

# AP4580

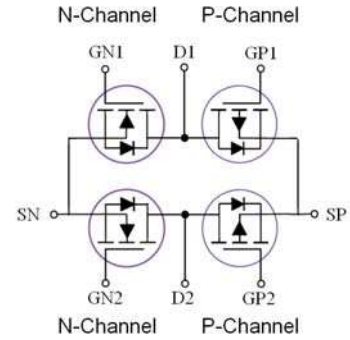
## Full-bridge of MOSFET

### Features

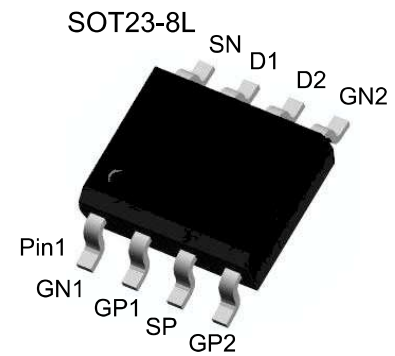
- |  |   |
|--|---|
| N-Channel                                    | P-Channel                                     |
| • $BV_{DSS} = 20V$                           | • $BV_{DSS} = -20V$                           |
| • $R_{DS(on)} (@V_{GS} = 4.5V) < 72m\Omega$  | • $R_{DS(on)} (@V_{GS} = -4.5V) < 146m\Omega$ |
| • $R_{DS(on)} (@V_{GS} = 2.5V) < 90m\Omega$  | • $R_{DS(on)} (@V_{GS} = -2.5V) < 220m\Omega$ |
| • Advanced Trench Technology                 |   |
| • Excellent $R_{DS(ON)}$ and Low Gate Charge |   |
| • Lead free product is acquired              |   |

### Application

- Load Switch
- PWM Application
- Power management



### 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	$^\circ C/W$

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N-Channel Electrical Characteristics ( $T_A = 25^\circ\text{C}$ unless otherwise noted)						
Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	20			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 20V, V_{GS} = 0V$			1	$\mu A$
$I_{GSS}$	Gate-Body Leakage Current	$V_{GS} = \pm 10V, V_{DS} = 0V$			$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	0.45	0.7	1.0	V
$R_{DS(ON)}$	Drain-Source On-State Resistance	$V_{GS} = 2.5V, I_D = 1.0A$		70	90	$m\Omega$
		$V_{GS} = 4.5V, I_D = 2.0A$		60	72	$m\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 5V, I_D = 1.5A$		20		S
<b>Drain-Source Diode Characteristics</b>						
$V_{SD}$	Diode Forward Voltage	$V_{GS} = 0V, I_S = 1.0A$			1.2	V
$I_S$	Maximum Body-Diode Continuous Current				2.0	A
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = 10V, V_{GS} = 0V$ $f = 1.0MHz$		240		pF
$C_{oss}$	Output Capacitance			45		pF
$C_{rss}$	Reverse Transfer Capacitance			23		pF
<b>Switching Characteristics</b>						
$Q_g$	Total Gate Charge	$V_{DS} = 10V, I_D = 2.0A$ $V_{GS} = 6V$		2.7		nC
$Q_{gs}$	Gate-Source Charge			0.5		nC
$Q_{gd}$	Gate-Drain Charge			0.4		nC
$t_{D(ON)}$	Turn-On Delay Time	$V_{DD} = 10V, I_D = 1A$ $V_{GS} = 6V$ $R_{GEN} = 6\text{ ohm}$		2.3		ns
$t_r$	Turn-On Rise Time			3.2		ns
$t_{D(OFF)}$	Turn-Off Delay Time			20		ns
$t_f$	Turn-Off Fall Time			3		ns

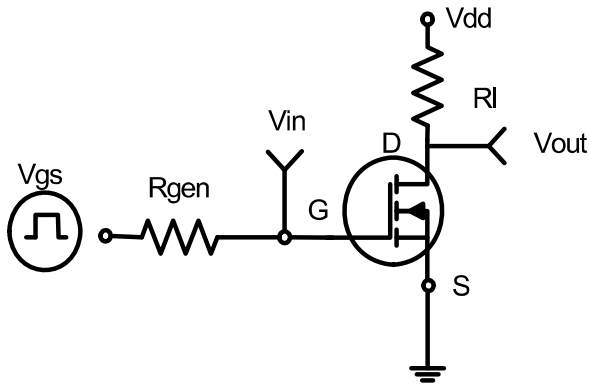
**Notes:**

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

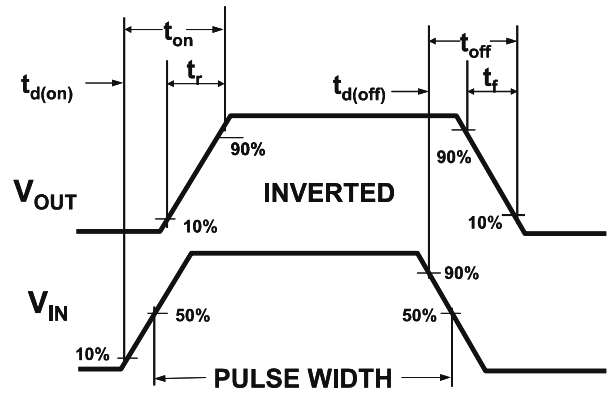
**AP4580**

**Full-bridge of MOSFET**

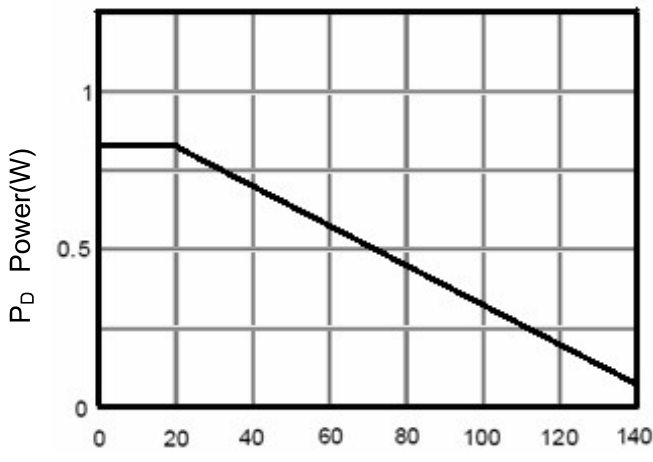
**Typical Electrical and Thermal Characteristics**



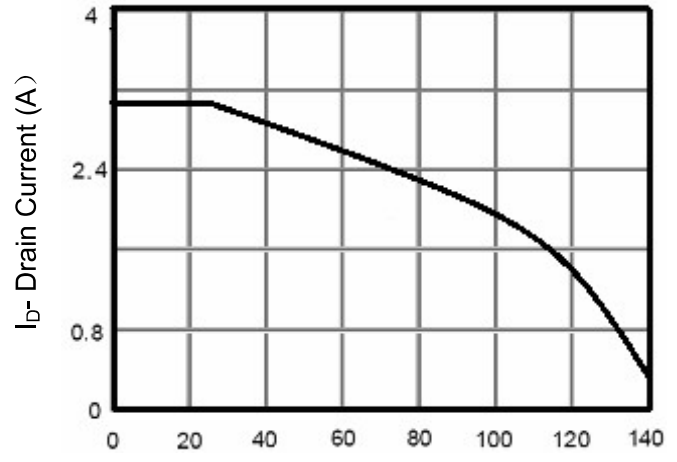
**Figure 1: Switching Test Circuit**



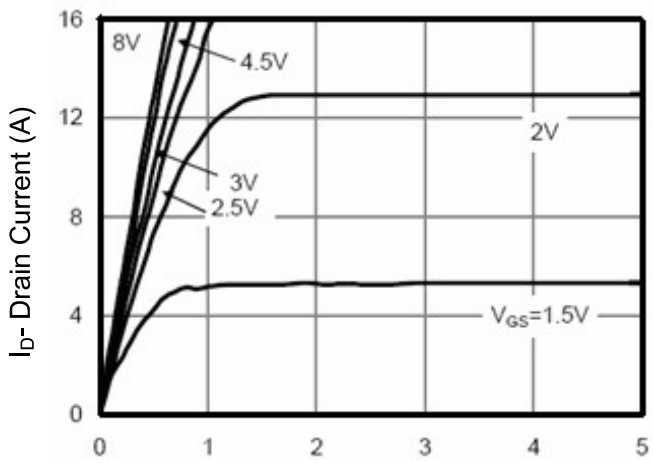
**Figure 2: Switching Waveforms**



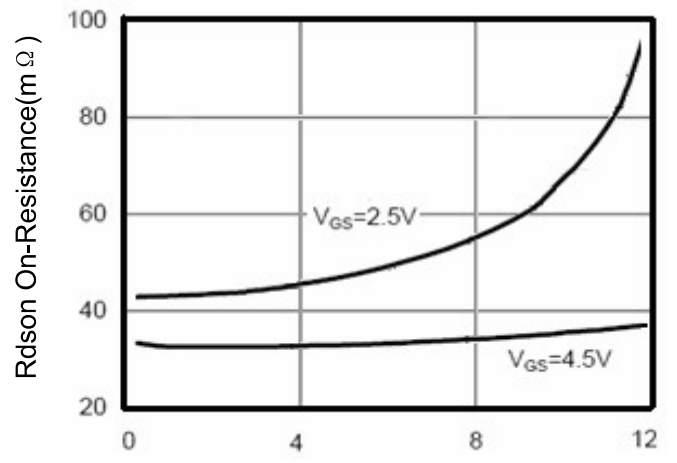
**Figure 3 Power Dissipation**



**Figure 4 Drain Current**



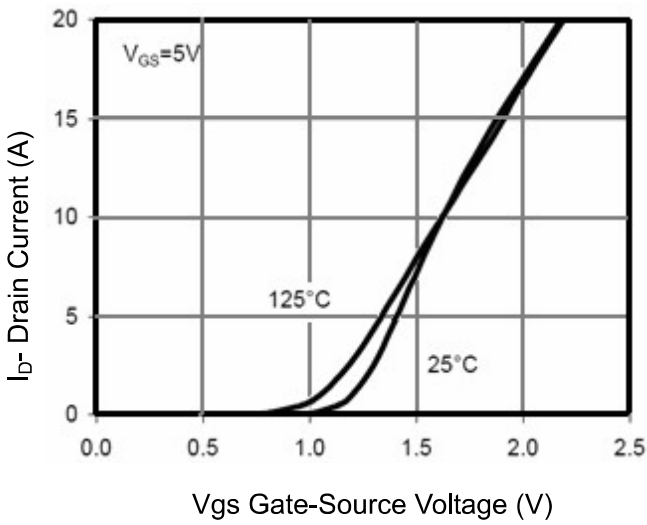
**Figure 5 Output Characteristics**



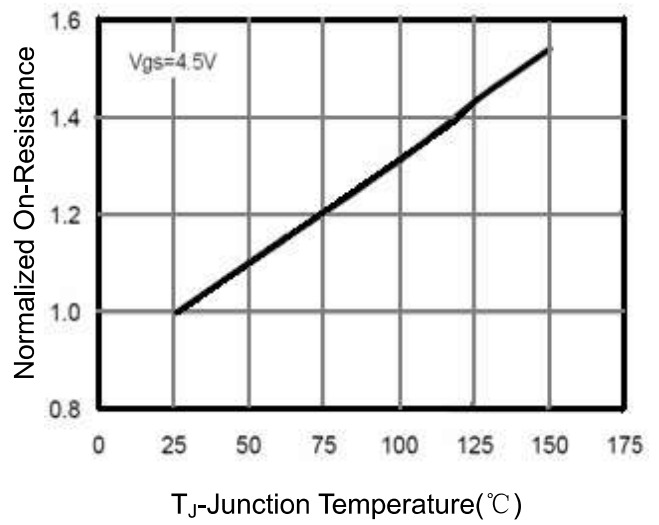
**Figure 6 Drain-Source On-Resistance**

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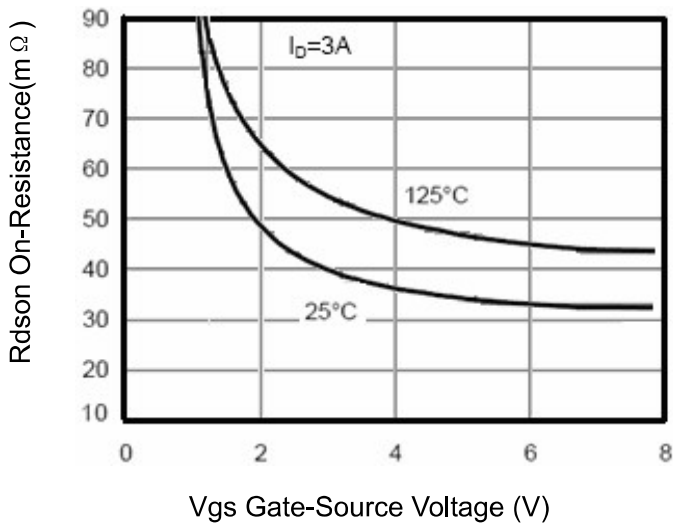
**Full-bridge of MOSFET**



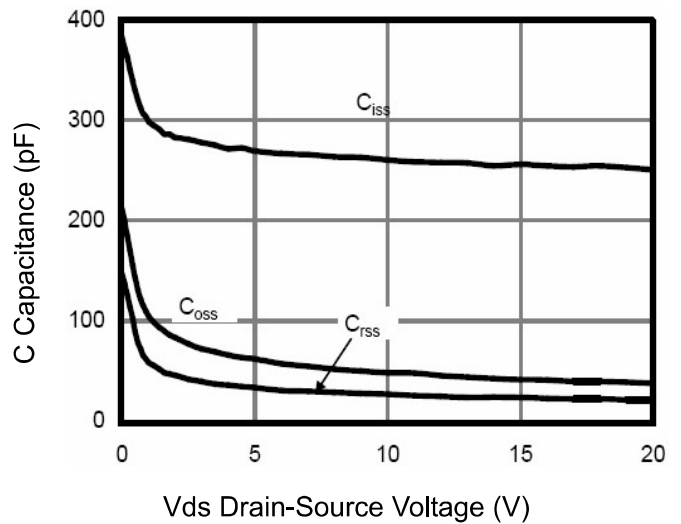
**Figure 7 Transfer Characteristics**



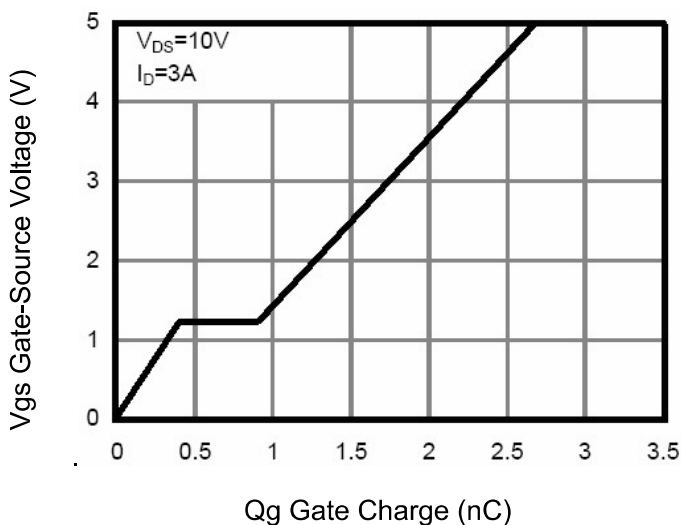
**Figure 8 Drain-Source On-Resistance**



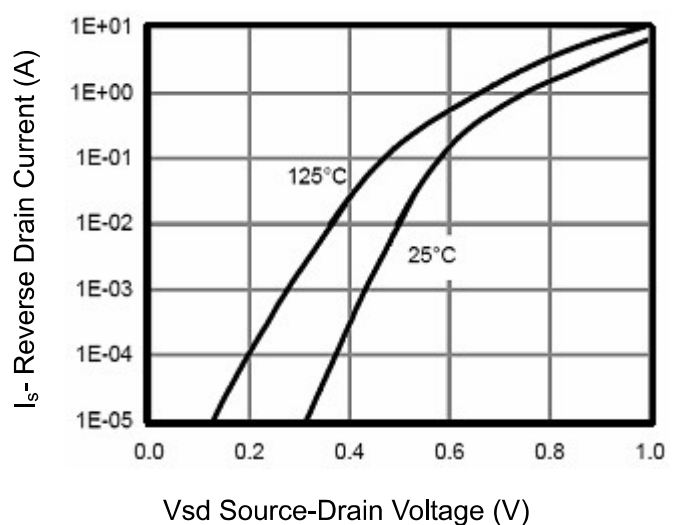
**Figure 9 Rdson vs Vgs**



**Figure 10 Capacitance vs Vds**



**Figure 11 Gate Charge**



**Figure 12 Source- Drain Diode Forward**

# AP4580

## Full-bridge of MOSFET

P-Channel Electrical Characteristics ( $T_A = 25^\circ\text{C}$ unless otherwise noted)						
Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = -250\mu A$	-20			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -20V, V_{GS} = 0V$			-1	$\mu A$
$I_{GSS}$	Gate-Body Leakage Current	$V_{GS} = \pm 10V, V_{DS} = 0V$			$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\mu A$	-0.45	0.7	-1.0	V
$R_{DS(ON)}$	Drain-Source On-State Resistance	$V_{GS} = -2.5V, I_D = -1.0A$		190	220	m $\Omega$
		$V_{GS} = -4.5V, I_D = -1.8A$		128	146	m $\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = -5V, I_D = -1.0A$		15		S
<b>Drain-Source Diode Characteristics</b>						
$V_{SD}$	Diode Forward Voltage	$V_{GS} = 0V, I_S = -1.0A$			-1.2	V
$I_S$	Maximum Body-Diode Continuous Current				-1.8	A
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = -10V, V_{GS} = 0V$ $f = 1.0MHz$		290		pF
$C_{oss}$	Output Capacitance			100		pF
$C_{riss}$	Reverse Transfer Capacitance			34		pF
<b>Switching Characteristics</b>						
$Q_g$	Total Gate Charge	$V_{DS} = -10V, I_D = -1.8A$ $V_{GS} = -6V$		3.0		nC
$Q_{gs}$	Gate-Source Charge			0.5		nC
$Q_{gd}$	Gate-Drain Charge			0.8		nC
$t_{D(ON)}$	Turn-On Delay Time	$V_{DD} = -10V, I_D = -1A$ $V_{GS} = -6V$ $R_{GEN} = 6\text{ ohm}$		9.5		ns
$t_r$	Turn-On Rise Time			4.9		ns
$t_{D(OFF)}$	Turn-Off Delay Time			21.5		ns
$t_f$	Turn-Off Fall Time			10		ns

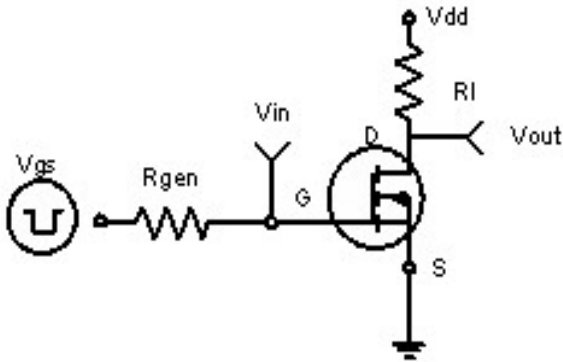
### Notes:

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3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
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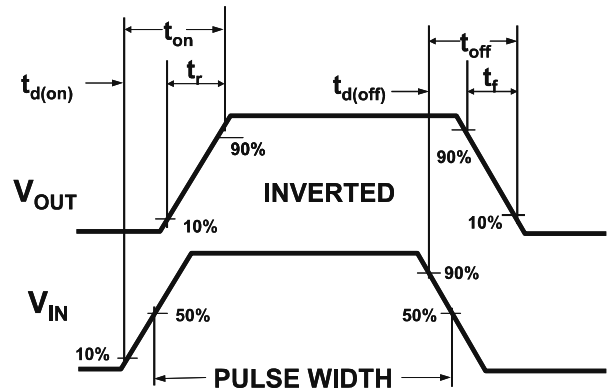
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**Full-bridge of MOSFET**

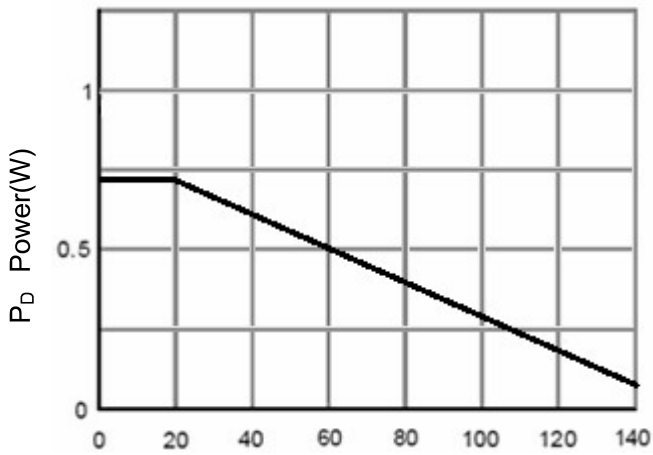
**Typical Electrical and Thermal Characteristics**



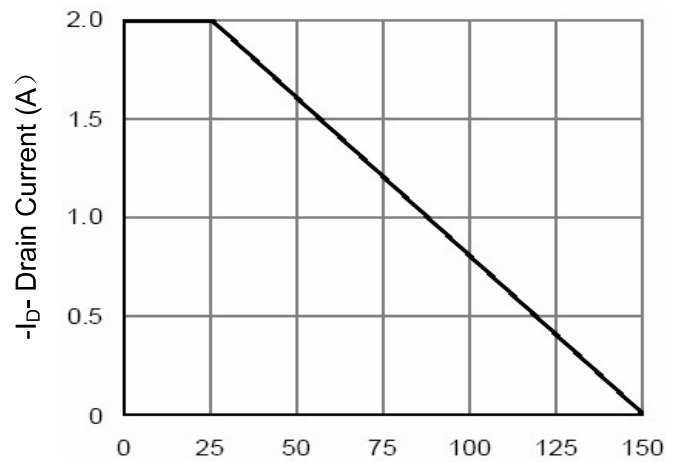
**Figure 1: Switching Test Circuit**



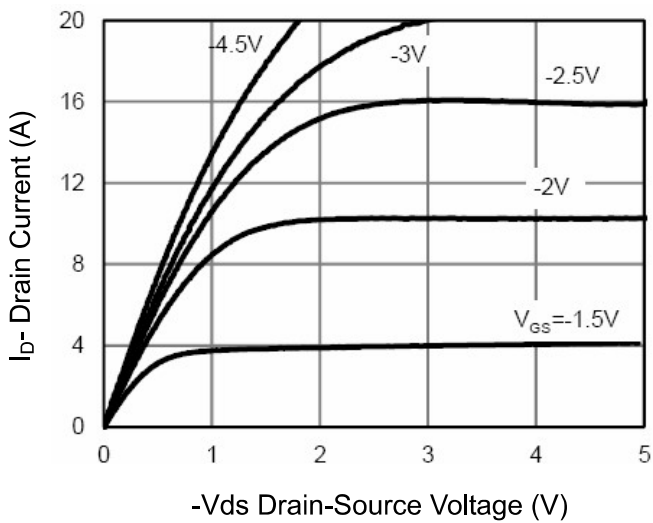
**Figure 2: Switching Waveforms**



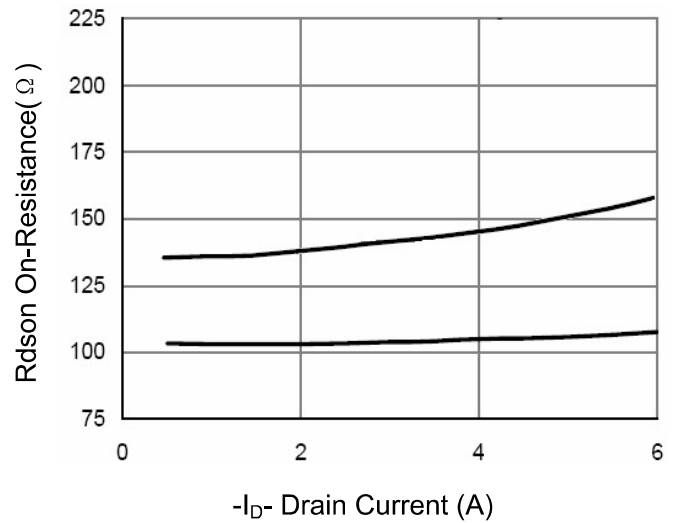
**Figure 3 Power Dissipation**



**Figure 4 Drain Current**



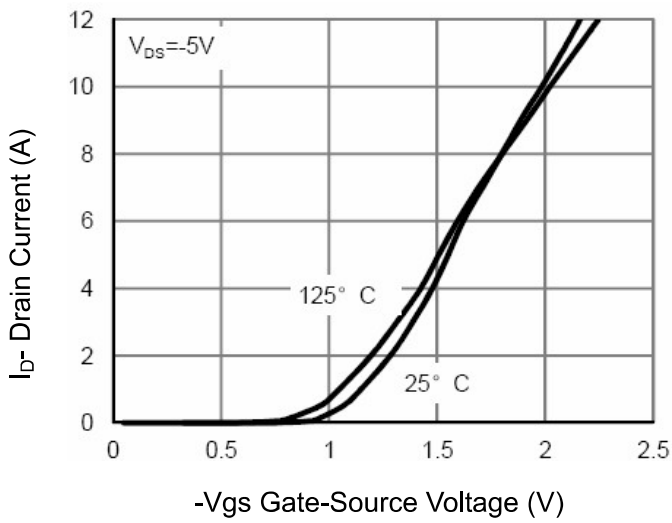
**Figure 5 Output Characteristics**



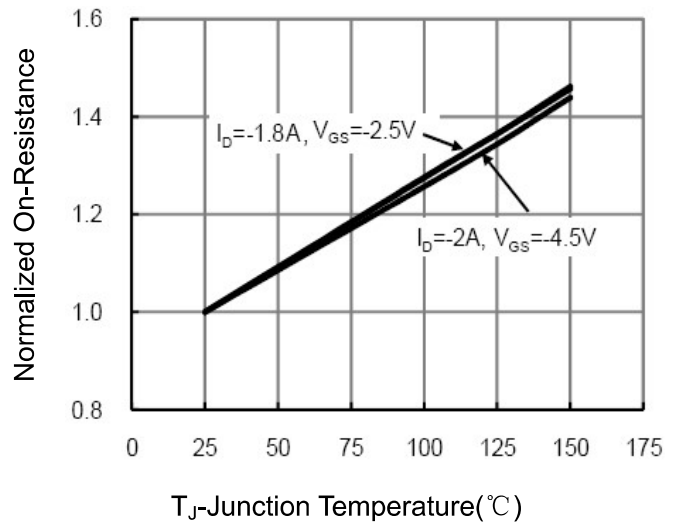
**Figure 6 Drain-Source On-Resistance**

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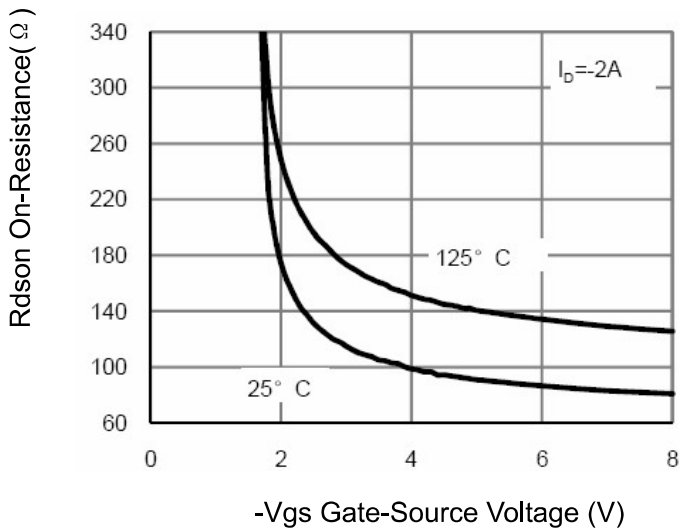
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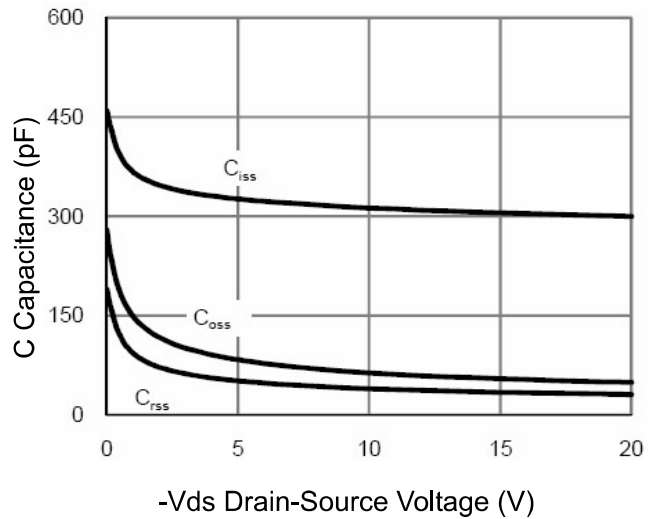
**Figure 7 Transfer Characteristics**



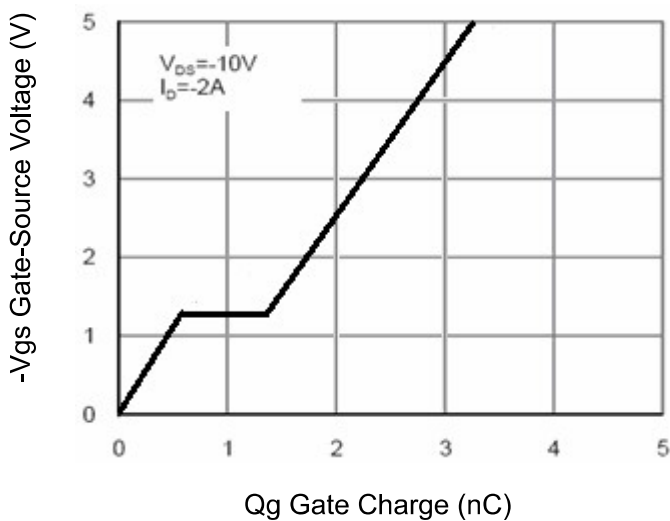
**Figure 8 Drain-Source On-Resistance**



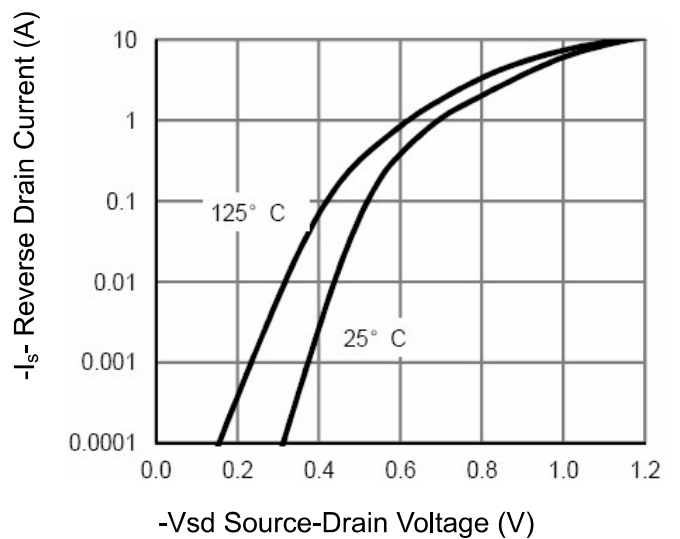
**Figure 9  $R_{DS(on)}$  vs  $V_{GS}$**



**Figure 10 Capacitance vs  $V_{DS}$**



**Figure 11 Gate Charge**



**Figure 12 Source- Drain Diode Forward**

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**Full-bridge of MOSFET**

**SOT23-8L Package Outline**

