

### 30V Half Bridge Dual N-Channel Super Trench Power MOSFET

#### Description

The NCEPB302G uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(ON)}$  and  $Q_g$ . It includes two specialized MOSFETs in a dual Power DFN5x6 package.

#### General Features

##### Q1 "High Side" MOSFET

- $V_{DS} = 30V, I_D = 25A$
- $R_{DS(ON)} < 8.1m\Omega @ V_{GS} = 10V$
- $R_{DS(ON)} < 11m\Omega @ V_{GS} = 4.5V$

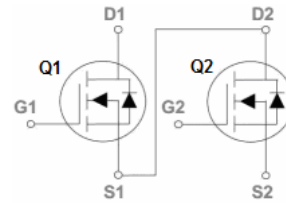
##### Q2 "Low Side" MOSFET

- $V_{DS} = 30V, I_D = 75A$
- $R_{DS(ON)} < 4.4m\Omega @ V_{GS} = 10V$
- $R_{DS(ON)} < 5.6m\Omega @ V_{GS} = 4.5V$

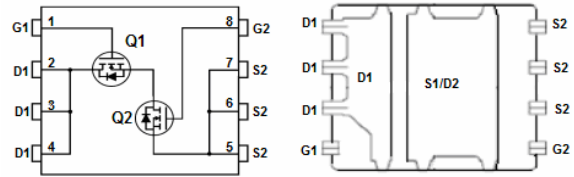
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 150 °C operating temperature
- **Pb free terminal plating**
- **RoHS compliant**
- **Halogen free**

#### Application

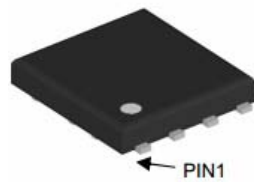
- Compact DC/DC converter applications
- 100% UIS TESTED!**  
**100% ΔVds TESTED!**



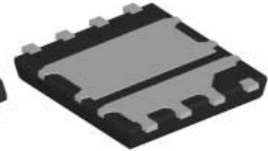
Schematic Diagram



pin assignment



Top View



Bottom View

#### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
PB302G	NCEPB302G	DFN5X6-8L	-	-	-

#### Absolute Maximum Ratings ( $T_C=25^\circ C$ unless otherwise noted)

Parameter	Symbol	Q1	Q2	Unit
Drain-Source Voltage	$V_{DS}$	30	30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V
Drain Current-Continuous (Note 2)	$I_D$	$T_C=25^\circ C$	25	75
		$T_C=100^\circ C$	18	52
Drain Current -Pulsed (Note 1)	$I_{DM}$	80	320	A
Power Dissipation	$P_D$	28	65	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	-55 To 150	$^\circ C$

#### Thermal Characteristic

Parameter	Symbol	Typ	Max	Unit
Thermal Resistance, Junction-to-Case (Note 2) (Q1)	$R_{\theta JC}$	4.2	4.5	$^\circ C/W$
Thermal Resistance, Junction-to-Case (Note 2) (Q2)	$R_{\theta JC}$	1.7	1.9	$^\circ C/W$

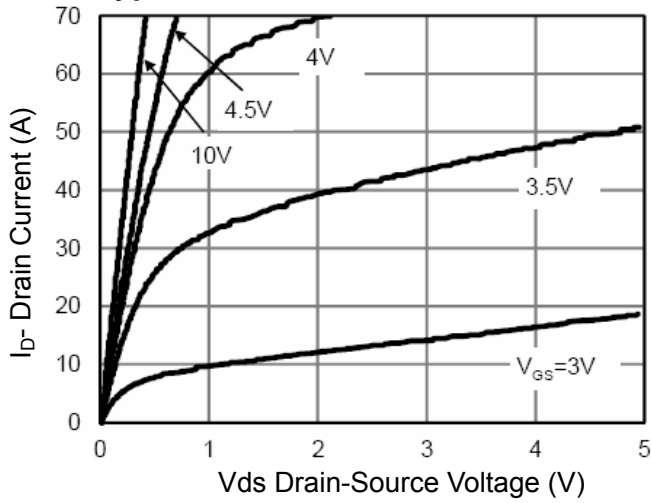
**Q1 Electrical Characteristics (T<sub>C</sub>=25°C unless otherwise noted)**

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	30		-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =30V, 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	-	-	±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	1.0	1.5	2.0	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =10A	-	7.6	8.1	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A	-	10	11	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =5V, I <sub>D</sub> =10A		30	-	S
<b>Dynamic Characteristics</b> (Note4)						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =15V, V <sub>GS</sub> =0V, F=1.0MHz	-	822	-	PF
Output Capacitance	C <sub>oss</sub>		-	344	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	15.3	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =15V, I <sub>D</sub> =10A V <sub>GS</sub> =10V, R <sub>G</sub> =1.6Ω	-	6.5	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	2.5	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	17	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	2.5	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =15V, I <sub>D</sub> =10A, V <sub>GS</sub> =10V	-	15	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	2.9		nC
Gate-Drain Charge	Q <sub>gd</sub>		-	2.1		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> =10A	-		1.2	V
Diode Forward Current (Note 2)	I <sub>S</sub>		-	-	25	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> = I <sub>S</sub> di/dt = 100A/μs (Note3)	-	11	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	19	-	nC

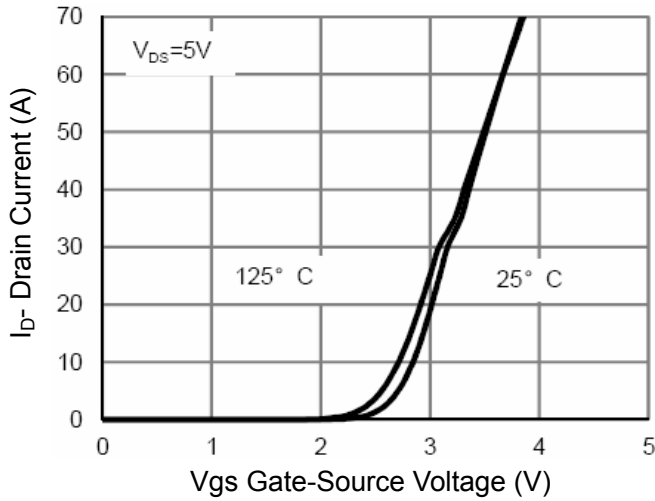
**Notes:**

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
5. EAS condition : T<sub>J</sub>=25°C, V<sub>DD</sub>=15V, V<sub>G</sub>=10V, L=0.5mH, R<sub>G</sub>=25Ω

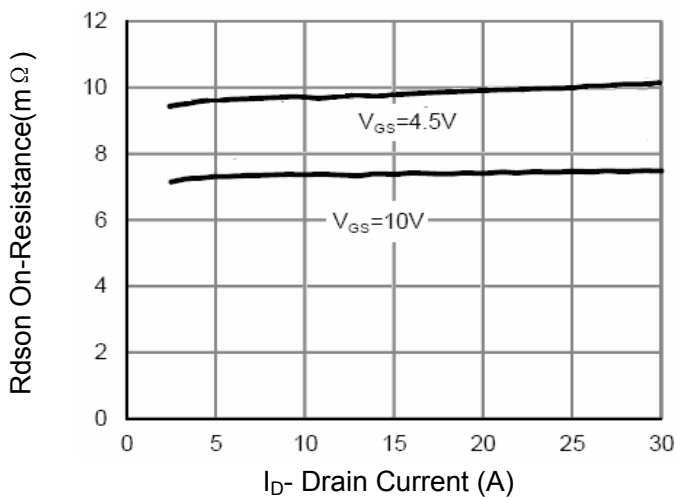
**Q1 Typical Electrical and Thermal Characteristics**



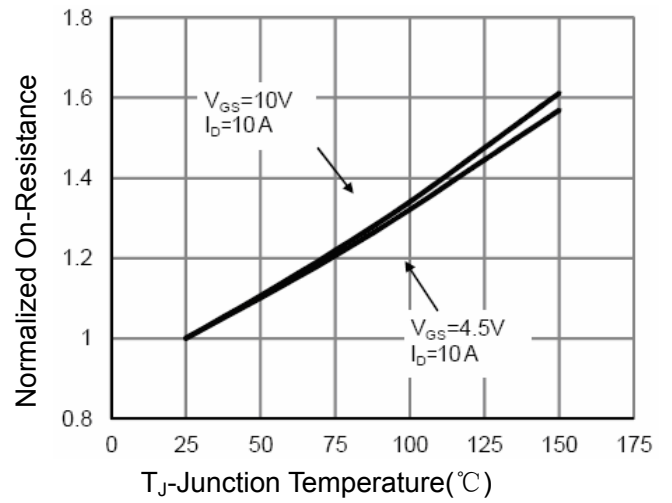
**Figure 1 Output Characteristics**



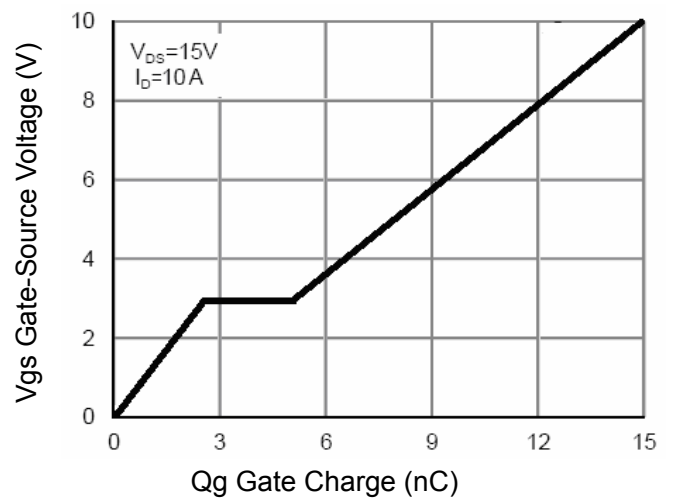
**Figure 2 Transfer Characteristics**



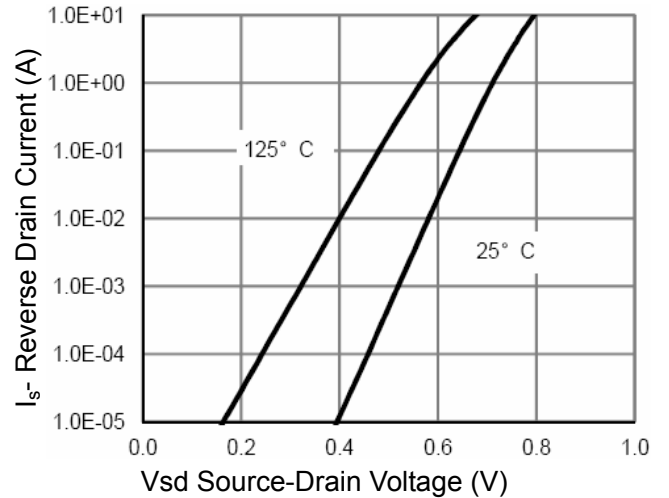
**Figure 3 Rds(on)- Drain Current**



**Figure 4 Rds(on)-Junction Temperature**



**Figure 5 Gate Charge**



**Figure 6 Source- Drain Diode Forward**

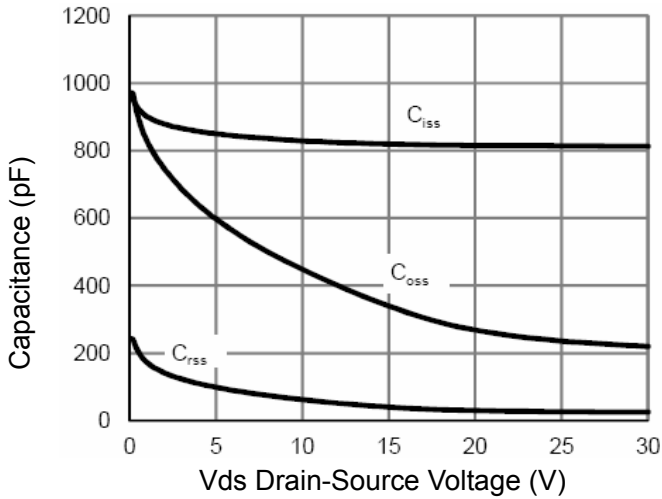
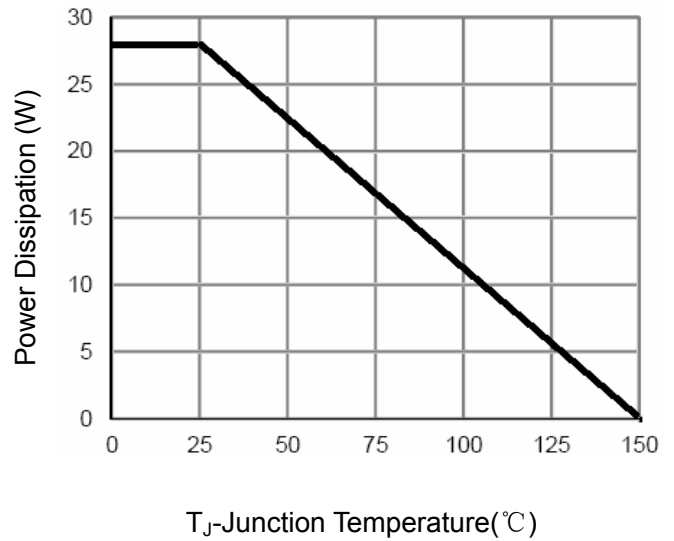


Figure 7 Capacitance vs Vds



T<sub>J</sub>-Junction Temperature(°C)  
Figure 9 Power De-rating

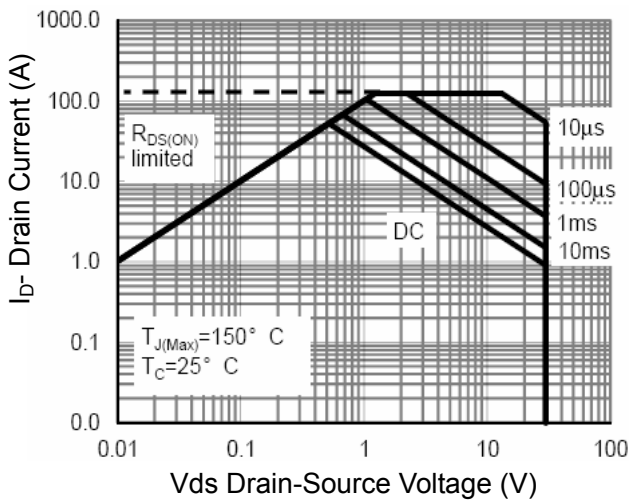


Figure 8 Safe Operation Area

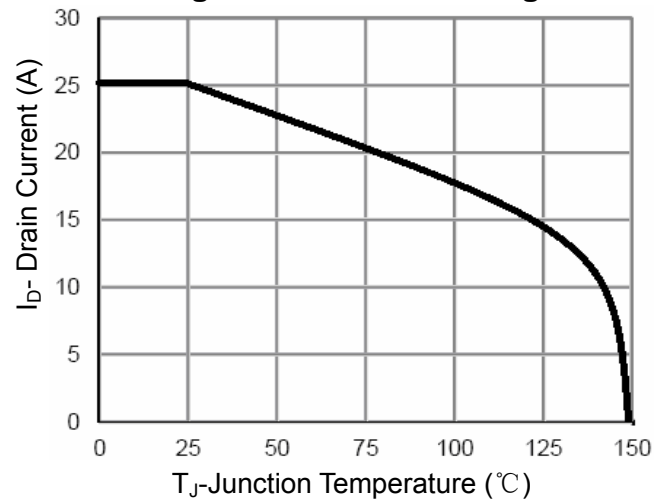


Figure 10 Current De-rating

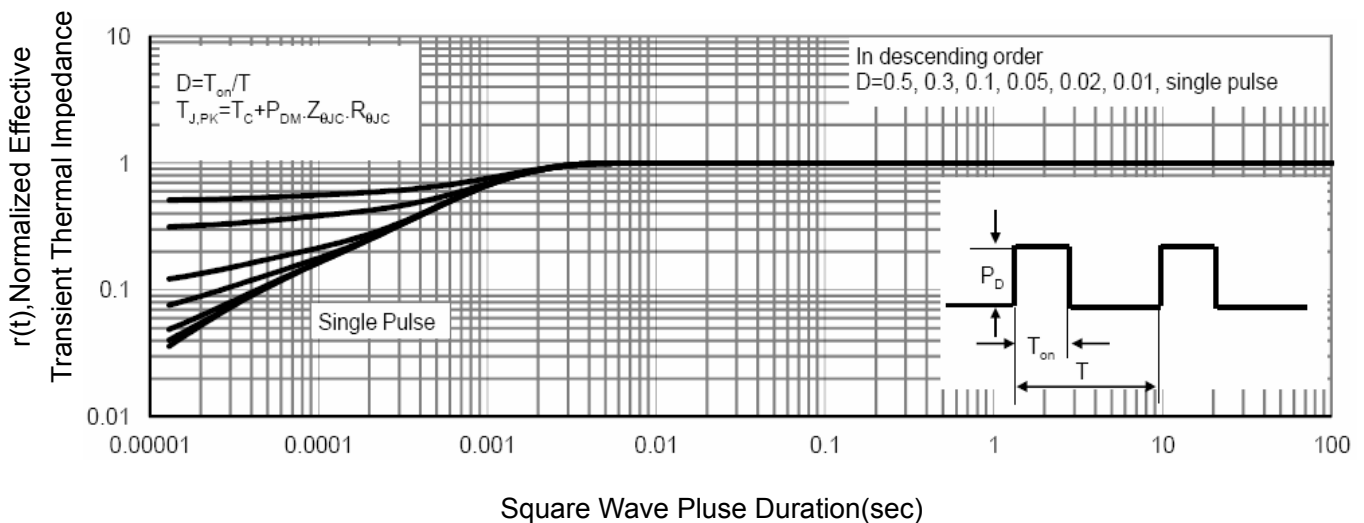


Figure 11 Normalized Maximum Transient Thermal Impedance

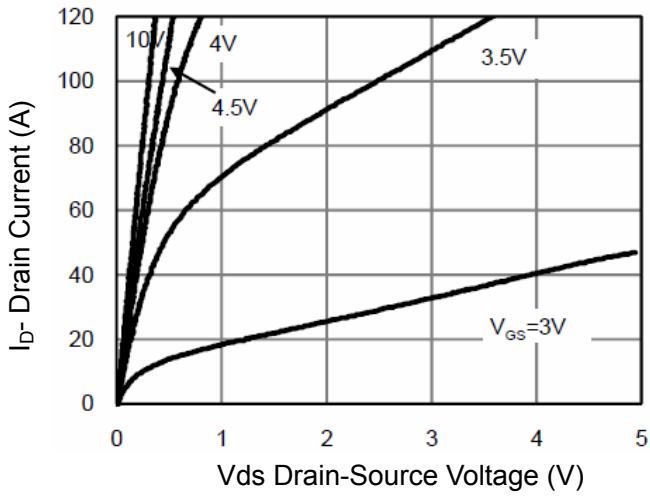
**Q2 Electrical Characteristics (TC=25°C unless otherwise noted)**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	30		-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=30V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 10$	$\mu A$
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.2		2.2	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=40A$	-	3.9	4.4	m $\Omega$
		$V_{GS}=4.5V, I_D=40A$	-	5.1	5.6	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=40A$		30	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	$C_{iss}$	$V_{DS}=15V, V_{GS}=0V,$ $F=1.0MHz$	-	2200	2640	PF
Output Capacitance	$C_{oss}$		-	807	906	PF
Reverse Transfer Capacitance	$C_{rss}$		-	22.7	27	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=15V, I_D=40A$ $V_{GS}=10V, R_G=1.6\Omega$	-	8	-	nS
Turn-on Rise Time	$t_r$		-	4.5	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	29	-	nS
Turn-Off Fall Time	$t_f$		-	8.5	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=15V, I_D=40A,$ $V_{GS}=10V$	-	34.6	38	nC
Gate-Source Charge	$Q_{gs}$		-	7.8		nC
Gate-Drain Charge	$Q_{gd}$		-	3.5		nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=40A$	-		1.2	V
Diode Forward Current	$I_S$		-	-	75	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^\circ C, I_F = I_S$ $di/dt = 500A/\mu s$ (Note 3)	-	16	-	nS
Reverse Recovery Charge	$Q_{rr}$		-	35	-	nC

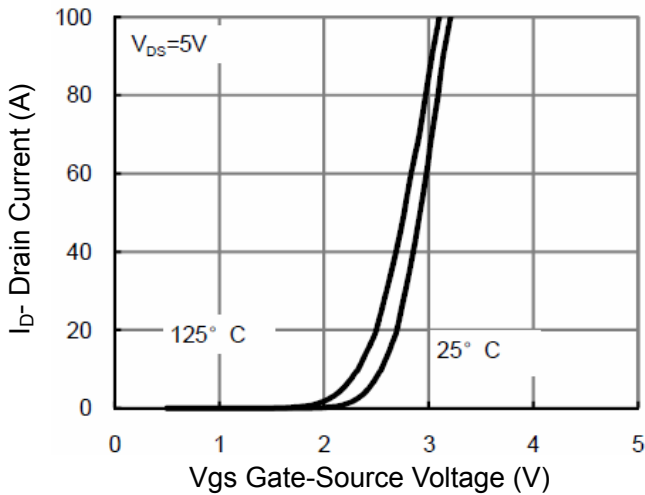
**Notes:**

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
5. EAS condition :  $T_J=25^\circ C, V_{DD}=15V, V_G=10V, L=0.5mH, R_g=25\Omega$

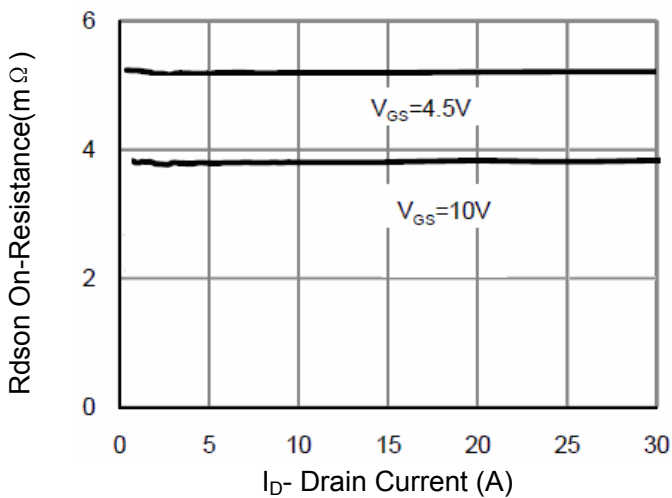
**Q2 Typical Electrical and Thermal Characteristics**



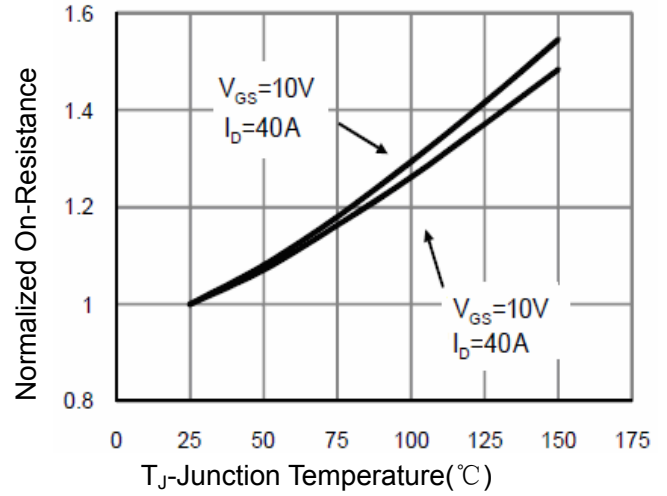
**Figure 1 Output Characteristics**



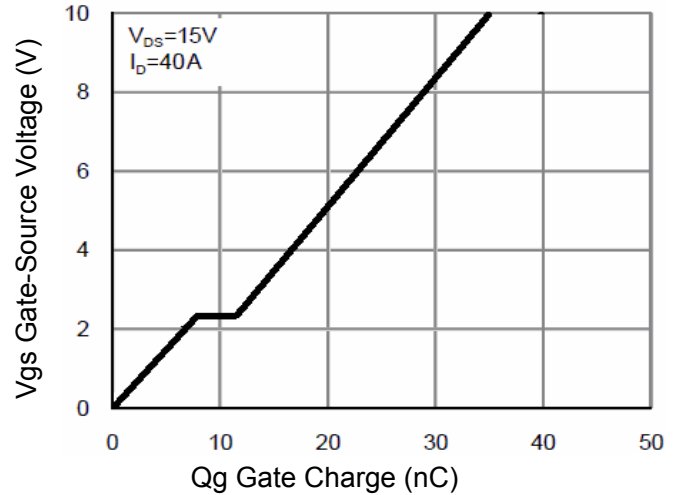
**Figure 2 Transfer Characteristics**



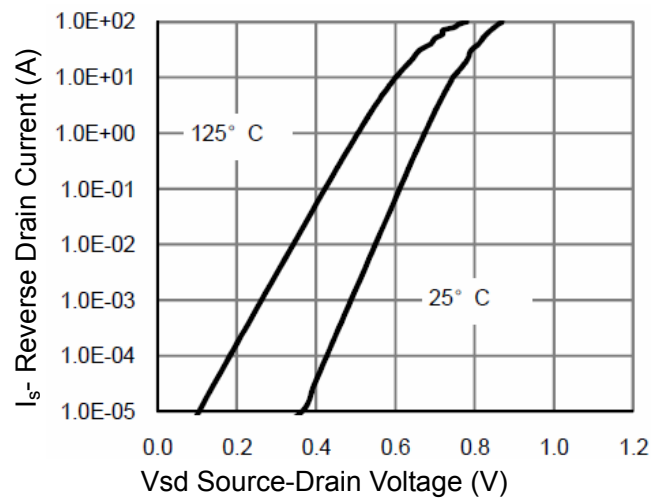
**Figure 3 Rdson- Drain Current**



**Figure 4 Rdson-Junction Temperature**



**Figure 5 Gate Charge**



**Figure 6 Source- Drain Diode Forward**

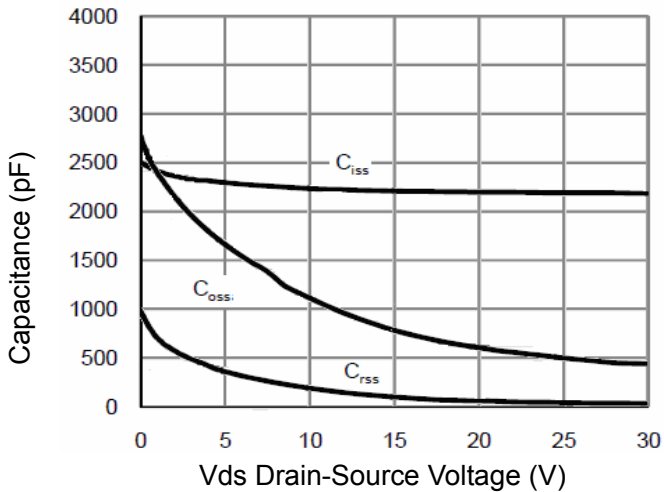


Figure 7 Capacitance vs Vds

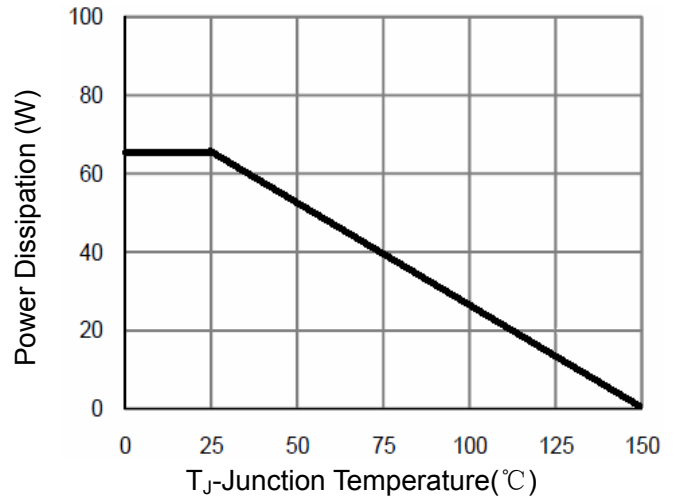


Figure 9 Power De-rating

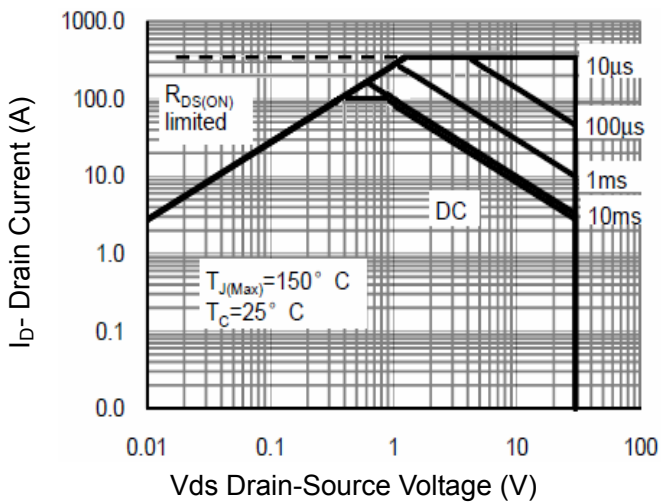


Figure 8 Safe Operation Area

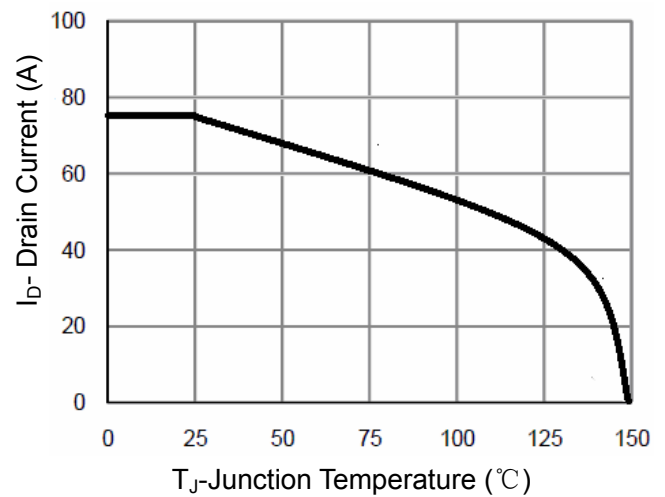


Figure 10 Current De-rating

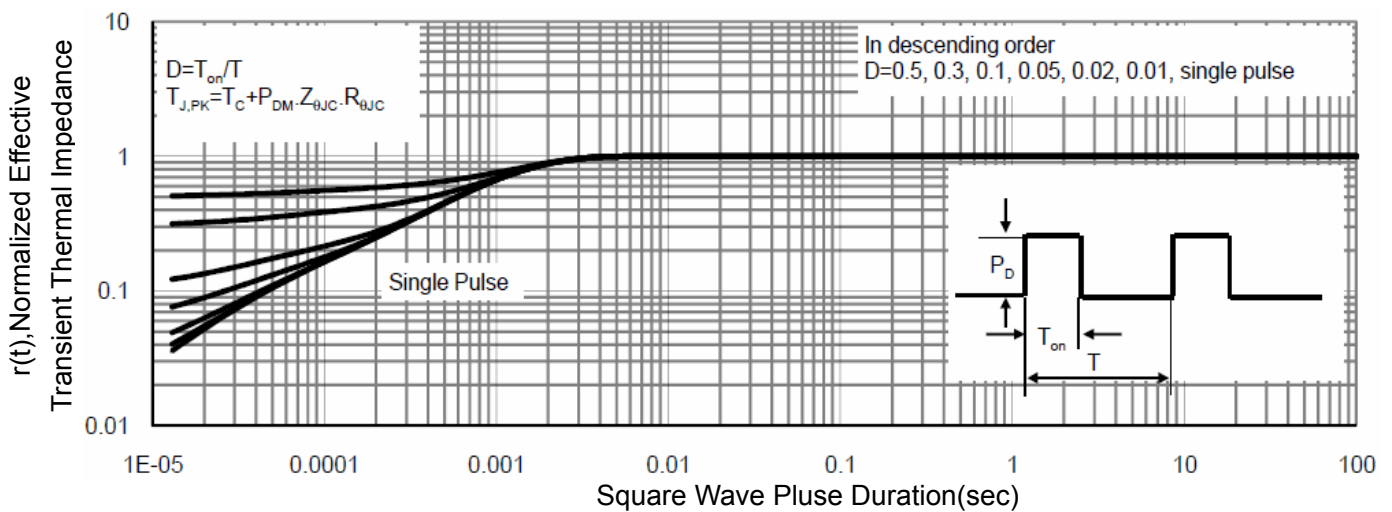
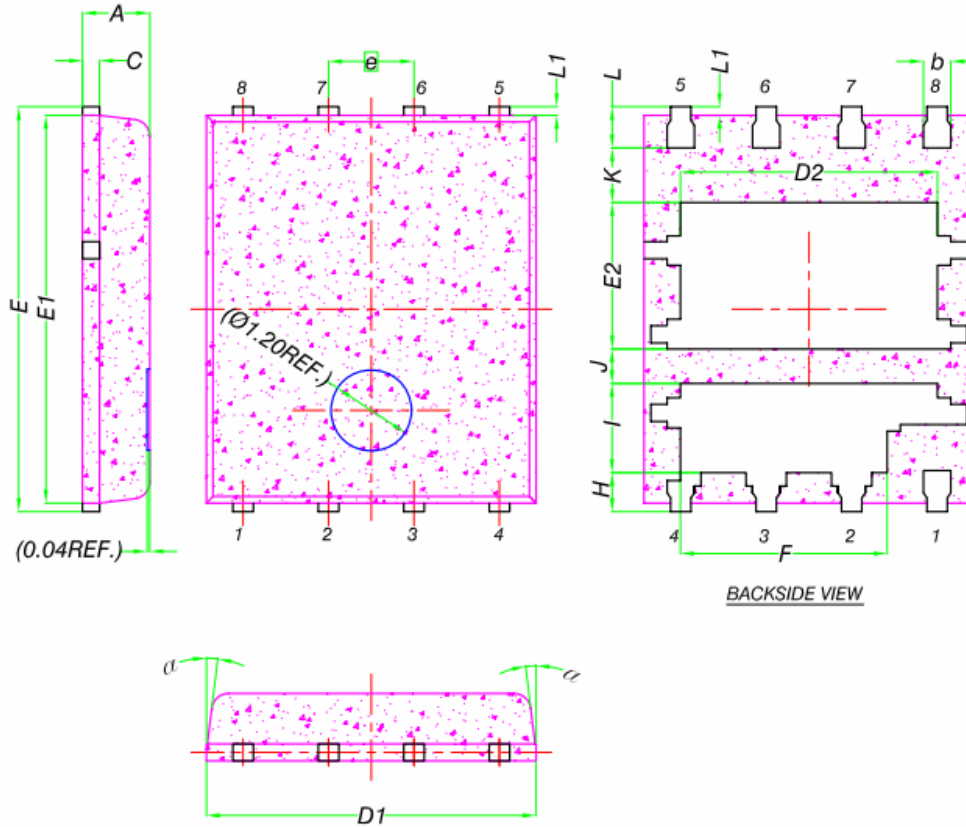


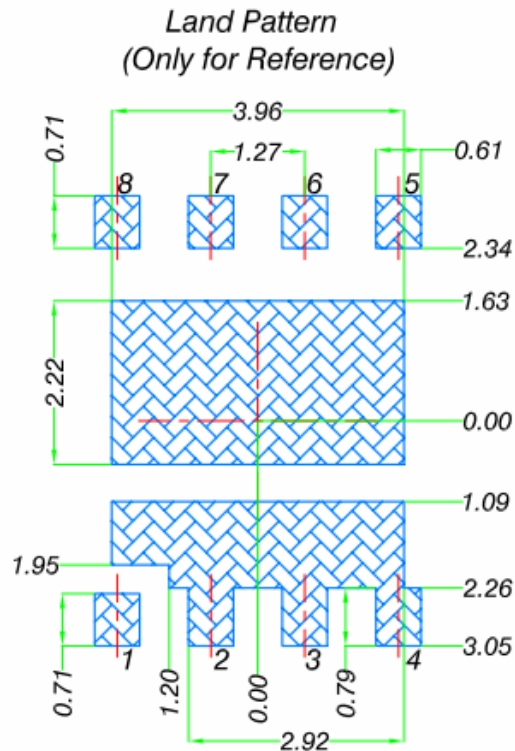
Figure 11 Normalized Maximum Transient Thermal Impedance



DFN5X6-8L Package Information



DIM.	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
b	0.33	0.41	0.51
C	0.20	0.25	0.30
D1	4.80	4.90	5.00
D2	3.61	3.81	3.96
E	5.90	6.00	6.10
E1	5.70	5.75	5.80
E2	2.02	2.17	2.32
$e$	1.27 BSC		
F	2.87	3.07	3.22
H	0.48	0.58	0.68
I	1.22	1.32	1.42
J	0.40	0.50	0.60
K	0.50	-	-
L	0.51	0.61	0.71
L1	0.06	0.13	0.20
$\alpha$	0°	-	12°





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