

## NCE N-Channel Enhancement Mode Power MOSFET

### Description

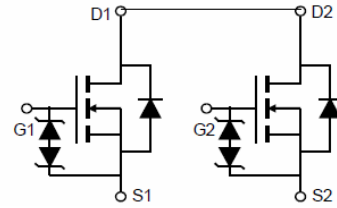
The NCE8651Q uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

### General Features

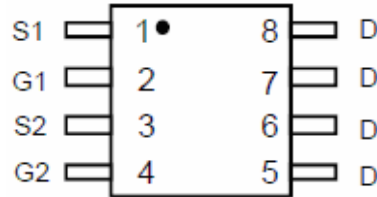
- $V_{DS} = 20V, I_D = 10A$   
 $R_{DS(ON)} < 11m\Omega @ V_{GS}=4.5V$   
 $R_{DS(ON)} < 11.5m\Omega @ V_{GS}=4V$   
 $R_{DS(ON)} < 12.5m\Omega @ V_{GS}=3.1V$   
 $R_{DS(ON)} < 15.5m\Omega @ V_{GS}=2.5V$
- High density cell design for ultra low  $R_{ds(on)}$
- Fully characterized avalanche voltage and current
- 2.5V Drive
- Common-drain type

### Application

- Battery protection switch
- Mobile device battery charging and discharging



Schematic diagram



Pin Assignment



DFN 3x3 top view

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCE8651Q	NCE8651Q	DFN 3x3	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	20	V
Gate-Source Voltage	$V_{GS}$	$\pm 12$	V
Drain Current-Continuous	$I_D$	10	A
Pulsed Drain Current	$I_{DM}$	32	A
Maximum Power Dissipation	$P_D$	1.5	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	$^\circ C$

### Thermal Characteristic

Thermal Resistance, Junction-to-Ambient <sup>(Note 2)</sup>	$R_{\theta JA}$	83	$^\circ C/W$
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**Electrical Characteristics (TC=25°C unless otherwise noted)**

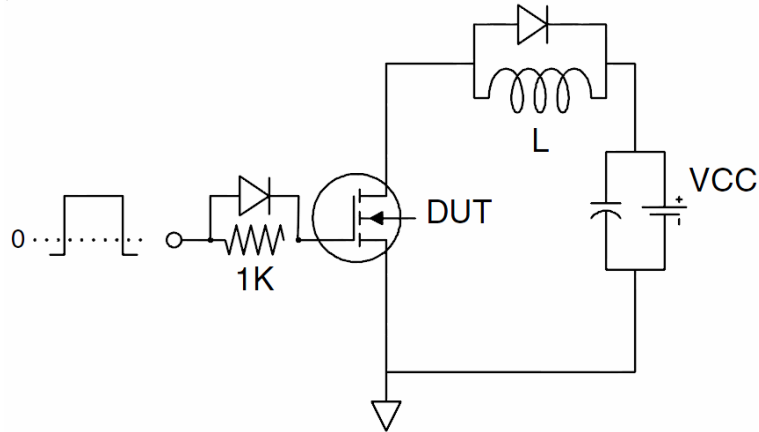
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	20		-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=20V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 10V, V_{DS}=0V$	-	-	$\pm 10$	$\mu A$
<b>On Characteristics (Note 3)</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	0.5	0.7	1	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=4.5V, I_D=10A$	-	7.2	11	m $\Omega$
		$V_{GS}=4V, I_D=5A$	-	7.4	11.5	
		$V_{GS}=3.1V, I_D=5A$		7.8	12.5	
		$V_{GS}=2.5V, I_D=2.5A$		8.6	15.5	
Forward Transconductance	$g_{FS}$	$V_{DS}=10V, I_D=5A$	5	-	-	S
<b>Dynamic Characteristics (Note 4)</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=10V, V_{GS}=0V,$ $F=1.0MHz$	-	1255	-	PF
Output Capacitance	$C_{oss}$		-	220	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	168	-	PF
<b>Switching Characteristics (Note 4)</b>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=10V, I_D=5A$ $V_{GS}=10V, R_{GEN}=50\Omega$	-	300	-	nS
Turn-on Rise Time	$t_r$		-	1000	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	4000	-	nS
Turn-Off Fall Time	$t_f$		-	2500	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=10V, I_D=10A,$ $V_{GS}=10V$	-	29	-	nC
Gate-Source Charge	$Q_{gs}$		-	5.2	-	nC
Gate-Drain Charge	$Q_{gd}$		-	6.3	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=10A$	-	0.85	1.2	V
Diode Forward Current (Note 2)	$I_S$		-	-	10	A

**Notes:**

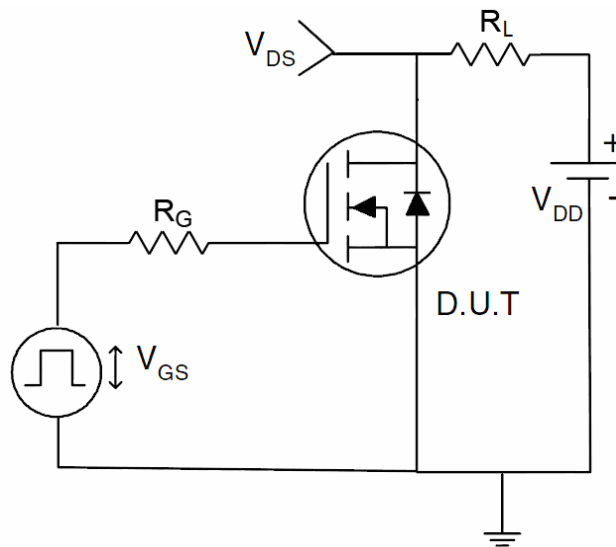
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production

## Test Circuit

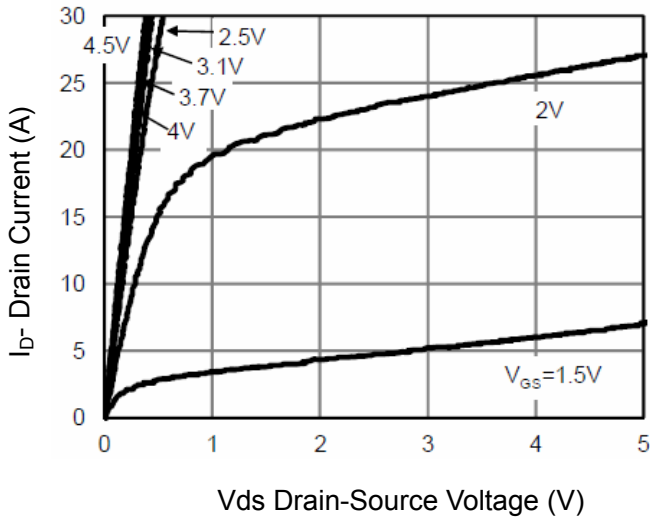
### 1) Gate Charge Test Circuit



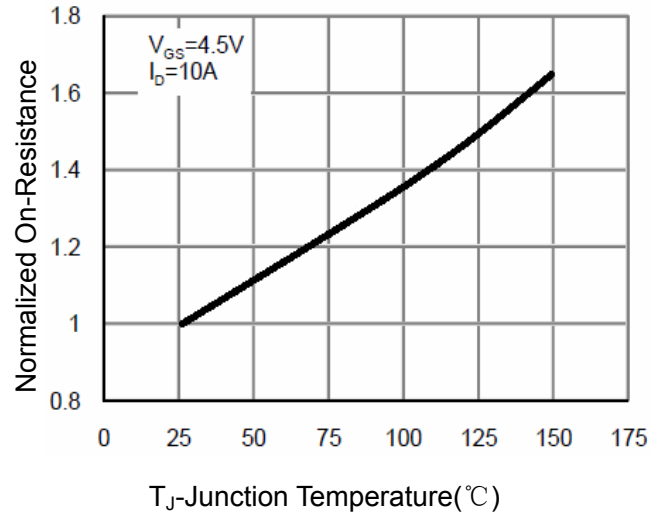
### 2) Switch Time Test Circuit



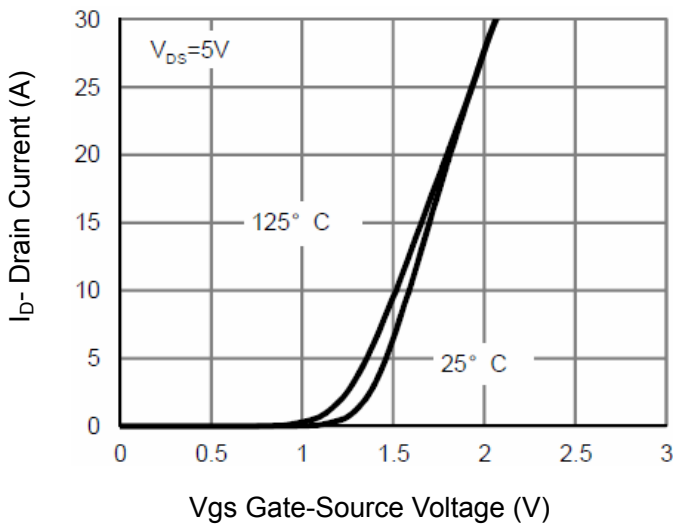
## Typical Electrical and Thermal Characteristics (Curves)



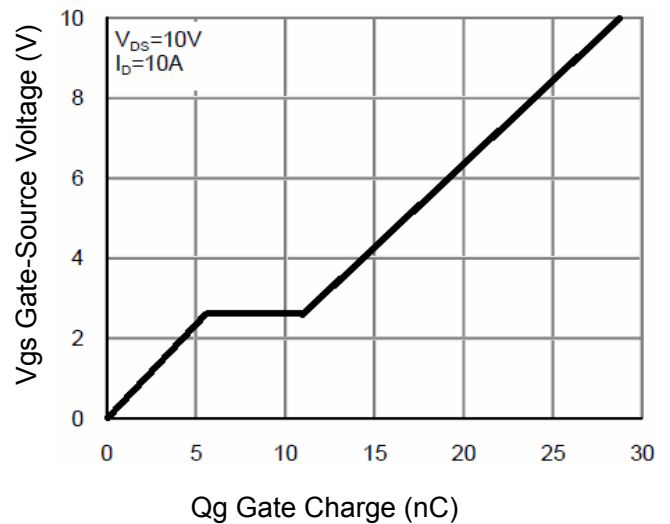
**Figure 1 Output Characteristics**



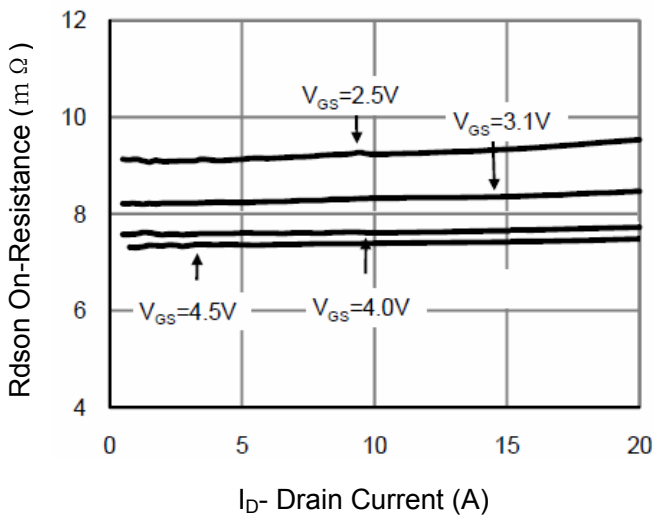
**Figure 4  $R_{dson}$ -Junction Temperature**



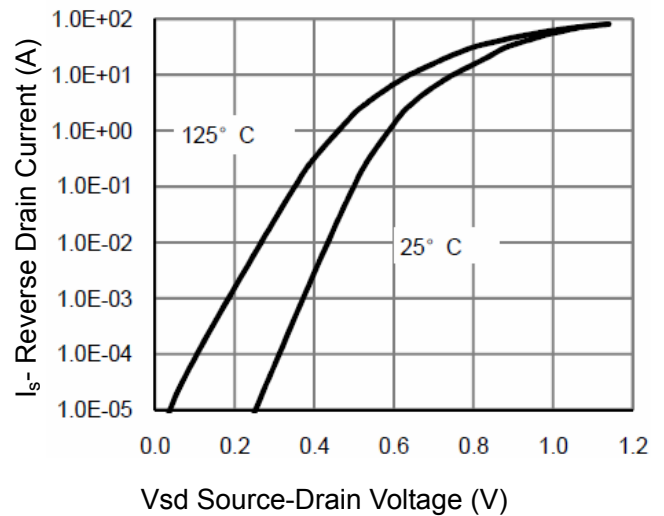
**Figure 2 Transfer Characteristics**



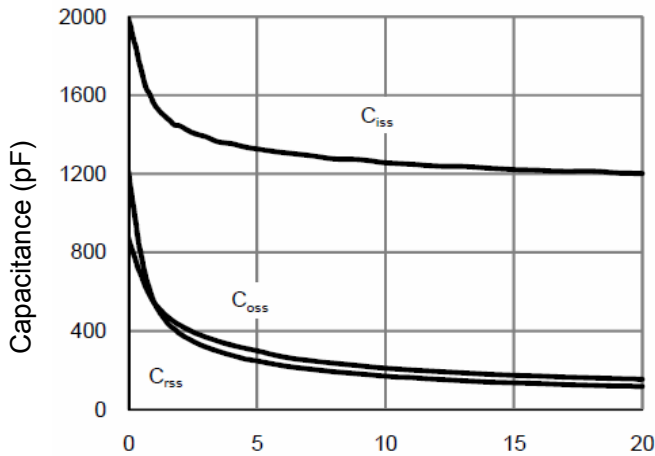
**Figure 5 Gate Charge**



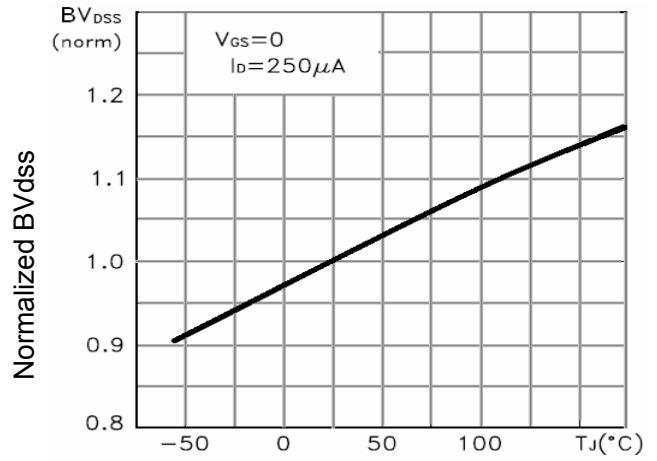
**Figure 3  $R_{dson}$ - Drain Current**



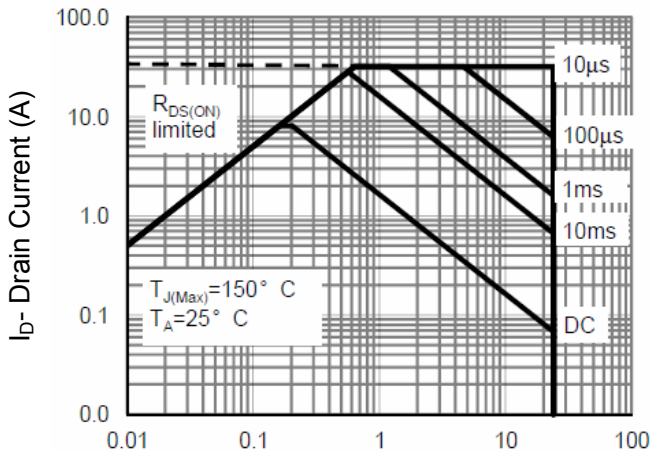
**Figure 6 Source- Drain Diode Forward**



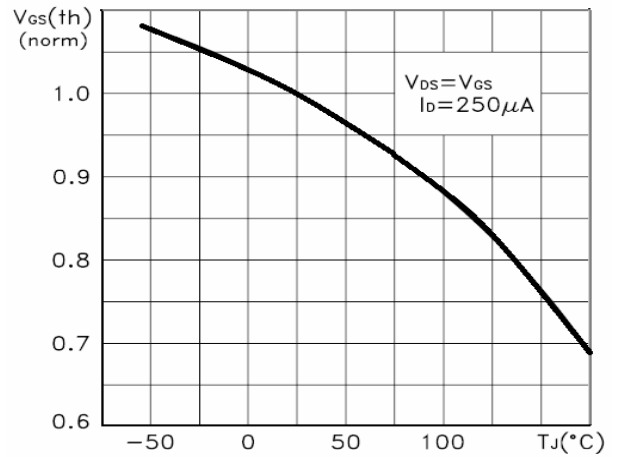
Vds Drain-Source Voltage (V)  
**Figure 7 Capacitance vs Vds**



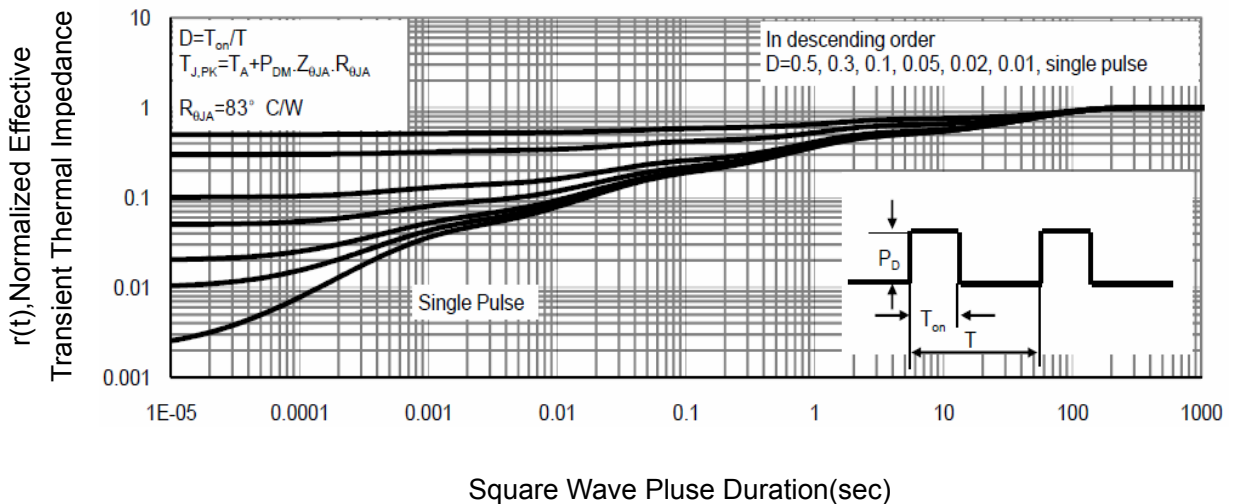
T<sub>J</sub>-Junction Temperature(°C)  
**Figure 9 BV<sub>DSS</sub> vs Junction Temperature**



Vds Drain-Source Voltage (V)  
**Figure 8 Safe Operation Area**

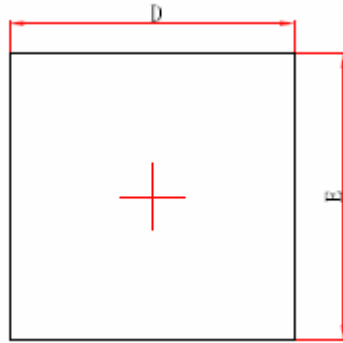


T<sub>J</sub>-Junction Temperature(°C)  
**Figure 10 V<sub>GS(th)</sub> vs Junction Temperature**

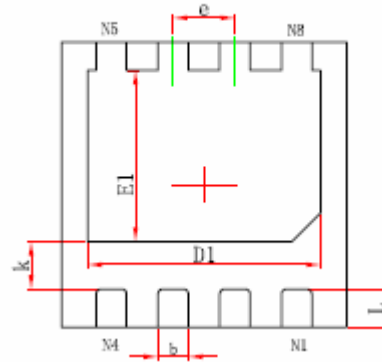


Square Wave Pulse Duration(sec)  
**Figure 11 Normalized Maximum Transient Thermal Impedance**

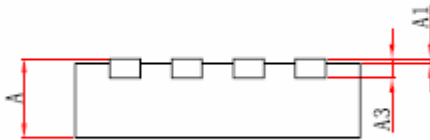
## DFN3X3 EP Package Information



**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	2.924	3.076	0.115	0.121
E	2.924	3.076	0.115	0.121
D1	2.350	2.550	0.093	0.100
E1	1.700	1.900	0.067	0.075
k	0.450	0.550	0.018	0.022
b	0.270	0.370	0.011	0.015
e	0.650TYP.		0.026TYP.	
L	0.324	0.476	0.013	0.019

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