

Contents

1 **Electrical ratings** 3

2 **Electrical characteristics** 4

 2.1 Electrical characteristics (curves) 6

3 **Test circuit** 9

4 **Package mechanical data** 10

5 **Packaging mechanical data** 16

6 **Revision history** 18



1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220, D ² PAK	TO-220FP	
V_{DS}	Drain-source voltage	60		V
V_{GS}	Gate- source voltage	± 20		V
I_D	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	50	50 ⁽¹⁾	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	35	35 ⁽¹⁾	A
$I_{DM}^{(2)}$	Drain current (pulsed)	200	200 ⁽¹⁾	A
P_{tot}	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	110	30	W
	Derating factor	0.73	0.20	W/ $^{\circ}\text{C}$
$E_{AS}^{(3)}$	Single pulse avalanche energy	340		mJ
$dv/dt^{(4)}$	Peak diode recovery voltage slope	7		V/ns
V_{ISO}	Insulation withstand voltage (DC)		2500	V
T_{stg}	Storage temperature	-55 to 175		$^{\circ}\text{C}$
T_j	Max. operating junction temperature			

1. Refer to soa for the max allowable current value on FP-type due to R_{th} value
2. Pulse width limited by safe operating area.
3. Starting $T_j = 25\text{ }^{\circ}\text{C}$, $V_{DD} = 30\text{ V}$, $I_D = 25\text{ A}$
4. $I_{SD} \leq 50\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_j \leq T_{JMAX}$

Table 3. Thermal data

Symbol	Parameter	Value			Unit
		D ² PAK	TO-220	TO-220FP	
$R_{thj-case}$	Thermal resistance junction-case max	1.36		5	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5			$^{\circ}\text{C}/\text{W}$

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	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20\ \text{V}$			± 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	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25\ \text{V}$, $f = 1\ \text{MHz}$, $V_{GS} = 0$	-	1300 300 105		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	$V_{DD} = 30\ \text{V}$, $I_D = 27.5\ \text{A}$ $R_G = 4.7\ \Omega$, $V_{GS} = 10\ \text{V}$ (see Figure 15)	-	20 50 36 15		ns ns ns ns
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 48\ \text{V}$, $I_D = 55\ \text{A}$, $V_{GS} = 10\ \text{V}$ (see Figure 16)	-	44.5 10.5 17.5	60	nC nC 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 Figure 17)	-	75 170 4.5		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 for TO-220, D²PAK

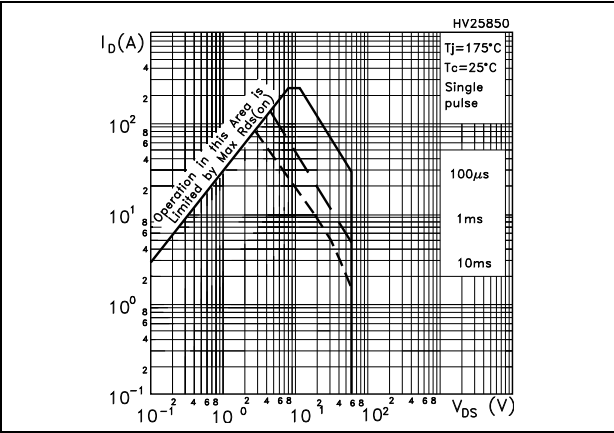


Figure 3. Thermal impedance for TO-220, D²PAK

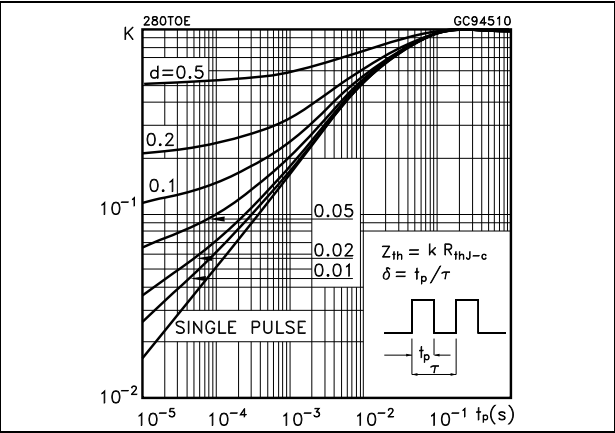


Figure 4. Safe operating area for TO-220FP

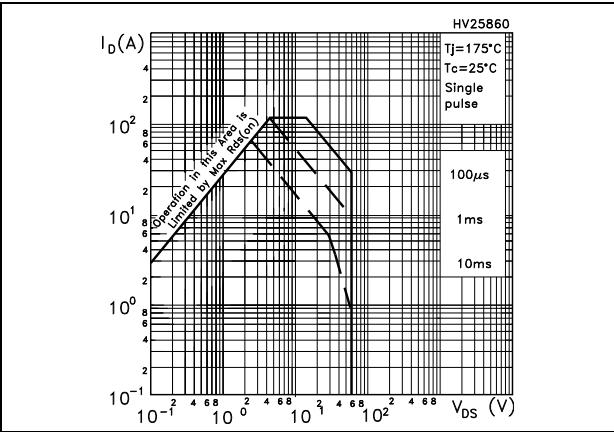


Figure 5. Thermal impedance TO-220FP

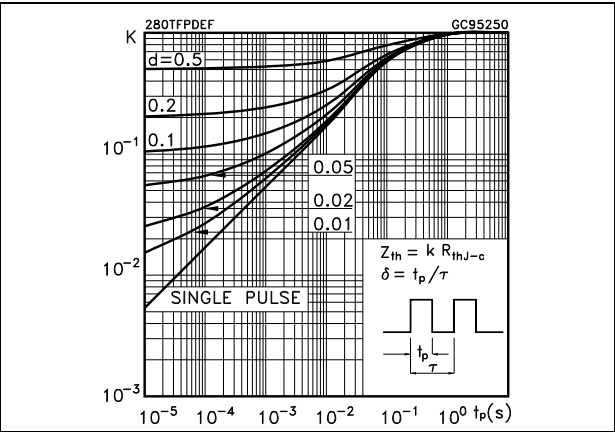


Figure 6. Output characteristics

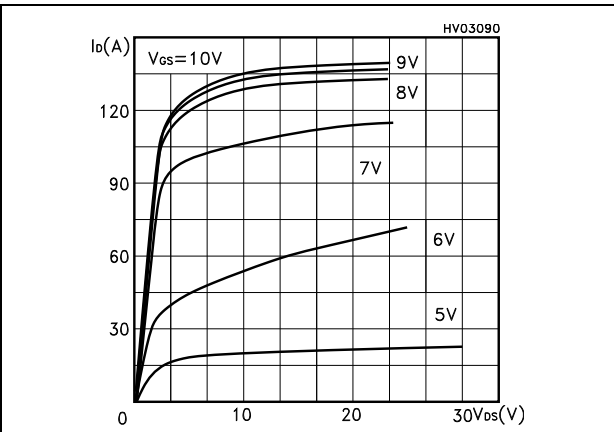


Figure 7. Transfer characteristics

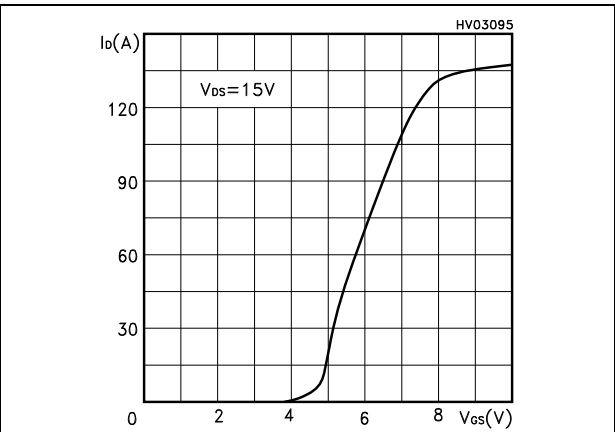


Figure 8. Transconductance

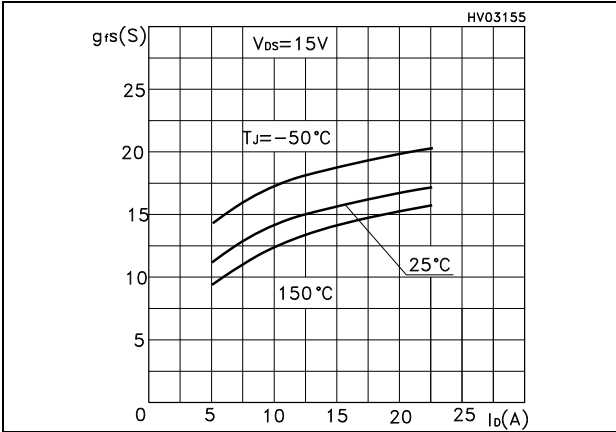


Figure 9. Static drain-source on-resistance

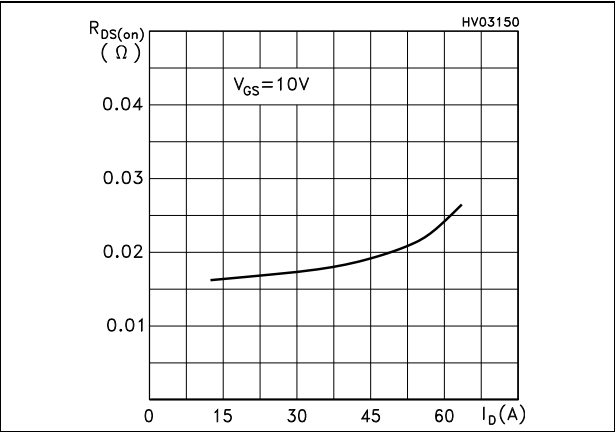


Figure 10. Gate charge vs gate-source voltage

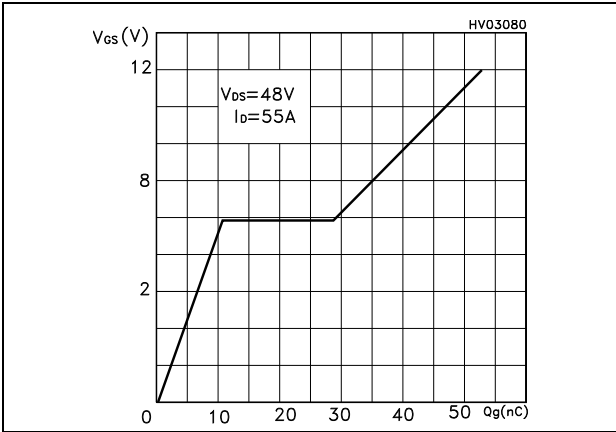


Figure 11. Capacitance variations

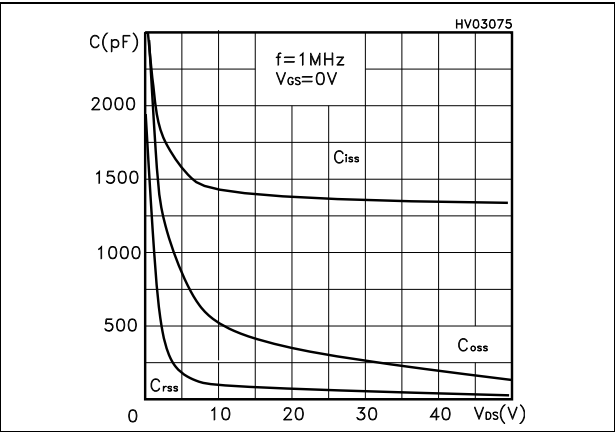


Figure 12. Normalized gate threshold voltage vs temperature

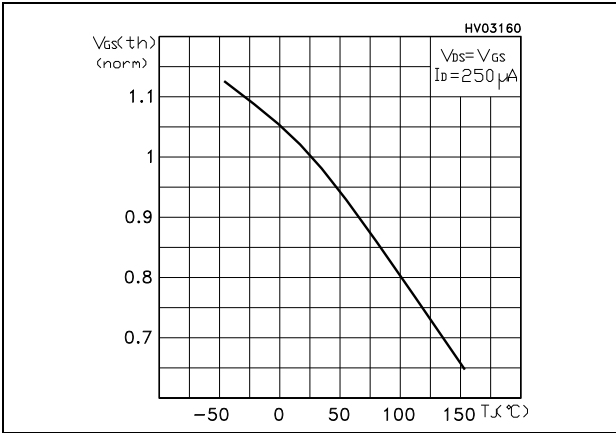


Figure 13. Normalized on-resistance vs temperature

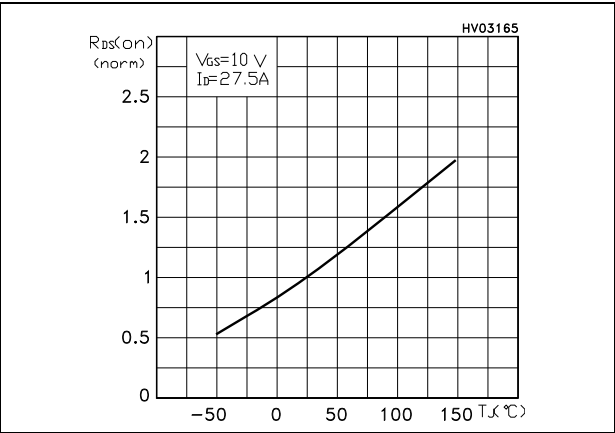
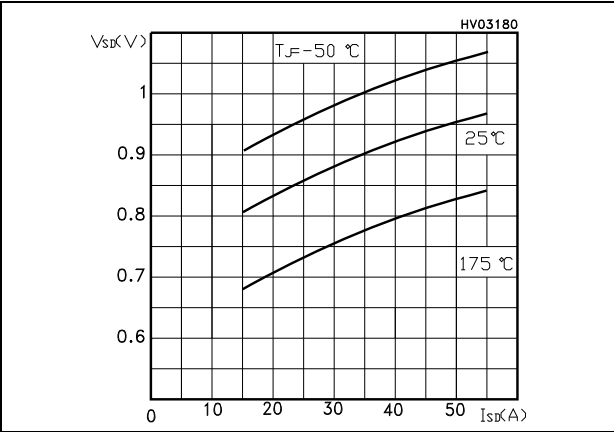


Figure 14. Source-drain diode forward characteristics



3 Test circuit

Figure 15. Switching times test circuit for resistive load

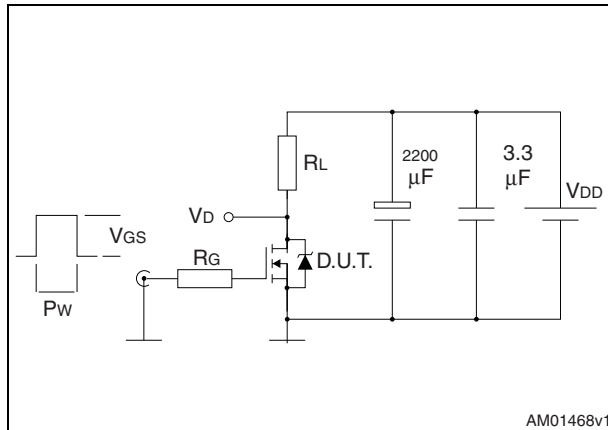


Figure 16. Gate charge test circuit

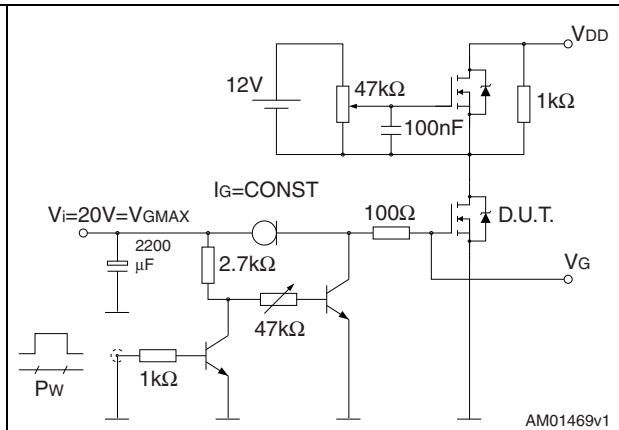


Figure 17. Test circuit for inductive load switching and diode recovery times

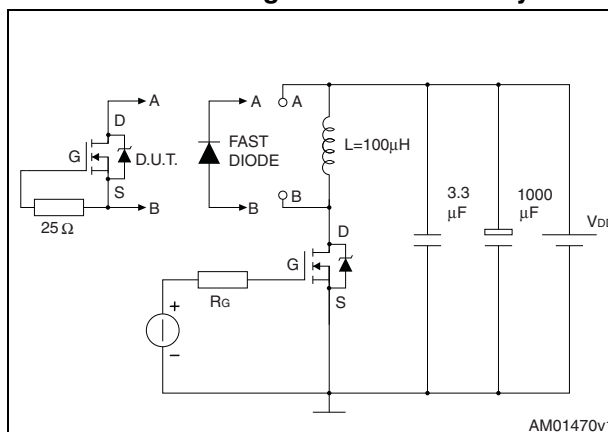


Figure 18. Unclamped inductive load test circuit

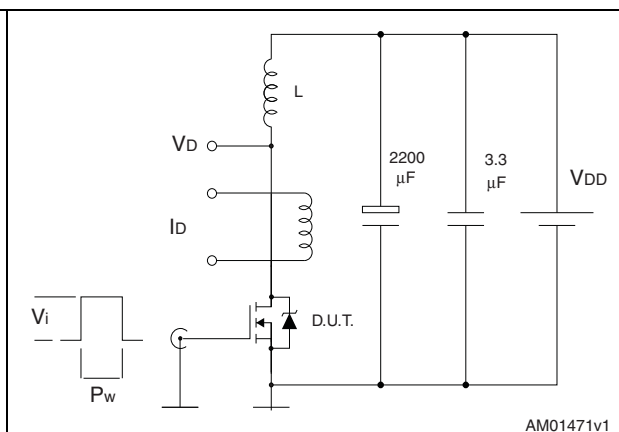


Figure 19. Unclamped inductive waveform

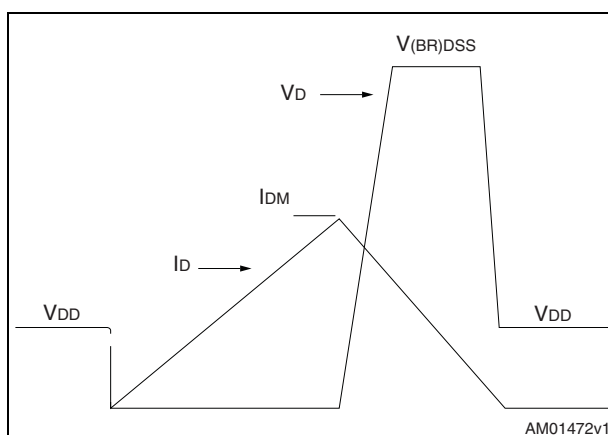
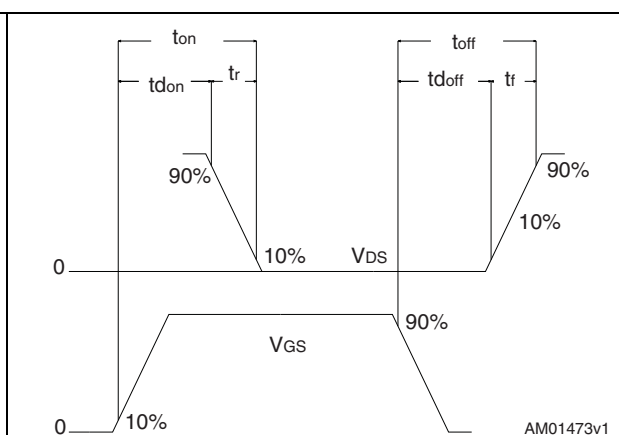


Figure 20. Switching time waveform



4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK[®] 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. D²PAK (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. D²PAK (TO-263) drawing

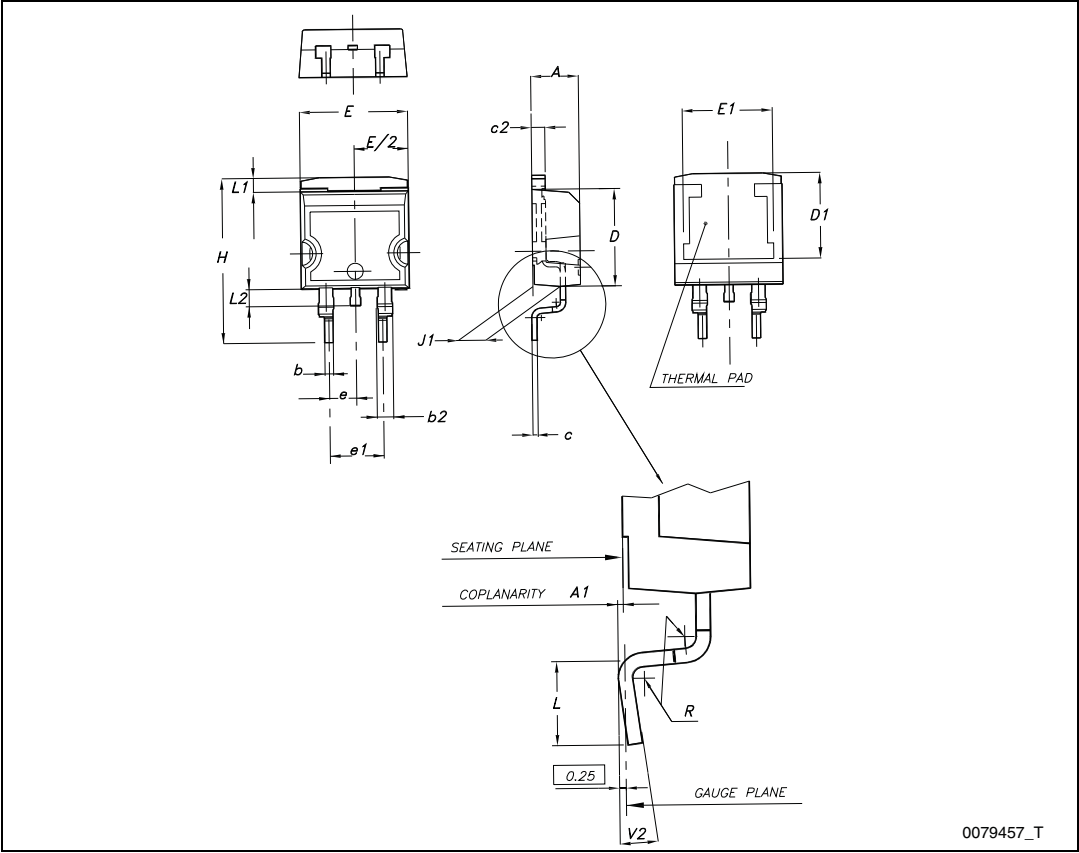
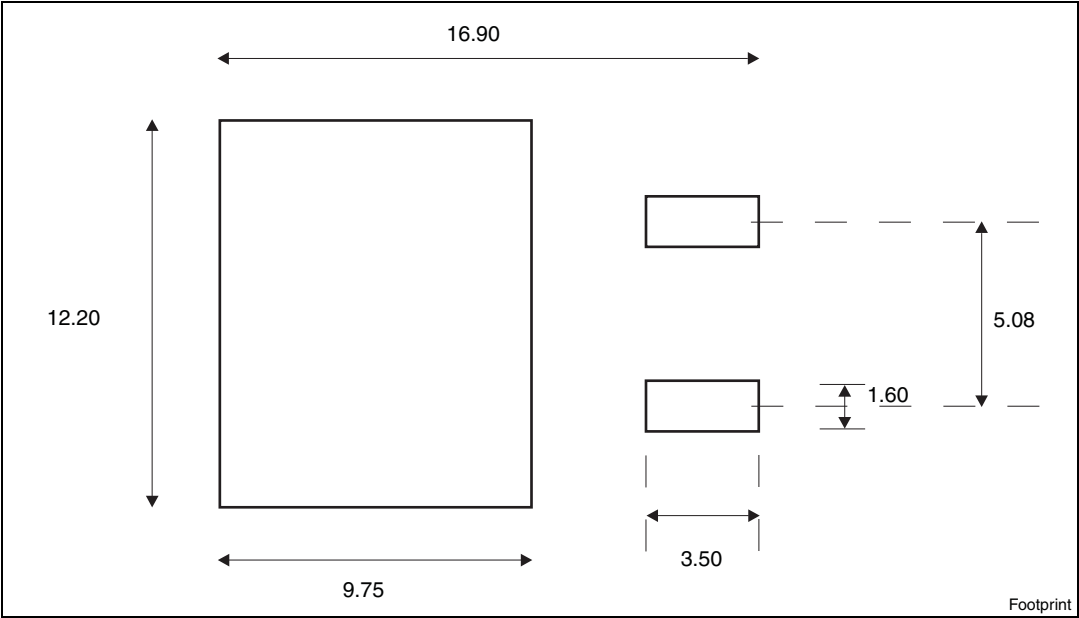


Figure 22. D²PAK footprint^(a)



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

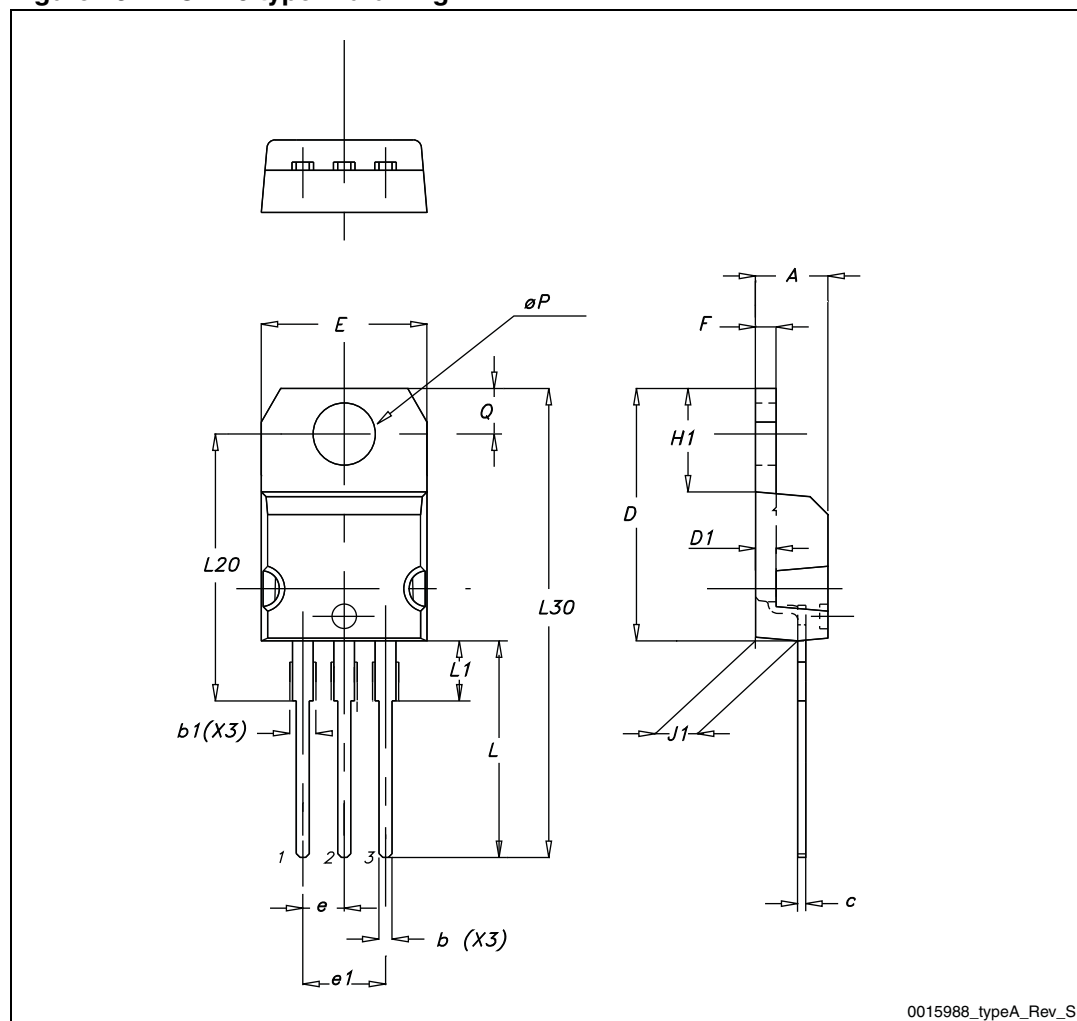
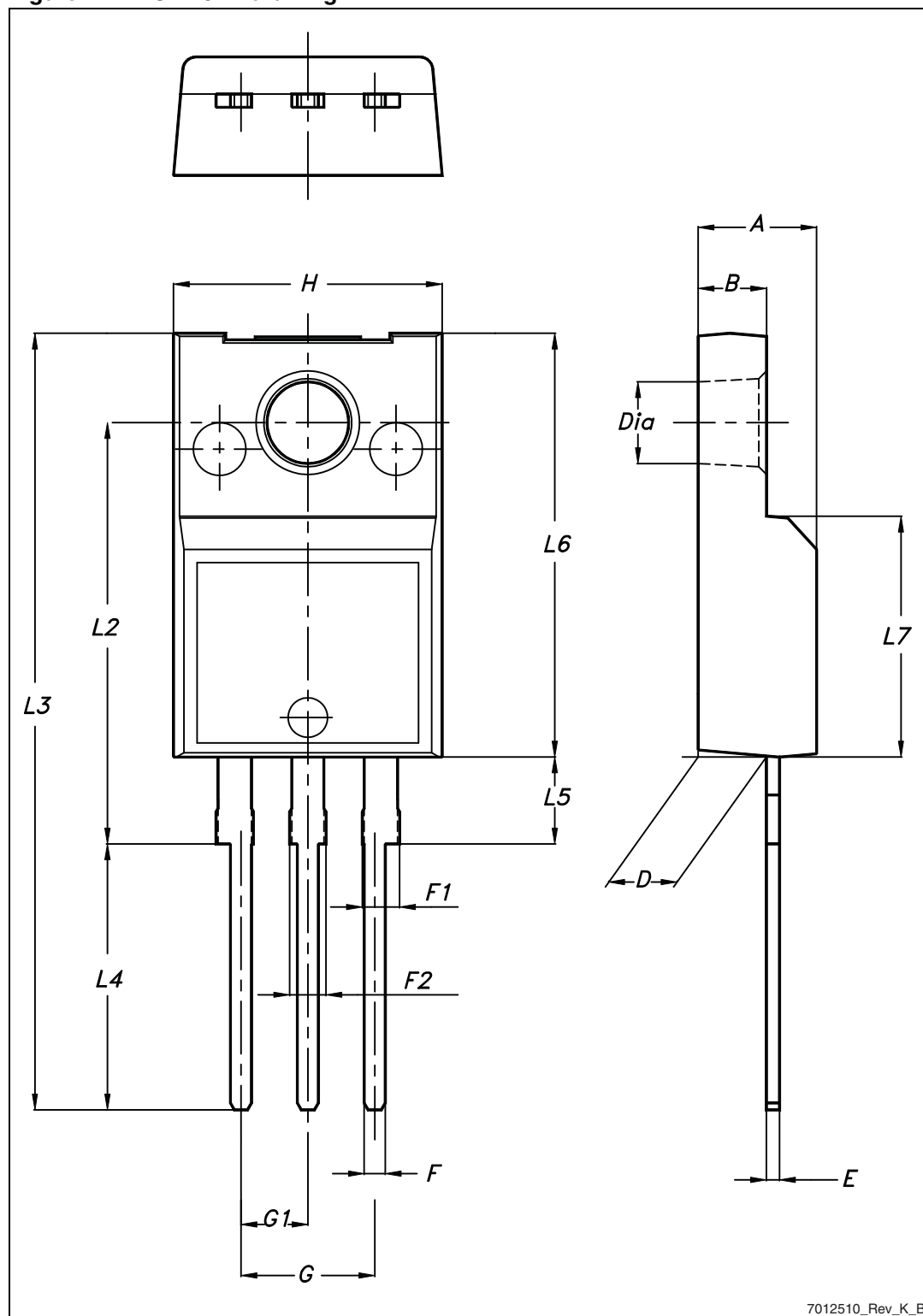


Table 9. TO-220FP mechanical data

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



5 Packaging mechanical data

Table 10. D²PAK (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

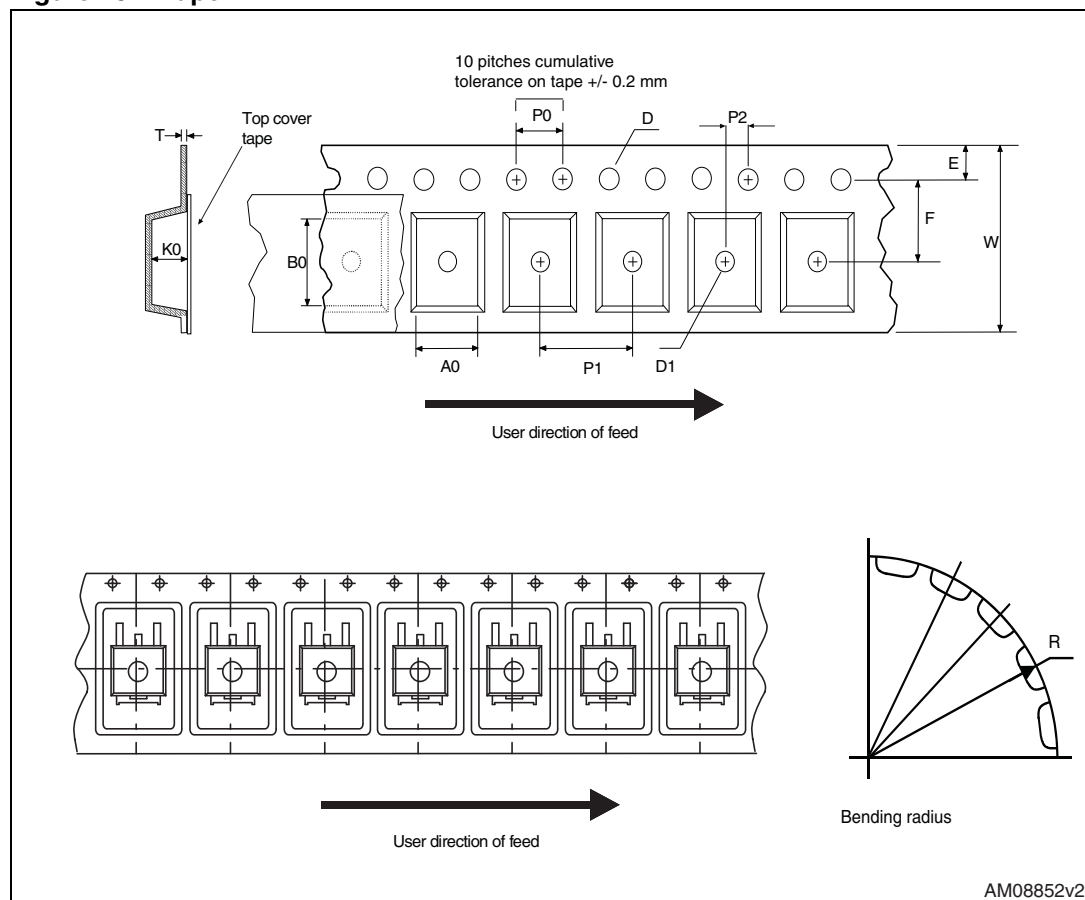
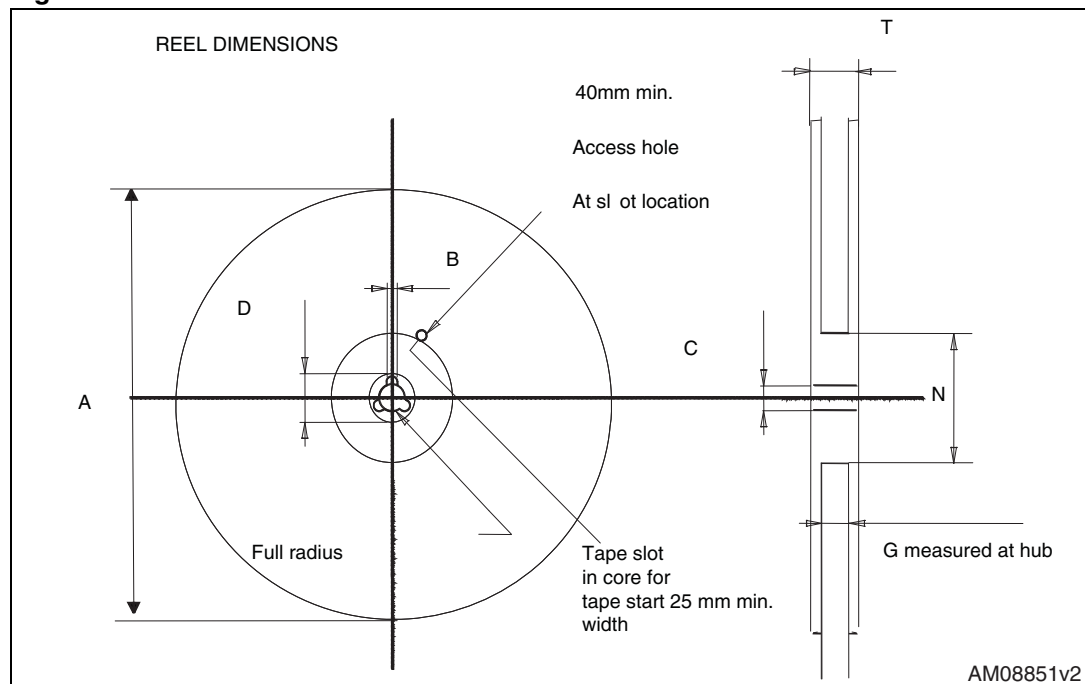


Figure 26. Reel



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 ² PAK package Section 4: Package mechanical data and Section 5: Packaging mechanical data have been updated Minor text changes

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