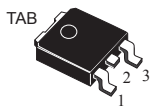
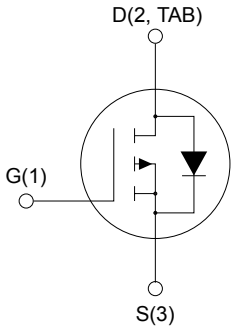
P-channel 30 V, 10 mΩ typ., 52 A, STripFET H6 Power MOSFET in a DPAK package



DPAK



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Features

Order codes	V_{DSS}	$R_{DS(on)}$ max	I_D	P_{TOT}
STD52P3LLH6	30 V	12 mΩ	52 A	70 W

- 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 H6 technology with a new trench gate structure. The resulting Power MOSFET exhibits very low $R_{DS(on)}$ in all packages.

Product status link
STD52P3LLH6

Product summary	
Order code	STD52P3LLH6
Marking	52P3LLH6
Package	DPAK
Packing	Tape and reel

Note: For the P-channel Power MOSFETs the actual polarity of the voltages and the current must be reversed.

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	30	V
V_{GS}	Gate-source voltage	±20	V
I_D	Drain current (continuous) at T_C = 25 °C	52	A
	Drain current (continuous) at T_C = 100 °C	37.5	A
I_{DM} (1)	Drain current (pulsed)	208	A
P_{TOT}	Total power dissipation at T_C = 25 °C	70	W
T_{stg}	Storage temperature	-55 to 175	°C
T_J	Max. operating junction temperature	175	°C

1. *Pulse width limited by safe operating area.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max	2.14	°C/W

Note: For the P-channel Power MOSFETs the actual polarity of the voltages and the current must be reversed.

2 Electrical characteristics

(T_C = 25 °C unless otherwise specified)

Table 3. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown Voltage	I_D = 250 µA, V_{GS} = 0 V	30			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 30 V			1	µA
		V_{GS} = 0 V, V_{DS} = 30 V, T_C = 125 °C			10	µA
I_{GSS}	Gate-body leakage current	V_{GS} = ±20 V, V_{DS} = 0 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 = 26 A		10	12	mΩ
		V_{GS} = 4.5 V, I_D = 26 A		14	17	mΩ

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	-	3350	-	pF
C_{oss}	Output capacitance		-	414	-	pF
C_{rss}	Reverse transfer capacitance		-	287	-	pF
Q_g	Total gate charge	V_{DD} = 15 V, I_D = 52 A, V_{GS} = 4.5 V (see Figure 13. Gate charge test circuit)	-	33	-	nC
Q_{gs}	Gate-source charge		-	14	-	nC
Q_{gd}	Gate-drain charge		-	11	-	nC

Table 5. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 24 V, I_D = 15 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 12. Switching times test circuit for resistive load)	-	12.8	-	ns
t_r	Rise time		-	112	-	ns
$t_{d(off)}$	Turn-off delay time		-	61	-	ns
t_f	Fall time		-	45	-	ns

Note: For the P-channel Power MOSFETs the actual polarity of the voltages and the current must be reversed.

Table 6. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{SD} (1)	Forward on voltage	I_{SD} = 52 A, V_{GS} = 0 V	-		1.1	V
t_{rr}	Reverse recovery time	I_{SD} = 52 A, di/dt = 100 A/µs, V_{DD} = 24 V (see Figure 14. Test circuit for inductive load switching and diode recovery times)	-	25.2		ns
Q_{rr}	Reverse recovery charge		-	17.4		nC
I_{RRM}	Reverse recovery current		-	1.4		A

1. *Pulsed: pulse duration = 300 µs, duty cycle 1.5%.*

Note: For the P-channel Power MOSFETs the actual polarity of the voltages and the current must be reversed.

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

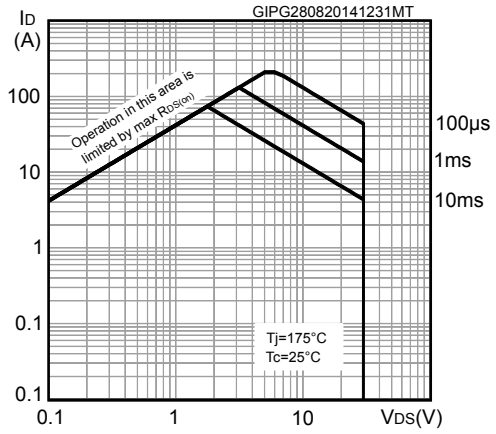


Figure 2. Thermal impedance

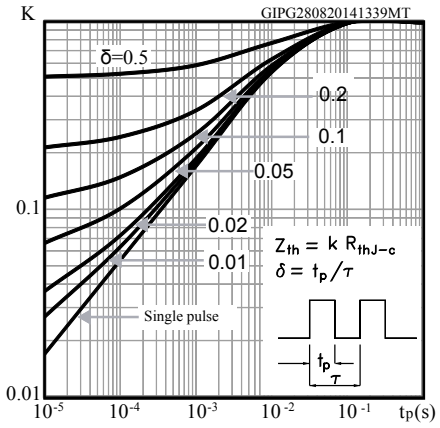


Figure 3. Output characteristics

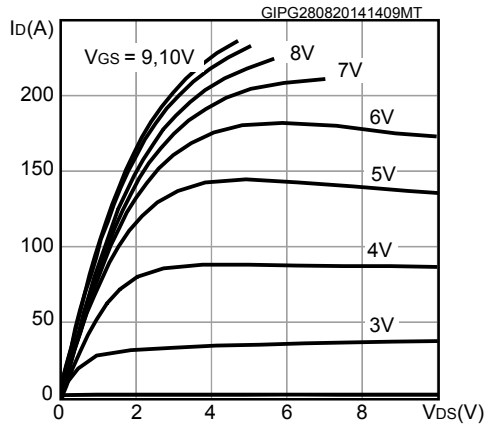


Figure 4. Transfer characteristics

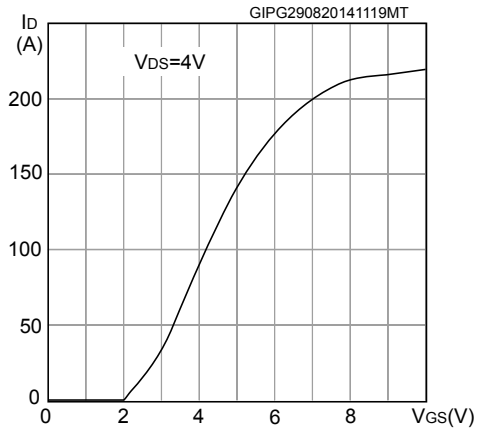


Figure 5. Gate charge vs gate-source voltage

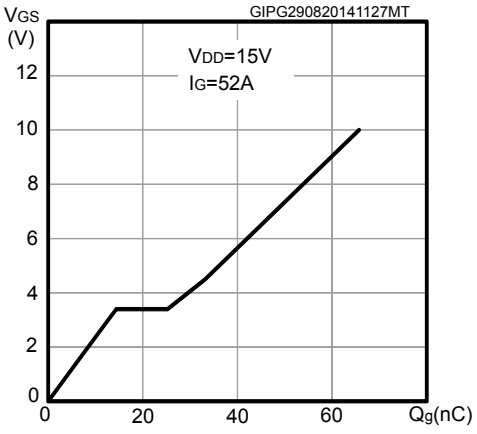


Figure 6. Static drain-source on-resistance

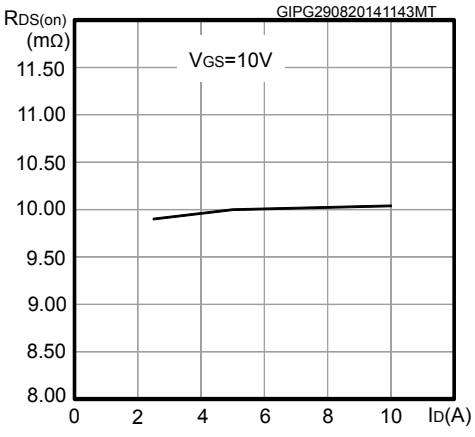


Figure 7. Capacitance variations

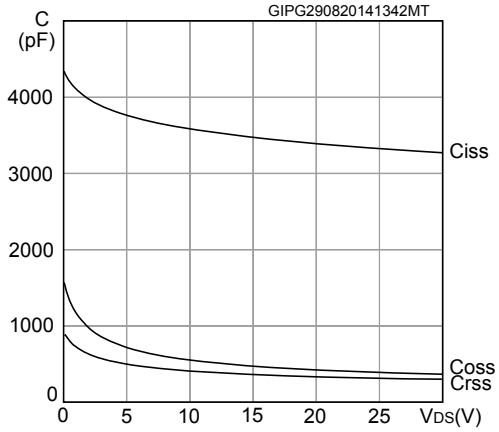


Figure 8. Normalized gate threshold voltage vs temperature

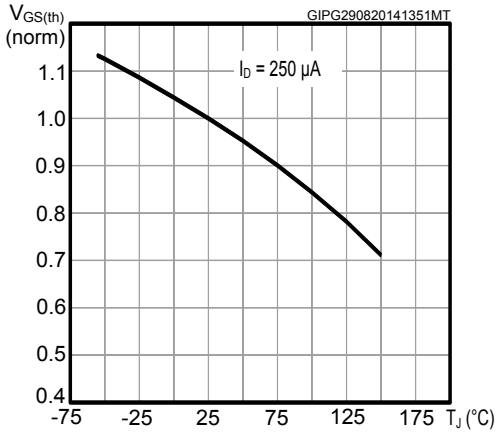


Figure 9. Normalized on-resistance vs temperature

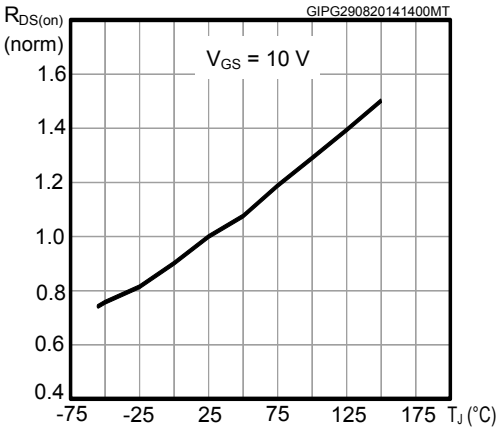


Figure 10. Normalized $V_{(BR)DSS}$ vs temperature

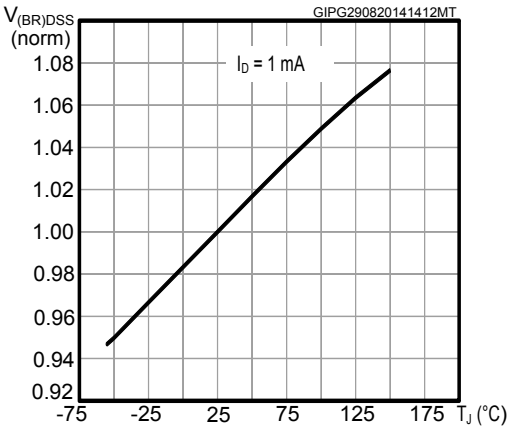
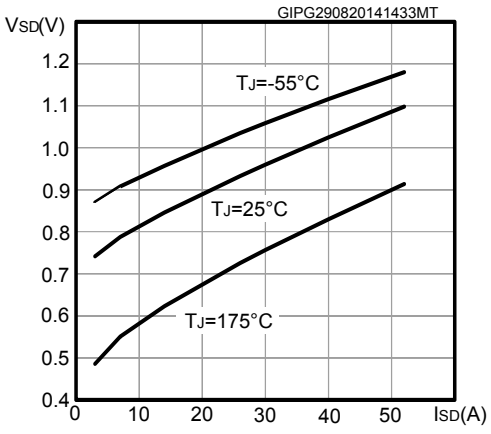


Figure 11. Source-drain diode forward characteristics



3 Test circuits

Figure 12. Switching times test circuit for resistive load

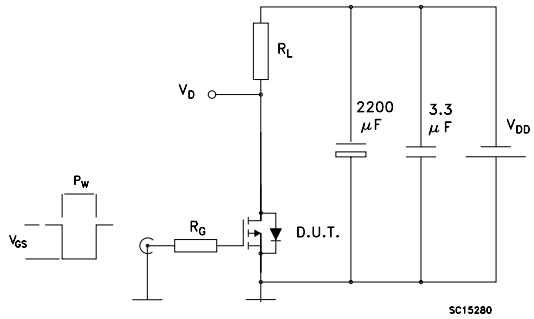


Figure 13. Gate charge test circuit

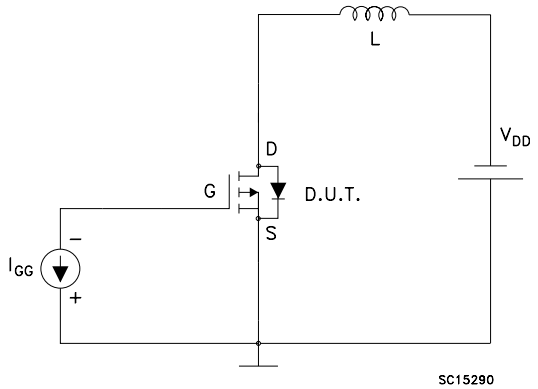
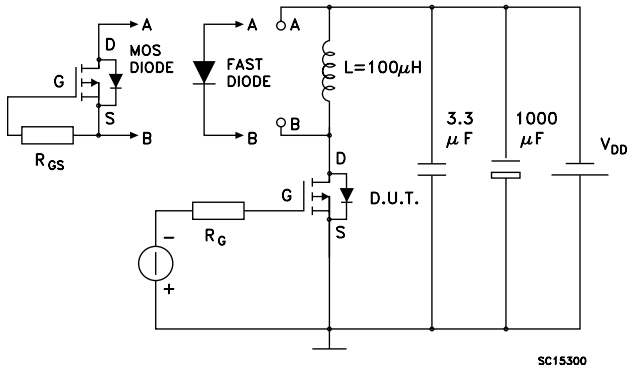


Figure 14. Test circuit for inductive load switching and diode recovery times



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 (TO-252) type A package information

Figure 15. DPAK (TO-252) type A package outline

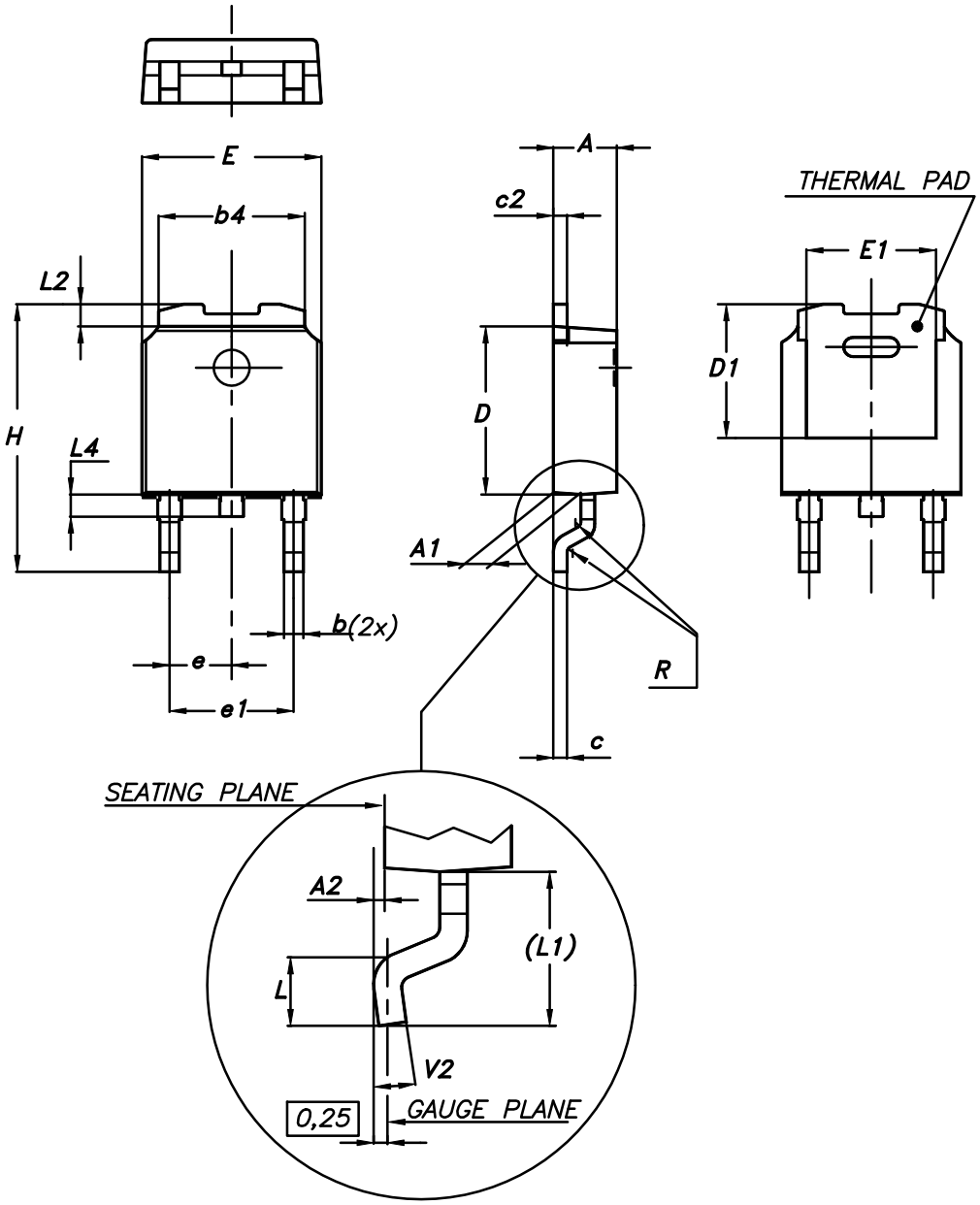


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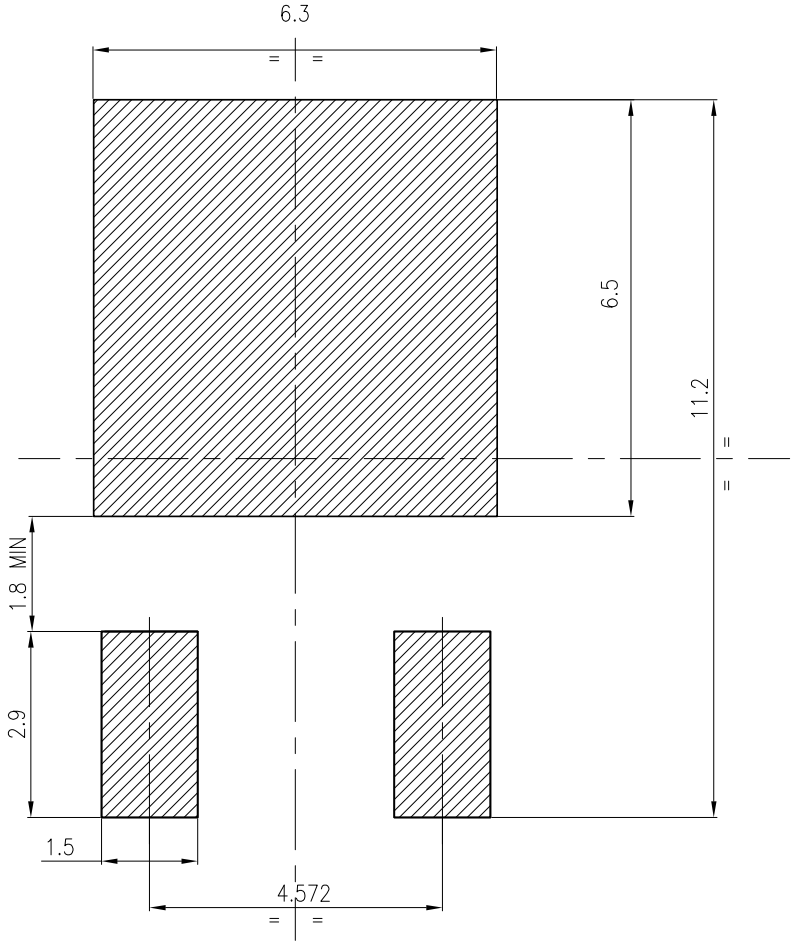
Table 7. **DPAK (TO-252) type A mechanical data**

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 16. **DPAK (TO-252) type A recommended footprint (dimensions are in mm)**



4.2 DPAK (TO-252) packing information

Figure 17. **DPAK (TO-252) tape outline**

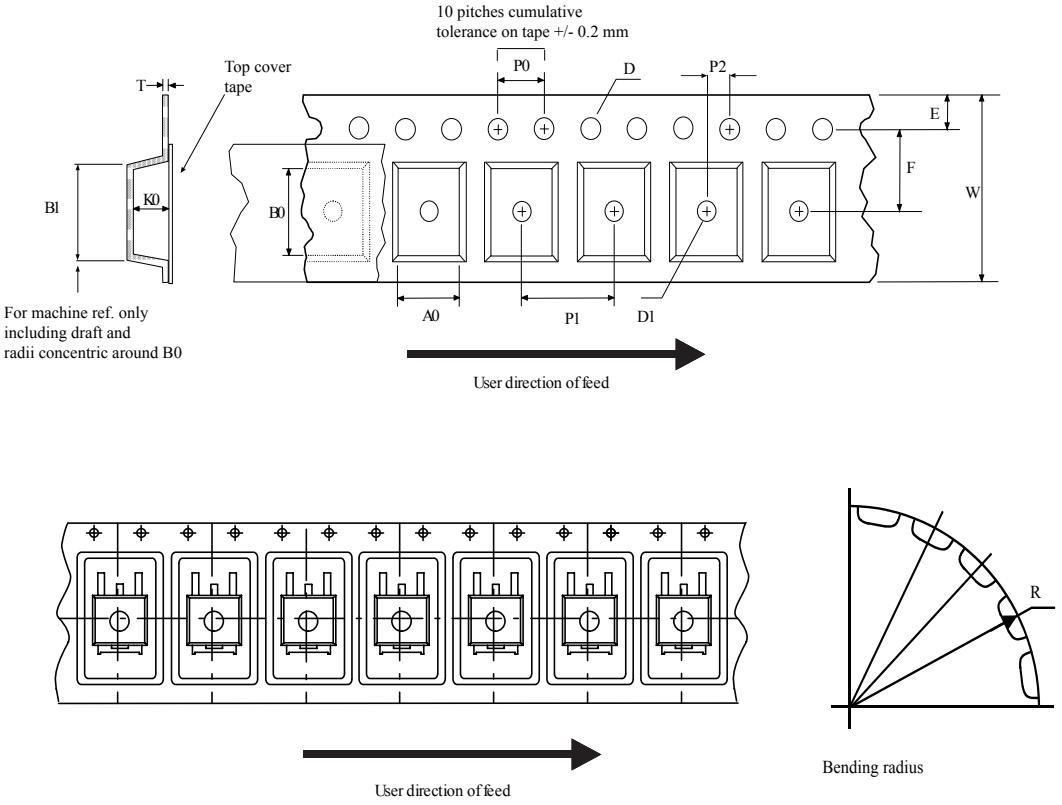


Figure 18. **DPAK (TO-252) reel outline**

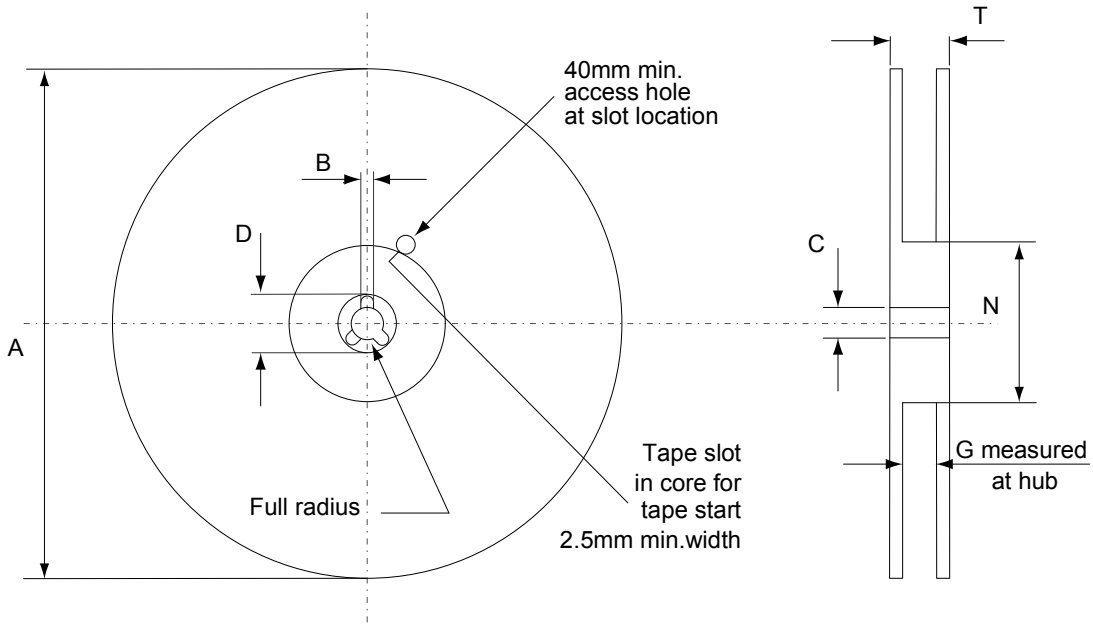


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Table 8. **DPAK (TO-252) tape and reel mechanical data**

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
02-Jun-2014	1	First release
24-Sep-2014	2	Updated the title, the features and the description in cover page. Updated *Table 2: "Absolute maximum ratings"*, *Section 2: "Electrical characteristics"*. Added *Section 2.1: "Electrical characteristics (curves)"*. Minor text changes.
11-Feb-2020	3	Datasheet status promoted from preliminary to production data. Minor text changes.

Contents