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# QN3001M3E

## N-Channel 30V Fast Switching MOSFET

### General Description

The QN3001M3E is a high performance trench N-channel MOSFET which utilizes extremely high cell density to provide low  $R_{DS(on)}$  and gate charge characteristics. It is ideally suited to support load switching application.

The QN3001M3E meets RoHS and Green Product requirements while supporting full function reliability.

### Features

- ✓ Advanced high cell density Trench technology
- ✓ Green Device Available
- ✓ Embedded ESD Protection.

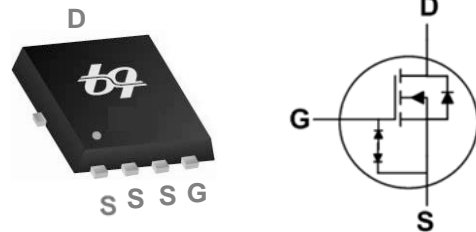
### Product Summary

$V_{DS}$	$R_{DS(ON)}$ max ( $V_{GS}=10V$ )	$I_D$ ( $T_C=25\text{ }^\circ\text{C}$ )
30V	2.3m $\Omega$	137A

### Applications

- ✓ Lithium-ion Battery Charging and Discharging Switch
- ✓ Load Switch
- ✓ DC-DC convertor

### Pin Configuration



### Ordering Information

Order Number	Package Type	Top Marking
QN3001M3E	PRPAK3X3	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;"> <p>Q N 3 0 0 1</p> <p>X X X X X X</p> <p>Pin 1 dot → ●</p> </div> <div style="margin-left: 10px;"> <p>→ Product Name</p> <p>→ Date Code</p> <p>→ Assy Code</p> <p>→ Sequence</p> <p>→ Weekly</p> <p>→ Yearly</p> </div> </div>

# QN3001M3E

## Absolute Maximum Ratings

Symbol	Parameter	Rating	Units
$V_{DS}$	Drain-Source Voltage	30	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	V
$I_D@T_C=25^\circ\text{C}$	Continuous Drain Current, $V_{GS}$ @ 10V <sup>1</sup>	137	A
$I_D@T_C=100^\circ\text{C}$	Continuous Drain Current, $V_{GS}$ @ 10V <sup>1</sup>	87	A
$I_D@T_A=25^\circ\text{C}$	Continuous Drain Current, $V_{GS}$ @ 10V <sup>1</sup>	21	A
$I_D@T_A=70^\circ\text{C}$	Continuous Drain Current, $V_{GS}$ @ 10V <sup>1</sup>	17	A
$I_{DM}$	Pulsed Drain Current <sup>2</sup>	274	A
EAS	Single Pulse Avalanche Energy <sup>3</sup>	193.4	mJ
$I_{AS}$	Avalanche Current	62.2	A
$P_D@T_C=25^\circ\text{C}$	Total Power Dissipation <sup>4</sup>	65	W
$P_D@T_A=25^\circ\text{C}$	Total Power Dissipation <sup>4</sup>	1.6	W
$T_{STG}$	Storage Temperature Range	-55 to 150	$^\circ\text{C}$
$T_J$	Operating Junction Temperature Range	-55 to 150	$^\circ\text{C}$

## Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction-Ambient <sup>1</sup>	47	75	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance Junction-Case	1.9	2.5	$^\circ\text{C/W}$

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## N-Channel Electrical Characteristics

N-Channel Electrical Characteristics: (T <sub>J</sub> =25 °C, unless otherwise noted)						
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =250uA	30	--	--	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	BVDSS Temperature Coefficient	Reference to 25°C, I <sub>D</sub> =1mA	--	0.010	--	V/°C
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance <sup>2</sup>	V <sub>GS</sub> =10V, I <sub>D</sub> =30A	--	1.8	2.3	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =30A	--	2.6	3.4	
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250uA	1.2	--	2.5	V
ΔV <sub>GS(th)</sub>	V <sub>GS(th)</sub> Temperature Coefficient		--	-4.6	--	mV/°C
I <sub>DSS</sub>	Drain-Source Leakage Current	V <sub>DS</sub> =24V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C	--	--	1	uA
		V <sub>DS</sub> =24V, V <sub>GS</sub> =0V, T <sub>J</sub> =55°C	--	--	5	
I <sub>GSS</sub>	Gate-Source Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V, T <sub>J</sub> =25°C	--	--	±10	uA
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =10A	--	29.5	--	S
R <sub>g</sub>	Gate Resistance	V <sub>DS</sub> =0V, V <sub>GS</sub> =0V, f=1MHz	--	2.2	--	Ω
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =15V, V <sub>GS</sub> =10V, I <sub>D</sub> =30A	--	84.3	--	nC
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =15V, V <sub>GS</sub> =4.5V, I <sub>D</sub> =30A	--	49.2	--	
Q <sub>gs</sub>	Gate-Source Charge		--	8.8	--	
Q <sub>gd</sub>	Gate-Drain Charge		--	31.3	--	
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DS</sub> =15V, V <sub>GS</sub> =10V, R <sub>G</sub> =3.3Ω, I <sub>D</sub> =30A	--	10.2	--	ns
t <sub>r</sub>	Rise Time		--	84.6	--	
t <sub>d(off)</sub>	Turn-Off Delay Time		--	69.9	--	
t <sub>f</sub>	Fall Time		--	77.3	--	
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =15V, V <sub>GS</sub> =0V, f=1MHz	--	2959	--	pF
C <sub>oss</sub>	Output Capacitance		--	793	--	
C <sub>rss</sub>	Reverse Transfer Capacitance		--	736	--	

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## Guaranteed Avalanche Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
EAS	Single Pulse Avalanche Energy <sup>5</sup>	$V_{DD}=25V$ , $L=0.1mH$ , $I_{AS}=44A$	96.8	--	--	mJ

## Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_S$	Continuous Source Current <sup>1,6</sup>	$V_G=V_D=0V$ , Force Current	--	--	137	A
$I_{SM}$	Pulsed Source Current <sup>2,6</sup>		--	--	274	A
$V_{SD}$	Diode Forward Voltage <sup>2</sup>	$V_{GS}=0V$ , $I_S=1A$ , $T_J=25^\circ C$	--	--	1	V
$t_{rr}$	Reverse Recovery Time	$I_F=30A$ , $di/dt=100A/\mu s$ , $T_J=25^\circ C$	--	55	--	nS
$Q_{rr}$	Reverse Recovery Charge		--	58	--	nC

### Note:

1. Test data conducted with surface mount attachment to 1 inch<sup>2</sup>, FR-4 board utilizing 2oz copper
2. Pulse Test. Pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
3. EAS data is a maximum rating. The test condition is  $V_{DD}=25V$ ,  $V_{GS}=10V$ ,  $L=0.1mH$
4. The power dissipation is limited by a 150°C maximum junction temperature
5. The Min. value is 100% EAS tested guarantee
6. The data is theoretically the same as  $I_D$  and  $I_{DM}$ . In real applications, it will be limited by total power

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## Typical Characteristics

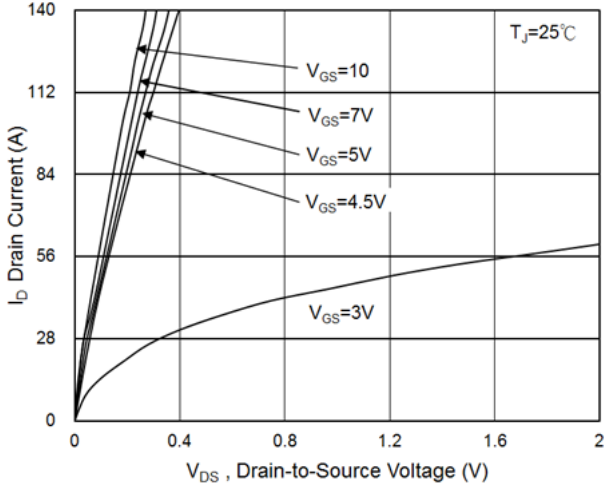


Fig.1: Typical Output Characteristics

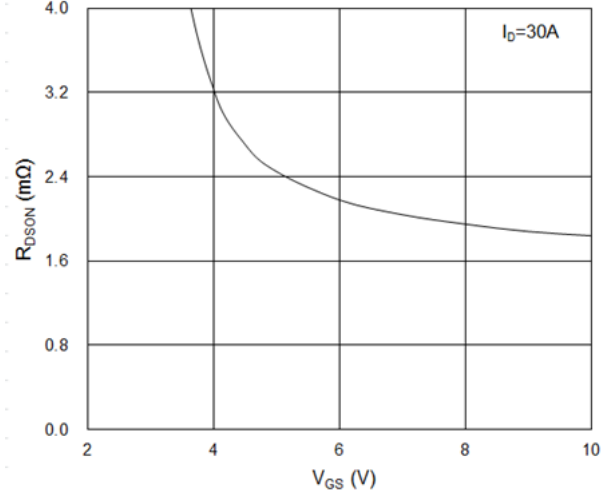


Fig.2: On-Resistance vs. Gate-Source

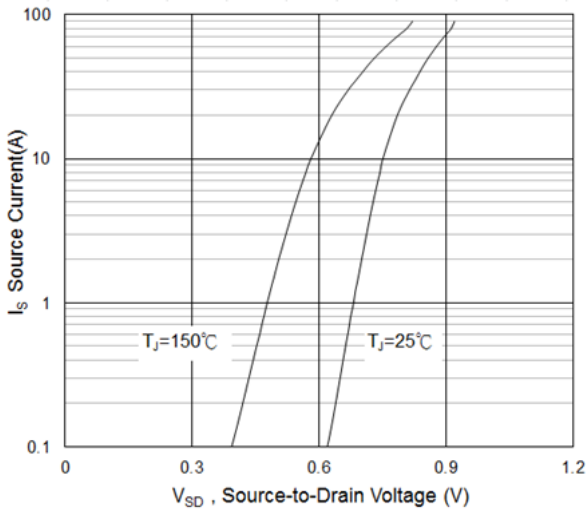


Fig.3: Forward Characteristics of Reverse

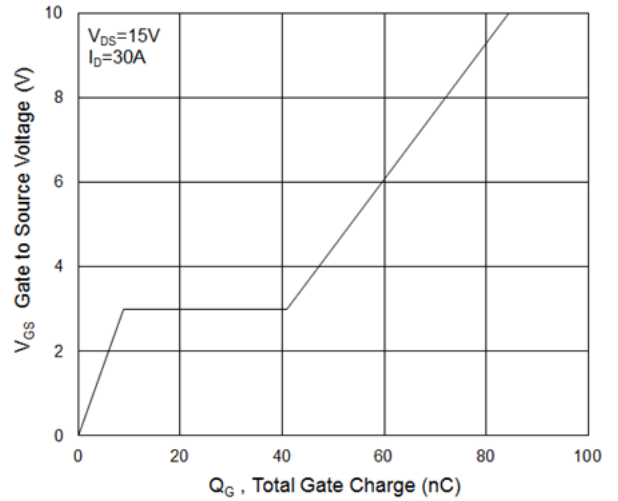


Fig.4: Gate-Charge Characteristics

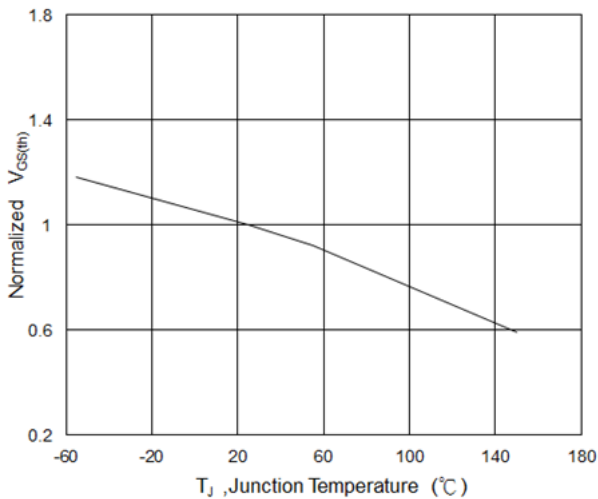


Fig.5: Normalized  $V_{GS(th)}$  vs.  $T_J$

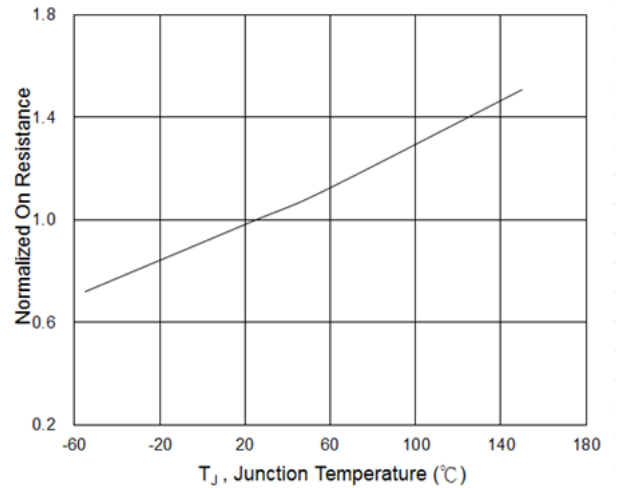


Fig.6: Normalized  $R_{DS(on)}$  vs.  $T_J$

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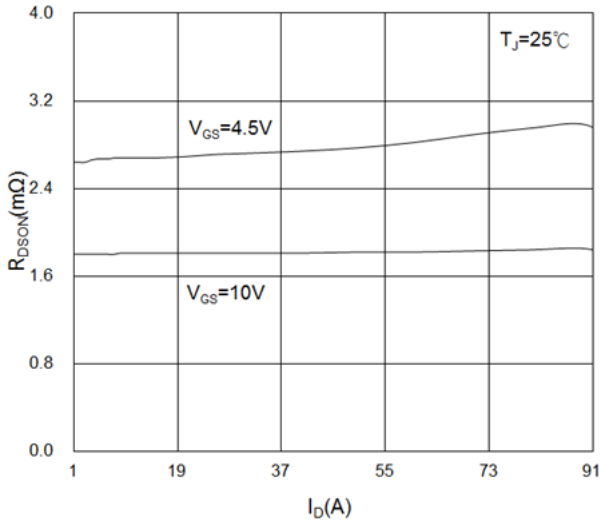


Fig.7: Drain-Source On-State Resistance

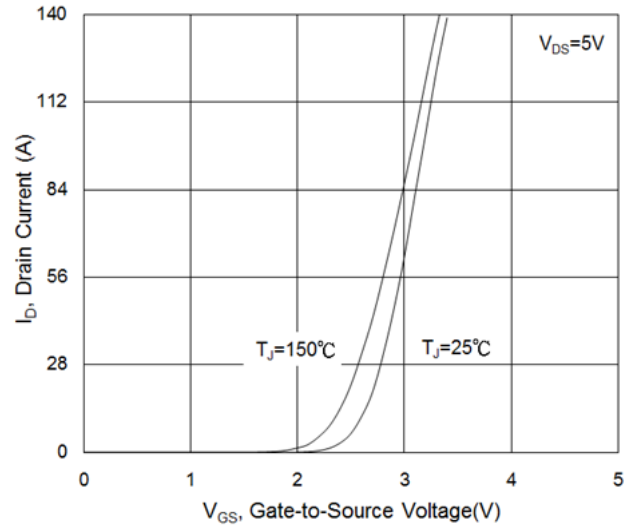


Fig.8: Transfer Characteristics

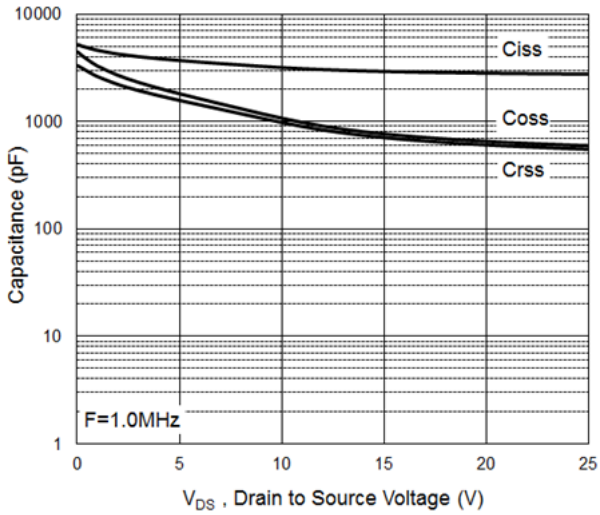


Fig.9: Capacitance

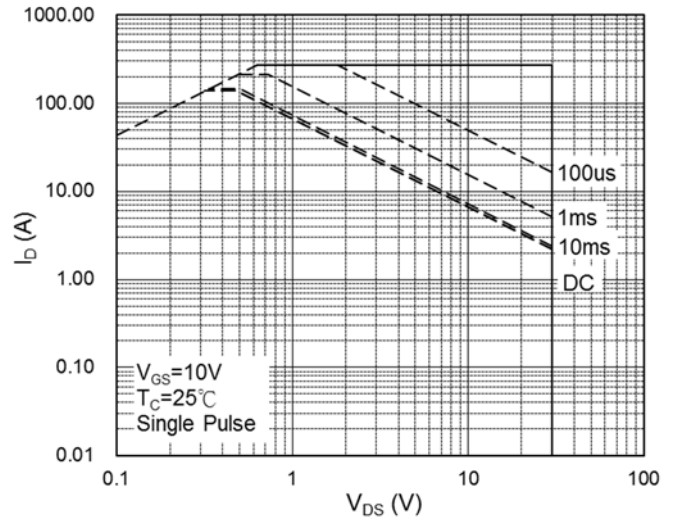


Fig.10: Safe Operating Area

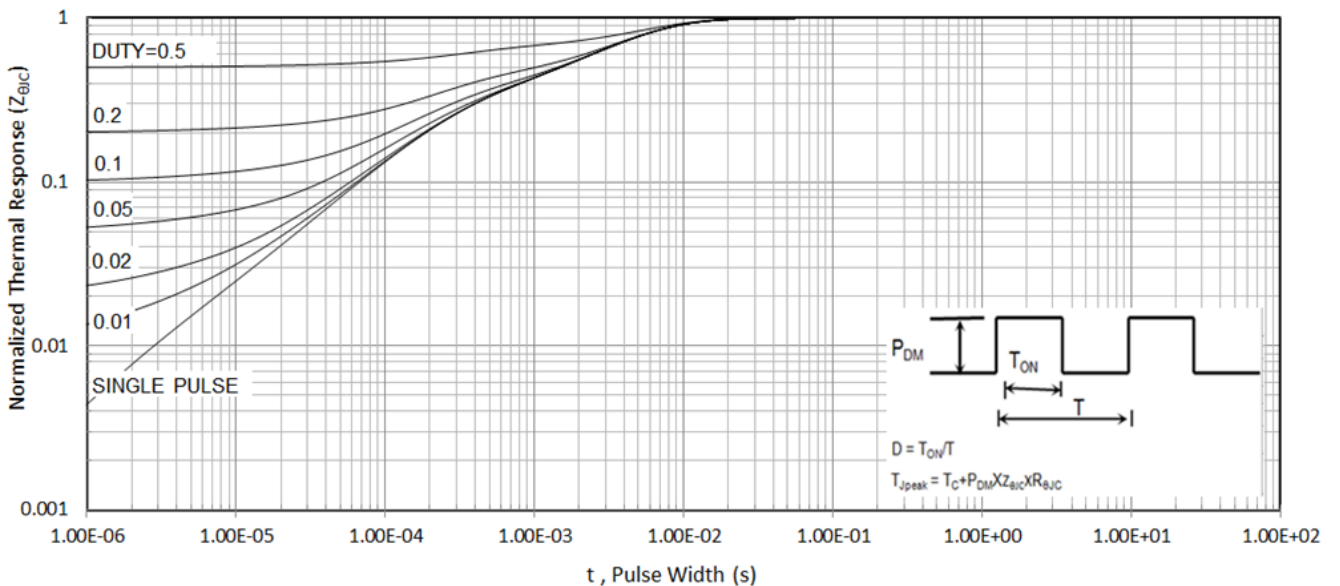


Fig.11: Transient Thermal Impedance

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