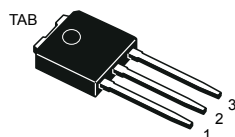
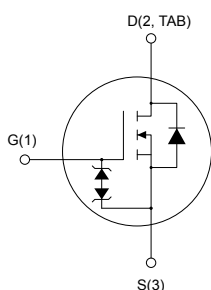


N-channel 1000 V, 6.25 Ω typ., 1.85 A SuperMESH Power MOSFET in an IPAK package



IPAK



AM01476v1_tab

Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STU2NK100Z	1000 V	8.5 Ω	1.85 A

- 100% avalanche tested
- Gate charge minimized
- Very low intrinsic capacitance
- Zener-protected

Applications

- Switching applications

Description

This high-voltage device is a Zener-protected N-channel Power MOSFET developed using the SuperMESH technology by STMicroelectronics, an optimization of the well-established PowerMESH. In addition to a significant reduction in on-resistance, this device is designed to ensure a high level of dv/dt capability for the most demanding applications.



Product status link

[STU2NK100Z](#)

Product summary

Order code	STU2NK100Z
Marking	2NK100Z
Package	IPAK
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	1000	V
V_{GS}	Gate-source voltage	± 30	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	1.85	A
	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	1.6	
$I_{DM}^{(1)}$	Drain current (pulsed)	7.4	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	70	W
ESD	Gate-source, human body model ($R = 1.5\text{ k}\Omega$, $C = 100\text{ pF}$)	3	kV
$dv/dt^{(2)}$	Peak diode recovery voltage slope	2.5	V/ns
T_{stg}	Storage temperature range	-55 to 150	$^{\circ}\text{C}$
T_J	Operating junction temperature range		$^{\circ}\text{C}$

1. Pulse width limited by safe operating area.

2. $I_{SD} \leq 1.85\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} = 80\% V_{(BR)DSS}$.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	1.79	$^{\circ}\text{C}/\text{W}$
R_{thJA}	Thermal resistance, junction-to-ambient	100	$^{\circ}\text{C}/\text{W}$

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width is limited by T_J max.)	1.85	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	170	mJ

2 Electrical characteristics

$T_C = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	1000			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 1000\text{ V}$			1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 1000\text{ V}$, $T_C = 125\text{ }^{\circ}\text{C}^{(1)}$			50	μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 30\text{ V}$			± 10	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 50\text{ }\mu\text{A}$	3	3.75	4.5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$, $I_D = 0.9\text{ A}$		6.25	8.5	Ω

1. Specified by design, not tested in production.

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	499	-	pF
C_{oss}	Output capacitance		-	53	-	pF
C_{rss}	Reverse transfer capacitance		-	9	-	pF
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{GS} = 0\text{ V}$, $V_{DS} = 0\text{ V to } 800\text{ V}$	-	28	-	pF
R_G	Gate input resistance	$f = 1\text{ MHz}$, open drain	-	6.6	-	Ω
Q_g	Total gate charge	$V_{DD} = 800\text{ V}$, $I_D = 1.85\text{ A}$, $V_{GS} = 0\text{ to } 10\text{ V}$ (see Figure 14. Test circuit for gate charge behavior)	-	16	-	nC
Q_{gs}	Gate-source charge		-	3	-	nC
Q_{gd}	Gate-drain charge		-	9	-	nC

1. $C_{oss\text{ eq.}}$ 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 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 500\text{ V}$, $I_D = 0.9\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$	-	7.2	-	ns
t_r	Rise time		-	6.5	-	ns
$t_{d(off)}$	Turn-off delay time	(see Figure 13. Test circuit for resistive load switching times and Figure 18. Switching time waveform)	-	41.5	-	ns
t_f	Fall time		-	32.5	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		1.85	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		7.4	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 1.85\text{ A}$, $V_{GS} = 0\text{ V}$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 1.85\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$ (see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	476		ns
Q_{rr}	Reverse recovery charge		-	1.6		μC
I_{RRM}	Reverse recovery current		-	6.9		A
t_{rr}	Reverse recovery time	$I_{SD} = 1.85\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$ (see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	532		ns
Q_{rr}	Reverse recovery charge		-	1.9		μC
I_{RRM}	Reverse recovery current		-	88		A

1. Pulse width is limited by safe operating area.
2. Pulsed: pulse duration = 300 μs , duty cycle 1.5%.

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

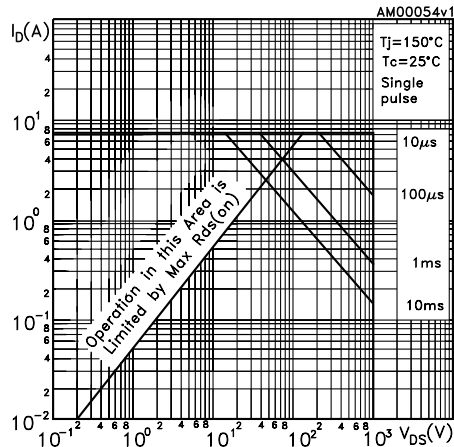


Figure 2. Thermal impedance

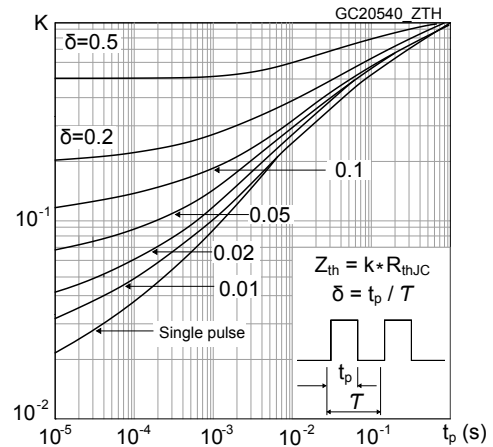


Figure 3. Output characteristics

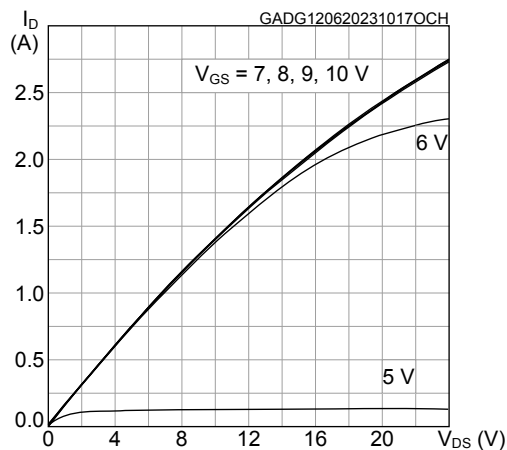


Figure 4. Transfer characteristics

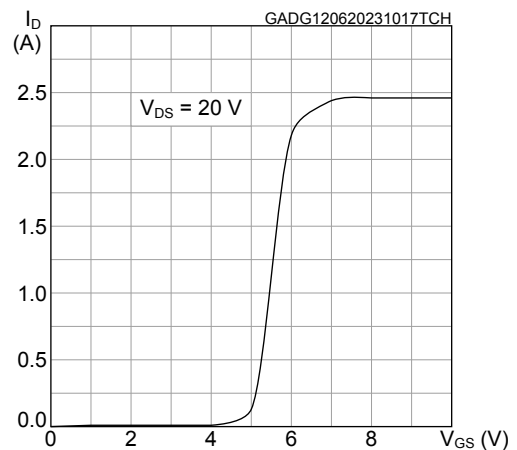


Figure 5. Normalized $V_{(BR)DSS}$ vs temperature

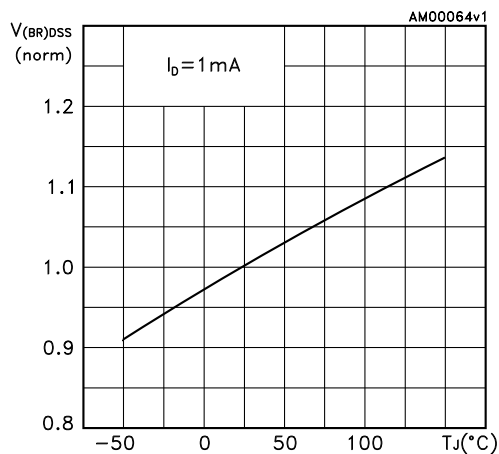


Figure 6. Static drain-source on resistance

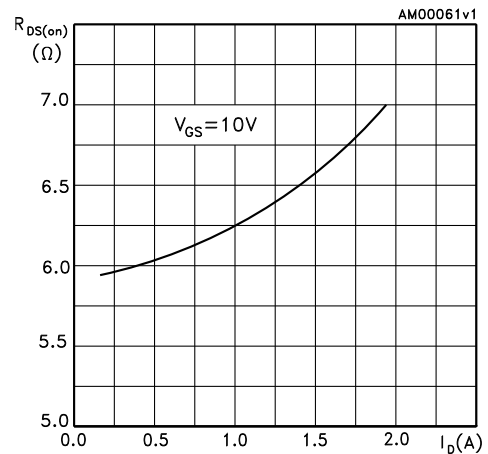


Figure 7. Gate charge vs gate-source voltage

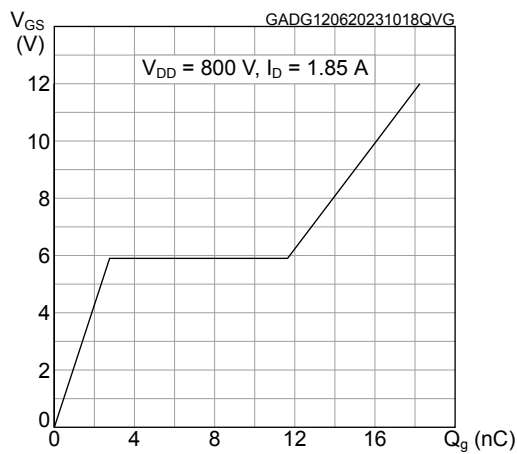


Figure 8. Capacitance variations

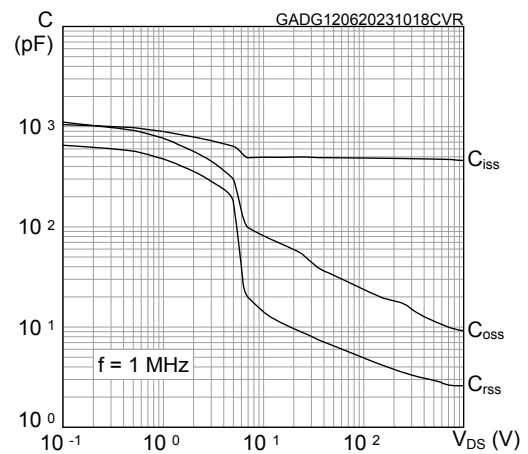


Figure 9. Normalized gate threshold voltage vs temperature

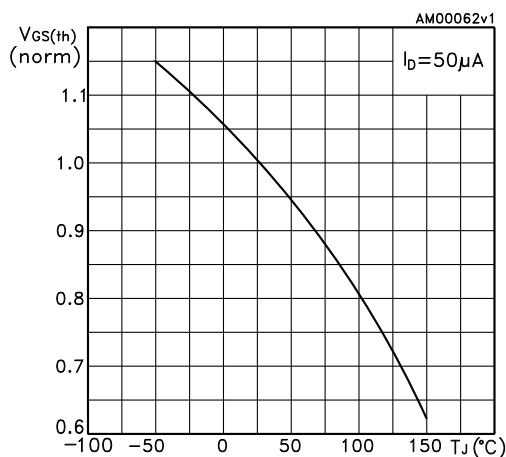


Figure 10. Normalized on resistance vs temperature

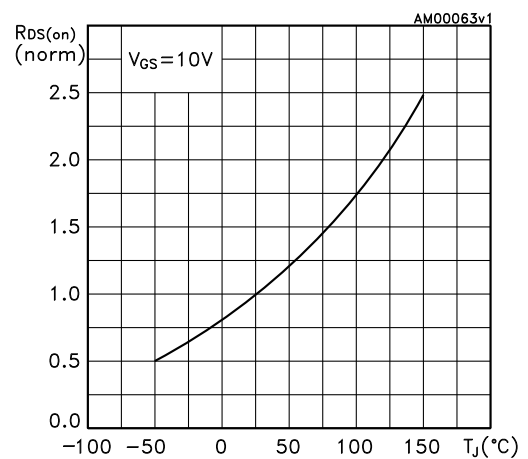


Figure 11. Source-drain diode forward characteristics

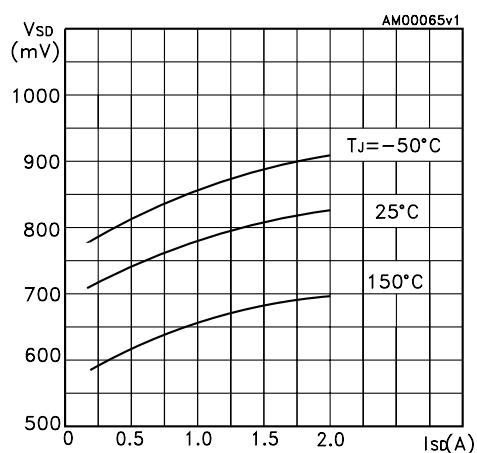
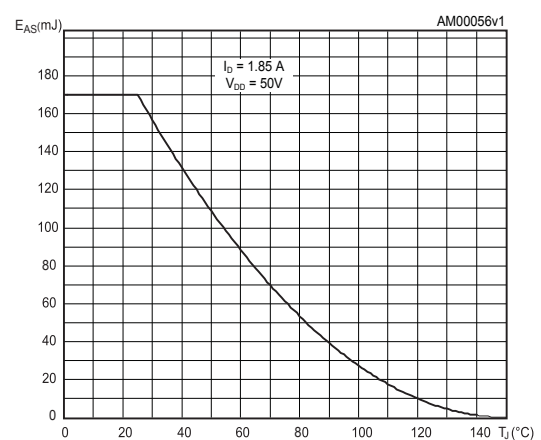


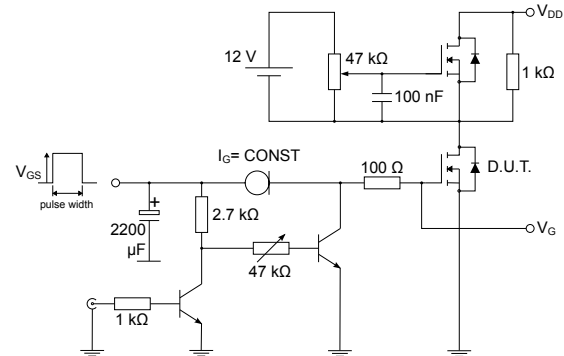
Figure 12. Maximum avalanche energy vs temperature



3 Test circuits

Figure 13. Test circuit for resistive load switching times


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Figure 14. Test circuit for gate charge behavior


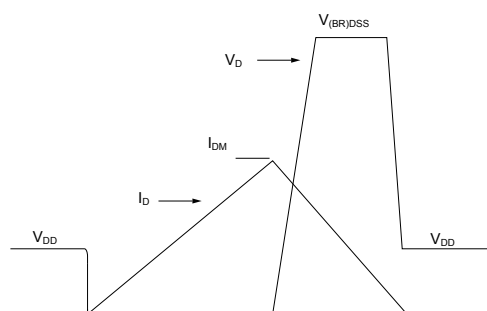
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Figure 15. Test circuit for inductive load switching and diode recovery times


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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

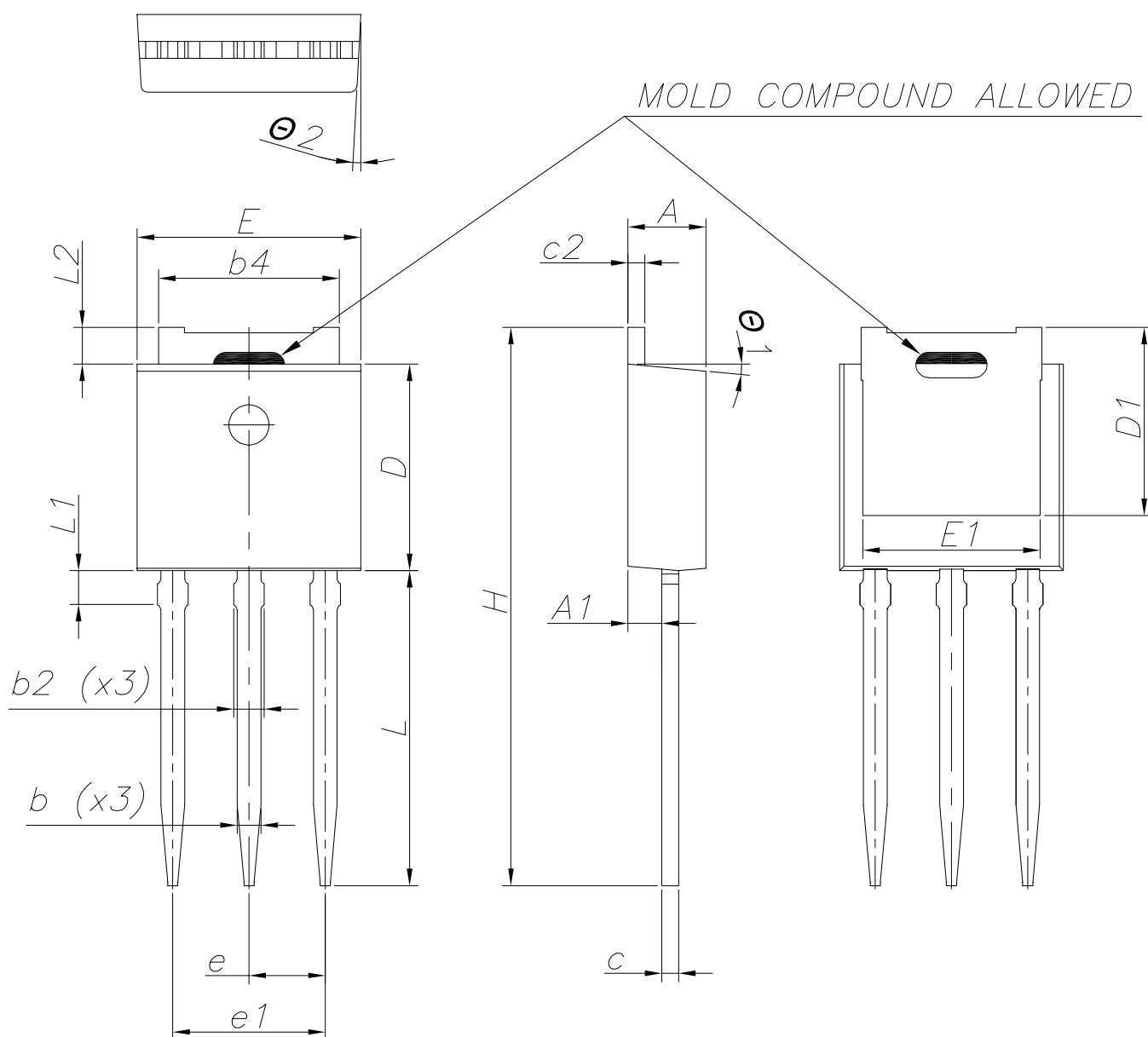

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4 Package information

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 IPAK (TO-251) type E package information

Figure 19. IPAK (TO-251) type E package outline



0068771_E_rev.16

Table 8. IPAK (TO-251) type E package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20	2.30	2.35
A1	0.90	1.00	1.10
b	0.66		0.79
b2			0.90
b4	5.23	5.33	5.43
c	0.46		0.59
c2	0.46		0.59
D	6.00	6.10	6.20
D1	5.30	5.53	5.75
E	6.50	6.60	6.70
E1	5.05	5.23	5.40
e	2.20	2.25	2.30
e1	4.40	4.50	4.60
H	16.18	16.48	16.78
L	9.00	9.30	9.60
L1	0.80	1.00	1.20
L2	0.90	1.08	1.25
Θ1	3°	5°	7°
Θ2	1°	3°	5°

Revision history

Table 9. Document revision history

Date	Revision	Changes
24-Oct-2007	1	First release
18-Jun-2008	2	– Inserted new package, mechanical data IPAK – Document status promoted from preliminary data to datasheet.
28-Jun-2018	3	Removed maturity status indication from cover page. The document status is production data. Updated title in cover page, <i>Section 1 Electrical ratings</i>, <i>Section 2 Electrical characteristics</i> and <i>Section 4 Package information</i>. Minor text changes.
15-Jun-2023	4	The part numbers STD2NK100Z and STP2NK100Z have been moved to a separate datasheet and the document has been updated accordingly. Removed "<i>Table 8. Gate-source Zener diode</i>". Updated Figure 3. Output characteristics, Figure 4. Transfer characteristics, Figure 7. Gate charge vs gate-source voltage and Figure 8. Capacitance variations. Removed "<i>Section 4.5 IPAK (TO-251) type A package information</i>" and added Section 4.1 IPAK (TO-251) type E package information. Minor text changes.

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