

Description

The VSM12NP03 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. This device is suitable for use in inverter and other applications.

General Features

N-channel

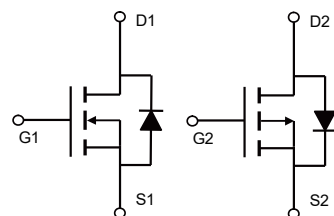
- $V_{DS} = 30V, I_D = 18A$
 $R_{DS(ON)} < 24m\Omega @ V_{GS}=10V$
 $R_{DS(ON)} < 37m\Omega @ V_{GS}=4.5V$
- High Power and current handling capability
- Lead free product is acquired
- Surface mount package

P-channel

- $V_{DS} = -30V, I_D = -12A$
 $R_{DS(ON)} < 35m\Omega @ V_{GS}=-10V$
 $R_{DS(ON)} < 75m\Omega @ V_{GS}=-4.5V$



DFN5x6



Schematic

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VSM12NP03	VSM12NP03-D56	DFN5x6	-	-	-

Absolute Maximum Ratings ($T_c=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	N-channel	P-channel	Unit
Drain-Source Voltage	V_{DS}	30	-30	V
Gate-Source Voltage	V_{GS}	± 20	± 20	V
Drain Current-Continuous (Note 2)	I_D	18	-12	A
		13.7	-9.4	
Drain Current - Pulsed (Note 1)	I_{DM}	72	-48	A
Power Dissipation	P_D	17	15	W
		11.1	9.6	
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150	-55 To 150	$^\circ\text{C}$

Thermal Characteristic

Thermal Resistance, Junction-to-Case (Note 2) (N-channel)	$R_{\theta JC}$	7.4	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Case (Note 2) (P-channel)	$R_{\theta JC}$	8.3	$^\circ\text{C/W}$

N-channel Electrical Characteristics ($T_c=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	30	33	-	V

Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =30V,V _{GS} =0V	-	-	1	μA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V,V _{DS} =0V	-	-	±100	nA
On Characteristics (Note 3)						
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} ,I _D =250μA	1.2	1.6	2.2	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =9A	-	19	24	mΩ
		V _{GS} =4.5V, I _D =9A	-	26	37	mΩ
Forward Transconductance	g _{FS}	V _{DS} =5V,I _D =9A	15	-	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =15V,V _{GS} =0V, F=1.0MHz	-	547	-	PF
Output Capacitance	C _{OSS}		-	65.6	-	PF
Reverse Transfer Capacitance	C _{rSS}		-	58.8	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =15V,I _D =9A V _{GS} =10V,R _{GEN} =6Ω	-	4.5	-	nS
Turn-on Rise Time	t _r		-	2.5	-	nS
Turn-Off Delay Time	t _{d(off)}		-	14.5	-	nS
Turn-Off Fall Time	t _f		-	3.5	-	nS
Total Gate Charge	Q _g	V _{DS} =15V,I _D =9A, V _{GS} =10V	-	15	-	nC
Gate-Source Charge	Q _{gs}		-	3.2	-	nC
Gate-Drain Charge	Q _{gd}		-	2.9	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V,I _S =9A	-	0.8	1.2	V
Diode Forward Current (Note 2)	I _S		-	-	18	A

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. The value of $R_{\theta JA}$ is measured with the device mounted on 1in 2 FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ C$. The value in any given application depends on the user's specific board design. Surface Mounted on FR4 Board, $t \leq 10$ sec. The current rating is based on the $t \leq 10s$ thermal resistance rating.
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production .

N-channel Typical Electrical and Thermal Characteristics

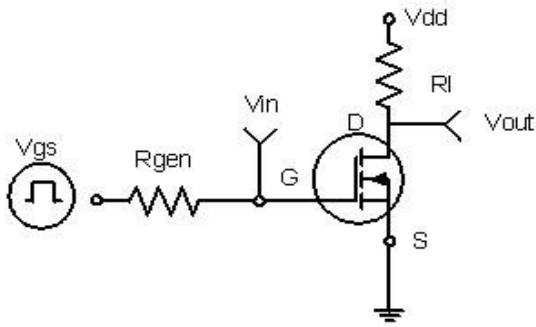


Figure 1: Switching Test Circuit

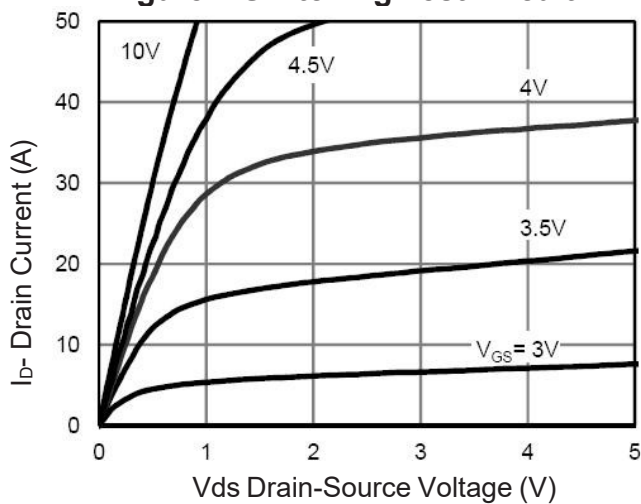


Figure 3 Output Characteristics

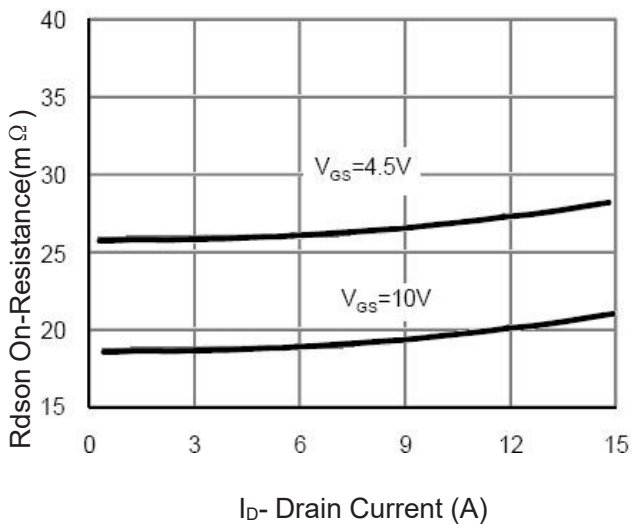


Figure 5 Drain-Source On-Resistance

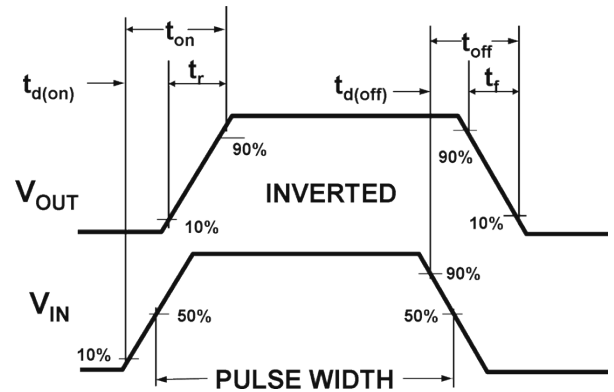


Figure 2: Switching Waveforms

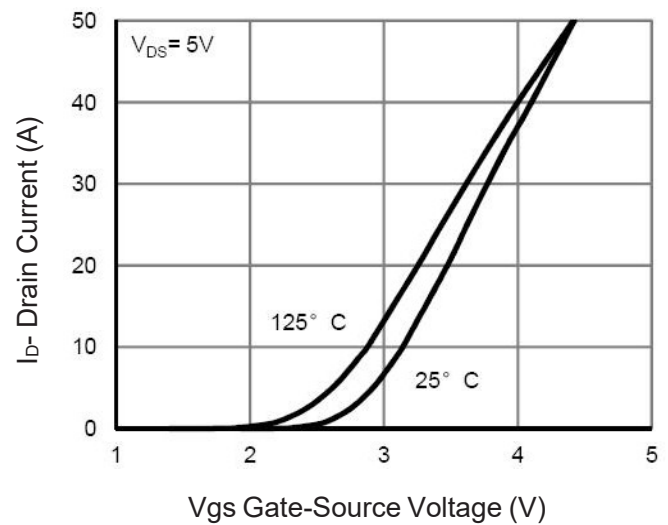


Figure 4 Transfer Characteristics

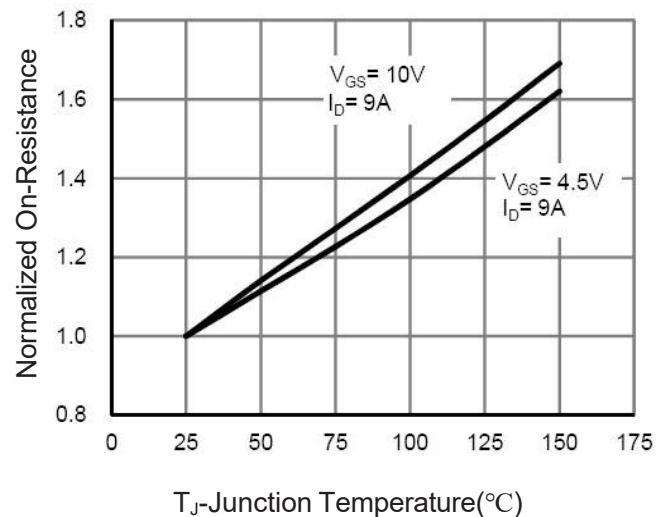
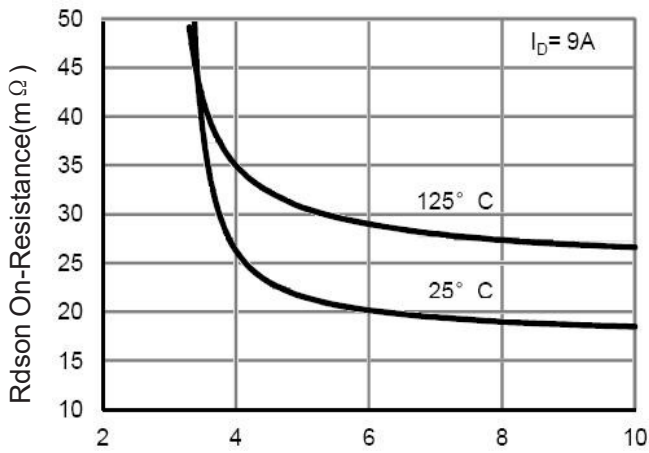
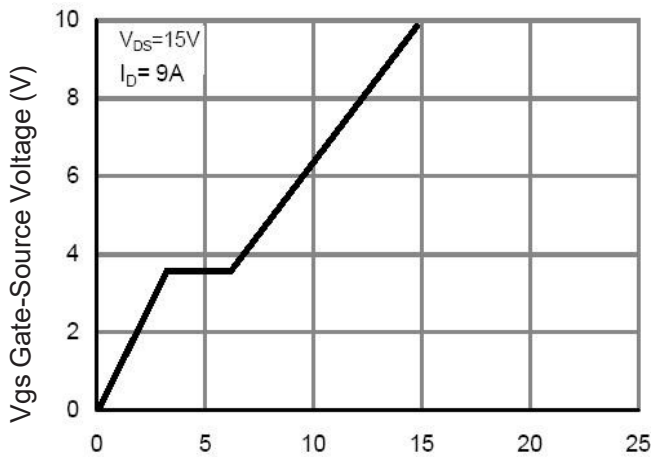


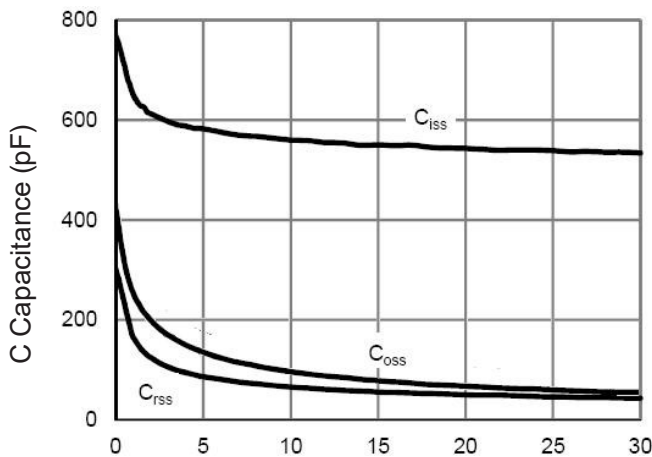
Figure 6 Drain-Source On-Resistance



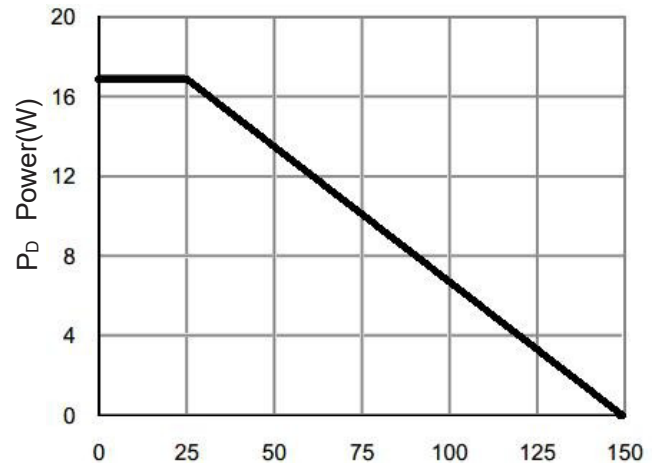
Vgs Gate-Source Voltage (V)

Figure7 Rdson vs Vgs


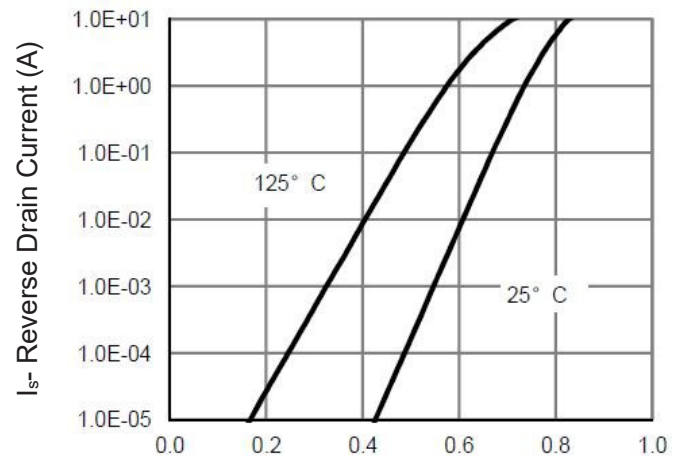
Qg Gate Charge (nC)

Figure 9 Gate Charge


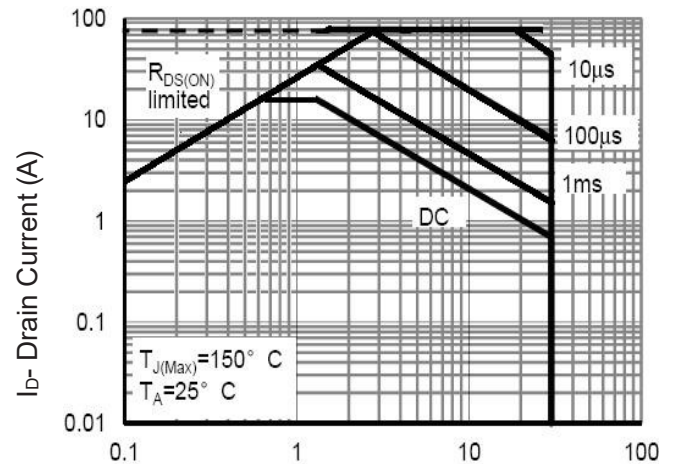
Vds Drain-Source Voltage (V)

Figure 11 Capacitance vs Vds


TJ-Junction Temperature(°C)

Figure 8 Power Dissipation


Vds Drain-Source Voltage (V)

Figure 10 Source- Drain Diode Forward


Vds Drain-Source Voltage (V)

Figure 12 Safe Operation Area

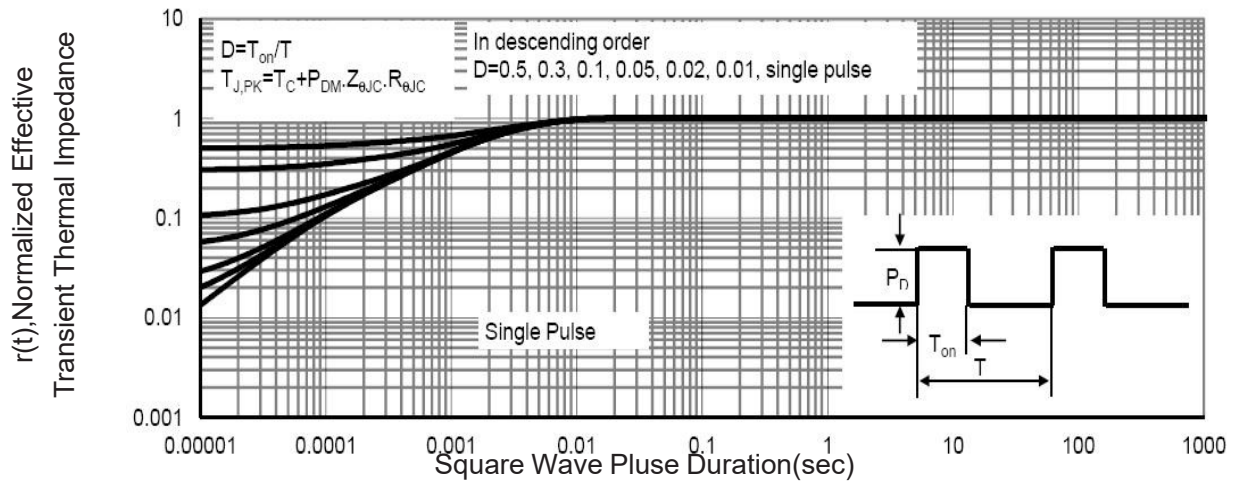


Figure 13 Normalized Maximum Transient Thermal Impedance

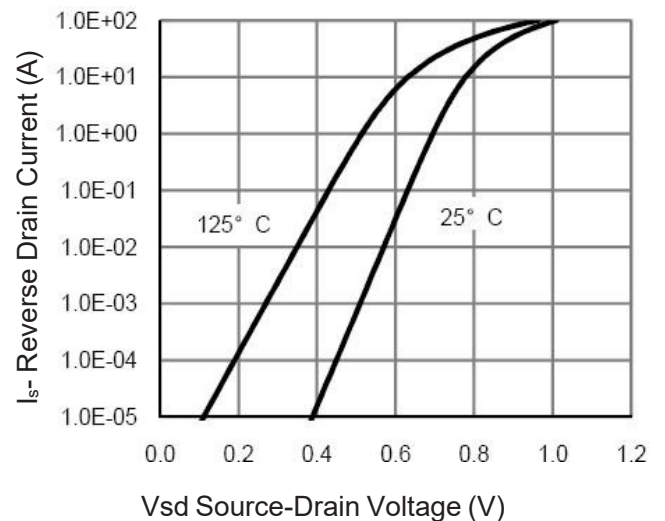
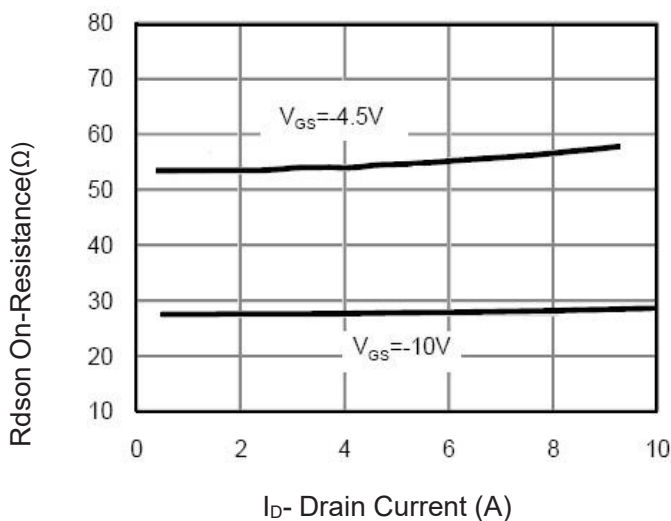
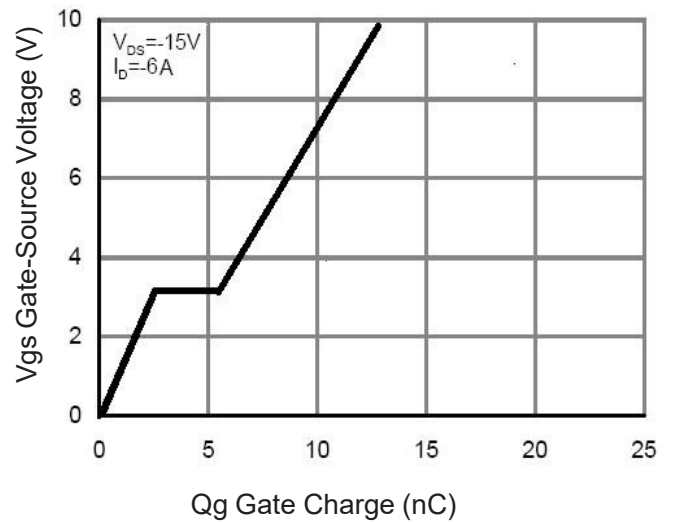
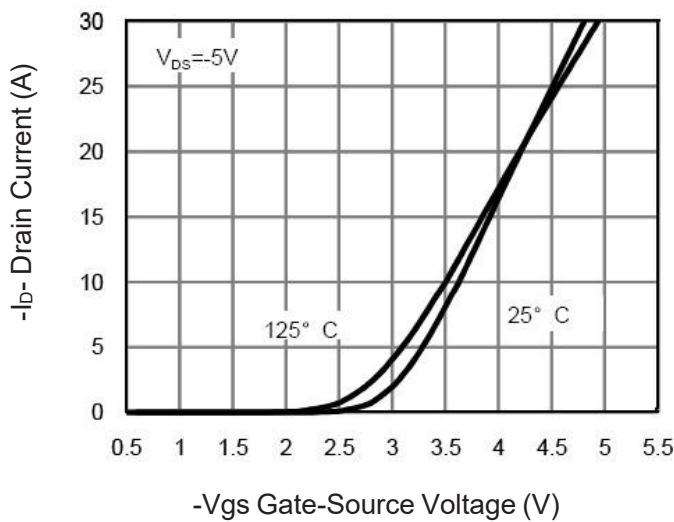
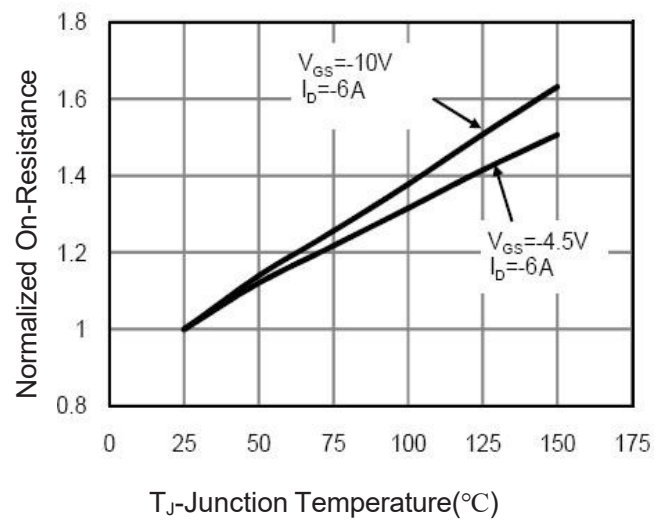
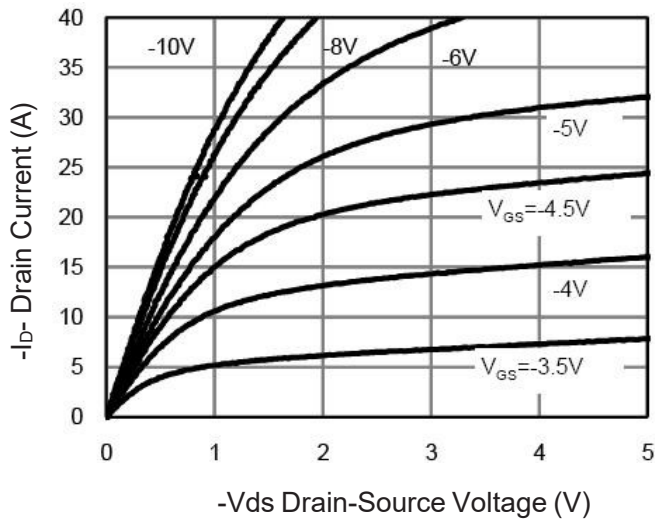
Electrical Characteristics ($T_A=25^{\circ}\text{C}$ unless otherwise noted)

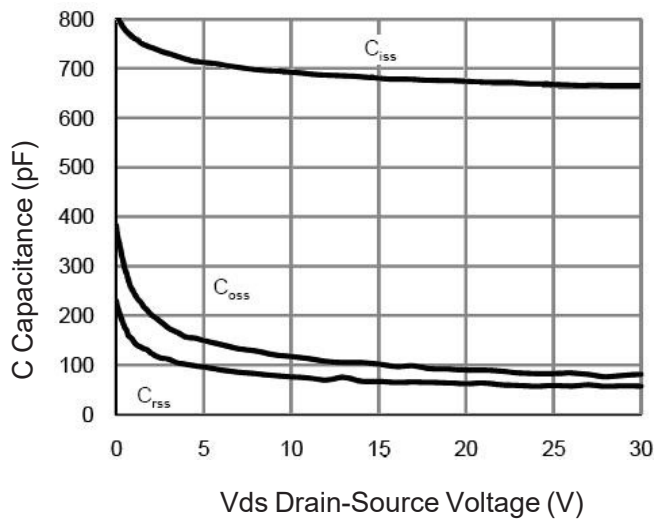
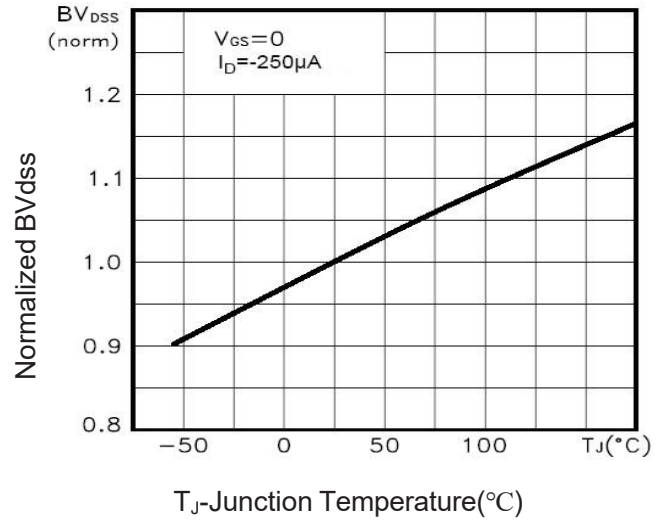
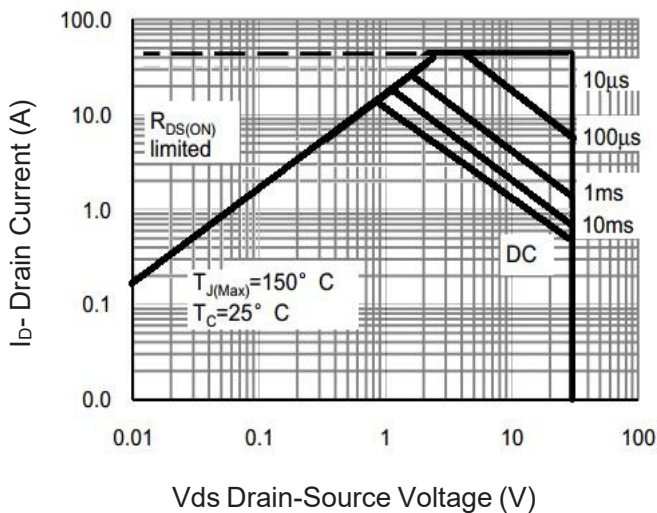
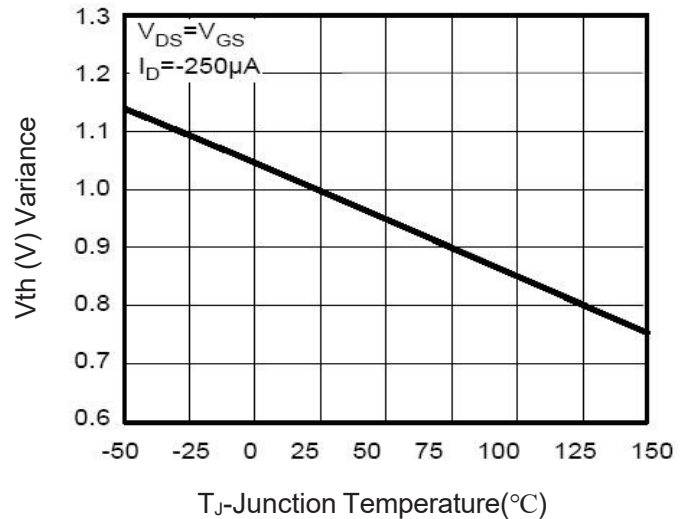
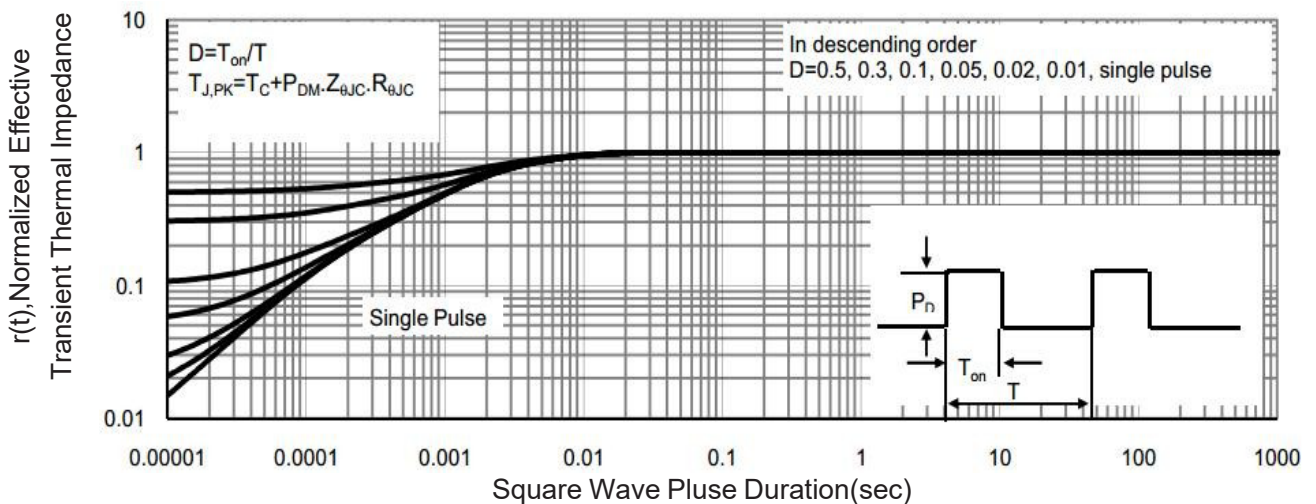
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=-250\mu A$	-30	-33	-	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=-30V, V_{GS}=0V$	-	-	1	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	± 100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1.2	-1.7	-2.5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=-10V, I_D=-6A$	-	29	35	m Ω
		$V_{GS}=-4.5V, I_D=-6A$	-	55	75	
Forward Transconductance	g_{FS}	$V_{DS}=-5V, I_D=-6A$	-	13	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C_{iss}	$V_{DS}=-15V, V_{GS}=0V,$ $F=1.0MHz$	-	691.9	-	PF
Output Capacitance	C_{oss}		-	113.7	-	PF
Reverse Transfer Capacitance	C_{rss}		-	109.4	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=-15V, I_D=-6A$ $V_{GS}=-10V, R_{GEN}=3\Omega$	-	7.5	-	nS
Turn-on Rise Time	t_r		-	5.5	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	19	-	nS
Turn-Off Fall Time	t_f		-	7	-	nS
Total Gate Charge	Q_g	$V_{DS}=-15V, I_D=-6A,$ $V_{GS}=-10V$	-	12.9	-	nC
Gate-Source Charge	Q_{gs}		-	2.5	-	nC
Gate-Drain Charge	Q_{gd}		-	2.7	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V_{SD}	$V_{GS}=0V, I_S=-6A$	-	-	-1.2	V
Diode Forward Current (Note 2)	I_S		-	-	-12	A

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, $t \leq 10$ sec.
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production

P- Channel Typical Electrical and Thermal Characteristics (Curves)




Figure 7 Capacitance vs Vds

Figure 9 BV_{DSS} vs Junction Temperature

Figure 8 Safe Operation Area

Figure 10 V_{GS(th)} vs Junction Temperature

Figure 11 Normalized Maximum Transient Thermal Impedance