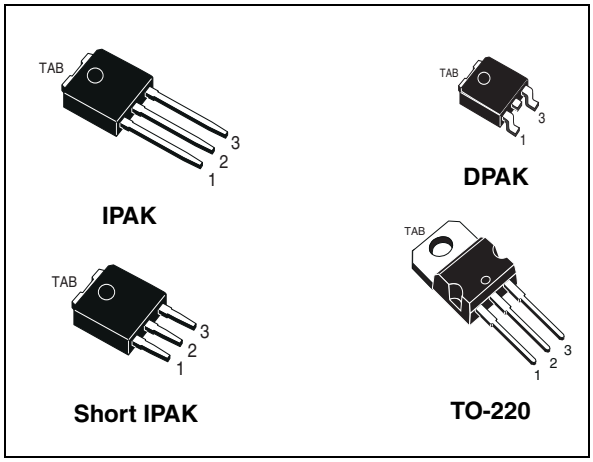
STD75N3LLH6, STP75N3LLH6
STU75N3LLH6, STU75N3LLH6-S

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

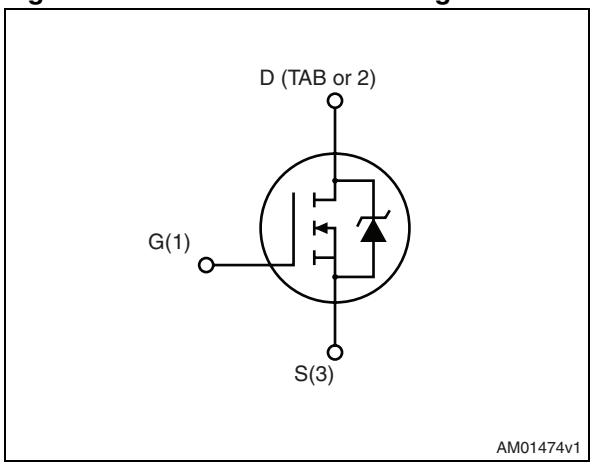


Table 1. Device summary

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

Contents

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 °C	75	A
I_D	Drain current (continuous) at T_C = 70 °C	56	A
I_D	Drain current (continuous) at T_C = 100 °C	47	A
I_{DM} (2)	Drain current (pulsed)	300	A
P_{TOT}	Total dissipation at T_C = 25 °C	60	W
	Derating factor	0.4	W/°C
T_j T_{stg}	Operating junction temperature storage temperature	-55 to 175	°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
		DPAK	TO-220	IPAK	Short IPAK	
$R_{thj\text{-}case}$	Thermal resistance junction-case (drain) (steady state)	2.5				°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-amb max	100	62.5	100		°C/W
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb max	35				°C/W
T_J	Maximum lead temperature for soldering purpose	275	300	275		°C

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

2 Electrical characteristics

(T_{CASE}=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)	I_D = 250 µA	30			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 30 V V_{DS} =30 V T_C = 125 °C			1 10	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 20 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	1	1.7	2.5	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 37.5 A SMD version		0.0042	0.0055	Ω
		V_{GS} = 10 V, I_D = 37.5 A		0.0046	0.0059	Ω
		V_{GS} = 4.5 V, I_D = 37.5 A SMD version		0.0065	0.008	Ω
		V_{GS} = 4.5 V, I_D = 37.5 A		0.0069	0.0084	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 V, f = 1 MHz, V_{GS} = 0	1350 230 140	1690 290 176	2030 350 210	pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 15 V, I_D = 75 A, V_{GS} = 4.5 V (see *Figure 14*)		17 8 6	23.8 11.2 8.4	nC nC nC
Q_{gs1} Q_{gs2}	Pre V_{th} gate-to-source charge Post V_{th} gate-to-source charge	V_{DD}=15 V, I_D = 75 A V_{GS} =5 V *(Figure 19)*		3.9 4.1	5.5 5.7	nC 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
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off delay time Fall time	V_{DD} = 15 V, I_D = 37.5 A R_G = 4.7 Ω V_{GS} = 5 V (see *Figure 13*)	-	9.5 30 37 12	-	ns ns ns ns

Table 7. Source drain diode

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

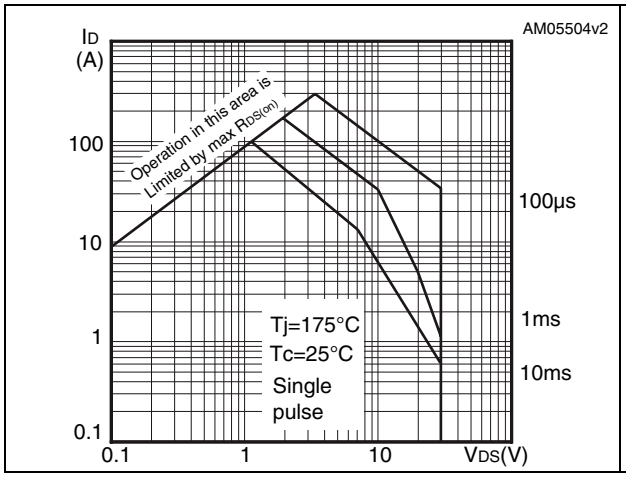


Figure 3. Thermal impedance

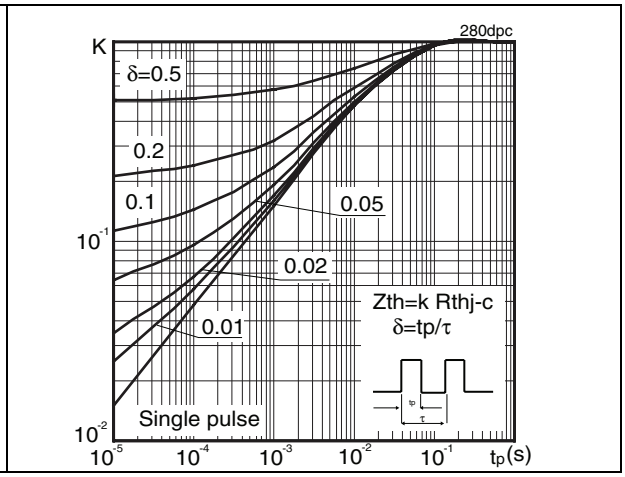


Figure 4. Output characteristics

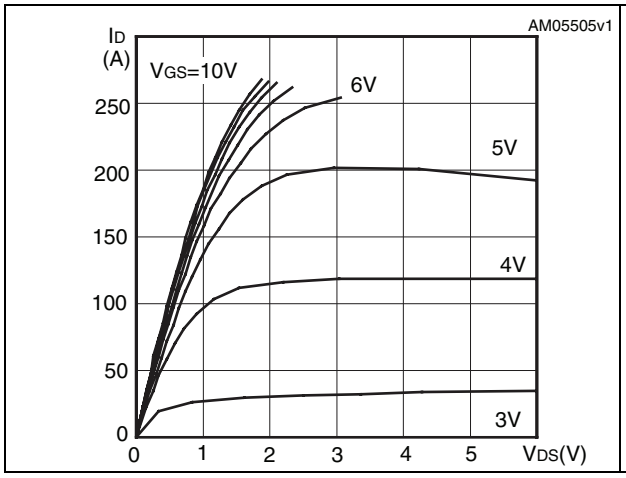


Figure 5. Transfer characteristics

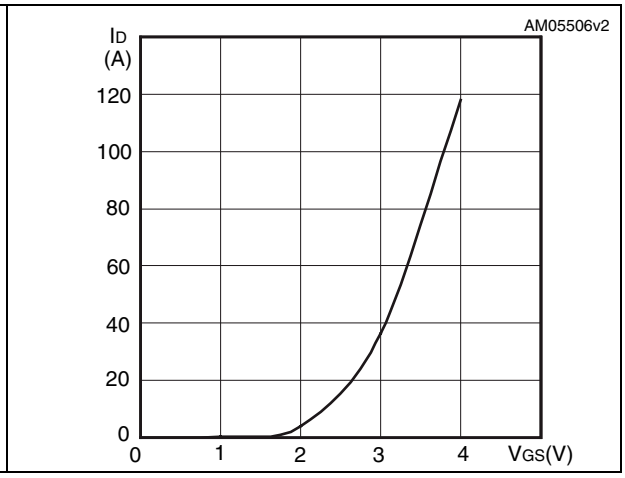


Figure 6. Normalized BV_{DSS} vs temperature

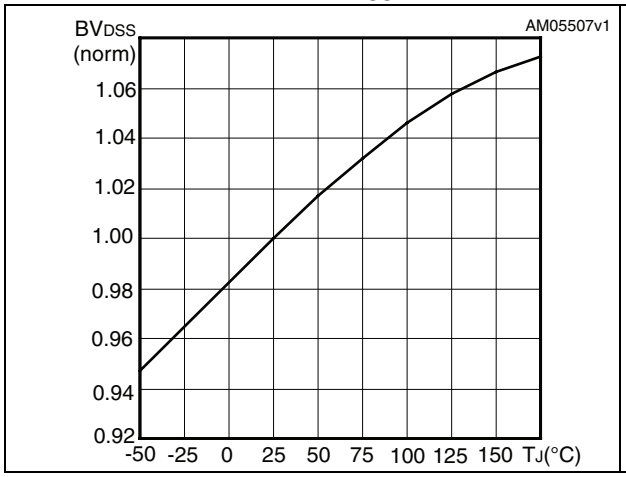


Figure 7. Static drain-source on resistance

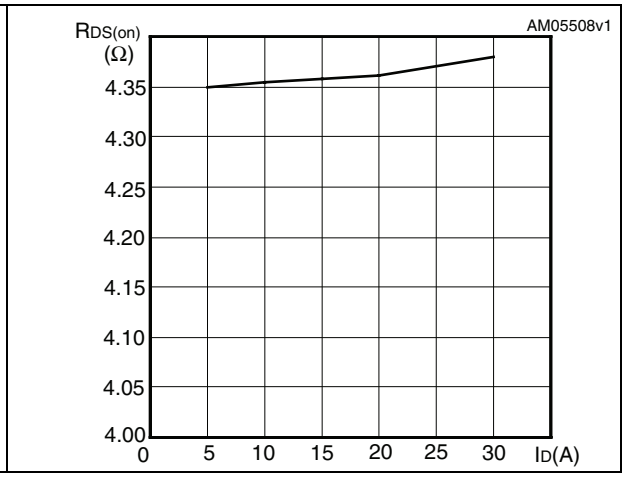


Figure 8. Gate charge vs gate-source voltage

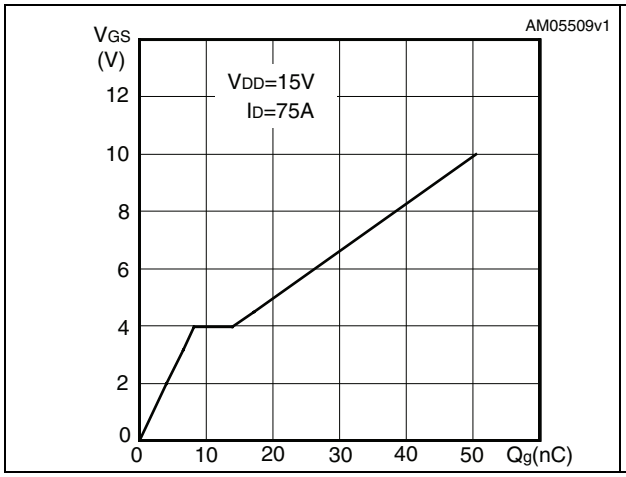


Figure 9. Capacitance variations

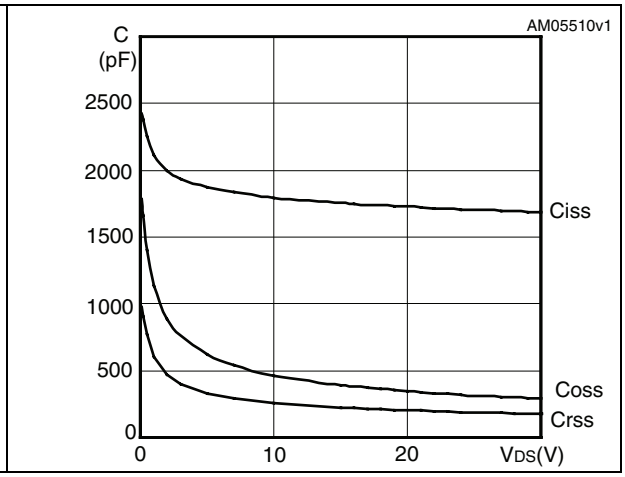


Figure 10. Normalized gate threshold voltage vs temperature

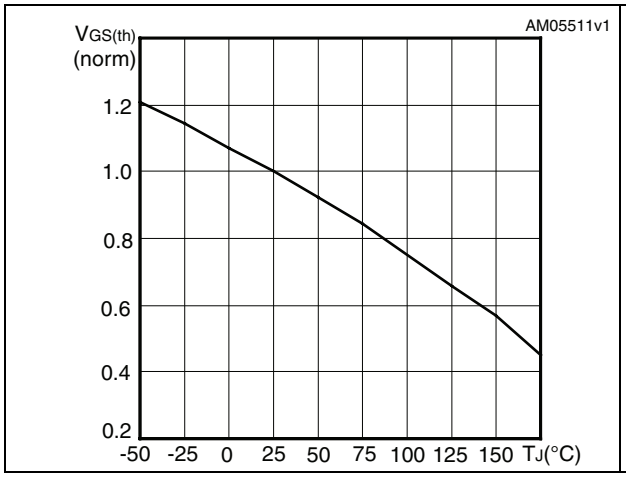


Figure 11. Normalized on resistance vs temperature

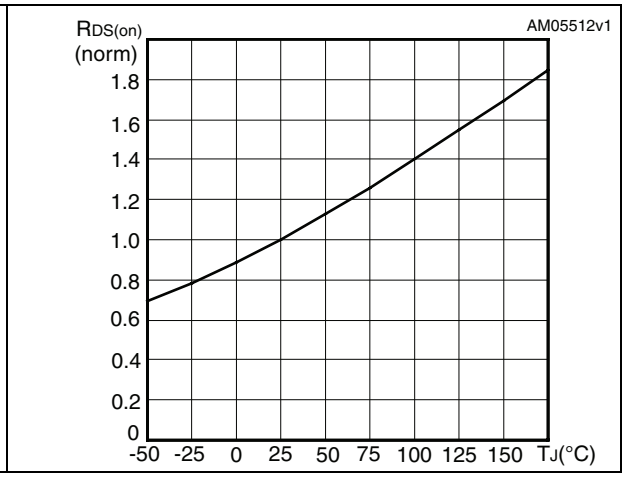
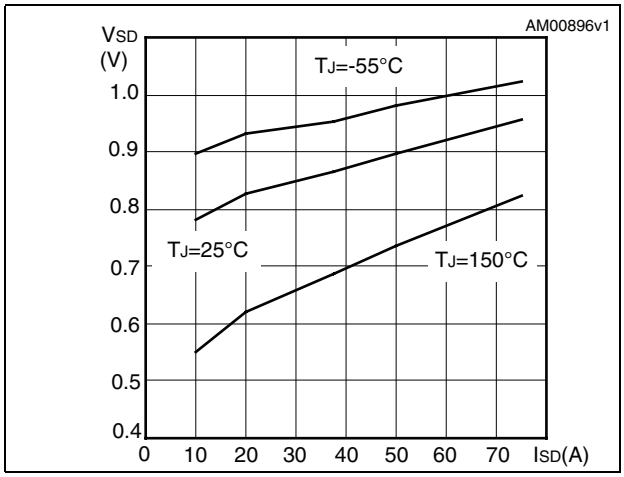


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

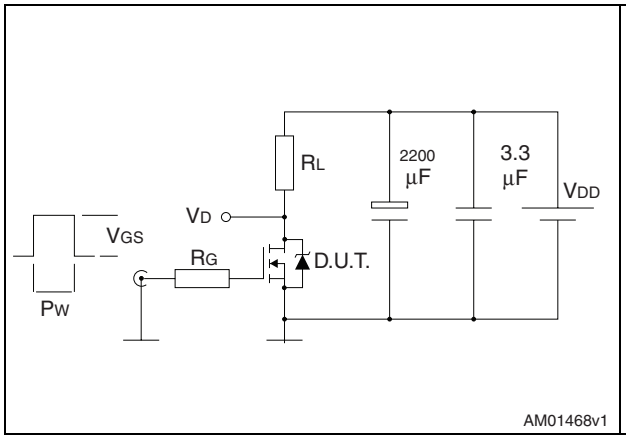


Figure 14. Gate charge test circuit

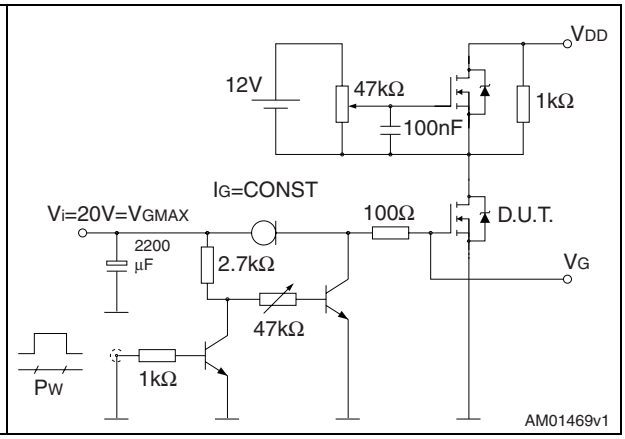


Figure 15. Test circuit for inductive load switching and diode recovery times

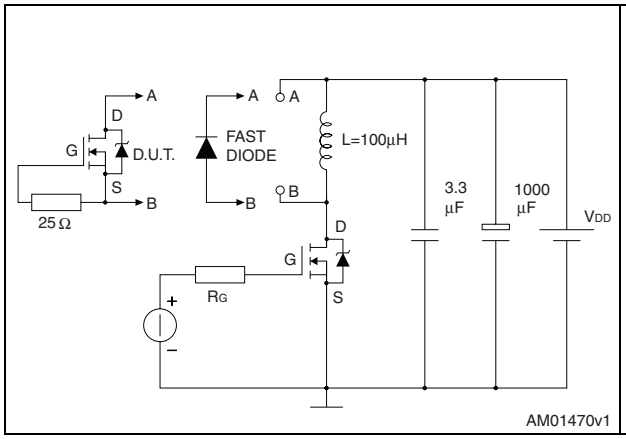


Figure 16. Unclamped inductive load test circuit

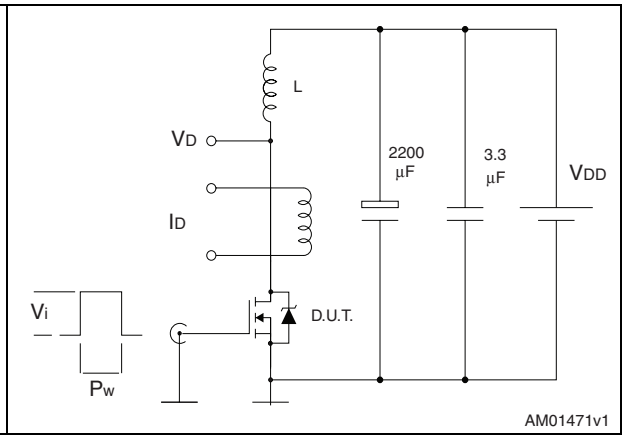


Figure 17. Unclamped inductive waveform

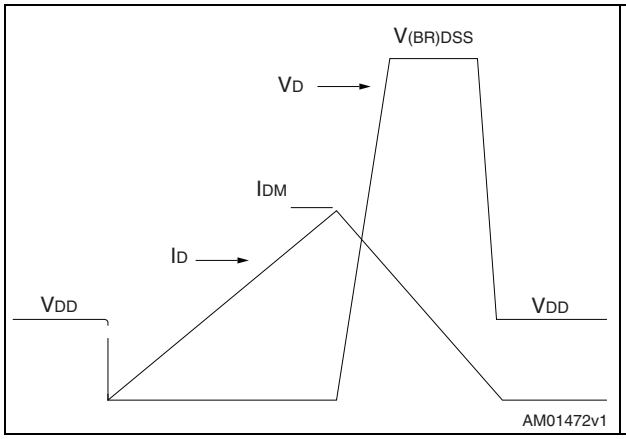


Figure 18. Switching time waveform

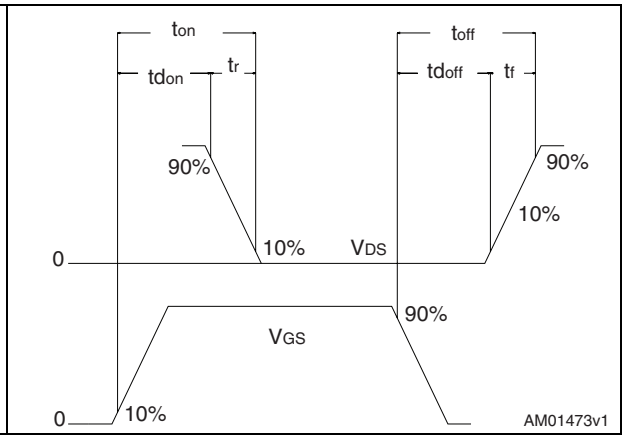
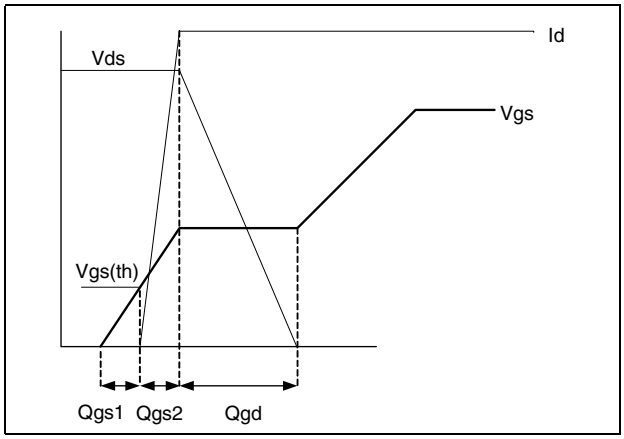


Figure 19. Gate charge waveform



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

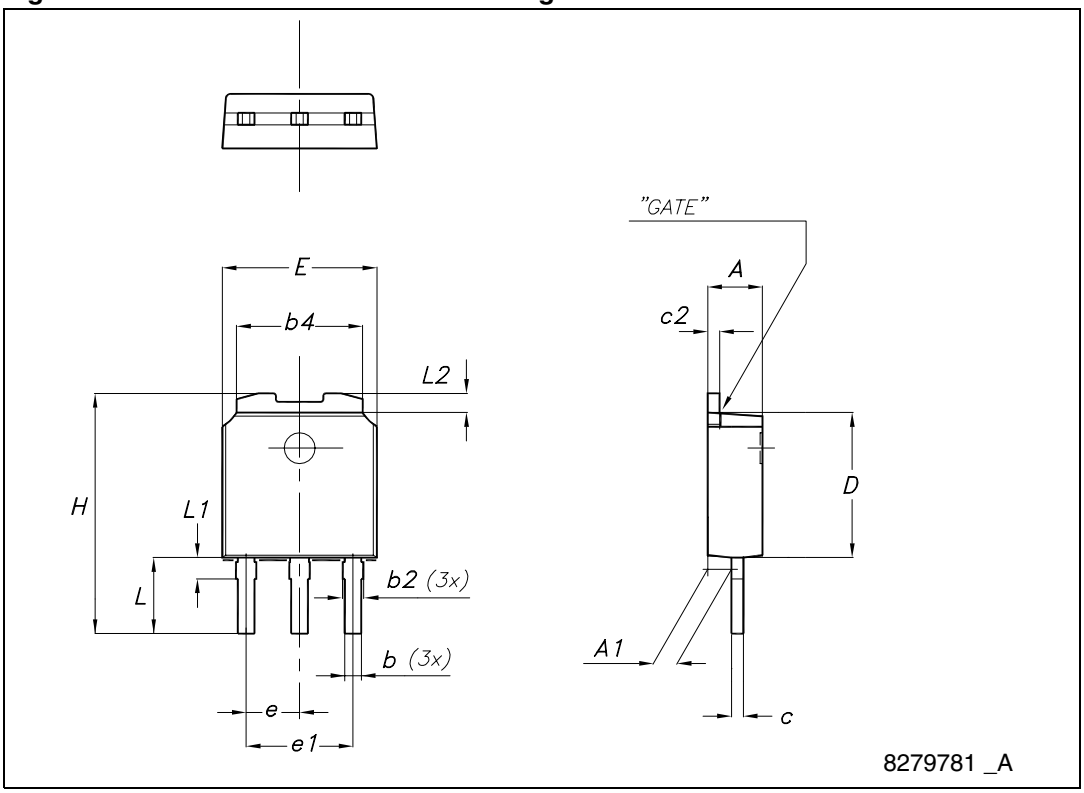
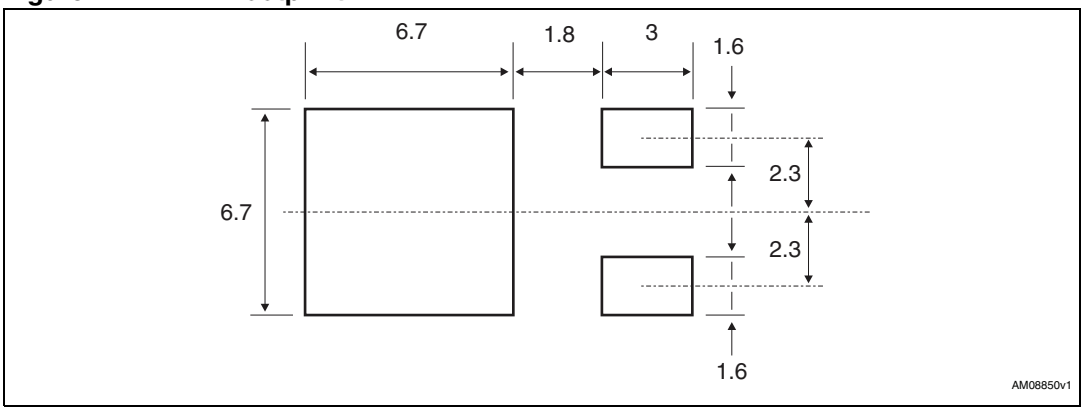


Table 9. DPAK (TO-252) mechanical data

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

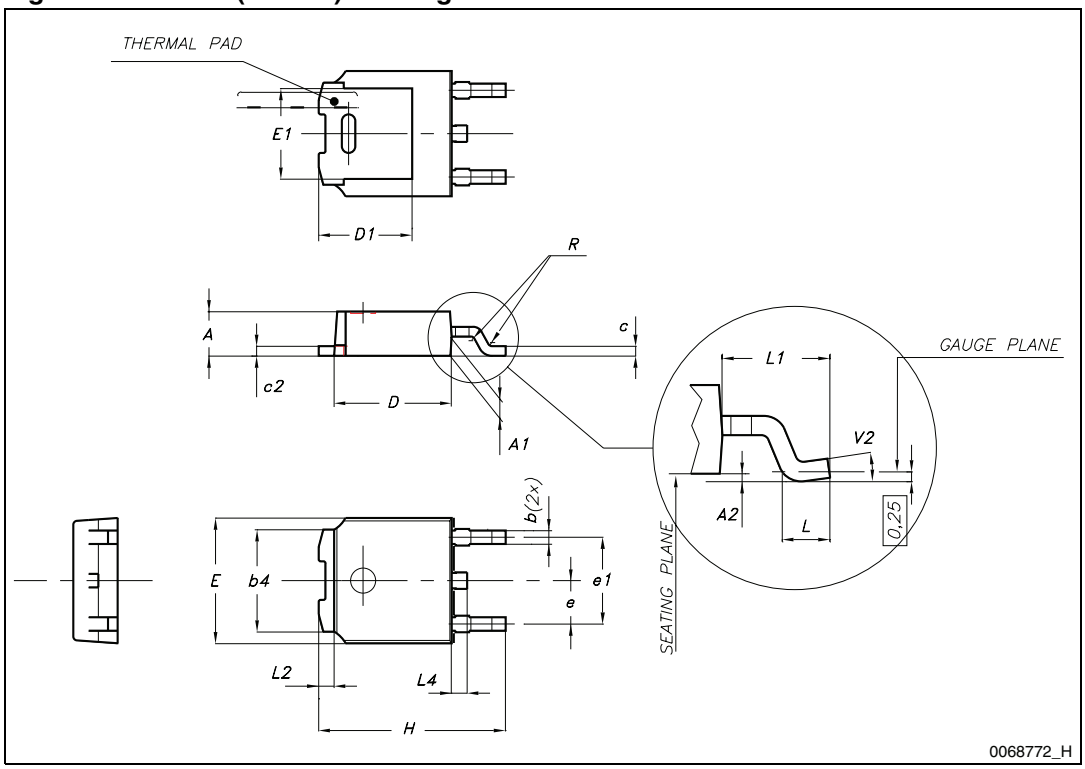


Table 10. IPAK (TO-251) mechanical data

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 ^{o}	

Figure 23. IPAK (TO-251) drawing

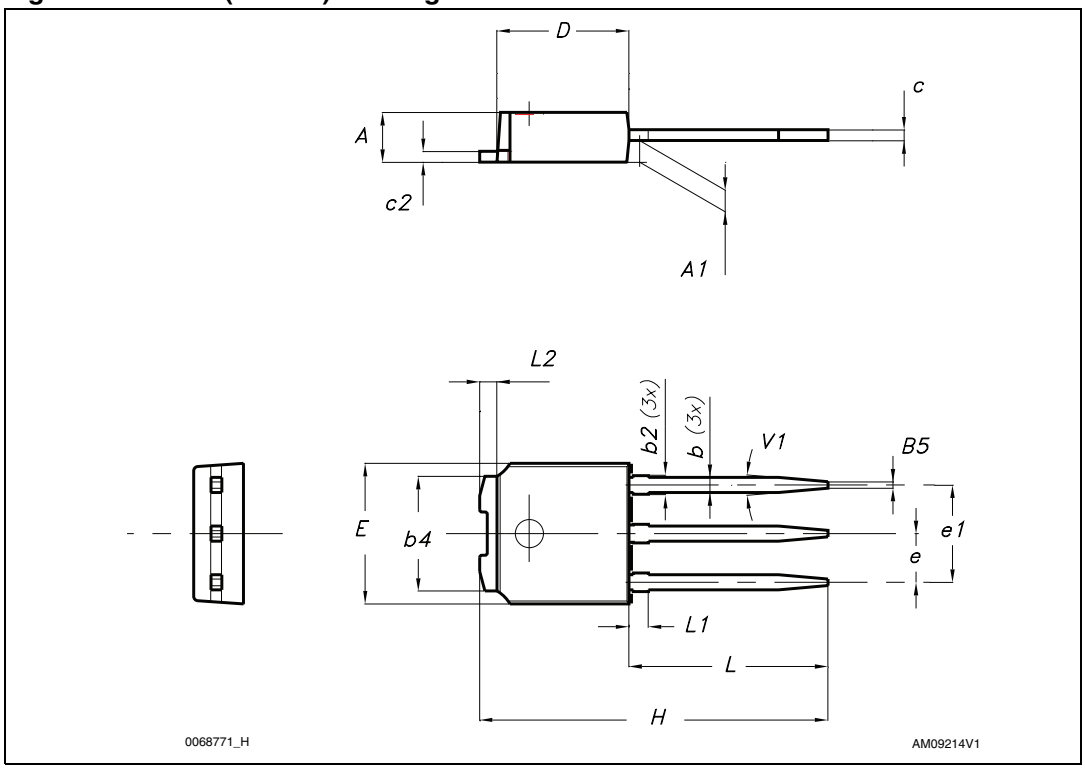
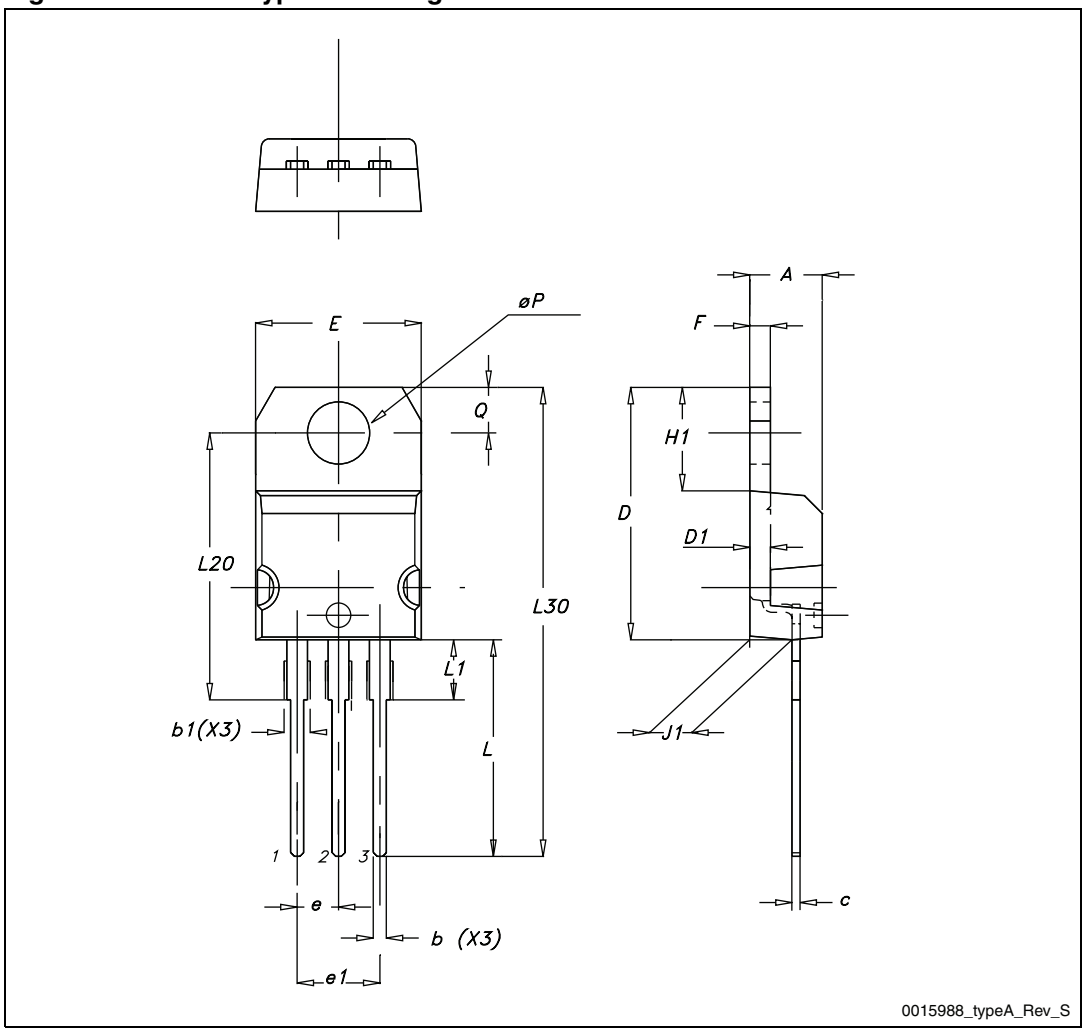


Table 11. TO-220 type A mechanical data

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



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)

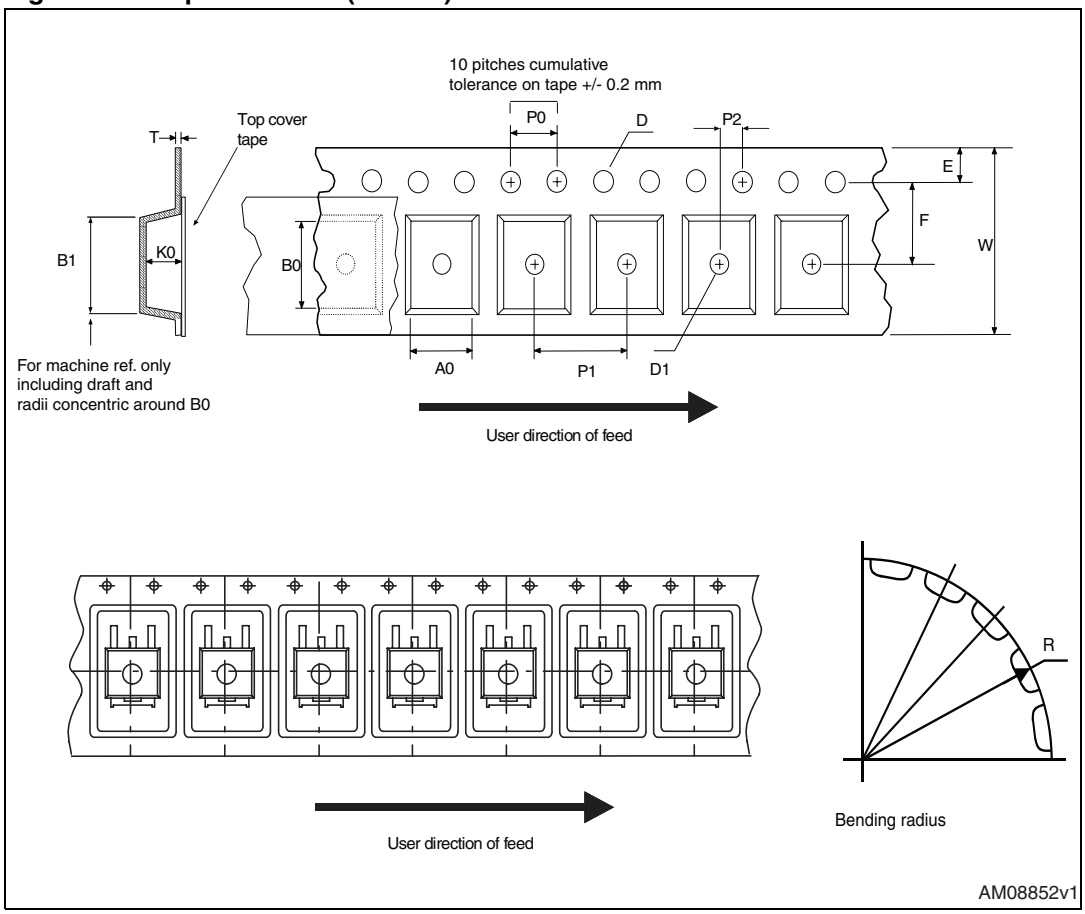
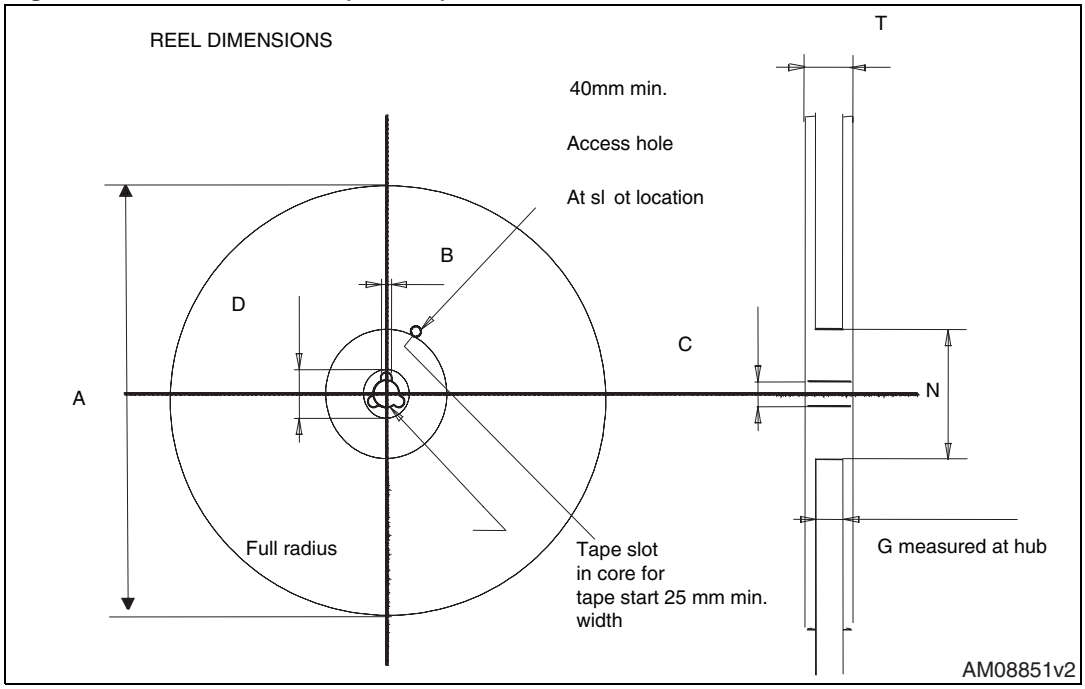


Figure 26. Reel for DPAK (TO-252)



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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