

OptiMOS^(TM)3 Power-Transistor
Features

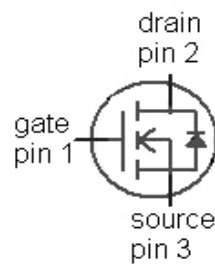
- Ideal for high frequency switching and sync. rec.
- Optimized technology for DC/DC converters
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- N-channel, logic level
- 100% avalanche tested
- Pb-free plating; RoHS compliant
- Qualified according to JEDEC¹⁾ for target applications

Product Summary

| | | |
|------------------|----|------------|
| V_{DS} | 60 | V |
| $R_{DS(on),max}$ | 22 | m Ω |
| I_D | 30 | A |



| | |
|----------------|---------------|
| Type | IPD220N06L3 G |
| | |
| Package | PG-TO-252-3 |
| Marking | 220N06L |


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

| Parameter | Symbol | Conditions | Value | Unit |
|----------------------------------------------|----------------|-----------------------------------------|-------------|--------------------|
| Continuous drain current | I_D | $T_C=25\text{ °C}$ | 30 | A |
| | | $T_C=100\text{ °C}$ | 21 | |
| Pulsed drain current ²⁾ | $I_{D,pulse}$ | $T_C=25\text{ °C}$ | 120 | |
| Avalanche energy, single pulse ³⁾ | E_{AS} | $I_D=20\text{ A}$, $R_{GS}=25\ \Omega$ | 13 | mJ |
| Gate source voltage | V_{GS} | | ± 20 | V |
| Power dissipation | P_{tot} | $T_C=25\text{ °C}$ | 36 | W |
| Operating and storage temperature | T_j, T_{stg} | | -55 ... 175 | $^{\circ}\text{C}$ |
| IEC climatic category; DIN IEC 68-1 | | | 55/175/56 | |

¹⁾J-STD20 and JESD22

²⁾ See figure 3 for more detailed information

³⁾ See figure 13 for more detailed information

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

Thermal characteristics

| | | | | | | |
|----------------------------------------|------------|----------------------------------------------|---|---|-----|-----|
| Thermal resistance, junction - case | R_{thJC} | | - | - | 4.2 | K/W |
| Thermal resistance, junction - ambient | 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 | $V_{(BR)DSS}$ | $V_{GS}=0\text{ V}, I_D=1\text{ mA}$ | 60 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=11\text{ }\mu\text{A}$ | 1.2 | 1.7 | 2.2 | |
| Zero gate voltage drain current | I_{DSS} | $V_{DS}=60\text{ V}, V_{GS}=0\text{ V}, T_j=25\text{ °C}$ | - | 0.1 | 1 | μA |
| | | $V_{DS}=60\text{ V}, V_{GS}=0\text{ V}, T_j=125\text{ °C}$ | - | 10 | 100 | |
| Gate-source leakage current | I_{GSS} | $V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$ | - | 1 | 100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}=10\text{ V}, I_D=30\text{ A}$ | - | 17.8 | 22.0 | m Ω |
| | | $V_{GS}=4.5\text{ V}, I_D=15\text{ A}$ | - | 27.4 | 39.8 | |
| Gate resistance | R_G | | - | 0.9 | - | Ω |
| Transconductance | g_{fs} | $ V_{DS} >2 I_D R_{DS(on)max}, I_D=30\text{ A}$ | 16 | 32 | - | S |

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} | $V_{GS}=0\text{ V}, V_{DS}=30\text{ V},$ $f=1\text{ MHz}$ | - | 1200 | 1600 | pF |
| Output capacitance | C_{oss} | | - | 270 | 360 | |
| Reverse transfer capacitance | C_{rss} | | - | 16 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}=30\text{ V}, V_{GS}=10\text{ V},$ $I_D=30\text{ A}, R_G=3\ \Omega$ | - | 9 | - | ns |
| Rise time | t_r | | - | 3 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 19 | - | |
| Fall time | t_f | | - | 3 | - | |

Gate Charge Characteristics⁵⁾

| | | | | | | |
|-----------------------|---------------|-----------------------------------------------------------------------------|---|-----|----|----|
| Gate to source charge | Q_{gs} | $V_{DD}=30\text{ V}, I_D=30\text{ A},$ $V_{GS}=0\text{ to }4.5\text{ V}$ | - | 5 | - | nC |
| Gate to drain charge | Q_{gd} | | - | 2 | - | |
| Switching charge | Q_{sw} | | - | 5 | - | |
| Gate charge total | Q_g | | - | 7 | 10 | |
| Gate plateau voltage | $V_{plateau}$ | | - | 4.1 | - | V |
| Output charge | Q_{oss} | $V_{DD}=30\text{ V}, V_{GS}=0\text{ V}$ | - | 13 | 17 | nC |

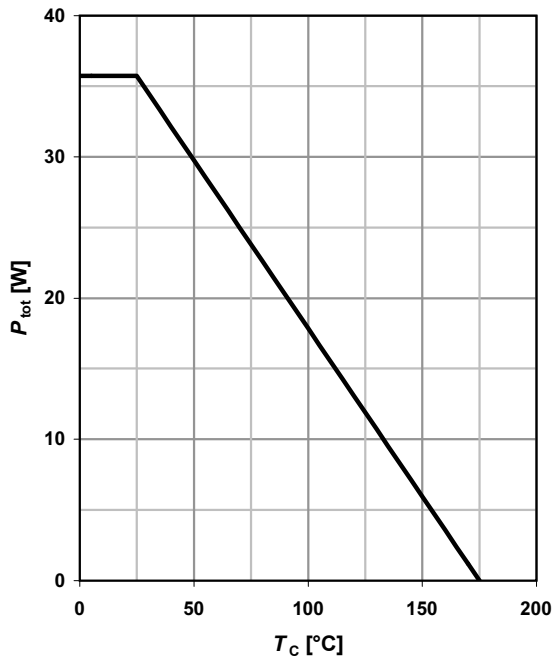
Reverse Diode

| | | | | | | |
|----------------------------------|---------------|---------------------------------------------------------------------------|---|-----|-----|----|
| Diode continuous forward current | I_S | $T_C=25\text{ }^\circ\text{C}$ | - | - | 30 | A |
| Diode pulse current | $I_{S,pulse}$ | | - | - | 120 | |
| Diode forward voltage | V_{SD} | $V_{GS}=0\text{ V}, I_F=30\text{ A},$ $T_j=25\text{ }^\circ\text{C}$ | - | 1.0 | 1.2 | V |
| Reverse recovery time | t_{rr} | $V_R=30\text{ V}, I_F=30\text{ A},$ $di_F/dt=100\text{ A}/\mu\text{s}$ | - | 27 | - | ns |
| Reverse recovery charge | Q_{rr} | | - | 23 | - | nC |

⁵⁾ See figure 16 for gate charge parameter definition

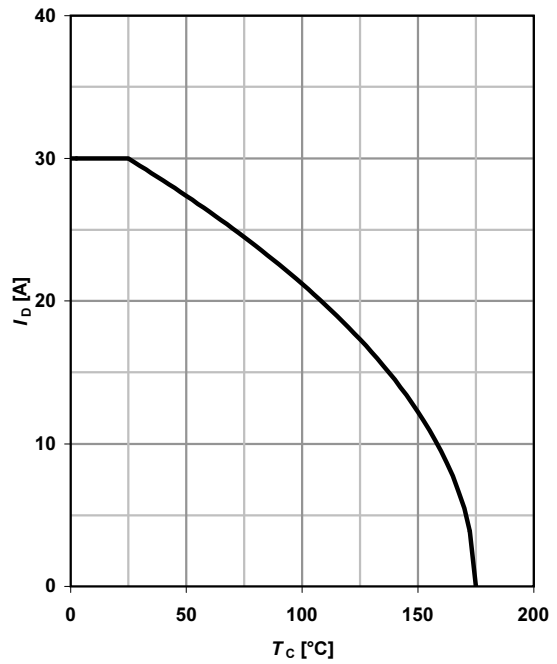
1 Power dissipation

$$P_{tot} = f(T_C)$$



2 Drain current

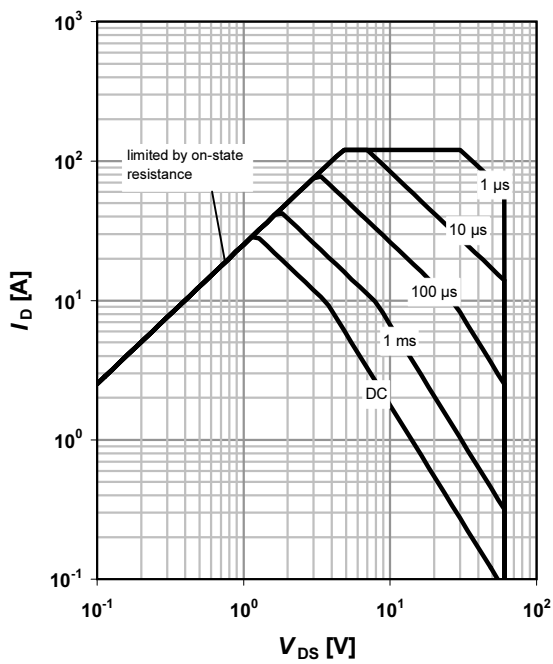
$$I_D = f(T_C); V_{GS} \geq 10 \text{ V}$$



3 Safe operating area

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

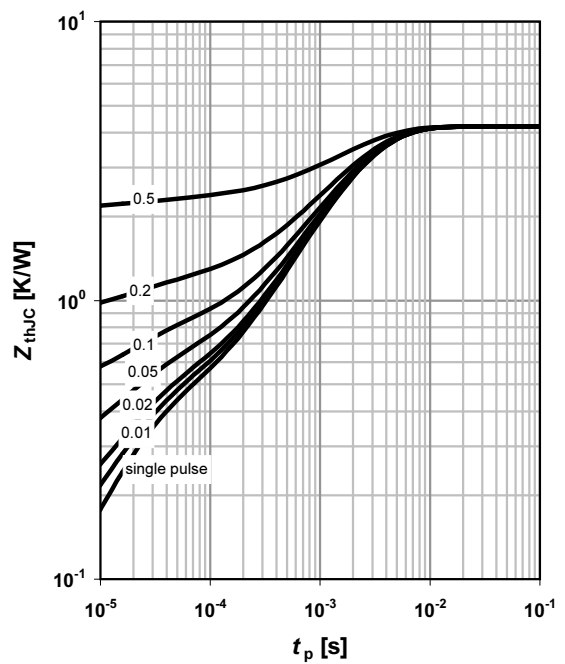
parameter: t_p



4 Max. transient thermal impedance

$$Z_{thJC} = f(t_p)$$

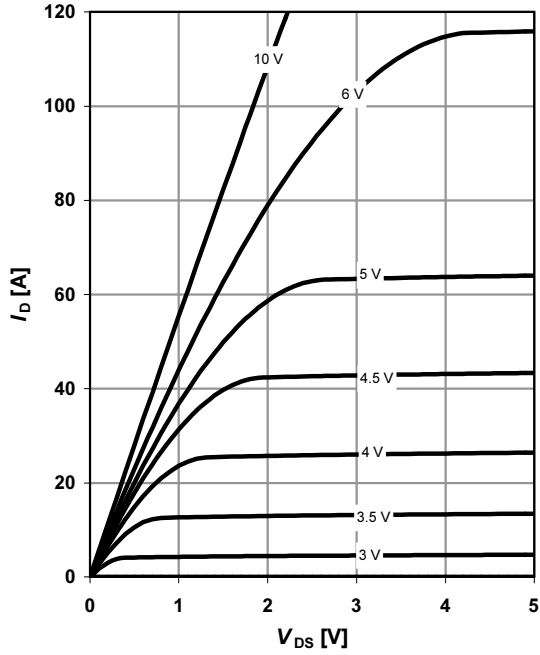
parameter: $D = t_p/T$



5 Typ. output characteristics

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

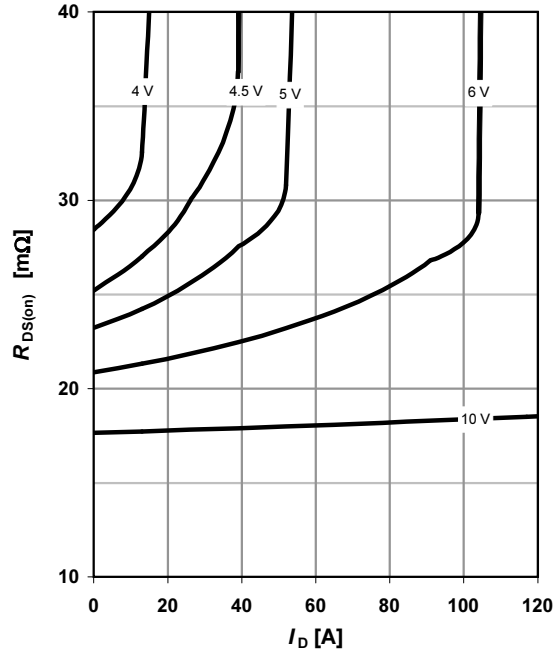
parameter: V_{GS}



6 Typ. drain-source on resistance

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

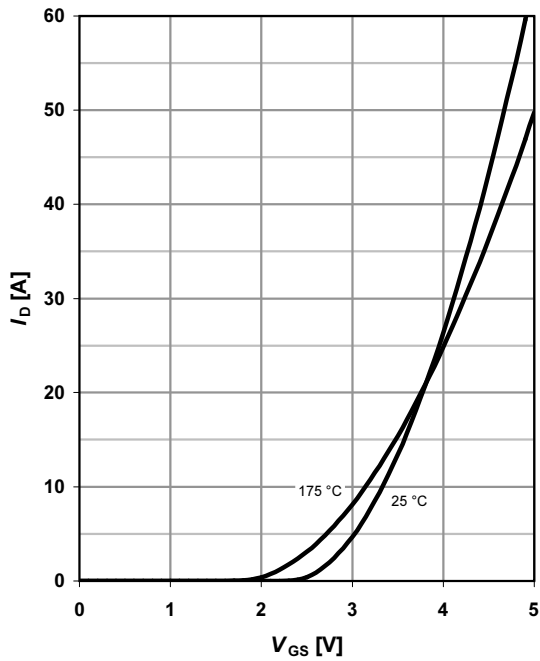
parameter: V_{GS}



7 Typ. transfer characteristics

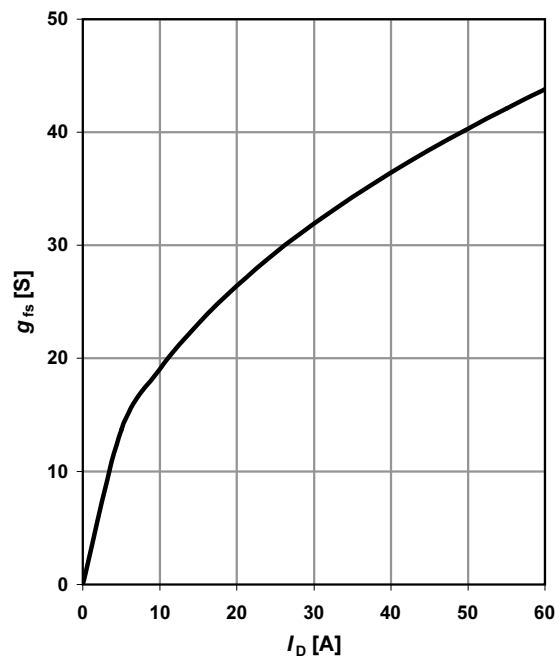
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

parameter: T_j



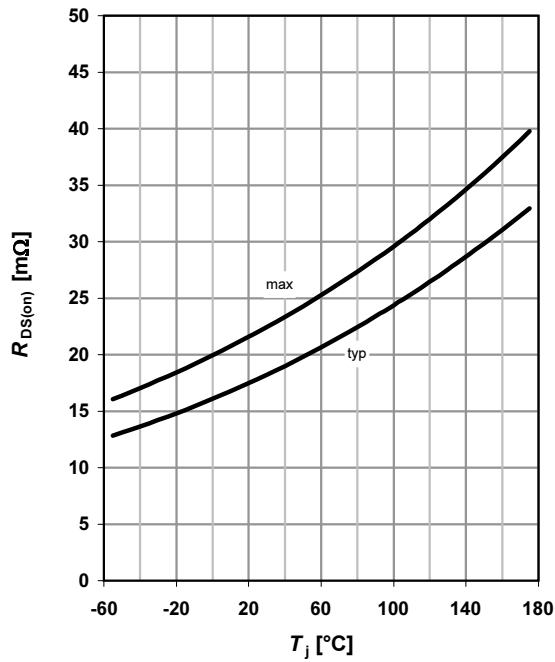
8 Typ. forward transconductance

$g_{fs} = f(I_D); T_j = 25\text{ }^\circ\text{C}$



9 Drain-source on-state resistance

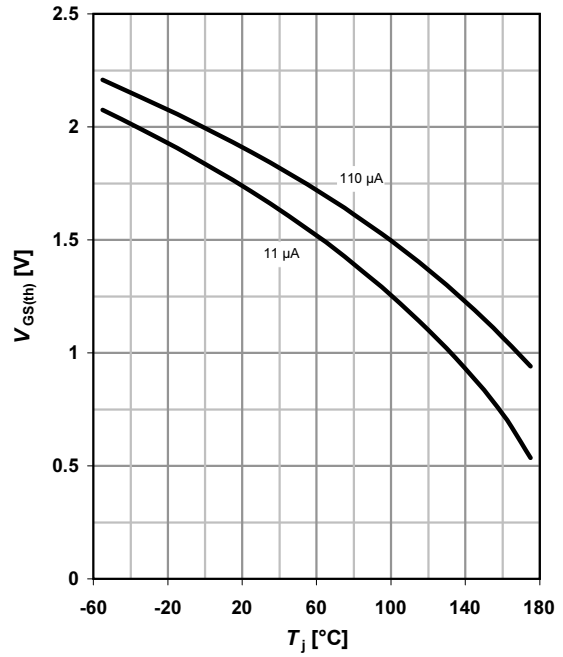
$R_{DS(on)} = f(T_j); I_D = 30 \text{ A}; V_{GS} = 10 \text{ V}$



10 Typ. gate threshold voltage

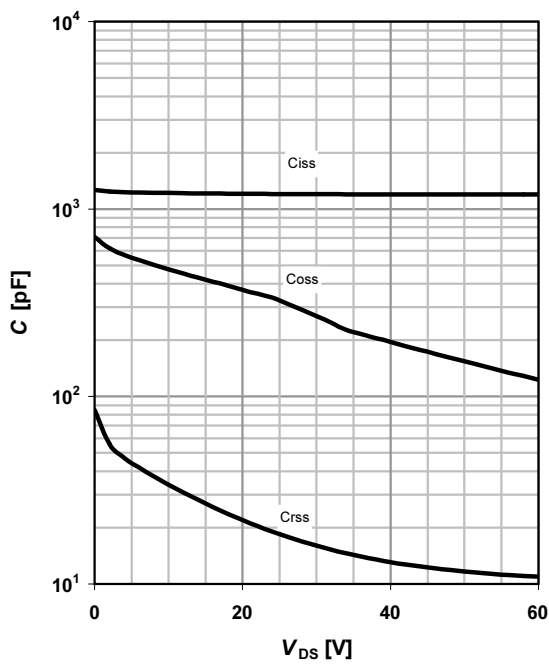
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

parameter: I_D



11 Typ. capacitances

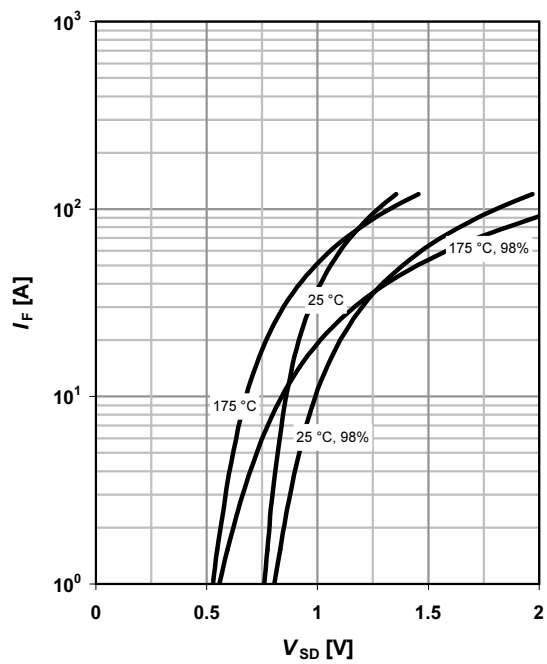
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$



12 Forward characteristics of reverse diode

$I_F = f(V_{SD})$

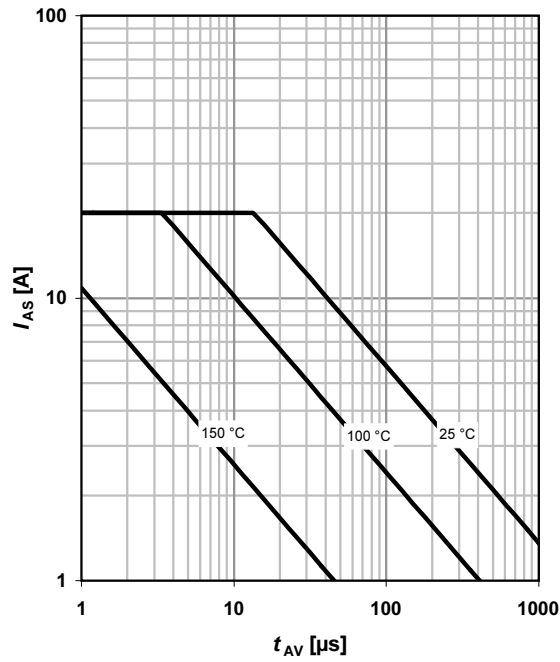
parameter: T_j



13 Avalanche characteristics

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

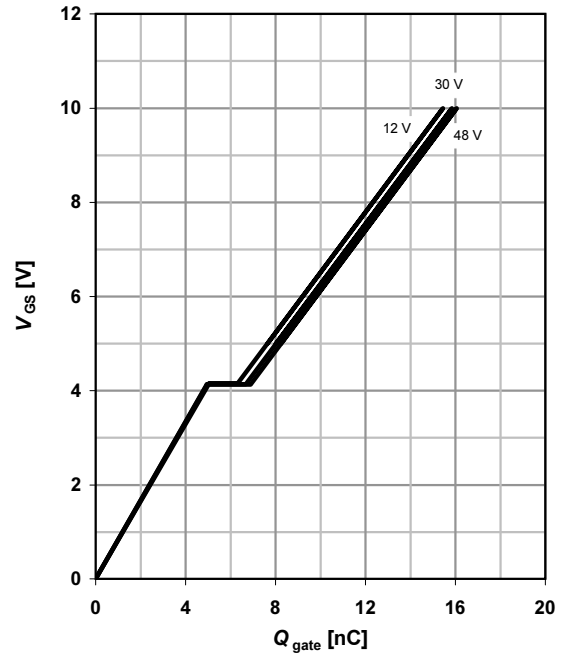
parameter: $T_{j(start)}$



14 Typ. gate charge

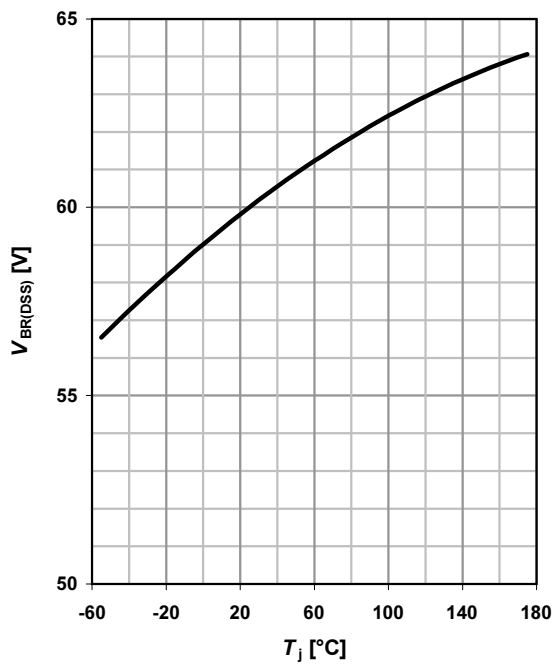
$V_{GS}=f(Q_{gate}); I_D=30 \text{ A pulsed}$

parameter: V_{DD}

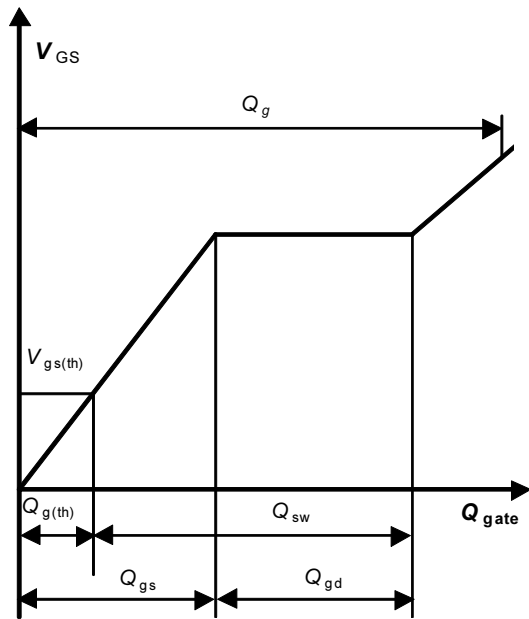


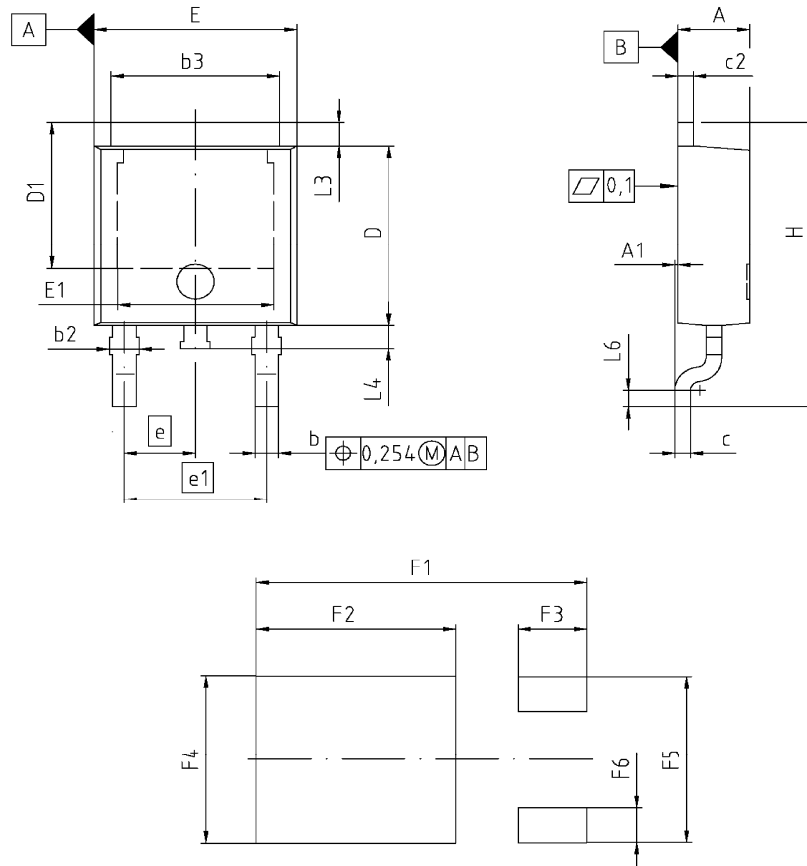
15 Drain-source breakdown voltage

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



16 Gate charge waveforms





| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|--------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 2.159 | 2.413 | 0.085 | 0.095 |
| A1 | 0.000 | 0.150 | 0.000 | 0.006 |
| b | 0.635 | 0.889 | 0.025 | 0.035 |
| b2 | 0.650 | 1.150 | 0.026 | 0.045 |
| b3 | 5.004 | 5.500 | 0.197 | 0.217 |
| c | 0.457 | 0.580 | 0.018 | 0.023 |
| c2 | 0.460 | 0.980 | 0.018 | 0.039 |
| D | 5.969 | 6.223 | 0.235 | 0.245 |
| D1 | 5.020 | 5.842 | 0.198 | 0.230 |
| E | 6.400 | 6.731 | 0.252 | 0.265 |
| E1 | 4.850 | 5.207 | 0.191 | 0.205 |
| e | 2.286 | | 0.090 | |
| e1 | 4.572 | | 0.180 | |
| N | 3 | | 3 | |
| H | 9.400 | 10.480 | 0.370 | 0.413 |
| L3 | 0.900 | 1.143 | 0.035 | 0.045 |
| L4 | 0.584 | 0.950 | 0.023 | 0.037 |
| L6 | 0.510 | 0.686 | 0.020 | 0.027 |
| F1 | 10.500 | 10.700 | 0.413 | 0.421 |
| F2 | 6.300 | 6.500 | 0.248 | 0.256 |
| F3 | 2.100 | 2.300 | 0.083 | 0.091 |
| F4 | 5.700 | 5.900 | 0.224 | 0.232 |
| F5 | 5.660 | 5.860 | 0.222 | 0.231 |
| F6 | 1.100 | 1.300 | 0.043 | 0.051 |

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JEDEC TO252

SCALE 0 2.0 4mm

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