



STD10NF10 STD10NF10-1

N-channel 100V - 0.115Ω - 13A - DPAK - IPAK
Low gate charge STripFET™ II Power MOSFET

General features

| Type | V _{DSS} | R _{DS(on)} | I _D |
|-------------|------------------|---------------------|----------------|
| STD10NF10 | 100V | <0.13Ω | 13A |
| STD10NF10-1 | 100V | <0.13Ω | 13A |

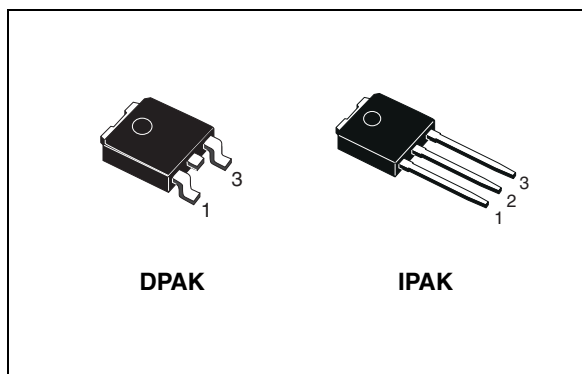
- Exceptional dv/dt capability
- Application oriented characterization

Description

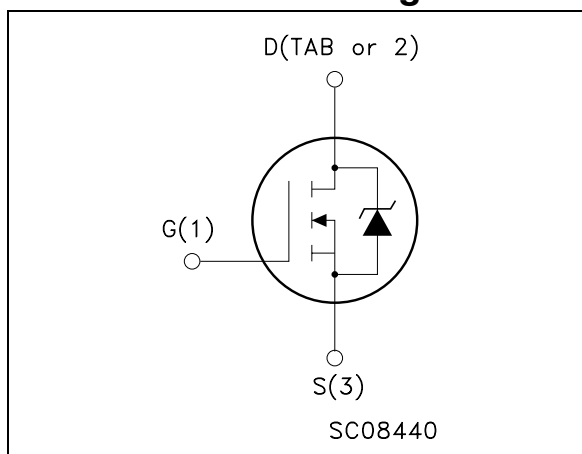
This MOSFET series realized with STMicroelectronics unique STripFET process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high-efficiency, high-frequency isolated DC-DC converters for Telecom and Computer applications. It is also intended for any applications with low gate drive requirements.

Applications

- Switching application



Internal schematic diagram



Order codes

| Part number | Marking | Package | Packaging |
|-------------|---------|---------|-------------|
| STD10NF10T4 | D10NF10 | DPAK | Tape & reel |
| STD10NF10-1 | D10NF10 | IPAK | Tube |

Contents

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1 Electrical ratings

Table 1. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|----------------|---|------------|---------------|
| V_{DS} | Drain-source voltage ($V_{GS} = 0$) | 100 | V |
| V_{DGR} | Drain-gate voltage ($R_{GS} = 20K\Omega$) | 100 | V |
| V_{GS} | Gate-source voltage | ± 20 | V |
| I_D | Drain current (continuous) at $T_C = 25^\circ C$ | 13 | A |
| I_D | Drain current (continuous) at $T_C = 100^\circ C$ | 9 | A |
| $I_{DM}^{(1)}$ | Drain current (pulsed) | 52 | A |
| P_{TOT} | Total dissipation at $T_C = 25^\circ C$ | 50 | W |
| | Derating factor | 0.33 | W/ $^\circ C$ |
| $E_{AS}^{(2)}$ | Single pulse avalanche energy | 70 | mJ |
| $dv/dt^{(3)}$ | Peak diode recovery voltage slope | 9 | V/ns |
| T_{stg} | Storage temperature | -55 to 175 | $^\circ C$ |
| T_J | Max. operating junction temperature | | |

1. Pulse width limited by safe operating area
2. Starting $T_J = 25^\circ C$, $I_D = 15A$, $V_{DD} = 50V$
3. $I_{SD} \leq 13A$, $di/dt \leq 300 A/\mu s$, $V_{DS} \leq V_{(BR)DSS}$, $T_J \leq T_{JMAX}$

Table 2. Thermal data

| Symbol | Parameter | Value | Unit |
|------------|--|-------|--------------|
| R_{thJC} | Thermal resistance junction-case Max | 3.0 | $^\circ C/W$ |
| R_{thJA} | Thermal resistance junction-ambient Max | 100 | $^\circ C/W$ |
| T_I | Maximum lead temperature for soldering purpose | 300 | $^\circ C$ |

2 Electrical characteristics

($T_{CASE} = 25^{\circ}C$ unless otherwise specified)

Table 3. On /off states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|--|---|------|-------|-----------|--------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $I_D = 250\mu A, V_{GS} = 0$ | 100 | | | V |
| I_{DSS} | Zero gate voltage drain current ($V_{GS} = 0$) | $V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating},$ $T_C = 125^{\circ}C$ | | | 1 10 | μA μA |
| I_{GSS} | Gate body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 20V$ | | | ± 100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}, I_D = 250\mu A$ | 2 | 3 | 4 | V |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS} = 10V, I_D = 5A$ | | 0.115 | 0.13 | Ω |

Table 4. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------------|------------------------------|--|------|------|------|------|
| $g_{fs}^{(1)}$ | Forward transconductance | $V_{DS} = 15V, I_D = 5A$ | | 20 | | S |
| C_{iss} | Input capacitance | $V_{DS} = 25V, f = 1 \text{ MHz},$ $V_{GS} = 0$ | | 460 | | pF |
| C_{oss} | Output capacitance | | | 70 | | pF |
| C_{rss} | Reverse transfer capacitance | | | 30 | | pF |
| Q_g | Total gate charge | $V_{DD} = 80V, I_D = 10A$ $V_{GS} = 10V$ | | 15.3 | 21 | nC |
| Q_{gs} | Gate-source charge | | | 3.7 | | nC |
| Q_{gd} | Gate-drain charge | | | 4.7 | | nC |

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

Table 5. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit | |
|--------------|---------------------|--|------|------|------|------|----|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 27V, I_D = 5A,$ $R_G = 4.7\Omega, V_{GS} = 10V$ <i>Figure 13 on page 8</i> | | 16 | | ns | |
| t_r | Rise time | | | 25 | | ns | |
| $t_{d(off)}$ | Turn-off delay time | | | | 32 | | ns |
| t_f | Fall time | | | | 8 | | ns |

Table 6. Source drain diode

| Symbol | Parameter | Test conditions | Min | Typ. | Max | Unit |
|-----------------------------------|--|---|-----|----------------|-----|--------------------|
| I_{SD} | Source-drain current | | | | 13 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | | | 52 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 10A, V_{GS} = 0$ | | | 1.5 | V |
| t_{rr} Q_{rr} I_{RRM} | Reverse recovery time Reverse recovery charge Reverse recovery current | $I_{SD} = 10A,$ $di/dt = 100A/\mu s,$ $V_{DD} = 50V, T_J = 150^\circ C$ <i>Figure 15 on page 8</i> | | 90 230 5 | | ns μC A |

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

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

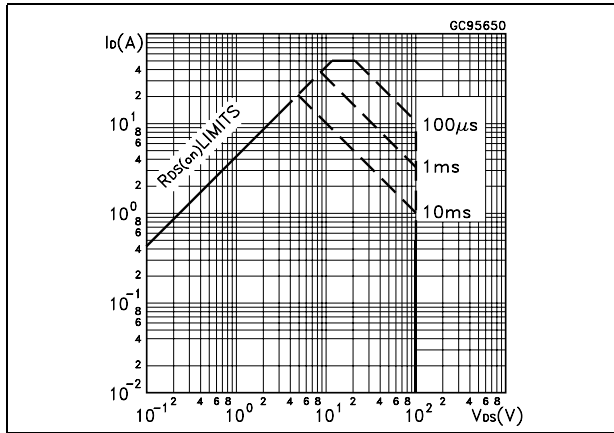


Figure 2. Thermal impedance

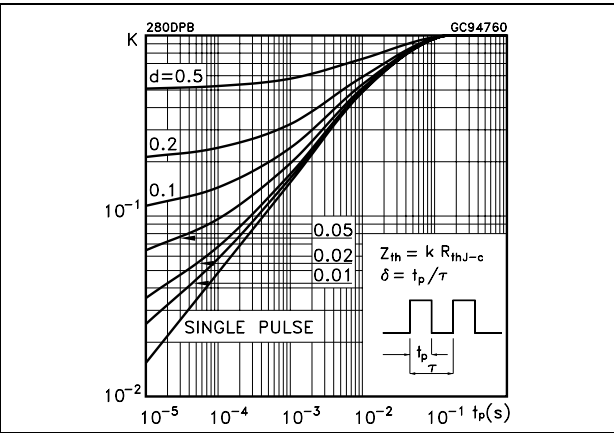


Figure 3. Output characteristics

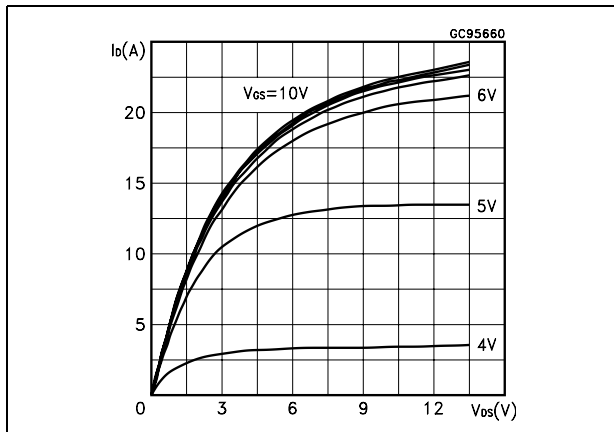


Figure 4. Transfer characteristics

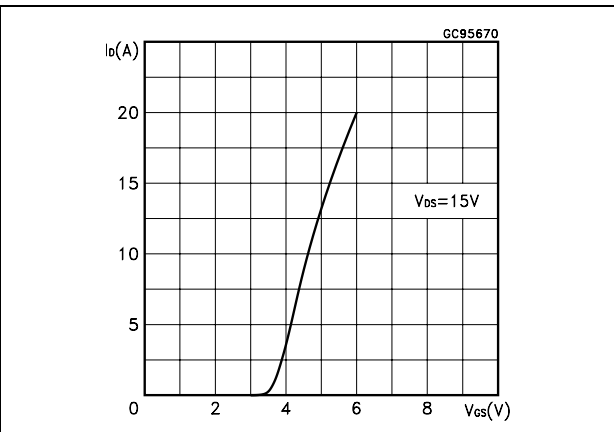


Figure 5. Transconductance

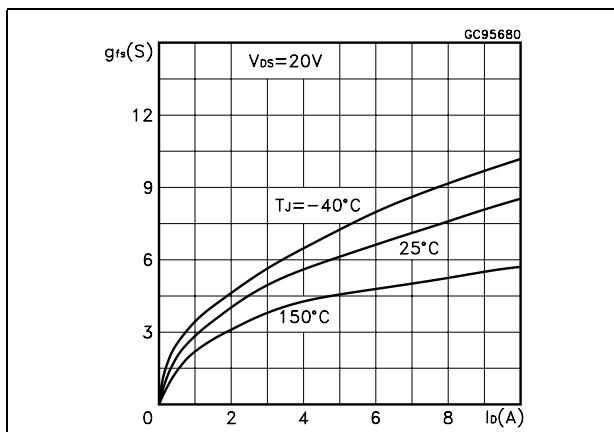


Figure 6. Static drain-source on resistance

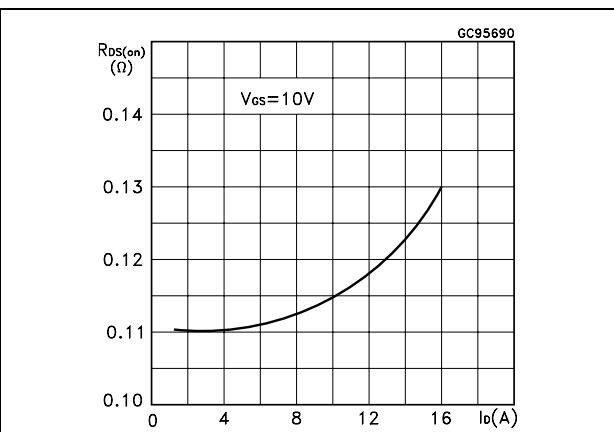


Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

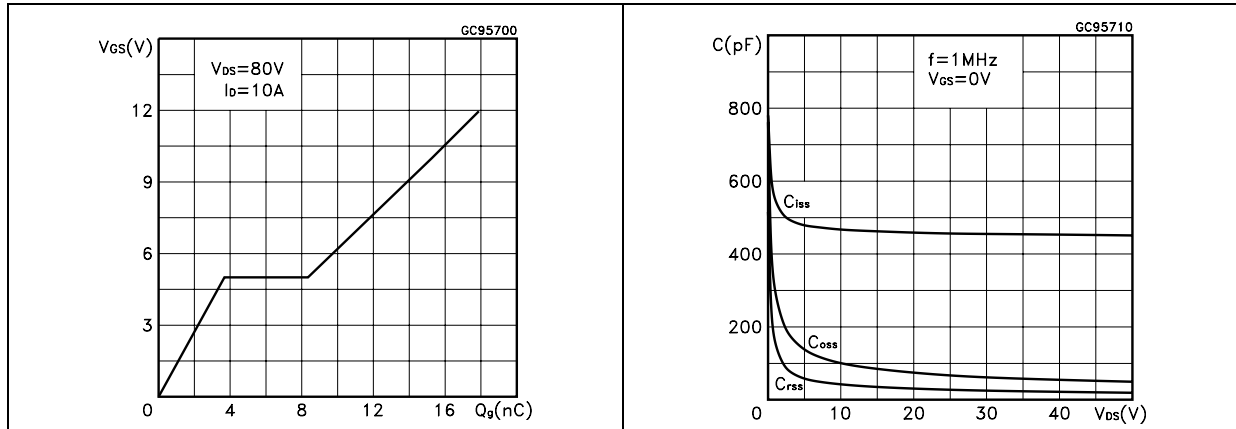


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature

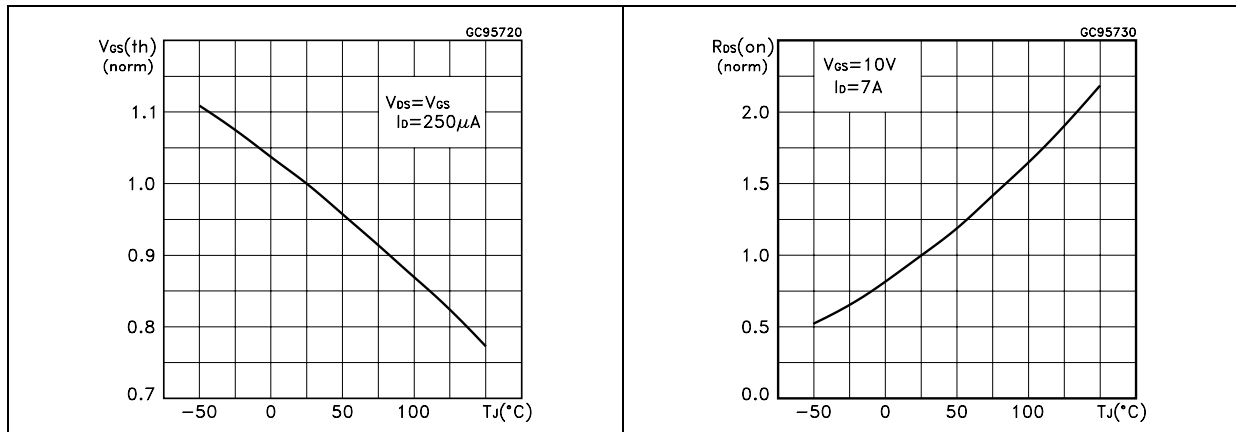
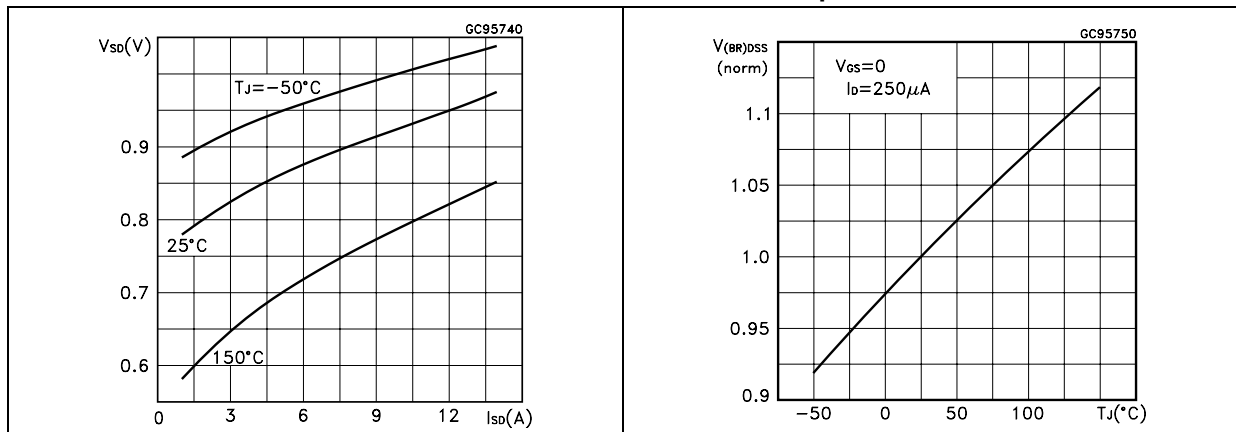


Figure 11. Source-drain diode forward characteristics Figure 12. Normalized breakdown voltage vs temperature



3 Test circuit

Figure 13. Switching times test circuit for resistive load

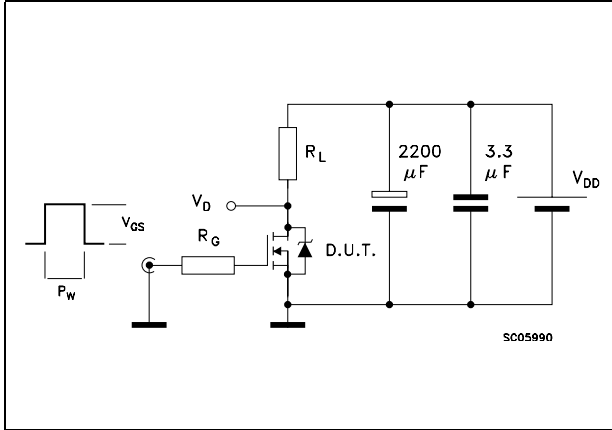


Figure 14. Gate charge test circuit

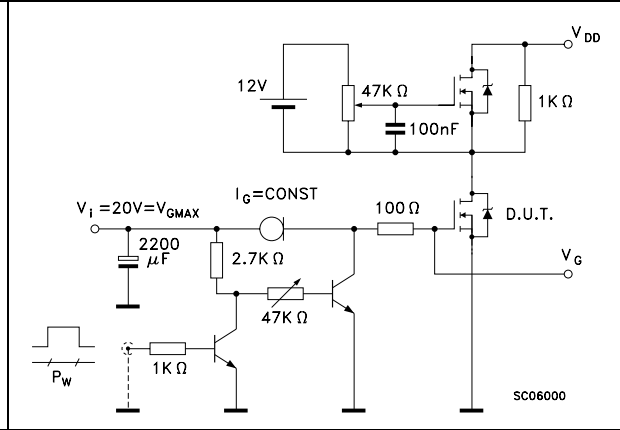


Figure 15. Test circuit for inductive load switching and diode recovery times

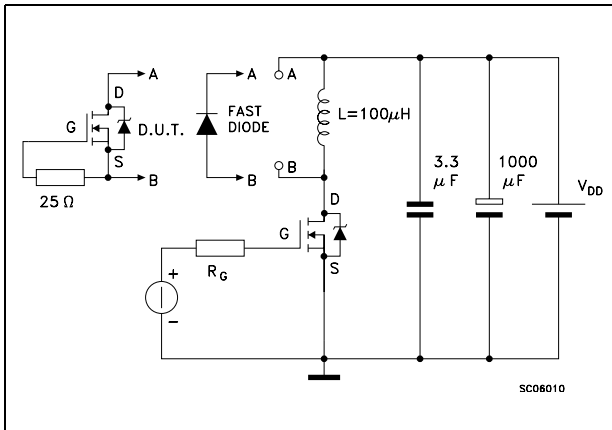


Figure 16. Unclamped Inductive load test circuit

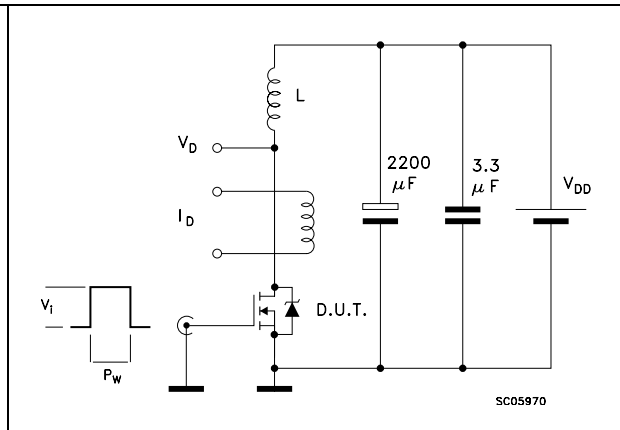
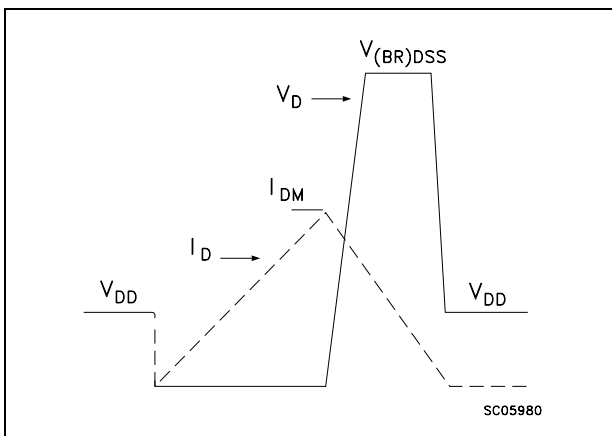


Figure 17. Unclamped inductive waveform

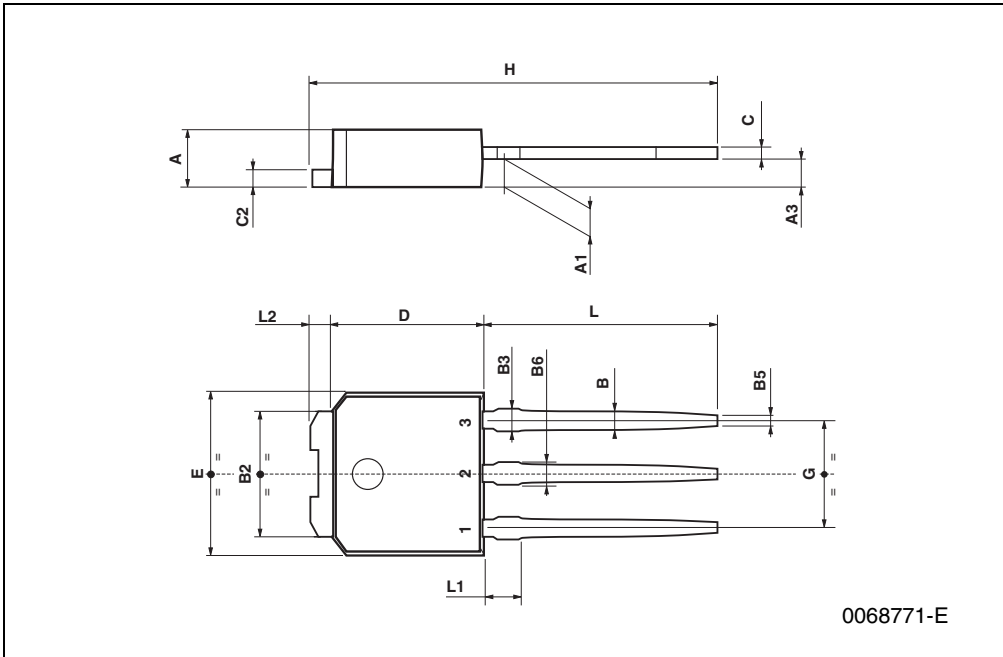


4 Package mechanical data

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

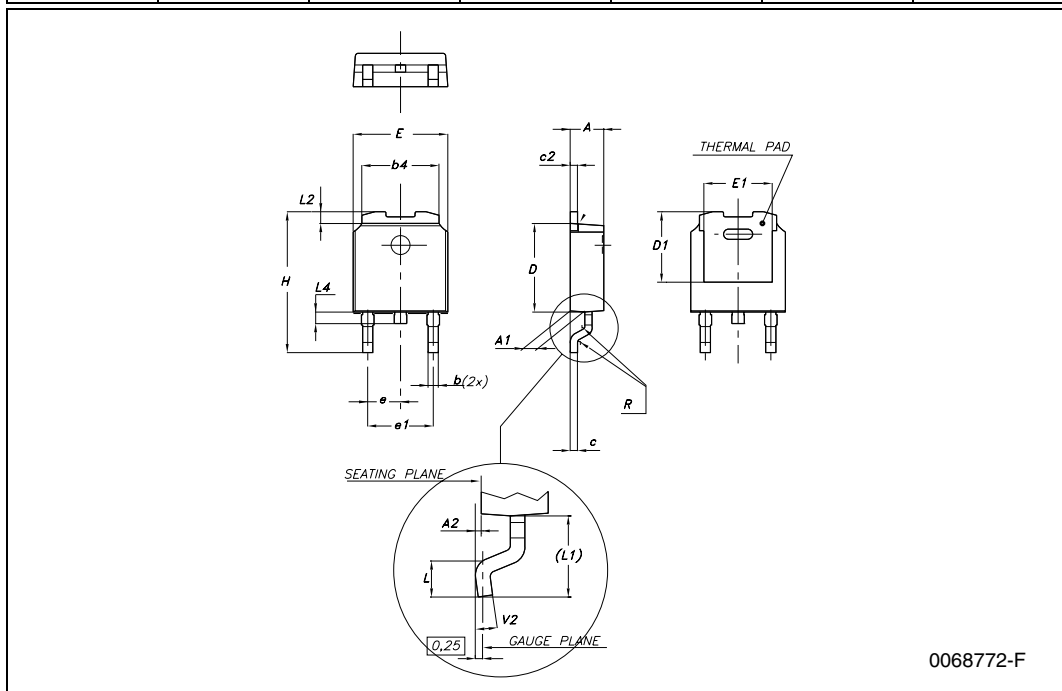
TO-251 (IPAK) MECHANICAL DATA

| 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 |



DPAK MECHANICAL DATA

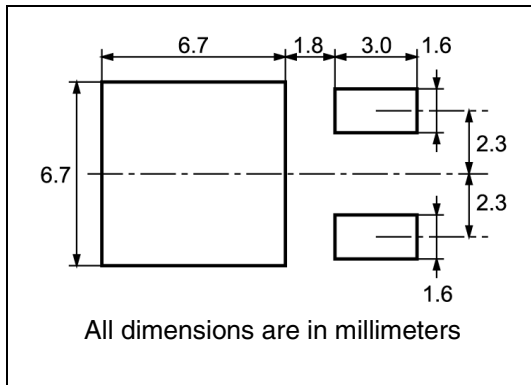
| DIM. | mm. | | | inch | | |
|------|------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 2.2 | | 2.4 | 0.086 | | 0.094 |
| A1 | 0.9 | | 1.1 | 0.035 | | 0.043 |
| A2 | 0.03 | | 0.23 | 0.001 | | 0.009 |
| B | 0.64 | | 0.9 | 0.025 | | 0.035 |
| b4 | 5.2 | | 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 |
| D1 | | 5.1 | | | 0.200 | |
| E | 6.4 | | 6.6 | 0.252 | | 0.260 |
| E1 | | 4.7 | | | 0.185 | |
| e | | 2.28 | | | 0.090 | |
| e1 | 4.4 | | 4.6 | 0.173 | | 0.181 |
| H | 9.35 | | 10.1 | 0.368 | | 0.397 |
| L | 1 | | | 0.039 | | |
| (L1) | | 2.8 | | | 0.110 | |
| L2 | | 0.8 | | | 0.031 | |
| L4 | 0.6 | | 1 | 0.023 | | 0.039 |
| R | | 0.2 | | | 0.008 | |
| V2 | 0° | | 8° | 0° | | 8° |



0068772-F

5 Packaging mechanical data

DPAK FOOTPRINT



TAPE AND REEL SHIPMENT

| DIM. | mm | | inch | |
|------|------|------|-------|--------|
| | MIN. | MAX. | MIN. | MAX. |
| A | | 330 | | 12.992 |
| B | 1.5 | | 0.059 | |
| C | 12.8 | 13.2 | 0.504 | 0.520 |
| D | 20.2 | | 0.795 | |
| G | 16.4 | 18.4 | 0.645 | 0.724 |
| N | 50 | | 1.968 | |
| T | | 22.4 | | 0.881 |

| BASE QTY | BULK QTY |
|----------|----------|
| 2500 | 2500 |

| DIM. | mm | | inch | |
|------|------|------|-------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A0 | 6.8 | 7 | 0.267 | 0.275 |
| B0 | 10.4 | 10.6 | 0.409 | 0.417 |
| B1 | | 12.1 | | 0.476 |
| D | 1.5 | 1.6 | 0.059 | 0.063 |
| D1 | 1.5 | | 0.059 | |
| E | 1.65 | 1.85 | 0.065 | 0.073 |
| F | 7.4 | 7.6 | 0.291 | 0.299 |
| K0 | 2.55 | 2.75 | 0.100 | 0.108 |
| P0 | 3.9 | 4.1 | 0.153 | 0.161 |
| P1 | 7.9 | 8.1 | 0.311 | 0.319 |
| P2 | 1.9 | 2.1 | 0.075 | 0.082 |
| R | 40 | | 1.574 | |
| W | 15.7 | 16.3 | 0.618 | 0.641 |

6 Revision history

Table 7. Revision history

| Date | Revision | Changes |
|-------------|----------|---------------------------|
| 09-Sep-2004 | 3 | Complete version |
| 07-Aug-2006 | 3 | New template, updated SOA |

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