots 500\text{ V}$                               |
| Gate source voltage (static) <sup>3)</sup>            | $V_{\text{GS}}$  | -7     | -    | 23   | V                | -                                                                    |
| Gate source voltage (transient)                       | $V_{\text{GS}}$  | -11    | -    | 25   | V                | $t_p \leq 500\text{ ns}$ , duty cycle $\leq 1\%$                     |
| Power dissipation                                     | $P_{\text{tot}}$ | -      | -    | 416  | W                | $T_c = 25^\circ\text{C}$                                             |
| Storage temperature                                   | $T_{\text{stg}}$ | -55    | -    | 150  | $^\circ\text{C}$ | -                                                                    |
| Operating junction temperature                        | $T_j$            |        |      | 175  |                  |                                                                      |
| Extended operating junction temperature <sup>4)</sup> | $T_j$            | -      | -    | 200  | $^\circ\text{C}$ | $\leq 100\text{ h}$ in the application lifetime                      |
| Mounting torque                                       | -                | -      | -    | n.a  | Ncm              | -                                                                    |
| Continuous reverse drain current <sup>1)</sup>        | $I_{\text{SDC}}$ | -      | -    | 129  | A                | $V_{\text{GS}} = 18\text{ V}$ , $T_c = 25^\circ\text{C}$             |
|                                                       |                  |        |      | 81   |                  | $V_{\text{GS}} = 0\text{ V}$ , $T_c = 25^\circ\text{C}$              |
| Peak reverse drain current <sup>2)</sup>              | $I_{\text{SM}}$  | -      | -    | 533  | A                | $T_c = 25^\circ\text{C}$ , $t_p \leq 250\text{ ns}$                  |
|                                                       |                  |        |      | 152  |                  | $T_c = 25^\circ\text{C}$                                             |
| Insulation withstand voltage                          | $V_{\text{ISO}}$ | -      | -    | n.a. | V                | $V_{\text{rms}}$ , $T_c = 25^\circ\text{C}$ , $t = 1\text{ min}$     |

1) 受  $T_{j,\text{max}}$  限制。

2) 脉冲宽度  $t_{\text{pulse}}$  受  $T_{j,\text{max}}$  限制。

3) 应用设计中的最大栅极源电压应符合 IPC-9592B 的规定。

4) 温度循环次数高达 7500 次，其中最大  $\Delta T$  限制为 100 K。

## 2 热特性

表 3 热特性

| Parameter                                       | Symbol        | Values |      |      | Unit | Note / Test condition                                                                                    |
|-------------------------------------------------|---------------|--------|------|------|------|----------------------------------------------------------------------------------------------------------|
|                                                 |               | Min.   | Typ. | Max. |      |                                                                                                          |
| Thermal resistance, junction - case             | $R_{th(j-c)}$ | -      | 0.26 | 0.36 | °C/W | Not subject to production test.<br>Parameter verified by design/characterization according to JESD51-14. |
| Soldering temperature, reflow soldering allowed | $T_{sold}$    | -      | -    | 260  | °C   | reflow MSL1                                                                                              |

### 3 工作范围

表 4 工作范围

| Parameter                    | Symbol        | Values |      |      | Unit | Note / Test condition |
|------------------------------|---------------|--------|------|------|------|-----------------------|
|                              |               | Min.   | Typ. | Max. |      |                       |
| Recommended turn-on voltage  | $V_{GS(on)}$  | -      | 18   | -    | V    | -                     |
| Recommended turn-off voltage | $V_{GS(off)}$ |        | 0    |      |      |                       |

## 4 电气特性

除非另有规定,  $T_j = 25^\circ\text{C}$

表 5 静态特性

| Parameter                                      | Symbol        | Values |      |      | Unit          | Note / Test condition                                                 |
|------------------------------------------------|---------------|--------|------|------|---------------|-----------------------------------------------------------------------|
|                                                |               | Min.   | Typ. | Max. |               |                                                                       |
| Drain-source breakdown voltage <sup>5)</sup>   | $V_{(BR)DSS}$ | 840    | -    | -    | V             | $V_{GS} = 0\text{ V}, I_D = 1.78\text{ mA}$                           |
| Gate threshold voltage <sup>6)</sup>           | $V_{GS(th)}$  | 3.5    | 4.5  | 5.6  | V             | $V_{DS} = V_{GS}, I_D = 17.8\text{ mA}, T_j = 25^\circ\text{C}$       |
|                                                |               | -      | 3.3  | -    |               | $V_{DS} = V_{GS}, I_D = 17.8\text{ mA}, T_j = 175^\circ\text{C}$      |
| Zero gate voltage drain current                | $I_{DSS}$     | -      | 1    | 75   | $\mu\text{A}$ | $V_{DS} = 750\text{ V}, V_{GS} = 0\text{ V}, T_j = 25^\circ\text{C}$  |
|                                                |               |        | 10   | -    |               | $V_{DS} = 750\text{ V}, V_{GS} = 0\text{ V}, T_j = 175^\circ\text{C}$ |
| Gate-source leakage current                    | $I_{GSS}$     | -      | -    | 100  | nA            | $V_{GS} = 23\text{ V}, V_{DS} = 0\text{ V}, T_j = 25^\circ\text{C}$   |
|                                                |               |        |      | -100 |               | $V_{GS} = -7\text{ V}, V_{DS} = 0\text{ V}, T_j = 25^\circ\text{C}$   |
| Forward transconductance                       | $g_{fs}$      | -      | 48   | -    | S             | $I_D = 80.9\text{ A}, V_{DS} = 20\text{ V}$                           |
| Drain-source on-state resistance               | $R_{DS(on)}$  | -      | 14.0 | -    | m $\Omega$    | $V_{GS} = 15\text{ V}, I_D = 80.9\text{ A}, T_j = 25^\circ\text{C}$   |
|                                                |               |        | 11.0 | 13.8 |               | $V_{GS} = 18\text{ V}, I_D = 80.9\text{ A}, T_j = 25^\circ\text{C}$   |
|                                                |               |        | 10.0 | -    |               | $V_{GS} = 20\text{ V}, I_D = 80.9\text{ A}, T_j = 25^\circ\text{C}$   |
| Drain-source on-state resistance <sup>7)</sup> | $R_{DS(on)}$  | -      | 17.5 | 22.0 | m $\Omega$    | $V_{GS} = 18\text{ V}, I_D = 80.9\text{ A}, T_j = 150^\circ\text{C}$  |
| Drain-source on-state resistance               | $R_{DS(on)}$  | -      | 20.0 | -    | m $\Omega$    | $V_{GS} = 18\text{ V}, I_D = 80.9\text{ A}, T_j = 175^\circ\text{C}$  |
| Internal gate resistance                       | $R_{G,int}$   | -      | 1.2  | -    | $\Omega$      | $f = 1\text{ MHz}$                                                    |

5) 作为异常运行条件下的稳健性测量, 不建议用于正常运行。

6) 在  $V_{GS} = +20\text{ V}$  条件下, 经过预处理脉冲后测试。不建议采用“线性模式”运行。如需评估潜在的“线性模式”运行, 请联系英飞凌销售办事处。

7) 由设计规定, 不进行生产测试。

表 6 动态特性

外部寄生元件 (PCB 布局) 对开关行为有显著影响。

必须尽量减少杂散电感和耦合电容。

如需布局建议, 请使用提供的应用笔记或联系英飞凌销售办事处。

| Parameter                                                  | Symbol      | Values |      |      | Unit | Note / Test condition                                                            |
|------------------------------------------------------------|-------------|--------|------|------|------|----------------------------------------------------------------------------------|
|                                                            |             | Min.   | Typ. | Max. |      |                                                                                  |
| Input capacitance                                          | $C_{iss}$   | -      | 3689 | -    | pF   | $V_{GS} = 0\text{ V}, V_{DS} = 500\text{ V}, f = 250\text{ kHz}$                 |
| Reverse transfer capacitance                               | $C_{rss}$   |        | 19   | -    |      |                                                                                  |
| Output capacitance <sup>8)</sup>                           | $C_{oss}$   |        | 245  | 318  |      |                                                                                  |
| Output charge <sup>8)</sup>                                | $Q_{oss}$   | -      | 226  | 294  | nC   | calculation based on $C_{oss}$                                                   |
| Effective output capacitance, energy related <sup>9)</sup> | $C_{o(er)}$ | -      | 312  | -    | pF   | $V_{GS} = 0\text{ V},$<br>$V_{DS} = 0 \dots 500\text{ V}$                        |
| Effective output capacitance, time related <sup>10)</sup>  | $C_{o(tr)}$ | -      | 452  | -    | pF   | $I_D = \text{constant}, V_{GS} = 0\text{ V},$<br>$V_{DS} = 0 \dots 500\text{ V}$ |

表 6 动态特性

外部寄生元件（PCB 布局）对开关行为有显著影响。

必须尽量减少杂散电感和耦合电容。

如需布局建议，请使用提供的应用笔记或联系英飞凌销售办事处。

| Parameter                                | Symbol       | Values |      |      | Unit          | Note / Test condition                                                                                                                                          |
|------------------------------------------|--------------|--------|------|------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                          |              | Min.   | Typ. | Max. |               |                                                                                                                                                                |
| Turn-on delay time                       | $t_{d(on)}$  | -      | 14   | -    | ns            | $V_{DD} = 500\text{ V}$ , $V_{GS} = 0/18\text{ V}$ ,<br>$I_D = 80.9\text{ A}$ , $R_{G,ext} = 1.8\text{ }\Omega$ ,<br>$L_{stray} = 15\text{ nH}$ ; see table 10 |
| Rise time                                | $t_r$        |        | 14   |      | ns            |                                                                                                                                                                |
| Turn-off delay time                      | $t_{d(off)}$ |        | 31   |      | ns            |                                                                                                                                                                |
| Fall time                                | $t_f$        |        | 8    |      | ns            |                                                                                                                                                                |
| Turn-ON switching losses <sup>11)</sup>  | $E_{on}$     |        | 103  |      | $\mu\text{J}$ |                                                                                                                                                                |
| Turn-OFF switching losses <sup>11)</sup> | $E_{off}$    |        | 137  |      | $\mu\text{J}$ |                                                                                                                                                                |
| Total switching losses <sup>11)</sup>    | $E_{tot}$    |        | 240  |      | $\mu\text{J}$ |                                                                                                                                                                |

8) 最大规格由计算出的六西格玛置信上限定义。

9)  $C_{o(er)}$  是一个固定电容，当  $V_{DS}$  从 0 上升至 500 V 时，其存储能量与  $C_{oss}$  相同

10)  $C_{o(tr)}$  是一个固定电容，当  $V_{DS}$  从 0 上升至 500 V 时，其充电时间与  $C_{oss}$  相同

11) MOSFET 采用半桥配置，无外部二极管。根据 IEC 60747-8 标准，通过特性验证参数。

表 7 栅极电荷特性

| Parameter                     | Symbol       | Values |      |      | Unit | Note / Test condition                                                                   |
|-------------------------------|--------------|--------|------|------|------|-----------------------------------------------------------------------------------------|
|                               |              | Min.   | Typ. | Max. |      |                                                                                         |
| Plateau gate to source charge | $Q_{GS(pl)}$ | -      | 27   | -    | nC   | $V_{DD} = 500\text{ V}$ , $I_D = 80.9\text{ A}$ ,<br>$V_{GS} = 0\text{ to }18\text{ V}$ |
| Gate to drain charge          | $Q_{GD}$     |        | 24   |      |      |                                                                                         |
| Total gate charge             | $Q_G$        |        | 106  |      |      |                                                                                         |

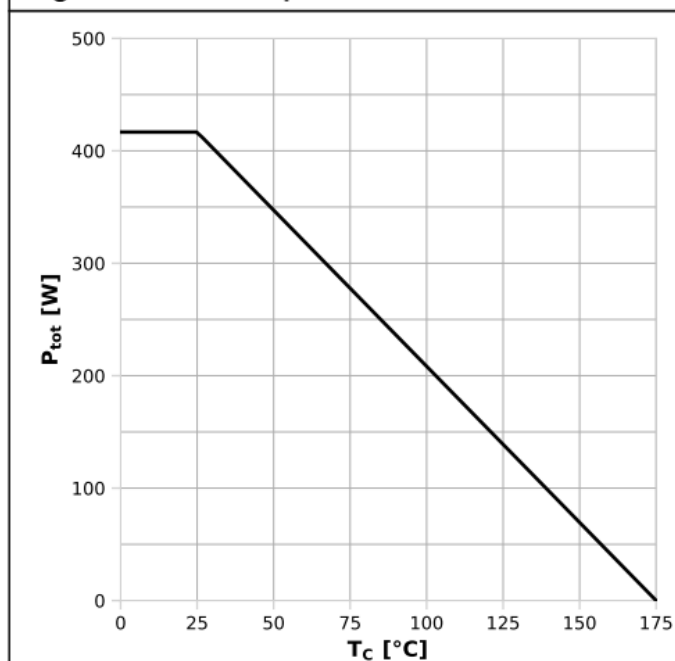
表 8 反向二极管特性

| Parameter                                     | Symbol    | Values |      |      | Unit | Note / Test condition                                                                                    |
|-----------------------------------------------|-----------|--------|------|------|------|----------------------------------------------------------------------------------------------------------|
|                                               |           | Min.   | Typ. | Max. |      |                                                                                                          |
| Drain-source reverse voltage                  | $V_{SD}$  | -      | 4.1  | 5.0  | V    | $V_{GS} = 0\text{ V}$ , $I_S = 80.9\text{ A}$ , $T_J = 25^\circ\text{C}$                                 |
|                                               |           |        | 3.8  | -    |      | $V_{GS} = 0\text{ V}$ , $I_S = 80.9\text{ A}$ , $T_J = 175^\circ\text{C}$                                |
| MOSFET forward recovery time                  | $t_{fr}$  | -      | 16   | -    | ns   | $V_{DD} = 500\text{ V}$ , $I_S = 80.9\text{ A}$ ,<br>$di_S/dt = 4000\text{ A}/\mu\text{s}$ ; see table 9 |
| MOSFET forward recovery charge <sup>12)</sup> | $Q_{fr}$  |        | 311  |      | nC   |                                                                                                          |
| MOSFET peak forward recovery current          | $I_{frm}$ |        | 39   |      | A    |                                                                                                          |

12)  $Q_{fr}$  包括  $Q_{oss}$

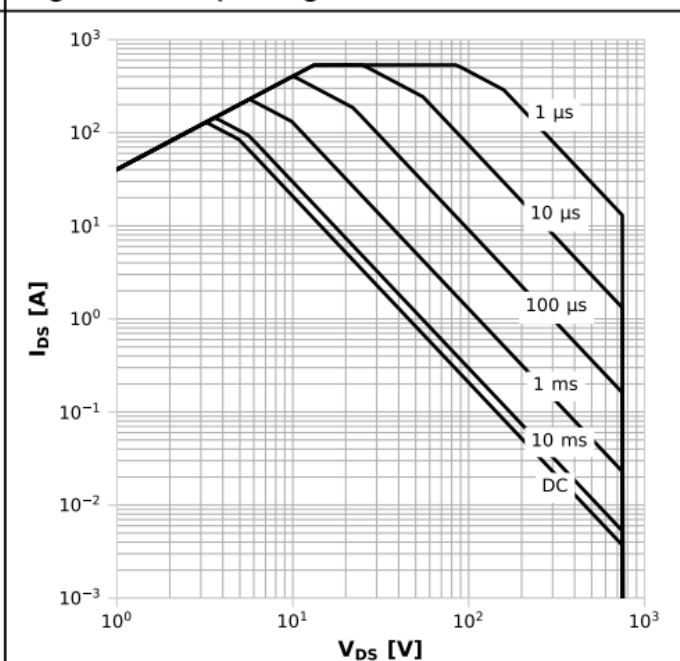
## 5 电气特性图

Diagram 1: Power dissipation



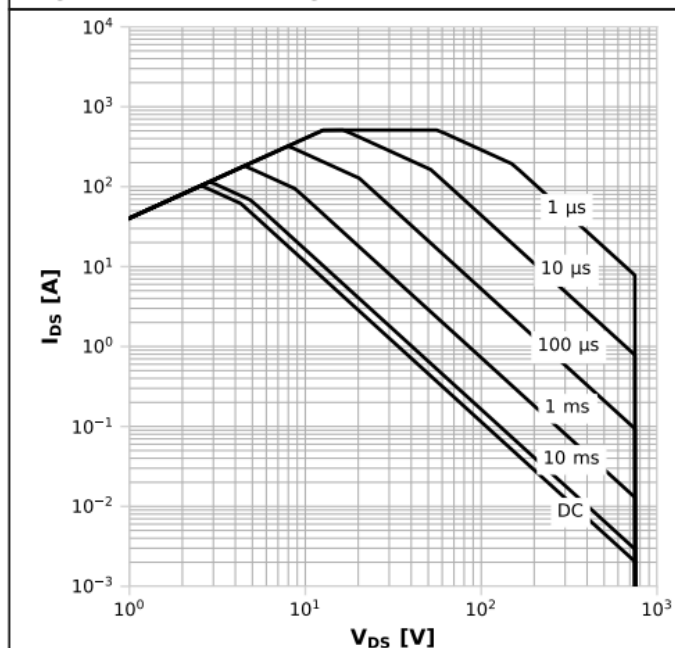
$$P_{\text{tot}} = f(T_c)$$

Diagram 2: Safe operating area



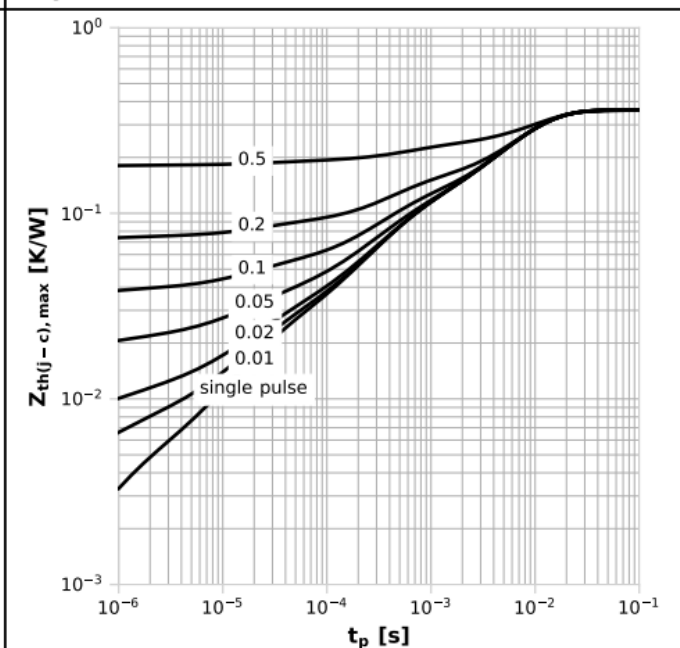
$$I_{\text{DS}} = f(V_{\text{DS}}); T_c = 25^\circ\text{C}; D = 0; \text{parameter: } t_p$$

Diagram 3: Safe operating area



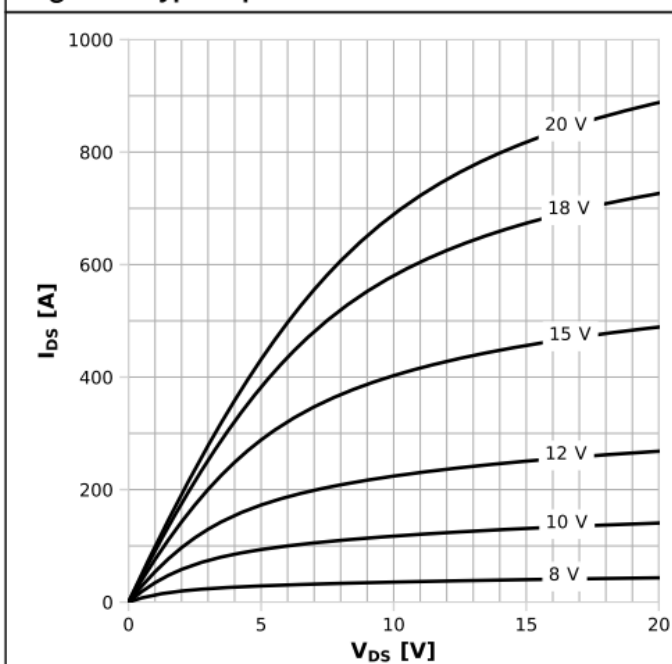
$$I_{\text{DS}} = f(V_{\text{DS}}); T_c = 80^\circ\text{C}; D = 0; \text{parameter: } t_p$$

Diagram 4: Max. transient thermal impedance



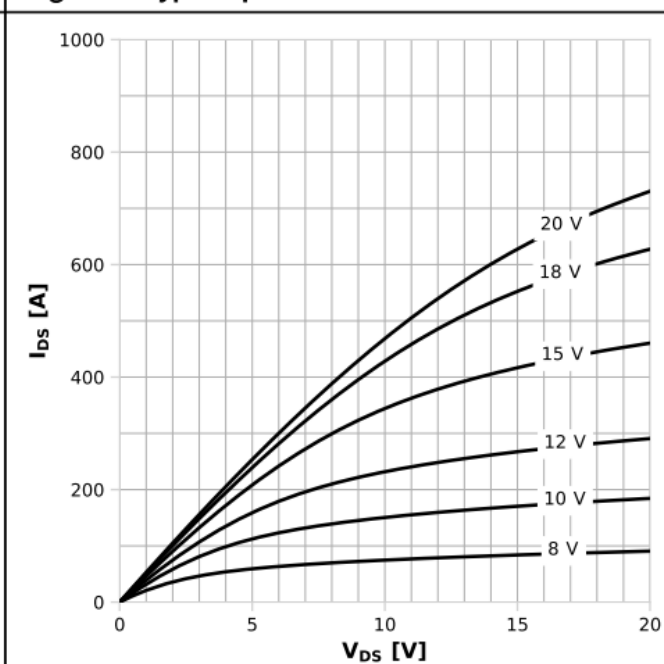
$$Z_{\text{th}(j-c),\text{max}} = f(t_p); \text{parameter: } D = t_p/T$$

Diagram 5: Typ. output characteristics



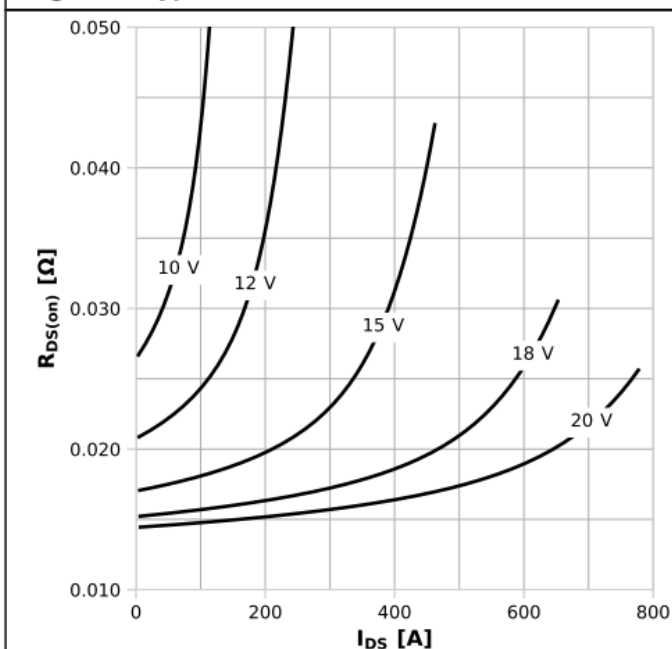
$$I_{DS} = f(V_{DS}); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$$

Diagram 6: Typ. output characteristics



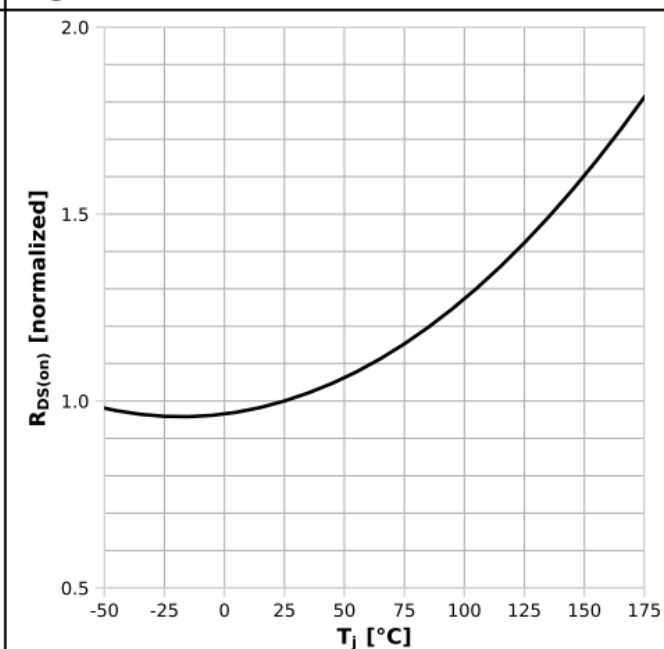
$$I_{DS} = f(V_{DS}); T_j = 175^\circ\text{C}; \text{parameter: } V_{GS}$$

Diagram 7: Typ. drain-source on-state resistance



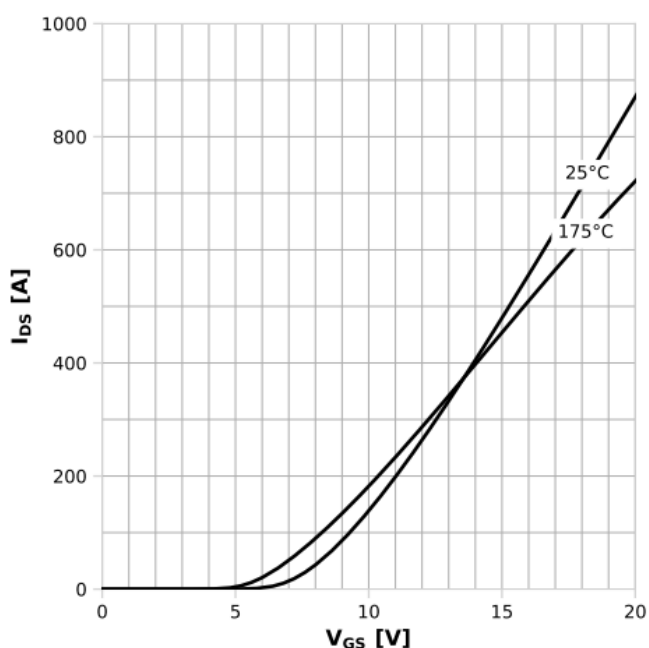
$$R_{DS(on)} = f(I_{DS}); T_j = 125^\circ\text{C}; \text{parameter: } V_{GS}$$

Diagram 8: Drain-source on-state resistance



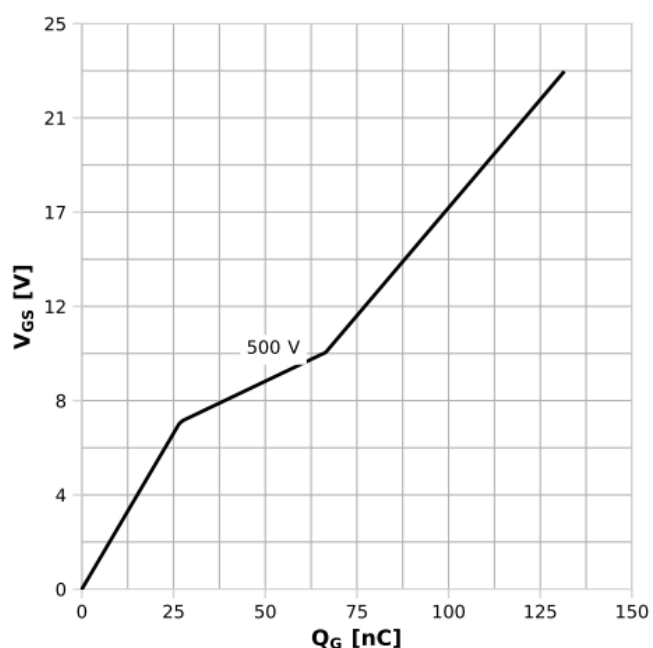
$$R_{DS(on)} = f(T_j); I_D = 80.9 \text{ A}; V_{GS} = 18 \text{ V}$$

Diagram 9: Typ. transfer characteristics



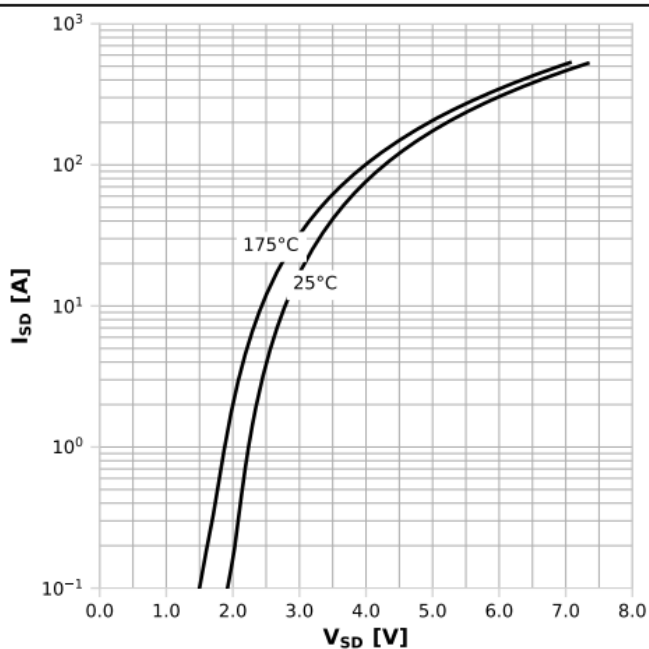
$$I_{DS}=f(V_{GS}); V_{DS}=20\text{ V}; \text{parameter: } T_j$$

Diagram 10: Typ. gate charge



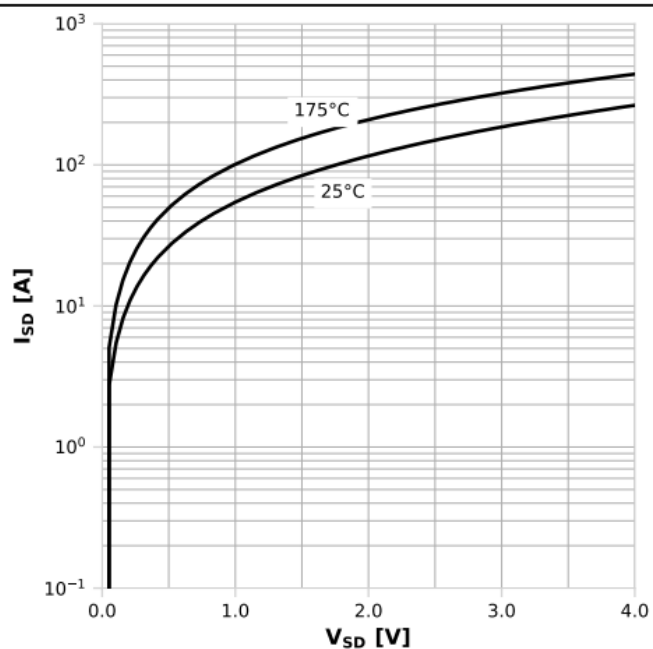
$$V_{GS}=f(Q_G); I_D=80.9\text{ A pulsed}; \text{parameter: } V_{DD}$$

Diagram 11: Typ. reverse drain current characteristics



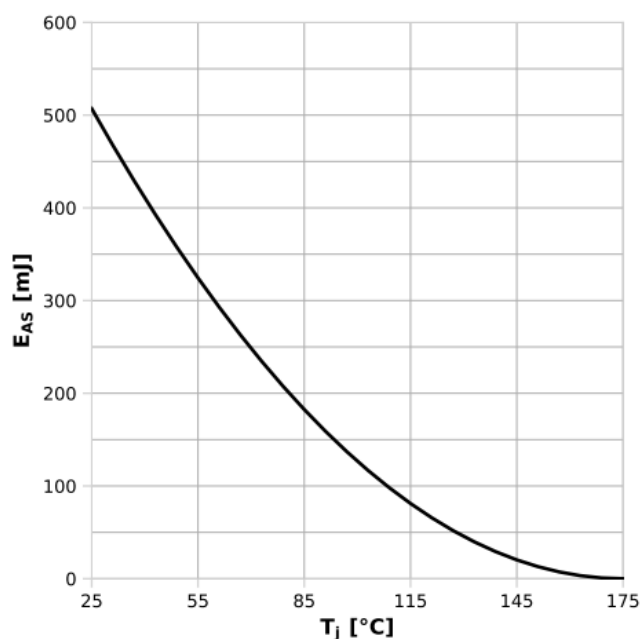
$$I_{SD}=f(V_{SD}); V_{GS}=0\text{ V}; \text{parameter: } T_j$$

Diagram 12: Typ. reverse drain current characteristics



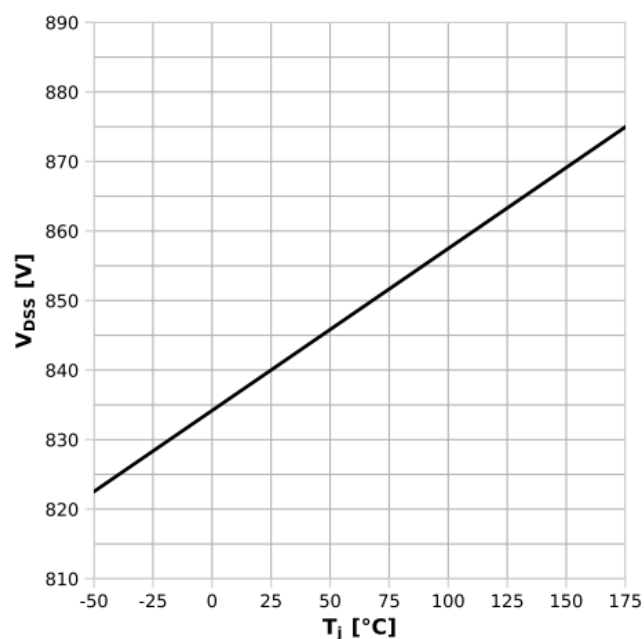
$$I_{SD}=f(V_{SD}); V_{GS}=18\text{ V}; \text{parameter: } T_j$$

Diagram 13: Avalanche energy



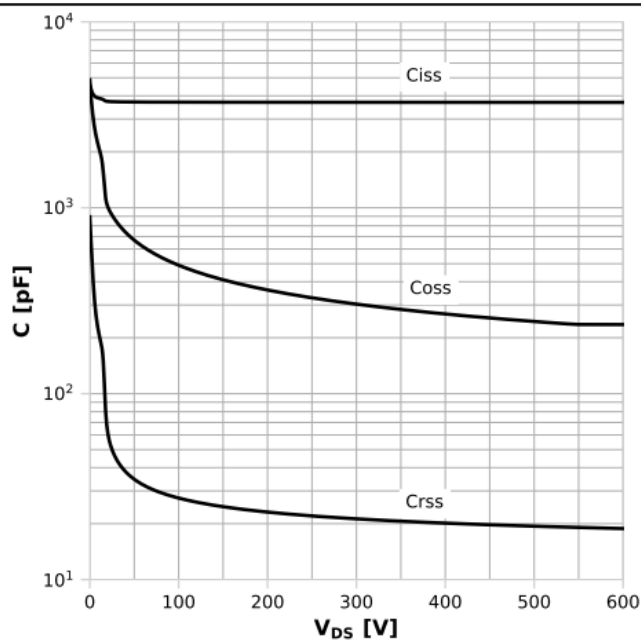
$E_{AS}=f(T_j); I_D=19.0\text{ A}; V_{DD}=50\text{ V}$

Diagram 14: Drain-source breakdown voltage



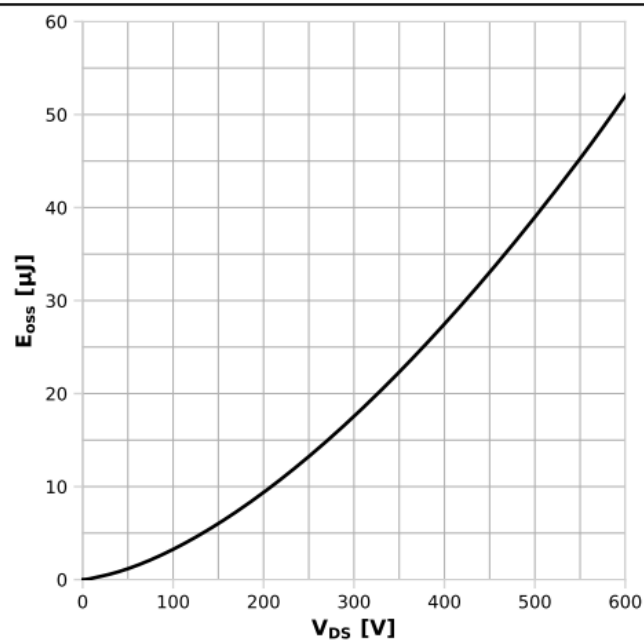
$V_{DSS}=f(T_j); I_D=1.78\text{ mA}$

Diagram 15: Typ. capacitances



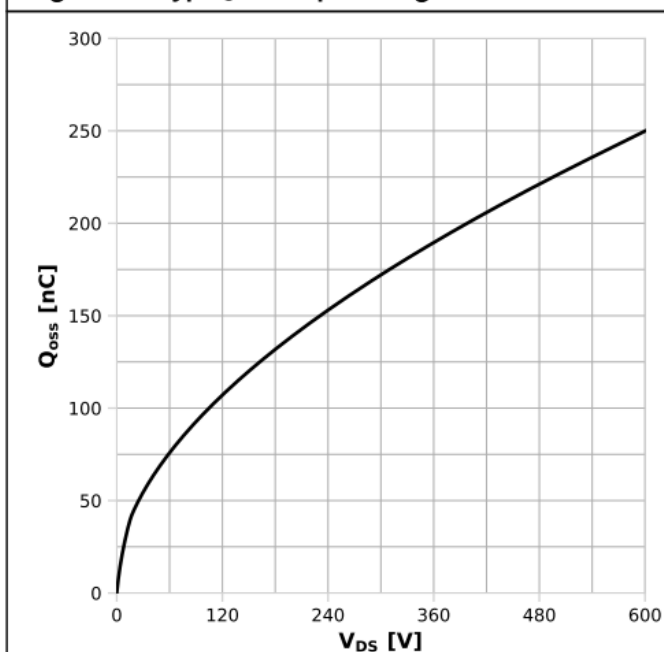
$C=f(V_{DS}); V_{GS}=0\text{ V}; f=250\text{ kHz}$

Diagram 16: Typ. Coss stored energy



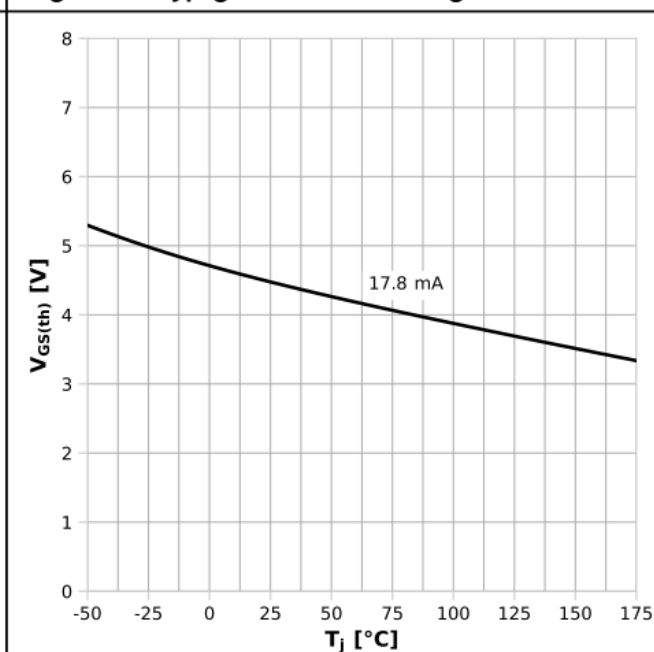
$E_{oss}=f(V_{DS})$

Diagram 17: Typ. Q<sub>oss</sub> output charge



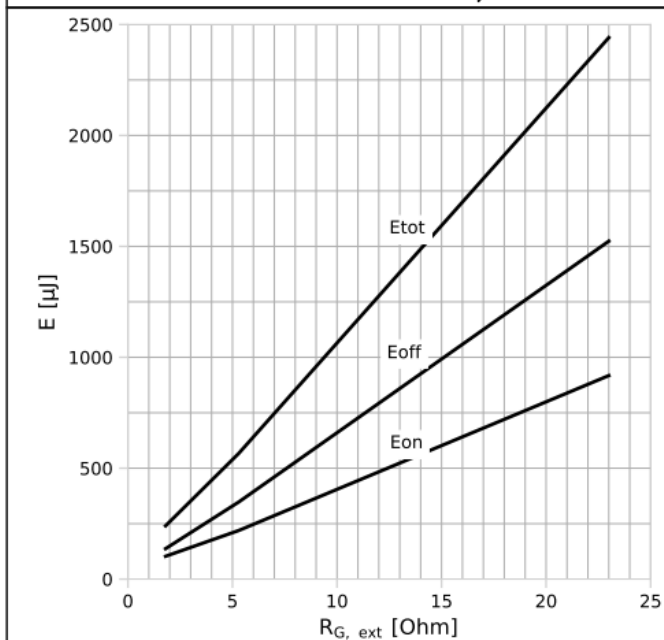
$Q_{oss}=f(V_{DS})$

Diagram 18: Typ. gate threshold voltage



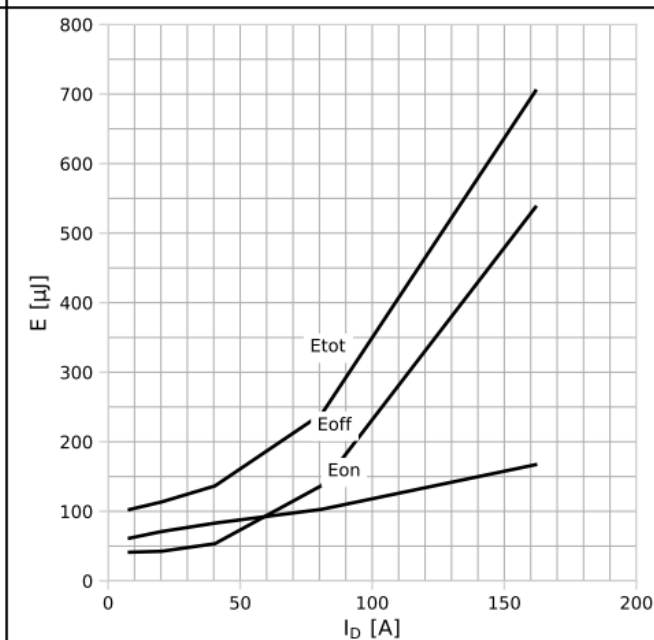
$V_{GS(th)}=f(T_J)$ ,  $V_{GS}=V_{DS}$ ; parameter:  $I_D$

Diagram 19: Typ. Switching Losses vs  $R_{G,ext}$



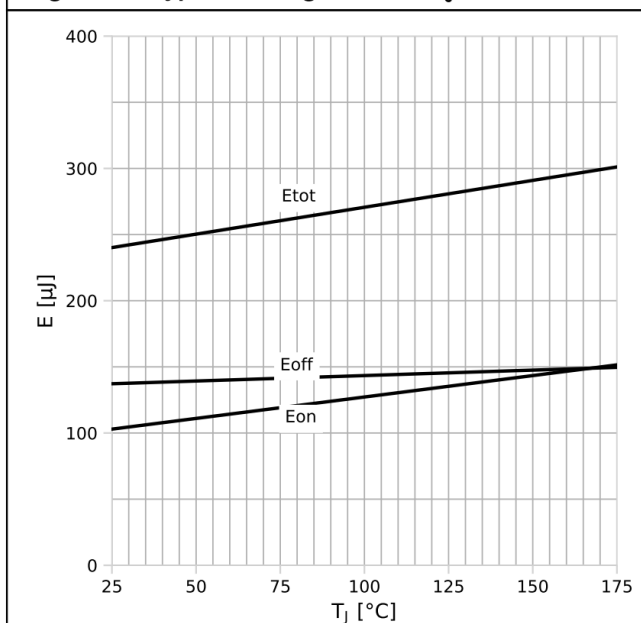
$V_{DD}=500\text{ V}$ ;  $I_D=80.9\text{ A}$ ;  $T_J=25^\circ\text{C}$

Diagram 20: Typ. Switching Losses vs switching current



$V_{DD}=500\text{ V}$ ;  $R_{G,ext}=1.8\text{ Ohm}$ ;  $T_J=25^\circ\text{C}$

**Diagram 21: Typ. Switching Losses vs  $T_J$**



$V_{DD}=500\text{ V}$ ;  $R_{G,ext}=1.8\text{ Ohm}$ ;  $I_D=80.9\text{ A}$

## 6 测试电路

表 9 体二极管特性

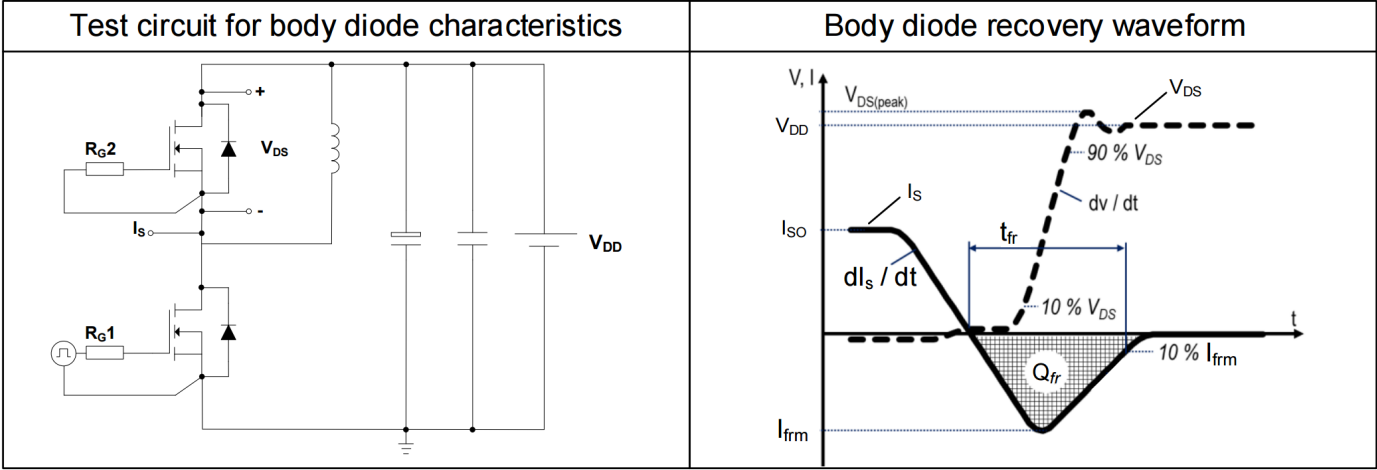


表 10 开关时间

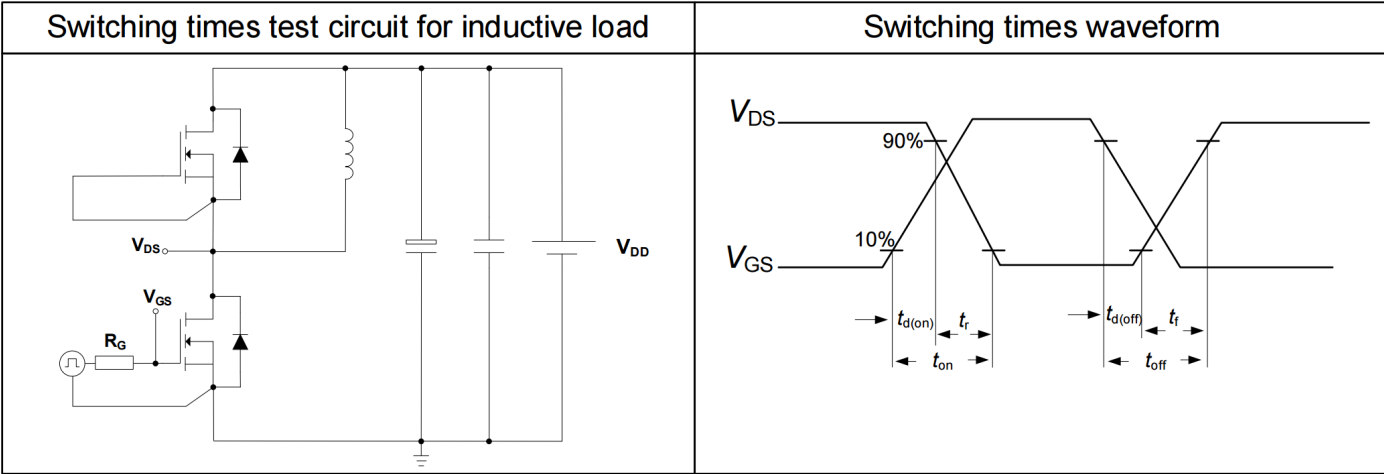
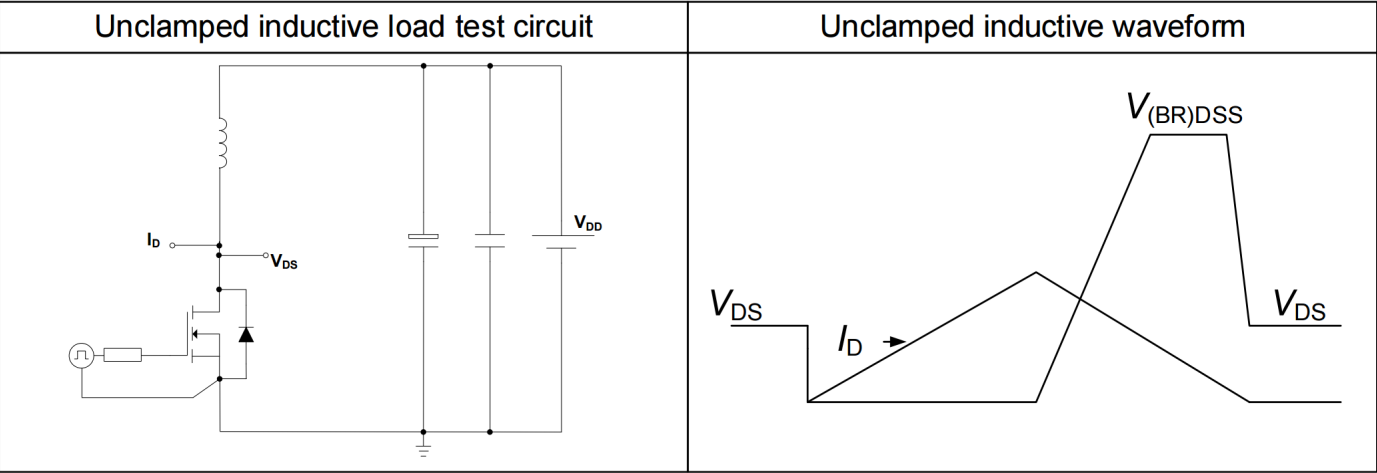


表 11 非钳位感性负载



7 封装外形

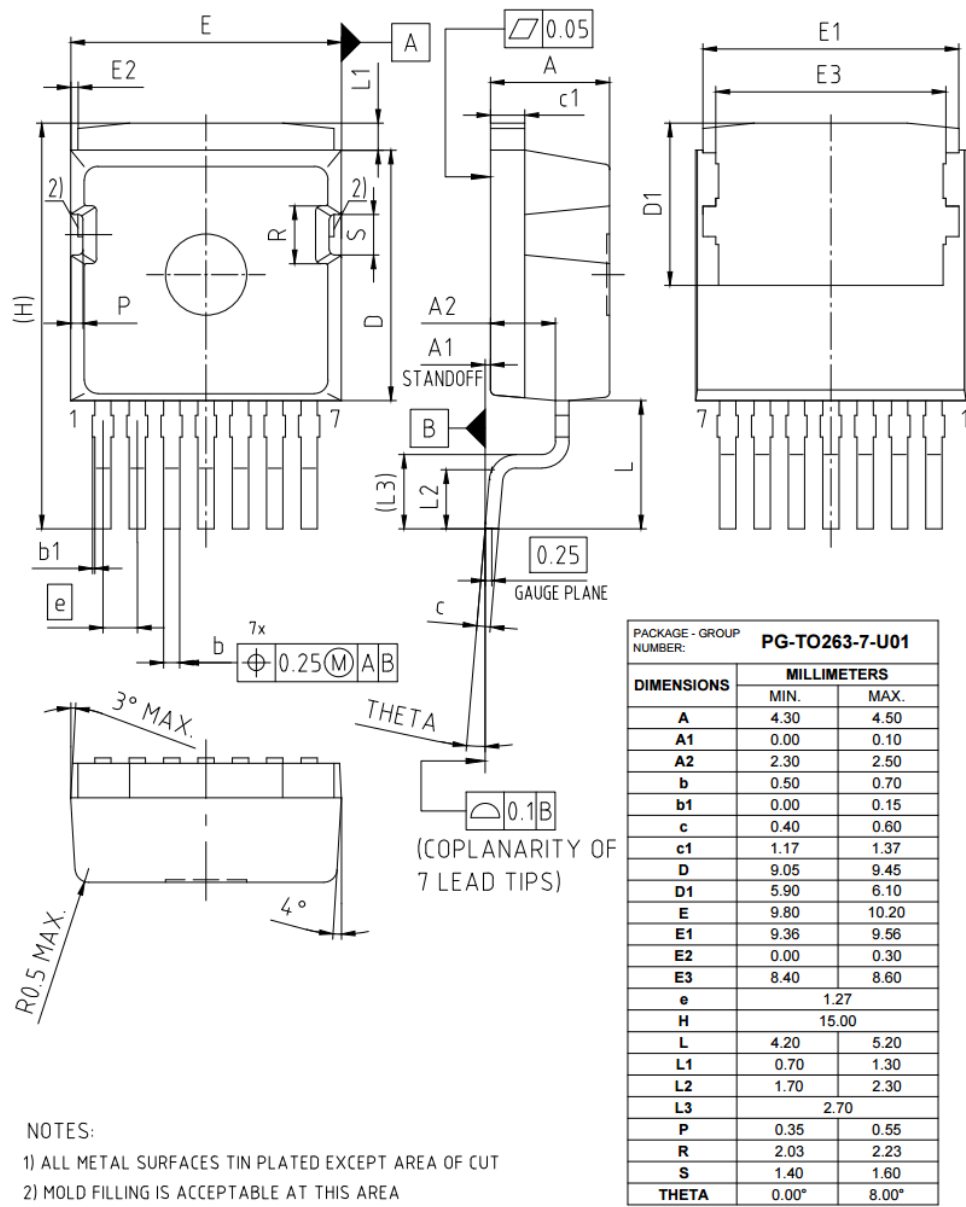


图 1 PG-TO263-7 外形图，尺寸单位为毫米

## 8 附录 A

表 12 相关链接

- [IFX CoolSiC CoolSiC™ MOSFET 750 V G2 网页](#)
- [IFX CoolSiC CoolSiC™ MOSFET 750 V G2 网页](#)
- [IFX CoolSiC CoolSiC™ MOSFET 750 V G2 仿真模型](#)
- [IFX 设计工具](#)

## 修订记录

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IMBG75R011M2H

**Revision 2026-03-24, Rev. 1. 0**

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Previous revisions

| Revision | Date       | Subjects (major changes since last revision) |
|----------|------------|----------------------------------------------|
| 1.0      | 2026-03-24 | Release of final version                     |

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