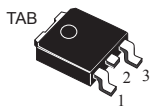
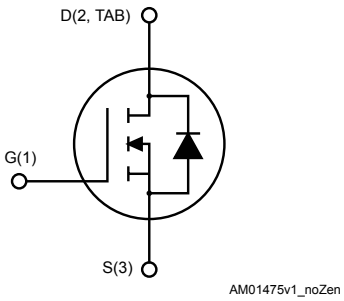
Datasheet

Automotive-grade N-channel 60 V, 32 mΩ typ., 24 A, STripFET II Power MOSFET in a DPAK package



DPAK



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D	P_{TOT}
STD20NF06LAG	60 V	40 mΩ	24 A	60 W

- AEC-Q101 qualified
- Exceptional dv/dt capability
- 100% avalanche tested
- Low gate charge

Applications

- Switching applications

Description

This Power MOSFET has been developed using STMicroelectronics' unique STripFET process, which is specifically designed to minimize input capacitance and gate charge. This renders the device suitable for use as primary switch in advanced high-efficiency isolated DC-DC converters for telecom and computer applications, and applications with low gate charge driving requirements.

Product status link
STD20NF06LAG

Product summary	
Order code	STD20NF06LAG
Marking	D20NF06L
Package	DPAK
Packing	Tape and reel

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	60	V
V_{GS}	Gate-source voltage	±18	V
I_D	Drain current (continuous) at T_{case} = 25 °C	24	A
	Drain current (continuous) at T_{case} = 100 °C	17	
I_{DM}(1)	Drain current (pulsed)	96	A
P_{TOT}	Total power dissipation at T_{case} = 25 °C	60	W
dv/dt(2)	Peak diode recovery voltage slope	10	V/ns
E_{AS}(3)	Single pulse avalanche energy	225	mJ
T_{stg}	Storage temperature range	-55 to 175	°C
T_j	Operating junction temperature range		

1. *Pulse width is limited by safe operating area.*
2. *I_{SD} ≤ 24 A, di/dt ≤ 300 A/ns, V_{DD} = 80% $V_{(BR)DSS}$*
3. *Starting T_j = 25°C, I_D = 14 A, V_{DD} = 60 V.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	2.5	°C/W
$R_{thj\text{-}pcb}$(1)	Thermal resistance junction-pcb	50	

1. *When mounted on a 1-inch² FR-4, 2 Oz copper board.*

2 Electrical characteristics

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

Table 3. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = 0 V, I_D = 250 µA	60			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_{case} = 125 °C(1)			10	
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = ±18 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	1		2.5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 12 A		32	40	mΩ
		V_{GS} = 5 V, I_D = 12 A			50	

1. *Defined by design, not subject to production test.*

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0 V	-	660	-	pF
C_{oss}	Output capacitance		-	170	-	
C_{rss}	Reverse transfer capacitance		-	70	-	
Q_g	Total gate charge	V_{DD} = 30 V, I_D = 20 A, V_{GS} = 5 V (see Figure 12. Test circuit for gate charge behavior)	-	13	-	nC
Q_{gs}	Gate-source charge		-	3.5	-	
Q_{gd}	Gate-drain charge		-	8	-	

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 30 V, I_D = 10 A, R_G = 4.7 Ω, V_{GS} = 5 V (see Figure 11. Test circuit for resistive load switching times and Figure 16. Switching time waveform)	-	11	-	ns
t_r	Rise time		-	50	-	
$t_{d(off)}$	Turn-off delay time		-	20	-	
t_f	Fall time		-	12	-	

Table 6. 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 V, I_{SD} = 24 A	-		1.5	V
t_{rr}	Reverse recovery time	I_{SD} = 20 A, di/dt = 100 A/µs,	-	56		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 20 V, T_J = 150 °C	-	108		nC
I_{RRM}	Reverse recovery current	(see Figure 13. Test circuit for inductive load switching and diode recovery times)	-	4		A

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 1. Safe operating area

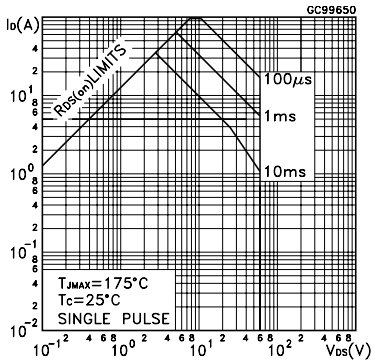


Figure 2. Thermal impedance

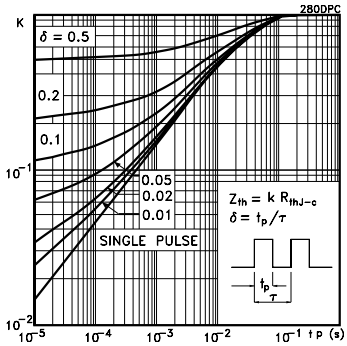


Figure 3. Output characteristics

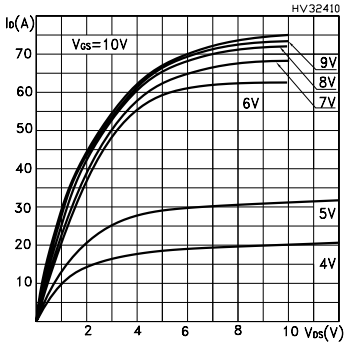


Figure 4. Transfer characteristics

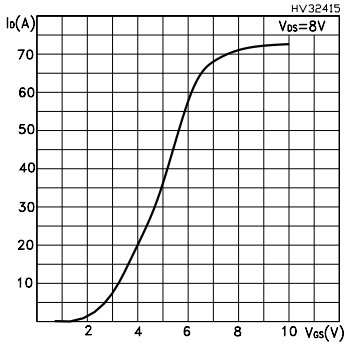


Figure 5. Gate charge vs gate-source voltage

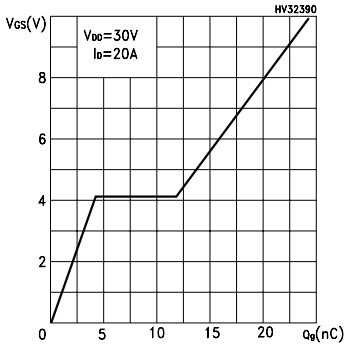


Figure 6. Static drain-source on-resistance

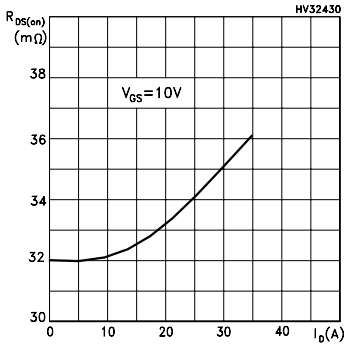


Figure 7. Capacitance variations

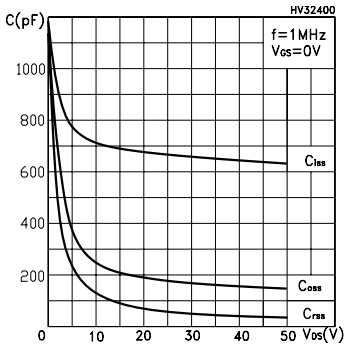


Figure 8. Normalized gate threshold voltage vs temperature

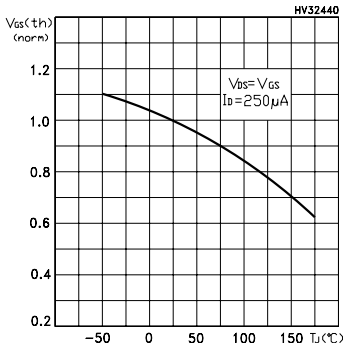


Figure 9. Normalized on-resistance vs temperature

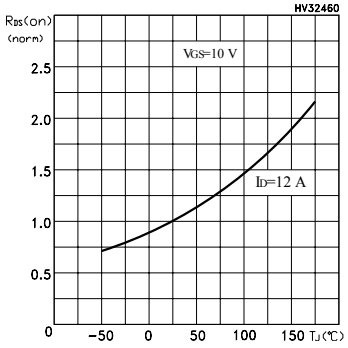
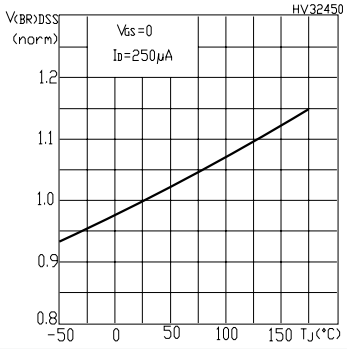


Figure 10. Normalized $V_{(BR)DSS}$ vs temperature



3 Test circuits

Figure 11. Test circuit for resistive load switching times

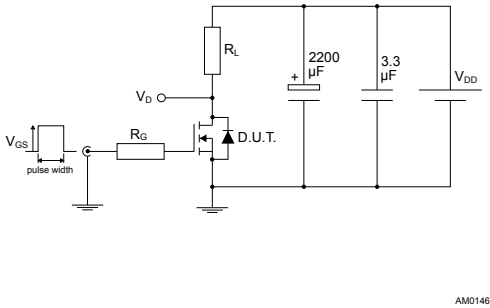


Figure 12. Test circuit for gate charge behavior

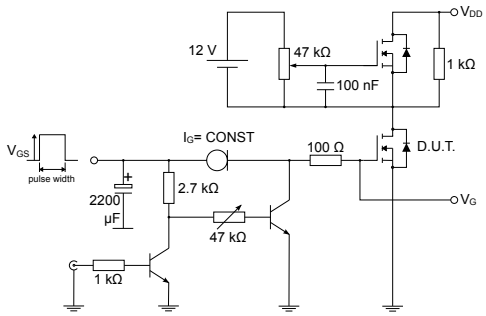


Figure 13. Test circuit for inductive load switching and diode recovery times

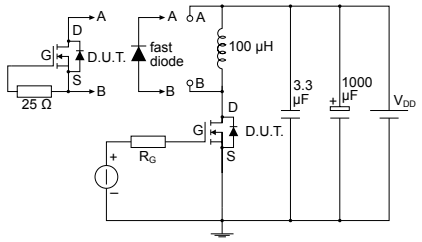


Figure 14. Unclamped inductive load test circuit

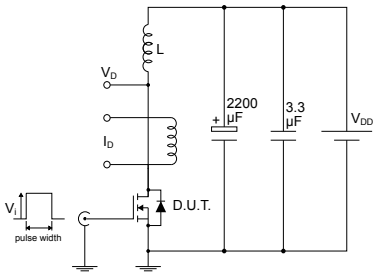


Figure 15. Unclamped inductive waveform

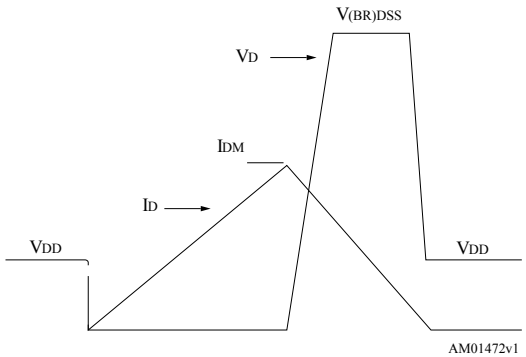
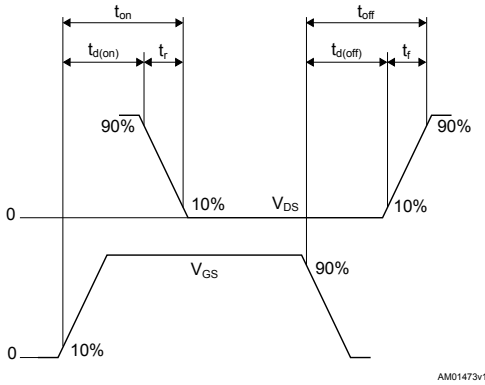


Figure 16. Switching time waveform



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 17. **DPAK (TO-252) type A package outline**

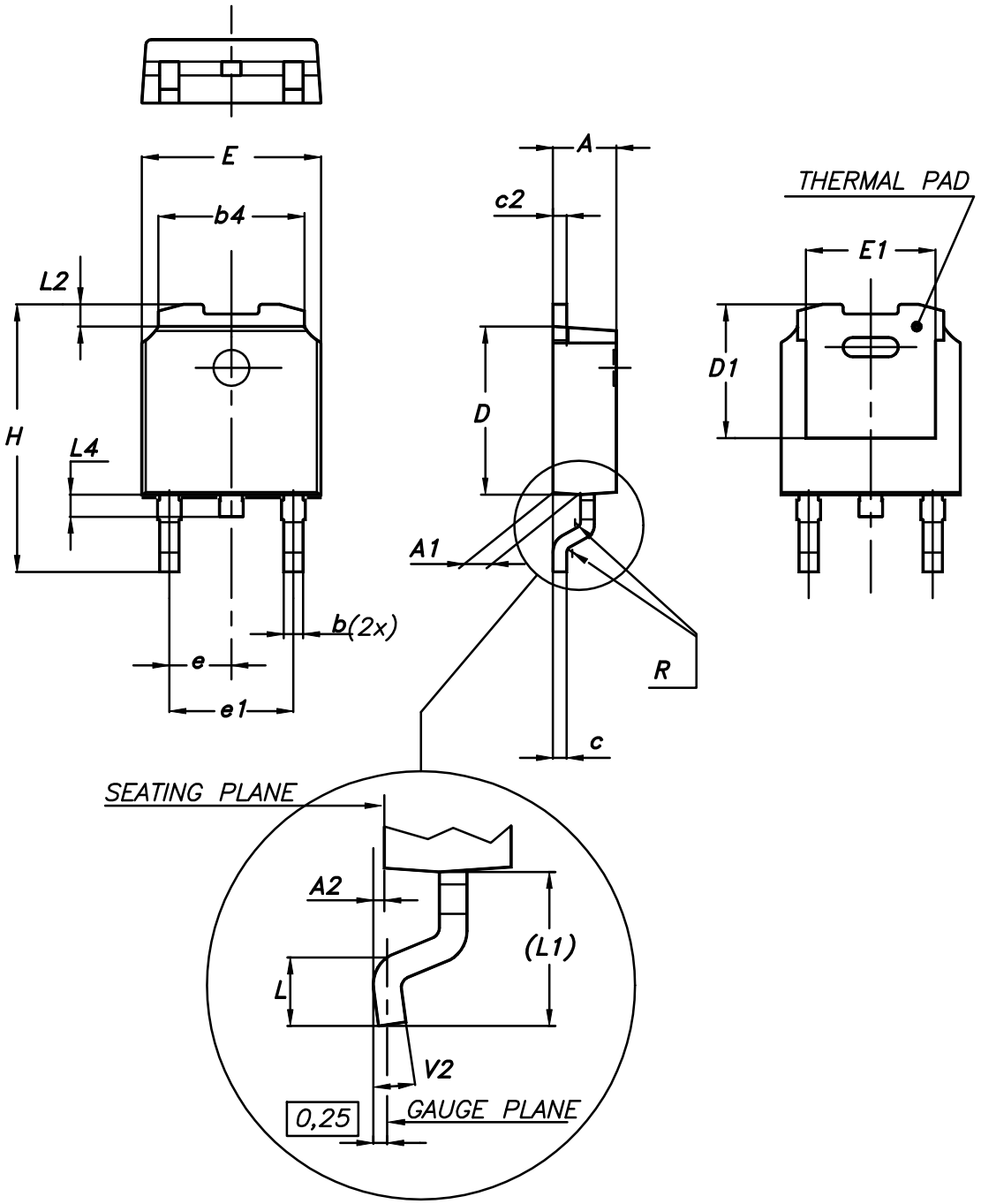


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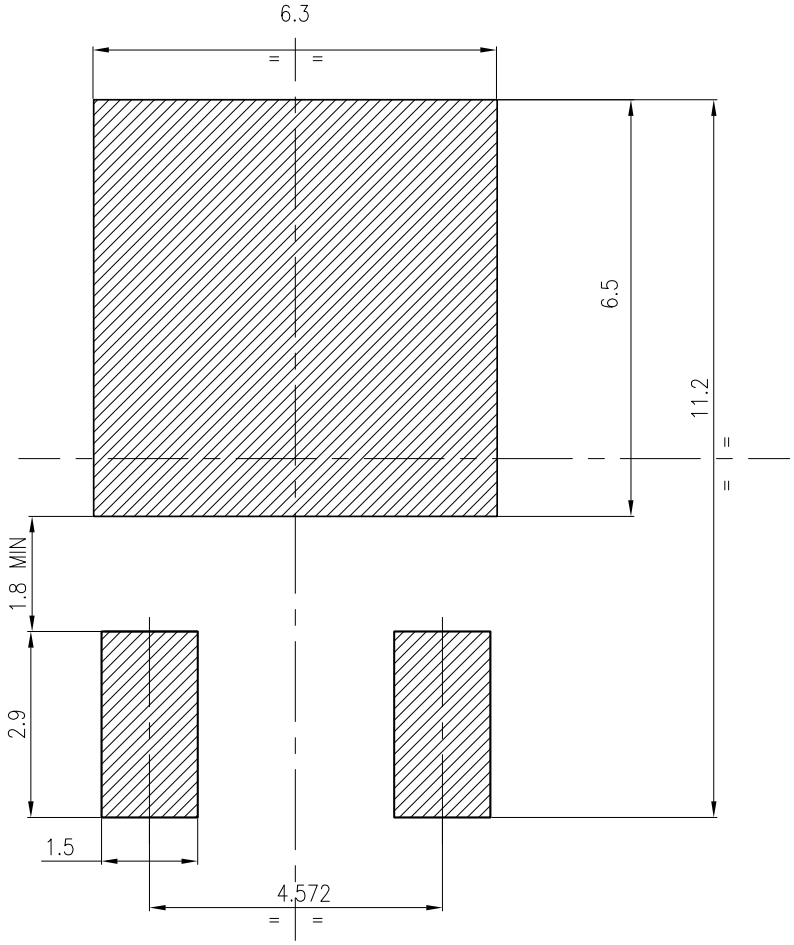
Table 7. **DPAK (TO-252) type A mechanical data**

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	2.159	2.286	2.413
e1	4.445	4.572	4.699
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 18. **DPAK (TO-252) type A recommended footprint (dimensions are in mm)**



4.2 DPAK (TO-252) packing information

Figure 19. **DPAK (TO-252) tape outline**

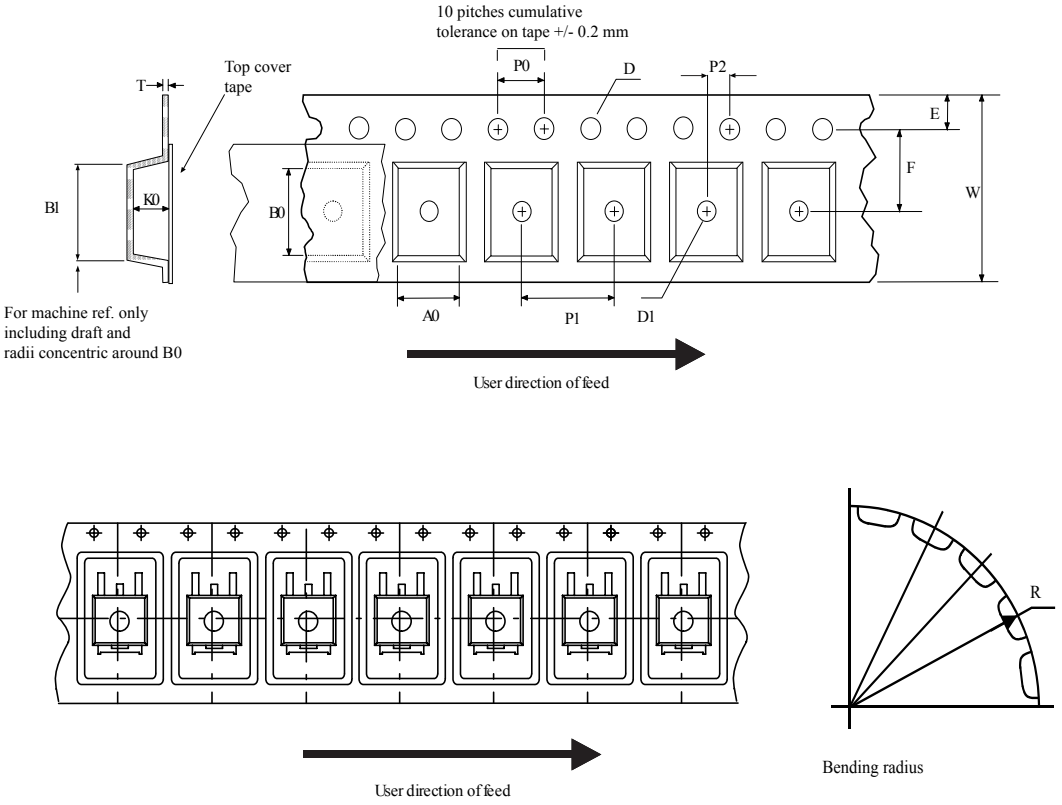


Figure 20. **DPAK (TO-252) reel outline**

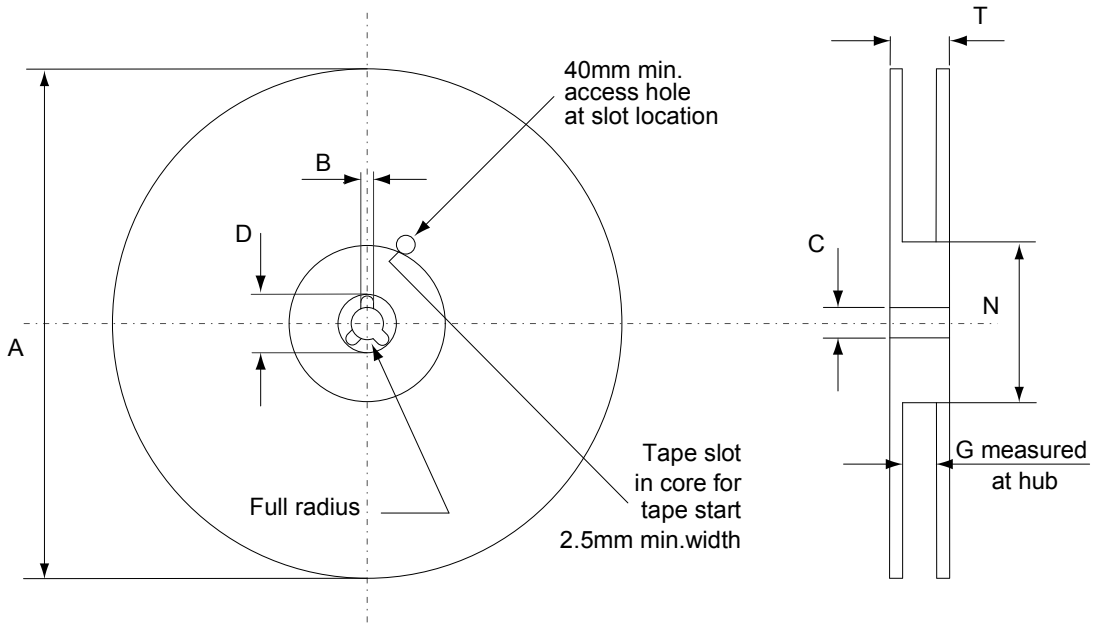


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Table 8. **DPAK (TO-252) tape and reel mechanical data**

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			

Revision history

Table 9. Document revision history

Date	Revision	Changes
25-Oct-2016	1	First release.
20-Mar-2017	2	Modified *Table 2: "Absolute maximum ratings"*, *Table 5: "Dynamic"*, *Table 6: "Switching times"* and *Table 7: "Source-drain diode"*. Modified *Figure 2: "Safe operating area"* and *Figure 10: "Normalized on-resistance vs temperature"*. Minor text changes
01-Oct-2019	3	Updated marking on cover page. Updated Table 2. Thermal data. Minor text changes

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