

# MOSFET

## OptiMOS™ Power-Transistor, 60 V

### Features

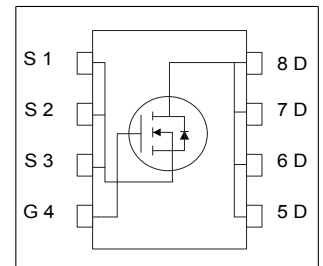
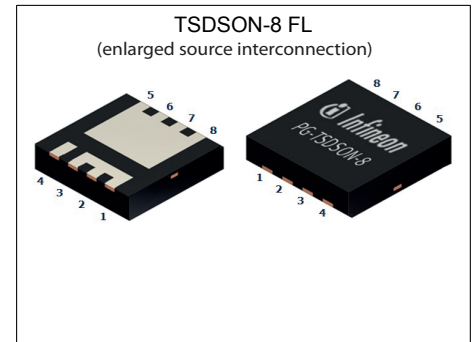
- Optimized for high performance SMPS, e.g. sync rec.
- 100% avalanche tested
- Superior thermal resistance
- N-channel
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

### Product validation

Fully qualified according to JEDEC for Industrial Applications

**Table 1 Key Performance Parameters**

| Parameter        | Value | Unit       |
|------------------|-------|------------|
| $V_{DS}$         | 60    | V          |
| $R_{DS(on),max}$ | 3.7   | m $\Omega$ |
| $I_D$            | 104   | A          |
| $Q_{oss}$        | 32    | nC         |
| $Q_G(0V..4.5V)$  | 18    | nC         |



| Type / Ordering Code | Package        | Marking | Related Links |
|----------------------|----------------|---------|---------------|
| BSZ037N06LS5         | PG-TSDSON-8 FL | 037N06L | -             |

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## 1 Maximum ratings

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

**Table 2 Maximum ratings**

| Parameter                                    | Symbol         | Values |      |                             | Unit | Note / Test Condition   |
|--|----------------|--------|------|-----------------------------|------|---|
|  |                | Min.   | Typ. | Max.                        |      |   |
| Continuous drain current <sup>1)</sup>       | $I_D$          | -      | -    | 104<br>65<br>87<br>55<br>18 | A    | $V_{GS}=10\text{ V}$ , $T_C=25\text{ °C}$<br>$V_{GS}=10\text{ V}$ , $T_C=100\text{ °C}$<br>$V_{GS}=4.5\text{ V}$ , $T_C=25\text{ °C}$<br>$V_{GS}=4.5\text{ V}$ , $T_C=100\text{ °C}$<br>$V_{GS}=10\text{ V}$ , $T_A=25\text{ °C}$ ,<br>$R_{THJA}=60\text{ °C/W}^2)$ |
| Pulsed drain current <sup>3)</sup>           | $I_{D,pulse}$  | -      | -    | 416                         | A    | $T_A=25\text{ °C}$  |
| Avalanche energy, single pulse <sup>4)</sup> | $E_{AS}$       | -      | -    | 117                         | mJ   | $I_D=20\text{ A}$ , $R_{GS}=25\text{ }\Omega$   |
| Gate source voltage                          | $V_{GS}$       | -20    | -    | 20                          | V    | -   |
| Power dissipation                            | $P_{tot}$      | -      | -    | 69<br>2.1                   | W    | $T_C=25\text{ °C}$<br>$T_A=25\text{ °C}$ , $R_{THJA}=60\text{ °C/W}^2)$   |
| Operating and storage temperature            | $T_j, T_{stg}$ | -55    | -    | 150                         | °C   | IEC climatic category; DIN IEC 68-1:<br>55/150/56   |

## 2 Thermal characteristics

**Table 3 Thermal characteristics**

| Parameter  | Symbol     | Values |      |      | Unit | Note / Test Condition |
|--|------------|--------|------|------|------|-----------------------|
|  |            | Min.   | Typ. | Max. |      |                       |
| Thermal resistance, junction - case, bottom      | $R_{thJC}$ | -      | -    | 1.8  | °C/W | -                     |
| Thermal resistance, junction - case, top         | $R_{thJC}$ | -      | -    | 20   | °C/W | -                     |
| Device on PCB,<br>6 cm <sup>2</sup> cooling area | $R_{thJA}$ | -      | -    | 60   | °C/W | -                     |

<sup>1)</sup> Rating refers to the product only with datasheet specified absolute maximum values, maintaining case temperature at 25°C. For higher case temperature please refer to Diagram 2. De-rating will be required based on the actual environmental conditions.

<sup>2)</sup> Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

<sup>3)</sup> See Diagram 3 for more detailed information

<sup>4)</sup> See Diagram 13 for more detailed information

### 3 Electrical characteristics

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

**Table 4 Static characteristics**

| Parameter                        | Symbol        | Values |            |            | Unit             | Note / Test Condition   |
|----------------------------------|---------------|--------|------------|------------|------------------|---|
|                                  |               | Min.   | Typ.       | Max.       |                  |   |
| Drain-source breakdown voltage   | $V_{(BR)DSS}$ | 60     | -          | -          | V                | $V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$   |
| Gate threshold voltage           | $V_{GS(th)}$  | 1.1    | 1.7        | 2.3        | V                | $V_{DS}=V_{GS}$ , $I_D=36\text{ }\mu\text{A}$   |
| Zero gate voltage drain current  | $I_{DSS}$     | -      | 0.1<br>10  | 1<br>100   | $\mu\text{A}$    | $V_{DS}=60\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=25\text{ °C}$<br>$V_{DS}=60\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_j=125\text{ °C}$ |
| Gate-source leakage current      | $I_{GSS}$     | -      | 10         | 100        | nA               | $V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$  |
| Drain-source on-state resistance | $R_{DS(on)}$  | -      | 3.1<br>4.2 | 3.7<br>5.3 | $\text{m}\Omega$ | $V_{GS}=10\text{ V}$ , $I_D=20\text{ A}$<br>$V_{GS}=4.5\text{ V}$ , $I_D=10\text{ A}$   |
| Gate resistance                  | $R_G$         | -      | 1.6        | 2.4        | $\Omega$         | -   |
| Transconductance                 | $g_{fs}$      | 33     | 66         | -          | S                | $ V_{DS} \geq 2 I_D /R_{DS(on)max}$ , $I_D=20\text{ A}$   |

**Table 5 Dynamic characteristics**

| Parameter                                  | Symbol       | Values |      |      | Unit | Note / Test Condition  |
|--|--------------|--------|------|------|------|--|
|  |              | Min.   | Typ. | Max. |      |  |
| Input capacitance                          | $C_{iss}$    | -      | 2400 | 3100 | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=30\text{ V}$ , $f=1\text{ MHz}$                                      |
| Output capacitance <sup>1)</sup>           | $C_{oss}$    | -      | 500  | 650  | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=30\text{ V}$ , $f=1\text{ MHz}$                                      |
| Reverse transfer capacitance <sup>1)</sup> | $C_{rss}$    | -      | 25   | 44   | pF   | $V_{GS}=0\text{ V}$ , $V_{DS}=30\text{ V}$ , $f=1\text{ MHz}$                                      |
| Turn-on delay time                         | $t_{d(on)}$  | -      | 9    | -    | ns   | $V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=20\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Rise time                                  | $t_r$        | -      | 5    | -    | ns   | $V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=20\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Turn-off delay time                        | $t_{d(off)}$ | -      | 26   | -    | ns   | $V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=20\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |
| Fall time                                  | $t_f$        | -      | 5    | -    | ns   | $V_{DD}=30\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=20\text{ A}$ ,<br>$R_{G,ext}=1.6\text{ }\Omega$ |

**Table 6 Gate charge characteristics<sup>2)</sup>**

| Parameter                                  | Symbol        | Values |      |      | Unit | Note / Test Condition  |
|--|---------------|--------|------|------|------|--|
|  |               | Min.   | Typ. | Max. |      |  |
| Gate to source charge                      | $Q_{gs}$      | -      | 6.6  | -    | nC   | $V_{DD}=30\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate charge at threshold                   | $Q_{g(th)}$   | -      | 4.2  | -    | nC   | $V_{DD}=30\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate to drain charge <sup>1)</sup>         | $Q_{gd}$      | -      | 5.3  | 8    | nC   | $V_{DD}=30\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Switching charge                           | $Q_{sw}$      | -      | 7.8  | -    | nC   | $V_{DD}=30\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate charge total <sup>1)</sup>            | $Q_g$         | -      | 18   | 22   | nC   | $V_{DD}=30\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate plateau voltage                       | $V_{plateau}$ | -      | 2.7  | -    | V    | $V_{DD}=30\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$ |
| Gate charge total <sup>1)</sup>            | $Q_g$         | -      | 35   | 47   | nC   | $V_{DD}=30\text{ V}$ , $I_D=20\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$  |
| Gate charge total, sync. FET <sup>1)</sup> | $Q_{g(sync)}$ | -      | 32   | 42   | nC   | $V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }10\text{ V}$                     |
| Output charge <sup>1)</sup>                | $Q_{oss}$     | -      | 32   | 42   | nC   | $V_{DD}=30\text{ V}$ , $V_{GS}=0\text{ V}$                                   |

<sup>1)</sup> Defined by design. Not subject to production test.

<sup>2)</sup> See "Gate charge waveforms" for parameter definition

**Table 7 Reverse diode**

| Parameter                             | Symbol        | Values |      |      | Unit | Note / Test Condition  |
|---------------------------------------|---------------|--------|------|------|------|--|
|                                       |               | Min.   | Typ. | Max. |      |  |
| Diode continuous forward current      | $I_S$         | -      | -    | 69   | A    | $T_C=25\text{ °C}$   |
| Diode pulse current                   | $I_{S,pulse}$ | -      | -    | 416  | A    | $T_C=25\text{ °C}$   |
| Diode forward voltage                 | $V_{SD}$      | -      | 0.80 | 1    | V    | $V_{GS}=0\text{ V}, I_F=20\text{ A}, T_j=25\text{ °C}$               |
| Reverse recovery time <sup>1)</sup>   | $t_{rr}$      | -      | 24   | 48   | ns   | $V_R=30\text{ V}, I_F=20\text{ A}, di_F/dt=100\text{ A}/\mu\text{s}$ |
| Reverse recovery charge <sup>1)</sup> | $Q_{rr}$      | -      | 11   | 22   | nC   | $V_R=30\text{ V}, I_F=20\text{ A}, di_F/dt=100\text{ A}/\mu\text{s}$ |

<sup>1)</sup> Defined by design. Not subject to production test.

### 4 Electrical characteristics diagrams

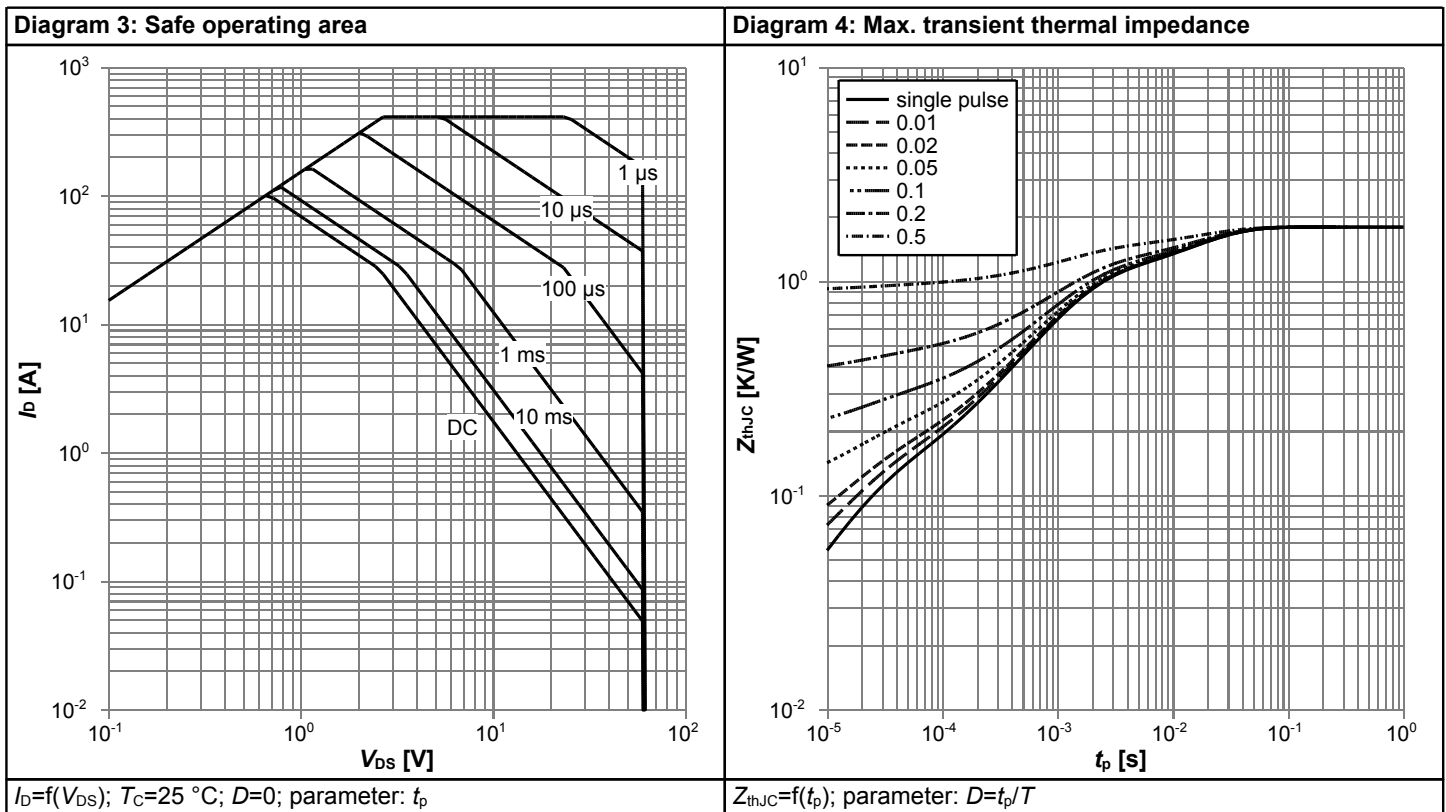
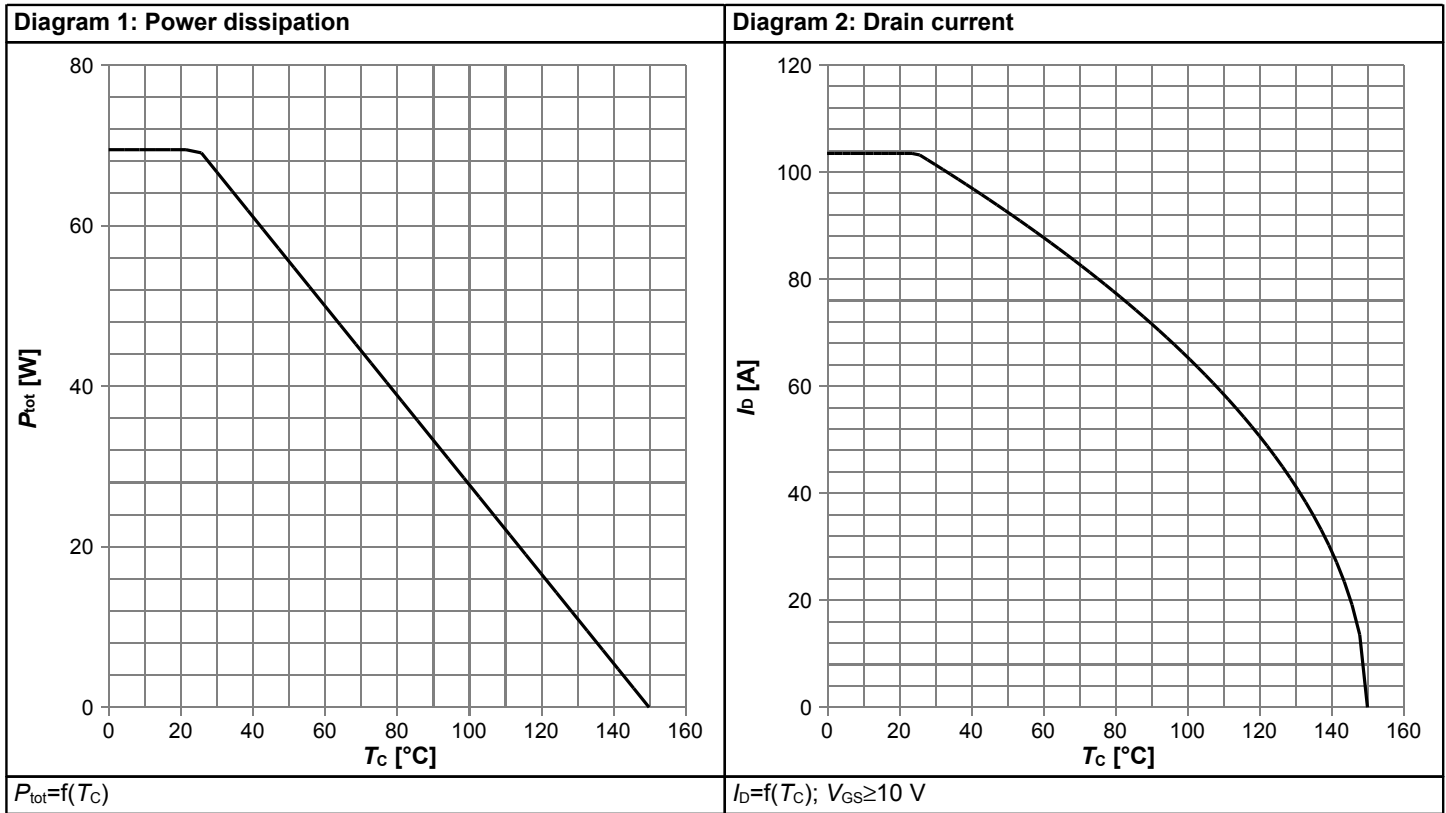
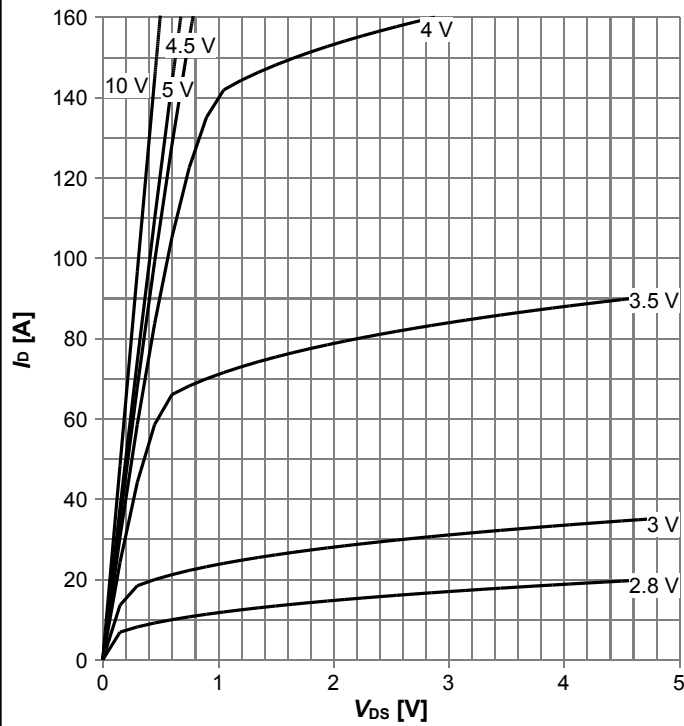
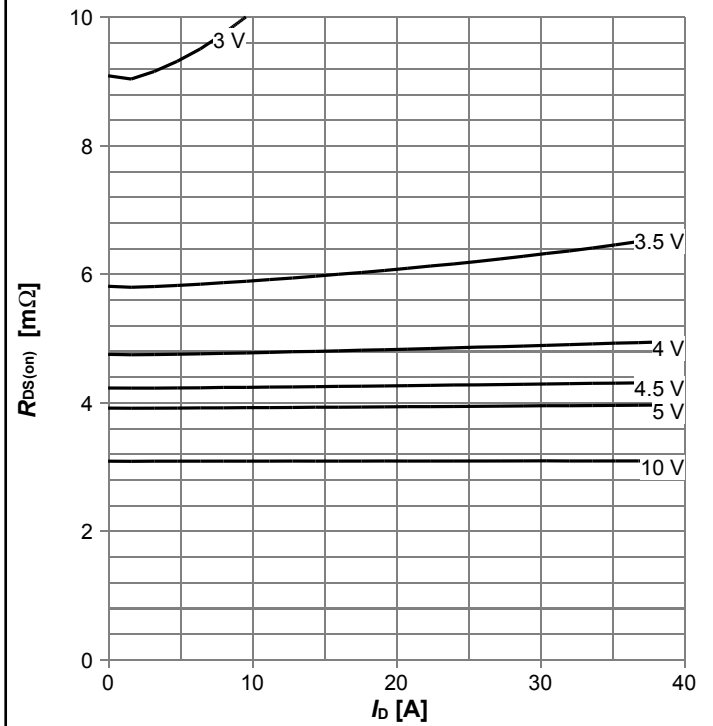


Diagram 5: Typ. output characteristics



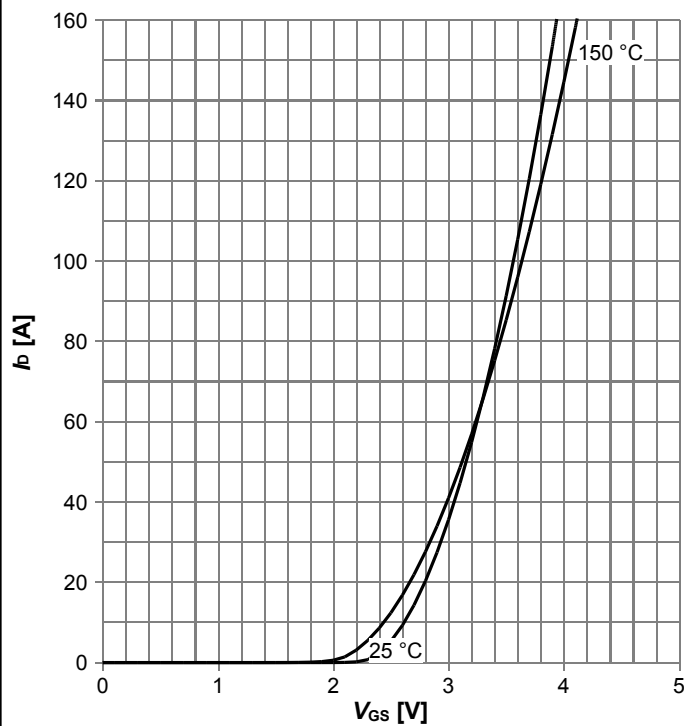
$I_D = f(V_{DS})$ ,  $T_j = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



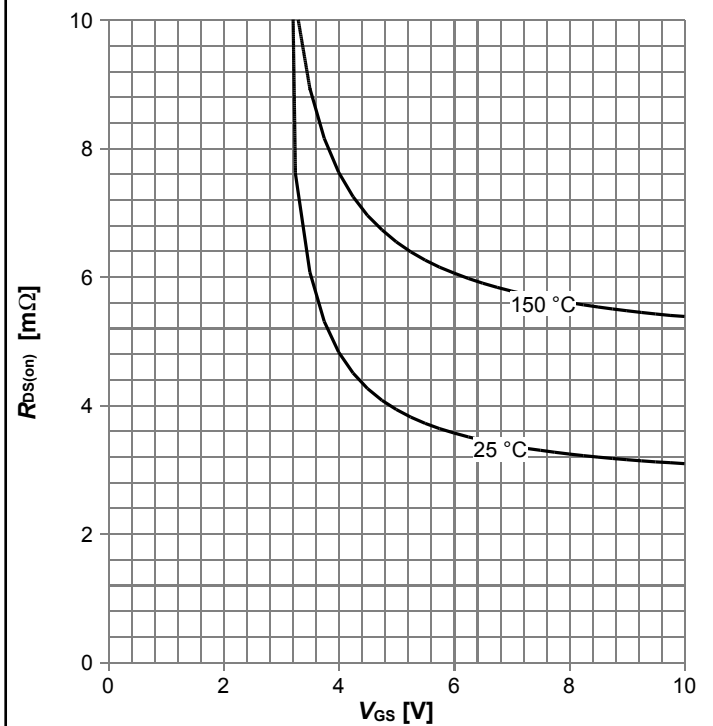
$R_{DS(on)} = f(I_D)$ ,  $T_j = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



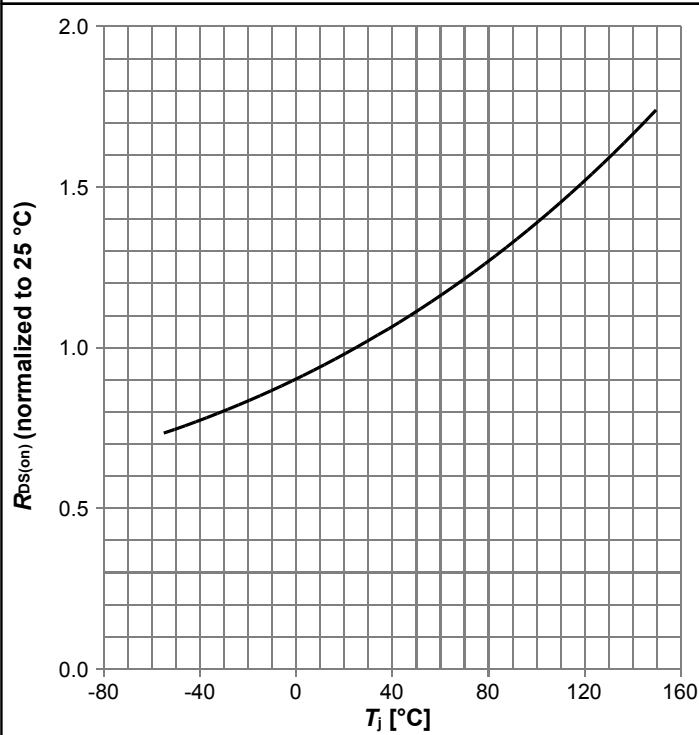
$I_D = f(V_{GS})$ ,  $|V_{DS}| > 2|I_D|R_{DS(on)max}$ ; parameter:  $T_j$

Diagram 8: Typ. drain-source on resistance



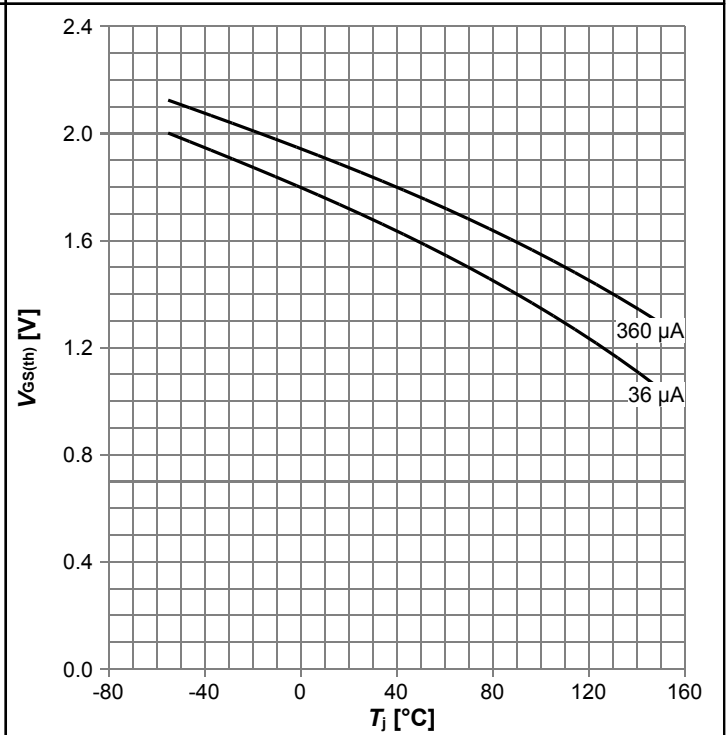
$R_{DS(on)} = f(V_{GS})$ ,  $I_D = 20\text{ A}$ ; parameter:  $T_j$

Diagram 9: Normalized drain-source on resistance



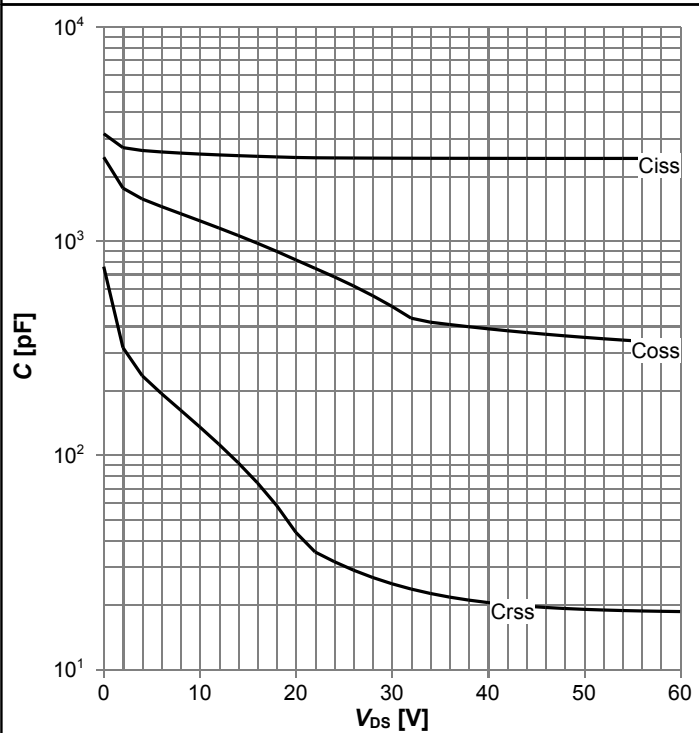
$R_{DS(on)}=f(T_j)$ ,  $I_D=20$  A,  $V_{GS}=10$  V

Diagram 10: Typ. gate threshold voltage



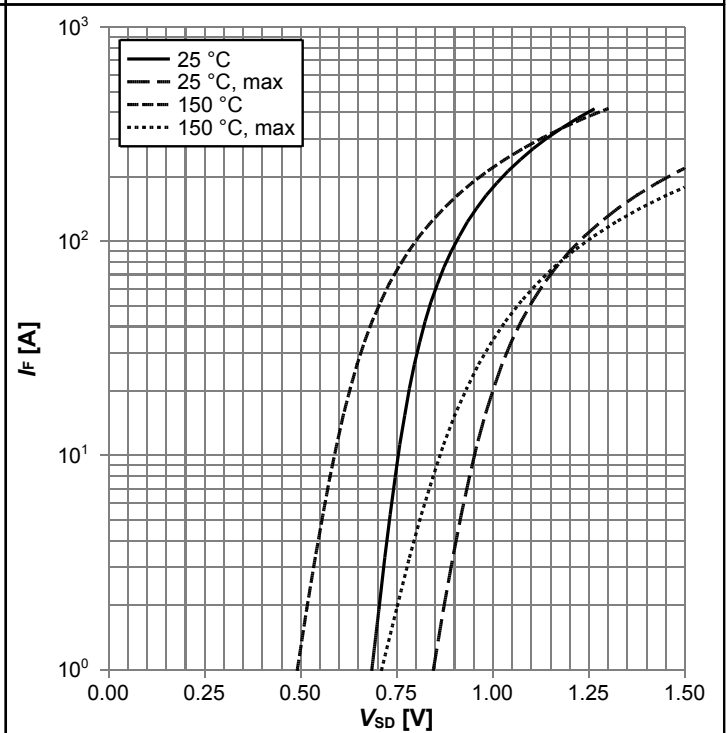
$V_{GS(th)}=f(T_j)$ ,  $V_{GS}=V_{DS}$ ; parameter:  $I_D$

Diagram 11: Typ. capacitances



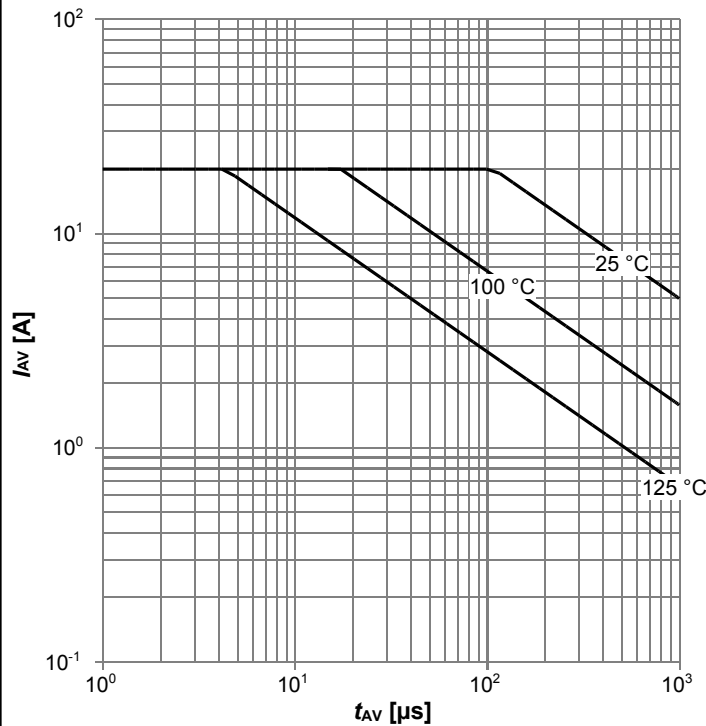
$C=f(V_{DS})$ ;  $V_{GS}=0$  V;  $f=1$  MHz

Diagram 12: Forward characteristics of reverse diode



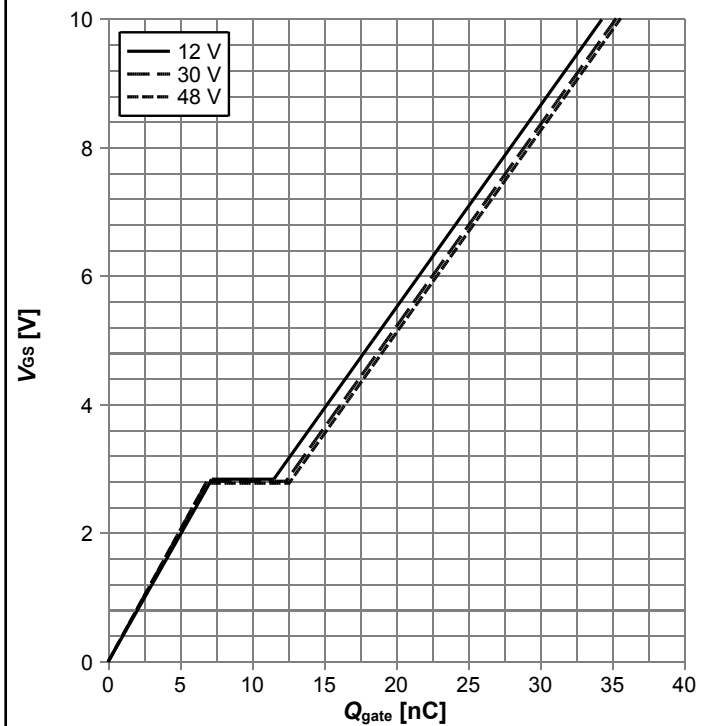
$I_F=f(V_{SD})$ ; parameter:  $T_j$

Diagram 13: Avalanche characteristics



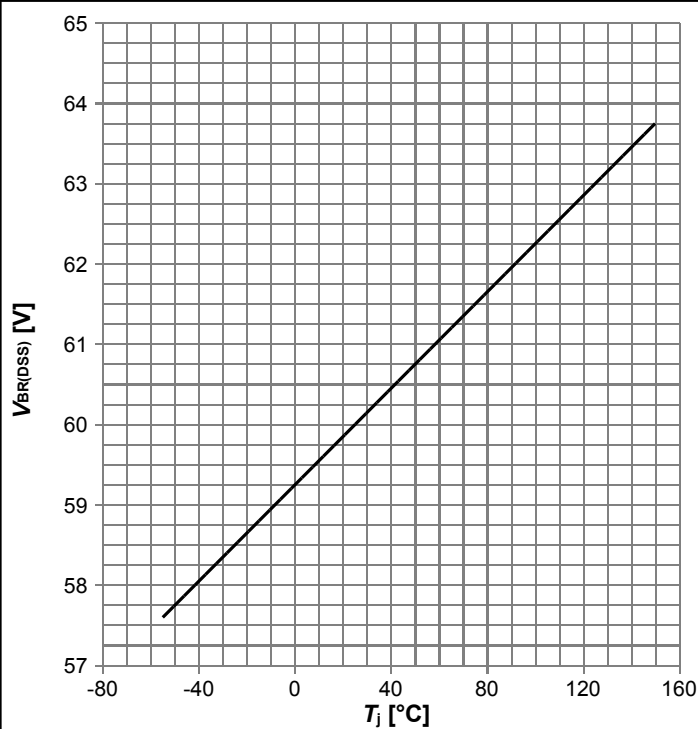
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega; \text{parameter: } T_{j,start}$

Diagram 14: Typ. gate charge



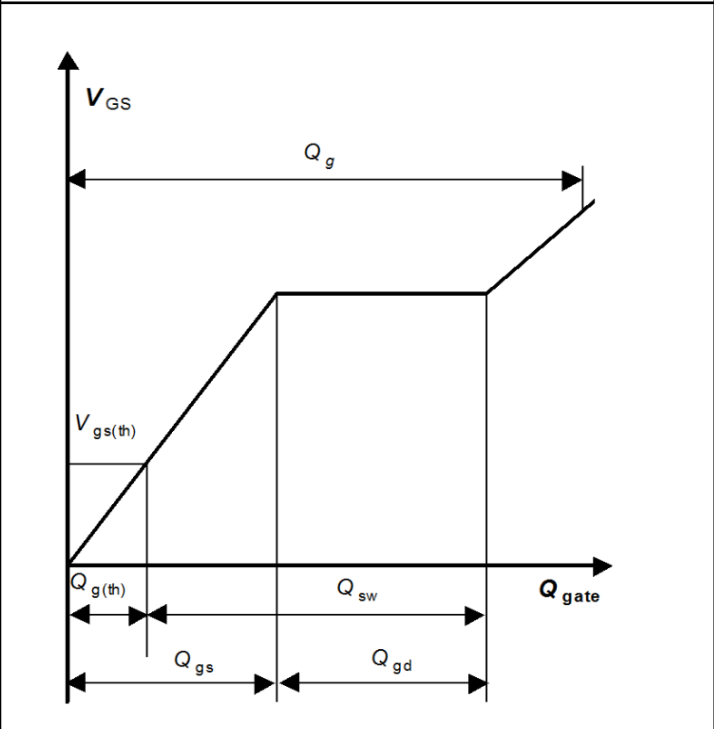
$V_{GS}=f(Q_{gate}), I_D=20 \text{ A pulsed}, T_j=25 \text{ °C}; \text{parameter: } V_{DD}$

Diagram 15: Drain-source breakdown voltage



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

Diagram Gate charge waveforms



### 5 Package Outlines

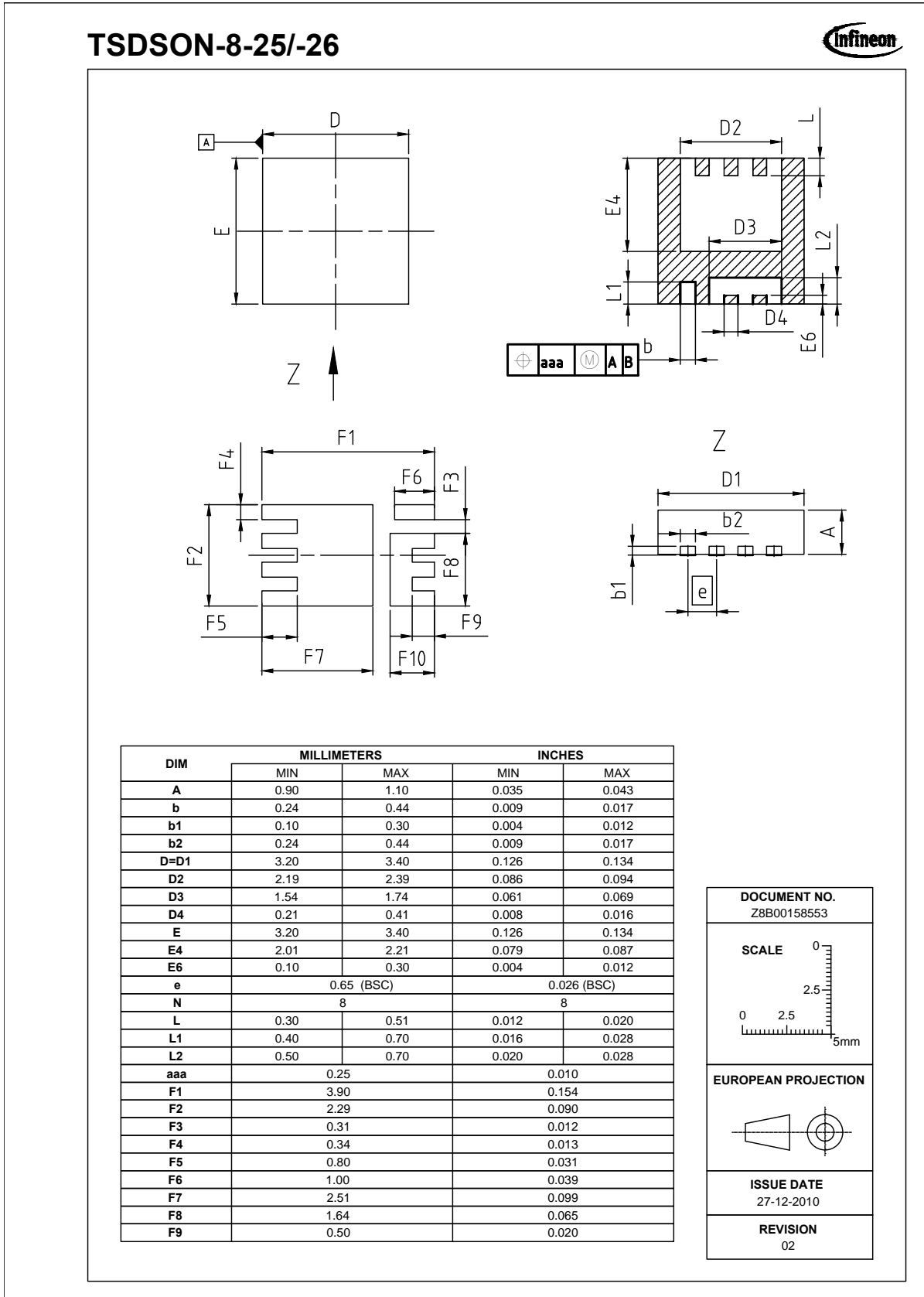


Figure 1 Outline PG-TSDSON-8 FL, dimensions in mm/inches

## Revision History

BSZ037N06LS5

**Revision: 2020-04-17, Rev. 2.1**

Previous Revision

| Revision | Date       | Subjects (major changes since last revision) |
|----------|------------|--|
| 2.0      | 2019-02-11 | Release of final version                     |
| 2.1      | 2020-04-17 | Update Current Rating                        |

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