

WTR04P190LS-HAF

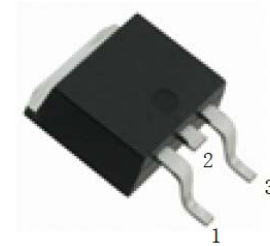
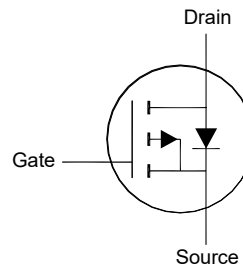
P-Channel Enhancement Mode MOSFET

Features

- Halogen and Antimony Free(HAF), RoHS compliant

Applications

- Motor Drive
- Synchronous Rectification in DC/DC and AC/DC Converters



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

Key Parameters

Parameter	Value	Unit
$-BV_{DSS}$	40	V
$R_{DS(ON) Max}$	19 @ $-V_{GS} = 10 V$	m Ω
$-V_{GS(th) typ}$	1.6	V
$Q_g typ$	19 @ $-V_{GS} = 4.5 V$	nC

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$-V_{DS}$	40	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current	$-I_D$	$T_c = 25^\circ C$ 32 $T_c = 100^\circ C$ 20	A
Peak Drain Current ¹⁾	$-I_{DM}$	130	A
Single-Pulse Avalanche Current	$-I_{AS}$	33	A
Single-Pulse Avalanche Energy ²⁾	E_{AS}	54	mJ
Power Dissipation	P_D	$T_c = 25^\circ C$ 34.7	W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 150	$^\circ C$

Thermal Characteristics

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	3.6	$^\circ C/W$
Thermal Resistance from Junction to Ambient ³⁾	$R_{\theta JA}$	50	$^\circ C/W$

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

²⁾ Limited by $T_{J(MAX)}$, starting $T_J = 25^\circ C$, $L = 0.1 mH$, $R_g = 25 \Omega$, $-I_{AS} = 33 A$, $-V_{GS} = 10 V$.

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 $-I_D = 250 \mu\text{A}$	$-V_{(BR)DSS}$	40	-	-	V
Drain-Source On-State Current at $-V_{DS} = 32 \text{ V}$	$-I_{DSS}$	-	-	1	μA
Gate-Source 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	-	2.5	V
Drain-Source On-State Resistance at $-V_{GS} = 10 \text{ V}$, $-I_D = 10 \text{ A}$ at $-V_{GS} = 4.5 \text{ V}$, $-I_D = 8 \text{ A}$	$R_{DS(ON)}$	- -	15 -	19 29	$\text{m}\Omega$
DYNAMIC PARAMETERS					
Gate resistance at $V_{DS} = 0 \text{ V}$, $f = 1 \text{ MHz}$	R_g	-	5.1	-	Ω
Forward Transconductance at $-V_{DS} = 5 \text{ V}$, $-I_D = 10 \text{ A}$	g_{fs}	-	24	-	S
Input Capacitance at $V_{GS} = 0 \text{ V}$, $-V_{DS} = 20 \text{ V}$, $f = 1 \text{ MHz}$	C_{iss}	-	2573	-	pF
Output Capacitance at $V_{GS} = 0 \text{ V}$, $-V_{DS} = 20 \text{ V}$, $f = 1 \text{ MHz}$	C_{oss}	-	174	-	pF
Reverse Transfer Capacitance at $V_{GS} = 0 \text{ V}$, $-V_{DS} = 20 \text{ V}$, $f = 1 \text{ MHz}$	C_{rss}	-	111	-	pF
Total Gate Charge at $-V_{GS} = 10 \text{ V}$, $-V_{DS} = 20 \text{ V}$, $-I_D = 10 \text{ A}$ at $-V_{GS} = 4.5 \text{ V}$, $-V_{DS} = 20 \text{ V}$, $-I_D = 10 \text{ A}$	Q_g	- -	42 19	- -	nC
Gate-Source Charge at $-V_{GS} = 10 \text{ V}$, $-V_{DS} = 20 \text{ V}$, $-I_D = 10 \text{ A}$	Q_{gs}	-	8.5	-	nC
Gate-Drain Charge at $-V_{GS} = 10 \text{ V}$, $-V_{DS} = 20 \text{ V}$, $-I_D = 10 \text{ A}$	Q_{gd}	-	5.5	-	nC
Turn-On Delay Time at $-V_{GS} = 10 \text{ V}$, $-V_{DD} = 20 \text{ V}$, $-I_D = 10 \text{ A}$, $R_g = 3 \Omega$	$t_{d(on)}$	-	14	-	nS
Turn-On Rise Time at $-V_{GS} = 10 \text{ V}$, $-V_{DD} = 20 \text{ V}$, $-I_D = 10 \text{ A}$, $R_g = 3 \Omega$	t_r	-	26	-	nS
Turn-Off Delay Time at $-V_{GS} = 10 \text{ V}$, $-V_{DD} = 20 \text{ V}$, $-I_D = 10 \text{ A}$, $R_g = 3 \Omega$	$t_{d(off)}$	-	27	-	nS
Turn-Off Fall Time at $-V_{GS} = 10 \text{ V}$, $-V_{DD} = 20 \text{ V}$, $-I_D = 10 \text{ A}$, $R_g = 3 \Omega$	t_f	-	5	-	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 Reverse Recovery Time at $-I_S = 10 \text{ A}$, $di/dt = 100 \text{ A} / \mu\text{s}$	t_{rr}	-	14.4	-	nS
Body Diode Reverse Recovery Charge at $-I_S = 10 \text{ A}$, $di/dt = 100 \text{ A} / \mu\text{s}$	Q_{rr}	-	9.4	-	nC

Electrical Characteristics Curves

Fig. 1 Typical Output Characteristic

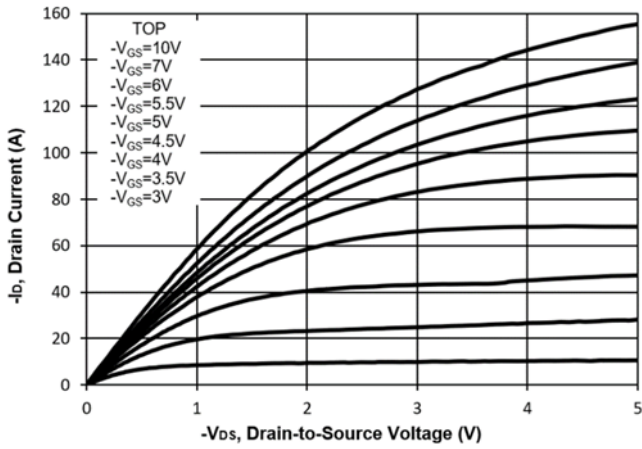


Fig. 2 Typical Transfer Characteristic

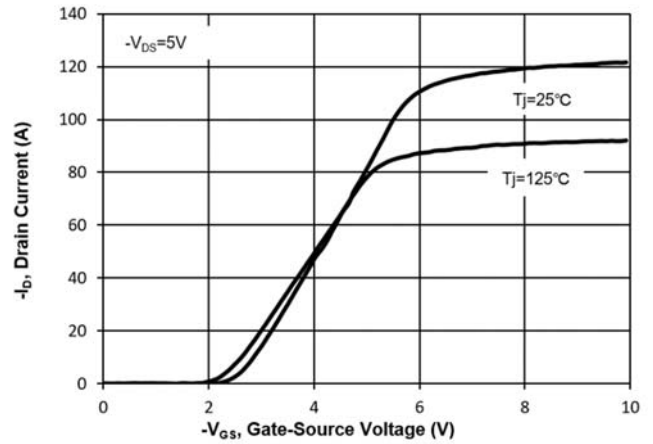


Fig. 3 On-Resistance vs. Drain Current

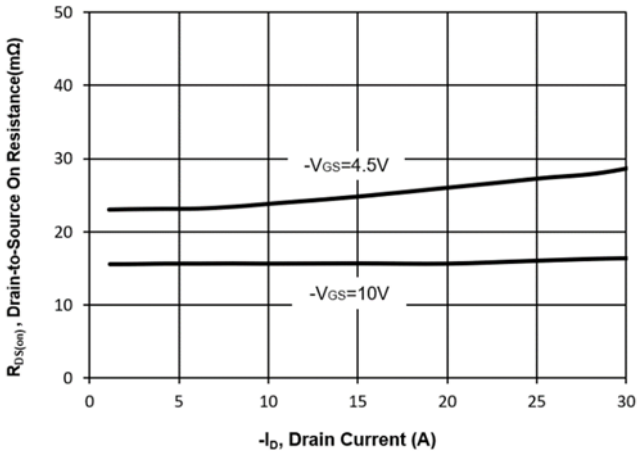


Fig. 4 On-Resistance vs. Gate Voltage

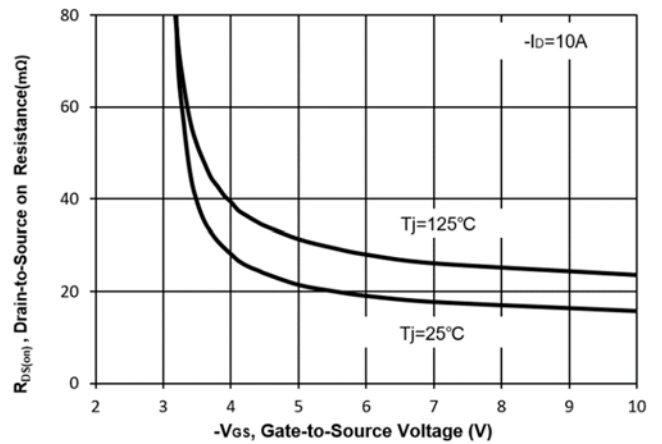


Fig. 5 On-Resistance vs. T_J

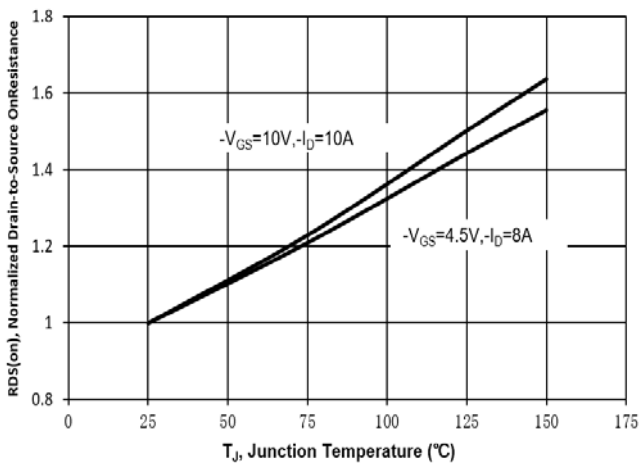
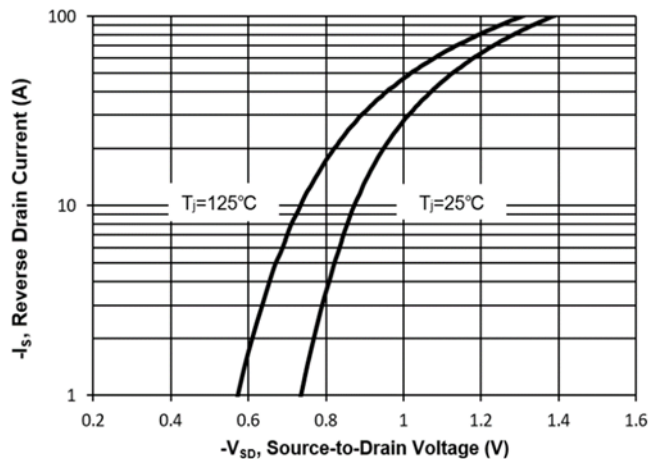


Fig. 6 Typical Forward Characteristic



Electrical Characteristics Curves

Fig. 7 Typical Junction Capacitance

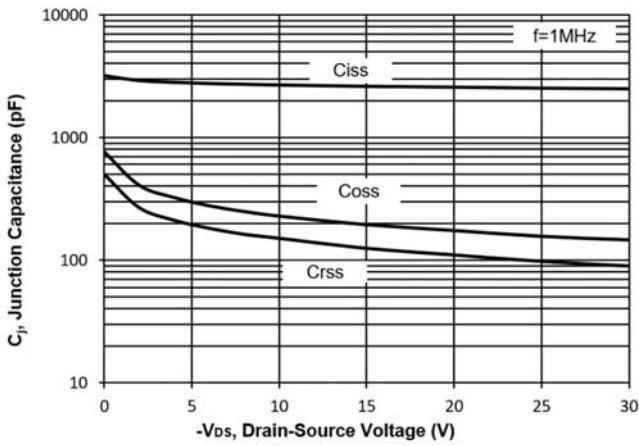


Fig. 8 Drain-Source Leakage Current vs. T_j

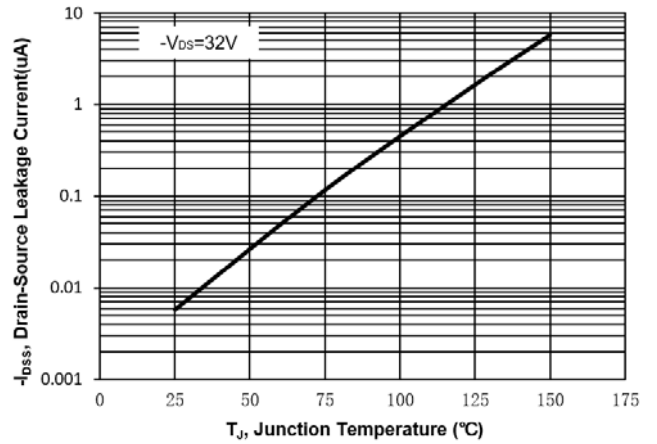


Fig. 9 $V_{(BR)DSS}$ vs. Junction Temperature

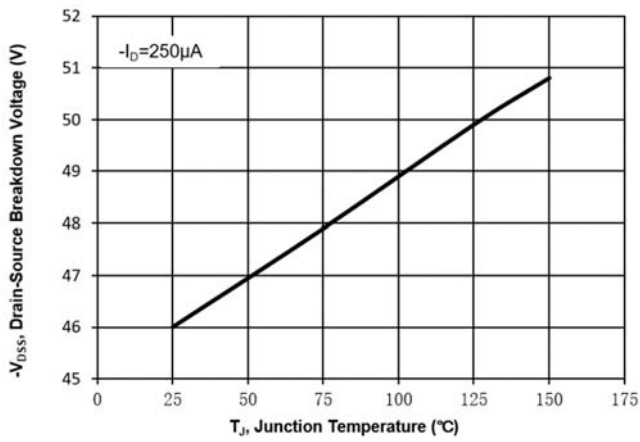


Fig. 10 Gate Threshold Variation vs. T_j

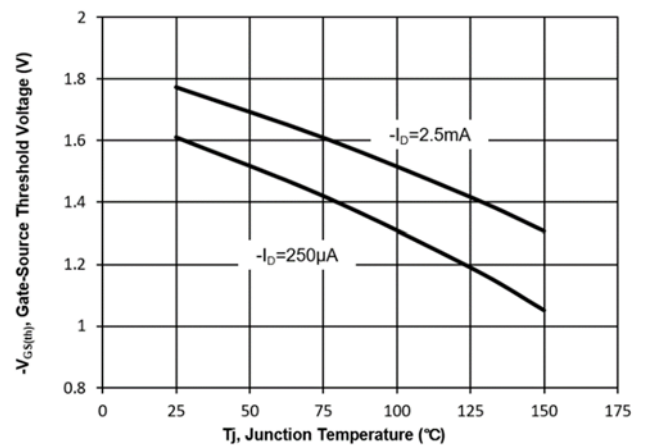


Fig. 11 Gate Charge

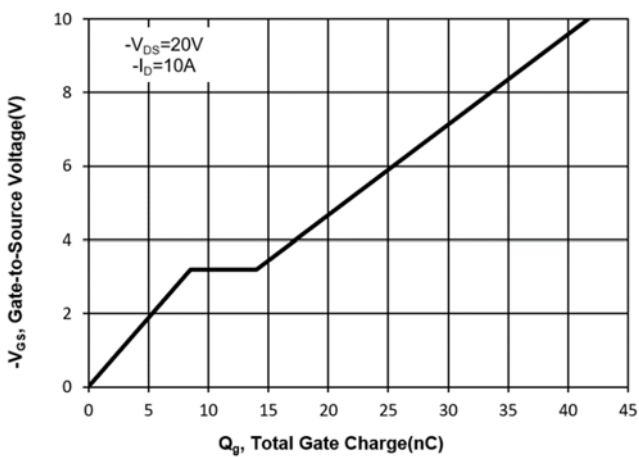
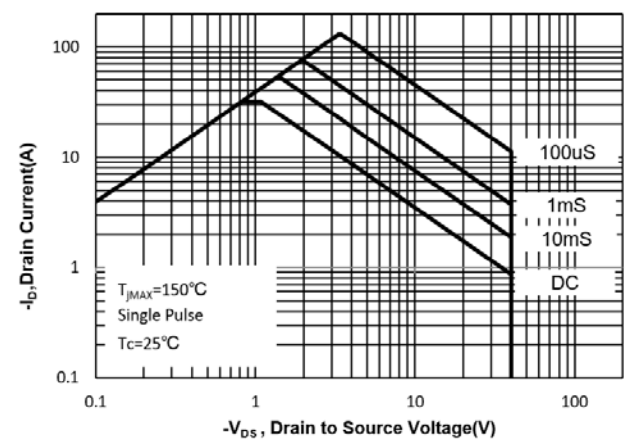


Fig. 12 Safe Operation Area



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Electrical Characteristics Curves

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

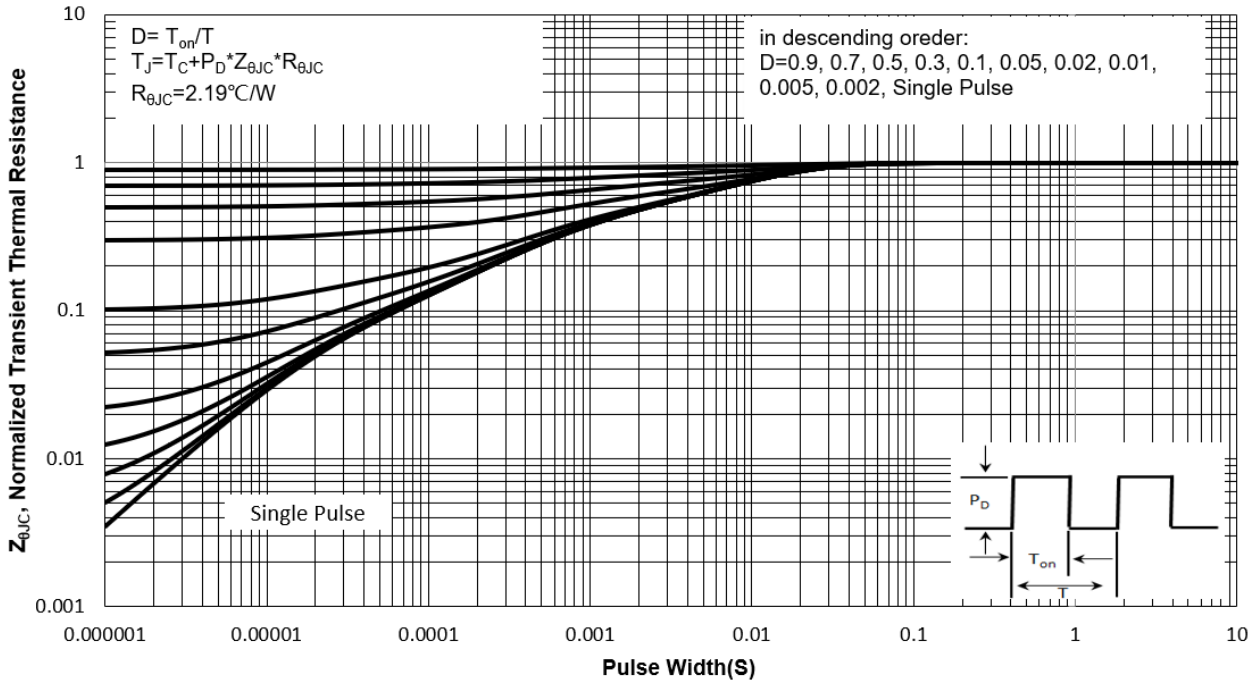
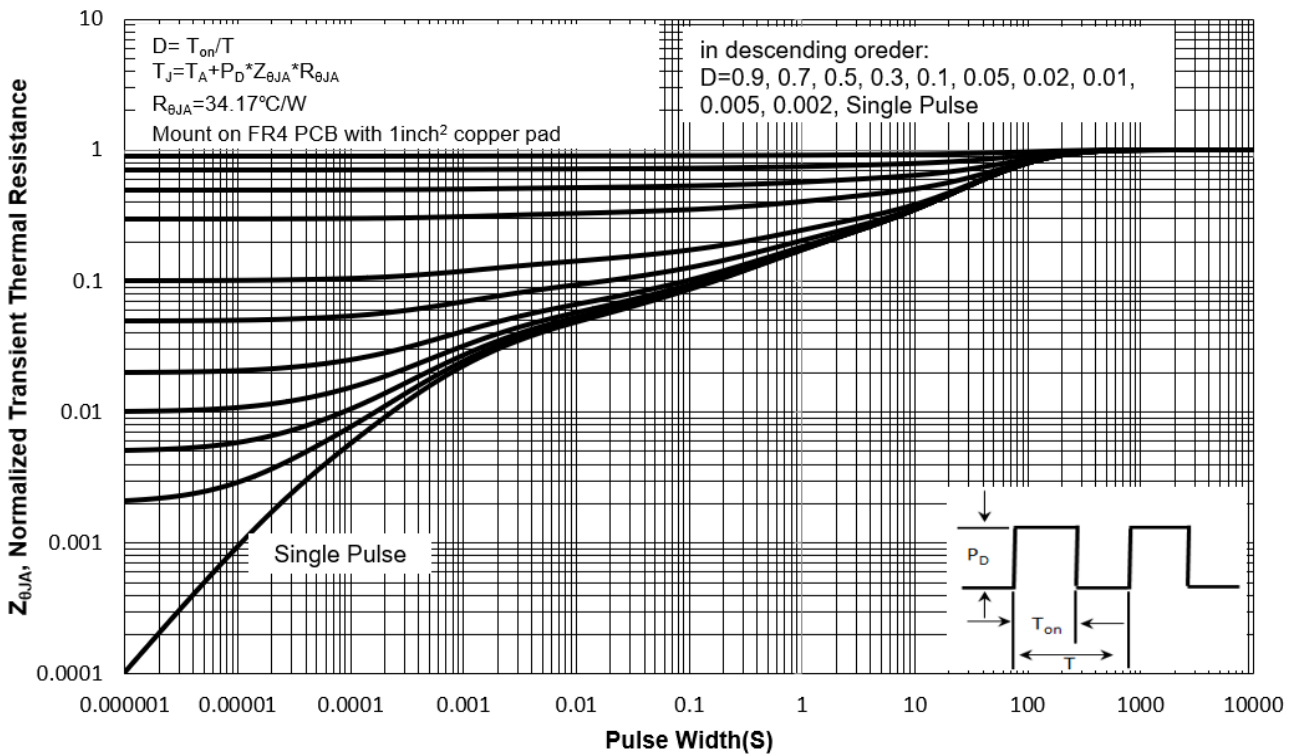


Fig.14 Normalized Maximum Transient Thermal Impedance($Z_{\theta JA}$)



Test Circuits

Fig.1-1 Switching times test circuit

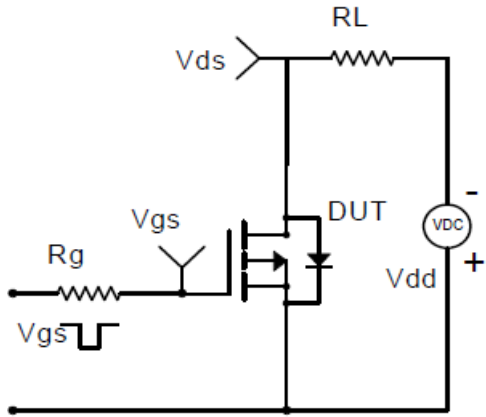


Fig.1-2 Switching Waveform

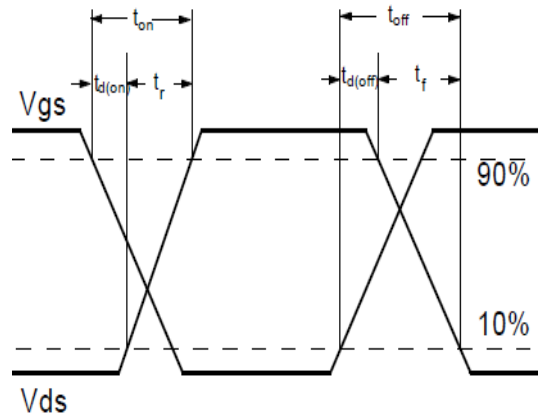


Fig.2-1 Gate charge test circuit

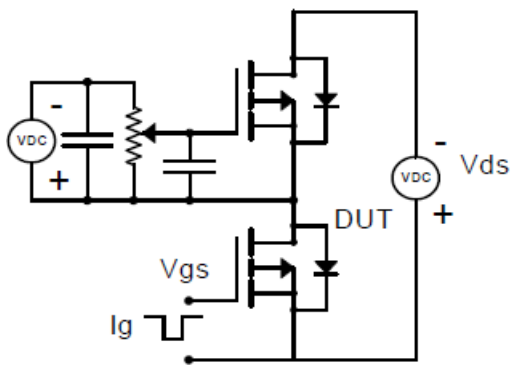


Fig.2-2 Gate charge waveform

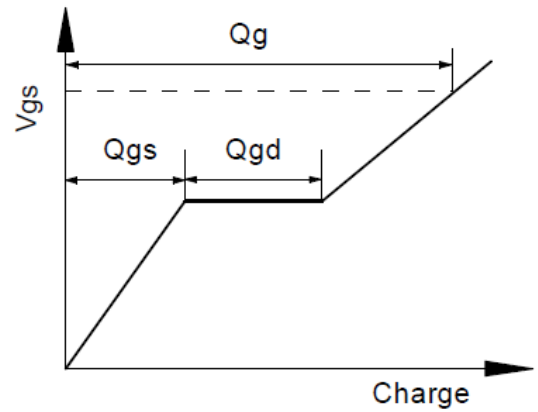


Fig.3-1 Avalanche test circuit

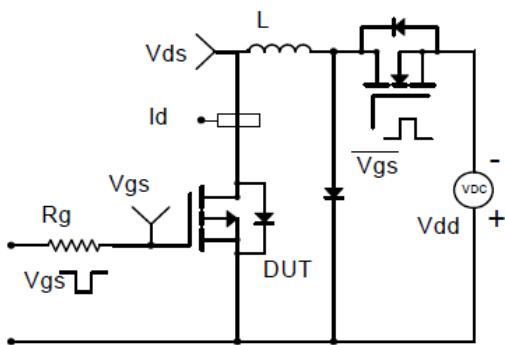
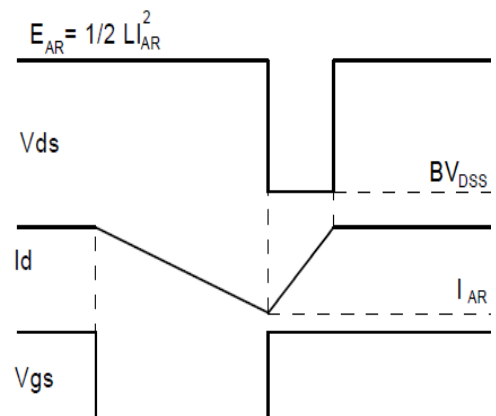


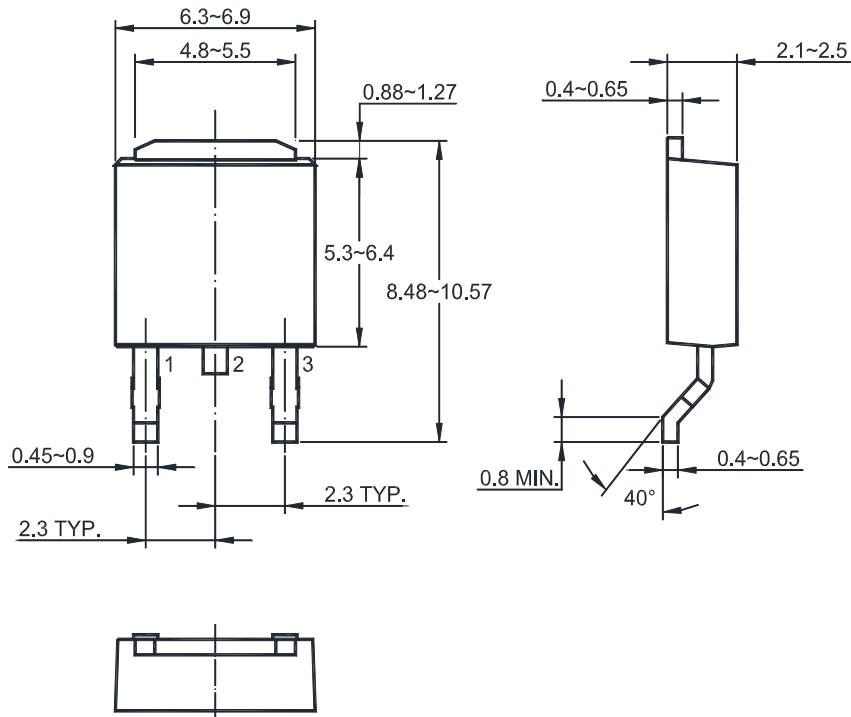
Fig.3-2 Avalanche waveform



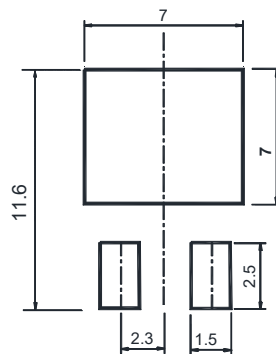
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Package Outline (Dimensions in mm)

TO-252



Recommended Soldering Footprint



Packing information

Package	Tape Width (mm)	Pitch		Reel Size		Per Reel Packing Quantity
		mm	inch	mm	inch	
TO-252	12	8 ± 0.1	0.315 ± 0.004	330	13	2,500

Marking information

" TR04P190LS " = Part No.
 " ***** " = Date Code Marking
 Font type: Arial



Winning Team
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