



STI300N4F6

N-channel 40 V, 1.7 mΩ typ., 160 A, STripFET™ VI DeepGATE™ Power MOSFET in a I²PAK package

Datasheet — production data

Features

Order code	V _{DS}	R _{DS(on)} max	I _D
STI300N4F6	40 V	2.2 mΩ	160 A ⁽¹⁾

1. Limited by wire bonding

- Standard level V_{GS(th)}
- 100% avalanche rated

Applications

- Automotive switching applications

Description

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

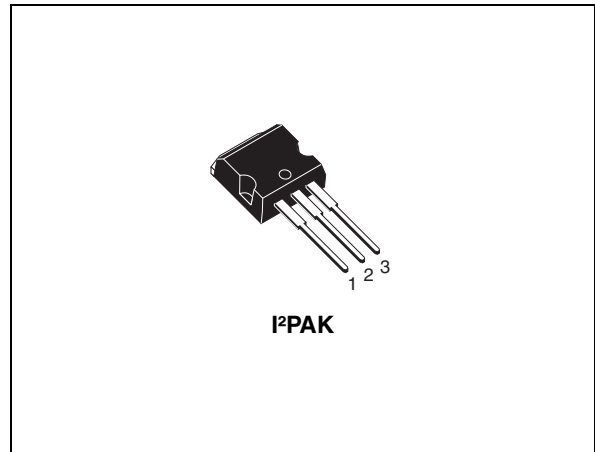


Figure 1. Internal schematic diagram

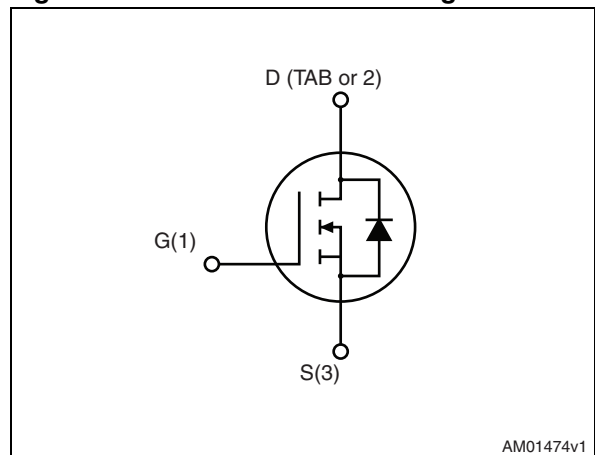


Table 1. Device summary

Order code	Marking	Package	Packaging
STI300N4F6	300N4F6	I ² PAK	Tube

Contents

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

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	± 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 ($V_{GS}=0$)	$I_D = 250\text{ }\mu\text{A}$	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	μA μA
I_{GSS}	Gate-source leakage current	$V_{GS} = \pm 20\text{ V}$, $V_{DS} = 0$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	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 Ω

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 Figure 14)		75.2		nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 20\text{ V}$, $I_D = 80\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 13)	-	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 Figure 15)	-	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 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

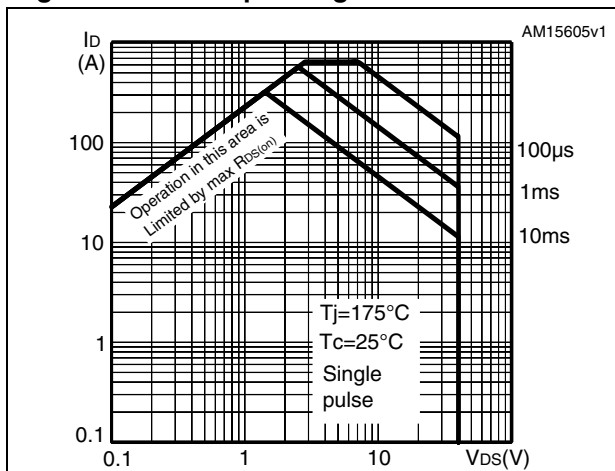


Figure 3. Thermal impedance

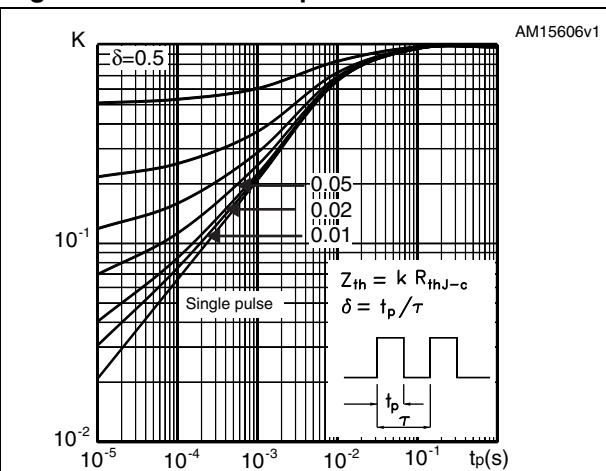


Figure 4. Output characteristics

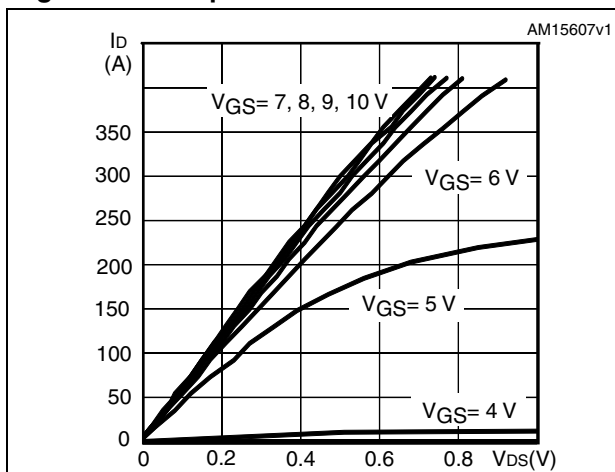


Figure 5. Transfer characteristics

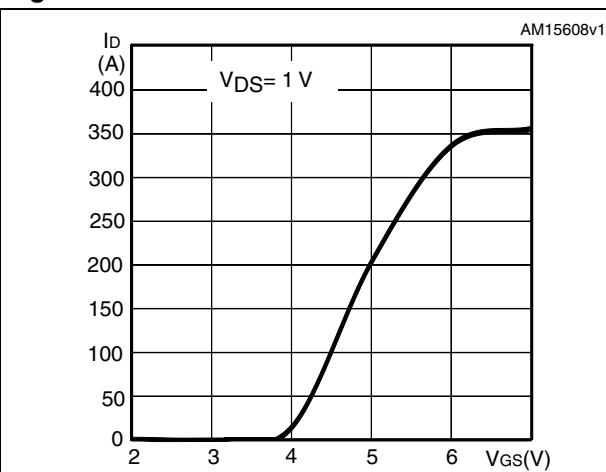


Figure 6. Gate charge vs gate-source voltage

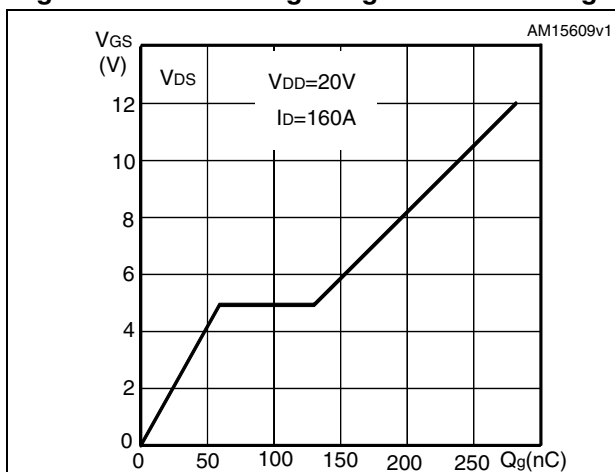


Figure 7. Static drain-source on-resistance

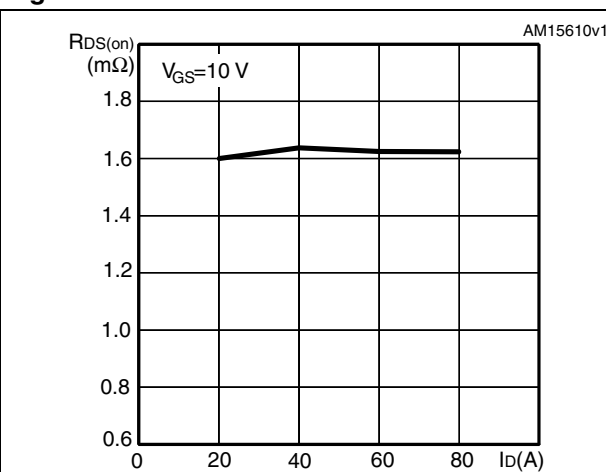


Figure 8. Capacitance variations

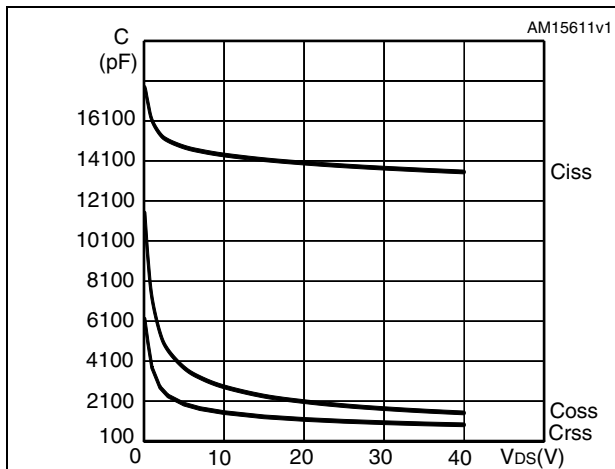


Figure 9. Drain-source diode forward characteristics

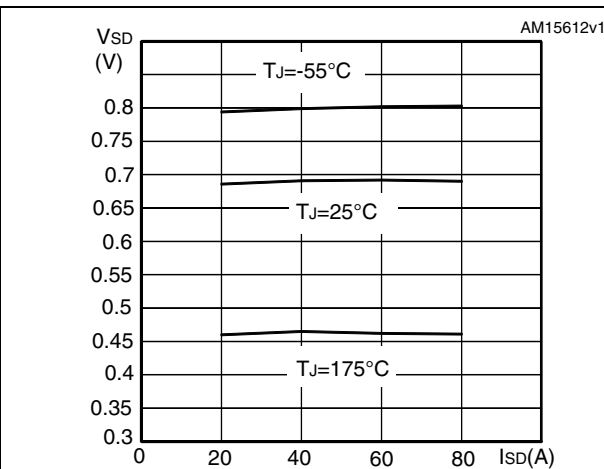


Figure 10. Normalized gate threshold voltage vs temperature

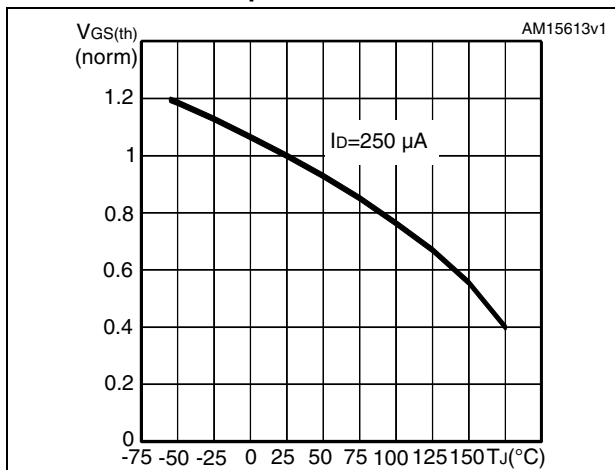


Figure 11. Normalized on-resistance vs temperature

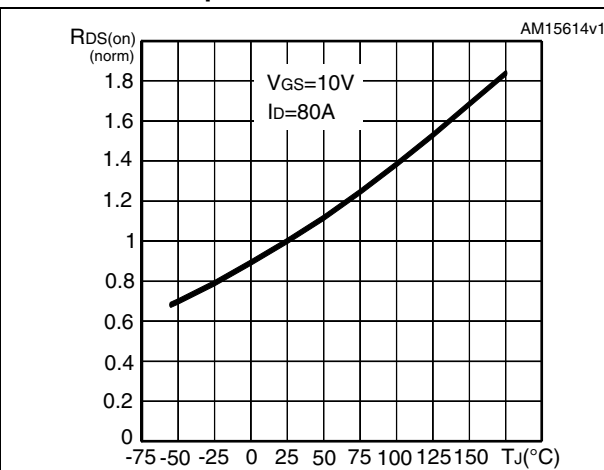
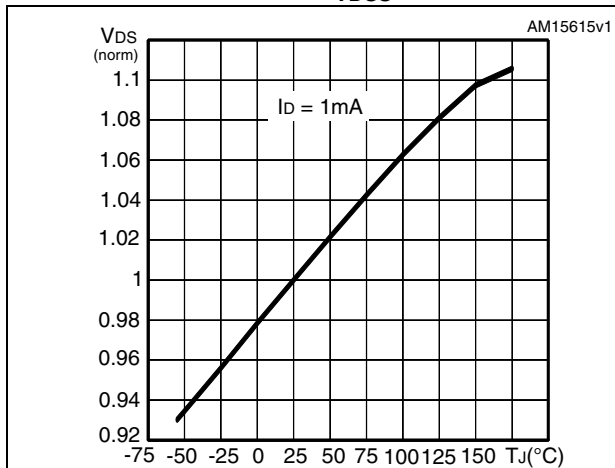
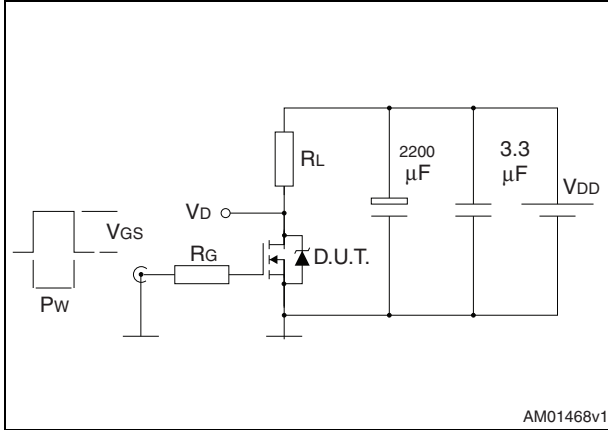


Figure 12. Normalized B_{VDS} vs temperature



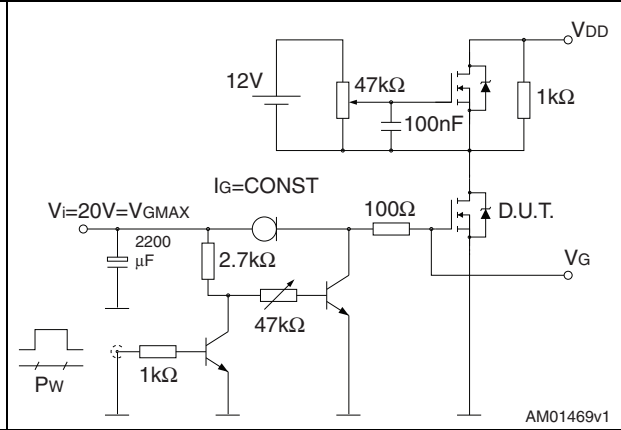
3 Test circuits

Figure 13. Switching times test circuit for resistive load



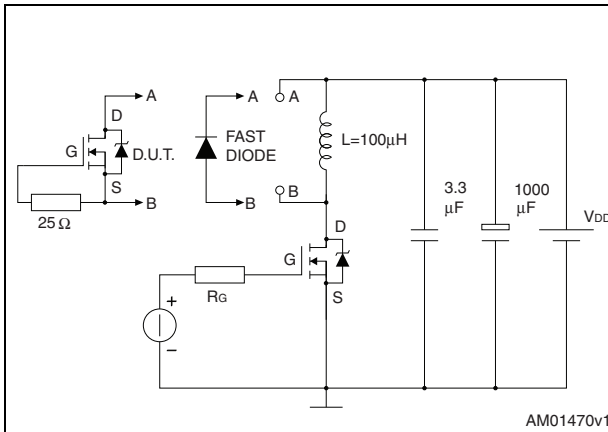
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Figure 14. Gate charge test circuit



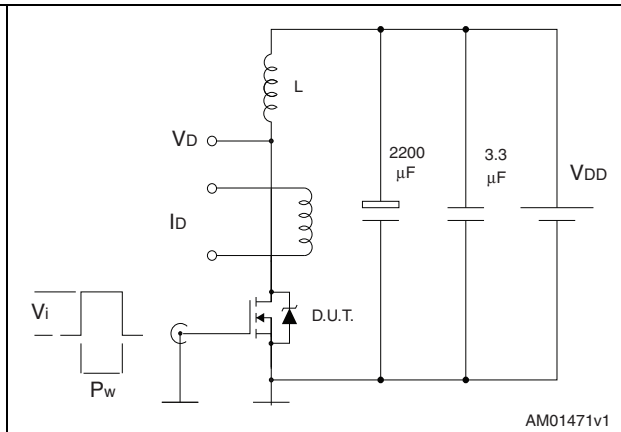
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Figure 15. Test circuit for inductive load switching and diode recovery times



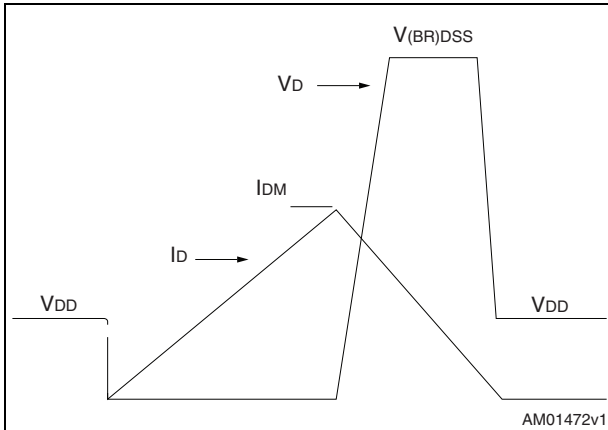
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Figure 16. Unclamped inductive load test circuit



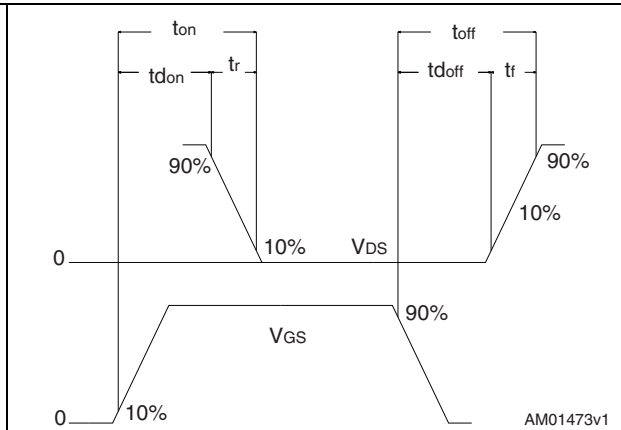
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Figure 17. Unclamped inductive waveform



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Figure 18. Switching time waveform



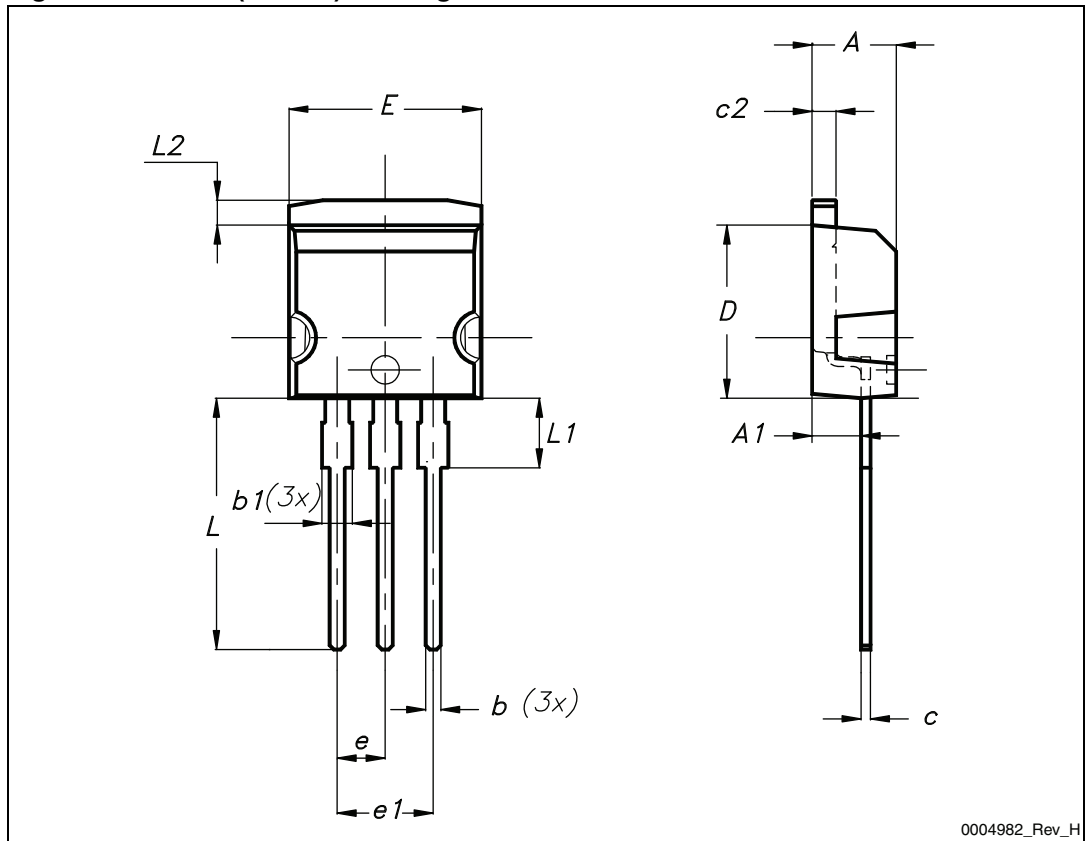
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4 Package mechanical data

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Table 8. 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 19. I²PAK (TO-262) drawing

5 Revision history

Table 9. Document revision history

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

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