

Description

The VSM8NP04 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

$V_{DS} = 40V, I_D = 8A$

$R_{DS(ON)} < 19m\Omega @ V_{GS} = 10V$

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

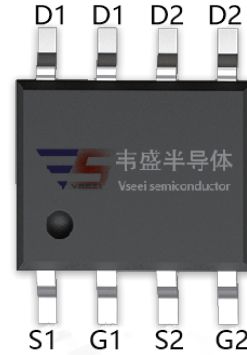
● P-Channel

$V_{DS} = -40V, I_D = -7A$

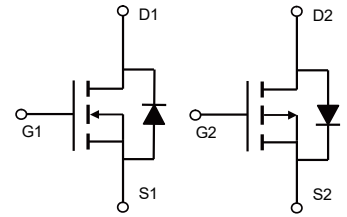
$R_{DS(ON)} < 35m\Omega @ V_{GS} = -10V$

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

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



SOP-8



Schematic

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VSM8NP04	VSM8NP04-S8	SOP-8	Ø330mm	12mm	4000 units

Absolute Maximum Ratings ($T_A = 25^\circ C$ 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	8	-7	A
		6	-5.5	
Pulsed Drain Current (Note 1)	I_{DM}	40	-30	A
Maximum Power Dissipation	P_D	2.0	2.0	W
Single pulse avalanche energy (Note 5)	E_{AS}	72	64	mJ
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150	-55 To 150	$^\circ C$

Thermal Characteristic

Thermal Resistance, Junction-to-Ambient (Note2)	$R_{\theta JA}$	N-Ch	62.5	$^\circ C/W$
Thermal Resistance, Junction-to-Ambient (Note2)	$R_{\theta JA}$	P-Ch	62.5	$^\circ C/W$
Thermal Resistance, Junction-to-Lead (Note2)	$R_{\theta JL}$	N-Ch	40	$^\circ C/W$
Thermal Resistance, Junction-to-Lead (Note2)	$R_{\theta JL}$	P-Ch	40	$^\circ C/W$

N-CH Electrical Characteristics ($T_A=25^{\circ}\text{C}$ unless otherwise noted)

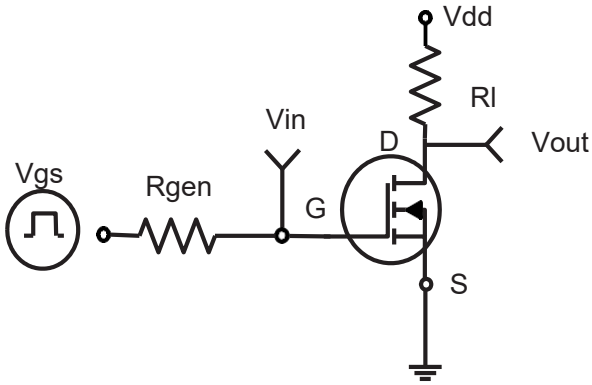
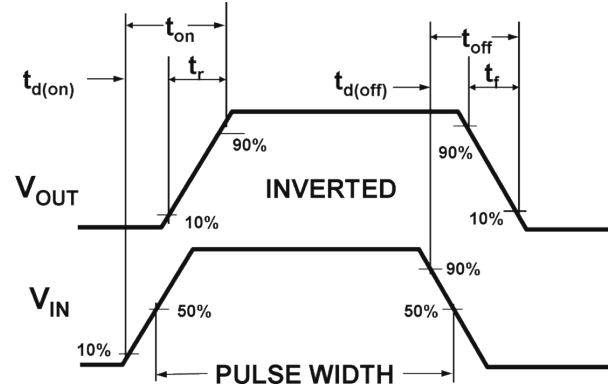
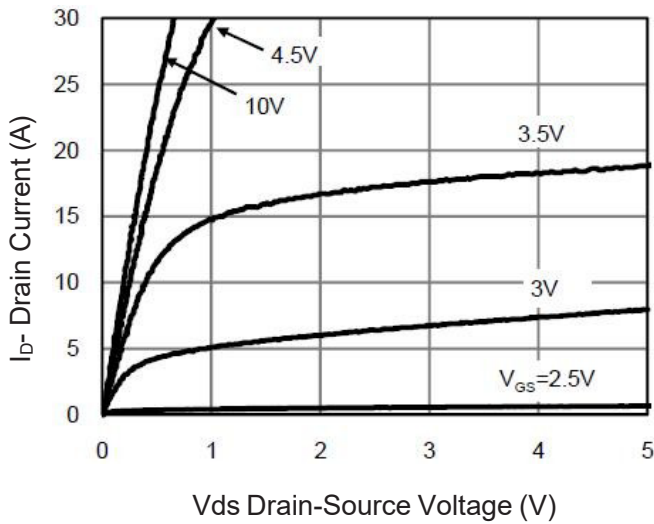
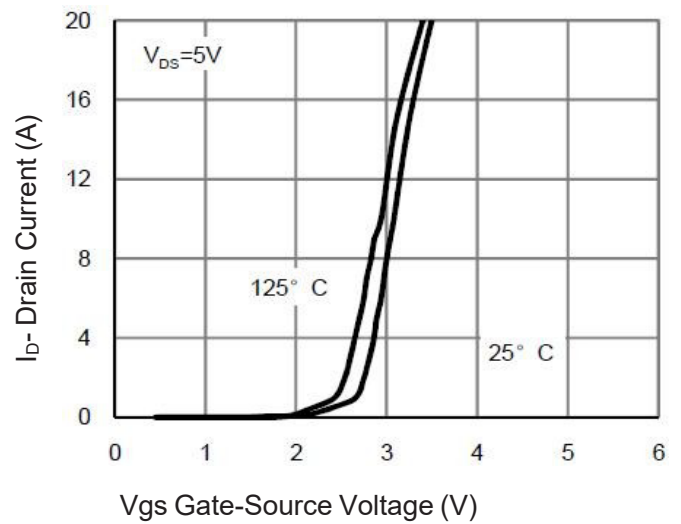
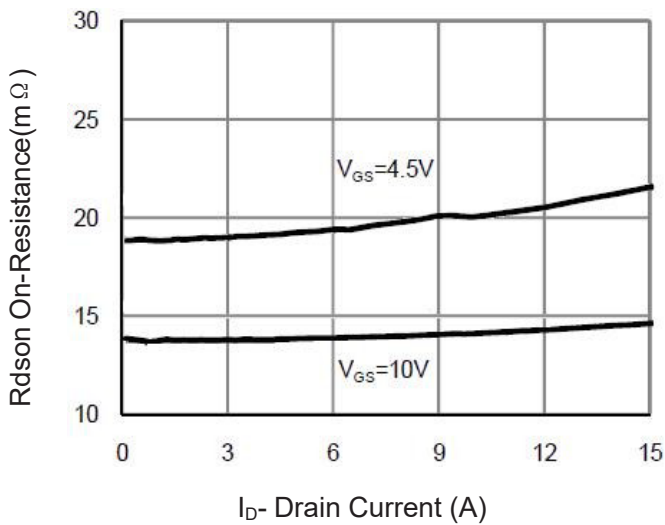
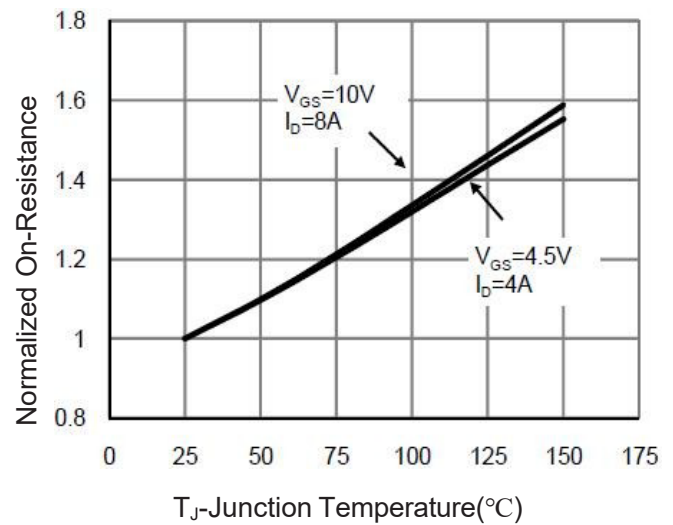
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	40	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=40V, V_{GS}=0V$	-	-	1	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	± 100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1	1.5	2.0	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=8A$	-	14	19	m Ω
		$V_{GS}=4.5V, I_D=4A$	-	19	29	m Ω
Forward Transconductance	g_{FS}	$V_{DS}=5V, I_D=8A$	-	20	-	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	$t_{d(on)}$	$V_{DD}=20V, R_L=2.5\Omega$ $V_{GS}=10V, R_{GEN}=3\Omega$	-	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	$V_{DS}=20V, I_D=8A,$ $V_{GS}=10V$	-	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}	$V_{GS}=0V, I_S=8A$	-	0.8	1.2	V

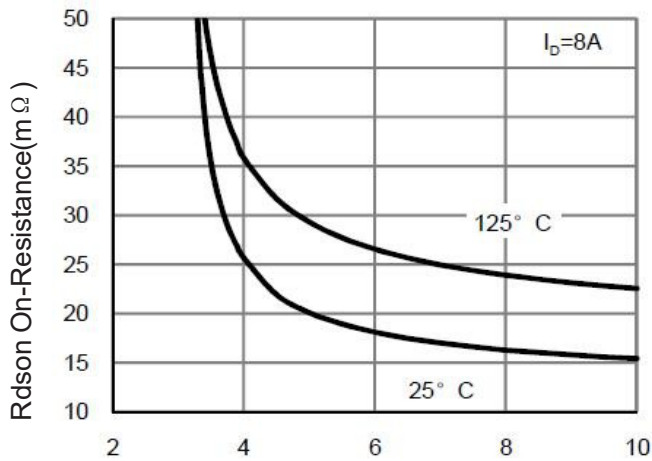
P-CH Electrical Characteristics (T_A=25°C unless otherwise noted)

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} =±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 =2.9Ω V _{GS} =-10V, R _{GEN} =6Ω	-	7.5	-	nS
Turn-on Rise Time	t _r		-	5.5	-	nS
Turn-Off Delay Time	t _{d(off)}		-	19	-	nS
Turn-Off Fall Time	t _f		-	7	-	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 =-7A	-	-	-1.2	V

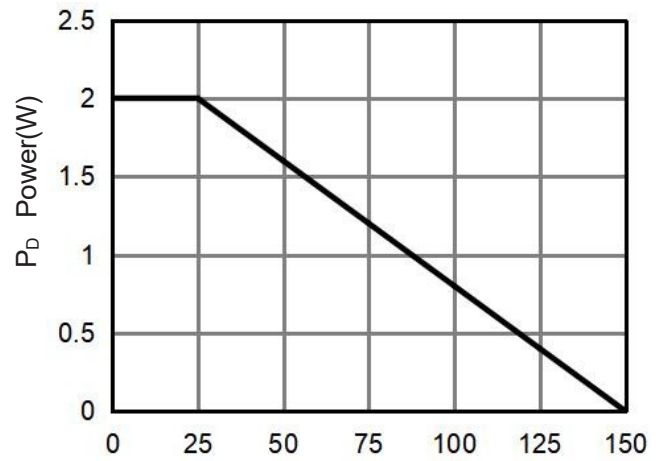
Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. The value of R_{θJA} is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T_A =25° C. The maximum allowed junction temperature of 175° C. The value in any given application depends on the user's specific board design. The R_{θJA} is the sum of the thermal impedance from junction to lead R_{θJL} and lead to ambient.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production.
5. EAS condition : T_J=25°C, N: V_{DD}=20V, V_G=10V, L=0.5mH, R_g=25Ω. P: V_{DD}=-20V, V_G=-10V, L=0.5mH, R_g=25Ω.

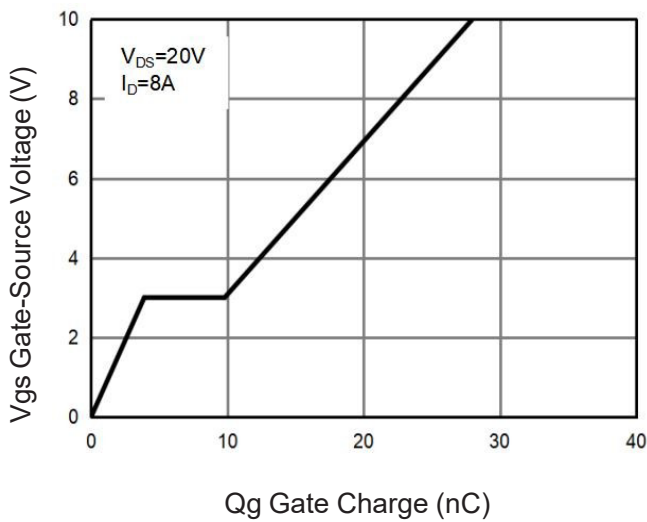

Figure 1: Switching Test Circuit

Figure 2: Switching Waveforms

Figure 3 Output Characteristics

Figure 4 Transfer Characteristics

Figure 5 Drain-Source On-Resistance

Figure 6 Drain-Source On-Resistance



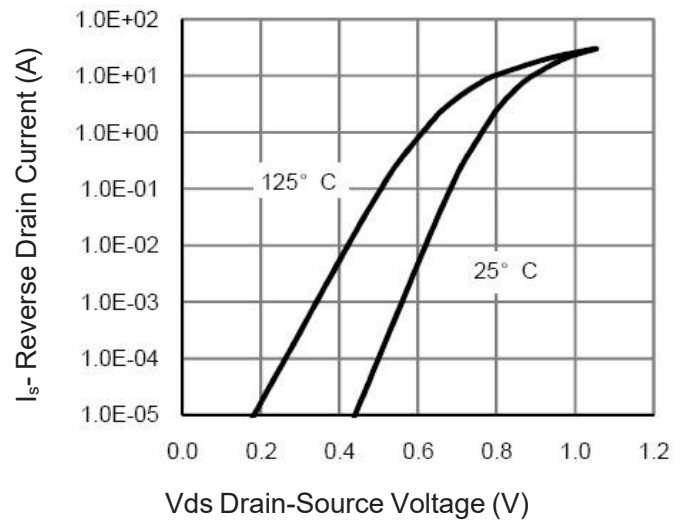
Vgs Gate-Source Voltage (V)
Figure 7 Rdson vs Vgs



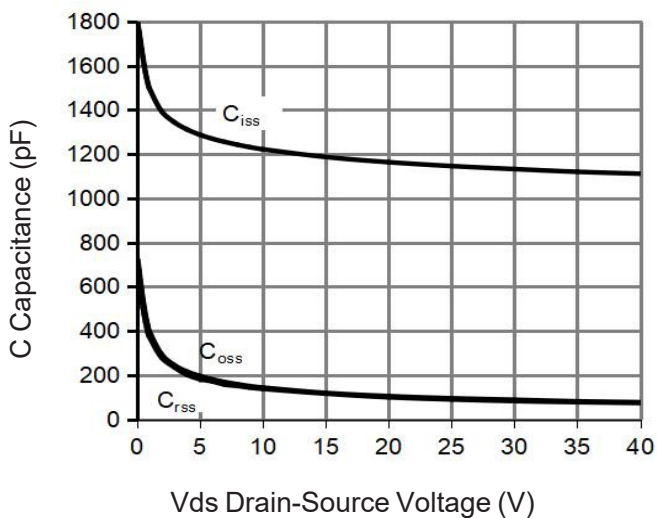
Tj-Junction Temperature(°C)
Figure 8 Power Dissipation



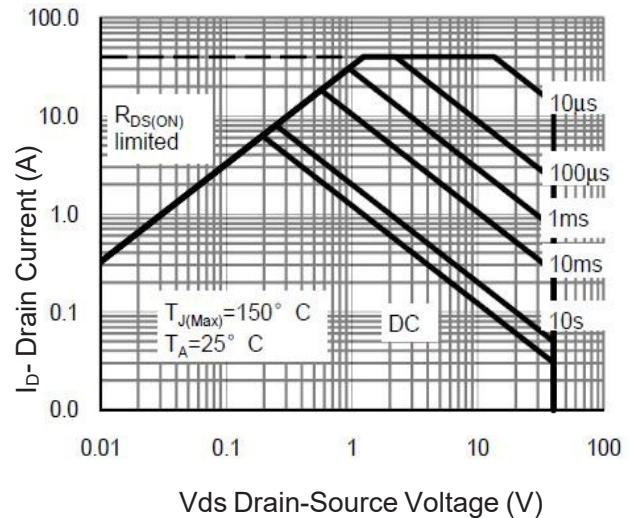
Qg Gate Charge (nC)
Figure 9 Gate Charge



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



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



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

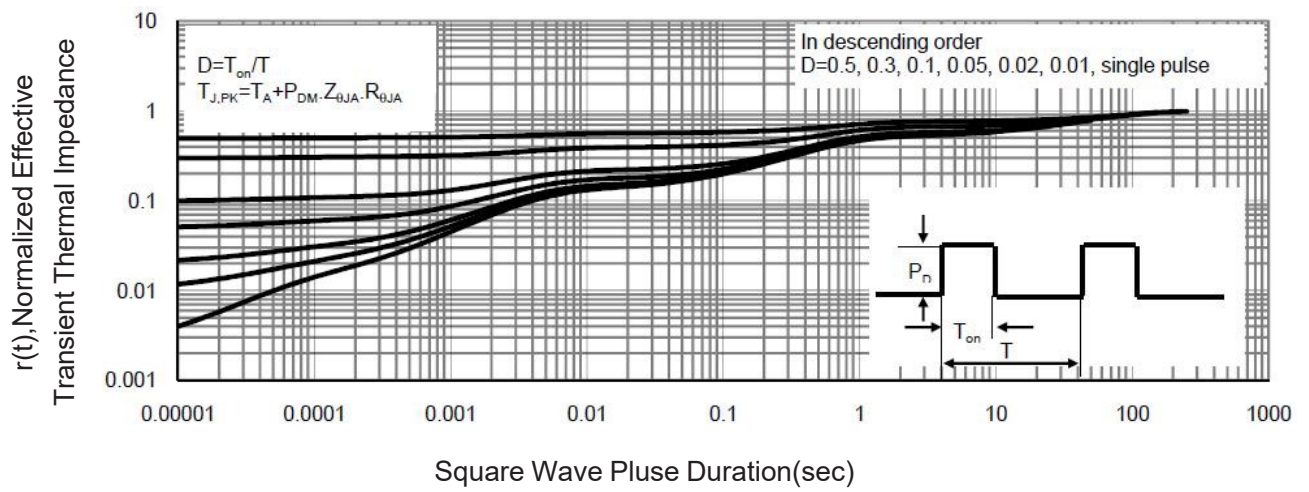
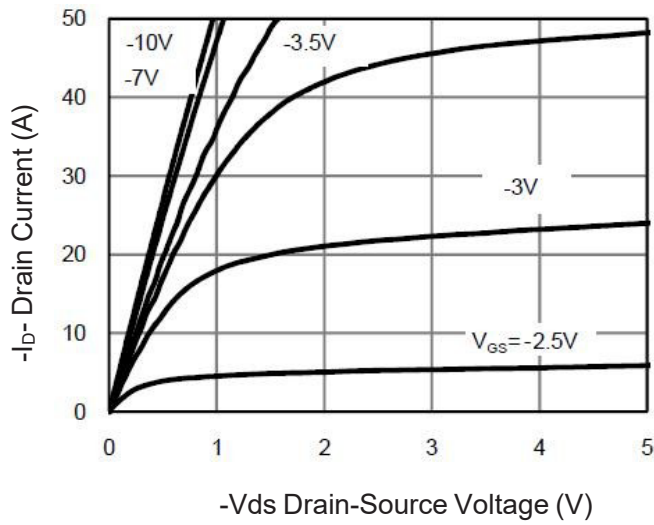
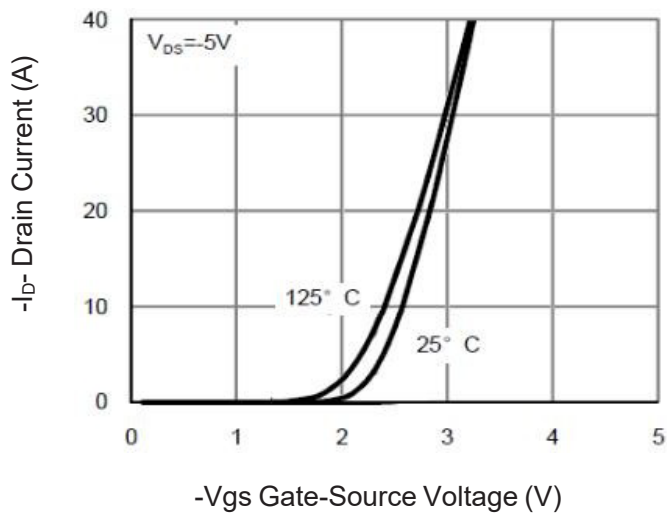
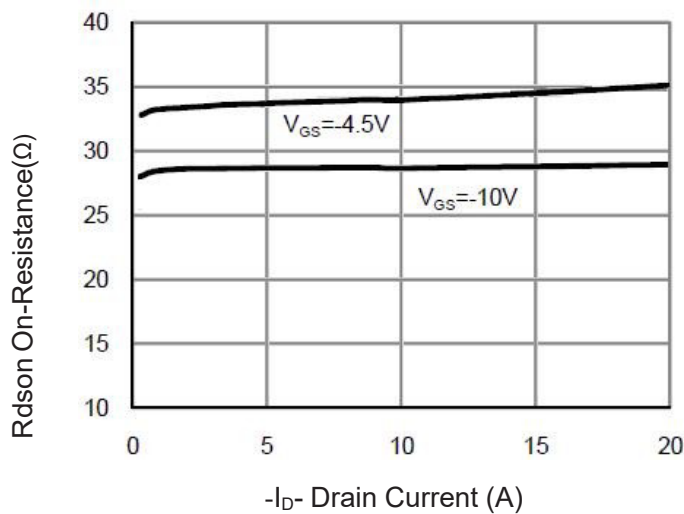
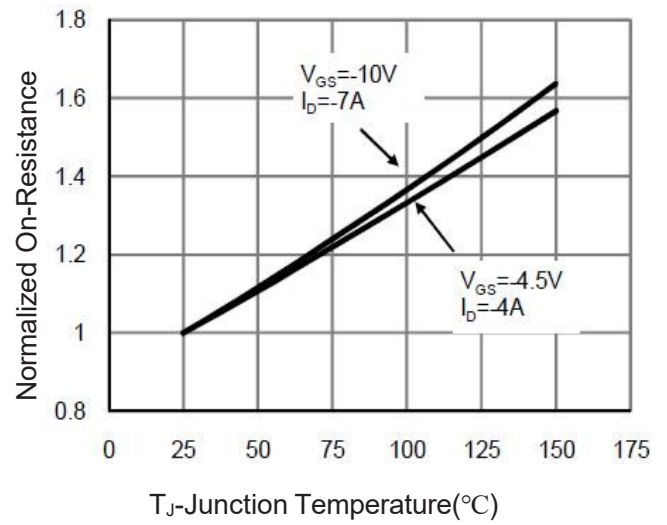
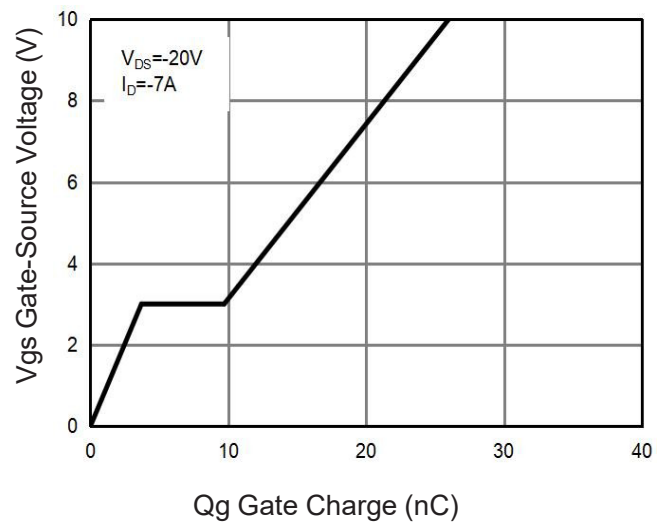
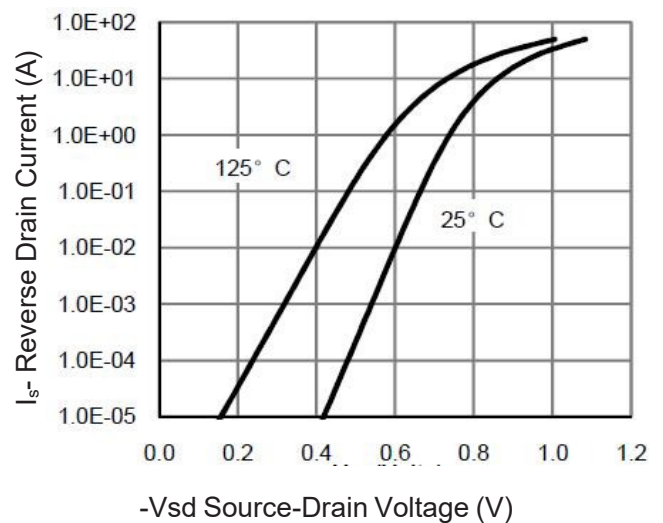
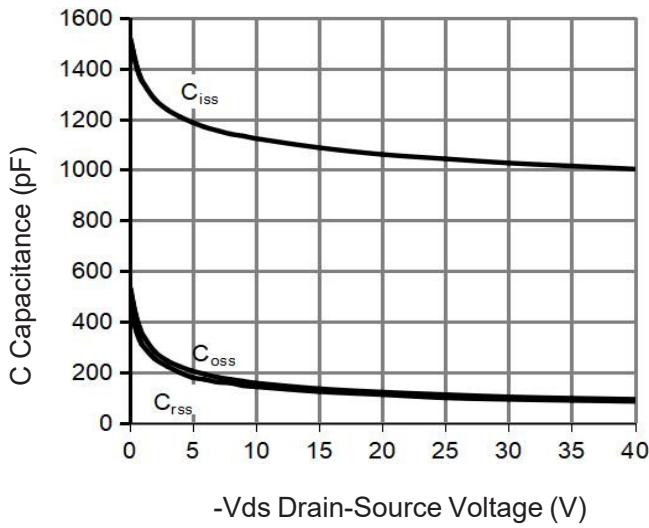
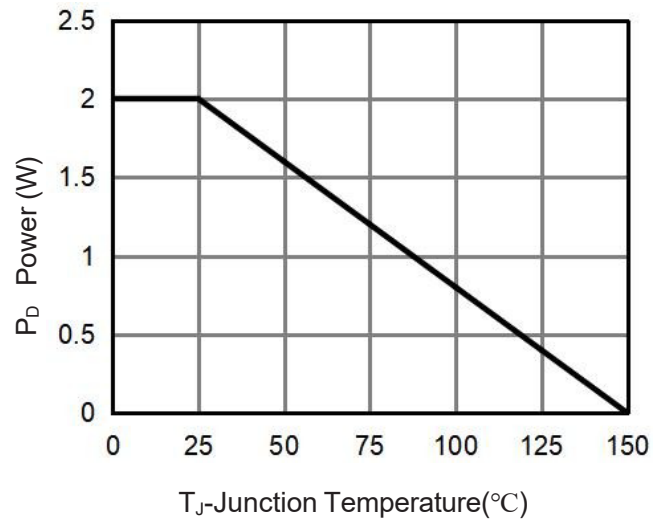
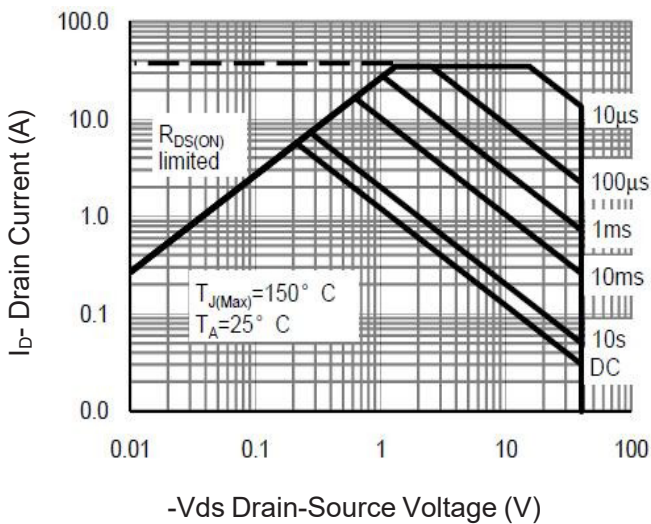
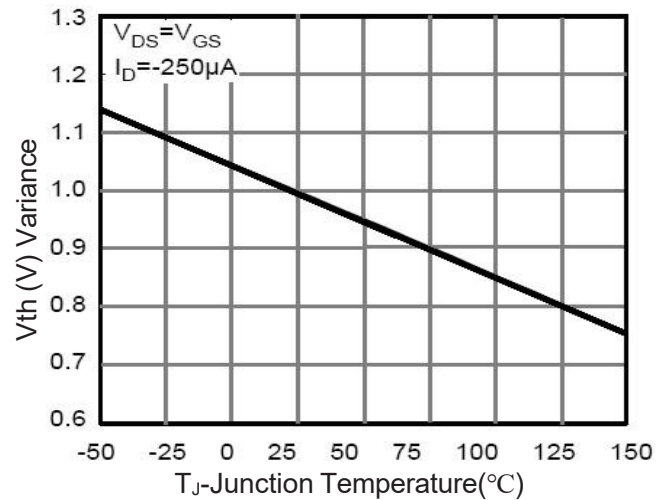
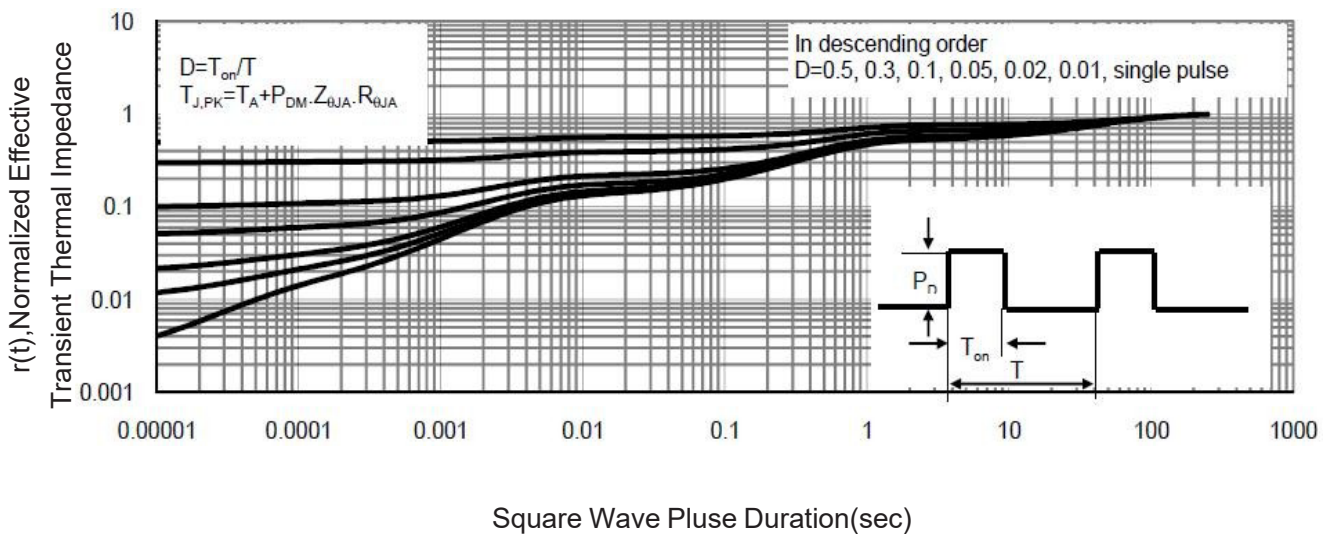
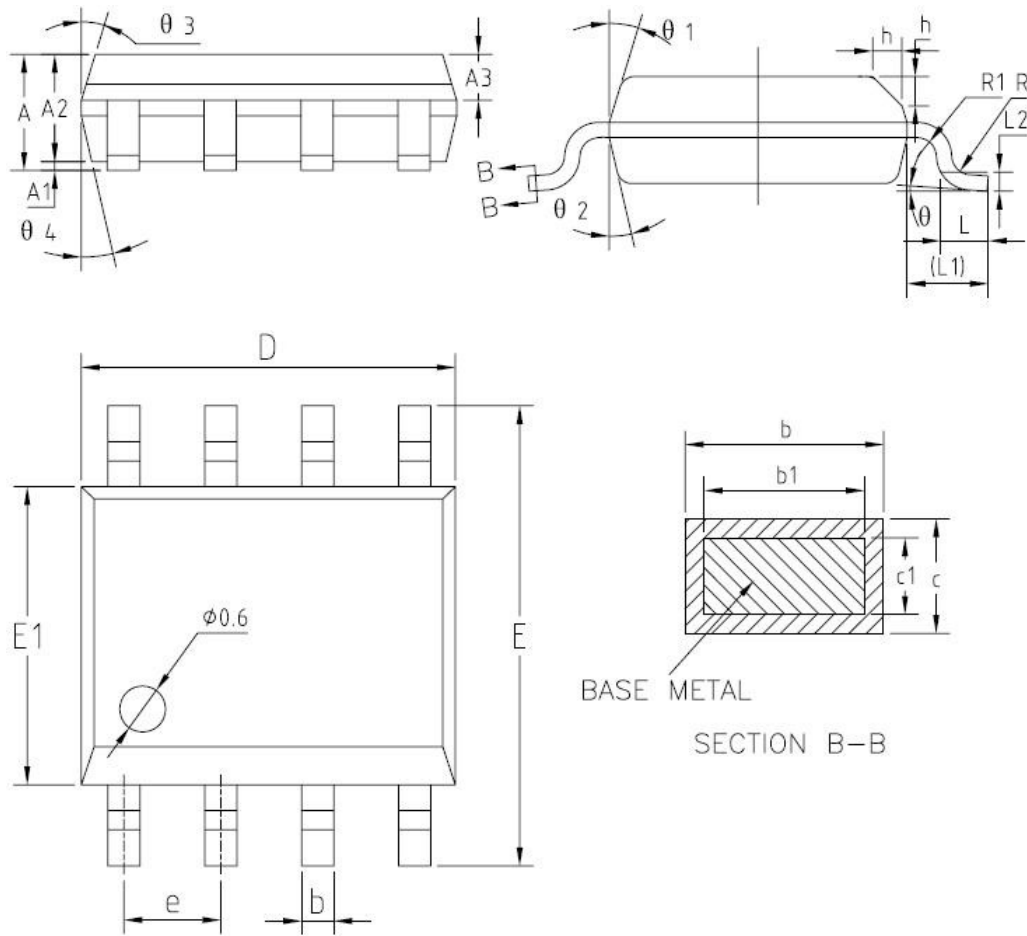


Figure 13 Normalized Maximum Transient Thermal Impedance


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



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	1.35	1.55	1.75
A1	0.10	0.15	0.25
A2	1.25	1.40	1.65
A3	0.50	0.60	0.70
b	0.38	—	0.51
b1	0.37	0.42	0.47
c	0.18	—	0.25
c1	0.17	0.20	0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.17	1.27	1.37
L	0.45	0.60	0.80
L1	1.04REF		
L2	0.25BSC		
R	0.07	—	—
R1	0.07	—	—
h	0.30	0.40	0.50
θ	0°	—	8°
$\theta 1$	15°	17°	19°
$\theta 2$	11°	13°	15°
$\theta 3$	15°	17°	19°
$\theta 4$	11°	13°	15°