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# QN4101M6N

## N-Channel 40V Fast Switching MOSFET

## General Description

The QN4101M6N is a high performance trench N-channel MOSFET which utilizes extremely high cell density to provide low Rdson and gate charge characteristics. It is ideally suited to support synchronous buck converter applications.

The QN4101M6N meets RoHS and Green Product requirements while supporting full function reliability.

## Features

- ✓ Advanced high cell density Trench technology
- ✓ Green Device Available

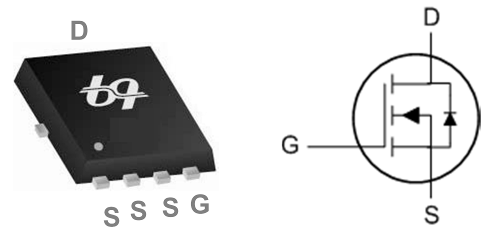
## Product Summary

| $V_{DS}$ | $R_{DS(ON)}$ max ($V_{GS}$=10V) | $I_D$ ($T_C$=25 °C) |
|---|---|---|
| 40V | 2.3mΩ | 136A |

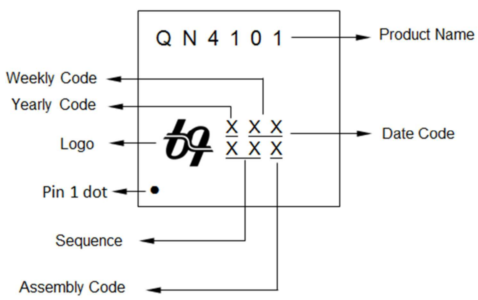
## Applications

- ✓ Synchronous rectifier for Consumer/Computing /Industry Power Supply
- ✓ Motor
- ✓ Load Switch

## Pin Configuration




## Ordering Information

| Order Number | Package Type | Top Marking |
|---|---|---|
| QN4101M6N | PRPAK5X6 |   |

# QN4101M6N

## Absolute Maximum Ratings

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 40 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | V |
| $I_D$@$T_C$=25°C | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 136 | A |
| $I_D$@$T_C$=100°C | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 86 | A |
| $I_D$@$T_A$=25°C | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 23 | A |
| $I_D$@$T_A$=70°C | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 18 | A |
| $I_{DM}$ | Pulsed Drain Current[2] | 272 | A |
| EAS | Single Pulse Avalanche Energy[3] | 526.7 | mJ |
| $I_{AS}$ | Avalanche Current | 45.9 | A |
| $P_D$@$T_C$=25°C | Total Power Dissipation[4] | 69 | W |
| $P_D$@$T_A$=25°C | Total Power Dissipation[4] | 2 | W |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | °C |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | °C |

## Thermal Data

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance ( > 10S)Junction-Ambient[1] | 13 | 17 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient[1] | 45 | 59 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case[1] | 1.8 | 2.3 | °C/W |

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## N-Channel Electrical Characteristics

| N-Channel Electrical Characteristics: ($T_J$=25 ℃, unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Parameter** | **Conditions** | **Min** | **Typ** | **Max** | **Unit** |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V, $I_D$=250uA | 40 | -- | -- | V |
| $\triangle BV_{DSS}$ /$\triangle T_J$ | BVDSS Temperature Coefficient | Reference to 25°C, $I_D$=1mA | -- | 0.019 | -- | V/°C |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance[2] | $V_{GS}$=10V, $I_D$=30A | -- | 1.8 | 2.3 | mΩ |
| | | $V_{GS}$=4.5V, $I_D$=20A | -- | 2.4 | 3.1 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$, $I_D$ =250uA | 1.2 | -- | 2.5 | V |
| $\triangle V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | -- | -4.8 | -- | mV/°C |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=32V, $V_{GS}$=0V,$T_J$=25°C | -- | -- | 1 | uA |
| | | $V_{DS}$=32V, $V_{GS}$=0V,$T_J$=55°C | -- | -- | 5 | |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±20V, $V_{DS}$=0V | -- | -- | ±100 | nA |
| gfs | Forward Transconductance | $V_{DS}$=5V, $I_D$=20A | -- | 53 | -- | S |
| $R_g$ | Gate Resistance | $V_{DS}$=0V, $V_{GS}$=0V, f=1MHz | -- | 1.0 | -- | Ω |
| $Q_g$ | Total Gate Charge (10V) | $V_{DS}$=20V, $V_{GS}$=10V, $I_D$=20A | -- | 54.0 | -- | nC |
| $Q_g$ | Total Gate Charge (4.5V) | $V_{DS}$=20V, $V_{GS}$=4.5V, $I_D$=20A | -- | 24.4 | -- | |
| $Q_{gs}$ | Gate-Source Charge | | -- | 12.3 | -- | |
| $Q_{gd}$ | Gate-Drain Charge | | -- | 5.8 | -- | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DS}$=20V, $V_{GS}$=10V, $R_G$=3.3Ω, $I_D$=20A | -- | 12.4 | -- | ns |
| $t_r$ | Rise Time | | -- | 43.3 | -- | |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 42.4 | -- | |
| $t_f$ | Fall Time | | -- | 7.2 | -- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=20V, $V_{GS}$=0V, f=1MHz | -- | 3844 | -- | pF |
| $C_{oss}$ | Output Capacitance | | -- | 706 | -- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | -- | 38 | -- | |

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## Guaranteed Avalanche Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| EAS | Single Pulse Avalanche Energy[5] | $V_{DD}$=25V , L=0.5mH , $I_{AS}$=33A | 272.25 | -- | -- | mJ |

## Diode Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current [1,6] | $V_G$=$V_D$=0V, Force Current | -- | 136 | -- | A |
| $I_{SM}$ | Pulsed Source Current[2,6] | | -- | 272 | -- | A |
| $V_{SD}$ | Diode Forward Voltage[2] | $V_{GS}$=0V, $I_S$=1A, $T_J$=25℃ | -- | 0.7 | 1.2 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_F$=20A, di/dt=100A/μs, $T_J$=25℃ | -- | 36 | -- | nS |
| $Q_{rr}$ | Reverse Recovery Charge | | -- | 32 | -- | nC |

**Note**:

1. Test data conducted with surface mount attachment to 1 inch$^2$, FR-4 board utilizing 2oz copper
2. Pulse Test. Pulse width ≦ 300uS, duty cycle ≦ 2%
3. EAS data is a maximum rating. The test condition is $V_{DD}$=25V, $V_{GS}$=10V, L=0.5mH
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

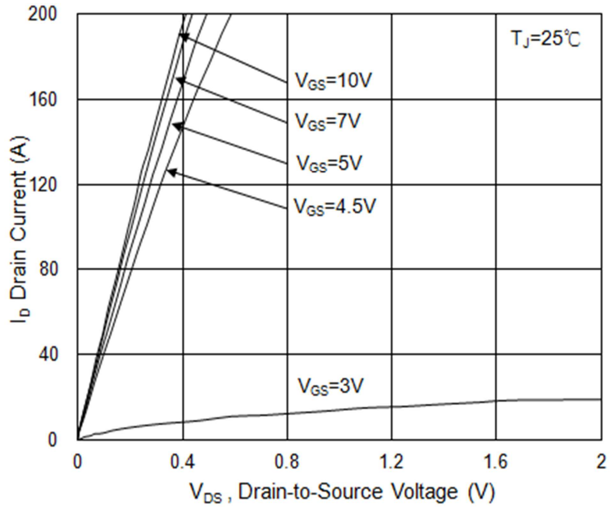


Fig.1: Typical Output Characteristics

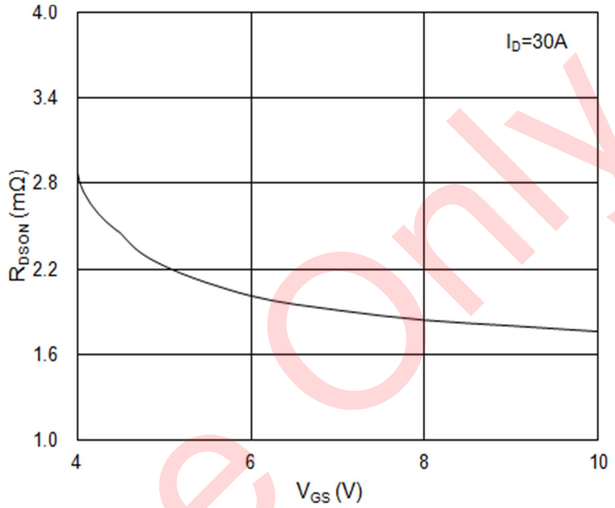


Fig.2: On-Resistance vs. Gate-Source

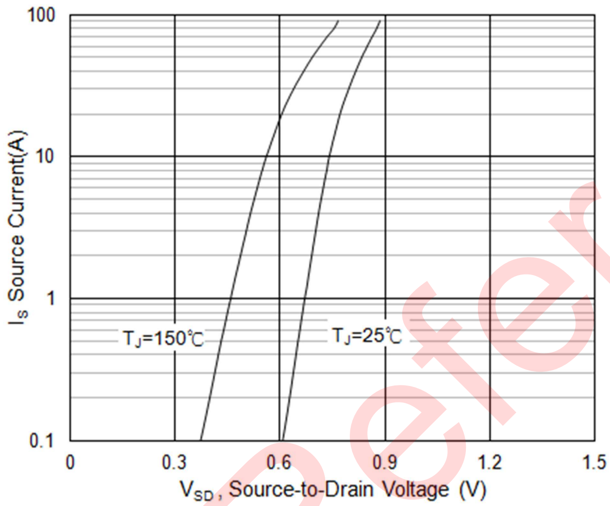


Fig.3: Forward Characteristics of Reverse

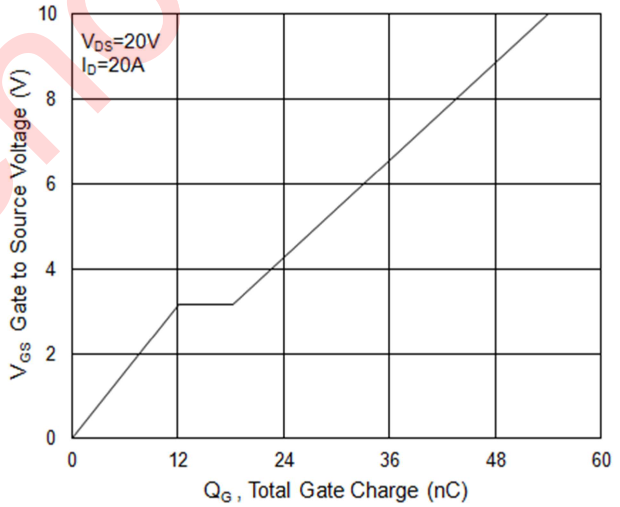


Fig.4: Gate-Charge Characteristics

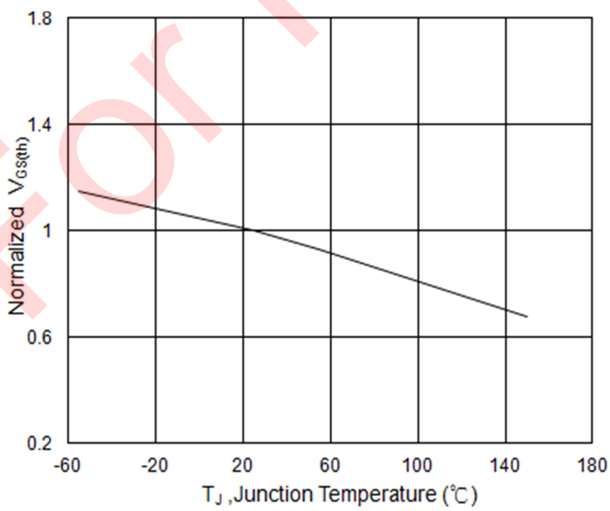


Fig.5: Normalized $V_{GS(th)}$ vs. $T_J$

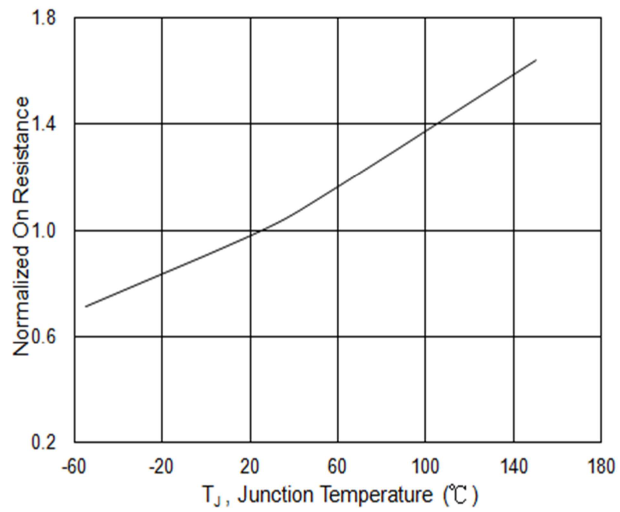


Fig.6: Normalized $R_{DSON}$ vs. $T_J$

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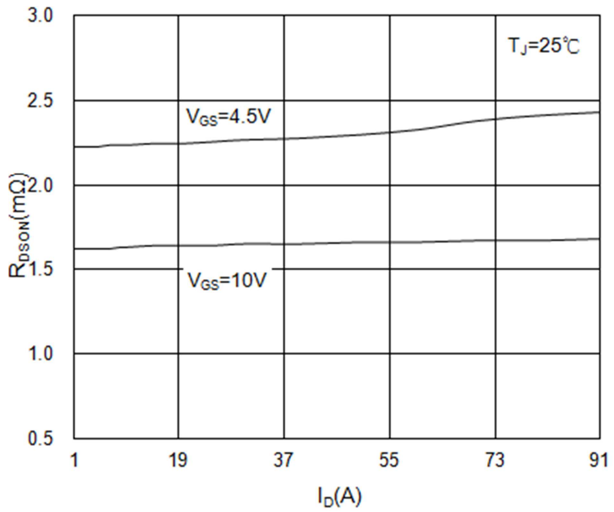


Fig.7: Drain-Source On-State Resistance

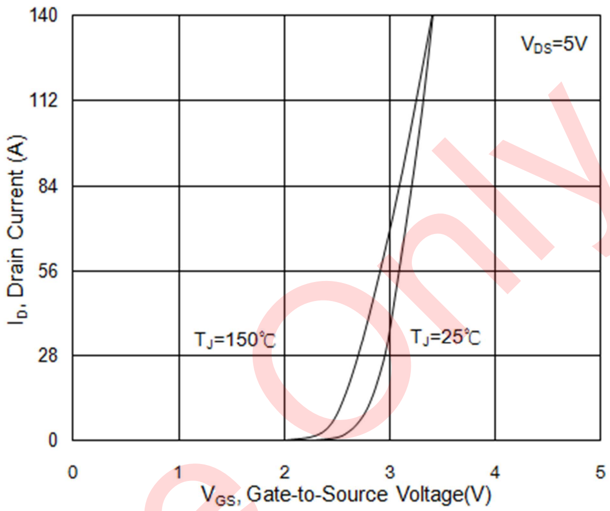


Fig.8: Transfer Characteristics

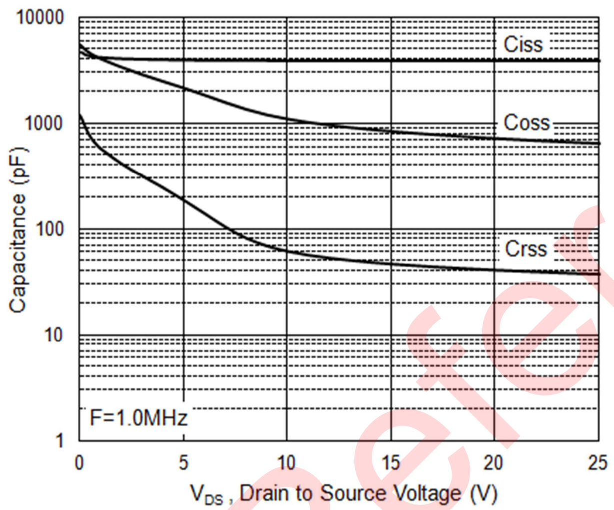


Fig.9: Capacitance

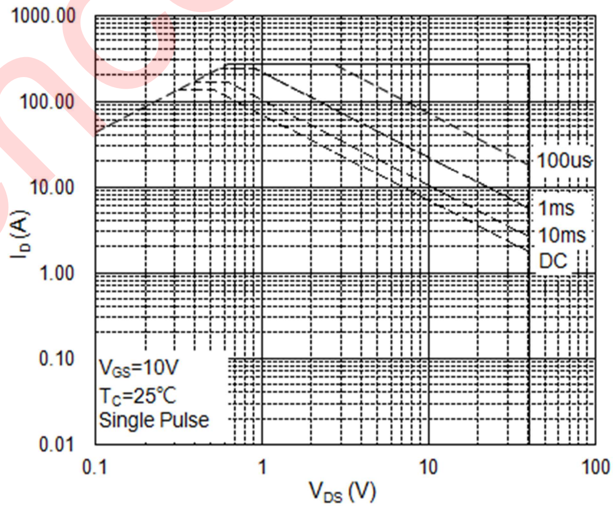


Fig.10: Safe Operating Area

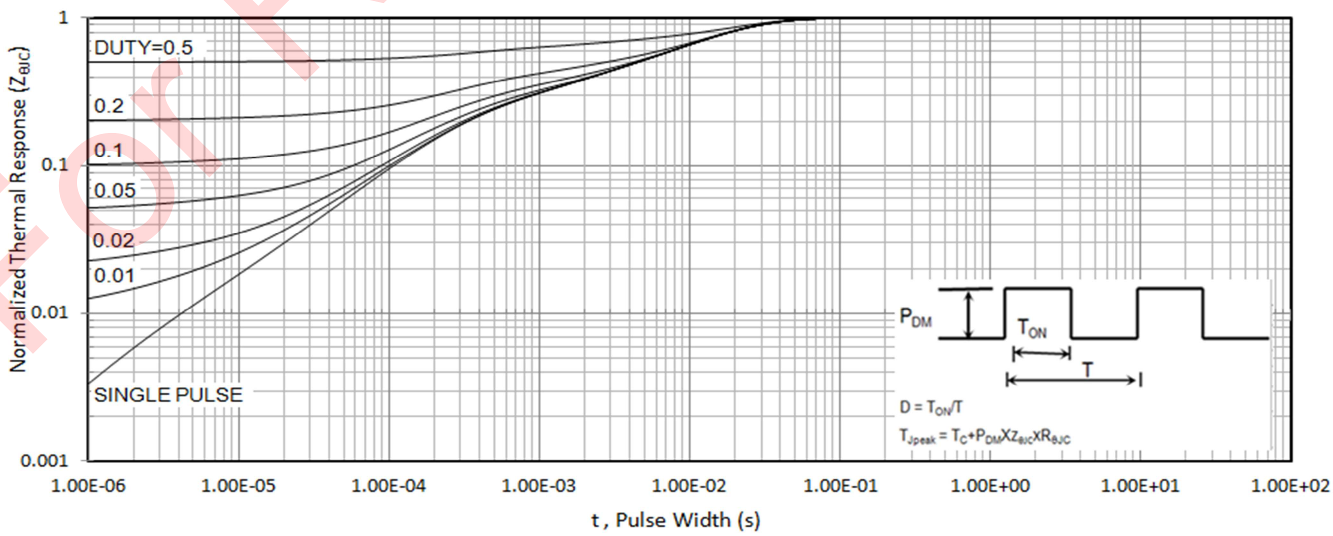


Fig.11: Transient Thermal Impedance

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