

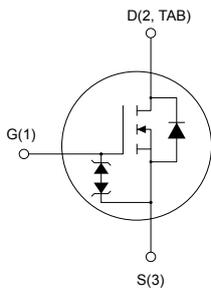
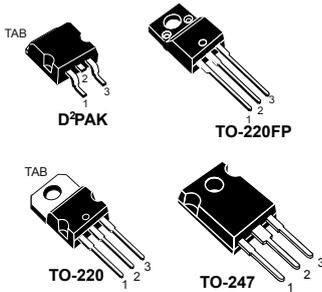


STB25N80K5, STF25N80K5 STP25N80K5, STW25N80K5

Datasheet

N-channel 800 V, 190 mΩ typ., 19.5 A MDmesh K5 Power MOSFET in a D²PAK, TO-220FP, TO-220 and TO-247 packages

Features



AM01476v1_tab

Order code	V _{DS}	R _{DS(on)} max.	I _D
STB25N80K5	800 V	260 mΩ	19.5 A
STF25N80K5			
STP25N80K5			
STW25N80K5			

- 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.



Product status links

[STB25N80K5](#)

[STF25N80K5](#)

[STP25N80K5](#)

[STW25N80K5](#)

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	19.5		A
	Drain current (continuous) at T _C = 100 °C	12.3		
I _{DM} ⁽¹⁾	Drain current (pulsed)	78		A
P _{TOT}	Total power dissipation at T _C = 25 °C	250	40	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	6		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. $I_{SD} \leq 19.5 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $V_{DS} (\text{peak}) < V_{(BR)DSS}$.

Table 2. Thermal data

Symbol	Parameter	Value				Unit
		D ² PAK	TO-247	TO-220	TO-220FP	
R _{thJC}	Thermal resistance, junction-to-case	0.5			3.1	°C/W
R _{thJA}	Thermal resistance, junction-to-ambient	30 ⁽¹⁾	50	62.5		°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.)	6.5	A
E _{AS}	Single pulse avalanche energy (starting T _J = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	200	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	$V_{GS} = 10\text{ V}$, $I_D = 10\text{ A}$	-	190	260	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	$V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	1600	-	pF
C_{oss}	Output capacitance		-	130	-	pF
C_{rss}	Reverse transfer capacitance		-	2	-	pF
$C_{o(tr)}^{(1)}$	Equivalent output capacitance time related	$V_{DS} = 0$ to 640 V , $V_{GS} = 0\text{ V}$	-	300	-	pF
$C_{o(er)}^{(2)}$	Equivalent output capacitance energy related	$V_{DS} = 0$ to 640 V , $V_{GS} = 0\text{ V}$	-	185	-	pF
R_g	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_D = 0\text{ A}$	-	4	-	Ω
Q_g	Total gate charge	$V_{DD} = 640\text{ V}$, $I_D = 19.5\text{ A}$, $V_{GS} = 0$ to 10 V	-	40	-	nC
Q_{gs}	Gate-source charge	(see the Figure 17. Test circuit for gate charge behavior)	-	10	-	nC
Q_{gd}	Gate-drain charge		-	25	-	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	$V_{DD} = 400\text{ V}$, $I_D = 10\text{ A}$,	-	25	-	ns
t_r	Rise time	$R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$	-	13	-	ns
$t_{d(off)}$	Turn-off delay time	(see the Figure 16. Test circuit for resistive load switching times and Figure 21. Switching time waveform)	-	60	-	ns
t_f	Fall time		-	-	15	-

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-	-	19.5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-	-	78	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 19.5\text{ A}$	-	-	1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 19.5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$,	-	515	-	ns
Q_{rr}	Reverse recovery charge	$V_{DD} = 60\text{ V}$	-	11	-	μC
I_{RRM}	Reverse recovery current	(see the Figure 18. Test circuit for inductive load switching and diode recovery times)	-	43.2	-	A
t_{rr}	Reverse recovery time	$I_{SD} = 19.5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$,	-	615	-	ns
Q_{rr}	Reverse recovery charge	$V_{DD} = 60\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$	-	13	-	μC
I_{RRM}	Reverse recovery current	(see the Figure 18. Test circuit for inductive load switching and diode recovery times)	-	43	-	A

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

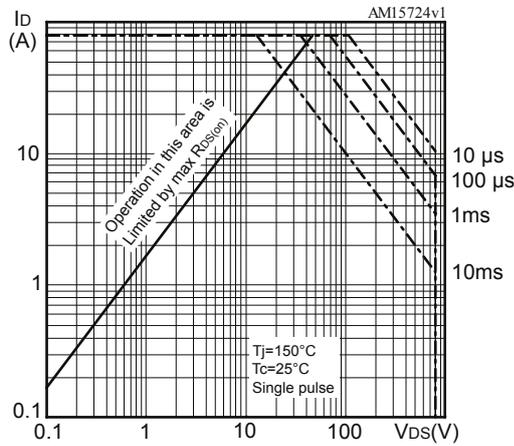
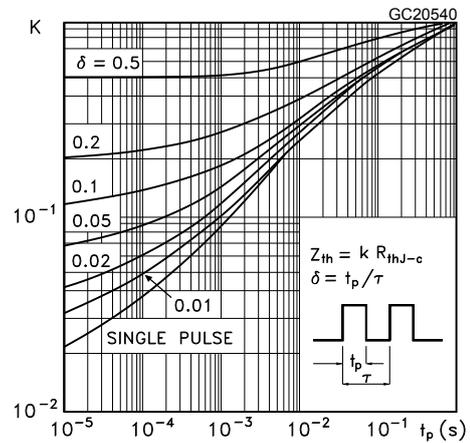
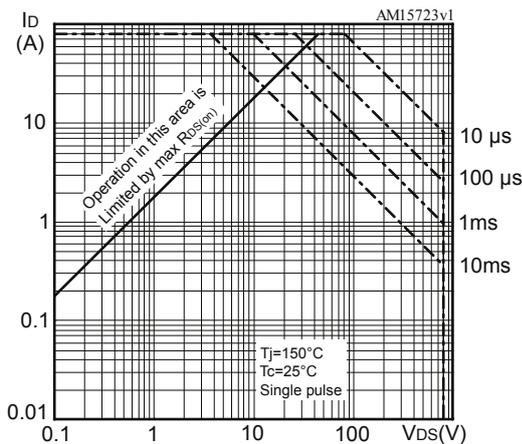
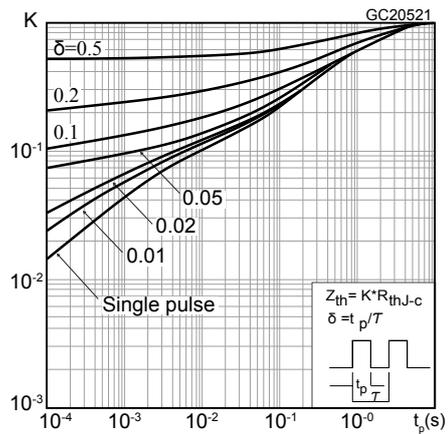
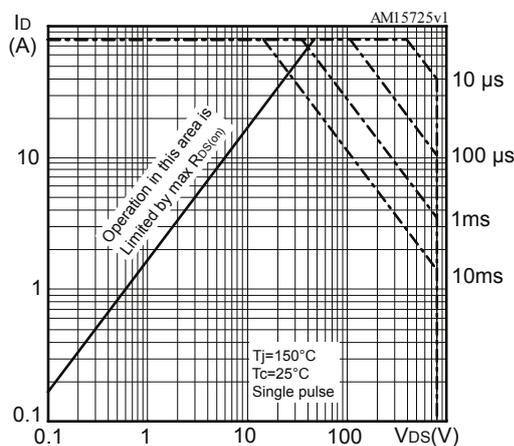
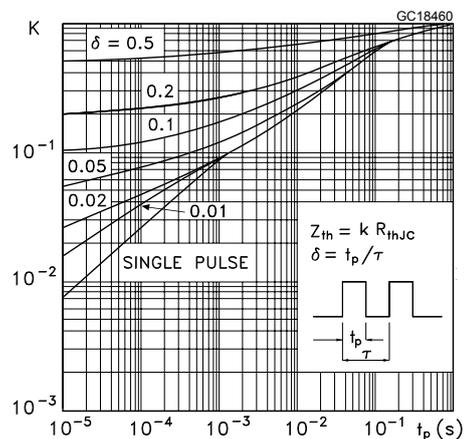
2.1 Electrical characteristics (curves)
Figure 1. Safe operating area for D²PAK and TO-220

Figure 2. Normalized transient thermal impedance for D²PAK and TO-220

Figure 3. Safe operating area for TO-220FP

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

Figure 5. Safe operating area for TO-247

Figure 6. Normalized transient thermal impedance for TO-247


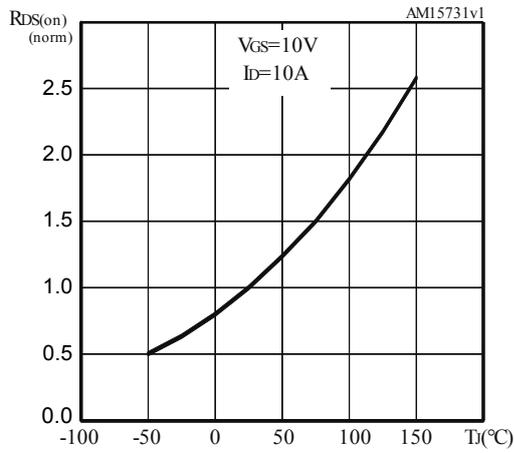
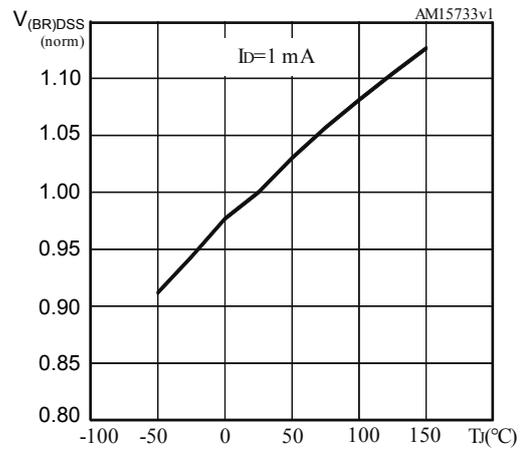
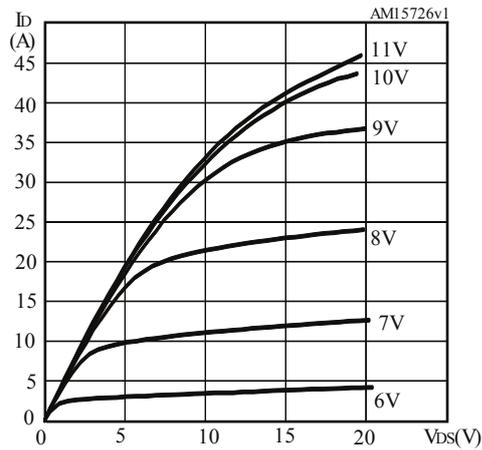
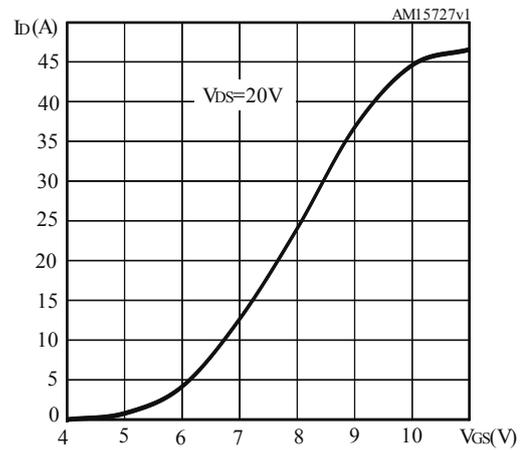
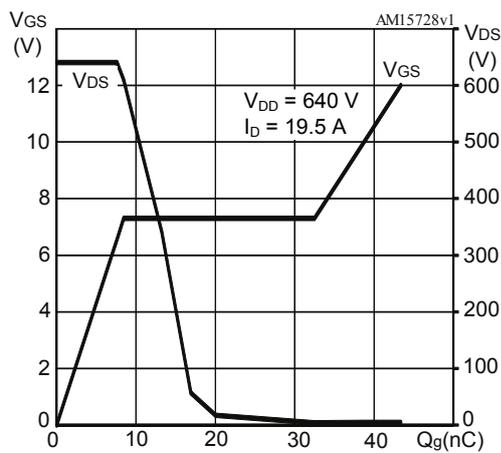
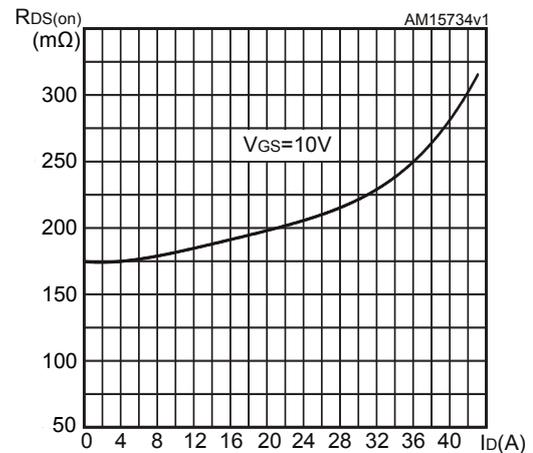
Figure 7. Normalized on-resistance vs temperature

Figure 8. Normalized breakdown voltage vs temperature

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

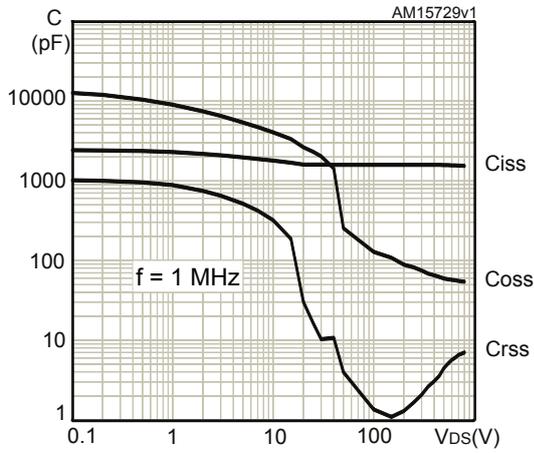


Figure 14. Typical output capacitance stored energy

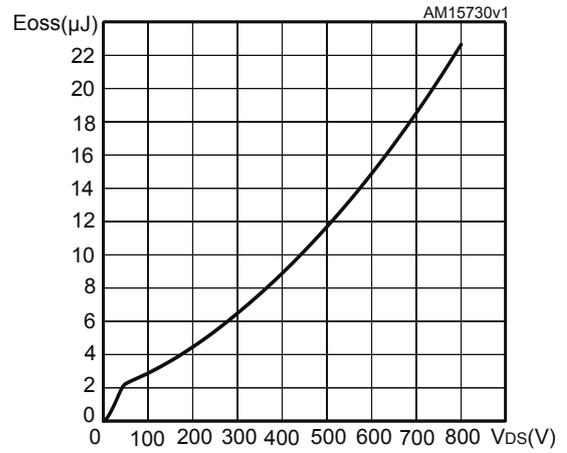
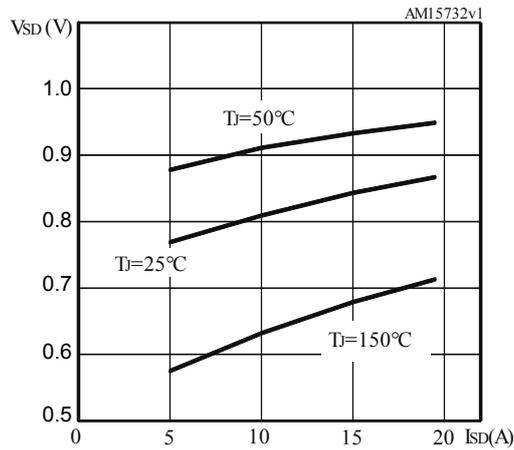
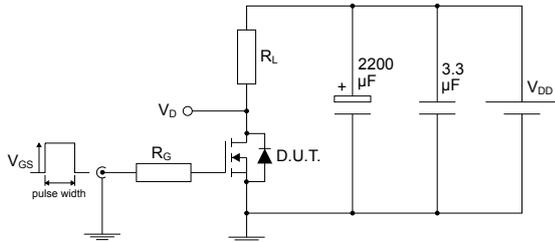


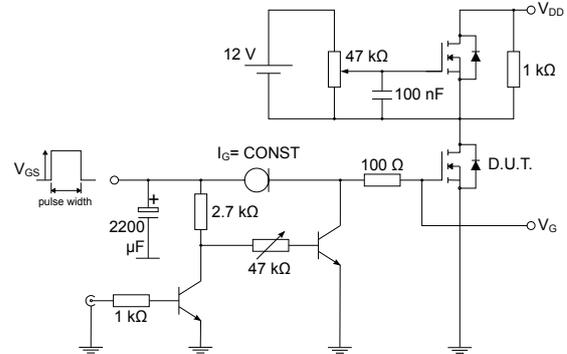
Figure 15. Typical reverse diode forward characteristics



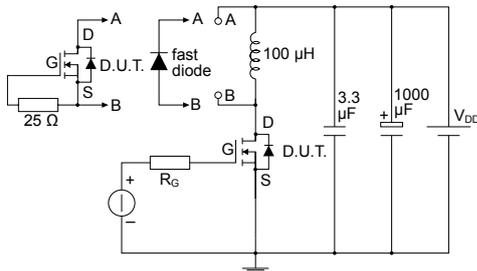
3 Test circuits

Figure 16. Test circuit for resistive load switching times


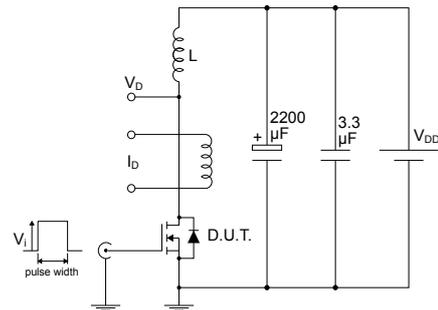
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Figure 17. Test circuit for gate charge behavior


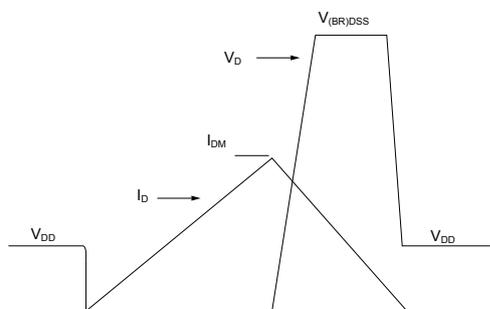
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Figure 18. Test circuit for inductive load switching and diode recovery times


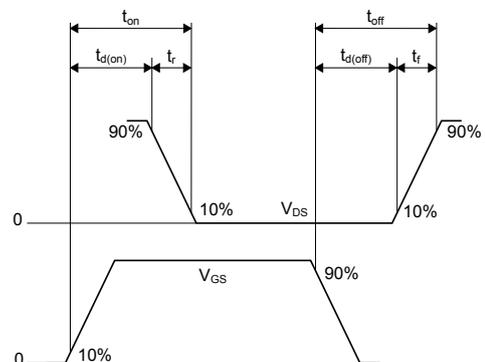
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Figure 19. Unclamped inductive load test circuit


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Figure 20. Unclamped inductive waveform


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Figure 21. Switching time waveform


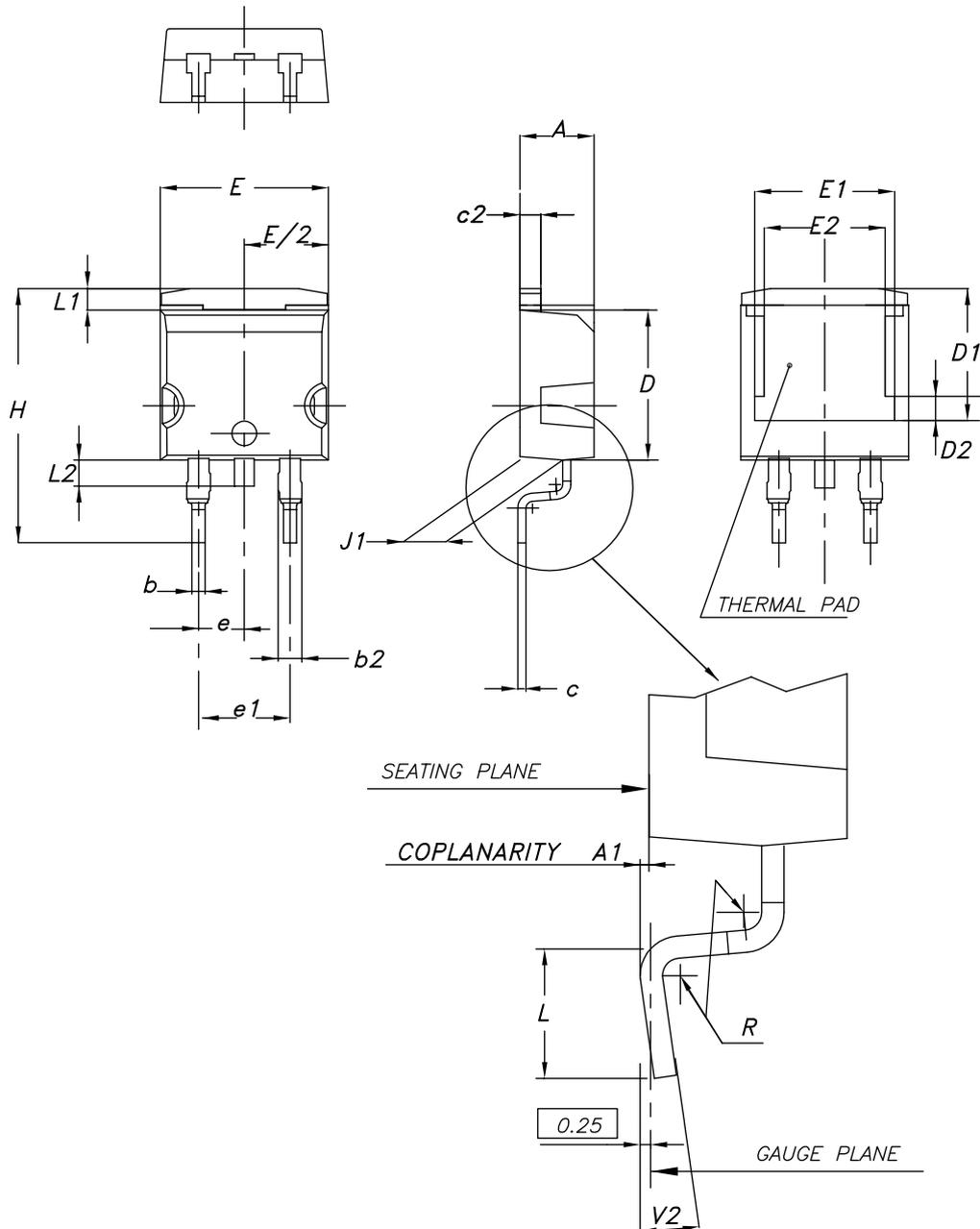
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4 Package information

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 A2 package information

Figure 22. D²PAK (TO-263) type A2 package outline

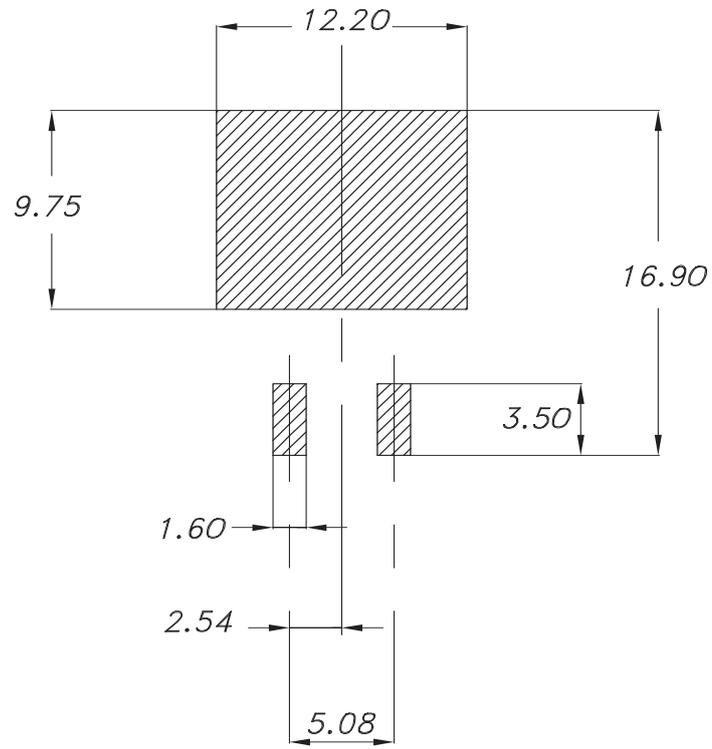


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Table 8. D²PAK (TO-263) type A2 package mechanical data

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	8.70	8.90	9.10
E2	7.30	7.50	7.70
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°

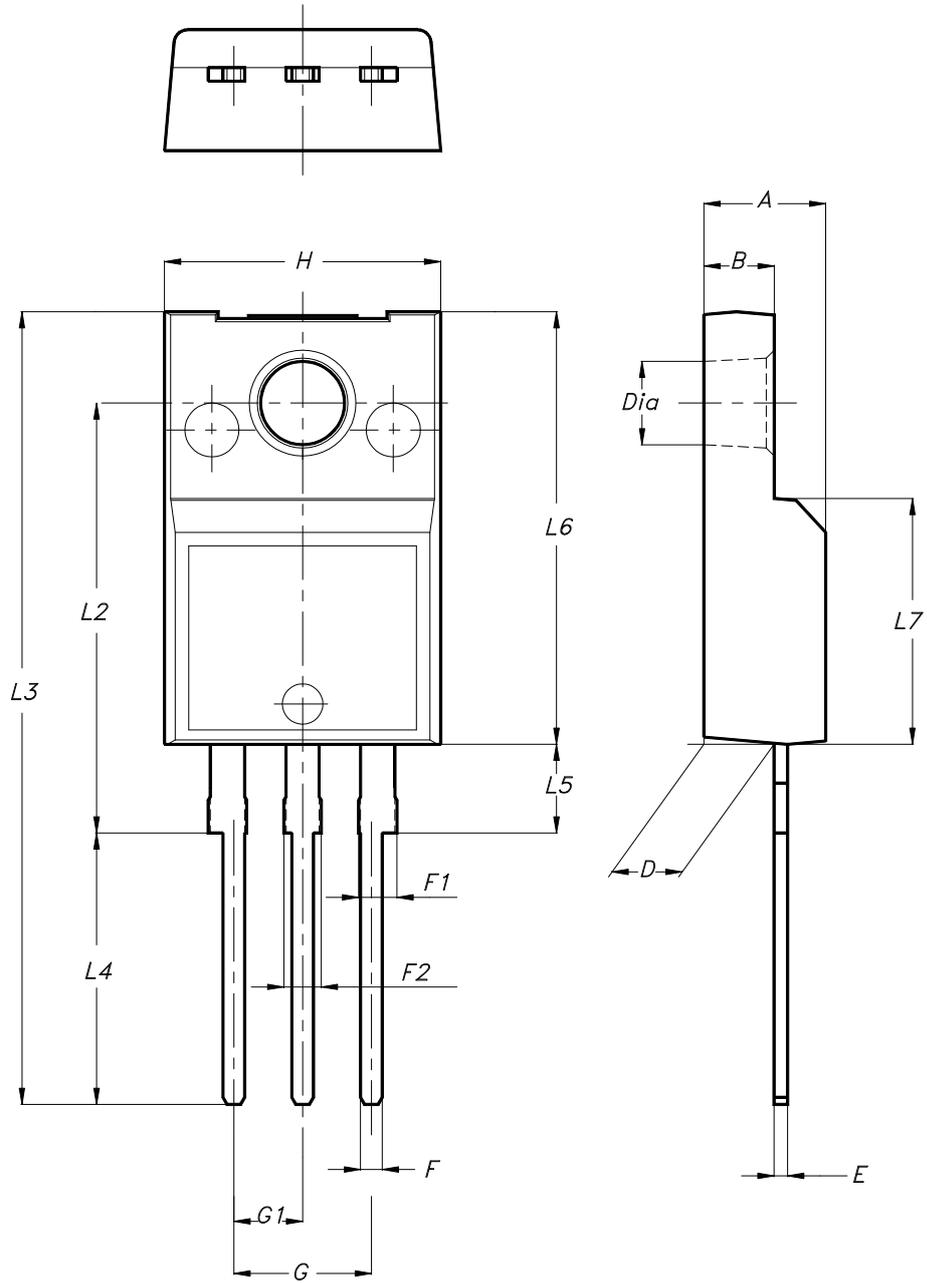
Figure 23. D²PAK (TO-263) recommended footprint (dimensions are in mm)



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4.2 TO-220FP type B package information

Figure 24. TO-220FP type B package outline



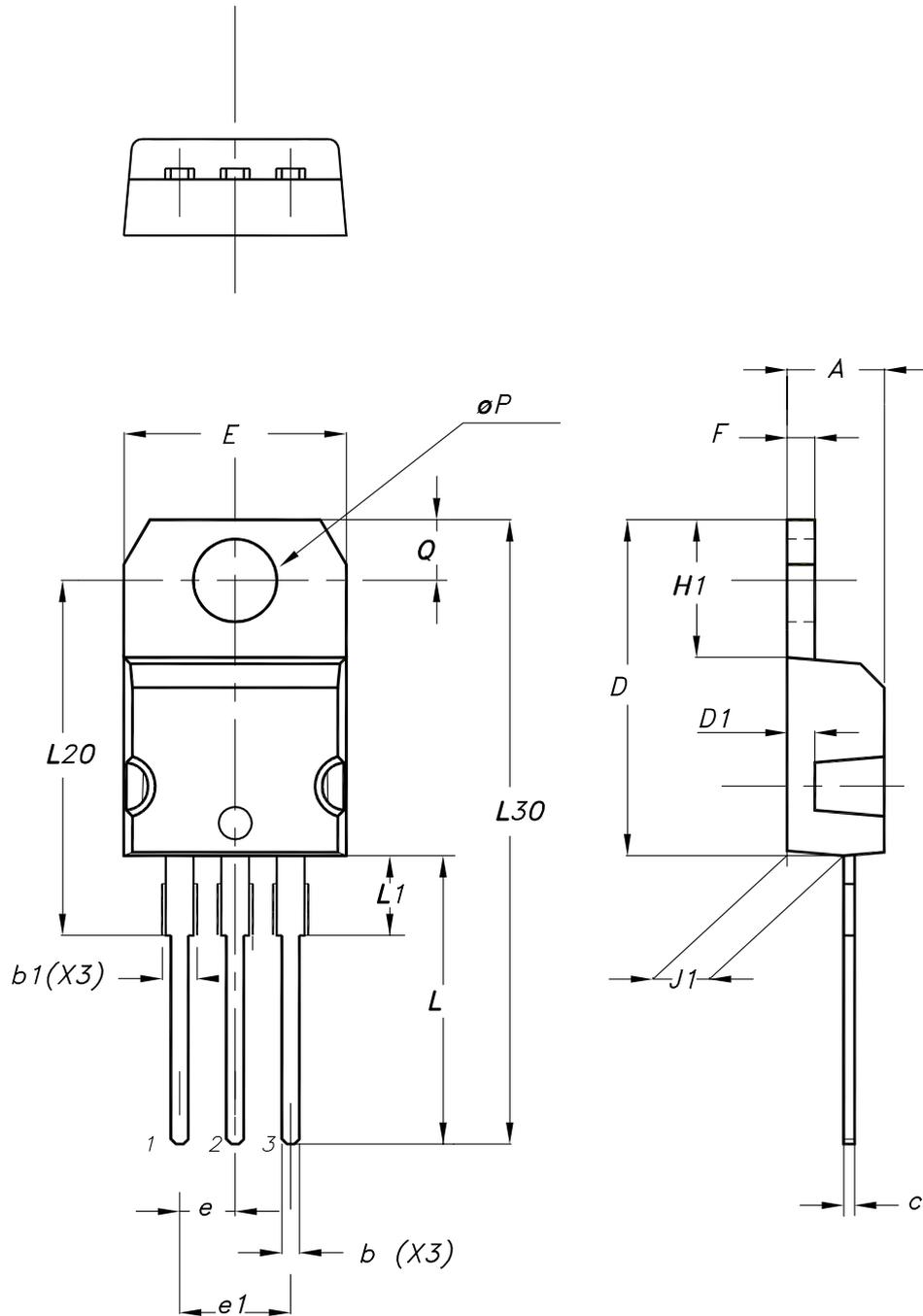
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Table 9. TO-220FP type B package mechanical data

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 25. TO-220 type A package outline



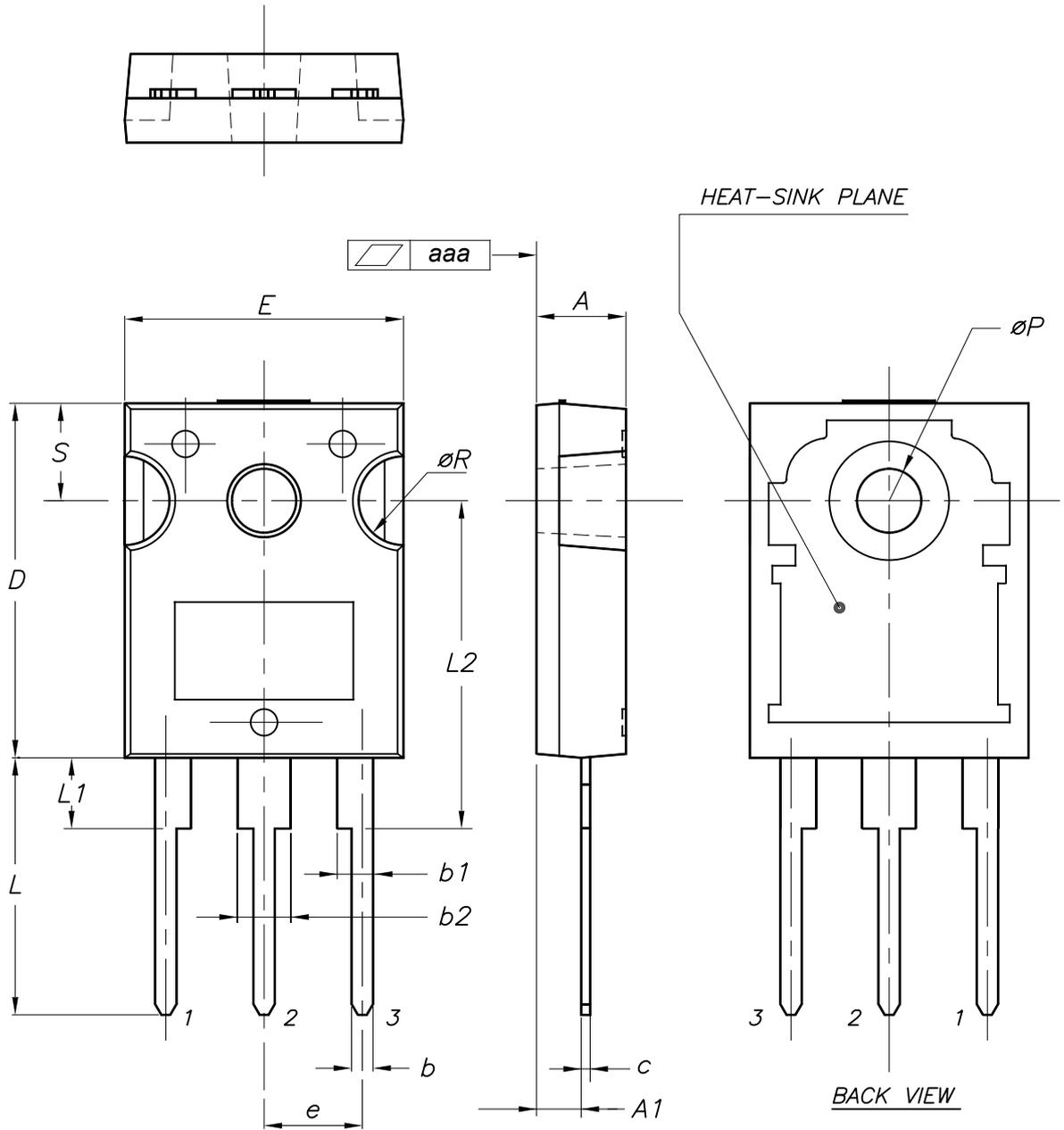
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Table 10. TO-220 type A package mechanical data

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 26. TO-247 package outline



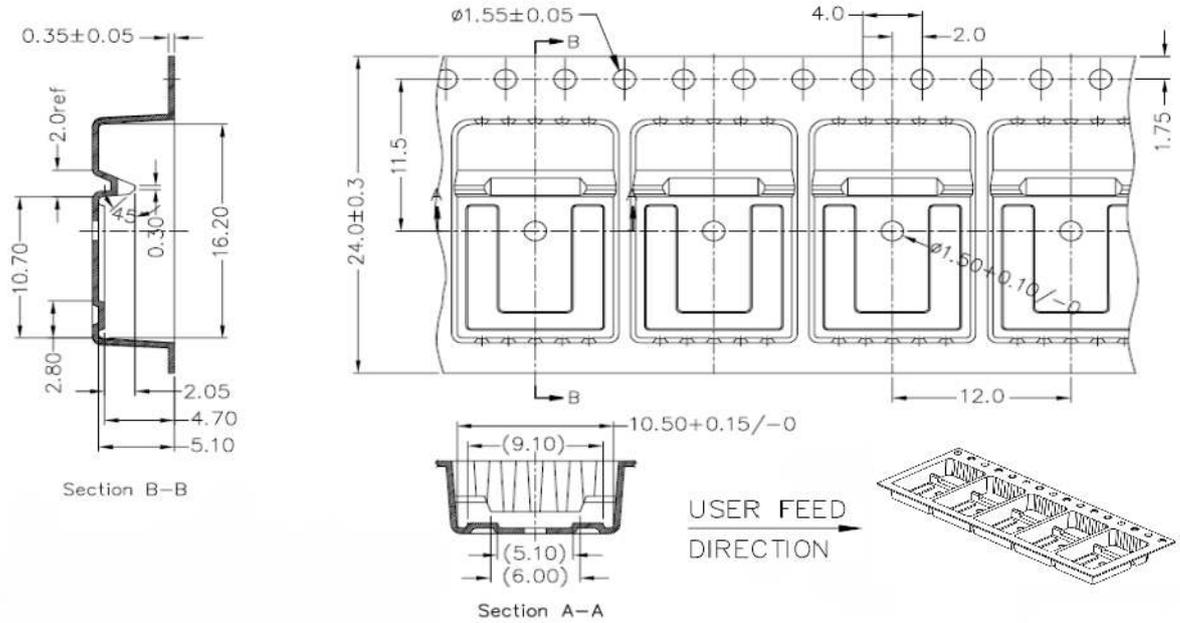
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Table 11. TO-247 package mechanical data

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 27. D²PAK tape drawing (dimensions are in mm)



DM01095771_2



5 Ordering information

Table 12. Order codes

Order codes	Marking	Package	Packing
STB25N80K5	25N80K5	D ² PAK	Tape and reel
STF25N80K5		TO-220FP	Tube
STP25N80K5		TO-220	
STW25N80K5		TO-247	

Revision history

Table 13. Document revision history

Date	Revision	Changes
17-Jul-2012	1	First release.
04-Jun-2013	2	Modified: I_{AR} , E_{AS} , dv/dt on <i>Table 2</i> , $R_{DS(on)}$ value on <i>Table 4</i> , entire values on <i>Table 5</i> , <i>6</i> and <i>7</i> . Updated: <i>Section 4: Package mechanical data</i> . Minor text changes. Updated: <i>Table 11</i> and <i>Figure 27</i> . Document status promoted from preliminary data to production data.
31-Oct-2014	3	Updated title, description and features in cover page. Updated <i>Figure 12: Static drain-source on-resistance</i> . Updated <i>Section 4.1: STB25N80K5, D²PAK</i> and <i>Section 4.4: STW25N80K5, TO-247</i> . Minor text change
05-Nov-2025	4	Updated <i>Section 4: Package information</i> . Minor text changes.



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