

Description

The VSM21NP04 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications.

General Features

● N-Channel

$$V_{DS} = 40V, I_D = 21A$$

$$R_{DS(ON)} < 17m\Omega @ V_{GS} = 10V$$

$$R_{DS(ON)} < 29m\Omega @ V_{GS} = 4.5V$$

● P-Channel

$$V_{DS} = -40V, I_D = -14A$$

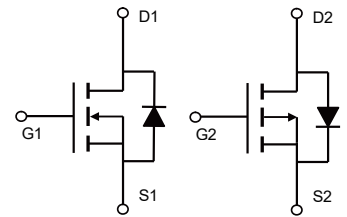
$$R_{DS(ON)} < 32m\Omega @ V_{GS} = -10V$$

$$R_{DS(ON)} < 45m\Omega @ V_{GS} = -4.5V$$

- High power and current handling capability
- Lead free product is acquired
- Surface mount package



TO-252



Schematic

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VSM21NP04	VSM21NP04-T2	TO-252	-	-	-

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

Parameter	Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage	V_{DS}	40	-40	V
Gate-Source Voltage	V_{GS}	± 25	± 25	V
Continuous Drain Current	I_D	21	-14	A
		17.5	-11.5	
Pulsed Drain Current (Note 1)	I_{DM}	84	-56	A
Maximum Power Dissipation	P_D	40	40	W
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)	$R_{\theta JC}$	N-Ch	3.1	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Case (Note 2)	$R_{\theta JC}$	P-Ch	3.1	$^\circ\text{C/W}$

N-CH Electrical Characteristics (T_A=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} =±25V, V _{DS} =0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =250μA	1	1.6	2.2	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =10A	-	14	17	mΩ
		V _{GS} =4.5V, I _D =5A	-	19	29	mΩ
Forward Transconductance	g _{FS}	V _{DS} =5V, I _D =10A		15	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =20V, V _{GS} =0V, F=1.0MHz	-	1110	-	PF
Output Capacitance	C _{oss}		-	114	-	PF
Reverse Transfer Capacitance	C _{rss}		-	109	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =20V, R _L =2Ω V _{GS} =10V, R _{GEN} =3Ω	-	4	-	nS
Turn-on Rise Time	t _r		-	11.5	-	nS
Turn-Off Delay Time	t _{d(off)}		-	18	-	nS
Turn-Off Fall Time	t _f		-	5.6	-	nS
Total Gate Charge	Q _g	V _{DS} =20V, I _D =10A, V _{GS} =10V	-	30	-	nC
Gate-Source Charge	Q _{gs}		-	5	-	nC
Gate-Drain Charge	Q _{gd}		-	7	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V, I _S =10A	-	0.8	1.2	V

P-CH Electrical Characteristics (T_A=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} =±25V, V _{DS} =0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =-250μA	-1.0	-1.6	-2.2	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =-10V, I _D =-7A	-	27	32	mΩ
		V _{GS} =-4.5V, I _D =-4A	-	34	45	mΩ
Forward Transconductance	g _{FS}	V _{DS} =-5V, I _D =-7A	-	15	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =-20V, V _{GS} =0V, F=1.0MHz	-	1139	-	PF
Output Capacitance	C _{oss}		-	114	-	PF
Reverse Transfer Capacitance	C _{rss}		-	103	-	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	-	10	-	nS
Turn-on Rise Time	t _r		-	15	-	nS
Turn-Off Delay Time	t _{d(off)}		-	30	-	nS
Turn-Off Fall Time	t _f		-	18	-	nS
Total Gate Charge	Q _g	V _{DS} =-20V, I _D =-7A V _{GS} =-10V	-	22.5	-	nC
Gate-Source Charge	Q _{gs}		-	2.4	-	nC
Gate-Drain Charge	Q _{gd}		-	5.1	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V, I _S =-14A	-	-	-1.2	V

Notes:

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

N- Channel Typical Electrical and Thermal Characteristics (Curves)

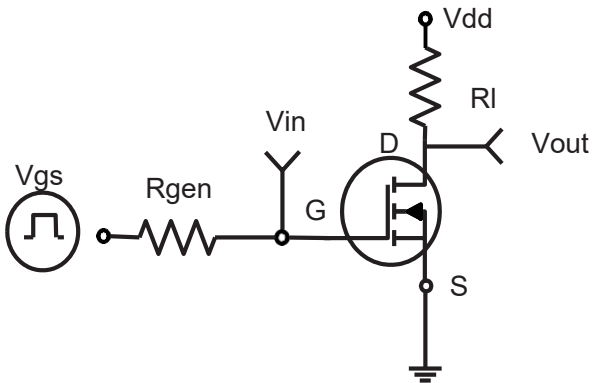


Figure 1:Switching Test Circuit

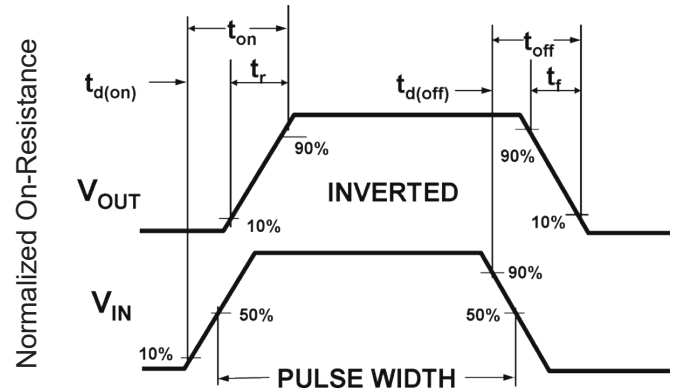


Figure 2:Switching Waveforms

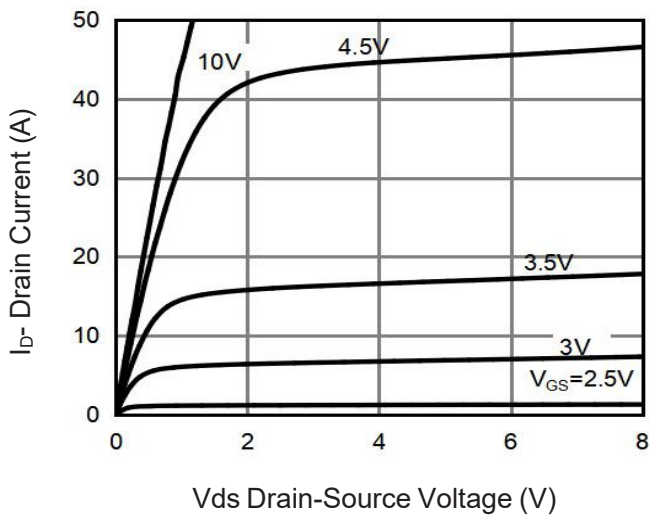


Figure 3 Output Characteristics

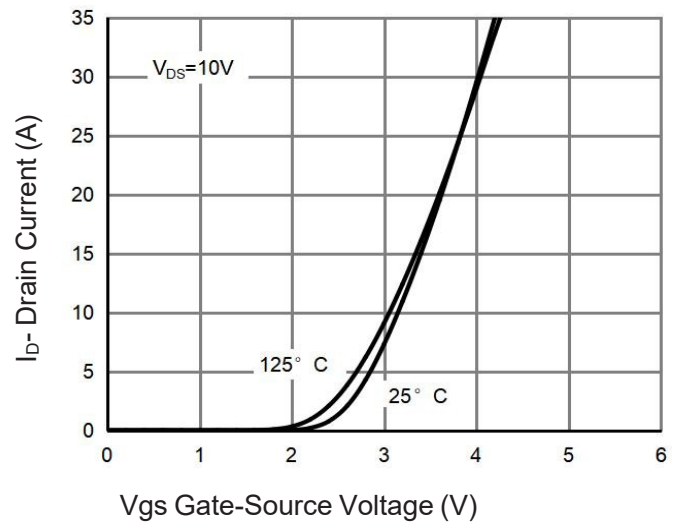


Figure 4 Transfer Characteristics

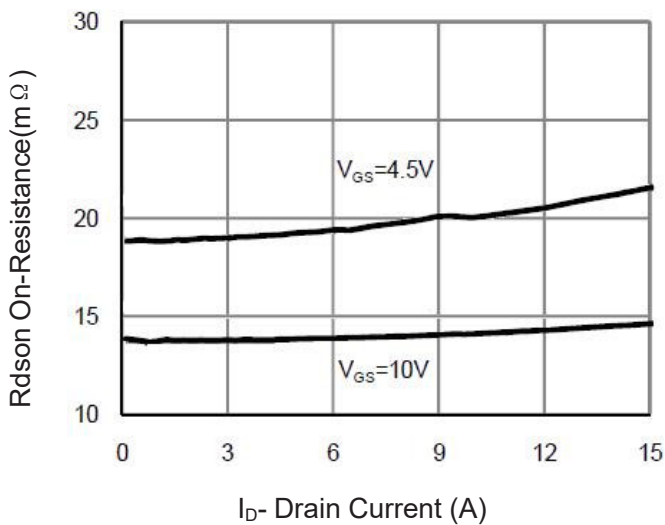


Figure 5 Drain-Source On-Resistance

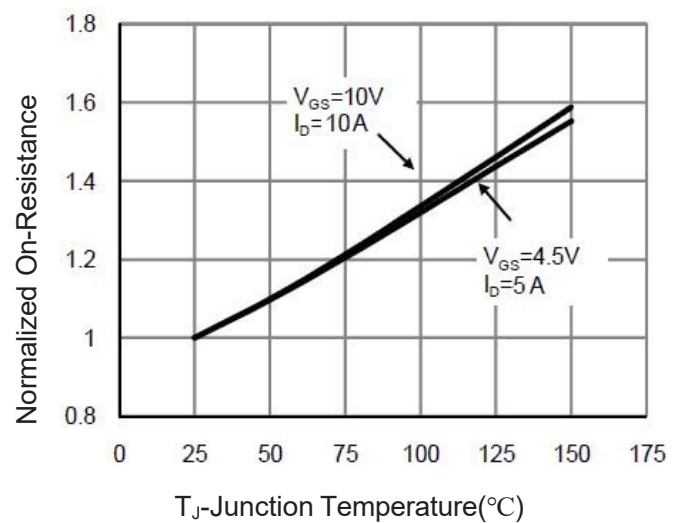
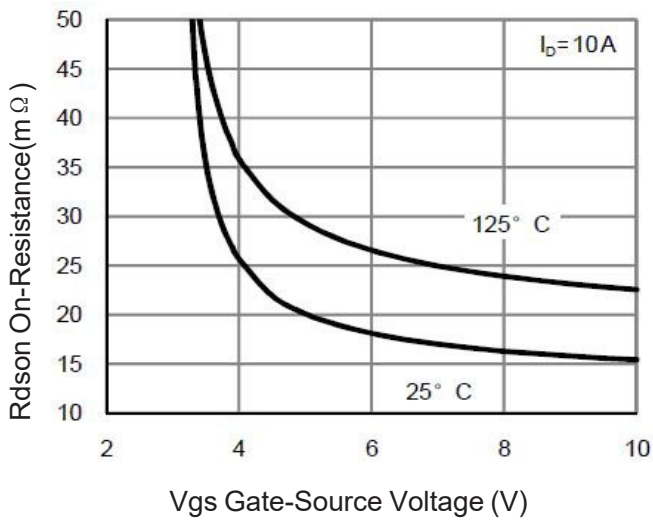
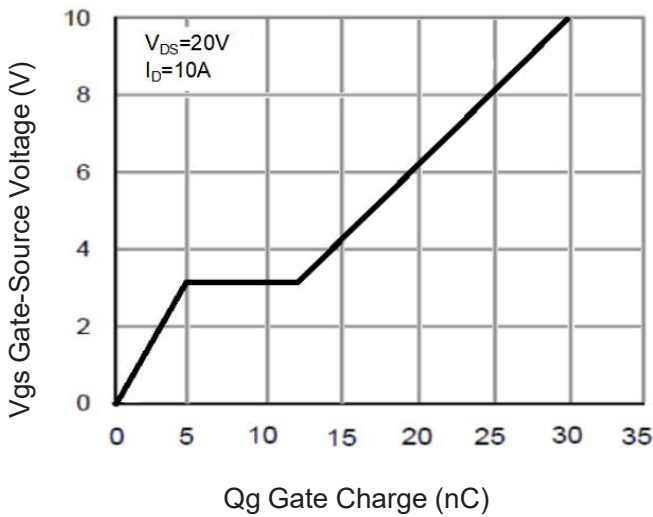
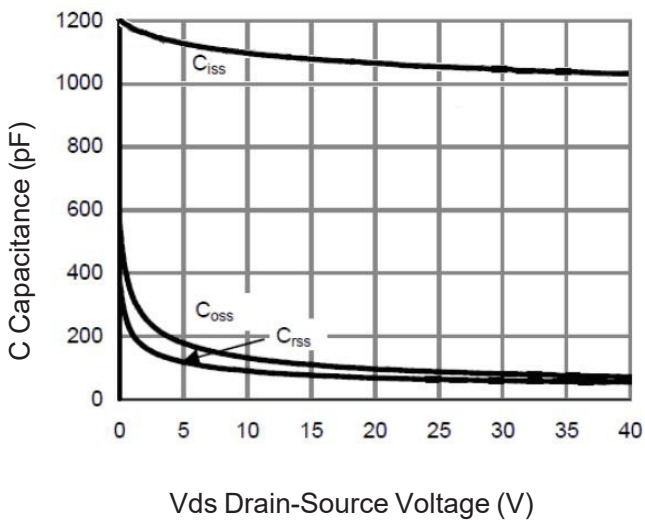
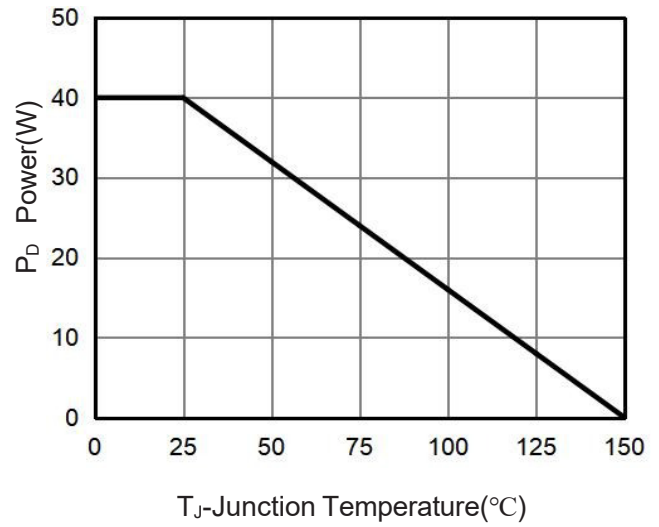
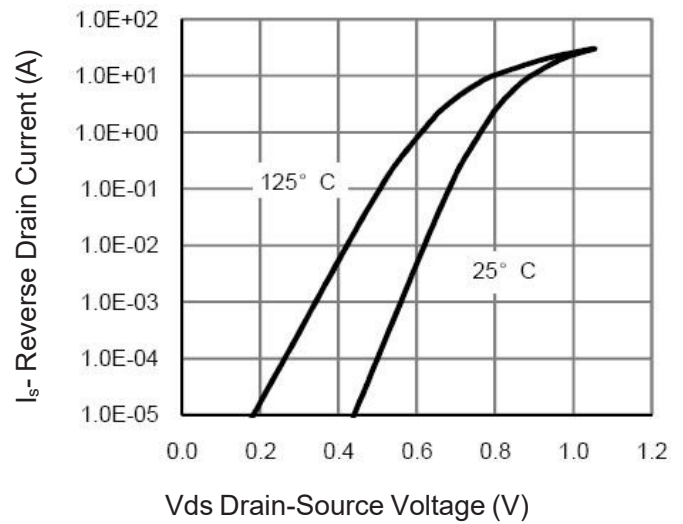
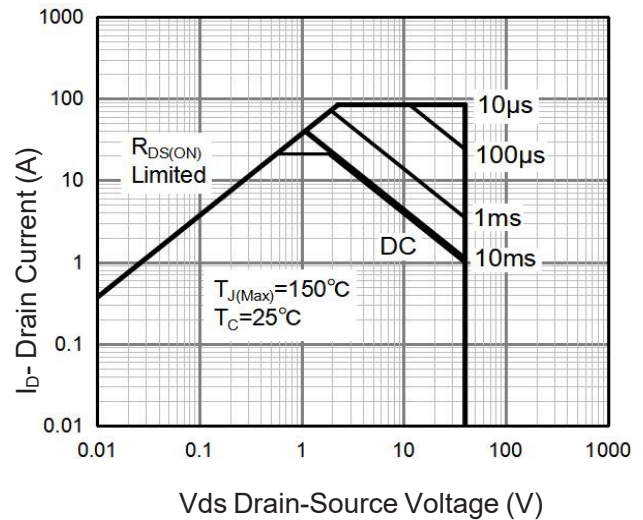


Figure 6 Drain-Source On-Resistance


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

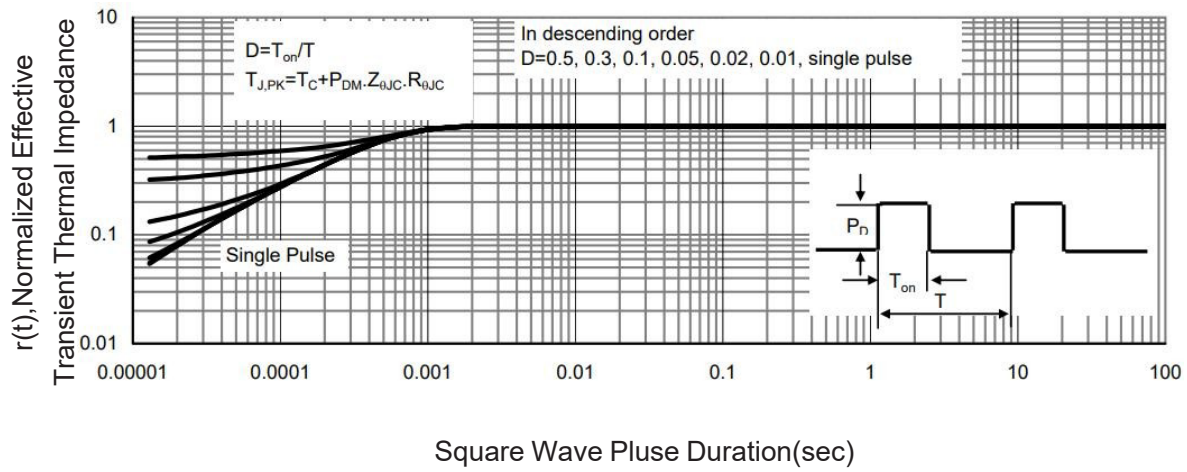
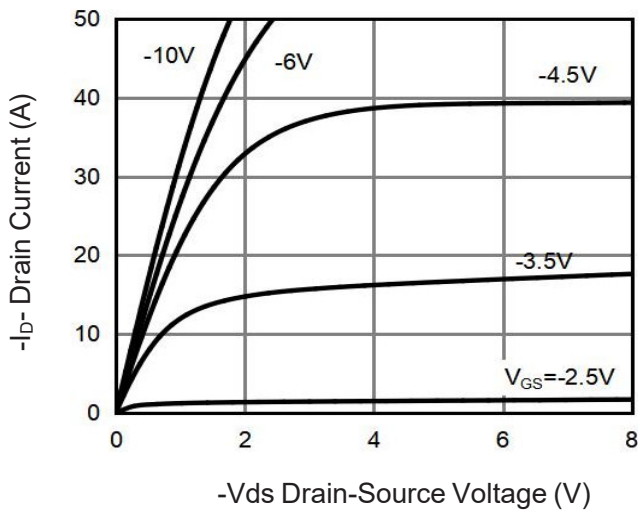
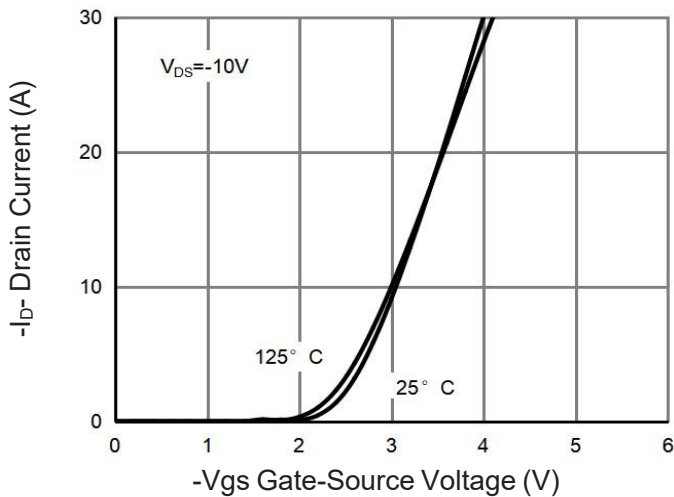
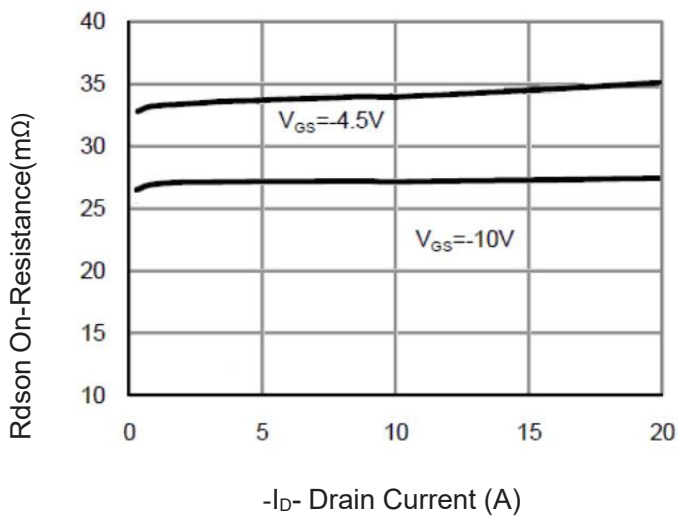
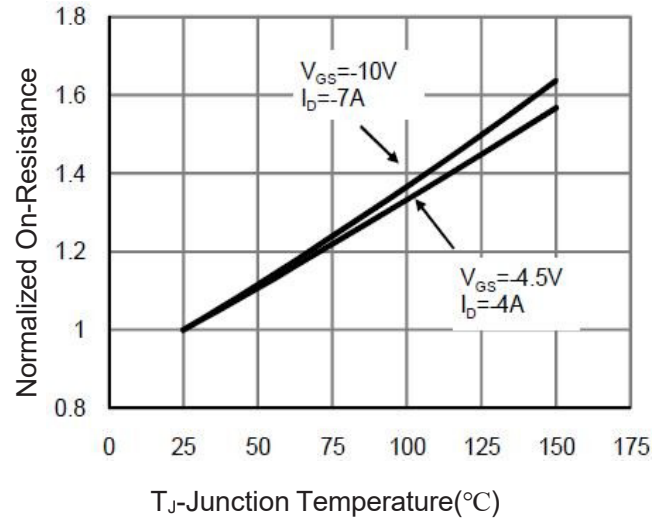
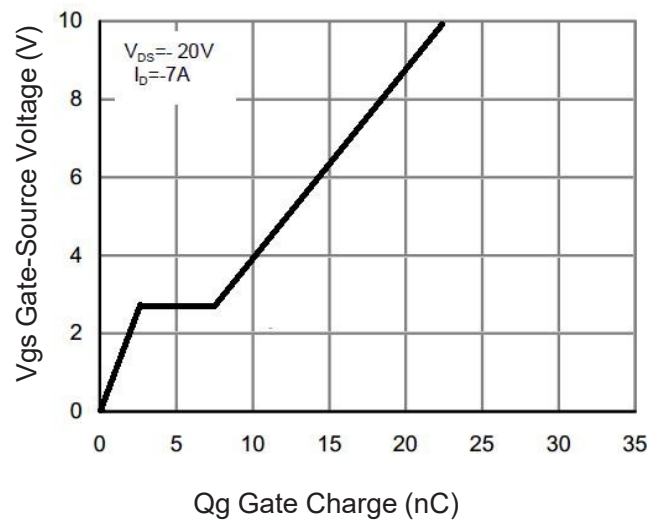
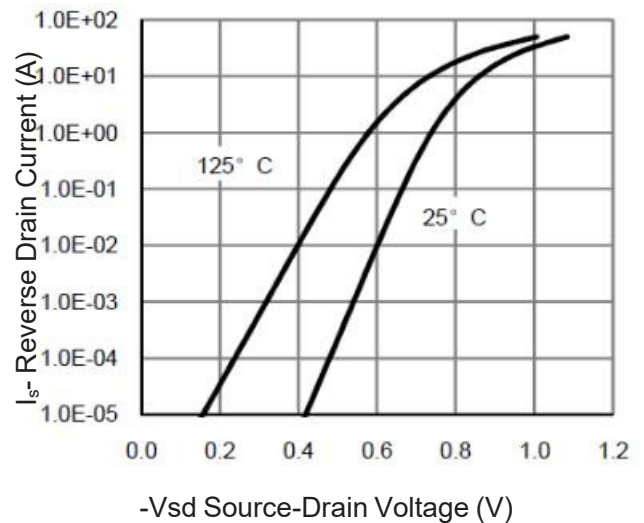
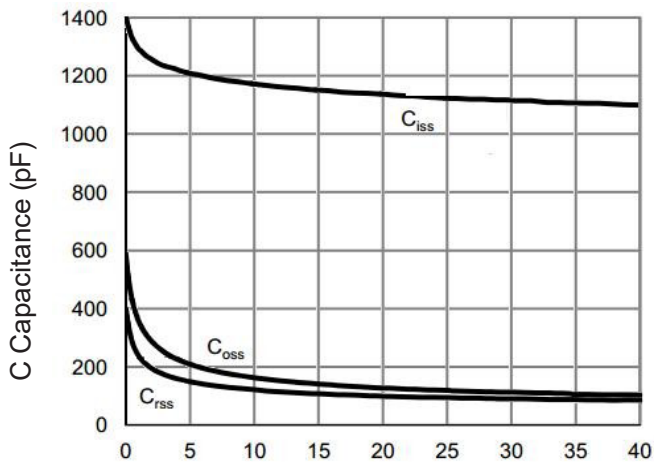


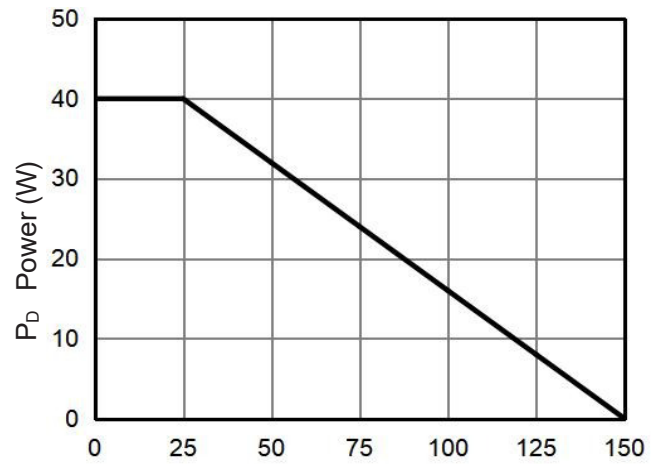
Figure 13 Normalized Maximum Transient Thermal Impedance

P- Channel Typical Electrical and Thermal Characteristics (Curves)

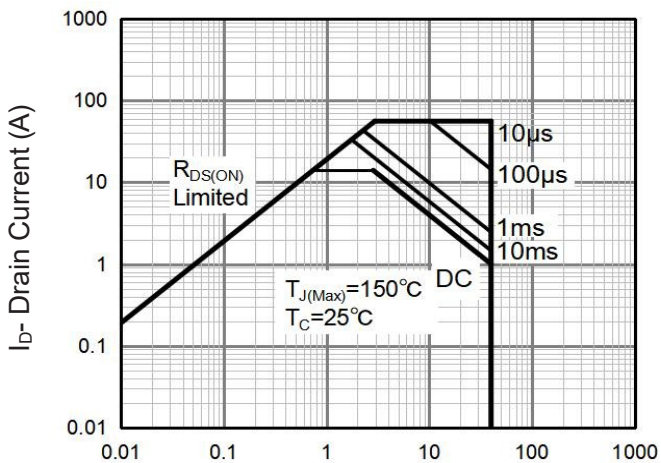

Figure 1 Output Characteristics

Figure 2 Transfer Characteristics

Figure 3 Rdson- Drain Current

Figure 4 Rdson-Junction Temperature

Figure 5 Gate Charge

Figure 6 Source- Drain Diode Forward



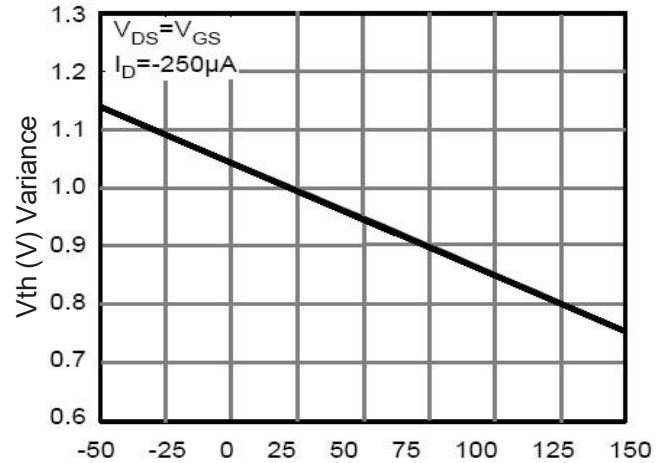
-Vds Drain-Source Voltage (V)
Figure 7 Capacitance vs Vds



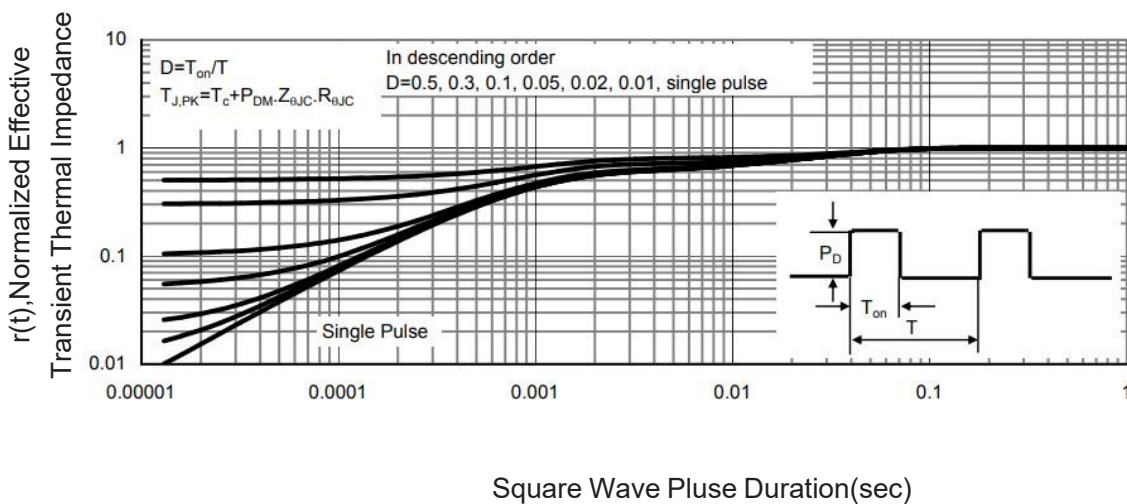
T_J -Junction Temperature(°C)
Figure 9 Power Dissipation



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



T_J -Junction Temperature(°C)
Figure 10 $V_{GS(th)}$ vs Junction Temperature



Square Wave Pluse Duration(sec)
Figure 11 Normalized Maximum Transient Thermal Impedance