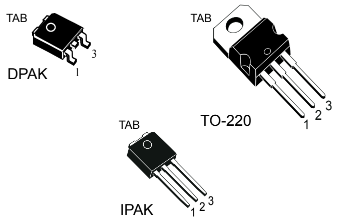
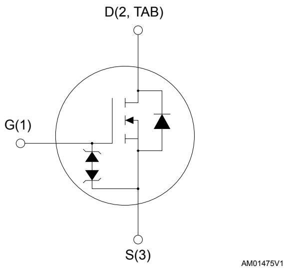
STD7N60M2, STP7N60M2, STU7N60M2

Datasheet

N-channel 600 V, 0.86 Ω typ., 5 A, MDmesh™ M2 Power MOSFETs in DPAK, TO-220 and IPAK packages





Features

Order codes	V_{DS} @ T_{Jmax}	$R_{DS(on)}$ max.	I_D
STD7N60M2	650 V	0.95 Ω	5 A
STP7N60M2			
STU7N60M2			

- 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, these devices exhibit low on-resistance and optimized switching characteristics, rendering them suitable for the most demanding high efficiency converters.

Product status link
STD7N60M2
STP7N60M2
STU7N60M2

Product summary	
Order code	**STD7N60M2**
Marking	7N60M2
Package	DPAK
Packing	Tape and reel
Order code	**STP7N60M2**
Marking	7N60M2
Package	TO-220
Packing	Tube
Order code	**STU7N60M2**
Marking	7N60M2
Package	IPAK
Packing	Tube

1 Electrical ratings

Table 1. **Absolute maximum ratings**

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	±25	V
I_D (1)	Drain current (continuous) at T_{case} = 25 °C	5	A
	Drain current (continuous) at T_{case} = 100 °C	3.5	
I_{DM} (2)	Drain current (pulsed)	20	A
P_{TOT}	Total dissipation at T_{case} = 25 °C	60	W
dv/dt (3)	Peak diode recovery voltage slope	15	V/ns
dv/dt (4)	MOSFET dv/dt ruggedness	50	
T_{stg}	Storage temperature range	-55 to 150	°C
T_j	Operating junction temperature range		

1. *Limited by maximum junction temperature.*
2. *Pulse width limited by safe operating area.*
3. $I_{SD} \leq 5$ A, di/dt ≤ 400 A/µs; $V_{DS\ peak} < V_{(BR)DSS}$, V_{DD}=400 V
4. $V_{DS} \leq 480$ V

Table 2. **Thermal data**

Symbol	Parameter	Value			Unit
		DPAK	TO-220	IPAK	
$R_{thj-case}$	Thermal resistance junction-case	2.08			°C/W
$R_{thj-pcb}$(1)	Thermal resistance junction-pcb	50			°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient		62.5	100	°C/W

1. *When mounted on 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})	1.5	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	99	mJ

2 Electrical characteristics

(T_{case} = 25 °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 V, I_D = 1 mA	600			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 600 V			1	µA
		V_{GS} = 0 V, V_{DS} = 600 V, T_{case} = 125 °C (1)			100	
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, 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 = 2.5 A		0.86	0.95	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	-	271	-	pF
C_{oss}	Output capacitance		-	15.7	-	
C_{rss}	Reverse transfer capacitance		-	0.68	-	
$C_{oss\ eq.}$ (1)	Equivalent output capacitance	V_{DS} = 0 to 480 V, V_{GS} = 0 V	-	75.5	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz, I_D = 0 A	-	7.2	-	Ω
Q_g	Total gate charge	V_{DD} = 480 V, I_D = 5 A, V_{GS} = 0 to 10 V (see Figure 17. Test circuit for gate charge behavior)	-	8.8	-	nC
Q_{gs}	Gate-source charge		-	1.8	-	
Q_{gd}	Gate-drain charge		-	4.3	-	

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 6. **Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 300 V, I_D = 2.5 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 16. Test circuit for resistive load switching times and Figure 21. Switching time waveform)	-	7.6	-	ns
t_r	Rise time		-	7.2	-	
$t_{d(off)}$	Turn-off delay time		-	19.3	-	
t_f	Fall time		-	15.9	-	

Table 7. **Source-drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		5	A
I_{SDM} (1)	Source-drain current (pulsed)		-		20	A
V_{SD} (2)	Forward on voltage	V_{GS} = 0 V, I_{SD} = 5 A	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 5 A, di/dt = 100 A/µs, V_{DD} = 60 V (see Figure 18. Test circuit for inductive load switching and diode recovery times)	-	275		ns
Q_{rr}	Reverse recovery charge		-	1.55		µC
I_{RRM}	Reverse recovery current		-	11		A
t_{rr}	Reverse recovery time	I_{SD} = 5 A, di/dt = 100 A/µs, V_{DD} = 60 V, T_j = 150 °C (see Figure 18. Test circuit for inductive load switching and diode recovery times)	-	376		ns
Q_{rr}	Reverse recovery charge		-	2.1		µC
I_{RRM}	Reverse recovery current		-	11		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 2. Safe operating area for DPAK and IPAK

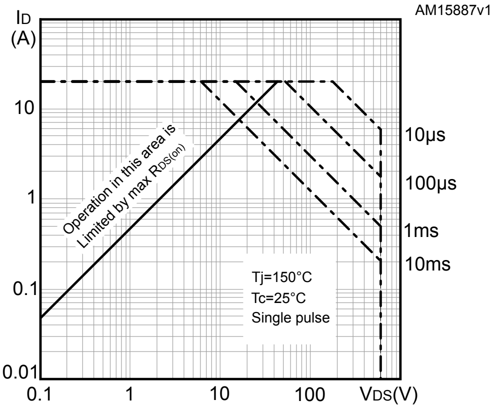


Figure 3. Thermal impedance for DPAK and IPAK

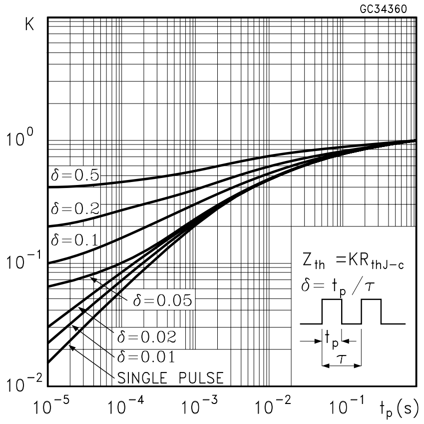


Figure 4. Safe operating area for TO-220

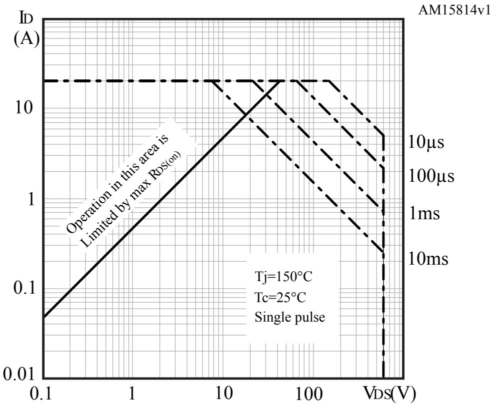


Figure 5. Thermal impedance for TO-220

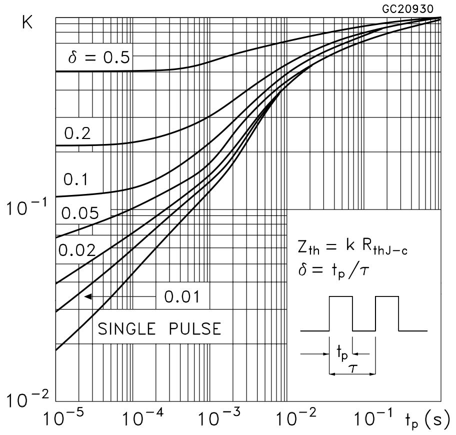


Figure 6. Output characteristics

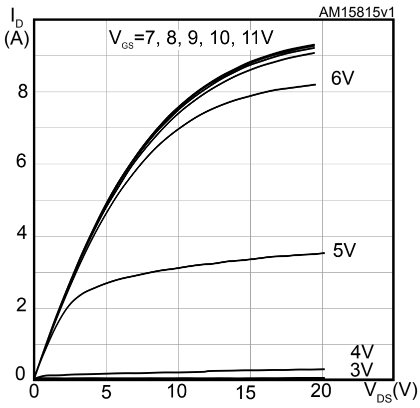


Figure 7. Transfer characteristics

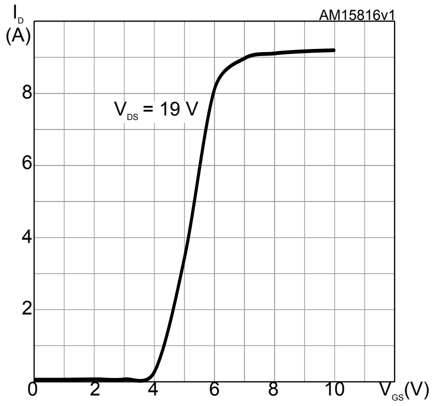


Figure 8. Gate charge vs gate-source voltage

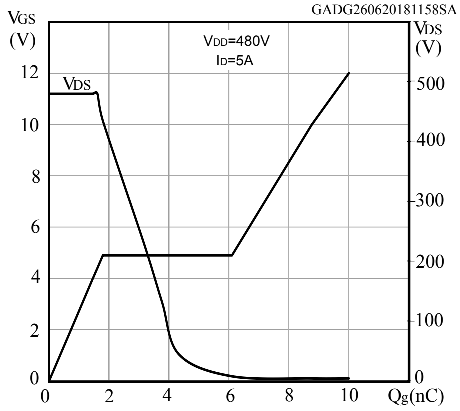


Figure 9. Static drain-source on-resistance

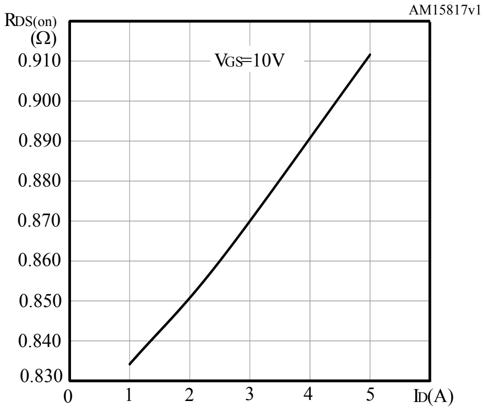


Figure 10. Capacitance variations

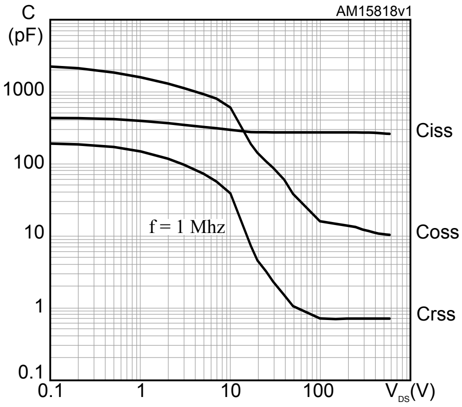


Figure 11. Output capacitance stored energy

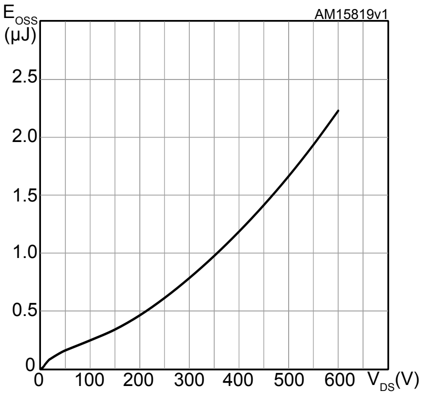


Figure 12. Normalized gate threshold voltage vs temperature

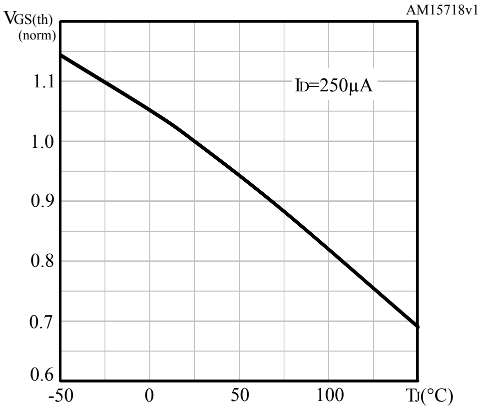


Figure 13. Normalized on-resistance vs temperature

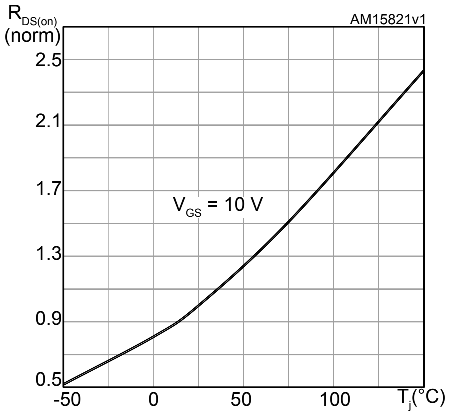


Figure 14. Source-drain diode forward characteristics

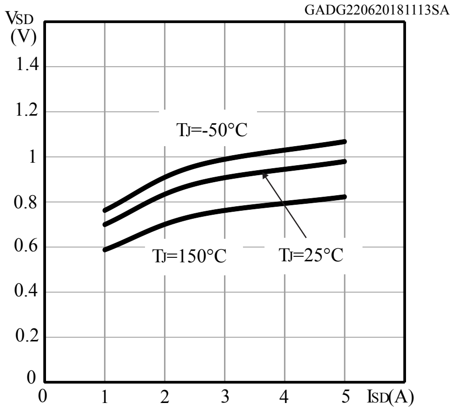
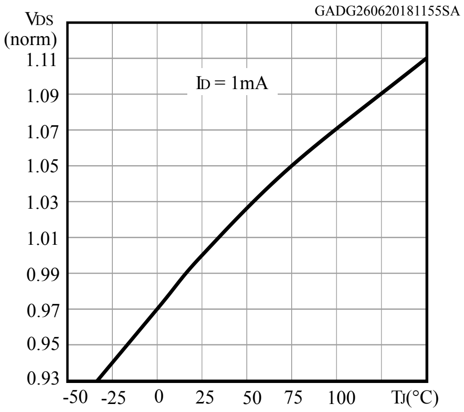


Figure 15. Normalized $V_{(BR)DSS}$ vs temperature



3 Test circuits

Figure 16. Test circuit for resistive load switching times

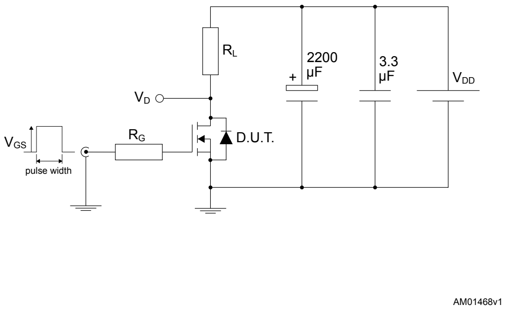


Figure 17. Test circuit for gate charge behavior

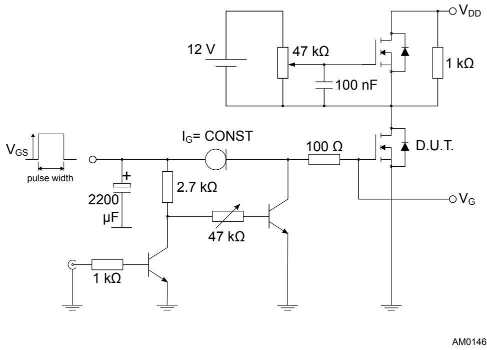


Figure 18. Test circuit for inductive load switching and diode recovery times

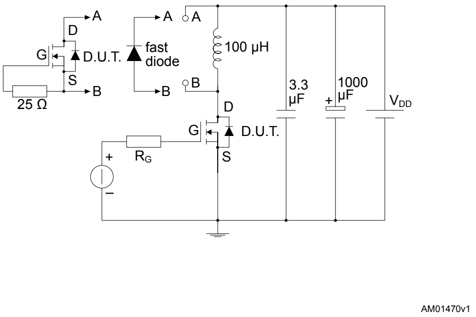


Figure 19. Unclamped inductive load test circuit

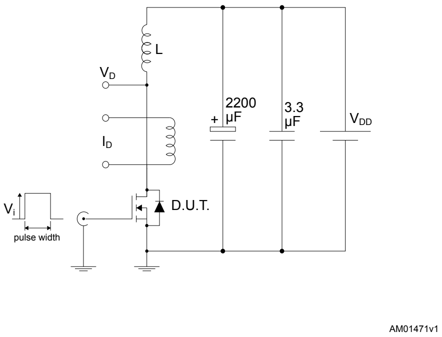


Figure 20. Unclamped inductive waveform

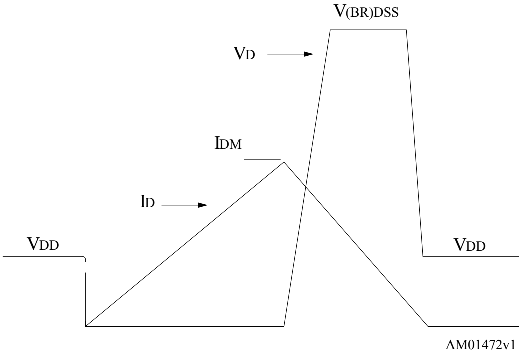
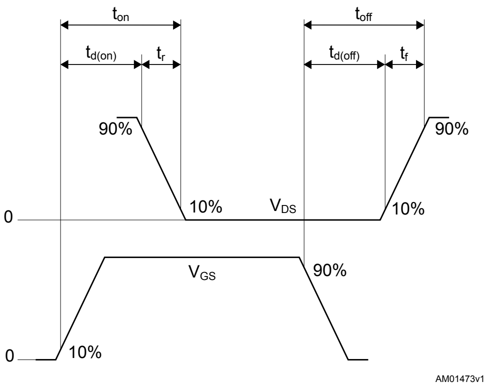


Figure 21. Switching time waveform



4 Package 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 DPAK (TO-252) type A package information

Figure 22. DPAK (TO-252) type A package outline

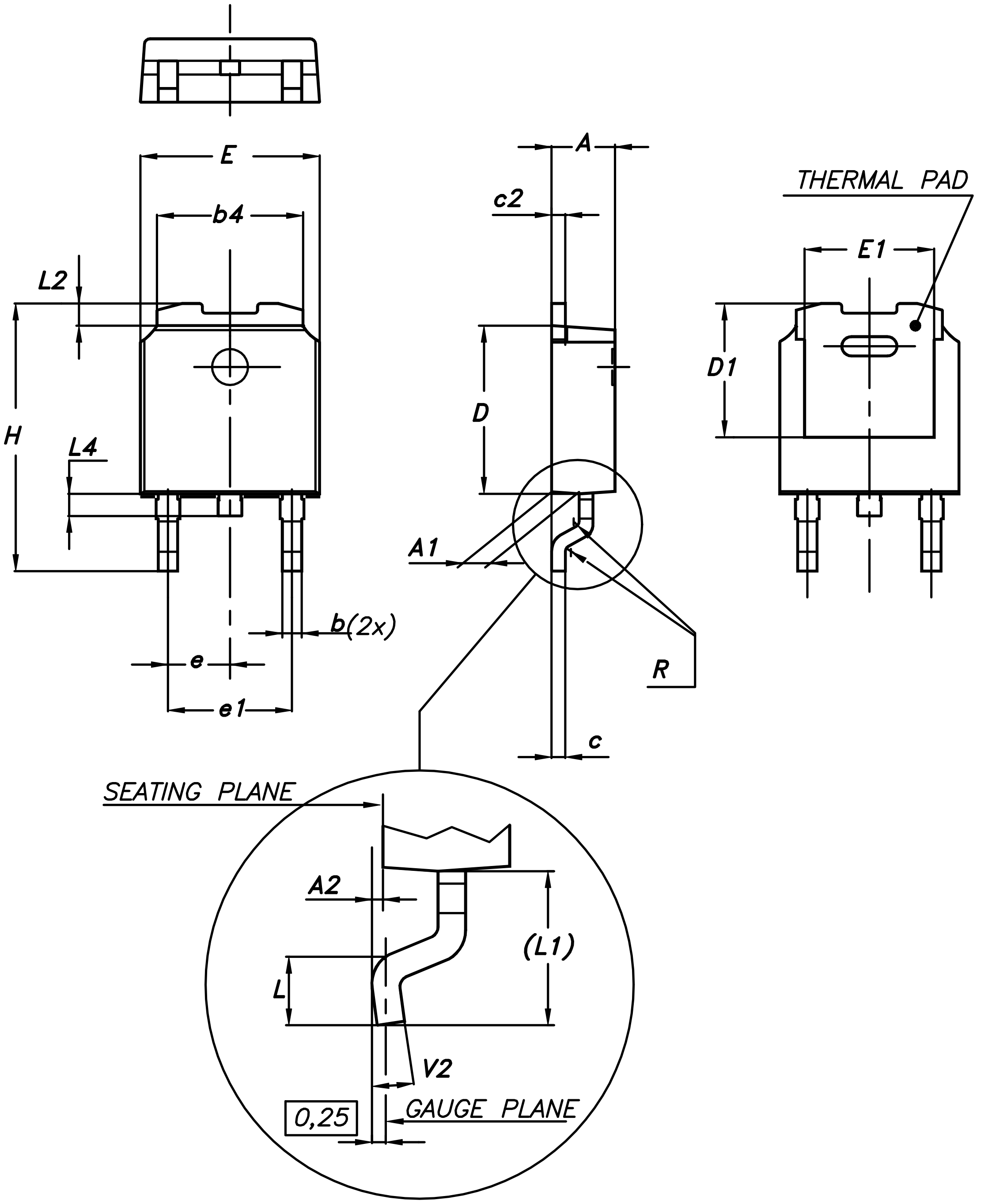


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Table 8. **DPAK (TO-252) type A mechanical data**

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°

4.2 DPAK (TO-252) type C package information

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

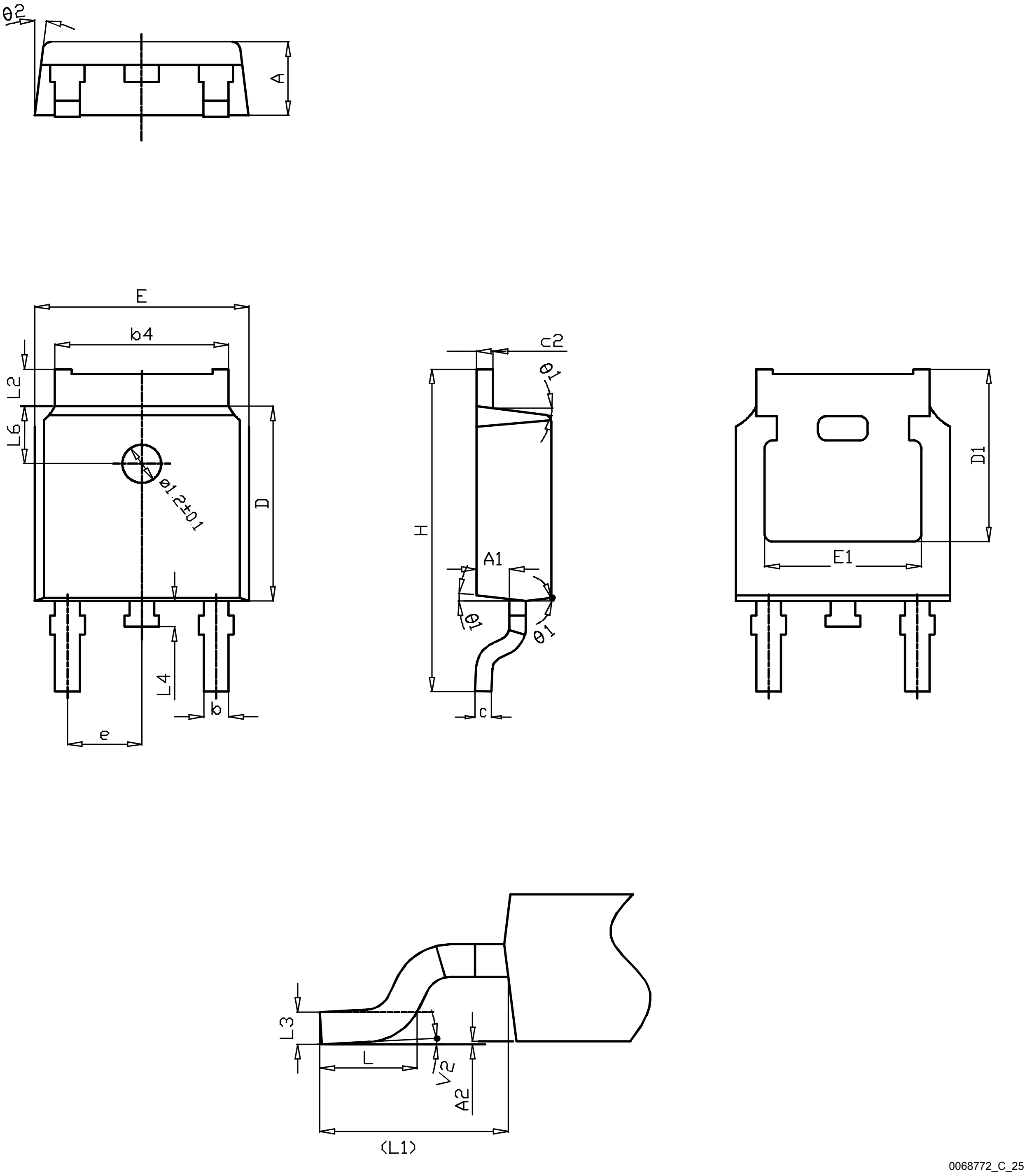

Table 9. **DPAK (TO-252) type C mechanical data**

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	5.25		
E	6.50	6.60	6.70
E1	4.70		
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°

4.3 DPAK (TO-252) type E package information

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

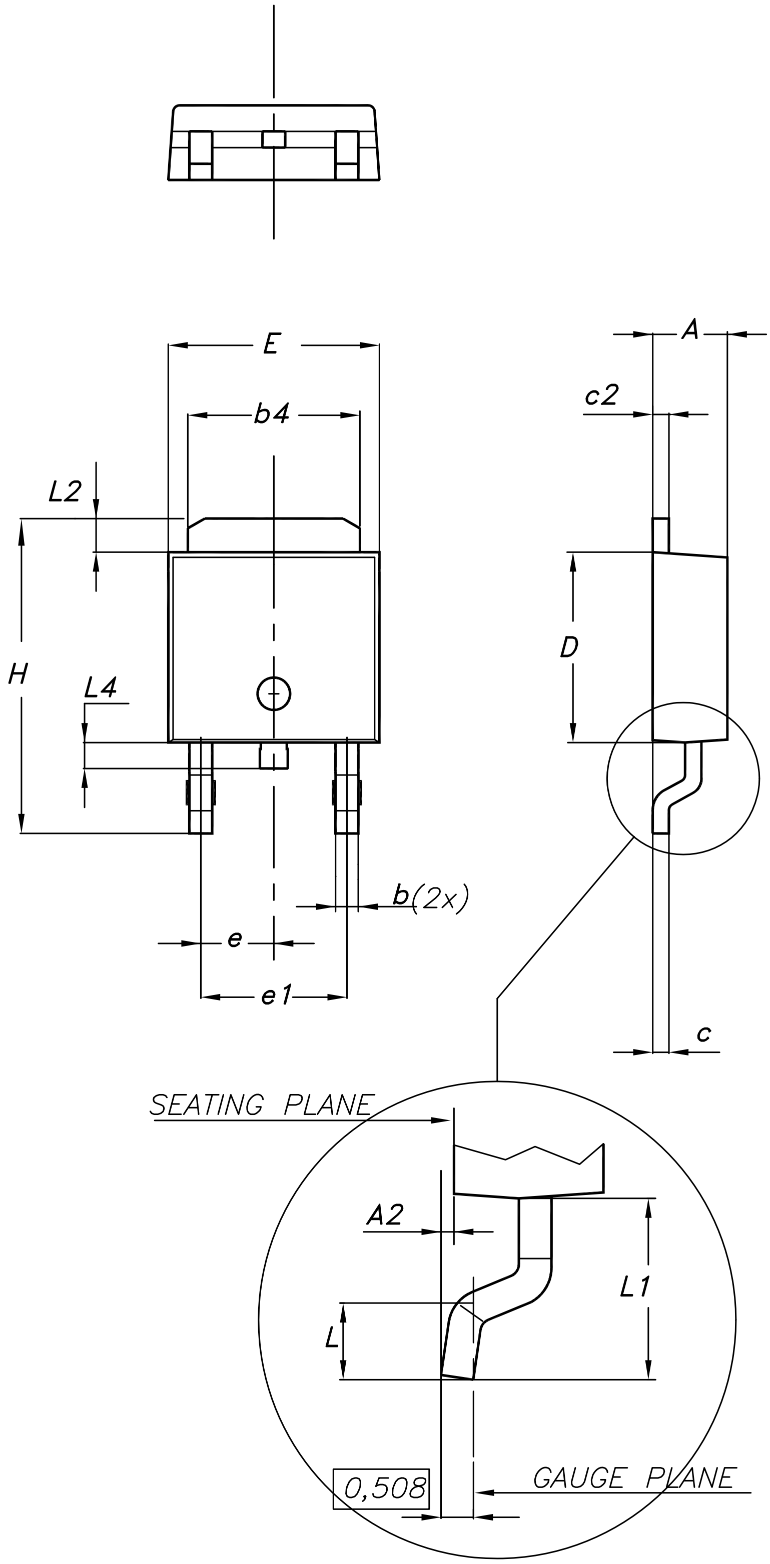

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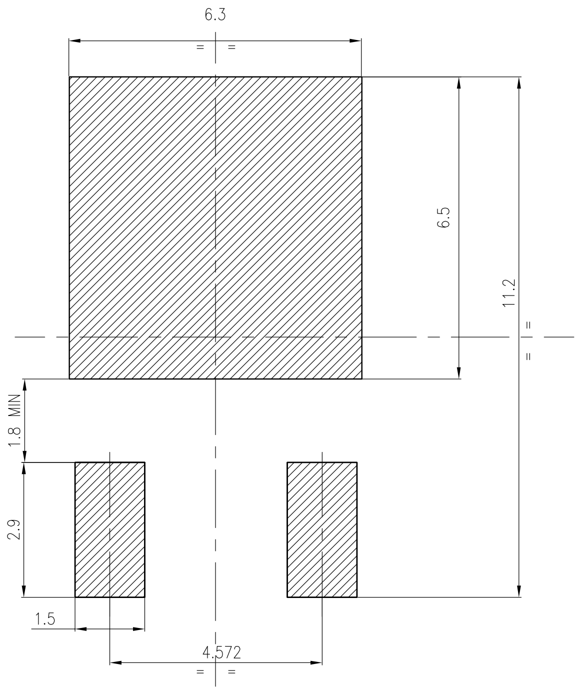
Table 10. **DPAK (TO-252) type E mechanical data**

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

Figure 25. **DPAK (TO-252) recommended footprint (dimensions are in mm)**



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4.4 DPAK (TO-252) packing information

Figure 26. **DPAK (TO-252) tape outline**

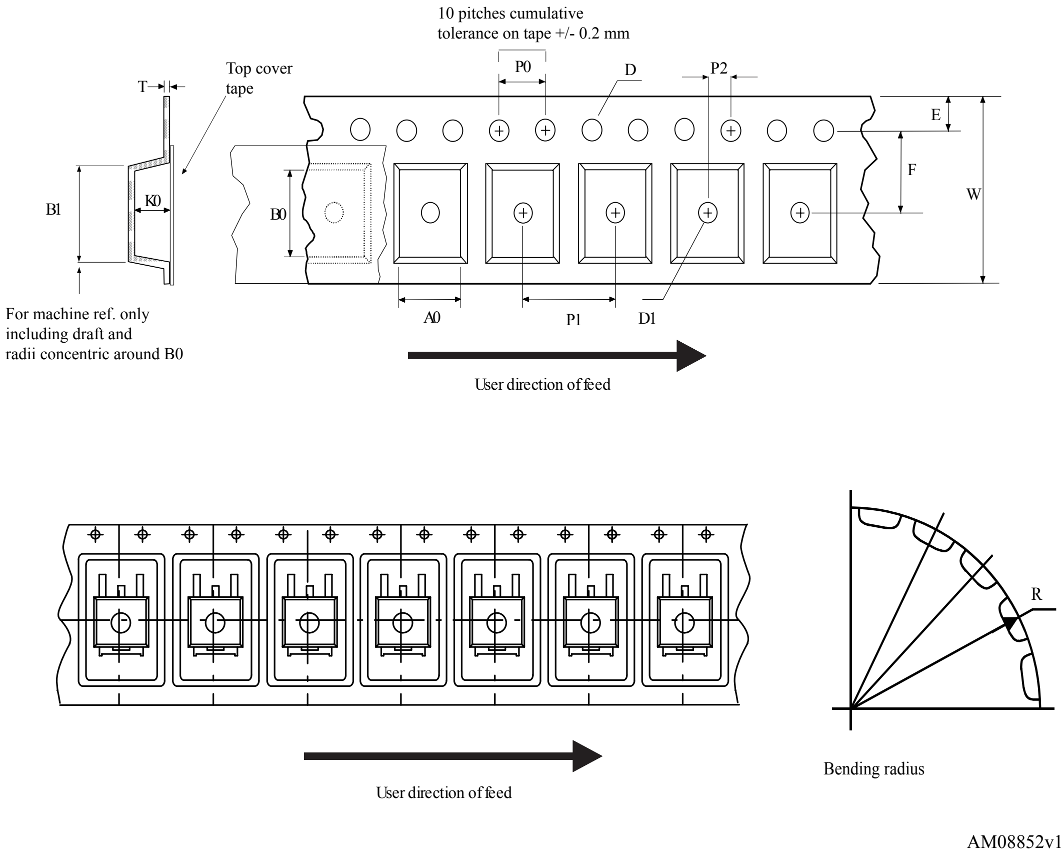

Figure 27. **DPAK (TO-252) reel outline**

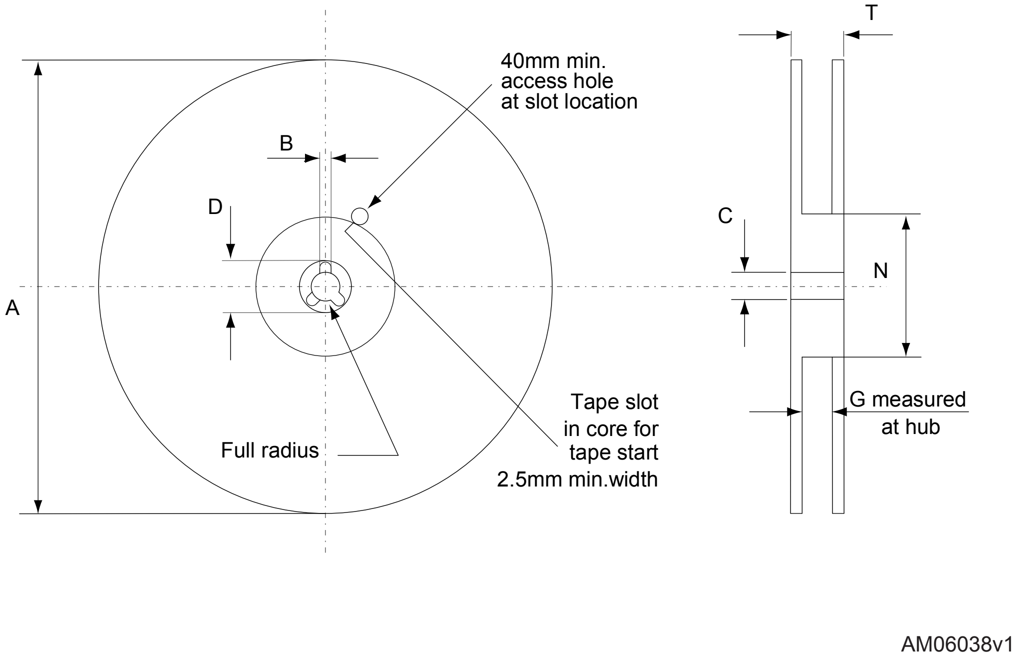

Table 11. **DPAK (TO-252) tape and reel mechanical data**

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			

4.5 TO-220 type A package information

Figure 28. **TO-220 type A package outline**

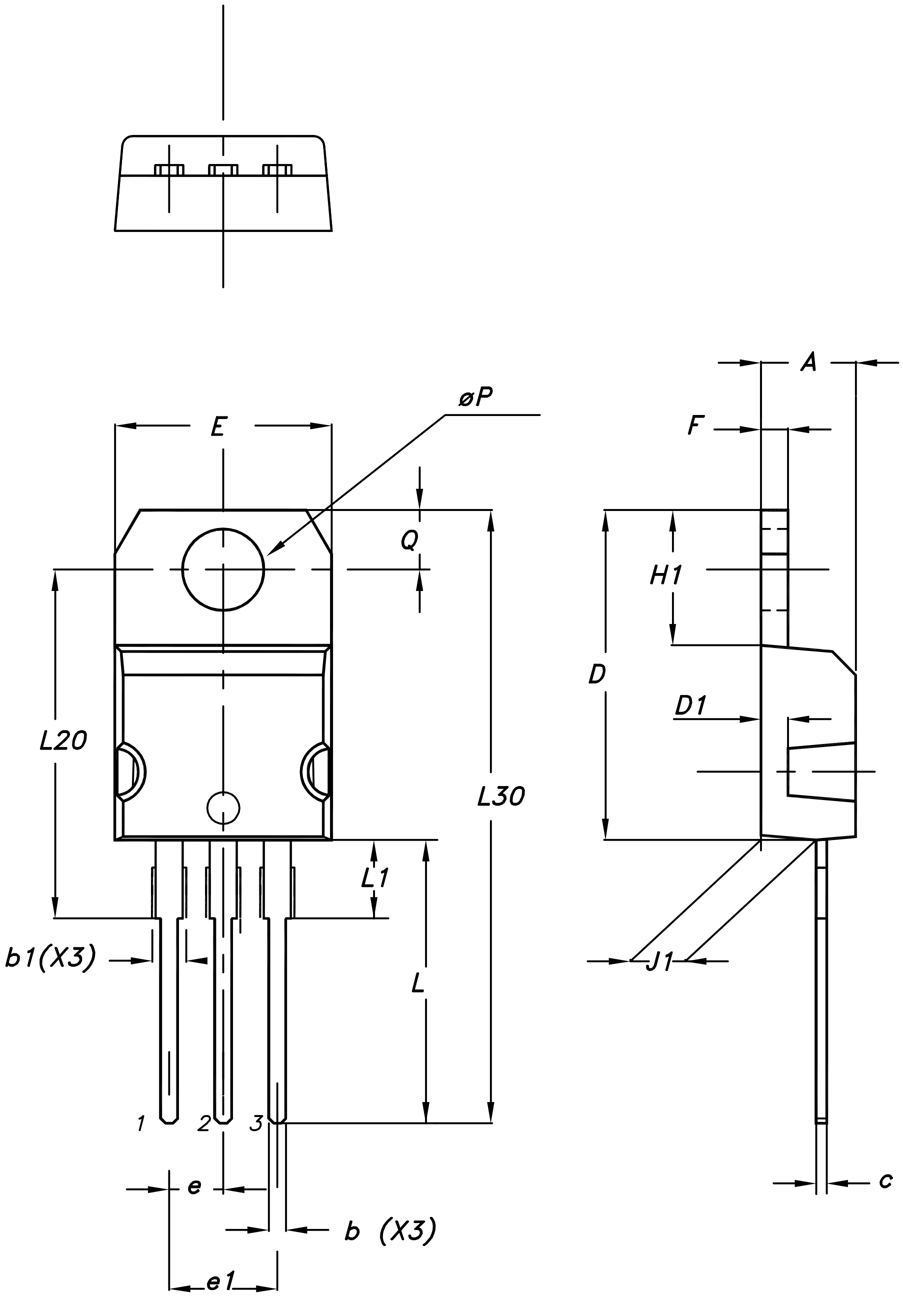

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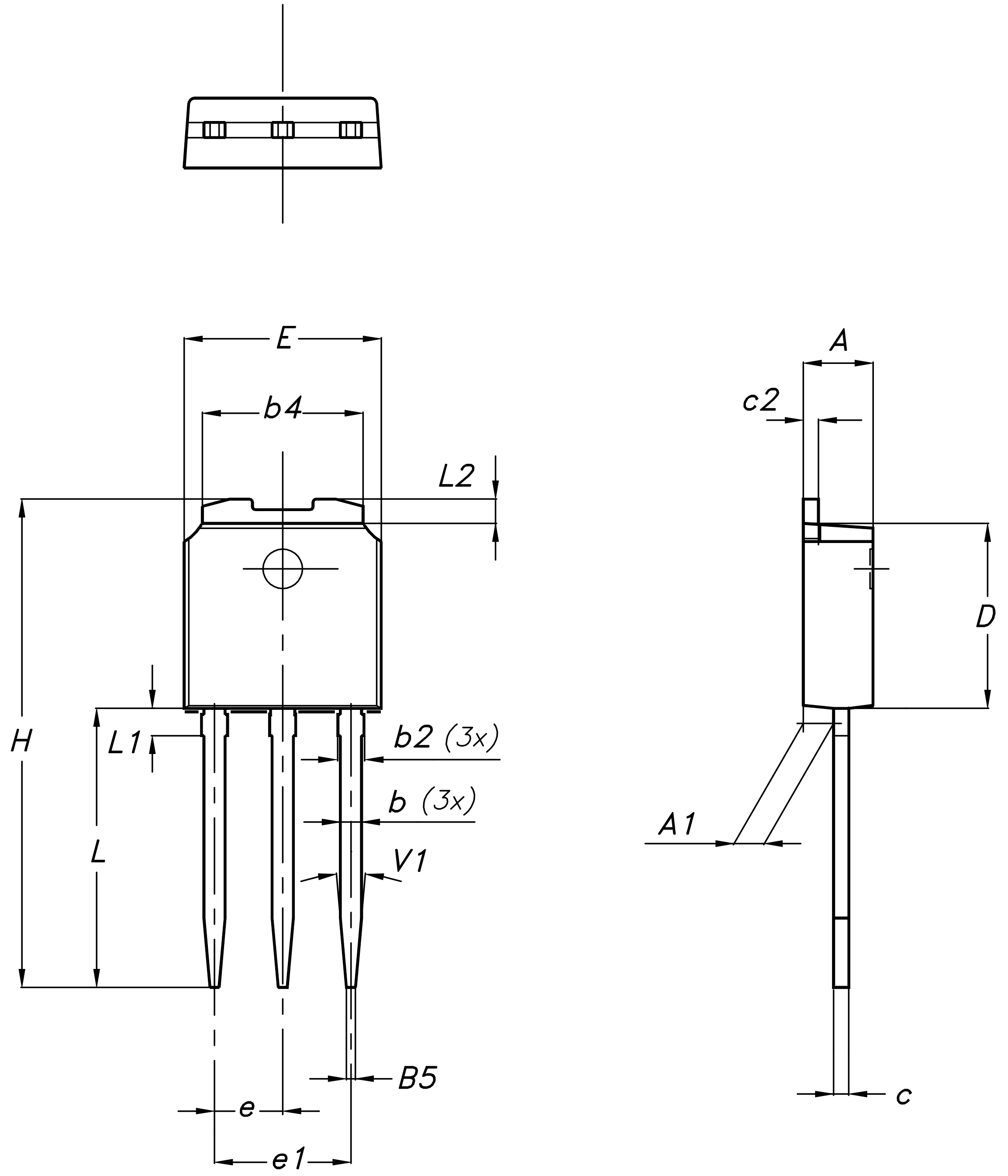
Table 12. **TO-220 type A package mechanical data**

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

4.6 IPAK (TO-251) type A package information

Figure 29. **IPAK (TO-251) type A package outline**



0068771_IK_typeA_rev14

Table 13. **IPAK (TO-251) type A package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
B5		0.30	
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
L1	0.80		1.20
L2		0.80	1.00
V1		10°	

4.7 IPAK (TO-251) type C package information

Figure 30. **IPAK (TO-251) type C package outline**

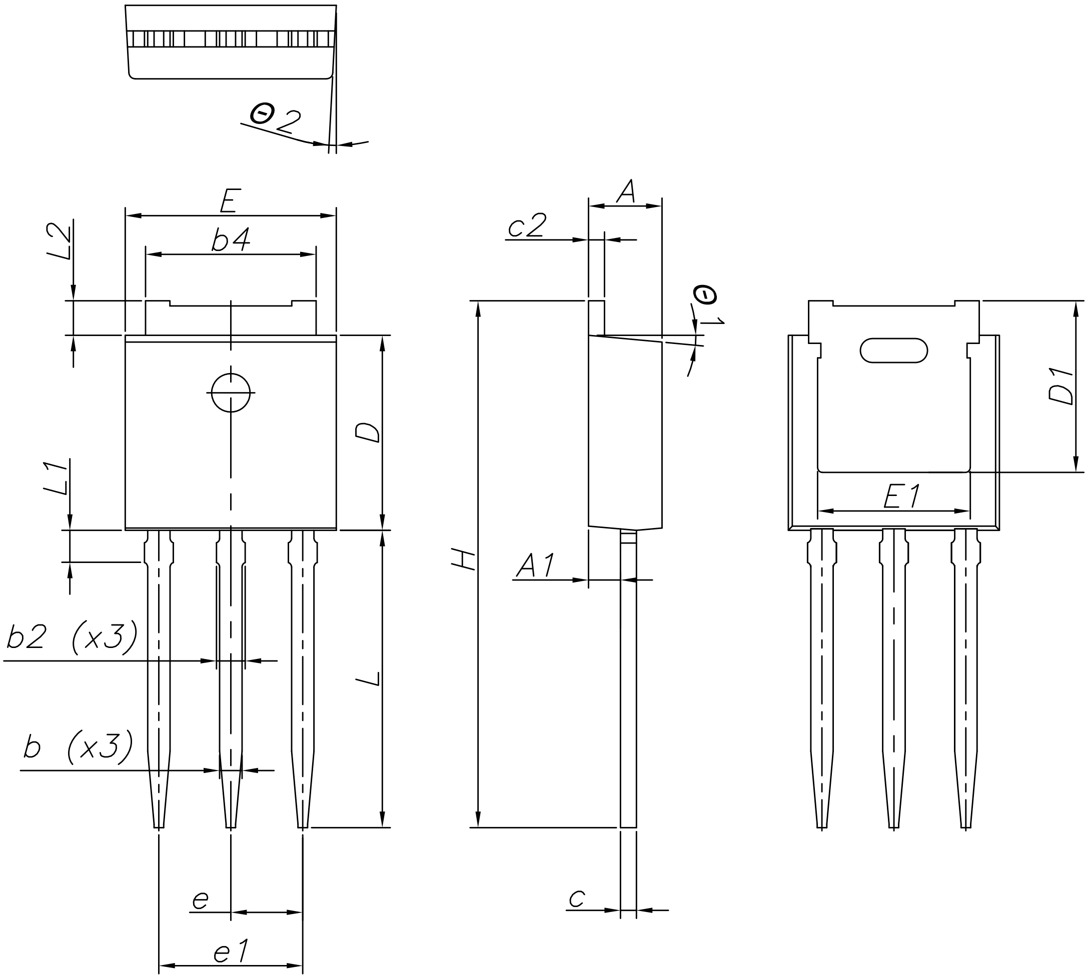


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Table 14. IPAK (TO-251) type C package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20	2.30	2.35
A1	0.90	1.00	1.10
b	0.66		0.79
b2			0.90
b4	5.23	5.33	5.43
c	0.46		0.59
c2	0.46		0.59
D	6.00	6.10	6.20
D1	5.20	5.37	5.55
E	6.50	6.60	6.70
E1	4.60	4.78	4.95
e	2.20	2.25	2.30
e1	4.40	4.50	4.60
H	16.18	16.48	16.78
L	9.00	9.30	9.60
L1	0.80	1.00	1.20
L2	0.90	1.08	1.25
θ1	3°	5°	7°
θ2	1°	3°	5°

Revision history

Table 15. **Document revision history**

Date	Revision	Changes
06-Jun-2013	1	First release.
12-Jul-2018	2	Removed maturity status indication from cover page. The document status is production data. Added Section 4.2 DPAK (TO-252) type C package information and Section 4.3 DPAK (TO-252) type E package information. Minor text changes.

Contents

Стандарт
Электрон
Связь

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.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

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