



## BUZ11

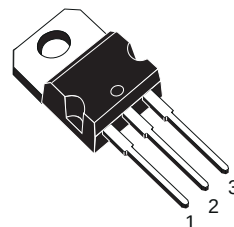
N - CHANNEL 50V - 0.03Ω - 33A TO-220  
STripFET™ MOSFET

| TYPE  | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|-------|------------------|---------------------|----------------|
| BUZ11 | 50 V             | < 0.04 Ω            | 33 A           |

- TYPICAL R<sub>DS(on)</sub> = 0.03 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE

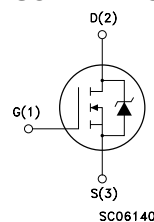
### APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



TO-220

### INTERNAL SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

| Symbol           | Parameter                                            | Value      | Unit |
|------------------|------------------------------------------------------|------------|------|
| V <sub>DS</sub>  | Drain-source Voltage (V <sub>GS</sub> = 0)           | 50         | V    |
| V <sub>DGR</sub> | Drain- gate Voltage (R <sub>GS</sub> = 20 kΩ)        | 50         | V    |
| V <sub>GS</sub>  | Gate-source Voltage                                  | ± 20       | V    |
| I <sub>D</sub>   | Drain Current (continuous) at T <sub>c</sub> = 25 °C | 33         | A    |
| I <sub>DM</sub>  | Drain Current (pulsed)                               | 134        | A    |
| P <sub>tot</sub> | Total Dissipation at T <sub>c</sub> = 25 °C          | 90         | W    |
| T <sub>stg</sub> | Storage Temperature                                  | -65 to 175 | °C   |
| T <sub>j</sub>   | Max. Operating Junction Temperature                  | 175        | °C   |
|                  | DIN HUMIDITY CATEGORY (DIN 40040)                    | E          |      |
|                  | IEC CLIMATIC CATEGORY (DIN IEC 68-1)                 | 55/150/56  |      |

First digit of the datecode being Z or K identifies silicon characterized in this datasheet.

**BUZ11****THERMAL DATA**

|                |                                     |     |      |                      |
|----------------|-------------------------------------|-----|------|----------------------|
| $R_{thj-case}$ | Thermal Resistance Junction-case    | Max | 1.67 | $^{\circ}\text{C/W}$ |
| $R_{thj-amb}$  | Thermal Resistance Junction-ambient | Max | 62.5 | $^{\circ}\text{C/W}$ |

**AVALANCHE CHARACTERISTICS**

| Symbol   | Parameter                                                                                                      | Value | Unit |
|----------|----------------------------------------------------------------------------------------------------------------|-------|------|
| $I_{AR}$ | Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max, $\delta < 1\%$ )            | 33    | A    |
| $E_{AS}$ | Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 25\text{ V}$ ) | 200   | mJ   |

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

| Symbol        | Parameter                                        | Test Conditions                                                                          | Min. | Typ. | Max.      | Unit                           |
|---------------|--------------------------------------------------|------------------------------------------------------------------------------------------|------|------|-----------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source Breakdown Voltage                   | $I_D = 250\text{ }\mu\text{A}$ $V_{GS} = 0$                                              | 50   |      |           | V                              |
| $I_{DSS}$     | Zero Gate Voltage Drain Current ( $V_{GS} = 0$ ) | $V_{DS} = \text{Max Rating}$<br>$V_{DS} = \text{Max Rating}$ $T_j = 125^{\circ}\text{C}$ |      |      | 1<br>10   | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{GSS}$     | Gate-body Leakage Current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 20\text{ V}$                                                               |      |      | $\pm 100$ | nA                             |

**ON (\*)**

| Symbol       | Parameter                         | Test Conditions                            | Min. | Typ. | Max. | Unit     |
|--------------|-----------------------------------|--------------------------------------------|------|------|------|----------|
| $V_{GS(th)}$ | Gate Threshold Voltage            | $V_{DS} = V_{GS}$ $I_D = 1\text{ mA}$      | 2.1  | 3    | 4    | V        |
| $R_{DS(on)}$ | Static Drain-source On Resistance | $V_{GS} = 10\text{ V}$ $I_D = 19\text{ A}$ |      | 0.03 | 0.04 | $\Omega$ |

**DYNAMIC**

| Symbol                              | Parameter                                                               | Test Conditions                                        | Min. | Typ.              | Max. | Unit           |
|-------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------|------|-------------------|------|----------------|
| $g_{fs} (*)$                        | Forward Transconductance                                                | $V_{DS} = 15\text{ V}$ $I_D = 19\text{ A}$             | 10   | 17                |      | S              |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input Capacitance<br>Output Capacitance<br>Reverse Transfer Capacitance | $V_{DS} = 25\text{ V}$ $f = 1\text{ MHz}$ $V_{GS} = 0$ |      | 2100<br>260<br>65 |      | pF<br>pF<br>pF |

**SWITCHING**

| Symbol       | Parameter           | Test Conditions                                    | Min. | Typ. | Max. | Unit |
|--------------|---------------------|----------------------------------------------------|------|------|------|------|
| $t_{d(on)}$  | Turn-on Time        | $V_{DD} = 30\text{ V}$ $I_D = 18\text{ A}$         |      | 40   |      | ns   |
| $t_r$        | Rise Time           | $R_{GS} = 50\text{ }\Omega$ $V_{GS} = 10\text{ V}$ |      | 200  |      | ns   |
| $t_{d(off)}$ | Turn-off Delay Time |                                                    |      | 220  |      | ns   |
| $t_f$        | Fall Time           |                                                    |      | 110  |      | ns   |

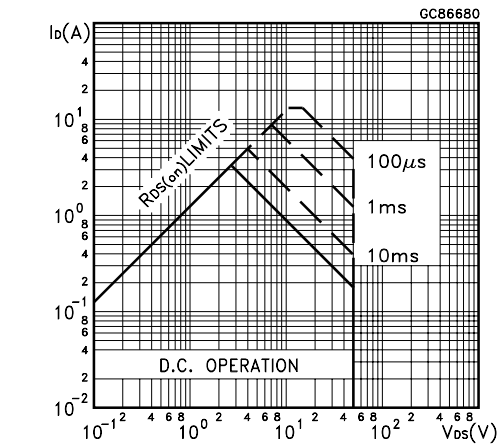
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ELECTRICAL CHARACTERISTICS (continued)  
SOURCE DRAIN DIODE

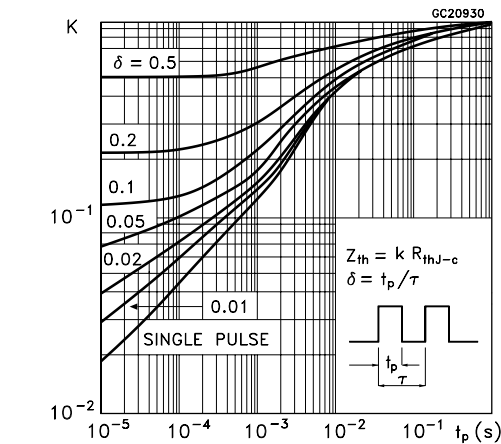
| Symbol                | Parameter                                             | Test Conditions                                                                                                         | Min. | Typ.       | Max.      | Unit                |
|-----------------------|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|------|------------|-----------|---------------------|
| $I_{SD}$<br>$I_{SDM}$ | Source-drain Current<br>Source-drain Current (pulsed) |                                                                                                                         |      |            | 33<br>134 | A<br>A              |
| $V_{SD} (*)$          | Forward On Voltage                                    | $I_{SD} = 60\text{ A}$ $V_{GS} = 0$                                                                                     |      |            | 1.8       | V                   |
| $t_{rr}$<br>$Q_{rr}$  | Reverse Recovery Time<br>Reverse Recovery Charge      | $I_{SD} = 36\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 30\text{ V}$ $T_j = 150\text{ }^{\circ}\text{C}$ |      | 75<br>0.24 |           | ns<br>$\mu\text{C}$ |

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

Safe Operating Area

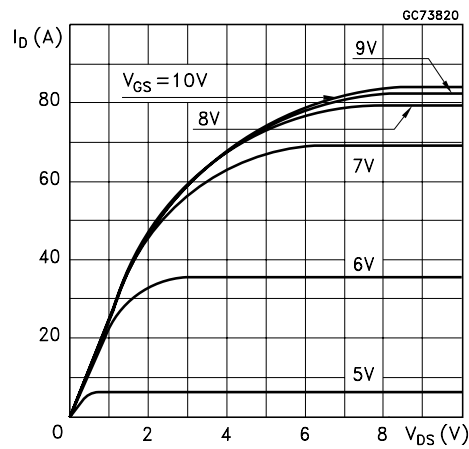


Thermal Impedance

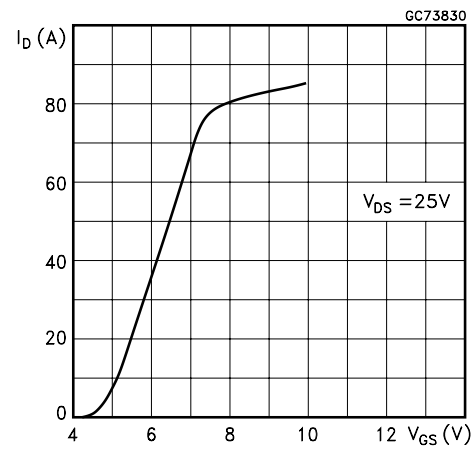


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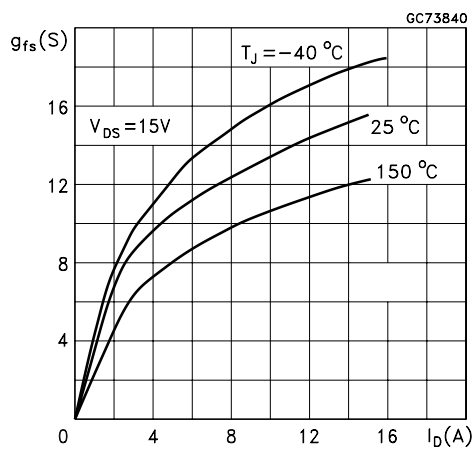
Output Characteristics



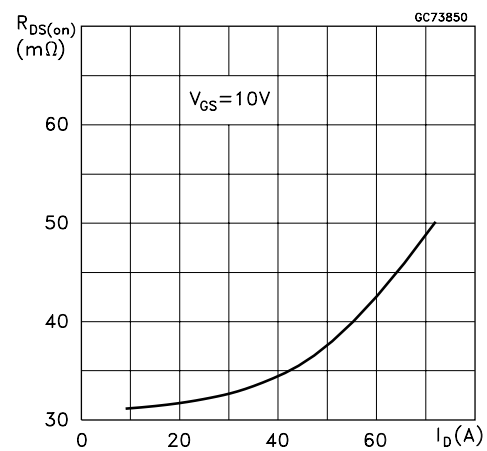
Transfer Characteristics



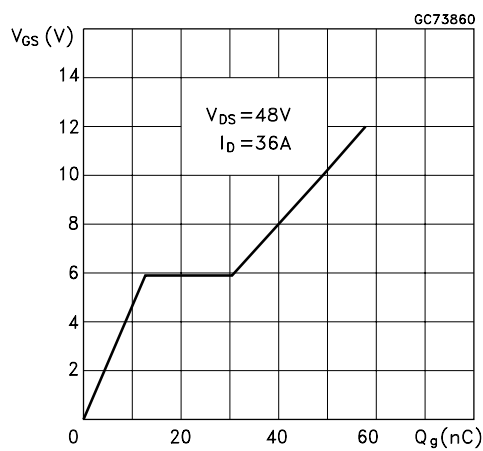
Transconductance



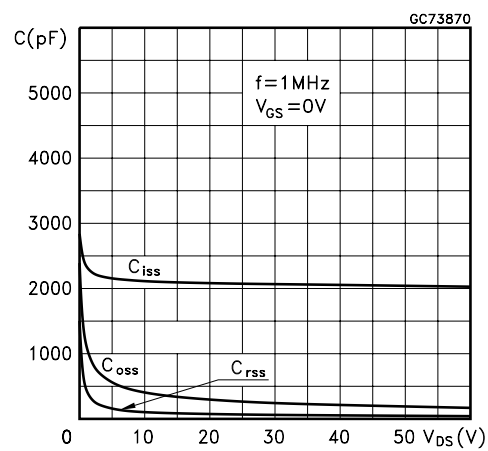
Static Drain-source On Resistance



Gate Charge vs Gate-source Voltage

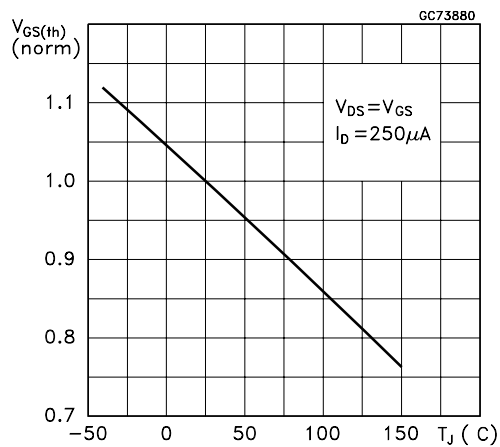


Capacitance Variations

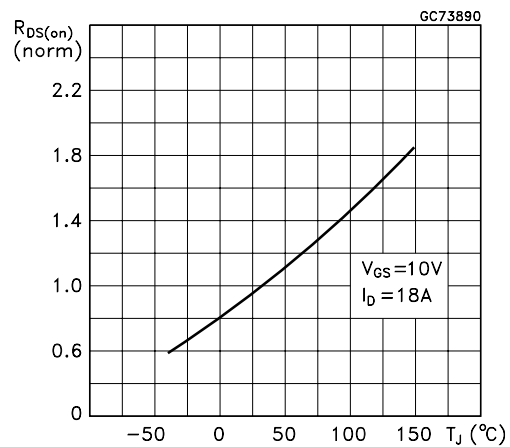


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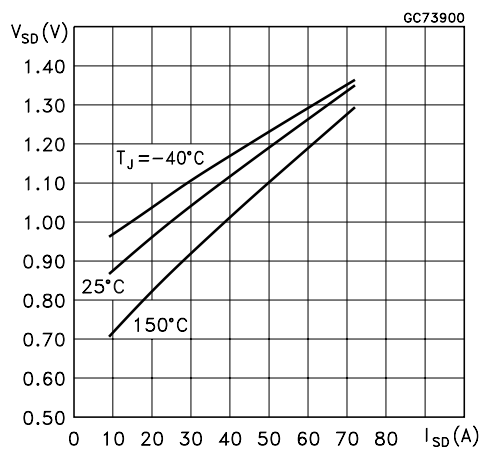
Normalized Gate Threshold Voltage vs Temperature

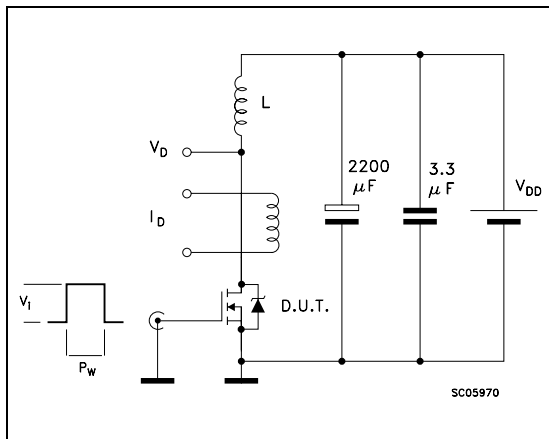
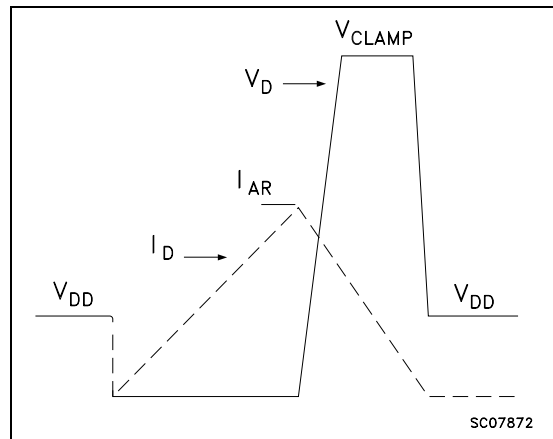
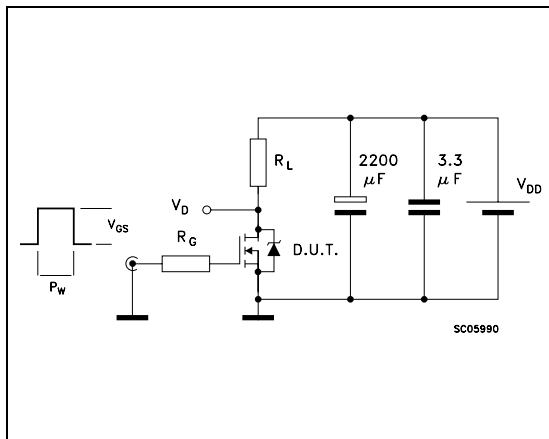
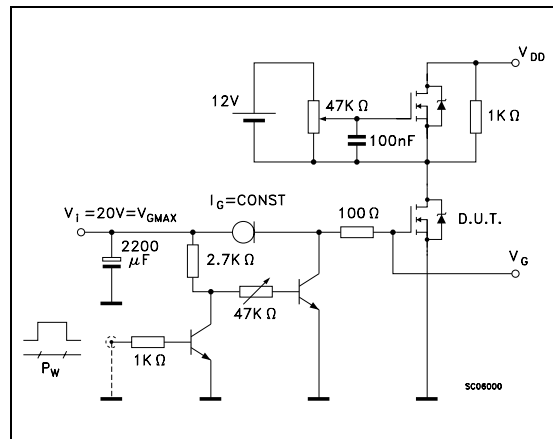
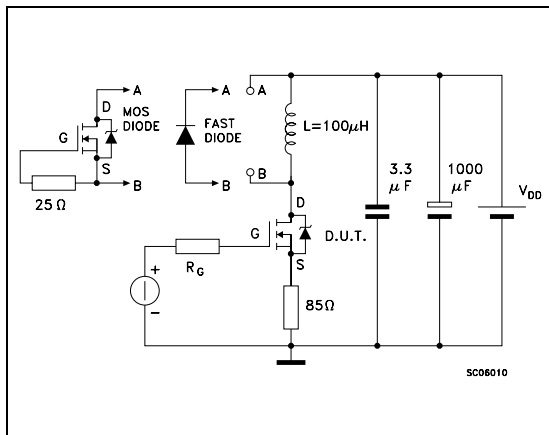


Normalized On Resistance vs Temperature



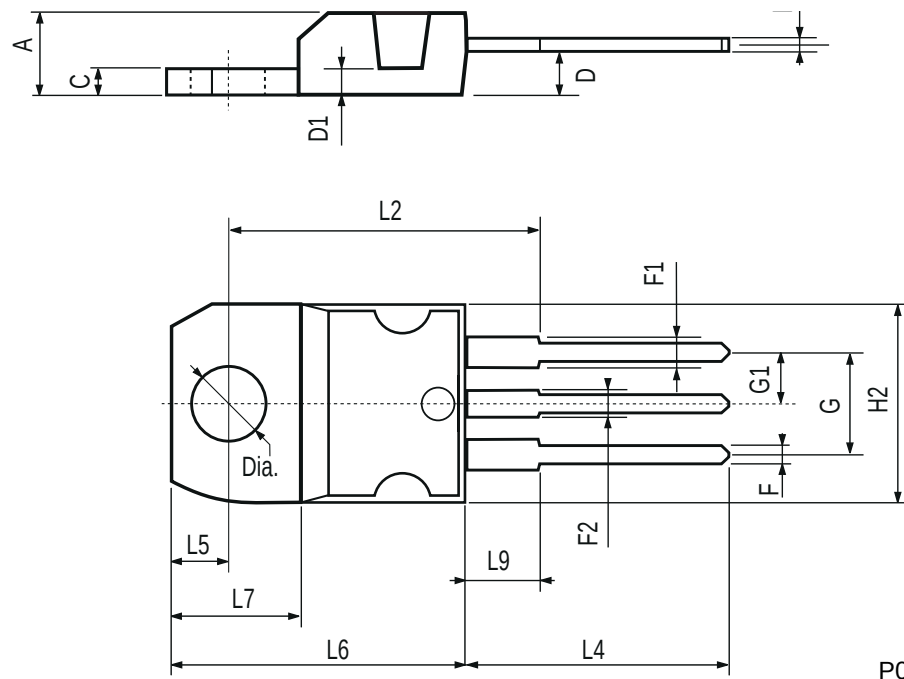
Source-drain Diode Forward Characteristics



**BUZ11****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**

**BUZ11****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 |



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