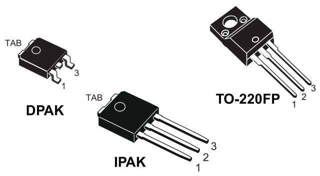
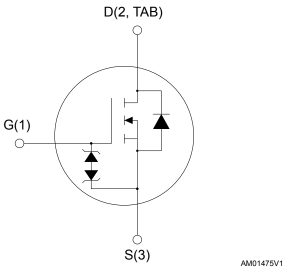
STD3N62K3, STF3N62K3, STU3N62K3

Datasheet

N-channel 620 V, 2.2 Ω typ., 2.7 A MDmesh™ K3 Power MOSFETs in DPAK, TO-220FP and IPAK packages





Features

Order code	V_{DS}	$R_{DS(on)}$max.	I_D	Package
STD3N62K3			2.7 A	DPAK
STF3N62K3	620 V	2.5 Ω	2.7 A	TO-220FP
STU3N62K3			2.7 A	IPAK

- 100% avalanche tested
- Extremely high dv/dt capability
- Very low intrinsic capacitance
- Improved diode reverse recovery characteristics
- Zener-protected

Applications

- Switching applications

Description

These MDmesh™ K3 Power MOSFETs are the result of improvements applied to STMicroelectronics' MDmesh™ technology, combined with a new optimized vertical structure. These devices boast an extremely low on-resistance, superior dynamic performance and high avalanche capability, rendering them suitable for the most demanding applications.

Product status link
STD3N62K3
STF3N62K3
STU3N62K3

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value			Unit
		DPAK	TO-220FP	IPAK	
V_{DS}	Drain-source voltage	620			V
V_{GS}	Gate-source voltage	±30			V
I_D	Drain current (continuous) at T_C = 25 °C	2.7	2.7 (1)	2.7	A
I_D	Drain current (continuous) at T_C = 100 °C	1.7	1.7 (1)	1.7	A
I_{DM} (2)	Drain current (pulsed)	10.8	10.8 (1)	10.8	A
P_{TOT}	Total dissipation at T_C = 25 °C	45	20	45	W
ESD	Gate-source human body model (C = 100 pF, R = 1.5 kΩ)	2.5			kV
dv/dt (3)	Peak diode recovery voltage slope	9			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_j	Operating junction temperature range	-55 to 150			°C
T_{stg}	Storage temperature range				

1. *Limited by maximum junction temperature.*
2. *Pulse width limited by safe operating area.*
3. *I_{SD} ≤ 2.7 A, di/dt ≤ 200 A/µs, V_{DSpeak} ≤ $V_{(BR)DSS}$, V_{DD} = 80% $V_{(BR)DSS}$.*

Table 2. Thermal data

Symbol	Parameter	Value			Unit
		DPAK	TO-220FP	IPAK	
$R_{thj-case}$	Thermal resistance junction-case	2.78	6.25	2.78	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient		62.5	100	°C/W
$R_{thj-pcb}$(1)	Thermal resistance junction-pcb	50			°C/W

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

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}(1)	Avalanche current, repetitive or not-repetitive	2.7	A
E_{AS}(2)	Single pulse avalanche energy	100	mJ

1. *Pulse width limited by T_j max.*
2. *Starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V.*

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	620			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 620 V			1	µA
		V_{GS} = 0 V, V_{DS} = 620 V, T_C = 125 °C (1)			50	µA
I_{GSS}	Gate body leakage current	V_{DS} = 0 V, V_{GS} = ±20 V			±10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 50 µA	3	3.75	4.5	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 1.4 A		2.2	2.5	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} = 25 V, f = 1 MHz, V_{GS} = 0 V	-	385	-	pF
C_{oss}	Output capacitance			55		
C_{rss}	Reverse transfer capacitance			6		
$C_{oss\ eq.}$ (1)	Equivalent output capacitance	V_{DS} = 0 to 496 V, V_{GS} = 0 V	-	32.3	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz open drain	-	10	-	Ω
Q_g	Total gate charge	V_{DD} = 496 V, I_D = 3.4 A, V_{GS} = 0 to 10 V (see Figure 16. Test circuit for gate charge behavior)	-	13	-	nC
Q_{gs}	Gate-source charge			2.5		
Q_{gd}	Gate-drain charge			7.5		

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} = 310 V, I_D = 1.7 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 15. Test circuit for resistive load switching times and Figure 20. Switching time waveform)	-	9	-	ns
t_r	Rise time			6.8		
$t_{d(off)}$	Turn-off delay time			22		
t_f	Fall time			15.6		

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		2.7	A
I_{SDM} (1)	Source-drain current (pulsed)				10.8	
V_{SD} (2)	Forward on voltage	I_{SD} = 2.7 A, V_{GS} = 0 V	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 2.7 A, di/dt = 100 A/µs V_{DD} = 60 V (see Figure 17. Test circuit for inductive load switching and diode recovery times)	-	190		ns
Q_{rr}	Reverse recovery charge			825		nC
I_{RRM}	Reverse recovery current			9		A
t_{rr}	Reverse recovery time	I_{SD} = 2.7 A, di/dt = 100 A/µs V_{DD} = 60 V, T_j = 150 °C (see Figure 17. Test circuit for inductive load switching and diode recovery times)	-	255		ns
Q_{rr}	Reverse recovery charge			1100		nC
I_{RRM}	Reverse recovery current			10		A

1. *Pulse width limited by safe operating area.*
2. *Pulsed: pulse duration = 300 µs, duty cycle 1.5%.*

Table 8. Gate-source Zener diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)GSO}$	Gate-source breakdown voltage	I_{GS} = ±1 mA, I_D = 0 A	30	-	-	V

The built-in back-to-back Zener diodes are specifically designed to enhance the ESD performance of the device. The Zener voltage facilitates efficient and cost-effective device integrity protection, thus eliminating the need for additional external componentry.

2.1 Electrical characteristics curves

Figure 1. Safe operating area for DPAK/IPAK

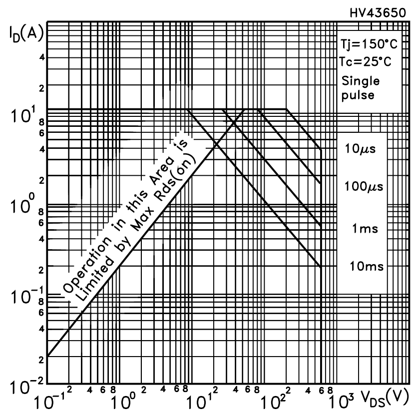


Figure 2. Thermal impedance for DPAK/IPAK

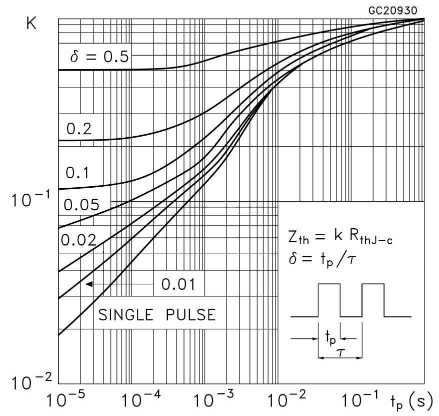


Figure 3. Safe operating area for TO-220FP

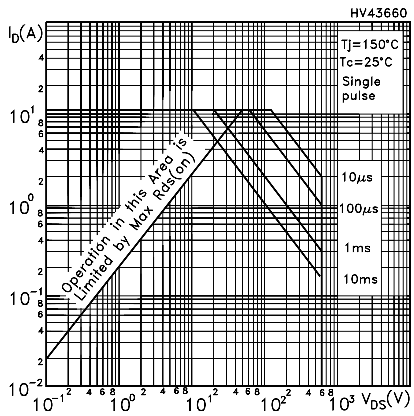


Figure 4. Thermal impedance for TO-220FP

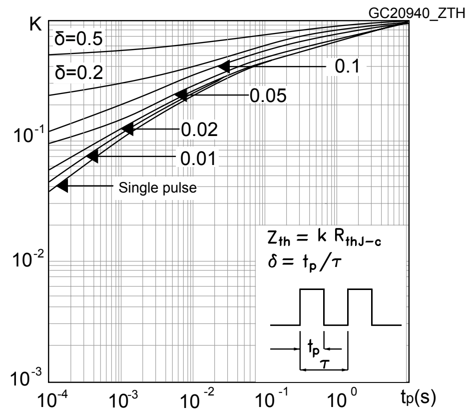


Figure 5. Output characterisics

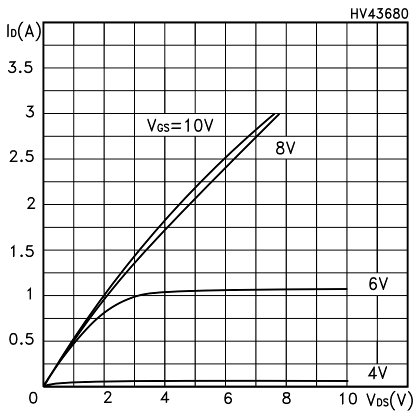


Figure 6. Transfer characteristics

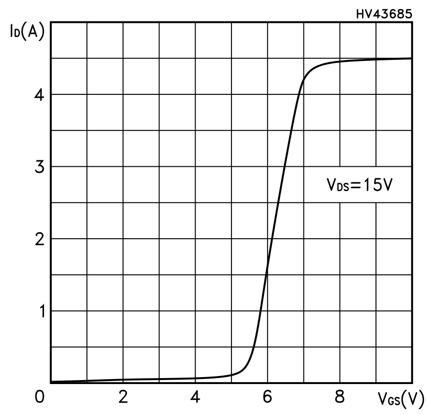


Figure 7. Normalized $V_{(BR)DSS}$ vs temperature

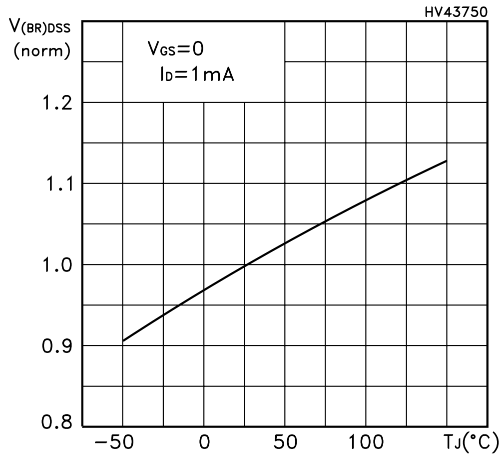


Figure 8. Static drain-source on-resistance

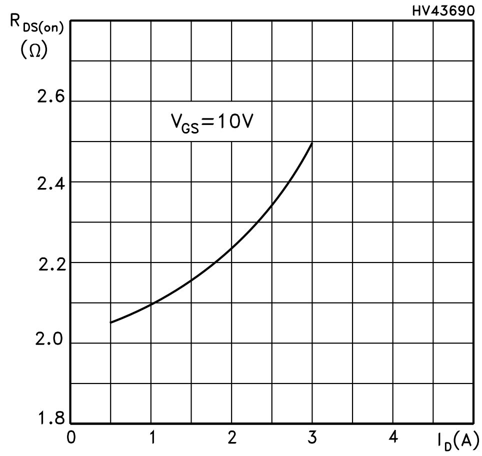


Figure 9. Gate charge vs gate-source voltage

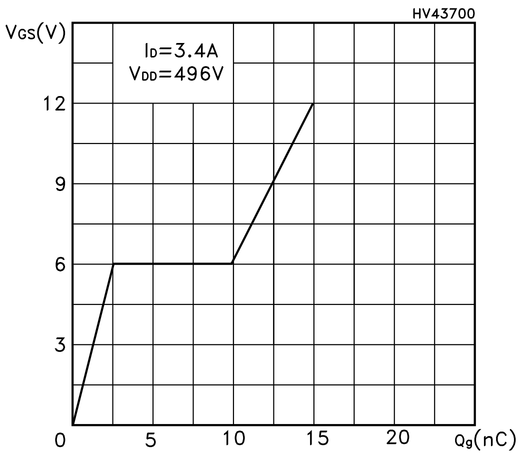


Figure 10. Capacitance variations

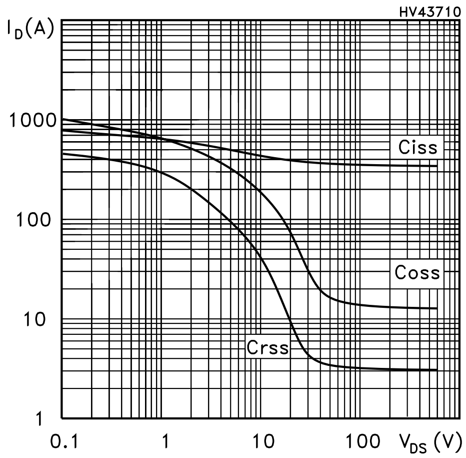


Figure 11. Normalized gate threshold voltage vs temperature

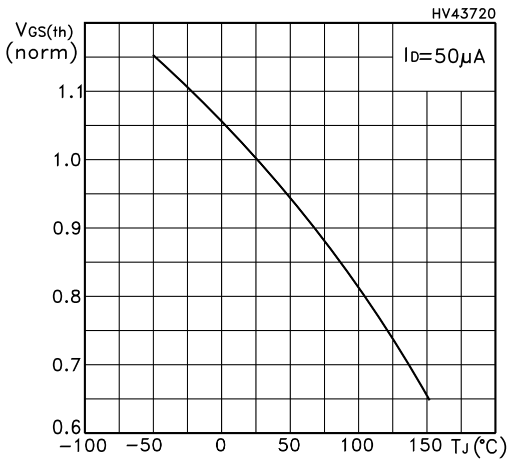


Figure 12. Normalized on-resistance vs temperature

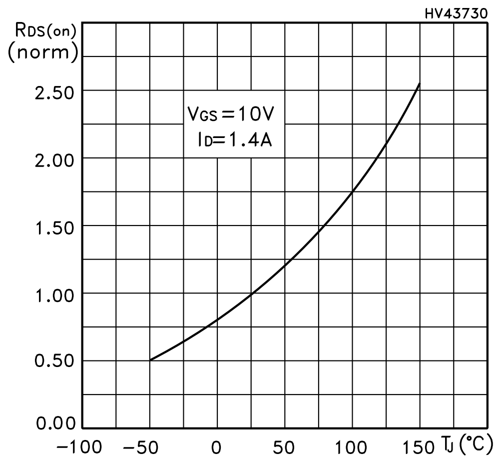


Figure 13. Source-drain diode forward characteristics

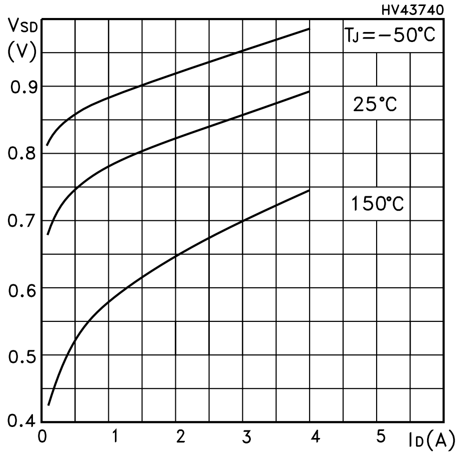
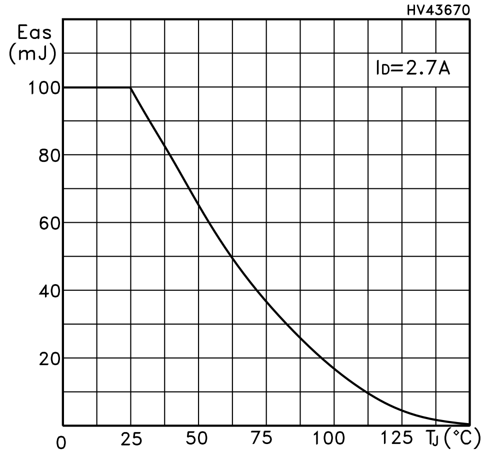


Figure 14. Maximum avalanche energy vs temperature



3 Test circuits

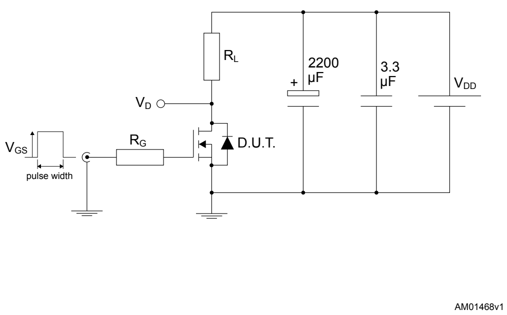


Figure 15. Test circuit for resistive load switching times

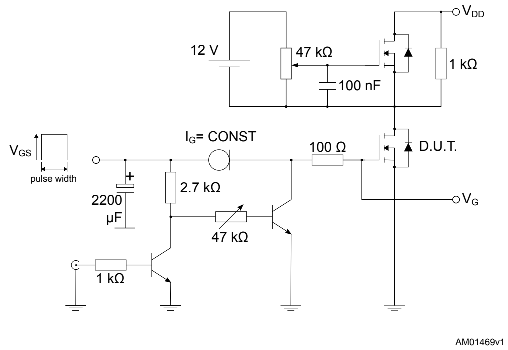


Figure 16. Test circuit for gate charge behavior

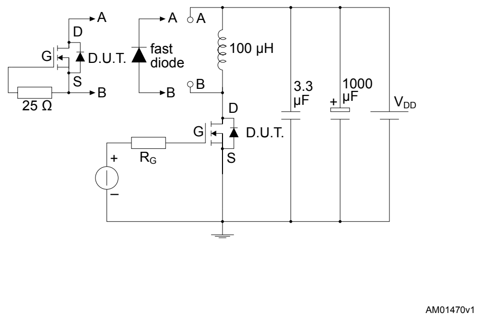


Figure 17. Test circuit for inductive load switching and diode recovery times

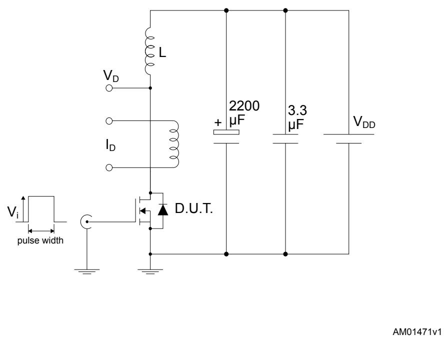


Figure 18. Unclamped inductive load test circuit

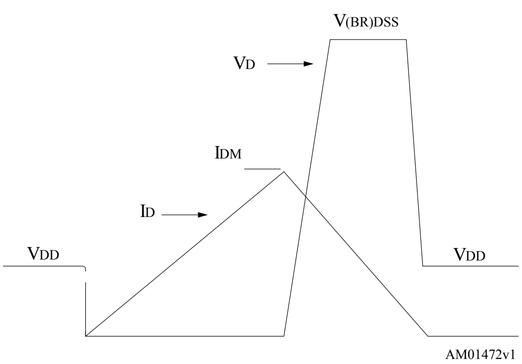


Figure 19. Unclamped inductive waveform

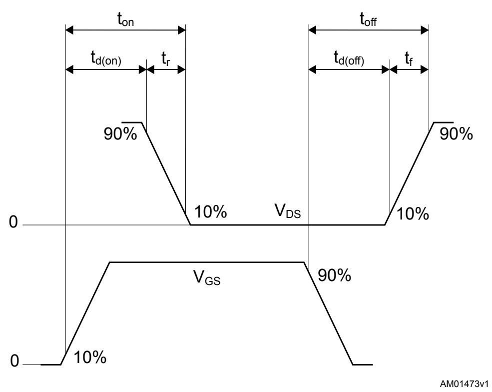


Figure 20. Switching time waveform

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 21. DPAK (TO-252) type A package outline

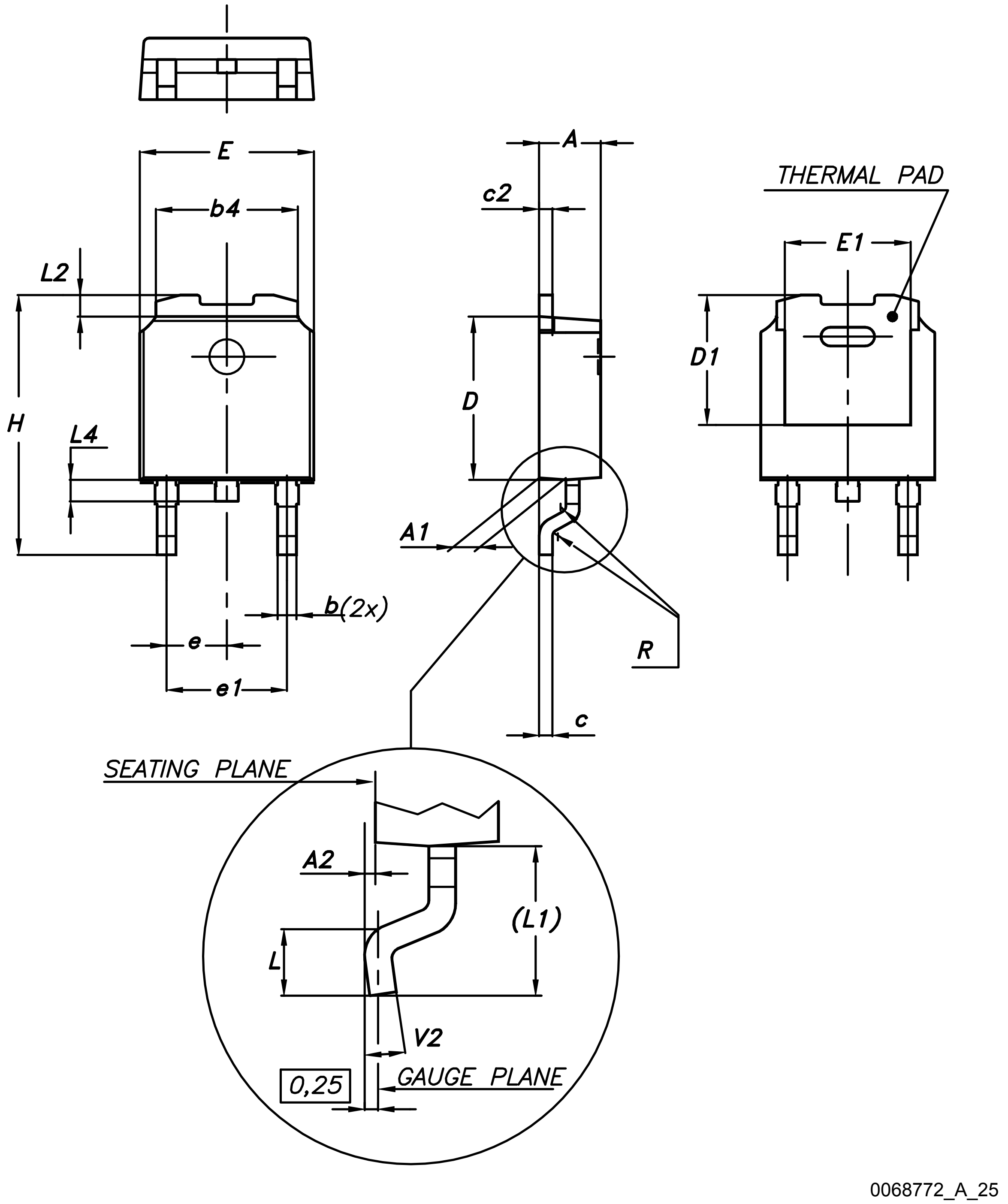


Table 9. **DPAK (TO-252) type A mechanical data**

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°

4.2 DPAK (TO-252) type C package information

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

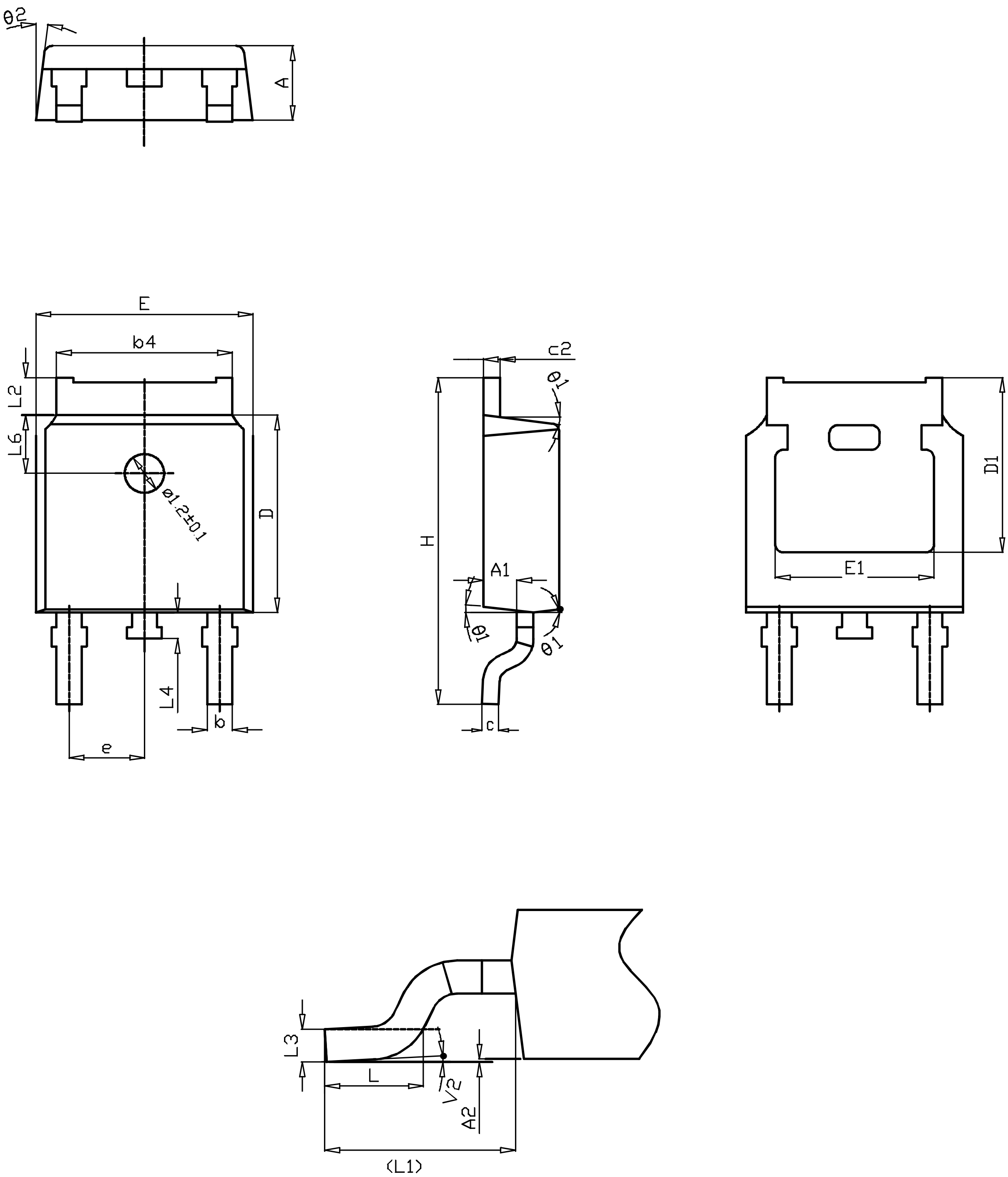


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Table 10. **DPAK (TO-252) type C mechanical data**

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	5.25		
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 23. DPAK (TO-252) type E package outline

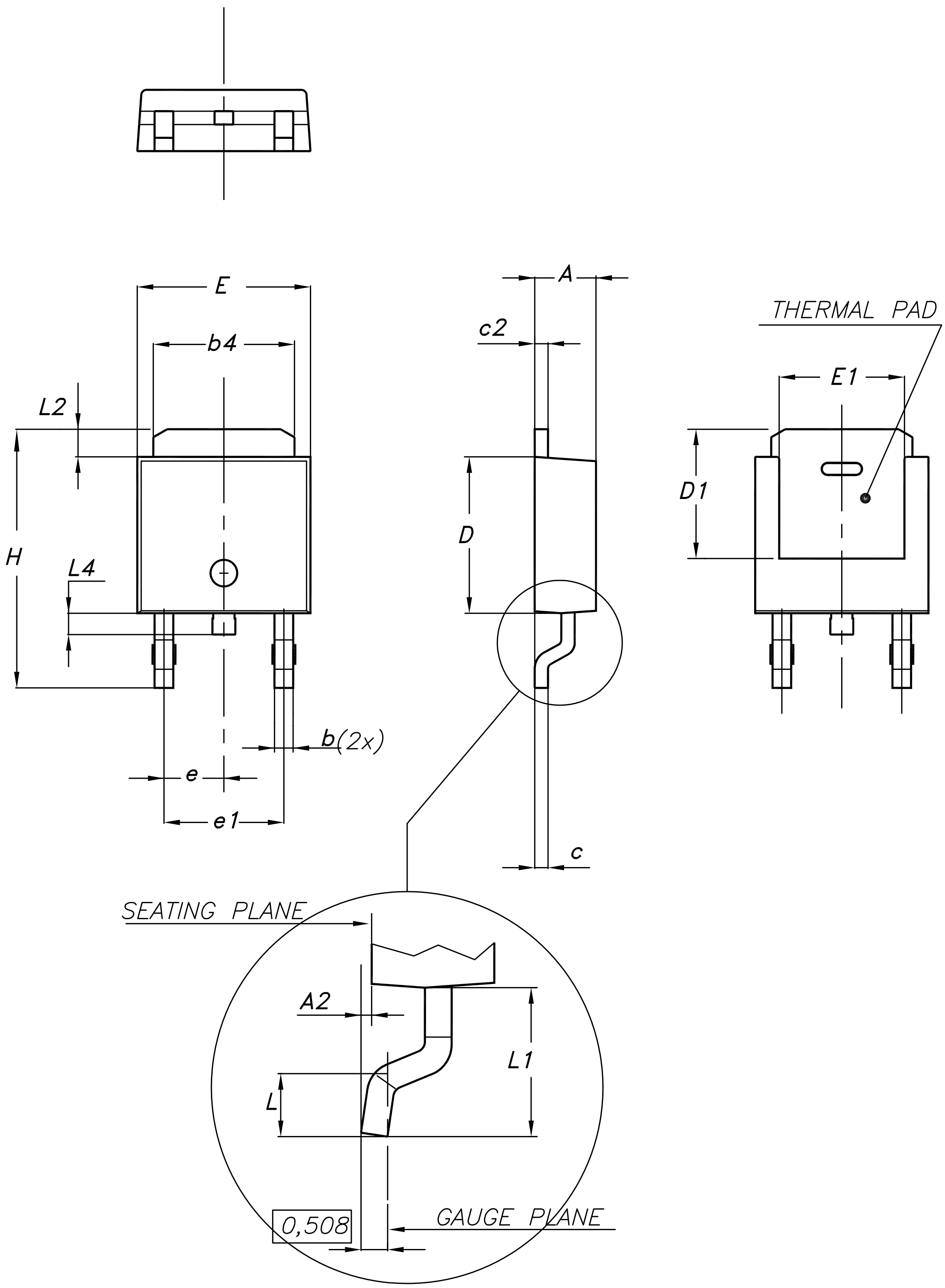

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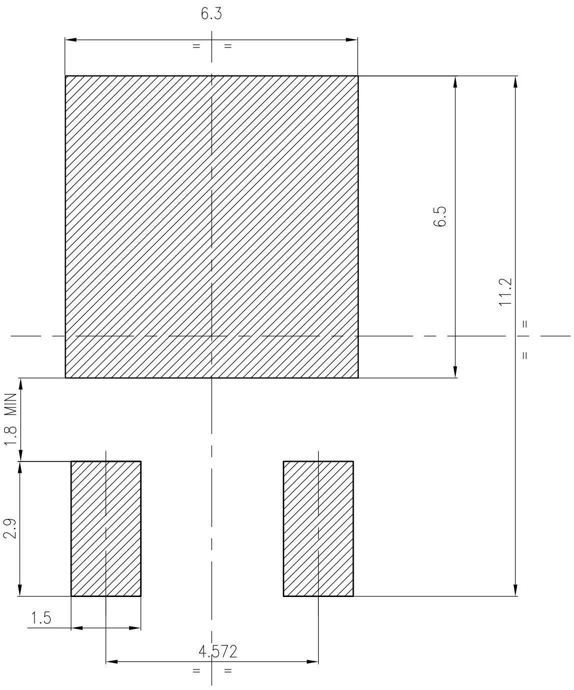
Table 11. **DPAK (TO-252) type E mechanical data**

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

Figure 24. **DPAK (TO-252) recommended footprint (dimensions are in mm)**



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4.4 DPAK (TO-252) packing information

Figure 25. DPAK (TO-252) tape outline

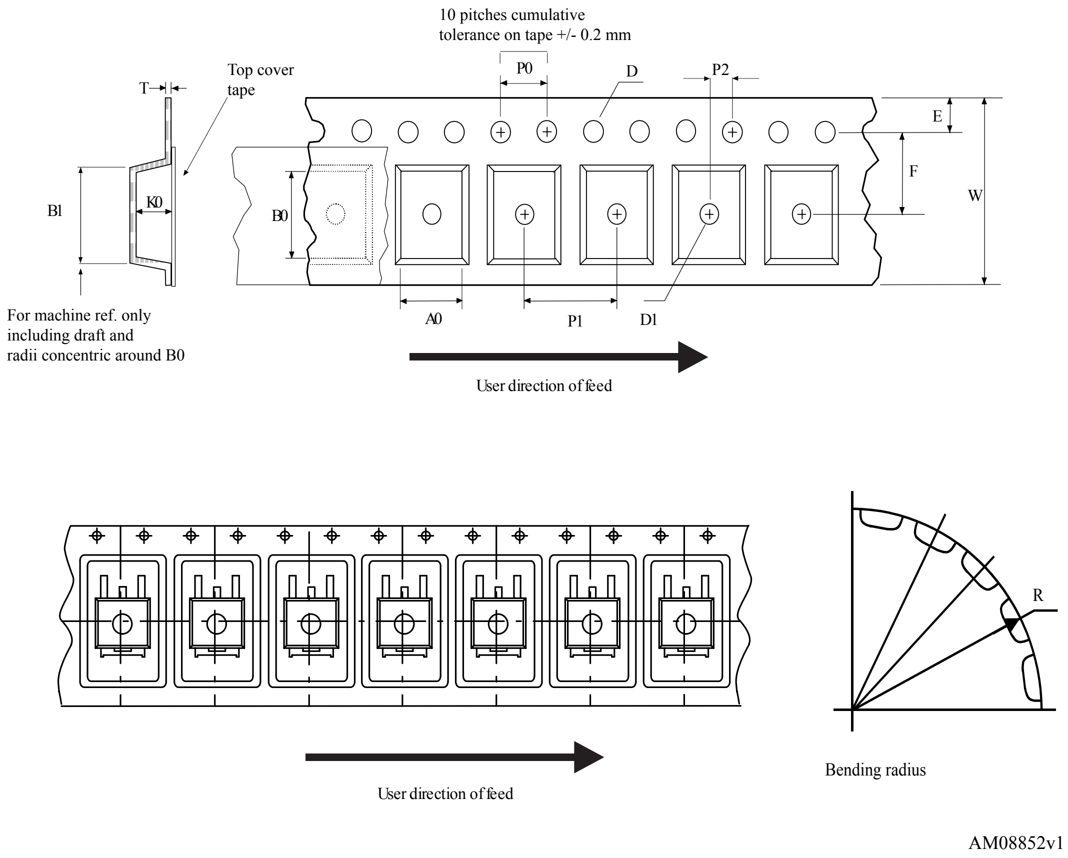

Figure 26. **DPAK (TO-252) reel outline**

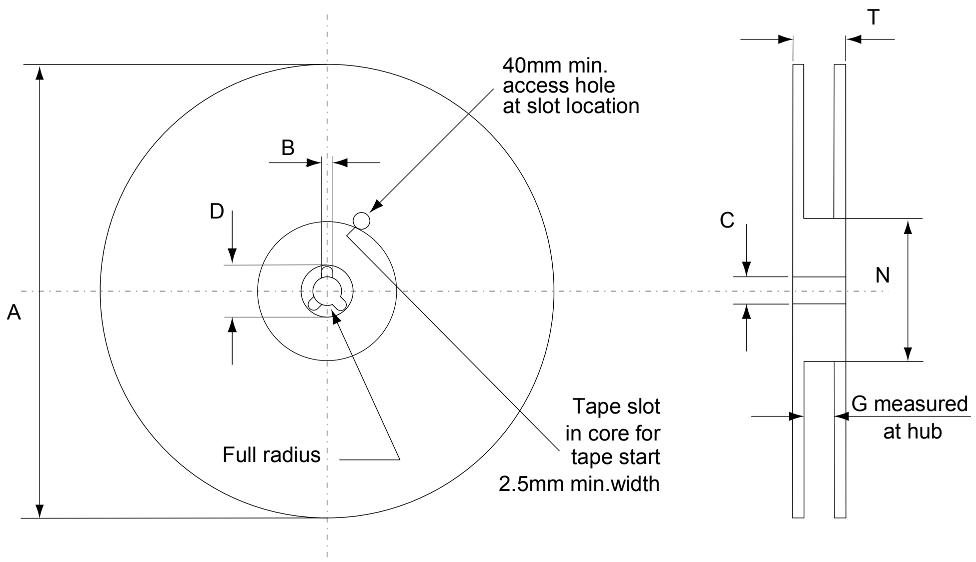

Table 12. **DPAK (TO-252) tape and reel mechanical data**

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-220FP package information

Figure 27. TO-220FP package outline

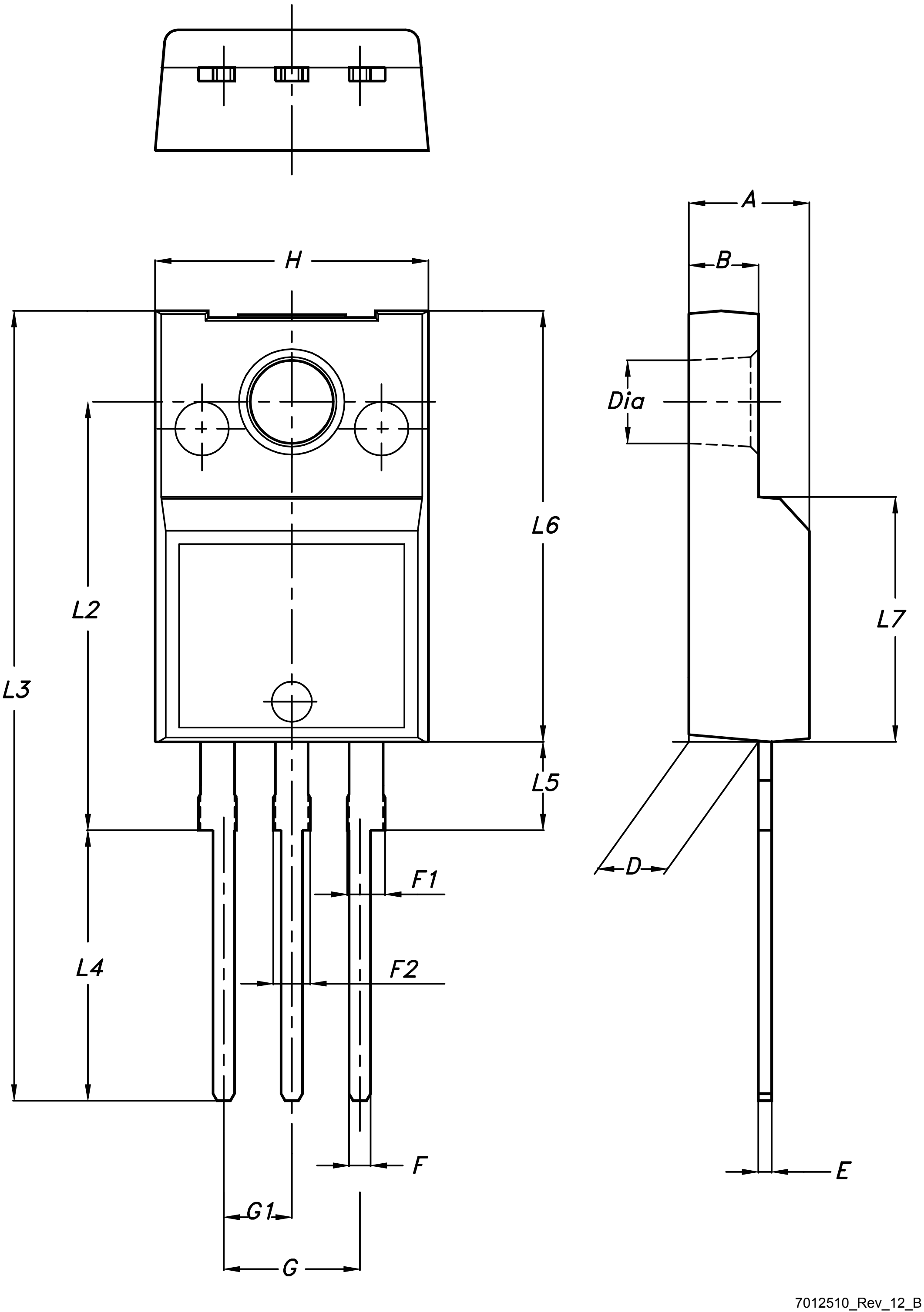

Table 13. TO-220FP package mechanical data

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

4.6 IPAK (TO-251) type A package information

Figure 28. **IPAK (TO-251) type A package outline**

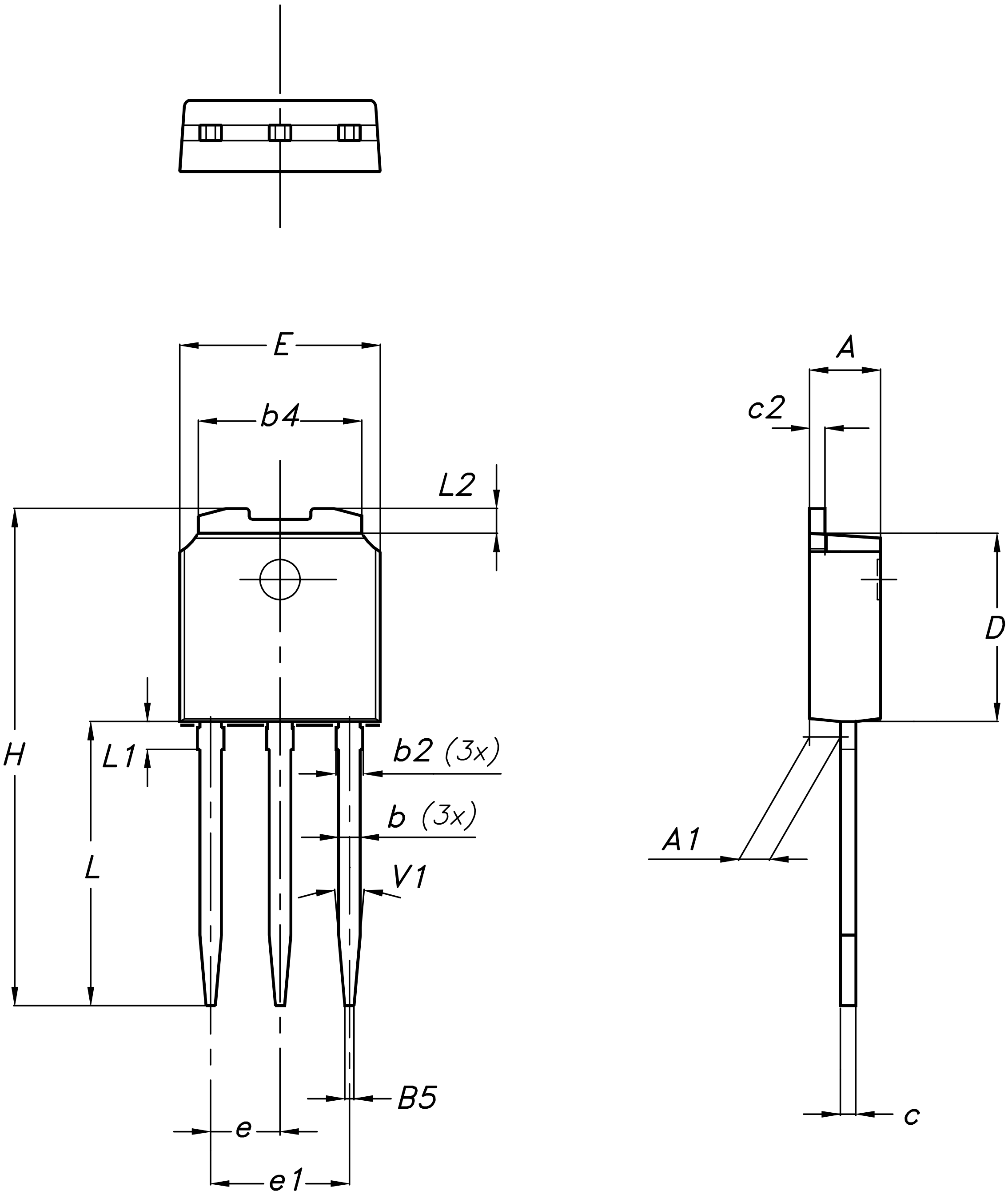

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Table 14. **IPAK (TO-251) type A package mechanical data**

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

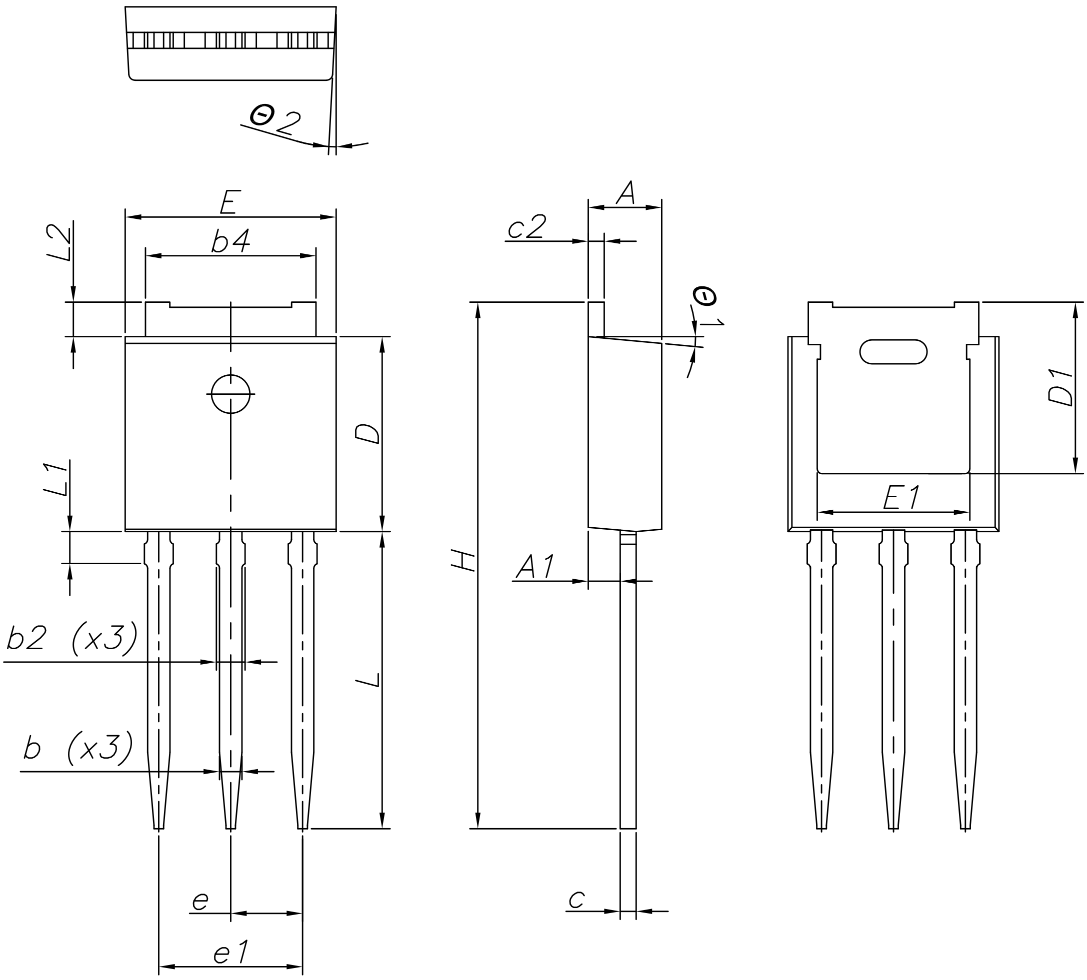

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Table 15. **IPAK (TO-251) type C package mechanical data**

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°

5 Ordering information

Table 16. **Order codes**

Order code	Marking	Package	Packing
STD3N62K3	3N62K3	DPAK	Tape and reel
STF3N62K3		TO-220FP	Tube
STU3N62K3		IPAK	Tube

Revision history

Table 17. Document revision history

Date	Version	Changes
10-Jul-2008	1	First release
17-Aug-2009	2	Modified: marking of the *Table 1*
02-Jul-2018	3	The part numbers STB3N62K3 and STP3N62K3 have been moved to a separate datasheet. Removed maturity status indication from cover page. The document status is production data. Updated title and features in cover page. Updated Section 1 Electrical ratings, Section 2 Electrical characteristics and Section 4 Package information. Added Section 5 Ordering information. Minor text changes.

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