N-channel 650 V, 0.198 Ω typ., 15 A, MDmesh™ M5 Power MOSFETs in D²PAK and DPAK packages
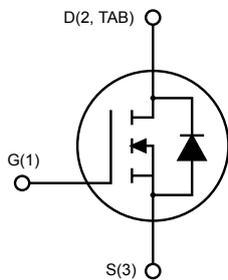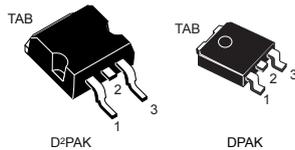

Features

Order codes	V_{DS} @ T_{Jmax}	$R_{DS(on)}$ max.	I_D
STB18N65M5	710 V	0.220 Ω	15 A
STD18N65M5			

- 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 link
STB18N65M5
STD18N65M5

Product summary	
STB18N65M5	
Order code	STB18N65M5
Marking	18N65M5
Package	D²PAK
Packing	Tape and reel
STD18N65M5	
Order code	STD18N65M5
Marking	18N65M5
Package	DPAK
Packing	Tape and reel

DS9171 - Rev 2 - August 2018
For further information contact your local STMicroelectronics sales office.

www.st.com

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	15	A
	Drain current (continuous) at T_C = 100 °C	9.4	A
I_{DM}[1]	Drain current (pulsed)	60	A
P_{TOT}	Total dissipation at T_C = 25 °C	110	W
dv/dt[2]	Peak diode recovery voltage slope	15	V/ns
T_j	Operating junction temperature range	-55 to 150	°C
T	Storage temperature range		

1. Pulse width limited by safe operating area.
2. $I_{SD} \leq 15$ A, di/dt ≤ 400 A/µs, V_{DD} = 400 V, $V_{DS(peak)} < V_{(BR)DSS}$.

Table 2. Thermal data

Symbol	Parameter	Value		Unit
		D²PAK	DPAK	
$R_{thj-case}$	Thermal resistance junction-case	1.14		°C/W
$R_{thj-pcb}$ [1]	Thermal resistance junction-pcb	30	50	°C/W

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

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or non-repetitive (pulse width limited by T_{jmax})	4	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	210	mJ

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	I_D = 1 mA, V_{GS} = 0 V	650			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 650 V			1	µA
		V_{GS} = 0 V, V_{DS} = 650 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 = 7.5 A		0.198	0.220	Ω

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} = 100 V, f = 1 MHz, V_{GS} = 0 V	-	1240	-	pF
C_{oss}	Output capacitance			32		
C_{rss}	Reverse transfer capacitance			3.2		
$C_{o(tr)}$ [1]	Equivalent capacitance time related	V_{DS} = 0 to 520 V, V_{GS} = 0 V	-	99	-	pF
$C_{o(er)}$ [2]	Equivalent capacitance energy related			30	-	
R_g	Gate input resistance	f = 1 MHz, I_D = 0 A	-	3	-	Ω
Q_g	Total gate charge	V_{DD} = 520 V, I_D = 7.5 A, V_{GS} = 0 to 10 V (see Figure 17. Test circuit for gate charge behavior)	-	31	-	nC
Q_{gs}	Gate-source charge			8		
Q_{gd}	Gate-drain charge			14		

1. *$C_{o(tr)}$ is a constant capacitance value that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.*

2. *$C_{o(er)}$ is a constant capacitance value that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.*

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(v)}$	Voltage delay time	V_{DD} = 400 V, I_D = 9.5 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 18. Test circuit for inductive load switching and diode recovery times and Figure 21. Switching time waveform)	-	36	-	ns
$t_{r(v)}$	Voltage rise time			7		
$t_{f(i)}$	Current fall time			9		
$t_{c(off)}$	Crossing time			11		

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		15	A
I_{SDM}[(1)]	Source-drain current (pulsed)				60	
V_{SD}[(2)]	Forward on voltage	I_{SD} = 15 A, V_{GS} = 0 V	-		1.5	V
t_{rr}	Reverse recovery time	I_{SD} = 15 A, di/dt = 100 A/µs		290		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 100 V	-	3.4		µC
I_{RRM}	Reverse recovery current	(see Figure 18. Test circuit for inductive load switching and diode recovery times)		23.5		A
t_{rr}	Reverse recovery time	I_{SD} = 15 A, di/dt = 100 A/µs		352		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 100 V, T_j = 150 °C	-	4		µC
I_{RRM}	Reverse recovery current	(see Figure 18. Test circuit for inductive load switching and diode recovery times)		24		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 for D^{2}PAK
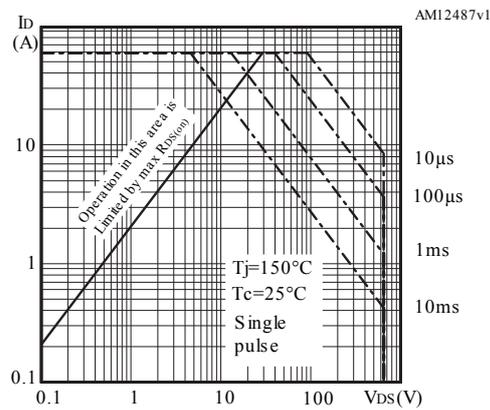
Figure 2. Thermal impedance for D^{2}PAK
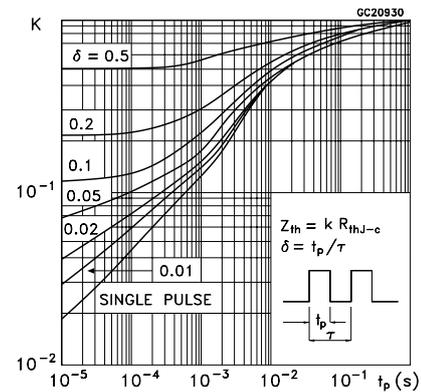
Figure 3. Safe operating area for DPAK
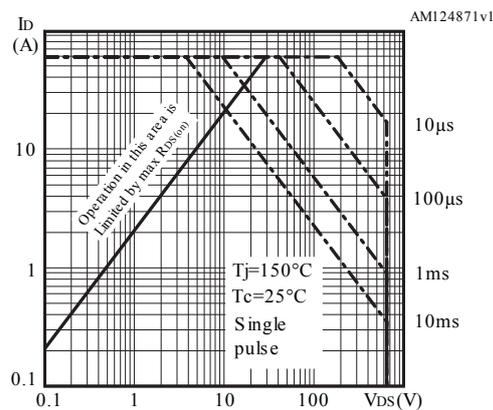
Figure 4. Thermal impedance for DPAK
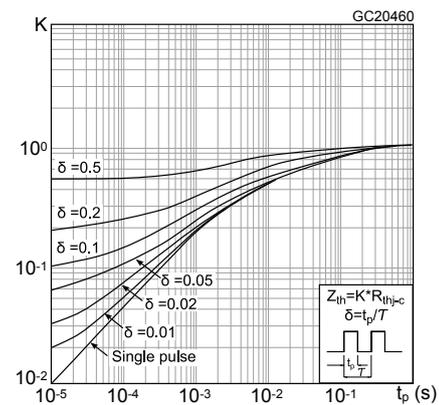
Figure 5. Output characteristics
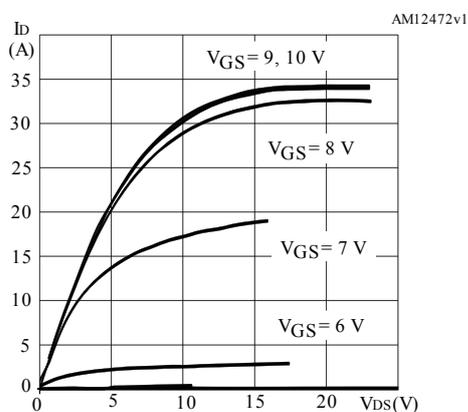

**Figure 6. Transfer characteristics**
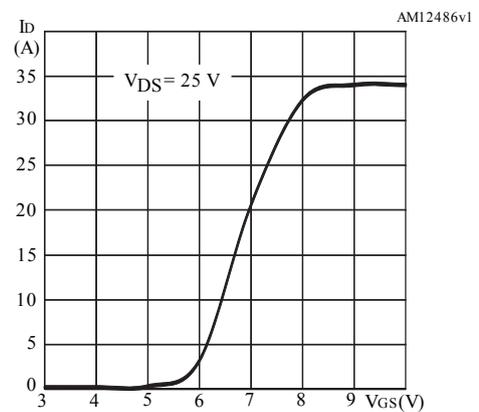
Figure 7. Gate charge vs gate-source voltage
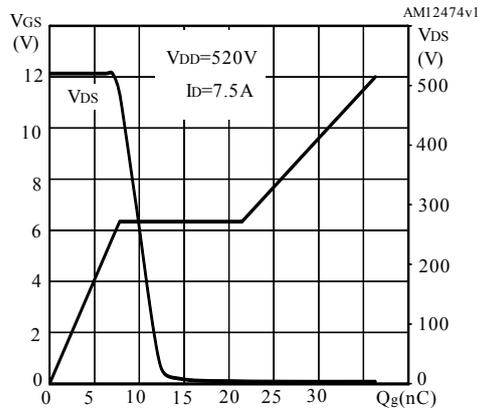
Figure 8. Static drain-source on-resistance
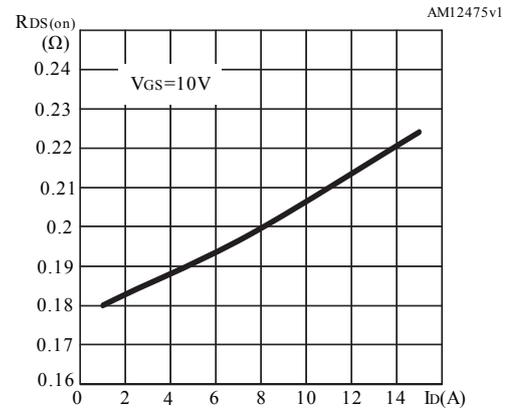
Figure 9. Capacitance variations
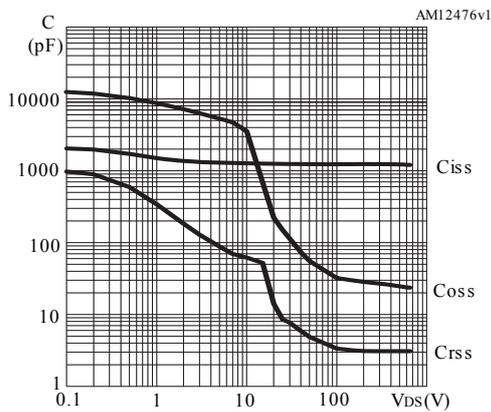
Figure 10. Output capacitance stored energy
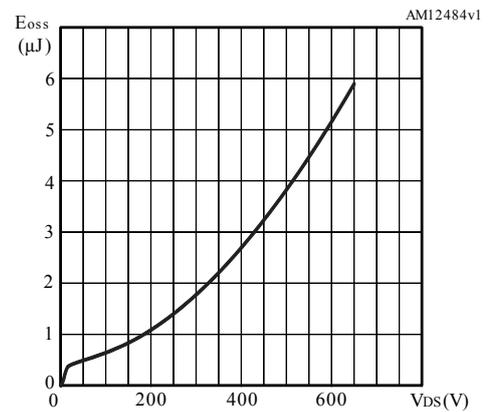
Figure 11. Normalized gate threshold voltage vs temperature
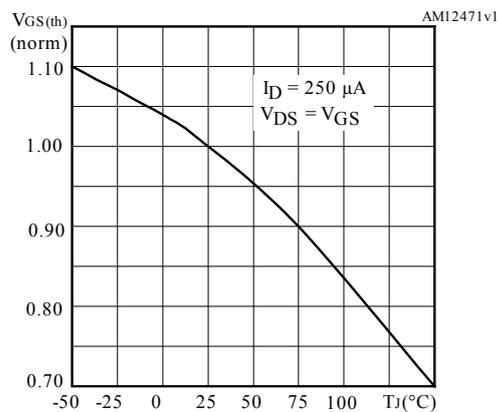
Figure 12. Normalized on-resistance vs temperature
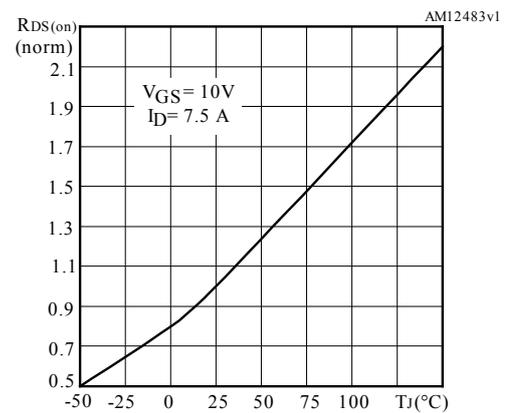
Figure 13. Source-drain diode forward characteristics
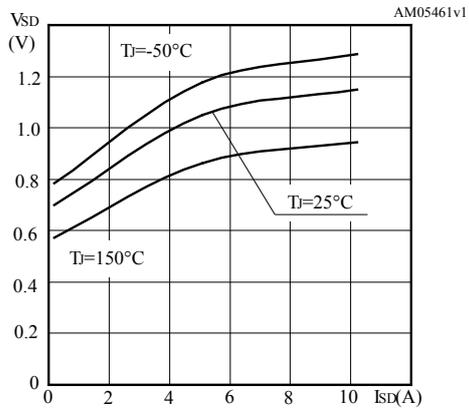
Figure 14. Normalized V(BR)DSS vs temperature
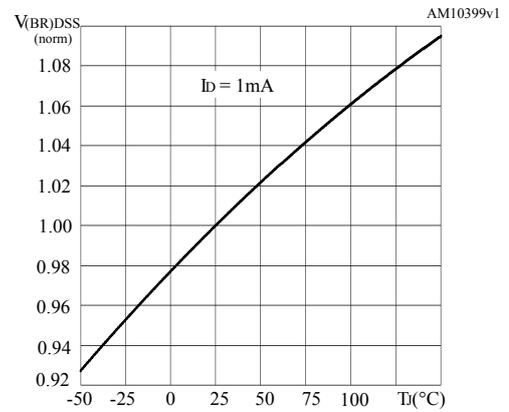
Figure 15. Switching losses vs gate resistance
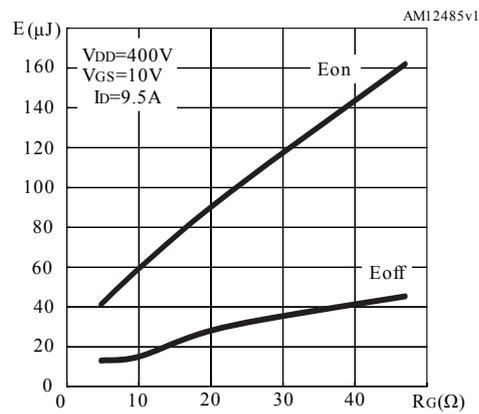
3 Test circuits

**Figure 16. Test circuit for resistive load switching times**
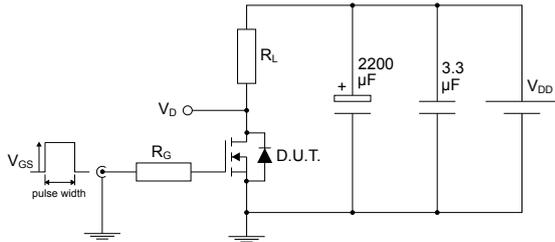
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Figure 17. Test circuit for gate charge behavior
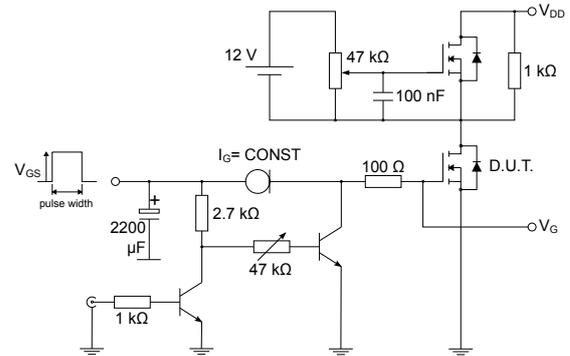
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Figure 18. Test circuit for inductive load switching and diode recovery times
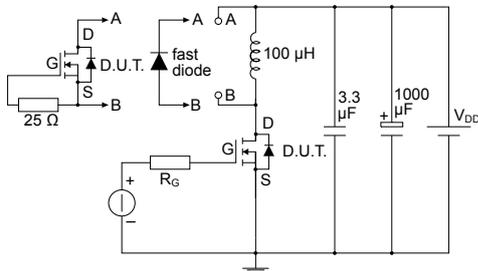
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Figure 19. Unclamped inductive load test circuit
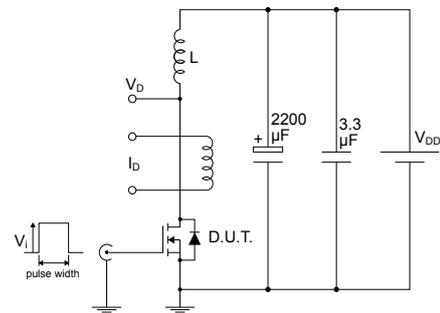
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Figure 20. Unclamped inductive waveform
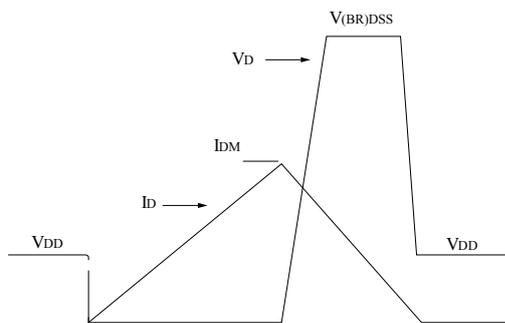
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Figure 21. Switching time waveform
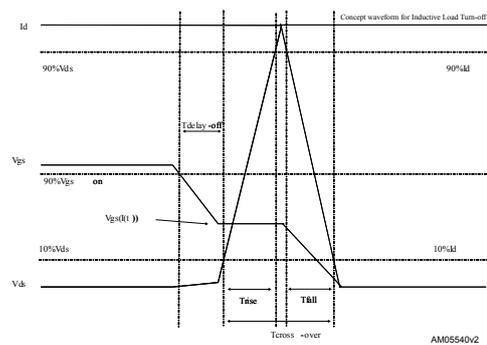
AM05540v2

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 A package information

Figure 22. D²PAK (TO-263) type A package outline
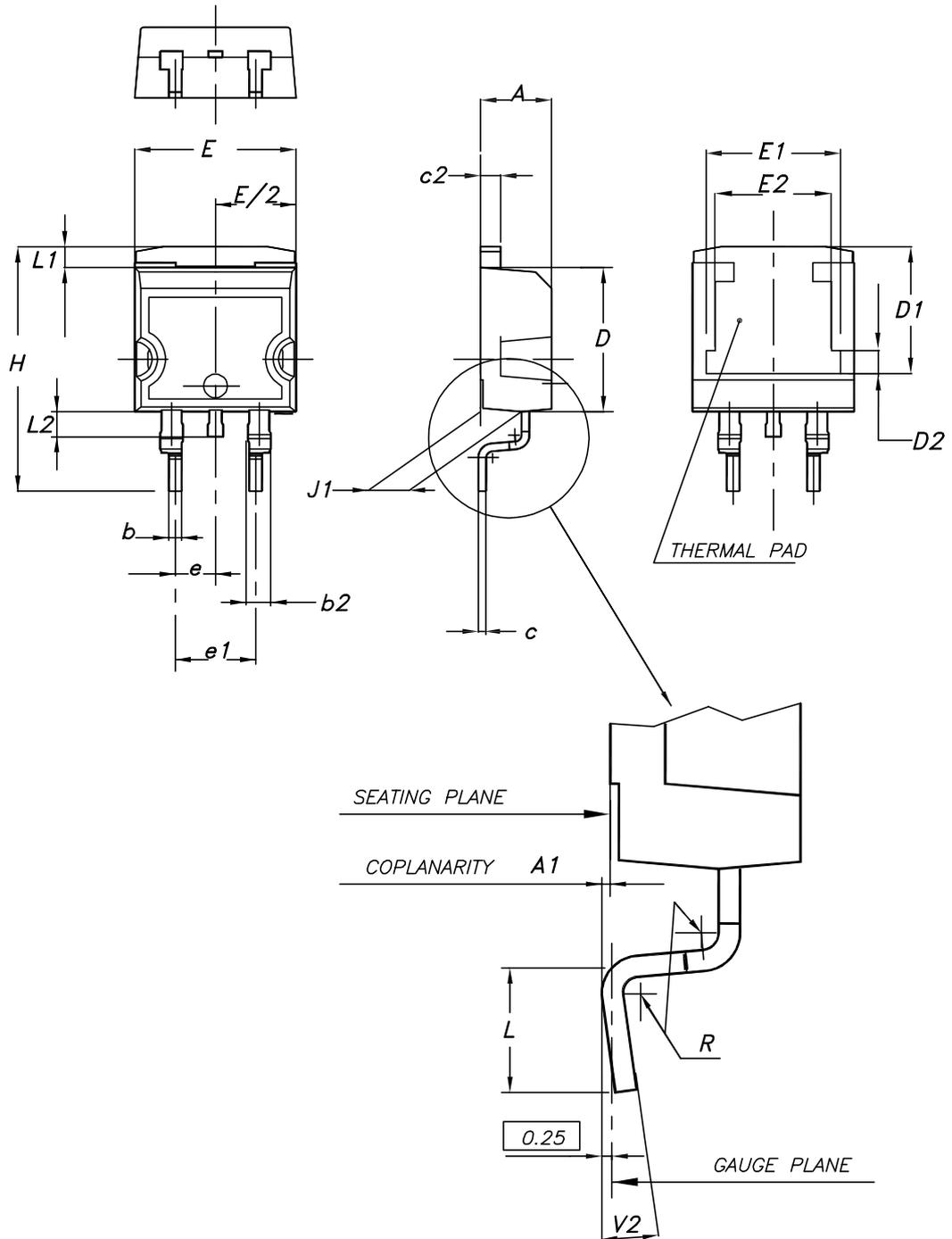
0079457_25

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 23. D²PAK (TO-263) recommended footprint (dimensions are in mm)
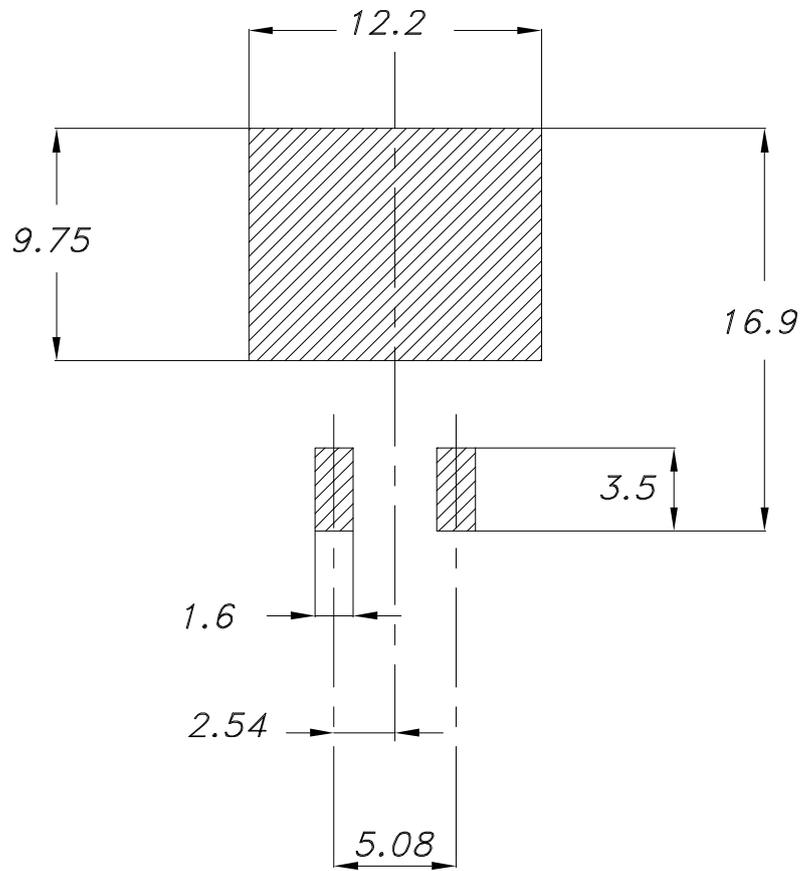
Footprint

4.2 DPAK (TO-252) type A2 package information

Figure 24. DPAK (TO-252) type A2 package outline
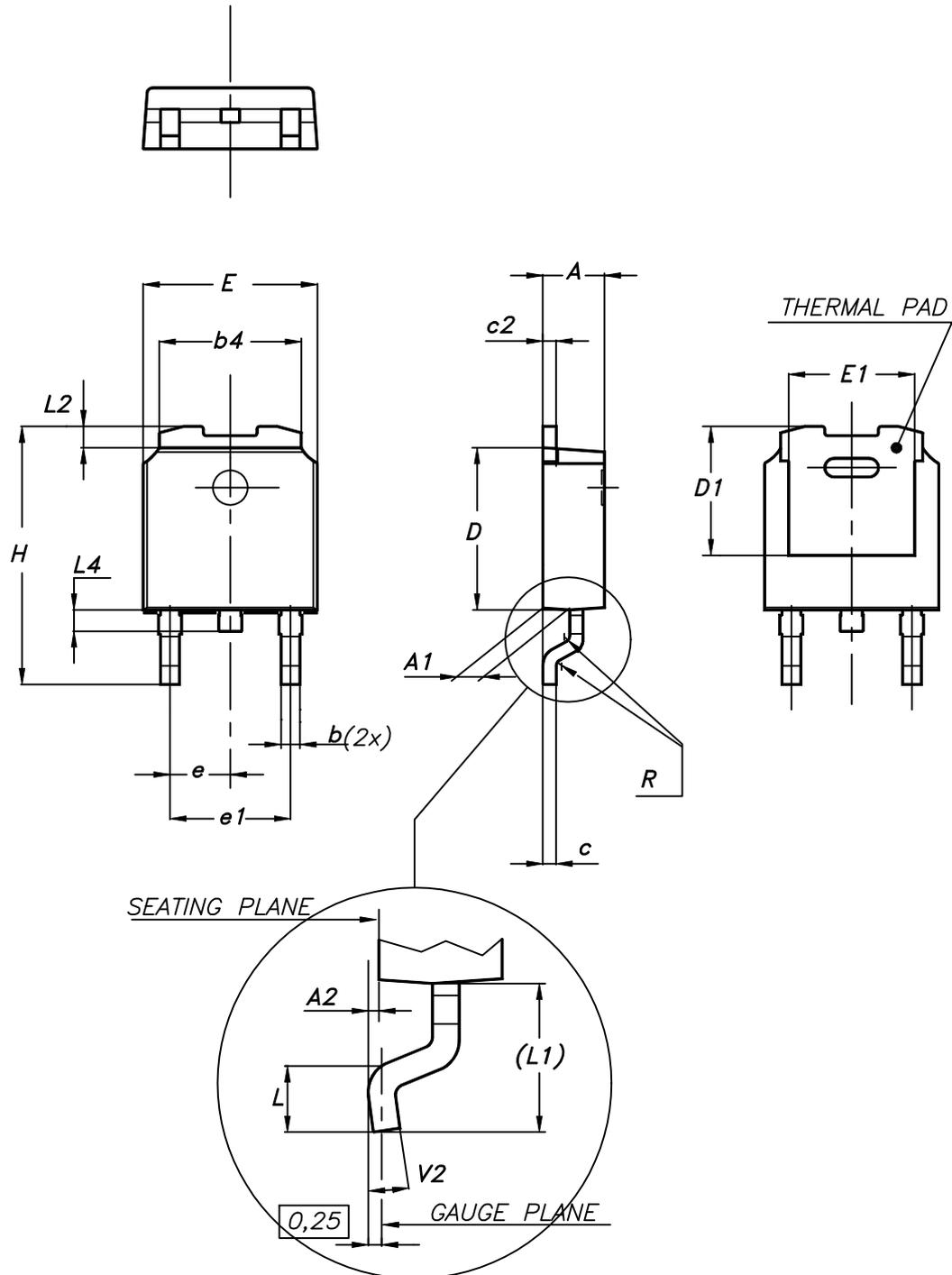
0068772_type-A2_rev25

**Table 9. DPAK (TO-252) type A2 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	5.10	5.20	5.30
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 C2 package information

Figure 25. DPAK (TO-252) type C2 package outline
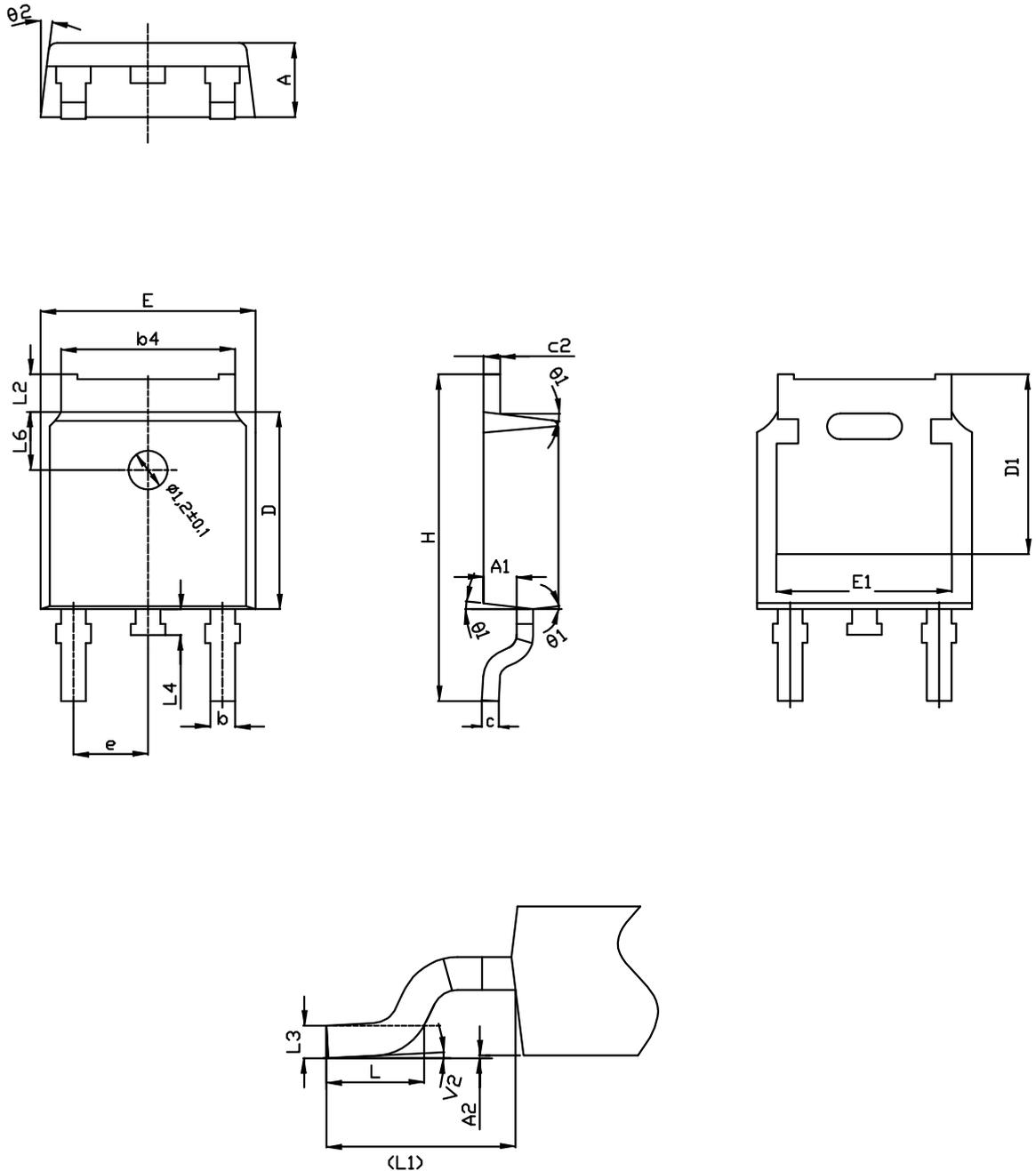
0068772_C2_25

Table 10. DPAK (TO-252) type C2 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	5.10		5.60
E	6.50	6.60	6.70
E1	5.20		5.50
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°

Figure 26. DPAK (TO-252) recommended footprint (dimensions are in mm)
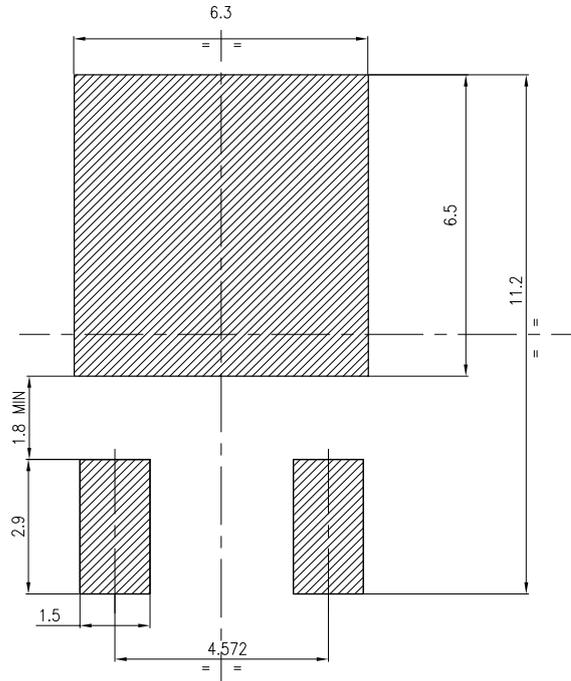
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4.4 D²PAK and DPAK packing information

Figure 27. Tape outline
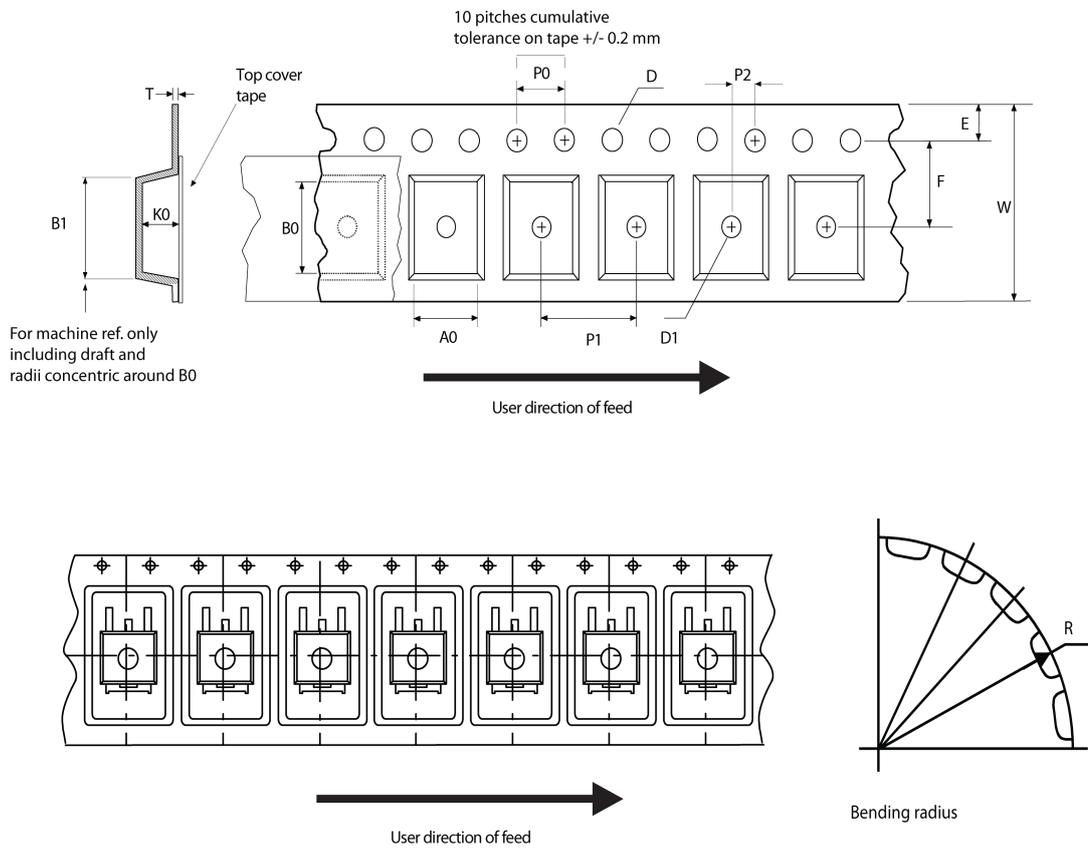
AM08852v1

Figure 28. Reel outline
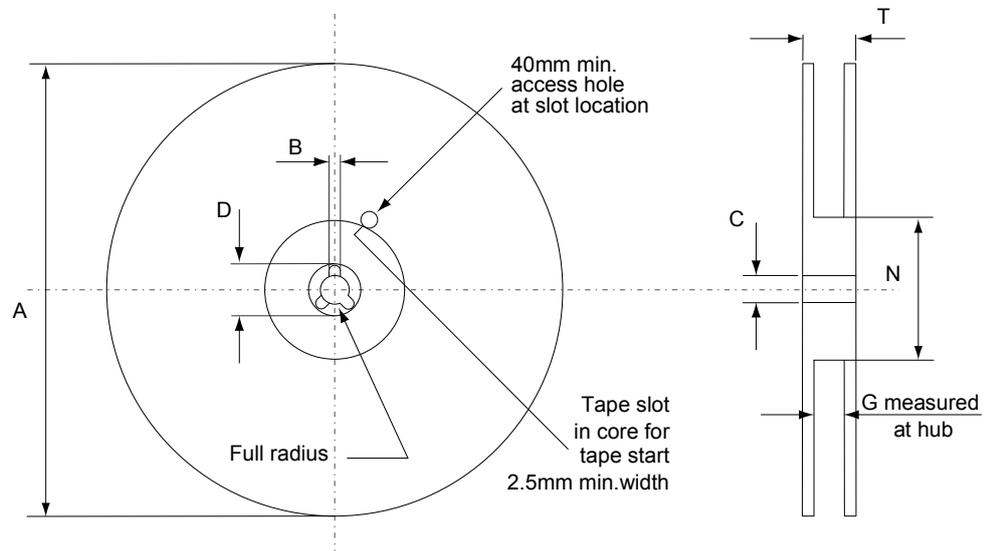

AM06038v1

Table 11. D²PAK tape and reel mechanical data

Tape			Reel		
	mm			mm	
Dim.	Min.	Max.	Dim.	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			

Table 12. 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			

Revision history

Table 13. Document revision history

Date	Version	Changes
18-Jul-2012	1	First release.
09-Aug-2018	2	Removed maturity status indication from cover page. The document status is production data. Updated Section 4 Package information. Minor text changes

Contents

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