

Description

The VSM7P04 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

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

$$R_{DS(ON)} < 22m\Omega @ V_{GS}=10V$$

$$R_{DS(ON)} < 45.5m\Omega @ V_{GS}=4.5V$$

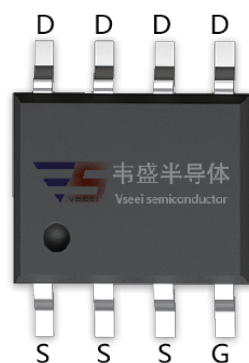
● P-Channel

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

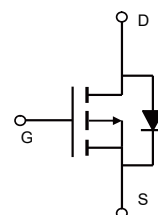
$$R_{DS(ON)} < 32m\Omega @ V_{GS}=-10V$$

$$R_{DS(ON)} < 51m\Omega @ V_{GS}=-4.5V$$

- 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
VSM7P04	VSM7P04-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	$T_A=25^{\circ}C$	I_D	8	-7	A
	$T_A=70^{\circ}C$		6	-5.5	
Pulsed Drain Current (Note 1)		I_{DM}	32	-28	A
Maximum Power Dissipation		P_D	2.0	2.0	W
Single pulse avalanche energy (Note 5)		E_{AS}	46	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-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	$^{\circ}C/W$

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 =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	1.6	2.2	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =8A	-	19	22	mΩ
		V _{GS} =4.5V, I _D =4A	-	35	45.5	mΩ
Forward Transconductance	g _{FS}	V _{DS} =5V, I _D =8A	-	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 =2.5Ω V _{GS} =10V, R _{GEN} =3Ω	-	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 =8A, 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 =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	-1.6	-2.2	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =-10V, I _D =-7A	-	28	32	mΩ
		V _{GS} =-4.5V, I _D =-4A	-	39	51	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)

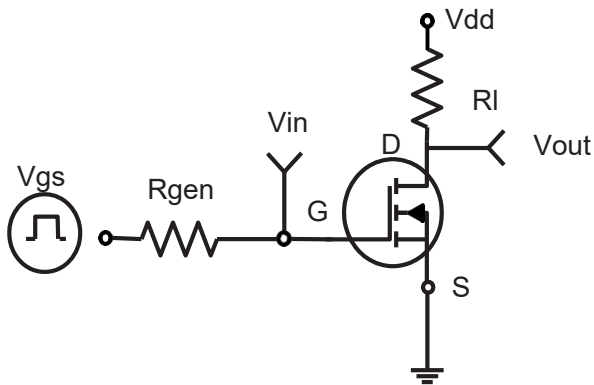


Figure 1: Switching Test Circuit

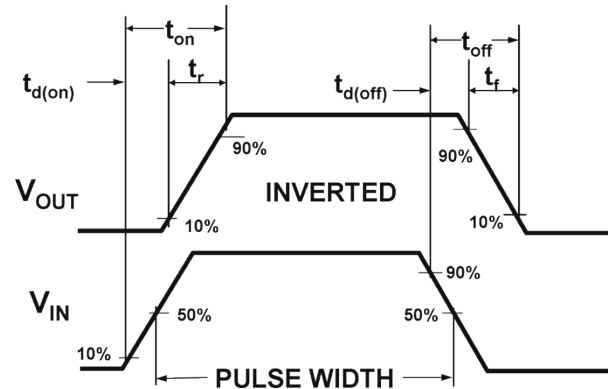


Figure 2: Switching Waveforms

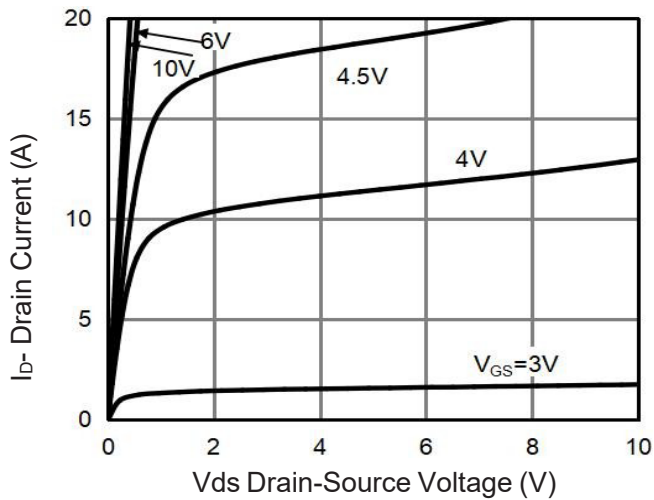


Figure 3: Output Characteristics

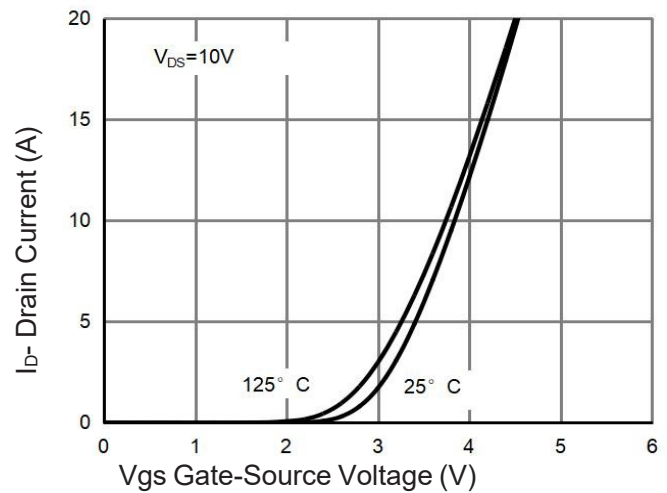


Figure 4: Transfer Characteristics

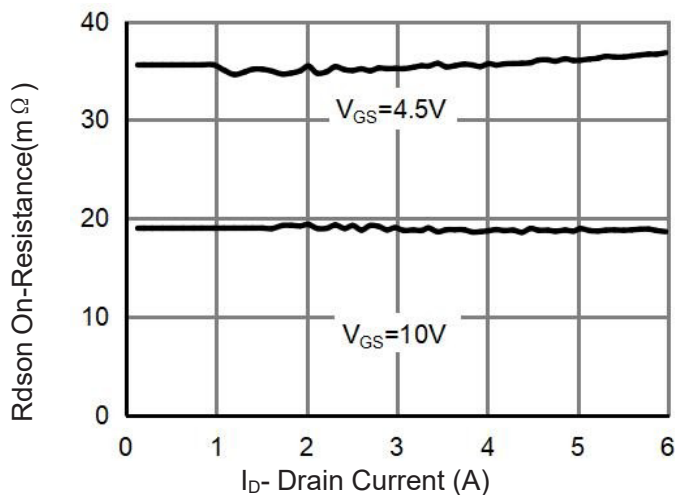


Figure 5: Drain-Source On-Resistance

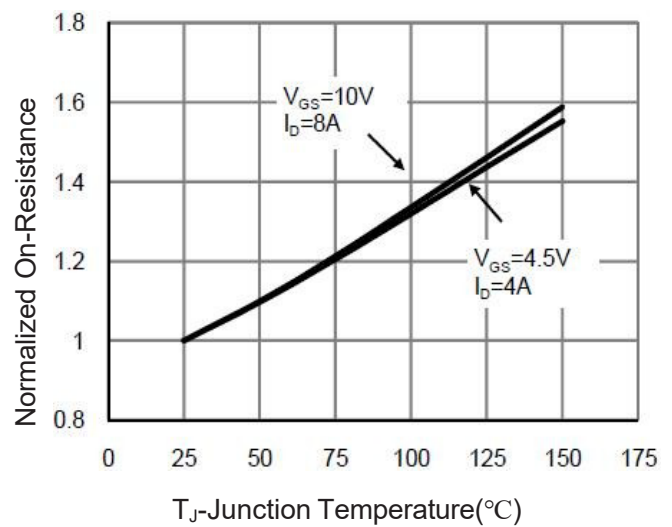
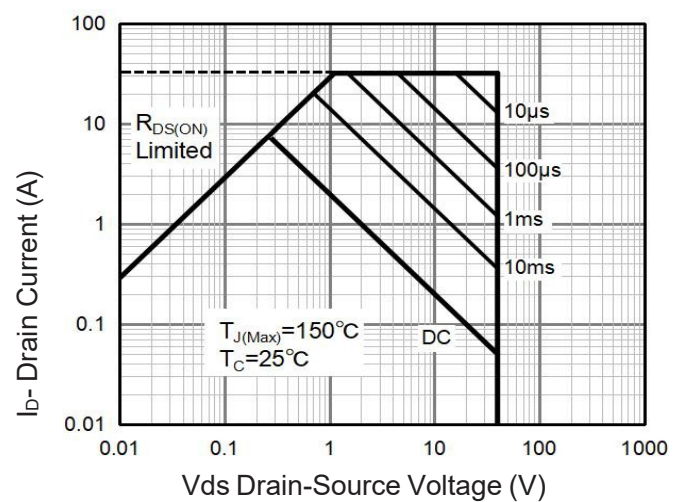
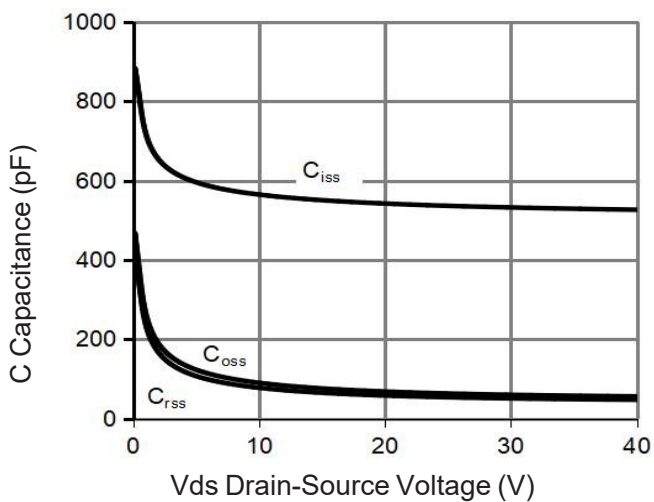
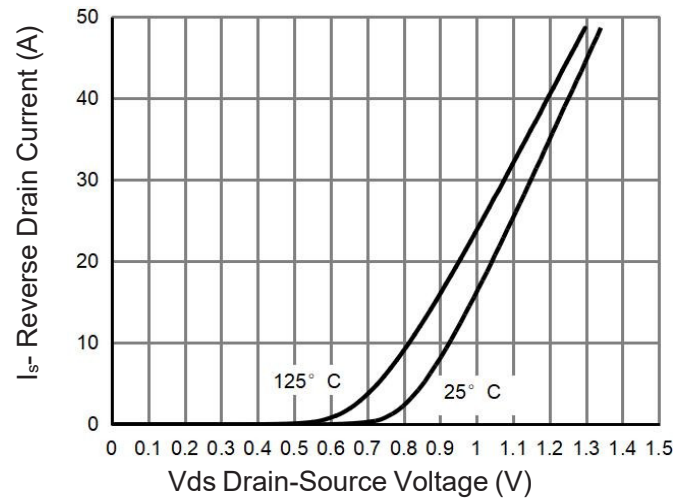
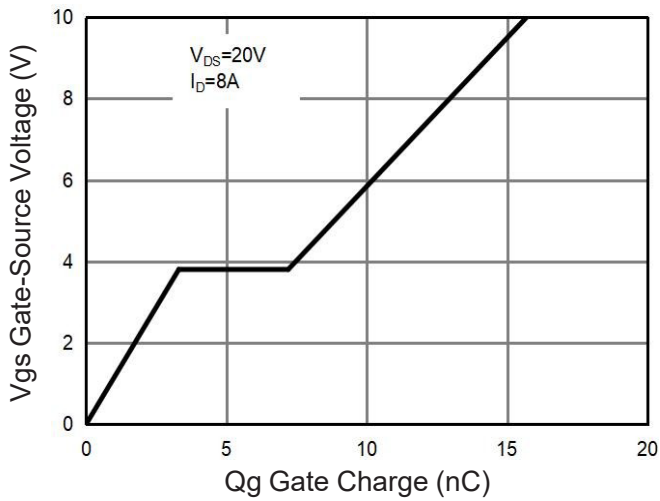
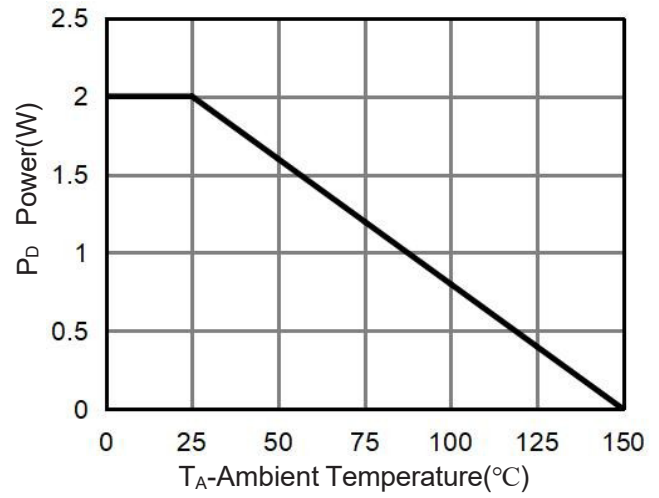
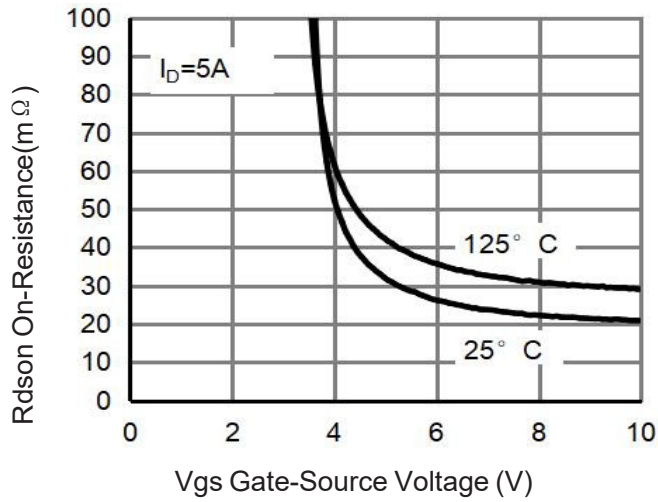


Figure 6: Drain-Source On-Resistance



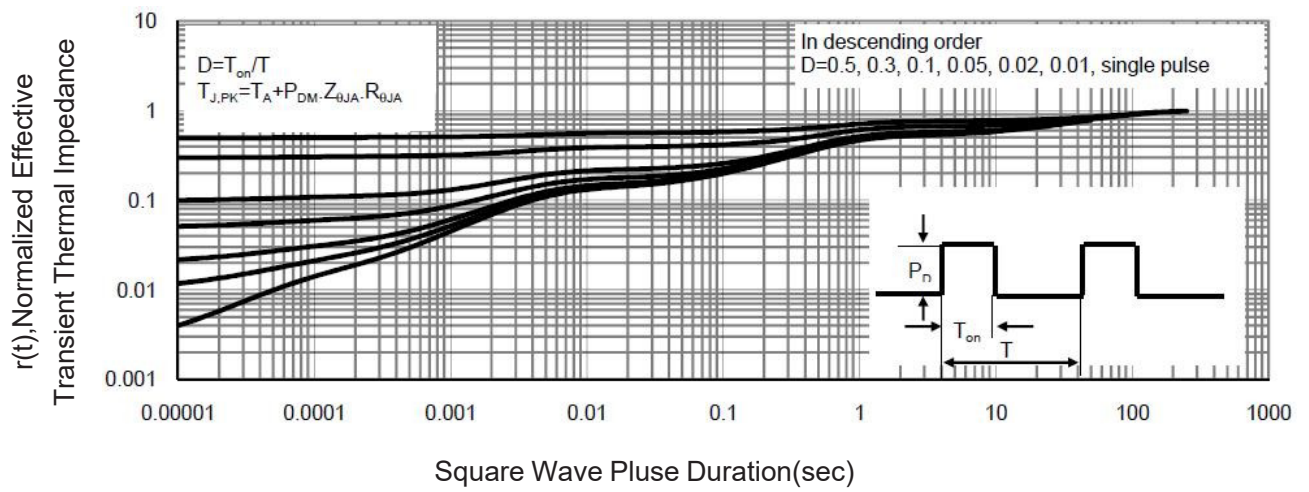
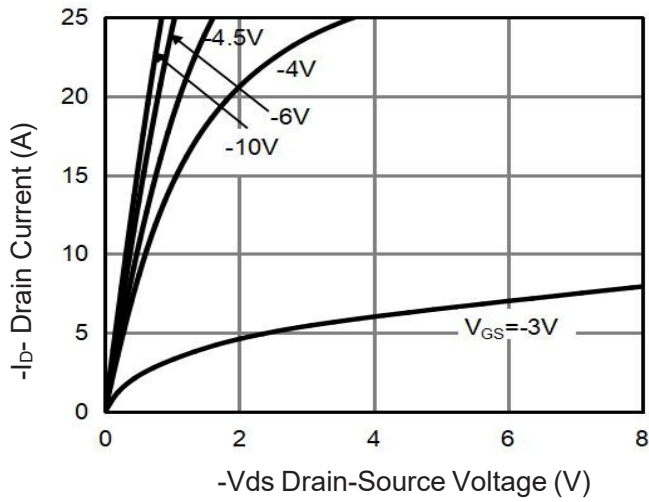
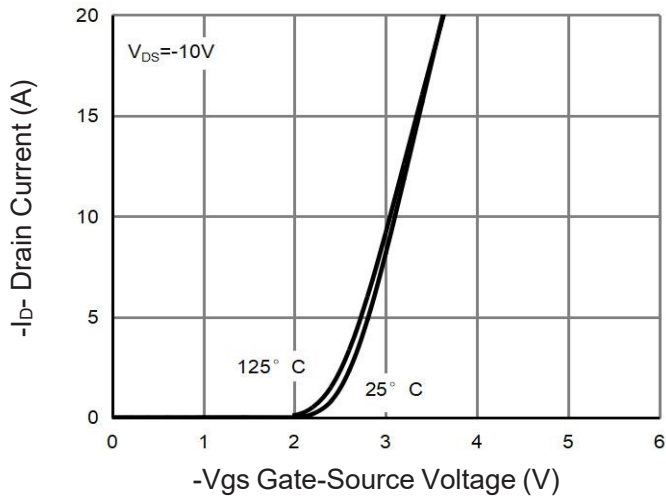
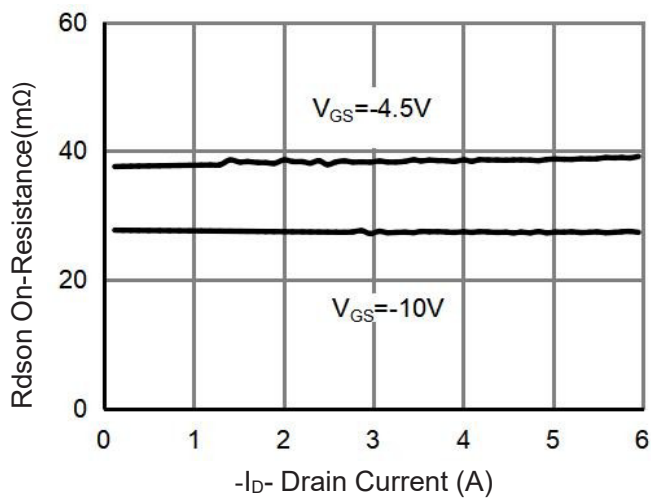
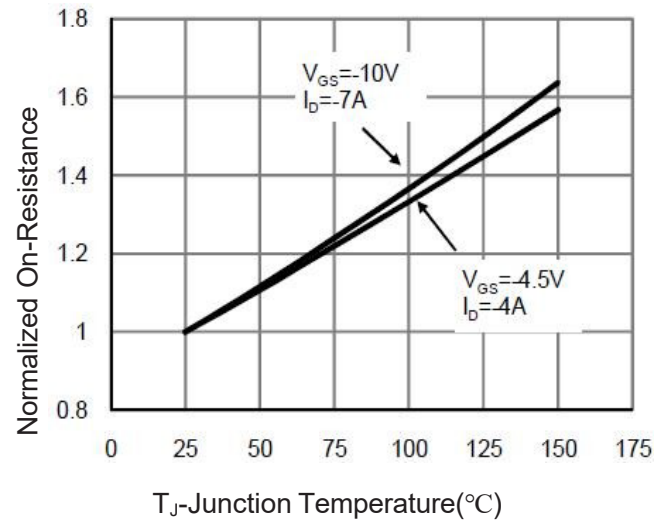
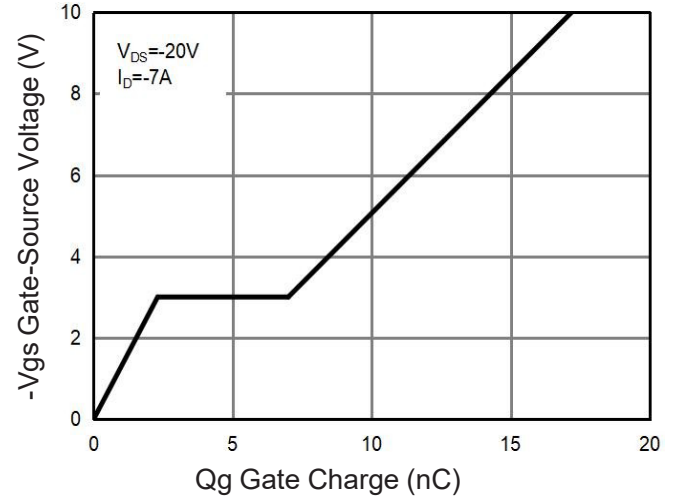
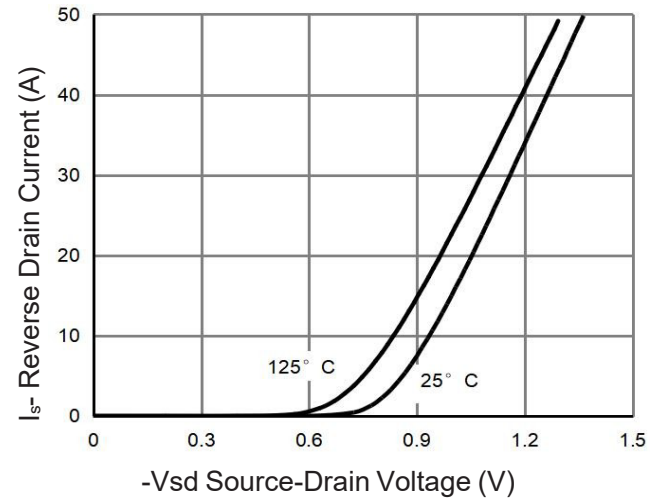
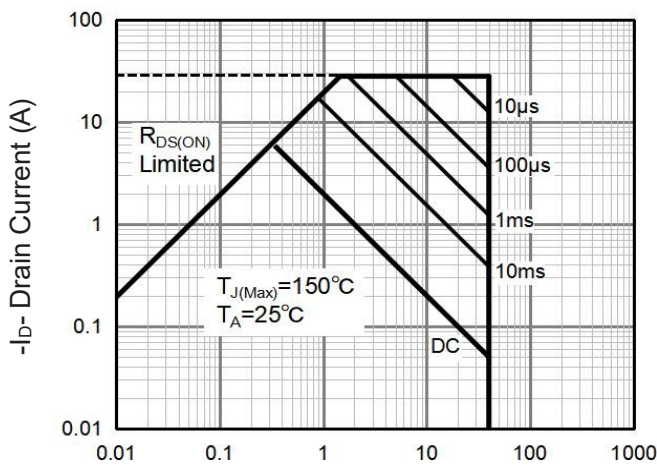


Figure 13 Normalized Maximum Transient Thermal Impedance


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)

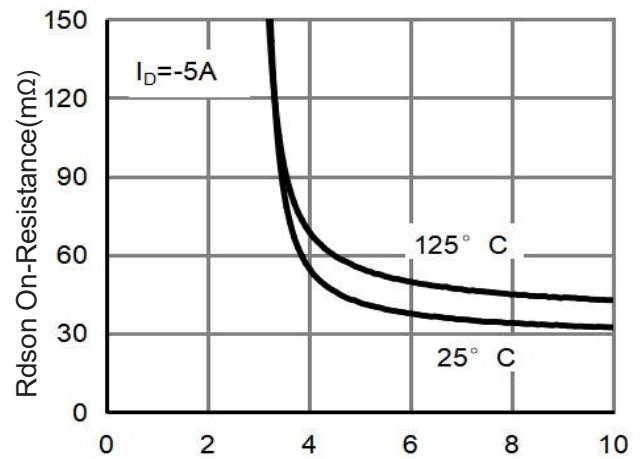
-V_{DS} Drain-Source Voltage (V)
Figure 7 Capacitance vs V_{DS}



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

P_D Power (W)

T_A-Ambient Temperature(°C)
Figure 9 Power Dissipation



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

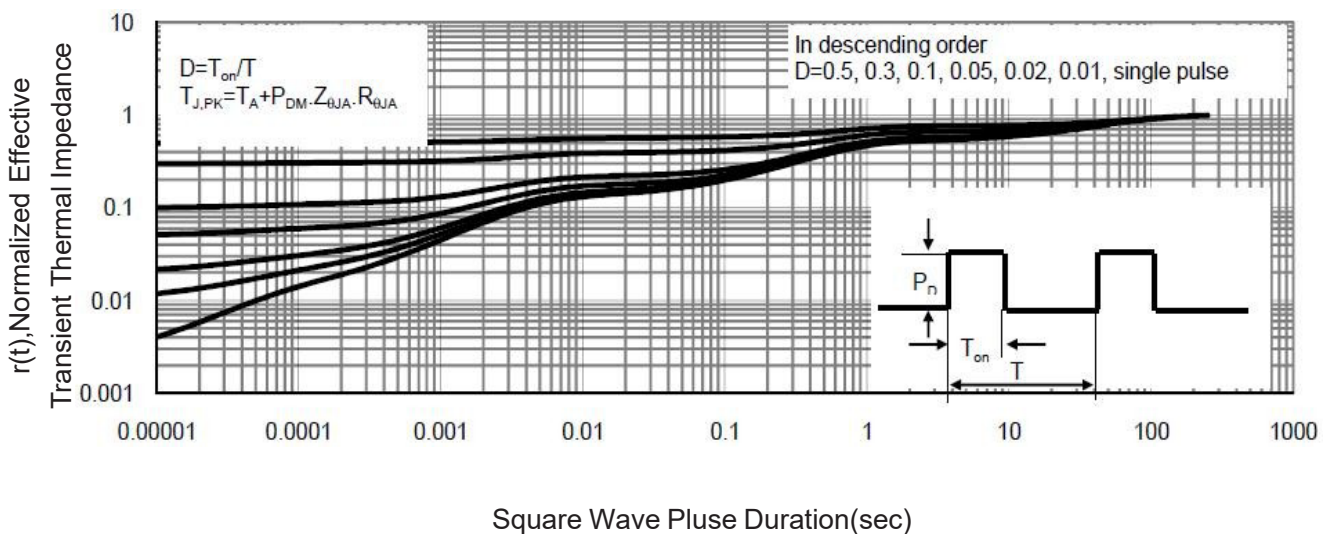
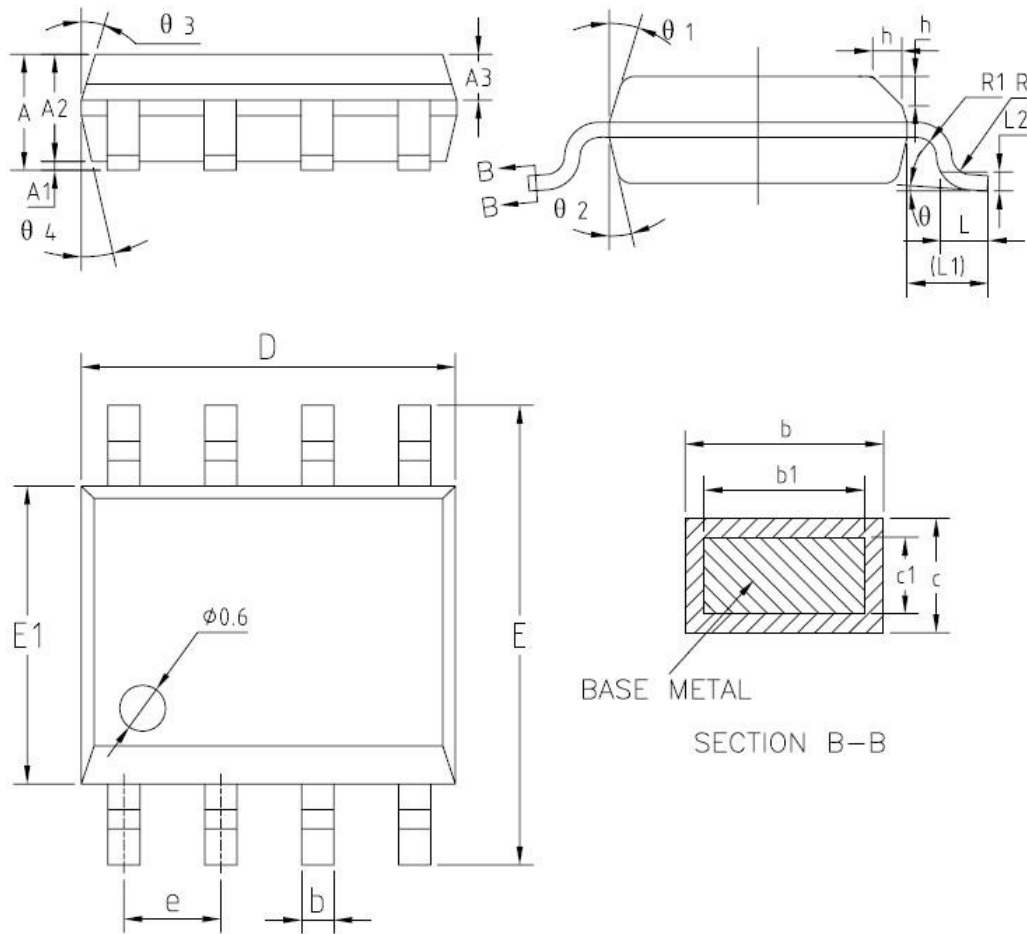


Figure 11 Normalized Maximum Transient Thermal Impedance

I_S- Reverse Drain Current (A)



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°