

Description

The VSM11NP04 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

$$V_{DS} = 40V, I_D = 22A$$

$$R_{DS(ON)} < 20m\Omega @ V_{GS}=10V$$

$$R_{DS(ON)} < 42m\Omega @ V_{GS}=4.5V$$

● P-Channel

$$V_{DS} = -40V, I_D = -11A$$

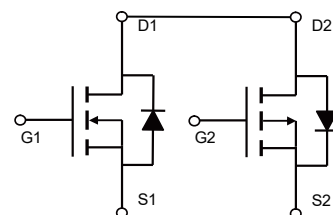
$$R_{DS(ON)} < 32m\Omega @ V_{GS}=-10V$$

$$R_{DS(ON)} < 50m\Omega @ V_{GS}=-4.5V$$

- 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
VSM11NP04	VSM11NP04-T2-4	TO-252-4L	-	-	-

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	$T_C=25^{\circ}C$	I_D	22	-11	A
	$T_C=70^{\circ}C$		14.4	-8.5	
Pulsed Drain Current (Note 1)		I_{DM}	88	-44	A
Maximum Power Dissipation	$T_C=25^{\circ}C$	P_D	40	30	W
Single pulse avalanche energy (Note 5)		E_{AS}	51	40	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-Case (Note2)	$R_{\theta JC}$	N-Ch	3.2	$^{\circ}C/W$
Thermal Resistance, Junction-to-Case (Note2)	$R_{\theta JC}$	P-Ch	4.2	$^{\circ}C/W$

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	1.6	2.2	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=10A$	-	17	20	m Ω
		$V_{GS}=4.5V, I_D=5A$	-	32	42	m Ω
Forward Transconductance	g_{FS}	$V_{DS}=5V, I_D=10A$	-	10	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C_{iss}	$V_{DS}=20V, V_{GS}=0V,$ $F=1.0MHz$	-	542	-	pF
Output Capacitance	C_{oss}		-	67.5	-	pF
Reverse Transfer Capacitance	C_{rss}		-	57.5	-	pF
Switching Characteristics (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=20V, R_L=2\Omega$ $V_{GS}=10V, R_{GEN}=6\Omega$	-	7	-	nS
Turn-on Rise Time	t_r		-	4	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	17	-	nS
Turn-Off Fall Time	t_f		-	7	-	nS
Total Gate Charge	Q_g	$V_{DS}=20V, I_D=10A,$ $V_{GS}=10V$	-	15.7	-	nC
Gate-Source Charge	Q_{gs}		-	3.3	-	nC
Gate-Drain Charge	Q_{gd}		-	3.9	-	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} =±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	-1.6	-2.2	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =-10V, I _D =-7A	-	26	32	mΩ
		V _{GS} =-4.5V, I _D =-5A	-	38	50	mΩ
Forward Transconductance	g _{FS}	V _{DS} =-5V, I _D =-7A	-	10	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =-20V, V _{GS} =0V, F=1.0MHz	-	616	-	pF
Output Capacitance	C _{oss}		-	79	-	pF
Reverse Transfer Capacitance	C _{rss}		-	68	-	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	-	nS
Turn-on Rise Time	t _r		-	5	-	nS
Turn-Off Delay Time	t _{d(off)}		-	19	-	nS
Turn-Off Fall Time	t _f		-	6	-	nS
Total Gate Charge	Q _g	V _{DS} =-20V, I _D =-7A V _{GS} =-10V	-	17.2	-	nC
Gate-Source Charge	Q _{gs}		-	2.3	-	nC
Gate-Drain Charge	Q _{gd}		-	4.7	-	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. 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
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.

N- Channel Typical Electrical and Thermal Characteristics (Curves)

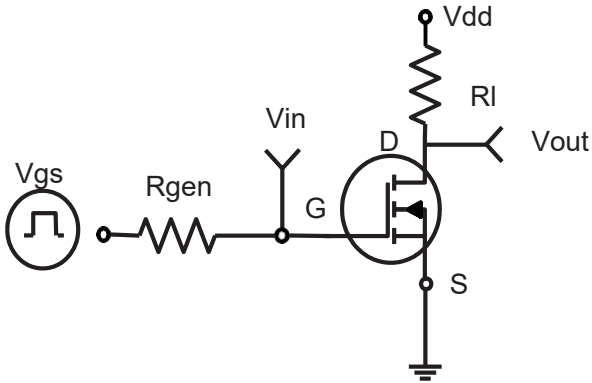


Figure 1: Switching Test Circuit

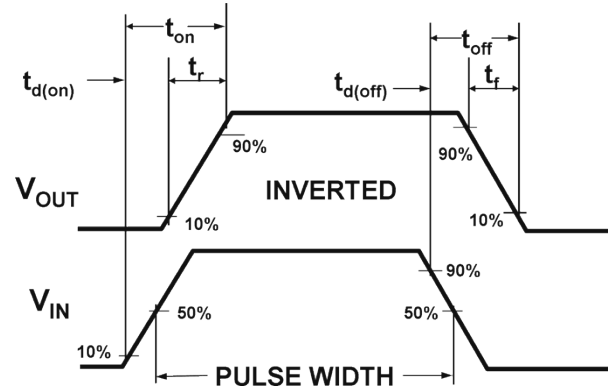


Figure 2: Switching Waveforms

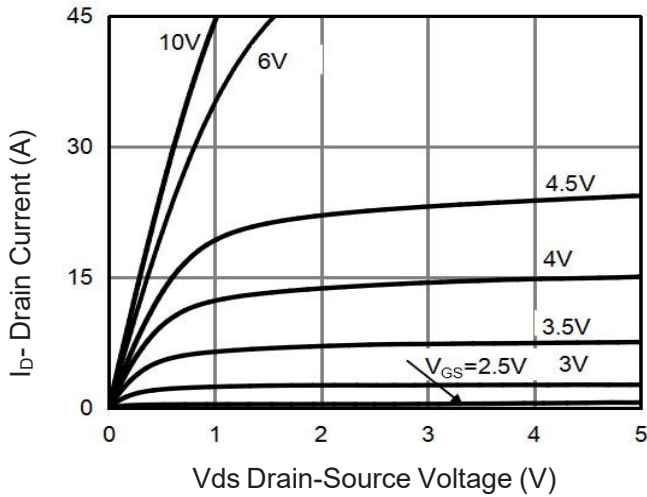


Figure 3 Output Characteristics

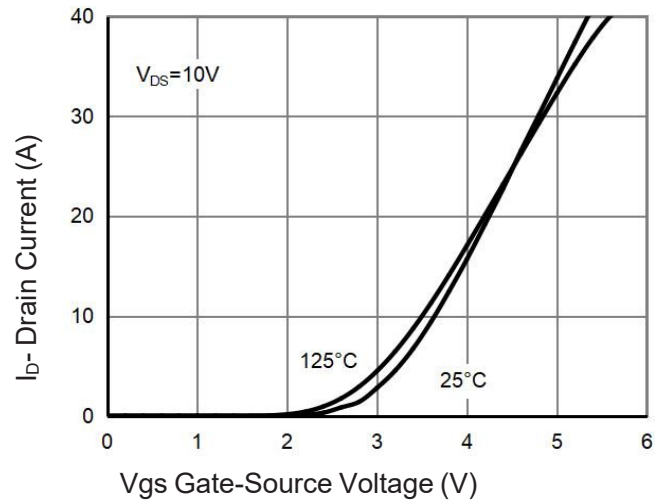


Figure 4 Transfer Characteristics

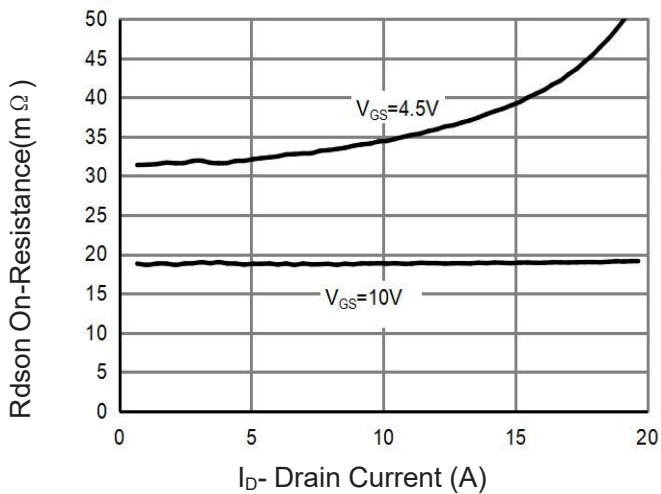


Figure 5 Drain-Source On-Resistance

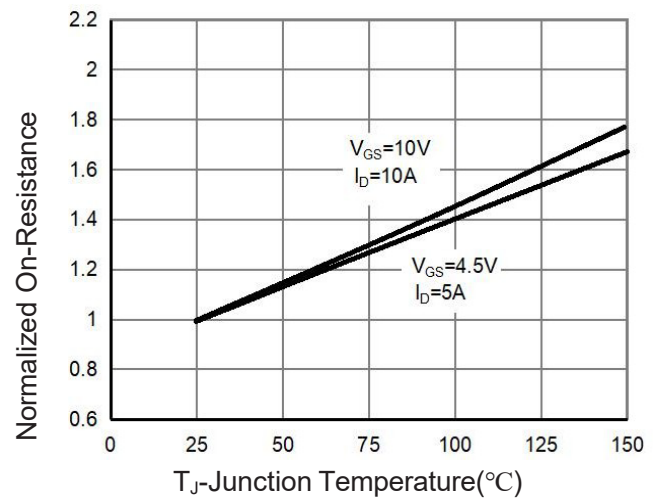
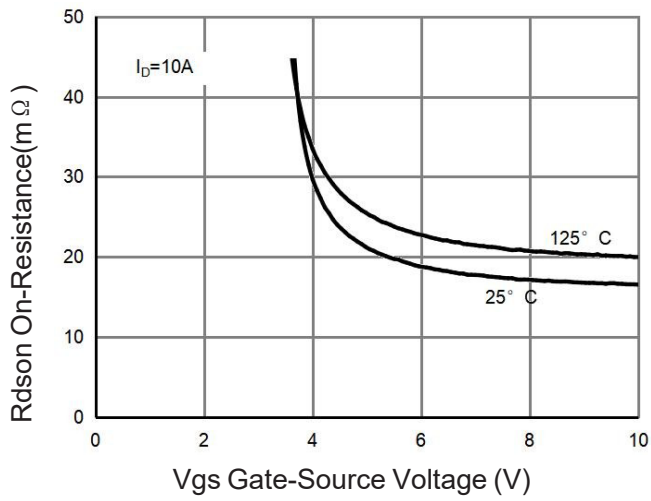
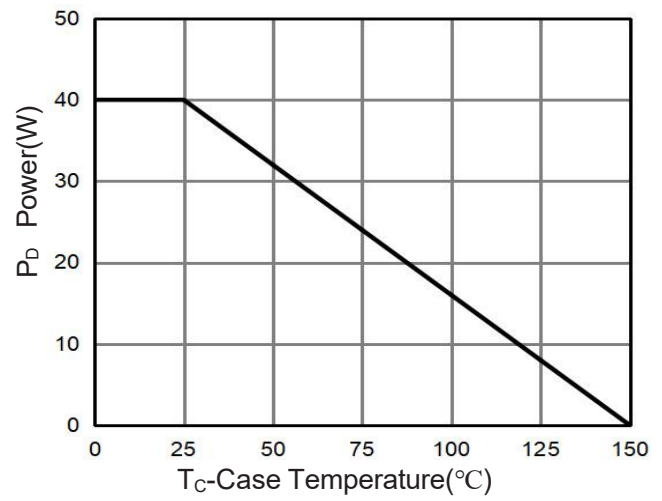
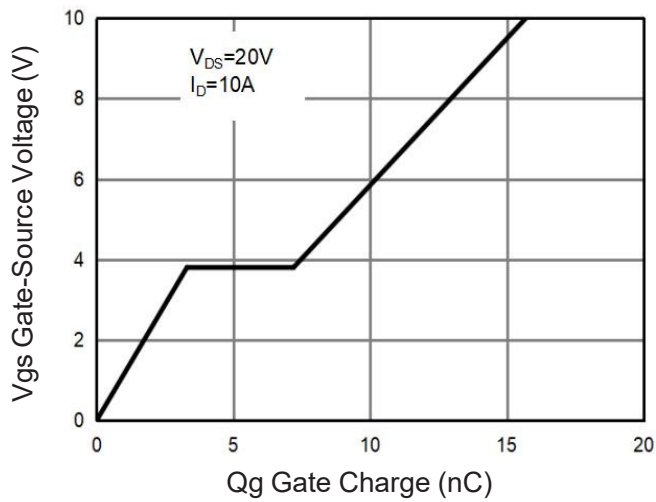
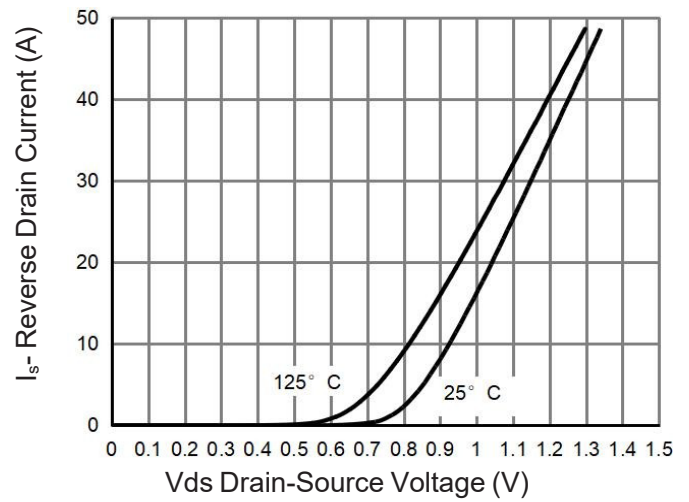
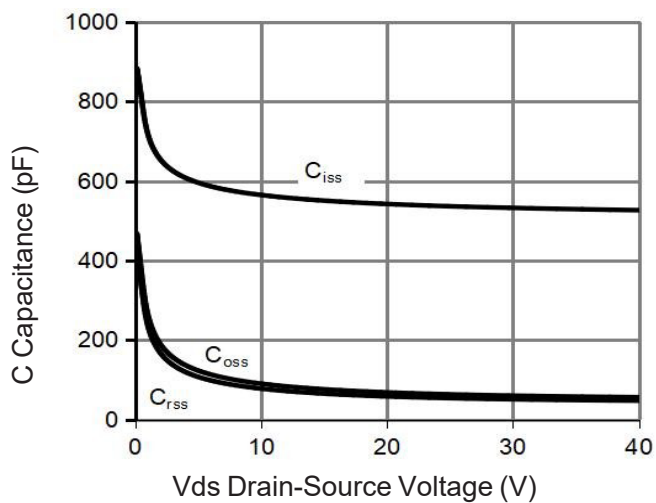
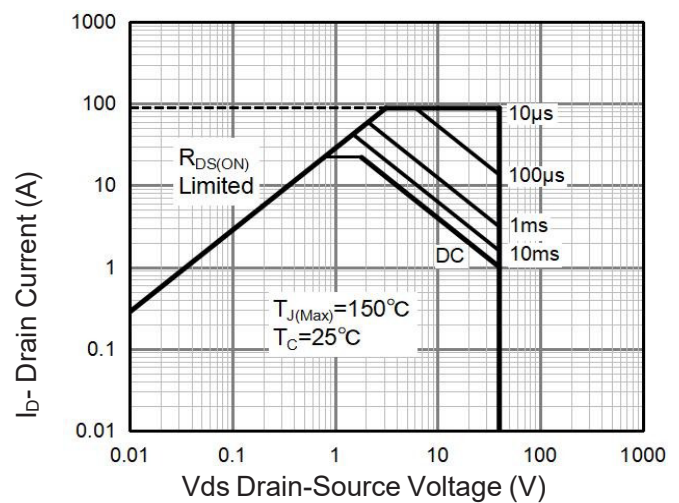


Figure 6 Drain-Source On-Resistance


Figure7 Rdson vs Vgs

Figure 8 Power Dissipation

Figure 9 Gate Charge

Figure 10 Source- Drain Diode Forward

Figure 11 Capacitance vs Vds

Figure 12 Safe Operation Area

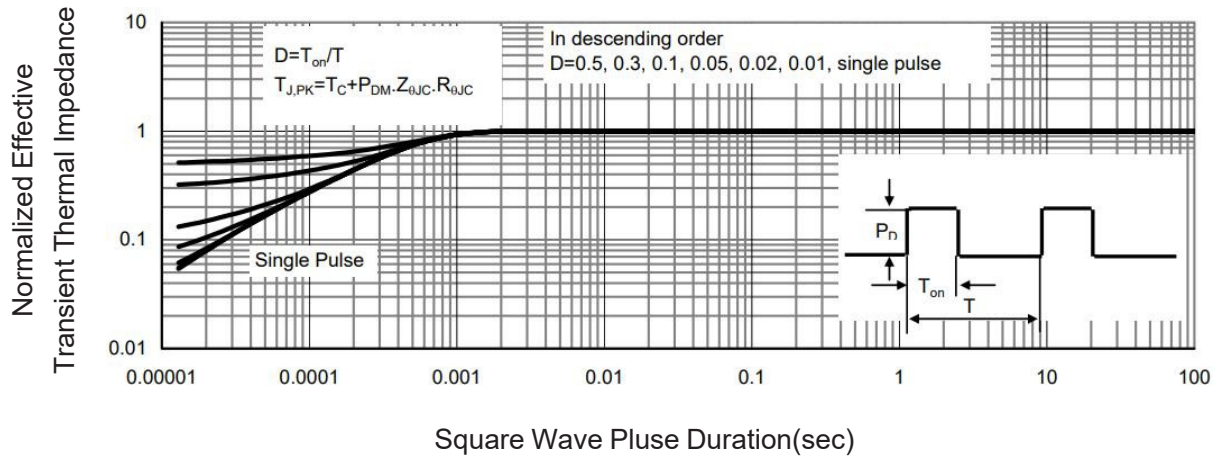
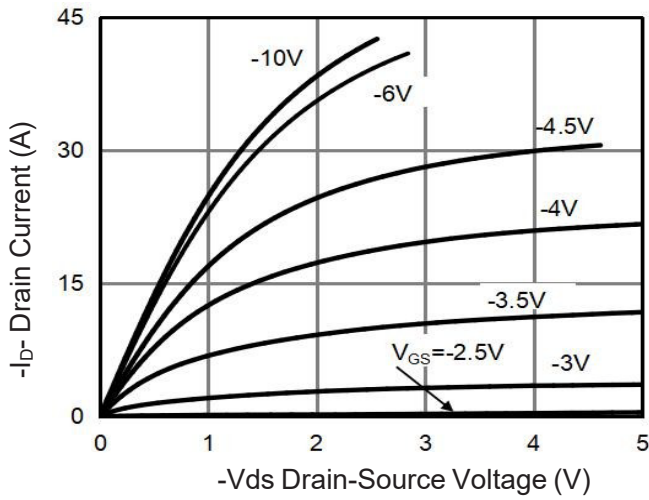
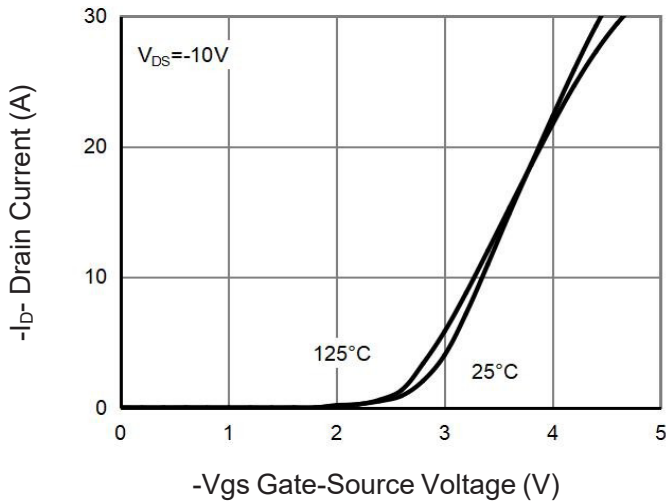
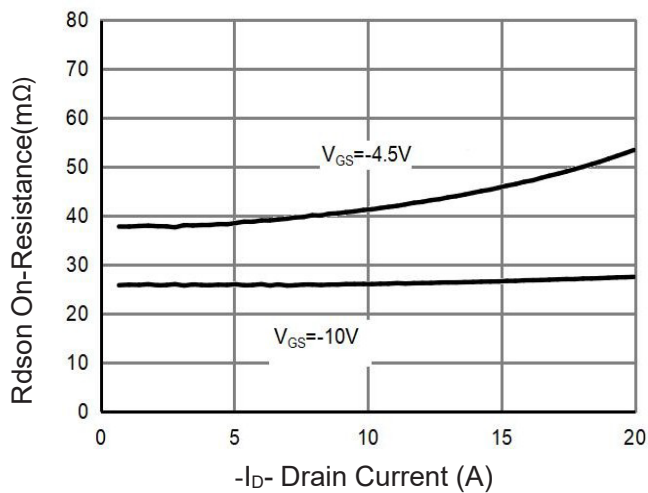
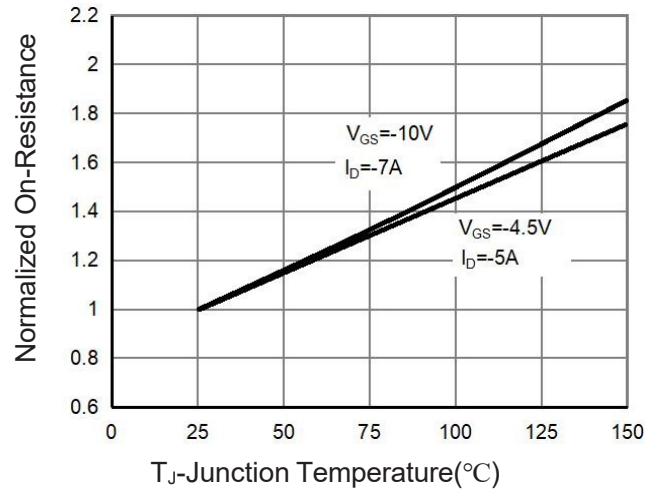
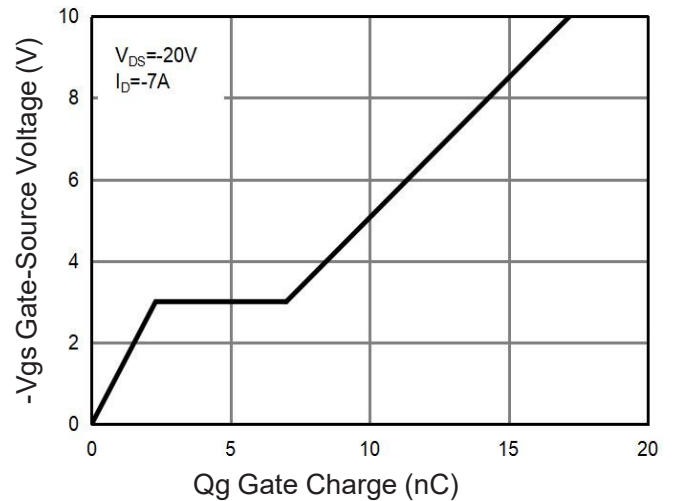
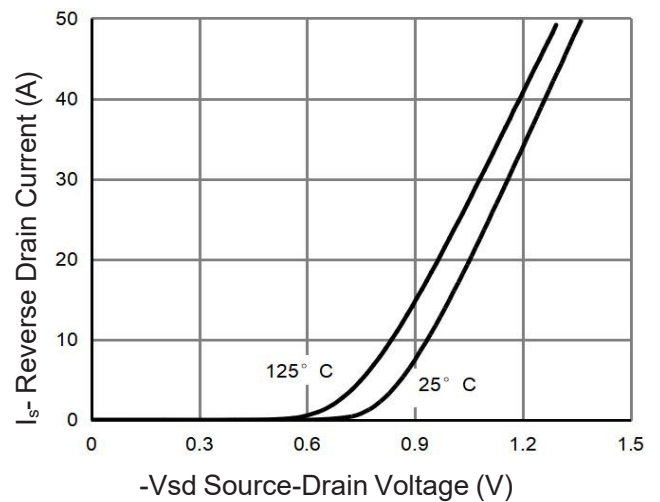
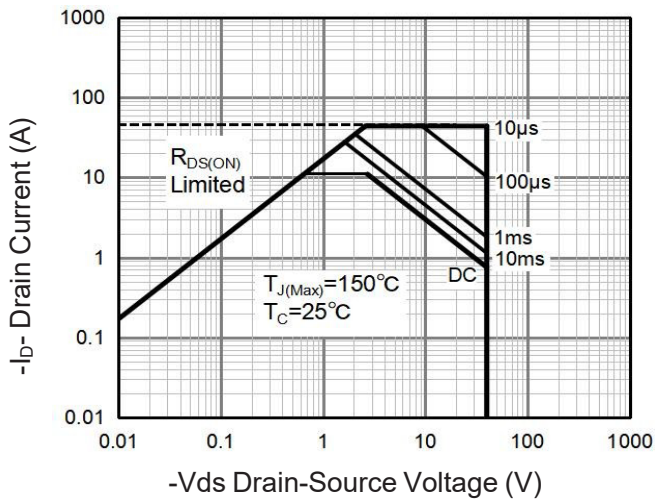


Figure 13 Normalized Maximum Transient Thermal Impedance


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

C Capacitance (pF)

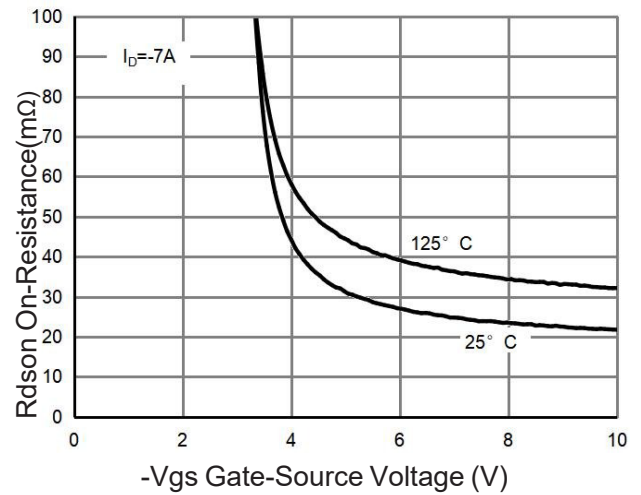
-V_{ds} Drain-Source Voltage (V)
Figure 7 Capacitance vs V_{ds}



-V_{ds} Drain-Source Voltage (V)
Figure 8 Safe Operation Area

 P_D Power (W)

T_C-Case Temperature(°C)
Figure 9 Power Dissipation



-V_{gs} Gate-Source Voltage (V)
Figure10 Rdson vs Vgs

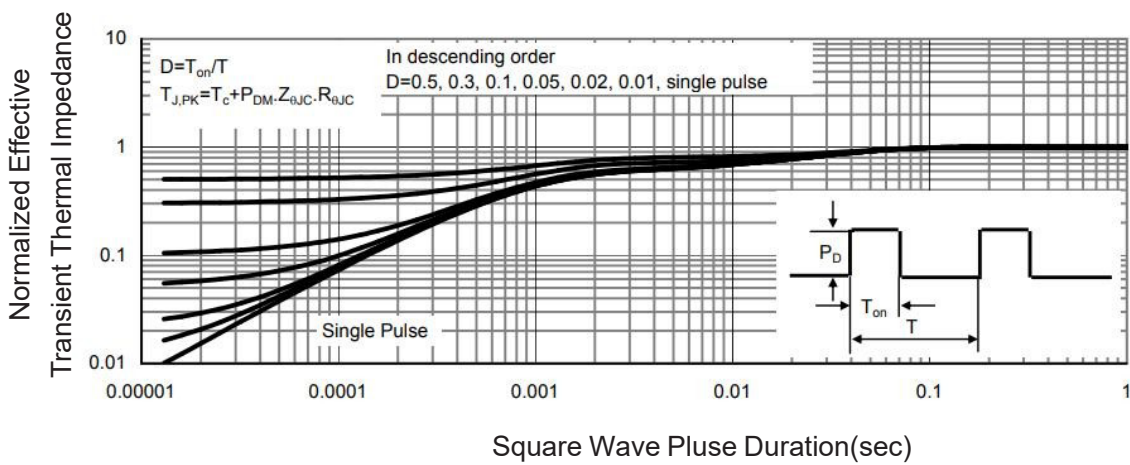
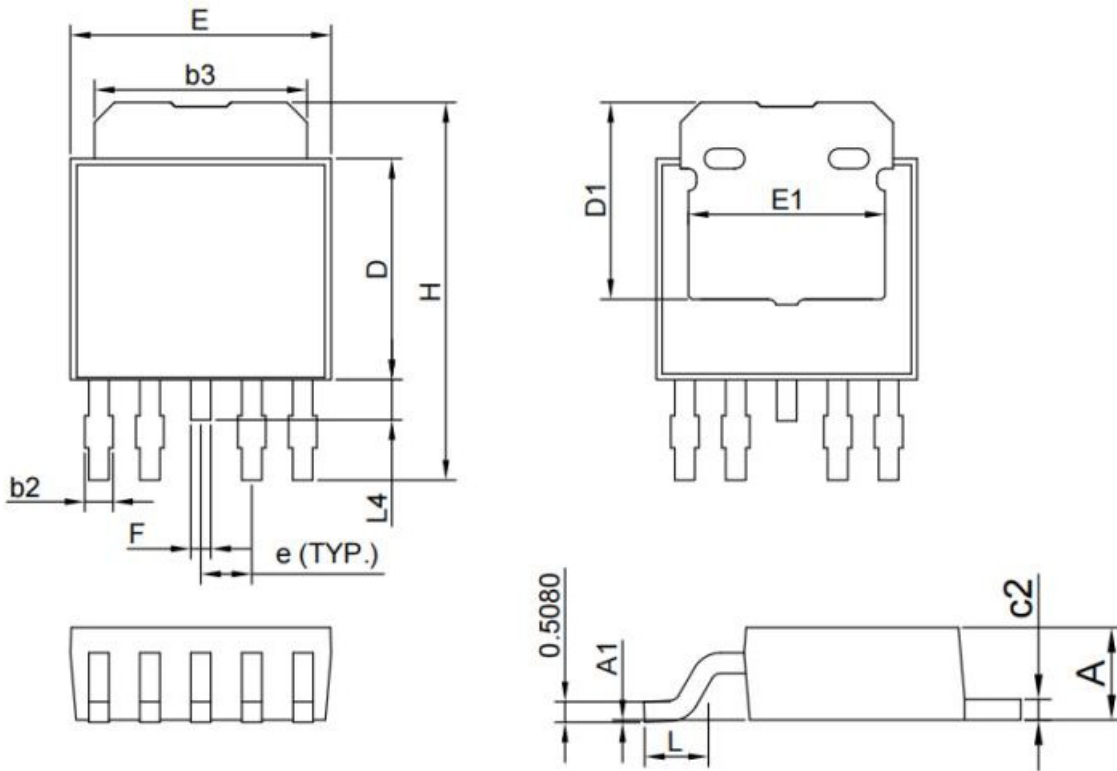


Figure 11 Normalized Maximum Transient Thermal Impedance



COMMON DIMENSIONS

UNITS OF MEASURE=MILLIMETER

SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.40
A1	0.00	0.08	0.15
b	0.45	0.53	0.60
b2	0.50	0.65	0.80
b3	5.20	5.35	5.50
c2	0.45	0.50	0.55
D	5.40	5.60	5.80
D1	4.57	—	—
E	6.40	6.60	6.80
E1	3.81	—	—
e	1.27 REF.		
F	0.40	0.50	0.60
H	9.40	9.80	10.20
L	1.40	1.59	1.77
L1	2.40	2.70	3.00
L2	0.80	1.00	1.20