

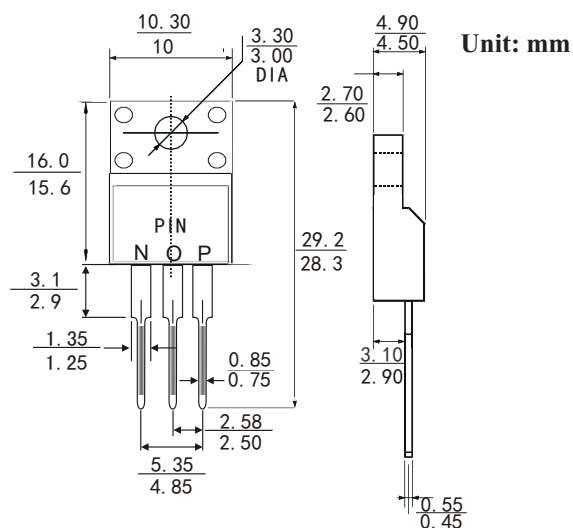
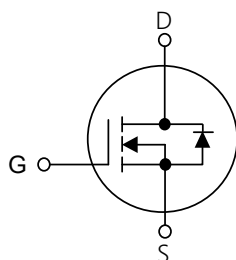
**TO-220F 18A, 650V N-CHANNEL POWER MOSFET**
**FEATURES**

- $R_{DS(ON)} < 0.25\Omega$  @  $V_{GS}=10V$
- Fast switching capability
- Low Gate Charge
- Lead free in compliance with EU RoHS directive.

**SYMBOL**

Pin Definition:

1. Gate
2. Drain
3. Source

**Block Diagram**


ABSOLUTE MAXIMUM RATINGS ( $T_C=25^\circ\text{C}$ , unless otherwise specified)

| Parameter                                         |                       | Symbol                           | TO --220F  |    | Unit |
|---------------------------------------------------|-----------------------|----------------------------------|------------|----|------|
| Drain-Source Voltage                              |                       | V <sub>DS</sub>                  | 650        |    | V    |
| Gate-Source Voltage                               |                       | V <sub>GS</sub>                  | ±30        |    | V    |
| Continuous Drain Current                          | T <sub>C</sub> =25°C  | I <sub>D</sub>                   | 18         |    | A    |
|                                                   | T <sub>C</sub> =100°C |                                  | 13         |    |      |
| Pulsed Drain Current (Note 1)                     |                       | I <sub>DM</sub>                  | 55         |    | A    |
| Single Pulse Avalanche Energy(Note 2)             |                       | E <sub>AS</sub>                  | 320        |    | mJ   |
| Avalanche Current(Note 1)                         |                       | I <sub>AR</sub>                  | 3          |    | A    |
| Repetitive Avalanche Energy(Note 1)               |                       | E <sub>AR</sub>                  | 2          |    | mJ   |
| Peak Diode Recovery dv/dt(Note 3)                 |                       | dv/dt                            | 15         |    | V/ns |
| Drain Source voltage slope(V <sub>ds</sub> =480V) |                       | dV <sub>ds</sub> /dt             | 50         |    | V/ns |
| Power Dissipation T <sub>C</sub> =25°C            |                       | P <sub>D</sub>                   | 151        | 35 | W    |
| Operating Junction and Storage Temperature        |                       | T <sub>J</sub> /T <sub>STG</sub> | -55 ~ +150 |    | °C   |
| Maximum Temperature for soldering                 |                       | T <sub>L</sub>                   | 300        |    | °C   |

Table 2. Thermal Characteristics

| Parameter                              | Symbol          | TO-220/TO-263 | ITO-220 | Unit                 |
|----------------------------------------|-----------------|---------------|---------|----------------------|
| Thermal resistance Junction to Ambient | $R_{\theta JA}$ | 62            | 62      | $^{\circ}\text{C/W}$ |
| Thermal resistance Junction to Case    | $R_{\theta JC}$ | 0.82          | 3.57    | $^{\circ}\text{C/W}$ |

 Table 3. Electrical Characteristics ( $T_J=25^{\circ}\text{C}$ , unless otherwise specified)

| Parameter                                              |         | Symbol              | Test Conditions                                                   | Min | Typ  | Max  | Unit |
|--------------------------------------------------------|---------|---------------------|-------------------------------------------------------------------|-----|------|------|------|
| Off Characteristics                                    |         |                     |                                                                   |     |      |      |      |
| Drain-Source Breakdown Voltage                         |         | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V,I <sub>D</sub> =250μA                         | 650 | --   | --   | V    |
| Drain-Source Leakage Current                           |         | I <sub>DSS</sub>    | V <sub>DS</sub> =650V,V <sub>GS</sub> =0V                         | --  | --   | 1    | μA   |
| Gate- Source Leakage Current                           | Forward | I <sub>GSS</sub>    | V <sub>GS</sub> =30V,V <sub>DS</sub> =0V                          | --  | --   | 100  | nA   |
|                                                        | Reverse |                     | V <sub>GS</sub> =-30V,V <sub>DS</sub> =0V                         | --  | --   | -100 | nA   |
| On Characteristics(Note 4)                             |         |                     |                                                                   |     |      |      |      |
| Gate Threshold Voltage                                 |         | V <sub>GS(TH)</sub> | V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =250μA           | 2.5 | --   | 4.5  | V    |
| Static Drain-Source On-State Resistance                |         | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V,I <sub>D</sub> =9A                           | --  | --   | 0.45 | Ω    |
| Dynamic Characteristics(Note 5)                        |         |                     |                                                                   |     |      |      |      |
| Input Capacitance                                      |         | C <sub>ISS</sub>    | V <sub>DS</sub> =25V,V <sub>GS</sub> =0V,f=1MHz                   | --  | 1230 | --   | pF   |
| Output Capacitance                                     |         | C <sub>OSS</sub>    |                                                                   | --  | 30   | --   | pF   |
| Reverse Transfer Capacitance                           |         | C <sub>RSS</sub>    |                                                                   | --  | 2.6  | --   | pF   |
| Switching Characteristics (Note 5)                     |         |                     |                                                                   |     |      |      |      |
| Turn-On Delay Time                                     |         | t <sub>d(on)</sub>  | V <sub>DD</sub> =400V,I <sub>D</sub> =9A,<br>R <sub>G</sub> =20Ω  | --  | 20   | --   | ns   |
| Turn-On Rise Time                                      |         | t <sub>R</sub>      |                                                                   | --  | 17   | --   | ns   |
| Turn-Off Delay Time                                    |         | t <sub>d(off)</sub> |                                                                   | --  | 170  | --   | ns   |
| Turn-Off Fall Time                                     |         | t <sub>f</sub>      |                                                                   | --  | 13   | --   | ns   |
| Total Gate Charge                                      |         | Q <sub>G</sub>      | V <sub>DS</sub> =400V,I <sub>D</sub> =9A,<br>V <sub>GS</sub> =10V | --  | 42   | --   | nC   |
| Gate-Source Charge                                     |         | Q <sub>GS</sub>     |                                                                   | --  | 6    | --   | nC   |
| Gate-Drain Charge                                      |         | Q <sub>GD</sub>     |                                                                   | --  | 29   | --   | nC   |
| Drain-Source Diode Characteristics and Maximum Ratings |         |                     |                                                                   |     |      |      |      |
| Drain-Source Diode Forward Voltage                     |         | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =9A                           | --  | --   | 1.5  | V    |
| Maximum Continuous Drain-Source Diode Forward Current  |         | I <sub>S</sub>      |                                                                   | --  | --   | 18   | A    |
| Reverse Recovery Time                                  |         | t <sub>rr</sub>     | V <sub>GS</sub> =0V, I <sub>F</sub> =9A                           | --  | 380  | --   | ns   |
| Reverse Recovery Charge                                |         | Q <sub>RR</sub>     | dI <sub>F</sub> /dt=100A/μs (Note 1)                              | --  | 4500 | --   | nC   |

Notes : 1 Repetitive Rating:Pulse width limited by maximum junction temperature

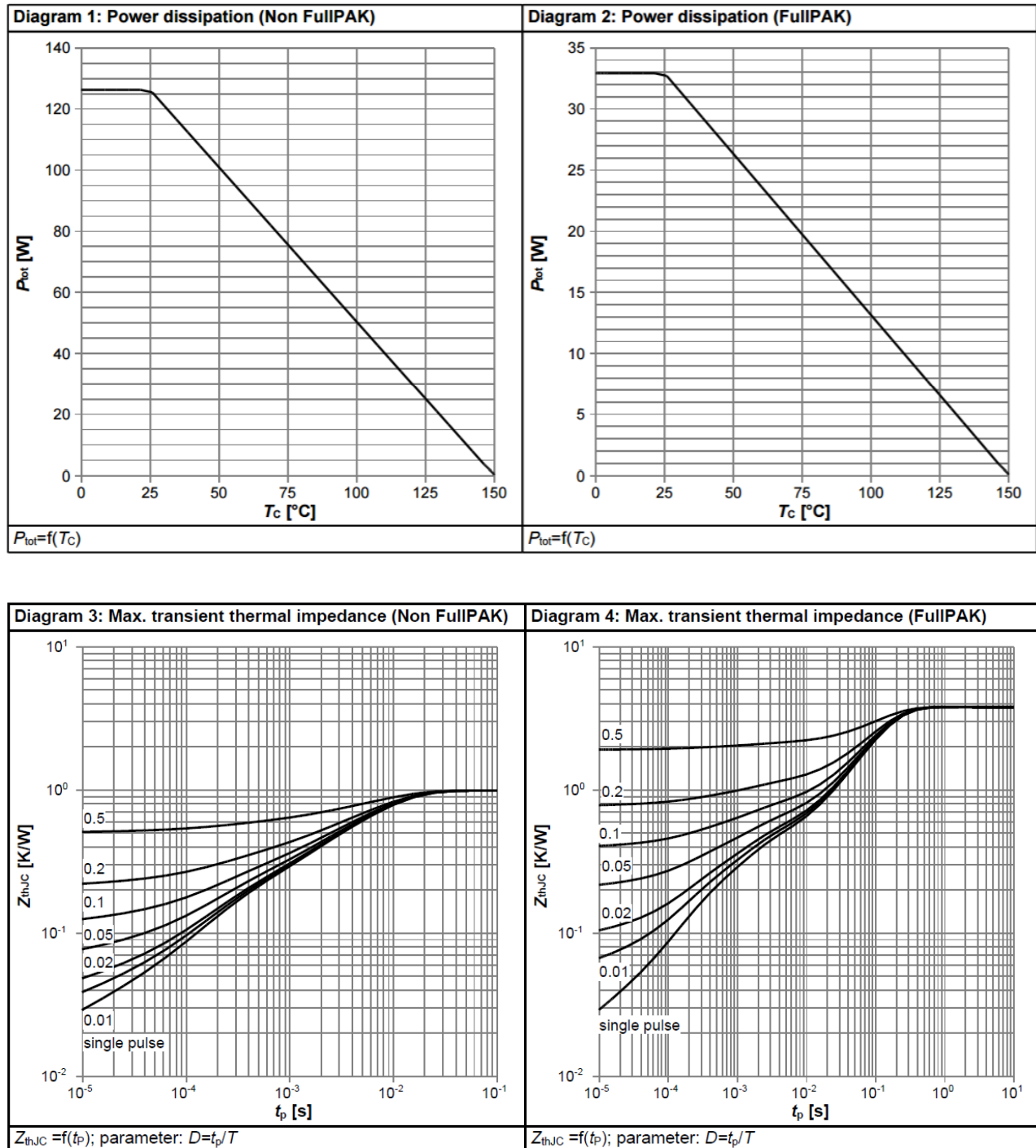
 2  $L=60\text{mH}, I_{AS}=4A, V_{DD}=150V$ , Starting  $T_J=25^{\circ}\text{C}$ 

 3  $I_{SD}\leq 4.5A, di/dt\leq 200A/\mu s, V_{DD}\leq BV_{DSS}$ , Starting  $T_J=25^{\circ}\text{C}$ 

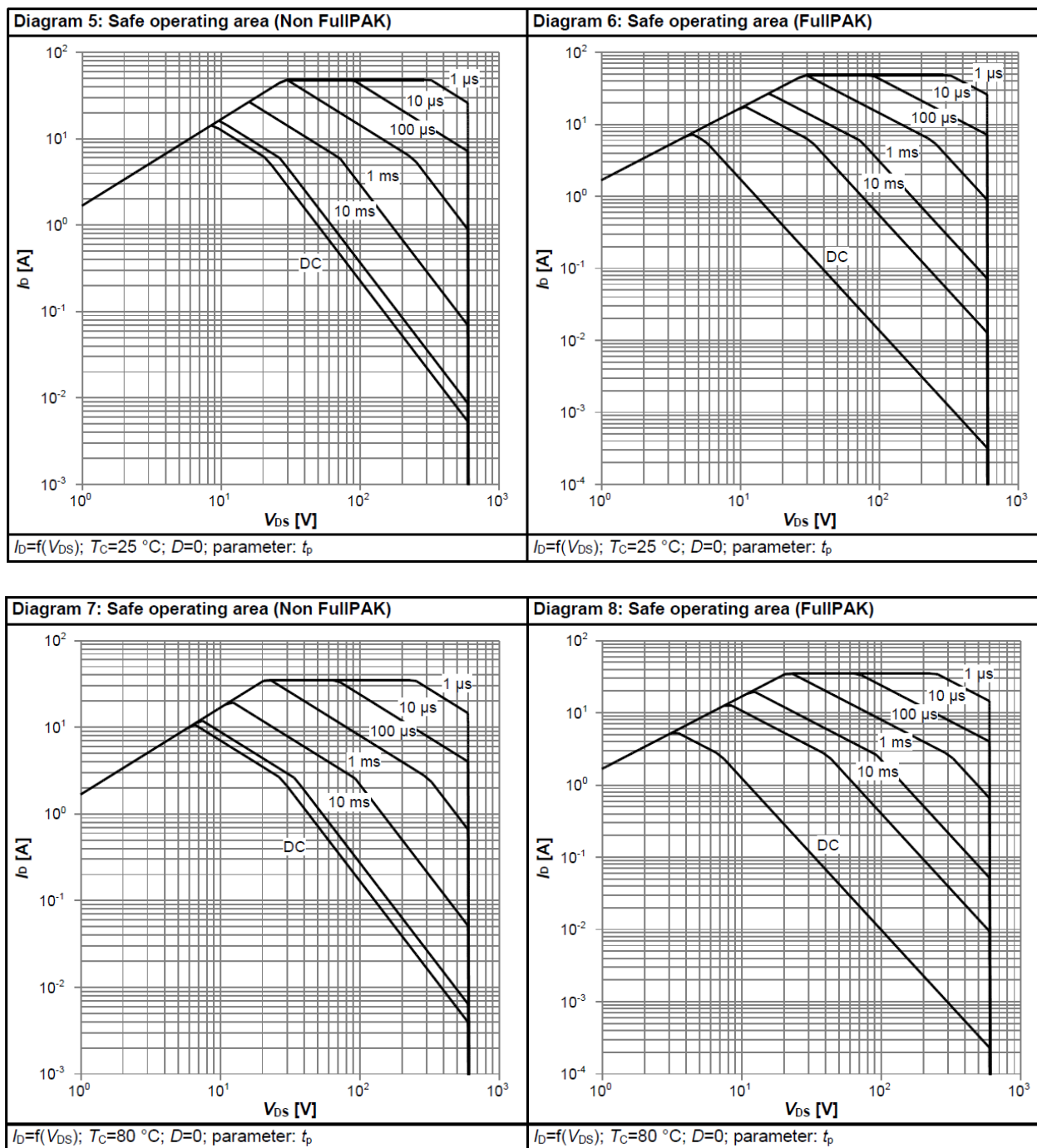
 4 Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ 

5 Guaranteed by design, not subject to production

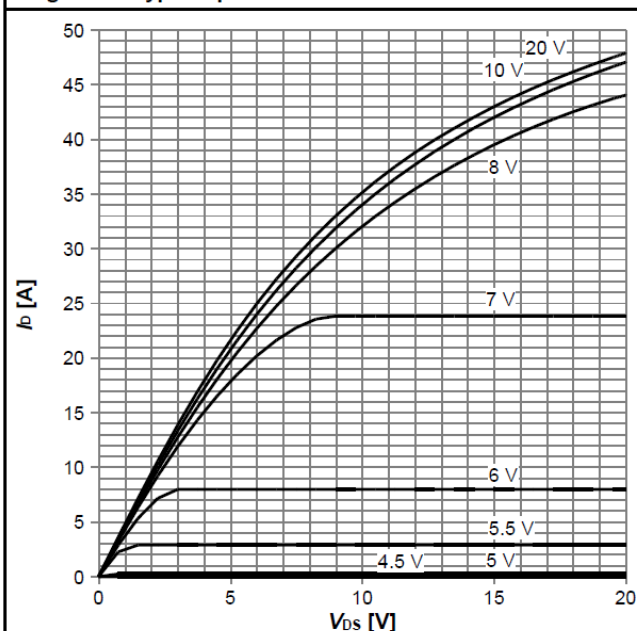
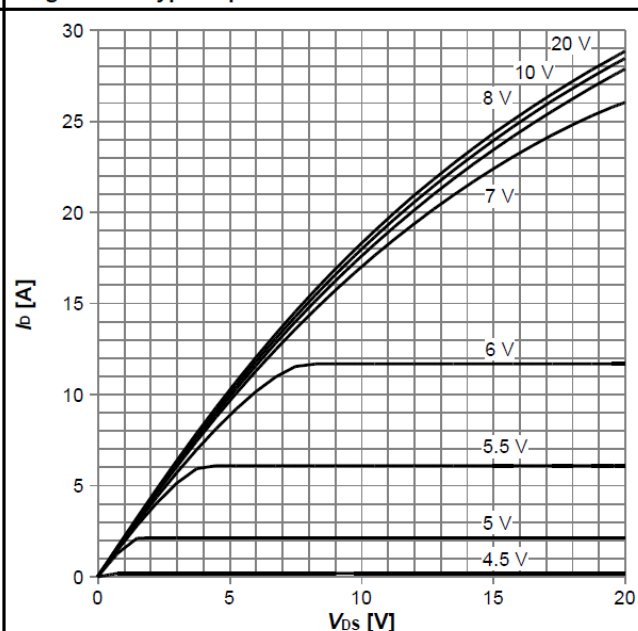
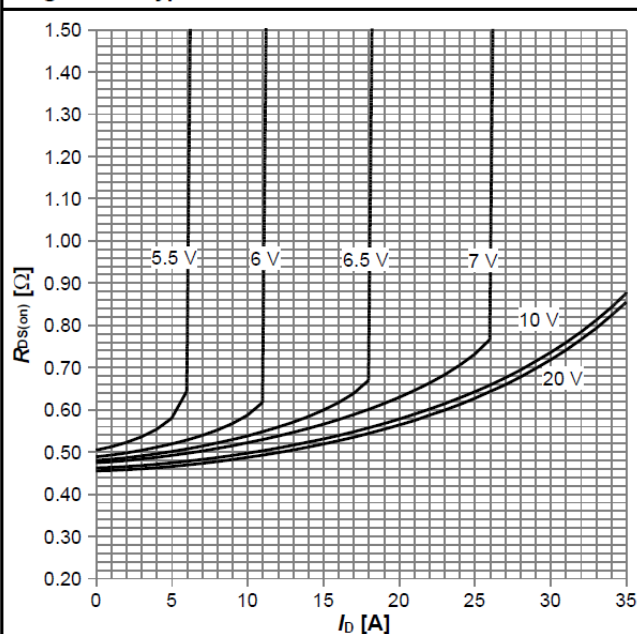
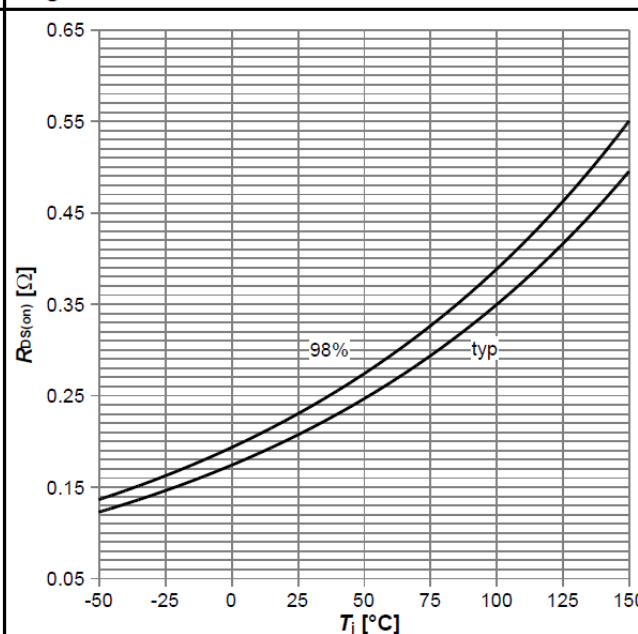
# Typical characteristics Diagrams



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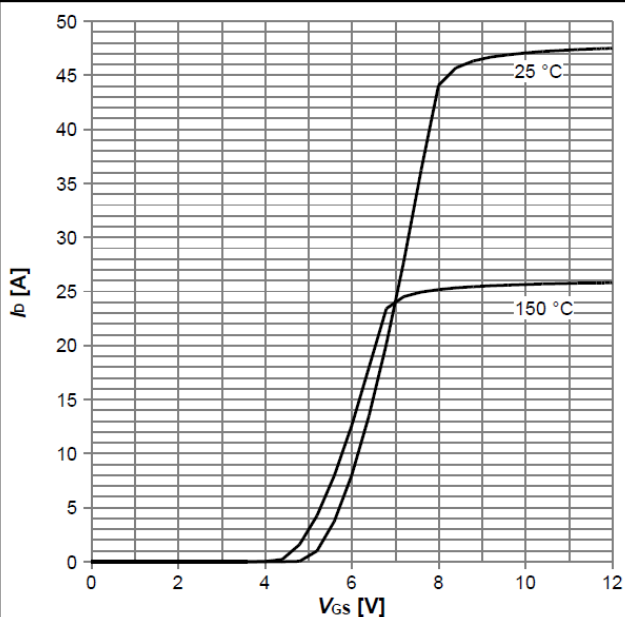


# Typical characteristics Diagrams

**Diagram 9: Typ. output characteristics**

 $I_D = f(V_{DS}); T_J = 25^\circ\text{C}; \text{parameter: } V_{GS}$ 
**Diagram 10: Typ. output characteristics**

 $I_D = f(V_{DS}); T_J = 125^\circ\text{C}; \text{parameter: } V_{GS}$ 
**Diagram 11: Typ. drain-source on-state resistance**

 $R_{DS(on)} = f(I_D); T_J = 125^\circ\text{C}; \text{parameter: } V_{GS}$ 
**Diagram 12: Drain-source on-state resistance**

 $R_{DS(on)} = f(T_J); I_D = 6.4\text{ A}; V_{GS} = 10\text{ V}$

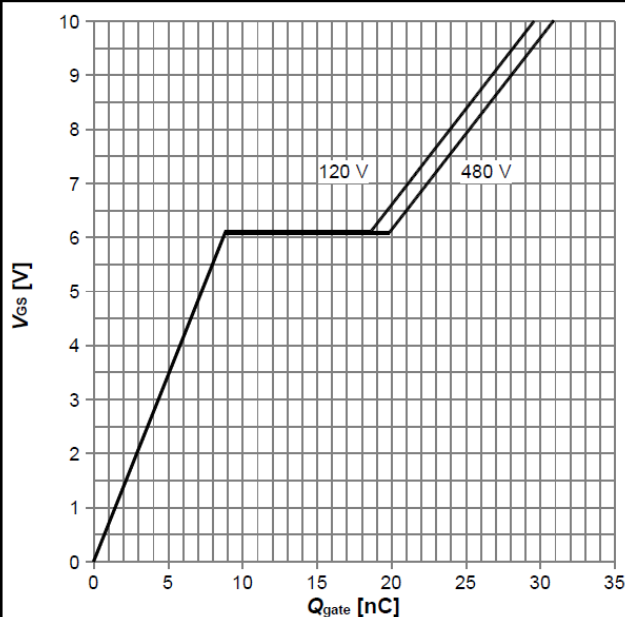
# Typical characteristics Diagrams

Diagram 13: Typ. transfer characteristics



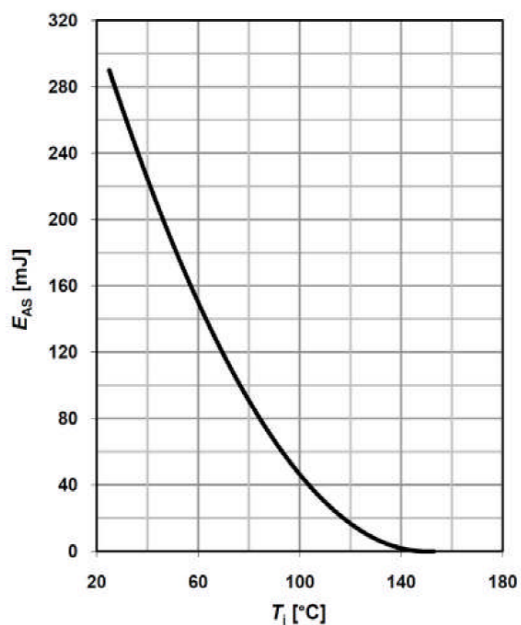
$I_D = f(V_{GS}); V_{DS} = 20V$ ; parameter:  $T_j$

Diagram 14: Typ. gate charge



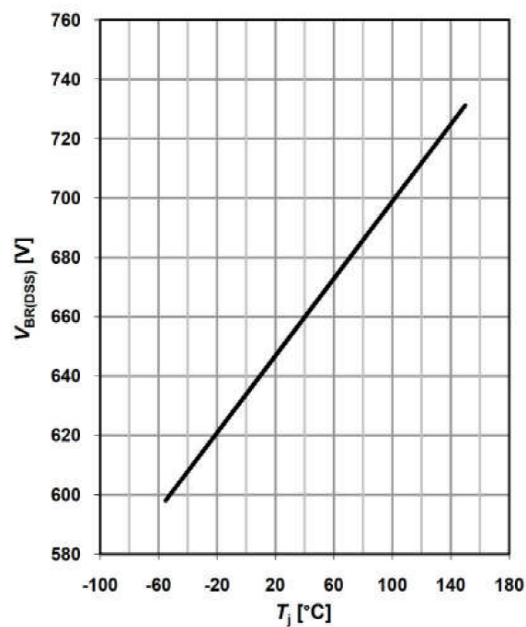
$V_{GS} = f(Q_{gate}); I_D = 8.0 A$  pulsed; parameter:  $V_{DD}$

Avalanche energy



$E_{AS} = f(T_j); I_D = 2.4 A; V_{DD} = 50 V$

Drain-source breakdown voltage



$V_{BR(DSS)} = f(T_j); I_D = 0.25 mA$