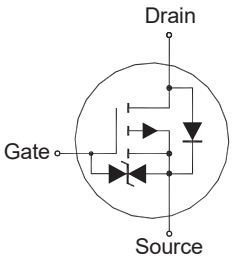
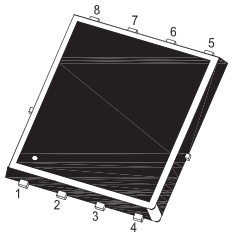
## P-Channel Enhancement Mode MOSFET

### Features

- Advanced trench cell design
- High speed switch
- Halogen and Antimony Free(HAF), RoHS compliant
- Built-in G-S Protection Diode
- Typical ESD Protection HBM Class 2




1.Source 2.Source 3.Source 4.Gate
5.Drain 6.Drain 7.Drain 8.Drain
DFN5060 Plastic Package

| Classification | Voltage Range(V) |
|---|---|
| 0A | < 125 |
| 0B | 125 to < 250 |
| 1A | 250 to < 500 |
| 1B | 500 to < 1000 |
| 1C | 1000 to < 2000 |
| 2 | 2000 to < 4000 |
| 3A | 4000 to < 8000 |
| 3B | ≥ 8000 |

### Key Parameters

| Parameter | Value | Unit |
|---|---|---|
| $-V_{(BR)DSS}$ | 30 | V |
| $R_{DS(ON)}$ Max | 7.5 @ $-V_{GS}$ = 10 V | mΩ |
| | 11.5 @ $-V_{GS}$ = 4.5 V | |
| $-V_{GS(th)}$ typ | 1.5 | V |
| $Q_g$ typ | 112 @ $-V_{GS}$ = 10 V | nC |

### Applications

- Portable appliances
- Battery management

### Absolute Maximum Ratings (at $T_a$ = 25℃ unless otherwise specified)

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $-V_{DS}$ | 30 | V |
| Gate-Source Voltage | | $V_{GS}$ | ± 20 | V |
| Drain Current | $T_c$ = 25℃<br>$T_c$ = 100℃ | $-I_D$ | 62<br>39 | A |
| Peak Drain Current [1] | | $-I_{DM}$ | 300 | A |
| Avalanche Current | | $-I_{AS}$ | 58.1 | A |
| Avalanche Energy [2] | | $E_{AS}$ | 168.8 | mJ |
| Power Dissipation | $T_c$ = 25℃ | $P_D$ | 41.1 | W |
| Operating Junction and Storage Temperature Range | | $T_J$,$T_{stg}$ | - 55 to + 150 | ℃ |

### Thermal Characteristics

| Parameter | Symbol | Max. | Unit |
|---|---|---|---|
| Thermal Resistance from Junction to Case | $R_{\theta JC}$ | 3 | ℃/W |
| Thermal Resistance from Junction to Ambient [3] | $R_{\theta JA}$ | 39 | ℃/W |

[1] Pulse Test: Pulse Width ≤ 100 μs, Duty Cycle ≤ 2%, Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$ = 150°C.
[2] Limited by $T_{J(MAX)}$, starting $T_J$ = 25 °C, L = 0.1 mH, $R_g$ = 25 Ω, $-I_{AS}$ = 58.1 A, $V_{GS}$ = 10 V.
[3] Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate in still air.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**Characteristics at $T_a$ = 25℃ unless otherwise specified**

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| **STATIC PARAMETERS** | | | | | |
| Drain-Source Breakdown Voltage<br>at $-I_D$ = 250 µA | $-V_{(BR)DSS}$ | 30 | - | - | V |
| Drain-Source On-State Current<br>at $-V_{DS}$ = 24 V | $-I_{DSS}$ | - | - | 1 | µA |
| Gate-Source Leakage Current<br>at $V_{GS}$ = ± 20 V | $I_{GSS}$ | - | - | ± 10 | µA |
| Gate-Source Threshold Voltage<br>at $V_{DS}$ = $V_{GS}$, $-I_D$ = 250 µA | $-V_{GS(th)}$ | 1 | - | 2.5 | V |
| Drain-Source On-State Resistance<br>at $-V_{GS}$ = 10 V, $-I_D$ = 20 A<br>at $-V_{GS}$ = 4.5 V, $-I_D$ = 15 A | $R_{DS(ON)}$ | -<br>- | 6<br>- | 7.5<br>11.5 | mΩ |
| **DYNAMIC PARAMETERS** | | | | | |
| Forward Transconductance<br>at $-V_{DS}$ = 5 V, $-I_D$ = 20 A | $g_{fs}$ | - | 9.1 | - | S |
| Gate resistance<br>at $V_{GS}$ = 0 V, $V_{DS}$ = 0 V, f = 1 MHz | $R_g$ | - | 4.4 | - | Ω |
| Input Capacitance<br>at $V_{GS}$ = 0 V, $-V_{DS}$ = 15 V, f = 1 MHz | $C_{iss}$ | - | 7150 | - | pF |
| Output Capacitance<br>at $V_{GS}$ = 0 V, $-V_{DS}$ = 15 V, f = 1 MHz | $C_{oss}$ | - | 650 | - | pF |
| Reverse Transfer Capacitance<br>at $V_{GS}$ = 0 V, $-V_{DS}$ = 15 V, f = 1 MHz | $C_{rss}$ | - | 472 | - | pF |
| Total Gate Charge<br>at $-V_{GS}$ = 10 V, $-V_{DS}$ = 15 V, $-I_D$ = 1 A<br>at $-V_{GS}$ = 4.5 V, $-V_{DS}$ = 15 V, $-I_D$ = 1 A | $Q_g$ | -<br>- | 112<br>53 | -<br>- | nC |
| Gate-Source Charge<br>at $-V_{GS}$ = 10 V, $-V_{DS}$ = 15 V, $-I_D$ = 1 A | $Q_{gs}$ | - | 19 | - | nC |
| Gate-Drain Charge<br>at $-V_{GS}$ = 10 V, $-V_{DS}$ = 15 V, $-I_D$ = 1 A | $Q_{gd}$ | - | 14 | - | nC |
| Turn-On Delay Time<br>at $-V_{GS}$ = 10 V, $-V_{DD}$ = 15 V, $-I_D$ = 1 A, $R_g$ = 3.3 Ω | $t_{d(on)}$ | - | 25 | - | ns |
| Turn-On Rise Time<br>at $-V_{GS}$ = 10 V, $-V_{DD}$ = 15 V, $-I_D$ = 1 A, $R_g$ = 3.3 Ω | $t_r$ | - | 10 | - | ns |
| Turn-Off Delay Time<br>at $-V_{GS}$ = 10 V, $-V_{DD}$ = 15 V, $-I_D$ = 1 A, $R_g$ = 3.3 Ω | $t_{d(off)}$ | - | 76 | - | ns |
| Turn-Off Fall Time<br>at $-V_{GS}$ = 10 V, $-V_{DD}$ = 15 V, $-I_D$ = 1 A, $R_g$ = 3.3 Ω | $t_f$ | - | 35 | - | ns |
| **Body-Diode PARAMETERS** | | | | | |
| Drain-Source Diode Forward Voltage<br>at $-I_S$ = 1 A, $V_{GS}$ = 0 V | $-V_{SD}$ | - | - | 1.3 | V |
| Body-Diode Continuous Current | $-I_S$ | - | - | 62 | A |
| Body-Diode Continuous Current, Pulsed | $-I_{SM}$ | - | - | 300 | A |
| Body Diode Reverse Recovery Time<br>at $-I_S$ = 1 A, di/dt = 100 A / µs | $t_{rr}$ | - | 26 | - | ns |
| Body Diode Reverse Recovery Charge<br>at $-I_S$ = 1 A, di/dt = 100 A / µs | $Q_{rr}$ | - | 19 | - | nC |


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## Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

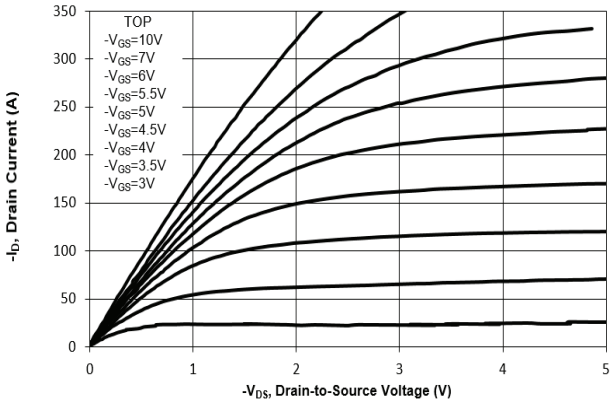



Fig. 2 Typical Transfer Characteristics

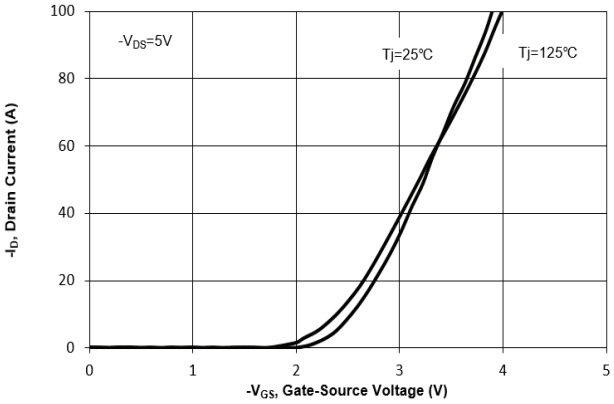



Fig. 3 on-Resistance vs. Drain Current

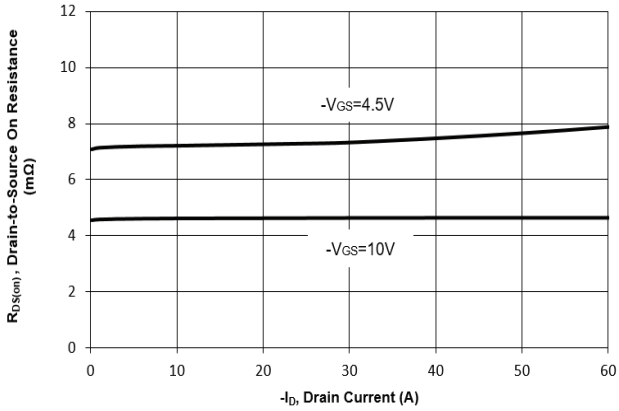



Fig. 4 on-Resistance vs. Gate to Source Voltage

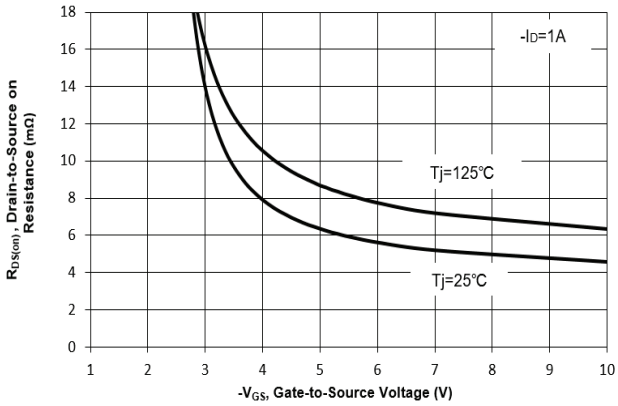



Fig. 5 on-Resistance vs.$T_j$

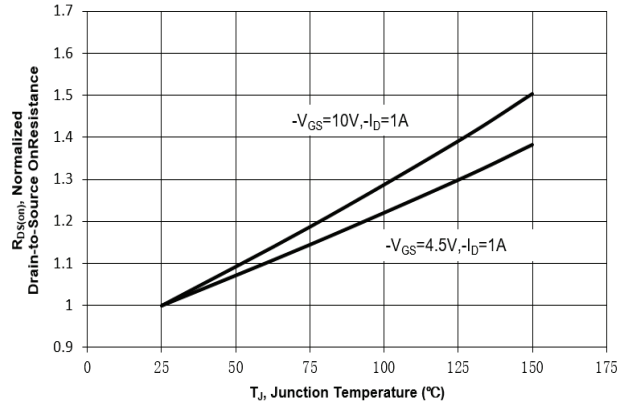
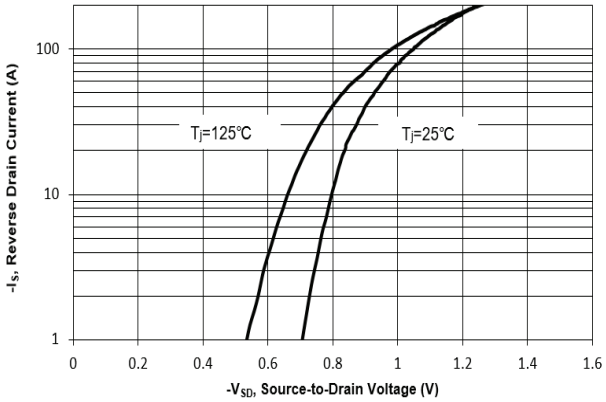



Fig. 6 Typical Body-Diode Forward Characteristics



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## Electrical Characteristics Curves

Fig. 7 Typical Junction Capacitance

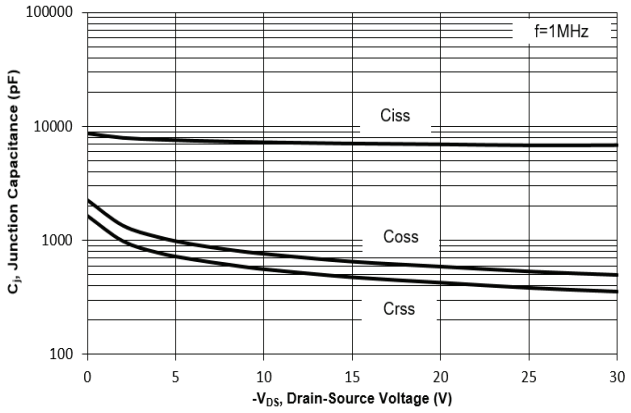



Fig. 8 Drain-Source Leakage Current vs. $T_j$

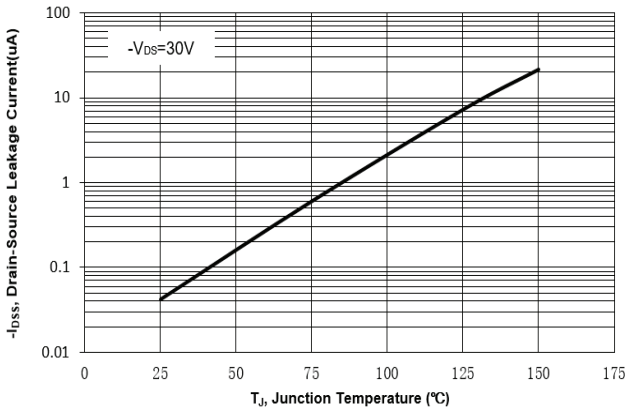



Fig. 9 $V_{(BR)DSS}$ vs. Junction Temperature

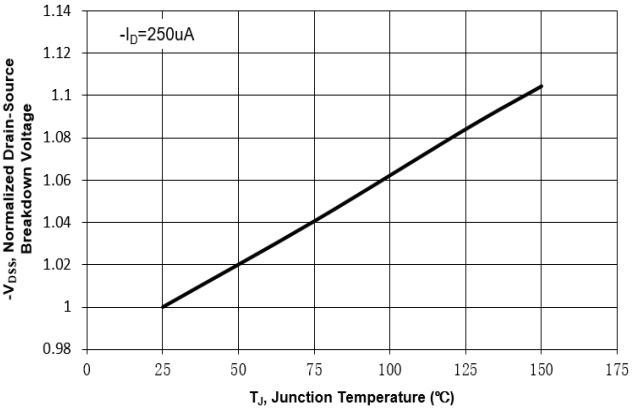



Fig. 10 Gate Threshold Variation vs. $T_j$

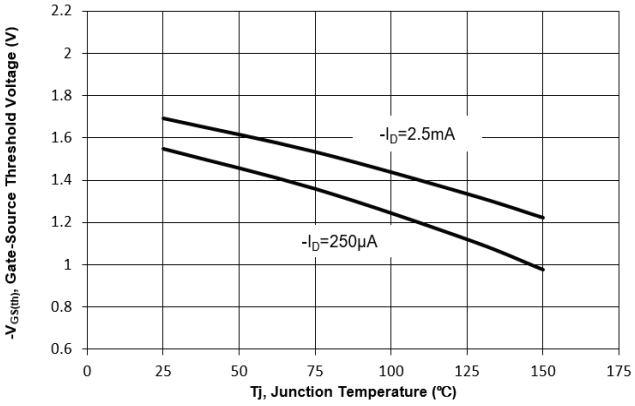



Fig. 11 Gate Charge

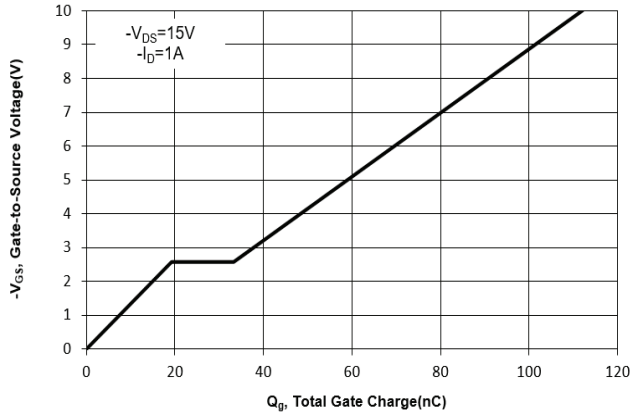
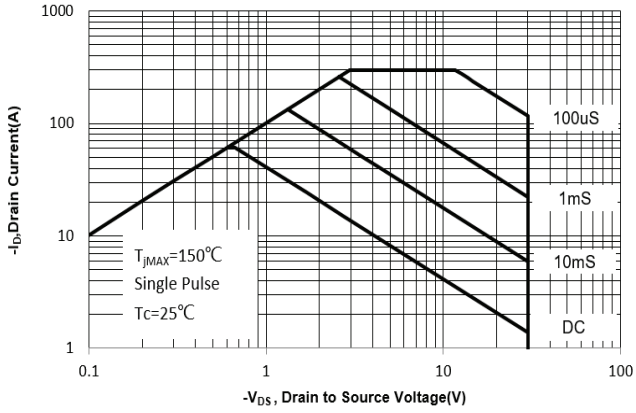



Fig. 12 Safe Operation Area





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## Electrical Characteristics Curves

Fig. 13 Normalized Maximum Transient Thermal Impedance($z_{\Theta JC}$)

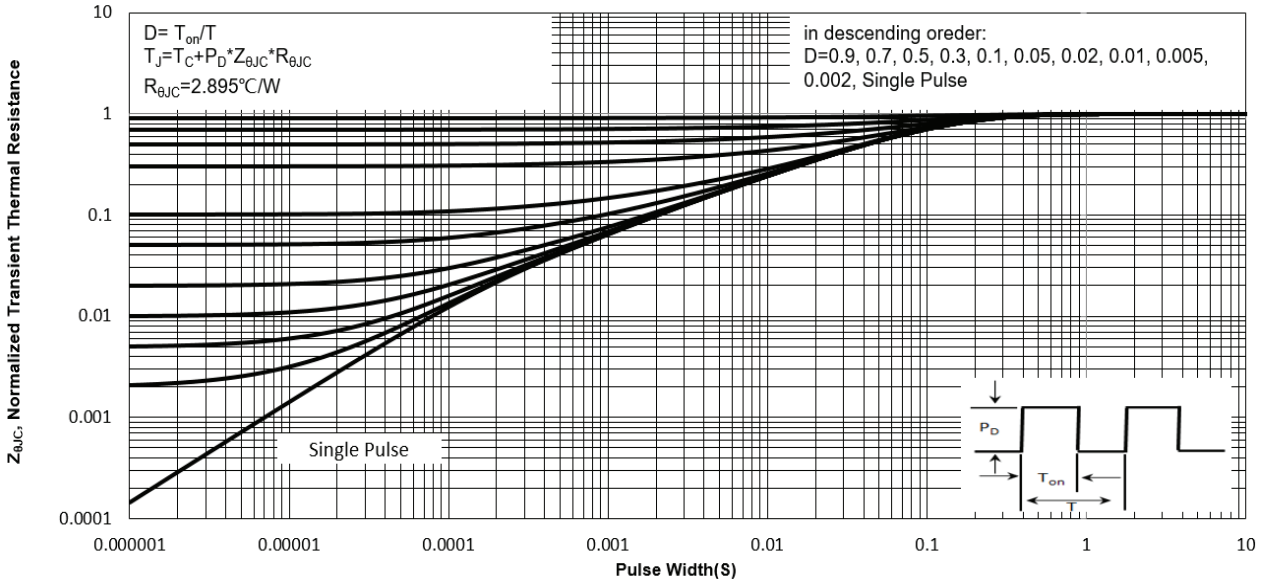
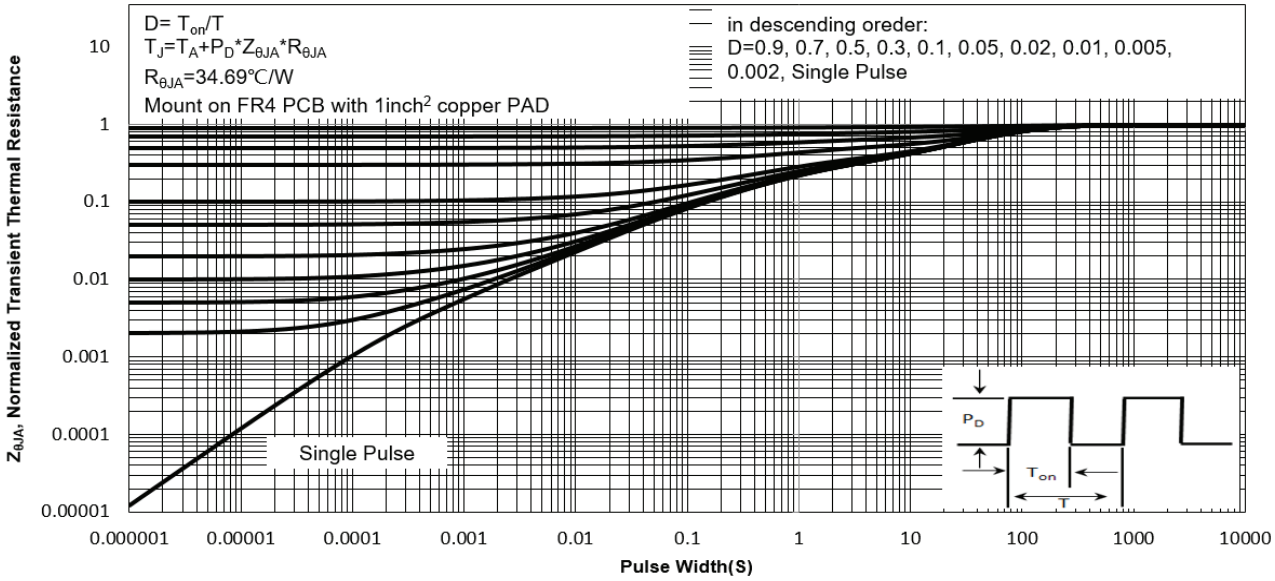



Fig. 14 Normalized Maximum Transient Thermal Impedance($z_{\Theta JA}$)





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**Test Circuits**

Fig.1-1 Switching times test circuit

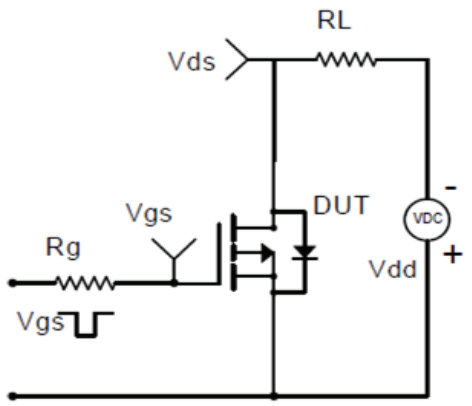



Fig.1-2 Switching Waveform

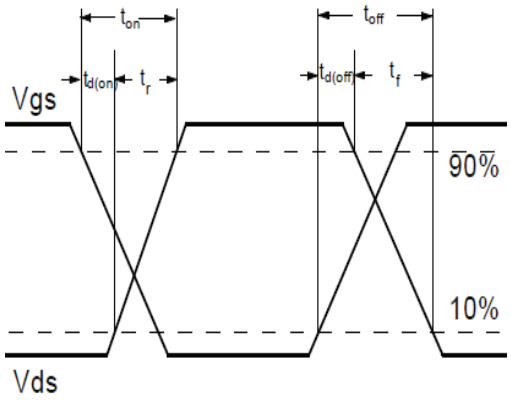



Fig.2-1 Gate charge test circuit

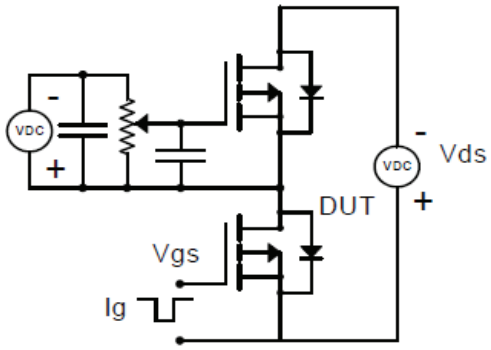



Fig.2-2 Gate charge waveform

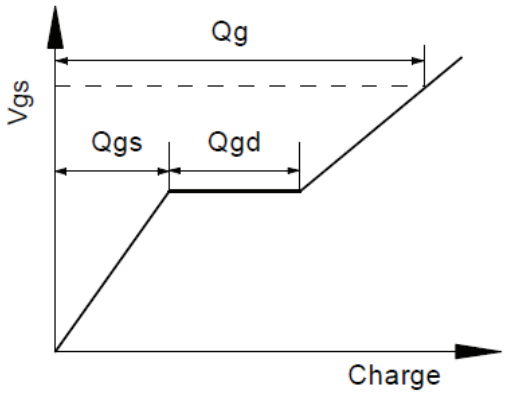



Fig.3-1 Avalanche test circuit

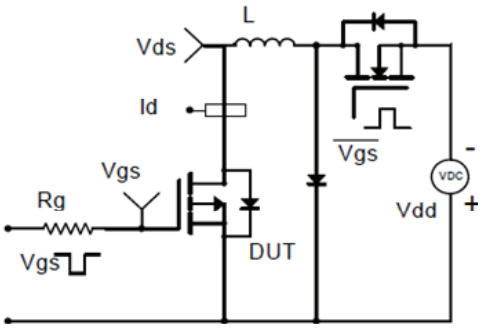
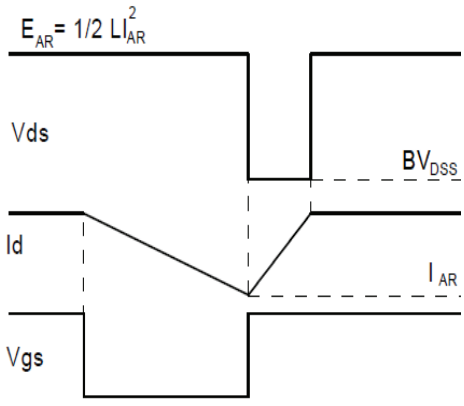



Fig.3-2 Avalanche waveform





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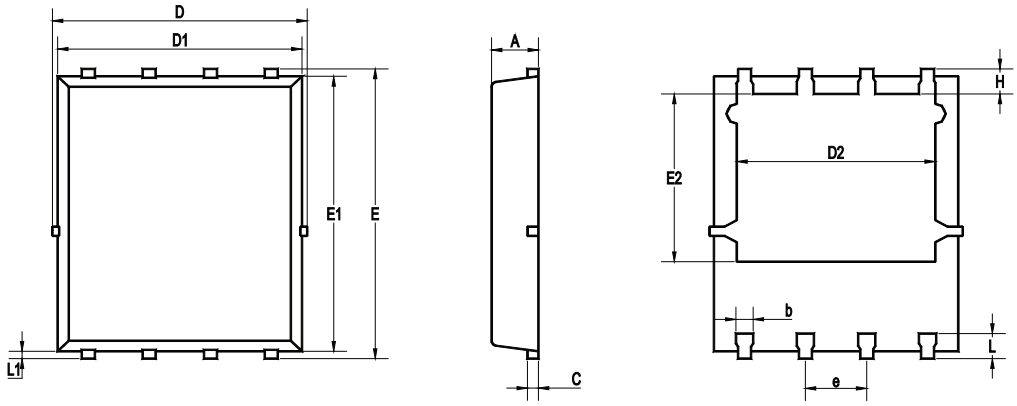
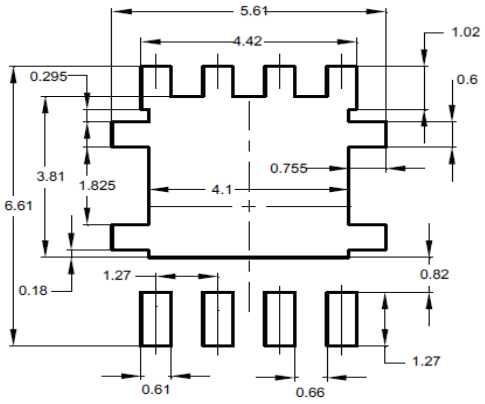
## Package Outline Dimensions (Units: mm)

**DFN5060**




| UNIT | A | b | C | D | D1 | D2 | E | E1 | E2 | e | L | L1 | H |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.12<br>0.9 | 0.51<br>0.33 | 0.34<br>0.11 | 5.26<br>4.7 | 5.1<br>4.7 | 4.5<br>3.56 | 6.25<br>5.75 | 6<br>5.6 | 3.66<br>3.18 | 1.37<br>1.17 | 0.71<br>0.35 | 0.2<br>0.06 | 0.71<br>0.35 |

## Recommended Soldering Footprint

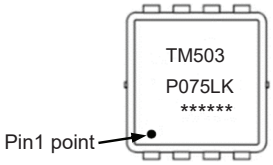



## Packing information

| Package | Tape Width (mm) | Pitch | | Reel Size | | Per Reel Packing Quantity |
|---|---|---|---|---|---|---|
| | | mm | inch | mm | inch | |
| DFN5060 | 12 | 8 ± 0.1 | 0.315 ± 0.004 | 330 | 13 | 5,000 |

## Marking information

" TM503P075LK " = Part No.
" ****** " = Date Code Marking
Font type: Arial





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