



# STF4N62K3, STF14N62K3, STI4N62K3, STP4N62K3, STU4N62K3

N-channel 620 V, 1.7  $\Omega$  typ., 3.8 A SuperMESH3™ Power MOSFET  
in TO-220FP, I<sup>2</sup>PAKFP, I<sup>2</sup>PAK, TO-220 and IPAK packages

Datasheet — production data

## Features

Order codes	V <sub>DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>	P <sub>TOT</sub>
STF4N62K3	620 V	< 2 $\Omega$	3.8 A	25 W
STF14N62K3				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.

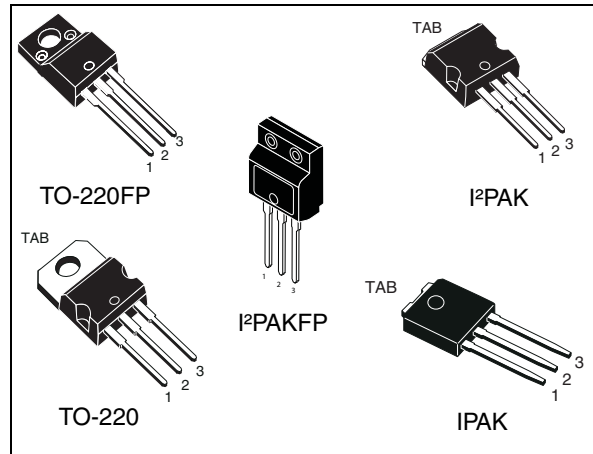
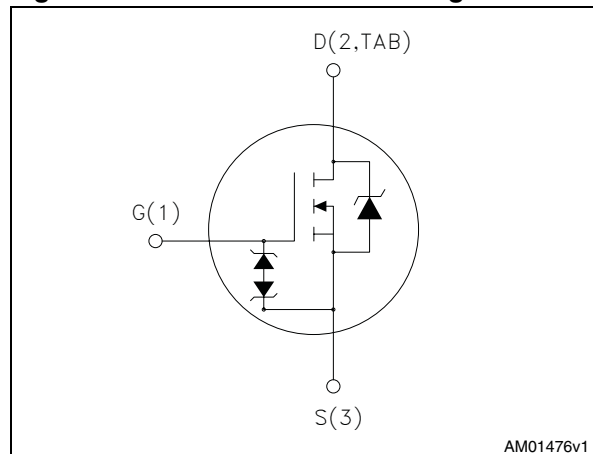


Figure 1. Internal schematic diagram



AM01476v1

Table 1. Device summary

Order codes	Marking	Package	Packaging
STF4N62K3	4N62K3	TO-220FP	Tube
STF14N62K3		I <sup>2</sup> PAKFP	
STI4N62K3		I <sup>2</sup> PAK	
STP4N62K3		TO-220	
STU4N62K3		IPAK	

# Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

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

1. Limited by maximum junction temperature.

2. Pulse width limited by safe operating area.

3. I<sub>SD</sub> ≤ 3.8 A, di/dt = 400 A/μs, V<sub>DD</sub> = 80% V<sub>(BR)DSS</sub>, V<sub>DS peak</sub> ≤ V<sub>(BR)DSS</sub>.

**Table 3. Thermal data**

Symbol	Parameter	Value			Unit
		TO-220FP I <sup>2</sup> PAKFP	I <sup>2</sup> PAK TO-220	I <sup>2</sup> PAK	
R <sub>thj-case</sub>	Thermal resistance junction-case max	5	1.79		°C/W
R <sub>thj-amb</sub>	Thermal resistance junction-ambient max	62.5			°C/W

## 2 Electrical characteristics

( $T_C = 25\text{ °C}$  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 ( $V_{GS} = 0$ )	$V_{DS} = 620\text{ V}$ $V_{DS} = 620\text{ V}, T_C = 125\text{ °C}$			1 50	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\text{ V}$			$\pm 10$	$\mu\text{A}$
$V_{GS(th)}$	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	$\Omega$

**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	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 496\text{ V}, I_D = 3.8\text{ A},$ $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 20</a> )		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%  $V_{DSS}$

**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 <a href="#">Figure 19</a> )		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 <a href="#">Figure 24</a> )	-	220		ns
$Q_{rr}$	Reverse recovery charge			1.4		$\mu\text{C}$
$I_{RRM}$	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 <a href="#">Figure 24</a> )	-	270		ns
$Q_{rr}$	Reverse recovery charge			1.9		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current			14		A

1. Pulse width limited by safe operating area

2. Pulsed: Pulse duration = 300  $\mu\text{s}$ , 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-220, I<sup>2</sup>PAK

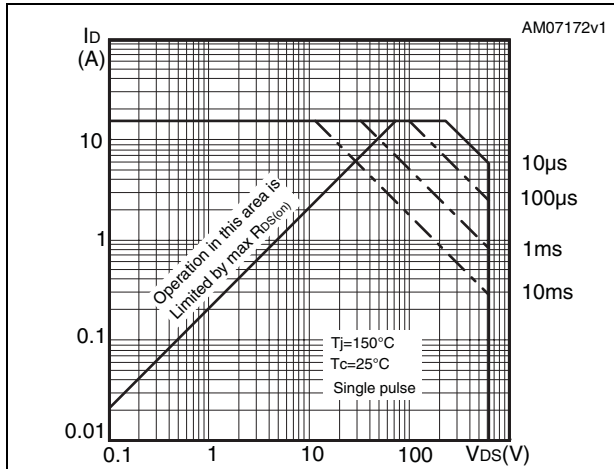


Figure 3. Thermal impedance for TO-220, I<sup>2</sup>PAK

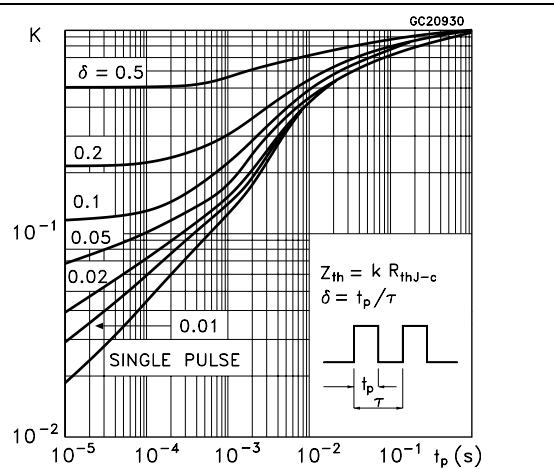


Figure 4. Safe operating area for TO-220FP, I<sup>2</sup>PAKFP

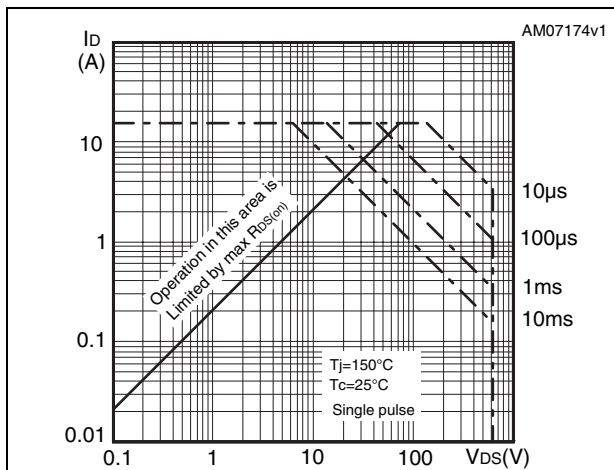


Figure 5. Thermal impedance for TO-220FP, I<sup>2</sup>PAKFP

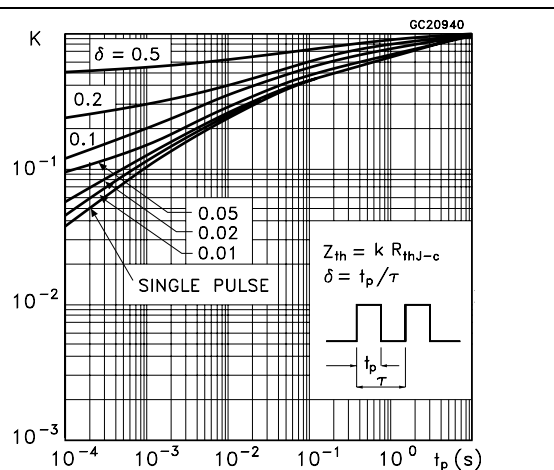


Figure 6. Safe operating area for IPAK

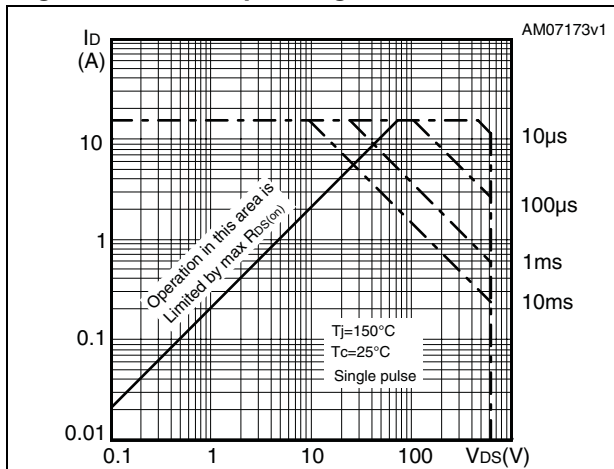


Figure 7. Thermal impedance for IPAK

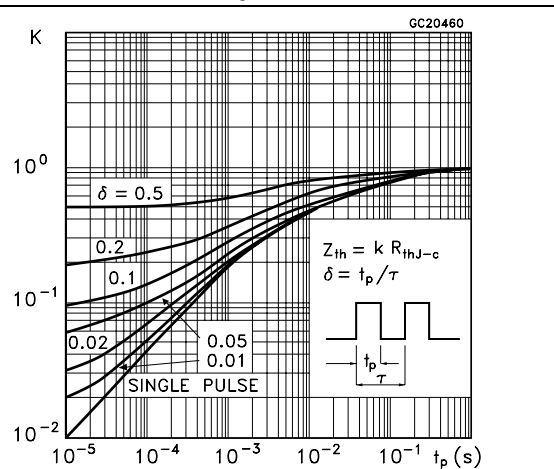


Figure 8. Output characteristics

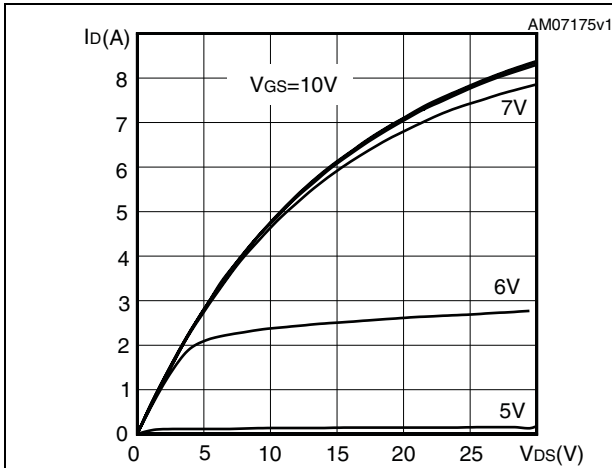


Figure 9. Transfer characteristics

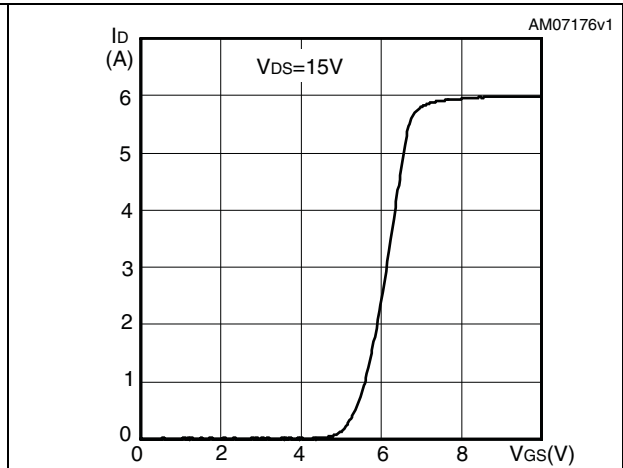


Figure 10. Gate charge vs gate-source voltage

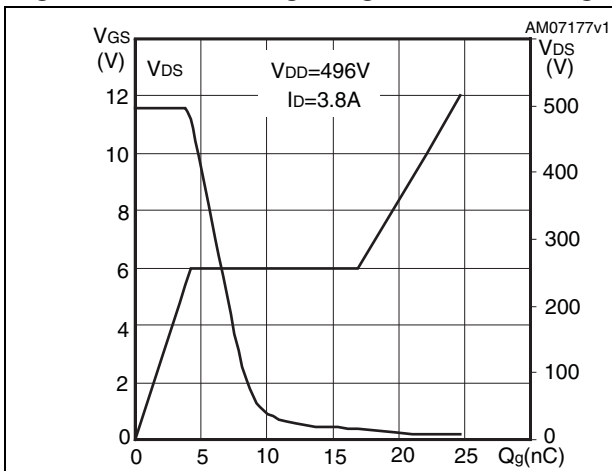


Figure 11. Static drain-source on resistance

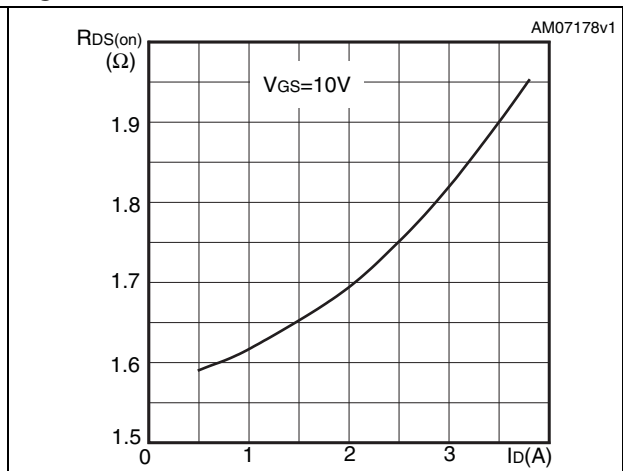


Figure 12. Capacitance variations

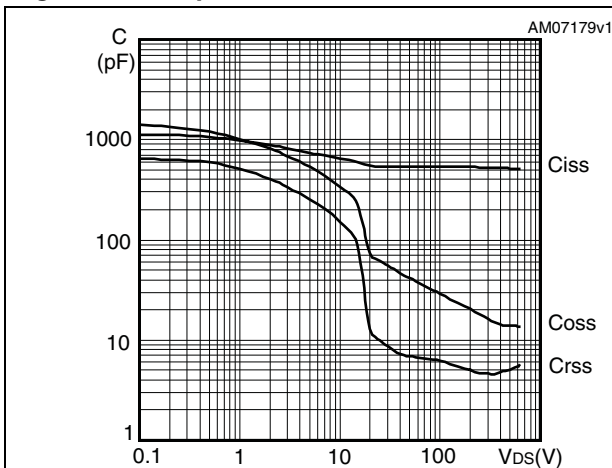


Figure 13. Output capacitance stored energy

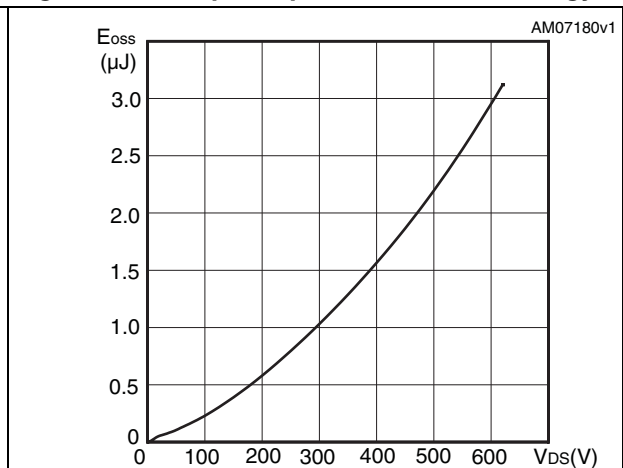


Figure 14. Normalized gate threshold voltage vs temperature

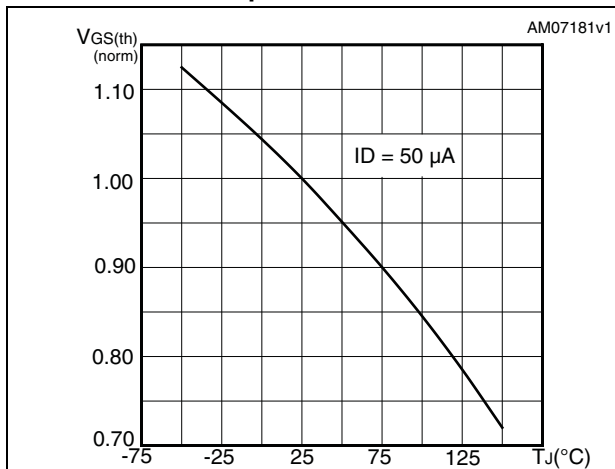


Figure 15. Normalized on resistance vs temperature

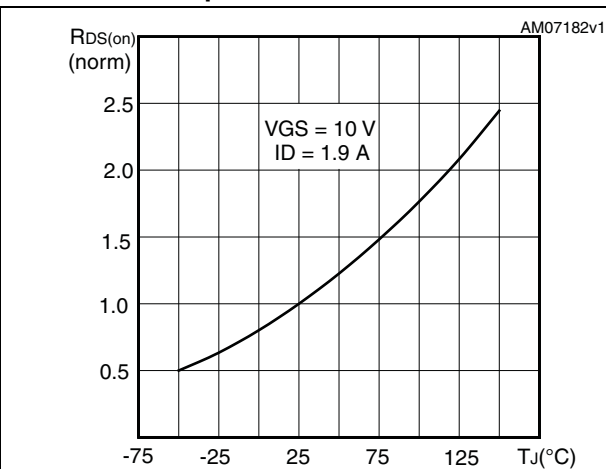


Figure 16. Maximum avalanche energy vs starting Tj

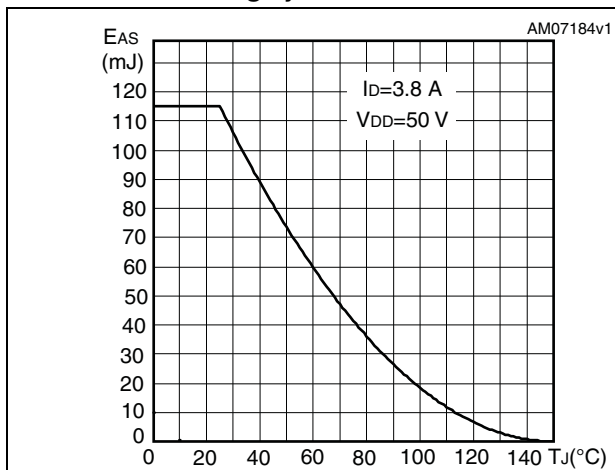


Figure 17. Normalized B<sub>VDSS</sub> vs temperature

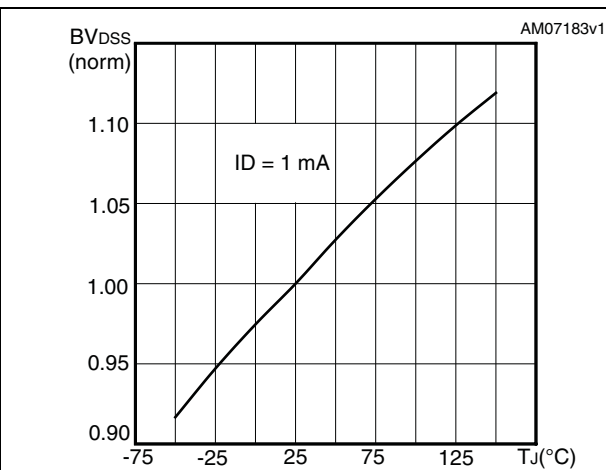
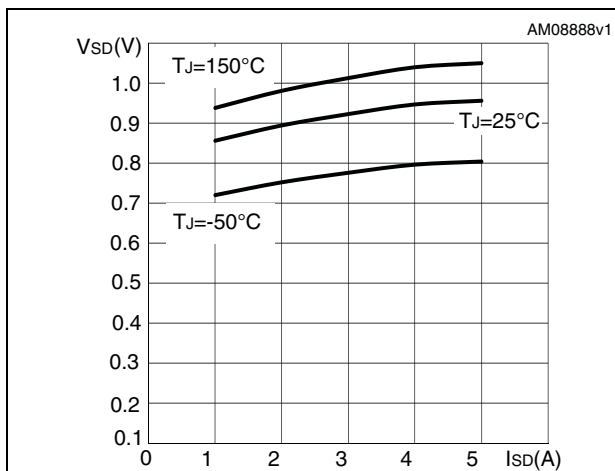
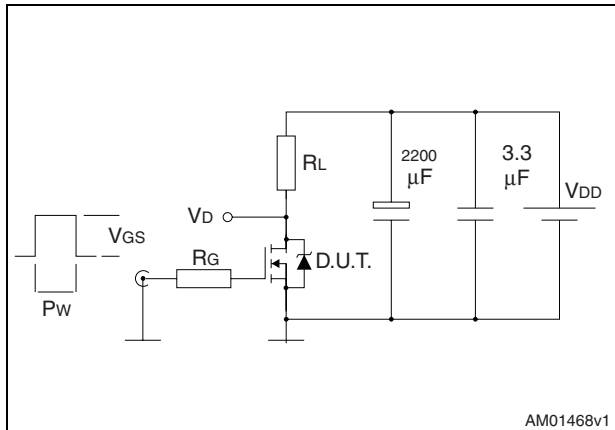


Figure 18. Source-drain diode forward characteristics



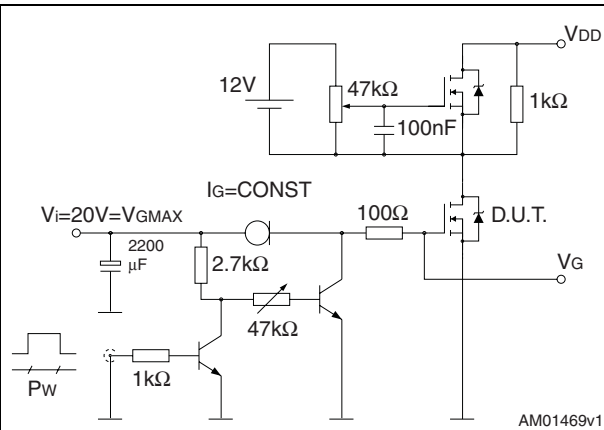
### 3 Test circuits

**Figure 19. Switching times test circuit for resistive load**



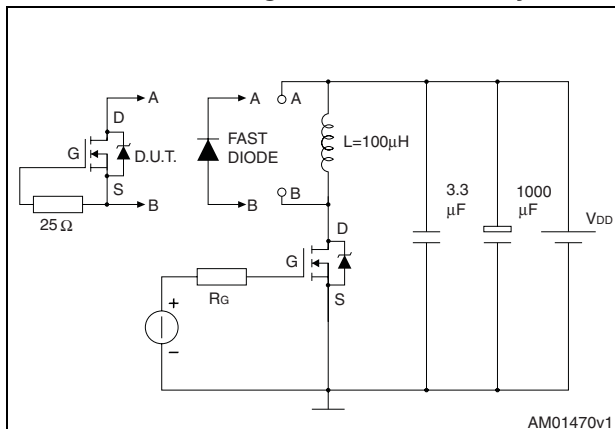
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**Figure 20. Gate charge test circuit**



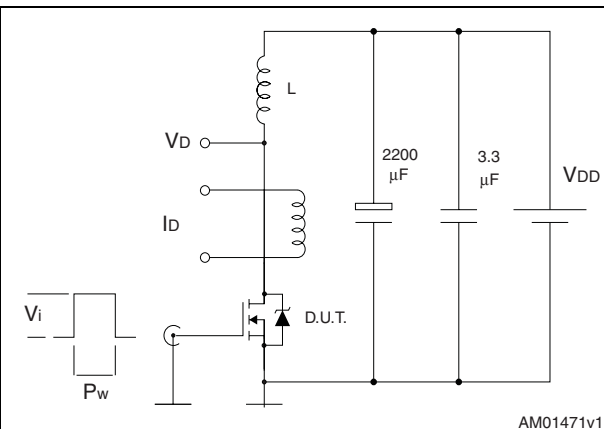
AM01469v1

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



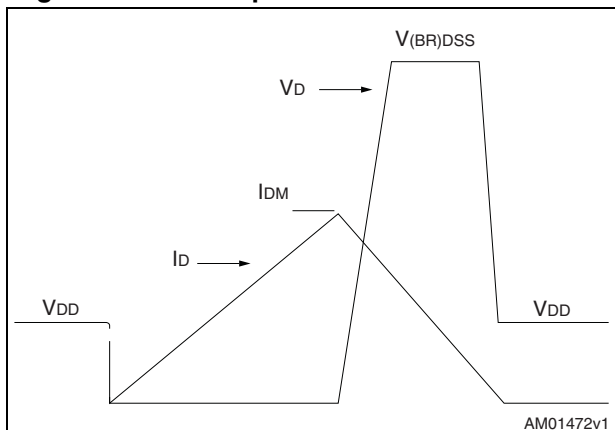
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**Figure 22. Unclamped inductive load test circuit**



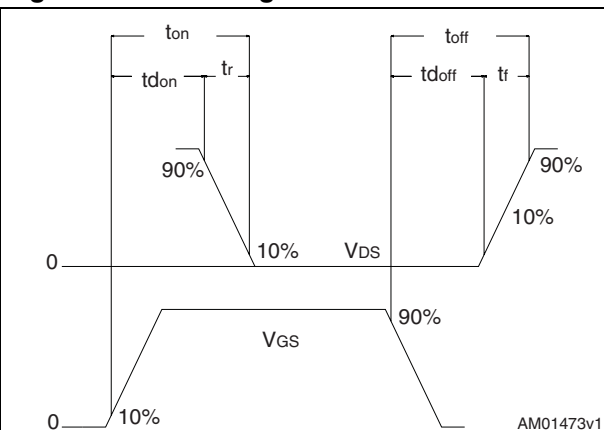
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**Figure 23. Unclamped inductive waveform**



AM01472v1

**Figure 24. Switching time waveform**



AM01473v1

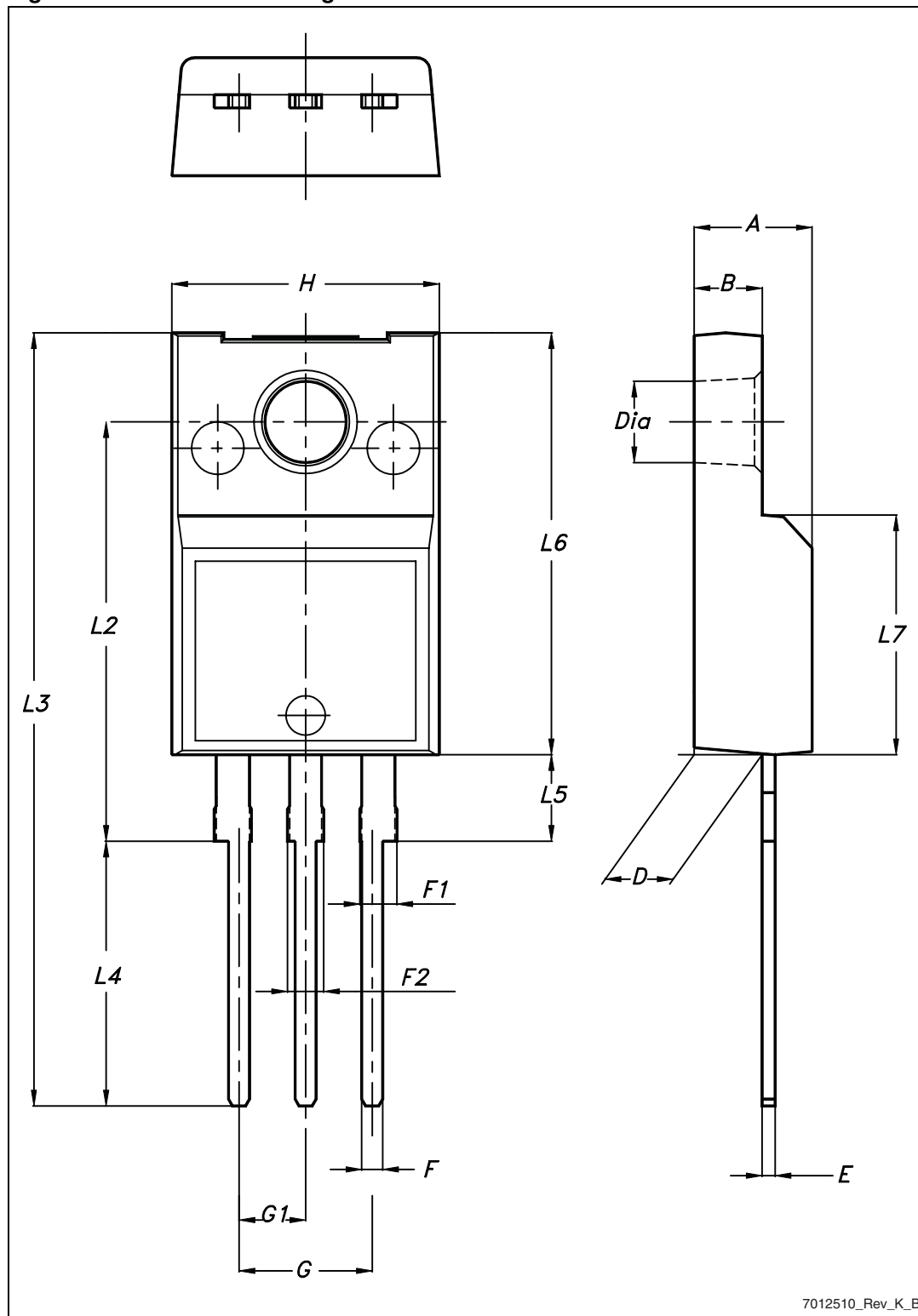
## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://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



7012510\_Rev\_K\_B

Table 10. I<sup>2</sup>PAKFP (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. I<sup>2</sup>PAKFP (TO-281) drawing

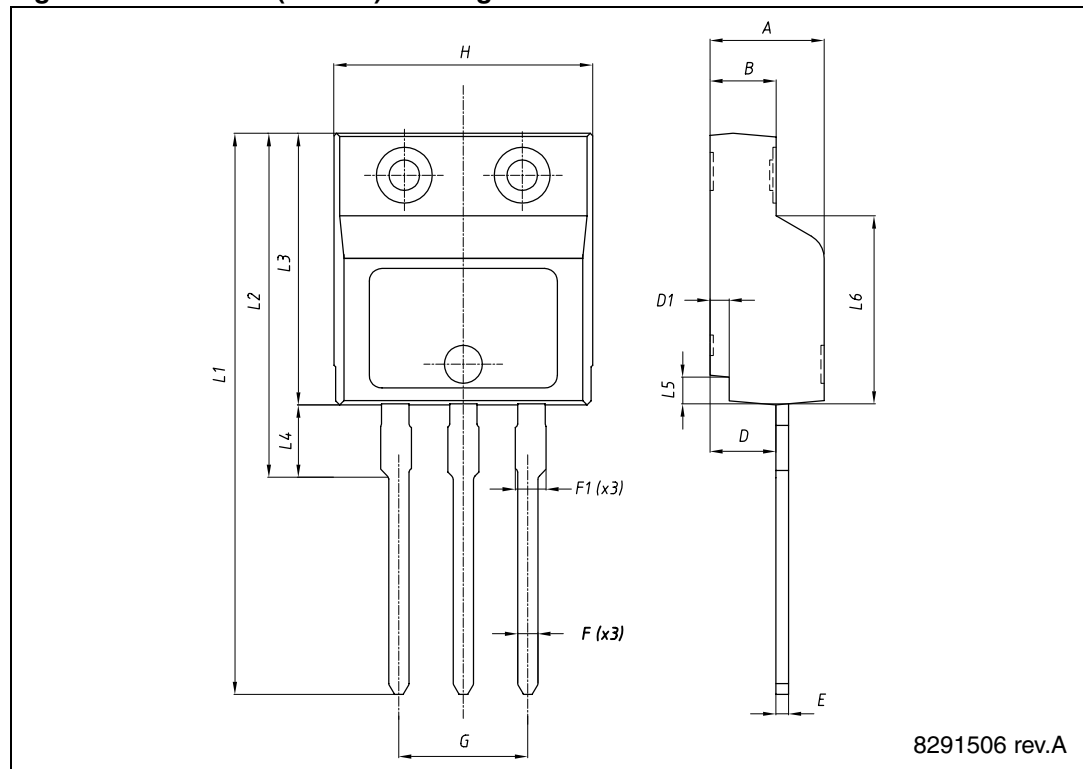
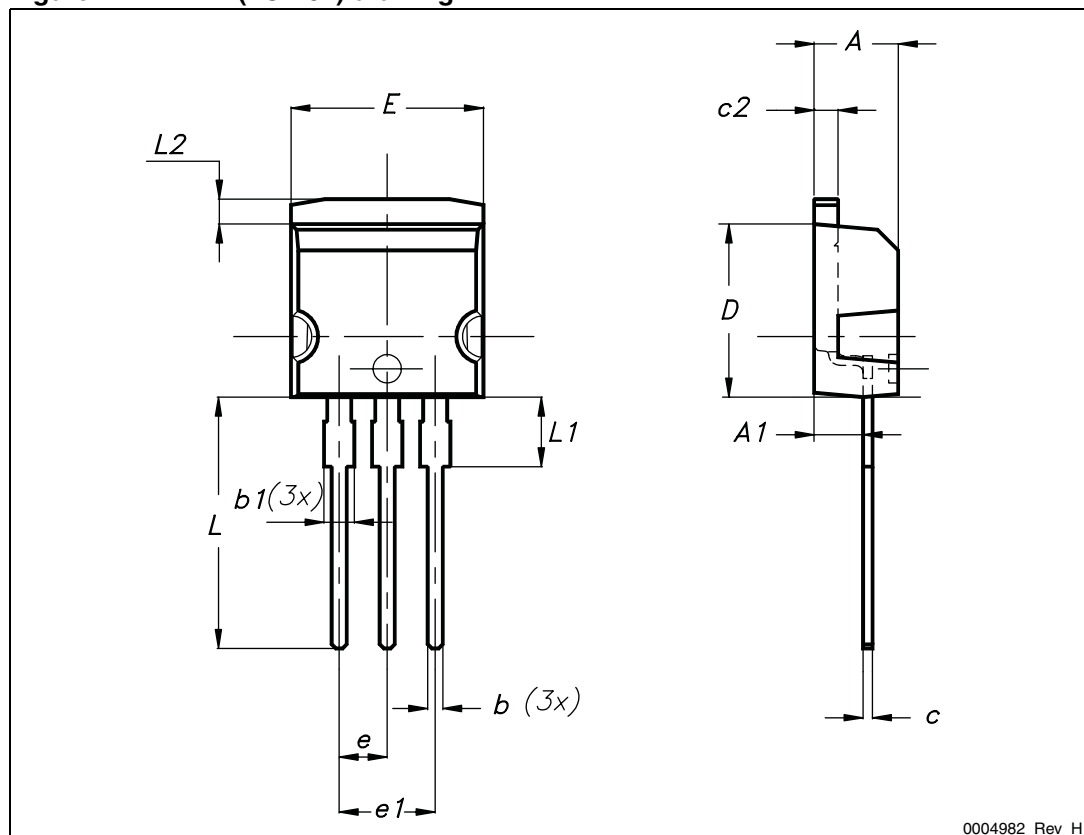


Table 11. I<sup>2</sup>PAK (TO-262) mechanical data

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. I<sup>2</sup>PAK (TO-262) drawing

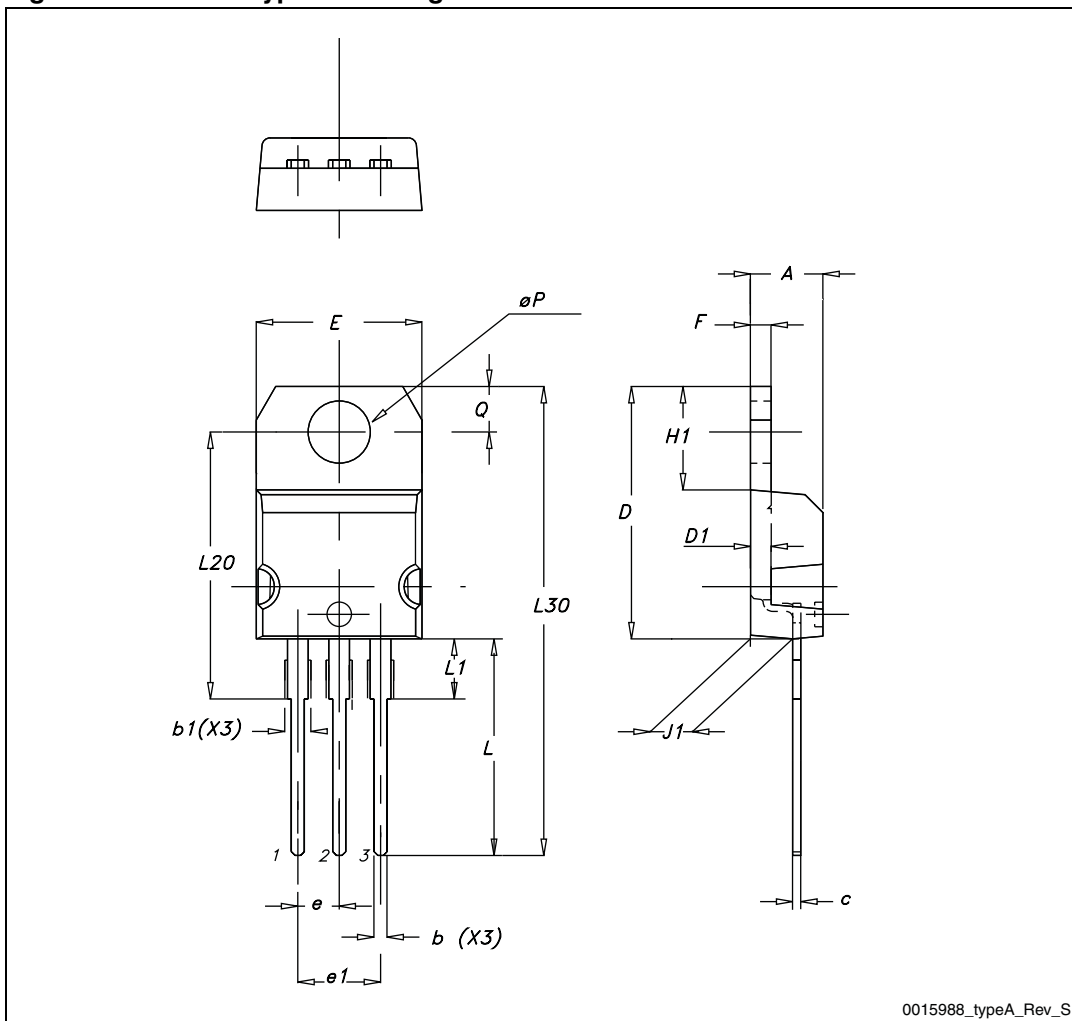


0004982\_Rev\_H

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 28. TO-220 type A drawing

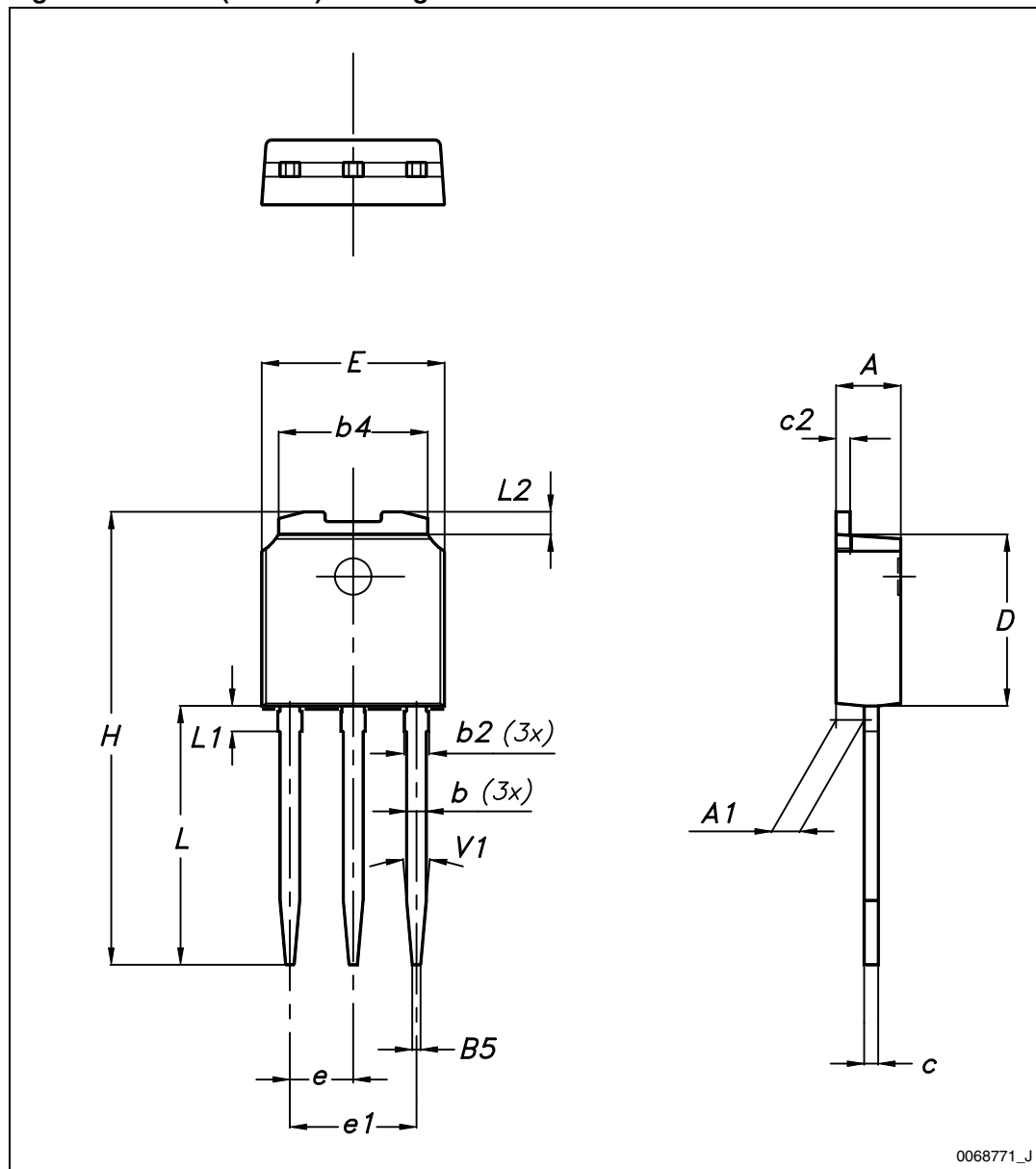


0015988\_typeA\_Rev\_S

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°	

Figure 29. IPAK (TO-251) drawing



0068771\_J

## 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 <a href="#">Table 5</a> . Updated <a href="#">Section 4: Package mechanical data</a> .
07-Aug-2012	4	Added package, mechanical data: I <sup>2</sup> PAKFP. Updated <a href="#">Table 1: Device summary</a> , <a href="#">Table 2: Absolute maximum ratings</a> , <a href="#">Table 3: Thermal data</a> , <a href="#">Table 4: On /off states</a> , <a href="#">Table 13: IPAK (TO-251) mechanical data</a> and <a href="#">Figure 29: IPAK (TO-251) drawing</a> Minor text changes.

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