



## STD65N55LF3

N-channel 55 V, 7.0 m $\Omega$ , 80 A DPAK  
STripFET™ III Power MOSFET

### Features

| Order code  | V <sub>DSS</sub> | R <sub>DS(on)</sub><br>max. | I <sub>D</sub> | P <sub>w</sub> |
|-------------|------------------|-----------------------------|----------------|----------------|
| STD65N55LF3 | 55 V             | < 8.5 m $\Omega$            | 80 A           | 110 W          |

- Low threshold drive
- 100% avalanche tested

### Application

- Switching applications
- Automotive

### Description

This product is a N-channel enhancement mode Power MOSFET built with STripFET™ III technology which is especially tailored to minimized on-state resistance and gate charge, providing superior switching performance.

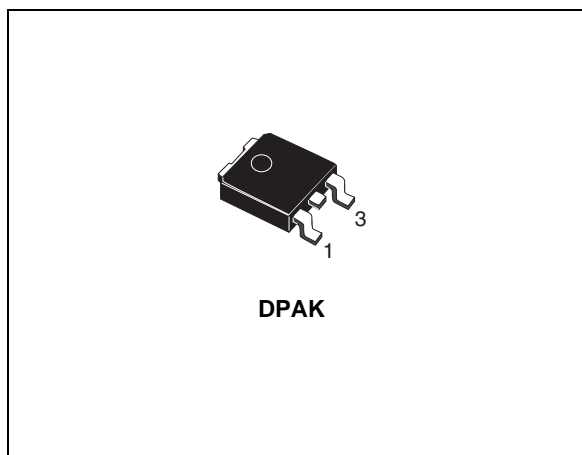


Figure 1. Internal schematic diagram

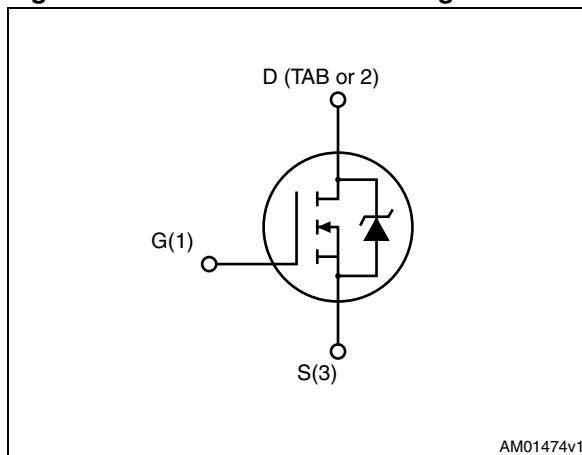


Table 1. Device summary

| Order code  | Marking  | Package | Packaging     |
|-------------|----------|---------|---------------|
| STD65N55LF3 | 65N55LF3 | DPAK    | Tape and reel |

# Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol             | Parameter   | Value      | Unit                |
|--------------------|---|------------|---------------------|
| $V_{DS}$           | Drain-source voltage ( $V_{GS}=0$ )                             | 55         | V                   |
| $V_{GS}$           | Gate-Source voltage   | $\pm 20$   | V                   |
| $I_D$              | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$  | 80         | A                   |
| $I_D$              | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$ | 56         | A                   |
| $I_{DM}^{(1)}$     | Drain current (pulsed)  | 320        | A                   |
| $P_{TOT}$          | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$           | 110        | W                   |
|                    | Derating factor   | 0.73       | W/ $^\circ\text{C}$ |
| $dv/dt^{(2)}$      | Peak diode recovery voltage slope                               | 11         | V/ns                |
| $E_{AS}^{(3)}$     | Single pulse avalanche energy                                   | 300        | mJ                  |
| $T_j$<br>$T_{stg}$ | Operating junction temperature<br>Storage temperature           | -55 to 175 | $^\circ\text{C}$    |

1. Pulse width limited by safe operating area
2.  $I_{SD} \leq 65\text{ A}$ ,  $di/dt \leq 300\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_j \leq T_{jmax}$
3. Starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_D = 10\text{ A}$ ,  $V_{DD} = 25\text{ V}$

**Table 3. Thermal resistance**

| Symbol              | Parameter                            | Value | Unit                      |
|---------------------|--------------------------------------|-------|---------------------------|
| $R_{thj-case}$      | Thermal resistance junction-case max | 1.36  | $^\circ\text{C}/\text{W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb max  | 50    | $^\circ\text{C}/\text{W}$ |

1. When mounted on FR-4 board of 1inch<sup>2</sup>, 2oz Cu.

## 2 Electrical characteristics

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

**Table 4. Static**

| Symbol        | Parameter  | Test conditions  | Min. | Typ. | Max.      | Unit                           |
|---------------|--|--|------|------|-----------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown Voltage                   | $I_D = 250\ \mu\text{A}$ , $V_{GS} = 0$  | 55   |      |           | V                              |
| $I_{DSS}$     | Zero gate voltage drain current ( $V_{GS} = 0$ ) | $V_{DS} = \text{Max rating}$ ,<br>$V_{DS} = \text{Max rating}$ , $T_c = 125\text{ °C}$ |      |      | 10<br>100 | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{GSS}$     | Gate body leakage current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 20\text{ V}$   |      |      | $\pm 200$ | nA                             |
| $V_{GS(th)}$  | Gate threshold voltage                           | $V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$   | 1    |      | 2.5       | V                              |
| $R_{DS(on)}$  | Static drain-source on resistance                | $V_{GS} = 10\text{ V}$ , $I_D = 32\text{ A}$   |      | 7.0  | 8.5       | m $\Omega$                     |
|               |  | $V_{GS} = 5\text{ V}$ , $I_D = 32\text{ A}$  |      | 8.5  | 12        | m $\Omega$                     |

**Table 5. Dynamic**

| Symbol    | Parameter                    | Test conditions   | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|---|------|------|------|------|
| $C_{iss}$ | Input capacitance            | $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ ,<br>$V_{GS} = 0$   |      | 2200 |      | pF   |
| $C_{oss}$ | Output capacitance           |   | -    | 470  | -    | pF   |
| $C_{rss}$ | Reverse transfer capacitance |   |      |      | 35   |      |
| $Q_g$     | Total gate charge            | $V_{DD} = 27.5\text{ V}$ , $I_D = 65\text{ A}$<br>$V_{GS} = 5\text{ V}$<br>(see <a href="#">Figure 16</a> ) |      | 20   |      | nC   |
| $Q_{gs}$  | Gate-source charge           |   | -    | 8    | -    | nC   |
| $Q_{gd}$  | Gate-drain charge            |   |      |      | 8    |      |

**Table 6. Switching on/off (inductive load)**

| Symbol       | Parameter           | Test conditions  | Min. | Typ. | Max. | Unit |
|--------------|---------------------|--|------|------|------|------|
| $t_{d(on)}$  | Turn-on delay time  | $V_{DD}=27\text{ V}$ , $I_D=32\text{ A}$ ,<br>$R_G=4.7\ \Omega$ , $V_{GS}=10\text{ V}$<br>(see <a href="#">Figure 15</a> ) | -    | 10   | -    | ns   |
| $t_r$        | Rise time           |  | -    | 25   | -    | ns   |
| $t_{d(off)}$ | Turn-off delay time |  | -    | 50   | -    | ns   |
| $t_f$        | Fall time           |  | -    | 10   | -    | ns   |

**Table 7. Source drain diode**

| Symbol    | Parameter                                    | Test conditions  | Min. | Typ. | Max. | Unit |
|-----------|--|--|------|------|------|------|
| $I_{SD}$  | Source-drain current                         |  | -    |      | 80   | A    |
| $I_{SDM}$ | Source-drain current (pulsed) <sup>(1)</sup> |  | -    |      | 320  | A    |
| $V_{SD}$  | Forward on voltage                           | $I_{SD}=65\text{ A}$ , $V_{GS}=0$  | -    |      | 1.5  | V    |
| $t_{rr}$  | Reverse recovery time                        | $I_{SD}=65\text{ A}$ ,<br>$di/dt=100\text{ A}/\mu\text{s}$ ,<br>$V_{DD}=30\text{ V}$ , $T_j=150\text{ }^\circ\text{C}$<br>(see <a href="#">Figure 17</a> ) | -    | 40   |      | ns   |
| $Q_{rr}$  | Reverse recovery charge                      |  | -    | 60   |      | nC   |
| $I_{RRM}$ | Reverse recovery current                     |  | -    | 3    |      | A    |

1. Pulsed: pulse duration = 300 $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

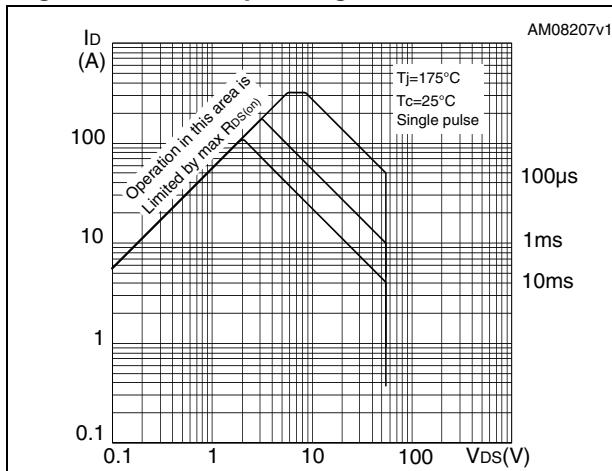


Figure 3. Thermal impedance

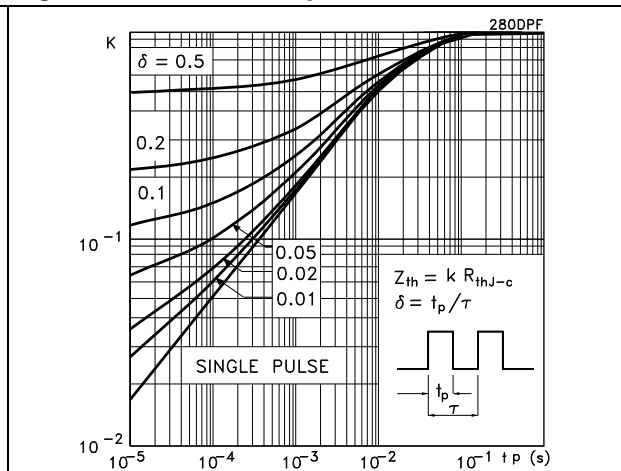


Figure 4. Output characteristics

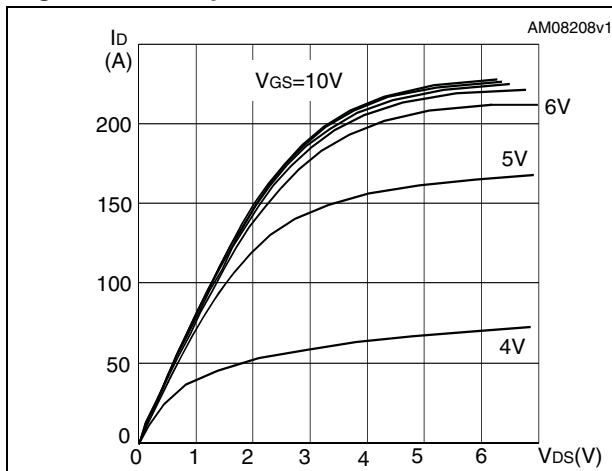


Figure 5. Transfer characteristics

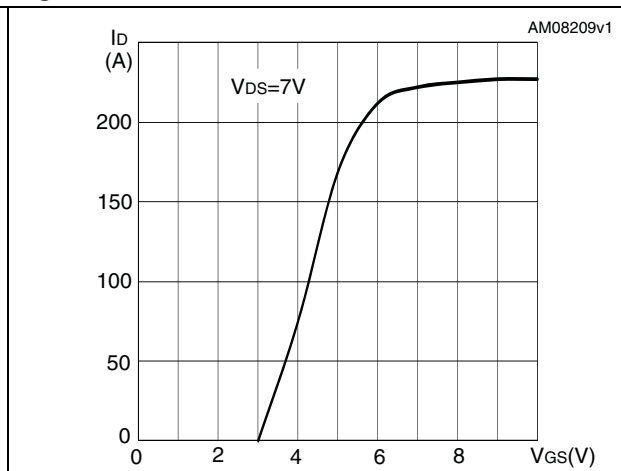


Figure 6. Normalized  $B_{V_{DSS}}$  vs temperature

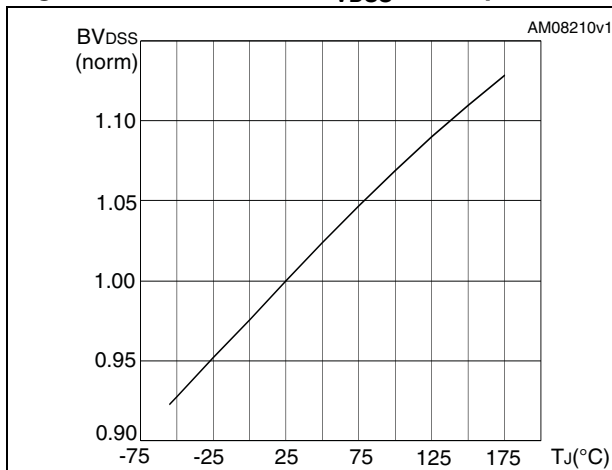


Figure 7. Static drain-source on resistance

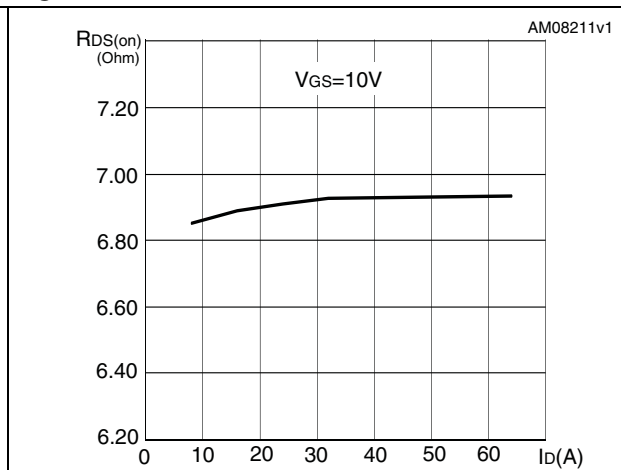


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

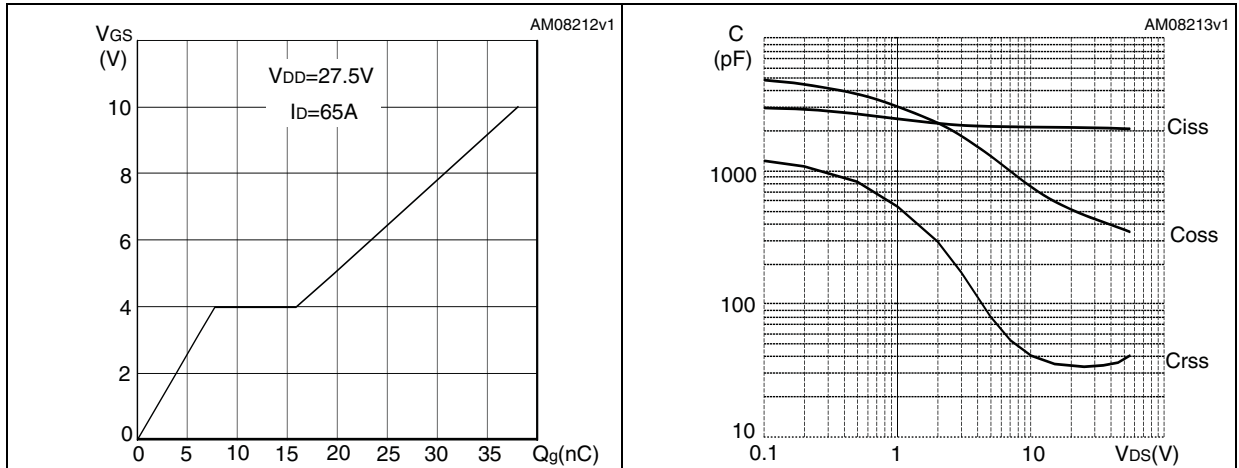


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

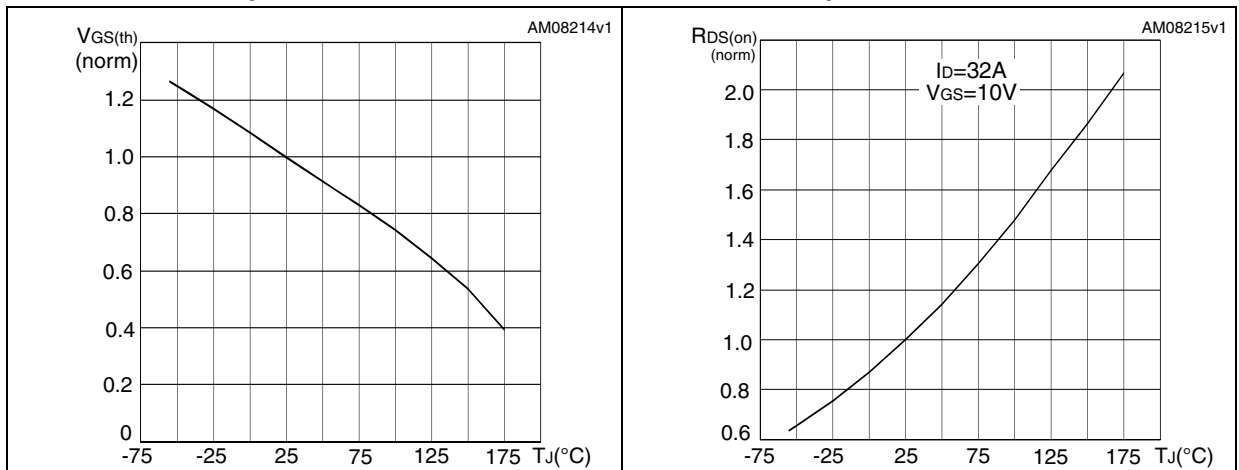
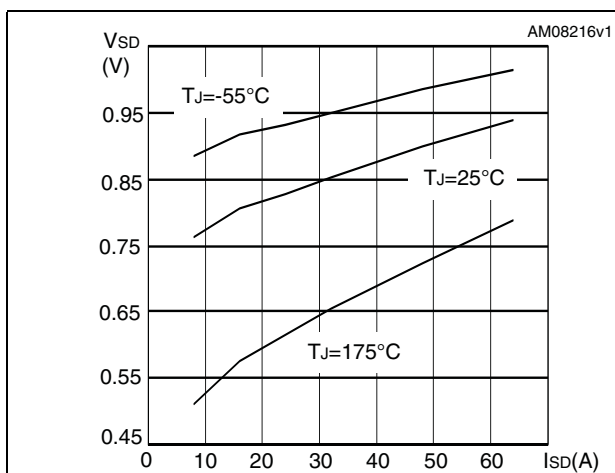


Figure 12. Source-drain diode forward characteristics

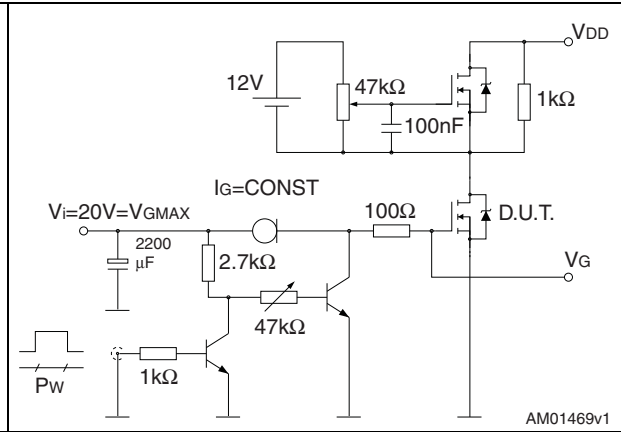


### 3 Test circuits

**Figure 13. Switching times test circuit for resistive load**



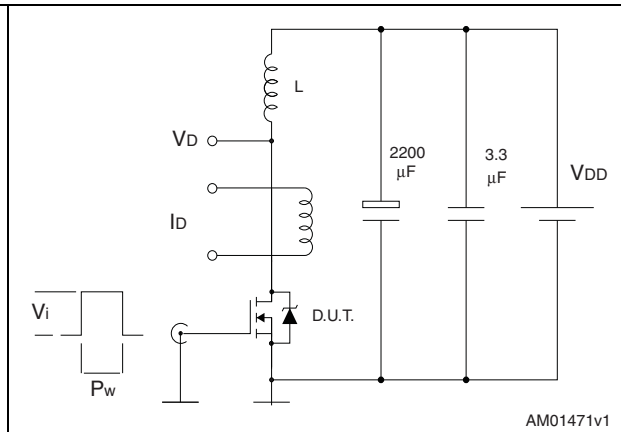
**Figure 14. Gate charge test circuit**



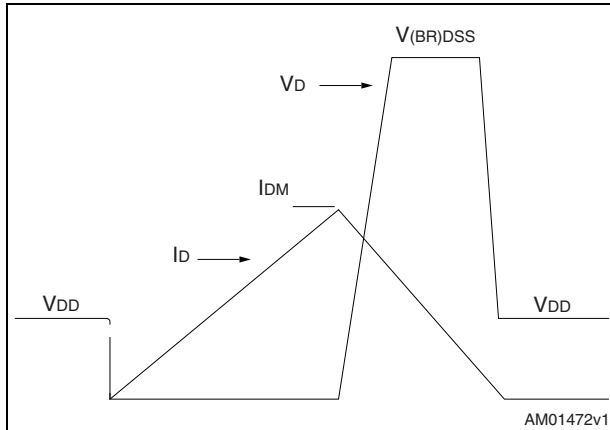
**Figure 15. Test circuit for inductive load switching and diode recovery times**



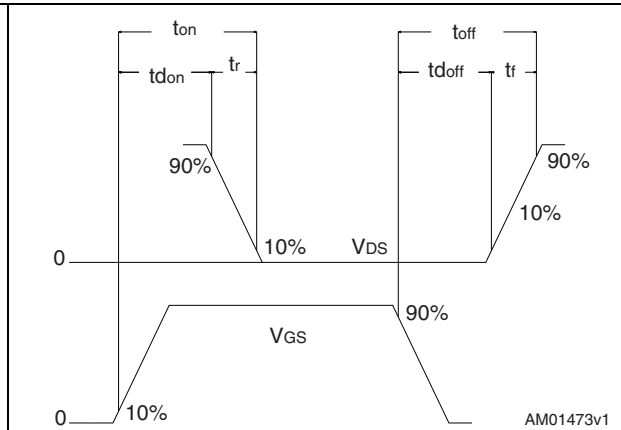
**Figure 16. Unclamped inductive load test circuit**



**Figure 17. Unclamped inductive waveform**



**Figure 18. Switching time waveform**



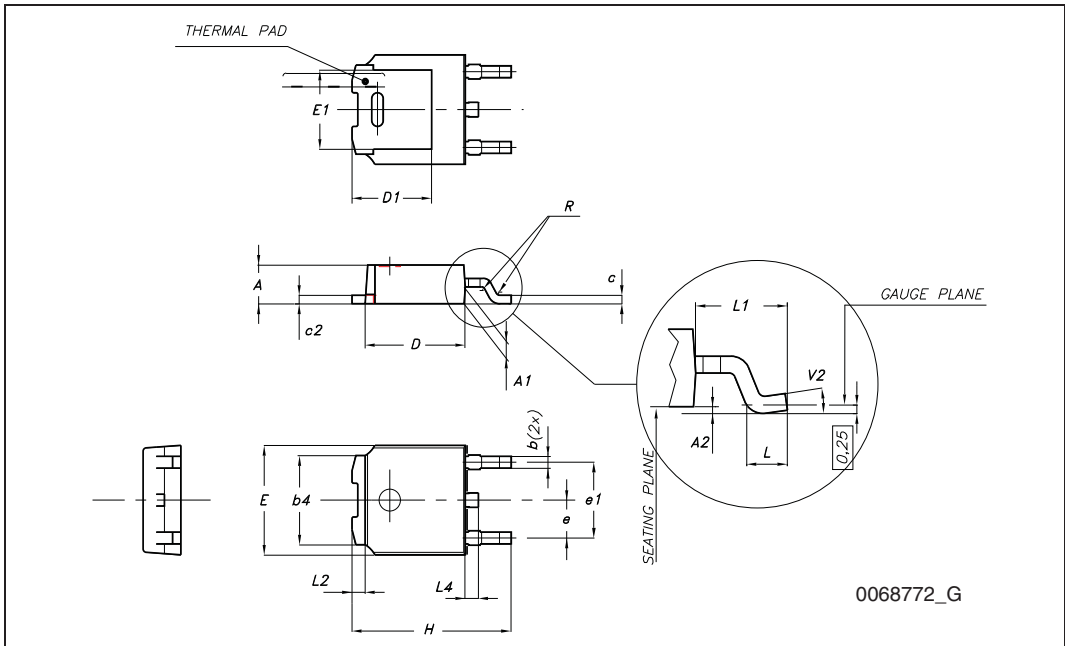


## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

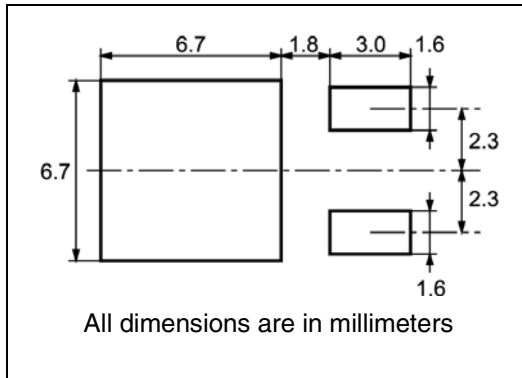
TO-252 (DPAK) mechanical data

| DIM. | mm.  |      |       |
|------|------|------|-------|
|      | min. | typ  | max.  |
| A    | 2.20 |      | 2.40  |
| A1   | 0.90 |      | 1.10  |
| A2   | 0.03 |      | 0.23  |
| b    | 0.64 |      | 0.90  |
| b4   | 5.20 |      | 5.40  |
| c    | 0.45 |      | 0.60  |
| c2   | 0.48 |      | 0.60  |
| D    | 6.00 |      | 6.20  |
| D1   |      | 5.10 |       |
| E    | 6.40 |      | 6.60  |
| E1   |      | 4.70 |       |
| e    |      | 2.28 |       |
| e1   | 4.40 |      | 4.60  |
| H    | 9.35 |      | 10.10 |
| L    | 1    |      |       |
| L1   |      | 2.80 |       |
| L2   |      | 0.80 |       |
| L4   | 0.60 |      | 1     |
| R    |      | 0.20 |       |
| V2   | 0°   |      | 8°    |



# 5 Packaging mechanical data

## DPAK FOOTPRINT



## TAPE AND REEL SHIPMENT

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start 2.5mm min. width

G measured at hub

| 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 |

10 pitches cumulative tolerance on tape +/- 0.2 mm

Center line of cavity

User Direction of Feed

For machine ref. only including draft and radii concentric around B0

TRL

FEED DIRECTION

Bending radius R min.

## 6 Revision history

**Table 8. Revision history**

| Date        | Revision | Changes  |
|-------------|----------|--|
| 20-Oct-2009 | 1        | First release.   |
| 12-Oct-2010 | 2        | Document status promoted from preliminary data to datasheet. |

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