



# STP40NS15

N-CHANNEL 150V - 0.042Ω - 40A TO-220

MESH OVERLAY™ MOSFET

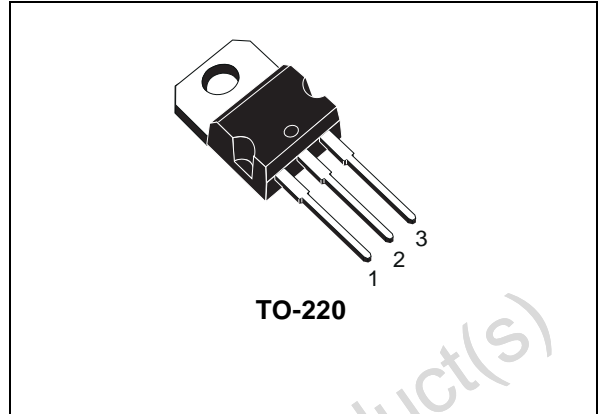
PRELIMINARY DATA

| TYPE      | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|-----------|------------------|---------------------|----------------|
| STP40NS15 | 150 V            | <0.052Ω             | 40A            |

- TYPICAL R<sub>DS(on)</sub> = 0.042Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- VERY LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED

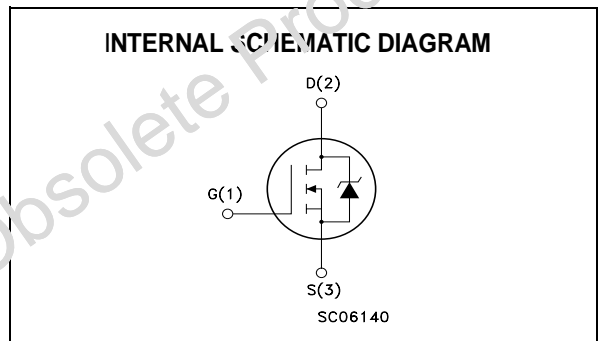
## DESCRIPTION

This powermos MOSFET is designed using the company's consolidated strip layout-based MESH OVERLAY™ process. This technology matches and improves the performances compared with standard parts from various sources.



## APPLICATIONS

- HIGH CURRENT SWITCHING
- UNINTERRUPTIBLE POWER SUPPLY (UPS)
- PRIMARY SWITCH IN ISOLATED DC-DC CONVERTERS



## ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter  | Value      | Unit |
|---------------------|--|------------|------|
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)           | 150        | V    |
| V <sub>DGR</sub>    | Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)         | 150        | V    |
| V <sub>GS</sub>     | Gate-source Voltage                                  | ±20        | V    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 25°C  | 40         | A    |
| I <sub>C</sub>      | Drain Current (continuous) at T <sub>C</sub> = 100°C | 25         | A    |
| I <sub>DM</sub> (●) | Drain Current (pulsed)                               | 160        | A    |
| P <sub>TOT</sub>    | Total Dissipation at T <sub>C</sub> = 25°C           | 140        | W    |
|                     | Derating Factor                                      | 0.933      | W/°C |
| dv/dt               | Peak Diode Recovery voltage slope                    | 9          | V/ns |
| T <sub>stg</sub>    | Storage Temperature                                  | -65 to 175 | °C   |
| T <sub>j</sub>      | Max. Operating Junction Temperature                  | 175        | °C   |

(●)Pulse width limited by safe operating area

## STP40NS15

### THERMAL DATA

|                |  |      |      |
|----------------|--|------|------|
| Rthj-case      | Thermal Resistance Junction-case Max           | 1.07 | °C/W |
| Rthj-amb       | Thermal Resistance Junction-ambient Max        | 62.5 | °C/W |
| Rthc-sink      | Thermal Resistance Case-sink Typ               | 0.5  | °C/W |
| T <sub>l</sub> | Maximum Lead Temperature For Soldering Purpose | 300  | °C   |

### AVALANCHE CHARACTERISTICS

| Symbol          | Parameter  | Max Value | Unit |
|-----------------|--|-----------|------|
| I <sub>AR</sub> | Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T <sub>j</sub> max)                                | 40        | A    |
| E <sub>AS</sub> | Single Pulse Avalanche Energy (starting T <sub>j</sub> = 25 °C, I <sub>D</sub> = I <sub>AR</sub> , V <sub>DD</sub> = 50 V) | 500       | mJ   |

### ELECTRICAL CHARACTERISTICS (TCASE = 25 °C UNLESS OTHERWISE SPECIFIED)

OFF

| Symbol               | Parameter   | Test Conditions   | Min. | Typ. | Max.    | Unit     |
|----------------------|---|---|------|------|---------|----------|
| V <sub>(BR)DSS</sub> | Drain-source Breakdown Voltage                        | I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0  | 150  |      |         | V        |
| I <sub>DSS</sub>     | Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0) | V <sub>DS</sub> = Max Rating<br>V <sub>DS</sub> = Max Rating, T <sub>C</sub> = 125 °C |      |      | 1<br>10 | μA<br>μA |
| I <sub>GSS</sub>     | Gate-body Leakage Current (V <sub>DS</sub> = 0)       | V <sub>GS</sub> = ±20V  |      |      | ±100    | nA       |

ON (1)

| Symbol              | Parameter                         | Test Conditions  | Min. | Typ.  | Max.  | Unit |
|---------------------|-----------------------------------|--|------|-------|-------|------|
| V <sub>GS(th)</sub> | Gate Threshold Voltage            | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA                               | 2    | 3     | 4     | V    |
| R <sub>DS(on)</sub> | Static Drain-source On Resistance | V <sub>GS</sub> = 10V, I <sub>D</sub> = 40 A   |      | 0.044 | 0.052 | Ω    |
| I <sub>D(on)</sub>  | On State Drain Current            | V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)max</sub> ,<br>V <sub>GS</sub> = 10V | 40   |       |       | A    |

DYNAMIC

| Symbol              | Parameter                    | Test Conditions   | Min. | Typ. | Max. | Unit |
|---------------------|------------------------------|---|------|------|------|------|
| g <sub>fs</sub> (1) | Forward Transconductance     | V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)max</sub> ,<br>I <sub>D</sub> = 20A |      | 20   |      | S    |
| C <sub>iss</sub>    | Input Capacitance            | V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0                                   |      | 2400 |      | pF   |
| C <sub>oss</sub>    | Output Capacitance           |   |      | 380  |      | pF   |
| C <sub>rss</sub>    | Reverse Transfer Capacitance |   |      | 160  |      | pF   |

## ELECTRICAL CHARACTERISTICS (CONTINUED)

## SWITCHING ON

| Symbol      | Parameter          | Test Conditions  | Min. | Typ. | Max. | Unit |
|-------------|--------------------|--|------|------|------|------|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD} = 75V, I_D = 20A$<br>$R_G = 4.7\Omega, V_{GS} = 10V$<br>(see test circuit, Figure 3) |      | 25   |      | ns   |
| $t_r$       | Rise Time          |  |      | 45   |      | ns   |
| $Q_g$       | Total Gate Charge  | $V_{DD} = 120V, I_D = 40A,$<br>$V_{GS} = 10V$  |      | 100  | 110  | nC   |
| $Q_{gs}$    | Gate-Source Charge |  |      | 17   |      | nC   |
| $Q_{gd}$    | Gate-Drain Charge  |  |      | 47   |      | nC   |

## SWITCHING OFF

| Symbol        | Parameter             | Test Conditions   | Min. | Typ. | Max. | Unit |
|---------------|-----------------------|---|------|------|------|------|
| $t_{d(off)}$  | Turn-off Delay Time   | $V_{DD} = 75V, I_D = 20A$<br>$R_G = 4.7\Omega, V_{GS} = 10V$<br>(see test circuit, Figure 3)      |      | 85   |      | ns   |
| $T_f$         | Fall Time             |   |      |      |      |      |
| $t_{r(Voff)}$ | Off-voltage Rise Time | $V_{clamp} = 120V, I_D = 20A,$<br>$R_G = 4.7\Omega, V_{GS} = 10V$<br>(see test circuit, Figure 5) |      | 47   |      | ns   |
| $t_f$         | Fall Time             |   |      | 35   |      | ns   |
| $t_c$         | Cross-over Time       |   |      | 70   |      | ns   |

## SOURCE DRAIN DIODE

| Symbol       | Parameter                     | Test Conditions  | Min. | Typ. | Max. | Unit |
|--------------|-------------------------------|--|------|------|------|------|
| $I_{SD}$     | Source-drain Current          |  |      |      | 40   | A    |
| $I_{SDM(2)}$ | Source-drain Current (pulsed) |  |      |      | 160  | A    |
| $V_{SD(1)}$  | Forward On Voltage            | $I_{SD} = 40A, V_{GS} = 0$   |      |      | 1.5  | V    |
| $t_{rr}$     | Reverse Recovery Time         | $I_{SD} = 40A, di/dt = 100A/\mu s,$<br>$V_{DD} = 50V, T_j = 150^\circ C$<br>(see test circuit, Figure 5) |      | 270  |      | ns   |
| $Q_{rr}$     | Reverse Recovery Charge       |  |      | 200  |      | nC   |
| $I_{RRM}$    | Reverse Recovery Current      |  |      | 1.5  |      | A    |

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

Fig. 1: Unclamped Inductive Load Test Circuit

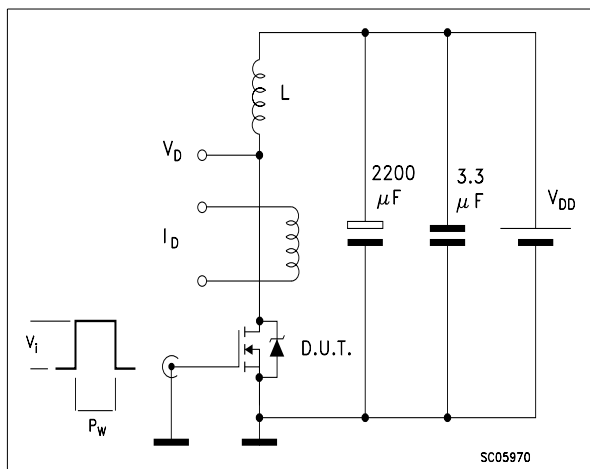


Fig. 2: Unclamped Inductive Waveform

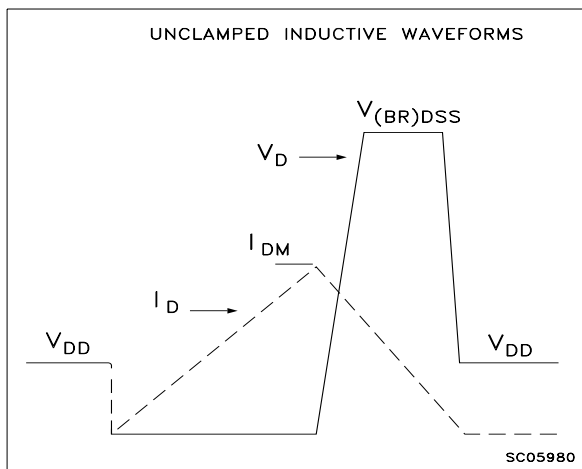


Fig. 3: Switching Times Test Circuit For Resistive Load

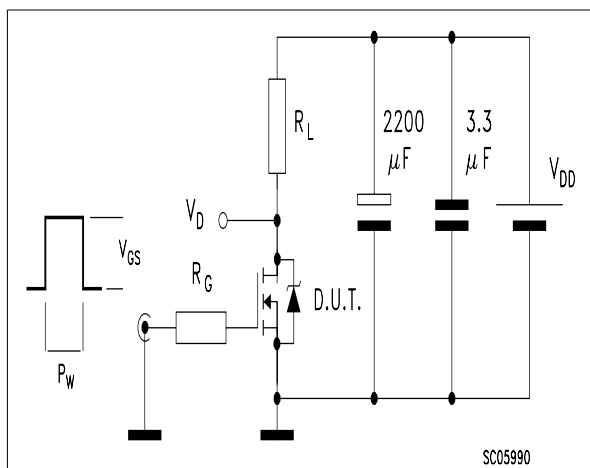


Fig. 4: Gate Charge test Circuit

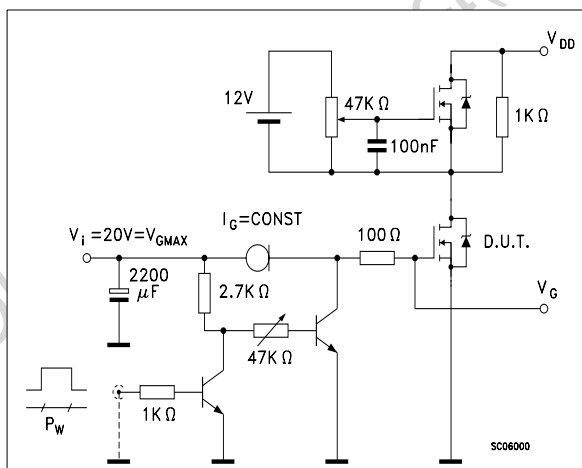
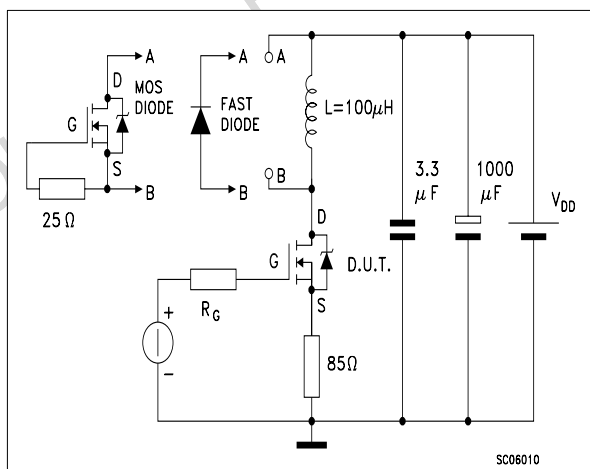
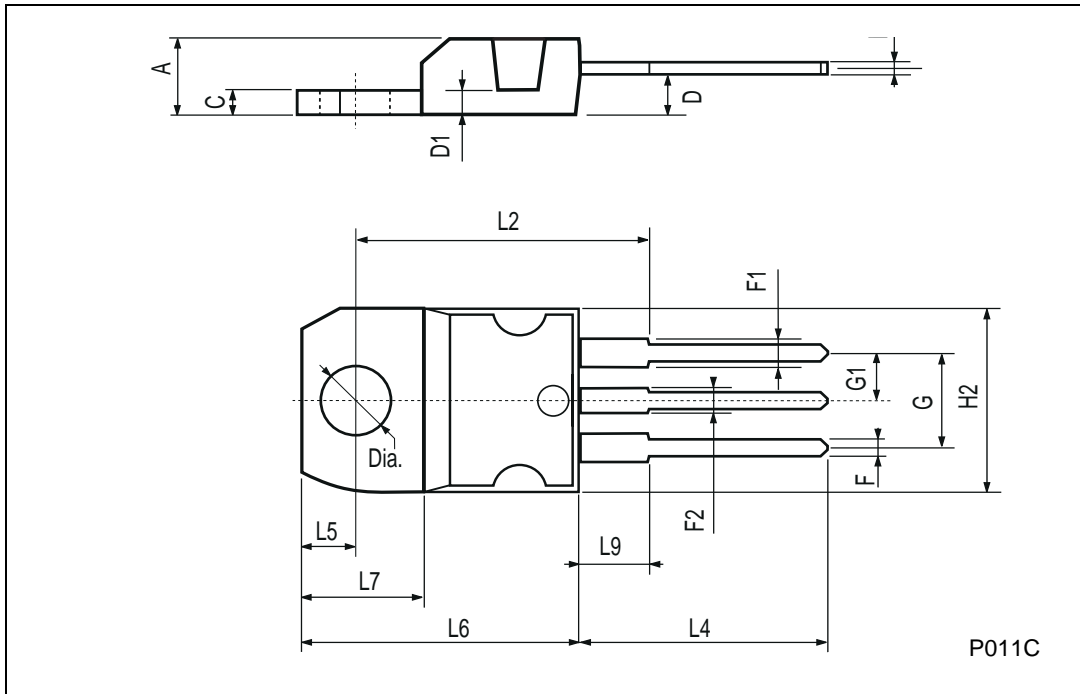


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



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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