



STB13N80K5, STF13N80K5 STP13N80K5, STW13N80K5

Datasheet

N-channel 800 V, 370 mΩ typ., 12 A MDmesh K5 Power MOSFET in a D²PAK, TO-220FP, TO-220 and TO-247 packages

Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STB13N80K5	800 V	450 mΩ	12 A
STF13N80K5			
STP13N80K5			
STW13N80K5			

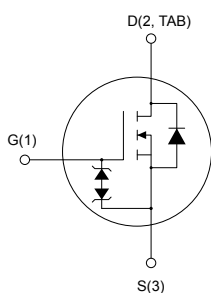
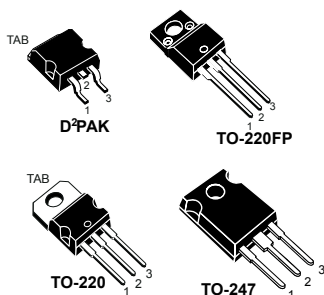
- Ultra-low gate charge
- Very low FoM (figure of merit)
- Zener-protected
- 100% avalanche tested

Applications

- Switching applications

Description

These very high voltage N-channel Power MOSFETs are designed using MDmesh K5 technology based on an innovative proprietary vertical structure. The result is a dramatic reduction in on-resistance and ultra-low gate charge for applications requiring superior power density and high efficiency.



AM01476v1_tab



Product status links

[STB13N80K5](#)

[STF13N80K5](#)

[STP13N80K5](#)

[STW13N80K5](#)

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		D ² PAK TO-220 TO-247	TO-220FP	
V _{GS}	Gate-source voltage	±30		V
I _D	Drain current (continuous) at T _C = 25 °C	12		A
	Drain current (continuous) at T _C = 100 °C	7.6		
I _{DM} ⁽¹⁾	Drain current (pulsed)	48		A
P _{TOT}	Total power dissipation at T _C = 25 °C	190	35	W
V _{iso}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T _C = 25 °C)	-	2.5	kV
dv/dt ⁽²⁾	Peak diode recovery voltage slope	4.5		V/ns
dv/dt ⁽³⁾	MOSFET dv/dt ruggedness	50		V/ns
T _{stg}	Storage temperature range	-55 to 150		°C
T _J	Operating junction temperature range			°C

1. Pulse width is limited by safe operating area.

2. I_{SD} ≤ 12 A, di/dt = 100 A/μs, V_{DS} (peak) < V_{(BR)DSS}.

3. V_{DD} ≤ 640 V.

Table 2. Thermal data

Symbol	Parameter	Value				Unit
		D ² PAK	TO-220	TO-220FP	TO-247	
R _{thJC}	Thermal resistance, junction-to-case	0.66		3.57	0.66	°C/W
R _{thJA}	Thermal resistance, junction-to-ambient	30 ⁽¹⁾	62.5		50	°C/W

1. When mounted on a standard 1 inch² area of FR-4 PCB with 2-oz copper.

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I _{AR}	Avalanche current, repetitive or non-repetitive (pulse width limited by T _J max.)	4	A
E _{AS}	Single pulse avalanche energy (starting T _J = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	148	mJ

2 Electrical characteristics

$T_C = 25\text{ °C}$ unless otherwise specified.

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	800	-	-	V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 800\text{ V}$	-	-	1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 800\text{ V}$, $T_C = 125\text{ °C}^{(1)}$	-	-	50	
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 20\text{ V}$	-	-	± 10	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 100\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 6\text{ A}$	-	370	450	m Ω

1. Specified by design, not tested in production.

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	870	-	pF
C_{oss}	Output capacitance		-	50	-	pF
C_{rss}	Reverse transfer capacitance		-	2	-	pF
$C_{o(tr)}^{(1)}$	Equivalent output capacitance time related	$V_{DS} = 0\text{ to }640\text{ V}$, $V_{GS} = 0\text{ V}$	-	110	-	pF
$C_{o(er)}^{(2)}$	Equivalent output capacitance energy related		-	43	-	pF
R_g	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_D = 0\text{ A}$	-	5	-	Ω
Q_g	Total gate charge	$V_{DD} = 640\text{ V}$, $I_D = 2.5\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$ (see the Figure 21. Test circuit for gate charge behavior)	-	29	-	nC
Q_{gs}	Gate-source charge		-	7	-	nC
Q_{gd}	Gate-drain charge		-	18	-	nC

1. $C_{o(tr)}$ is a constant capacitance value that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

2. $C_{o(er)}$ is a constant capacitance value that gives the same stored energy as C_{oss} while V_{DS} is rising 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	$V_{DD} = 400\text{ V}$, $I_D = 6\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$	-	16	-	ns
t_r	Rise time		-	16	-	ns
$t_{d(off)}$	Turn-off delay time	(see the Figure 20. Test circuit for resistive load switching times and Figure 25. Switching time waveform)	-	42	-	ns
t_f	Fall time		-	16	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-	-	14	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-	-	56	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 12\text{ A}$	-	-	1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 12\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$	-	406	-	ns
Q_{rr}	Reverse recovery charge		-	5.7	-	μC
I_{RRM}	Reverse recovery current	(see the Figure 22. Test circuit for inductive load switching and diode recovery times)	-	28	-	A
t_{rr}	Reverse recovery time	$I_{SD} = 12\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$	-	600	-	ns
Q_{rr}	Reverse recovery charge		-	7.9	-	μC
I_{RRM}	Reverse recovery current	(see the Figure 22. Test circuit for inductive load switching and diode recovery times)	-	26	-	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)

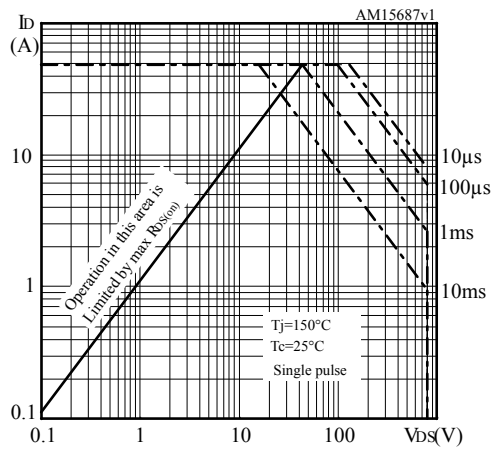
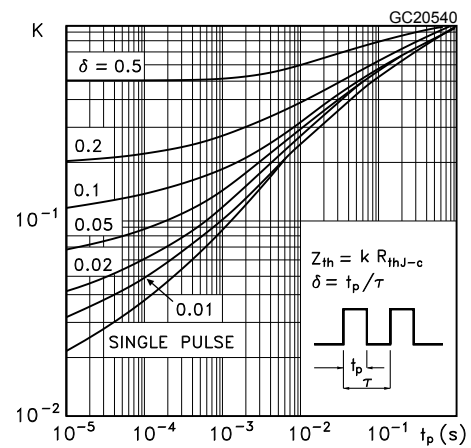
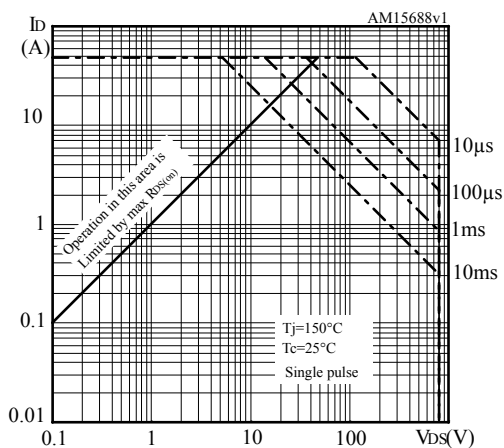
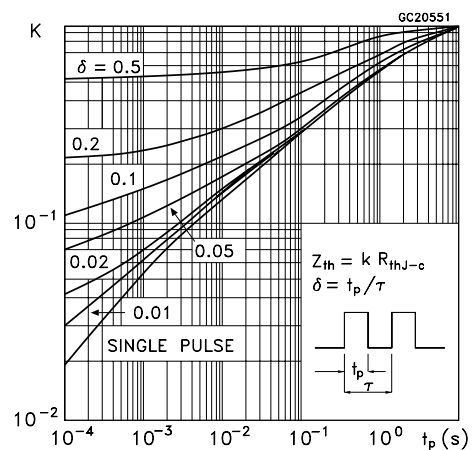
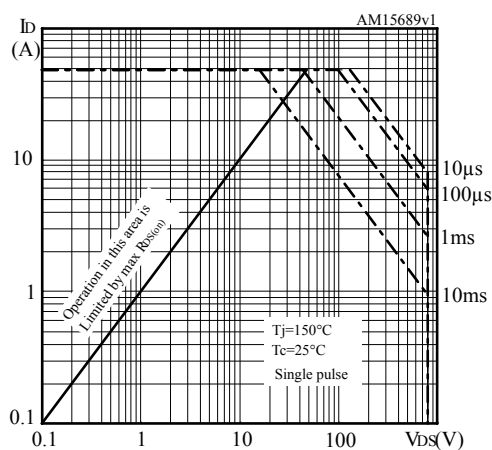
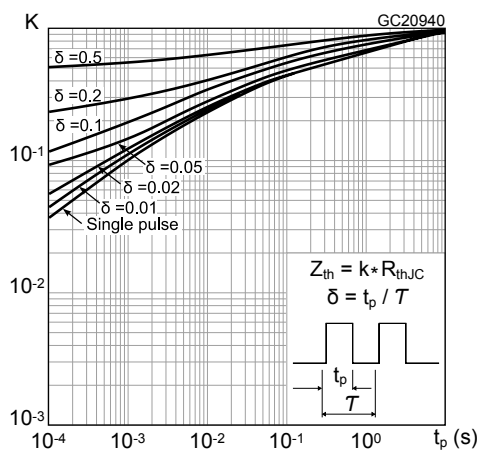
Figure 1. Safe operating area for D²PAK

Figure 2. Normalized transient thermal impedance for D²PAK

Figure 3. Safe operating area for TO-220FP

Figure 4. Normalized transient thermal impedance for TO-220FP

Figure 5. Safe operating area for TO-220

Figure 6. Normalized transient thermal impedance for TO-220


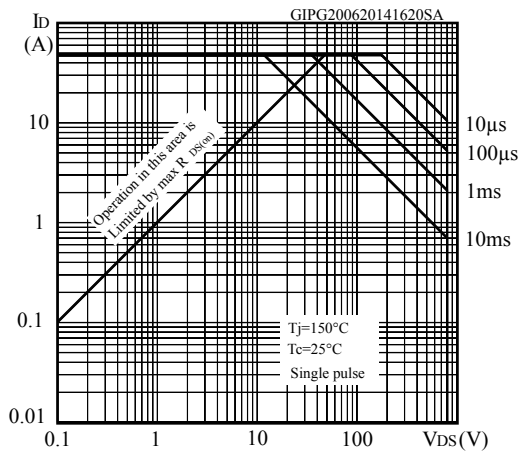
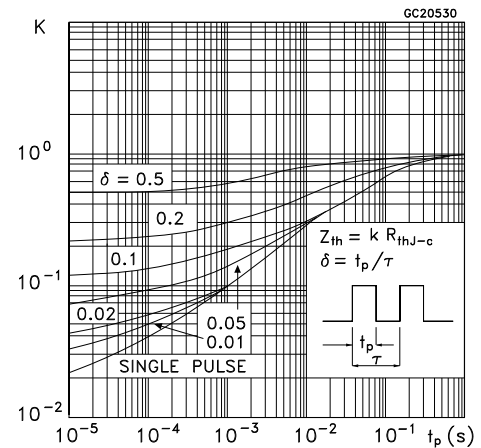
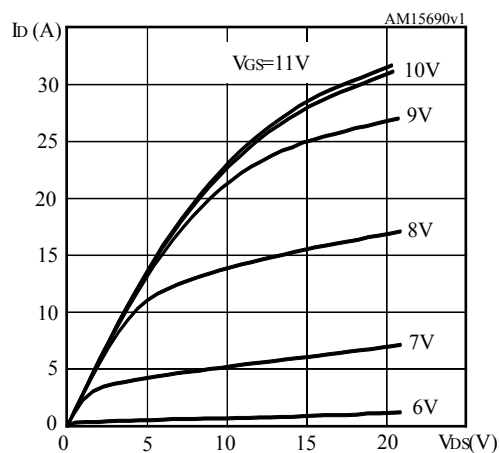
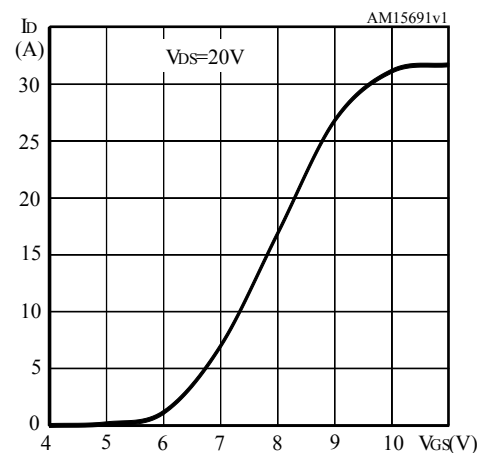
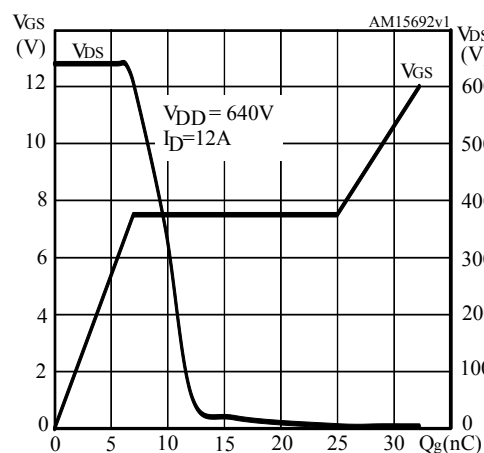
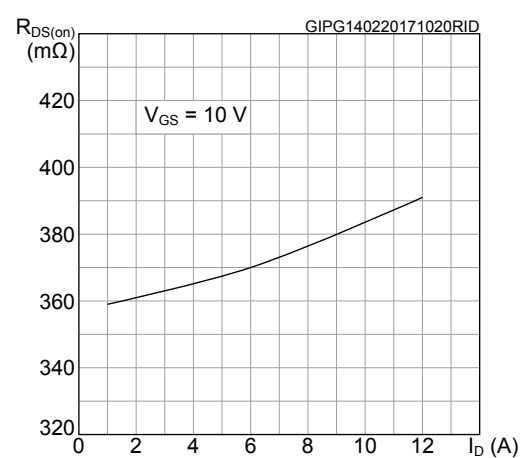
Figure 7. Safe operating area for TO-247

Figure 8. Normalized transient thermal impedance for TO-247

Figure 9. Typical output characteristics

Figure 10. Typical transfer characteristics

Figure 11. Typical gate charge characteristics

Figure 12. Typical drain-source on-resistance


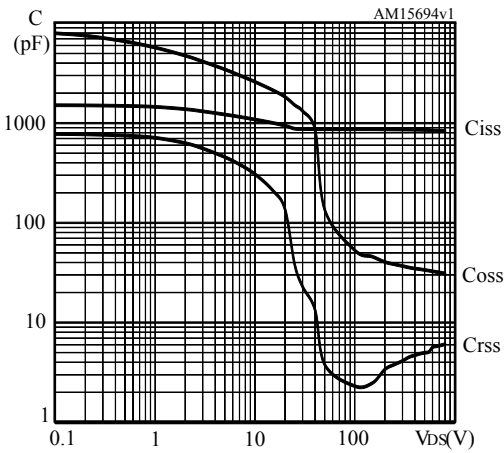
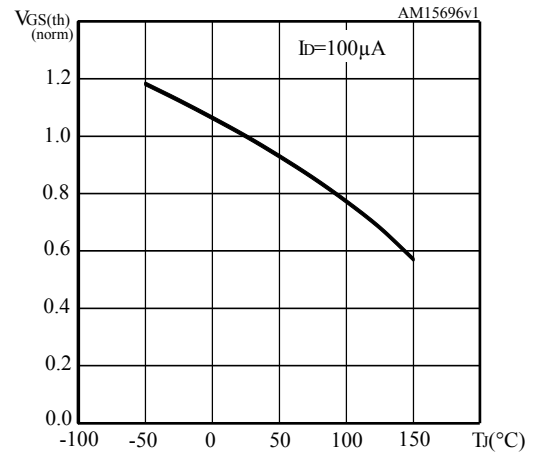
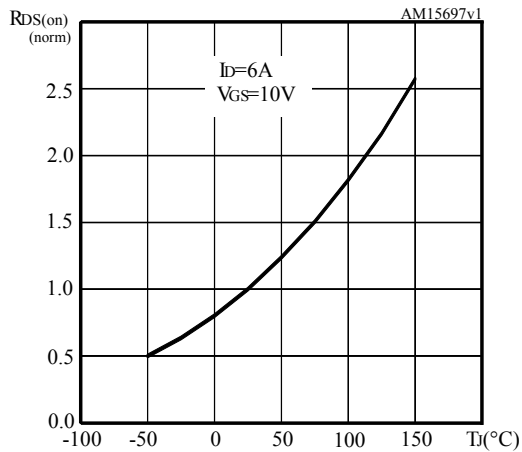
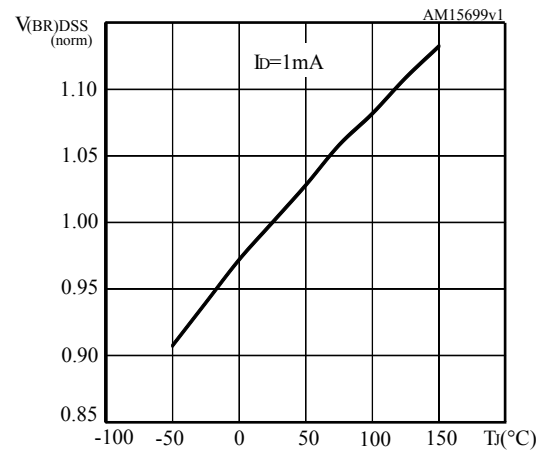
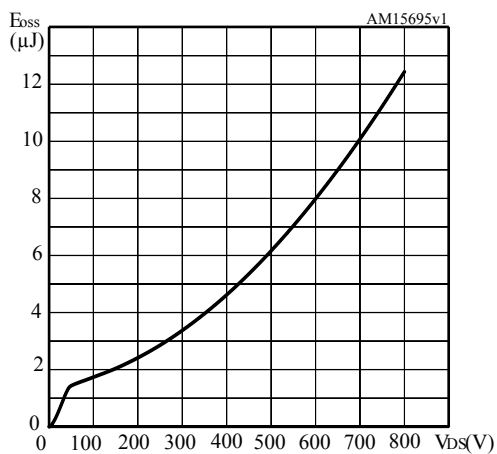
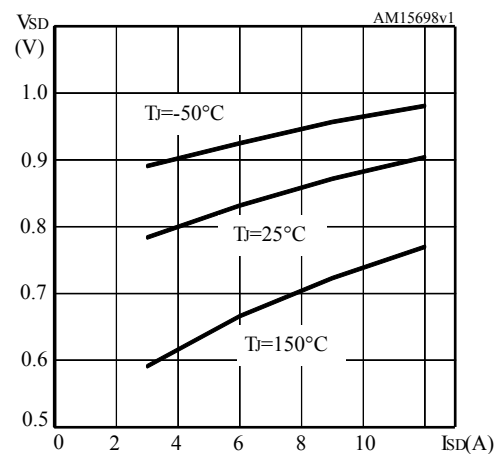
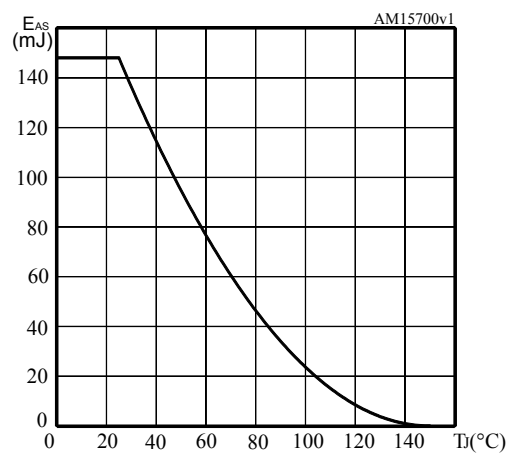
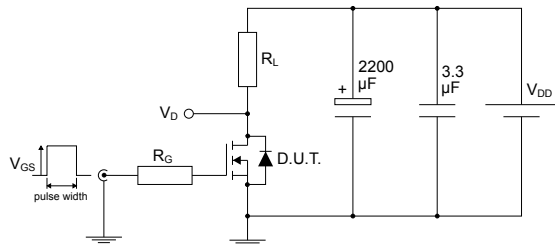
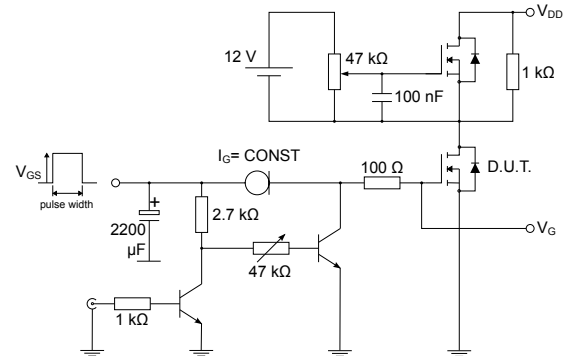
Figure 13. Typical capacitance characteristics

Figure 14. Normalized gate threshold vs temperature

Figure 15. Normalized on-resistance vs temperature

Figure 16. Normalized breakdown voltage vs temperature

Figure 17. Typical output capacitance stored energy

Figure 18. Typical reverse diode forward characteristics


Figure 19. Maximum avalanche energy vs temperature


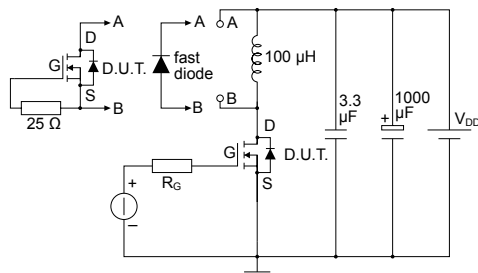
3 Test circuits

Figure 20. Test circuit for resistive load switching times


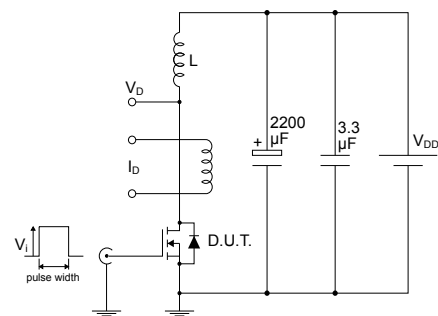
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Figure 21. Test circuit for gate charge behavior


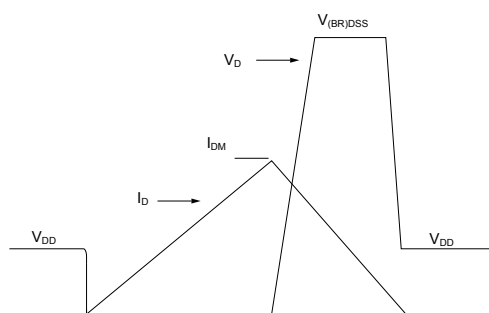
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Figure 22. Test circuit for inductive load switching and diode recovery times


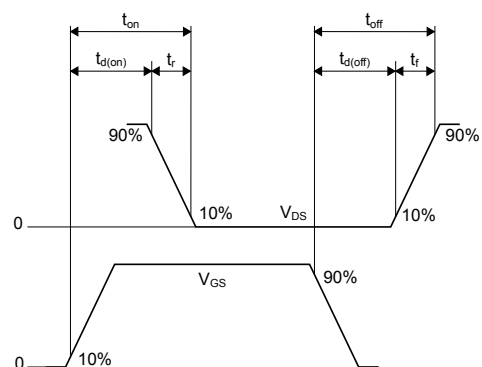
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Figure 23. Unclamped inductive load test circuit


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Figure 24. Unclamped inductive waveform


AM01472v1

Figure 25. Switching time waveform


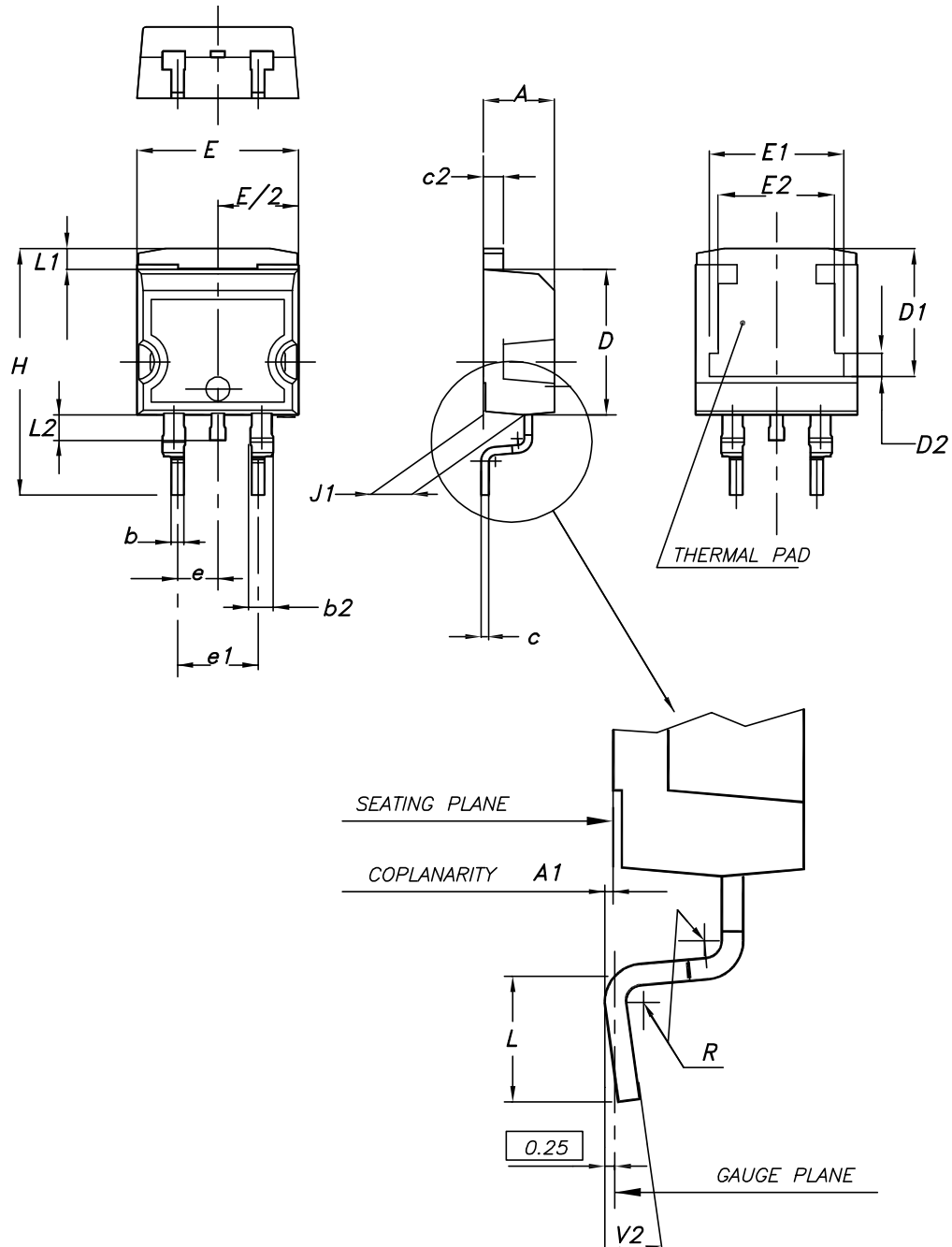
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4 Package information

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

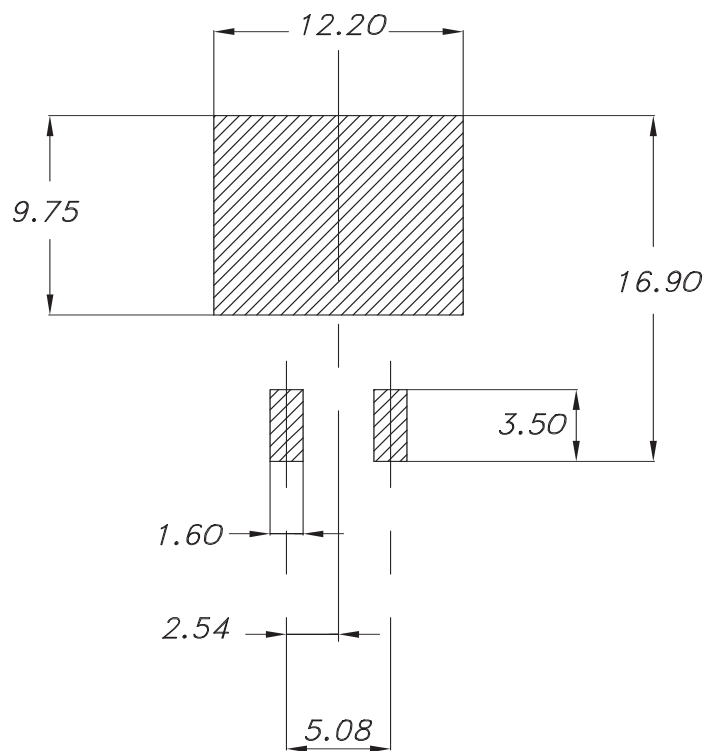
Figure 26. D²PAK (TO-263) type A package outline



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Table 8. D²PAK (TO-263) type A package mechanical data

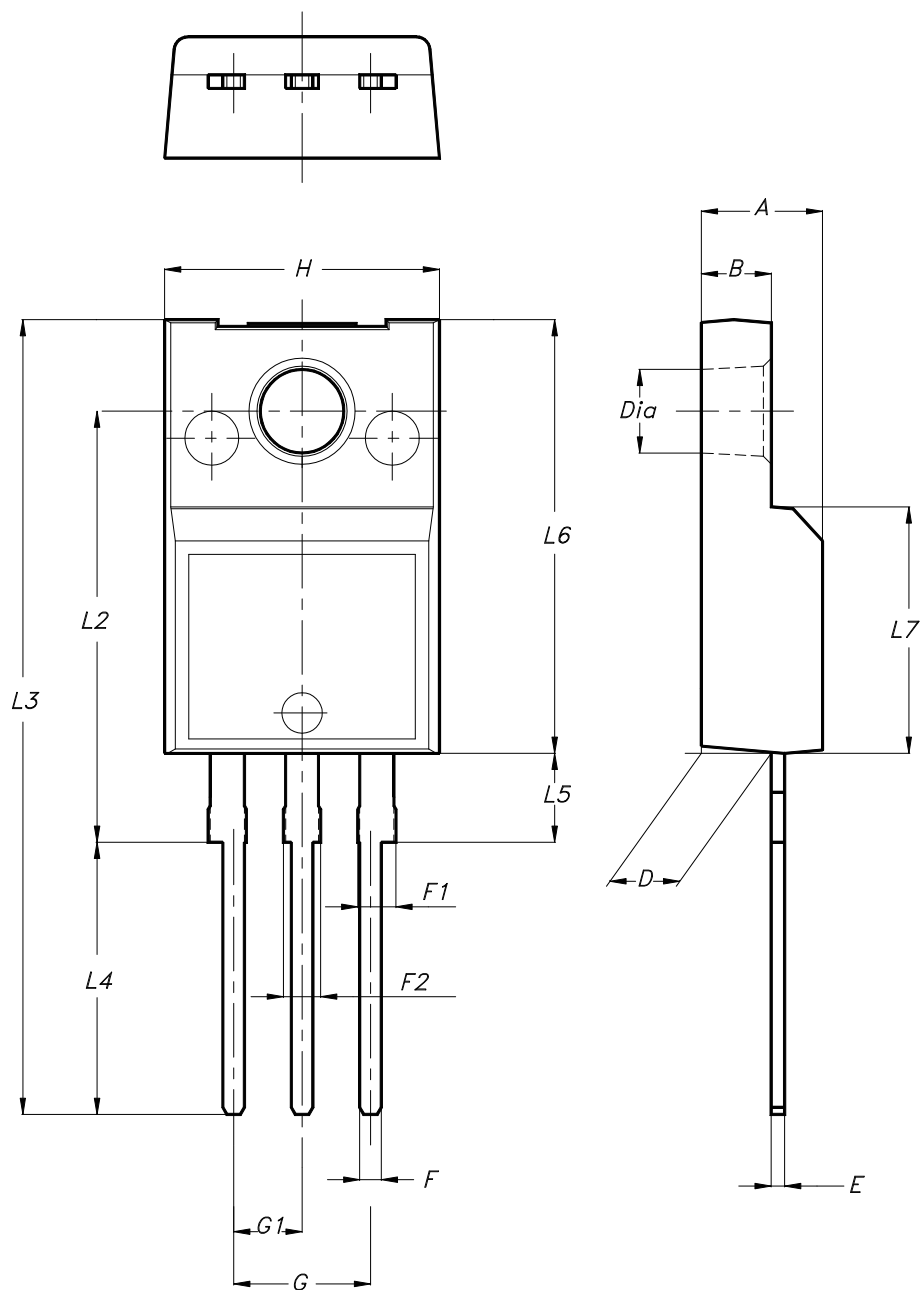
Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50	7.75	8.00
D2	1.10	1.30	1.50
E	10.00		10.40
E1	8.30	8.50	8.70
E2	6.85	7.05	7.25
e		2.54	
e1	4.88		5.28
H	15.00		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.40	
V2	0°		8°

Figure 27. D²PAK (TO-263) recommended footprint (dimensions are in mm)


0079457_Rev27_footprint

4.2 TO-220FP type B package information

Figure 28. TO-220FP type B package outline



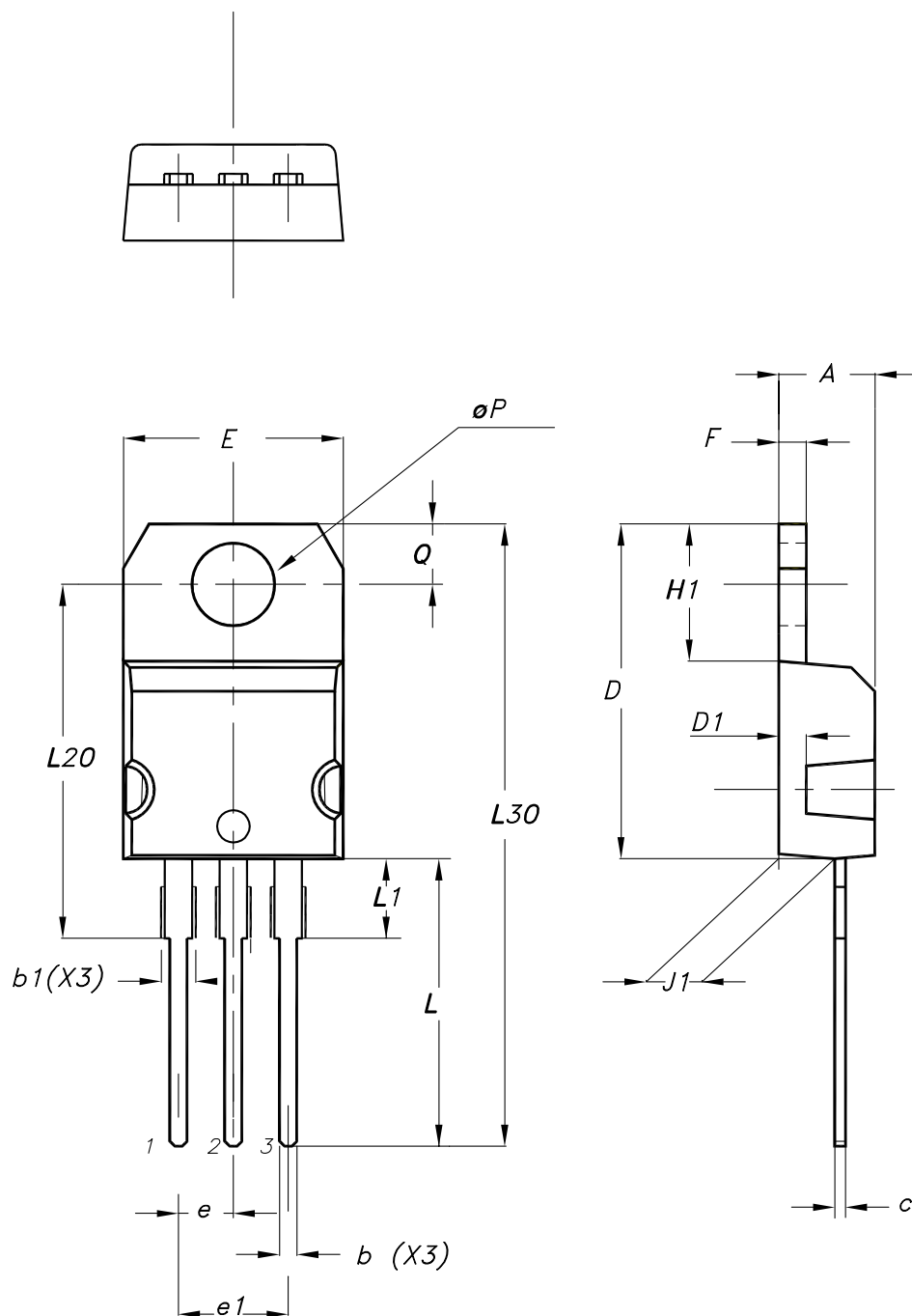
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Table 9. TO-220FP type B package mechanical data

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

4.3 TO-220 type A package information

Figure 29. TO-220 type A package outline



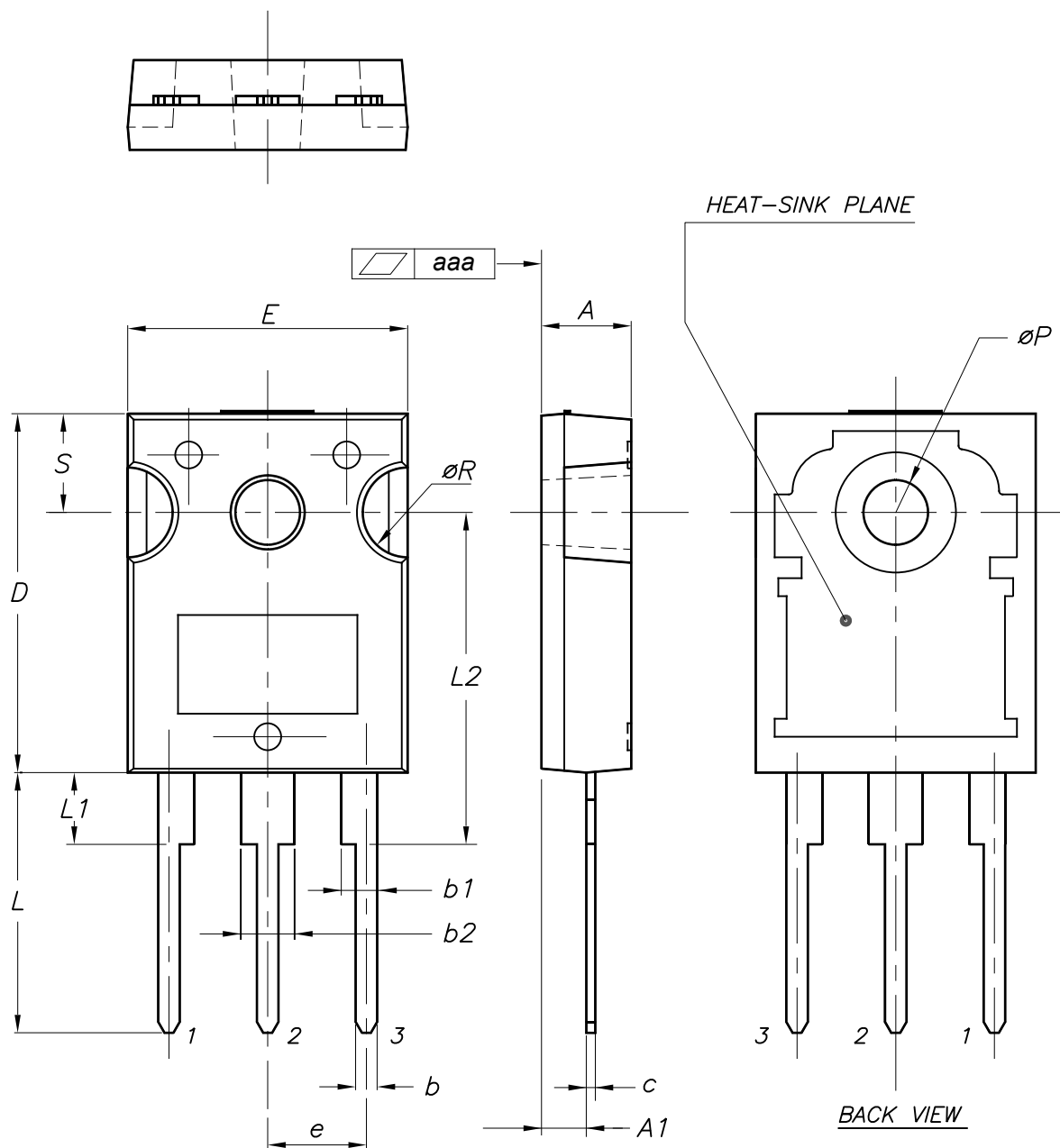
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Table 10. TO-220 type A package mechanical data

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
Slug flatness		0.03	0.10

4.4 TO-247 package information

Figure 30. TO-247 package outline



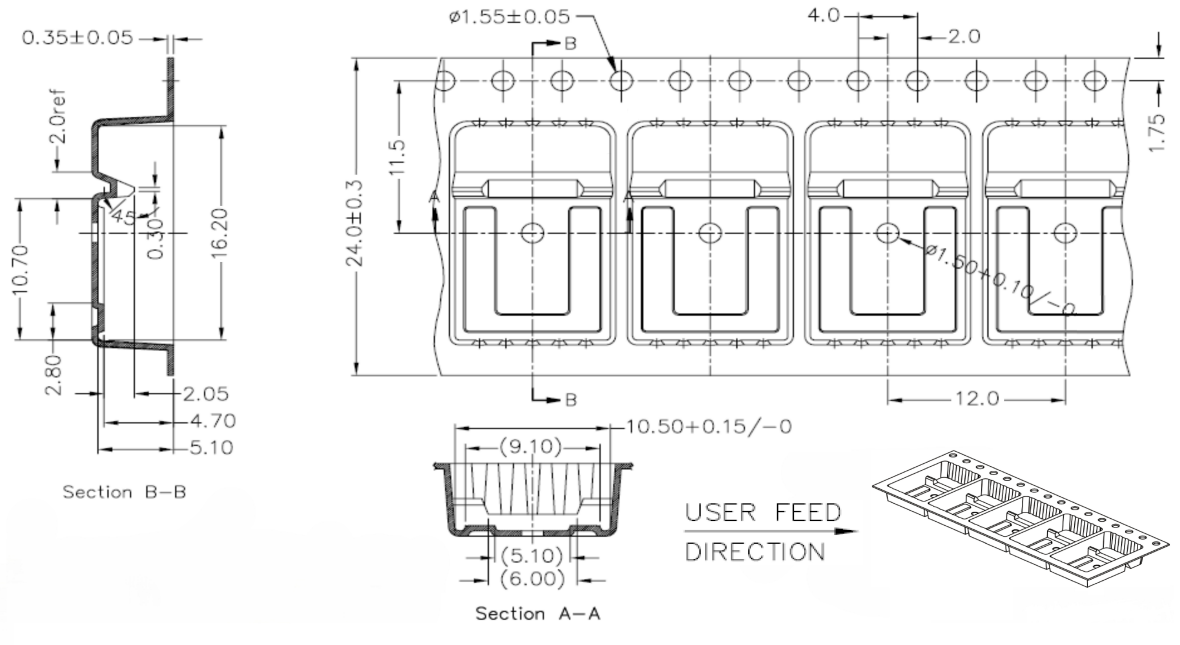
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Table 11. TO-247 package mechanical data

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

4.5 D²PAK packing information

Figure 31. D²PAK tape drawing (dimensions are in mm)



DM01095771_2



5 Ordering information

Table 12. Order codes

Order codes	Marking	Package	Packing
STB13N80K5	13N80K5	D ² PAK	Tape and reel
STF13N80K5		TO-220FP	Tube
STP13N80K5		TO-220	
STW13N80K5		TO-247	

Revision history

Table 13. Document revision history

Date	Revision	Changes
07-Mar-2013	1	First release.
27-Mar-2013	2	Updated Figure 1: Internal schematic diagram. Minor text changes. Document status promoted from preliminary data to production data.
15-Apr-2013	3	Modified: E_{AS} value, the entire typical values on Table 5, 6 and 7. Inserted: Section 2.1: <i>Electrical characteristics (curves)</i> . Minor text changes.
27-Jun-2014	4	Added: TO-247 package. Added: Figure 8 and 9. Updated: Section 4: <i>Package mechanical data</i> . Minor text changes.
08-Sep-2017	5	Updated title, features and description. Updated Figure 13: "Static drain-source on-resistance". Updated Table 2: "Absolute maximum ratings", Table 5: "On/offstate", Table 6: "Dynamic" and Table 8: "Source-drain diode". Updated Section 5: "Package information". Minor text changes.
30-Oct-2025	6	Updated Section 4: <i>Package information</i> . Minor text changes.



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