

N-channel 100 V, 0.0145 Ω typ., 45 A, STripFET™ VII DeepGATE™ Power MOSFETs in DPAK, I²PAK and TO-220 packages

Datasheet - production data

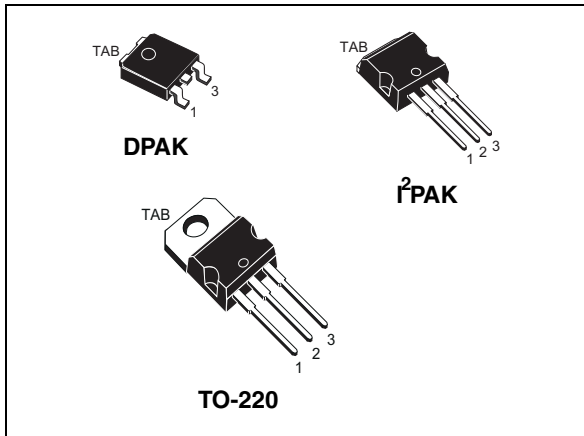
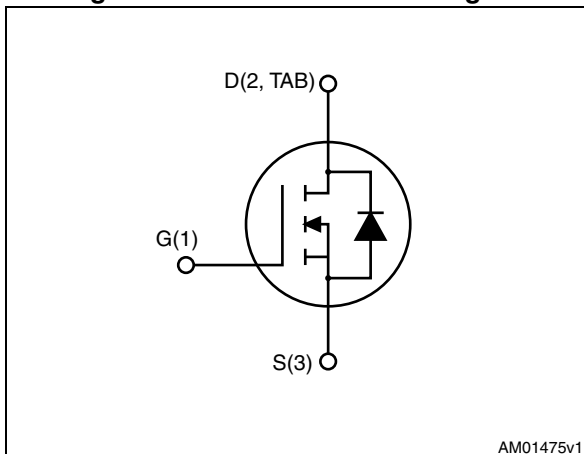


Figure 1. Internal schematic diagram



Features

Order codes	V _{DS}	R _{DS(on)} max. ⁽¹⁾	I _D	P _{TOT}
STD45N10F7	100 V	0.018 Ω	45 A	60 W
STI45N10F7				
STP45N10F7				

1. @ V_{GS} = 10 V

- Ultra low on-resistance
- 100% avalanche tested

Applications

- Switching applications

Description

These devices utilize the 7th generation of design rules of ST's proprietary STripFET™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest R_{DS(on)} in all packages.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STD45N10F7	45N10F7	DPAK	Tape and reel
STI45N10F7		I ² PAK	Tube
STP45N10F7		TO-220	

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	100	V
V_{GS}	Gate-source voltage	20	V
I_D	Drain current (continuous) at $T_C = 25\text{ °C}$	45	A
I_D	Drain current (continuous) at $T_C = 100\text{ °C}$	32	A
$I_{DM}^{(1)}$	Drain current (pulsed)	180	A
P_{TOT}	Total dissipation at $T_C = 25\text{ °C}$	60	W
T_J	Operating junction temperature	-55 to 175	°C
T_{stg}	Storage temperature		°C

1. Pulse width limited by safe operating area.

Table 3. Thermal resistance

Symbol	Parameter	Value		Unit
		DPAK	TO-220 I ² PAK	
$R_{thj-case}$	Thermal resistance junction-case	2.5	2.5	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient		62.5	°C/W
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	31.2		°C/W

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

2 Electrical characteristics

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

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage ($V_{GS} = 0$)	$I_D = 1\text{ mA}$	100		-	V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 100\text{ V}$			10	μA
		$V_{DS} = 100\text{ V}; T_C = 125\text{ °C}$			100	μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = 20\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2.5		4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 22.5\text{ A}$		0.0145	0.018	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 50\text{ V}, f = 1\text{ MHz}, V_{GS} = 0$	-	1640	-	pF
C_{oss}	Output capacitance		-	360	-	pF
C_{riss}	Reverse transfer capacitance		-	25	-	pF
Q_g	Total gate charge	$V_{DD} = 50\text{ V}, I_D = 45\text{ A}$	-	25	-	nC
Q_{gs}	Gate-source charge	$V_{GS} = 10\text{ V}$	-	5.1	-	nC
Q_{gd}	Gate-drain charge	Figure 14	-	12.2	-	nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 50\text{ V}, I_D = 22.5\text{ A}, R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$ Figure 13	-	15	-	ns
t_r	Rise time		-	17	-	ns
$t_{d(off)}$	Turn-off delay time		-	24	-	ns
t_f	Fall time		-	8	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		45	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		180	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 45 \text{ A}, V_{GS} = 0$	-		1.1	V
t_{rr}	Reverse recovery time	$I_{SD} = 45 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s},$ $V_{DD} = 80 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$	-	53		ns
Q_{rr}	Reverse recovery charge		-	67		nC
I_{RRM}	Reverse recovery current		-	2.5		A

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

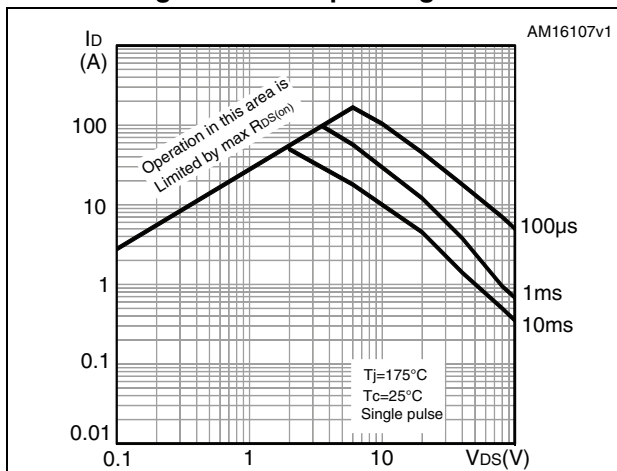


Figure 3. Thermal impedance

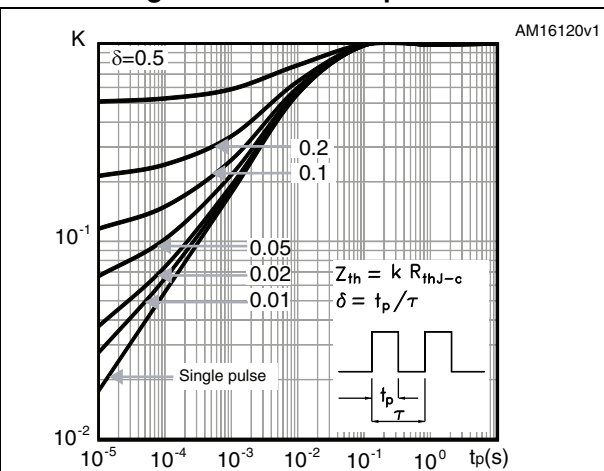


Figure 4. Output characteristics

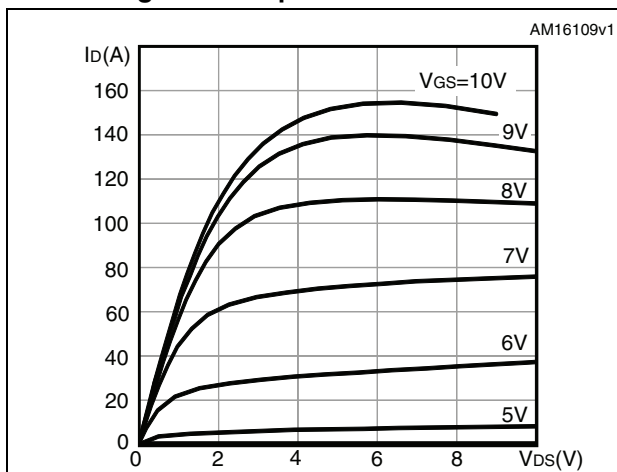


Figure 5. Transfer characteristics

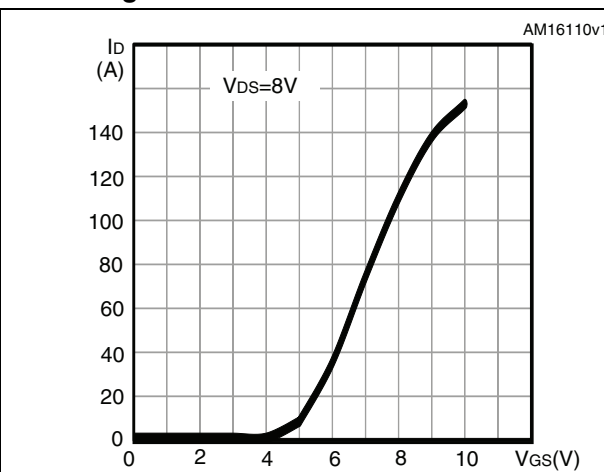


Figure 6. Gate charge vs gate-source voltage

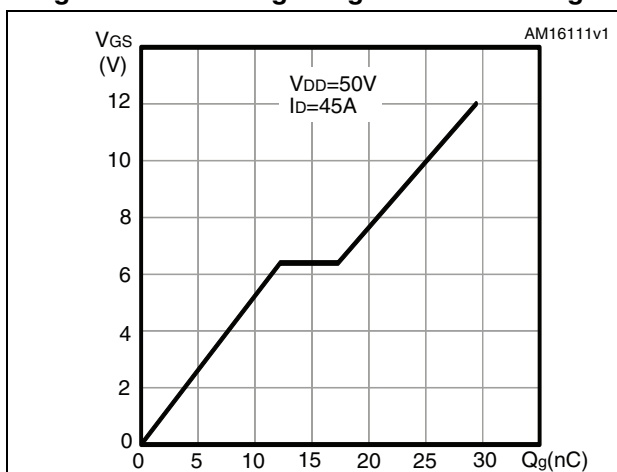


Figure 7. Static drain-source on-resistance

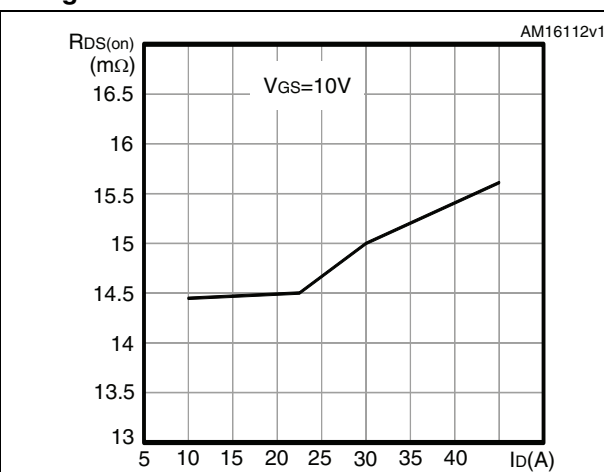


Figure 8. Capacitance variations

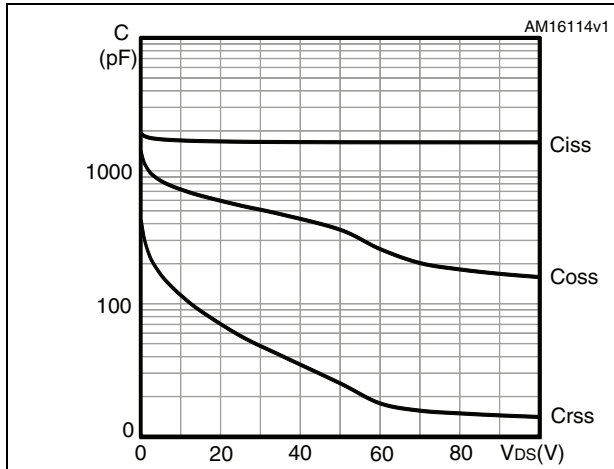


Figure 9. Normalized gate threshold voltage vs temperature

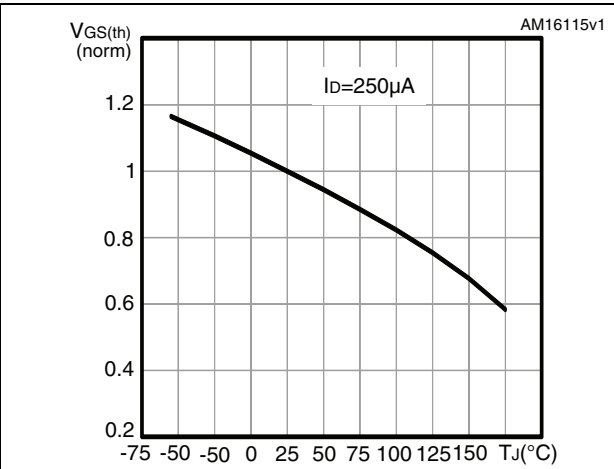


Figure 10. Normalized on-resistance vs temperature

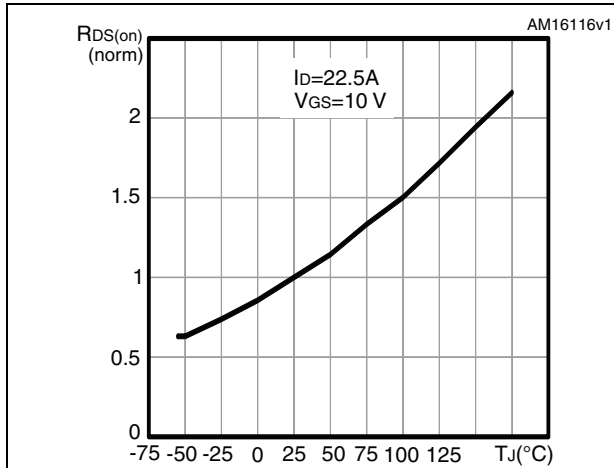


Figure 11. Source-drain diode forward characteristics

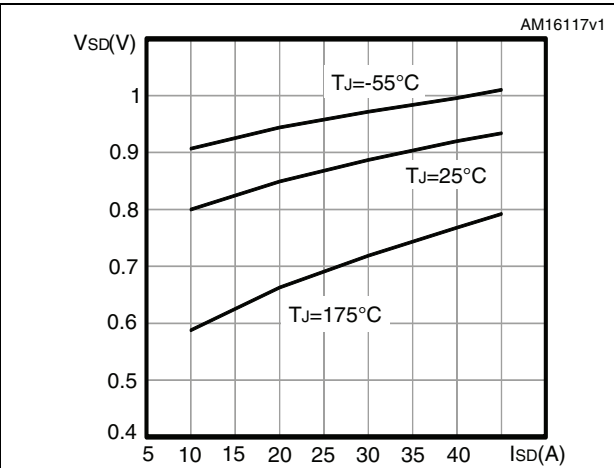
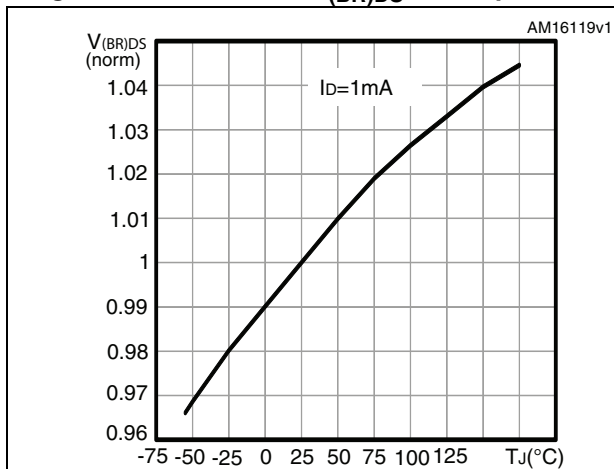


Figure 12. Normalized V_{(BR)DS} vs temperature



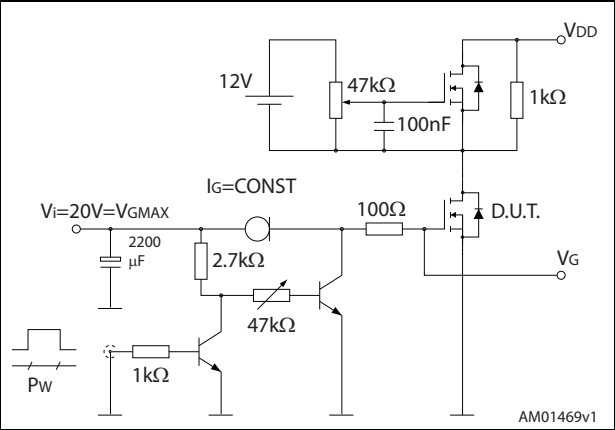
3 Test circuits

Figure 13. Switching times test circuit for resistive load



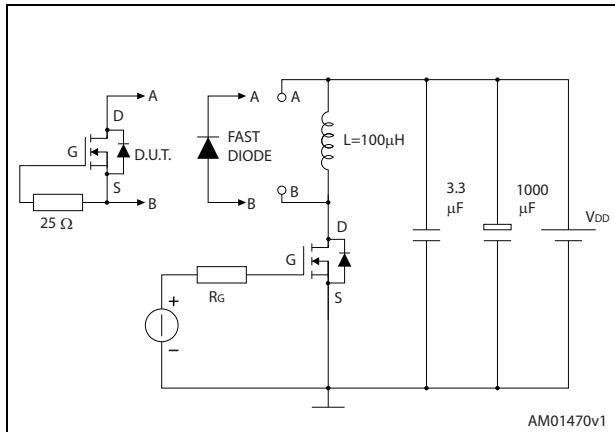
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Figure 14. Gate charge test circuit



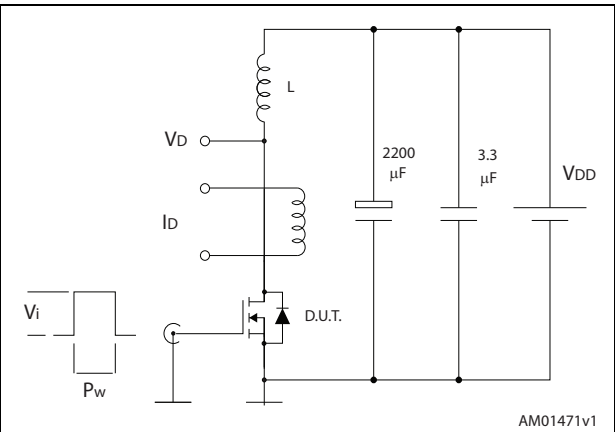
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Figure 15. Test circuit for inductive load switching and diode recovery times



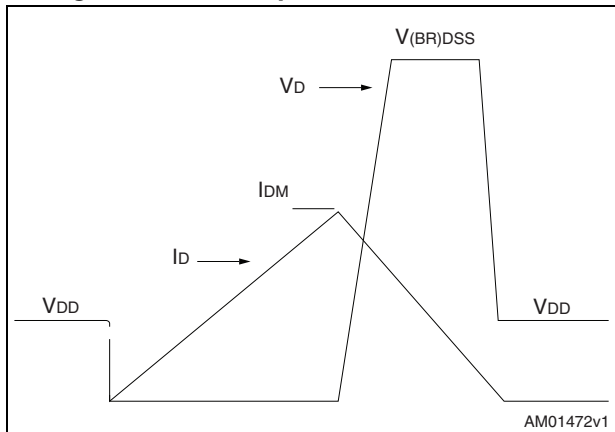
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Figure 16. Unclamped inductive load test circuit



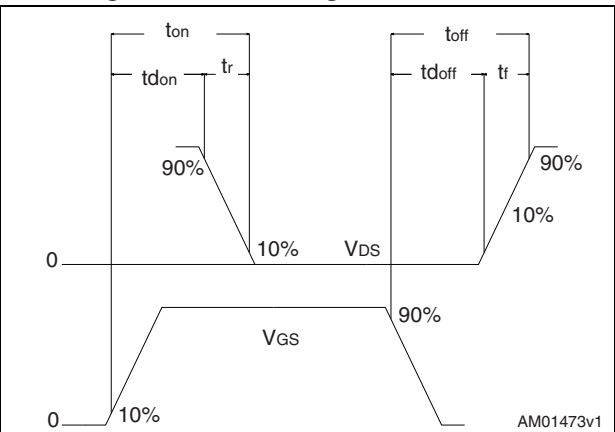
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Figure 17. Unclamped inductive waveform



AM01472v1

Figure 18. Switching time waveform



AM01473v1

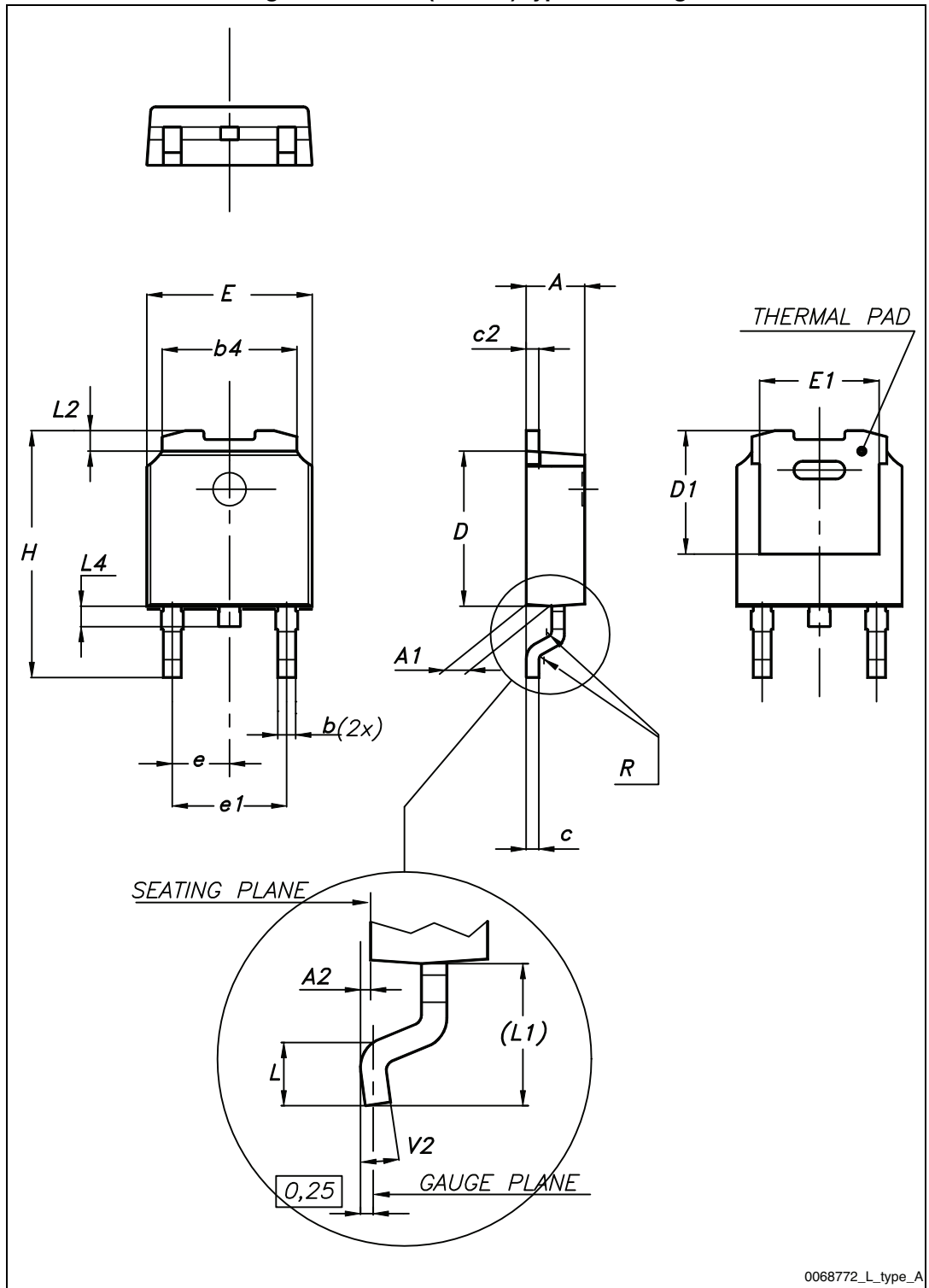
4 Package mechanical data

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.

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

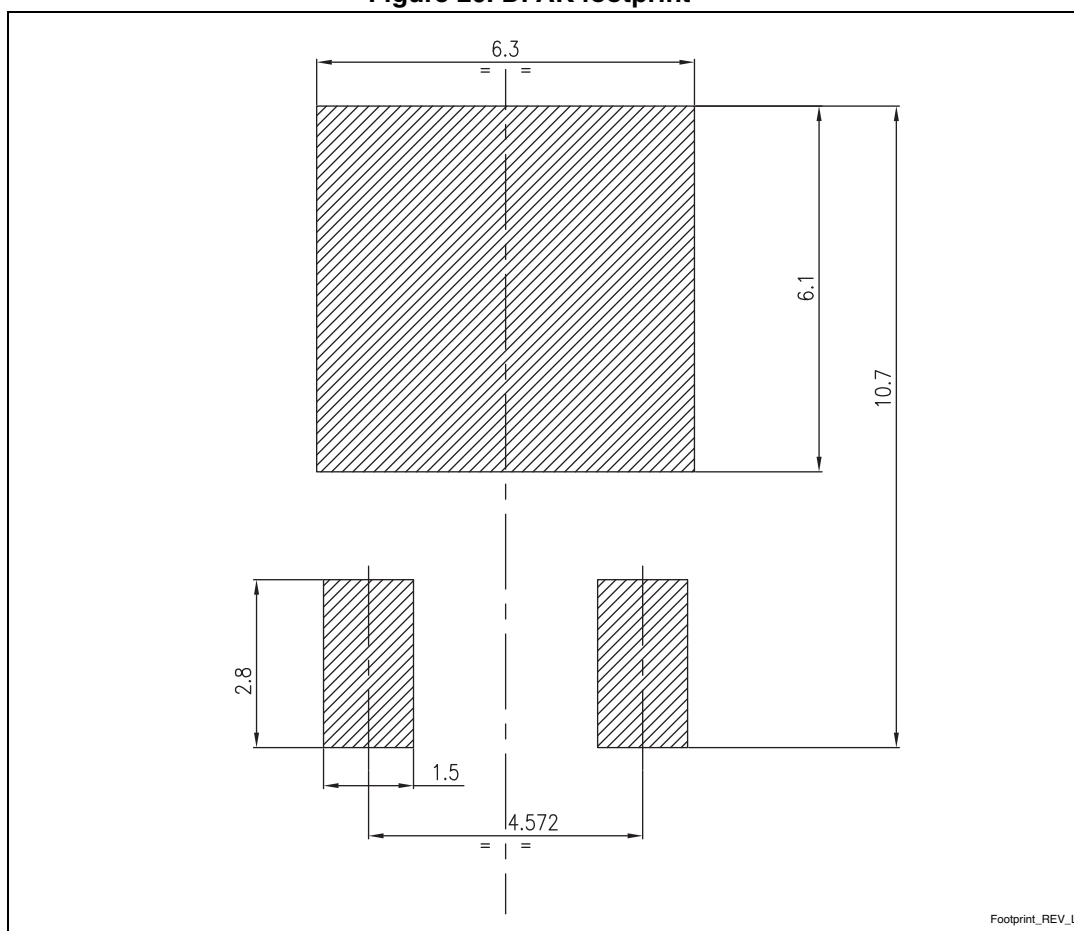
Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
(L1)		2.80	
L2		0.80	
L4	0.60		1.00
R		0.20	
V2	0°		8°

Figure 19. DPAK (TO-252) type A drawing



0068772_L_type_A

Figure 20. DPAK footprint (a)



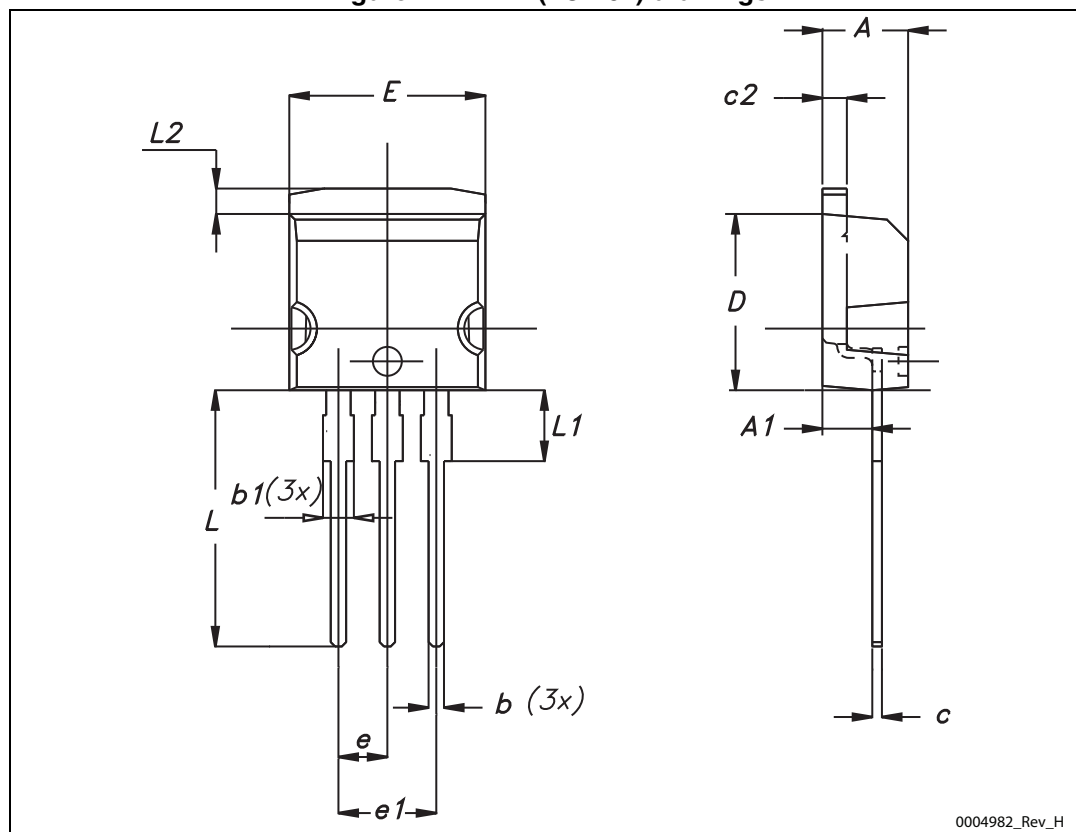
Footprint_REV_L

a. All dimensions are in millimeters

Table 9. I²PAK (TO-262) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	2.40		2.72
b	0.61		0.88
b1	1.14		1.70
c	0.49		0.70
c2	1.23		1.32
D	8.95		9.35
e	2.40		2.70
e1	4.95		5.15
E	10		10.40
L	13		14
L1	3.50		3.93
L2	1.27		1.40

Figure 21. I²PAK (TO-262) drawings

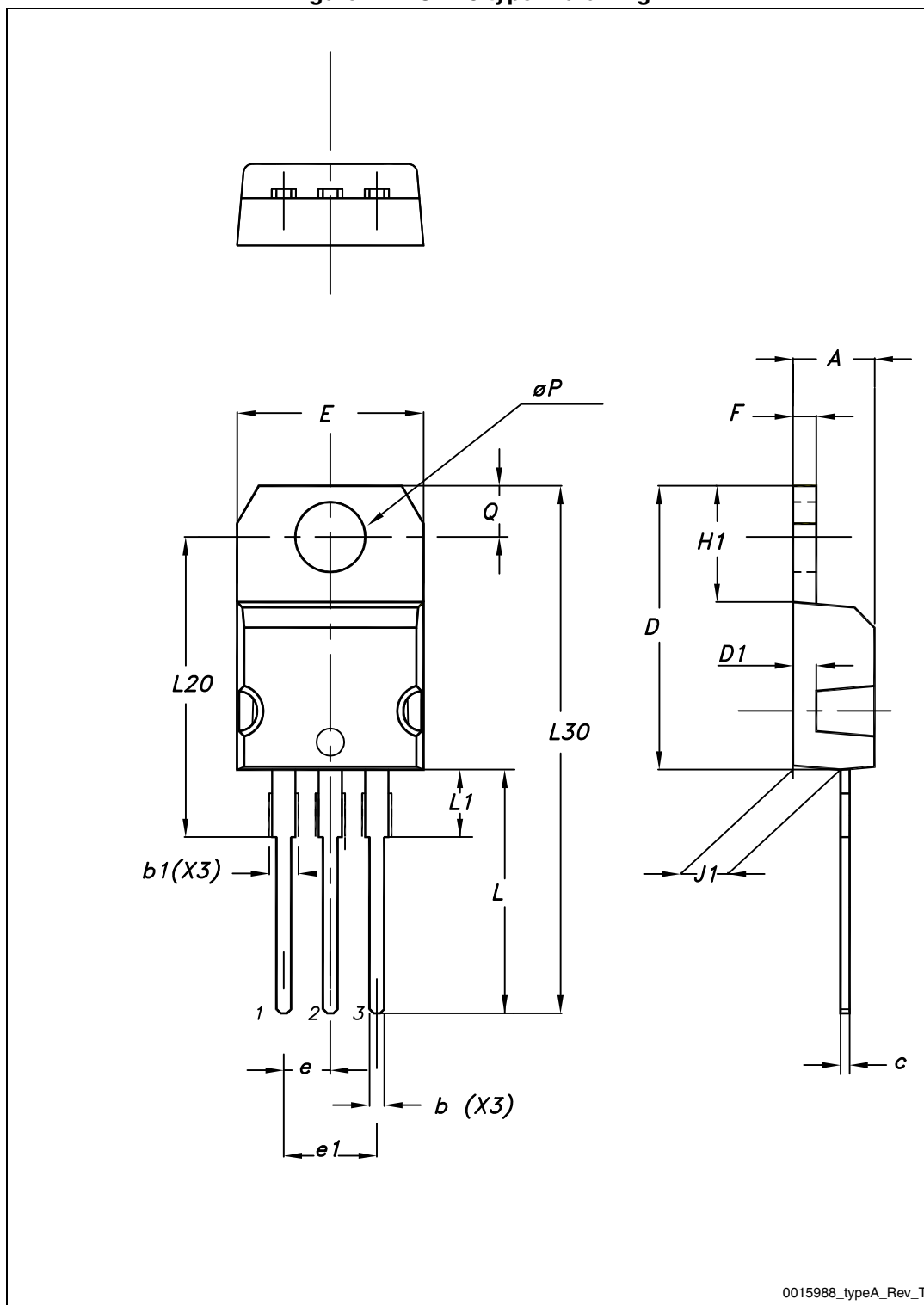


0004982_Rev_H

Table 10. TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		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		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
ØP	3.75		3.85
Q	2.65		2.95

Figure 22. TO-220 type A drawing



5 Packaging mechanical data

Table 11. 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			

Figure 23. Tape

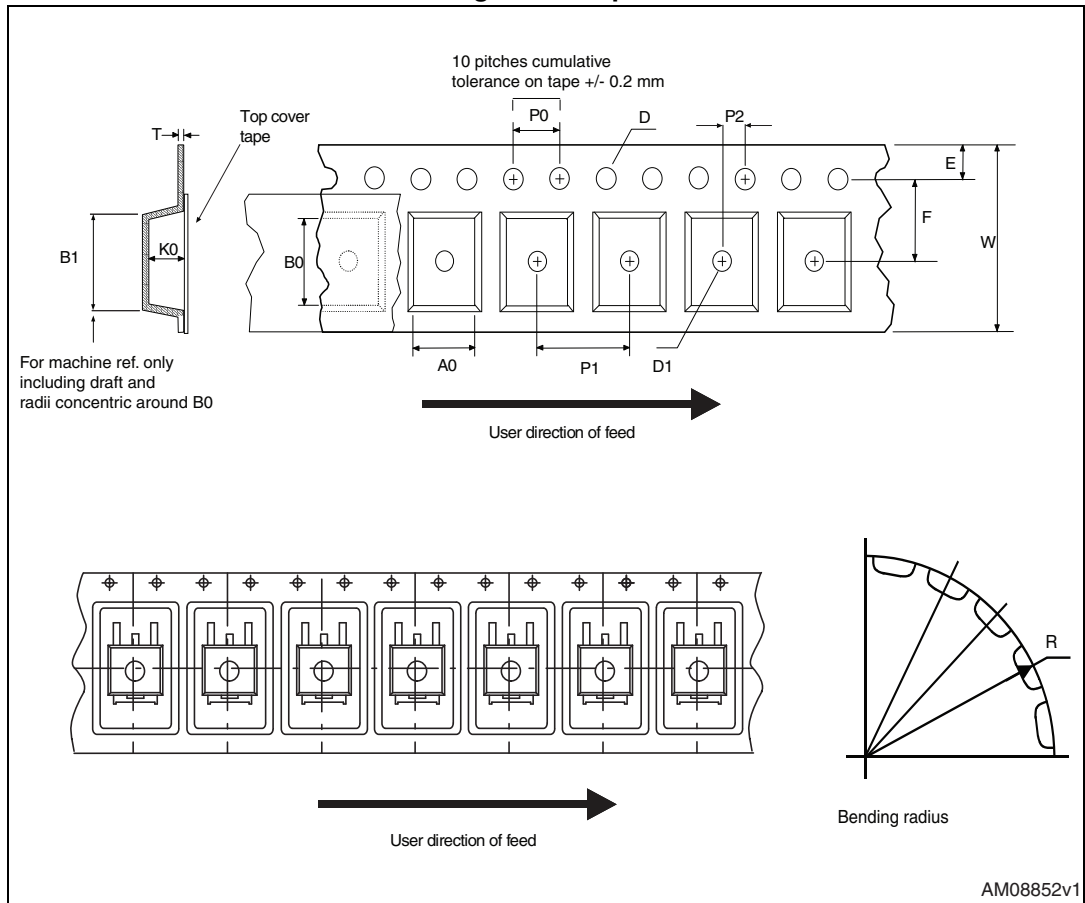
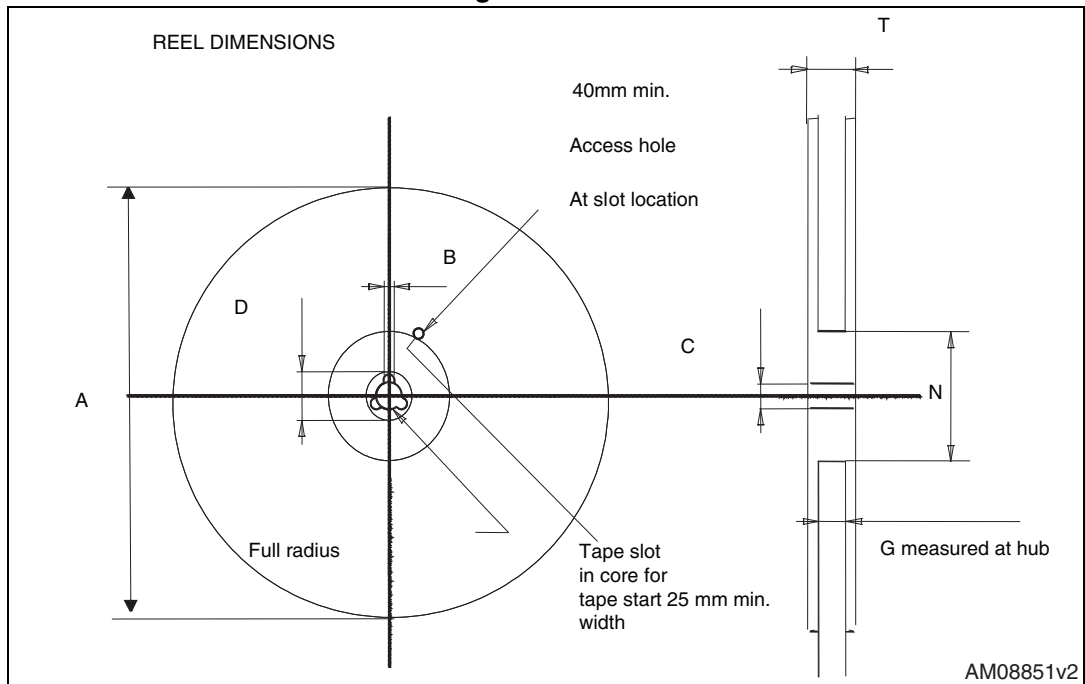


Figure 24. Reel



6 Revision history

Table 12. Document revision history

Date	Revision	Changes
10-Oct-2013	1	First release.

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