



# STD9N10L

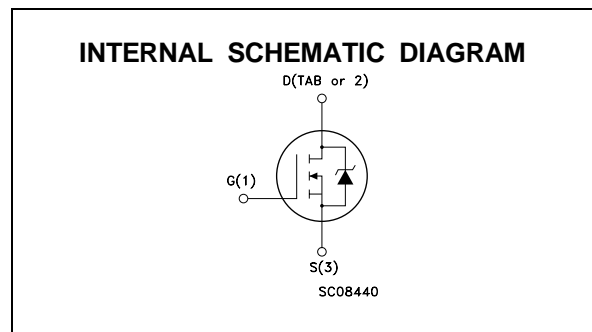
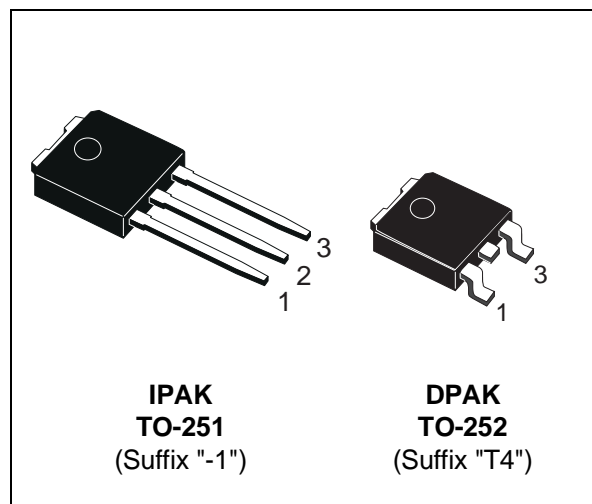
## N - CHANNEL 100V - 0.22Ω - 9A IPAK/DPAK POWER MOS TRANSISTOR

| TYPE     | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|----------|------------------|---------------------|----------------|
| STD9N10L | 100 V            | < 0.27 Ω            | 9 A            |

- TYPICAL R<sub>DS(on)</sub> = 0.22 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- HIGH dV/dt RUGGEDNESS
- APPLICATION ORIENTED CHARACTERIZATION
- SURFACE-MOUNTING DPAK (TO-252) POWER PACKAGE IN TAPE & REEL (SUFFIX "T4")

### APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- POWER MOTOR CONTROL
- DC-DC & DC-AC CONVERTERS
- SYNCHRONOUS RECTIFICATION



### ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter   | Value      | Unit |
|---------------------|---|------------|------|
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)            | 100        | V    |
| V <sub>DGR</sub>    | Drain- gate Voltage (R <sub>GS</sub> = 20 kΩ)         | 100        | V    |
| V <sub>GS</sub>     | Gate-source Voltage                                   | ± 20       | V    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>c</sub> = 25 °C  | 9          | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>c</sub> = 100 °C | 6.4        | A    |
| I <sub>DM</sub> (●) | Drain Current (pulsed)                                | 36         | A    |
| P <sub>tot</sub>    | Total Dissipation at T <sub>c</sub> = 25 °C           | 45         | W    |
|                     | Derating Factor                                       | 0.3        | W/°C |
| dV/dt(1)            | Peak Diode Recovery voltage slope                     | 7          | 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

## STD9N10L

### THERMAL DATA

|                       |  |     |      |      |
|-----------------------|--|-----|------|------|
| R <sub>thj-case</sub> | Thermal Resistance Junction-case               | Max | 3.33 | °C/W |
| R <sub>thj-amb</sub>  | Thermal Resistance Junction-ambient            | Max | 100  | °C/W |
| R <sub>thc-sink</sub> | Thermal Resistance Case-sink                   | Typ | 1.5  | °C/W |
| T <sub>J</sub>        | Maximum Lead Temperature For Soldering Purpose |     | 275  | °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)                                | 9         | 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> = 25 V) | 25        | mJ   |

### ELECTRICAL CHARACTERISTICS (T<sub>case</sub> = 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  | 100  |      |           | 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 x 0.8 T <sub>c</sub> = 125 °C |      |      | 10<br>100 | μA<br>μA |
| I <sub>GSS</sub>     | Gate-body Leakage Current (V <sub>DS</sub> = 0)       | V <sub>GS</sub> = ± 15 V   |      |      | ± 100     | nA       |

ON (\*)

| 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> = 250 μA  | 1    | 1.7          | 2.5          | V      |
| R <sub>DS(on)</sub> | Static Drain-source On Resistance | V <sub>GS</sub> = 5V I <sub>D</sub> = 4.5 A<br>V <sub>GS</sub> = 10V I <sub>D</sub> = 4.5 A T <sub>c</sub> = 100°C |      | 0.22<br>0.21 | 0.27<br>0.25 | Ω<br>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> = 5 V                             | 9    |              |              | A      |

### DYNAMIC

| Symbol              | Parameter                    | Test Conditions  | Min. | Typ. | Max. | Unit |
|---------------------|------------------------------|--|------|------|------|------|
| g <sub>fs</sub> (*) | Forward Transconductance     | V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)max</sub> I <sub>D</sub> = 4.5 A | 4    | 7    |      | S    |
| C <sub>iss</sub>    | Input Capacitance            | V <sub>DS</sub> = 25 V f = 1 MHz V <sub>GS</sub> = 0                                 |      | 520  | 700  | pF   |
| C <sub>oss</sub>    | Output Capacitance           |  |      | 90   | 120  | pF   |
| C <sub>rss</sub>    | Reverse Transfer Capacitance |  |      | 30   | 40   | pF   |

**ELECTRICAL CHARACTERISTICS** (continued)

**SWITCHING ON**

| Symbol      | Parameter          | Test Conditions  | Min. | Typ. | Max. | Unit |
|-------------|--------------------|--|------|------|------|------|
| $t_{d(on)}$ | Turn-on Time       | $V_{DD} = 50\text{ V}$ $I_D = 4.5\text{ A}$                      |      | 10   | 14   | ns   |
| $t_r$       | Rise Time          | $R_G = 4.7\ \Omega$ $V_{GS} = 5\text{ V}$                        |      | 25   | 35   | ns   |
| $Q_g$       | Total Gate Charge  | $V_{DD} = 80\text{ V}$ $I_D = 9\text{ A}$ $V_{GS} = 10\text{ V}$ |      | 13   | 18   | nC   |
| $Q_{gs}$    | Gate-Source Charge |  |      | 5.5  |      | nC   |
| $Q_{gd}$    | Gate-Drain Charge  |  |      | 6    |      | nC   |

**SWITCHING OFF**

| Symbol        | Parameter             | Test Conditions                           | Min. | Typ. | Max. | Unit |
|---------------|-----------------------|---|------|------|------|------|
| $t_{r(Voff)}$ | Off-voltage Rise Time | $V_{DD} = 80\text{ V}$ $I_D = 9\text{ A}$ |      | 10   | 14   | ns   |
| $t_f$         | Fall Time             | $R_G = 4.7\ \Omega$ $V_{GS} = 5\text{ V}$ |      | 10   | 14   | ns   |
| $t_c$         | Cross-over Time       |   |      | 25   | 35   | ns   |

**SOURCE DRAIN DIODE**

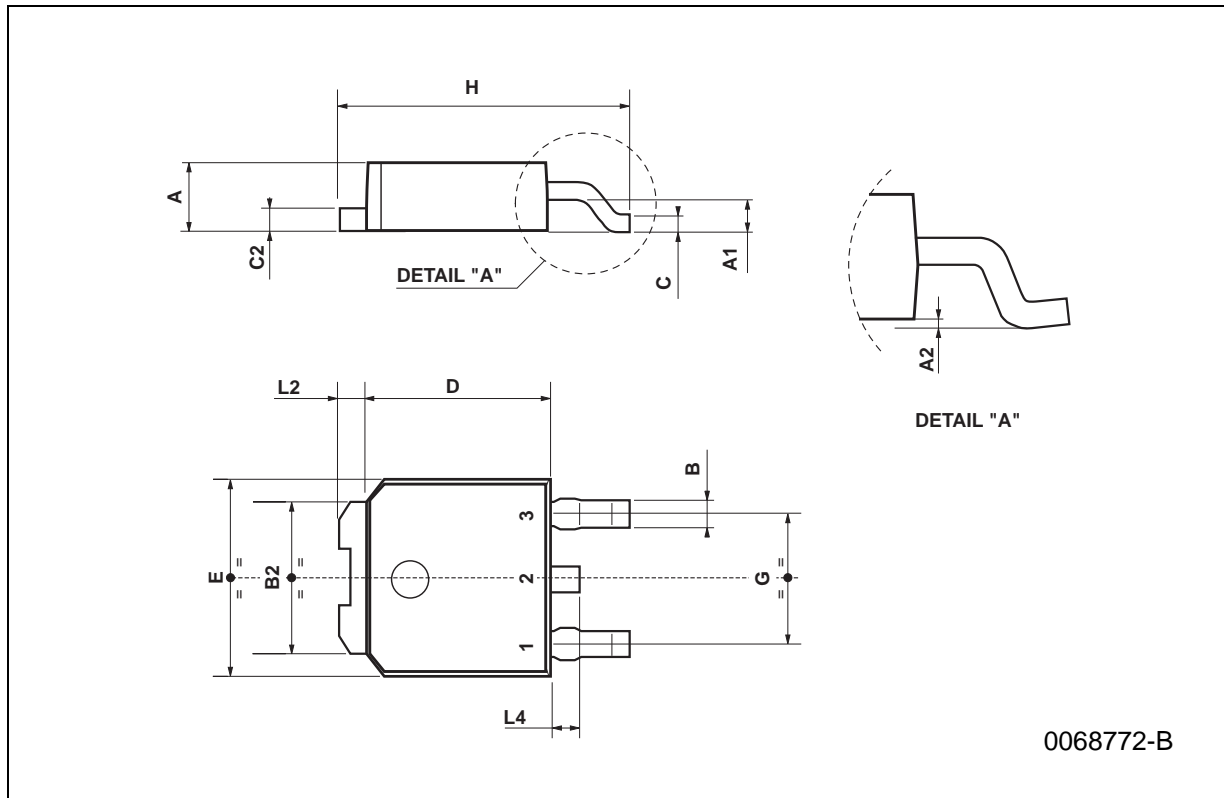
| Symbol             | Parameter                     | Test Conditions  | Min. | Typ. | Max. | Unit          |
|--------------------|-------------------------------|--|------|------|------|---------------|
| $I_{SD}$           | Source-drain Current          |  |      |      | 9    | A             |
| $I_{SDM}(\bullet)$ | Source-drain Current (pulsed) |  |      |      | 36   | A             |
| $V_{SD} (*)$       | Forward On Voltage            | $I_{SD} = 9\text{ A}$ $V_{GS} = 0$   |      |      | 1.5  | V             |
| $t_{rr}$           | Reverse Recovery Time         | $I_{SD} = 9\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 25\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ |      | 110  |      | ns            |
| $Q_{rr}$           | Reverse Recovery Charge       |  |      | 0.4  |      | $\mu\text{C}$ |
| $I_{RRM}$          | Reverse Recovery Current      |  |      | 7.2  |      | A             |

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

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

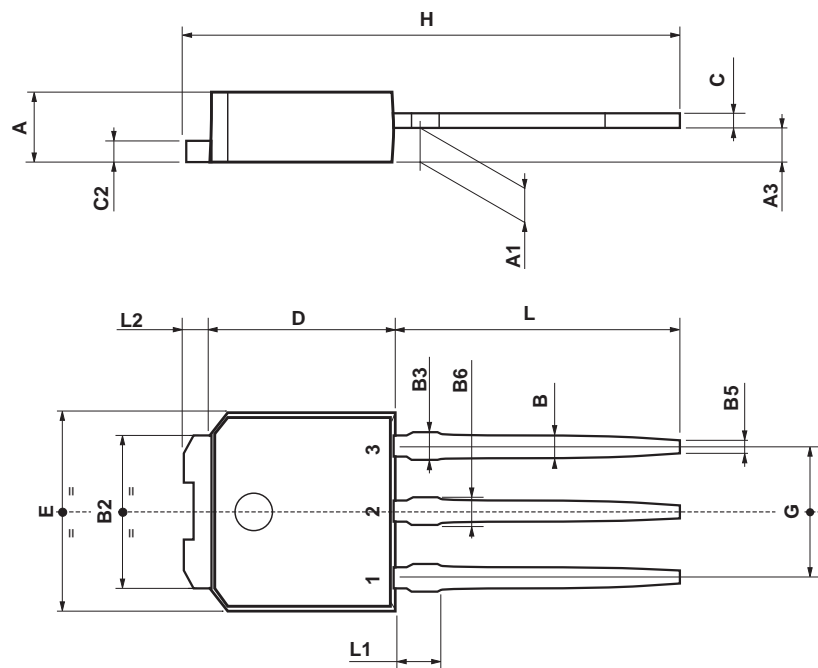
TO-252 (DPAK) MECHANICAL DATA

| DIM. | mm   |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    | 2.2  |      | 2.4  | 0.086 |       | 0.094 |
| A1   | 0.9  |      | 1.1  | 0.035 |       | 0.043 |
| A2   | 0.03 |      | 0.23 | 0.001 |       | 0.009 |
| B    | 0.64 |      | 0.9  | 0.025 |       | 0.035 |
| B2   | 5.2  |      | 5.4  | 0.204 |       | 0.212 |
| C    | 0.45 |      | 0.6  | 0.017 |       | 0.023 |
| C2   | 0.48 |      | 0.6  | 0.019 |       | 0.023 |
| D    | 6    |      | 6.2  | 0.236 |       | 0.244 |
| E    | 6.4  |      | 6.6  | 0.252 |       | 0.260 |
| G    | 4.4  |      | 4.6  | 0.173 |       | 0.181 |
| H    | 9.35 |      | 10.1 | 0.368 |       | 0.397 |
| L2   |      | 0.8  |      |       | 0.031 |       |
| L4   | 0.6  |      | 1    | 0.023 |       | 0.039 |



**TO-251 (IPAK) MECHANICAL DATA**

| DIM. | mm   |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    | 2.2  |      | 2.4  | 0.086 |       | 0.094 |
| A1   | 0.9  |      | 1.1  | 0.035 |       | 0.043 |
| A3   | 0.7  |      | 1.3  | 0.027 |       | 0.051 |
| B    | 0.64 |      | 0.9  | 0.025 |       | 0.031 |
| B2   | 5.2  |      | 5.4  | 0.204 |       | 0.212 |
| B3   |      |      | 0.85 |       |       | 0.033 |
| B5   |      | 0.3  |      |       | 0.012 |       |
| B6   |      |      | 0.95 |       |       | 0.037 |
| C    | 0.45 |      | 0.6  | 0.017 |       | 0.023 |
| C2   | 0.48 |      | 0.6  | 0.019 |       | 0.023 |
| D    | 6    |      | 6.2  | 0.236 |       | 0.244 |
| E    | 6.4  |      | 6.6  | 0.252 |       | 0.260 |
| G    | 4.4  |      | 4.6  | 0.173 |       | 0.181 |
| H    | 15.9 |      | 16.3 | 0.626 |       | 0.641 |
| L    | 9    |      | 9.4  | 0.354 |       | 0.370 |
| L1   | 0.8  |      | 1.2  | 0.031 |       | 0.047 |
| L2   |      | 0.8  | 1    |       | 0.031 | 0.039 |



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