



THE DATASHEET OF STP75N3LLH6





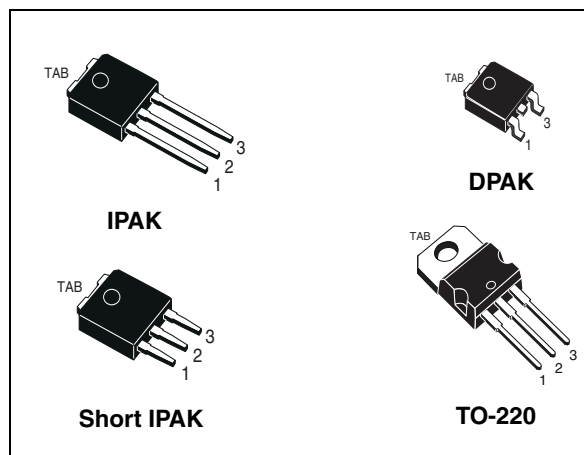
STD75N3LLH6, STP75N3LLH6 STU75N3LLH6, STU75N3LLH6-S

N-channel 30 V, 0.0042 Ω , 75 A, DPAK, TO-220, IPAK, Short IPAK
STripFET™ VI DeepGATE™ Power MOSFET

Features

Order codes	V _{DSS}	R _{DS(on)} max	I _D
STD75N3LLH6	30 V	< 0.0055 Ω	75 A
STP75N3LLH6		< 0.0059 Ω	
STU75N3LLH6			
STU75N3LLH6-S			

- R_{DS(on)} * Q_g industry benchmark
- Extremely low on-resistance R_{DS(on)}
- High avalanche ruggedness
- Low gate drive power losses



Application

Switching applications

Description

This N-Channel Power MOSFET product utilizes the 6th generation of design rules of ST's proprietary STripFET™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest R_{DS(on)} in all packages.

Figure 1. Internal schematic diagram

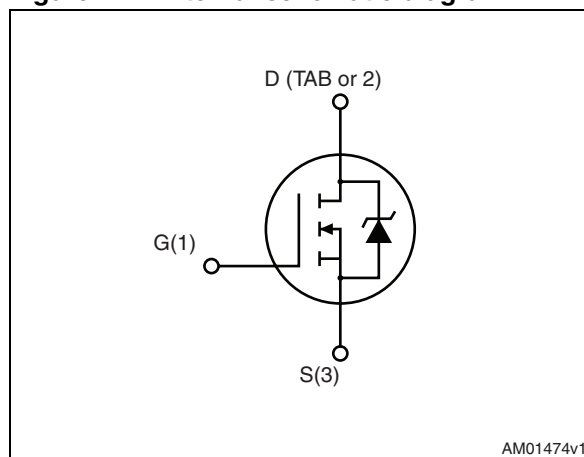


Table 1. Device summary

Order codes	Marking	Package	Packaging
STD75N3LLH6	75N3LLH6	DPAK	Tape and reel
STP75N3LLH6		TO-220	Tube
STU75N3LLH6		IPAK	
STU75N3LLH6-S		Short IPAK	

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	30	V
V_{GS}	Gate-source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	75	A
I_D	Drain current (continuous) at $T_C = 70\text{ }^\circ\text{C}$	56	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	47	A
$I_{DM}^{(2)}$	Drain current (pulsed)	300	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	60	W
	Derating factor	0.4	W/ $^\circ\text{C}$
T_j T_{stg}	Operating junction temperature storage temperature	-55 to 175	$^\circ\text{C}$

1. The value is rated according to Rthj-case
2. Pulse width limited by safe operating area

Table 3. Thermal data

Symbol	Parameter	Value				Unit
		DKAK	TO-220	IPAK	Short IPAK	
$R_{thj-case}$	Thermal resistance junction-case (drain) (steady state)	2.5				$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-amb max	100	62.5	100		$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb max	35				$^\circ\text{C}/\text{W}$
T_J	Maximum lead temperature for soldering purpose	275	300	275		$^\circ\text{C}$

1. When mounted on FR-4 board of 1in², 2oz Cu. t < 10 sec

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 ($V_{GS} = 0$)	$I_D = 250 \mu\text{A}$	30			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 30 \text{ V}$ $V_{DS} = 30 \text{ V } T_C = 125^{\circ}\text{C}$			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	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	1	1.7	2.5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10 \text{ V}, I_D = 37.5 \text{ A}$ SMD version		0.0042	0.0055	Ω
		$V_{GS} = 10 \text{ V}, I_D = 37.5 \text{ A}$		0.0046	0.0059	Ω
		$V_{GS} = 4.5 \text{ V}, I_D = 37.5 \text{ A}$ SMD version		0.0065	0.008	Ω
		$V_{GS} = 4.5 \text{ V}, I_D = 37.5 \text{ A}$		0.0069	0.0084	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25 \text{ V}, f = 1 \text{ MHz},$ $V_{GS} = 0$	1350	1690	2030	pF
C_{oss}	Output capacitance		230	290	350	pF
C_{rss}	Reverse transfer capacitance		140	176	210	pF
Q_g	Total gate charge	$V_{DD} = 15 \text{ V}, I_D = 75 \text{ A},$ $V_{GS} = 4.5 \text{ V}$ (see Figure 14)		17	23.8	nC
Q_{gs}	Gate-source charge			8	11.2	nC
Q_{gd}	Gate-drain charge			6	8.4	nC
Q_{gs1}	Pre V_{th} gate-to-source charge	$V_{DD} = 15 \text{ V}, I_D = 75 \text{ A}$ $V_{GS} = 5 \text{ V}$ (Figure 19)		3.9	5.5	nC
Q_{gs2}	Post V_{th} gate-to-source charge			4.1	5.7	nC
R_G	Gate input resistance	f=1 MHz gate bias Bias=0 test signal level=20 mV open drain	1.25	1.7	2	Ω

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 15\text{ V}$, $I_D = 37.5\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 5\text{ V}$ (see Figure 13)	-	9.5	-	ns
t_r	Rise time			30		ns
$t_{d(off)}$	Turn-off delay time			37		ns
t_f	Fall time			12		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		75	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				300	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 37.5\text{ A}$, $V_{GS} = 0$	-		1.1	V
t_{rr}	Reverse recovery time	$I_{SD} = 75\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 24\text{ V}$ (see Figure 15)	-	24		ns
Q_{rr}	Reverse recovery charge			16.8		nC
I_{RRM}	Reverse recovery current			1.4		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

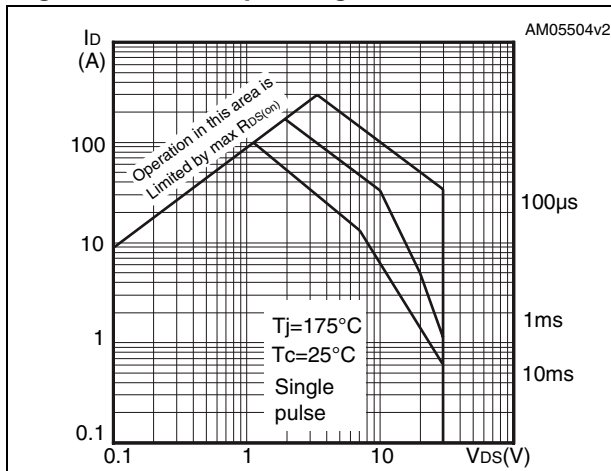


Figure 3. Thermal impedance

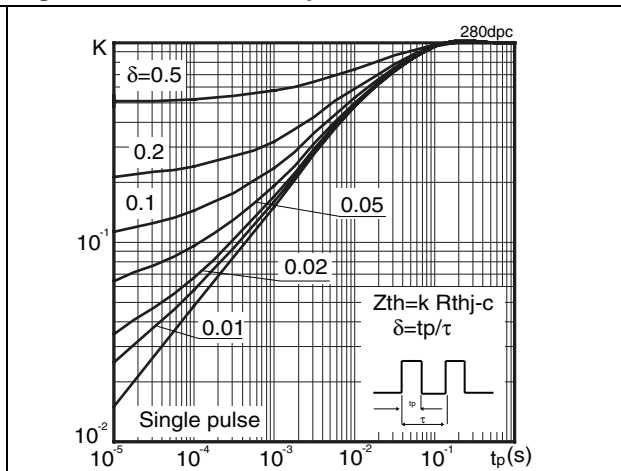


Figure 4. Output characteristics

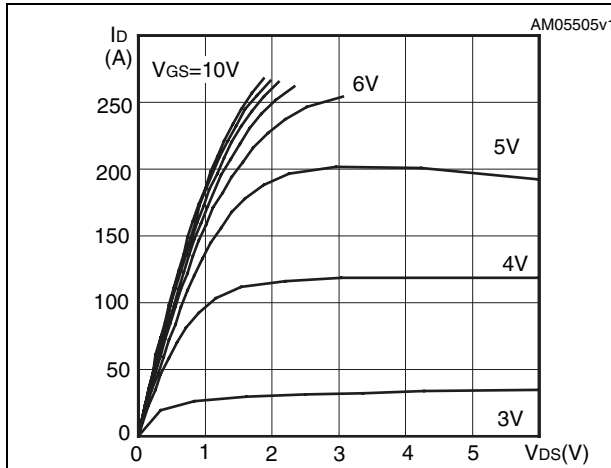


Figure 5. Transfer characteristics

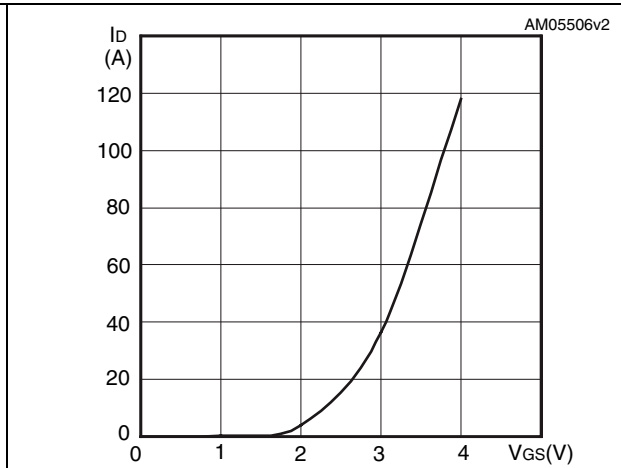


Figure 6. Normalized BV_{DSS} vs temperature

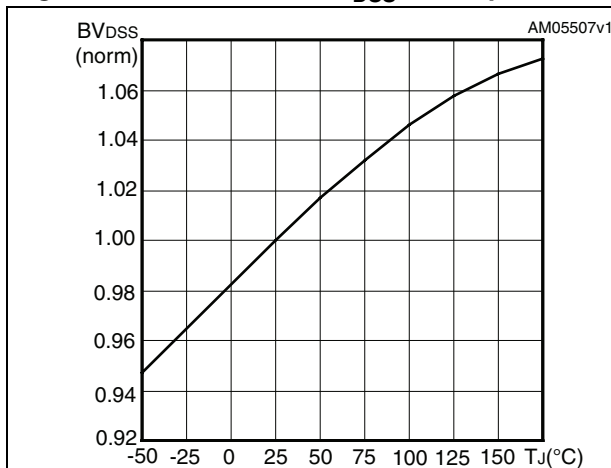


Figure 7. Static drain-source on resistance

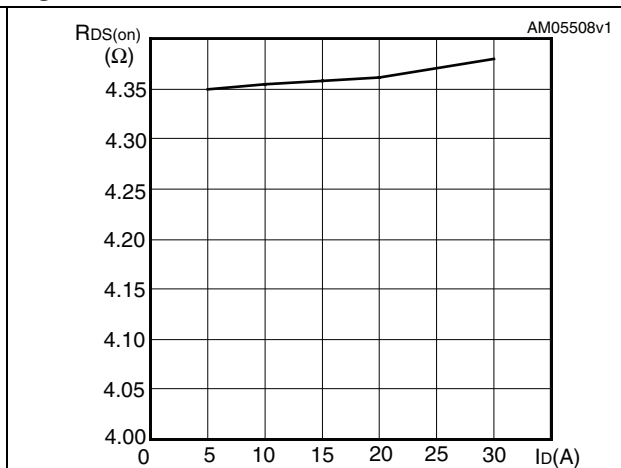


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

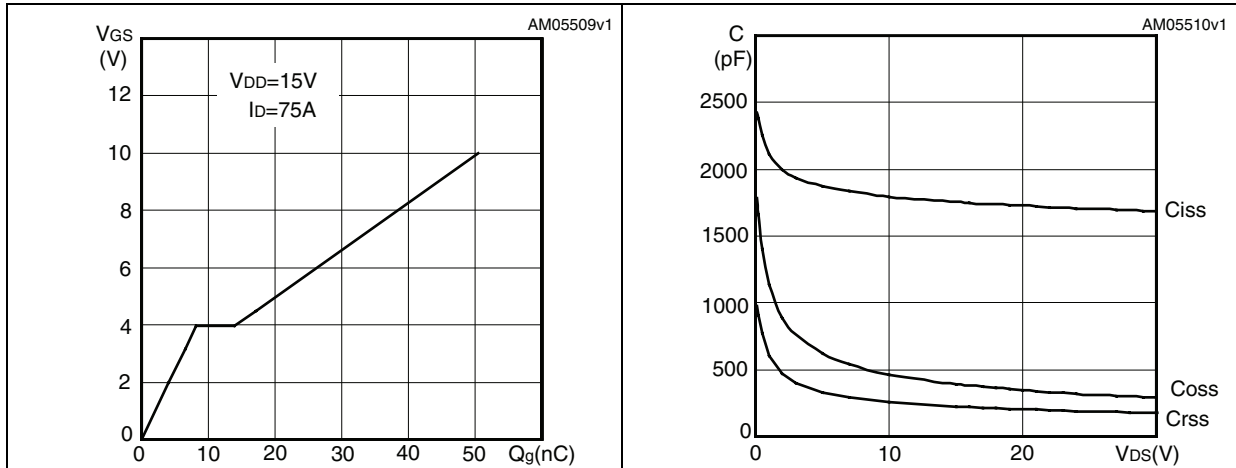


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

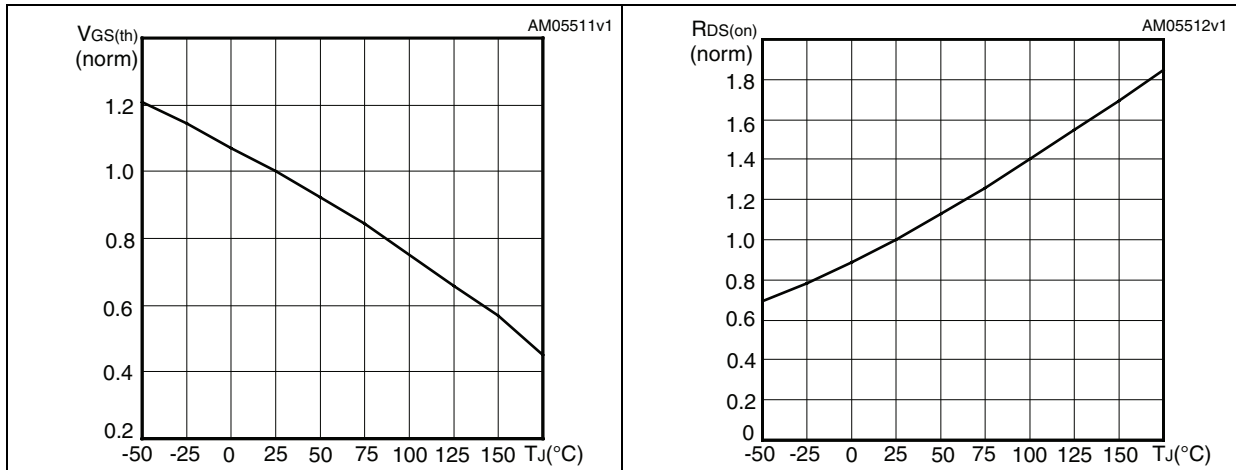
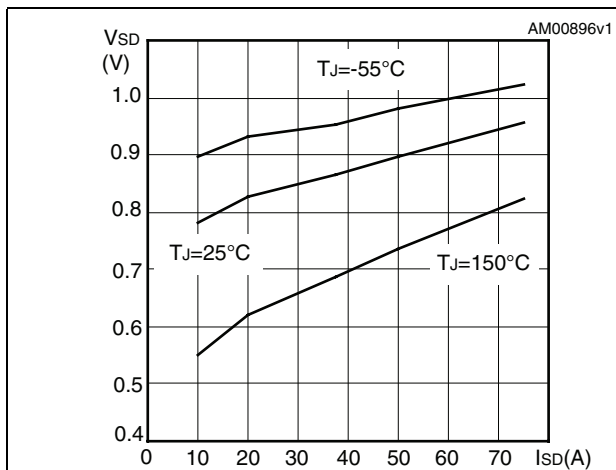
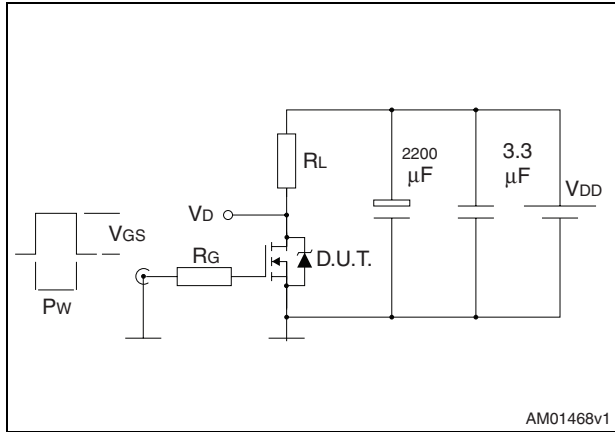


Figure 12. Source-drain diode forward characteristics



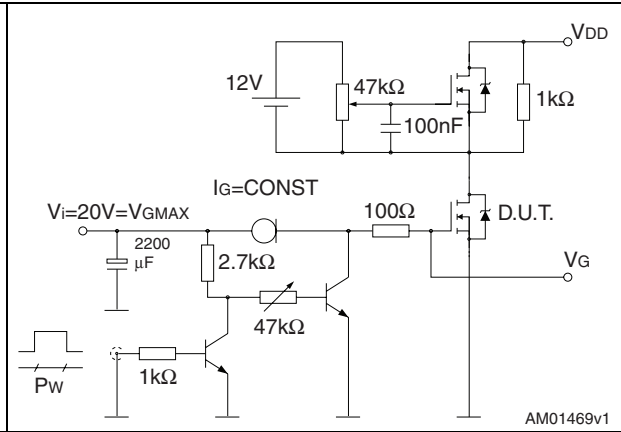
3 Test circuits

Figure 13. Switching times test circuit for resistive load



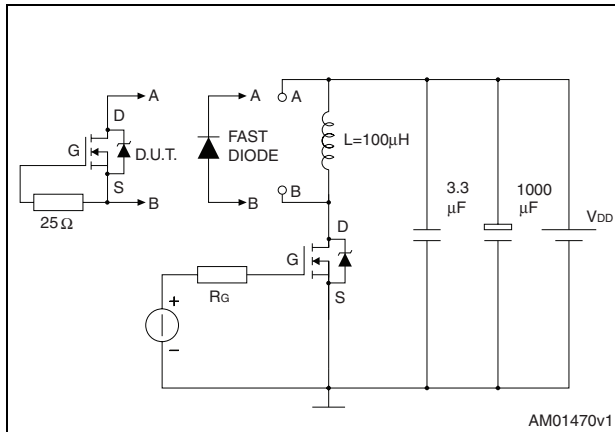
AM01468v1

Figure 14. Gate charge test circuit



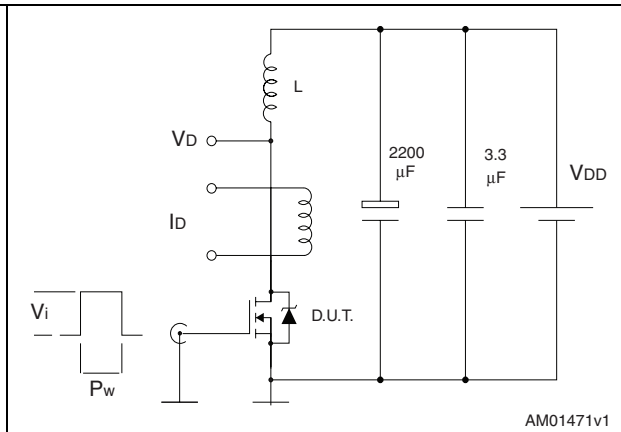
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Figure 15. Test circuit for inductive load switching and diode recovery times



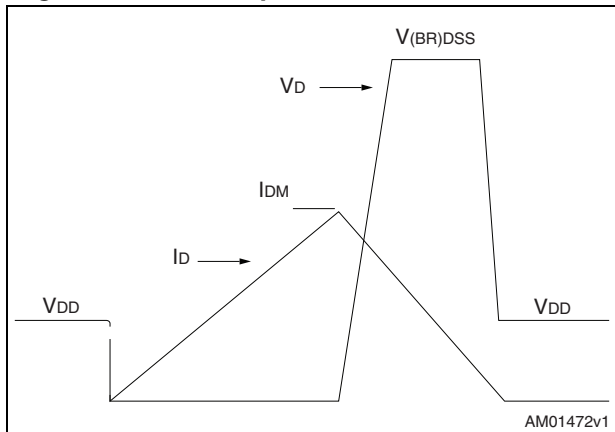
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Figure 16. Unclamped inductive load test circuit



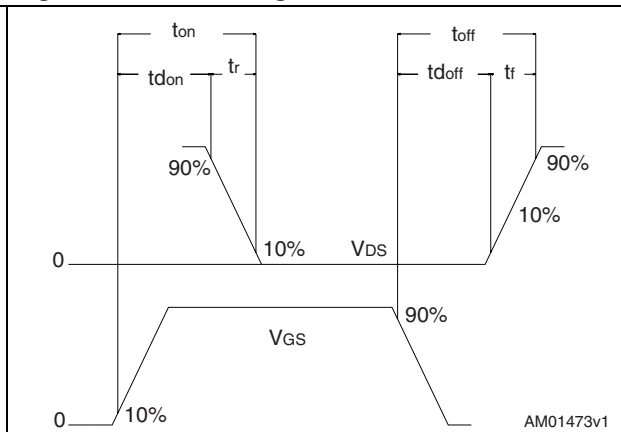
AM01471v1

Figure 17. Unclamped inductive waveform



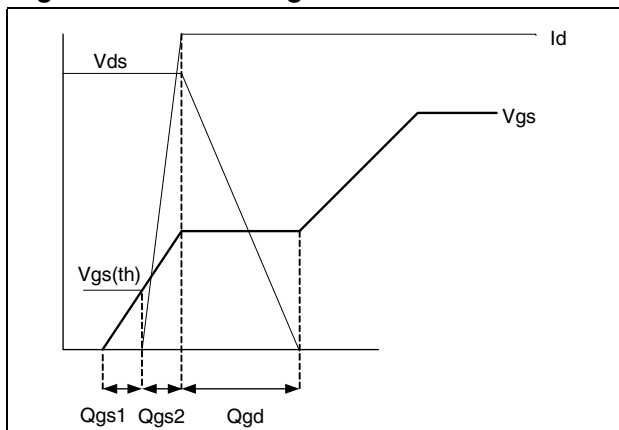
AM01472v1

Figure 18. Switching time waveform



AM01473v1

Figure 19. Gate charge 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 8. Short IPAK mechanical dimensions

Dim.	mm		
	Min	Typ	Max
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.25	
e1	4.40		4.60
H	9.80		10.40
L	3.00		3.40
L1	0.80		1.20
L2		0.80	1.00

Figure 20. Short IPAK mechanical drawing

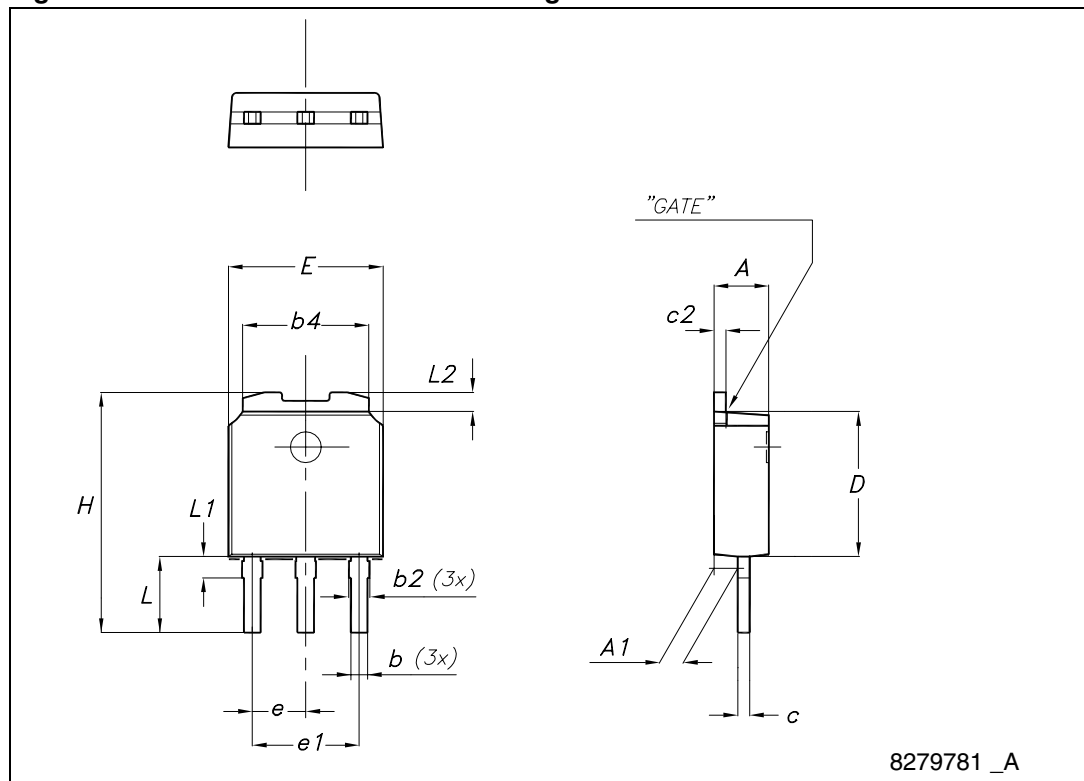
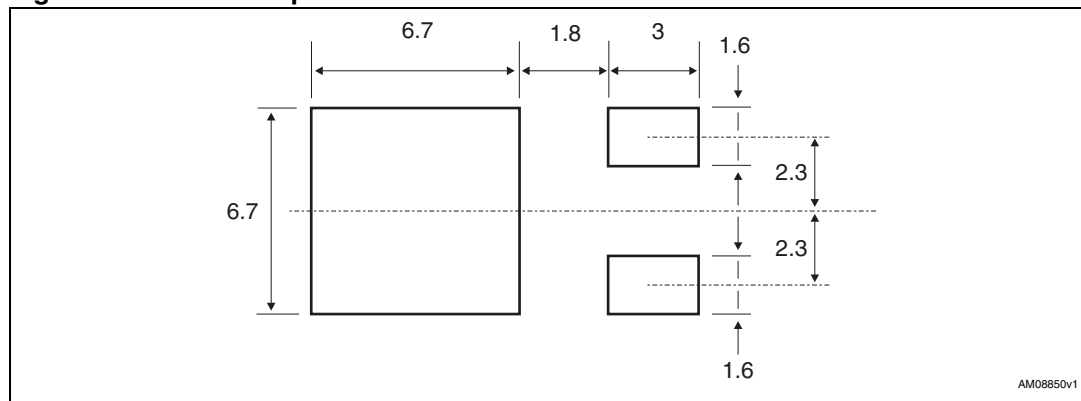


Table 9. DPAK (TO-252) mechanical data

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 21. DPAK footprint^(a)



a. All dimension are in millimeters

Figure 22. DPAK (TO-252) drawing

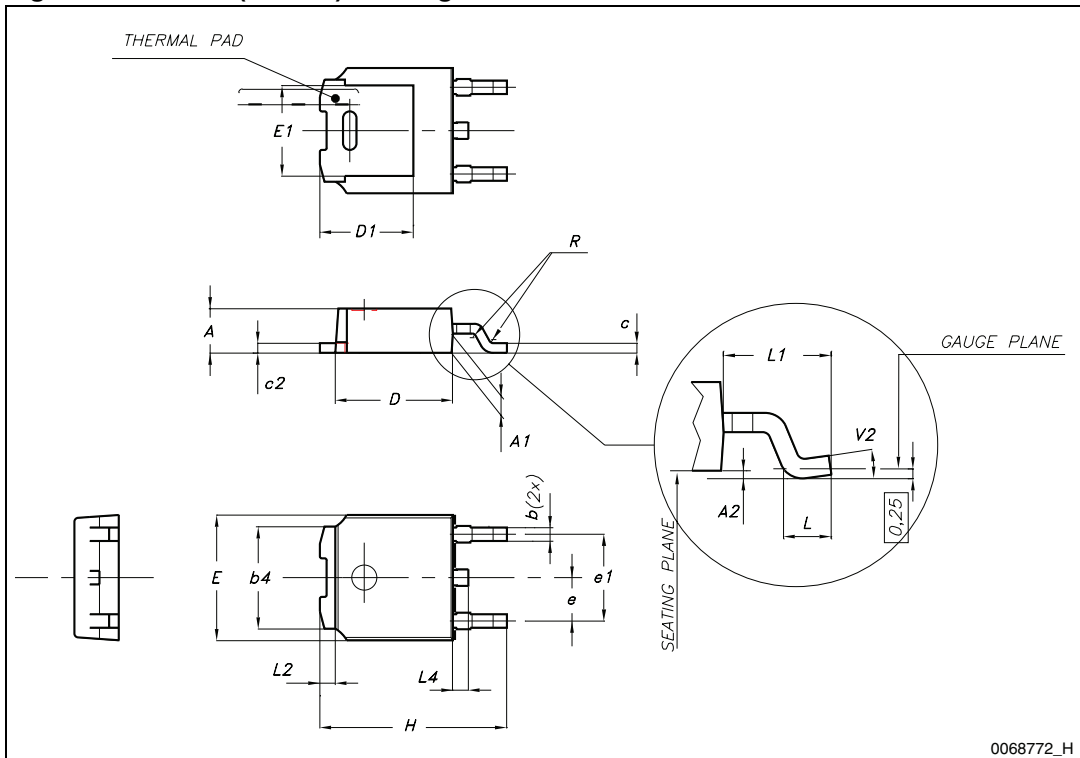


Table 10. IPAK (TO-251) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
B5		0.3	
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
L1	0.80		1.20
L2		0.80	1.00
V1		10 °	

Figure 23. IPAK (TO-251) drawing

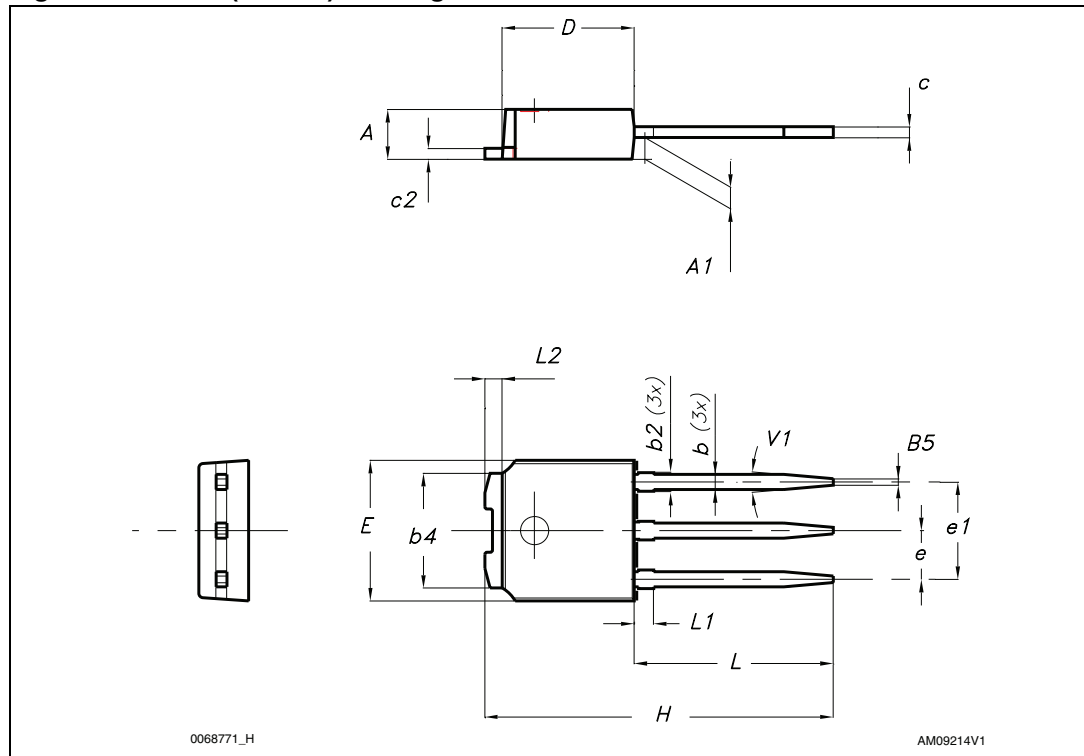
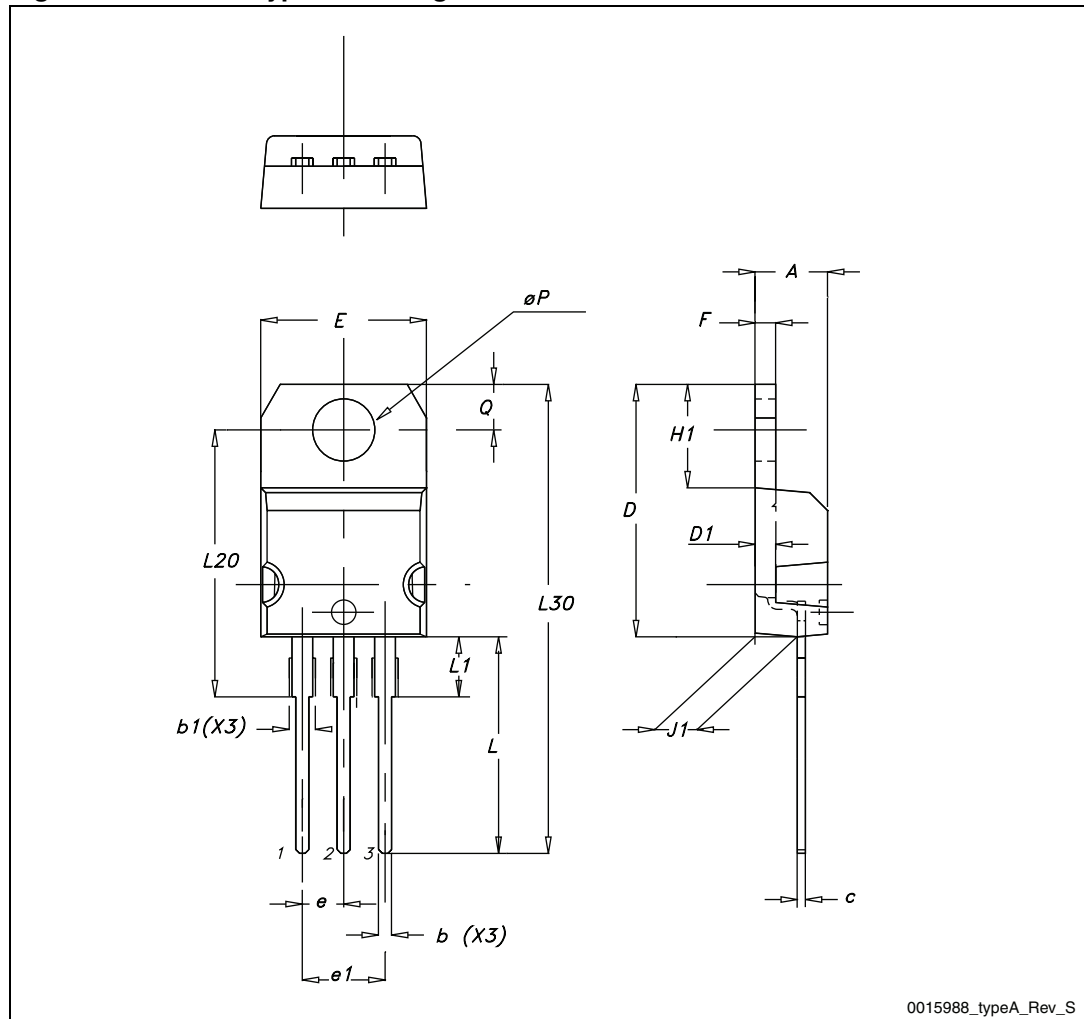


Table 11. TO-220 type A mechanical data

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	
∅P	3.75		3.85
Q	2.65		2.95

Figure 24. TO-220 type A drawing



0015988_typeA_Rev_S

5 Packaging mechanical data

Table 12. 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 25. Tape for DPAK (TO-252)

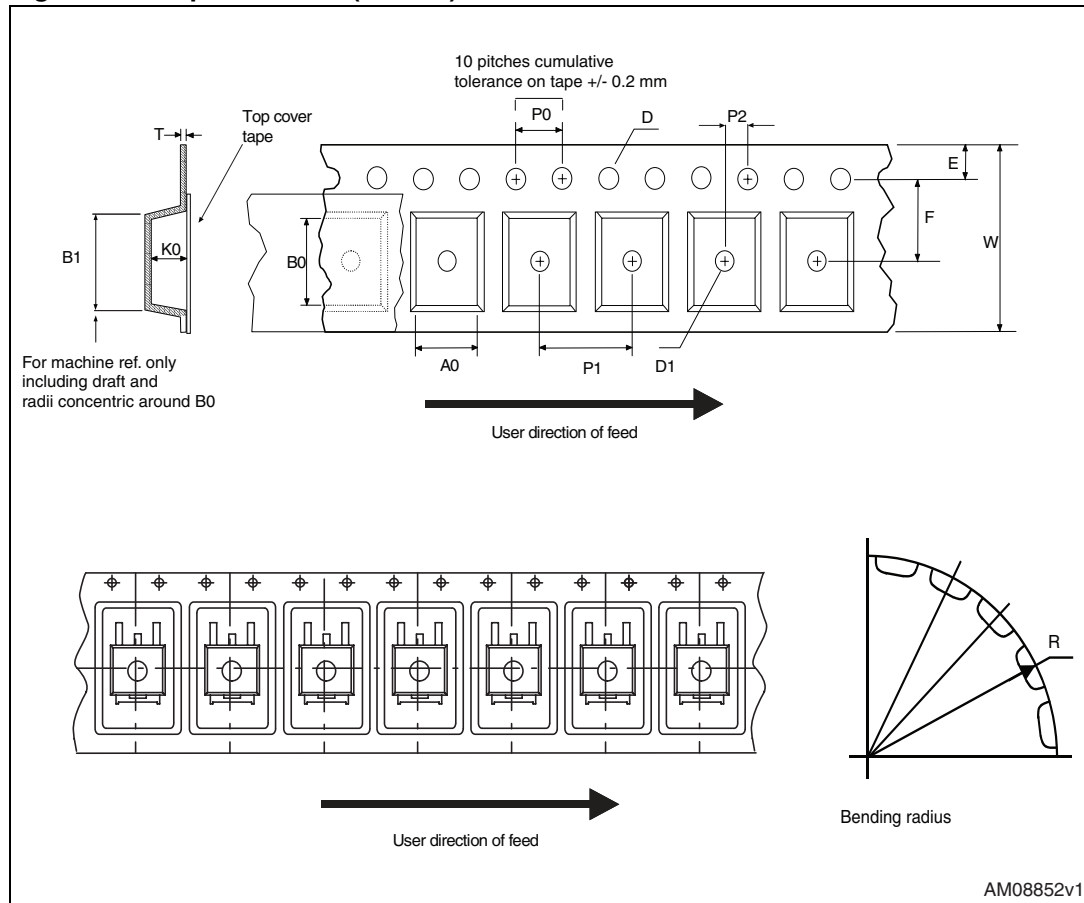
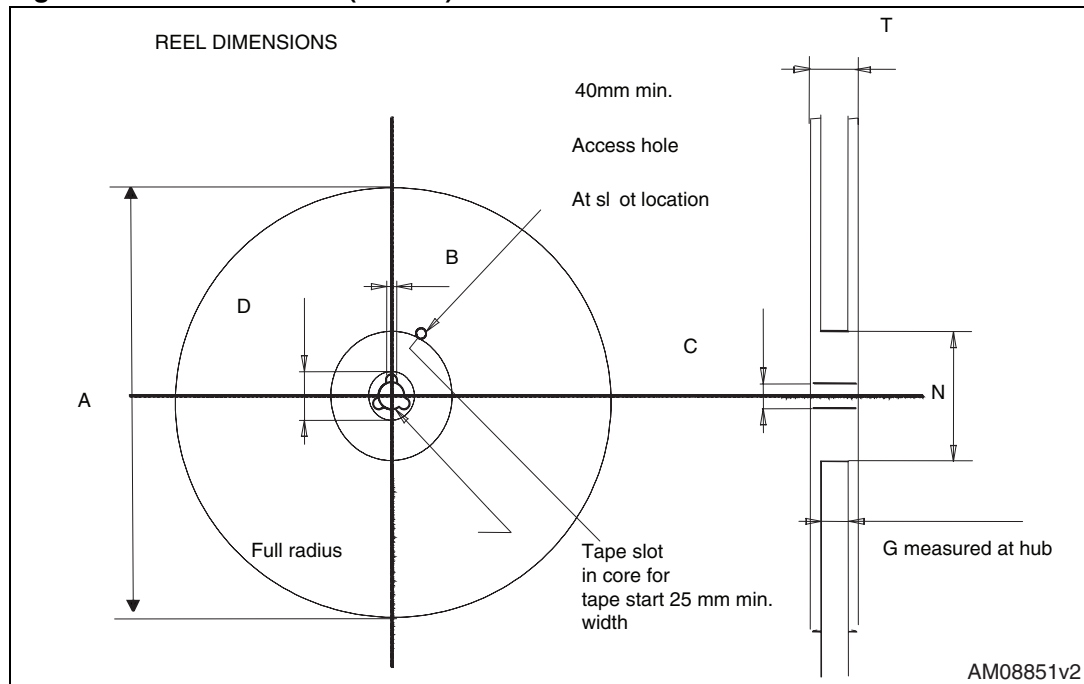


Figure 26. Reel for DPAK (TO-252)



6 Revision history

Table 13. Document revision history

Date	Revision	Changes
01-Jul-2009	1	First issue.
02-Oct-2009	2	– Added device in Short IPAK. – Document status promoted from preliminary data to datasheet.
19-Apr-2011	3	– Added max values in Table 5: Dynamic . – Added new package and mechanical data. – Inserted new I_D value @ 70 °C (see Table 2: Absolute maximum ratings)
04-Jul-2011	4	Updated: mechanical data

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