

N and P-Channel Enhancement Mode Power MOSFET

**Description**

The HM4630D 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**

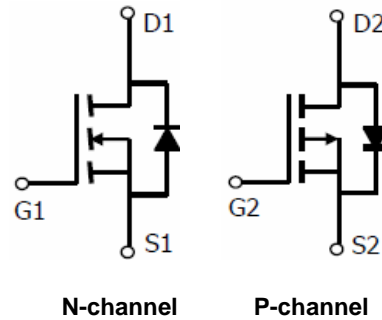
● **N-Channel**

- $V_{DS} = 20V, I_D = 5A$
- $R_{DS(ON)} < 65m\Omega @ V_{GS}=4.5V$
- $R_{DS(ON)} < 90m\Omega @ V_{GS}=2.5V$

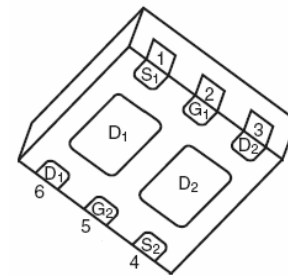
● **P-Channel**

- $V_{DS} = -20V, I_D = -5A$
- $R_{DS(ON)} < 110m\Omega @ V_{GS}=-4.5V$
- $R_{DS(ON)} < 140m\Omega @ V_{GS}=-2.5V$

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



N-channel P-channel



Pin assignment

**Package Marking and Ordering Information**

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
20**	HM4630D	DFN2X2-6L	Ø180mm	8mm	3000 units

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

Parameter	Symbol	N-Channel	P-Channel	Unit	
Drain-Source Voltage	$V_{DS}$	20	-20	V	
Gate-Source Voltage	$V_{GS}$	$\pm 12$	$\pm 12$	V	
Continuous Drain Current	$I_D$	$T_A=25^\circ C$	5	-5	A
		$T_A=70^\circ C$	3.5	-3.5	
Pulsed Drain Current <sup>(Note 1)</sup>	$I_{DM}$	15	-15	A	
Maximum Power Dissipation	$P_D$	0.8	0.8	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 <sup>(Note2)</sup>	$R_{\theta JA}$	N-Ch	156	$^\circ C/W$
Thermal Resistance, Junction-to-Ambient <sup>(Note2)</sup>	$R_{\theta JA}$	P-Ch	156	$^\circ C/W$

**N-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	20	22	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =20V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±12V, V <sub>DS</sub> =0V	-	-	±100	nA
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	0.5	0.75	1.2	V
Drain-Source On-State Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> =2.5V, I <sub>D</sub> =2.8A	-	35	90	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =5A	-	29	65	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =5V, I <sub>D</sub> =5A	-	8	-	S
<b>Dynamic Characteristics</b> (Note4)						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =10V, V <sub>GS</sub> =0V, F=1.0MHz	-	260	-	PF
Output Capacitance	C <sub>OSS</sub>		-	48	-	PF
Reverse Transfer Capacitance	C <sub>RSS</sub>		-	27	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =10V, R <sub>L</sub> =3.3Ω V <sub>GS</sub> =4.5V, R <sub>GEN</sub> =6Ω	-	2.5	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	3.2	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	21	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	3	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =10V, I <sub>D</sub> =5A, V <sub>GS</sub> =4.5V	-	2.9	5	nC
Gate-Source Charge	Q <sub>gs</sub>		-	0.4	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	0.6	-	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> =5A	-	-	1.2	V
Diode Forward Current (Note 2)	I <sub>S</sub>		-	-	5	A

**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

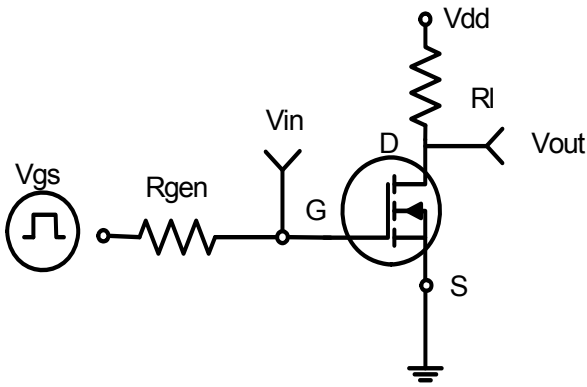
**P-CH Electrical Characteristics (TA=25°C unless otherwise noted)**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=-250\mu A$	-20		-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=-20V, V_{GS}=0V$	-	-	-1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 12V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-0.4	-0.7	-1	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=-4.5V, I_D=-2.5A$	-	78	110	m $\Omega$
		$V_{GS}=-2.5V, I_D=-2A$	-	102	140	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=-5V, I_D=-2.5A$	-	9.5	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	$C_{iss}$	$V_{DS}=-10V, V_{GS}=0V,$ $F=1.0MHz$	-	325	-	PF
Output Capacitance	$C_{oss}$		-	63	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	37	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=-10V, R_L=5\Omega$ $V_{GS}=-4.5V, R_{GEN}=3\Omega$	-	11	-	nS
Turn-on Rise Time	$t_r$		-	5.5	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	22	-	nS
Turn-Off Fall Time	$t_f$		-	8	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=-10V, I_D=-2A,$ $V_{GS}=-4.5V$	-	3.2	-	nC
Gate-Source Charge	$Q_{gs}$		-	0.6	-	nC
Gate-Drain Charge	$Q_{gd}$		-	0.9	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=-5A$	-	-	-1.2	V
Diode Forward Current	$I_S$		-	-	-5	A

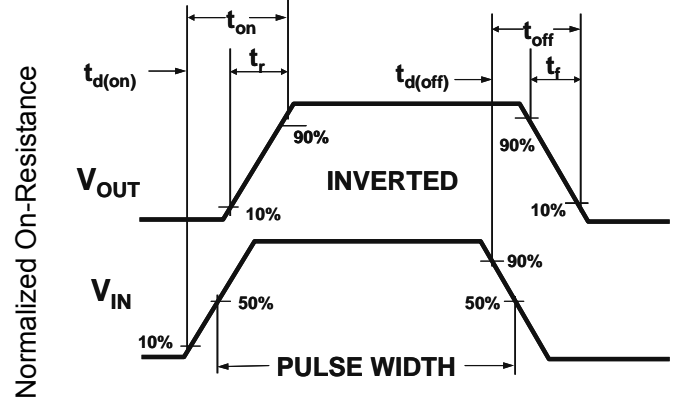
**Notes:**

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2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
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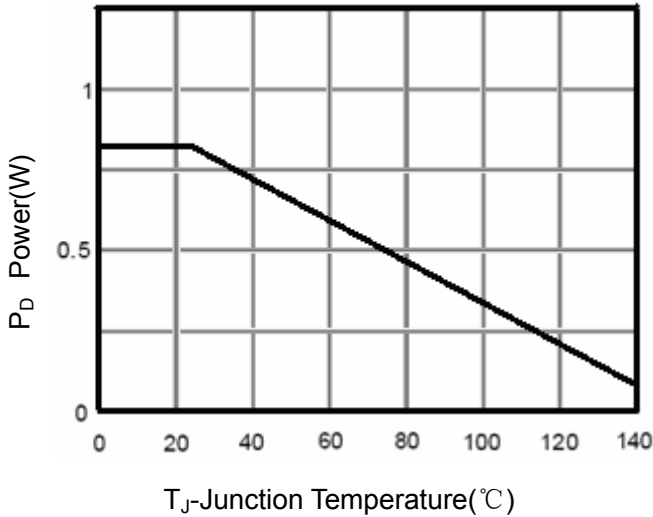
**N- Channel Typical Electrical and Thermal Characteristics (Curves)**



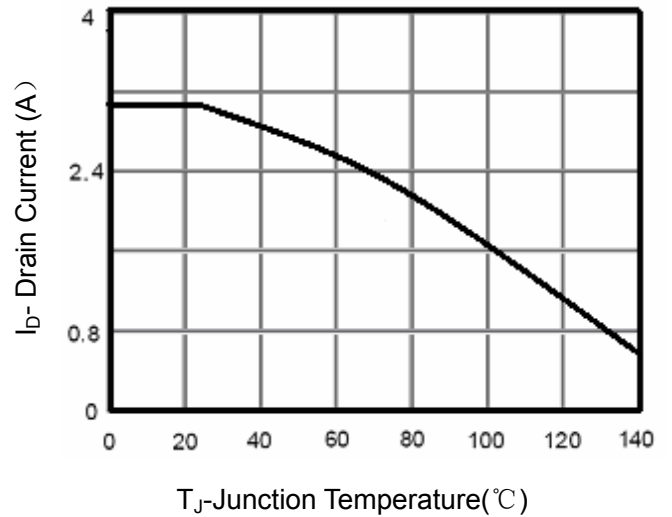
**Figure 1: Switching Test Circuit**



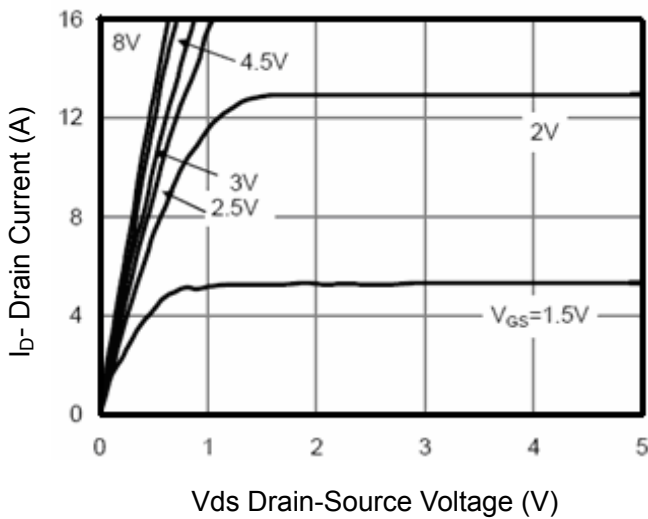
**Figure 2: Switching Waveforms**



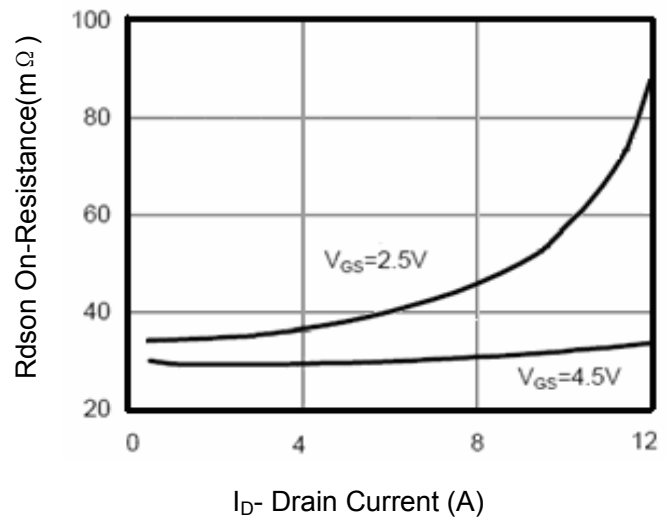
**Figure 3 Power Dissipation**



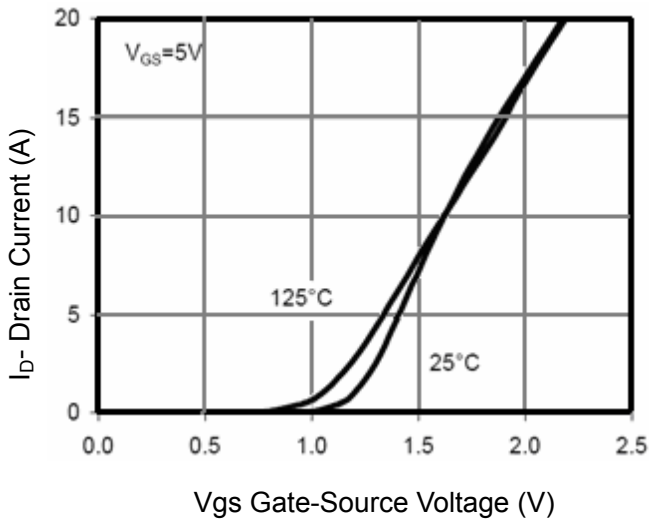
**Figure 4 Drain Current**



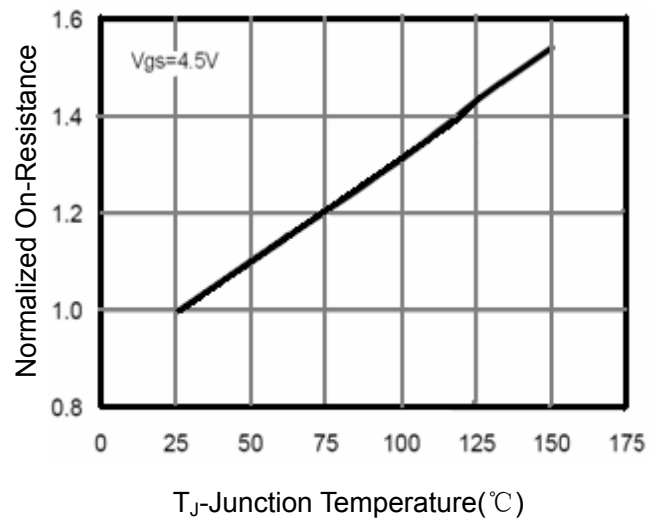
**Figure 5 Output Characteristics**



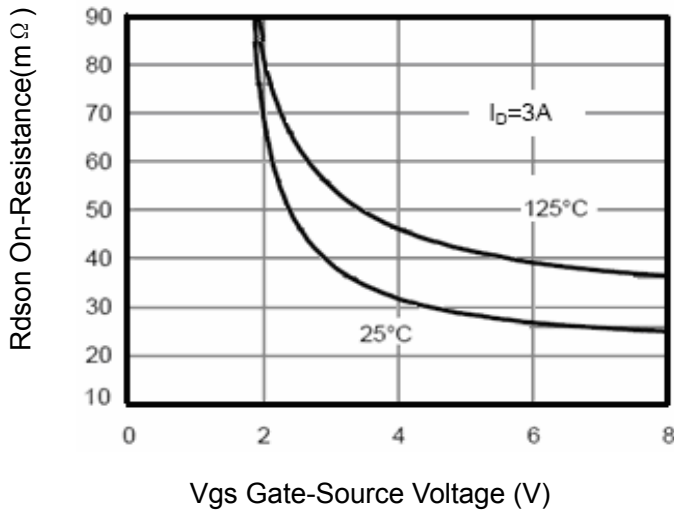
**Figure 6 Drain-Source On-Resistance**



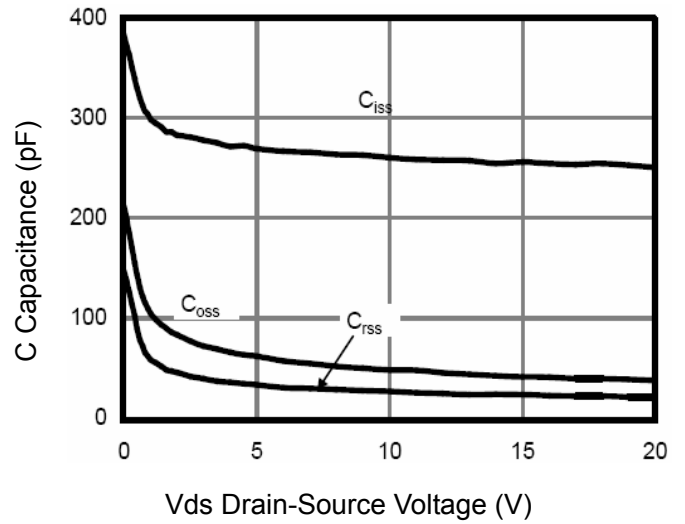
**Figure 7 Transfer Characteristics**



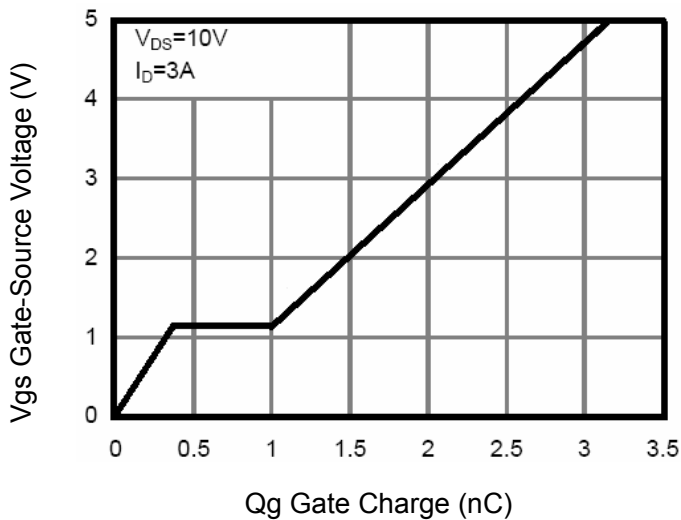
**Figure 8 Drain-Source On-Resistance**



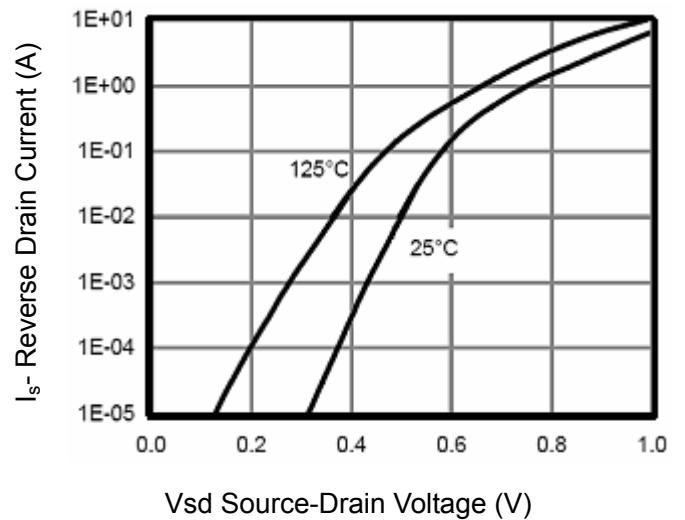
**Figure 9 Rdson vs Vgs**



**Figure 10 Capacitance vs Vds**



**Figure 11 Gate Charge**



**Figure 12 Source- Drain Diode Forward**

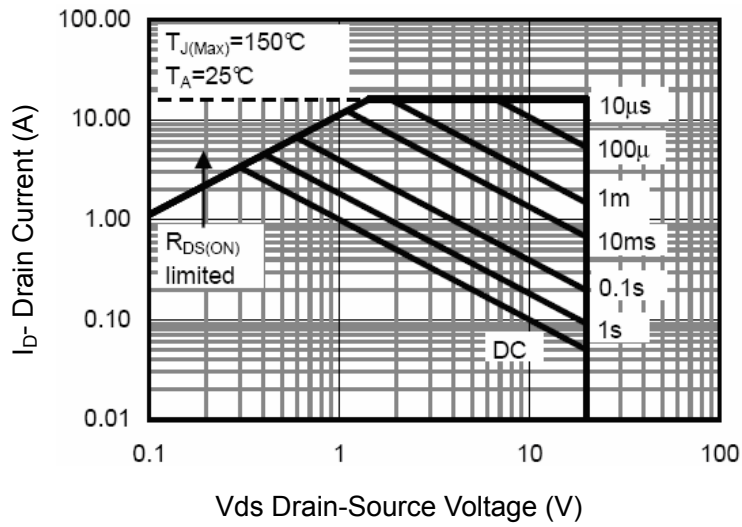


Figure 13 Safe Operation Area

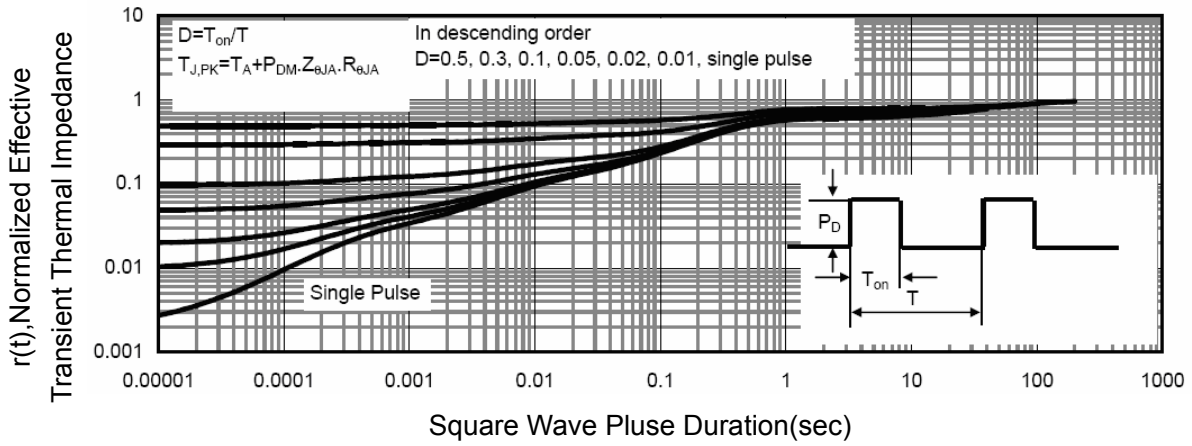
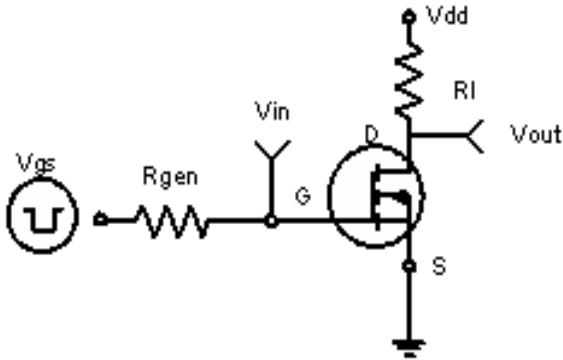
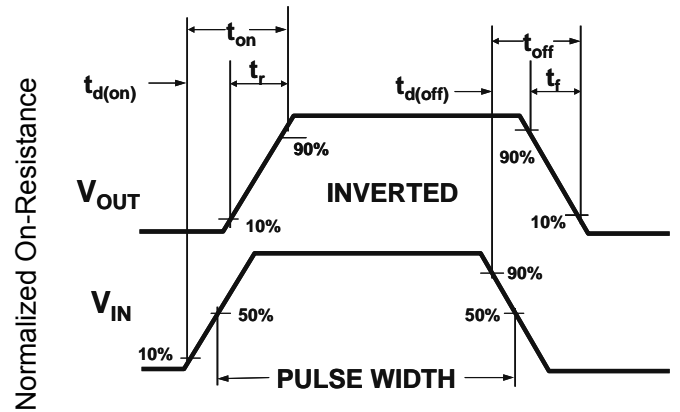


Figure 14 Normalized Maximum Transient Thermal Impedance

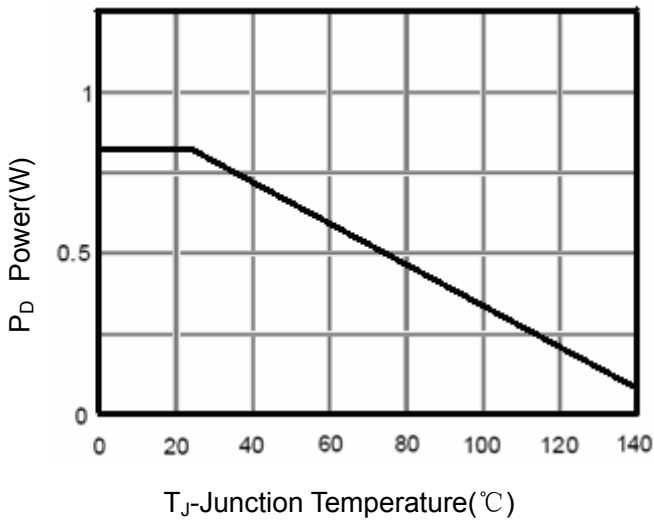
**P- Channel Typical Electrical and Thermal Characteristics (Curves)**



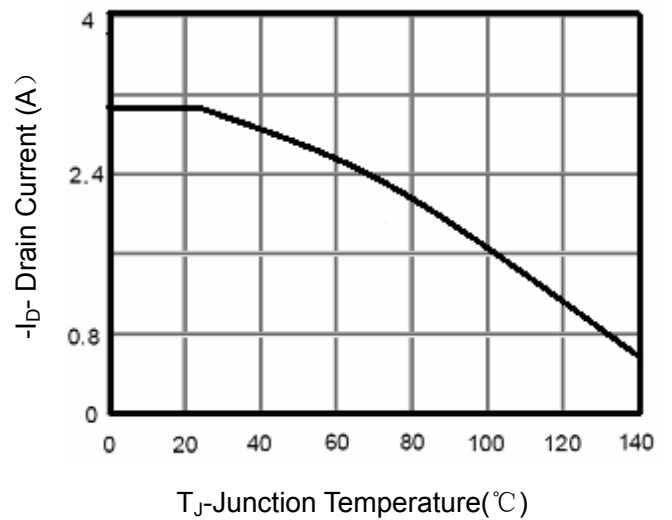
**Figure 1: Switching Test Circuit**



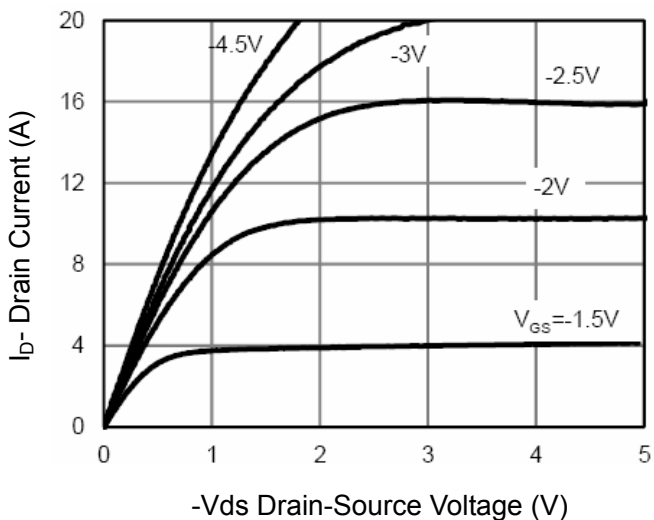
**Figure 2: Switching Waveforms**



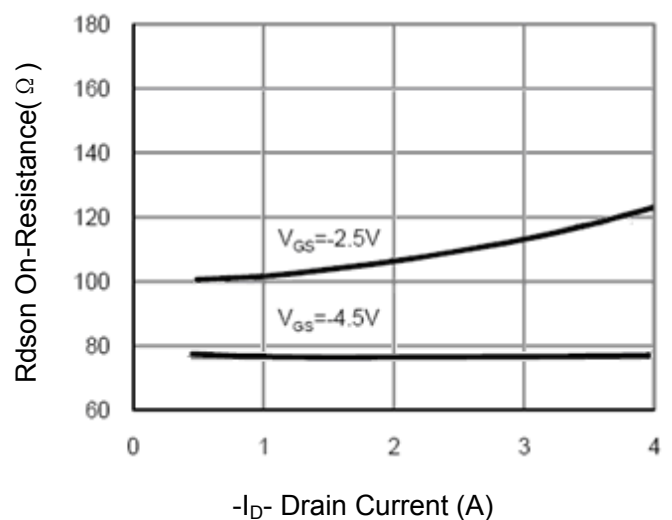
**Figure 3 Power Dissipation**



**Figure 4 Drain Current**



**Figure 5 Output Characteristics**



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

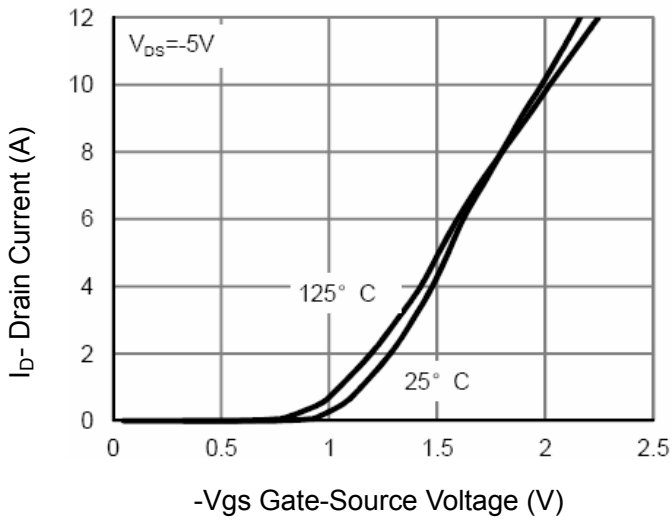


Figure 7 Transfer Characteristics

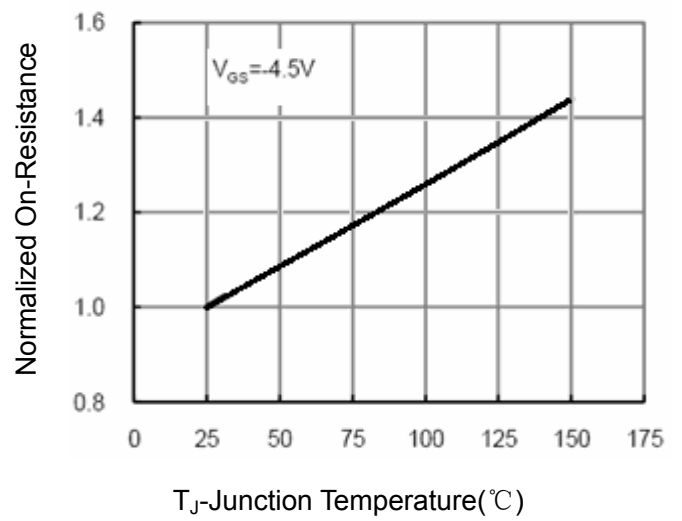


Figure 8 Drain-Source On-Resistance

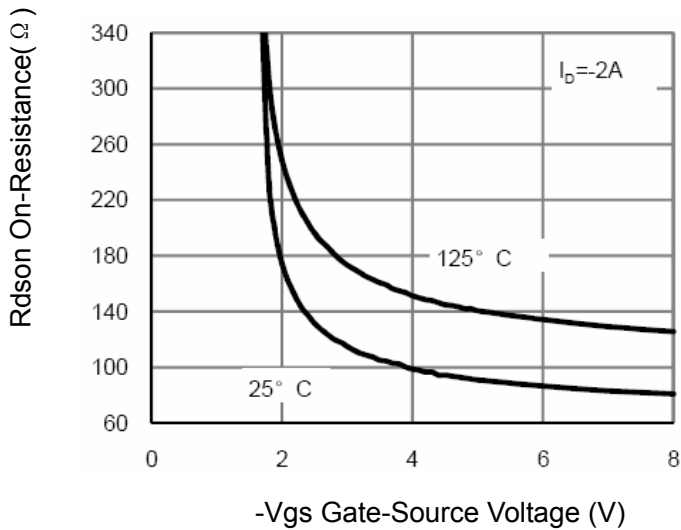


Figure 9 Rdson vs Vgs

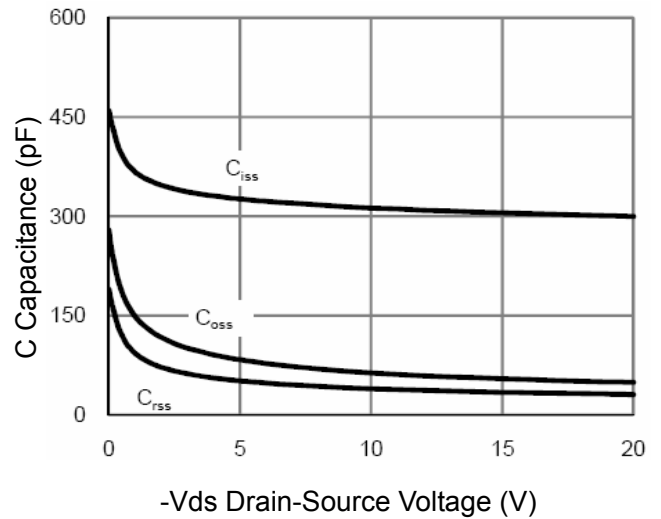


Figure 10 Capacitance vs Vds

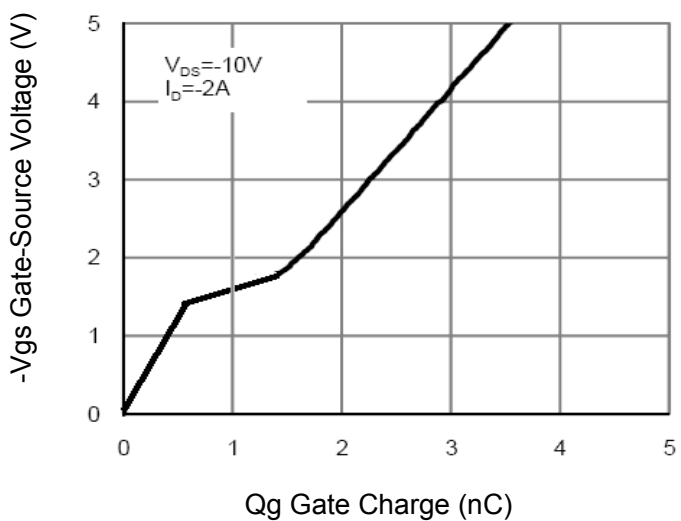


Figure 11 Gate Charge

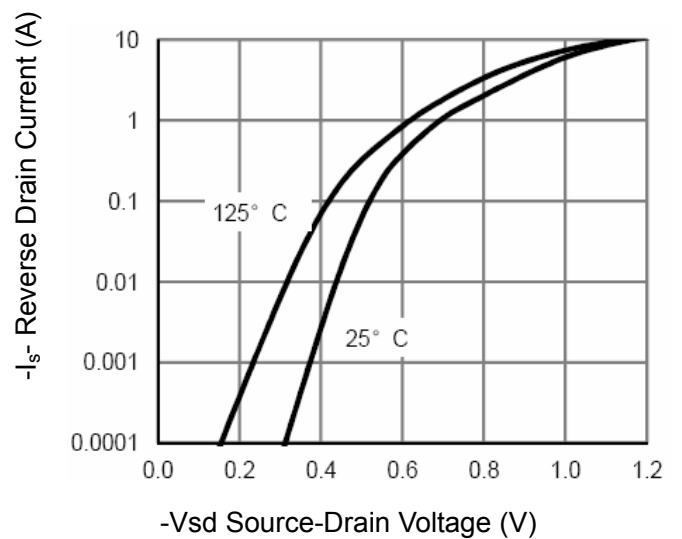


Figure 12 Source- Drain Diode Forward



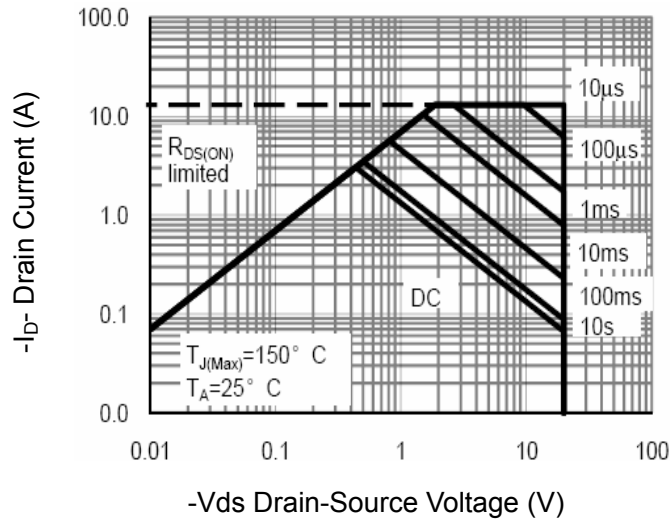


Figure 13 Safe Operation Area

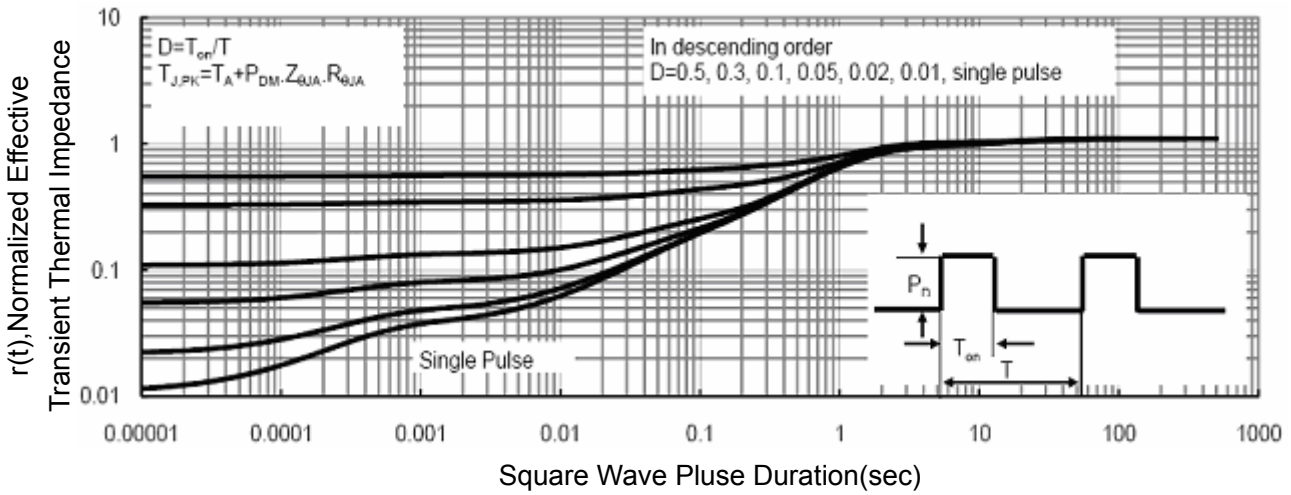
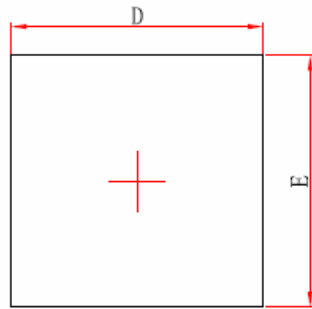
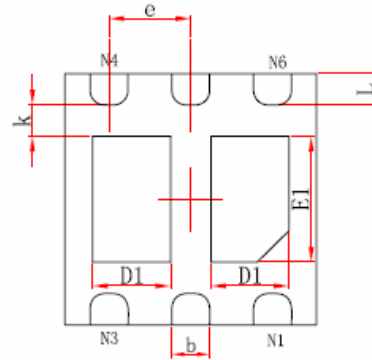


Figure 14 Normalized Maximum Transient Thermal Impedance

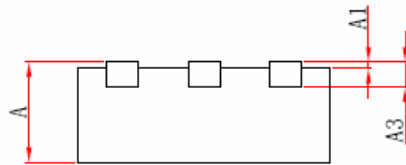
DFN2X2-6L Package Information



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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