

WTR04P058L-HAF

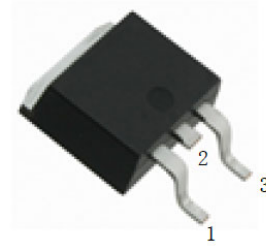
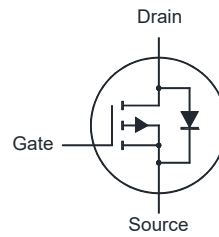
P-Channel Enhancement Mode MOSFET

Features

- Fast switching
- Halogen and Antimony Free(HAF),
RoHS compliant

Applications

- Motor Drive
- Power Tools
- LED Lighting



1. Gate 2. Drain 3. Source
TO-252 Plastic Package

Key Parameters

| Parameter | Value | Unit |
|-------------------|-------------------------|------------|
| $-BV_{DSS}$ | 40 | V |
| $R_{DS(ON)}$ Max | 5.8 @ $-V_{GS} = 10$ V | m Ω |
| | 7.5 @ $-V_{GS} = 4.5$ V | |
| $-V_{GS(th)}$ typ | 1.4 | V |
| Q_g typ | 125 @ $-V_{GS} = 10$ V | nC |

Absolute Maximum Ratings (at $T_a = 25^\circ\text{C}$ unless otherwise specified)

| Parameter | Symbol | Value | Unit |
|--|----------------|---------------------------|------------------|
| Drain-Source Voltage | $-V_{DS}$ | 40 | V |
| Gate-Source Voltage | $-V_{GS}$ | ± 20 | V |
| Drain Current | $-I_D$ | $T_c = 25^\circ\text{C}$ | 60 |
| | | $T_c = 100^\circ\text{C}$ | 37.8 |
| Peak Drain Current, Pulsed ¹⁾ | $-I_{DM}$ | 300 | A |
| Single-Pulse Avalanche Current | $-I_{AS}$ | 46 | A |
| Single-Pulse Avalanche Energy ²⁾ | E_{AS} | 106 | mJ |
| Power Dissipation | P_D | 50 | W |
| Operating Junction and Storage Temperature Range | T_j, T_{stg} | - 55 to + 150 | $^\circ\text{C}$ |

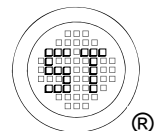
Thermal Characteristics

| Parameter | Symbol | Max. | Unit |
|---|-----------------|------|---------------------------|
| Thermal Resistance from Junction to Case | $R_{\theta JC}$ | 2.5 | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance from Junction to Ambient ³⁾ | $R_{\theta JA}$ | 40 | $^\circ\text{C}/\text{W}$ |

¹⁾ Pulse Test: Pulse Width ≤ 100 μs , Duty Cycle $\leq 2\%$, Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)} = 150^\circ\text{C}$.

²⁾ Limited by $T_{J(MAX)}$, starting $T_j = 25^\circ\text{C}$, $L = 0.1$ mH, $R_g = 25$ Ω , $-I_{AS} = 46$ A, $V_{GS} = 10$ V.

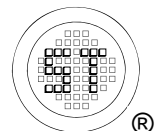
³⁾ Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate in still air.



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Characteristics at $T_a = 25^\circ\text{C}$ unless otherwise specified

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|--|---------------|--------|-----------|------------|------------------|
| STATIC PARAMETERS | | | | | |
| Drain-Source Breakdown Voltage at $-I_D = 250 \mu\text{A}$ | $-BV_{DS}$ | 40 | - | - | V |
| Drain-Source Leakage Current at $-V_{DS} = 40 \text{ V}$ | $-I_{DSS}$ | - | - | 1 | μA |
| Gate Leakage Current at $V_{GS} = \pm 20 \text{ V}$ | I_{GSS} | - | - | ± 100 | nA |
| Gate-Source Threshold Voltage at $V_{DS} = V_{GS}$, $-I_D = 250 \mu\text{A}$ | $-V_{GS(th)}$ | 1.2 | - | 2.5 | V |
| Drain-Source On-State Resistance at $-V_{GS} = 10 \text{ V}$, $-I_D = 25 \text{ A}$ at $-V_{GS} = 4.5 \text{ V}$, $-I_D = 12 \text{ A}$ | $R_{DS(on)}$ | - - | 4.8 - | 5.8 7.5 | $\text{m}\Omega$ |
| DYNAMIC PARAMETERS | | | | | |
| Forward Transconductance at $-V_{DS} = 10 \text{ V}$, $-I_D = 3 \text{ A}$ | g_{fs} | - | 19 | - | S |
| Gate Resistance at $V_{DS} = 0 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$ | R_g | - | 3.5 | - | Ω |
| Input Capacitance at $-V_{DS} = 25 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$ | C_{iss} | - | 6463 | - | pF |
| Output Capacitance at $-V_{DS} = 25 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$ | C_{oss} | - | 554 | - | pF |
| Reverse Transfer Capacitance at $-V_{DS} = 25 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$ | C_{rss} | - | 368 | - | pF |
| Total Gate Charge at $-V_{DS} = 20 \text{ V}$, $-I_D = 25 \text{ A}$, $-V_{GS} = 10 \text{ V}$ at $-V_{DS} = 20 \text{ V}$, $-I_D = 25 \text{ A}$, $-V_{GS} = 4.5 \text{ V}$ | Q_g | - - | 125 60 | - - | nC |
| Gate-Source Charge at $-V_{DS} = 20 \text{ V}$, $-I_D = 25 \text{ A}$, $-V_{GS} = 10 \text{ V}$ | Q_{gs} | - | 20 | - | nC |
| Gate-Drain Charge at $-V_{DS} = 20 \text{ V}$, $-I_D = 25 \text{ A}$, $-V_{GS} = 10 \text{ V}$ | Q_{gd} | - | 24 | - | nC |
| Turn-On Delay Time at $-V_{DD} = 20 \text{ V}$, $-I_D = 25 \text{ A}$, $-V_{GS} = 10 \text{ V}$, $R_g = 6 \Omega$ | $t_{d(on)}$ | - | 64 | - | ns |
| Turn-On Rise Time at $-V_{DD} = 20 \text{ V}$, $-I_D = 25 \text{ A}$, $-V_{GS} = 10 \text{ V}$, $R_g = 6 \Omega$ | t_r | - | 74 | - | ns |
| Turn-Off Delay Time at $-V_{DD} = 20 \text{ V}$, $-I_D = 25 \text{ A}$, $-V_{GS} = 10 \text{ V}$, $R_g = 6 \Omega$ | $t_{d(off)}$ | - | 77 | - | ns |
| Turn-Off Fall Time at $-V_{DD} = 20 \text{ V}$, $-I_D = 25 \text{ A}$, $-V_{GS} = 10 \text{ V}$, $R_g = 6 \Omega$ | t_f | - | 24 | - | ns |
| Body-Diode PARAMETERS | | | | | |
| Drain-Source Diode Forward Voltage at $-I_S = 1 \text{ A}$, $V_{GS} = 0 \text{ V}$ | $-V_{SD}$ | - | - | 1 | V |
| Body-Diode Continuous Current | $-I_S$ | - | - | 60 | A |
| Body-Diode Continuous Current, Pulsed | $-I_{SM}$ | - | - | 300 | A |
| Body Diode Reverse Recovery Time at $-I_S = 25 \text{ A}$, $di/dt = 100 \text{ A} / \mu\text{s}$ | t_{rr} | - | 19 | - | ns |
| Body Diode Reverse Recovery Charge at $-I_S = 25 \text{ A}$, $di/dt = 100 \text{ A} / \mu\text{s}$ | Q_{rr} | - | 11 | - | nC |



Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

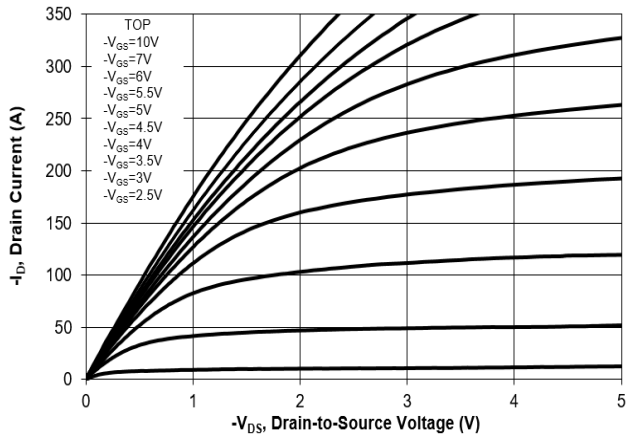


Fig. 2 Typical Transfer Characteristics

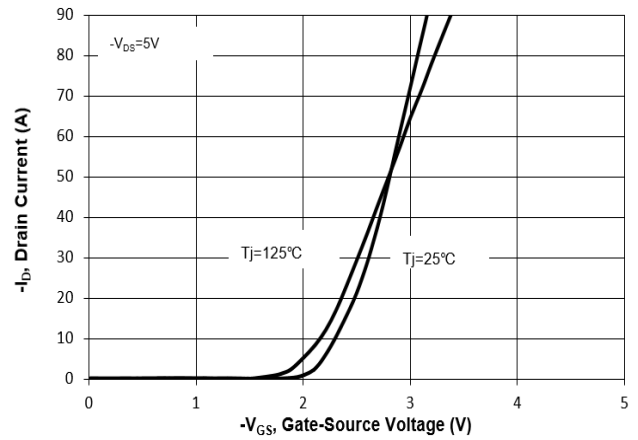


Fig. 3 On-Resistance vs. Drain Current

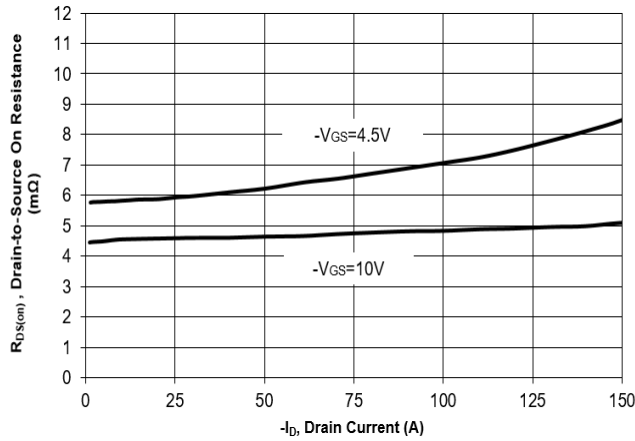


Fig. 4 On-Resistance vs. Gate to Source Voltage

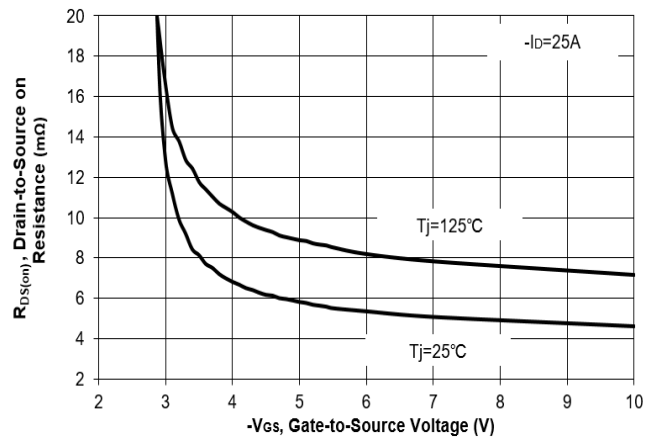


Fig. 5 On-Resistance vs. Tj

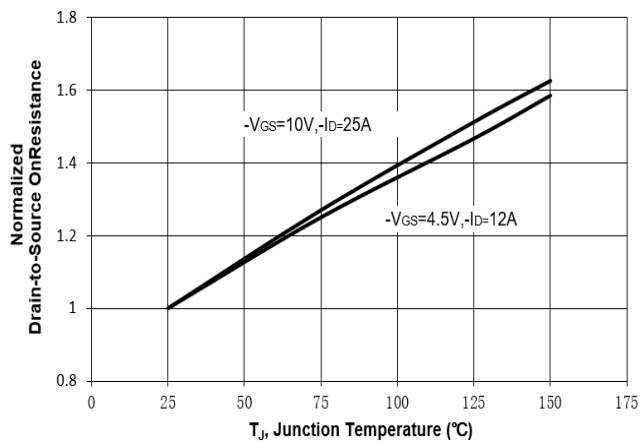
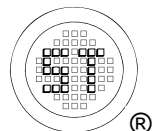
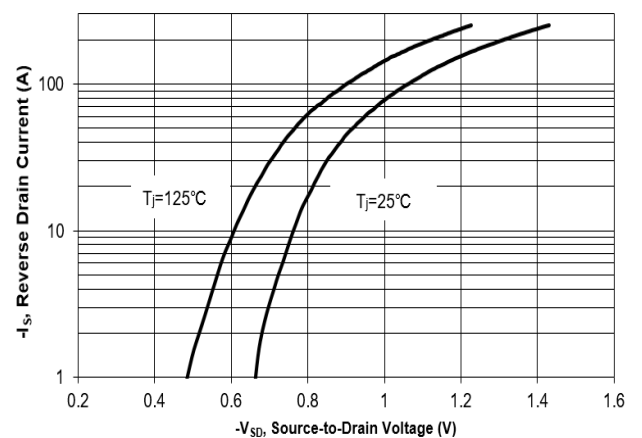


Fig. 6 Typical Body-Diode Forward Characteristics



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Electrical Characteristics Curves

Fig. 7 Typical Junction Capacitance

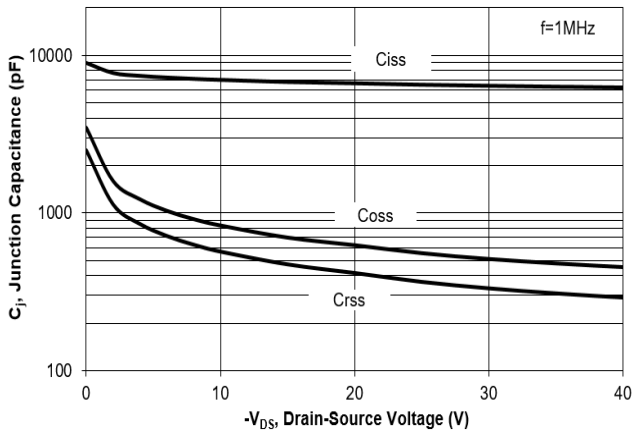


Fig. 8 Drain-Source Leakage Current vs. Tj

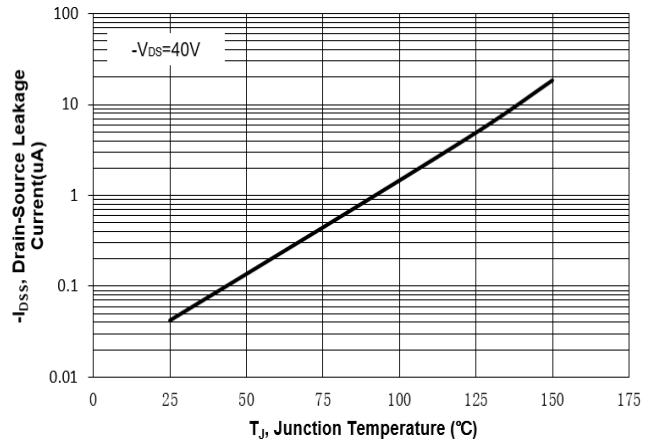


Fig. 9 V(BR)DSS vs. Junction Temperature

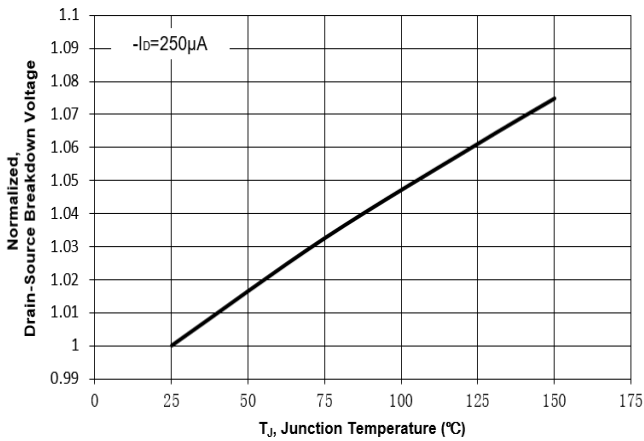


Fig. 10 Gate Threshold Variation vs. Tj

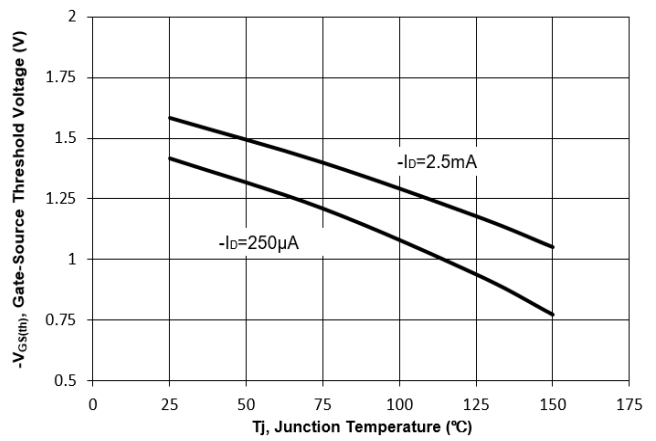


Fig. 11 Gate Charge

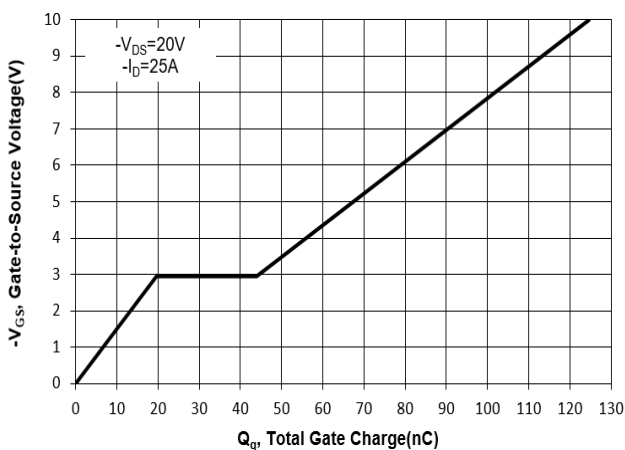
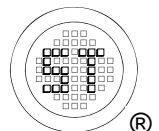
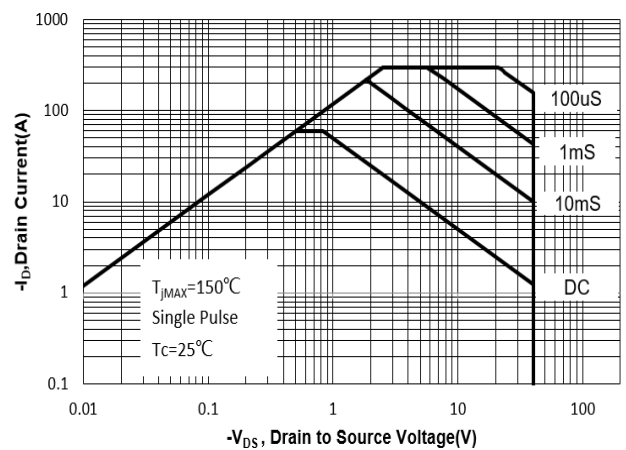


Fig. 12 Safe Operation Area



Electrical Characteristics Curves

Fig.13 Normalized Maximum Transient Thermal Impedance($Z_{\theta JC}$)

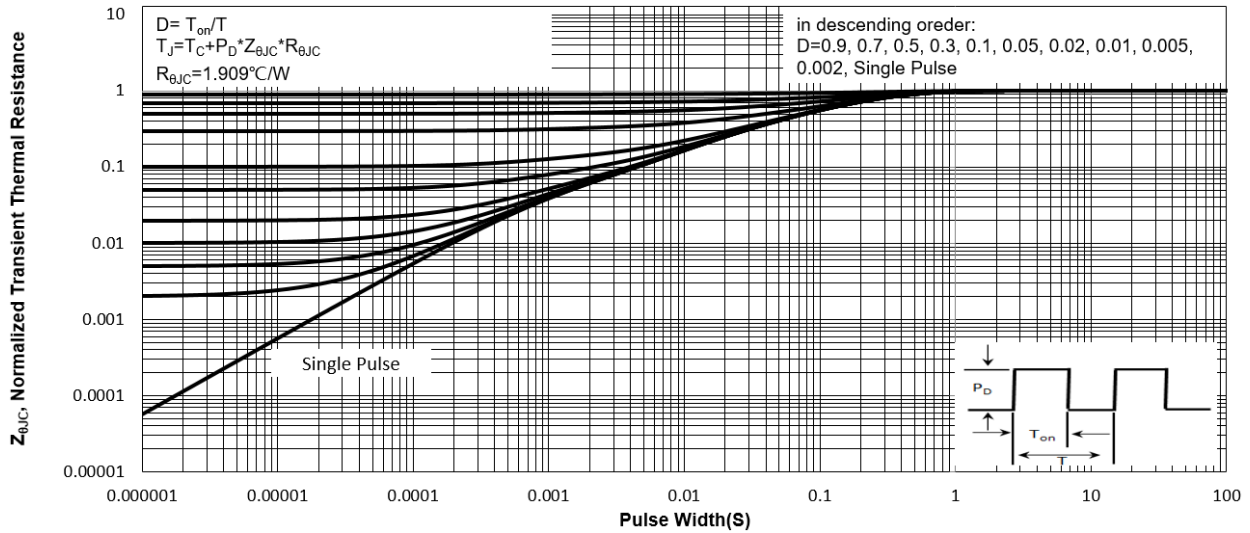
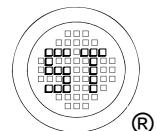
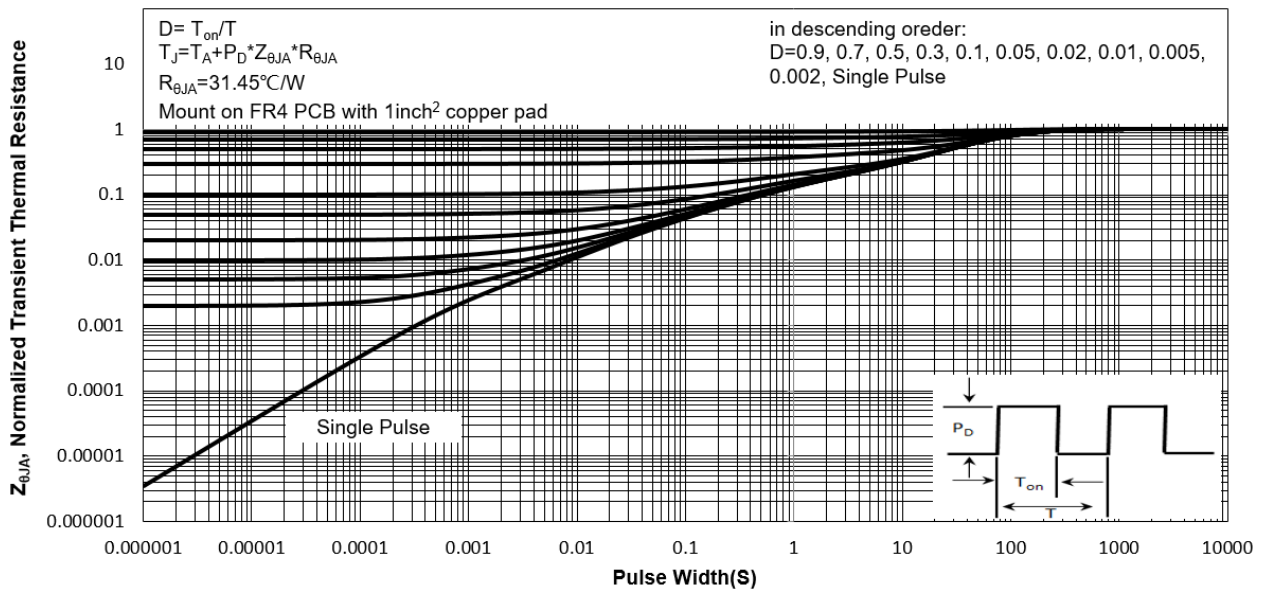


Fig.14 Normalized Maximum Transient Thermal Impedance($Z_{\theta JA}$)



Test Circuits

Fig.1-1 Switching times test circuit

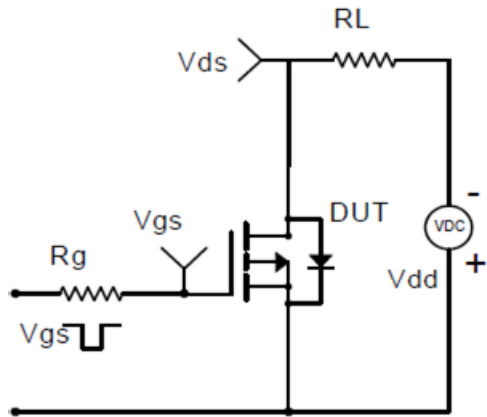


Fig.1-2 Switching Waveform

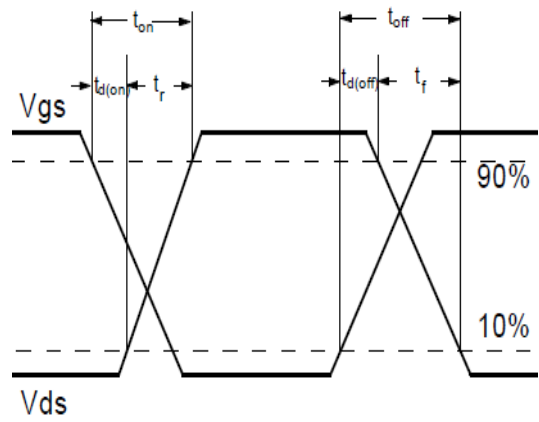


Fig.2-1 Gate charge test circuit

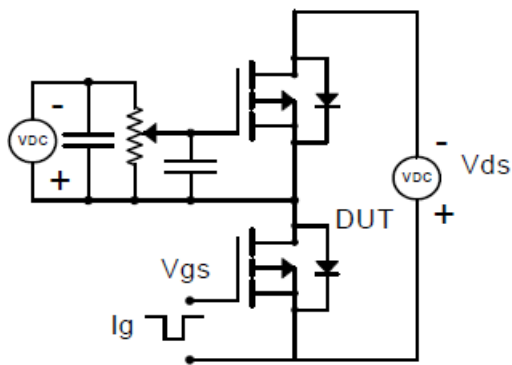


Fig.2-2 Gate charge waveform

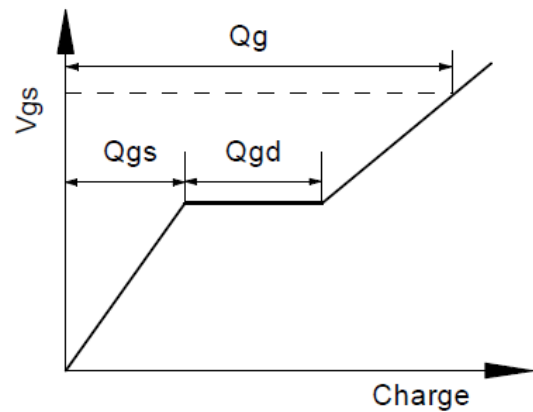


Fig.3-1 Avalanche test circuit

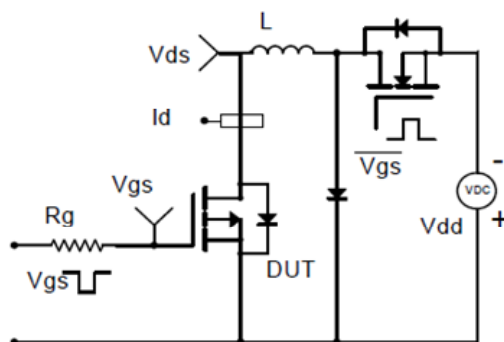
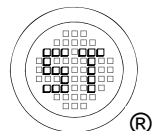
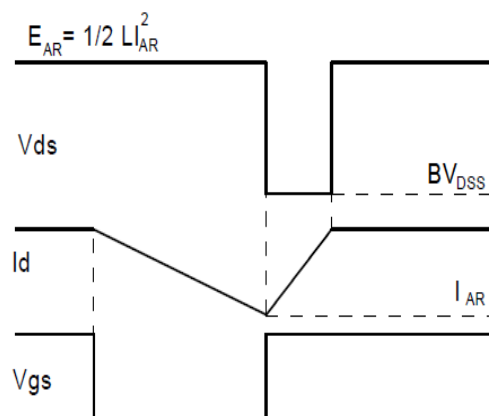


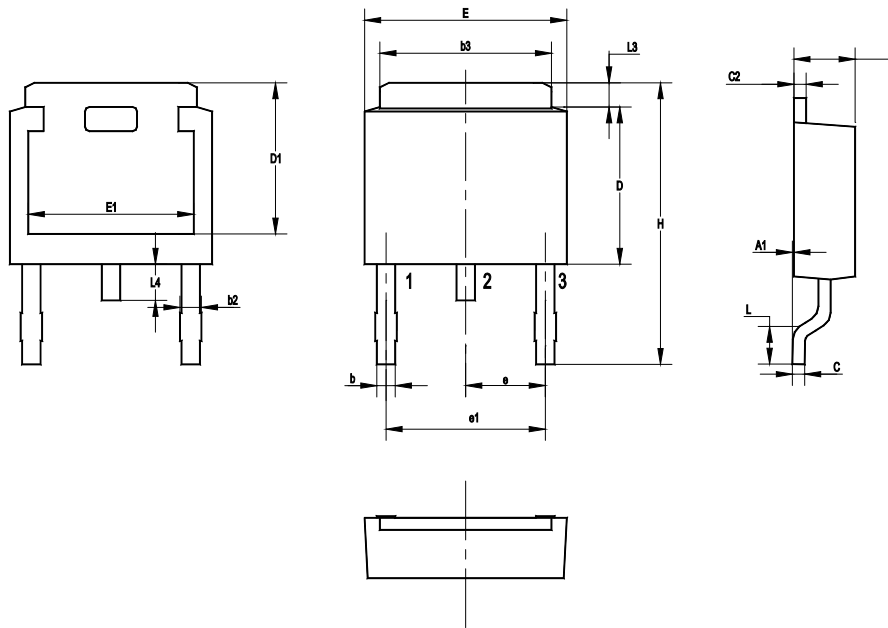
Fig.3-2 Avalanche waveform



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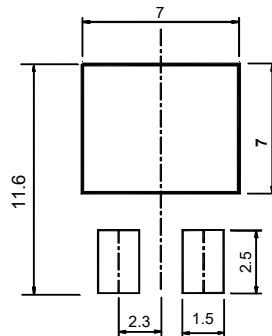
Package Outline Dimensions (Units: mm)

TO-252



| UNIT | A | A1 | b | b2 | b3 | C | C2 | D | D1 | E | E1 | e | e1 | H | L | L3 | L4 |
|------|-----|------|-----|------|-----|------|------|-----|-----|-----|-----|------|------|------|------|------|------|
| mm | 2.5 | 0.15 | 1.0 | 1.15 | 5.5 | 0.65 | 0.65 | 6.2 | 5.4 | 6.7 | 5.0 | 2.30 | 4.60 | 10.7 | 1.78 | 1.20 | 1.10 |
| | 2.1 | 0 | 0.5 | 0.65 | 4.9 | 0.4 | 0.4 | 5.6 | 5.0 | 6.1 | 4.6 | TYP. | TYP. | 9 | 1.40 | 0.85 | 0.51 |

Recommended Soldering Footprint



Packing information

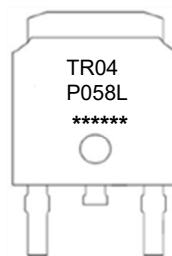
| Package | Tape Width (mm) | Pitch | | Reel Size | | Per Reel Packing Quantity |
|---------|-----------------|---------|---------------|-----------|------|---------------------------|
| | | mm | inch | mm | inch | |
| TO-252 | 16 | 8 ± 0.1 | 0.315 ± 0.004 | 330 | 13 | 2,500 |

Marking information

" TR04P058L " = Part No.

" ***** " = Date Code Marking

Font type: Arial



Disclaimer: Our company reserve the right to make modifications, enhancements, improvements, corrections or other changes to improve product design, functions and reliability, anytime without notice.

