

Description

The VSM11P06 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

- $V_{DS} = 60V, I_D = 14A$
 $R_{DS(ON)} < 52m\Omega @ V_{GS} = 10V$
 $R_{DS(ON)} < 62m\Omega @ V_{GS} = 4.5V$
ESD Rating: 2800V HBM

p channel

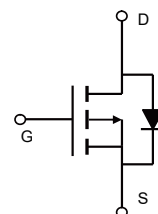
- $V_{DS} = -60V, I_D = -11A$
 $R_{DS(ON)} < 99m\Omega @ V_{GS} = -10V$
 $R_{DS(ON)} < 110m\Omega @ V_{GS} = -4.5V$
ESD Rating: 2800V HBM
- High density cell design for ultra low R_{dson}
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high E_{AS}
- Excellent package for good heat dissipation

Application

- H-bridge
- Inverters



DFN5x6



Schematic

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VSM11P06	VSM11P06-D56	DFN5x6	Ø330mm	12mm	5000units

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	$T_c = 25^\circ C$	I_D	14	-11	A
	$T_c = 100^\circ C$		9	-7	
Pulsed Drain Current (Note 1)		I_{DM}	56	-44	A
Maximum Power Dissipation	$T_c = 25^\circ C$	P_D	24		W
Single pulse avalanche energy (Note 5)		E_{AS}	23		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)	$R_{\theta JC}$	5.2	$^\circ C/W$
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Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	50	$^{\circ}\text{C/W}$
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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 =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	-	-	±10	μA
On Characteristics (Note 3)						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =250μA	1.1	1.6	2.1	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =10A	-	45.5	52	mΩ
		V _{GS} =4.5V, I _D =8A	-	49	62	mΩ
Forward Transconductance	g _{FS}	V _{DS} =5V, I _D =10A	-	12	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =30V, V _{GS} =0V, F=1.0MHz	-	617	-	pF
Output Capacitance	C _{OSS}		-	43.4	-	pF
Reverse Transfer Capacitance	C _{rSS}		-	35.7	-	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		-	11	-	nS
Turn-Off Delay Time	t _{d(off)}		-	26	-	nS
Turn-Off Fall Time	t _f		-	9	-	nS
Total Gate Charge	Q _g	V _{DS} =30V, I _D =10A, V _{GS} =10V	-	20	-	nC
Gate-Source Charge	Q _{gs}		-	2	-	nC
Gate-Drain Charge	Q _{gd}		-	4	-	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}	TJ = 25°C, IF =10A	-	23	-	nS
Reverse Recovery Charge	Q _{rr}	di/dt = 100A/μs ^(Note3)	-	10	-	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: $T_J=25^{\circ}\text{C}$, $V_{DD}=20V$, $V_G=10V$, $L=0.5mH$, $R_g=25\Omega$

N- Channel Typical Electrical and Thermal Characteristics (Curves)

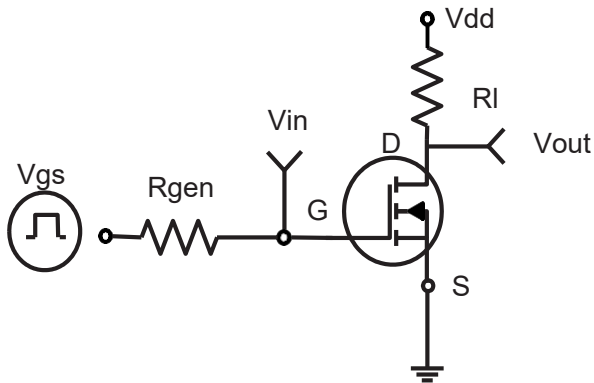


Figure 1: Switching Test Circuit

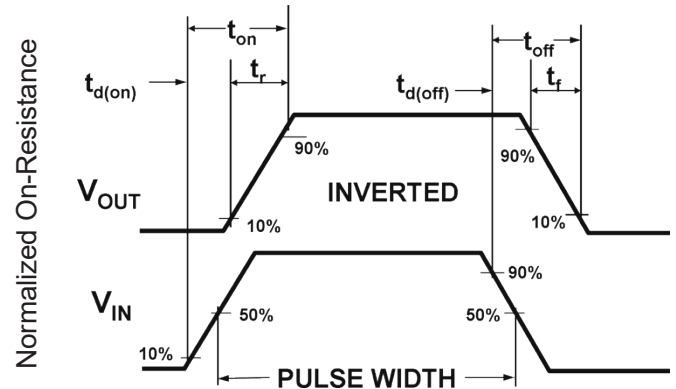


Figure 2: Switching Waveforms

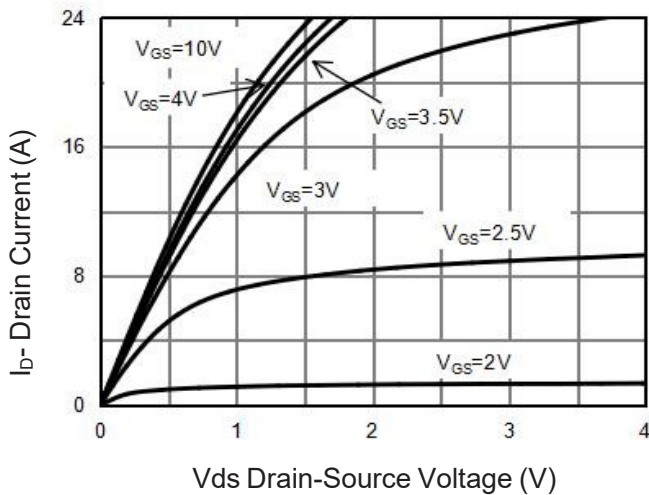


Figure 3 Output Characteristics

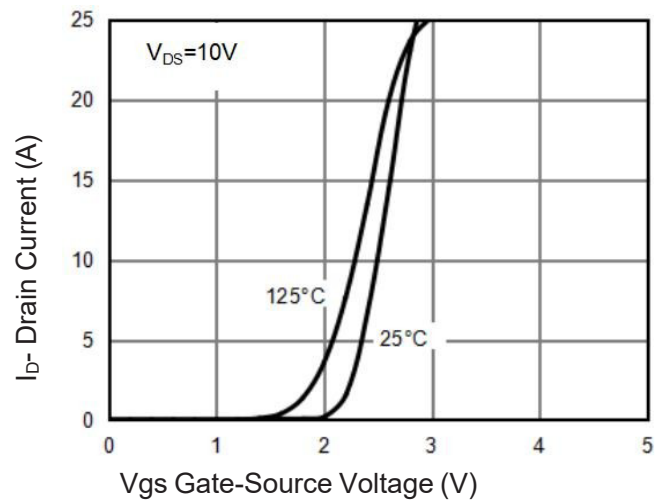


Figure 4 Transfer Characteristics

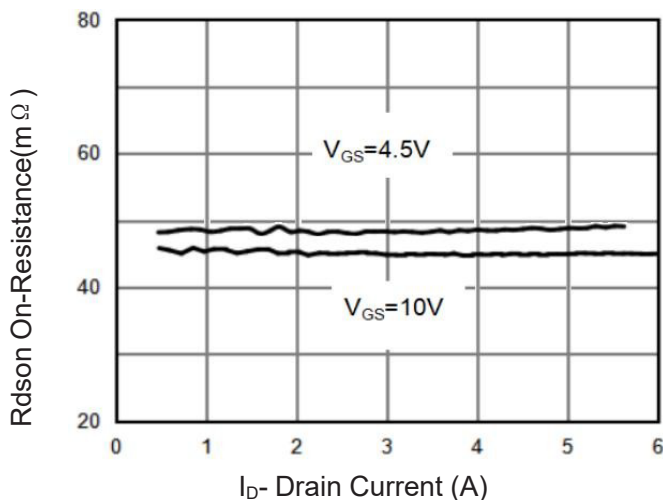


Figure 5 Rdson- Drain Current

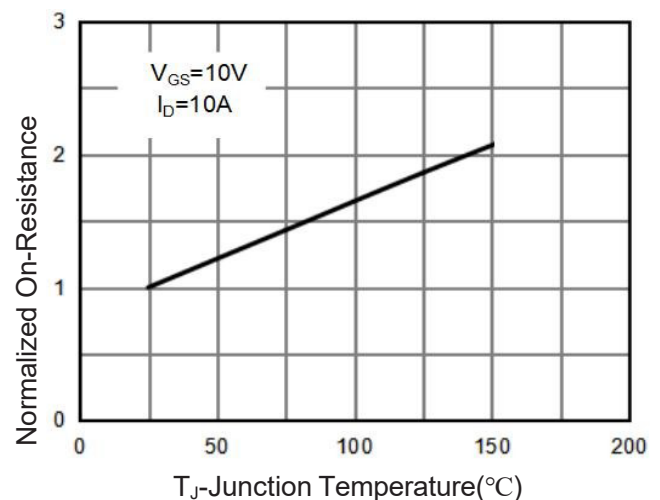
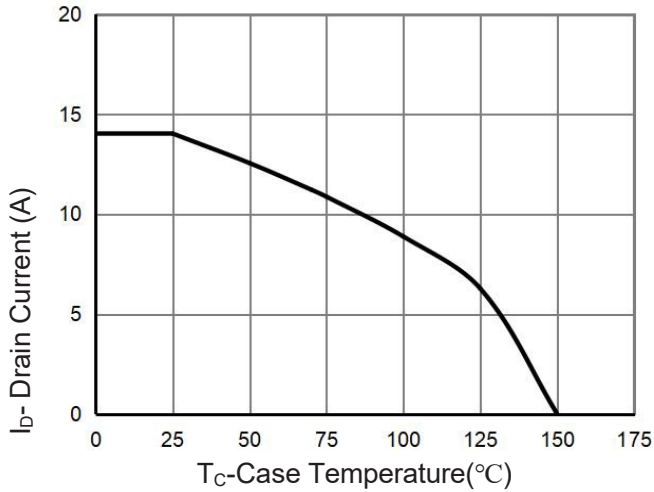
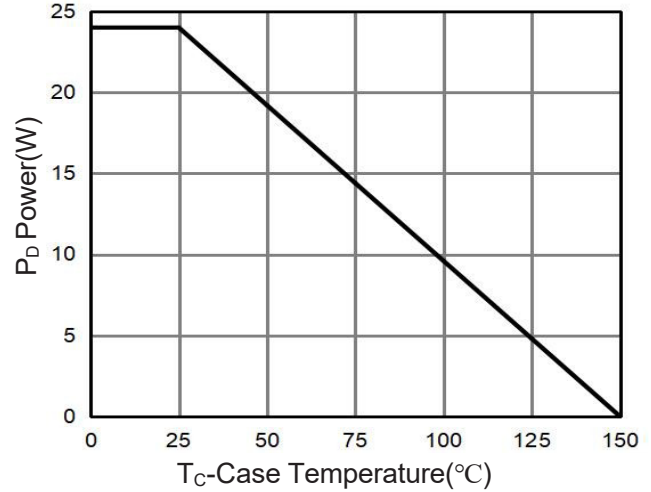
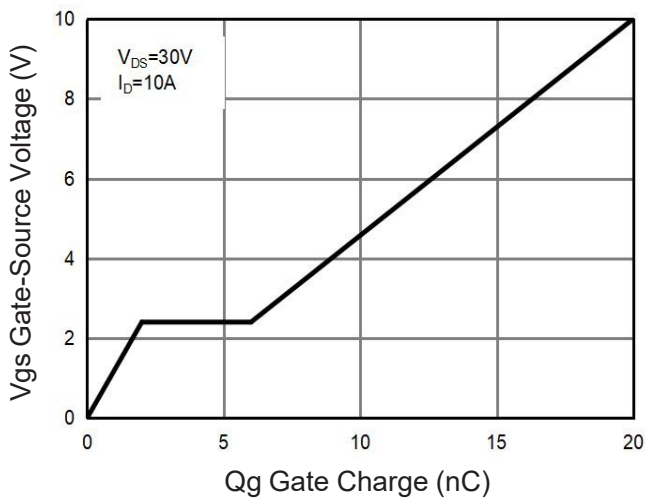
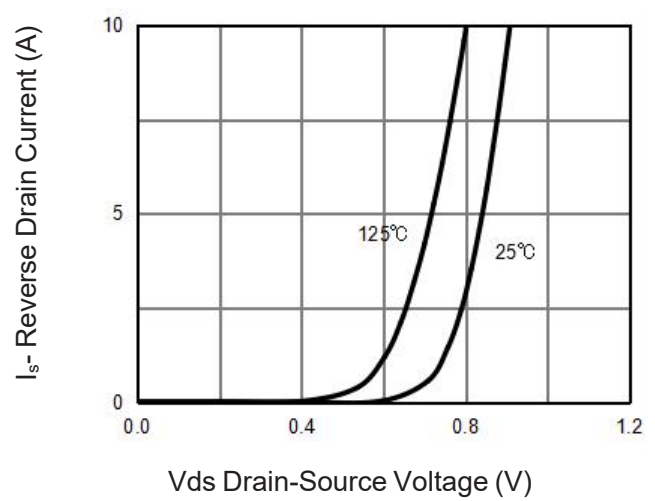
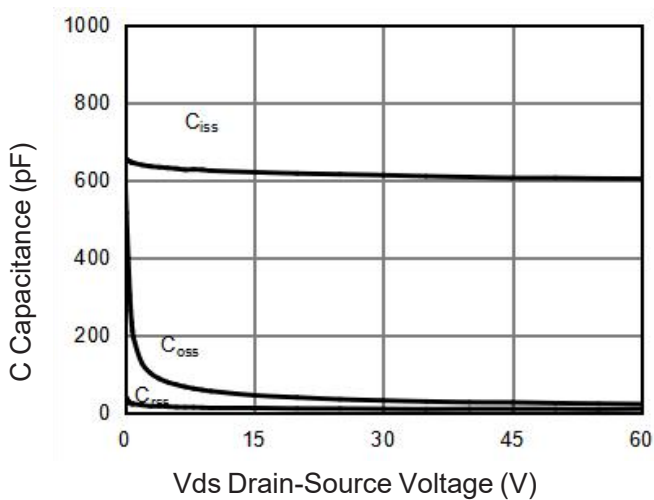
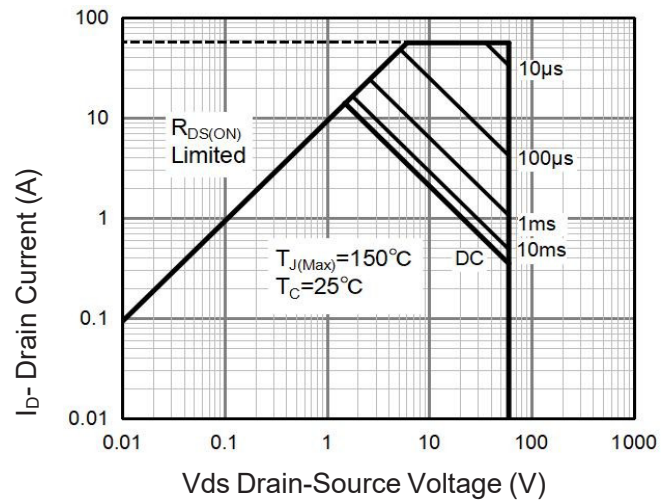


Figure 6 Drain-Source On-Resistance


Figure7 Rdson vs Vgs

Figure 8 Power Dissipation

Figure 9 Gate Charge

Figure 10 Source- Drain Diode Forward

Figure 11 Capacitance vs Vds

Figure 12 Safe Operation Area

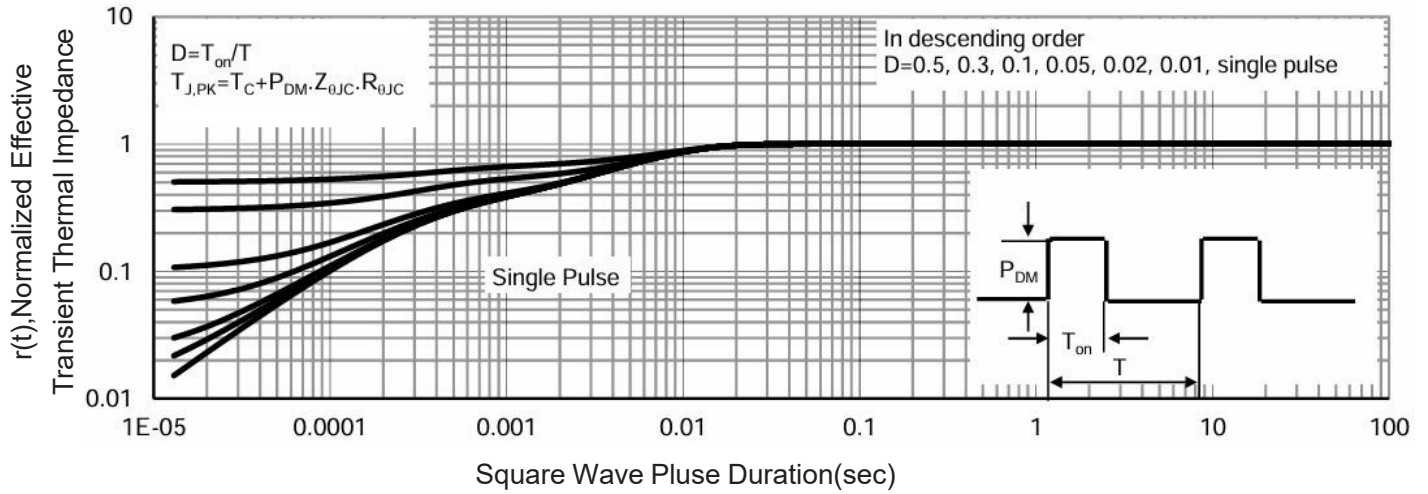
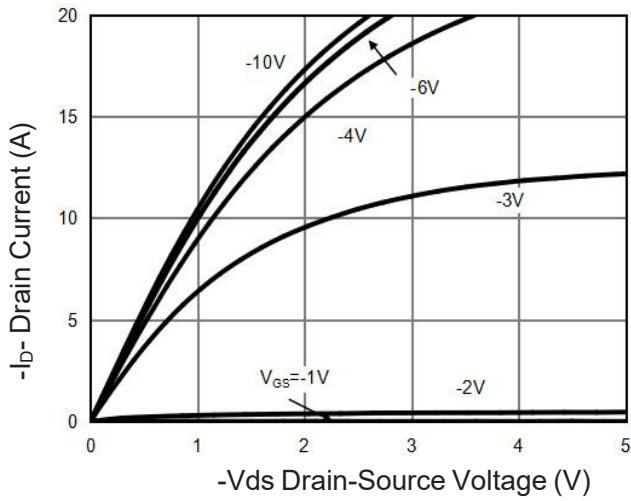
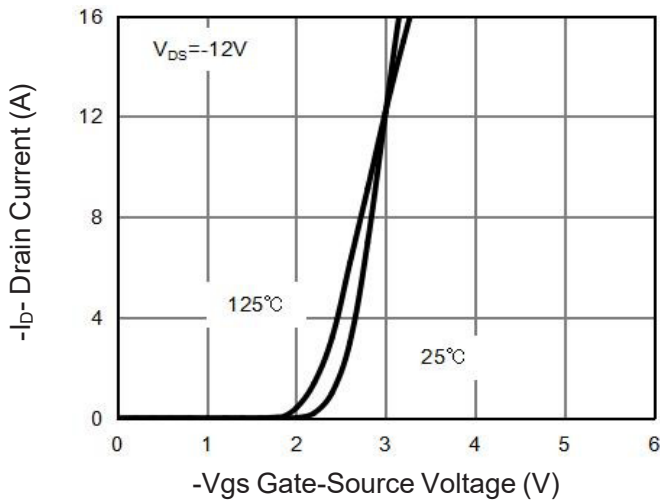
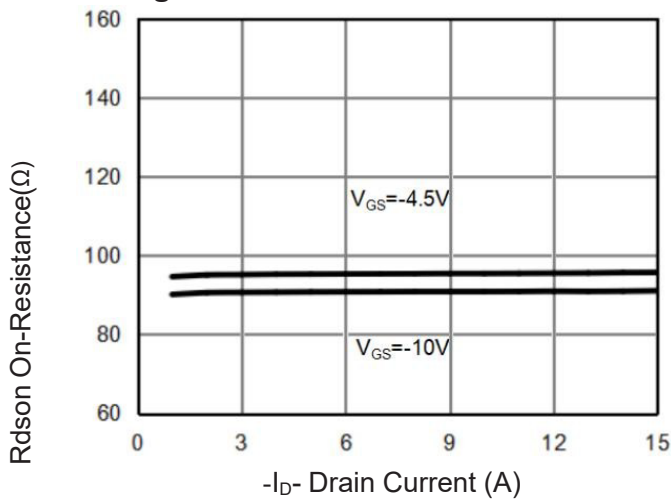
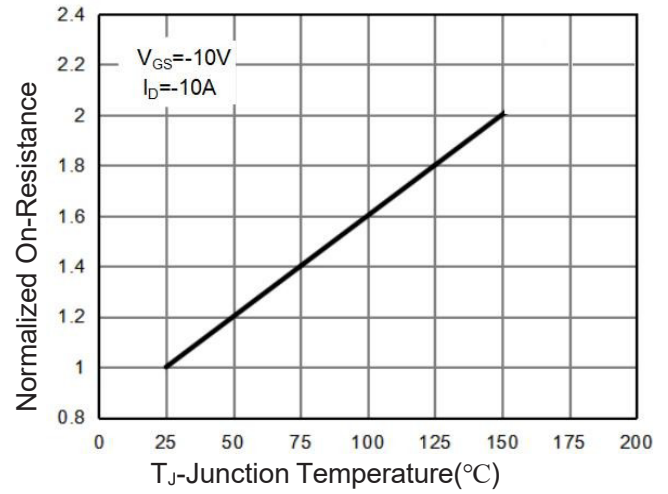
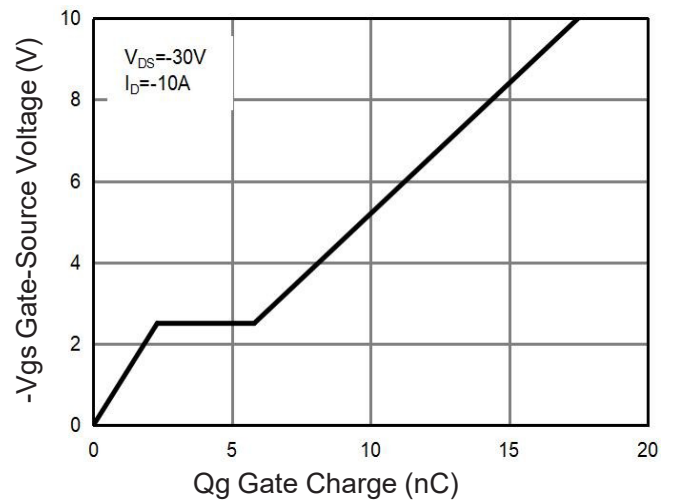
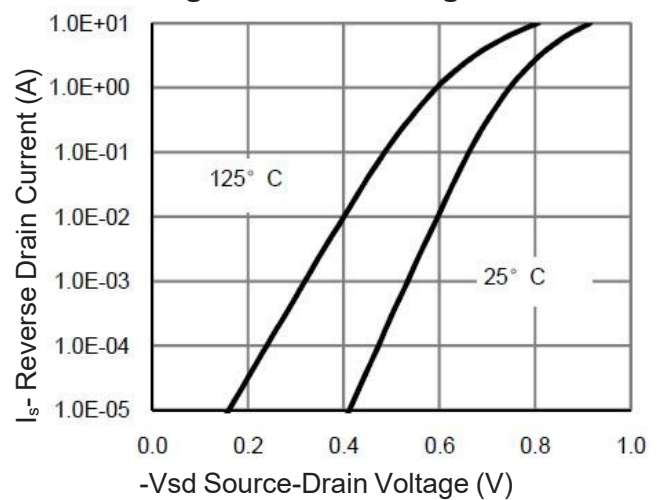
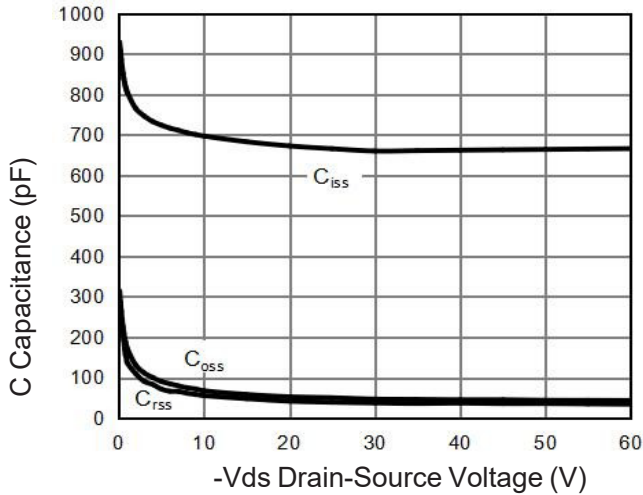
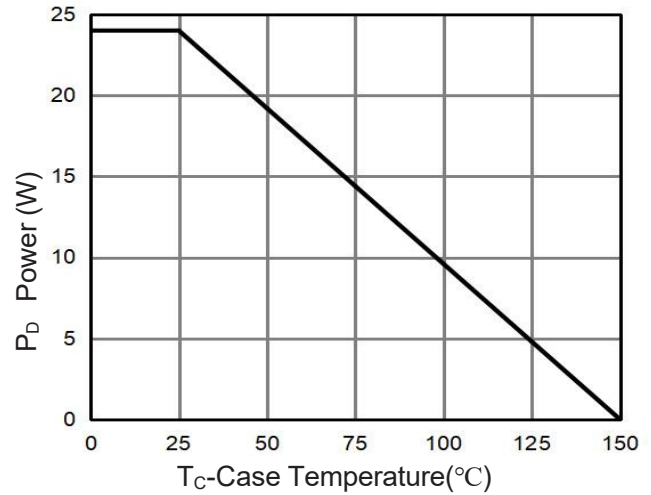
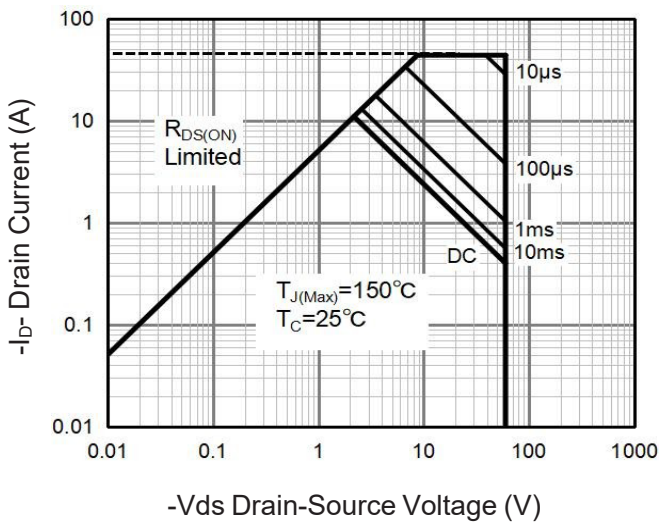
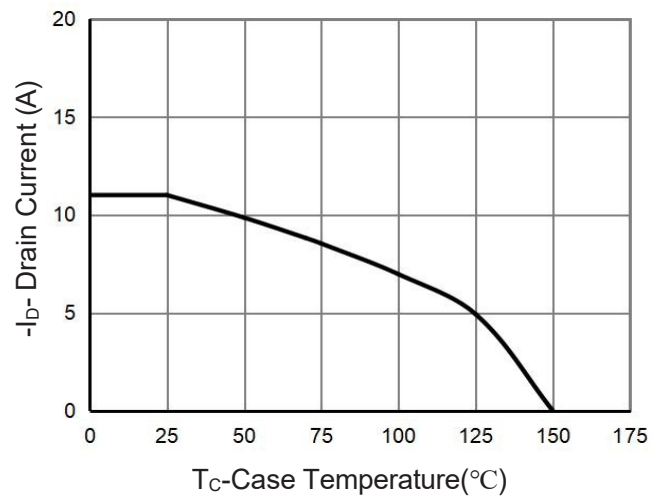
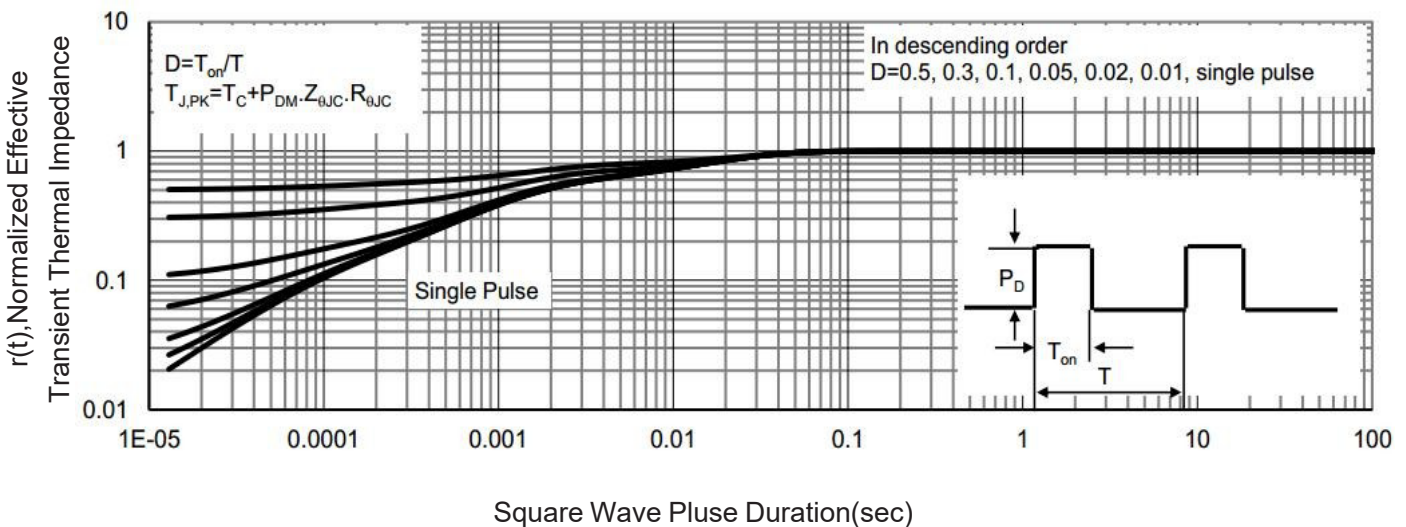


Figure 13 Normalized Maximum Transient Thermal Impedance

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	-1.1	-1.6	-2.1	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =-10V, I _D =-10A	-	89	99	mΩ
		V _{GS} =-4.5V, I _D =-3A	-	94	110	mΩ
Forward Transconductance	g _{FS}	V _{DS} =-12V, I _D =-10A	-	15	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =-30V, V _{GS} =0V, F=1.0MHz	-	660.1	-	pF
Output Capacitance	C _{oss}		-	46.8	-	pF
Reverse Transfer Capacitance	C _{rss}		-	37.3	-	pF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =-30V, R _L =3Ω V _{GS} =-10V, R _{GEN} =3Ω	-	4.5	-	nS
Turn-on Rise Time	t _r		-	3.6	-	nS
Turn-Off Delay Time	t _{d(off)}		-	17	-	nS
Turn-Off Fall Time	t _f		-	3	-	nS
Total Gate Charge	Q _g	V _{DS} =-30V, I _D =-10A V _{GS} =-10V	-	17.5	-	nC
Gate-Source Charge	Q _{gs}		-	2.3	-	nC
Gate-Drain Charge	Q _{gd}		-	3.5	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V, I _S =-11A	-	-	-1.2	V
Diode Forward Current (Note 2)	I _S		-	-	-11	A
Reverse Recovery Time	t _{rr}	T _J = 25°C, I _F =-11A	-	28	-	nS
Reverse Recovery Charge	Q _{rr}	di/dt = -100A/μs(Note3)	-	32	-	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


Figure 7 Capacitance vs Vds

Figure 9 Power Dissipation

Figure 8 Safe Operation Area

Figure 10 ID Current De-rating

Figure 11 Normalized Maximum Transient Thermal Impedance