



STB40NS15

N-channel 150V - 0.045Ω - 40A - D²PAK
MESH OVERLAY™ Power MOSFET

Features

| Type | V _{DSS} | R _{DS(on)} (max) | I _D |
|-----------|------------------|------------------------------|----------------|
| STB40NS15 | 150V | <0.052Ω | 40A |

- Exceptional dv/dt capability
- Gate charge minimized
- Very low intrinsic capacitances

Applications

- Switching application

Description

This Power 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.

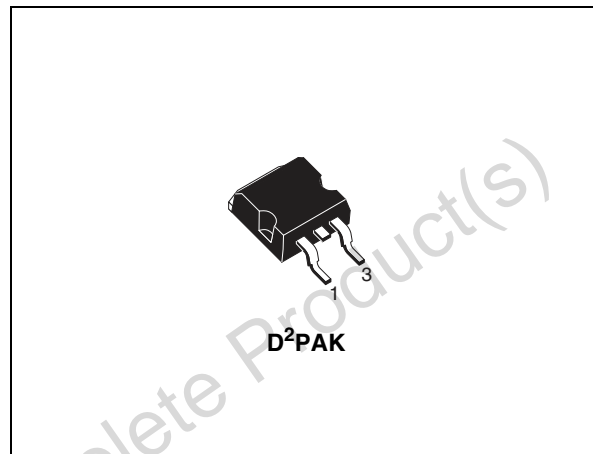


Figure 1. Internal schematic diagram

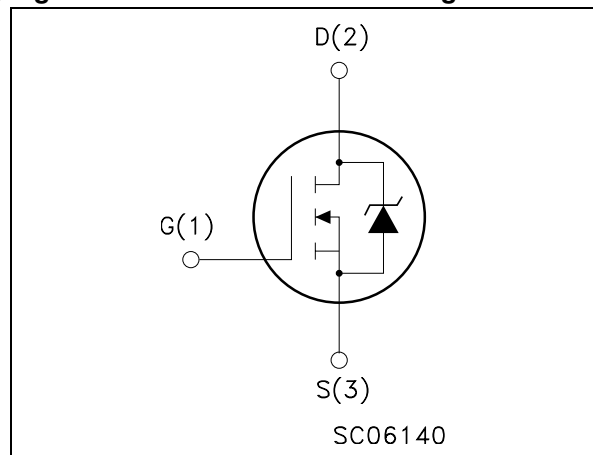


Table 1. Device summary

| Part number | Marking | Package | Packaging |
|-------------|---------|--------------------|-------------|
| STB40NS15T4 | B40NF15 | D ² PAK | Tape & reel |

Contents

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Obsolete Product(s) - Obsolete Product(s)

1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|----------------|---------------------------------------------------------|------------|---------------------|
| V_{DS} | Drain-source voltage ($V_{GS} = 0$) | 150 | V |
| V_{DGR} | Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$) | 150 | V |
| V_{GS} | Gate- source voltage | ± 20 | V |
| I_D | Drain current (continuous) at $T_C = 25^\circ\text{C}$ | 40 | A |
| I_D | Drain current (continuous) at $T_C = 100^\circ\text{C}$ | 25 | A |
| $I_{DM}^{(1)}$ | Drain current (pulsed) | 160 | A |
| P_{tot} | Total dissipation at $T_C = 25^\circ\text{C}$ | 300 | W |
| | Derating Factor | 2 | W/ $^\circ\text{C}$ |
| dv/dt | Peak diode recovery avalanche energy | 7 | V/ns |
| T_{stg} | Storage temperature | -65 to 175 | $^\circ\text{C}$ |
| T_j | Max. operating junction temperature | | |

1. Pulse width limited by safe operating area.

Table 3. Thermal data

| Symbol | Parameter | value | Unit |
|-----------|------------------------------------------------|-------|---------------------------|
| Rthj-case | Thermal resistance junction-case max | 0.5 | $^\circ\text{C}/\text{W}$ |
| Rthj-amb | Thermal resistance junction-ambient max | 62.5 | $^\circ\text{C}/\text{W}$ |
| T_J | Maximum lead temperature for soldering purpose | 300 | $^\circ\text{C}$ |

Table 4. Avalanche characteristics

| Symbol | Parameter | Max value | Unit |
|----------|---------------------------------------------------------------------------------------------------------------|-----------|------|
| I_{AR} | Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max) | 40 | A |
| E_{AS} | Single pulse avalanche energy (starting $T_j = 25^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50 \text{ V}$) | 350 | mJ |

2 Electrical characteristics

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

Table 5. On/off states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|--------------------------------------------------|---------------------------------------------------------------------------------------|------|-------|-----------|--------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $I_D = 250\mu A, V_{GS} = 0$ | 150 | | | 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 | $V_{GS} = 10V, I_D = 20A$ | | 0.045 | 0.052 | Ω |

Table 6. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------------------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|------|----------------------|------|----------------------|
| $g_{fs}^{(1)}$ | Forward transconductance | $V_{DS} = 10V, I_D = 20A$ | | 29.4 | | S |
| C_{iss} C_{oss} C_{rss} | Input capacitance Output capacitance Reverse transfer capacitance | $V_{DS} = 25V, f = 1MHz,$ $V_{GS} = 0$ | | 2420 380 160 | | pF pF pF |
| $t_{d(on)}$ t_r $t_{d(off)}$ t_f | Turn-on delay time Rise time Turn-off delay time Fall time | $V_{DD} = 75V, I_D = 20A$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see Figure 13) | | 25 45 85 35 | | ns ns ns ns |
| Q_g Q_{gs} Q_{gd} | Total gate charge Gate-source charge Gate-drain charge | $V_{DD} = 120V, I_D = 40A,$ $V_{GS} = 10V, R_G = 4.7\Omega$ (see Figure 14) | | 100 17 47 | 110 | nC nC nC |

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

Table 7. Source drain diode

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------------------------|------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|------|-------------------|-----------|---------------|
| I_{SD} $I_{SDM}^{(1)}$ | Source-drain current Source-drain current (pulsed) | | | | 40 160 | A A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 40A, V_{GS} = 0$ | | | 1.5 | V |
| t_{rr} Q_{rr} I_{RRM} | Reverse recovery time Reverse recovery charge Reverse recovery current | $I_{SD} = 40A, di/dt = 100A/\mu s,$ $V_{DD} = 100V, T_j = 150^\circ C$ (see Figure 15) | | 270 200 1.5 | | ns nC A |

1. Pulse width limited by safe operating area.

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

Obsolete Product(s) - Obsolete Product(s)

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

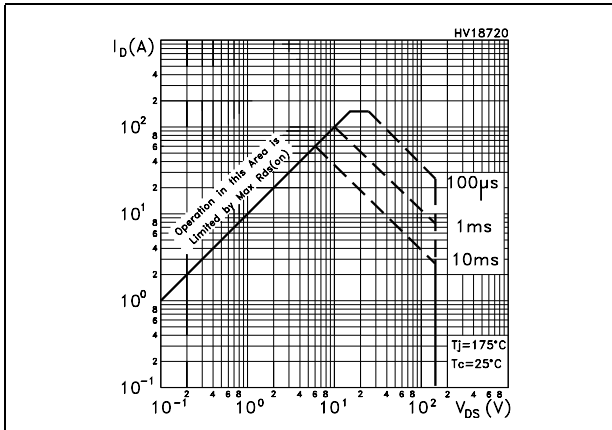


Figure 3. Thermal impedance

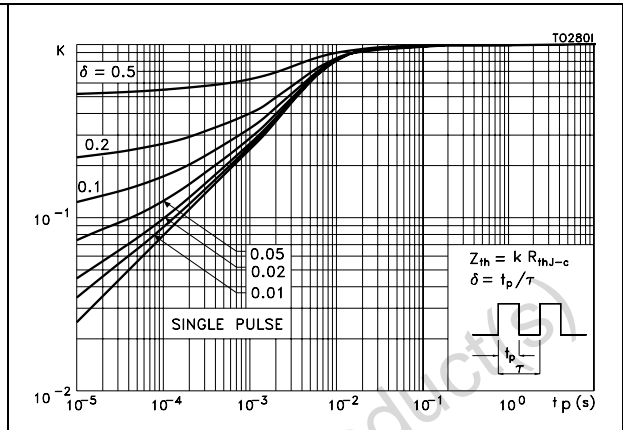


Figure 4. Output characteristics

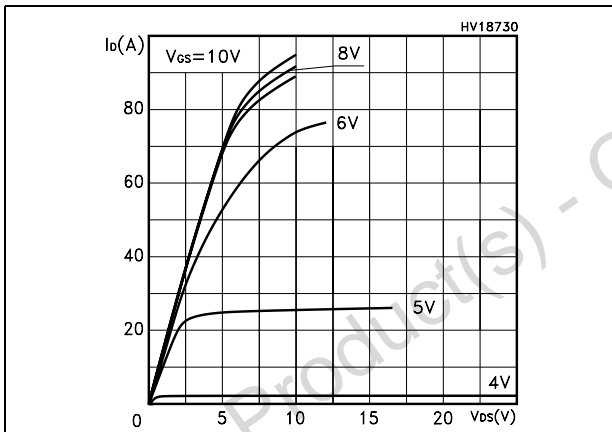


Figure 5. Transfer characteristics

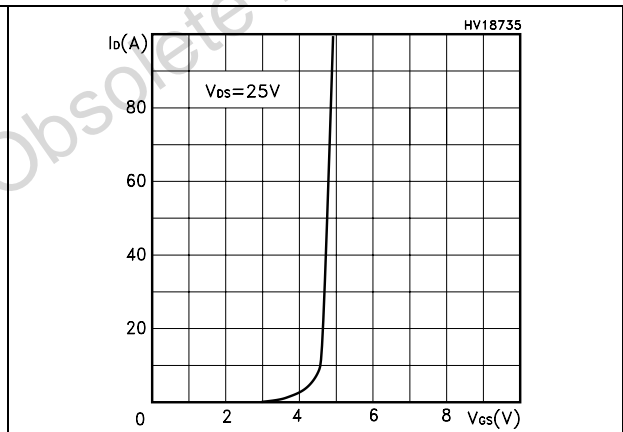


Figure 6. Transconductance

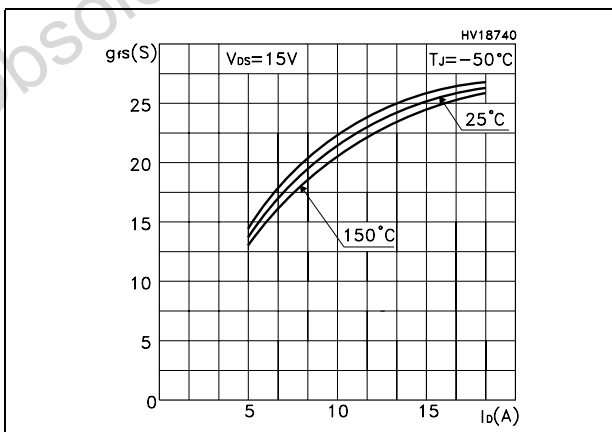


Figure 7. Static drain-source on resistance

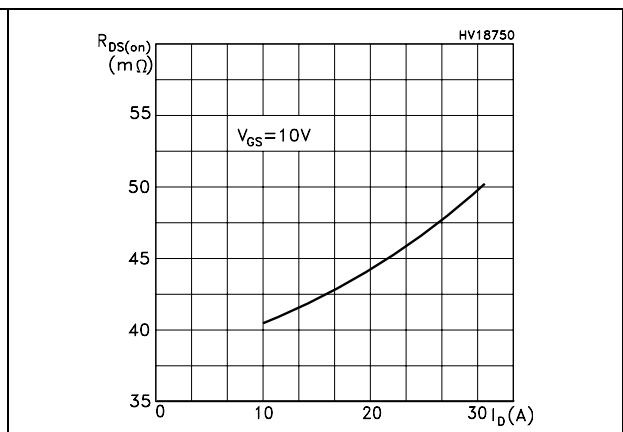


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

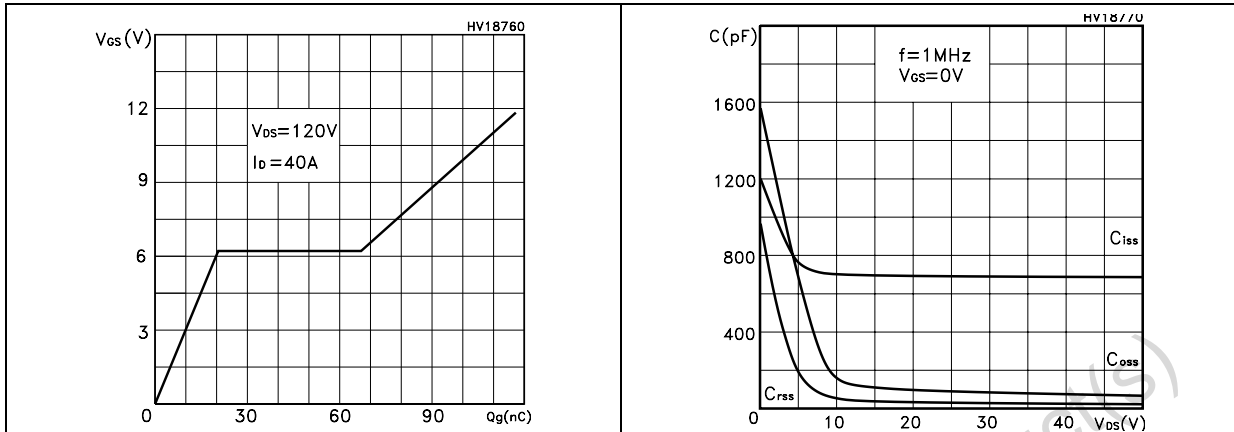


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

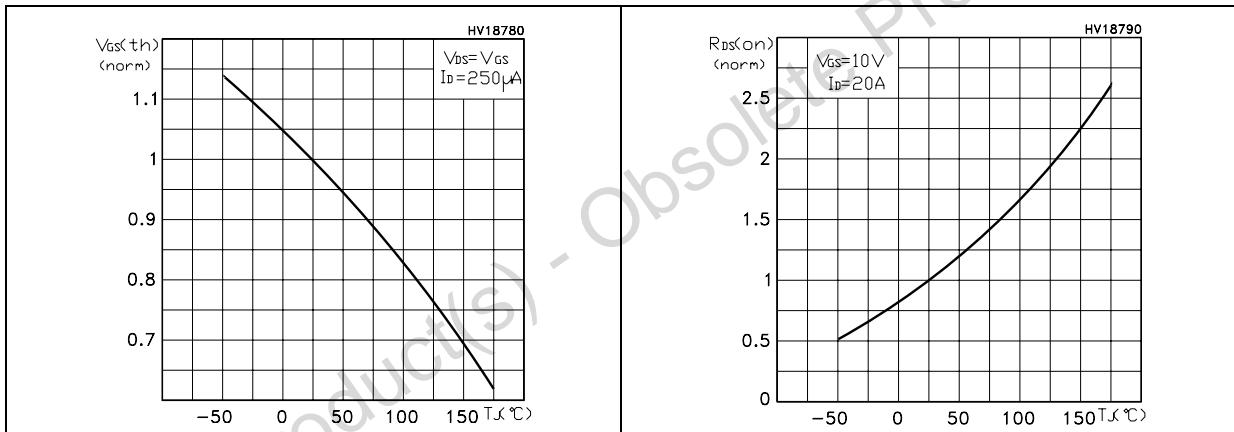
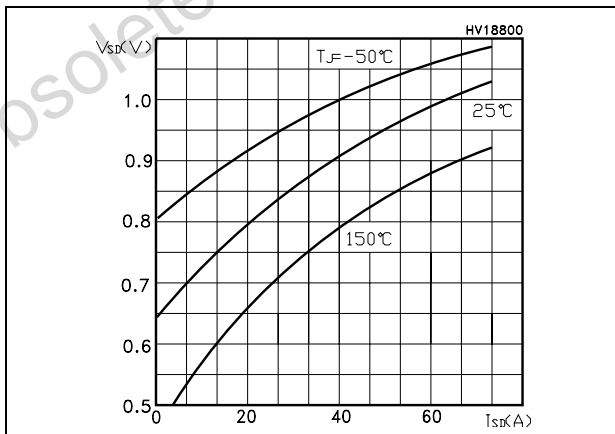


Figure 12. Source-drain diode forward characteristics



3 Test circuit

Figure 13. Switching times test circuit for resistive load

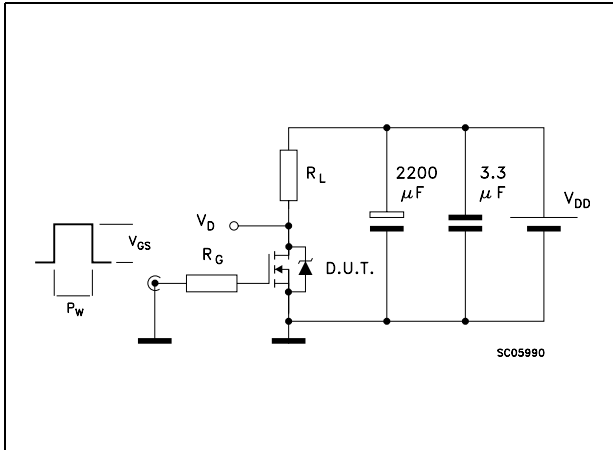


Figure 14. Gate charge test circuit

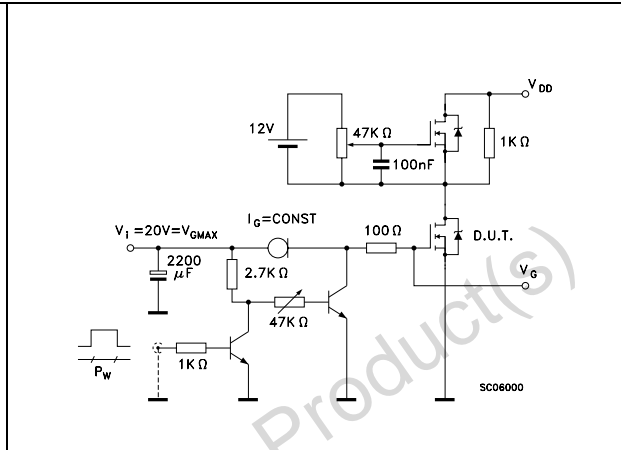


Figure 15. Test circuit for inductive load switching and diode recovery times

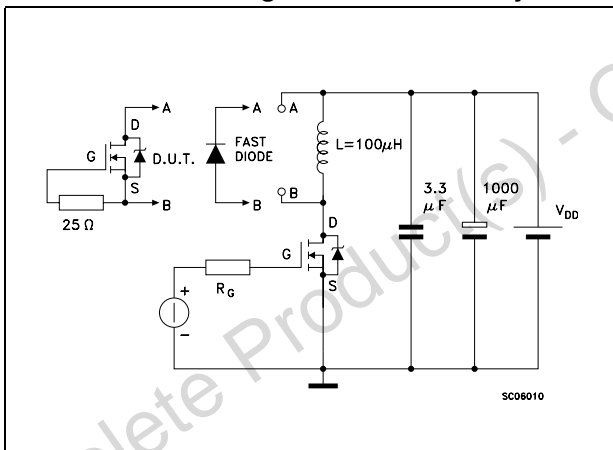


Figure 16. Unclamped Inductive load test circuit

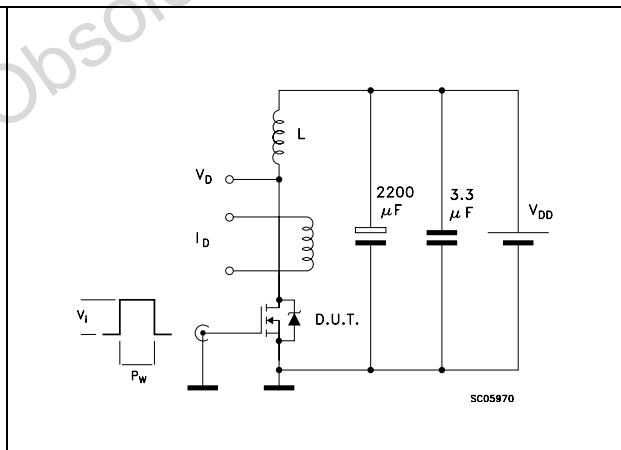


Figure 17. Unclamped inductive waveform

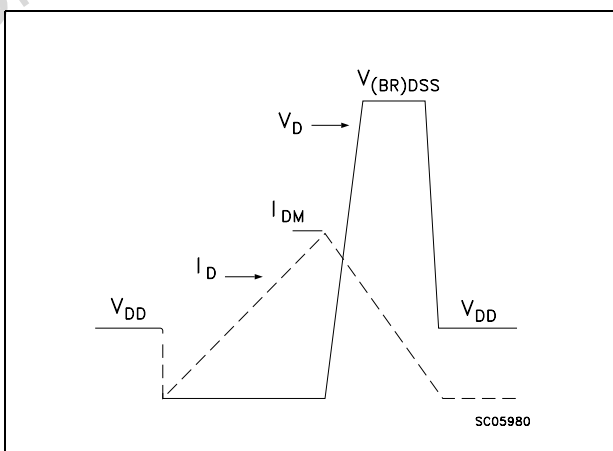
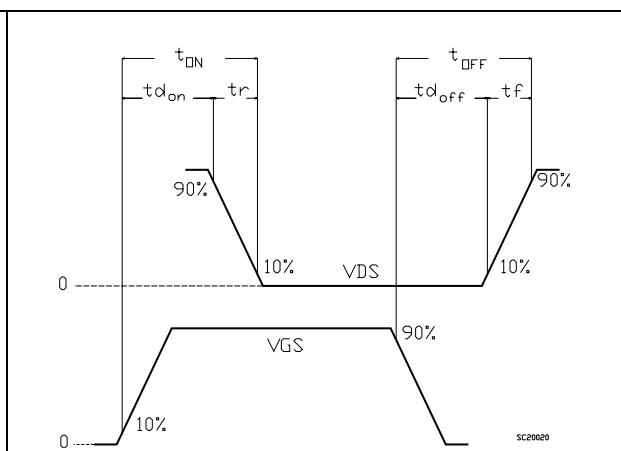


Figure 18. Switching time waveform



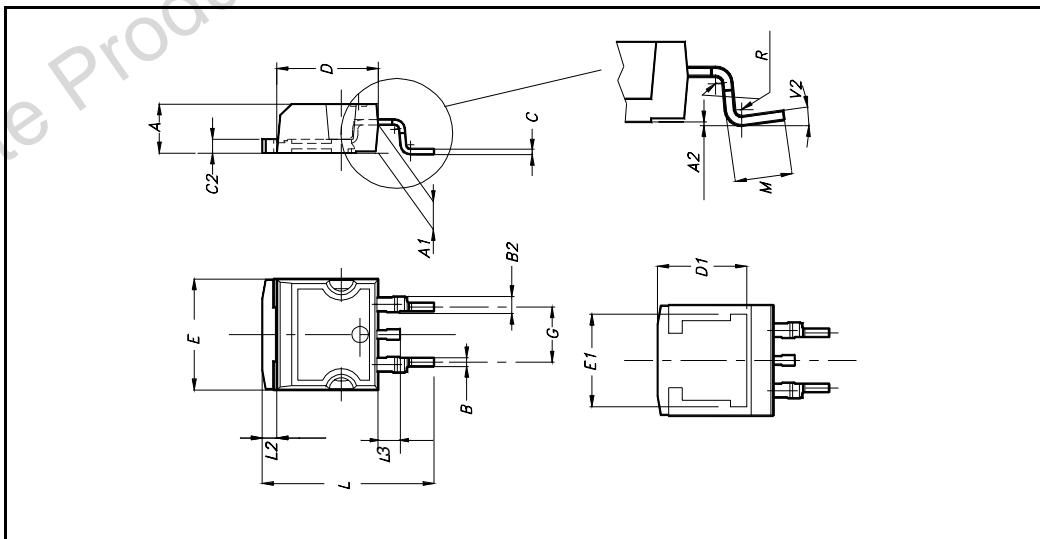
4 Package mechanical data

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

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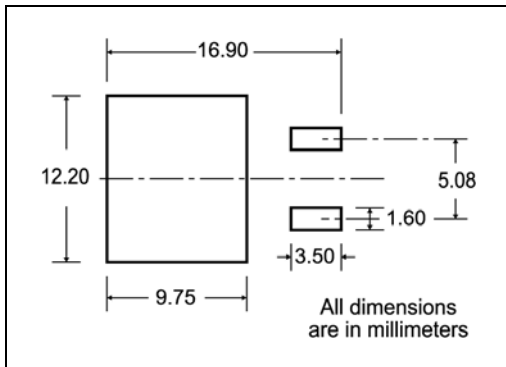
D²PAK MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|------|------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.4 | | 4.6 | 0.173 | | 0.181 |
| A1 | 2.49 | | 2.69 | 0.098 | | 0.106 |
| A2 | 0.03 | | 0.23 | 0.001 | | 0.009 |
| B | 0.7 | | 0.93 | 0.027 | | 0.036 |
| B2 | 1.14 | | 1.7 | 0.044 | | 0.067 |
| C | 0.45 | | 0.6 | 0.017 | | 0.023 |
| C2 | 1.23 | | 1.36 | 0.048 | | 0.053 |
| D | 8.95 | | 9.35 | 0.352 | | 0.368 |
| D1 | | 8 | | | 0.315 | |
| E | 10 | | 10.4 | 0.393 | | |
| E1 | | 8.5 | | | 0.334 | |
| G | 4.88 | | 5.28 | 0.192 | | 0.208 |
| L | 15 | | 15.85 | 0.590 | | 0.625 |
| L2 | 1.27 | | 1.4 | 0.050 | | 0.055 |
| L3 | 1.4 | | 1.75 | 0.055 | | 0.068 |
| M | 2.4 | | 3.2 | 0.094 | | 0.126 |
| R | | 0.4 | | | 0.015 | |
| V2 | 0° | | 4° | | | |



5 Packing mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT

TAPE MECHANICAL DATA

| DIM. | mm | | inch | |
|------|------|------|--------|--------|
| | MIN. | MAX. | MIN. | MAX. |
| A0 | 10.5 | 10.7 | 0.413 | 0.421 |
| B0 | 15.7 | 15.9 | 0.618 | 0.626 |
| D | 1.5 | 1.6 | 0.059 | 0.063 |
| D1 | 1.59 | 1.61 | 0.062 | 0.063 |
| E | 1.65 | 1.85 | 0.065 | 0.073 |
| F | 11.4 | 11.6 | 0.449 | 0.456 |
| K0 | 4.8 | 5.0 | 0.189 | 0.197 |
| P0 | 3.9 | 4.1 | 0.153 | 0.161 |
| P1 | 11.9 | 12.1 | 0.468 | 0.476 |
| P2 | 1.9 | 2.1 | 0.075 | 0.082 |
| R | 50 | | 1.574 | |
| T | 0.25 | 0.35 | 0.0098 | 0.0137 |
| W | 23.7 | 24.3 | 0.933 | 0.956 |

REEL MECHANICAL DATA

| 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 | 24.4 | 26.4 | 0.960 | 1.039 |
| N | 100 | | 3.937 | |
| T | | 30.4 | | 1.197 |

| BASE QTY | BULK QTY |
|----------|----------|
| 1000 | 1000 |

* on sales type

6 Revision history

Table 8. Document revision history

| Date | Revision | Changes |
|-------------|----------|---------------------------------|
| 21-Jun-2004 | 2 | Preliminary version |
| 26-Jun-2006 | 3 | New template, no content change |
| 24-Oct-2007 | 4 | Minor text changes |

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