

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

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

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

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

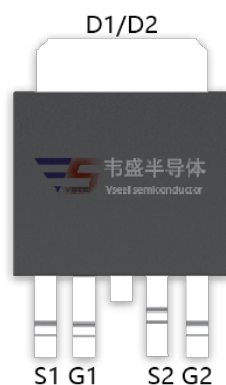
● P-Channel

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

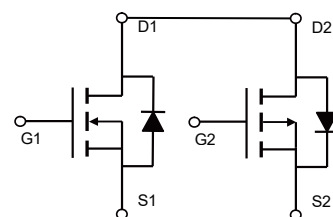
$$R_{DS(ON)} < 32m\Omega @ V_{GS}=-10V$$

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

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



TO-252-4L



Schematic

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VSM21NP04		TO-252-4L	-	-	-

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	$T_C=25^\circ\text{C}$	I_D	21	-14	A
	$T_C=70^\circ\text{C}$		17.5	-11.5	
Pulsed Drain Current (Note 1)		I_{DM}	84	-56	A
Maximum Power Dissipation	$T_C=25^\circ\text{C}$	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 (Note2)	$R_{\theta JC}$	N-Ch	3.1	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Case (Note2)	$R_{\theta JC}$	P-Ch	3.1	$^\circ\text{C/W}$

N-CH 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}	$V_{GS}=0V, I_D=250\mu A$	40	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=40V, V_{GS}=0V$	-	-	1	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 25V, V_{DS}=0V$	-	-	± 100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1	1.6	2.2	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=10A$	-	14	17	m Ω
		$V_{GS}=4.5V, I_D=5A$	-	19	29	m Ω
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	$t_{d(on)}$	$V_{DD}=20V, R_L=2\Omega$ $V_{GS}=10V, R_{GEN}=3\Omega$	-	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 ($T_A=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=-250\mu A$	-40	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=-40V, V_{GS}=0V$	-	-	-1	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 25V, V_{DS}=0V$	-	-	± 100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1.0	-1.6	-2.2	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=-10V, I_D=-7A$	-	27	32	m Ω
		$V_{GS}=-4.5V, I_D=-4A$	-	34	45	m Ω
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	$t_{d(on)}$	$V_{DD}=-20V, R_L=2.3\Omega$ $V_{GS}=-10V, R_{GEN}=6\Omega$	-	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, $t \leq 10$ sec.
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 (Curves)

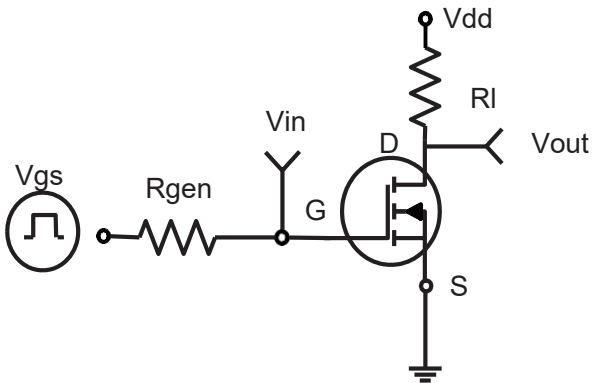


Figure 1: Switching Test Circuit

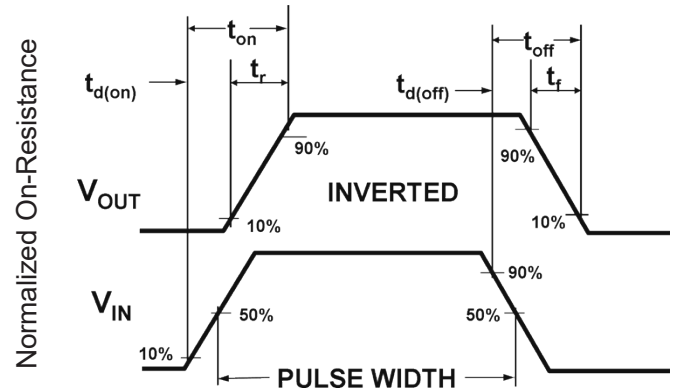


Figure 2: Switching Waveforms

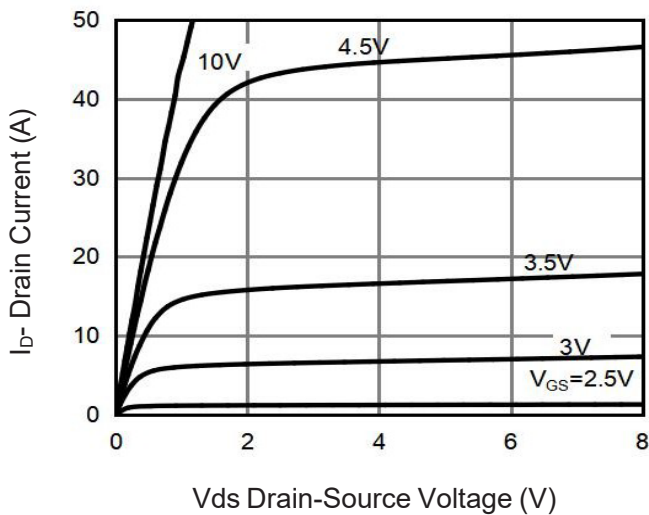


Figure 3 Output Characteristics

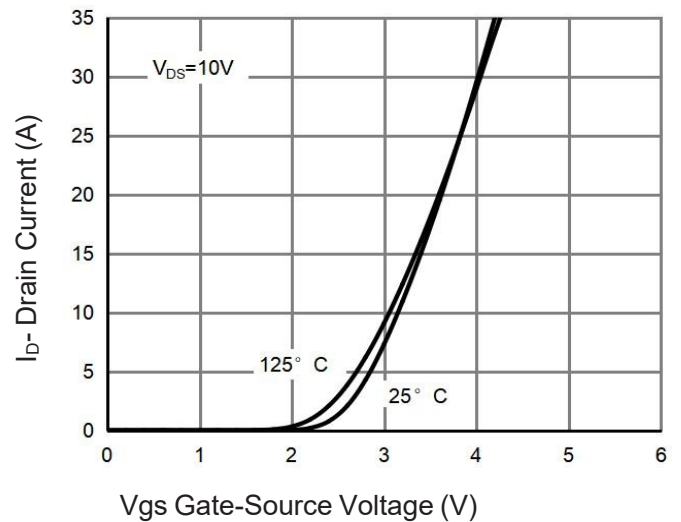


Figure 4 Transfer Characteristics

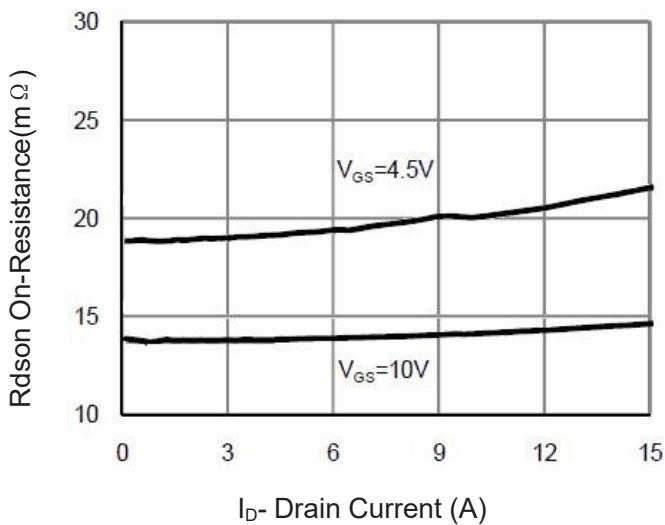


Figure 5 Drain-Source On-Resistance

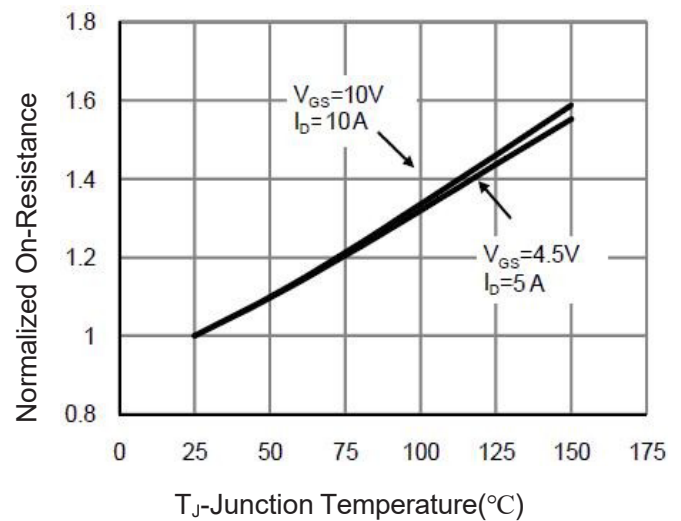
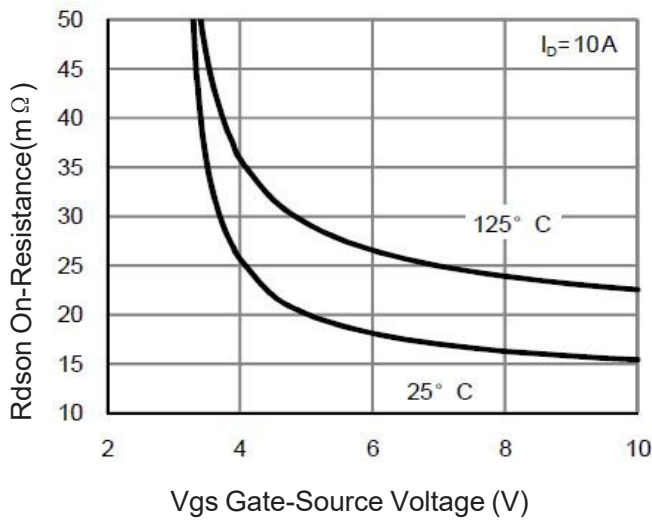
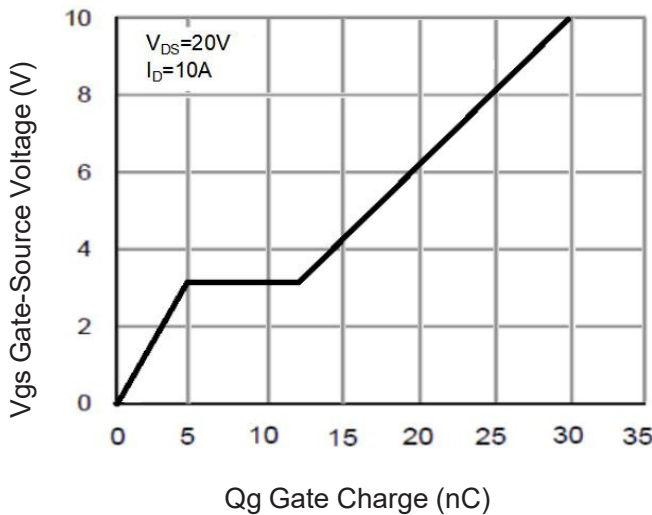
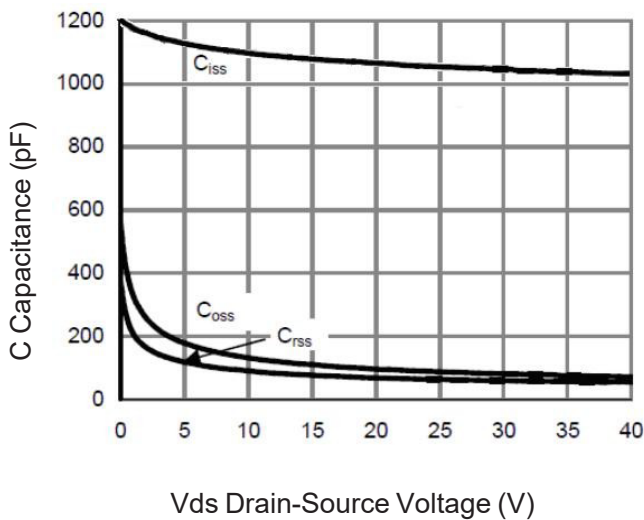
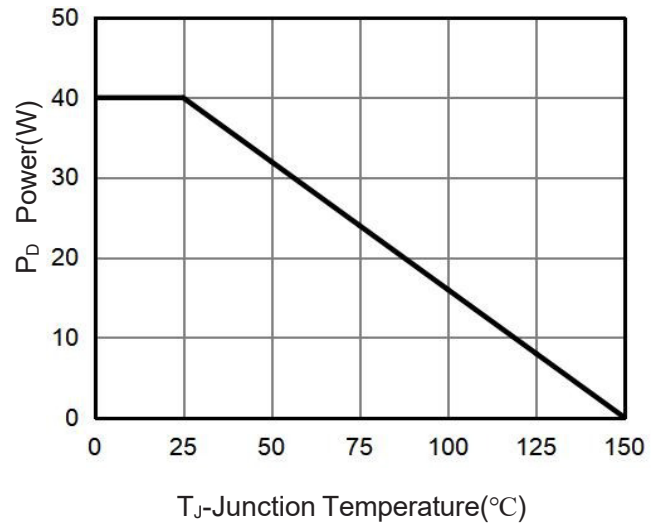
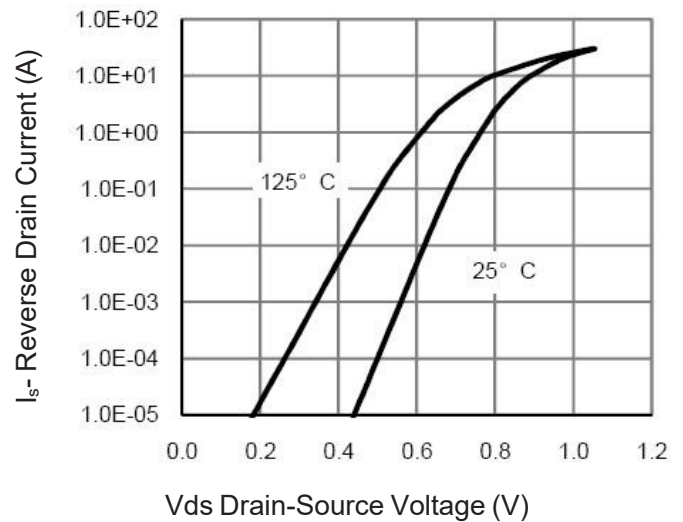
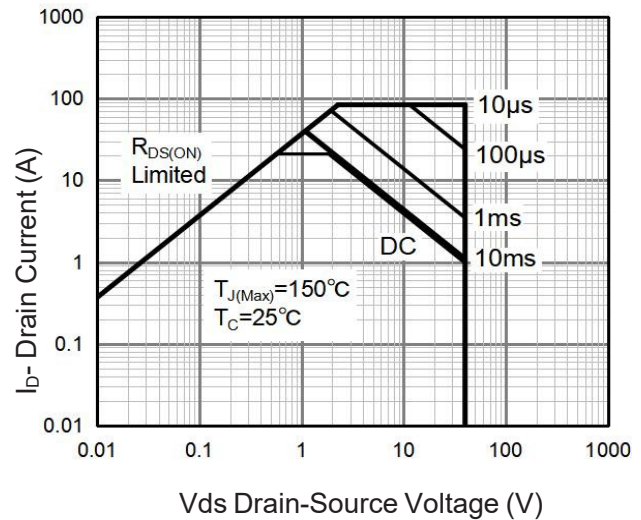


Figure 6 Drain-Source On-Resistance


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

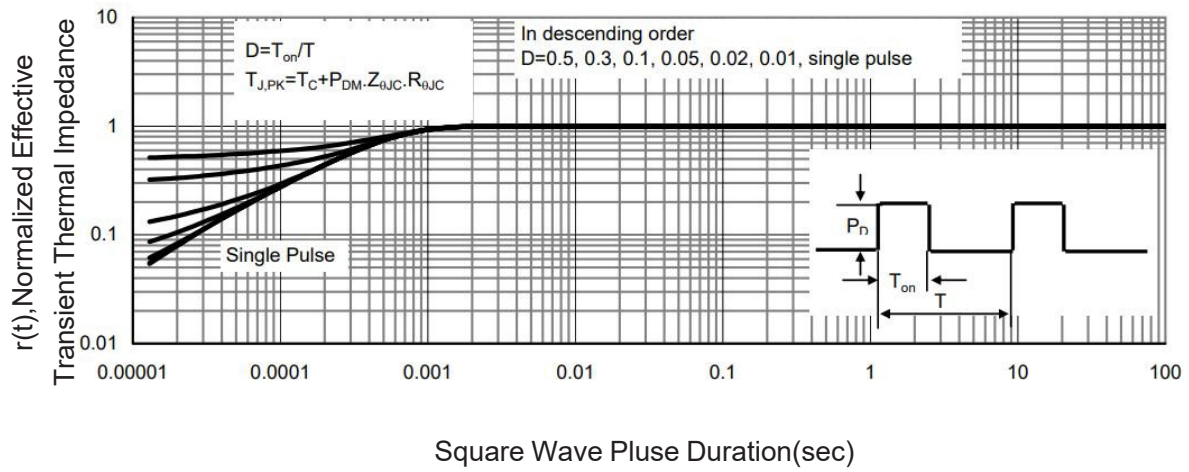
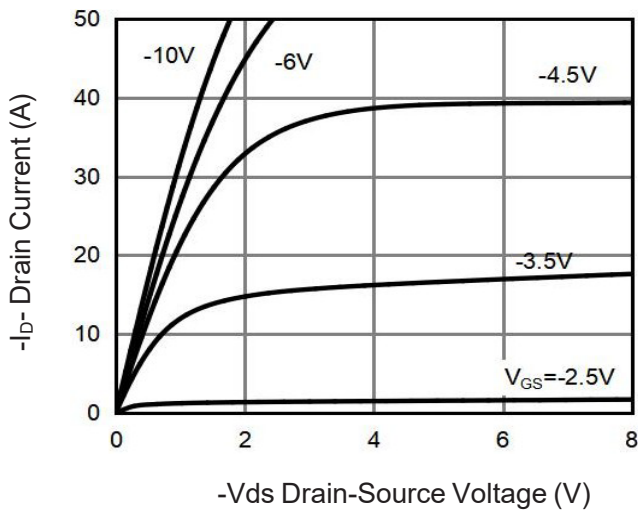
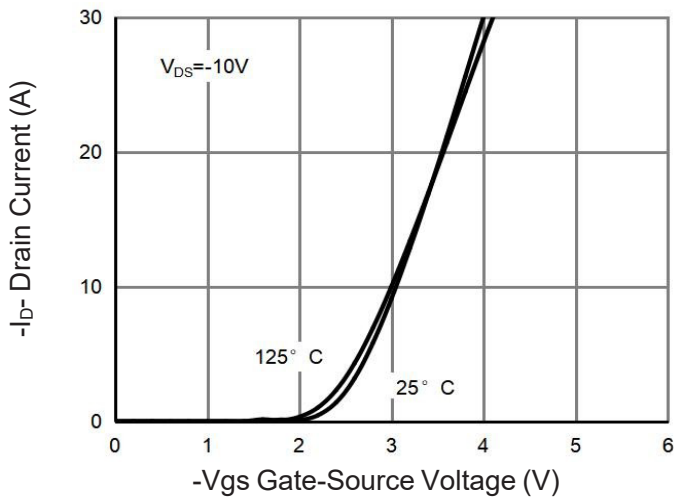
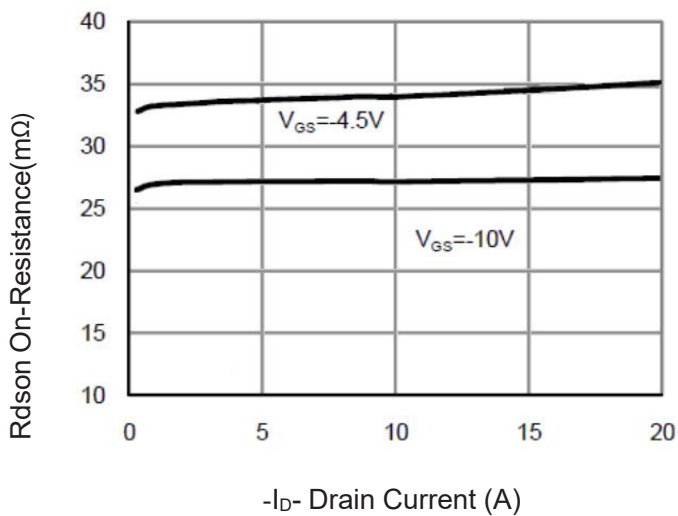
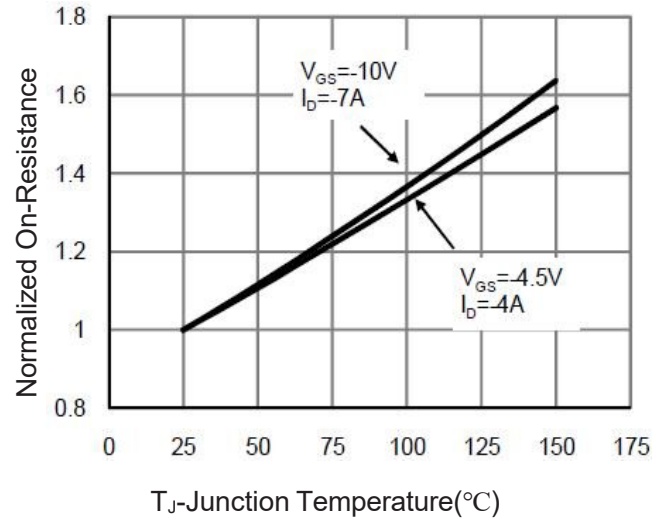
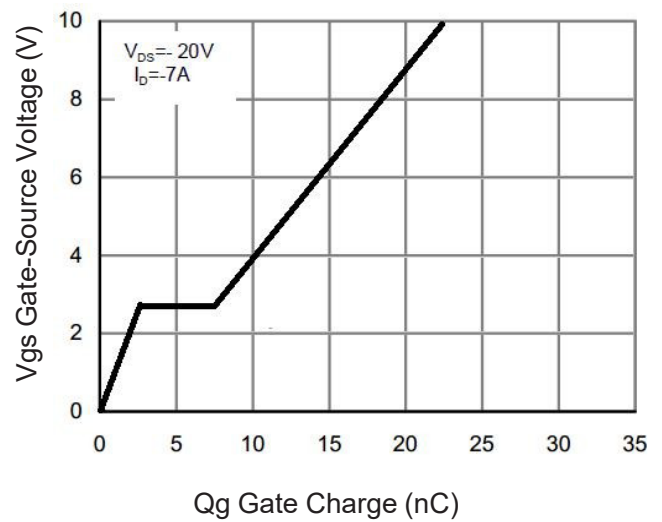
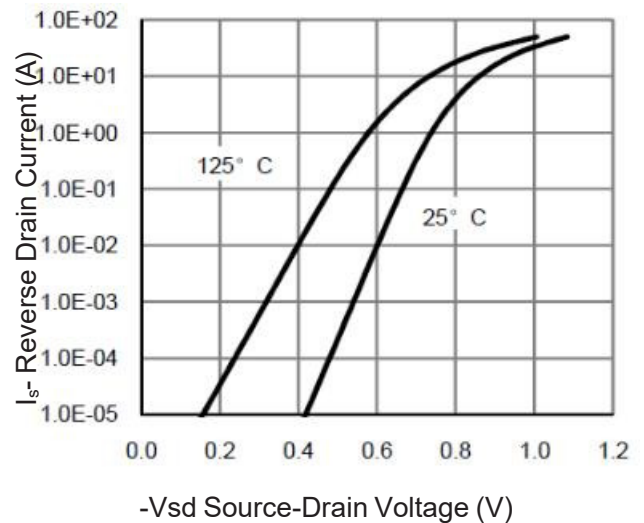
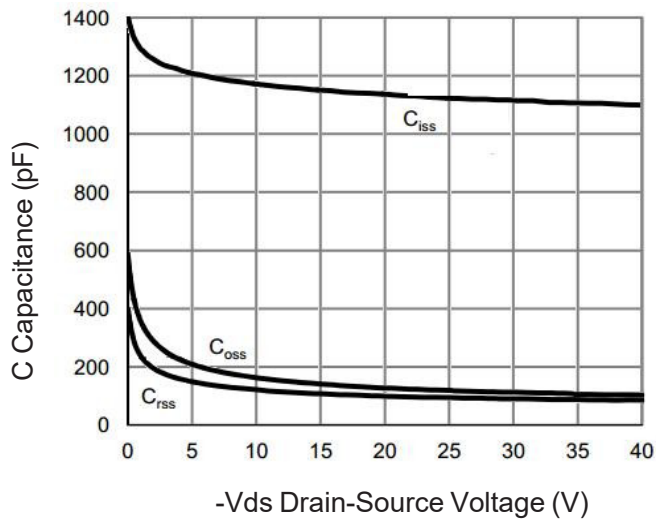
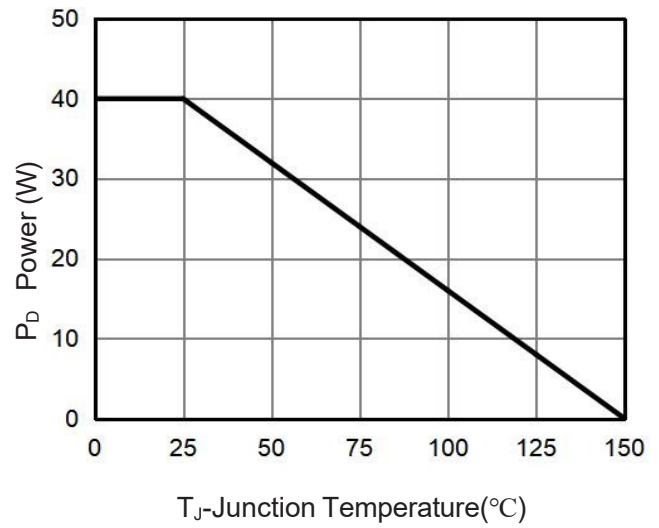
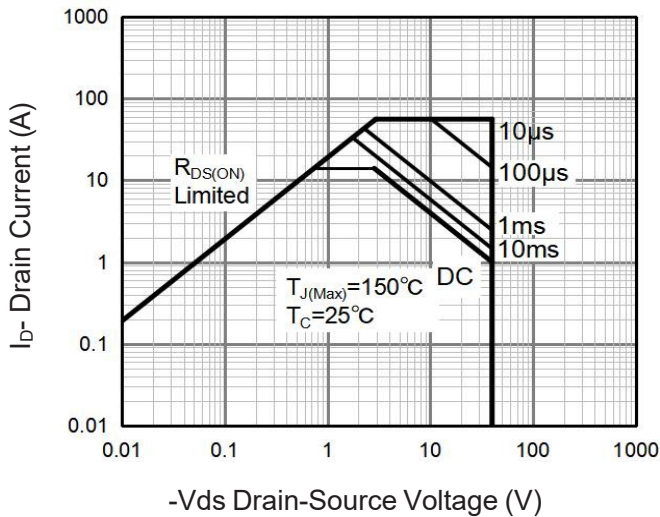
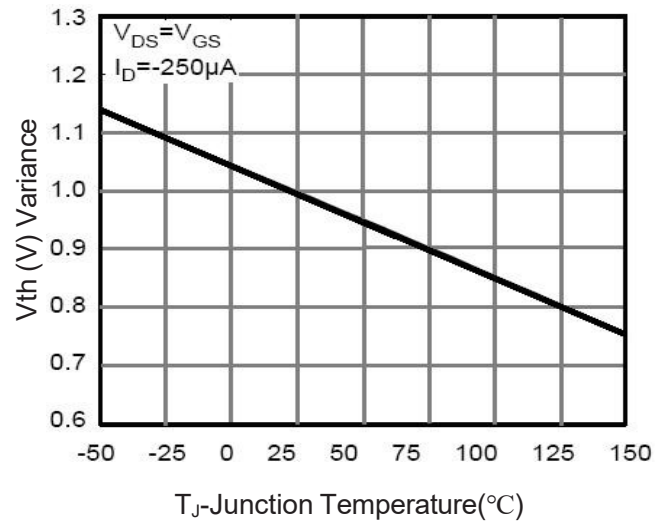
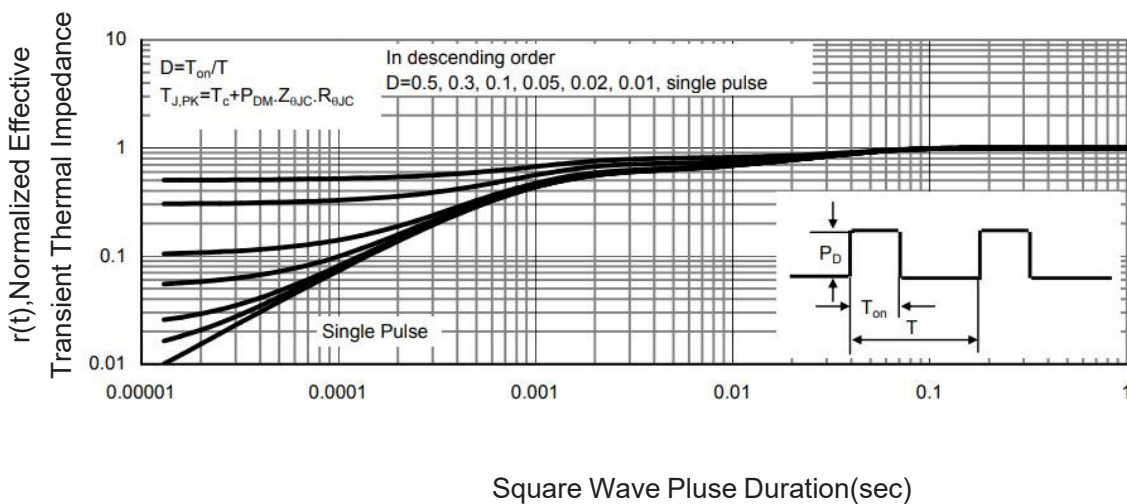


Figure 13 Normalized Maximum Transient Thermal Impedance

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


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