

MOSFET

Metal Oxide Semiconductor Field Effect Transistor

OptiMOS™

OptiMOS™ Power-MOSFET, 40 V
BSC010N04LS

Data Sheet

Rev. 2.2
Final

1 Description

Features

- Optimized for synchronous rectification
- Very low on-resistance $R_{DS(on)}$
- 100% avalanche tested
- Superior thermal resistance
- N-channel, logic level
- Qualified according to JEDEC¹⁾ for target applications
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21
- Higher solder joint reliability due to enlarged source interconnection

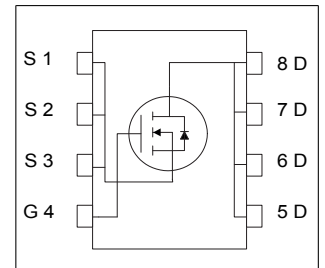
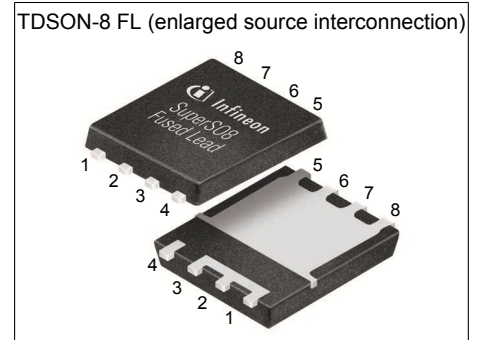


Table 1 Key Performance Parameters

| Parameter | Value | Unit |
|------------------|-------|-----------|
| V_{DS} | 40 | V |
| $R_{DS(on),max}$ | 1.0 | $m\Omega$ |
| I_D | 100 | A |
| Q_{oss} | 84 | nC |
| $Q_g(0V..10V)$ | 95 | nC |

| Type / Ordering Code | Package | Marking | Related Links |
|----------------------|------------|----------|---------------|
| BSC010N04LS | TDSO8-8 FL | 010N04LS | - |

¹⁾ J-STD20 and JESD22

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2 Maximum ratings

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

Table 2 Maximum ratings

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|----------------|--------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Continuous drain current | I_D | - | - | 100 | A | $V_{GS}=10\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=4.5\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=4.5\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=10\text{ V}$, $T_A=25\text{ °C}$, $R_{thJA}=50\text{ K/W}^1)$ |
| | | - | - | 100 | | |
| | | - | - | 100 | | |
| | | - | - | 100 | | |
| | | - | - | 38 | | |
| Pulsed drain current ²⁾ | $I_{D,pulse}$ | - | - | 400 | A | $T_C=25\text{ °C}$ |
| Avalanche current, single pulse ³⁾ | I_{AS} | - | - | 50 | A | $T_C=25\text{ °C}$ |
| Avalanche energy, single pulse | E_{AS} | - | - | 330 | mJ | $I_D=50\text{ A}$, $R_{GS}=25\text{ }\Omega$ |
| Gate source voltage | V_{GS} | -20 | - | 20 | V | - |
| Power dissipation | P_{tot} | - | - | 139 | W | $T_C=25\text{ °C}$ $T_A=25\text{ °C}$, $R_{thJA}=50\text{ K/W}^1)$ |
| | | - | - | 2.5 | | |
| Operating and storage temperature | T_j, T_{stg} | -55 | - | 150 | °C | IEC climatic category; DIN IEC 68-1: 55/150/56 |

3 Thermal characteristics

Table 3 Thermal characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|------------|--------|------|------|------|-----------------------|
| | | Min. | Typ. | Max. | | |
| Thermal resistance, junction - case, bottom | R_{thJC} | - | 0.5 | 0.9 | K/W | - |
| Thermal resistance, junction - case, top | R_{thJC} | - | - | 20 | K/W | - |
| Device on PCB, 6 cm ² cooling area ¹⁾ | R_{thJA} | - | - | 50 | K/W | - |

¹⁾ 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.

²⁾ See figure 3 for more detailed information

³⁾ See figure 13 for more detailed information

4 Electrical characteristics

Table 4 Static characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|----------------------------------|---------------|--------|-------------|------------|------------------|---|
| | | Min. | Typ. | Max. | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | 40 | - | - | V | $V_{GS}=0\text{ V}$, $I_D=1\text{ mA}$ |
| Gate threshold voltage | $V_{GS(th)}$ | 1.2 | - | 2 | V | $V_{DS}=V_{GS}$, $I_D=250\text{ }\mu\text{A}$ |
| Zero gate voltage drain current | I_{DSS} | - | 0.1 10 | 1 100 | μA | $V_{DS}=40\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ }^\circ\text{C}$ $V_{DS}=40\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=125\text{ }^\circ\text{C}$ |
| Gate-source leakage current | I_{GSS} | - | 10 | 100 | nA | $V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$ |
| Drain-source on-state resistance | $R_{DS(on)}$ | - | 1.0 0.85 | 1.3 1.0 | $\text{m}\Omega$ | $V_{GS}=4.5\text{ V}$, $I_D=50\text{ A}$ $V_{GS}=10\text{ V}$, $I_D=50\text{ A}$ |
| Gate resistance ¹⁾ | R_G | - | 0.8 | 1.6 | Ω | - |
| Transconductance | g_{fs} | 140 | 270 | - | S | $ V_{DS} >2 I_D R_{DS(on)max}$, $I_D=50\text{ A}$ |

Table 5 Dynamic characteristics

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|--|--------------|--------|------|------|------|--|
| | | Min. | Typ. | Max. | | |
| Input capacitance ¹⁾ | C_{iss} | - | 6800 | 9520 | pF | $V_{GS}=0\text{ V}$, $V_{DS}=20\text{ V}$, $f=1\text{ MHz}$ |
| Output capacitance ¹⁾ | C_{oss} | - | 1900 | 2660 | pF | $V_{GS}=0\text{ V}$, $V_{DS}=20\text{ V}$, $f=1\text{ MHz}$ |
| Reverse transfer capacitance ¹⁾ | C_{rss} | - | 160 | 320 | pF | $V_{GS}=0\text{ V}$, $V_{DS}=20\text{ V}$, $f=1\text{ MHz}$ |
| Turn-on delay time | $t_{d(on)}$ | - | 10 | - | ns | $V_{DD}=20\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext,ext}=1.6\text{ }\Omega$ |
| Rise time | t_r | - | 12 | - | ns | $V_{DD}=20\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext,ext}=1.6\text{ }\Omega$ |
| Turn-off delay time | $t_{d(off)}$ | - | 46 | - | ns | $V_{DD}=20\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext,ext}=1.6\text{ }\Omega$ |
| Fall time | t_f | - | 9 | - | ns | $V_{DD}=20\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext,ext}=1.6\text{ }\Omega$ |

¹⁾ Defined by design. Not subject to production test

Table 6 Gate charge characteristics¹⁾

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|------------------------------------|---------------|--------|------|------|------|--|
| | | Min. | Typ. | Max. | | |
| Gate to source charge | Q_{gs} | - | 16 | - | nC | $V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge at threshold | $Q_{g(th)}$ | - | 11 | - | nC | $V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate to drain charge ²⁾ | Q_{gd} | - | 15 | 21 | nC | $V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Switching charge | Q_{sw} | - | 21 | - | nC | $V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total ²⁾ | Q_g | - | 95 | 133 | nC | $V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate plateau voltage | $V_{plateau}$ | - | 2.4 | - | V | $V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Gate charge total ²⁾ | Q_g | - | 49 | 69 | nC | $V_{DD}=20\text{ V}$, $I_D=50\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate charge total, sync. FET | $Q_{g(sync)}$ | - | 84 | - | nC | $V_{DS}=0.1\text{ V}$, $V_{GS}=0\text{ to }10\text{ V}$ |
| Output charge ²⁾ | Q_{oss} | - | 84 | 118 | nC | $V_{DD}=20\text{ V}$, $V_{GS}=0\text{ V}$ |

Table 7 Reverse diode

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|-------------------------------------|---------------|--------|------|------|------|--|
| | | Min. | Typ. | Max. | | |
| Diode continuous forward current | I_S | - | - | 100 | A | $T_C=25\text{ °C}$ |
| Diode pulse current | $I_{S,pulse}$ | - | - | 400 | A | $T_C=25\text{ °C}$ |
| Diode forward voltage | V_{SD} | - | 0.81 | 1 | V | $V_{GS}=0\text{ V}$, $I_F=50\text{ A}$, $T_J=25\text{ °C}$ |
| Reverse recovery time ²⁾ | t_{rr} | - | 36 | 72 | ns | $V_R=20\text{ V}$, $I_F=50\text{ A}$, $di_F/dt=400\text{ A}/\mu\text{s}$ |
| Reverse recovery charge | Q_{rr} | - | 50 | - | nC | $V_R=20\text{ V}$, $I_F=50\text{ A}$, $di_F/dt=400\text{ A}/\mu\text{s}$ |

¹⁾ See "Gate charge waveforms" for parameter definition

²⁾ Defined by design. Not subject to production test

5 Electrical characteristics diagrams

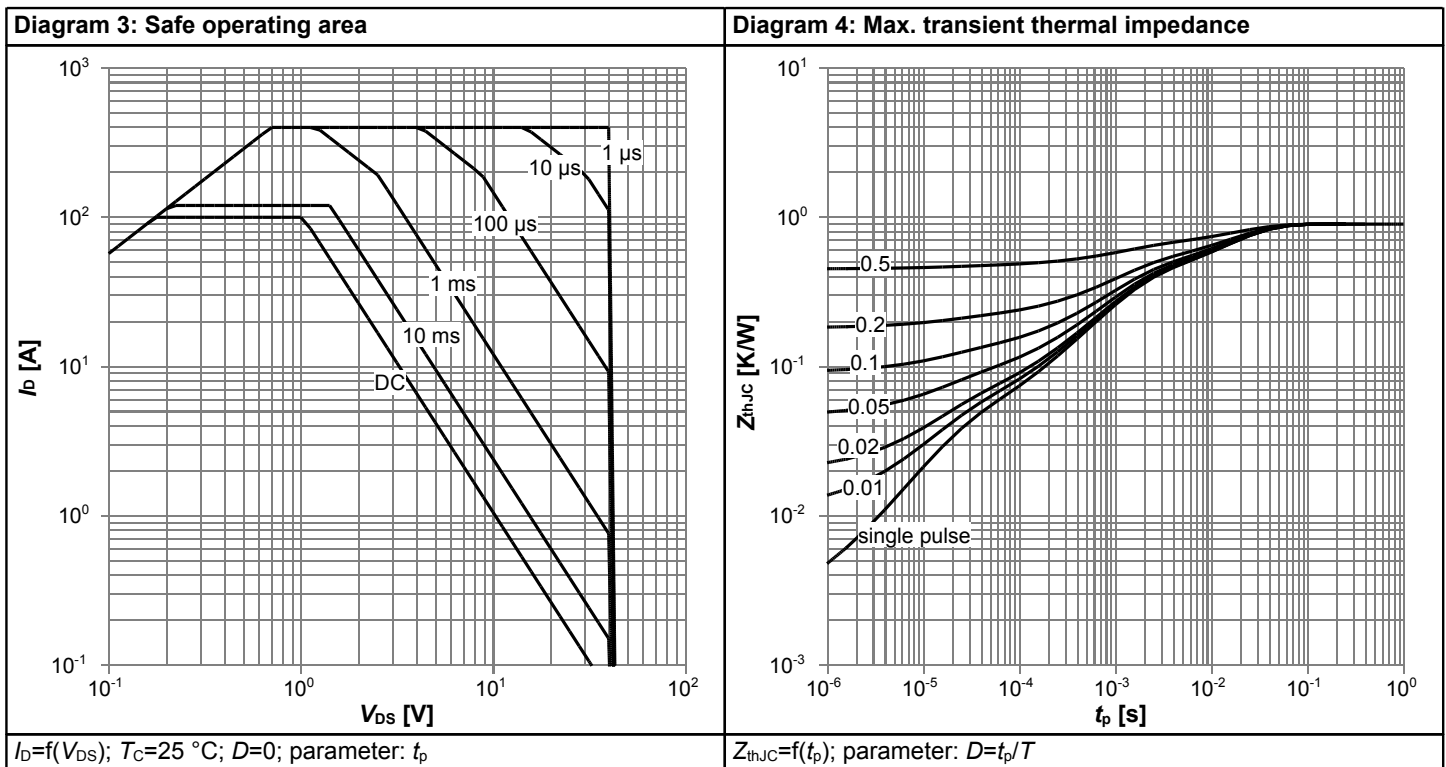
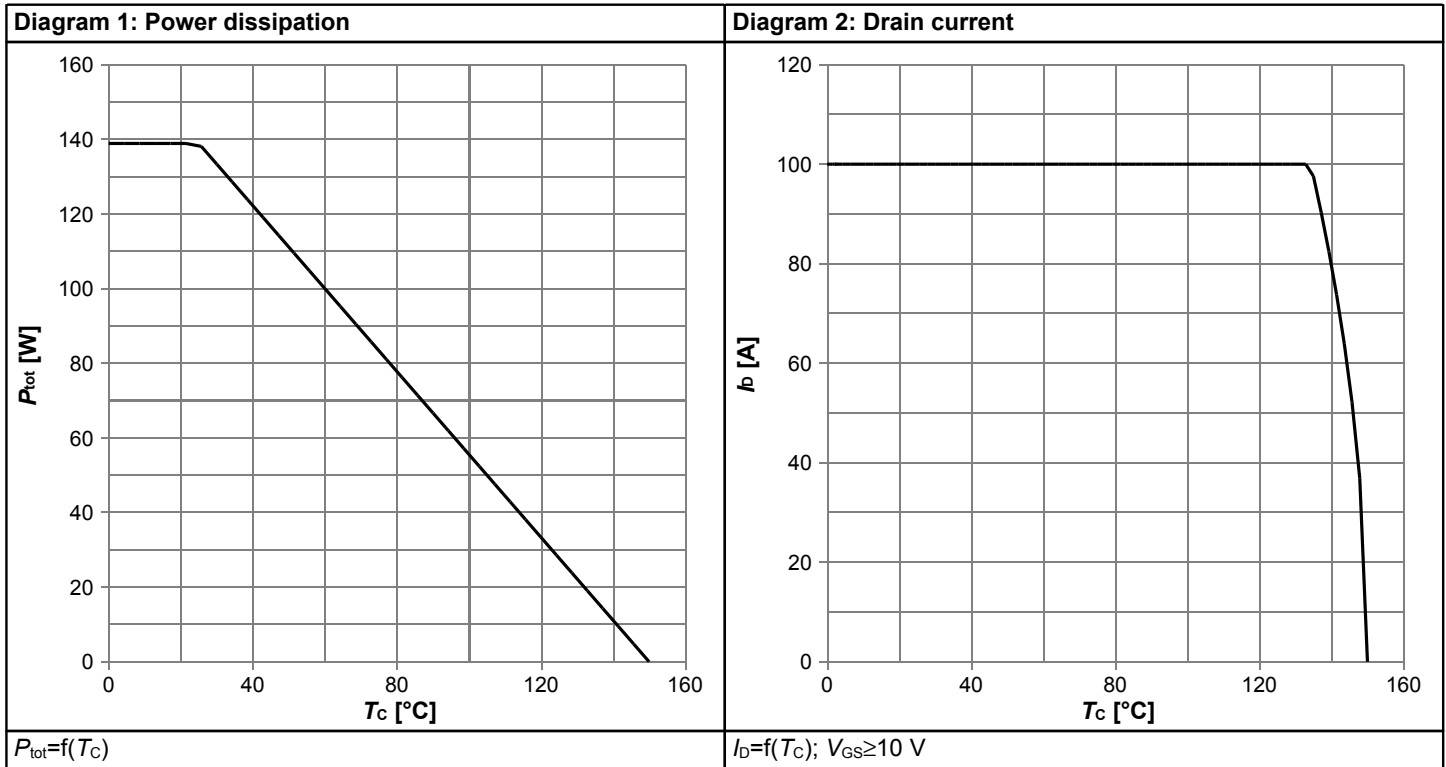
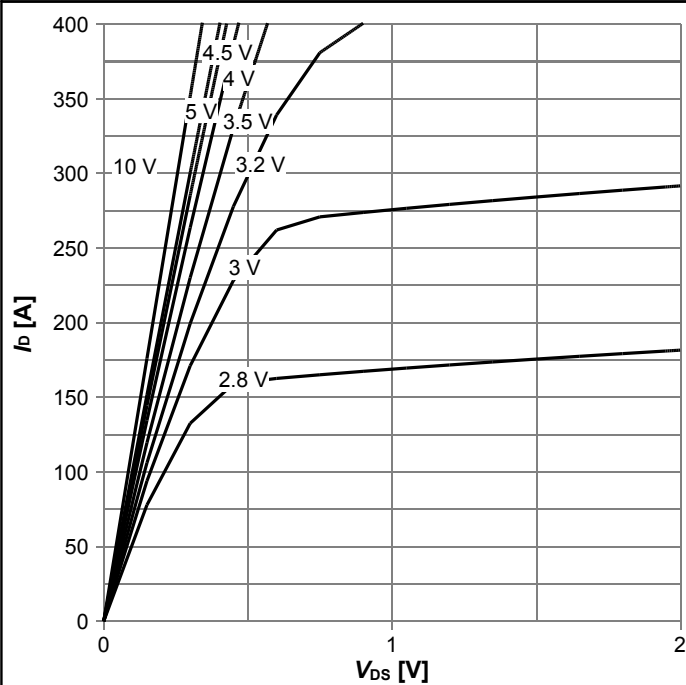
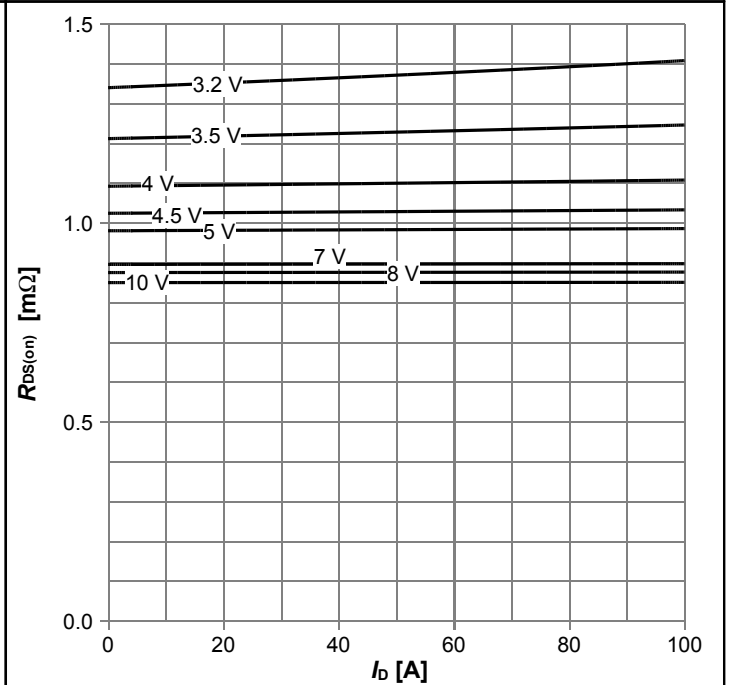


Diagram 5: Typ. output characteristics



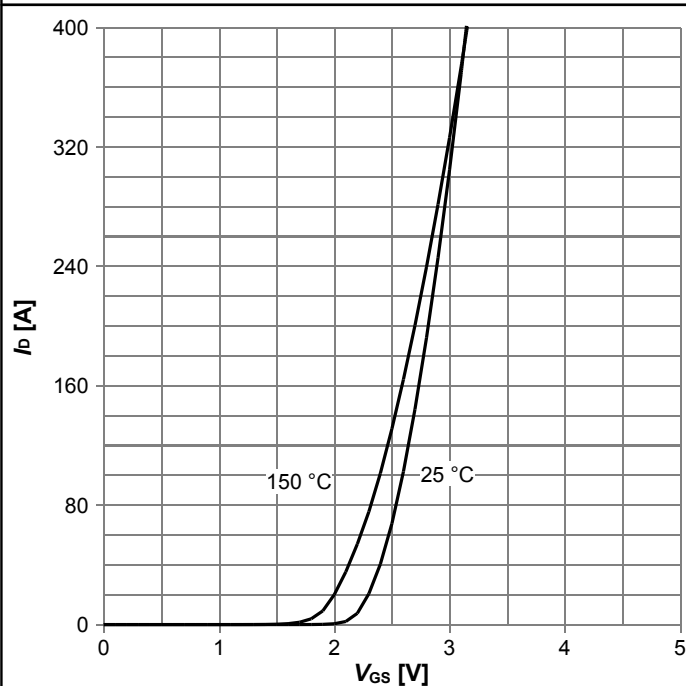
$I_D=f(V_{DS}); T_j=25\text{ }^\circ\text{C};$ parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



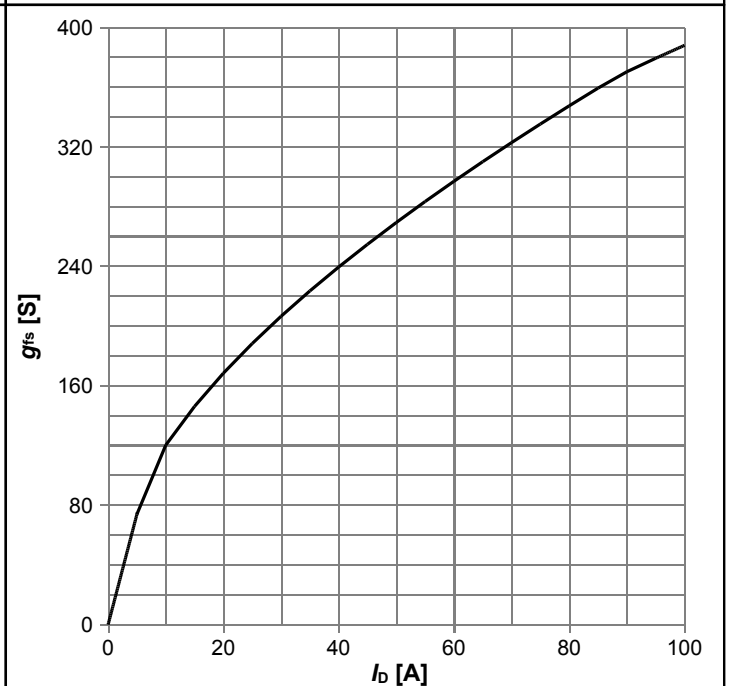
$R_{DS(on)}=f(I_D); T_j=25\text{ }^\circ\text{C};$ parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



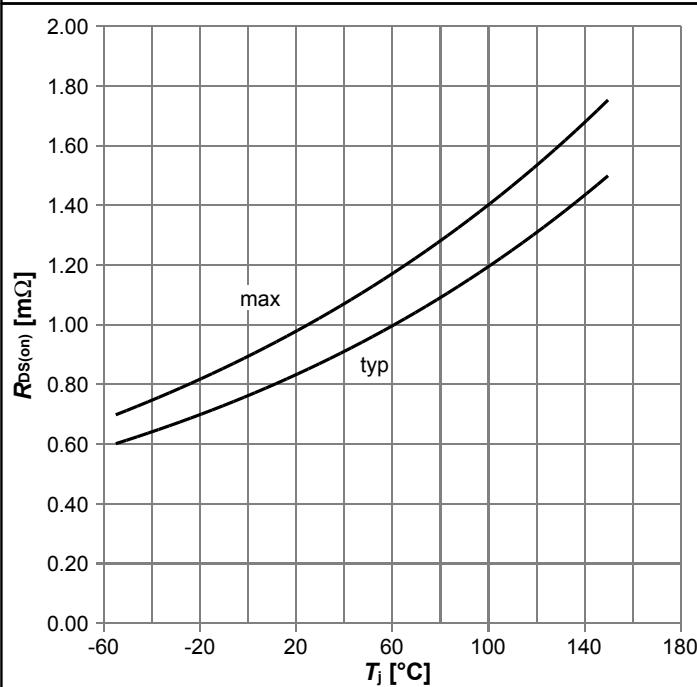
$I_D=f(V_{GS}); |V_{DS}|>2|I_D|R_{DS(on)max};$ parameter: T_j

Diagram 8: Typ. forward transconductance



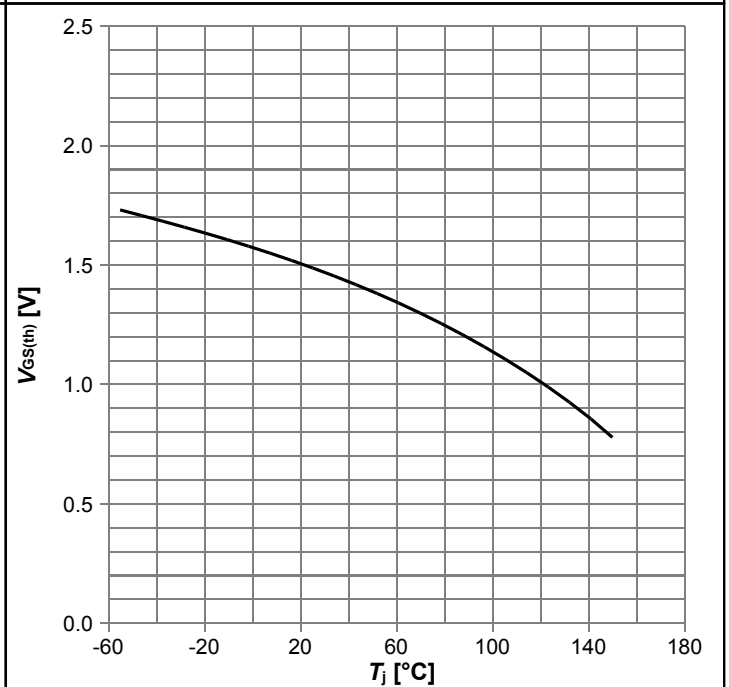
$g_{fs}=f(I_D); T_j=25\text{ }^\circ\text{C}$

Diagram 9: Drain-source on-state resistance



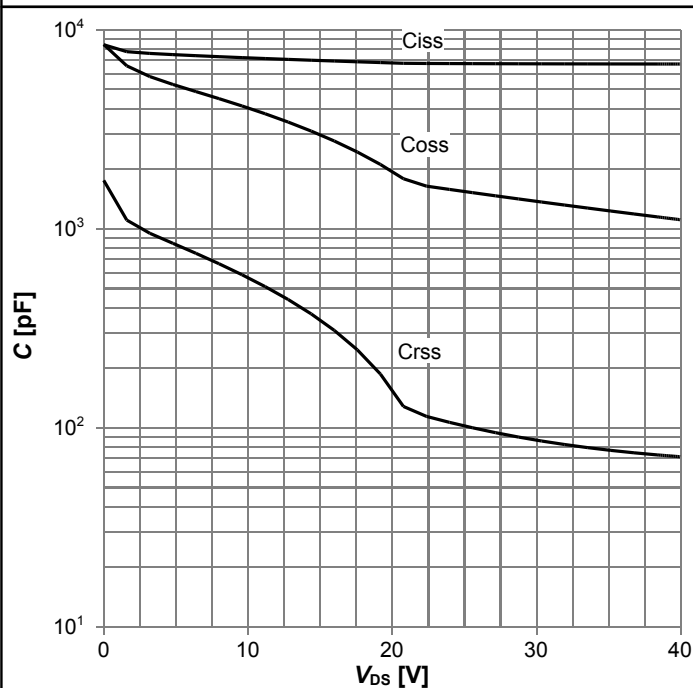
$R_{DS(on)}=f(T_j); I_D=50\text{ A}; V_{GS}=10\text{ V}$

Diagram 10: Typ. gate threshold voltage



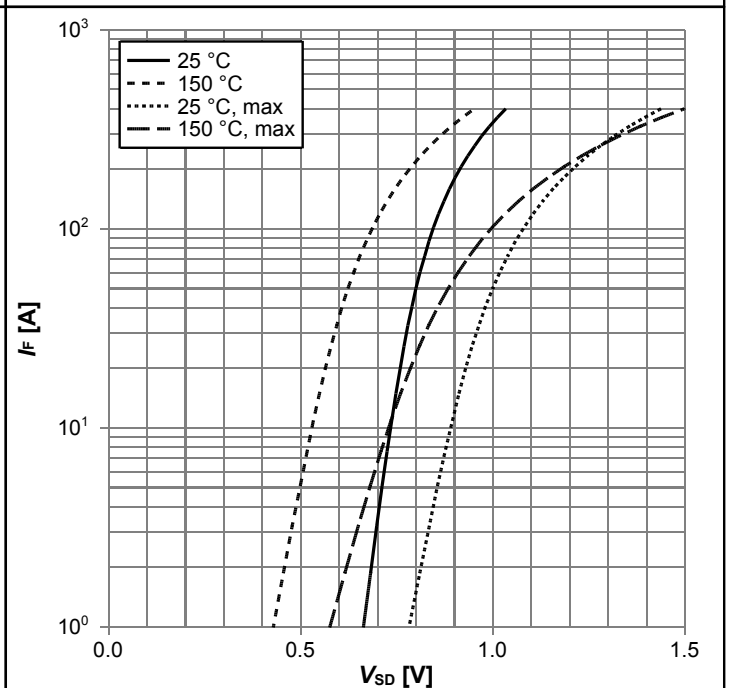
$V_{GS(th)}=f(T_j); V_{GS}=V_{DS}; I_D=250\ \mu\text{A}$

Diagram 11: Typ. capacitances



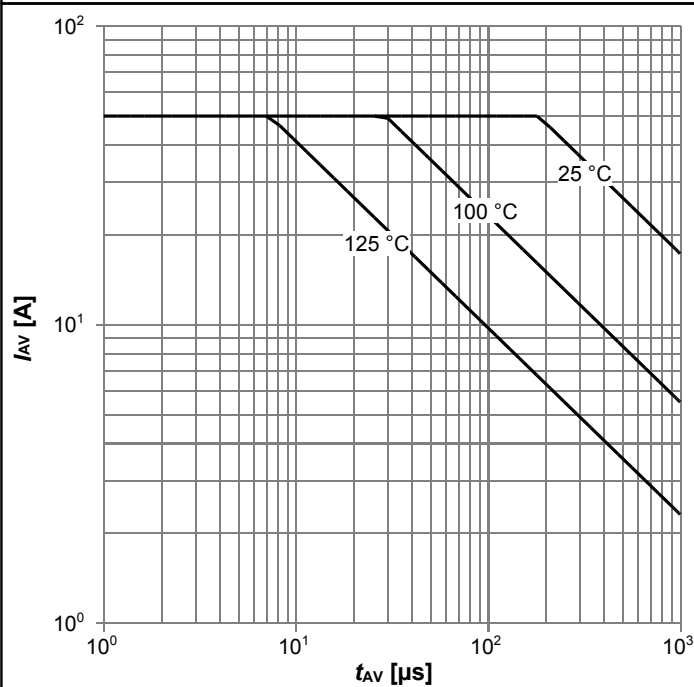
$C=f(V_{DS}); V_{GS}=0\text{ V}; f=1\text{ MHz}$

Diagram 12: Forward characteristics of reverse diode



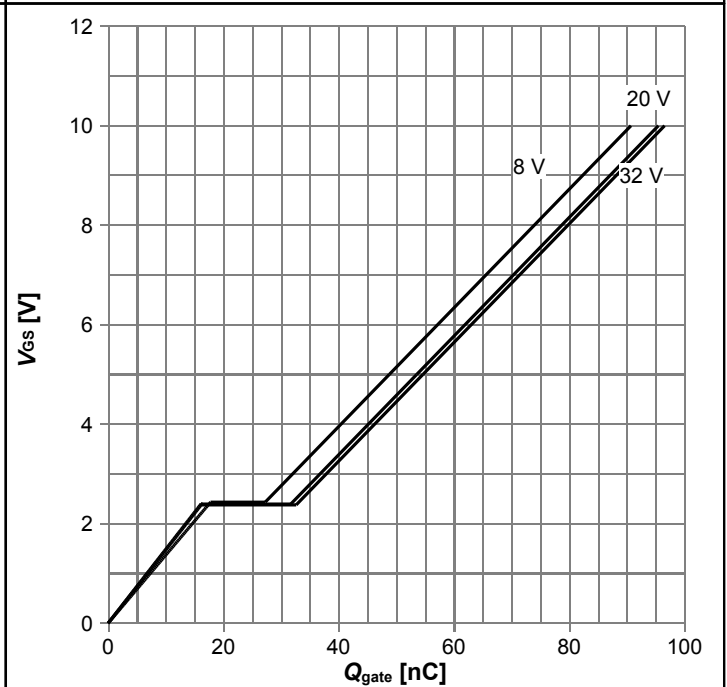
$I_F=f(V_{SD}); \text{parameter: } T_j$

Diagram 13: Avalanche characteristics



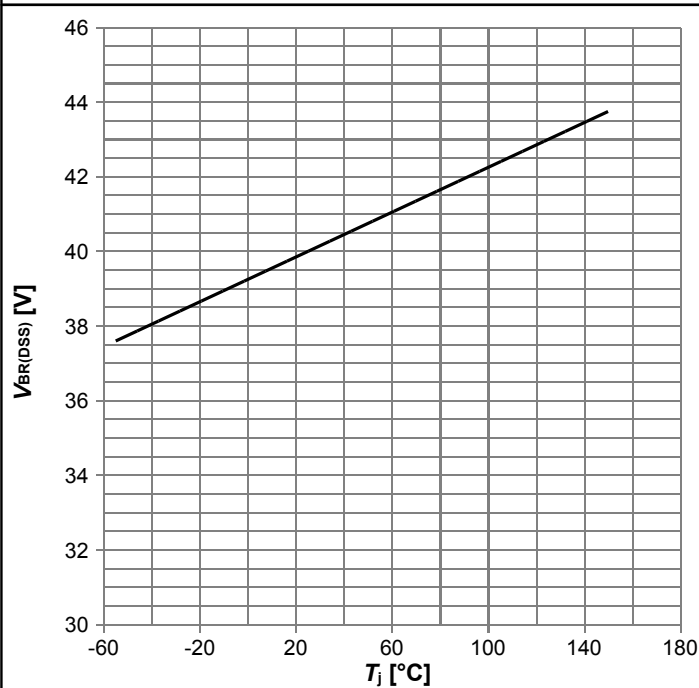
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega$; parameter: $T_{j(start)}$

Diagram 14: Typ. gate charge



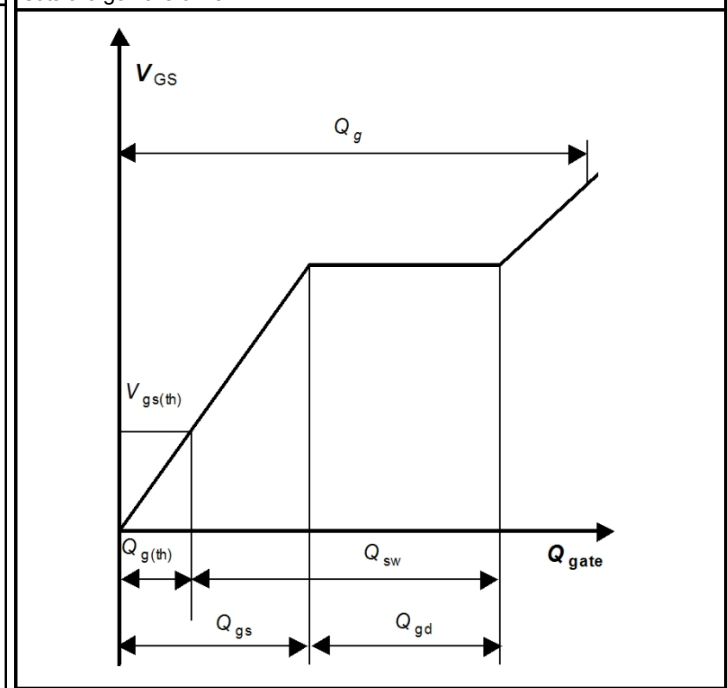
$V_{GS}=f(Q_{gate}); I_D=50$ A pulsed; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage

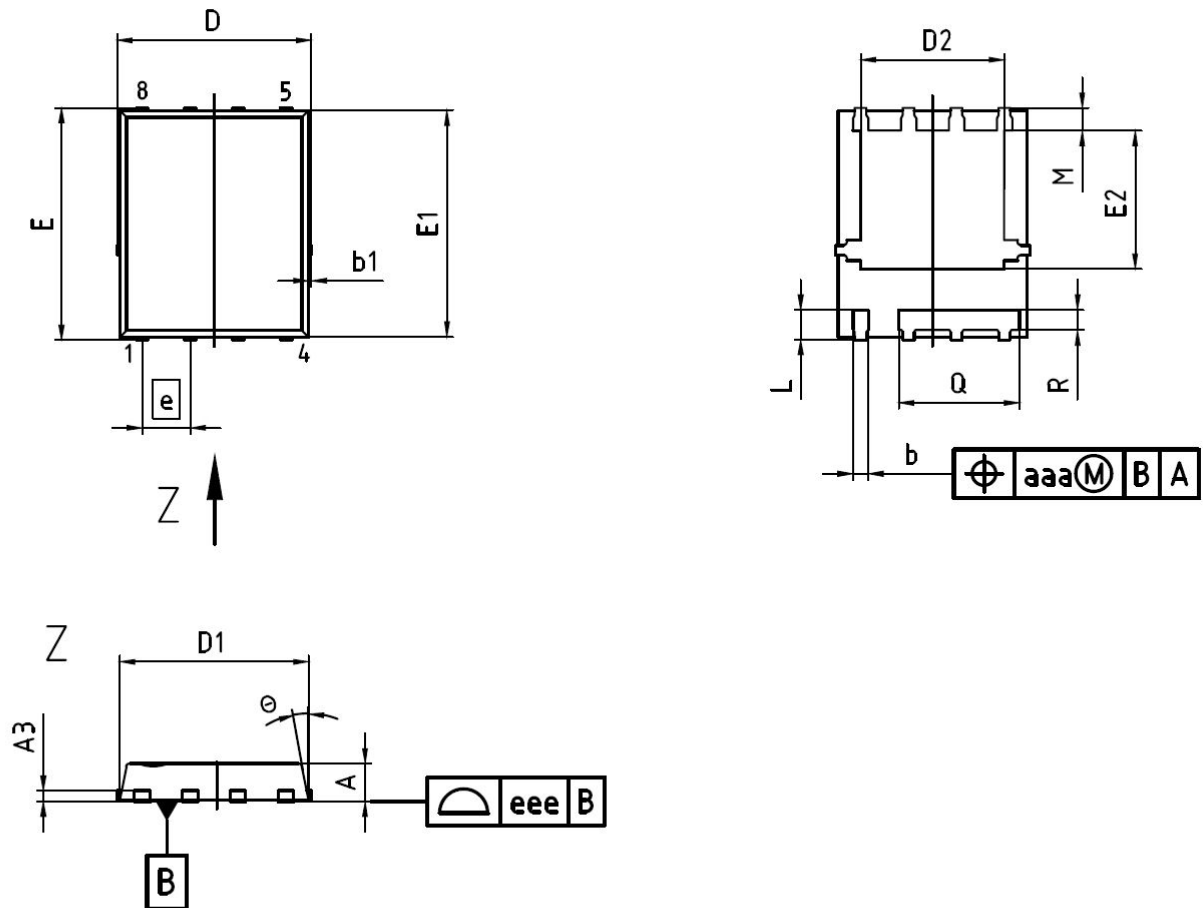


$V_{BR(DSS)}=f(T_j); I_D=1$ mA

Gate charge waveforms



6 Package Outlines



| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.90 | 1.10 | 0.035 | 0.043 |
| A3 | 0.25 (REF) | | 0.011 (REF) | |
| b | 0.34 | 0.54 | 0.013 | 0.021 |
| b1 | 0.02 | 0.22 | 0.001 | 0.009 |
| D | 5.15 (BSC) | | 0.203 (BSC) | |
| D1 | 5.00 (BSC) | | 0.197 (BSC) | |
| D2 | 3.70 | 4.40 | 0.146 | 0.173 |
| E | 6.15 (BSC) | | 0.242 (BSC) | |
| E1 | 6.00 (BSC) | | 0.236 (BSC) | |
| E2 | 3.40 | 3.80 | 0.134 | 0.150 |
| e | 1.27 (BSC) | | 0.050 (BSC) | |
| N | 8 | | 8 | |
| L | 0.74 | 0.84 | 0.029 | 0.033 |
| M | 0.45 | 0.66 | 0.018 | 0.026 |
| θ | 8.5° | 12° | 8.5° | 12° |
| Q | 3.15 | 3.25 | 0.124 | 0.128 |
| R | 0.48 | 0.58 | 0.019 | 0.023 |
| aaa | 0.25 | | 0.010 | |
| eee | 0.08 | | 0.003 | |

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| <p>REVISION 01</p> |

Figure 1 Outline TDSON-8 FL, dimensions in mm/inches

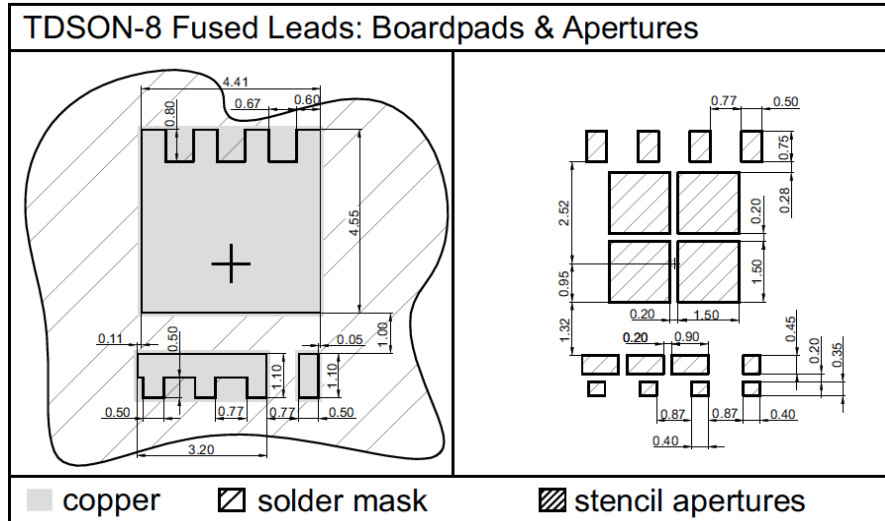


Figure 2 Outline Footprint TDSON-8 FL

Revision History

BSC010N04LS

Revision: 2014-06-27, Rev. 2.2

Previous Revision

| Revision | Date | Subjects (major changes since last revision) |
|----------|------------|--|
| 2.2 | 2014-06-27 | Rev. 2.2 |

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