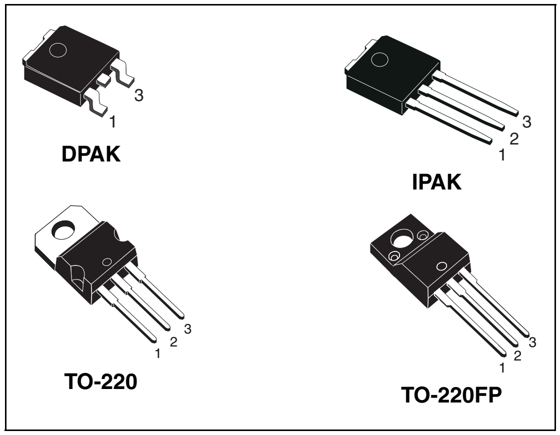
STD2N62K3, STF2N62K3
STP2N62K3, STU2N62K3

N-channel 620 V, 3 Ω, 2.2 A, DPAK, IPAK, TO-220, TO-220FP
SuperMESH3™ Power MOSFET

Features

Type	V_{DSS}	$R_{DS(on)}$ max	I_D	Pw
STD2N62K3	620 V	< 3.6 Ω	2.2 A	45 W
STF2N62K3				20 W
STP2N62K3				45 W
STU2N62K3				

- 100% avalanche tested
- Extremely high dv/dt capability
- Gate charge minimized
- Very low intrinsic capacitance
- Improved diode reverse recovery characteristics
- Zener-protected



Application

Switching applications

Description

These devices are made using the SuperMESH3™ Power MOSFET technology that is obtained via improvements applied to STMicroelectronics' SuperMESH™ technology combined with a new optimized vertical structure. The resulting product has an extremely low on resistance, superior dynamic performance and high avalanche capability, making it especially suitable for the most demanding applications.

Figure 1. Internal schematic diagram

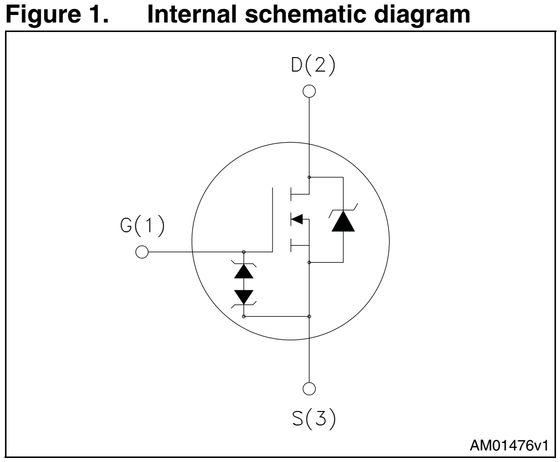


Table 1. Device summary

Order codes	Marking	Package	Packaging
STD2N62K3	2N62K3	DPAK	Tape and reel
STF2N62K3	2N62K3	TO-220FP	Tube
STP2N62K3	2N62K3	T0-220	
STU2N62K3	2N62K3	IPAK	

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		DPAK, IPAK, TO-220	TO-220FP	
V_{DS}	Drain-source voltage (V_{GS} = 0)	620		V
V_{GS}	Gate- source voltage	± 30		V
I_D	Drain current (continuous) at T_C = 25 °C	2.2	2.2 (1)	A
I_D	Drain current (continuous) at T_C = 100 °C	1	1 (1)	A
I_{DM} (2)	Drain current (pulsed)	8.8	8.8 (1)	A
P_{TOT}	Total dissipation at T_C = 25 °C	45	20	W
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max)	2.2		A
E_{AS}	Single pulse avalanche energy (starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	85		mJ
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1 s;Tc=25 °C)		2500	V
dv/dt (3)	Peak diode recovery voltage slope	12		V/ns
T_{stg}	Storage temperature	-55 to 150		°C
T_j	Max. operating junction temperature	150		°C

1. Limited only by maximum temperature allowed
2. Pulse width limited by safe operating area
3. I_{SD} ≤ 2.2 A, di/dt ≤ 400 A/µs,V_{DS} peak ≤$V_{(BR)DSS}$, V_{DD} = 80% $V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	Value				Unit
		DPAK	IPAK	TO-220	TO-220FP	
$R_{thj-case}$	Thermal resistance junction-case max	2.78			6.25	°C/W
$R_{thj-pcb}$	Thermal resistance junction-pcb max	50				°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient max		100	62.5		°C/W
T_l	Maximum lead temperature for soldering purpose		300			°C

2 Electrical characteristics

(T_C = 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	I_D = 1 mA, V_{GS} = 0	620			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max rating V_{DS} = Max rating, T_C=125 °C			1 50	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 20 V			± 10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 50 µA	3	3.75	4.5	V
$R_{DS(on}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 1.1 A		3	3.6	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} = 50 V, f = 1 MHz, V_{GS} = 0	-	340 26 4	-	pF pF pF
$C_{o(tr)}$(1)	Equivalent capacitance time related	V_{DS} = 0 to 496 V, V_{GS} = 0	-	17	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz open drain	-	5	-	Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 496 V, I_D = 1.1 A, V_{GS} = 10 V (see *Figure 20*)	-	15 3 9	-	nC nC nC

1. Time related is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

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} = 310 V, I_D = 1.1 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 19*)	-	8 4.4 21 22	-	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)		-		2.2 8.8	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 2.2 A, V_{GS} = 0	-		1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 2.2 A, di/dt = 100 A/µs V_{DD} = 60 V (see *Figure 24*)	-	200 900 9		ns nC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 2.2 A, di/dt = 100 A/µs V_{DD} = 60 V, T_j = 150 °C (see *Figure 24*)	-	240 1150 10		ns nC A

1. Pulse width limited by safe operating area
2. Pulsed: Pulse duration = 300 µs, duty cycle 1.5%

Table 8. Gate-source Zener diode

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
BV_{GSO}	Gate-source breakdown voltage	Igs=± 1 mA (open drain)	30			V

The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components.

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for DPAK and IPAK

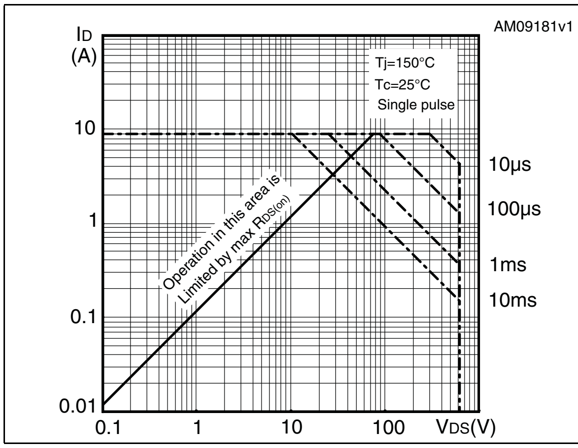


Figure 3. Thermal impedance for DPAK and IPAK

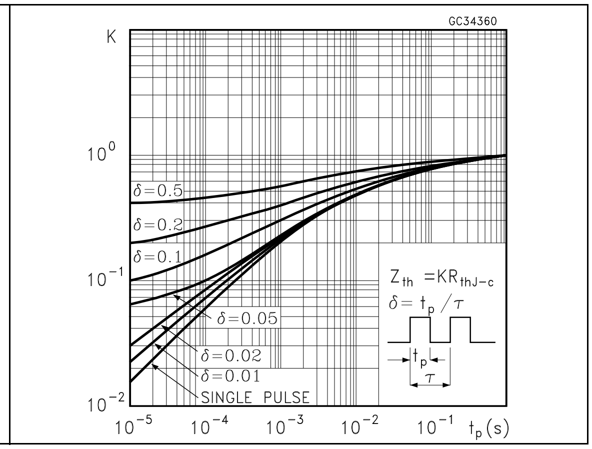


Figure 4. Safe operating area for TO-220FP

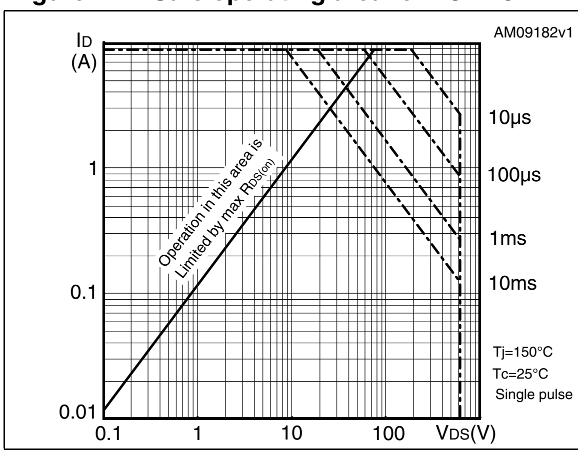


Figure 5. Thermal impedance for TO-220FP

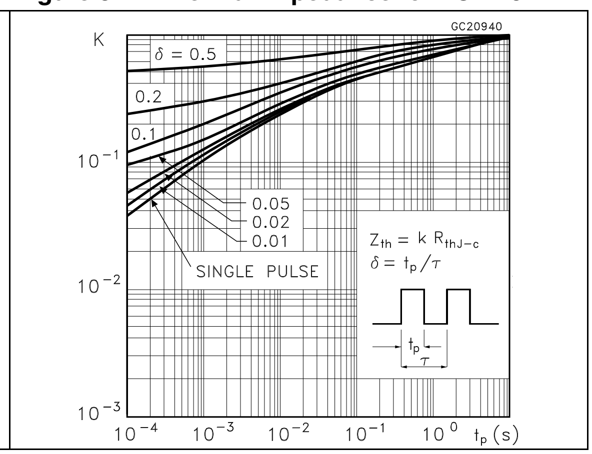


Figure 6. Safe operating area for TO-220

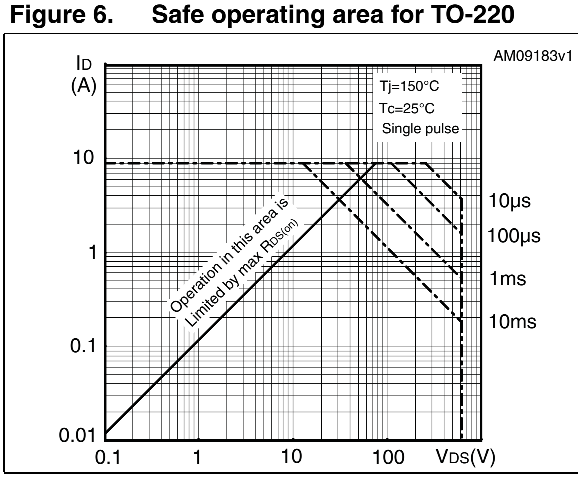


Figure 7. Thermal impedance for TO-220

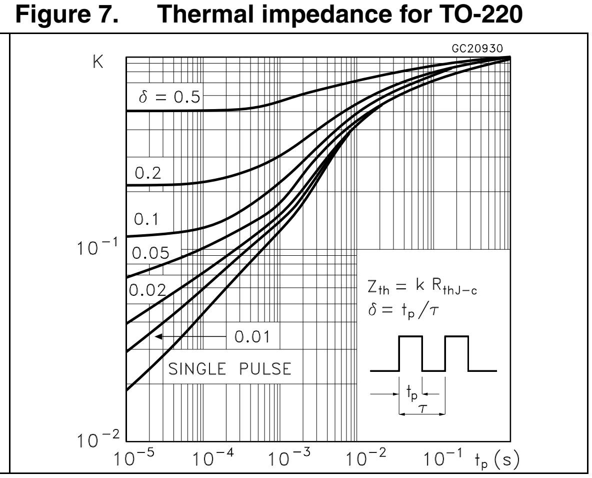


Figure 8. Output characteristics

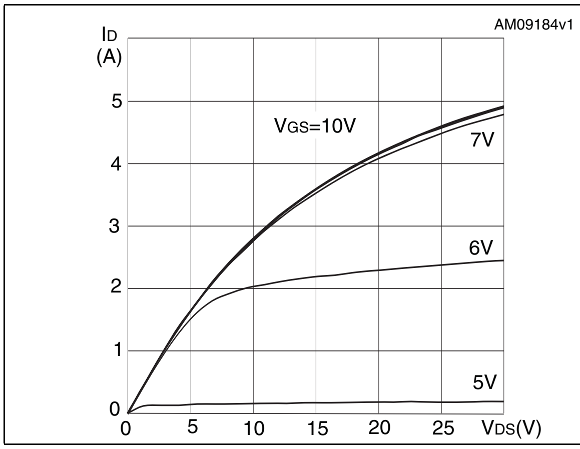


Figure 9. Transfer characteristics

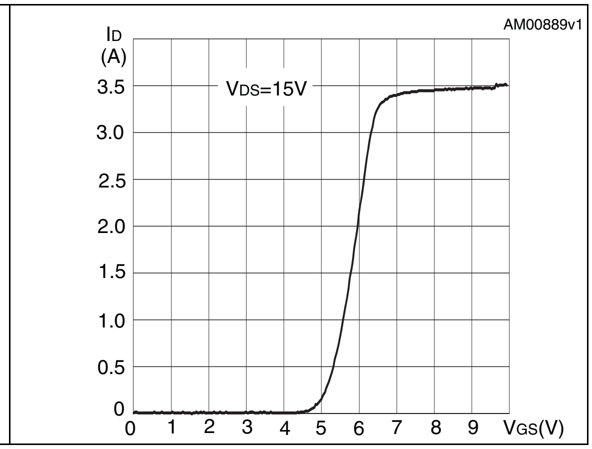


Figure 10. Gate charge vs gate-source voltage

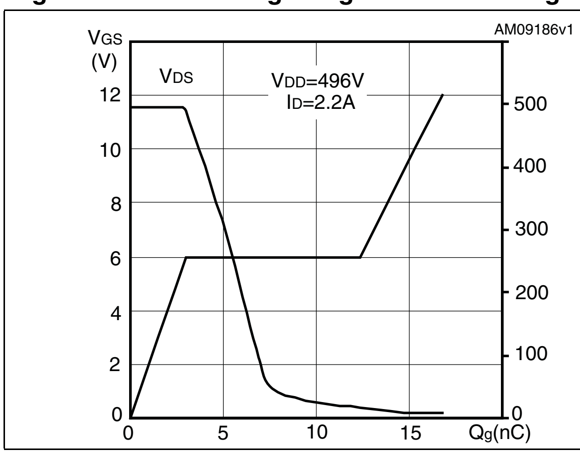


Figure 11. Static drain-source on resistance

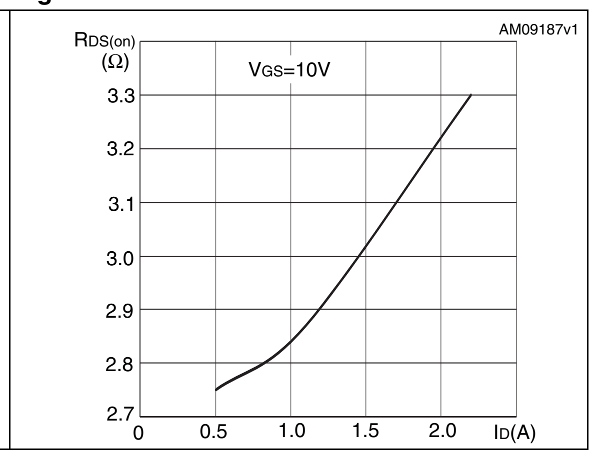


Figure 12. Capacitance variations

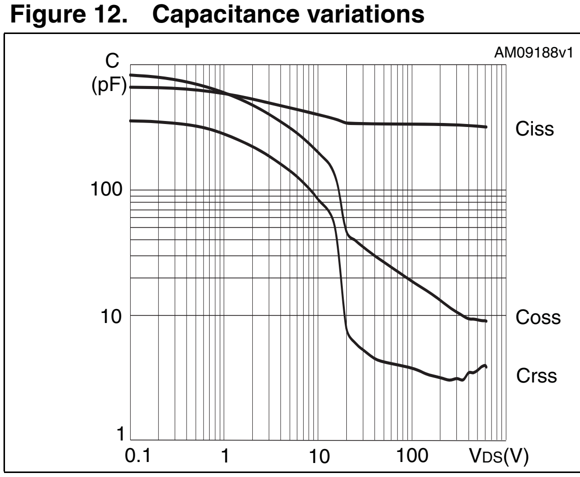


Figure 13. Output capacitance stored energy

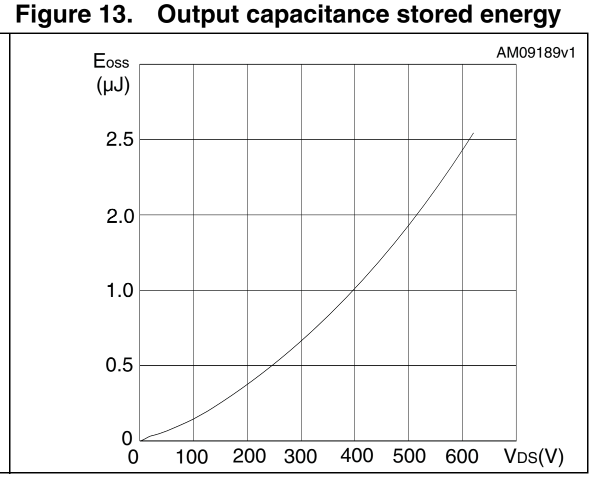


Figure 14. Normalized gate threshold voltage vs temperature

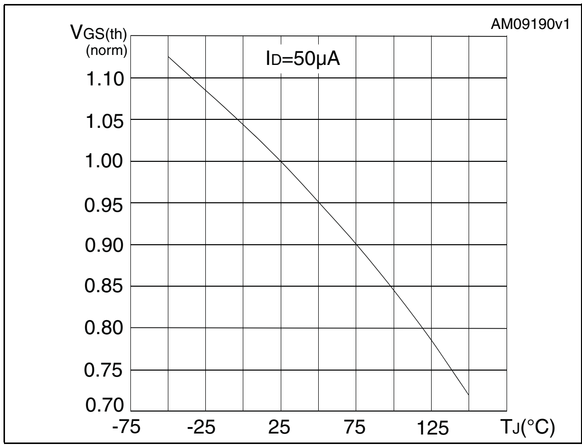


Figure 15. Normalized on resistance vs temperature

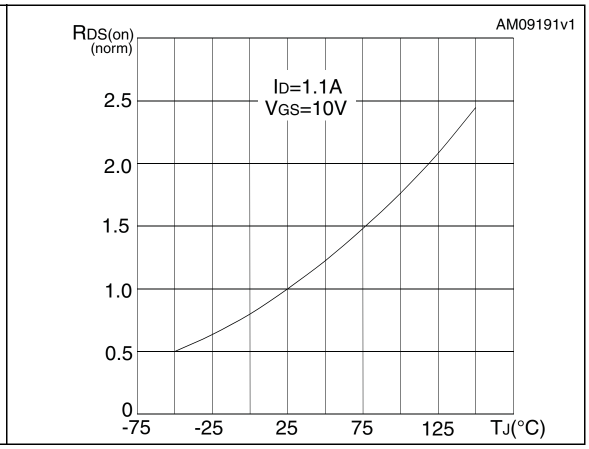


Figure 16. Source-drain diode forward characteristics

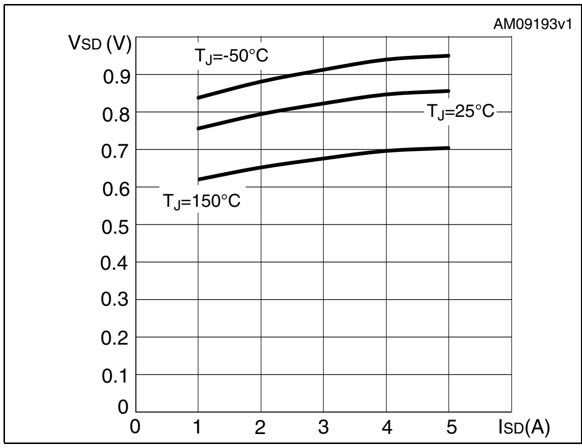


Figure 17. Normalized B_{VDSS} vs temperature

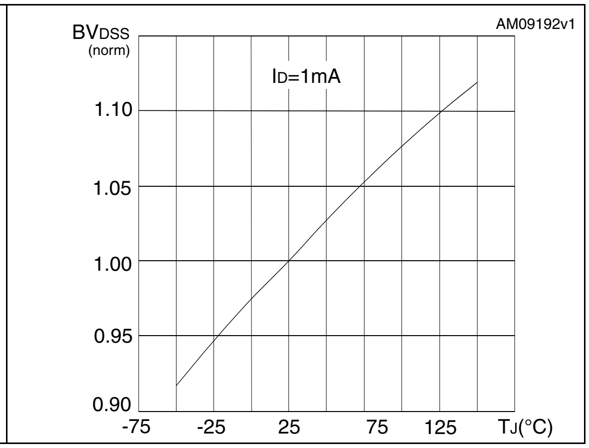
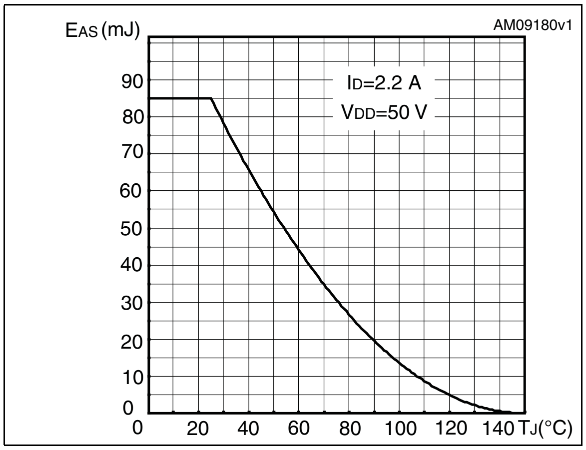


Figure 18. Maximum avalanche energy vs starting Tj



3 Test circuits

Figure 19. Switching times test circuit for resistive load

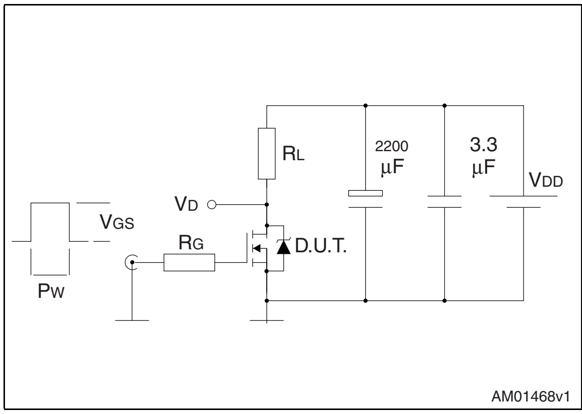


Figure 20. Gate charge test circuit

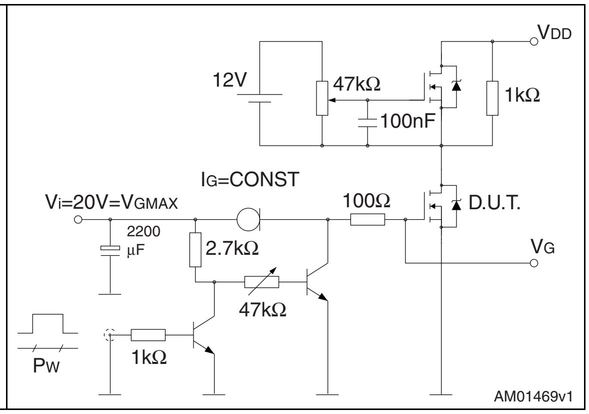


Figure 21. Test circuit for inductive load switching and diode recovery times

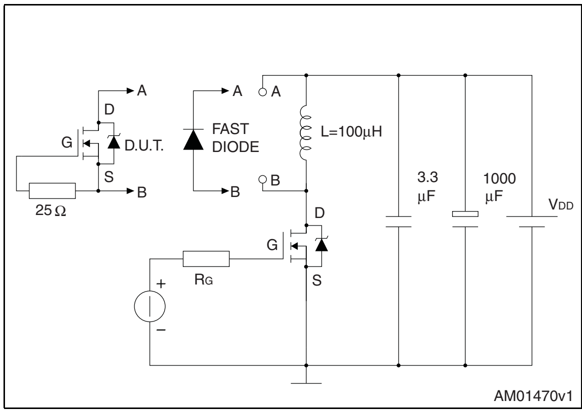


Figure 22. Unclamped Inductive load test circuit

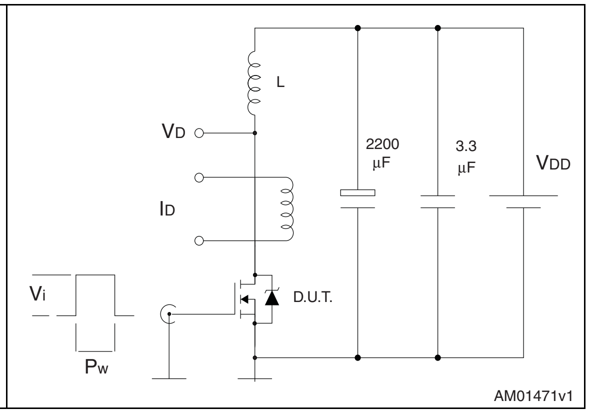


Figure 23. Unclamped inductive waveform

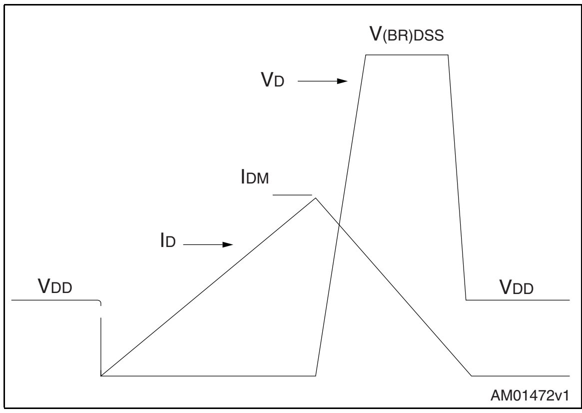
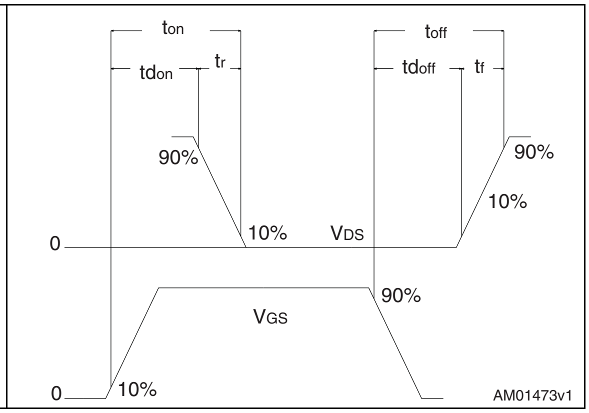


Figure 24. Switching time waveform



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 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 25. TO-220FP drawing

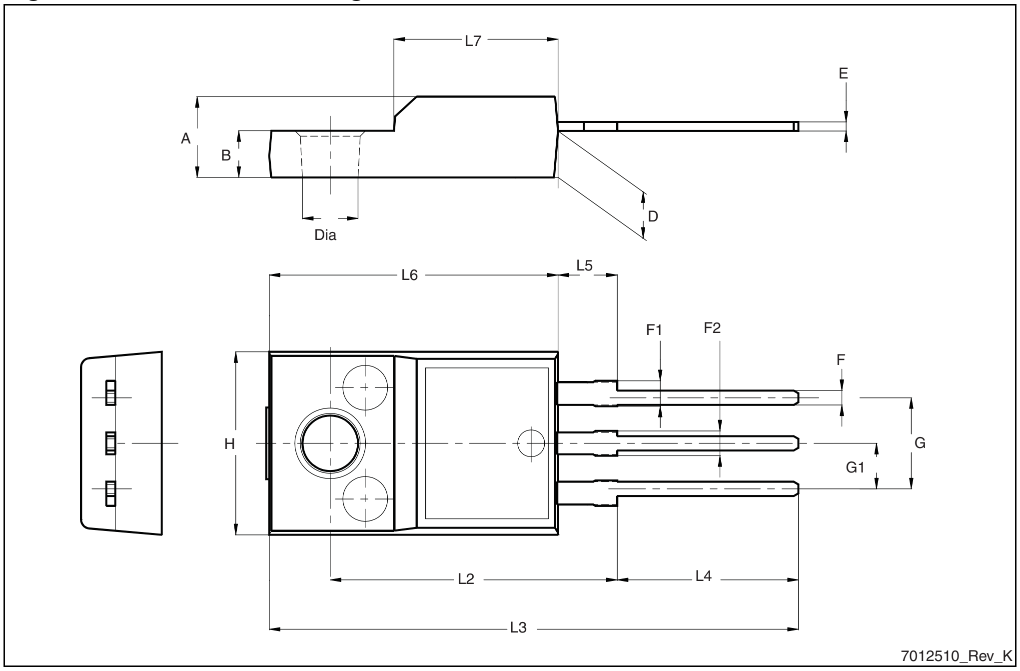
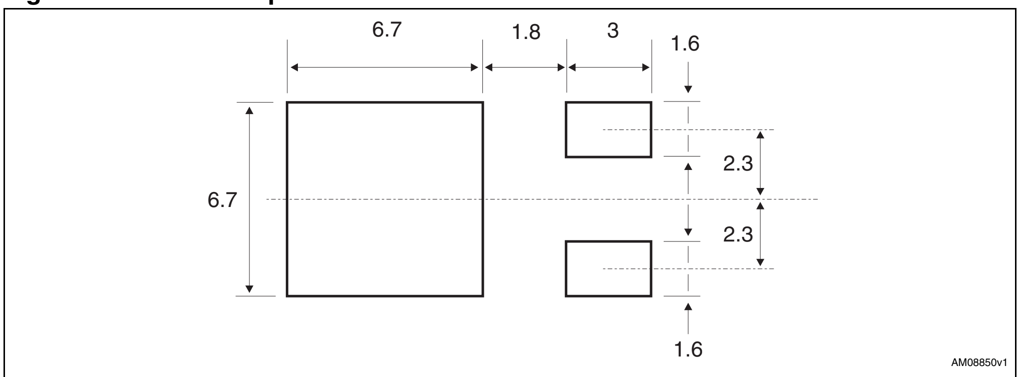


Table 10. DPAK (TO-252) mechanical data

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 26. DPAK footprint[a]



a. All dimension are in millimeters

Figure 27. DPAK (TO-252) drawing

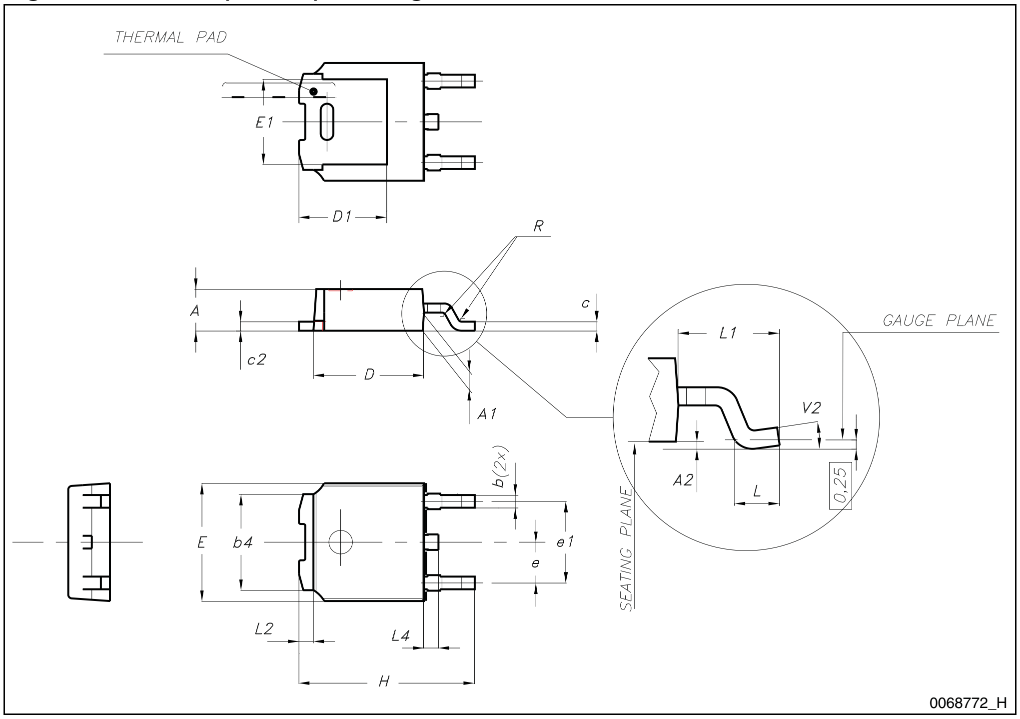


Table 11. IPAK (TO-251) mechanical data

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 28. IPAK (TO-251) drawing

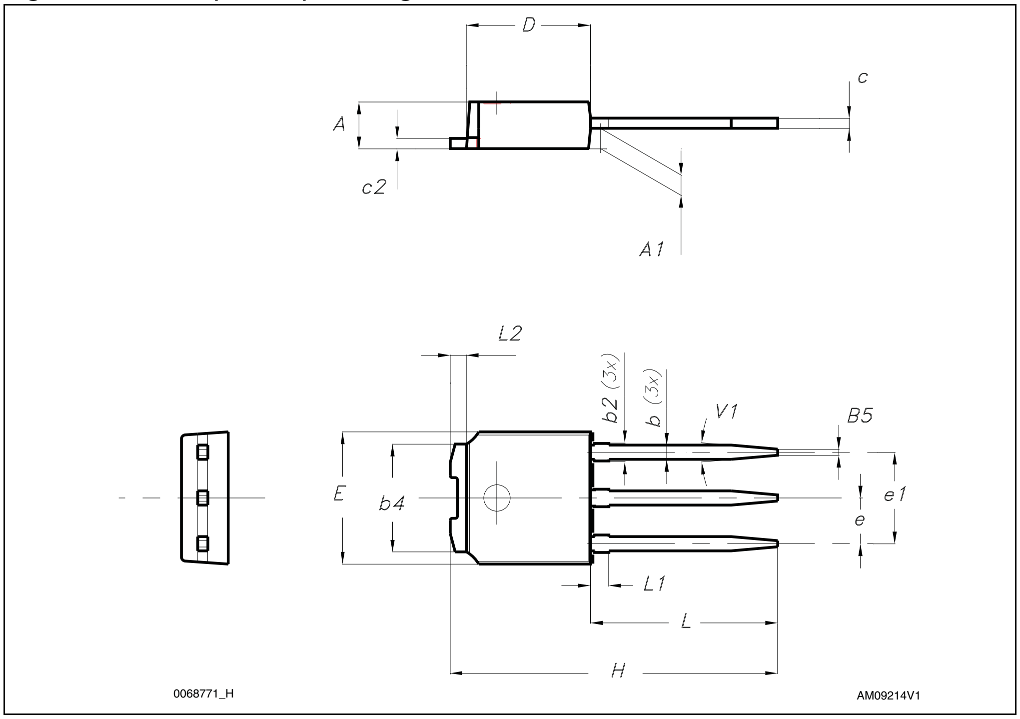
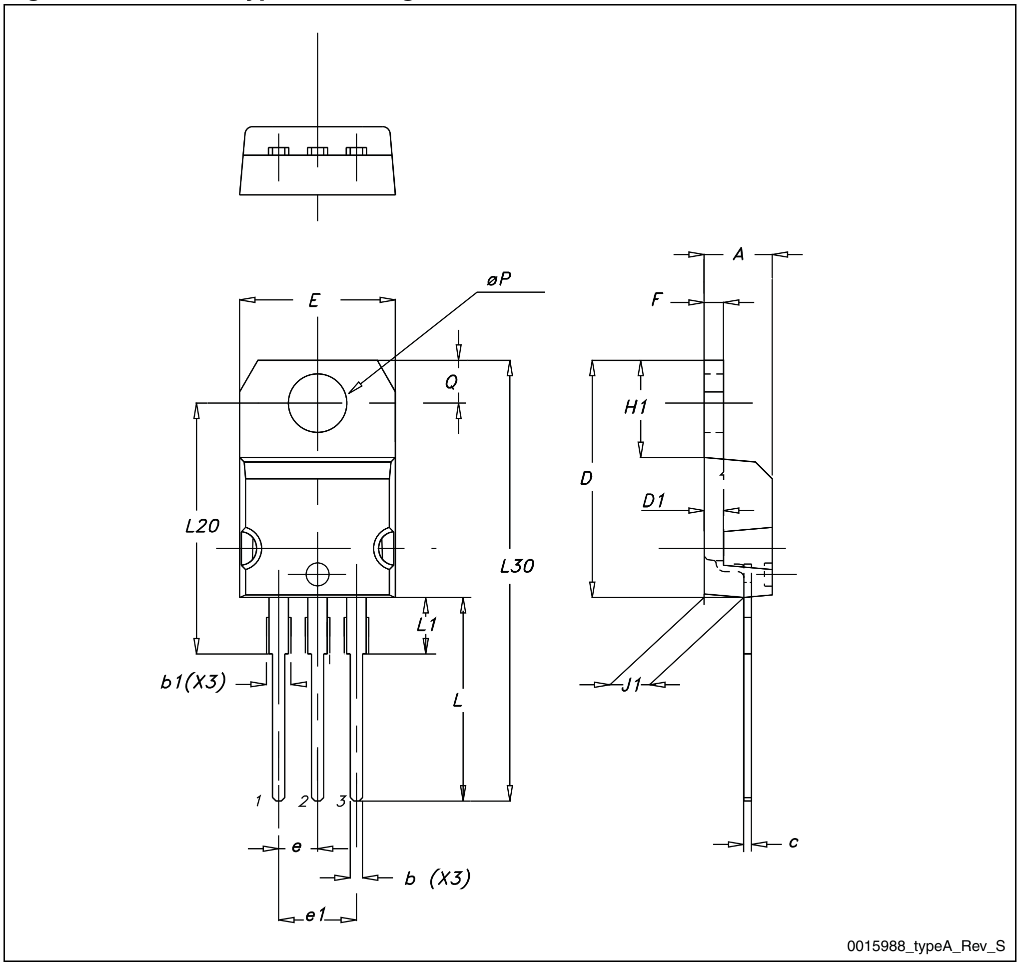


Table 12. TO-220 type A mechanical data

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 29. TO-220 type A drawing



5 Packaging mechanical data

Table 13. 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 30. Tape for DPAK (TO-252)

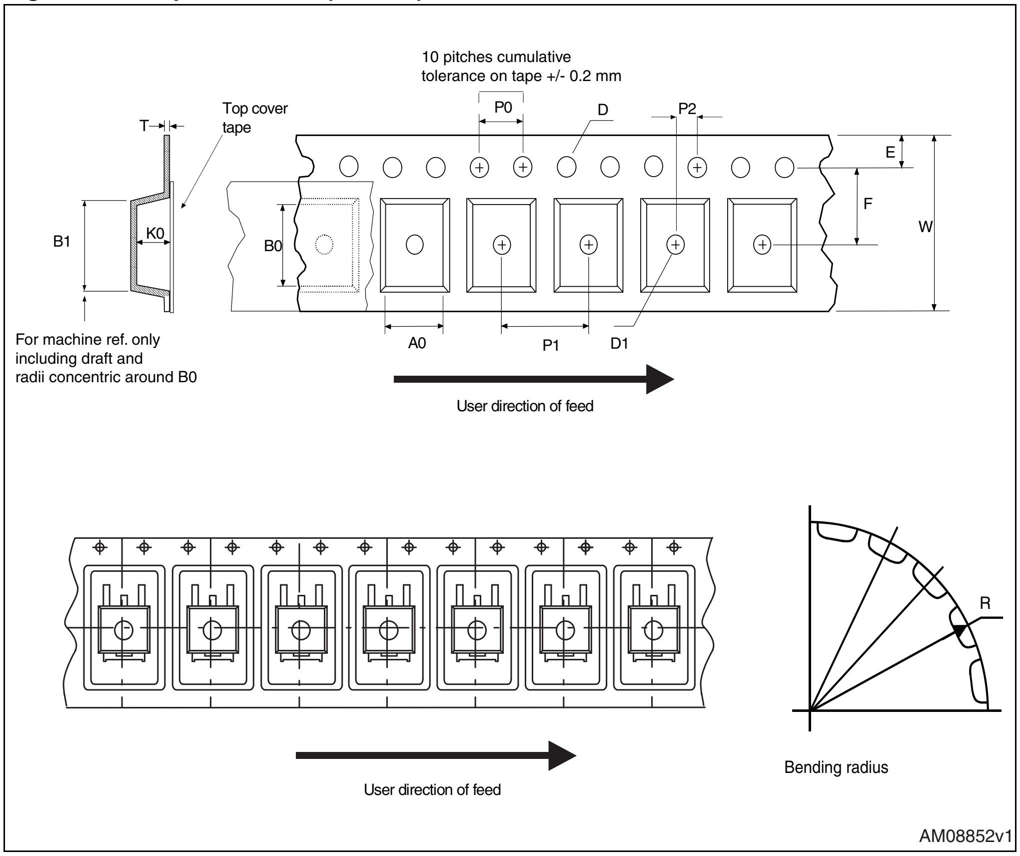
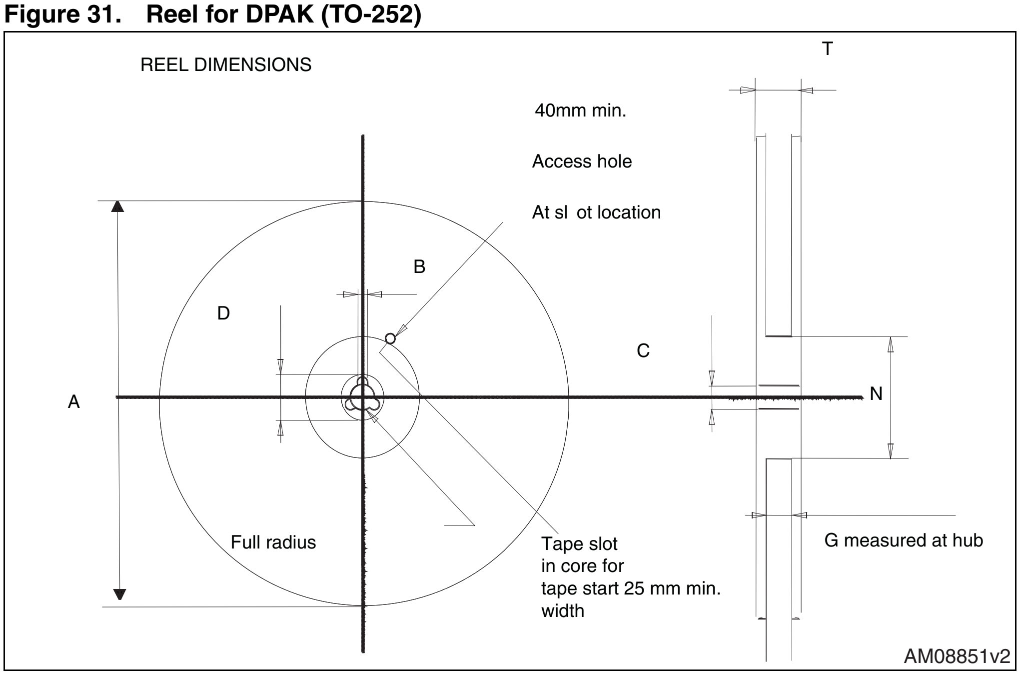


Figure 31. Reel for DPAK (TO-252)



6 Revision history

Table 14. Document revision history

Date	Revision	Changes
31-May-2011	1	First release

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