

MOSFET

CoolSiC™ Automotive Power Device 750 V G1

The 750 V CoolSiC™ is built over the solid silicon carbide technology developed in Infineon in more than 20 years. Leveraging the wide bandgap SiC material characteristics, the 750V CoolSiC™ MOSFET offers a unique combination of performance, reliability and ease of use. Suitable for high temperature and harsh operations, it enables the simplified and cost effective deployment of the highest system efficiency.

Features

- Highly robust 750V technology, 100% avalanche tested
- Best-in-class $R_{DS(on)} \times Q_{fr}$
- Excellent $R_{DS(on)} \times Q_{oss}$ and $R_{DS(on)} \times Q_G$
- Unique combination of low C_{rfs}/C_{iss} and high $V_{GS(th)}$
- Infineon proprietary die attach technology
- Driver source pin available

Benefits

- Enhanced robustness and reliability for bus voltages beyond 500 V
- Superior efficiency in hard switching
- Higher switching frequency in soft switching topologies
- Robustness against parasitic turn on for unipolar gate driving
- Reduced switching losses through improved gate control

Potential applications

Uni- and bidirectional On Board Chargers and HV-LV DCDC converters:

- hard switching half bridges
- soft switching topologies

Product validation

Qualified according to AEC Q101

Please note: The source and driver source pins are not exchangeable. Their exchange might lead to malfunction.

Table 1 Key Performance Parameters

| Parameter | Value | Unit |
|-----------------------------------|-------|------|
| V_{DSS} over full $T_{j,range}$ | 750 | V |
| $R_{DS(on),typ}$ | 140 | mΩ |
| $R_{DS(on),max}$ | 182 | mΩ |
| Q_G,typ | 13 | nC |
| $I_{DM,max}$ | 38 | A |
| $Q_{oss,typ}$ @ 500 V | 28 | nC |
| $E_{oss,typ}$ @ 500 V | 5.1 | μJ |

| Type / Ordering Code | Package | Marking | Related Links |
|----------------------|------------|----------|----------------|
| AIMZA75R140M1H | PG-TO247-4 | 75A140M1 | see Appendix A |

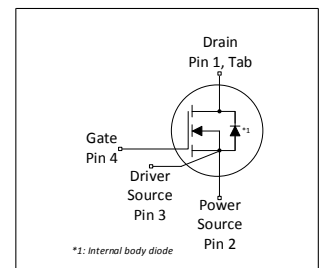
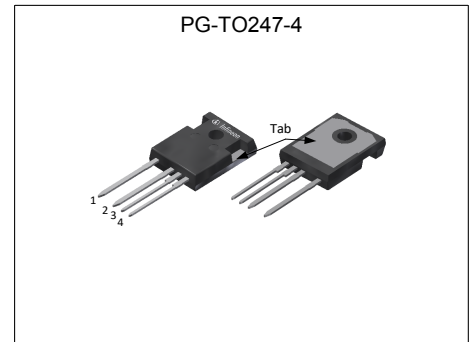


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1 Maximum ratings

at $T_j = 25\text{ °C}$, unless otherwise specified.

Note: for optimum lifetime and reliability, Infineon recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.

Table 2 Maximum ratings

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|--|------------------|--------|------|----------|------|---|
| | | Min. | Typ. | Max. | | |
| Continuous DC drain current ¹⁾ | I_{DDC} | - | - | 16 11 | A | $T_C = 25\text{ °C}$ $T_C = 100\text{ °C}$ |
| Peak drain current ²⁾ | I_{DM} | - | - | 38 | A | $T_C = 25\text{ °C}$, $V_{\text{GS}} = 18\text{ V}$ |
| Avalanche energy, single pulse | E_{AS} | - | - | 48 | mJ | $I_{\text{D}} = 1.8\text{ A}$, $V_{\text{DD}} = 50\text{ V}$; see table 11 |
| Avalanche current, single pulse | I_{AS} | - | - | 1.8 | A | - |
| MOSFET dv/dt ruggedness | dv/dt | - | - | 200 | V/ns | $V_{\text{DS}} = 0\text{...}500\text{ V}$ |
| Gate source voltage (static) | V_{GS} | -5 | - | 23 | V | - |
| Gate source voltage (transient) | V_{GS} | -10 | - | 25 | V | $t_p \leq 500\text{ ns}$, duty cycle $\leq 1\%$ |
| Power dissipation | P_{tot} | - | - | 86 | W | $T_C = 25\text{ °C}$ |
| Storage temperature | T_{stg} | -55 | - | 150 | °C | - |
| Operating junction temperature | T_j | -55 | - | 175 | °C | - |
| Mounting torque | - | - | - | 60 | Ncm | M3 and M3.5 screws |
| Continuous reverse drain current ¹⁾ | I_{SDC} | - | - | 16 11 | A | $V_{\text{GS}} = 18\text{ V}$, $T_C = 25\text{ °C}$ $V_{\text{GS}} = 0\text{ V}$, $T_C = 25\text{ °C}$ |
| Peak reverse drain current ²⁾ | I_{SM} | - | - | 38 13 | A | $T_C = 25\text{ °C}$, $t_p \leq 250\text{ ns}$ $T_C = 25\text{ °C}$ |
| Insulation withstand voltage | V_{ISO} | - | - | n. a. | V | V_{rms} , $T_C = 25\text{ °C}$, $t = 1\text{ min}$ |

¹⁾ Limited by $T_{j,\text{max}}$

²⁾ Pulse width t_p limited by $T_{j,\text{max}}$

2 Thermal characteristics

Table 3 Thermal characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---------------|--------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Thermal resistance, junction - case | $R_{th(j-c)}$ | - | - | 1.74 | °C/W | Not subject to production test. Parameter verified by design/characterization according to JESD51-14. |
| Soldering temperature, wave soldering only allowed at leads | T_{sold} | - | - | 260 | °C | 1.6mm (0.063 in.) from case for 10s |

3 Operating range

Table 4 Operating range

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---------------|--------|------|------|------|-----------------------|
| | | Min. | Typ. | Max. | | |
| Gate-source voltage operating range including undershoots ¹⁾ | V_{GS} | -2 | - | 20 | V | - |
| Recommended turn-on voltage | $V_{GS(on)}$ | - | 18 | - | V | - |
| Recommended turn-off voltage | $V_{GS(off)}$ | - | 0 | - | V | - |

¹⁾ **Important notice:** If the gate source voltage of the device in application exceeds the operating range (Table 4), the device $R_{DS(on)}$ and $V_{GS(th)}$ might exceed the maximum value stated in the datasheet at the end of the lifetime of the device. In order to ensure sound operation of the device over the planned lifetime, the maximum ratings (Table 2) and the application note AN2018-09 must be considered.

4 Electrical characteristics

at $T_j = 25\text{ °C}$, unless otherwise specified

Table 5 Static characteristics

For applications with applied blocking voltage > 525 V, it is required that the customer evaluates the impact of cosmic radiation effect in early design phase and contacts the Infineon sales office for the necessary technical support.

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|--------------------------------------|--------------|--------|--------------------------|---------------|------------------|---|
| | | Min. | Typ. | Max. | | |
| Drain-source voltage ¹⁾ | V_{DSS} | 750 | - | - | V | $V_{GS} = 0\text{ V}$, $I_D = 0.17\text{ mA}$, $T_j = -55\text{ °C}$ to 175 °C |
| Gate threshold voltage ²⁾ | $V_{GS(th)}$ | 3.5 | 4.3 | 5.6 | V | $V_{DS} = V_{GS}$, $I_D = 1.7\text{ mA}$ |
| Zero gate voltage drain current | I_{DSS} | - | 1 10 | 75 - | μA | $V_{DS} = 750\text{ V}$, $V_{GS} = 0\text{ V}$, $T_j = 25\text{ °C}$ $V_{DS} = 750\text{ V}$, $V_{GS} = 0\text{ V}$, $T_j = 175\text{ °C}$ |
| Gate-source leakage current | I_{GSS} | - | - | 100 | nA | $V_{GS} = 20\text{ V}$, $V_{DS} = 0\text{ V}$ |
| Drain-source on-state resistance | $R_{DS(on)}$ | - | 172 140 129 252 | - 182 - | $\text{m}\Omega$ | $V_{GS} = 15\text{ V}$, $I_D = 4.7\text{ A}$, $T_j = 25\text{ °C}$ $V_{GS} = 18\text{ V}$, $I_D = 4.7\text{ A}$, $T_j = 25\text{ °C}$ $V_{GS} = 20\text{ V}$, $I_D = 4.7\text{ A}$, $T_j = 25\text{ °C}$ $V_{GS} = 18\text{ V}$, $I_D = 4.7\text{ A}$, $T_j = 175\text{ °C}$ |
| Internal gate resistance | $R_{G,int}$ | - | 16 | - | Ω | $f = 1\text{ MHz}$ |

Table 6 Dynamic characteristics

External parasitic elements (PCB layout) influence switching behavior significantly.

Stray inductances and coupling capacitances must be minimized.

For layout recommendations please use provided application notes or contact Infineon sales office.

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|--|--------------|--------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Input capacitance | C_{iss} | - | 351 | - | pF | $V_{GS} = 0\text{ V}$, $V_{DS} = 500\text{ V}$, $f = 250\text{ kHz}$ |
| Reverse transfer capacitance | C_{riss} | - | 2.5 | - | pF | $V_{GS} = 0\text{ V}$, $V_{DS} = 500\text{ V}$, $f = 250\text{ kHz}$ |
| Output capacitance ³⁾ | C_{oss} | - | 32 | 41 | pF | $V_{GS} = 0\text{ V}$, $V_{DS} = 500\text{ V}$, $f = 250\text{ kHz}$ |
| Output charge ³⁾ | Q_{oss} | - | 28 | 37 | nC | calculation based on C_{oss} |
| Effective output capacitance, energy related ⁴⁾ | $C_{o(er)}$ | - | 41 | - | pF | $V_{GS} = 0\text{ V}$, $V_{DS} = 0\text{...}500\text{ V}$ |
| Effective output capacitance, time related ⁵⁾ | $C_{o(tr)}$ | - | 57 | - | pF | $I_D = \text{constant}$, $V_{GS} = 0\text{ V}$, $V_{DS} = 0\text{...}500\text{ V}$ |
| Turn-on delay time | $t_{d(on)}$ | - | 6 | - | ns | $V_{DD} = 500\text{ V}$, $V_{GS} = 18\text{ V}$, $I_D = 4.7\text{ A}$, $R_G = 1.8\text{ }\Omega$; see table 10 |
| Rise time | t_r | - | 7 | - | ns | $V_{DD} = 500\text{ V}$, $V_{GS} = 18\text{ V}$, $I_D = 4.7\text{ A}$, $R_G = 1.8\text{ }\Omega$; see table 10 |
| Turn-off delay time | $t_{d(off)}$ | - | 13 | - | ns | $V_{DD} = 500\text{ V}$, $V_{GS} = 18\text{ V}$, $I_D = 4.7\text{ A}$, $R_G = 1.8\text{ }\Omega$; see table 10 |
| Fall time | t_f | - | 13 | - | ns | $V_{DD} = 500\text{ V}$, $V_{GS} = 18\text{ V}$, $I_D = 4.7\text{ A}$, $R_G = 1.8\text{ }\Omega$; see table 10 |

¹⁾ Tested at $T_j = 25\text{ °C}$, minimum V_{DSS} verified by design over full junction temperature range.

²⁾ Tested after 1 ms pulse at $V_{GS} = +20\text{ V}$. "Linear mode" operation is not recommended. For assessment of potential "linear mode" operation, please contact Infineon sales office.

³⁾ Maximum specification is defined by calculated six sigma upper confidence bound.

⁴⁾ $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 500 V.

⁵⁾ $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 500 V.

Table 7 Gate charge characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|-------------------------------|--------------|--------|------|------|------|--|
| | | Min. | Typ. | Max. | | |
| Plateau gate to source charge | $Q_{GS(pl)}$ | - | 2.8 | - | nC | $V_{DD} = 500\text{ V}$, $I_D = 4.7\text{ A}$, $V_{GS} = 0\text{ to }18\text{ V}$ |
| Gate to drain charge | Q_{GD} | - | 3.3 | - | nC | $V_{DD} = 500\text{ V}$, $I_D = 4.7\text{ A}$, $V_{GS} = 0\text{ to }18\text{ V}$ |
| Total gate charge | Q_G | - | 13 | - | nC | $V_{DD} = 500\text{ V}$, $I_D = 4.7\text{ A}$, $V_{GS} = 0\text{ to }18\text{ V}$ |

Table 8 Reverse diode characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|--|-----------|--------|-----------|--------|------|--|
| | | Min. | Typ. | Max. | | |
| Drain-source reverse voltage | V_{SD} | - | 3.9 | 5.3 | V | $V_{GS} = 0\text{ V}$, $I_S = 4.7\text{ A}$, $T_j = 25\text{ °C}$ |
| MOSFET forward recovery time | t_{fr} | - - | 20 7 | - - | ns | $V_{DD} = 500\text{ V}$, $I_S = 4.7\text{ A}$, $di_S/dt = 1000\text{ A}/\mu\text{s}$; see table 9 $V_{DD} = 500\text{ V}$, $I_S = 4.7\text{ A}$, $di_S/dt = 4000\text{ A}/\mu\text{s}$; see table 9 |
| MOSFET forward recovery charge ¹⁾ | Q_{fr} | - - | 46 57 | - - | nC | $V_{DD} = 500\text{ V}$, $I_S = 4.7\text{ A}$, $di_S/dt = 1000\text{ A}/\mu\text{s}$; see table 9 $V_{DD} = 500\text{ V}$, $I_S = 4.7\text{ A}$, $di_S/dt = 4000\text{ A}/\mu\text{s}$; see table 9 |
| MOSFET peak forward recovery current | I_{frm} | - - | 4.6 16 | - - | A | $V_{DD} = 500\text{ V}$, $I_S = 4.7\text{ A}$, $di_S/dt = 1000\text{ A}/\mu\text{s}$; see table 9 $V_{DD} = 500\text{ V}$, $I_S = 4.7\text{ A}$, $di_S/dt = 4000\text{ A}/\mu\text{s}$; see table 9 |

¹⁾ Q_{fr} includes Q_{oss}

5 Electrical characteristics diagrams

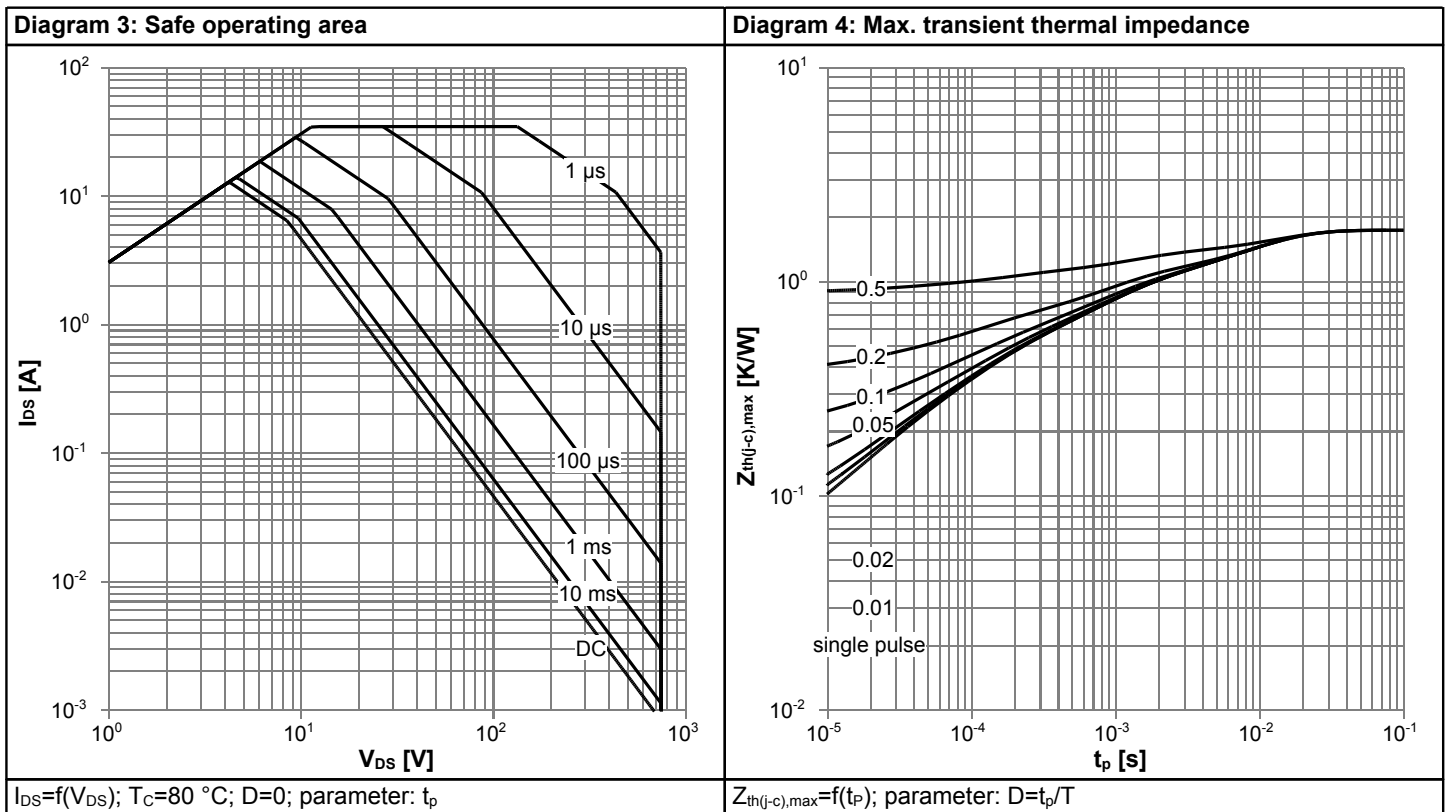
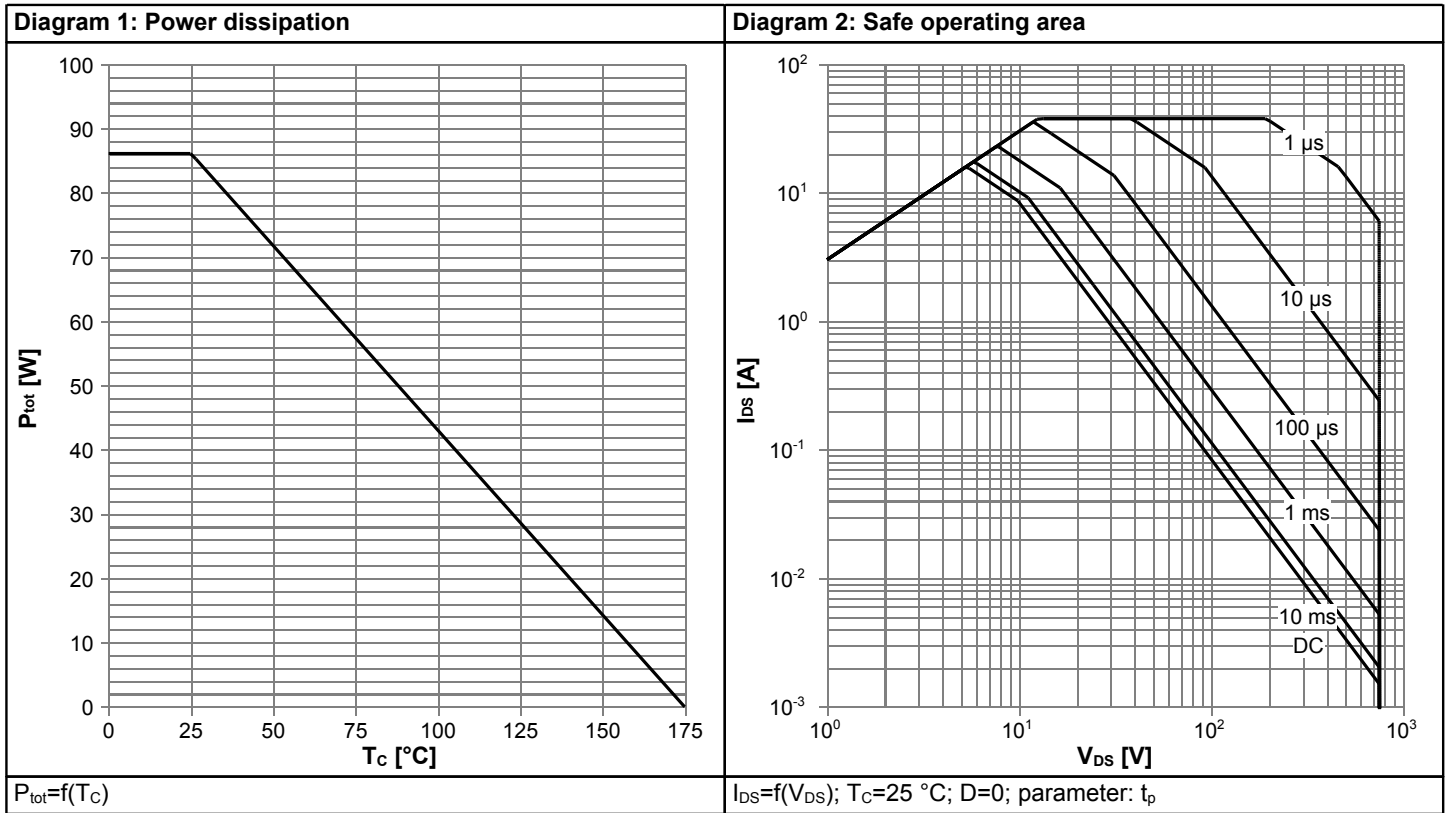
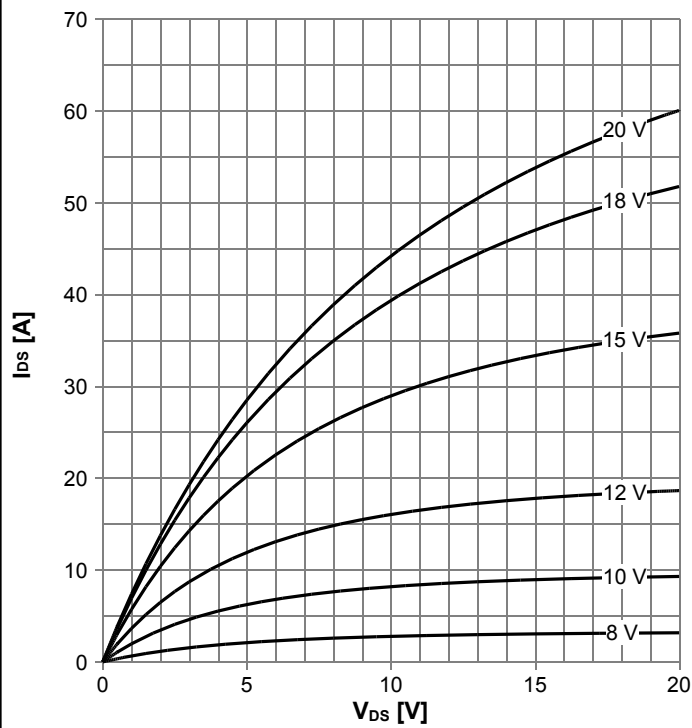
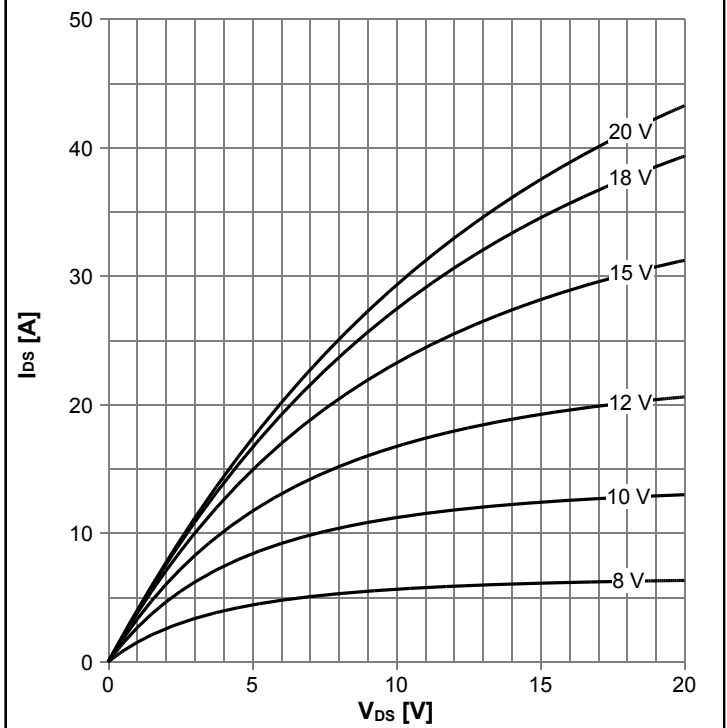


Diagram 5: Typ. output characteristics



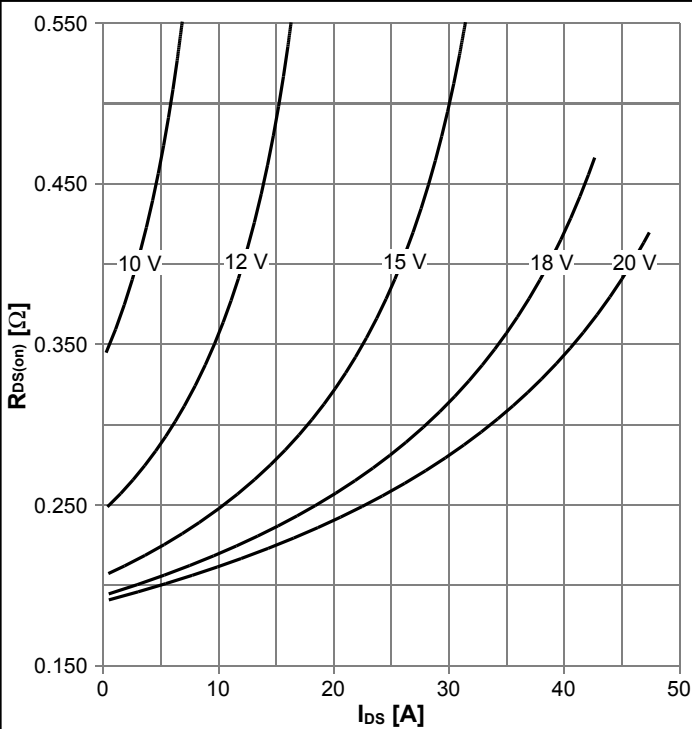
$I_{DS}=f(V_{DS}); T_j=25\text{ °C}; \text{parameter: } V_{GS}$

Diagram 6: Typ. output characteristics



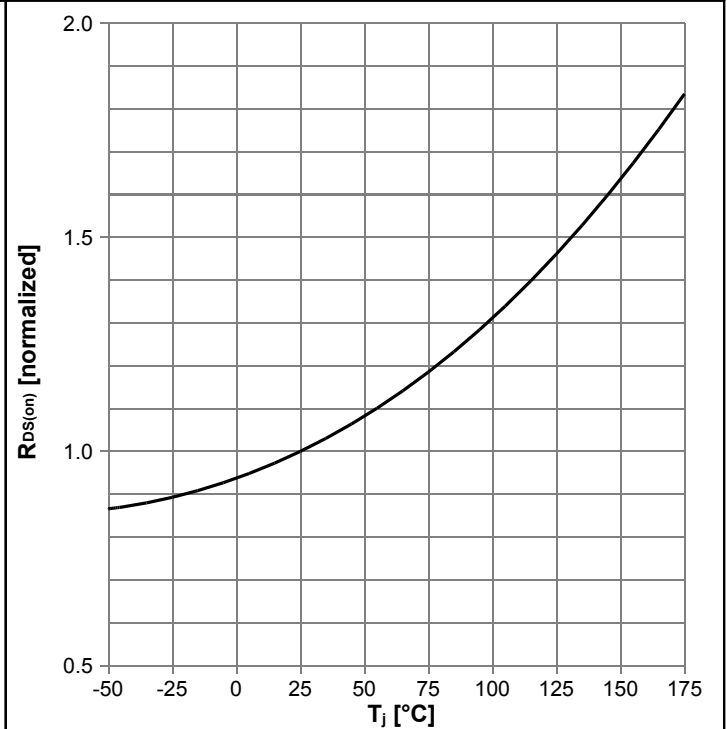
$I_{DS}=f(V_{DS}); T_j=175\text{ °C}; \text{parameter: } V_{GS}$

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



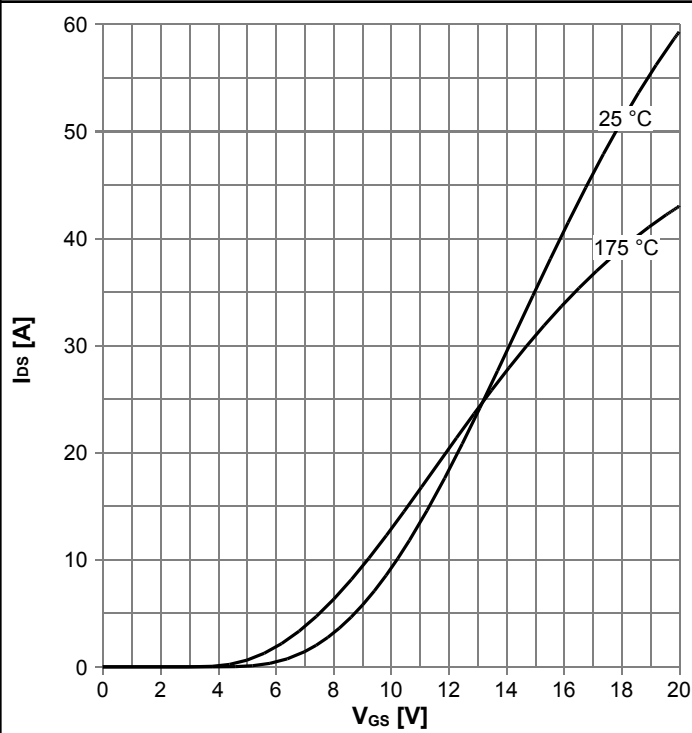
$R_{DS(on)}=f(I_{DS}); T_j=125\text{ °C}; \text{parameter: } V_{GS}$

Diagram 8: Drain-source on-state resistance



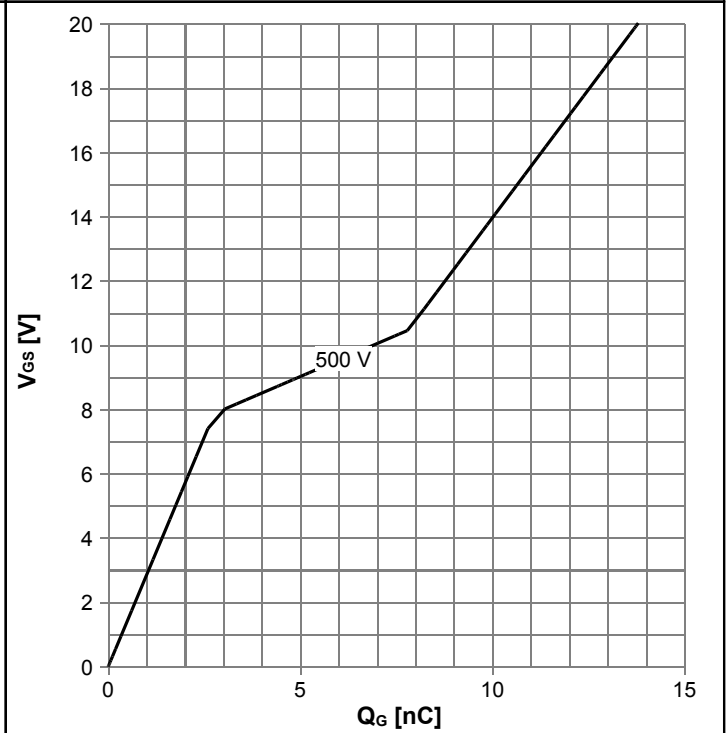
$R_{DS(on)}=f(T_j); I_D=4.7\text{ A}; V_{GS}=18\text{ V}$

Diagram 9: Typ. transfer characteristics



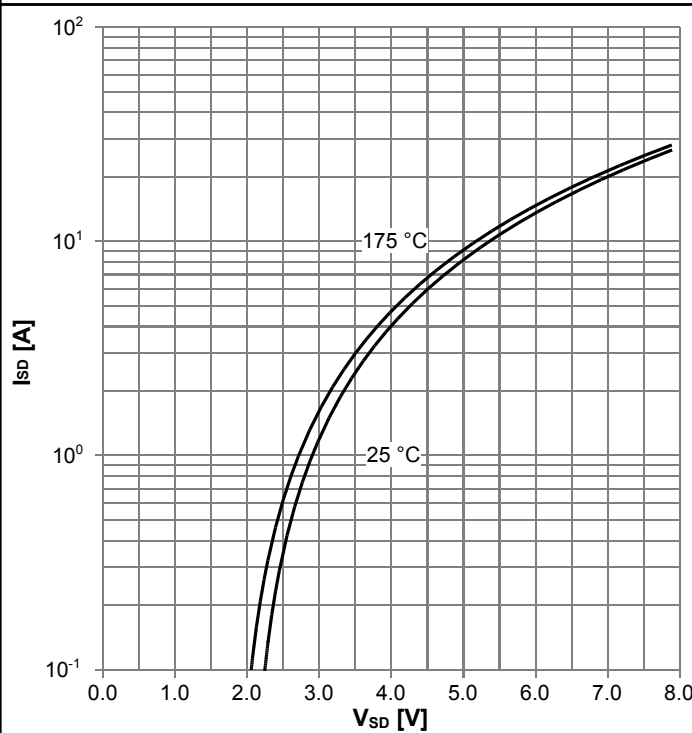
$I_{DS}=f(V_{GS})$; $V_{DS}=20\text{ V}$; parameter: T_j

Diagram 10: Typ. gate charge



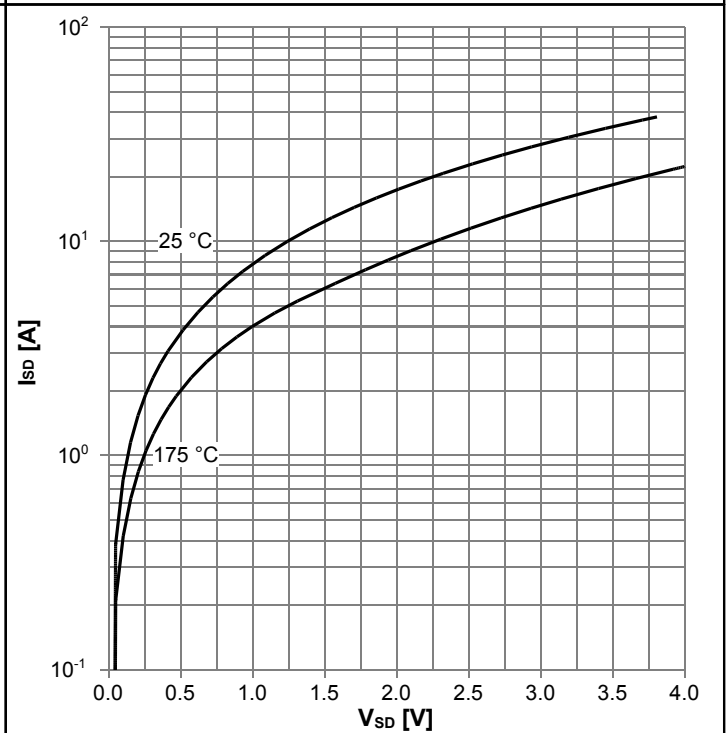
$V_{GS}=f(Q_G)$; $I_D=4.7\text{ A}$ pulsed; parameter: V_{DD}

Diagram 11: Typ. reverse drain current characteristics



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

Diagram 12: Typ. reverse drain current characteristics



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

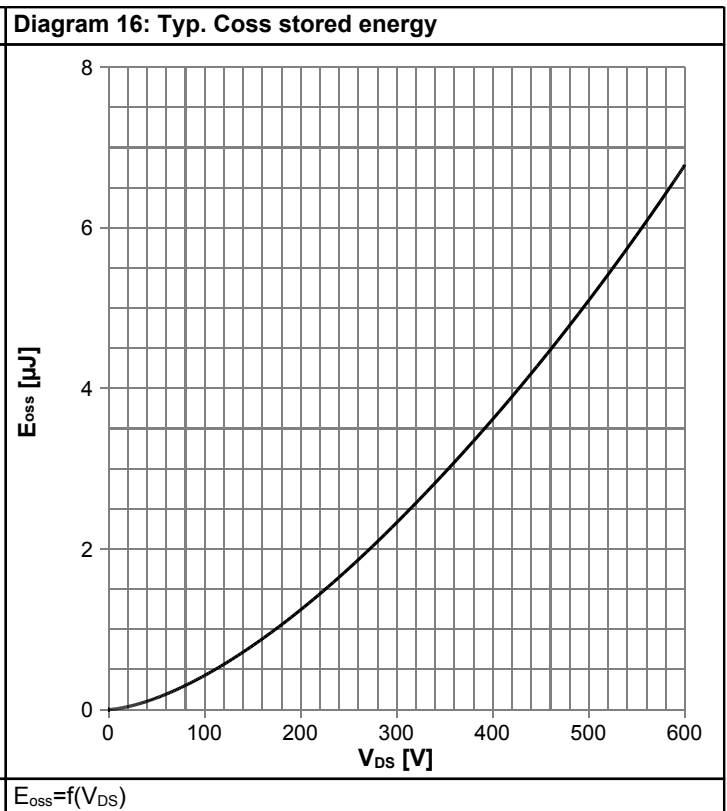
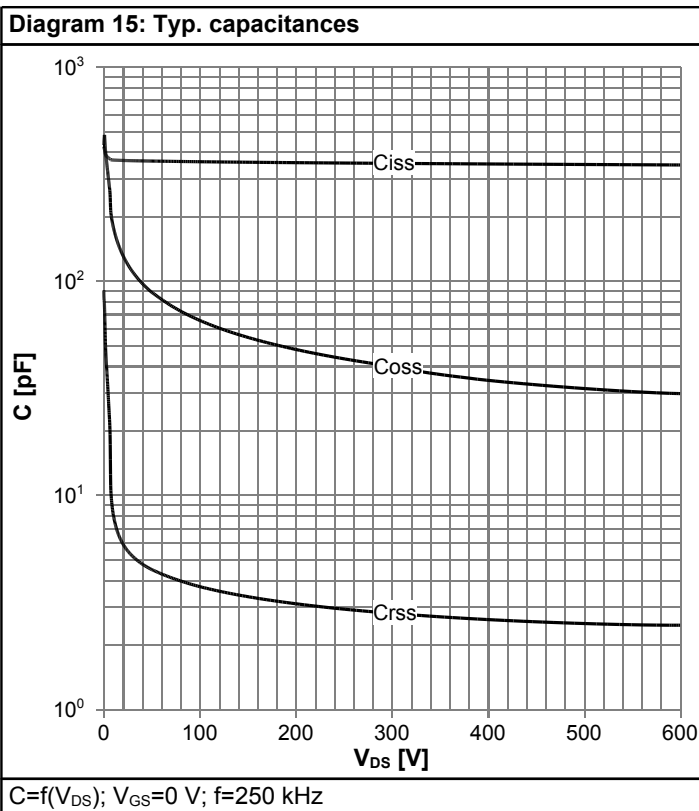
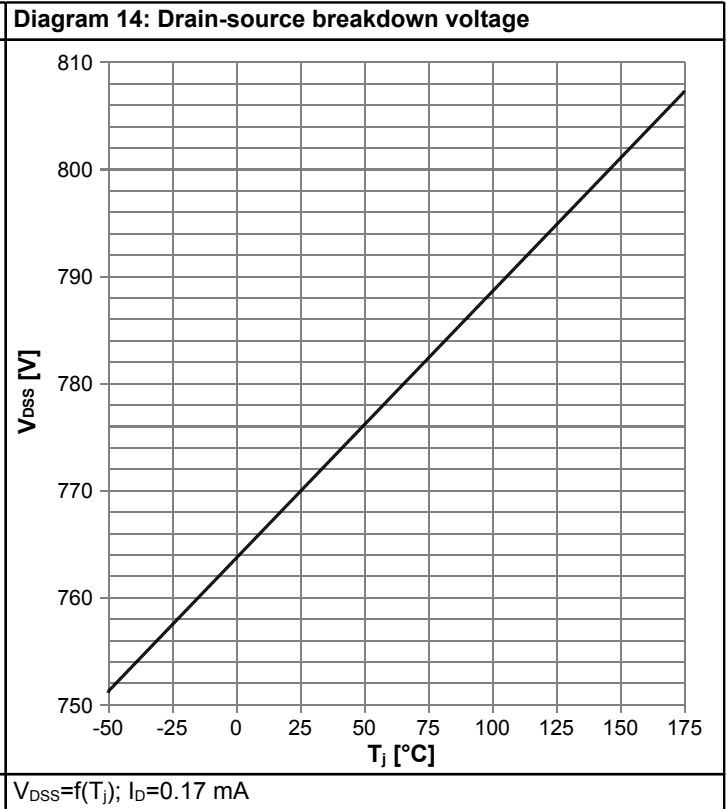
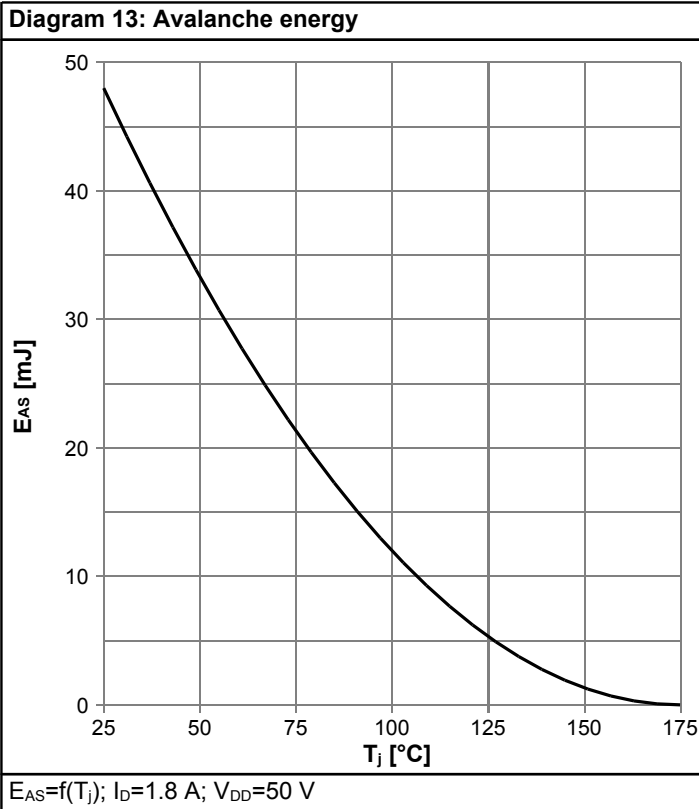
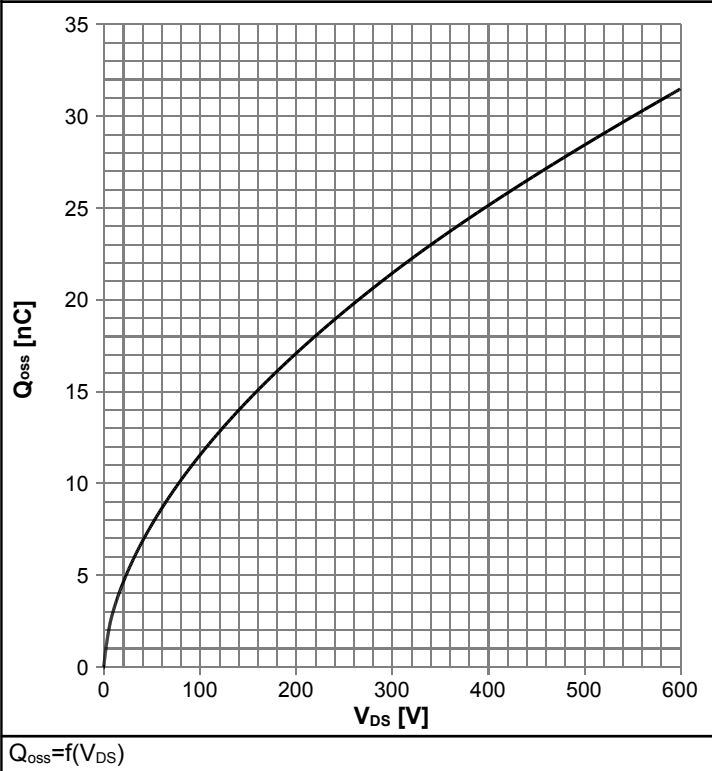


Diagram 17: Typ. Q_{oss} output charge



6 Test Circuits

Table 9 Body diode characteristics

| Test circuit for body diode characteristics | Body diode recovery waveform |
|---|------------------------------|
| | |

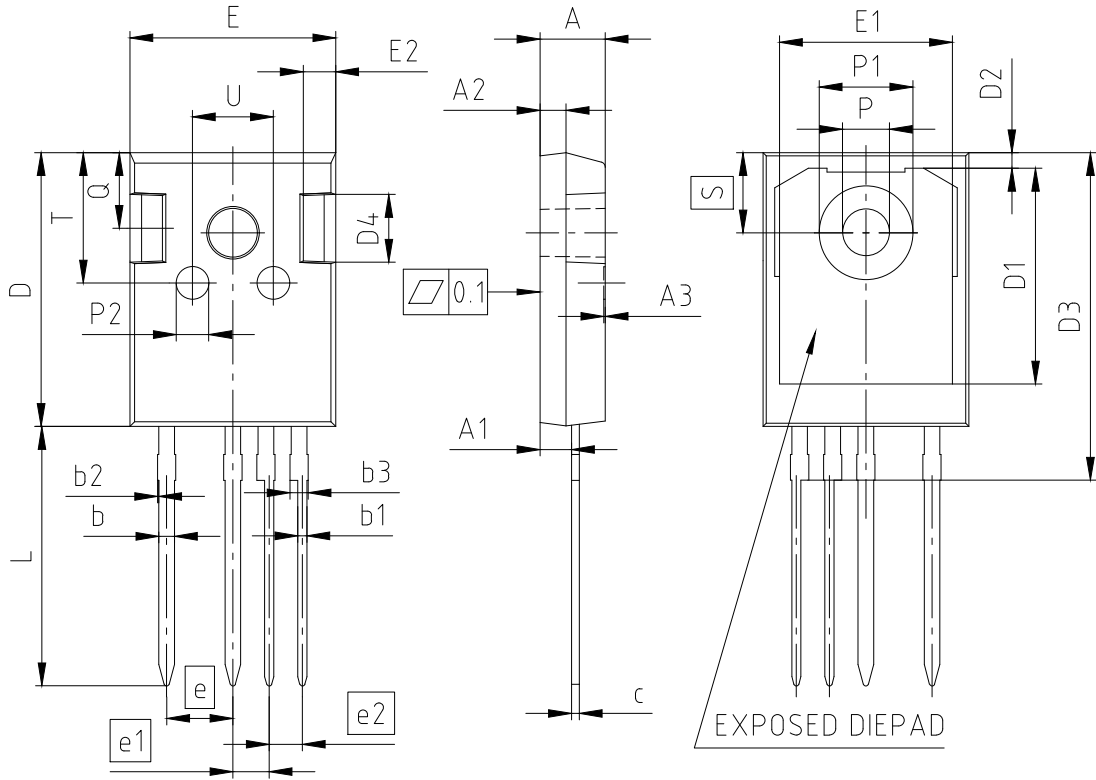
Table 10 Switching times

| Switching times test circuit for inductive load | Switching times waveform |
|---|--------------------------|
| | |

Table 11 Unclamped inductive load

| Unclamped inductive load test circuit | Unclamped inductive waveform |
|---------------------------------------|------------------------------|
| | |

7 Package Outlines



NOTES:
 DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURRS

| PACKAGE - GROUP NUMBER: | | PG-TO247-4-U02 | | | |
|-------------------------|-------------|----------------|------------|-------------|-------|
| DIMENSIONS | MILLIMETERS | | DIMENSIONS | MILLIMETERS | |
| | MIN. | MAX. | | MIN. | MAX. |
| A | 4.90 | 5.10 | E | 15.70 | 15.90 |
| A1 | 2.31 | 2.51 | E1 | 13.10 | 13.50 |
| A2 | 1.90 | 2.10 | E2 | 2.40 | 2.60 |
| A3 | 0.05 | 0.25 | e | 5.08 | |
| b | 1.10 | 1.30 | e1 | 2.79 | |
| b1 | 0.65 | 0.79 | e2 | 2.54 | |
| b2 | --- | 0.20 | N | 4 | |
| b3 | 1.34 | 1.44 | L | 19.80 | 20.10 |
| c | 0.58 | 0.66 | øP | 3.50 | 3.70 |
| D | 20.90 | 21.10 | øP1 | 7.00 | 7.40 |
| D1 | 16.25 | 16.85 | øP2 | 2.40 | 2.60 |
| D2 | 1.05 | 1.35 | Q | 5.60 | 6.00 |
| D3 | 24.97 | 25.27 | S | 6.15 | |
| D4 | 4.90 | 5.10 | T | 9.80 | 10.20 |
| | | | U | 6.00 | 6.40 |

Figure 1 Outline PG-TO247-4, dimensions in mm

8 Appendix A

Table 12 Related Links

- IFX CoolSiC™ Automotive Power Device 750 V G1 Webpage: www.infineon.com
- IFX CoolSiC™ Automotive Power Device 750 V G1 application note: www.infineon.com
- IFX CoolSiC™ Automotive Power Device 750 V G1 simulation model: www.infineon.com
- IFX Design tools: www.infineon.com

Revision History

AIMZA75R140M1H

Revision: 2024-01-29, Rev. 2.0

Previous Revision

| Revision | Date | Subjects (major changes since last revision) |
|----------|------------|--|
| 2.0 | 2024-01-29 | Release of final version |

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[G2R1000MT17D](#) [G3R60MT07K](#) [G2R50MT33K](#) [G3R12MT12K](#) [G3R160MT12D](#) [G3R160MT12J-TR](#) [G3R160MT17D](#) [G3R160MT17J-TR](#)
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