# 014N04T-D5

## *40V N-Channel Super Trench Power MOSFET*

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### *Description*

014N04T-D5 is uses Super Trench technology and design to provide excellent RDS(ON) with low gate charge. It can be used in a wide variety of applications

### *MAIN CHARACTERISTICS*

| | |
|---|---|
| **ID** | **219A** |
| **VDSS** | **40v** |
| **$R_{DS(ON)Typ}$ (at VGS=10V)** | **1.1mΩ** |

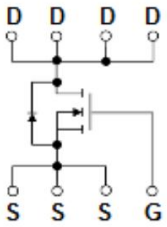
### *General Features*

- Advanced shielded-gate technology
- Ultra-low on-resistance and gate-charge
- RoHS compliant

### *Application*

- DC/DC Converter
- Motor controllers
- Battery-driven electronic products, electrical equipment and machines


PDFN5×6-8L




## Package Marking and Ordering Information

| Device Marking | Device | Device Package | Quantity |
|---|---|---|---|
| 014N04T | 014N04T-D5 | PDFN5×6-8L | 5000 pcs/Tape & Reel |

**Absolute maximum ratings**

| Symbol | Parameter | | Limit | Unit |
|---|---|---|---|---|
| $V_{DSS}$ | Drain-source voltage | | 40 | V |
| $V_{GSS}$ | Gate-Source Voltage | | ±20 | V |
| $I_D$ | Drain Current -continuous(TC=25℃) (1) | | 219 | A |
| | Drain Current -continuous(TC=100℃) (1) | | 138 | |
| $I_{DM}$ | Drain Current-Pulsed (4) | | 345 | A |
| $P_D$ | Power Dissipation | Tc=25℃ | 114 | W |
| $E_{AS}$ | Single pulsed avalanche energy (5) | | 238 | mJ |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature Range | | –50~150 | ℃ |

**Thermal Characteristics**

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Juction-to-Case | 1.1 | ℃/W |
| $R_{\theta JA}$ | Thermal Resistance, Juction-to-Ambient (3) | 43.2 | ℃/W |

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**Electrical Characteristics $T_C$=25℃** unless otherwise noted

| Symbol | Parameter | Conditions | Min. | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| **Static Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain Source breakdown voltage | $V_{GS}$=0V,$I_D$=250uA,$T_J$=25℃ | 40 | - | - | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=40V,$V_{GS}$=0V | - | - | 1 | uA |
| $I_{GSS}$ | Gate-to-Source Forward Leakage | $V_{GS}$=±20V,$V_{DS}$=0V | - | - | ±100 | nA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$,$I_D$=250uA | 1 | - | 2 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V, $I_D$=10A | - | 1.1 | 1.4 | mΩ |
| | | $V_{GS}$=4.5V, $I_D$=10A | - | 1.4 | 1.8 | mΩ |
| $R_G$ | Gate Resistance | f = 1 MHz | - | 1.5 | - | Ω |
| **Dynamic Characteristics** | | | | | | |
| Ciss | Input Capacitance | $V_{GS}$ = 0V<br>$V_{DS}$ = 20V<br>f =1MHz | - | 6015 | - | pF |
| Coss | Output Capacitance | | - | 2290 | - | pF |
| Crss | Reverse Transfer Capacitance | | - | 165 | - | pF |
| **SWITCHING Characteristics** | | | | | | |
| $T_{D(on)}$ | Turn-on Delay Time | $V_{DD}$ = 20V<br>$V_{GS}$ = 4.5V<br>$R_G$ = 3Ω<br>$I_D$ = 20A | - | 24 | - | ns |
| $T_r$ | Turn-on Rise Time | | - | 84 | - | ns |
| $T_{D(off)}$ | Turn-off Delay Time | | - | 62 | - | ns |
| $T_f$ | Turn-off Fall Time | | - | 20 | - | ns |
| $Q_g$ | Total Gate Charge | $V_{DD}$ = 20V<br>$V_{GS}$ = 4.5V<br>$I_D$ = 20A | - | 55 | - | nC |
| $Q_{gs}$ | Gate Source Charge | | - | 15 | - | nC |
| $Q_{gd}$ | Gate Drain Charge | | - | 19 | - | nC |
| **Drain-Source Diode Characteristics and Maximum Ratings** | | | | | | |
| $V_{SD}$ | Drain-Source Diode Forward Voltage | $I_S$ = 50A, VGS = 0V | - | - | 1.2 | V |
| $T_{rr}$ | Reverse Recovery Time | $I_S$ = 20A, VGS = 0V<br>di/dt = 100A/μs | - | 88 | - | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | - | 185 | - | nC |

Notes:

1. Rated according to $R_{\theta JC}$
2. Rated according to $R_{\theta JA}$
3. Surface-mounted on 1 inch² FR4 board, 2 oz Cu
4. Limited by maximum $T_J$
5. Starting $T_J$ = 25° C, $V_{DD}$ = 30V, $V_{GS}$ = 10V, L = 0.1mH
6. Pulse width limited by maximum TJ

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

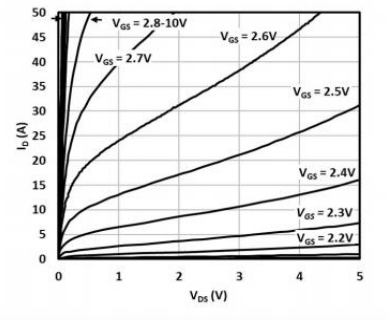



Fig. 1 Output characteristics

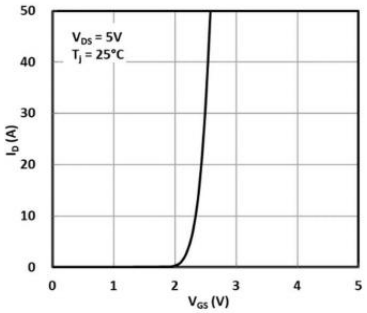



Fig. 2 Transfer characteristics

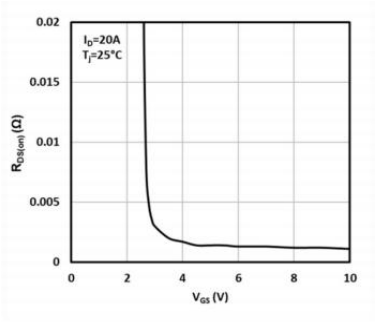



Fig.3 On-resistance vs. gate voltage

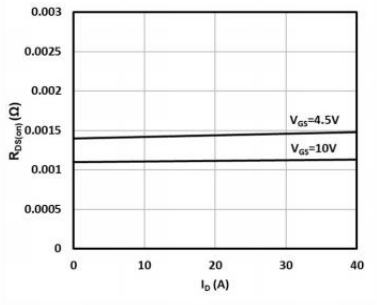



Fig.4 On-resistance vs. drain current

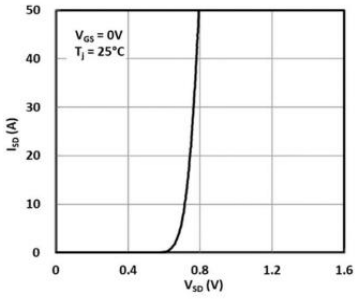



Fig.5 Source-to-drain diode forward characteristics

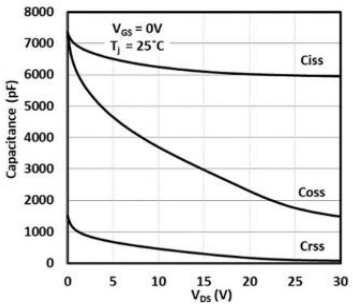



Fig.6 Capacitance vs. drain-to-source voltage

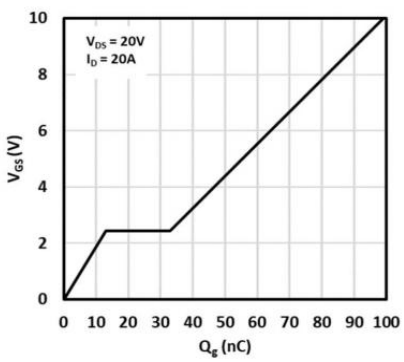



Fig.7 Gate-to-source voltage vs. gate charge

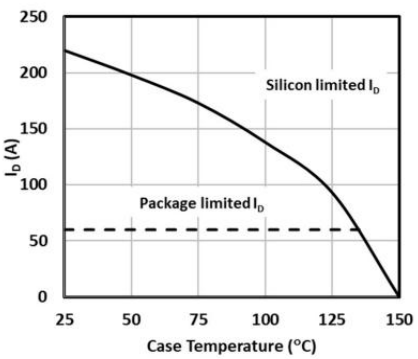



Fig.8 Maximum drain current vs. case temperature

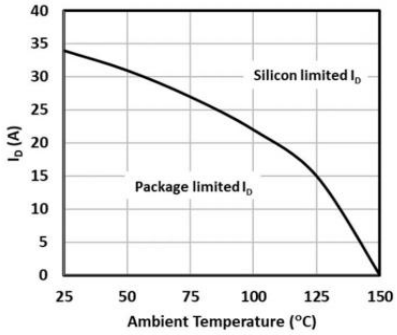
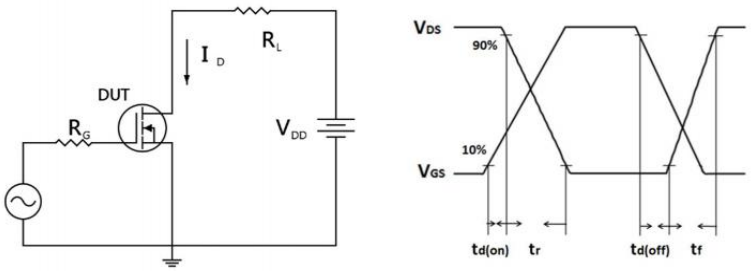
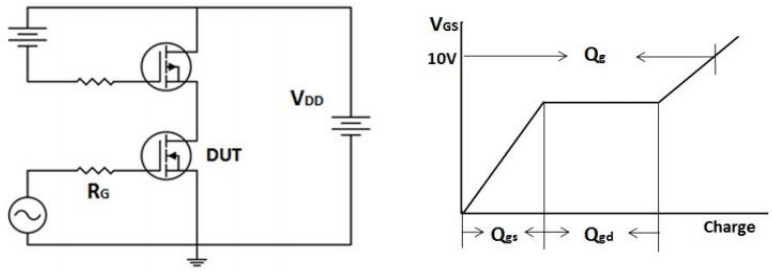



**Fig. 9 Maximum drain current vs. ambient temperature**

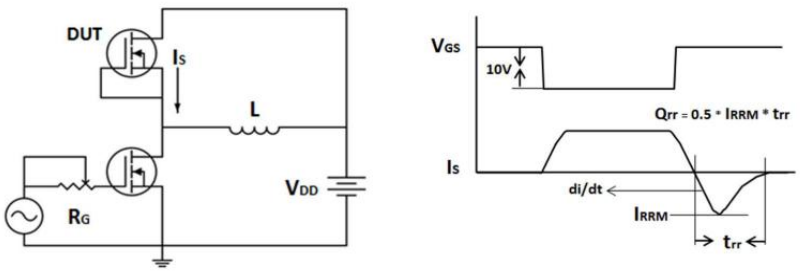
## Test Circuits and Waveforms



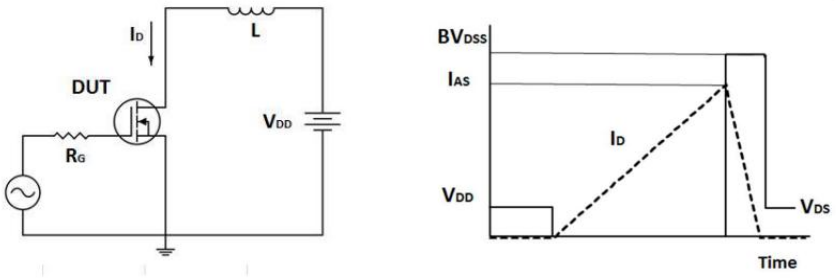

**Resistive switching time test circuit & waveforms**




**Gate charge test circuit & waveform**

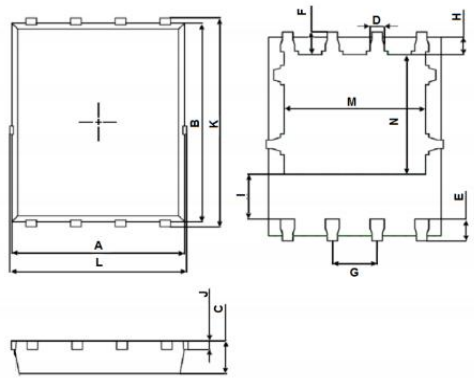



**Peak diode recovery dv/dt test circuit & waveforms**




Unclamped inductive switching test circuit & waveforms

**PDFN5*6-8L Package Information**




| PDFN5×6-8L | | |
|---|---|---|
| **Dimension** | **Min.** | **Max.** |
| A | 4.824 | 4.976 |
| B | 5.674 | 5.826 |
| C | 0.900 | 1.000 |
| D | 0.350 | 0.450 |
| E | 0.559 | 0.711 |
| F | 0.574 | 0.726 |
| G | 1.250 | 1.290 |
| H | 0.424 | 0.576 |
| I | 1.190 | 1.390 |
| J | 0.154 | 0.354 |
| K | 5.974 | 6.126 |
| L | 4.944 | 5.096 |
| M | 3.910 | 4.110 |
| N | 3.375 | 3.575 |