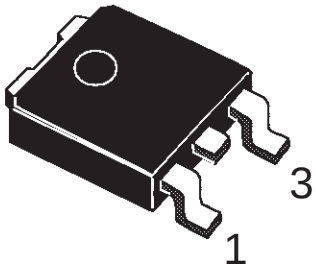
# STD5NM60

## N-CHANNEL 600V - 0.8Ω - 5A DPAK
## MDmesh™ Power MOSFET

**PRELIMINARY DATA**

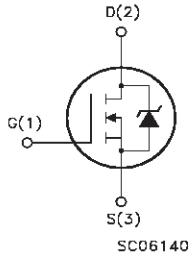
| TYPE | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ |
|---|---|---|---|
| STD5NM60 | 600V | <0.9Ω | 5 A |

- TYPICAL $R_{DS}(on)$ = 0.8Ω
- HIGH dv/dt AND AVALANCHE CAPABILITIES
- 100% AVALANCHE TESTED
- LOW INPUT CAPACITANCE AND GATE CHARGE
- LOW GATE INPUT RESISTANCE
- TIGHT PROCESS CONTROL AND HIGH MANUFACTORING YIELDS




**DPAK**
**TO-252**

### INTERNAL SCHEMATIC DIAGRAM




### DESCRIPTION

The MDmesh™ is a new revolutionary MOSFET technology that associates the Multiple Drain process with the Company's PowerMESH™ horizontal layout. The resulting product has an outstanding low on-resistance, impressively high dv/dt and excellent avalanche characteristics. The adoption of the Company's proprietary strip technique yields overall dynamic performance that is significantly better than that of similar completition's products.

### APPLICATIONS

The MDmesh™ family is very suitable for increase the power density of high voltage converters allowing system miniaturization and higher efficiencies.

### ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-source Voltage ($V_{GS}$ = 0) | 600 | V |
| $V_{DGR}$ | Drain-gate Voltage ($R_{GS}$ = 20 kΩ) | 600 | V |
| $V_{GS}$ | Gate- source Voltage | ±30 | V |
| $I_D$ | Drain Current (continuos) at $T_C$ = 25°C | 5 | A |
| $I_D$ | Drain Current (continuos) at $T_C$ = 100°C | 3.1 | A |
| $I_{DM}$ (●) | Drain Current (pulsed) | 20 | A |
| $P_{TOT}$ | Total Dissipation at $T_C$ = 25°C | 50 | W |
| | Derating Factor | 0.4 | W/°C |
| dv/dt(1) | Peak Diode Recovery voltage slope | 6 | V/ns |
| $T_{stg}$ | Storage Temperature | –65 to 150 | °C |
| $T_j$ | Max. Operating Junction Temperature | 150 | °C |

(●)Pulse width limited by safe operating area

(1)$I_{SD}$<5A, di/dt<200A/µs, $V_{DD}$<$V_{(BR)DSS}$, $T_J$<$T_{JMAX}$

## THERMAL DATA

| | | | |
|---|---|---|---|
| Rthj-case | Thermal Resistance Junction-case Max | 2.5 | °C/W |
| Rthj-amb | Thermal Resistance Junction-ambient Max | 62.5 | °C/W |
| Rthc-sink | Thermal Resistance Case-sink Typ | 0.5 | °C/W |
| $T_l$ | Maximum Lead Temperature For Soldering Purpose | 300 | °C |

## AVALANCHE CHARACTERISTICS

| Symbol | Parameter | Max Value | Unit |
|---|---|---|---|
| $I_{AR}$ | Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max) | 5 | A |
| $E_{AS}$ | Single Pulse Avalanche Energy (starting $T_j$ = 25 °C, $I_D$ = $I_{AR}$, $V_{DD}$ = 50 V) | 400 | mJ |

## ELECTRICAL CHARACTERISTICS (TCASE = 25 °C UNLESS OTHERWISE SPECIFIED)

OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source Breakdown Voltage | $I_D$ = 250 µA, $V_{GS}$ = 0 | 600 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current ($V_{GS}$ = 0) | $V_{DS}$ = Max Rating | | | 1 | µA |
| | | $V_{DS}$ = Max Rating, $T_C$ = 125 °C | | | 10 | µA |
| $I_{GSS}$ | Gate-body Leakage Current ($V_{DS}$ = 0) | $V_{GS}$ = ±30V | | | ±100 | nA |

ON (1)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA | 3 | 4 | 5 | V |
| $R_{DS(on)}$ | Static Drain-source On Resistance | $V_{GS}$ = 10V, $I_D$ = 2.5A | | 0.8 | 0.9 | Ω |
| $I_{D(on)}$ | On State Drain Current | $V_{DS}$ > $I_{D(on)}$ x $R_{DS(on)max}$, $V_{GS}$ = 10V | 5 | | | A |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ (1) | Forward Transconductance | $V_{DS}$ > $I_{D(on)}$ x $R_{DS(on)max}$, $I_D$ = 2.5A | | 2.4 | | S |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 25V, f = 1 MHz, $V_{GS}$ = 0 | | 412 | | pF |
| $C_{oss}$ | Output Capacitance | | | 94 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 10 | | pF |
| $R_G$ | Gate Input Resistance | f=1 MHz Gate DC Bias = 0 Test Signal Level = 20mV Open Drain | | 3 | | Ω |

Note: 1. Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %.

**ELECTRICAL CHARACTERISTICS** (CONTINUED)

SWITCHING ON

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD}$ = 300V, $I_D$ = 2.5A | | 16 | | ns |
| $t_r$ | Rise Time | $R_G$ = 4.7Ω $V_{GS}$ = 10V (see test circuit, Figure 3) | | 9 | | ns |
| $Q_g$ | Total Gate Charge | $V_{DD}$ = 400V, $I_D$ = 5A, $V_{GS}$ = 10V | | 13 | | nC |
| $Q_{gs}$ | Gate-Source Charge | | | 3 | | nC |
| $Q_{gd}$ | Gate-Drain Charge | | | 11 | | nC |

SWITCHING OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{r(Voff)}$ | Off-voltage Rise Time | $V_{DD}$ = 480V, $I_D$ = 5A, $R_G$ = 4.7Ω, $V_{GS}$ = 10V (see test circuit, Figure 5) | | 20 | | ns |
| $t_f$ | Fall Time | | | 29 | | ns |
| $t_c$ | Cross-over Time | | | 30 | | ns |

SOURCE DRAIN DIODE

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$ | Source-drain Current | | | | 5 | A |
| $I_{SDM}$ (2) | Source-drain Current (pulsed) | | | | 20 | A |
| $V_{SD}$ (1) | Forward On Voltage | $I_{SD}$ = 5A, $V_{GS}$ = 0 | | | 1.5 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_{SD}$ = 5A, di/dt = 100A/µs, $V_{DD}$ = 100V, $T_j$ = 150°C (see test circuit, Figure 5) | | 300 | | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 1.8 | | µC |
| $I_{RRM}$ | Reverse Recovery Current | | | 12 | | A |

Note: 1. Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %.
2. Pulse width limited by safe operating area.

**Fig. 1:** Unclamped Inductive Load Test Circuit

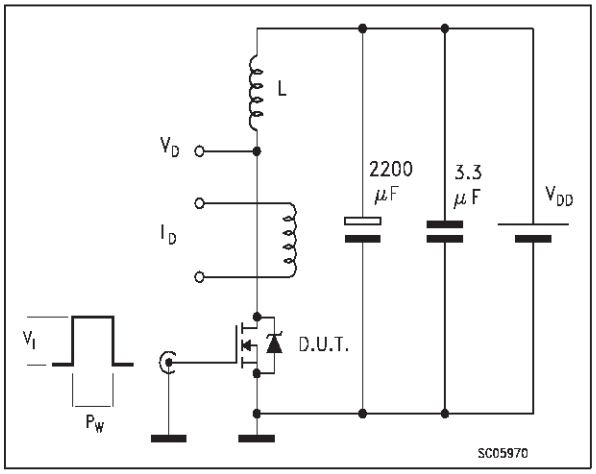



**Fig. 2:** Unclamped Inductive Waveform

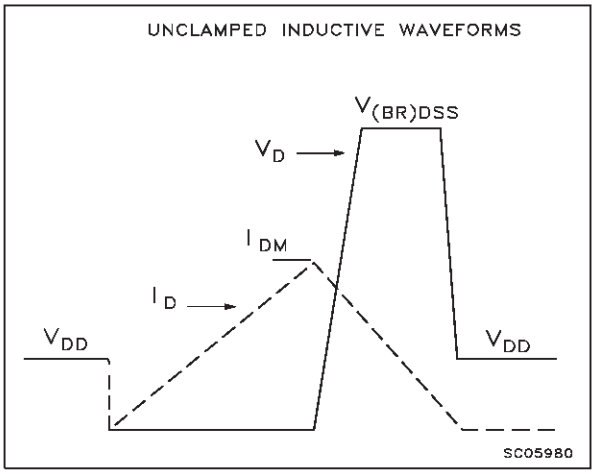



**Fig. 3:** Switching Times Test Circuit For Resistive Load

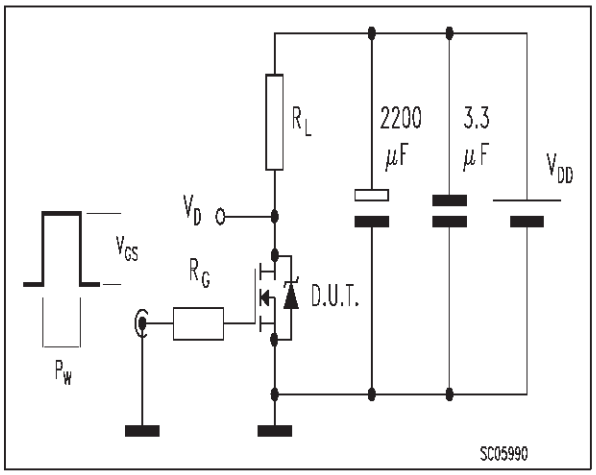



**Fig. 4:** Gate Charge test Circuit

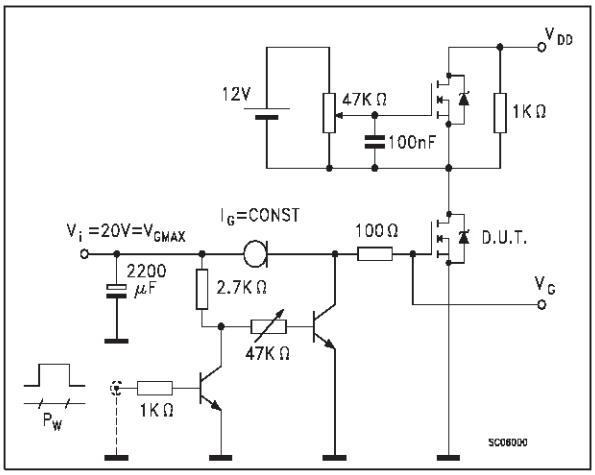
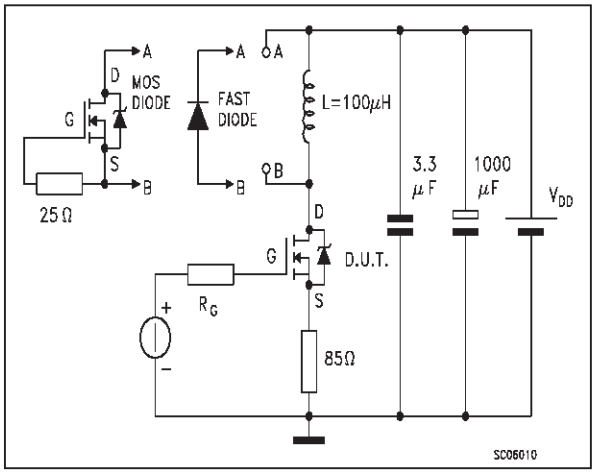
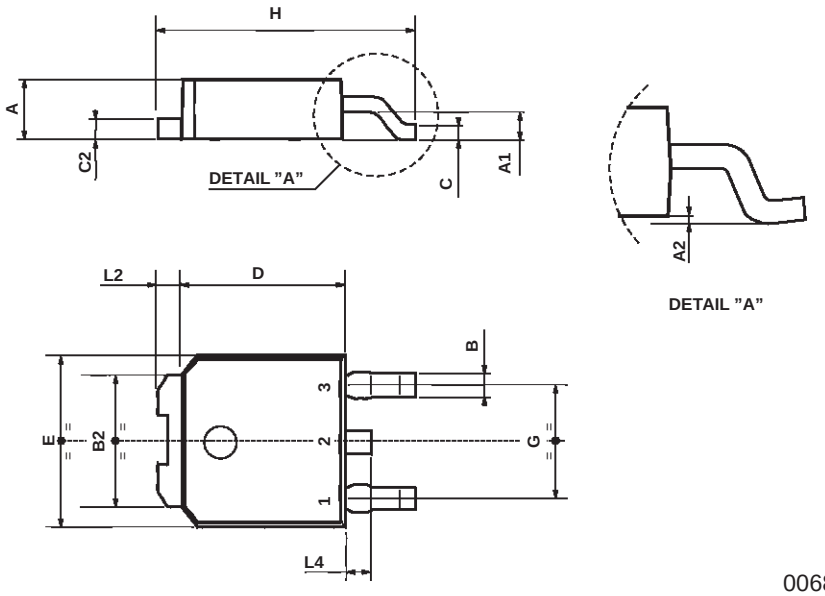



**Fig. 5:** Test Circuit For Inductive Load Switching And Diode Recovery Times



## 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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