STB24N65M2, STF24N65M2, STP24N65M2

N-channel 650 V, 0.185 Ω typ., 16 A MDmesh M2 Power MOSFET in D2PAK, TO-220FP and TO-220 packages

Datasheet - production data

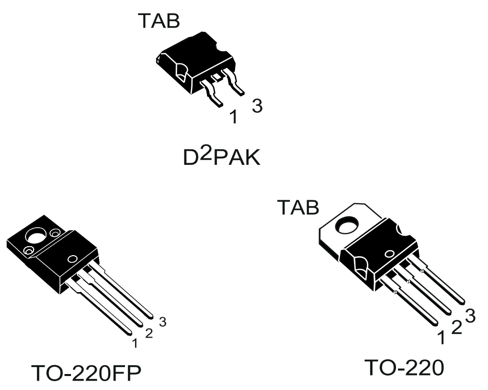
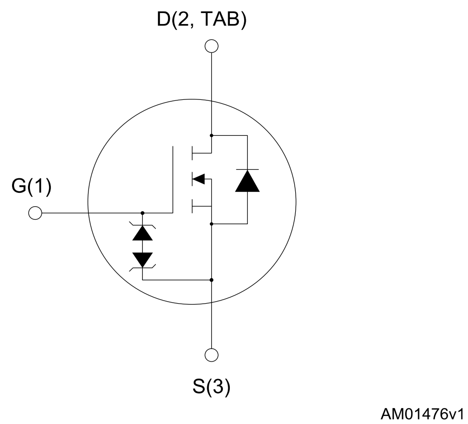


Figure 1: Internal schematic diagram



Features

Order codes	V_{DS}	$R_{DS(on)}$ max	I_D
STB24N65M2	650 V	0.23 Ω	16 A
STF24N65M2			
STP24N65M2			

- 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 MDmesh™ M2 technology. Thanks to their strip layout and improved vertical structure, the devices exhibit low on-resistance and optimized switching characteristics, rendering them suitable for the most demanding high efficiency converters.

Table 1: Device summary

Order codes	Marking	Package	Packaging
STB24N65M2	24N65M2	D^2PAK	Tape and reel
STF24N65M2		TO-220FP	Tube
STP24N65M2		TO-220	

This is information on a product in full production.

Contents

1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value		Unit
		D^2PAK TO-220	TO-220FP	
V_{GS}	Gate-source voltage	± 25		V
I_D	Drain current (continuous) at T_C = 25 °C	16	16 (1)	A
I_D	Drain current (continuous) at T_C = 100 °C	10	10 (1)	A
I_{DM} (2)	Drain current (pulsed)	64	64 (1)	A
P_{TOT}	Total dissipation at T_C = 25 °C	150	30	W
dv/dt (3)	Peak diode recovery voltage slope	15		V/ns
dv/dt (4)	MOSFET dv/dt ruggedness	50		V/ns
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T_C = 25 °C)		2500	V
T_{stg}	Storage temperature	- 55 to 150		°C
T_j	Max. operating junction temperature			

Notes:

(1)Limited by maximum junction temperature.

(2)Pulse width limited by safe operating area.

(3)I_{SD} ≤ 16 A, di/dt ≤ 400 A/µs; $V_{DS(peak)} < V_{(BR)DSS}$, V_{DD} = 80% $V_{(BR)DSS}$.

(4)V_{DS} ≤ 520 V

Table 3: Thermal data

Symbol	Parameter	Value			Unit
		D^2PAK	TO-220	TO-220FP	
$R_{thj\text{-}case}$	Thermal resistance junction-case max	0.83		4.2	°C/W
$R_{thj\text{-}pcb}$	Thermal resistance junction-pcb max (1)	30			°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max		62.5		°C/W

Notes:

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

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_{jmax})	2.2	A
E_{AS}	Single pulse avalanche energy (starting T_j=25°C, I_D= I_{AR}; V_{DD}=50V)	650	mJ

2 Electrical characteristics

(T_C = 25 °C unless otherwise specified)

Table 5: 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	650			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 650 V			1	µA
		V_{DS} = 650 V, T_C=125 °C			100	µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 25 V			±10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 8 A		0.185	0.23	Ω

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 100 V, f = 1 MHz, V_{GS} = 0	-	1060	-	pF
C_{oss}	Output capacitance		-	47.5	-	pF
C_{rss}	Reverse transfer capacitance		-	1.65	-	pF
$C_{oss\ eq.}$ (1)	Equivalent output capacitance	V_{DS} = 0 to 520 V, V_{GS} = 0	-	229	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz, I_D = 0	-	7	-	Ω
Q_g	Total gate charge	V_{DD} = 520 V, I_D = 16 A, V_{GS} = 10 V	-	29	-	nC
Q_{gs}	Gate-source charge		-	3.8	-	nC
Q_{gd}	Gate-drain charge		-	14	-	nC

Notes:

(1) $C_{oss\ eq.}$ 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 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 325 V, I_D = 8 A, R_G = 4.7 Ω, V_{GS} = 10 V	-	10	-	ns
t_r	Rise time		-	9.5	-	ns
$t_{d(off)}$	Turn-off delay time		-	68	-	ns
t_f	Fall time		-	25.5	-	ns

Table 8: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		16	A
I_{SDM}[(1)]	Source-drain current (pulsed)		-		64	A
V_{SD}[(2)]	Forward on voltage	I_{SD} = 16 A, V_{GS} = 0	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 16 A, di/dt = 100 A/µs V_{DD} = 60 V	-	350		ns
Q_{rr}	Reverse recovery charge		-	4.5		µC
I_{RRM}	Reverse recovery current		-	26		A
t_{rr}	Reverse recovery time	I_{SD} = 16 A, di/dt = 100 A/µs V_{DD} = 60 V, T_j = 150 °C	-	496		ns
Q_{rr}	Reverse recovery charge		-	6.5		µC
I_{RRM}	Reverse recovery current		-	25.5		A

Notes:

(1)Pulse width limited by safe operating area.

(2)Pulsed: pulse duration = 300 µs, duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area for D2PAK and TO-220

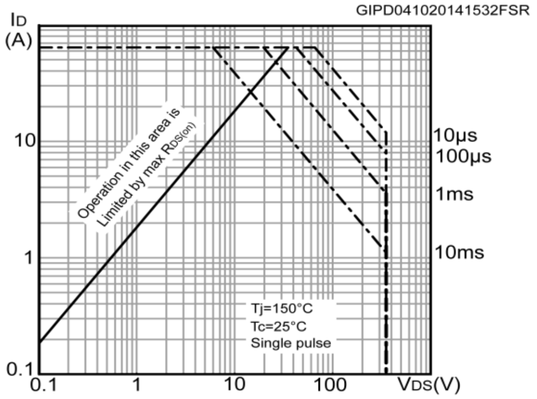


Figure 3: Thermal impedance for D2PAK and TO-220

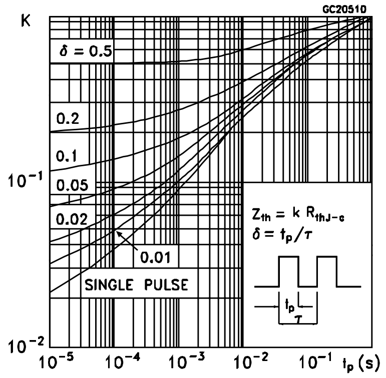


Figure 4: Safe operating area for TO-220FP

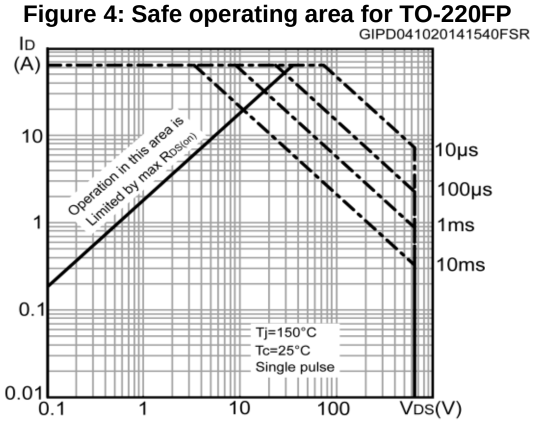


Figure 5: Thermal impedance for TO-220FP

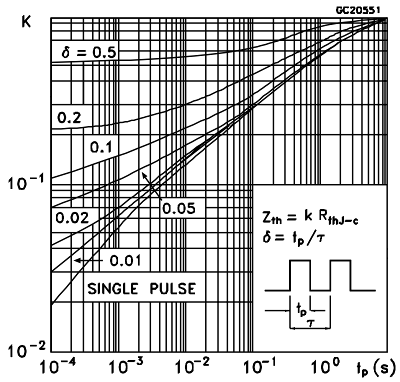


Figure 6: Output characteristics

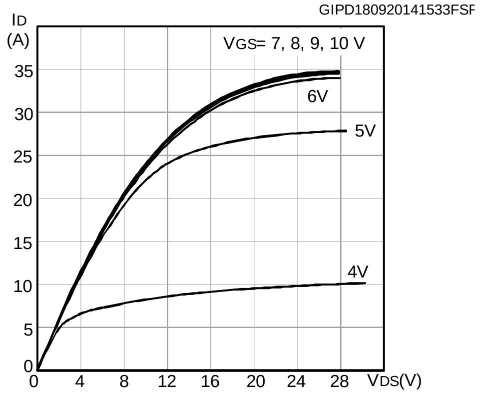


Figure 7: Transfer characteristics

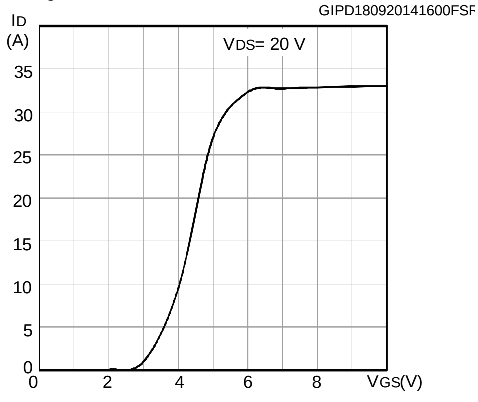


Figure 8: Gate charge vs gate-source voltage

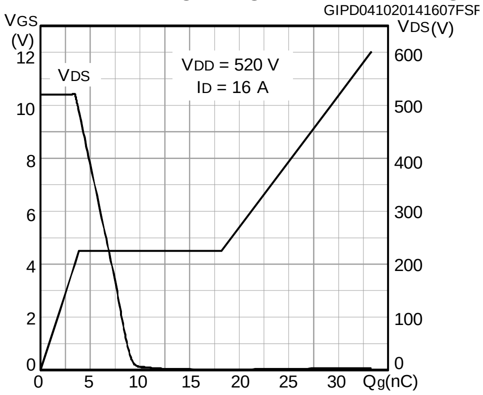


Figure 9: Static drain-source on-resistance

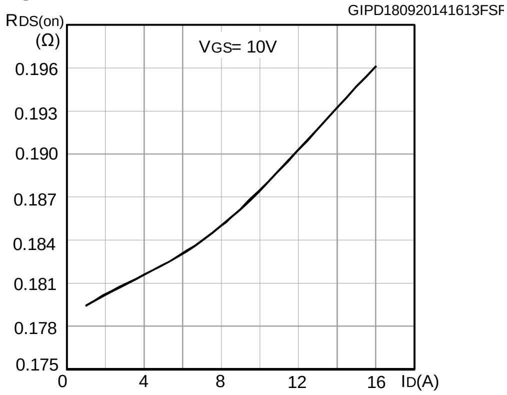


Figure 10: Capacitance variations

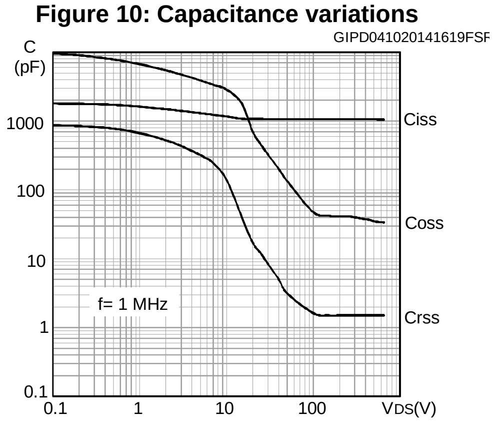


Figure 11: Normalized gate threshold voltage vs temperature

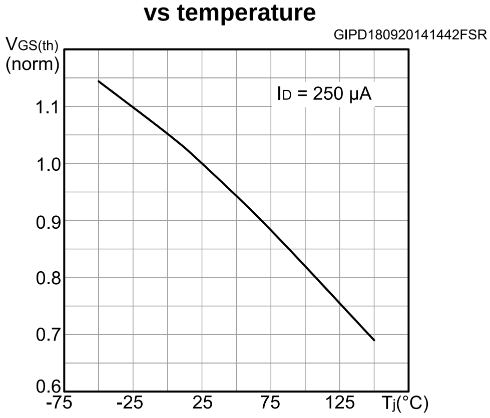


Figure 12: Normalized on-resistance

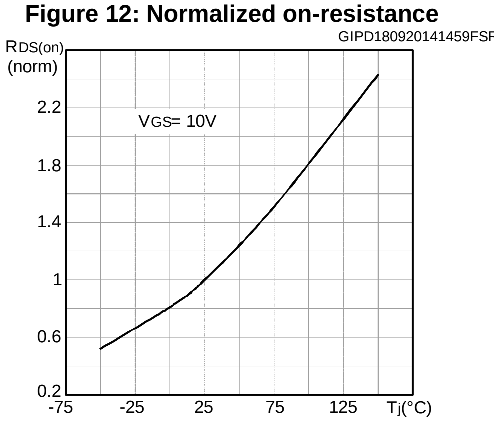


Figure 13: Normalized V(BR)DSS vs temperature

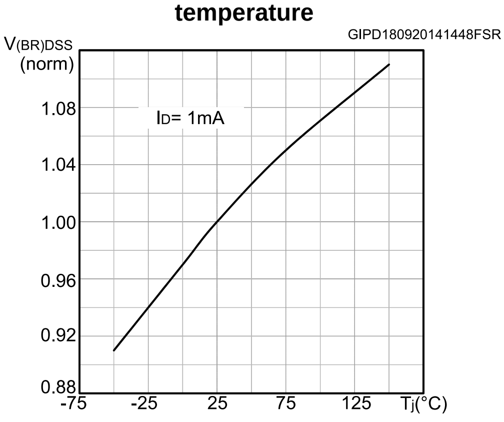


Figure 14: Source-drain diode forward characteristics

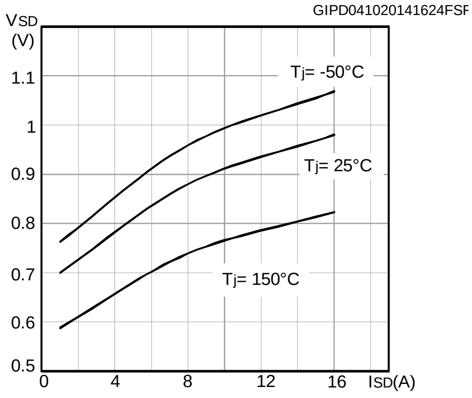
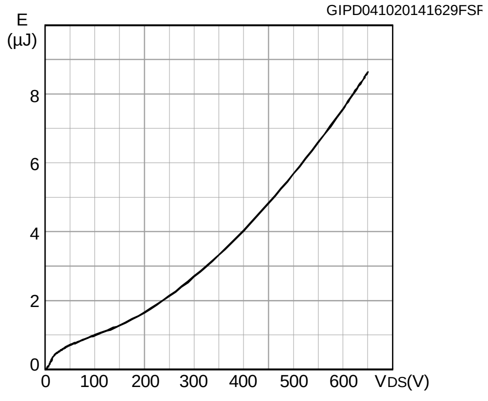


Figure 15: Output capacitance stored energy



3 Test circuits

Figure 16: Switching times test circuit for resistive load

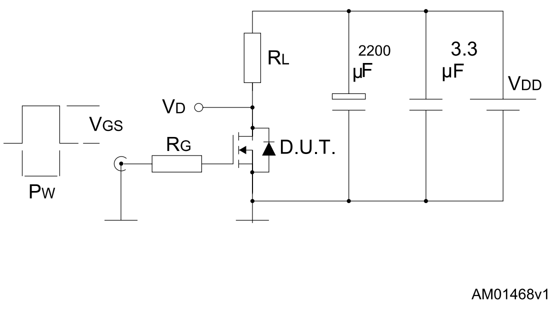


Figure 17: Gate charge test circuit

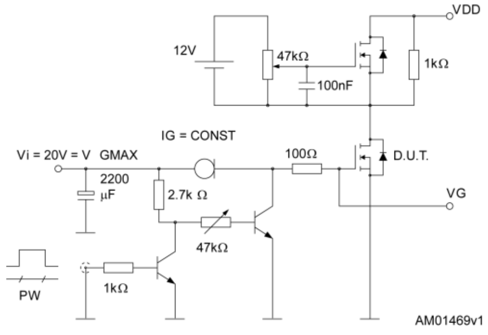


Figure 18: Test circuit for inductive load switching and diode recovery times

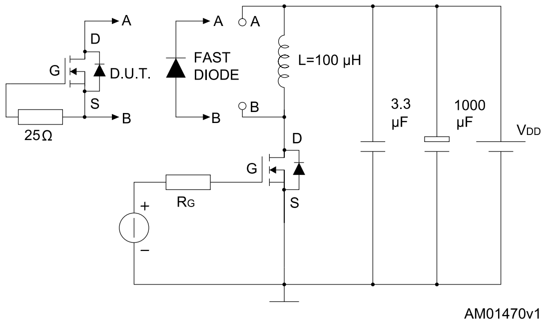


Figure 19: Unclamped inductive load test circuit

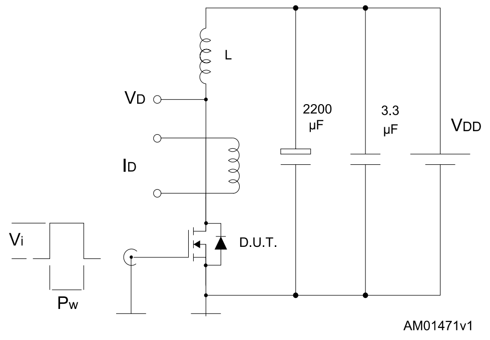


Figure 20: Unclamped inductive waveform

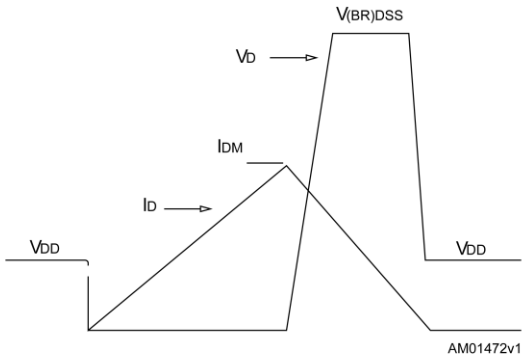
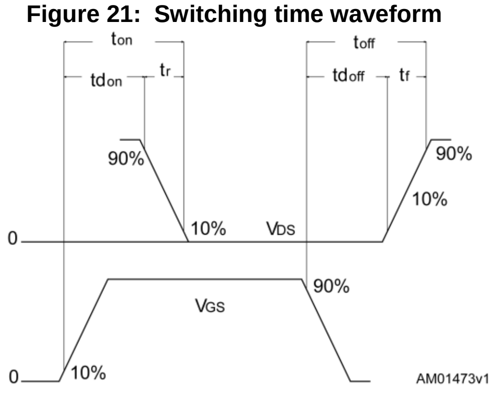


Figure 21: Switching time waveform



4 Package mechanical data

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 22: D²PAK (TO-263) drawing

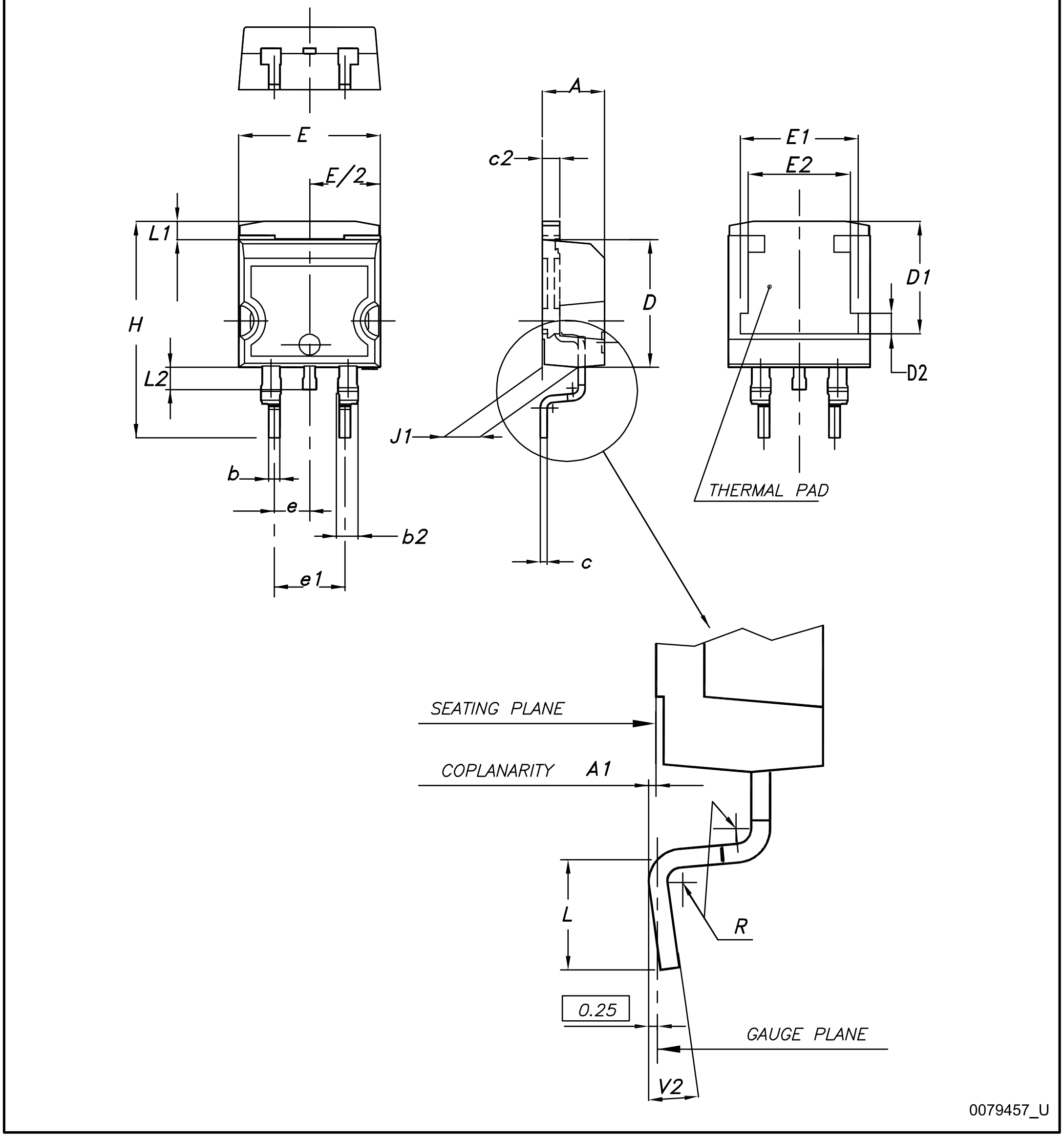
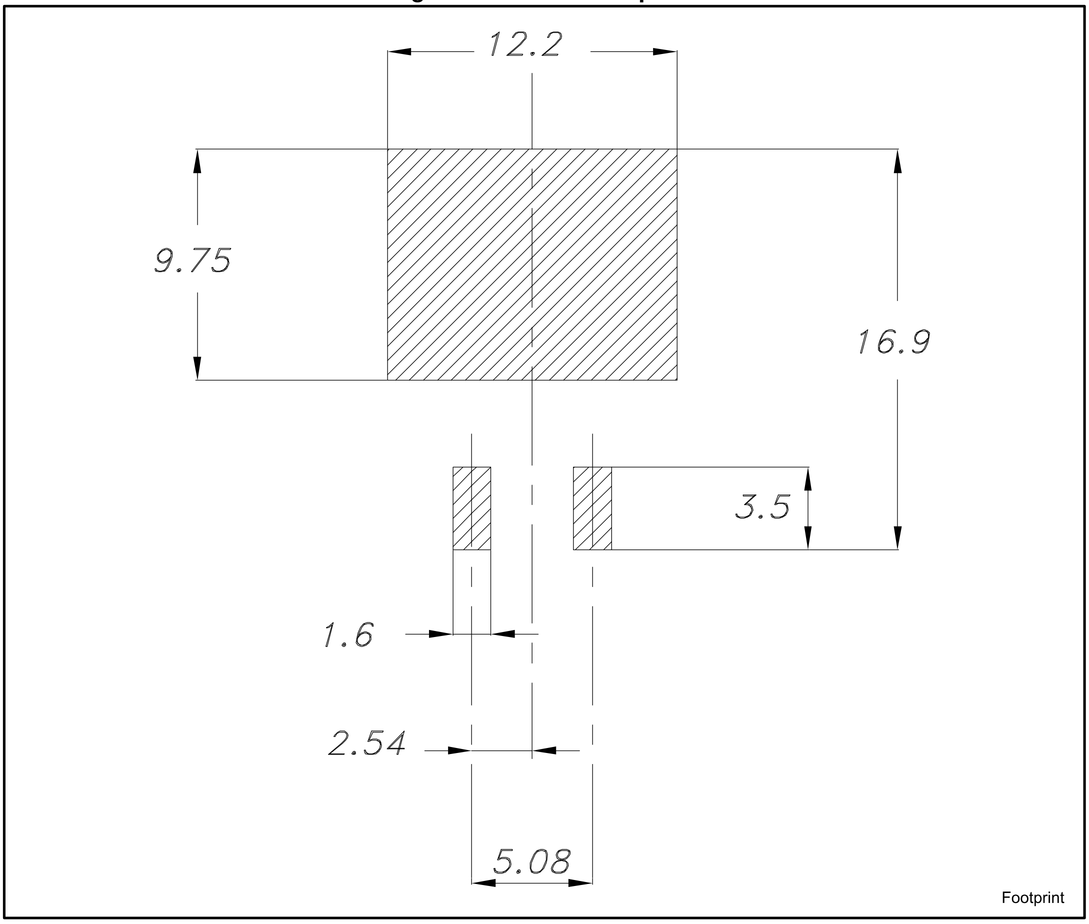


Table 9: D²PAK (TO-263) mechanical data

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		10.40
E1	8.50	8.70	8.90
E2	6.85	7.05	7.25
e		2.54	
e1	4.88		5.28
H	15		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.4	
V2	0°		8°

Figure 23: D²PAK footprint



All the dimensions are in millimeters.

4.2 TO-220FP package information

Figure 24: TO-220FP package outline

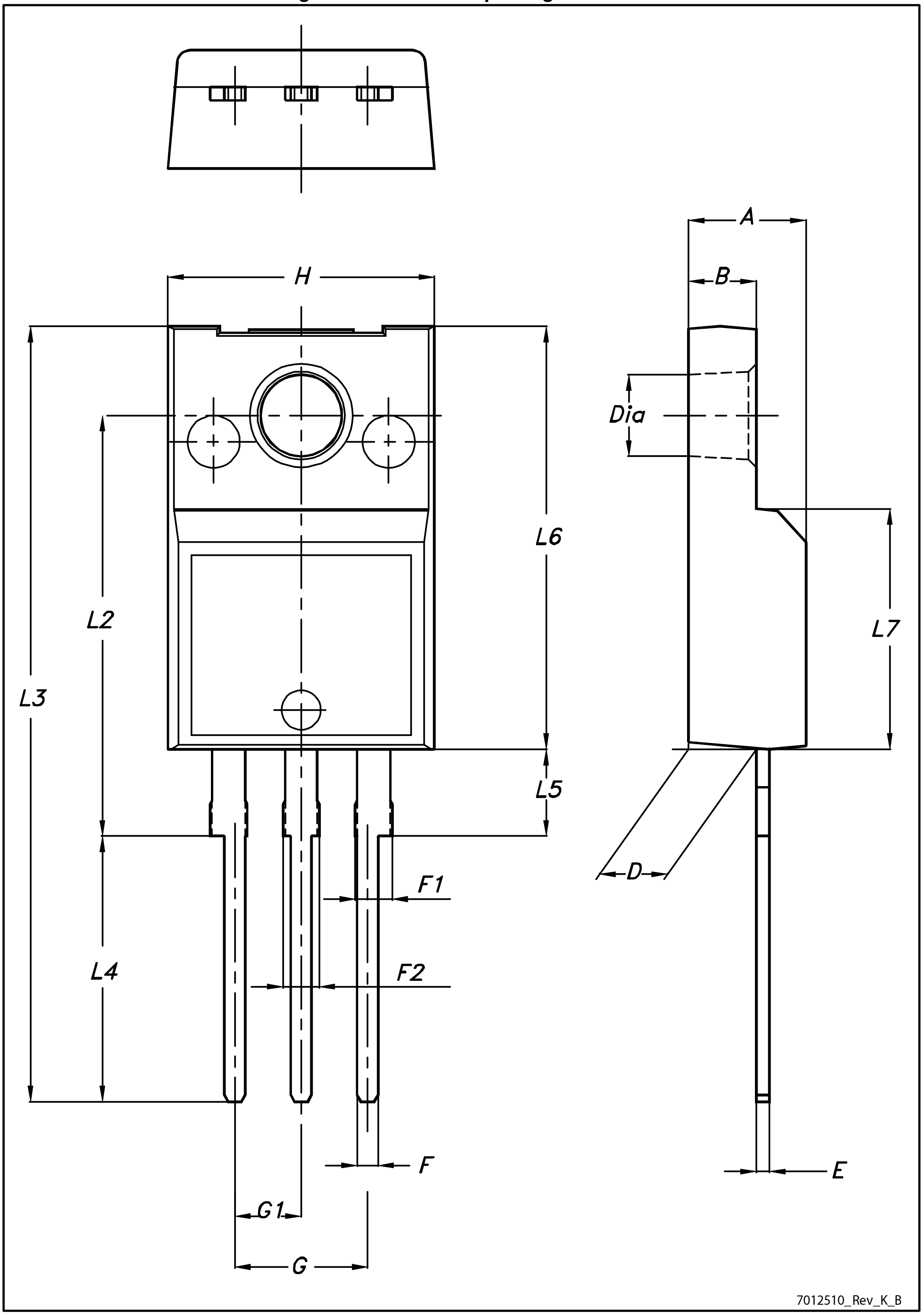


Table 10: TO-220FP mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.4		4.6
B	2.5		2.7
D	2.5		2.75
E	0.45		0.7
F	0.75		1
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.2
G1	2.4		2.7
H	10		10.4
L2		16	
L3	28.6		30.6
L4	9.8		10.6
L5	2.9		3.6
L6	15.9		16.4
L7	9		9.3
Dia	3		3.2

4.3 TO-220 type A package information

Figure 25: TO-220 type A package outline

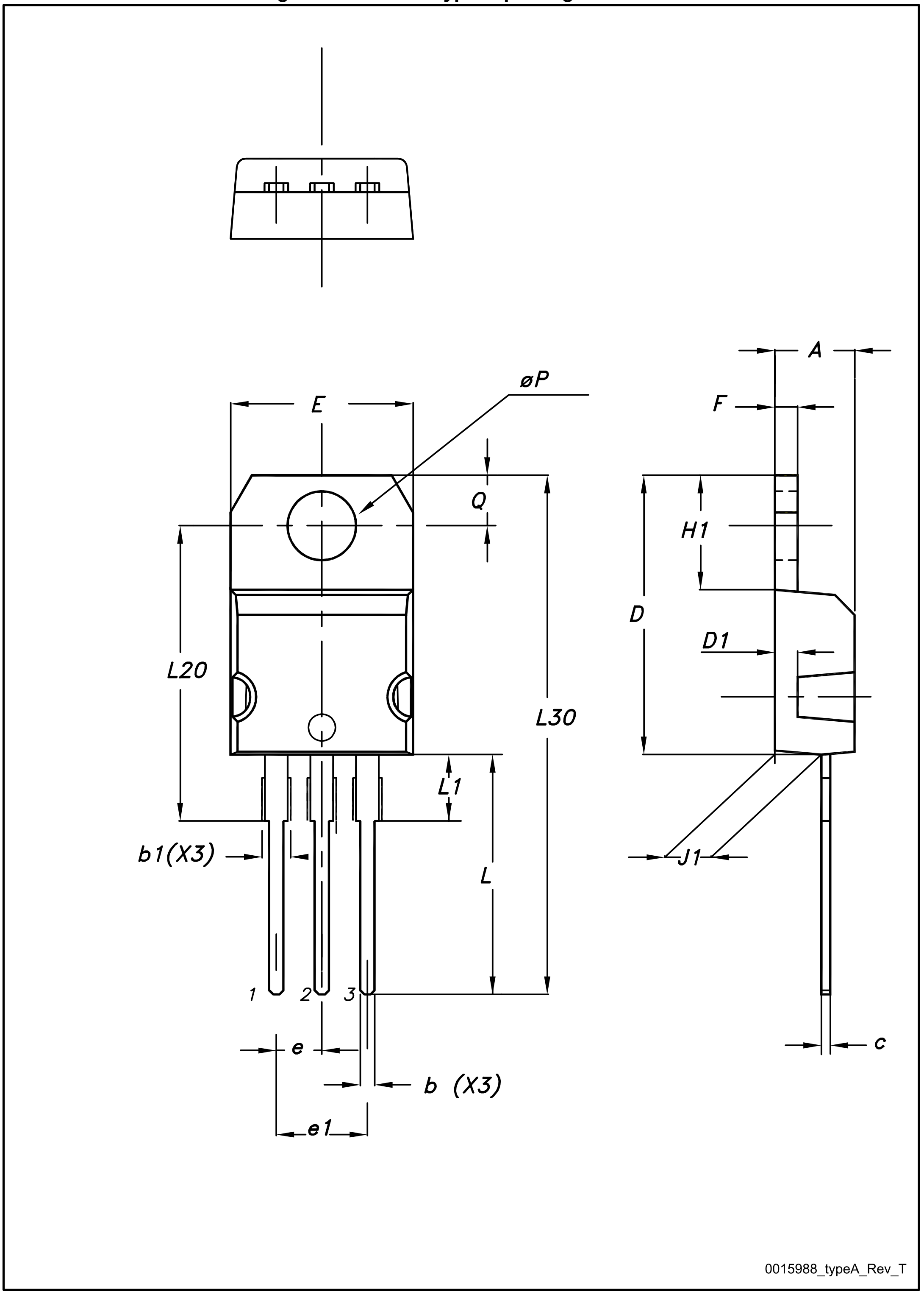


Table 11: TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		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		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
øP	3.75		3.85
Q	2.65		2.95

5 Packaging mechanical data

Figure 26: Tape

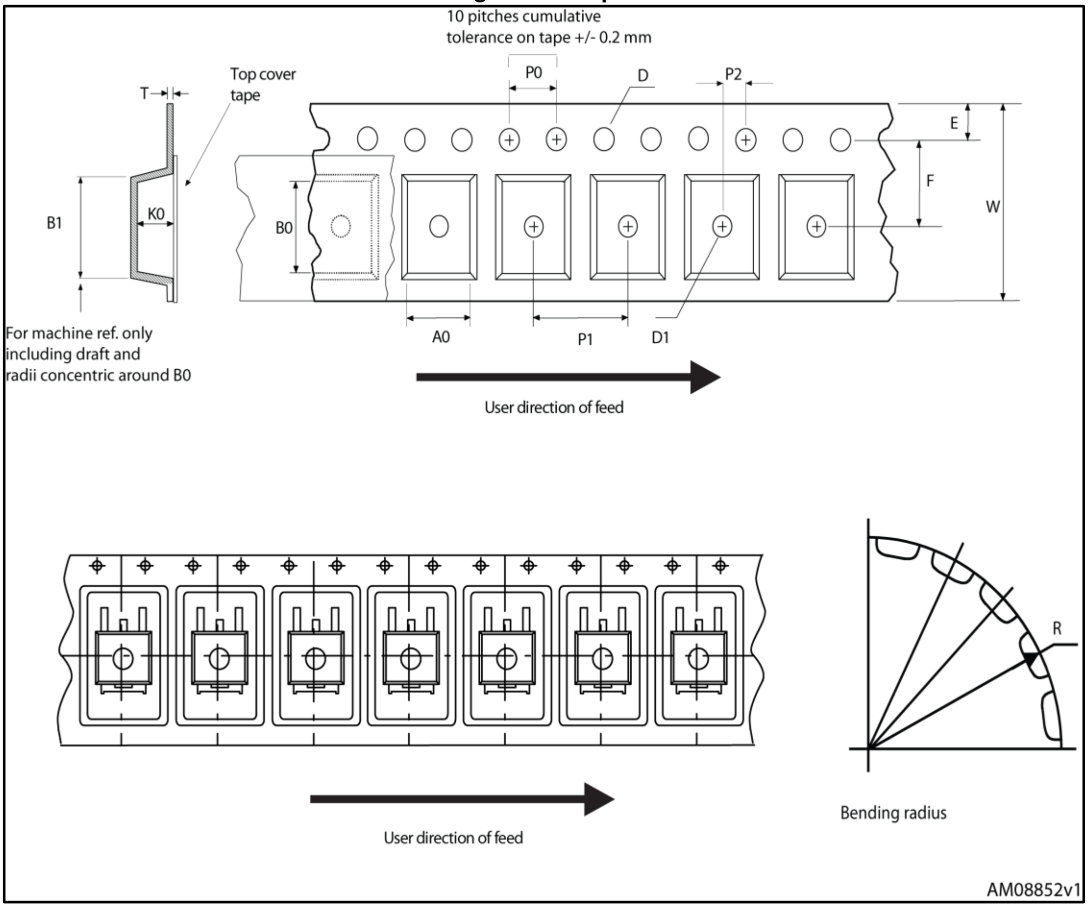


Figure 27: Reel

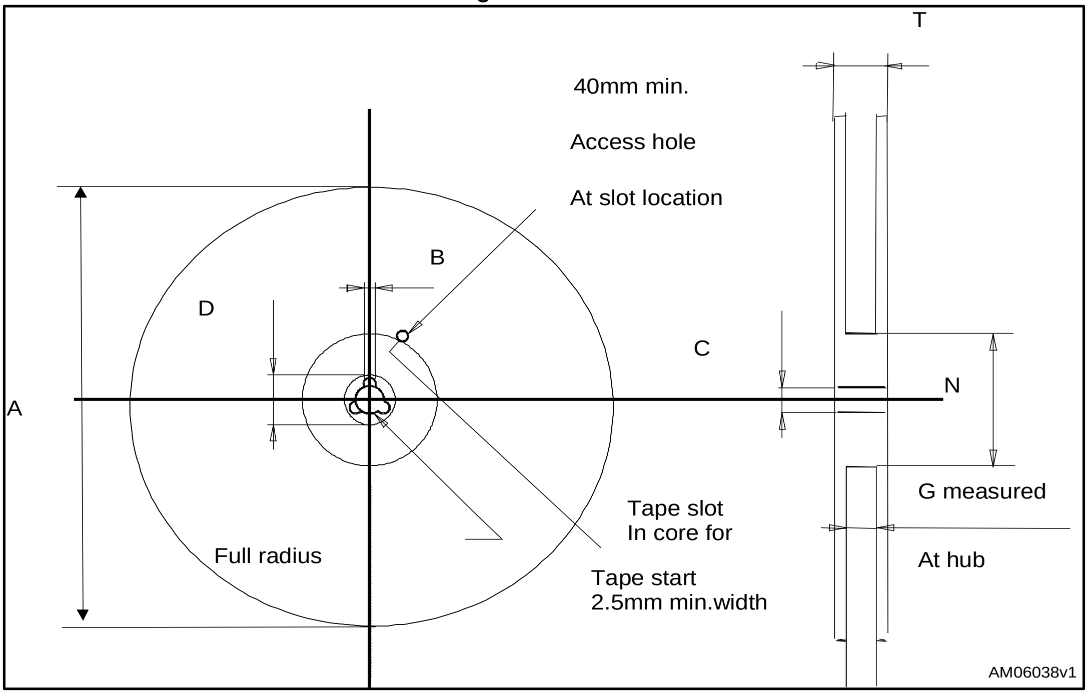


Table 12: D²PAK (TO-263) tape and reel mechanical data

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 qty		1000
P2	1.9	2.1	Bulk qty		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

6 Revision history

Table 13: Document revision history

Date	Revision	Changes
09-Jun-2014	1	First release.
11-Nov-2014	2	Document status promoted from preliminary to production data.

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

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