

Automotive-grade P-channel -80 V, 18.5 mΩ typ., -40 A STripFET™ F6 Power MOSFET in a DPAK package

Datasheet - production data

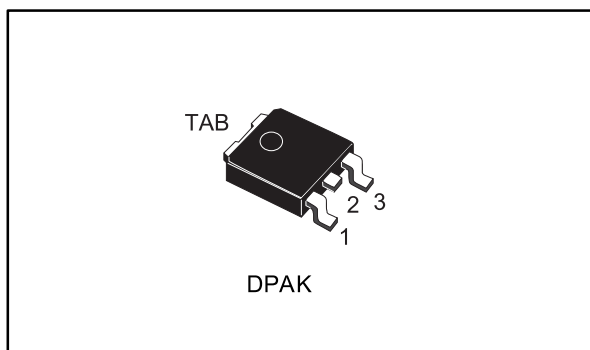
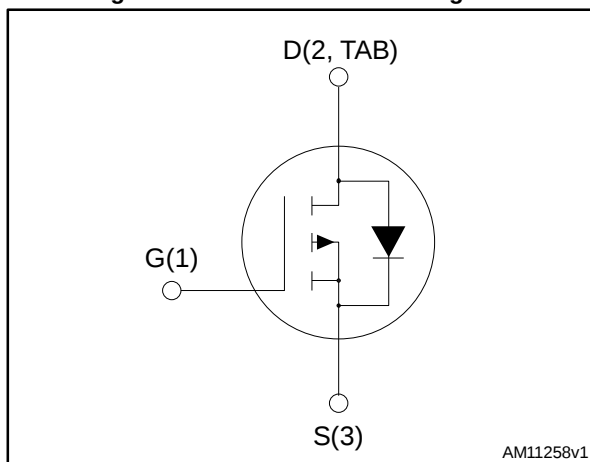


Figure 1: Internal schematic diagram



Features

Order code	V _{DSS}	R _{DS(on)} max.	I _D
STD40P8F6AG	-80 V	28 mΩ	-40 A

- 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 a P-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
STD40P8F6AG	40P8F6	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	-80	V
V_{GS}	Gate-source voltage	± 20	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	-40	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	-28	A
$I_{DM}^{(1)}$	Drain current (pulsed)	-160	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	100	W
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ }^{\circ}\text{C}$, $I_D = -40\text{ A}$, $V_{DD} = -60\text{ V}$)	240	mJ
T_{stg}	Storage temperature range	-55 to 175	$^{\circ}\text{C}$
T_J	Junction temperature range		

Notes:

⁽¹⁾Pulse width limited by safe operating area.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1.5	$^{\circ}\text{C/W}$
$R_{thj-pcb}$	Thermal resistance junction-pcb max ⁽¹⁾	50	$^{\circ}\text{C/W}$

Notes:

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

2 Electrical characteristics

(T_C = 25 °C unless otherwise specified)

Table 4: Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source breakdown voltage	V _{GS} = 0 V, I _D = -1 mA	-80			V
I _{DSS}	Zero gate voltage Drain current	V _{GS} = 0 V, V _{DS} = -60 V			-1	μA
		V _{GS} = 0 V, V _{DS} = -60 V, T _C = 125 °C ⁽¹⁾			-10	μA
I _{GSS}	Gate-body leakage current	V _{DS} = 0 V, V _{GS} = ±20 V			±100	nA
V _{GS(th)}	Gate threshold voltage	V _{DS} = V _{GS} , I _D = -250 μA	-2		-4	V
R _{DS(on)}	Static drain-source on-resistance	V _{GS} = -10 V, I _D = -20 A		18.5	28	mΩ

Notes:

⁽¹⁾Defined by design, not subject to production test.

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C _{iss}	Input capacitance	V _{DS} = -25 V, f = 1 MHz, V _{GS} = 0 V	-	4112	-	pF
C _{oss}	Output capacitance		-	366	-	pF
C _{rss}	Reverse transfer capacitance		-	188	-	pF
Q _g	Total gate charge	V _{DD} = -40 V, I _D = -40 A, V _{GS} = -10 V (see Figure 14: "Gate charge test circuit")	-	73	-	nC
Q _{gs}	Gate-source charge		-	17.1	-	nC
Q _{gd}	Gate-drain charge		-	18	-	nC

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = -40\text{ V}$, $I_D = -20\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = -10\text{ V}$ (see Figure 13 : "Switching times test circuit for resistive load")	-	17.5	-	ns
t_r	Rise time		-	28.5	-	ns
$t_{d(off)}$	Turn-off-delay time		-	68.5	-	ns
t_f	Fall time		-	34.5	-	ns

Table 7: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		-40	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		-160	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = -40\text{ A}$	-		-1.2	V
t_{rr}	Reverse recovery time	$I_{SD} = -40\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = -64\text{ V}$, (see Figure 15 : "Test circuit for inductive load switching and diode recovery times")	-	35		ns
Q_{rr}	Reverse recovery charge		-	44		nC
I_{RRM}	Reverse recovery current		-	-2.5		A

Notes:

⁽¹⁾Pulse width limited by safe operating area.

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

2.1 Electrical characteristics (curves)



For the P-channel Power MOSFET, current and voltage polarities are reversed.

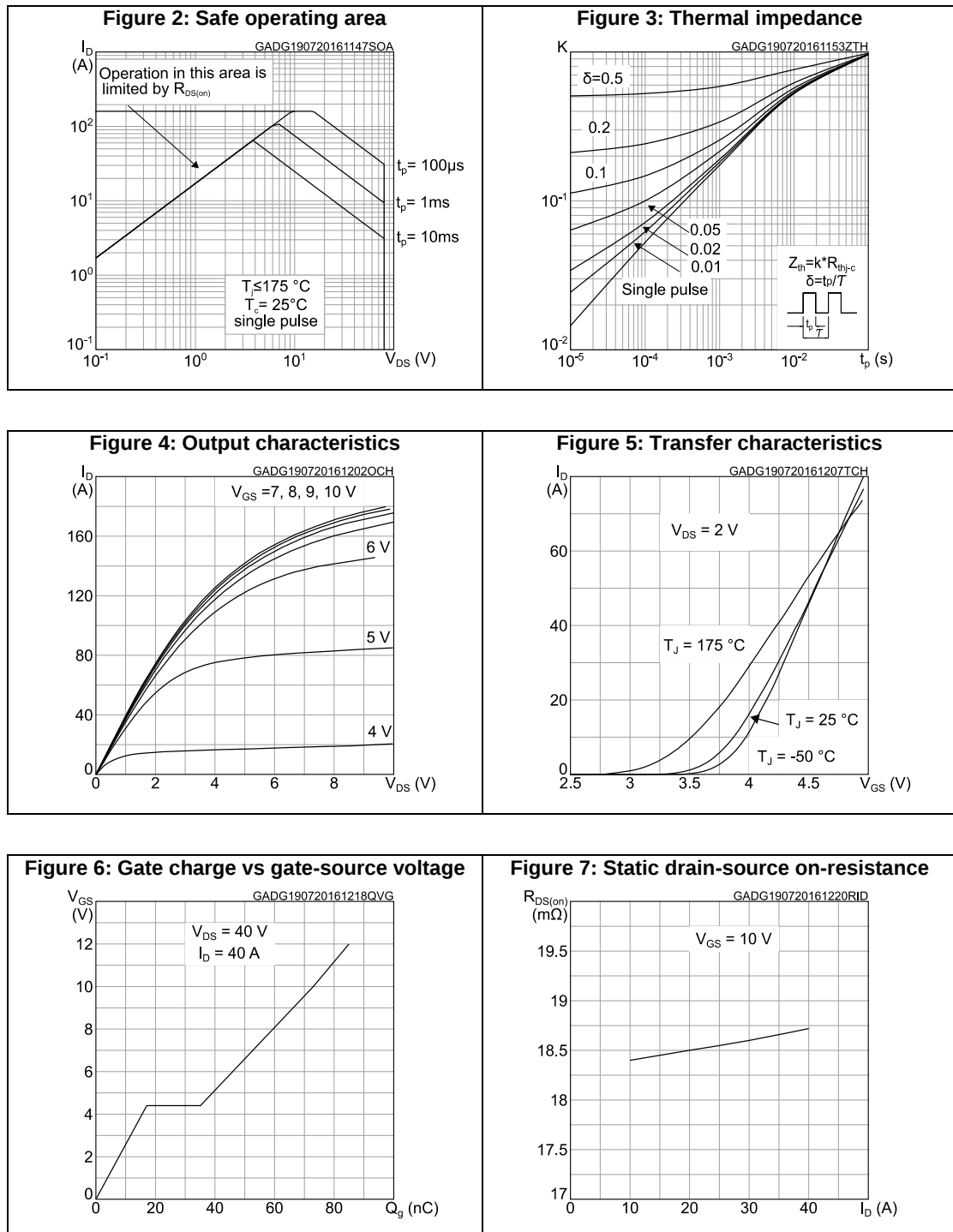


Figure 8: Capacitance variations

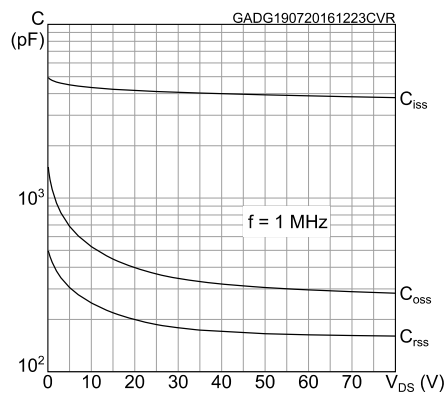
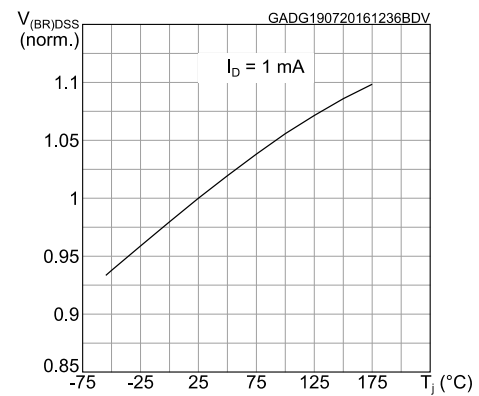
Figure 9: Normalized V_{(BR)DSS} vs temperature

Figure 10: Normalized gate threshold voltage vs temperature

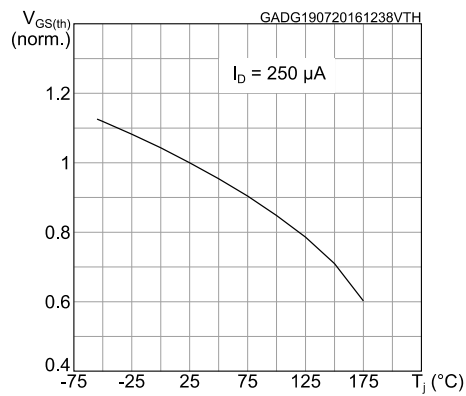


Figure 11: Normalized on-resistance vs temperature

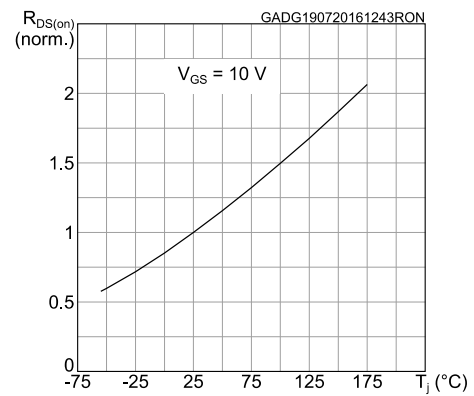
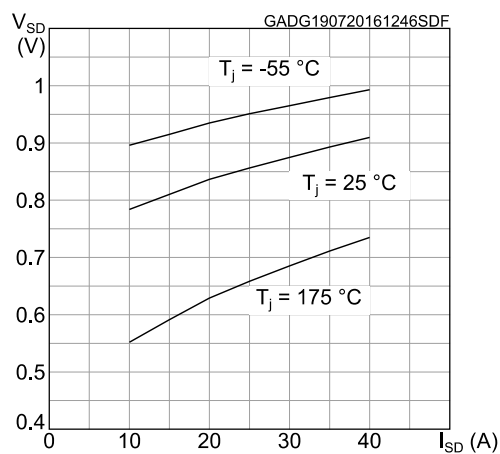


Figure 12: Source-drain diode forward characteristics



3 Test circuits

Figure 13: Switching times test circuit for resistive load

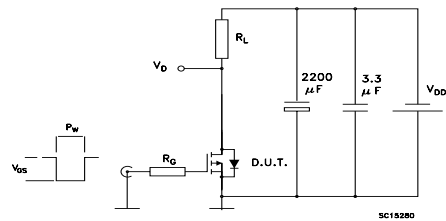


Figure 14: Gate charge test circuit

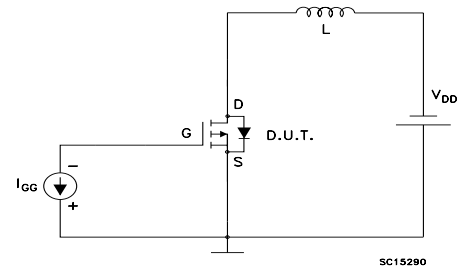
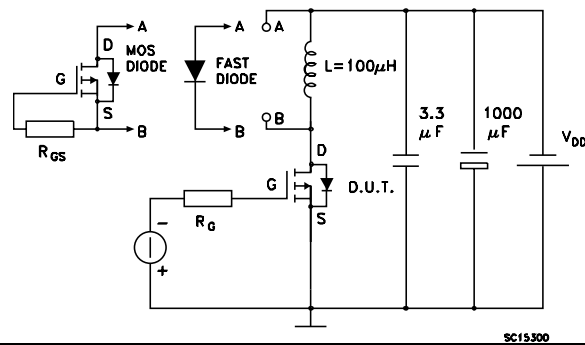


Figure 15: Test circuit for inductive load switching and diode recovery times



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 type A2 package information

Figure 16: DPAK (TO-252) type A2 package outline

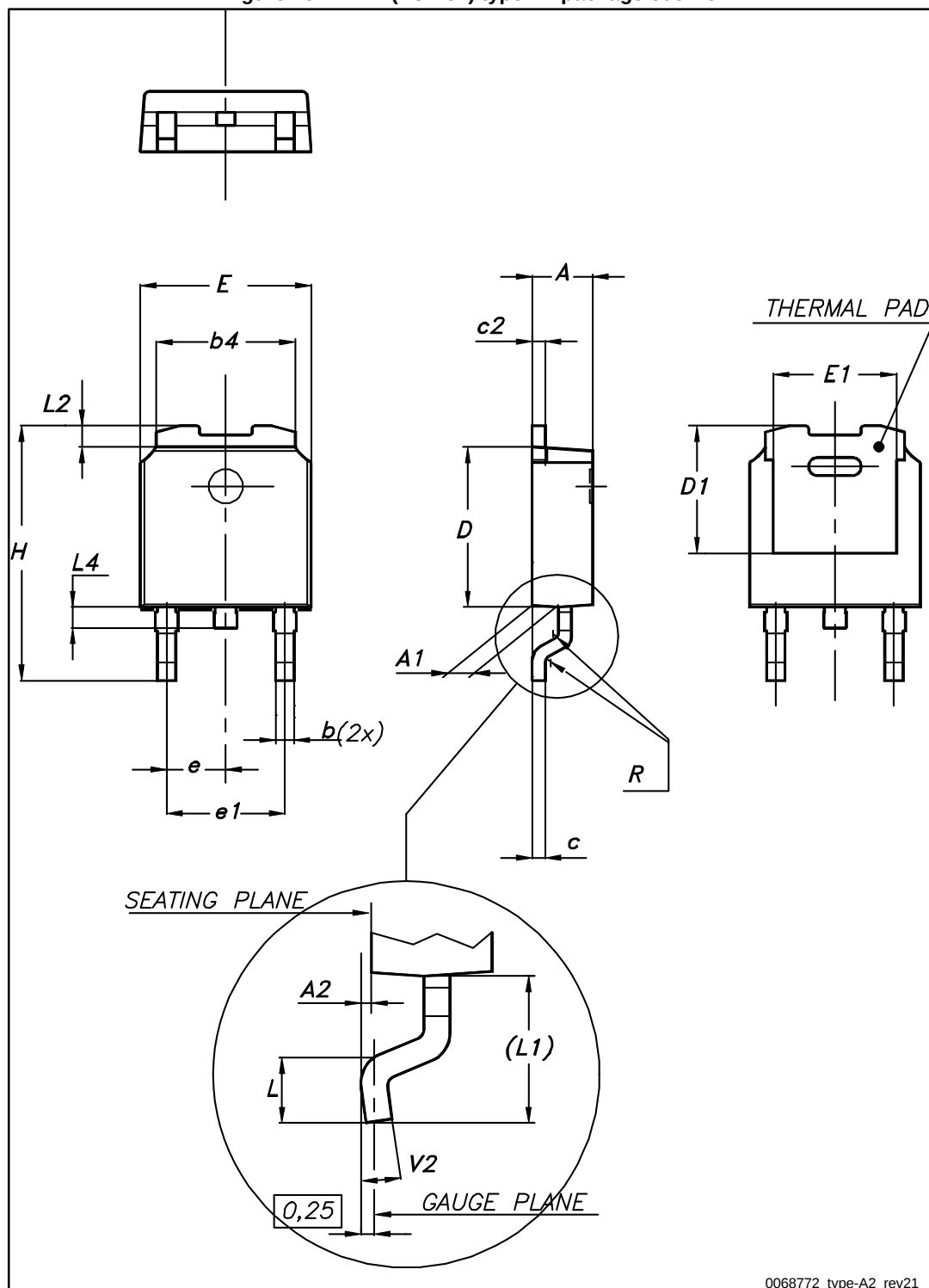
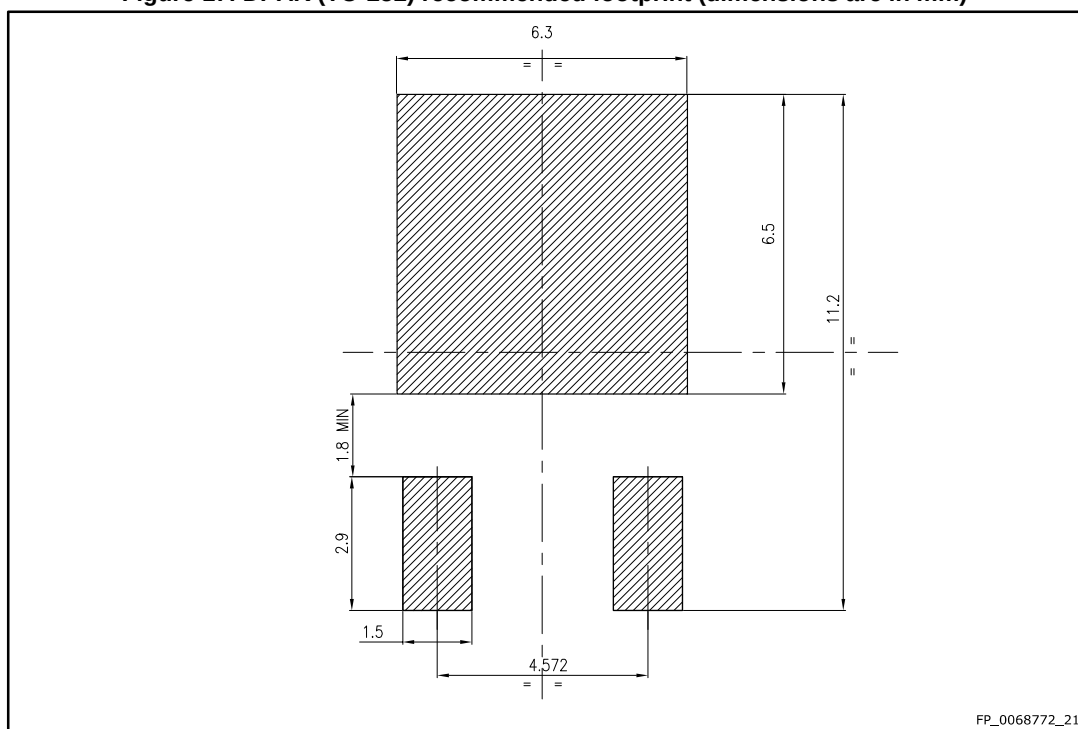


Table 8: DPAK (TO-252) type A2 mechanical data

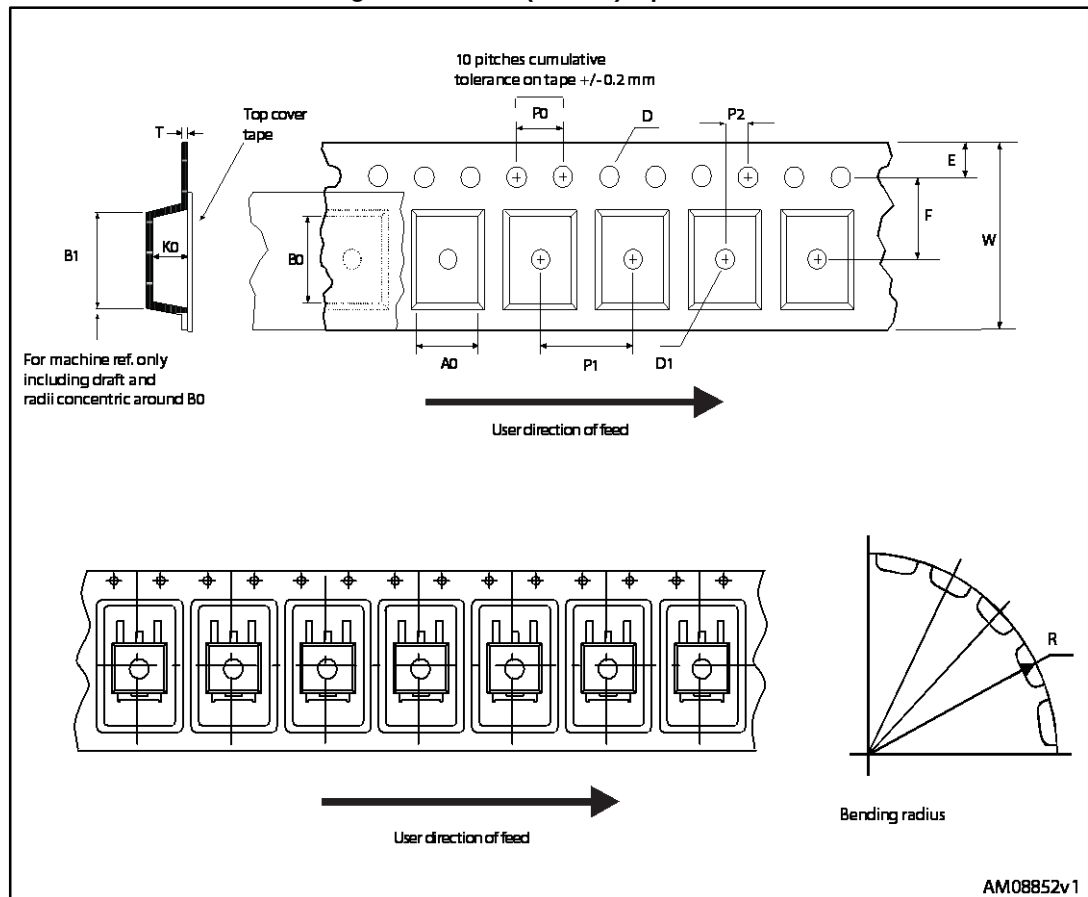
Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1	4.95	5.10	5.25
E	6.40		6.60
E1	5.10	5.20	5.30
e	2.16	2.28	2.40
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
L1	2.60	2.80	3.00
L2	0.65	0.80	0.95
L4	0.60		1.00
R		0.20	
V2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

Figure 17: DPAK (TO-252) recommended footprint (dimensions are in mm)



4.2 DPAK packing information

Figure 18: 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.
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- 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
19-Jul-2016	1	First release.

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