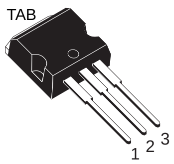
STI10NM60N

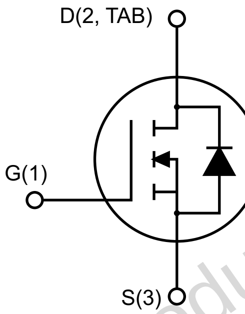
N-channel 600 V, 0.53 Ω typ.,10 A MDmesh™ II Power MOSFET in I²PAK package

Datasheet - obsolete product



I²PAK

Figure 1. Internal schematic diagram



Features

Order code	V_{DS} @$T_J$max	$R_{DS(on)}$ max.	I_D	P_{TOT}
STI10NM60N	650 V	< 0.55 Ω	10 A	70 W

- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET developed using the second generation of MDmesh™ technology. This revolutionary Power MOSFET associates a vertical structure to the company's strip layout to yield one of the world's lowest on-resistance and gate charge. It is therefore suitable for the most demanding high efficiency converters.

Table 1. Device summary

Order code	Marking	Package	Packing
STI10NM60N	10NM60N	I²PAK	Tube

This is information on a discontinued product. www.st.com

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	
		I²PAK	Unit
V_{GS}	Gate- source voltage	± 25	V
I_D	Drain current (continuous) at T_C = 25 °C	10	A
I_D	Drain current (continuous) at T_C = 100 °C	5	A
I_{DM} (1)	Drain current (pulsed)	32	A
P_{TOT}	Total dissipation at T_C = 25 °C	70	W
dv/dt (2)	Peak diode recovery voltage slope	15	V/ns
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T_C = 25 °C)		V
T_J T_{stg}	Operating junction temperature Storage temperature	- 55 to 150	°C

1. Pulse width limited by safe operating area.
2. $I_{SD} \leq 10$ A, di/dt ≤ 400 A/µs, V_{DS} peak ≤ $V_{(BR)DSS}$, V_{DD} = 80% $V_{(BR)DSS}$.

Table 3. Thermal data

Symbol	Parameter	Value	
		I²PAK	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max.	1.79	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max.	62.50	°C/W
$R_{thj\text{-}pcb}$	Thermal resistance junction-pcb max.		°C/W

Table 4. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AS}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max.)	4	A
E_{AS}	Single pulse avalanche energy (starting T_J = 25 °C, I_D = I_{AS}, V_{DD} = 50 V)	200	mJ

2 Electrical characteristics

(T_{case} = 25 °C unless otherwise specified)

Table 5. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 1 mA, V_{GS} = 0 I_D = 1 mA, V_{GS} = 0, T_C = 150 °C	600	650		V
I_{DSS}	Zero-gate voltage drain current (V_{GS} = 0)	V_{DS} = 600 V V_{DS} = 600 V, T_C = 125 °C			1 100	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 25 V			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 4 A		0.53	0.55	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 50 V, f = 1 MHz, V_{GS} = 0	-	540	-	pF
C_{oss}	Output capacitance		-	44	-	pF
C_{rss}	Reverse transfer capacitance		-	1.2	-	pF
$C_{oss\ eq}$ (1)	Equivalent capacitance time related	V_{DS} = 0 to 480 V, V_{GS} = 0	-	110	-	pF
R_g	Gate input resistance	f =1 MHz open drain	-	6	-	Ω
Q_g	Total gate charge	V_{DD} = 480 V, I_D = 8 A, V_{GS} = 10 V	-	19	-	nC
Q_{gs}	Gate-source charge		-	3	-	nC
Q_{gd}	Gate-drain charge		-	10	-	nC

1. $C_{oss\ eq.}$ time related 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 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 300 V, I_D = 4 A, R_G = 4.7 Ω, V_{GS} = 10 V	-	10	-	ns
t_r	Rise time		-	12	-	ns
$t_{d(off)}$	Turn-off-delay time		-	32	-	ns
t_f	Fall time		-	15	-	ns

Table 8. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)		-		8 32	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 8 A, V_{GS} = 0	-		1.3	V
t_{rr}	Reverse recovery time	I_{SD} = 8 A, di/dt = 100 A/µs V_{DD}= 60 V	-	250		ns
Q_{rr}	Reverse recovery charge		-	2.12		µC
I_{RRM}	Reverse recovery current			17		A
t_{rr}	Reverse recovery time	I_{SD} = 8 A, di/dt = 100 A/µs V_{DD}= 60 V T_J = 150 °C	-	315		ns
Q_{rr}	Reverse recovery charge			2.6		µC
I_{RRM}	Reverse recovery current			16.5		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 for I²PAK

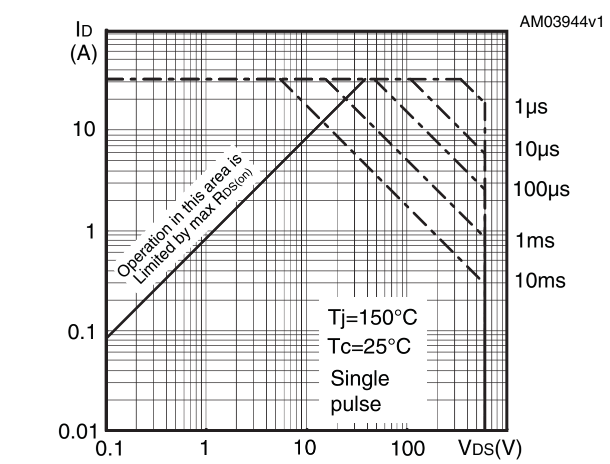


Figure 3. Thermal impedance for I²PAK

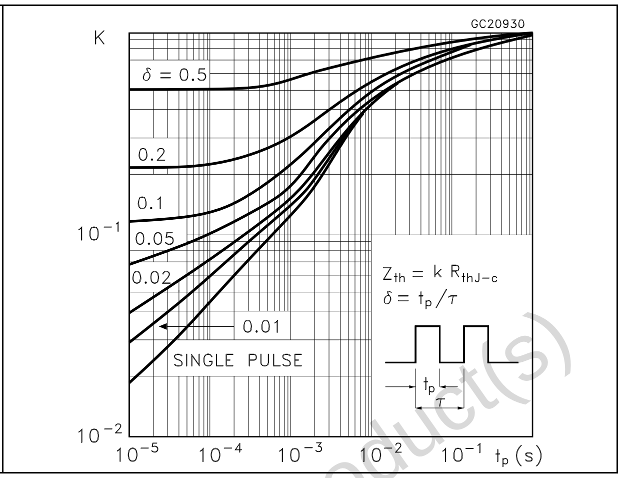


Figure 4. Output characteristics

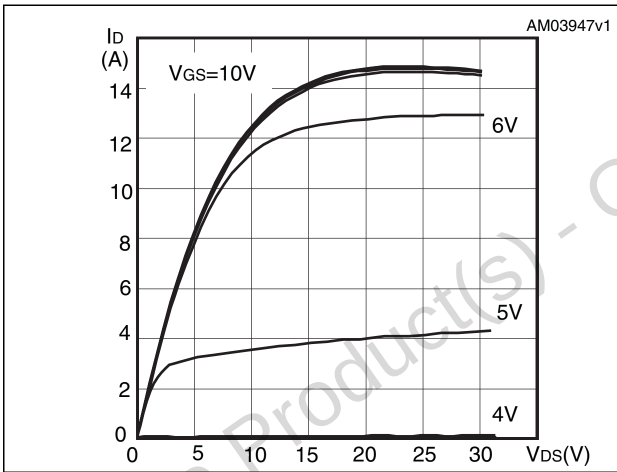


Figure 5. Transfer characteristics

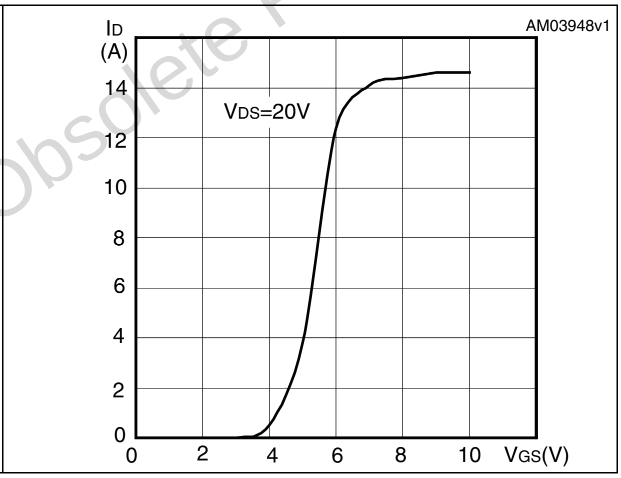


Figure 6. Normalized V_{DS} vs. temperature

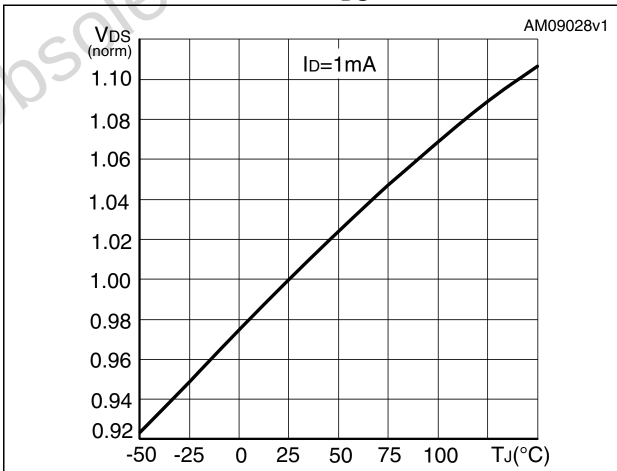


Figure 7. Static drain-source on-resistance

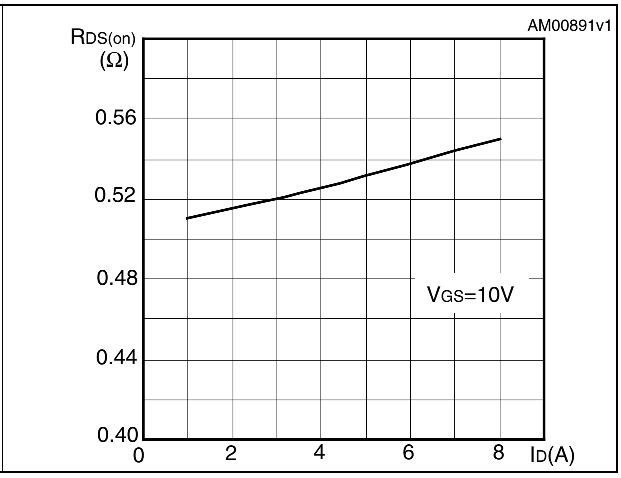


Figure 8. Gate charge vs. gate-source voltage

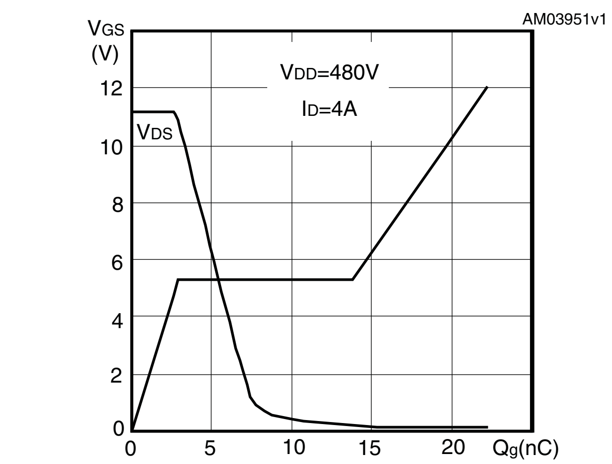


Figure 9. Capacitance variations

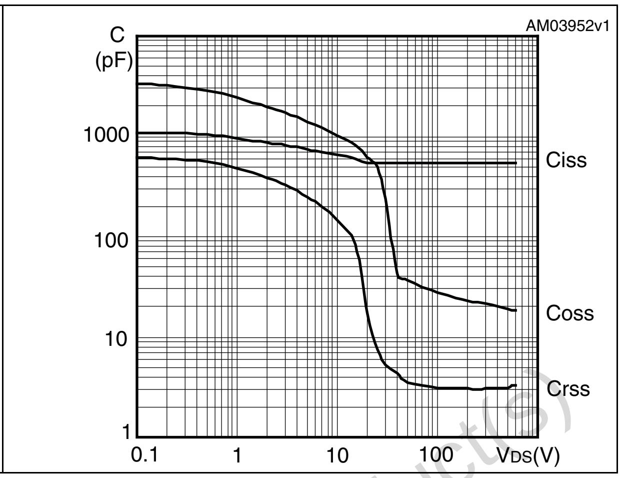


Figure 10. Normalized gate threshold voltage vs. temperature

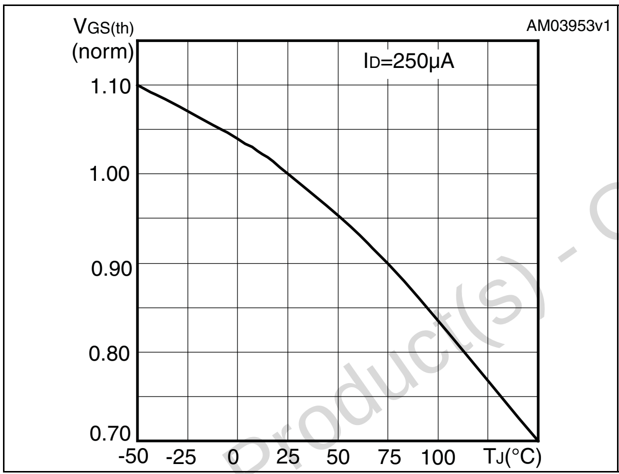
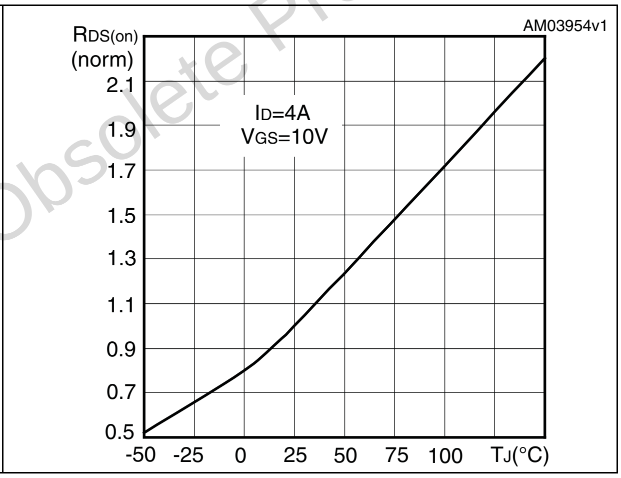


Figure 11. Normalized on-resistance vs. temperature



3 Test circuits

Figure 12. Switching times test circuit for resistive load

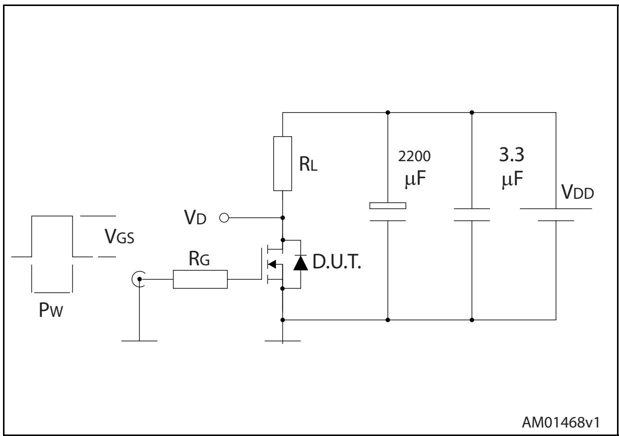


Figure 13. Gate charge test circuit

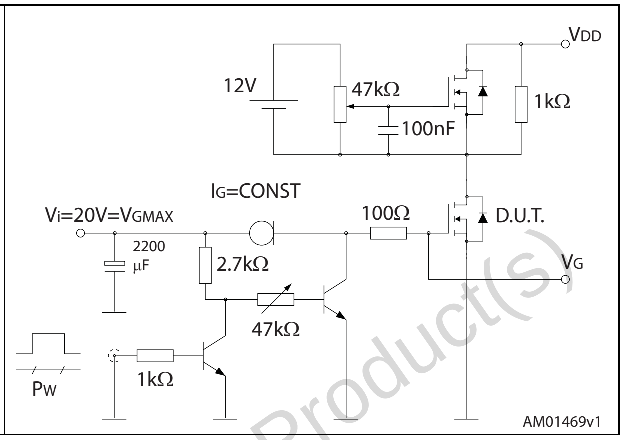


Figure 14. Test circuit for inductive load switching and diode recovery times

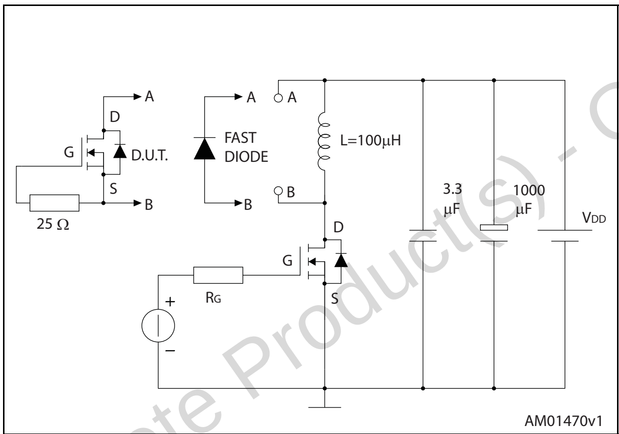


Figure 15. Unclamped inductive load test circuit

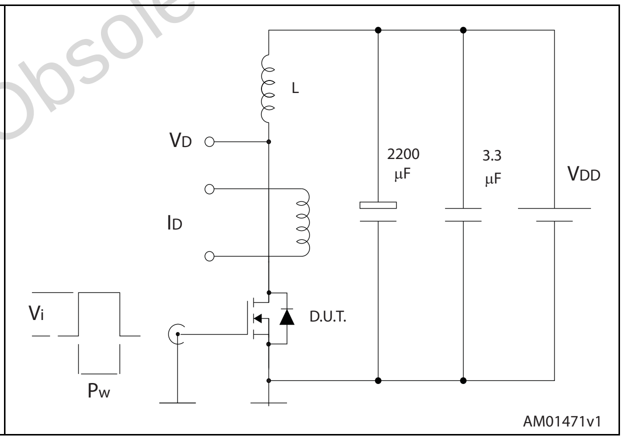


Figure 16. Unclamped inductive waveform

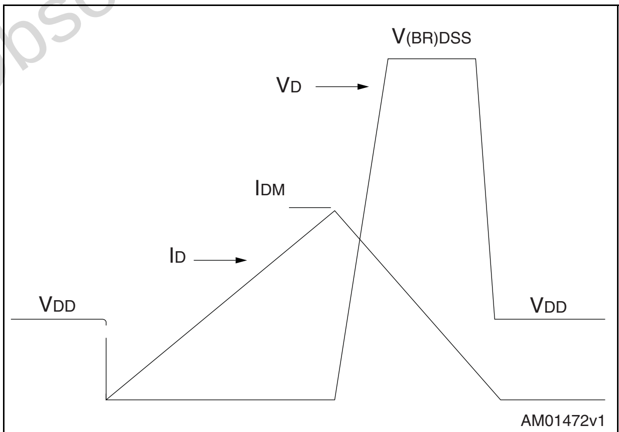
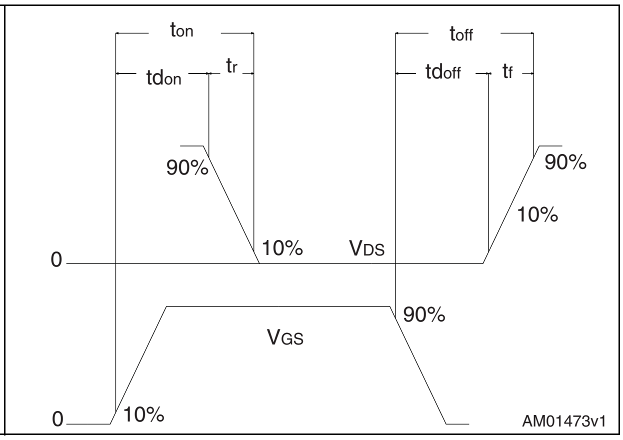


Figure 17. Switching time waveform



4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

4.1 I^2PAK package information

Figure 18. I^2PAK (TO-262) package outline

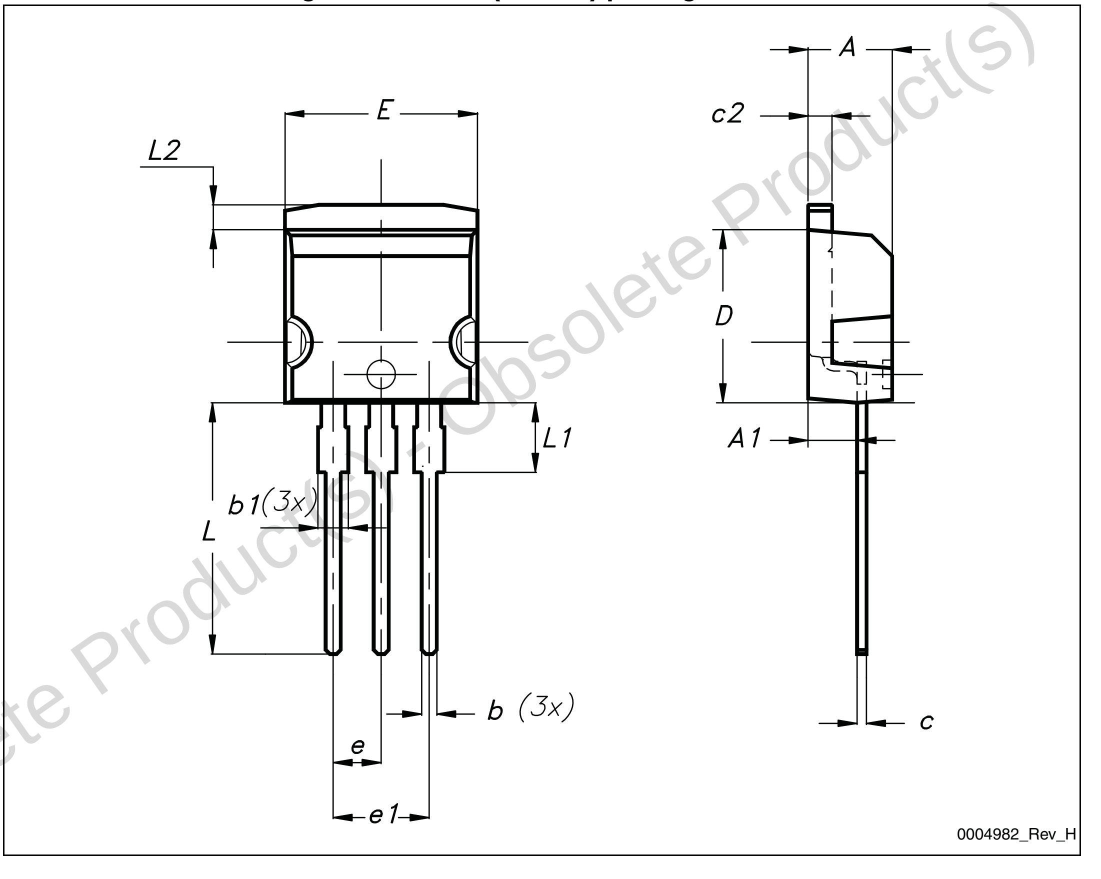


Table 9. I²PAK (TO-262) package mechanical data

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

5 Revision history

Table 10. Document revision history

Date	Revision	Changes
10-Jun-2009	1	First release
12-Jan-2010	2	Figure 4: Safe operating area for TO-220FP has been corrected
31-Mar-2010	3	Features have been corrected
17-Sep-2010	4	Content reworked to improve readability
24-Nov-2010	5	Corrected I_D value
16-Nov-2012	6	Inserted new package and mechanical data: I^2PAK
18-Jul-2013	7	Updated Section 4: Package mechanical data. Minor text changes.
02-Dec-2015	8	Part numbers STD10NM60N, STF10NM60N, STP10NM60N, STU10NM60N have been moved to a separate datasheet.