

HM6604D

Complementary Enhancement Mode Field Effect Transistor

General Description

The HM6604D uses advanced trench technology MOSFETs to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, an inverter, and for a host of other applications. Both devices are ESD protected. *HM6604D are electrically identical.*

-RoHS Compliant

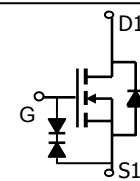
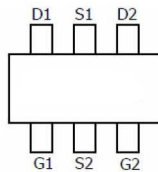
-HM6604D is Halogen Free

Features

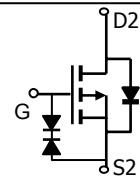
n-channel	p-channel
$V_{DS} (V) = 20V$	-20V
$I_D = 0.9A (V_{GS}=4.5V)$	-0.8A ($V_{GS}=-4.5V$)

$R_{DS(ON)}$	$R_{DS(ON)}$
$< 270m\Omega (V_{GS}=4.5V)$	$< 480m\Omega (V_{GS}=-4.5V)$
$< 330m\Omega (V_{GS}=2.5V)$	$< 950m\Omega (V_{GS}=-2.5V)$
$< 450m\Omega (V_{GS}=1.8V)$	$< 2200m\Omega (V_{GS}=-1.8V)$

SOT-23-6L top view



n-channel



p-channel

Absolute Maximum Ratings $T_A=25^\circ C$ unless otherwise noted

Parameter	Symbol	Max n-channel	Max p-channel	Units
Drain-Source Voltage	V_{DS}	20	-20	V
Gate-Source Voltage	V_{GS}	± 8	± 8	V
Continuous Drain Current ^A	$T_A=25^\circ C$	0.9	-0.8	A
	$T_A=70^\circ C$	0.7	-0.56	
Pulsed Drain Current ^B	I_{DM}	5	-2.4	
Power Dissipation	$T_A=25^\circ C$	0.3	0.3	W
	$T_A=70^\circ C$	0.19	0.19	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	-55 to 150	$^\circ C$

Thermal Characteristics: n-channel and p-channel

Parameter	Symbol	Device	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	n-ch	360	415	$^\circ C/W$
Maximum Junction-to-Ambient ^A		n-ch	400	460	$^\circ C/W$
Maximum Junction-to-Lead ^C	$R_{\theta JL}$	n-ch	300	350	$^\circ C/W$
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	p-ch	360	415	$^\circ C/W$
Maximum Junction-to-Ambient ^A		p-ch	400	460	$^\circ C/W$
Maximum Junction-to-Lead ^C	$R_{\theta JL}$	p-ch	300	350	$^\circ C/W$

N-Channel: Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV _{DSS}	Drain-Source Breakdown Voltage	I _D =250μA, V _{GS} =0V	20			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =16V, V _{GS} =0V T _J =55°C			1 5	μA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} =±8V			25	μA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =250μA	0.45		1.2	V
I _{D(ON)}	On state drain current	V _{GS} =4.5V, V _{DS} =5V	5			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =4.5V, I _D =0.9A T _J =125°C		220	270	mΩ
		V _{GS} =2.5V, I _D =0.75A		260	330	mΩ
		V _{GS} =1.8V, I _D =0.7A		330	450	mΩ
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =0.8A		2.6		S
V _{SD}	Diode Forward Voltage	I _S =0.5A, V _{GS} =0V		0.69	1	V
I _S	Maximum Body-Diode Continuous Current				0.4	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =10V, f=1MHz		101	120	pF
C _{oss}	Output Capacitance			17		pF
C _{rss}	Reverse Transfer Capacitance			14		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		3	4	Ω
SWITCHING PARAMETERS						
Q _g	Total Gate Charge	V _{GS} =4.5V, V _{DS} =10V, I _D =0.8A		1.57	1.9	nC
Q _{gs}	Gate Source Charge			0.13		nC
Q _{gd}	Gate Drain Charge			0.36		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =5V, V _{DS} =10V, R _L =12.5Ω, R _{GEN} =6Ω		3.2		ns
t _r	Turn-On Rise Time			4		ns
t _{D(off)}	Turn-Off DelayTime			15.5		ns
t _f	Turn-Off Fall Time			2.4		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =0.8A, dI/dt=100A/μs		6.7	8.1	ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =0.8A, dI/dt=100A/μs		1.6		nC

A: 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 value in any given application depends on the user's specific board design. The current rating is based on the t ≤ 10s thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

C: The R_{θJA} is the sum of the thermal impedance from junction to lead R_{θJL} and lead to ambient.

D: The static characteristics in Figures 1 to 6 are obtained using 80μs pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C. The SOA curve provides a single pulse rating.

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N-Channel: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

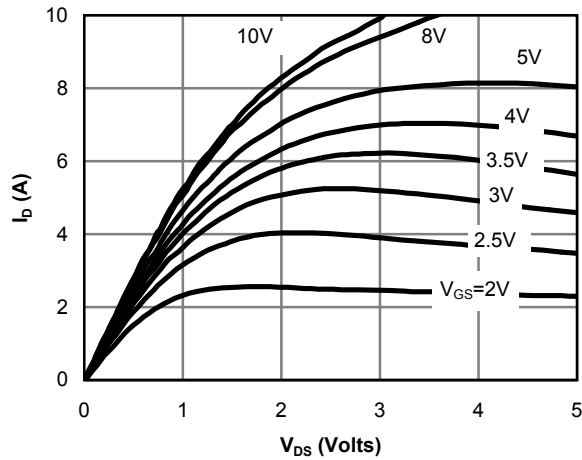


Fig 1: On-Region Characteristics

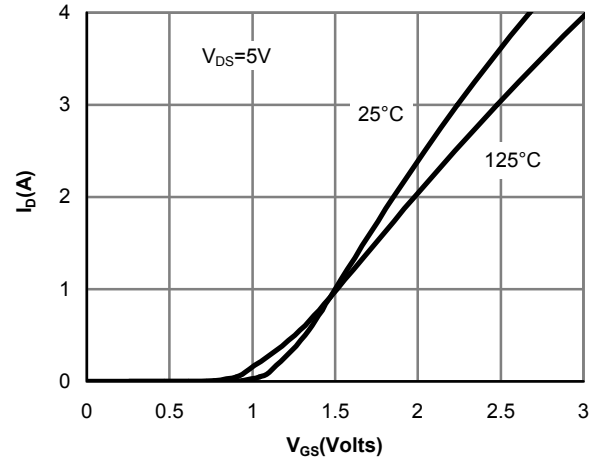


Figure 2: Transfer Characteristics

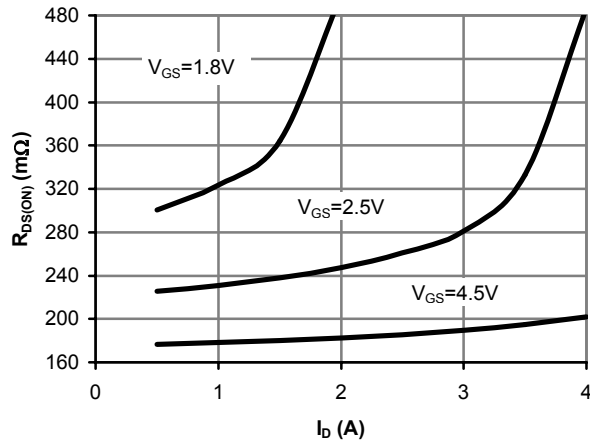


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

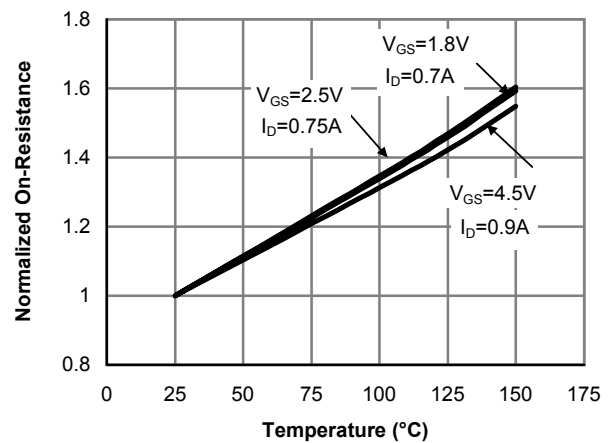


Figure 4: On-Resistance vs. Junction Temperature

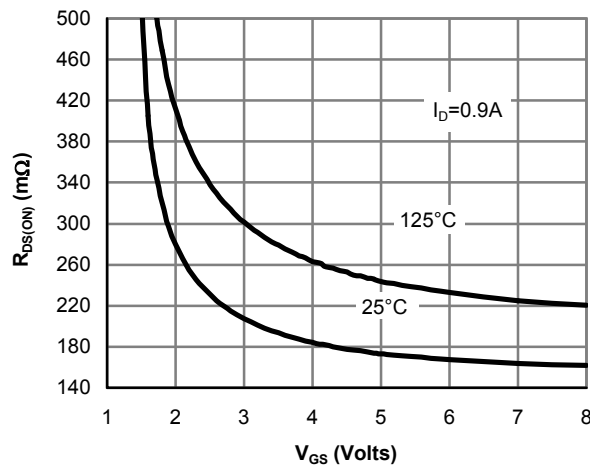


Figure 5: On-Resistance vs. Gate-Source Voltage

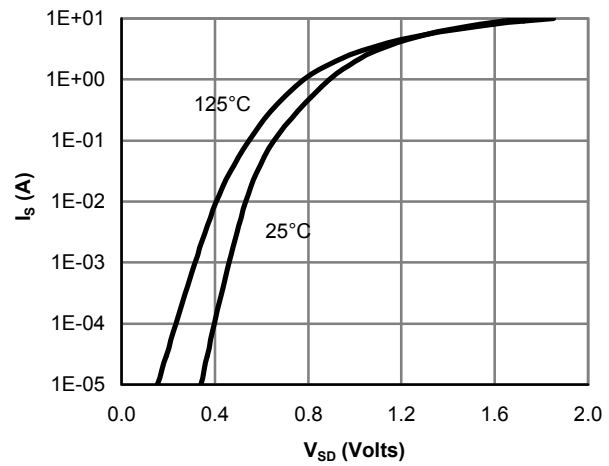
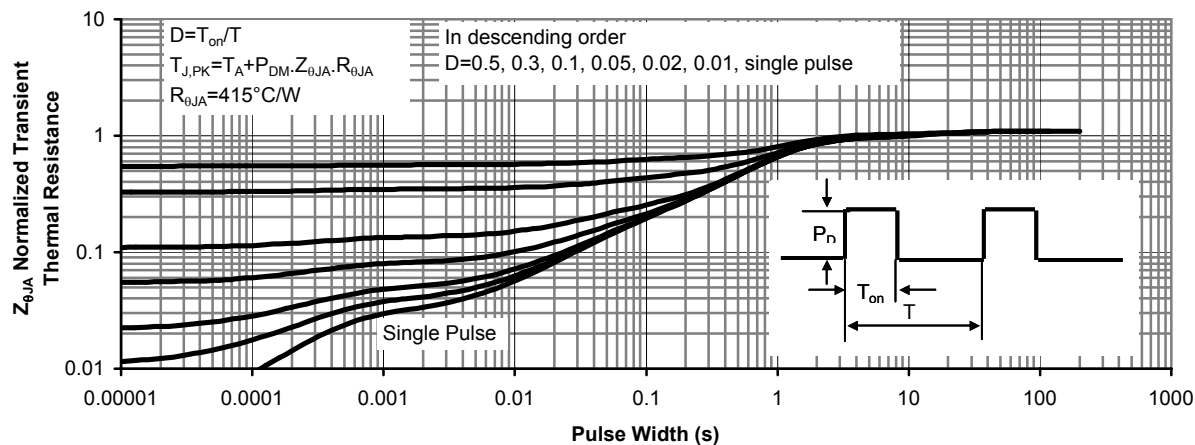
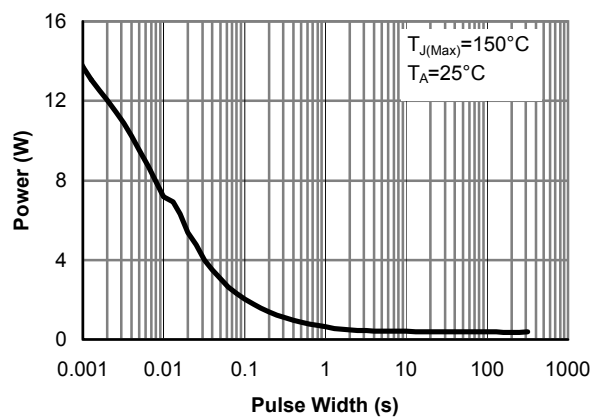
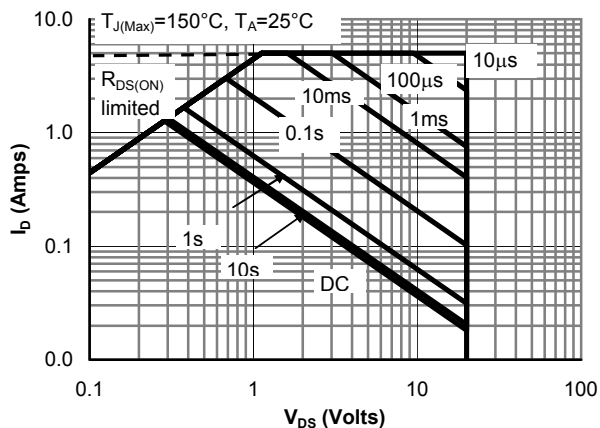
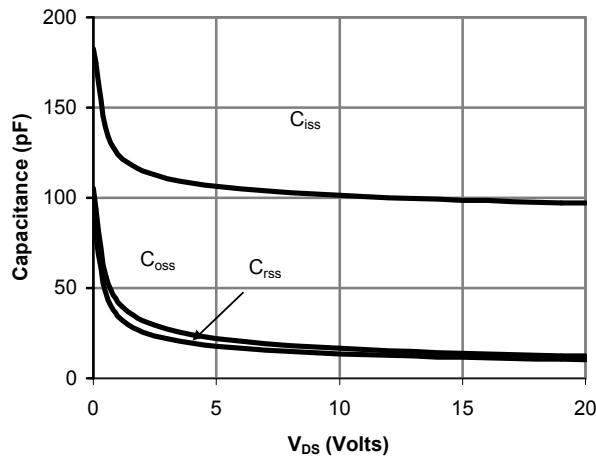
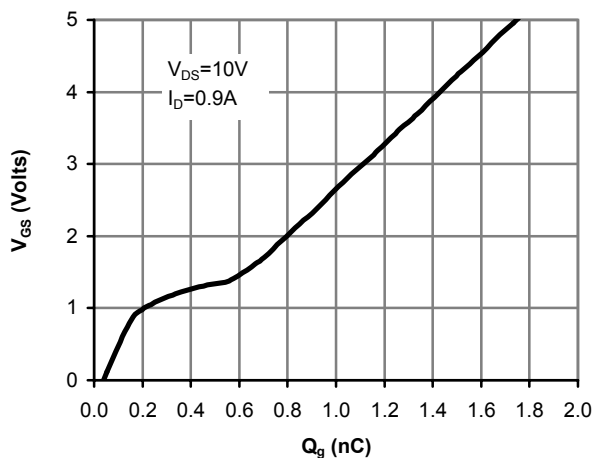


Figure 6: Body-Diode Characteristics

N-Channel: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



P-Channel Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV _{DSS}	Drain-Source Breakdown Voltage	I _D =-250μA, V _{GS} =0V	-20			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =-16V, V _{GS} =0V T _J =55°C			-1 -5	μA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} =±8V			±10	μA
V _{GS(t)}	Gate Threshold Voltage	V _{DS} =V _{GS} I _D =-250μA	-0.45		-1.2	V
I _{D(ON)}	On state drain current	V _{GS} =-4.5V, V _{DS} =-5V	-3			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =-4.5V, I _D =-0.8A T _J =125°C		350 440	480 670	mΩ
		V _{GS} =-2.5V, I _D =-0.5A		550	950	mΩ
		V _{GS} =-1.8V, I _D =-0.4A		780	2200	mΩ
g _{FS}	Forward Transconductance	V _{DS} =-5V, I _D =-0.8A		1.7		S
V _{SD}	Diode Forward Voltage	I _S =-0.5A, V _{GS} =0V		-0.86	-1	V
I _S	Maximum Body-Diode Continuous Current				-0.4	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =-10V, f=1MHz		114	140	pF
C _{oss}	Output Capacitance			17		pF
C _{rss}	Reverse Transfer Capacitance			14		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		12	17	Ω
SWITCHING PARAMETERS						
Q _g	Total Gate Charge	V _{GS} =-4.5V, V _{DS} =-10V, I _D =-0.8A		1.44	1.8	nC
Q _{gs}	Gate Source Charge			0.14		nC
Q _{gd}	Gate Drain Charge			0.35		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =-4.5V, V _{DS} =-10V, R _L =16.7Ω, R _{GEN} =3Ω		6.5		ns
t _r	Turn-On Rise Time			6.5		ns
t _{D(off)}	Turn-Off DelayTime			18.2		ns
t _f	Turn-Off Fall Time			5.5		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =-0.8A, dI/dt=100A/μs		10	13	ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =-0.8A, dI/dt=100A/μs		3		nC

A: 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 value in any given application depends on the user's specific board design. The current rating is based on the ≤ 10s thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

C. The R_{θJA} is the sum of the thermal impedance from junction to lead R_{θJL} and lead to ambient.

D. The static characteristics in Figures 1 to 6,12,14 are obtained using 80μs pulses, duty cycle 0.5% max.

E. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C. The SOA curve provides a single pulse rating.

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P-Channel: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

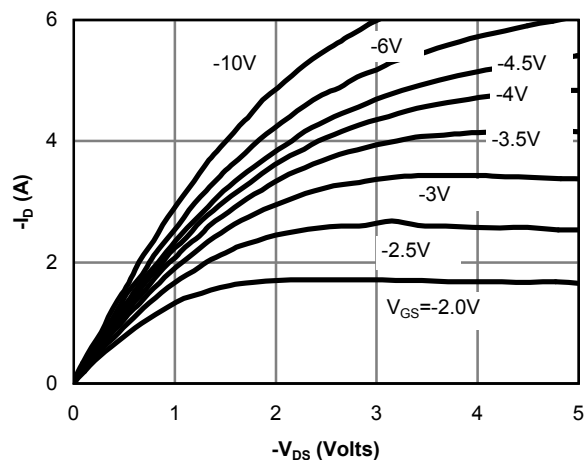


Fig 1: On-Region Characteristics

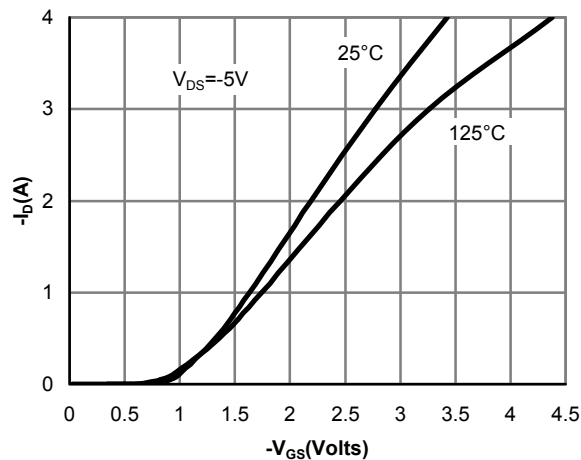


Figure 2: Transfer Characteristics

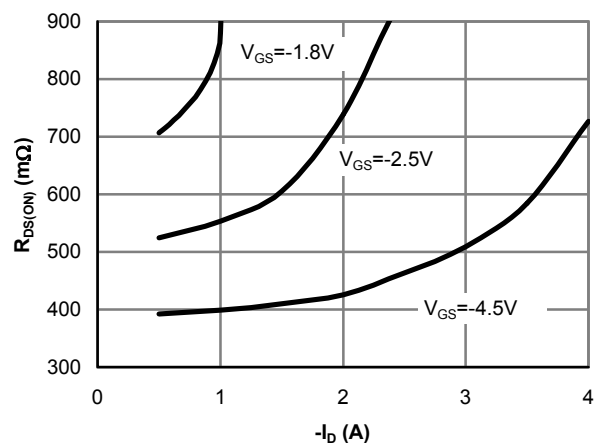


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

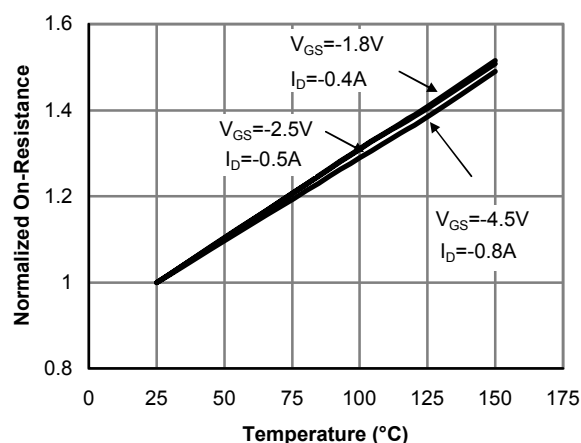


Figure 4: On-Resistance vs. Junction Temperature

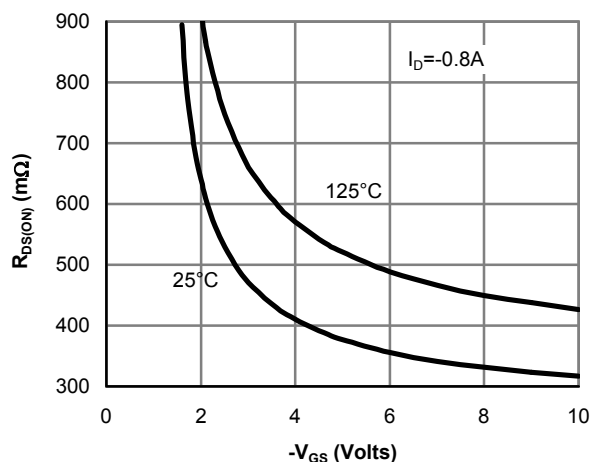


Figure 5: On-Resistance vs. Gate-Source Voltage

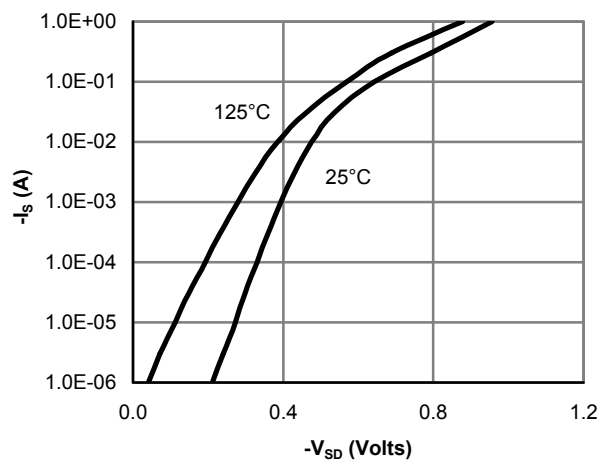
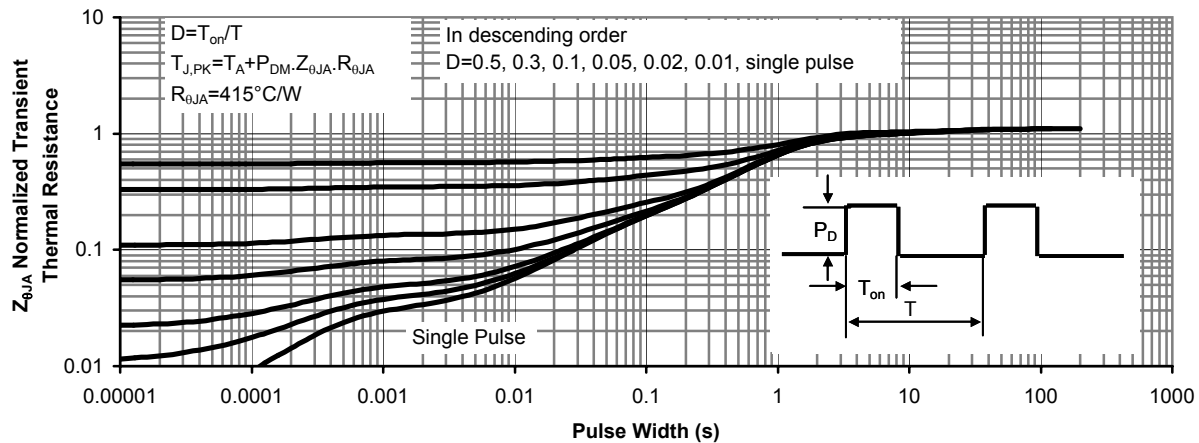
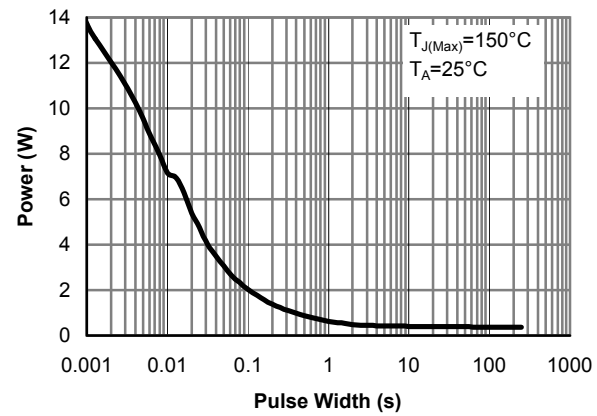
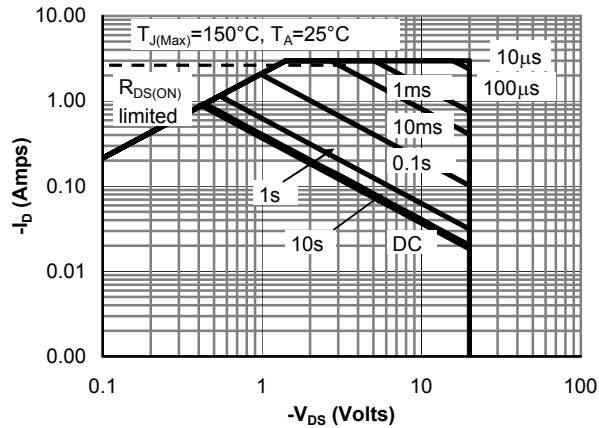
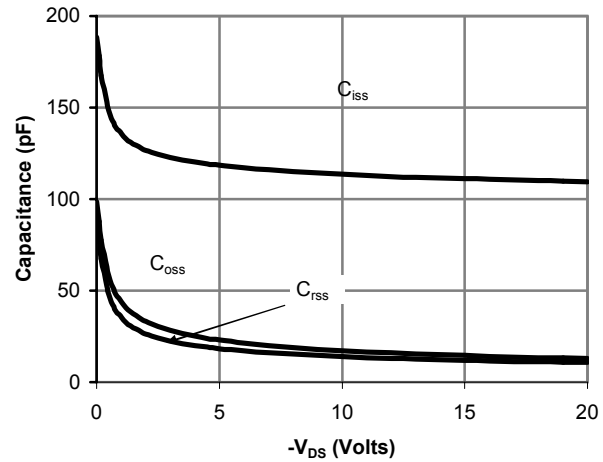
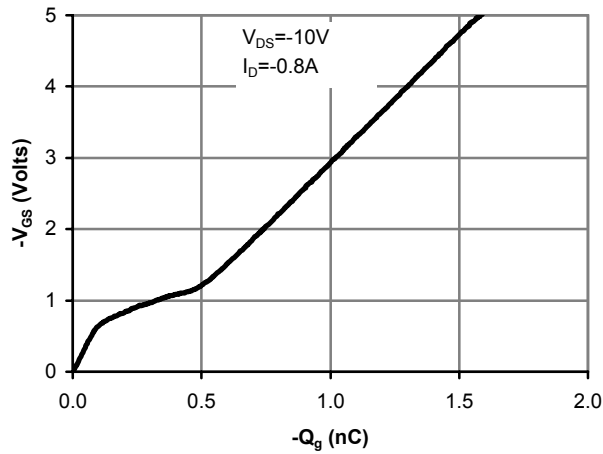
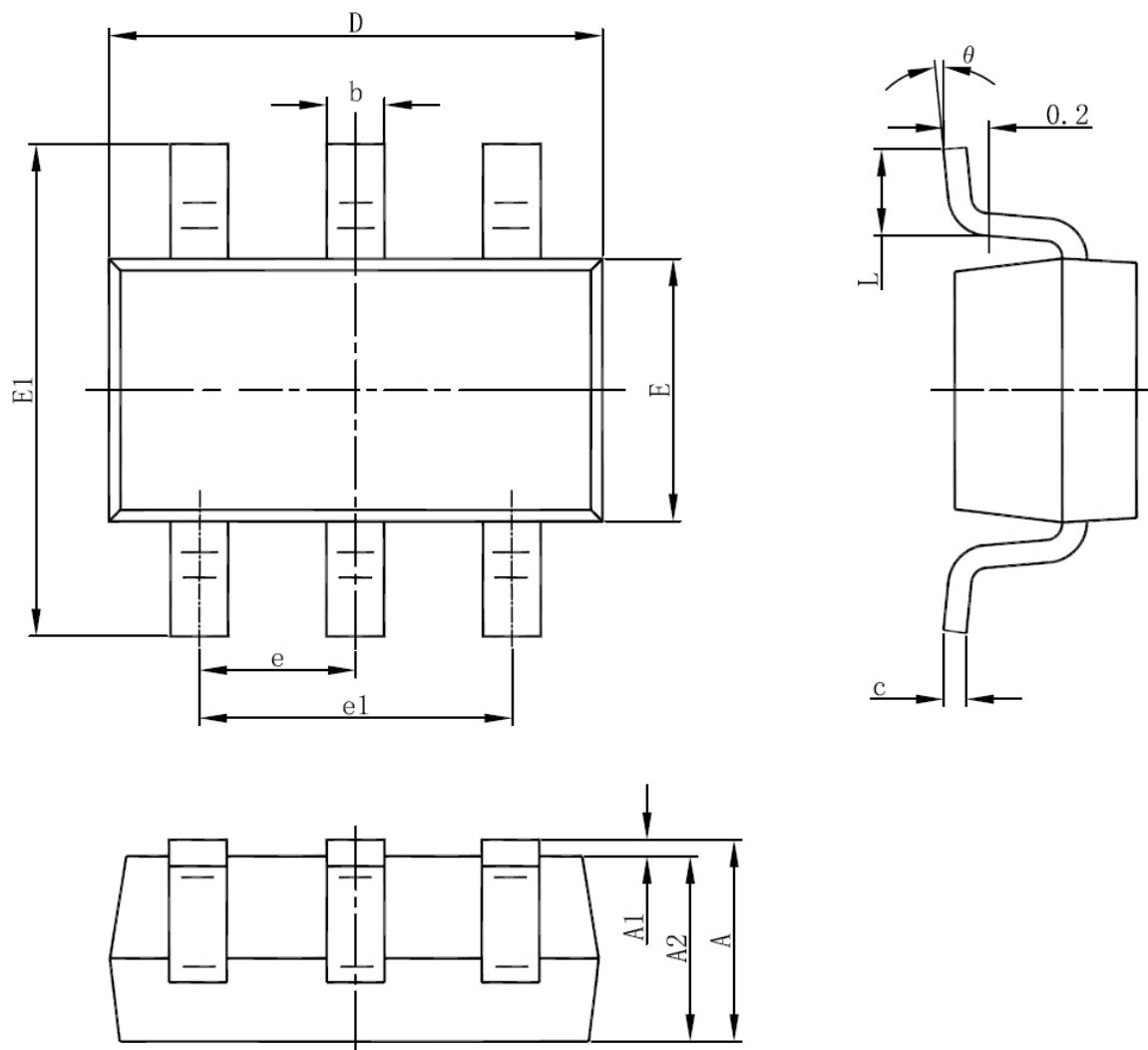


Figure 6: Body-Diode Characteristics

P-Channel: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



SOT23-6L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°