

**N and P-Channel Enhancement Mode Power MOSFET**

**Description**

The HM4615 uses advanced trench technology to provide excellent  $R_{DS(ON)}$  and low gate charge . The SOP-8 package is universally preferred for all commercial industrial surface mount applications and suited for low voltage applications such as DC/DC converters.

**General Features**

● **N-Channel**

$V_{DS} = 100V, I_D = 6.5A$

$R_{DS(ON)} < 37m\Omega @ V_{GS}=10V$  (Typ:33m $\Omega$ )

● **P-Channel**

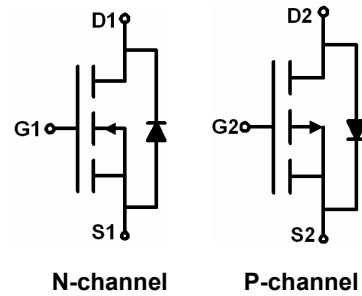
$V_{DS} = 100V, I_D = -4.5A$

$R_{DS(ON)} < 100m\Omega @ V_{GS}=-10V$  (Typ:85m $\Omega$ )

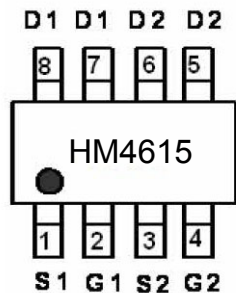
- High power and current handing capability
- Lead free product is acquired
- Surface mount package

**Application**

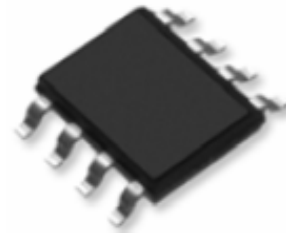
- Battery protection
- Load switch
- Power management



Schematic diagram



Marking and pin assignment



SOP-8 top view

**Package Marking and Ordering Information**

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
HM4615	HM4615	SOP-8	Ø330mm	12mm	2500 units

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

Parameter		Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage		$V_{DS}$	100	-100	V
Gate-Source Voltage		$V_{GS}$	$\pm 20$	$\pm 20$	V
Continuous Drain Current	$T_A=25^{\circ}C$	$I_D$	6.5	-4.5	A
	$T_A=70^{\circ}C$		4.6	-3.0	
Pulsed Drain Current (Note 1)		$I_{DM}$	26	-18	A
Maximum Power Dissipation	$T_A=25^{\circ}C$	$P_D$	3	3	W
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	50	°C/W
		P-Ch	50	

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	100	110	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=100V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2	3.3	4	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=6.5A$	-	33	37	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=6.5A$	20	-	-	S
<b>Dynamic Characteristics</b> (Note4)						
Input Capacitance	$C_{iss}$	$V_{DS}=50V, V_{GS}=0V,$ $F=1.0MHz$	-	2000	-	PF
Output Capacitance	$C_{oss}$		-	300	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	250	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=50V, I_D=6.5A, R_L=5\Omega,$ $R_G=1\Omega, V_{GS}=10V$	-	12	-	nS
Turn-on Rise Time	$t_r$		-	10	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	19	-	nS
Turn-Off Fall Time	$t_f$		-	8	-	nS
Total Gate Charge	$Q_g$	$I_D=6.5A, V_{DD}=50V, V_{GS}=10V$	-	42	-	nC
Gate-Source Charge	$Q_{gs}$		-	9	-	nC
Gate-Drain Charge	$Q_{gd}$		-	10	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=6.5A$	-	0.85	1.2	V
Diode Forward Current (Note 2)	$I_S$		-	-	6.5	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^\circ\text{C}, I_F = 6.5A$ $di/dt = 100A/\mu s$ (Note3)	-	30		nS
Reverse Recovery Charge	$Q_{rr}$		-	44		nC

**P-CH Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =-250μA	-100	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =-100V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±20	μA
<b>On Characteristics (Note 3)</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA	-1	-1.9	-3	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-4.5A	-	85	100	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =-50V, I <sub>D</sub> =-4.5A	5	-	-	S
<b>Dynamic Characteristics (Note4)</b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =-25V, V <sub>GS</sub> =0V, F=1.0MHz	-	2100	-	PF
Output Capacitance	C <sub>oss</sub>		-	590	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	140	-	PF
<b>Switching Characteristics (Note 4)</b>						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =-50V, I <sub>D</sub> =-4.5A V <sub>GS</sub> =-10V, R <sub>GEN</sub> =9.1Ω	-	16	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	73	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	34	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	57	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =-80V, I <sub>D</sub> =-4.5A, V <sub>GS</sub> =-10V	-	61	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	14	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	29	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =-4.5A	-	-	-1.2	V
Diode Forward Current (Note 2)	I <sub>S</sub>	-	-	-	-4.5	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> = -4.5A di/dt = 100A/μs(Note3)	-	88.3	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	65.9	-	nC
Forward Turn-On Time	t <sub>on</sub>	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

**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

N- Channel Typical Electrical and Thermal Characteristics (Curves)

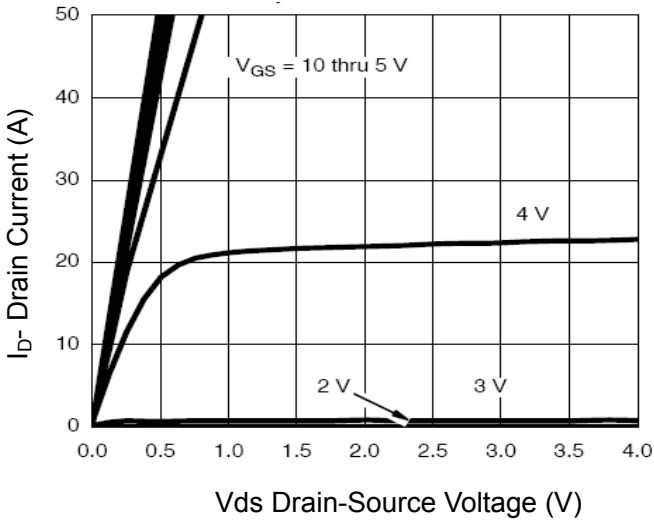


Figure 1 Output Characteristics

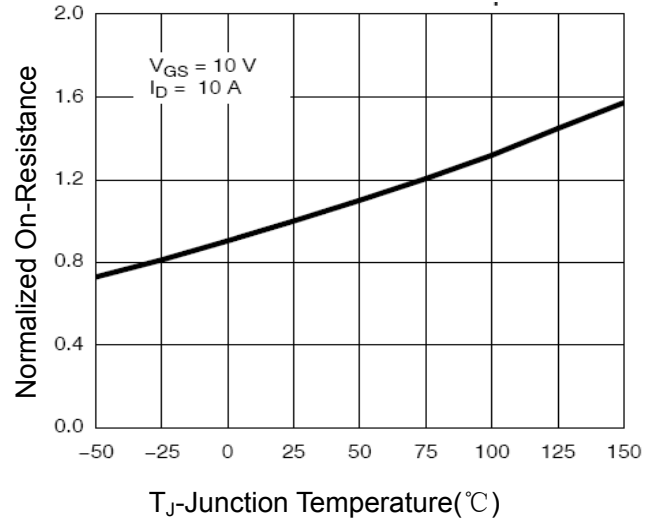


Figure 4 Rdson- Junction Temperature

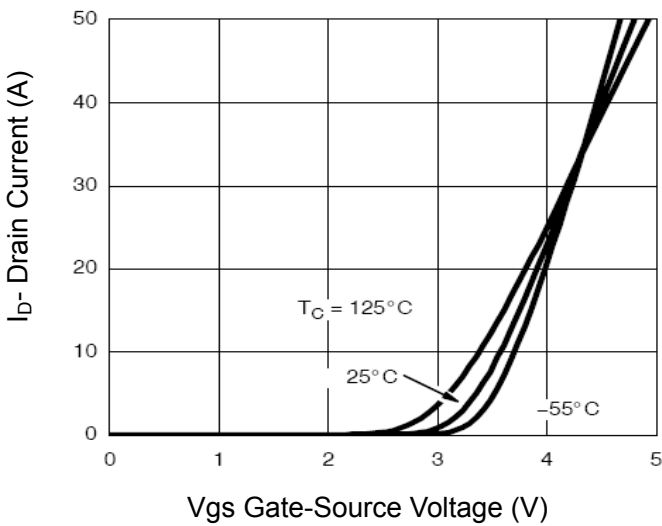


Figure 2 Transfer Characteristics

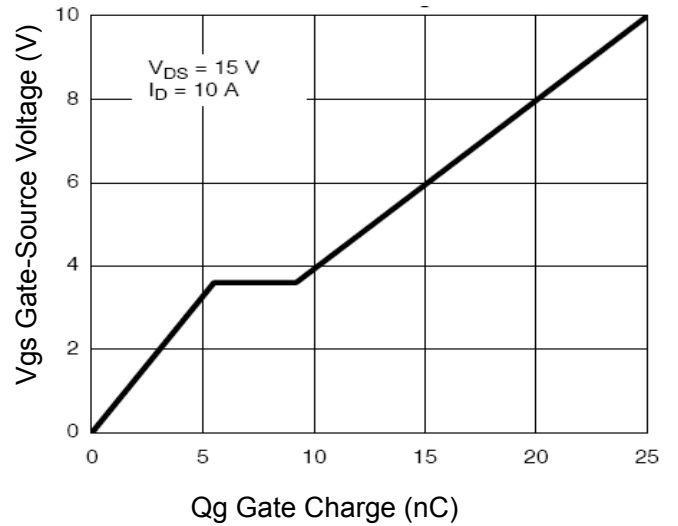


Figure 5 Gate Charge

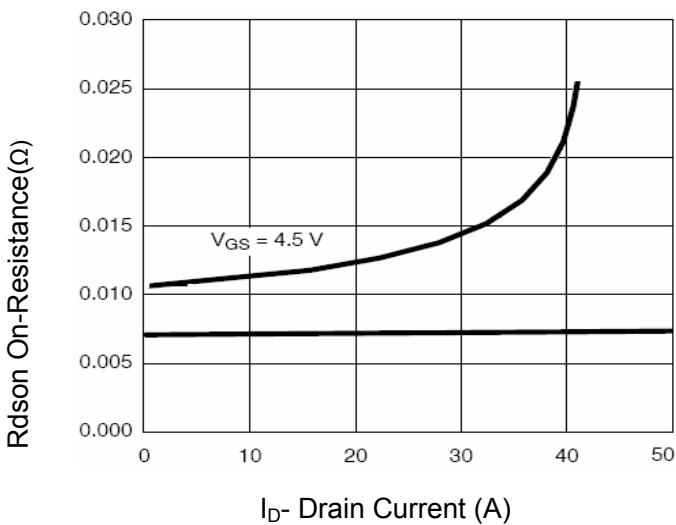


Figure 3 Rdson- Drain Current

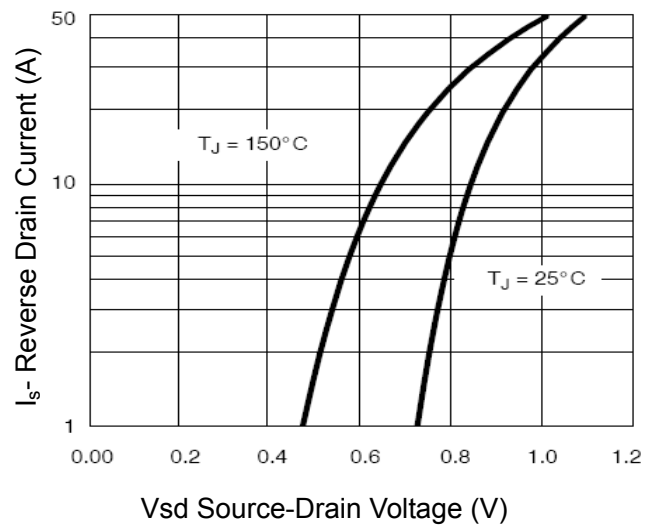
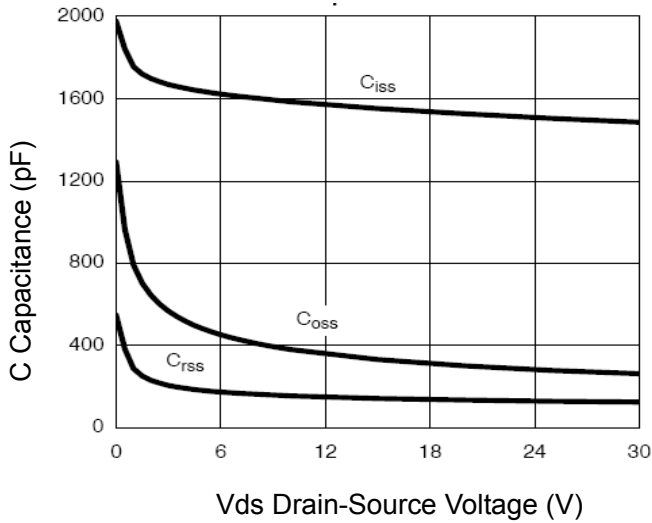
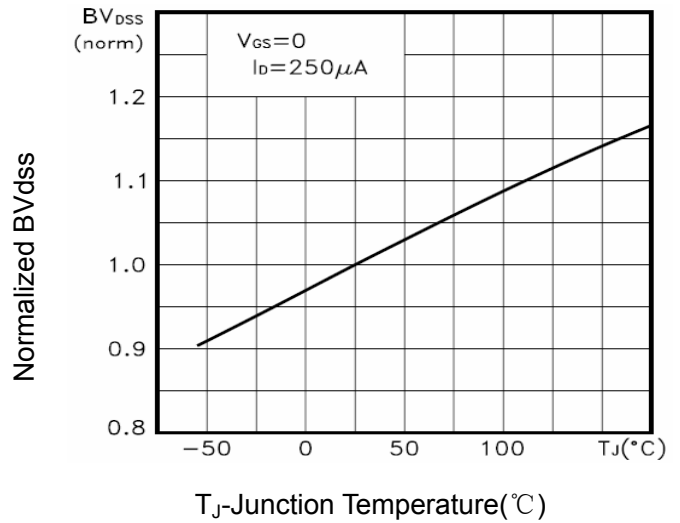


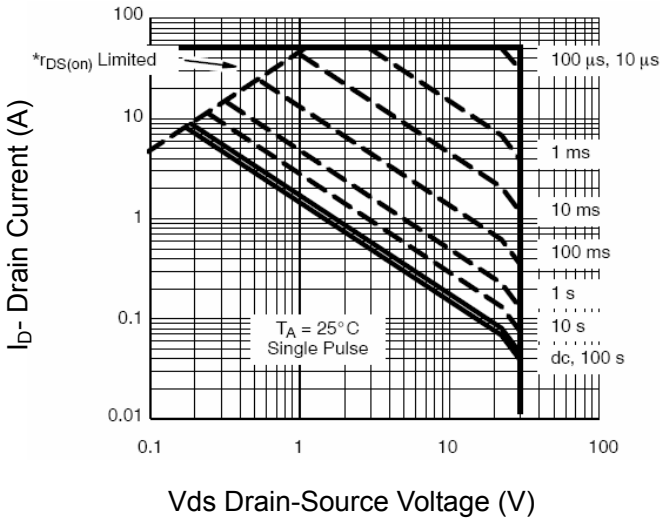
Figure 6 Source- Drain Diode Forward



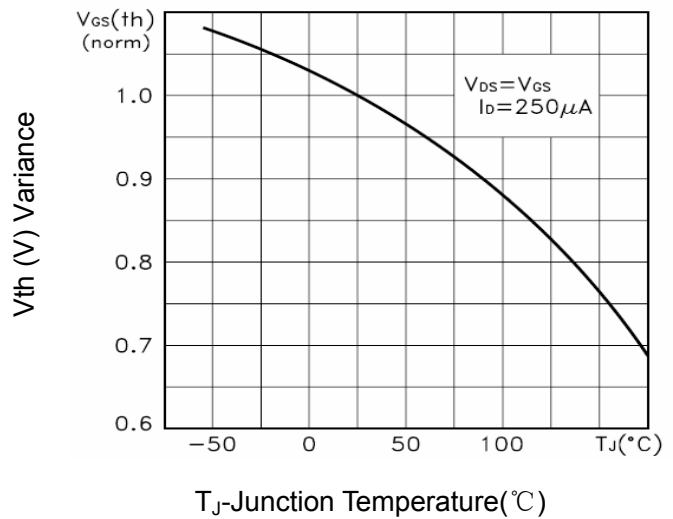
Vds Drain-Source Voltage (V)  
**Figure 7 Capacitance vs Vds**



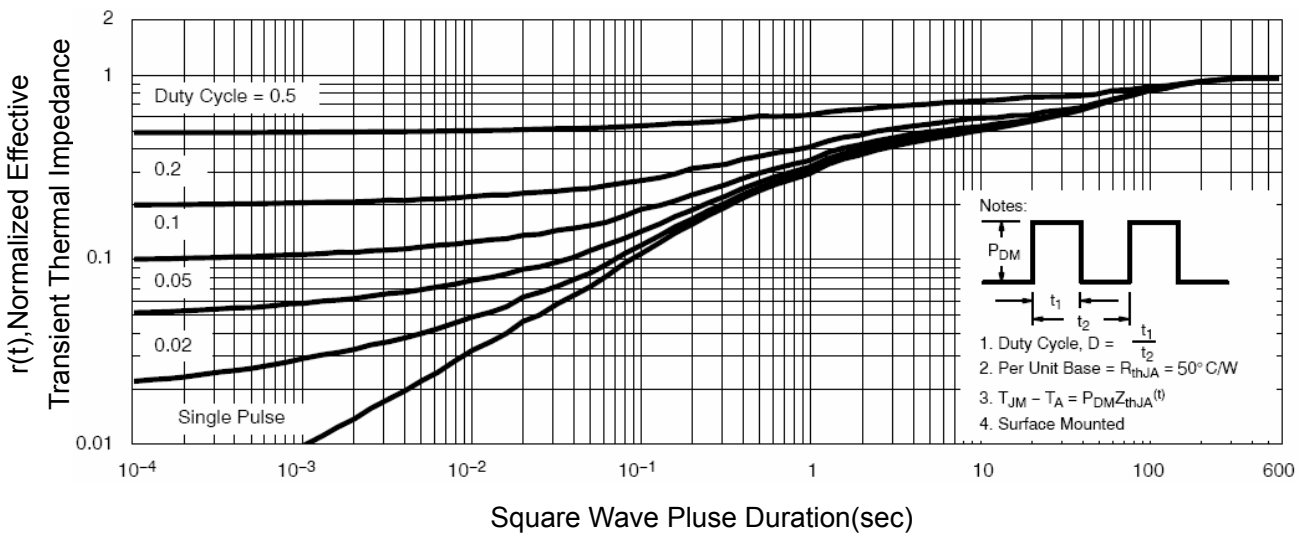
T<sub>J</sub>-Junction Temperature(°C)  
**Figure 9 BV<sub>DSS</sub> vs Junction Temperature**



Vds Drain-Source Voltage (V)  
**Figure 8 Safe Operation Area**



T<sub>J</sub>-Junction Temperature(°C)  
**Figure 10 V<sub>GS(th)</sub> vs Junction Temperature**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

P-Channel Typical Electrical and Thermal Characteristics

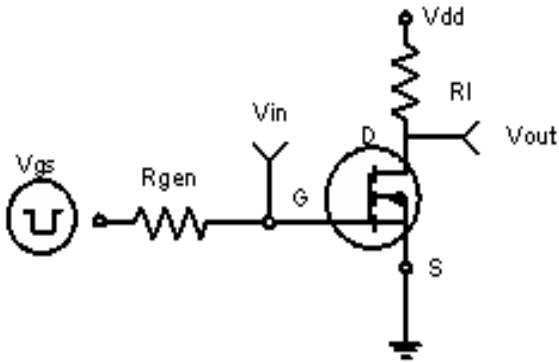


Figure 1: Switching Test Circuit

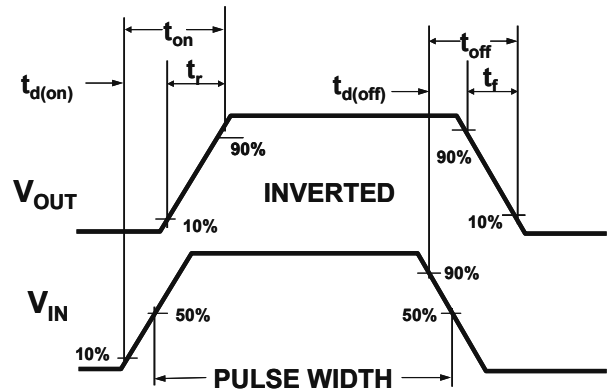


Figure 2: Switching Waveforms

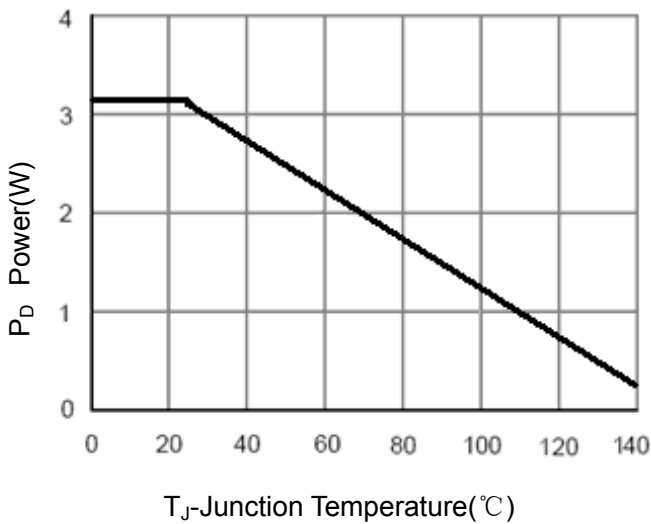


Figure 3 Power Dissipation

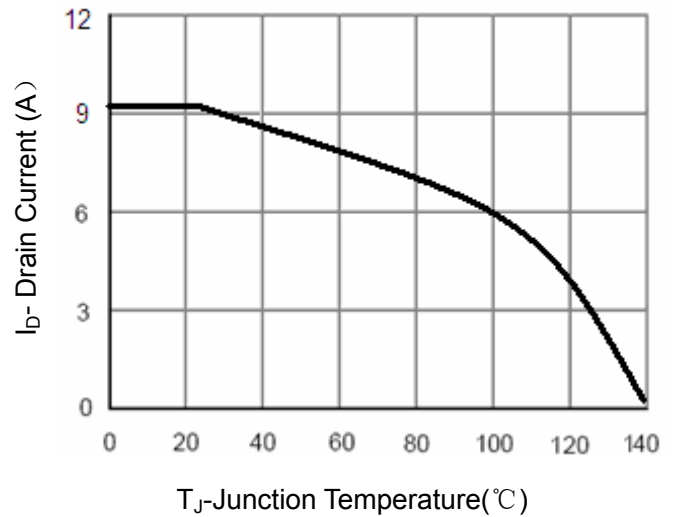


Figure 4 Drain Current

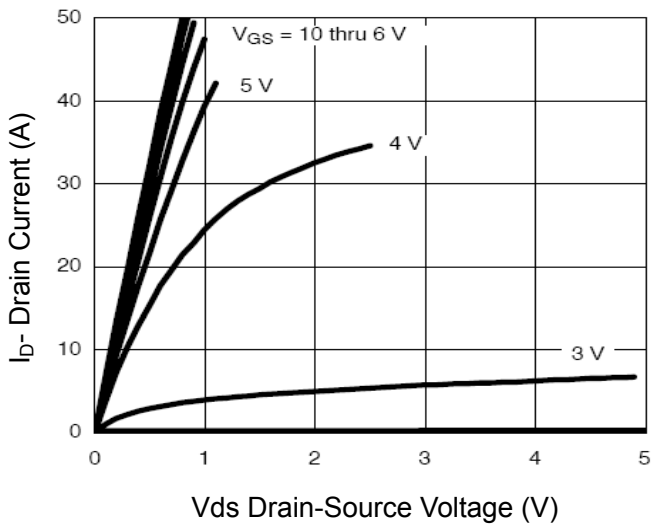


Figure 5 Output Characteristics

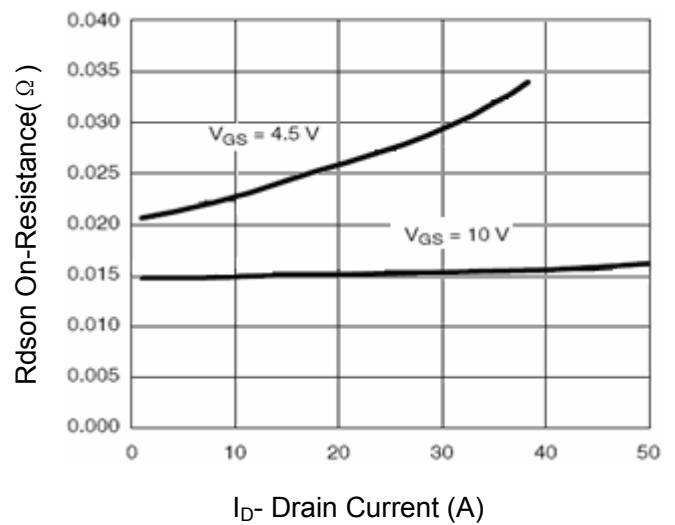
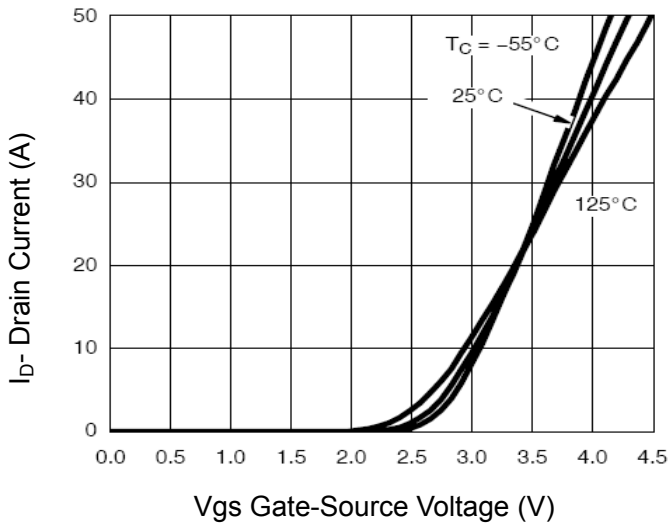
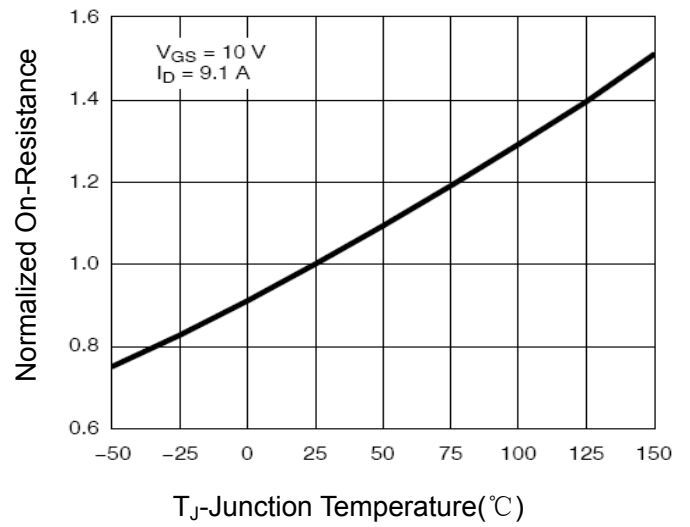


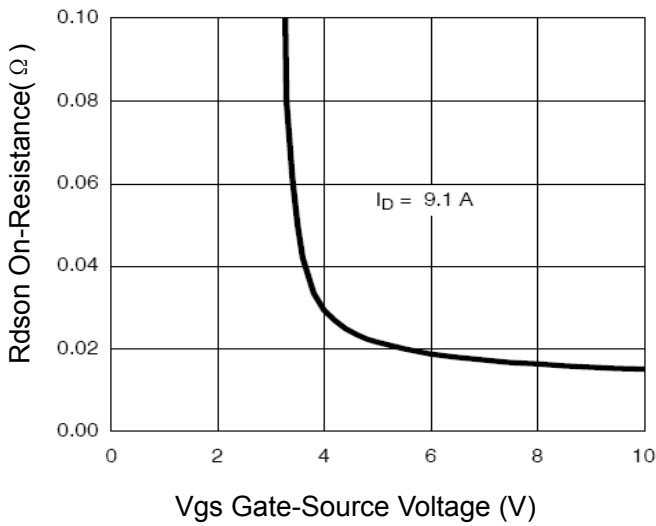
Figure 6 Drain-Source On-Resistance



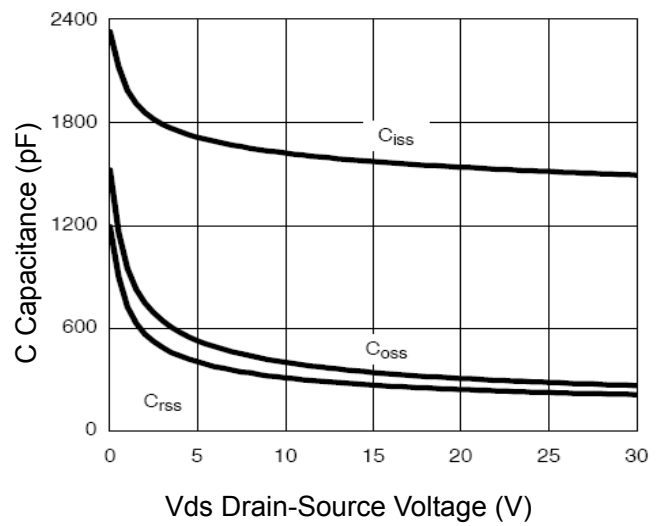
**Figure 7 Transfer Characteristics**



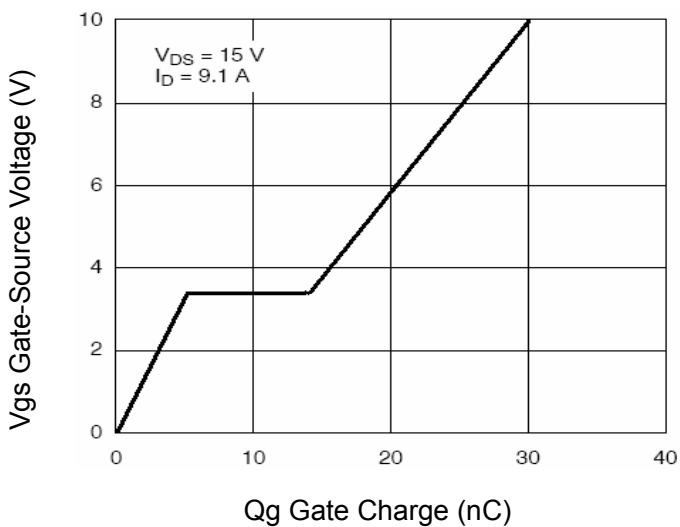
**Figure 8 Drain-Source On-Resistance**



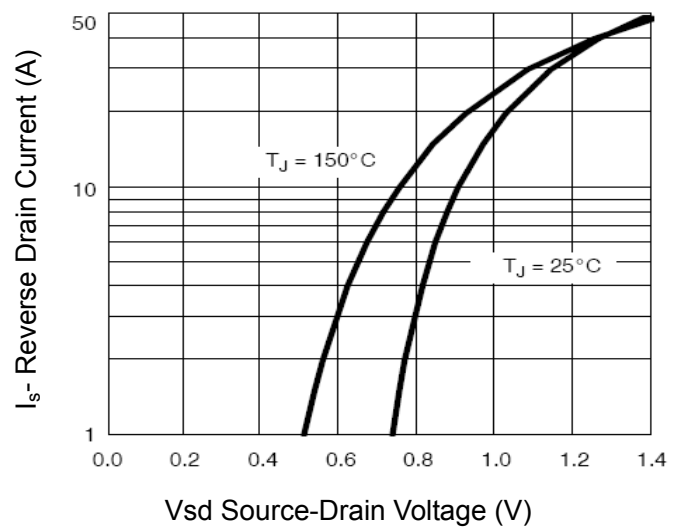
**Figure 9 Rdson vs Vgs**



**Figure 10 Capacitance vs Vds**



**Figure 11 Gate Charge**



**Figure 12 Source- Drain Diode Forward**

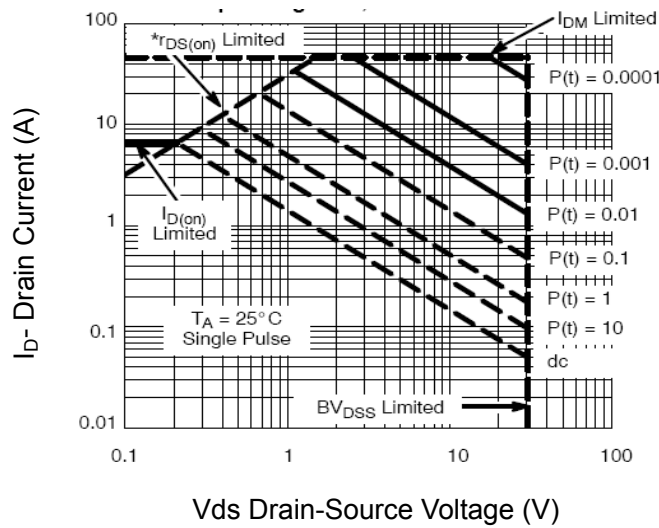


Figure 13 Safe Operation Area

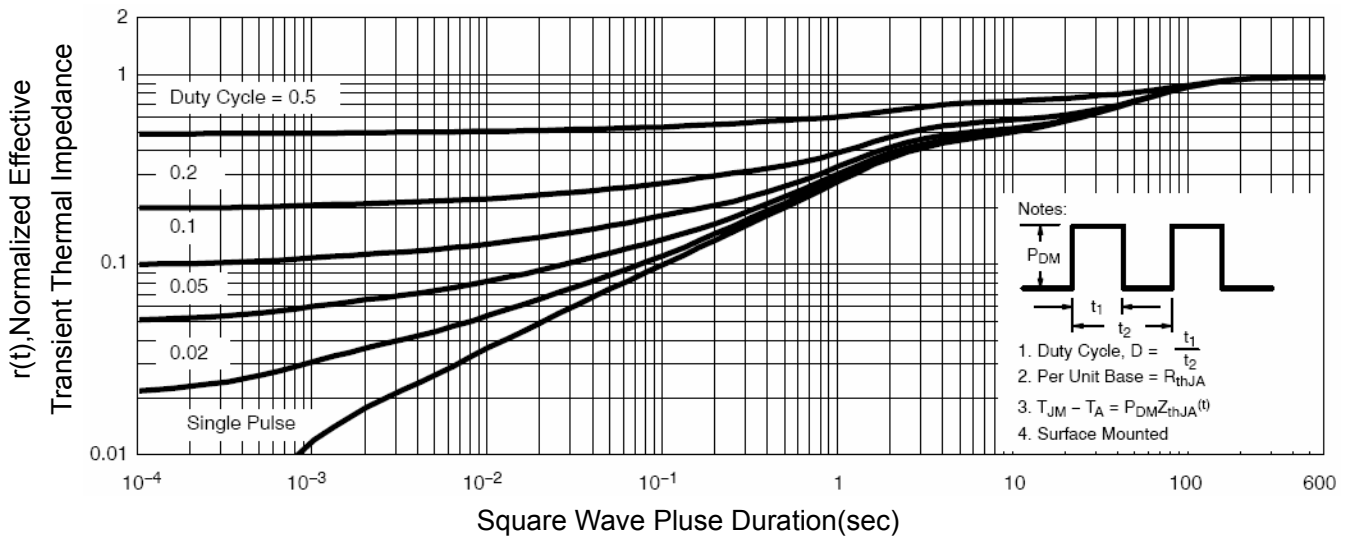
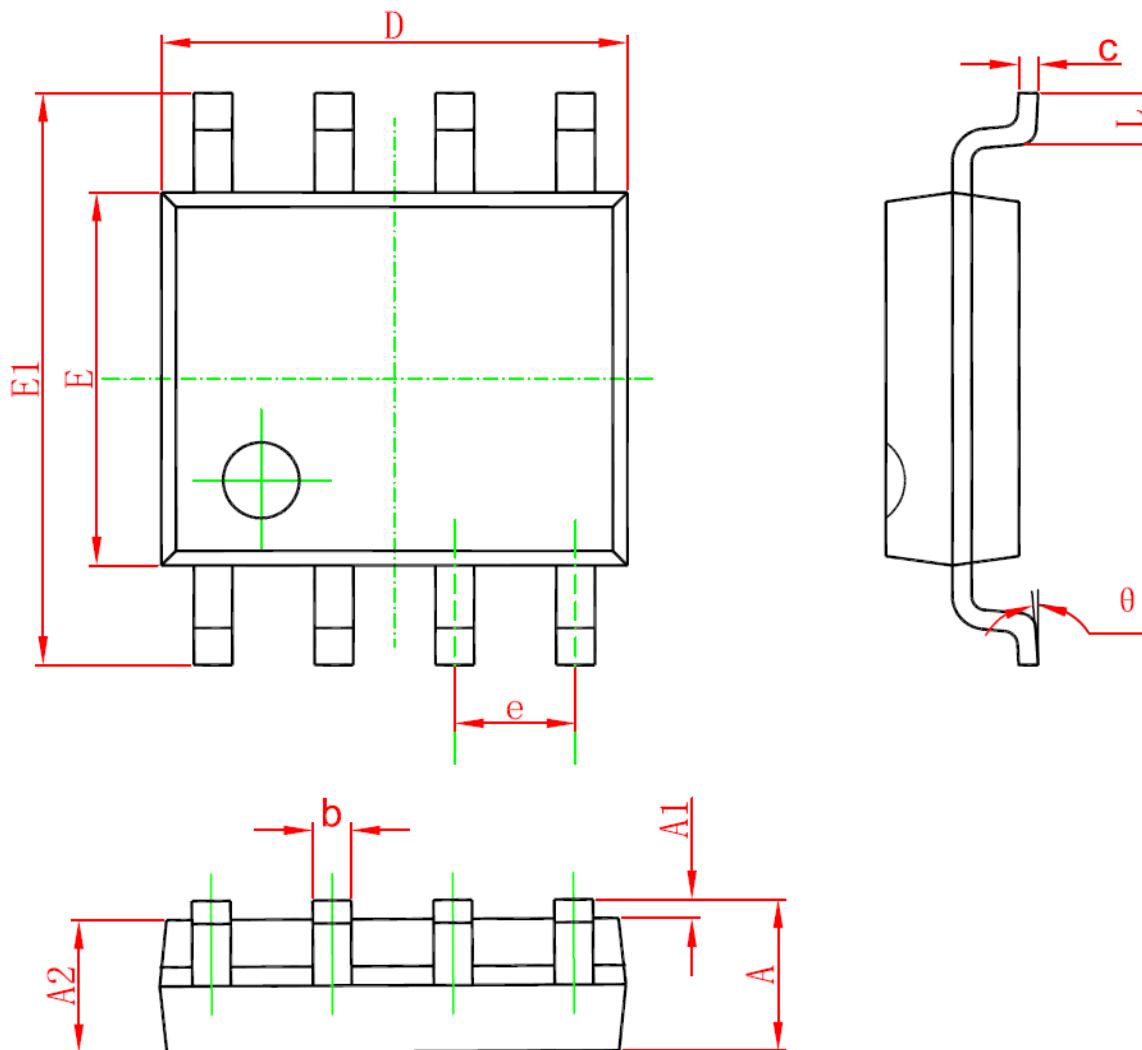


Figure 14 Normalized Maximum Transient Thermal Impedance



SOP-8 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

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