

N and P-Channel Enhancement Mode Power MOSFET

Description

The HM4612D uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications.

General Features

● N-Channel

$$V_{DS} = 12V, I_D = 5A$$

$$R_{DS(ON)} < 32m\Omega @ V_{GS} = 4.5V$$

$$R_{DS(ON)} < 42m\Omega @ V_{GS} = 2.5V$$

$$R_{DS(ON)} < 80m\Omega @ V_{GS} = 1.8V$$

● P-Channel

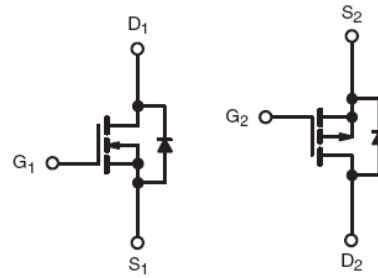
$$V_{DS} = -12V, I_D = -5A$$

$$R_{DS(ON)} < 74m\Omega @ V_{GS} = -4.5V$$

$$R_{DS(ON)} < 110m\Omega @ V_{GS} = -2.5V$$

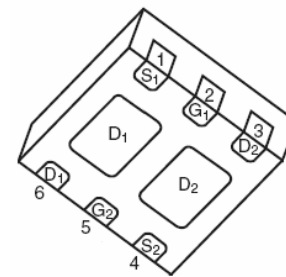
$$R_{DS(ON)} < 220m\Omega @ V_{GS} = -1.8V$$

● Load Switch for Portable Devices



N-channel

P-channel



Pin assignment

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
12**	HM4612D	DFN2X2-6L	-	-	-

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

Parameter		Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage		V_{DS}	12	-12	V
Gate-Source Voltage		V_{GS}	± 12	± 12	V
Continuous Drain Current	$T_A = 25^\circ\text{C}$	I_D	5	-5	A
	$T_A = 70^\circ\text{C}$		4.5	-3.8	
Pulsed Drain Current ^(Note 1)		I_{DM}	20	-15	A
Maximum Power Dissipation	$T_A = 25^\circ\text{C}$	P_D	1.9	1.9	W
Operating Junction and Storage Temperature Range		T_J, T_{STG}	-55 To 150	-55 To 150	$^\circ\text{C}$

Thermal Characteristic

Thermal Resistance, Junction-to-Ambient ^(Note2)	$R_{\theta JA}$	N-Ch	65	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient ^(Note2)	$R_{\theta JA}$	P-Ch	65	$^\circ\text{C/W}$

N-CH Electrical Characteristics (T_A=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V I _D =250μA	12	20	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =12V,V _{GS} =0V	-	-	1	μA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±12V,V _{DS} =0V	-	-	±100	nA
On Characteristics ^(Note 3)						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} ,I _D =250μA	0.4	0.6	1	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =4.5V, I _D =5A	-	28	32	mΩ
		V _{GS} =2.5V, I _D =4.6A	-	36	42	mΩ
		V _{GS} =1.8V, I _D =4.1A	-	55	80	mΩ
Forward Transconductance	g _{FS}	V _{DS} =10V,I _D =5A	-	20	-	S
Dynamic Characteristics ^(Note4)						
Input Capacitance	C _{ISS}	V _{DS} =6V,V _{GS} =0V, F=1.0MHz	-	495	-	PF
Output Capacitance	C _{OSS}		-	155	-	PF
Reverse Transfer Capacitance	C _{RSS}		-	95	-	PF
Switching Characteristics ^(Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =6V, R _L =1.2Ω V _{GS} =10V,R _{GEN} =4.5Ω	-	7.0	-	nS
Turn-on Rise Time	t _r		-	5.0	-	nS
Turn-Off Delay Time	t _{d(off)}		-	18	-	nS
Turn-Off Fall Time	t _f		-	6	-	nS
Total Gate Charge	Q _g	V _{DS} =6V,I _D =5A, V _{GS} =4.5V	-	6.6	-	nC
Gate-Source Charge	Q _{gs}		-	1	-	nC
Gate-Drain Charge	Q _{gd}		-	1.2	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage ^(Note 3)	V _{SD}	V _{GS} =0V,I _S =5A	-	-	1.2	V

P-CH Electrical Characteristics (T_A=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V, I _D =-250μA	-30	-33	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =-12V, V _{GS} =0V	-	-	-1	μA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±12V, V _{DS} =0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =-250μA	-0.4	-0.7	-1	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =-4.5V, I _D =-4.5A	-	60	74	mΩ
		V _{GS} =-2.5V, I _D =-3.2A	-	84	110	mΩ
		V _{GS} =-1.8V, I _D =-1A	-	130	220	mΩ
Forward Transconductance	g _{FS}	V _{DS} =-10V, I _D =-5A	-	10	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =-6V, V _{GS} =0V, F=1.0MHz	-	520	-	PF
Output Capacitance	C _{oss}		-	100	-	PF
Reverse Transfer Capacitance	C _{rss}		-	65	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =-6V, R _L =2.3Ω V _{GS} =-10V, R _{GEN} =6Ω	-	7.5	-	nS
Turn-on Rise Time	t _r		-	5.5	-	nS
Turn-Off Delay Time	t _{d(off)}		-	19	-	nS
Turn-Off Fall Time	t _f		-	7	-	nS
Total Gate Charge	Q _g	V _{DS} =-6V, I _D =-4.5A V _{GS} =-4.5V	-	9.2	-	nC
Gate-Source Charge	Q _{gs}		-	1.6	-	nC
Gate-Drain Charge	Q _{gd}		-	2.2	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V, I _S =-5A	-	-	-1.2	V

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)

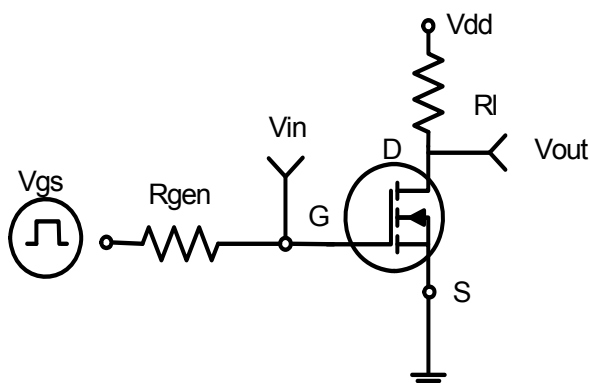


Figure 1: Switching Test Circuit

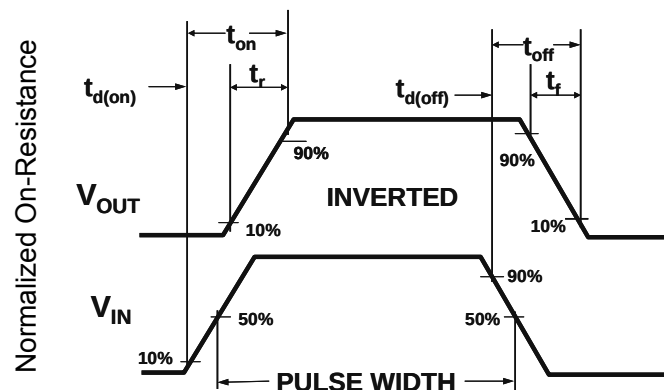


Figure 2: Switching Waveforms

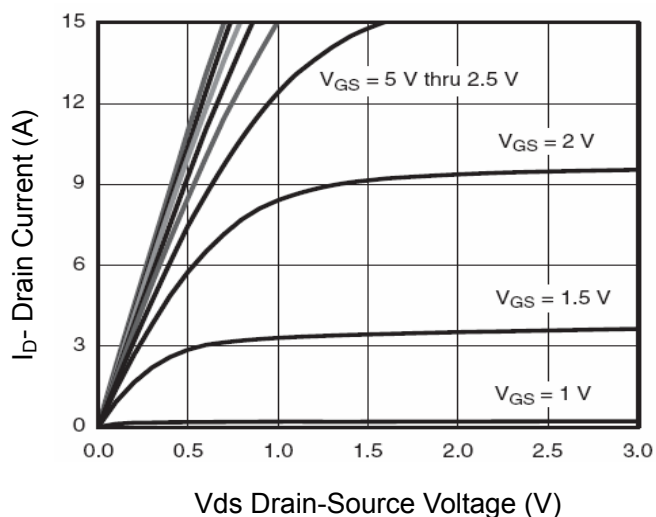


Figure 3 Output Characteristics

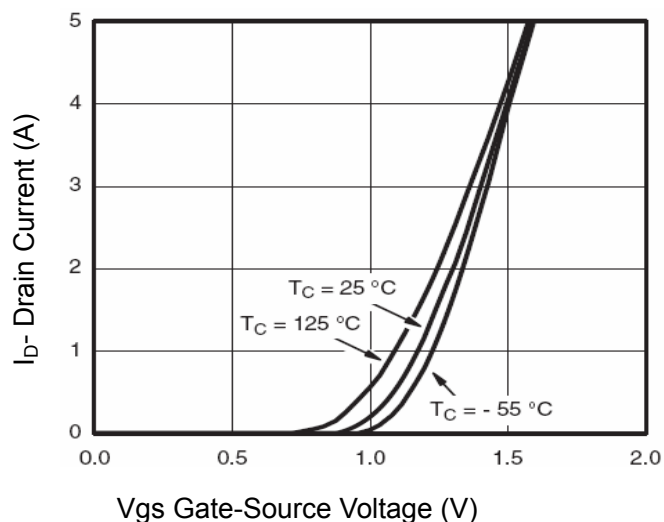


Figure 4 Transfer Characteristics

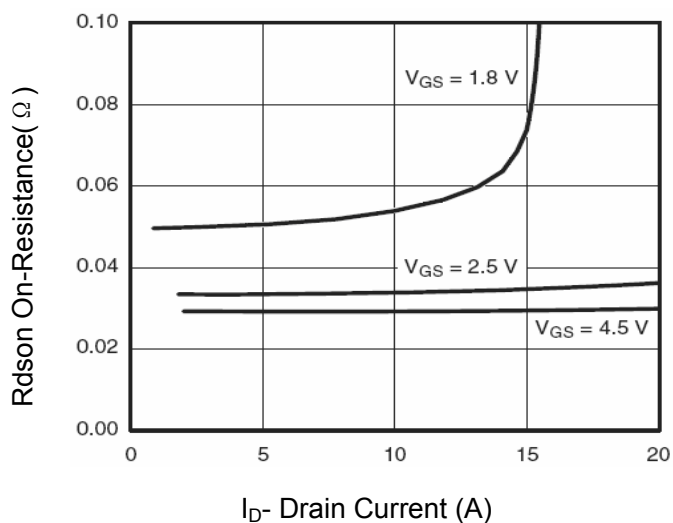


Figure 5 Drain-Source On-Resistance

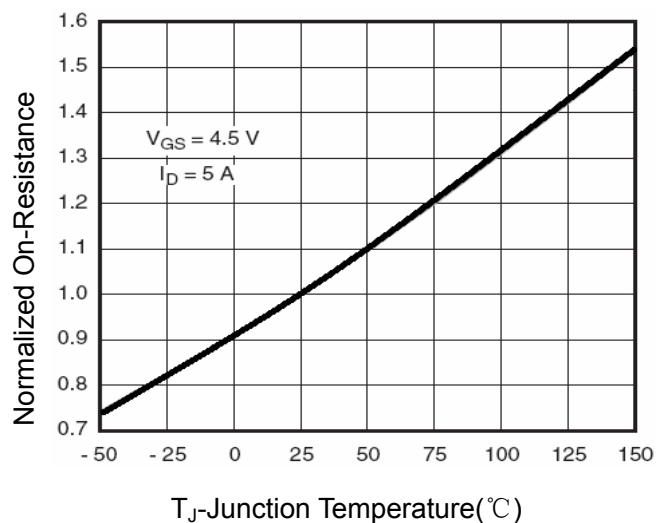
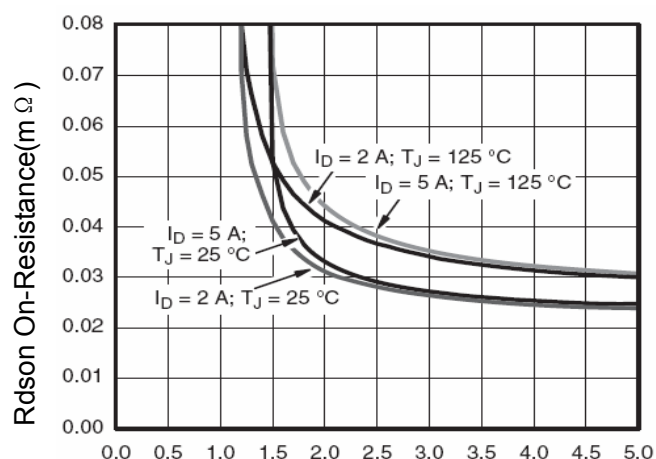
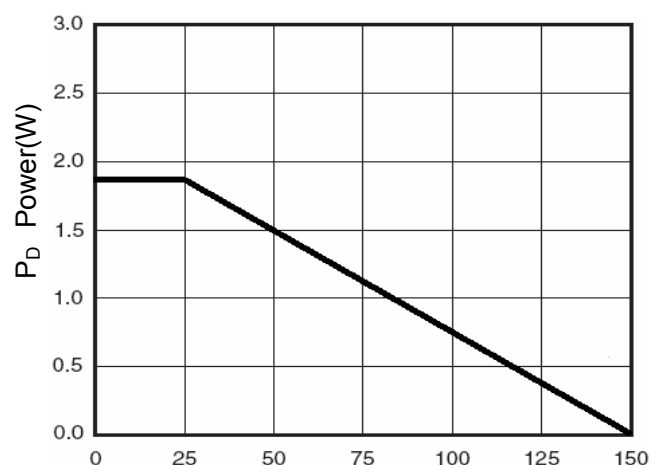


Figure 6 Drain-Source On-Resistance



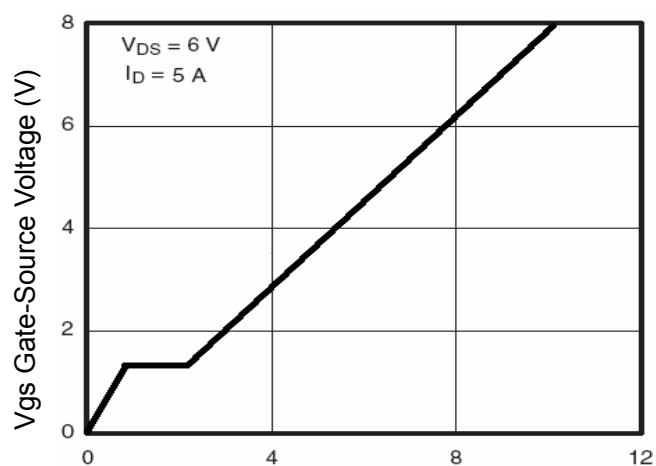
Vgs Gate-Source Voltage (V)

Figure 7 Rdson vs Vgs



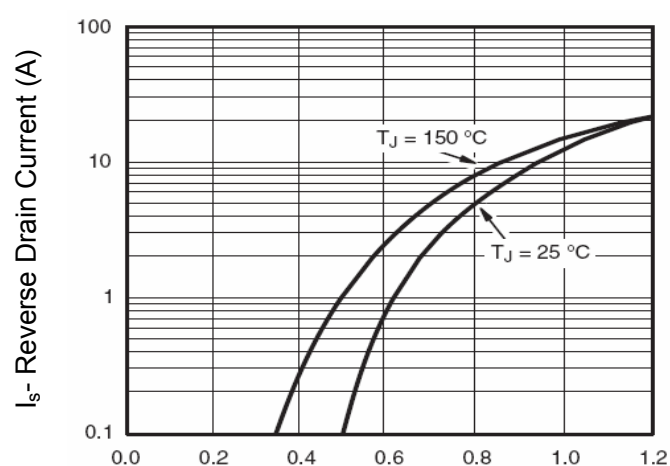
TJ-Junction Temperature(°C)

Figure 8 Power Dissipation



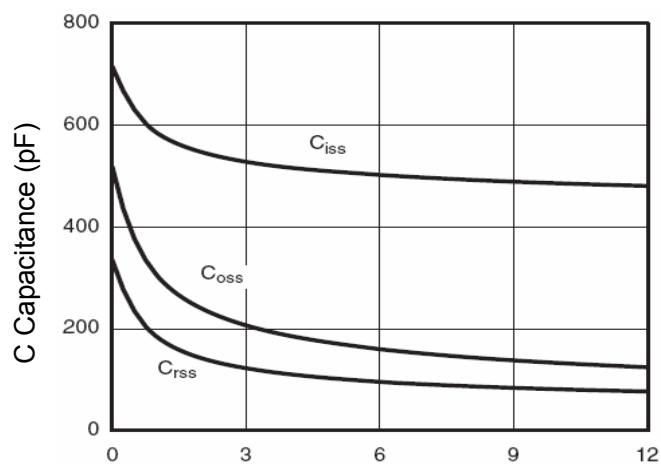
Qg Gate Charge (nC)

Figure 9 Gate Charge



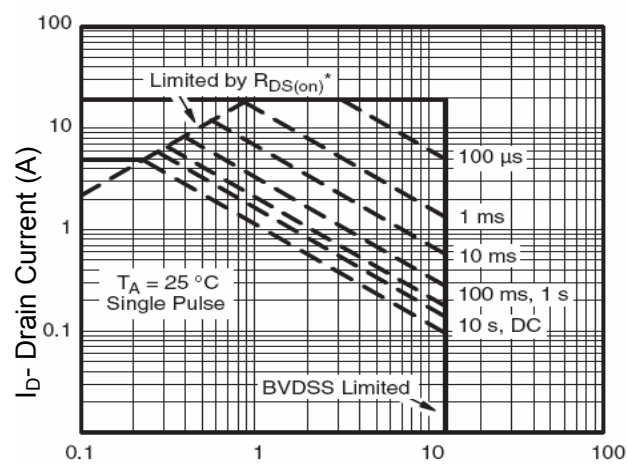
Vds Drain-Source Voltage (V)

Figure 10 Source- Drain Diode Forward



Vds Drain-Source Voltage (V)

Figure 11 Capacitance vs Vds



Vds Drain-Source Voltage (V)

Figure 12 Safe Operation Area

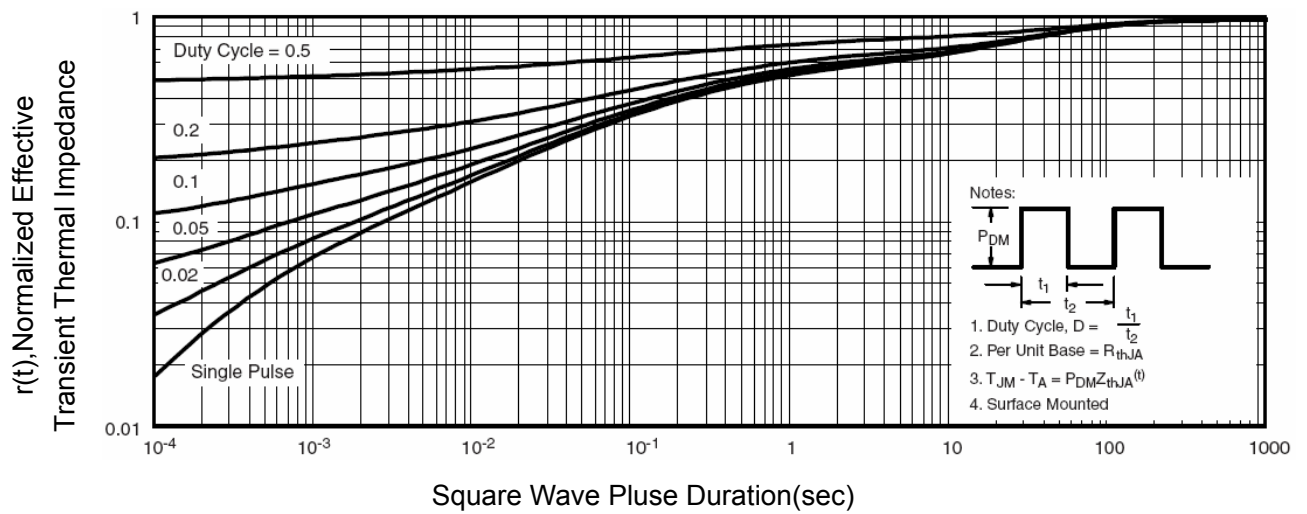


Figure 13 Normalized Maximum Transient Thermal Impedance

P- Channel Typical Electrical and Thermal Characteristics (Curves)

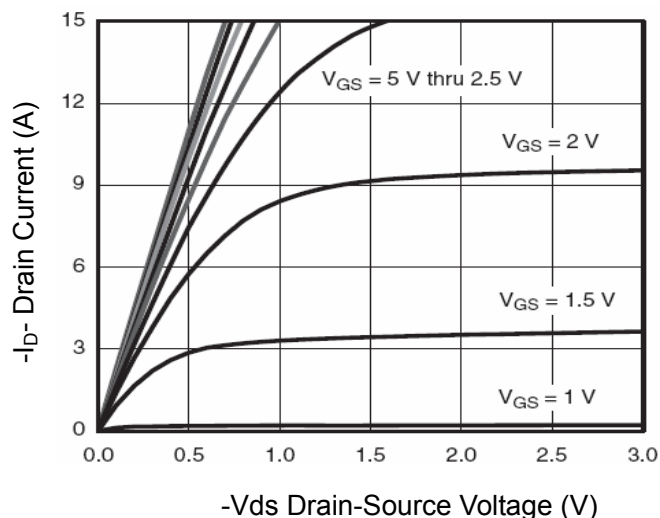


Figure 1 Output Characteristics

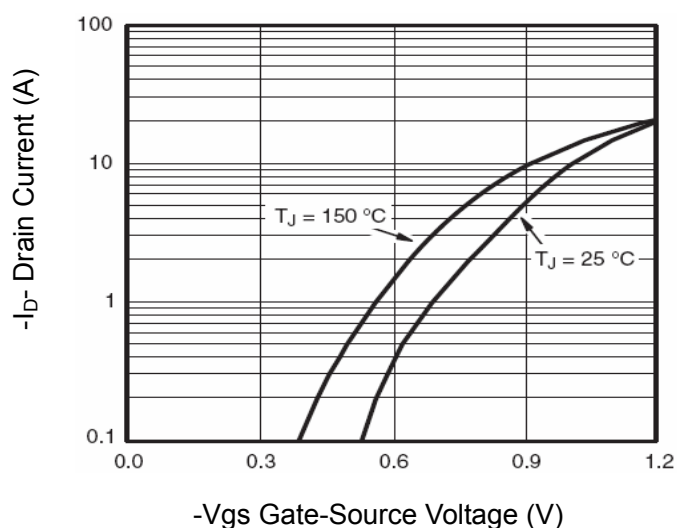


Figure 2 Transfer Characteristics

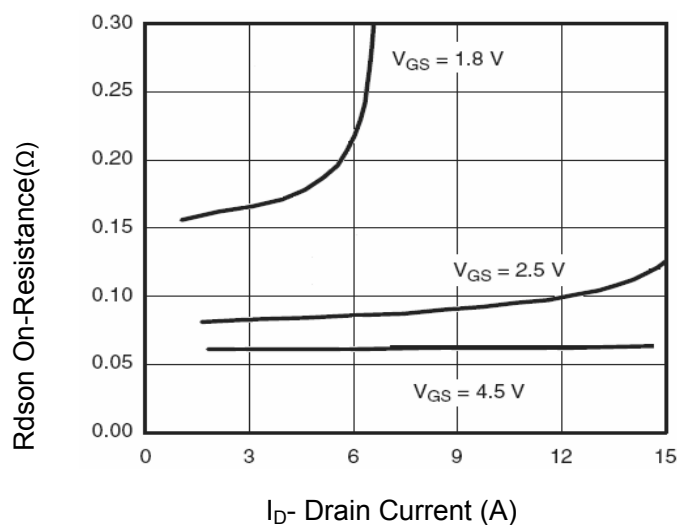


Figure 3 Rdson- Drain Current

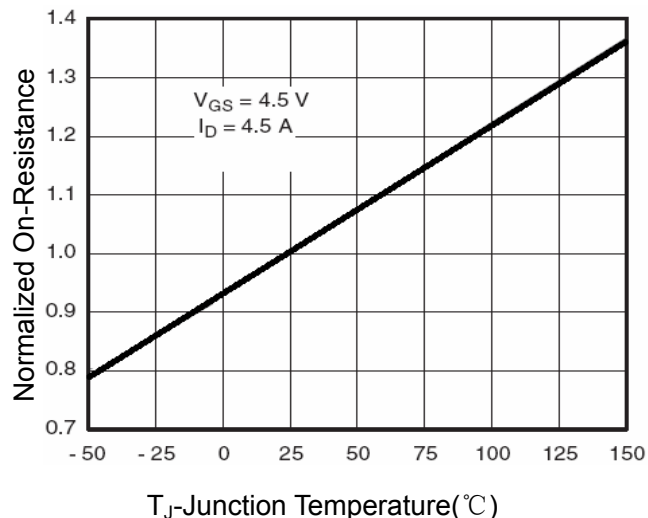


Figure 4 Rdson-Junction Temperature

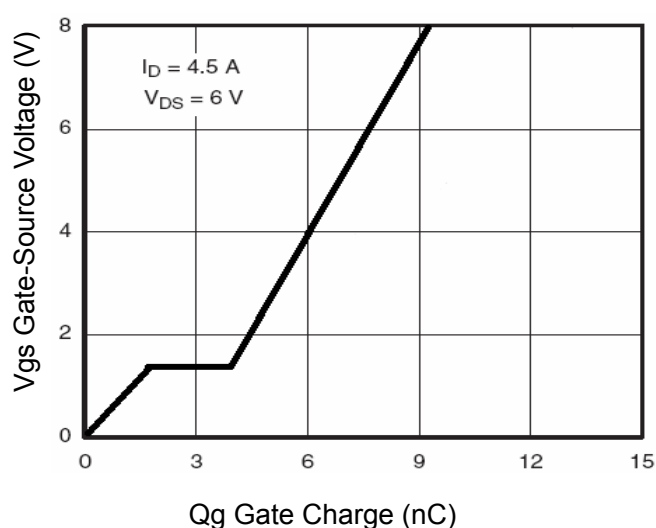


Figure 5 Gate Charge

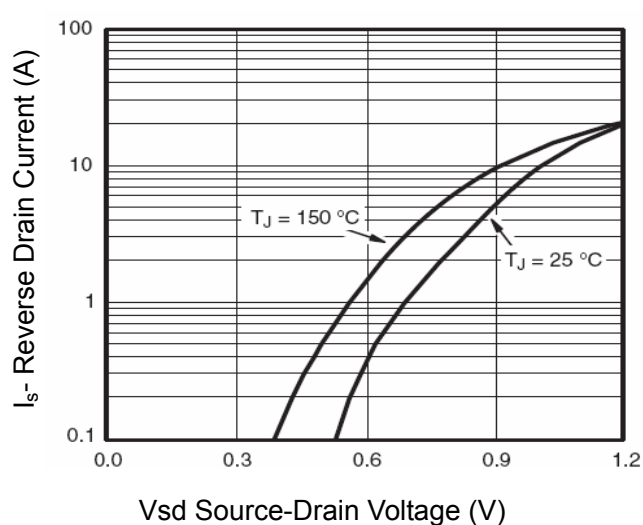


Figure 6 Source- Drain Diode Forward

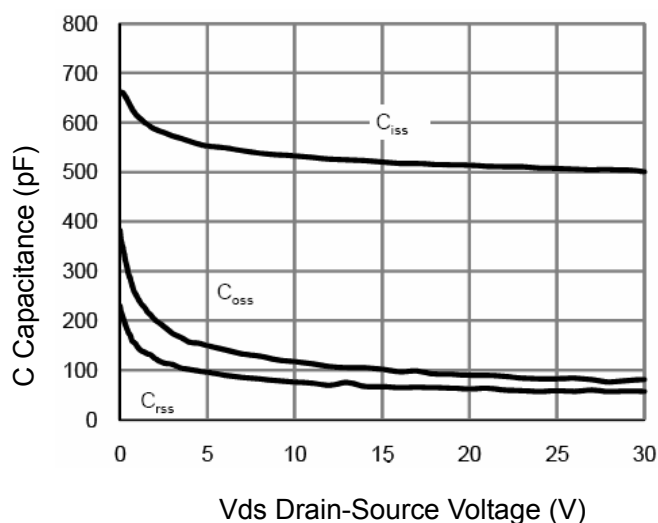


Figure 7 Capacitance vs Vds

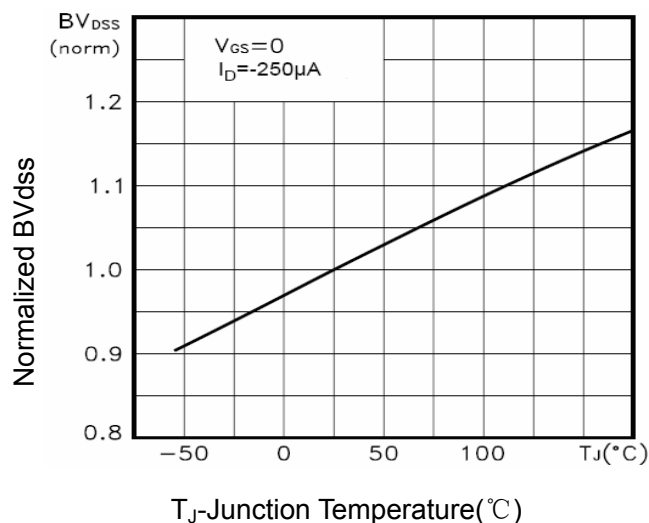


Figure 9 BV_{DSS} vs Junction Temperature

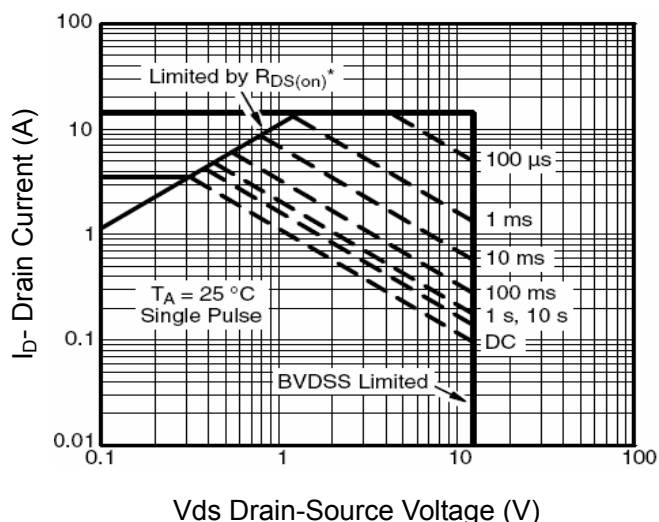


Figure 8 Safe Operation Area

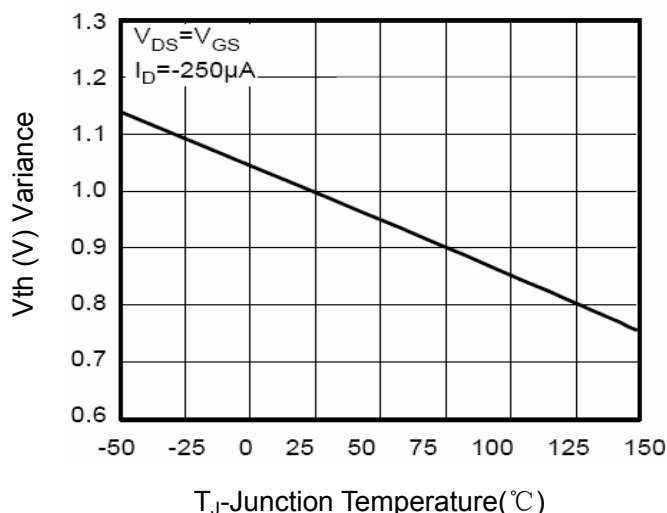


Figure 10 $V_{GS(th)}$ vs Junction Temperature

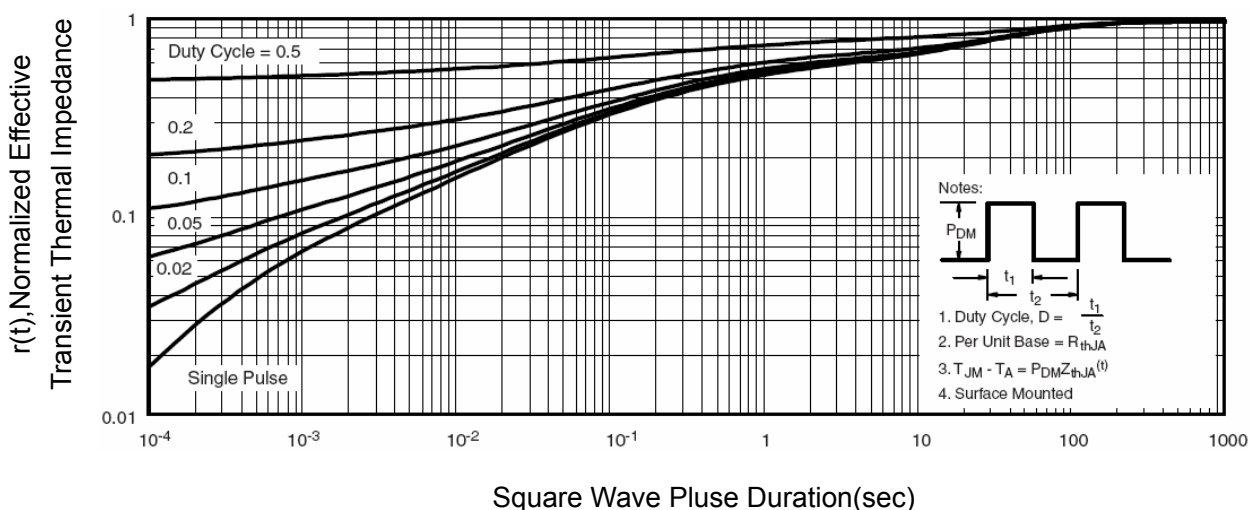
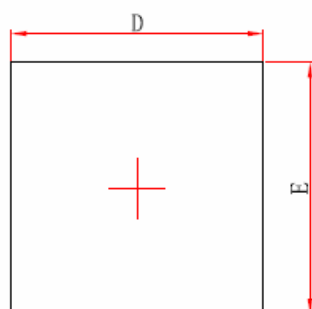
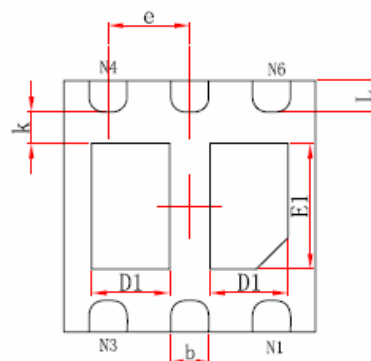


Figure 11 Normalized Maximum Transient Thermal Impedance

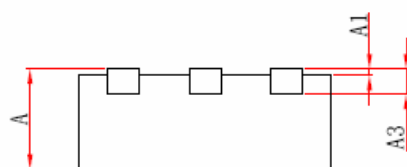
DFN2X2-6L Package Information



Top View



Bottom View



Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	1.924	2.076	0.076	0.082
E	1.924	2.076	0.076	0.082
D1	0.520	0.720	0.020	0.028
E1	0.900	1.100	0.035	0.043
k	0.200MIN.		0.008MIN.	
b	0.250	0.350	0.010	0.014
e	0.650TYP.		0.026TYP.	
L	0.174	0.326	0.007	0.013

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