

Automotive-grade N-channel 40 V, 7 mΩ typ., 54 A STripFET™ F6 Power MOSFET in a DPAK package

Datasheet - production data

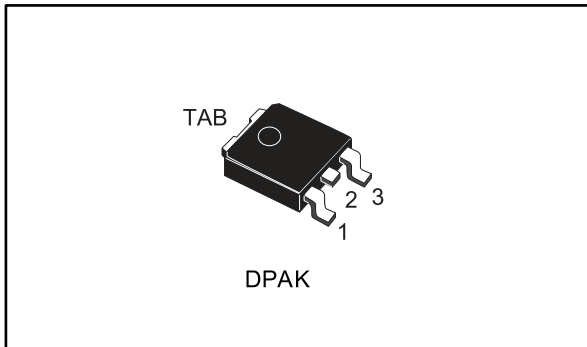
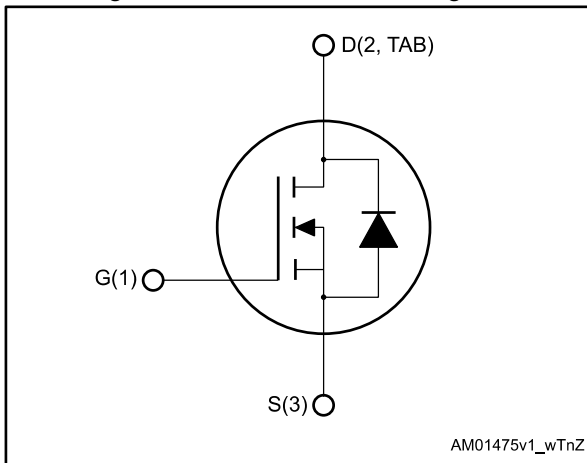


Figure 1: Internal schematic diagram



Features

| Order code | V _{DS} | R _{DS(on)} max. | I _D | P _{TOT} |
|-------------|-----------------|--------------------------|----------------|------------------|
| STD64N4F6AG | 40 V | 8.2 mΩ | 54 A | 60 W |

- Designed for automotive applications and AEC-Q101 qualified
- Very low on-resistance
- Very low gate charge
- High avalanche ruggedness
- Low gate drive power loss

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET developed using the STripFET™ F6 technology with a new trench gate structure. The resulting Power MOSFET exhibits very low R_{DS(on)} in all packages.

Table 1: Device summary

| Order code | Marking | Package | Packing |
|-------------|---------|---------|---------------|
| STD64N4F6AG | 64N4F6 | DPAK | Tape and reel |

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1 Electrical ratings

Table 2: Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|----------------|---|------------|------|
| V_{DS} | Drain-source voltage | 40 | V |
| V_{GS} | Gate-source voltage | ± 20 | V |
| I_D | Drain current (continuous) at $T_{case} = 25\text{ °C}^{(1)}$ | 54 | A |
| | Drain current (continuous) at $T_{case} = 100\text{ °C}$ | 46 | |
| $I_{DM}^{(2)}$ | Drain current (pulsed) | 216 | A |
| P_{TOT} | Total dissipation at $T_{case} = 25\text{ °C}$ | 60 | W |
| T_{stg} | Storage temperature | -55 to 175 | °C |
| T_j | Operating junction temperature | | |

Notes:

⁽¹⁾ Current is limited by package.

⁽²⁾ Pulse width is limited by safe operating area.

Table 3: Thermal data

| Symbol | Parameter | Value | Unit |
|---------------------|----------------------------------|-------|------|
| $R_{thj-case}$ | Thermal resistance junction-case | 2.5 | °C/W |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb | 35 | |

Notes:

⁽¹⁾ When mounted on a 1-inch² FR-4, 2 Oz copper board.

Table 4: Avalanche characteristics

| Symbol | Parameter | Value | Unit |
|----------------|---|-------|------|
| $I_{AS}^{(1)}$ | Avalanche current, repetitive or not repetitive | 54 | A |
| $E_{AS}^{(2)}$ | Single pulse avalanche energy | 180 | mJ |

Notes:

⁽¹⁾ Pulse width limited by T_{jmax} .

⁽²⁾ starting $T_j = 25\text{ °C}$, $I_D = I_{AS}$, $V_{DD} = 25\text{ V}$.

2 Electrical characteristics

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

Table 5: Static

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|-----------------------------------|---|------|------|-----------|---------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$ | 40 | | | V |
| I_{DSS} | Zero gate voltage drain current | $V_{GS} = 0\text{ V}$, $V_{DS} = 40\text{ V}$ | | | 1 | μA |
| | | $V_{GS} = 0\text{ V}$, $V_{DS} = 40\text{ V}$, $T_{\text{case}} = 125\text{ °C}$ | | | 10 | |
| I_{GSS} | Gate-body leakage current | $V_{DS} = 0\text{ V}$, $V_{GS} = \pm 20\text{ V}$ | | | ± 100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$ | 2 | | 4.5 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS} = 10\text{ V}$, $I_D = 27\text{ A}$ | | 7 | 8.2 | m Ω |

Table 6: Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|--|------|------|------|---------------|
| C_{iss} | Input capacitance | $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$ | - | 2415 | - | μF |
| C_{oss} | Output capacitance | | - | 232 | - | |
| C_{rss} | Reverse transfer capacitance | | - | 170 | - | |
| Q_g | Total gate charge | $V_{DD} = 20\text{ V}$, $I_D = 54\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 14 : "Gate charge test circuit") | - | 44 | - | nC |
| Q_{gs} | Gate-source charge | | - | 15 | - | |
| Q_{gd} | Gate-drain charge | | - | 12 | - | |

Table 7: Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|---------------------|--|------|------|------|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 20\text{ V}$, $I_D = 27\text{ A}$ $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 13 : "Switching times test circuit for resistive load" and Figure 18 : "Switching time waveform") | - | 21.2 | - | ns |
| t_r | Rise time | | - | 113 | - | |
| $t_{d(off)}$ | Turn-off delay time | | - | 40.4 | - | |
| t_f | Fall time | | - | 25.2 | - | |

Table 8: Source-drain diode

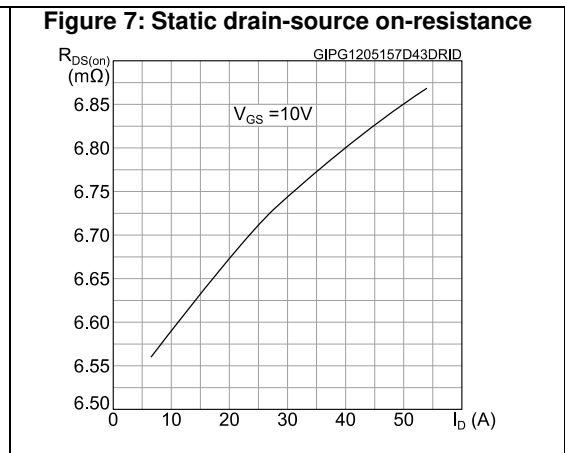
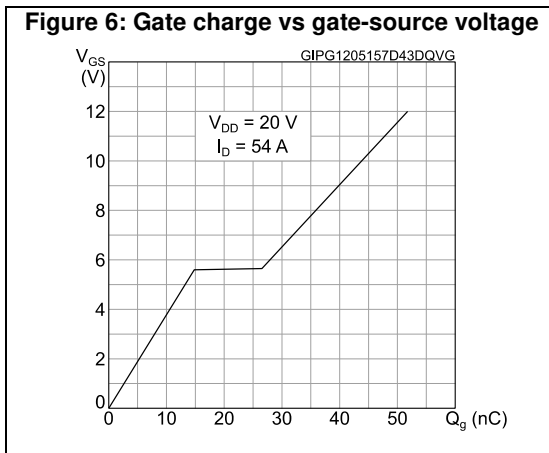
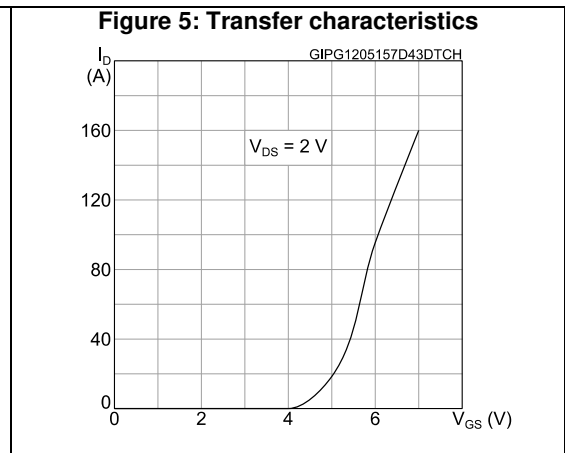
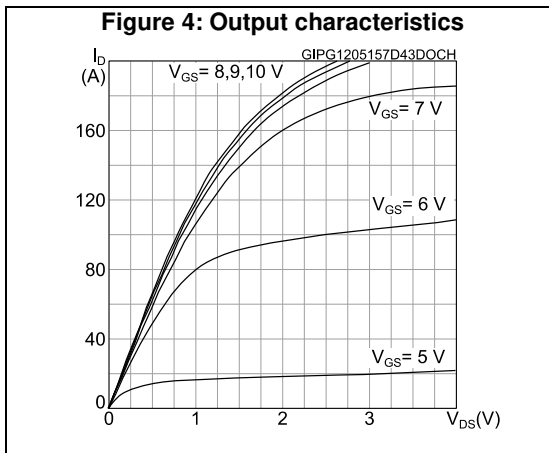
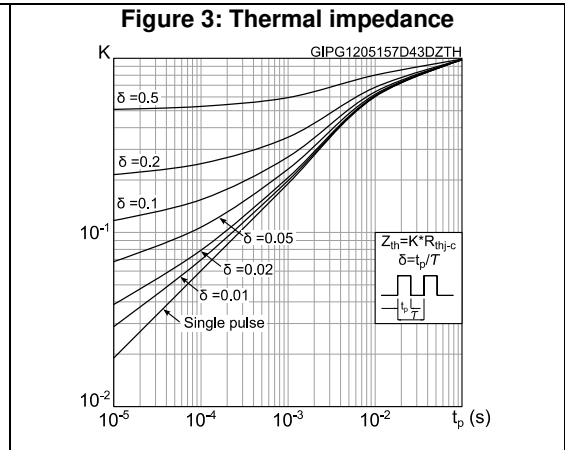
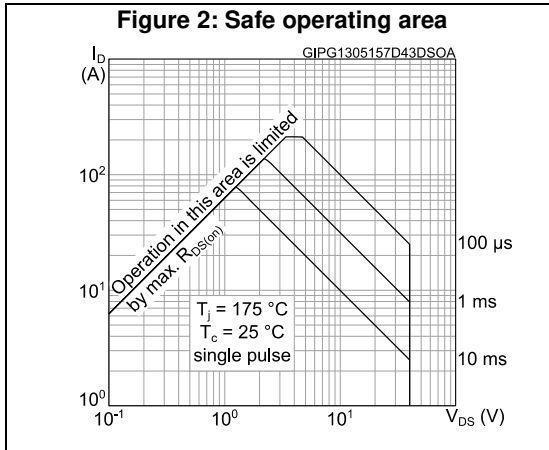
| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|---|------|------|------|------|
| I_{SD} | Source-drain current | | - | | 54 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | - | | 216 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $V_{GS} = 0\text{ V}$, $I_{SD} = 27\text{ A}$ | - | | 1.3 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 54\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 32\text{ V}$ (see Figure 15 : "Test circuit for inductive load switching and diode recovery times") | - | 29.4 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 31.3 | | nC |
| I_{RRM} | Reverse recovery current | | - | 2.1 | | A |

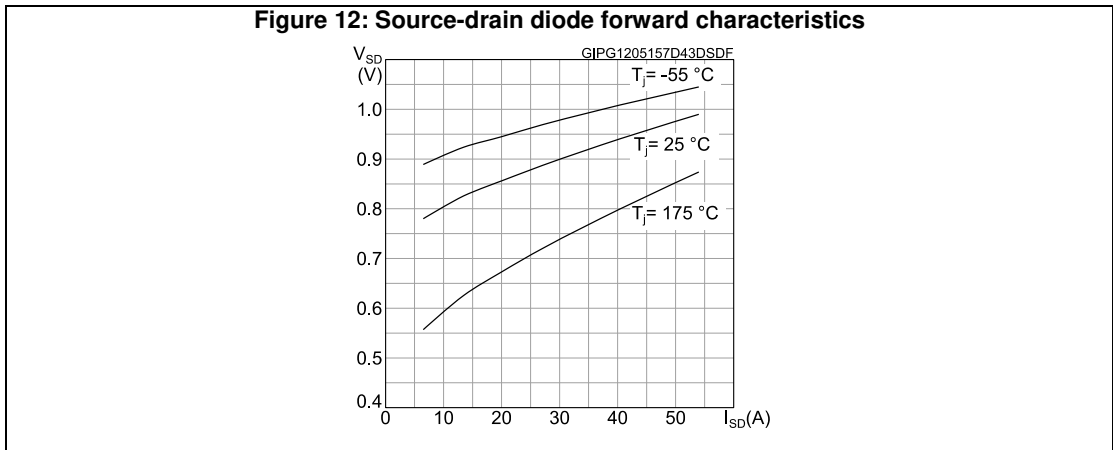
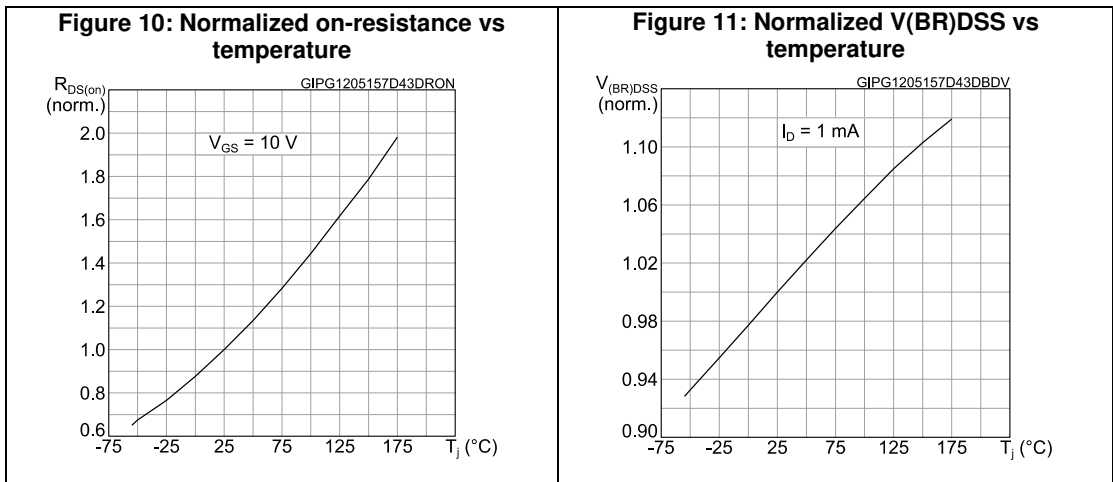
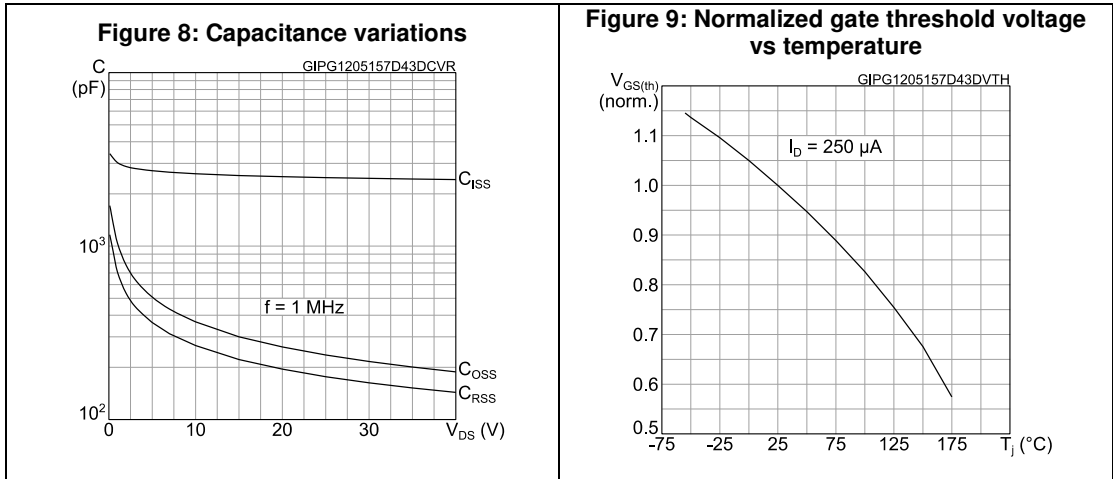
Notes:

(1) Pulse width is limited by safe operating area.

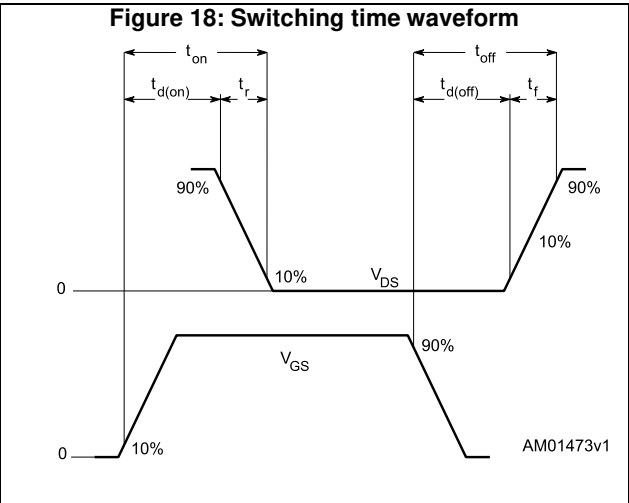
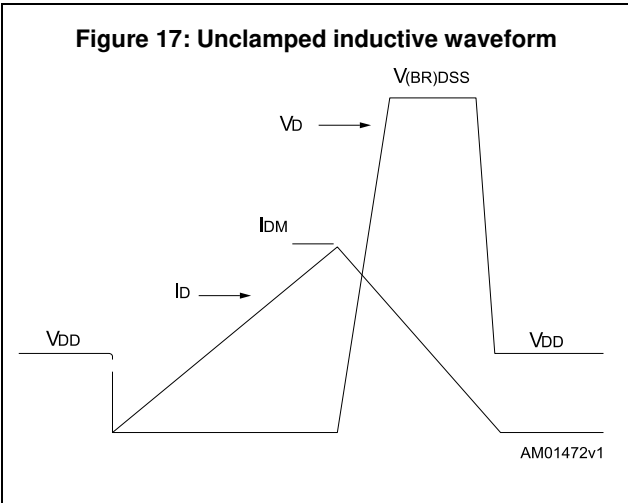
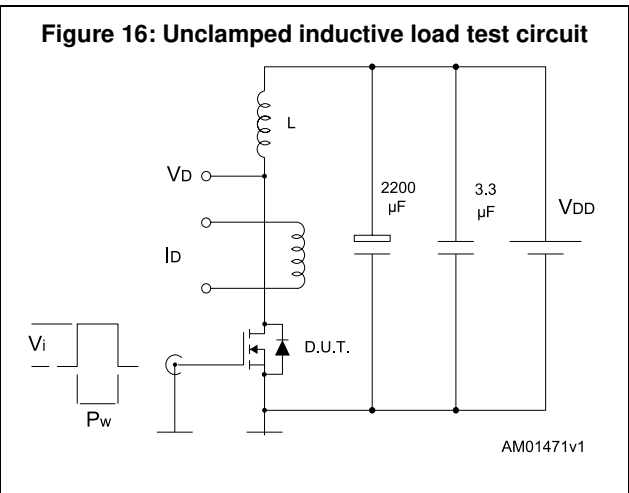
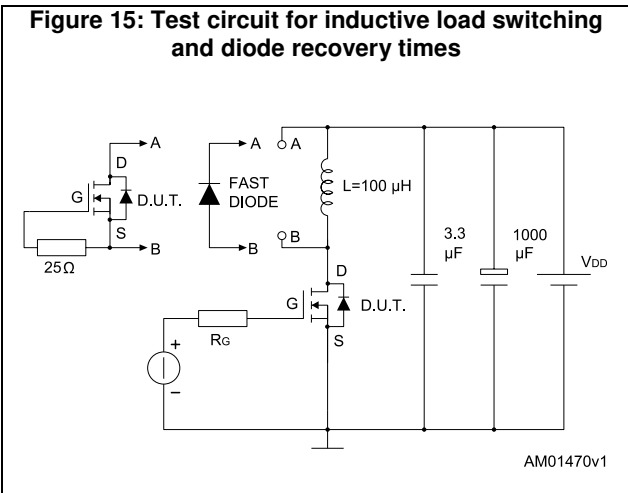
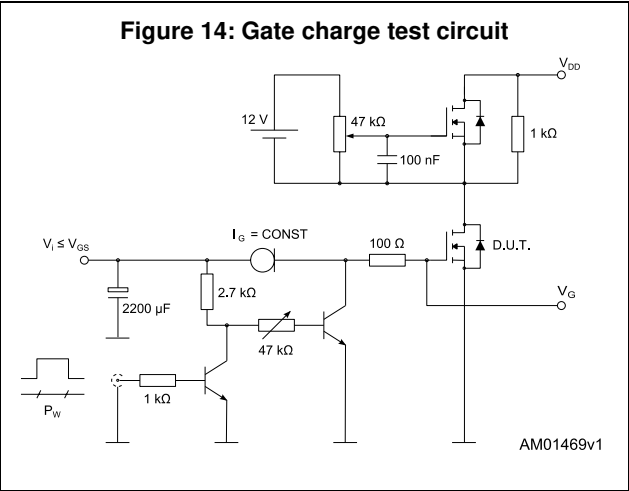
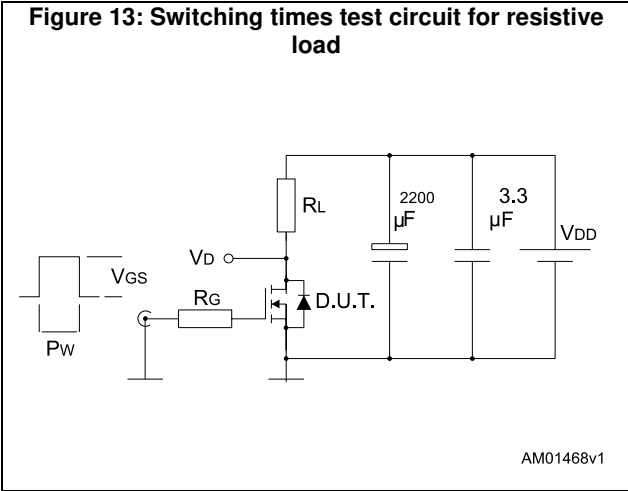
(2) Pulse test: pulse duration = 300 μs , duty cycle 1.5%.

2.1 Electrical characteristics (curves)





3 Test circuits



4 Package information

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

4.1 DPAK (TO-252) type A package information

Figure 19: DPAK (TO-252) type A package outline

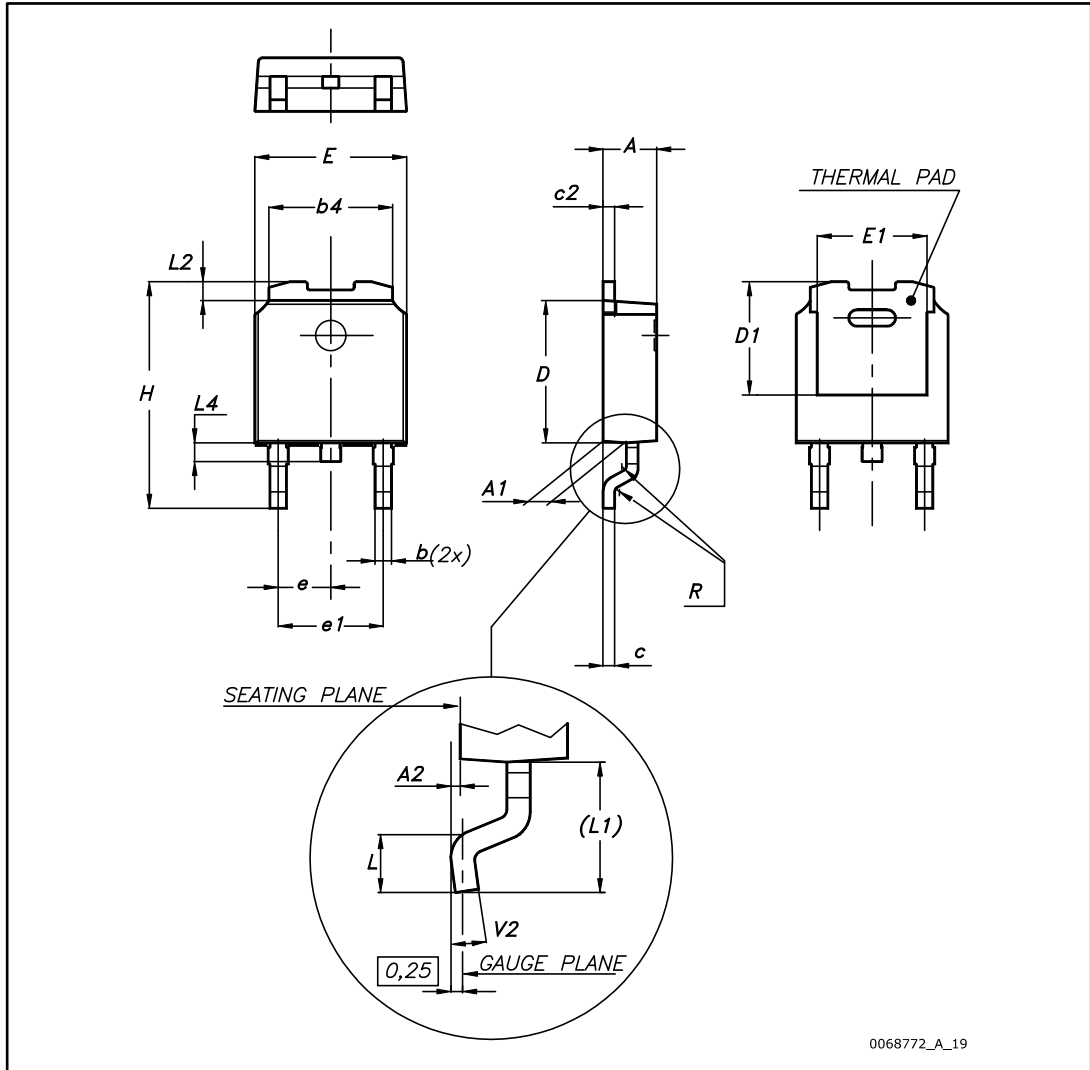
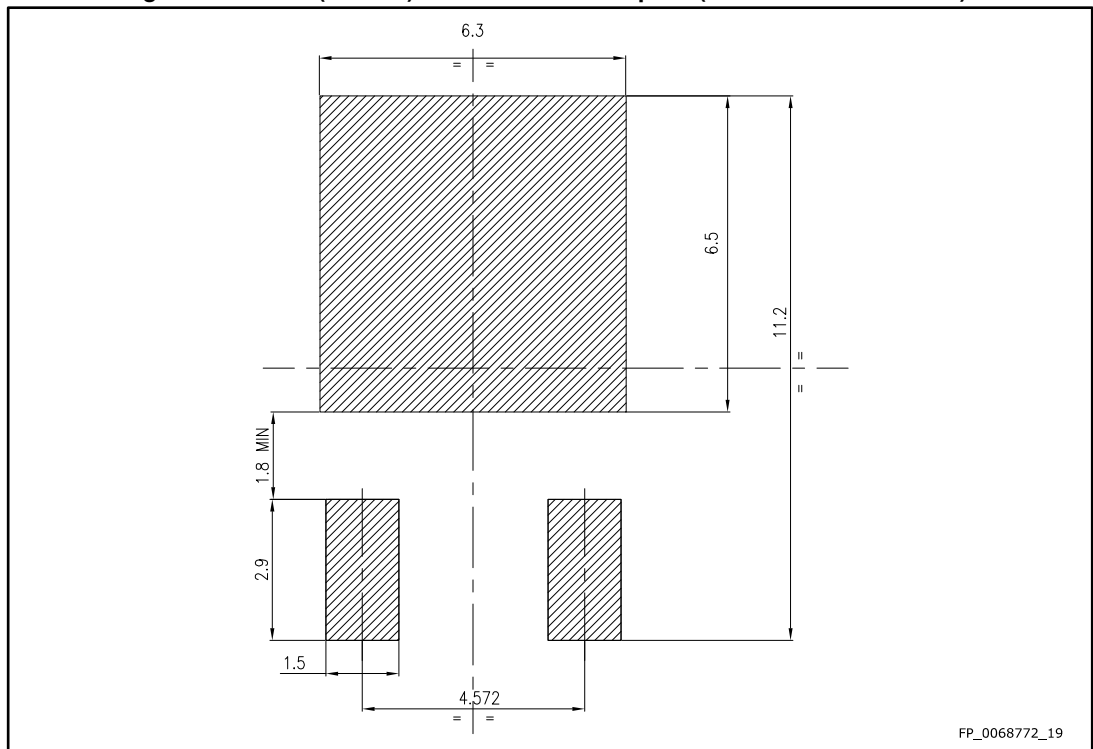


Table 9: DPAK (TO-252) type A mechanical data

| 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 | 4.95 | 5.10 | 5.25 |
| E | 6.40 | | 6.60 |
| E1 | 4.60 | 4.70 | 4.80 |
| e | 2.16 | 2.28 | 2.40 |
| e1 | 4.40 | | 4.60 |
| H | 9.35 | | 10.10 |
| L | 1.00 | | 1.50 |
| (L1) | 2.60 | 2.80 | 3.00 |
| L2 | 0.65 | 0.80 | 0.95 |
| L4 | 0.60 | | 1.00 |
| R | | 0.20 | |
| V2 | 0° | | 8° |

Figure 20: DPAK (TO-252) recommended footprint (dimensions are in mm)



4.2 DPAK (TO-252) packing information

Figure 21: DPAK (TO-252) tape outline

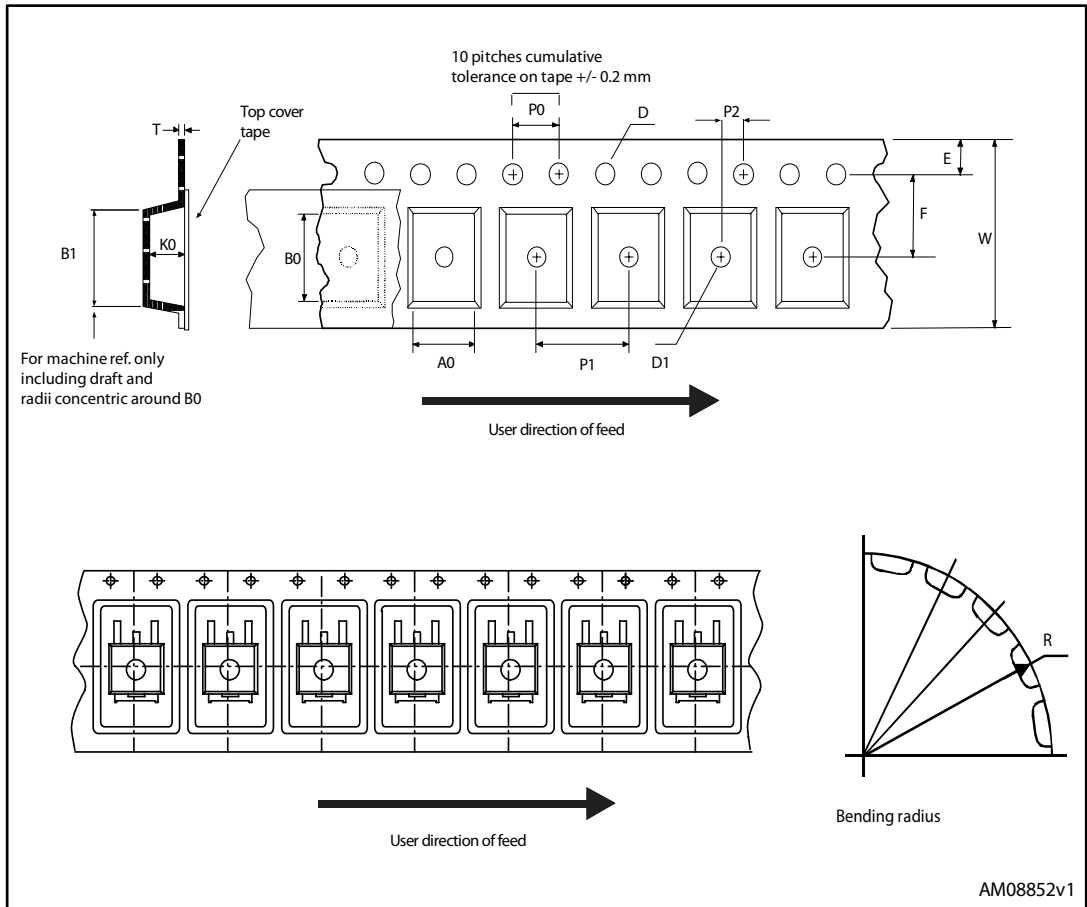
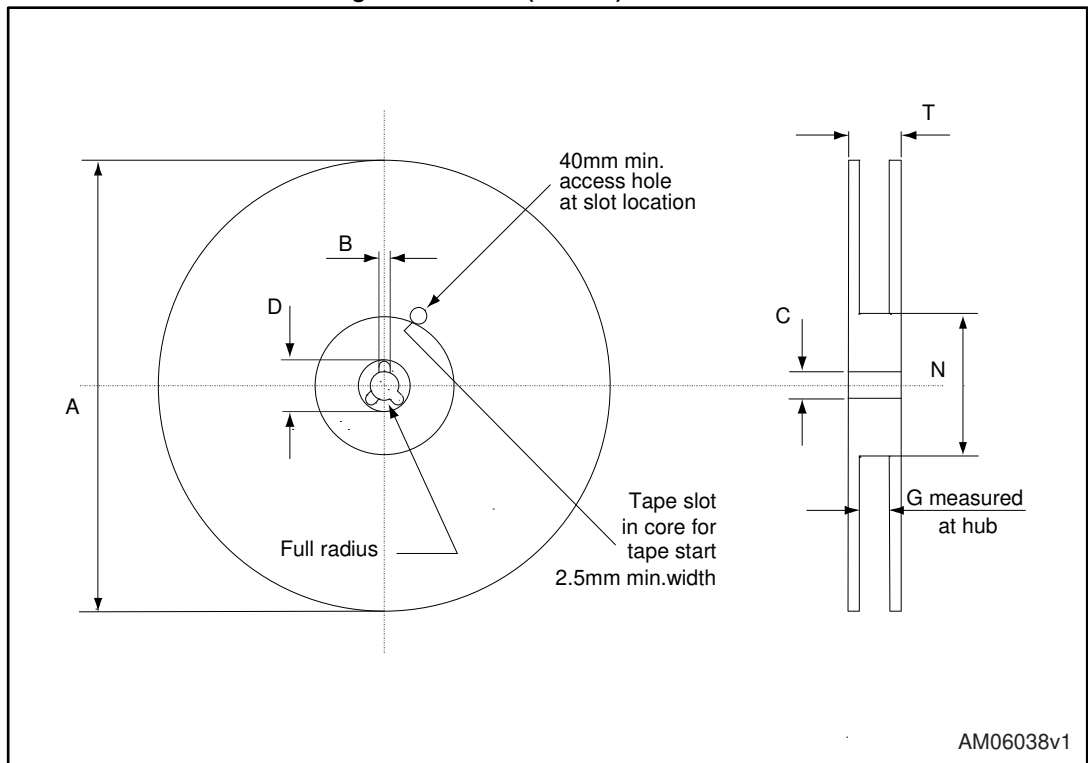


Figure 22: DPAK (TO-252) reel outline



AM06038v1

Table 10: DPAK (TO-252) tape and reel mechanical data

| Tape | | | Reel | | |
|------|------|------|-----------|------|------|
| Dim. | mm | | Dim. | mm | |
| | Min. | Max. | | Min. | Max. |
| A0 | 6.8 | 7 | A | | 330 |
| B0 | 10.4 | 10.6 | B | 1.5 | |
| B1 | | 12.1 | C | 12.8 | 13.2 |
| D | 1.5 | 1.6 | D | 20.2 | |
| D1 | 1.5 | | G | 16.4 | 18.4 |
| E | 1.65 | 1.85 | N | 50 | |
| F | 7.4 | 7.6 | T | | 22.4 |
| K0 | 2.55 | 2.75 | | | |
| P0 | 3.9 | 4.1 | Base qty. | | 2500 |
| P1 | 7.9 | 8.1 | Bulk qty. | | 2500 |
| P2 | 1.9 | 2.1 | | | |
| R | 40 | | | | |
| T | 0.25 | 0.35 | | | |
| W | 15.7 | 16.3 | | | |

5 Revision history

Table 11: Document revision history

| Date | Revision | Changes |
|-------------|----------|----------------|
| 10-Jun-2015 | 1 | First release. |

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