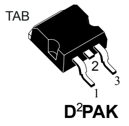
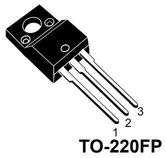
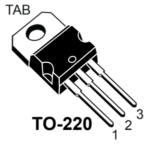
STB6NK90ZT4, STP6NK90Z
STP6NK90ZFP, STW7NK90Z

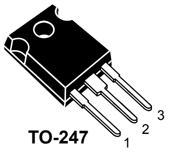
Datasheet

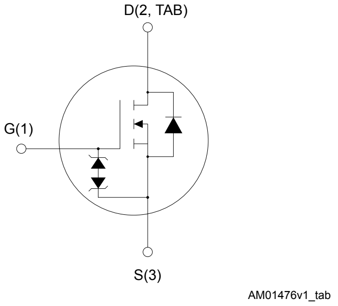
N-channel 900 V, 1.56 Ω typ., 5.8 A SuperMESH Power MOSFET in D²PAK, TO-220, TO-220FP and TO-247 packages











Features

Order codes	V_{DS}	$R_{DS(on)}$max.	I_D
STB6NK90ZT4	900 V	2 Ω	5.8 A
STP6NK90Z			
STP6NK90ZFP			
STW7NK90Z			

- 100% avalanche tested
- Gate charge minimized
- Very low intrinsic capacitance
- Zener-protected

Applications

- Switching applications

Description

These high-voltage devices are Zener-protected N-channel Power MOSFETs developed using the SuperMESH technology by STMicroelectronics, an optimization of the well-established PowerMESH. In addition to a significant reduction in on-resistance, these devices are designed to ensure a high level of dv/dt capability for the most demanding applications.

Product status
STB6NK90ZT4
STP6NK90Z
STP6NK90ZFP
STW7NK90Z

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		D^2PAK, TO-220, TO-247	TO-220FP	
V_{DS}	Drain-source voltage	900		V
V_{GS}	Gate-source voltage	± 30		V
I_D	Drain current (continuous) at T_C = 25 °C	5.8	5.8 (1)	A
I_D	Drain current (continuous) at T_C = 100 °C	3.65	3.65 (1)	A
I_{DM} (2)	Drain current (pulsed)	23.2	23.2	A
P_{TOT}	Total power dissipation at T_C = 25 °C	140	30	W
dv/dt (3)	Peak diode recovery voltage slope	4.5		V/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			°C

1. *Limited by maximum junction temperature.*
2. *Pulse width limited by safe operating area.*
3. $I_{SD} \leq 5.8$ *A, di/dt ≤ 200 A/μs,* $V_{DD} \leq V_{(BR)DSS}$.

Table 2. Thermal data

Symbol	Parameter	Value				Unit
		D^2PAK	TO-220	TO-220FP	TO-247	
R_{thJC}	Thermal resistance, junction-to-case	0.89		4.2	0.89	°C/W
R_{thJA}	Thermal resistance, junction-to-ambient	62.5			50	°C/W

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_J max.)	5.8	A
E_{AS}	Single pulse avalanche energy (starting T_J = 25 °C, $I_D = I_{AR}$, V_{DD} = 50 V)	300	mJ

2 Electrical characteristics

(T_C = 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	900			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 900 V			1	µA
		V_{GS} = 0 V, V_{DS} = 900 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 = 100 µA	3	3.75	4.5	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 2.9 A		1.56	2	Ω

1. *Specified by design, not tested in production.*

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	-	1350		pF
C_{oss}	Output capacitance		-	130		
C_{rss}	Reverse transfer capacitance		-	26		
$C_{oss\ eq.}$ (1)	Equivalent output capacitance	V_{GS} = 0 V, V_{DS} = 0 V to 720 V	-	70		pF
$t_{d(on)}$	Turn-on delay time	V_{DD} = 450 V, I_D = 3 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 17. Test circuit for resistive load switching times and Figure 22. Switching time waveform)	-	17		ns
t_r	Rise time		-	20		
$t_{r(off)}$	Turn-off delay time		-	45		
t_r	Fall time		-	20		
Q_g	Total gate charge	V_{DD} = 720 V, I_D = 5.8 A, V_{GS} = 0 to 10 V (see Figure 18. Test circuit for gate charge behavior)	-	46.5	60.5(2)	nC
Q_{gs}	Gate-source charge		-	8.5		
Q_{gd}	Gate-drain charge		-	25		
$t_{r(Voff)}$	Off-voltage rise time	V_{DD} = 720 V, I_D = 5.8 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 19. Test circuit for inductive load switching and diode recovery times)	-	11		ns
t_r	Fall time		-	12		
t_c	Cross-over time		-	20		

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}.*
2. *Specified by design, not tested in production.*

Table 6. **Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}(1)	Source-drain current		-		5.8	A
I_{SDM}(2)	Source-drain current (pulsed)		-		23.2	
V_{SD}	Forward on voltage	I_{SD} = 5.8 A, V_{GS} = 0 V	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 5.8 A, di/dt = 100 A/µs V_{DD} = 36 V, T_J = 150 °C (see Figure 19. Test circuit for inductive load switching and diode recovery times)	-	840		ns
Q_{rr}	Reverse recovery charge		-	5880		nC
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%.*

2.1 Electrical characteristics curves

Figure 1. **Safe operating area for TO-220/D^{2}PAK**

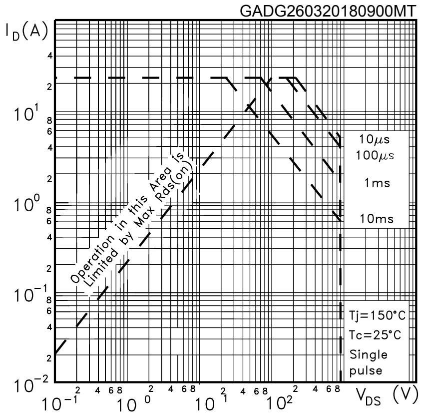


Figure 2. **Thermal impedance for TO-220/D^{2}PAK**

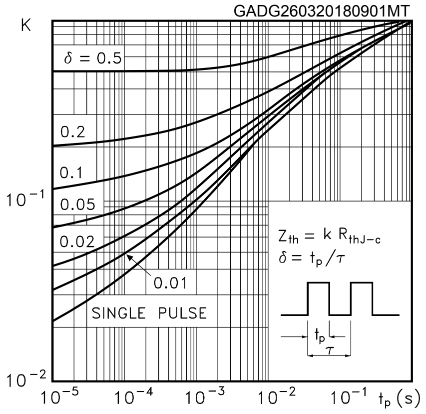


Figure 3. **Safe operating area for TO-220FP**

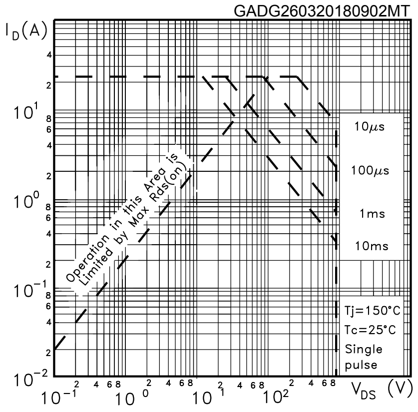


Figure 4. **Thermal impedance for TO-220FP**

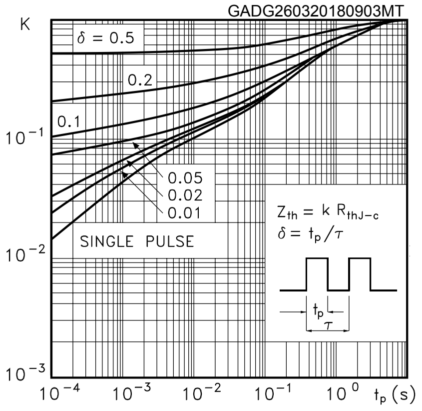


Figure 5. **Safe operating area for TO-247**

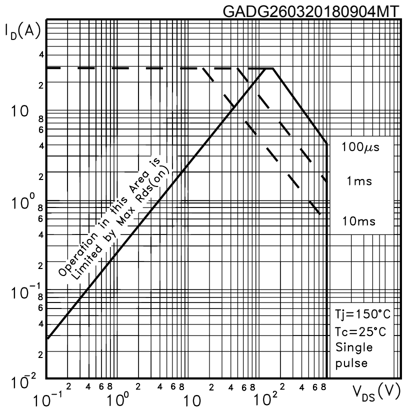


Figure 6. **Thermal impedance for TO-247**

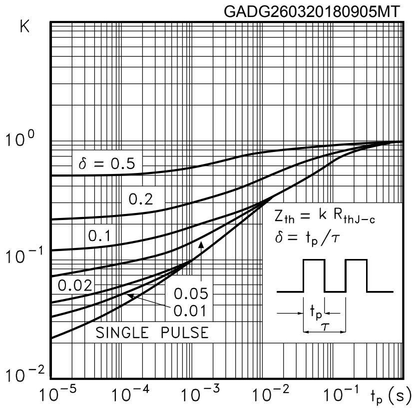


Figure 7. **Output characterisics**

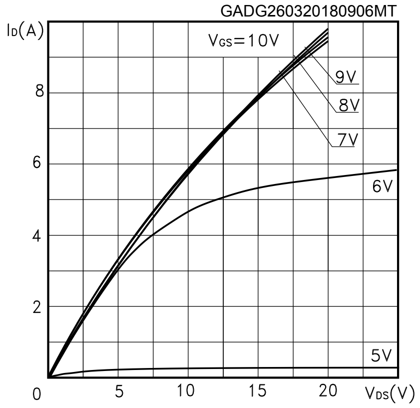


Figure 8. **Transfer characteristics**

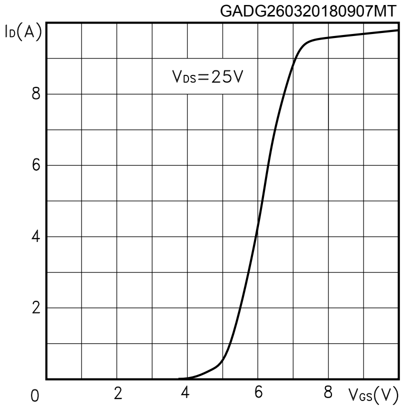


Figure 9. **Static drain-source on resistance**

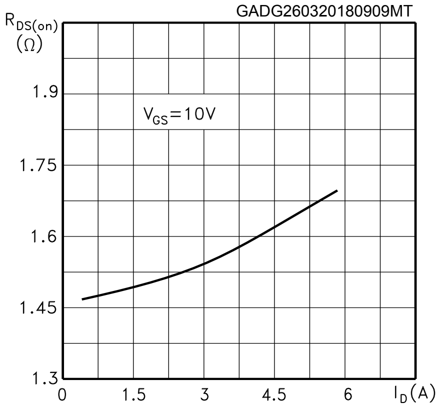


Figure 10. **Gate charge vs gate-source voltage**

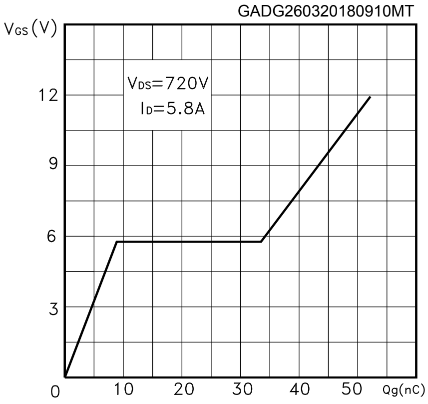


Figure 11. **Capacitance variations**

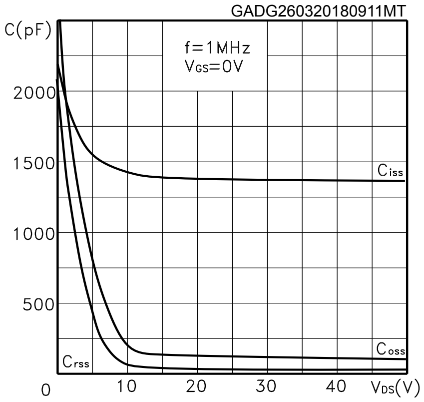


Figure 12. **Normalized gate threshold voltage vs temperature**

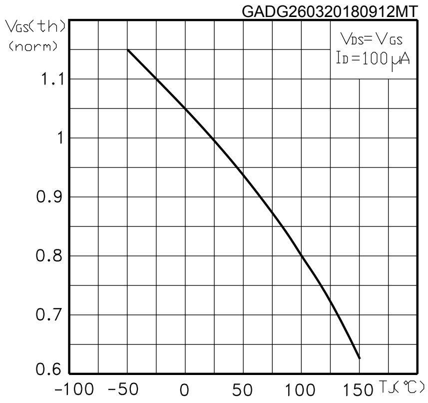


Figure 13. Normalized on resistance vs temperature

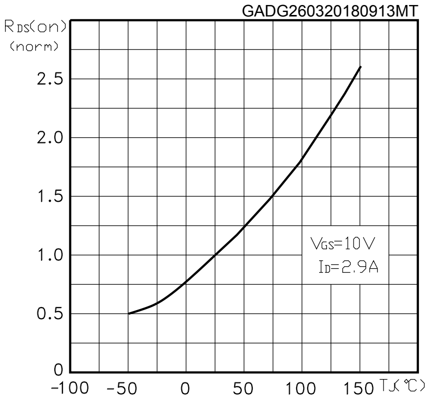


Figure 14. Source-drain diode forward characteristic

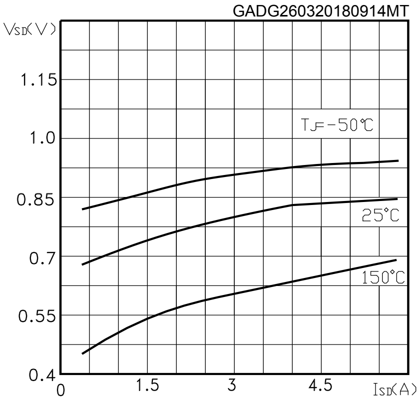


Figure 15. Normalized $V_{(BR)DSS}$ vs temperature

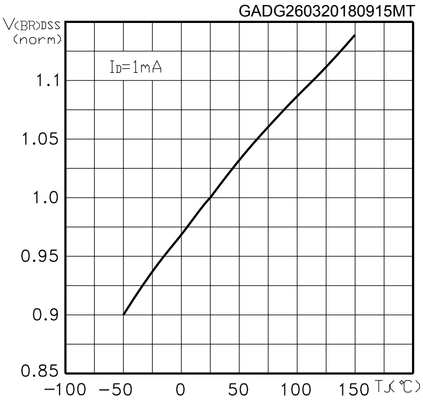
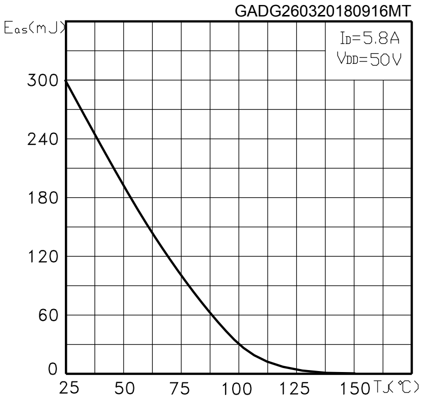


Figure 16. Maximum avalanche energy vs temperature



3 Test circuits

Figure 17. Test circuit for resistive load switching times

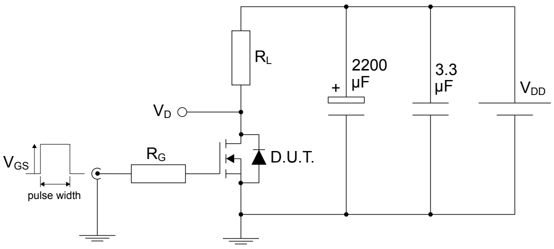


Figure 18. Test circuit for gate charge behavior

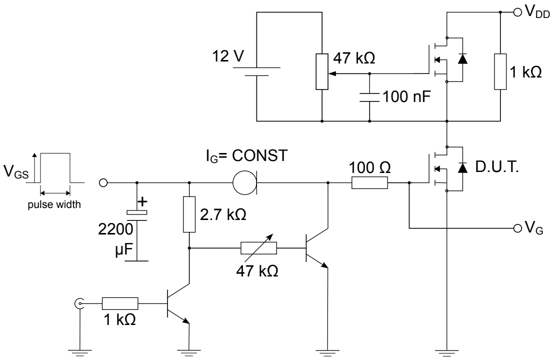


Figure 19. Test circuit for inductive load switching and diode recovery times

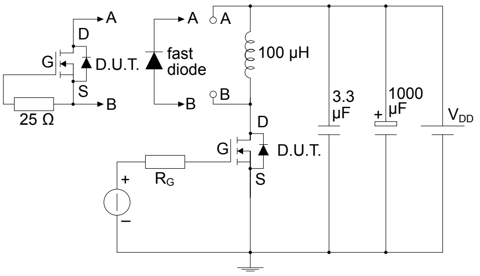


Figure 20. Unclamped inductive load test circuit

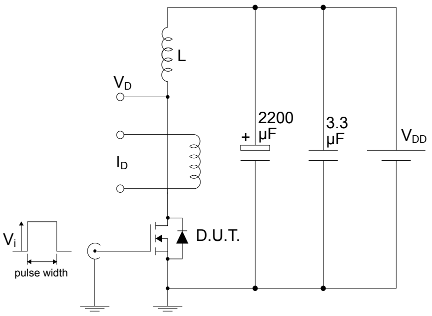


Figure 21. Unclamped inductive waveform

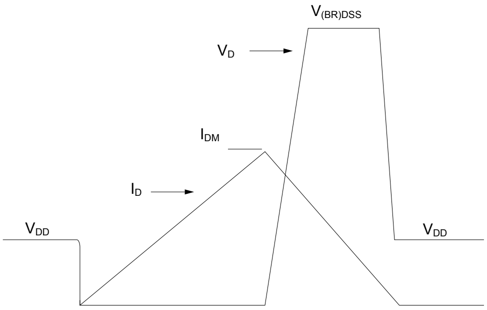
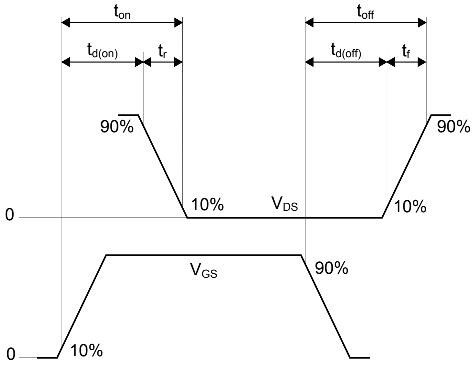


Figure 22. Switching time waveform



4 Package information

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 23. **D²PAK (TO-263) type A package outline**

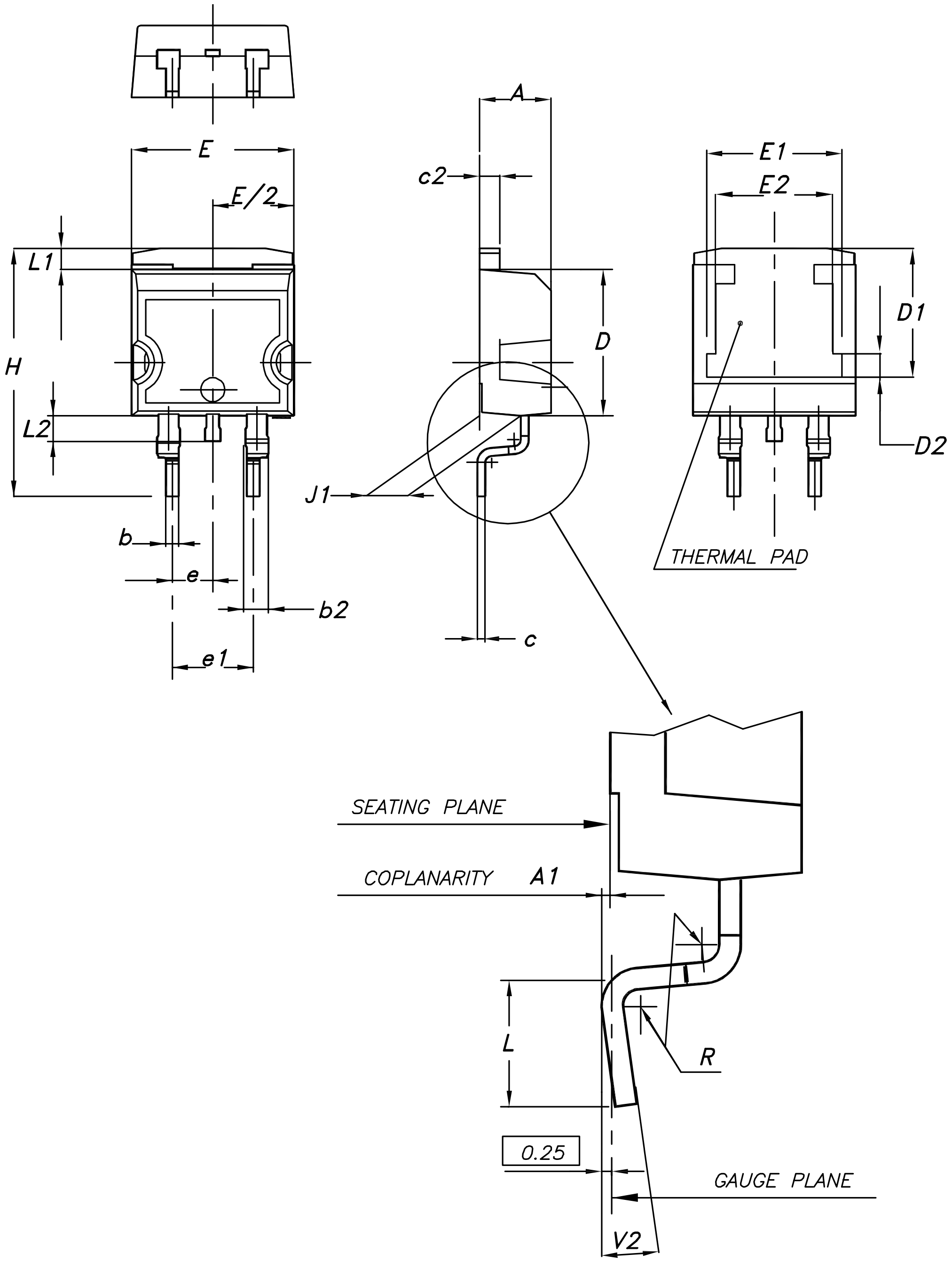


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Table 7. **D²PAK (TO-263) type A package mechanical data**

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°

4.2 D²PAK (TO-263) type B package information

Figure 24. D²PAK (TO-263) type B package outline

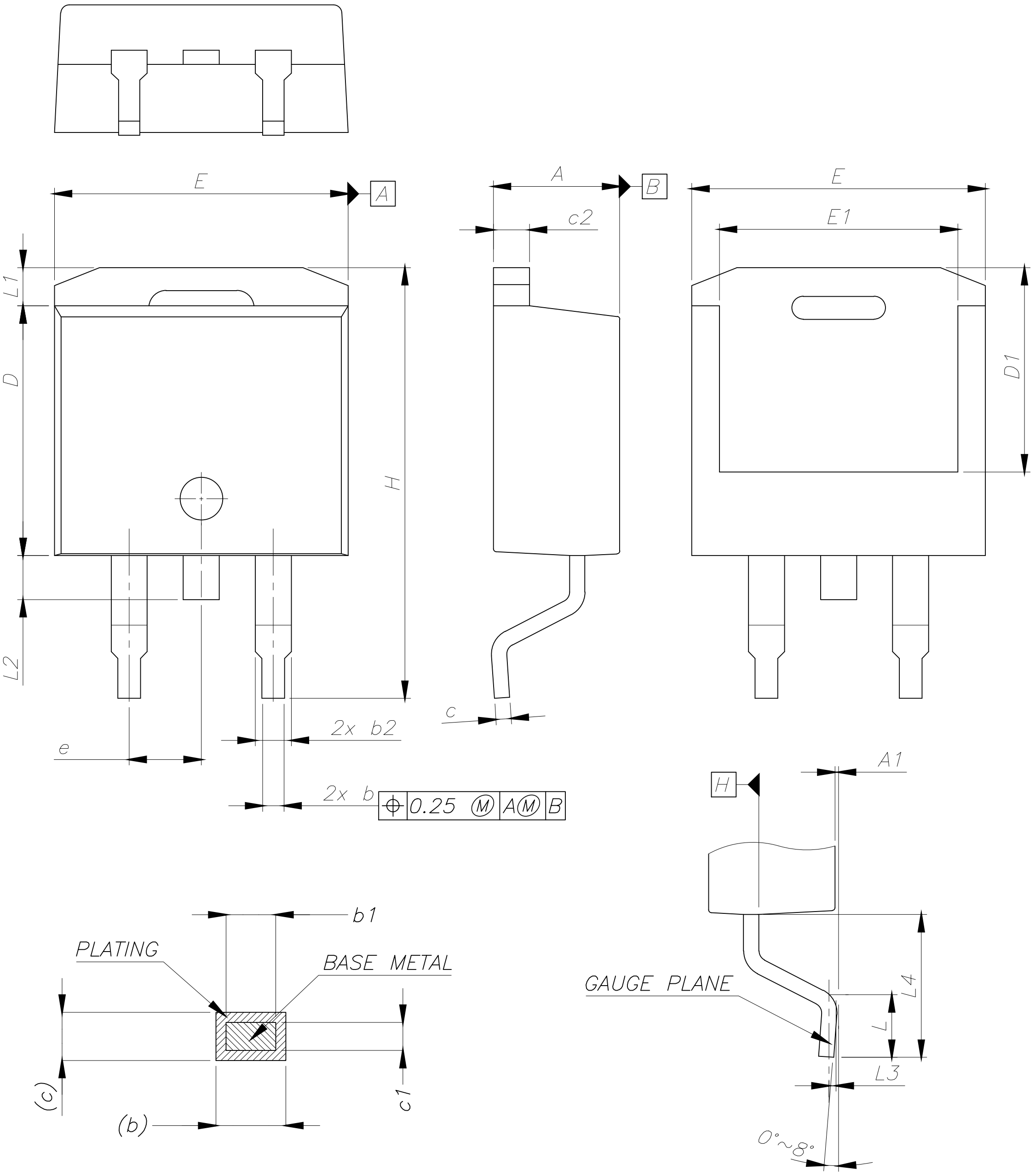

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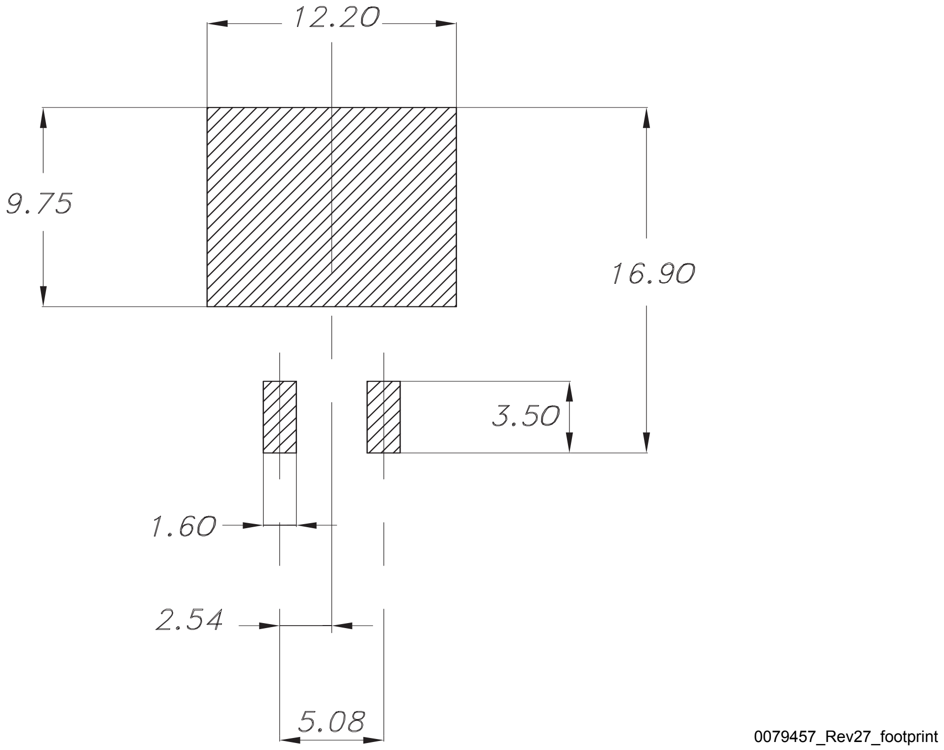
Table 8. **D²PAK (TO-263) type B mechanical data**

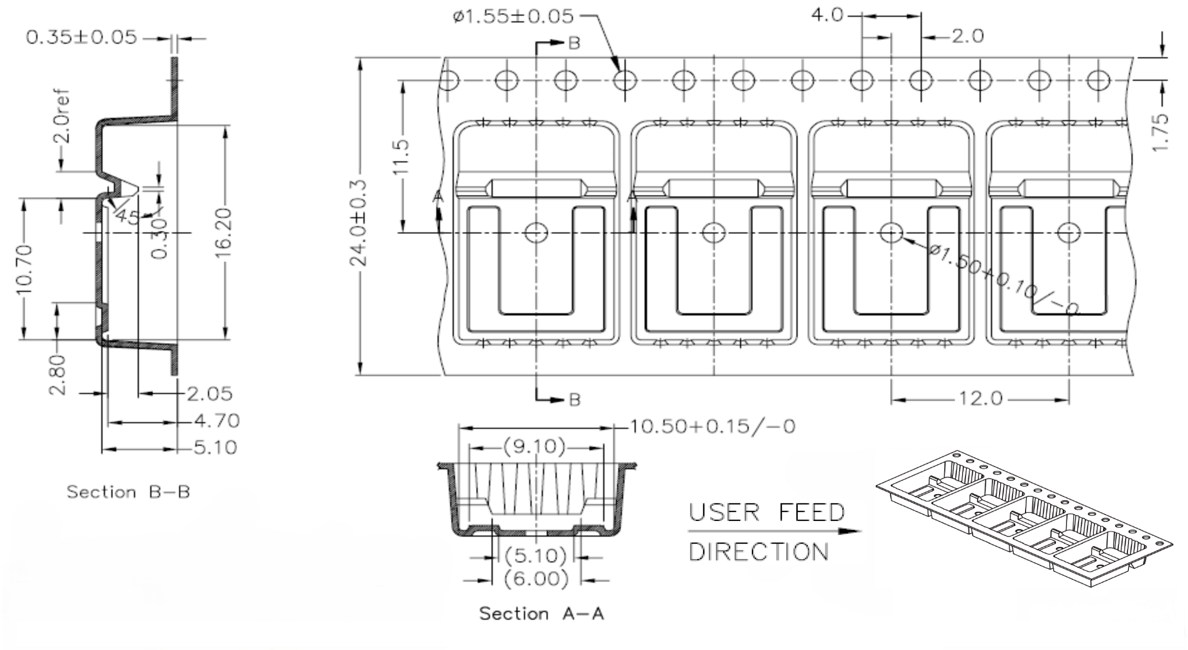
Dim.	mm		
	Min.	Typ.	Max.
A	4.36		4.56
A1	0.00		0.25
b	0.70		0.90
b1	0.51		0.89
b2	1.17		1.37
c	0.38		0.694
c1	0.38		0.534
c2	1.19		1.34
D	8.60		9.00
D1	6.90		7.50
E	10.15		10.55
E1	8.10		8.70
e		2.54 BSC	
H	15.00		15.60
L	1.90		2.50
L1			1.65
L2			1.78
L3		0.25	
L4	4.78		5.28

Figure 25. **D²PAK (TO-263) recommended footprint (dimensions are in mm)**



4.3 D²PAK packing information

Figure 26. D²PAK tape drawing (dimensions are in mm)



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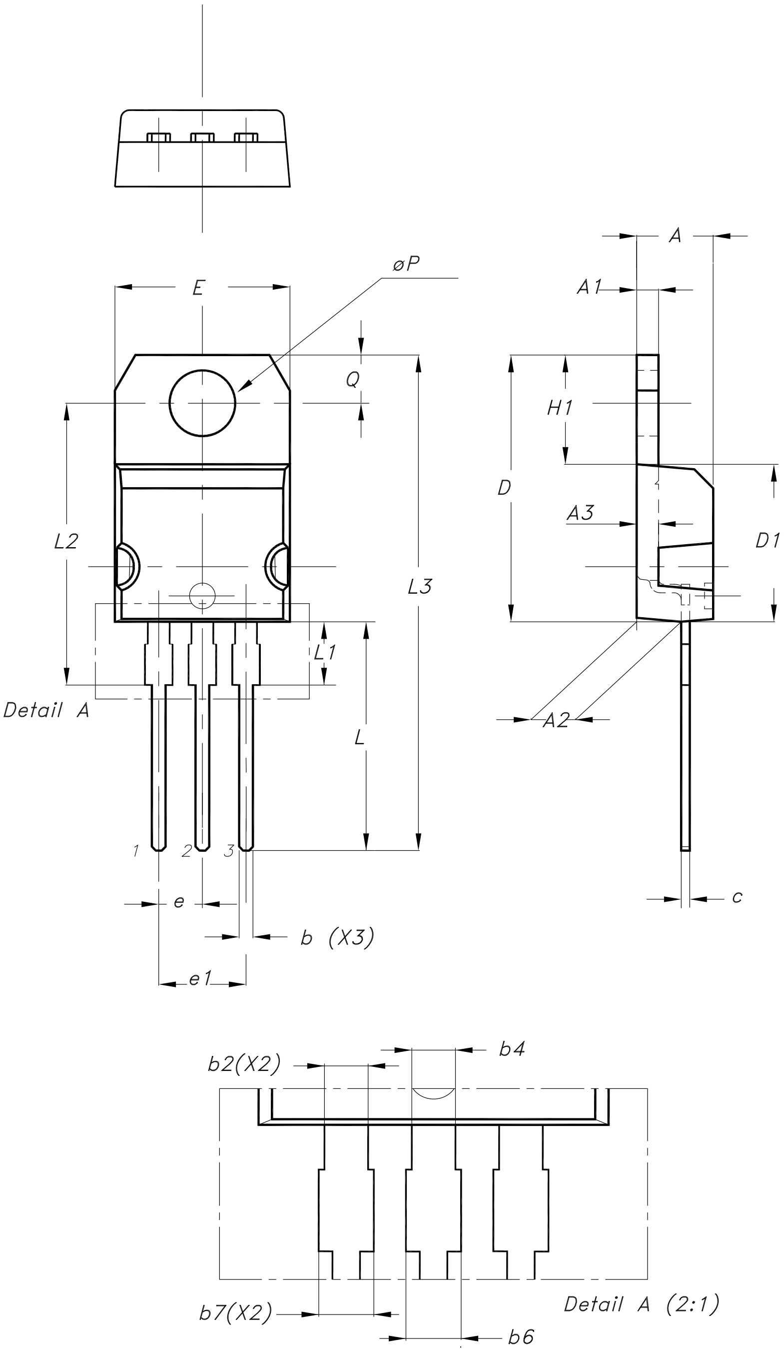
4.4 TO-220 type H package information

Figure 27. TO-220 type H package outline



0015988_H_24

Table 9. TO-220 type H package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40	4.45	4.50
A1	1.22		1.32
A2	2.49	2.59	2.69
A3	1.17	1.27	1.37
b	0.78		0.87
b2	1.25		1.34
b4	1.20		1.29
b6			1.50
b7			1.45
c	0.49		0.56
D	15.40	15.50	15.60
D1	9.05	9.15	9.25
E	10.08	10.18	10.28
e	2.44	2.54	2.64
e1	4.98	5.08	5.18
H1	6.25	6.35	6.45
L	13.20	13.40	13.60
L1	3.50	3.70	3.90
L2	16.30	16.40	16.50
L3	28.70	28.90	29.10
∅P	3.75	3.80	3.85
Q	2.70	2.80	2.90
Slug flatness		0.03	0.10

4.5 TO-220FP type B package information

Figure 28. **TO-220FP type B package outline**

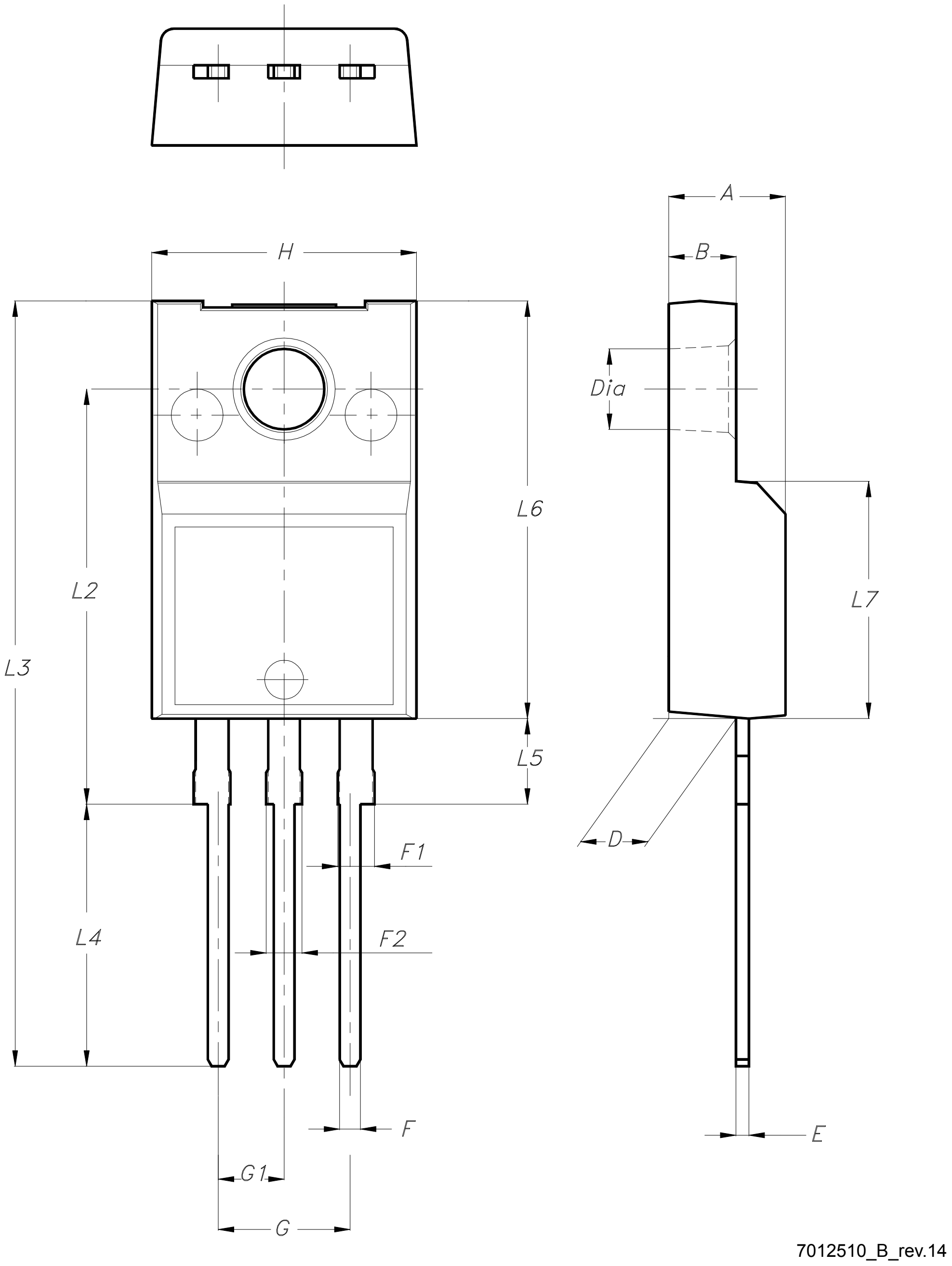
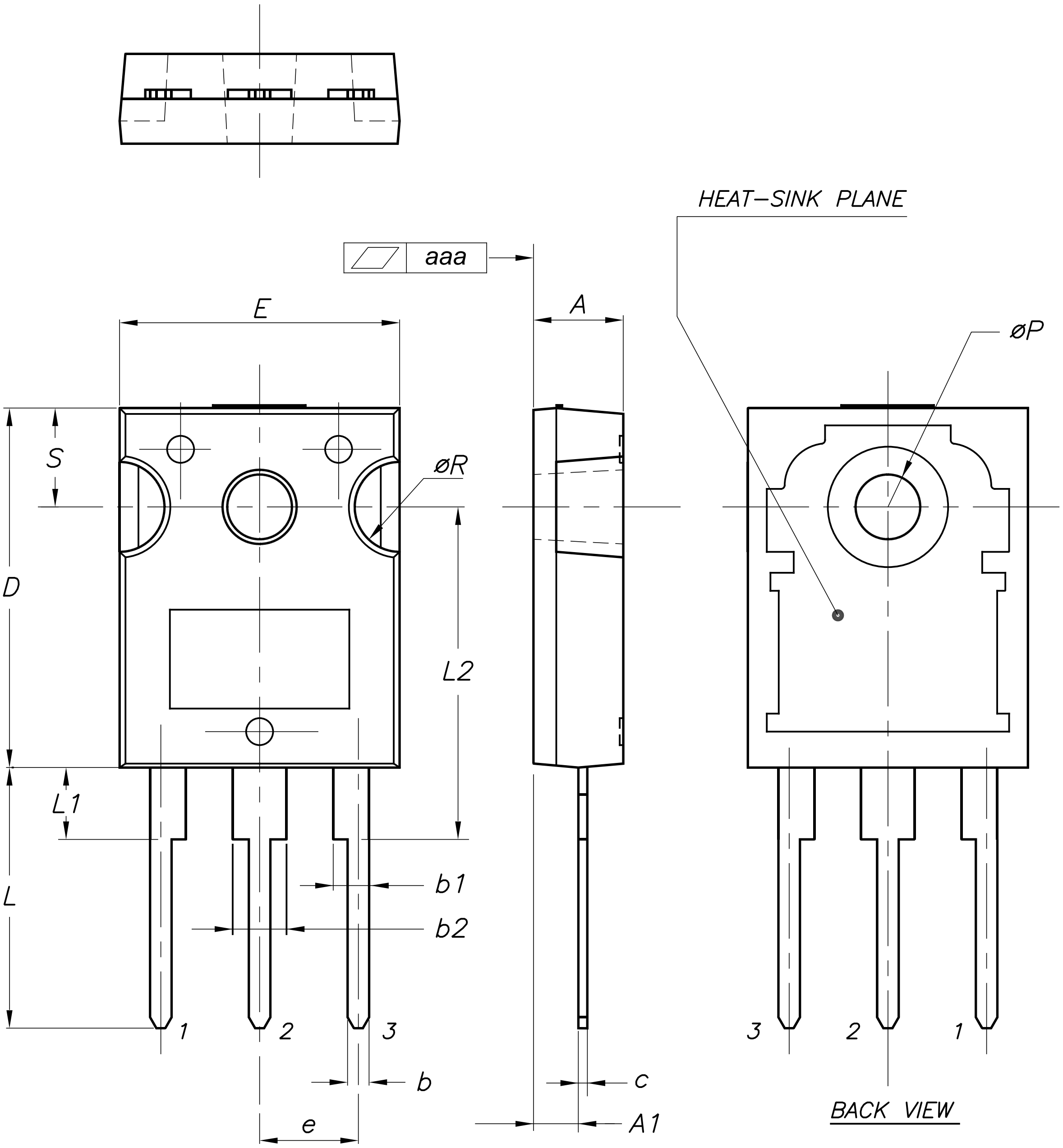


Table 10. **TO-220FP type B package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
B	2.50		2.70
D	2.50		2.75
E	0.45		0.70
F	0.75		1.00
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.20
G1	2.40		2.70
H	10.00		10.40
L2		16.00	
L3	28.60		30.60
L4	9.80		10.60
L5	2.90		3.60
L6	15.90		16.40
L7	9.00		9.30
Dia	3.00		3.20

4.6 TO-247 package information

Figure 29. TO-247 package outline



0075325_10

Table 11. **TO-247 package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
ØP	3.55		3.65
ØR	4.50		5.50
S	5.30	5.50	5.70
aaa		0.04	0.10

5 Ordering information

Table 12. **Order codes**

Order code	Marking	Package	Packing
STB6NK90ZT4	B6NK90Z	D^2PAK	Tape e reel
STP6NK90Z	P6NK90Z	TO-220	Tube
STP6NK90ZFP	P6NK90ZFP	TO-220FP	Tube
STW7NK90Z	W7NK90Z	TO-247	Tube

Revision history

Table 13. **Document revision history**

Date	Version	Changes
29-Nov-2005	3	Complete version
16-Aug-2006	4	New template, no content change
10-Apr-2007	5	Typo mistake on Table 2
04-Apr-2018	6	Removed maturity status indication from cover page. The document status is production data. Updated *Table 5. Dynamic* and *Table 6. Source drain diode*. Minor text changes.
19-Sep-2025	7	Updated Section 4: Package information. Minor text changes.

Contents

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