# STL120NH02V

## N-channel 20V - 0.0025Ω - 120A - PowerFLAT™ (6x5) STripFET™ III Power MOSFET

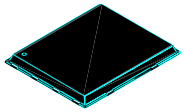
**Target Specification**

## General features

| Type | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ |
|---|---|---|---|
| STL120NH02V | 20V | <0.003Ω | 28A(1) |

1. Value limited by wire bonding

- Improved die-to-footprint ratio
- Very low profile package (1mm max)
- Very low thermal resistance
- Conduction losses reduced
- 2.5V gate drive
- Switching losses reduced
- Very low threshold device

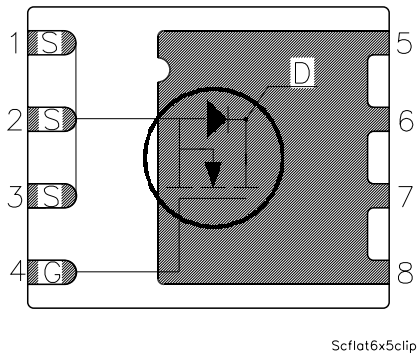


**(Chip scale package)**

## Description

The STL120NH02V utilizes the latest advanced design rules of ST's proprietary STripFET™ Technology. Thanks to a very low threshold, it is ideal for Synchronous Buck Converter in point of load brick module. The Chip-scaled PowerFLAT™ package allows a significant board space saving, still boosting the performance.

## Internal schematic diagram




## Applications

- Switching application

## Order codes

| Part number | Marking | Package | Packaging |
|---|---|---|---|
| STL120NH02V | L120NH02V | PowerFLAT™ (6x5) | Tape & reel |

# Contents

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-source voltage ($V_{GS}$ = 0) | 20 | V |
| $V_{GS}$ | Gate-source voltage | ±8 | V |
| $I_D$ | Drain current (continuous) at $T_C$ = 25°C | 120 | A |
| $I_D$ | Drain current (continuous) at $T_C$ = 100°C | 75 | A |
| $I_{DM}$ (1) | Drain current (pulsed) | 480 | A |
| $I_D$(2) | Drain current (continuous) at $T_C$ = 25°C | 28 | A |
| $P_{TOT}$(2) | Total dissipation at $T_C$ = 25°C | 100 | W |
| $P_{TOT}$(3) | Total dissipation at $T_C$ = 25°C | 4 | W |
| | Derating factor | 0.03 | W/°C |
| $T_j$<br>$T_{stg}$ | Operating junction temperature<br>storage temperature | -55 to 175 | °C |

1. Pulse width limited by safe operating area
2. When mounted on FR-4 board of 1in², 2oz Cu. t<10sec
3. The value is rated according $R_{thj\text{-}C}$.

**Table 2. Thermal data**

| | | | |
|---|---|---|---|
| Rthj-case | Thermal resistance junction-case (drain) (Steady state) | 1.56 | °C/W |
| Rthj-pcb(1) | Thermal resistance junction-pcb max | 31.2 | °C/W |

1. When mounted on FR-4 board of 1in², 2oz Cu. t<10sec

**Table 3. Avalanche characteristics**

| Symbol | Parameter | Max value | Unit |
|---|---|---|---|
| $I_{AR}$ | Avalanche current, repetitive or not-repetitive (pulse width limited by $T_j$ max) | 10 | A |
| $E_{AS}$ | Single pulse avalanche energy (starting $T_j$ = 25 °C, $I_D$ = $I_{AR}$, $V_{DD}$ = 50 V) | TBD | mJ |

# 2 Electrical characteristics

($T_{CASE}$=25°C unless otherwise specified)

**Table 4. On/off states**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $I_D$ = 250µA, $V_{GS}$ =0 | 20 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current ($V_{GS}$ = 0) | $V_{DS}$ = max rating<br>$V_{DS}$ =max rating, $T_C$ = 125°C | | | 1<br>10 | µA<br>µA |
| $I_{GSS}$ | Gate-body leakage current ($V_{DS}$ = 0) | $V_{GS}$ = ± 8V | | | ±100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA | 0.60 | | | V |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS}$ = 4.5V, $I_D$ = 14A<br>$V_{GS}$ = 2.5V, $I_D$ = 14A | | 0.0025<br>0.003 | 0.003<br>0.004 | Ω<br>Ω |

**Table 5. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ (1) | Forward transconductance | $V_{DS}$ = 16V, $I_D$ = 14A | | TBD | | S |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input capacitance<br>Output capacitance<br>Reverse transfer capacitance | $V_{DS}$ = 25V, f = 1MHz, $V_{GS}$ = 0 | | TBD<br>TBD<br>TBD | | pF<br>pF<br>pF |
| $t_{d(on)}$<br>$t_r$<br>$t_{d(off)}$<br>$t_f$ | Turn-on delay time<br>Rise time<br>Turn-off delay time<br>Fall time | $V_{DD}$ = 10V, $I_D$ = 14A<br>$R_G$ = 4.7Ω $V_{GS}$ = 4.5V<br>(see *Figure 1*) | | TBD<br>TBD<br>TBD<br>TBD | | ns<br>ns<br>ns<br>ns |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total gate charge<br>Gate-source charge<br>Gate-drain charge | $V_{DD}$ = 10V, $I_D$ = 28A,<br>$V_{GS}$ = 2.5V, $R_G$ = 4.7Ω<br>(see *Figure 2*) | | 33<br>TBD<br>TBD | 44 | nC<br>nC<br>nC |
| $R_G$ | Gate Input Resistance | f=1MHz Gate DC Bias =0 Test Signal Level =20mV Open Drain | | 1.8 | | Ω |

1. Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %.

**Table 6. Source drain diode**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$<br>$I_{SDM}$ (1) | Source-drain current<br>Source-drain current (pulsed) | | | | 28<br>112 | A<br>A |
| $V_{SD}$ (2) | Forward on voltage | $I_{SD}$ = 28A, $V_{GS}$ = 0 | | | TBD | V |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD}$ = 28A, di/dt = 100A/µs,<br>$V_{DD}$ = 16V<br>(see *Figure 3*) | | TBD<br>TBD<br>TBD | | ns<br>nC<br>A |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD}$ = 28A, di/dt = 100A/µs,<br>$V_{DD}$ = 16V, $T_j$ = 150°C<br>(see *Figure 3*) | | TBD<br>TBD<br>TBD | | ns<br>nC<br>A |

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

# 3 Test circuit

**Figure 1. Switching times test circuit for resistive load**

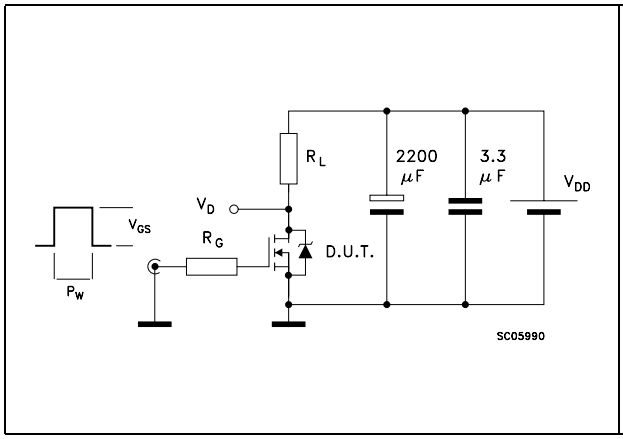



**Figure 2. Gate charge test circuit**

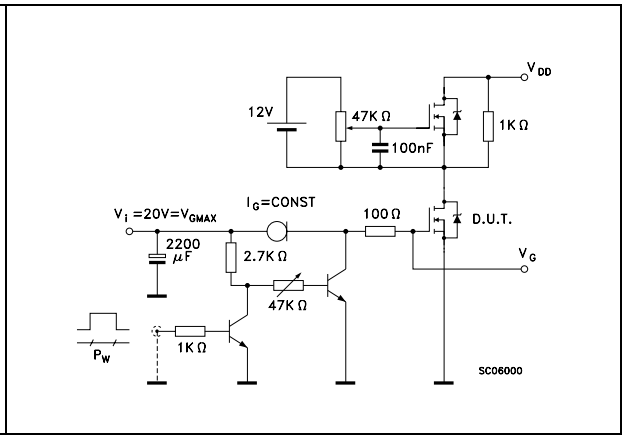



**Figure 3. Test circuit for inductive load switching and diode recovery times**

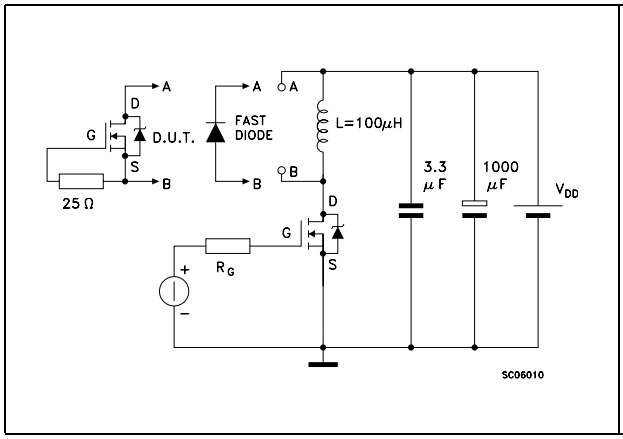



**Figure 4. Unclamped Inductive load test circuit**

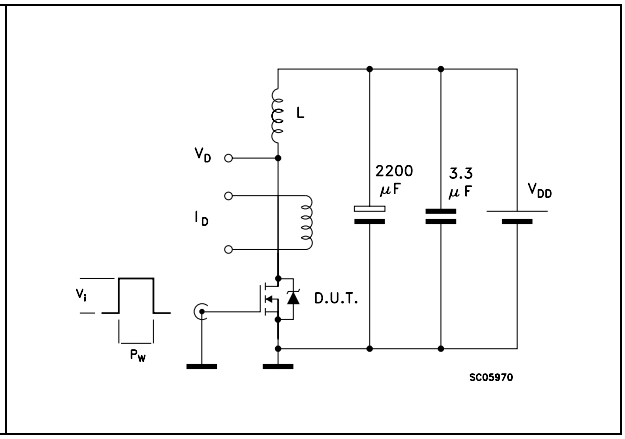



**Figure 5. Unclamped inductive waveform**

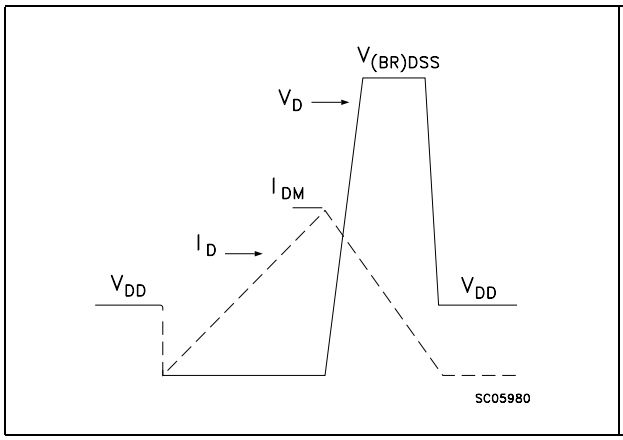
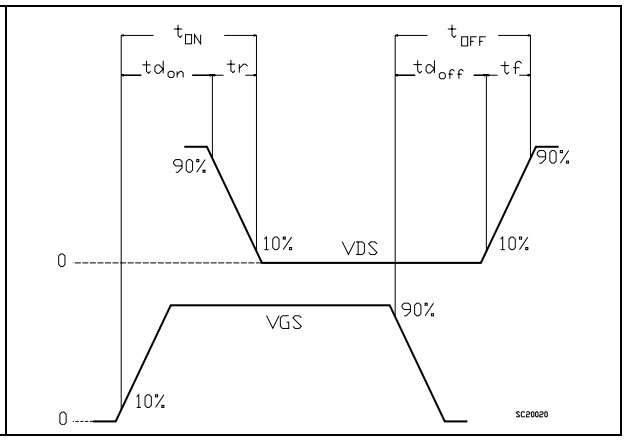



**Figure 6. Switching time waveform**

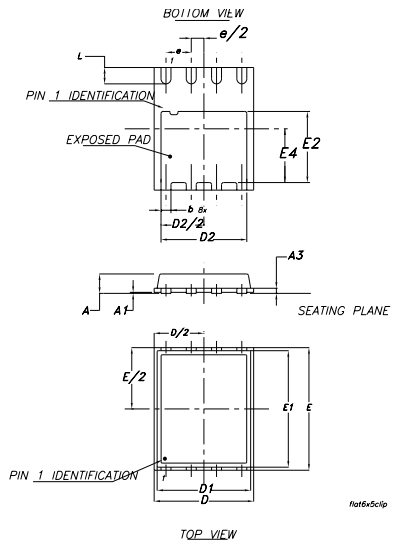


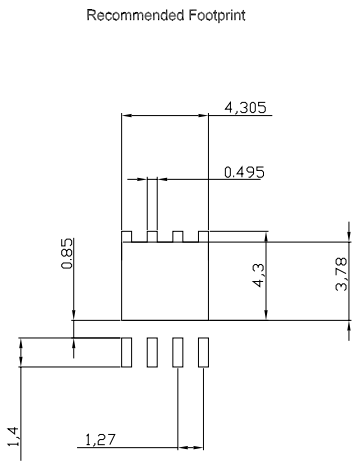
# 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com

## PowerFLAT™ (6x5) MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 0.80 | 0.83 | 0.93 | 0.031 | 0.032 | 0.036 |
| A1 | | 0.02 | 0.05 | | 0.0007 | 0.0019 |
| A3 | | 0.20 | | | 0.007 | |
| b | 0.35 | 0.40 | 0.47 | 0.013 | 0.015 | 0.018 |
| D | | 5.00 | | | 0.196 | |
| D1 | | 4.75 | | | 0.187 | |
| D2 | 4.15 | 4.20 | 4.25 | 0.163 | 0.165 | 0.167 |
| E | | 6.00 | | | 0.236 | |
| E1 | | 5.75 | | | 0.226 | |
| E2 | 3.43 | 3.48 | 3.53 | 0.135 | 0.137 | 0.139 |
| E4 | 2.58 | 2.63 | 2.68 | | 0.103 | 0.105 |
| e | | 1.27 | | | 0.050 | |
| L | 0.70 | 0.80 | 0.90 | 0.027 | 0.031 | 0.035 |




Note: all dimentions are in mm.

# 5 Revision history

**Table 7. Revision history**

| Date | Revision | Changes |
|---|---|---|
| 24-Jun-2005 | 1 | New document |
| 04-Sep-2006 | 2 | New template, no content change |

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