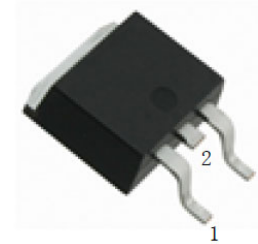
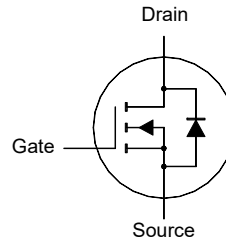


WTR02N060US-HAF

N-Channel Enhancement Mode MOSFET

Features

- Low $R_{DS(ON)}$
- Halogen and Antimony Free(HAF), RoHS compliant



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

Key Parameters

Parameter	Value	Unit
BV_{DSS}	20	V
$R_{DS(ON)}$ Max	6 @ $V_{GS} = 4.5$ V	m Ω
	7 @ $V_{GS} = 2.5$ V	
$V_{GS(th)}$ typ	0.6	V
Q_g typ	44 @ $V_{GS} = 4.5$ V	nC

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

Parameter	Symbol	Value	Unit	
Drain-Source Voltage	V_{DS}	20	V	
Gate-Source Voltage	V_{GS}	± 12	V	
Drain Current	I_D	$T_c = 25^\circ\text{C}$	67	A
		$T_c = 100^\circ\text{C}$	42	A
Peak Drain Current, Pulsed ¹⁾	I_{DM}	280	A	
Avalanche Current	I_{AS}	35.7	A	
Single Pulse Avalanche Energy ²⁾	E_{AS}	63.7	mJ	
Power Dissipation	P_{tot}	31.2	W	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 150	$^\circ\text{C}$	

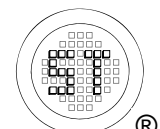
Thermal Characteristics

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Case	$R_{\theta JC}$	4	$^\circ\text{C/W}$
Thermal Resistance from Junction to Ambient ³⁾	$R_{\theta JA}$	37	$^\circ\text{C/W}$

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 , $I_D = 35.7$ A, $V_{GS} = 10$ V.

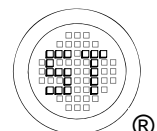
³⁾ Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate in still air.



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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_{DSS}	20	-	-	V
Drain-Source Leakage Current at $V_{DS} = 20 \text{ V}$	I_{DSS}	-	-	1	μA
Gate Leakage Current at $V_{GS} = \pm 12 \text{ V}$	I_{GSS}	-	-	± 100	nA
Gate-Source Threshold Voltage at $V_{DS} = V_{GS}$, $I_D = 250 \mu\text{A}$	$V_{GS(th)}$	0.3	-	1	V
Drain-Source On-State Resistance at $V_{GS} = 4.5 \text{ V}$, $I_D = 20 \text{ A}$ at $V_{GS} = 2.5 \text{ V}$, $I_D = 18 \text{ A}$	$R_{DS(on)}$	- -	4.5 -	6 7	$\text{m}\Omega$
DYNAMIC PARAMETERS					
Forward Transconductance at $V_{DS} = 5 \text{ V}$, $I_D = 20 \text{ A}$	g_{fs}	-	42.5	-	S
Gate Resistance at $V_{GS} = 0 \text{ V}$, $V_{DS} = 0 \text{ V}$, $f = 1 \text{ MHz}$	R_g	-	0.7	-	Ω
Input Capacitance at $V_{GS} = 0 \text{ V}$, $V_{DS} = 10 \text{ V}$, $f = 1 \text{ MHz}$	C_{iss}	-	2619	-	pF
Output Capacitance at $V_{GS} = 0 \text{ V}$, $V_{DS} = 10 \text{ V}$, $f = 1 \text{ MHz}$	C_{oss}	-	388	-	pF
Reverse Transfer Capacitance at $V_{GS} = 0 \text{ V}$, $V_{DS} = 10 \text{ V}$, $f = 1 \text{ MHz}$	C_{rss}	-	344	-	pF
Gate charge total at $V_{DS} = 10 \text{ V}$, $V_{GS} = 4.5 \text{ V}$, $I_D = 20 \text{ A}$ at $V_{DS} = 10 \text{ V}$, $V_{GS} = 2.5 \text{ V}$, $I_D = 20 \text{ A}$	Q_g	- -	44 26	- -	nC
Gate to Source Charge at $V_{DS} = 10 \text{ V}$, $V_{GS} = 4.5 \text{ V}$, $I_D = 20 \text{ A}$	Q_{gs}	-	5.6	-	nC
Gate to Drain Charge at $V_{DS} = 10 \text{ V}$, $V_{GS} = 4.5 \text{ V}$, $I_D = 20 \text{ A}$	Q_{gd}	-	15	-	nC
Turn-On Delay Time at $V_{DS} = 10 \text{ V}$, $V_{GS} = 4.5 \text{ V}$, $I_D = 20 \text{ A}$, $R_g = 3.3 \Omega$	$t_{d(on)}$	-	25	-	nS
Turn-On Rise Time at $V_{DS} = 10 \text{ V}$, $V_{GS} = 4.5 \text{ V}$, $I_D = 20 \text{ A}$, $R_g = 3.3 \Omega$	t_r	-	82	-	nS
Turn-Off Delay Time at $V_{DS} = 10 \text{ V}$, $V_{GS} = 4.5 \text{ V}$, $I_D = 20 \text{ A}$, $R_g = 3.3 \Omega$	$t_{d(off)}$	-	30	-	nS
Turn-Off Fall Time at $V_{DS} = 10 \text{ V}$, $V_{GS} = 4.5 \text{ V}$, $I_D = 20 \text{ A}$, $R_g = 3.3 \Omega$	t_f	-	8	-	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	-	-	67	A
Body-Diode Continuous Current, Pulsed	I_{SM}	-	-	280	A
Body Diode Reverse Recovery Time at $I_s = 20 \text{ A}$, $di/dt = 100 \text{ A} / \mu\text{s}$	t_{rr}	-	26	-	nS
Body Diode Reverse Recovery Charge at $I_s = 20 \text{ A}$, $di/dt = 100 \text{ A} / \mu\text{s}$	Q_{rr}	-	16.7	-	nC



Electrical Characteristics Curves

Fig. 1 Typical Output Characteristic

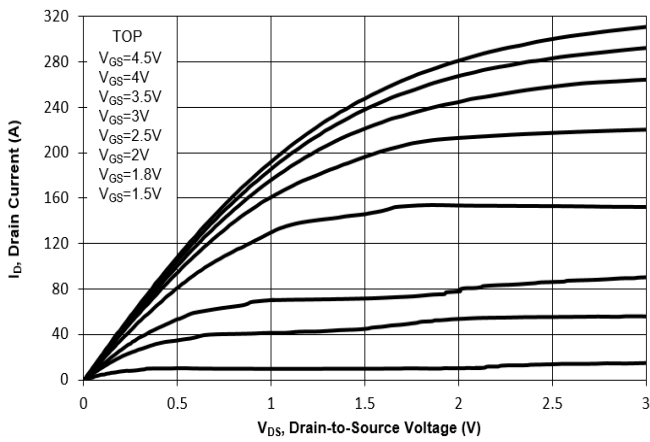


Fig. 2 Typical Transfer Characteristic

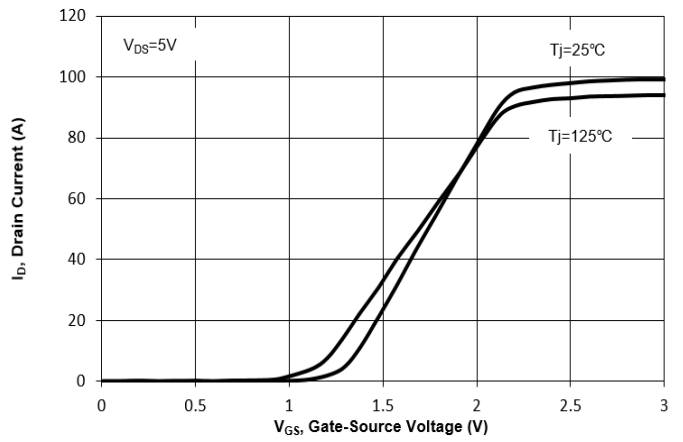


Fig. 3 On-Resistance vs. Drain Current

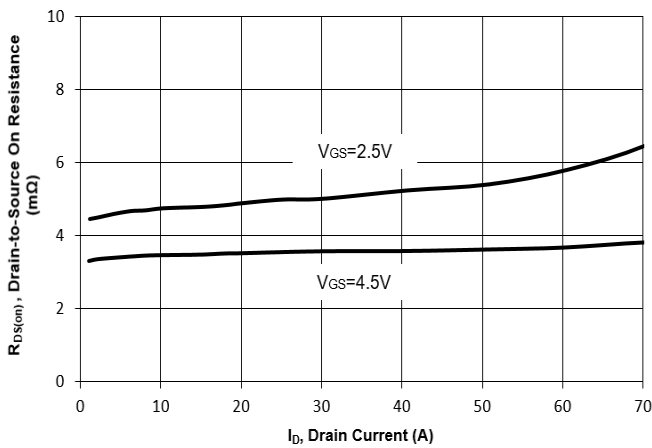


Fig. 4 On-Resistance vs. Gate Voltage

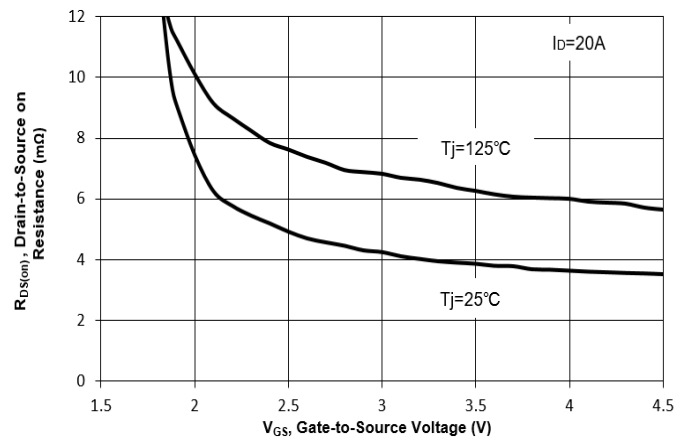


Fig. 5 On-Resistance vs. T_J

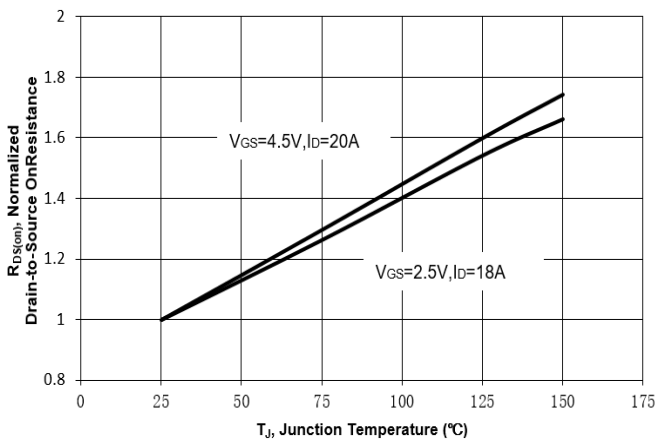
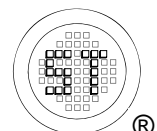
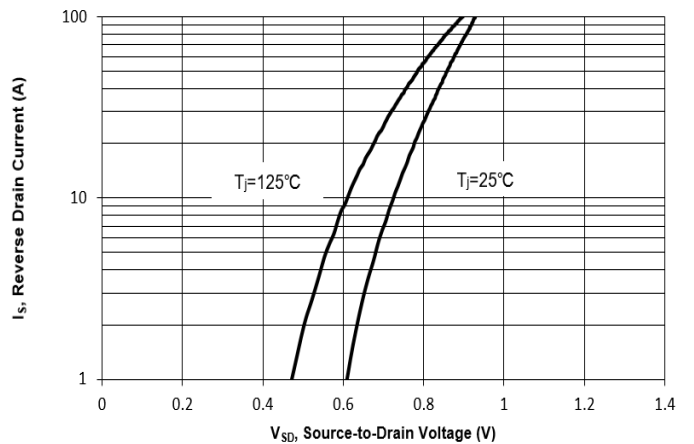


Fig. 6 Typical Body-Diode Forward Characteristic



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Electrical Characteristics Curves

Fig. 7 Typical Junction Capacitance

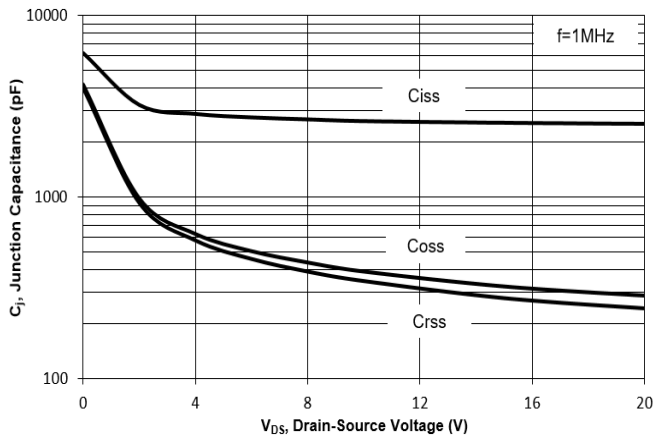


Fig. 8 Drain-Source Leakage Current vs. T_J

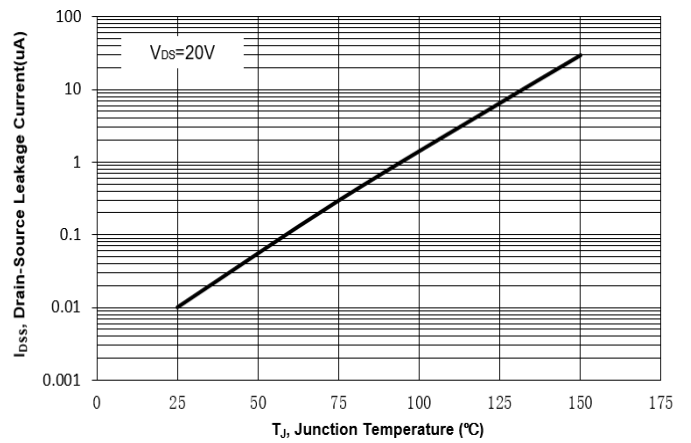


Fig. 9 $V_{(BR)DSS}$ vs. Junction Temperature

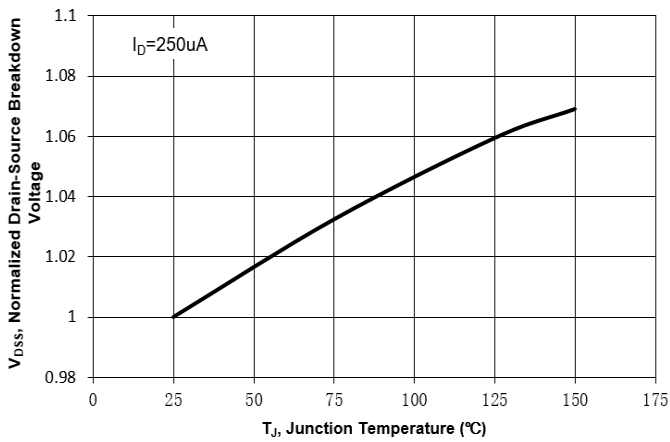


Fig. 10 Gate Threshold Variation vs. T_J

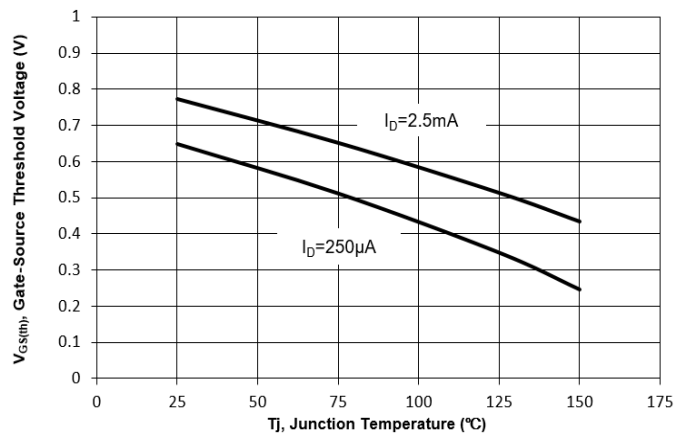


Fig. 11 Gate Charge

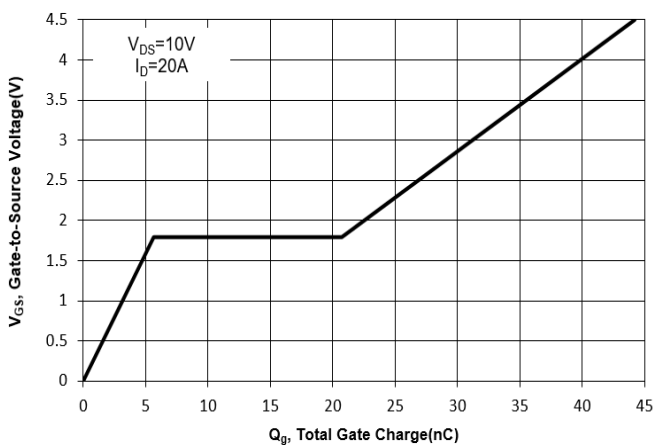
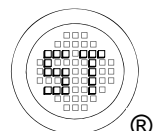
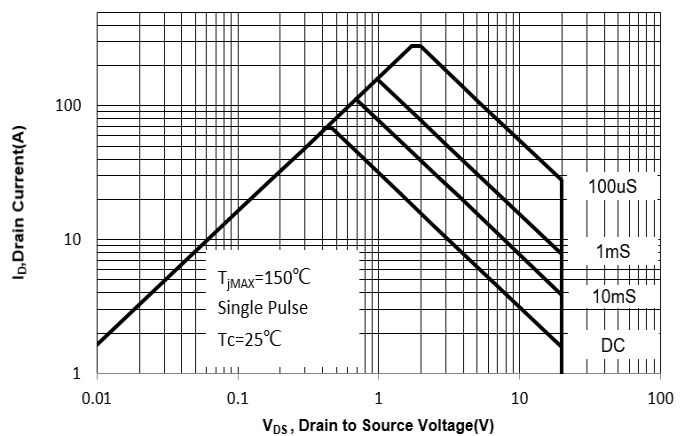


Fig. 12 Safe Operation Area



Electrical Characteristics Curves

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

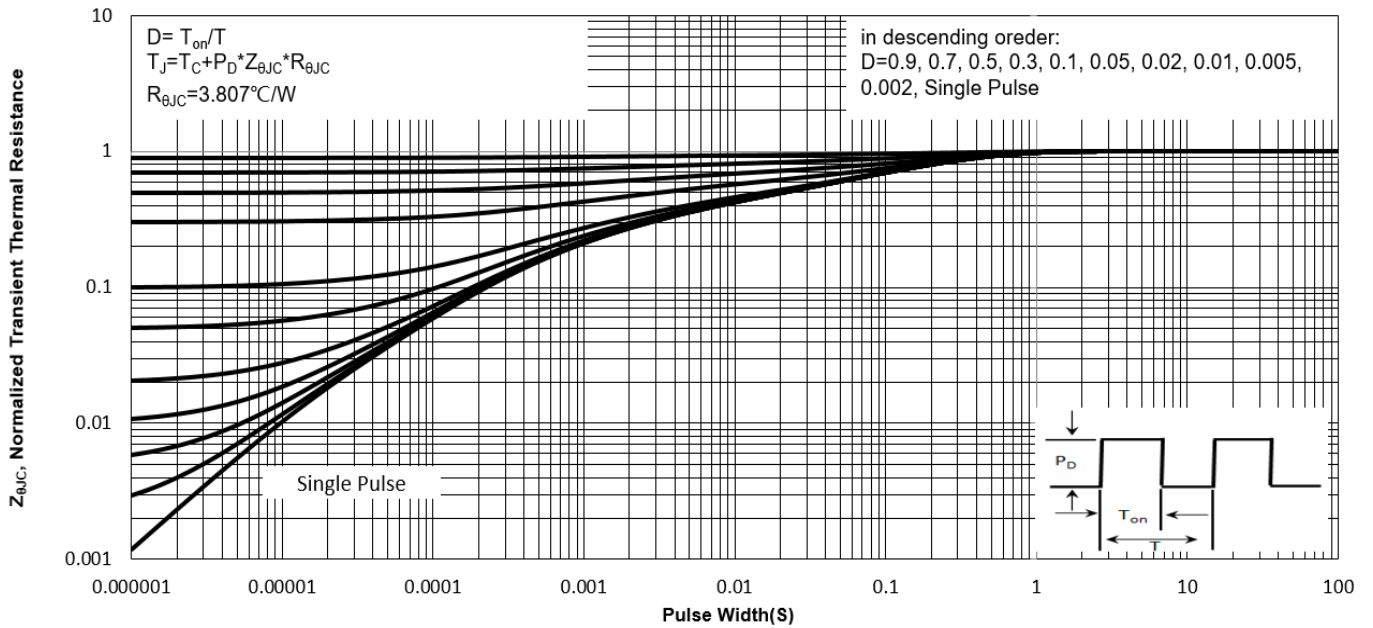
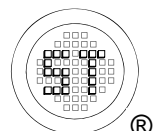
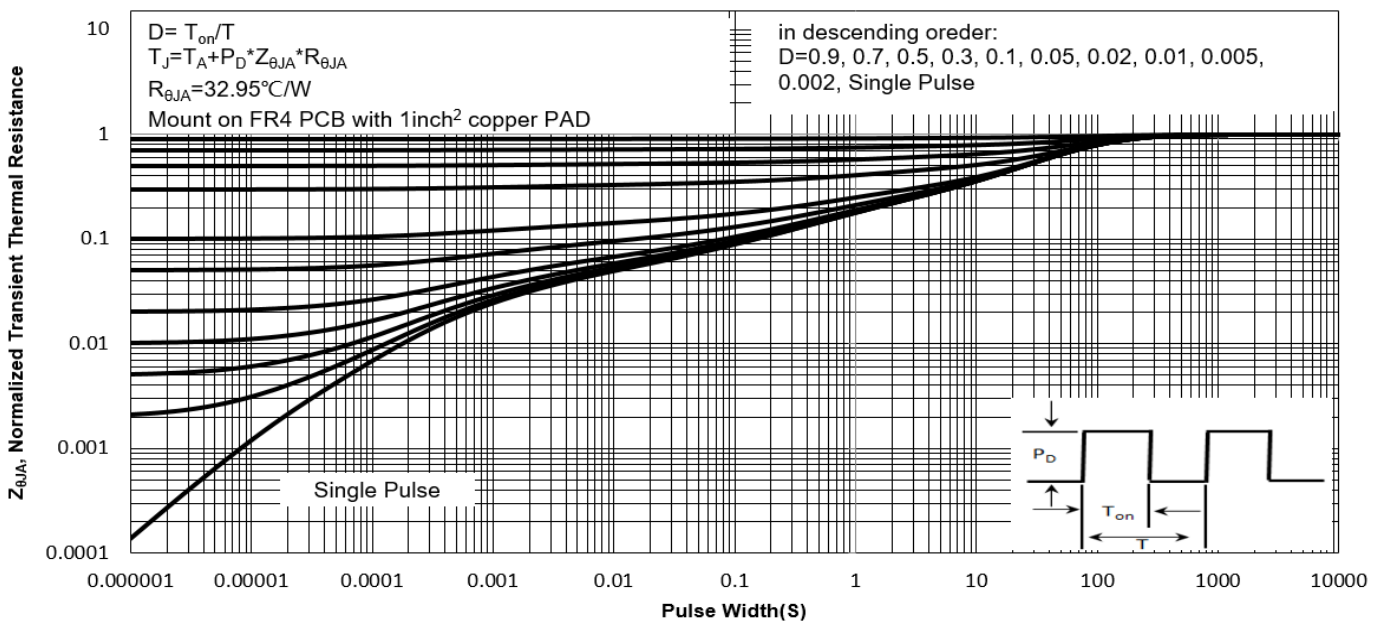


Fig. 14 Normalized Maximum Transient Thermal Impedance($z_{\theta JA}$)



Test Circuits

Fig.1-1 Switching times test circuit

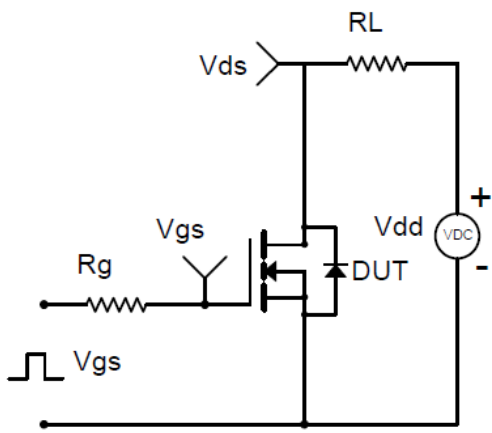


Fig.1-2 Switching Waveform

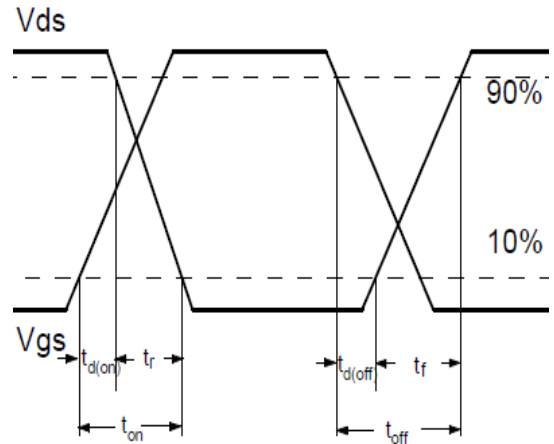


Fig.2-1 Gate charge test circuit

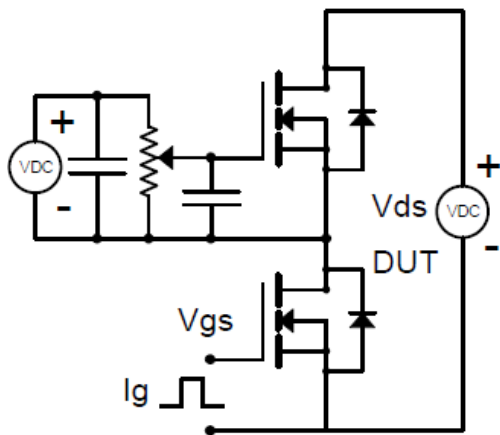


Fig.2-2 Gate charge waveform

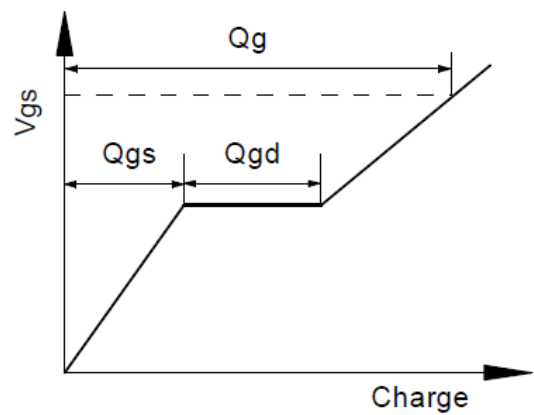


Fig.3-1 Avalanche test circuit

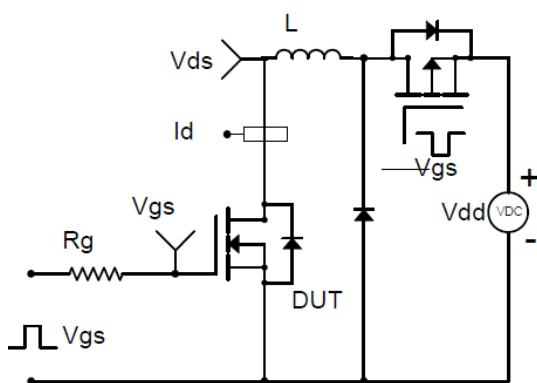
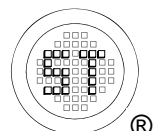
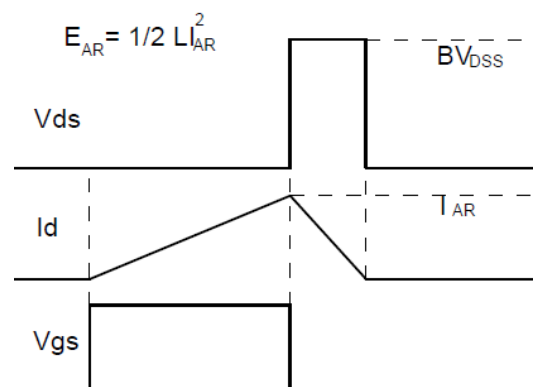


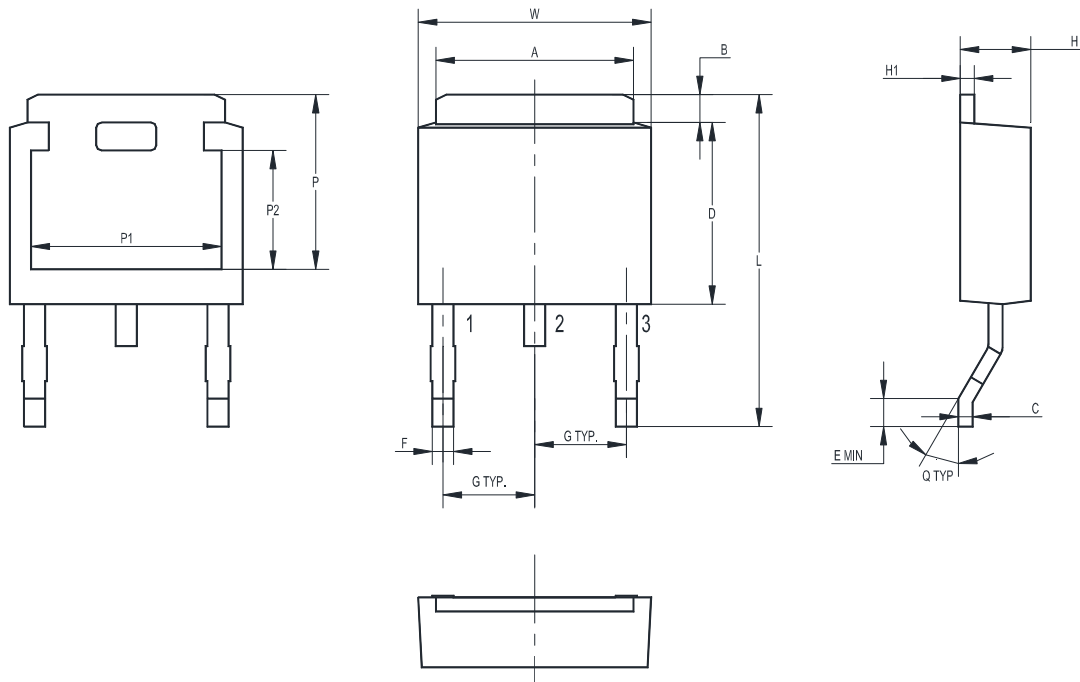
Fig.3-2 Avalanche waveform



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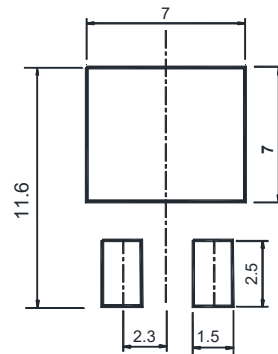
Package Outline (Dimensions in mm)

TO-252



UNIT	A	B	C	D	E	F	G	W	H	H1	Q	L	P	P1	P2
mm	5.5	1.20	0.65	6.2	0.8	1.0	2.3	6.7	2.5	0.65	60°	10.7	5.4	5.0	3.4
	4.9	0.85	0.4	5.6	MIN	0.5	TYP	6.1	2.1	0.4	TYP	9	5.0	4.6	2.9

Recommended Soldering Footprint



Packing information

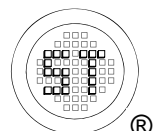
Package	Tape Width (mm)	Pitch		Reel Size		Per Reel Packing Quantity
		mm	inch	mm	inch	
TO-252	12	8 ± 0.1	0.315 ± 0.004	330	13	2,500

Marking information

" TR02N060US " = Part No.

" ***** " = Date Code Marking

Font type: Arial



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