

N-Channel Enhancement Mode MOSFET

TDM31052

**DESCRIPTION**

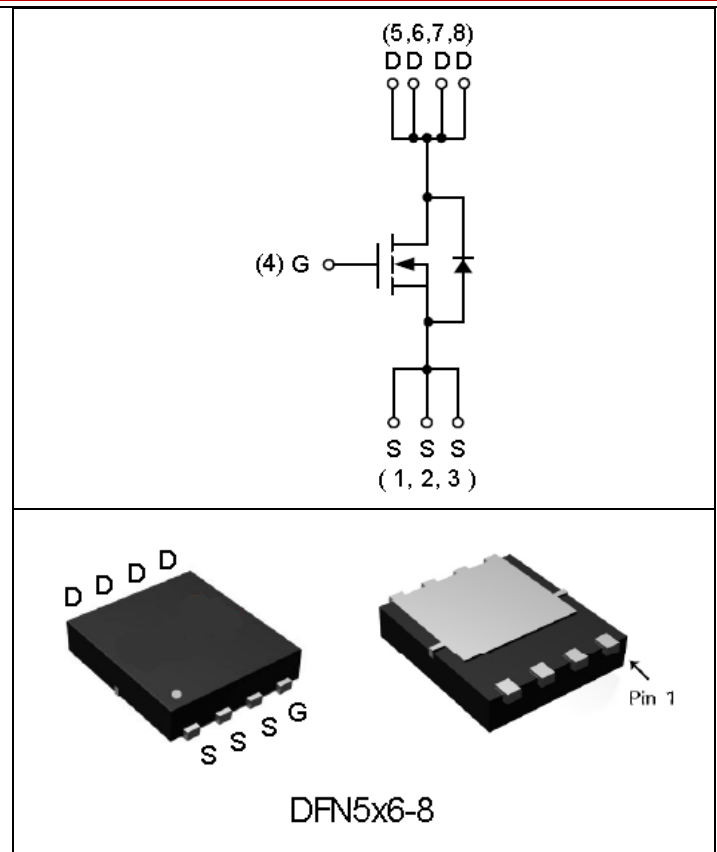
The TDM31052 uses advanced trench technology to provide excellent RDS(ON) and low gate charge. This device is suitable for use as a load switch or in PWM applications.

**GENERAL FEATURES**

- RDS(ON) < 11.7mΩ @ VGS=4.5V  
RDS(ON) < 9.0mΩ @ VGS=10V
- High Power and current handling capability
- Lead free product is available
- DFN5X6-8 Package

**Application**

- PWM applications
- Load switch
- Power management
- Hard Switched and High Frequency Circuits



ABSOLUTE MAXIMUM RATINGS(TA=25°C unless otherwise noted)

| Parameter                                       | Symbol                                 | Limit      | Unit |
|---|--|------------|------|
| Drain-Source Voltage                            | V <sub>DS</sub>                        | 100        | V    |
| Gate-Source Voltage                             | V <sub>GS</sub>                        | ±20        | V    |
| Diode Continuous Forward Current                | I <sub>S</sub> (T <sub>C</sub> =25°C)  | 30         | A    |
| Drain Current @ Continuous                      | I <sub>D</sub> (T <sub>C</sub> =25°C)  | 62         | A    |
|   | I <sub>D</sub> (T <sub>C</sub> =100°C) | 39         | A    |
| Pulsed Drain Current                            | I <sub>DM</sub> (T <sub>C</sub> =25°C) | 248        | A    |
| Maximum Power Dissipation                       | P <sub>D</sub> (T <sub>C</sub> =25°C)  | 71         | W    |
|   | P <sub>D</sub> (T <sub>C</sub> =100°C) | 28         | W    |
| Drain Current @ Continuous                      | I <sub>D</sub> (T <sub>A</sub> =25°C)  | 10.7       | A    |
|   | I <sub>D</sub> (T <sub>A</sub> =70°C)  | 8.6        | A    |
| Maximum Power Dissipation                       | P <sub>D</sub> (T <sub>A</sub> =25°C)  | 2.08       | W    |
|   | P <sub>D</sub> (T <sub>A</sub> =70°C)  | 1.33       | W    |
| Thermal Resistance,Junction-to-Case             | R <sub>θJC</sub>                       | 1.75       | °C/W |
| Thermal Resistance,Junction-to-Ambient (Note 1) | R <sub>θJA</sub>                       | 60         | °C/W |
| Avalanche Current, Single pulse                 | I <sub>AS</sub> (L=0.5mH)              | 25         | A    |
| Avalanche Energy, Single pulse                  | E <sub>AS</sub> (L=0.5mH)              | 156        | mJ   |
| Maximum Operating Junction Temperature          | T <sub>J</sub>                         | 150        | °C   |
| Storage Temperature Range                       | T <sub>STG</sub>                       | -55 To 150 | °C   |

**ELECTRICAL CHARACTERISTICS** ( $T_A=25^{\circ}\text{C}$  unless otherwise noted)

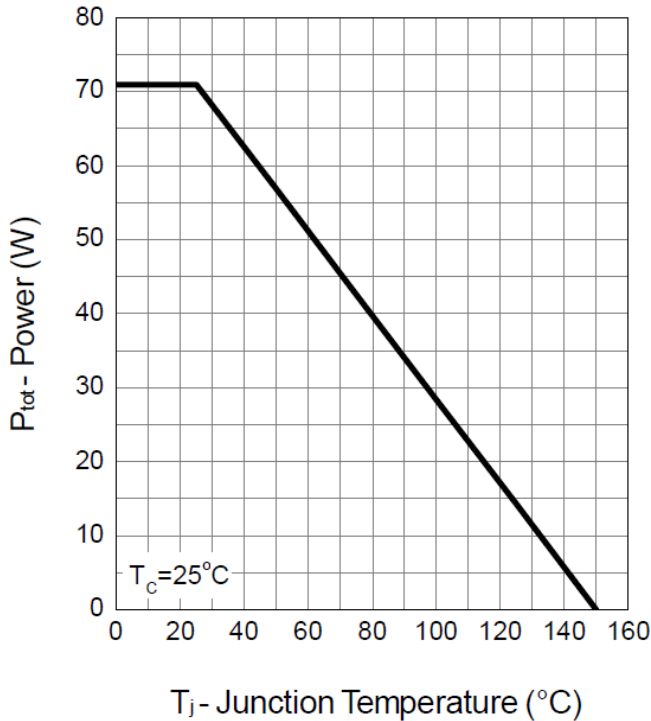
| Parameter                                 | Symbol       | Condition  | Min | Typ  | Max       | Unit       |
|---|--------------|--|-----|------|-----------|------------|
| <b>OFF CHARACTERISTICS</b>                |              |  |     |      |           |            |
| Drain-Source Breakdown Voltage            | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$                                    | 100 | -    | -         | V          |
| Zero Gate Voltage Drain Current           | $I_{DSS}$    | $V_{DS}=80V, V_{GS}=0V$                                      | -   | -    | 1         | $\mu A$    |
| Gate-Body Leakage Current                 | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$                                  | -   | -    | $\pm 100$ | nA         |
| <b>ON CHARACTERISTICS</b> (Note 2)        |              |  |     |      |           |            |
| Gate Threshold Voltage                    | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$                                | 1   | 2    | 3         | V          |
| Drain-Source On-State Resistance          | $R_{DS(ON)}$ | $V_{GS}=4.5V, I_D=20A$                                       | -   | 9.0  | 11.7      | m $\Omega$ |
|   | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=25A$  | -   | 7.5  | 9.0       | m $\Omega$ |
| <b>DYNAMIC CHARACTERISTICS</b> (Note3)    |              |  |     |      |           |            |
| Gate Resistance                           | $R_G$        | $V_{DS}=0V, V_{GS}=0V, F=1.0MHz$                             | -   | 1.0  | -         | $\Omega$   |
| Input Capacitance                         | $C_{iss}$    | $V_{DS}=30V, V_{GS}=0V, F=1.0MHz$                            | -   | 2310 | 3000      | PF         |
| Output Capacitance                        | $C_{oss}$    |  | -   | 690  | -         | PF         |
| Reverse Transfer Capacitance              | $C_{rss}$    |  | -   | 50   | -         | PF         |
| <b>SWITCHING CHARACTERISTICS</b> (Note 3) |              |  |     |      |           |            |
| Turn-on Delay Time                        | $t_{d(on)}$  | $V_{DS}=30V, R_L=30\Omega, V_{GEN}=10V, R_G=6\Omega, I_D=1A$ | -   | 20   | 36        | nS         |
| Turn-on Rise Time                         | $t_r$        |  | -   | 9    | 17        | nS         |
| Turn-Off Delay Time                       | $t_{d(off)}$ |  | -   | 51   | 100       | nS         |
| Turn-Off Fall Time                        | $t_f$        |  | -   | 65   | 116       | nS         |
| Total Gate Charge                         | $Q_g$        | $V_{DS}=50V, I_D=9A, V_{GS}=4.5V$                            | -   | 44   | 66        | nC         |
| Gate-Source Charge                        | $Q_{gs}$     |  | -   | 8    | -         | nC         |
| Gate-Drain Charge                         | $Q_{gd}$     |  | -   | 9    | -         | nC         |
| Body Diode Reverse Recovery Time          | $T_{rr}$     | $I_F=9A, di/dt=100A/\mu s$                                   | -   | 52   | -         | nS         |
| Body Diode Reverse Recovery Charge        | $Q_{rr}$     |  | -   | 82   | -         | nC         |
| <b>DRAIN-SOURCE DIODE CHARACTERISTICS</b> |              |  |     |      |           |            |
| Diode Forward Voltage (Note 2)            | $V_{SD}$     | $V_{GS}=0V, I_S=2A$  | -   | 0.8  | 1.3       | V          |

**NOTES:**

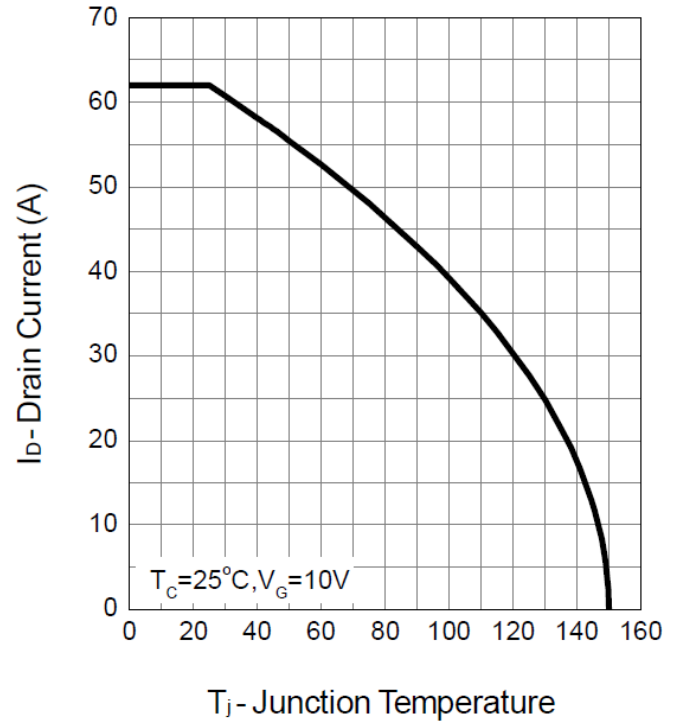
1. Pulse width limited by max. junction temperature.
2. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
3. Guaranteed by design, not subject to production testing

Typical Operating Characteristics

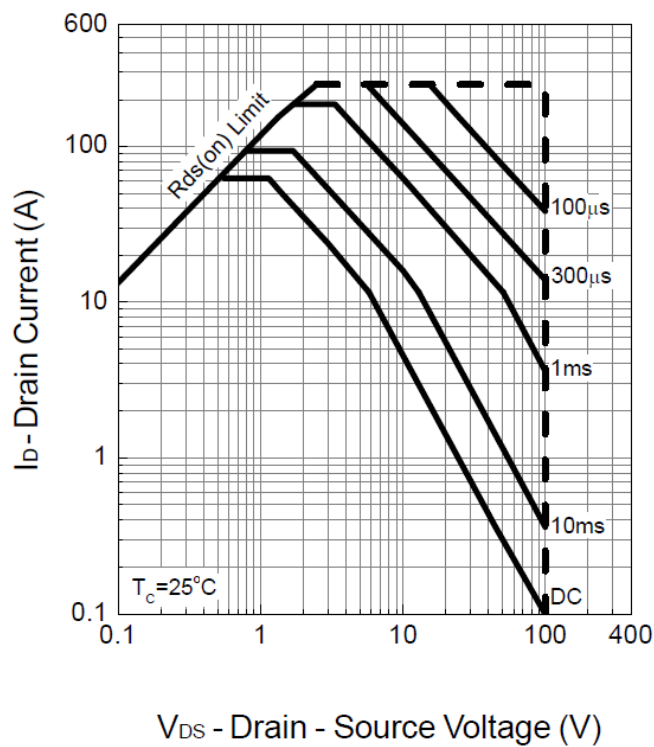
Power Dissipation



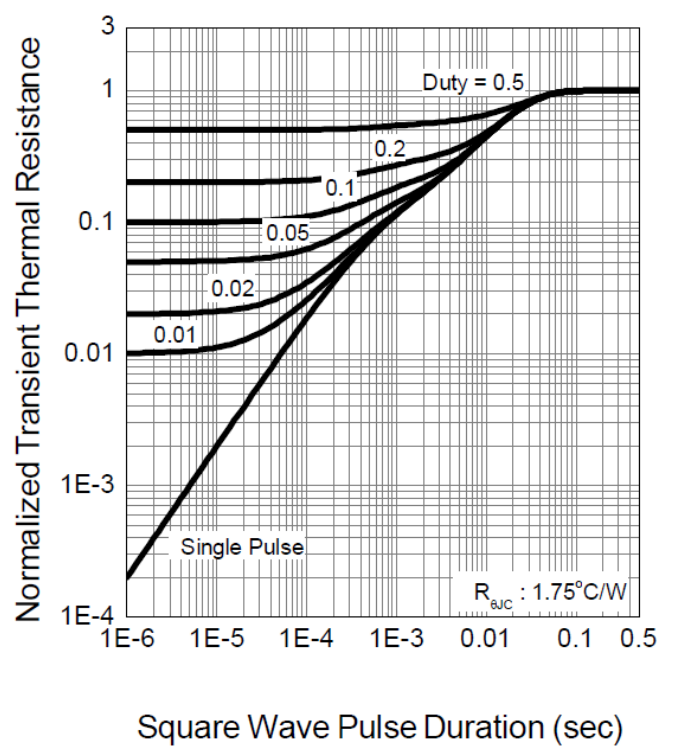
Drain Current



Safe Operation Area

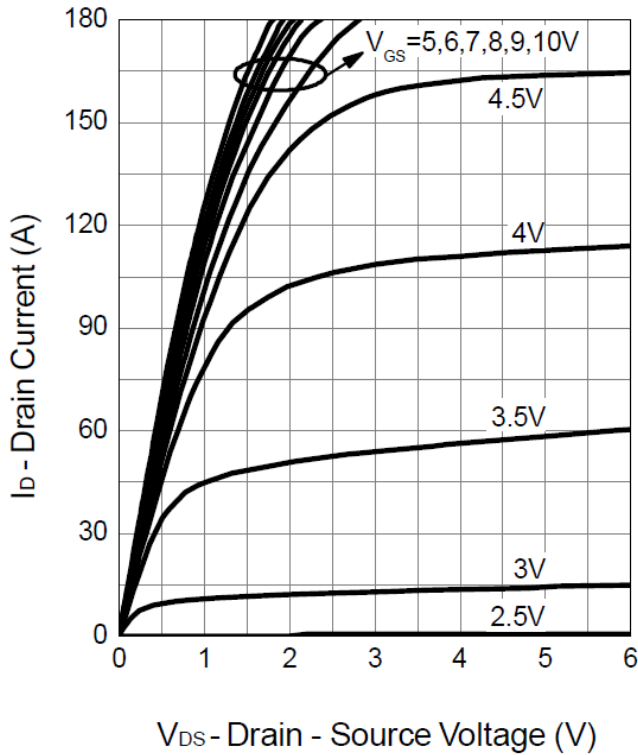


Thermal Transient Impedance

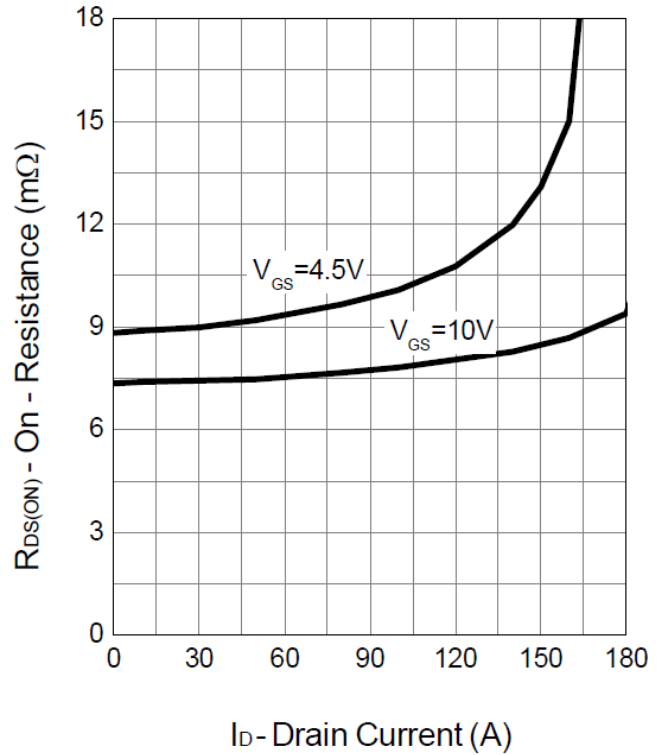


Typical Operating Characteristics (Cont.)

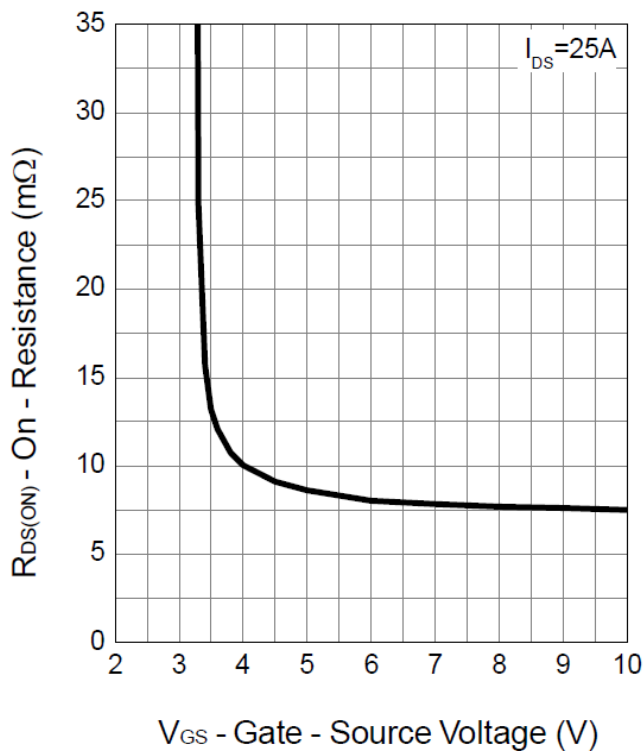
Output Characteristics



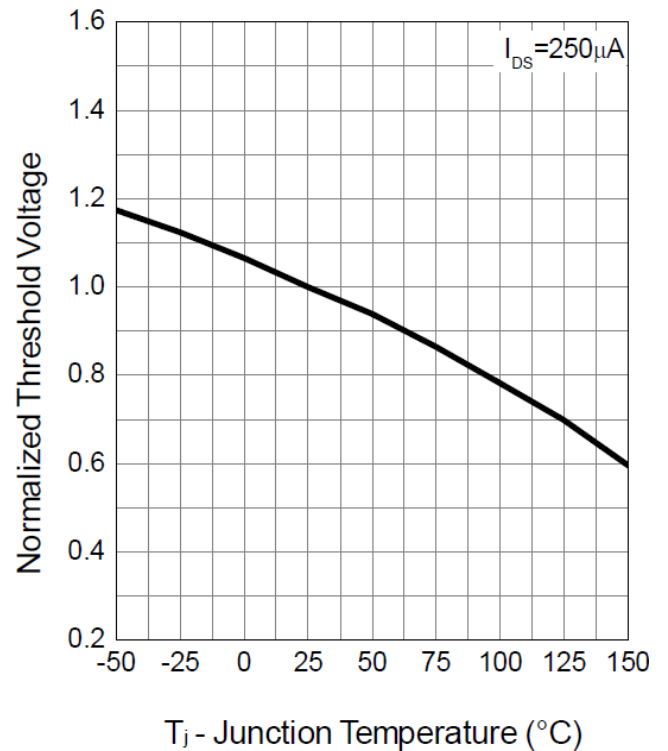
Drain-Source On Resistance



Gate-Source On Resistance

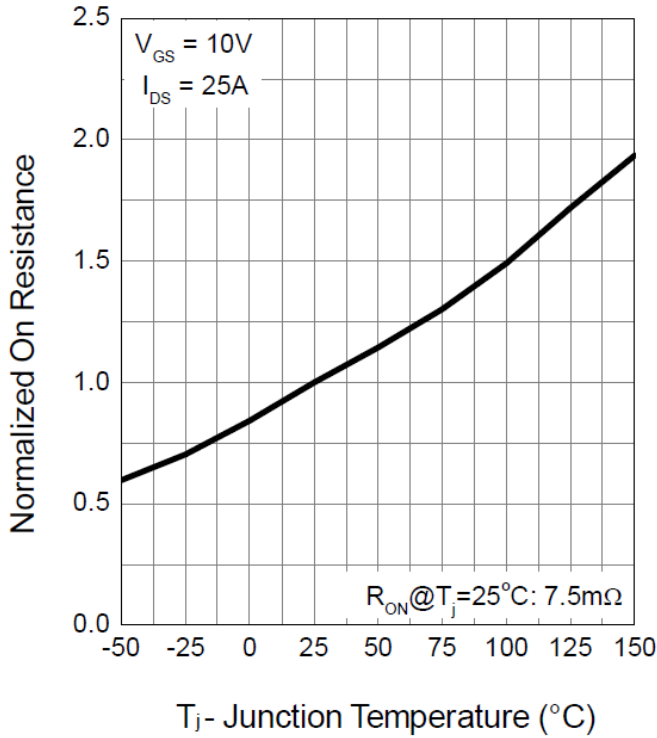


Gate Threshold Voltage

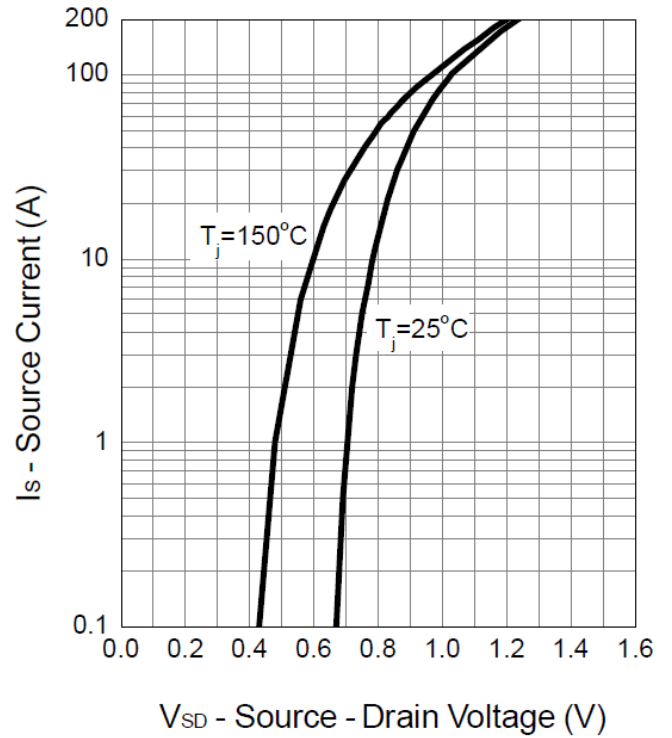


Typical Operating Characteristics (Cont.)

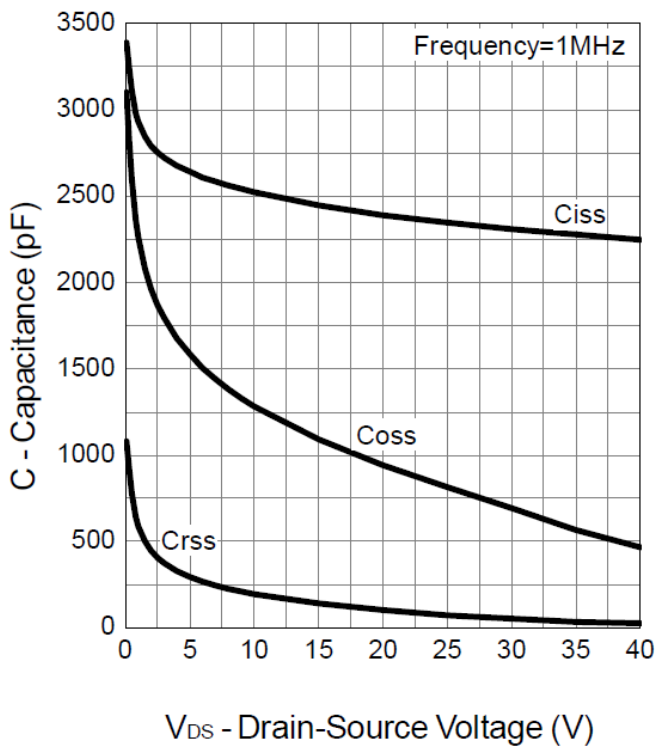
Drain-Source On Resistance



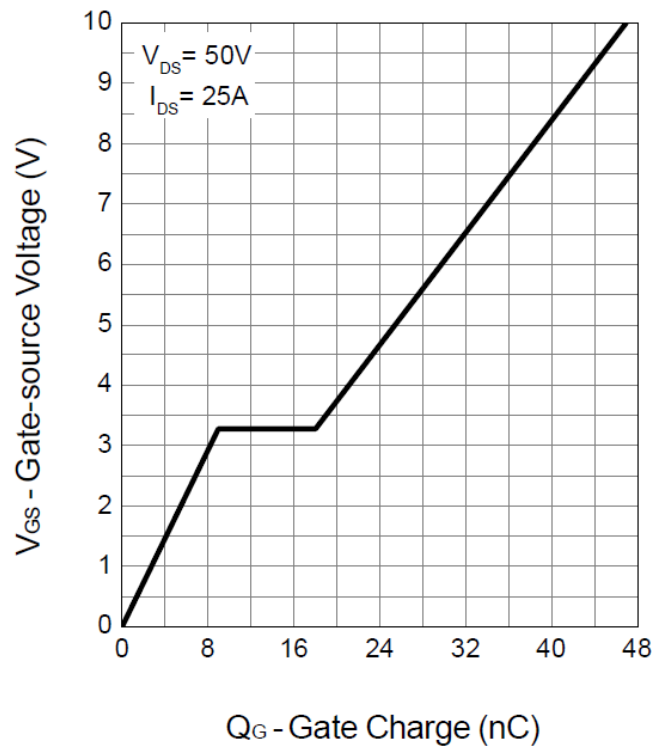
Source-Drain Diode Forward



Capacitance

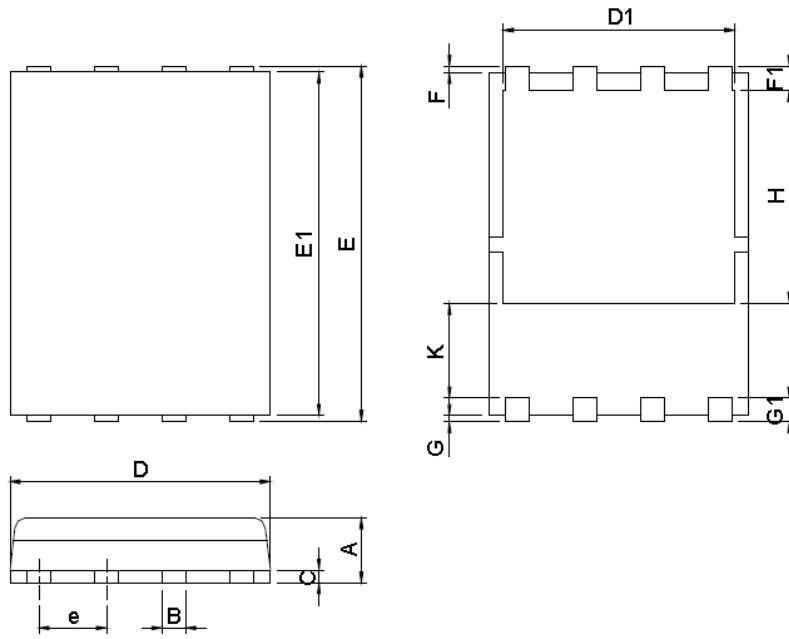


Gate Charge



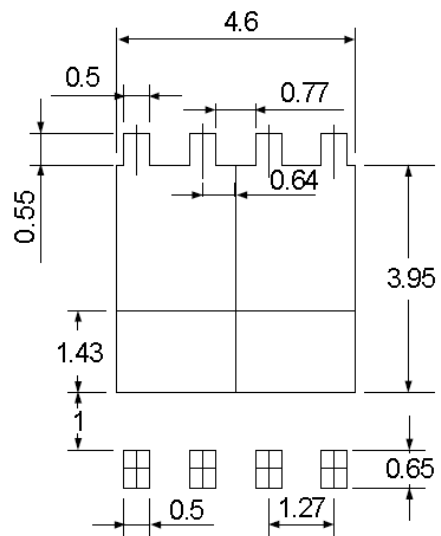
Package Information

DFN5\*6-8 Package



| DIMENSIONS | DFN5x6-8    |      |           |       |
|------------|-------------|------|-----------|-------|
|            | MILLIMETERS |      | INCHES    |       |
|            | MIN.        | MAX. | MIN.      | MAX.  |
| A          | 0.90        | 1.20 | 0.035     | 0.047 |
| B          | 0.3         | 0.51 | 0.012     | 0.020 |
| C          | 0.19        | 0.25 | 0.007     | 0.010 |
| D          | 4.80        | 5.30 | 0.189     | 0.209 |
| D1         | 4.00        | 4.40 | 0.157     | 0.173 |
| E          | 5.90        | 6.20 | 0.232     | 0.244 |
| E1         | 5.50        | 5.80 | 0.217     | 0.228 |
| e          | 1.27 BSC    |      | 0.050 BSC |       |
| F          | 0.05        | 0.30 | 0.002     | 0.012 |
| F1         | 0.35        | 0.75 | 0.014     | 0.030 |
| G          | 0.05        | 0.30 | 0.002     | 0.012 |
| G1         | 0.35        | 0.75 | 0.014     | 0.030 |
| H          | 3.34        | 3.9  | 0.131     | 0.154 |
| K          | 0.762       | -    | 0.03      | -     |

RECOMMENDED LAND PATTERN



UNIT: mm

Note : 1.Dimension D, D1,D2 and E1 do not include mold flash or protrusions.  
Mold flash or protrusions shall not exceed 10 mil.

Design Notes