

## 20V Complementary MOSFET

### DESCRIPTION

The SMC2520CSQ is the N+P channel complementary mode power field effect transistors, used trench technology are well suited for high efficiency fast switching applications, this devices are well suited for applications in the small surface mount package.

### PART NUMBER INFORMATION

**SMC 2520 C SQ - TR G**  
 a      b      c      d      e      f

- a : Company name
- b : Product Serial number
- c : Complementary
- d : Package code      SQ: SOT-23-6L
- e : Handling code      TR: Tape&Reel
- f : Green produce code      G: RoHS Compliant

### FEATURES

#### N-Channel

**$V_{DS}=20V, I_D=5A$**

$R_{DS(ON)}=30m\Omega(Typ.)@V_{GS}=4.5V$

$R_{DS(ON)}=38m\Omega(Typ.)@V_{GS}=2.5V$

$R_{DS(ON)}=50m\Omega(Typ.)@V_{GS}=1.8V$

#### P-Channel

**$V_{DS}=-20V, I_D=-3.3A$**

$R_{DS(ON)}=60m\Omega(Typ.)@V_{GS}=-4.5V$

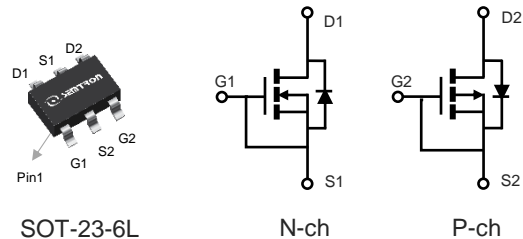
$R_{DS(ON)}=80m\Omega(Typ.)@V_{GS}=-3.5V$

$R_{DS(ON)}=110m\Omega(Typ.)@V_{GS}=-1.8V$

- ◆ High-speed switching, Low On-resistance

### APPLICATIONS

- ◆ DC/DC Converter
- ◆ Load Switch



### ABSOLUTE MAXIMUM RATINGS ( $T_A=25^\circ C$ Unless otherwise noted)

Symbol	Parameter	Rating		Units	
		N-ch	P-ch		
$V_{DSS}$	Drain-Source Voltage	20	-20	V	
$V_{GSS}$	Gate-Source Voltage	$\pm 10$	$\pm 10$	V	
$I_D$	Continuous Drain Current	$T_A=25^\circ C$	5	-3.3	A
		$T_A=70^\circ C$	4	-2.7	A
$I_{DM}$	Pulsed Drain Current <sup>B</sup>	20	-13.6	A	
$P_D$	Power Dissipation <sup>A</sup>	$T_A=25^\circ C$	1.3	1.3	W
		$T_A=70^\circ C$	0.8	0.8	W
$T_J$	Operation Junction Temperature	-55/150		$^\circ C$	
$T_{STG}$	Storage Temperature Range	-55/150		$^\circ C$	

### THERMAL RESISTANCE

Symbol	Parameter	Typ	Max	Units
$R_{\theta JA}$	Thermal Resistance Junction to Ambient <sup>A</sup>	$t \leq 10s$	95	$^\circ C/W$
	Thermal Resistance Junction to Ambient <sup>AC</sup>	Steady-State	130	

## ■ N-ch ELECTRICAL CHARACTERISTICS ( $T_A=25^\circ\text{C}$ Unless otherwise noted )

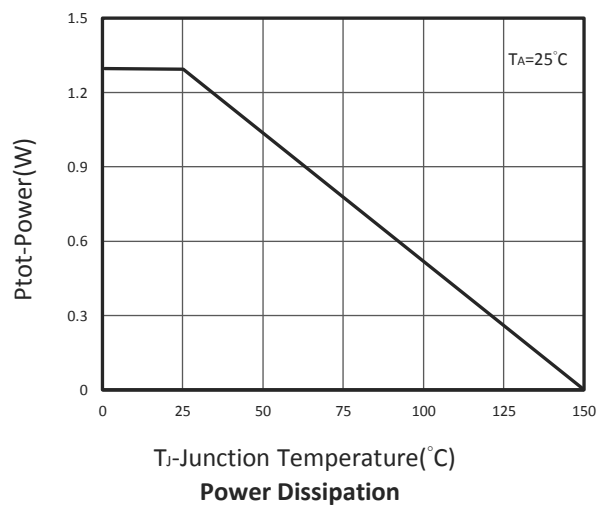
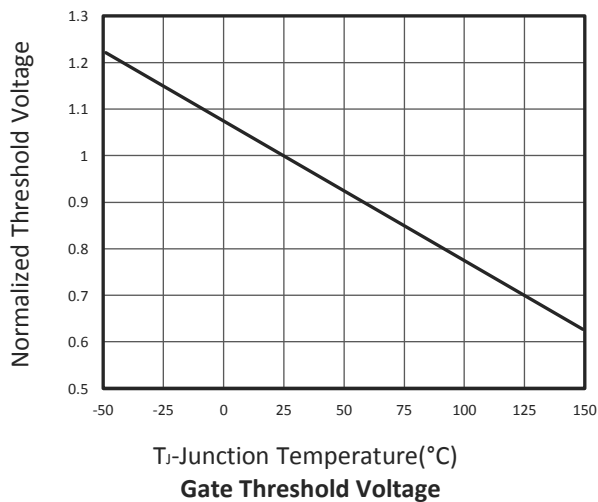
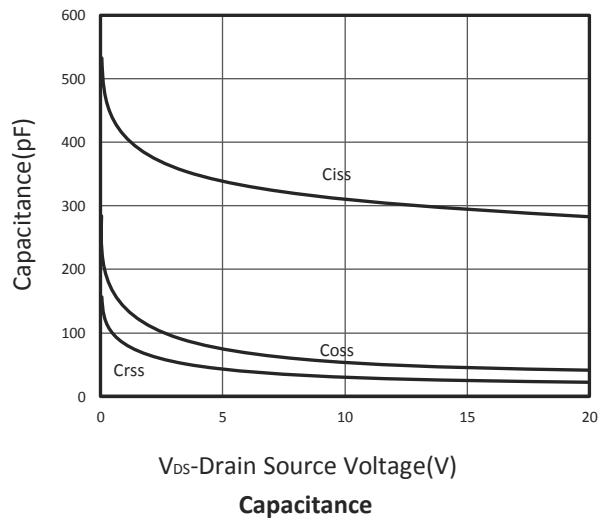
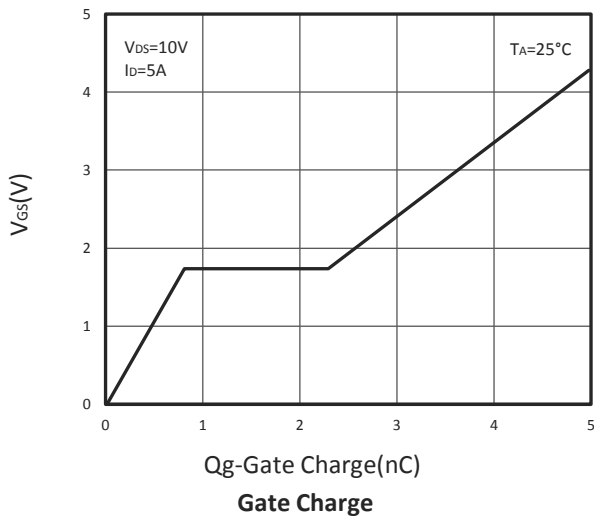
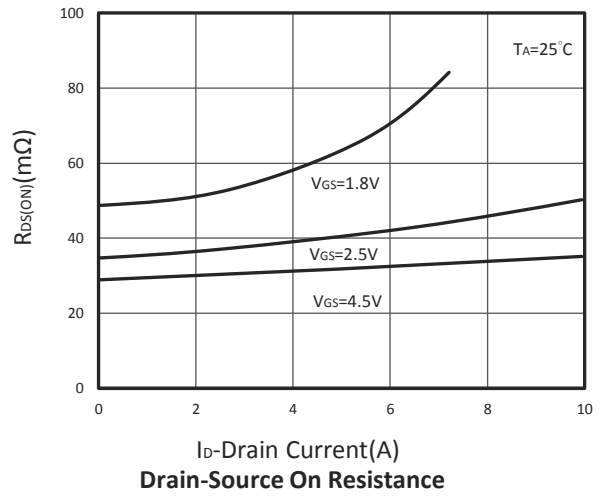
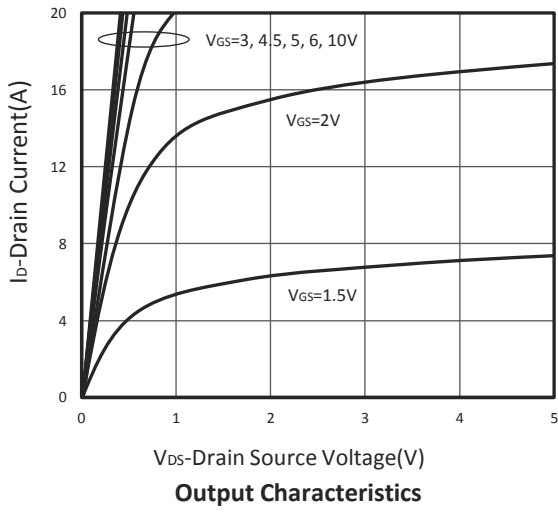
Symbol	Parameter	Condition	Min	Typ	Max	Unit
<b>Static Parameters</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =250 $\mu$ A	20			V
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250 $\mu$ A	0.4	0.6	1	V
I <sub>GSS</sub>	Gate Leakage Current	V <sub>DS</sub> =0V, V <sub>GS</sub> = $\pm$ 10V			$\pm$ 100	nA
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =20V, V <sub>GS</sub> =0V, T <sub>J</sub> =25 $^\circ$ C			1	$\mu$ A
		V <sub>DS</sub> =16V, V <sub>GS</sub> =0V, T <sub>J</sub> =75 $^\circ$ C			10	
R <sub>DS(ON)</sub>	Drain-source On-Resistance <sup>D</sup>	V <sub>GS</sub> =4.5V, I <sub>D</sub> =4A		30	35	m $\Omega$
		V <sub>GS</sub> =2.5V, I <sub>D</sub> =3A		38	45	
		V <sub>GS</sub> =1.8V, I <sub>D</sub> =2A		50	60	
G <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =4A		4		S
<b>Diode Characteristics</b>						
V <sub>SD</sub>	Diode Forward Voltage <sup>D</sup>	I <sub>S</sub> =1A, V <sub>GS</sub> =0V			1	V
I <sub>S</sub>	Diode Continuous Forward Current				2.5	A
<b>Dynamic and Switching Parameters <sup>E</sup></b>						
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =10V, V <sub>GS</sub> =4.5V, I <sub>D</sub> =5A		5.7	8	nC
Q <sub>gs</sub>	Gate-Source Charge			0.8	1.1	
Q <sub>gd</sub>	Gate-Drain Charge			1.5	2.1	
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =10V, V <sub>GS</sub> =0V, f=1MHz		305		pF
C <sub>oss</sub>	Output Capacitance			52		
C <sub>rss</sub>	Reverse Transfer Capacitance			43		
t <sub>d(on)</sub>	Turn-On Time	V <sub>DD</sub> =10V, V <sub>GEN</sub> =4.5V R <sub>G</sub> =6 $\Omega$ , I <sub>D</sub> =1A		3	6	nS
t <sub>r</sub>				7.8	15	
t <sub>d(off)</sub>	Turn-Off Time			12	23	
t <sub>f</sub>				5.4	10	

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.

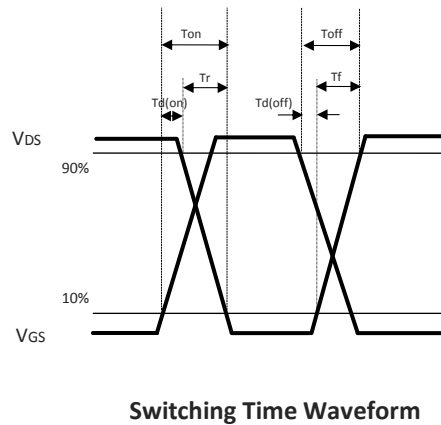
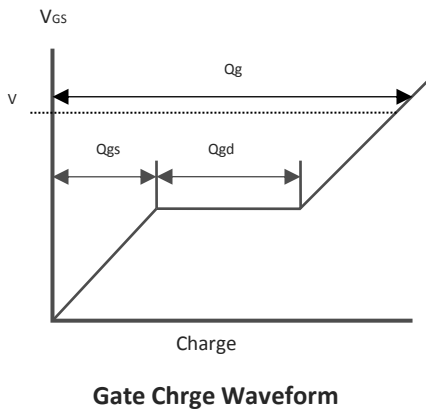
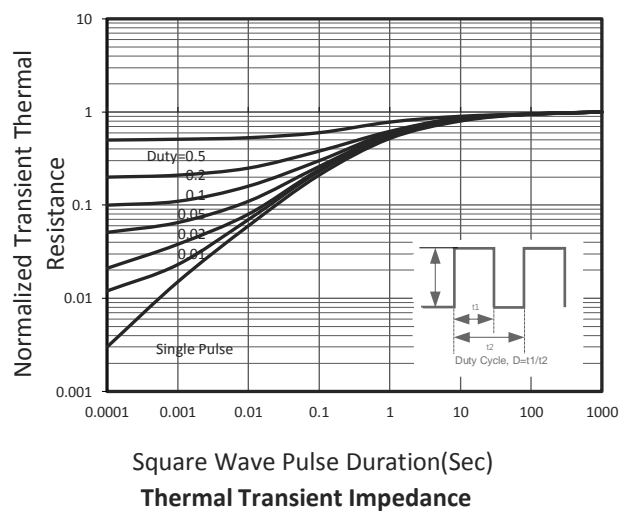
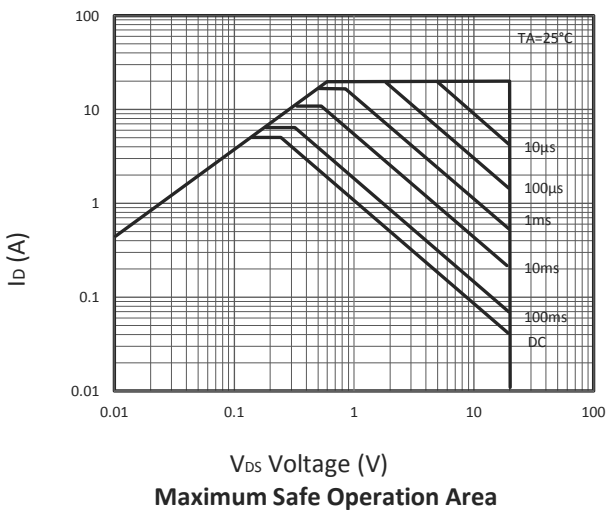
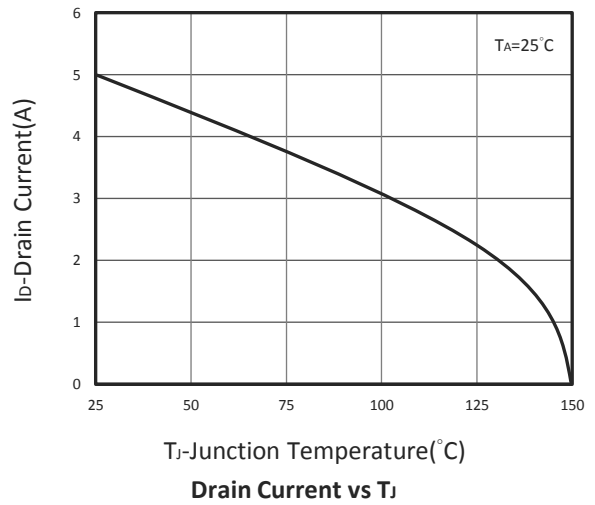
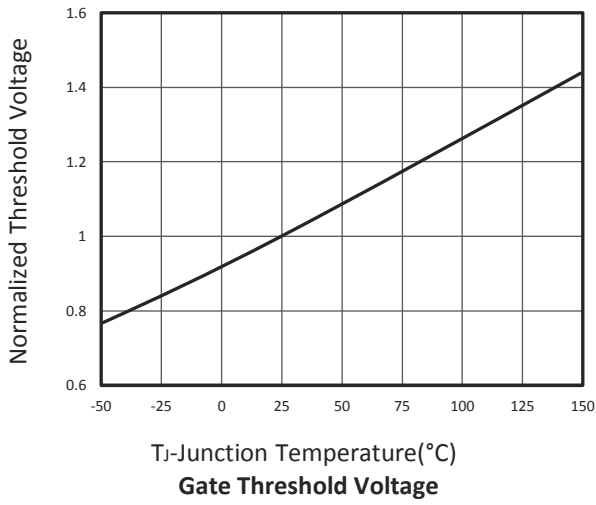
- A. Surface mounted on FR4 board using 1 in<sup>2</sup> pad size.
- B. Pulsed width limited by maximum junction temperature, T<sub>J(MAX)</sub>=150 $^\circ$ C (initial temperature T<sub>J</sub>=25 $^\circ$ C).
- C. Using  $\leq$  10s junction-to-ambient thermal resistance is base on T<sub>J(MAX)</sub>=150 $^\circ$ C.
- D. Pulse test width  $\leq$ 300 $\mu$ s and duty cycle  $\leq$  2%.
- E. Guaranteed by design, not subject to production testing.

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## N-ch TYPICAL CHARACTERISTICS



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## ■ P-ch ELECTRICAL CHARACTERISTICS ( $T_A=25^\circ\text{C}$ Unless otherwise noted )

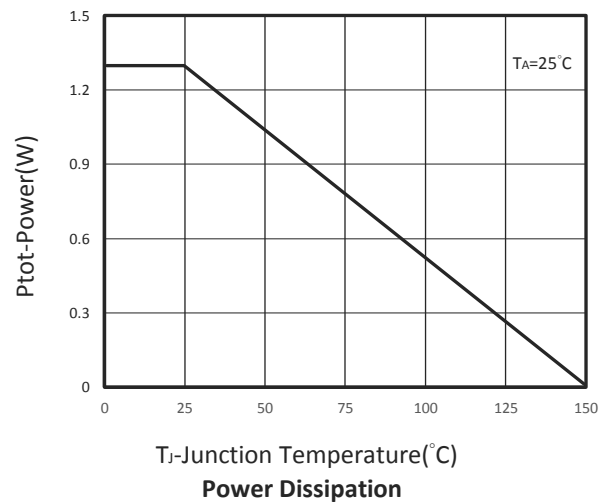
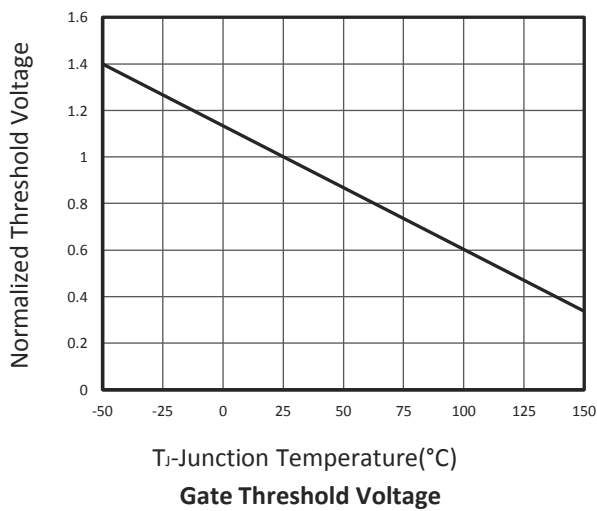
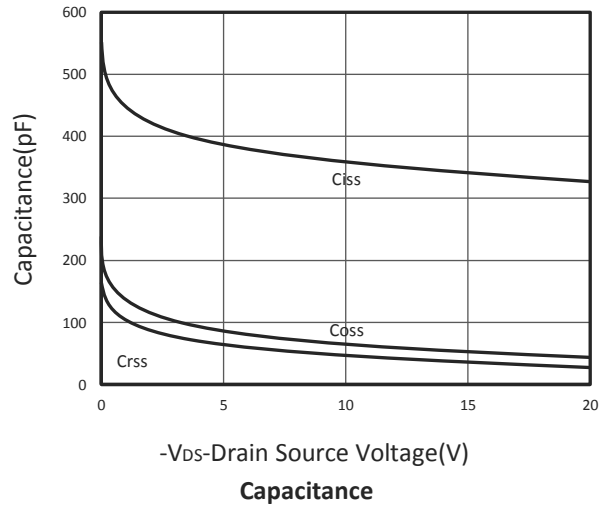
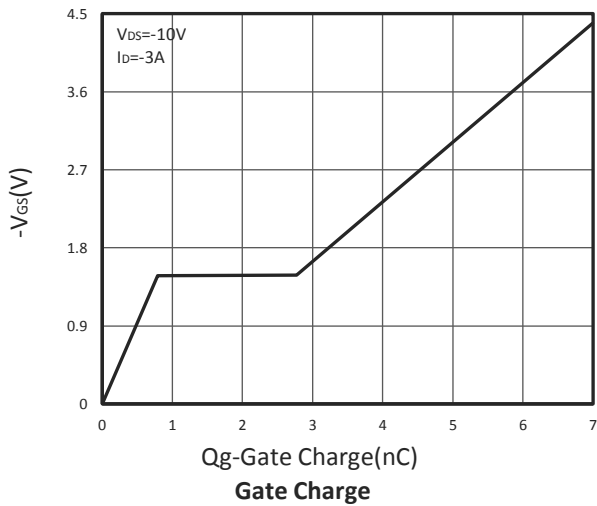
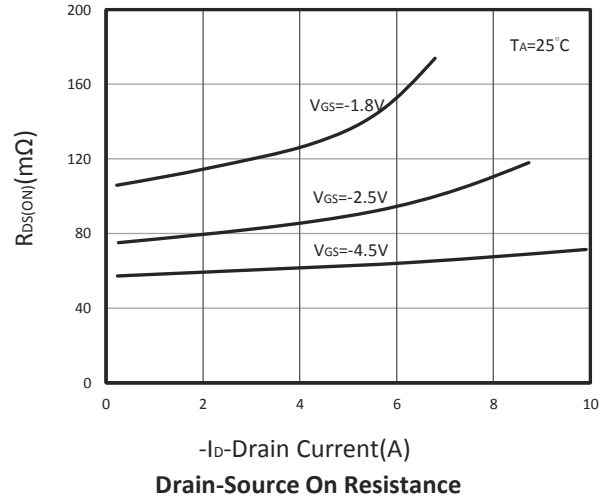
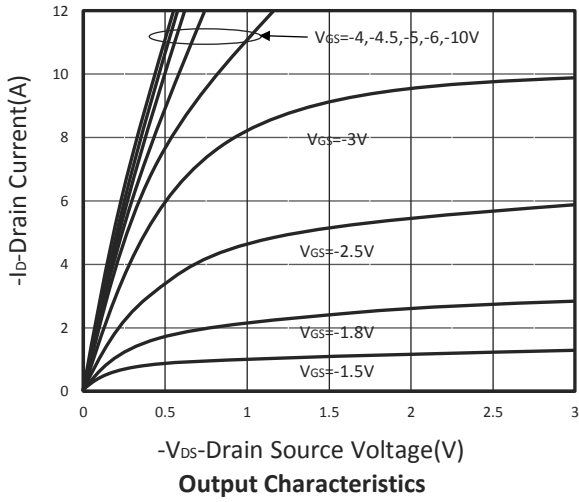
Symbol	Parameter	Condition	Min	Typ	Max	Unit
<b>Static Parameters</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =-250μA	-20			V
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA	-0.4	-0.7	-1	V
I <sub>GSS</sub>	Gate Leakage Current	V <sub>DS</sub> =0V, V <sub>GS</sub> =±10V			±100	nA
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C			-1	μA
		V <sub>DS</sub> =-16V, V <sub>GS</sub> =0V, T <sub>J</sub> =75°C			-10	
R <sub>DS(ON)</sub>	Drain-source On-Resistance <sup>D</sup>	V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-3.3A		60	75	mΩ
		V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-2.5A		80	100	
		V <sub>GS</sub> =-1.8V, I <sub>D</sub> =-1.8A		110	130	
G <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =-5V, I <sub>D</sub> =-3A		2.5		S
<b>Diode Characteristics</b>						
V <sub>SD</sub>	Diode Forward Voltage <sup>D</sup>	I <sub>S</sub> =-1A, V <sub>GS</sub> =0V			-1	V
I <sub>S</sub>	Diode Continuous Forward Current				-3.2	A
t <sub>rr</sub>	Reverse Recovery Time	I <sub>S</sub> =-3A, di/dt=100A/μs		13.2		ns
Q <sub>rr</sub>	Reverse Recovery Charge	T <sub>J</sub> =25°C		7.4		nC
<b>Dynamic and Switching Parameters<sup>E</sup></b>						
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =-10V, V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-3A		7.2	10.1	nC
Q <sub>gs</sub>	Gate-Source Charge			0.8	1.1	
Q <sub>gd</sub>	Gate-Drain Charge			2	2.8	
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =-10V, V <sub>GS</sub> =0V, f=1MHz		360		pF
C <sub>oss</sub>	Output Capacitance			70		
C <sub>rss</sub>	Reverse Transfer Capacitance			55		
t <sub>d(on)</sub>	Turn-On Time	V <sub>DD</sub> =-10V, V <sub>GEN</sub> =-4.5V, R <sub>G</sub> =3Ω, I <sub>D</sub> =-3A		4.8	9	nS
t <sub>r</sub>				12.8	24	
t <sub>d(off)</sub>	Turn-Off Time			20	38	
t <sub>f</sub>				6	11	

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.

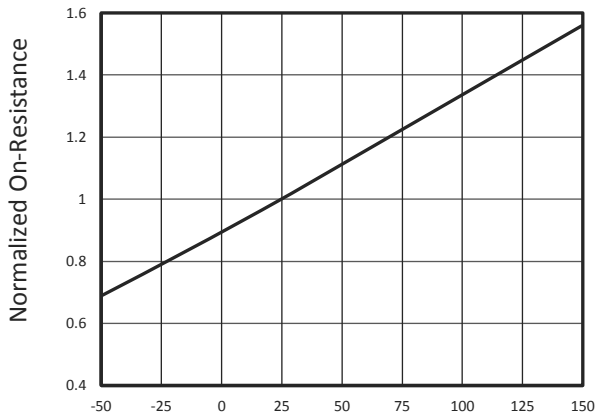
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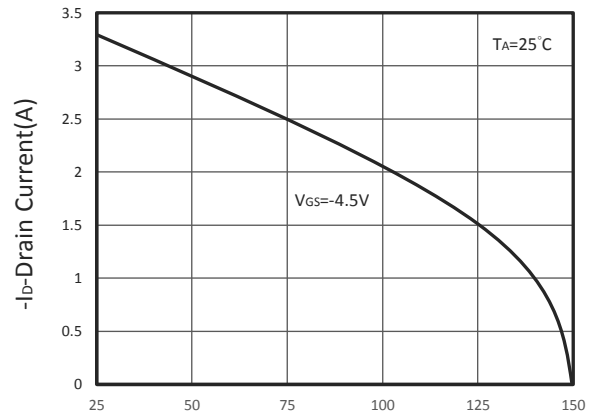
## P-ch TYPICAL CHARACTERISTICS



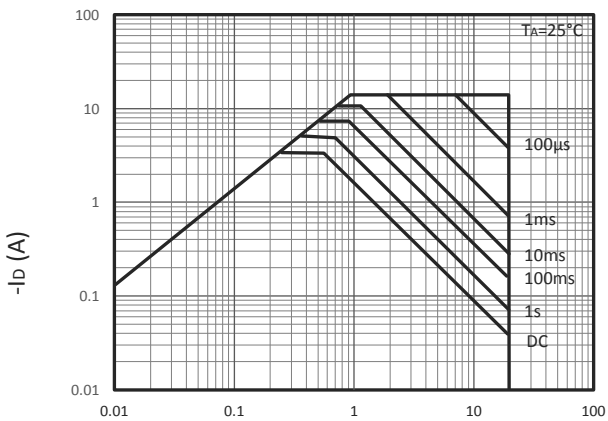
## P-ch TYPICAL CHARACTERISTICS



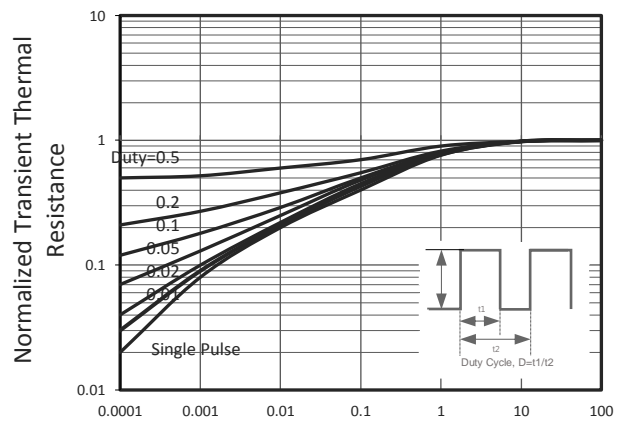
T<sub>J</sub>-Junction Temperature(°C)  
Drain-Source On Resistance



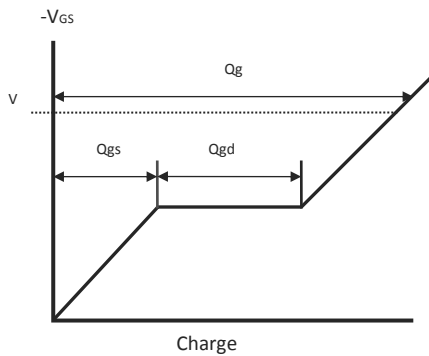
T<sub>J</sub>-Junction Temperature(°C)  
Drain Current vs T<sub>J</sub>



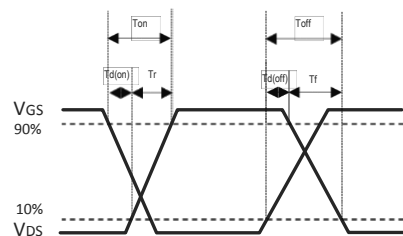
-V<sub>DS</sub> Voltage (V)  
Maximum Safe Operation Area



Square Wave Pulse Duration(Sec)  
Thermal Transient Impedance

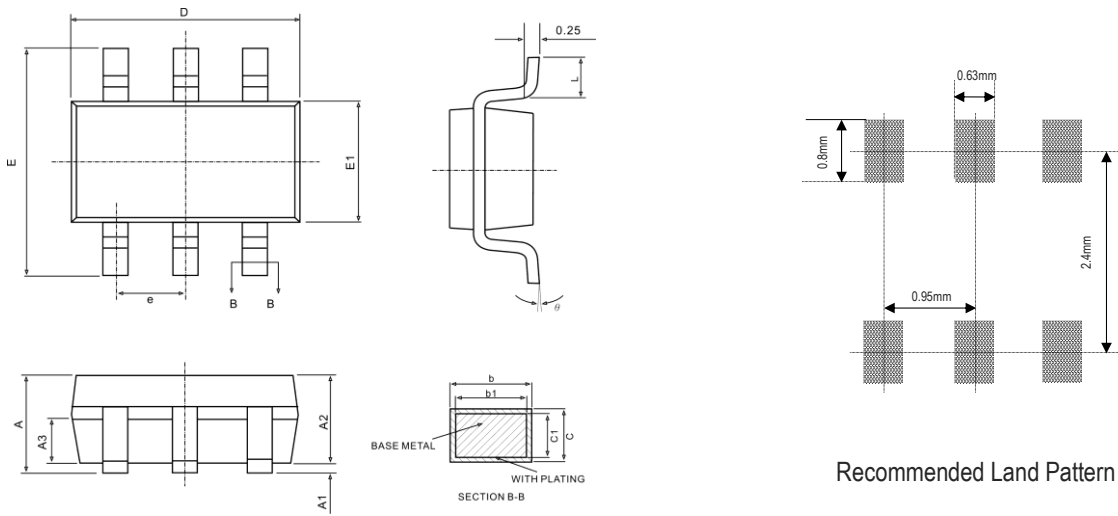


Gate Charge Waveform



Switching Time Waveform

## ■ SOT-23-6L PACKAGE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	-	1.300	-	0.051
A1	0.040	0.100	0.002	0.004
A2	1.000	1.200	0.039	0.047
A3	0.550	0.750	0.022	0.030
b	0.340	0.430	0.013	0.017
b1	0.330	0.380	0.013	0.015
c	0.150	0.210	0.006	0.008
c1	0.140	0.160	0.006	0.006
D	2.720	3.120	0.107	0.123
E	2.600	3.000	0.102	0.118
E1	1.400	1.800	0.055	0.071
e	0.950 BSC		0.066 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°