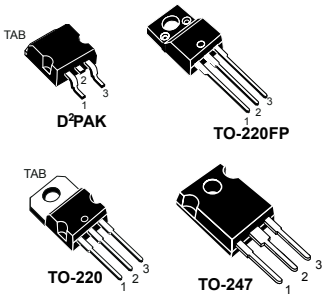
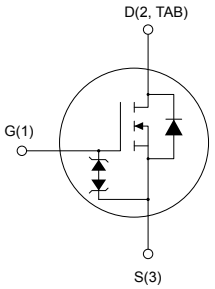
STB13N80K5, STF13N80K5
STP13N80K5, STW13N80K5

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





AM01476v1_tab

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.

STPOWER

Product status links
STB13N80K5
STF13N80K5
STP13N80K5
STW13N80K5

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		D^2PAK 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^2PAK	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 °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	800	-	-	V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 800 V	-	-	1	µA
		V_{GS} = 0 V, V_{DS} = 800 V, T_C = 125 °C(1)	-	-	50	
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	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 6 A	-	370	450	mΩ

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 V, f = 1 MHz, V_{GS} = 0 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 to 640 V, V_{GS} = 0 V	-	110	-	pF
$C_{o(er)}$(2)	Equivalent output capacitance energy related		-	43	-	pF
R_g	Intrinsic gate resistance	f = 1 MHz, I_D = 0 A	-	5	-	Ω
Q_g	Total gate charge	V_{DD} = 640 V, I_D = 2.5 A, V_{GS} = 0 to 10 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 V, I_D = 6 A, R_G = 4.7 Ω, V_{GS} = 10 V (see the Figure 20. Test circuit for resistive load switching times and Figure 25. Switching time waveform)	-	16	-	ns
t_r	Rise time		-	16	-	ns
$t_{d(off)}$	Turn-off delay time		-	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 V, I_{SD} = 12 A	-	-	1.5	V
t_{rr}	Reverse recovery time	I_{SD} = 12 A, di/dt = 100 A/µs,	-	406	-	ns
Q_{rr}	Reverse recovery charge	V_{DD} = 60 V	-	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 A, di/dt = 100 A/µs,	-	600	-	ns
Q_{rr}	Reverse recovery charge	V_{DD} = 60 V, T_J = 150 °C	-	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

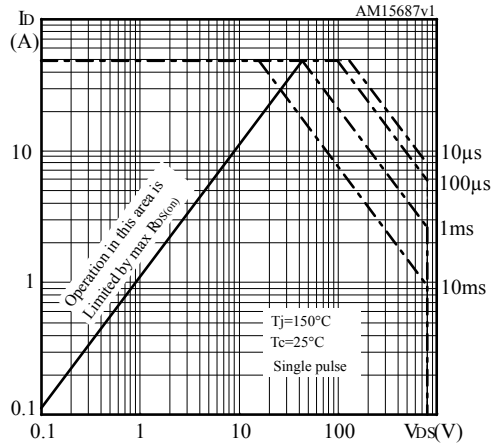


Figure 2. Normalized transient thermal impedance for D²PAK

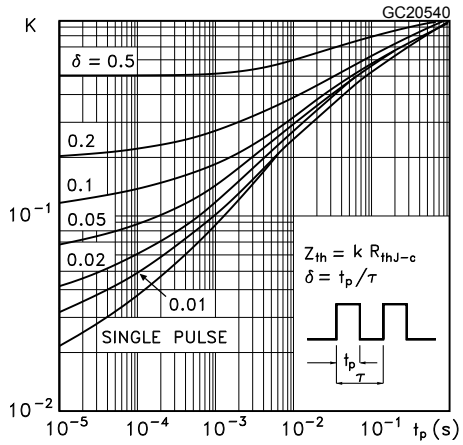


Figure 3. Safe operating area for TO-220FP

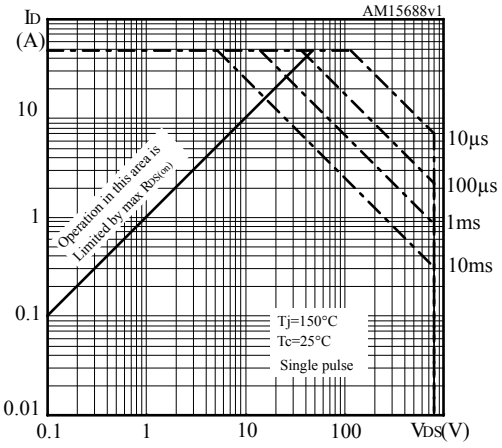


Figure 4. Normalized transient thermal impedance for TO-220FP

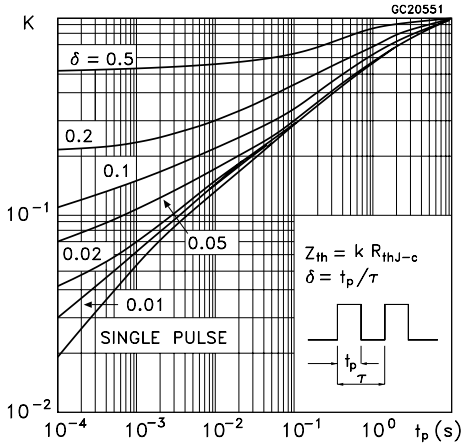


Figure 5. Safe operating area for TO-220

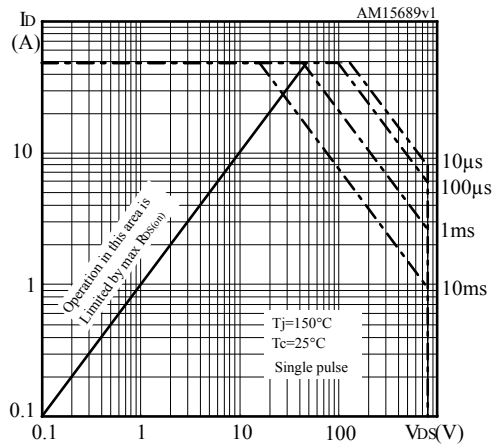


Figure 6. Normalized transient thermal impedance for TO-220

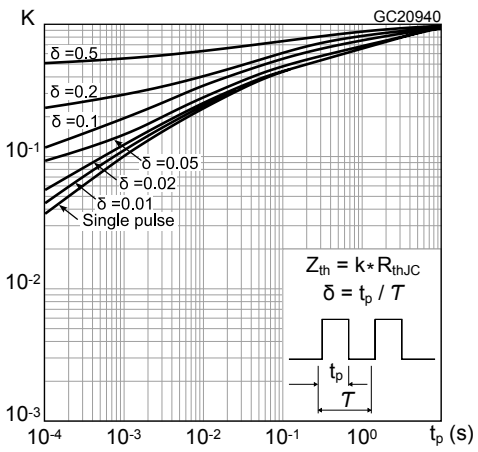


Figure 7. Safe operating area for TO-247

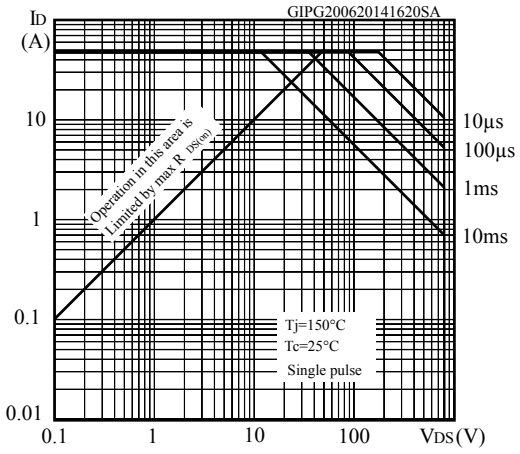


Figure 8. Normalized transient thermal impedance for TO-247

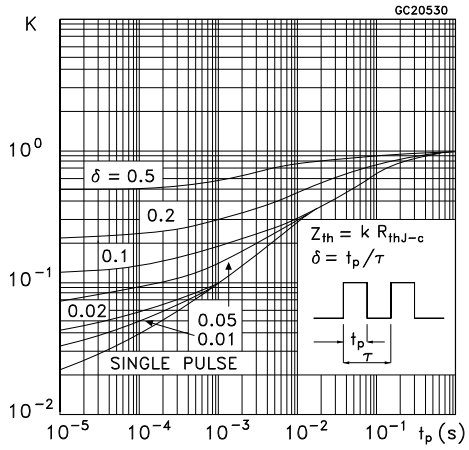


Figure 9. Typical output characteristics

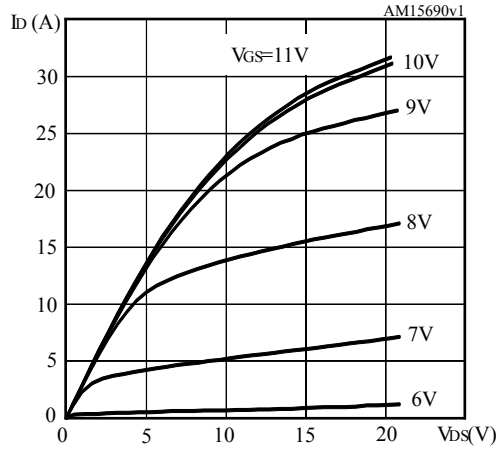


Figure 10. Typical transfer characteristics

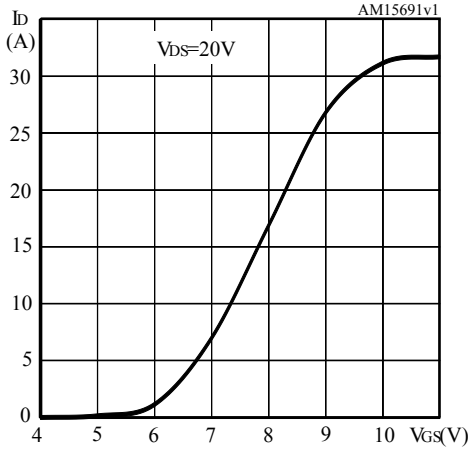


Figure 11. Typical gate charge characteristics

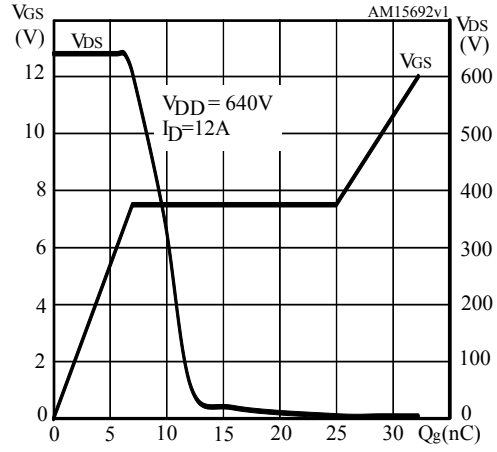


Figure 12. Typical drain-source on-resistance

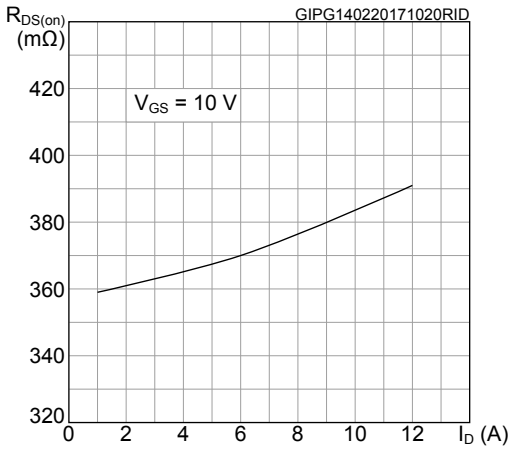


Figure 13. Typical capacitance characteristics

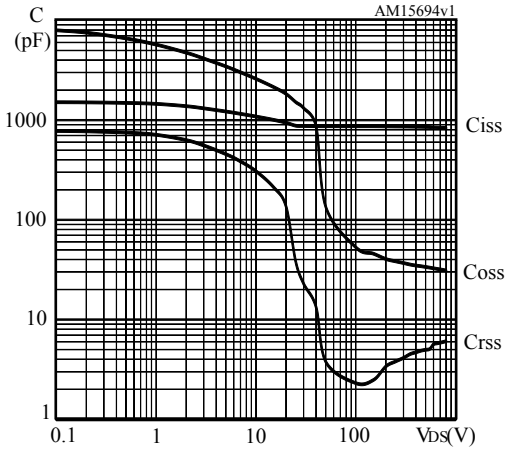


Figure 14. Normalized gate threshold vs temperature

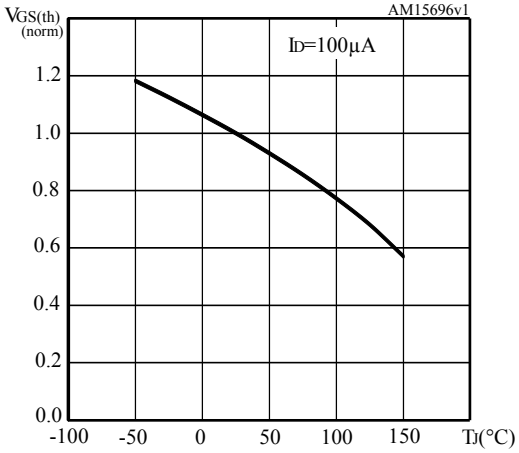


Figure 15. Normalized on-resistance vs temperature

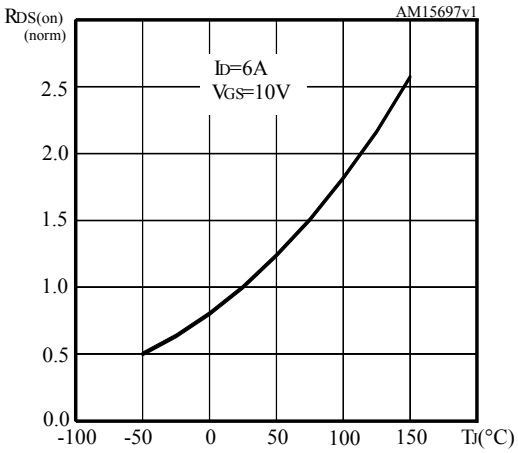


Figure 16. Normalized breakdown voltage vs temperature

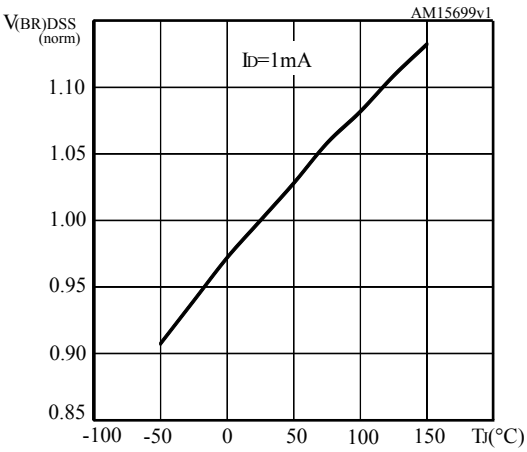


Figure 17. Typical output capacitance stored energy

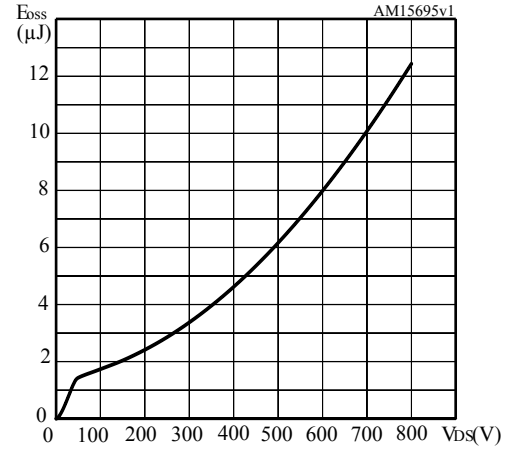


Figure 18. Typical reverse diode forward characteristics

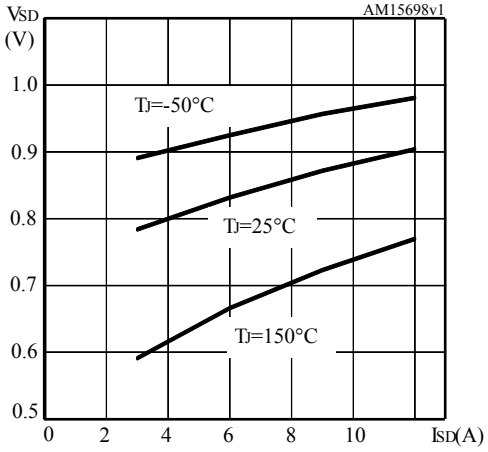
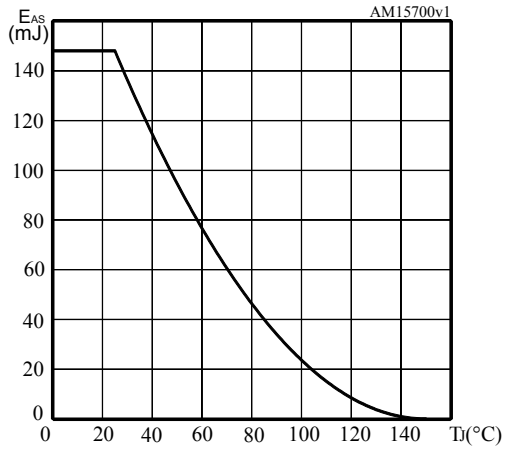


Figure 19. Maximum avalanche energy vs temperature



3 Test circuits

Figure 20. Test circuit for resistive load switching times

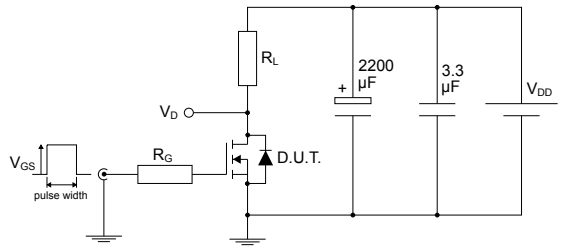


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Figure 21. Test circuit for gate charge behavior

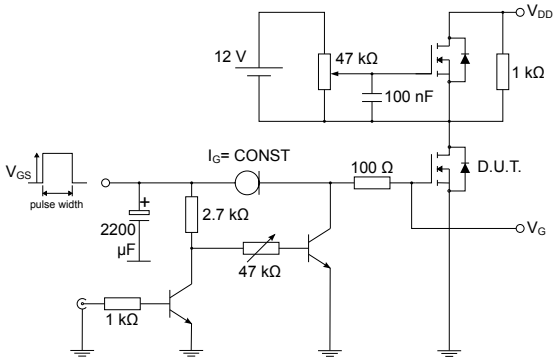

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Figure 22. Test circuit for inductive load switching and diode recovery times

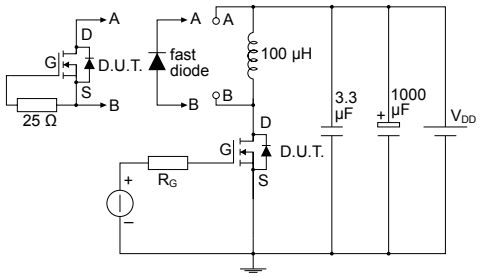

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Figure 23. Unclamped inductive load test circuit

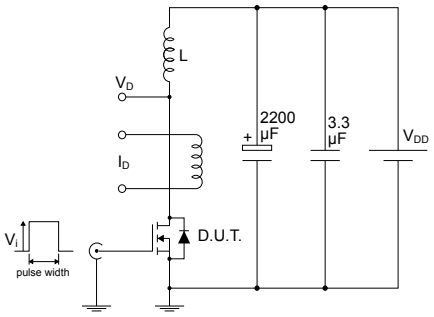

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Figure 24. Unclamped inductive waveform

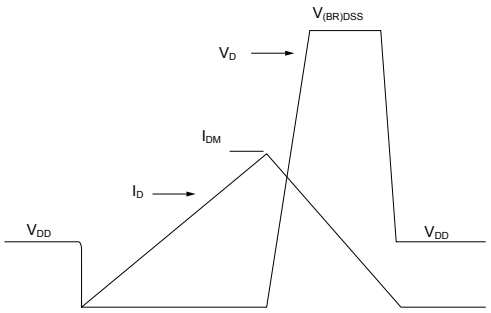

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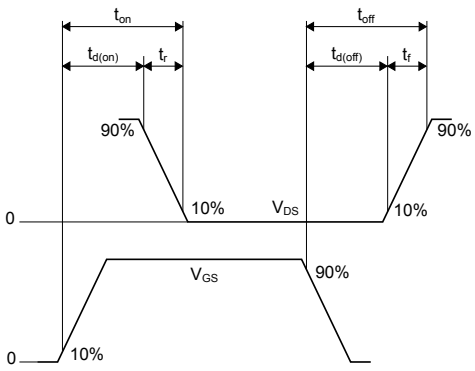
Figure 25. Switching time waveform



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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**

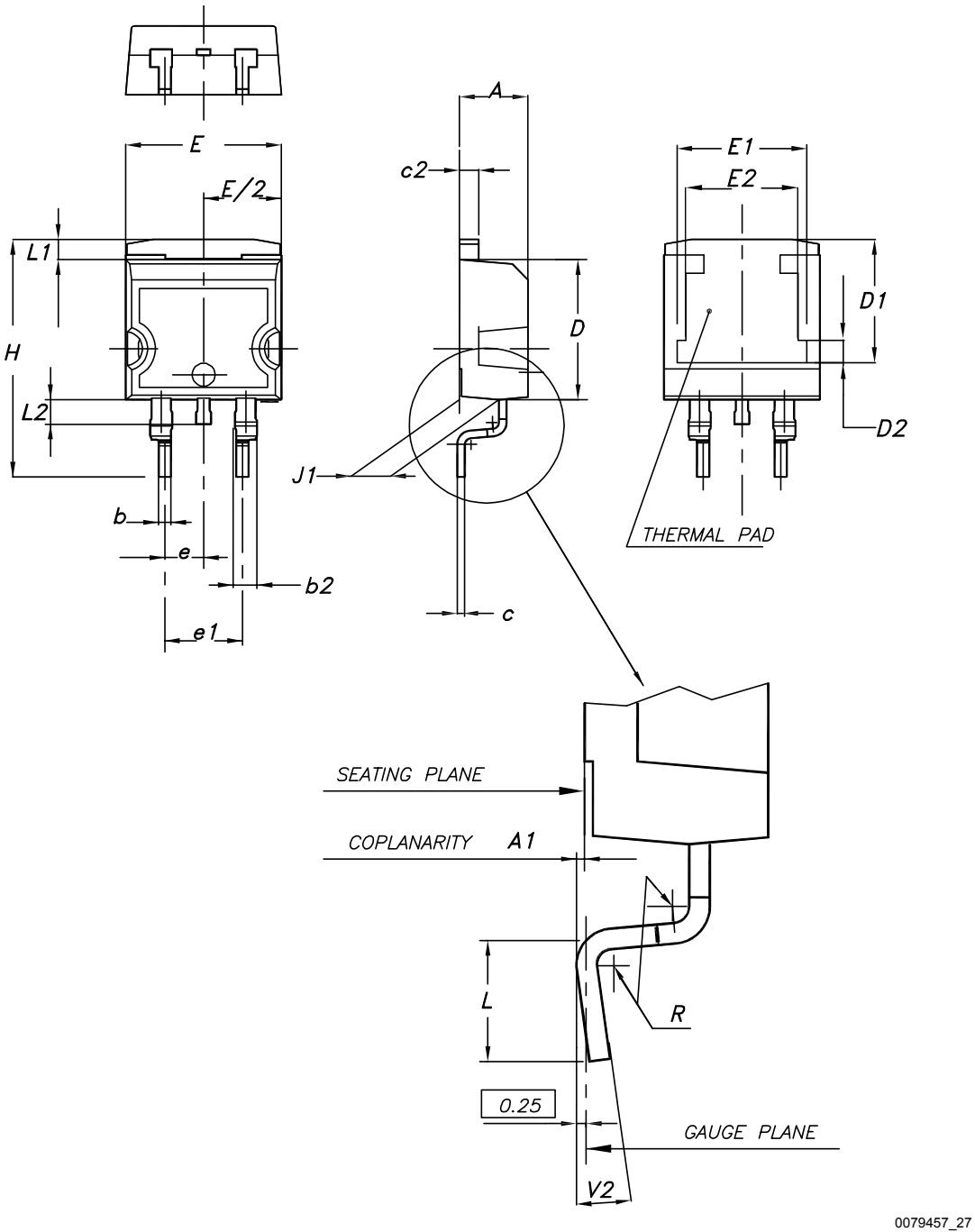
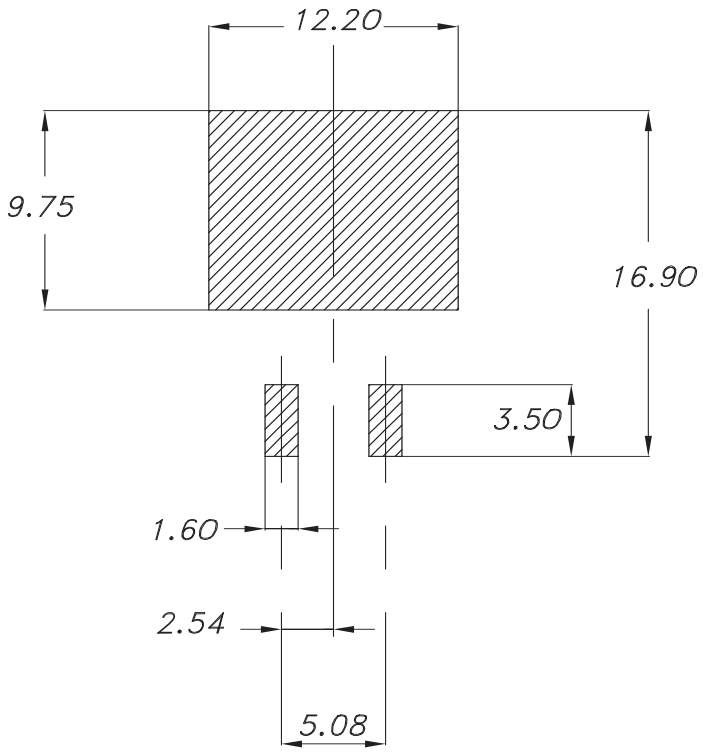


Table 8. D²PAK (TO-263) type A package mechanical data

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)**



4.2 TO-220FP type B package information

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

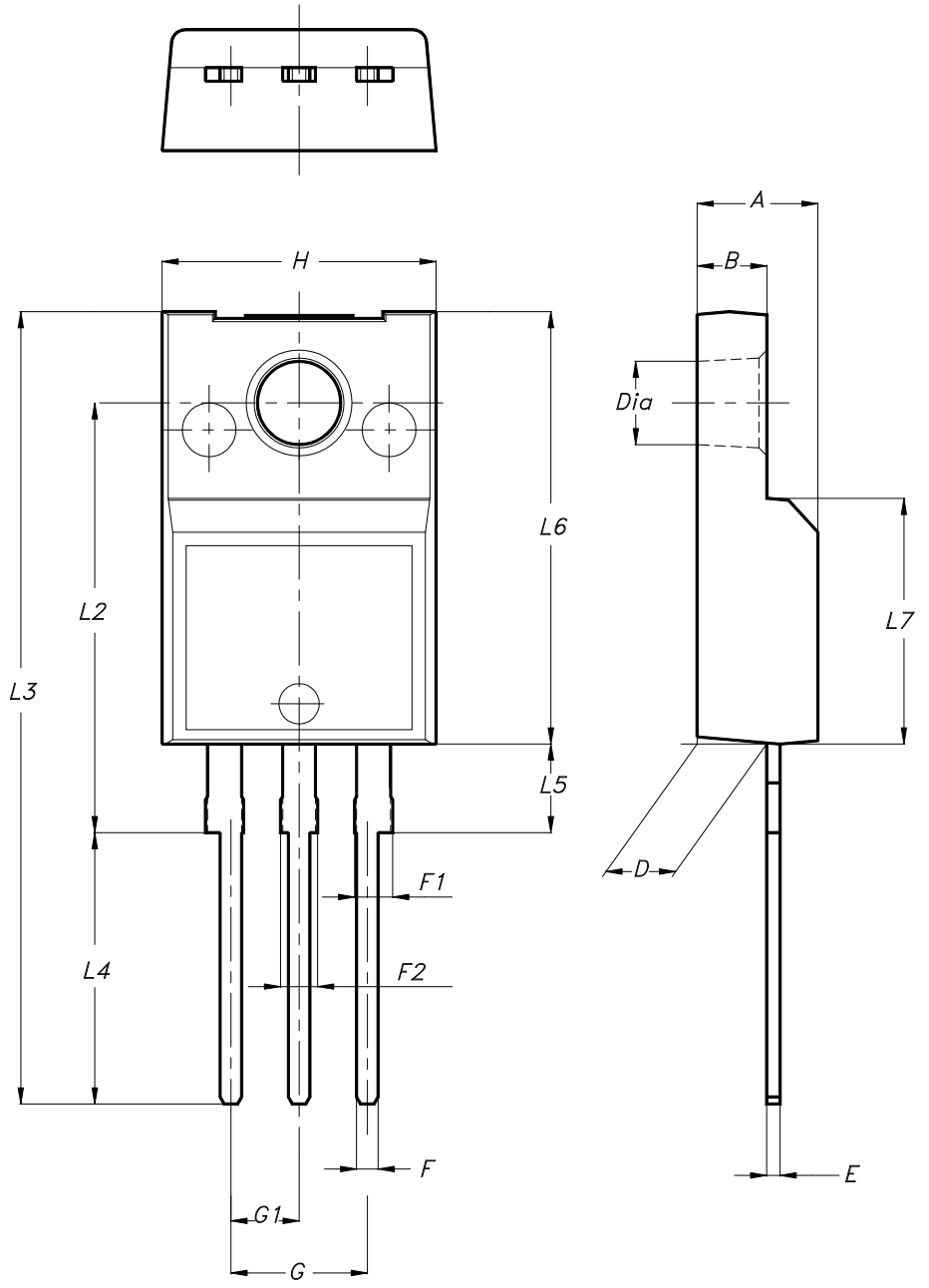


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Table 9. **TO-220FP type B package mechanical data**

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**

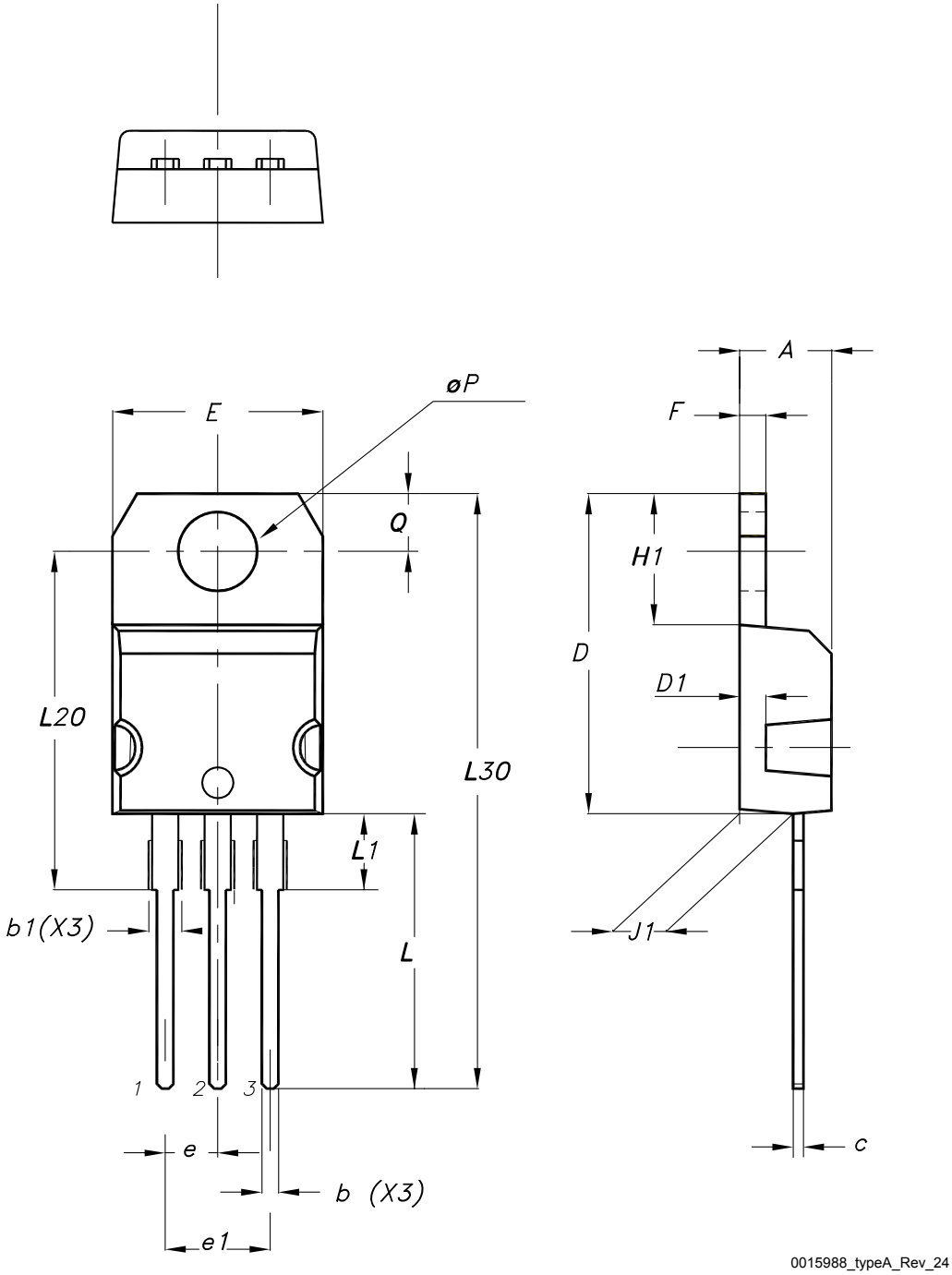

Table 10. **TO-220 type A package mechanical data**

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**

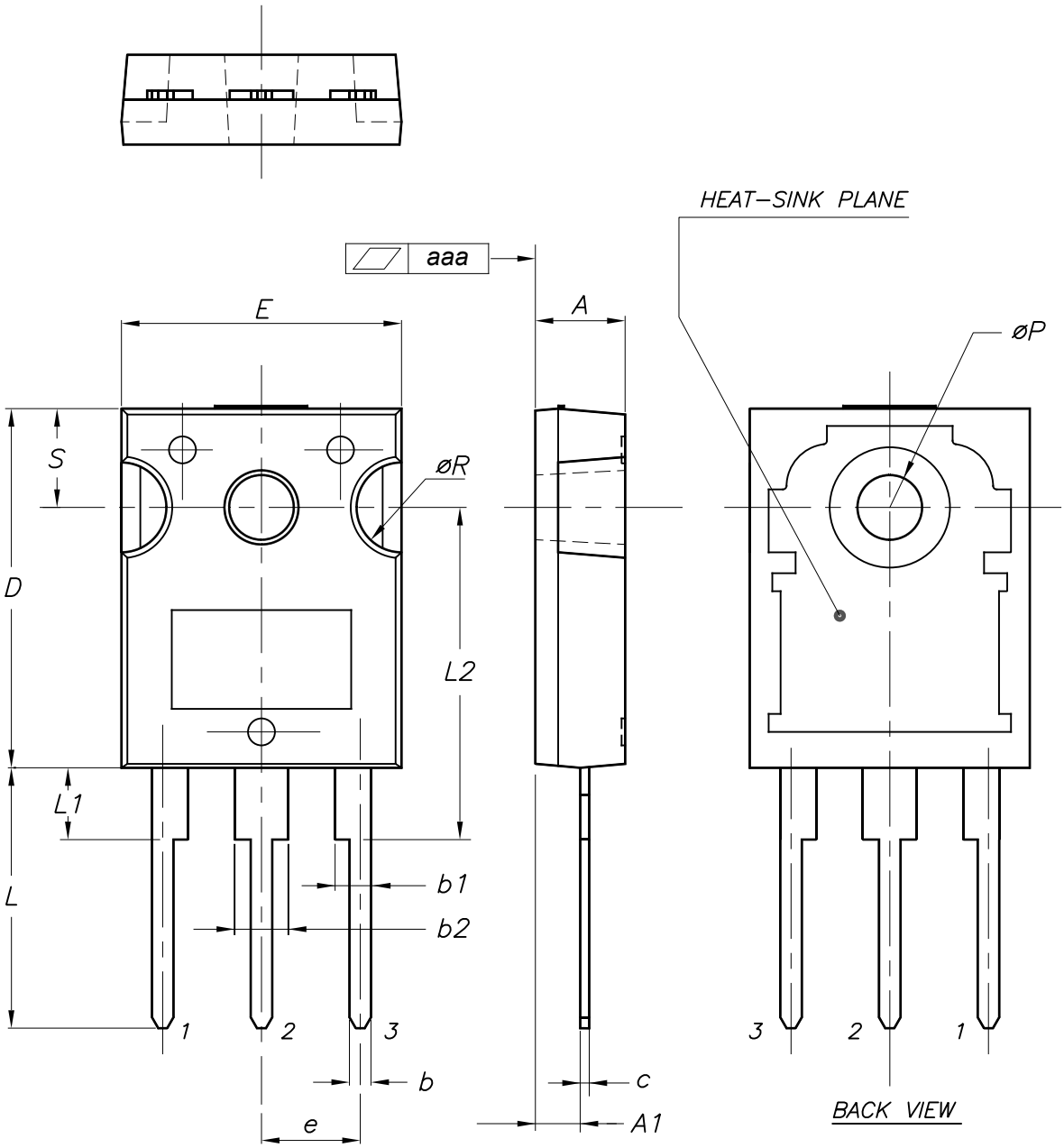

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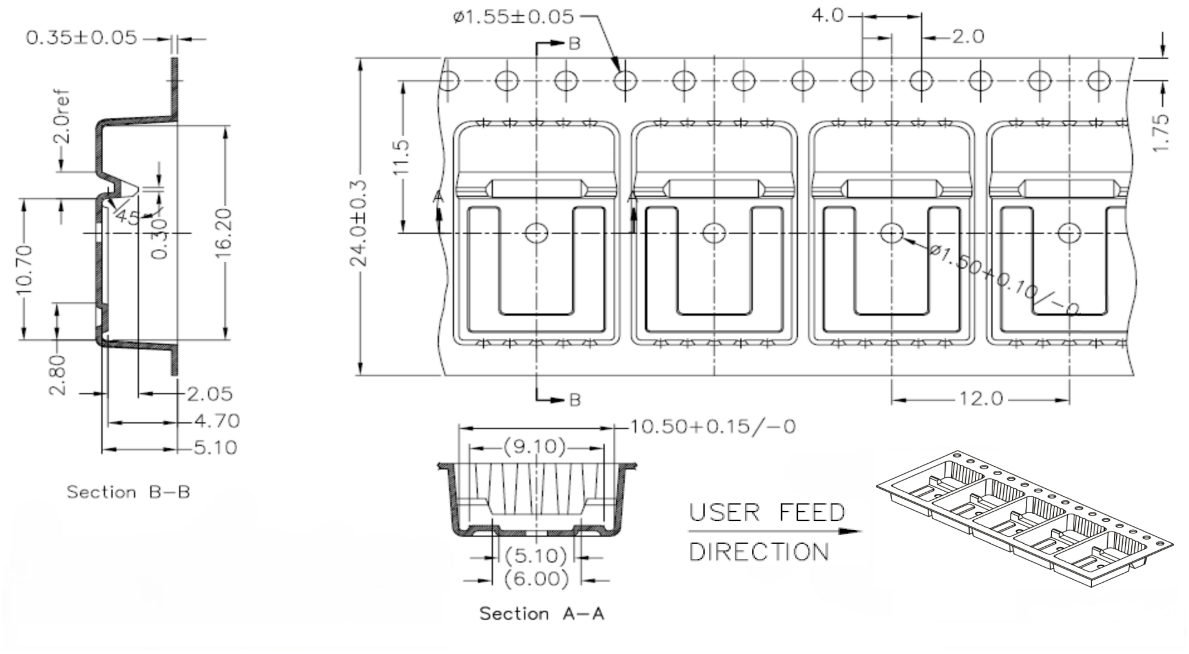
Table 11. **TO-247 package mechanical data**

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	D²PAK	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: Electrical characteristics (curves)*. Minor text changes.
27-Jun-2014	4	Added: TO-247 package. Added: *Figure 8* and *9*. Updated: *Section 4: Package mechanical data*. 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: Package information. Minor text changes.

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