



## Description

The SM4186T9RL uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.



TO-252-2L

## General Features

$V_{DS} = 40V$   $I_D = 50A$

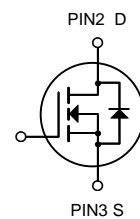
$R_{DS(ON)} < 16m\Omega$  @  $V_{GS}=10V$

## Application

Battery protection

Load switch

Uninterruptible power supply



N-Channel MOSFET

## Package Marking and Ordering Information

Product ID	Pack	Brand	Qty(PCS)
SM4186T9RL	TO-252-2L	HXY MOSFET	2500

## Absolute Maximum Ratings ( $T_C=25^\circ C$ unless otherwise noted)

Symbol	Parameter	Rating	Units
$V_{DS}$	Drain-Source Voltage	40	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	V
$I_D@T_C=25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	50	A
$I_D@T_C=100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	25	A
$I_{DM}$	Pulsed Drain Current <sup>2</sup>	80	A
EAS	Single Pulse Avalanche Energy <sup>3</sup>	19	mJ
$I_{AS}$	Avalanche Current	30	A
$P_D@T_C=25^\circ C$	Total Power Dissipation <sup>4</sup>	20	W
$T_{STG}$	Storage Temperature Range	-55 to 150	$^\circ C$
$T_J$	Operating Junction Temperature Range	-55 to 150	$^\circ C$
$R_{\theta JA}$	Thermal Resistance Junction-ambient (Steady State) <sup>1</sup>	55	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction-Case <sup>1</sup>	4.32	$^\circ C/W$



**Electrical Characteristics ( $T_A=25^{\circ}\text{C}$  unless otherwise noted)**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	40	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=40V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1	1.5	2.0	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=8A$	-	11.0	16	m $\Omega$
		$V_{GS}=4.5V, I_D=4A$	-	18.9	24	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=8A$	33	-	-	S
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=20V, V_{GS}=0V,$ $F=1.0\text{MHz}$	-	964	-	PF
Output Capacitance	$C_{oss}$		-	109	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	96	-	PF
<b>Switching Characteristics</b>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=20V, R_L=2.5\Omega$ $V_{GS}=10V, R_{GEN}=3\Omega$	-	5.5	-	nS
Turn-on Rise Time	$t_r$		-	14	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	24	-	nS
Turn-Off Fall Time	$t_f$		-	12	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=20V, I_D=8A,$ $V_{GS}=10V$	-	22.9	-	nC
Gate-Source Charge	$Q_{gs}$		-	3.5	-	nC
Gate-Drain Charge	$Q_{gd}$		-	5.3	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=9A$	-	0.8	1.2	V



### Typical Electrical and Thermal Characteristics (Curves)

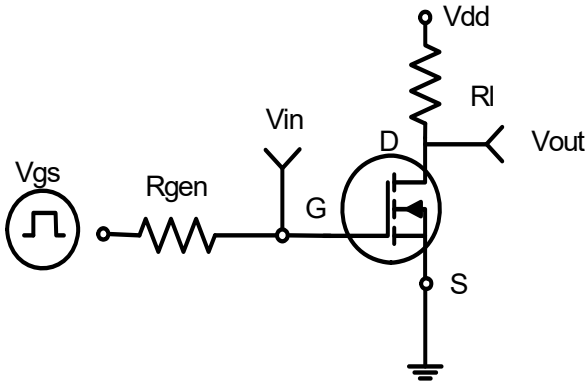


Figure 1: Switching Test Circuit

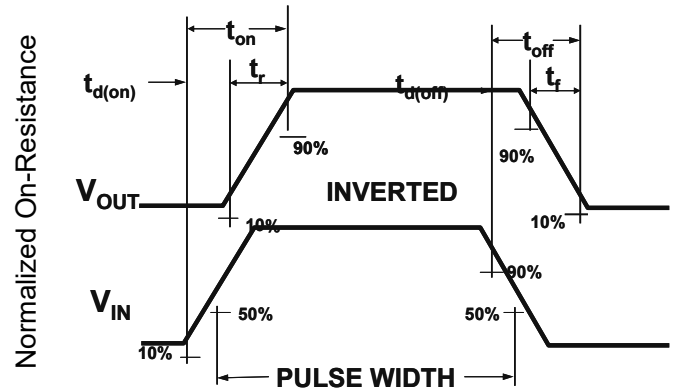


Figure 2: Switching Waveforms

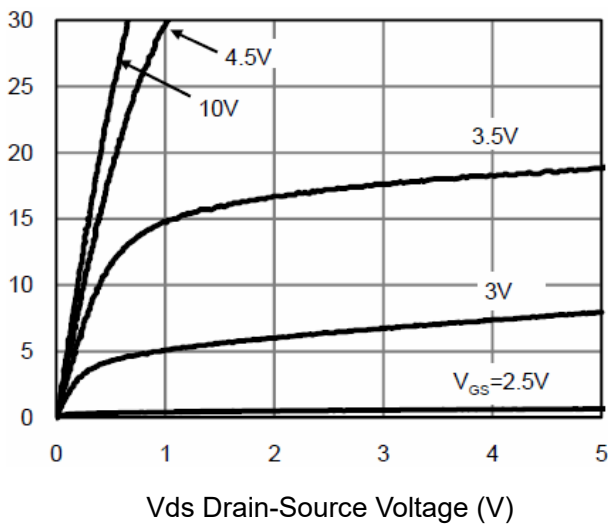


Figure 3 Output Characteristics

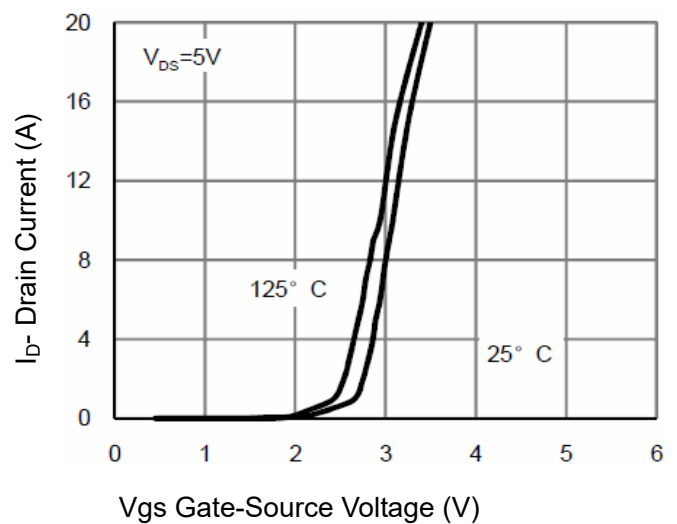


Figure 4 Transfer Characteristics

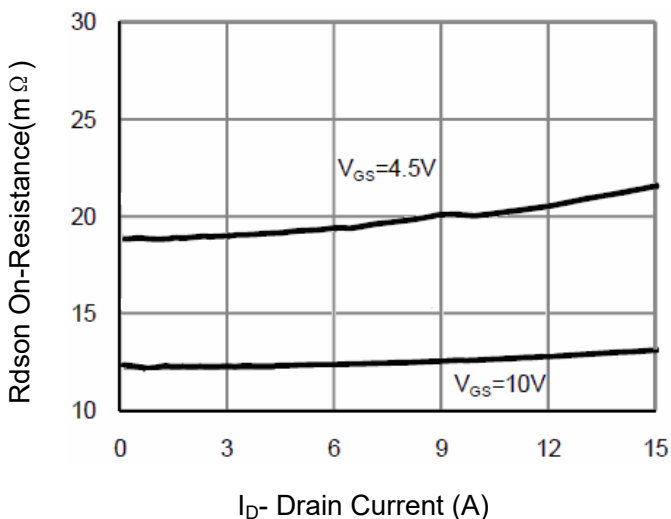


Figure 5 Drain-Source On-Resistance

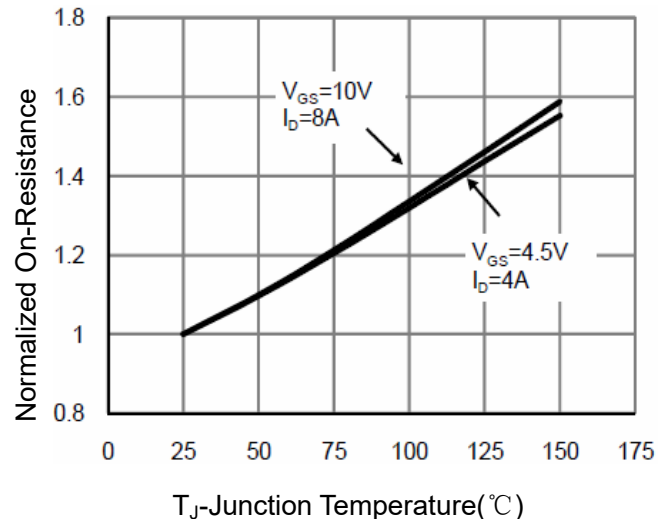
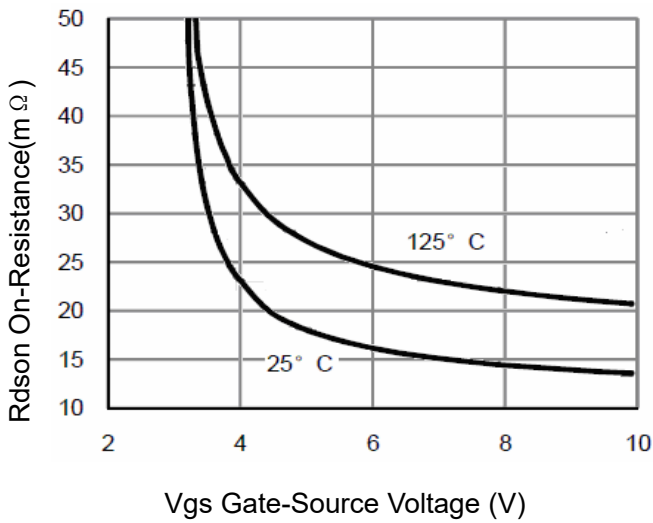
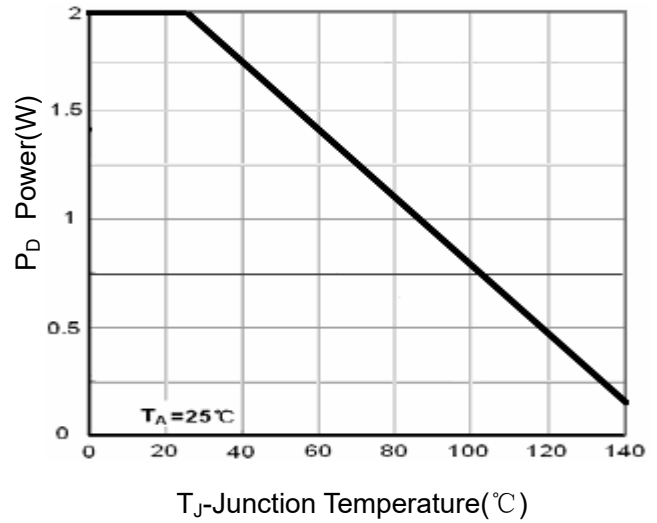


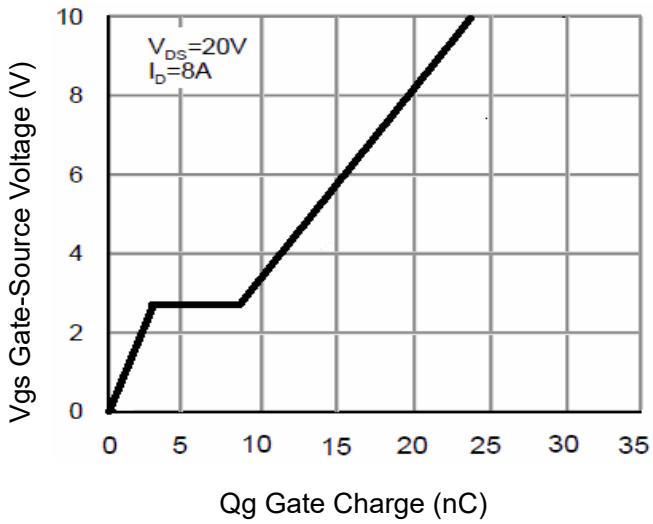
Figure 6 Drain-Source On-Resistance



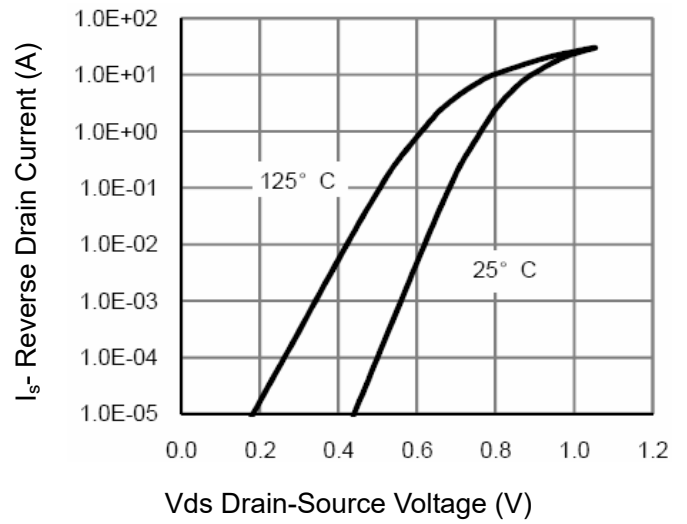
Vgs Gate-Source Voltage (V)  
**Figure 7 Rdson vs Vgs**



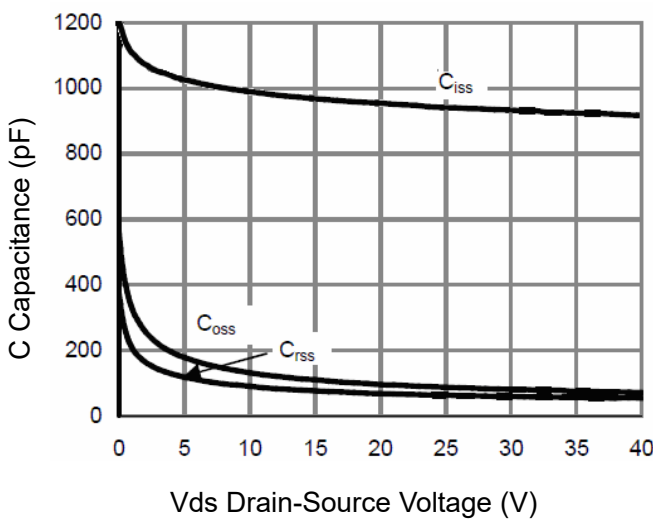
Tj-Junction Temperature(°C)  
**Figure 8 Power Dissipation**



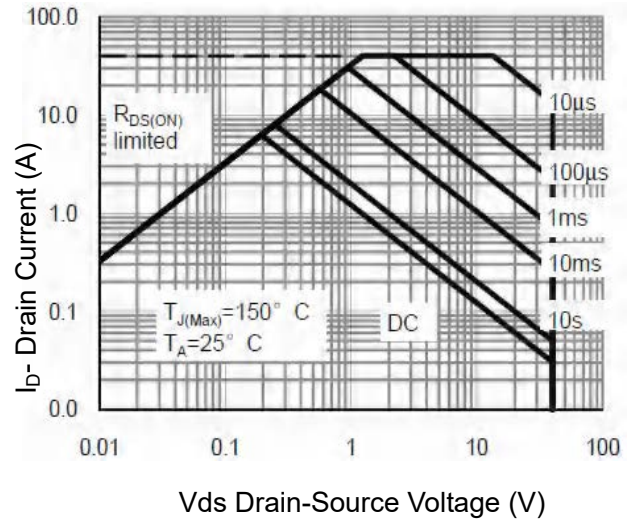
Qg Gate Charge (nC)  
**Figure 9 Gate Charge**



Vds Drain-Source Voltage (V)  
**Figure 10 Source- Drain Diode Forward**



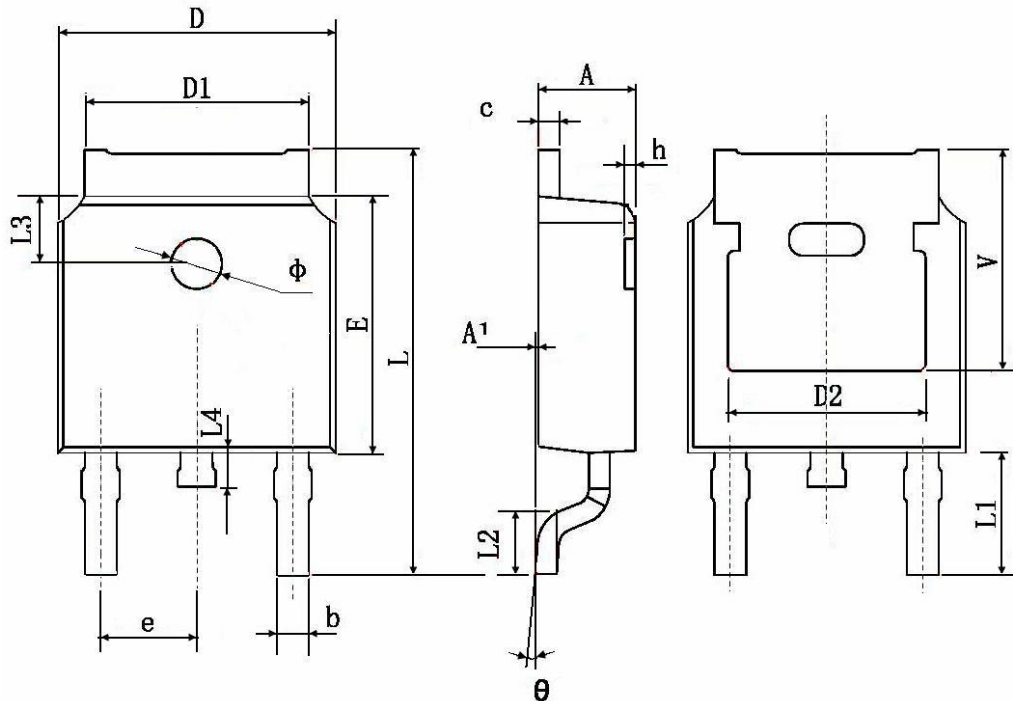
Vds Drain-Source Voltage (V)  
**Figure 11 Capacitance vs Vds**



Vds Drain-Source Voltage (V)  
**Figure 12 Safe Operation Area**



### TO-252-2L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.660	0.860	0.026	0.034
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	0.483 TYP.		0.190 TYP.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.800	10.400	0.386	0.409
L1	2.900 TYP.		0.114 TYP.	
L2	1.400	1.700	0.055	0.067
L3	1.600 TYP.		0.063 TYP.	
L4	0.600	1.000	0.024	0.039
φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 TYP.		0.211 TYP.	



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