

OptiMOS®-P2 Power-Transistor

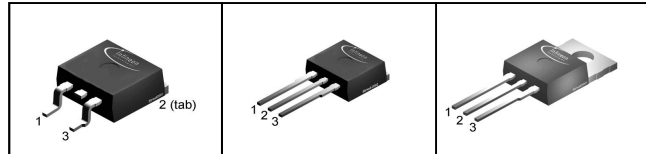
Features

- P-channel - Normal Level - Enhancement mode
- AEC qualified
- MSL1 up to 260°C peak reflow
- 175°C operating temperature
- Green package (RoHS compliant)
- 100% Avalanche tested

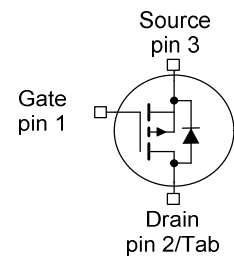
Product Summary

| | | |
|----------------------------|------|----|
| V_{DS} | -40 | V |
| $R_{DS(on)}$ (SMD Version) | 3.5 | mΩ |
| I_D | -120 | A |

PG-TO263-3-2 PG-TO262-3-1 PG-TO220-3-1



| Type | Package | Marking |
|----------------|--------------|---------|
| IPB120P04P4-04 | PG-TO263-3-2 | 4PP0404 |
| IPI120P04P4-04 | PG-TO262-3-1 | 4PP0404 |
| IPP120P04P4-04 | PG-TO220-3-1 | 4PP0404 |


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

| Parameter | Symbol | Conditions | Value | Unit |
|--|----------------|--|--------------|------|
| Continuous drain current ¹⁾ | I_D | $T_C=25\text{ °C}$, $V_{GS}=-10\text{V}$ | -120 | A |
| | | $T_C=100\text{ °C}$, $V_{GS}=-10\text{V}^{2)}$ | -110 | |
| Pulsed drain current ²⁾ | $I_{D,pulse}$ | $T_C=25\text{ °C}$ | -480 | |
| Avalanche energy, single pulse | E_{AS} | $I_D=-60\text{A}$ | 78 | mJ |
| Avalanche current, single pulse | I_{AS} | - | -120 | A |
| Gate source voltage | V_{GS} | - | ±20 | V |
| Power dissipation | P_{tot} | $T_C=25\text{ °C}$ | 136 | W |
| Operating and storage temperature | T_j, T_{stg} | - | -55 ... +175 | °C |
| IEC climatic category; DIN IEC 68-1 | - | - | 55/175/56 | |

| Parameter | Symbol | Conditions | Values | | | Unit |
|--|------------|--|--------|------|------|------|
| | | | min. | typ. | max. | |
| Thermal characteristics²⁾ | | | | | | |
| Thermal resistance, junction - case | R_{thJC} | - | - | - | 1.1 | K/W |
| Thermal resistance, junction - ambient, leaded | R_{thJA} | - | - | - | 62 | |
| SMD version, device on PCB | R_{thJA} | minimal footprint | - | - | 62 | |
| | | 6 cm ² cooling area ³⁾ | - | - | 40 | |

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

| | | | | | | |
|----------------------------------|---------------|--|------|-------|------|------------|
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}=0V, I_D=-1mA$ | -40 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=-340\mu A$ | -2.0 | -3.0 | -4.0 | |
| Zero gate voltage drain current | I_{DSS} | $V_{DS}=-32V, V_{GS}=0V, T_j=25^\circ\text{C}$ | - | -0.05 | -1 | μA |
| | | $V_{DS}=-32V, V_{GS}=0V, T_j=125^\circ\text{C}^{2)}$ | - | -20 | -200 | |
| Gate-source leakage current | I_{GSS} | $V_{GS}=-20V, V_{DS}=0V$ | - | - | -100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}=-10V, I_D=-100A$ | - | 2.9 | 3.8 | m Ω |
| | | $V_{GS}=-10V, I_D=-100A, \text{SMD version}$ | - | 2.6 | 3.5 | |

| Parameter | Symbol | Conditions | Values | | | Unit |
|-----------|--------|------------|--------|------|------|------|
| | | | min. | typ. | max. | |

Dynamic characteristics²⁾

| | | | | | | |
|------------------------------|--------------|--|---|-------|-------|----|
| Input capacitance | C_{iss} | $V_{GS}=0V, V_{DS}=-25V,$ $f=1MHz$ | - | 11380 | 14790 | pF |
| Output capacitance | C_{oss} | | - | 3410 | 4430 | |
| Reverse transfer capacitance | C_{rss} | | - | 90 | 180 | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}=-20V,$ $V_{GS}=-10V, I_D=-120A,$ $R_G=3.5\Omega$ | - | 30 | - | ns |
| Rise time | t_r | | - | 20 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 49 | - | |
| Fall time | t_f | | - | 52 | - | |

Gate Charge Characteristics²⁾

| | | | | | | |
|-----------------------|---------------|--|---|------|-----|----|
| Gate to source charge | Q_{gs} | $V_{DD}=-32V,$ $I_D=-120A,$ $V_{GS}=0$ to $-10V$ | - | 62 | 80 | nC |
| Gate to drain charge | Q_{gd} | | - | 30 | 60 | |
| Gate charge total | Q_g | | - | 158 | 205 | |
| Gate plateau voltage | $V_{plateau}$ | | - | -5.3 | - | V |

Reverse Diode

| | | | | | | |
|--|---------------|--|---|----|------|----|
| Diode continuous forward current ²⁾ | I_S | $T_C=25^\circ C$ | - | - | -120 | A |
| Diode pulse current ²⁾ | $I_{S,pulse}$ | | - | - | -480 | |
| Diode forward voltage | V_{SD} | $V_{GS}=0V, I_F=-100A,$ $T_j=25^\circ C$ | - | -1 | -1.3 | V |
| Reverse recovery time ²⁾ | t_{rr} | $V_R=-20V, I_F=-50A,$ $di_F/dt=-100A/\mu s$ | - | 69 | - | ns |
| Reverse recovery charge ²⁾ | Q_{rr} | | - | 95 | - | nC |

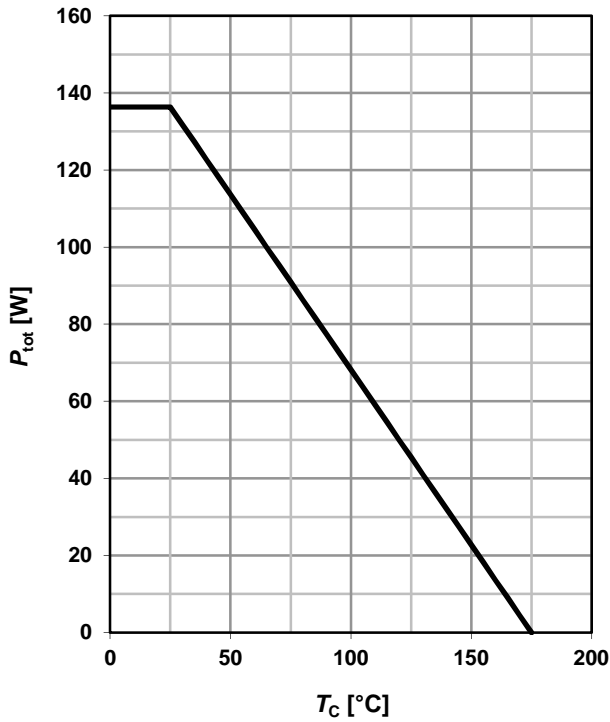
¹⁾ Current is limited by bondwire; with an $R_{thJC} = 1.1K/W$ the chip is able to carry -155A at 25°C.

²⁾ Defined by design. Not subject to production test.

³⁾ Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm² (one layer, 70 μm thick) copper area for drain connection. PCB is vertical in still air.

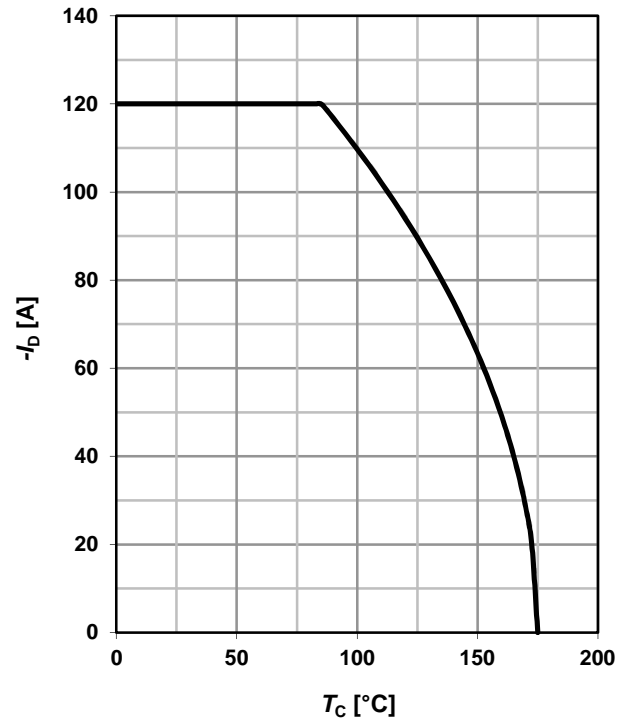
1 Power dissipation

$P_{tot} = f(T_C); V_{GS} \leq -6V$



2 Drain current

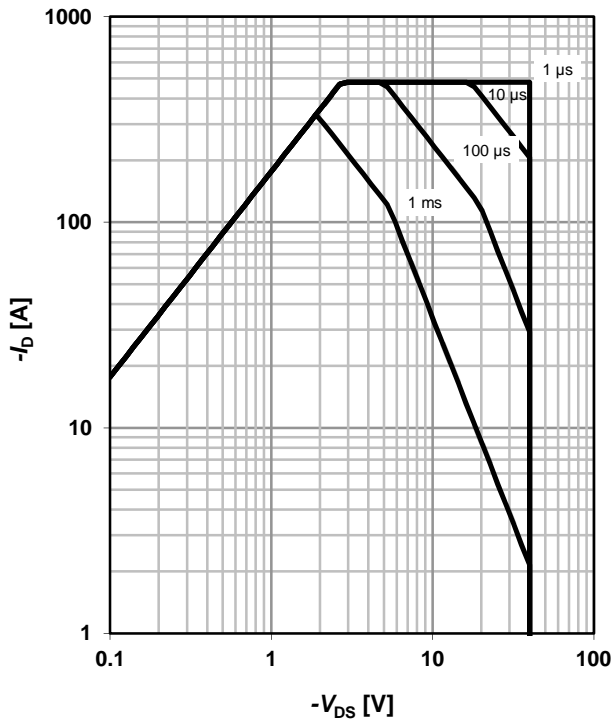
$I_D = f(T_C); V_{GS} \leq -6V; SMD$



3 Safe operating area

$I_D = f(V_{DS}); T_C = 25\text{ °C}; D = 0; SMD$

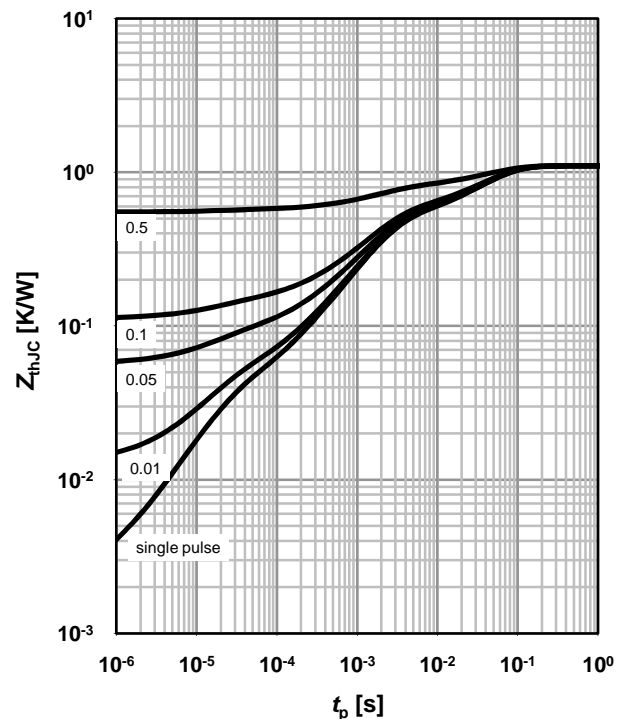
parameter: t_p



4 Max. transient thermal impedance

$Z_{thJC} = f(t_p)$

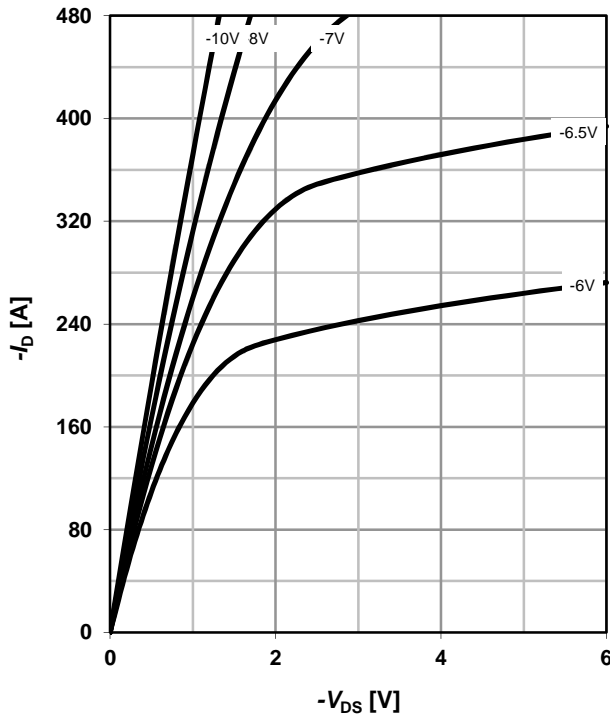
parameter: $D = t_p/T$



5 Typ. output characteristics

$I_D = f(V_{DS}); T_j = 25\text{ °C}; \text{SMD}$

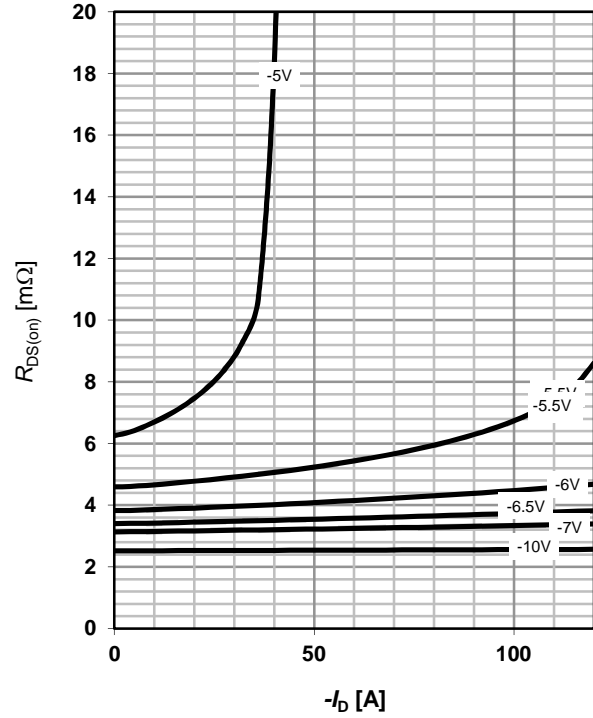
parameter: V_{GS}



6 Typ. drain-source on-state resistance

$R_{DS(on)} = f(I_D); T_j = 25\text{ °C}; \text{SMD}$

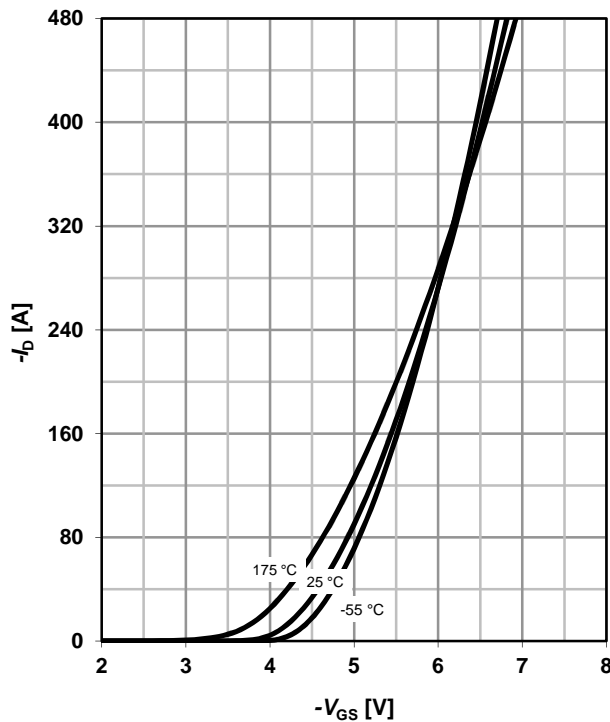
parameter: V_{GS}



7 Typ. transfer characteristics

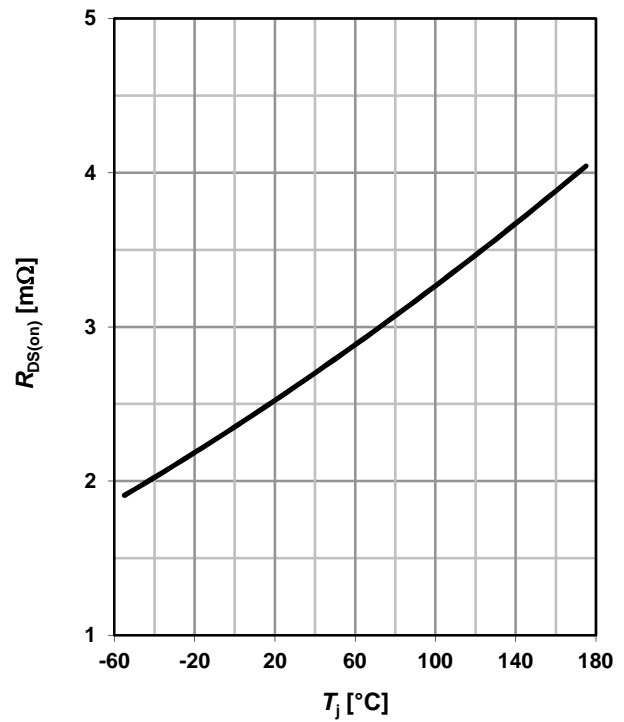
$I_D = f(V_{GS}); V_{DS} = -6V$

parameter: T_j



8 Typ. drain-source on-state resistance

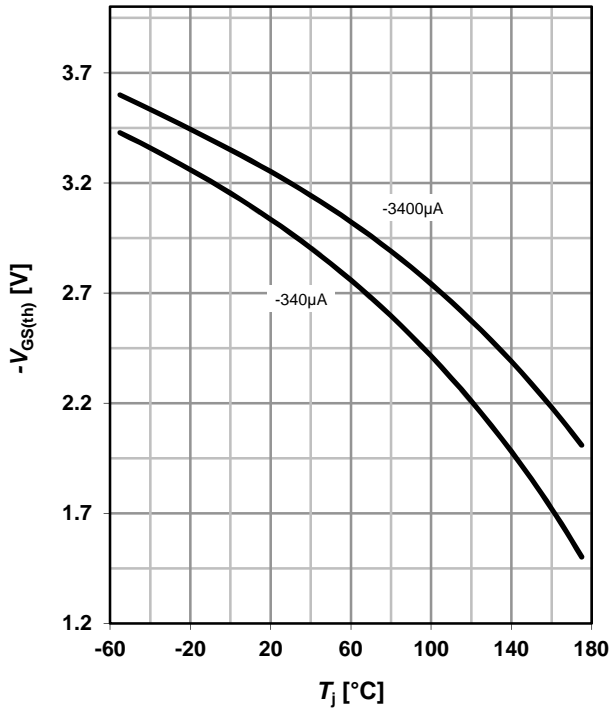
$R_{DS(on)} = f(T_j); I_D = -100\text{ A}; V_{GS} = -10\text{ V}; \text{SMD}$



9 Typ. gate threshold voltage

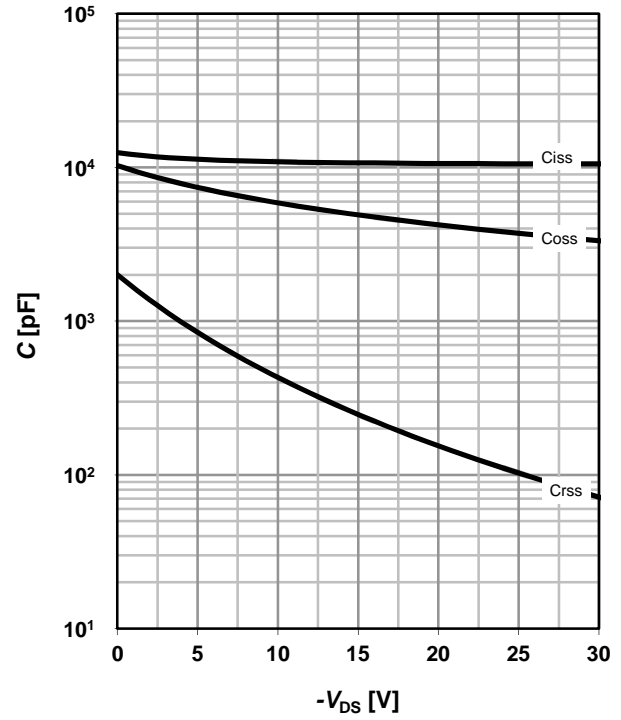
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter: I_D



10 Typ. capacitances

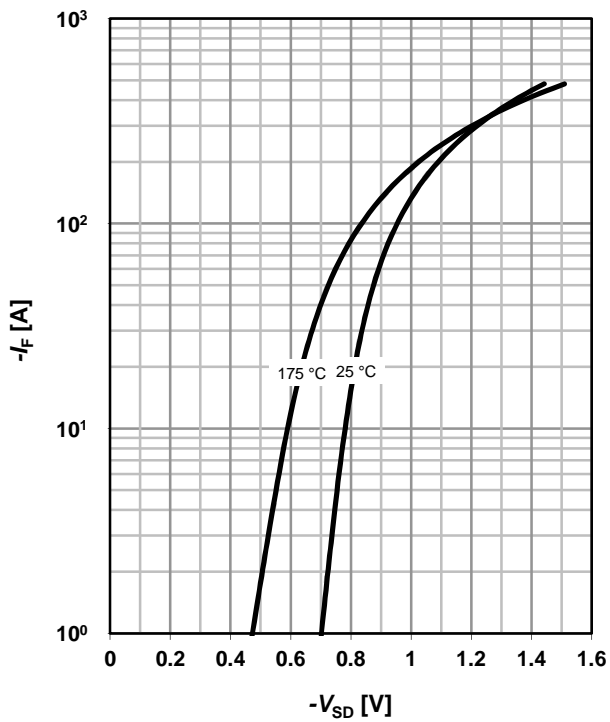
$C = f(V_{DS}); V_{GS} = 0 V; f = 1 MHz$



11 Typical forward diode characteristics

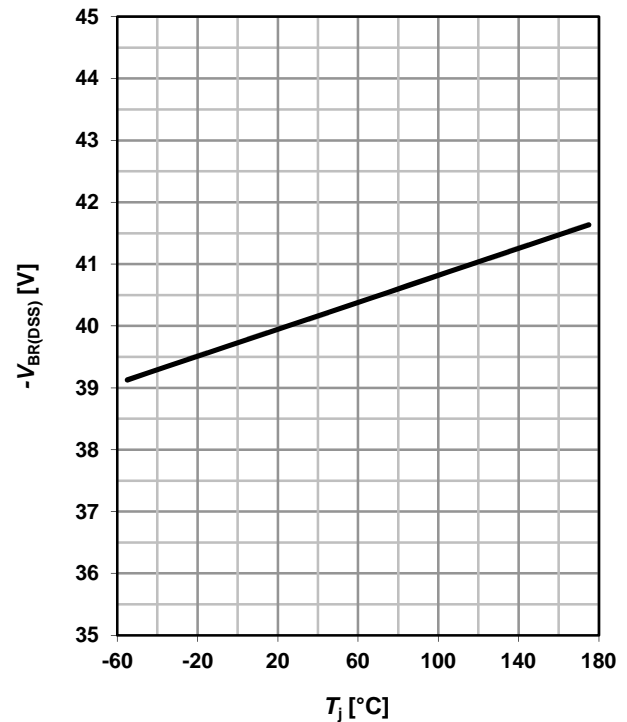
$I_F = f(V_{SD})$

parameter: T_j



12 Drain-source breakdown voltage

$V_{BR(DSS)} = f(T_j); I_D = -1 mA$

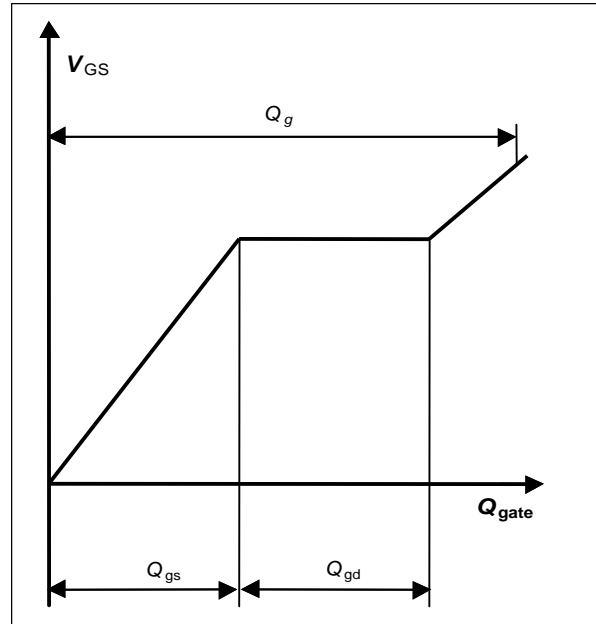
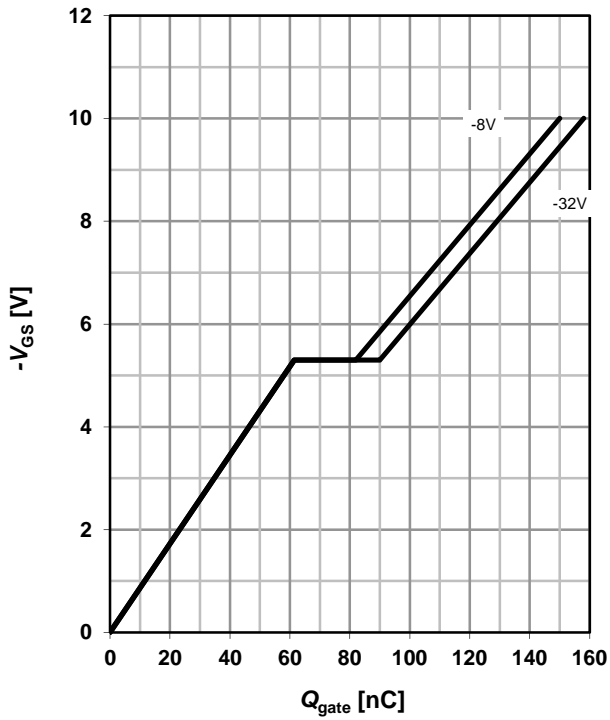


13 Typ. gate charge

$V_{GS} = f(Q_{gate}); I_D = -120$ A pulsed

parameter: V_{DD}

14 Gate charge waveforms



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Revision History

| Version | Date | Changes |
|---------|------------|-------------------|
| 1.0 | 2011-01-25 | Final Data Sheet |
| 1.1 | 2015-05-27 | Update of marking |