STD60NF55LA

N-channel 55 V, 0.012 Ω, 60 A DPAK STripFET™ II Power MOSFET

Features

Order code	V_{DSS}	$R_{DS(on)}$	I_D
STD60NF55LA	55V	<0.015Ω	60A

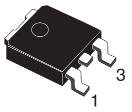
- Low threshold drive

Applications

- Switching application
- Automotive

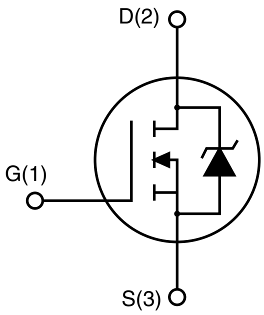
Description

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.



DPAK

Figure 1. Internal schematic diagram



AM01475v1

Table 1. Device summary

Order code	Marking	Package	Packaging
STD60NF55LA	D60NF55LA	DPAK	Tape and reel

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	55	V
V_{GS}	Gate- source voltage	± 15	V
I_D	Drain current (continuous) at T_C = 25 °C	60	A
I_D	Drain current (continuous) at T_C = 100 °C	42	A
I_{DM}(1)	Drain current (pulsed)	240	A
P_{tot}	Total dissipation at T_C = 25 °C	110	W
	Derating factor	0.73	W/°C
dv/dt(2)	Peak diode recovery voltage slope	16	V/ns
E_{AS} (3)	Single pulse avalanche energy	400	mJ
T_{stg}	Storage temperature	-55 to 175	°C
T_j	Max. operating junction temperature		

1. Pulse width limited by safe operating area.
2. $I_{SD} \leq 40A$, di/dt $\leq 350A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$, $Tj \leq T_{JMAX}$.
3. Starting T_j = 25 °C, I_D = 17.5 A, V_{DD} =24 V

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1.36	°C/W
$R_{thj-amb}$	Thermal resistance junction-to ambient max	100	°C/W

2 Electrical characteristics

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

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 250 µA, V_{GS} =0	55			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 55 V V_{DS} = 55 V, T_C=125 °C			1 10	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 15 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	1		2	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 30 A V_{GS} = 5 V, I_D = 30 A		0.012 0.014	0.015 0.017	Ω Ω
$I_{D(on)}$	On state drain current	V_{GS} = 3.5 V, V_{DS} ≥12 V -55 °C < Tj < 150 °C	35			A

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward transconductance	V_{DS} = 10 V, I_D = 30 A	-	35		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0	-	1950 390 130		pF pF pF
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off delay time Fall time	V_{DD} = 25 V, I_D = 30 A R_G = 4.7 Ω V_{GS} = 4.5 V (see *Figure 14*)	-	30 180 80 35		ns ns ns ns
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 40 V, I_D = 60 A, V_{GS} = 5 V, R_G = 4.7 Ω (see *Figure 15*)	-	40 10 20	56	nC nC nC

1. Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %.

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)		-		60 240	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 60 A, V_{GS} = 0	-		1.3	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 40 A, di/dt = 100 A/µs, V_{DD} = 25 V, T_j = 150 °C (see *Figure 16*)	-	65 130 4		ns nC 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

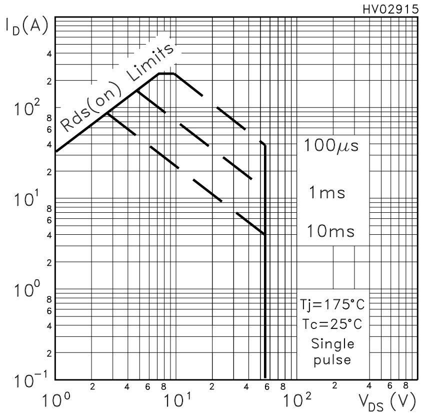


Figure 3. Thermal impedance

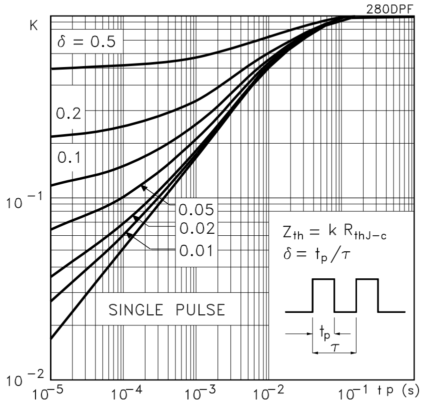


Figure 4. Output characterisics

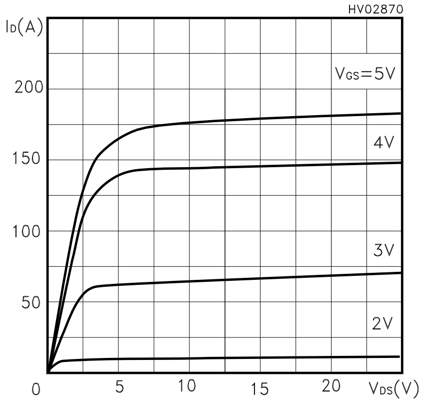


Figure 5. Transfer characteristics

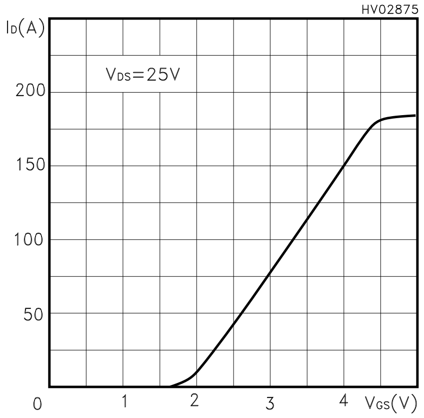


Figure 6. Transconductance

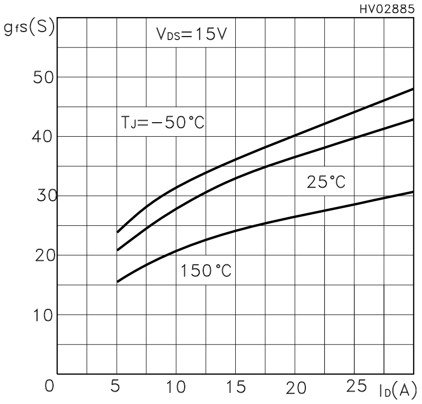


Figure 7. Static drain-source on resistance

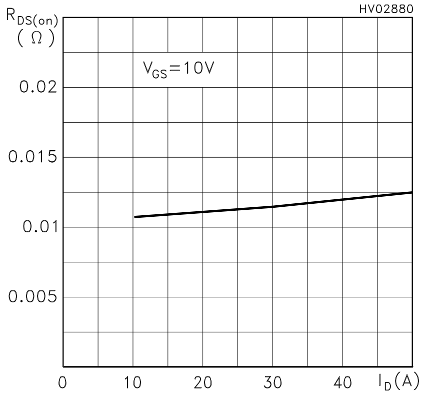


Figure 8. Gate charge vs gate-source voltage

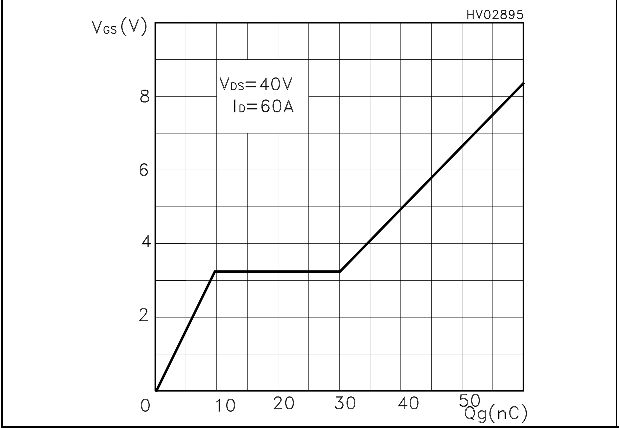


Figure 9. Capacitance variations

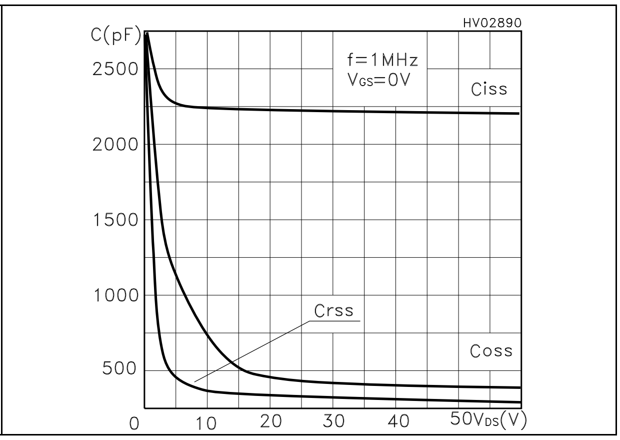


Figure 10. Normalized gate threshold voltage vs temperature

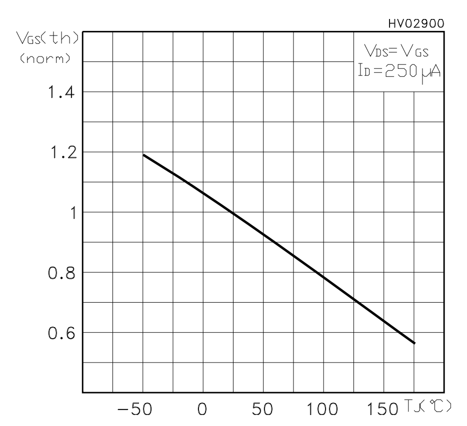


Figure 11. Normalized on resistance vs temperature

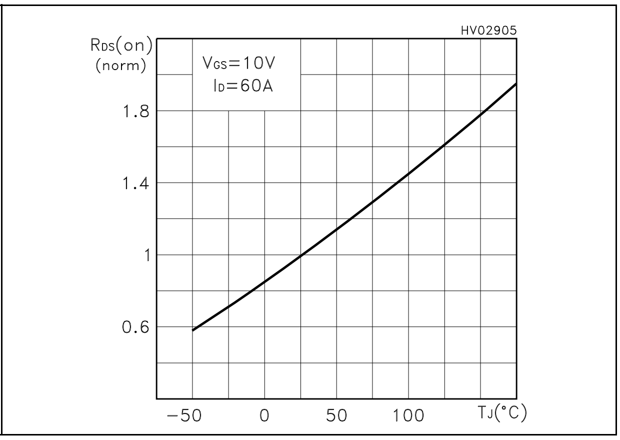


Figure 12. Source-drain diode forward characteristics

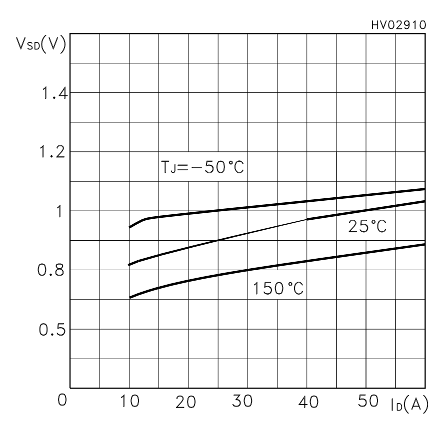
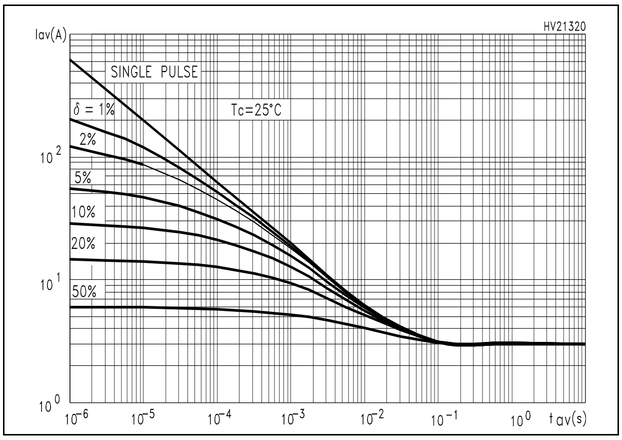


Figure 13. Allowable I_{AV} vs time in avalanche



The previous curve gives the safe operating area for unclamped inductive loads, single pulse or repetitive, under the following conditions:

$P_{D(AVE)} = 0.5^* (1.3^*BV_{DSS}{}^*I_{AV})$

$E_{AS(AR)} = P_{D(AVE)}{}^*t_{AV}$

Where:

I_{AV} is the allowable current in avalanche,

$P_{D(AVE)}$ is the average power dissipation in avalanche (single pulse)

t_{AV} is the time in avalanche.

To derate above 25°C, at fixed I_{AV}, the following equation must be applied:

$I_{AV}=2^*(T_{jmax}-T_{CASE}) / (1.3^*BV_{DSS}{}^*Z_{th})$

Where:

$Z_{th}= K^*R_{th}$ is the value coming from normalized thermal response at fixed pulse width equal to T_{AV}

3 Test circuit

Figure 14. Switching times test circuit for resistive load

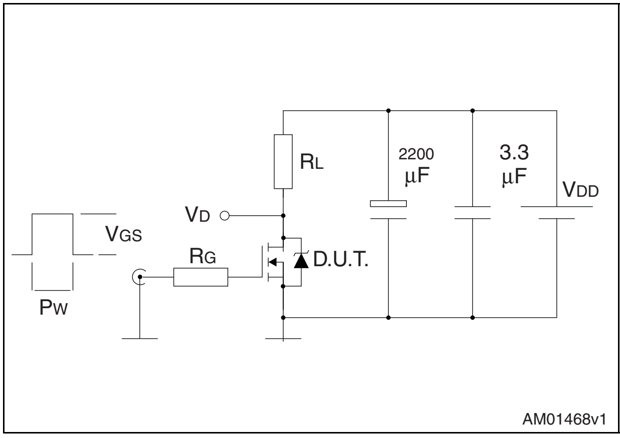


Figure 15. Gate charge test circuit

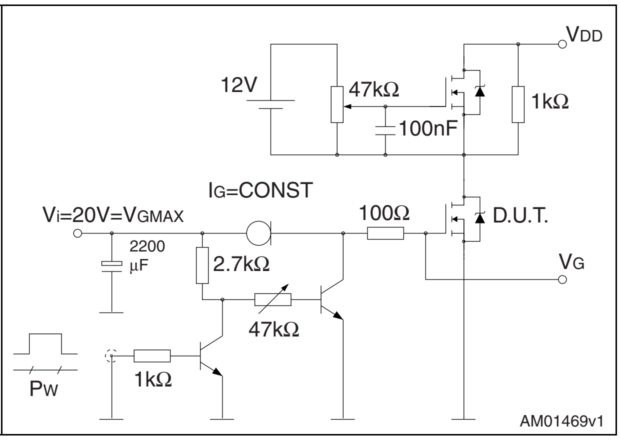


Figure 16. Test circuit for inductive load switching and diode recovery times

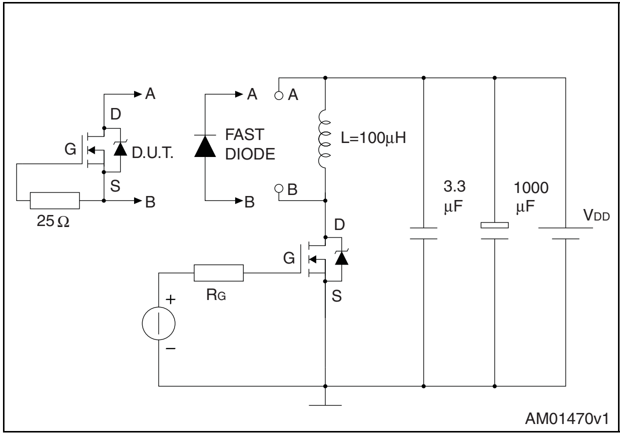


Figure 17. Unclamped Inductive load test circuit

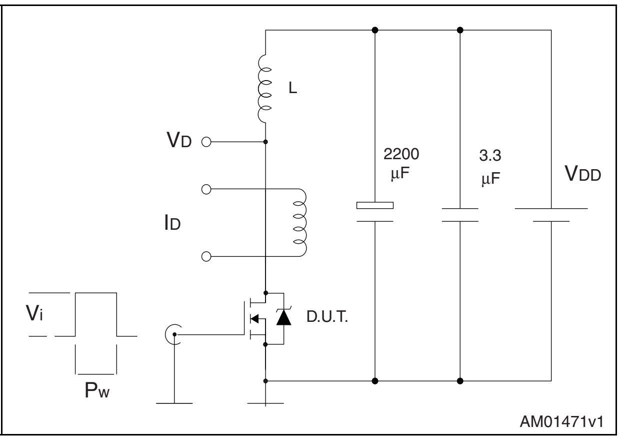


Figure 18. Unclamped inductive waveform

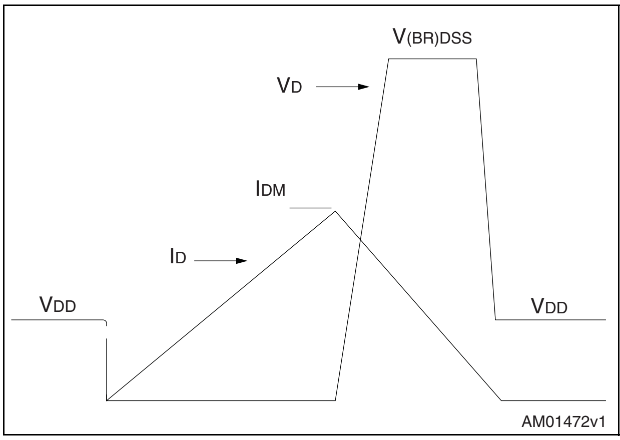
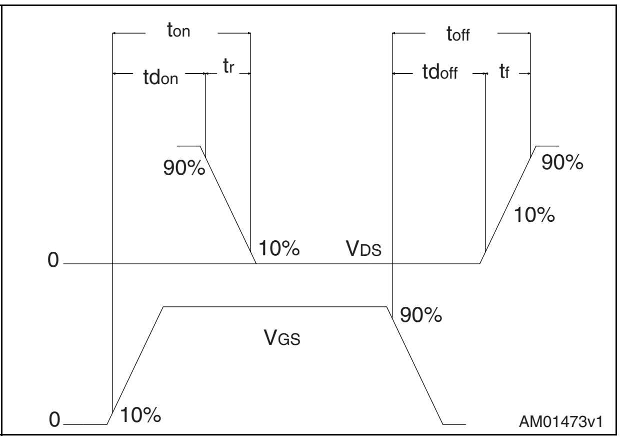


Figure 19. Switching time waveform



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.

Table 7. DPAK (TO-252) 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		1.50
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0°		8°

Figure 20. DPAK (TO-252) drawing

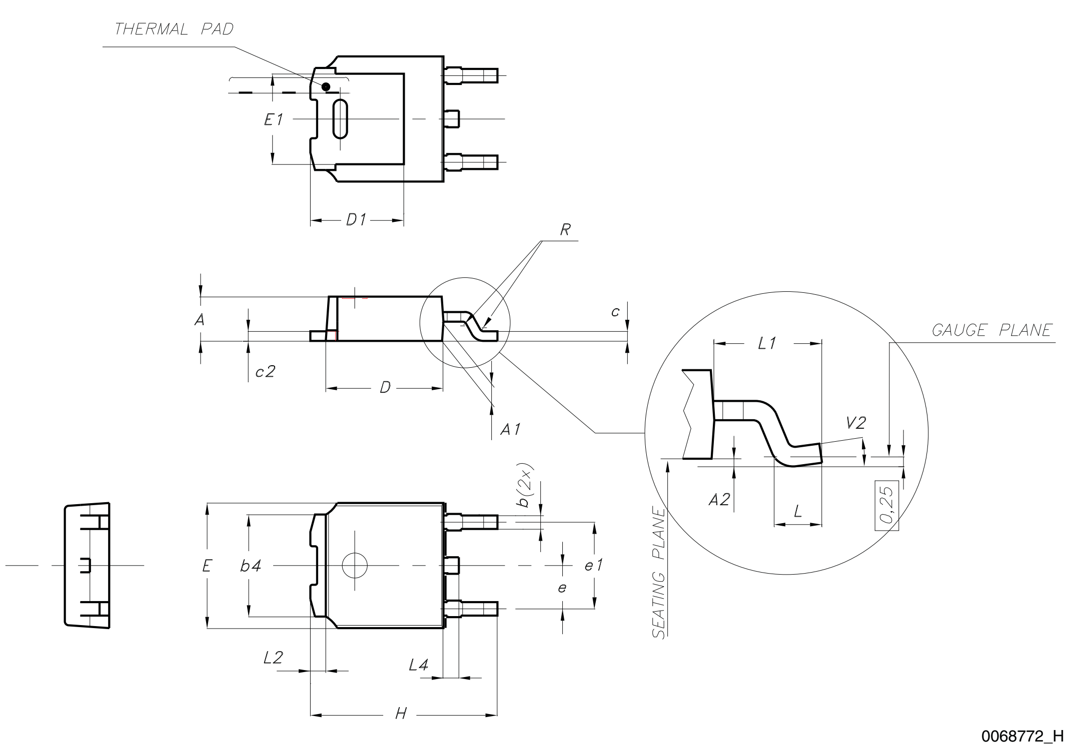
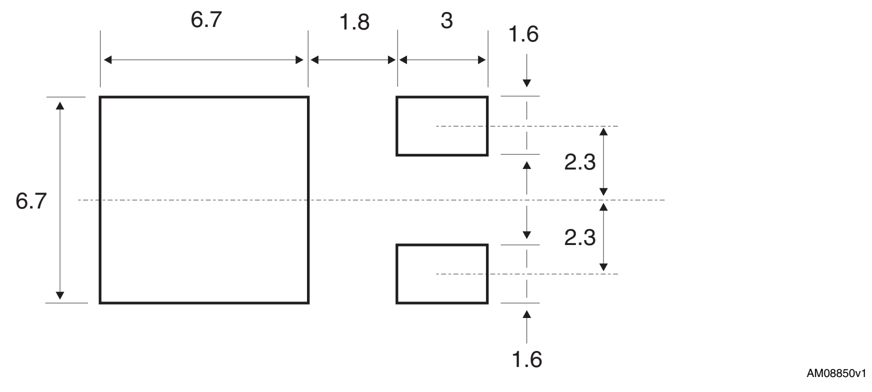


Figure 21. DPAK footprint[a]



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[a] All dimension are in millimeters

5 Packing mechanical data

Table 8. 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 22. Tape for DPAK (TO-252)

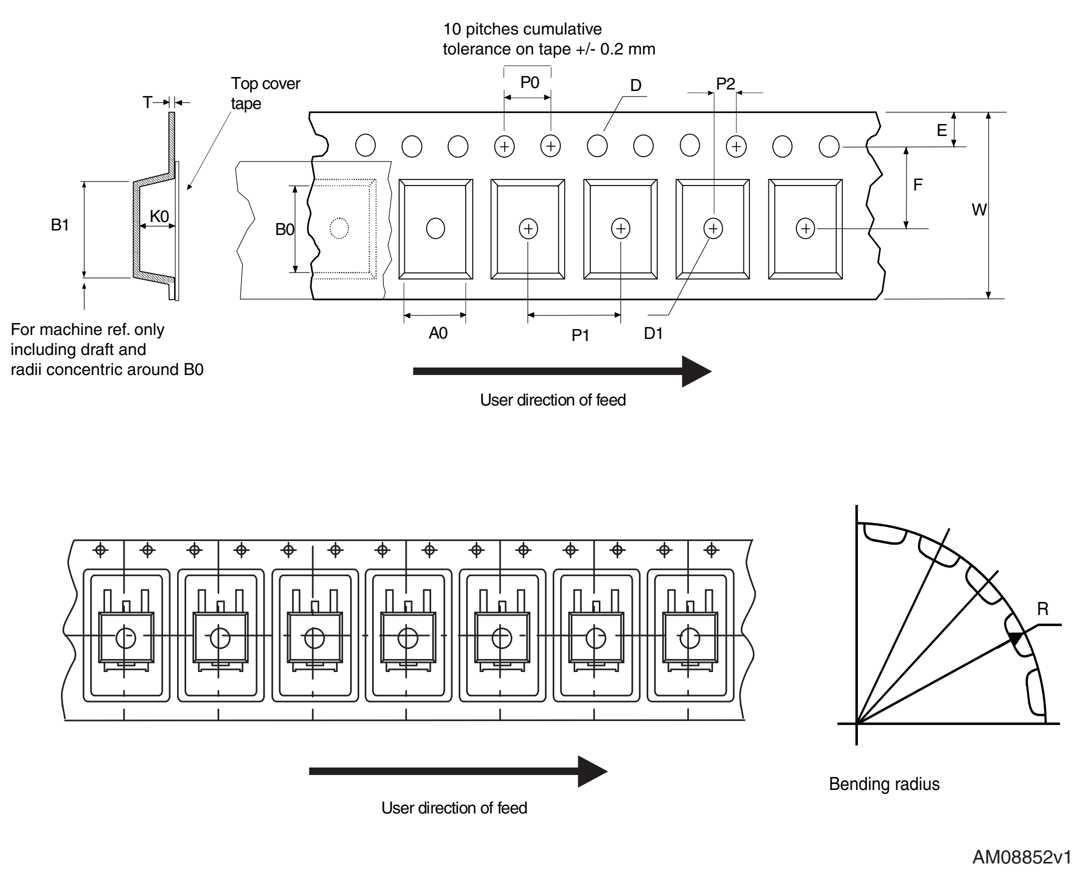
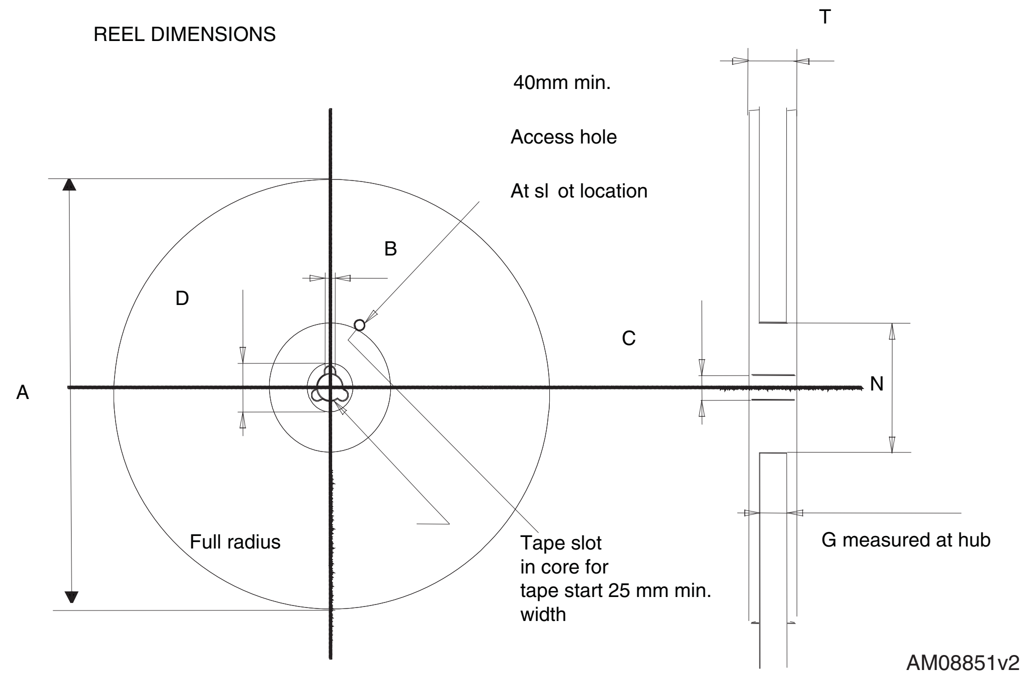


Figure 23. Reel for DPAK (TO-252)



6 Revision history

Table 9. Revision history

Date	Revision	Changes
11-May-2005	1	First release
31-Jan-2006	2	New template
05-Oct-2011	3	*Section : Applications* has been modified Minor text changes

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