

Description

Features

- N-Channel: 30V, 12A
 $R_{DS(ON)} < 12m\Omega @ V_{GS} = 10V$
 $R_{DS(ON)} < 17.8m\Omega @ V_{GS} = 4.5V$
- P-Channel: -30V, -10A
 $R_{DS(ON)} < 26.3m\Omega @ V_{GS} = -10V$
 $R_{DS(ON)} < 40.3m\Omega @ V_{GS} = -4.5V$
- Excellent Gate Charge x $R_{DS(ON)}$ Product(FOM)
- Very Low On-resistance $R_{DS(ON)}$
- Fast Switching Speed

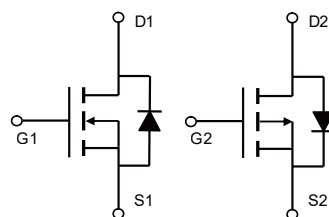
Application

- Battery Protection
- Load Switch
- Power Management

100% UIS TESTED!
100% ΔV_{ds} TESTED!



DFN5x6



Schematic

Package Marking and Ordering Information

Device Marking	Device	Outline	Package	Reel Size	Reel (pcs)	Per Carton (pcs)
VSM12NP03	VSM12NP03-D56	TAPING	DFN5x6	13"	2500	25000

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	T _C = 25°C	-10	A
		T _C = 100°C	-6.5	A
I _{DM}	Pulsed Drain Current ^{note1}	48	-40	A
E _{AS}	Single Pulsed Avalanche Energy ^{note2}	42	36	mJ
P _D	Power Dissipation	T _C = 25°C	4.3	W
R _{θJC}	Thermal Resistance, Junction to Case	39	29	°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 Characteristics						
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,	-	-	1.0	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 note3	V _{GS} =10V, I _D =6A	-	9.6	12	mΩ
		V _{GS} =4.5V, I _D =3A	-	13.7	17.8	
Dynamic Characteristics						
C _{iSS}	Input Capacitance	V _{DS} =15V, V _{GS} =0V, f=1.0MHz	-	1011	-	pF
C _{oSS}	Output Capacitance		-	142	-	pF
C _{rSS}	Reverse Transfer Capacitance		-	119	-	pF
Q _g	Total Gate Charge	V _{DD} =15V, I _D =6A, V _{GS} =10V	-	19	-	nC
Q _{gs}	Gate-Source Charge		-	6.3	-	nC
Q _{gd}	Gate-Drain(“Miller”) Charge		-	4.5	-	nC
Switching Characteristics						
t _{d(on)}	Turn-on Delay Time	V _{DD} =15V,I _D =6A, R _{GEN} =3Ω, V _{GS} =10V	-	6	-	ns
t _r	Turn-on Rise Time		-	5	-	ns
t _{d(off)}	Turn-off Delay Time		-	25	-	ns
t _f	Turn-off Fall Time		-	7	-	ns
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain to Source Diode Forward Current		-	-	12	A
I _{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	48	A
V _{SD}	Drain to Source Diode Forward Voltage	V _{GS} =0V, I _S =12A	-	-	1.2	V
trr	Body Diode Reverse Recovery Time	I _F =12A, di/dt=100A/μs	-	7	-	ns
Qrr	Body Diode Reverse Recovery Charge		-	6.3	-	nC

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

2. EAS condition: Starting T_J=25°C, V_{DD}=15V, V_{GS}=10V, R_g=25Ω, L=0.5mH, I_{AS}=13A

3. Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%

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

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
Off Characteristics						
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 = -10A	-	21	26.3	mΩ
		V _{GS} = -4.5V, I _D = -5A	-	31	40.3	
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = -15V, V _{GS} =0V, f=1.0MHz	-	1240	-	pF
C _{oss}	Output Capacitance		-	151	-	pF
C _{rss}	Reverse Transfer Capacitance		-	138	-	pF
Q _g	Total Gate Charge	V _{DD} = -15V, I _D = -6A, V _{GS} = -10V	-	24	-	nC
Q _{gs}	Gate-Source Charge		-	3.7	-	nC
Q _{gd}	Gate-Drain(“Miller”) Charge		-	4.8	-	nC
Switching Characteristics						
t _{d(on)}	Turn-on Delay Time	V _{DD} = -15V, I _D = -10A, V _{GS} = -10V, R _{GEN} =3Ω	-	11	-	ns
t _r	Turn-on Rise Time		-	5.5	-	ns
t _{d(off)}	Turn-off Delay Time		-	3.5	-	ns
t _f	Turn-off Fall Time		-	4.6	-	ns
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain to Source Diode Forward Current		-	-	-10	A
I _{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	-40	A
V _{SD}	Drain to Source Diode Forward Voltage	V _{GS} =0V, I _S = -10A	-	-	-1.2	V

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

2. EAS condition: Starting T_J=25°C, V_{DD}=-15V, V_{GS}=-10V, R_g=25Ω, L=0.5mH, I_{AS}= -12A

3. Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%

Typical Performance Characteristics-N

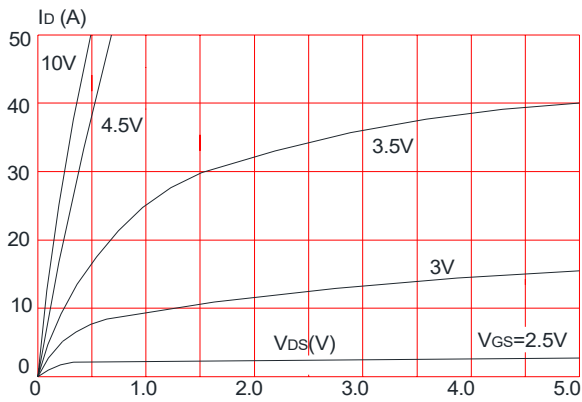
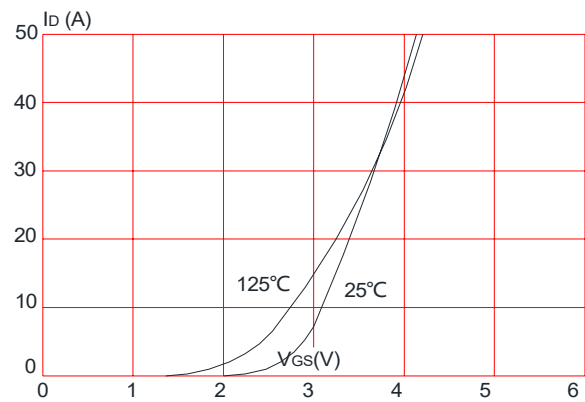
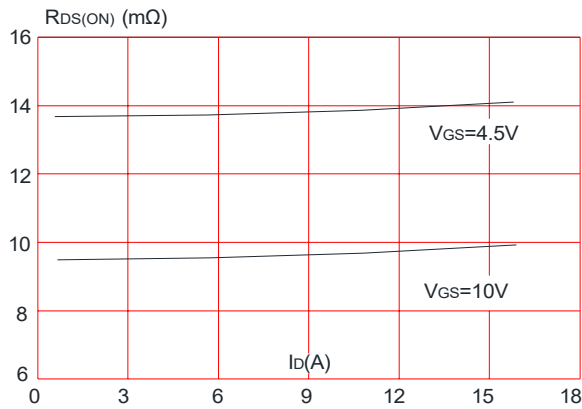
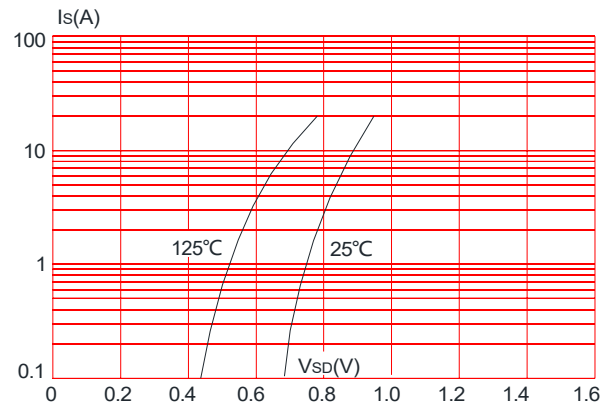
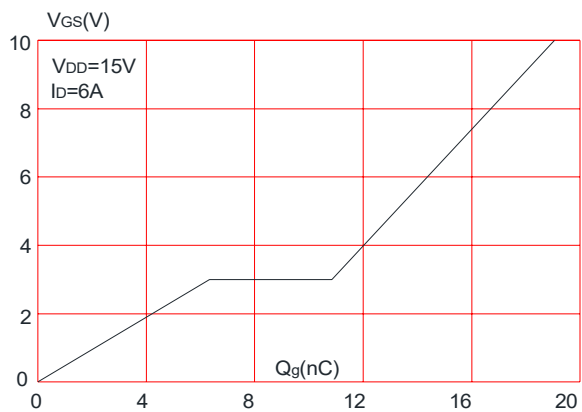
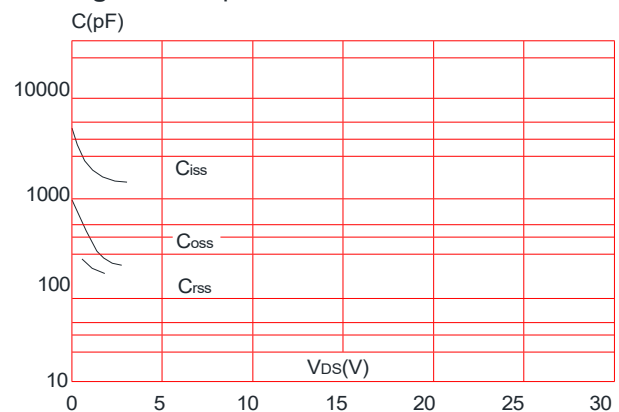
Figure 1: Output Characteristics

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

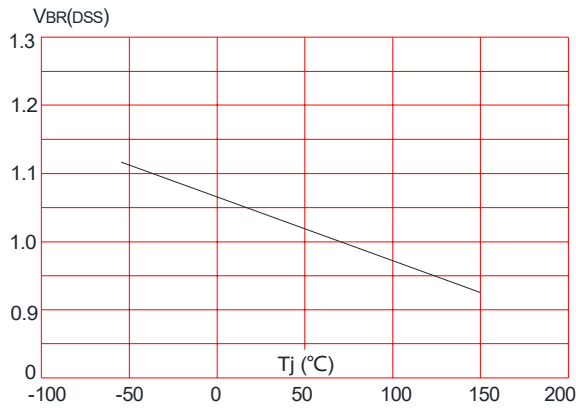


Figure 8: Normalized on Resistance vs. Junction Temperature

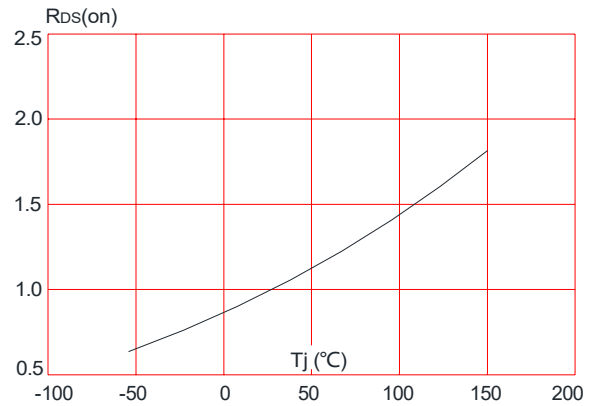


Figure 9: Maximum Safe Operating Area

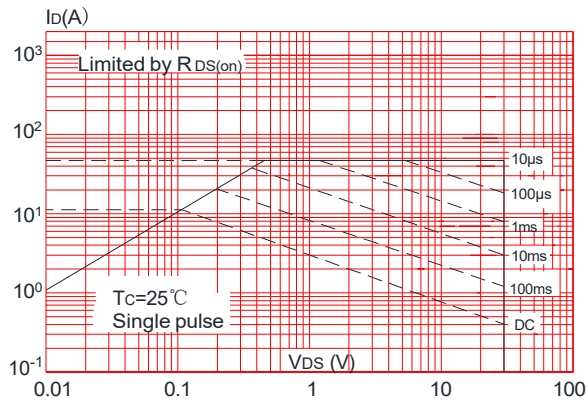


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

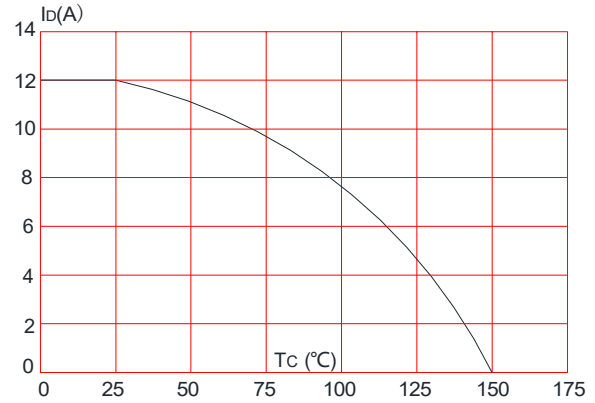
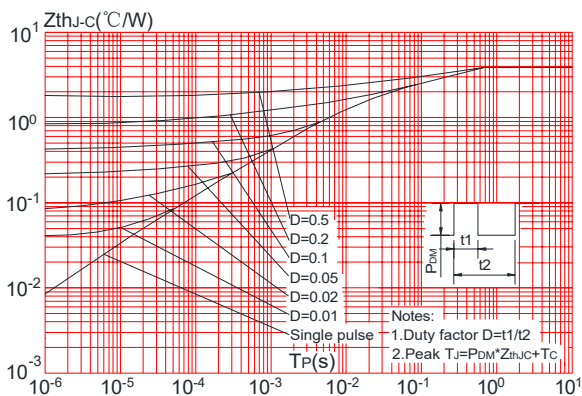


Figure 11: Maximum Effective Transient Thermal Impedance, Junction-to-Case



Test Circuit-N

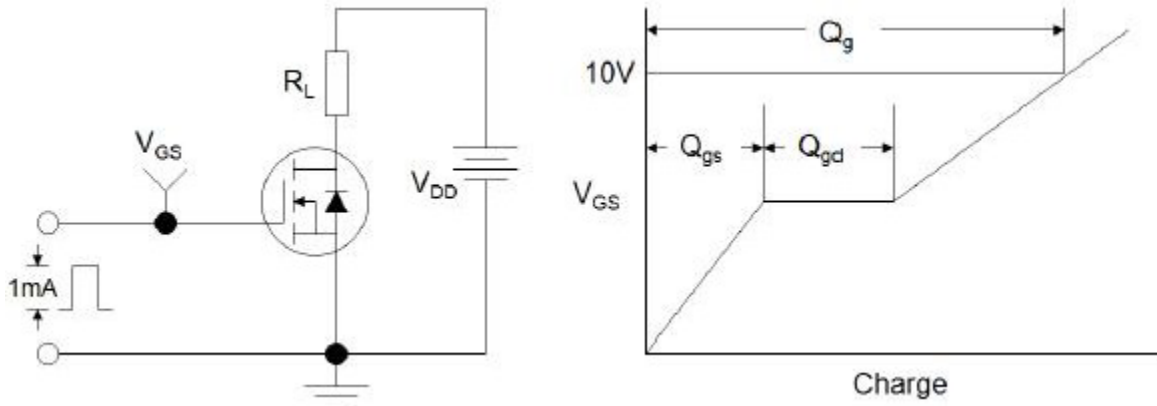


Figure1:Gate Charge Test Circuit & Waveform

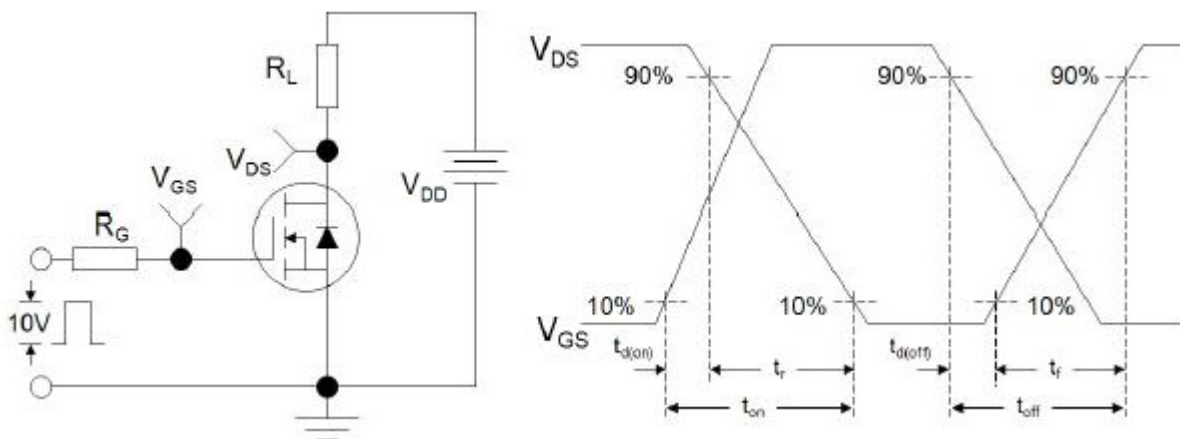


Figure 2: Resistive Switching Test Circuit & Waveforms

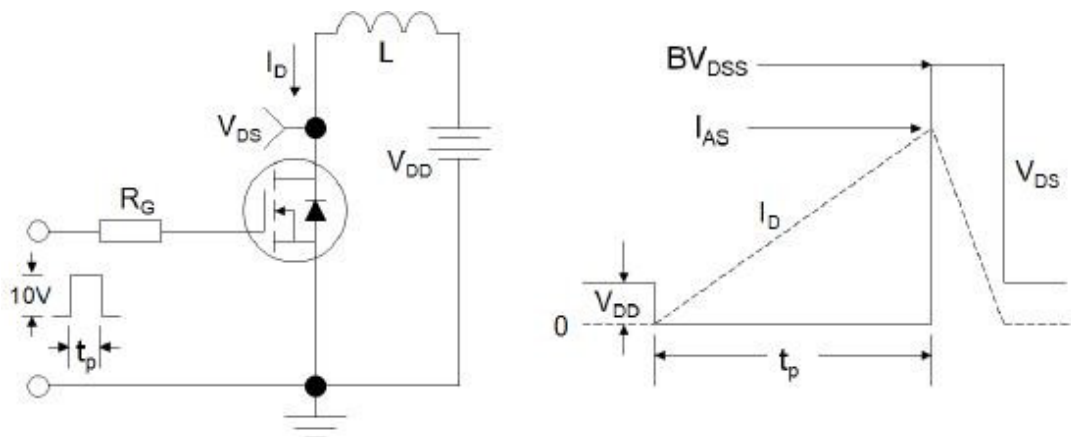


Figure 3:Unclamped Inductive Switching Test Circuit & Wavefor

Typical Performance Characteristics-P

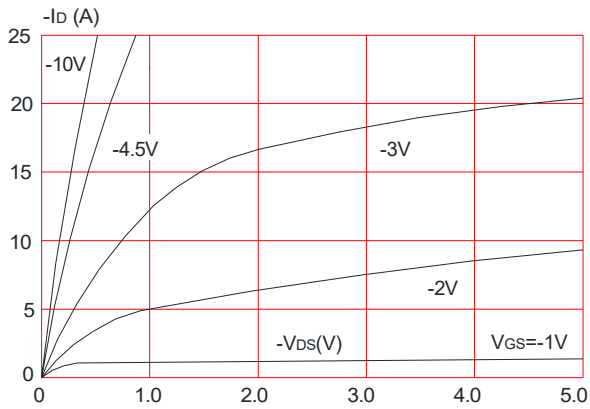
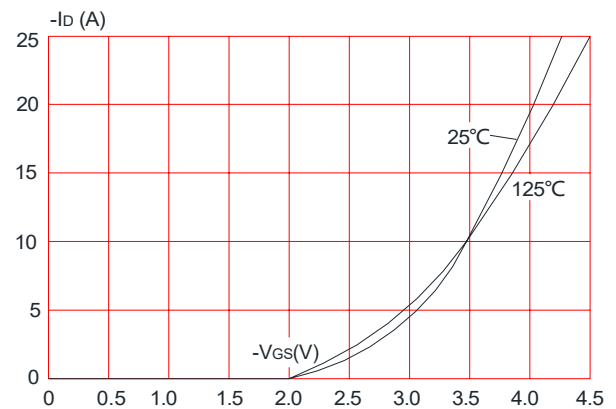
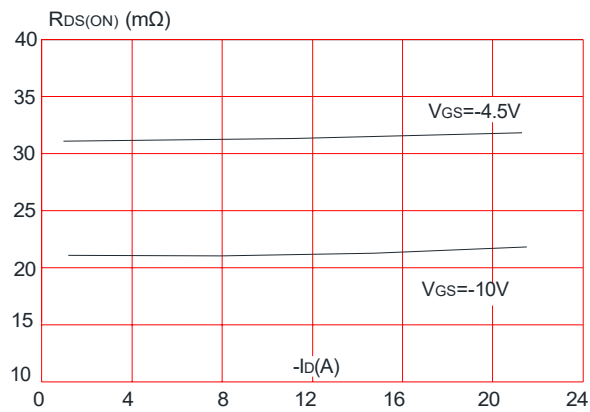
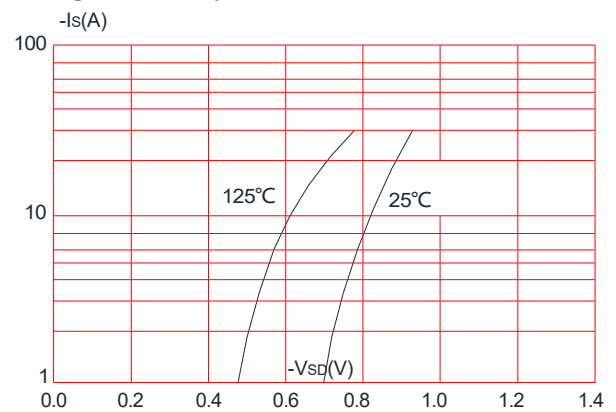
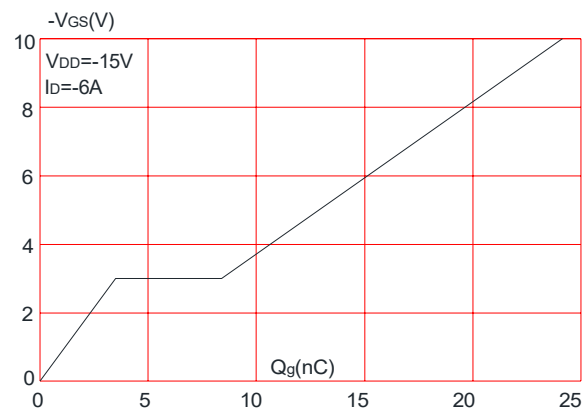
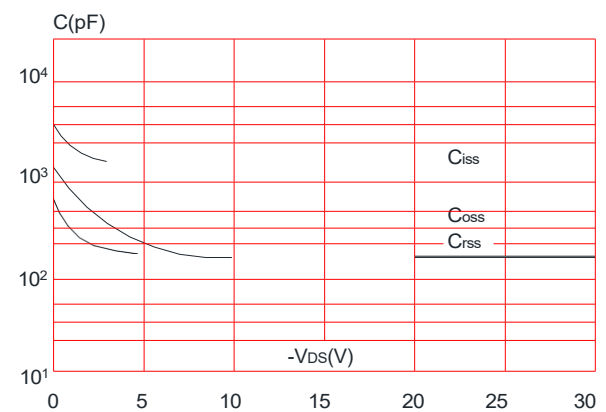
Figure 1: Output Characteristics

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

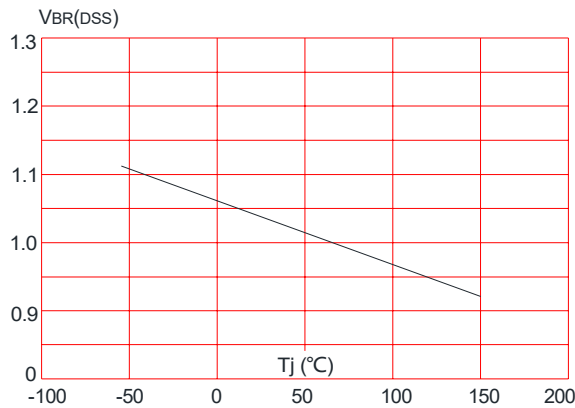


Figure 8: Normalized on Resistance vs. Junction Temperature

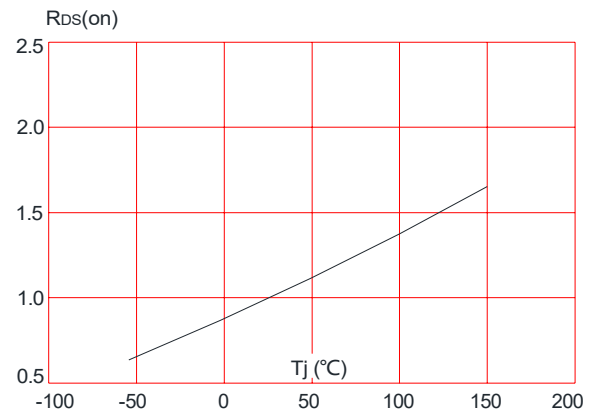


Figure 9: Maximum Safe Operating Area

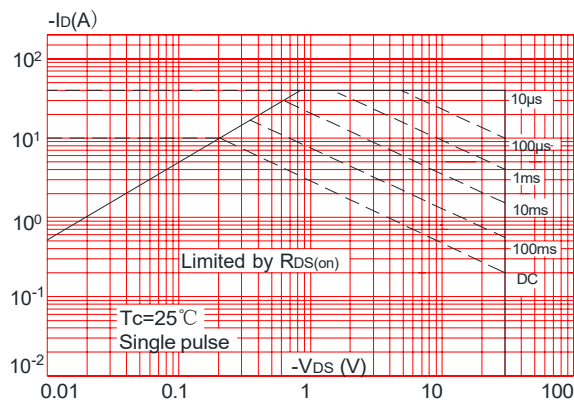


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

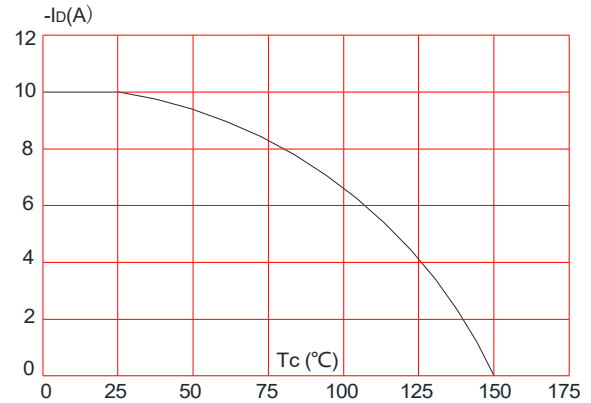
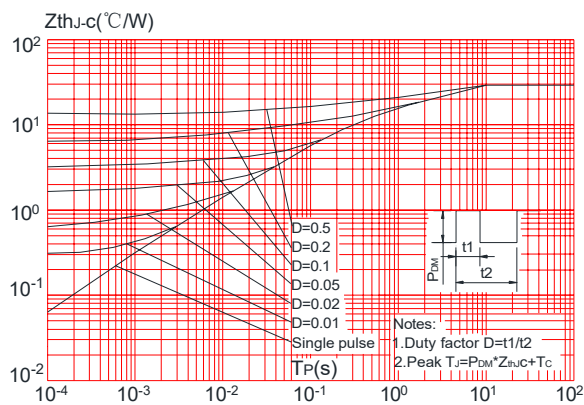
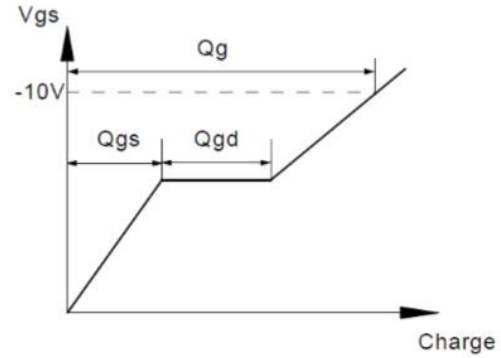
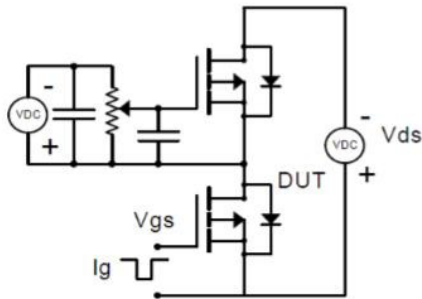


Figure 11: Maximum Effective Transient Thermal Impedance, Junction-to-Case

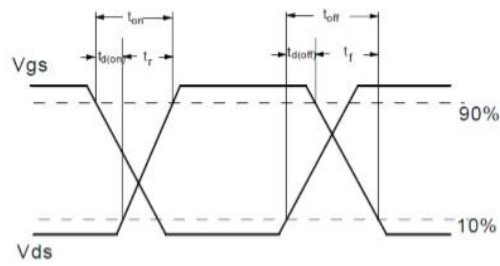
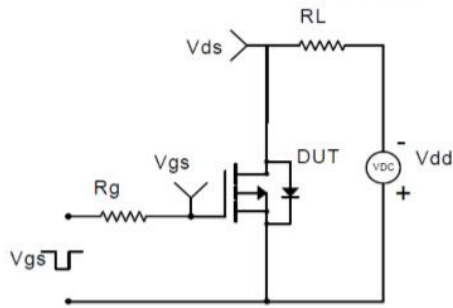


Test Circuit-P

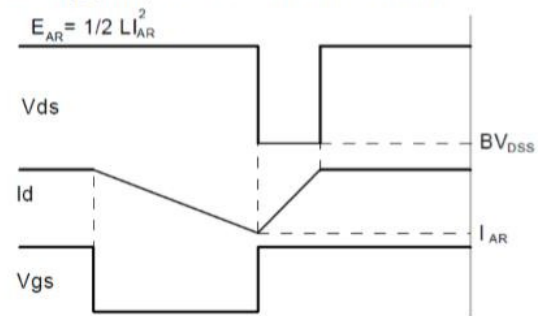
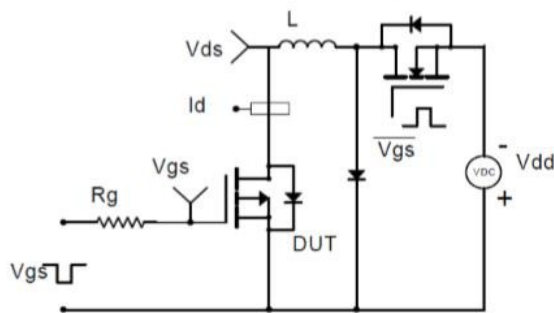
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

