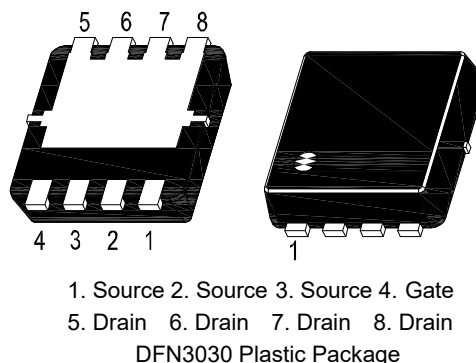
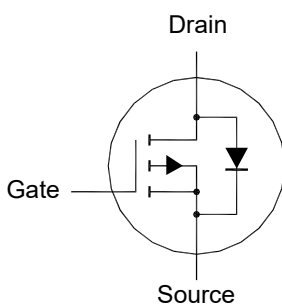


# WTM304P190LS-AH

## P-Channel Enhancement Mode MOSFET

### Features

- AEC-Q101 Qualified
- Halogen and Antimony Free(HAF), RoHS compliant



### Applications

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

### Key Parameters

Parameter	Value	Unit
$-BV_{DSS}$	40	V
$R_{DS(ON) Max}$	19 @ $-V_{GS} = 10 V$	m $\Omega$
	29 @ $-V_{GS} = 4.5 V$	m $\Omega$
$-V_{GS(th) typ}$	1.5	V
$Q_g typ$	42 @ $-V_{GS} = 10 V$	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	$V_{GS}$	$\pm 20$	V
Drain Current	$-I_D$	$T_c = 25^\circ C$	30
		$T_c = 100^\circ C$	19
Peak Drain Current, Pulsed <sup>1)</sup>	$-I_{DM}$	120	A
Single-Pulse Avalanche Current	$-I_{AS}$	33	A
Single-Pulse Avalanche Energy <sup>2)</sup>	$E_{AS}$	54	mJ
Power Dissipation	$P_D$	25	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	$R_{\theta JC}$	5	$^\circ C/W$
Thermal Resistance from Junction to Ambient <sup>3)</sup>	$R_{\theta JA}$	50	$^\circ C/W$

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

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

<sup>3)</sup> 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
<b>STATIC PARAMETERS</b>					
Drain-Source Breakdown Voltage at $-I_D = 250 \mu\text{A}$	$-BV_{DSS}$	40	-	-	V
Drain-Source Leakage Current at $-V_{DS} = 32 \text{ V}$	$-I_{DSS}$	-	-	1	$\mu\text{A}$
Gate Leakage Current at $V_{GS} = \pm 20 \text{ V}$	$I_{GSS}$	-	-	$\pm 100$	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 $-V_{GS} = 10 \text{ V}$ , $-I_D = 10 \text{ A}$ at $-V_{GS} = 4.5 \text{ V}$ , $-I_D = 8 \text{ A}$	$R_{DS(on)}$	- -	15 -	19 29	m $\Omega$
<b>DYNAMIC PARAMETERS</b>					
Gate resistance at $V_{DS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$	$R_g$	-	5.1	-	$\Omega$
Forward Transconductance at $-V_{DS} = 5 \text{ V}$ , $-I_D = 5 \text{ A}$	$g_{fs}$	-	15	-	S
Input Capacitance at $-V_{DS} = 20 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$	$C_{iss}$	-	2573	-	pF
Output Capacitance at $-V_{DS} = 20 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$	$C_{oss}$	-	174	-	pF
Reverse Transfer Capacitance at $-V_{DS} = 20 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$	$C_{rss}$	-	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 $-V_{DD} = 20 \text{ V}$ , $-V_{GS} = 10 \text{ V}$ , $-I_D = 10 \text{ A}$ , $R_g = 3.3 \Omega$	$t_{d(on)}$	-	14	-	nS
Turn-On Rise Time at $-V_{DD} = 20 \text{ V}$ , $-V_{GS} = 10 \text{ V}$ , $-I_D = 10 \text{ A}$ , $R_g = 3.3 \Omega$	$t_r$	-	26	-	nS
Turn-Off Delay Time at $-V_{DD} = 20 \text{ V}$ , $-V_{GS} = 10 \text{ V}$ , $-I_D = 10 \text{ A}$ , $R_g = 3.3 \Omega$	$t_{d(off)}$	-	27	-	nS
Turn-Off Fall Time at $-V_{DD} = 20 \text{ V}$ , $-V_{GS} = 10 \text{ V}$ , $-I_D = 10 \text{ A}$ , $R_g = 3.3 \Omega$	$t_f$	-	5	-	nS
<b>Body-Diode PARAMETERS</b>					
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	$-I_S$	-	-	30	A
Body-Diode Continuous Current, Pulsed	$-I_{SM}$	-	-	120	A
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

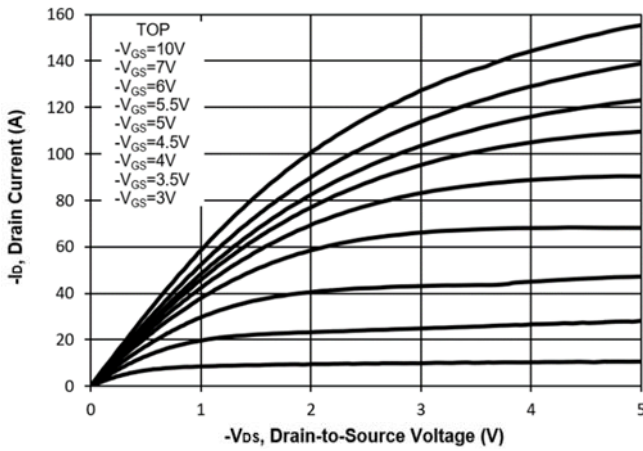


Fig. 2 Typical Transfer Characteristic

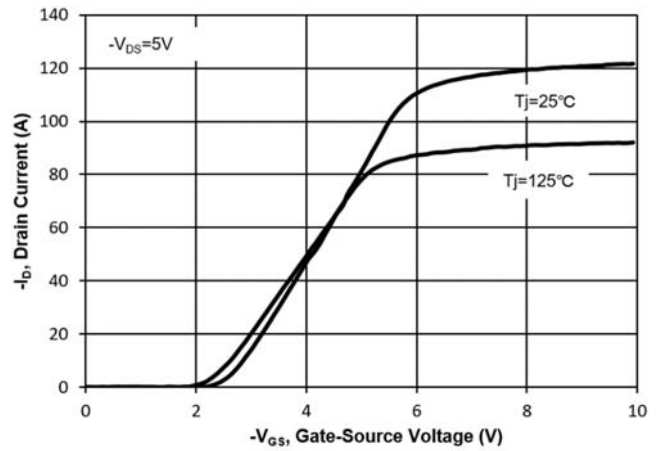


Fig. 3 on-Resistance vs Drain Current

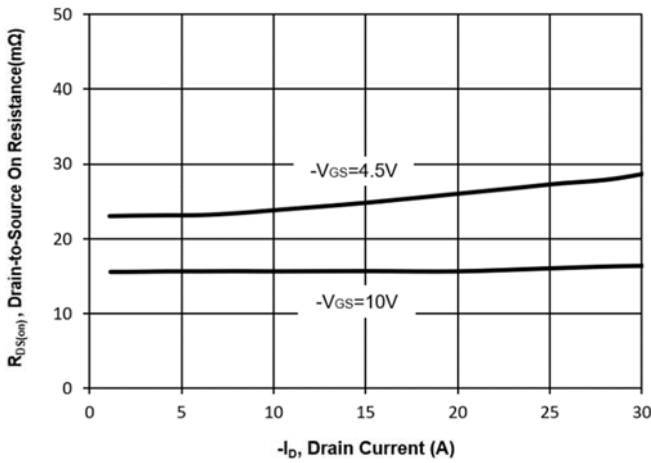


Fig. 4 on-Resistance vs. Gate Voltage

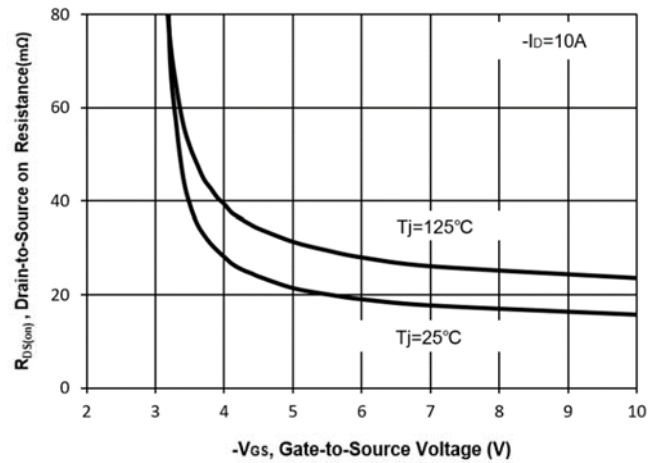


Fig. 5 on-Resistance vs. Tj

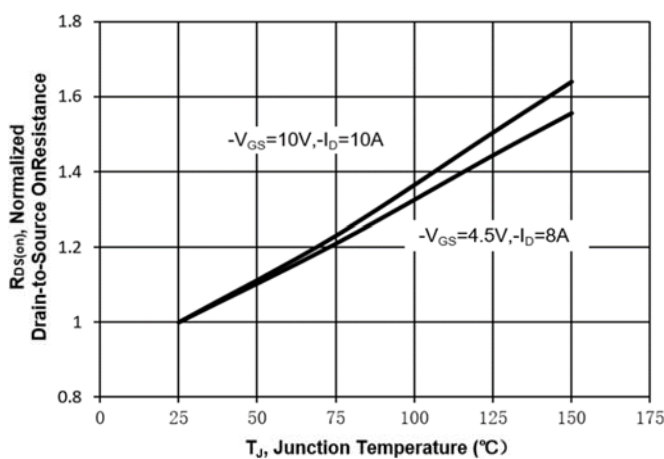
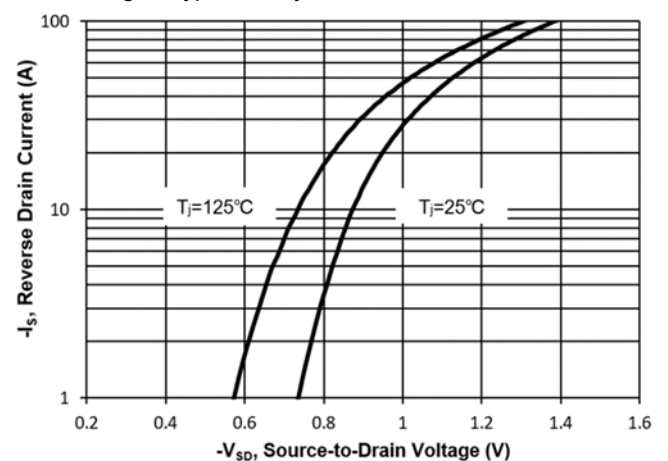


Fig. 6 Typical Body Diode Forward Characteristic



## Electrical Characteristics Curves

Fig. 7 Typical Junction Capacitance

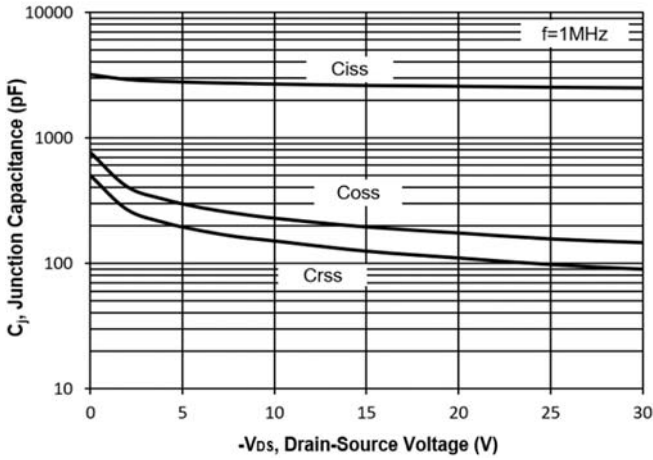


Fig. 8 Drain-Source Leakage Current vs. Tj

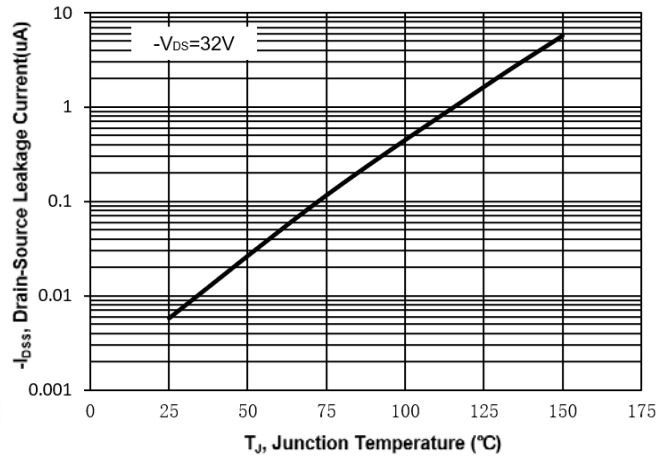


Fig. 9 V(BR)DSS vs. Junction Temperature

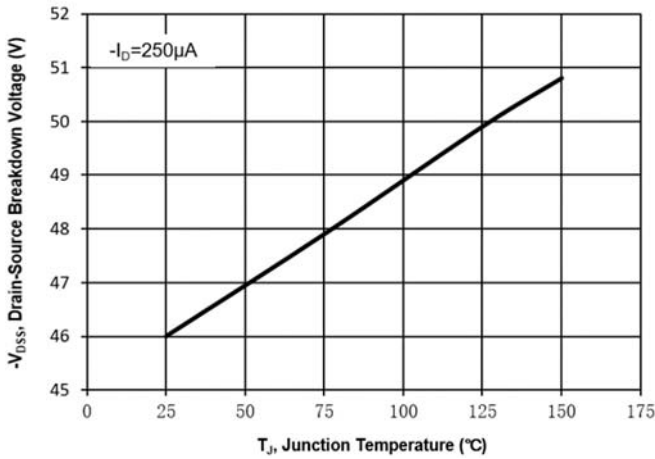


Fig. 10 Gate Threshold Variation vs. Tj

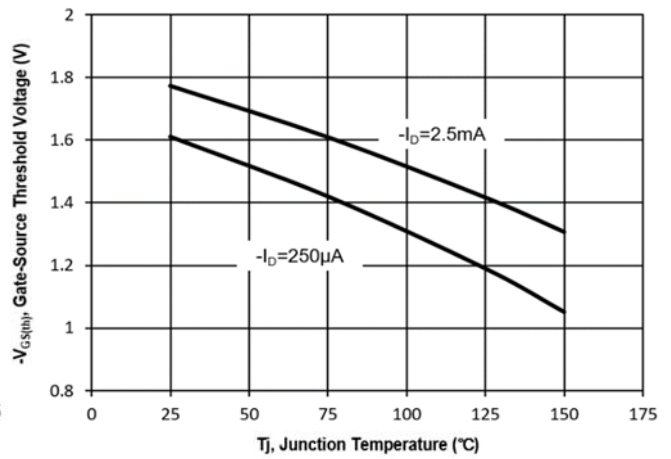


Fig. 11 Gate Charge

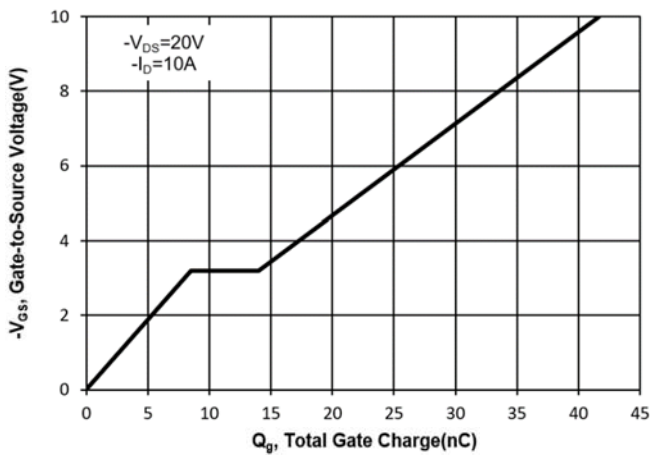
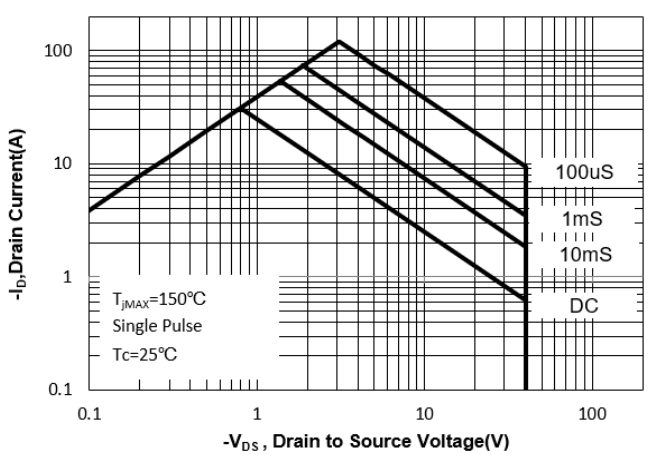


Fig. 12 Safe Operation Area



# WTM304P190LS-AH

## Electrical Characteristics Curves

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

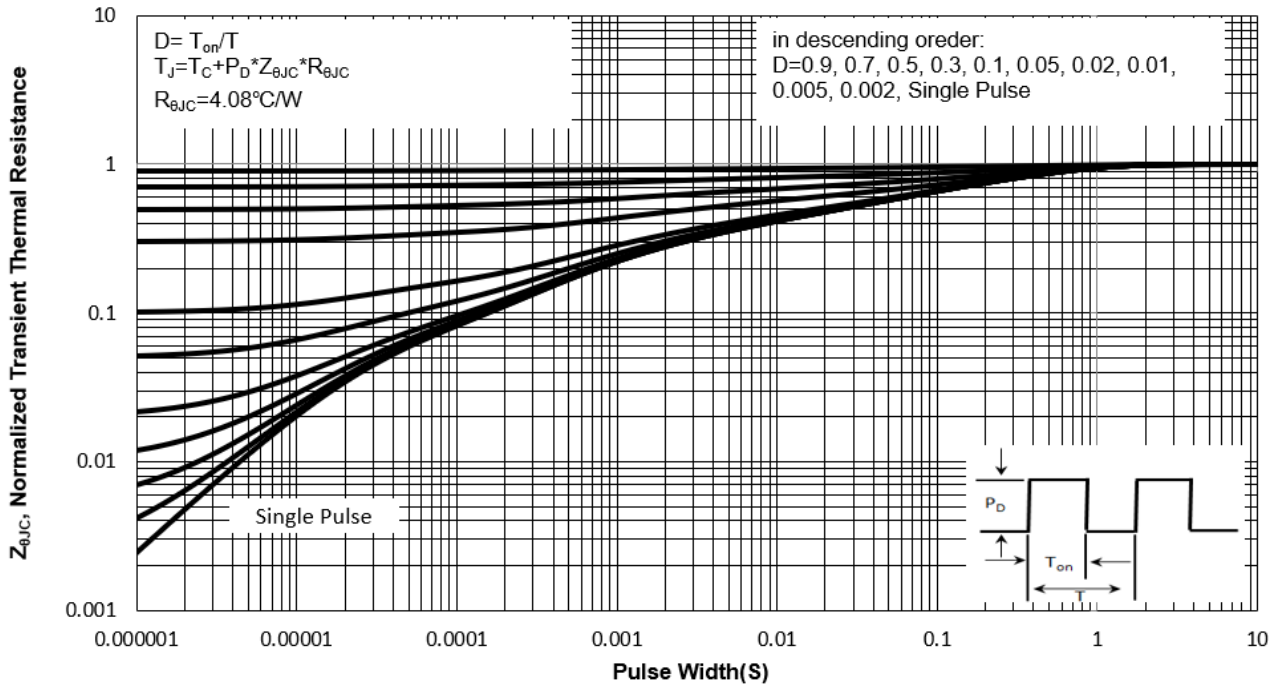
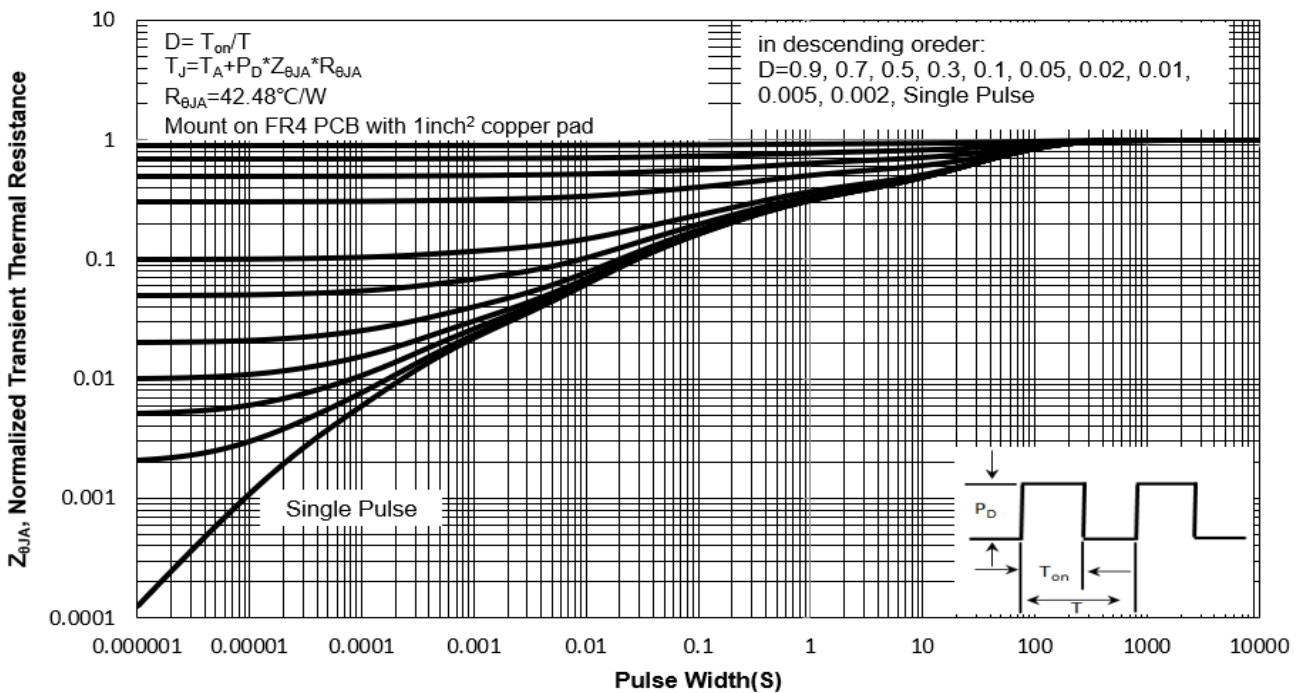


Fig. 14 Normalized Maximum Transient Thermal Impedance( $z_{\theta JA}$ )



## Test Circuits

Fig.1-1 Switching times test circuit

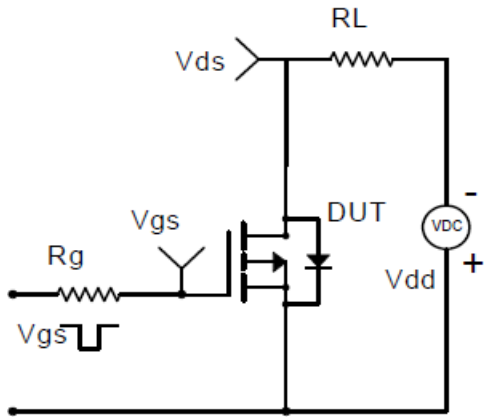


Fig.1-2 Switching Waveform

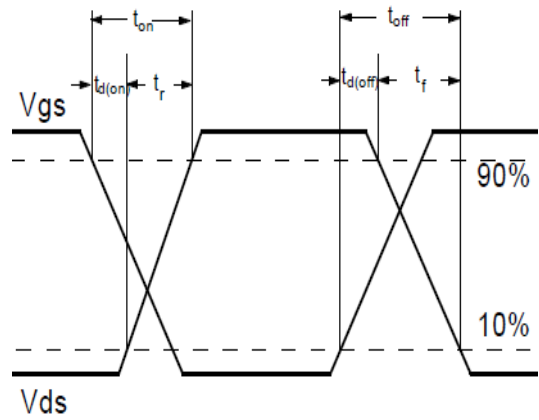


Fig.2-1 Gate charge test circuit

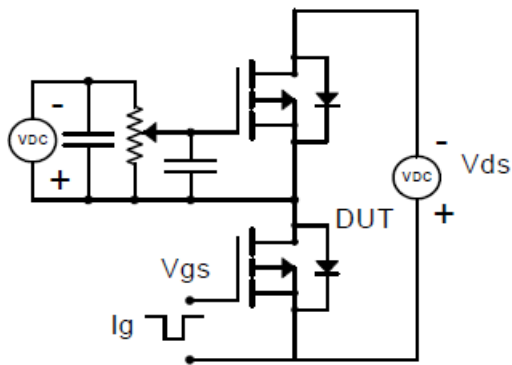


Fig.2-2 Gate charge waveform

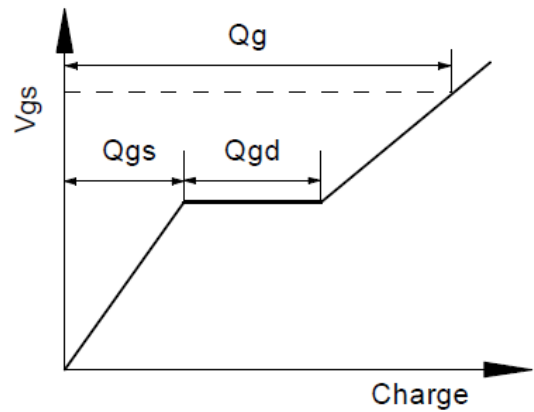


Fig.3-1 Avalanche test circuit

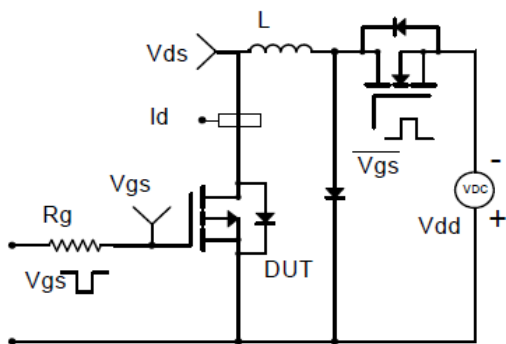
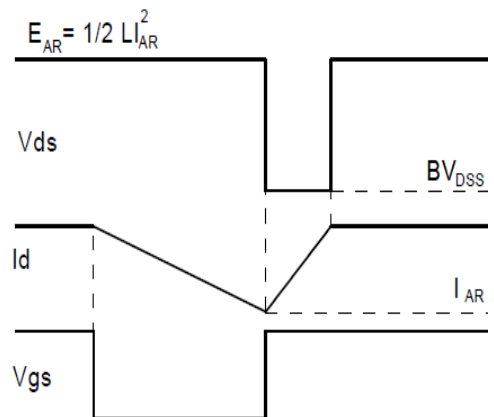


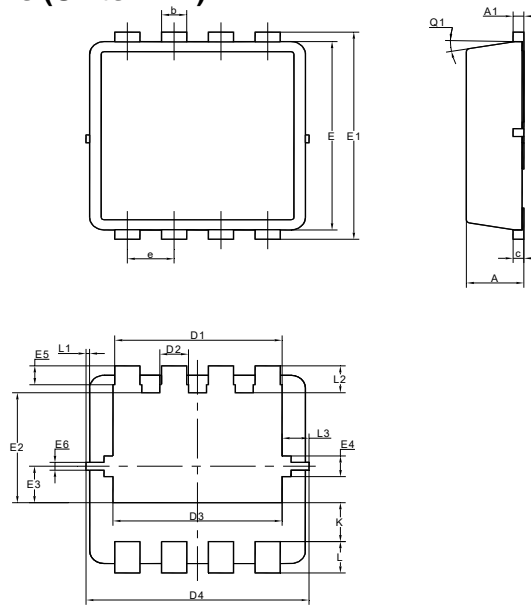
Fig.3-2 Avalanche waveform



# WTM304P190LS-AH

## Package Outline Dimensions (Units: mm)

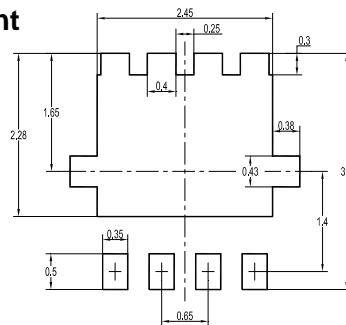
DFN3030



UNIT	A	A1	b	c	D	D1	D2	D3	D4	E	E1	E2	E3
mm	0.9	0.05	0.35	0.25	3.1	2.45	0.5	2.7	3.2	3.1	3.3	1.85	0.68
	0.7	0	0.24	0.1	2.9	2.25	0.3	2.5	3	2.9	3.1	1.65	0.48

UNIT	E4	E5	E6	e	K	L	L1	L2	L3	θ1
mm	0.43	0.4	0.175	0.7	0.72	0.5	0.1	0.53	0.475	12°
	0.23	0.2	0.075	0.6	0.52	0.3	0	0.33	0.275	0°

## Recommended Soldering Footprint

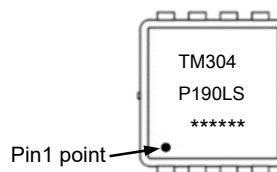


## Packing information

Package	Tape Width (mm)	Pitch		Reel Size		Per Reel Packing Quantity
		mm	inch	mm	inch	
DFN3030	12	8 ± 0.1	0.315 ± 0.004	330	13	5,000

## Marking information

- " TM304P190LS " = Part No.
- " \*\*\*\*\* " = Date Code Marking
- Font type: Arial



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