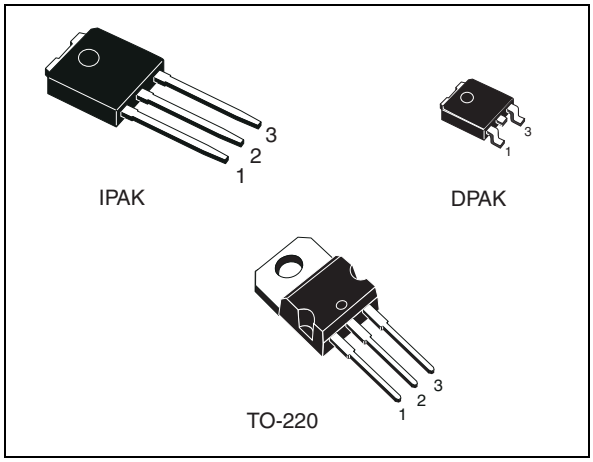
STD27N3LH5, STP27N3LH5 STU27N3LH5

N-channel 30 V, 0.014 Ω, 27 A, DPAK, IPAK, TO-220 STripFET™ V Power MOSFET

Features

Type	V_{DSS}	$R_{DS(on)}$ max	I_D
STD27N3LH5	30 V	0.019 Ω	27 A
STP27N3LH5	30 V	0.020 Ω	27 A
STU27N3LH5	30 V	0.020 Ω	27 A

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



Application

- Switching applications

Description

This STripFET™V Power MOSFET technology is among the latest improvements, which have been especially tailored to achieve very low on-state resistance providing also one of the best-in-class figure of merit (FOM).

Figure 1. Internal schematic diagram

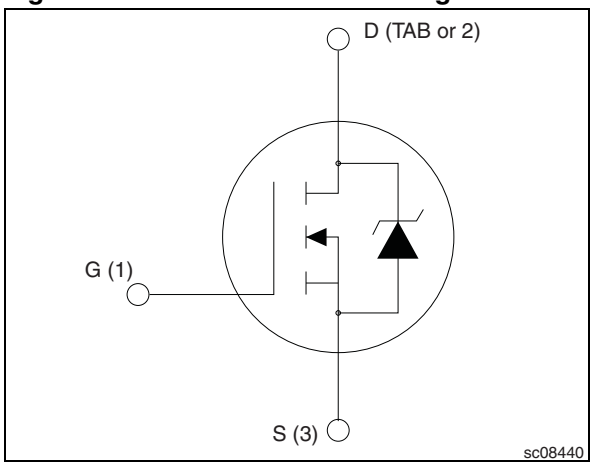


Table 1. Device summary

Order codes	Marking	Package	Packaging
STD27N3LH5	27N3LH5	DPAK	Tape and reel
STU27N3LH5	27N3LH5	IPAK	Tube
STP27N3LH5	27N3LH5	TO-220	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		DPAK, IPAK	TO-220	
V_{DS}	Drain-source voltage (V_{GS} = 0)	30		V
V_{GS}	Gate-Source voltage	± 22		V
I_D (1)	Drain current (continuous) at T_C = 25 °C	27		A
I_D	Drain current (continuous) at T_C = 100 °C	19		A
I_{DM} (2)	Drain current (pulsed)	108		A
P_{TOT}	Total dissipation at T_C = 25 °C	30	45	W
	Derating factor	0.2		W/°C
E_{AS} (3)	Single pulse avalanche energy	50		mJ
T_J T_{stg}	Operating junction temperature Storage temperature	- 55 to 175		°C

1. Limited by wire bonding
2. Pulse width limited by safe operating area
3. Starting T_J = 25 °C, I_D = 21 A, L= 0.2 mH

Table 3. Thermal resistance

Symbol	Parameter	Value		Unit
		DPAK, IPAK	TO-220	
R_{thJC}	Thermal resistance junction-case max	5	3.33	°C/W
R_{thJA}	Thermal resistance junction-case max	100		°C/W
T_J	Maximum lead temperature for soldering purpose	275		°C

2 Electrical characteristics

(T_{CASE} = 25 °C unless otherwise specified)

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown Voltage	I_D = 250 µA, V_{GS}= 0	30			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 30 V V_{DS} = 30 V, Tc = 125 °C			1 10	µA µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ± 22 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	1		2.5	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10 V, I_D= 13.5 A SMD version		0.015 0.014	0.020 0.019	Ω Ω
		V_{GS} = 4.5 V, I_D= 13.5 A SMD version		0.021 0.020	0.028 0.027	Ω 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	-	475 97 19	-	pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 15 V, I_D = 27 A V_{GS} = 5 V *(Figure 16)*	-	4.6 1.7 1.9	-	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 = 27 A V_{GS} = 5 V *(Figure 21)*	-	0.67 0.84	-	nC nC
R_G	Gate input resistance	f = 1 MHz gate bias = 0 test signal level = 20 mV open drain	-	2.5	-	Ω

Table 6. Switching on/off (resistive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time Rise time	V_{DD} = 15 V, I_D = 13.5 A, R_G = 4.7 Ω, V_{GS} = 10 V *(Figure 15 and Figure 20)*	-	4 22	-	ns ns
$t_{d(off)}$ t_f	Turn-off delay time Fall time	V_{DD} = 15 V, I_D = 13.5 A, R_G = 4.7 Ω, V_{GS} = 10 V *(Figure 15 and Figure 20)*	-	13 2.8	-	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)		-		27 108	A A
V_{SD}	Forward on voltage	I_{SD} = 13.5 A, V_{GS} = 0	-		1.1	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 27 A, di/dt = 100 A/µs, V_{DD} = 25 V *(Figure 17)*	-	16.2 7.8 1		ns nC A

1. Pulsed: pulse duration = 300 µs, duty cycle 1.5 %

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220

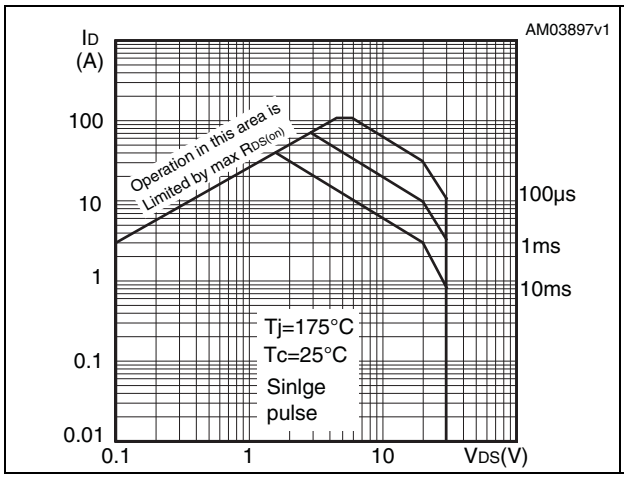


Figure 3. Thermal impedance for TO-220

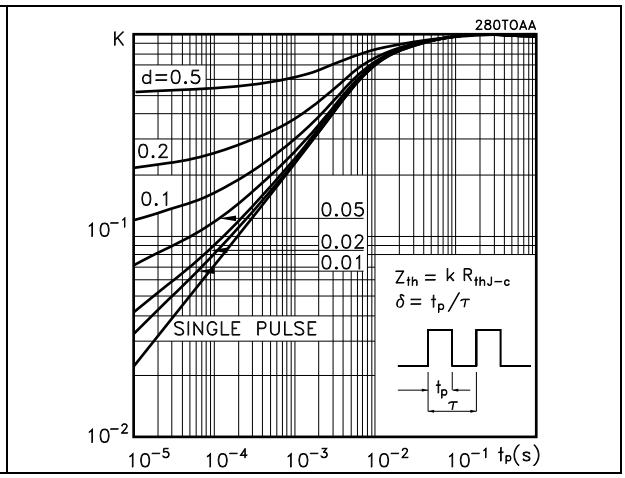


Figure 4. Safe operating area for DPAK, IPAK

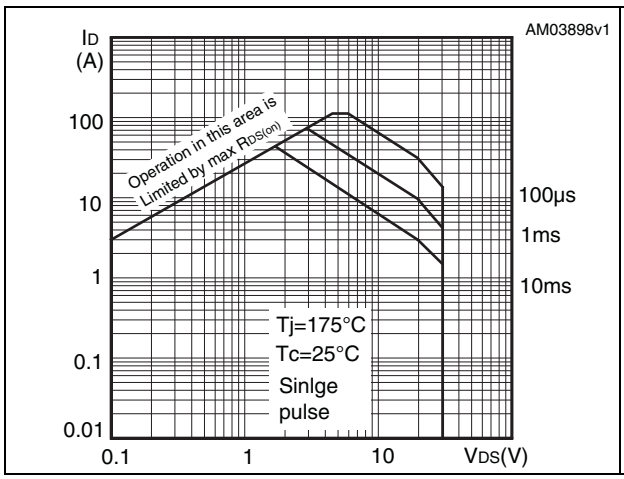


Figure 5. Thermal impedance for DPAK, IPAK

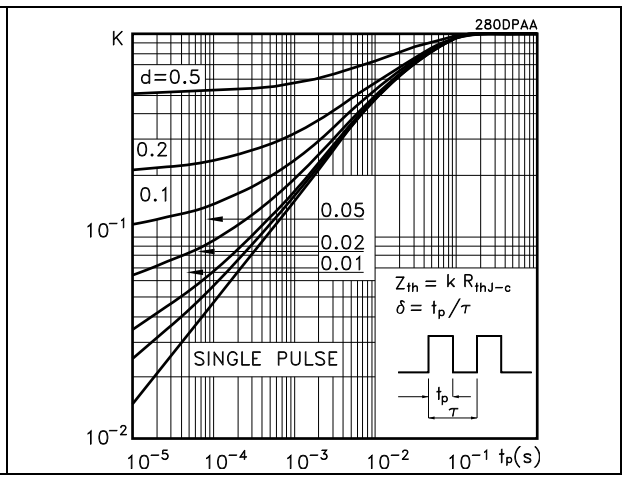


Figure 6. Output characteristics

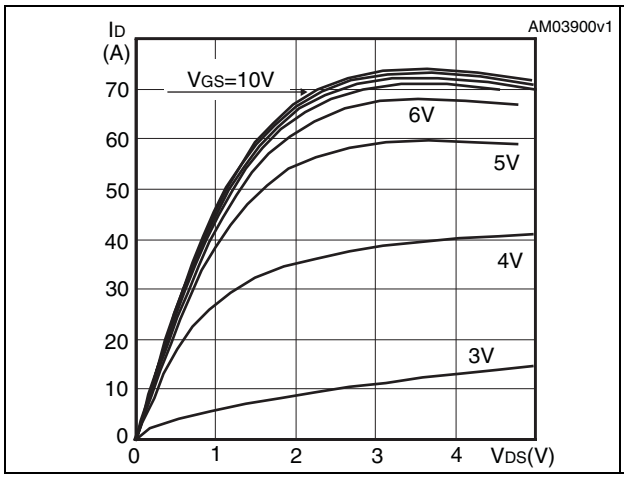


Figure 7. Transfer characteristics

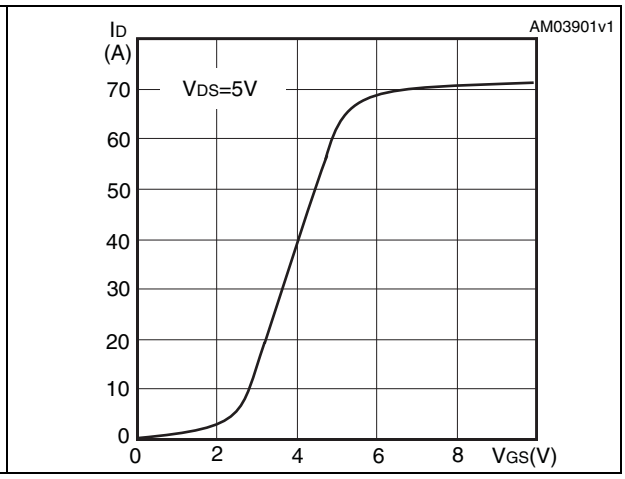


Figure 8. Normalized BV_{DSS} vs temperature

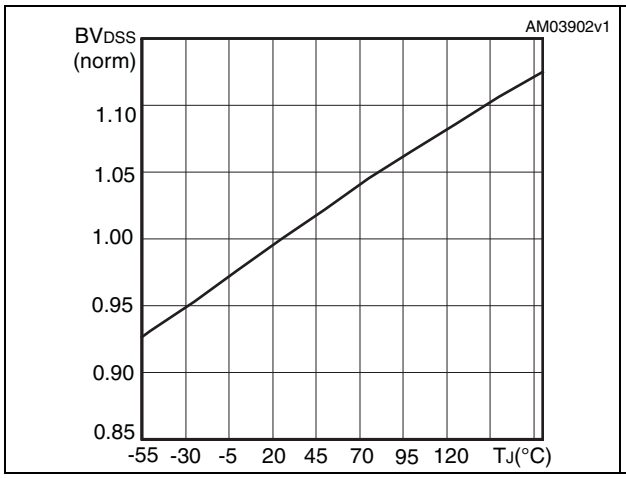


Figure 9. Static drain-source on resistance

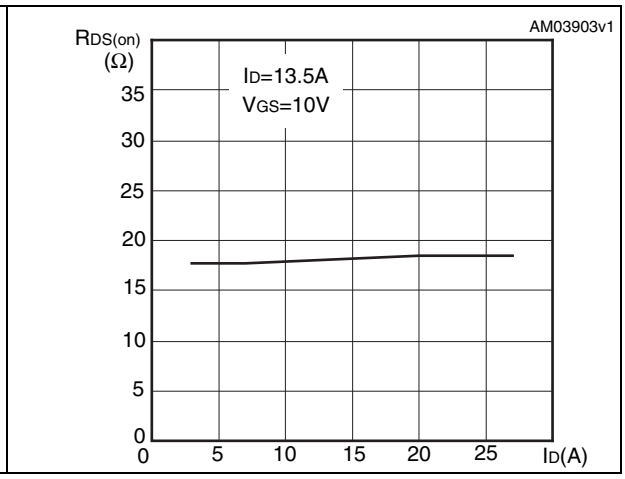


Figure 10. Gate charge vs gate-source voltage

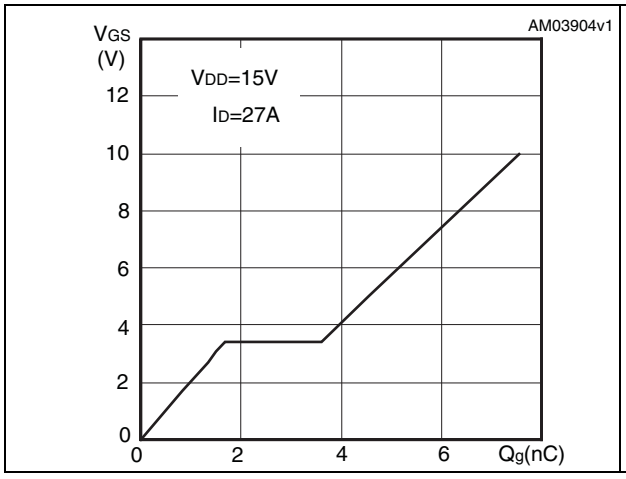


Figure 11. Capacitance variations

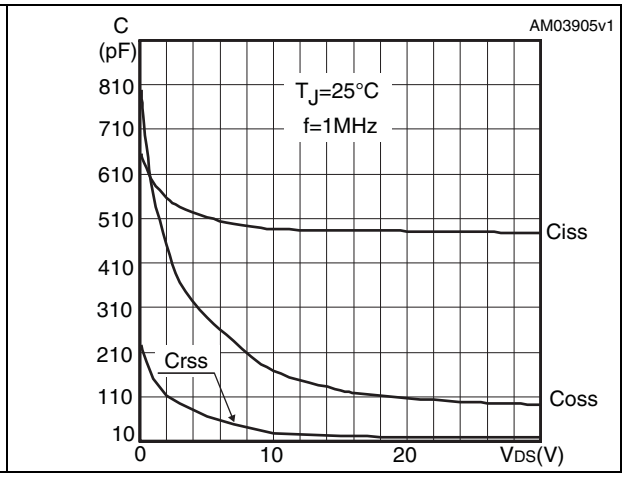


Figure 12. Normalized gate threshold voltage vs temperature

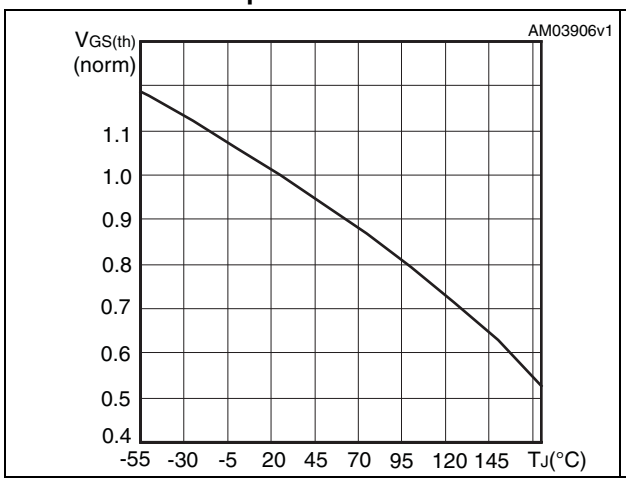


Figure 13. Normalized on resistance vs temperature

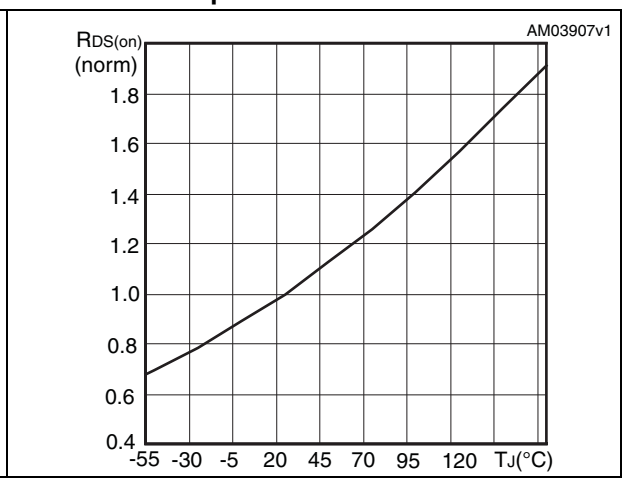
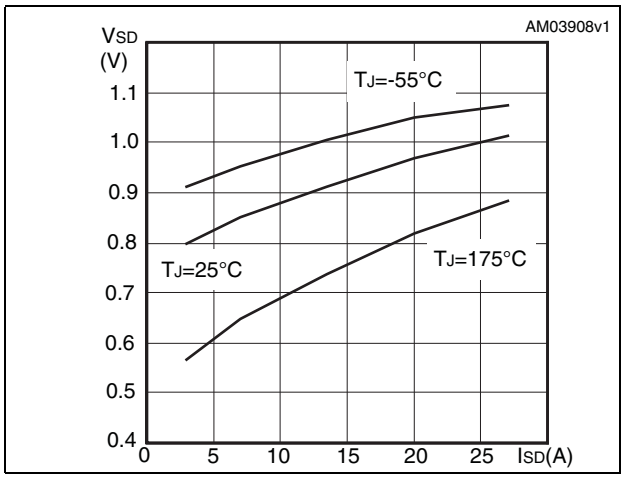


Figure 14. Source-drain diode forward characteristics



3 Test circuits

Figure 15. Switching times test circuit for resistive load

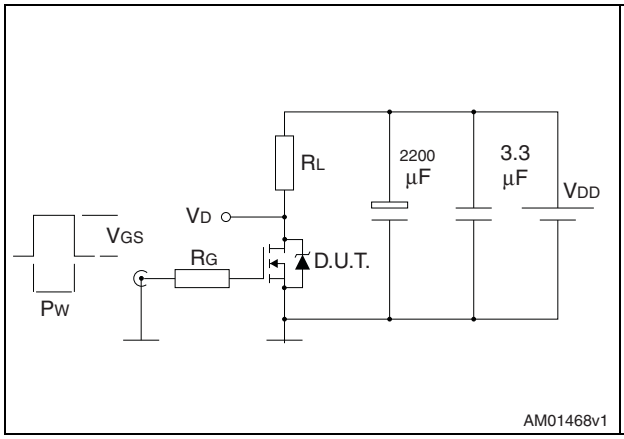


Figure 16. Gate charge test circuit

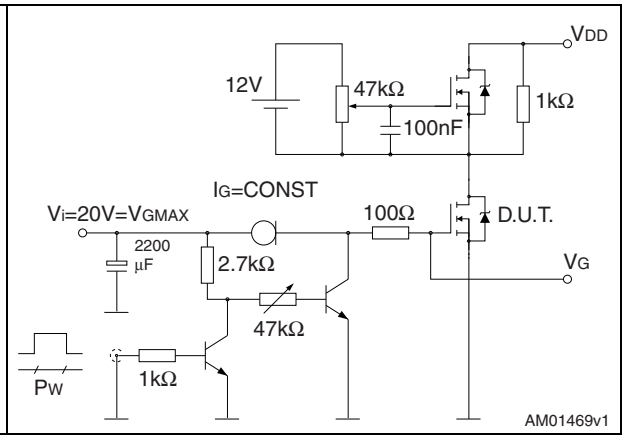


Figure 17. Test circuit for inductive load switching and diode recovery times

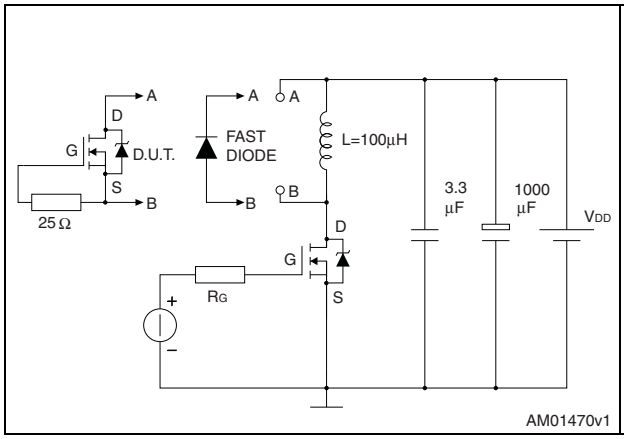


Figure 18. Unclamped inductive load test circuit

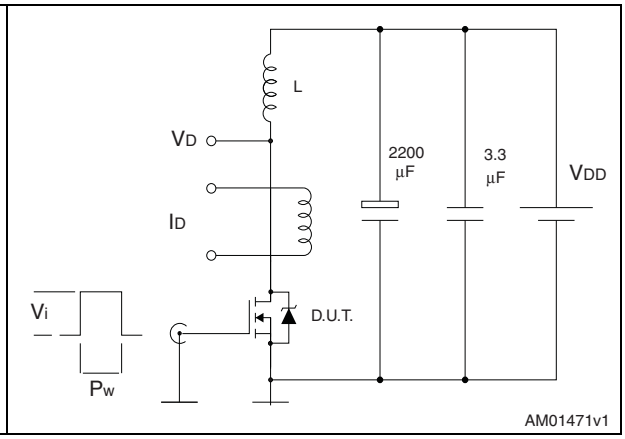


Figure 19. Unclamped inductive waveform

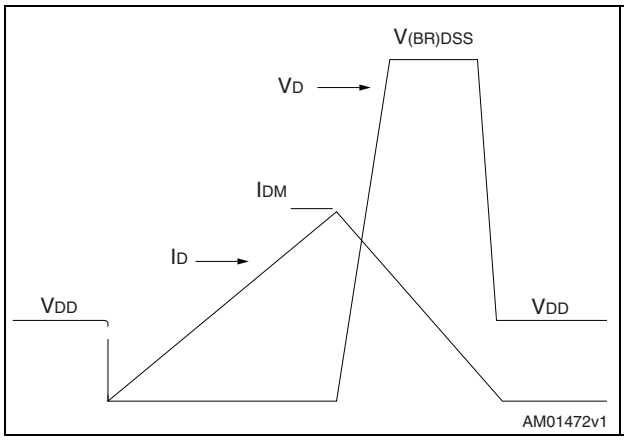


Figure 20. Switching time waveform

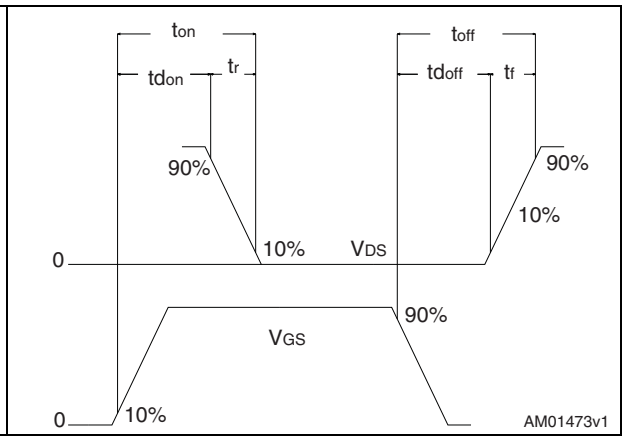
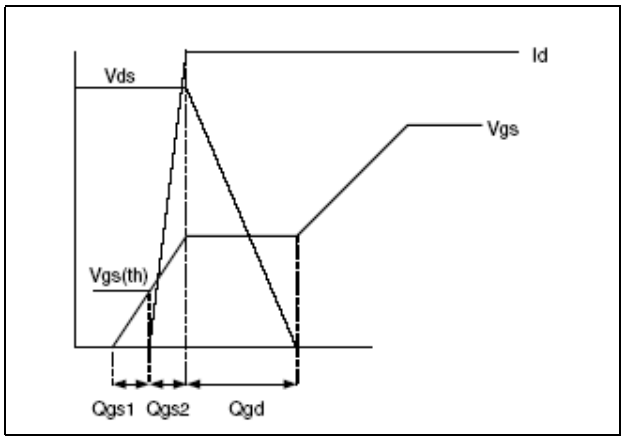


Figure 21. Gate charge waveform



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. 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		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0°		8°

Figure 22. DPAK (TO-252) drawing

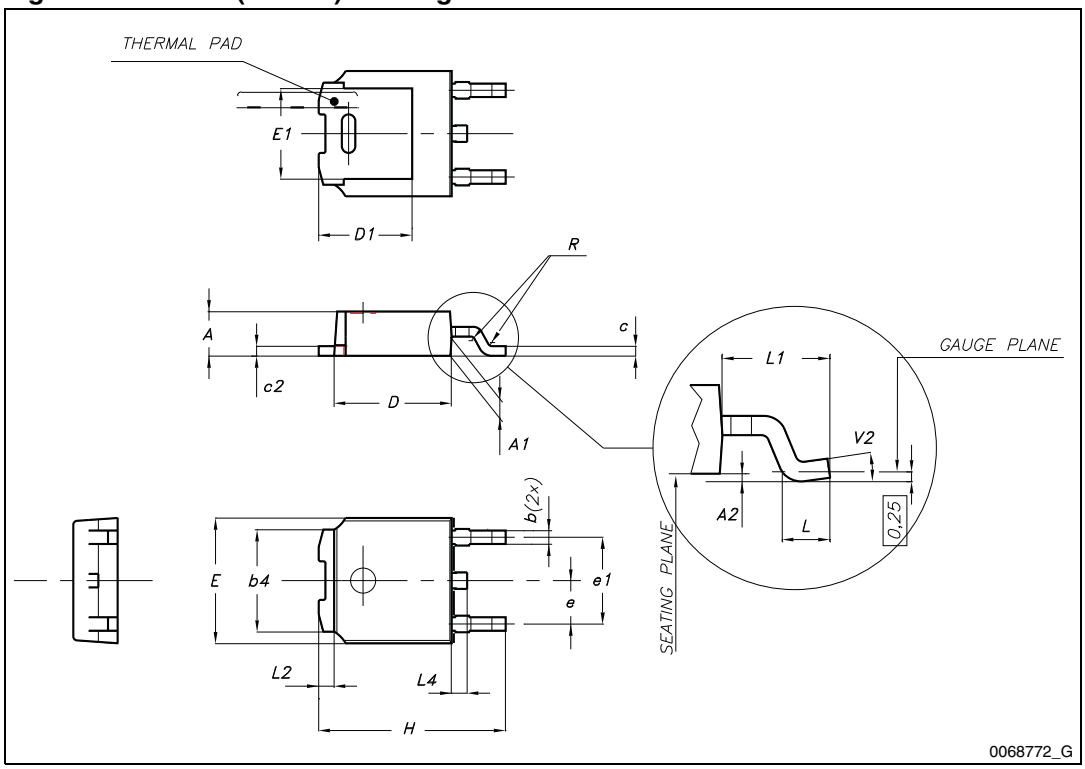
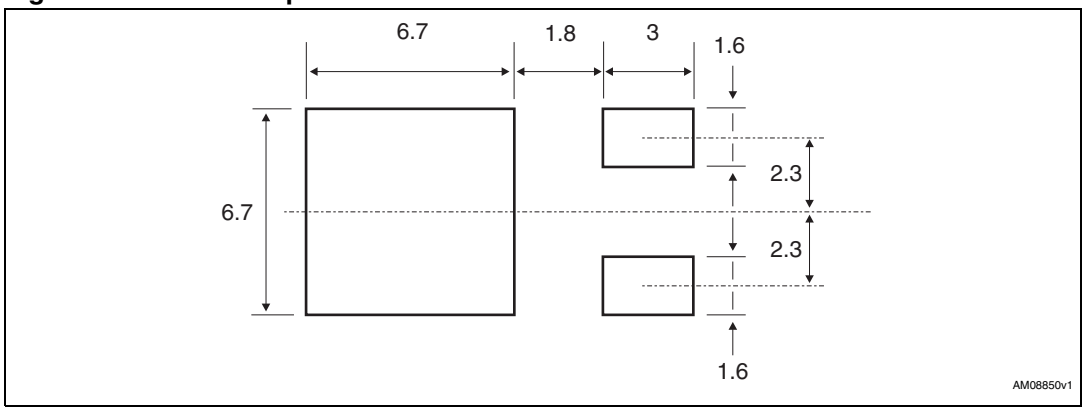


Figure 23. DPAK footprint[a]



a. All dimension are in millimeters

Table 9. 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 24. IPAK (TO-251) drawing

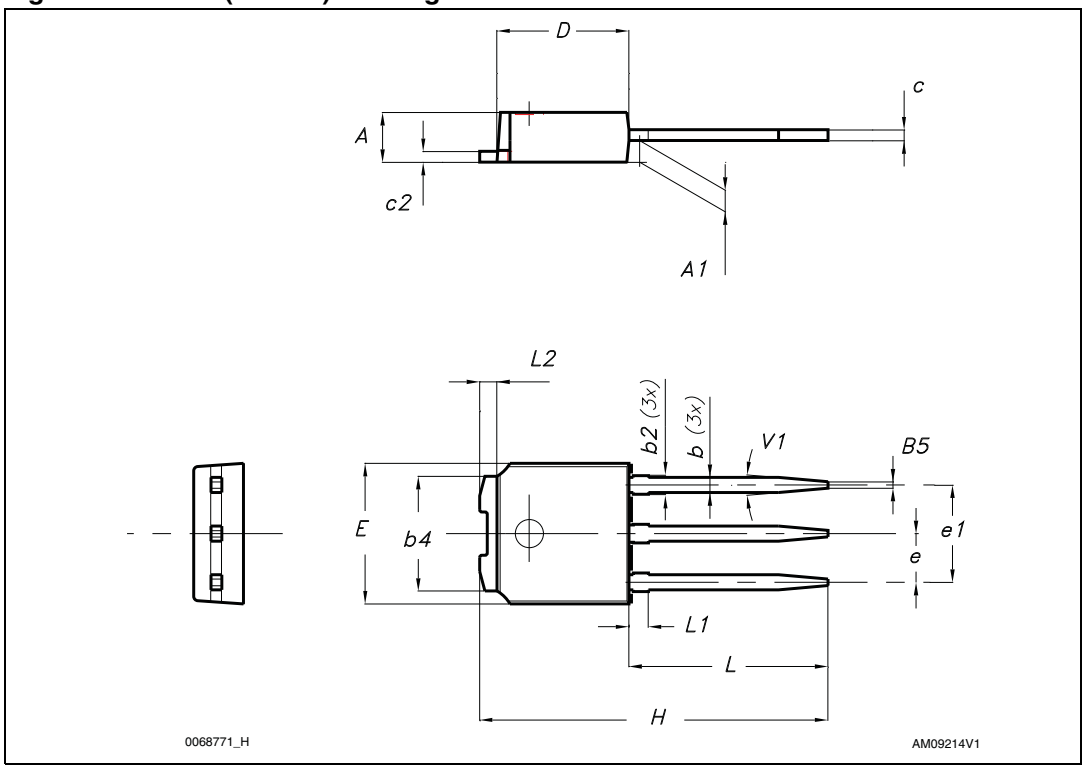
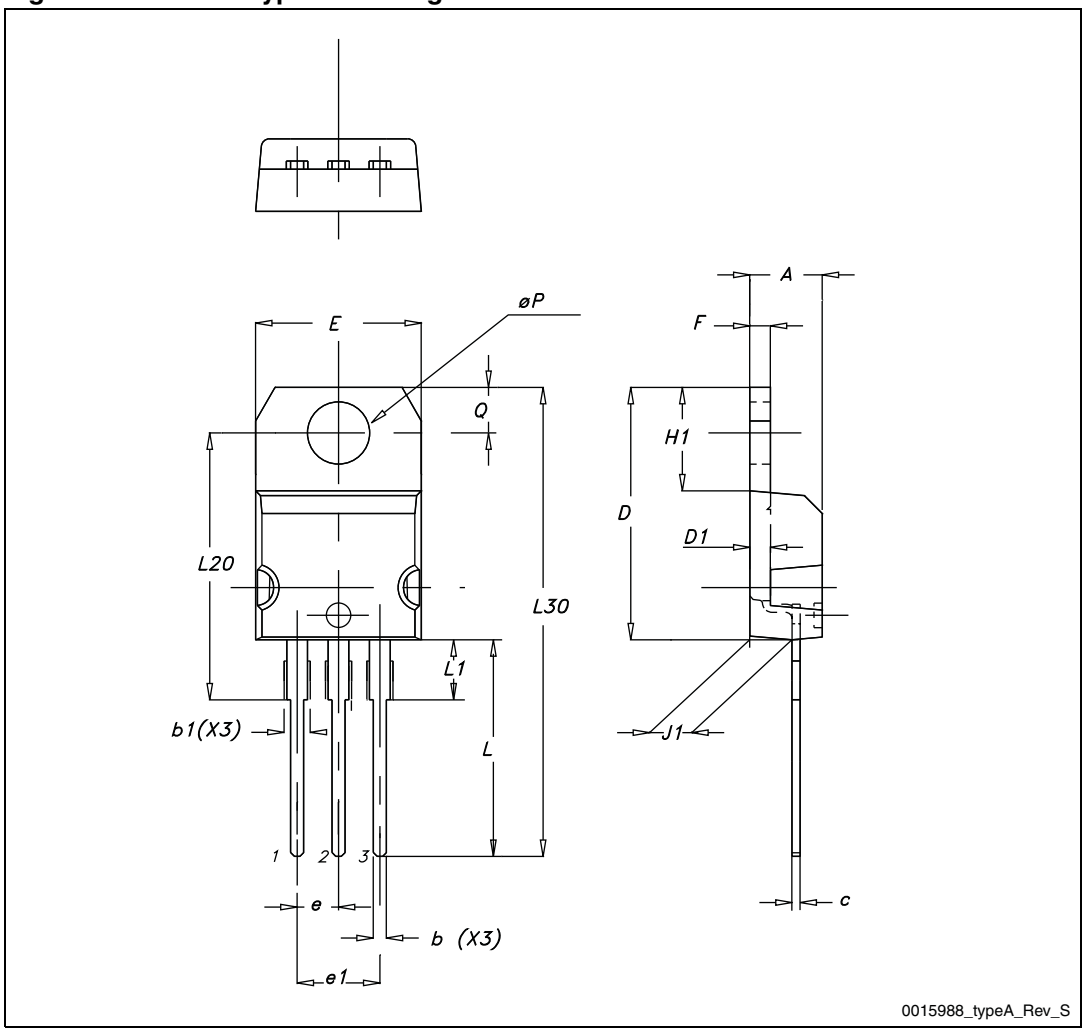


Table 10. TO-220 type A mechanical data

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 25. TO-220 type A drawing



5 Packaging mechanical data

Table 11. 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 26. Tape for DPAK (TO-252)

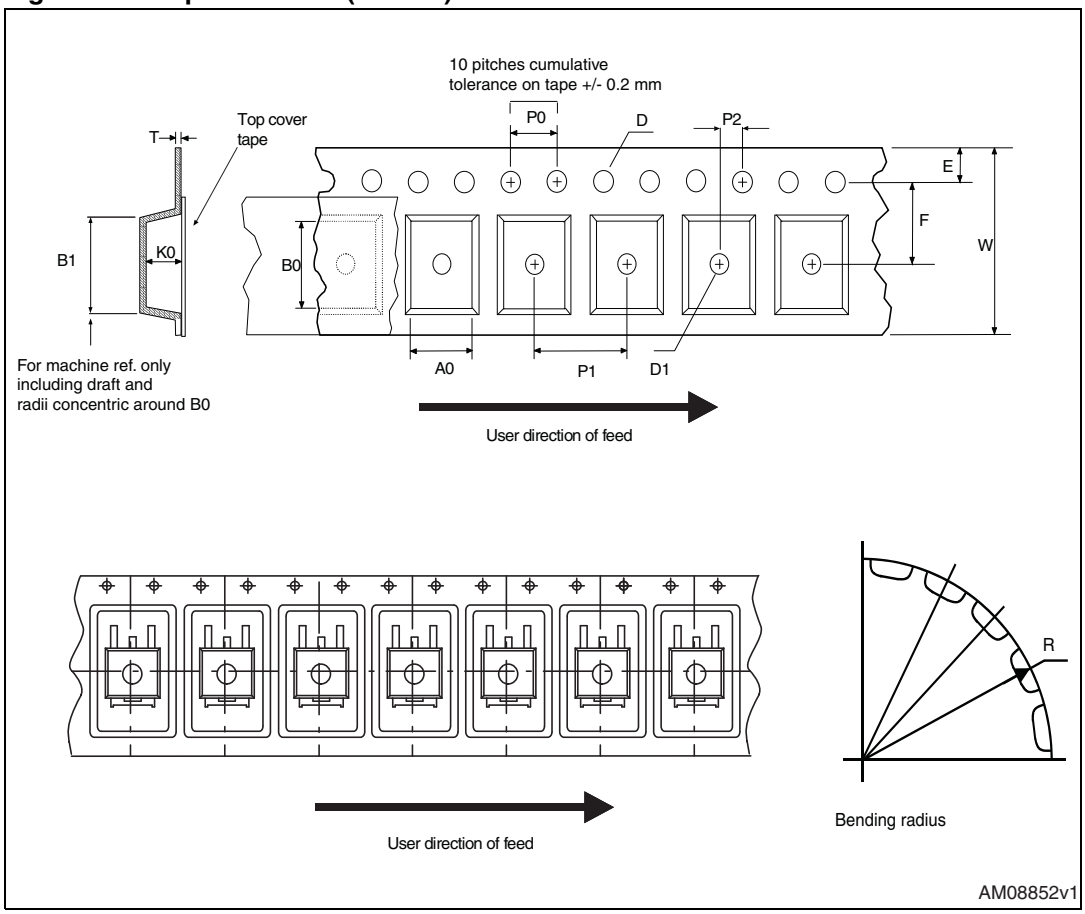
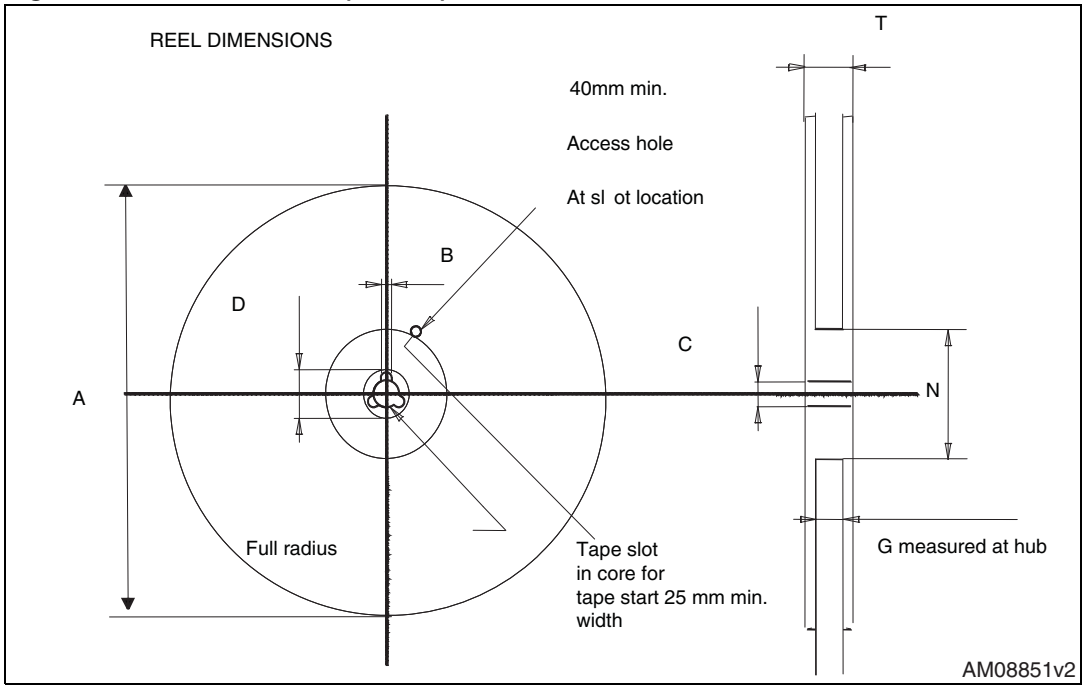


Figure 27. Reel for DPAK (TO-252)



6 Revision history

Table 12. Document revision history

Date	Revision	Changes
06-May-2009	1	First release
25-May-2009	2	Updated test condition for Q_g in *Table 5: Dynamic*
07-Mar-2011	3	$V_{GS(th)}$ max. value has been inserted in *Table 4: Static*

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