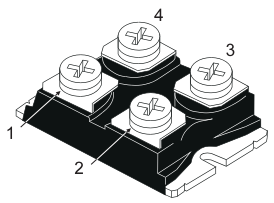
SGS-THOMSON MICROELECTRONICS

# STE53NA50

## N - CHANNEL ENHANCEMENT MODE FAST POWER MOS TRANSISTOR

| TYPE | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ |
|---|---|---|---|
| STE53NA50 | 500 V | < 0.085 Ω | 53 A |

- TYPICAL $R_{DS(on)}$ = 0.075 Ω
- HIGH CURRENT POWER MODULE
- AVALANCHE RUGGED TECHNOLOGY
- VERY LARGE SOA - LARGE PEAK POWER CAPABILITY
- EASY TO MOUNT
- SAME CURRENT CAPABILITY FOR THE TWO SOURCE TERMINALS
- EXTREMELY LOW Rth (Junction to case)
- VERY LOW INTERNAL PARASITIC INDUCTANCE
- ISOLATED PACKAGE UL RECOGNIZED

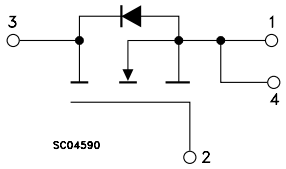



**ISOTOP**

### APPLICATIONS

- SMPS & UPS
- MOTOR CONTROL
- WELDING EQUIPMENT
- OUTPUT STAGE FOR PWM, ULTRASONIC CIRCUITS

**INTERNAL SCHEMATIC DIAGRAM**

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### ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-source Voltage ($V_{GS}$ = 0) | 500 | V |
| $V_{DGR}$ | Drain- gate Voltage ($R_{GS}$ = 20 kΩ) | 500 | V |
| $V_{GS}$ | Gate-source Voltage | ± 30 | V |
| $I_D$ | Drain Current (continuous) at $T_c$ = 25 °C | 53 | A |
| $I_D$ | Drain Current (continuous) at $T_c$ = 100 °C | 33 | A |
| $I_{DM}$(•) | Drain Current (pulsed) | 212 | A |
| $P_{tot}$ | Total Dissipation at $T_c$ = 25 °C | 460 | W |
| | Derating Factor | 3.68 | W/°C |
| $T_{stg}$ | Storage Temperature | -55 to 150 | °C |
| $T_j$ | Max. Operating Junction Temperature | 150 | °C |
| $V_{ISO}$ | Insulation Withhstand Voltage (AC-RMS) | 2500 | V |

(•) Pulse width limited by safe operating area



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## THERMAL DATA

| | | | | |
|---|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal Resistance Junction-case | Max | 0.27 | °C/W |
| $R_{thc\text{-}h}$ | Thermal Resistance Case-heatsink With Conductive Grease Applied | Max | 0.05 | °C/W |

## AVALANCHE CHARACTERISTICS

| Symbol | Parameter | Max Value | Unit |
|---|---|---|---|
| $I_{AR}$ | Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max, $\delta < 1\%$) | 26 | A |
| $E_{AS}$ | Single Pulse Avalanche Energy (starting $T_j$ = 25 °C, $I_D = I_{AR}$, $V_{DD}$ = 50 V) | 1014 | mJ |

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

OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source Breakdown Voltage | $I_D$ = 1 mA $V_{GS}$ = 0 | 500 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current ($V_{GS}$ = 0) | $V_{DS}$ = Max Rating<br>$V_{DS}$ = Max Rating $T_c$ = 125 °C | | | 100<br>1000 | µA<br>µA |
| $I_{GSS}$ | Gate-body Leakage Current ($V_{DS}$ = 0) | $V_{GS}$ = ± 30 V | | | ± 400 | nA |

ON (*)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$ $I_D$ = 1 mA | 2.25 | 3 | 3.75 | V |
| $R_{DS(on)}$ | Static Drain-source On Resistance | $V_{GS}$ = 10V $I_D$ = 27 A | | 0.075 | 0.085 | Ω |
| $I_{D(on)}$ | On State Drain Current | $V_{DS}$ > $I_{D(on)}$ x $R_{DS(on)max}$<br>$V_{GS}$ = 10 V | 53 | | | A |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ (*) | Forward Transconductance | $V_{DS}$ >$I_{D(on)}$ X $R_{DS(on)MAX}$ $I_D$ = 27 A | 25 | | | 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 | | 13<br>1500<br>450 | 16<br>2000<br>650 | nF<br>pF<br>pF |

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## 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 | $V_{DD}$ = 250 V $I_D$ = 27 A<br>$R_G$ = 4.7 Ω $V_{GS}$ = 10 V<br>(see test circuit, figure 1) | | 57<br>92 | 80<br>130 | ns<br>ns |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total Gate Charge<br>Gate-Source Charge<br>Gate-Drain Charge | $V_{DD}$ = 400 V $I_D$ = 53 A $V_{GS}$ = 10 V | | 470<br>54<br>219 | 658 | nC<br>nC<br>nC |

SWITCHING OFF

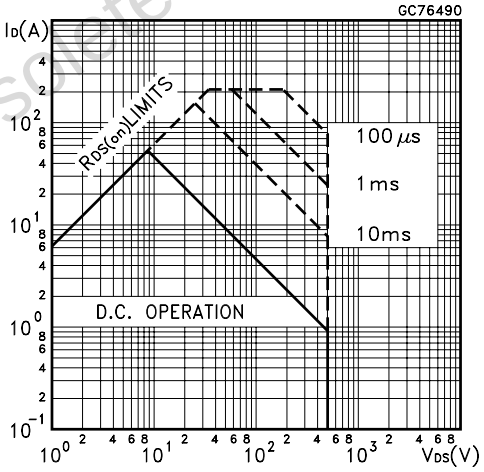
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{r(Voff)}$<br>$t_f$<br>$t_c$ | Off-voltage Rise Time<br>Fall Time<br>Cross-over Time | $V_{DD}$ = 400 V $I_D$ = 53 A<br>$R_G$ = 4.7 Ω $V_{GS}$ = 10 V<br>(see test circuit, figure 3) | | 105<br>36<br>145 | 145<br>50<br>205 | ns<br>ns<br>ns |

SOURCE DRAIN DIODE

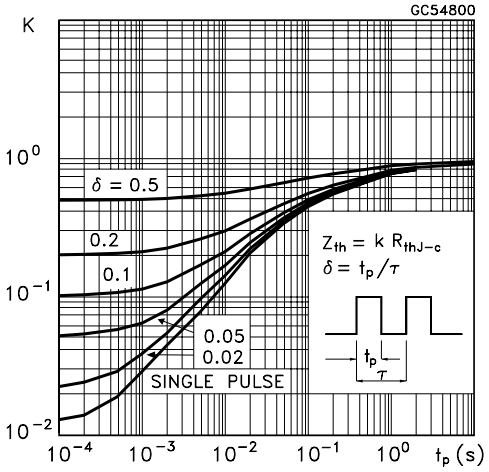
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$<br>$I_{SDM}$(•) | Source-drain Current<br>Source-drain Current (pulsed) | | | | 53<br>212 | A<br>A |
| $V_{SD}$ (*) | Forward On Voltage | $I_{SD}$ = 53 A $V_{GS}$ = 0 | | | 1.6 | V |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse Recovery Time<br>Reverse Recovery Charge<br>Reverse Recovery Current | $I_{SD}$ = 53 A di/dt = 100 A/µs<br>$V_R$ = 100 V $T_j$ = 150 °C<br>(see test circuit, figure 3) | | 1000<br>31.5<br>63 | | ns<br>µC<br>A |

(*) Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %
(•) Pulse width limited by safe operating area

Safe Operating Area for




Thermal Impedance

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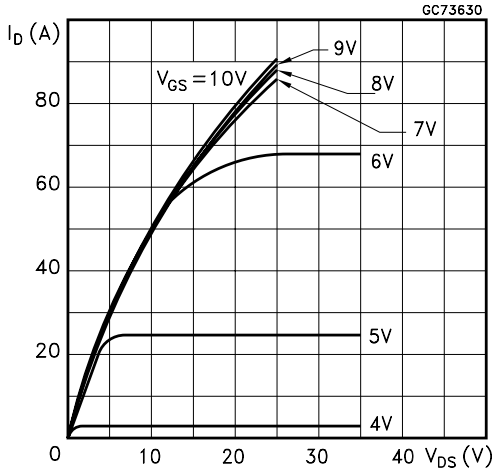
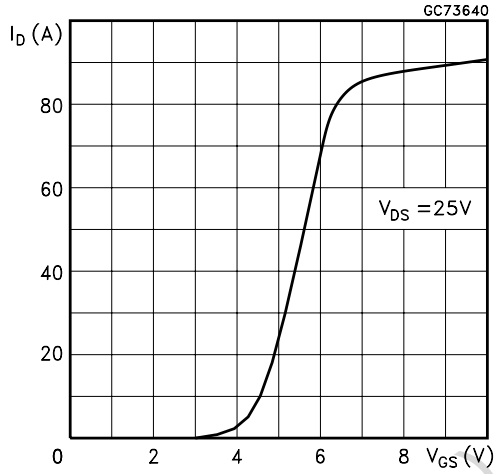
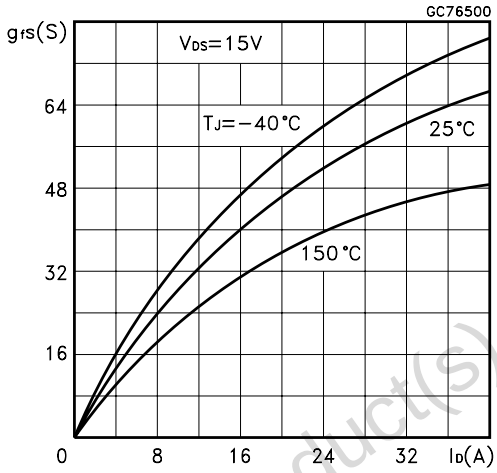
Output Characteristics



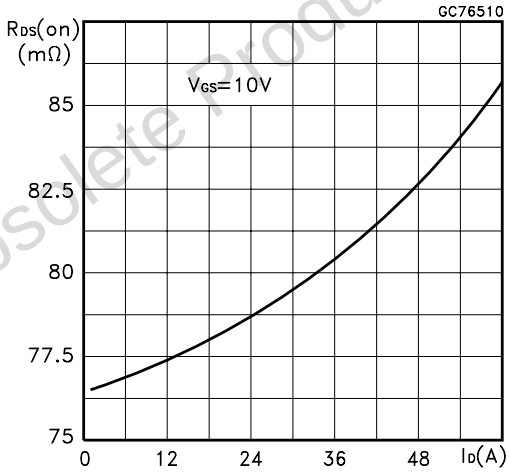

Transfer Characteristics



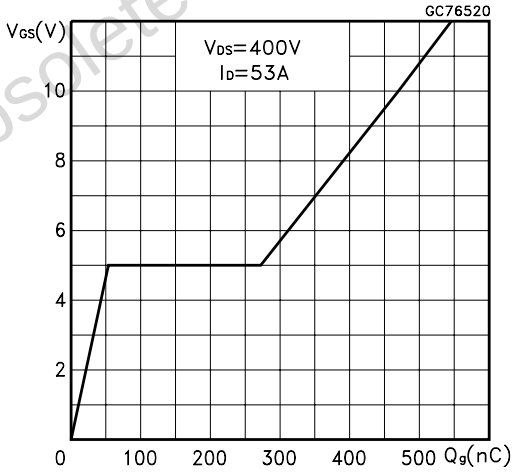

Transconductance



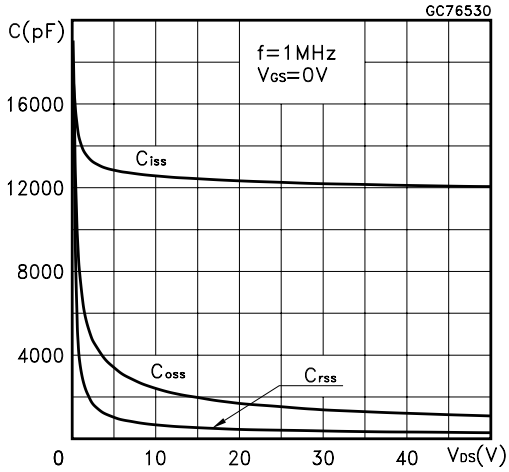

Static Drain-source On Resistance




Gate Charge vs Gate-source Voltage




Capacitance Variations

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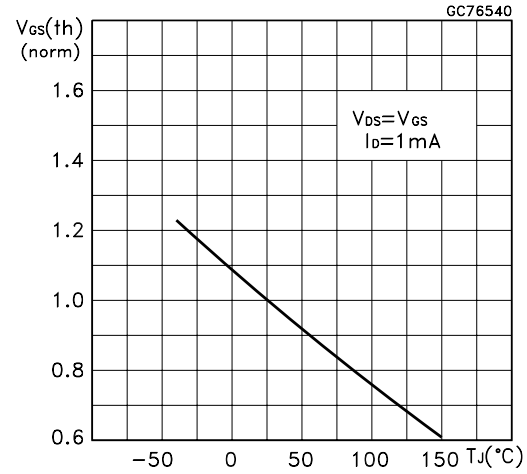
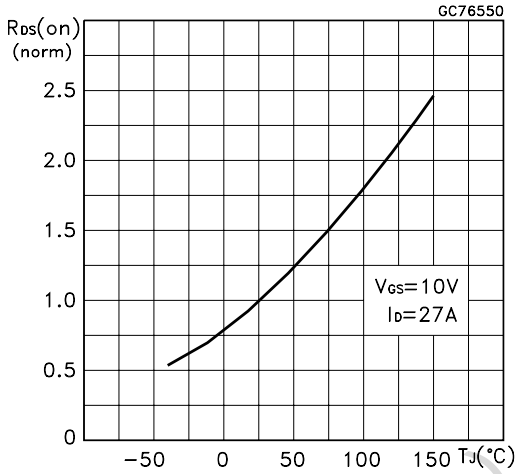
Normalized Gate Threshold Voltage vs Temperature




Normalized On Resistance vs Temperature




Source-drain Diode Forward Characteristics

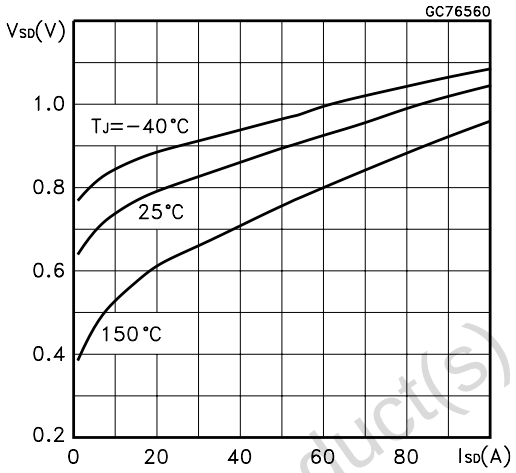



**Fig. 1:** Switching Times Test Circuits For Resistive Load

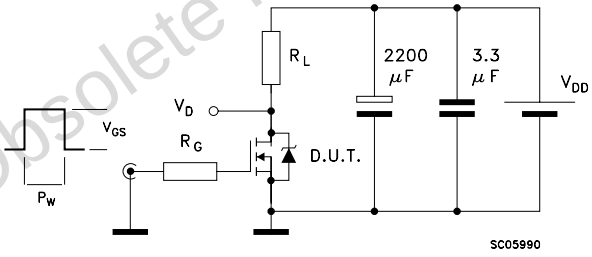



**Fig. 2:** Gate Charge test Circuit

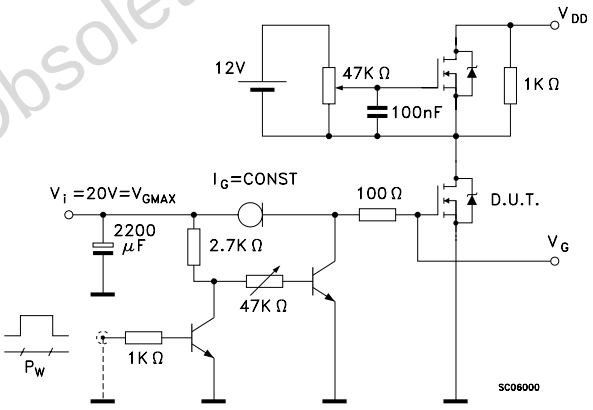
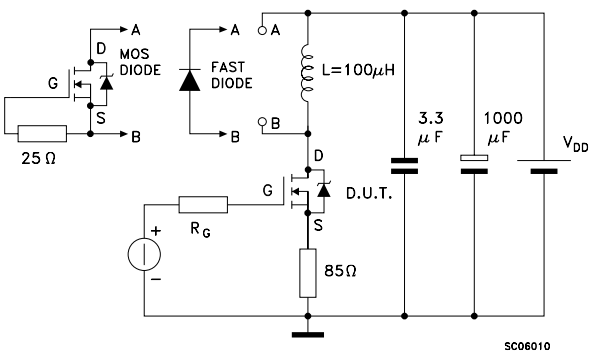



**Fig. 3:** Test Circuit For Inductive Load Switching And Diode Recovery Times

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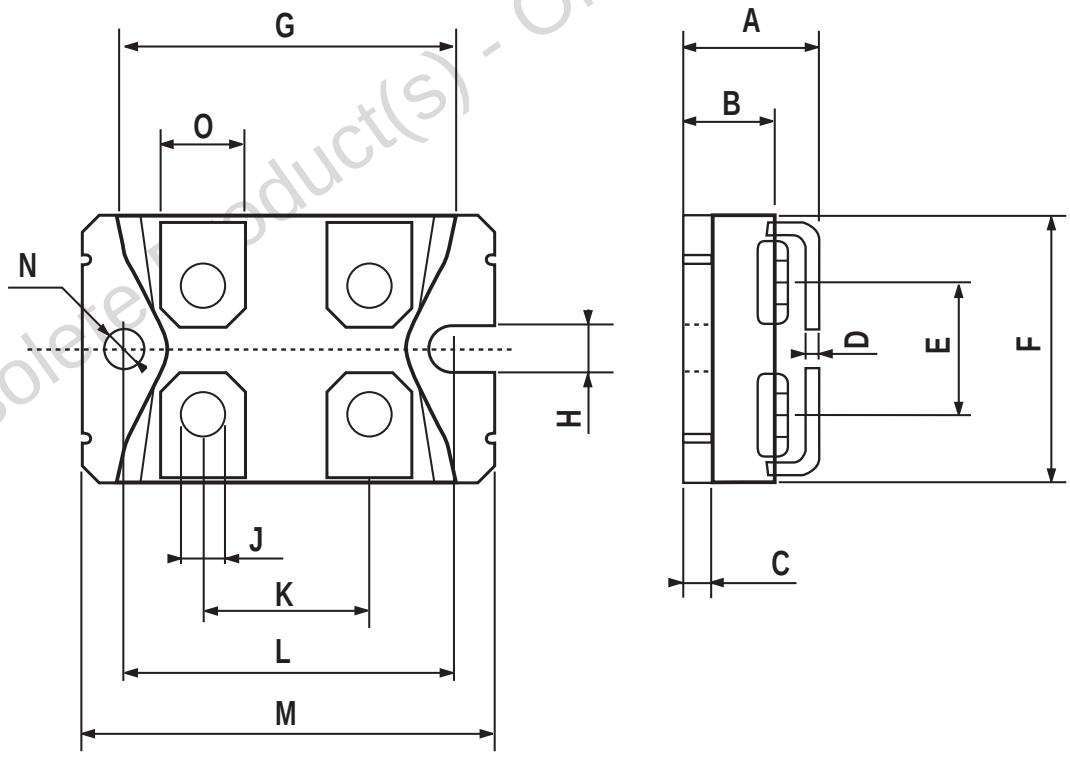
## ISOTOP MECHANICAL DATA

| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 11.8 | | 12.2 | 0.466 | | 0.480 |
| B | 8.9 | | 9.1 | 0.350 | | 0.358 |
| C | 1.95 | | 2.05 | 0.076 | | 0.080 |
| D | 0.75 | | 0.85 | 0.029 | | 0.033 |
| E | 12.6 | | 12.8 | 0.496 | | 0.503 |
| F | 25.15 | | 25.5 | 0.990 | | 1.003 |
| G | 31.5 | | 31.7 | 1.240 | | 1.248 |
| H | 4 | | | 0.157 | | |
| J | 4.1 | | 4.3 | 0.161 | | 0.169 |
| K | 14.9 | | 15.1 | 0.586 | | 0.594 |
| L | 30.1 | | 30.3 | 1.185 | | 1.193 |
| M | 37.8 | | 38.2 | 1.488 | | 1.503 |
| N | 4 | | | 0.157 | | |
| O | 7.8 | | 8.2 | 0.307 | | 0.322 |

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