STB26NM60N, STP26NM60N

N-channel 600 V, 0.135 Ω typ., 20 A MDmesh™ II Power MOSFETs in D²PAK and TO-220 packages

Datasheet - production data

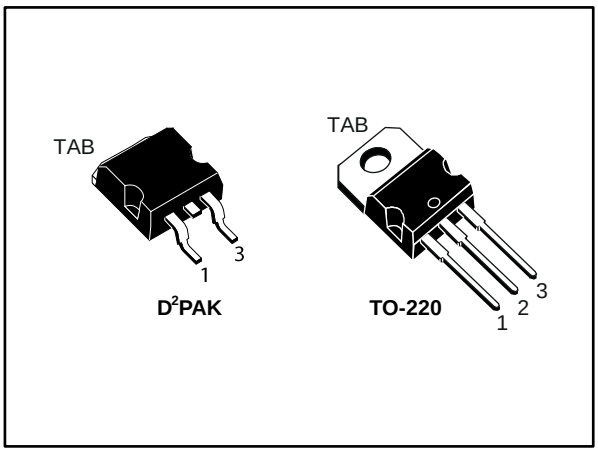
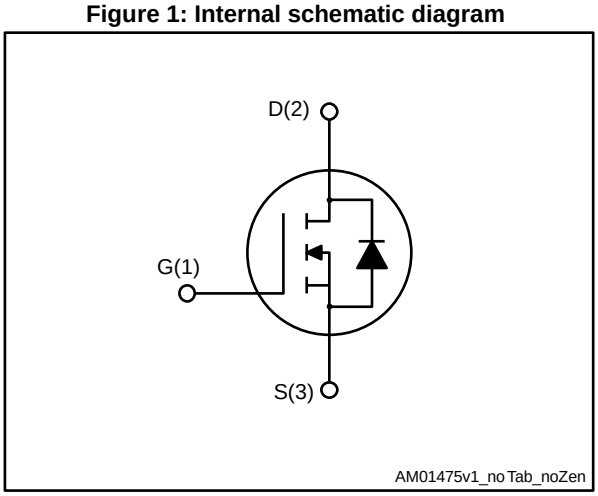


Figure 1: Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max	I_D
STB26NM60N	600 V	0.165 Ω	20 A
STP26NM60N			

- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance

Applications

- Switching applications

Description

These devices are N-channel Power MOSFETs developed using the second generation of MDmesh™ technology. This revolutionary Power MOSFET associates a vertical structure to the company's strip layout to yield one of the world's lowest on-resistance and gate charge. It is therefore suitable for the most demanding high efficiency converters.

Table 1: Device summary

Order code	Marking	Package	Packaging
STB26NM60N	26NM60N	D²PAK	Tape and reel
STP26NM60N		TO-220	Tube

Contents

1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	600	V
V_{GS}	Gate-source voltage	±30	V
I_D	Drain current (continuous) at T_C = 25 °C	20	A
I_D	Drain current (continuous) at T_C = 100 °C	12.6	A
I_{DM} (1)	Drain current (pulsed)	80	A
P_{TOT}	Total dissipation at T_C = 25 °C	140	W
dv/dt (2)	Peak diode recovery voltage slope	15	V/ns
T_{stg}	Storage temperature range	-55 to 150	°C
T_j	Operating junction temperature range		

Notes:

(1)Pulse width limited by safe operating area.

(2)I_{SD} ≤ 20 A, di/dt ≤ 400 A/µs, $V_{DS(peak)}$ ≤ $V_{(BR)DSS}$, V_{DD} = 80% $V_{(BR)DSS}$

Table 3: Thermal data

Symbol	Parameter	Value		Unit
		D²PAK	TO-220	
$R_{thj\text{-}case}$	Thermal resistance junction-case	0.89		°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient		62.5	°C/W
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb	30		°C/W

Notes:

(1)When mounted on FR-4 board of 1inch², 2oz Cu, t < 10 s.

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AS}	Single pulse avalanche current (pulse width limited by T_{jmax})	6	A
E_{AS}	Single pulse avalanche energy (starting T_J=25 °C, I_D=I_{AS}, V_{DD}=50 V)	610	mJ

2 Electrical characteristics

(T_{CASE} = 25 °C unless otherwise specified)

Table 5: 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	600			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 600 V			1	µA
		V_{GS} = 0 V, V_{DS} = 600 V, T_C= 125 °C (1)			100	
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = ±25 V			±0.1	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 10 A		0.135	0.165	Ω

Notes:

(1)Defined by design, not subject to production test.

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 50 V, f = 1 MHz, V_{GS} = 0 V	-	1800	-	pF
C_{oss}	Output capacitance		-	115	-	pF
C_{rss}	Reverse transfer capacitance		-	6	-	pF
$C_{oss\ eq.}$ (1)	Equivalent output capacitance	V_{GS} = 0 V, V_{DS} = 0 to 480 V	-	310	-	pF
Q_g	Total gate charge	V_{DD} = 480 V, I_D = 20 A, V_{GS} = 10 V (see *Figure 14: "Test circuit for gate charge behavior"*)	-	60	-	nC
Q_{gs}	Gate-source charge		-	8.5	-	nC
Q_{gd}	Gate-drain charge		-	30	-	nC
R_G	Gate input resistance	f=1 MHz, I_D=0 A	-	2.8	-	Ω

Notes:

(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_{DS}

Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 300 V, I_D = 10 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 13: "Test circuit for resistive load switching times"* and *Figure 18: "Switching time waveform"*)	-	13	-	ns
t_r	Rise time		-	25	-	ns
$t_{d(off)}$	Turn-off delay time		-	85	-	ns
t_f	Fall time		-	50	-	ns

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		20	A
I_{SDM}(1)	Source-drain current (pulsed)		-		80	A
V_{SD}(2)	Forward on voltage	I_{SD} = 20 A, V_{GS} = 0	-		1.5	V
t_{rr}	Reverse recovery time	I_{SD} = 20 A, di/dt = 100 A/µs V_{DD} = 60 V (see *Figure 15: "Test circuit for inductive load switching and diode recovery times"*)	-	370		ns
Q_{rr}	Reverse recovery charge		-	5.8		µC
I_{RRM}	Reverse recovery current		-	31.6		A
t_{rr}	Reverse recovery time	I_{SD} = 20 A, di/dt = 100 A/µs V_{DD} = 60 V, T_j = 150 °C (see *Figure 15: "Test circuit for inductive load switching and diode recovery times"*)	-	450		ns
Q_{rr}	Reverse recovery charge		-	7.5		µC
I_{RRM}	Reverse recovery current		-	32.5		A

Notes:

(1)Pulse width limited by safe operating area.

(2)Pulsed: pulse duration = 300 µs, duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

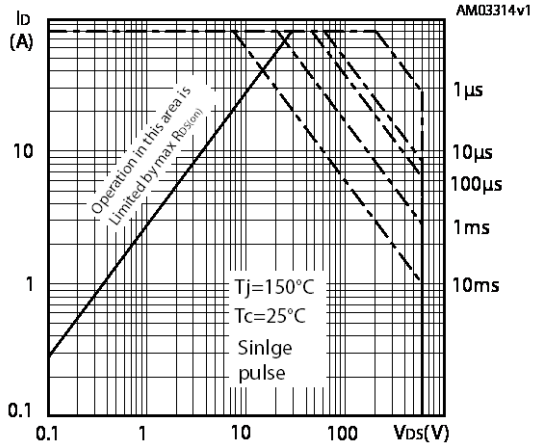


Figure 3: Thermal impedance

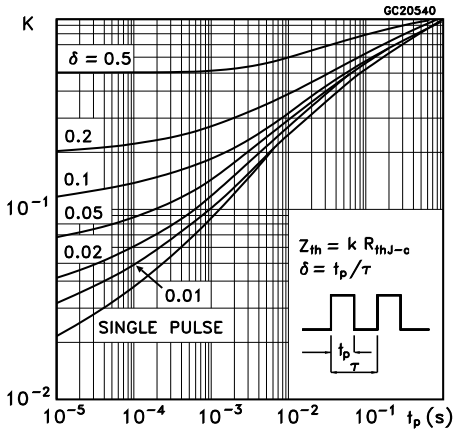


Figure 4: Output characteristics

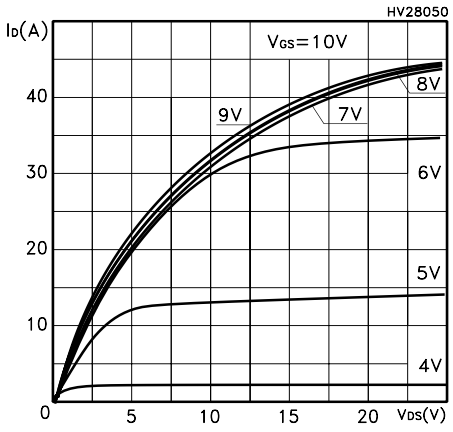


Figure 5: Transfer characteristics

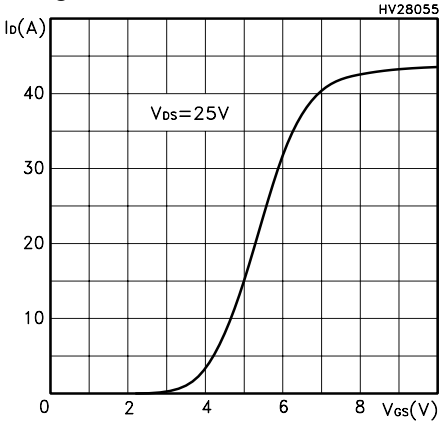


Figure 6: Gate charge vs gate-source voltage

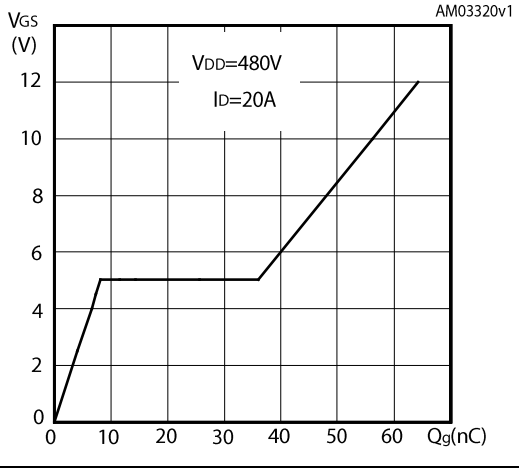


Figure 7: Static drain-source on-resistance

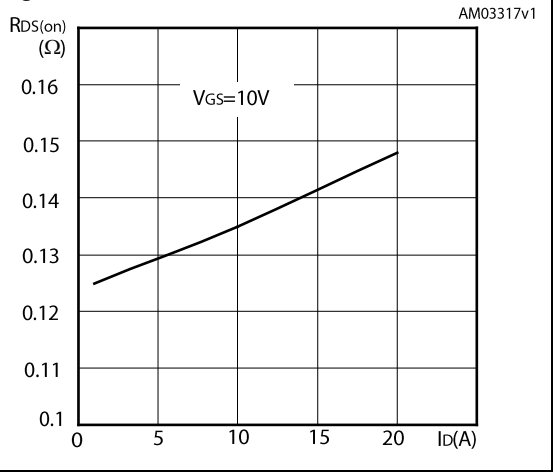


Figure 8: Capacitance variations

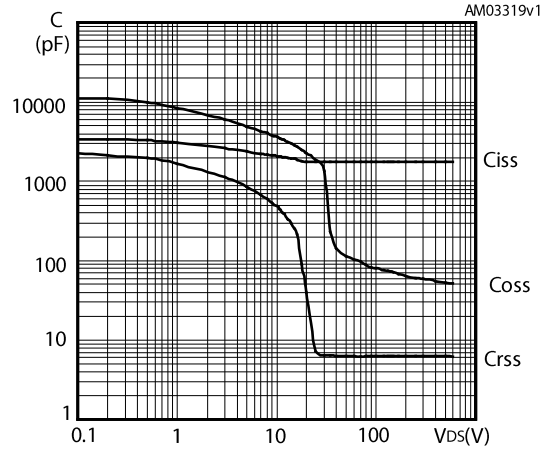


Figure 9: Source-drain diode forward characteristics

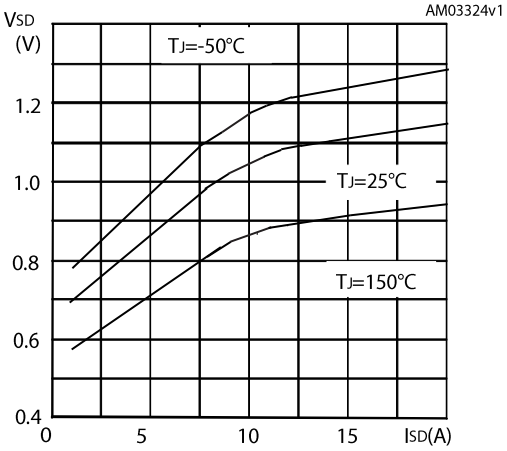


Figure 10: Normalized gate threshold voltage vs temperature

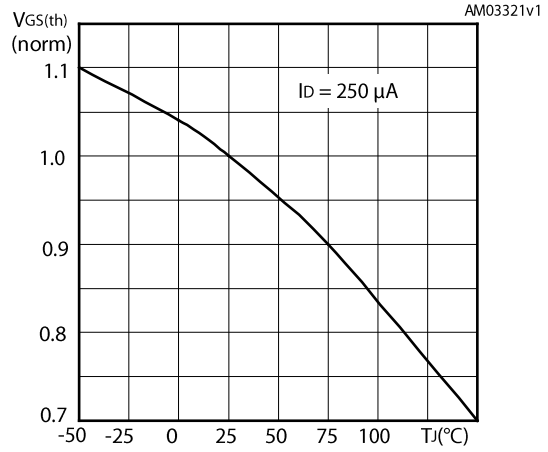


Figure 11: Normalized on-resistance vs temperature

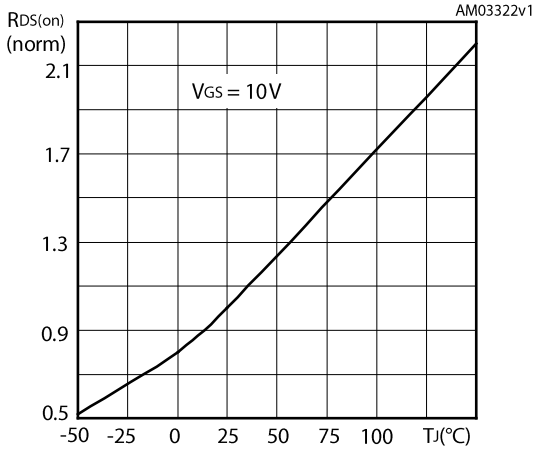
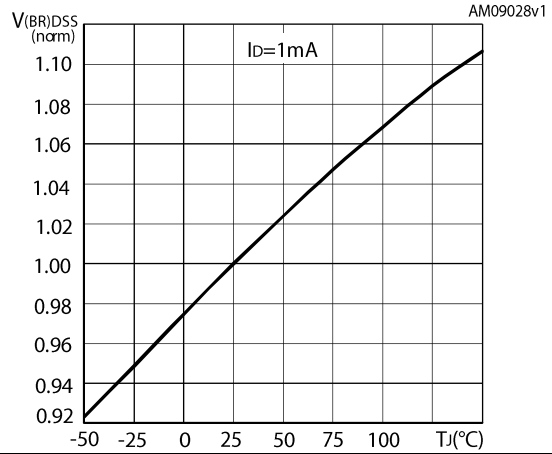


Figure 12: Normalized $V_{(BR)DSS}$ vs temperature



3 Test circuits

Figure 13: Test circuit for resistive load switching times

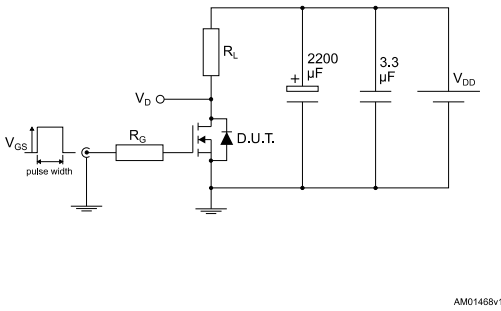


Figure 14: Test circuit for gate charge behavior

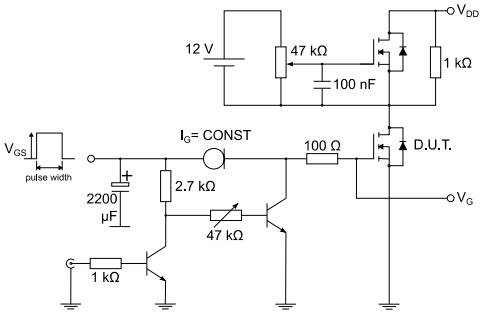


Figure 15: Test circuit for inductive load switching and diode recovery times

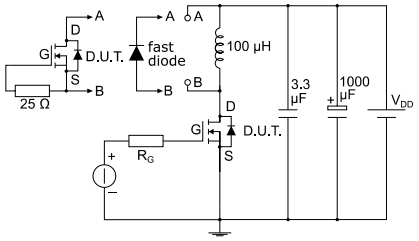


Figure 16: Unclamped inductive load test circuit

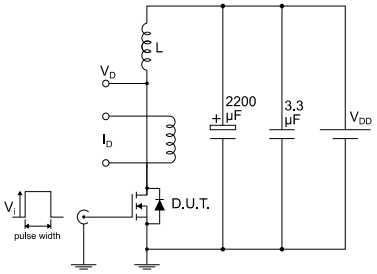


Figure 17: Unclamped inductive waveform

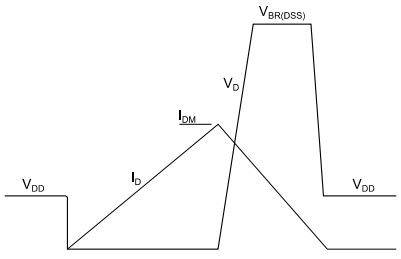
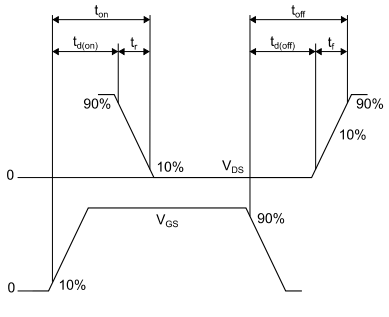


Figure 18: Switching time waveform



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 D2PAK (TO-263) type A package information

Figure 19: D²PAK (TO-263) type A package outline

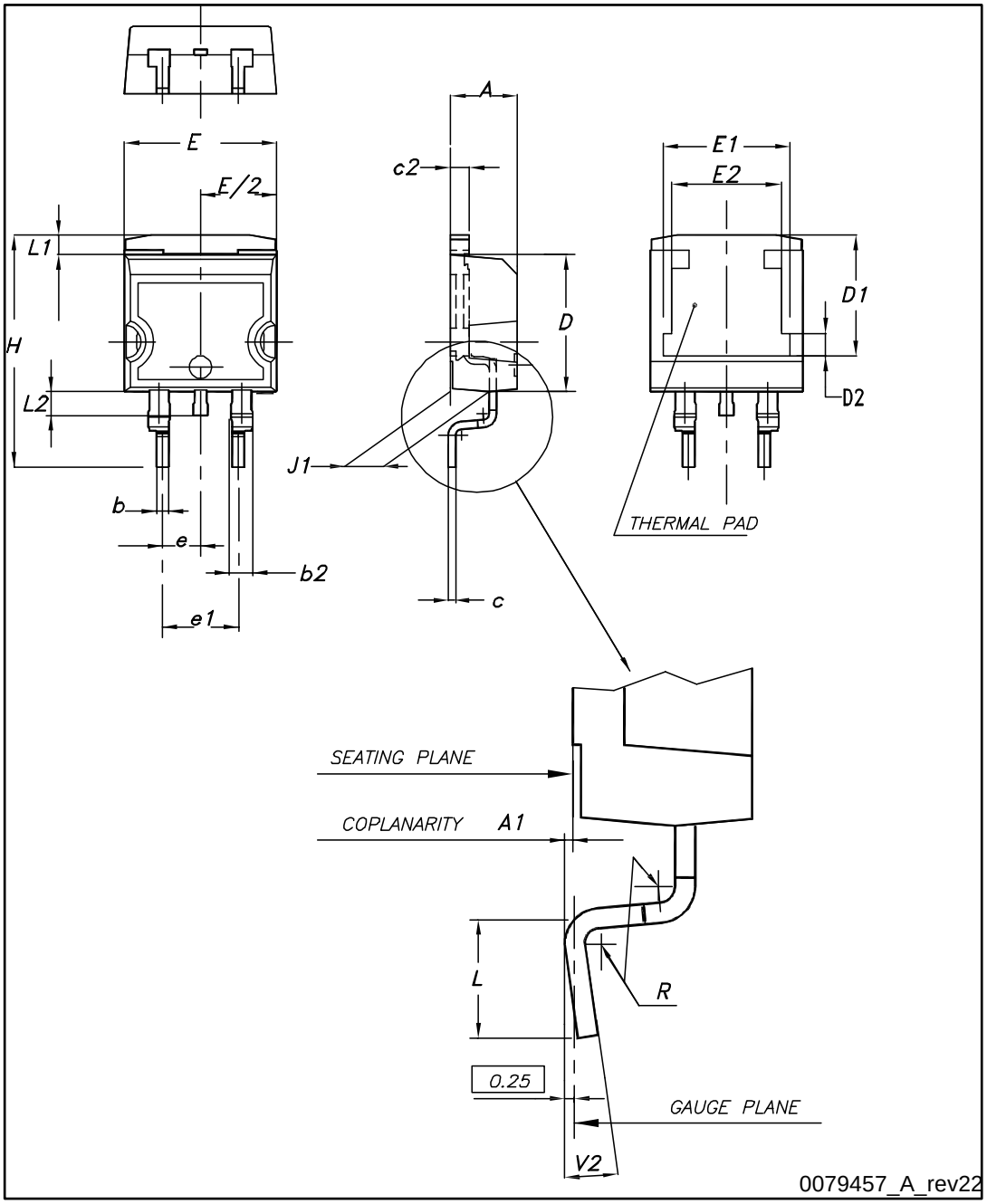
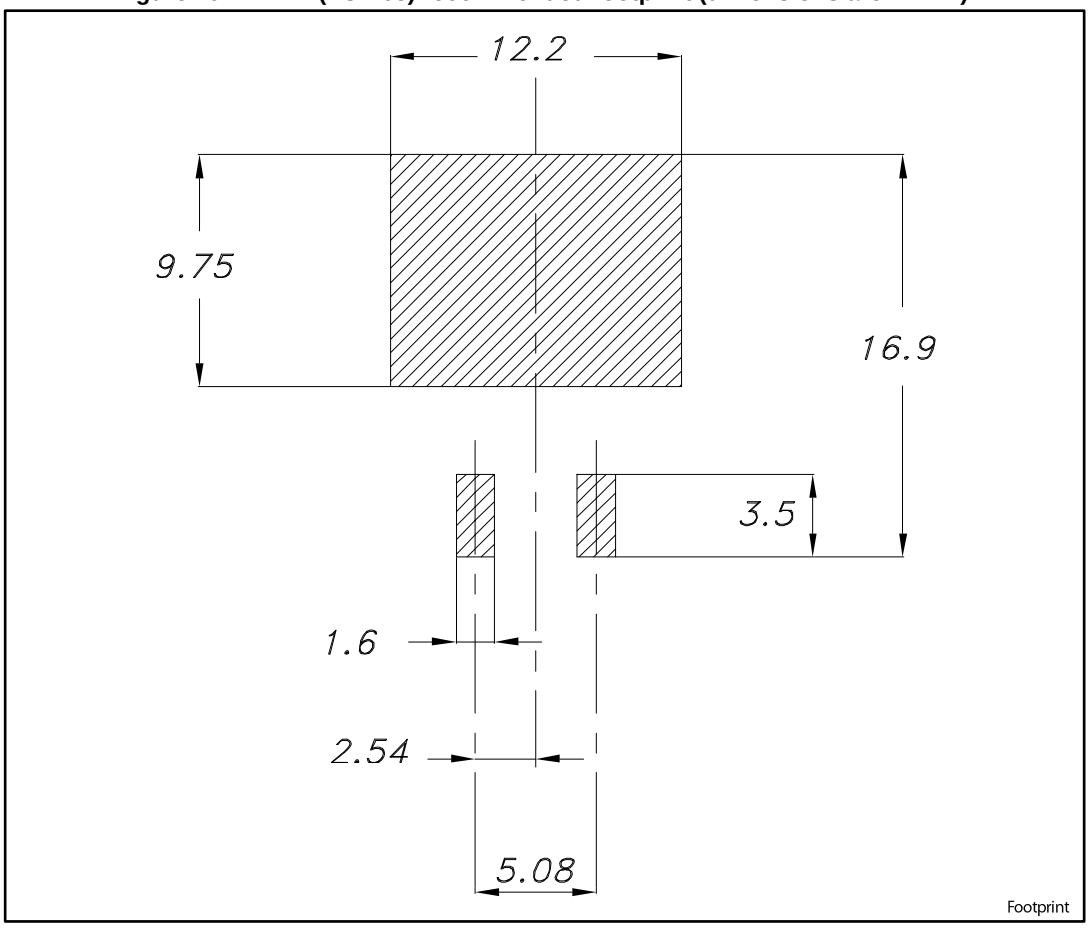


Table 9: D²PAK (TO-263) type A package mechanical data

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		10.40
E1	8.50	8.70	8.90
E2	6.85	7.05	7.25
e		2.54	
e1	4.88		5.28
H	15		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.4	
V2	0°		8°

Figure 20: D²PAK (TO-263) recommended footprint (dimensions are in mm)



4.2 D2PAK packaging information

Figure 21: Tape outline

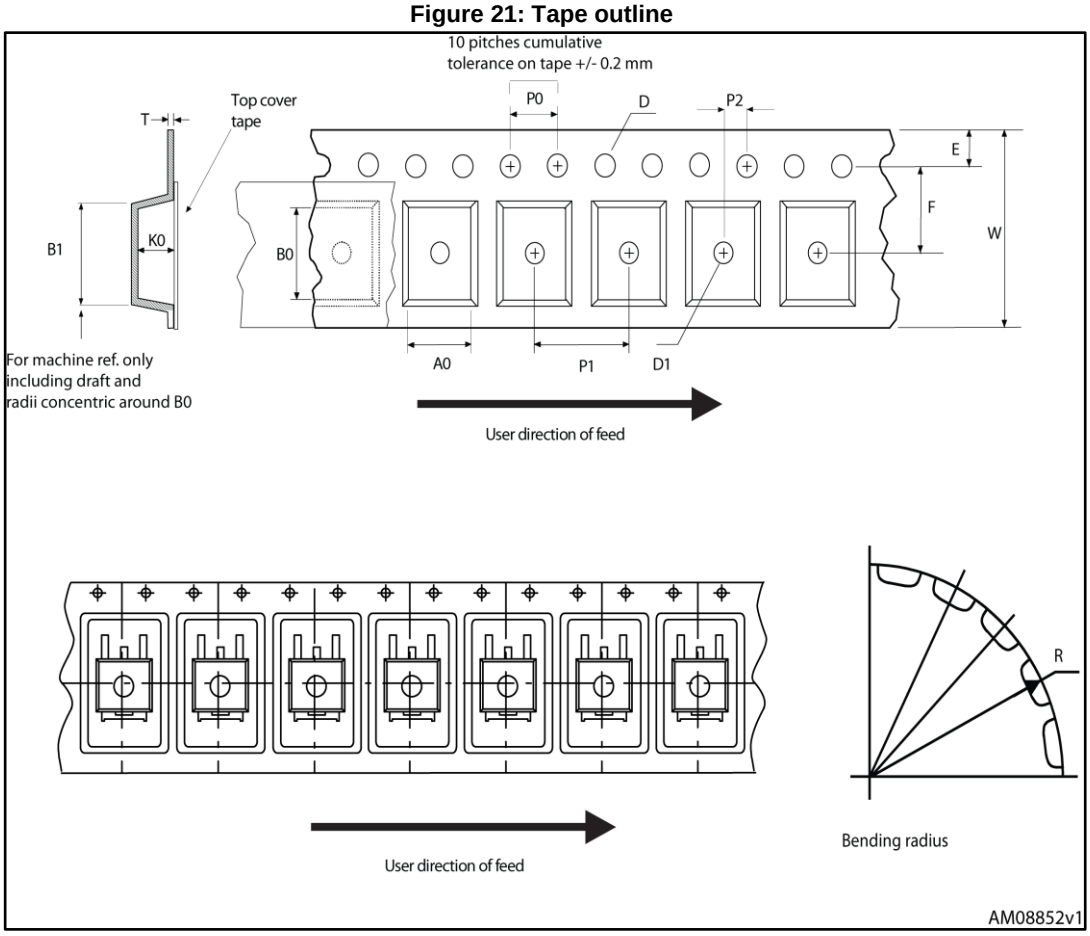


Figure 22: Reel outline

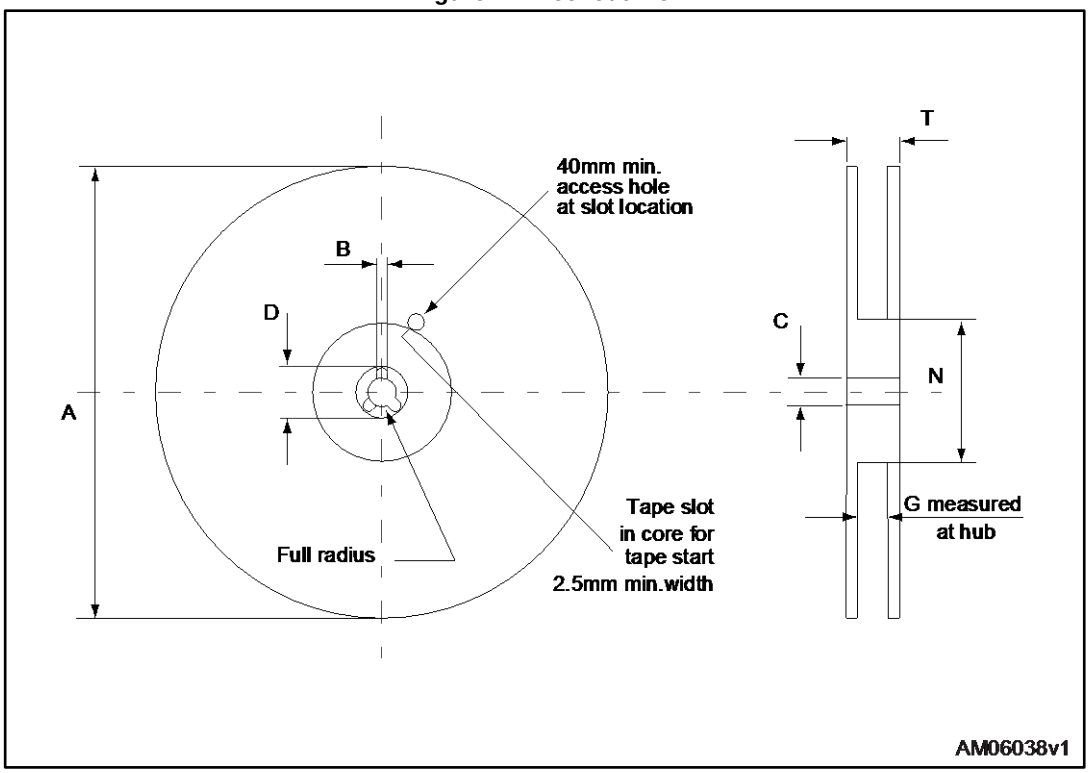


Table 10: D²PAK tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1	Base quantity		1000
P2	1.9	2.1	Bulk quantity		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

4.3 TO-220 type A package information

Figure 23: TO-220 type A package outline

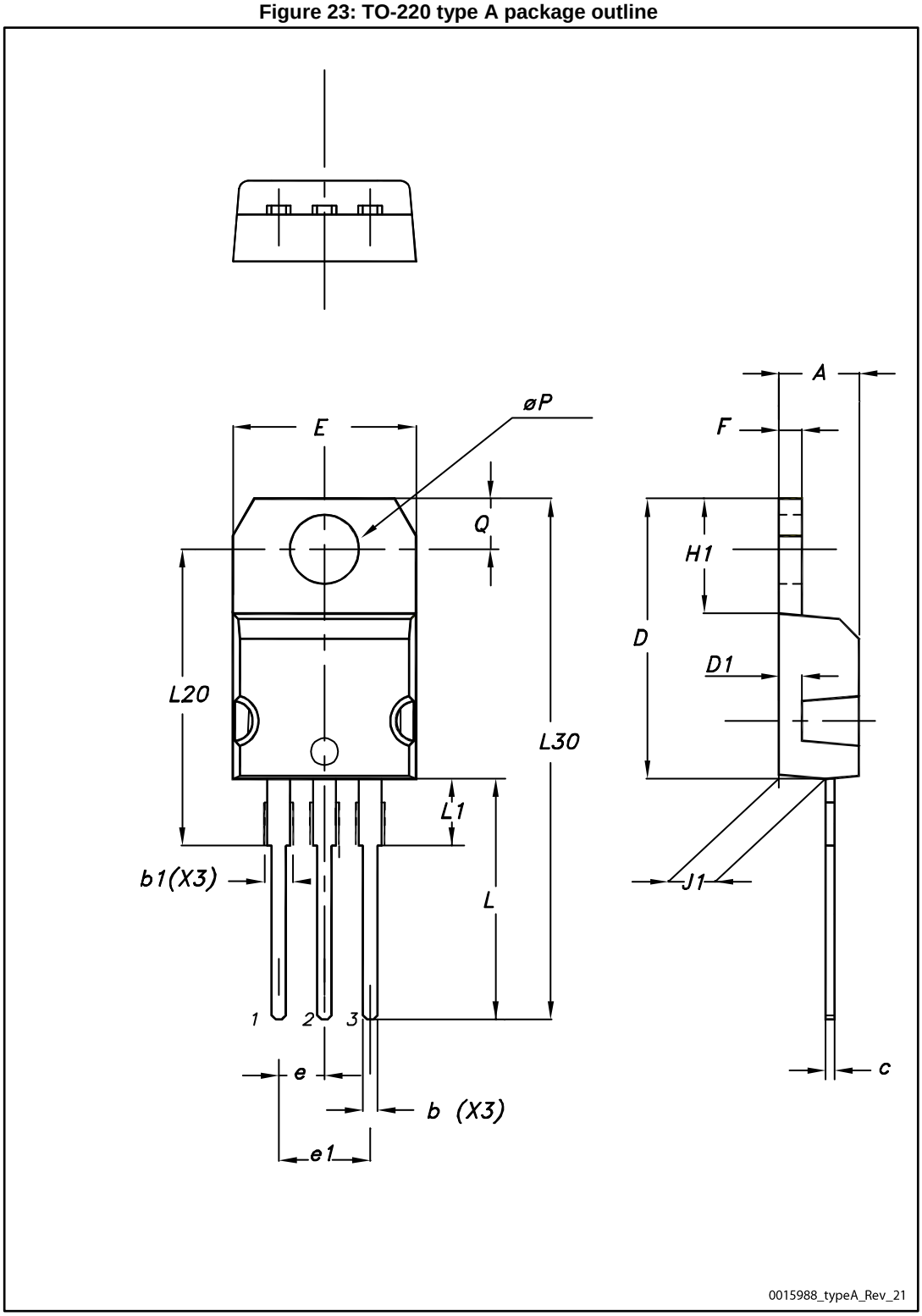


Table 11: TO-220 type A mechanical data

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

5 Revision history

Table 12: Document revision history

Date	Revision	Changes
29-Apr-2009	1	First release.
17-Dec-2009	2	Added new package, mechanical data: D²PAK
20-Jun-2011	3	Inserted device in I²PAK.
13-Mar-2012	4	Updated P_{TOT} and derating factor in *Table 2*. Update $R_{thj\text{-}case}$ for TO-220FP in *Table 3*. Update *Figure 10* and *Figure 15*. Update *Section 5: Packaging mechanical data*.
20-Jun-2012	5	Updated title on the cover page. Minor text changes.
09-Sep-2013	6	– The part numbers STI26NM60N and STW26NM60N have been moved to the separate datasheets – Modified: V_{GS} value in *Table 2*.
12-Dec-2016	7	The part number STF26NM60N has been moved to a separate datasheet. Modified *Table 2: "Absolute maximum ratings"*, *Table 3: "Thermal data"*, *Table 5: "On/off states"*, *Table 6: "Dynamic"* and *Table 7: "Switching times"*. Modified *Section 2.1: "Electrical characteristics (curves)"*. Minor text changes.

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