

30V Half Bridge Dual N-Channel Enhancement Mode Power MOSFET

Description

The NCEB301Q is designed to provide a high efficiency synchronous buck power stage with optimal layout and board space utilization. It includes two specialized MOSFETs in a dual Power DFN3X3 package. The Q1 "High Side" MOSFET is designed to minimize switching losses. The Q2 "Low Side" MOSFET uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge.

General Features

Q1 "High Side" MOSFET

$V_{DS} = 30V, I_D = 15A$

$R_{DS(ON)} < 11.5m\Omega @ V_{GS}=10V$

$R_{DS(ON)} < 19m\Omega @ V_{GS}=4.5V$

- Excellent gate charge x $R_{DS(on)}$ product(FOM)
- Very low on-resistance $R_{DS(on)}$
- 150 °C operating temperature
- Pb-free lead plating
- 100% UIS tested

Application

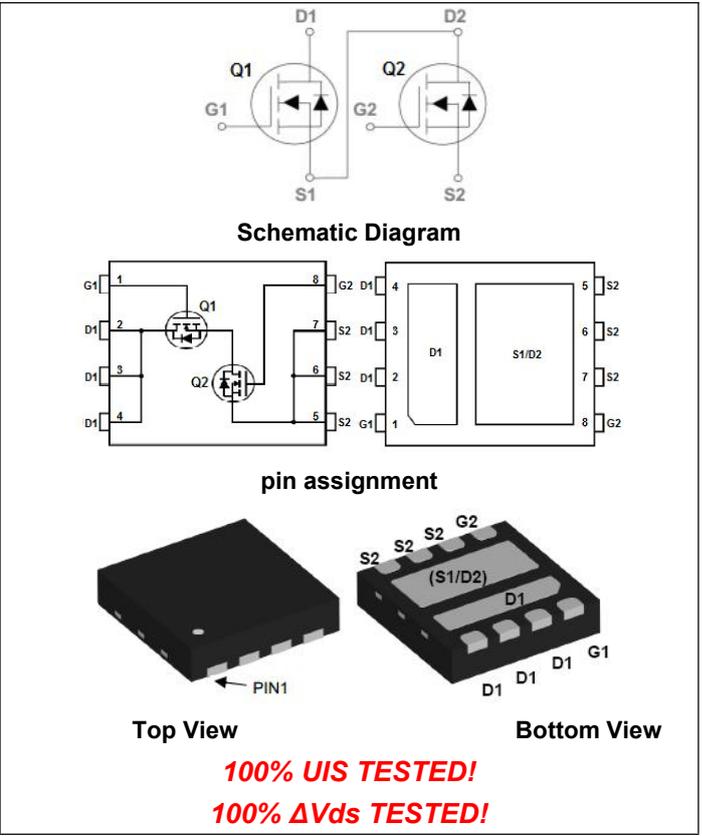
- Compact DC/DC converter applications

Q2 "Low Side" MOSFET

$V_{DS} = 30V, I_D = 20A$

$R_{DS(ON)} < 8.2m\Omega @ V_{GS}=10V$

$R_{DS(ON)} < 13m\Omega @ V_{GS}=4.5V$



Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCEB301Q	NCEB301Q	DFN3X3-8L	-	-	-

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}	± 20	± 20	V
Drain Current-Continuous (Note 2)	I_D	$T_C=25^\circ C$	15	20
		$T_C=100^\circ C$	10.6	14.1
Drain Current -Pulsed (Note 1)	I_{DM}	60	80	A
Power Dissipation	P_D	18	20	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)	$R_{\theta JC}$	6.5	7	$^\circ C/W$
Thermal Resistance, Junction-to-Case (Note 2) (Q2)	$R_{\theta JC}$	6	6.3	$^\circ C/W$

Q1 Electrical Characteristics (T_c=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	-	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =30V, V _{GS} =0V	-	-	1	μA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =250μA	1.0	1.5	2.2	V
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} =10V, I _D =10A	-	9.8	11.5	mΩ
		V _{GS} =4.5V, I _D =10A	-	15.3	19	mΩ
Gate resistance	R _g	V _{DS} =0V, V _{GS} =0V, F=1.0MHz	1.0	2.8	4.3	Ω
Forward Transconductance	g _{FS}	V _{DS} =5V, I _D =10A	-	12	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =15V, V _{GS} =0V, F=1.0MHz	-	690	-	pF
Output Capacitance	C _{oss}		-	105	-	pF
Reverse Transfer Capacitance	C _{rss}		-	80	-	pF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =15V, R _L =0.75Ω V _{GS} =10V, R _G =3Ω	-	5	-	nS
Turn-on Rise Time	t _r		-	3.5	-	nS
Turn-Off Delay Time	t _{d(off)}		-	19	-	nS
Turn-Off Fall Time	t _f		-	3.5	-	nS
Total Gate Charge	Q _g	V _{DS} =15V, I _D =10A, V _{GS} =10V	-	15	-	nC
Gate-Source Charge	Q _{gs}		-	2.5	-	nC
Gate-Drain Charge	Q _{gd}		-	3	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V, I _S =10A	-	-	1.2	V
Diode Forward Current (Note 2)	I _S		-	-	15	A
Reverse Recovery Time	t _{rr}	T _J = 25°C, I _F = 10A	-	19	-	nS
Reverse Recovery Charge	Q _{rr}	di/dt = 100A/μs (Note3)	-	10	-	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_j=25°C, V_{DD}=15V, V_G=10V, L=0.5mH, R_g=25Ω

Q1 Typical Electrical and Thermal Characteristics (Curves)

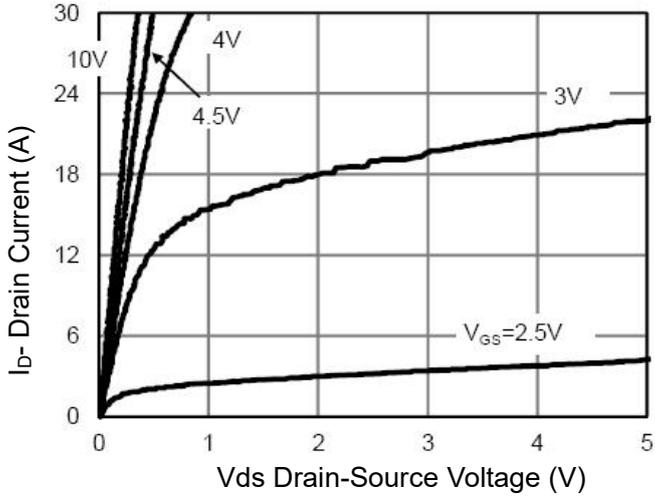


Figure 1 Output Characteristics

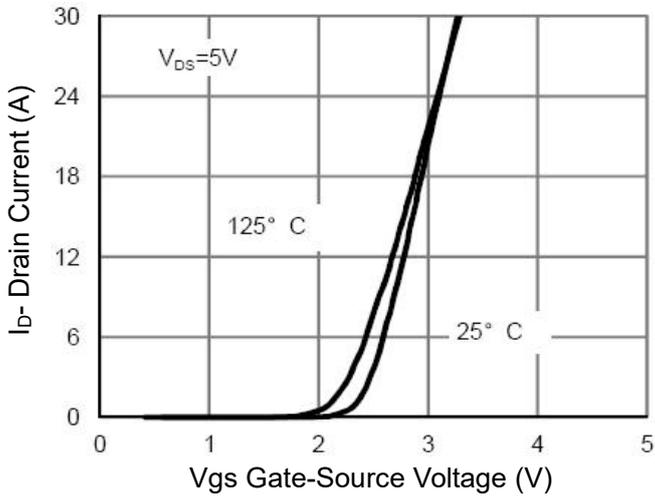


Figure 2 Transfer Characteristics

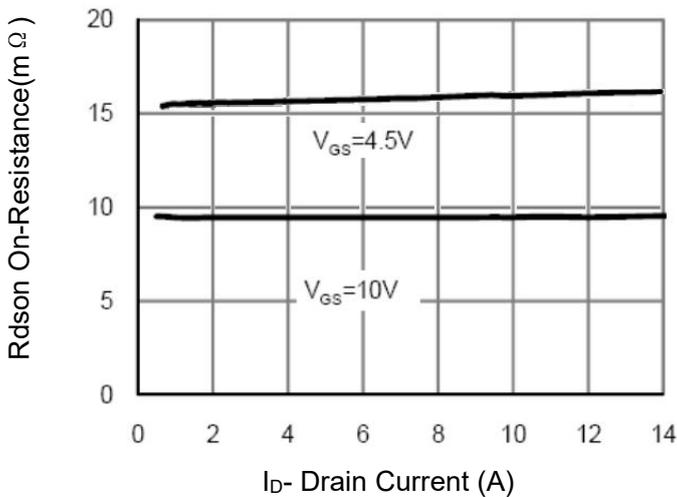


Figure 3 Rdson- Drain Current

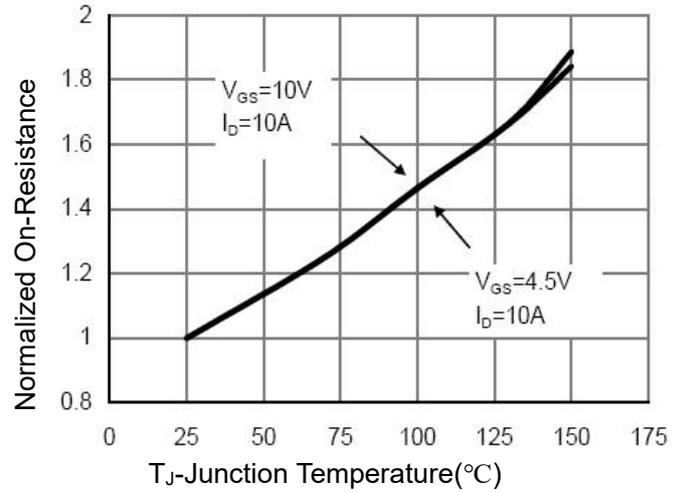


Figure 4 Rdson-Junction Temperature

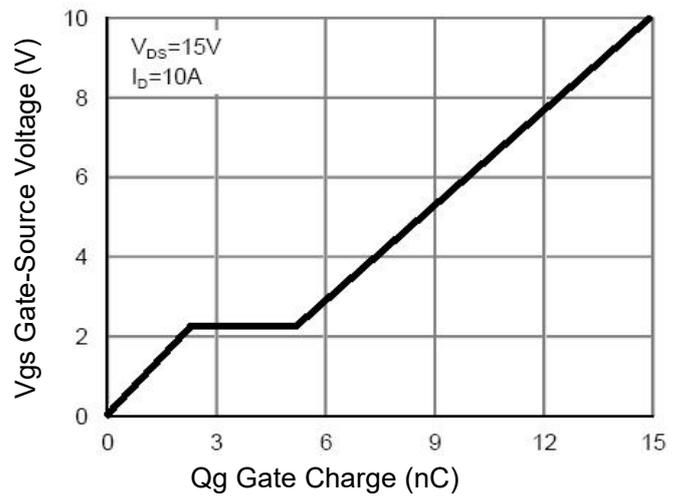


Figure 5 Gate Charge

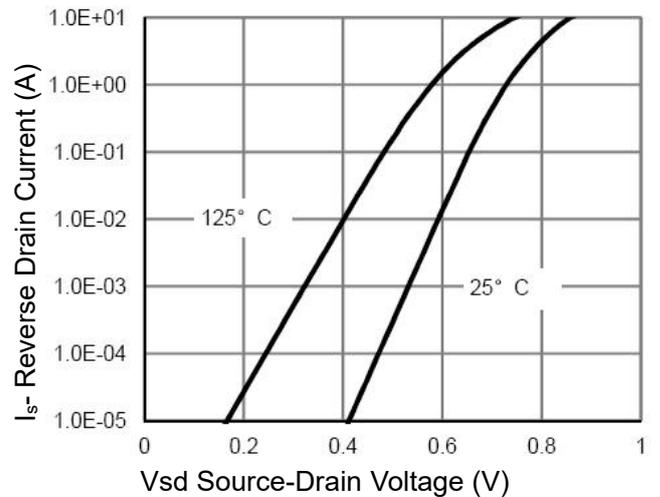


Figure 6 Source- Drain Diode Forward

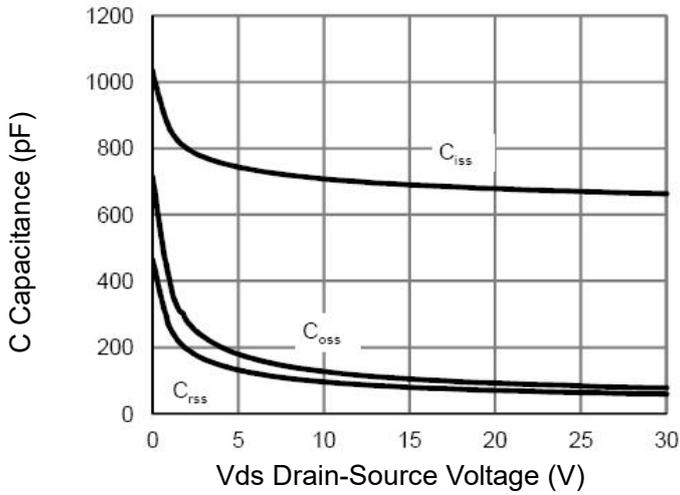


Figure 7 Capacitance vs Vds

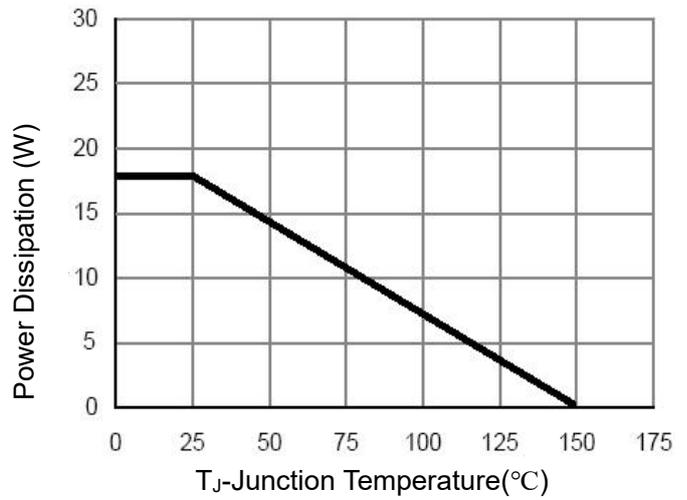


Figure 9 Power De-rating

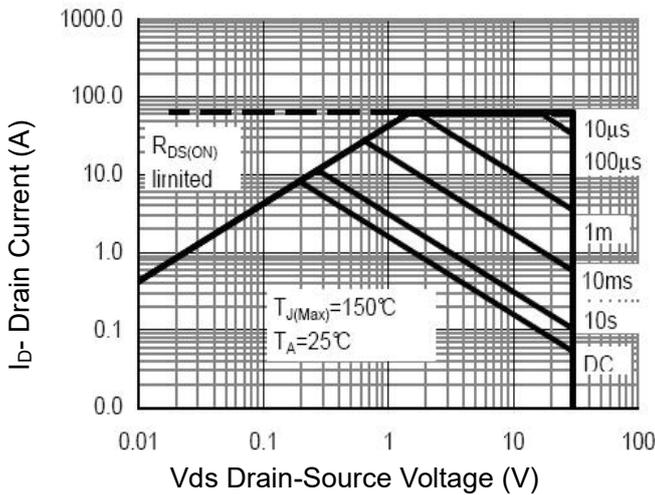


Figure 8 Safe Operation Area

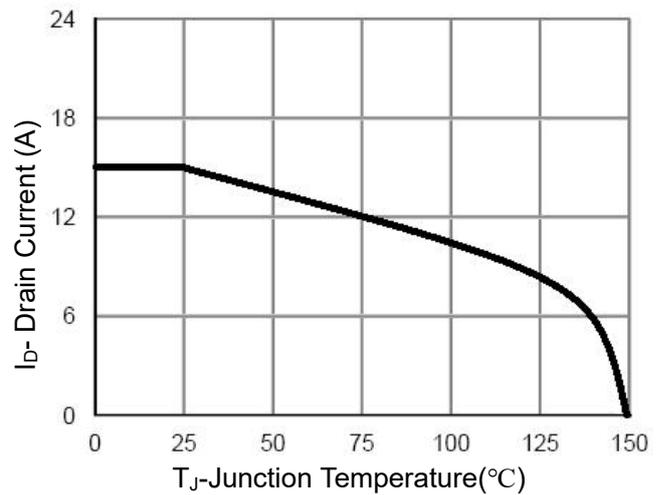


Figure 10 ID Current De-rating

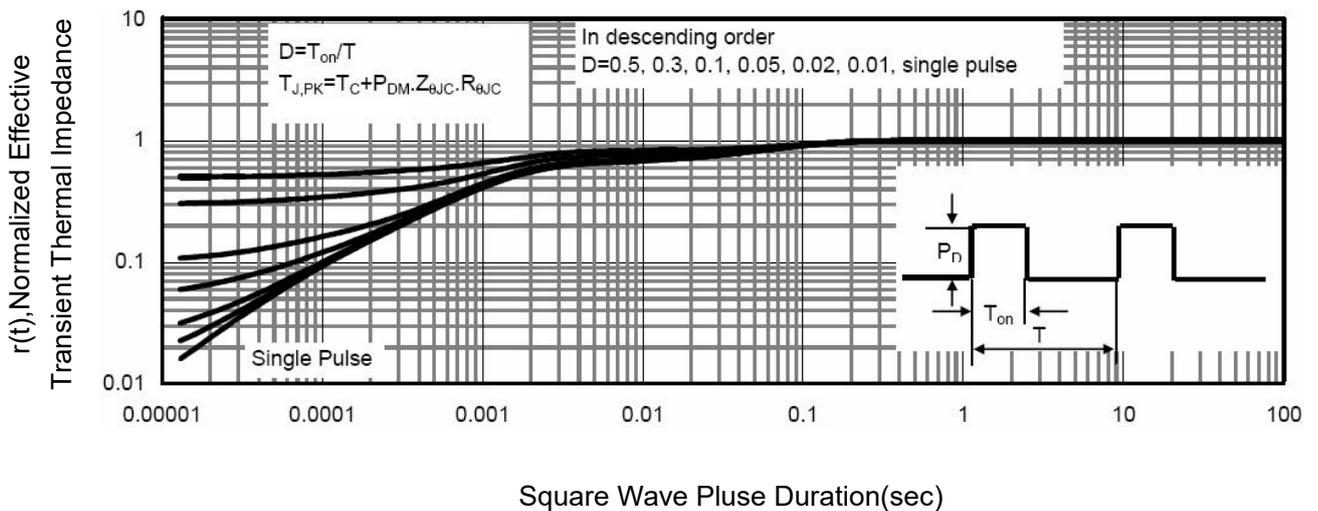


Figure 11 Normalized Maximum Transient Thermal Impedance

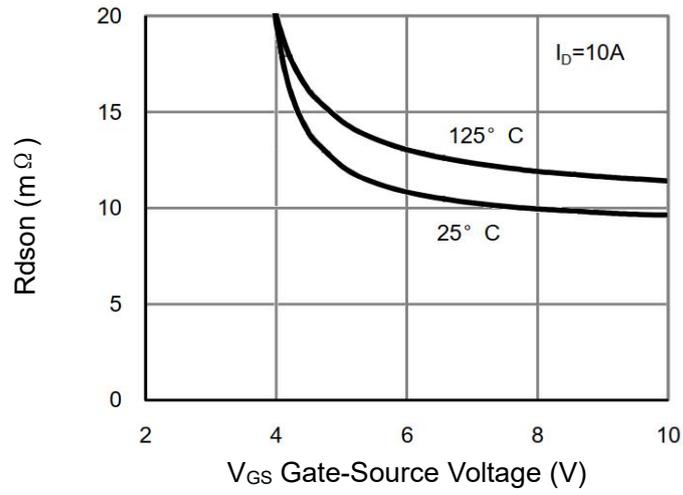


Figure 12 R_{dson} vs V_{GS}

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	30	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=30V, V_{GS}=0V$	-	-	1	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	± 100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.0	1.5	2.2	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=10A$	-	6.4	8.2	m Ω
		$V_{GS}=4.5V, I_D=10A$	-	10.0	13.0	m Ω
Gate resistance	R_g	$V_{DS}=0V, V_{GS}=0V, F=1.0MHz$	0.7	2.1	3.6	Ω
Forward Transconductance	g_{FS}	$V_{DS}=5V, I_D=10A$	-	15	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C_{iss}	$V_{DS}=15V, V_{GS}=0V,$ $F=1.0MHz$	-	960	-	pF
Output Capacitance	C_{oss}		-	157	-	pF
Reverse Transfer Capacitance	C_{rss}		-	140	-	pF
Switching Characteristics (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=15V, R_L=0.75\Omega$ $V_{GS}=10V, R_G=3\Omega$	-	5	-	nS
Turn-on Rise Time	t_r		-	12	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	19	-	nS
Turn-Off Fall Time	t_f		-	6	-	nS
Total Gate Charge	Q_g	$V_{DS}=15V, I_D=10A,$ $V_{GS}=10V$	-	24	-	nC
Gate-Source Charge	Q_{gs}		-	3	-	nC
Gate-Drain Charge	Q_{gd}		-	6	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V_{SD}	$V_{GS}=0V, I_S=10A$	-	-	1.2	V
Diode Forward Current (Note 2)	I_S		-	-	20	A
Reverse Recovery Time	t_{rr}	$T_J = 25^\circ C, I_F = 10A$	-	19	-	nS
Reverse Recovery Charge	Q_{rr}	$di/dt = 100A/\mu s$ (Note3)	-	10	-	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 (Curves)

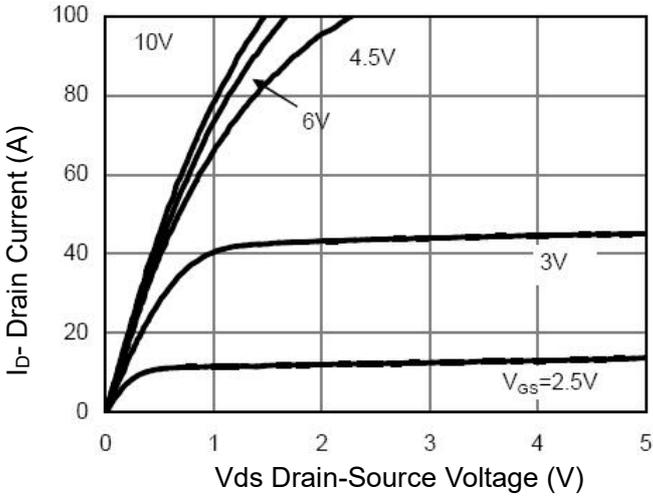


Figure 1 Output Characteristics

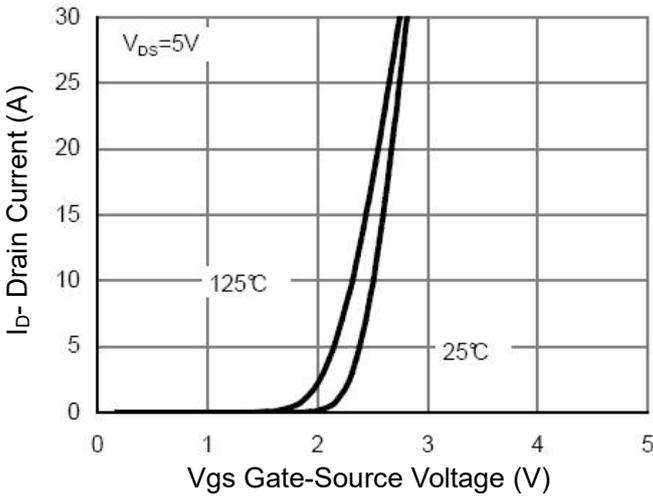


Figure 2 Transfer Characteristics

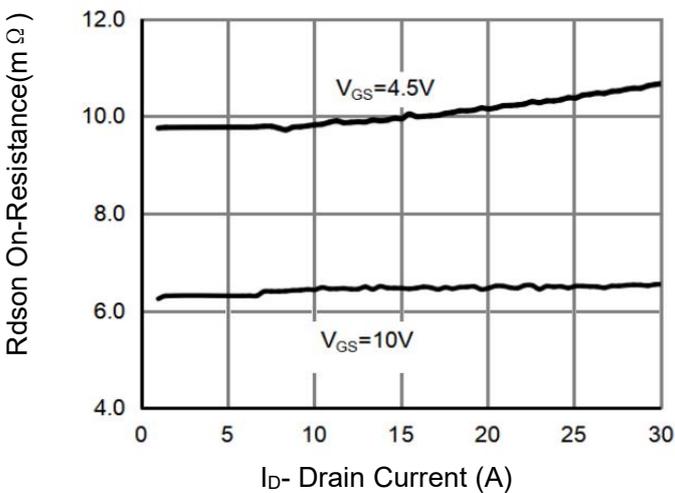


Figure 3 $R_{DS(on)}$ - Drain Current

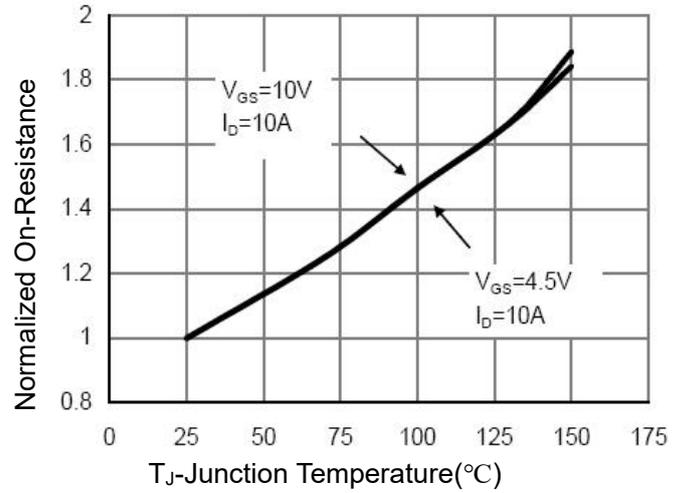


Figure 4 $R_{DS(on)}$ -Junction Temperature

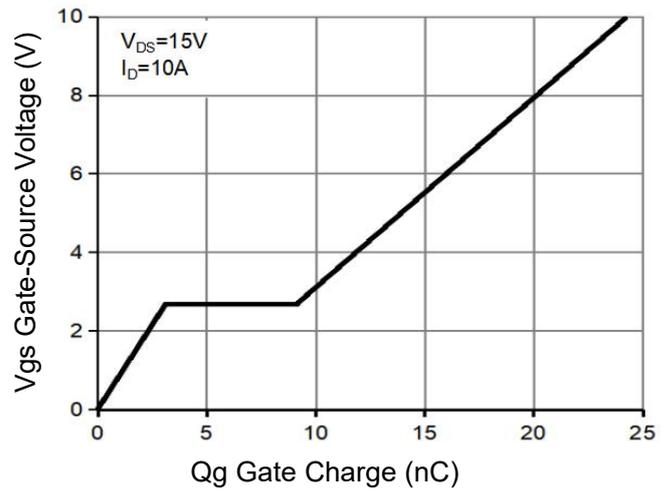


Figure 5 Gate Charge

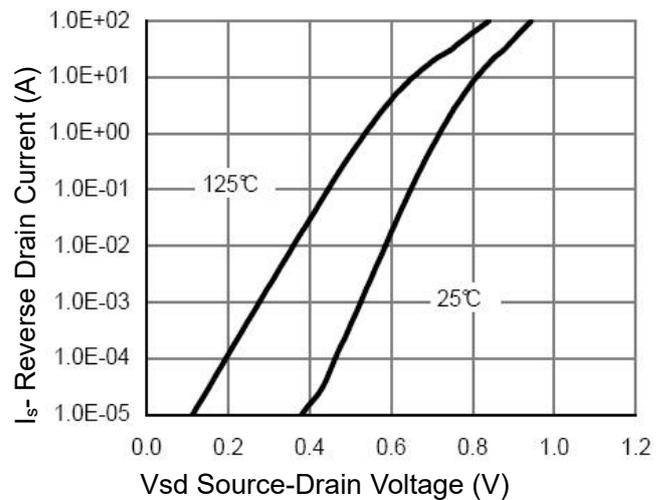


Figure 6 Source- Drain Diode Forward

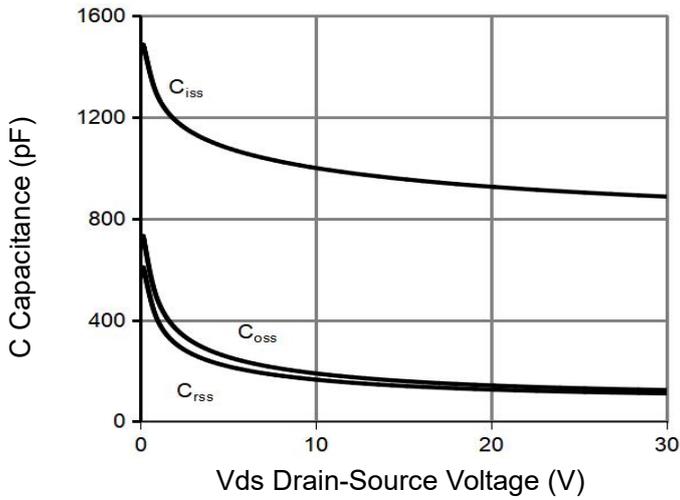


Figure 7 Capacitance vs Vds

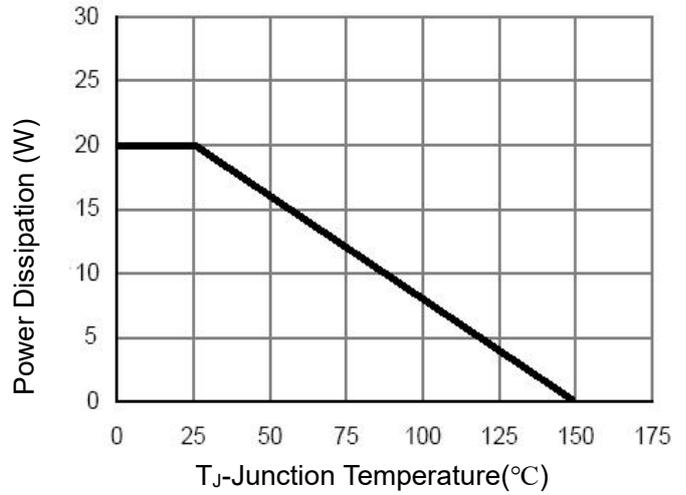


Figure 9 Power De-rating

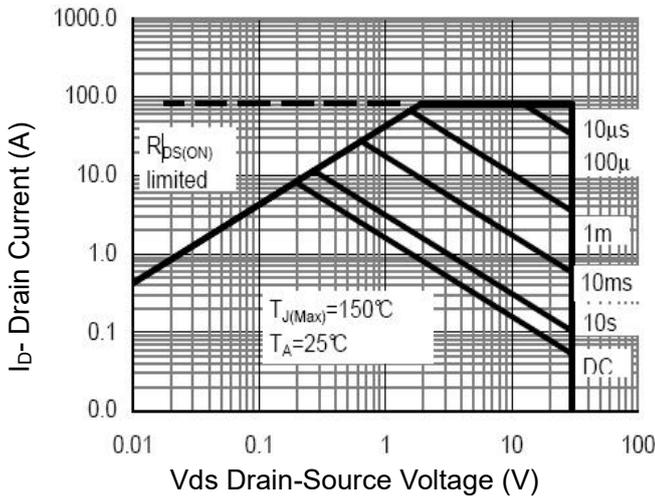


Figure 8 Safe Operation Area

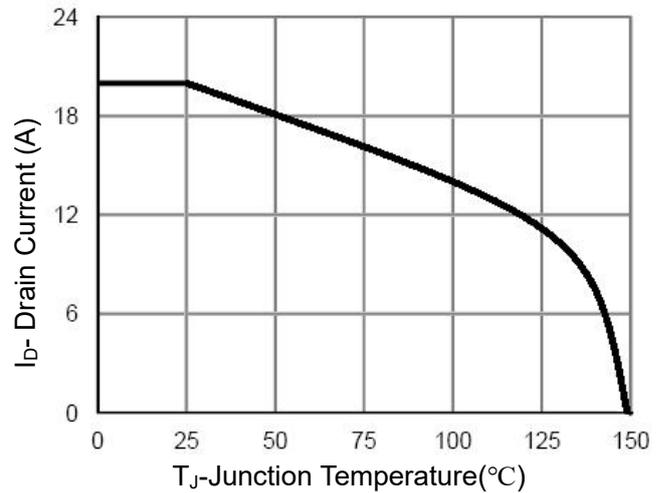


Figure 10 ID Current De-rating

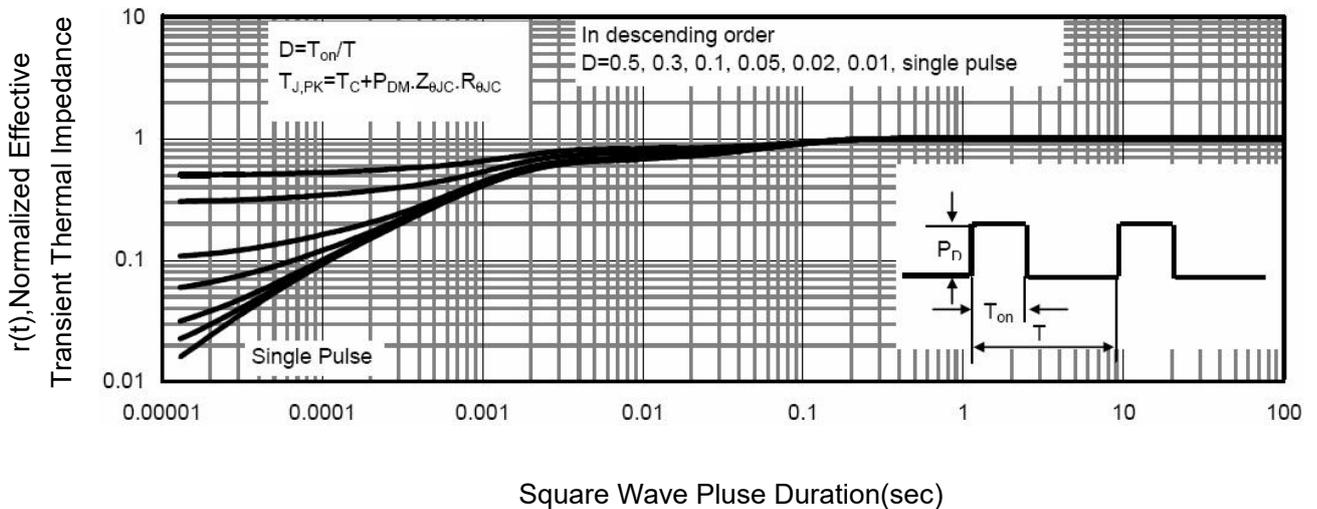
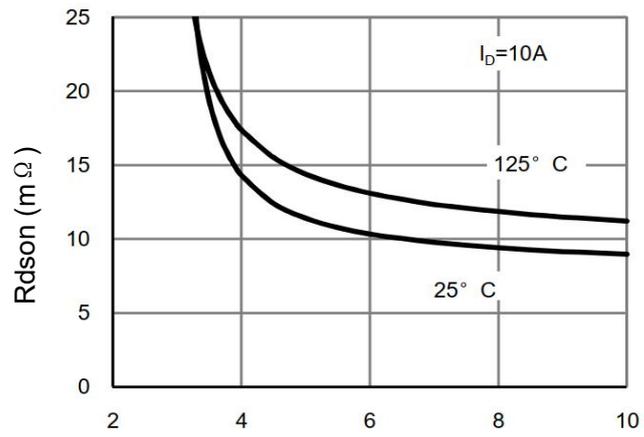
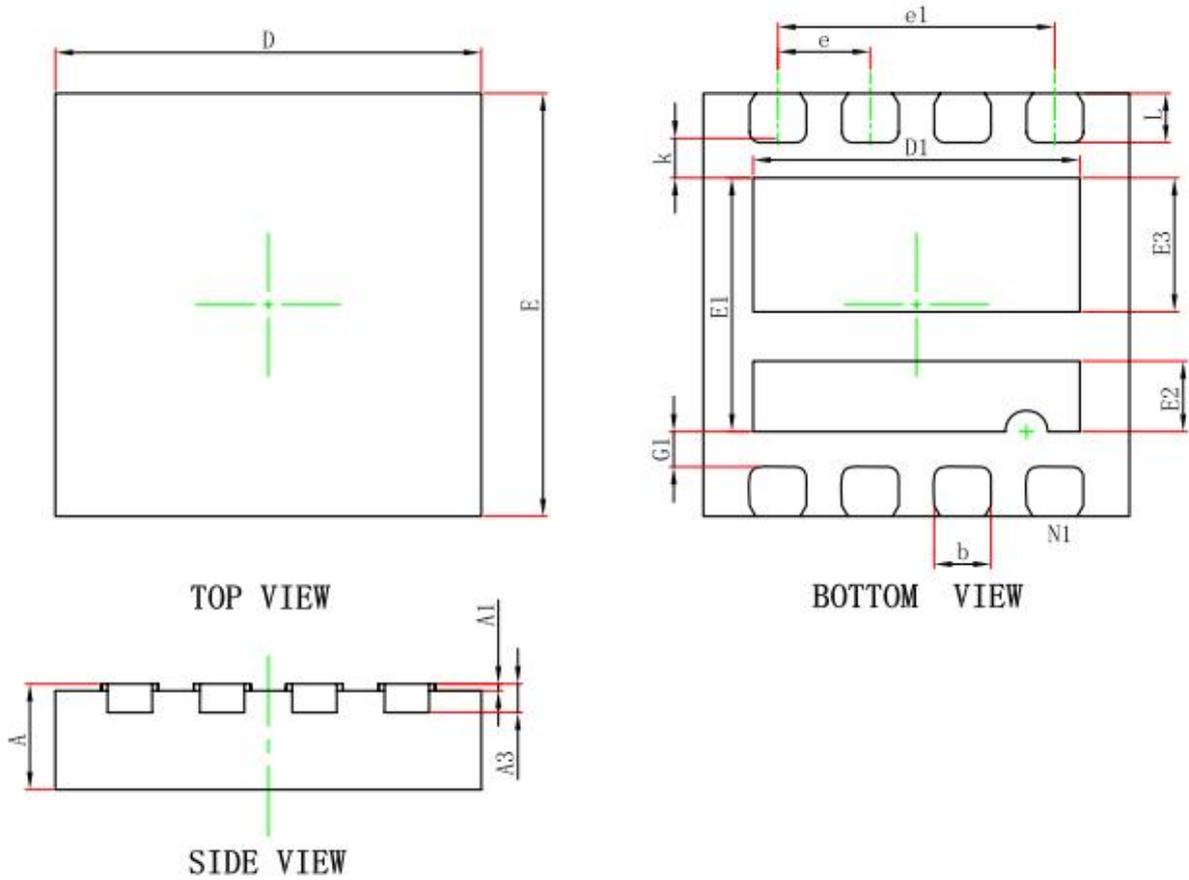


Figure 11 Normalized Maximum Transient Thermal Impedance



Vgs Gate-Source Voltage (V)
Figure 12 R_{dson} vs V_{gs}

DFN3X3-8L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	2.950	3.050	0.116	0.120
E	2.950	3.050	0.116	0.120
D1	2.250	2.350	0.089	0.093
E1	1.700	1.900	0.067	0.075
E2	0.450	0.550	0.018	0.022
E3	0.900	1.000	0.035	0.039
k	0.200	0.300	0.008	0.012
G1	0.200	0.300	0.008	0.012
b	0.350	0.450	0.014	0.018
e	0.650BSC		0.026BSC	
e1	1.95BSC		0.077BSC	
L	0.300	0.400	0.012	0.016

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