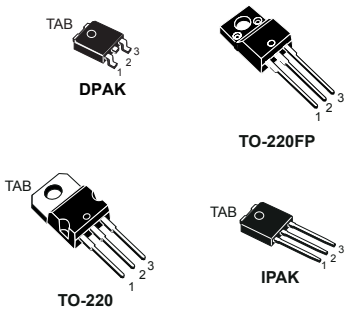
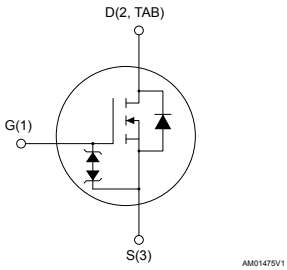
STD5N62K3, STF5N62K3
STP5N62K3, STU5N62K3

Datasheet

N-channel 620 V, 1.28 Ω typ., 4.2 A MDmesh™ K3 Power MOSFETs in DPAK, TO-220FP, TO-220 and IPAK packages





Product status link
STD5N62K3
STF5N62K3
STP5N62K3
STU5N62K3

Features

Order code	V_{DS}	$R_{DS(on)}$max.	I_D	Package
STD5N62K3	620 V	1.6 Ω	4.2 A	DPAK
STF5N62K3				TO-220FP
STP5N62K3				TO-220
STU5N62K3				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.

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		DPAK, TO-220, IPAK	TO-220FP	
V_{DS}	Drain-source voltage	620		V
V_{GS}	Gate-source voltage	±30		V
I_D	Drain current (continuous) at T_C = 25 °C	4.2	4.2 (1)	A
I_D	Drain current (continuous) at T_C = 100 °C	3	3 (1)	A
I_{DM} (2)	Drain current (pulsed)	16.8	16.8 (1)	A
P_{TOT}	Total dissipation at T_C = 25 °C	70	25	W
dv/dt (3)	Peak diode recovery voltage slope	12		V/ns
di/dt (3)	Diode reverse recovery current slope	400		A/ns
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T_C = 25 °C)		2.5	kV
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} ≤ 4.2 A, V_{DSpeak} ≤ $V_{(BR)SS}$, V_{DD} = 80% $V_{(BR)DSS}$.*

Table 2. Thermal data

Symbol	Parameter	Value				Unit
		DPAK	TO-220	IPAK	TO-220FP	
$R_{thj\text{-}case}$	Thermal resistance junction-case	1.79			5	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient		62.5	100	62.5	°C/W
$R_{thj\text{-}pcb}$ (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	4.2	A
E_{AS} (2)	Single pulse avalanche energy	120	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 = 2.1 A		1.28	1.6	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} = 50 V, f = 1 MHz, V_{GS} = 0 V	-	680	-	pF
C_{oss}	Output capacitance			50		
C_{rss}	Reverse transfer capacitance			8		
$C_{oss\ eq.}$ (1)	Equivalent output capacitance	V_{DS} = 0 to 496 V, V_{GS} = 0 V	-	16.6	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz open drain	-	4	-	Ω
Q_g	Total gate charge	V_{DD} = 496 V, I_D = 4.2 A, V_{GS} = 0 to 10 V (see Figure 19. Test circuit for gate charge behavior)	-	26	-	nC
Q_{gs}	Gate-source charge			4		
Q_{gd}	Gate-drain charge			16		

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 = 4.2 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 18. Test circuit for resistive load switching times and Figure 23. Switching time waveform)	-	12	-	ns
t_r	Rise time			8		
$t_{d(off)}$	Turn-off delay time			40		
t_f	Fall time			21		

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		4.2	A
I_{SDM} (1)	Source-drain current (pulsed)				16.8	
V_{SD} (2)	Forward on voltage	I_{SD} = 4.2 A, V_{GS} = 0 V	-		1.5	V
t_{rr}	Reverse recovery time	I_{SD} = 4.2 A, di/dt = 100 A/µs	-	290		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 60 V (see Figure 20. Test circuit for inductive load switching and diode recovery times)		1.9		µC
I_{RRM}	Reverse recovery current			13		A
t_{rr}	Reverse recovery time	I_{SD} = 4.2 A, di/dt = 100 A/µs	-	320		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 60 V, T_j = 150 °C (see Figure 20. Test circuit for inductive load switching and diode recovery times)		2.2		µC
I_{RRM}	Reverse recovery current			14		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 and IPAK

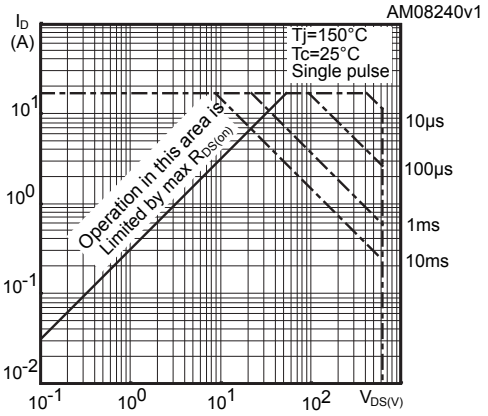


Figure 2. Thermal impedance for DPAK and IPAK

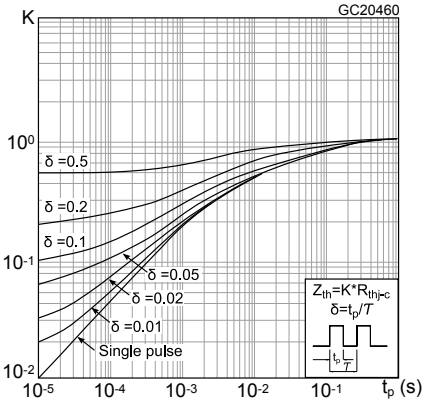


Figure 3. Safe operating area for TO-220FP

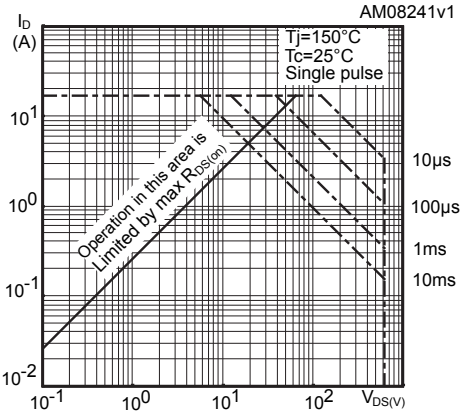


Figure 4. Thermal impedance for TO-220FP

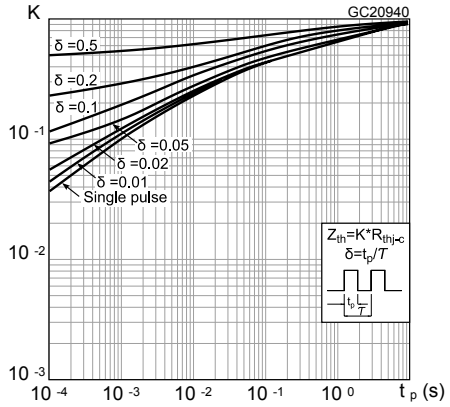


Figure 5. Safe operating area for TO-220

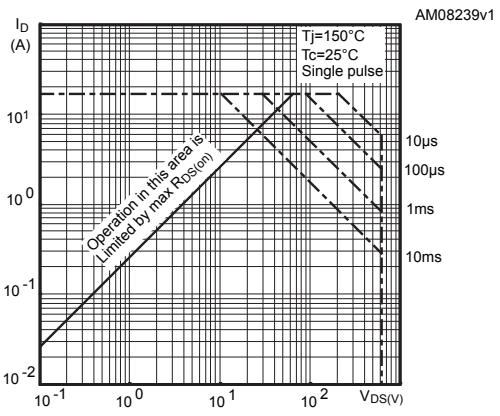


Figure 6. Thermal impedance for TO-220

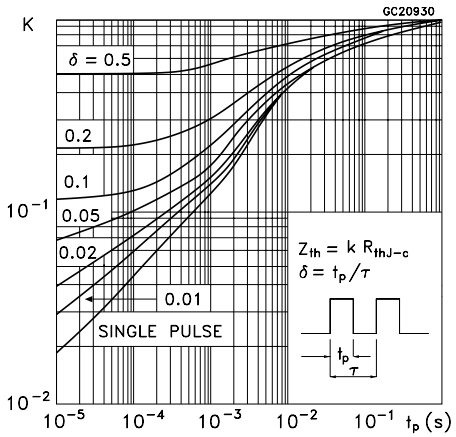


Figure 7. Output characterisics

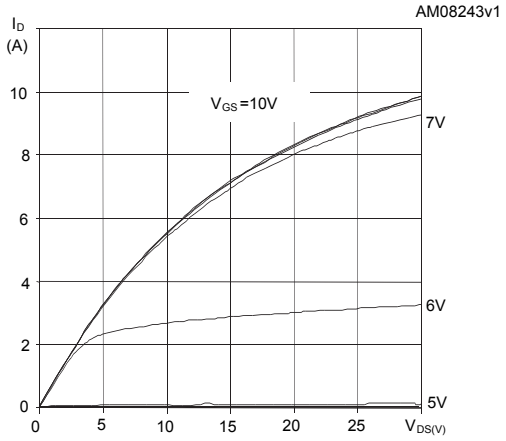


Figure 8. Transfer characteristics

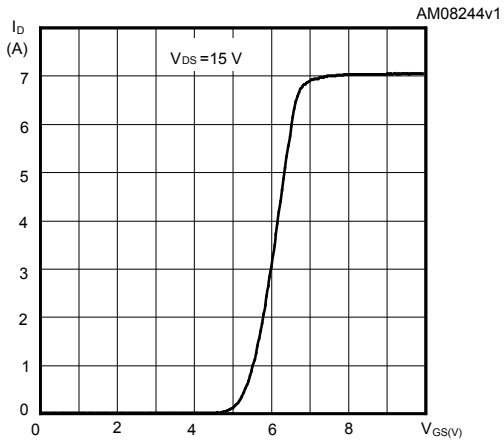


Figure 9. Normalized $V_{(BR)DSS}$ vs temperature

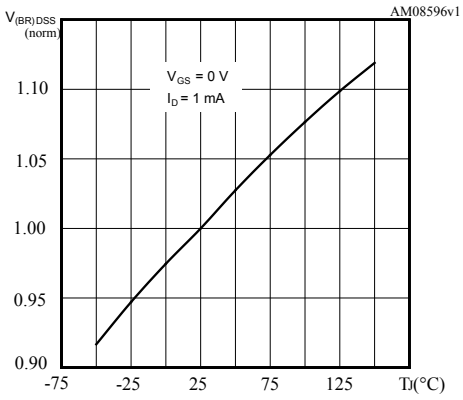


Figure 10. Static drain-source on-resistance

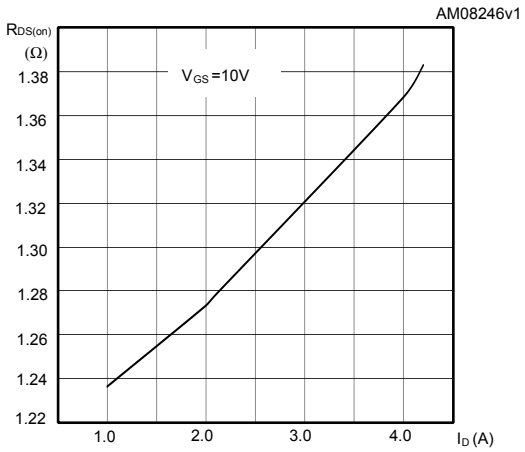


Figure 11. Gate charge vs gate-source voltage

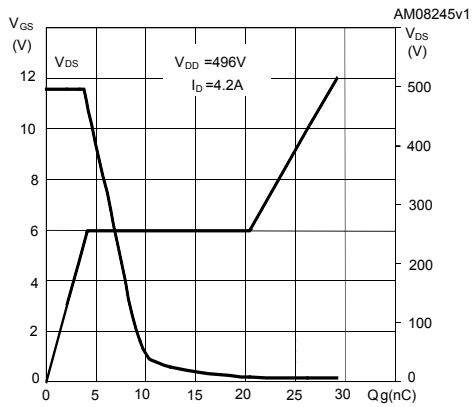


Figure 12. Capacitance variations

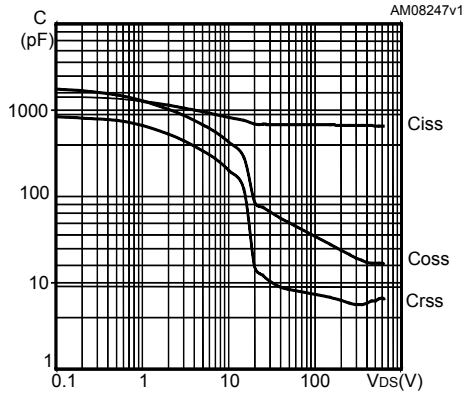


Figure 13. Normalized gate threshold voltage vs temperature

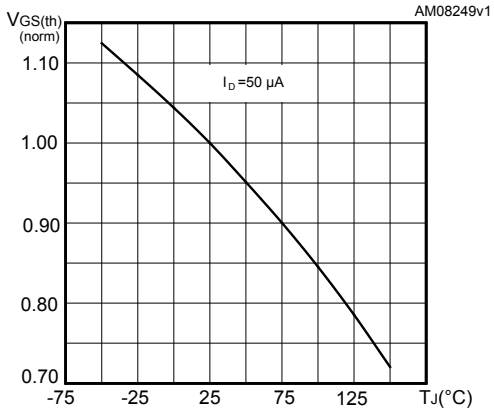


Figure 14. Normalized on-resistance vs temperature

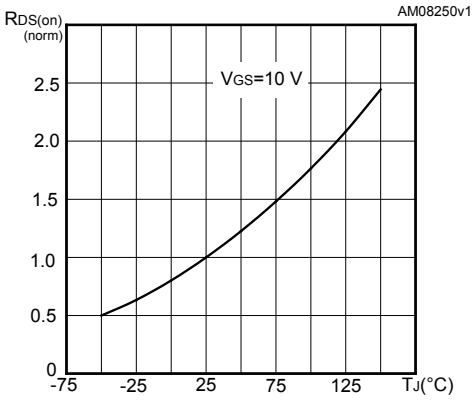


Figure 15. Source-drain diode forward characteristics

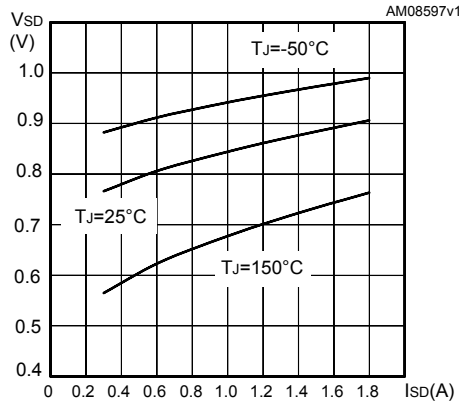


Figure 16. Maximum avalanche energy vs temperature

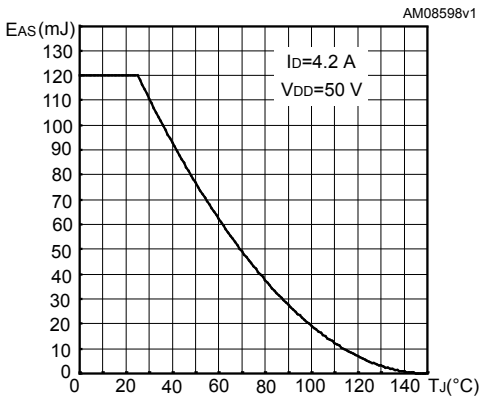
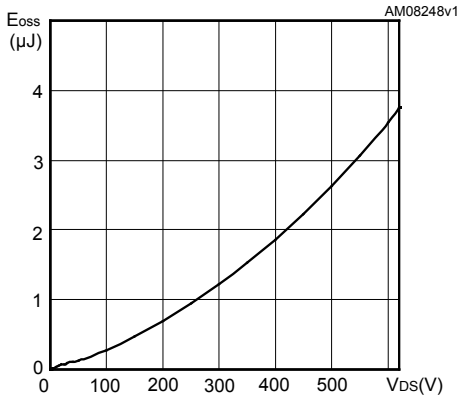


Figure 17. Output capacitance stored energy



3 Test circuits

Figure 18. Test circuit for resistive load switching times

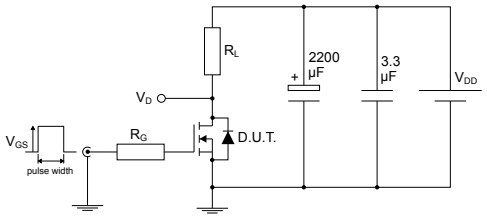


Figure 19. Test circuit for gate charge behavior

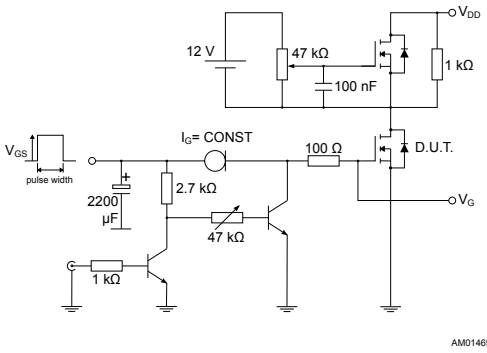


Figure 20. Test circuit for inductive load switching and diode recovery times

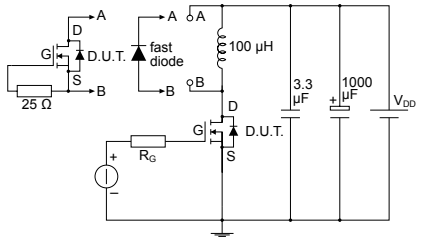


Figure 21. Unclamped inductive load test circuit

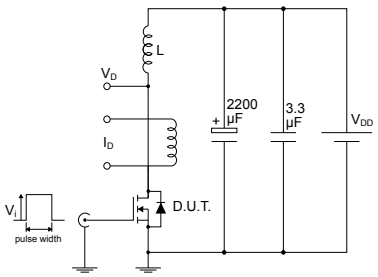


Figure 22. Unclamped inductive waveform

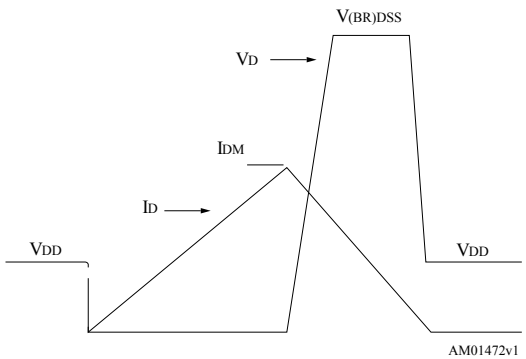
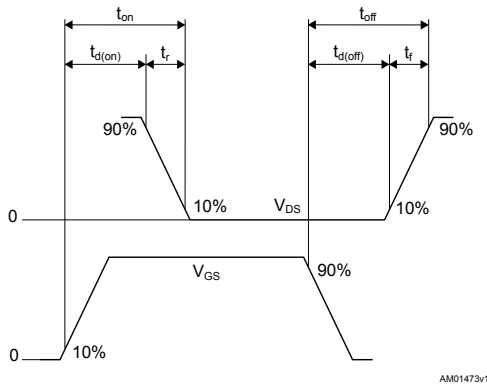


Figure 23. Switching time waveform

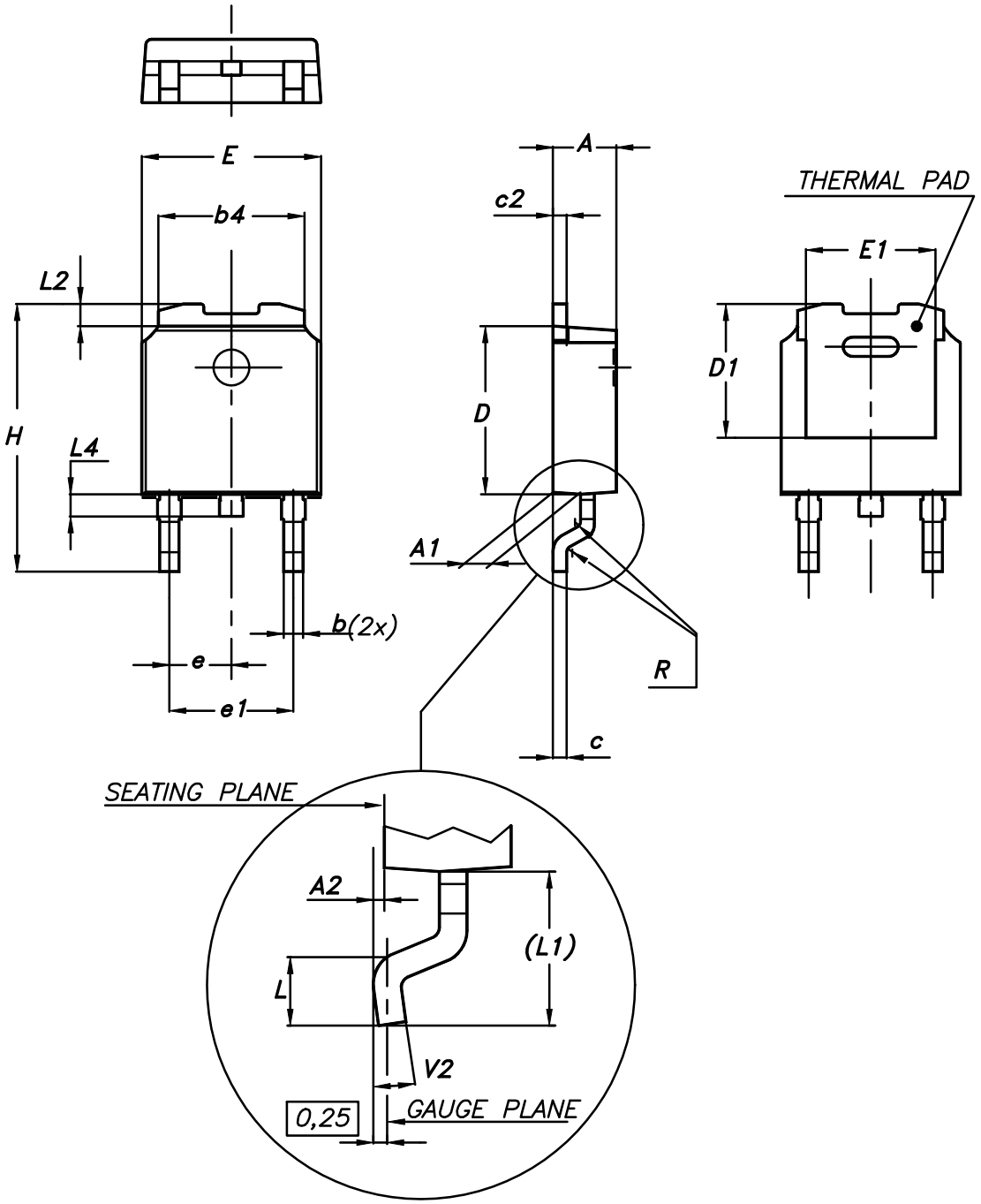


4 Package information

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 24. **DPAK (TO-252) type A package outline**



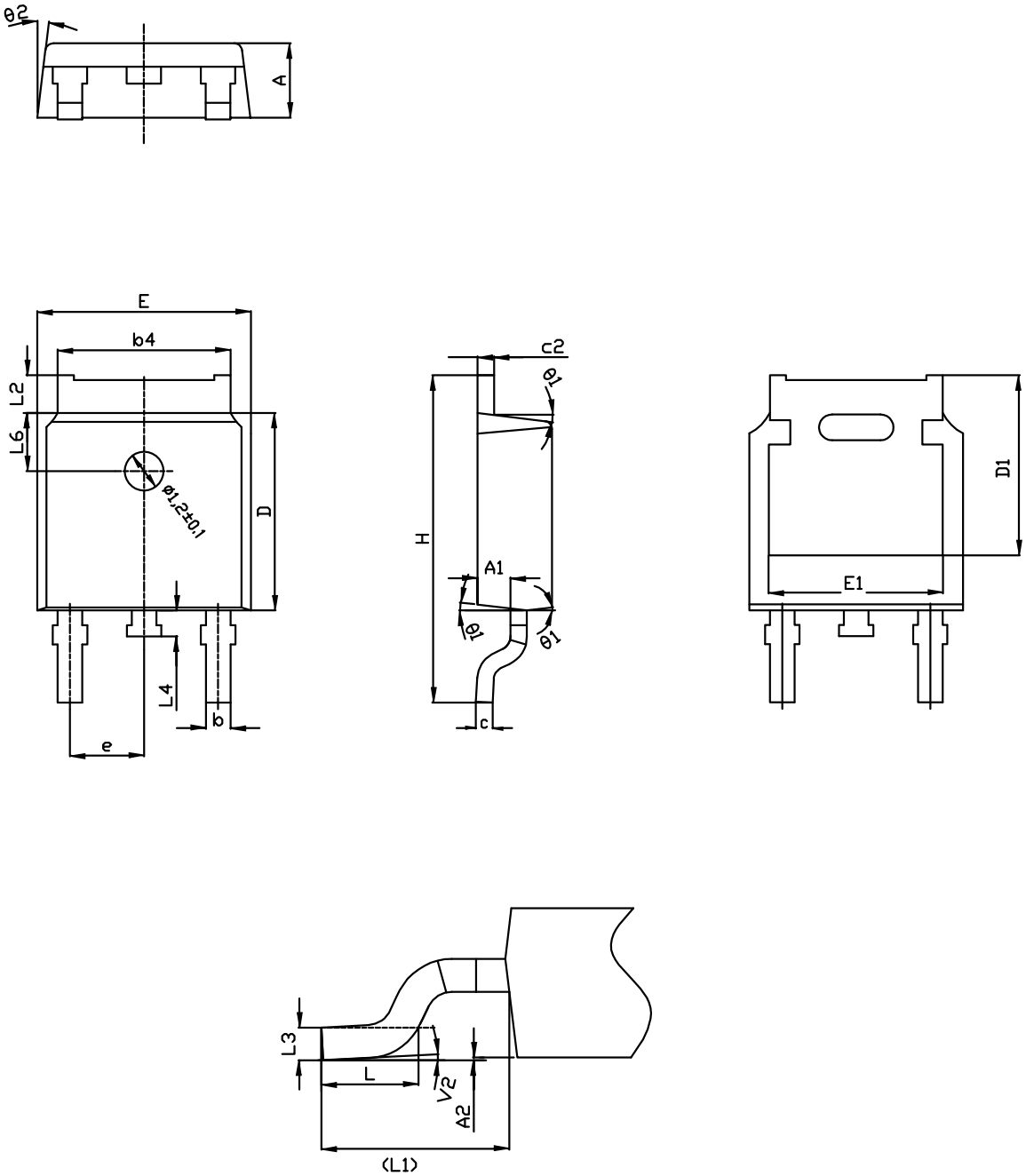
0068772_A_25

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 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°

4.3 DPAK (TO-252) type E package information

Figure 26. **DPAK (TO-252) type E package outline**

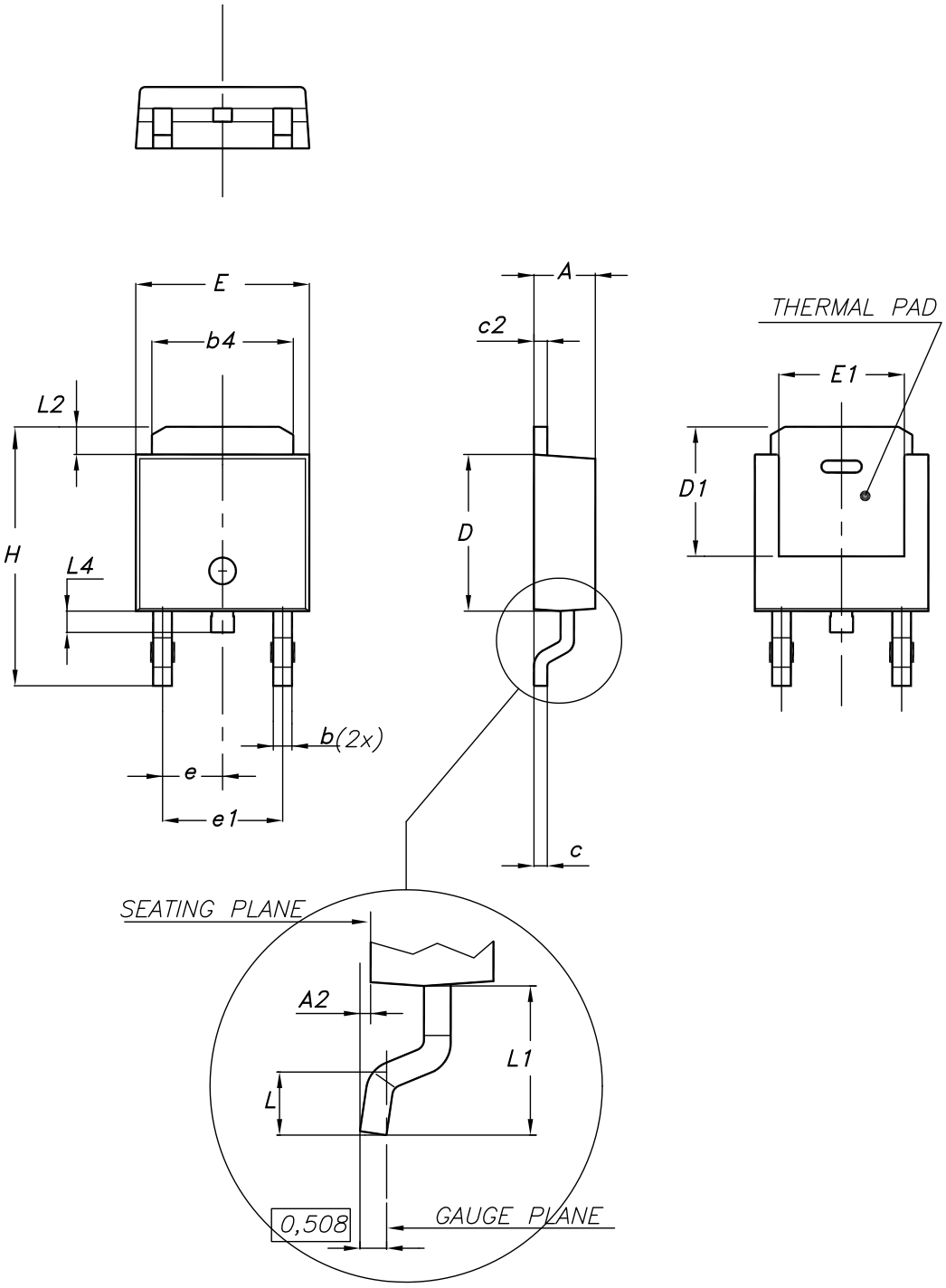
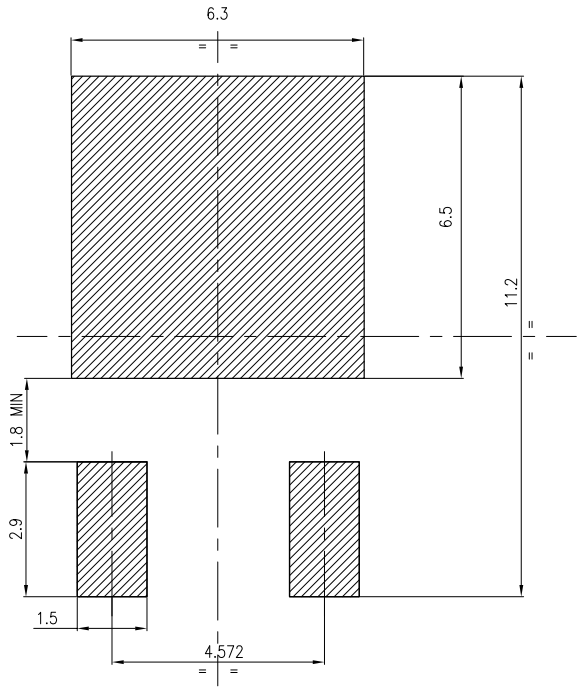


Table 11. DPAK (TO-252) type E mechanical data

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 27. DPAK (TO-252) recommended footprint (dimensions are in mm)



4.4 DPAK (TO-252) packing information

Figure 28. **DPAK (TO-252) tape outline**

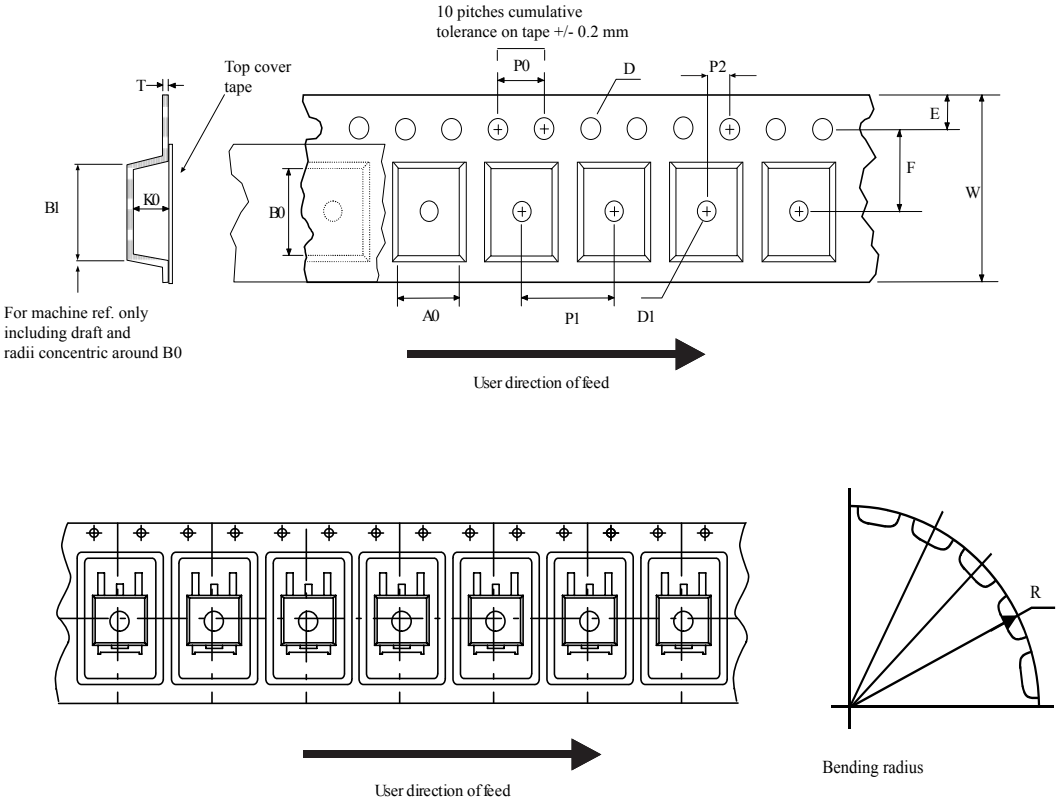
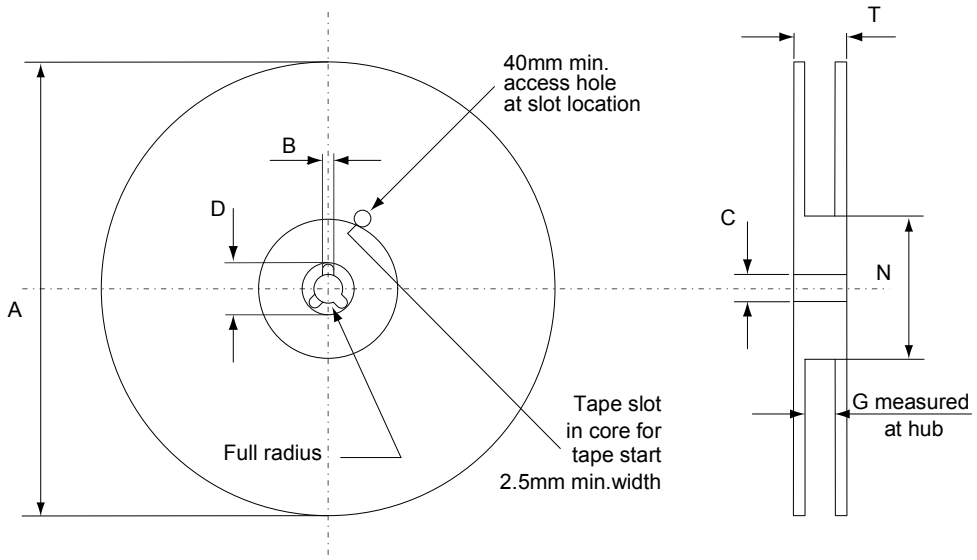


Figure 29. **DPAK (TO-252) reel outline**



AM06038v1

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 30. **TO-220FP package outline**

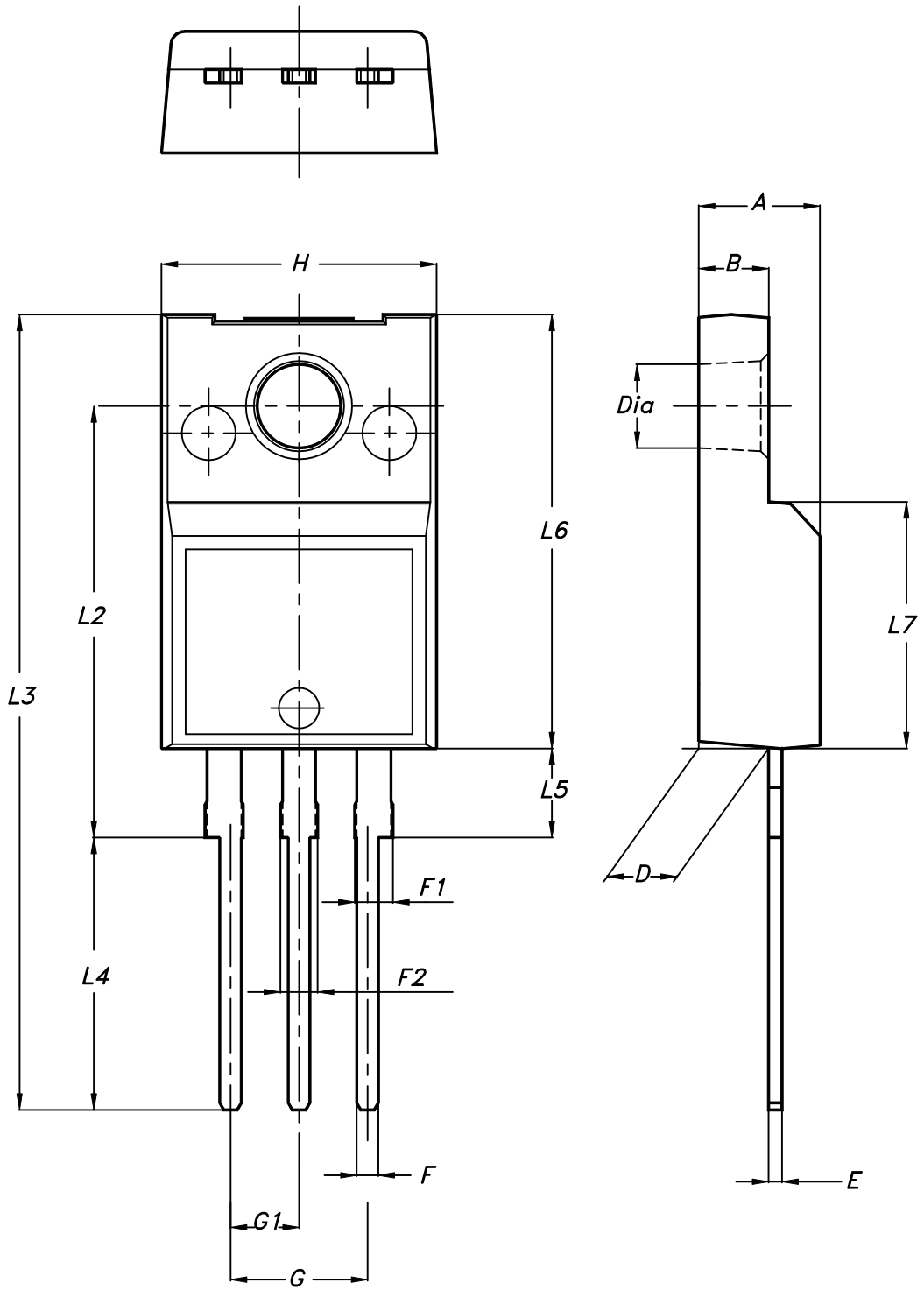
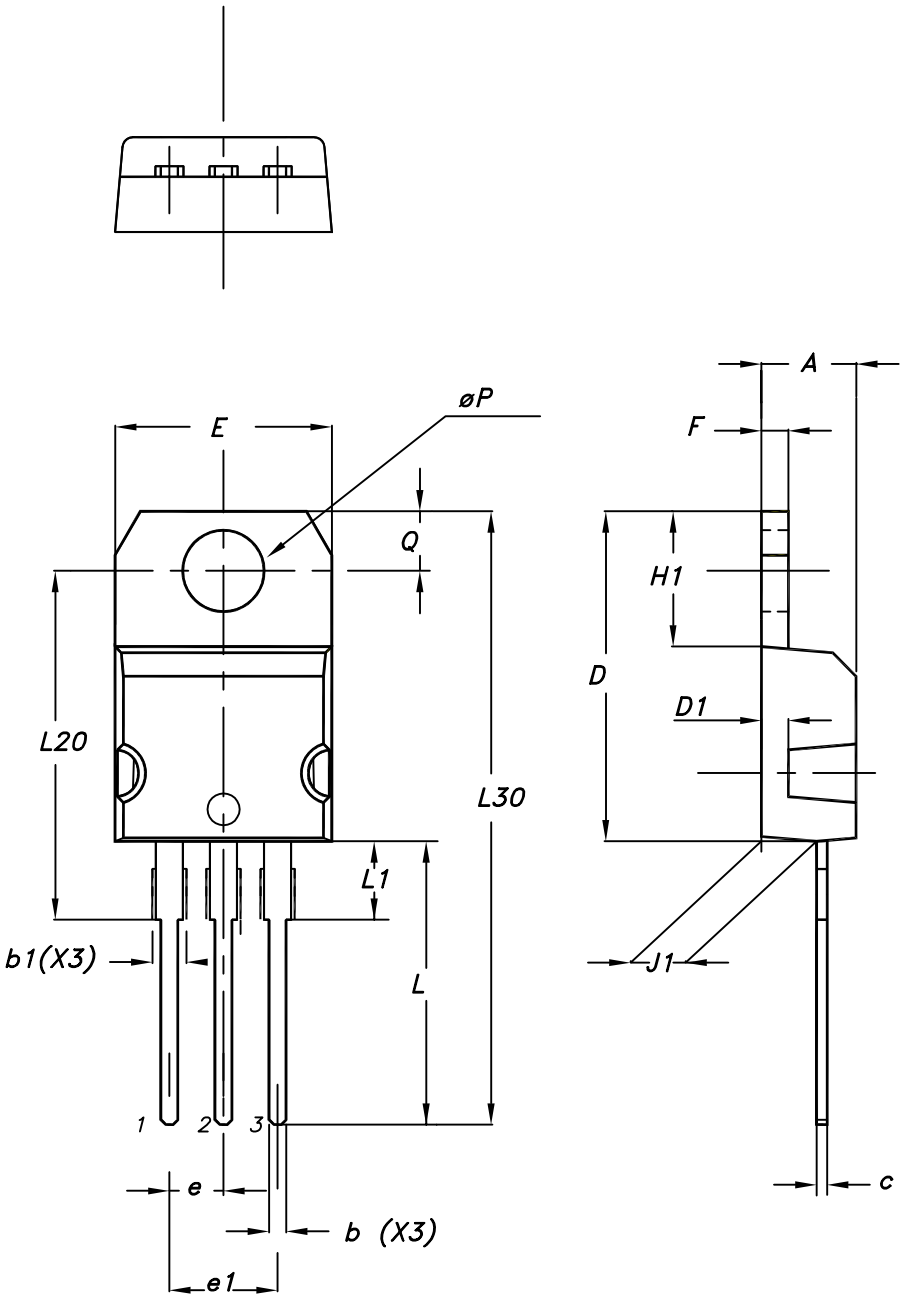


Table 13. **TO-220FP package mechanical data**

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 TO-220 type A package information

Figure 31. **TO-220 type A package outline**



0015988_typeA_Rev_21

Table 14. **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

4.7 IPAK (TO-251) type A package information

Figure 32. **IPAK (TO-251) type A package outline**

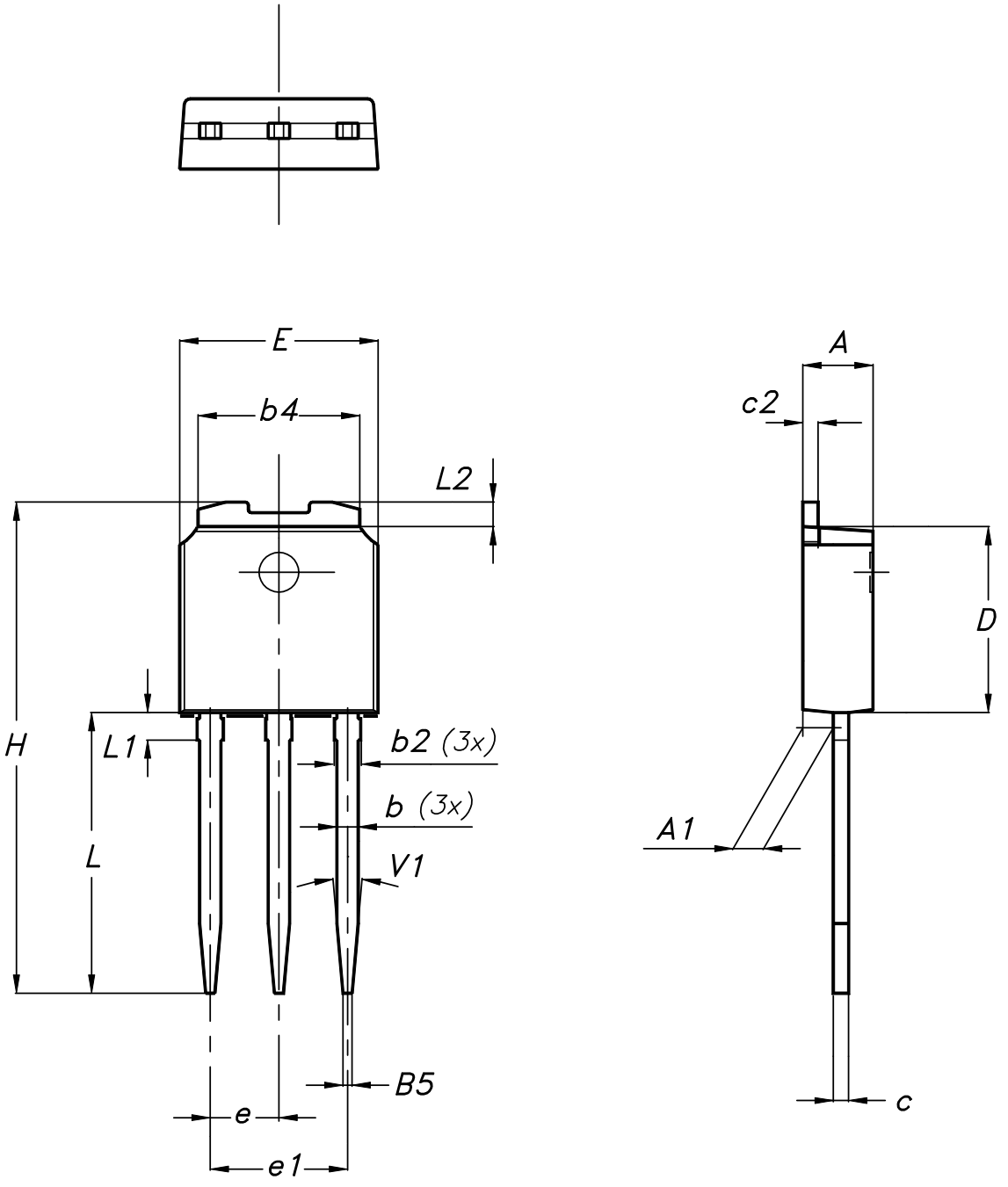


Table 15. **IPAK (TO-251) type A package mechanical data**

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°	

5 Ordering information

Table 16. **Order codes**

Order code	Marking	Package	Packing
STD5N62K3	5N62K3	DPAK	Tape and reel
STF5N62K3		TO-220FP	Tube
STP5N62K3		TO-220	
STU5N62K3		IPAK	

Revision history

Table 17. **Document revision history**

Date	Version	Changes
09-Apr-2010	1	First release
20-Oct-2010	2	– Added new package, mechanical data: IPAK; – Added new package, mechanical data: D²PAK; – Document status promoted from preliminary data to datasheet.
24-Sep-2018	3	The part number STB5N62K3 has been moved to a separate datasheet. Removed maturity status indication from cover page. The document status is production data. Updated title, features and description on cover page. Updated Section 1 Electrical ratings, Section 2 Electrical characteristics and Section 4 Package information. Minor text changes.

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