

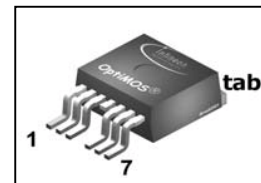
OptiMOS™ 3 Power-Transistor
Features

- MOSFET for ORing and Uninterruptible Power Supply
- Qualified according to JEDEC¹⁾ for target applications
- N-channel
- Normal level
- Ultra-low on-resistance $R_{DS(on)}$
- 100% Avalanche tested
- Pb-free plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

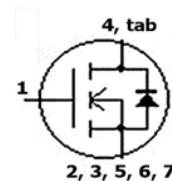
Product Summary

| | | |
|------------------|-----|------------|
| V_{DS} | 40 | V |
| $R_{DS(on),max}$ | 2.0 | m Ω |
| I_D | 140 | A |

PG-TO263-7



| Type | Package | Marking |
|--------------|------------|---------|
| IPB020N04N G | PG-TO263-7 | 020N04N |


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

| Parameter | Symbol | Conditions | Value | Unit |
|---|---------------|---|----------|------|
| Continuous drain current | I_D | $V_{GS}=10\text{ V}, T_C=25\text{ °C}$ | 140 | A |
| | | $V_{GS}=10\text{ V}, T_C=100\text{ °C}$ | 140 | |
| Pulsed drain current ²⁾ | $I_{D,pulse}$ | $T_C=25\text{ °C}$ | 980 | |
| Avalanche current, single pulse ³⁾ | I_{AS} | $T_C=25\text{ °C}$ | 100 | |
| Avalanche energy, single pulse | E_{AS} | $I_D=100\text{ A}, R_{GS}=25\text{ }\Omega$ | 140 | mJ |
| Gate source voltage | V_{GS} | | ± 20 | V |

¹⁾ J-STD20 and JESD22

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

| Parameter | Symbol | Conditions | Value | Unit |
|-------------------------------------|-----------------------|--------------------|-------------|------|
| Power dissipation | P_{tot} | $T_c=25\text{ °C}$ | 167 | 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 characteristics

| | | | | | | |
|-------------------------------------|-------------------|--|---|---|-----|-----|
| Thermal resistance, junction - case | R_{thJC} | | - | - | 0.9 | K/W |
| SMD version, device on PCB | R_{thJA} | minimal footprint | - | - | 62 | |
| | | 6 cm ² cooling area ⁴⁾ | - | - | 40 | |

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

| | | | | | | |
|----------------------------------|-----------------------------|--|----|-----|-----|---------------|
| Drain-source breakdown voltage | $V_{(\text{BR})\text{DSS}}$ | $V_{\text{GS}}=0\text{ V}, I_{\text{D}}=1\text{ mA}$ | 40 | - | - | V |
| Gate threshold voltage | $V_{\text{GS(th)}}$ | $V_{\text{DS}}=V_{\text{GS}}, I_{\text{D}}=95\text{ }\mu\text{A}$ | 2 | - | 4 | |
| Zero gate voltage drain current | I_{DSS} | $V_{\text{DS}}=40\text{ V}, V_{\text{GS}}=0\text{ V}, T_j=25\text{ °C}$ | - | 0.1 | 1 | μA |
| | | $V_{\text{DS}}=40\text{ V}, V_{\text{GS}}=0\text{ V}, T_j=125\text{ °C}$ | - | 10 | 100 | |
| Gate-source leakage current | I_{GSS} | $V_{\text{GS}}=20\text{ V}, V_{\text{DS}}=0\text{ V}$ | - | 10 | 100 | nA |
| Drain-source on-state resistance | $R_{\text{DS(on)}}$ | $V_{\text{GS}}=10\text{ V}, I_{\text{D}}=100\text{ A}$ | - | 1.7 | 2 | m Ω |
| Gate resistance | R_{G} | | - | 2.1 | - | Ω |
| Transconductance | g_{fs} | $ V_{\text{DS}} >2 I_{\text{D}} R_{\text{DS(on)max}}, I_{\text{D}}=100\text{ A}$ | 85 | 170 | - | S |

²⁾ See figure 3 for more detailed information

³⁾ See figure 13 for more detailed information

⁴⁾ 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.

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

Dynamic characteristics

| | | | | | | |
|------------------------------|--------------|---|---|------|------|----|
| Input capacitance | C_{iss} | $V_{GS}=0\text{ V}, V_{DS}=20\text{ V},$ $f=1\text{ MHz}$ | - | 7300 | 9700 | pF |
| Output capacitance | C_{oss} | | - | 2000 | 2700 | |
| Reverse transfer capacitance | C_{rss} | | - | 77 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}=20\text{ V}, V_{GS}=10\text{ V},$ $I_D=30\text{ A}, R_G=1.6\ \Omega$ | - | 27 | - | ns |
| Rise time | t_r | | - | 6.4 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 40 | - | |
| Fall time | t_f | | - | 7.8 | - | |

Gate Charge Characteristics⁵⁾

| | | | | | | |
|------------------------------|---------------|--|---|-----|-----|----|
| Gate to source charge | Q_{gs} | $V_{DD}=20\text{ V}, I_D=30\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$ | - | 35 | - | nC |
| Gate charge at threshold | $Q_{g(th)}$ | | - | 22 | - | |
| Gate to drain charge | Q_{gd} | | - | 11 | - | |
| Switching charge | Q_{sw} | | - | 24 | - | |
| Gate charge total | Q_g | | - | 90 | 120 | |
| Gate plateau voltage | $V_{plateau}$ | | - | 4.8 | - | |
| Gate charge total, sync. FET | $Q_{g(sync)}$ | $V_{DS}=0.1\text{ V},$ $V_{GS}=0\text{ to }10\text{ V}$ | - | 85 | - | |
| Output charge | Q_{oss} | $V_{DD}=20\text{ V}, V_{GS}=0\text{ V}$ | - | 73 | - | |

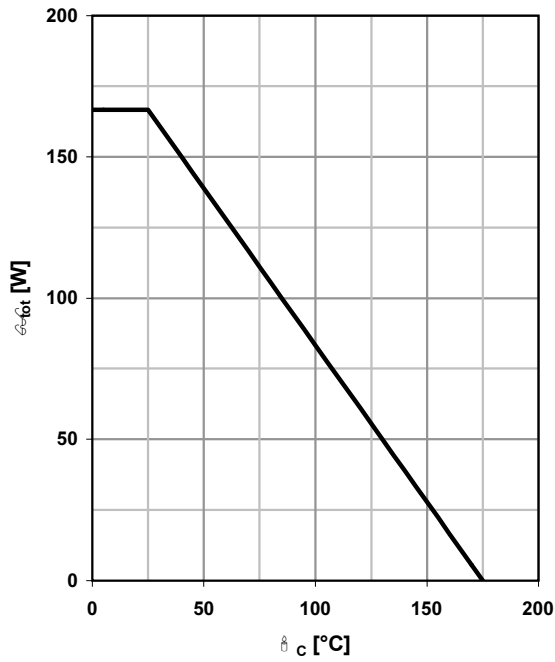
Reverse Diode

| | | | | | | |
|----------------------------------|---------------|--|---|------|-----|----|
| Diode continuous forward current | I_S | $T_C=25\text{ }^\circ\text{C}$ | - | - | 139 | A |
| Diode pulse current | $I_{S,pulse}$ | | - | - | 980 | |
| Diode forward voltage | V_{SD} | $V_{GS}=0\text{ V}, I_F=100\text{ A},$ $T_j=25\text{ }^\circ\text{C}$ | - | 0.91 | 1.2 | V |
| Reverse recovery charge | Q_{rr} | $V_R=20\text{ V}, I_F=I_S,$ $di_F/dt=400\text{ A}/\mu\text{s}$ | - | 88 | - | nC |

⁵⁾ See figure 16 for gate charge parameter definition

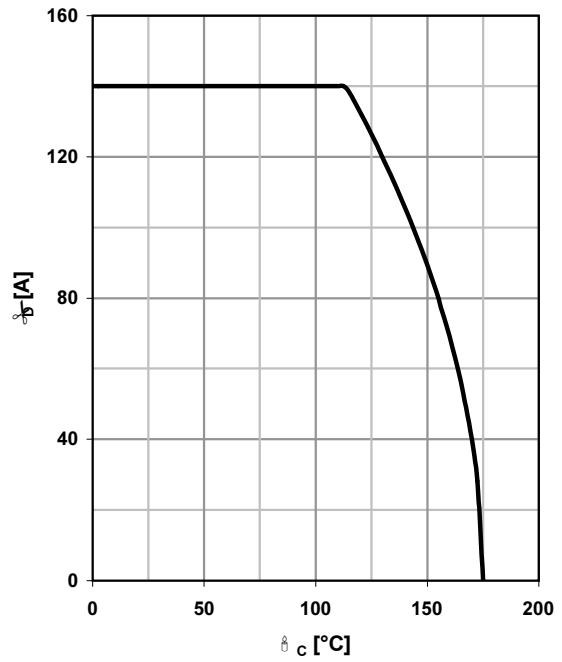
1 Power dissipation

$P_{tot} = f(T_c)$



2 Drain current

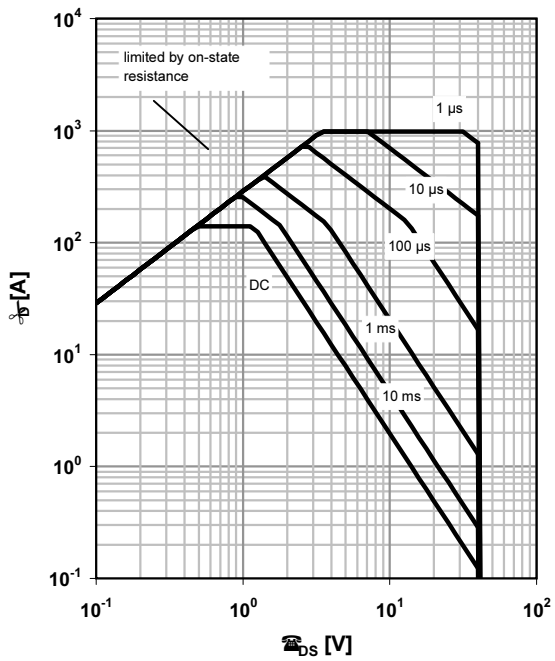
$I_D = f(T_c); V_{GS} \geq 10 V$



3 Safe operating area

$I_D = f(V_{DS}); T_c = 25^\circ C; D = 0$

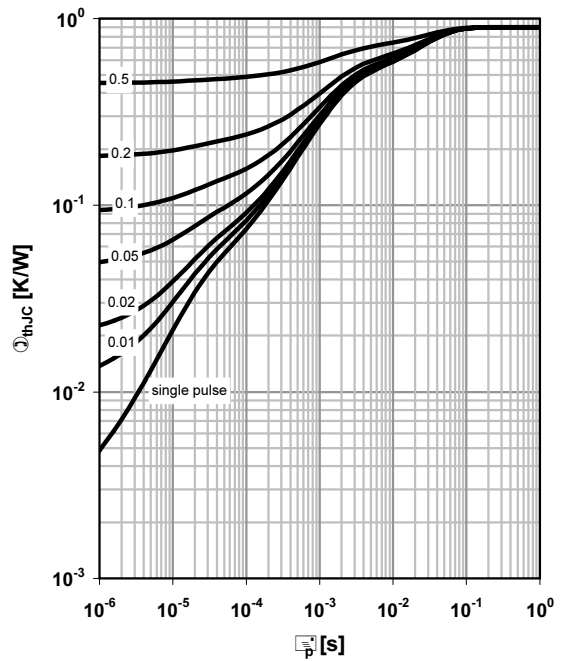
parameter: t_p



4 Max. transient thermal impedance

$Z_{thJC} = f(t_p)$

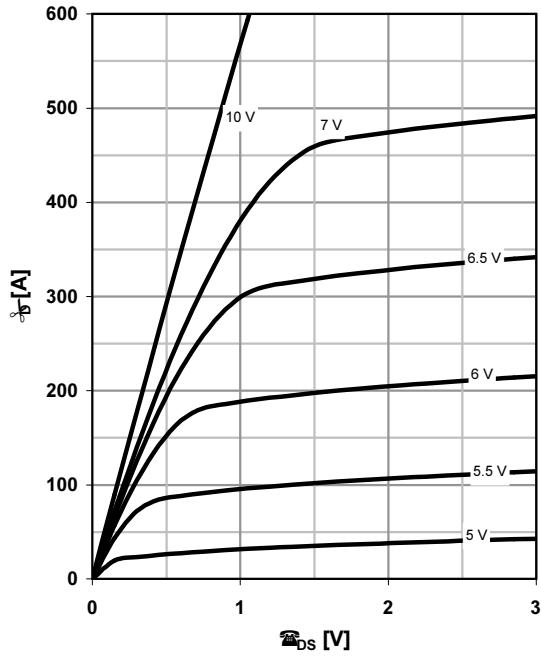
parameter: $D = t_p / T$



5 Typ. output characteristics

$I_D = f(V_{DS}); T_j = 25\text{ °C}$

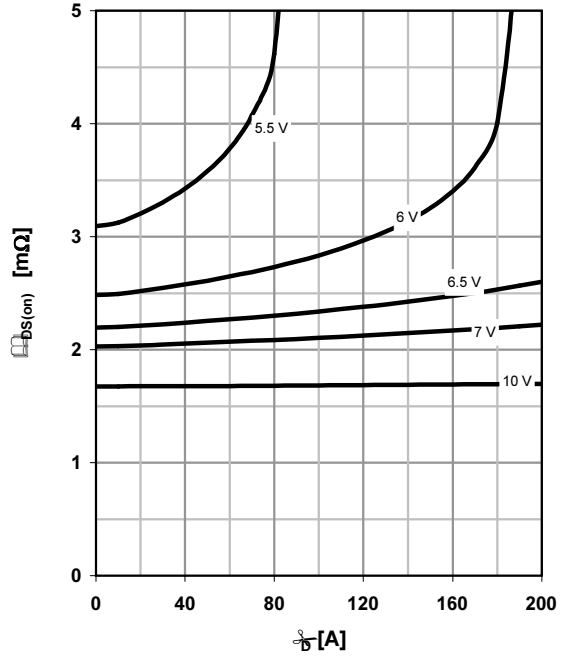
parameter: V_{GS}



6 Typ. drain-source on resistance

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

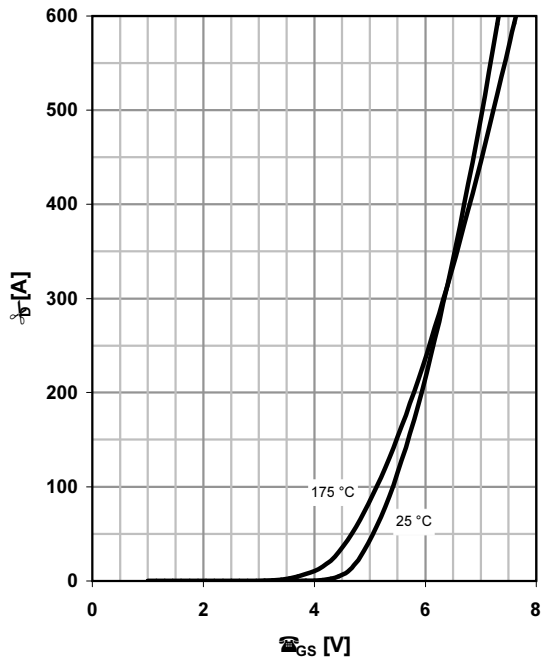
parameter: V_{GS}



7 Typ. transfer characteristics

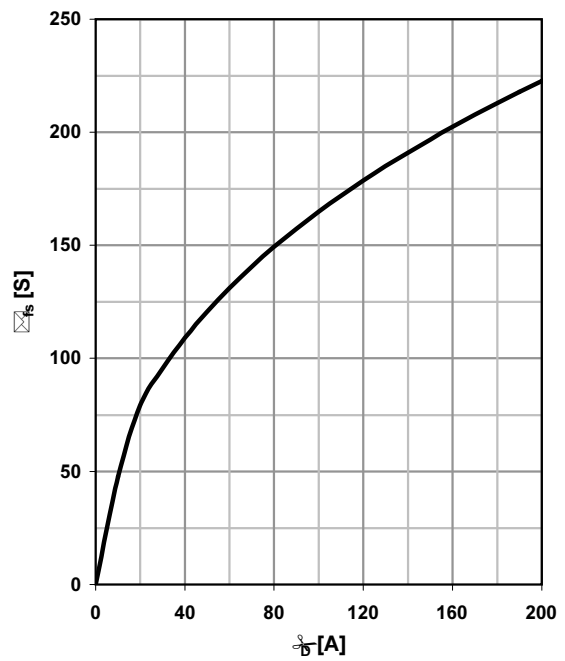
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

parameter: T_j



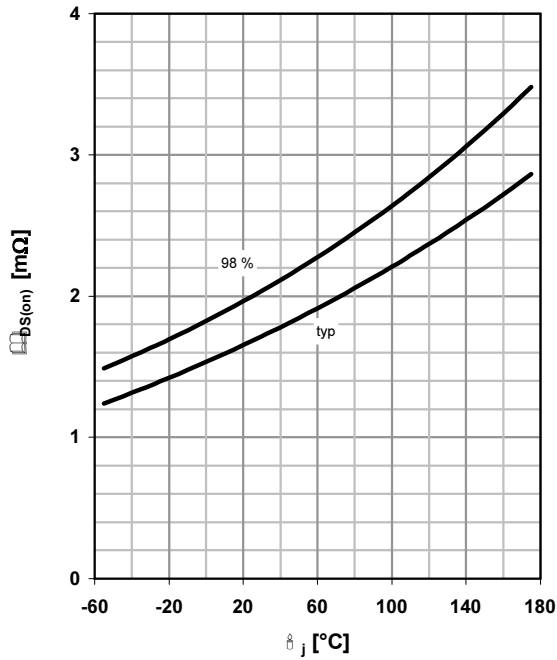
8 Typ. forward transconductance

$g_{fs} = f(I_D); T_j = 25\text{ °C}$



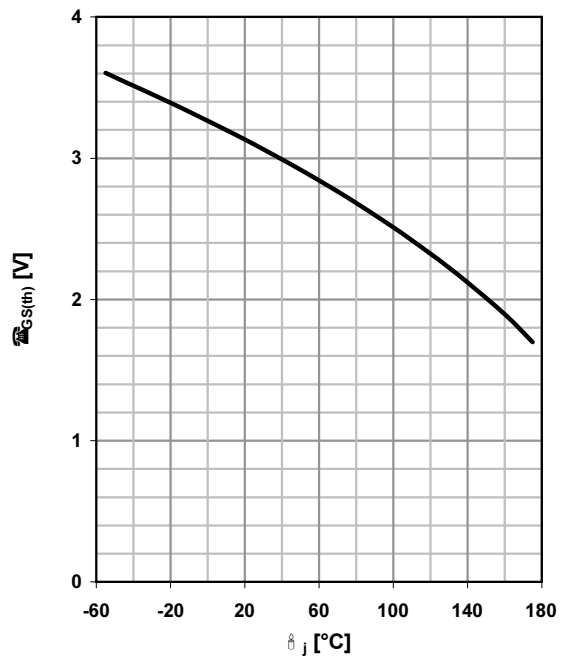
9 Drain-source on-state resistance

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



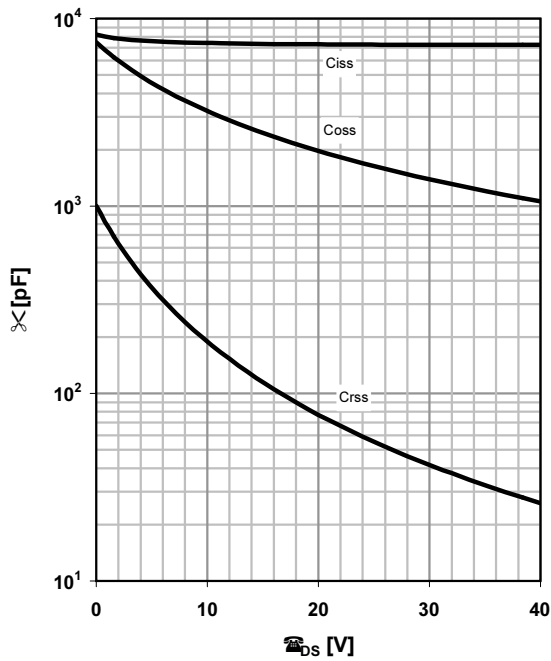
10 Typ. gate threshold voltage

$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}; I_D = 250 \mu\text{A}$



11 Typ. capacitances

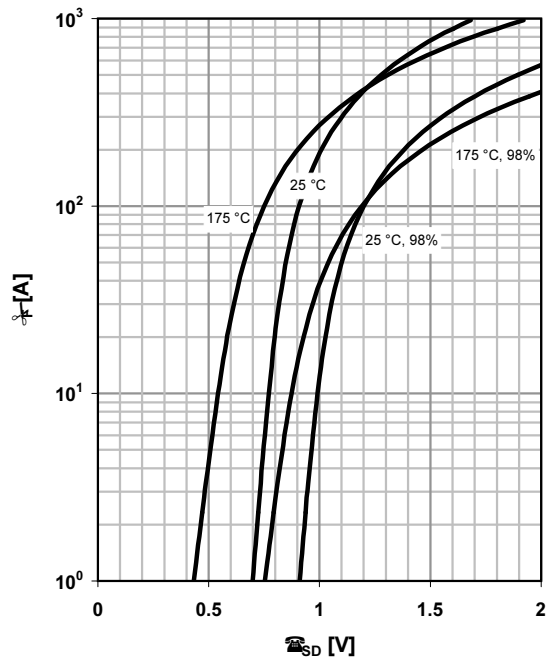
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



12 Forward characteristics of reverse diode

$I_F = f(V_{SD})$

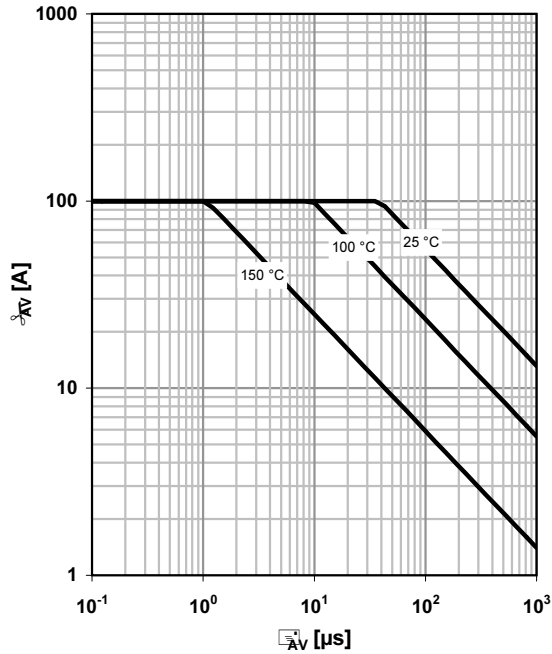
parameter: T_j



13 Avalanche characteristics

$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$

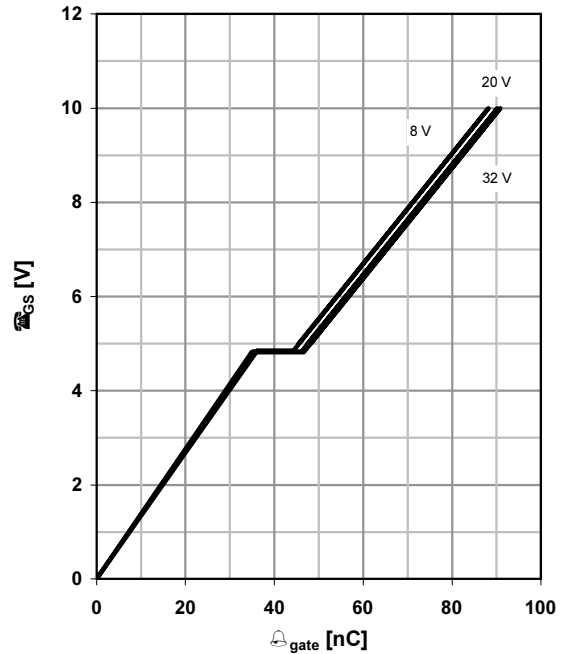
parameter: $T_{j(start)}$



14 Typ. gate charge

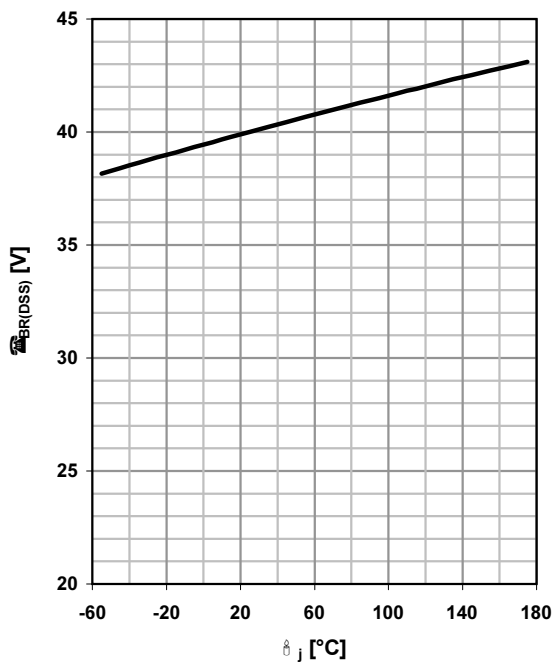
$V_{GS}=f(Q_{gate}); I_D=30 \text{ A pulsed}$

parameter: V_{DD}

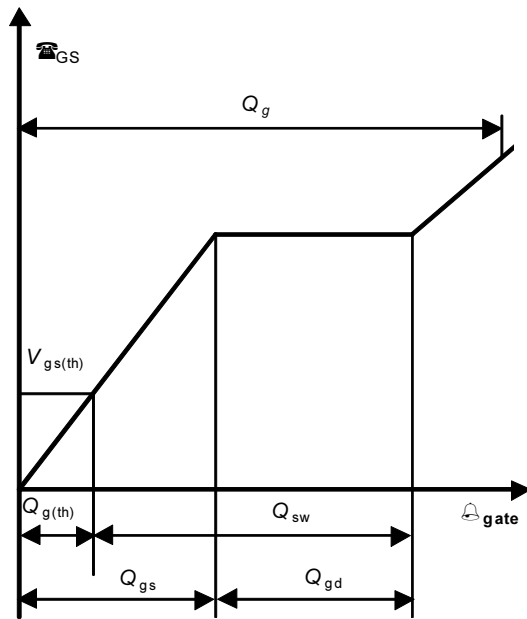


15 Drain-source breakdown voltage

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

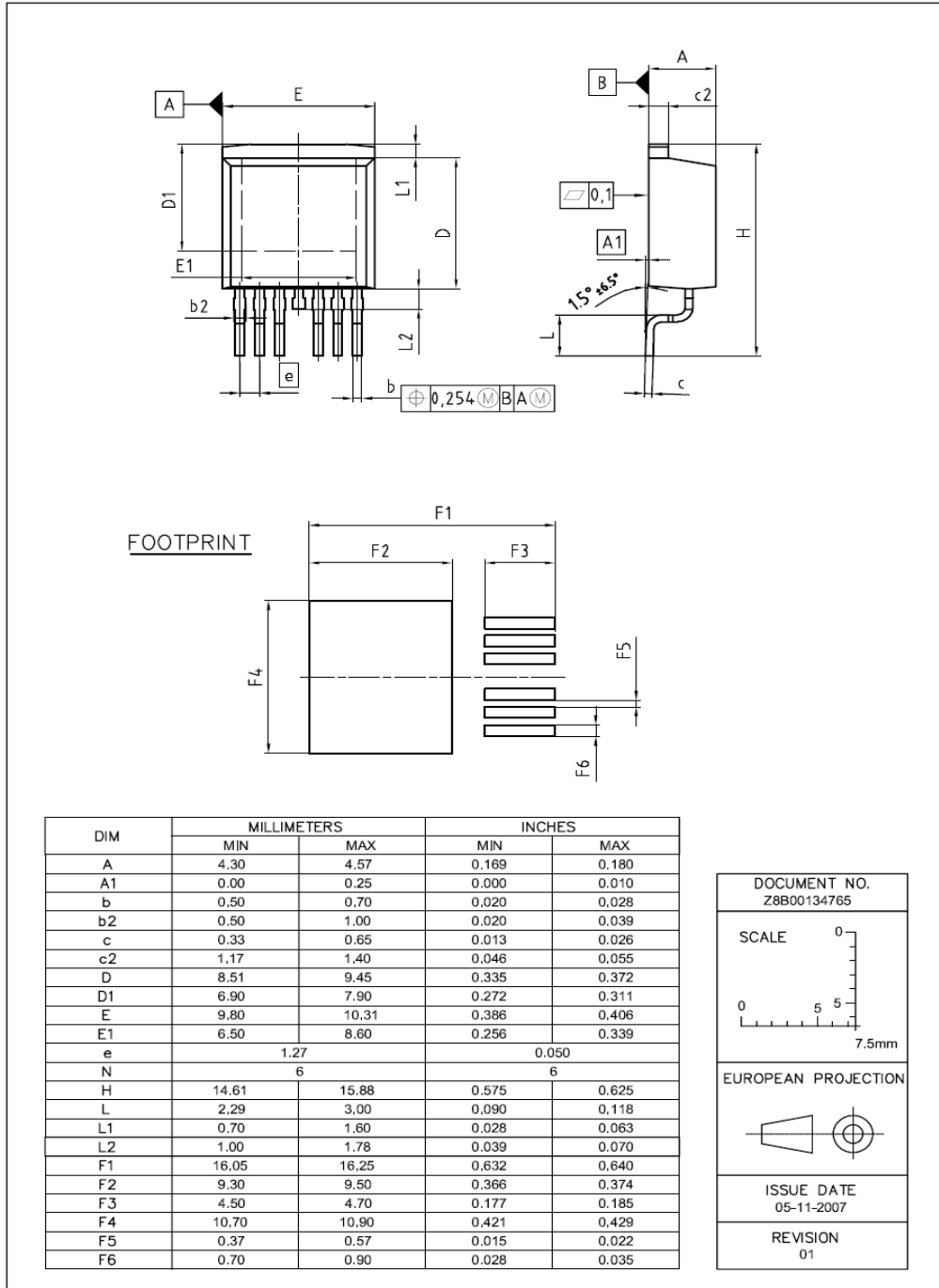


16 Gate charge waveforms



Package Outline
PG-TO263-7

TO263-7-2 / TO263-7-3 / TO263-7-5 / TO263-7-7





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