



# STI300N4F6

N-channel 40 V, 1.7 mΩ typ., 160 A, STripFET™ VI DeepGATE™ Power MOSFET in a I<sup>2</sup>PAK package

Datasheet — production data

## Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STI300N4F6	40 V	2.2 mΩ	160 A <sup>(1)</sup>

1. Limited by wire bonding

- Standard level V<sub>GS(th)</sub>
- 100% avalanche rated

## Applications

- Automotive 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.

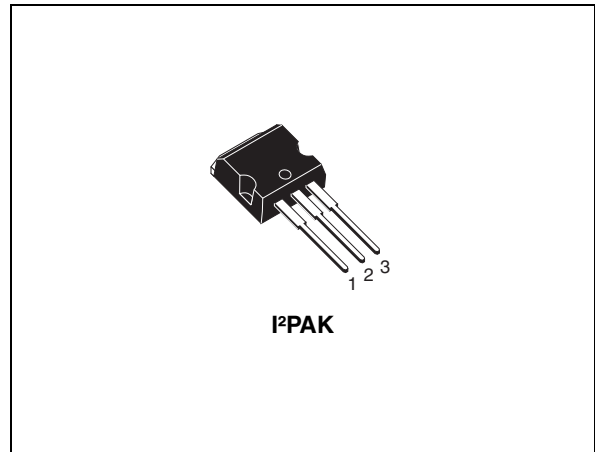


Figure 1. Internal schematic diagram

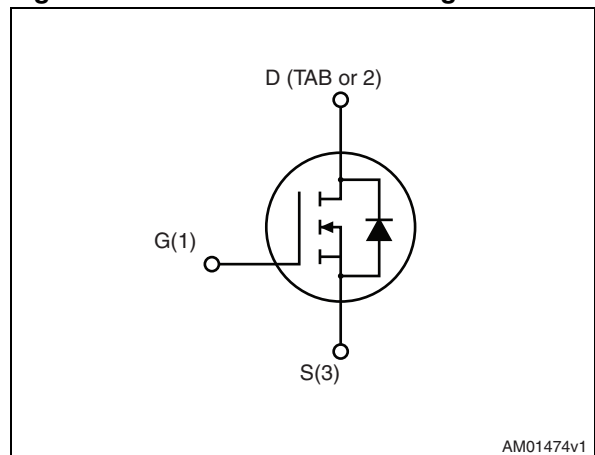


Table 1. Device summary

Order code	Marking	Package	Packaging
STI300N4F6	300N4F6	I <sup>2</sup> PAK	Tube

## Contents

<b>1</b>	<b>Electrical ratings</b> .....	<b>3</b>
<b>2</b>	<b>Electrical characteristics</b> .....	<b>4</b>
	2.1 Electrical characteristics (curves) .....	6
<b>3</b>	<b>Test circuits</b> .....	<b>8</b>
<b>4</b>	<b>Package mechanical data</b> .....	<b>9</b>
<b>5</b>	<b>Revision history</b> .....	<b>12</b>

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	40	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	160	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	160	A
$I_{DM}^{(2)}$	Drain current (pulsed)	640	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	300	W
$I_{AV}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_{j\text{max}}$ )	160	A
$E_{AS}$	Single pulse avalanche energy (starting $T_J=25\text{ }^\circ\text{C}$ , $I_D=I_{AV}$ , $V_{DD}=35\text{ V}$ )	1100	mJ
$T_{stg}$	Storage temperature	- 55 to 175	$^\circ\text{C}$
$T_j$	Operating junction temperature		

1. Limited by wire bonding

2. Pulse width limited by safe operating area

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj\text{-case}}$	Thermal resistance junction-case max	0.5	$^\circ\text{C/W}$
$R_{thj\text{-amb}}$	Thermal resistance junction-ambient max	62.5	

## 2 Electrical characteristics

( $T_J = 25\text{ °C}$  unless otherwise specified)

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage ( $V_{GS}=0$ )	$I_D = 250\ \mu\text{A}$	40			V
$I_{DSS}$	Zero gate voltage drain current	$V_{DS} = 40\ \text{V}$ , $V_{DS} = 40\ \text{V}$ , $T_C = 125\text{ °C}$			1 100	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-source leakage current	$V_{GS} = \pm 20\ \text{V}$ , $V_{DS} = 0$			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	$V_{GS} = 10\ \text{V}$ , $I_D = 80\ \text{A}$		1.7	2.2	m $\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25\ \text{V}$ , $f = 1\ \text{MHz}$ , $V_{GS} = 0$	-	13800	-	nF
$C_{oss}$	Output capacitance			1870		nF
$C_{rss}$	Reverse transfer capacitance			1095		nF
$Q_g$	Total gate charge	$V_{DD} = 20\ \text{V}$ , $I_D = 160\ \text{A}$	-	240	-	nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 10\ \text{V}$		59		nC
$Q_{gd}$	Gate-drain charge	(see <a href="#">Figure 14</a> )		75.2		nC

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 20\ \text{V}$ , $I_D = 80\ \text{A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\ \text{V}$ (see <a href="#">Figure 13</a> )	-	28	-	ns
$t_r$	Rise time			98		ns
$t_{d(off)}$	Turn-off delay time			190		ns
$t_f$	Fall time			95		ns

**Table 7. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$I_{SD}$	Source-drain current		-	-	160	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-	-	640	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 160 \text{ A}, V_{GS} = 0$	-		1.1	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 160 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s},$ $V_{DD} = 32 \text{ V}, T_J = 25 \text{ }^\circ\text{C}$ (see <a href="#">Figure 15</a> )	-	58.7		ns
$Q_{rr}$	Reverse recovery charge			99.2		nC
$I_{RRM}$	Reverse recovery current			3.38		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

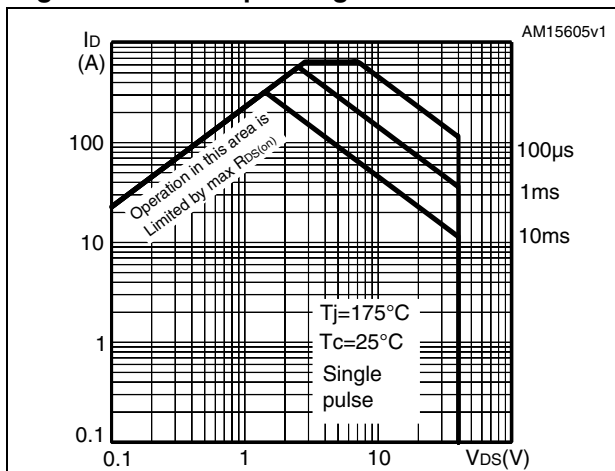


Figure 3. Thermal impedance

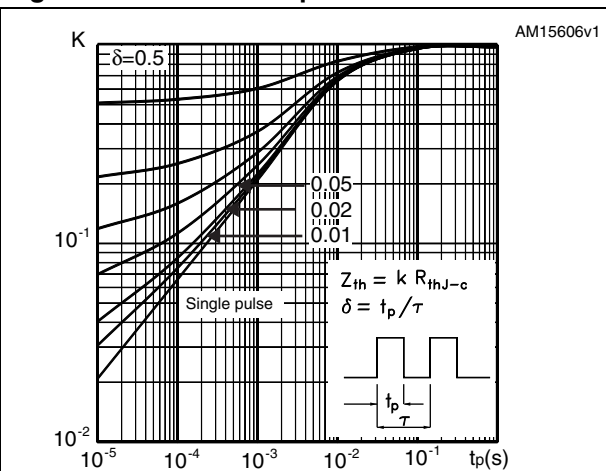


Figure 4. Output characteristics

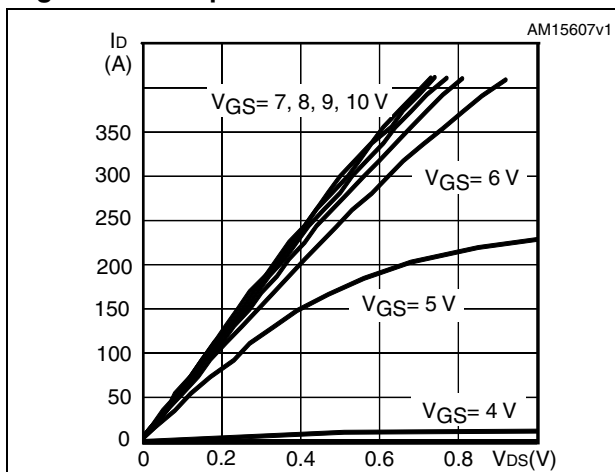


Figure 5. Transfer characteristics

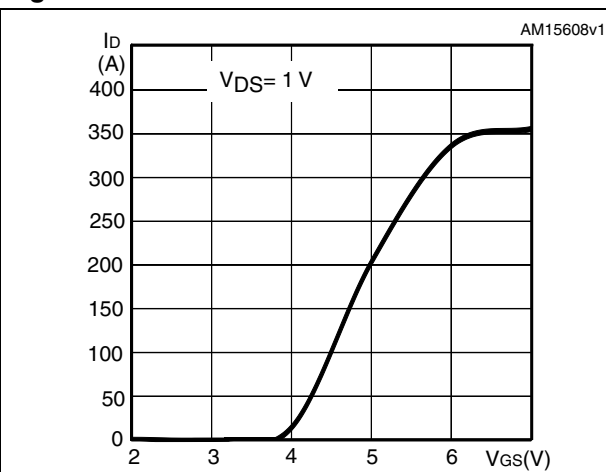


Figure 6. Gate charge vs gate-source voltage

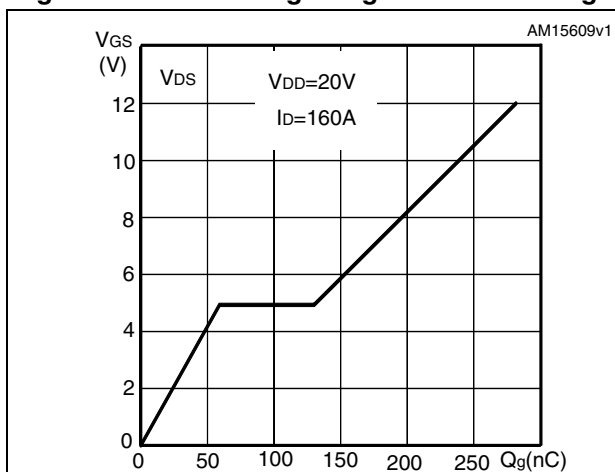


Figure 7. Static drain-source on-resistance

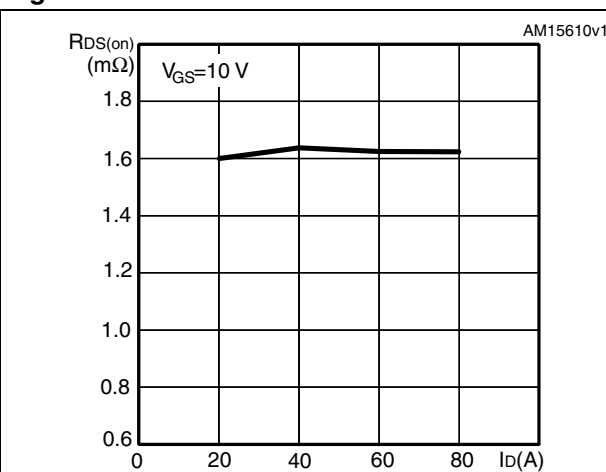


Figure 8. Capacitance variations

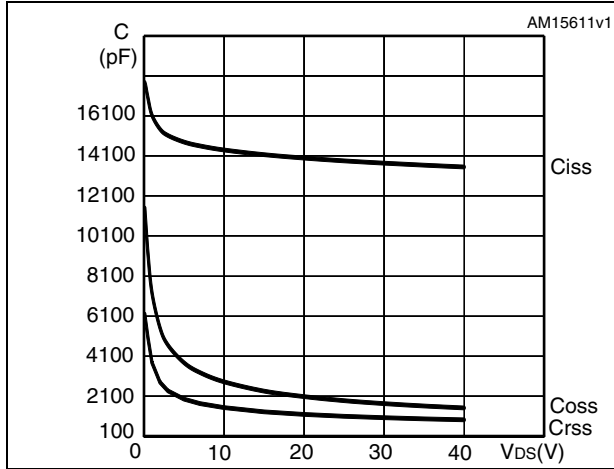


Figure 9. Drain-source diode forward characteristics

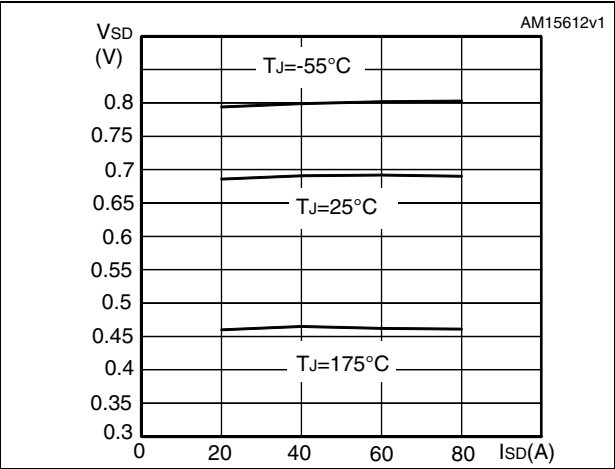


Figure 10. Normalized gate threshold voltage vs temperature

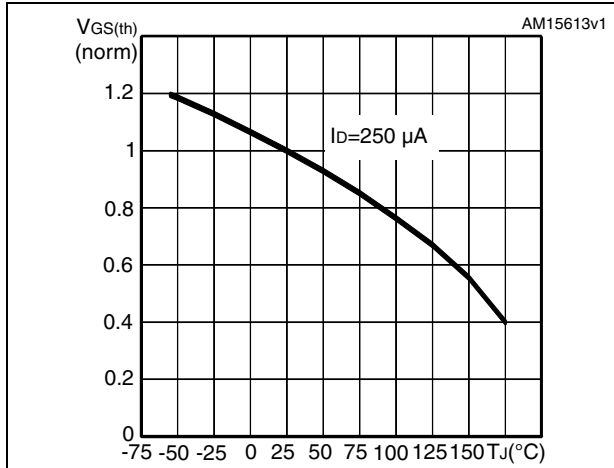


Figure 11. Normalized on-resistance vs temperature

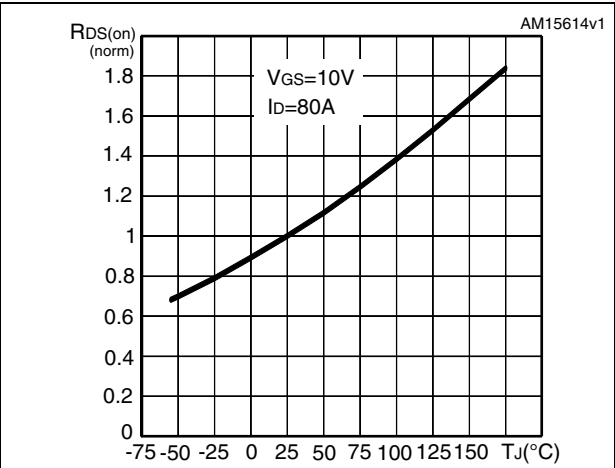
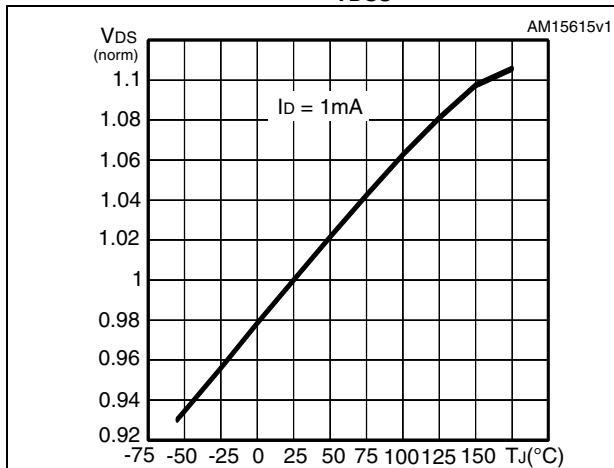
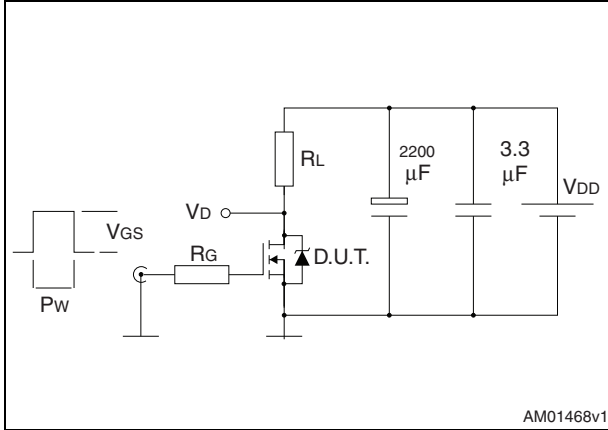


Figure 12. Normalized BVDS vs temperature



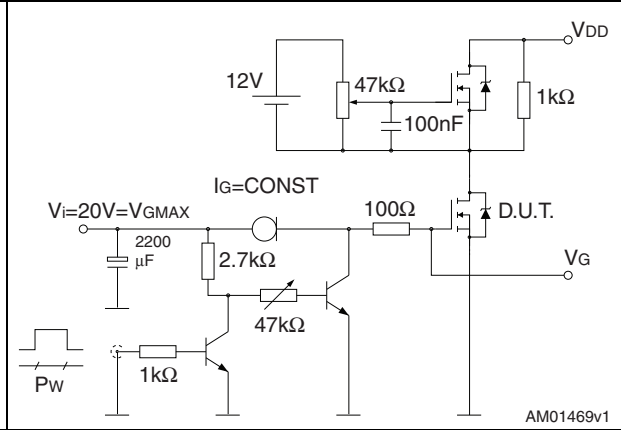
### 3 Test circuits

**Figure 13. Switching times test circuit for resistive load**



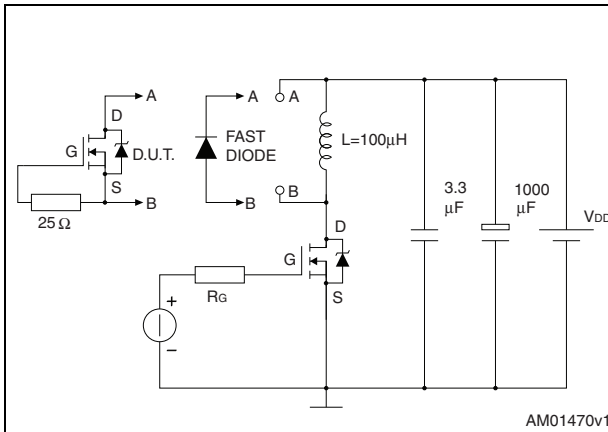
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**Figure 14. Gate charge test circuit**



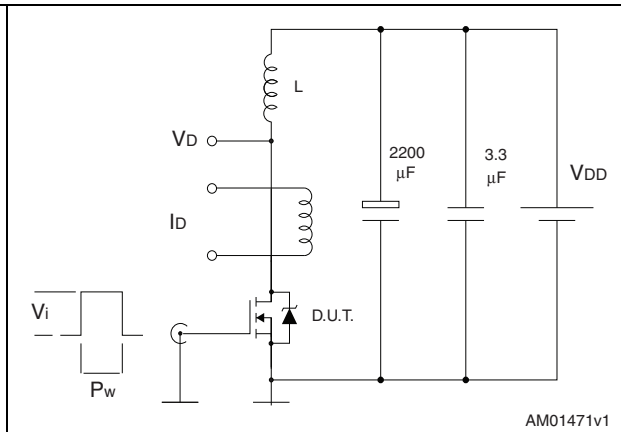
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**Figure 15. Test circuit for inductive load switching and diode recovery times**



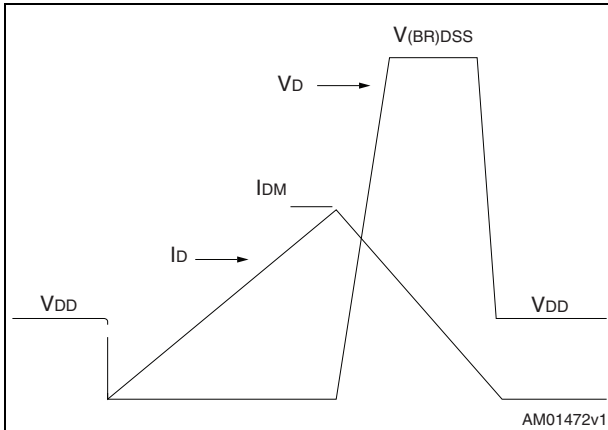
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**Figure 16. Unclamped inductive load test circuit**



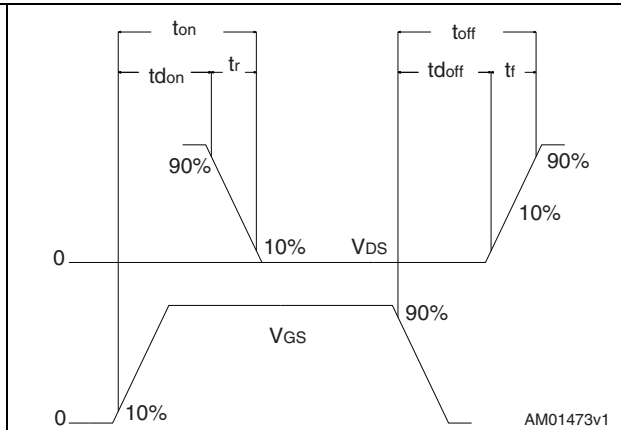
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**Figure 17. Unclamped inductive waveform**



AM01472v1

**Figure 18. Switching time waveform**



AM01473v1



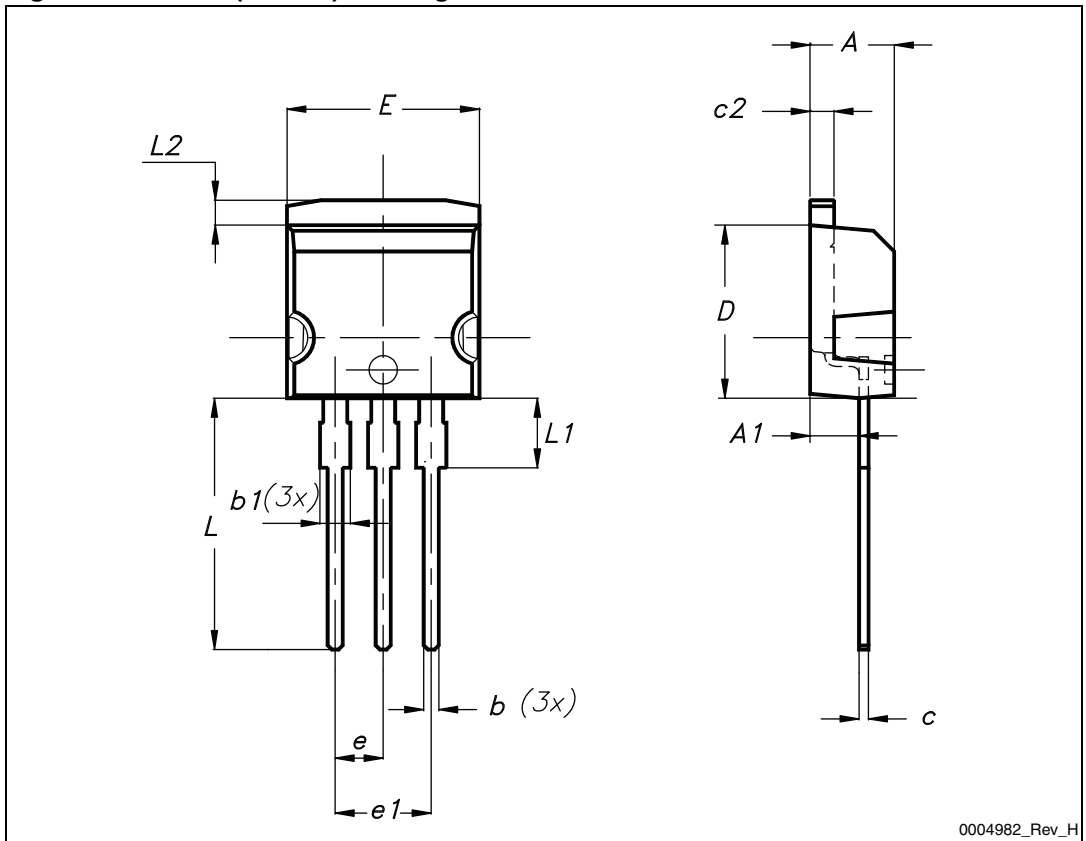
## 4 Package mechanical data

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<sup>®</sup> is an ST trademark.

Table 8. 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 19. I<sup>2</sup>PAK (TO-262) drawing



0004982\_Rev\_H

## 5 Revision history

**Table 9. Document revision history**

Date	Revision	Changes
05-Oct-2010	1	First release
01-Feb-2013	2	– Added: <a href="#">Section 2.1: Electrical characteristics (curves)</a> – Minor text changes – Updated: <a href="#">Section 4: Package mechanical data</a>

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