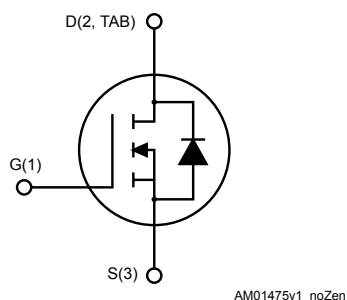
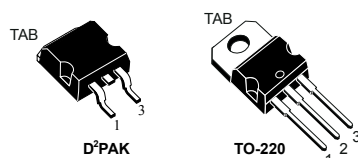


N-channel 200 V, 15 mΩ, 65 A, MDmesh™ M5 Power MOSFETs in D²PAK and TO-220 packages



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	D ² PAK
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 $T_C = 25\text{ }^{\circ}\text{C}$	65	A
	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	41	A
$I_{DM}^{(1)}$	Drain current (pulsed)	232	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	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 $T_J = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	500	mJ
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
T_J	Operating junction temperature range	-55 to 150	$^{\circ}\text{C}$
T_{stg}	Storage temperature range		

1. Pulse width limited by safe operating area

2. $I_{SD} \leq 65\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DS(peak)} < V_{(BR)DSS}$

Table 2. Thermal data

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

2 Electrical characteristics

($T_{CASE} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

Table 3. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$, $V_{GS} = 0\text{ V}$	200			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 200\text{ V}$			1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 200\text{ V}$, $T_C = 125\text{ }^{\circ}\text{C}^{(1)}$			100	μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 25\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$, $I_D = 32.5\text{ A}$		15	20	m Ω

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

Table 4. Dynamic

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

- $C_{o(tr)}$ 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} .
- $C_{o(er)}$ 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	$V_{DD} = 160\text{ V}$, $I_D = 65\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (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	$I_{SD} = 65\text{ A}$, $V_{GS} = 0\text{ V}$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 65\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$ (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	$I_{SD} = 65\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (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)

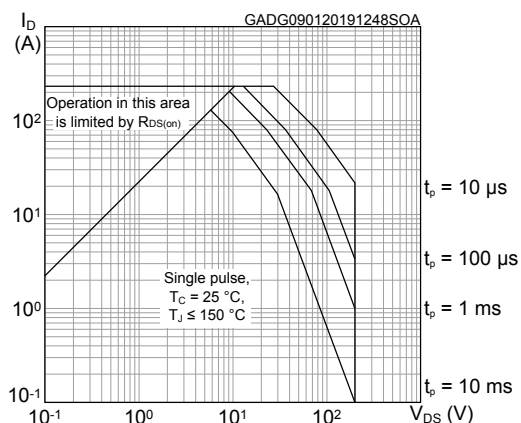
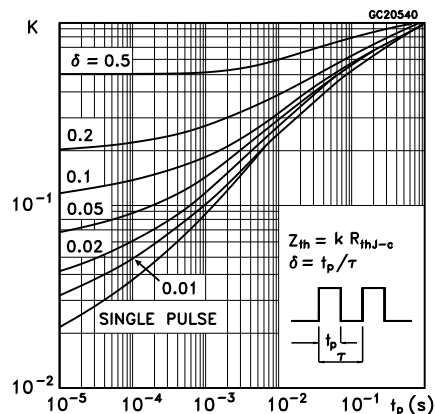
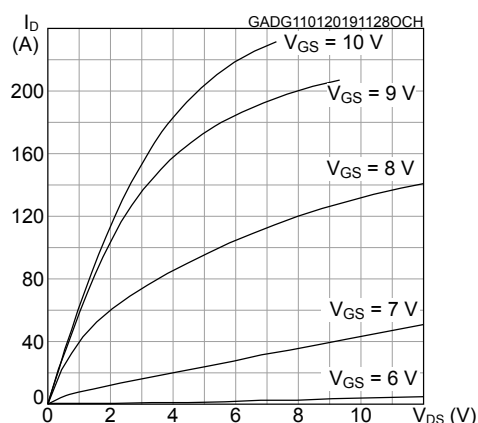
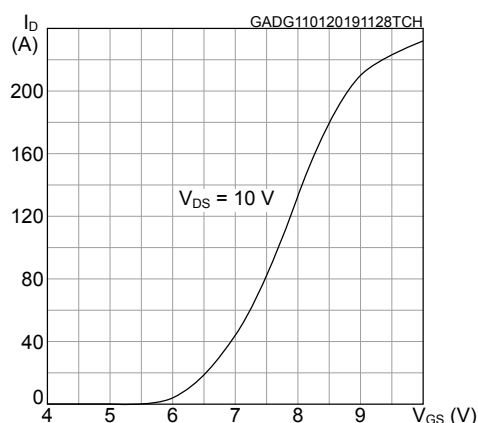
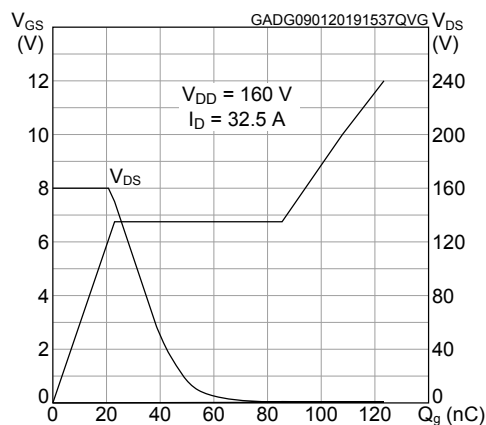
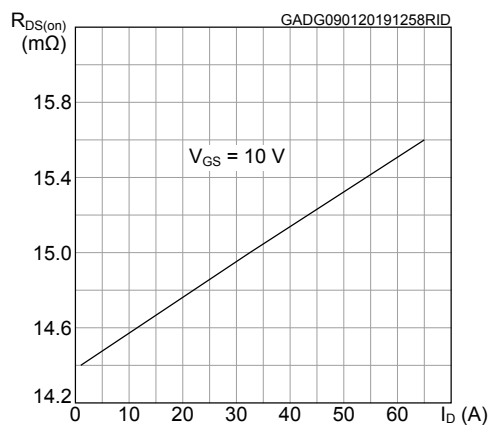
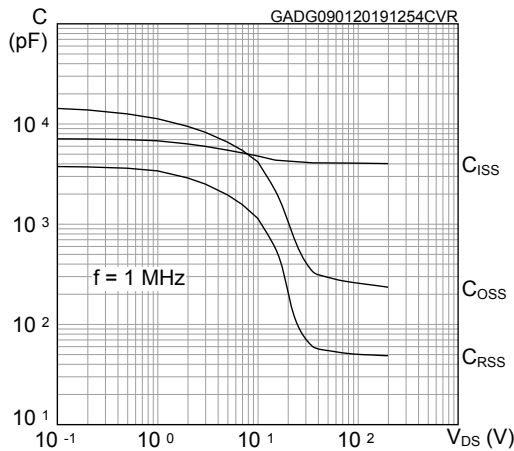
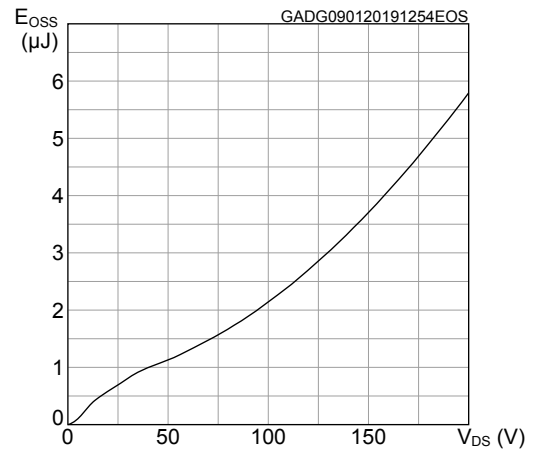
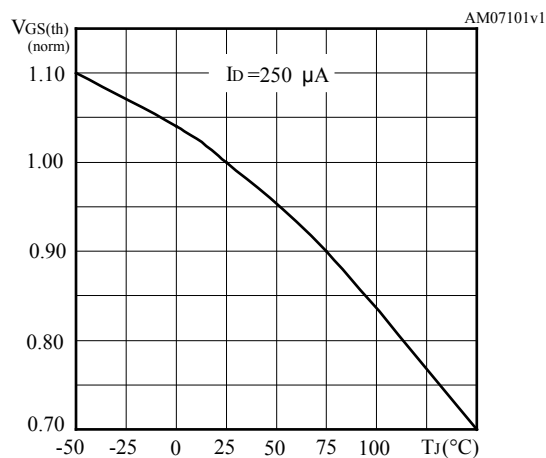
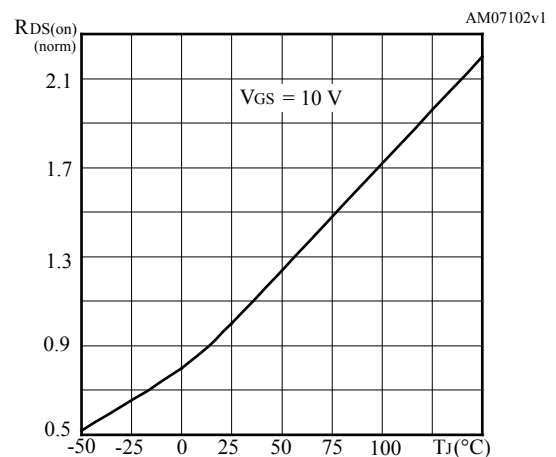
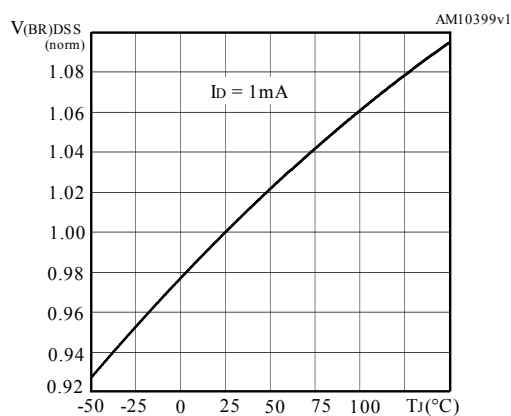
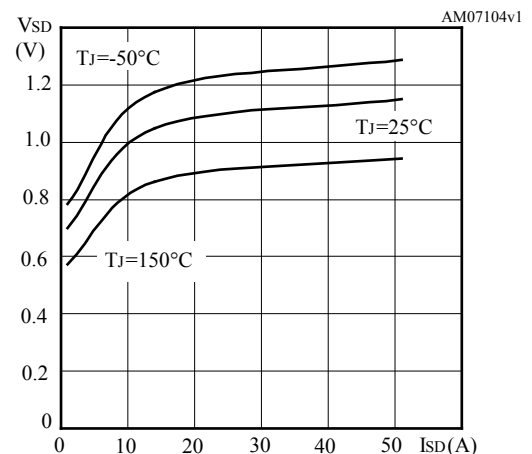
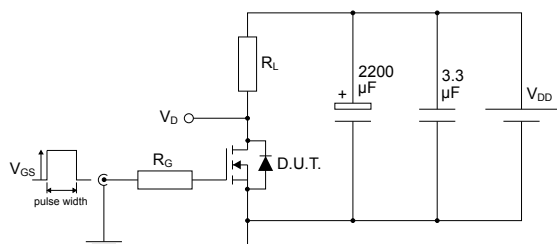
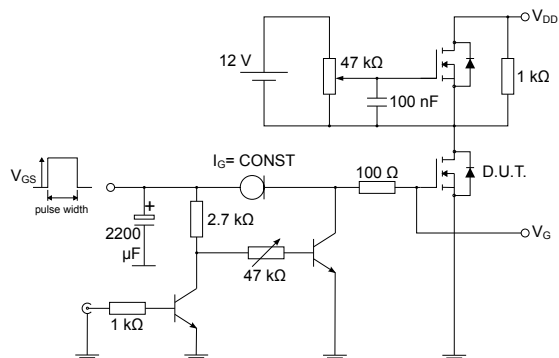
Figure 1. Safe operating area

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


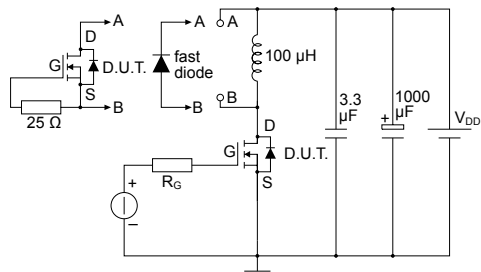
3 Test circuits

Figure 13. Test circuit for resistive load switching times


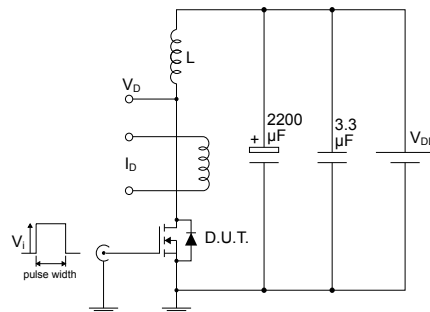
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Figure 14. Test circuit for gate charge behavior


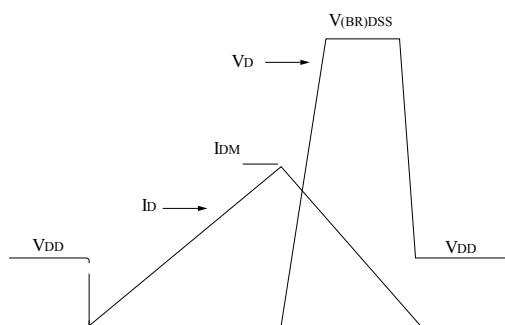
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Figure 15. Test circuit for inductive load switching and diode recovery times


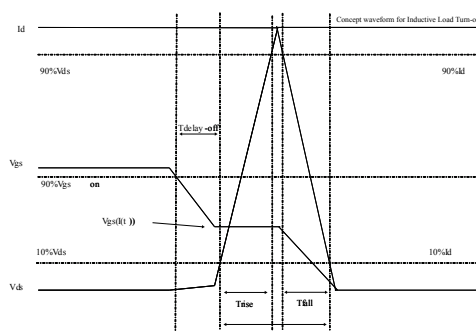
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Figure 16. Unclamped inductive load test circuit


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Figure 17. Unclamped inductive waveform


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Figure 18. Switching time waveform


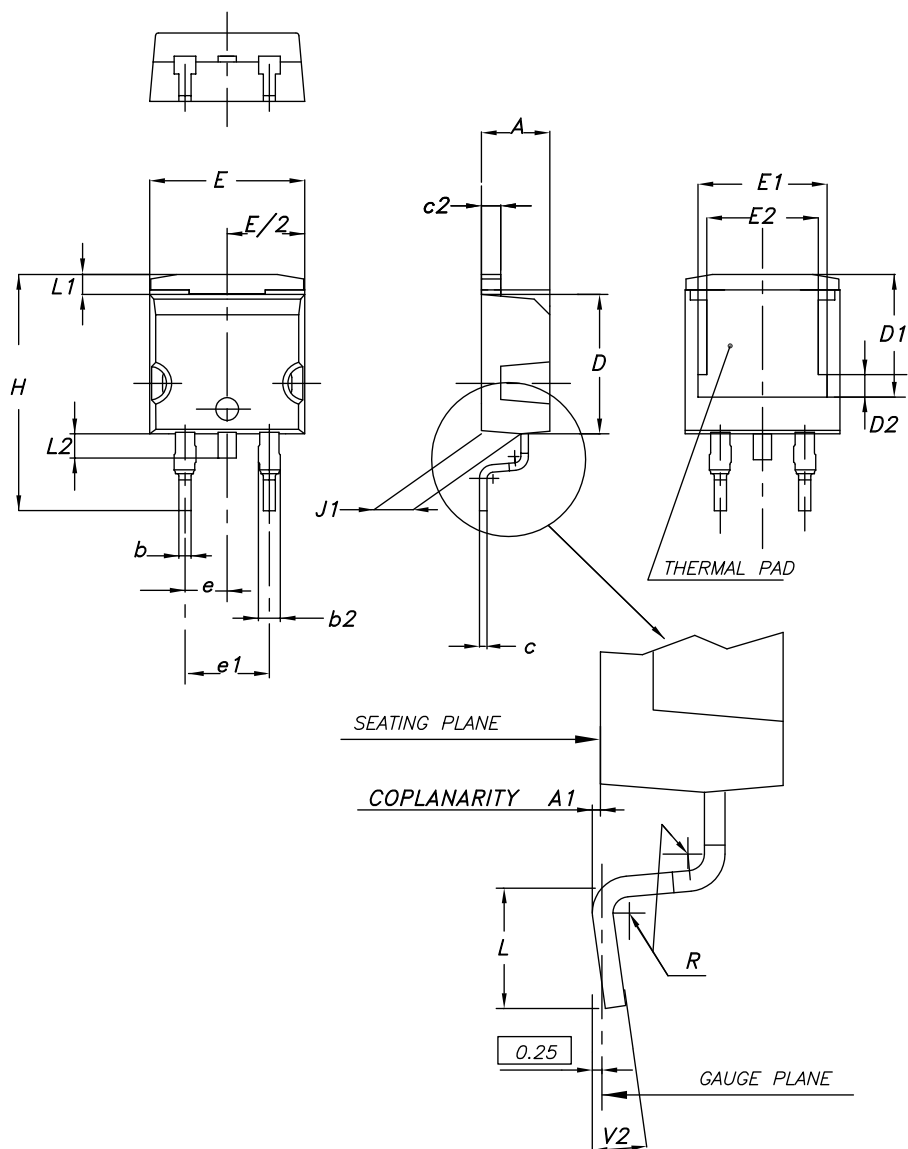
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4 Package information

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 A2 package information

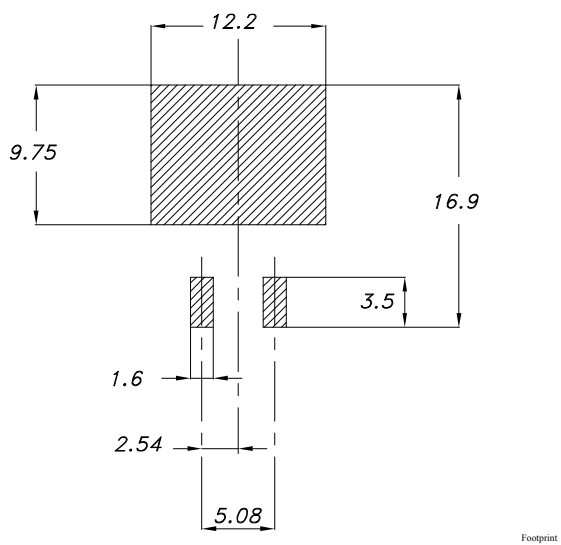
Figure 19. D²PAK (TO-263) type A2 package outline



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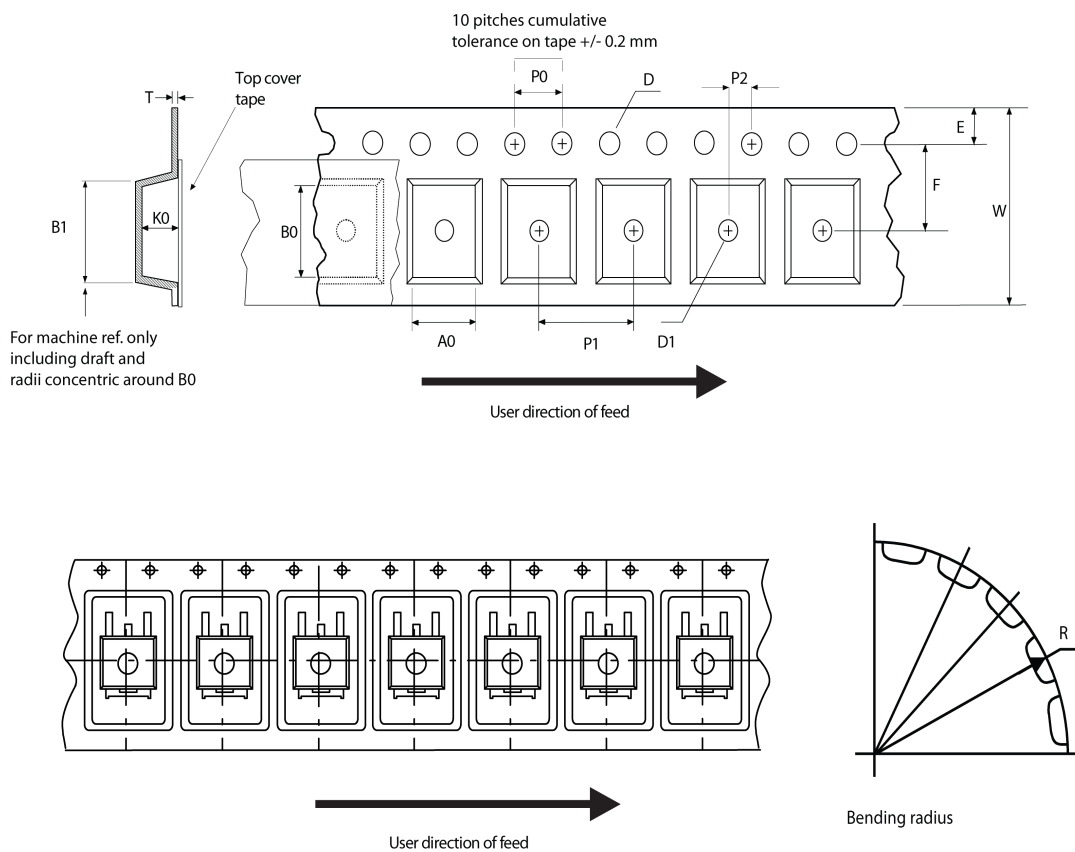
Table 7. D²PAK (TO-263) type A2 package mechanical data

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°

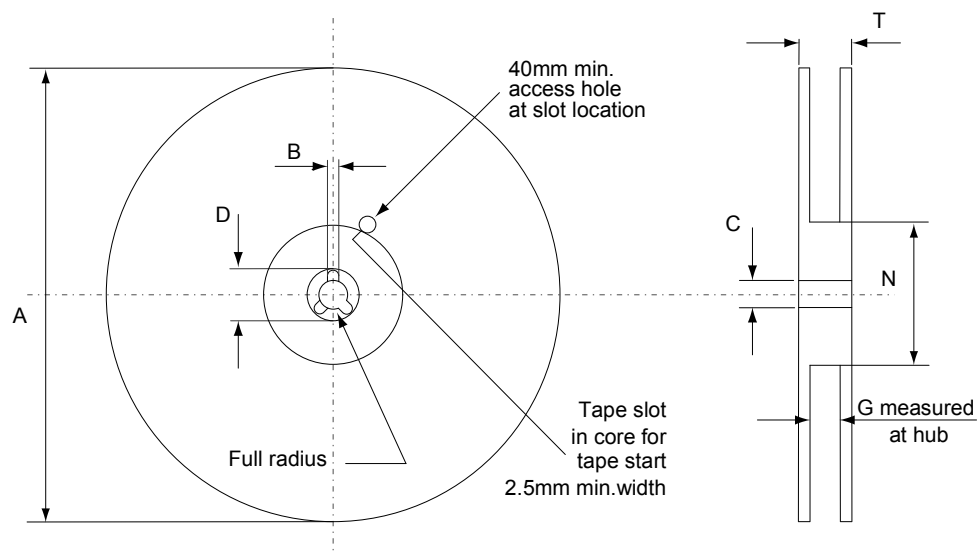
Figure 20. D²PAK (TO-263) recommended footprint (dimensions are in mm)


4.2 D²PAK packing information

Figure 21. D²PAK tape outline



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Figure 22. D²PAK reel outline


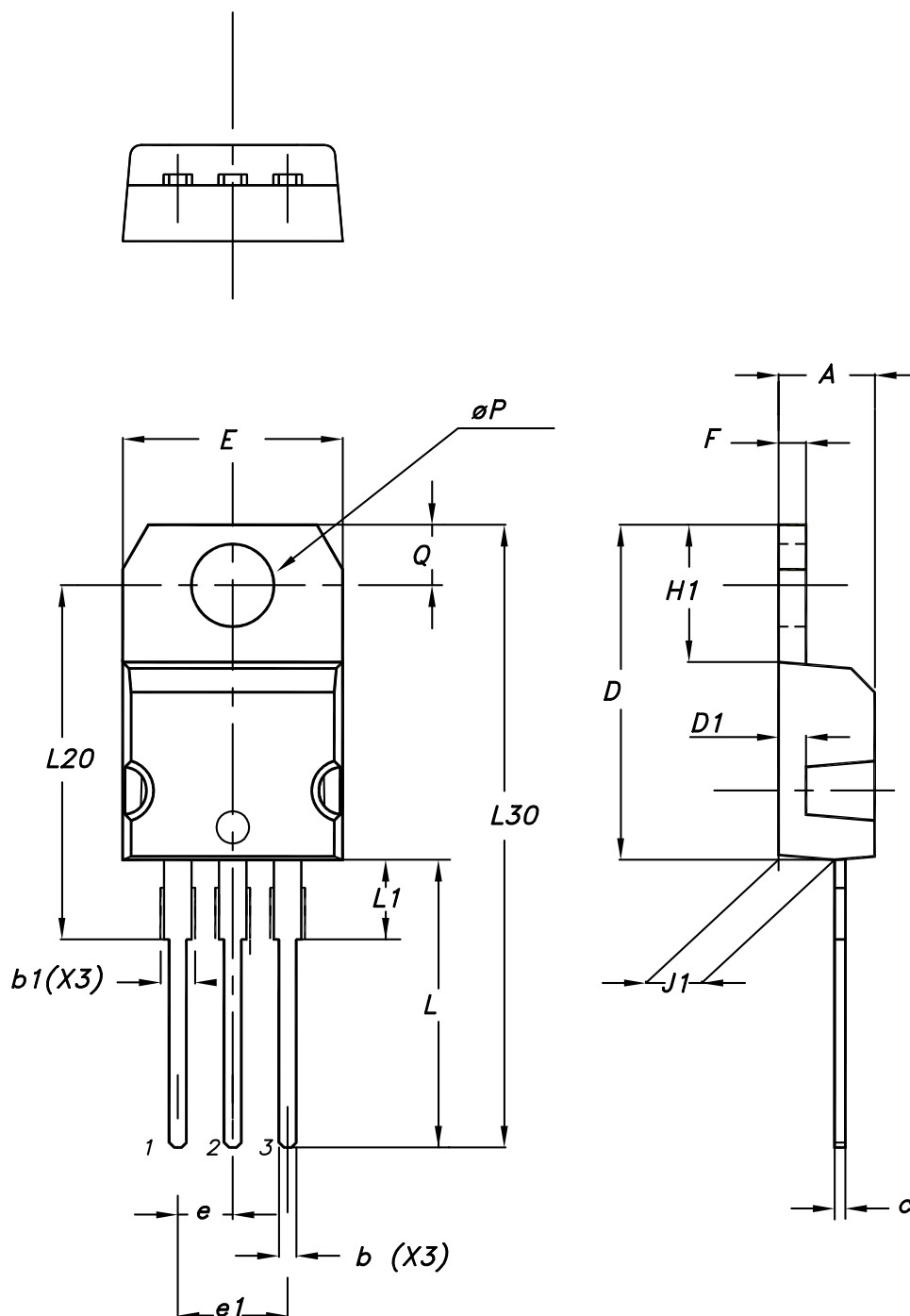
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Table 8. D²PAK tape and reel mechanical data

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



0015988_typeA_Rev_22

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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