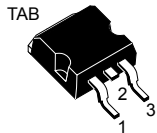
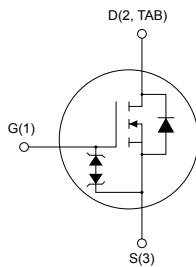


N-channel 600 V, 162 mΩ typ., 17 A, MDmesh™ M6 Power MOSFET in a D²PAK package


 D²PAK


AM01475V1

Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STB24N60M6	600 V	190 mΩ	17 A

- Reduced switching losses
- Lower R_{DS(on)} per area vs previous generation
- Low gate input resistance
- 100% avalanche tested
- Zener-protected

Applications

- Switching applications
- LLC converters
- Boost PFC converters

Description

The new MDmesh™ M6 technology incorporates the most recent advancements to the well-known and consolidated MDmesh family of SJ MOSFETs. STMicroelectronics builds on the previous generation of MDmesh devices through its new M6 technology, which combines excellent R_{DS(on)} per area improvement with one of the most effective switching behaviors available, as well as a user-friendly experience for maximum end-application efficiency.

Product status link

[STB24N60M6](#)

Product summary

Order code	STB24N60M6
Marking	24N60M6
Package	D ² PAK
Packing	Tape and reel

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 $T_{case} = 25\text{ °C}$	17	A
	Drain current (continuous) at $T_{case} = 100\text{ °C}$	10.7	
$I_{DM}^{(1)}$	Drain current (pulsed)	52.5	A
P_{TOT}	Total dissipation at $T_{case} = 25\text{ °C}$	130	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
$dv/dt^{(3)}$	MOSFET dv/dt ruggedness	50	
T_{stg}	Storage temperature range	-55 to 150	°C
T_j	Operating junction temperature range		

1. Pulse width is limited by safe operating area.
2. $I_{SD} \leq 17\text{ A}$, $di/dt = 400\text{ A}/\mu\text{s}$, $V_{DS} < V_{(BR)DSS}$, $V_{DD} = 400\text{ V}$
3. $V_{DS} \leq 480\text{ V}$

Table 2. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.96	°C/W
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	30	°C/W

1. When mounted on FR-4 board of 1 inch², 2 oz Cu.

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or non-repetitive (pulse width limited by T_{Jmax})	3.2	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	250	mJ

2 Electrical characteristics

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

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$V_{\text{GS}} = 0\text{ V}$, $I_{\text{D}} = 1\text{ mA}$	600			V
I_{DSS}	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 600\text{ V}$			1	μA
		$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 600\text{ V}$, $T_{\text{case}} = 125\text{ }^{\circ}\text{C}^{(1)}$			100	
I_{GSS}	Gate-body leakage current	$V_{\text{DS}} = 0\text{ V}$, $V_{\text{GS}} = \pm 25\text{ V}$			± 5	μA
$V_{\text{GS}(\text{th})}$	Gate threshold voltage	$V_{\text{DS}} = V_{\text{GS}}$, $I_{\text{D}} = 250\text{ }\mu\text{A}$	3.25	4	4.75	V
$R_{\text{DS}(\text{on})}$	Static drain-source on-resistance	$I_{\text{D}} = 8.5\text{ A}$, $V_{\text{GS}} = 10\text{ V}$		162	190	$\text{m}\Omega$

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

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{\text{DS}} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{\text{GS}} = 0\text{ V}$	-	960	-	pF
C_{oss}	Output capacitance		-	76	-	
C_{riss}	Reverse transfer capacitance		-	4.5	-	
$C_{\text{oss eq.}}^{(1)}$	Equivalent output capacitance	$V_{\text{DS}} = 0\text{ to }480\text{ V}$, $V_{\text{GS}} = 0\text{ V}$	-	181	-	pF
R_{G}	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_{\text{D}} = 0\text{ A}$	-	5	-	Ω
Q_{g}	Total gate charge	$V_{\text{DD}} = 480\text{ V}$, $I_{\text{D}} = 17\text{ A}$, $V_{\text{GS}} = 0\text{ to }10\text{ V}$ (see Figure 14. Test circuit for gate charge behavior)	-	23	-	nC
Q_{gs}	Gate-source charge		-	4.8	-	
Q_{gd}	Gate-drain charge		-	12.8	-	

1. $C_{\text{oss eq.}}$ 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} .

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{\text{d}(\text{on})}$	Turn-on delay time	$V_{\text{DD}} = 300\text{ V}$, $I_{\text{D}} = 8.5\text{ A}$, $R_{\text{G}} = 4.7\text{ }\Omega$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 13. Test circuit for resistive load switching times and Figure 18. Switching time waveform)	-	17.7	-	ns
t_{r}	Rise time		-	32	-	
$t_{\text{d}(\text{off})}$	Turn-off delay time		-	38.3	-	
t_{f}	Fall time		-	9	-	

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		17	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		52.5	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 17\text{ A}$, $V_{GS} = 0\text{ V}$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 17\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$	-	225		ns
Q_{rr}	Reverse recovery charge		-	2.3		μC
I_{RRM}	Reverse recovery current	(see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	20.4		A
t_{rr}	Reverse recovery time	$I_{SD} = 17\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$	-	387		ns
Q_{rr}	Reverse recovery charge		-	3.85		μC
I_{RRM}	Reverse recovery current		(see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	25.1	

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 1. Safe operating area

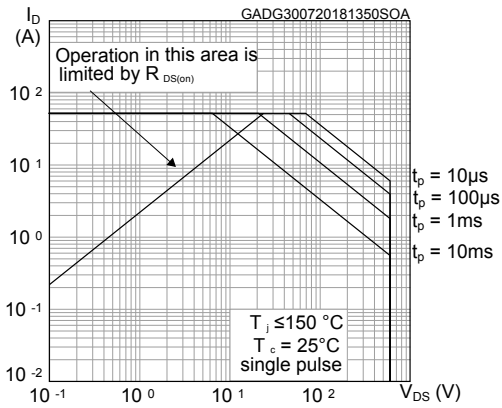


Figure 2. Thermal impedance

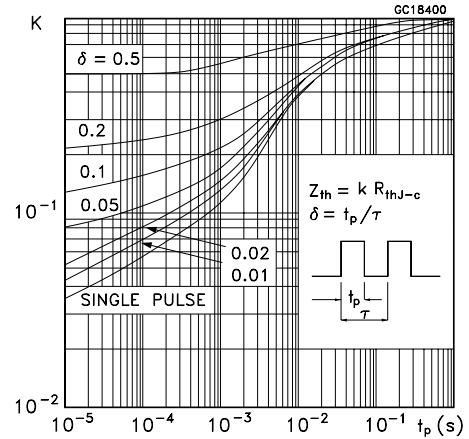


Figure 3. Output characteristics

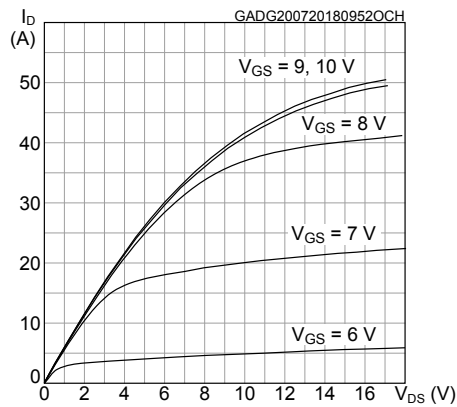


Figure 4. Transfer characteristics

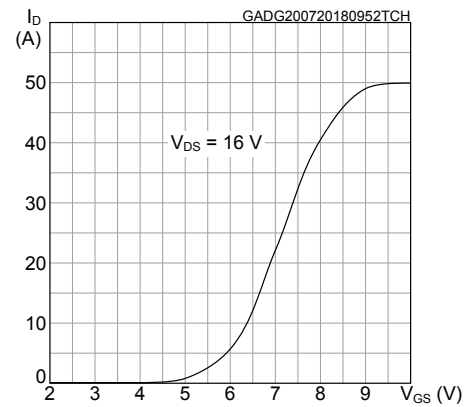


Figure 5. Gate charge vs gate-source voltage

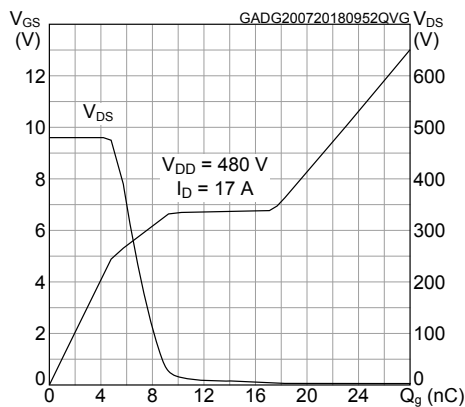


Figure 6. Static drain-source on-resistance

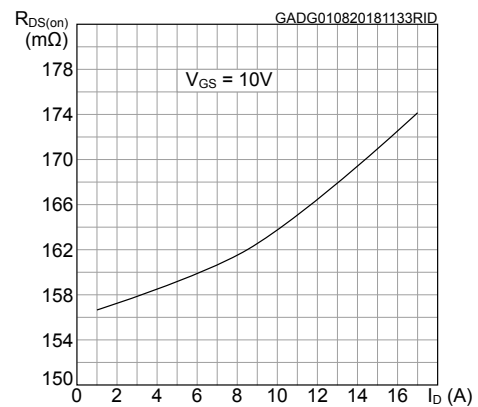


Figure 7. Capacitance variations

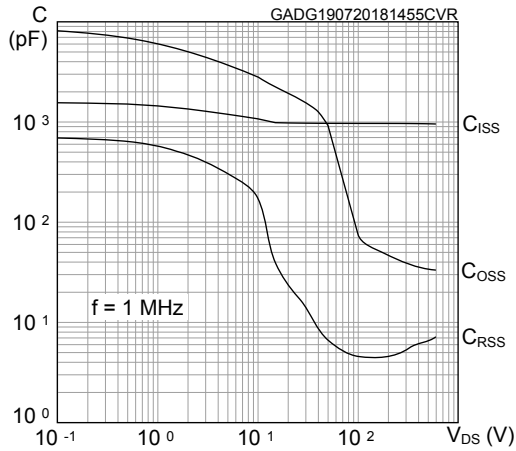


Figure 8. Output capacitance stored energy

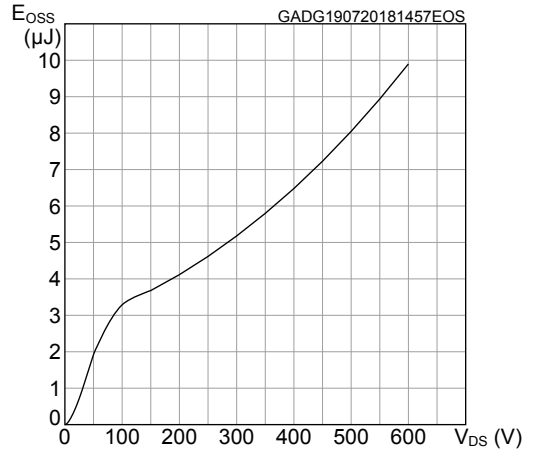


Figure 9. Normalized gate threshold voltage vs temperature

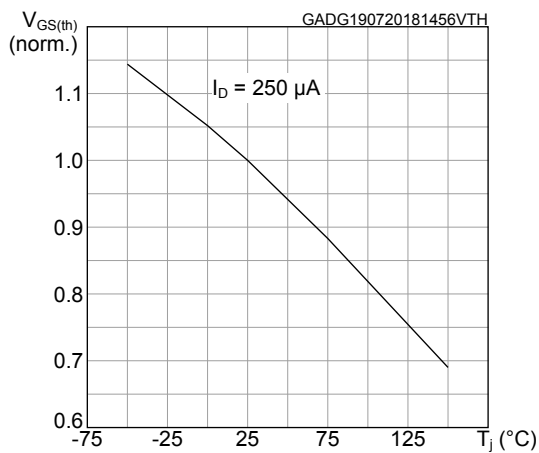


Figure 10. Normalized on-resistance vs temperature

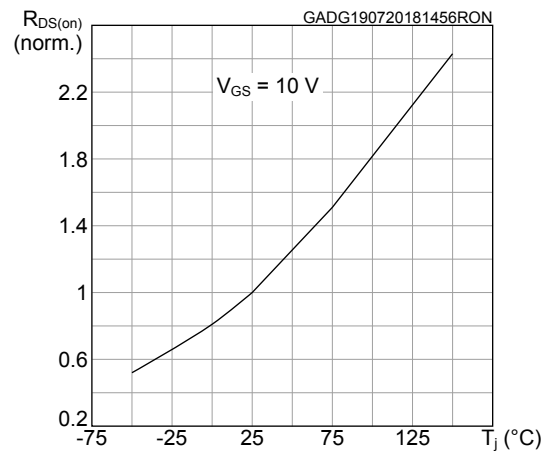


Figure 11. Normalized $V_{(BR)DSS}$ vs temperature

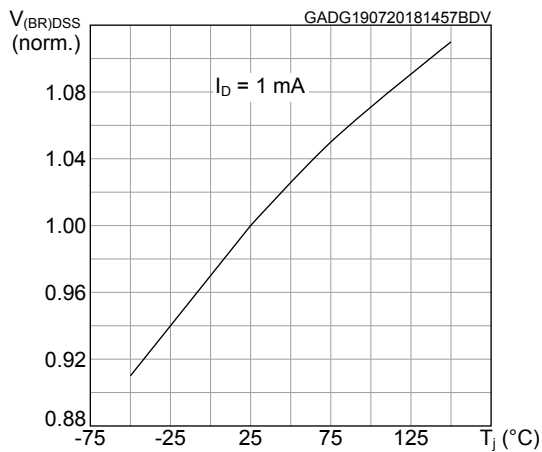
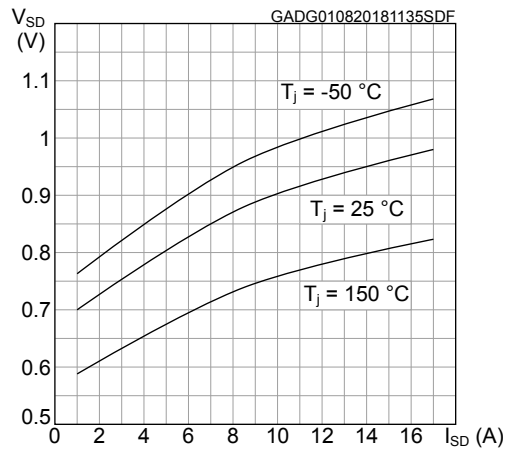
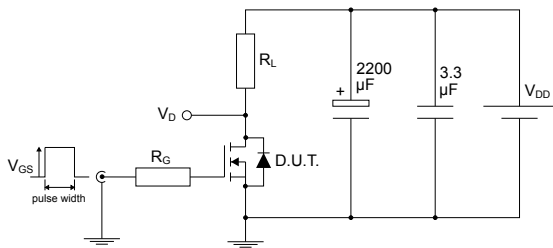


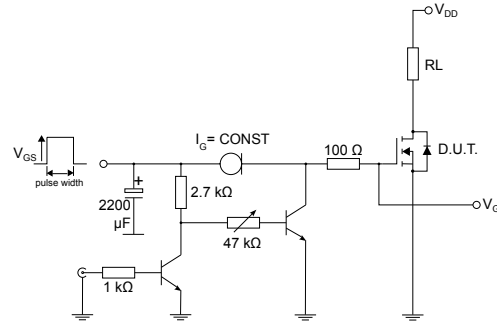
Figure 12. Source-drain diode forward characteristics



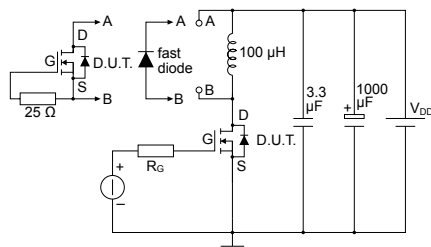
3 Test circuits

Figure 13. Test circuit for resistive load switching times


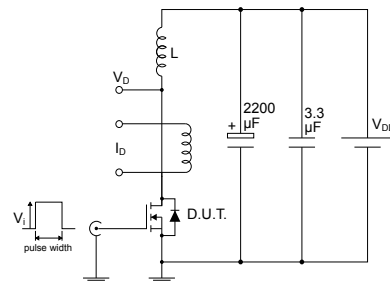
AM01468v1

Figure 14. Test circuit for gate charge behavior


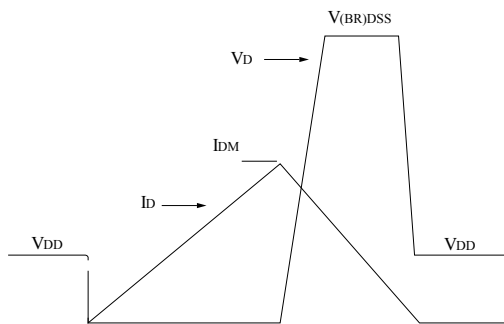
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Figure 15. Test circuit for inductive load switching and diode recovery times


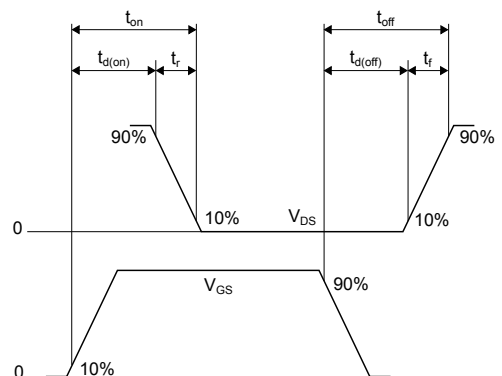
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Figure 16. Unclamped inductive load test circuit


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Figure 17. Unclamped inductive waveform


AM01472v1

Figure 18. Switching time waveform


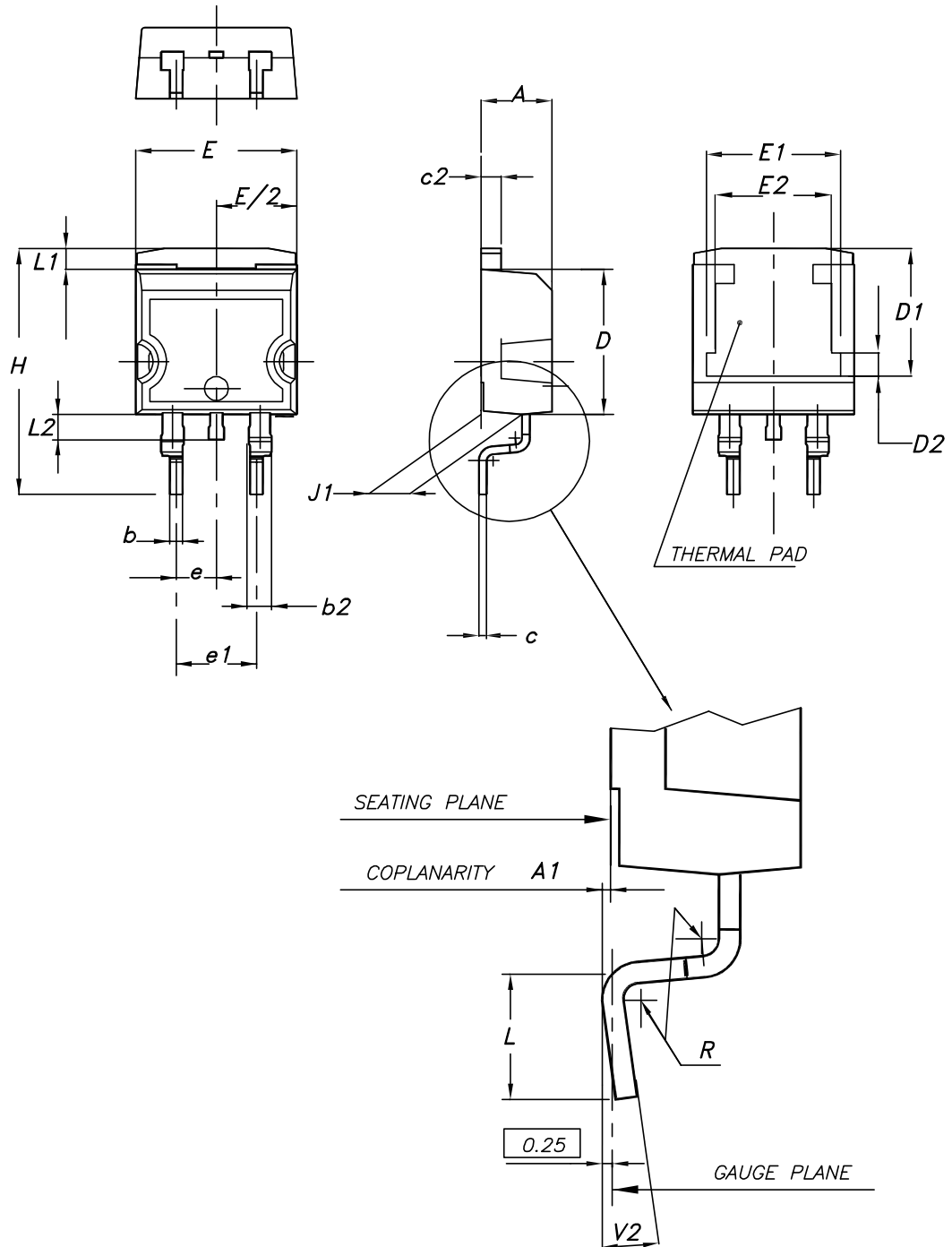
AM01473v1

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 package information

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

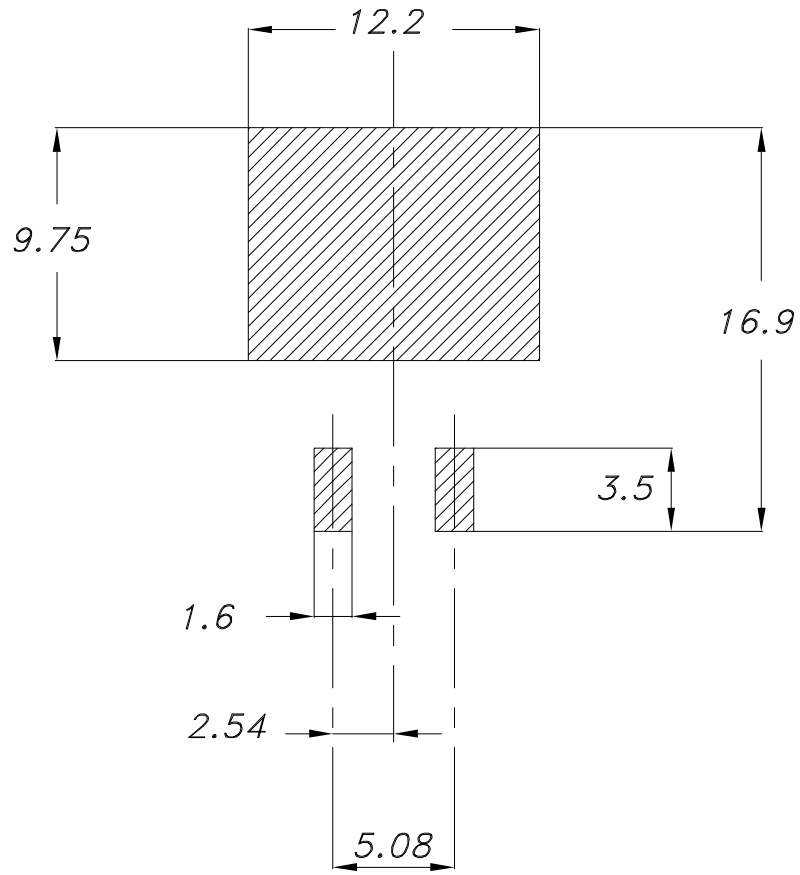


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Table 8. D²PAK (TO-263) type A package mechanical data

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°

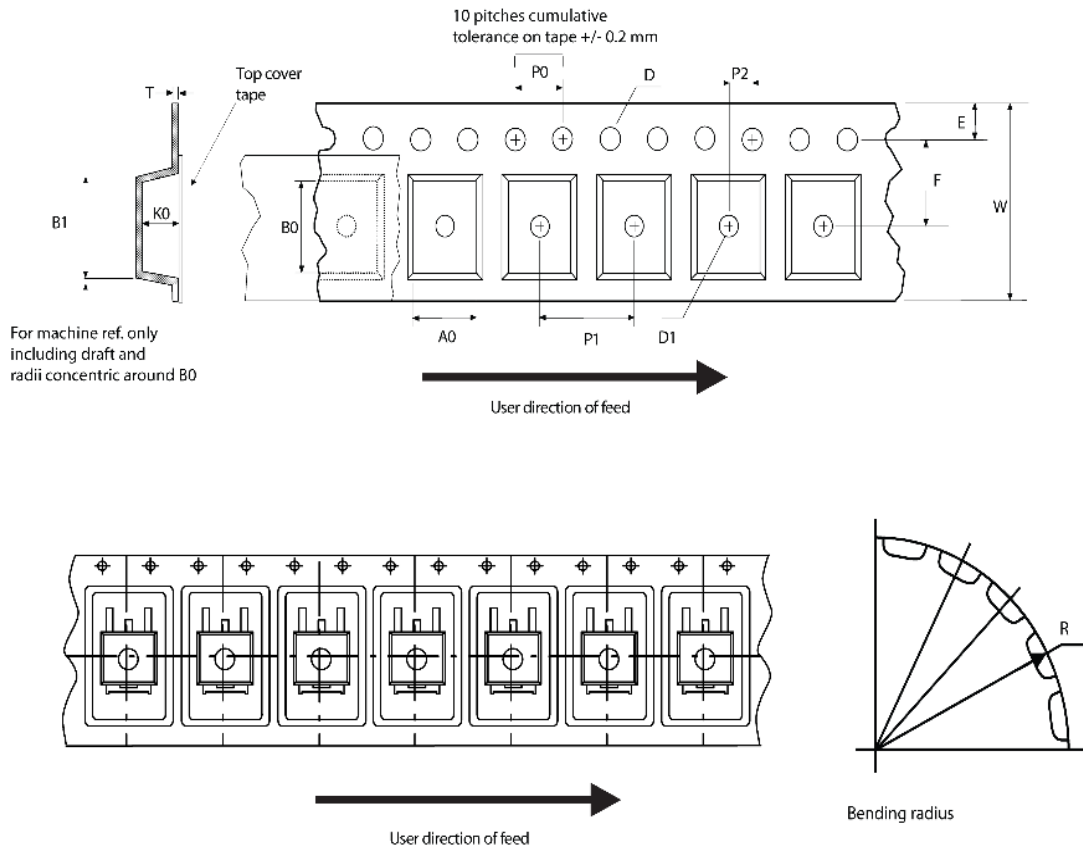
Figure 20. D²PAK (TO-263) recommended footprint (dimensions are in mm)



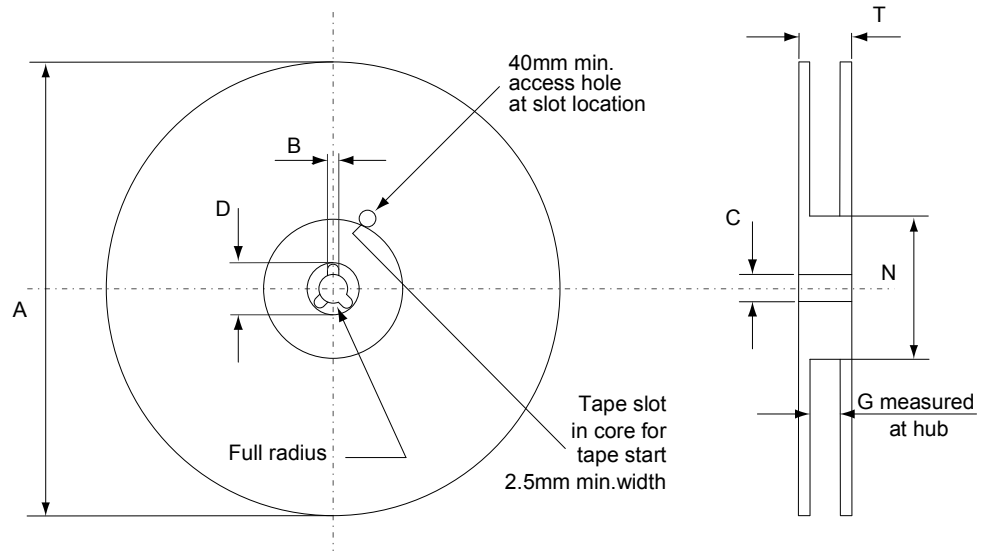
Footprint

4.2 D²PAK packing information

Figure 21. D²PAK tape outline



AM08852v1

Figure 22. D²PAK reel outline


AM06038v1

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
06-Aug-2018	1	Initial release.

Contents

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