

## N and P-Channel Enhancement Mode Power MOSFET

### Description

The HM4615B 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

$V_{DS} = 100V, I_D = 4.0A$

$R_{DS(ON)} < 80m\Omega @ V_{GS}=10V$

#### ● P-Channel

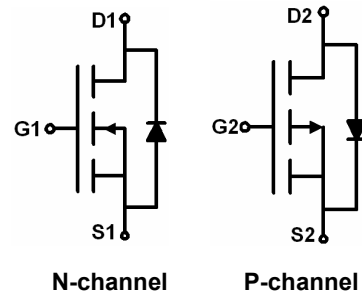
$V_{DS} = 100V, I_D = -3.5A$

$R_{DS(ON)} < 210m\Omega @ V_{GS}=-10V$

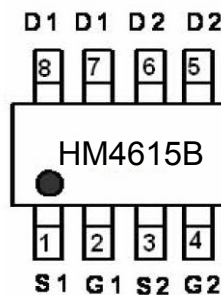
- High power and current handling capability
- Lead free product is acquired
- Surface mount package

### Application

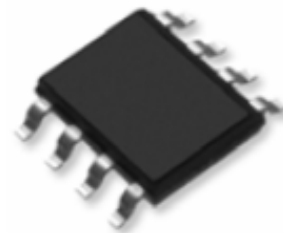
- Battery protection
- Load switch
- Power management



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
HM4615B	HM4615B	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	$I_D$	$T_A=25^\circ C$	4.0	-3.5	A
		$T_A=70^\circ C$	2.1	-2.45	
Pulsed Drain Current (Note 1)	$I_{DM}$	12	-10.5	A	
Maximum Power Dissipation	$P_D$	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	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.0		2.5	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=4.0A$	-		80	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=4.0A$	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	$t_{d(on)}$	$V_{DD}=50V, I_D=4.0A, R_L=5\Omega,$ $R_G=1\Omega, V_{GS}=10V$	-	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	$Q_g$	$I_D=4.0A, V_{DD}=50V, V_{GS}=10V$	-	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)	$V_{SD}$	$V_{GS}=0V, I_S=4.0A$	-	0.85	1.2	V
Diode Forward Current (Note 2)	$I_S$		-	-	6.5	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^\circ\text{C}, I_F = 4.0A$ $di/dt = 100A/\mu s$ (Note3)	-	30		nS
Reverse Recovery Charge	$Q_{rr}$		-	44		nC

**P-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	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=-100V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 20$	$\mu A$
<b>On Characteristics (Note 3)</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1.2		-2.5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=-10V, I_D=-3.5A$	-		210	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=-50V, I_D=-3.5A$	5	-	-	S
<b>Dynamic Characteristics (Note4)</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=-25V, V_{GS}=0V,$ $F=1.0MHz$	-	2100	-	PF
Output Capacitance	$C_{oss}$		-	590	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	140	-	PF
<b>Switching Characteristics (Note 4)</b>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=-50V, I_D=-3.5A$ $V_{GS}=-10V, R_{GEN}=9.1\Omega$	-	16	-	nS
Turn-on Rise Time	$t_r$		-	73	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	34	-	nS
Turn-Off Fall Time	$t_f$		-	57	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=-80V, I_D=-3.5A,$ $V_{GS}=-10V$	-	61	-	nC
Gate-Source Charge	$Q_{gs}$		-	14	-	nC
Gate-Drain Charge	$Q_{gd}$		-	29	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=-3.5A$	-	-	-1.2	V
Diode Forward Current (Note 2)	$I_S$	-	-	-	-3.5	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^{\circ}\text{C}, I_F = -3.5A$ $di/dt = 100A/\mu s(\text{Note3})$	-	88.3	-	nS
Reverse Recovery Charge	$Q_{rr}$		-	65.9	-	nC
Forward Turn-On Time	$t_{on}$	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,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production

N- Channel Typical Electrical and Thermal Characteristics (Curves)

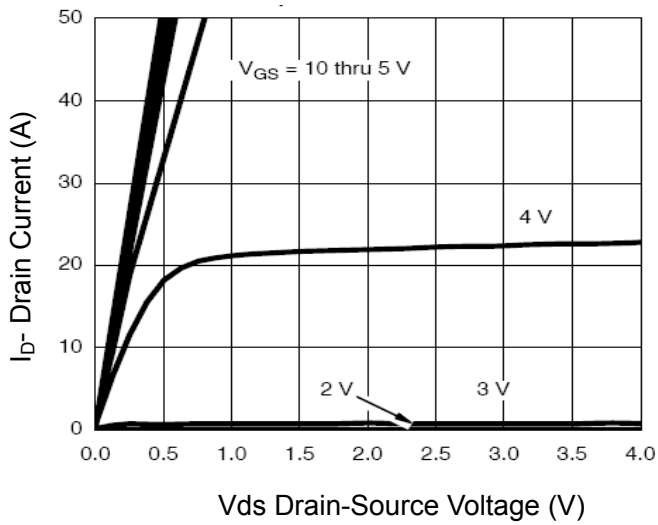


Figure 1 Output Characteristics

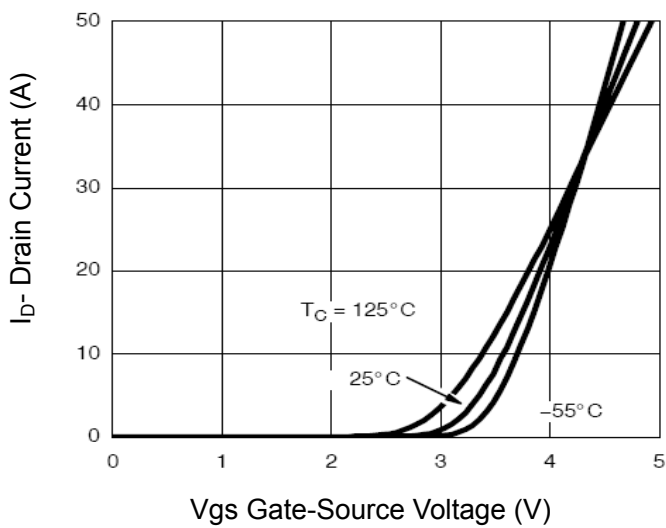


Figure 2 Transfer Characteristics

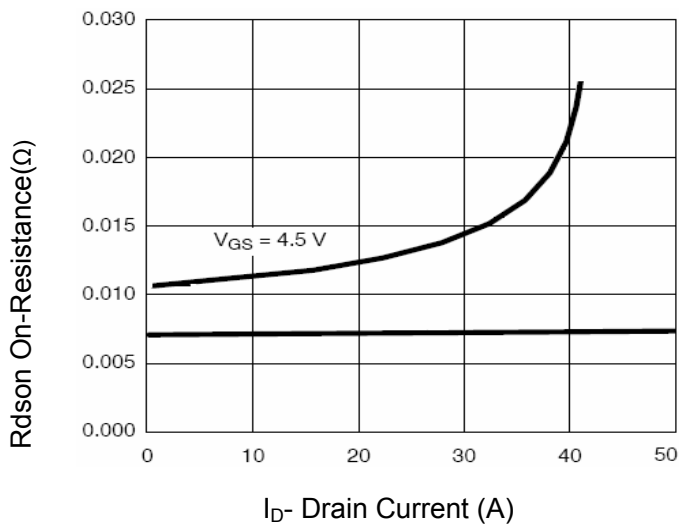


Figure 3 Rdson- Drain Current

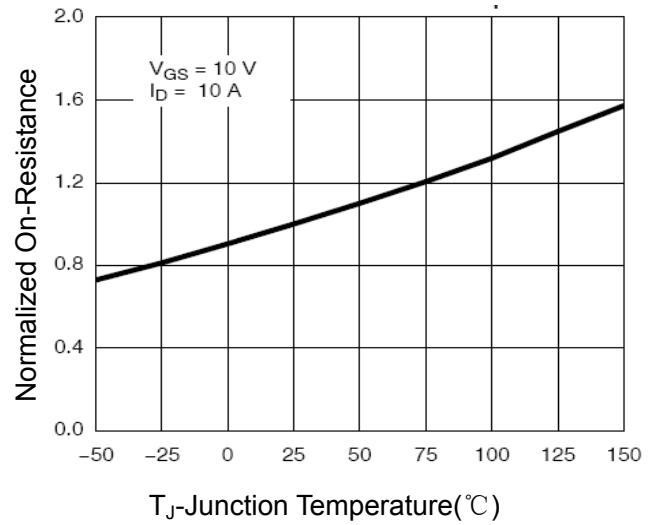


Figure 4 Rdson- Junction Temperature

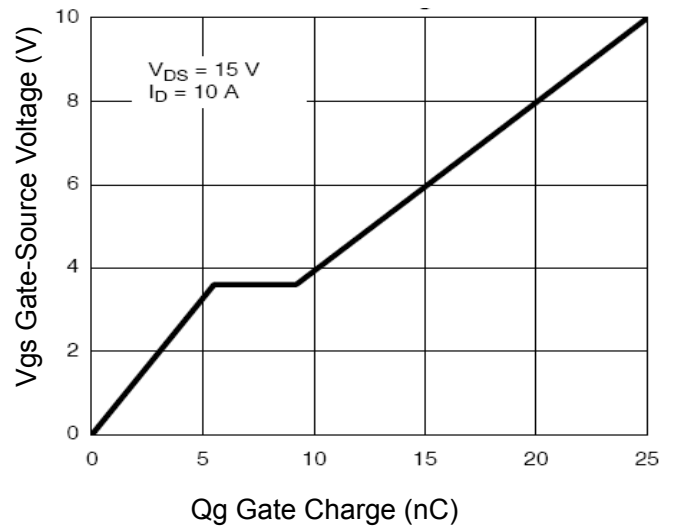


Figure 5 Gate Charge

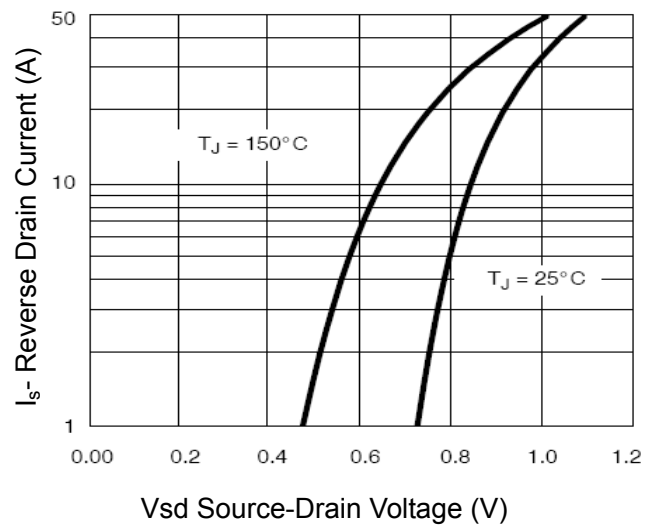


Figure 6 Source- Drain Diode Forward

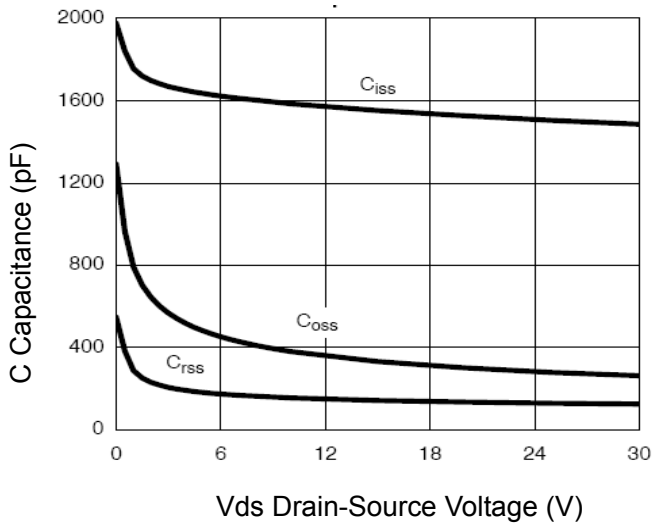


Figure 7 Capacitance vs Vds

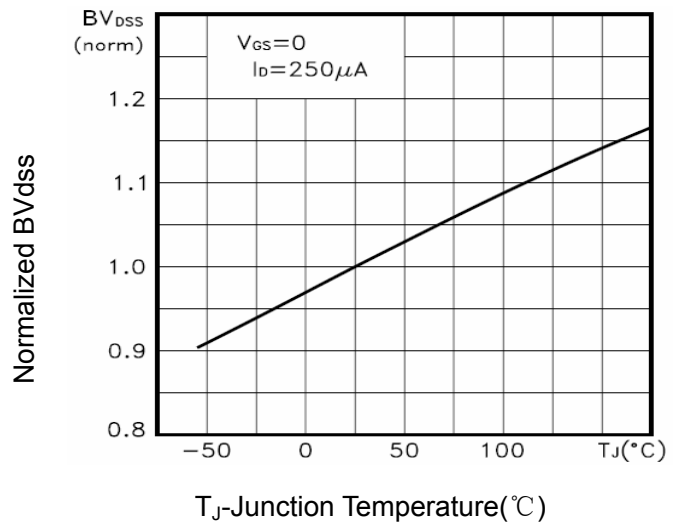


Figure 9  $BV_{DSS}$  vs Junction Temperature

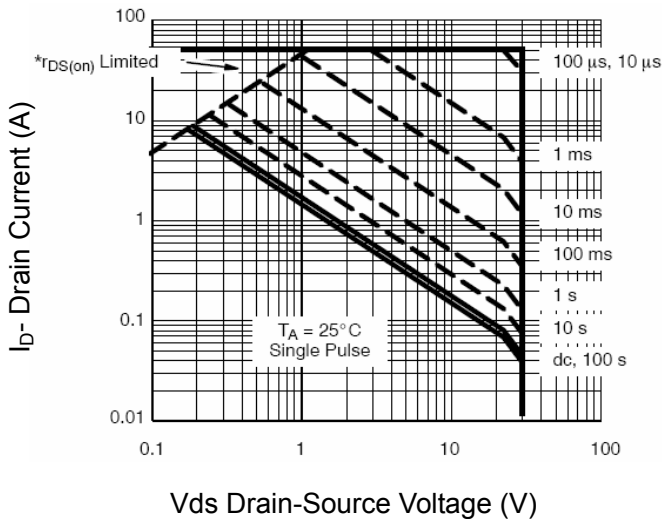


Figure 8 Safe Operation Area

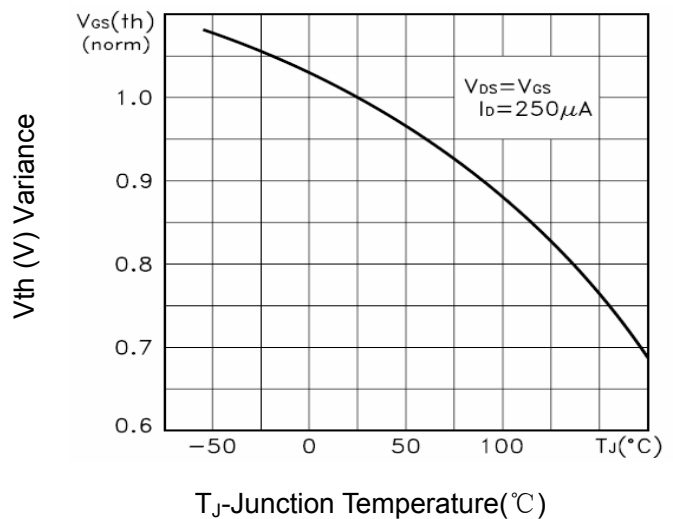


Figure 10  $V_{GS(th)}$  vs Junction Temperature

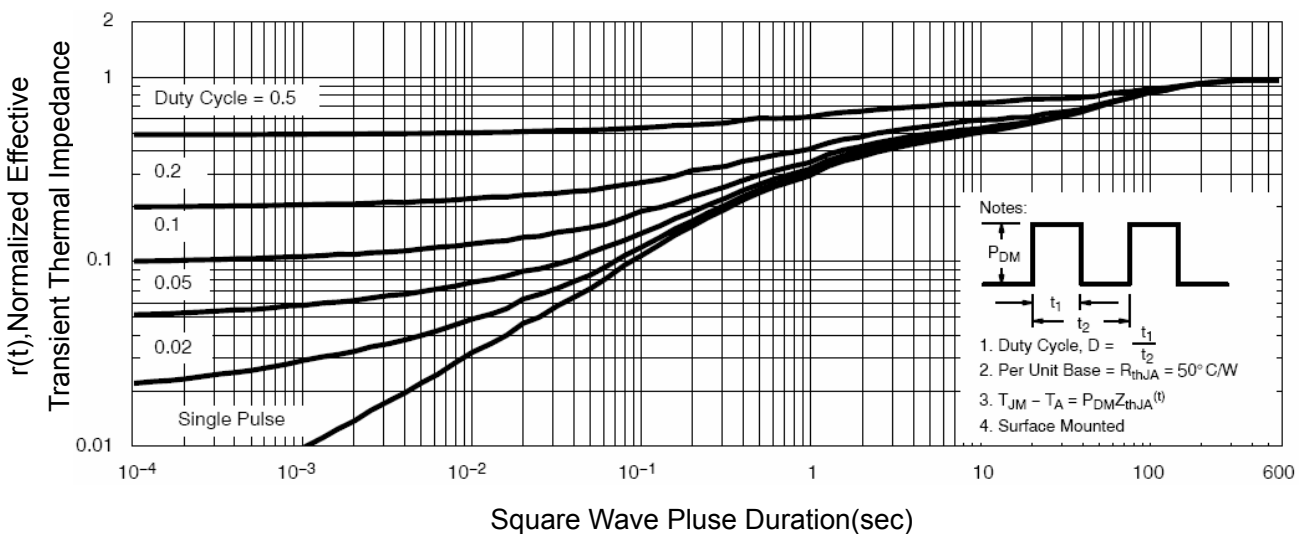


Figure 11 Normalized Maximum Transient Thermal Impedance

P-Channel Typical Electrical and Thermal Characteristics

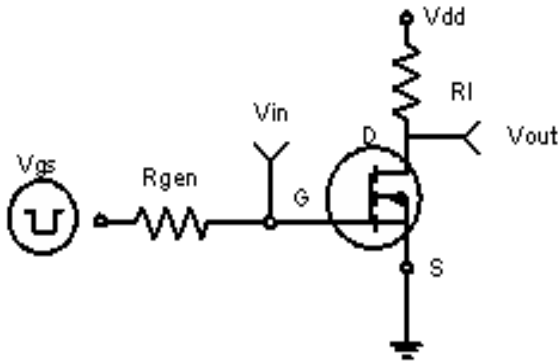


Figure 1: Switching Test Circuit

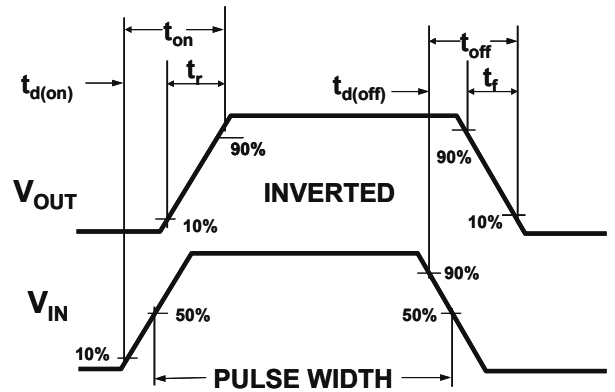


Figure 2: Switching Waveforms

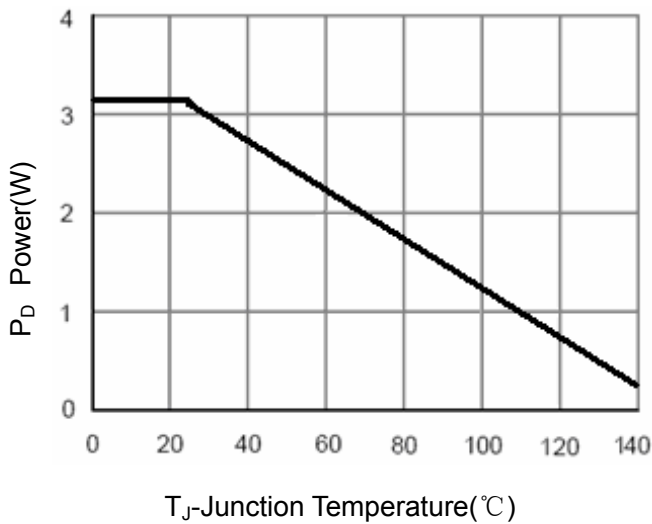


Figure 3 Power Dissipation

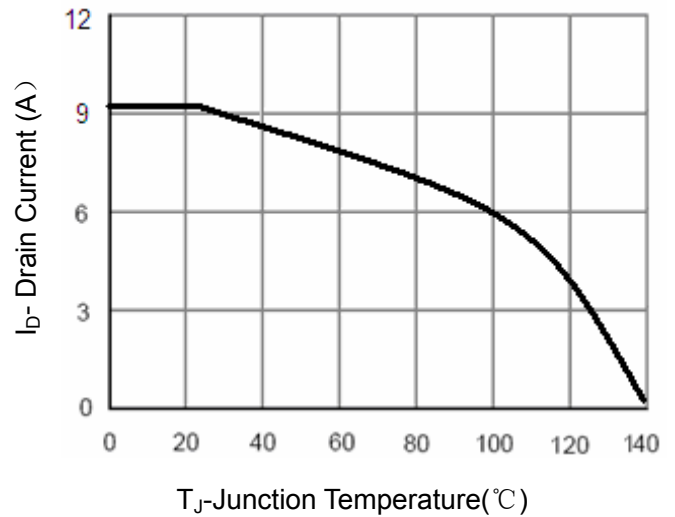


Figure 4 Drain Current

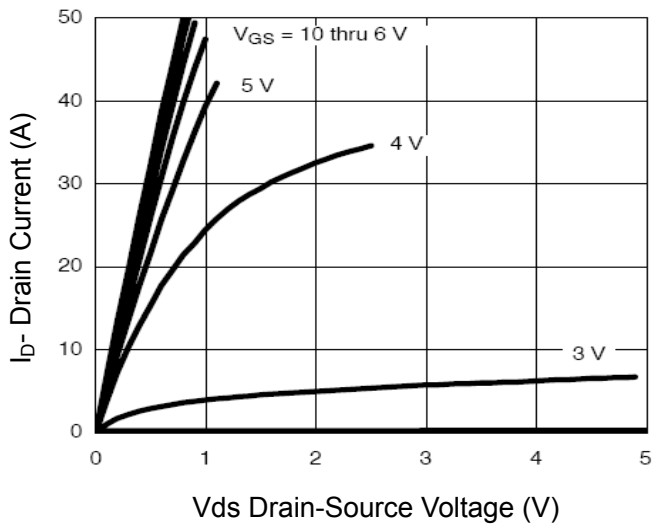


Figure 5 Output Characteristics

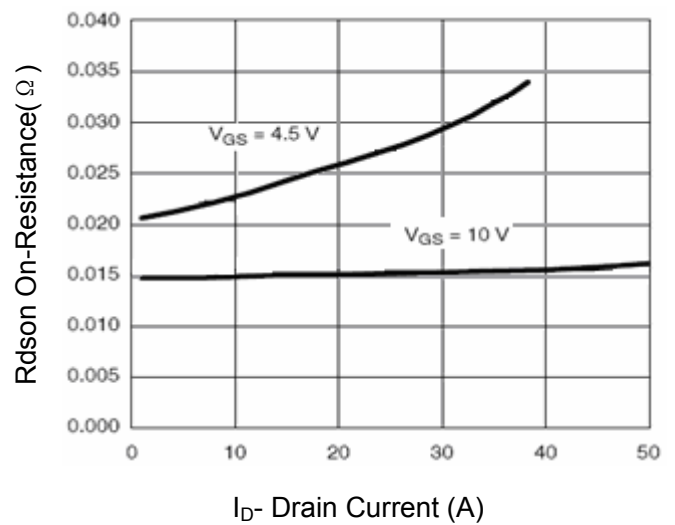


Figure 6 Drain-Source On-Resistance

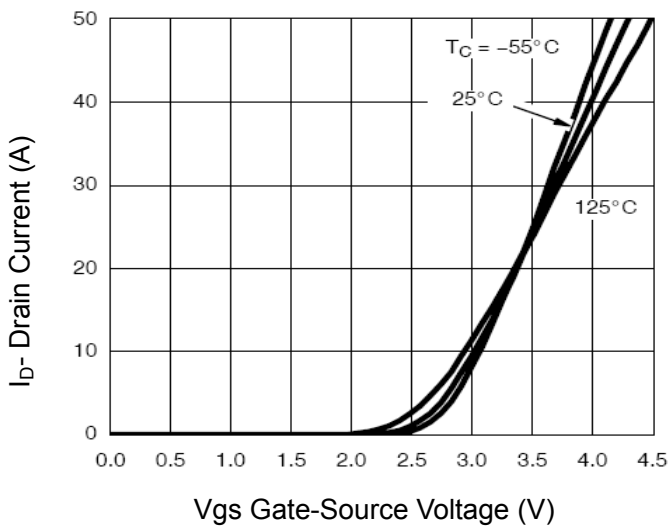


Figure 7 Transfer Characteristics

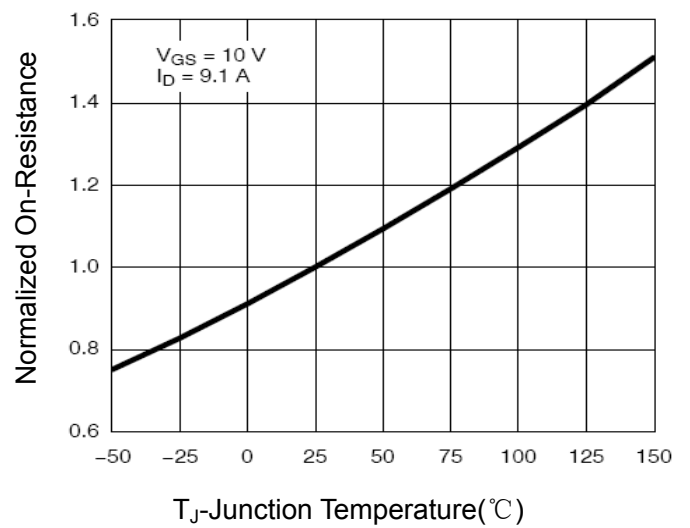


Figure 8 Drain-Source On-Resistance

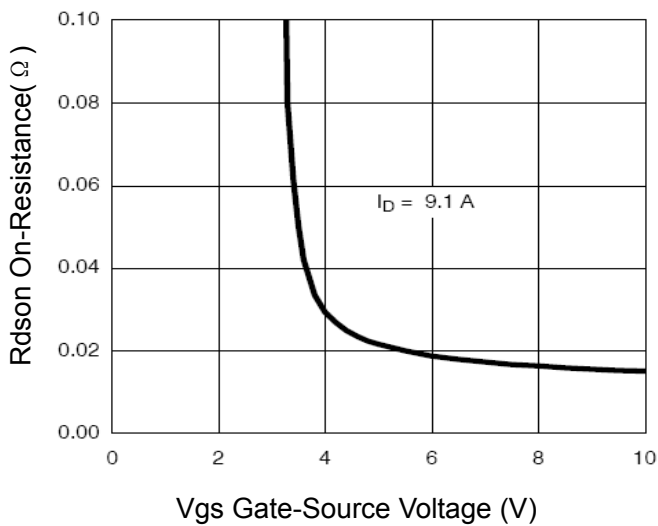


Figure 9  $R_{DS(on)}$  vs  $V_{GS}$

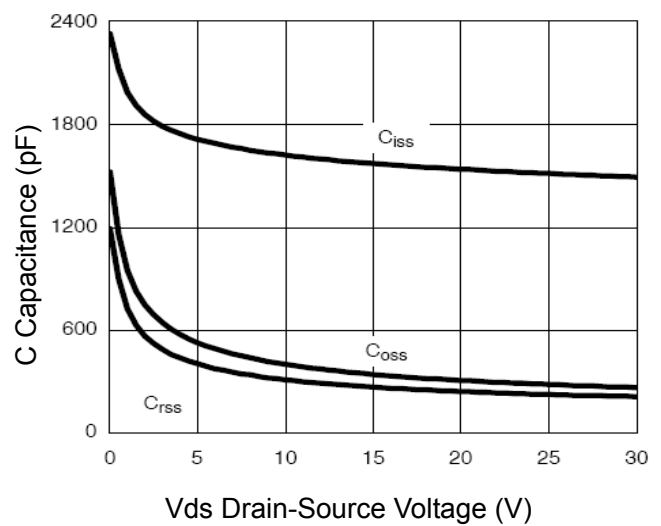


Figure 10 Capacitance vs  $V_{DS}$

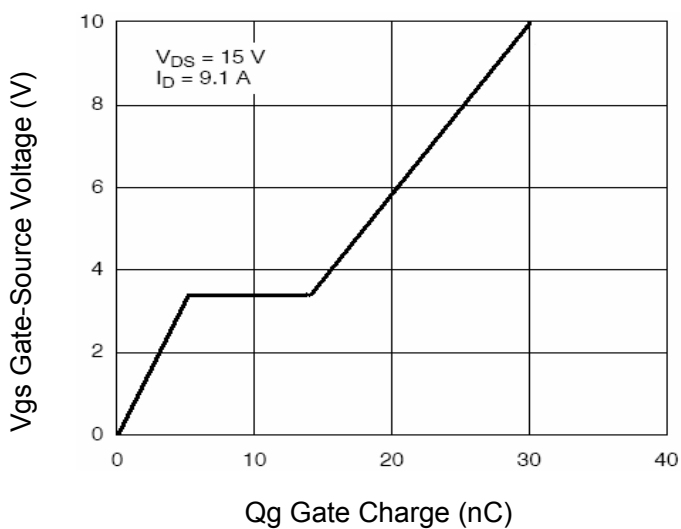


Figure 11 Gate Charge

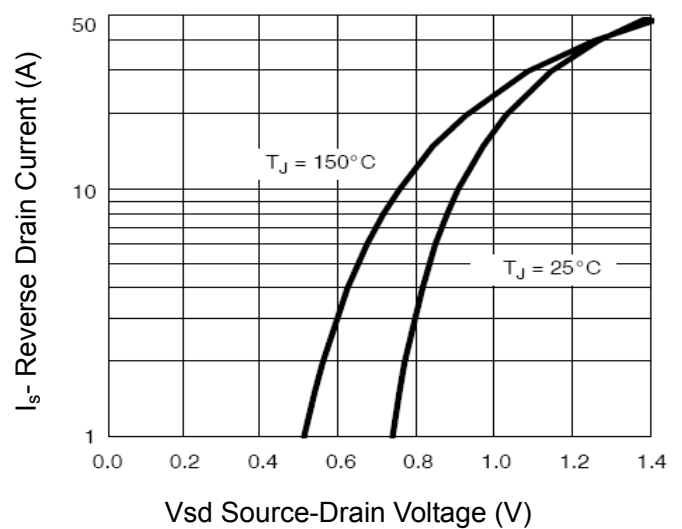


Figure 12 Source- Drain Diode Forward

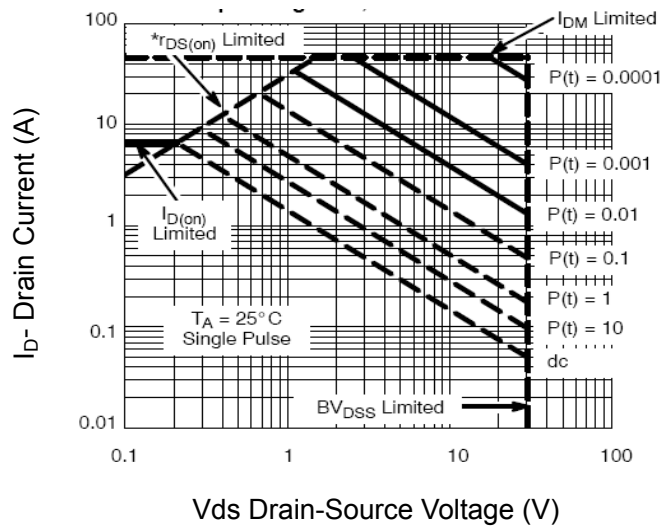


Figure 13 Safe Operation Area

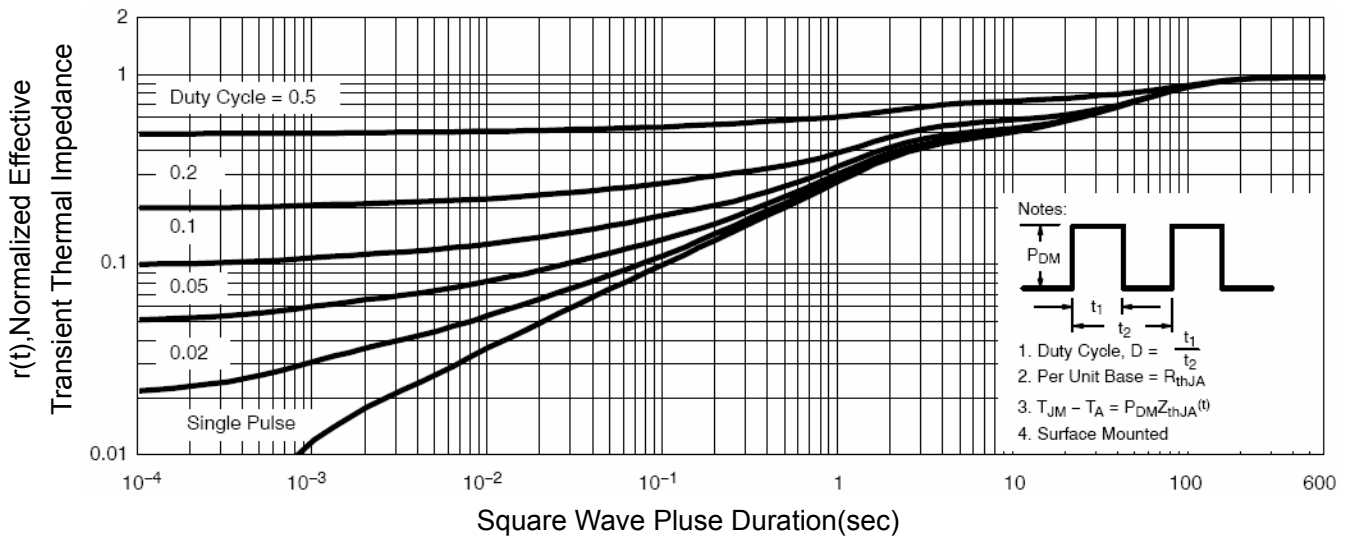
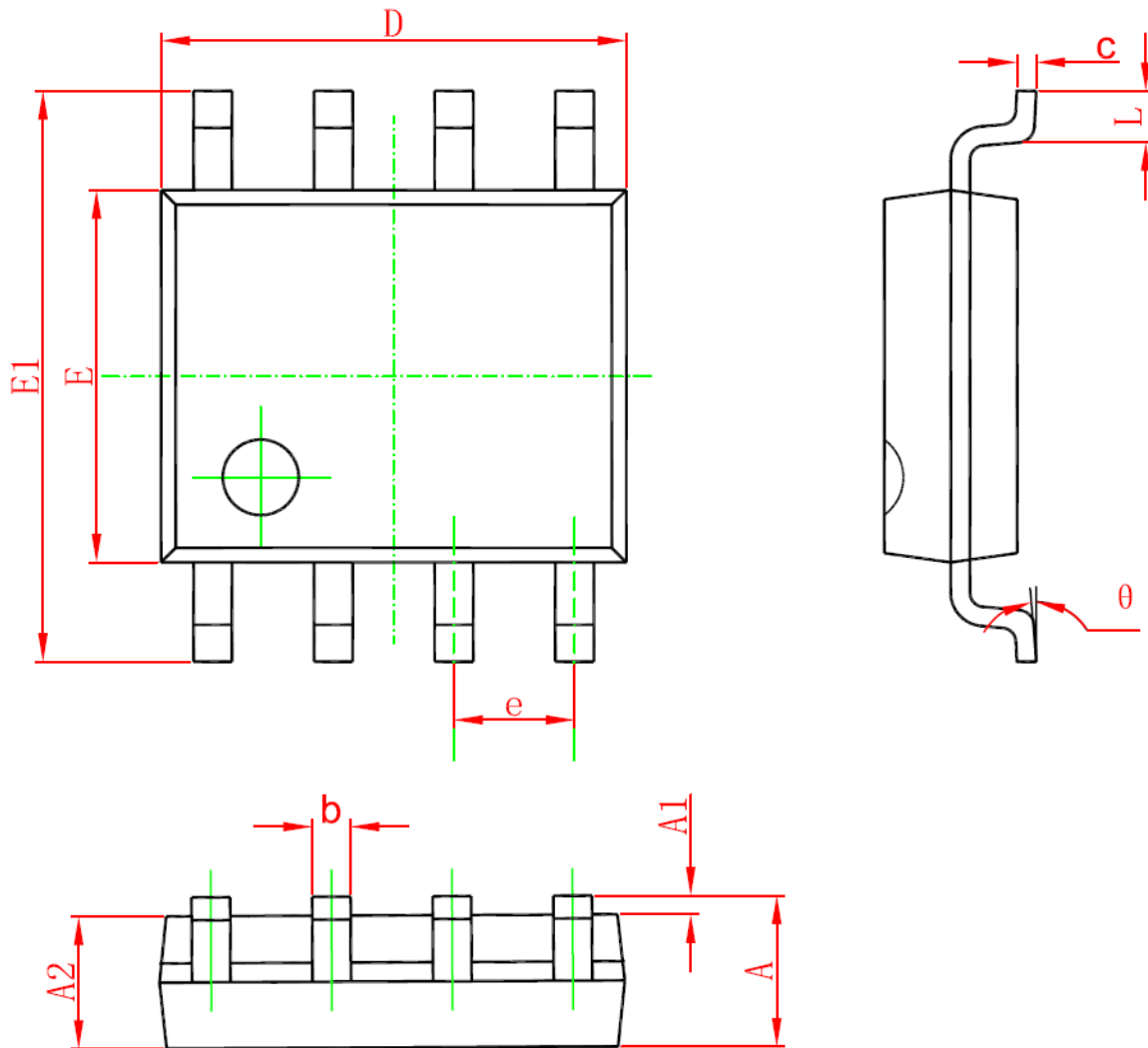


Figure 14 Normalized Maximum Transient Thermal Impedance



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°