

Description

The VSM16NP06 uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. It can be used in a wide variety of applications.

General Features

N channel

- $V_{DS} = 60V, I_D = 20A$
 $R_{DS(ON)} < 28m\Omega @ V_{GS} = 10V$
 $R_{DS(ON)} < 32m\Omega @ V_{GS} = 4.5V$

p channel

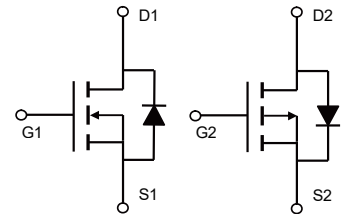
- $V_{DS} = -60V, I_D = -16A$
 $R_{DS(ON)} < 60m\Omega @ V_{GS} = -10V$
 $R_{DS(ON)} < 72m\Omega @ V_{GS} = -4.5V$
- High density cell design for ultra low R_{dson}
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high E_{AS}
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

Application

- H-bridge
- Inverters



DFN5x6



Schematic

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VSM16NP06	VSM16NP06-D56	DFN5x6	-	-	-

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

Parameter	Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage	V_{DS}	60	-60	V
Gate-Source Voltage	V_{GS}	± 20	± 20	V
Continuous Drain Current	I_D	20	-16	A
		14	-11.2	
Pulsed Drain Current (Note 1)	I_{DM}	60	-48	A
Maximum Power Dissipation	P_D	42		W
Single pulse avalanche energy (Note 5)	E_{AS}	72		mJ
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150		$^\circ C$

Thermal Characteristic

Thermal Resistance, Junction-to-Case (Note 2)	$R_{\theta JC}$	3	$^\circ C/W$
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Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	60	$^{\circ}C/W$
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N-Channel Electrical Characteristics ($T_C=25^{\circ}C$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V I _D =250μA	60	-	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =60V, V _{GS} =0V	-	-	1	μA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =250μA	1.2	1.6	2.5	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =10A	-	23	28	mΩ
		V _{GS} =4.5V, I _D =10A	-	27	32	mΩ
Forward Transconductance	g _{FS}	V _{DS} =5V, I _D =10A	11	-	-	S
Gate resistance	R _g	V _{DS} =0V, V _{GS} =0V, F=1.0MHz		2.2		Ω
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =30V, V _{GS} =0V, F=1.0MHz	-	973.2	-	PF
Output Capacitance	C _{oss}		-	61.2	-	PF
Reverse Transfer Capacitance	C _{rss}		-	58.8	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =30V ,R _L =3Ω V _{GS} =10V, R _G =3Ω	-	7	-	nS
Turn-on Rise Time	t _r		-	20	-	nS
Turn-Off Delay Time	t _{d(off)}		-	16	-	nS
Turn-Off Fall Time	t _f		-	23	-	nS
Total Gate Charge	Q _g	V _{DS} =30V, I _D =10A, V _{GS} =10V	-	25		nC
Gate-Source Charge	Q _{gs}		-	4.5		nC
Gate-Drain Charge	Q _{gd}		-	6.5		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V, I _S =10A	-		1.2	V
Diode Forward Current (Note 2)	I _S		-	-	20	A
Reverse Recovery Time	t _{rr}	T _J = 25°C, I _F =10A di/dt = 100A/μs (Note3)	-	29	-	nS
Reverse Recovery Charge	Q _{rr}		-	49	-	nC
Forward Turn-On Time	t _{on}	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

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
5. EAS condition: $T_J=25^{\circ}C, V_{DD}=30V, V_G=10V, L=0.5mH, R_g=25\Omega$

N-Channel Typical Electrical and Thermal Characteristics (Curves)

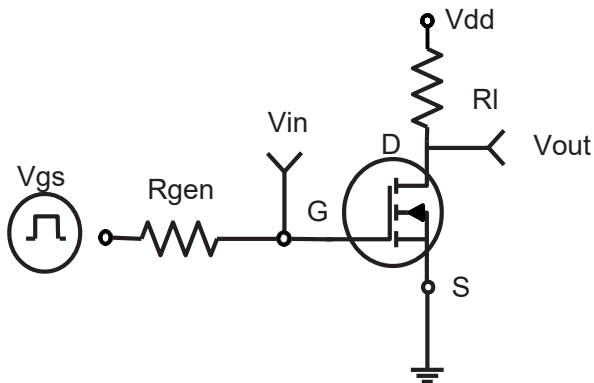


Figure 1: Switching Test Circuit

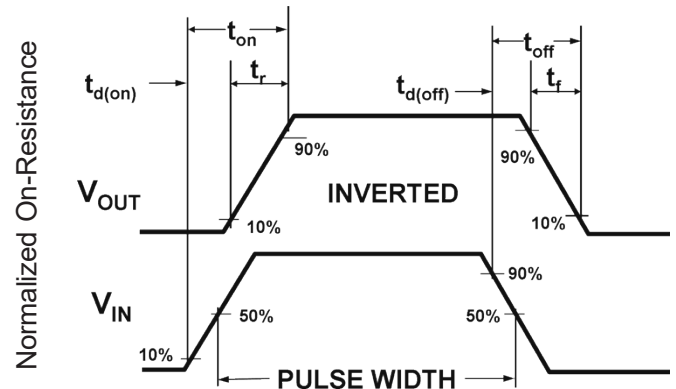


Figure 2: Switching Waveforms

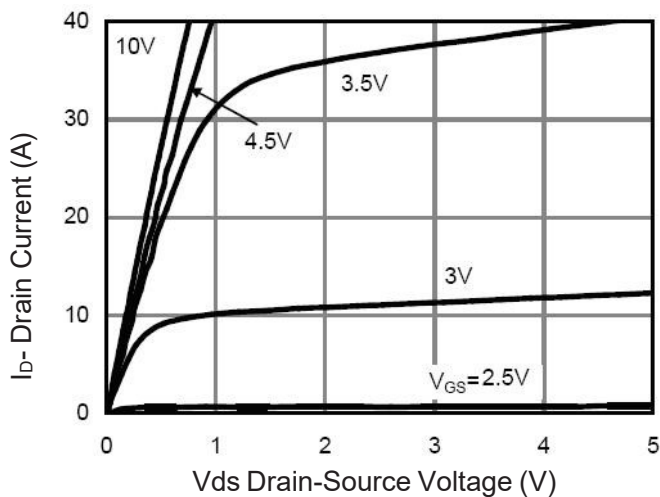


Figure 3 Output Characteristics

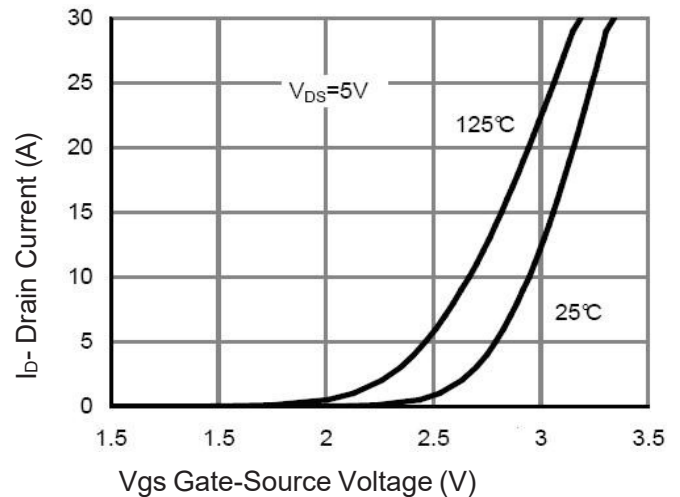


Figure 4 Transfer Characteristics

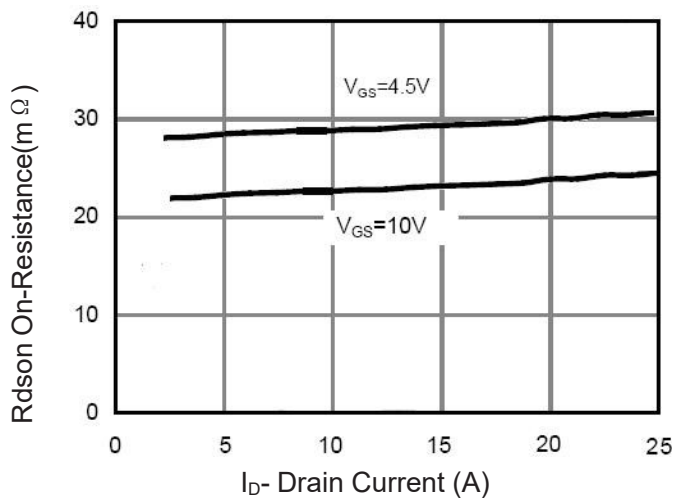


Figure 5 Rdson- Drain Current

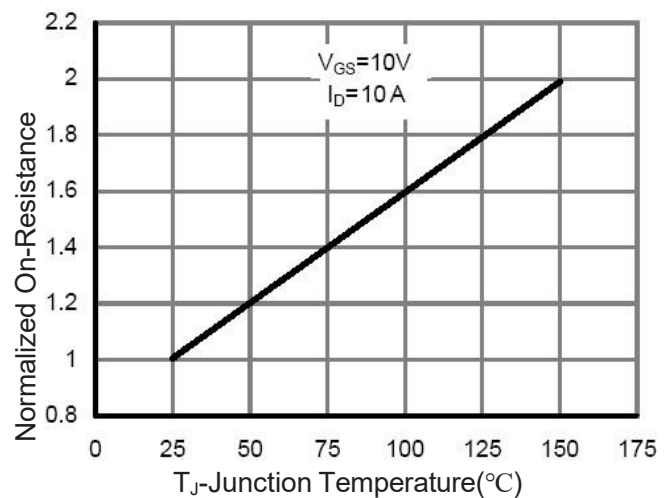
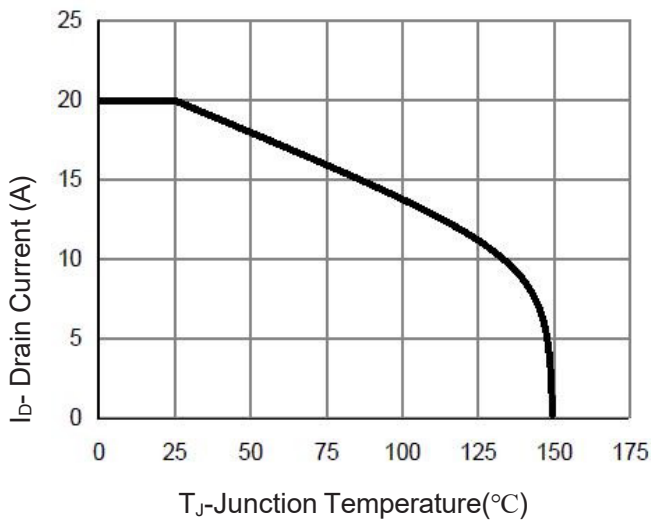
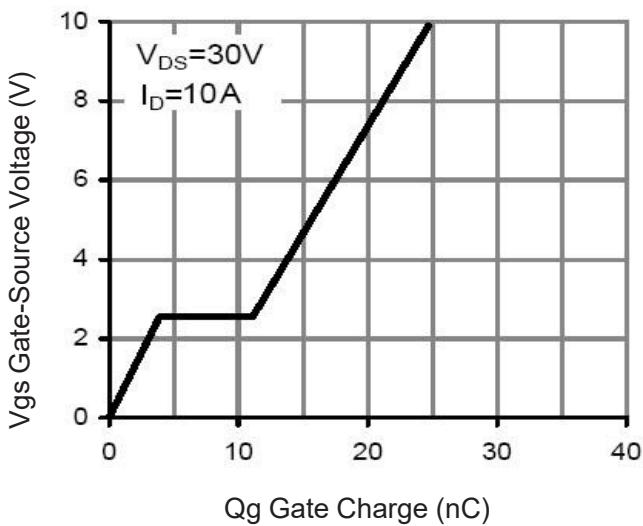
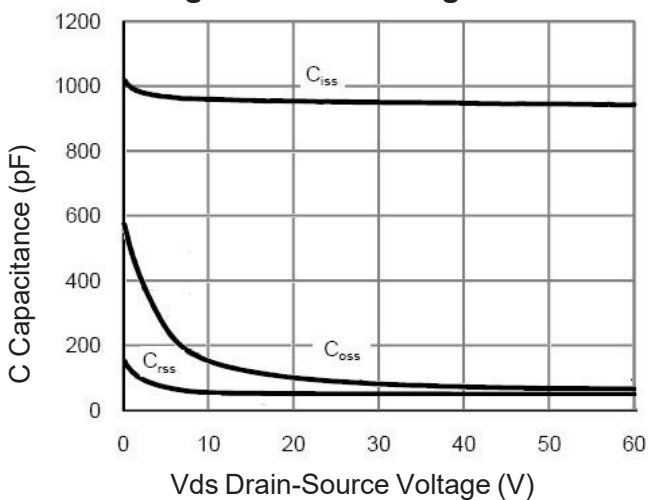
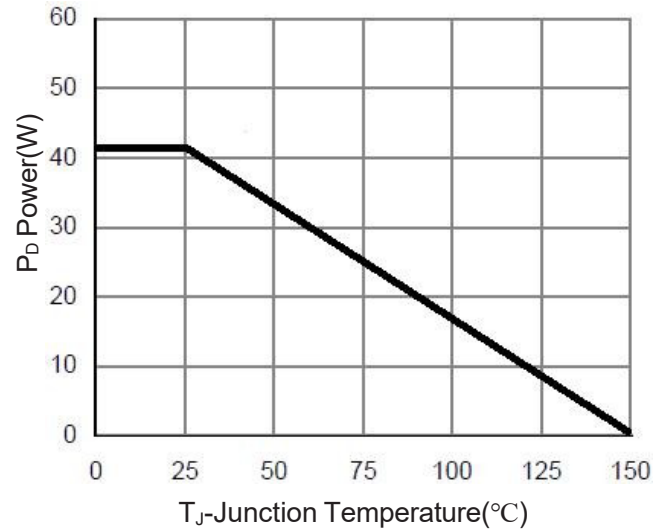
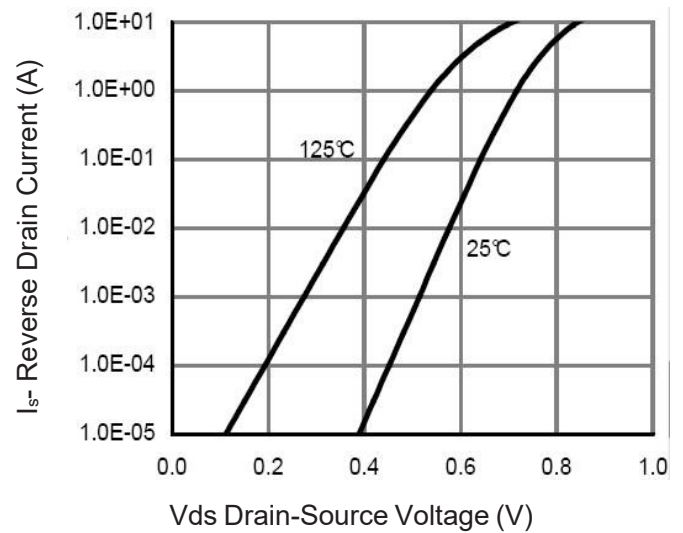
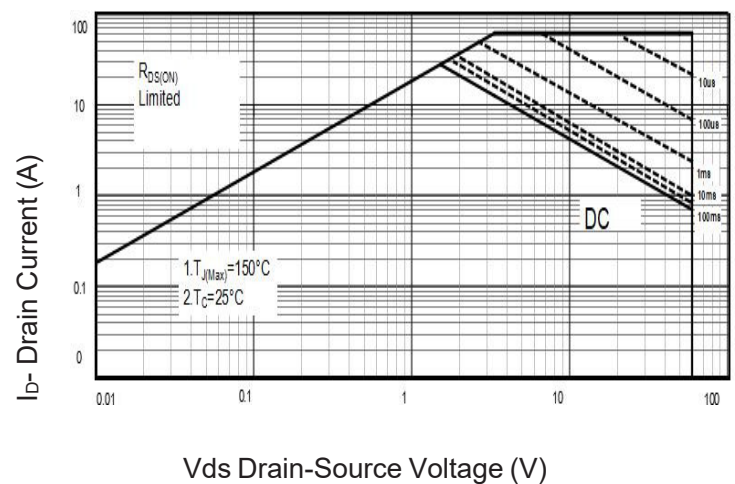


Figure 6 Drain-Source On-Resistance


Figure7 Rdson vs Vgs

Figure 9 Gate Charge

Figure 11 Capacitance vs Vds

Figure 8 Power Dissipation

Figure 10 Source- Drain Diode Forward

Figure 12 Safe Operation Area

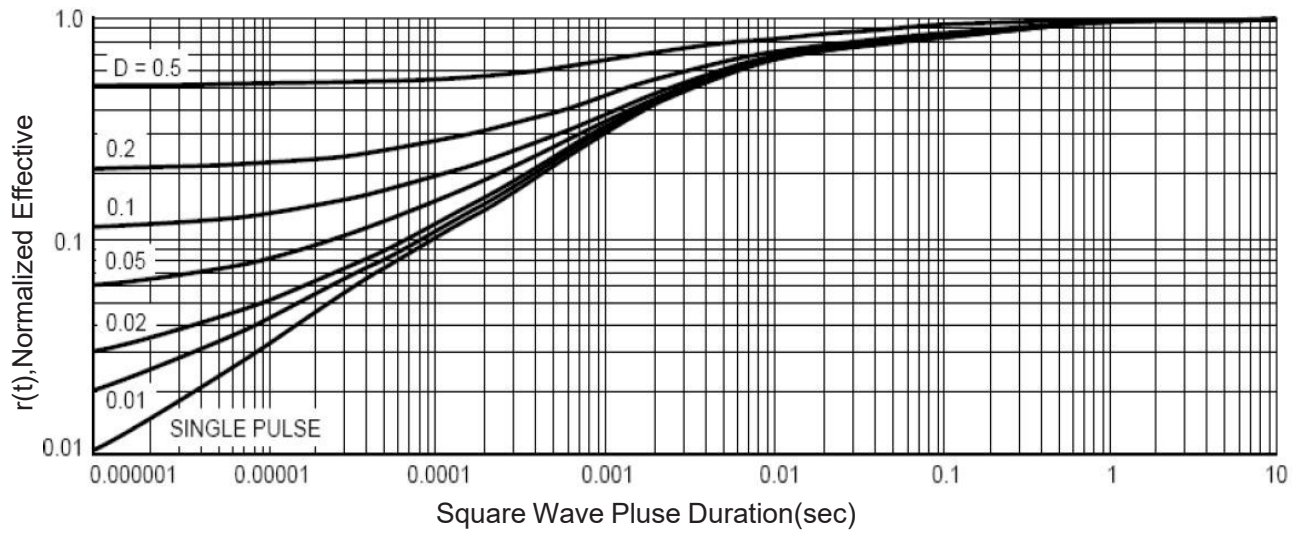
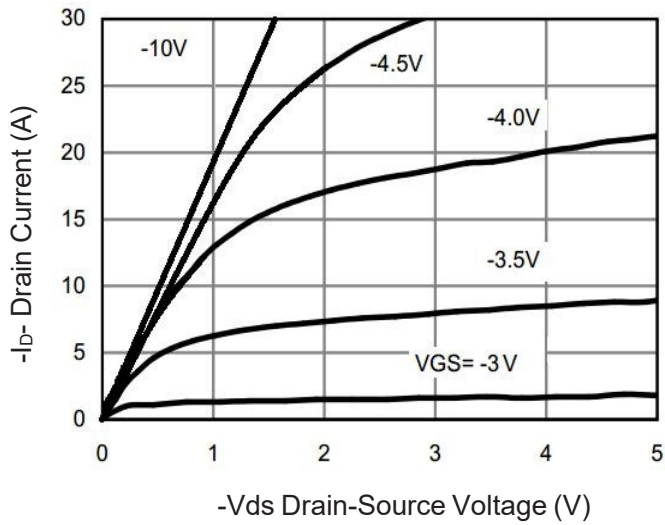
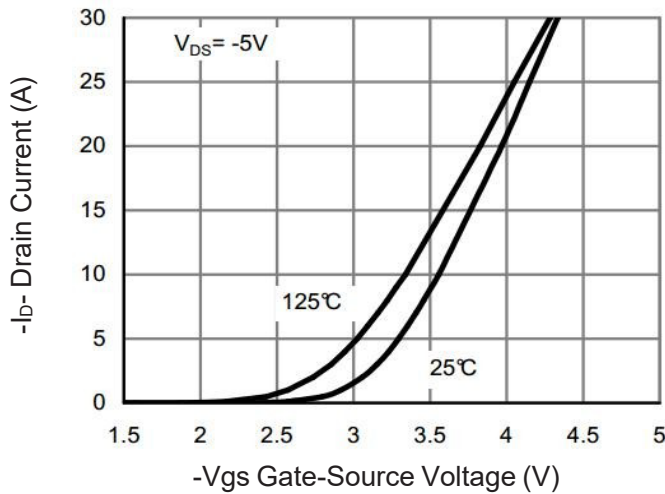
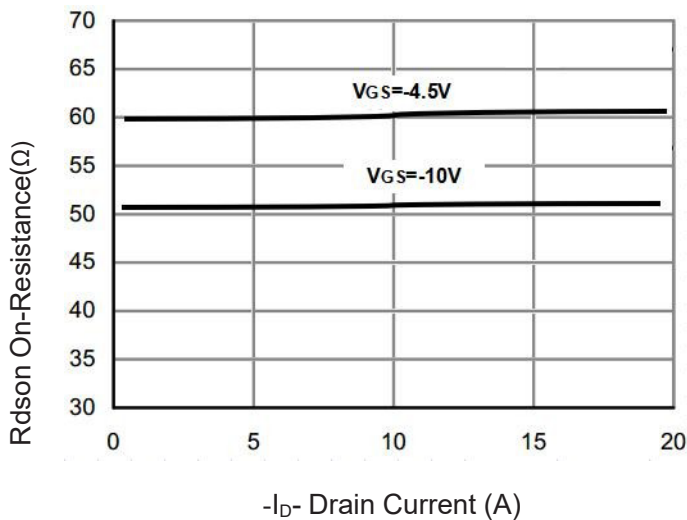
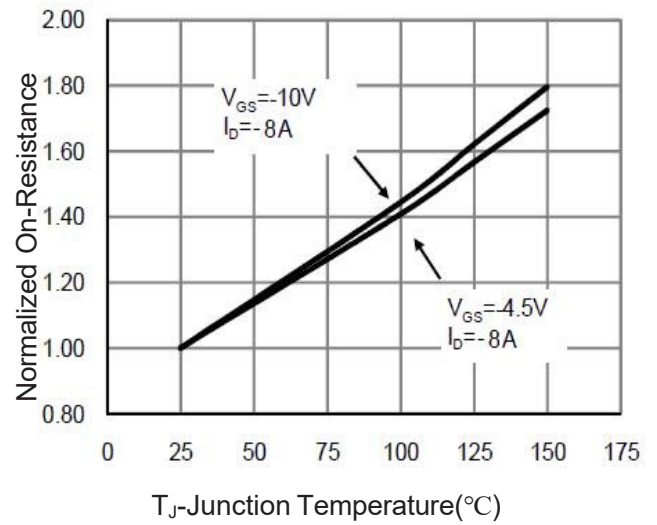
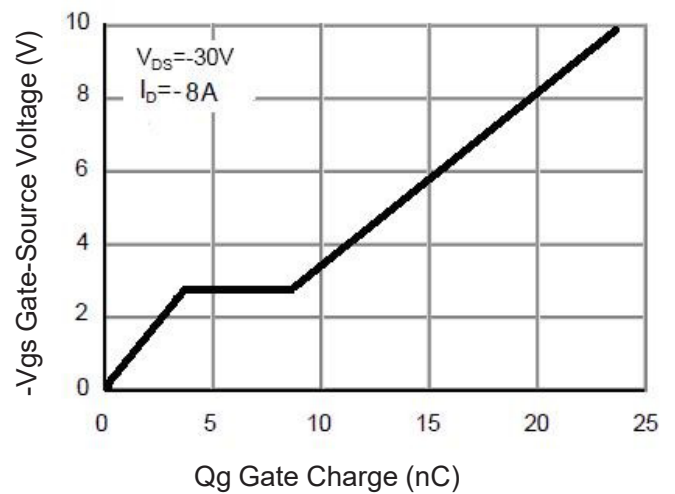
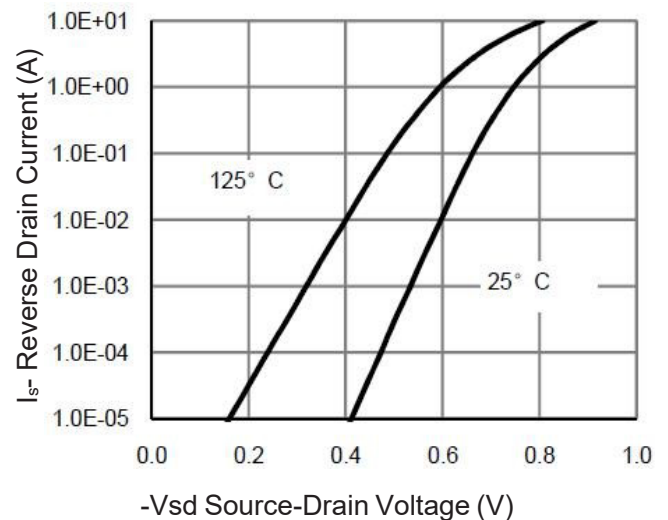


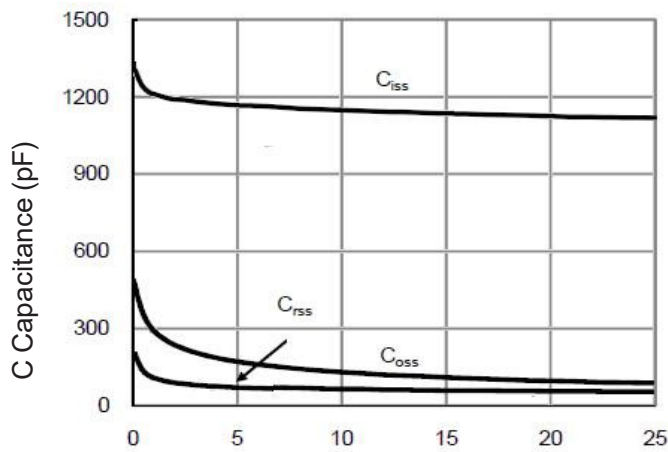
Figure 13 Normalized Maximum Transient Thermal Impedance

P-Channel Electrical Characteristics (T_c=25°C unless otherwise noted)

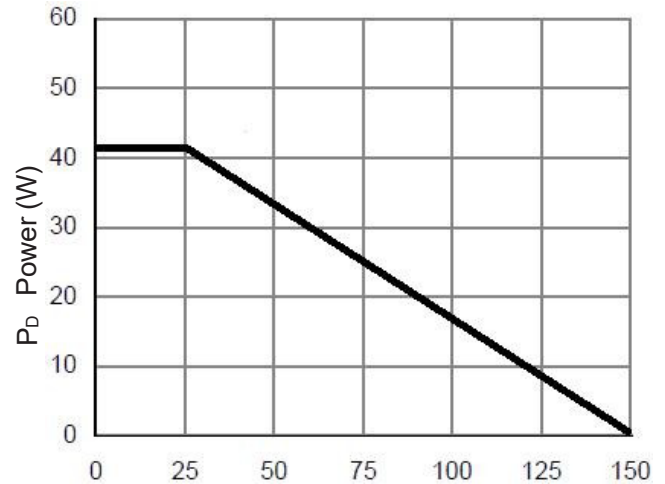
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V I _D =-250μA	-60	-	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =-60V,V _{GS} =0V	-	-	-1	μA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V,V _{DS} =0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} ,I _D =-250μA	-1.0	-1.5	-2.0	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =-10V, I _D =-8A	-	52	60	mΩ
		V _{GS} =-4.5V, I _D =-8A	-	60	72	mΩ
Forward Transconductance	g _{FS}	V _{DS} =-5V,I _D =-8A	-	15	-	S
Gate resistance	R _g	V _{DS} =0V,V _{GS} =0V,F=1.0MHz		8.5		Ω
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =-30V,V _{GS} =0V, F=1.0MHz	-	1108	-	PF
Output Capacitance	C _{oss}		-	73.7	-	PF
Reverse Transfer Capacitance	C _{rss}		-	58.2	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =-30V, R _L =3.75Ω V _{GS} =-10V,R _{GEN} =3Ω	-	8	-	nS
Turn-on Rise Time	t _r		-	4	-	nS
Turn-Off Delay Time	t _{d(off)}		-	32	-	nS
Turn-Off Fall Time	t _f		-	7	-	nS
Total Gate Charge	Q _g	V _{DS} =-30V,I _D =-8A V _{GS} =-10V	-	23.4	-	nC
Gate-Source Charge	Q _{gs}		-	4.1	-	nC
Gate-Drain Charge	Q _{gd}		-	4.8	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V,I _S =-16A	-	-	-1.2	V
Diode Forward Current (Note 2)	I _S		-	-	-16	A
Reverse Recovery Time	t _{rr}	T _J = 25°C, I _F =- 8A	-	25		nS
Reverse Recovery Charge	Q _{rr}	di/dt = -100A/μs(Note3)	-	31		nC

P- Channel Typical Electrical and Thermal Characteristics (Curves)

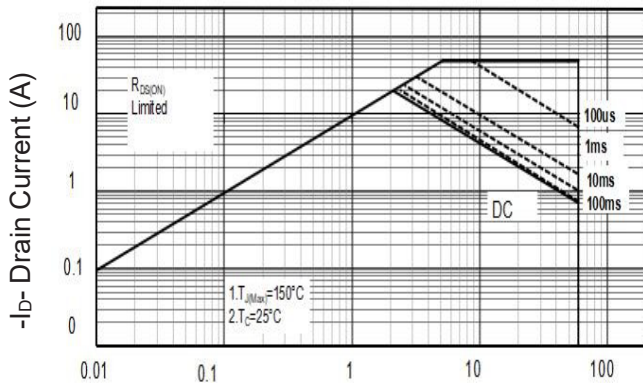

Figure 1 Output Characteristics

Figure 2 Transfer Characteristics

Figure 3 Rdson- Drain Current

Figure 4 Rdson-Junction Temperature

Figure 5 Gate Charge

Figure 6 Source- Drain Diode Forward



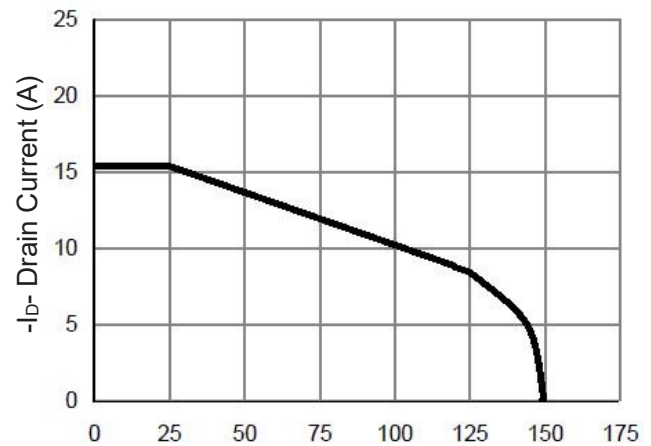
-Vds Drain-Source Voltage (V)
Figure 7 Capacitance vs Vds



T_J-Junction Temperature(°C)
Figure 9 Power Dissipation



-Vds Drain-Source Voltage (V)
Figure 8 Safe Operation Area



T_J-Junction Temperature(°C)
Figure 10 ID Current De-rating

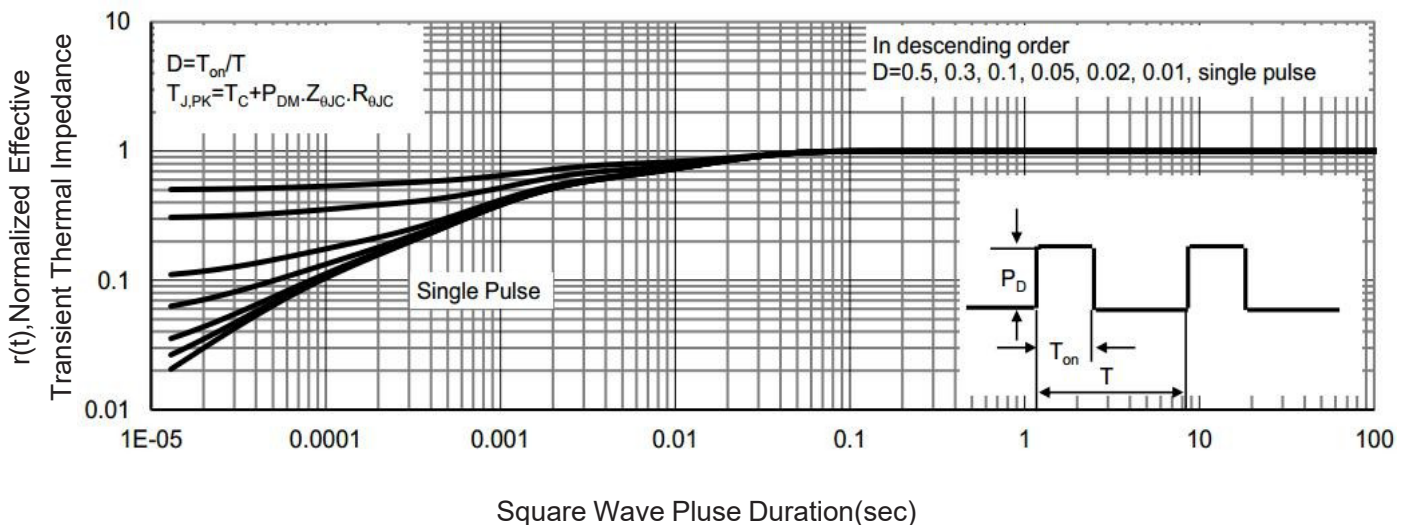


Figure 11 Normalized Maximum Transient Thermal Impedance