

N-channel 40 V, 2.5 mΩ typ., 80 A STripFET™ F6 Power MOSFET in a DPAK package

Datasheet - preliminary data

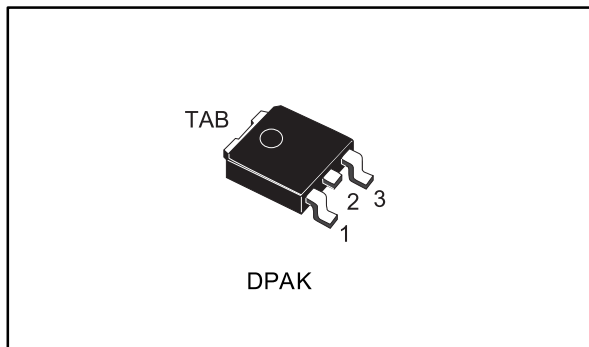
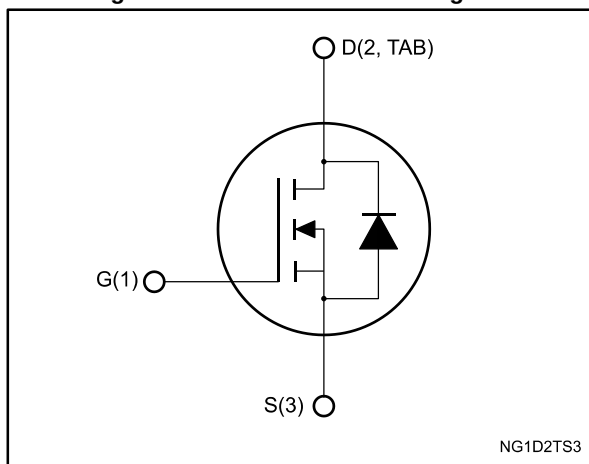


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STD180N4F6	40 V	2.8 mΩ	80 A	130 W

- Very low on-resistance
- Very low gate charge
- High avalanche ruggedness
- Low gate drive power loss

Applications

- Switching applications
- Power tools

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
STD180N4F6	180N4F6	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
$I_D^{(1)}$	Drain current (continuous) at $T_{case} = 25\text{ }^{\circ}\text{C}$	80	A
	Drain current (continuous) at $T_{case} = 100\text{ }^{\circ}\text{C}$	80	
I_{DM}	Drain current (pulsed)	320	A
P_{TOT}	Total dissipation at $T_{case} = 25\text{ }^{\circ}\text{C}$	130	W
T_{stg}	Storage temperature range	-55 to 175	$^{\circ}\text{C}$
T_j	Operating junction temperature range		

Notes:

⁽¹⁾ Limited by package

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	1.15	$^{\circ}\text{C/W}$
$R_{thj-amb}^{(1)}$	Thermal resistance junction-pcb	50	

Notes:

⁽¹⁾ When mounted on FR-4 board of 1 inch², 2 oz Cu.

2 Electrical characteristics

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

Table 4: Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$V_{\text{GS}} = 0\text{ V}$, $I_{\text{D}} = 250\text{ }\mu\text{A}$	40			V
I_{DSS}	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 40\text{ V}$			1	μA
		$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 40\text{ V}$, $T_{\text{case}} = 125\text{ }^{\circ}\text{C}$			100	
I_{GSS}	Gate-body leakage current	$V_{\text{DS}} = 0\text{ V}$, $V_{\text{GS}} = \pm 20\text{ V}$			± 100	nA
$V_{\text{GS(th)}}$	Gate threshold voltage	$V_{\text{DS}} = V_{\text{GS}}$, $I_{\text{D}} = 250\text{ }\mu\text{A}$	3		4.5	V
$R_{\text{DS(on)}}$	Static drain-source on-resistance	$V_{\text{GS}} = 10\text{ V}$, $I_{\text{D}} = 40\text{ A}$		2.5	2.8	m Ω

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{\text{DS}} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{\text{GS}} = 0\text{ V}$	-	7735	-	pF
C_{oss}	Output capacitance		-	745	-	
C_{rss}	Reverse transfer capacitance		-	560	-	
Q_{g}	Total gate charge	$V_{\text{DD}} = 20\text{ V}$, $I_{\text{D}} = 80\text{ A}$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 14: "Test circuit for gate charge behavior")	-	130	-	nC
Q_{gs}	Gate-source charge		-	36	-	
Q_{gd}	Gate-drain charge		-	42	-	

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{\text{d(on)}}$	Turn-on delay time	$V_{\text{DD}} = 20\text{ V}$, $I_{\text{D}} = 40\text{ A}$ $R_{\text{G}} = 4.7\text{ }\Omega$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 13: "Test circuit for resistive load switching times" and Figure 18: "Switching time waveform")	-	24	-	ns
t_{r}	Rise time		-	150	-	
$t_{\text{d(off)}}$	Turn-off delay time		-	106	-	
t_{f}	Fall time		-	57	-	

Table 7: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{SD}^{(1)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 80\text{ A}$	-		1.3	V
t_{rr}	Reverse recovery time	$I_{SD} = 80\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 32\text{ V}$, $T_j = 25\text{ }^\circ\text{C}$ (see Figure 15: "Test circuit for inductive load switching and diode recovery times")	-	36		ns
Q_{rr}	Reverse recovery charge		-	40		nC
I_{RRM}	Reverse recovery current		-	2.3		A

Notes:

⁽¹⁾ Pulse test: pulse duration = 300 μs , duty cycle 1.5%.

2.1 Electrical characteristics (curves)

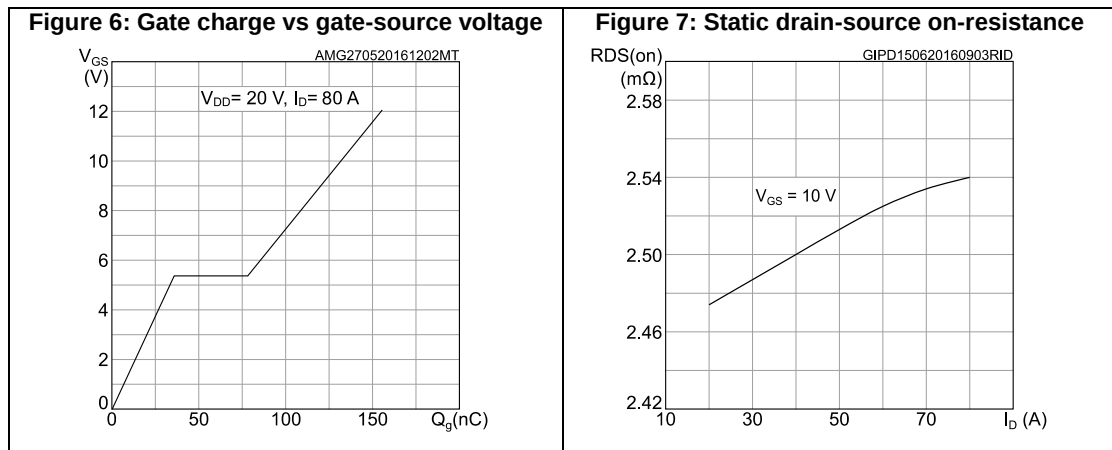
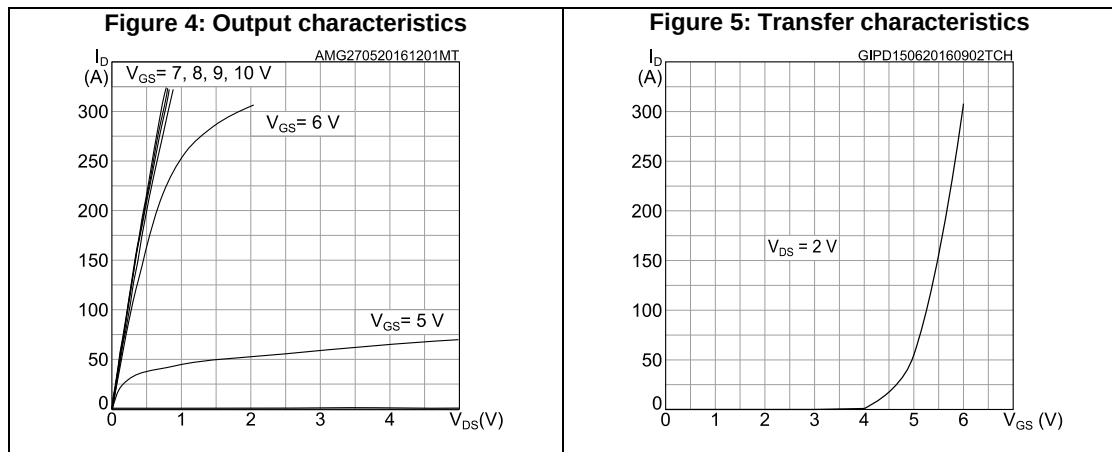
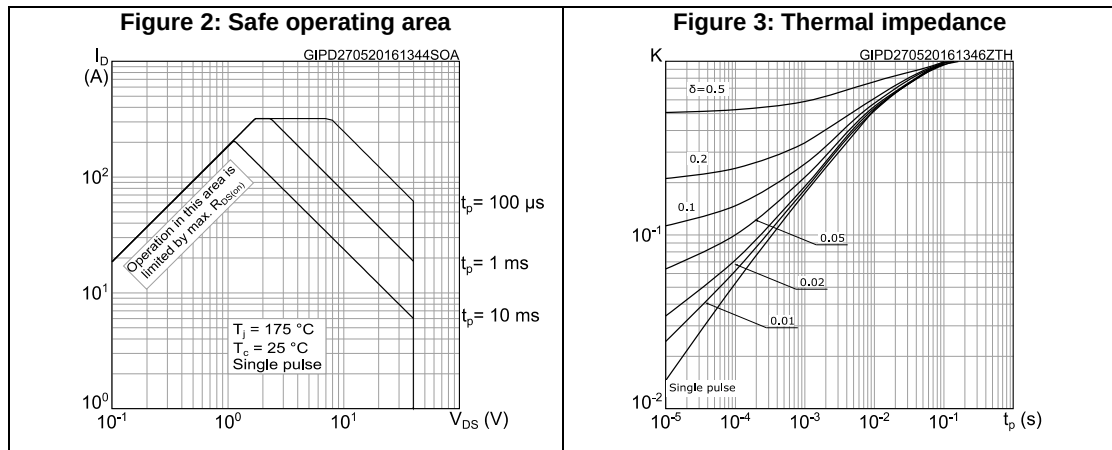


Figure 8: Capacitance variations

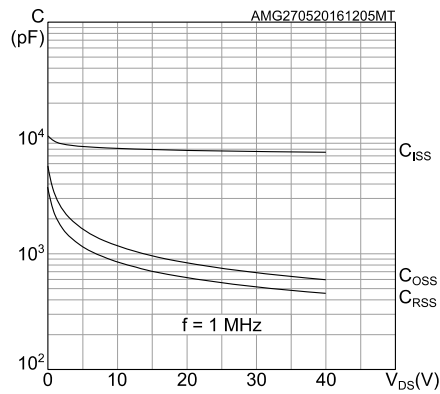


Figure 9: Normalized gate threshold voltage vs temperature

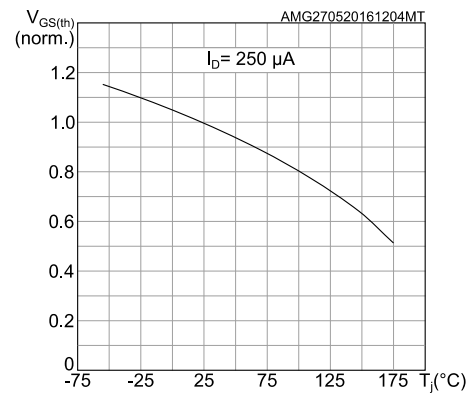


Figure 10: Normalized on-resistance vs temperature

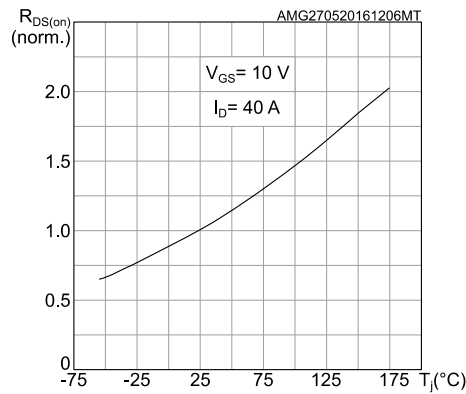
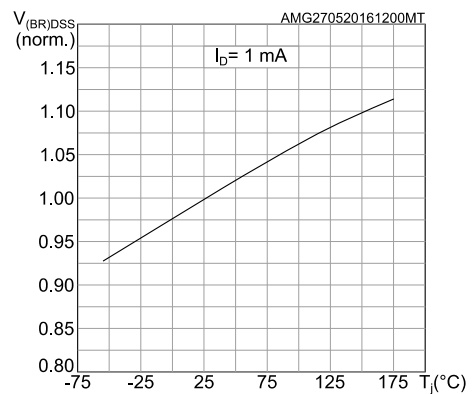
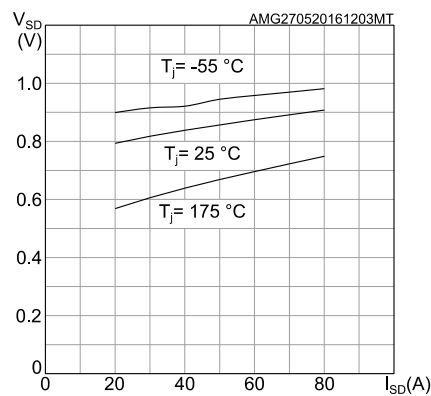
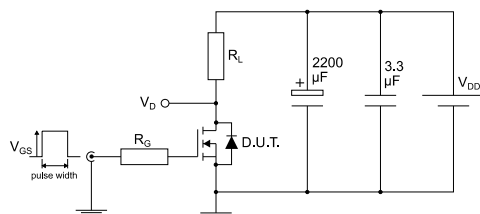
Figure 11: Normalized $V_{(BR)DSS}$ vs temperature

Figure 12: Source-drain diode forward characteristics



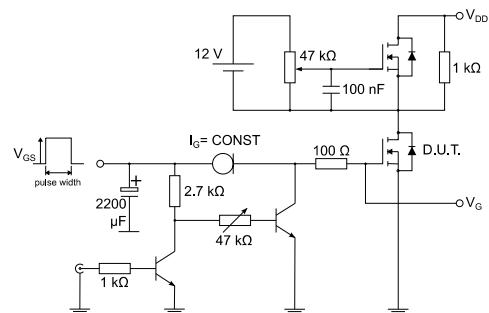
3 Test circuits

Figure 13: Test circuit for resistive load switching times



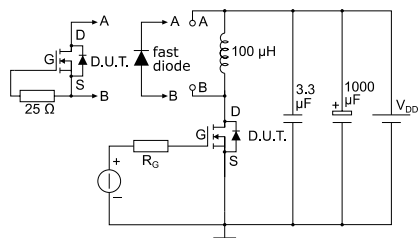
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Figure 14: Test circuit for gate charge behavior



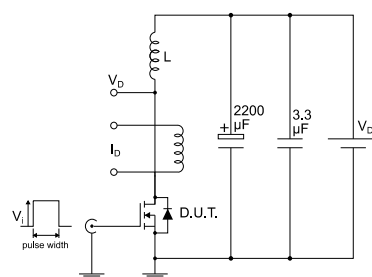
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Figure 15: Test circuit for inductive load switching and diode recovery times



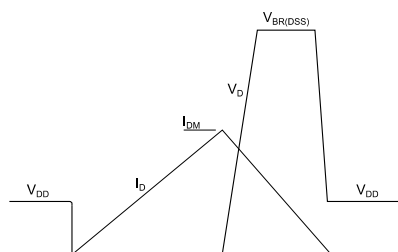
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Figure 16: Unclamped inductive load test circuit



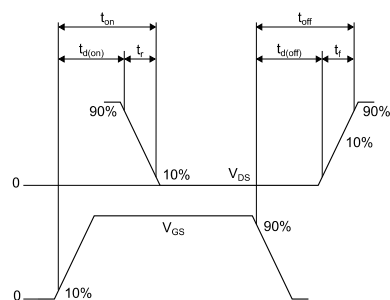
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Figure 17: Unclamped inductive waveform



AM01472v1

Figure 18: Switching time waveform



AM01473v1

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 package information

Figure 19: DPAK (TO-252) type A2 package outline

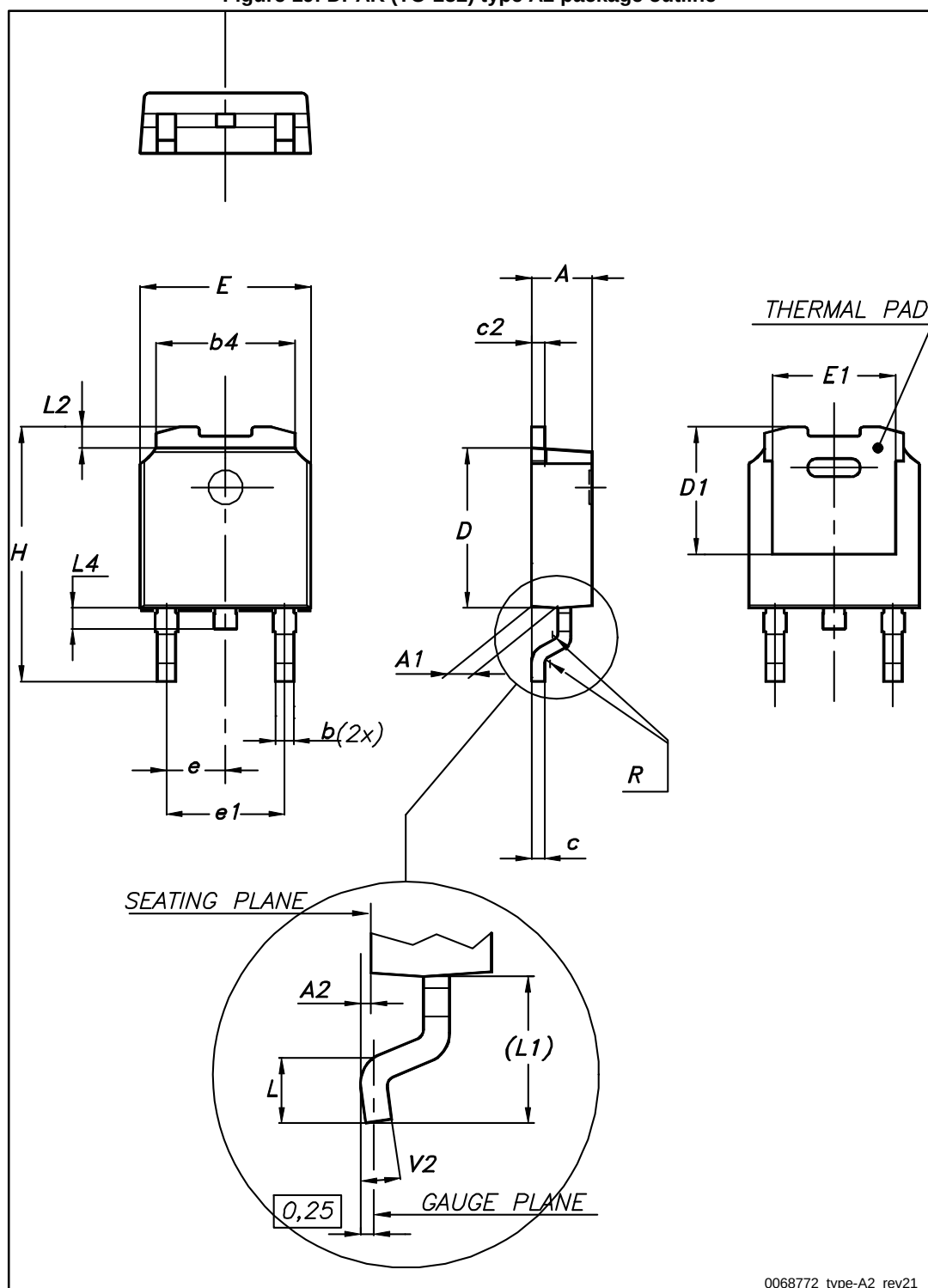
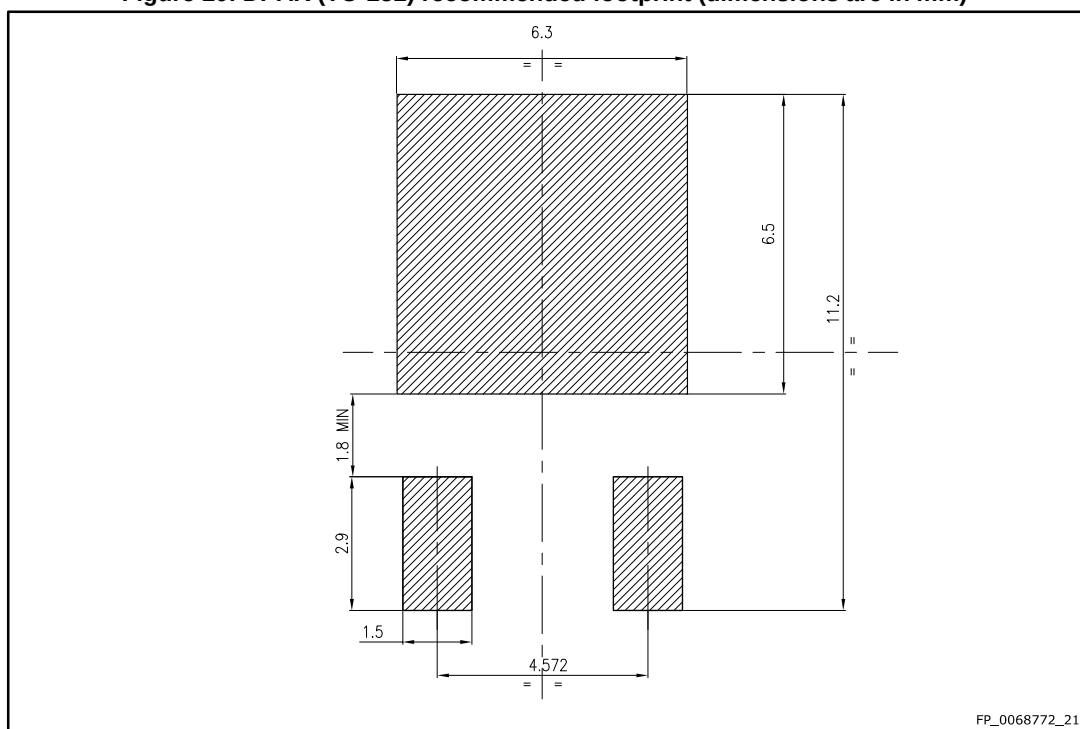


Table 8: DPAK (TO-252) type A2 mechanical data

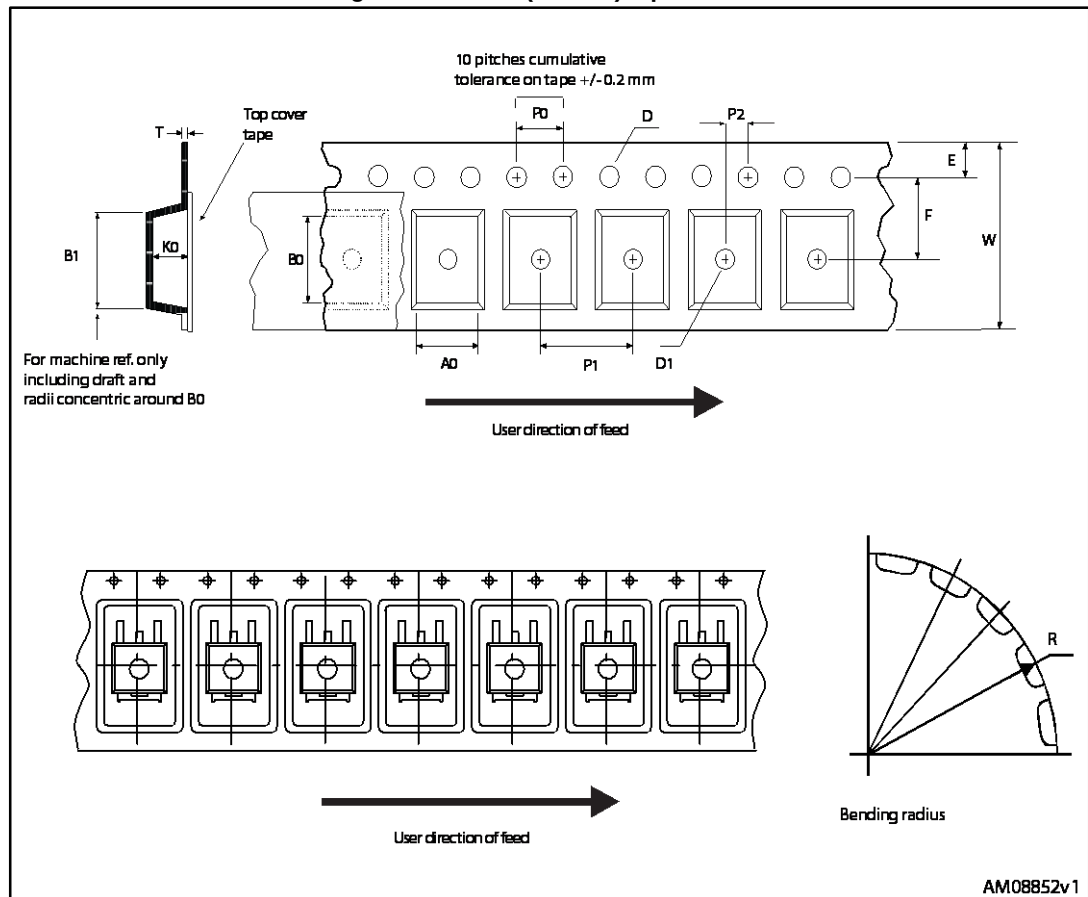
Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1	4.95	5.10	5.25
E	6.40		6.60
E1	5.10	5.20	5.30
e	2.16	2.28	2.40
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
L1	2.60	2.80	3.00
L2	0.65	0.80	0.95
L4	0.60		1.00
R		0.20	
V2	0°		8°

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



4.2 DPAK packing information

Figure 21: DPAK (TO-252) tape outline



Technical drawing of a tape reel showing front and side views with dimensions A through T.

Front View Dimensions:

- A:** Overall diameter of the reel.
- B:** Width of the tape slot.
- C:** Distance from the center to the start of the tape slot.
- D:** Distance from the center to the start of the tape slot.
- E:** Distance from the center to the start of the tape slot.
- F:** Distance from the center to the start of the tape slot.
- G:** Distance from the center to the start of the tape slot.
- H:** Distance from the center to the start of the tape slot.
- I:** Distance from the center to the start of the tape slot.
- J:** Distance from the center to the start of the tape slot.
- K:** Distance from the center to the start of the tape slot.
- L:** Distance from the center to the start of the tape slot.
- M:** Distance from the center to the start of the tape slot.
- N:** Distance from the center to the start of the tape slot.
- O:** Distance from the center to the start of the tape slot.
- P:** Distance from the center to the start of the tape slot.
- Q:** Distance from the center to the start of the tape slot.
- R:** Distance from the center to the start of the tape slot.
- S:** Distance from the center to the start of the tape slot.
- T:** Distance from the center to the start of the tape slot.

Side View Dimensions:

- A:** Overall diameter of the reel.
- B:** Width of the tape slot.
- C:** Distance from the center to the start of the tape slot.
- D:** Distance from the center to the start of the tape slot.
- E:** Distance from the center to the start of the tape slot.
- F:** Distance from the center to the start of the tape slot.
- G:** Distance from the center to the start of the tape slot.
- H:** Distance from the center to the start of the tape slot.
- I:** Distance from the center to the start of the tape slot.
- J:** Distance from the center to the start of the tape slot.
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- M:** Distance from the center to the start of the tape slot.
- N:** Distance from the center to the start of the tape slot.
- O:** Distance from the center to the start of the tape slot.
- P:** Distance from the center to the start of the tape slot.
- Q:** Distance from the center to the start of the tape slot.
- R:** Distance from the center to the start of the tape slot.
- S:** Distance from the center to the start of the tape slot.
- T:** Distance from the center to the start of the tape slot.

Notes:

- 40mm min. access hole at slot location
- Tape slot in core for tape start
- 2.5mm min. width
- Full radius
- G measured at hub

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 10: Document revision history

Date	Revision	Changes
10-Nov-2015	1	First release.
26-Jul-2016	2	Updated title in cover page. Updated $R_{DS(on) \text{ max.}}$ value in Features. Updated Table 4: "Static" and Table 5: "Dynamic" . Added Section 2.1: "Electrical characteristics (curves)" and Section 4.2: "DPAK packing information" . Minor text changes.

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