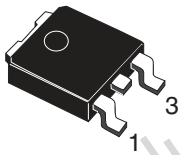
# STD35NF3LL

## N-channel 30V - 0.014Ω - 35A - DPAK
## STripFET™ II Power MOSFET

## General features

| Type | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ |
|---|---|---|---|
| STD35NF3LL | 30V | <0.0195Ω | 35A |

- Optimal $R_{DS}(on)$ x $Q_g$ trade-off @ 4.5V
- Conduction losses reduced
- Switching losses reduced
- Low threshold drive

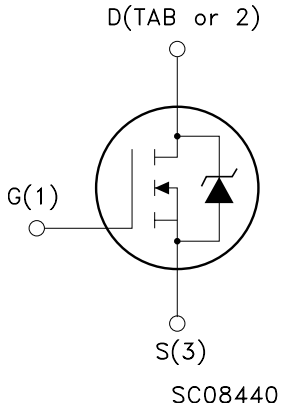



DPAK

## Description

This application specific Power MOSFET is the third generation of STMicroelectronics unique "single feature size™" strip-based process. The resulting transistor shows the best trade-off between on-resistance and gate charge. When used as high and low side in buck regulators, it gives the best performance in terms of both conduction and switching losses. This is extremely important for motherboards where fast switching and high efficiency are of paramount importance. remarkable manufacturing reproducibility.

## Internal schematic diagram




## Applications

- Switching application

## Order codes

| Part number | Marking | Package | Packaging |
|---|---|---|---|
| STD35NF3LLT4 | D35NF3LL | DPAK | Tape & reel |

# Contents

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-source voltage ($V_{GS}$ = 0) | 30 | V |
| $V_{GS}$ | Gate- source voltage | ± 16 | V |
| $I_D$ | Drain current (continuous) at $T_C$ = 25°C | 35 | A |
| $I_D$ | Drain current (continuous) at $T_C$ = 100°C | 25 | A |
| $I_{DM}$ (1) | Drain current (pulsed) | 140 | A |
| $P_{tot}$ | Total dissipation at $T_C$ = 25°C | 50 | W |
| | Derating factor | 0.33 | W/°C |
| $E_{AS}$ (2) | Single pulse avalanche energy | 300 | mJ |
| $T_{stg}$ | Storage temperature | -55 to 175 | °C |
| $T_j$ | Max. operating junction temperature | | |

1. Pulse width limited by safe operating area.
2. Starting $T_j$ = 25 °C, $I_D$ = 17.5A, $V_{DD}$ =24V

**Table 2. Thermal data**

| | | | |
|---|---|---|---|
| Rthj-case | Thermal resistance junction-case max | 3 | °C/W |
| Rthj-amb | Thermal resistance junction-to ambient max | 100 | °C/W |
| $T_J$ | Maximum lead temperature for soldering purpose | 300 | °C |

# 2 Electrical characteristics

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

**Table 3. On/off states**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $I_D$ = 250µA, $V_{GS}$ =0 | 30 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current ($V_{GS}$ = 0)<br>$V_{DS}$ = Max rating<br>$V_{DS}$ = Max rating @125°C | | | | 1<br>10 | µA<br>µA |
| $I_{GSS}$ | Gate-body leakage current ($V_{DS}$ = 0) | $V_{GS}$ = ± 16V | | | ±100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA | 1 | | 2.5 | V |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS}$ = 10V, $I_D$ = 17.5A<br>$V_{GS}$ = 4.5V, $I_D$ = 17.5A | | 0.014<br>0.016 | 0.0195<br>0.0215 | Ω<br>Ω |

**Table 4. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ (1) | Forward transconductance | $V_{DS}$ = 15V, $I_D$ = 17.5A | | 19 | | 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 | | 800<br>250<br>60 | | 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 | $V_{DD}$ = 15V, $I_D$ = 17.5A<br>$R_G$ = 4.7Ω $V_{GS}$ = 4.5V<br>(see *Figure 12*) | | 17<br>100<br>20<br>21 | | 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 | $V_{DD}$ = 24V, $I_D$ = 35A,<br>$V_{GS}$ = 5V, $R_G$ = 4.7Ω<br>(see *Figure 13*) | | 12.5<br>42<br>5.2 | 17 | nC<br>nC<br>nC |

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

**Table 5. 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) | | | | 35<br>140 | A<br>A |
| $V_{SD}$ (2) | Forward on voltage | $I_{SD}$ = 35A, $V_{GS}$ = 0 | | | 1.3 | V |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD}$ = 35A, di/dt = 100A/µs,<br>$V_{DD}$ = 15V, $T_j$ = 150°C<br>(see *Figure 17*) | | 35<br>44<br>2.5 | | ns<br>nC<br>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**

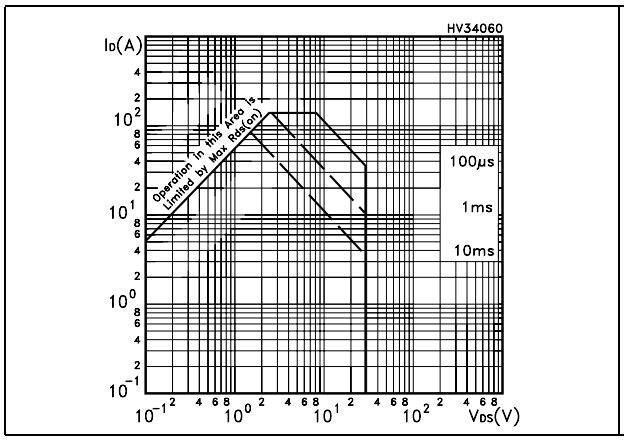



**Figure 2. Thermal impedance**

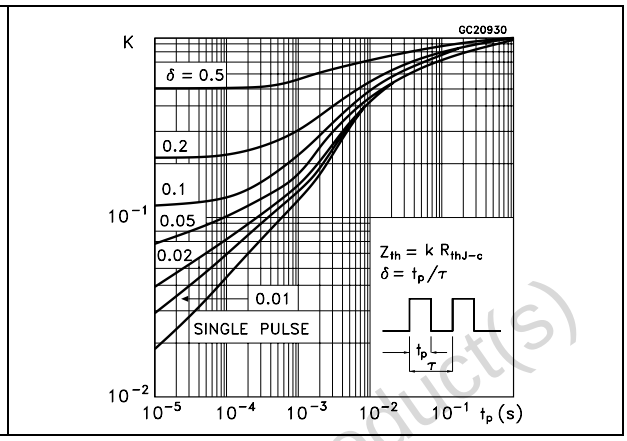



**Figure 3. Output characteristics**

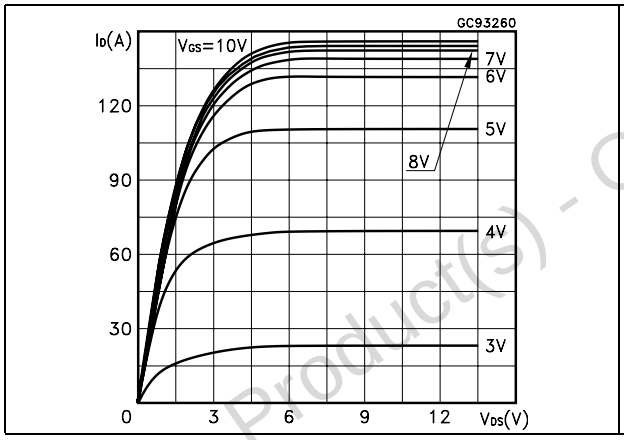



**Figure 4. Transfer characteristics**

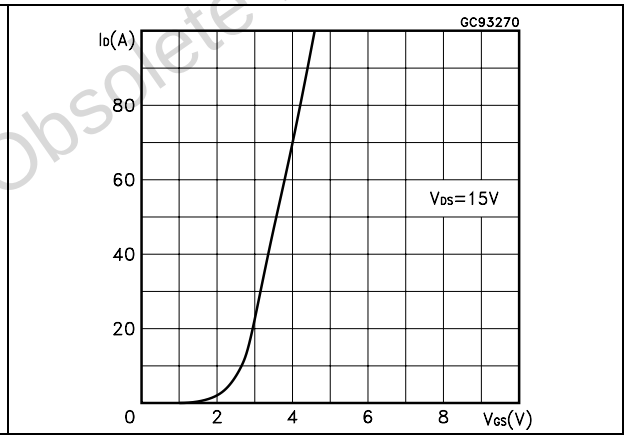



**Figure 5. Transconductance**

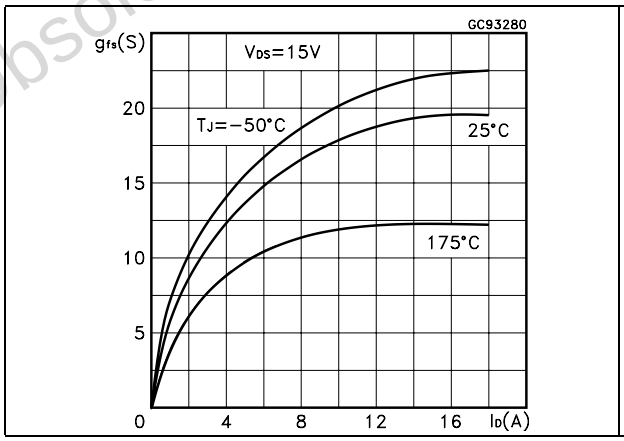



**Figure 6. Static drain-source on resistance**

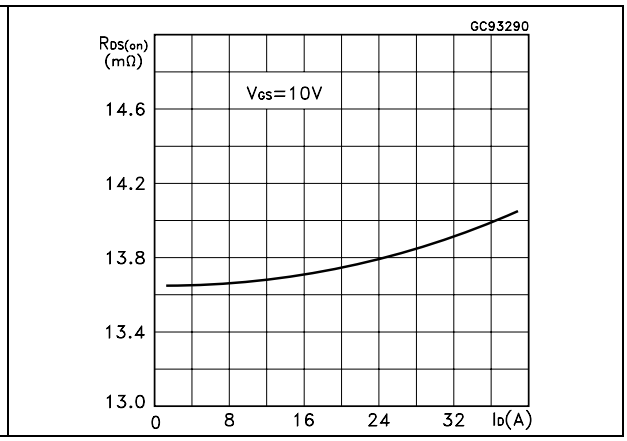


**Figure 7. Gate charge vs. gate-source voltage**

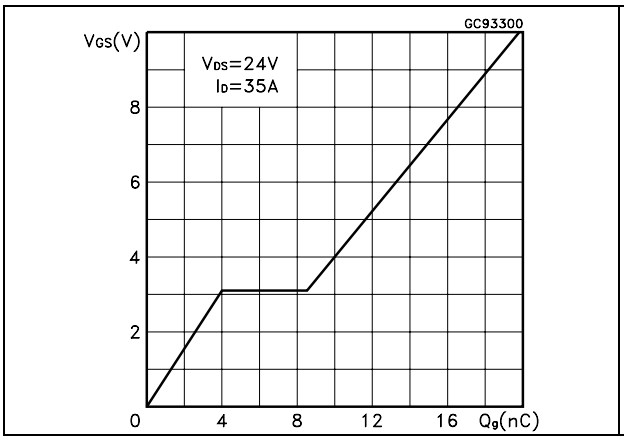



**Figure 8. Capacitance variations**

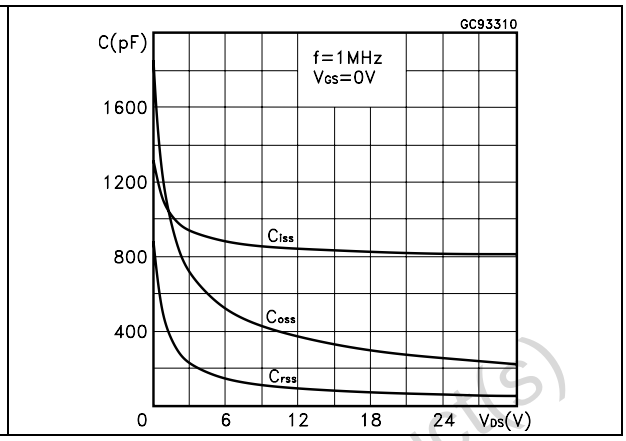



**Figure 9. Normalized gate threshold voltage vs. temperature**

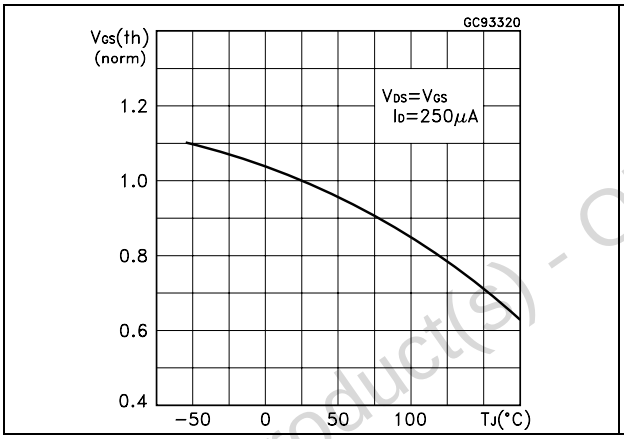



**Figure 10. Normalized on resistance vs. temperature**

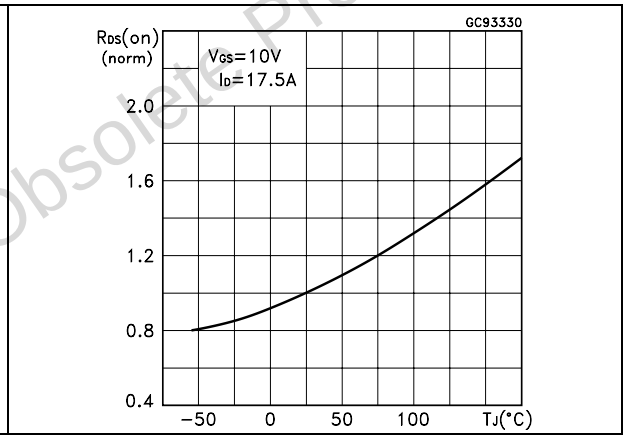
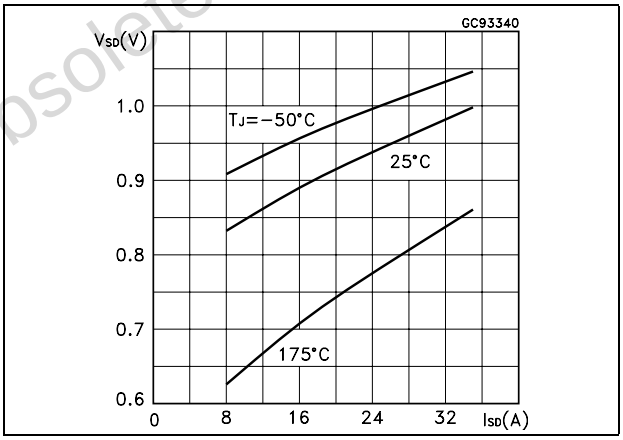



**Figure 11. Source-drain diode forward characteristics**



# 3 Test circuit

**Figure 12. Switching times test circuit for resistive load**

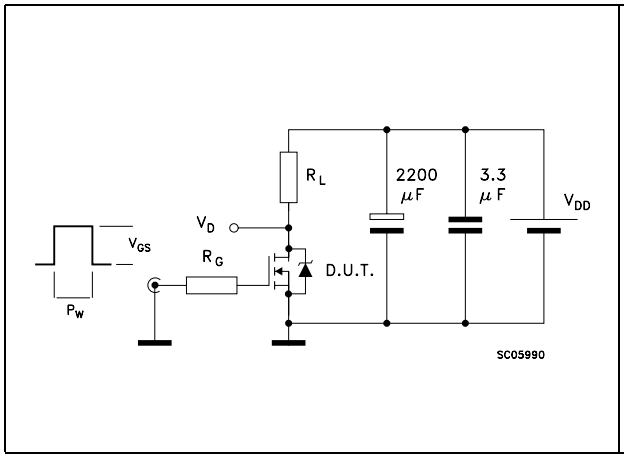



**Figure 13. Gate charge test circuit**

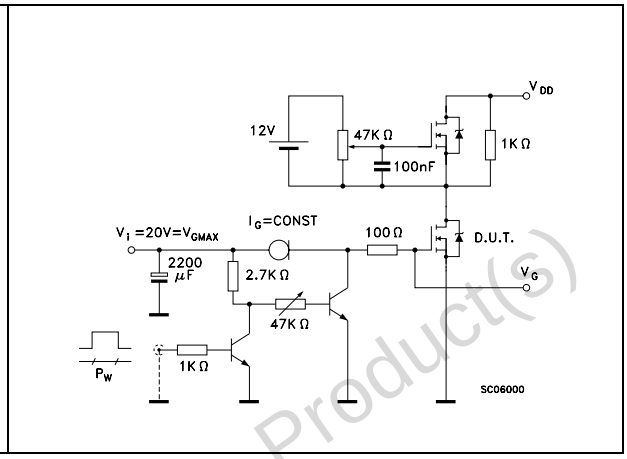



**Figure 14. Test circuit for inductive load switching and diode recovery times**

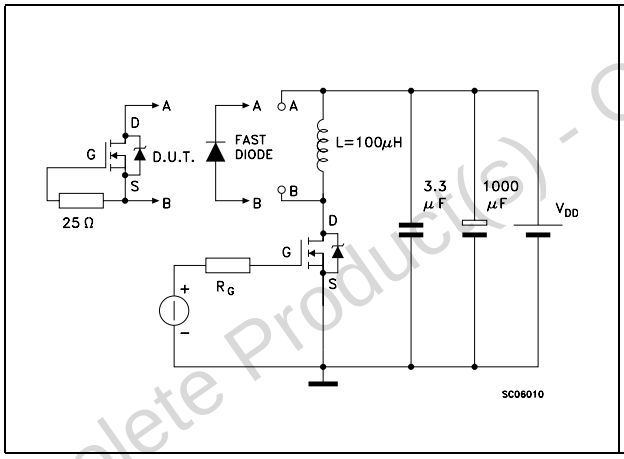



**Figure 15. Unclamped Inductive load test circuit**

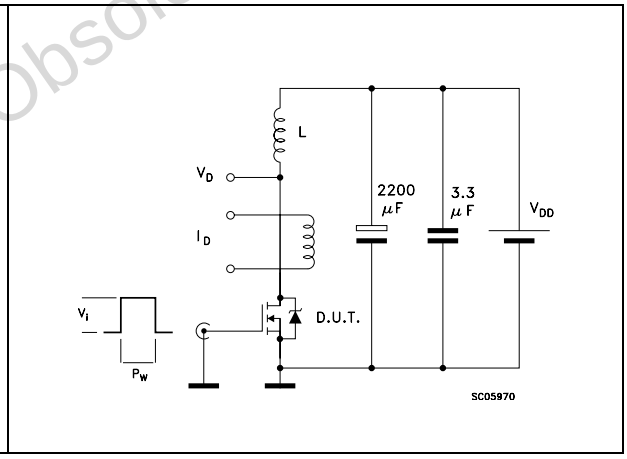



**Figure 16. Unclamped inductive waveform**

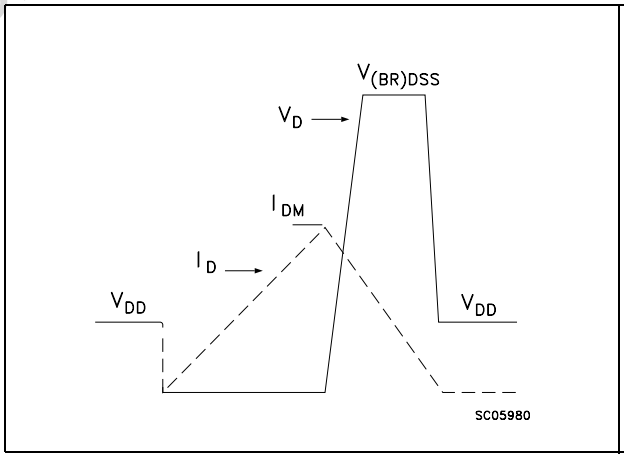
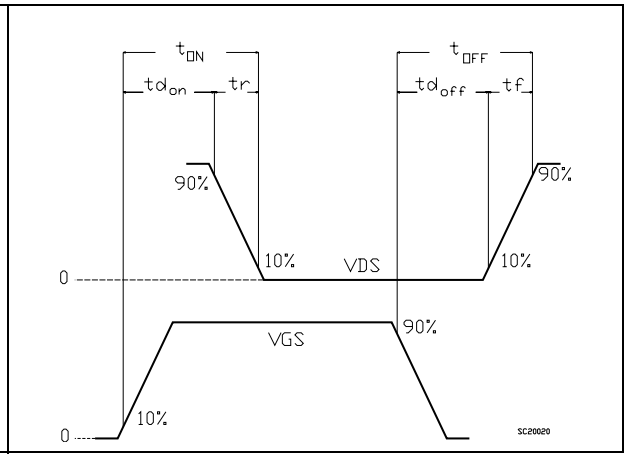



**Figure 17. Switching time waveform**

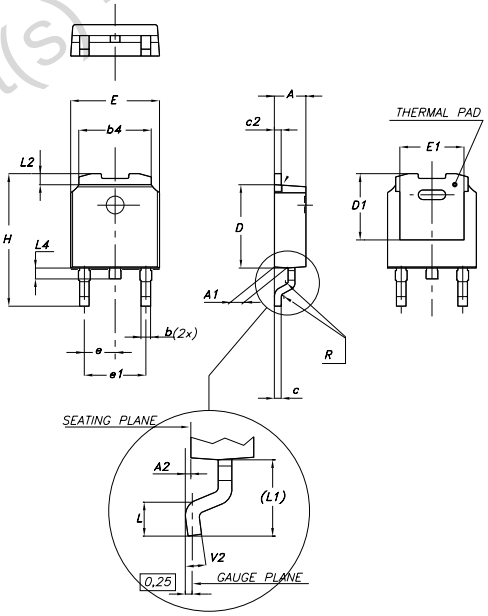


# 4 Package mechanical data

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*

## 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° |

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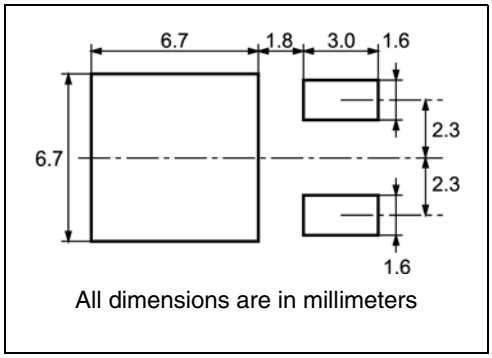
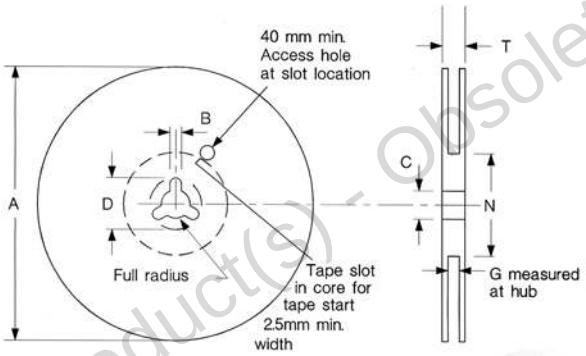
# 5 Packing mechanical data

### DPAK FOOTPRINT




All dimensions are in millimeters

### TAPE AND REEL SHIPMENT



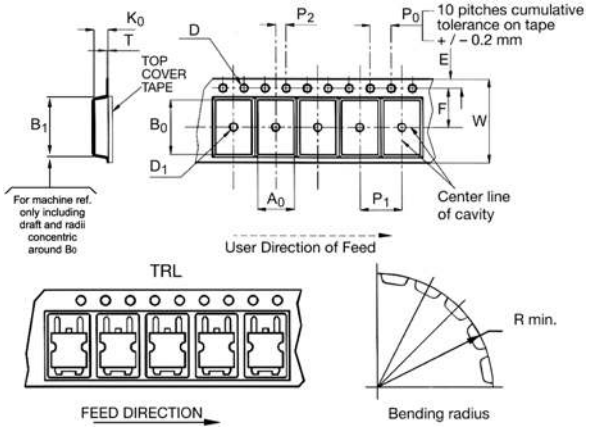

REEL MECHANICAL DATA

| 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 | 16.4 | 18.4 | 0.645 | 0.724 |
| N | 50 | | 1.968 | |
| T | | 22.4 | | 0.881 |

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

TAPE MECHANICAL DATA

| 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 6. Revision history

| Date | Revision | Changes |
|---|---|---|
| 21-Jun-2004 | 2 | Preliminary version |
| 06-Jul-2006 | 3 | New template, no content change |
| 14-sep-2006 | 4 | Removed IPAK |
| 20-Feb-2007 | 5 | Typo mistake on page 1 |