STB120N10F4, STP120N10F4

N-channel 100 V, 8 mΩ typ., 120 A, STripFET™ DeepGATE™ Power MOSFETs in D^{2}PAK and TO-220 packages

Datasheet – production data

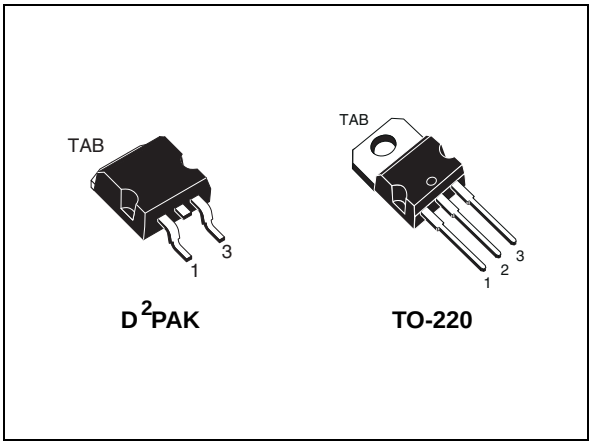
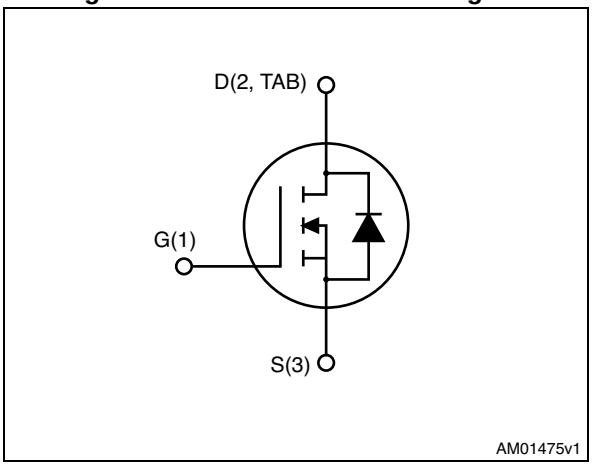


Figure 1. Internal schematic diagram



Features

Order codes	V_{DS}	$R_{DS(on)}$ max.	I_D
STB120N10F4	100 V	10 mΩ	120 A
STP120N10F4			

- N-channel enhancement mode
- Very low on-resistance
- Low gate charge
- 100% avalanche rated

Applications

- Switching applications

Description

These devices are N-channel Power MOSFETs developed using ST's STripFET™ DeepGATE™ technology. The devices have a new gate structure and are specially designed to minimize on-state resistance to provide superior switching performance.

Table 1. Device summary

Order codes	Marking	Packages	Packaging
STB120N10F4	120N10F4	D^{2}PAK	Tape and reel
STP120N10F4		TO-220	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	100	V
V_{GS}	Gate-source voltage	± 20	V
I_D	Drain current (continuous) at T_C = 25 °C	120	A
I_D	Drain current (continuous) at T_C = 100 °C	85	A
I_{DM} (1)	Drain current (pulsed)	390	A
P_{TOT}	Total dissipation at T_C = 25 °C	300	W
	Derating factor	2	W/°C
E_{AS} (2)	Single pulse avalanche energy	215	mJ
T_{stg}	Storage temperature	– 55 to 175	°C
T_j	Max. operating junction temperature		

1. Pulse width limited by safe operating area
2. Starting T_j = 25 °C, I_D= 65 A, V_{DD}= 50 V

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		D^2PAK	TO-220	
$R_{thj\text{-}case}$	Thermal resistance junction-case max	0.5		°C/W
$R_{thj\text{-}pcb}$	Thermal resistance junction-pcb max	35		°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max		62.5	°C/W

2 Electrical characteristics

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

Table 4. 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	100			V
I_{DSS}	Zero gate voltage Drain current (V_{GS} = 0)	V_{DS} = 100 V			1	µA
		V_{DS} = 100 V,T_C=125 °C			100	µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	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 = 60 A		8	10	mΩ

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0	-	7290	-	pF
C_{oss}	Output capacitance		-	568	-	pF
C_{rss}	Reverse transfer capacitance		-	387	-	pF
Q_g	Total gate charge	V_{DD} = 50 V, I_D = 120 A, V_{GS} = 10 V *(see Figure 14)*	-	131	-	nC
Q_{gs}	Gate-source charge		-	40	-	nC
Q_{gd}	Gate-drain charge		-	37	-	nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 50 V, I_D = 60 A R_G = 4.7 Ω V_{GS} = 10 V *(see Figure 13)*	-	32	-	ns
t_r	Rise time		-	116	-	ns
$t_{d(off)}$	Turn-off-delay time	V_{DD} = 50 V, I_D = 60 A, R_G = 4.7 Ω, V_{GS} = 10 V *(see Figure 13)*	-	111	-	ns
t_f	Fall time		-	79	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		120	A
I_{SDM} (1)	Source-drain current (pulsed)		-		390	A
V_{SD} (2)	Forward on voltage	I_{SD} = 60 A, V_{GS} = 0	-		1.2	V
t_{rr}	Reverse recovery time	I_{SD} = 120 A, V_{DD} = 80 V di/dt = 100 A/µs, T_j = 150 °C *(see Figure 15)*	-	72		ns
Q_{rr}	Reverse recovery charge		-	215		nC
I_{RRM}	Reverse recovery current		-	6		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 2. Safe operating area

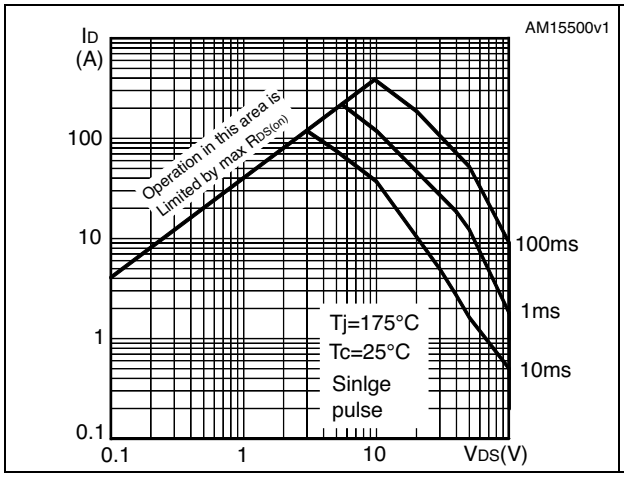


Figure 3. Thermal impedance

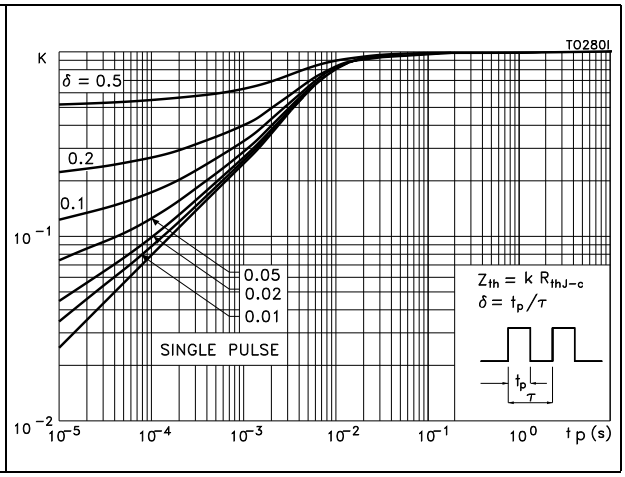


Figure 4. Output characteristics

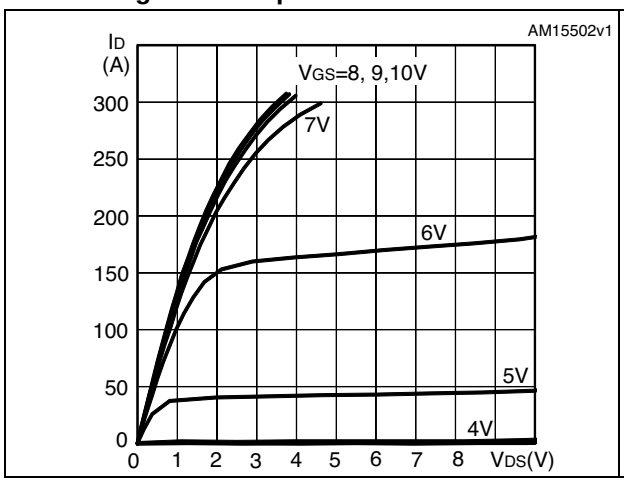


Figure 5. Transfer characteristics

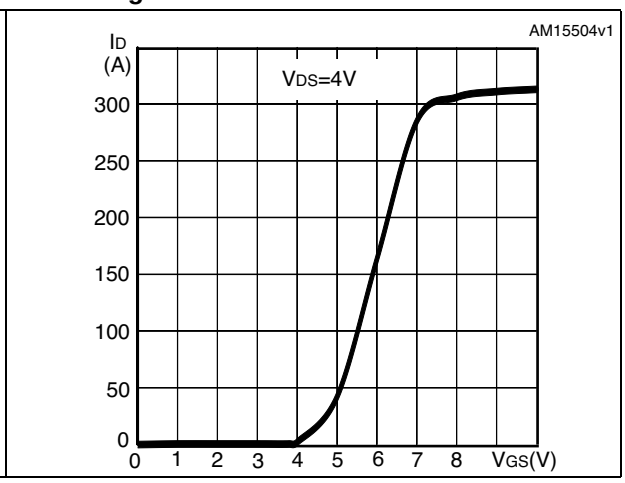


Figure 6. Gate charge vs gate-source voltage

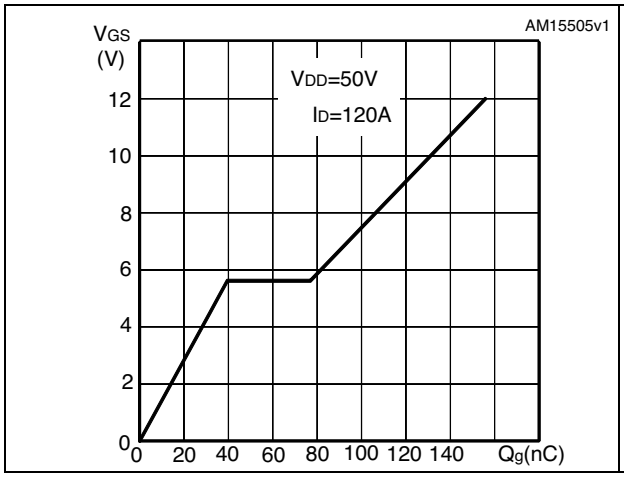


Figure 7. Static drain-source on-resistance

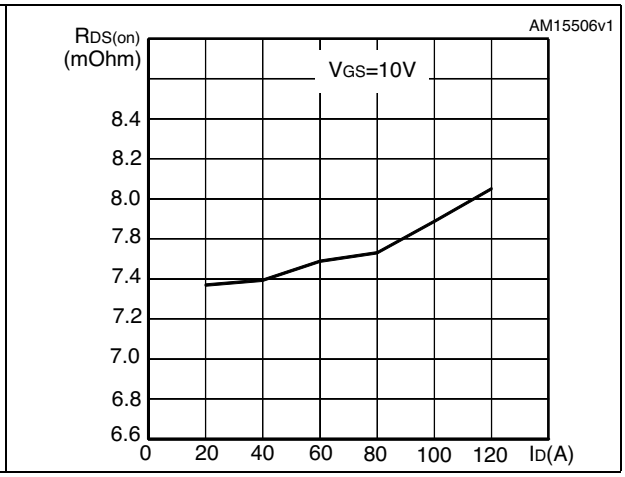


Figure 8. Capacitance variations

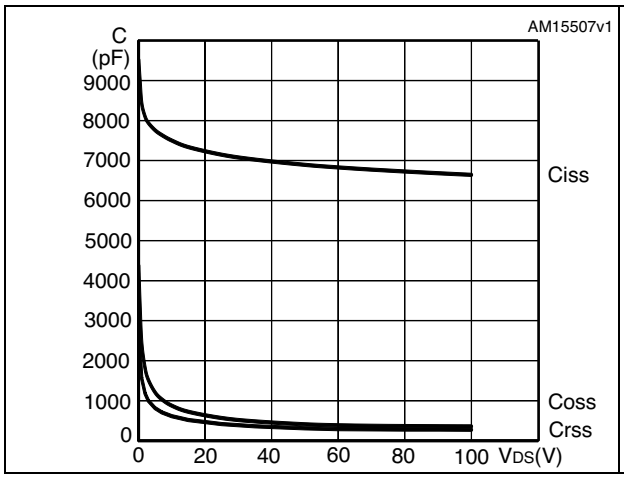


Figure 9. Source-drain diode forward characteristics

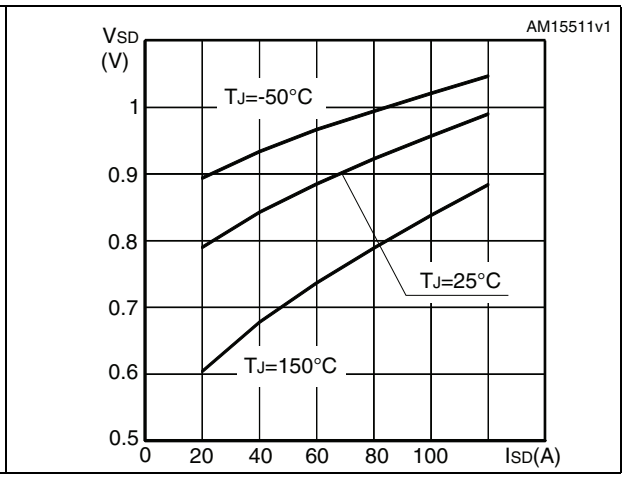


Figure 10. Normalized gate threshold voltage vs temperature

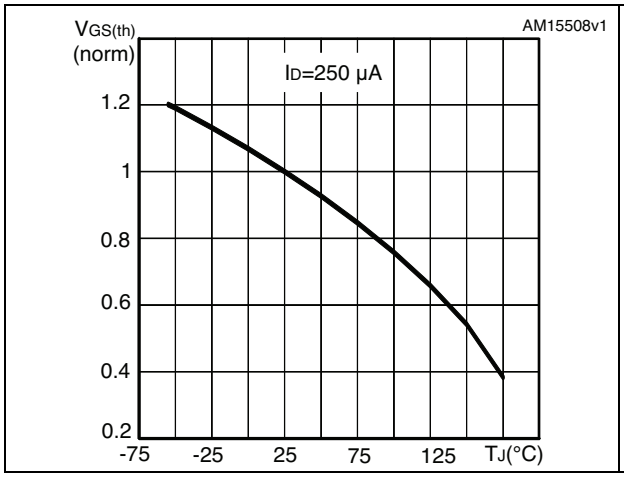


Figure 11. Normalized on-resistance vs temperature

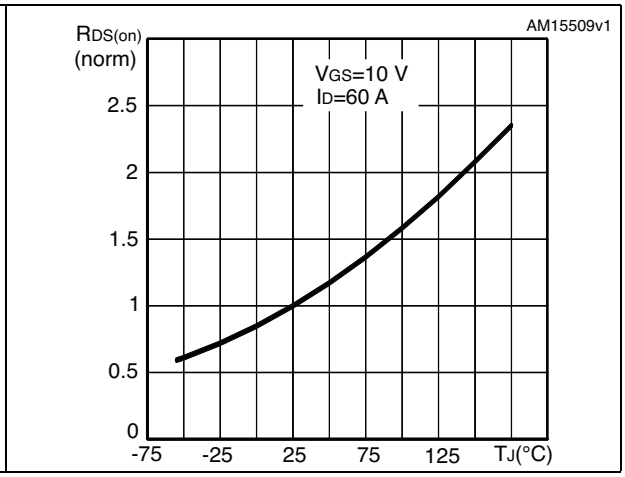
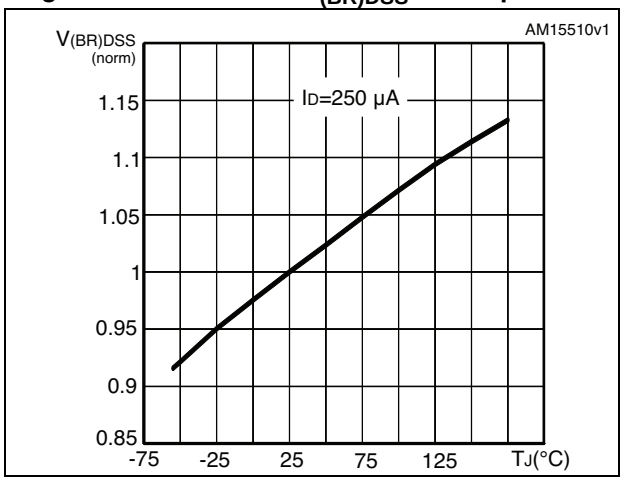


Figure 12. Normalized $V_{(BR)DSS}$ vs temperature



3 Test circuits

Figure 13. Switching times test circuit for resistive load

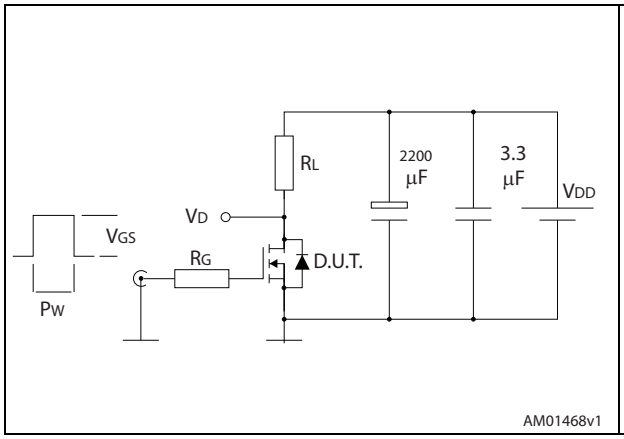


Figure 14. Gate charge test circuit

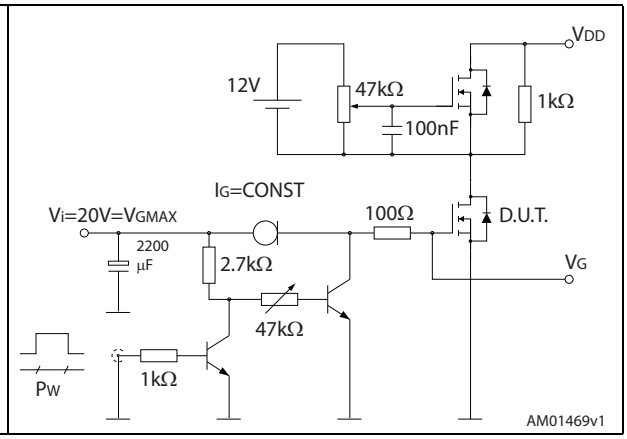


Figure 15. Test circuit for inductive load switching and diode recovery times

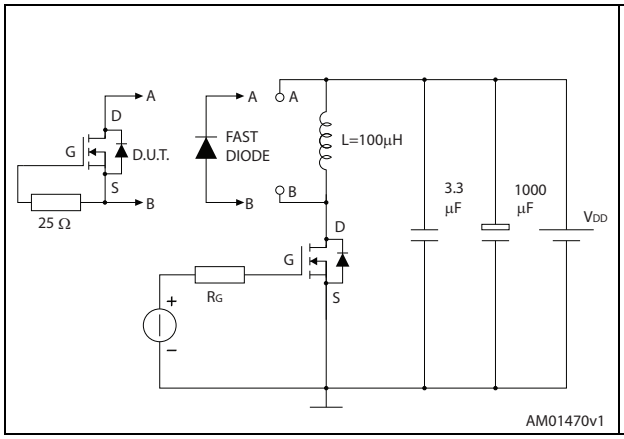


Figure 16. Unclamped inductive load test circuit

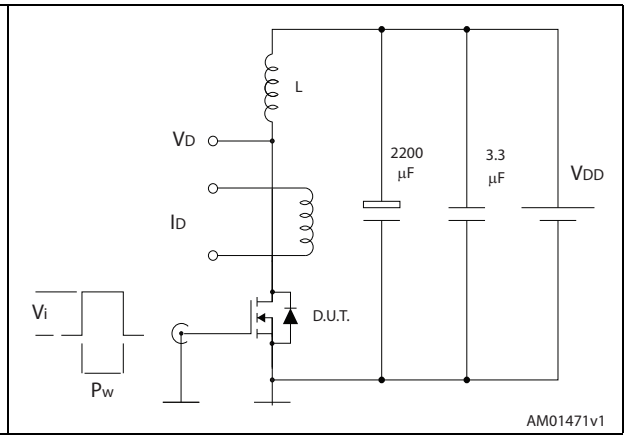


Figure 17. Unclamped inductive waveform

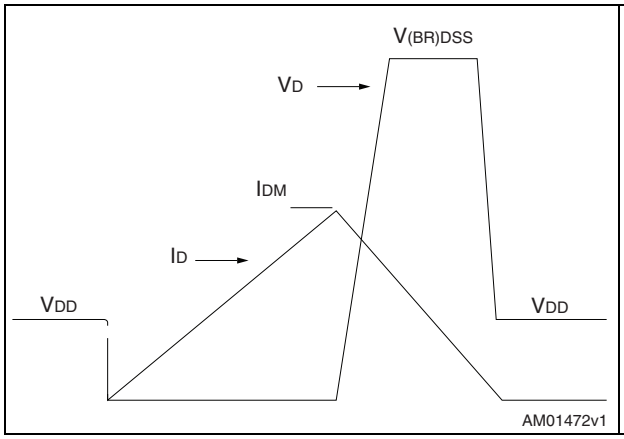
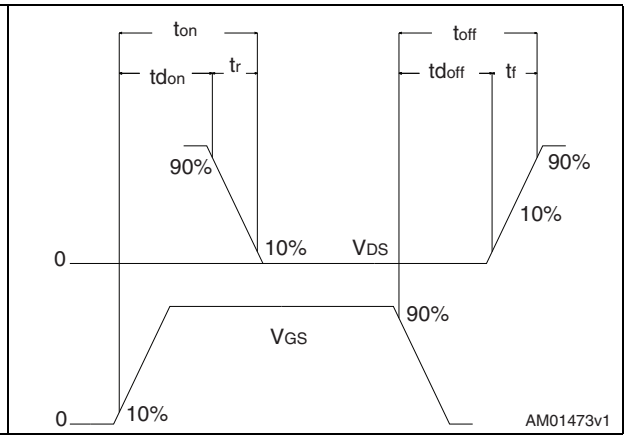


Figure 18. Switching time waveform



4 Package mechanical data

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, STB120N10F4

Figure 19. D²PAK (TO-263) drawing

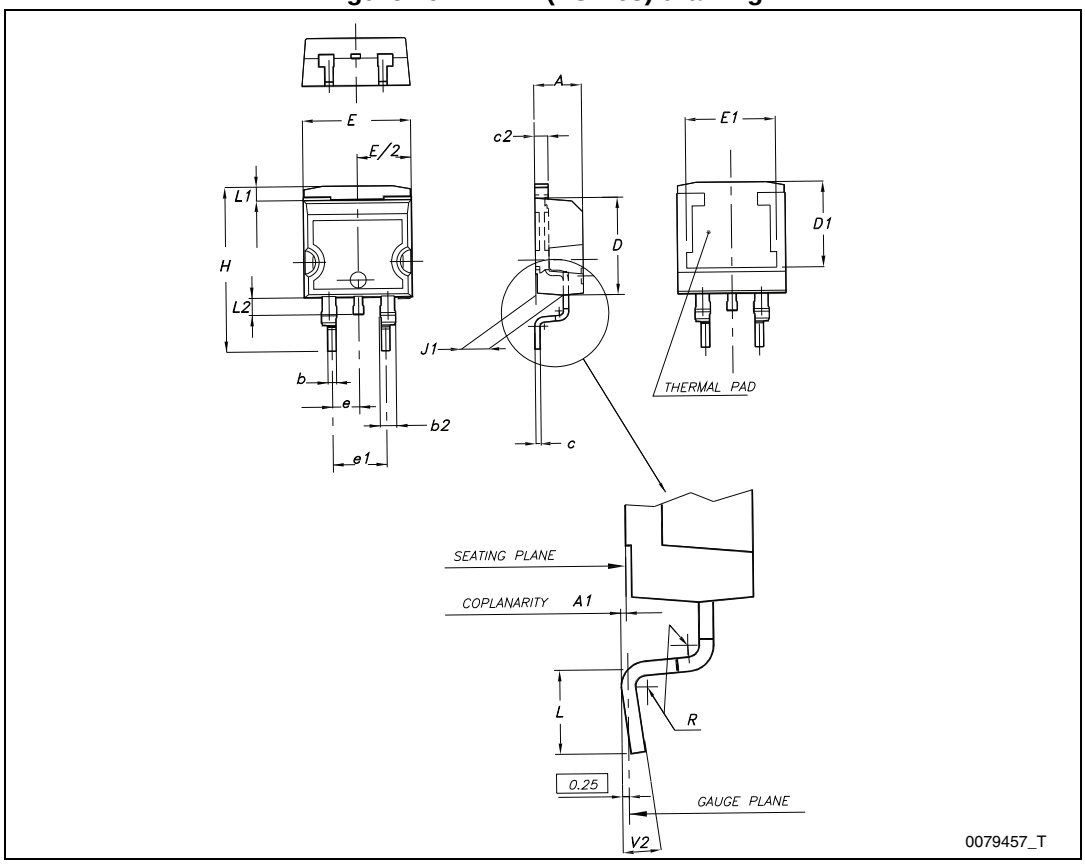
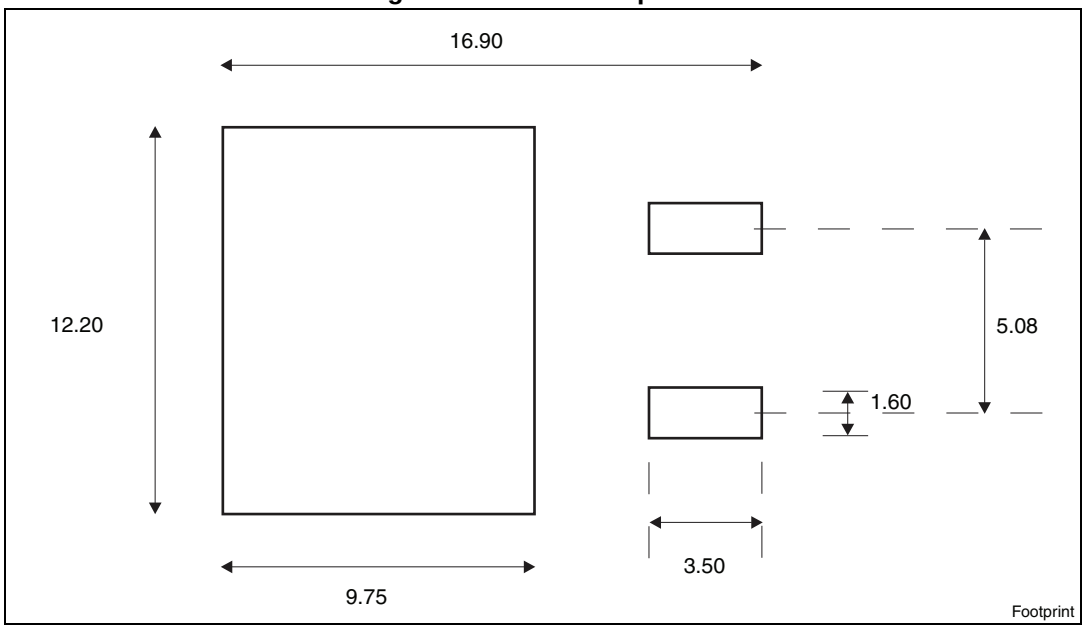


Table 8. D²PAK (TO-263) mechanical data

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		
E	10		10.40
E1	8.50		
e		2.54	
e1	4.88		5.28
H	15		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.4	
V2	0°		8°

Figure 20. D²PAK footprint[a]



a. All dimension are in millimeters

4.2 TO-220, STP120N10F4

Figure 21. TO-220 type A drawing

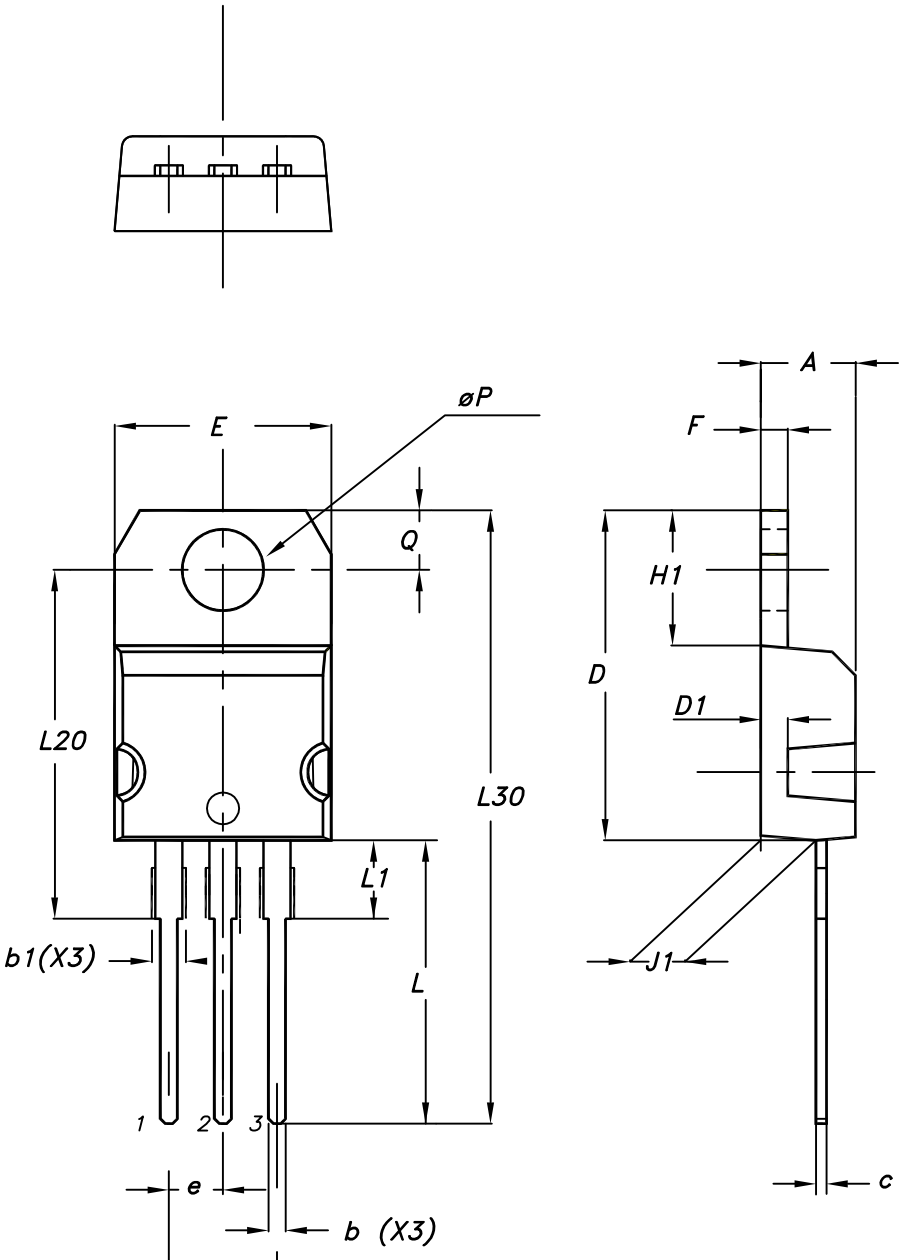


Table 9. TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		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		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
ØP	3.75		3.85
Q	2.65		2.95

5 Packaging mechanical data

Figure 22. Tape

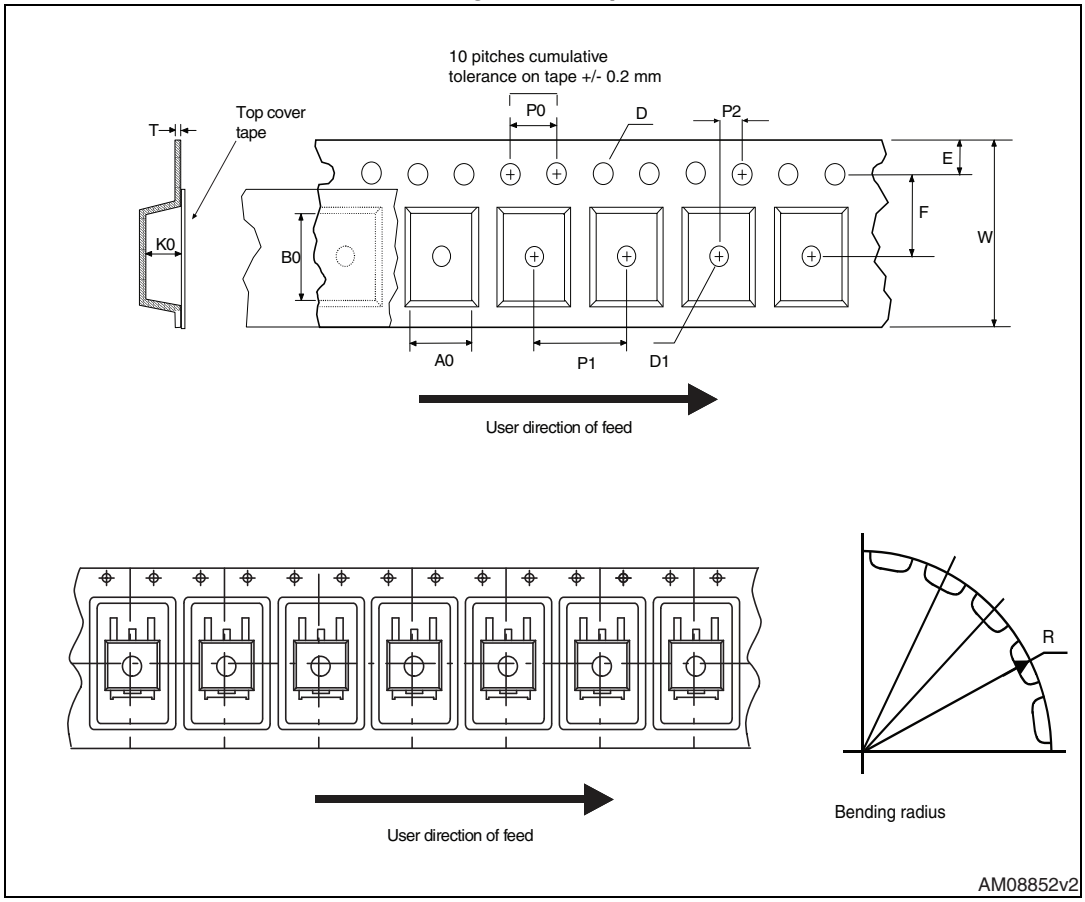


Figure 23. Reel

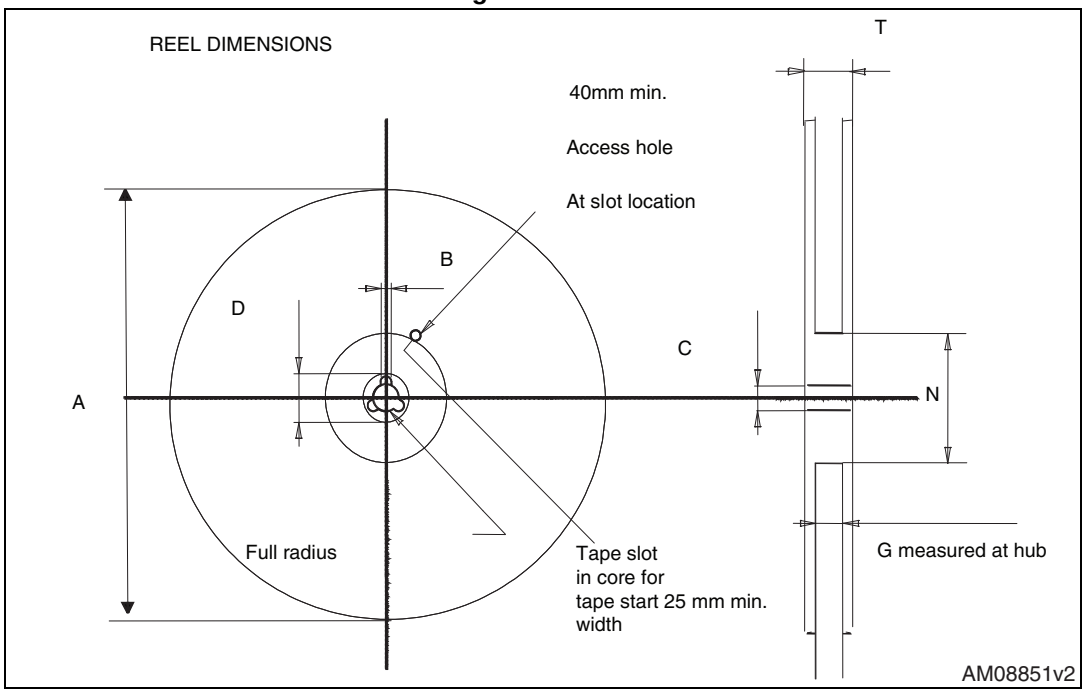


Table 10. D²PAK (TO-263) tape and reel mechanical data

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 qty		1000
P2	1.9	2.1	Bulk qty		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

6 Revision history

Table 11. Document revision history

Date	Revision	Changes
02-Apr-2014	1	First release.

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