# P-Channel Enhancement Mode MOSFET TDM3405

## DESCRIPTION

The TDM3405 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

- -40V/-55A
- RDS(ON) < 15mΩ @ VGS=-4.5V
  RDS(ON) < 9.4mΩ @ VGS=-10V
  RDS(ON) < 8mΩ @ VGS=-20V
- Reliable and Rugged
- HBM ESD capability level of 8KV typical
- Lead free product is available
- DFN5X6 Package

## Application

- PWM applications
- Load switch
- Power management
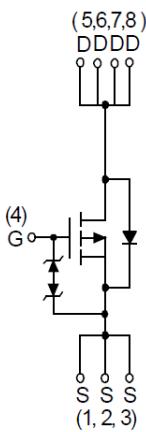


P-Channel MOSFET
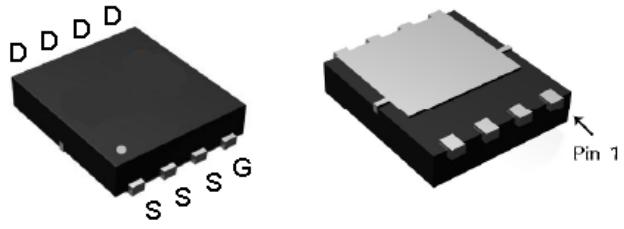


DFN5x6-8

## ABSOLUTE MAXIMUM RATINGS(TA=25℃unless otherwise noted)

| Parameter | Symbol | Rating | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | -40 | V |
| Gate-Source Voltage | $V_{GS}$ | ±25 | V |
| Continuous Drain Current($V_{GS}$=-10V) note1 | $I_D$ (T$_A$=25℃) | -17 | A |
| | $I_D$ (T$_A$=70℃) | -14 | A |
| 300μs Pulsed Drain Current Tested note1 | $I_{DP}$(T$_A$=25℃) | -69 | A |
| Continuous Drain Current (VGS=-10V) note2 | $I_D$ (T$_C$=25℃) | -55 | A |
| | $I_D$ (T$_C$=100℃) | -35 | A |
| 300μs Pulsed Drain Current Tested note2 | $I_{DP}$(T$_C$=25℃) | -222 | A |
| Diode Continuous Forward Current note2 | $I_S$ | -27 | A |
| Maximum Power Dissipation note1 | $P_D$(T$_A$=25℃) | 5 | W |
| | $P_D$(T$_A$=70℃) | 3.2 | W |
| Maximum Power Dissipation note2 | $P_D$(T$_C$=25℃) | 52 | W |
| | $P_D$(T$_C$=100℃) | 20 | W |

## P-Channel Enhancement Mode MOSFET      TDM3405

| | | | | |
|---|---|---|---|---|
| Maximum Junction Temperature | $T_J$ | 150 | ℃ |
| Storage Temperature Range | $T_{STG}$ | -55 to 150 | ℃ |
| Thermal Resistance-Junction to Ambient note1 | $R_{θJA}$ | 60 | ℃/W |
| Thermal Resistance-Junction to Case note2 | $R_{θJC}$ | 2.4 | ℃/W |

NOTES:

1. Surface Mounted on 1in$^2$ pad area, t≤ 10sec. $R_{θJA}$ steady state t = 999s.

2. The power dissipation $P_D$ is based on $T_{J(MAX)}$ = 150$^o$C, and it is useful for reducing junction-to-case thermal resistance ($R_{θJC}$) when additional heat sink is used.

## ELECTRICAL CHARACTERISTICS ($T_A$=25℃ unless otherwise noted)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| STATIC CHARACTERISTICS | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V, $I_D$=-250μA | -40 | - | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=-32, $V_{GS}$=0V | - | - | -1 | μA |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V, $V_{DS}$=0V | - | - | ±10 | μA |
| ON CHARACTERISTICS (Note 3) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=VGS,$I_D$=-250μA | -1.5 | -2 | -2.5 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}$=-4.5V,$I_{DS}$=-15A | - | 11 | 15 | mΩ |
| | | $V_{GS}$=-10V, $I_{DS}$=-25A | - | 7.5 | 9.4 | mΩ |
| | | $V_{GS}$=-20V, $I_{DS}$=-25A | - | 6.6 | 8 | mΩ |
| DYNAMIC CHARACTERISTICS (Note4) | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$=-20V,$V_{GS}$=0V, F=1.0MHz | - | 2780 | 3610 | PF |
| Output Capacitance | $C_{oss}$ | | - | 425 | - | PF |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 330 | - | PF |
| SWITCHING CHARACTERISTICS (Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=-20V, $R_L$=20Ω, $V_{GEN}$=-10V, $R_G$=6Ω $I_{DS}$=-1A | - | 17 | 30 | nS |
| Turn-on Rise Time | $t_r$ | | - | 14 | 25 | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 59 | 106 | nS |
| Turn-Off Fall Time | $t_f$ | | - | 22 | 40 | nS |
| Total Gate Charge | $Q_g$ | $V_{DS}$=-20V,$I_{DS}$=-25A,$V_{GS}$=-10V | - | 59 | 83 | nC |
| Gate-Source Charge | $Q_{gs}$ | | - | 8 | - | nC |
| Gate-Drain Charge | $Q_{gd}$ | | - | 16 | - | nC |
| Body Diode Reverse Recovery Time | $T_{rr}$ | $I_{DS}$=-25A, dI/dt=100A/μs | - | 23 | - | nS |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | | - | 10 | - | nC |
| DRAIN-SOURCE DIODE CHARACTERISTICS | | | | | | |
| Diode Forward Voltage (Note 3) | $V_{SD}$ | $V_{GS}$=0V,$I_{SD}$=-1A | - | -0.7 | -1 | V |

NOTES:

3 Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.

4 Guaranteed by design, not subject to production testing
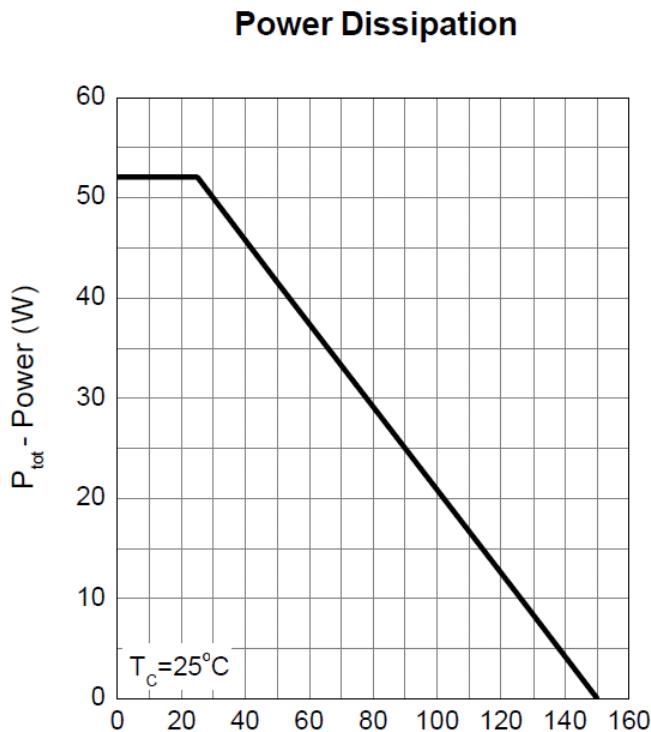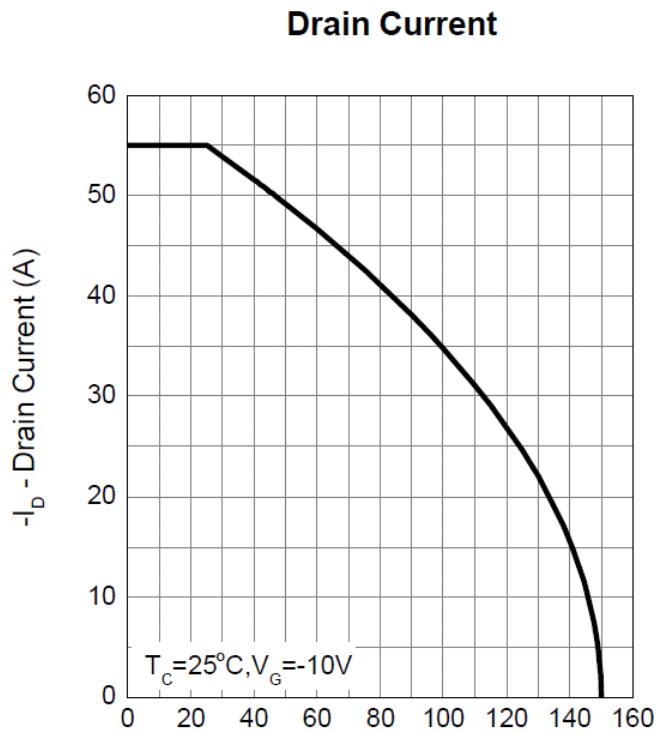
| P-Channel Enhancement Mode MOSFET | TDM3405 |

## Typical Operating Characteristics

### Power Dissipation



### Drain Current



### Safe Operation Area



### Thermal Transient Impedance
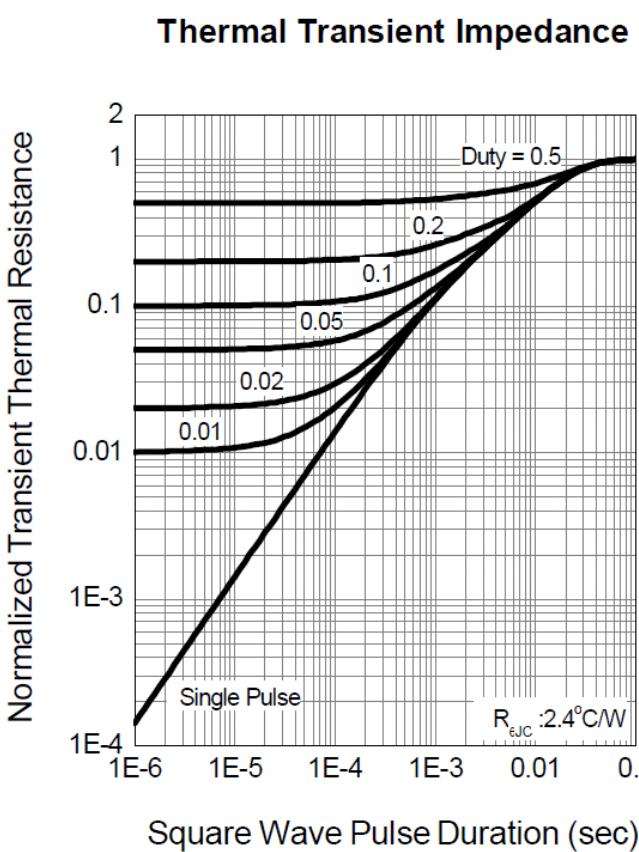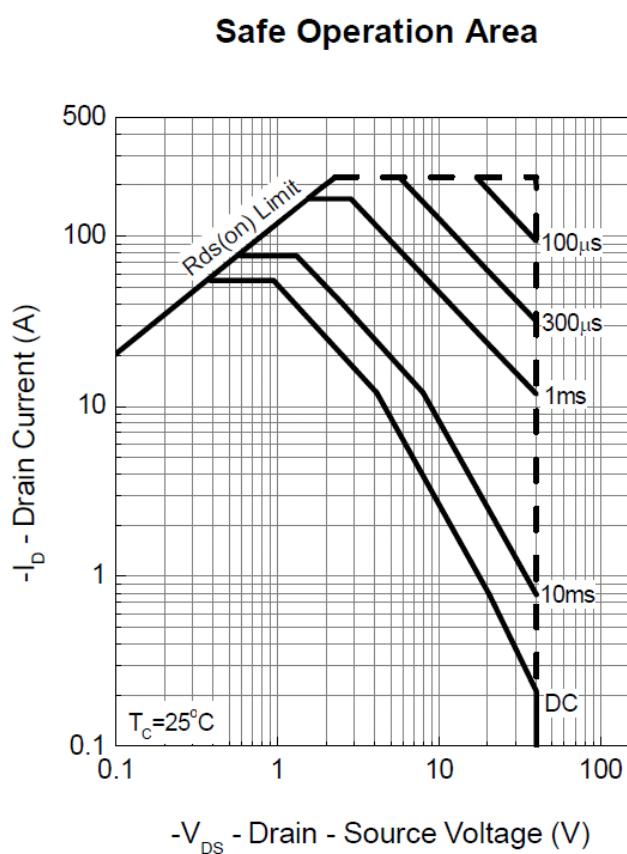
## Typical Operating Characteristics(Cont.)

### Output Characteristics
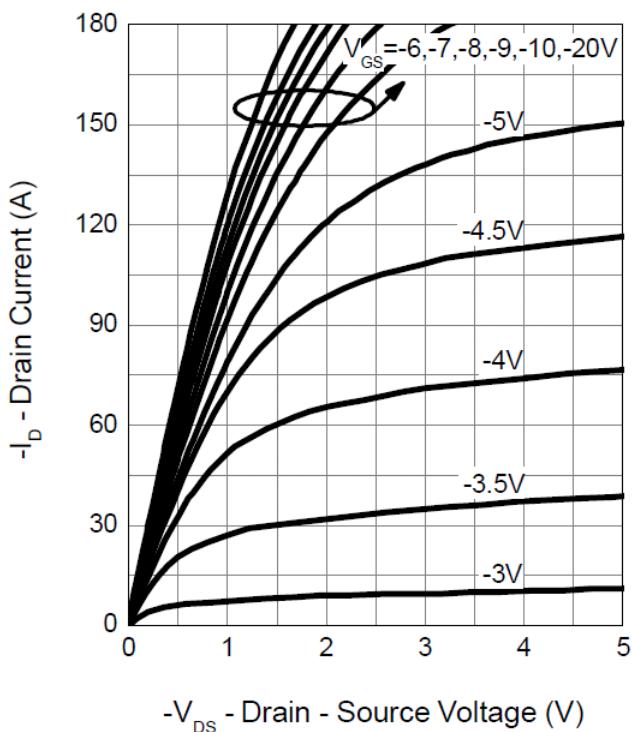


### Drain-Source On Resistance
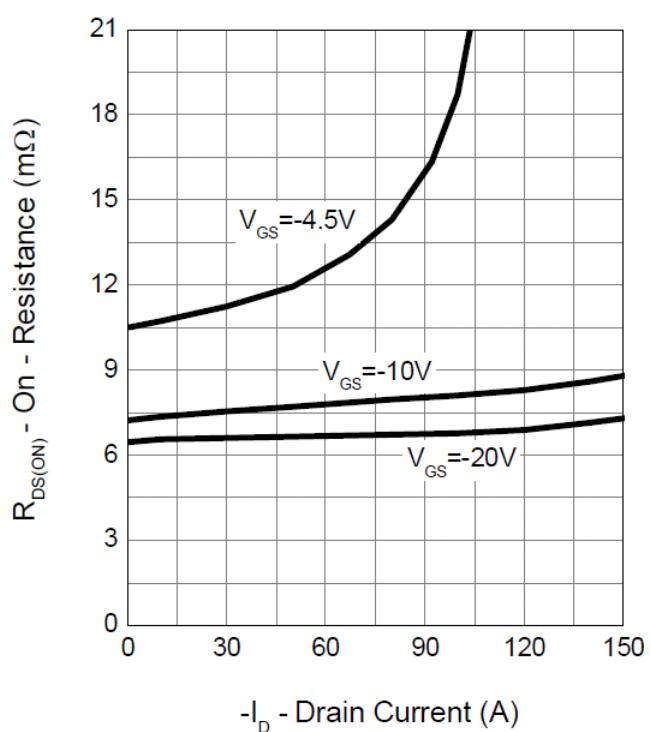


### Gate-Source On Resistance
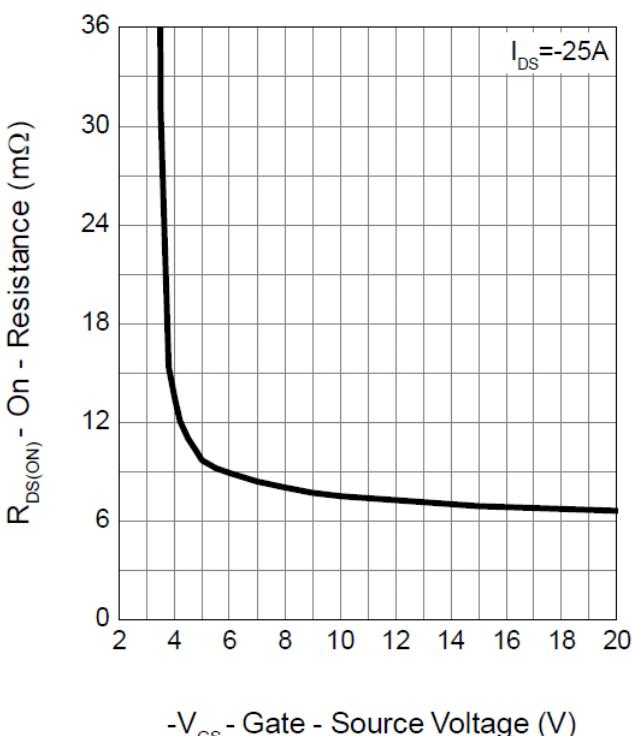


### Gate Threshold Voltage
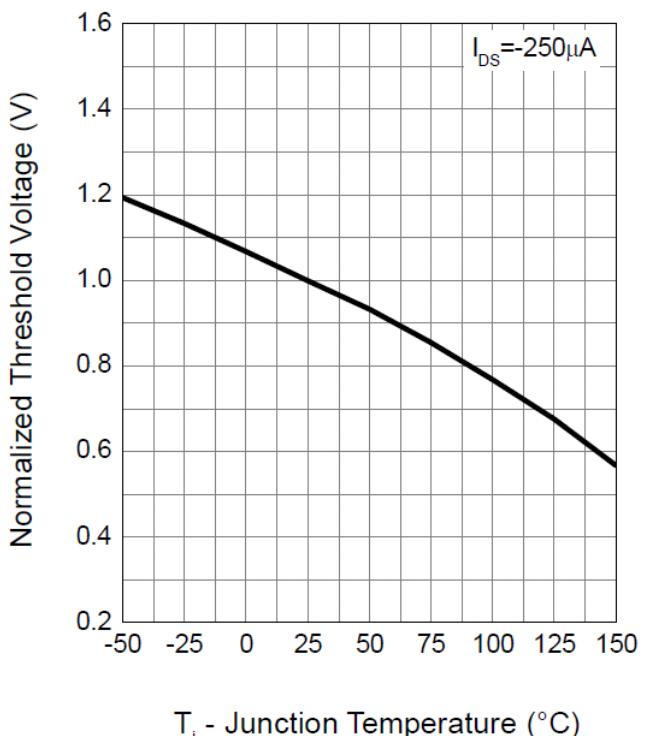
## P-Channel Enhancement Mode MOSFET — TDM3405

## Typical Operating Characteristics (Cont.)

### Drain-Source On Resistance

$V_{GS} = -10V$
$I_{DS} = -25A$

$R_{ON}$@$T_j$=25°C: 7.5mΩ

Normalized On Resistance vs. $T_j$ - Junction Temperature (°C)
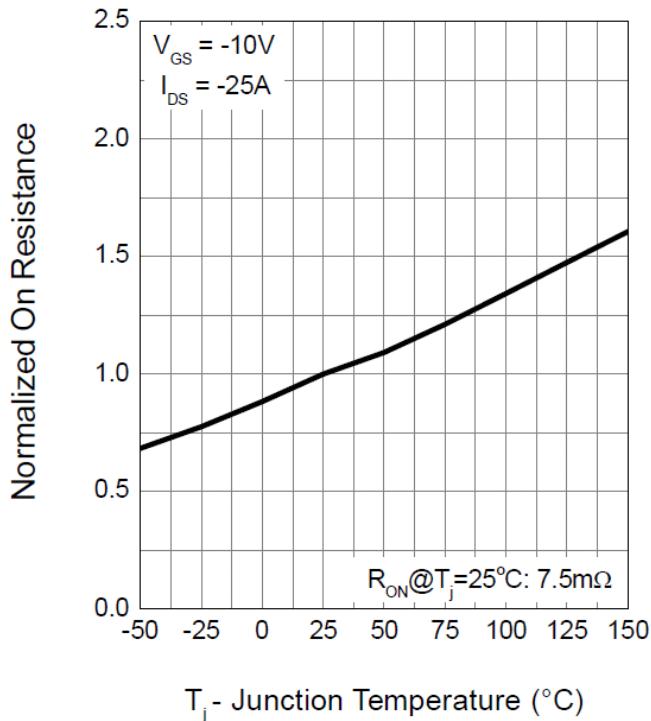
### Source-Drain Diode Forward

$T_j$=150°C

$T_j$=25°C

-$I_S$ - Source Current (A) vs. -$V_{SD}$ - Source - Drain Voltage (V)

### Capacitance

Frequency=1MHz

Ciss

Coss

Crss

C - Capacitance (pF) vs. -$V_{DS}$ - Drain - Source Voltage (V)

### Gate Charge

$V_{DS}$=-20V
$I_{DS}$=-25A

-$V_{GS}$ - Gate-Source Voltage (V) vs. $Q_G$ - Gate Charge (nC)
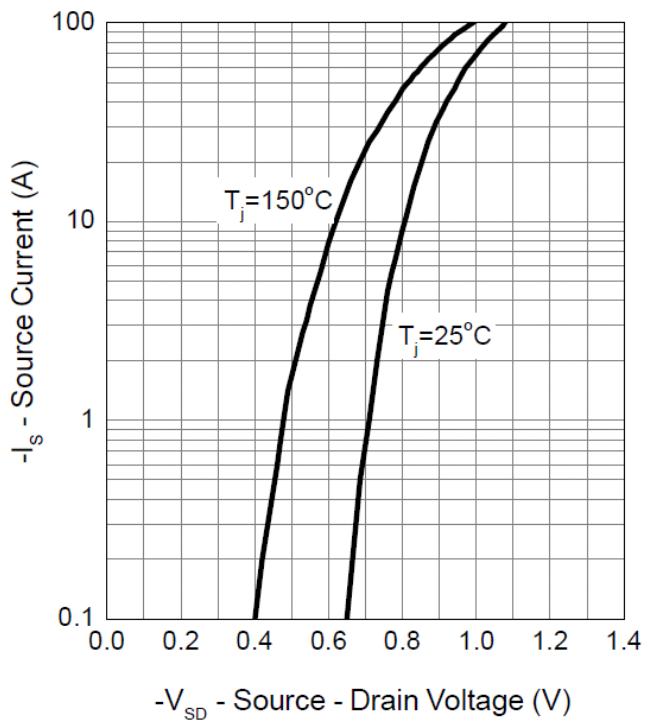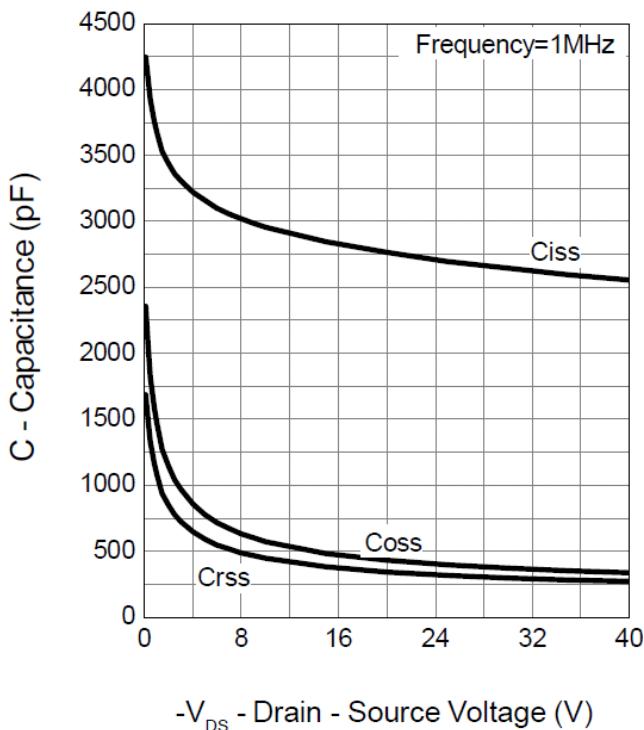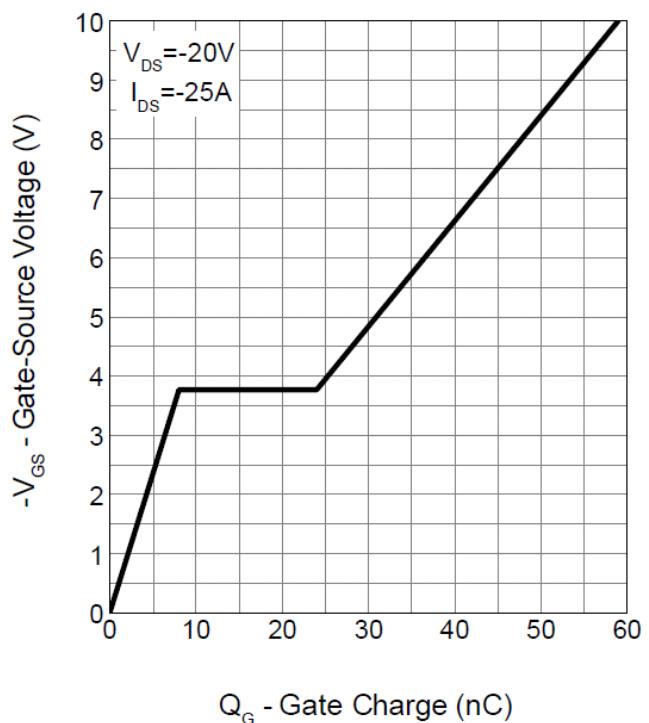
## Package Information

DFN5*6-8 Package



### RECOMMENDED LAND PATTERN
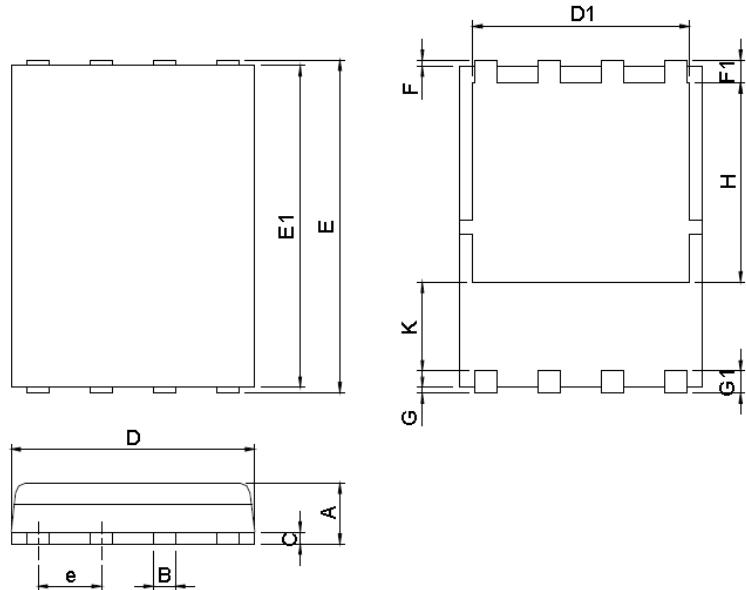


| SYMBOL | DFN5x6-8 | | | |
| --- | --- | --- | --- | --- |
| | MILLIMETERS | | INCHES | |
| | MIN. | MAX. | MIN. | MAX. |
| A | 0.90 | 1.20 | 0.035 | 0.047 |
| B | 0.3 | 0.51 | 0.012 | 0.020 |
| C | 0.19 | 0.25 | 0.007 | 0.010 |
| D | 4.80 | 5.30 | 0.189 | 0.209 |
| D1 | 4.00 | 4.40 | 0.157 | 0.173 |
| 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 | - |
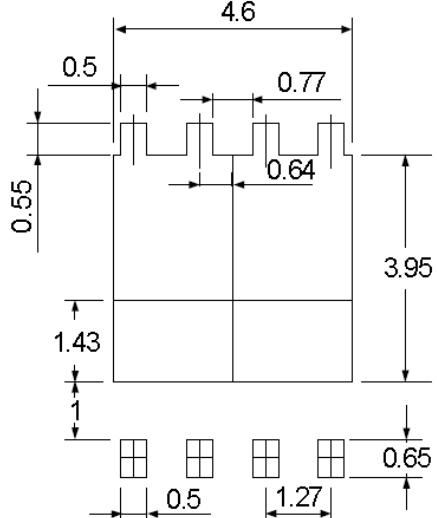
UNIT: mm

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

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