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STF4N62K3, STFI4N62K3, STI4N62K3, STP4N62K3, STU4N62K3

N-channel 620 V, 1.7 Ω typ., 3.8 A SuperMESH3™ Power MOSFET in TO-220FP, I²PAKFP, I²PAK, TO-220 and IPAK packages

Datasheet — production data

Features

Order codes	V _{DSS}	R _{DS(on)} max	I _D	P _{TOT}
STF4N62K3	620 V	< 2 Ω	3.8 A	25 W
STFI4N62K3				25 W
STI4N62K3				70 W
STP4N62K3				70 W
STU4N62K3				70 W

- 100% avalanche tested
- Extremely high dv/dt capability
- Gate charge minimized
- Very low intrinsic capacitance
- 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.

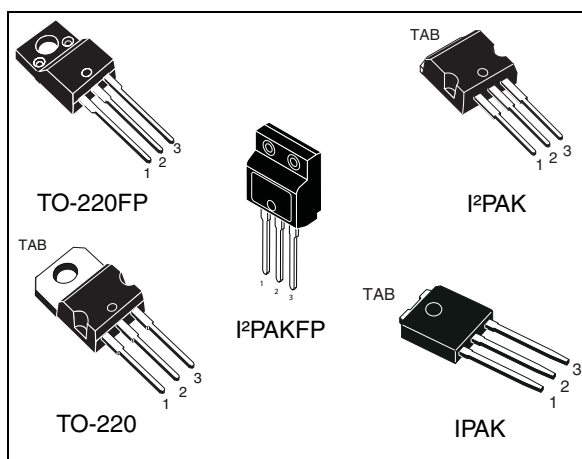
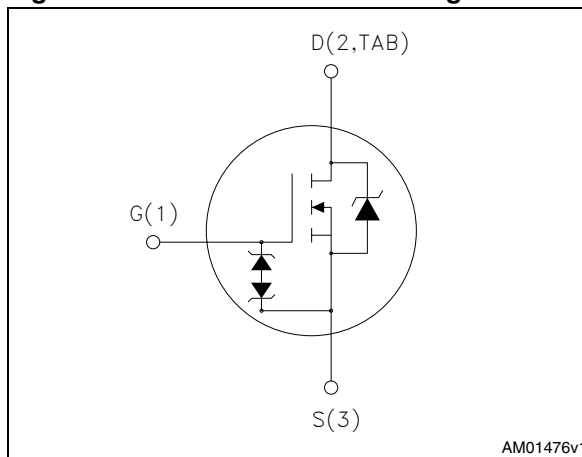


Figure 1. Internal schematic diagram



AM01476v1

Table 1. Device summary

Order codes	Marking	Package	Packaging
STF4N62K3	4N62K3	TO-220FP	Tube
STFI4N62K3		I ² PAKFP	
STI4N62K3		I ² PAK	
STP4N62K3		TO-220	
STU4N62K3		IPAK	

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STF4N62K3, STFI4N62K3, STI4N62K3, STP4N62K3, STU4N62K3
Electrical ratings

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value			Unit
		TO-220FP I ² PAKFP	I ² PAK TO-220	I ² PAK	
V _{DS}	Drain-source voltage	620			V
V _{GS}	Gate- source voltage	± 30			V
I _D	Drain current (continuous) at T _C = 25 °C	3.8 ⁽¹⁾	3.8		A
I _D	Drain current (continuous) at T _C = 100 °C	2 ⁽¹⁾	2		A
I _{DM} ⁽²⁾	Drain current (pulsed)	15.2 ⁽¹⁾	15.2		A
P _{TOT}	Total dissipation at T _C = 25 °C	25	70		W
I _{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T _j max)	3.8			A
E _{AS}	Single pulse avalanche energy (starting T _j = 25°C, I _D = I _{AR} , V _{DD} = 50V)	115			mJ
ESD	Gate-source human body model (R = 1.5 kΩ, C = 100 pF)	2.5			kV
dv/dt ⁽³⁾	Peak diode recovery voltage slope	12			V/ns
V _{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T _C = 25 °C)	2500			V
T _{stg}	Storage temperature	- 55 to 150			°C
T _j	Max. operating junction temperature	150			°C

- Limited by maximum junction temperature.
- Pulse width limited by safe operating area.
- I_{SD} ≤ 3.8 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	I ² PAK	
R _{thj-case}	Thermal resistance junction-case max	5	1.79		°C/W
R _{thj-amb}	Thermal resistance junction-ambient max	62.5			°C/W

Electrical characteristics

STF4N62K3, STFI4N62K3, STI4N62K3, STP4N62K3, STU4N62K3

2 Electrical characteristics

($T_C = 25\text{ }^\circ\text{C}$ unless otherwise specified)

Table 4. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$, $V_{GS} = 0$	620			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 620\text{ V}$ $V_{DS} = 620\text{V}$, $T_C = 125\text{ }^\circ\text{C}$			1 50	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 10	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 50\text{ }\mu\text{A}$	3	3.75	4.5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$, $I_D = 1.9\text{ A}$		1.7	2	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 50\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$		550		pF
C_{oss}	Output capacitance			42		pF
C_{rss}	Reverse transfer capacitance			7		pF
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{DS} = 0\text{ to }496\text{ V}$, $V_{GS} = 0$		27		pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	2	5	10	Ω
Q_g	Total gate charge	$V_{DD} = 496\text{ V}$, $I_D = 3.8\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 20)		22		nC
Q_{gs}	Gate-source charge			4		nC
Q_{gd}	Gate-drain charge			13		nC

1. $C_{oss\text{ eq.}}$ 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}

STF4N62K3, STFI4N62K3, STI4N62K3, STP4N62K3, STU4N62K3
Electrical characteristics
Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}$, $I_D = 1.9\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 19)		10		ns
t_r	Rise time			9		ns
$t_{d(off)}$	Turn-off-delay time			29	-	ns
t_f	Fall time			19		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current				3.8	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				15.2	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 3.8\text{ A}$, $V_{GS} = 0$			1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 3.8\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$ (see Figure 24)		220		ns
Q_{rr}	Reverse recovery charge			1.4		μC
I_{RRM}	Reverse recovery current			13		A
t_{rr}	Reverse recovery time	$I_{SD} = 3.8\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 24)		270		ns
Q_{rr}	Reverse recovery charge			1.9		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.

Electrical characteristics

STF4N62K3, STFI4N62K3, STI4N62K3, STP4N62K3, STU4N62K3

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220, I²PAK

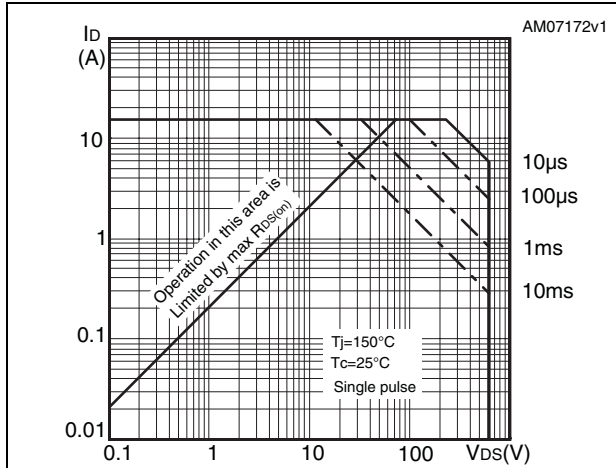


Figure 3. Thermal impedance for TO-220, I²PAK

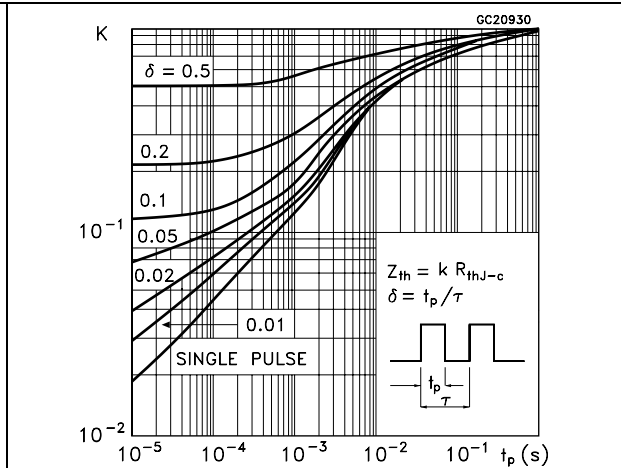


Figure 4. Safe operating area for TO-220FP, I²PAKFP

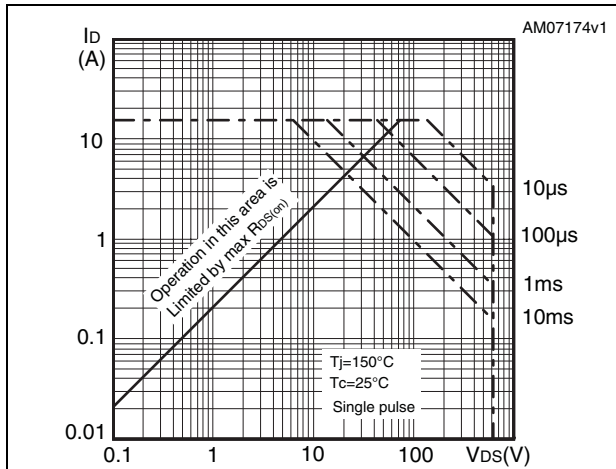


Figure 5. Thermal impedance for TO-220FP, I²PAKFP

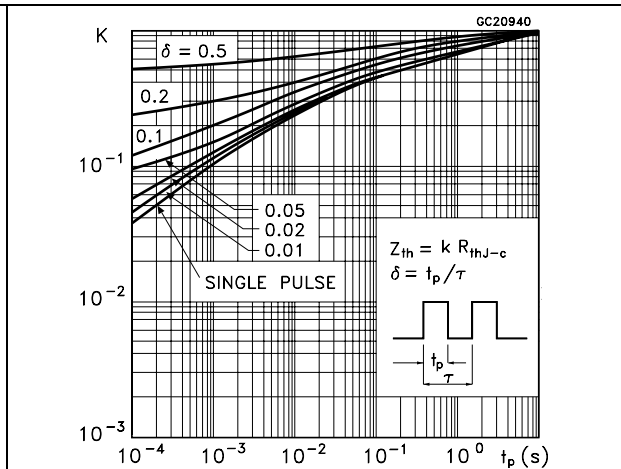


Figure 6. Safe operating area for IPAK

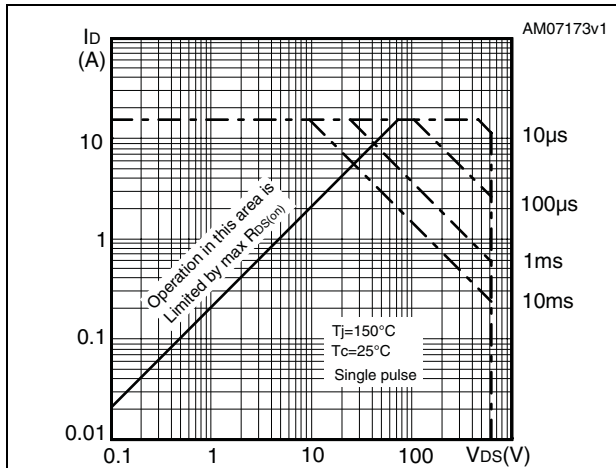
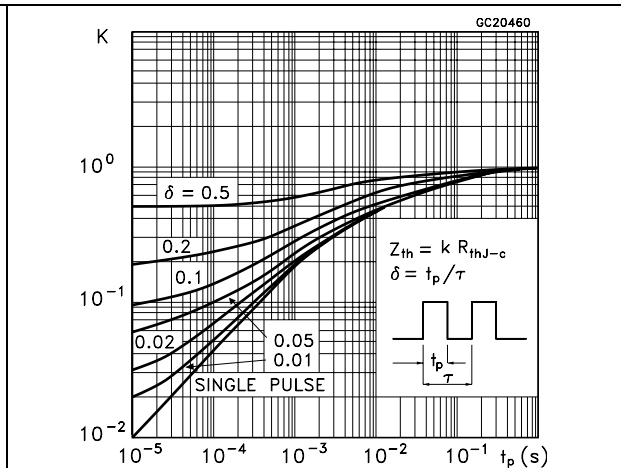


Figure 7. Thermal impedance for IPAK



STF4N62K3, STFI4N62K3, STI4N62K3, STP4N62K3, STU4N62K3

Electrical characteristics

Figure 8. Output characteristics

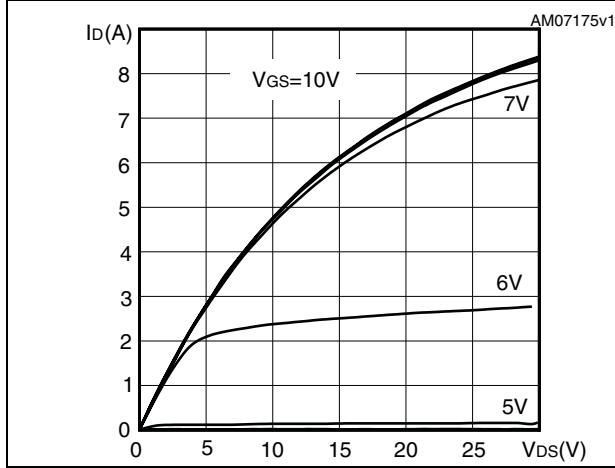


Figure 9. Transfer characteristics

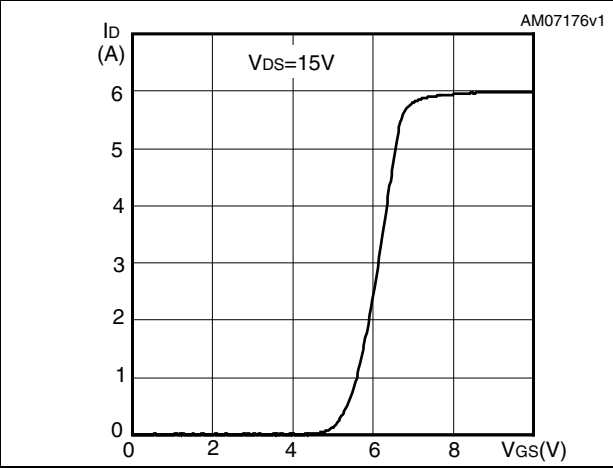


Figure 10. Gate charge vs gate-source voltage **Figure 11. Static drain-source on resistance**

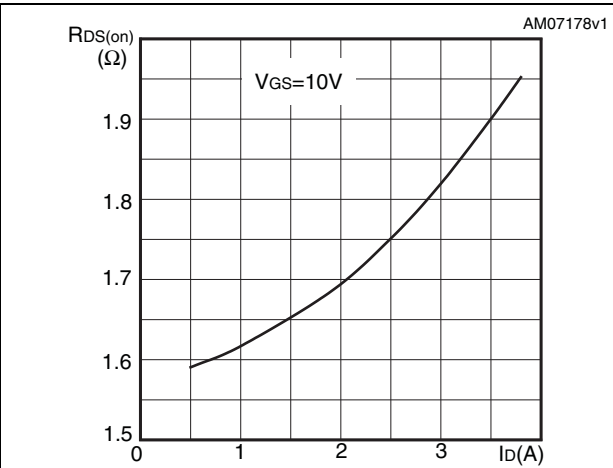
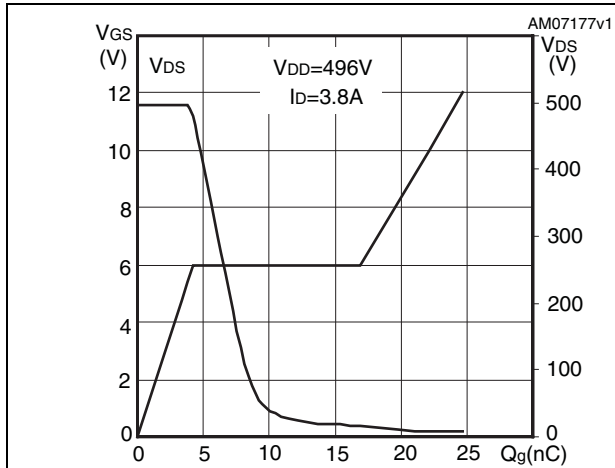


Figure 12. Capacitance variations

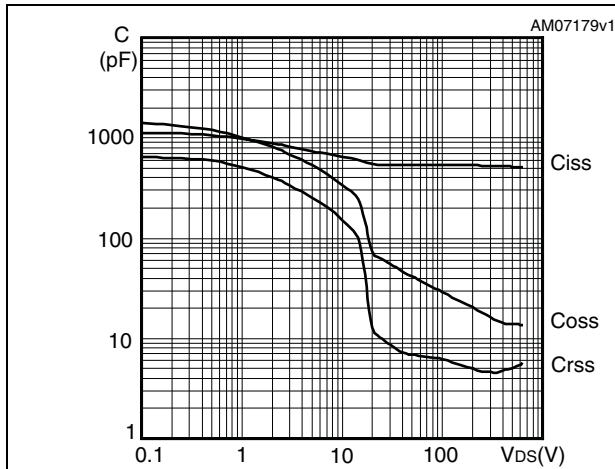
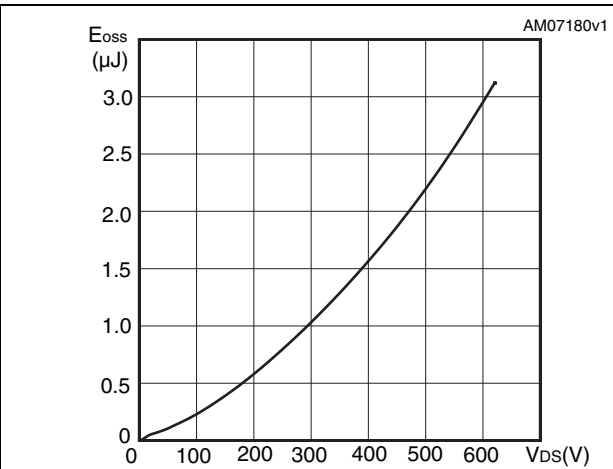


Figure 13. Output capacitance stored energy



Electrical characteristics

STF4N62K3, STFI4N62K3, STI4N62K3, STP4N62K3, STU4N62K3

Figure 14. Normalized gate threshold voltage vs temperature

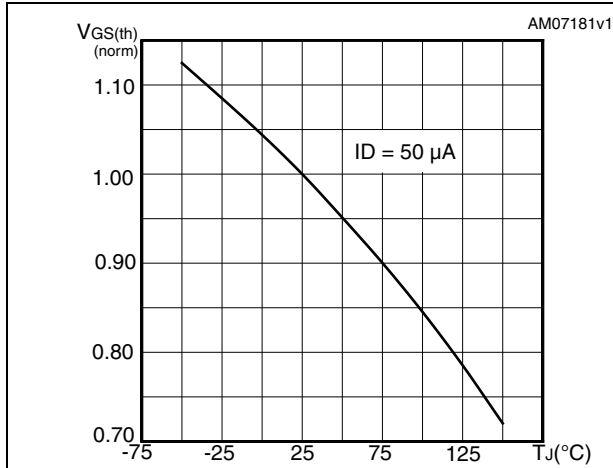


Figure 15. Normalized on resistance vs temperature

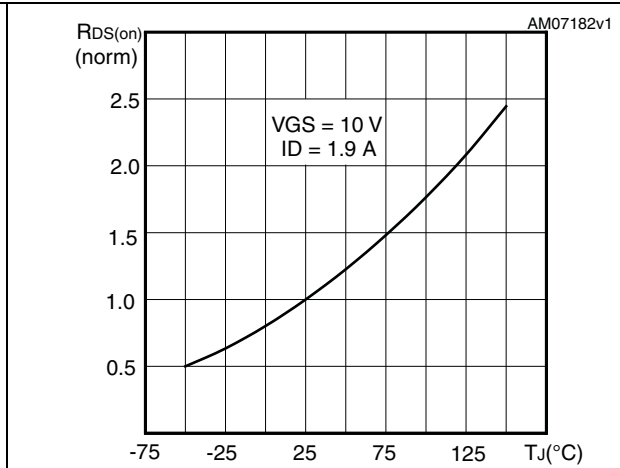


Figure 16. Maximum avalanche energy vs starting Tj

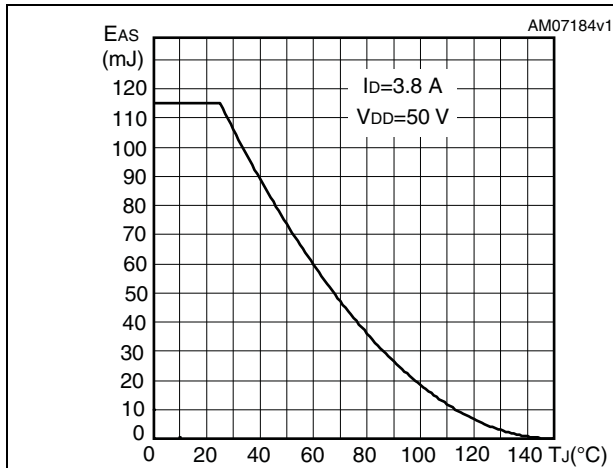


Figure 17. Normalized B_VDSS vs temperature

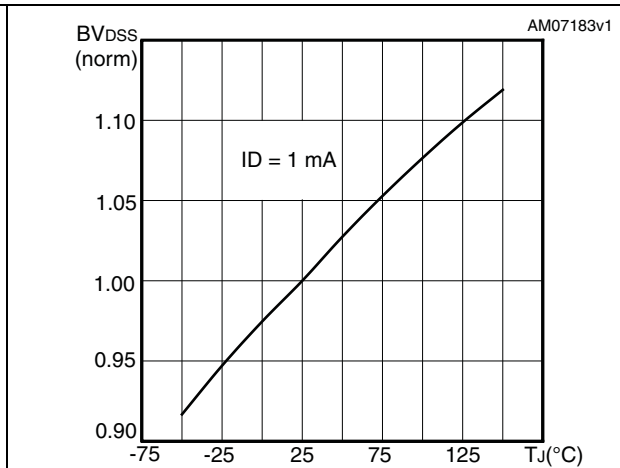
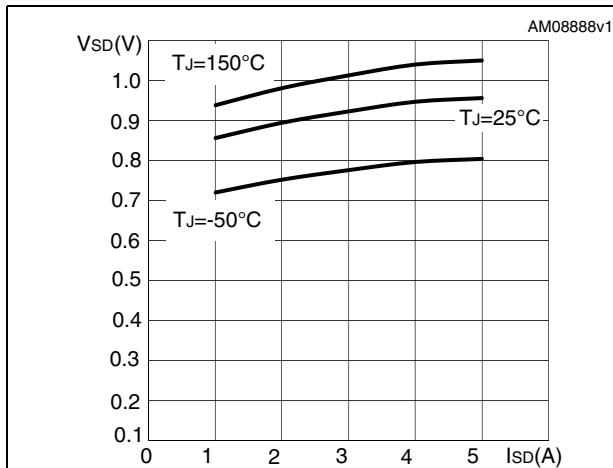


Figure 18. Source-drain diode forward characteristics



STF4N62K3, STFI4N62K3, STI4N62K3, STP4N62K3, STU4N62K3

Test circuits

3 Test circuits

Figure 19. Switching times test circuit for resistive load

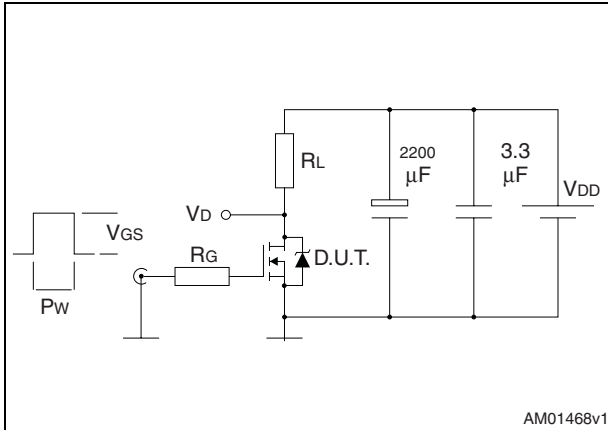


Figure 20. Gate charge test circuit

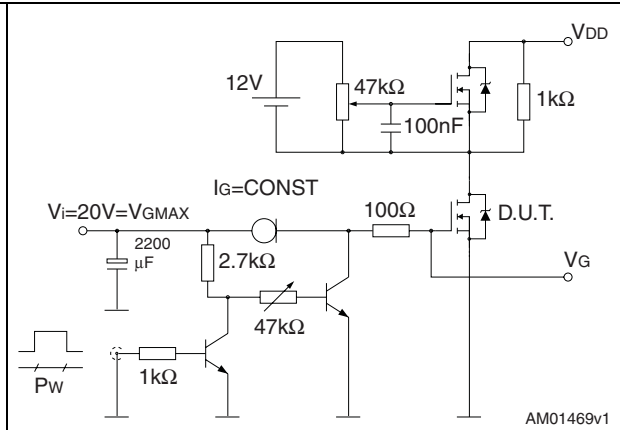


Figure 21. Test circuit for inductive load switching and diode recovery times

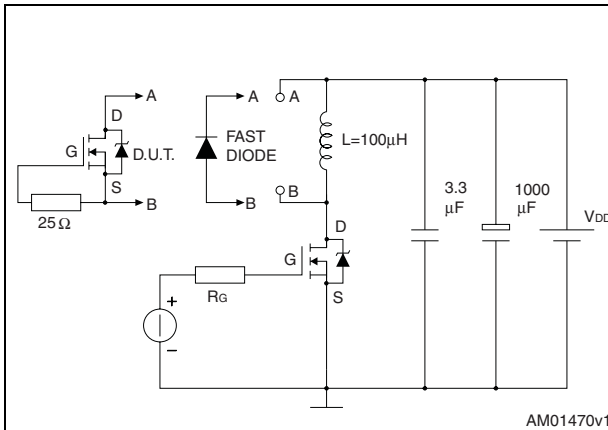


Figure 22. Unclamped inductive load test circuit

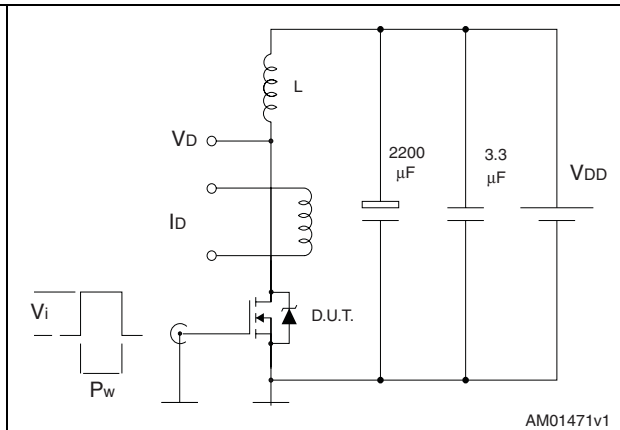


Figure 23. Unclamped inductive waveform

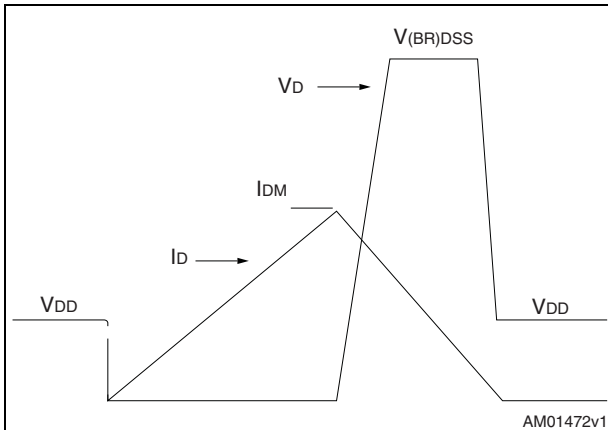
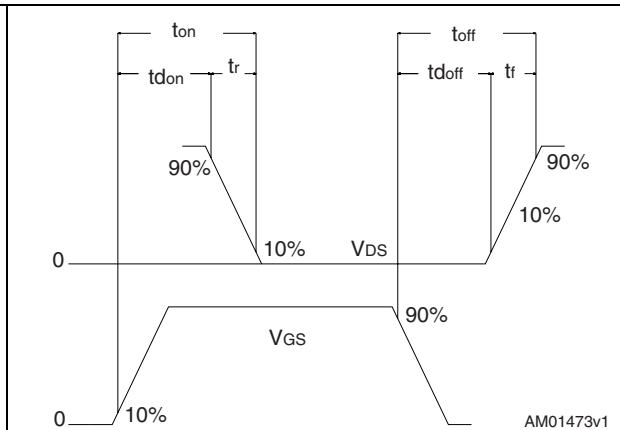


Figure 24. Switching time waveform



Package mechanical data
STF4N62K3, STFI4N62K3, STI4N62K3, STP4N62K3, STU4N62K3

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.

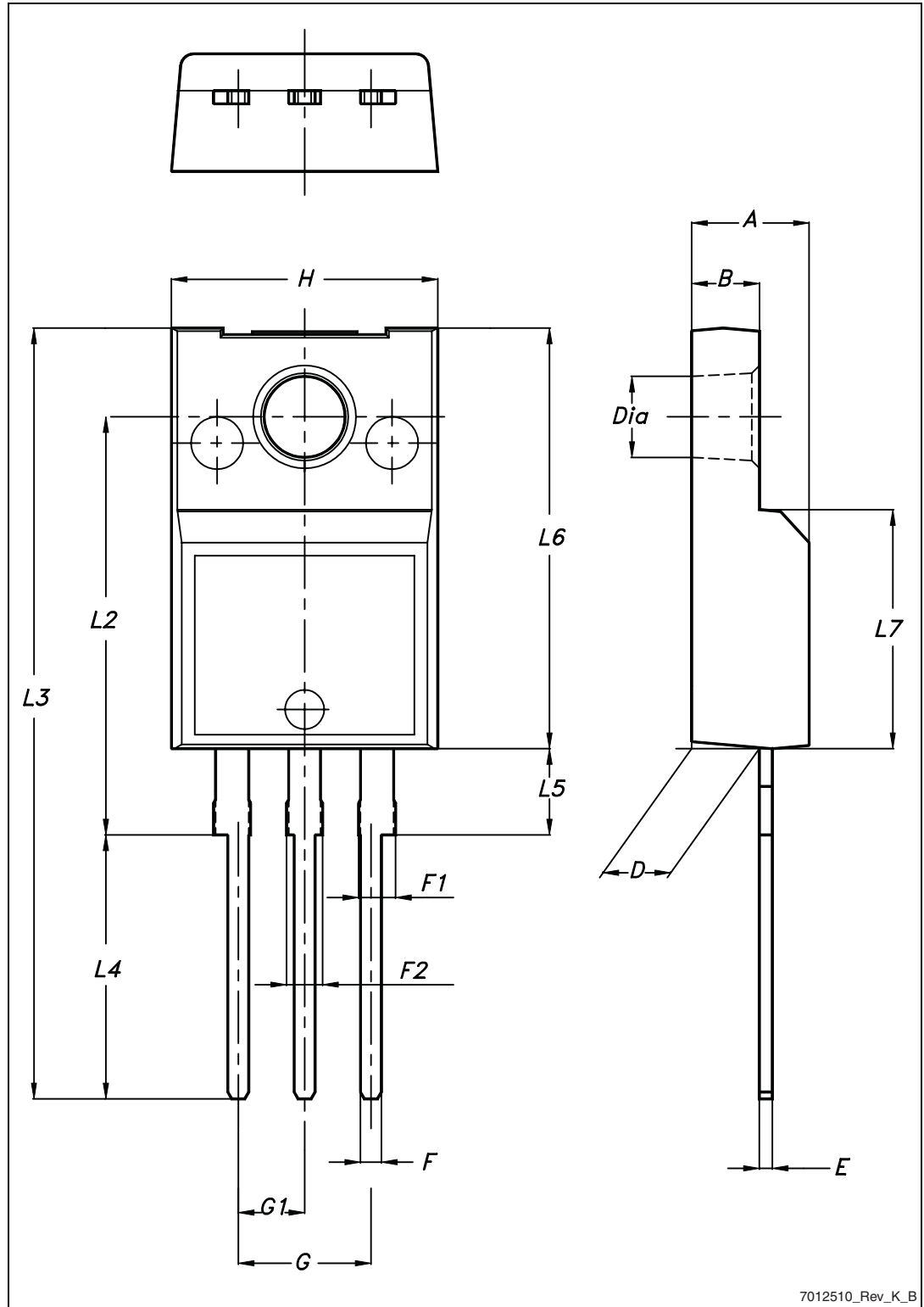
Table 9. TO-220FP mechanical data

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

STF4N62K3, STFI4N62K3, STI4N62K3, STP4N62K3, STU4N62K3

Package mechanical data

Figure 25. TO-220FP drawing



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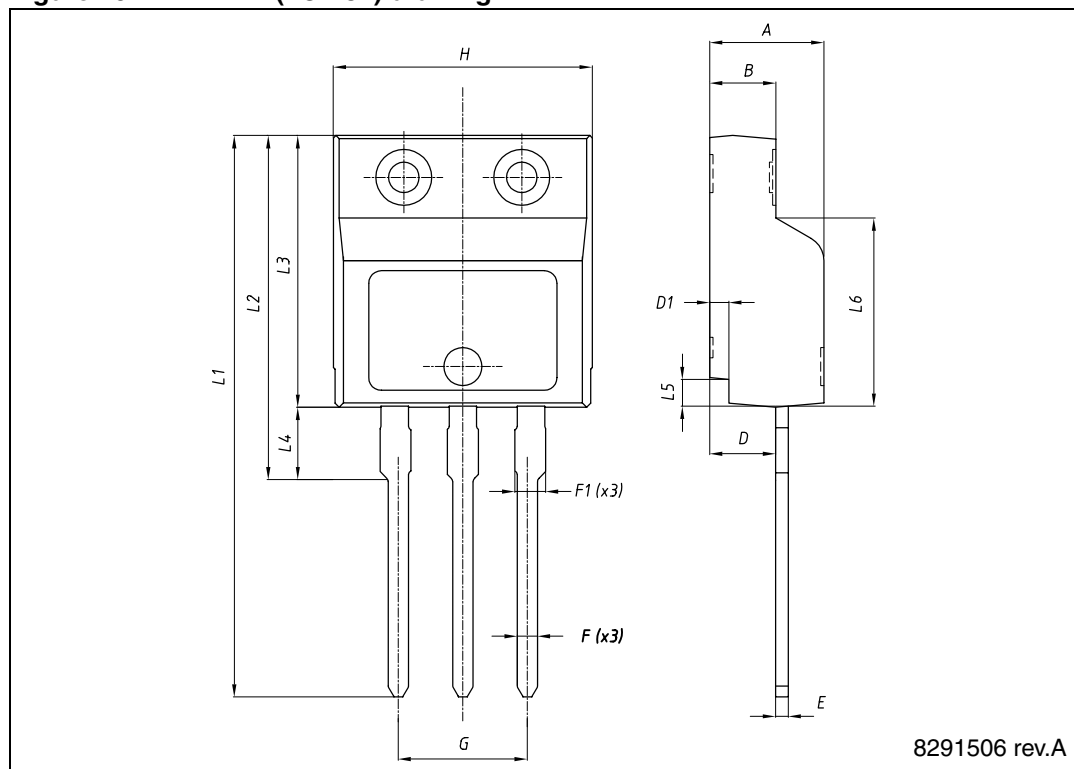
Package mechanical data

STF4N62K3, STFI4N62K3, STI4N62K3, STP4N62K3, STU4N62K3

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 26. I²PAKFP (TO-281) drawing



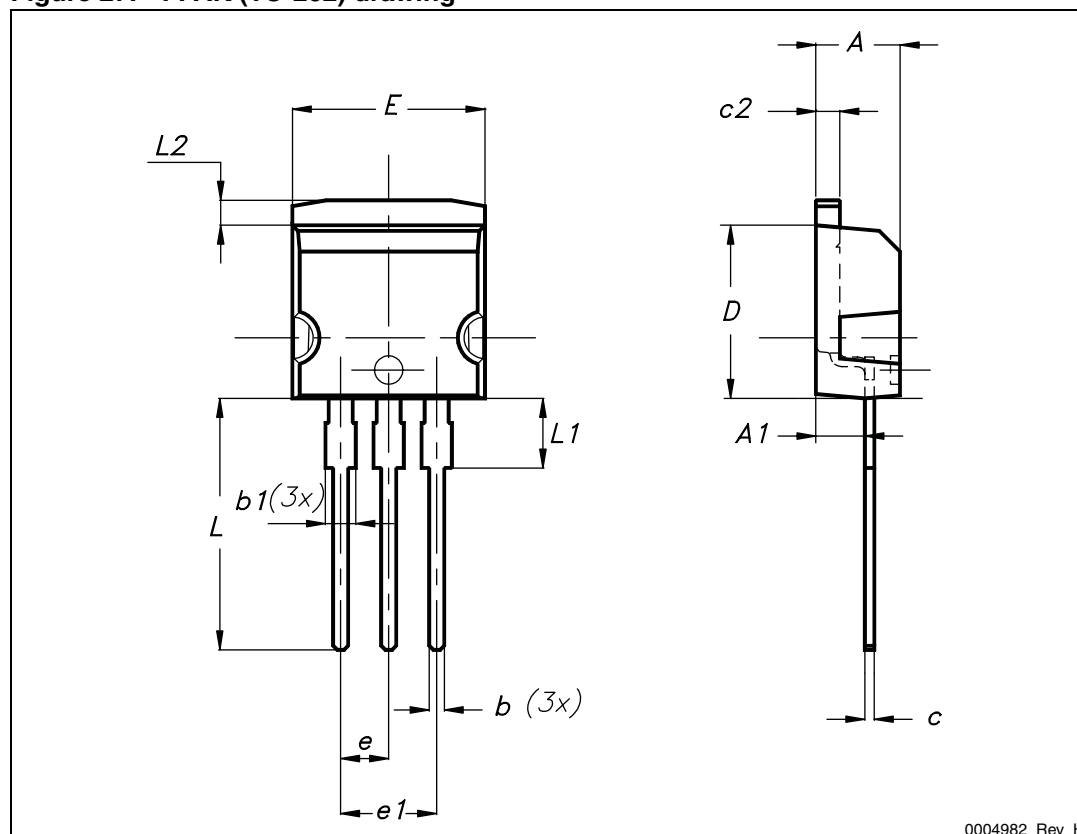
STF4N62K3, STFI4N62K3, STI4N62K3, STP4N62K3, STU4N62K3

Package mechanical data

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 27. I²PAK (TO-262) drawing



0004982_Rev_H

Package mechanical data

STF4N62K3, STFI4N62K3, STI4N62K3, STP4N62K3, STU4N62K3

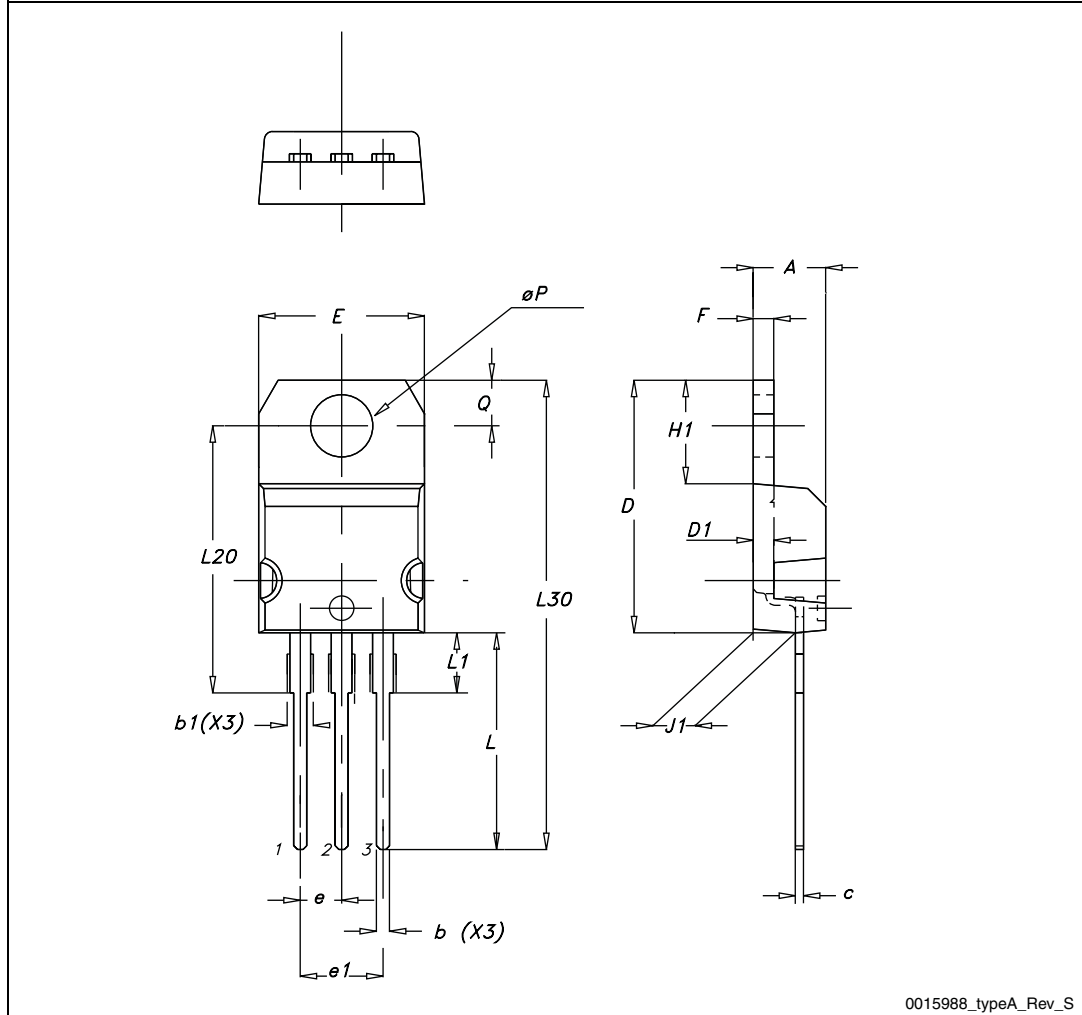
Table 12. TO-220 type A mechanical data

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

STF4N62K3, STFI4N62K3, STI4N62K3, STP4N62K3, STU4N62K3

Package mechanical data

Figure 28. TO-220 type A drawing



Package mechanical data

STF4N62K3, STFI4N62K3, STI4N62K3, STP4N62K3, STU4N62K3

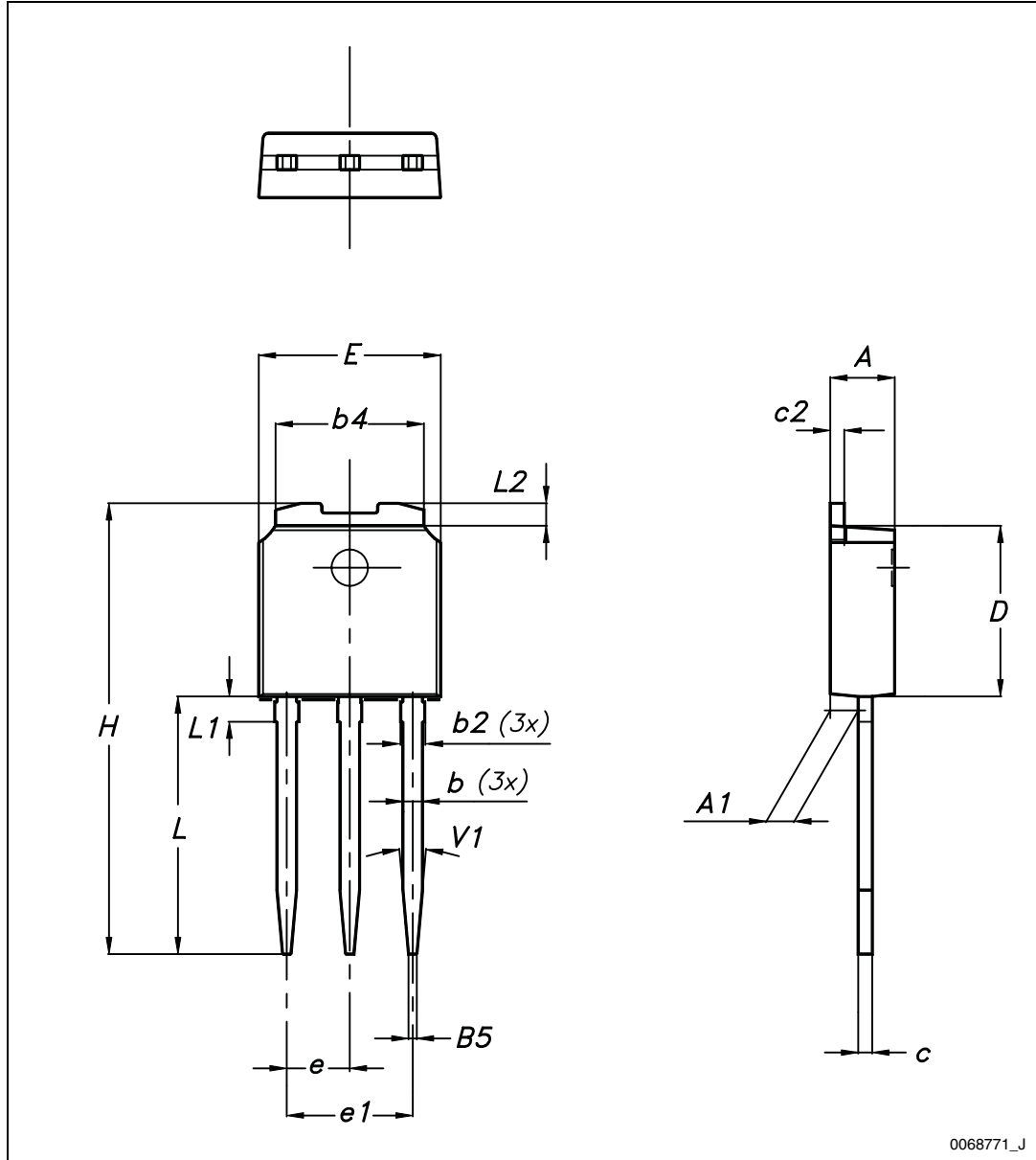
Table 13. IPAK (TO-251) mechanical data

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		0.30	
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°	

STF4N62K3, STFI4N62K3, STI4N62K3, STP4N62K3, STU4N62K3

Package mechanical data

Figure 29. IPAK (TO-251) drawing



Revision history

STF4N62K3, STFI4N62K3, STI4N62K3, STP4N62K3, STU4N62K3

5 Revision history

Table 14. Document revision history

Date	Revision	Changes
05-May-2010	1	First release
16-Dec-2010	2	Document status promoted from preliminary data to datasheet.
27-Mar-2012	3	Inserted max and min. values for R_G in Table 5 . Updated Section 4: Package mechanical data .
07-Aug-2012	4	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 , Table 13: IPAK (TO-251) mechanical data and Figure 29: IPAK (TO-251) drawing Minor text changes.

STF4N62K3, STFI4N62K3, STI4N62K3, STP4N62K3, STU4N62K3

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