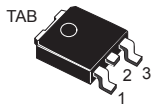
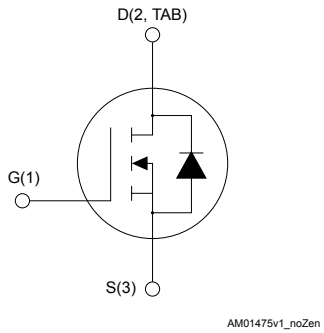
N-channel 250 V, 195 mΩ typ., 14 A STripFET II Power MOSFET in a DPAK package



DPAK



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STD16NF25	250 V	235 mΩ	14 A

- Exceptional dv/dt capability
- 100% avalanche tested
- 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.

Product status link
STD16NF25

Product summary	
Order code	STD16NF25
Marking	16NF25
Package	DPAK
Packing	Tape and reel

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	250	V
V_{GS}	Gate-source voltage	±20	V
I_D	Drain current (continuous) at T_C = 25 °C	14	A
	Drain current (continuous) at T_C = 100 °C	8.8	
I_{DM}(1)	Drain current (pulsed)	56	A
P_{TOT}	Total power dissipation at T_C = 25 °C	85	W
dv/dt(2)	Peak diode recovery voltage slope	15	V/ns
T_{stg}	Storage temperature range	-55 to 150	°C
T_J	Operating junction temperature range		°C

1. *Pulse width is limited by safe operating area.*
2. *I_{SD} ≤ 14 A, di/dt ≤ 300 A/µs, V_{DD} = 80%$V_{(BR)DSS}$.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	1.47	°C/W
R_{thJA}(1)	Thermal resistance, junction-to-ambient	50	°C/W

1. *When mounted on 1 inch^2 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_J max.)	13	A
E_{AS}	Single pulse avalanche energy (starting T_J = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	100	mJ

2 Electrical characteristics

T_C = 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	V_{GS} = 0 V, I_D = 1 mA	250			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 250 V			1	µA
		V_{GS} = 0 V, V_{DS} = 250 V, T_C = 125 °C(1)			10	
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = ±20 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 6.5 A		195	235	mΩ

1. *Specified by design, not tested in production.*

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0 V	-	680	-	pF
C_{oss}	Output capacitance		-	125	-	pF
C_{rss}	Reverse transfer capacitance		-	20	-	pF
$C_{oss\ eq.}$(1)	Equivalent output capacitance	V_{GS} = 0 V, V_{DS} = 0 to 200 V	-	48	-	pF
R_G	Gate input resistance	f = 1 MHz, I_D = 0 A	-	2.1	-	Ω
Q_g	Total gate charge	V_{DD} = 200 V, I_D = 13 A, V_{GS} = 0 to 10 V (see Figure 14. Test circuit for gate charge behavior)	-	18	-	nC
Q_{gs}	Gate-source charge		-	3	-	nC
Q_{gd}	Gate-drain charge		-	9	-	nC

1. *$C_{oss\ eq.}$ 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
$t_{d(on)}$	Turn-on delay time	V_{DD} = 125 V, I_D = 6.5 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 13. Test circuit for resistive load switching times and Figure 18. Switching time waveform)	-	9	-	ns
t_r	Rise time		-	17	-	ns
$t_{d(off)}$	Turn-off delay time		-	35	-	ns
t_f	Fall time		-	17	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		14	A
I_{SDM}(1)	Source-drain current (pulsed)		-		56	A
V_{SD}(2)	Forward on voltage	I_{SD} = 13 A, V_{GS} = 0 V	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 13 A, di/dt = 100 A/µs, V_{DD} = 60 V (see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	133		ns
Q_{rr}	Reverse recovery charge		-	651		nC
I_{RRM}	Reverse recovery current		-	10		A
t_{rr}	Reverse recovery time	I_{SD} = 13 A, di/dt = 100 A/µs, V_{DD} = 60 V, T_J = 150 °C (see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	157		ns
Q_{rr}	Reverse recovery charge		-	895		nC
I_{RRM}	Reverse recovery current		-	11		A

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

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

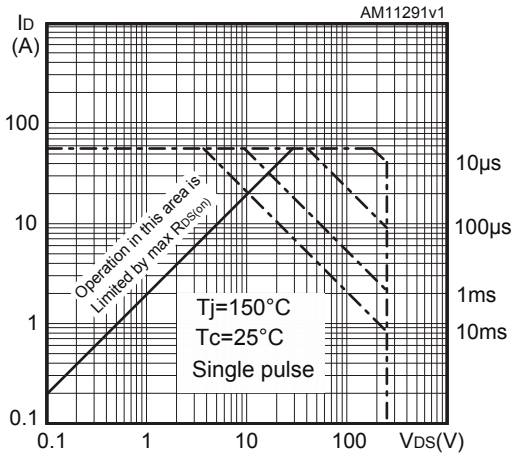


Figure 2. Thermal impedance

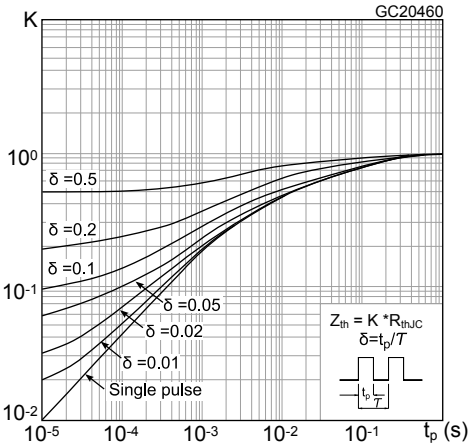


Figure 3. Output characterisics

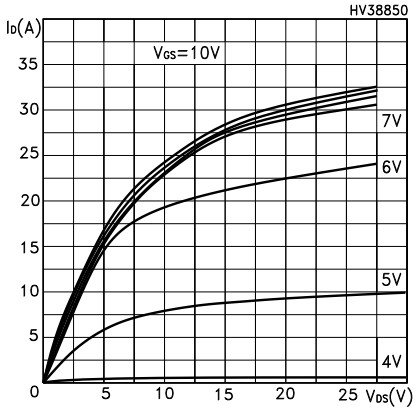


Figure 4. Transfer characteristics

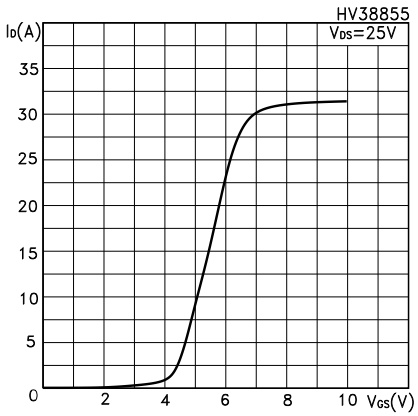


Figure 5. Normalized $V_{(BR)DSS}$ vs temperature

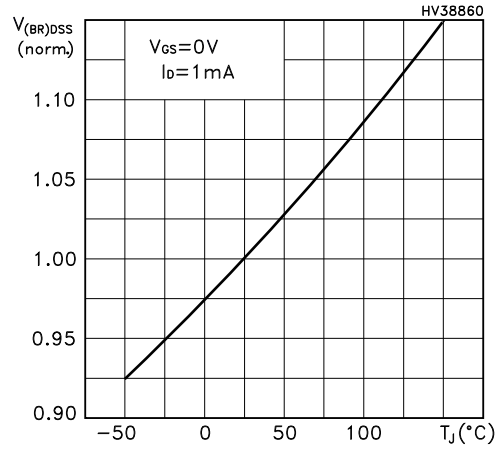


Figure 6. Static drain-source on resistance

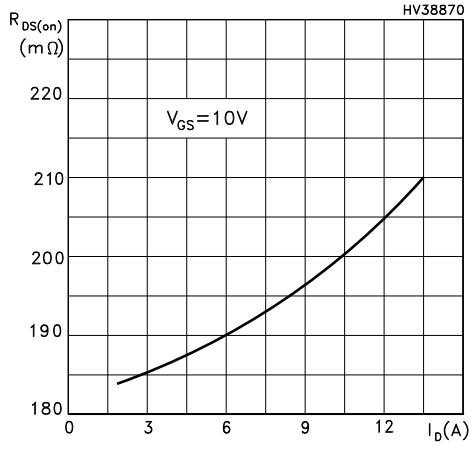


Figure 7. Gate charge vs gate-source voltage

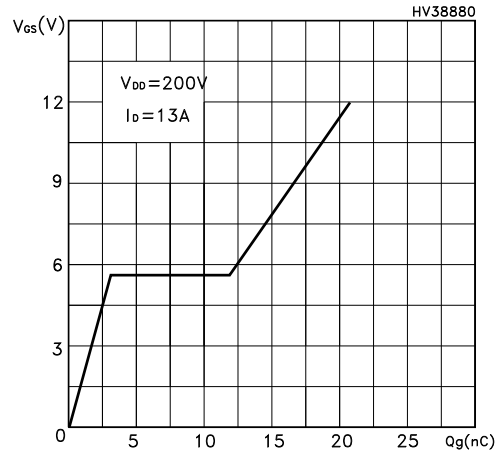


Figure 8. Capacitance variations

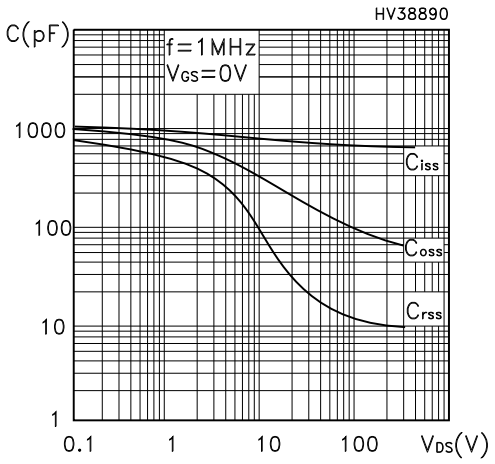


Figure 9. Normalized gate threshold voltage vs temperature

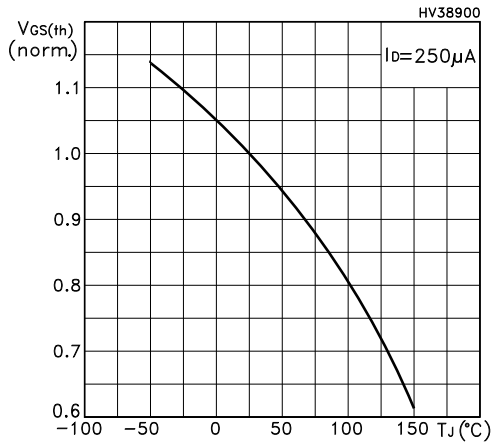


Figure 10. Normalized on resistance vs temperature

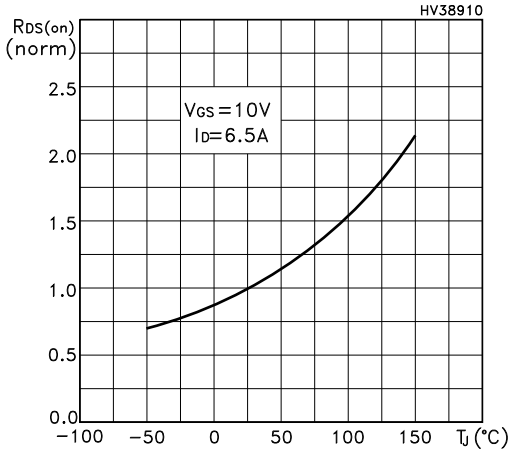


Figure 11. Source-drain diode forward characteristics

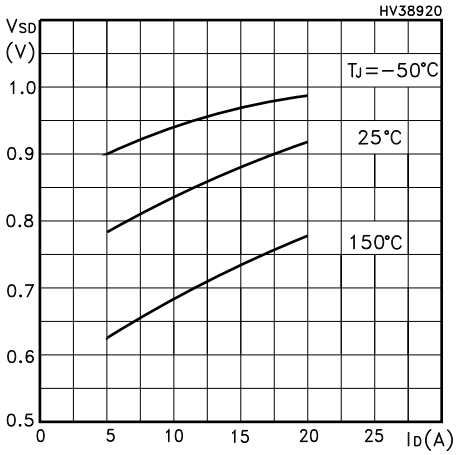
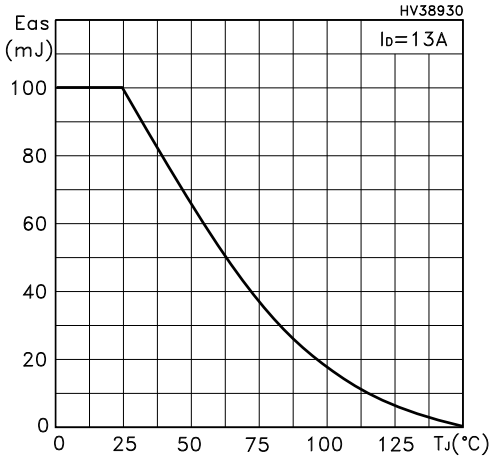


Figure 12. Maximum avalanche energy vs temperature



3 Test circuits

Figure 13. Test circuit for resistive load switching times

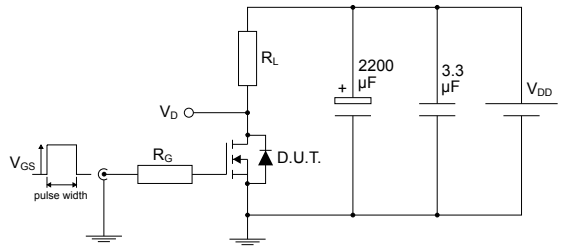


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Figure 14. Test circuit for gate charge behavior

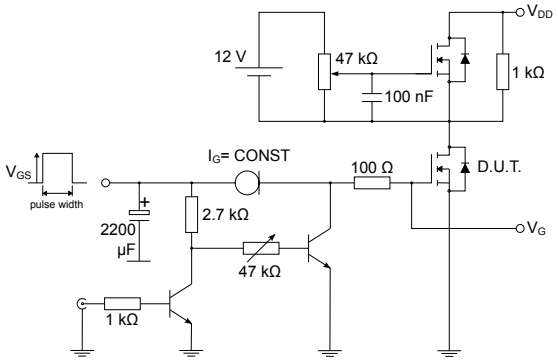

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Figure 15. Test circuit for inductive load switching and diode recovery times

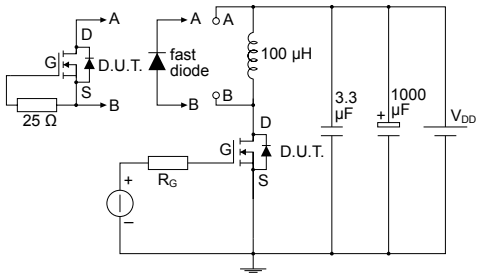

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Figure 16. Unclamped inductive load test circuit

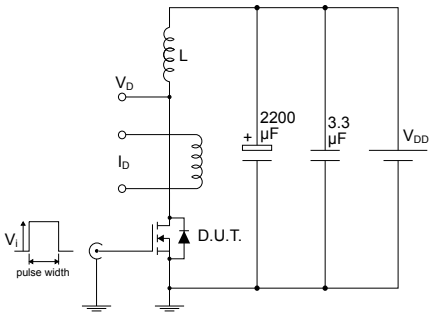

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Figure 17. Unclamped inductive waveform

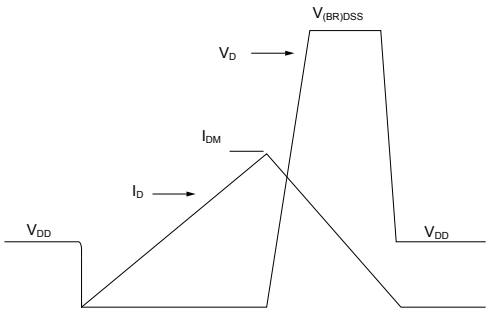

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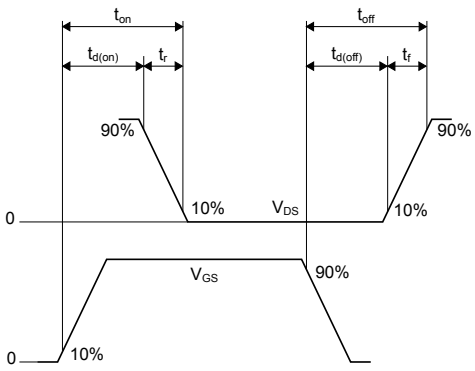
Figure 18. Switching time waveform



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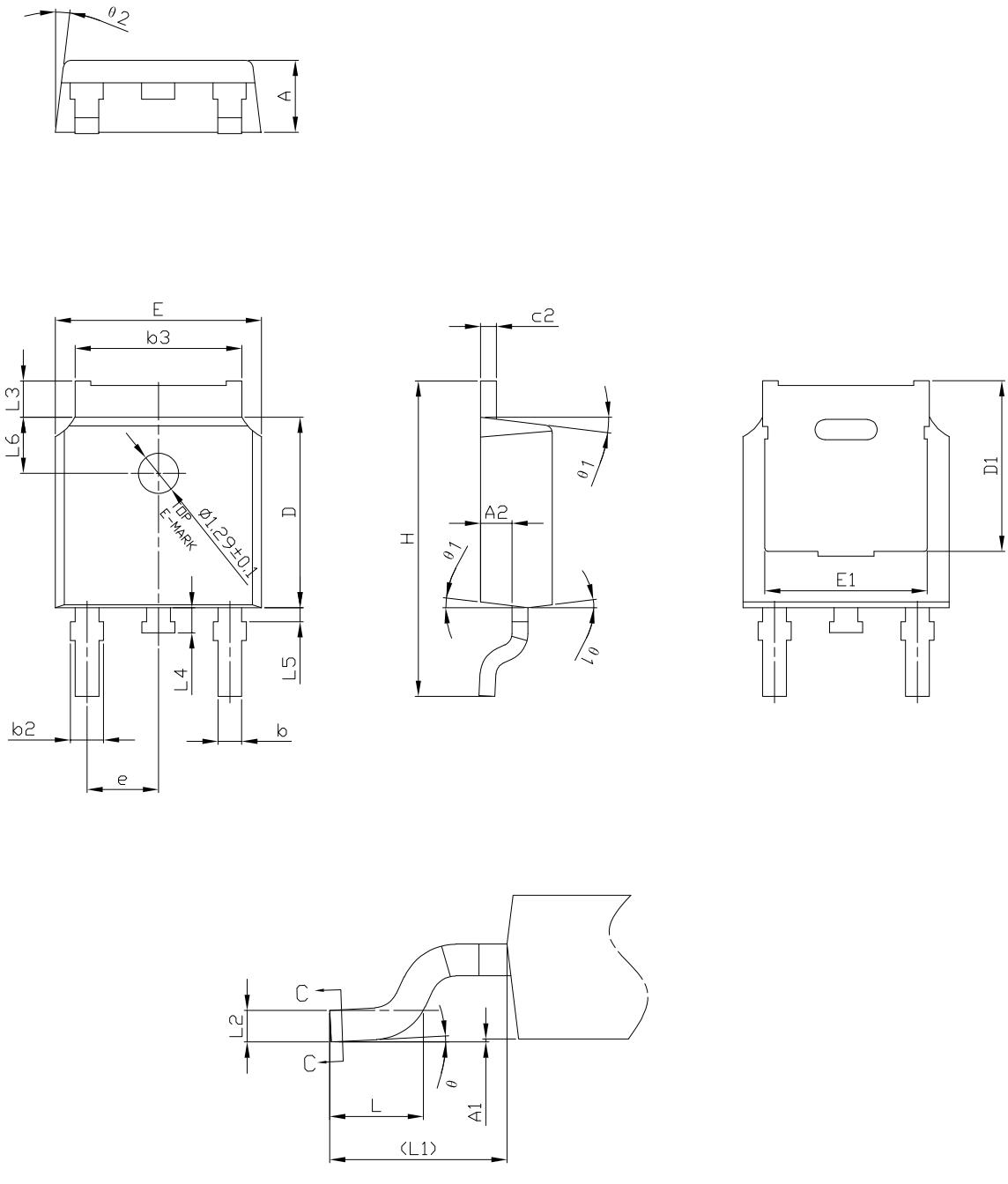
4 Package information

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 C3 package information

Figure 19. DPAK (TO-252) type C3 package outline

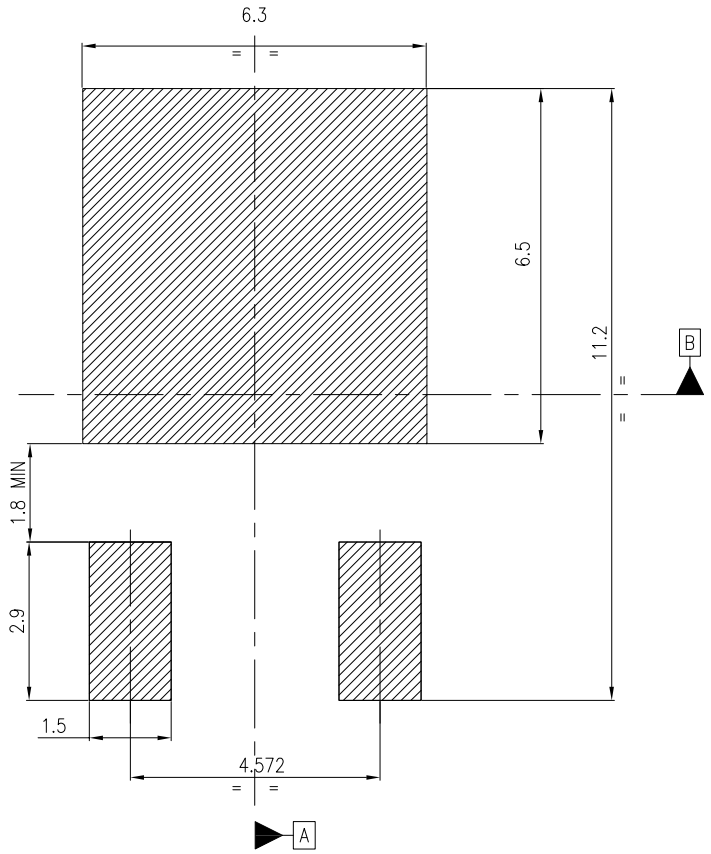


0068772_type-C3_rev34

Table 8. **DPAK (TO-252) type C3 mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0.00		0.10
A2	0.90	1.01	1.10
b	0.72		0.85
b2	0.72		1.10
b3	5.13	5.33	5.46
c	0.47		0.60
c2	0.47		0.60
D	6.00	6.10	6.20
D1	5.20	5.45	5.70
E	6.50	6.60	6.70
E1	5.00	5.20	5.40
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	0.51 BSC		
L3	0.90		1.25
L4	0.60	0.80	1.00
L5	0.15		0.75
L6	1.80 REF		
θ	0°		8°
θ1	5°	7°	9°
θ2	5°	7°	9°

Figure 20. DPAK (TO-252) recommended footprint (dimensions are in mm)



Notes:

1) This footprint is able to ensure insulation up to 630 Vrms (according to CEI IEC 664−1)

2) The device must be positioned within ⌖ | 0.05 | A | B

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4.2 DPAK (TO-252) packing information

Figure 21. **DPAK (TO-252) tape outline**

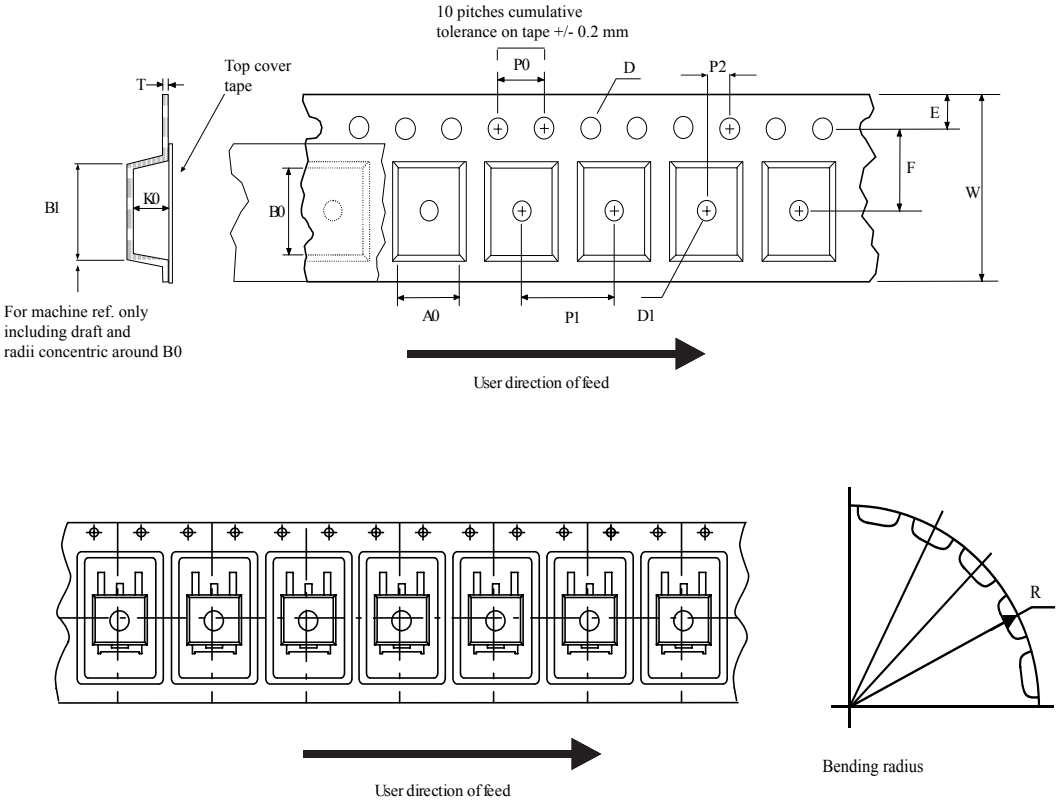

Figure 22. **DPAK (TO-252) reel outline**

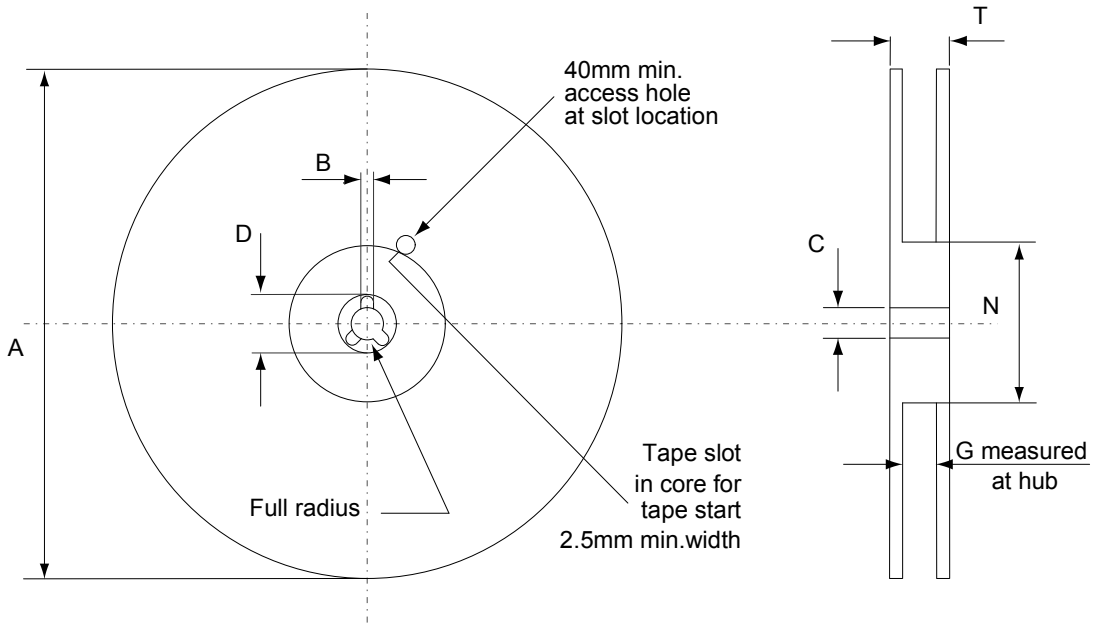

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Table 9. **DPAK (TO-252) tape and reel mechanical data**

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			

Revision history

Table 10. **Document revision history**

Date	Revision	Changes
12-Oct-2007	1	Initial release.
13-Nov-2007	2	Modified: *Figure 13: Capacitance variations.*
29-Mar-2012	3	*Figure 2: Safe operating area for TO-220, Figure 4: Safe operating area for TO-220FP* and *Figure 6: Safe operating area for DPAK* have been updated. *Section 4: Package mechanical data* and *Section 5: Packaging mechanical data* have been updated. Minor text changes
06-Mar-2013	4	– Modified: PTOT, derating factor values, *note 1* on *Table 2*, Rthj-case, Rthj-amb only for TO-220 and DPAK – Updated: *Section 4: Package mechanical data* – Minor text changes
21-Jan-2019	5	The part number STP16NF25 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.
19-Jul-2023	6	The part number STF16NF25 has been moved to a separate datasheet and the document has been updated accordingly. Removed "*Section 4.1 DPAK (TO-252) type A package information*" and replaced "*Section 4.2 DPAK (TO-252) type C2 package information*" with Section 4.1 DPAK (TO-252) type C3 package information. Minor text changes.

Contents