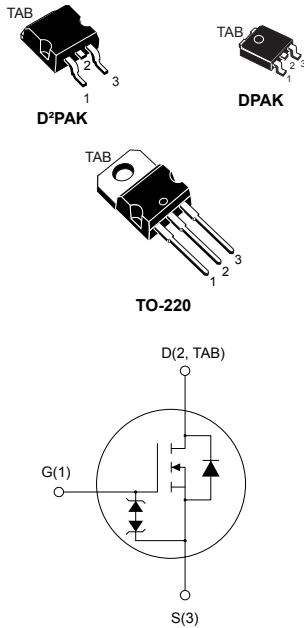




N-channel 600 V, 0.55 Ω typ., 7.5 A MDmesh M2 Power MOSFET in a D²PAK, DPAK and TO-220 packages



AM01476v1_tab



Features

Order codes	$V_{DS} @ T_J \text{ max.}$	$R_{DS(on)} \text{ max.}$	I_D	Package
STB10N60M2	650 V	0.60 Ω	7.5 A	D ² PAK
STD10N60M2				DPAK
STP10N60M2				TO-220

- Extremely low gate charge
- Excellent output capacitance (C_{OSS}) profile
- 100% avalanche tested
- Zener-protected

Applications

- Switching applications

Description

These devices are N-channel Power MOSFETs developed using the MDmesh M2 technology. Thanks to their strip layout and improved vertical structure, these devices exhibit low on-resistance and optimized switching characteristics, rendering them suitable for the most demanding high-efficiency converters.

Product status links

[STB10N60M2](#)

[STD10N60M2](#)

[STP10N60M2](#)

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 $T_C = 25\text{ }^{\circ}\text{C}$	7.5	A
	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	4.9	
$I_{DM}^{(1)}$	Drain current (pulsed)	30	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	85	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	$^{\circ}\text{C}$
T_J	Operating junction temperature range		$^{\circ}\text{C}$

1. Pulse limited by safe operating area.
2. $I_{SD} \leq 7.5\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DS(peak)} < V_{(BR)DSS}$, $V_{DD} = 400\text{ V}$.
3. $V_{DS} \leq 480\text{ V}$.

Table 2. Thermal data

Symbol	Parameter	Value			Unit
		D ² PAK	DPAK	TO-220	
R_{thJC}	Thermal resistance, junction-to-case	1.47			$^{\circ}\text{C}/\text{W}$
R_{thJA}	Thermal resistance, junction-to-ambient	30 ⁽¹⁾	50 ⁽¹⁾	62.5	$^{\circ}\text{C}/\text{W}$

1. When mounted on a standard 1 inch² area of FR-4 PCB with 2-oz copper.

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
$I_{AR}^{(1)}$	Avalanche current, repetitive or not repetitive	1.5	A
$E_{AS}^{(2)}$	Single pulse avalanche energy	110	mJ

1. Pulse width limited by T_J max.
2. Starting $T_J = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$.

2 Electrical characteristics

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

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	600			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 600\text{ V}$			1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 600\text{ V}$, $T_C = 125\text{ }^{\circ}\text{C}^{(1)}$			100	
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 25\text{ V}$			± 10	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 3\text{ A}$		0.55	0.60	Ω

1. Specified by design, not tested in production.

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	400	-	pF
C_{oss}	Output capacitance		-	22	-	pF
C_{rss}	Reverse transfer capacitance		-	0.84	-	pF
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{DS} = 0\text{ to }480\text{ V}$, $V_{GS} = 0\text{ V}$	-	83	-	pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_D = 0\text{ A}$	-	6.4	-	Ω
Q_g	Total gate charge	$V_{DD} = 480\text{ V}$, $I_D = 7.5\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$ (see Figure 16. Test circuit for gate charge behavior)	-	13.5	-	nC
Q_{gs}	Gate-source charge		-	2.1	-	nC
Q_{gd}	Gate-drain charge		-	7.2	-	nC

1. $C_{oss\text{ eq.}}$ 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
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}$, $I_D = 3.75\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$	-	8.8	-	ns
t_r	Rise time		-	8	-	ns
$t_{d(off)}$	Turn-off delay time	(see Figure 15. Test circuit for resistive load switching times and Figure 20. Switching time waveform)	-	32.5	-	ns
t_f	Fall time		-	13.2	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		7.5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		30	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 7.5\text{ A}$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 7.5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$ (see Figure 17. Test circuit for inductive load switching and diode recovery times)	-	270		ns
Q_{rr}	Reverse recovery charge		-	2		μC
I_{RRM}	Reverse recovery current		-	14.4		A
t_{rr}	Reverse recovery time	$I_{SD} = 7.5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$ (see Figure 17. Test circuit for inductive load switching and diode recovery times)	-	376		ns
Q_{rr}	Reverse recovery charge		-	2.8		μC
I_{RRM}	Reverse recovery current		-	15		A

1. Pulse width is limited by safe operating area.

2. Pulse test: pulse duration = 300 μs , duty cycle 1.5%.

2.1 Electrical characteristics (curves)

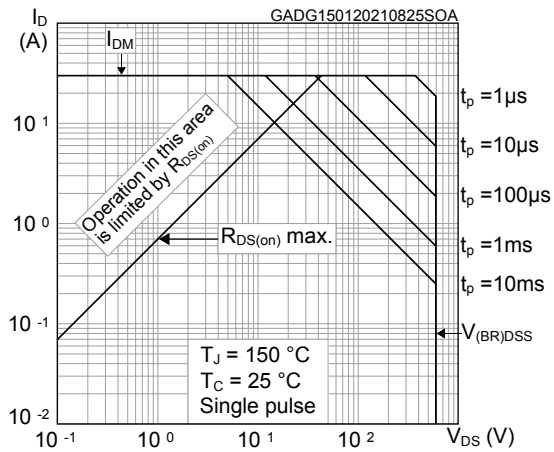
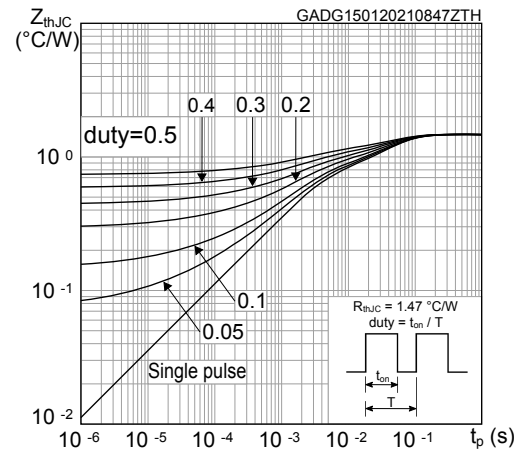
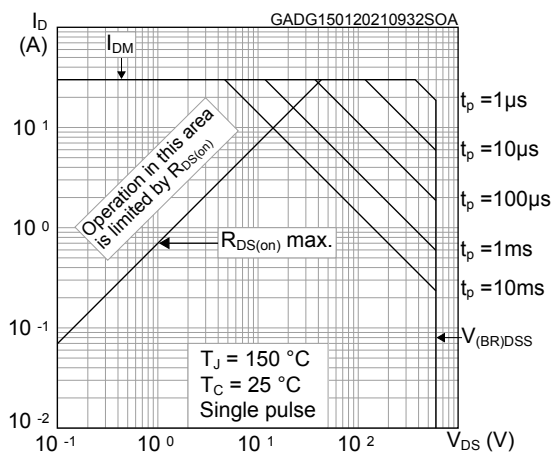
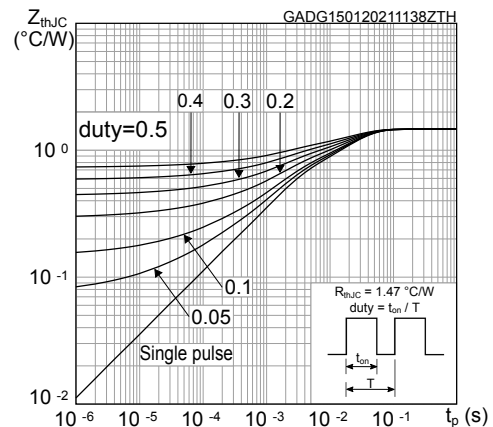
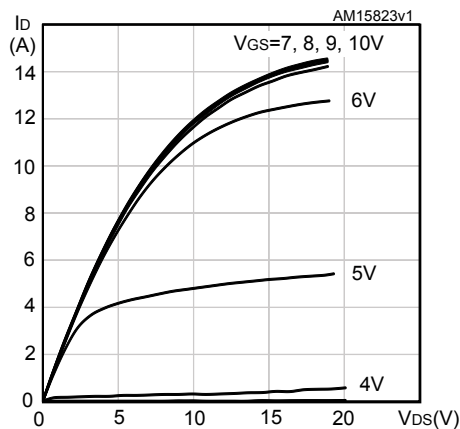
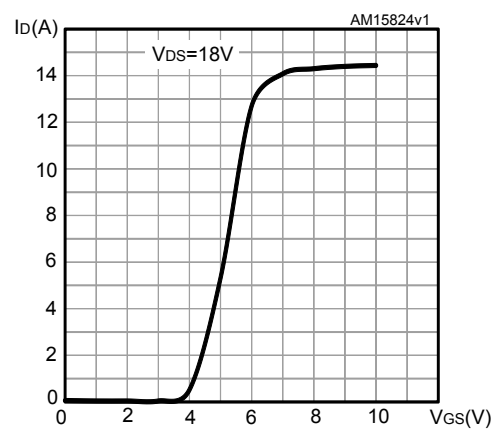
Figure 1. Safe operating area for D²PAK and TO-220

Figure 2. Maximum transient thermal impedance for D²PAK and TO-220

Figure 3. Safe operating area for DPAK

Figure 4. Maximum transient thermal impedance for DPAK

Figure 5. Output characteristics

Figure 6. Transfer characteristics


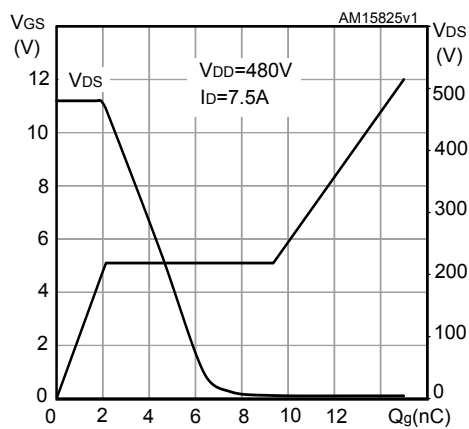
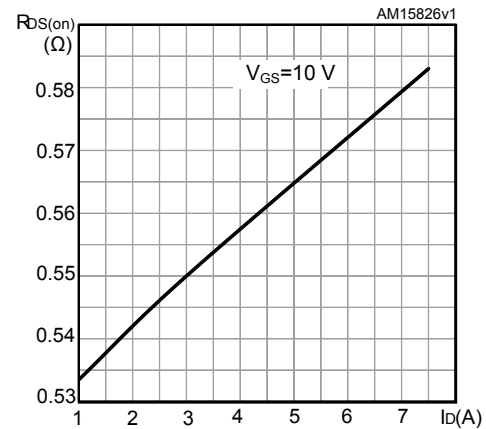
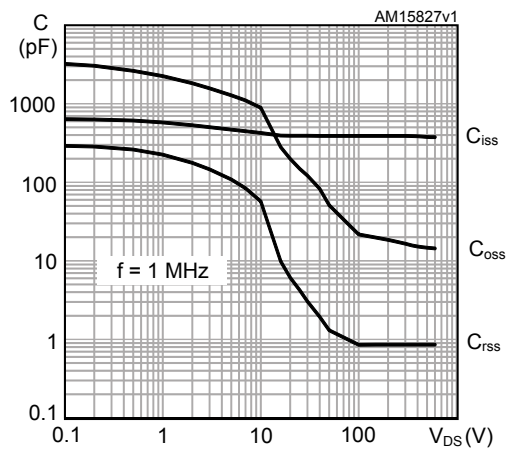
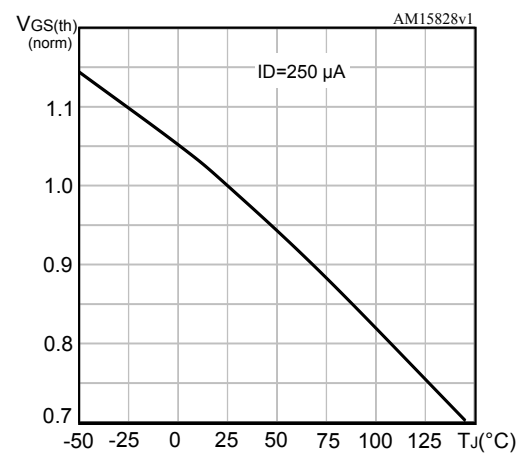
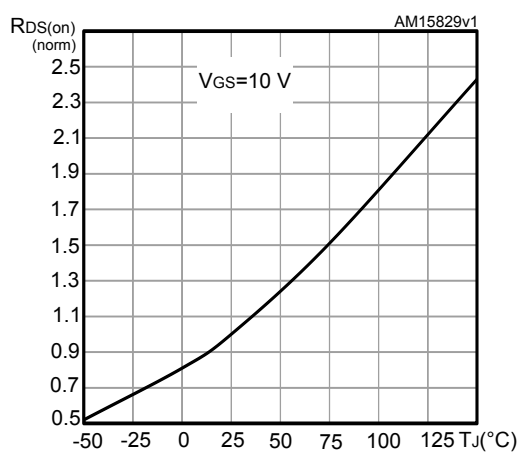
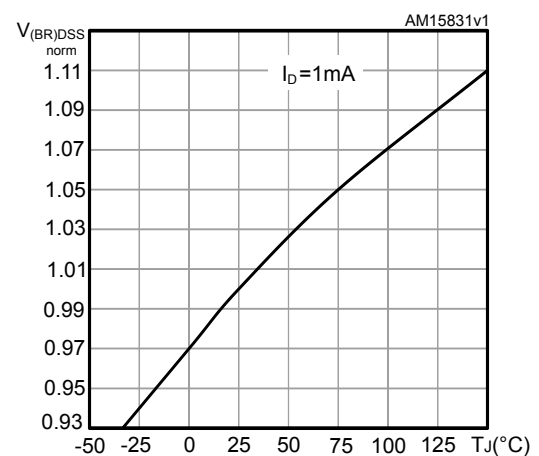
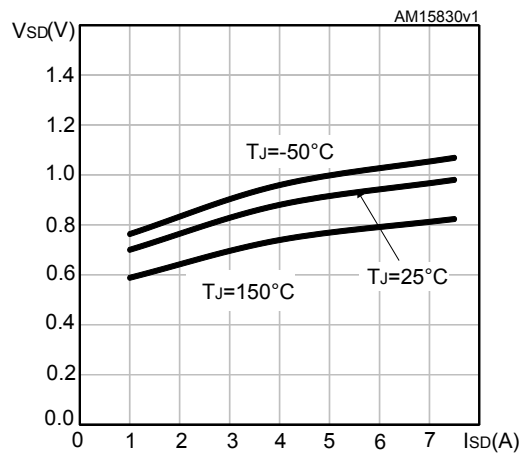
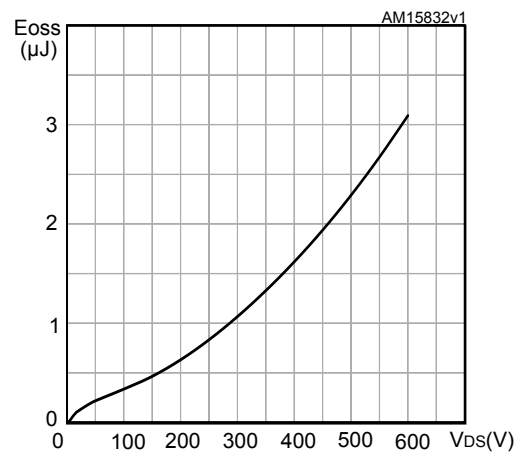
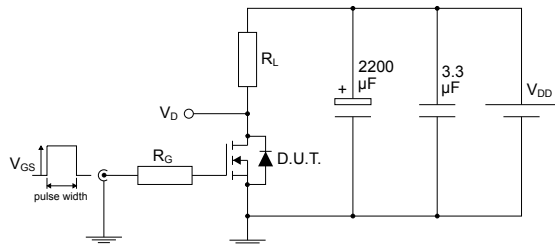
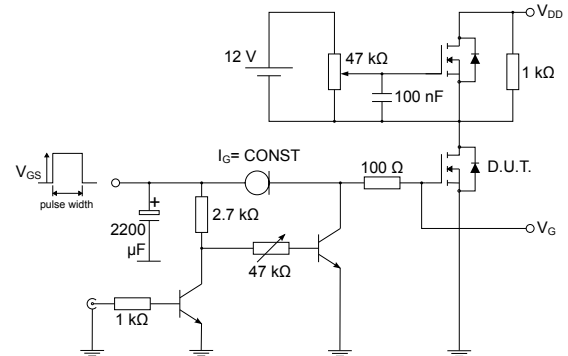
Figure 7. Gate charge vs gate-source voltage

Figure 8. Static drain-source on-resistance

Figure 9. Capacitance variations

Figure 10. Normalized gate threshold voltage vs temperature

Figure 11. Normalized on-resistance vs temperature

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


Figure 13. Source-drain diode forward characteristics

Figure 14. Output capacitance stored energy


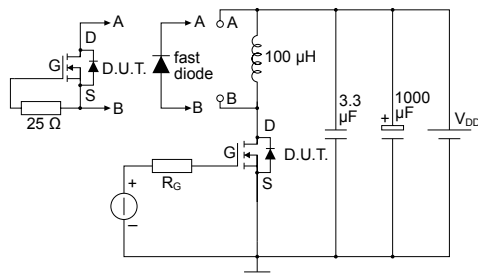
3 Test circuits

Figure 15. Test circuit for resistive load switching times


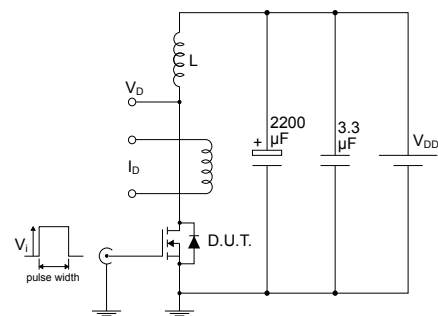
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Figure 16. Test circuit for gate charge behavior


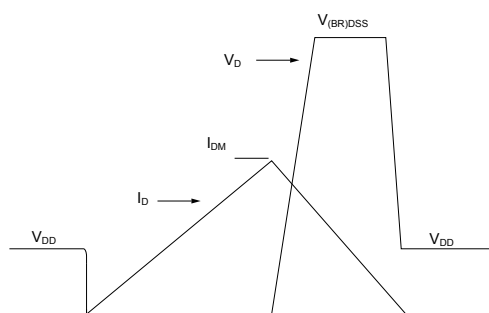
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Figure 17. Test circuit for inductive load switching and diode recovery times


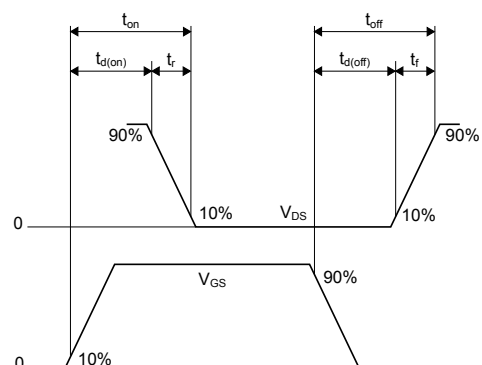
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Figure 18. Unclamped inductive load test circuit


AM01471v1

Figure 19. Unclamped inductive waveform


AM01472v1

Figure 20. Switching time waveform


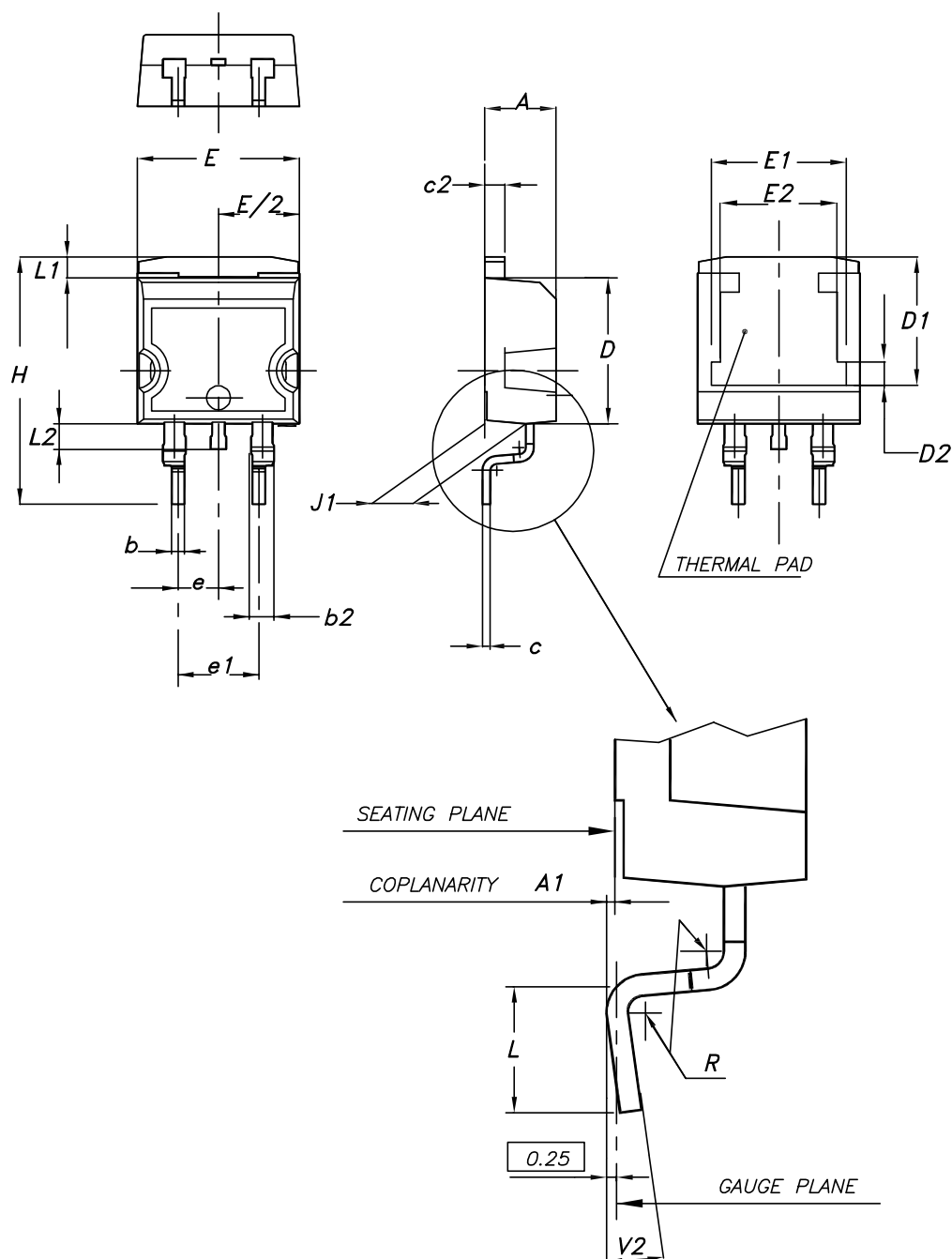
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4 Package information

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 A package information

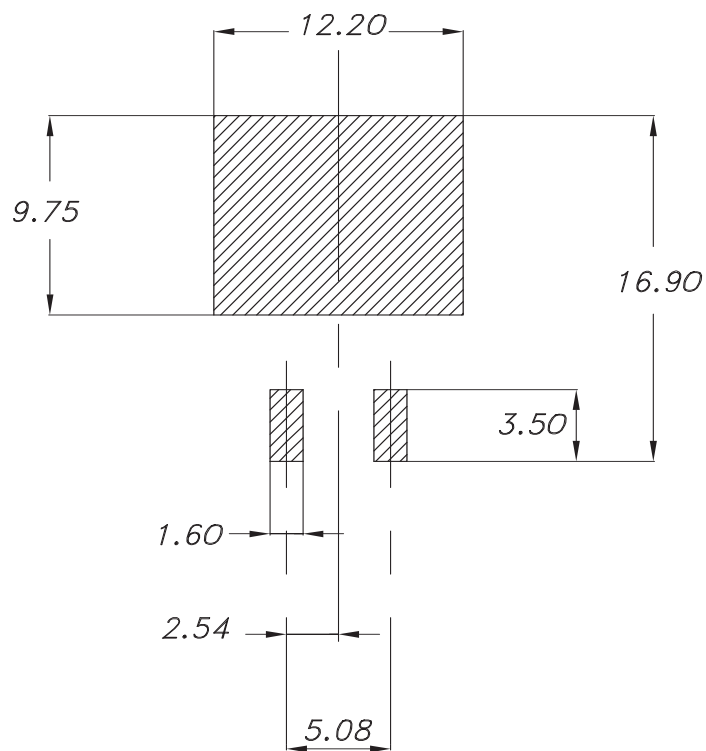
Figure 21. D²PAK (TO-263) type A package outline



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

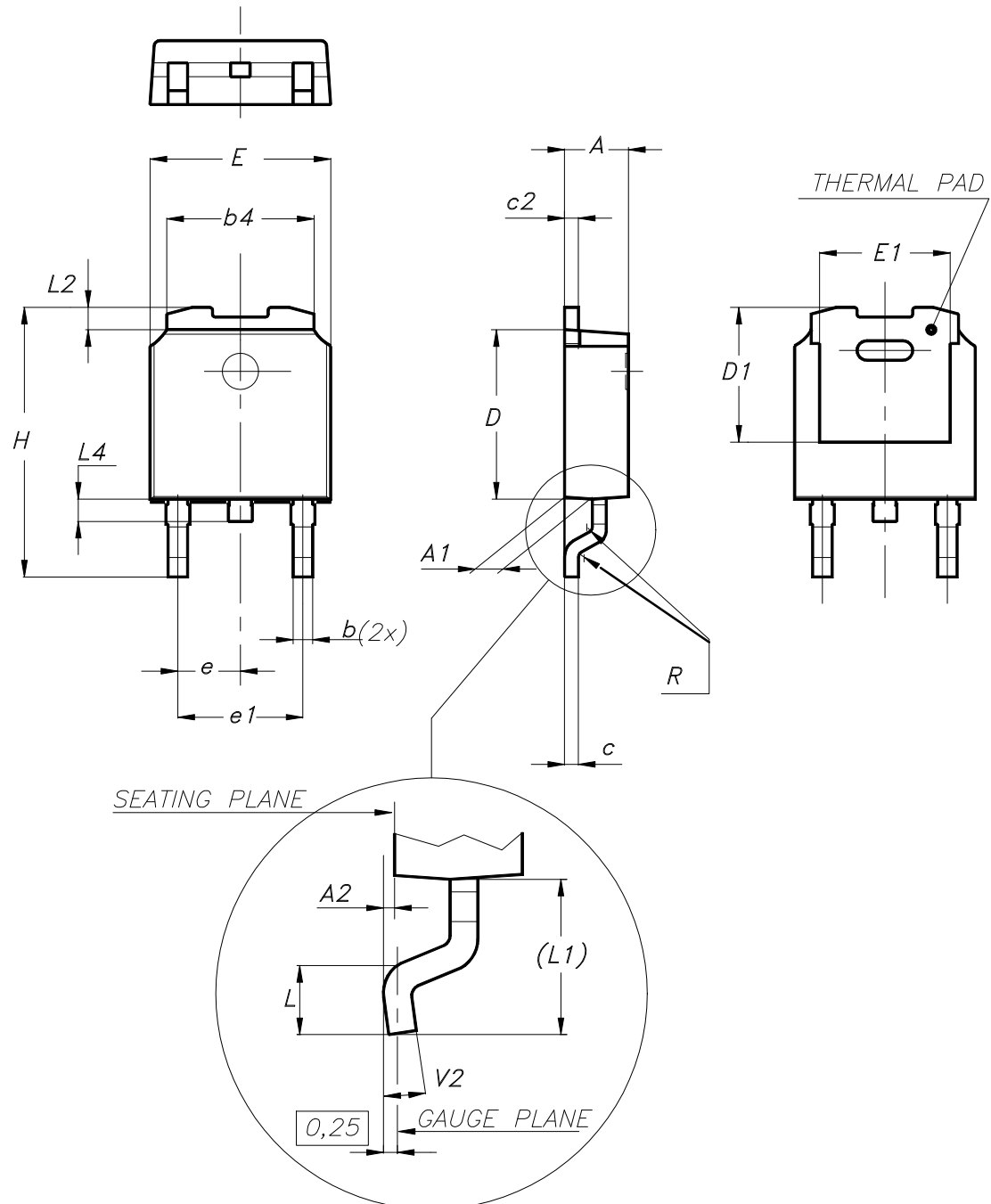
Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50	7.75	8.00
D2	1.10	1.30	1.50
E	10.00		10.40
E1	8.30	8.50	8.70
E2	6.85	7.05	7.25
e		2.54	
e1	4.88		5.28
H	15.00		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.40	
V2	0°		8°

Figure 22. D²PAK (TO-263) recommended footprint (dimensions are in mm)


0079457_Rev27_footprint

4.2 DPAK (TO-252) type A package information

Figure 23. DPAK (TO-252) type A package outline



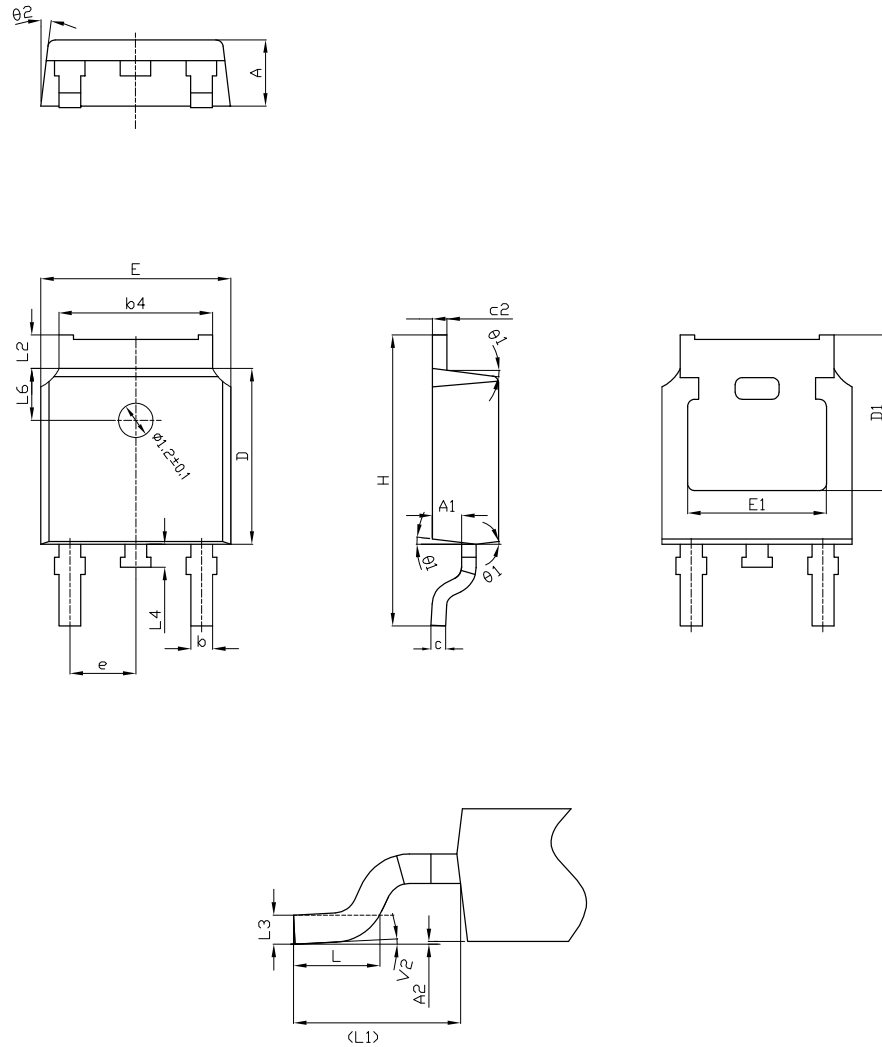
0068772_A_36

Table 9. DPAK (TO-252) type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1	4.95	5.10	5.25
E	6.40		6.60
E1	4.60	4.70	4.80
e	2.159	2.286	2.413
e1	4.445	4.572	4.699
H	9.35		10.10
L	1.00		1.50
(L1)	2.60	2.80	3.00
L2	0.65	0.80	0.95
L4	0.60		1.00
R		0.20	
V2	0°		8°

4.3 DPAK (TO-252) type C package information

Figure 24. DPAK (TO-252) type C package outline



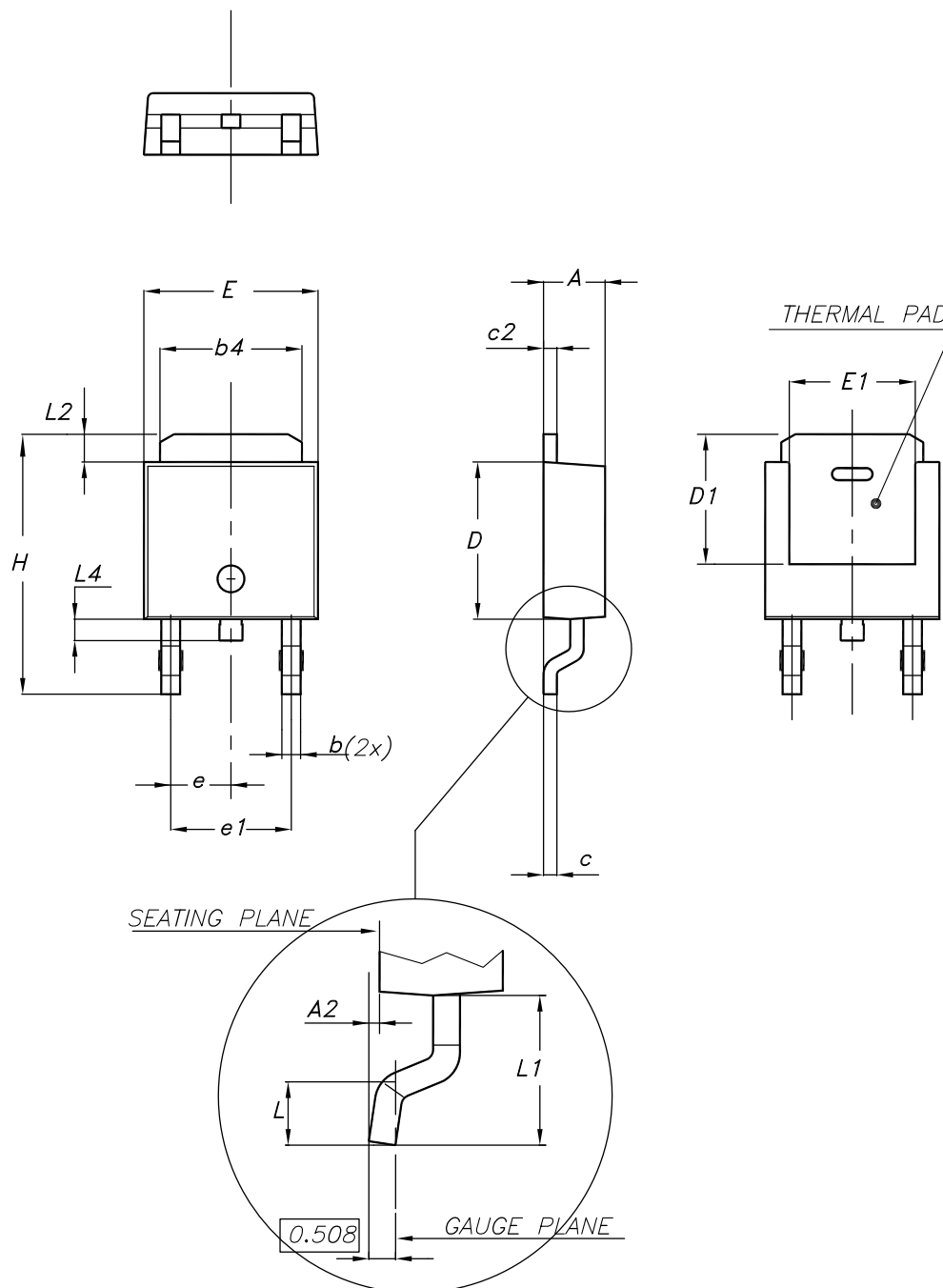
0068772_C_36

Table 10. DPAK (TO-252) type C mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0.90	1.01	1.10
A2	0.00		0.10
b	0.72		0.85
b4	5.13	5.33	5.46
c	0.47		0.60
c2	0.47		0.60
D	6.00	6.10	6.20
D1	5.15	5.40	5.65
E	6.50	6.60	6.70
E1	4.70	4.85	5.00
e	2.186	2.286	2.386
H	9.80	10.10	10.40
L	1.40	1.50	1.70
L1	2.90 REF		
L2	0.90		1.25
L3	0.51 BSC		
L4	0.60	0.80	1.00
L6	1.80 BSC		
θ1	5°	7°	9°
θ2	5°	7°	9°
V2	0°		8°

4.4 DPAK (TO-252) type E package information

Figure 25. DPAK (TO-252) type E package outline



0068772_typeE_rev.36

Table 11. DPAK (TO-252) type E mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.18		2.39
A2			0.13
b	0.65		0.884
b4	4.95		5.46
c	0.46		0.61
c2	0.46		0.60
D	5.97		6.22
D1	5.21		
E	6.35		6.73
E1	4.32		
e		2.286	
e1		4.572	
H	9.94		10.34
L	1.50		1.78
L1		2.74	
L2	0.89		1.27
L4			1.02

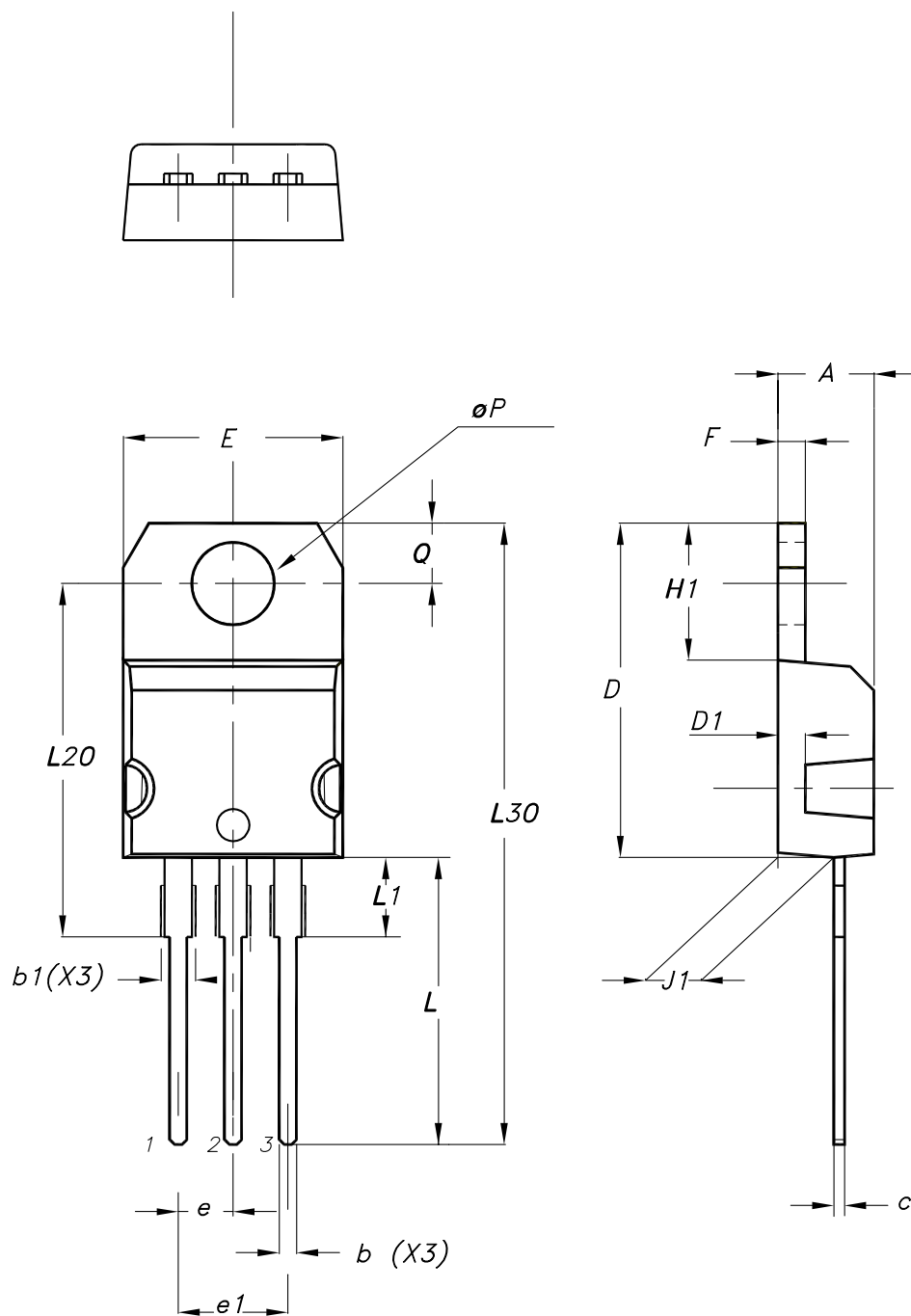
Technical drawing of a mechanical part. The drawing shows a cross-section of a part with a central vertical axis. The top view is a rectangle with a width of 6.3 and a height of 6.5. The bottom view shows two rectangular features, each with a width of 1.5 and a height of 2.9. The distance between the centers of these two features is 4.572. The total height of the part is 11.2. A dimension of 1.8 MIN is indicated for the distance from the top surface to the top of the lower features. Section lines are shown in the top view, and a section line is shown in the bottom view. A label 'B' is present in the bottom right corner.

2) The device must be positioned within $\oplus 0.05 \text{ A B}$

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4.5 TO-220 type A package information

Figure 27. TO-220 type A package outline



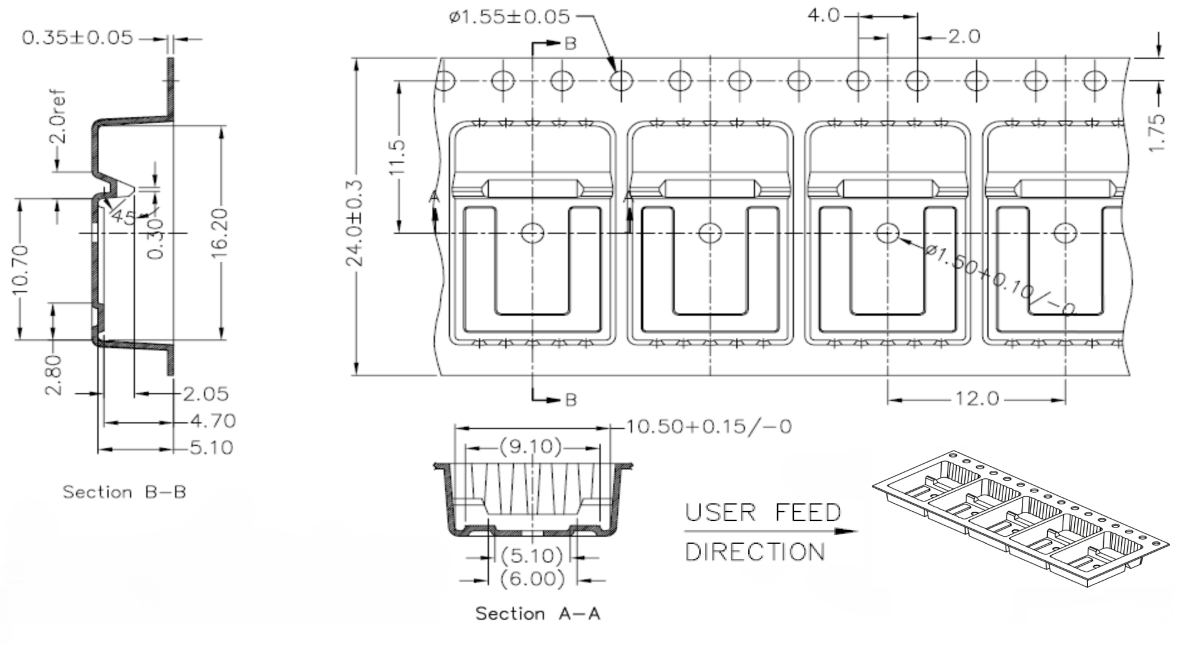
0015988_typeA_Rev_24

Table 12. 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
Slug flatness		0.03	0.10

4.6 D²PAK packing information

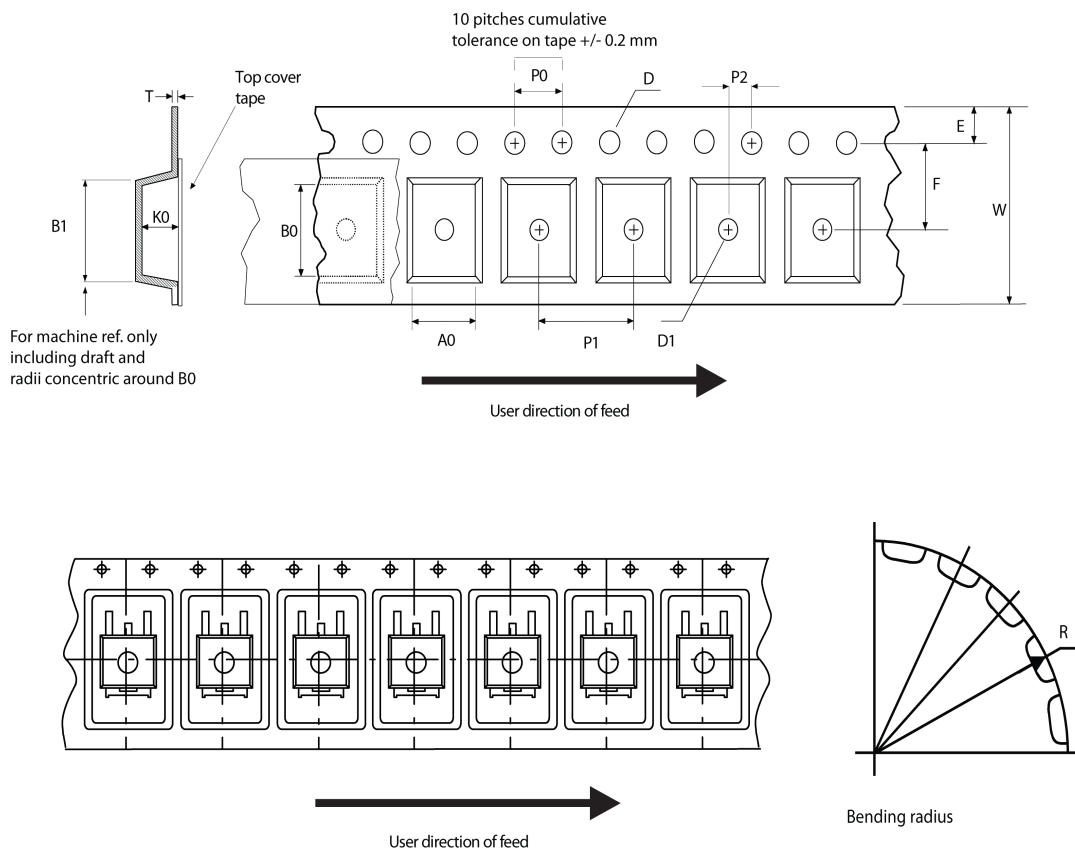
Figure 28. D²PAK tape drawing (dimensions are in mm)



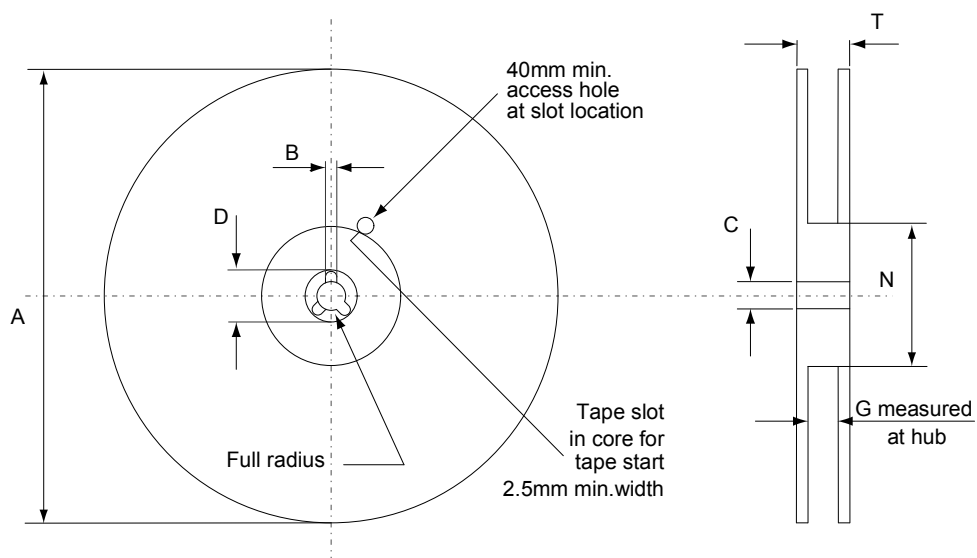
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4.7 DPAK packing information

Figure 29. DPAK tape outline



AM08852v1

Figure 30. DPAK reel outline


AM06038v1

Table 13. DPAK tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	6.8	7	A		330
B0	10.4	10.6	B	1.5	
B1		12.1	C	12.8	13.2
D	1.5	1.6	D	20.2	
D1	1.5		G	16.4	18.4
E	1.65	1.85	N	50	
F	7.4	7.6	T		22.4
K0	2.55	2.75			
P0	3.9	4.1	Base qty.		2500
P1	7.9	8.1	Bulk qty.		2500
P2	1.9	2.1			
R	40				
T	0.25	0.35			
W	15.7	16.3			



5 Order codes

Table 14. Device summary

Order code	Marking	Package	Packing
STB10N60M2	10N60M2	D ² PAK	Tape and reel
STD10N60M2		DPAK	
STP10N60M2		TO-220	Tube

Revision history

Table 15. Document revision history

Date	Version	Changes
29-May-2013	1	First release.
06-Dec-2013	2	– Added: D²PAK package – Modified: title and R_{DS(on)} values in cover page – Modified: R_{DS(on)} values in <i>Table 5</i> – Modified: R_G value in <i>Table 6</i> – Modified: <i>Figure 9</i> and I_D value in <i>Figure 12</i> – Added: <i>Table 9, 13, Figure 22</i> and <i>23</i> – Updated: <i>Table 10, 11, Figure 24, 25</i> and <i>26</i> Minor text changes.
08-Mar-2017	3	Updated the title and the description in cover page. Updated <i>Table 4: "Avalanche characteristics"</i> . Updated <i>Section 4.2: "DPAK (TO-252) type A package information"</i> . Added <i>Section 4.4: "DPAK (TO-252) type E package information"</i> , and <i>Section 4.7: "IPAK (TO-251) type C package information"</i> . Minor text changes.
19-Jan-2021	4	The part number STU10N60M2 have been removed and the document has been updated accordingly. Updated <i>Figure 1. Safe operating area for D²PAK and TO-220</i> , <i>Figure 2. Maximum transient thermal impedance for D²PAK and TO-220</i> , <i>Figure 3. Safe operating area for DPAK</i> and <i>Figure 4. Maximum transient thermal impedance for DPAK</i> . Minor text changes.
08-Jul-2025	5	Updated Section 4: Package information . Minor text changes.

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