

## NCE N-Channel Enhancement Mode Power MOSFET

### Description

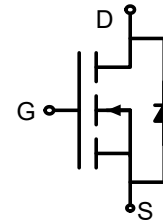
The NCE4003 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge. This device is suitable for use as a Battery protection or in other switching application.

### General Features

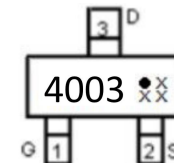
- $V_{DS} = 40V, I_D = 3A$   
 $R_{DS(ON)} = 33m\Omega @ V_{GS}=10V(Typ)$   
 $R_{DS(ON)} = 52m\Omega @ V_{GS}=4.5V(Typ)$
- High power and current handling capability
- Lead free product is acquired
- Surface mount package

### Application

- Battery switch
- DC/DC converter



Schematic Diagram



Marking and Pin Assignment



SOT-23 Top View

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
4003	NCE4003	SOT-23	Ø180mm	8 mm	3000 units

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	3	A
Drain Current-Pulsed (Note 1)	$I_{DM}$	10	A
Single pulse avalanche energy (Note 5)	$E_{AS}$	15	mJ
Maximum Power Dissipation	$P_D$	0.7	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	$^{\circ}C$

### Thermal Characteristic

Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	179	$^{\circ}C/W$
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## Electrical Characteristics ( $T_A=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =250μA	40	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =40V, 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
On Characteristics (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> =3A	-	33	40	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =1A	-	52	68	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =5V, I <sub>D</sub> =3A	-	6	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =20V, V <sub>GS</sub> =0V, F=1.0MHz	-	265	-	PF
Output Capacitance	C <sub>oss</sub>		-	35	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	32	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =20V, I <sub>D</sub> =3A V <sub>GS</sub> =10V, R <sub>GEN</sub> =1Ω	-	5	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	10	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	12	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	8	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =20V, I <sub>D</sub> =3A, V <sub>GS</sub> =10V	-	10.2	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	1.7	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	2.1	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =3A	-	-	1.2	V
Diode Forward Current (Note 2)	I <sub>S</sub>		-	-	3	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
5. EAS condition :  $T_J=25^{\circ}\text{C}, V_{DD}=20V, V_G=10V, L=0.5mH, R_g=25\Omega$

## Typical Electrical and Thermal Characteristics

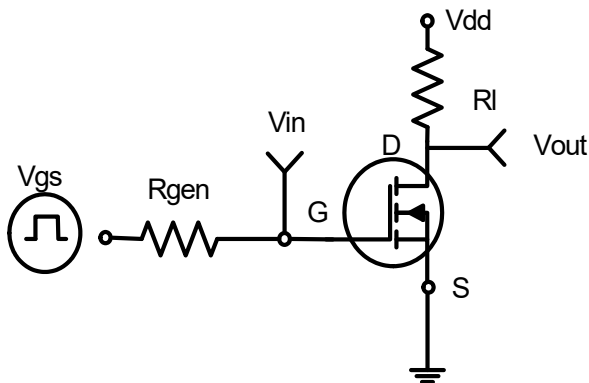


Figure 1: Switching Test Circuit

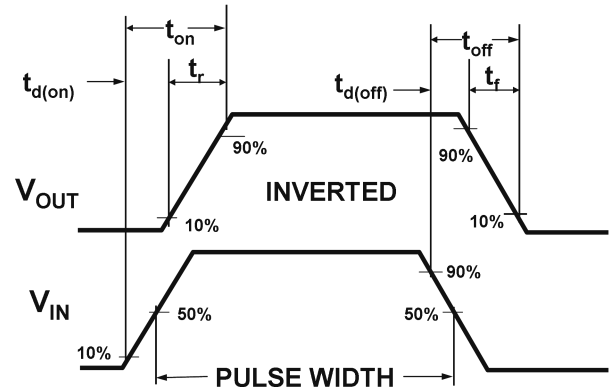


Figure 2: Switching Waveforms

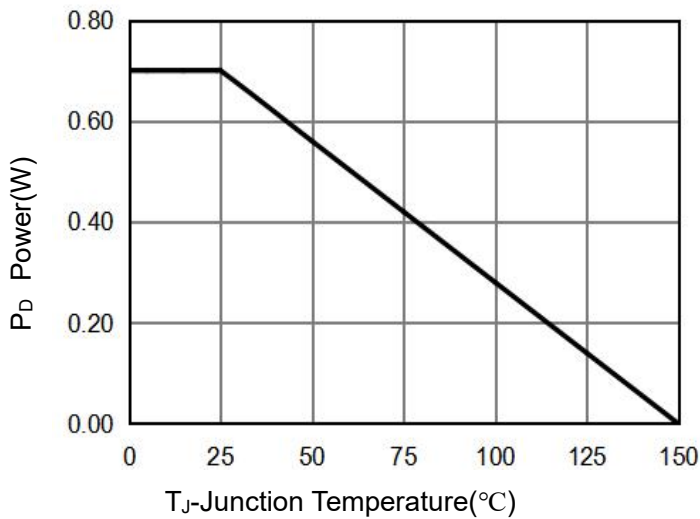


Figure 3 Power Dissipation

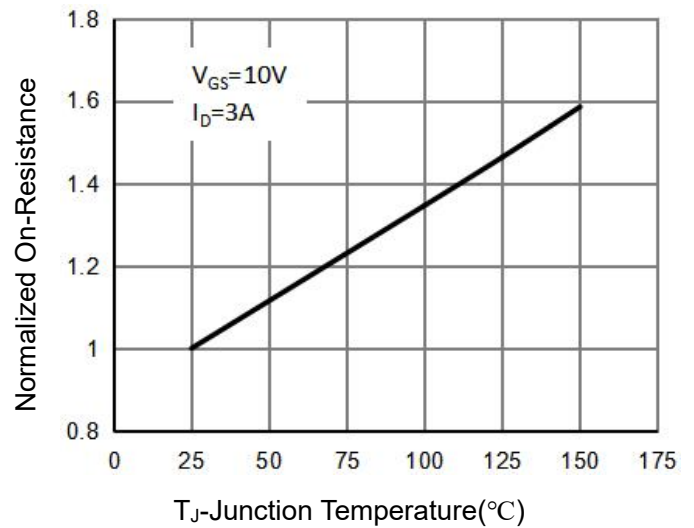


Figure 4 Drain-Source On-Resistance

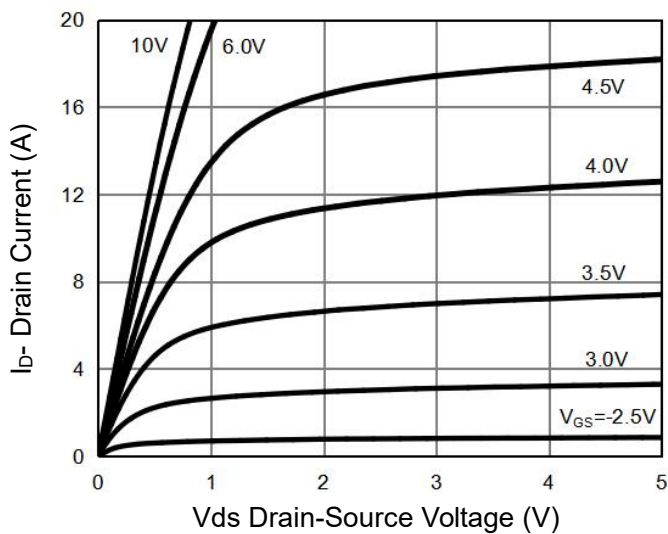


Figure 5 Output Characteristics

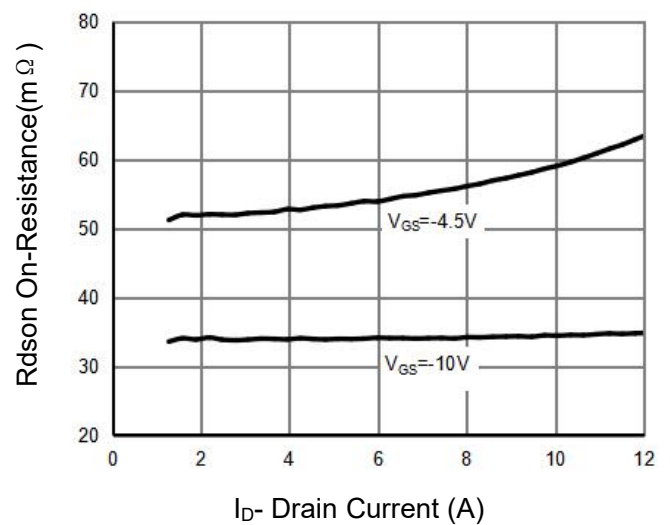
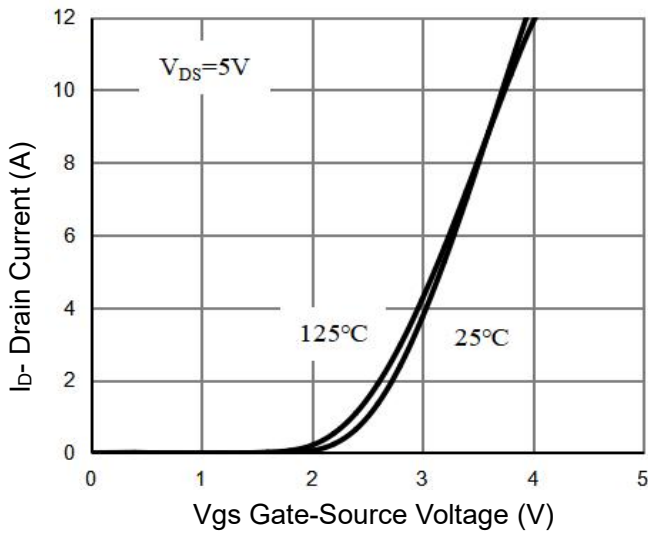
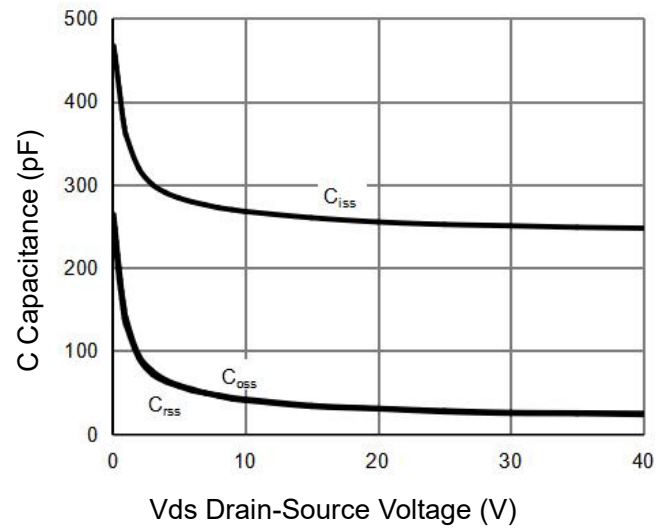


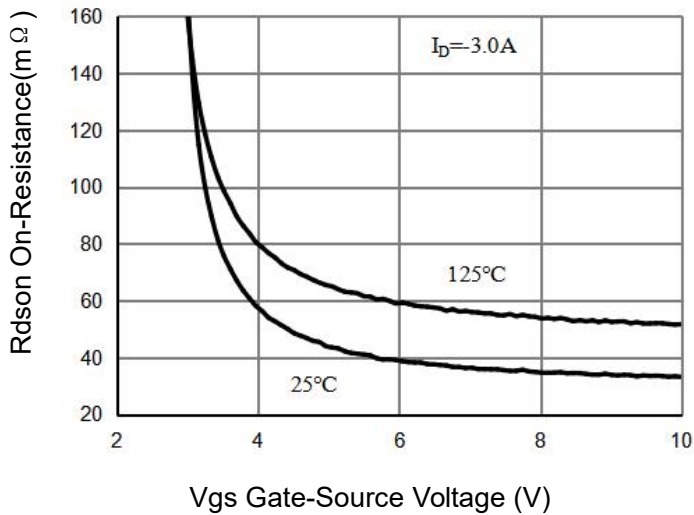
Figure 6 Drain-Source On-Resistance



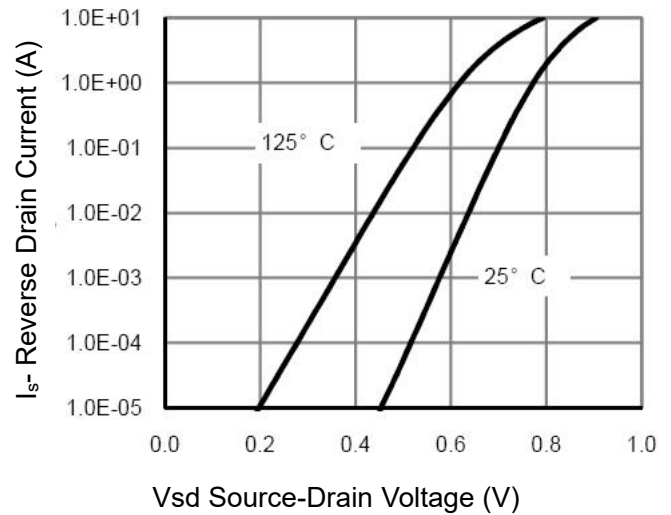
**Figure 7 Transfer Characteristics**



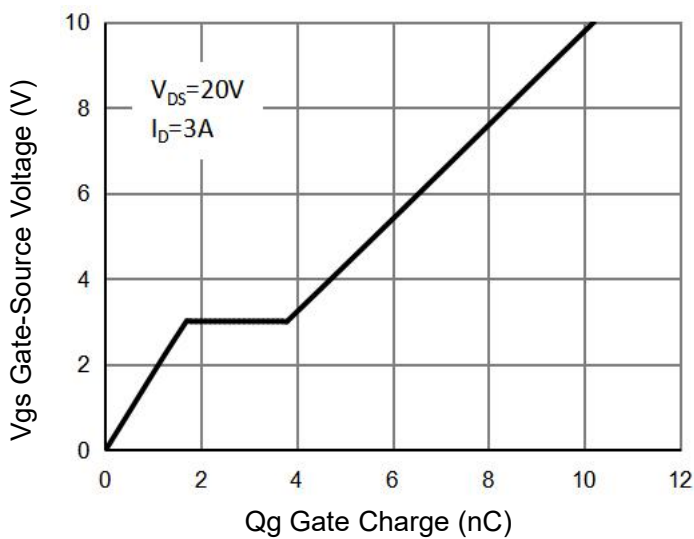
**Figure 10 Capacitance vs Vds**



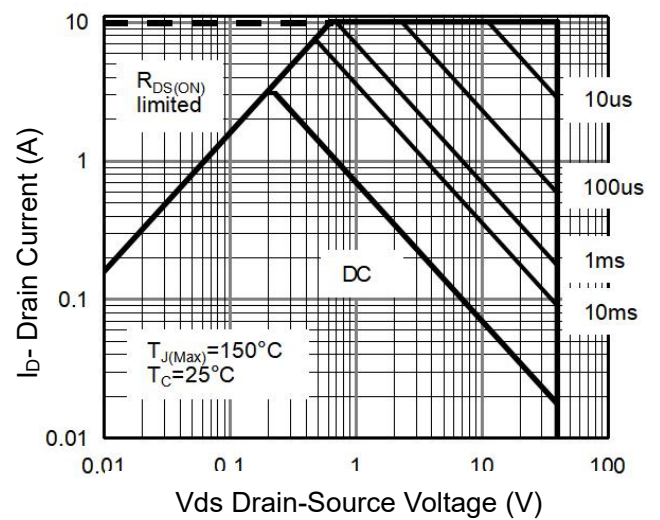
**Figure 9 Rdson vs Vgs**



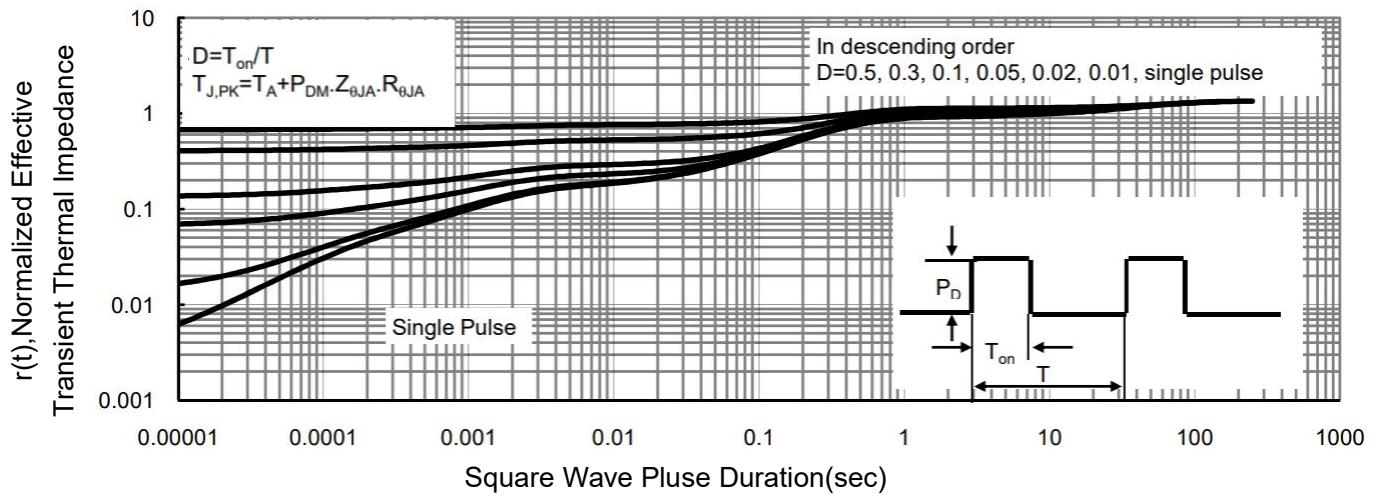
**Figure 11 Source- Drain Diode Forward**



**Figure 11 Gate Charge**

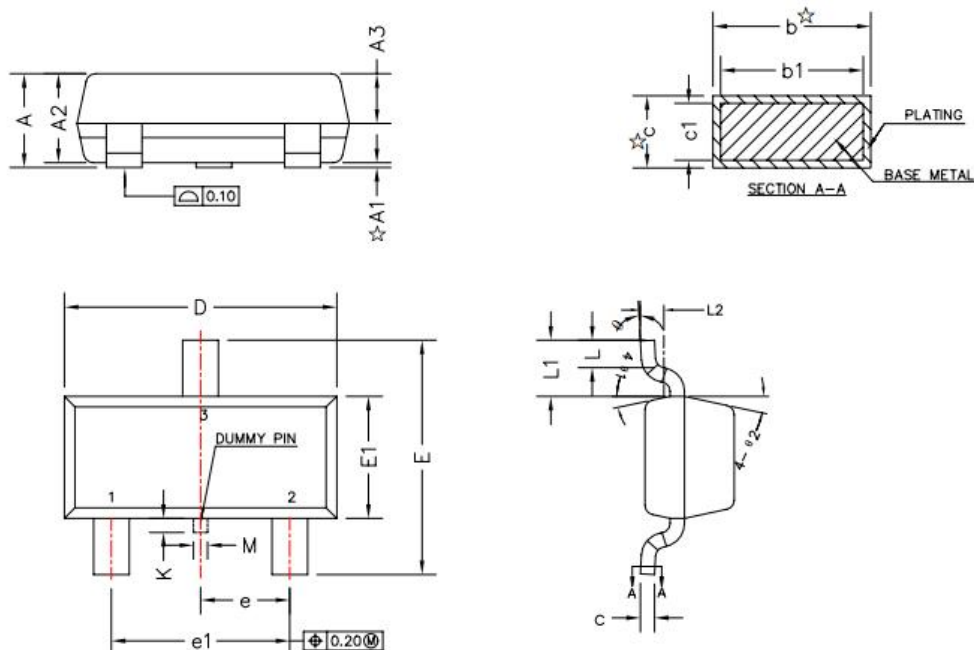


**Figure 12 Safe Operation Area**



**Figure 13 Normalized Maximum Transient Thermal Impedance**

## SOT-23 Package Information



Symbol	Millimeters	
	Min.	Max.
A	0.89	1.12
A1	0.01	0.10
A2	0.88	1.02
A3	0.43	0.63
b	0.36	0.50
b1	0.35	0.45
c	0.14	0.20
c1	0.14	0.16
D	2.80	3.00
E	2.35	2.64
E1	1.20	1.40
e	0.90	1.00
e1	1.80	2.00
L	0.40	0.60
L1	0.6REF	
L2	0.25BSC	
M	0.10	0.25
K	0.00	0.25
θ	0°	8°
θ1	10°	14°
θ2	10°	14°

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