

## P-channel 30 V, 0.024 $\Omega$ typ., 12 A, STripFET™ VI DeepGATE™ Power MOSFET in a DPAK package

Datasheet - production data

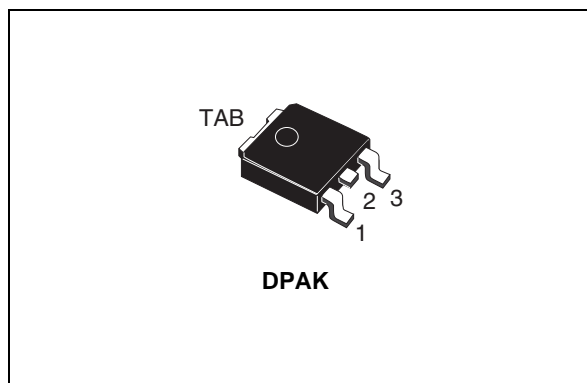
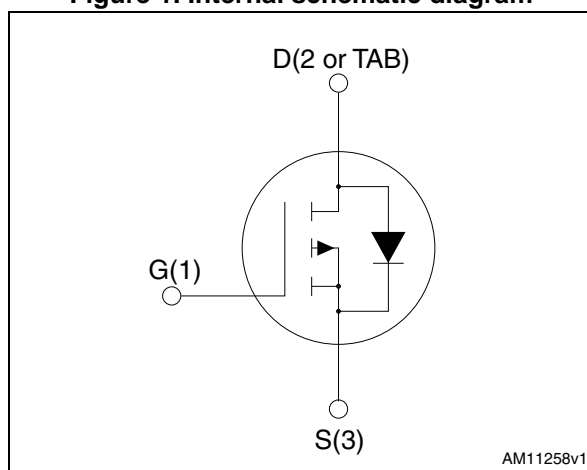


Figure 1. Internal schematic diagram



### Features

Order code	V <sub>DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>	P <sub>TOT</sub>
STD26P3LLH6	30 V	0.030 $\Omega$ <sup>(1)</sup>	12 A	40 W

1. @ V<sub>GS</sub> = 10 V

- R<sub>DS(on)</sub> \* Q<sub>g</sub> industry benchmark
- Extremely low on-resistance R<sub>DS(on)</sub>
- High avalanche ruggedness
- Low gate input resistance

### Applications

- Switching applications
- LCC converters, resonant converters

### Description

This device is a P-channel Power MOSFET developed using the 6<sup>th</sup> generation of STripFET™ DeepGATE™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest R<sub>DS(on)</sub> in all packages

Table 1. Device summary

Order code	Marking	Package	Packaging
STD26P3LLH6	26P3LLH6	DPAK	Tape and reel

**Note:** For the P-channel Power MOSFETs the actual polarity of the voltages and the current must be reversed.

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	30	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	12	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	8.5	A
$I_{DM}^{(1)(2)}$	Drain current (pulsed)	48	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	40	W
$T_{stg}$	Storage temperature	-55 to 175	$^\circ\text{C}$
$T_j$	Max. operating junction temperature	175	$^\circ\text{C}$

1. Limited by wire bonding.

2. Pulse width limited by safe operating area.

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	3.75	$^\circ\text{C/W}$

**Table 4. Avalanche characteristics**

Symbol	Parameter	Value	Unit
$E_{AS}$	Single pulse avalanche energy (starting $T_J=25\text{ }^\circ\text{C}$ , $I_D=6\text{ A}$ , $I_{AS}=12\text{ A}$ , $V_{DD}=25\text{ V}$ , $V_{gs}=10\text{ V}$ )	350	mJ

**Note:** For the P-channel Power MOSFETs the actual polarity of the voltages and the current must be reversed.

## 2 Electrical characteristics

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

**Table 5. Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0$	30			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 30\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 30\text{ V}$ , $T_c = 125\text{ }^{\circ}\text{C}$			10	$\mu\text{A}$
$I_{GSS}$	Gate body leakage current	$V_{GS} = \pm 20\text{ V}$ , ( $V_{DS} = 0$ )			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$	1		2.5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$ , $I_D = 6\text{ A}$		0.024	0.03	$\Omega$
		$V_{GS} = 4.5\text{ V}$ , $I_D = 6\text{ A}$		0.038	0.045	$\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$	-	1450	-	pF
$C_{oss}$	Output capacitance		-	178	-	pF
$C_{rss}$	Reverse transfer capacitance		-	120	-	pF
$Q_g$	Total gate charge	$V_{DD} = 24\text{ V}$ , $I_D = 12\text{ A}$ $V_{GS} = 4.5\text{ V}$ (see <a href="#">Figure 14</a> )	-	12	-	nC
$Q_{gs}$	Gate-source charge		-	4.4	-	nC
$Q_{gd}$	Gate-drain charge		-	5	-	nC
$R_g$	Gate input resistance	$f = 1\text{ MHz}$ , gate DC Bias = 0, test signal level = 20 mV, $I_D = 0$	-	1.8	-	$\Omega$

**Note:** For the P-channel Power MOSFETs the actual polarity of the voltages and the current must be reversed.

Table 7. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 24\text{ V}$ , $I_D = 1.5\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 13</a> )	-	15	-	ns
$t_r$	Rise time		-	15	-	ns
$t_{d(off)}$	Turn-off delay time		-	24	-	ns
$t_f$	Fall time		-	21	-	ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		12	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		48	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 12\text{ A}$ , $V_{GS} = 0$	-		1.1	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 12\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 16\text{ V}$ (see <a href="#">Figure 15</a> )	-	15		ns
$Q_{rr}$	Reverse recovery charge		-	6.5		nC
$I_{RRM}$	Reverse recovery current		-	0.9		A

1. Pulse width limited by safe operating area

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

**Note:** For the P-channel Power MOSFETs the actual polarity of the voltages and the current must be reversed.

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

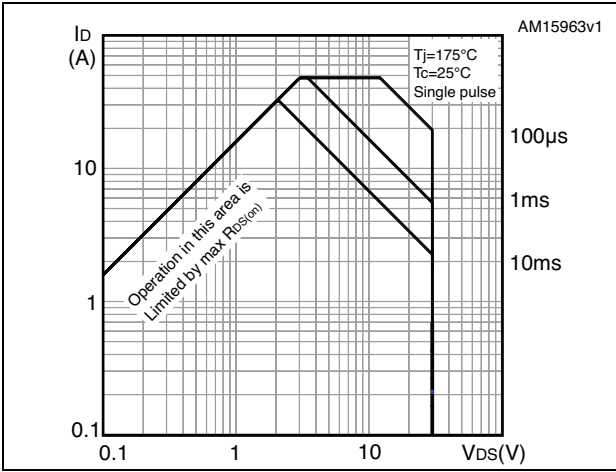


Figure 3. Thermal impedance

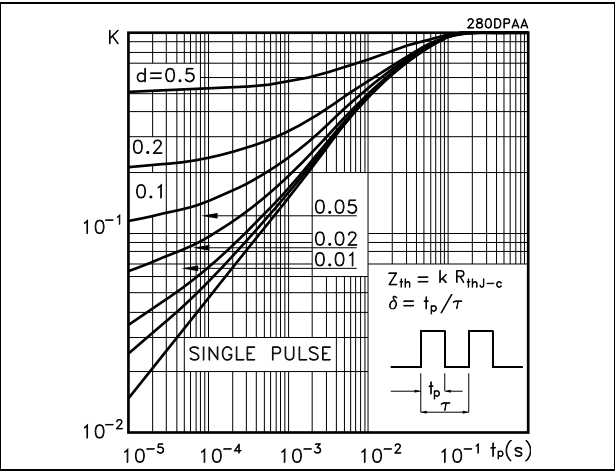


Figure 4. Output characteristics

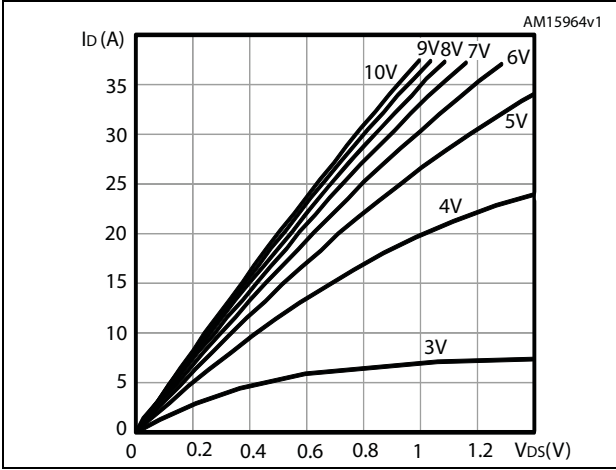


Figure 5. Transfer characteristics

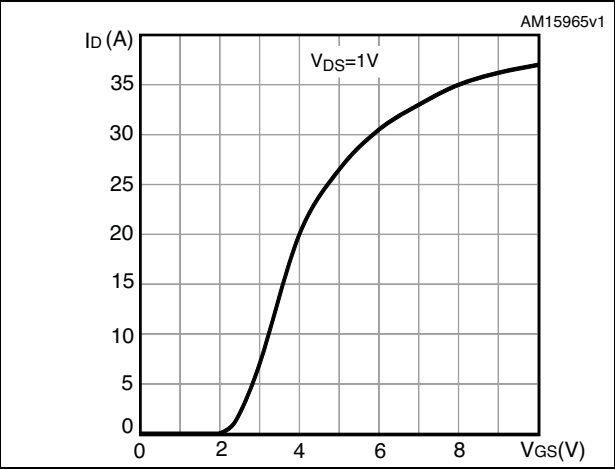


Figure 6. Gate charge vs gate-source voltage

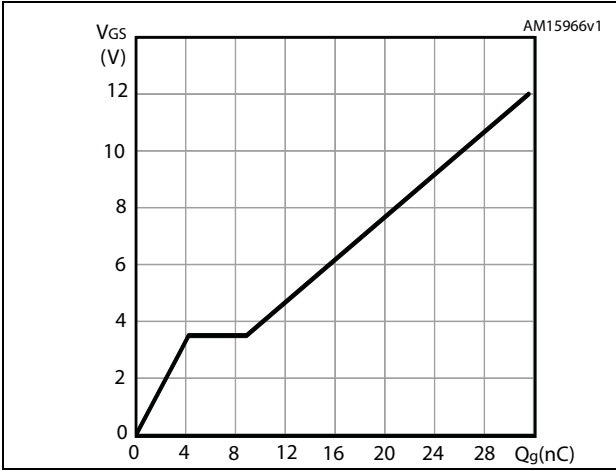


Figure 7. Static drain-source on-resistance

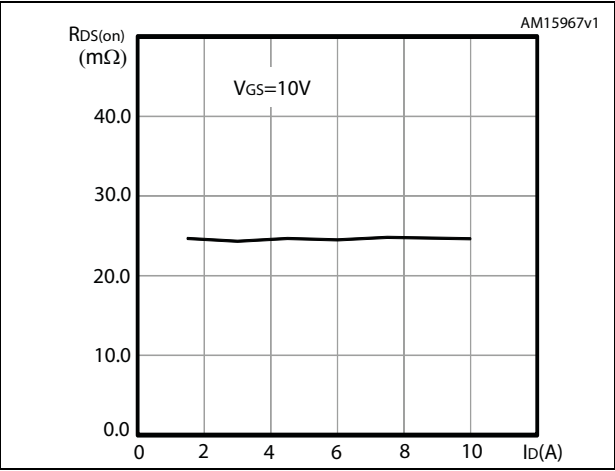


Figure 8. Capacitance variations

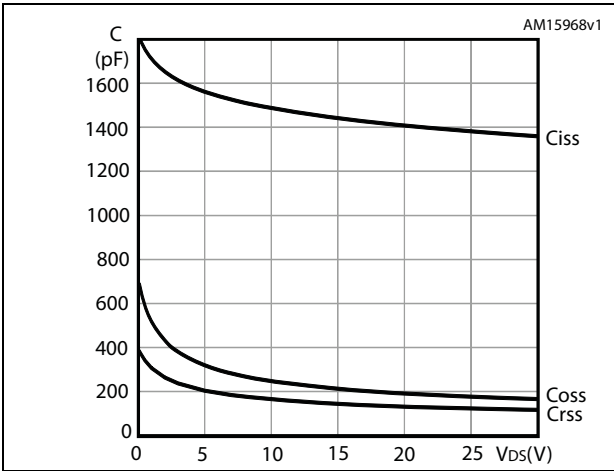


Figure 9. Normalized gate threshold voltage vs temperature

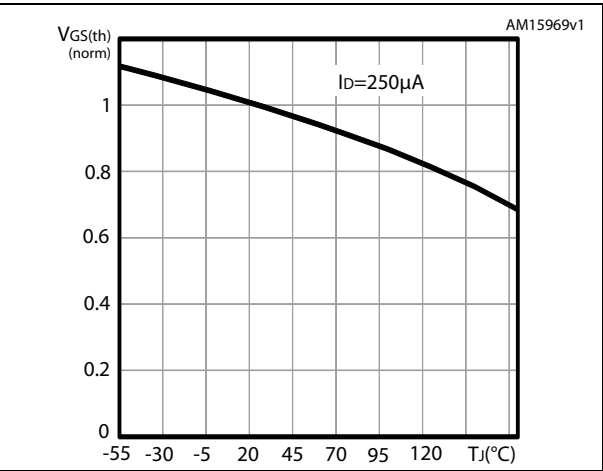


Figure 10. Normalized on-resistance vs temperature

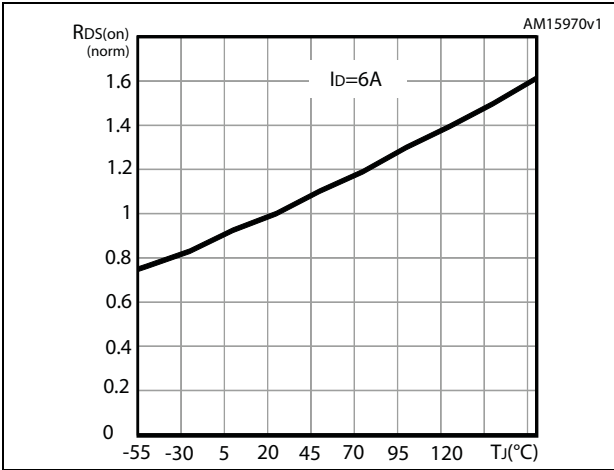


Figure 11. Normalized  $V_{DS}$  vs temperature

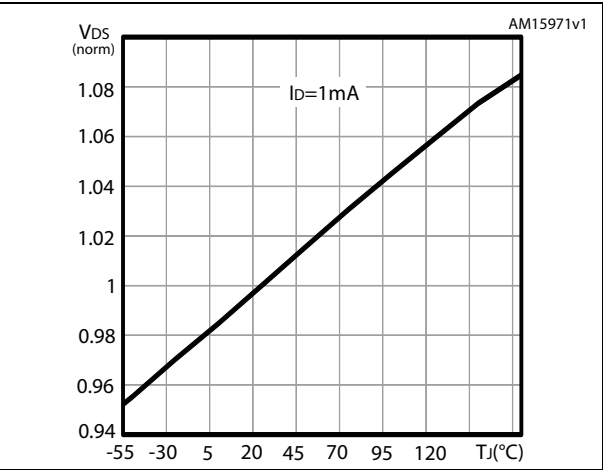
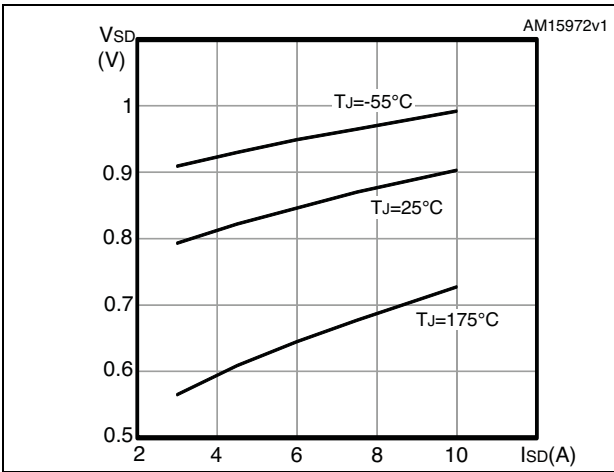


Figure 12. Source-drain diode forward characteristics



### 3 Test circuits

Figure 13. Switching times test circuit for resistive load

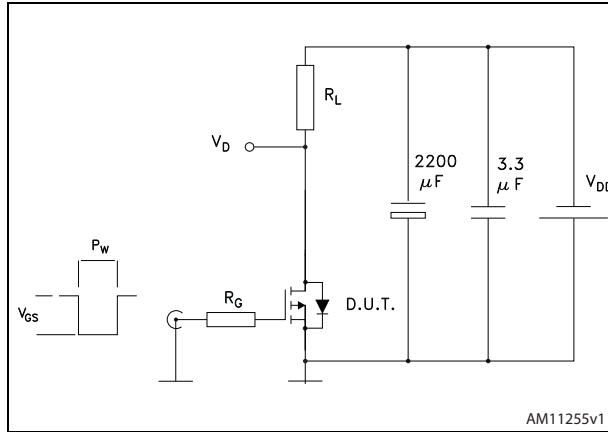


Figure 14. Gate charge test circuit

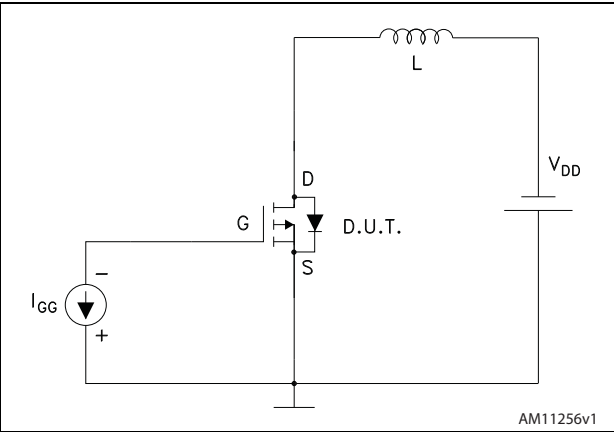


Figure 15. Test circuit for diode recovery behavior

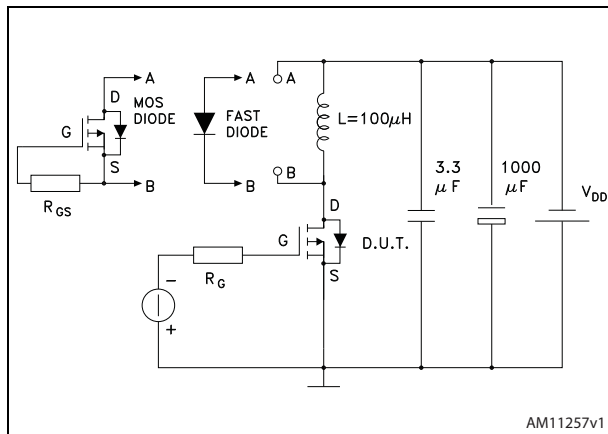


Figure 16. Unclamped inductive load test circuit

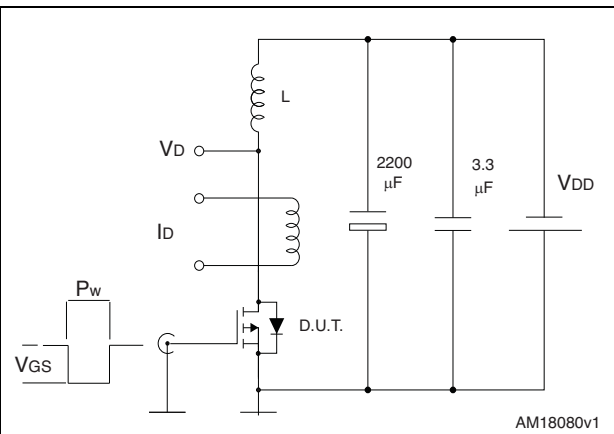


Figure 17. Unclamped inductive waveform

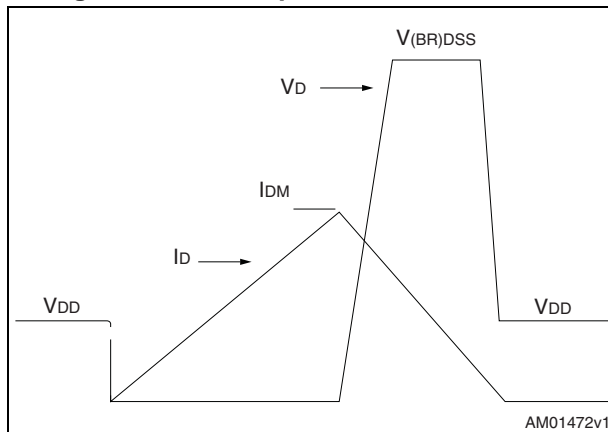
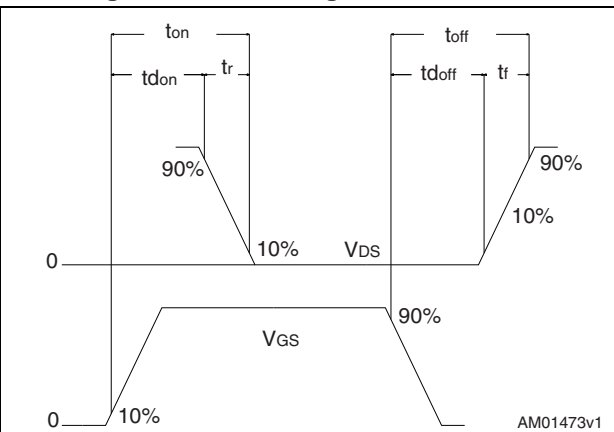


Figure 18. Switching time waveform

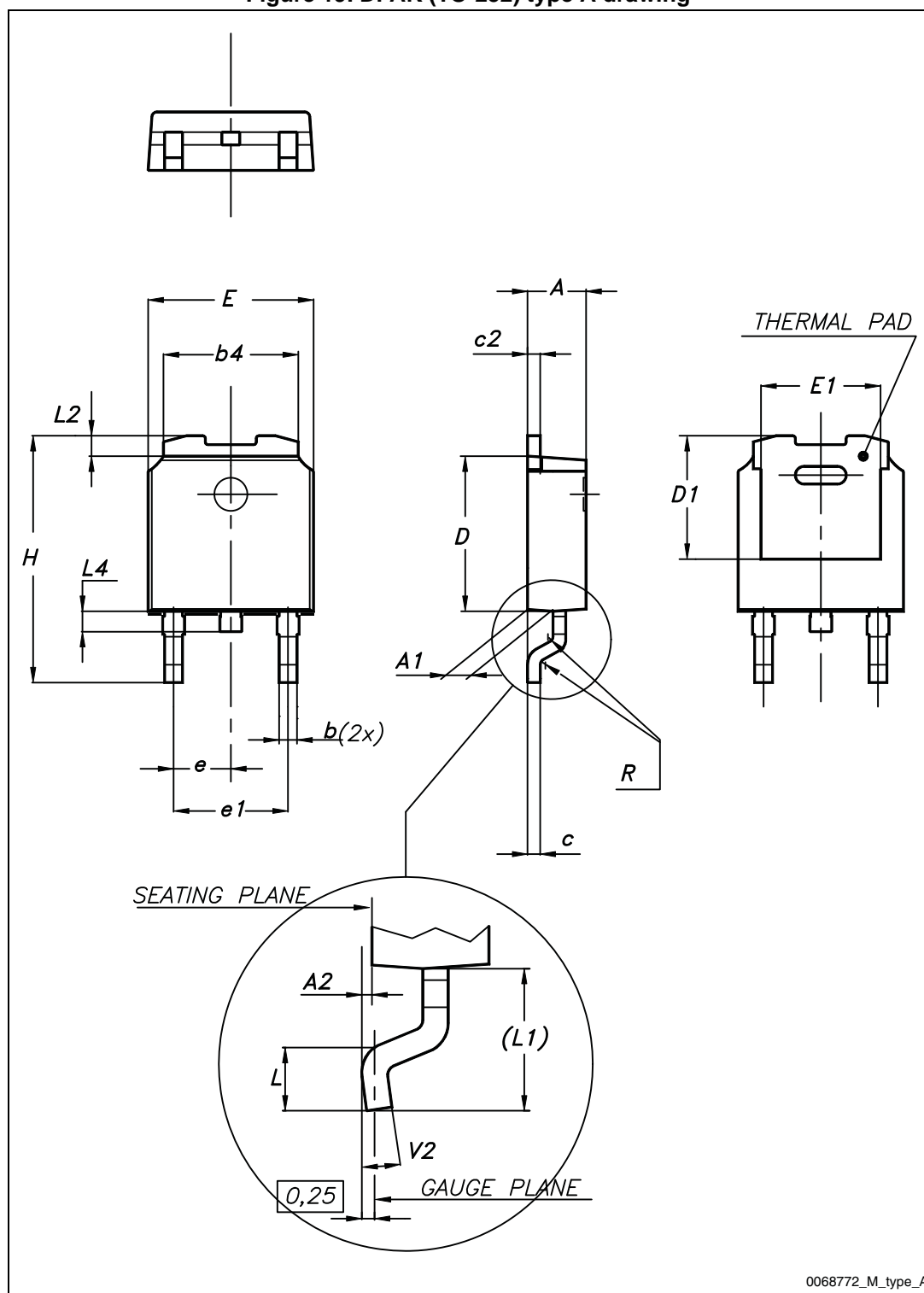




## 4 Package mechanical data

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<sup>®</sup> is an ST trademark.

Figure 19. DPAK (TO-252) type A drawing

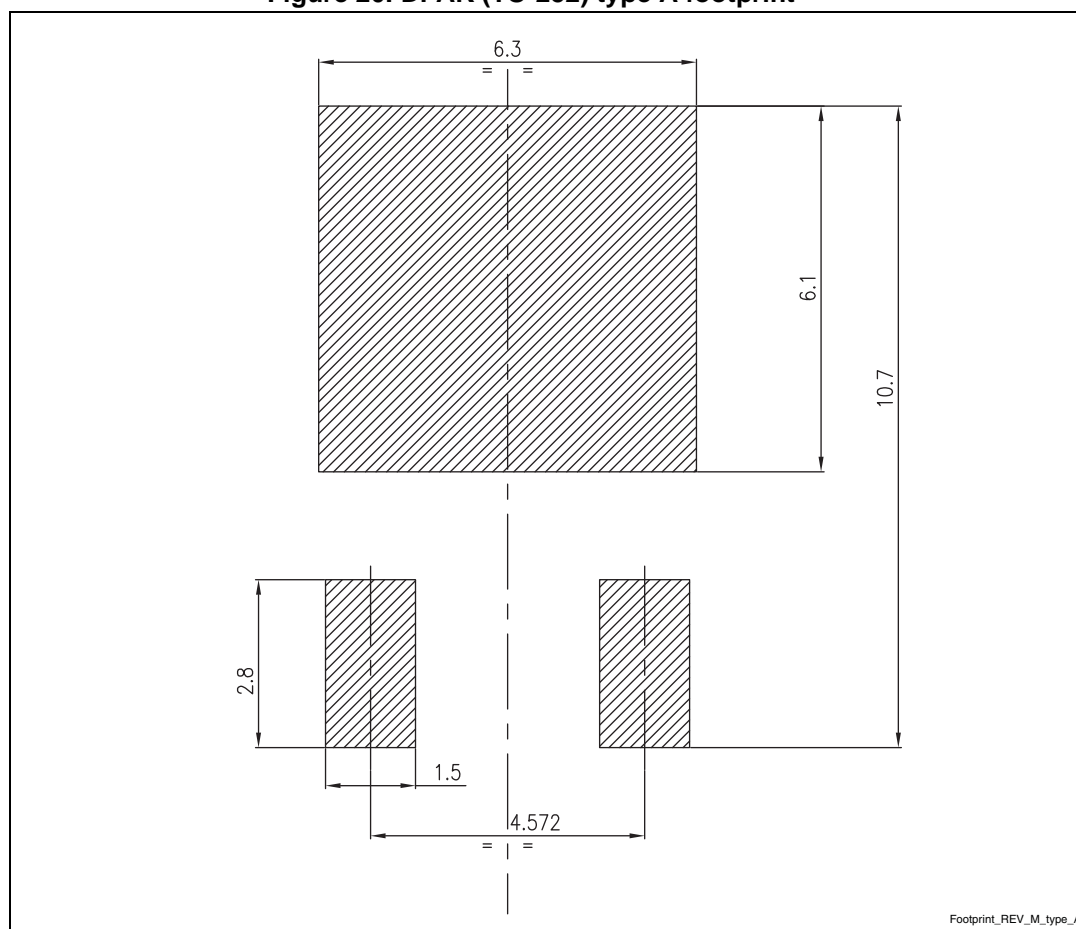


0068772\_M\_type\_A

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		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
(L1)		2.80	
L2		0.80	
L4	0.60		1.00
R		0.20	
V2	0°		8°

Figure 20. DPAK (TO-252) type A footprint (a)



a. All dimensions are in millimeters

## 5 Packaging mechanical data

Figure 21. Tape for DPAK (TO-252)

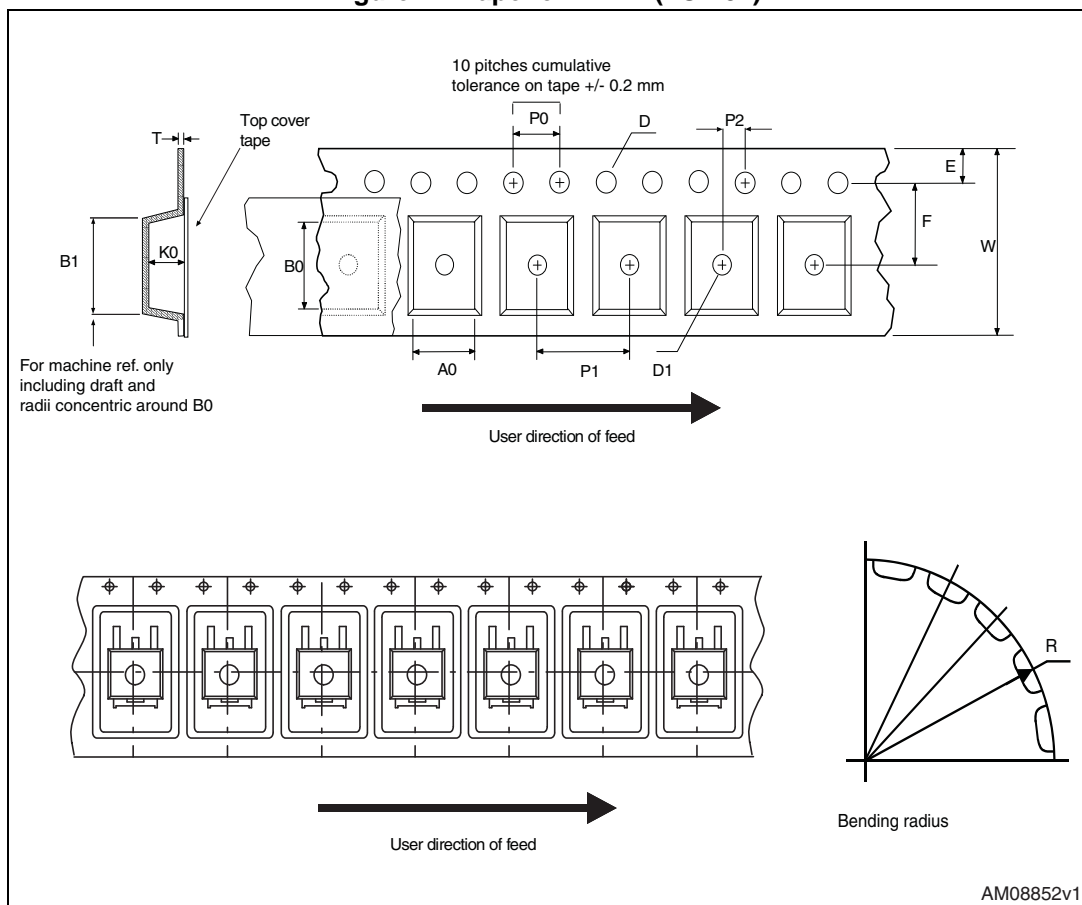


Figure 22. Reel for DPAK (TO-252)

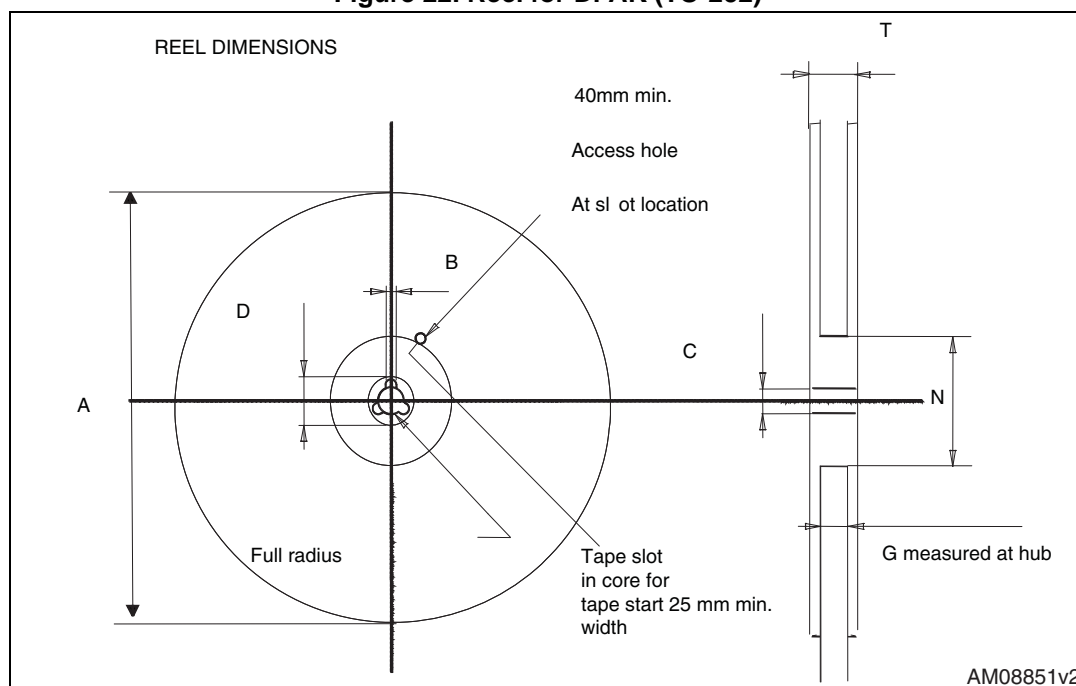


Table 10. DPAK (TO-252) tape and reel mechanical data

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			

## 6 Revision history

**Table 11. Document revision history**

Date	Revision	Changes
22-Aug-2012	1	First release
31-Jan-2013	2	<ul style="list-style-type: none"> <li>– Modified: <math>R_{DS(on)}</math> on the title, <a href="#">Features table</a> and <a href="#">Table 5</a></li> <li>– Modified: typical values on <a href="#">Table 6</a>, <a href="#">7</a>, <a href="#">8</a></li> <li>– Modified: <math>V_{SD}</math> max value on <a href="#">Table 8</a></li> <li>– Updated: <a href="#">Section 4: Package mechanical data</a></li> </ul>
16-Jul-2013	3	<ul style="list-style-type: none"> <li>– Modified: <math>V_{GS}</math> and <math>I_D=100</math> °C values in <a href="#">Table 2</a></li> <li>– Modified: <math>R_{DS(on)}</math> max value in <a href="#">Table 5</a>, <a href="#">Figure 13</a>, <a href="#">14</a> and <a href="#">15</a></li> <li>– Inserted: <a href="#">Section 2.1: Electrical characteristics (curves)</a></li> </ul>
10-Sep-2013	4	<ul style="list-style-type: none"> <li>– Updated <math>Q_g</math> value in <a href="#">Table 6: Dynamic</a>.</li> </ul>
06-Feb-2014	5	<ul style="list-style-type: none"> <li>– Added: <a href="#">Table 4: Avalanche characteristics</a></li> <li>– Modified: <a href="#">Figure 2</a>, <a href="#">5</a> and <a href="#">12</a></li> <li>– Updated: <a href="#">Section 4: Package mechanical data</a></li> <li>– Added: <a href="#">Figure 16</a>, <a href="#">17</a> and <a href="#">18</a></li> <li>– Minor text changes</li> </ul>

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