



STW60NE10

N - CHANNEL 100V - 0.016Ω - 60A TO-247 STripFET™ POWER MOSFET

| TYPE | V _{DSS} | R _{DS(on)} | I _D |
|-----------|------------------|---------------------|----------------|
| STW60NE10 | 100 V | <0.022 Ω | 60 A |

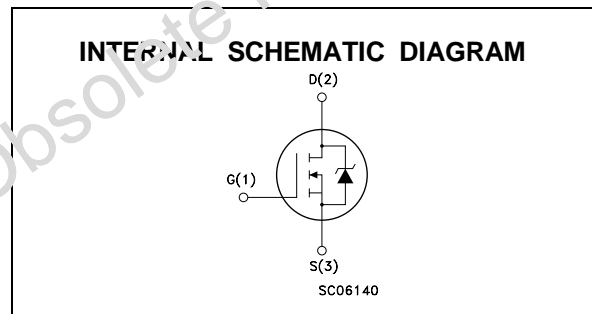
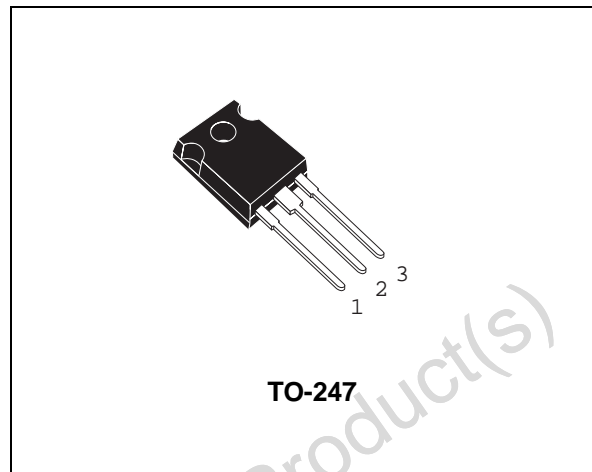
- TYPICAL R_{DS(on)} = 0.016 Ω
- EXCEPTIONAL dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- APPLICATION ORIENTED CHARACTERIZATION

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 (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc)



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---------------------|---|------------|------|
| V _{DS} | Drain-source Voltage (V _{GS} = 0) | 100 | V |
| V _{DG} | 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 | 60 | A |
| I _D | Drain Current (continuous) at T _c = 100 °C | 42 | A |
| I _{DM} (●) | Drain Current (pulsed) | 240 | A |
| P _{tot} | Total Dissipation at T _c = 25 °C | 180 | W |
| | Derating Factor | 1.2 | W/°C |
| dv/dt (1) | Peak Diode Recovery voltage slope | 9 | 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} ≤ 60 A, di/dt ≤ 200 A/μs, V_{DD} ≤ V_{(BR)DSS}, T_j ≤ T_{JMAX}

STW60NE10

THERMAL DATA

| | | | | |
|-----------------------|--|-----|------|------|
| R _{thj-case} | Thermal Resistance Junction-case | Max | 0.83 | °C/W |
| R _{thj-amb} | Thermal Resistance Junction-ambient | Max | 30 | °C/W |
| R _{thc-sink} | Thermal Resistance Case-sink | Typ | 0.1 | °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) | 60 | A |
| E _{AS} | Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 35 V) | 500 | 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 = 250 μA V _{GS} = 0 | 100 | | | V |
| I _{DSS} | Zero Gate Voltage Drain Current (V _{GS} = 0) | V _{DS} = Max Rating V _{DS} = Max Rating T _c = 125 °C | | | 1 10 | μA 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} = 10 V I _D = 30 A | | 0.016 | 0.022 | Ω |
| I _{D(on)} | On State Drain Current | V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V | 60 | | | A |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------------|------------------------------|---|------|------|------|------|
| g _{fs} (*) | Forward Transconductance | V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 18 A | | 30 | | S |
| C _{iss} | Input Capacitance | V _{DS} = 25 V f = 1 MHz V _{GS} = 0 | | 5300 | | pF |
| C _{oss} | Output Capacitance | | | 640 | | pF |
| C _{rss} | Reverse Transfer Capacitance | | | 215 | | pF |

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-------------|--------------------|--|------|------|------|------|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD} = 50\text{ V}$ $I_D = 30\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (Resistive Load, see fig. 3) | | 28 | | ns |
| t_r | Rise Time | | | 100 | | ns |
| Q_g | Total Gate Charge | $V_{DD} = 80\text{ V}$ $I_D = 60\text{ A}$ $V_{GS} = 10\text{ V}$ | | 142 | 185 | nC |
| Q_{gs} | Gate-Source Charge | | | 27 | | nC |
| Q_{gd} | Gate-Drain Charge | | | 59 | | nC |

SWITCHING OFF

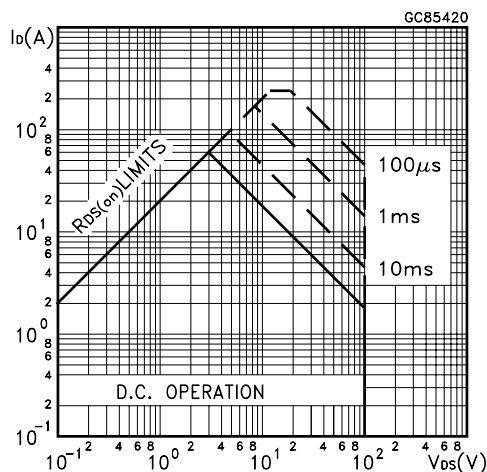
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------|-----------------------|---|------|------|------|------|
| $t_{d(off)}$ | Turn-off Delay Time | $V_{DD} = 50\text{ V}$ $I_D = 30\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (Resistive Load, see fig. 3) | | 160 | | ns |
| t_f | Fall Time | | | 45 | | ns |
| $t_{r(voff)}$ | Off-voltage Rise Time | $V_{clamp} = 80\text{ V}$ $I_D = 60\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (Inductive Load, see fig. 5) | | 40 | | ns |
| t_f | Fall Time | | | 45 | | ns |
| t_c | Cross-over Time | | | 85 | | ns |

SOURCE DRAIN DIODE

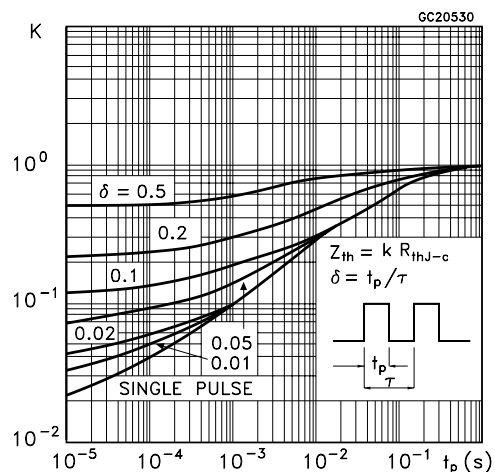
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------------------|-------------------------------|---|------|------|------|---------------|
| I_{SD} | Source-drain Current | | | | 60 | A |
| $I_{SDM}(\bullet)$ | Source-drain Current (pulsed) | | | | 240 | A |
| $V_{SD} (*)$ | Forward On Voltage | $I_{SD} = 60\text{ A}$ $V_{GS} = 0$ | | | 1.5 | V |
| t_{rr} | Reverse Recovery Time | $I_{SD} = 60\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 50\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$ (see test circuit, fig. 5) | | 170 | | ns |
| Q_{rr} | Reverse Recovery Charge | | | 1.02 | | μC |
| I_{RRM} | Reverse Recovery Current | | | 12 | | A |

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

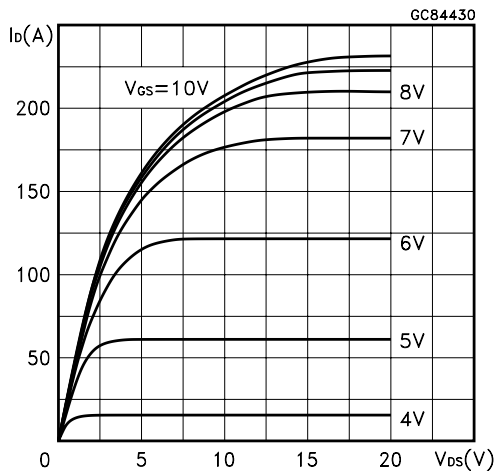
Safe Operating Area



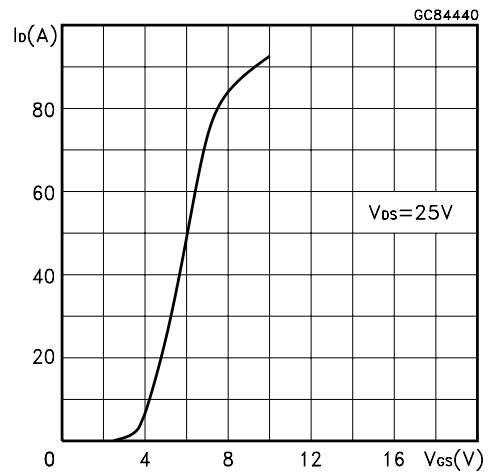
Thermal Impedance



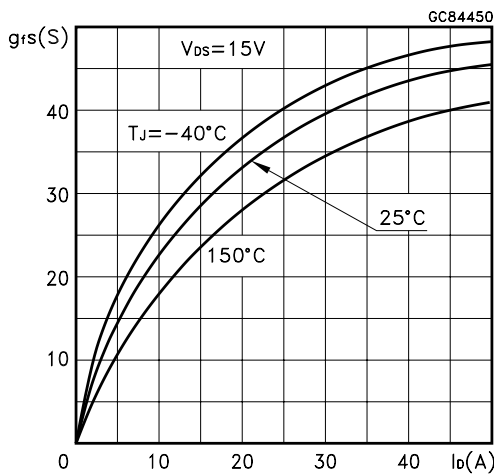
Output Characteristics



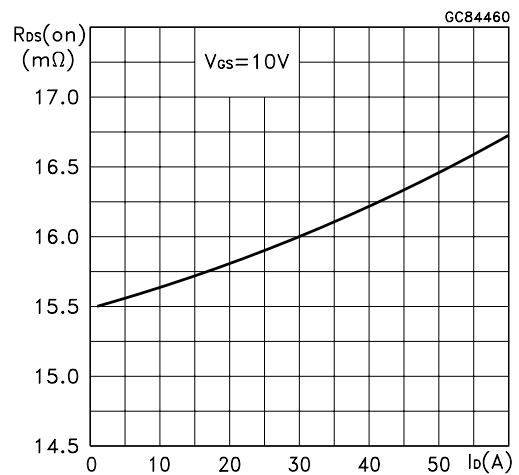
Transfer Characteristics



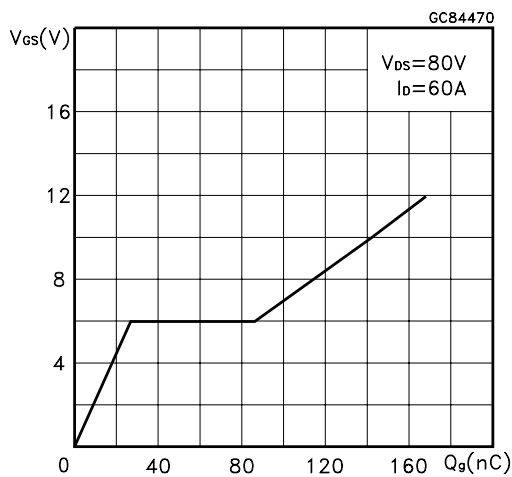
Transconductance



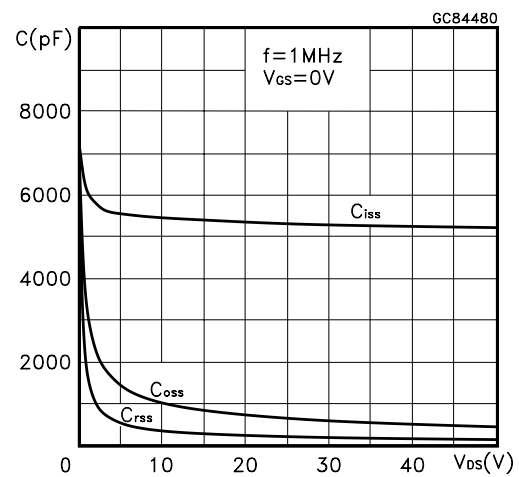
Static Drain-source On Resistance



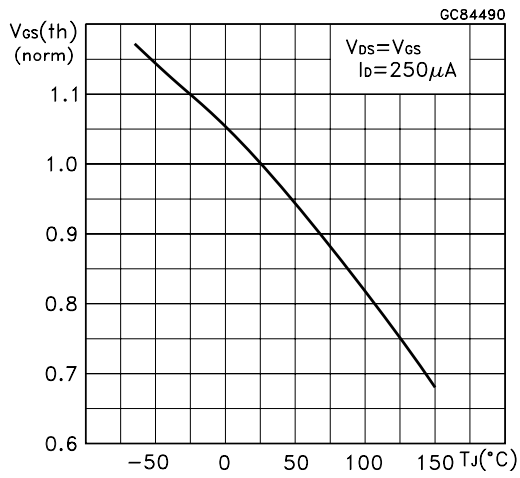
Gate Charge vs Gate-source Voltage



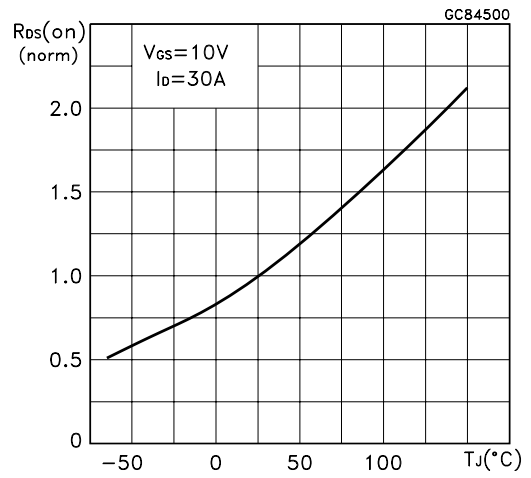
Capacitance Variations



Normalized Gate Threshold Voltage vs Temperature



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics

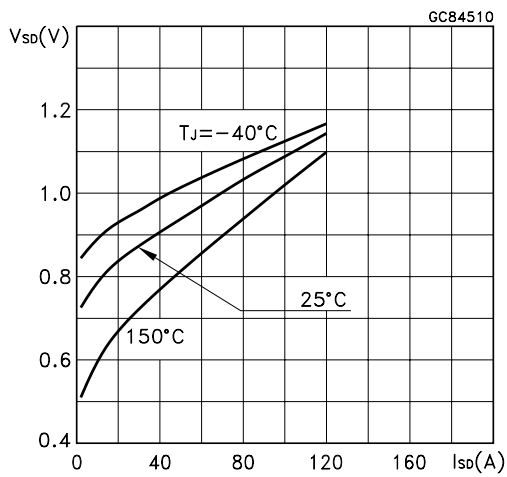


Fig. 1: Unclamped Inductive Load Test Circuit



Fig. 2: Unclamped Inductive Waveform

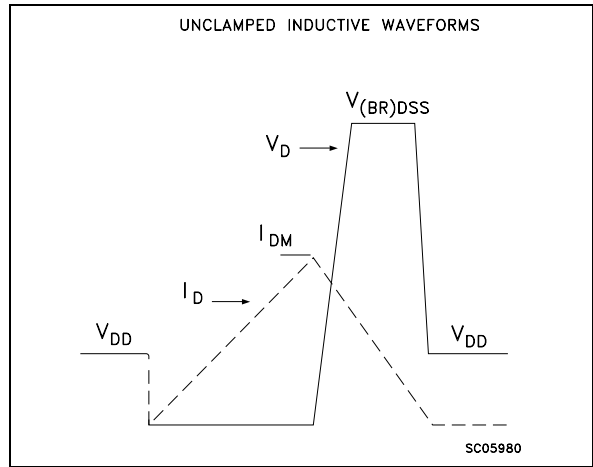


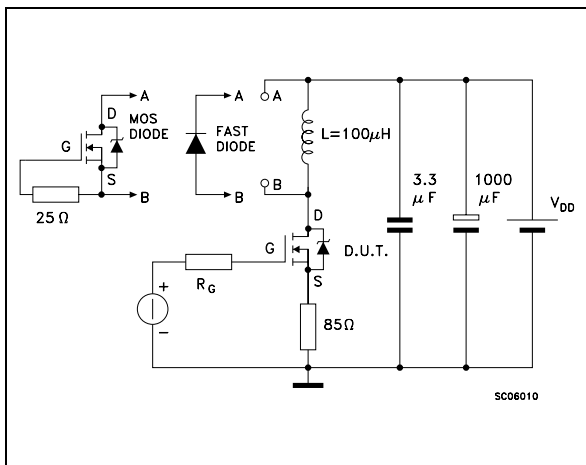
Fig. 3: Switching Times Test Circuits For Resistive Load



Fig. 4: Gate Charge test Circuit

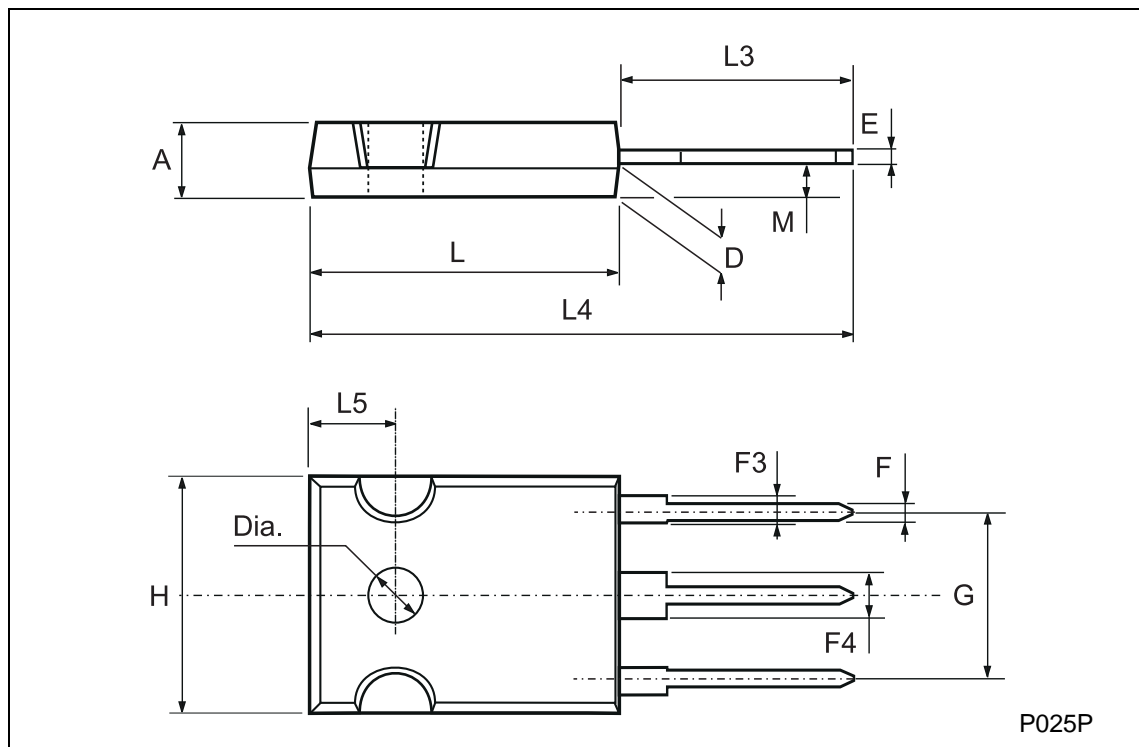


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



TO-247 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.7 | | 5.3 | 0.185 | | 0.209 |
| D | 2.2 | | 2.6 | 0.087 | | 0.102 |
| E | 0.4 | | 0.8 | 0.016 | | 0.031 |
| F | 1 | | 1.4 | 0.039 | | 0.055 |
| F3 | 2 | | 2.4 | 0.079 | | 0.094 |
| F4 | 3 | | 3.4 | 0.118 | | 0.134 |
| G | | 10.9 | | | 0.429 | |
| H | 15.3 | | 15.9 | 0.602 | | 0.626 |
| L | 19.7 | | 20.3 | 0.776 | | 0.779 |
| L3 | 14.2 | | 14.8 | 0.559 | 0.413 | 0.582 |
| L4 | | 34.6 | | | 1.362 | |
| L5 | | 5.5 | | | 0.217 | |
| M | 2 | | 3 | 0.079 | | 0.118 |
| Dia | 3.55 | | 3.65 | 0.140 | | 0.144 |



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