SGS-THOMSON MICROELECTRONICS

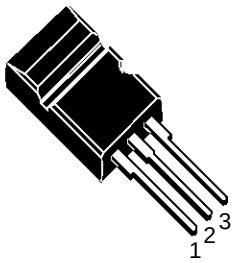
# STU13NB60

## N-CHANNEL ENHANCEMENT MODE PowerMESH™ MOSFET

**PRELIMINARY DATA**

| TYPE | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ |
|---|---|---|---|
| STU13NB60 | 600 V | < 0.45 Ω | 12.6 A |

- TYPICAL $R_{DS(on)}$ = 0.4 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- VERY LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED
- ± 30V GATE TO SOURCE VOLTAGE RATING

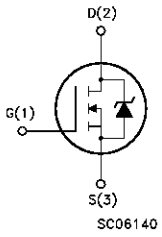



**Max220**

### DESCRIPTION

Using the latest high voltage MESH OVERLAY™ process, SGS-Thomson has designed an advanced family of power MOSFETs with outstanding performances. The new patent pending strip layout coupled with the Company's proprietary edge termination structure, gives the lowest $R_{DS(on)}$ per area, exceptional avalanche and dv/dt capabilities and unrivalled gate charge and switching characteristics.

### INTERNAL SCHEMATIC DIAGRAM




### APPLICATIONS

- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVE

### 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 (continuous) at $T_c$ = 25 °C | 12.6 | A |
| $I_D$ | Drain Current (continuous) at $T_c$ = 100 °C | 7.9 | A |
| $I_{DM}$(•) | Drain Current (pulsed) | 50.4 | A |
| $P_{tot}$ | Total Dissipation at $T_c$ = 25 °C | 160 | W |
| | Derating Factor | 1.28 | W/°C |
| dv/dt(1) | Peak Diode Recovery voltage slope | 4.5 | 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) $I_{SD}$ ≤13A, di/dt ≤ 200 A/µs, $V_{DD}$ ≤ $V_{(BR)DSS}$, Tj ≤ $T_{JMAX}$

## THERMAL DATA

| | | | | |
|---|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal Resistance Junction-case | Max | 0.78 | $^oC/W$ |
| $R_{thj\text{-}amb}$ | Thermal Resistance Junction-ambient | Max | 62.5 | oC/W |
| $R_{thc\text{-}sink}$ | Thermal Resistance Case-sink | Typ | 0.5 | $^oC/W$ |
| $T_l$ | Maximum Lead Temperature For Soldering Purpose | | 300 | $^oC$ |

## AVALANCHE CHARACTERISTICS

| Symbol | Parameter | Max Value | Unit |
|---|---|---|---|
| $I_{AR}$ | Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max, $\delta < 1\%$) | 12.6 | A |
| $E_{AS}$ | Single Pulse Avalanche Energy (starting $T_j = 25\ ^oC$, $I_D = I_{AR}$, $V_{DD} = 50$ V) | 800 | mJ |

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

OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source Breakdown Voltage | $I_D = 250\ \mu A$ $V_{GS} = 0$ @ $100^oC$ | 600 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current ($V_{GS} = 0$) | $V_{DS}$ = Max Rating<br>$V_{DS}$ = Max Rating $T_c = 125\ ^oC$ | | | 1<br>50 | $\mu A$<br>$\mu A$ |
| $I_{GSS}$ | Gate-body Leakage Current ($V_{DS} = 0$) | $V_{GS} = \pm 30$ V | | | $\pm 100$ | nA |

ON (*)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}$ $I_D = 250\ \mu A$ | 3 | 4 | 5 | V |
| $R_{DS(on)}$ | Static Drain-source On Resistance | $V_{GS} = 10$V $I_D = 6.3$ A | | 0.4 | 0.45 | $\Omega$ |
| $I_{D(on)}$ | On State Drain Current | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$<br>$V_{GS} = 10$ V | 12.6 | | | A |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ (*) | Forward Transconductance | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 6.3$ A | 6 | 9 | | 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 $V_{GS} = 0$ | | 2950<br>370<br>33 | 3840<br>480<br>43 | pF<br>pF<br>pF |

**ELECTRICAL CHARACTERISTICS** (continued)

SWITCHING ON

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$<br>$t_r$ | Turn-on Time<br>Rise Time | $V_{DD}$ = 300 V $I_D$ = 6.3 A<br>$R_G$ = 4.7 Ω $V_{GS}$ = 10 V<br>(see test circuit, figure 3) | | 30<br>14 | 42<br>20 | ns<br>ns |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total Gate Charge<br>Gate-Source Charge<br>Gate-Drain Charge | $V_{DD}$ = 480 V $I_D$ =12.6 A $V_{GS}$ = 10 V | | 65<br>18<br>27 | 91 | nC<br>nC<br>nC |

SWITCHING OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{r(Voff)}$<br>$t_f$<br>$t_c$ | Off-voltage Rise Time<br>Fall Time<br>Cross-over Time | $V_{DD}$ = 480 V $I_D$ = 12.6 A<br>$R_G$ = 4.7 Ω $V_{GS}$ = 10 V<br>(see test circuit, figure 5) | | 21<br>18<br>32 | 29<br>25<br>45 | ns<br>ns<br>ns |

SOURCE DRAIN DIODE

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$<br>$I_{SDM}$(•) | Source-drain Current<br>Source-drain Current (pulsed) | | | | 12.6 | A<br>A |
| $V_{SD}$ (*) | Forward On Voltage | $I_{SD}$ = 12.6 A $V_{GS}$ = 0 | | | 1.6 | V |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse Recovery Time<br>Reverse Recovery Charge<br>Reverse Recovery Current | $I_{SD}$ = 12.6 A di/dt = 100 A/µs<br>$V_{DD}$ = 100 V $T_j$ = 150 °C<br>(see test circuit, figure 5) | | 820<br>9.6<br>23.5 | | ns<br>µC<br>A |

(*) Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %

(•) Pulse width limited by safe operating area

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

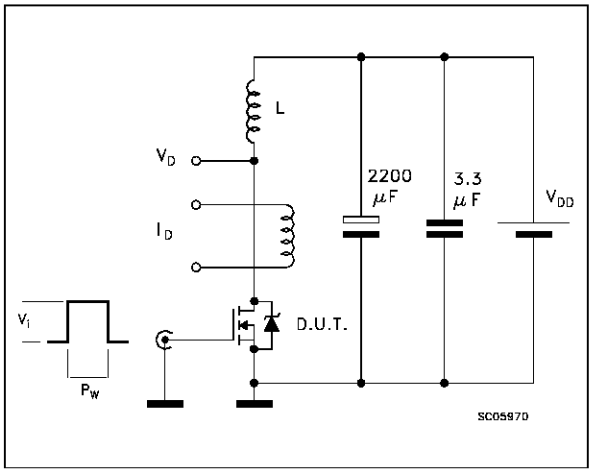



**Fig. 2:** Unclamped Inductive Waveform

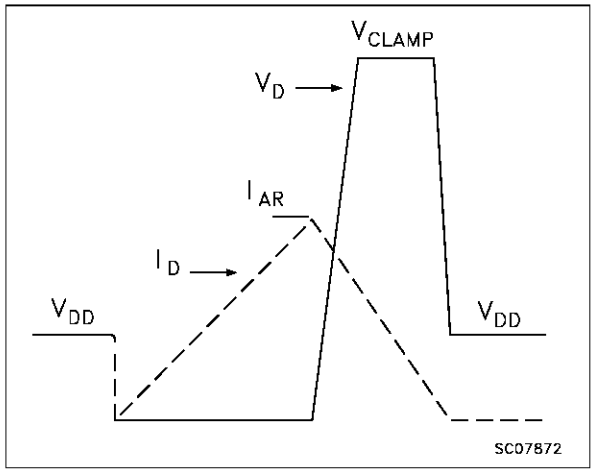



**Fig. 3:** Switching Times Test Circuits For Resistive Load

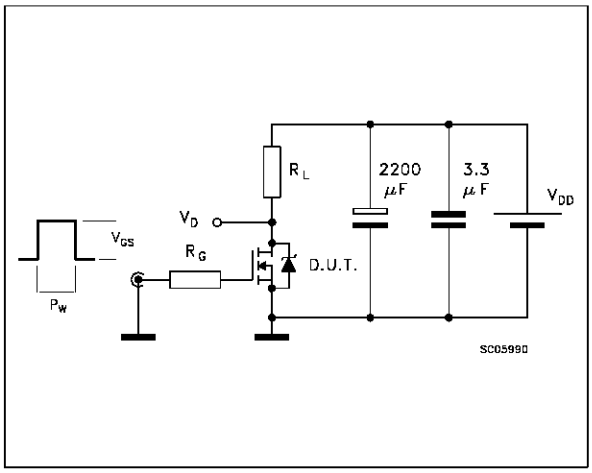



**Fig. 4:** Gate Charge test Circuit

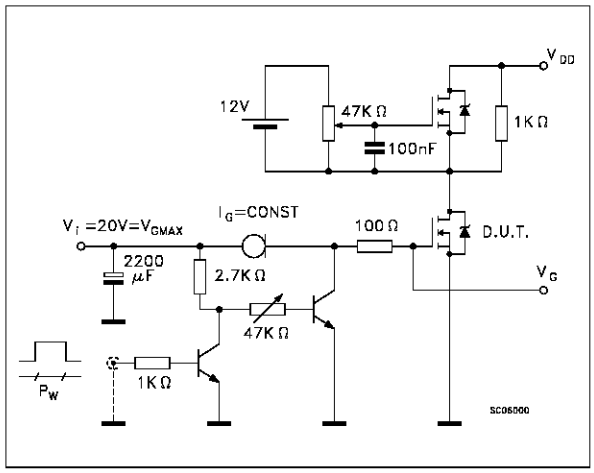
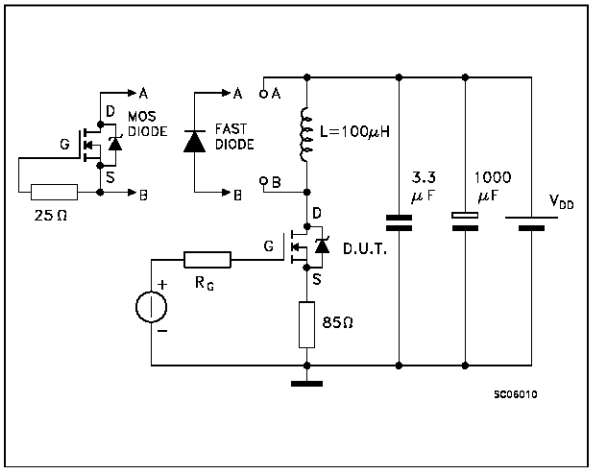
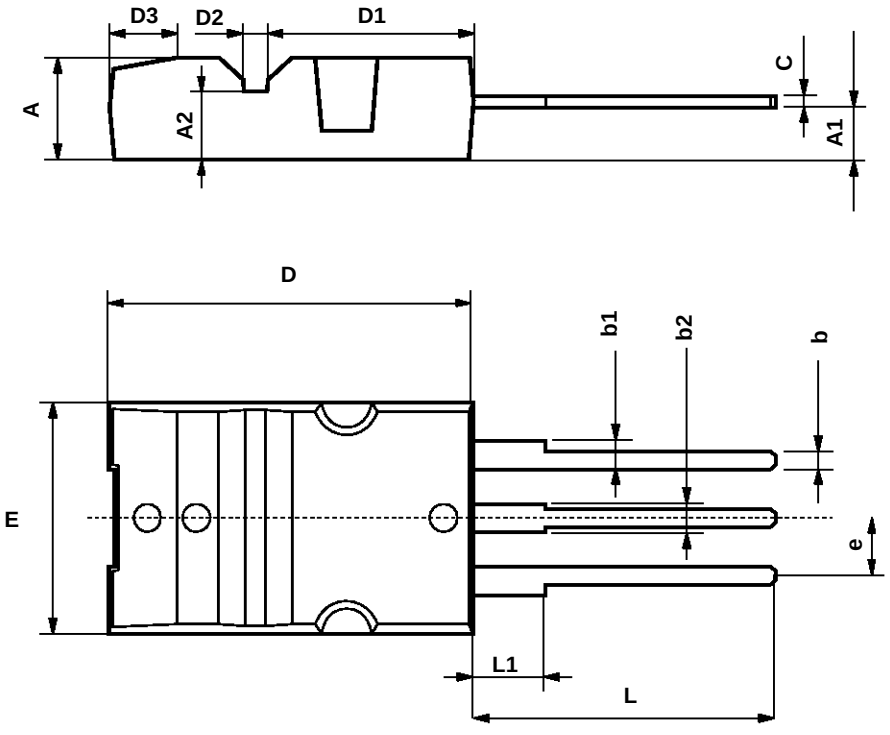



**Fig. 5:** Test Circuit For Inductive Load Switching And Diode Recovery Times



## Max220 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.3 | | 4.6 | 0.169 | | 0.181 |
| A1 | 2.2 | | 2.4 | 0.087 | | 0.094 |
| A2 | 2.9 | | 3.1 | 0.114 | | 0.122 |
| b | 0.7 | | 0.93 | 0.027 | | 0.036 |
| b1 | 1.25 | | 1.4 | 0.049 | | 0.055 |
| b2 | 1.2 | | 1.38 | 0.047 | | 0.054 |
| c | 0.45 | | 0.6 | | 0.18 | 0.023 |
| D | 15.9 | | 16.3 | | 0.626 | 0.641 |
| D1 | 9 | | 9.35 | 0.354 | | 0.368 |
| D2 | 0.8 | | 1.2 | 0.031 | | 0.047 |
| D3 | 2.8 | | 3.2 | 0.110 | | 0.126 |
| e | 2.44 | | 2.64 | 0.096 | | 0.104 |
| E | 10.05 | | 10.35 | 0.396 | | 0.407 |
| L | 13.2 | | 13.6 | 0.520 | | 0.535 |
| L1 | 3 | | 3.4 | 0.118 | | 0.133 |

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