

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

Datasheet - production data

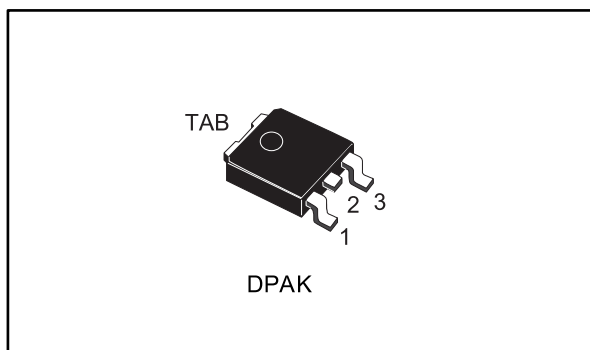
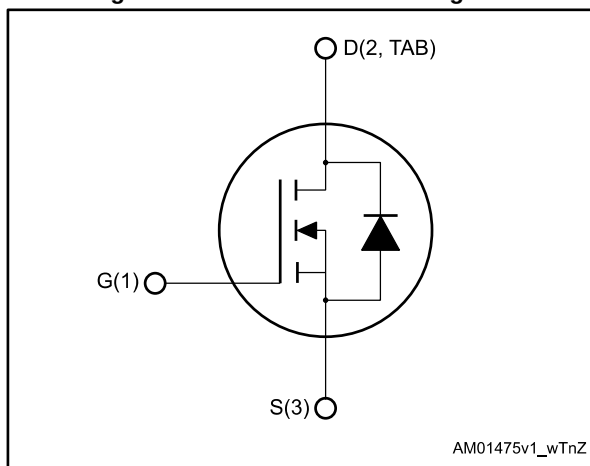


Figure 1: Internal schematic diagram



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

Contents

1	Electrical ratings	3
2	Electrical characteristics	4
	2.1 Electrical characteristics (curves).....	6
3	Test circuits	8
4	Package information	9
	4.1 DPAK (TO-252) type A package information.....	9
	4.2 DPAK (TO-252) packing information.....	12
5	Revision history	14

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 $T_{case} = 25\text{ }^{\circ}\text{C}$ ⁽¹⁾	54	A
	Drain current (continuous) at $T_{case} = 100\text{ }^{\circ}\text{C}$	46	
I_{DM} ⁽²⁾	Drain current (pulsed)	216	A
P_{TOT}	Total dissipation at $T_{case} = 25\text{ }^{\circ}\text{C}$	60	W
T_{stg}	Storage temperature	-55 to 175	$^{\circ}\text{C}$
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	$^{\circ}\text{C/W}$
$R_{thj-pcb}$ ⁽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 $T_j = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AS}$, $V_{DD} = 25\text{ V}$.

2 Electrical characteristics

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

Table 5: Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	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
		$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 40\text{ V}$, $T_{\text{case}} = 125\text{ °C}$			10	
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	$V_{\text{DS}} = V_{\text{GS}}$, $I_{\text{D}} = 250\text{ }\mu\text{A}$	2		4.5	V
$R_{\text{DS(on)}}$	Static drain-source on-resistance	$V_{\text{GS}} = 10\text{ V}$, $I_{\text{D}} = 27\text{ A}$		7	8.2	m Ω

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{\text{DS}} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{\text{GS}} = 0\text{ V}$	-	2415	-	pF
C_{oss}	Output capacitance		-	232	-	
C_{rss}	Reverse transfer capacitance		-	170	-	
Q_{g}	Total gate charge	$V_{\text{DD}} = 20\text{ V}$, $I_{\text{D}} = 54\text{ A}$, $V_{\text{GS}} = 10\text{ V}$ (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
$t_{\text{d(on)}}$	Turn-on delay time	$V_{\text{DD}} = 20\text{ V}$, $I_{\text{D}} = 27\text{ A}$ $R_{\text{G}} = 4.7\text{ }\Omega$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 13: "Switching times test circuit for resistive load" and Figure 18: "Switching time waveform")	-	21.2	-	ns
t_{r}	Rise time		-	113	-	
$t_{\text{d(off)}}$	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)

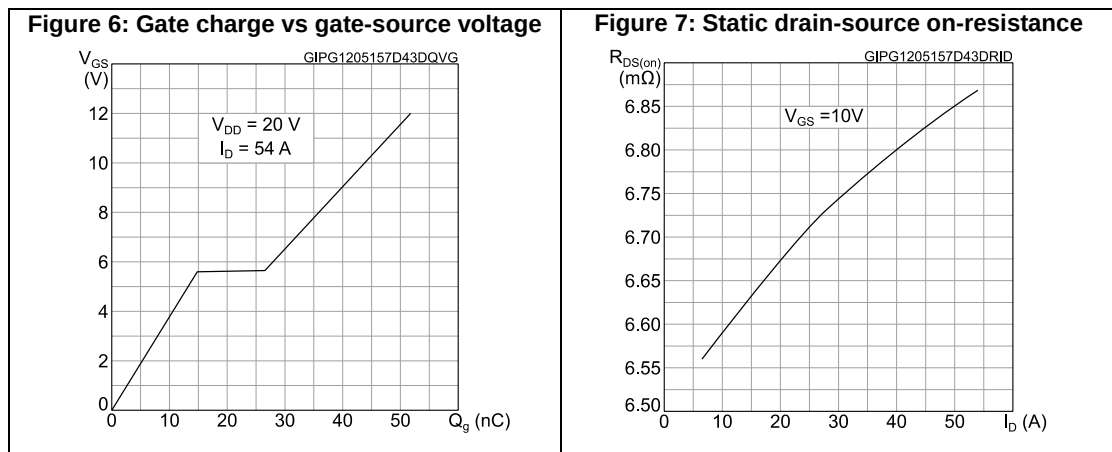
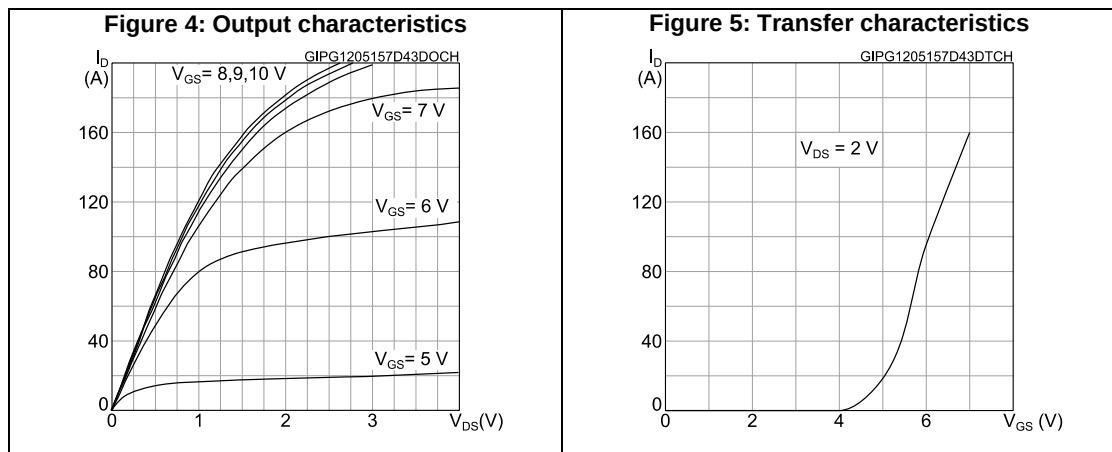
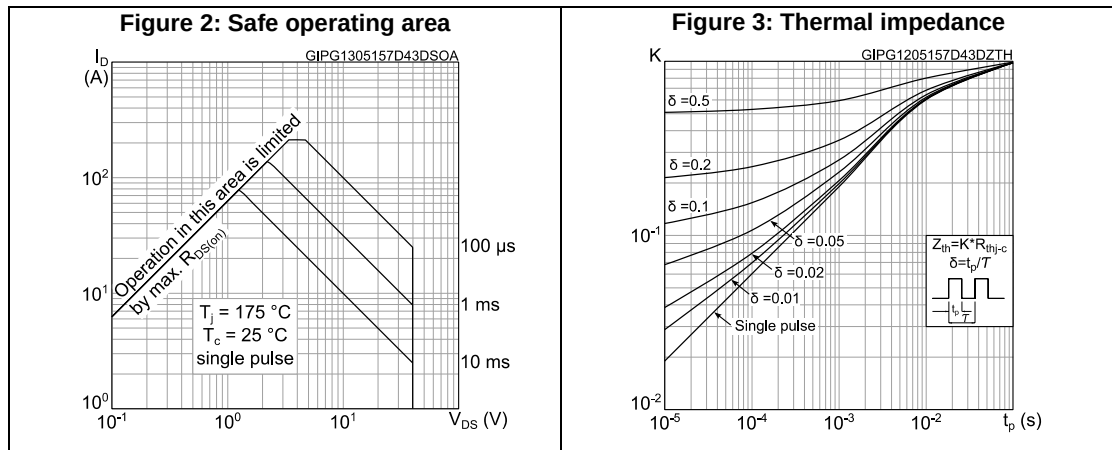


Figure 8: Capacitance variations

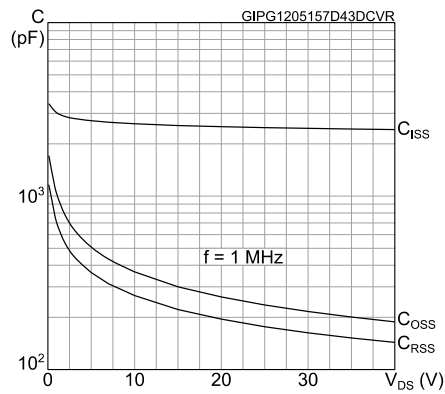


Figure 9: Normalized gate threshold voltage vs temperature

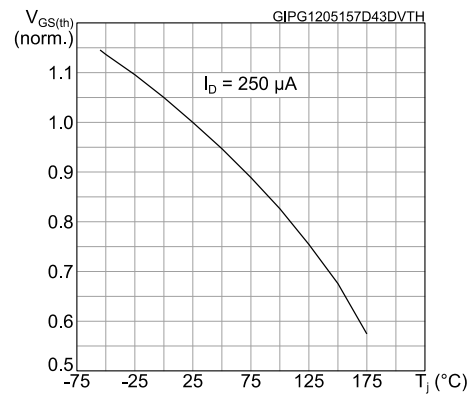


Figure 10: Normalized on-resistance vs temperature

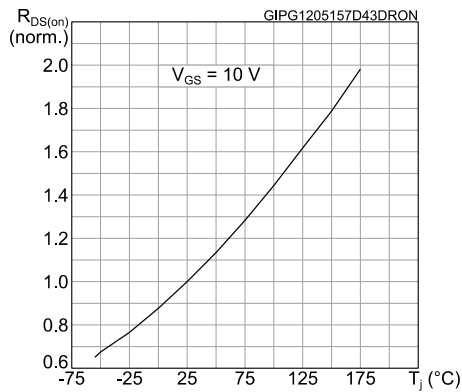


Figure 11: Normalized V(BR)DSS vs temperature

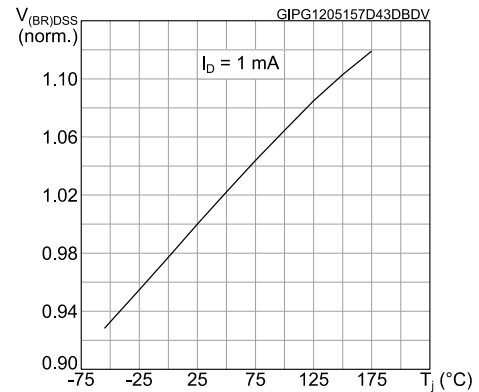
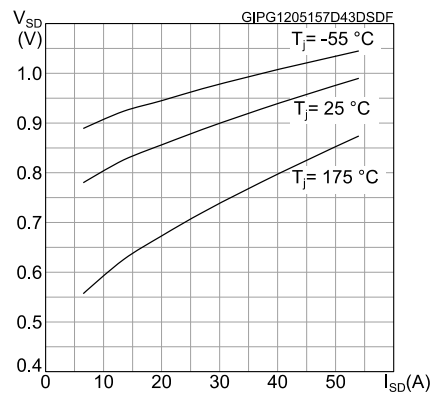
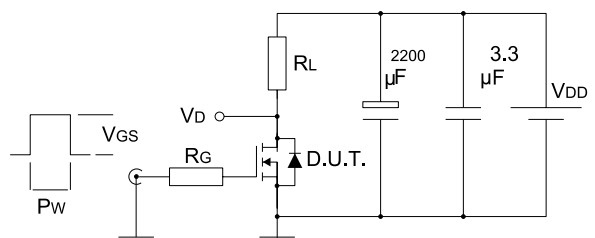


Figure 12: Source-drain diode forward characteristics



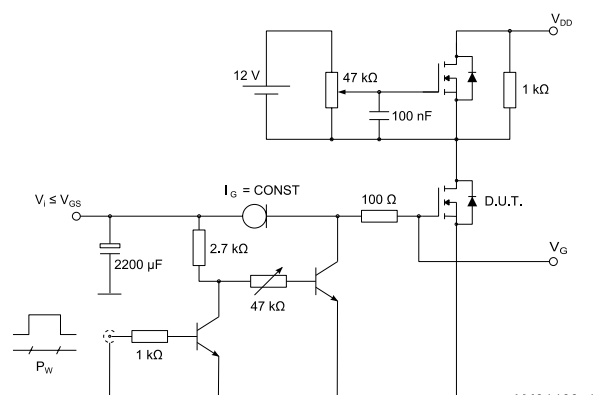
3 Test circuits

Figure 13: Switching times test circuit for resistive load



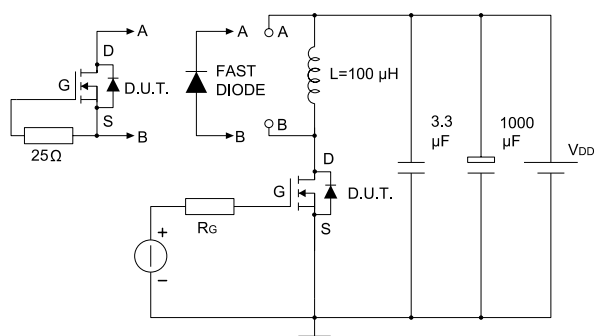
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Figure 14: Gate charge test circuit



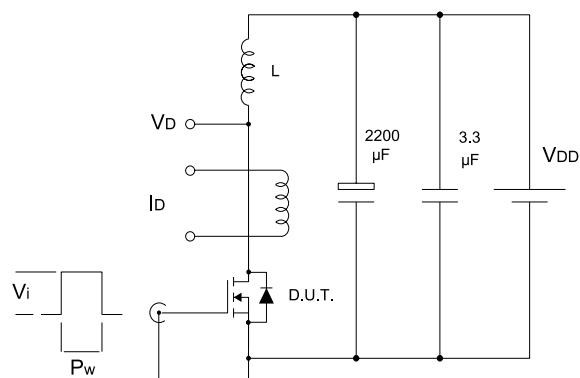
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Figure 15: Test circuit for inductive load switching and diode recovery times



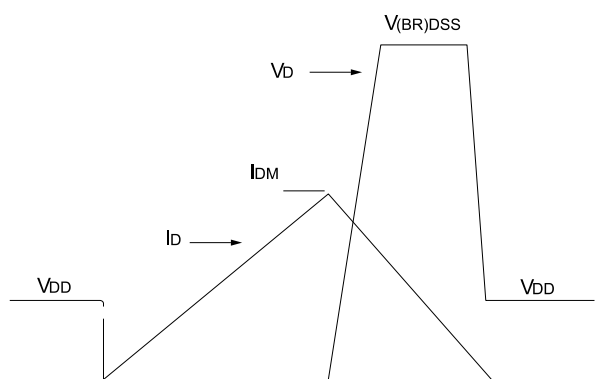
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Figure 16: Unclamped inductive load test circuit



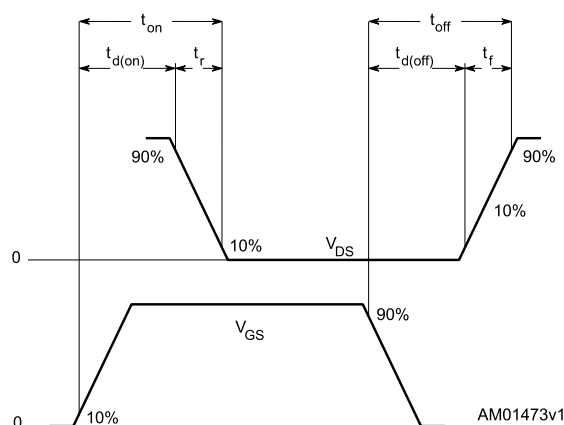
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Figure 17: Unclamped inductive waveform



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

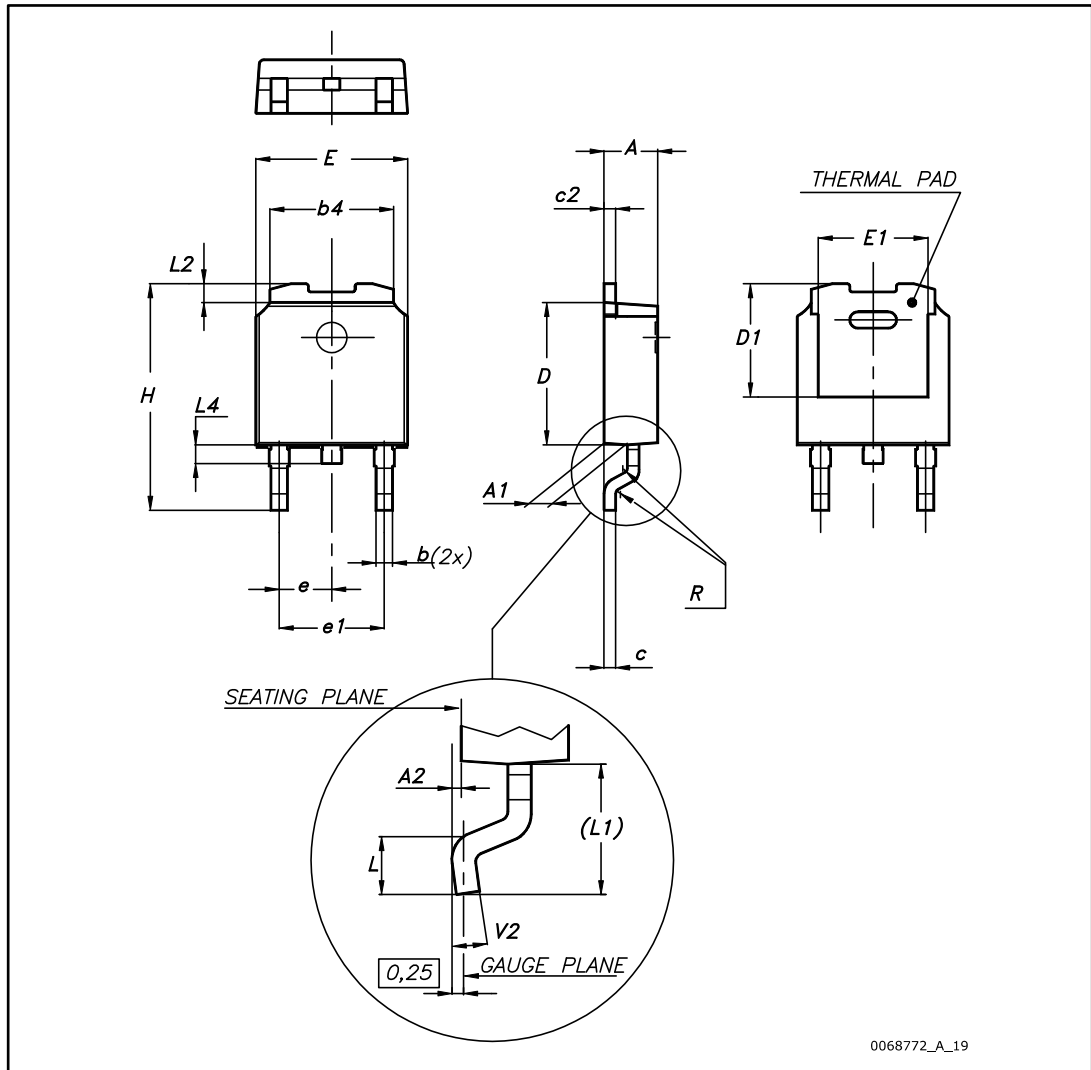
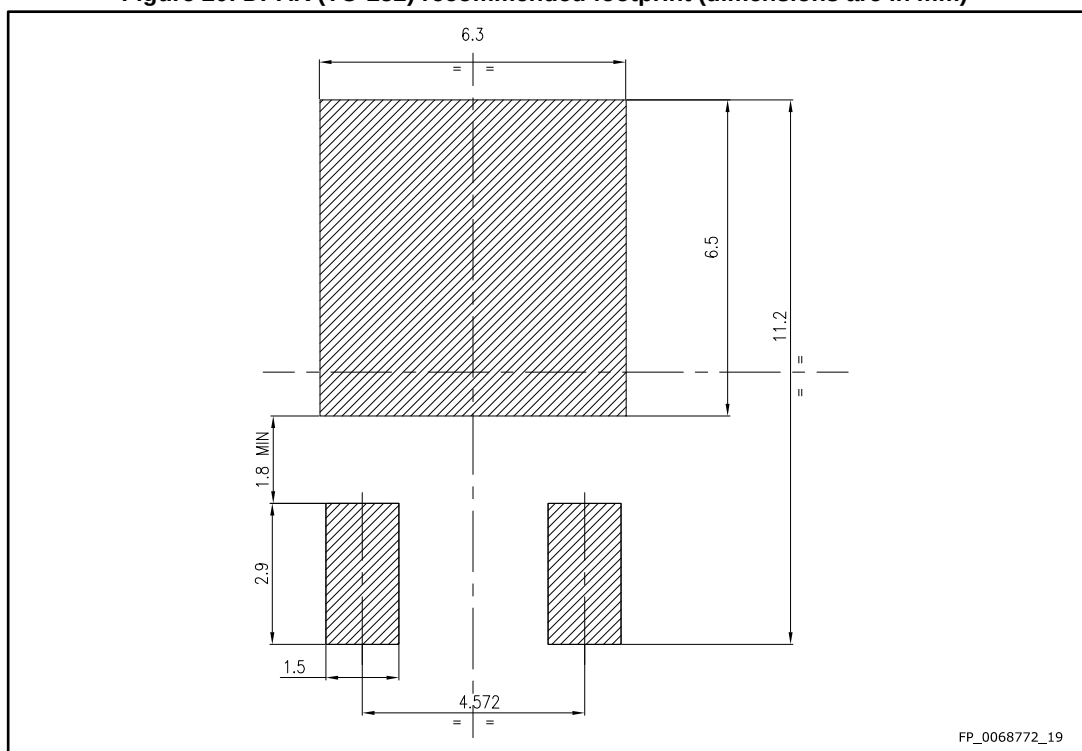


Table 9: DPAK (TO-252) type A mechanical data

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

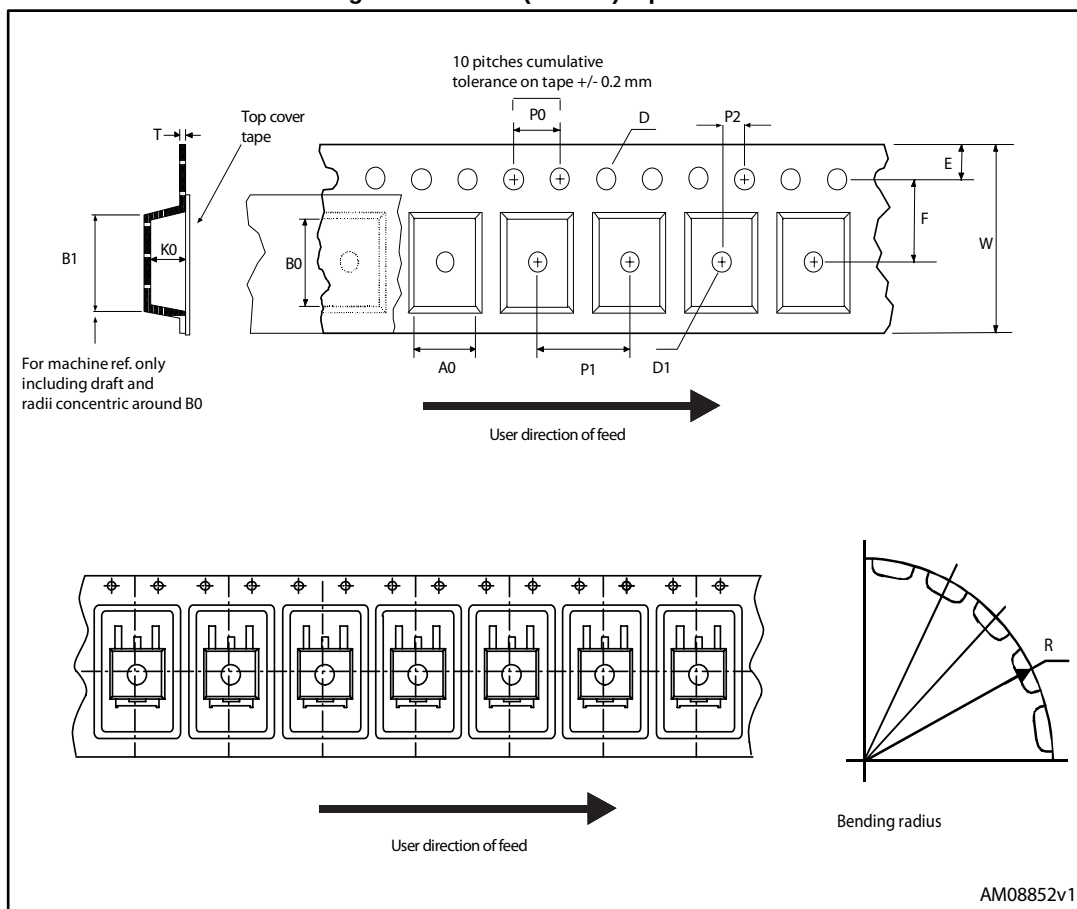


Figure 22: DPAK (TO-252) reel outline

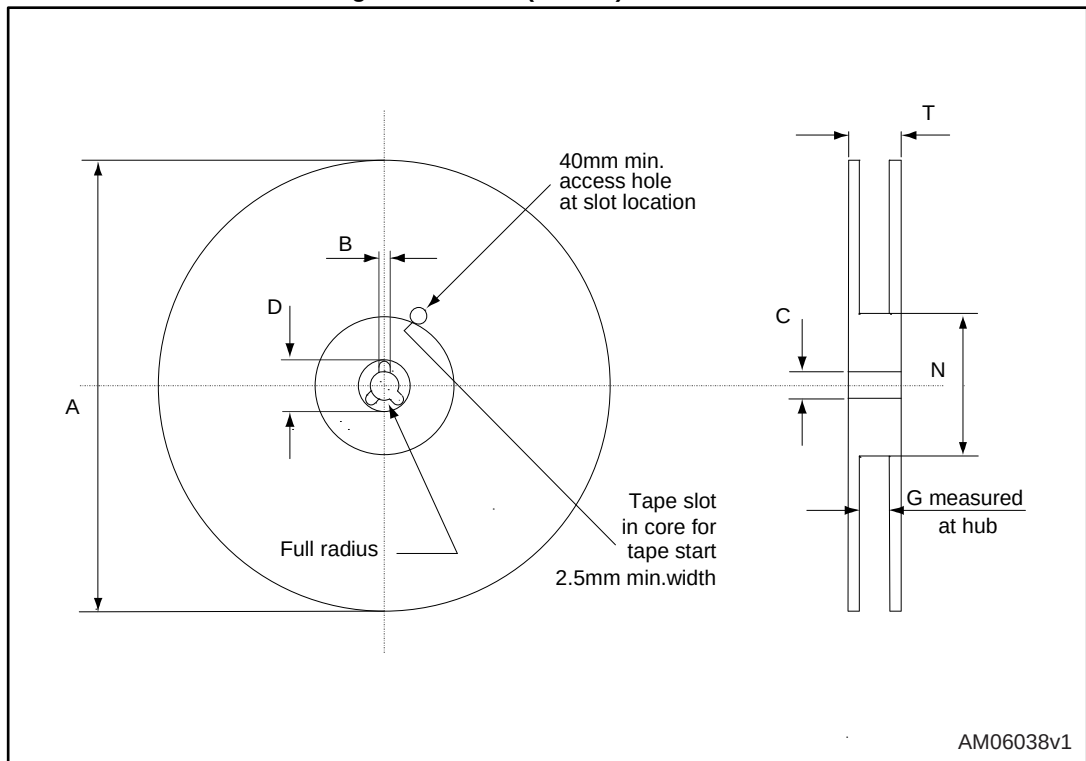


Table 10: DPAK (TO-252) tape and reel mechanical data

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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