

Automotive-grade N-channel 60 V, 0.07 Ω typ., 12 A, StripFET™ II Power MOSFET in a DPAK package

Datasheet - production data

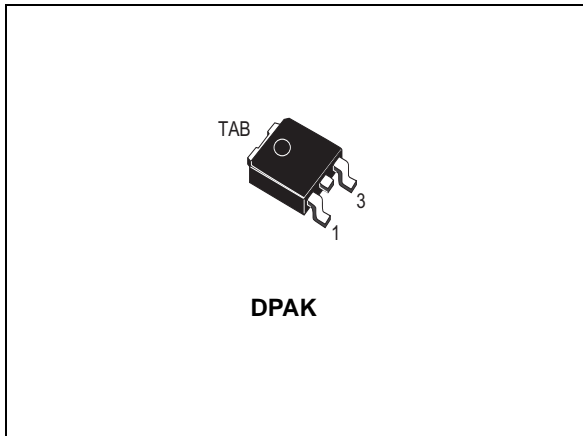
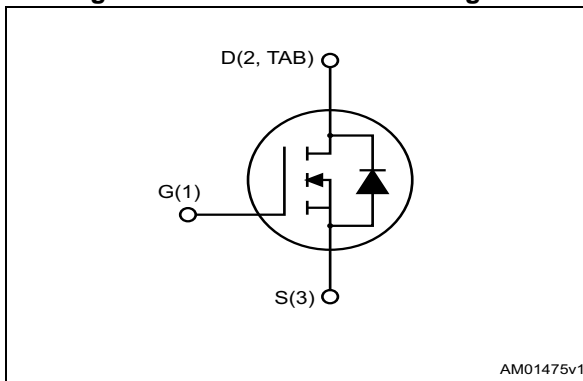


Figure 1. Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STD12NF06LT4	60 V	0.09 Ω	12 A

- Designed for automotive applications and AEC-Q101 qualified
- Exceptional dv/dt capability
- Low gate charge

Applications

- Switching applications

Description

This Power MOSFET has been developed using STMicroelectronics' unique STRipFET process, which is specifically designed to minimize input capacitance and gate charge. This renders the device suitable for use as primary switch in advanced high-efficiency isolated DC-DC converters for telecom and computer applications, and applications with low gate charge driving requirements.

Table 1. Device summary

Order code	Marking	Package	Packaging
STD12NF06LT4	D12NF06L	DPAK	Tape and reel

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source voltage	60	V
V _{GS}	Gate-source voltage	± 16	V
I _D	Drain current (continuous) at T _C = 25 °C	12	A
I _D	Drain current (continuous) at T _C = 100 °C	8.5	A
I _{DM} ⁽¹⁾	Drain current (pulsed)	48	A
P _{TOT}	Total dissipation at T _C = 25 °C	30	W
	Derating factor	0.2	W/°C
dv/dt ⁽²⁾	Peak diode recovery voltage slope	15	V/ns
E _{AS} ⁽³⁾	Single pulse avalanche energy	100	mJ
T _{stg}	Storage temperature	-55 to 175	°C
T _J	Max. operating junction temperature		

1. Pulse width limited by safe operating area
2. I_{SD} ≤ 12 A, di/dt ≤ 200 A/μs, V_{DS} ≤ 40 V, T_J ≤ T_{JMAX}
3. Starting T_J = 25 °C, I_D = 6 A, V_{DD} = 30 V

Table 3. Thermal data

Symbol	Parameter	Value	Unit
R _{thj-case}	Thermal resistance junction-case max.	5	°C/W
R _{thj-pcb} ⁽¹⁾	Thermal resistance junction-pcb max.	50	°C/W

1. When mounted on FR-4 board of 1 inch², 2 oz Cu.

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	$V_{GS} = 0, I_D = 250\ \mu A,$	60			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0, V_{DS} = 60$			1	μA
		$V_{GS} = 0, V_{DS} = 60$ $T_C = 125\text{ °C}$			10	μA
I_{GSS}	Gate body leakage current	$V_{DS} = 0$ $V_{GS} = \pm 16\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu A$	1		2	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 6\text{ A}$		0.07	0.09	Ω
		$V_{GS} = 5\text{ V}, I_D = 6\text{ A}$		0.08	0.1	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}, f = 1\text{ MHz},$ $V_{GS} = 0$		350		pF
C_{oss}	Output capacitance			75		pF
C_{riss}	Reverse transfer capacitance			30		pF
Q_g	Total gate charge	$V_{DD} = 48\text{ V}, I_D = 12\text{ A}$ $V_{GS} = 5\text{ V}$ see Figure 14		7.5	10	nC
Q_{gs}	Gate-source charge			2.5		nC
Q_{gd}	Gate-drain charge			3.0		nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30\text{ V}, I_D = 6\text{ A},$ $R_G = 4.7\ \Omega, V_{GS} = 4.5\text{ V}$ see Figure 13		10		ns	
t_r	Rise time			35		ns	
$t_{d(off)}$	Turn-off delay time				20		ns
t_f	Fall time				13		ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current				12	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				48	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 12\text{ A}$, $V_{GS} = 0$			1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 12\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 16\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$ see Figure 15		50		ns
Q_{rr}	Reverse recovery charge			65		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

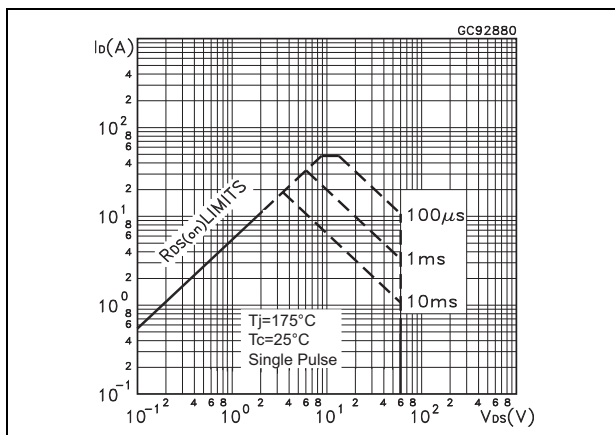


Figure 3. Thermal impedance

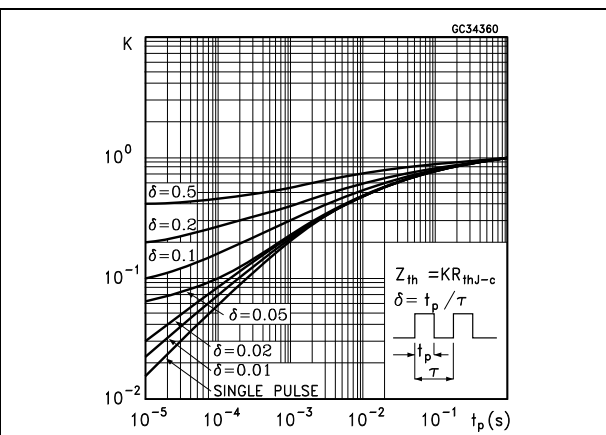


Figure 4. Output characteristics

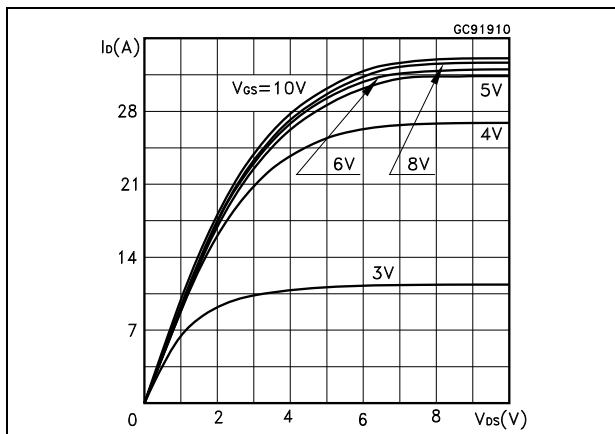


Figure 5. Transfer characteristics

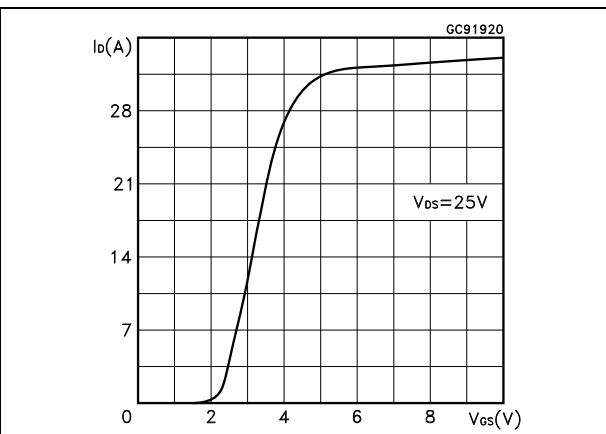


Figure 6. Normalized $V_{(BR)DSS}$ vs. temperature

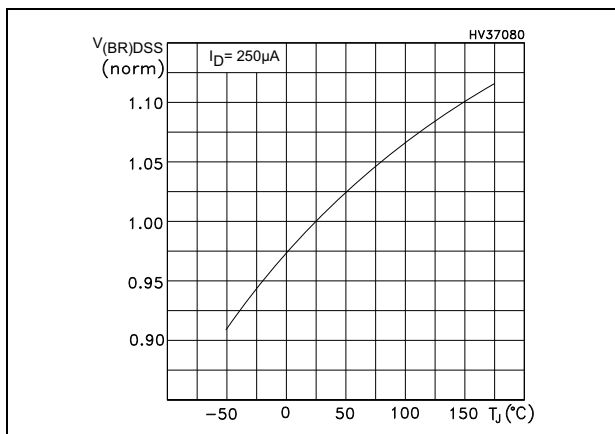


Figure 7. Static drain-source on-resistance

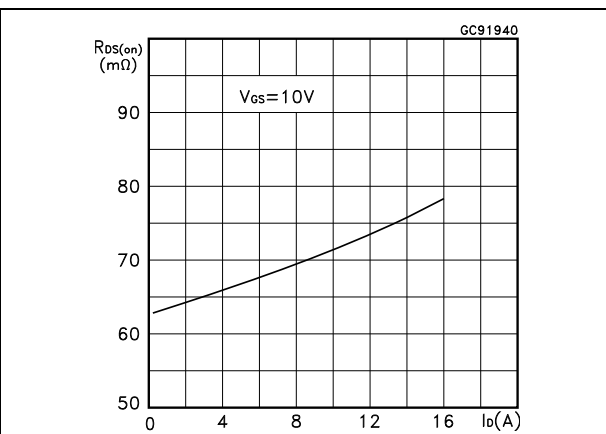


Figure 8. Gate charge vs. gate-source voltage

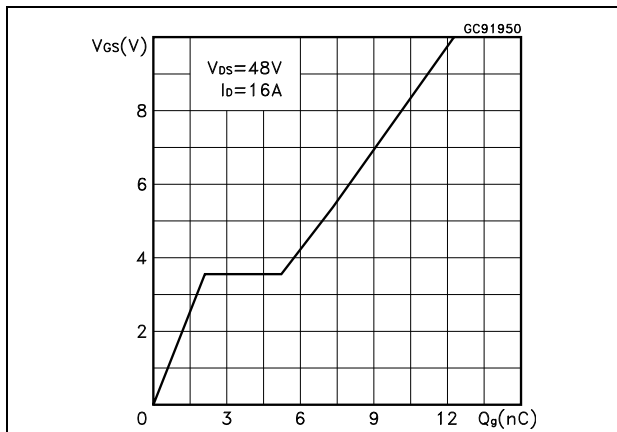


Figure 9. Capacitance variations

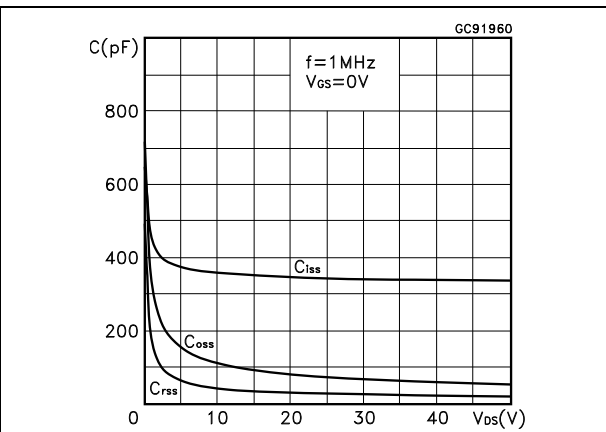


Figure 10. Normalized gate threshold voltage vs. temperature

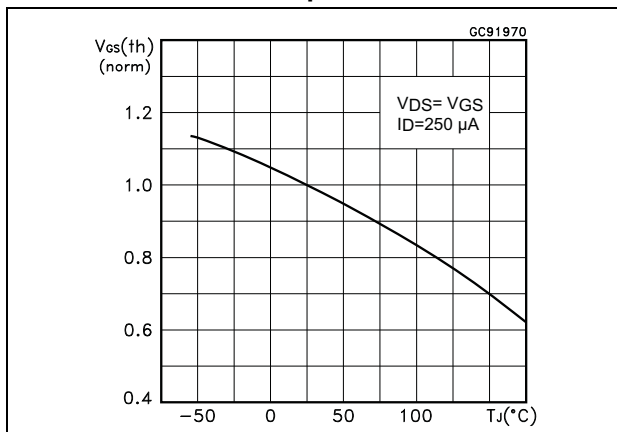


Figure 11. Normalized on-resistance vs. temperature

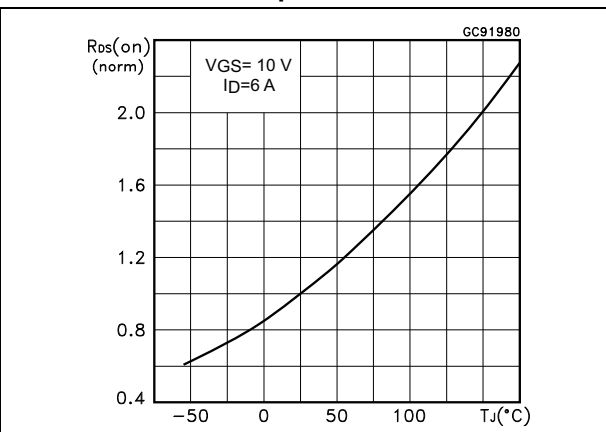
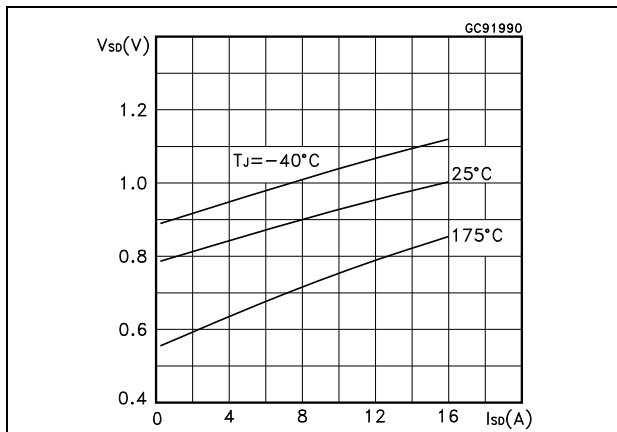


Figure 12. Source-drain diode forward characteristics



3 Test circuit

Figure 13. Switching times test circuit for resistive load



Figure 14. Gate charge test circuit



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



Figure 16. Unclamped inductive load test circuit



Figure 17. Unclamped inductive waveform

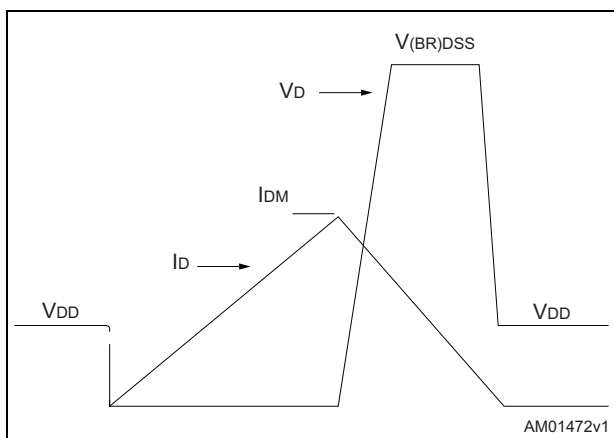
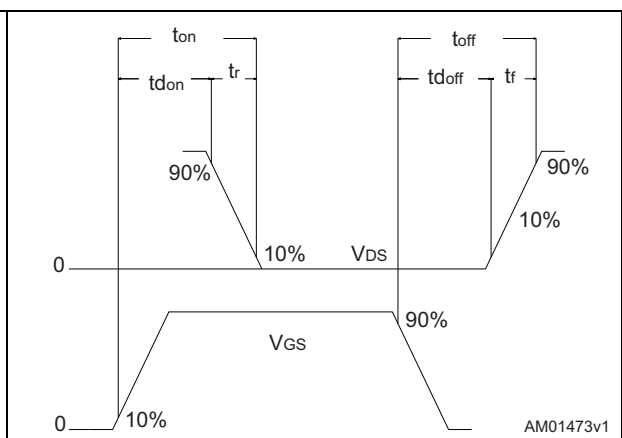


Figure 18. Switching time waveform



4 Package 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.

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

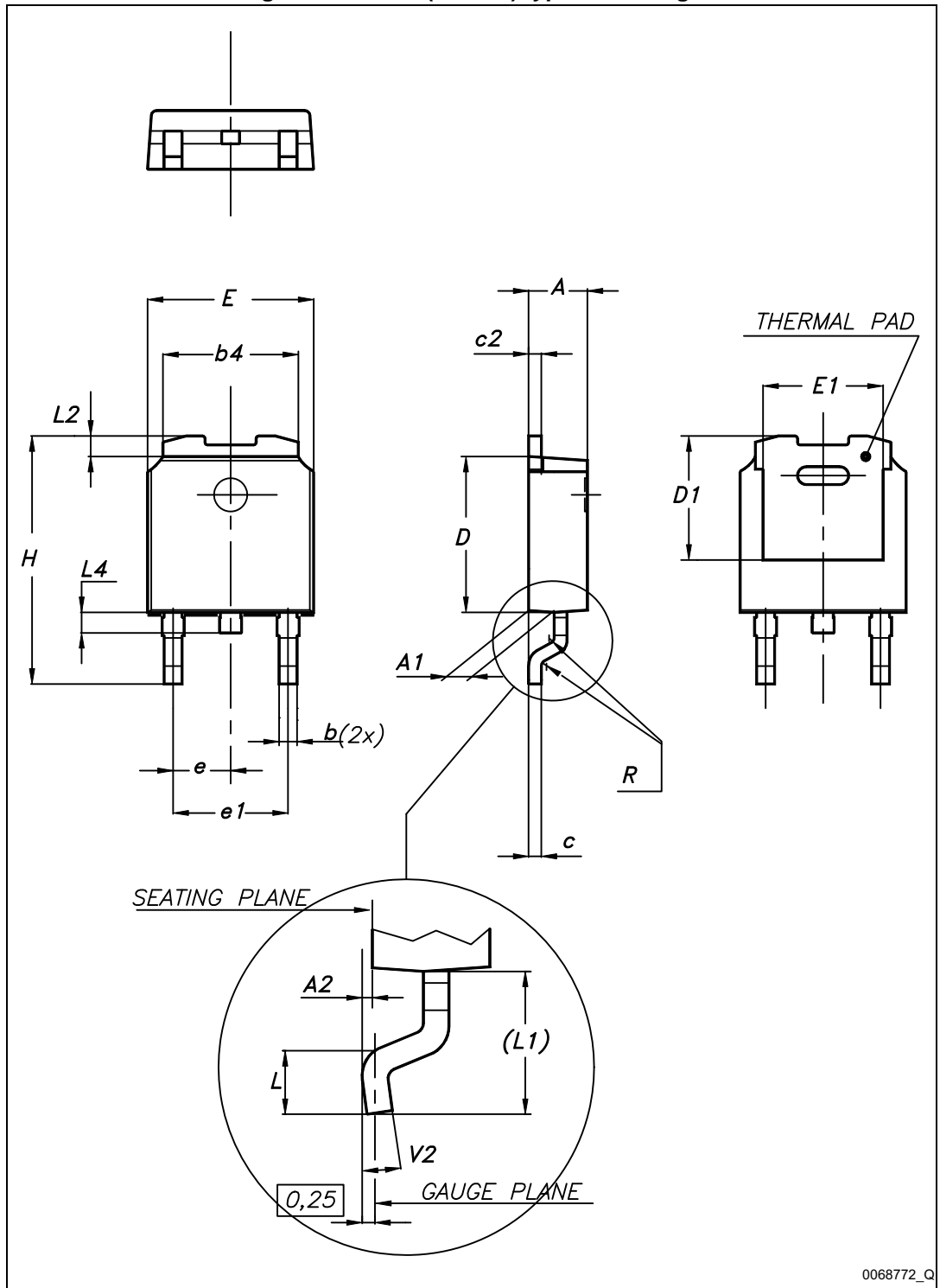
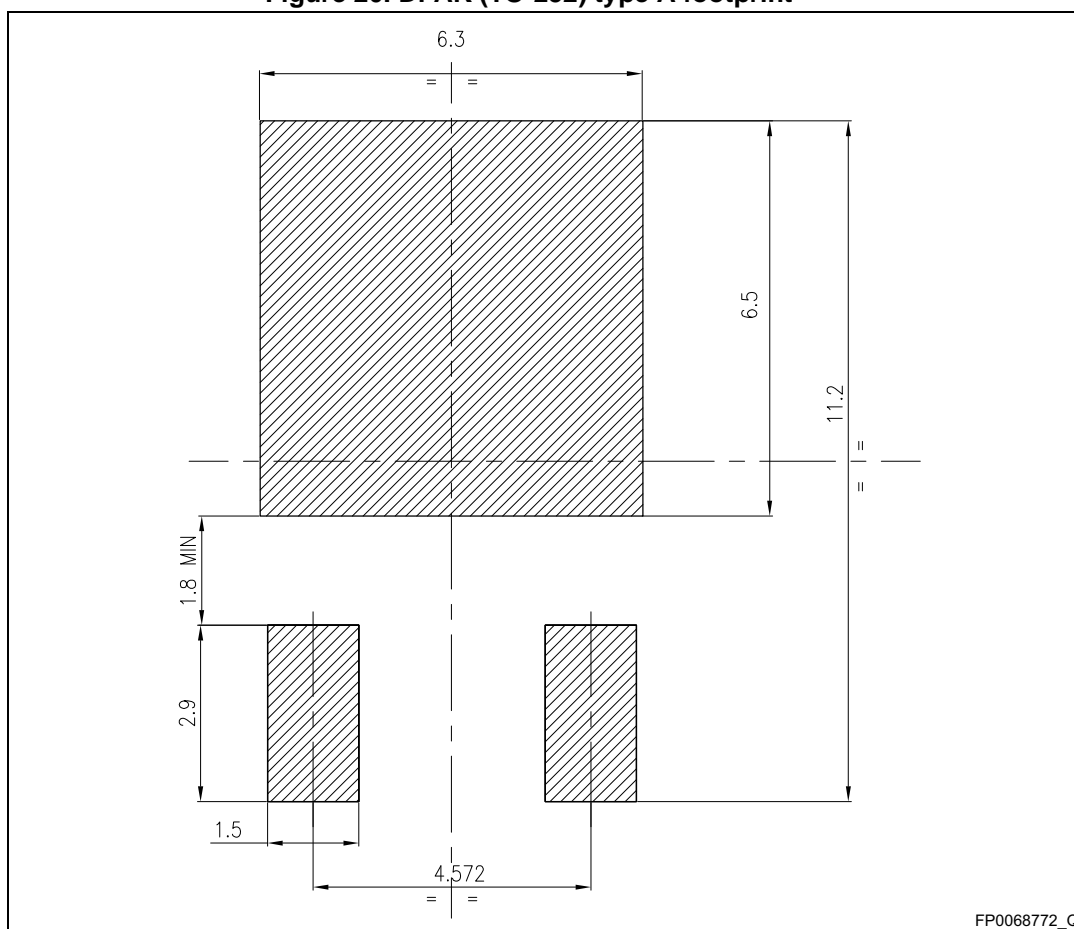


Table 8. DPAK (TO-252) type A mechanical data

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 20. DPAK (TO-252) type A footprint (a)



a. All dimensions are in millimeters

5 Packaging mechanical data

Figure 21. Tape

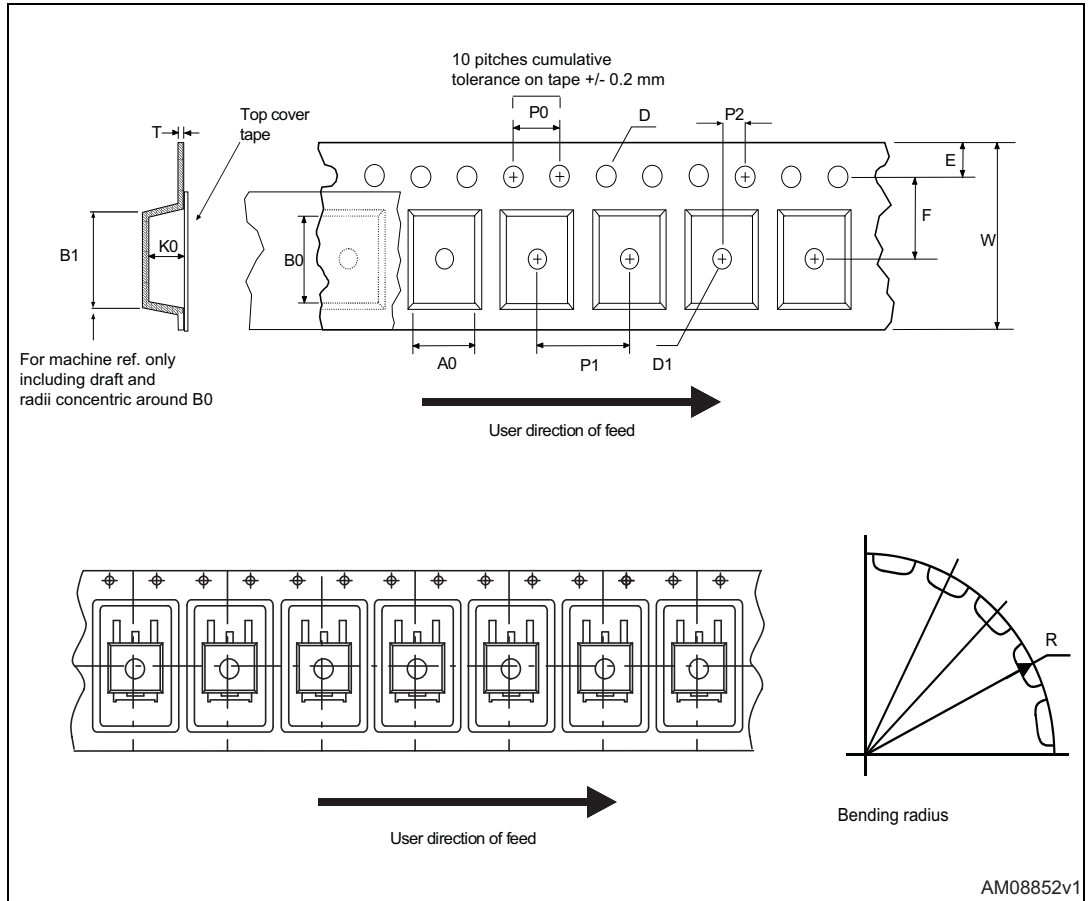
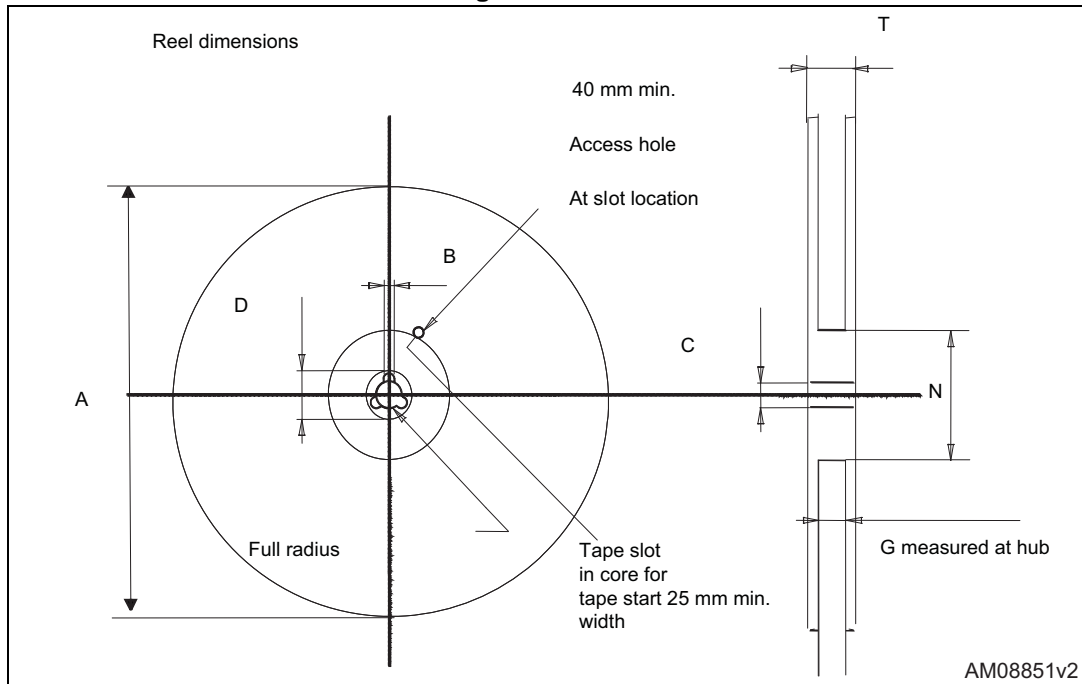


Figure 22. Reel



AM08851v2

Table 9. 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			

6 Revision history

Table 10. Document revision history

Date	Revision	Changes
26-Jun-2014	1	First release.
14-Nov-2014	2	Updated title and features in cover page Updated Table 3.: Thermal data , Table 4.: On/off states and Table 5.: Dynamic Updated Figure 2: Safe operating area , Figure 3: Thermal impedance , Figure 6.: Normalized $V_{(BR)DSS}$ vs. temperature , Figure 10. , Figure 11.: Normalized on-resistance vs. temperature and Section 4: Package mechanical data .

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