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

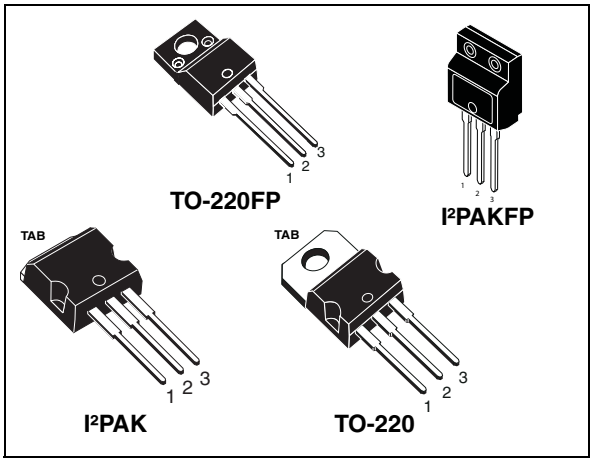
Datasheet – production data

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.

Figure 1. Internal schematic diagram

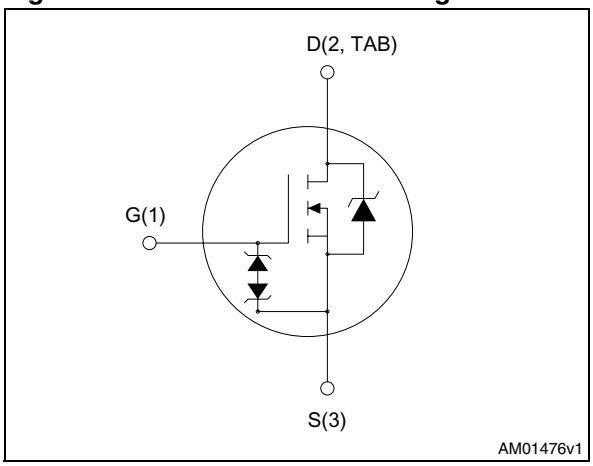


Table 1. Device summary

Order codes	Marking	Package	Packaging
STF10N62K3	10N62K3	TO-220FP	Tube
STFI10N62K3	10N62K3	I²PAKFP	
STI10N62K3	10N62K3	I²PAK	
STP10N62K3	10N62K3	TO-220	

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220FP I²PAKFP	I²PAK 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 I²PAKFP	I²PAK TO-220	
$R_{thj\text{-}case}$	Thermal resistance junction-case max	4.17	1.00	°C/W
$Rt_{hj\text{-}amb}$	Thermal resistance junction-ambient max	62.5		°C/W

2 Electrical characteristics

(Tcase = 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
$t_{d(on)}$ 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 = 4 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 17*)	-	14.5 15 41 31	-	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)		-		8.4 33.6	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 8 A, V_{GS} = 0	-		1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 8 A, di/dt = 100A/µs V_{DD} = 60 V (see *Figure 22*)	-	320 2 13		ns µC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 8 A, di/dt = 100 A/µs V_{DD} = 60 V, T_j = 150 °C (see *Figure 22*)	-	410 2.9 14		ns µC 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 (ID = 0)	Igs= ± 1 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

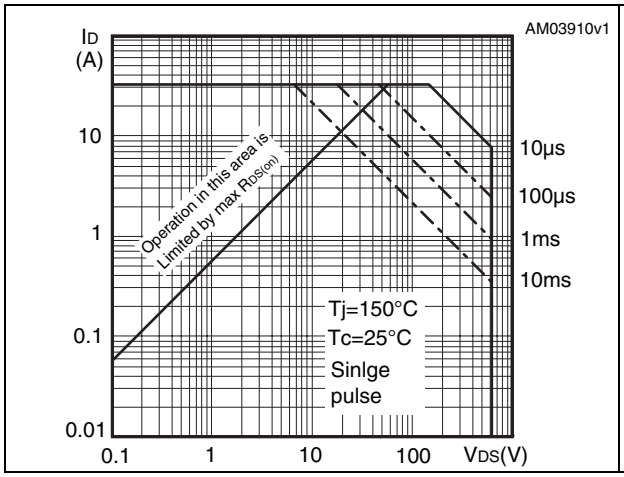


Figure 3. Thermal impedance for TO-220FP, I²PAKFP

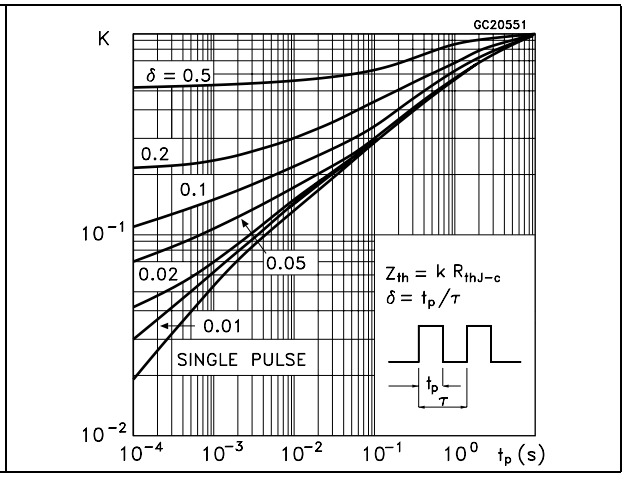


Figure 4. Safe operating area for I²PAK, TO-220

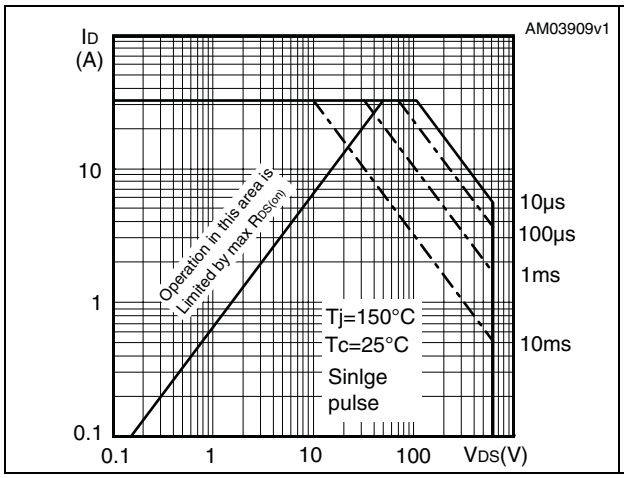


Figure 5. Thermal impedance for I²PAK, TO-220

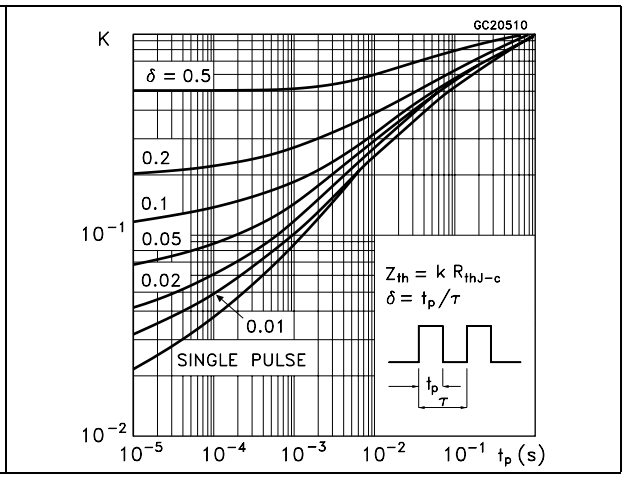


Figure 6. Output characteristics

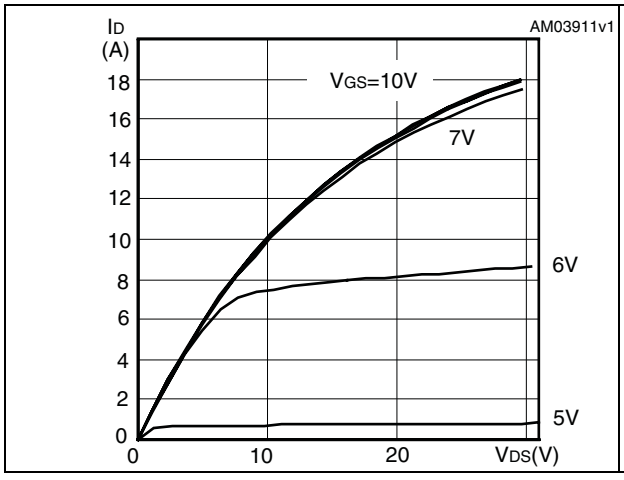


Figure 7. Transfer characteristics

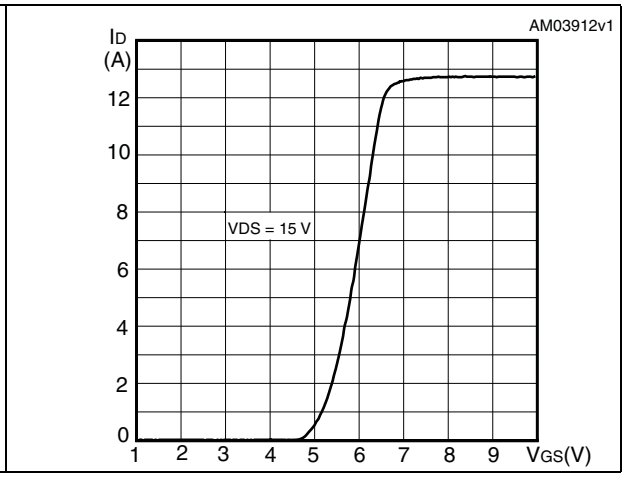


Figure 8. Normalized BV_{DSS} vs temperature

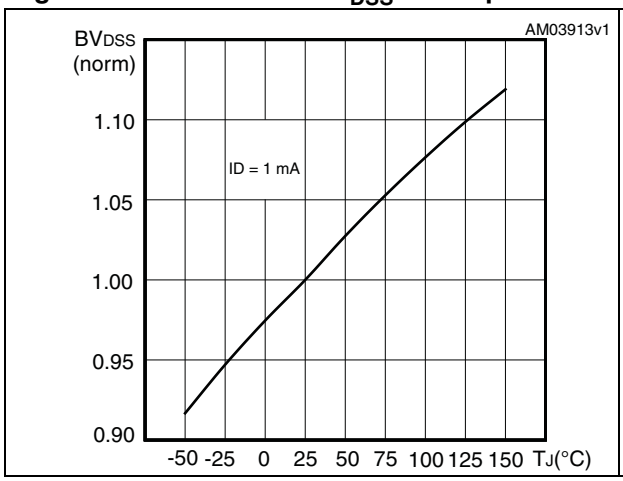


Figure 9. Static drain-source on-resistance

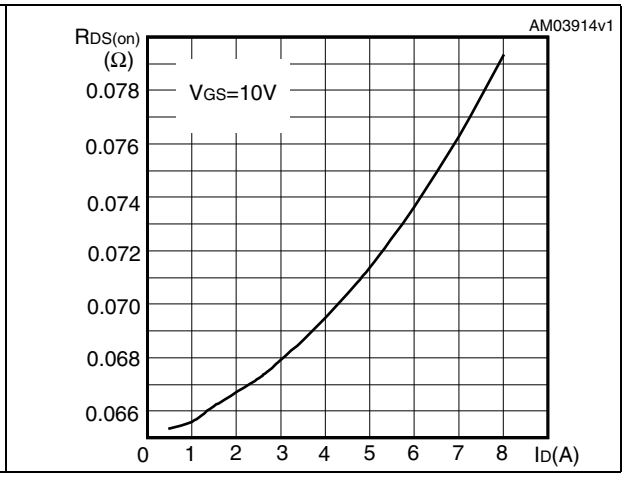


Figure 10. Output capacitance stored energy

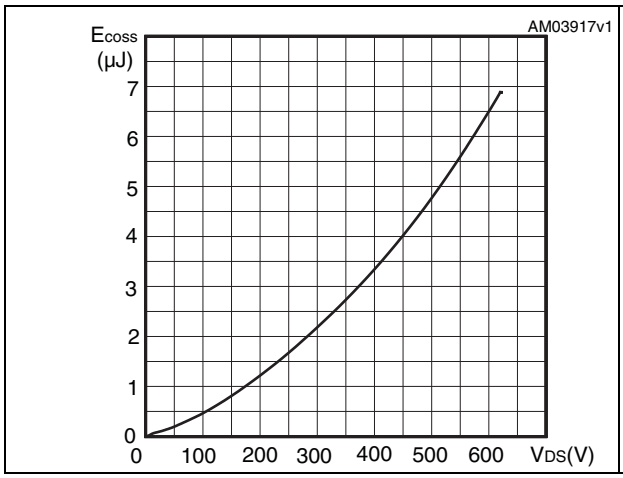


Figure 11. Capacitance variations

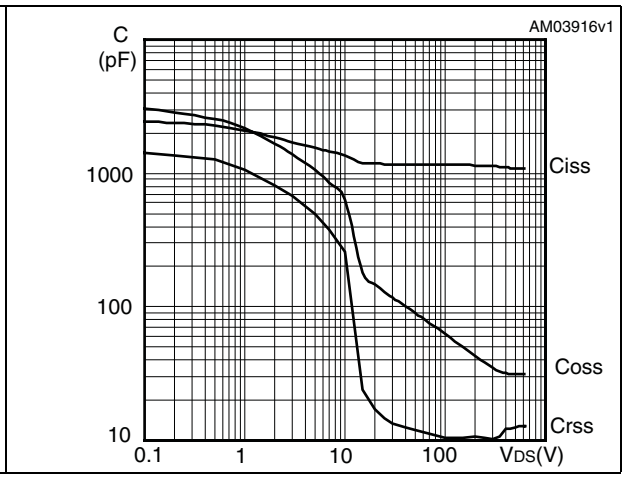


Figure 12. Gate charge vs gate-source voltage

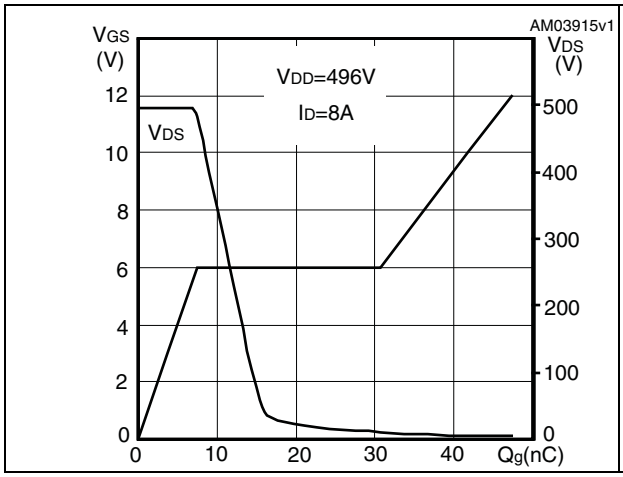


Figure 13. Normalized on-resistance vs temperature

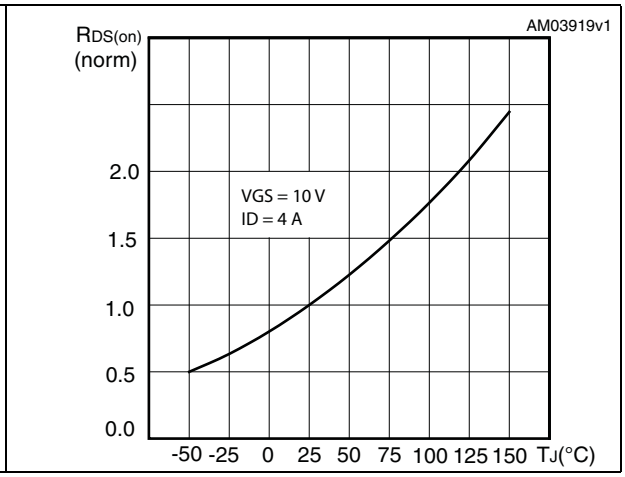


Figure 14. Normalized gate threshold voltage vs temperature

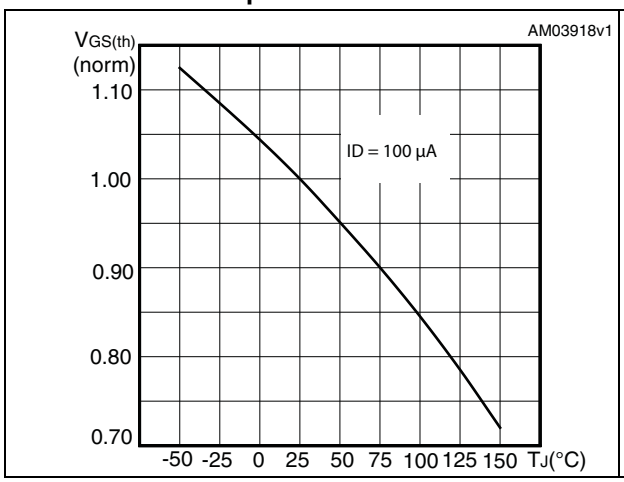


Figure 15. Maximum avalanche energy vs temperature

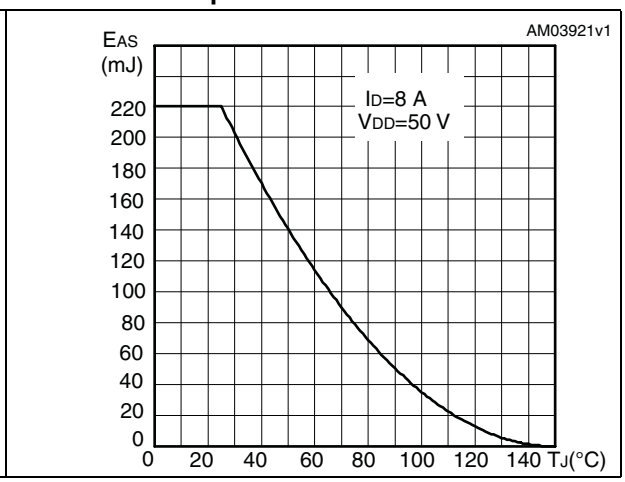
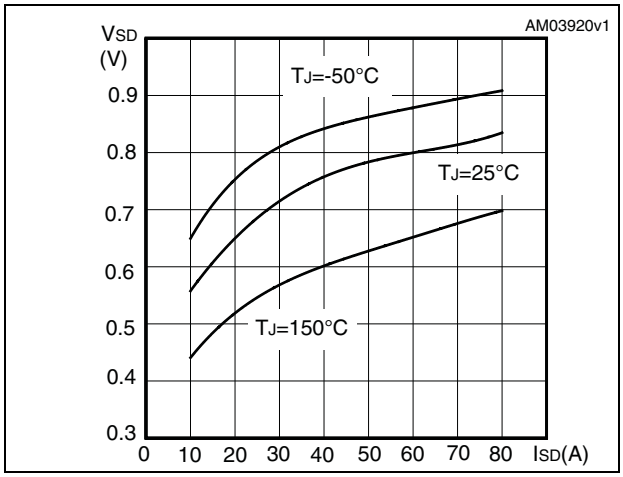


Figure 16. Source-drain diode forward characteristics



3 Test circuits

Figure 17. Switching times test circuit for resistive load

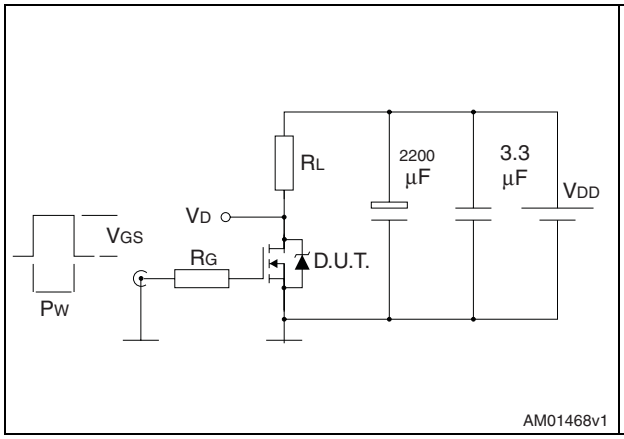


Figure 18. Gate charge test circuit

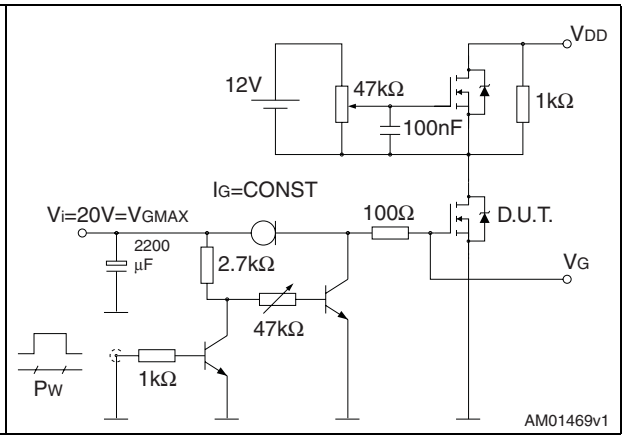


Figure 19. Test circuit for inductive load switching and diode recovery times

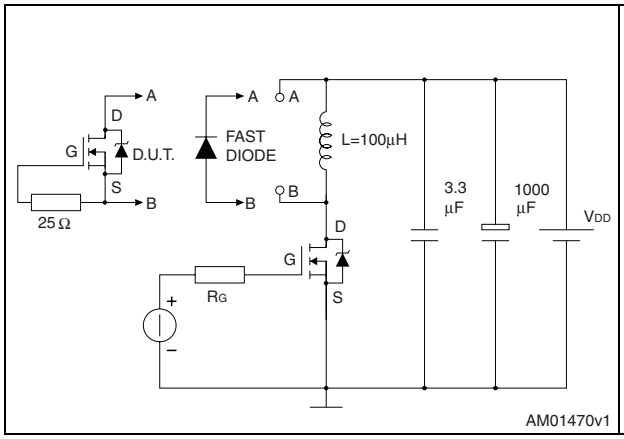


Figure 20. Unclamped inductive load test circuit

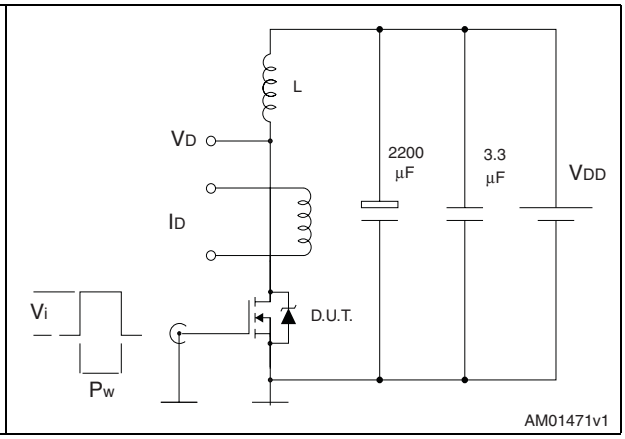


Figure 21. Unclamped inductive waveform

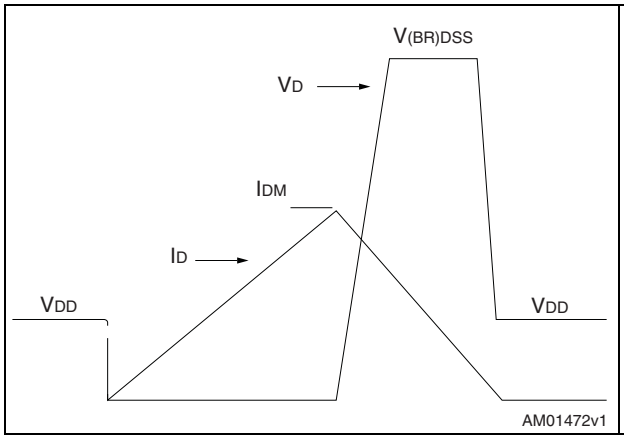
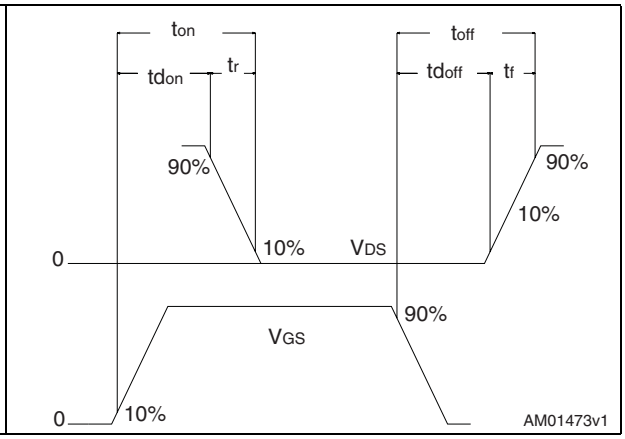


Figure 22. Switching time waveform



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 23. TO-220FP drawing

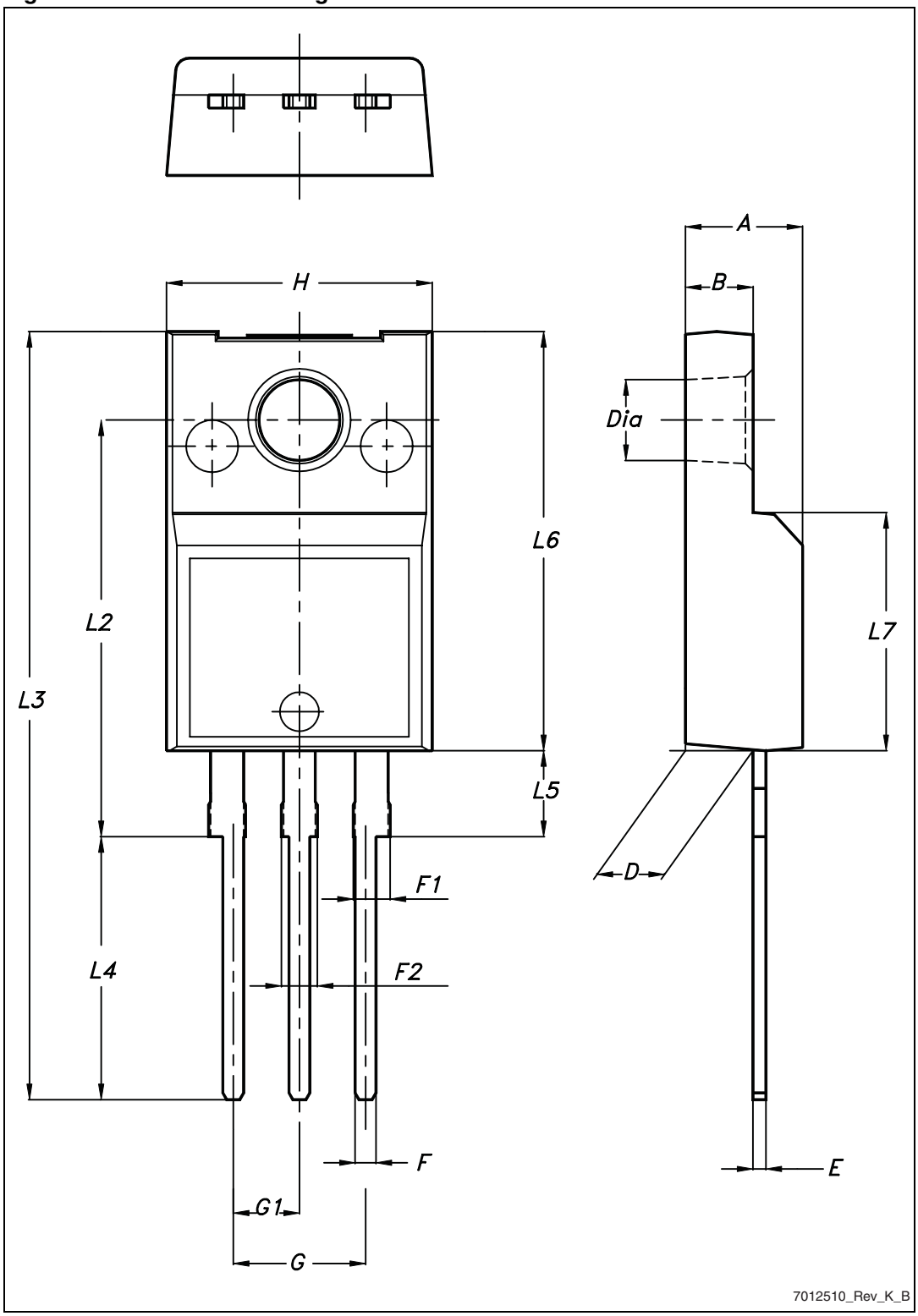


Table 10. I^2PAKFP (TO-281) mechanical data

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. I^2PAKFP (TO-281) drawing

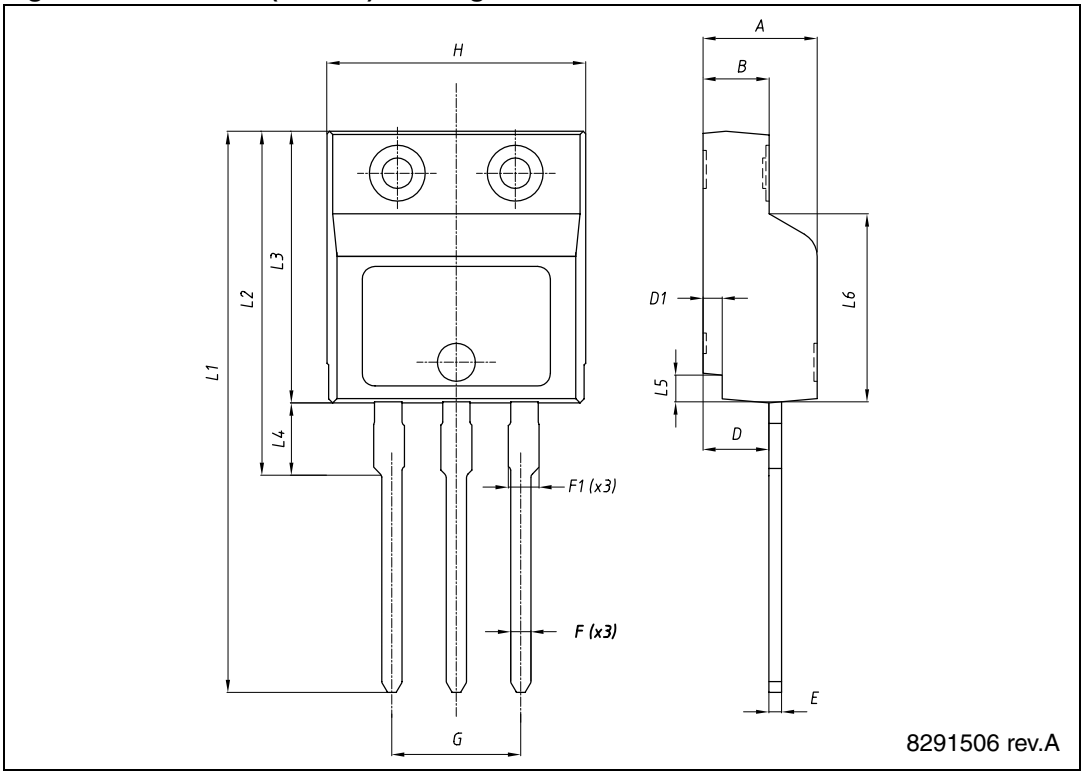


Table 11. I²PAK (TO-262) mechanical data

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

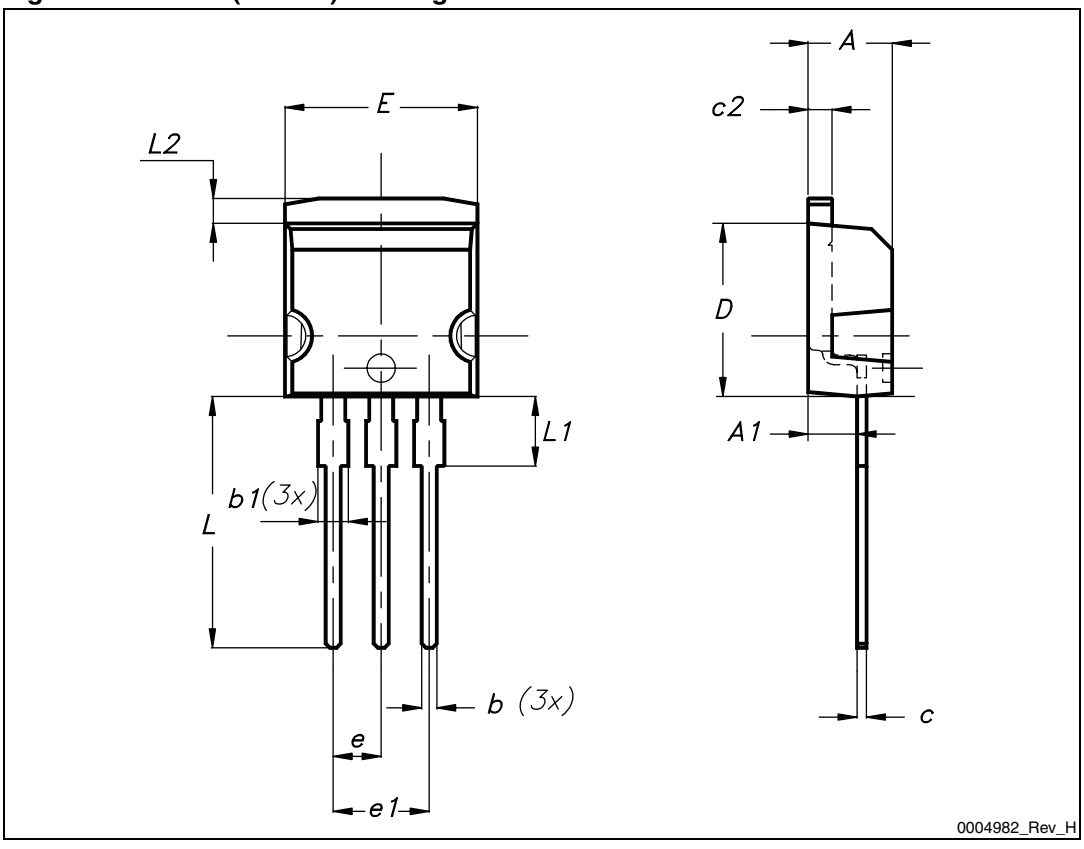
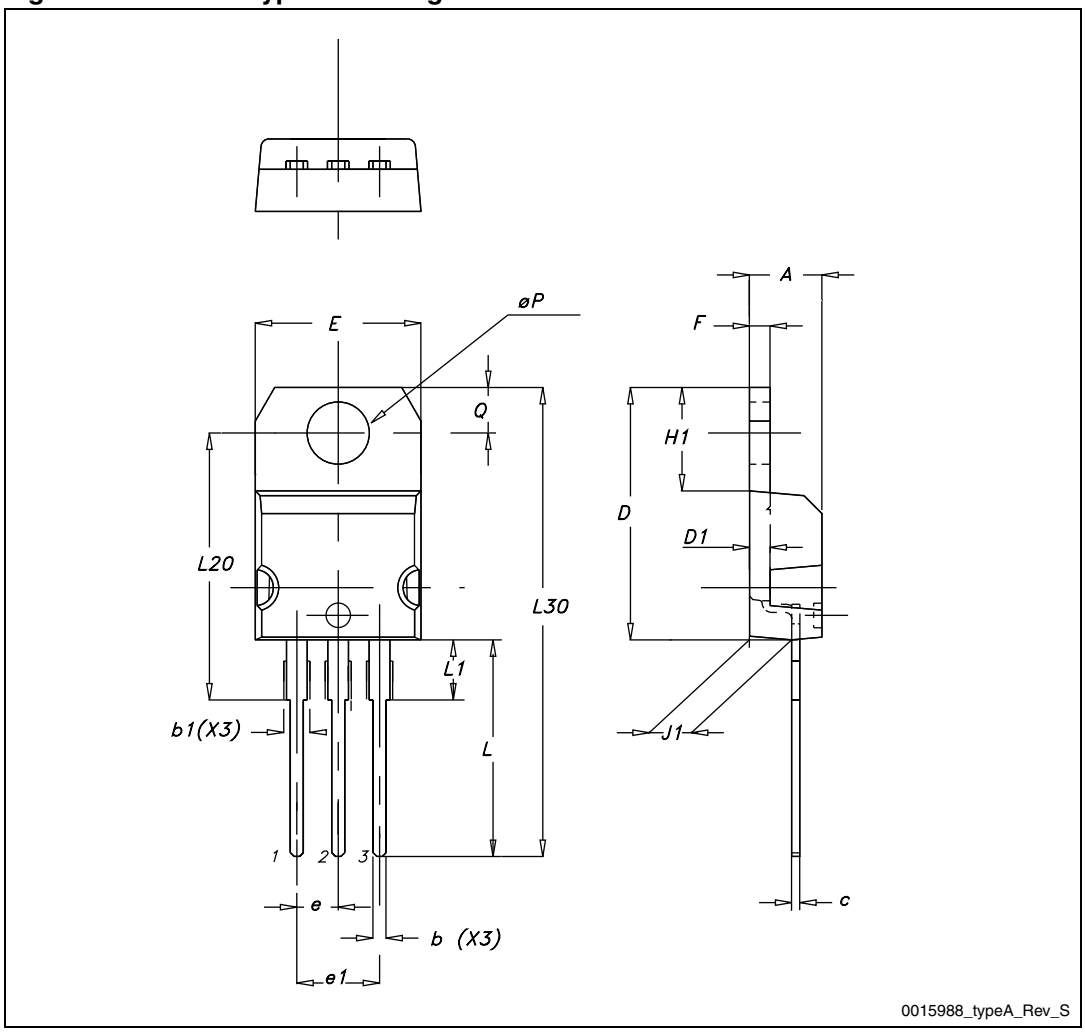


Table 12. TO-220 type A mechanical data

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	
∅P	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: I²PAK
06-Aug-2012	3	Added package, mechanical data: I²PAKFP 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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