STB120NF10T4, STP120NF10, STW120NF10

N-channel 100 V, 9.0 mΩ typ., 110 A STripFET™ II Power MOSFETs in D²PAK, TO-220 and TO-247 packages

Datasheet - production data

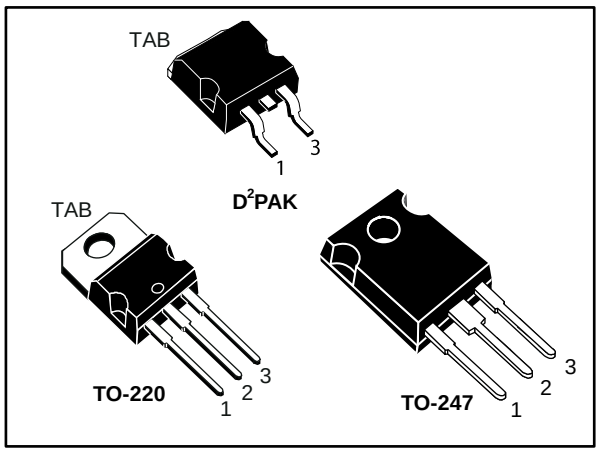
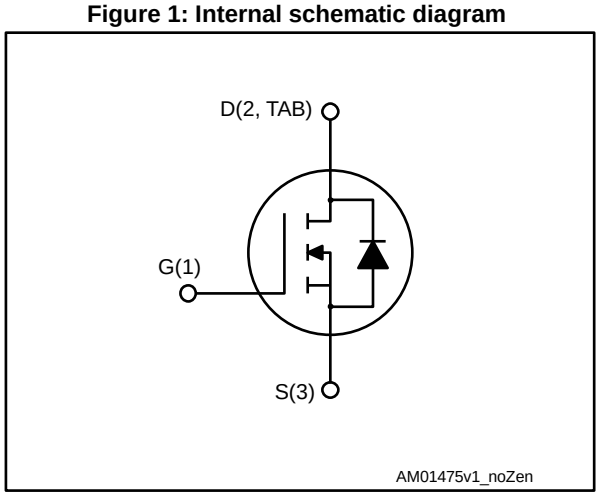


Figure 1: Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STB120NF10T4	100 V	10.5 mΩ	110 A
STP120NF10			
STW120NF10			

- 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.

Table 1: Device summary

Order code	Marking	Package	Packing
STB120NF10T4	B120NF10	D²PAK	Tape and reel
STP120NF10	P120NF10	TO-220	Tube
STW120NF10	120NF10	TO-247	

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	110	A
	Drain current (continuous) at T_C = 100 °C	77	A
I_{DM}(1)	Drain current (pulsed)	440	A
P_{TOT}	Total dissipation at T_C = 25 °C	312	W
dv/dt(2)	Peak diode recovery voltage slope	10	V/ns
E_{AS}(3)	Single pulse avalanche energy	550	mJ
T_j	Operating junction temperature range	-55 to 175	°C
T_{stg}	Storage temperature range		

Notes:

(1)Pulse width is limited by safe operating area.

(2)I_{SD} ≤ 110 A, di/dt ≤ 300 A/µs, V_{DD} = 80% $V_{(BR)DSS}$

(3)Starting T_j =25 °C, I_D = 60 A, V_{DD} = 50 V

Table 3: Thermal data

Symbol	Parameter	Value			Unit
		TO-220	TO-247	D²PAK	
$R_{thj\text{-}case}$	Thermal resistance junction-case	0.48			°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	62.5			°C/W
$R_{thj\text{-}pcb}$	Thermal resistance junction-pcb(1)			35	°C/W

Notes:

(1)When mounted on an 1-inch² FR-4, 2 Oz copper board.

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	V_{GS} = 0 V, I_D = 250 µA	100			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 100 V			1	µA
		V_{GS} = 0 V, V_{DS}= 100 V, T_c = 125 °C(1)			10	µA
I_{GSS}	Gate-source 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 = 60 A		9.0	10.5	mΩ

Notes:

(1)Defined by design, not subject to production test.

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 V	-	5200		pF
C_{oss}	Output capacitance			785		pF
C_{rss}	Reverse transfer capacitance			325		pF
Q_g	Total gate charge	V_{DD} = 80 V, I_D= 120 A, V_{GS} = 0 to 10 V (see *Figure 14: "Test circuit for gate charge behavior"*)	-	172	233(1)	nC
Q_{gs}	Gate-source charge			32		nC
Q_{gd}	Gate-drain charge			64		nC

Notes:

(1)Defined by design, not subject to production test.

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: "Test circuit for resistive load switching times"* and *Figure 18: "Switching time waveform"*)	-	25	-	ns
t_r	Rise time		-	90	-	ns
$t_{d(off)}$	Turn-off delay time		-	132	-	ns
t_f	Fall time		-	68	-	ns

Table 7: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source drain current		-		110	A
I_{SDM}(1)	Source-drain current (pulsed)		-		440	A
V_{SD}(2)	Forward on voltage	I_{SD} = 120 A, V_{GS}= 0 V	-		1.3	V
t_{rr}	Reverse recovery time	I_{SD} = 120 A, di/dt = 100 A/µs, V_{DD} = 40 V, T_j = 150 °C (see *Figure 15: "Test circuit for inductive load switching and diode recovery times"*)	-	152		ns
Q_{rr}	Reverse recovery charge		-	760		nC
I_{RRM}	Reverse recovery current		-	10		A

Notes:

(1)Pulse width is 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

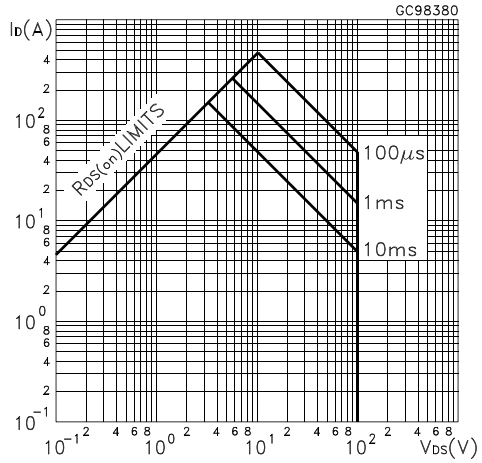


Figure 3: Thermal impedance

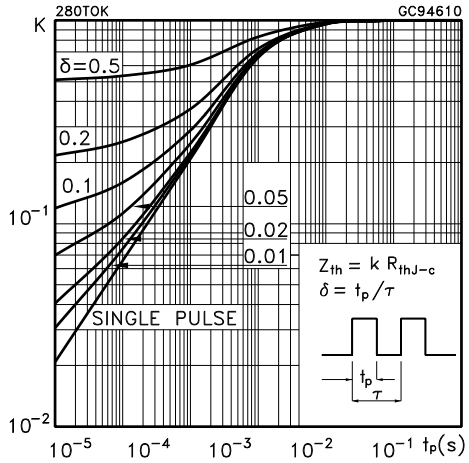


Figure 4: Output characteristics

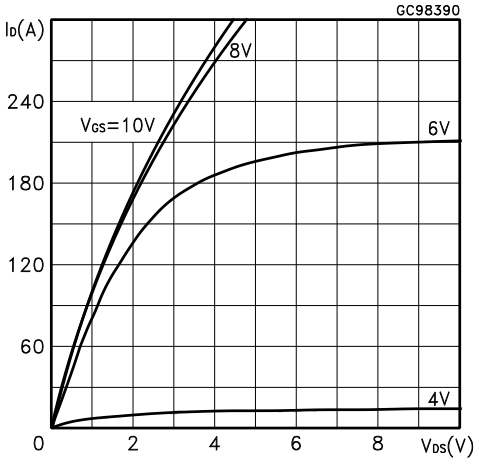


Figure 5: Transfer characteristics

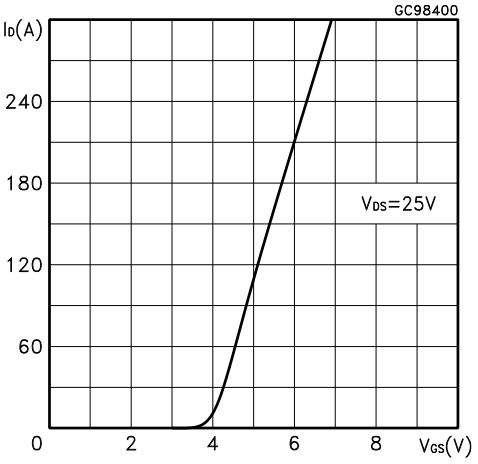


Figure 6: Normalized $V_{(BR)DSS}$ vs temperature

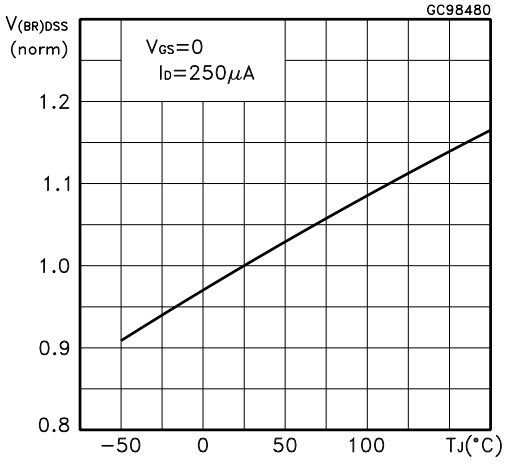


Figure 7: Static drain-source on-resistance

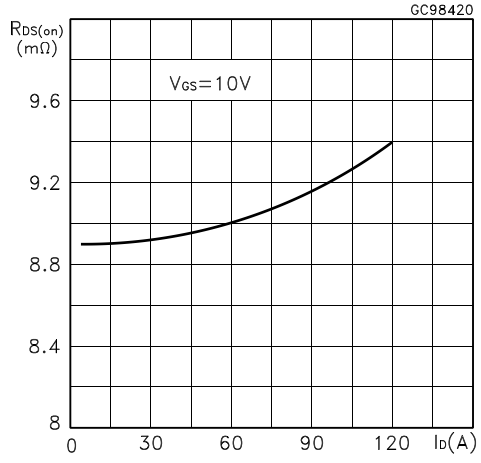


Figure 8: Gate charge vs gate-source voltage

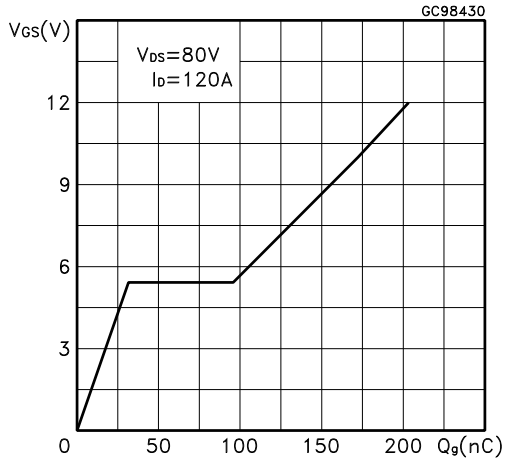


Figure 9: Capacitance variations

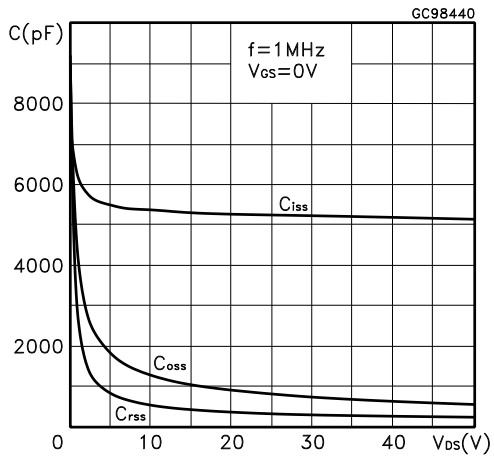


Figure 10: Normalized gate threshold voltage vs temperature

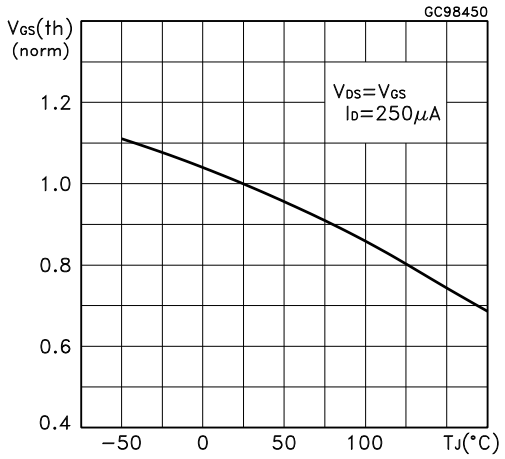


Figure 11: Normalized on-resistance vs temperature

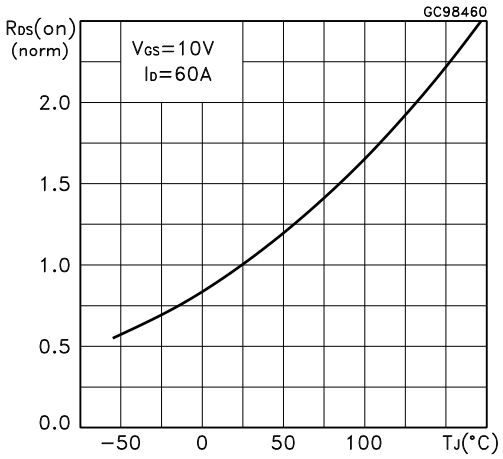
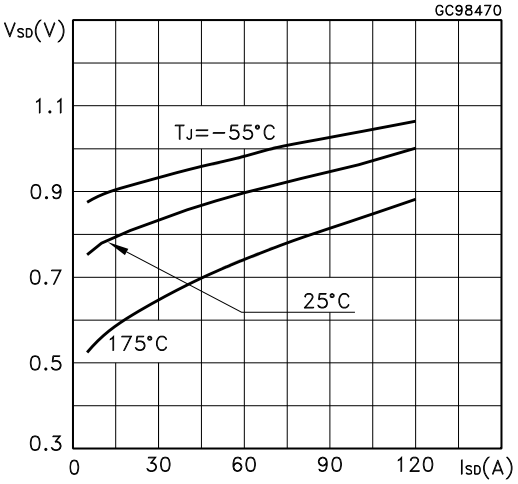


Figure 12: Source-drain diode forward characteristics



3 Test circuits

Figure 13: Test circuit for resistive load switching times

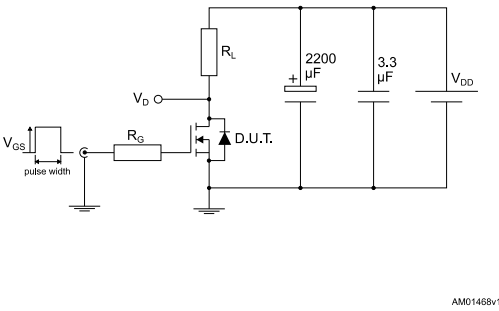


Figure 14: Test circuit for gate charge behavior

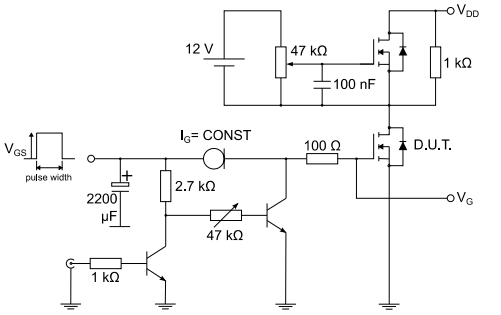


Figure 15: Test circuit for inductive load switching and diode recovery times

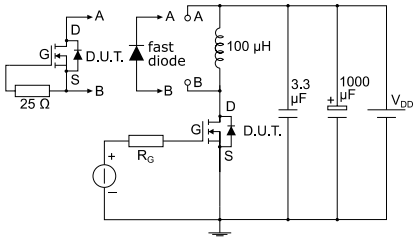


Figure 16: Unclamped inductive load test circuit

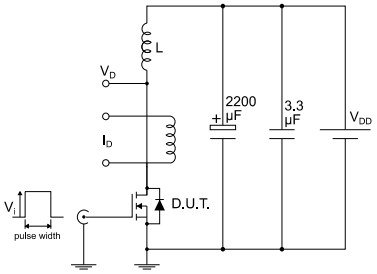


Figure 17: Unclamped inductive waveform

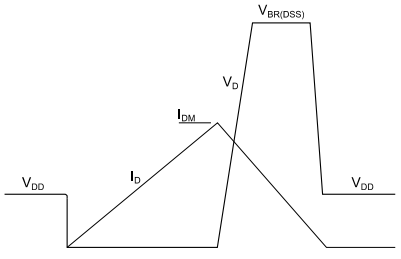
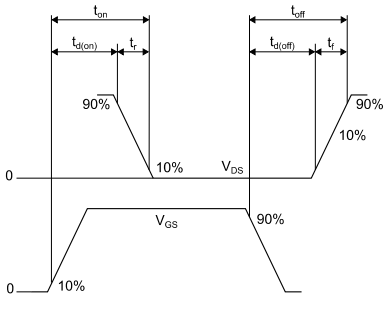


Figure 18: Switching time waveform



4 Package 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 A2 package information

Figure 19: D²PAK (TO-263) type A2 package outline

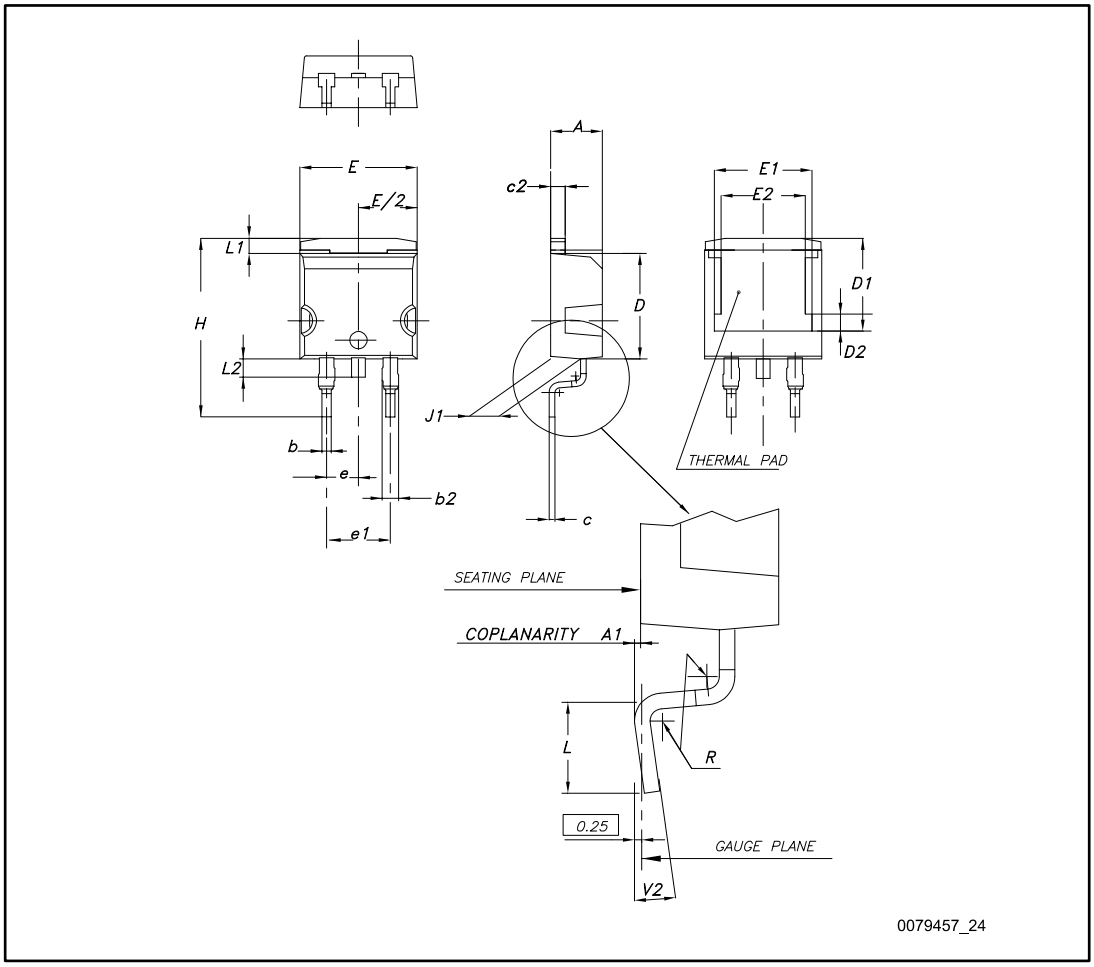
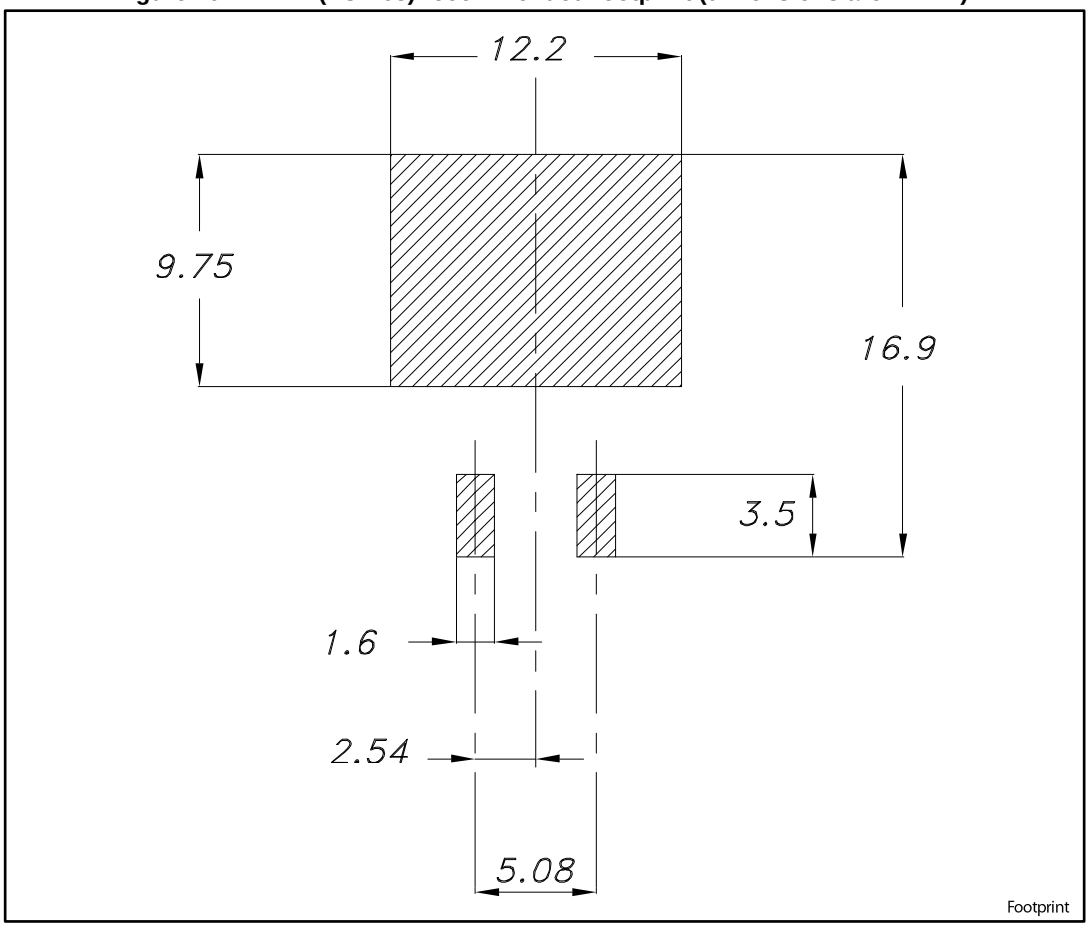


Table 8: D²PAK (TO-263) type A2 package mechanical data

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	8.70	8.90	9.10
E2	7.30	7.50	7.70
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 D²PAK packing information

Figure 21: D²PAK tape outline

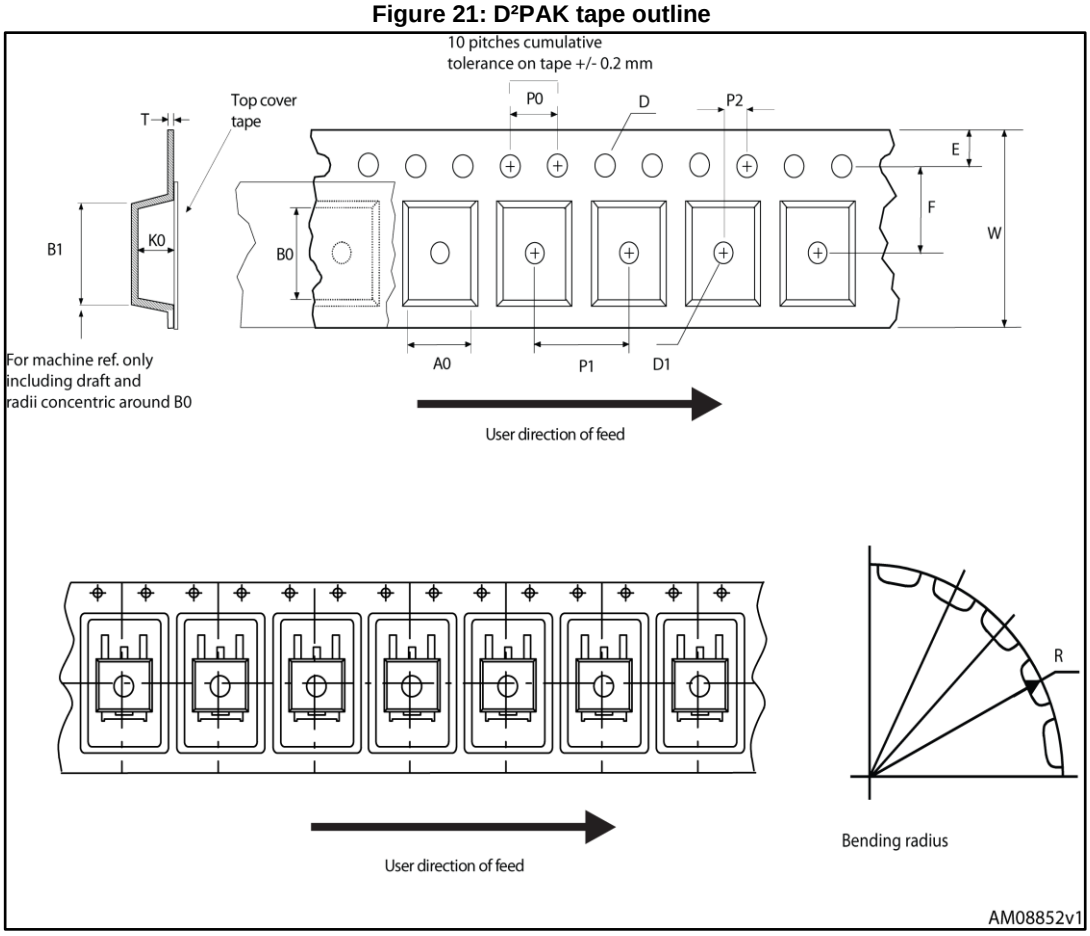


Figure 22: D²PAK reel outline

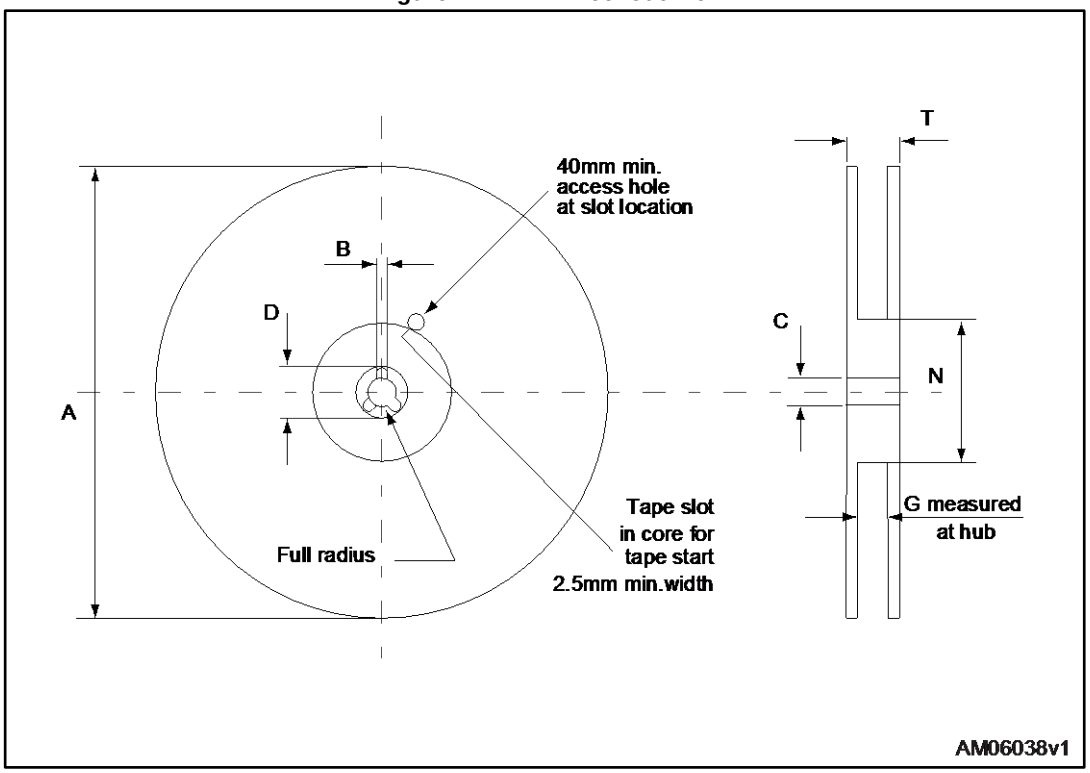


Table 9: D²PAK tape and reel mechanical data

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			

4.3 TO-220 package information

Figure 23: TO-220 type A package outline

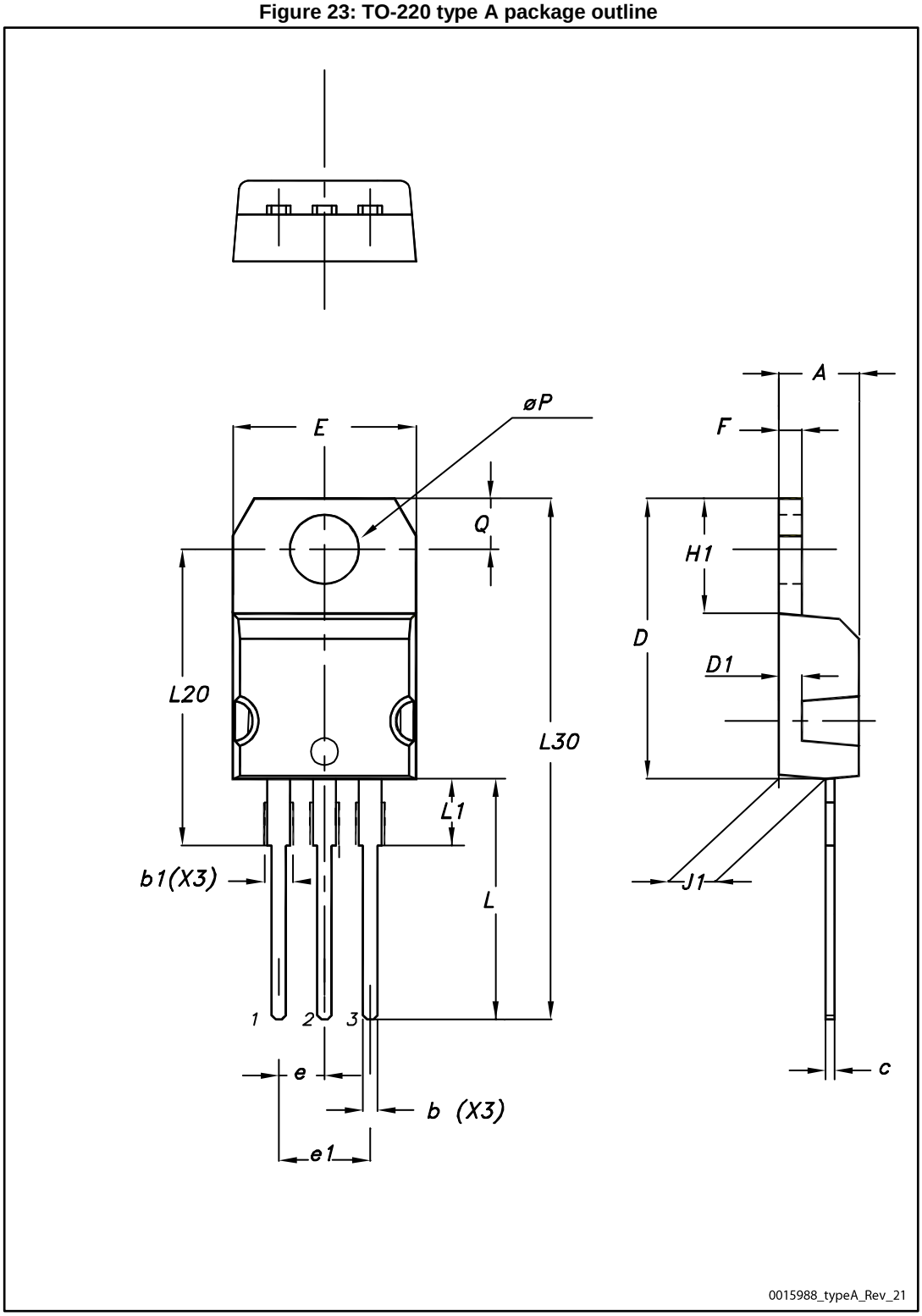


Table 10: TO-220 type A package mechanical data

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

4.4 TO-247 package information

Figure 24: TO-247 package outline

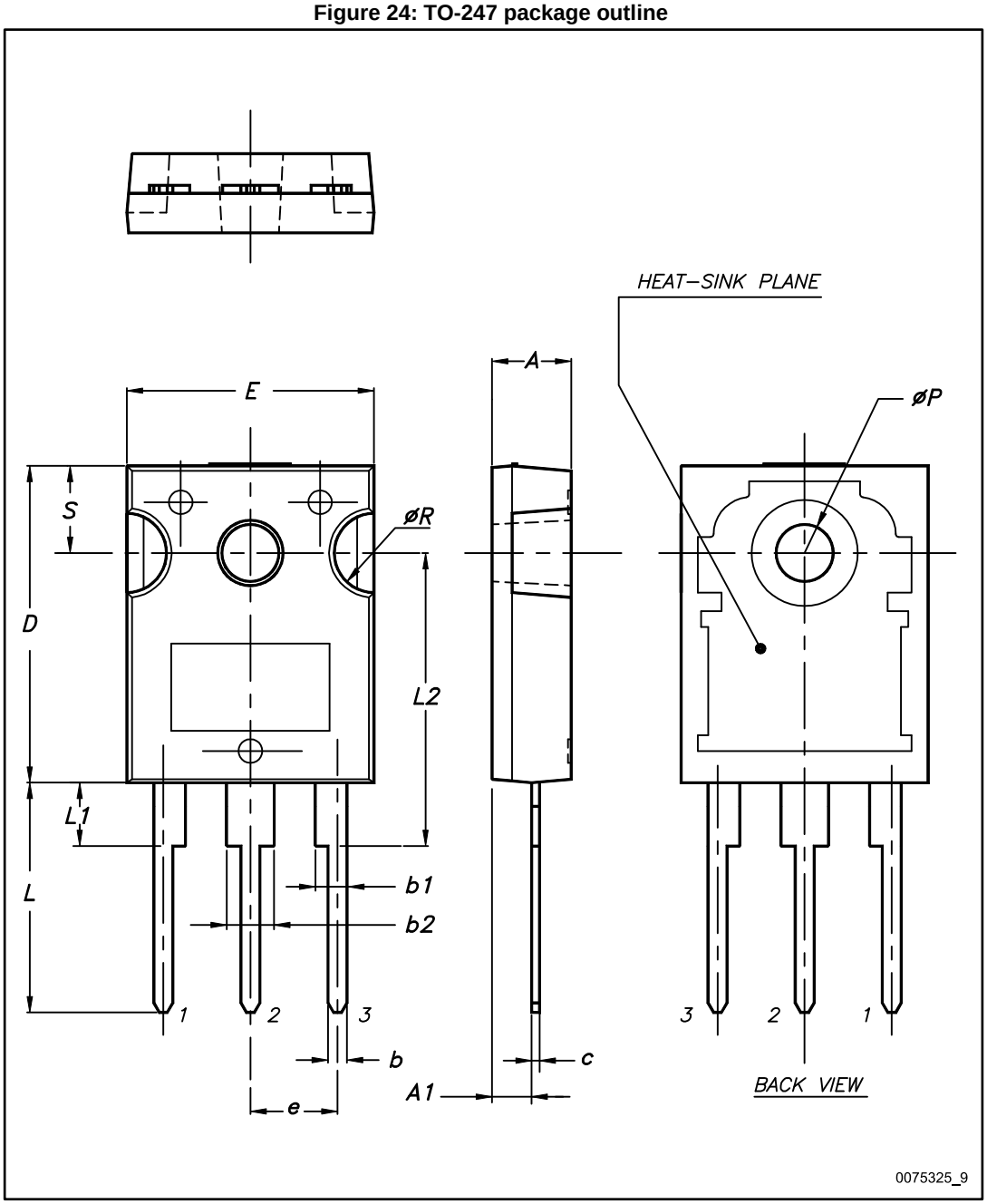


Table 11: TO-247 package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
ØP	3.55		3.65
ØR	4.50		5.50
S	5.30	5.50	5.70

5 Revision history

Table 12: Document revision history

Date	Revision	Changes
20-Mar-2006	2	Preliminary datasheet
31-Mar-2006	3	Typing error
19-Jun-2006	4	New template, no content change
28-Jun-2006	5	New I_D value on *Table 2*
05-Oct-2006	6	New value on *Table 7*
11-May-2011	7	Added new package and mechanical data: TO-220FP
03-Nov-2017	8	Part number STF120NF10 has been moved to a separate datasheet. Updated features, description and device summary on cover page. Updated *Table 2: "Absolute maximum ratings"*, *Table 3: "Thermal data"* and *Table 4: "On/off states"*. Updated *Section 4: "Package information"*. Minor text changes

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