

Description

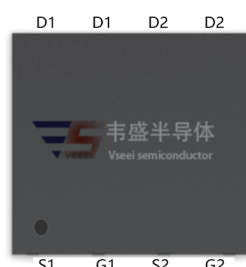
Features

- N-Channel: 30V, 9A
 $R_{DS(ON)} < 21m\Omega @ V_{GS} = 10V$
 $R_{DS(ON)} < 35m\Omega @ V_{GS} = 4.5V$
- P-Channel: -30V, -5A
 $R_{DS(ON)} < 52m\Omega @ V_{GS} = -10V$
 $R_{DS(ON)} < 90m\Omega @ V_{GS} = -4.5V$
- Excellent Gate Charge x $R_{DS(ON)}$ Product(FOM)
- Very Low On-resistance $R_{DS(ON)}$
- Fast Switching Speed

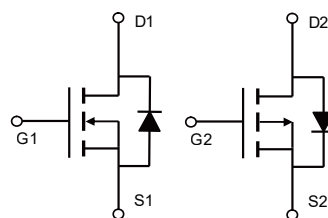
Application

- Battery Protection
- Load Switch
- Power Management

100% UIS TESTED!
100% ΔV_{ds} TESTED!



DFN3x3



Schematic

Package Marking and Ordering Information

Device Marking	Device	OUTLINE	Device Package	Reel Size	Reel (PCS)	Per Carton (PCS)
VSM9NP03	VSM9NP03-D33	TAPING	DFN3x3	13inch	5000	50000

Absolute Maximum Ratings (T_C=25°C unless otherwise specified)

Symbol	Parameter	Max. N-Channel	Max. P-Channel	Units
V _{DSS}	Drain-Source Voltage	30	-30	V
V _{GSS}	Gate-Source Voltage	±20	±20	V
I _D	Continuous Drain Current	9	-5	A
		T _C = 25°C		
		T _C = 100°C		
I _{DM}	Pulsed Drain Current ^{note1}	36	-20	A
E _{AS}	Single Pulsed Avalanche Energy ^{note2}	12	12	mJ
P _D	Power Dissipation	2.9	2.2	W
		T _C = 25°C		
R _{θJC}	Thermal Resistance, Junction to Case	43	57	°C/W
T _J , T _{STG}	Operating and Storage Temperature Range	-55 to +150		°C

N-Channel Electrical Characteristics (T_J=25°C unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
Off Characteristic						
V _{(BR)DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _D =250μA	30	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =30V, V _{GS} =0V	-	-	1	μA
I _{GSS}	Gate to Body Leakage Current	V _{DS} =0V, V _{GS} =±20V	-	-	±100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =250μA	1.0	1.5	2.5	V
R _{DS(on)}	Static Drain-Source on-Resistance note2	V _{GS} =10V, I _D =5A	-	16	21	mΩ
		V _{GS} =4.5V, I _D =3A	-	25	35	mΩ
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} =15V, V _{GS} =0V, f=1.0MHz	-	490	-	pF
C _{oss}	Output Capacitance		-	79	-	pF
C _{rss}	Reverse Transfer Capacitance		-	61	-	pF
Q _g	Total Gate Charge	V _{DS} =15V, I _D =5.8A, V _{GS} =10V	-	5.2	-	nC
Q _{gs}	Gate-Source Charge		-	0.9	-	nC
Q _{gd}	Gate-Drain(“Miller”) Charge		-	1.3	-	nC
Switching Characteristics						
t _{d(on)}	Turn-on Delay Time	V _{DS} =15V, I _D =3A, V _{GS} =10V, R _{REN} =3Ω	-	4.5	-	ns
t _r	Turn-on Rise Time		-	2.5	-	ns
t _{d(off)}	Turn-off Delay Time		-	14.5	-	ns
t _f	Turn-off Fall Time		-	3.5	-	ns
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain to Source Diode Forward Current		-	-	9	A
I _{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	36	A
V _{SD}	Drain to Source Diode Forward Voltage	V _{GS} =0V, I _S =9A	-	0.8	1.2	V

Notes: 1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2. EAS condition : T_J=25°C, V_{DD}=15V, V_{GS}=10V, L=0.5mH, R_g=25Ω, I_{AS}=7A

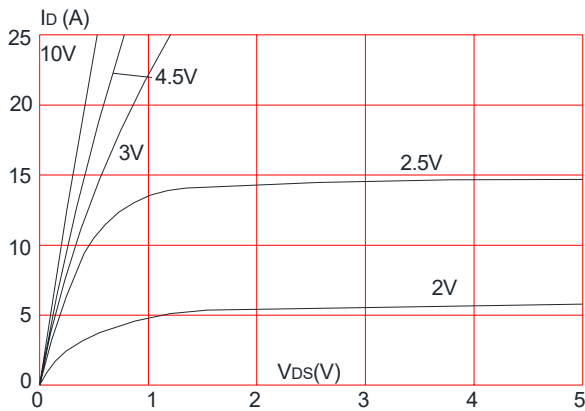
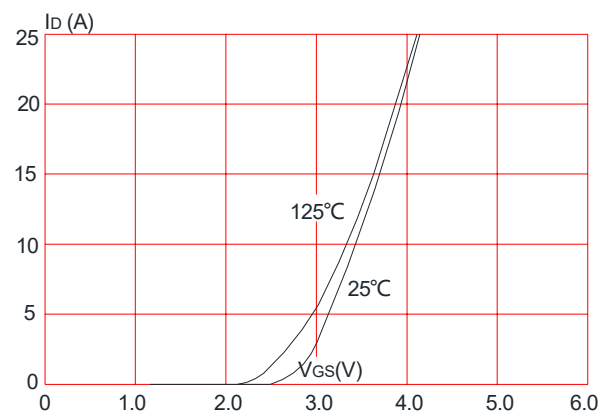
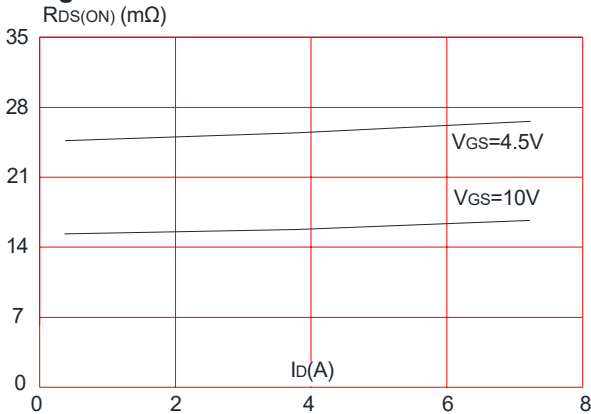
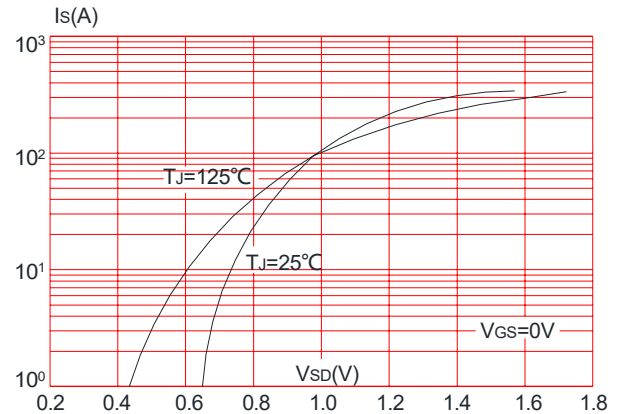
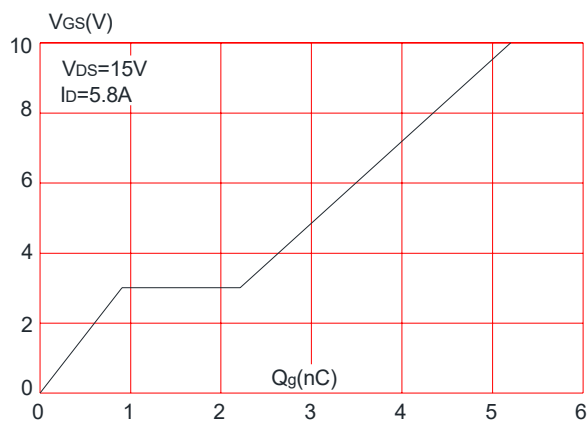
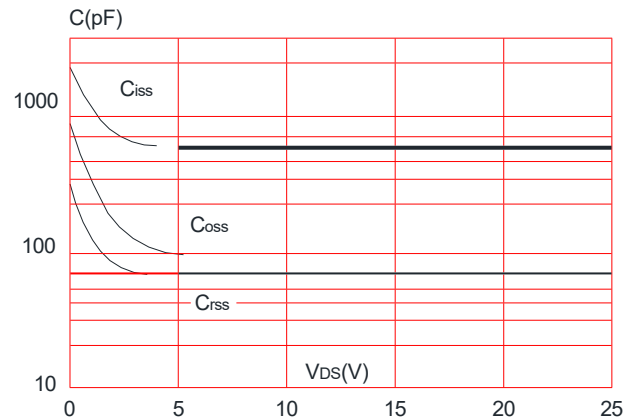
T_J=25°C, V_{DD}= -15V, V_{GS}= -10V, L=0.5mH, R_g=25Ω, I_{AS}= -7A

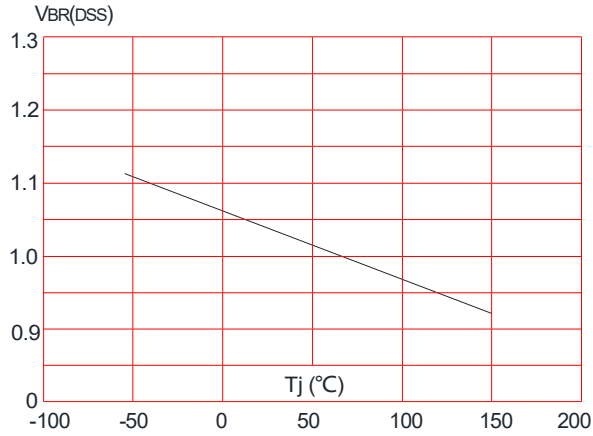
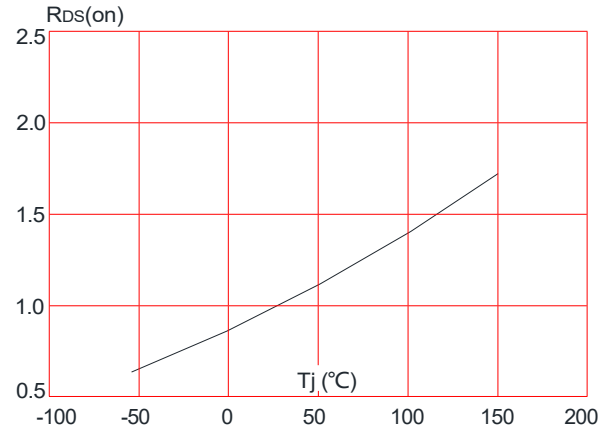
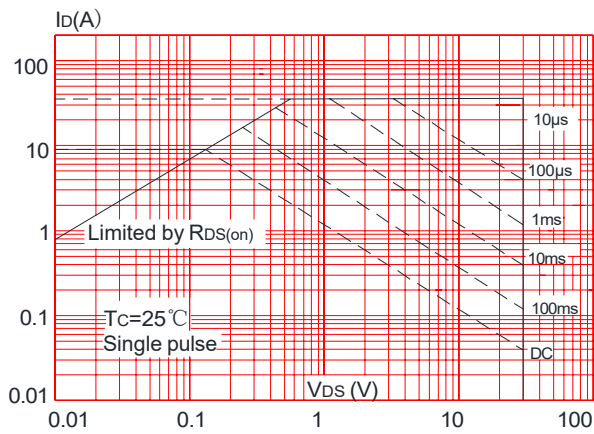
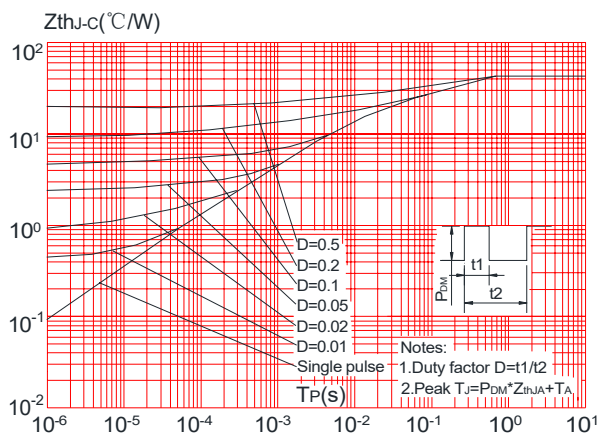
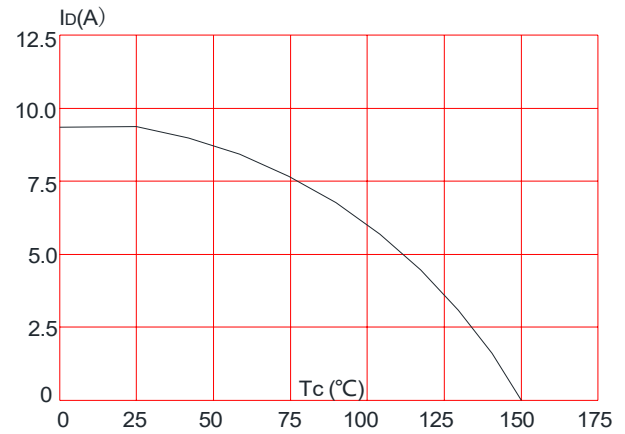
3. Pulse Test: Pulse Width≤300μs, Duty Cycle≤0.5%

P-Channel Electrical Characteristics (T_J=25°C unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
Off Characteristic						
V _{(BR)DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _D = -250μA	-30	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = -30V, V _{GS} =0V,	-	-	-1	μA
I _{GSS}	Gate to Body Leakage Current	V _{DS} =0V, V _{GS} = ±20V	-	-	±100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D = -250μA	-1.0	-1.6	-2.5	V
R _{DS(on)}	Static Drain-Source on-Resistance note3	V _{GS} = -10V, I _D = -4.1A	-	40	52	mΩ
		V _{GS} = -4.5V, I _D = -3.5A	-	64	90	
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = -15V, V _{GS} =0V, f=1.0MHz	-	580	-	pF
C _{oss}	Output Capacitance		-	98	-	pF
C _{rss}	Reverse Transfer Capacitance		-	74	-	pF
Q _g	Total Gate Charge	V _{DS} = -15V, I _D = -4.1A, V _{GS} = -10V	-	6.8	-	nC
Q _{gs}	Gate-Source Charge		-	1	-	nC
Q _{gd}	Gate-Drain(“Miller”) Charge		-	1.4	-	nC
Switching Characteristics						
t _{d(on)}	Turn-on Delay Time	V _{DD} = -15V, I _D = -1A, V _{GS} = -10V, R _{GEN} =2.5Ω	-	14	-	ns
t _r	Turn-on Rise Time		-	61	-	ns
t _{d(off)}	Turn-off Delay Time		-	19	-	ns
t _f	Turn-off Fall Time		-	10	-	ns
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain to Source Diode Forward Current		-	-	-5	A
I _{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	-20	A
V _{SD}	Drain to Source Diode Forward Voltage	V _{GS} =0V, I _S = -5A	-	-0.8	-1.2	V

Typical Performance Characteristics-N

Figure1: Output Characteristics

Figure 2: Typical Transfer Characteristics

Figure 3: On-resistance vs. Drain Current

Figure 4: Body Diode Characteristics

Figure 5: Gate Charge Characteristics

Figure 6: Capacitance Characteristics



Figure 9: Maximum Safe Operating Area

Figure 10: Maximum Continuous Drain Current vs. Case Temperature

Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient


Test Circuit-N

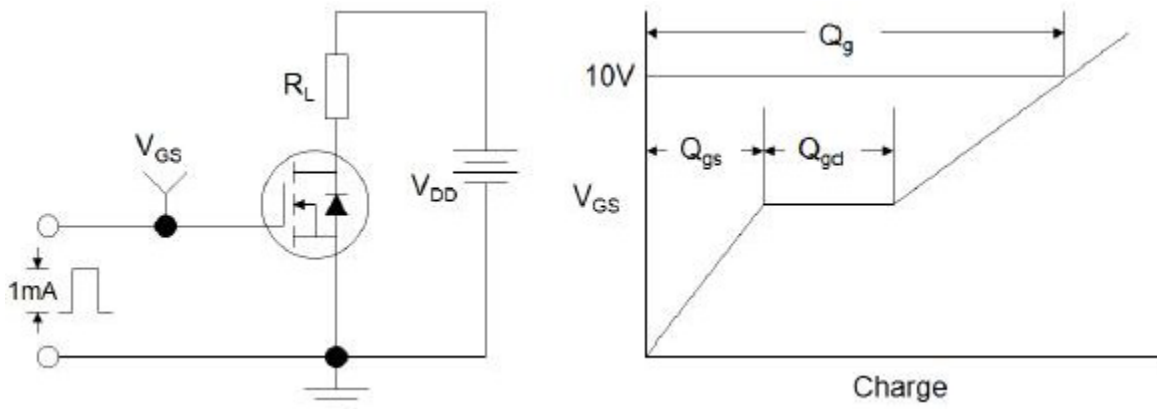


Figure1:Gate Charge Test Circuit & Waveform

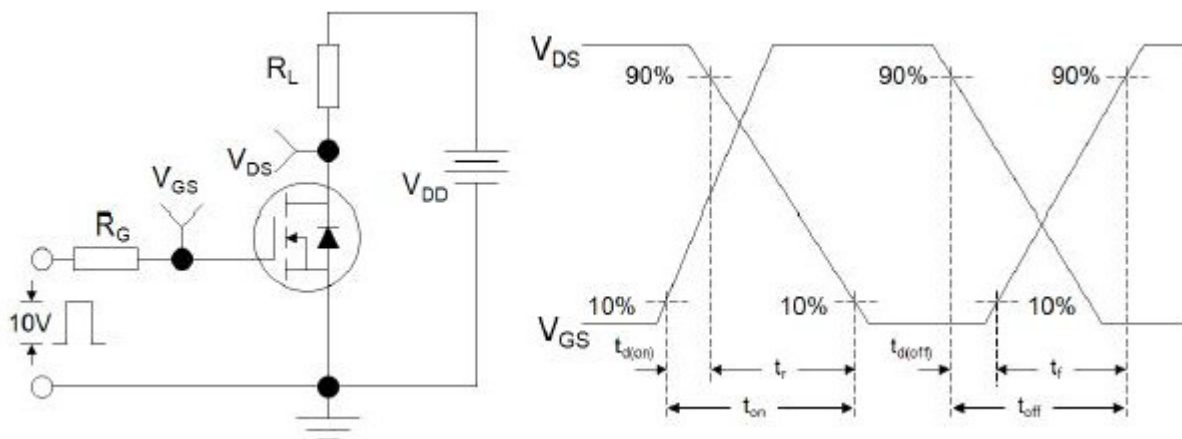


Figure 2: Resistive Switching Test Circuit & Waveforms

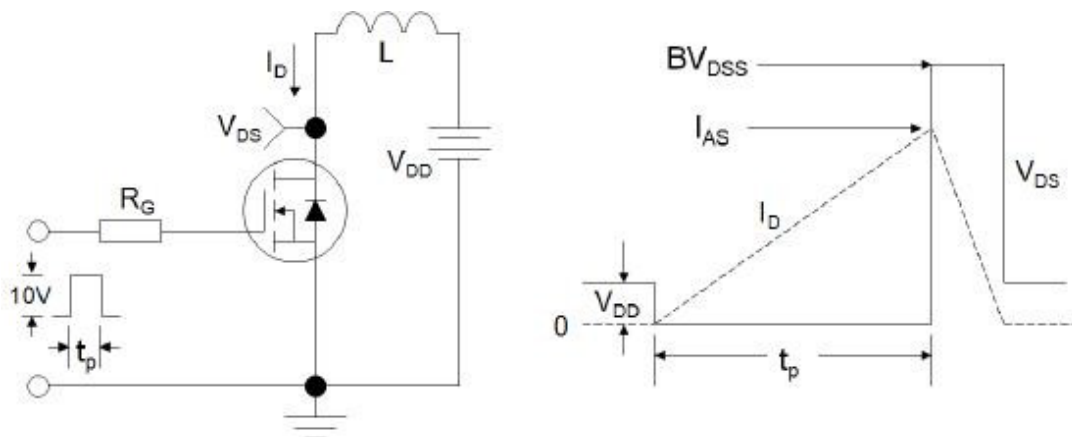


Figure 3:Unclamped Inductive Switching Test Circuit & Waveforms

Typical Performance Characteristics-P

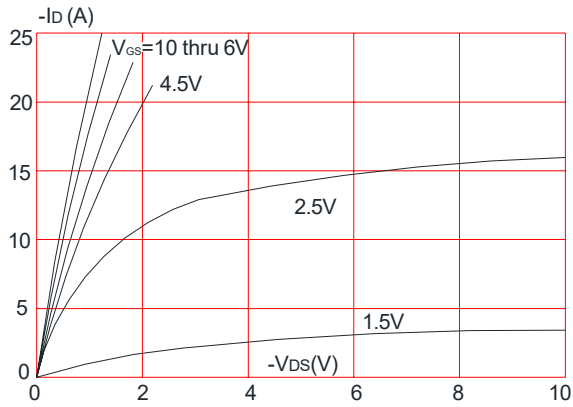
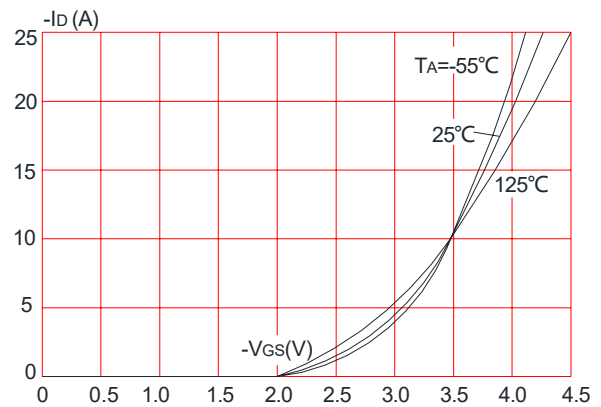
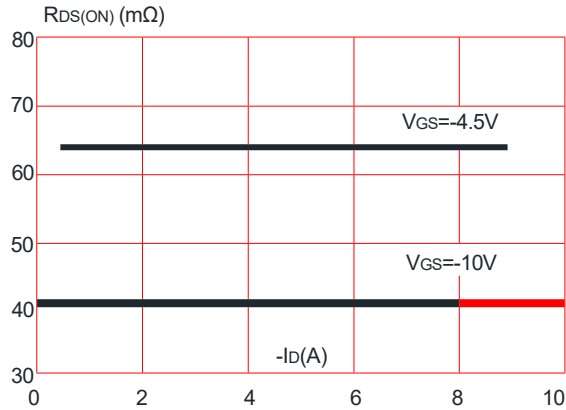
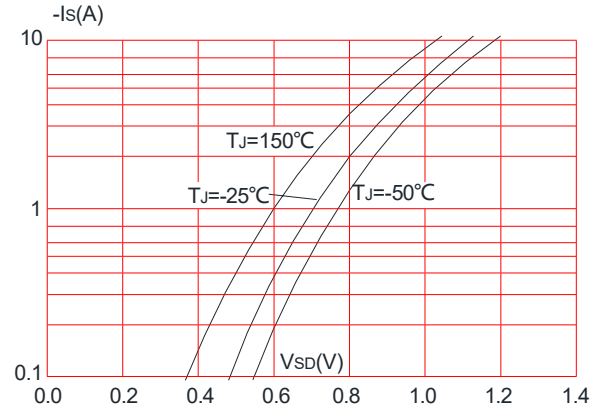
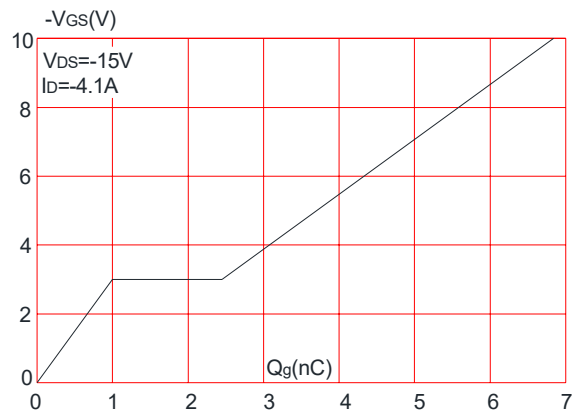
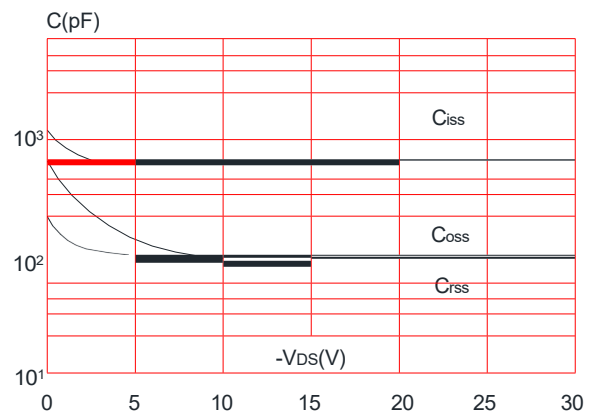
Figure1: Output Characteristics

Figure 2: Typical Transfer Characteristics

Figure 3: On-resistance vs. Drain Current

Figure 4: Body Diode Characteristics

Figure 5: Gate Charge Characteristics

Figure 6: Capacitance Characteristics


Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

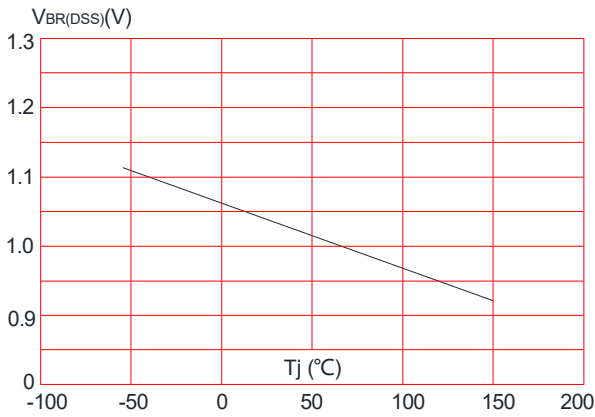


Figure 8: Normalized on Resistance vs. Junction Temperature

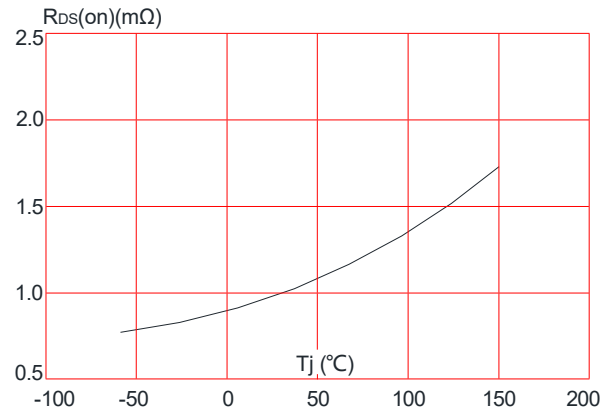


Figure 9: Maximum Safe Operating Area

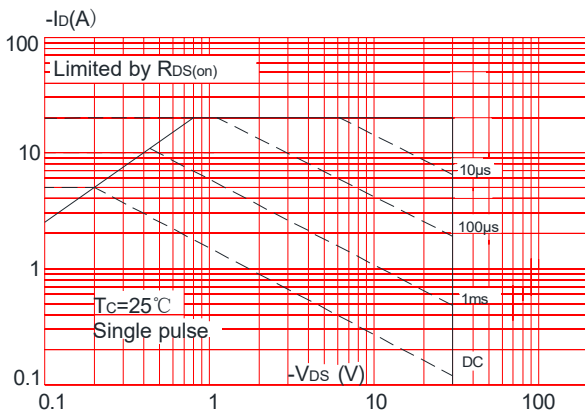


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

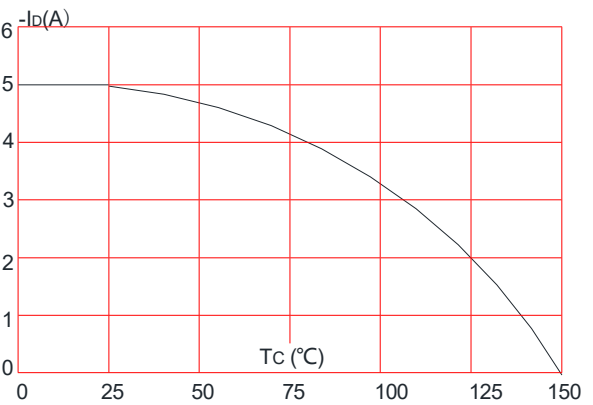
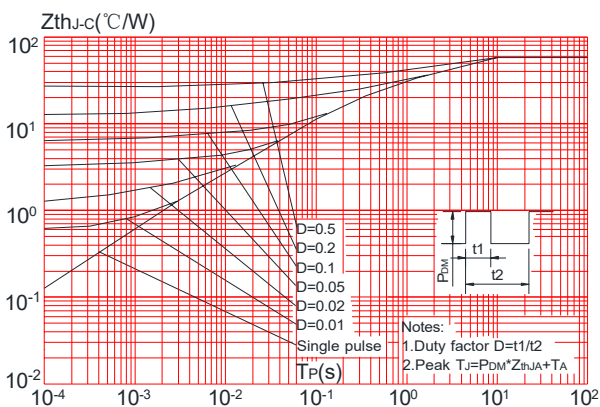
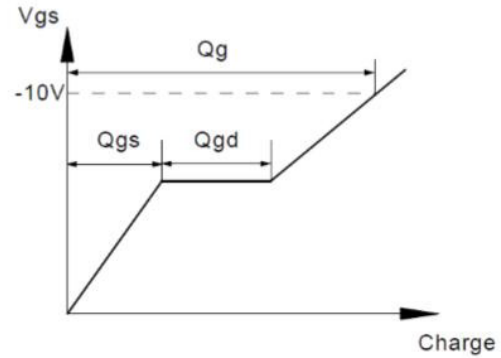
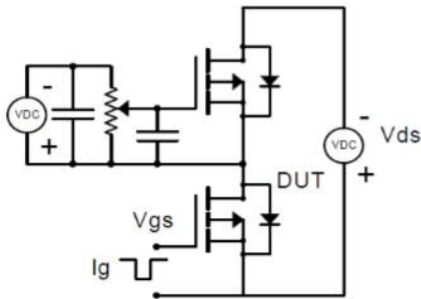


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

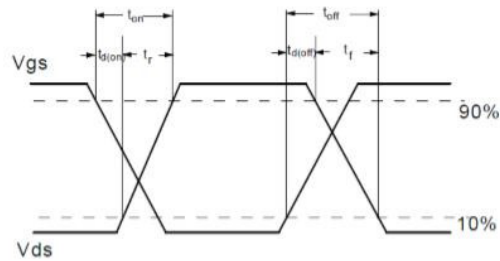
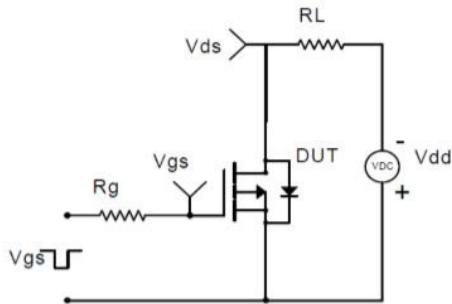


Test Circuit-P

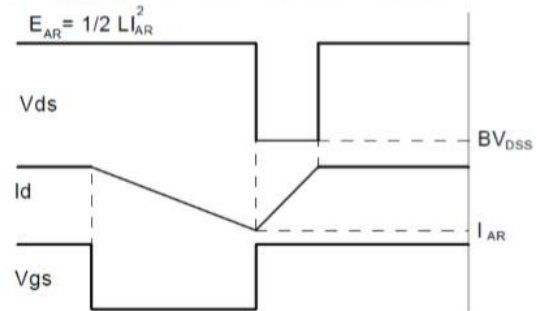
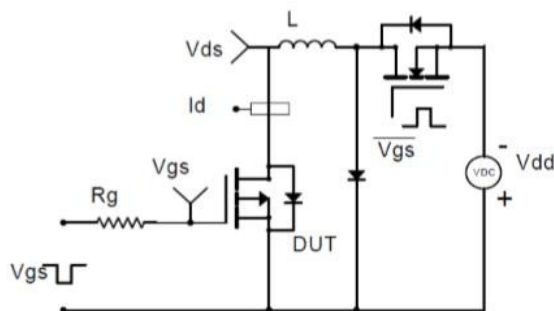
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

