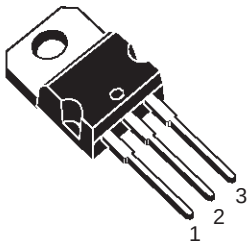
# STP50NE10

## N - CHANNEL 100V - 0.021Ω - 50A - $D^2$PAK
## STripFET™ POWER MOSFET

| TYPE | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ |
|---|---|---|---|
| STP50NE10 | 100 V | <0.027 Ω | 50 A |

- TYPICAL $R_{DS(on)}$ = 0.021 Ω
- EXCEPTIONAL dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- LOW GATE CHARGE AT 100 °C
- APPLICATION ORIENTED CHARACTERIZATION




**TO-220**

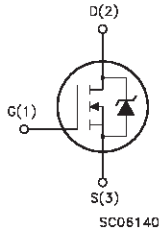
### DESCRIPTION

This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

### APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- DC-DC & DC-AC CONVERTERS
- AUTOMOTIVE ENVIRONMENT

### INTERNAL SCHEMATIC DIAGRAM




### ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-source Voltage ($V_{GS}$ = 0) | 100 | V |
| $V_{DGR}$ | Drain- gate Voltage ($R_{GS}$ = 20 kΩ) | 100 | V |
| $V_{GS}$ | Gate-source Voltage | ± 20 | V |
| $I_D$ | Drain Current (continuous) at $T_c$ = 25 °C | 50 | A |
| $I_D$ | Drain Current (continuous) at $T_c$ = 100 °C | 35 | A |
| $I_{DM}$(•) | Drain Current (pulsed) | 200 | A |
| $P_{tot}$ | Total Dissipation at $T_c$ = 25 °C | 150 | W |
| | Derating Factor | 1 | W/°C |
| dv/dt (1) | Peak Diode Recovery voltage slope | 6 | V/ns |
| $T_{stg}$ | Storage Temperature | -65 to 175 | °C |
| $T_j$ | Max. Operating Junction Temperature | 175 | °C |

(•) Pulse width limited by safe operating area

(1) $I_{SD}$ ≤ 50 A, di/dt ≤ 300 A/µs, $V_{DD}$ ≤ $V_{(BR)DSS}$, $T_j$ ≤ $T_{JMAX}$

## THERMAL DATA

| | | | | |
|---|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal Resistance Junction-case | Max | 1 | $^oC/W$ |
| $R_{thj\text{-}amb}$ | 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) | 50 | A |
| $E_{AS}$ | Single Pulse Avalanche Energy (starting $T_j$ = 25 $^oC$, $I_D = I_{AR}$, $V_{DD}$ = 50 V) | 300 | 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 µA $V_{GS}$ = 0 | 100 | | | 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>10 | µA<br>µA |
| $I_{GSS}$ | Gate-body Leakage Current ($V_{DS}$ = 0) | $V_{GS}$ = ± 20 V | | | ± 100 | nA |

ON (*)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$ $I_D$ = 250 µA | 2 | 3 | 4 | V |
| $R_{DS(on)}$ | Static Drain-source On Resistance | $V_{GS}$ = 10V $I_D$ = 25 A | | 0.021 | 0.027 | Ω |
| $I_{D(on)}$ | On State Drain Current | $V_{DS}$ > $I_{D(on)}$ x $R_{DS(on)max}$<br>$V_{GS}$ = 10 V | 50 | | | A |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ (*) | Forward Transconductance | $V_{DS}$ > $I_{D(on)}$ x $R_{DS(on)max}$ $I_D$ =25 A | 20 | 35 | | 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 | | 4350<br>500<br>175 | 6000<br>675<br>238 | 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 | $V_{DD}$ = 50 V $I_D$ = 25 A<br>$R_G$ =4.7 Ω $V_{GS}$ = 10 V<br>(see test circuit, figure 3) | | 25<br>100 | 34<br>135 | ns<br>ns |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total Gate Charge<br>Gate-Source Charge<br>Gate-Drain Charge | $V_{DD}$ = 80 V $I_D$ = 50 A $V_{GS}$ = 10 V | | 123<br>24<br>47 | 166 | 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 | $V_{DD}$ = 80 V $I_D$ = 50 A<br>$R_G$ =4.7 Ω $V_{GS}$ = 10 V<br>(see test circuit, figure 5) | | 45<br>35<br>65 | 61<br>48<br>88 | ns<br>ns<br>ns |

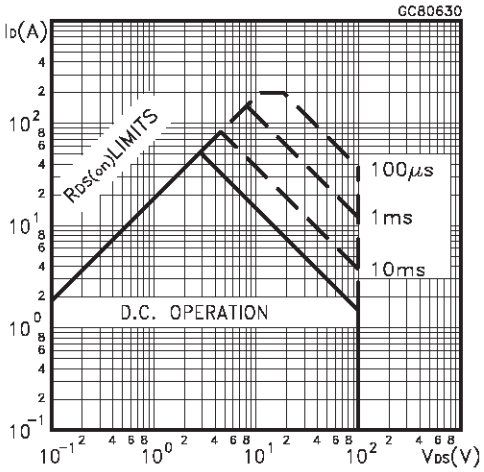
SOURCE DRAIN DIODE

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$<br>$I_{SDM}$(•) | Source-drain Current<br>Source-drain Current (pulsed) | | | | 50<br>200 | A<br>A |
| $V_{SD}$ (*) | Forward On Voltage | $I_{SD}$ = 50 A $V_{GS}$ = 0 | | | 1.5 | V |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse Recovery Time<br>Reverse Recovery Charge<br>Reverse Recovery Current | $I_{SD}$ = 50 A di/dt = 100 A/µs<br>$V_{DD}$ = 30 V $T_j$ = 150 °C<br>(see test circuit, figure 5) | | 155<br>815<br>10.5 | 210<br>1100<br>15 | ns<br>nC<br>A |

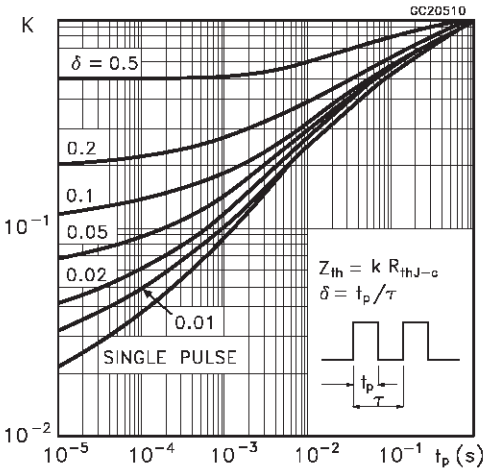
(*) Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %

(•) Pulse width limited by safe operating area

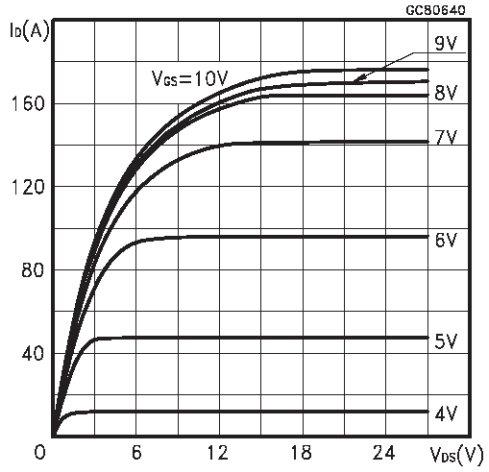
Safe Operating Area



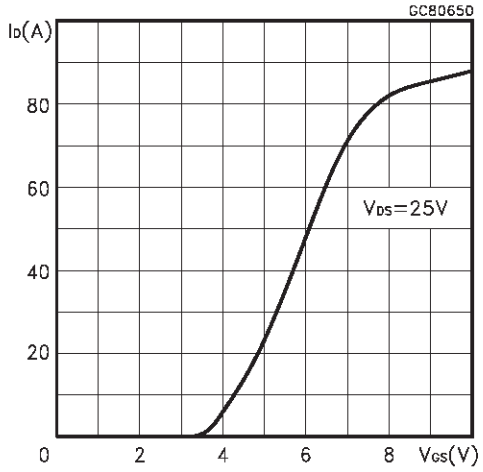

Thermal Impedance



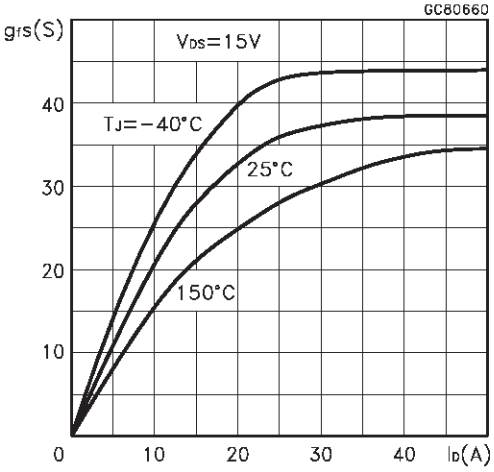
Output Characteristics



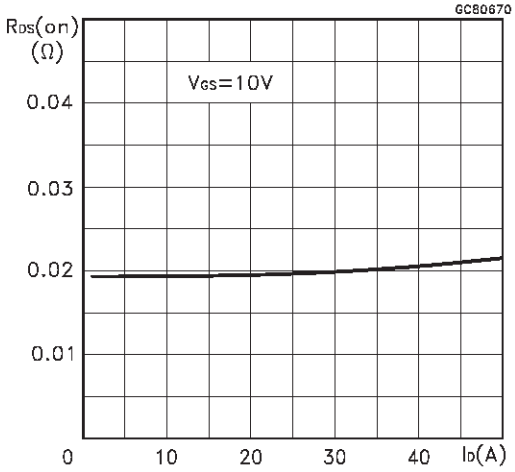

Transfer Characteristics



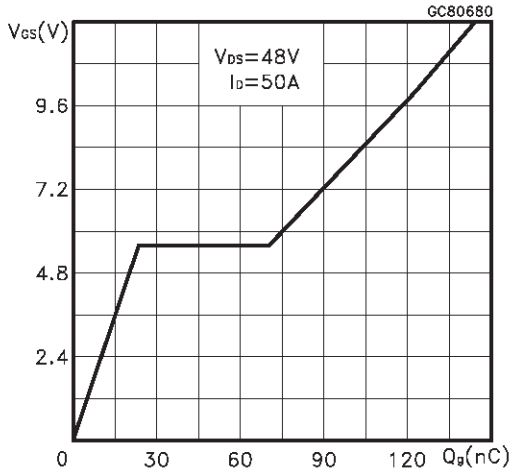

Transconductance



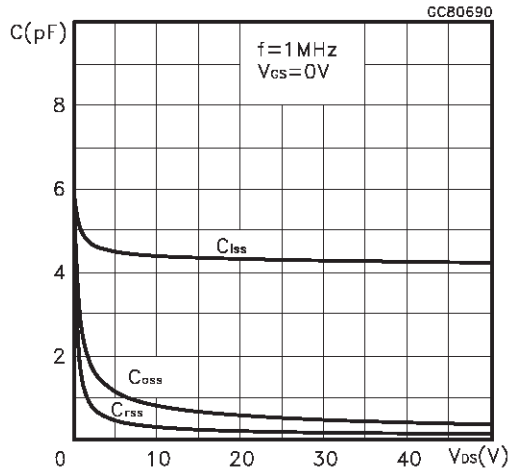

Static Drain-source On Resistance



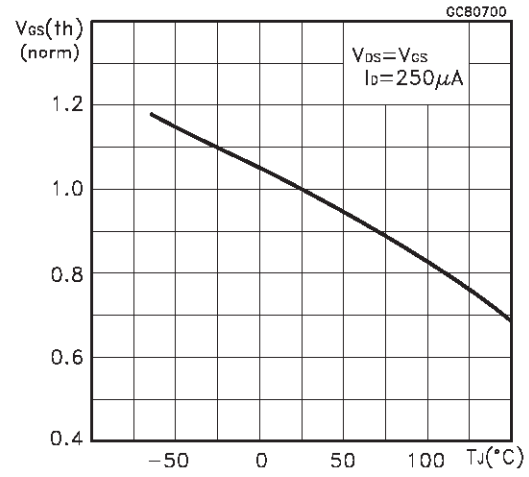

Gate Charge vs Gate-source Voltage



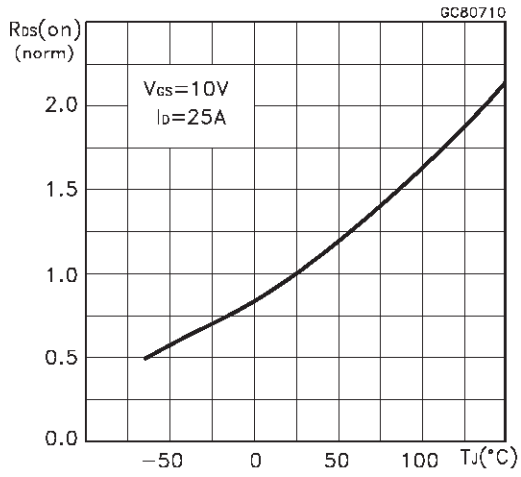

Capacitance Variations



Normalized Gate Threshold Voltage vs Temperature




Normalized On Resistance vs Temperature




Source-drain Diode Forward Characteristics

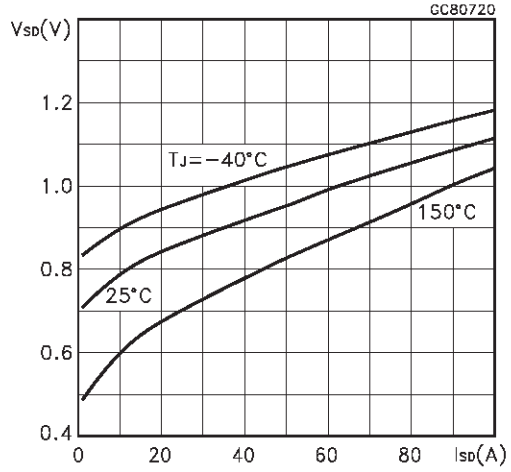


**Fig. 1:** Unclamped Inductive Load Test Circuit

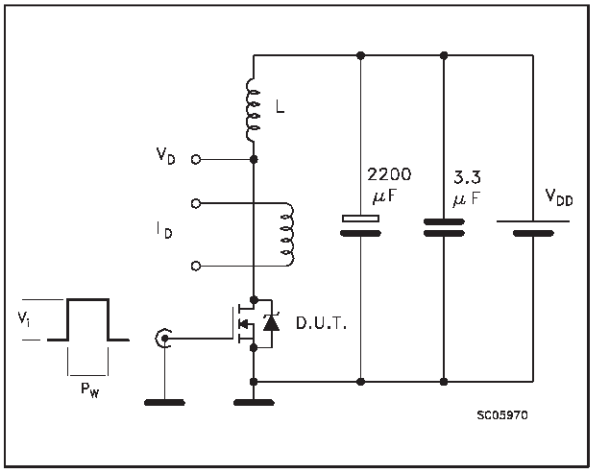



**Fig. 2:** Unclamped Inductive Waveform

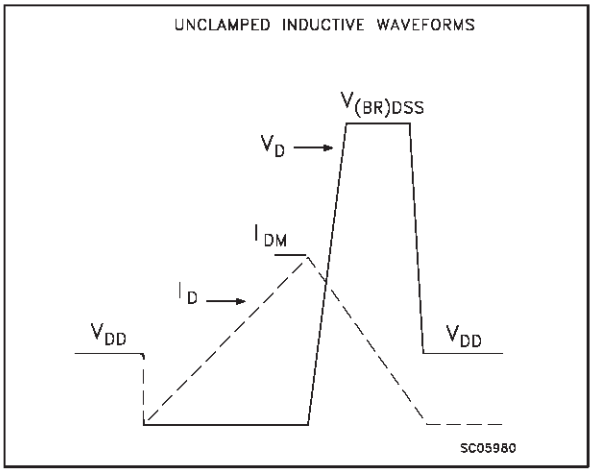



**Fig. 3:** Switching Times Test Circuits For Resistive Load

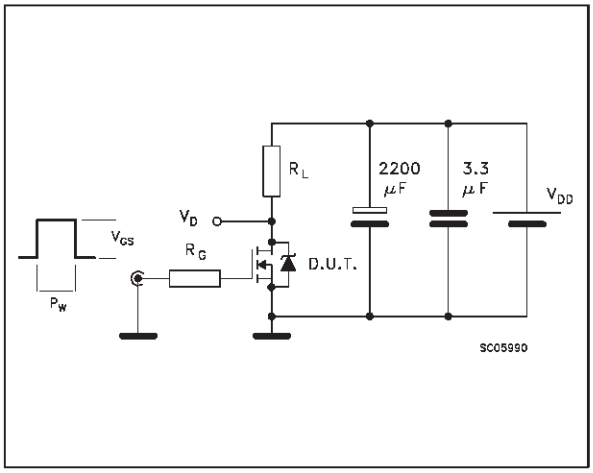



**Fig. 4:** Gate Charge test Circuit

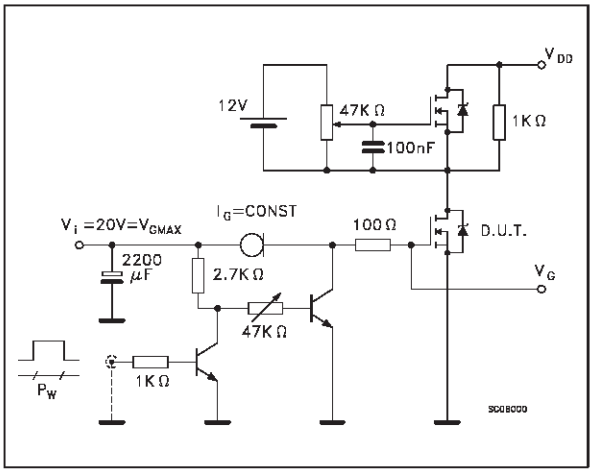
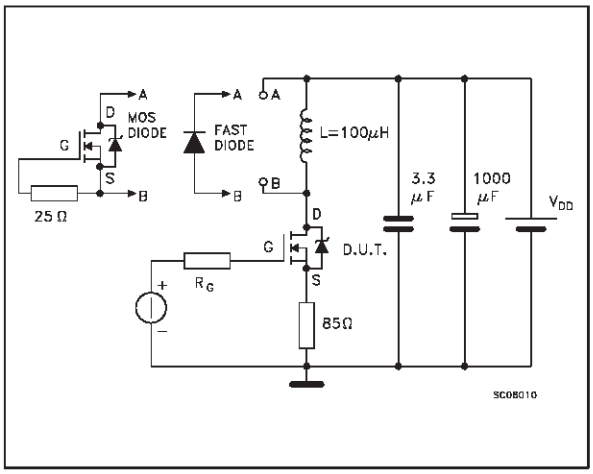



**Fig. 5:** Test Circuit For Inductive Load Switching And Diode Recovery Times



## TO-220 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| C | 1.23 | | 1.32 | 0.048 | | 0.051 |
| D | 2.40 | | 2.72 | 0.094 | | 0.107 |
| D1 | | 1.27 | | | 0.050 | |
| E | 0.49 | | 0.70 | 0.019 | | 0.027 |
| F | 0.61 | | 0.88 | 0.024 | | 0.034 |
| F1 | 1.14 | | 1.70 | 0.044 | | 0.067 |
| F2 | 1.14 | | 1.70 | 0.044 | | 0.067 |
| G | 4.95 | | 5.15 | 0.194 | | 0.203 |
| G1 | 2.4 | | 2.7 | 0.094 | | 0.106 |
| H2 | 10.0 | | 10.40 | 0.393 | | 0.409 |
| L2 | | 16.4 | | | 0.645 | |
| L4 | 13.0 | | 14.0 | 0.511 | | 0.551 |
| L5 | 2.65 | | 2.95 | 0.104 | | 0.116 |
| L6 | 15.25 | | 15.75 | 0.600 | | 0.620 |
| L7 | 6.2 | | 6.6 | 0.244 | | 0.260 |
| L9 | 3.5 | | 3.93 | 0.137 | | 0.154 |
| DIA. | 3.75 | | 3.85 | 0.147 | | 0.151 |