



STF10N62K3, STFI10N62K3, STI10N62K3, STP10N62K3

N-channel 620 V, 0.68 Ω typ., 8.4 A SuperMESH3™
Power MOSFET in TO-220FP, I²PAKFP, I²PAK, TO-220 packages

Datasheet – production data

Features

Type	V _{DSS}	R _{DS(on) max}	I _D	P _w
STF10N62K3	620 V	< 0.75 Ω	8.4 A ⁽¹⁾	30 W
STFI10N62K3				
STI10N62K3			8.4 A	125 W
STP10N62K3				

1. Limited by package

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

Applications

- Switching applications

Description

These SuperMESH3™ Power MOSFETs are the result of improvements applied to STMicroelectronics' SuperMESH™ technology, combined with a new optimized vertical structure. These devices boast an extremely low on-resistance, superior dynamic performance and high avalanche capability, rendering them suitable for the most demanding applications.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STF10N62K3	10N62K3	TO-220FP	Tube
STFI10N62K3	10N62K3	I ² PAKFP	
STI10N62K3	10N62K3	I ² PAK	
STP10N62K3	10N62K3	TO-220	

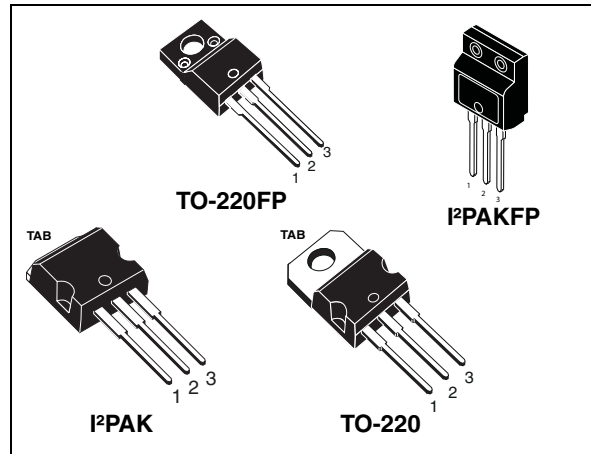
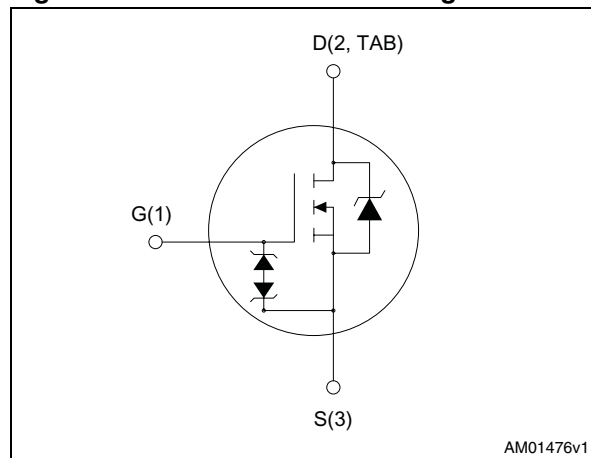


Figure 1. Internal schematic diagram



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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220FP I ² PAKFP	I ² PAK TO-220	
V _{DS}	Drain source voltage	620		V
V _{GS}	Gate-source voltage	± 30		V
I _D	Drain current (continuous) at T _C = 25 °C	8.4 ⁽¹⁾	8.4	A
I _D	Drain current (continuous) at T _C = 100 °C	5.2 ⁽¹⁾	5.2	A
I _{DM} ⁽²⁾	Drain current (pulsed)	33.6 ⁽¹⁾	33.6	A
P _{TOT}	Total dissipation at T _C = 25 °C	30	125	W
I _{AR}	Max current during repetitive or single pulse avalanche (pulse width limited by T _{JMAX})	8		A
E _{AS}	Single pulse avalanche energy ⁽³⁾	220		mJ
dv/dt ⁽⁴⁾	Peak diode recovery voltage slope	12		V/ns
ESD	Gate-source human body model (R = 1.5 kΩ, C = 100 pF)	2.5		kV
V _{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1 s; T _C =25 °C)	2500		V
T _j T _{stg}	Operating junction temperature Storage temperature	-55 to 150		°C

1. Limited by maximum junction temperature

2. Pulse width limited by safe operating area

3. Starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V

4. I_{SD} ≤ 8.4 A, di/dt = 400 A/μs, V_{DD} = 80% V_{(BR)DSS}, V_{DS peak} ≤ V_{(BR)DSS}

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		TO-220FP I ² PAKFP	I ² PAK TO-220	
R _{thj-case}	Thermal resistance junction-case max	4.17	1.00	°C/W
R _{thj-amb}	Thermal resistance junction-ambient max	62.5		°C/W

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	I _D = 1 mA, V _{GS} = 0	620			V
I _{DSS}	Zero gate voltage drain current (V _{GS} = 0)	V _{DS} = 620 V V _{DS} = 620 V, 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 = 100 μA	3	3.75	4.5	V
R _{DS(on)}	Static drain-source on resistance	V _{GS} = 10 V, I _D = 4 A		0.68	0.75	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g _{fs} ⁽¹⁾	Forward transconductance	V _{DS} = 15 V, I _D = 4 A	-	6	-	S
C _{iss} C _{oss} C _{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V _{DS} = 50 V, f = 1 MHz, V _{GS} = 0	-	1250 138 16	-	pF pF pF
C _{o(tr)} ⁽²⁾	Equivalent capacitance time related	V _{DS} = 0 to 496 V, V _{GS} = 0	-	56	-	pF
C _{o(er)} ⁽³⁾	Equivalent capacitance energy related	V _{DS} = 0 to 496 V, V _{GS} = 0	-	38	-	pF
R _G	Gate input resistance	f = 1 MHz Gate DC Bias = 0 Test signal level = 20 mV open drain	-	3.5	-	Ω
Q _g Q _{gs} Q _{gd}	Total gate charge Gate-source charge Gate-drain charge	V _{DD} = 496 V, I _D = 8 A, V _{GS} = 10 V (see Figure 18)	-	42 7.4 23	-	nC nC nC

1. Pulsed: pulse duration = 300 μs, duty cycle 1.5%
2. C_{oss eq} 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}
3. C_{oss eq} energy related is defined as a constant equivalent capacitance giving the same stored energy 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
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 310\text{ V}$, $I_D = 4\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 17)	-	14.5	-	ns
t_r	Rise time			15		ns
$t_{d(off)}$	Turn-off-delay time			41		ns
t_f	Fall time			31		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		8.4	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				33.6	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 8\text{ A}$, $V_{GS} = 0$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 8\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$ (see Figure 22)	-	320		ns
Q_{rr}	Reverse recovery charge			2		μC
I_{RRM}	Reverse recovery current			13		A
t_{rr}	Reverse recovery time	$I_{SD} = 8\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 22)	-	410		ns
Q_{rr}	Reverse recovery charge			2.9		μC
I_{RRM}	Reverse recovery current			14		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
$V_{(BR)GSO}$	Gate-source breakdown voltage ($I_D = 0$)	$I_{GS} = \pm 1\text{ mA}$	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 TO-220FP, I²PAKFP

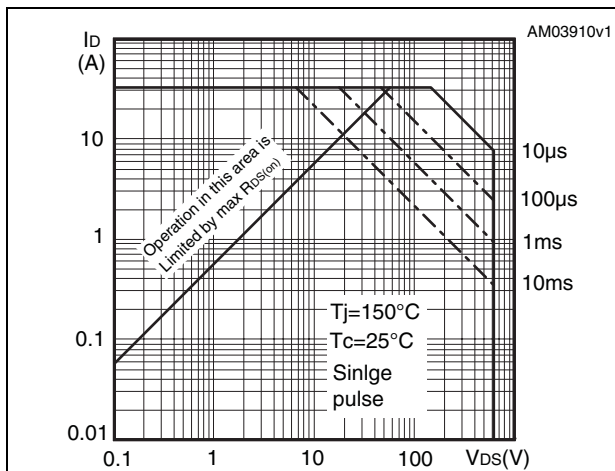


Figure 3. Thermal impedance for TO-220FP, I²PAKFP

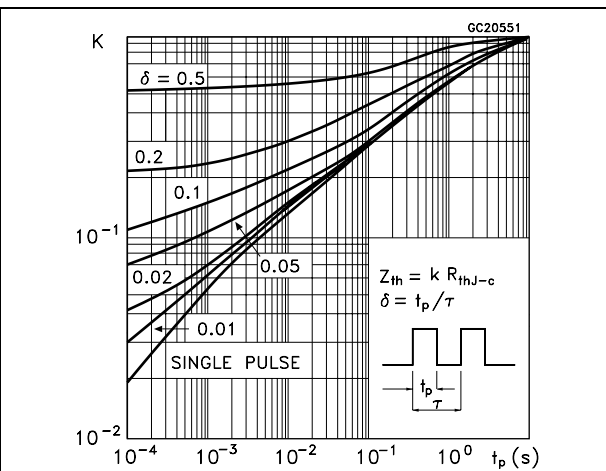


Figure 4. Safe operating area for I²PAK, TO-220

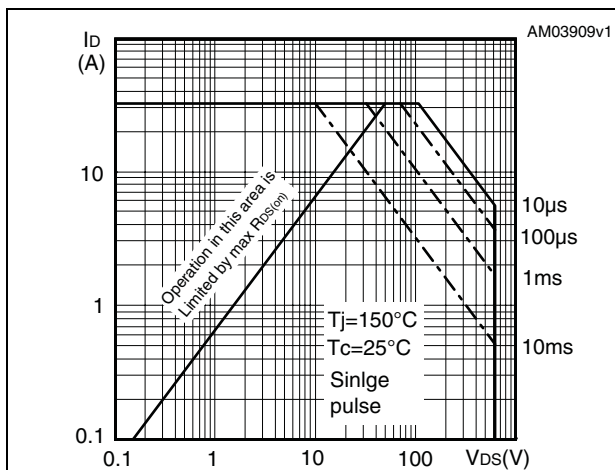


Figure 5. Thermal impedance for I²PAK, TO-220

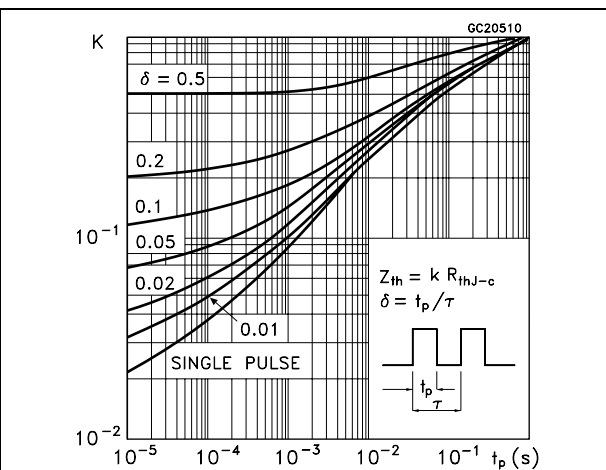


Figure 6. Output characteristics

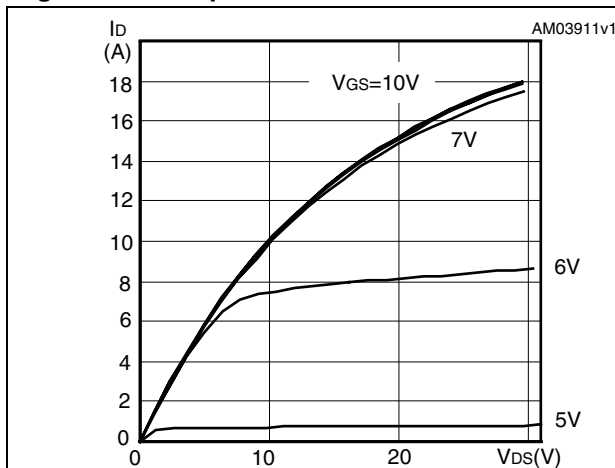


Figure 7. Transfer characteristics

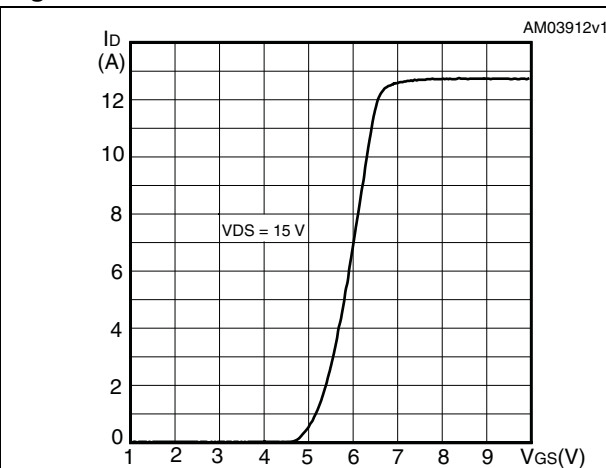


Figure 8. Normalized BV_{DSS} vs temperature

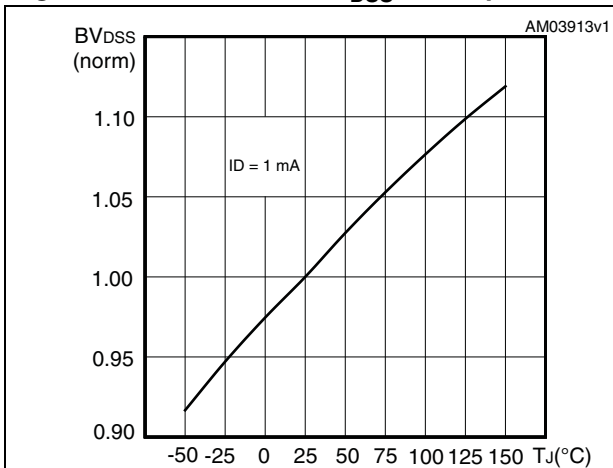


Figure 9. Static drain-source on-resistance

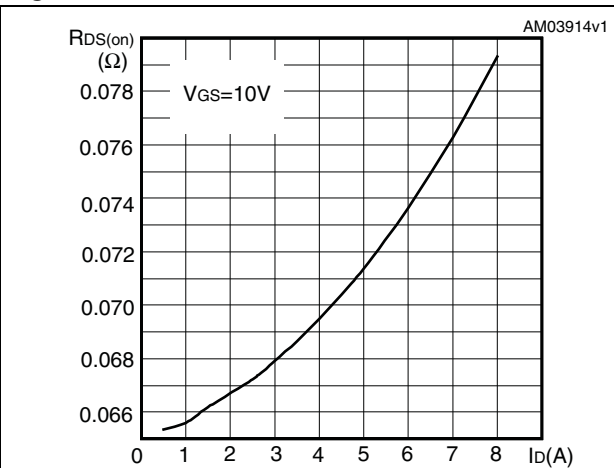


Figure 10. Output capacitance stored energy

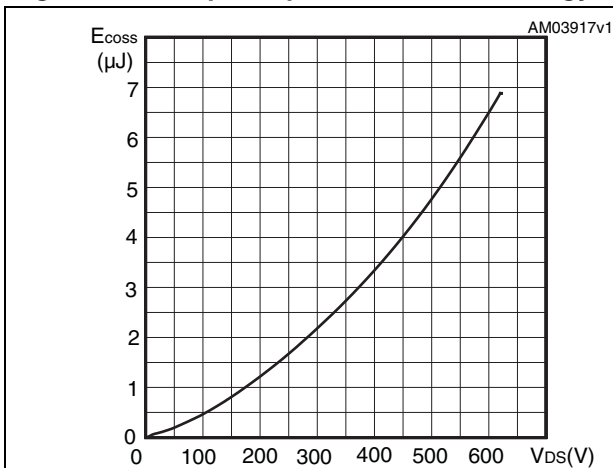


Figure 11. Capacitance variations

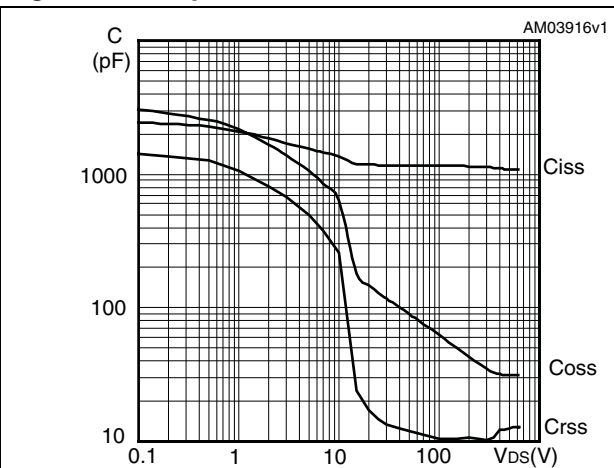


Figure 12. Gate charge vs gate-source voltage

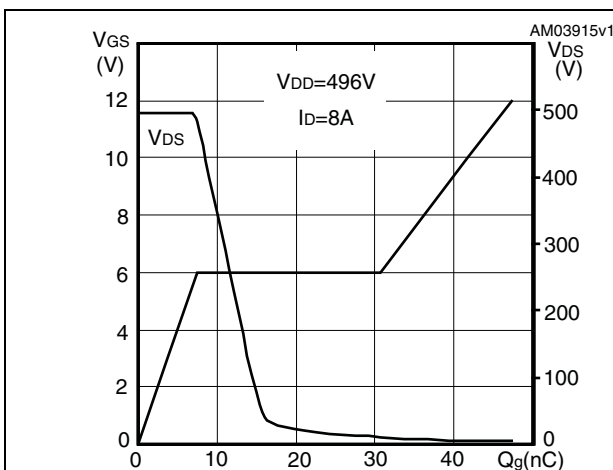


Figure 13. Normalized on-resistance vs temperature

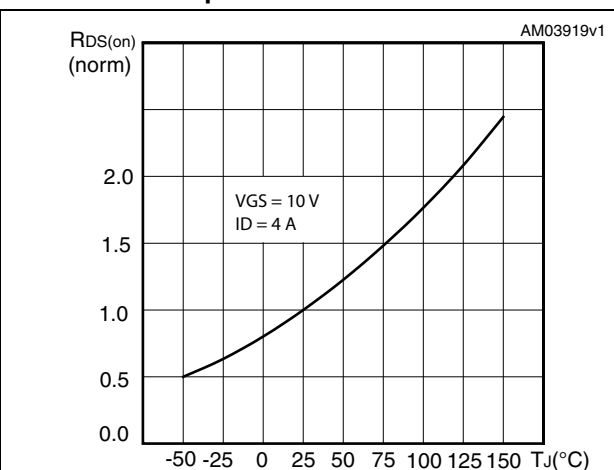


Figure 14. Normalized gate threshold voltage vs temperature

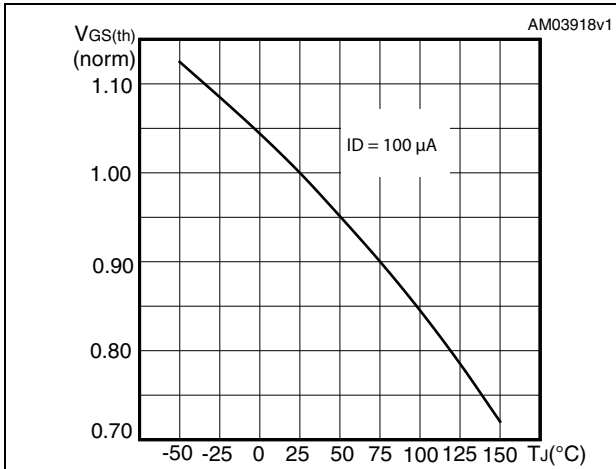


Figure 15. Maximum avalanche energy vs temperature

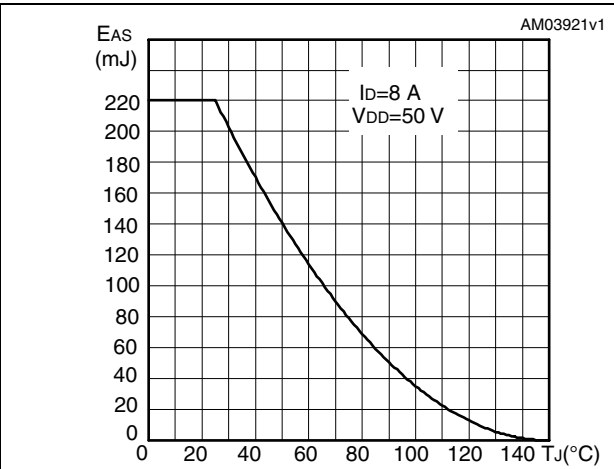
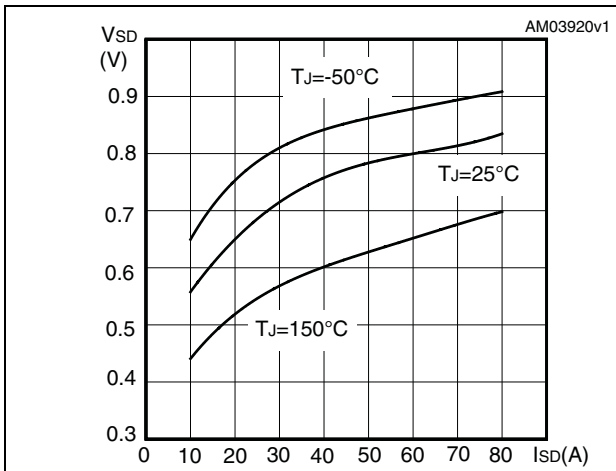
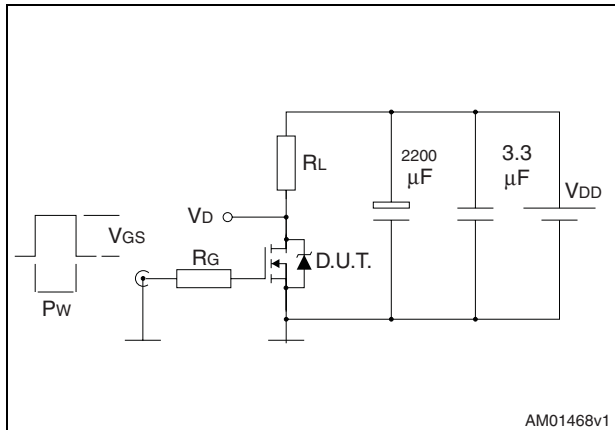


Figure 16. Source-drain diode forward characteristics



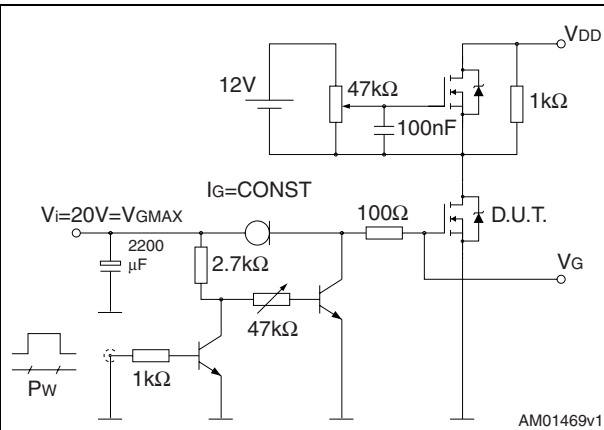
3 Test circuits

Figure 17. Switching times test circuit for resistive load



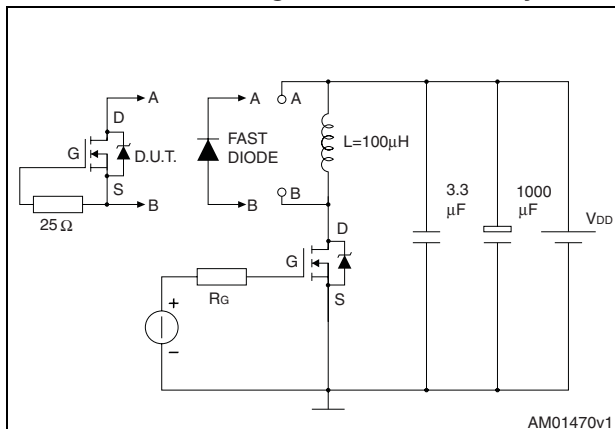
AM01468v1

Figure 18. Gate charge test circuit



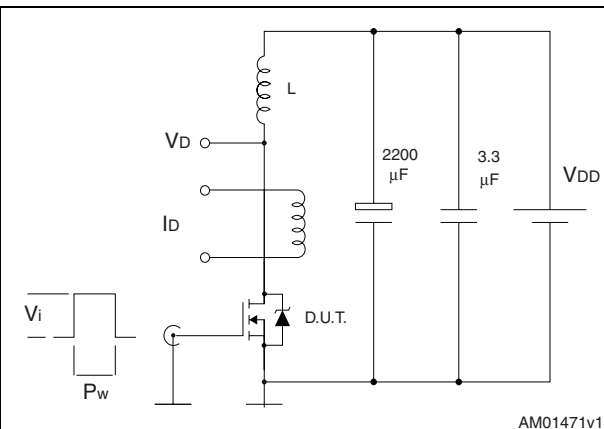
AM01469v1

Figure 19. Test circuit for inductive load switching and diode recovery times



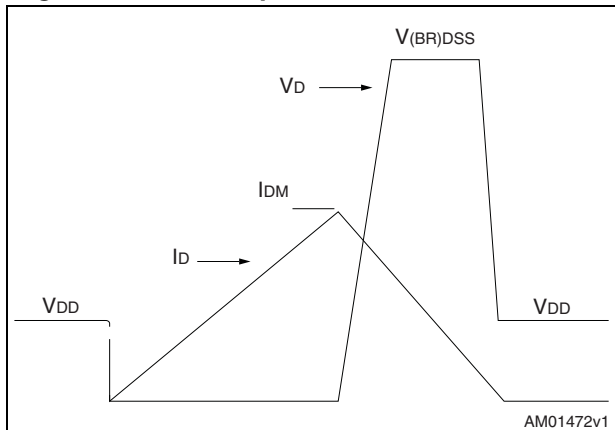
AM01470v1

Figure 20. Unclamped inductive load test circuit



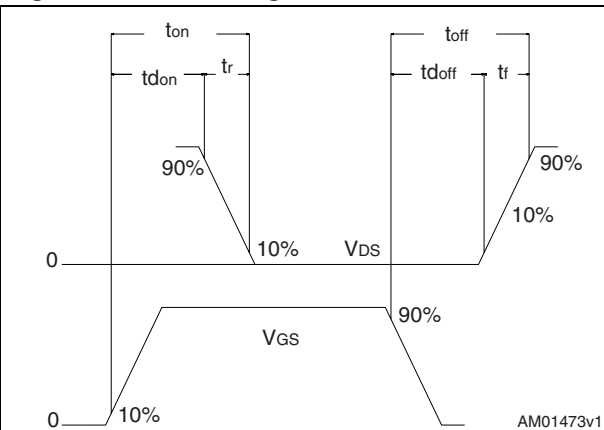
AM01471v1

Figure 21. Unclamped inductive waveform



AM01472v1

Figure 22. Switching time waveform



AM01473v1

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

Table 10. I²PAKFP (TO-281) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
B	2.50		2.70
D	2.50		2.75
D1	0.65		0.85
E	0.45		0.70
F	0.75		1.00
F1			1.20
G	4.95	-	5.20
H	10.00		10.40
L1	21.00		23.00
L2	13.20		14.10
L3	10.55		10.85
L4	2.70		3.20
L5	0.85		1.25
L6	7.30		7.50

Figure 24. I²PAKFP (TO-281) drawing

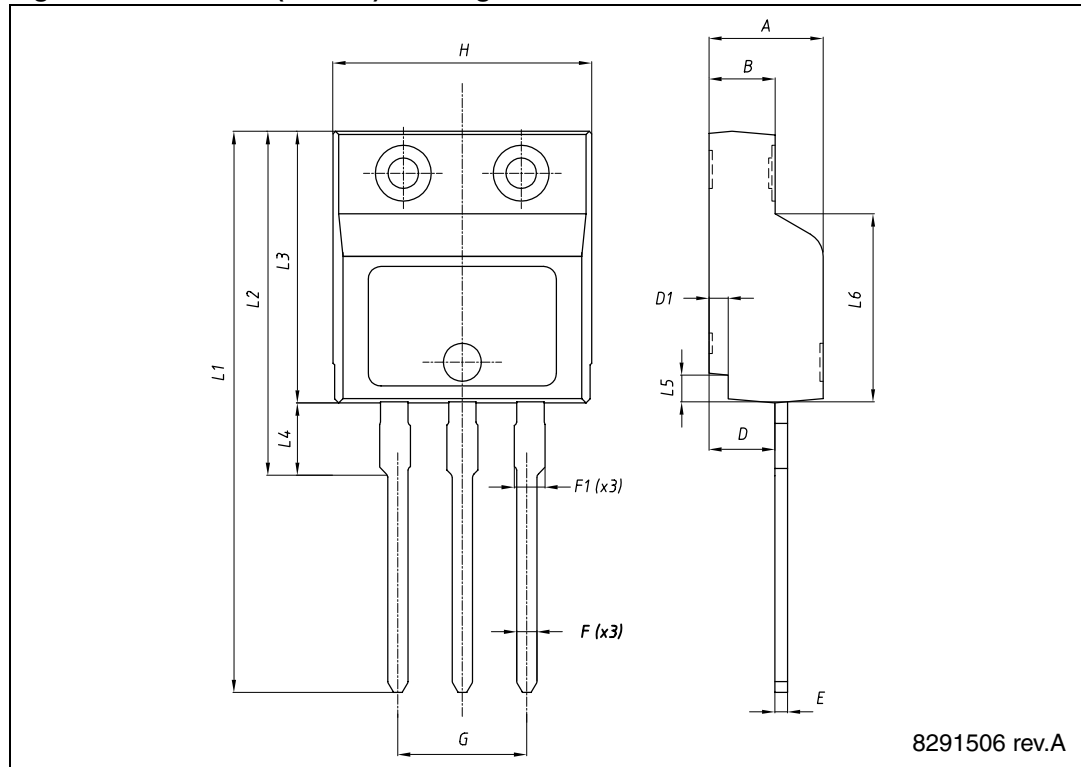


Table 11. I²PAK (TO-262) mechanical data

DIM.	mm.		
	min.	typ	max.
A	4.40		4.60
A1	2.40		2.72
b	0.61		0.88
b1	1.14		1.70
c	0.49		0.70
c2	1.23		1.32
D	8.95		9.35
e	2.40		2.70
e1	4.95		5.15
E	10		10.40
L	13		14
L1	3.50		3.93
L2	1.27		1.40

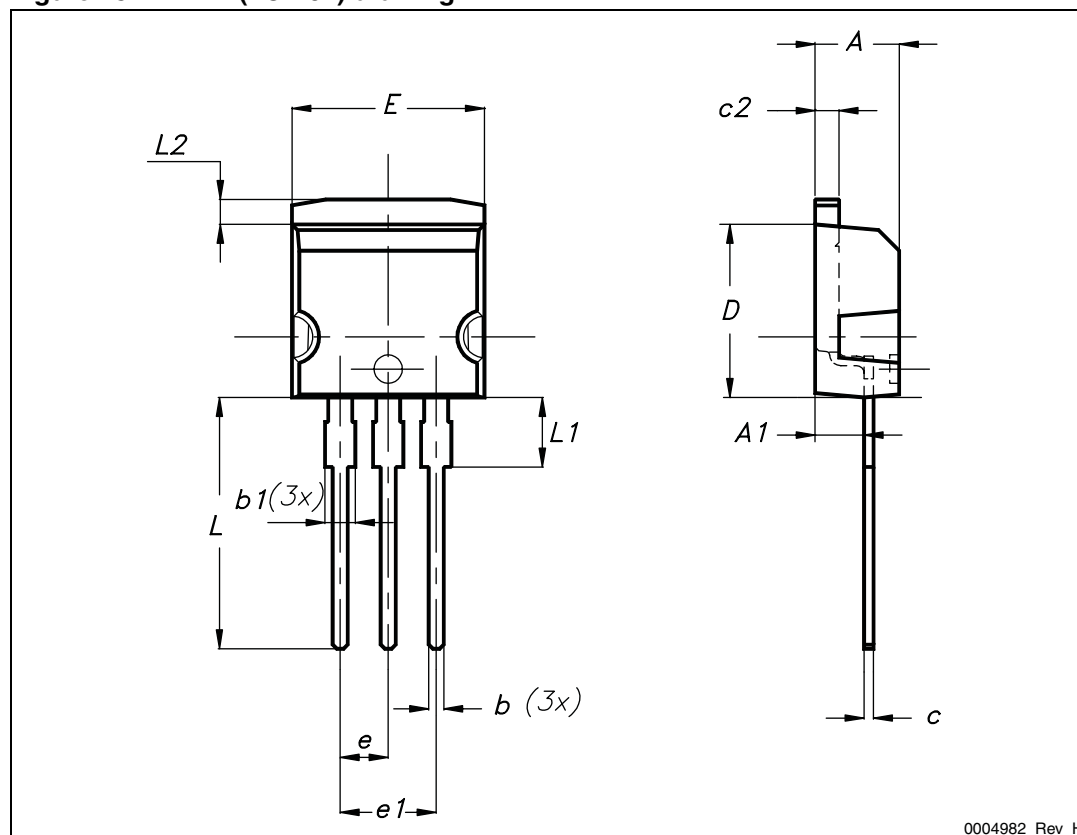
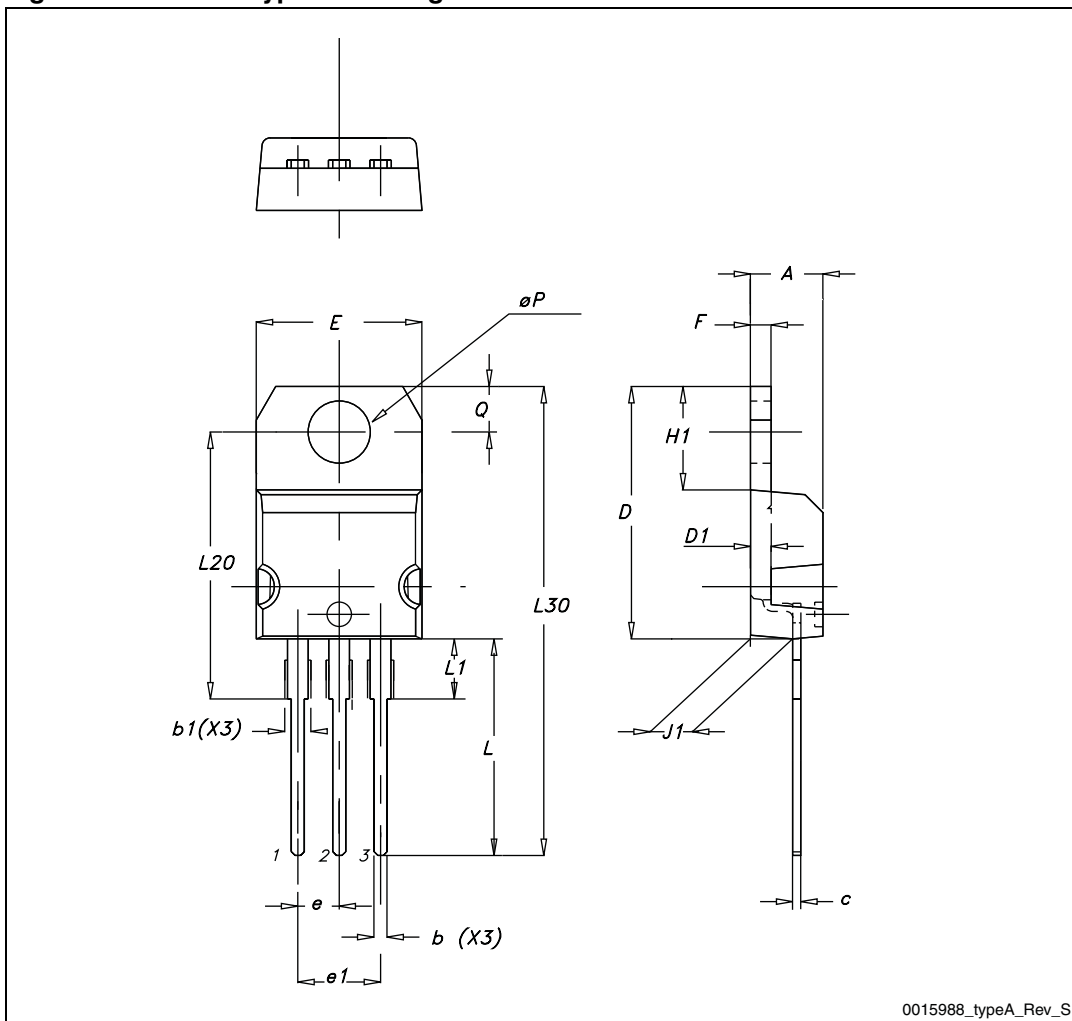
Figure 25. I²PAK (TO-262) drawing

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	
ØP	3.75		3.85
Q	2.65		2.95

Figure 26. TO-220 type A drawing



5 Revision history

Table 13. Document revision history

Date	Revision	Changes
08-Jun-2009	1	First release.
22-Jun-2009	2	Added new package, mechanical data: I ² PAK
06-Aug-2012	3	Added package, mechanical data: I ² PAKFP Updated Table 1: Device summary , Table 2: Absolute maximum ratings , Table 3: Thermal data , Table 4: On /off states . Minor text changes.
13-Sep-2012	4	Changed value in the title from 3.8 A to 8.4 A.

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