

Description

The VSM28NP04 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

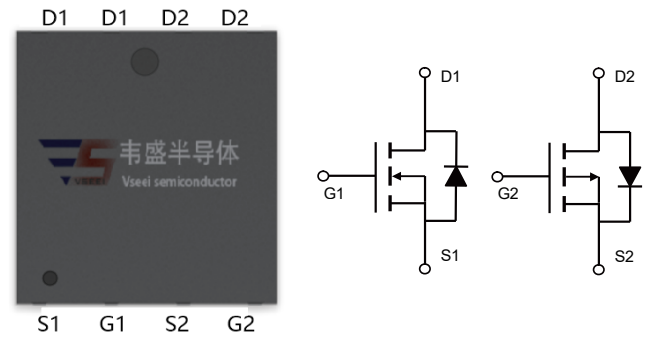
- $V_{DS}=40V, I_D=28A$
 $R_{DS(ON)} < 18m\Omega @ V_{GS}=10V$
 $R_{DS(ON)} < 28m\Omega @ V_{GS}=4.5V$

p channel

- $V_{DS}=-40V, I_D=-15A$
 $R_{DS(ON)} < 35m\Omega @ V_{GS}=-10V$
 $R_{DS(ON)} < 45m\Omega @ V_{GS}=-4.5V$
- 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
VSM28NP04	VSM28NP04-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}	40	-40	V
Gate-Source Voltage	V_{GS}	± 20	± 20	V
Continuous Drain Current	I_D	28	-15	A
		19.8	-10.6	
Pulsed Drain Current (Note 1)	I_{DM}	120	-60	A
Maximum Power Dissipation	P_D	35		W
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150		$^{\circ}C$

Thermal Characteristic

Thermal Resistance, Junction-to-Case (Note 2)	$R_{\theta JC}$	3.6	$^{\circ}C/W$
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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	40	-	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =40V, 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	1.4	2.0	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =15A	-	15	18	mΩ
		V _{GS} =4.5V, I _D =10A	-	22	28	mΩ
Forward Transconductance	g _{FS}	V _{DS} =5V, I _D =15A	-	25	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =20V, V _{GS} =0V, F=1.0MHz	-	1163	-	pF
Output Capacitance	C _{oss}		-	104	-	pF
Reverse Transfer Capacitance	C _{rss}		-	100	-	pF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =20V ,R _L =2.5Ω V _{GS} =10V, R _G =3Ω	-	5.5	-	nS
Turn-on Rise Time	t _r		-	14	-	nS
Turn-Off Delay Time	t _{d(off)}		-	24	-	nS
Turn-Off Fall Time	t _f		-	12	-	nS
Total Gate Charge	Q _g	V _{DS} =20V, I _D =15A, V _{GS} =10V	-	28		nC
Gate-Source Charge	Q _{gs}		-	3.9		nC
Gate-Drain Charge	Q _{gd}		-	5.9		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V, I _S =15A	-	-	1.2	V
Diode Forward Current (Note 2)	I _S		-	-	28	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
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)

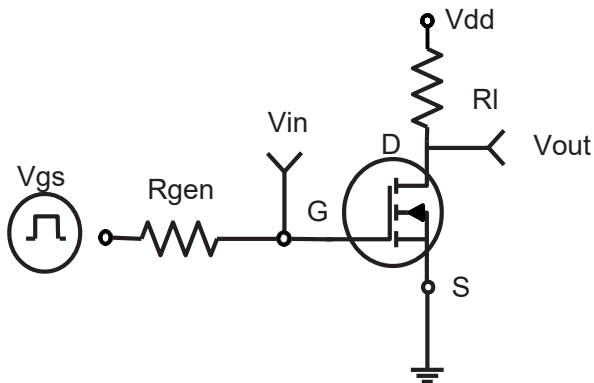


Figure 1:Switching Test Circuit

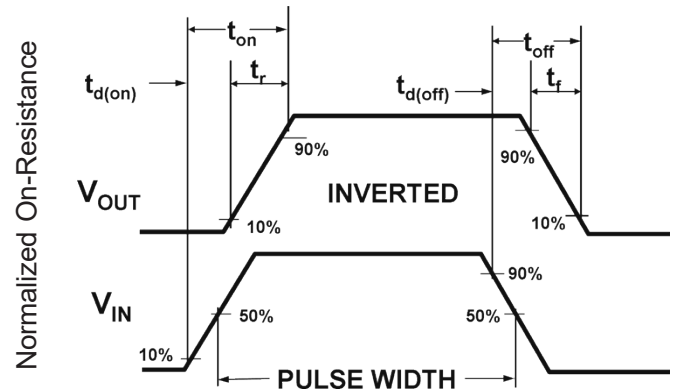


Figure 2:Switching Waveforms

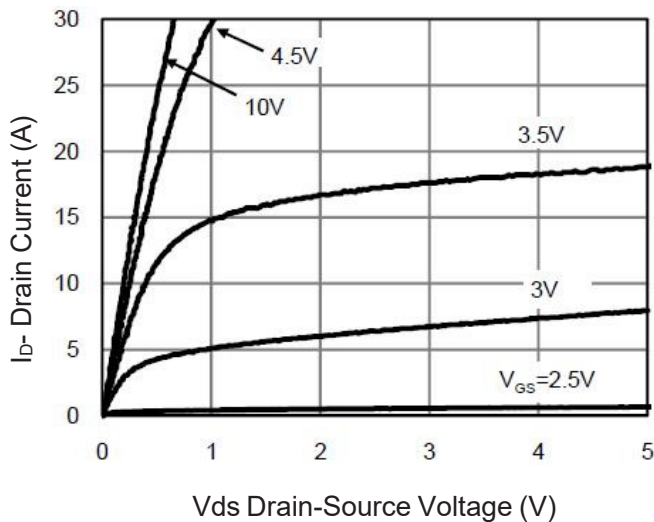


Figure 3 Output Characteristics

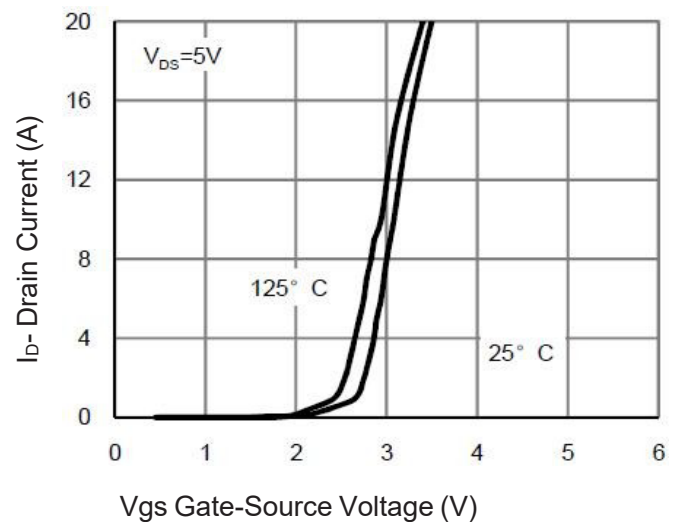


Figure 4 Transfer Characteristics

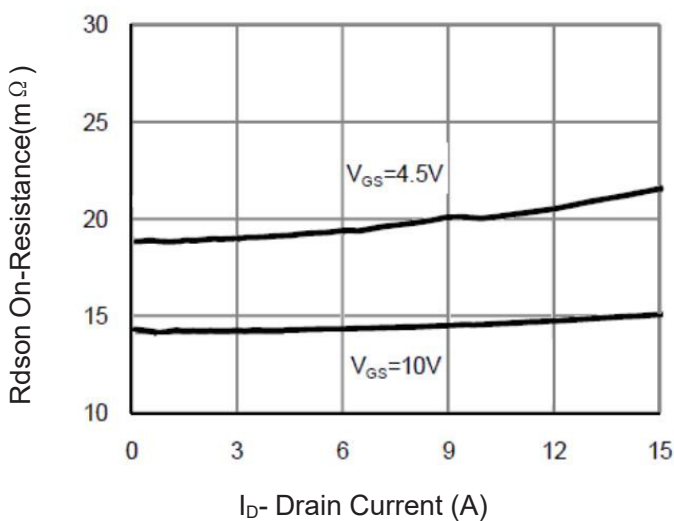


Figure 5 Drain-Source On-Resistance

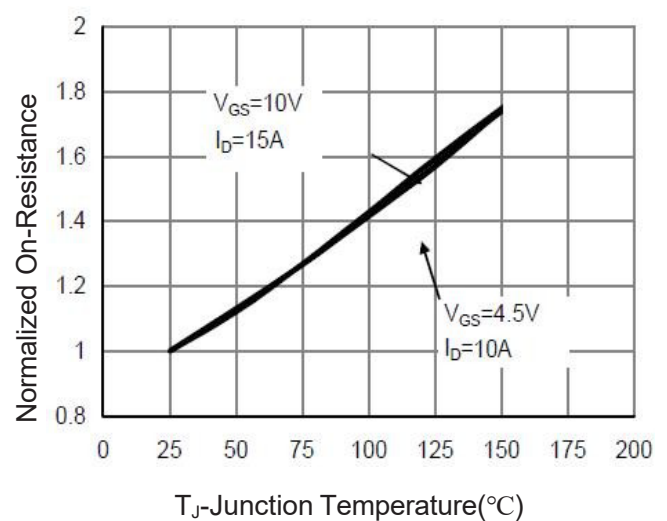
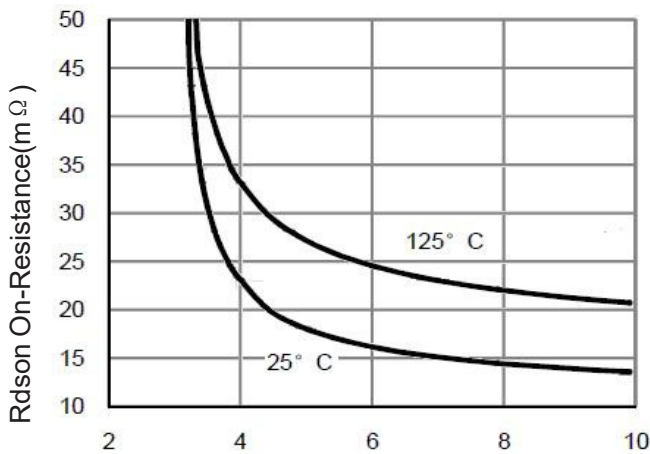
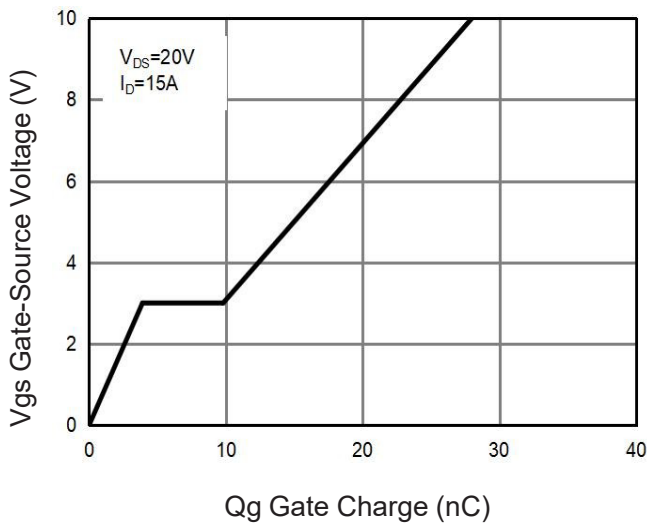


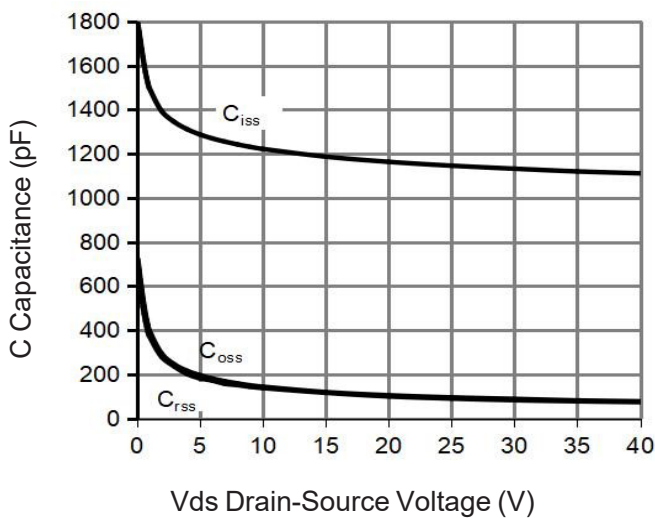
Figure 6 Drain-Source On-Resistance



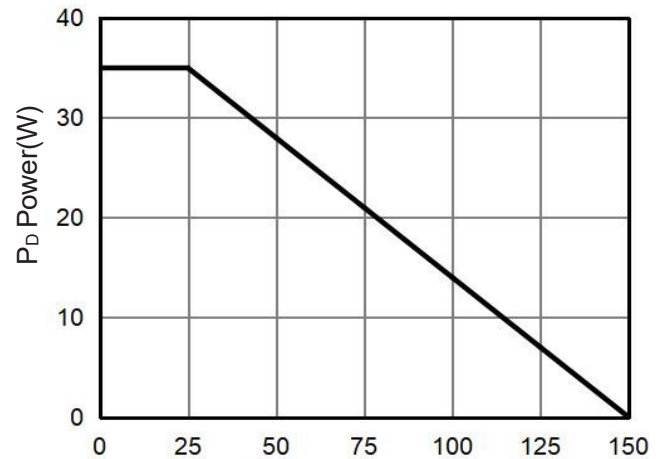
Vgs Gate-Source Voltage (V)
Figure 7 Rdson vs Vgs



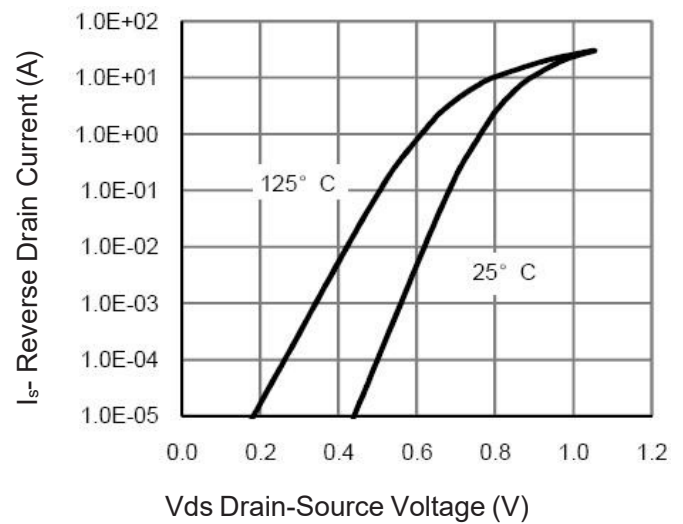
Qg Gate Charge (nC)
Figure 9 Gate Charge



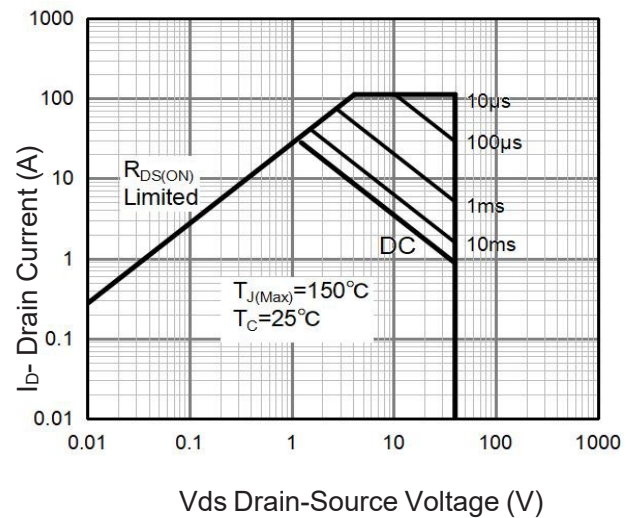
Vds Drain-Source Voltage (V)
Figure 11 Capacitance vs Vds



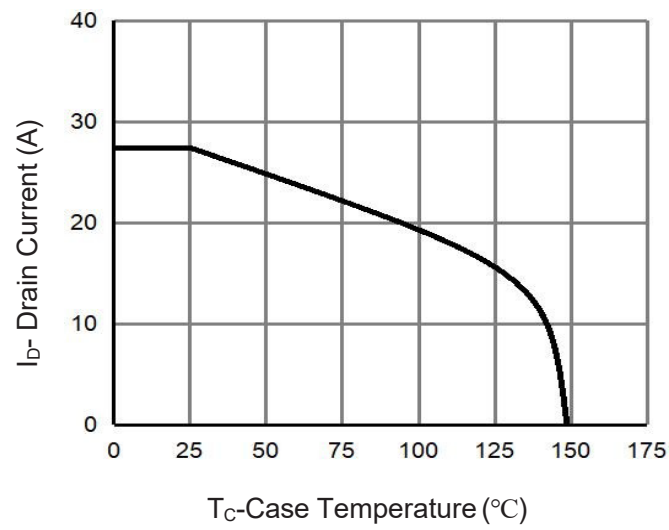
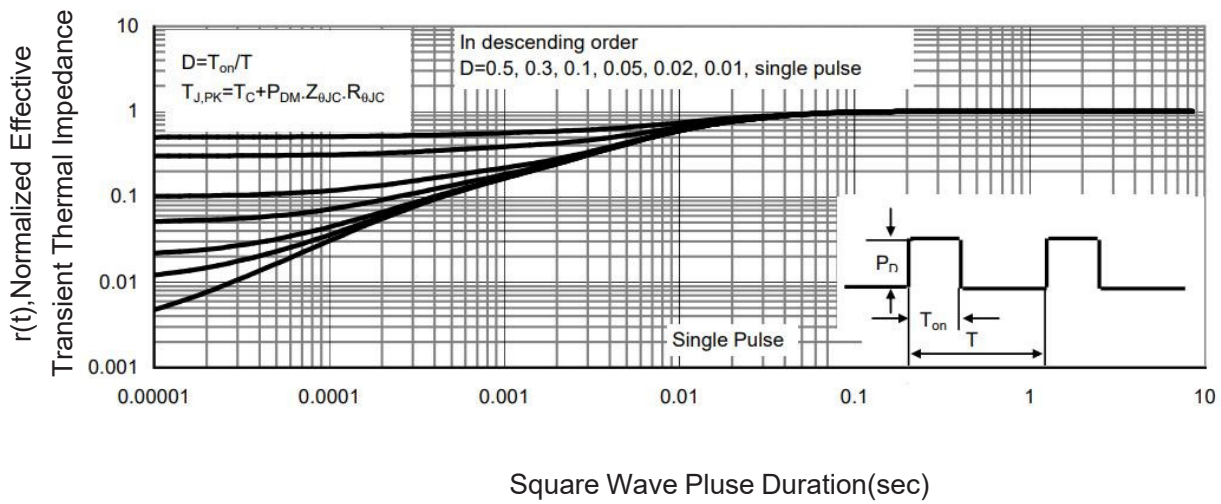
TC-Case Temperature(°C)
Figure 8 Power Dissipation



Vds Drain-Source Voltage (V)
Figure 10 Source- Drain Diode Forward



Vds Drain-Source Voltage (V)
Figure 12 Safe Operation Area


Figure 10 Current De-rating

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	-40	-	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =-40V, 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 =-7A	-	29	35	mΩ
		V _{GS} =-4.5V, I _D =-4A	-	34	45	mΩ
Forward Transconductance	g _{FS}	V _{DS} =-5V, I _D =-7A	-	20	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =-20V, V _{GS} =0V, F=1.0MHz	-	1060	-	pF
Output Capacitance	C _{oss}		-	121	-	pF
Reverse Transfer Capacitance	C _{rss}		-	111	-	pF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =-20V, R _L =2.3Ω V _{GS} =-10V, R _{GEN} =6Ω	-	5.5	-	nS
Turn-on Rise Time	t _r		-	14	-	nS
Turn-Off Delay Time	t _{d(off)}		-	24	-	nS
Turn-Off Fall Time	t _f		-	12	-	nS
Total Gate Charge	Q _g	V _{DS} =-20V, I _D =-7A V _{GS} =-10V	-	26	-	nC
Gate-Source Charge	Q _{gs}		-	3.7	-	nC
Gate-Drain Charge	Q _{gd}		-	6.0	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V, I _S =-10A	-	-	-1.2	V

P- Channel Typical Electrical and Thermal Characteristics (Curves)

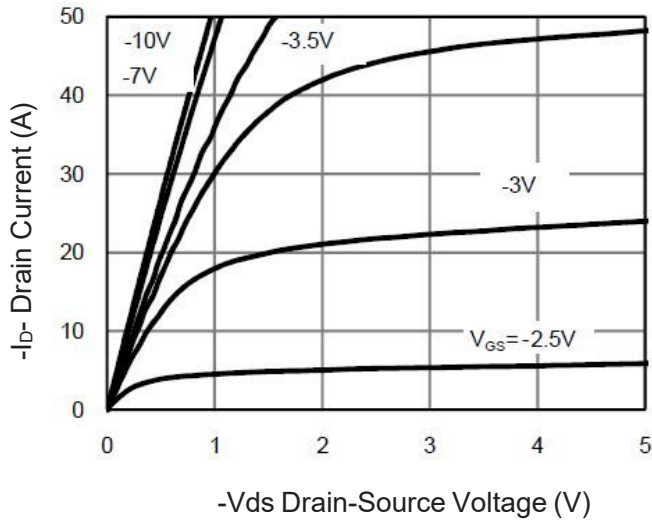


Figure 1 Output Characteristics

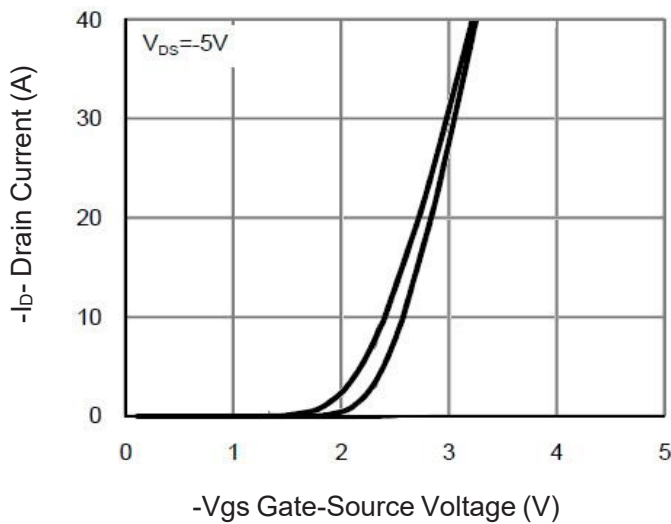


Figure 2 Transfer Characteristics

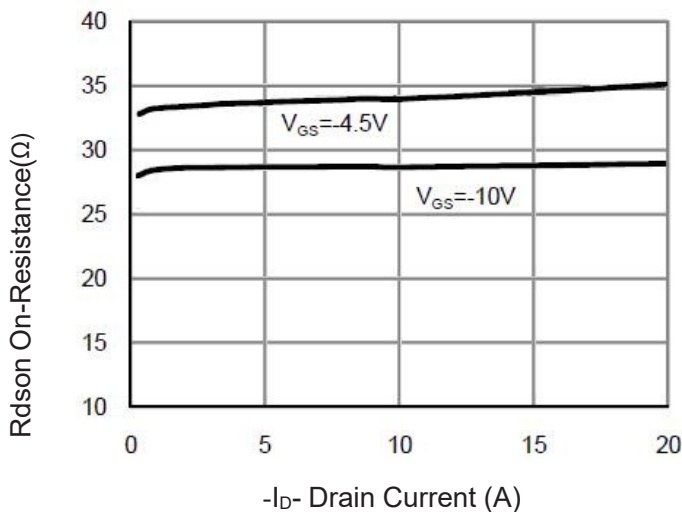


Figure 3 Rdson- Drain Current

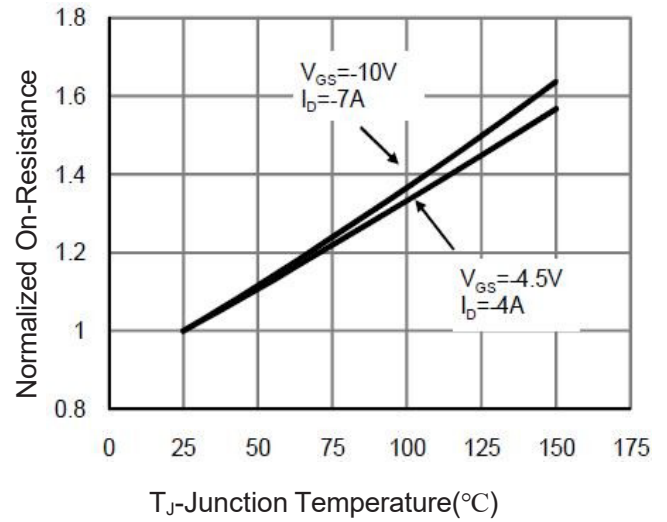


Figure 4 Rdson-Junction Temperature

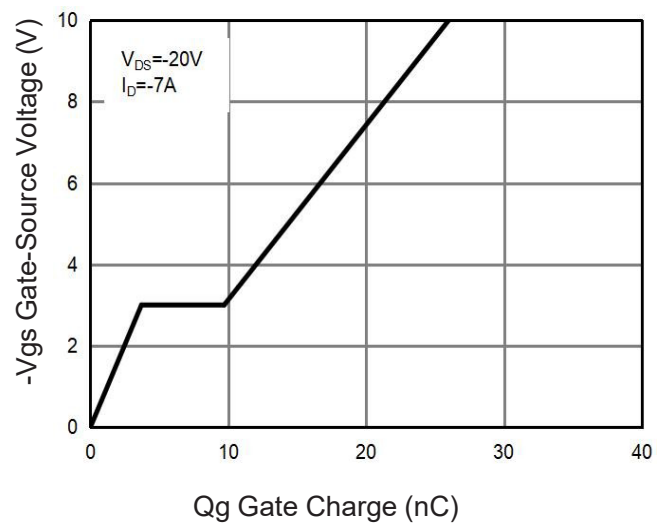


Figure 5 Gate Charge

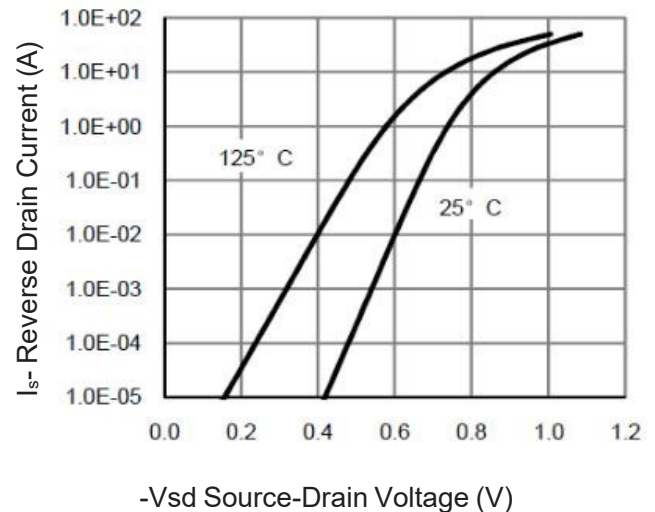
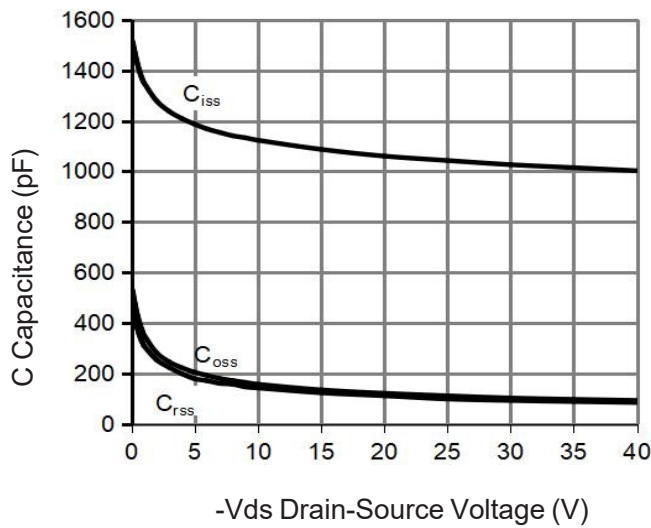
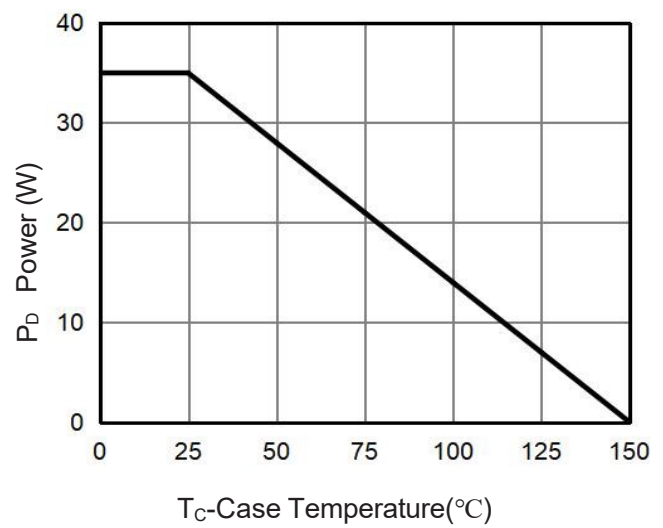
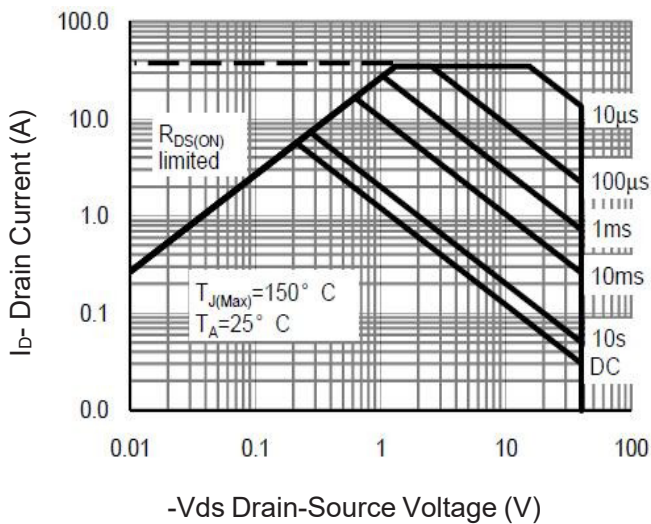
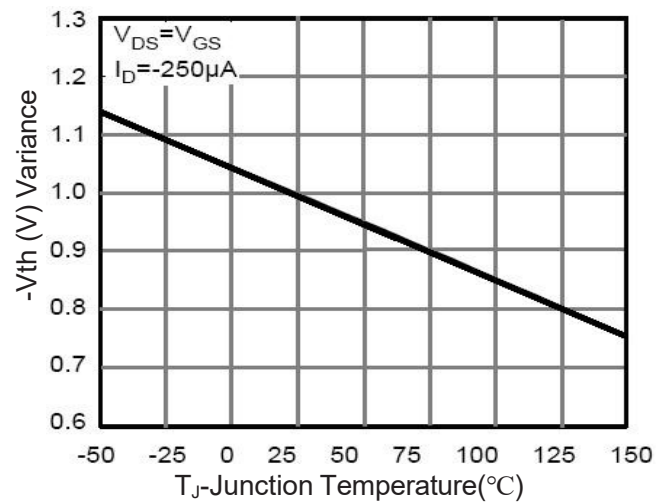
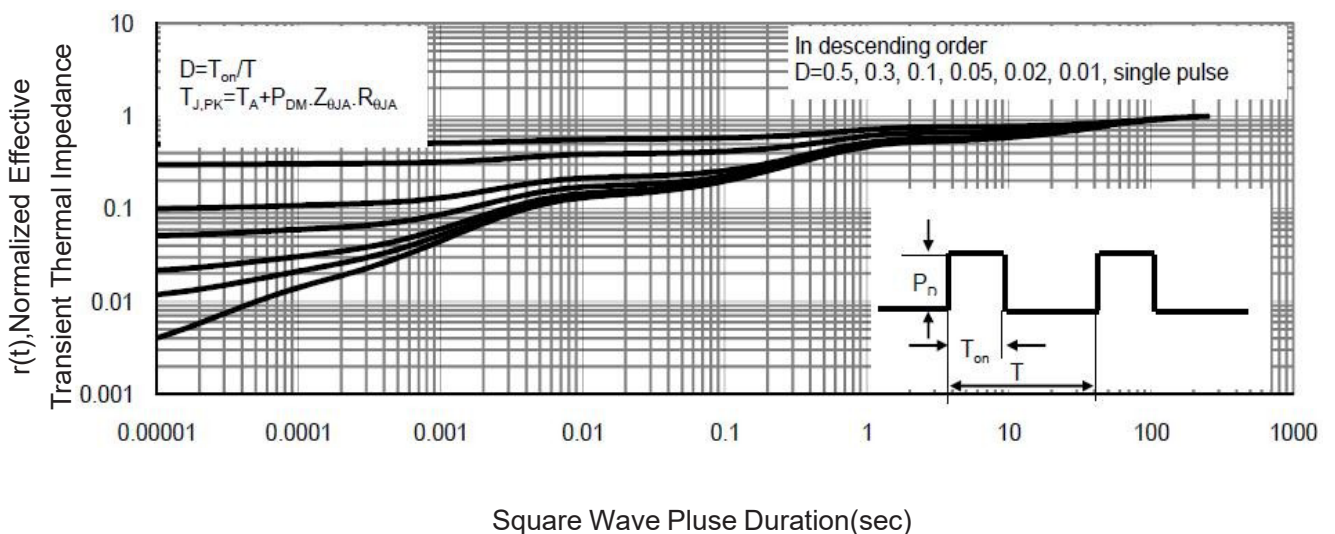


Figure 6 Source- Drain Diode Forward


Figure 7 Capacitance vs Vds

Figure 9 Power Dissipation

Figure 8 Safe Operation Area

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

Figure 11 Normalized Maximum Transient Thermal Impedance

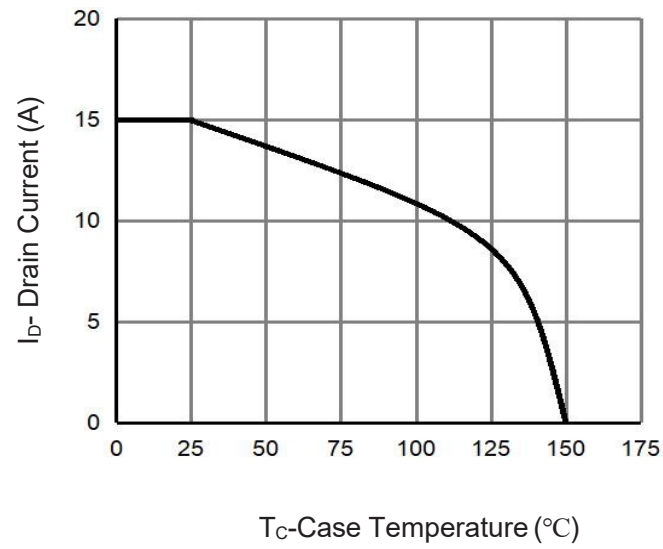


Figure 12 Current De-rating