

OptiMOS™3 Power-Transistor
Features

- Fast switching MOSFET for SMPS
- Optimized technology for DC/DC converters
- Qualified according to JEDEC¹⁾ for target applications
- N-channel; Normal level
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Very low on-resistance $R_{DS(on)}$
- Superior thermal resistance
- 100% Avalanche tested
- Pb-free plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

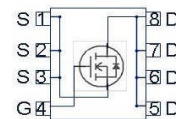
Product Summary

| | | |
|------------------|------|------------|
| V_{DS} | 40 | V |
| $R_{DS(on),max}$ | 10.5 | m Ω |
| I_D | 40 | A |

PG-TSDSON-8



| Type | Package | Marking |
|---------------|-------------|---------|
| BSZ105N04NS G | PG-TSDSON-8 | 105N04N |


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

| Parameter | Symbol | Conditions | Value | Unit |
|---|---------------|---|----------|------|
| Continuous drain current | I_D | $V_{GS}=10\text{ V}, T_C=25\text{ °C}$ | 40 | A |
| | | $V_{GS}=10\text{ V}, T_C=100\text{ °C}$ | 29 | |
| | | $V_{GS}=10\text{ V}, T_A=25\text{ °C}, R_{thJA}=60\text{ K/W}^{2)}$ | 11 | |
| Pulsed drain current ³⁾ | $I_{D,pulse}$ | $T_C=25\text{ °C}$ | 160 | |
| Avalanche current, single pulse ⁴⁾ | I_{AS} | $T_C=25\text{ °C}$ | 20 | |
| Avalanche energy, single pulse | E_{AS} | $I_D=20\text{ A}, R_{GS}=25\ \Omega$ | 20 | 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} | $T_C=25\text{ °C}$ | 35 | W |
| | | $T_A=25\text{ °C}$, $R_{\text{thJA}}=60\text{ K/W}^2)$ | 2.1 | |
| Operating and storage temperature | T_j, T_{stg} | | -55 ... 150 | °C |
| IEC climatic category; DIN IEC 68-1 | | | 55/150/56 | |

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

Thermal characteristics

| | | | | | | |
|-------------------------------------|-------------------|--|---|---|-----|-----|
| Thermal resistance, junction - case | R_{thJC} | | - | - | 3.6 | K/W |
| Device on PCB | R_{thJA} | 6 cm ² cooling area ²⁾ | - | - | 60 | |

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 | $V_{\text{GS(th)}}$ | $V_{\text{DS}}=V_{\text{GS}}, I_{\text{D}}=14\text{ }\mu\text{A}$ | 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 | $R_{\text{DS(on)}}$ | $V_{\text{GS}}=10\text{ V}, I_{\text{D}}=20\text{ A}$ | - | 8.8 | 10.5 | m Ω |
| Gate resistance | R_{G} | | - | 1 | - | Ω |
| Transconductance | g_{fs} | $ V_{\text{DS}} >2 I_{\text{D}} R_{\text{DS(on)max}}, I_{\text{D}}=20\text{ A}$ | 15 | 30 | - | S |

²⁾ 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.

³⁾ See figure 3 for more detailed information

⁴⁾ See figure 13 for more detailed information

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

Dynamic characteristics

| | | | | | | |
|------------------------------|--------------|---|---|------|------|----|
| Input capacitance | C_{iss} | $V_{GS}=0\text{ V}, V_{DS}=20\text{ V},$ $f=1\text{ MHz}$ | - | 1000 | 1300 | pF |
| Output capacitance | C_{oss} | | - | 330 | 440 | |
| Reverse transfer capacitance | C_{rss} | | - | 11 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}=20\text{ V}, V_{GS}=10\text{ V},$ $I_D=20\text{ A}, R_G=1.6\ \Omega$ | - | 7.0 | - | ns |
| Rise time | t_r | | - | 1.2 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 9.5 | - | |
| Fall time | t_f | | - | 2.6 | - | |

Gate Charge Characteristics⁵⁾

| | | | | | | |
|------------------------------|---------------|--|---|-----|----|----|
| Gate to source charge | Q_{gs} | $V_{DD}=20\text{ V}, I_D=20\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$ | - | 5.7 | - | nC |
| Gate charge at threshold | $Q_{g(th)}$ | | - | 3.1 | - | |
| Gate to drain charge | Q_{gd} | | - | 1.7 | - | |
| Switching charge | Q_{sw} | | - | 4.3 | - | |
| Gate charge total | Q_g | | - | 13 | 17 | |
| Gate plateau voltage | $V_{plateau}$ | | - | 5.5 | - | |
| Gate charge total, sync. FET | $Q_{g(sync)}$ | $V_{DS}=0.1\text{ V},$ $V_{GS}=0\text{ to }10\text{ V}$ | - | 12 | - | nC |
| Output charge | Q_{oss} | $V_{DD}=20\text{ V}, V_{GS}=0\text{ V}$ | - | 12 | - | |

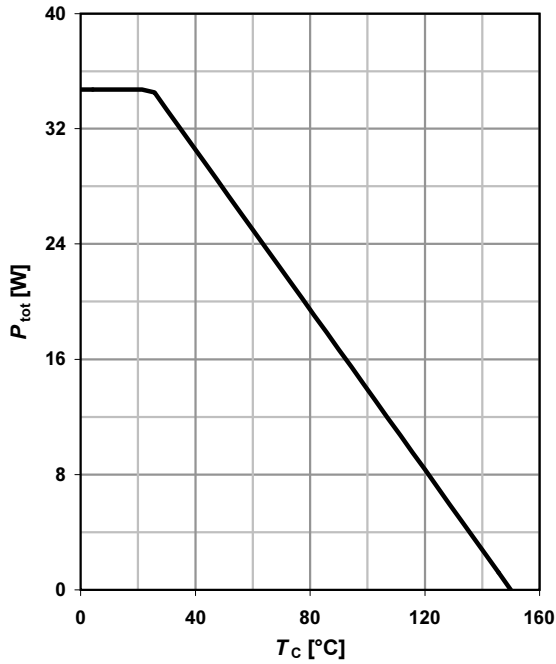
Reverse Diode

| | | | | | | |
|----------------------------------|---------------|---|---|------|-----|----|
| Diode continuous forward current | I_S | $T_C=25\text{ }^\circ\text{C}$ | - | - | 29 | A |
| Diode pulse current | $I_{S,pulse}$ | | - | - | 160 | |
| Diode forward voltage | V_{SD} | $V_{GS}=0\text{ V}, I_F=20\text{ A},$ $T_j=25\text{ }^\circ\text{C}$ | - | 0.89 | 1.2 | V |
| Reverse recovery charge | Q_{rr} | $V_R=20\text{ V}, I_F=I_S,$ $di_F/dt=400\text{ A}/\mu\text{s}$ | - | 14 | - | nC |

⁵⁾ See figure 16 for gate charge parameter definition

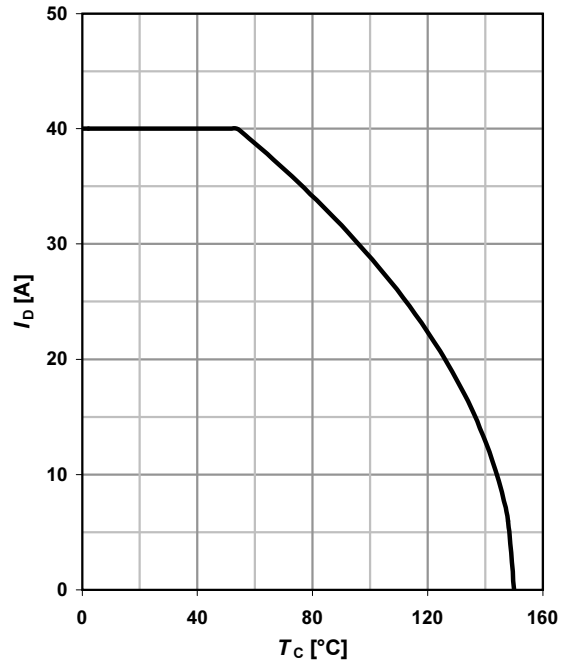
1 Power dissipation

$P_{tot}=f(T_C)$



2 Drain current

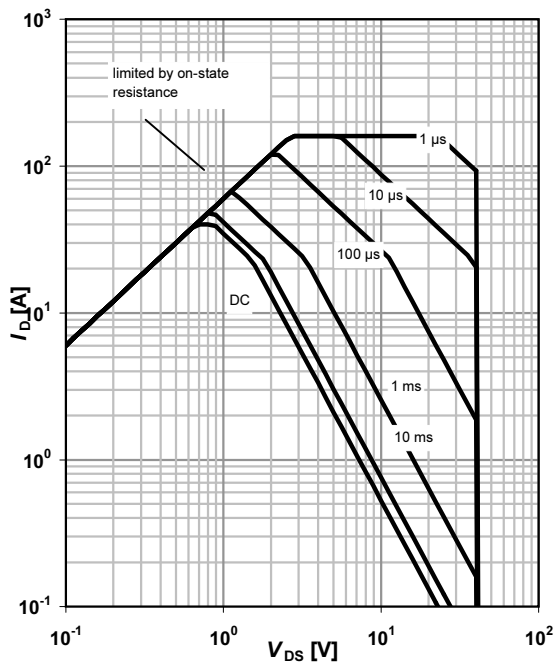
$I_D=f(T_C); V_{GS} \geq 10 V$



3 Safe operating area

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

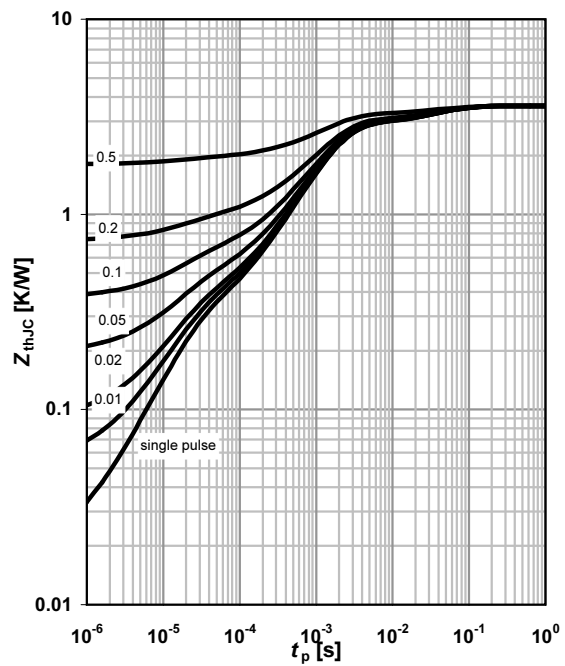
parameter: t_p



4 Max. transient thermal impedance

$Z_{thJC}=f(t_p)$

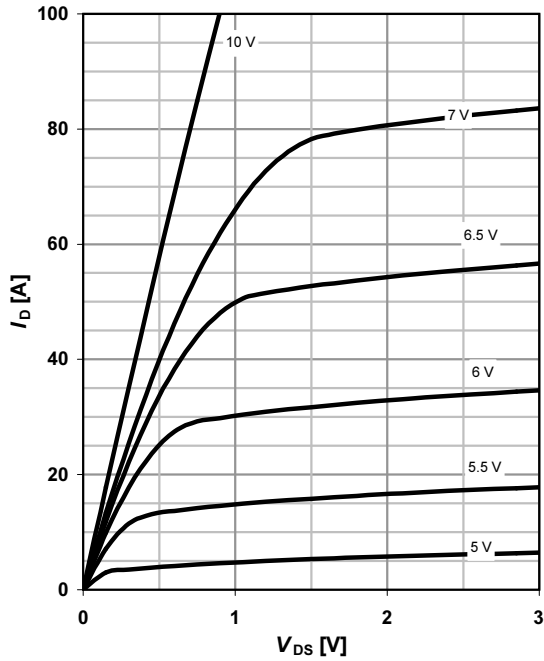
parameter: $D=t_p/T$



5 Typ. output characteristics

$I_D = f(V_{DS}); T_j = 25\text{ °C}$

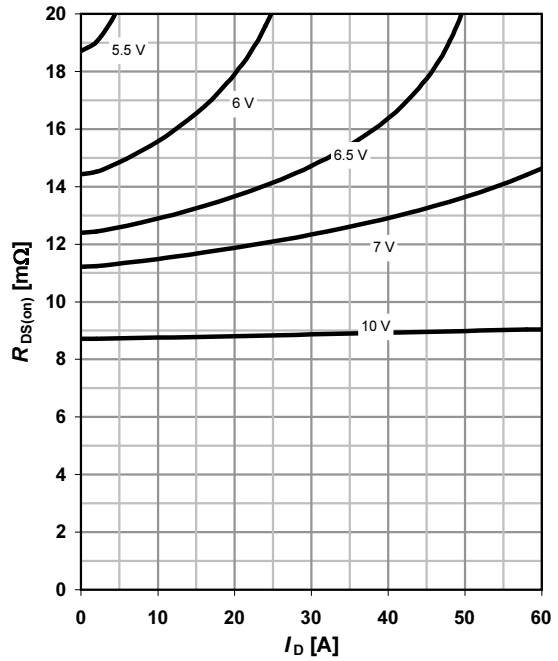
parameter: V_{GS}



6 Typ. drain-source on resistance

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

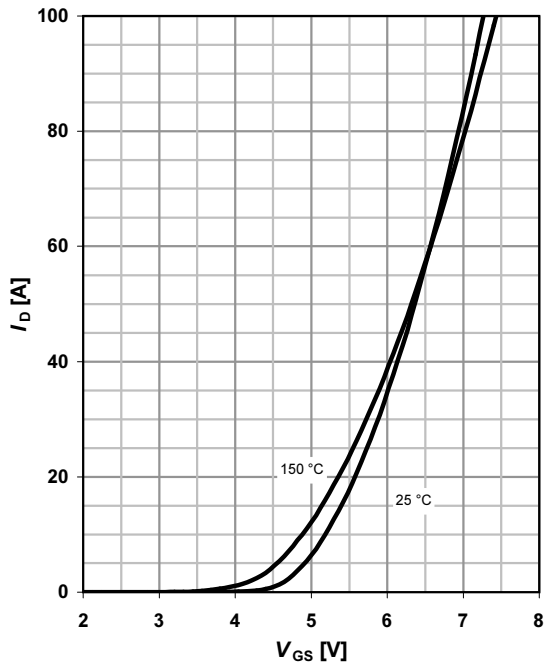
parameter: V_{GS}



7 Typ. transfer characteristics

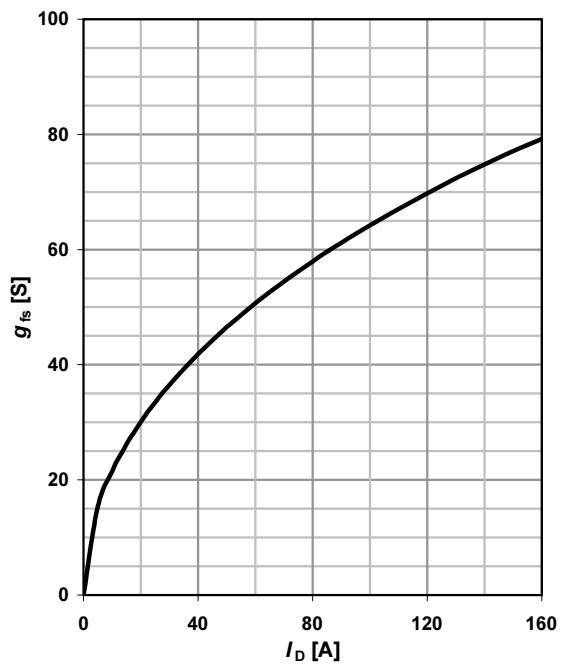
$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

parameter: T_j



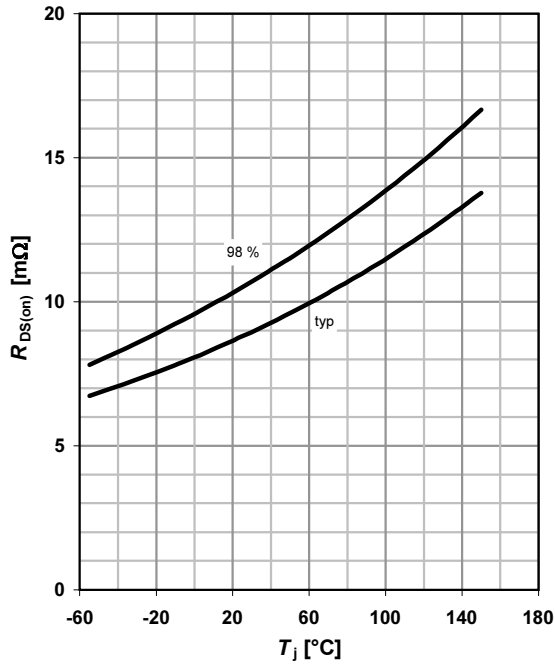
8 Typ. forward transconductance

$g_{fs} = f(I_D); T_j = 25\text{ °C}$

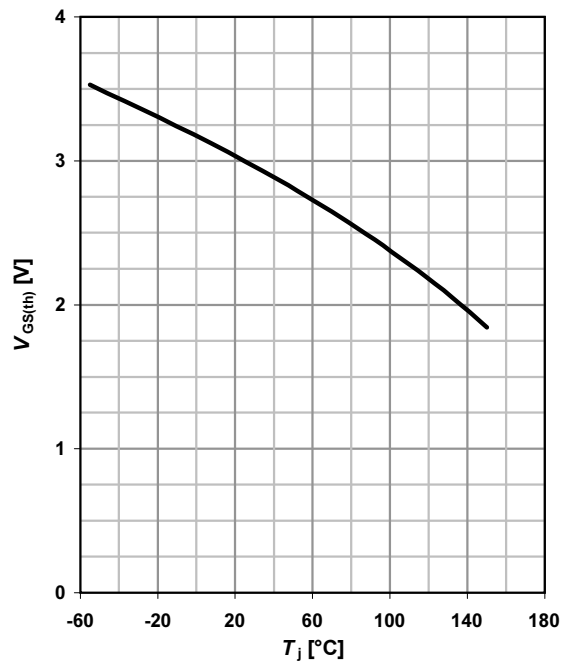


9 Drain-source on-state resistance

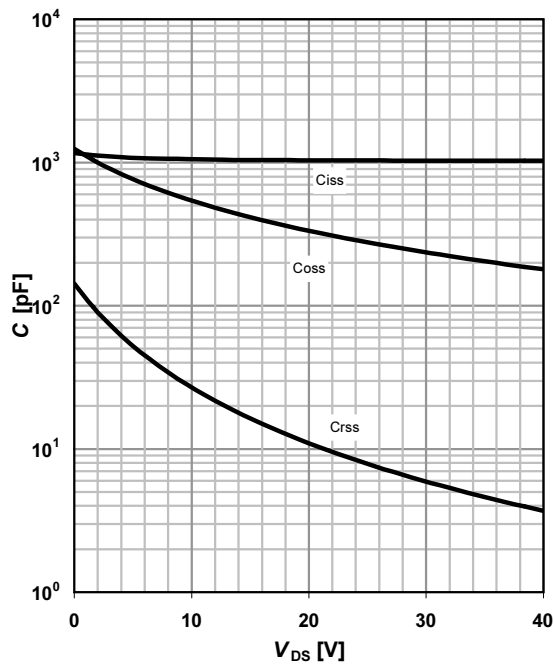
$$R_{DS(on)} = f(T_j); I_D = 20 \text{ A}; V_{GS} = 10 \text{ V}$$


10 Typ. gate threshold voltage

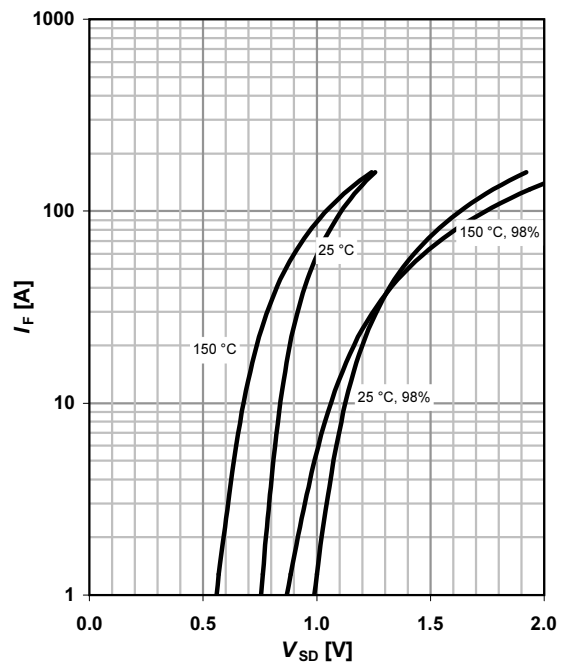
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}; I_D = 14 \mu\text{A}$$


11 Typ. capacitances

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

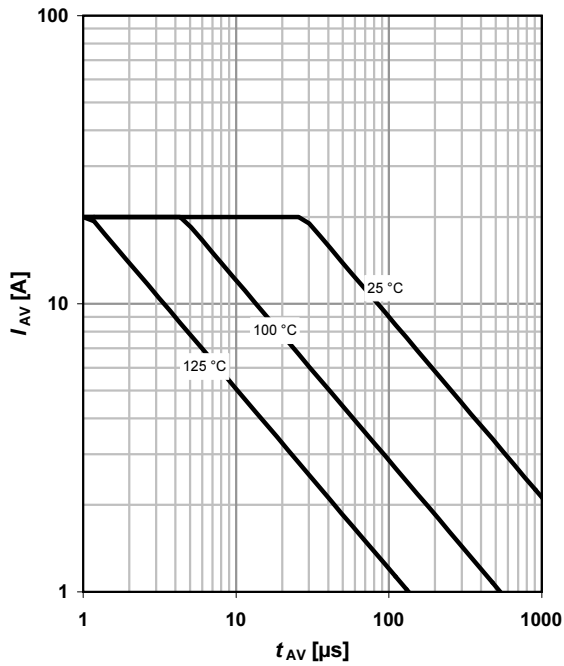

12 Forward characteristics of reverse diode

$$I_F = f(V_{SD})$$

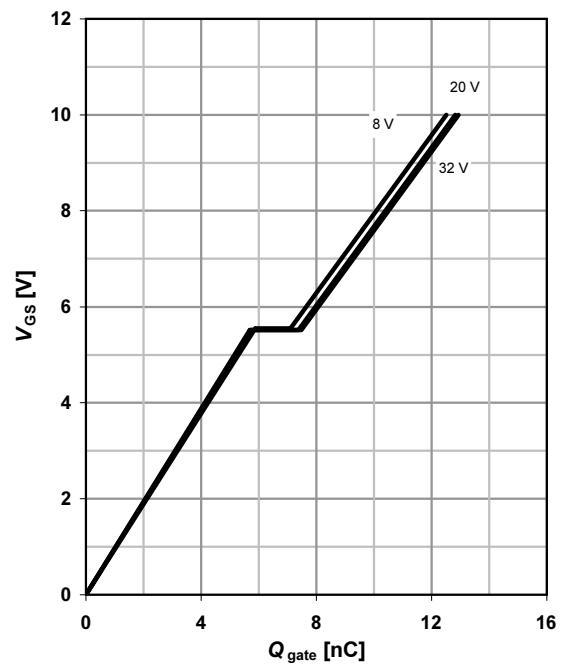
 parameter: T_j


13 Avalanche characteristics

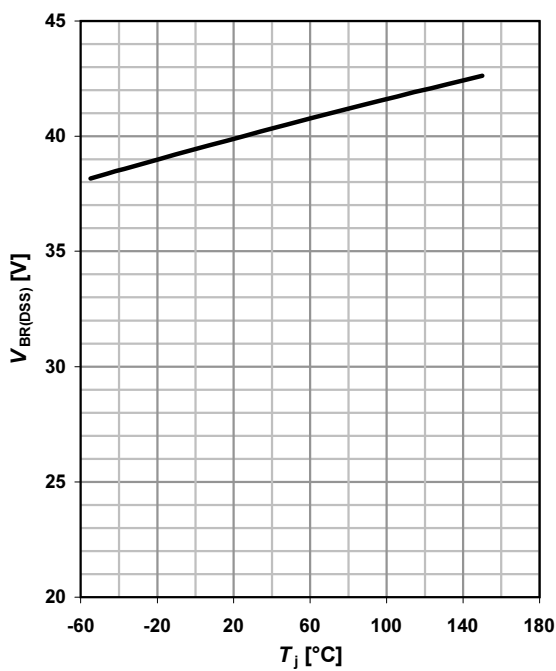
$$I_{AS} = f(t_{AV}); R_{GS} = 25 \Omega$$

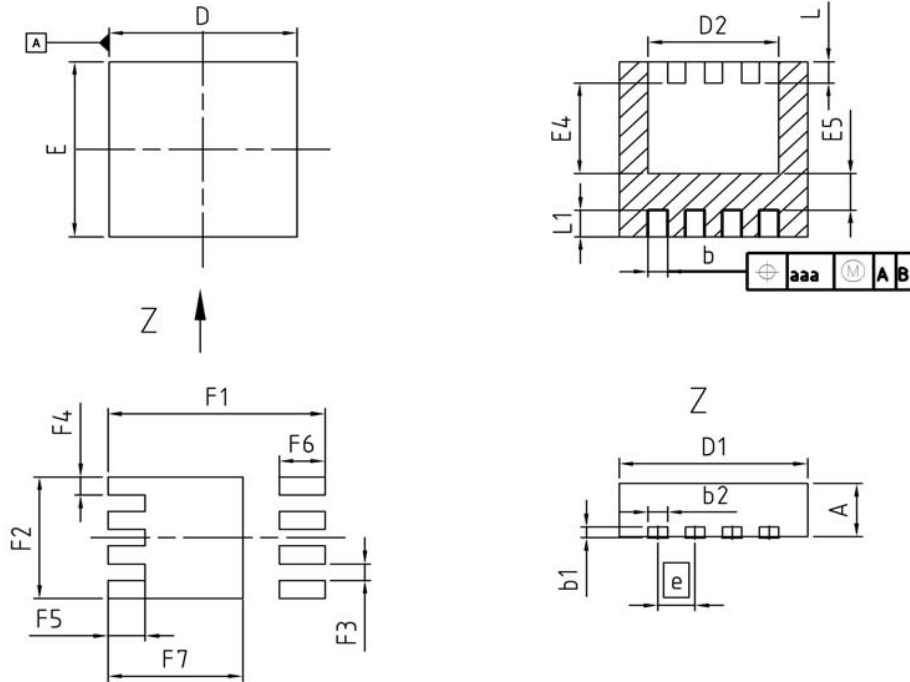
 parameter: $T_{j(\text{start})}$

14 Typ. gate charge

$$V_{GS} = f(Q_{\text{gate}}); I_D = 20 \text{ A pulsed}$$

 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-TSDSON-8


| DIM | MILLIMETERS | | INCHES | |
|------|-------------|------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.90 | 1.10 | 0.035 | 0.043 |
| b | 0.24 | 0.44 | 0.009 | 0.017 |
| b1 | 0.10 | 0.30 | 0.004 | 0.012 |
| b2 | 0.20 | 0.44 | 0.008 | 0.017 |
| D=D1 | 3.20 | 3.40 | 0.126 | 0.134 |
| D2 | 2.15 | 2.45 | 0.085 | 0.096 |
| E | 3.20 | 3.40 | 0.126 | 0.134 |
| E4 | 1.60 | 1.81 | 0.063 | 0.071 |
| E5 | 0.59 | 0.86 | 0.023 | 0.034 |
| e | 0.65 | | 0.026 | |
| N | 8 | | 8 | |
| L | 0.30 | 0.56 | 0.012 | 0.022 |
| L1 | 0.33 | 0.60 | 0.013 | 0.024 |
| aaa | 0.25 | | 0.010 | |
| F1 | 3.80 | | 0.150 | |
| F2 | 2.29 | | 0.090 | |
| F3 | 0.31 | | 0.012 | |
| F4 | 0.34 | | 0.013 | |
| F5 | 0.65 | | 0.026 | |
| F6 | 0.80 | | 0.031 | |
| F7 | 2.36 | | 0.093 | |

| |
|-----------------------------|
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