



## AP4580 Full-bridge of MOSFET

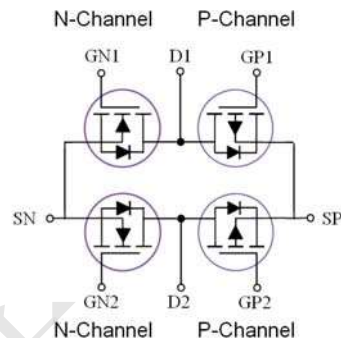
### Features

#### N-Channel

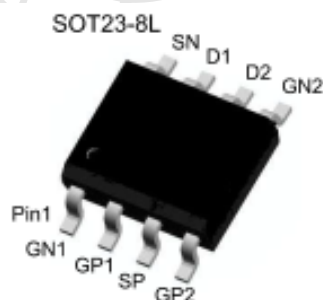
- $BV_{DSS} = 20V$
- $R_{DS(on)} (@V_{GS} = 4.5V) < 72m\Omega$
- $R_{DS(on)} (@V_{GS} = 2.5V) < 90m\Omega$
- Advanced Trench Technology
- Excellent  $R_{DS(on)}$  and Low Gate Charge
- Lead free product is acquired

#### P-Channel

- $BV_{DSS} = -20V$
- $R_{DS(on)} (@V_{GS} = -4.5V) < 146m\Omega$
- $R_{DS(on)} (@V_{GS} = -2.5V) < 220m\Omega$



### Package



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

Parameter	Symbol	Maximum		Units
		N-Channel	P-Channel	
Drain-Source Voltage	$V_{DS}$	20	-20	V
Gate-Source Voltage	$V_{GS}$	$\pm 10$	$\pm 10$	V
Drain Current ( $T_A=25^\circ C, t<10s, V_{GS}=10V$ )	$I_D$	2.0	-1.8	A
Drain Current ( $T_A=75^\circ C, t<10s, V_{GS}=10V$ )		1.5	-1.3	A
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	12	-10	A
Power Dissipation <sup>b</sup> ( $T_A=25^\circ C$ )	$P_D$	1.4	1.4	W
Power Dissipation <sup>b</sup> ( $T_A=75^\circ C$ )		1.0	0.9	W
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 ~ +150	-55 ~ +150	$^\circ C$

### Thermal Characteristics

Parameter	Symbol	Maximum		Units
		P-Channel	N-Channel	
Junction-to-Ambient <sup>a</sup> ( $t \leq 10s$ )	$R_{\theta JA}$	100	100	$^\circ C/W$
Junction-to-Ambient <sup>a,d</sup> (Steady-State)		130	130	$^\circ C/W$
Junction-to-Lead (Steady-State)	$R_{\theta JL}$	90	90	$^\circ C/W$



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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Off Characteristics						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V , I <sub>D</sub> = 250uA	20			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 20V , V <sub>GS</sub> = 0V			1	uA
I <sub>GSS</sub>	Gate-Body Leakage Current	V <sub>GS</sub> = ±10V, V <sub>DS</sub> = 0V			±100	nA
On Characteristics						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250uA	0.45	0.7	1.0	V
R <sub>DS(on))</sub>	Drain-Source On-State Resistance	V <sub>GS</sub> = 2.5V , I <sub>D</sub> = 1.0A		70	90	mΩ
		V <sub>GS</sub> = 4.5V , I <sub>D</sub> = 2.0A		60	72	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 5V , I <sub>D</sub> = 1.5A		20		S
Drain-Source Diode Characteristics						
V <sub>SD</sub>	Diode Forward Voltage	V <sub>GS</sub> = 0V , I <sub>S</sub> = 1.0A			1.2	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				2.0	A
Dynamic Characteristics						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 10V , V <sub>GS</sub> = 0V f = 1.0MHz		240		pF
C <sub>oss</sub>	Output Capacitance			45		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			23		pF
Switching Characteristics						
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 10V , I <sub>D</sub> = 2.0A V <sub>GS</sub> = 6V		2.7		nC
Q <sub>gs</sub>	Gate-Source Charge			0.5		nC
Q <sub>gd</sub>	Gate-Drain Charge			0.4		nC
t <sub>D(ON)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 10V , ID = 1A V <sub>GS</sub> = 6 V R <sub>GEN</sub> = 6 ohm		2.3		ns
t <sub>r</sub>	Turn-On Rise Time			3.2		ns
t <sub>D(OFF)</sub>	Turn-Off Delay Time			20		ns
t <sub>f</sub>	Turn-Off Fall Time			3		ns

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production



## AP4580 Full-bridge of MOSFET

### Typical Electrical and Thermal Characteristics

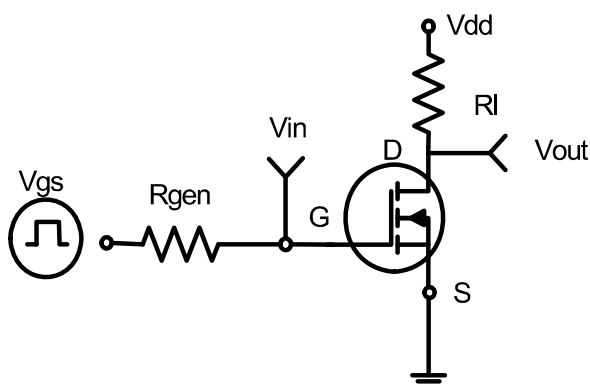


Figure 1: Switching Test Circuit

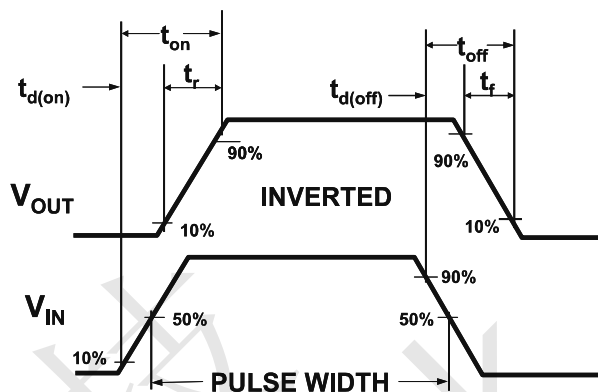


Figure 2: Switching Waveforms

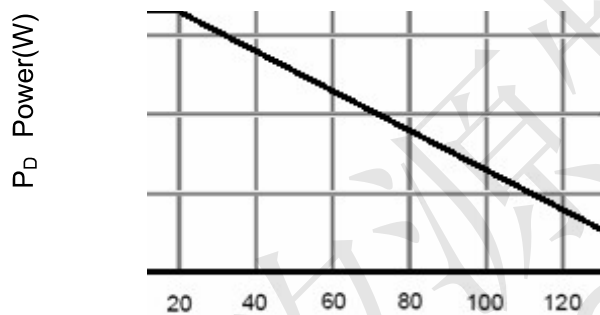


Figure 3 Power Dissipation

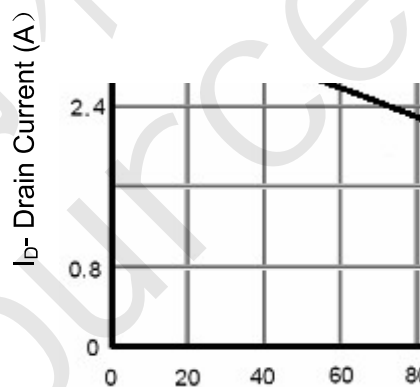


Figure 4 Drain Current

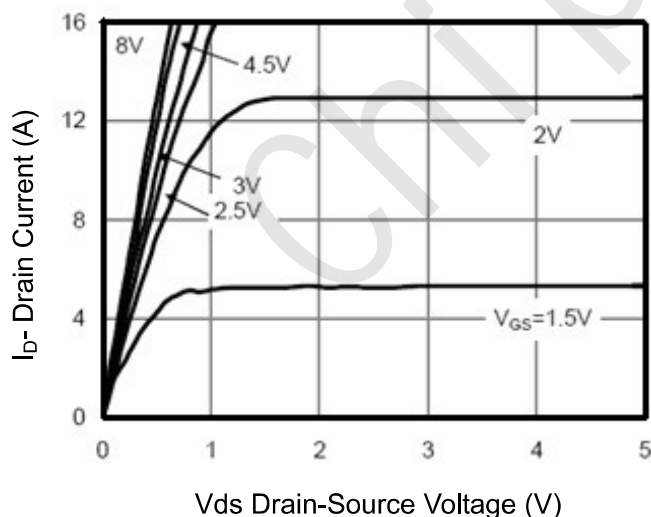


Figure 5 Output Characteristics

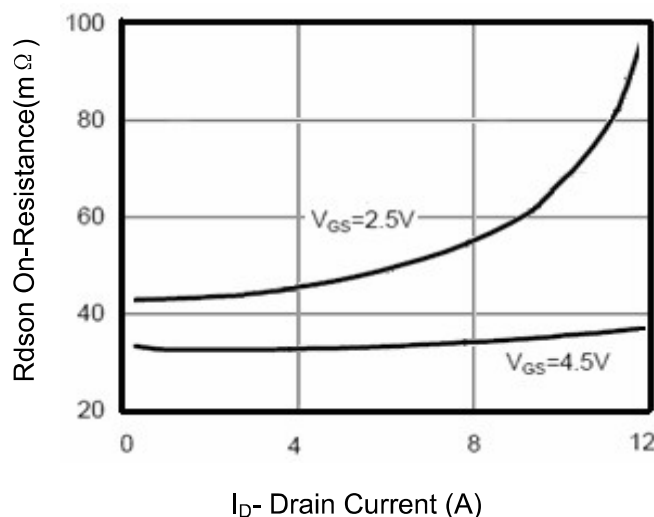


Figure 6 Drain-Source On-Resistance



## AP4580 Full-bridge of MOSFET

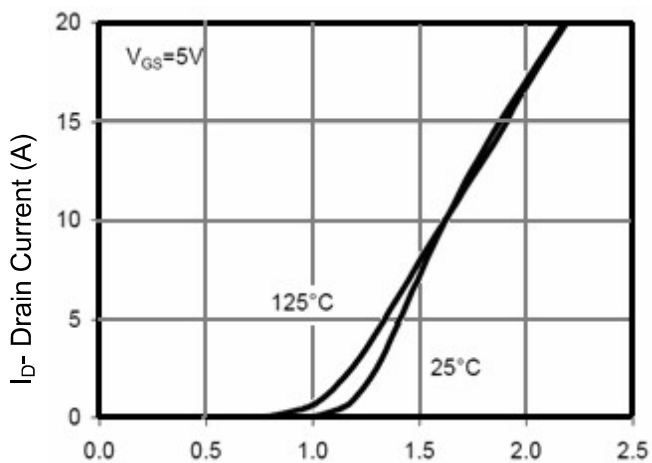


Figure 7 Transfer Characteristics

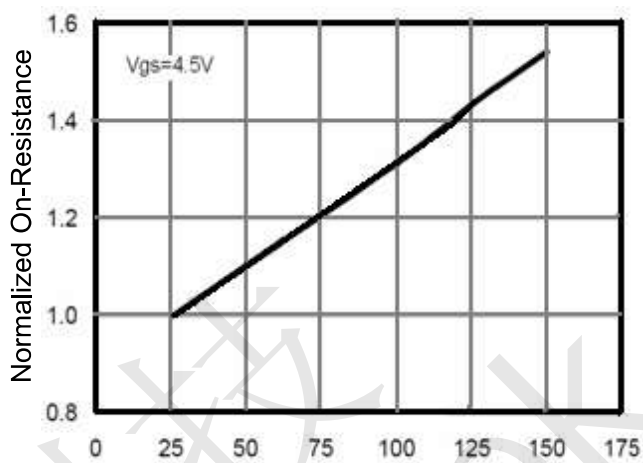


Figure 8 Drain-Source On-Resistance

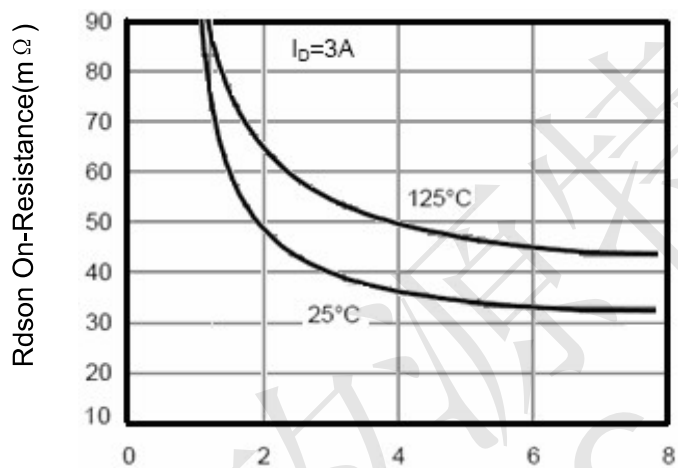


Figure 9  $R_{DS(on)}$  vs  $V_{GS}$

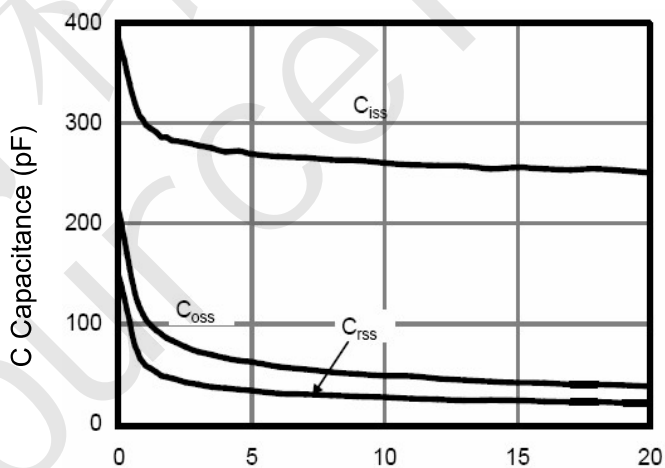


Figure 10 Capacitance vs  $V_{DS}$

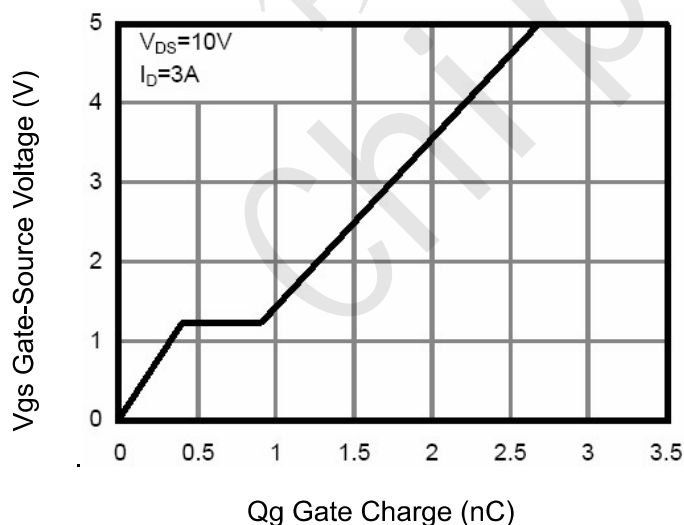


Figure 11 Gate Charge

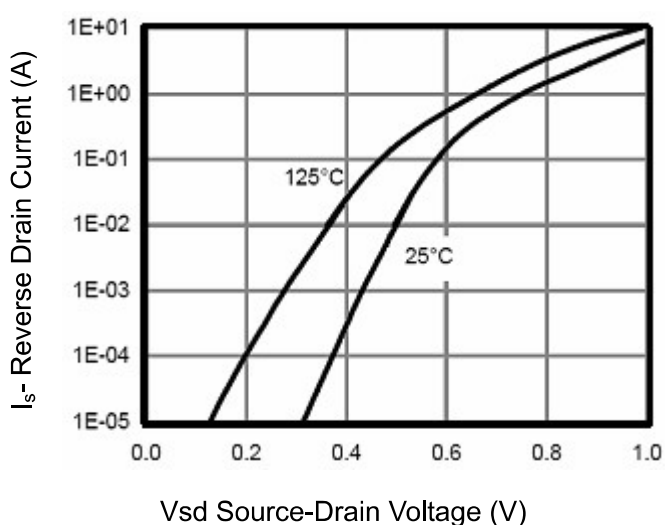


Figure 12 Source- Drain Diode Forward



## AP4580 Full-bridge of MOSFET

P-Channel Electrical Characteristics (T <sub>A</sub> = 25°C unless otherwise noted)						
Symbol	Parameter	Conditions	Min	Typ	Max	Units
Off Characteristics						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V , I <sub>D</sub> = -250uA	-20			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = -20V , V <sub>GS</sub> = 0V			-1	uA
I <sub>GSS</sub>	Gate-Body Leakage Current	V <sub>GS</sub> = ±10V, V <sub>DS</sub> = 0V			±100	nA
On Characteristics						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250uA	-0.45	0.7	-1.0	V
R <sub>DS(ON)</sub>	Drain-Source On-State Resistance	V <sub>GS</sub> = -2.5V , I <sub>D</sub> = -1.0A		190	220	mΩ
		V <sub>GS</sub> = -4.5V , I <sub>D</sub> = -1.8A		128	146	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = -5V , I <sub>D</sub> = -1.0A		15		S
Drain-Source Diode Characteristics						
V <sub>SD</sub>	Diode Forward Voltage	V <sub>GS</sub> = 0V , I <sub>S</sub> = -1.0A			-1.2	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				-1.8	A
Dynamic Characteristics						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = -10V , V <sub>GS</sub> = 0V f = 1.0MHz		290		pF
C <sub>oss</sub>	Output Capacitance			100		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			34		pF
Switching Characteristics						
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = -10V , I <sub>D</sub> = -1.8A V <sub>GS</sub> = -6V		3.0		nC
Q <sub>gs</sub>	Gate-Source Charge			0.5		nC
Q <sub>gd</sub>	Gate-Drain Charge			0.8		nC
t <sub>D(ON)</sub>	Turn-On Delay Time	V <sub>DD</sub> = -10V , I <sub>D</sub> = -1A V <sub>GS</sub> = -6 V R <sub>GEN</sub> = 6 ohm		9.5		ns
t <sub>r</sub>	Turn-On Rise Time			4.9		ns
t <sub>D(OFF)</sub>	Turn-Off Delay Time			21.5		ns
t <sub>f</sub>	Turn-Off Fall Time			10		ns

### 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



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### Typical Electrical and Thermal Characteristics

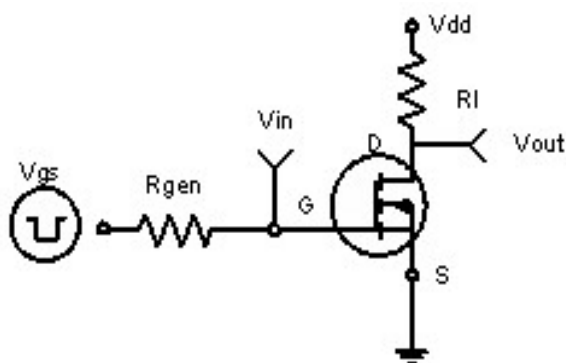


Figure 1: Switching Test Circuit

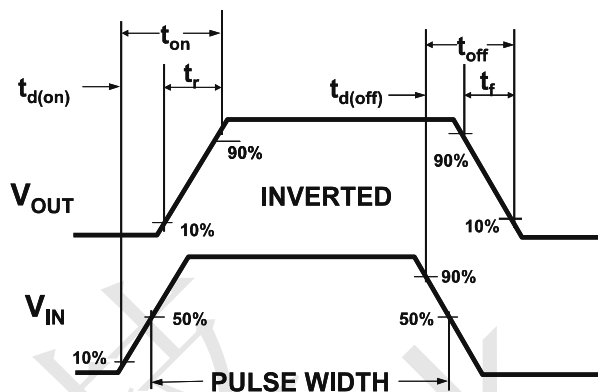


Figure 2: Switching Waveforms

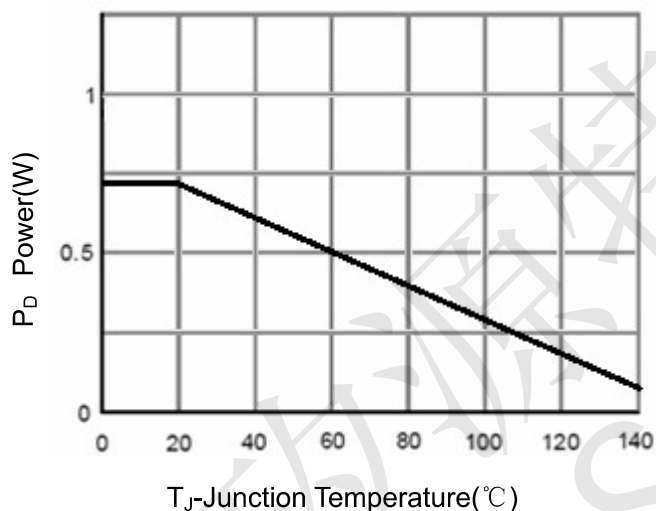


Figure 3 Power Dissipation

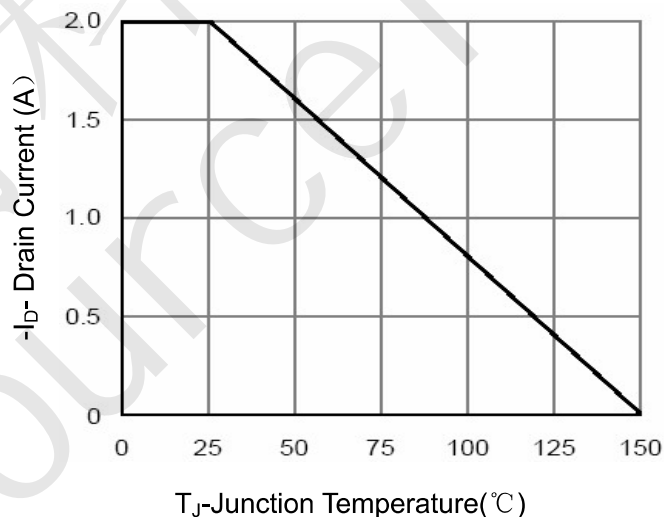


Figure 4 Drain Current

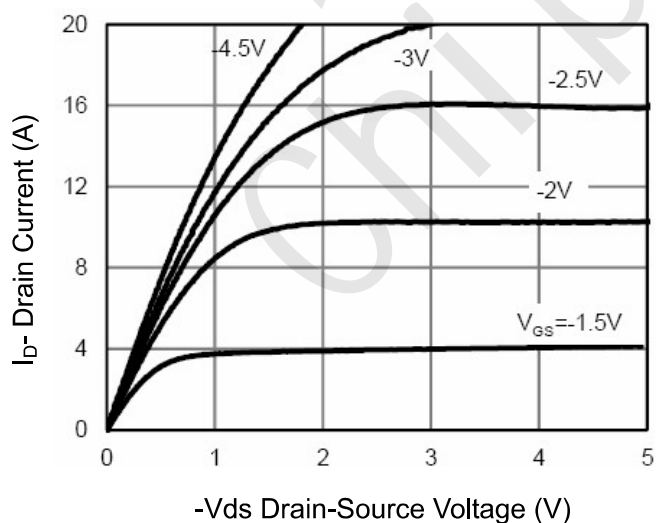


Figure 5 Output Characteristics

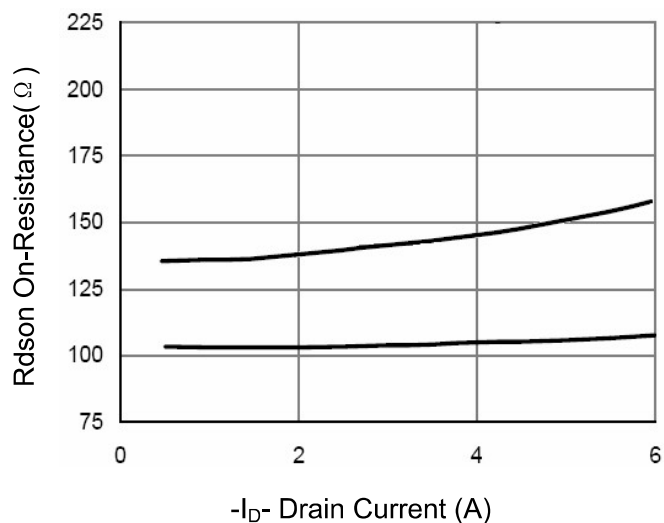


Figure 6 Drain-Source On-Resistance



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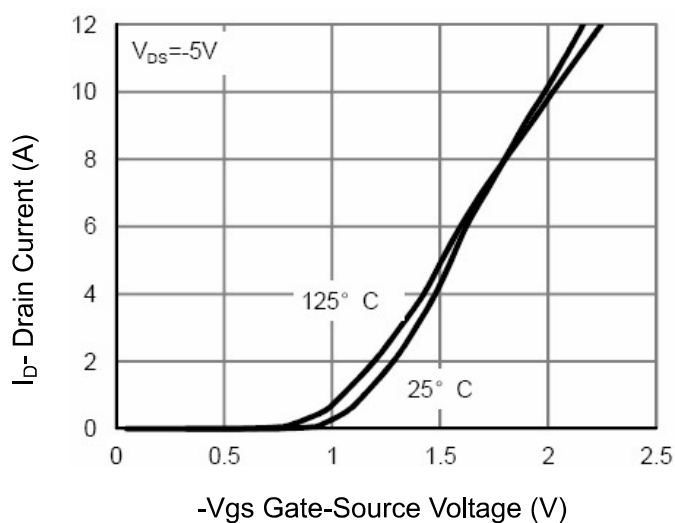


Figure 7 Transfer Characteristics

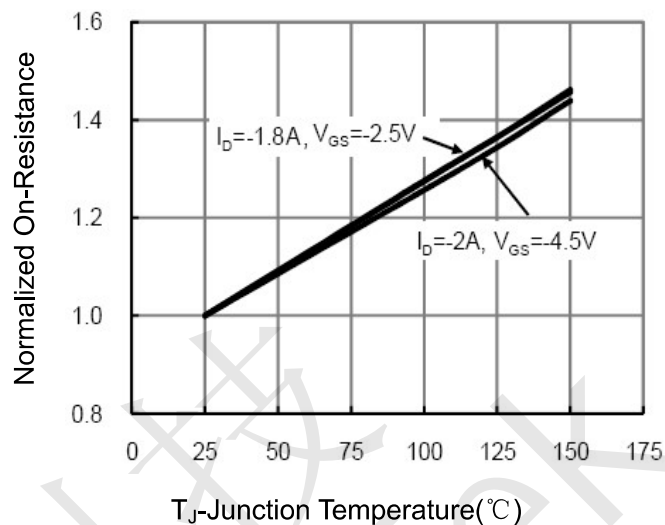


Figure 8 Drain-Source On-Resistance

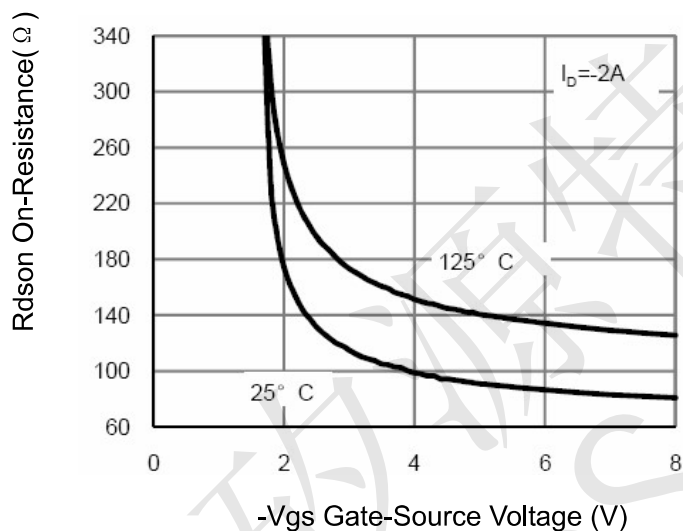


Figure 9  $R_{DS(on)}$  vs  $V_{GS}$

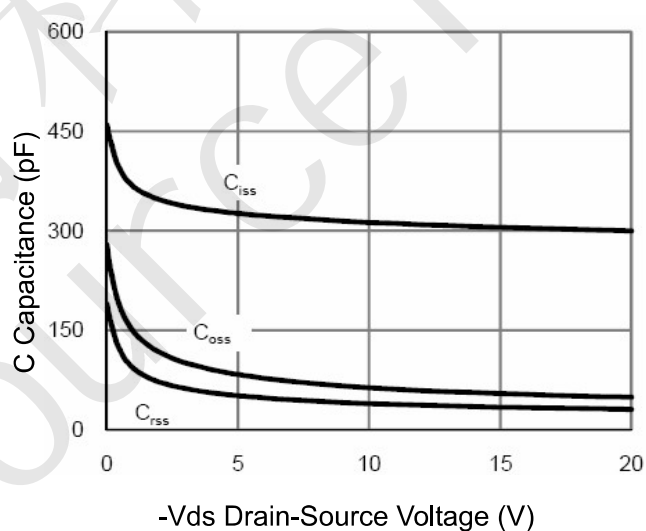


Figure 10 Capacitance vs  $V_{DS}$

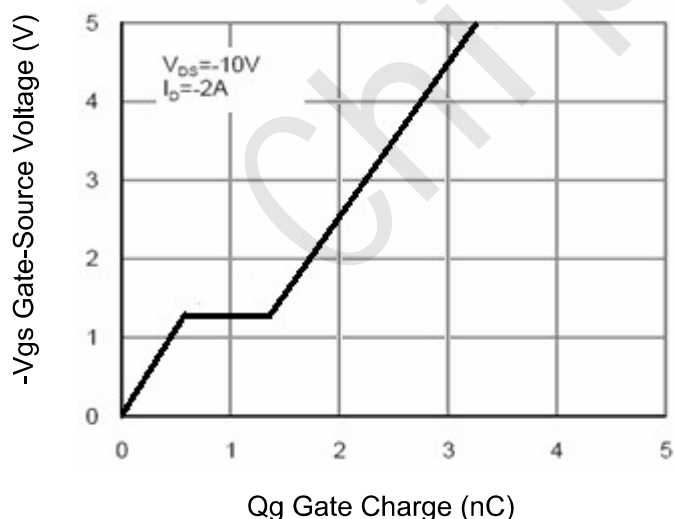


Figure 11 Gate Charge

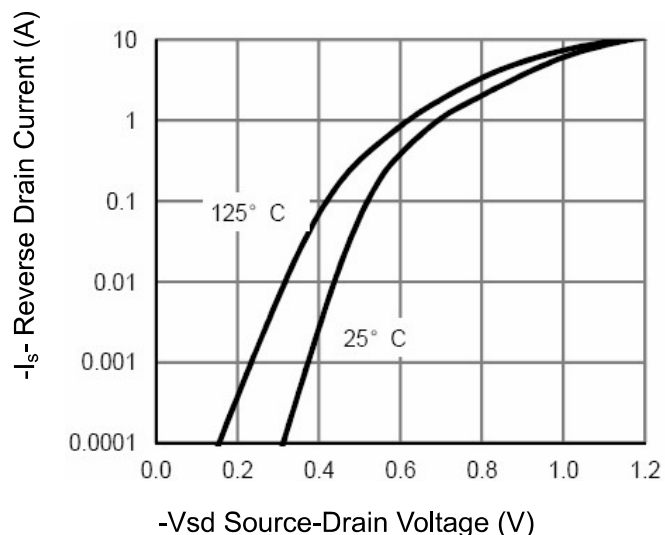


Figure 12 Source- Drain Diode Forward



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### SOT23-8L Package Outline

