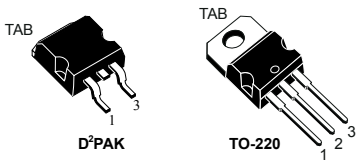
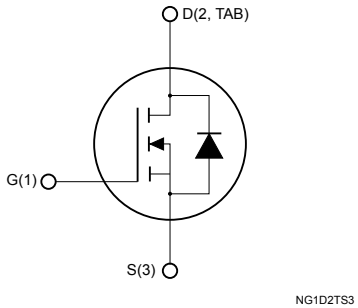
Automotive N-channel 55 V, 6.5 mΩ typ., 80 A STripFET II Power MOSFETs in D²PAK and TO-220 packages





Features

Order codes	V_{DSS}	$R_{DS(on)}$	I_D
STB141NF55	55 V	< 8 mΩ	80 A
STP141NF55			

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

Applications

- Switching applications

Description

These Power MOSFETs have been developed using STMicroelectronics' unique STripFET process, which is specifically designed to minimize input capacitance and gate charge. This renders the devices 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 links
STB141NF55
STP141NF55

Product summary	
Order code	**STB141NF55**
Marking	B141NF55
Package	D²PAK
Packing	Tape and reel
Order code	**STP141NF55**
Marking	P141NF55
Package	TO-220
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	55	V
V_{GS}	Gate-source voltage	±20	V
I_D (1)	Drain current (continuous) at T_C = 25 °C	80	A
I_D (1)	Drain current (continuous) at T_c = 100 °C	80	A
I_{DM} (2)	Drain current (pulsed)	320	A
P_{TOT}	Total power dissipation at T_C = 25 °C	300	W
	Derating factor	2	W/°C
dv/dt (3)	Peak diode recovery voltage slope	10	V/ns
E_{AS} (4)	Single pulse avalanche energy	1.3	J
T_{stg}	Storage temperature range	-55 to 175	°C
T_j	Operating junction temperature range		

1. *Current limited by package.*
2. *Pulse width limited by safe operating area.*
3. *I_{SD} ≤ 80 A, di/dt ≤ 300A/µs, V_{DD} = 80 % $V_{(BR)DSS}$*
4. *Starting T_j = 25°C, I_D = 40 A, V_{DD} = 30 V*

Table 2. Thermal data

Symbol	Parameter	Value		Unit
		TO -220	D^2PAK	
$R_{thj\text{-}case}$	Thermal resistance junction-case max	0.5		°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max	62.5	-	°C/W
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb max	-	35	°C/W
T_l	Maximum lead temperature for soldering purpose (for 10 sec, 1.6 mm from case)	300		°C

1. *When mounted on 1 inch², FR4 board, 2 oz Cu*

2 Electrical characteristics

(T_C = 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	I_D = 250 µA, V_{GS} = 0 V	55			V
I_{DSS}	Zero gate voltage drain (V_{GS} = 0)	V_{DS} = Max rating			1	µA
		V_{DS} = Max rating, T_C= 125 °C			10	
I_{GSS}	Gate-body leakage (V_{DS} = 0)	V_{GS} = ±20 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS} , I_D = 250 µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 40 A		6.5	8	mΩ

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward transconductance	V_{DS} = 15V, I_D= 40 A	-	100	-	S
Ciss	Input capacitance	V_{DS} = 25 V, f = 1 MHz V_{GS} = 0	-	5300	-	pF
Coss	Output capacitance		-	1000	-	
Crss	Reverse transfer capacitance		-	290	-	
Q_g	Total gate charge	V_{DD} = 44V, I_D= 80A V_{GS} =10 V (see Figure 14. Test circuit for gate charge behavior)	-	142	-	nC
Q_{gs}	Gate-source charge		-	27	-	
Q_{gd}	Gate-drain charge		-	55	-	

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

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 27.5 V, I_D = 40 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 13. Test circuit for resistive load switching times)	-	30	-	ns
t_r	Rise time		-	150	-	ns
$t_{d(off)}$	Turn-off delay time		-	125	-	ns
t_f	Fall time		-	45	-	ns

Table 6. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		180	A
I_{SDM} (1)	Source-drain current (pulsed)		-		320	A
V_{SD} (2)	Forward on voltage	I_{SD} = 80 A, V_{GS} = 0 V	-		1.5	V
t_{rr}	Reverse recovery time	I_{SD} = 80 A, di/dt = 100 A/µs	-	90		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 20 V, T_J = 150 °C	-	275		nC
I_{RRM}	Reverse recovery current	(see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	6.5		A

1. *Pulse width limited by safe operating area.*
2. *Pulsed: pulse duration=300 µs, duty cycle 1.5%.*

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

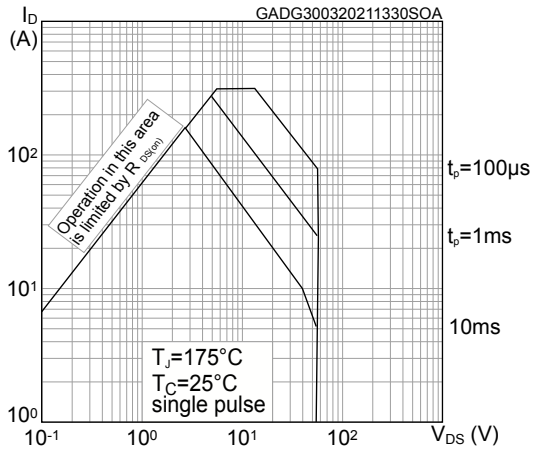


Figure 2. Thermal impedance

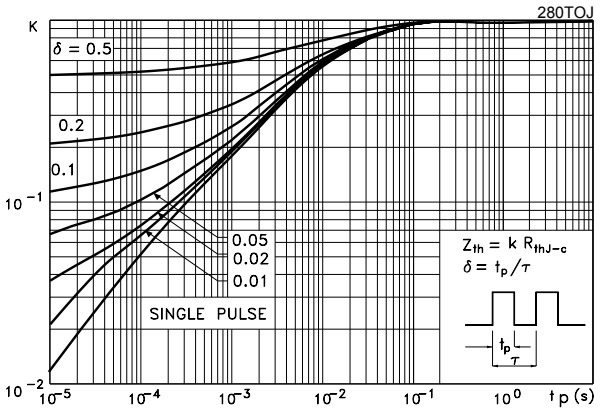


Figure 3. Output characteristics

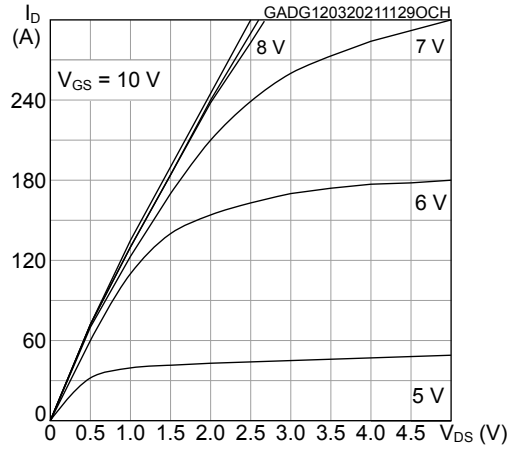


Figure 4. Transfer characteristics

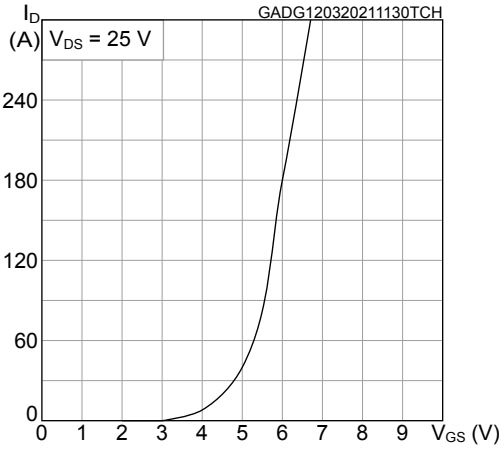


Figure 5. Transconductance

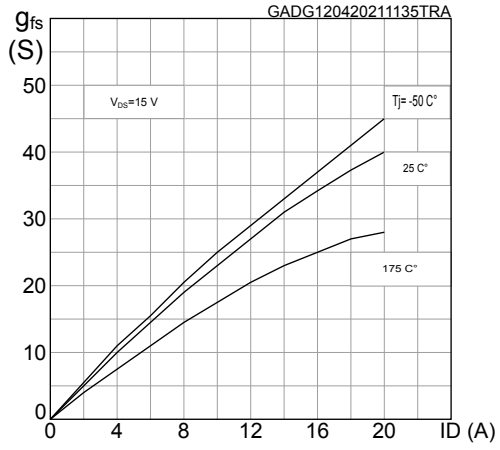


Figure 6. Static drain-source on resistance

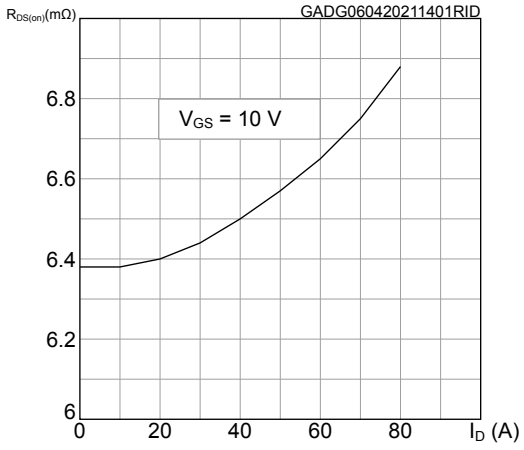


Figure 7. Capacitance variations

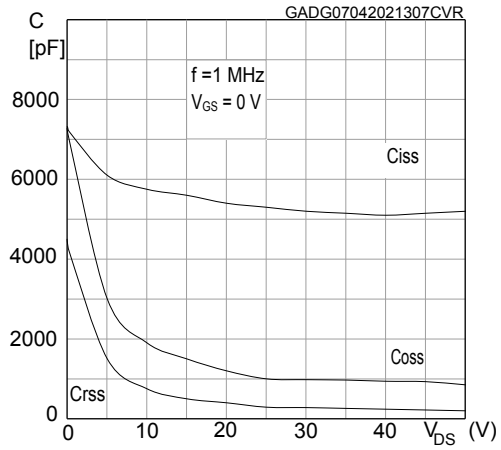


Figure 8. Gate charge vs gate-source voltage

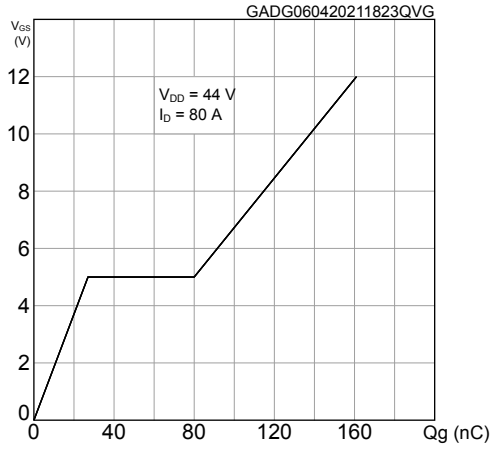


Figure 9. Normalized breakdown voltage vs temperature

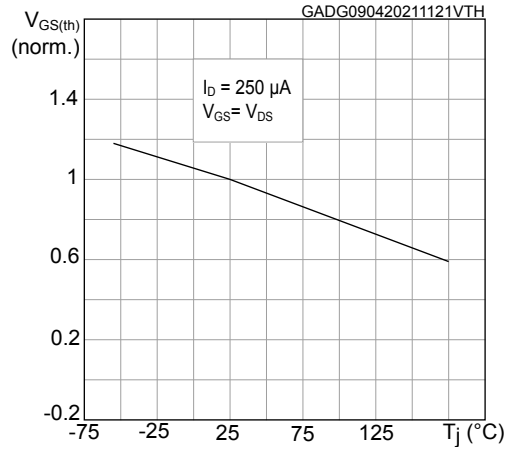


Figure 10. Normalized on resistance vs temperature

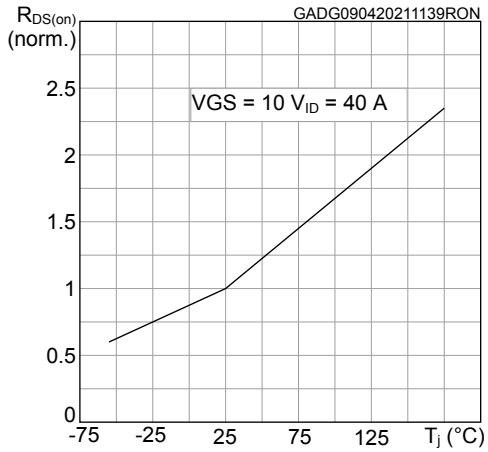


Figure 11. Source-drain diode forward characteristics

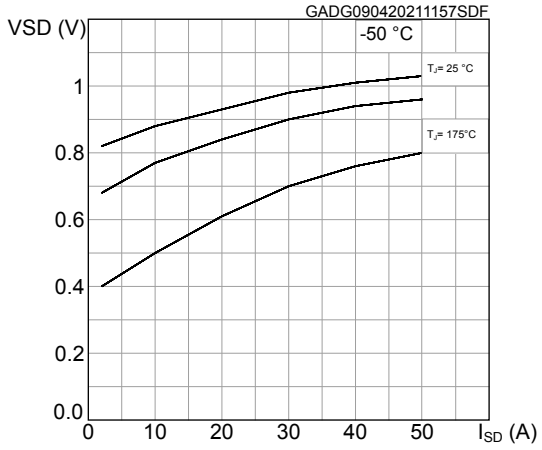
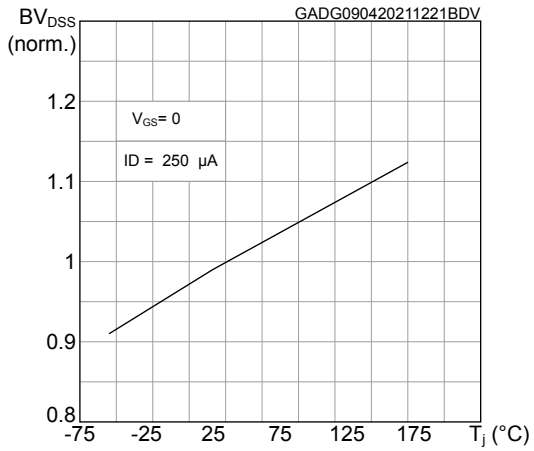


Figure 12. Normalized BV_{DSS} vstemperature



3 Test circuits

Figure 13. Test circuit for resistive load switching times

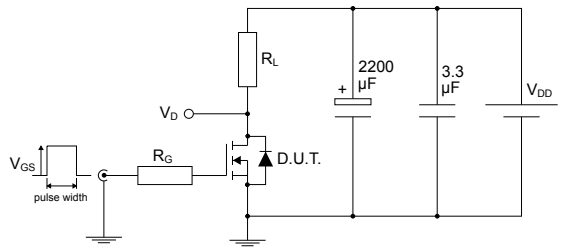


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Figure 14. Test circuit for gate charge behavior

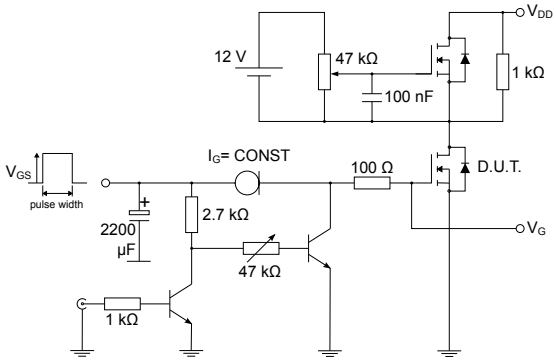

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Figure 15. Test circuit for inductive load switching and diode recovery times

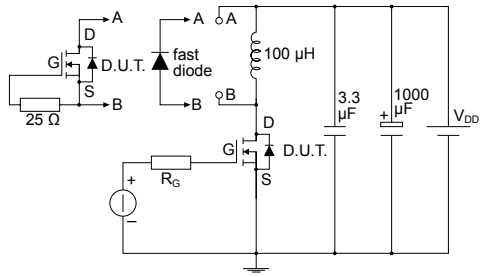

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Figure 16. Unclamped inductive load test circuit

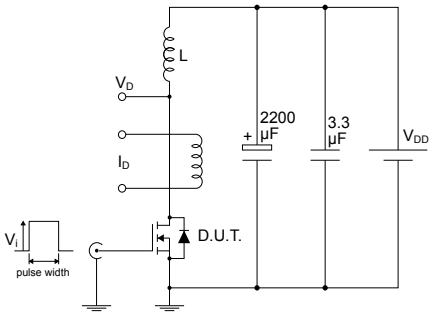

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Figure 17. Unclamped inductive waveform

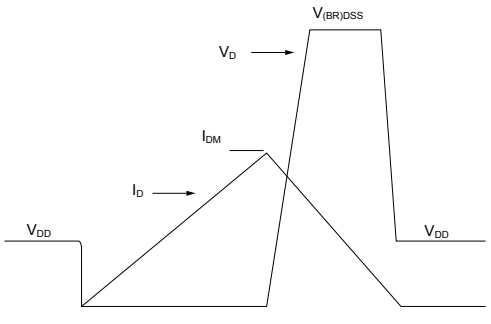

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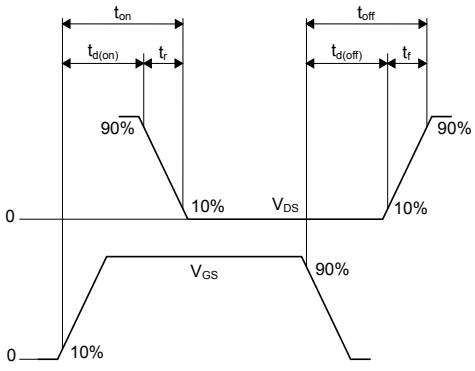
Figure 18. Switching time waveform



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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 D²PAK (TO-263) type A package information

Figure 19. **D²PAK (TO-263) type A package outline**

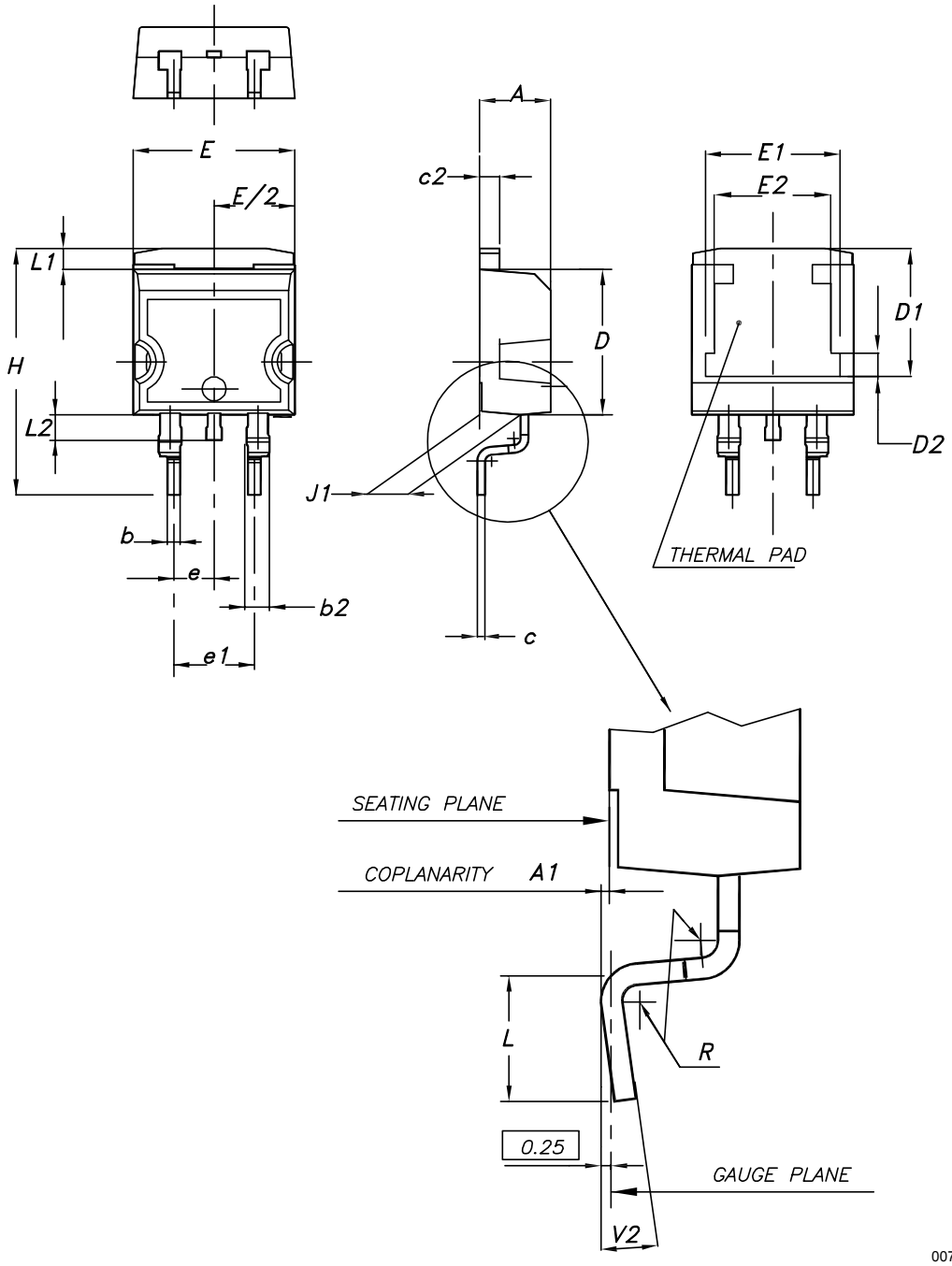
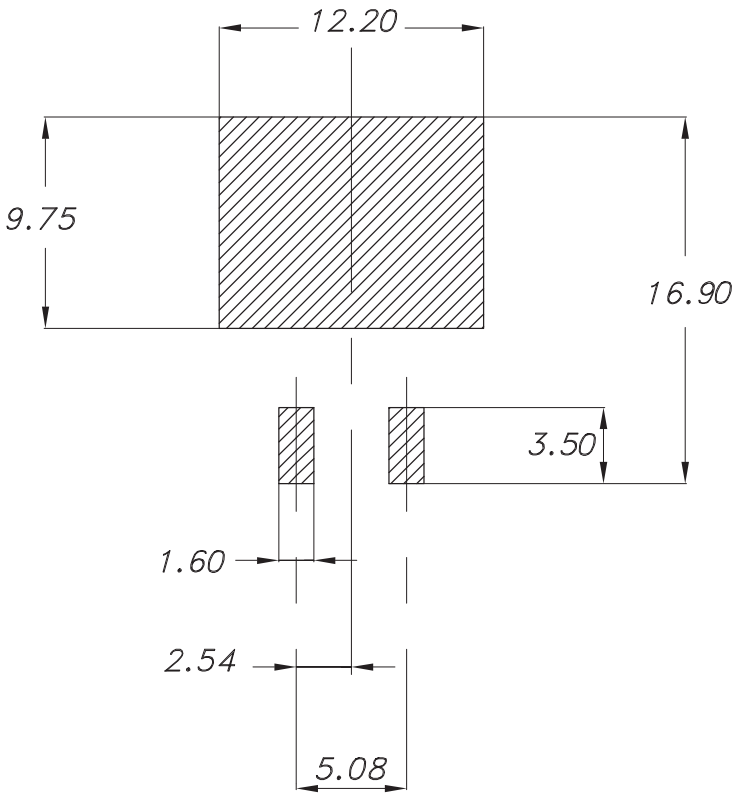


Table 7. **D²PAK (TO-263) type A package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50	7.75	8.00
D2	1.10	1.30	1.50
E	10.00		10.40
E1	8.30	8.50	8.70
E2	6.85	7.05	7.25
e		2.54	
e1	4.88		5.28
H	15.00		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.40	
V2	0°		8°

Figure 20. **D²PAK (TO-263) recommended footprint (dimensions are in mm)**



4.2 TO-220 type A package information

Figure 21. **TO-220 type A package outline**

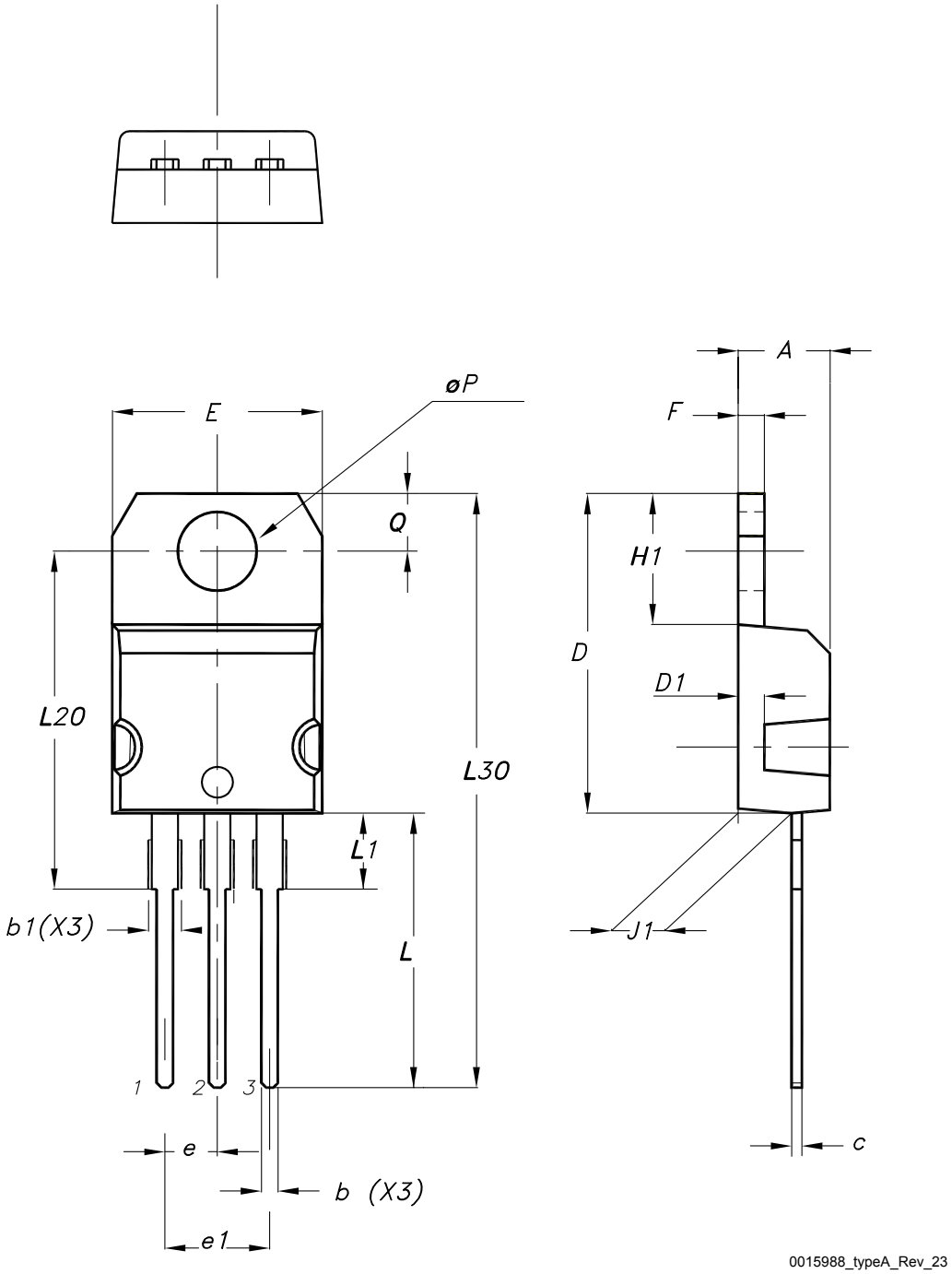


Table 8. **TO-220 type A package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.55
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10.00		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13.00		14.00
L1	3.50		3.93
L20		16.40	
L30		28.90	
øP	3.75		3.85
Q	2.65		2.95
Slug flatness		0.03	0.10

4.3 D²PAK packing information

Figure 22. **D²PAK tape outline**

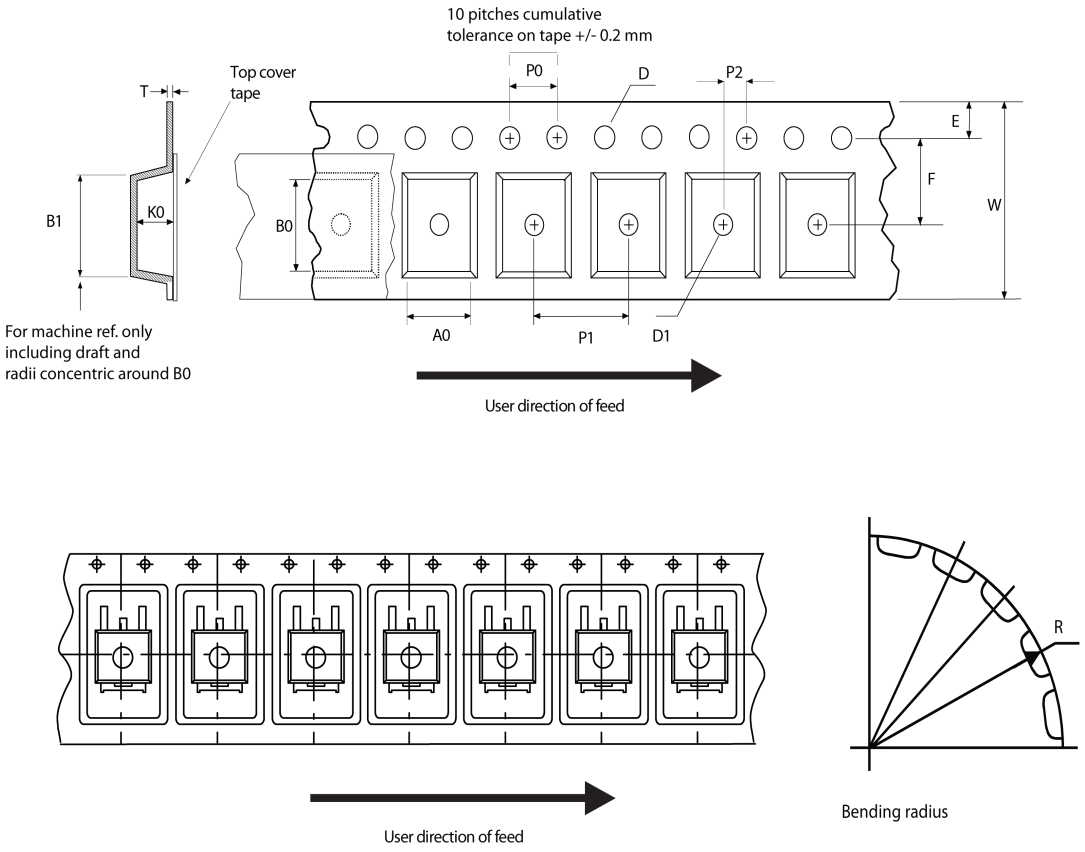


Figure 23. **D²PAK reel outline**

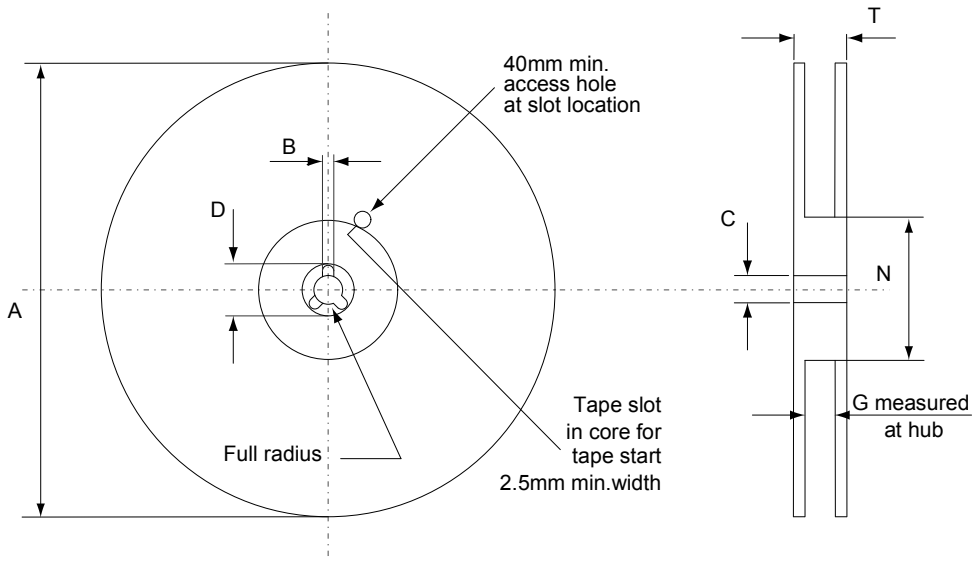


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Table 9. **D²PAK tape and reel mechanical data**

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1	Base quantity		1000
P2	1.9	2.1	Bulk quantity		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

Revision history

Table 10. **Document revision history**

Date	Version	Changes
01-Aug-2007	1	First release.
03-Jan-2022	2	The part number in IPAK package has been removed.

Contents