



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.

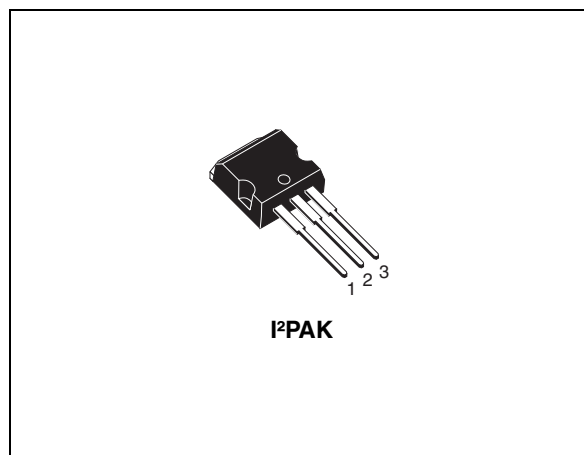


Figure 1. Internal schematic diagram

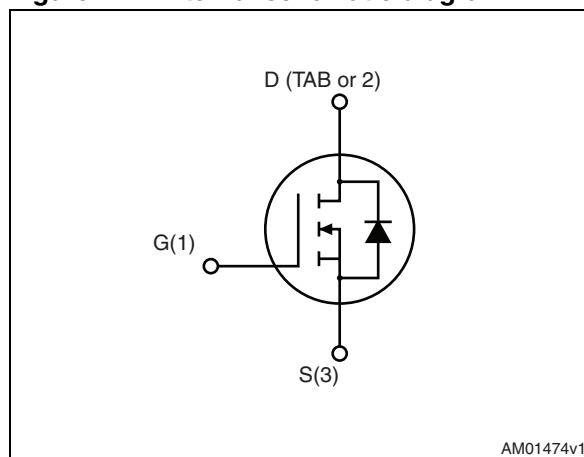


Table 1. Device summary

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

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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
$R_{thj-case}$	Thermal resistance junction-case max	0.5	$^{\circ}\text{C/W}$
$R_{thj-amb}$	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} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 160\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 32\text{ V}$, $T_J = 25\text{ °C}$ (see Figure 15)	-	58.7 99.2 3.38		ns nC 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

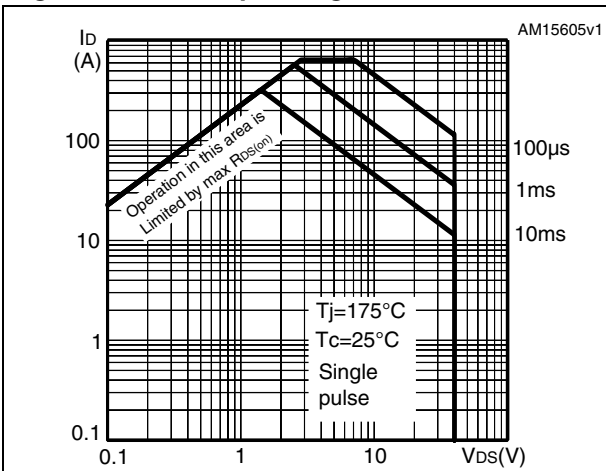


Figure 3. Thermal impedance

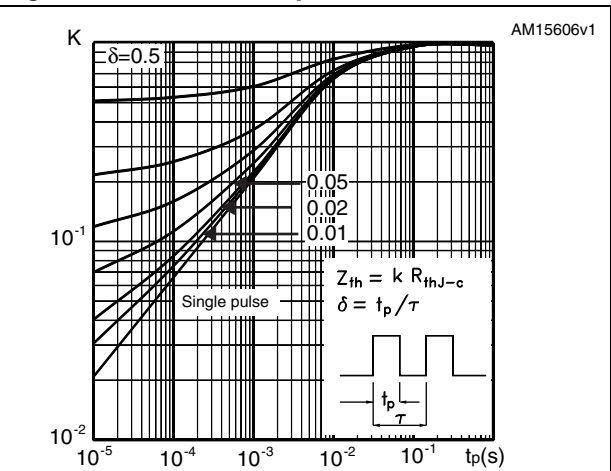


Figure 4. Output characteristics

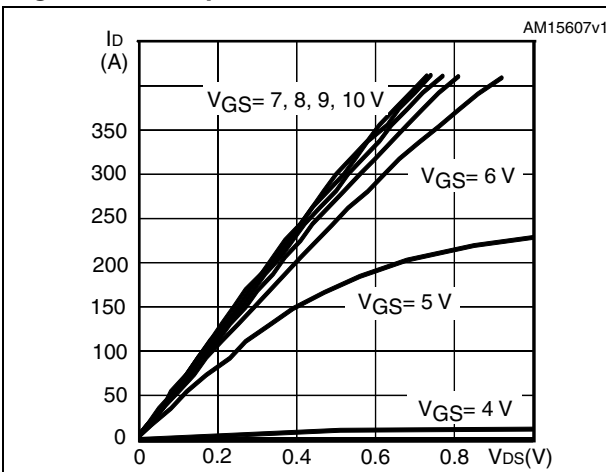


Figure 5. Transfer characteristics

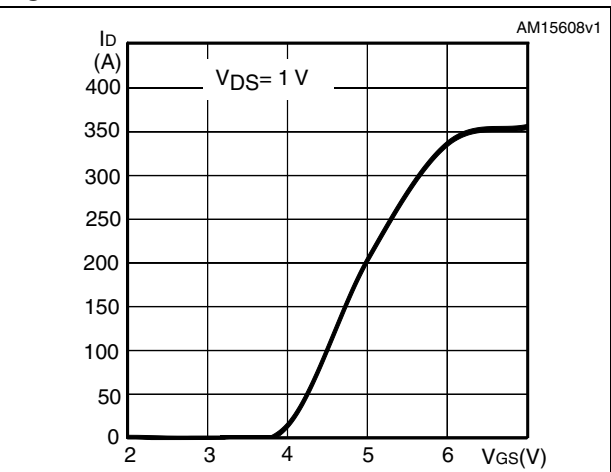


Figure 6. Gate charge vs gate-source voltage

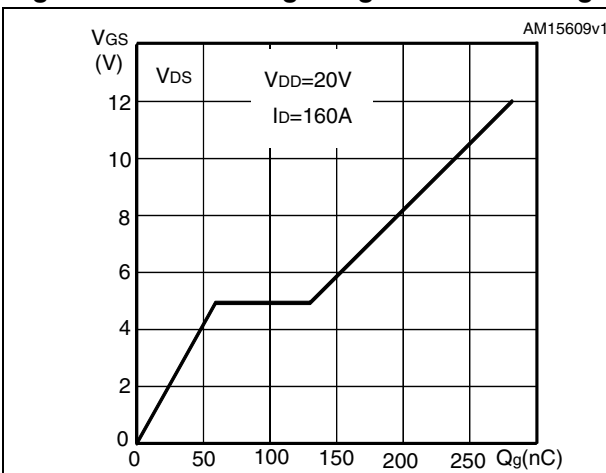


Figure 7. Static drain-source on-resistance

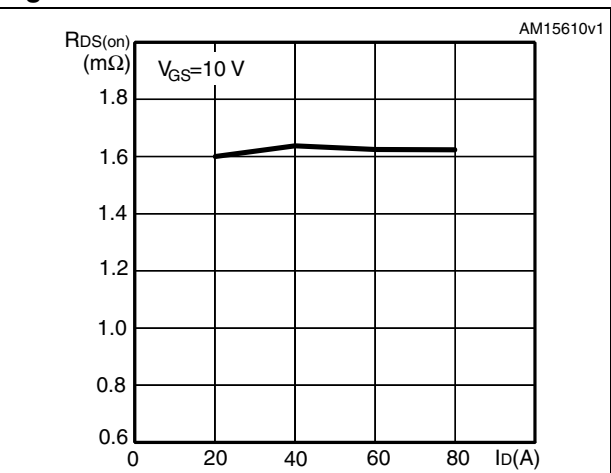


Figure 8. Capacitance variations

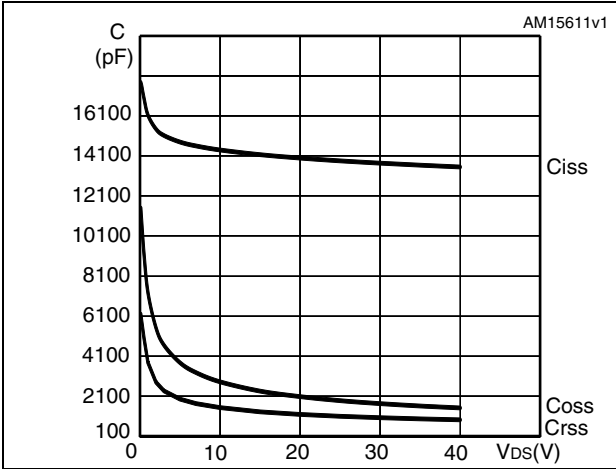


Figure 9. Drain-source diode forward characteristics

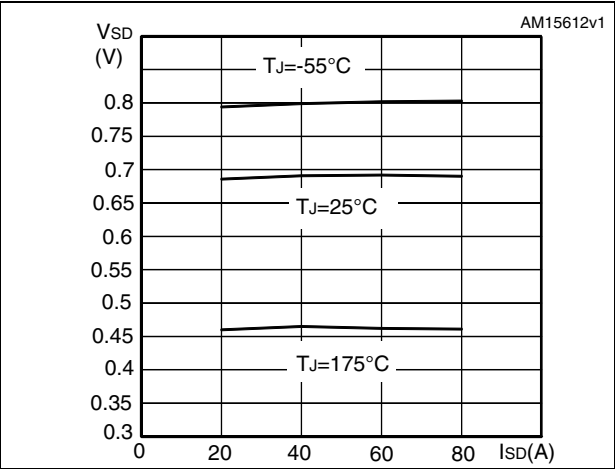


Figure 10. Normalized gate threshold voltage vs temperature

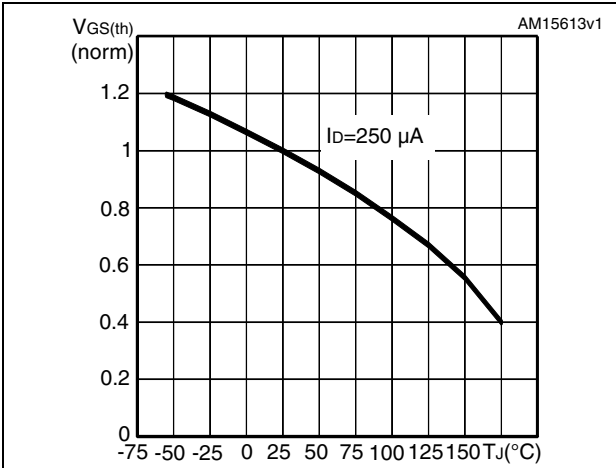


Figure 11. Normalized on-resistance vs temperature

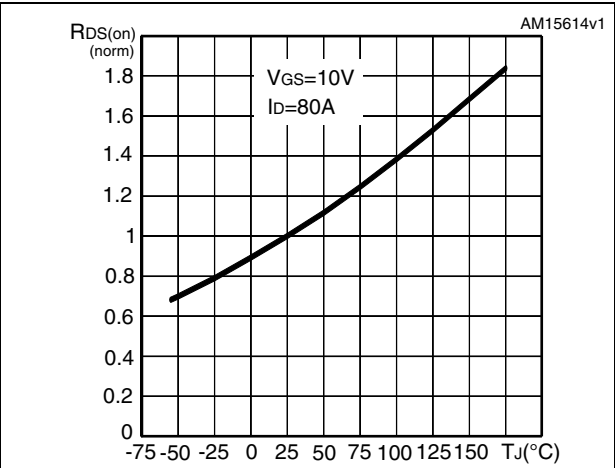
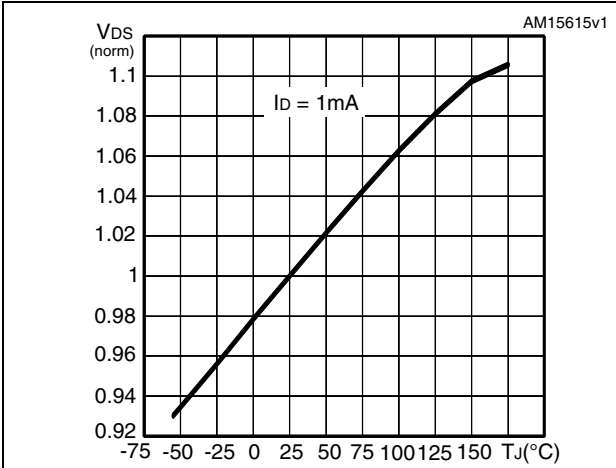


Figure 12. Normalized B_{VDS} vs temperature



3 Test circuits

Figure 13. Switching times test circuit for resistive load

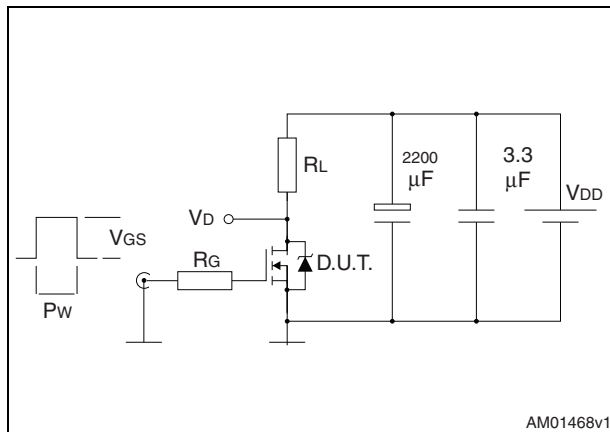


Figure 14. Gate charge test circuit

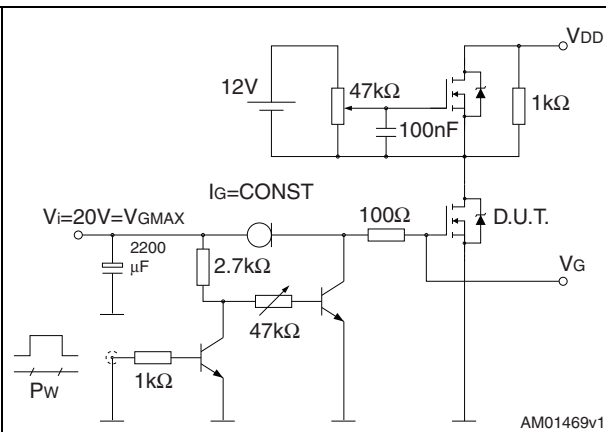


Figure 15. Test circuit for inductive load switching and diode recovery times

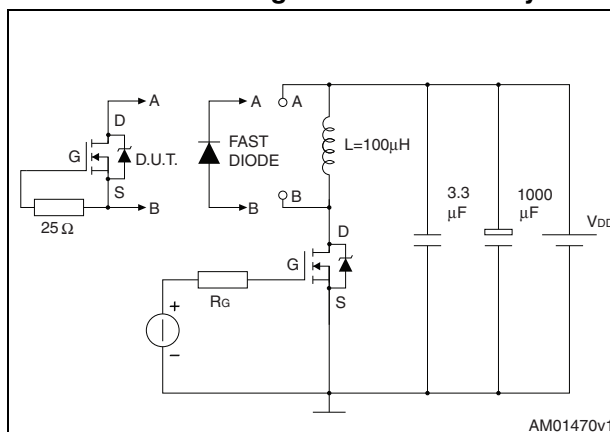


Figure 16. Unclamped inductive load test circuit

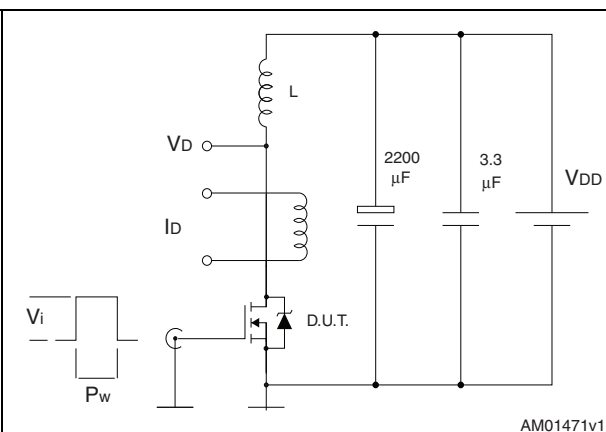


Figure 17. Unclamped inductive waveform

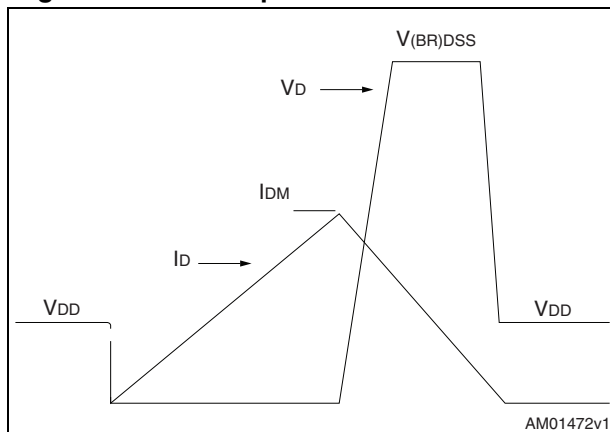
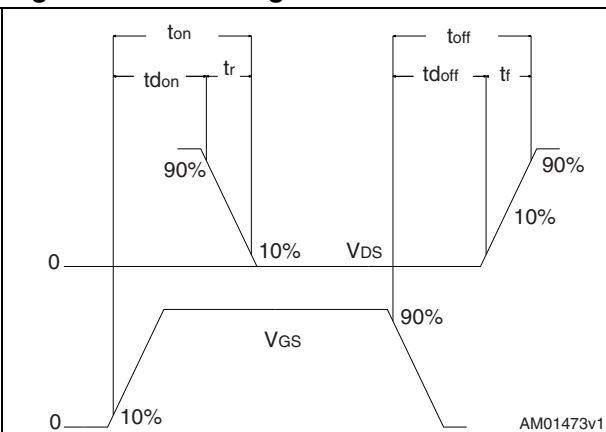


Figure 18. Switching time waveform

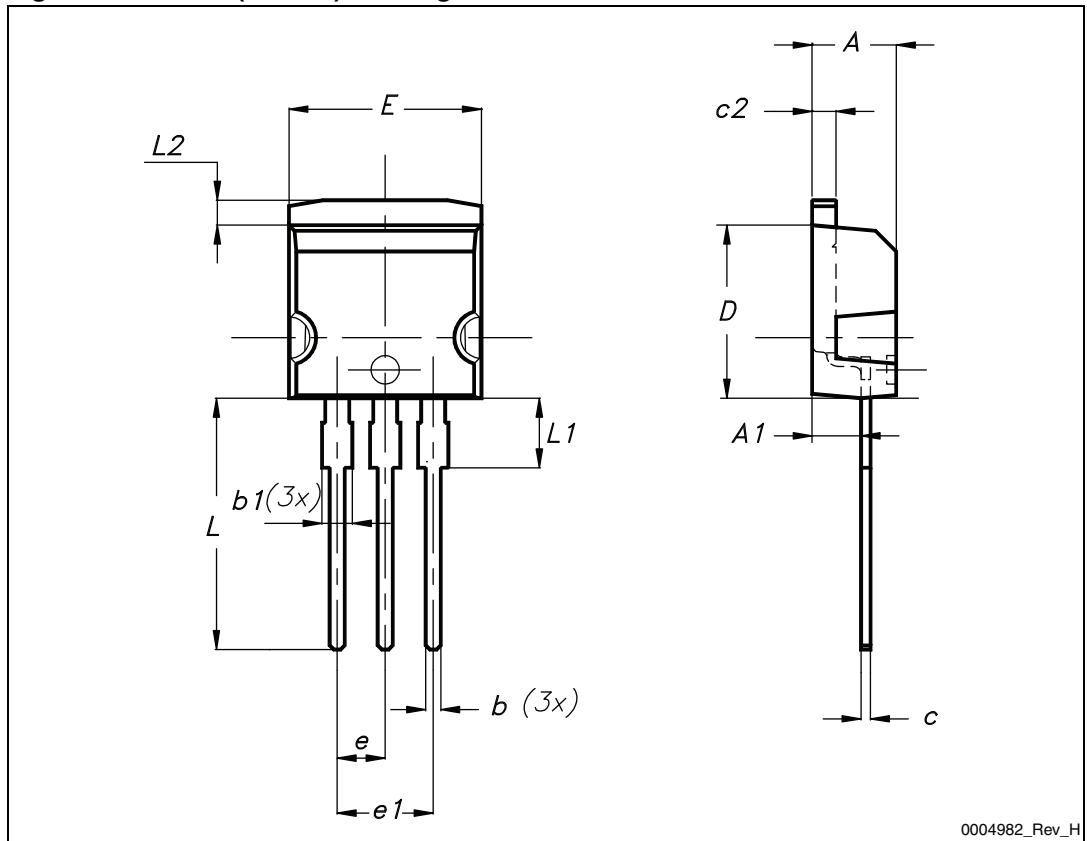


4 Package mechanical data

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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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