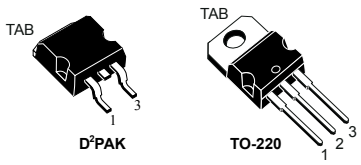
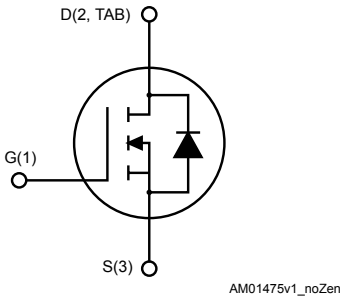
Datasheet

N-channel 200 V, 15 mΩ, 65 A, MDmesh™ M5 Power MOSFETs in D²PAK and TO-220 packages





Features

Order codes	V_{DS}	$R_{DS(on)}$ max.	I_D
STB80N20M5	200 V	20 mΩ	65 A
STP80N20M5			

- Extremely low $R_{DS(on)}$
- Low gate charge and input capacitance
- Excellent switching performance
- 100% avalanche tested

Applications

- Switching applications

Description

These devices are N-channel Power MOSFETs based on the MDmesh™ M5 innovative vertical process technology combined with the well-known PowerMESH™ horizontal layout. The resulting products offer extremely low on-resistance, making them particularly suitable for applications requiring high power and superior efficiency.

Product status links
STB80N20M5
STP80N20M5

Product summary	
Order code: STB80N20M5	
Marking	80N20M5
Package	D²PAK
Packing	Tape and reel
Order code: STP80N20M5	
Marking	80N20M5
Package	TO-220
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	±25	V
I_D	Drain current (continuous) at T_C = 25 °C	65	A
	Drain current (continuous) at T_C = 100 °C	41	A
I_{DM}(1)	Drain current (pulsed)	232	A
P_{TOT}	Total power dissipation at T_C = 25 °C	190	W
I_{AR}	Avalanche current, repetitive or non-repetitive (pulse width limited by T_{Jmax})	20	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	500	mJ
dv/dt(2)	Peak diode recovery voltage slope	15	V/ns
T_j	Operating junction temperature range	-55 to 150	°C
T_{stg}	Storage temperature range		

1. *Pulse width limited by safe operating area*
2. *I_{SD} ≤ 65 A, di/dt ≤ 400 A/µs, $V_{DS(peak)}$ < $V_{(BR)DSS}$*

Table 2. Thermal data

Symbol	Parameter	Value		Unit
		D^2PAK	TO-220	
$R_{thj\text{-}case}$	Thermal resistance junction-case	0.66		°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient		62.5	°C/W
$R_{thj\text{-}pcb}$	Thermal resistance junction-pcb	30		°C/W

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	I_D = 1 mA, V_{GS} = 0 V	200			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 200 V			1	µA
		V_{GS} = 0 V, V_{DS} = 200 V, T_C = 125 °C(1)			100	µA
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = ±25 V			100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	3	4	5	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 32.5 A		15	20	mΩ

1. *Defined by design, not subject to production test.*

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 50 V, f = 1 MHz, V_{GS} = 0 V	-	4080	-	pF
C_{oss}	Output capacitance			290		
C_{rss}	Reverse transfer capacitance			50		
$C_{o(tr)}$(1)	Time-related equivalent capacitance	V_{DS} = 0 to 160 V, V_{GS} = 0 V	-	740	-	pF
$C_{o(er)}$(2)	Energy-related equivalent capacitance		-	295	-	pF
Rg	Gate input resistance	f = 1 MHz open drain	-	2	-	Ω
Q_g	Total gate charge	V_{DD} = 160 V, I_D = 32.5 A, V_{GS} = 0 to 10 V (see Figure 14. Test circuit for gate charge behavior)	-	108	-	nC
Q_{gs}	Gate-source charge			23		
Q_{gd}	Gate-drain charge			62		

1. *$C_{o(tr)}$ is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}.*
2. *$C_{o(er)}$ is defined as a constant equivalent capacitance giving the same stored energy as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}.*

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(v)}$	Voltage delay time	V_{DD} = 160 V, I_D = 65 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 15. Test circuit for inductive load switching and diode recovery times and Figure 18. Switching time waveform)	-	83	-	ns
$t_{r(v)}$	Voltage rise time			26		
$t_{f(i)}$	Current fall time			46		
$t_{c(off)}$	Crossing time			77		

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		65	A
I_{SDM} (1)	Source-drain current (pulsed)				232	
V_{SD} (2)	Forward on voltage	I_{SD} = 65 A, V_{GS} = 0 V	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 65 A, di/dt = 100 A/µs, V_{DD} = 60 V (see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	178		ns
Q_{rr}	Reverse recovery charge			1.4		µC
I_{RRM}	Reverse recovery current			16		A
t_{rr}	Reverse recovery time	I_{SD} = 65 A, di/dt = 100 A/µs, V_{DD} = 60 V, T_j = 150 °C (see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	219		ns
Q_{rr}	Reverse recovery charge			2.1		µC
I_{RRM}	Reverse recovery current			20		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

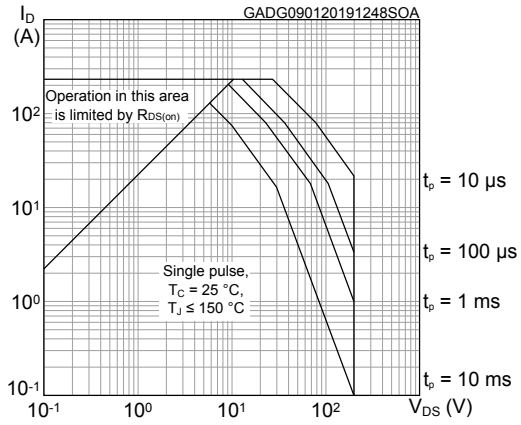


Figure 2. Thermal impedance

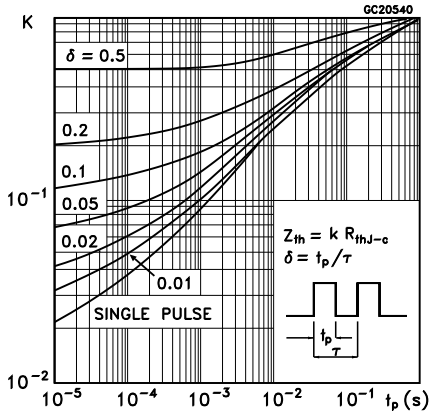


Figure 3. Output characteristics

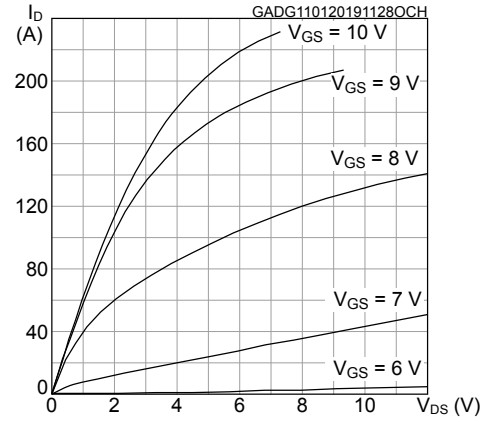


Figure 4. Transfer characteristics

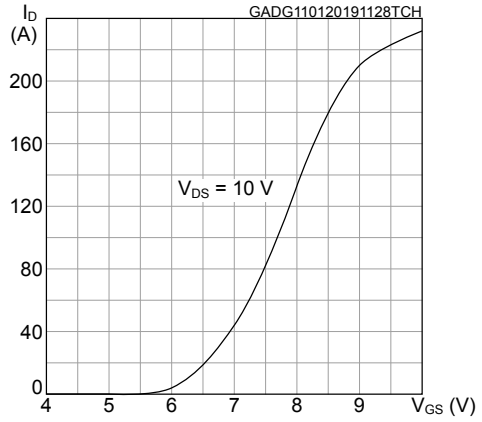


Figure 5. Gate charge vs gate-source voltage

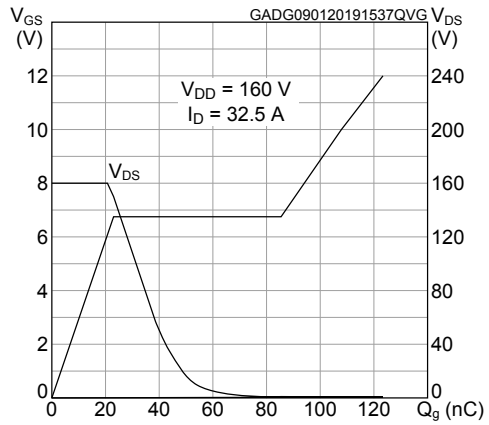


Figure 6. Static drain-source on-resistance

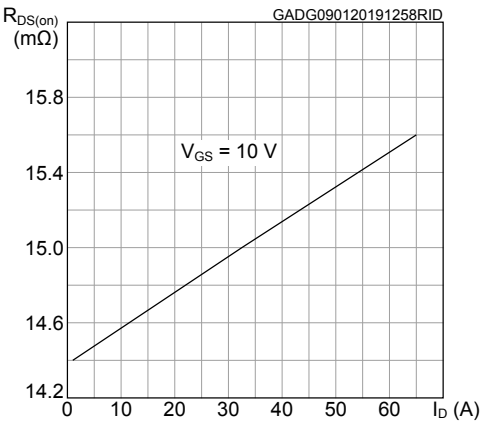


Figure 7. Capacitance variations

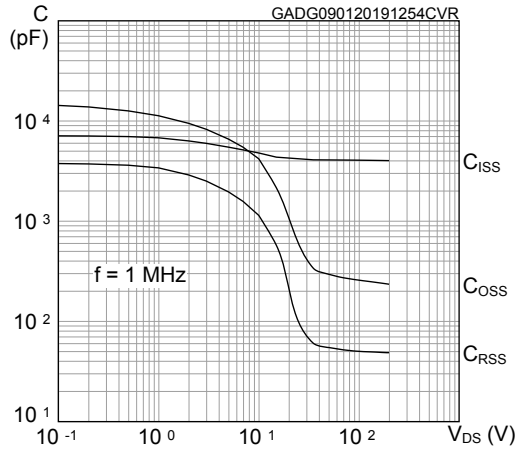


Figure 8. Output capacitance stored energy

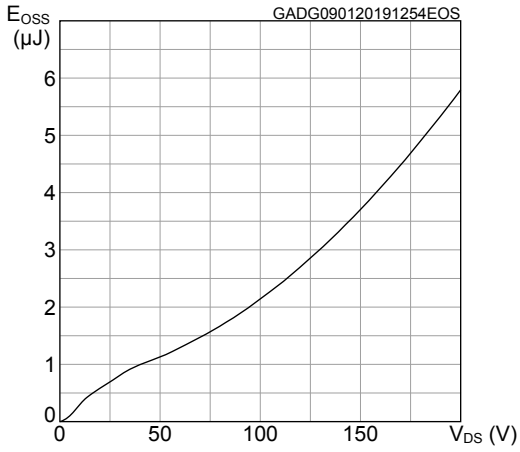


Figure 9. Normalized gate threshold voltage vs temperature

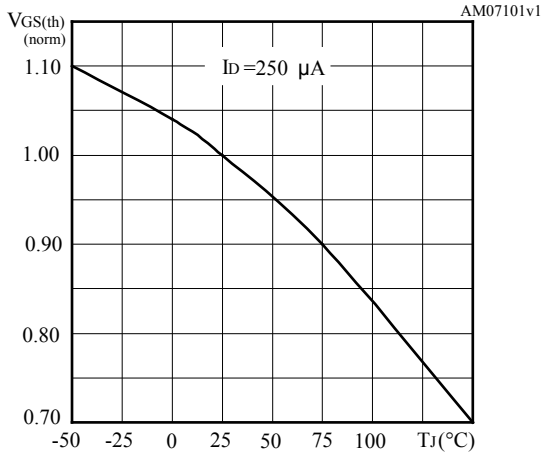


Figure 10. Normalized on-resistance vs temperature

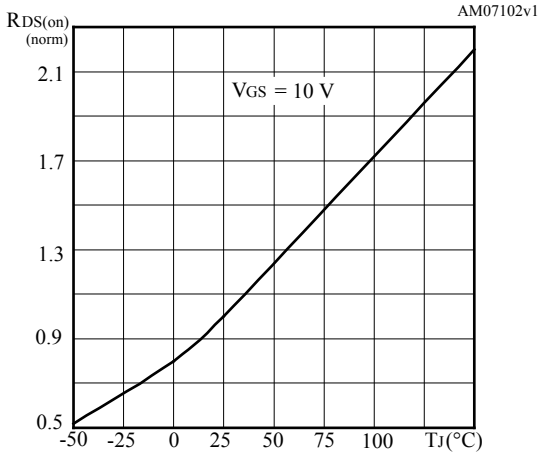


Figure 11. Normalized $V_{(BR)DSS}$ vs temperature

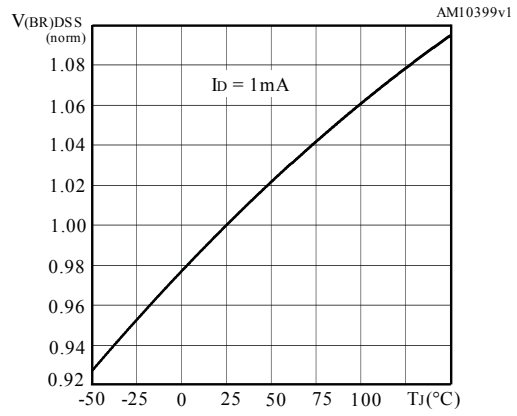
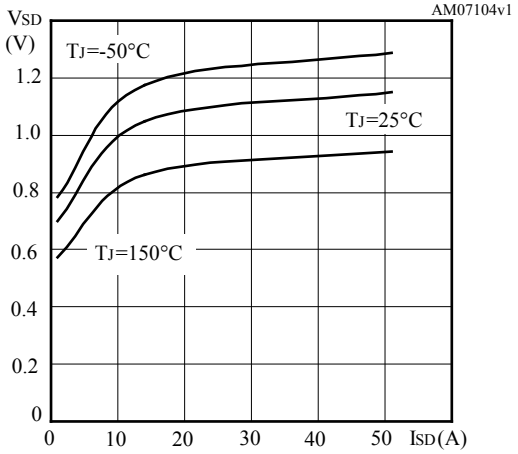


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Test circuit for resistive load switching times

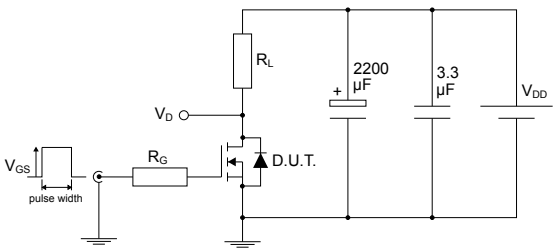


Figure 14. Test circuit for gate charge behavior

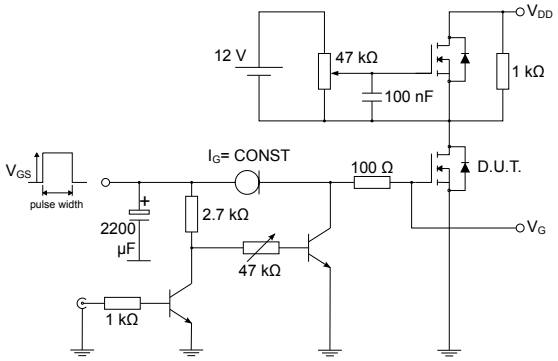


Figure 15. Test circuit for inductive load switching and diode recovery times

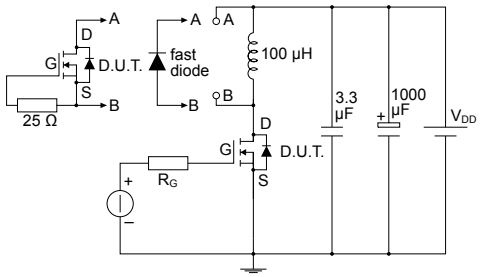


Figure 16. Unclamped inductive load test circuit

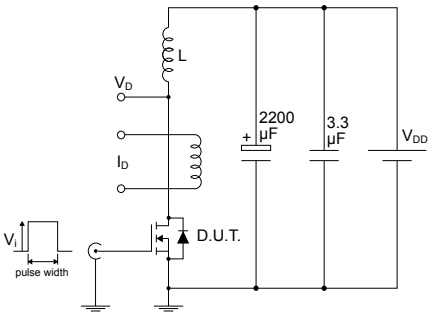


Figure 17. Unclamped inductive waveform

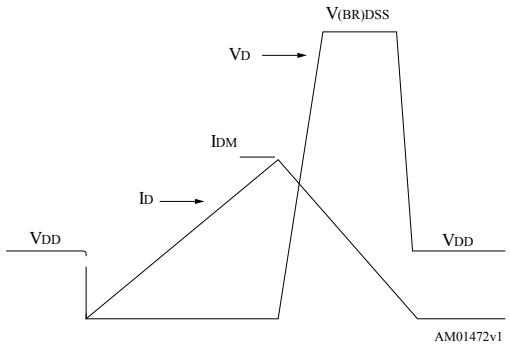
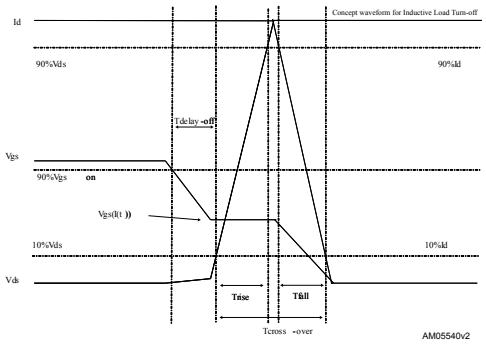


Figure 18. Switching time waveform



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

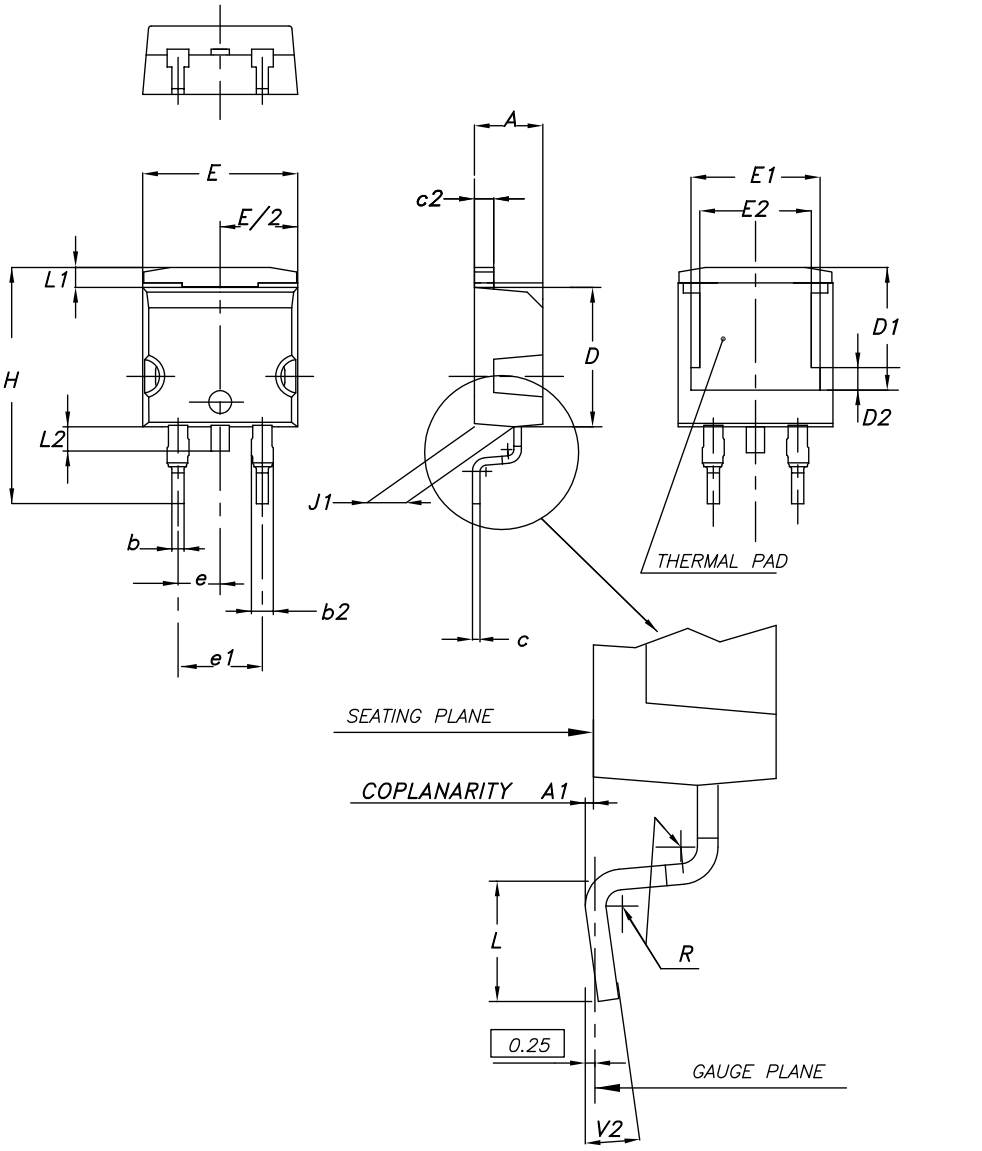
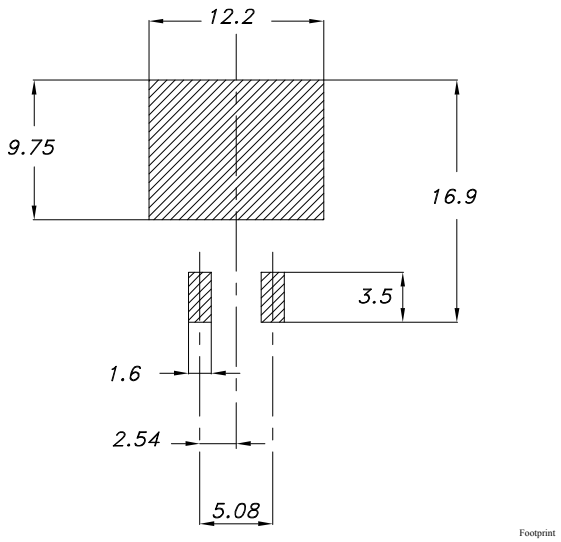


Table 7. D²PAK (TO-263) type A2 package mechanical data

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

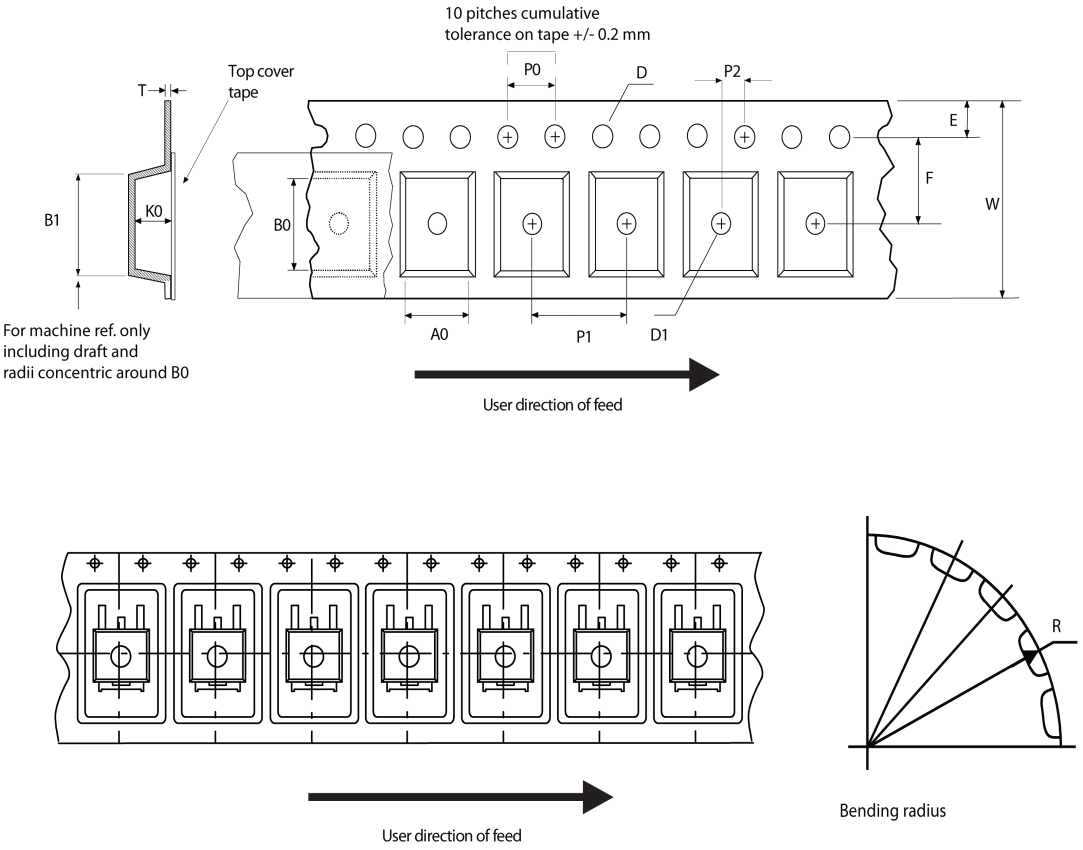


Figure 22. **D²PAK reel outline**

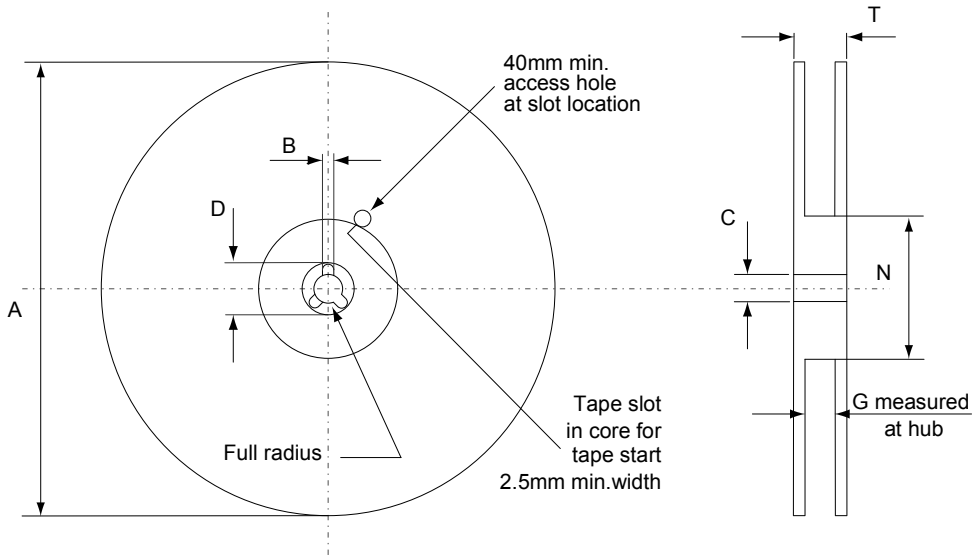


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Table 8. **D²PAK tape and reel mechanical data**

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 type A package information

Figure 23. **TO-220 type A package outline**

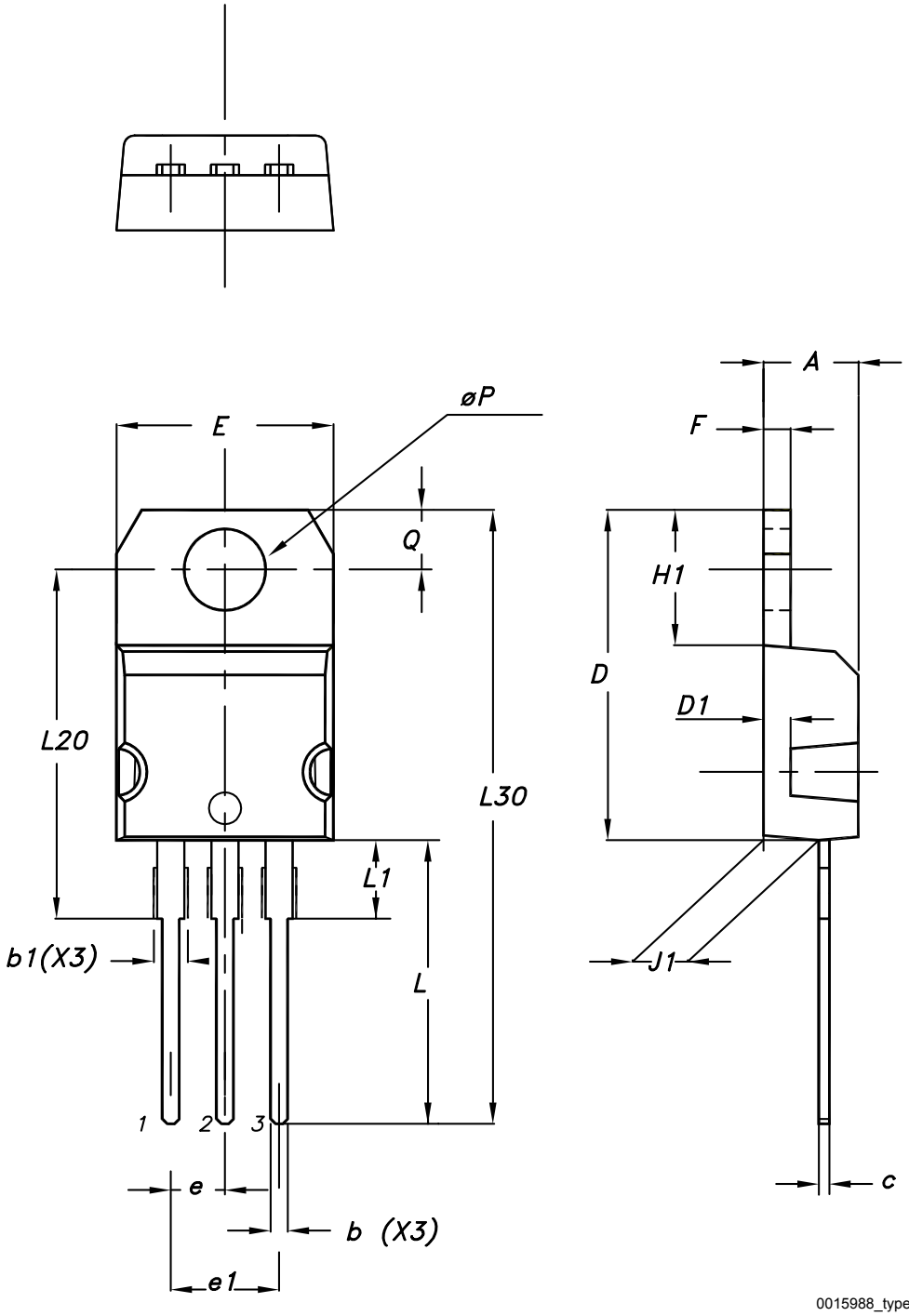

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Table 9. **TO-220 type A package mechanical data**

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

Revision history

Table 10. **Document revision history**

Date	Version	Changes
01-Jul-2009	1	First release
03-Jul-2010	2	Document status promoted from preliminary data to datasheet
16-Jan-2019	3	Updated title, features and internal schematic diagram on cover page. Updated Section 1 Electrical ratings, Section 2 Electrical characteristics and Section 4.1 D²PAK (TO-263) type A2 package information. Minor text changes.

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