



# STB55NF06, STP55NF06, STP55NF06FP

N-channel 60 V, 0.015  $\Omega$ , 50 A STripFET™ II Power MOSFET in D<sup>2</sup>PAK, TO-220 and TO-220FP packages

Datasheet — production data

## Features

Order code	V <sub>DSS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
STB55NF06	60 V	< 0.018 $\Omega$	50 A
STP55NF06			50 A <sup>(1)</sup>
STP55NF06FP			50 A <sup>(1)</sup>

1. Refer to soa for the max allowable current value on FP-type due to R<sub>th</sub> value

- 100% avalanche tested
- Exceptional dv/dt capability

## Applications

- Switching application

## Description

These Power MOSFETs have been developed using STMicroelectronics' unique STripFET process, which is specifically designed to minimize input capacitance and gate charge. This renders the devices 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.

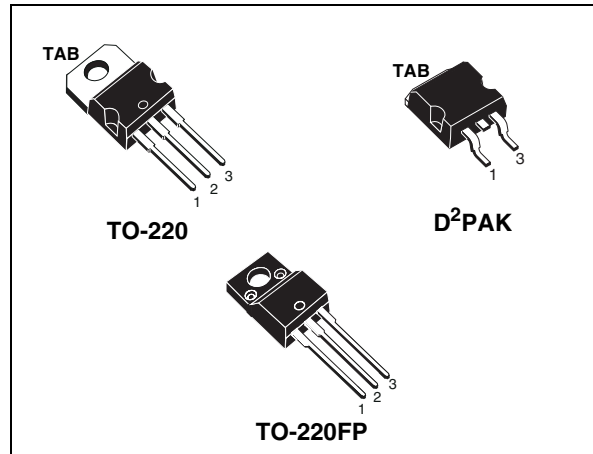
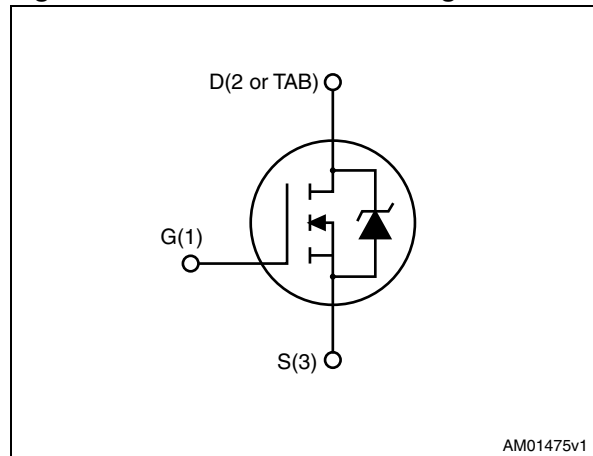


Figure 1. Internal schematic diagram



AM01475v1

Table 1. Device summary

Order code	Marking	Package	Packaging
STB55NF06	B55NF06	D <sup>2</sup> PAK	Tape and reel
STP55NF06	P55NF06	TO-220	Tube
STP55NF06FP	P55NF06FP	TO-220	

## Contents

<b>1</b>	<b>Electrical ratings</b> .....	<b>3</b>
<b>2</b>	<b>Electrical characteristics</b> .....	<b>4</b>
	2.1 Electrical characteristics (curves) .....	6
<b>3</b>	<b>Test circuit</b> .....	<b>9</b>
<b>4</b>	<b>Package mechanical data</b> .....	<b>10</b>
<b>5</b>	<b>Packaging mechanical data</b> .....	<b>16</b>
<b>6</b>	<b>Revision history</b> .....	<b>18</b>

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
		TO-220, D <sup>2</sup> PAK	TO-220FP	
V <sub>DS</sub>	Drain-source voltage	60		V
V <sub>GS</sub>	Gate- source voltage	± 20		V
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 25 °C	50	50 <sup>(1)</sup>	A
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 100 °C	35	35 <sup>(1)</sup>	A
I <sub>DM</sub> <sup>(2)</sup>	Drain current (pulsed)	200	200 <sup>(1)</sup>	A
P <sub>tot</sub>	Total dissipation at T <sub>C</sub> = 25 °C	110	30	W
	Derating factor	0.73	0.20	W/°C
E <sub>AS</sub> <sup>(3)</sup>	Single pulse avalanche energy	340		mJ
dv/dt <sup>(4)</sup>	Peak diode recovery voltage slope	7		V/ns
V <sub>ISO</sub>	Insulation withstand voltage (DC)		2500	V
T <sub>stg</sub>	Storage temperature	-55 to 175		°C
T <sub>j</sub>	Max. operating junction temperature			

1. Refer to soa for the max allowable current value on FP-type due to R<sub>th</sub> value
2. Pulse width limited by safe operating area.
3. Starting T<sub>j</sub> = 25 °C, V<sub>DD</sub> = 30 V, I<sub>D</sub> = 25 A
4. I<sub>SD</sub> ≤ 50 A, di/dt ≤ 400 A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>j</sub> ≤ T<sub>JMAX</sub>

**Table 3. Thermal data**

Symbol	Parameter	Value			Unit
		D <sup>2</sup> PAK	TO-220	TO-220FP	
R <sub>thj-case</sub>	Thermal resistance junction-case max	1.36		5	°C/W
R <sub>thj-amb</sub>	Thermal resistance junction-ambient max	62.5			°C/W

## 2 Electrical characteristics

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

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250 \mu\text{A}$ , $V_{GS} = 0$	60			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 60 \text{ V}$ $V_{DS} = 60 \text{ V}$ , @ $T_J = 125^{\circ}\text{C}$			1 10	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20 \text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250 \mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10 \text{ V}$ , $I_D = 27.5 \text{ A}$		0.015	0.018	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25 \text{ V}$ , $f = 1\text{MHz}$ , $V_{GS} = 0$	-	1300		pF
$C_{oss}$	Output capacitance			300		pF
$C_{rss}$	Reverse transfer capacitance			105		pF
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30 \text{ V}$ , $I_D = 27.5 \text{ A}$ $R_G = 4.7 \Omega$ , $V_{GS} = 10 \text{ V}$ (see <a href="#">Figure 15</a> )	-	20		ns
$t_r$	Rise time			50		ns
$t_{d(off)}$	Turn-off delay time			36		ns
$t_f$	Fall time			15		ns
$Q_g$	Total gate charge	$V_{DD} = 48 \text{ V}$ , $I_D = 55 \text{ A}$ , $V_{GS} = 10 \text{ V}$ (see <a href="#">Figure 16</a> )	-	44.5	60	nC
$Q_{gs}$	Gate-source charge			10.5		nC
$Q_{gd}$	Gate-drain charge			17.5		nC

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)		-		50 200	A A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 50 \text{ A}$ , $V_{GS} = 0$	-		1.5	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 50 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ , $V_{DD} = 30 \text{ V}$ , $T_j = 150 \text{ }^\circ\text{C}$ (see <a href="#">Figure 17</a> )	-	75 170 4.5		ns nC A

1. Pulse width limited by safe operating area.
2. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220, D<sup>2</sup>PAK

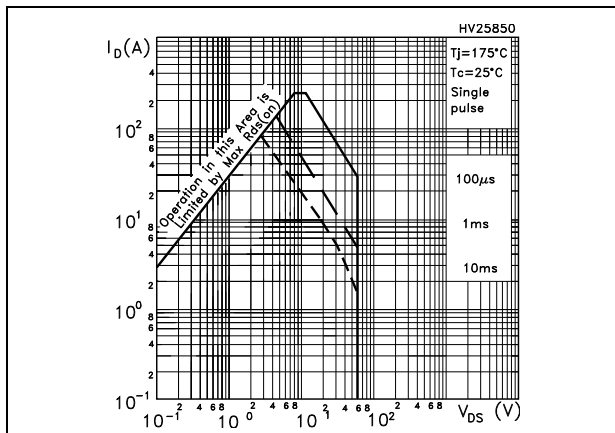


Figure 3. Thermal impedance for TO-220, D<sup>2</sup>PAK

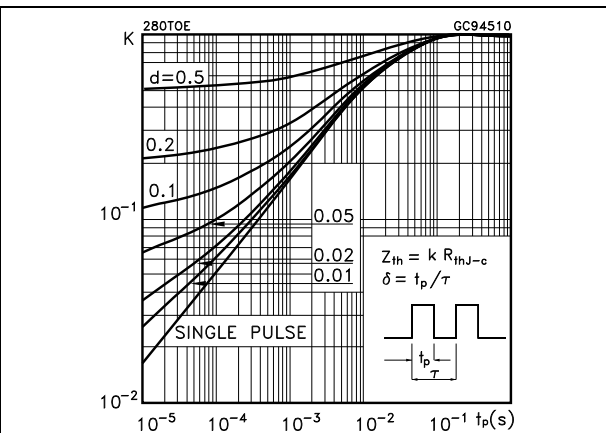


Figure 4. Safe operating area for TO-220FP

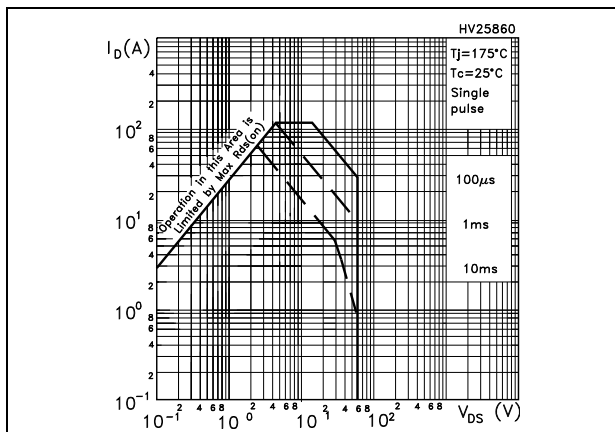


Figure 5. Thermal impedance TO-220FP

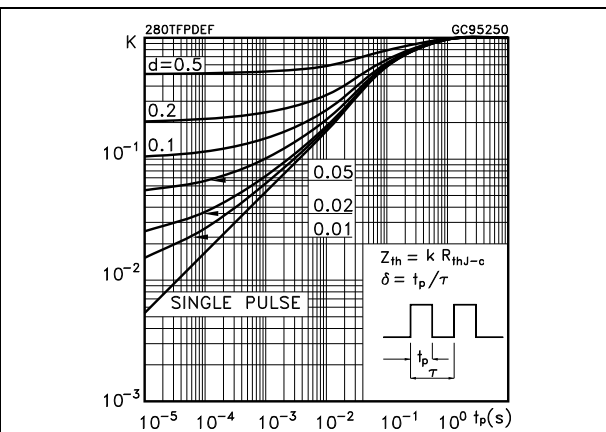


Figure 6. Output characteristics

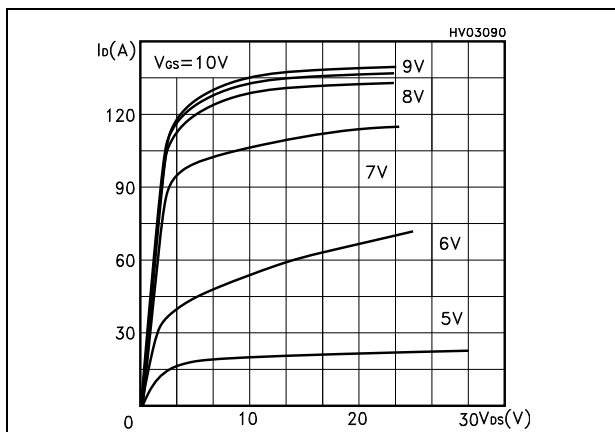


Figure 7. Transfer characteristics

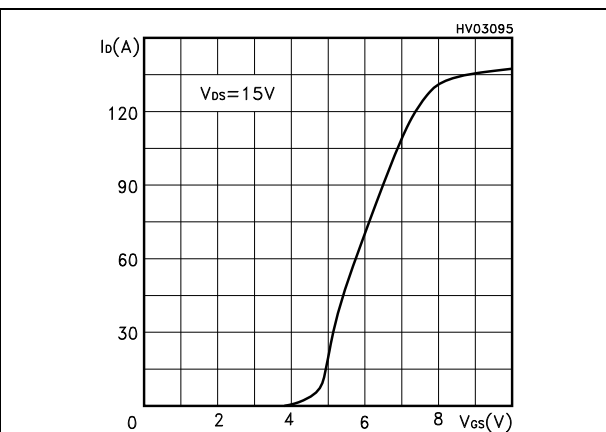


Figure 8. Transconductance

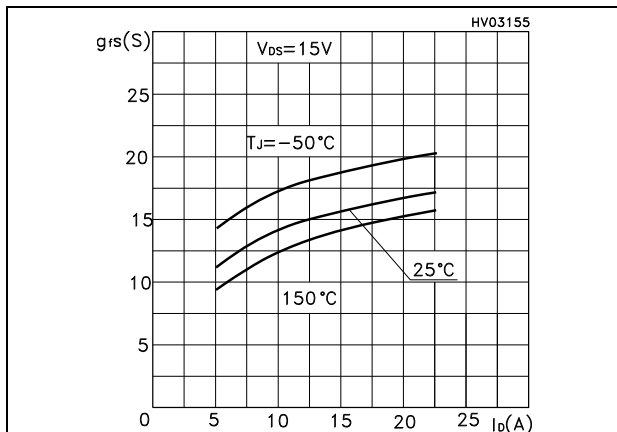


Figure 9. Static drain-source on-resistance

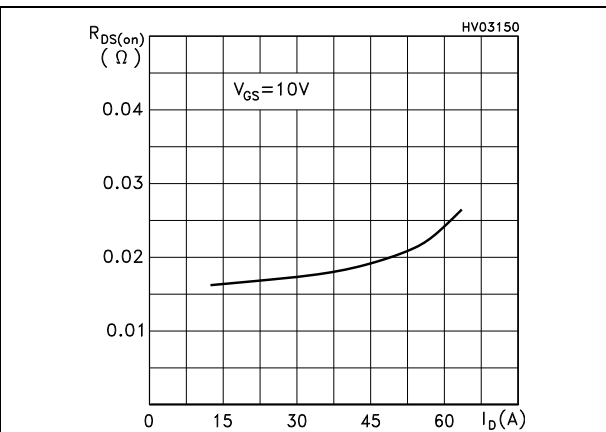


Figure 10. Gate charge vs gate-source voltage Figure 11. Capacitance variations

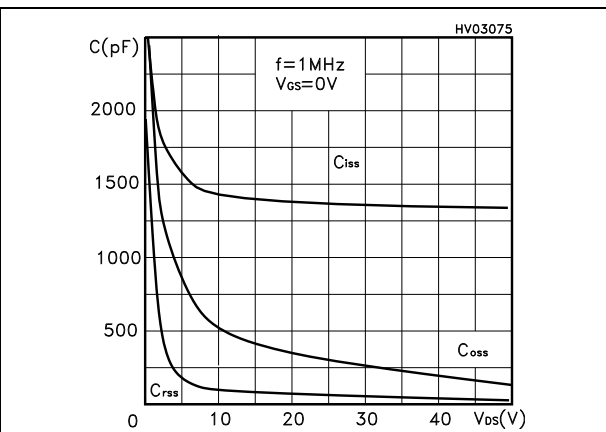
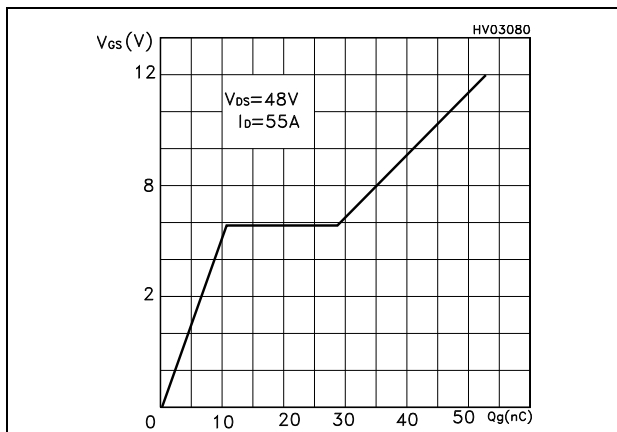


Figure 12. Normalized gate threshold voltage vs temperature

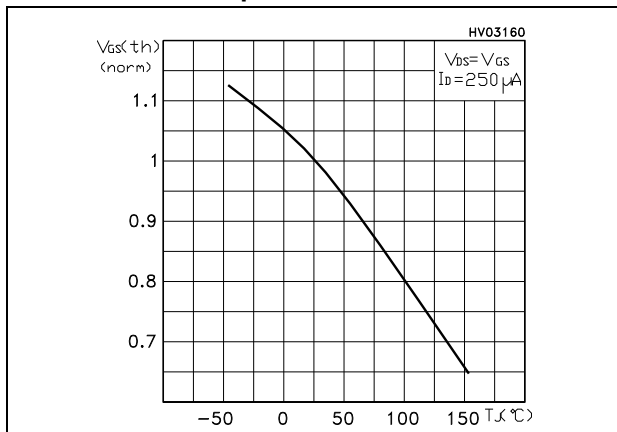


Figure 13. Normalized on-resistance vs temperature

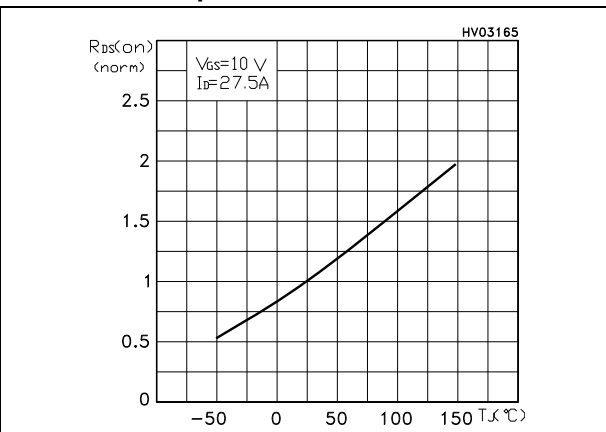
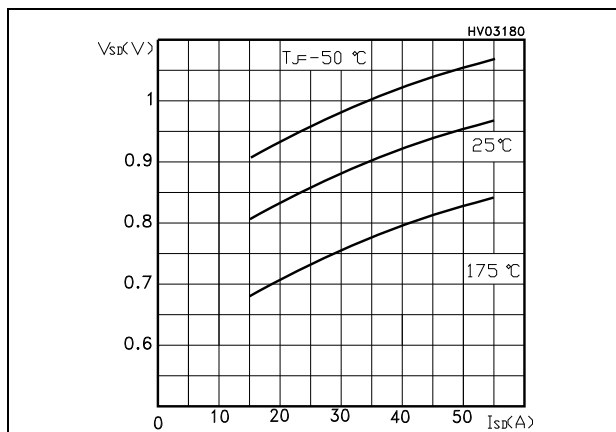


Figure 14. Source-drain diode forward characteristics





### 3 Test circuit

Figure 15. Switching times test circuit for resistive load



Figure 16. Gate charge test circuit

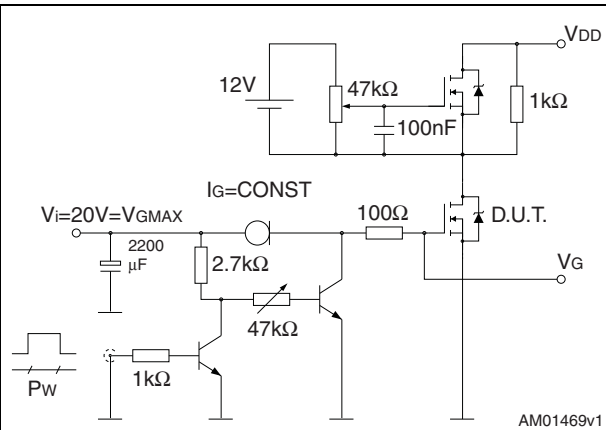


Figure 17. Test circuit for inductive load switching and diode recovery times

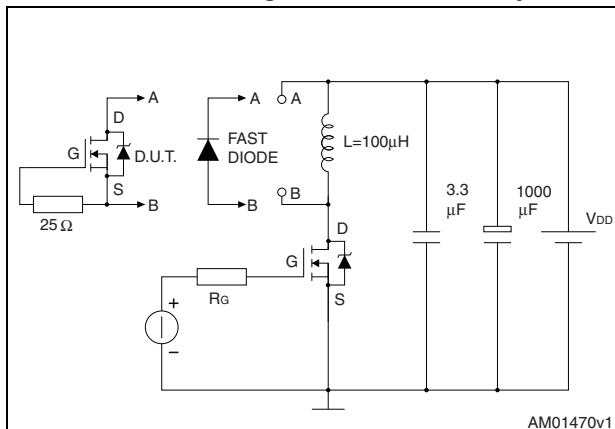


Figure 18. Unclamped inductive load test circuit

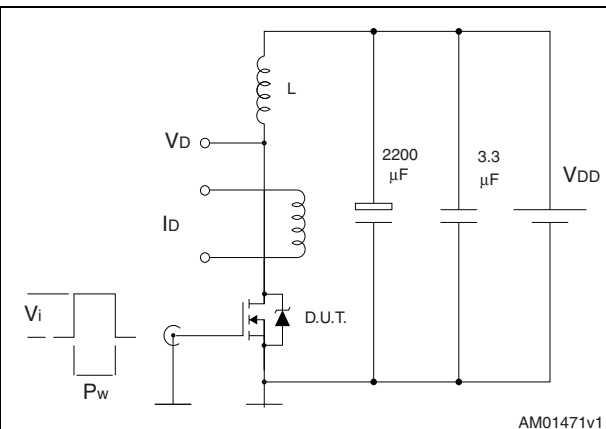


Figure 19. Unclamped inductive waveform

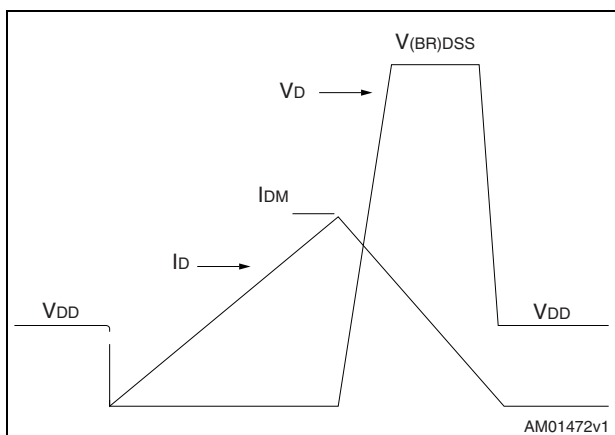
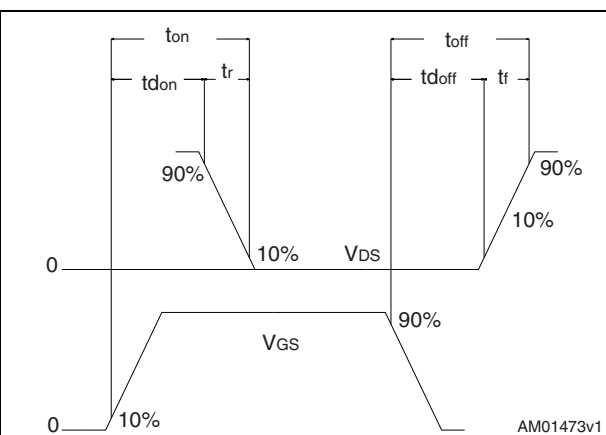


Figure 20. Switching time waveform



## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

**Table 7. D<sup>2</sup>PAK (TO-263) mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50		
E	10		10.40
E1	8.50		
e		2.54	
e1	4.88		5.28
H	15		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.4	
V2	0°		8°

Figure 21. D<sup>2</sup>PAK (TO-263) drawing



Figure 22. D<sup>2</sup>PAK footprint<sup>(a)</sup>



a. All dimensions are in millimeters

Table 8. 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 23. TO-220 type A drawing

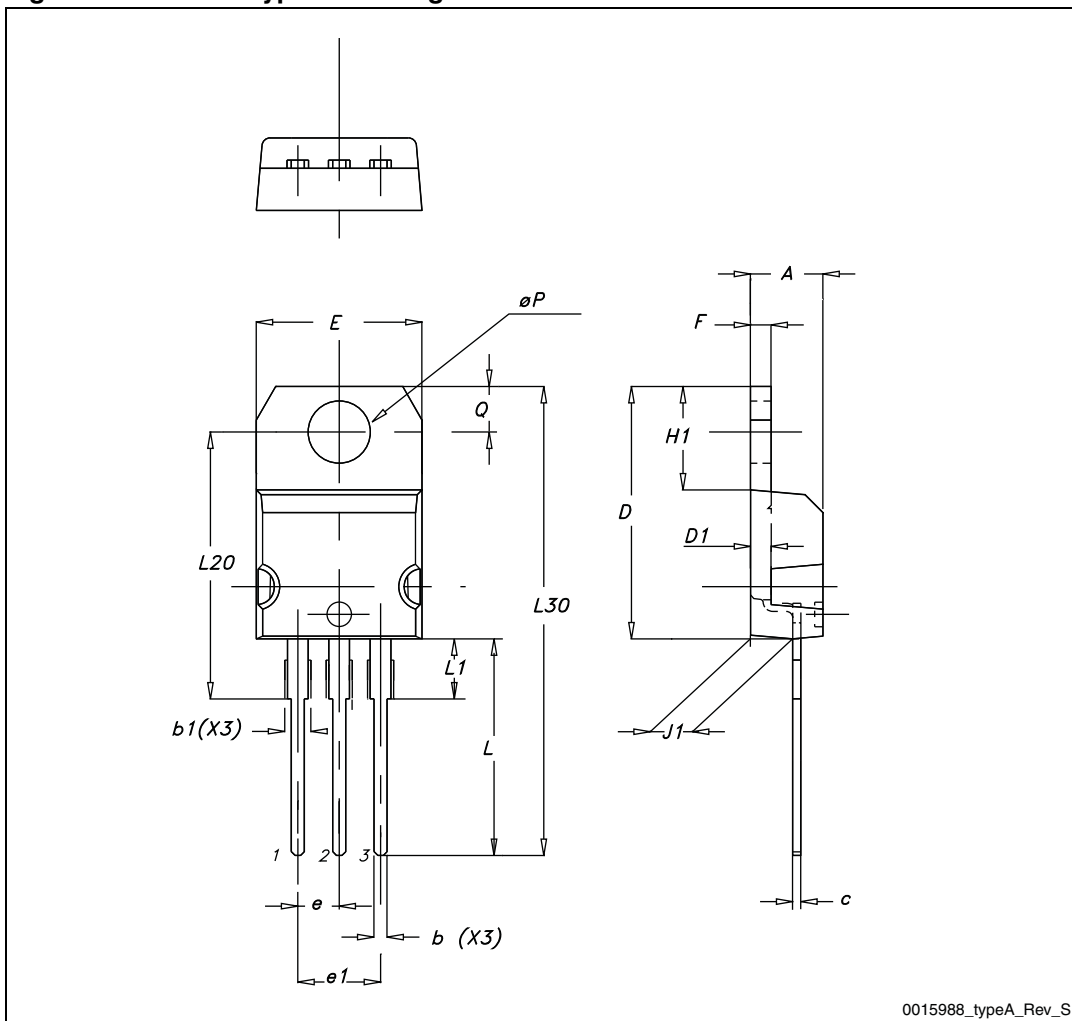
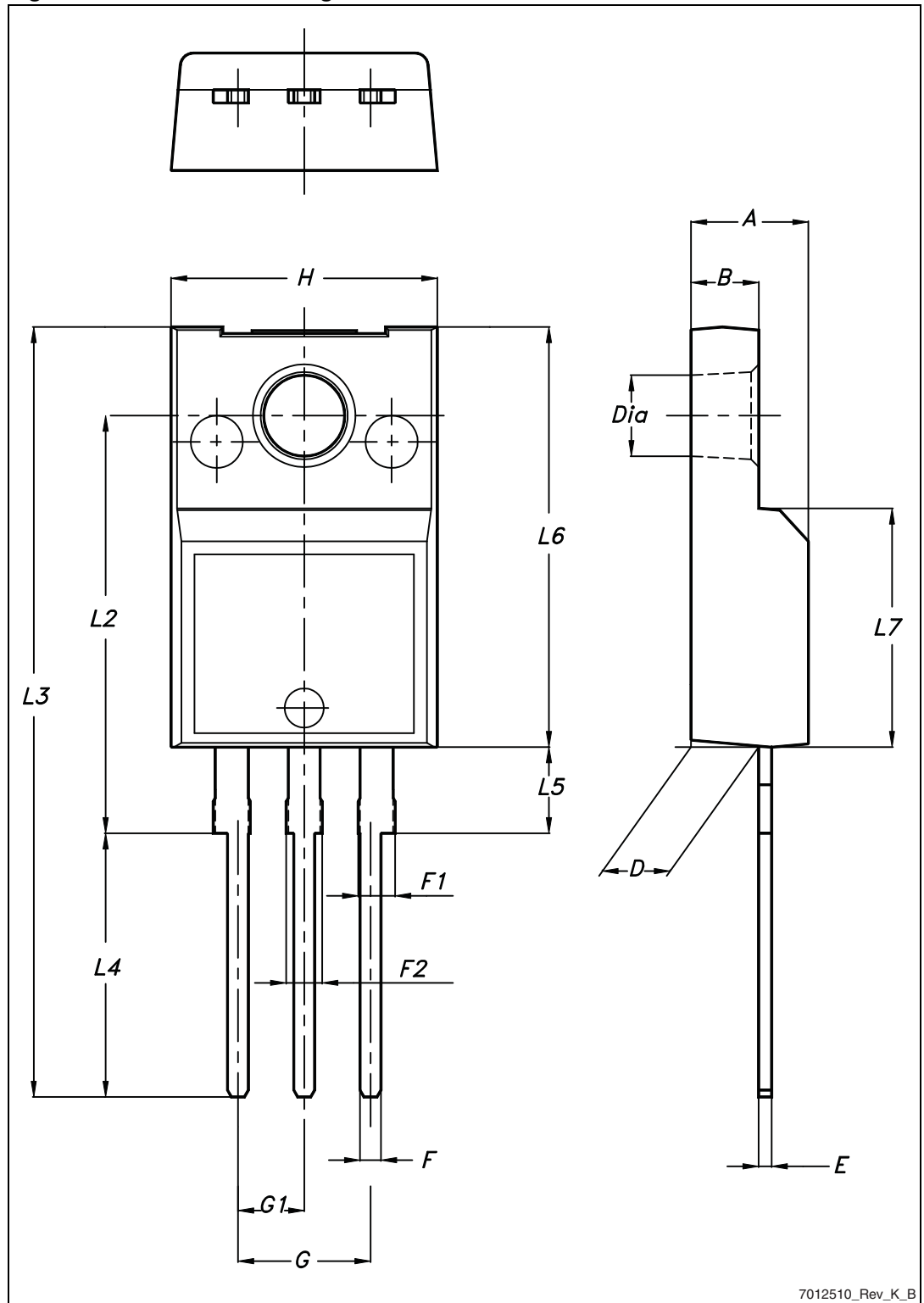


Table 9. TO-220FP mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.4		4.6
B	2.5		2.7
D	2.5		2.75
E	0.45		0.7
F	0.75		1
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.2
G1	2.4		2.7
H	10		10.4
L2		16	
L3	28.6		30.6
L4	9.8		10.6
L5	2.9		3.6
L6	15.9		16.4
L7	9		9.3
Dia	3		3.2

Figure 24. TO-220FP drawing



7012510\_Rev\_K\_B

## 5 Packaging mechanical data

Table 10. D<sup>2</sup>PAK (TO-263) tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1		Base qty	1000
P2	1.9	2.1		Bulk qty	1000
R	50				
T	0.25	0.35			
W	23.7	24.3			



Figure 25. Tape

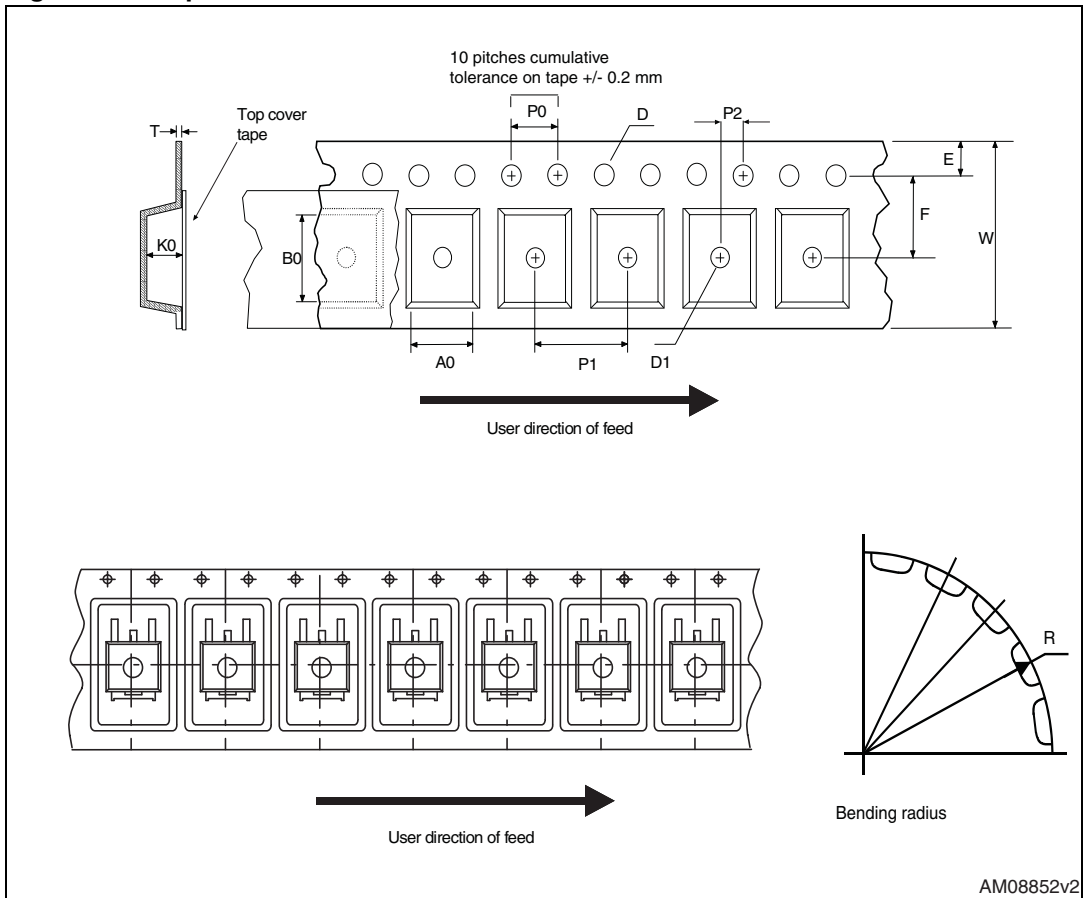
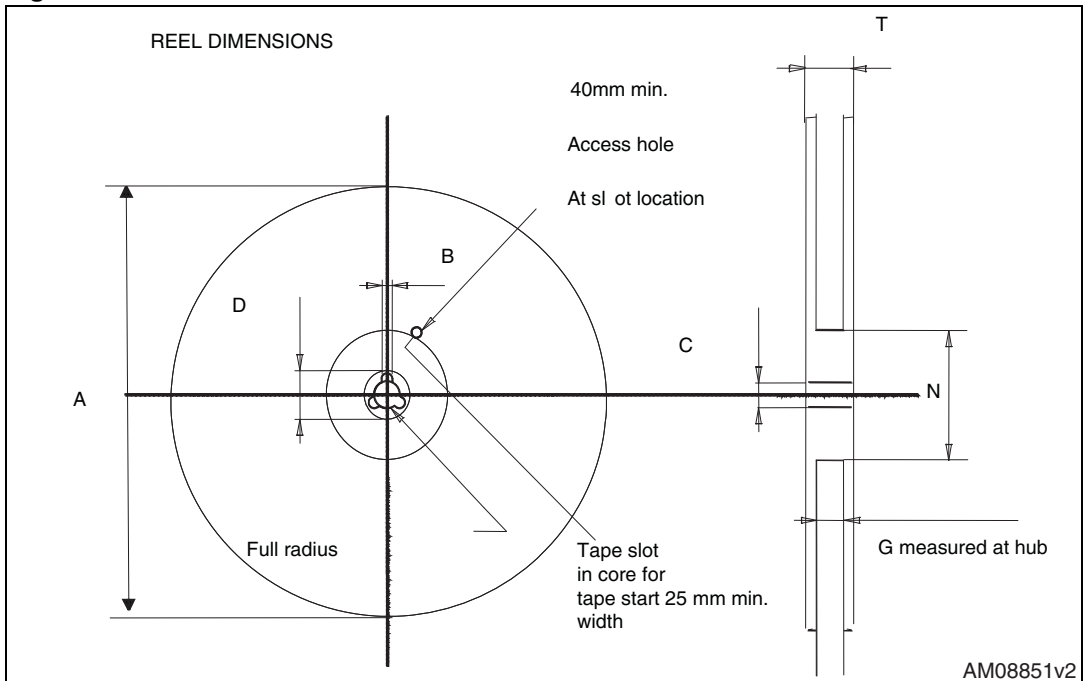


Figure 26. Reel



## 6 Revision history

**Table 11. Document revision history**

Date	Revision	Changes
19-Oct-2005	7	Preliminary document
02-Dec-2005	8	New datasheet according to PCN MLD-PMT/05/1115
28-Mar-2006	9	Inserted ecopack indication
26-Jun-2006	10	New template, no content change
25-May-2012	11	Removed part number STB55NF06-1 in I <sup>2</sup> PAK package <i>Section 4: Package mechanical data</i> and <i>Section 5: Packaging mechanical data</i> have been updated Minor text changes

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