

# N-channel 40 V, 5.8 mΩ typ., 80 A STripFET™ VI DeepGATE™ Power MOSFET in a IPAK package

Datasheet – production data

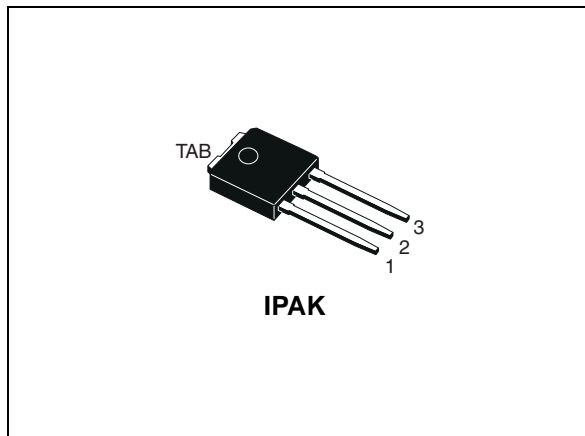
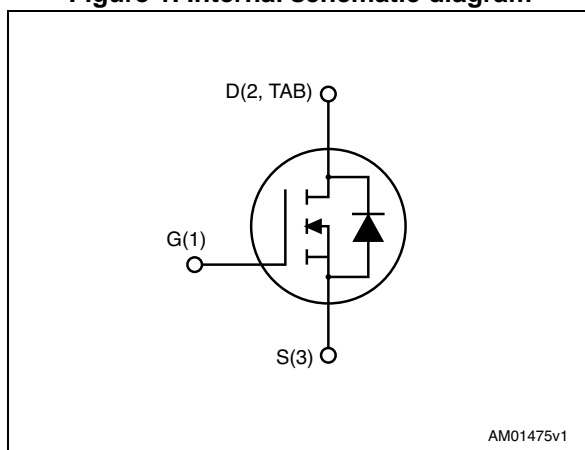


Figure 1. Internal schematic diagram



## Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STU80N4F6	40 V	6.3 mΩ	80 A

- Low gate charge
- Very low on-resistance
- High avalanche ruggedness

## Applications

- Switching applications

## Description

This device is an N-channel Power MOSFET developed using the 6<sup>th</sup> generation of STripFET™ DeepGATE™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest R<sub>DS(on)</sub> in all packages.

Table 1. Device summary

Order code	Marking	Package	Packaging
STU80N4F6	80N4F6	IPAK	Tube

## Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	40	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	80	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	56	A
$I_{DM}^{(2)}$	Drain current (pulsed)	320	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	70	W
$I_{AV}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_{Jmax}$ )	40	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$ , $I_D = I_{AV}$ , $V_{DD} = 25\text{ V}$ )	149	mJ
	Derating factor	0.47	W/ $^\circ\text{C}$
$T_{stg}$	Storage temperature	-55 to 175	$^\circ\text{C}$
$T_j$	Max. operating junction temperature		$^\circ\text{C}$

1. Current limited by package.
2. Pulse width limited by safe operating area

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	2.14	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	100	$^\circ\text{C}/\text{W}$

## 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	$I_D = 250\ \mu\text{A}$ , $V_{GS} = 0$	40			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 40\text{ V}$ $V_{DS} = 40\text{ V}$ , $T_C = 125\text{ °C}$			1 100	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$	2		4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$ , $I_D = 40\text{ A}$		5.8	6.3	m $\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$	-	2150	-	pF
$C_{oss}$	Output capacitance		-	335	-	pF
$C_{riss}$	Reverse transfer capacitance		-	160	-	pF
$Q_g$	Total gate charge	$V_{DD} = 20\text{ V}$ , $I_D = 80\text{ A}$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 14</a> )	-	36	-	nC
$Q_{gs}$	Gate-source charge		-	11	-	nC
$Q_{gd}$	Gate-drain charge		-	9	-	nC

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 20\text{ V}$ , $I_D = 40\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 15</a> )	-	10.5	-	ns
$t_r$	Rise time		-	7.6	-	ns
$t_{d(off)}$	Turn-off delay time		-	46.1	-	ns
$t_f$	Fall time		-	11.9	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		80	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		320	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 40\text{ A}$ , $V_{GS} = 0$	-		1.3	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 80\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 32\text{ V}$ (see <a href="#">Figure 17</a> )	-	41.1		ns
$Q_{rr}$	Reverse recovery charge		-	43.6		nC
$I_{RRM}$	Reverse recovery current		-	2.1		A

1. Pulse width limited by safe operating area.
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

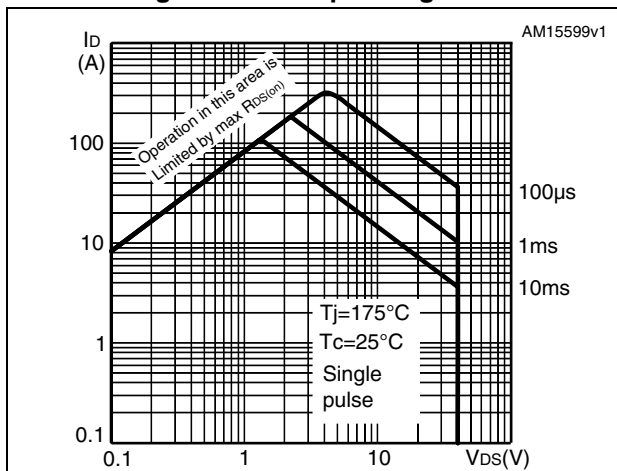


Figure 3. Thermal impedance

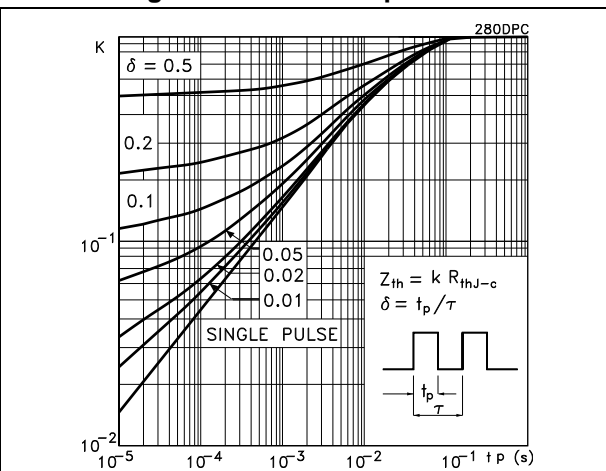


Figure 4. Output characteristics

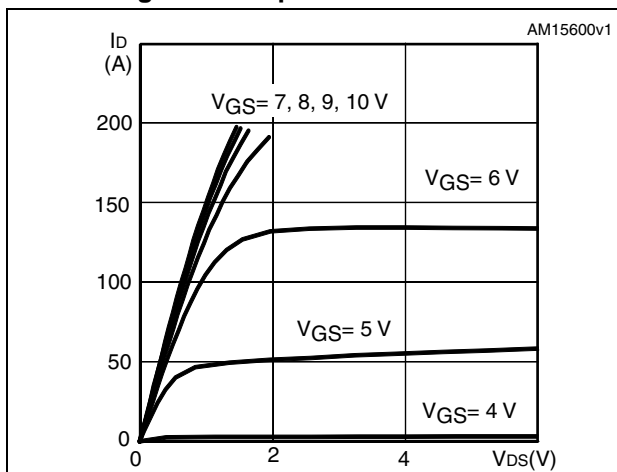


Figure 5. Transfer characteristics

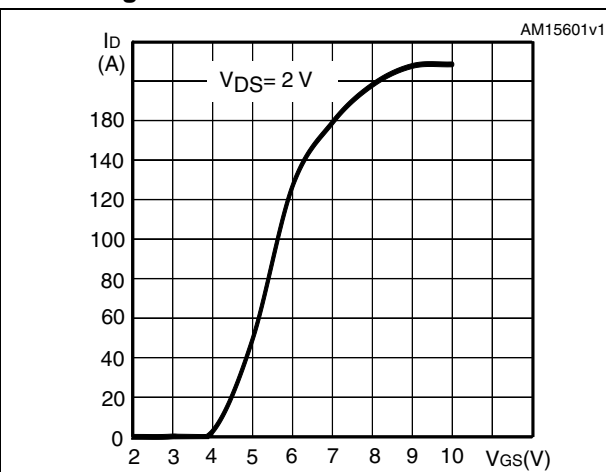


Figure 6. Gate charge vs gate-source voltage

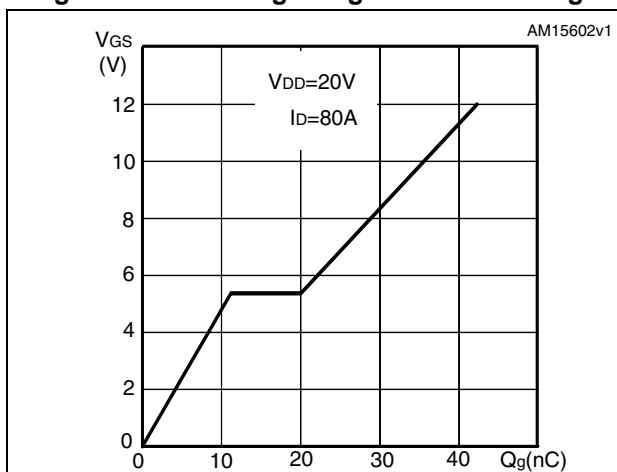


Figure 7. Static drain-source on-resistance

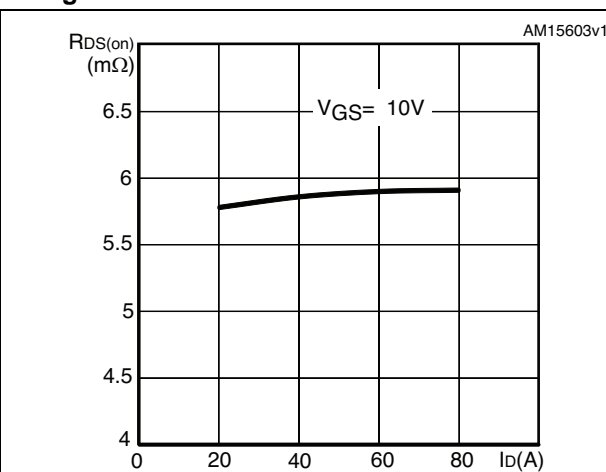


Figure 8. Capacitance variations

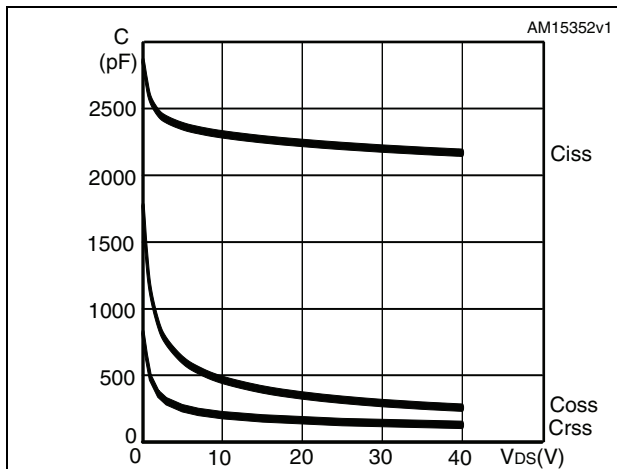


Figure 9. Drain-source diode forward characteristics

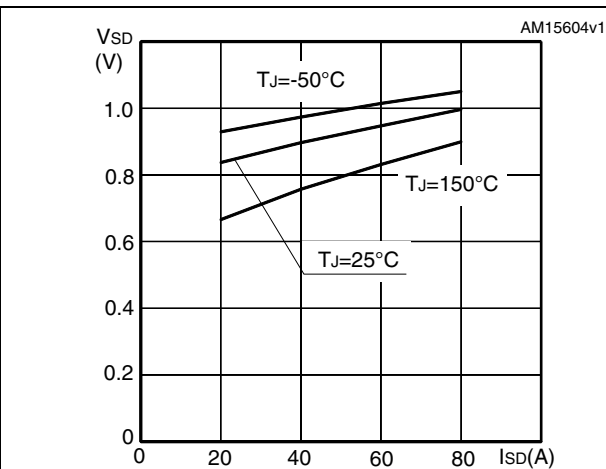


Figure 10. Normalized gate threshold voltage vs temperature

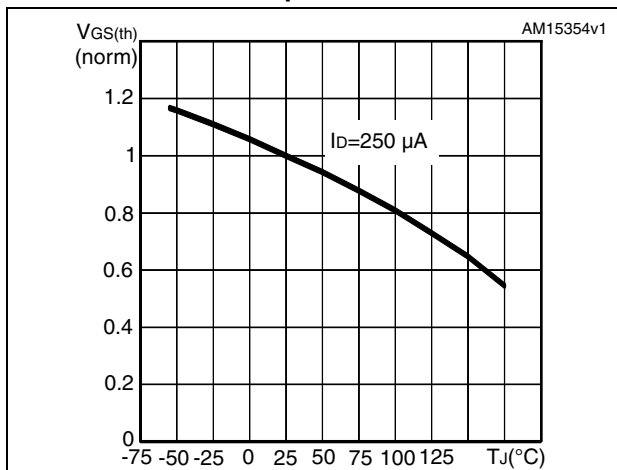


Figure 11. Normalized on-resistance vs temperature

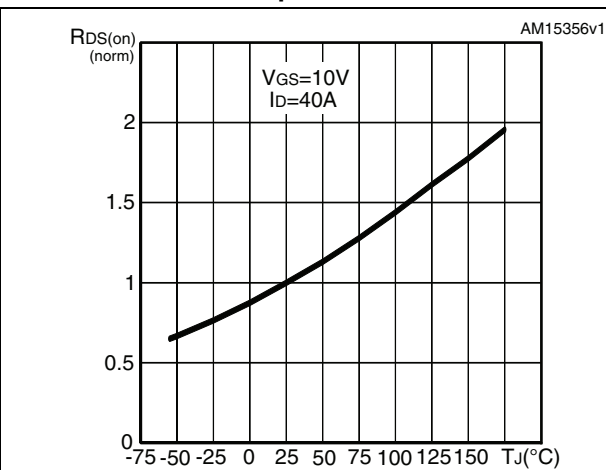
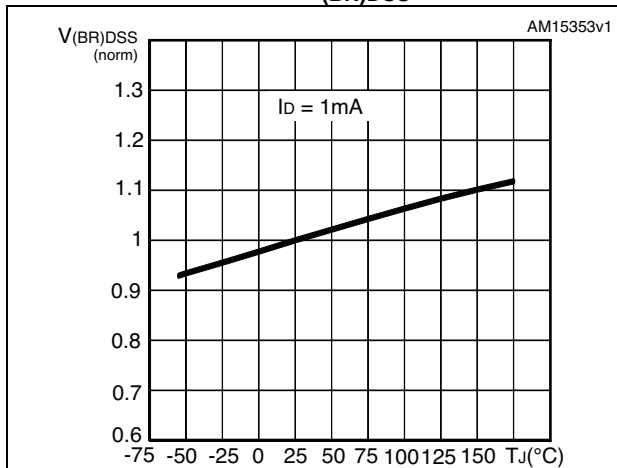


Figure 12. Normalized V(BR)DSS vs temperature



### 3 Test circuits

Figure 13. Switching times test circuit for resistive load



AM01468v1

Figure 14. Gate charge test circuit



AM01469v1

Figure 15. Test circuit for inductive load switching and diode recovery times



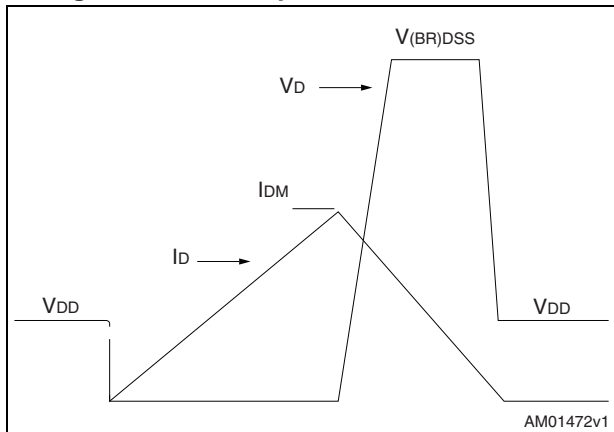
AM01470v1

Figure 16. Unclamped inductive load test circuit



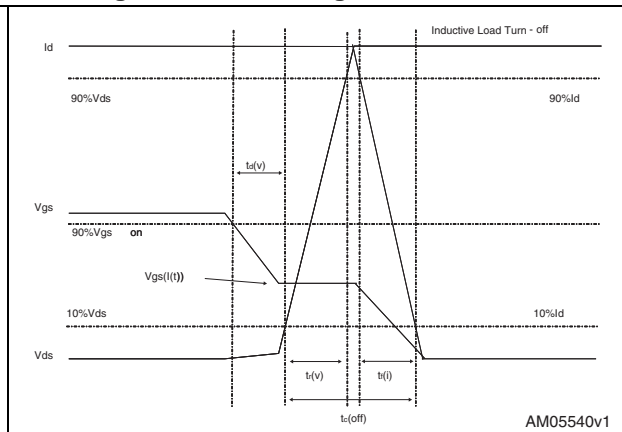
AM01471v1

Figure 17. Unclamped inductive waveform



AM01472v1

Figure 18. Switching time waveform



AM05540v1



## 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.

Figure 19. IPAK (TO-251) drawing

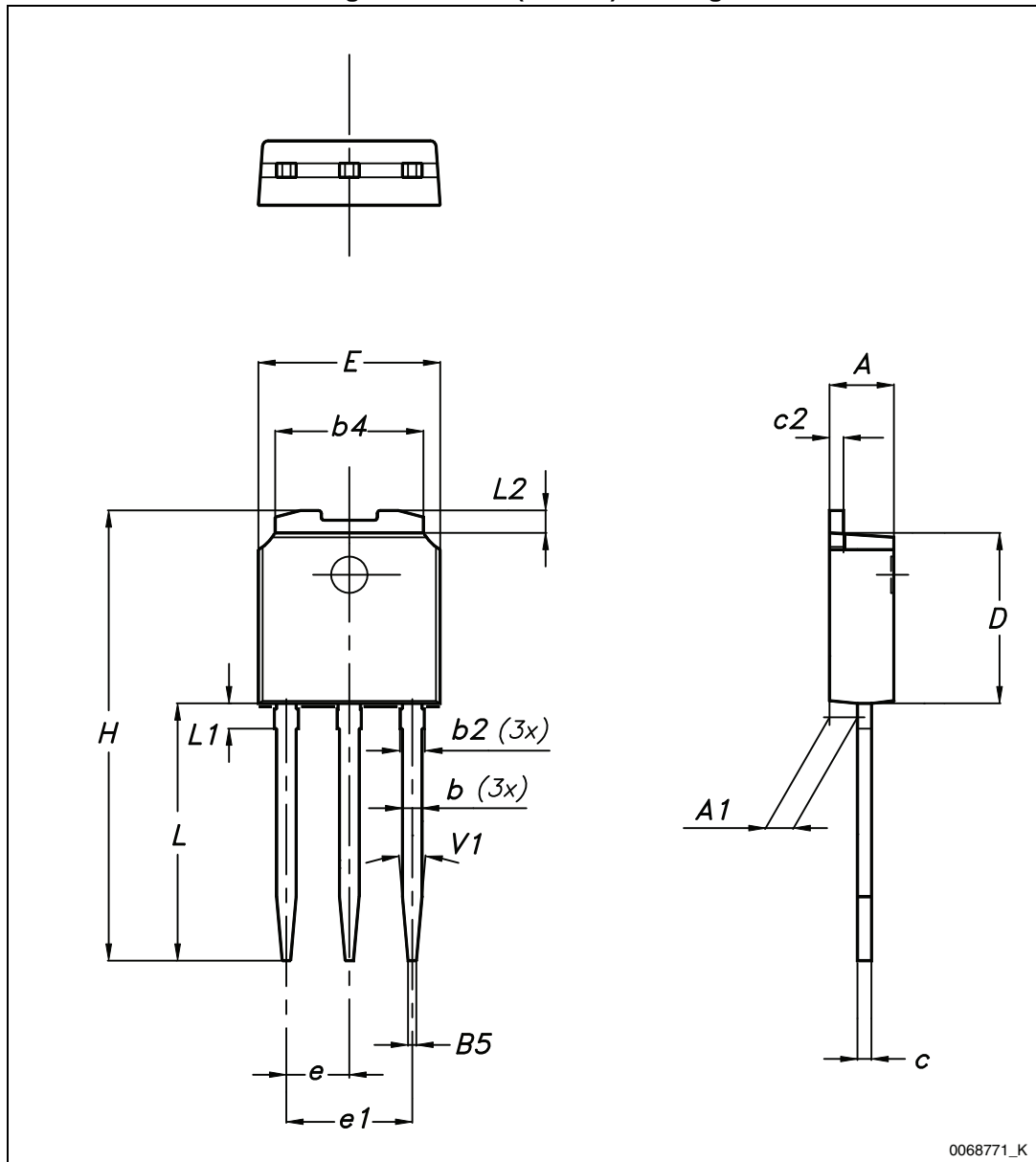


Table 8. IPAK (TO-251) mechanical data

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°	

## 5 Revision history

**Table 9. Document revision history**

Date	Revision	Changes
26-Oct-2012	1	Initial release.
01-Mar-2013	2	<ul style="list-style-type: none"><li>– Added: IPAK package</li><li>– The part number STI80N4F6 has been moved to a separate datasheet</li><li>– Added: <a href="#">Figure 2, 3, 4, 5, 6, 7 and 9</a></li></ul>
05-Mar-2013	3	<ul style="list-style-type: none"><li>– Minor text changes</li><li>– Modified: <a href="#">Table 3</a></li></ul>
28-Feb-2014	4	<ul style="list-style-type: none"><li>– The part number STD80N4F6 has been moved to a separate datasheet</li><li>– Minor text changes</li></ul>

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