



STU7NB90 STU7NB90I

N-CHANNEL 900V - 1.1 Ω - 7.3 A Max220/Max220I
PowerMesh™ MOSFET

| TYPE | V _{DSS} | R _{DS(on)} | I _D |
|-----------|------------------|---------------------|----------------|
| STU7NB90 | 900 V | < 1.45 Ω | 7.3 A |
| STU7NB90I | 900 V | < 1.45 Ω | 7.3 A |

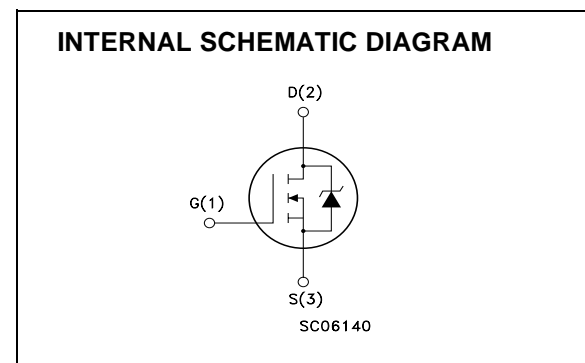
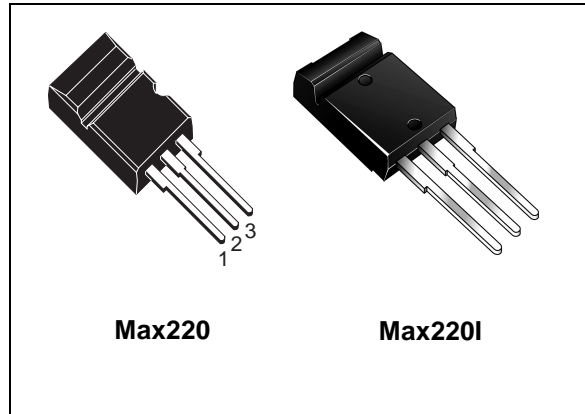
- TYPICAL R_{DS(on)} = 1.1 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- VERY LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED
- REDUCED VOLTAGE SPREAD

DESCRIPTION

Using the latest high voltage MESH OVERLAY™ process, STMicroelectronics has designed an advanced family of power MOSFETs with outstanding performances. The new patent pending strip layout coupled with the Company's propriety edge termination structure, gives the lowest R_{DS(on)} per area, exceptional avalanche and dv/dt capabilities and unrivalled gate charge and switching characteristics.

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | | Unit |
|---------------------|---|------------|-----------|------|
| | | STU7NB90 | STU7NB90I | |
| V _{DS} | Drain-source Voltage (V _{GS} = 0) | 900 | | V |
| V _{DGR} | Drain-gate Voltage (R _{GS} = 20 k Ω) | 900 | | V |
| V _{GS} | Gate- source Voltage | ± 30 | | V |
| I _D | Drain Current (continuous) at T _C = 25°C | 7.3 | 7.3 (*) | A |
| I _D | Drain Current (continuous) at T _C = 100°C | 4.6 | 4.6 (*) | A |
| I _{DM} (•) | Drain Current (pulsed) | 29.2 | 29.2 (*) | A |
| P _{TOT} | Total Dissipation at T _C = 25°C | 170 | 60 | W |
| | Derating Factor | 1.36 | 0.47 | W/°C |
| dv/dt (1) | Peak Diode Recovery voltage slope | 4 | | V/ns |
| V _{ISO} | Insulation Withstand Voltage (DC) | - | 2500 | V |
| T _{stg} | Storage Temperature | -65 to 150 | | °C |
| T _j | Max. Operating Junction Temperature | 150 | | °C |

(•) Pulse width limited by safe operating area

(1) I_{SD} ≤ 7.3 A, di/dt ≤ 200 A/ μ s, V_{DD} \leq V(BR)_{DSS}, T_j \leq T_{JMAX}.

(*) Current Limited by Package

STU7NB90 - STU7NB90I

THERMAL DATA

| | | Max220 | Max220I | |
|----------------|--|--------|---------|------|
| Rthj-case | Thermal Resistance Junction-case Max | 0.734 | 2.1 | °C/W |
| Rthj-amb | Thermal Resistance Junction-ambient Max | 62.5 | | °C/W |
| T _I | 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) | 7.3 | A |
| E _{AS} | Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V) | 600 | mJ |

ELECTRICAL CHARACTERISTICS (TCASE = 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 | 900 | | | V |
| I _{DSS} | Zero Gate Voltage Drain Current (V _{GS} = 0) | V _{DS} = Max Rating V _{DS} = Max Rating, T _C = 125 °C | | | 1 50 | µA µA |
| I _{GSS} | Gate-body Leakage Current (V _{DS} = 0) | V _{GS} = ±30V | | | ±100 | nA |

ON (1)

| 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 = 4 A | | 1.1 | 1.45 | Ω |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------------|------------------------------|---|------|------|------|------|
| g _{fs} (1) | Forward Transconductance | V _{DS} > I _{D(on)} × R _{DS(on)max} , I _D = 4 A | | 8 | | S |
| C _{iss} | Input Capacitance | V _{DS} = 25V, f = 1 MHz, V _{GS} = 0 | | 2120 | | pF |
| C _{oss} | Output Capacitance | | | 225 | | pF |
| C _{rss} | Reverse Transfer Capacitance | | | 23 | | pF |

ELECTRICAL CHARACTERISTICS (CONTINUED)

SWITCHING ON

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-------------|--------------------|--|------|------|------|------|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD} = 450\text{ V}$, $I_D = 3.5\text{ A}$ $R_G = 4.7\Omega$, $V_{GS} = 10\text{ V}$ (see test circuit, Figure 3) | | 25 | | ns |
| t_r | Rise Time | | | 12 | | ns |
| Q_g | Total Gate Charge | $V_{DD} = 720\text{ V}$, $I_D = 7.4\text{ A}$, $V_{GS} = 10\text{ V}$ | | 51 | 72 | nC |
| Q_{gs} | Gate-Source Charge | | | 12.5 | | nC |
| Q_{gd} | Gate-Drain Charge | | | 23.5 | | nC |

SWITCHING OFF

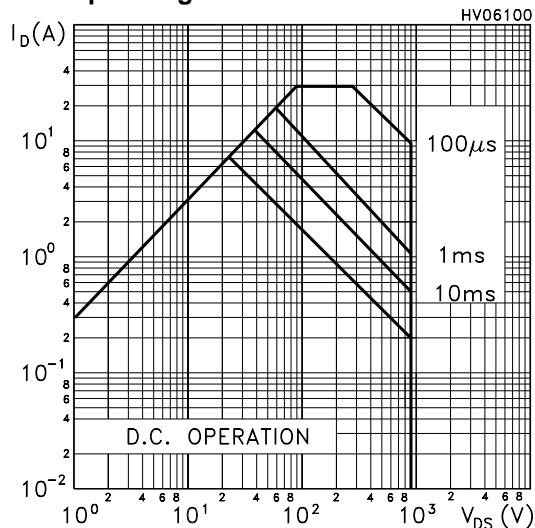
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------|-----------------------|--|------|------|------|------|
| $t_{r(Voff)}$ | Off-voltage Rise Time | $V_{DD} = 720\text{ V}$, $I_D = 7.4\text{ A}$, $R_G = 4.7\Omega$, $V_{GS} = 10\text{ V}$ (see test circuit, Figure 5) | | 22 | | ns |
| t_f | Fall Time | | | 15 | | ns |
| t_c | Cross-over Time | | | 31 | | ns |

SOURCE DRAIN DIODE

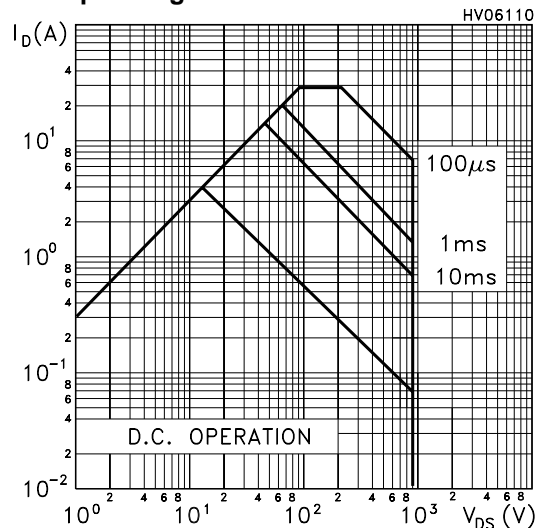
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------------|-------------------------------|---|------|------|------|---------------|
| I_{SD} | Source-drain Current | | | | 7.3 | A |
| $I_{SDM(2)}$ | Source-drain Current (pulsed) | | | | 29.2 | A |
| $V_{SD(1)}$ | Forward On Voltage | $I_{SD} = 7.3\text{ A}$, $V_{GS} = 0$ | | | 1.6 | V |
| t_{rr} | Reverse Recovery Time | $I_{SD} = 7.4\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 100\text{ V}$, $T_J = 150^\circ\text{C}$ (see test circuit, Figure 5) | | 700 | | ns |
| Q_{rr} | Reverse Recovery Charge | | | 6.3 | | μC |
| I_{RRM} | Reverse Recovery Current | | | 18 | | A |

Note: 1. Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %.
2. Pulse width limited by safe operating area.

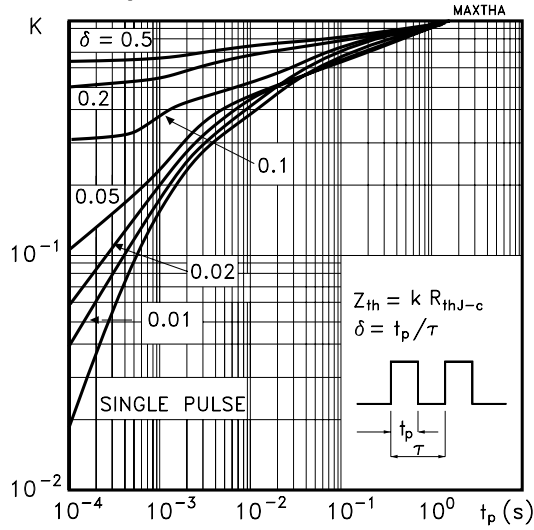
Safe Operating Area for Max220



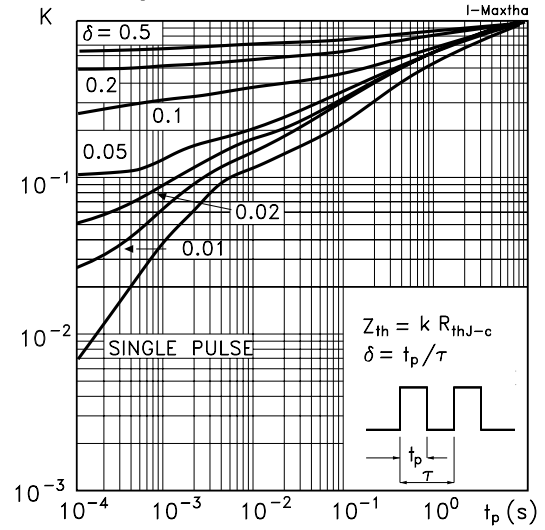
Safe Operating Area for Max220I



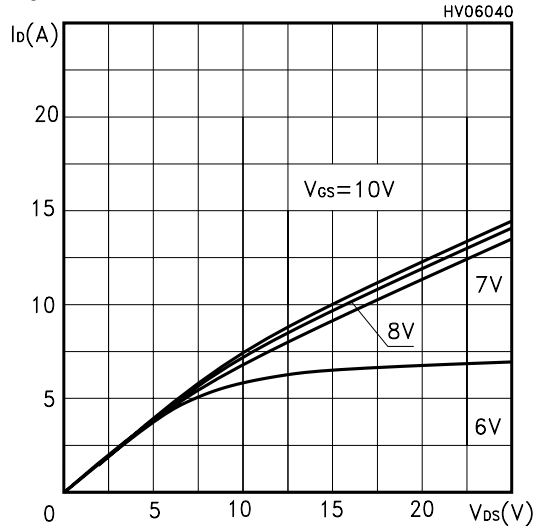
Thermal Impedence for Max220



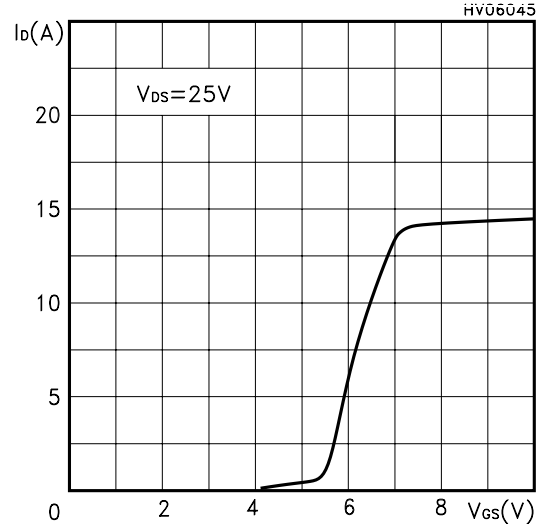
Thermal Impedence for Max220I



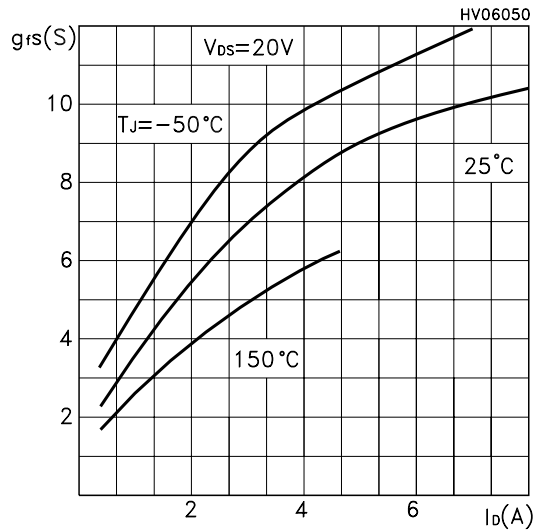
Output Characteristics



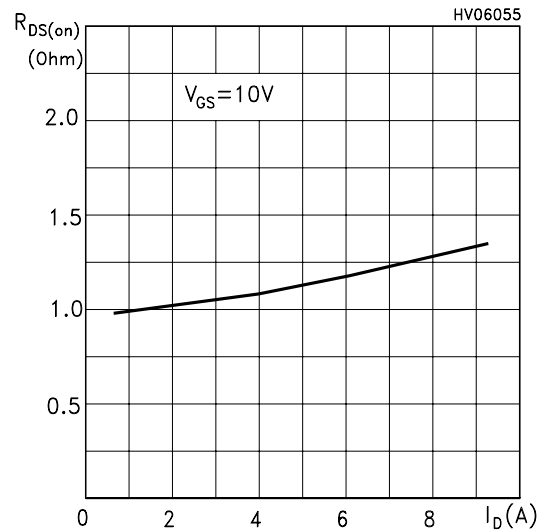
Transfer Characteristics



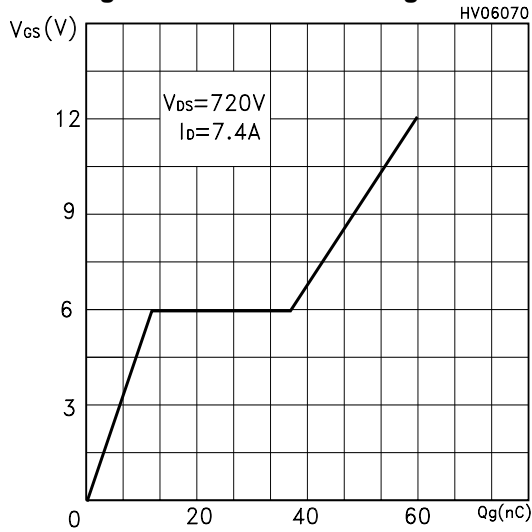
Transconductance



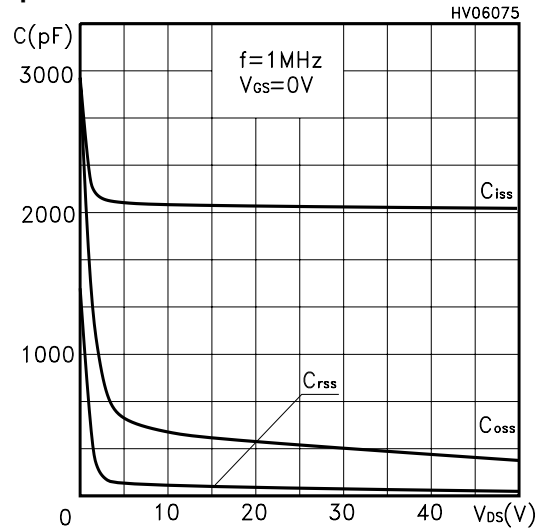
Static Drain-source On Resistance



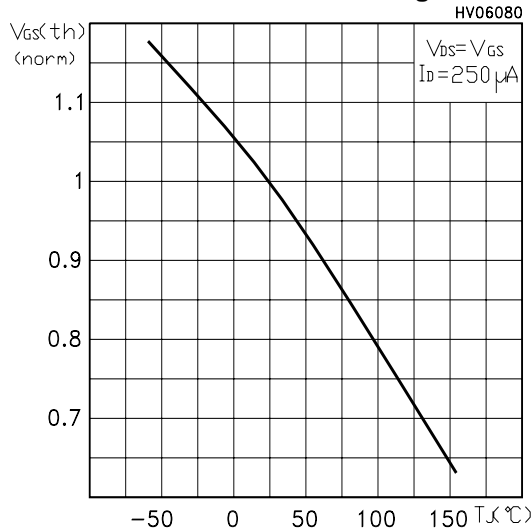
Gate Charge vs Gate-source Voltage



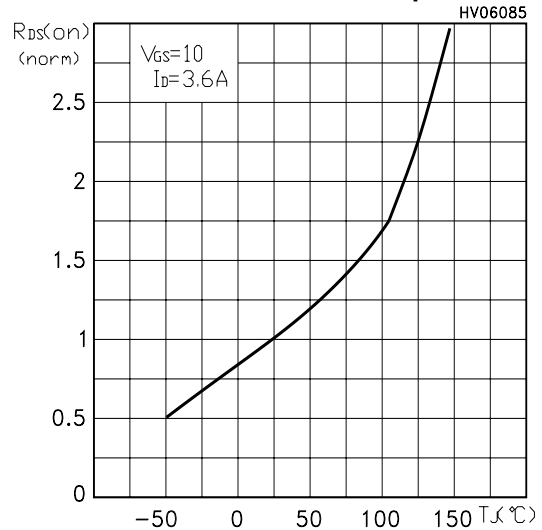
Capacitance Variations



Normalized Gate Threshold Voltage vs Temp.



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics

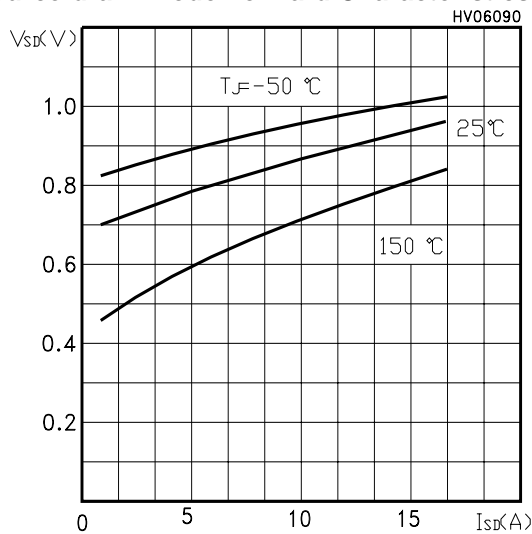


Fig. 1: Unclamped Inductive Load Test Circuit

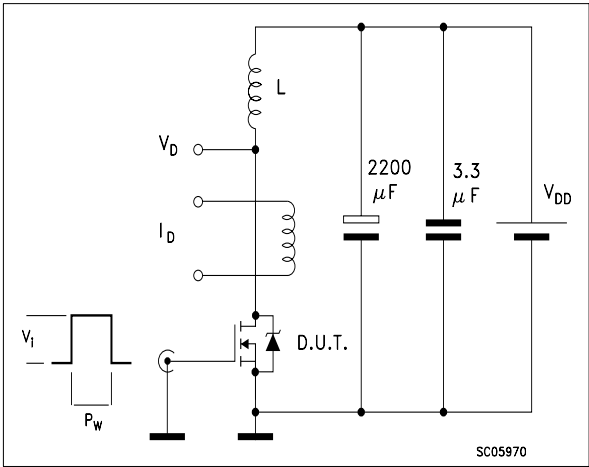


Fig. 2: Unclamped Inductive Waveform

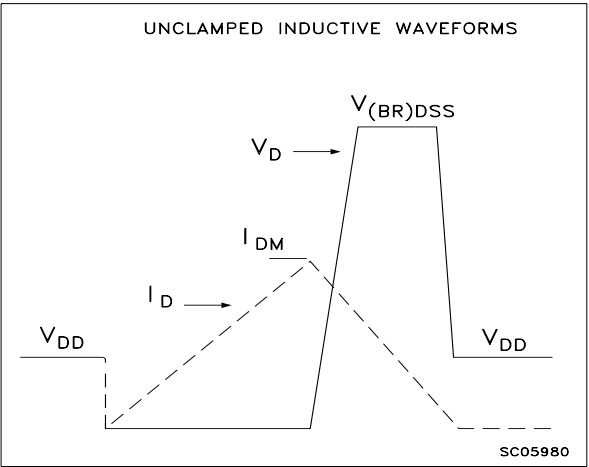


Fig. 3: Switching Times Test Circuit For Resistive Load

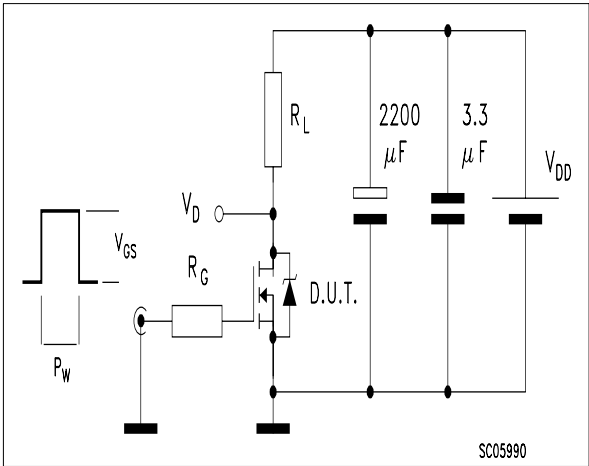


Fig. 4: Gate Charge test Circuit

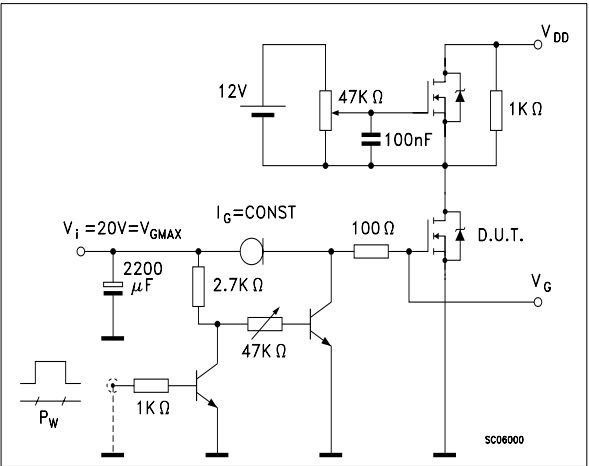
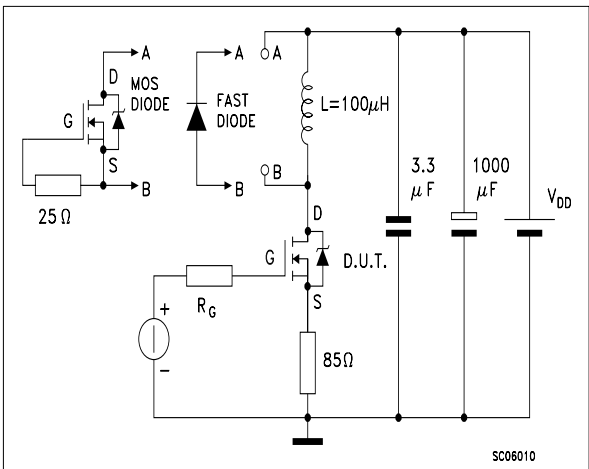
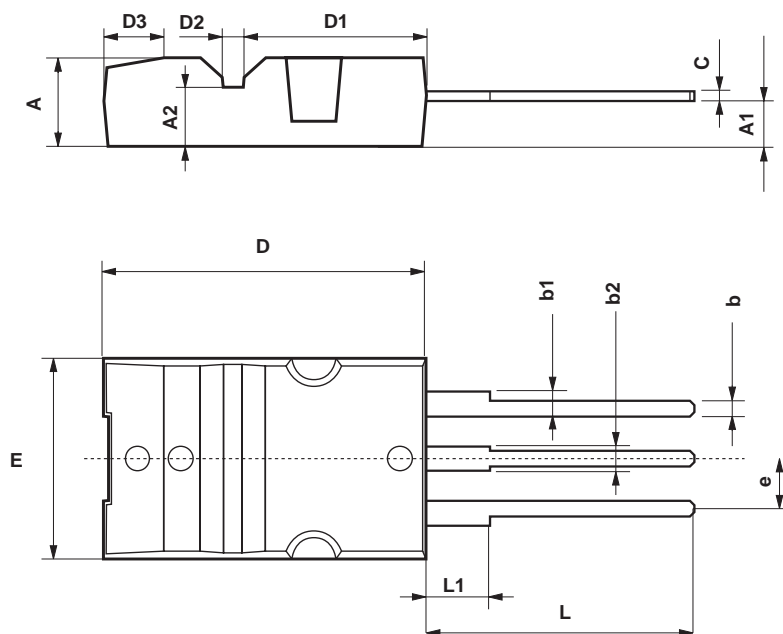


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



Max220 MECHANICAL DATA

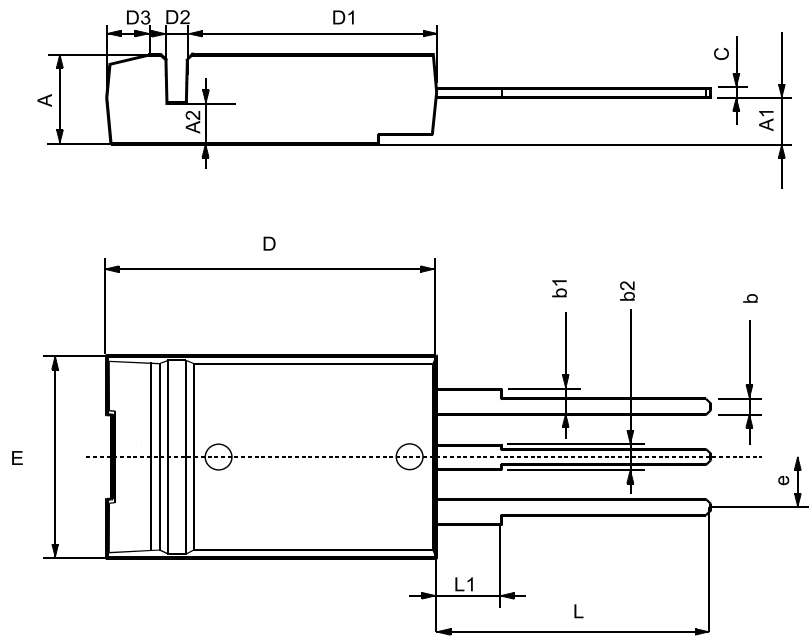
| DIM. | mm | | | inch | | |
|------|-------|------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.3 | | 4.6 | 0.169 | | 0.181 |
| A1 | 2.2 | | 2.4 | 0.087 | | 0.094 |
| A2 | 2.9 | | 3.1 | 0.114 | | 0.122 |
| b | 0.7 | | 0.93 | 0.027 | | 0.036 |
| b1 | 1.25 | | 1.4 | 0.049 | | 0.055 |
| b2 | 1.2 | | 1.38 | 0.047 | | 0.054 |
| c | 0.45 | | 0.6 | | 0.18 | 0.023 |
| D | 15.9 | | 16.3 | | 0.626 | 0.641 |
| D1 | 9 | | 9.35 | 0.354 | | 0.368 |
| D2 | 0.8 | | 1.2 | 0.031 | | 0.047 |
| D3 | 2.8 | | 3.2 | 0.110 | | 0.126 |
| e | 2.44 | | 2.64 | 0.096 | | 0.104 |
| E | 10.05 | | 10.35 | 0.396 | | 0.407 |
| L | 13.2 | | 13.6 | 0.520 | | 0.535 |
| L1 | 3 | | 3.4 | 0.118 | | 0.133 |



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I-Max220 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|-------|------|-------|-------|------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.3 | | 4.6 | 0.169 | | 0.181 |
| A1 | 2.6 | | 2.75 | 0.102 | | 0.108 |
| A2 | 1.95 | | 2.15 | 0.077 | | 0.084 |
| b | 0.7 | | 0.93 | 0.027 | | 0.036 |
| b1 | 1.25 | | 1.4 | 0.049 | | 0.055 |
| b2 | 1.2 | | 1.38 | 0.047 | | 0.054 |
| c | 0.45 | | 0.6 | 0.017 | | 0.023 |
| D | 15.9 | | 16.3 | 0.626 | | 0.641 |
| D1 | 12.5 | | 12.9 | 0.492 | | 0.508 |
| D2 | 0.6 | | 1 | 0.023 | | 0.039 |
| D3 | 1.75 | | 2.15 | 0.069 | | 0.084 |
| e | 2.44 | | 2.64 | 0.096 | | 0.104 |
| E | 10.05 | | 10.35 | 0.396 | | 0.407 |
| L | 13.2 | | 13.6 | 0.520 | | 0.535 |
| L1 | 3 | | 3.4 | 0.118 | | 0.133 |



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