

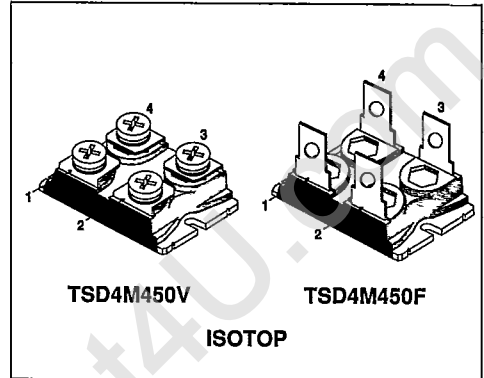
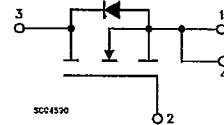
**SGS-THOMSON N - CHANNEL ENHANCEMENT MODE**  
**ISOFET POWER MOS TRANSISTOR MODULE**

| TYPE        | V <sub>DSS</sub> | R <sub>Ds(on)</sub> | I <sub>D</sub> |
|-------------|------------------|---------------------|----------------|
| TSD4M450F/V | 500 V            | 0.1 Ω               | 45 A           |

- HIGH CURRENT POWER MOS MODULE
- VERY LOW R<sub>th</sub> JUNCTION TO CASE
- DUAL SOURCE CONTACTS
- VERY LARGE SOA - LARGE PEAK POWER CAPABILITY
- ISOLATED CASE (2500V RMS)
- EASY TO MOUNT
- VERY LOW INTERNAL PARASITIC INDUCTANCE (TYPICALLY 5 < ns)
- AVALANCHE RUGGEDNESS TECHNOLOGY (SEE IRFP450 FOR RATING)

**INDUSTRIAL APPLICATIONS:**

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


**INTERNAL SCHEMATIC DIAGRAM**

**ABSOLUTE MAXIMUM RATINGS**

| Symbol              | Parameter   | Value      | Unit |
|---------------------|---|------------|------|
| V <sub>DS</sub>     | Drain-Source Voltage (V <sub>GS</sub> = 0)            | 500        | V    |
| V <sub>DGR</sub>    | Drain-Gate Voltage (R <sub>GS</sub> = 20 kΩ)          | 500        | V    |
| V <sub>GS</sub>     | Gate-Source Voltage                                   | ± 20       | V    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>c</sub> = 25 °C  | 45         | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>c</sub> = 100 °C | 28         | A    |
| I <sub>DM</sub> (*) | Drain Current (pulsed)                                | 180        | A    |
| P <sub>tot</sub>    | Total Dissipation at T <sub>c</sub> = 25 °C           | 500        | W    |
|                     | Derating Factor                                       | 4          | W/°C |
| T <sub>stg</sub>    | Storage Temperature                                   | -55 to 150 | °C   |
| T <sub>J</sub>      | Max. Operating Junction Temperature                   | 150        | °C   |
| V <sub>iso</sub>    | Insulation Withstand Voltage (AC-RMS)                 | 2500       | V    |

(\*) Pulse width limited by safe operating area

**THERMAL DATA** S G S-THOMSON

|                |   |     |      |      |
|----------------|---|-----|------|------|
| $R_{thj-case}$ | Thermal Resistance Junction-Case                                | Max | 0.25 | °C/W |
| $R_{thc-h}$    | Thermal Resistance Case-Heatsink With Conductive Grease Applied | Max | 0.05 | °C/W |

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

OFF

| Symbol        | Parameter  | Test Conditions   | Min. | Typ. | Max.      | Unit                |
|---------------|--|---|------|------|-----------|---------------------|
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage                   | $I_D = 1\text{ mA}$ $V_{GS} = 0$  | 500  |      |           | V                   |
| $I_{DSS}$     | Zero Gate Voltage Drain Current ( $V_{GS} = 0$ ) | $V_{DS} = \text{Max Rating}$<br>$V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125\text{ °C}$ |      |      | 400<br>2  | $\mu\text{A}$<br>mA |
| $I_{GSS}$     | Gate-Body Leakage Current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 20\text{ V}$  |      |      | $\pm 500$ | nA                  |

ON (\*)

| Symbol       | Parameter                         | Test Conditions                            | Min. | Typ. | Max. | Unit     |
|--------------|-----------------------------------|--|------|------|------|----------|
| $V_{GS(th)}$ | Gate Threshold Voltage            | $V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$      | 2    |      | 4    | V        |
| $R_{DS(on)}$ | Static Drain-Source On Resistance | $V_{GS} = 10\text{ V}$ $I_D = 28\text{ A}$ |      |      | 0.1  | $\Omega$ |

DYNAMIC

| Symbol    | Parameter                    | Test Conditions  | Min. | Typ. | Max.  | Unit |
|-----------|------------------------------|--|------|------|-------|------|
| $g_{fs}$  | Forward Transconductance     | $V_{DS} = 25\text{ V}$ $I_D = 28\text{ A}$             | 28   |      |       | mho  |
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$ |      |      | 12000 | pF   |
| $C_{oss}$ | Output Capacitance           |  |      |      | 2400  | pF   |
| $C_{rss}$ | Reverse Transfer Capacitance |  |      |      | 1000  | pF   |

SWITCHING (INDUCTIVE LOAD)

| Symbol         | Parameter             | Test Conditions   | Min. | Typ. | Max. | Unit             |
|----------------|-----------------------|---|------|------|------|------------------|
| $t_{d(on)}$    | Turn-on Time          | $V_{DD} = 250\text{ V}$ $I_D = 28\text{ A}$<br>$R_{GS} = 25\ \Omega$ $V_{GS} = 10\text{ V}$ |      |      | 180  | ns               |
| $(di/dt)_{on}$ | Turn-on Current Slope |   |      |      | 150  | A/ $\mu\text{s}$ |
| $t_{d(off)}$   | Turn-off Delay Time   |   |      |      | 3000 | ns               |
| $t_f$          | Fall Time             |   |      |      | 300  | ns               |

SOURCE DRAIN DIODE

| Symbol             | Parameter                     | Test Conditions   | Min. | Typ. | Max. | Unit |
|--------------------|-------------------------------|---|------|------|------|------|
| $I_{SD}$           | Source-Drain Current          |   |      |      | 45   | A    |
| $I_{SDM}(\bullet)$ | Source-Drain Current (pulsed) |   |      |      | 180  | A    |
| $V_{SD}$           | Forward On Voltage            | $I_{SD} = 45\text{ A}$ $V_{GS} = 0$                       |      |      | 1.4  | V    |
| $t_{rr}$           | Reverse Recovery Time         | $I_{SD} = 45\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ |      | 1300 |      | ns   |

(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

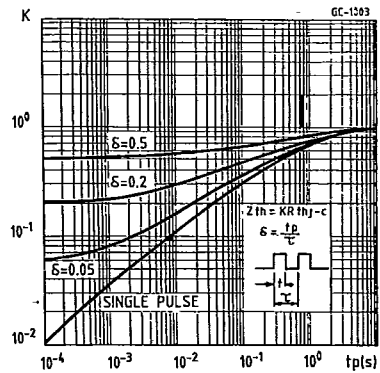
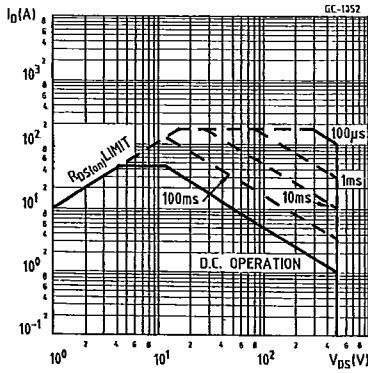
( $\bullet$ ) Pulse width limited by safe operating area

SGS-THOMSON

T-39-15

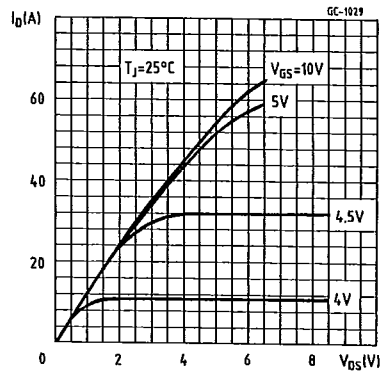
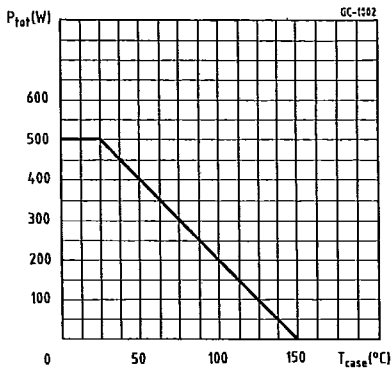
Safe Operating Areas

Thermal Impedance



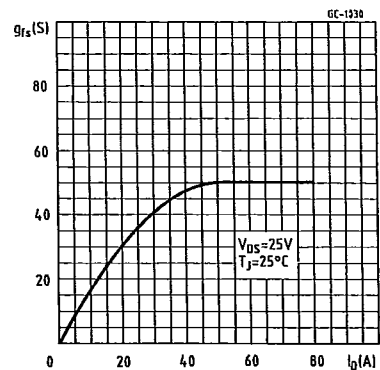
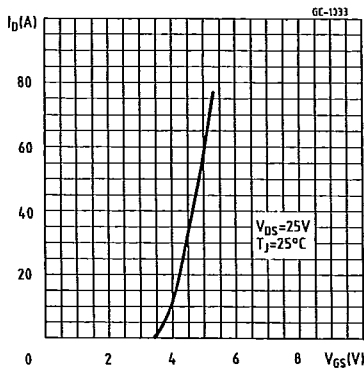
Derating Curve

Output Characteristics



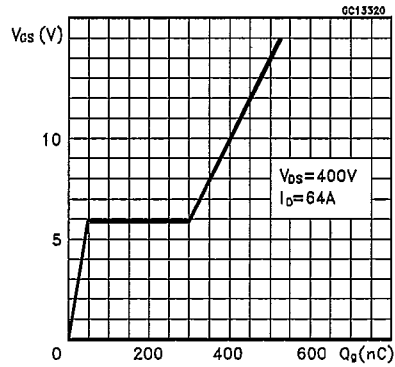
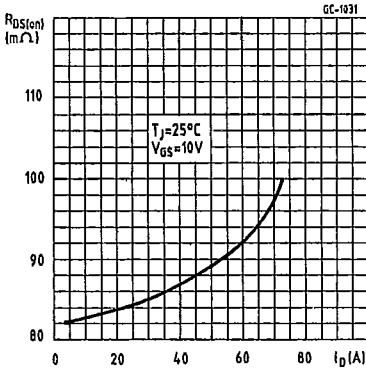
Transfer Characteristics

Transconductance



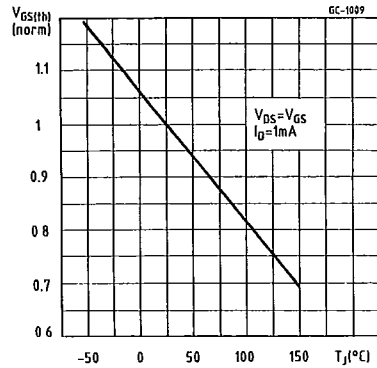
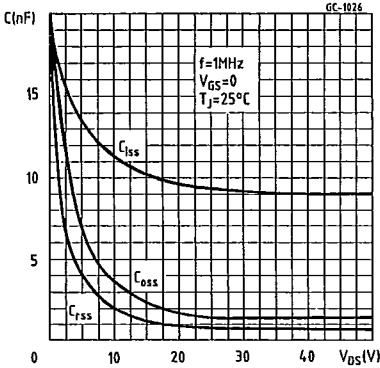
Static Drain-Source On Resistance

Gate Charge vs Gate-source Voltage



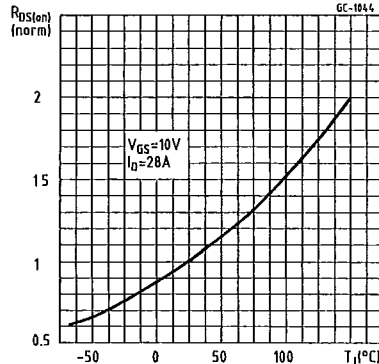
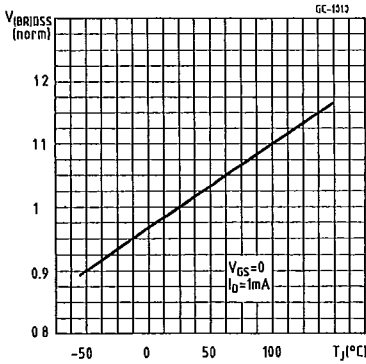
Capacitance Variation

Normalized Gate Threshold Voltage vs Temperature



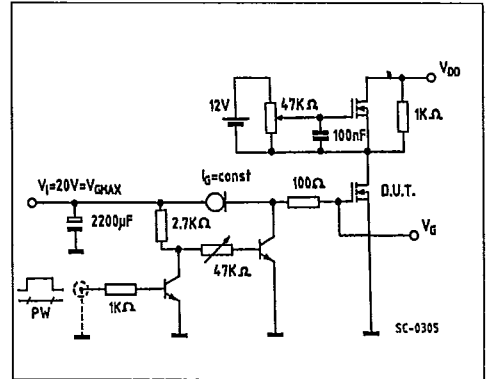
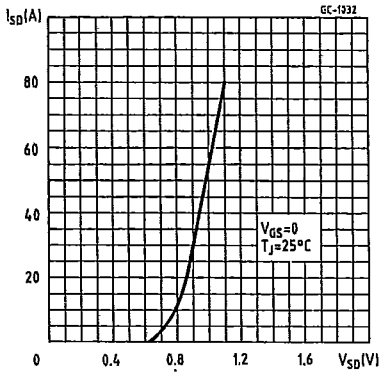
Normalized Breakdown Voltage vs Temperature

Normalized On Resistance vs Temperature



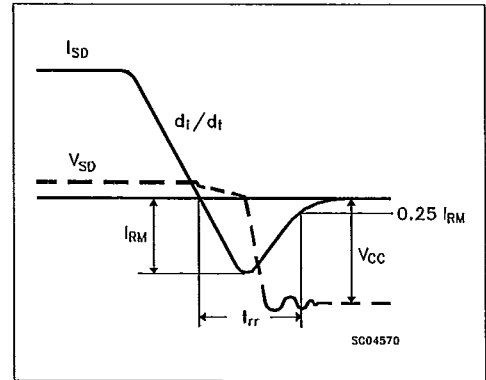
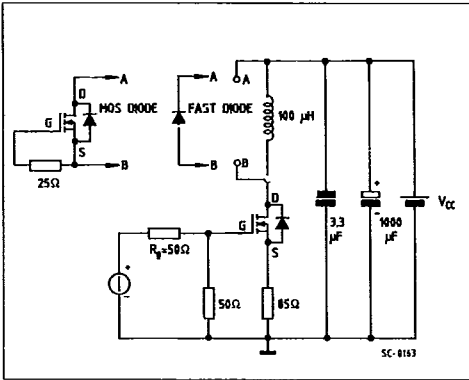
Source-Drain Diode Forward Characteristics

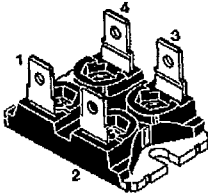
Gate Charge Test Circuit



Test Circuit For Inductive Load Switching and Diode Reverse Recovery Times

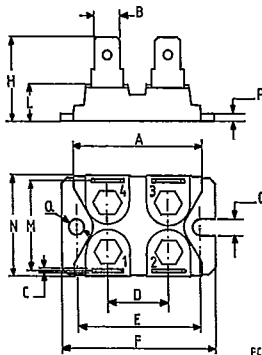
Diode Reverse Recovery Time Waveform





**ISOTOP**  
**Fast-on version**  
 sales types with the suffix F

**MECHANICAL DATA**



FC-9309

|   | DIMENSIONS |      |        |       |
|---|------------|------|--------|-------|
|   | mm         |      | Inches |       |
|   | min.       | max  | min.   | max   |
| A | 31.5       | 31.7 | 1.240  | 1.248 |
| B | 6.2        | 6.4  | 0.244  | 0.252 |
| C | 0.75       | 0.85 | 0.029  | 0.033 |
| D | 14.9       | 15.1 | 0.586  | 0.590 |
| E | 30.1       | 30.3 | 1.185  | 1.193 |
| F | 38         | 38.2 | 1.496  | 1.503 |
| G | 4          | -    | 0.157  | -     |
| H | 20.3       | 20.7 | 0.799  | 0.815 |
| L | 8.9        | 9.1  | 0.350  | 0.358 |
| M | 22.4       | 23   | 0.881  | 0.905 |
| N | 25.2       | 25.4 | 0.992  | 1.000 |
| P | 1.95       | 2.05 | 0.076  | 0.080 |
| Q | 4          | -    | 0.157  | -     |

**PIN CONNECTIONS**

**MOSFET**

pin 1: Source      pin 2: Gate  
 pin 3: Drain      pin 4: Source sensings

**DARLINGTON**

pin 1: Emitter      pin 2: Base1  
 pin 3: Collector    pin 4: Base 2

**TRANSISTOR**

pin 1: Emitter      pin 2: Base  
 pin 3: Collector    pin 4: Emitter sensing

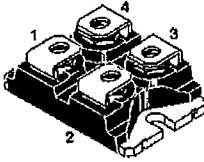
Torque: Mounting  $1.3 \pm 0.2 \text{ N} \cdot \text{m}$  (max)

Weight: Package 25.5 g

Note: The mechanical data are the same for the 3 pin version (4th pin missing)

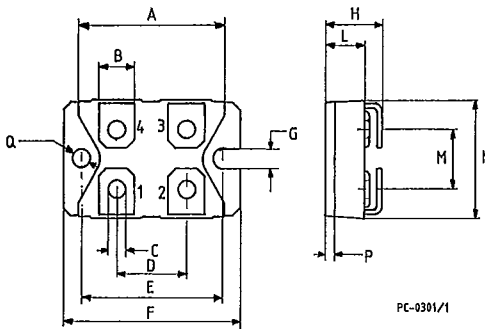
S G S-THOMSON

T-91-20



**ISOTOP**  
Screw version  
sales types with the suffix V

**MECHANICAL DATA**



|   | DIMENSIONS |      |        |       |
|---|------------|------|--------|-------|
|   | mm         |      | Inches |       |
|   | min.       | max  | min.   | max   |
| A | 31.5       | 31.7 | 1.240  | 1.248 |
| B | 7.8        | 8.2  | 0.307  | 0.322 |
| C | 4.1        | 4.3  | 0.161  | 0.169 |
| D | 14.9       | 15.1 | 0.586  | 0.590 |
| E | 30.1       | 30.3 | 1.185  | 1.193 |
| F | 38         | 38.2 | 1.496  | 1.503 |
| G | 4          | -    | 0.157  | -     |
| H | 11.8       | 12.2 | 0.464  | 0.480 |
| L | 8.9        | 9.1  | 0.350  | 0.358 |
| M | 12.6       | 12.8 | 0.496  | 0.503 |
| N | 25.2       | 25.4 | 0.992  | 1.000 |
| P | 1.95       | 2.05 | 0.076  | 0.080 |
| Q | 4          | -    | 0.157  | -     |

**PIN CONNECTIONS**

**MOSFET**

pin 1: Source      pin 2: Gate  
pin 3: Drain      pin 4: Source sensings

**DARLINGTON**

pin 1: Emitter      pin 2: Base1  
pin 3: Collector    pin 4: Base 2

**TRANSISTOR**

pin 1: Emitter      pin 2: Base  
pin 3: Collector    pin 4: Emitter sensing

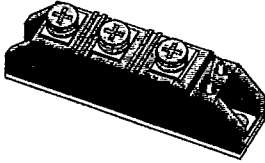
Torque: Terminal  $1.3 \pm 0.2 \text{ N} \cdot \text{m}$  (max)  
Mounting  $1.3 \pm 0.2 \text{ N} \cdot \text{m}$  (max)

Weight: Package 29 g  
4 Screws: 7,5 g

Note: The mechanical data are the same for the 3 pin version  
(4th pin missing)

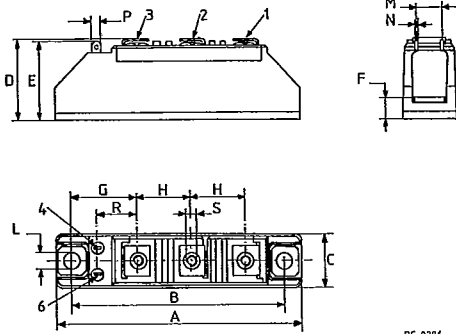
SGS-THOMSON

T-91-20



TRANSPACK (TO-240)

MECHANICAL DATA



PC-0236

|   | DIMENSIONS |       |            |       |
|---|------------|-------|------------|-------|
|   | mm         |       | Inches     |       |
|   | min.       | max   | min.       | max   |
| A | 91.5       | 92.5  | 3.602      | 3.641 |
| B | 79.75      | 80.25 | 3.140      | 3.160 |
| C | 19.5       | 20.55 | 0.767      | 0.809 |
| D | 29.00      | 31.00 | 1.141      | 1.220 |
| E | 28.8       | 30    | 1.134      | 1.181 |
| F | 8.5 typ.   |       | 0.334 typ. |       |
| G | 24.4 typ.  |       | 0.960 typ. |       |
| H | 19.5       | 20.5  | 0.767      | 0.807 |
| L | 6.2 typ.   |       | 0.244 typ. |       |
| M | 8.95       | 11.05 | 0.352      | 0.435 |
| N | 0.78       | 0.84  | 0.030      | 0.033 |
| P | 2.72       | 2.87  | 0.107      | 0.113 |
| R | 14         | -     | 0.551      | -     |
| S | M5         |       |            |       |

Torque: Terminal  $2.2 \pm 0.5 \text{ N} \cdot \text{m}$  (max)  
 Mounting  $3.5 \pm 0.5 \text{ N} \cdot \text{m}$  (max)

Weight: Package 110 g  
 Accessory 21 g

Note: The mechanical data are the same for the 2 power pin version (either pin 1 or pin 2 missing)