

Automotive-grade N-channel 60 V, 19 mΩ typ., 24 A STripFET™ F6 Power MOSFET in a DPAK package

Datasheet - production data

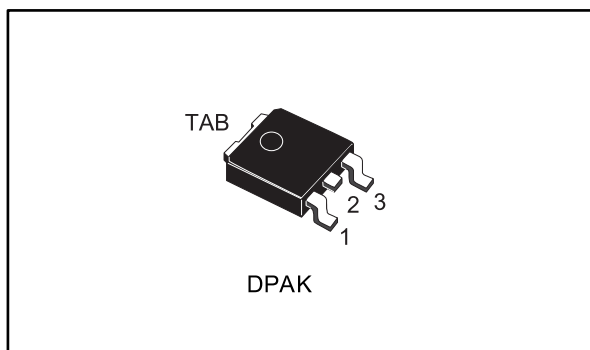
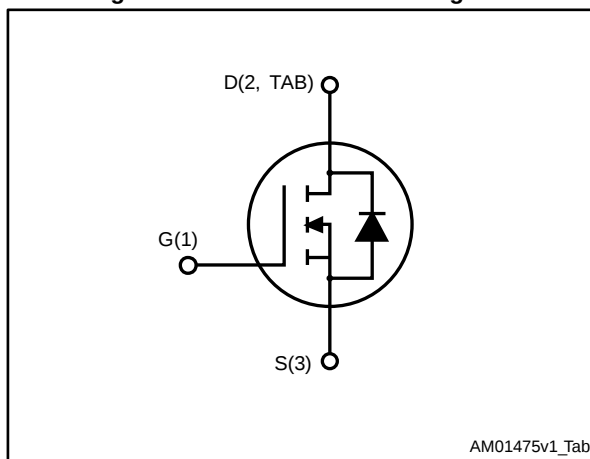


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STD30N6LF6AG	60 V	25 mΩ	24 A	40 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
STD30N6LF6AG	30N6LF6	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	60	V
V_{GS}	Gate-source voltage	±20	V
I_D	Drain current (continuous) at $T_{case} = 25\text{ °C}$	24	A
	Drain current (continuous) at $T_{case} = 100\text{ °C}$	17	
$I_{DM}^{(1)}$	Drain current (pulsed)	96	A
P_{TOT}	Total dissipation at $T_{case} = 25\text{ °C}$	40	W
$E_{AS}^{(2)}$	Single pulse avalanche energy	130	mJ
T_{stg}	Storage temperature	-55 to 175	°C
T_j	Operating junction temperature		

Notes:

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

⁽²⁾ starting $T_j = 25\text{ °C}$, $I_D = 24\text{ A}$, $V_{DD} = 43.5\text{ V}$.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	3.75	°C/W
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	35	

Notes:

⁽¹⁾ When mounted on a 1-inch² FR-4 board, 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	$V_{\text{GS}} = 0\text{ V}$, $I_{\text{D}} = 250\text{ }\mu\text{A}$	60			V
I_{DSS}	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 60\text{ V}$			1	μA
		$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 60\text{ V}$, $T_{\text{case}} = 125\text{ }^{\circ}\text{C}$			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	$V_{\text{DS}} = V_{\text{GS}}$, $I_{\text{D}} = 250\text{ }\mu\text{A}$	1		2.5	V
$R_{\text{DS(on)}}$	Static drain-source on-resistance	$V_{\text{GS}} = 10\text{ V}$, $I_{\text{D}} = 12\text{ A}$		19	25	m Ω
		$V_{\text{GS}} = 4.5\text{ V}$, $I_{\text{D}} = 12\text{ A}$		24	30	

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ISS}	Input capacitance	$V_{\text{DS}} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{\text{GS}} = 0\text{ V}$	-	1320	-	pF
C_{OSS}	Output capacitance		-	88.5	-	
C_{RSS}	Reverse transfer capacitance		-	58	-	
Q_{g}	Total gate charge	$V_{\text{DD}} = 30\text{ V}$, $I_{\text{D}} = 24\text{ A}$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 14: "Gate charge test circuit")	-	26	-	nC
Q_{gs}	Gate-source charge		-	6	-	
Q_{gd}	Gate-drain charge		-	3.3	-	

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{\text{d(on)}}$	Turn-on delay time	$V_{\text{DD}} = 30\text{ V}$, $I_{\text{D}} = 12\text{ A}$, $R_{\text{G}} = 4.7\text{ }\Omega$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 13: "Switching times test circuit for resistive load" and Figure 18: "Switching time waveform")	-	10	-	ns
t_{r}	Rise time		-	19	-	
$t_{\text{d(off)}}$	Turn-off delay time		-	56	-	
t_{f}	Fall time		-	7	-	

Table 7: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		24	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		96	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 24\text{ A}$	-		1.3	V
t_{rr}	Reverse recovery time	$I_{SD} = 24\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 48\text{ V}$, $T_J = 150\text{ °C}$ (see <i>Figure 15: "Test circuit for inductive load switching and diode recovery times")</i>)	-	22.4		ns
Q_{rr}	Reverse recovery charge		-	22.2		nC
I_{RRM}	Reverse recovery current		-	2		A

Notes:

⁽¹⁾ Current is limited by package.

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

2.1 Electrical characteristics (curves)

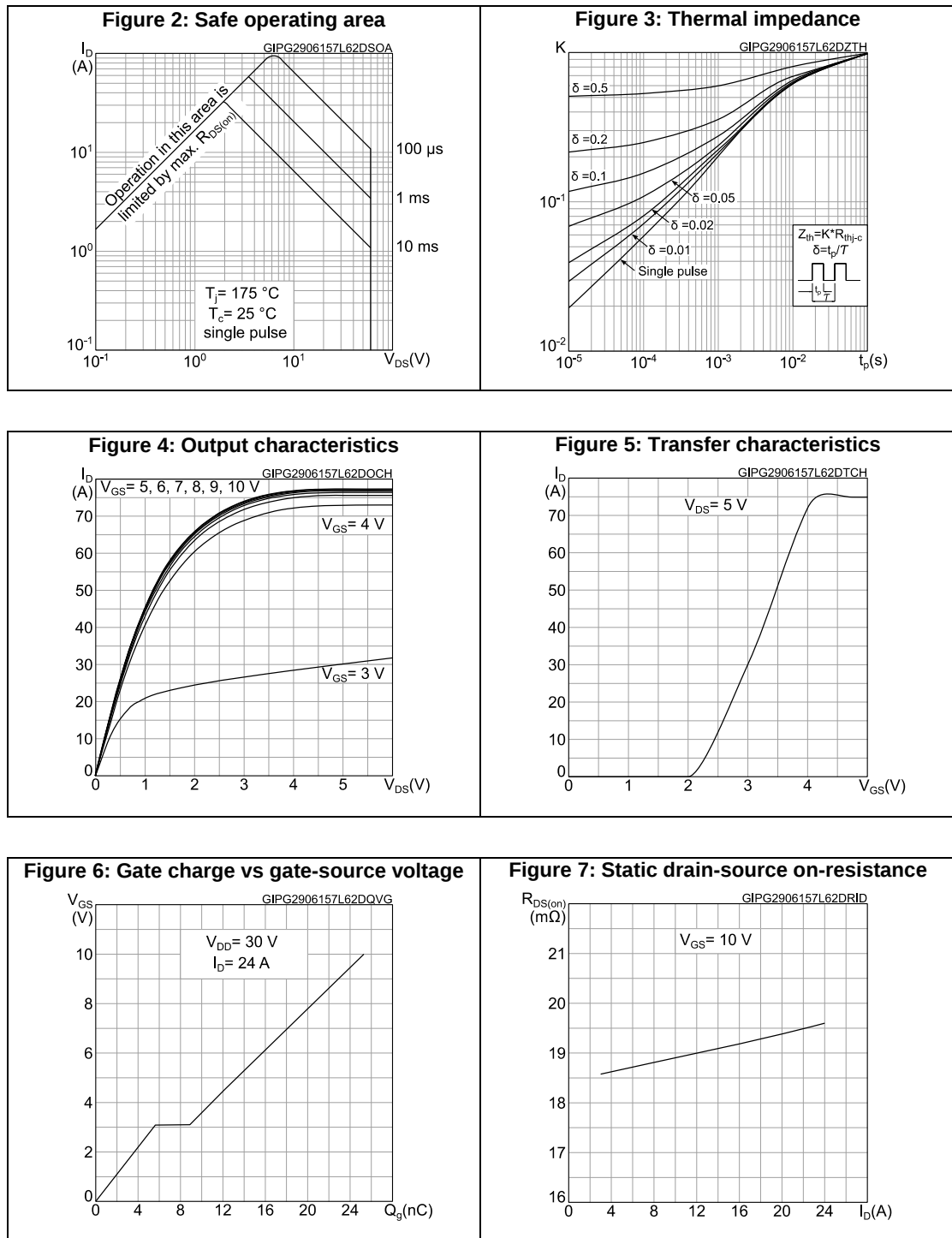


Figure 8: Capacitance variations

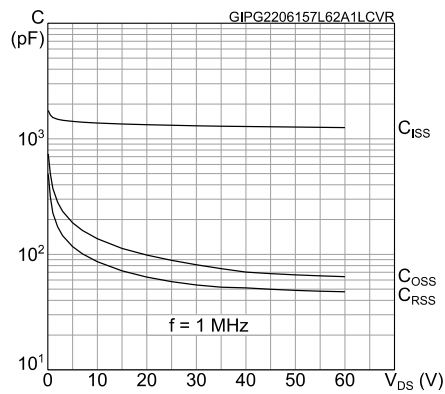


Figure 9: Normalized gate threshold voltage vs temperature

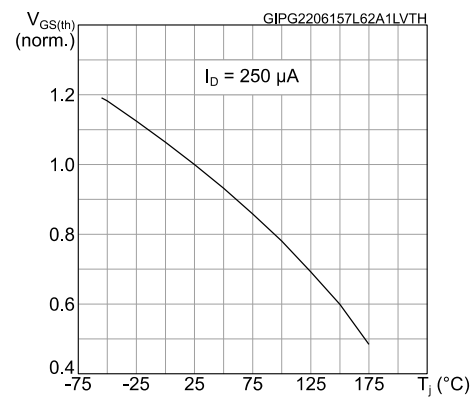


Figure 10: Normalized on-resistance vs temperature

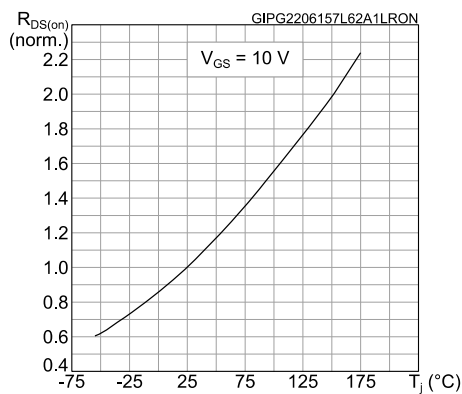


Figure 11: Normalized V(BR)DSS vs temperature

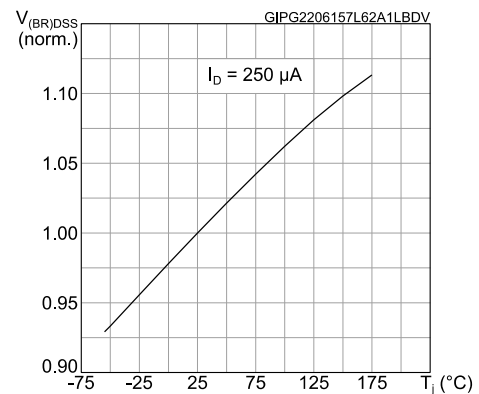
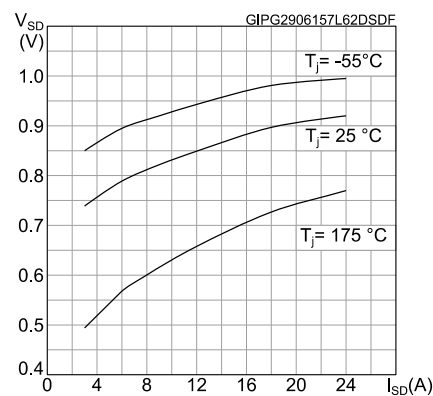
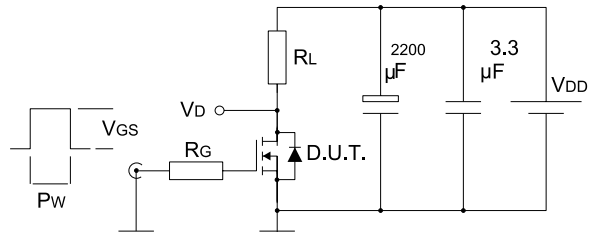


Figure 12: Source-drain diode forward characteristics



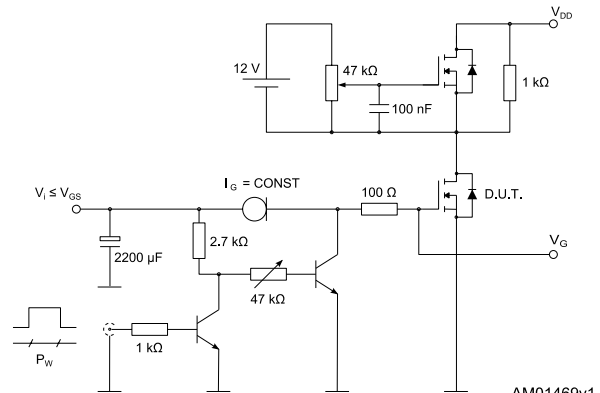
3 Test circuits

Figure 13: Switching times test circuit for resistive load



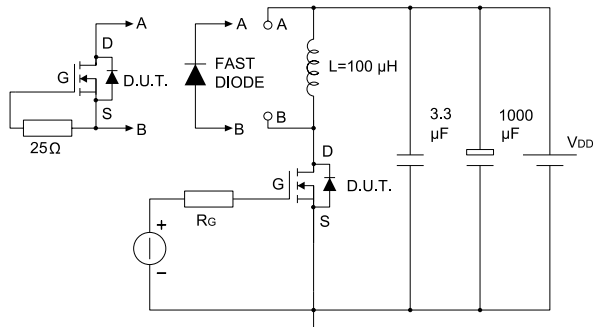
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Figure 14: Gate charge test circuit



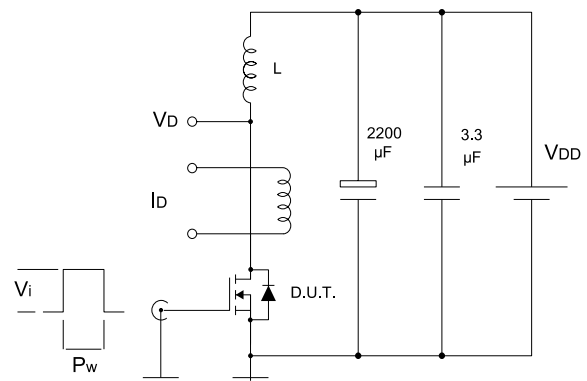
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Figure 15: Test circuit for inductive load switching and diode recovery times



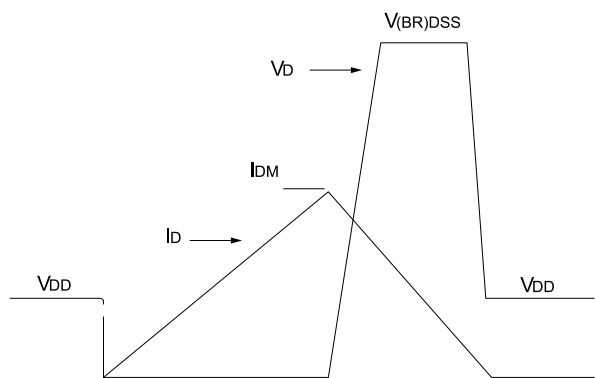
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Figure 16: Unclamped inductive load test circuit



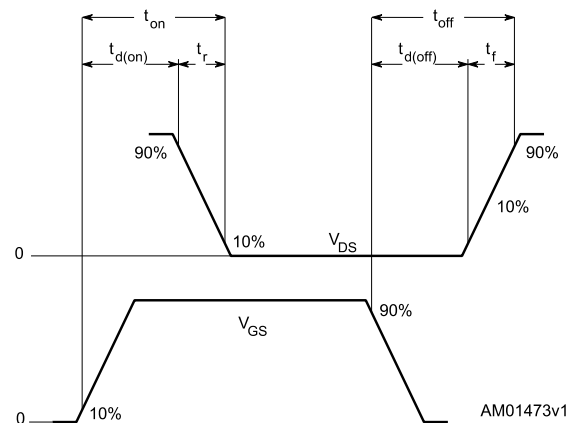
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Figure 17: Unclamped inductive waveform



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 (TO-252) type A package information

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

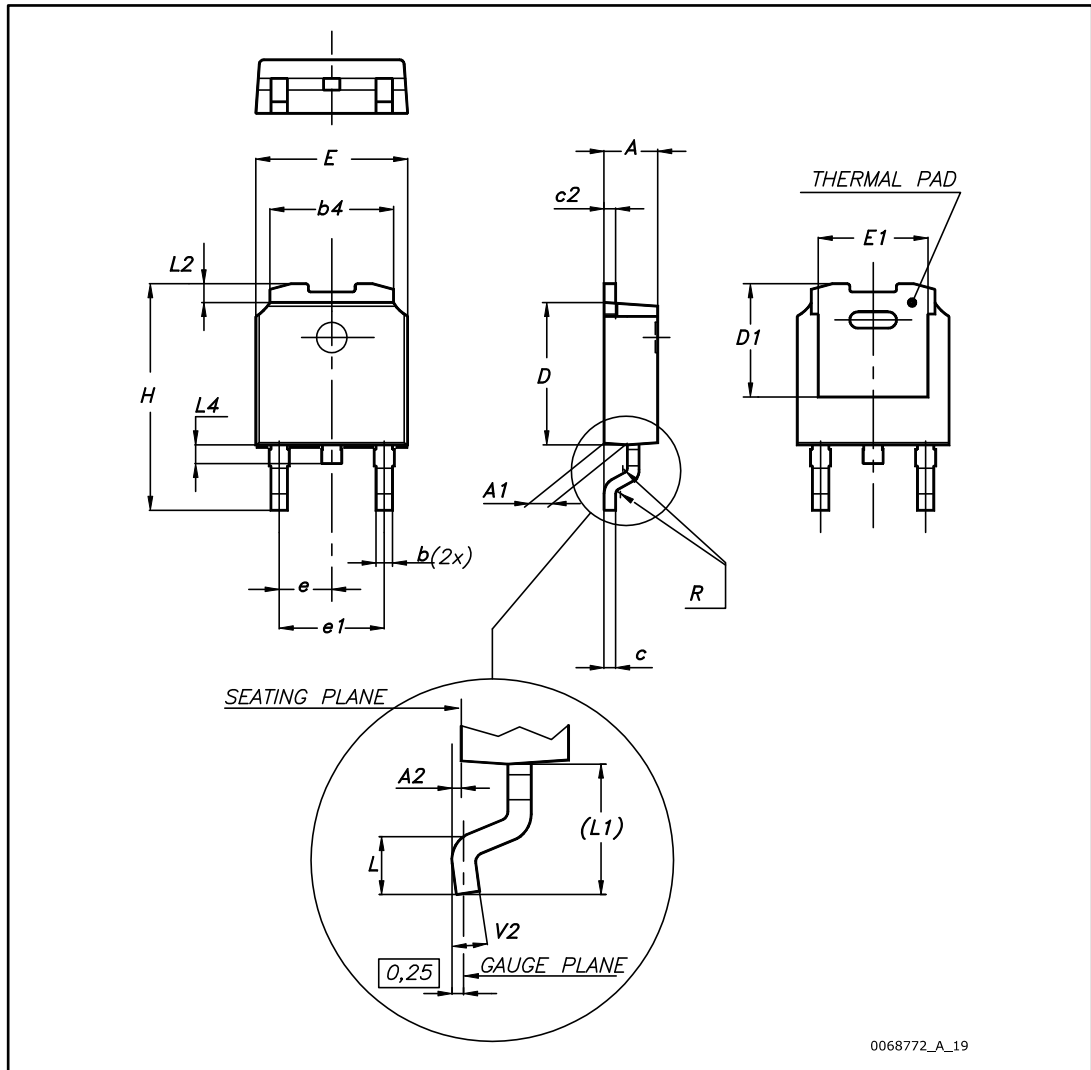
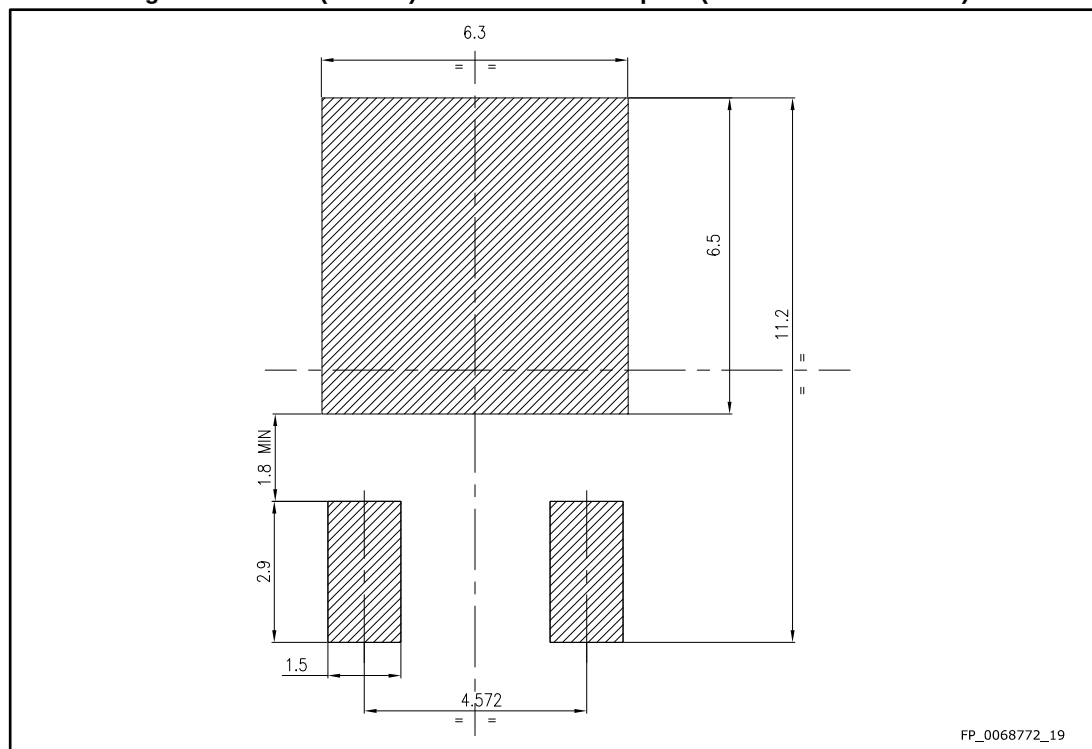


Table 8: DPAK (TO-252) type A mechanical data

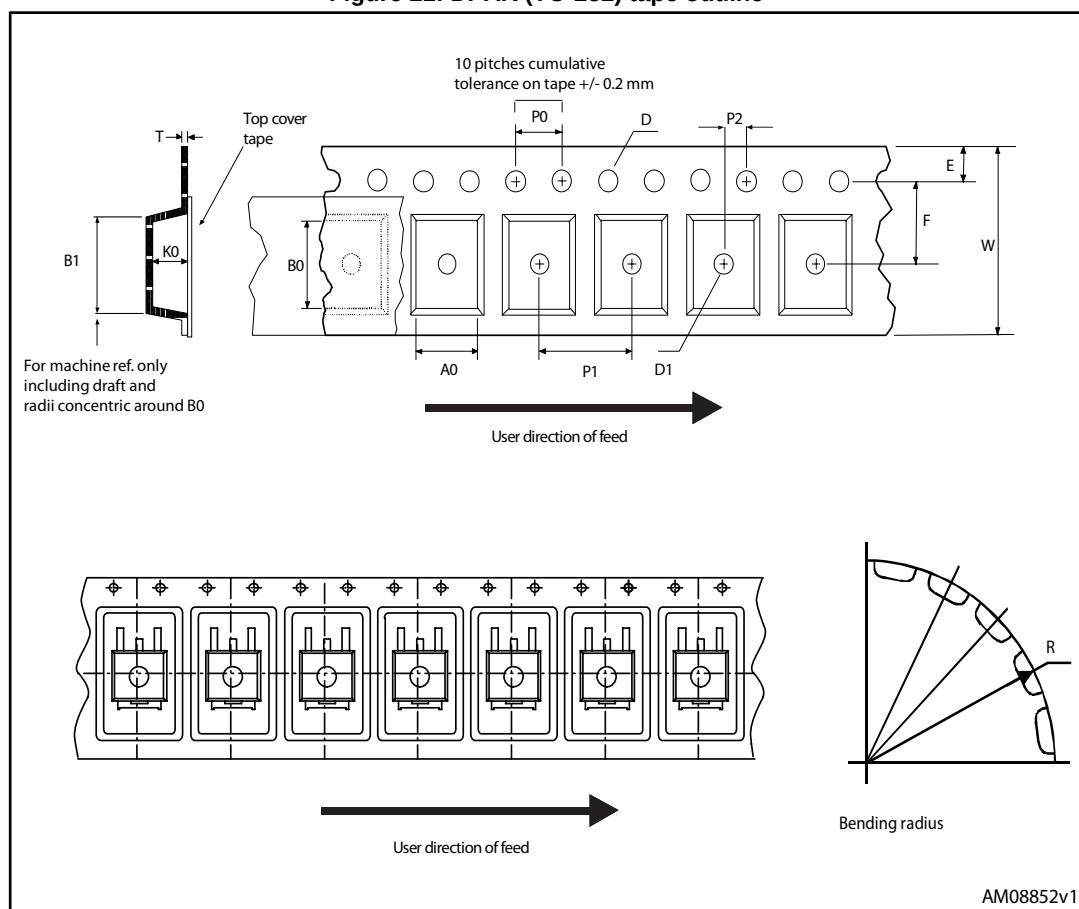
Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1	4.95	5.10	5.25
E	6.40		6.60
E1	4.60	4.70	4.80
e	2.16	2.28	2.40
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
(L1)	2.60	2.80	3.00
L2	0.65	0.80	0.95
L4	0.60		1.00
R		0.20	
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



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:** Diameter of the central hub.
- C:** Diameter of the tape slot.
- D:** Diameter of the inner core.
- E:** Diameter of the tape slot.
- F:** Diameter of the inner core.
- G:** Diameter of the tape slot.
- H:** Diameter of the inner core.
- I:** Diameter of the tape slot.
- J:** Diameter of the inner core.
- K:** Diameter of the tape slot.
- L:** Diameter of the inner core.
- M:** Diameter of the tape slot.
- N:** Diameter of the inner core.
- O:** Diameter of the tape slot.
- P:** Diameter of the inner core.
- Q:** Diameter of the tape slot.
- R:** Diameter of the inner core.
- S:** Diameter of the tape slot.
- T:** Diameter of the inner core.

Side View Dimensions:

- U:** Thickness of the tape.
- V:** Thickness of the tape.
- W:** Thickness of the tape.
- X:** Thickness of the tape.
- Y:** Thickness of the tape.
- Z:** Thickness of the tape.
- AA:** Thickness of the tape.
- AB:** Thickness of the tape.
- AC:** Thickness of the tape.
- AD:** Thickness of the tape.
- AE:** Thickness of the tape.
- AF:** Thickness of the tape.
- AG:** Thickness of the tape.
- AH:** Thickness of the tape.
- AI:** Thickness of the tape.
- AJ:** Thickness of the tape.
- AK:** Thickness of the tape.
- AL:** Thickness of the tape.
- AM:** Thickness of the tape.
- AN:** Thickness of the tape.
- AO:** Thickness of the tape.
- AP:** Thickness of the tape.
- AQ:** Thickness of the tape.
- AR:** Thickness of the tape.
- AS:** Thickness of the tape.
- AT:** Thickness of the tape.

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
30-Jun-2015	1	First release.

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