



# STD40NF3LL

## N-CHANNEL 30V - 0.0095 $\Omega$ - 40A DPAK LOW GATE CHARGE STripFET™ POWER MOSFET

PRELIMINARY DATA

| TYPE       | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|------------|------------------|---------------------|----------------|
| STD40NF3LL | 30 V             | < 0.0115 $\Omega$   | 40 A           |

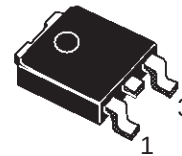
- TYPICAL R<sub>DS(on)</sub> = 0.0115  $\Omega$  @ 4.5V
- OPTIMAL R<sub>DS(on)</sub> x Q<sub>g</sub> TRADE-OFF @ 4.5V
- CONDUCTION LOSSES REDUCED
- SWITCHING LOSSES REDUCED

### DESCRIPTION

This application specific Power Mosfet is the third generation of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows the best trade-off between on-resistance and gate charge. When used as high and low side in buck regulators, it gives the best performance in terms of both conduction and switching losses. This is extremely important for motherboards where fast switching and high efficiency are of paramount importance.

### APPLICATIONS

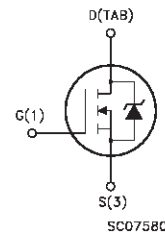
- SPECIFICALLY DESIGNED AND OPTIMISED FOR HIGH EFFICIENCY CPU CORE DC/DC CONVERTERS



**DPAK  
TO-252  
(Suffix "T4")**

ADD SUFFIX "T4" FOR ORDERING IN TAPE & REEL

### INTERNAL SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter                                              | Value      | Unit |
|---------------------|--------------------------------------------------------|------------|------|
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)             | 30         | V    |
| V <sub>DGR</sub>    | Drain- gate Voltage (R <sub>GS</sub> = 20 k $\Omega$ ) | 30         | V    |
| V <sub>GS</sub>     | Gate-source Voltage                                    | $\pm 16$   | V    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>c</sub> = 25 °C   | 40         | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>c</sub> = 100 °C  | 28         | A    |
| I <sub>DM</sub> (•) | Drain Current (pulsed)                                 | 160        | A    |
| P <sub>tot</sub>    | Total Dissipation at T <sub>c</sub> = 25 °C            | 55         | W    |
|                     | Derating Factor                                        | 0.37       | W/°C |
| T <sub>stg</sub>    | Storage Temperature                                    | -65 to 175 | °C   |
| T <sub>j</sub>      | Max. Operating Junction Temperature                    | 175        | °C   |

(•) Pulse width limited by safe operating area

## STD40NF3LL

### THERMAL DATA

|                |                                                |     |      |               |
|----------------|------------------------------------------------|-----|------|---------------|
| $R_{thj-case}$ | Thermal Resistance Junction-case               | Max | 2.73 | $^{\circ}C/W$ |
| $R_{thj-amb}$  | Thermal Resistance Junction-ambient            | Max | 62.5 | $^{\circ}C/W$ |
| $T_l$          | Maximum Lead Temperature For Soldering Purpose |     | 300  | $^{\circ}C$   |

### ELECTRICAL CHARACTERISTICS ( $T_{case} = 25^{\circ}C$ unless otherwise specified)

#### OFF

| Symbol        | Parameter                                        | Test Conditions                                                                   | Min. | Typ. | Max.      | Unit               |
|---------------|--------------------------------------------------|-----------------------------------------------------------------------------------|------|------|-----------|--------------------|
| $V_{(BR)DSS}$ | Drain-source Breakdown Voltage                   | $I_D = 250 \mu A$ $V_{GS} = 0$                                                    | 30   |      |           | V                  |
| $I_{DSS}$     | Zero Gate Voltage Drain Current ( $V_{GS} = 0$ ) | $V_{DS} = \text{Max Rating}$<br>$V_{DS} = \text{Max Rating}$ $T_c = 125^{\circ}C$ |      |      | 1<br>10   | $\mu A$<br>$\mu A$ |
| $I_{GSS}$     | Gate-body Leakage Current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 16 V$                                                               |      |      | $\pm 100$ | nA                 |

#### ON (\*)

| Symbol       | Parameter                         | Test Conditions                                              | Min. | Typ.             | Max.             | Unit                 |
|--------------|-----------------------------------|--------------------------------------------------------------|------|------------------|------------------|----------------------|
| $V_{GS(th)}$ | Gate Threshold Voltage            | $V_{DS} = V_{GS}$ $I_D = 250 \mu A$                          | 1    |                  | 2.5              | V                    |
| $R_{DS(on)}$ | Static Drain-source On Resistance | $V_{GS} = 10V$ $I_D = 20 A$<br>$V_{GS} = 4.5V$ $I_D = 10 A$  |      | 0.0095<br>0.0115 | 0.0115<br>0.0135 | $\Omega$<br>$\Omega$ |
| $I_{D(on)}$  | On State Drain Current            | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$<br>$V_{GS} = 10 V$ | 40   |                  |                  | A                    |

#### DYNAMIC

| Symbol                              | Parameter                                                               | Test Conditions                                        | Min. | Typ.               | Max. | Unit           |
|-------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------|------|--------------------|------|----------------|
| $g_{fs} (*)$                        | Forward Transconductance                                                | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 20 A$ |      | 40                 |      | S              |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input Capacitance<br>Output Capacitance<br>Reverse Transfer Capacitance | $V_{DS} = 25 V$ $f = 1 MHz$ $V_{GS} = 0$               |      | 1700<br>500<br>115 |      | pF<br>pF<br>pF |

**ELECTRICAL CHARACTERISTICS** (continued)**SWITCHING ON**

| Symbol      | Parameter          | Test Conditions                                                             | Min. | Typ. | Max. | Unit |
|-------------|--------------------|-----------------------------------------------------------------------------|------|------|------|------|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD} = 15\text{ V}$ $I_D = 20\text{ A}$                                  |      | 20   |      | ns   |
| $t_r$       | Rise Time          | $R_G = 4.7\ \Omega$ $V_{GS} = 4.5\text{ V}$<br>(Resistive Load, see fig. 3) |      | 170  |      | ns   |
| $Q_g$       | Total Gate Charge  | $V_{DD} = 24\text{ V}$ $I_D = 40\text{ A}$ $V_{GS} = 10\text{ V}$           |      | 43   | 56   | nC   |
| $Q_{gs}$    | Gate-Source Charge |                                                                             |      | 10   |      | nC   |
| $Q_{gd}$    | Gate-Drain Charge  |                                                                             |      | 10   |      | nC   |

**SWITCHING OFF**

| Symbol       | Parameter           | Test Conditions                                                             | Min. | Typ. | Max. | Unit |
|--------------|---------------------|-----------------------------------------------------------------------------|------|------|------|------|
| $t_{d(off)}$ | Turn-off Delay Time | $V_{DD} = 15\text{ V}$ $I_D = 20\text{ A}$                                  |      | 40   |      | ns   |
| $t_f$        | Fall Time           | $R_G = 4.7\ \Omega$ $V_{GS} = 4.5\text{ V}$<br>(Resistive Load, see fig. 3) |      | 60   |      | ns   |

**SOURCE DRAIN DIODE**

| Symbol             | Parameter                     | Test Conditions                                                                                                                                     | Min. | Typ. | Max. | Unit |
|--------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $I_{SD}$           | Source-drain Current          |                                                                                                                                                     |      |      | 40   | A    |
| $I_{SDM}(\bullet)$ | Source-drain Current (pulsed) |                                                                                                                                                     |      |      | 160  | A    |
| $V_{SD} (*)$       | Forward On Voltage            | $I_{SD} = 40\text{ A}$ $V_{GS} = 0$                                                                                                                 |      |      | 1.5  | V    |
| $t_{rr}$           | Reverse Recovery Time         | $I_{SD} = 40\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 15\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$<br>(see test circuit, fig. 5) |      | 40   |      | ns   |
| $Q_{rr}$           | Reverse Recovery Charge       |                                                                                                                                                     |      | 52   |      | nC   |
| $I_{RRM}$          | Reverse Recovery Current      |                                                                                                                                                     |      | 2.4  |      | A    |

(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

Fig. 1: Unclamped Inductive Load Test Circuit

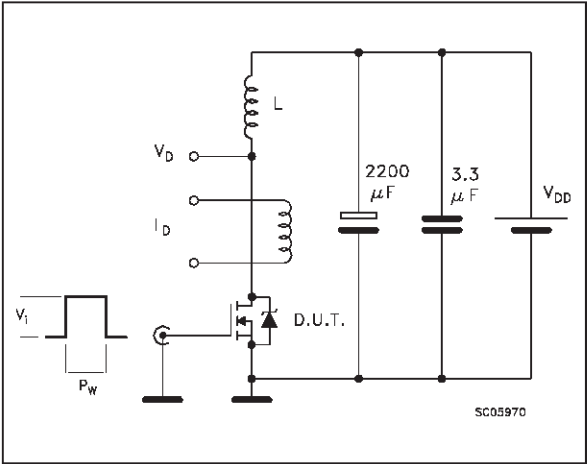


Fig. 2: Unclamped Inductive Waveform

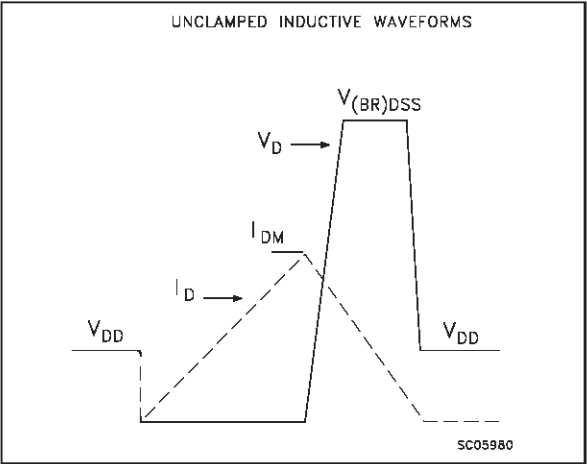


Fig. 3: Switching Times Test Circuits For Resistive Load

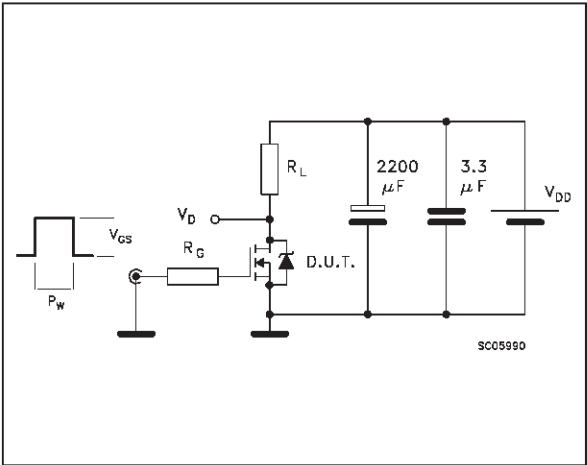


Fig. 4: Gate Charge test Circuit

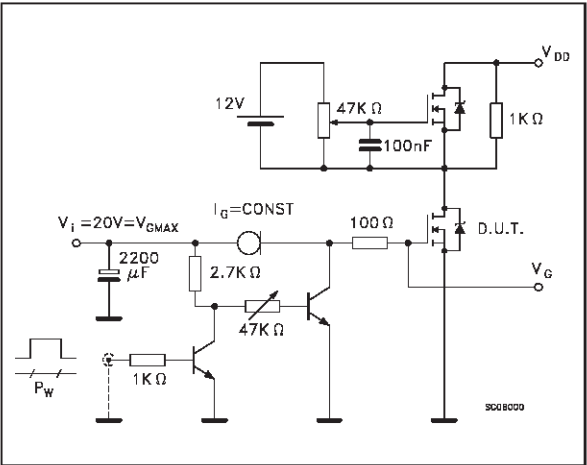
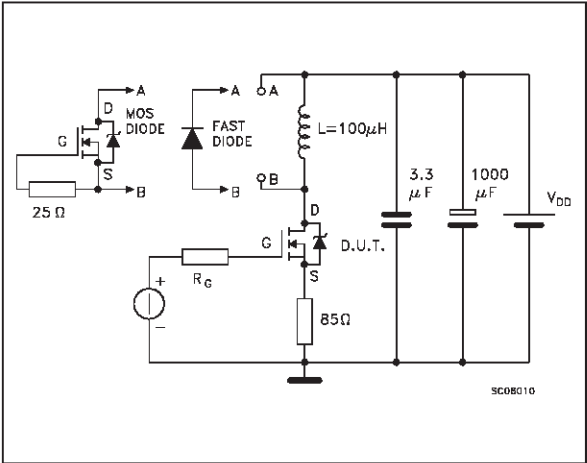
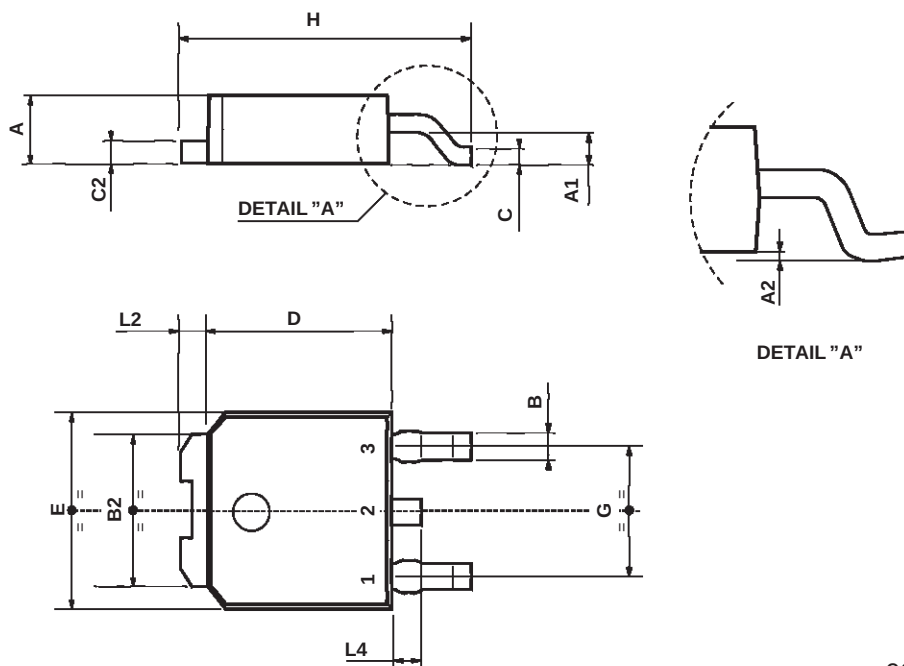


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



## TO-252 (DPAK) MECHANICAL DATA

| DIM. | mm   |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    | 2.2  |      | 2.4  | 0.086 |       | 0.094 |
| A1   | 0.9  |      | 1.1  | 0.035 |       | 0.043 |
| A2   | 0.03 |      | 0.23 | 0.001 |       | 0.009 |
| B    | 0.64 |      | 0.9  | 0.025 |       | 0.035 |
| B2   | 5.2  |      | 5.4  | 0.204 |       | 0.212 |
| C    | 0.45 |      | 0.6  | 0.017 |       | 0.023 |
| C2   | 0.48 |      | 0.6  | 0.019 |       | 0.023 |
| D    | 6    |      | 6.2  | 0.236 |       | 0.244 |
| E    | 6.4  |      | 6.6  | 0.252 |       | 0.260 |
| G    | 4.4  |      | 4.6  | 0.173 |       | 0.181 |
| H    | 9.35 |      | 10.1 | 0.368 |       | 0.397 |
| L2   |      | 0.8  |      |       | 0.031 |       |
| L4   | 0.6  |      | 1    | 0.023 |       | 0.039 |



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