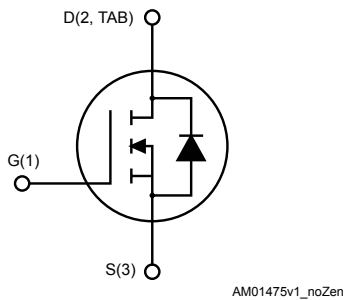


N-channel 500 V, 0.73 Ω typ., 5 A, MDmesh™ II Power MOSFETs in DPAK and TO-220 packages



DPAK

TO-220



Features

Order codes	$V_{DS} @ T_{Jmax}$	$R_{DS(on)}$ max.	I_D
STD8NM50N	550 V	0.79 Ω	5 A
STP8NM50N			

- 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. These revolutionary Power MOSFETs associate a vertical structure to the company's strip layout to yield one of the world's lowest on-resistance and gate charge. They are therefore suitable for the most demanding high-efficiency converters.

Product status links

[STD8NM50N](#)
[STP8NM50N](#)

Product summary

Order code	STD8NM50N
Marking	8NM50N
Package	DPAK
Packing	Tape and reel
Order code	STP8NM50N
Marking	8NM50N
Package	TO-220
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	500	
V_{GS}	Gate-source voltage	± 25	V
I_D	Drain current (continuous) at $T_{case} = 25\text{ }^\circ\text{C}$	5	A
	Drain current (continuous) at $T_{case} = 100\text{ }^\circ\text{C}$	3	
$I_{DM}^{(1)}$	Drain current (pulsed)	20	A
P_{TOT}	Total dissipation at $T_{case} = 25\text{ }^\circ\text{C}$	45	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
T_{stg}	Storage temperature range	-55 to 150	$^\circ\text{C}$
T_j	Operating junction temperature range		

1. Limited by maximum junction temperature

2. $I_{SD} \leq 5\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DS(Peak)} \leq V_{(BR)DSS}$, $V_{DD} = 80\% V_{(BR)DSS}$

Table 2. Thermal data

Symbol	Parameter	Value		Unit
		DPAK	TO-220	
$R_{thj-case}$	Thermal resistance junction-case	2.78		$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient		62.5	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	50		$^\circ\text{C}/\text{W}$

1. When mounted on an 1 inch² FR-4, 2 Oz copper board

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or non-repetitive (pulse width limited by T_{Jmax})	2	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	140	mJ

2 Electrical characteristics

($T_{\text{case}} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$V_{\text{GS}} = 0\text{ V}$, $I_{\text{D}} = 1\text{ mA}$	500			V
I_{DSS}	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 500\text{ V}$			1	μA
		$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 500\text{ V}$, $T_{\text{case}} = 125\text{ }^{\circ}\text{C}$ ⁽¹⁾			100	
I_{GSS}	Gate-body leakage current	$V_{\text{DS}} = 0\text{ V}$, $V_{\text{GS}} = \pm 25\text{ V}$			± 100	nA
$V_{\text{GS}(\text{th})}$	Gate threshold voltage	$V_{\text{DS}} = V_{\text{GS}}$, $I_{\text{D}} = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{\text{DS}(\text{on})}$	Static drain-source on-resistance	$V_{\text{GS}} = 10\text{ V}$, $I_{\text{D}} = 2.5\text{ A}$		0.73	0.79	Ω

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

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance		-	364	-	pF
C_{oss}	Output capacitance	$V_{\text{DS}} = 50\text{ V}$, $f = 1\text{ MHz}$, $V_{\text{GS}} = 0\text{ V}$	-	33	-	
C_{riss}	Reverse transfer capacitance		-	1.2	-	
$C_{\text{oss eq.}}^{(1)}$	Equivalent output capacitance	$V_{\text{DS}} = 0\text{ to }400\text{ V}$, $V_{\text{GS}} = 0\text{ V}$	-	147.5	-	pF
R_{G}	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_{\text{D}} = 0\text{ A}$	-	5.4	-	Ω
Q_{g}	Total gate charge	$V_{\text{DD}} = 400\text{ V}$, $I_{\text{D}} = 5\text{ A}$,	-	14	-	nC
Q_{gs}	Gate-source charge	$V_{\text{GS}} = 0\text{ to }10\text{ V}$	-	3	-	
Q_{gd}	Gate-drain charge	(see Figure 15. Test circuit for gate charge behavior)	-	7	-	

1. $C_{\text{oss eq.}}$ 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} .

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{\text{d}(\text{on})}$	Turn-on delay time	$V_{\text{DD}} = 250\text{ V}$, $I_{\text{D}} = 2.5\text{ A}$,	-	7	-	ns
t_{r}	Rise time	$R_{\text{G}} = 4.7\text{ }\Omega$, $V_{\text{GS}} = 10\text{ V}$	-	4.4	-	
$t_{\text{d}(\text{off})}$	Turn-off delay time	(see Figure 14. Test circuit for resistive load switching times and Figure 19. Switching time waveform)	-	25	-	
t_{f}	Fall time		-	9	-	

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		20	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 5\text{ A}$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$	-	187		ns
Q_{rr}	Reverse recovery charge		-	1.3		μC
I_{RRM}	Reverse recovery current	(see Figure 16. Test circuit for inductive load switching and diode recovery times)	-	14		A
t_{rr}	Reverse recovery time	$I_{SD} = 5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$	-	224		ns
Q_{rr}	Reverse recovery charge		-	1.5		μC
I_{RRM}	Reverse recovery current		(see Figure 16. Test circuit for inductive load switching and diode recovery times)	-	13	

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

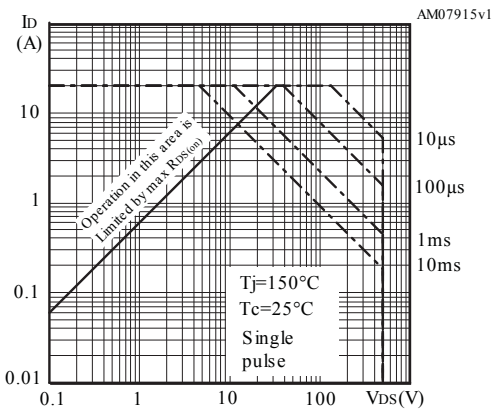
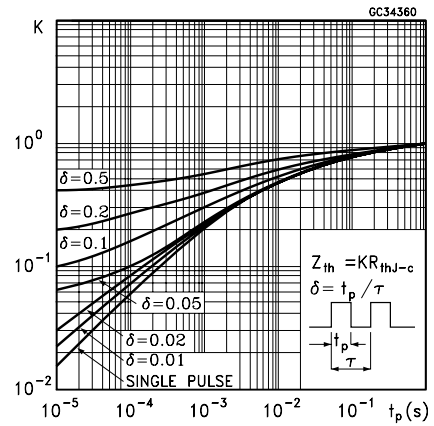
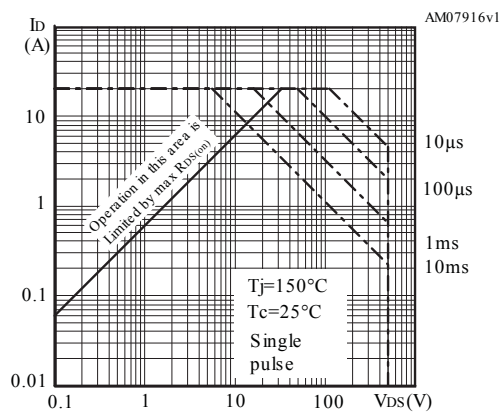
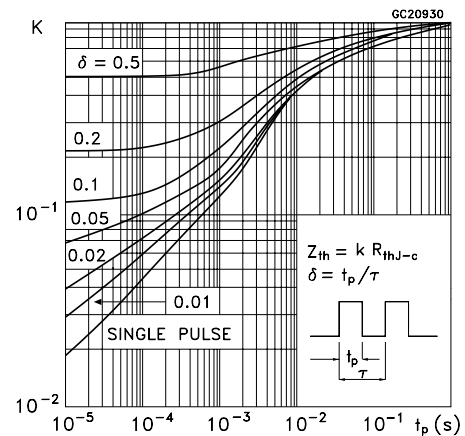
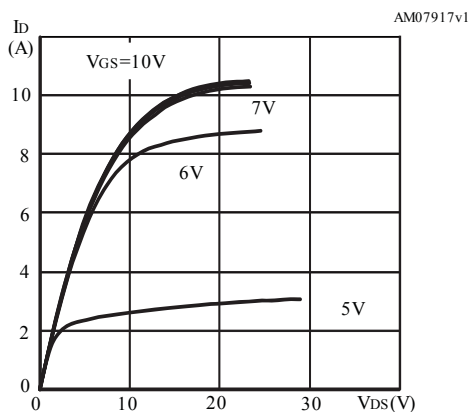
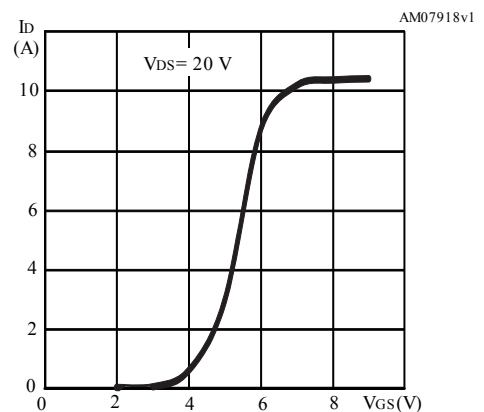
2.1 Electrical characteristics (curves)
Figure 1. Safe operating area for DPAK

Figure 2. Thermal impedance for DPAK

Figure 3. Safe operating area for TO-220

Figure 4. Thermal impedance for TO-220

Figure 5. Output characteristics

Figure 6. Transfer characteristics


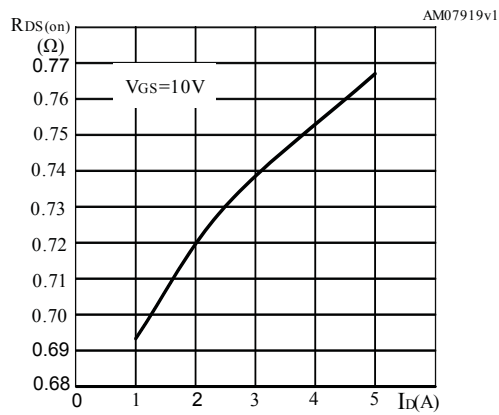
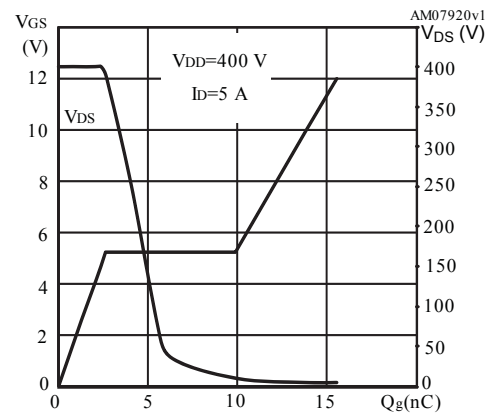
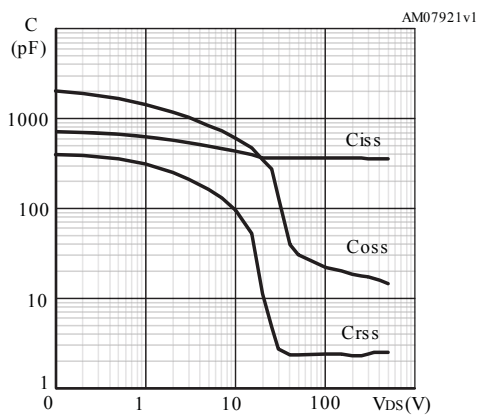
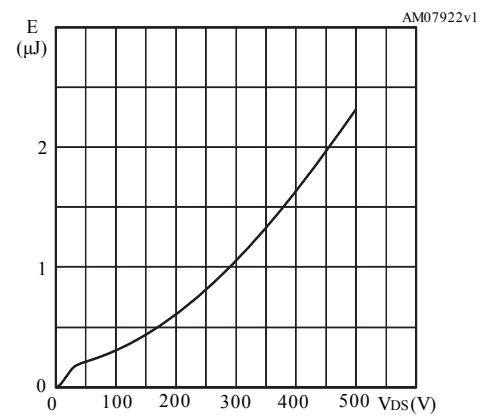
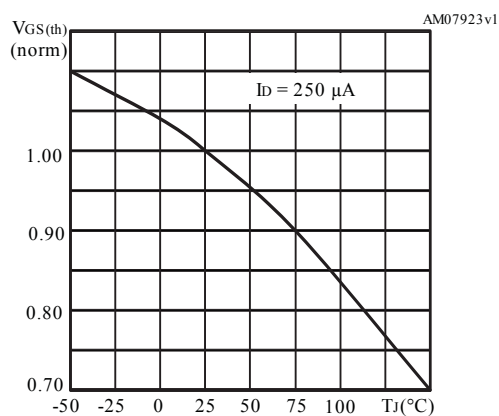
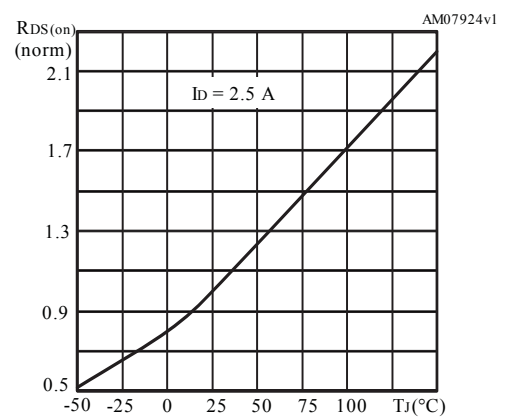
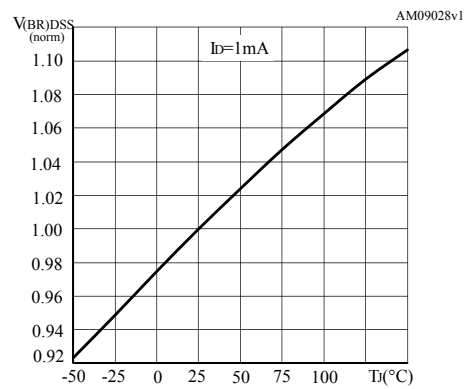
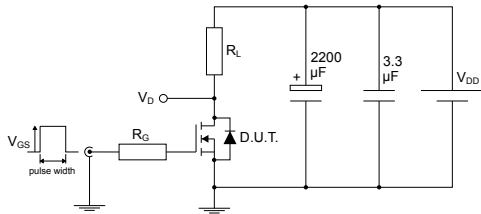
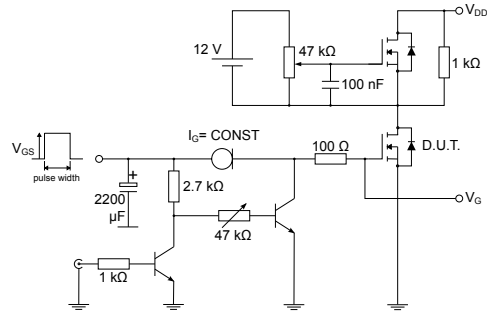
Figure 7. Static drain-source on-resistance

Figure 8. Gate charge vs gate-source voltage

Figure 9. Capacitance variations

Figure 10. Output capacitance stored energy

Figure 11. Normalized gate threshold voltage vs temperature

Figure 12. Normalized on-resistance vs temperature


Figure 13. Normalized $V_{(BR)DSS}$ vs temperature


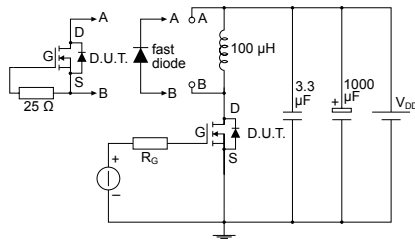
3 Test circuits

Figure 14. Test circuit for resistive load switching times


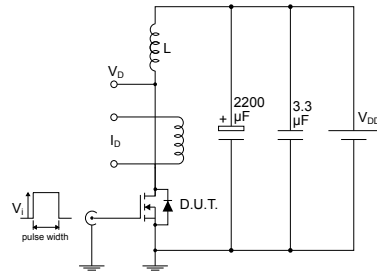
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Figure 15. Test circuit for gate charge behavior


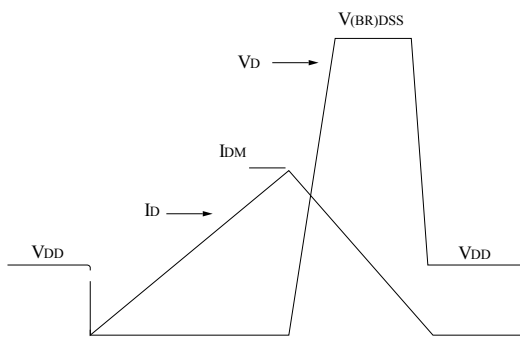
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Figure 16. Test circuit for inductive load switching and diode recovery times


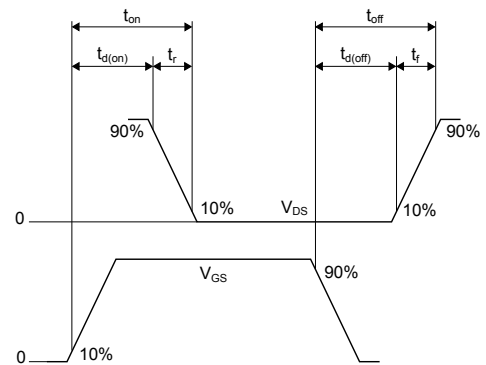
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Figure 17. Unclamped inductive load test circuit


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Figure 18. Unclamped inductive waveform


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Figure 19. Switching time waveform


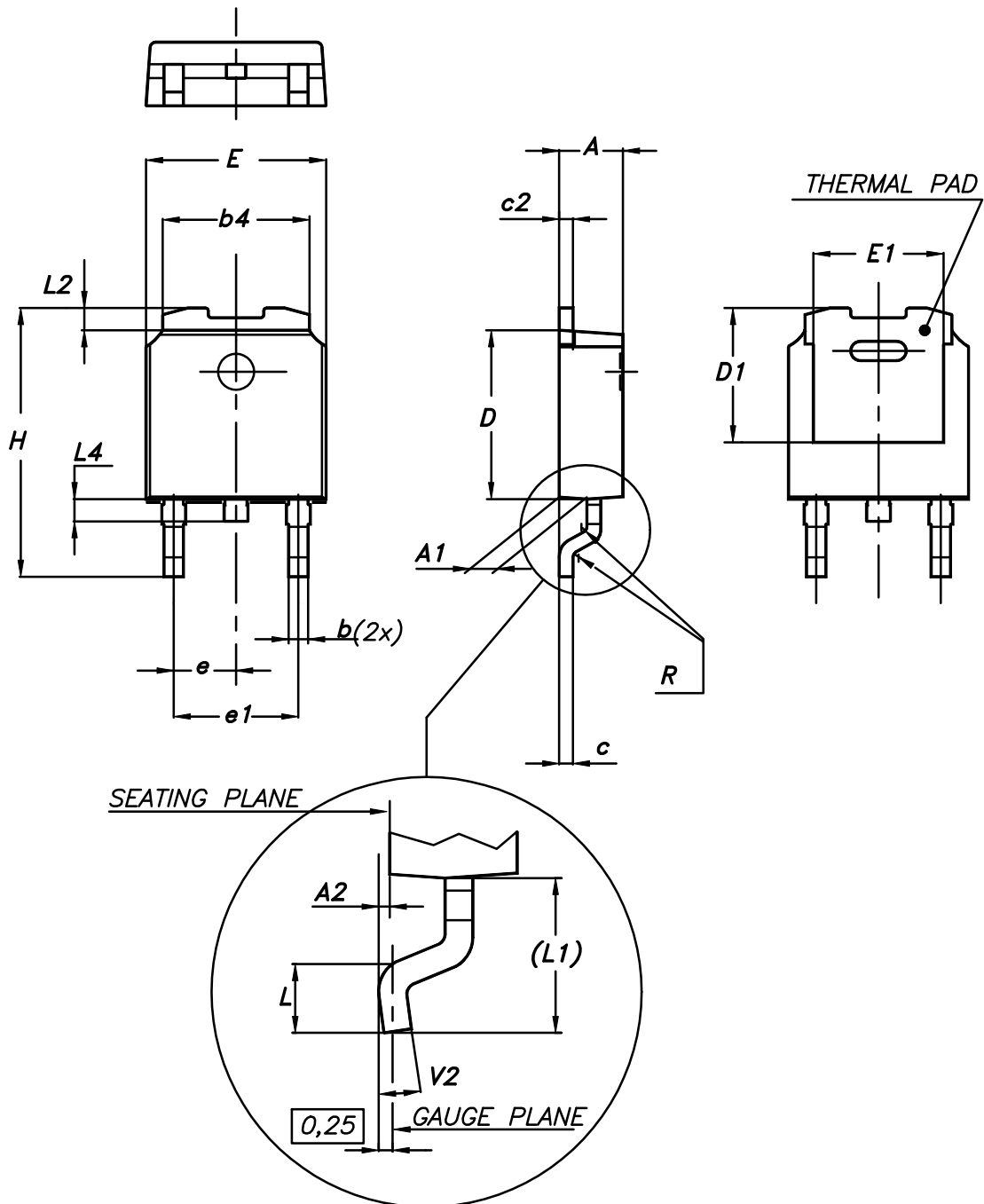
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4 Package information

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 DPAK (TO-252) type A package information

Figure 20. DPAK (TO-252) type A package outline



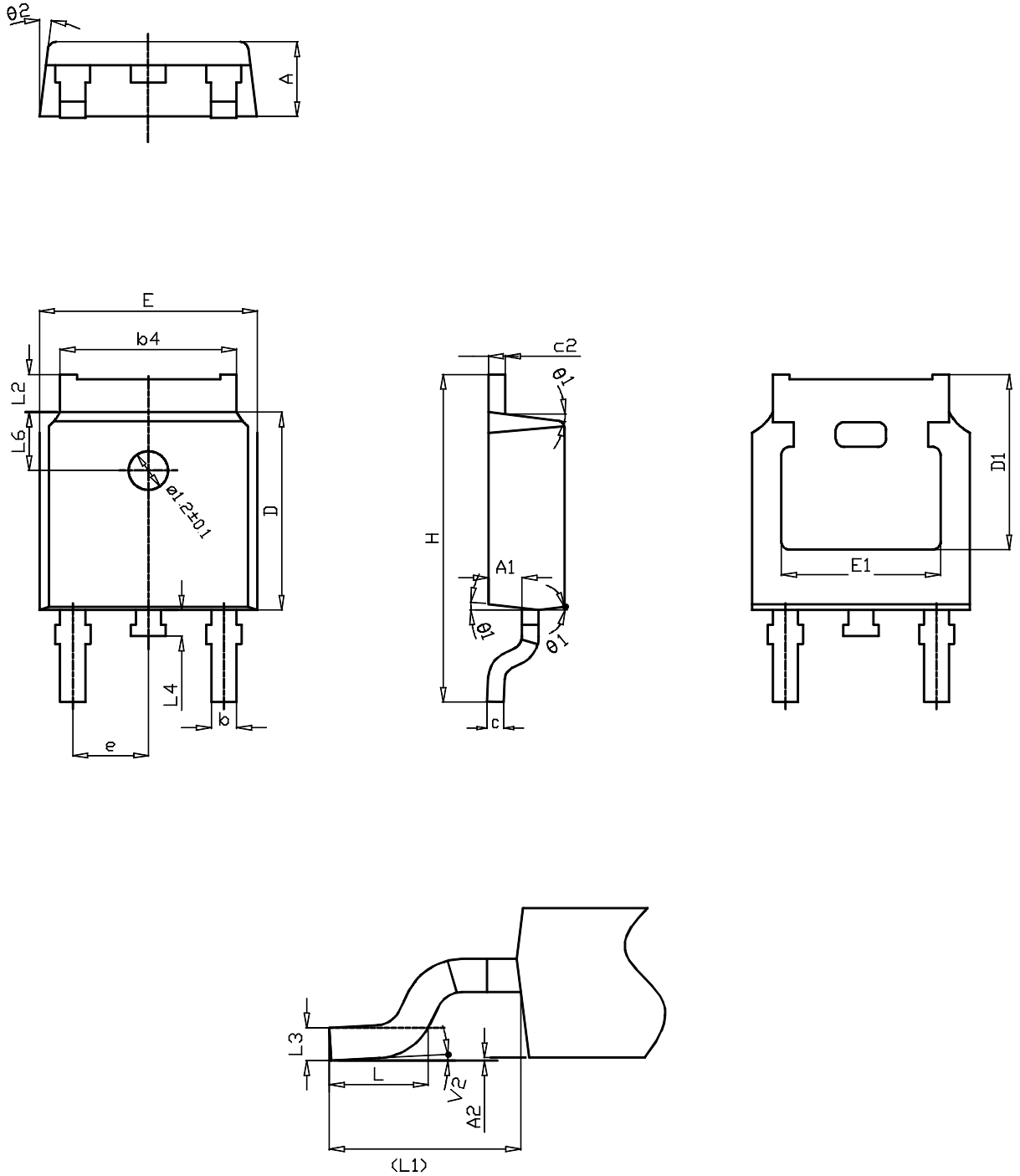
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Table 8. DPAK (TO-252) type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1	4.95	5.10	5.25
E	6.40		6.60
E1	4.60	4.70	4.80
e	2.159	2.286	2.413
e1	4.445	4.572	4.699
H	9.35		10.10
L	1.00		1.50
(L1)	2.60	2.80	3.00
L2	0.65	0.80	0.95
L4	0.60		1.00
R		0.20	
V2	0°		8°

4.2 DPAK (TO-252) type C package information

Figure 21. DPAK (TO-252) type C package outline

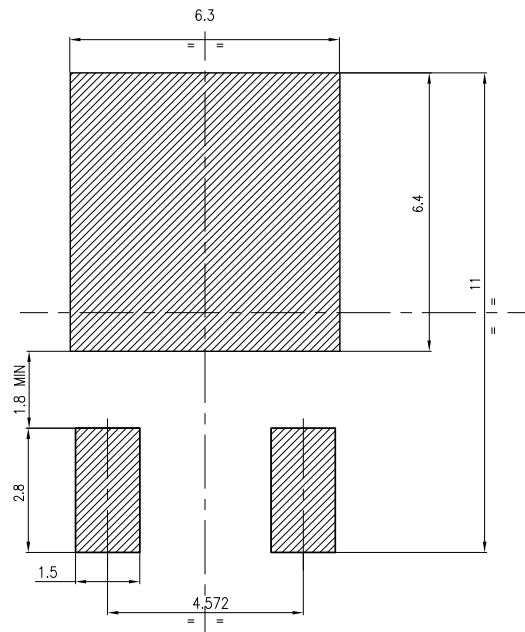


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Table 9. DPAK (TO-252) type C mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0.90	1.01	1.10
A2	0.00		0.10
b	0.72		0.85
b4	5.13	5.33	5.46
c	0.47		0.60
c2	0.47		0.60
D	6.00	6.10	6.20
D1	5.25		
E	6.50	6.60	6.70
E1	4.70		
e	2.186	2.286	2.386
H	9.80	10.10	10.40
L	1.40	1.50	1.70
L1	2.90 REF		
L2	0.90		1.25
L3	0.51 BSC		
L4	0.60	0.80	1.00
L6	1.80 BSC		
θ1	5°	7°	9°
θ2	5°	7°	9°
V2	0°		8°

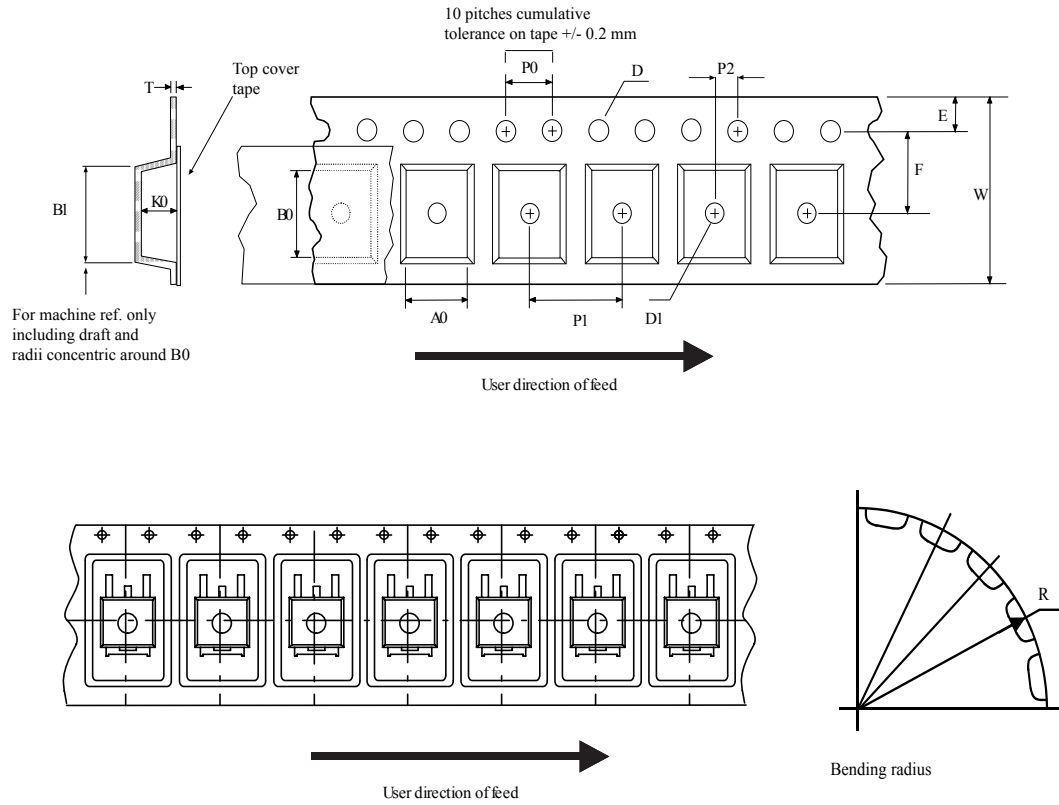
Figure 22. DPAK (TO-252) recommended footprint (dimensions are in mm)



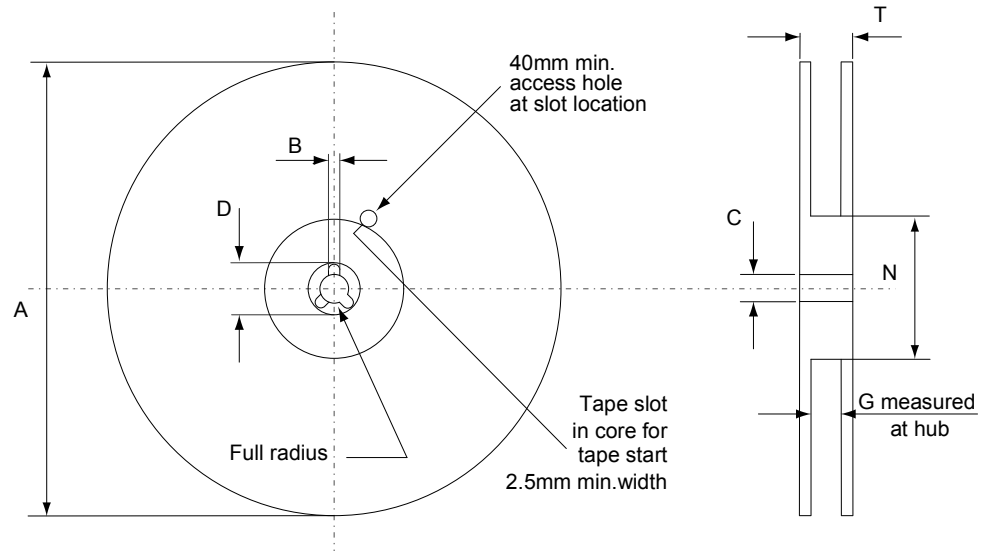
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4.3 DPAK (TO-252) packing information

Figure 23. DPAK (TO-252) tape outline



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Figure 24. DPAK (TO-252) reel outline


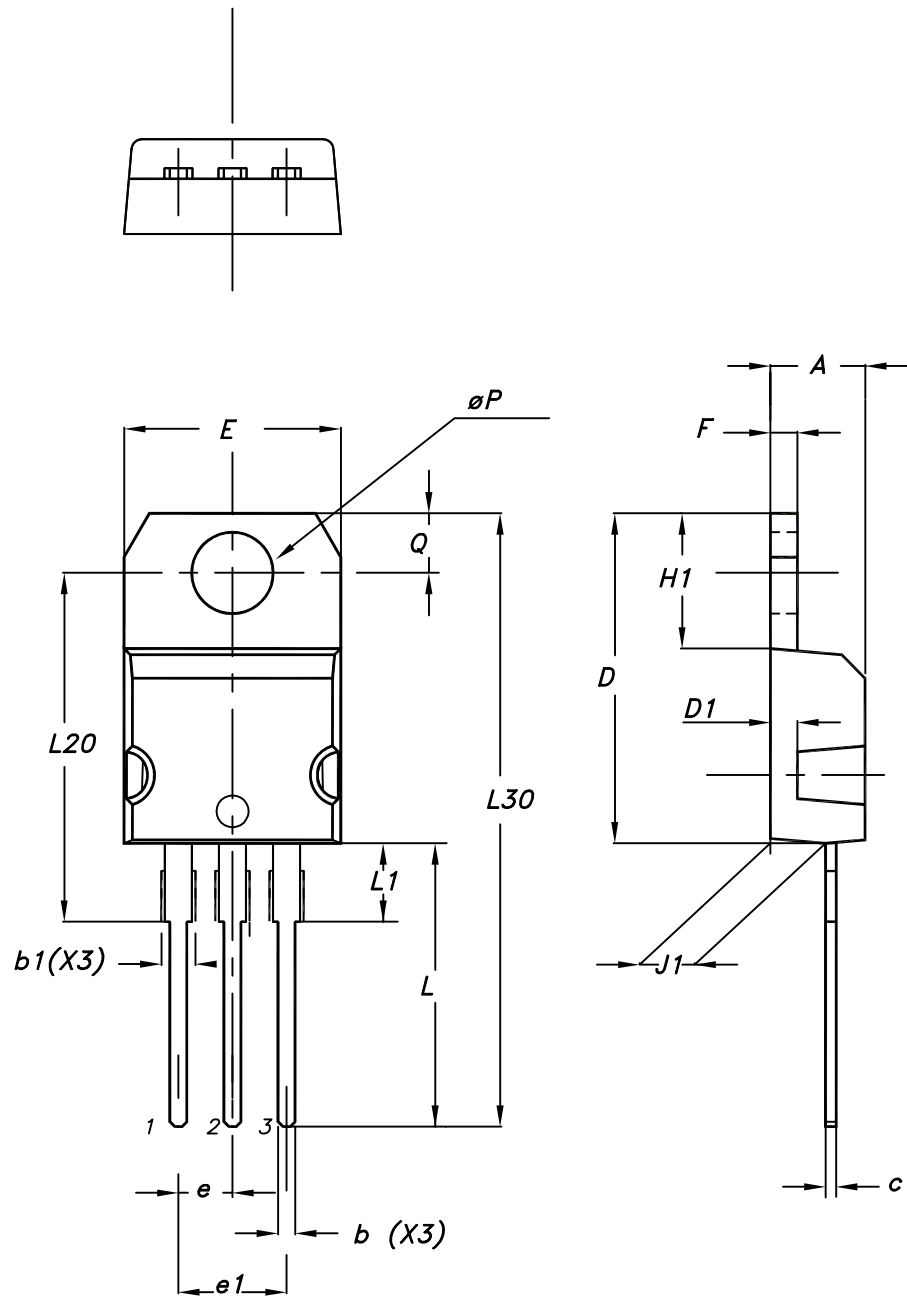
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Table 10. DPAK (TO-252) tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	6.8	7	A		330
B0	10.4	10.6	B	1.5	
B1		12.1	C	12.8	13.2
D	1.5	1.6	D	20.2	
D1	1.5		G	16.4	18.4
E	1.65	1.85	N	50	
F	7.4	7.6	T		22.4
K0	2.55	2.75			
P0	3.9	4.1	Base qty.		2500
P1	7.9	8.1	Bulk qty.		2500
P2	1.9	2.1			
R	40				
T	0.25	0.35			
W	15.7	16.3			

4.4 TO-220 type A package information

Figure 25. TO-220 type A package outline



0015988_typeA_Rev_21

Table 11. 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

Revision history

Table 12. Document revision history

Date	Version	Changes
20-Apr-2010	1	Initial release.
03-Sep-2010	2	Document status promoted from preliminary data to datasheet. Inserted <i>Section 2.1: Electrical characteristics (curves)</i> . Corrected RDS(on) max value in: <i>Features</i> .
03-Feb-2011	3	Modified: <i>Figure 4</i> . Modified: <i>note 1</i> . Modified: <i>Table 5</i> .
21-Oct-2011	4	Updated VDSS (@Tjmax) in cover page. Updated Section 4: Package mechanical data. Minor text changes
15-Nov-2011	5	The part number STF8NM50N has been moved to a separate datasheet.
13-Sep-2012	6	<i>Figure 2</i> and <i>Figure 4</i> have been modified. <i>Section 4: Package mechanical data</i> has been updated.
04-Sep-2018	7	The part number STU8NM50N has been moved to a separate datasheet. Removed maturity status indication from cover page. The document status is production data. Updated Section 4 Package information . Minor text changes

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