

WTQ06P1K4L-HAF

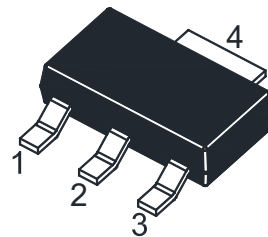
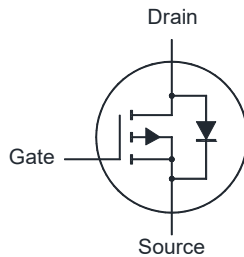
P-Channel Enhancement Mode MOSFET

Features

- Halogen and Antimony Free(HAF), RoHS compliant

Applications

- Portable appliances
- Battery management



1.Gate 2.Drain 3.Source 4.Drain
SOT-223 Plastic Package

Key Parameters

| Parameter | Value | Unit |
|-------------------|-------------------------|------------|
| $-BV_{DSS}$ | 60 | V |
| $R_{DS(ON)}$ Max | 160 @ $-V_{GS} = 10$ V | m Ω |
| | 200 @ $-V_{GS} = 4.5$ V | |
| $-V_{GS(th)}$ typ | 1.7 | V |
| Q_g typ | 9.3 @ $-V_{GS} = 10$ V | nC |

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

| Parameter | Symbol | Value | Unit |
|--|----------------|---------------------------|------------------|
| Drain-Source Voltage | $-V_{DS}$ | 60 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | V |
| Drain Current | $-I_D$ | $T_c = 25^\circ\text{C}$ | 6 |
| | | $T_c = 100^\circ\text{C}$ | 3.8 |
| Peak Drain Current, Pulsed ¹⁾ | $-I_{DM}$ | 22 | A |
| Single-Pulse Avalanche Current | $-I_{AS}$ | 14 | A |
| Single-Pulse Avalanche Energy ²⁾ | E_{AS} | 10 | mJ |
| Power Dissipation | P_D | 10.4 | W |
| Operating Junction and Storage Temperature Range | T_j, T_{stg} | - 55 to + 150 | $^\circ\text{C}$ |

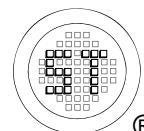
Thermal Characteristics

| Parameter | Symbol | Max. | Unit |
|---|-----------------|------|--------------------|
| Thermal Resistance from Junction to Case | $R_{\theta JC}$ | 12 | $^\circ\text{C/W}$ |
| Thermal Resistance from Junction to Ambient ³⁾ | $R_{\theta JA}$ | 50 | $^\circ\text{C/W}$ |

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 , $I_{AS} = 14$ A, $V_{GS} = 10$ V.

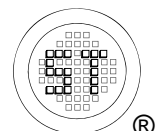
³⁾ Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate in still air.



WTQ06P1K4L-HAF

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

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|--|---------------|--------|------------|------------|---------------|
| STATIC PARAMETERS | | | | | |
| Drain-Source Breakdown Voltage at $-I_D = 250 \mu\text{A}$ | $-BV_{DSS}$ | 60 | - | - | V |
| Drain-Source Leakage Current at $-V_{DS} = 60 \text{ V}$ | $-I_{DSS}$ | - | - | 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 $-V_{GS} = 10 \text{ V}$, $-I_D = 5 \text{ A}$ at $-V_{GS} = 4.5 \text{ V}$, $-I_D = 4 \text{ A}$ | $R_{DS(on)}$ | - - | 146 - | 160 200 | m Ω |
| DYNAMIC PARAMETERS | | | | | |
| Forward Transconductance at $-V_{DS} = 5 \text{ V}$, $-I_D = 5 \text{ A}$ | g_{fs} | - | 6 | - | S |
| Gate Resistance at $V_{DS} = 0 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$ | R_g | - | 17.6 | - | Ω |
| Input Capacitance at $-V_{DS} = 30 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$ | C_{iss} | - | 496 | - | pF |
| Output Capacitance at $-V_{DS} = 30 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$ | C_{oss} | - | 32 | - | pF |
| Reverse Transfer Capacitance at $-V_{DS} = 30 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$ | C_{riss} | - | 10 | - | pF |
| Total Gate Charge at $-V_{DS} = 30 \text{ V}$, $-V_{GS} = 10 \text{ V}$, $-I_D = 5 \text{ A}$ at $-V_{DS} = 30 \text{ V}$, $-V_{GS} = 4.5 \text{ V}$, $-I_D = 5 \text{ A}$ | Q_g | - - | 9.3 4.3 | - - | nC |
| Gate-Source Charge at $-V_{DS} = 30 \text{ V}$, $-V_{GS} = 10 \text{ V}$, $-I_D = 5 \text{ A}$ | Q_{gs} | - | 2.2 | - | nC |
| Gate-Drain Charge at $-V_{DS} = 30 \text{ V}$, $-V_{GS} = 10 \text{ V}$, $-I_D = 5 \text{ A}$ | Q_{gd} | - | 1.6 | - | nC |
| Turn-On Delay Time at $-V_{DD} = 30 \text{ V}$, $-V_{GS} = 10 \text{ V}$, $-I_D = 5 \text{ A}$, $R_g = 3.3 \Omega$ | $t_{d(on)}$ | - | 6 | - | ns |
| Turn-On Rise Time at $-V_{DD} = 30 \text{ V}$, $-V_{GS} = 10 \text{ V}$, $-I_D = 5 \text{ A}$, $R_g = 3.3 \Omega$ | t_r | - | 12 | - | ns |
| Turn-Off Delay Time at $-V_{DD} = 30 \text{ V}$, $-V_{GS} = 10 \text{ V}$, $-I_D = 5 \text{ A}$, $R_g = 3.3 \Omega$ | $t_{d(off)}$ | - | 12 | - | ns |
| Turn-Off Fall Time at $-V_{DD} = 30 \text{ V}$, $-V_{GS} = 10 \text{ V}$, $-I_D = 5 \text{ A}$, $R_g = 3.3 \Omega$ | t_f | - | 2 | - | ns |
| Body-Diode PARAMETERS | | | | | |
| Drain-Source Diode Forward Voltage at $-I_S = 1 \text{ A}$, $V_{GS} = 0 \text{ V}$ | $-V_{SD}$ | - | - | 1.2 | V |
| Body-Diode Continuous Current | $-I_S$ | - | - | 6 | A |
| Body-Diode Continuous Current, Pulsed | $-I_{SM}$ | - | - | 22 | A |
| Body Diode Reverse Recovery Time at $-I_S = 5 \text{ A}$, $di/dt = 100 \text{ A} / \mu\text{s}$ | t_{rr} | - | 9 | - | ns |
| Body Diode Reverse Recovery Charge at $-I_S = 5 \text{ A}$, $di/dt = 100 \text{ A} / \mu\text{s}$ | Q_{rr} | - | 5.2 | - | nC |



WTQ06P1K4L-HAF

Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

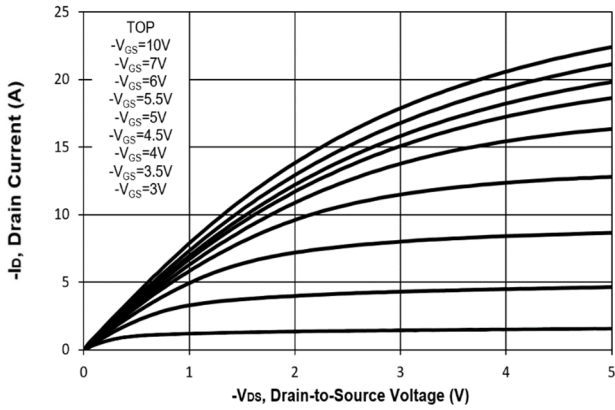


Fig. 2 Typical Transfer Characteristics

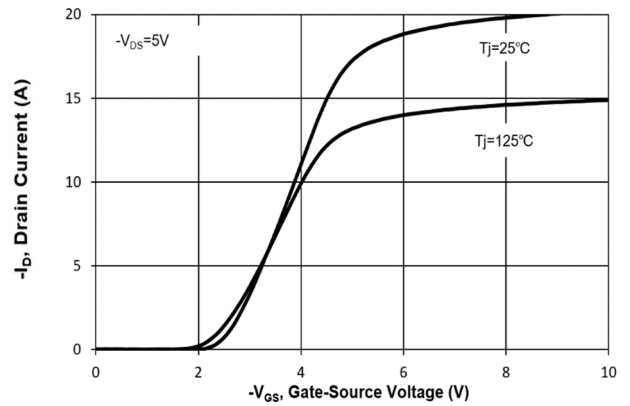


Fig. 3 On-Resistance vs. Drain Current

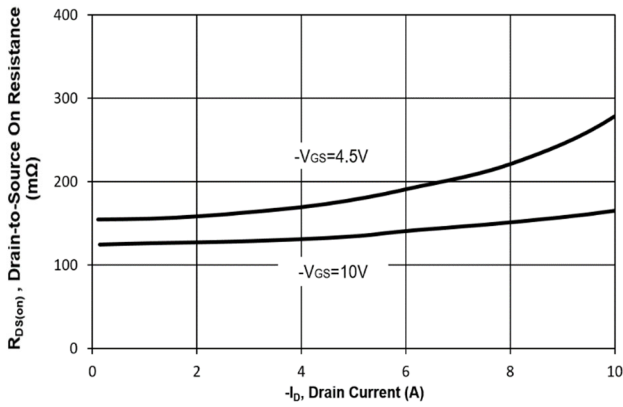


Fig. 4 on-Resistance vs. Gate to Source Voltage

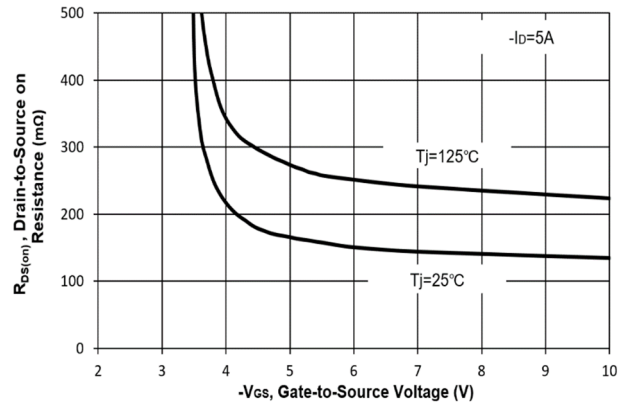


Fig. 5 on-Resistance vs. T_J

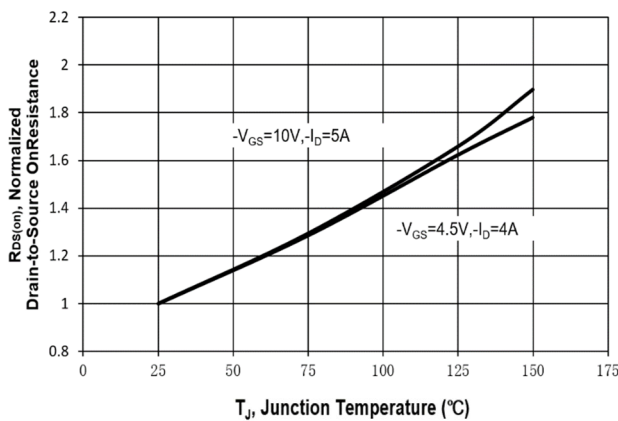
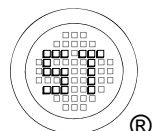
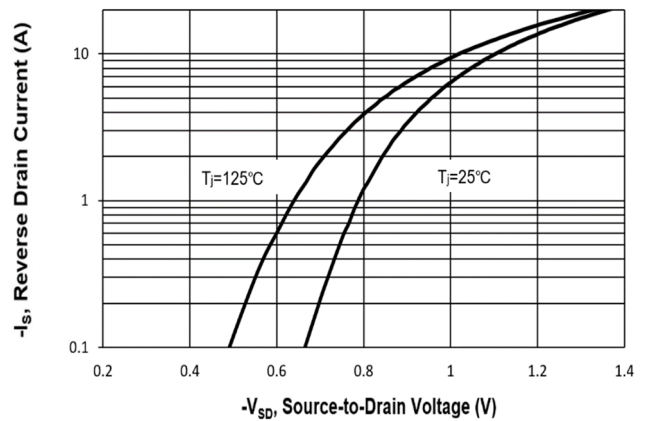


Fig. 6 Typical Body Diode Forward Characteristics



WTQ06P1K4L-HAF

Electrical Characteristics Curves

Fig. 7 Typical Junction Capacitance

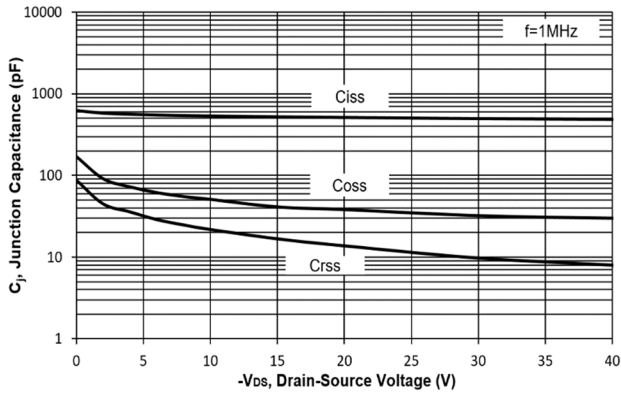


Fig. 8 Drain-Source Leakage Current vs. Tj

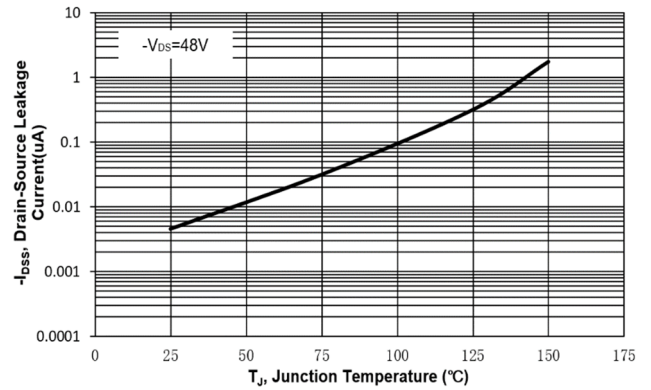


Fig. 9 V(BR)DSS vs. Junction Temperature

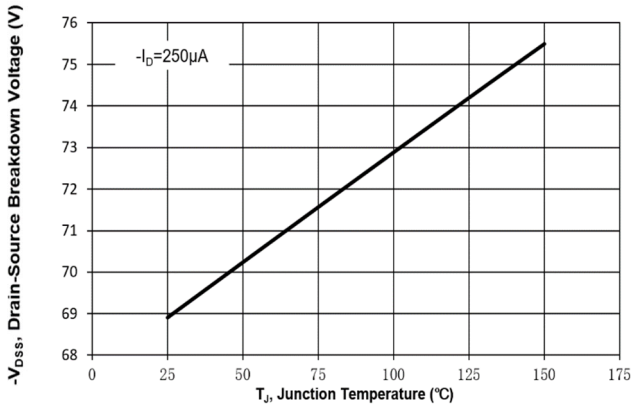


Fig. 10 Gate Threshold Variation vs. Tj

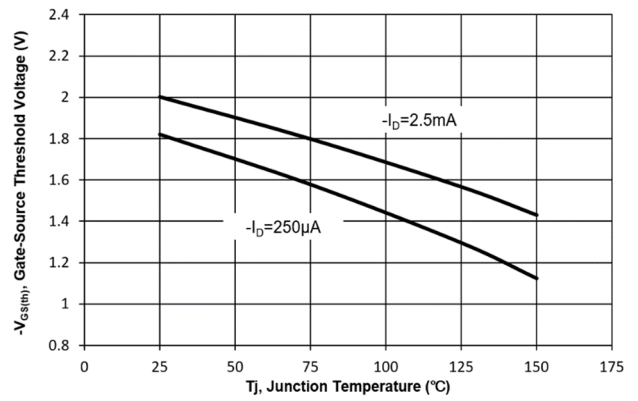


Fig. 11 Gate Charge

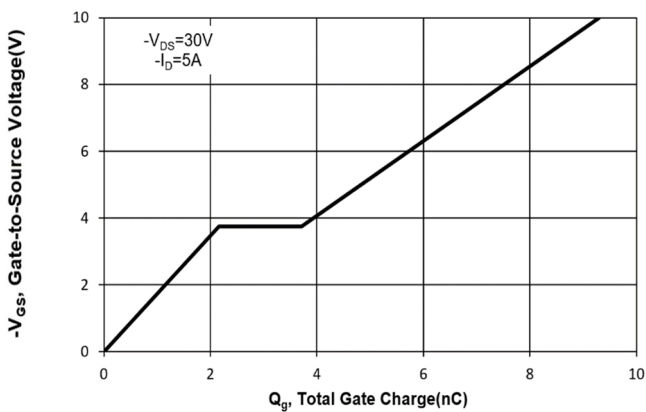
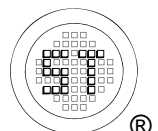
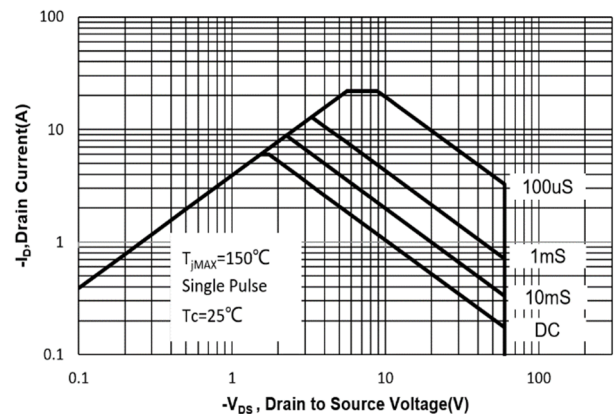


Fig. 12 Safe Operation Area



WTQ06P1K4L-HAF

Electrical Characteristics Curves

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

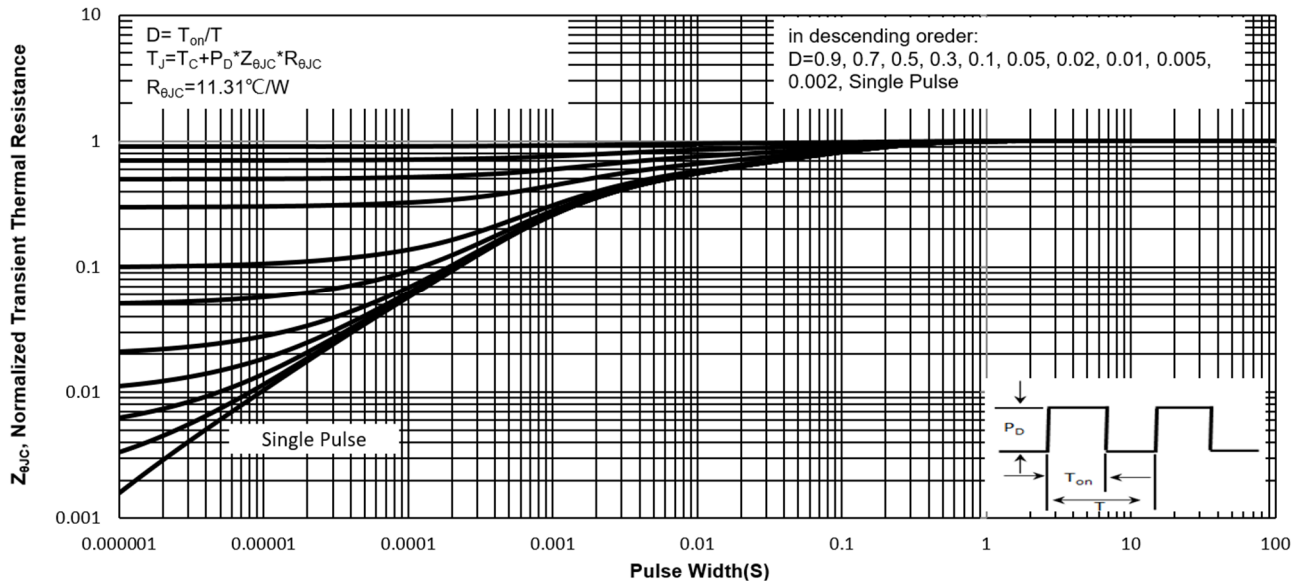
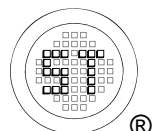
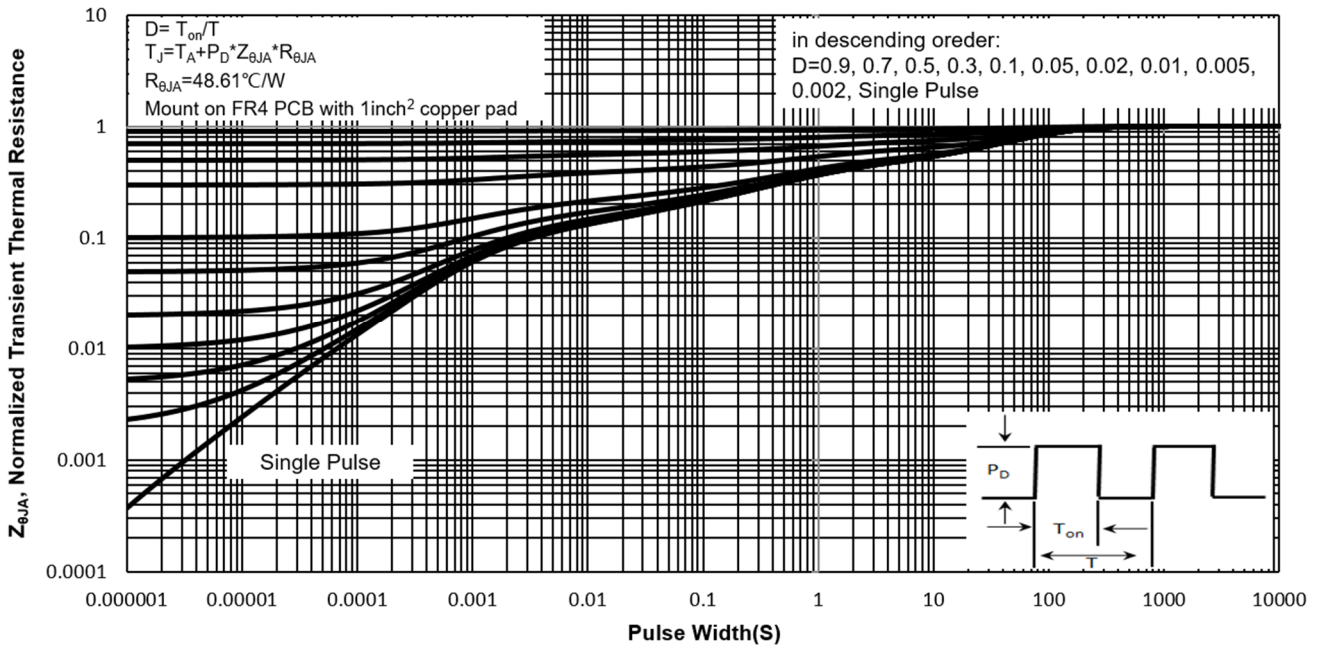


Fig. 14 Normalized Maximum Transient Thermal Impedance($Z_{\theta JA}$)



WTQ06P1K4L-HAF

Test Circuits

Fig.1-1 Switching times test circuit

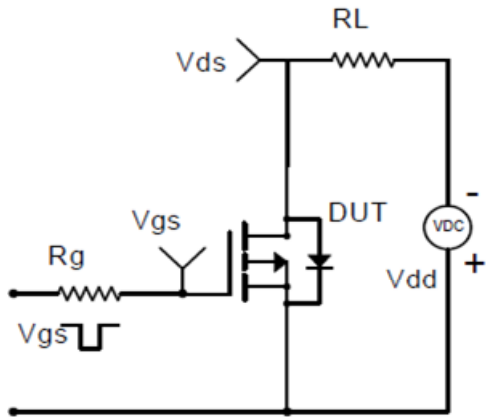


Fig.1-2 Switching Waveform

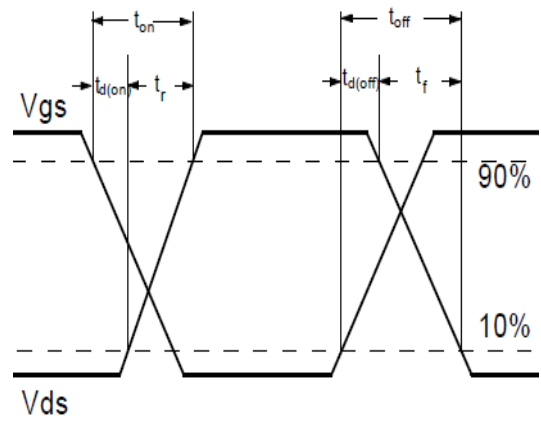


Fig.2-1 Gate charge test circuit

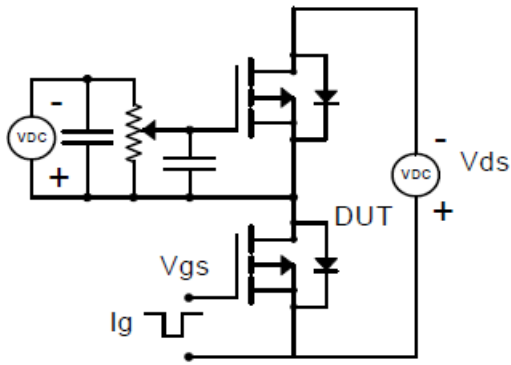


Fig.2-2 Gate charge waveform

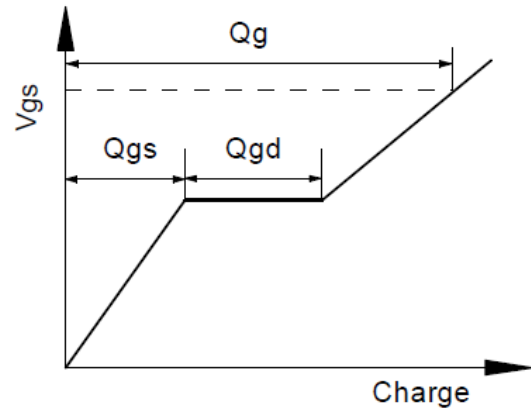


Fig.3-1 Avalanche test circuit

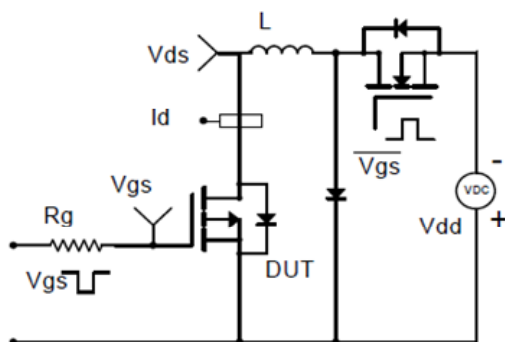
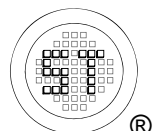
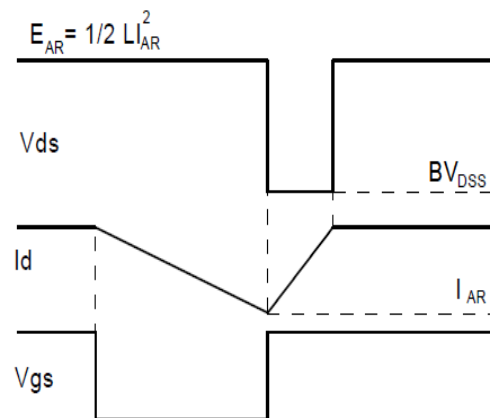


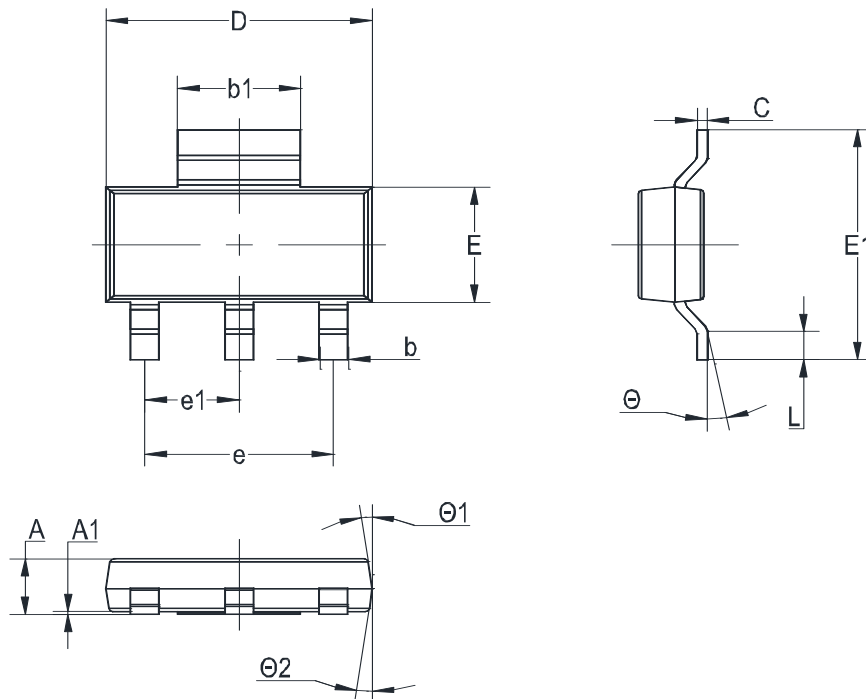
Fig.3-2 Avalanche waveform



WTQ06P1K4L-HAF

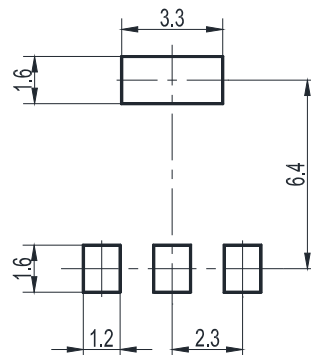
Package Outline (Dimensions in mm)

SOT-223



| Unit | A | A1 | b | b1 | C | D | E | E1 | e | e1 | L | Θ | Θ1 | Θ2 |
|------|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|----|----|
| mm | 1.8 | 0.1 | 0.8 | 3.1 | 0.32 | 6.7 | 3.7 | 7.3 | 4.6 | 2.3 | 1.1 | 10° | 7° | 7° |
| | 1.5 | MAX | 0.6 | 2.9 | 0.22 | 6.3 | 3.3 | 6.7 | TYP | TYP | 0.7 | 0° | 0° | 0° |

Recommended Soldering Footprint



Packing information

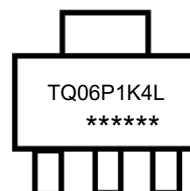
| Package | Tape Width (mm) | Pitch | | Reel Size | | Per Reel Packing Quantity |
|---------|-----------------|---------|---------------|-----------|------|---------------------------|
| | | mm | inch | mm | inch | |
| SOT-223 | 12 | 8 ± 0.1 | 0.315 ± 0.004 | 330 | 13 | 3,000 |

Marking information

" TQ06P1K4L " = 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.

