

## Automotive-grade P-channel -60 V, 0.13 $\Omega$ typ., -10 A STripFET™ F6 Power MOSFET in a DPAK package

Datasheet - production data

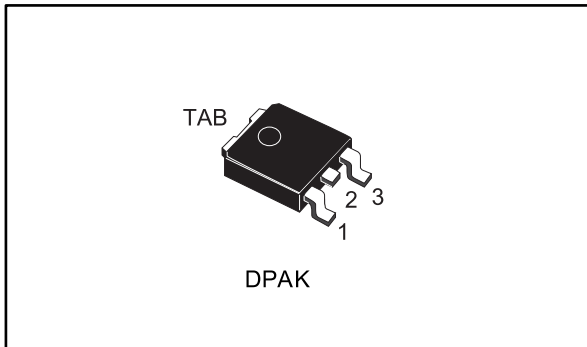
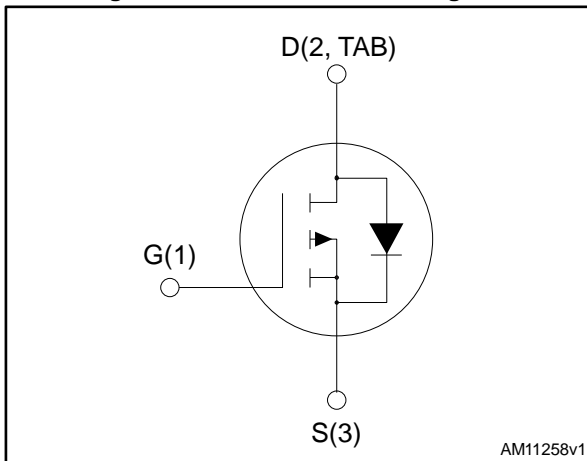


Figure 1: Internal schematic diagram



### Features

Order code	V <sub>DSS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
STD15P6F6AG	-60 V	0.16 $\Omega$	-10 A

- Designed for automotive applications and AEC-Q101 qualified
- Very low on-resistance
- Very low gate charge
- High avalanche ruggedness
- Low gate drive power loss

### Applications

- Switching applications

### Description

This device is a P-channel Power MOSFET developed using the STripFET™ F6 technology, with a new trench gate structure. The resulting Power MOSFET exhibits very low R<sub>DS(on)</sub> in all packages.

Table 1: Device summary

Order code	Marking	Package	Packaging
STD15P6F6AG	15P6F6	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	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	-10	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	-7.2	A
$I_{DM}^{(2)}$	Drain current (pulsed)	-40	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	35	W
$E_{AS}$	Single pulse avalanche energy (starting $T_J=25\text{ }^\circ\text{C}$ , $I_D=-3\text{ A}$ , $V_{DD}=-40\text{ V}$ )	80	mJ
$V_{DG}$	Drain-gate voltage	-20	V
$T_{stg}$	Storage temperature	-55 to 175	$^\circ\text{C}$
$T_J$	Maximum junction temperature	175	$^\circ\text{C}$

**Notes:**

<sup>(1)</sup>Limited by package

<sup>(2)</sup>Pulse width limited by safe operating area.

**Table 3: Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	4.29	$^\circ\text{C/W}$
$R_{thj-pcb}$	Thermal resistance junction-pcb max <sup>(1)</sup>	50	$^\circ\text{C/W}$

**Notes:**

<sup>(1)</sup>When mounted on 1 inch<sup>2</sup> FR-4, 2 Oz copper board

## 2 Electrical characteristics

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

**Table 4: Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$ , $I_D = -250\text{ }\mu\text{A}$	-60			V
$I_{DSS}$	Zero gate voltage Drain current	$V_{GS} = 0\text{ V}$ , $V_{DS} = -60\text{ V}$			-1	$\mu\text{A}$
		$V_{GS} = 0\text{ V}$ , $V_{DS} = -60\text{ V}$ , $T_C = 125\text{ }^\circ\text{C}$			-10	$\mu\text{A}$
$I_{GSS}$	Gate-body leakage current	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$	-2		-4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = -10\text{ V}$ , $I_D = -5\text{ A}$		0.13	0.16	$\Omega$

**Table 5: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = -48\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$	-	340	-	pF
$C_{oss}$	Output capacitance		-	40	-	pF
$C_{rss}$	Reverse transfer capacitance		-	20	-	pF
$Q_g$	Total gate charge	$V_{DD} = -30\text{ V}$ , $I_D = -10\text{ A}$ , $V_{GS} = -10\text{ V}$ (see <a href="#">Figure 14: "Gate charge test circuit"</a> )	-	6.4	-	nC
$Q_{gs}$	Gate-source charge		-	1.7	-	nC
$Q_{gd}$	Gate-drain charge		-	1.7	-	nC

**Table 6: Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = -48\text{ V}$ , $I_D = -5\text{ A}$ , $R_G = 4.7\text{ }\Omega$ , $V_{GS} = -10\text{ V}$ (see <a href="#">Figure 13: "Switching times test circuit for resistive load"</a> )	-	64	-	ns
$t_r$	Rise time		-	5.3	-	ns
$t_{d(off)}$	Turn-off-delay time		-	14	-	ns
$t_f$	Fall time		-	3.7	-	ns

Table 7: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		-10	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		-40	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$ , $I_{SD} = -5\text{ A}$	-		-1.1	V
$t_{rr}$	Reverse recovery time	$I_{SD} = -10\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = -48\text{ V}$ , (see <a href="#">Figure 15: "Test circuit for inductive load switching and diode recovery times"</a> )	-	20		ns
$Q_{rr}$	Reverse recovery charge		-	17.8		nC
$I_{RRM}$	Reverse recovery current		-	-1.8		A

**Notes:**

<sup>(1)</sup>Pulse width limited by safe operating area.

<sup>(2)</sup>Pulse test: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.2 Electrical characteristics (curves)

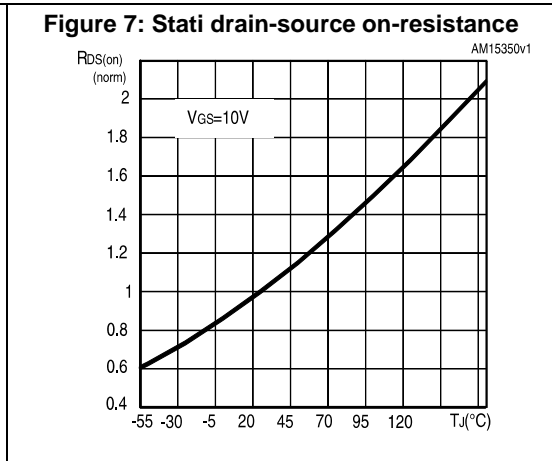
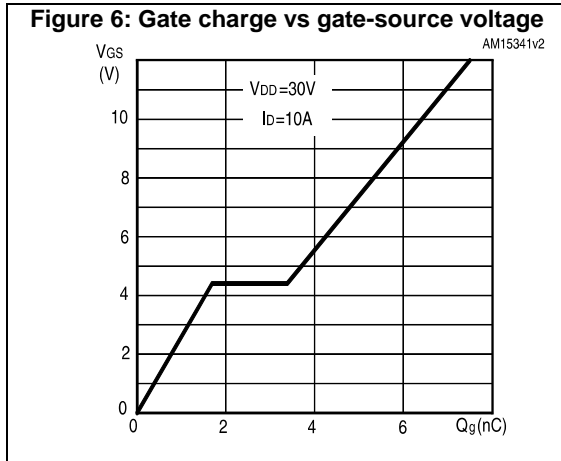
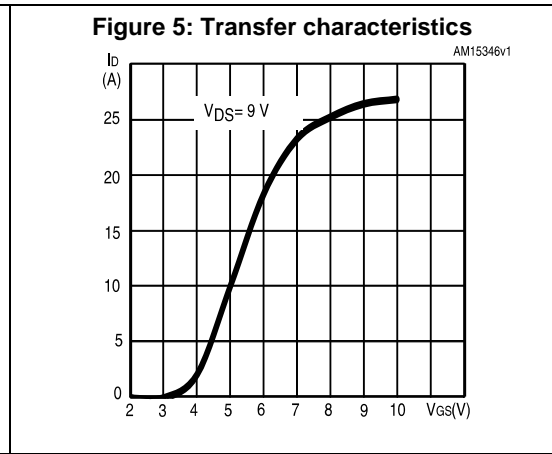
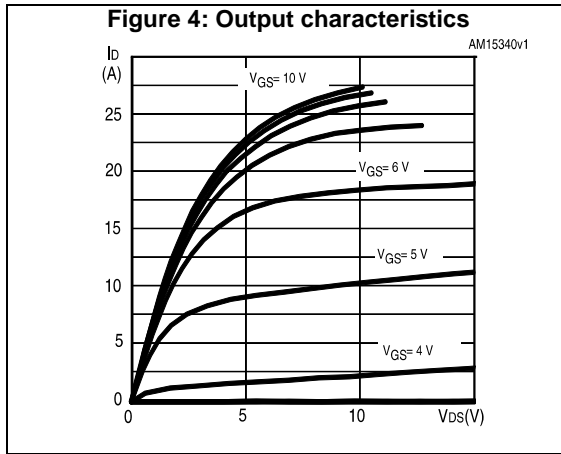
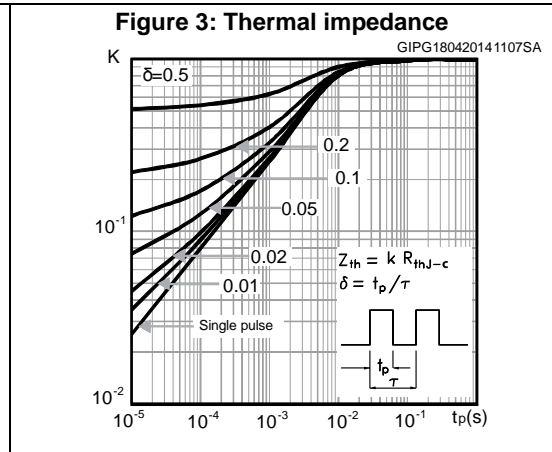
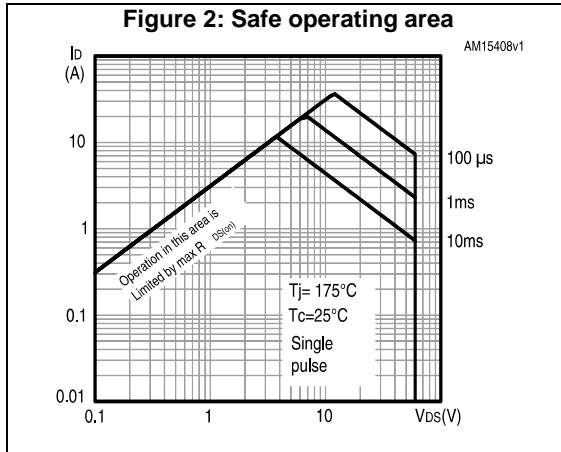


Figure 8: Capacitance variations

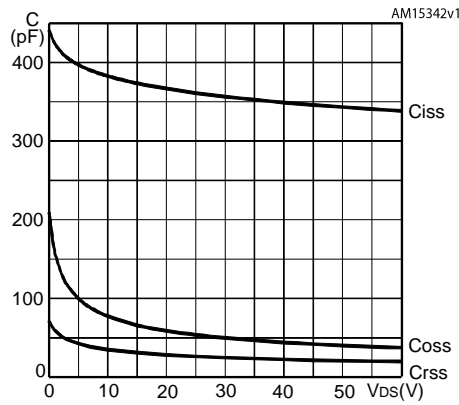


Figure 9: Normalized V(BR)DSS vs temperature

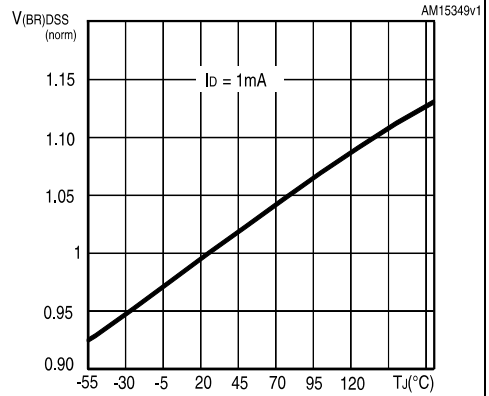


Figure 10: Normalized gate threshold voltage vs temperature

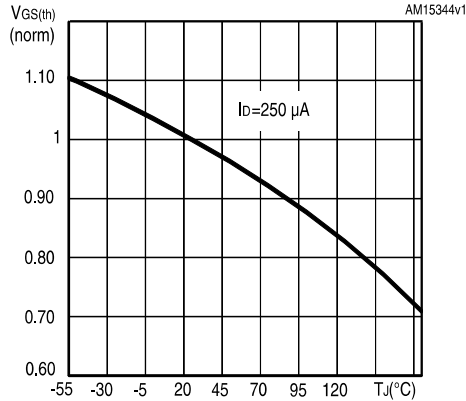


Figure 11: Normalized on-resistance vs. temperature

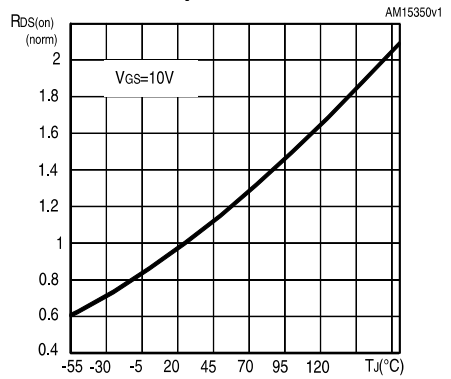
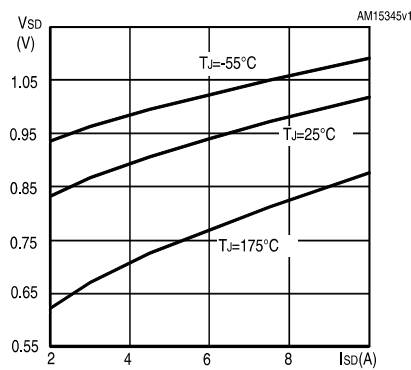


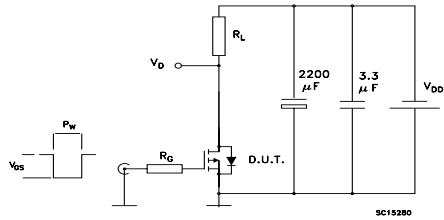
Figure 12: Source-drain diode forward characteristics



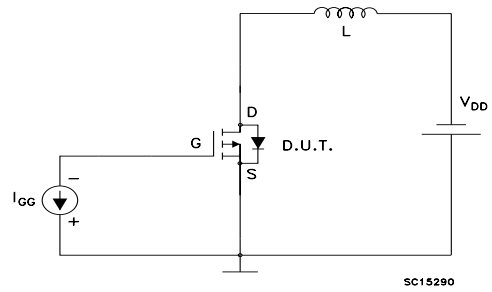
For the P-channel Power MOSFET, current and voltage polarities are reversed.

### 3 Test circuits

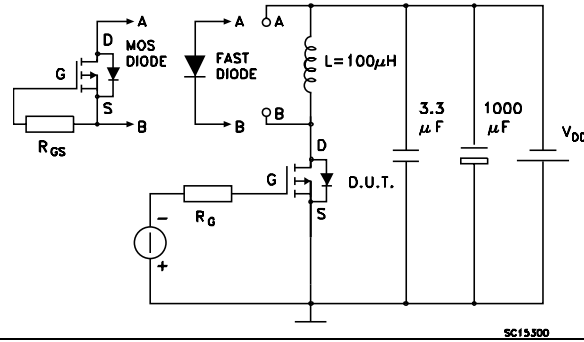
**Figure 13: Switching times test circuit for resistive load**



**Figure 14: Gate charge test circuit**



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





## 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](http://www.st.com). ECOPACK® is an ST trademark.

### 4.1 DPAK package information

Figure 16: DPAK (TO-252) type A package outline

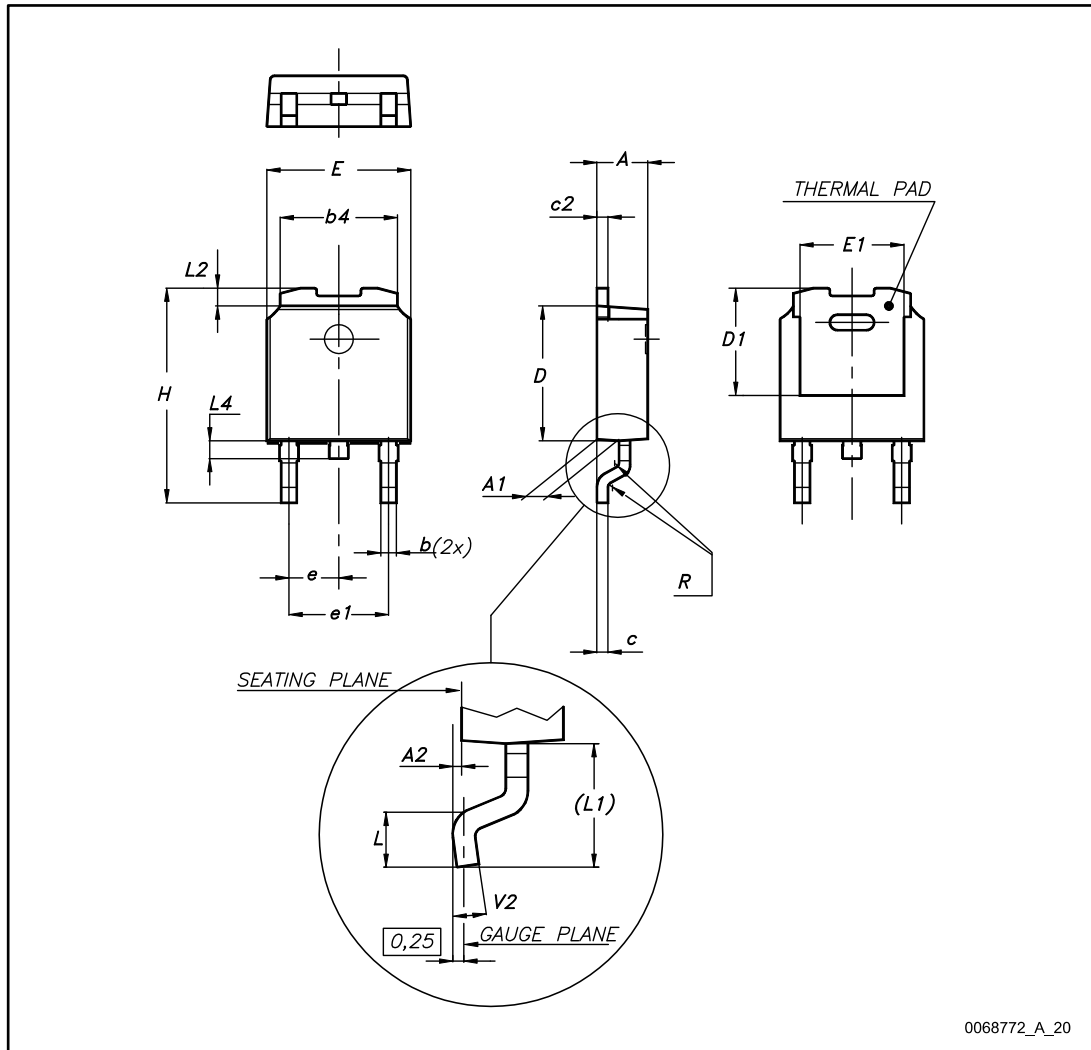
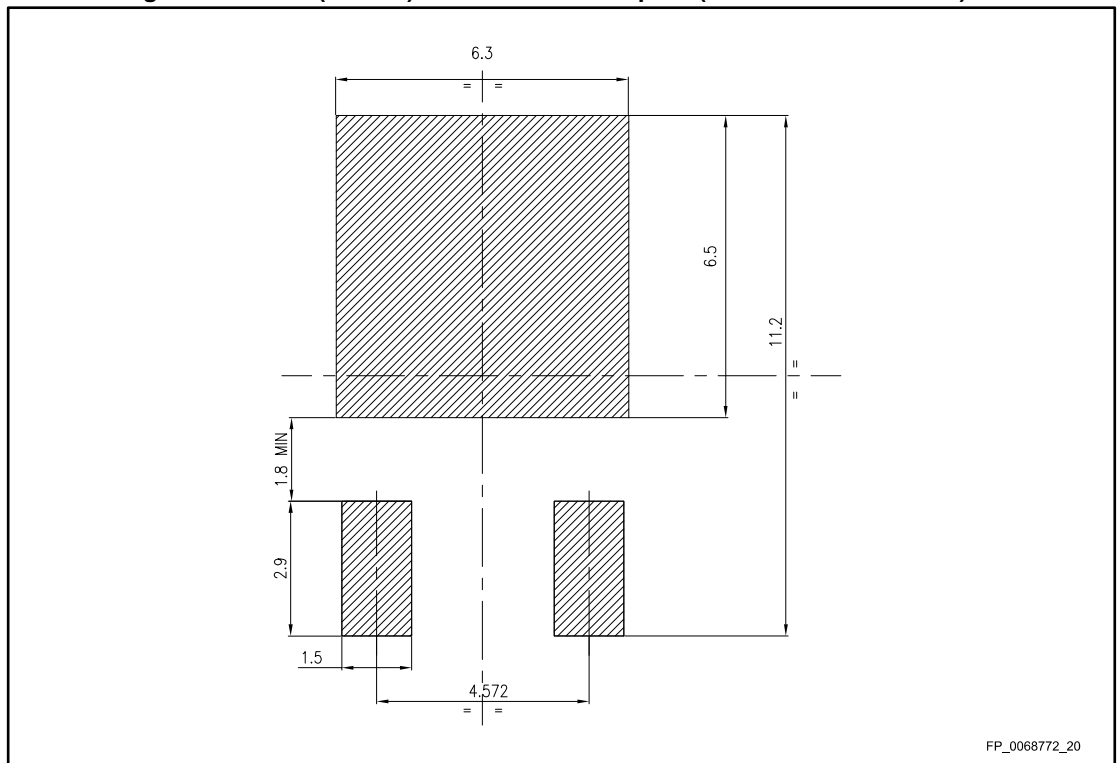


Table 8: DPAK (TO-252) type A mechanical data

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	2.16	2.28	2.40
e1	4.40		4.60
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°

Figure 17: DPAK (TO-252) recommended footprint (dimensions are in mm)



## 4.2 Packing information

Figure 18: DPAK (TO-252) tape outline

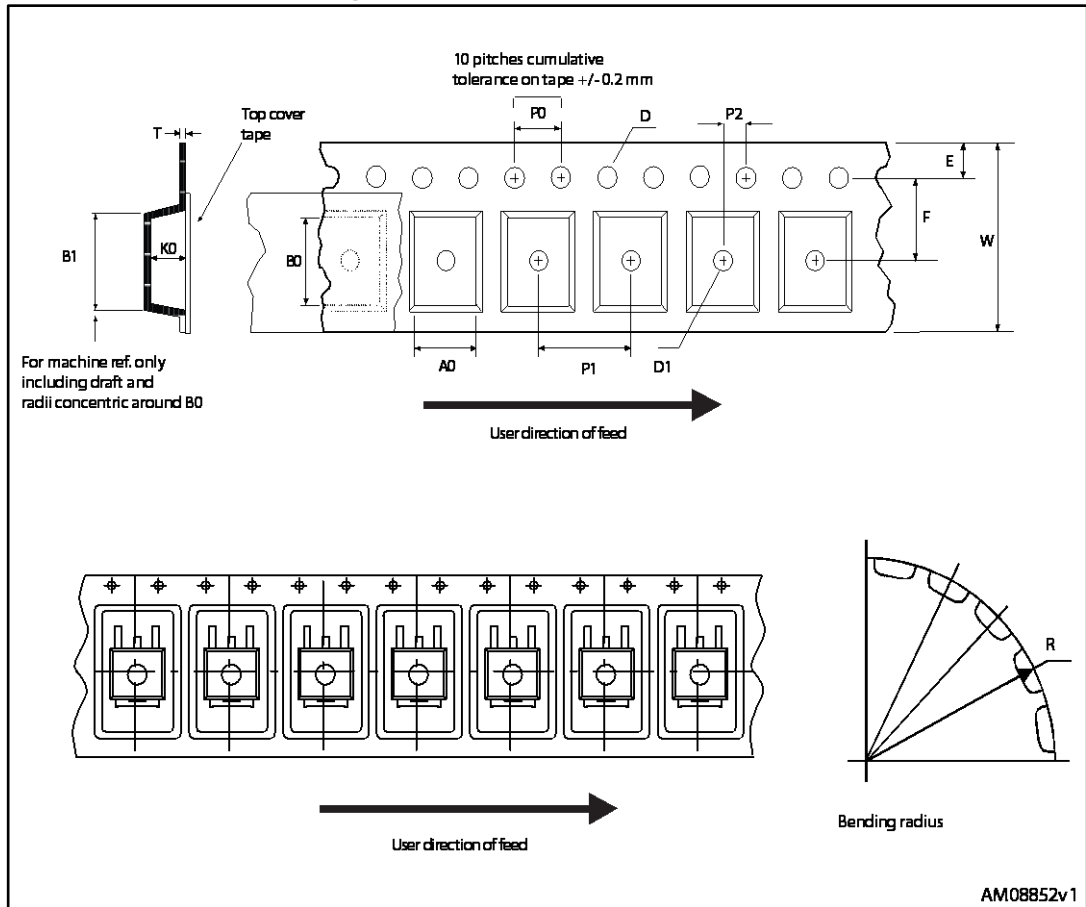


Figure 19: DPAK (TO-252) reel outline

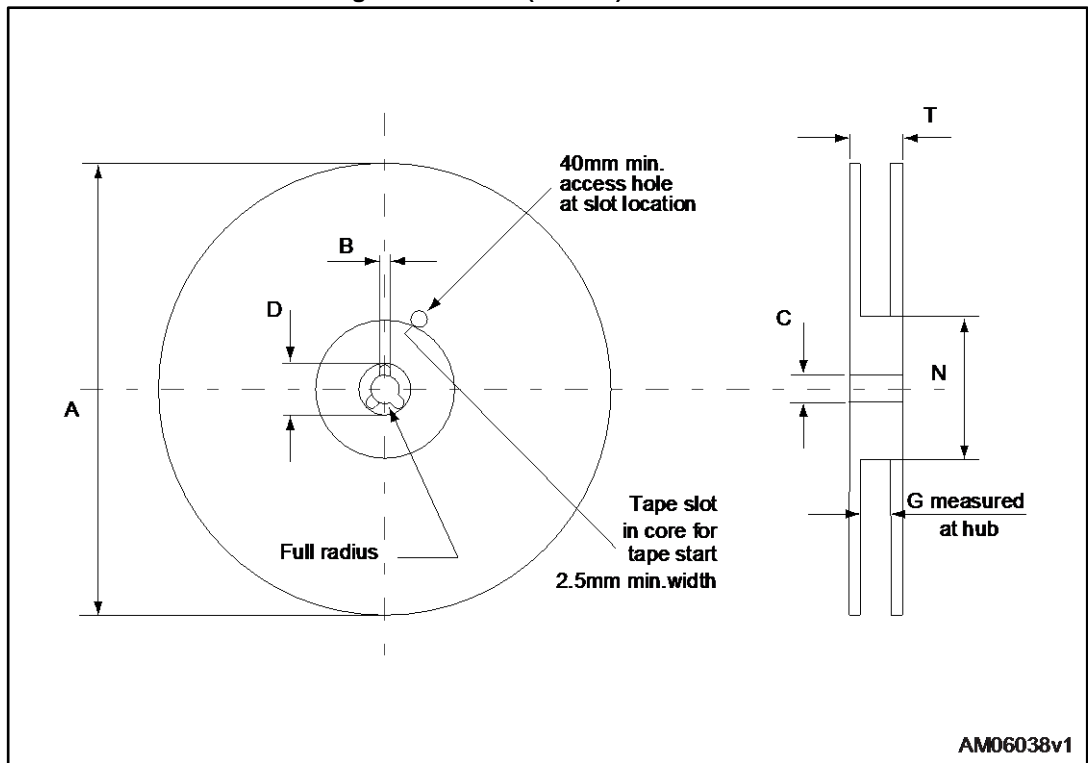


Table 9: DPAK (TO-252) tape and reel mechanical data

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			

## 5 Revision history

Table 10: Document revision history

Date	Revision	Changes
20-Oct-2015	1	First release.

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