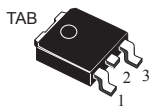
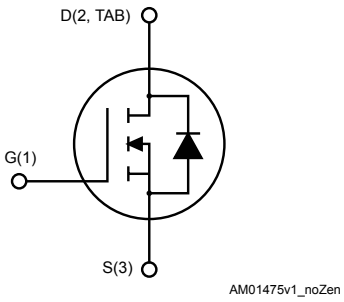
N-channel 60 V, 3.1 mΩ typ., 80 A STripFET F7 Power MOSFET in a DPAK package



DPAK



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D	P_{TOT}
STD140N6F7	60 V	3.8 m Ω	80 A	134 W

- Among the lowest $R_{DS(on)}$ on the market
- Excellent FoM (figure of merit)
- Low C_{rss}/C_{iss} ratio for EMI immunity
- High avalanche ruggedness

Applications

- Switching applications

Description

This N-channel Power MOSFET utilizes STripFET F7 technology with an enhanced trench gate structure that results in very low on-state resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

Product status
STD140N6F7

Product summary	
Order code	STD140N6F7
Marking	140N6F7
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	±20	V
I_D (1)	Drain current (continuous) at T_{case} = 25 °C	80	A
	Drain current (continuous) at T_{case} = 100 °C	80	
I_{DM} (2)	Drain current (pulsed)	320	A
P_{TOT}	Total power dissipation at T_{case} = 25 °C	134	W
E_{AS} (3)	Single pulse avalanche energy	200	mJ
dv/dt (4)	Drain-body diode dynamic dv/dt ruggedness	7.1	V/ns
T_{stg}	Storage temperature range	-55 to 175	°C
T_j	Operating junction temperature range		

1. *Current is limited by package.*
2. *Pulse width is limited by safe operating area.*
3. *starting T_j = 25 °C, I_D = 20 A, V_{DD} = 30 V.*
4. *I_{SD}= 80 A; di/dt = 600 A/µs; V_{DD} = 48 V; T_j < T_{jmax}*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb	50	°C/W
$R_{thj\text{-}c}$	Thermal resistance junction-case	1.12	

1. *When mounted on FR-4 board of 1 inch², 2oz Cu, t < 10 s.*

2 Electrical characteristics

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

Table 3. On/off-states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = 0 V, I_D = 1 mA	60			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 60 V			1	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 = 40 A		3.1	3.8	mΩ

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 30 V, f = 1 MHz, V_{GS} = 0 V	-	3100	-	pF
C_{oss}	Output capacitance		-	1520	-	
C_{rss}	Reverse transfer capacitance		-	193	-	
Q_g	Total gate charge	V_{DD} = 30 V, I_D = 80 A, V_{GS} = 0 to 10 V (see Figure 13. Test circuit for gate charge behavior)	-	55	-	nC
Q_{gs}	Gate-source charge		-	19	-	
Q_{gd}	Gate-drain charge		-	18	-	

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 = 40 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 12. Test circuit for resistive load switching times and Figure 17. Switching time waveform)	-	24	-	ns
t_r	Rise time		-	68	-	
$t_{d(off)}$	Turn-off delay time		-	39	-	
t_f	Fall time		-	20	-	

Table 6. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{SD} (1)	Forward on voltage	V_{GS} = 0 V, I_{SD} = 80 A	-		1.2	V
t_{rr}	Reverse recovery time	I_{SD} = 80 A, di/dt = 100 A/µs, V_{DD} = 48 V (see Figure 14. Test circuit for inductive load switching and diode recovery times)	-	42.4		ns
Q_{rr}	Reverse recovery charge		-	36.2		nC
I_{RRM}	Reverse recovery current		-	1.8		A

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

2.1 Characteristics curves

Figure 1. Safe operating area

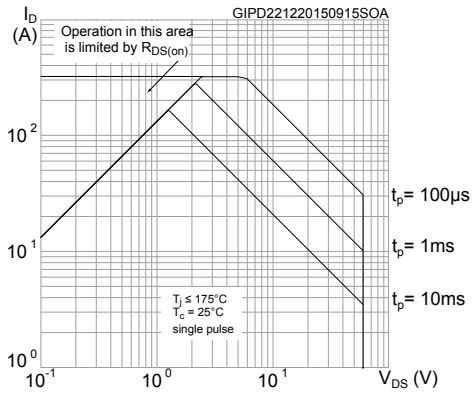


Figure 2. Thermal impedance

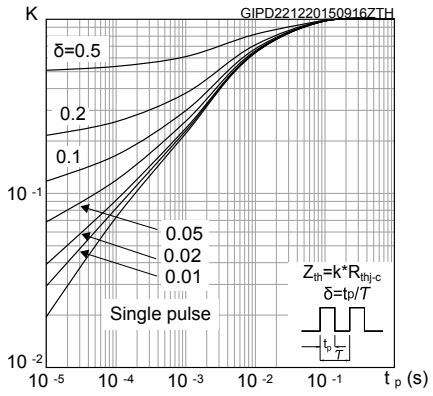


Figure 3. Output characteristics

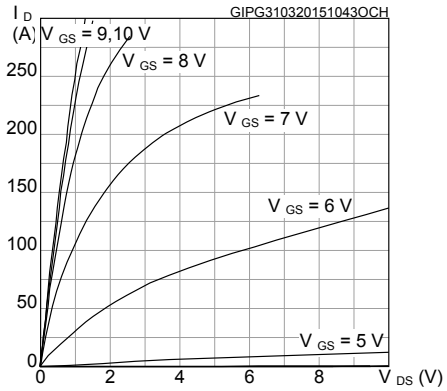


Figure 4. Transfer characteristics

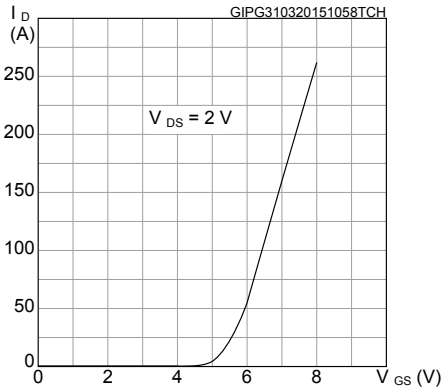


Figure 5. Gate charge vs gate-source voltage

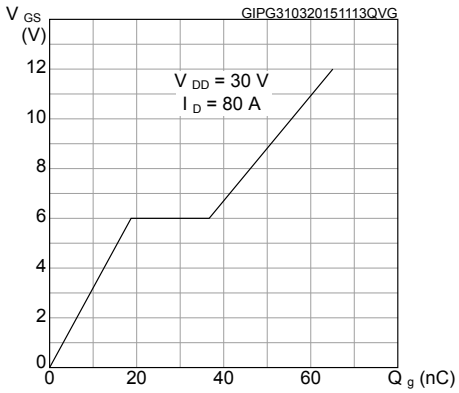


Figure 6. Static drain-source on-resistance

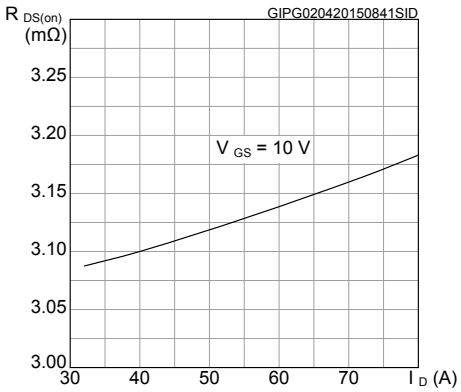


Figure 7. Capacitance variations

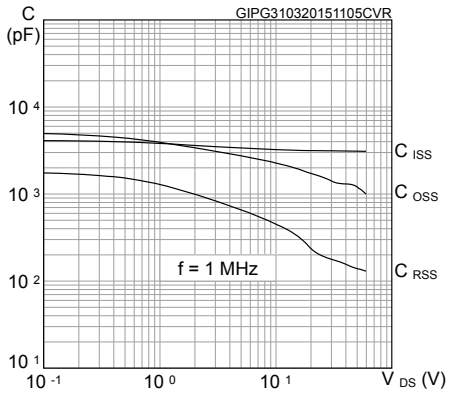


Figure 8. Normalized gate threshold voltage vs temperature

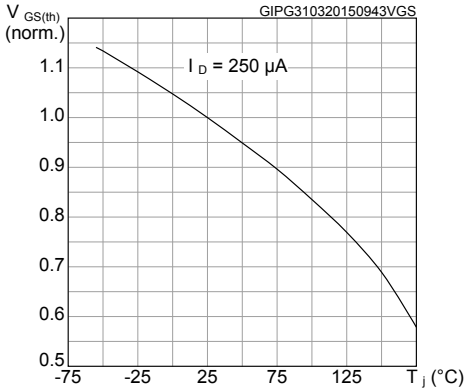


Figure 9. Normalized on-resistance vs temperature

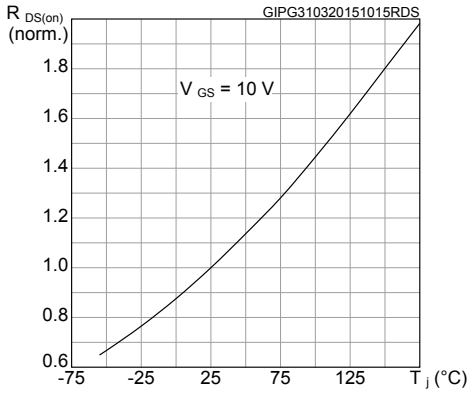


Figure 10. Normalized $V_{(BR)DSS}$ vs temperature

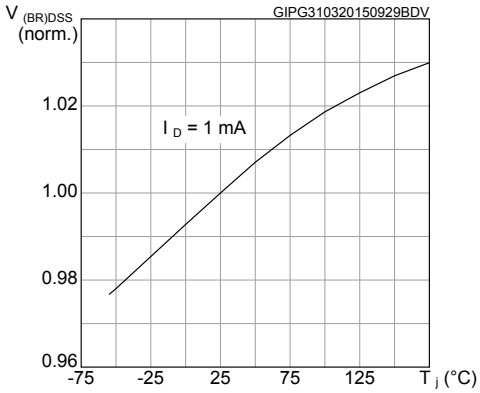
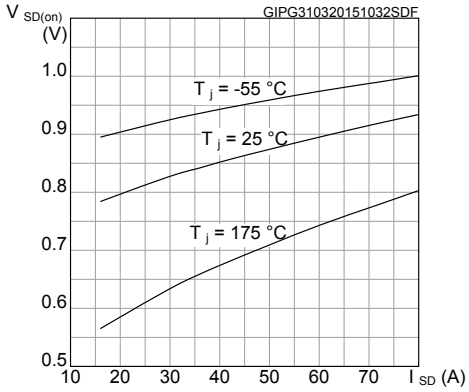


Figure 11. Source-drain diode forward characteristics



3 Test circuits

Figure 12. Test circuit for resistive load switching times

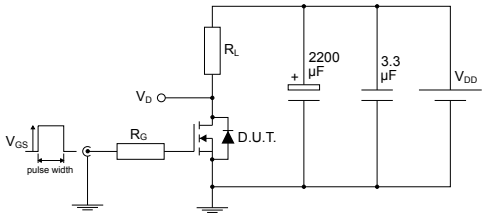


Figure 13. Test circuit for gate charge behavior

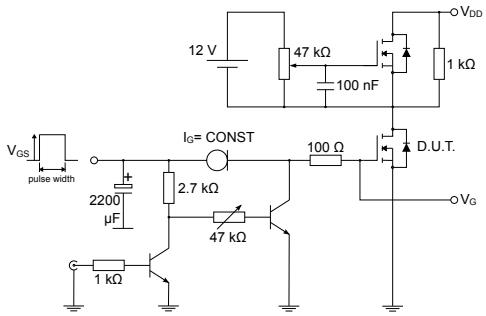


Figure 14. Test circuit for inductive load switching and diode recovery times

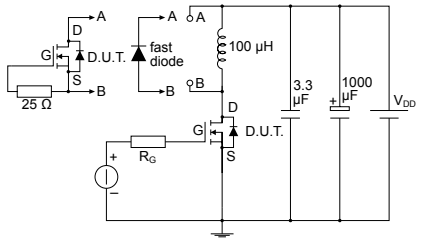


Figure 15. Unclamped inductive load test circuit

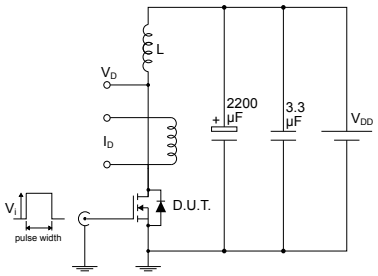


Figure 16. Unclamped inductive waveform

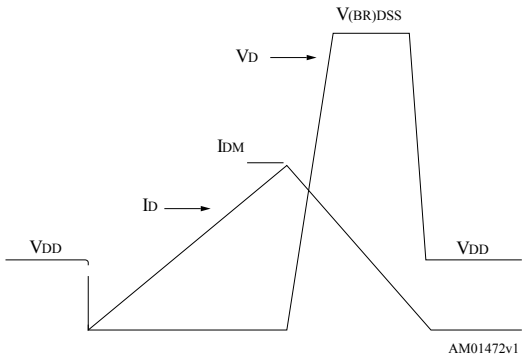
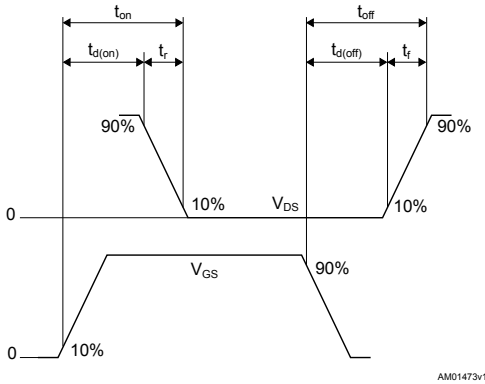


Figure 17. Switching time waveform



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 A2 package information

Figure 18. **DPAK (TO-252) type A2 package outline**

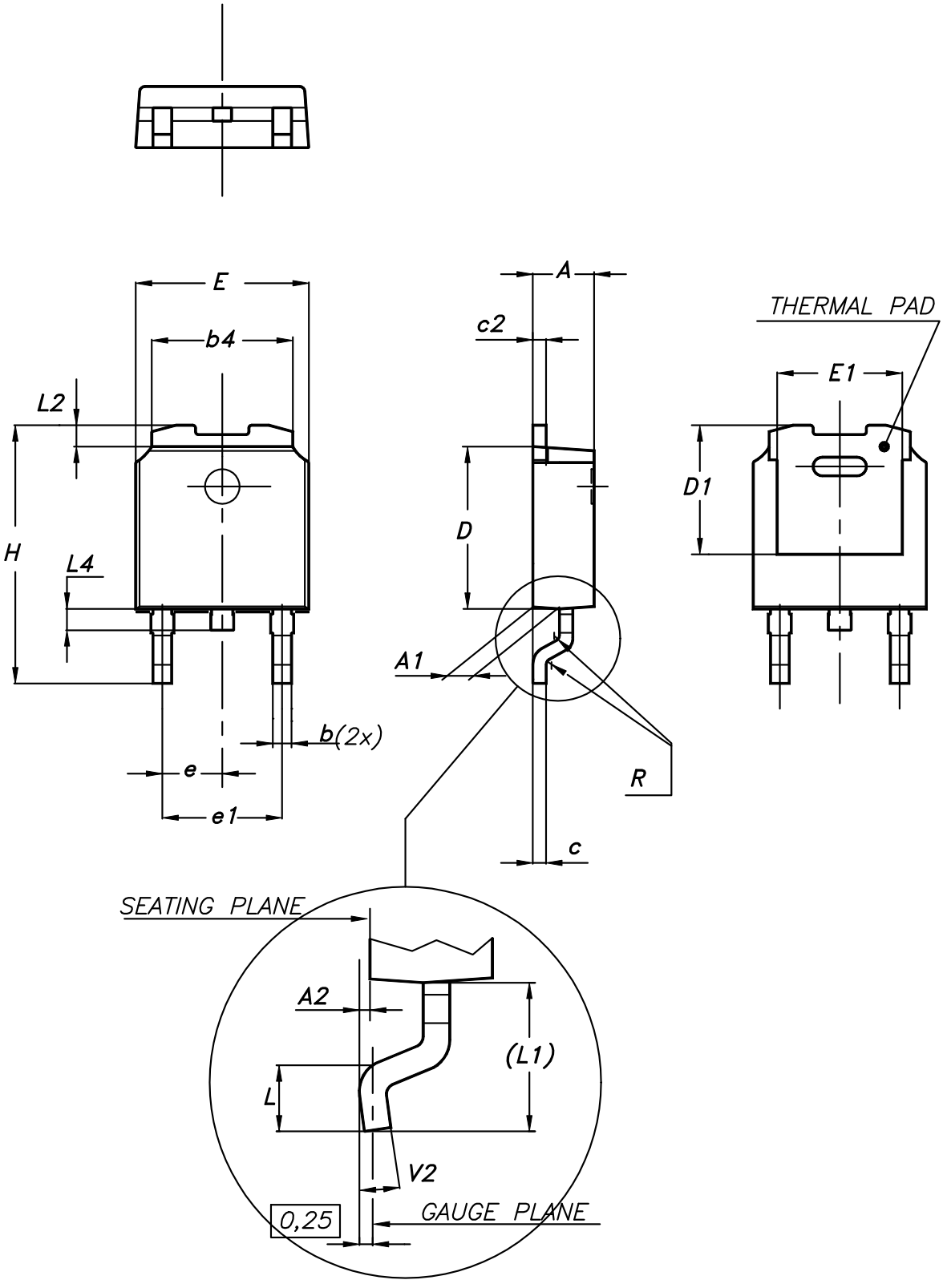
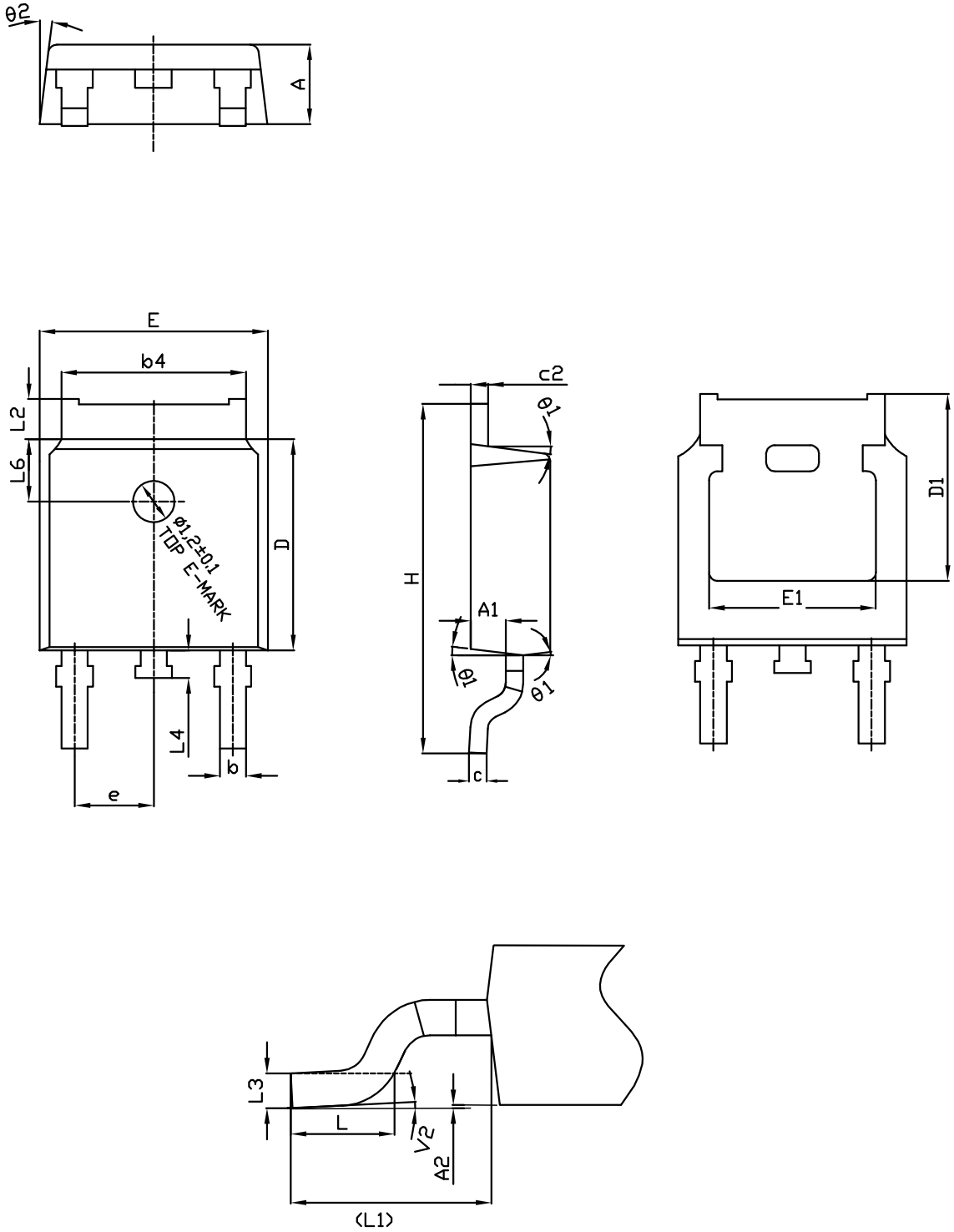


Table 7. **DPAK (TO-252) type A2 mechanical data**

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	2.159	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°

4.2 DPAK (TO-252) type C2 package information

Figure 19. **DPAK (TO-252) type C2 package outline**

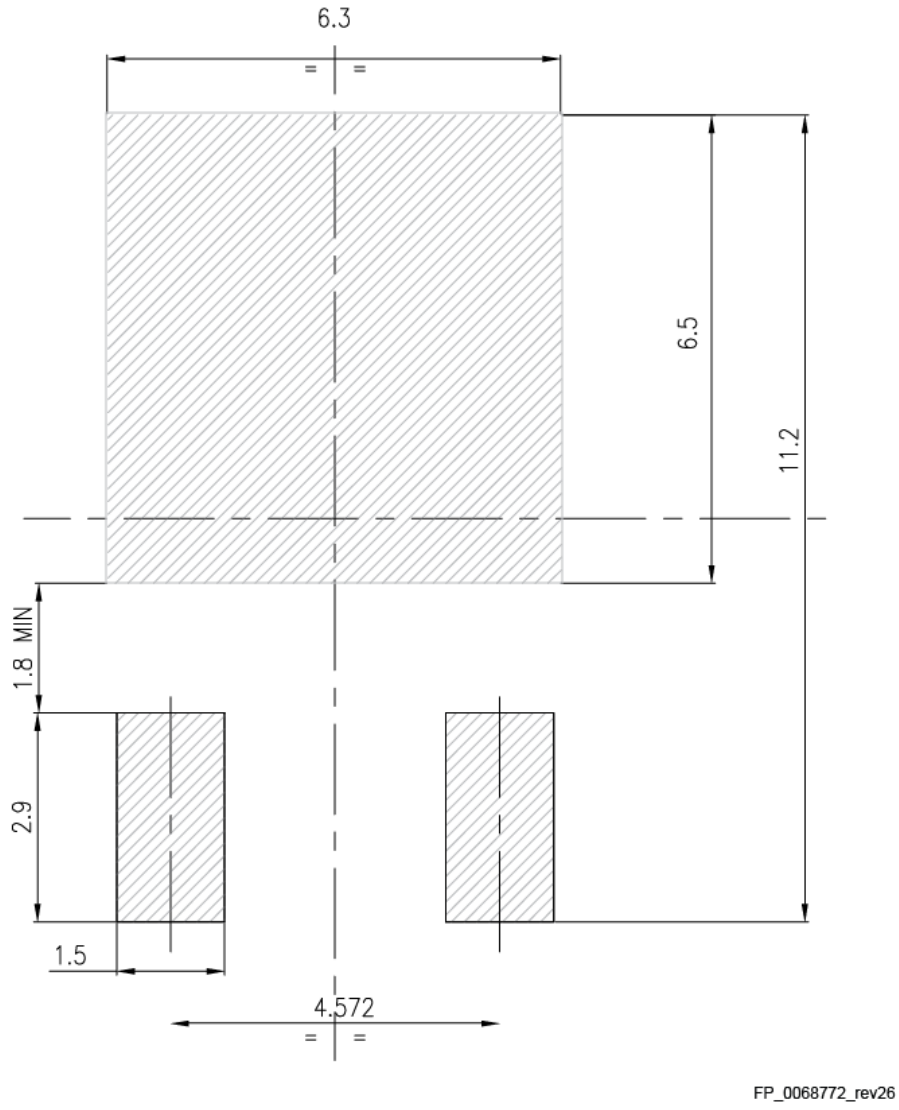


0068772_type-C2_rev26

Table 8. **DPAK (TO-252) type C2 mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0.90	1.01	1.10
A2	0.00		0.10
b	0.72		0.85
b4	5.13	5.33	5.46
c	0.47		0.60
c2	0.47		0.60
D	6.00	6.10	6.20
D1	5.10		5.60
E	6.50	6.60	6.70
E1	5.20		5.50
e	2.186	2.286	2.386
H	9.80	10.10	10.40
L	1.40	1.50	1.70
L1		2.90 REF	
L2	0.90		1.25
L3		0.51 BSC	
L4	0.60	0.80	1.00
L6		1.80 BSC	
θ1	5°	7°	9°
θ2	5°	7°	9°
V2	0°		8°

Figure 20. **DPAK (TO-252) recommended footprint (dimensions are in mm)**



4.3 DPAK (TO-252) packing information

Figure 21. **DPAK (TO-252) tape outline**

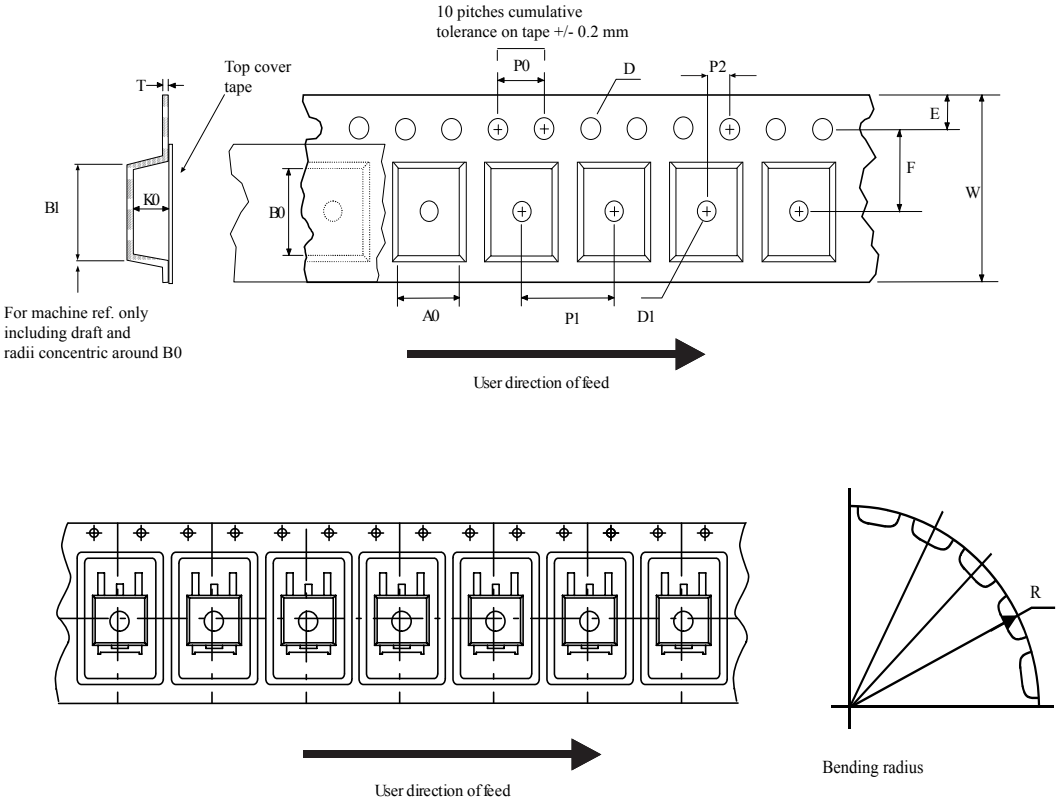


Figure 22. **DPAK (TO-252) reel outline**

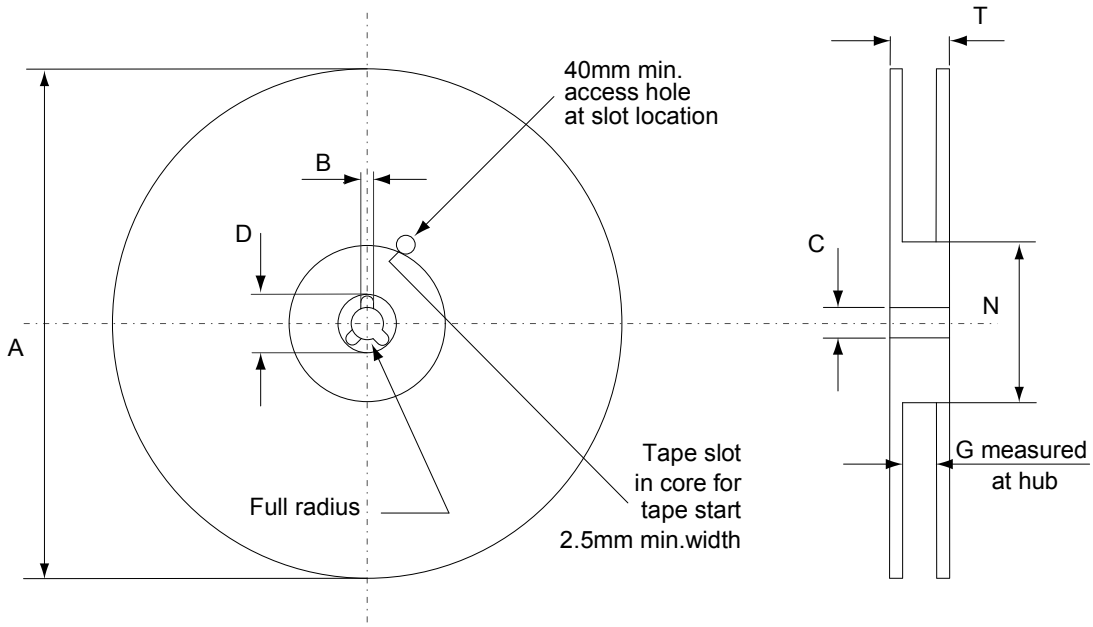


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Table 9. **DPAK (TO-252) tape and reel mechanical data**

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 10. **Document revision history**

Date	Revision	Changes
21-Dec-2015	1	First release.
11-Apr-2016	2	Datasheet promoted from preliminary data to production data. Minor text changes.
10-Apr-2019	3	Added Section 4.2 DPAK (TO-252) type C2 package information. Minor text changes.

Contents

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