

N-channel 800 V, 2.75 Ω typ., 2 A MDmesh™ K5 Power MOSFET in TO-220 and IPAK packages

Datasheet - production data

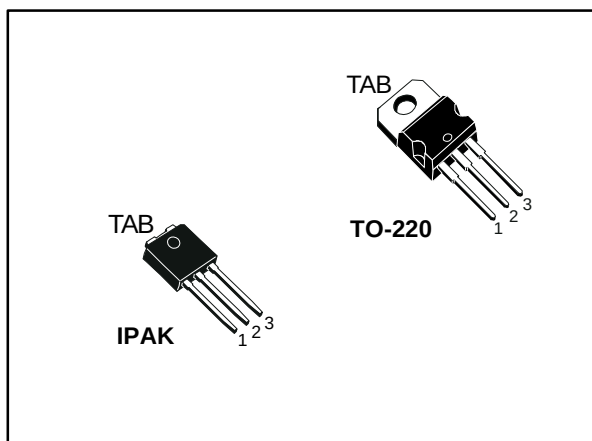
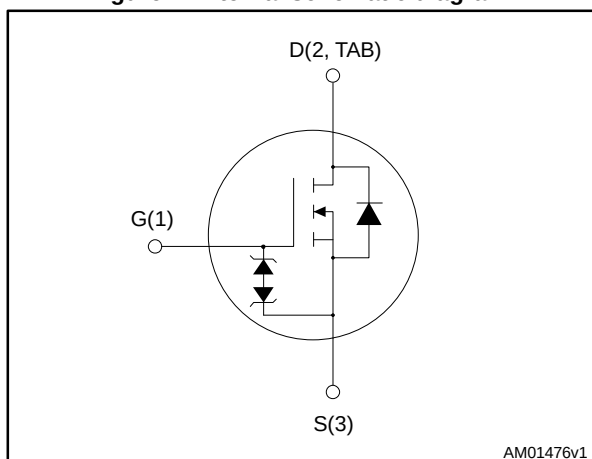


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max	I _D
STP3LN80K5	800 V	3.25 Ω	2 A
STU3LN80K5			

- Industry's lowest R_{DS(on)} x area
- Industry's best FoM (figure of merit)
- Ultra-low gate charge
- 100% avalanche tested
- Zener-protected

Applications

- Switching applications

Description

These very high voltage N-channel Power MOSFET are designed using MDmesh™ K5 technology based on an innovative proprietary vertical structure. The result is a dramatic reduction in on-resistance and ultra-low gate charge for applications requiring superior power density and high efficiency.

Table 1: Device summary

Order code	Marking	Package	Packing
STP3LN80K5	3LN80K5	TO-220	Tube
STU3LN80K5		IPAK	

Contents

1	Electrical ratings	3
2	Electrical characteristics	4
	2.1 Electrical characteristics (curves).....	6
3	Test circuits	9
4	Package information	10
	4.1 IPAK package information.....	10
	4.2 TO-220 type A package information.....	12
5	Revision history	14

1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	± 30	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	2	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	1.25	A
$I_D^{(1)}$	Drain current (pulsed)	8	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	45	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	4.5	V/ns
$dv/dt^{(3)}$	MOSFET dv/dt ruggedness	50	
T_{stg}	Storage temperature range	- 55 to 150	$^{\circ}\text{C}$
T_j	Operating junction temperature range		

Notes:

(1) Pulse width limited by safe operating area.

(2) $I_{SD} \leq 2\text{ A}$, $di/dt \leq 100\text{ A}/\mu\text{s}$; $V_{DSpeak} < V_{(BR)DSS}$, $V_{DD} = 640\text{ V}$.

(3) $V_{DS} \leq 640\text{ V}$.

Table 3: Thermal data

Symbol	Parameter	Value		Unit
		TO-220	IPAK	
$R_{thj-case}$	Thermal resistance junction-case	2.78		$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient	62.5	100	$^{\circ}\text{C}/\text{W}$

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_{jmax})	0.7	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25^{\circ}\text{C}$, $I_D = I_{AR}$; $V_{DD} = 50\text{ V}$)	155	mJ

2 Electrical characteristics

(T_C = 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 V	800			V
I _{DSS}	Zero gate voltage drain current	V _{DS} = 800 V, V _{GS} = 0 V			1	μA
		V _{DS} = 800 V, V _{GS} = 0 V, T _C = 125 °C ⁽¹⁾			50	μA
I _{GSS}	Gate body leakage current	V _{GS} = ± 20 V, V _{DS} = 0 V			±10	μA
V _{GS(th)}	Gate threshold voltage	V _{DS} = V _{GS} , I _D = 100 μA	3	4	5	V
R _{DS(on)}	Static drain-source on-resistance	V _{GS} = 10 V, I _D = 1 A		2.75	3.25	Ω

Notes:

⁽¹⁾Defined by design, not subject to production test.

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C _{iss}	Input capacitance	V _{DS} = 100 V, f = 1 MHz, V _{GS} = 0 V	-	102	-	pF
C _{oss}	Output capacitance		-	11	-	pF
C _{rss}	Reverse transfer capacitance		-	0.1	-	pF
C _{otr} ⁽¹⁾	Equivalent capacitance time related	V _{DS} = 0 to 640 V, V _{GS} = 0 V	-	20	-	pF
C _{oer} ⁽²⁾	Equivalent capacitance energy related		-	7	-	pF
R _G	Intrinsic gate resistance	f = 1 MHz, I _D = 0 A	-	12	-	Ω
Q _g	Total gate charge	V _{DD} = 640 V, I _D = 2 A, V _{GS} = 10 V (see Figure 17: "Test circuit for gate charge behavior")	-	2.63	-	nC
Q _{gs}	Gate-source charge		-	0.91	-	nC
Q _{gd}	Gate-drain charge		-	1.53	-	nC

Notes:

⁽¹⁾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}

⁽²⁾Energy related is defined as a constant equivalent capacitance giving the same stored energy 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	$V_{DD} = 400\text{ V}$, $I_D = 1\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 16: "Test circuit for resistive load switching times" and Figure 21: "Switching time waveform")	-	6.2	-	ns
t_r	Rise time		-	7	-	ns
$t_{d(off)}$	Turn-off delay time		-	30	-	ns
t_f	Fall time		-	26	-	ns

Table 8: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		2	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		8	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 2\text{ A}$, $V_{GS} = 0\text{ V}$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 2\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$ (see Figure 18: "Test circuit for inductive load switching and diode recovery times")	-	210		ns
Q_{rr}	Reverse recovery charge		-	0.8		μC
I_{RRM}	Reverse recovery current		-	7.6		A
t_{rr}	Reverse recovery time	$I_{SD} = 2\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$, (see Figure 18: "Test circuit for inductive load switching and diode recovery times")	-	345		ns
Q_{rr}	Reverse recovery charge		-	1.2		μC
I_{RRM}	Reverse recovery current		-	7.2		A

Notes:

(1)Pulse width limited by safe operating area.

(2)Pulsed: pulse duration = 300 μs , duty cycle 1.5%.

Table 9: Gate-source Zener diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)GSO}$	Gate-source breakdown voltage	$I_{GS} = \pm 1\text{ mA}$, $I_D = 0\text{ A}$	30	-	-	V

The built-in back-to-back Zener diodes are specifically designed to enhance the ESD performance of the device. The Zener voltage facilitates efficient and cost-effective device integrity protection, thus eliminating the need for additional external componentry.

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area for TO-220

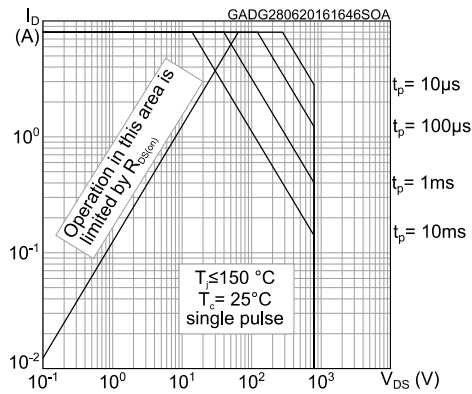


Figure 3: Thermal impedance for TO-220

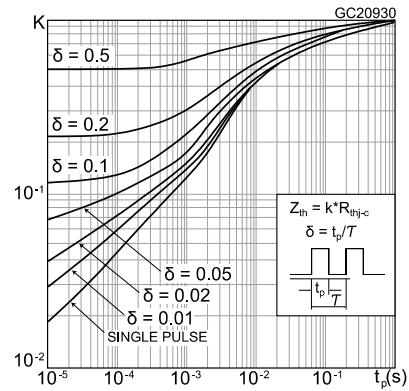


Figure 4: Safe operating area for IPAK

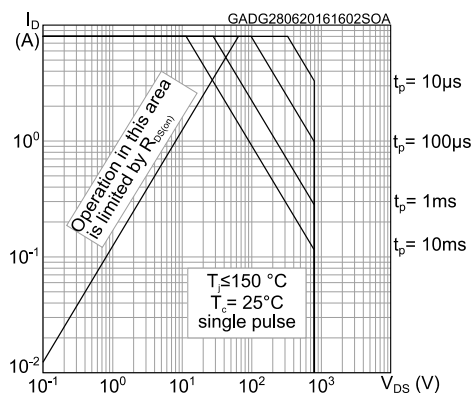


Figure 5: Thermal impedance for IPAK

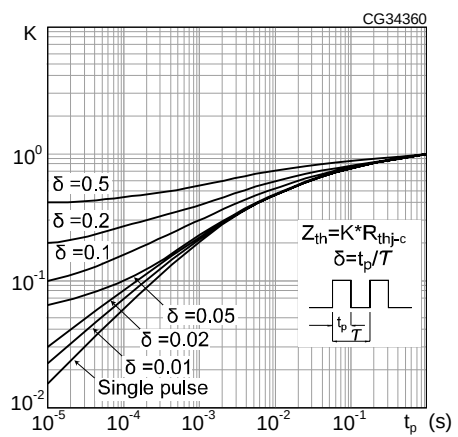


Figure 6: Output characteristics

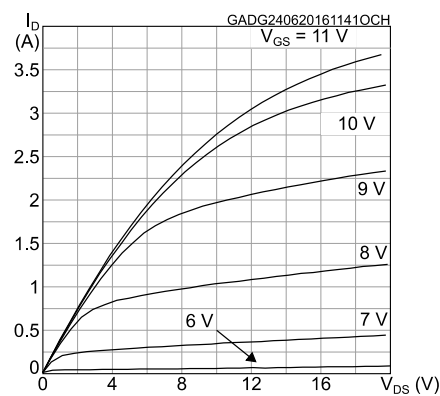


Figure 7: Transfer characteristics

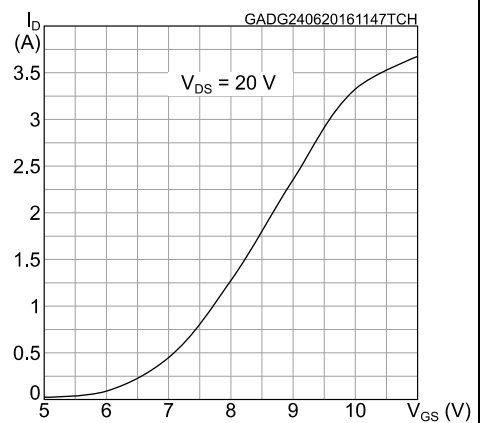


Figure 8: Gate charge vs gate-source voltage

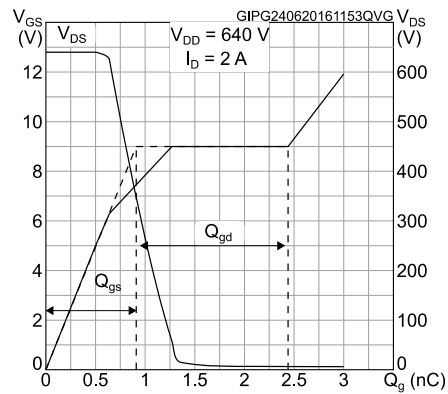


Figure 9: Static drain-source on-resistance

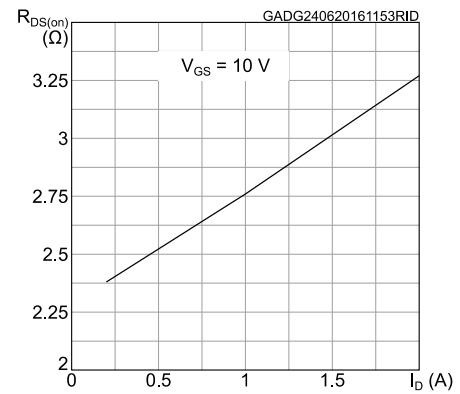


Figure 10: Capacitance variations

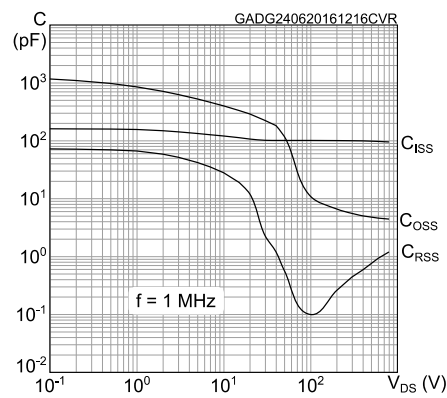


Figure 11: Source-drain diode forward characteristics

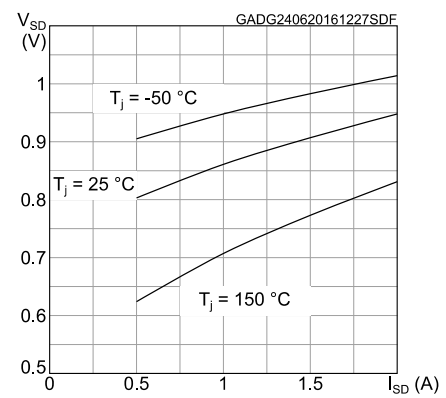


Figure 12: Normalized gate threshold voltage vs temperature

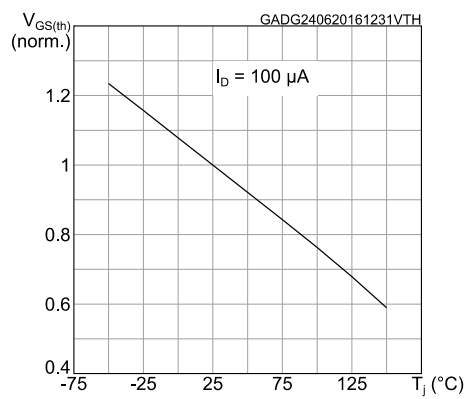


Figure 13: Normalized on-resistance vs temperature

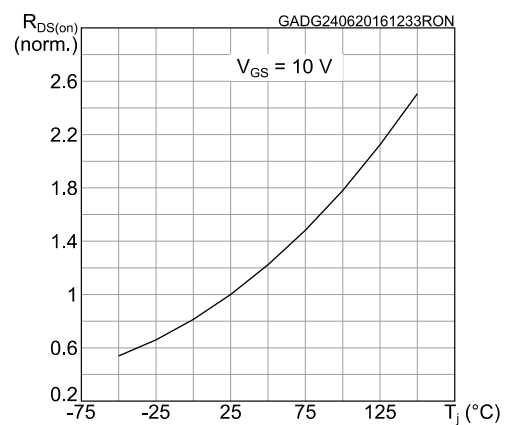
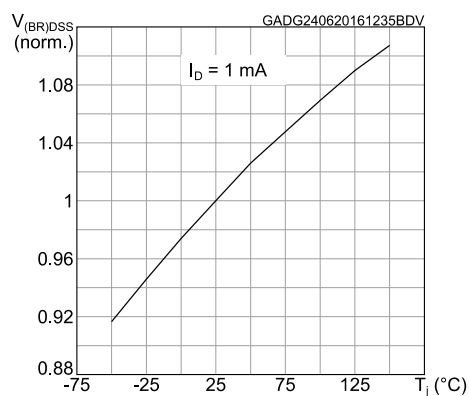
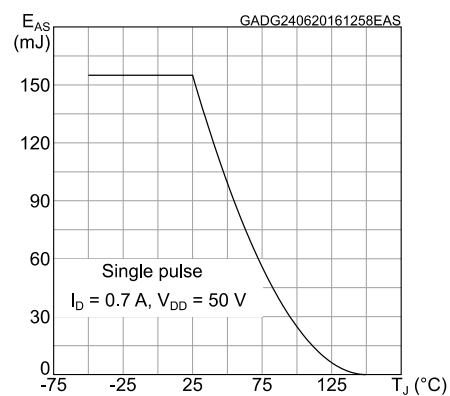
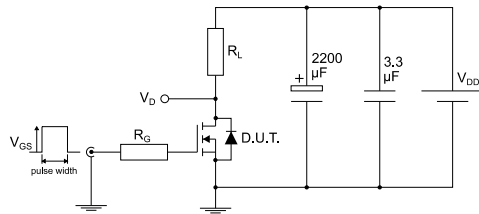


Figure 14: Normalized $V_{(BR)DSS}$ vs temperature**Figure 15: Maximum avalanche energy vs starting T_J** 

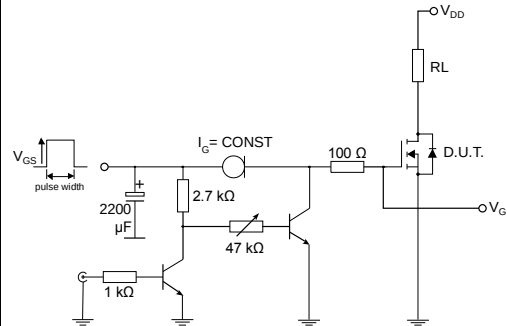
3 Test circuits

Figure 16: Test circuit for resistive load switching times



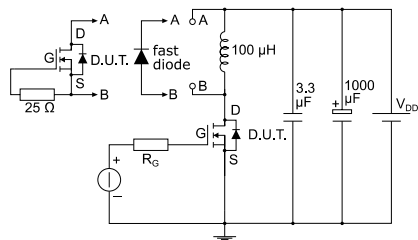
AM01468v1

Figure 17: Test circuit for gate charge behavior



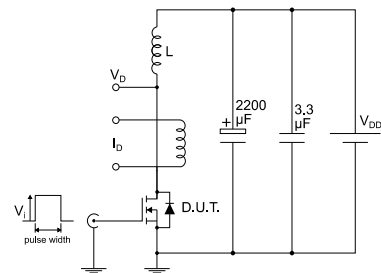
AM01469v10

Figure 18: Test circuit for inductive load switching and diode recovery times



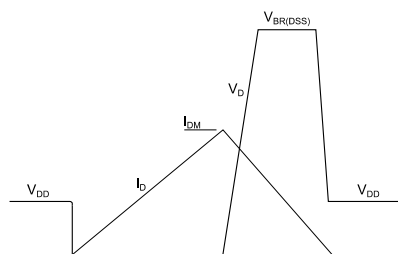
AM01470v1

Figure 19: Unclamped inductive load test circuit



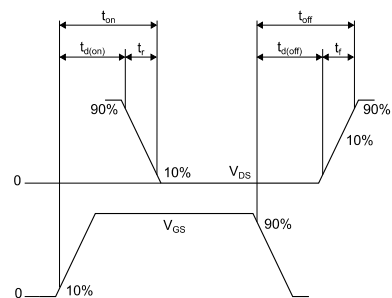
AM01471v1

Figure 20: Unclamped inductive waveform



AM01472v1

Figure 21: Switching time waveform



AM01473v1

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 package information

Figure 22: IPAK (TO-251) type A package outline

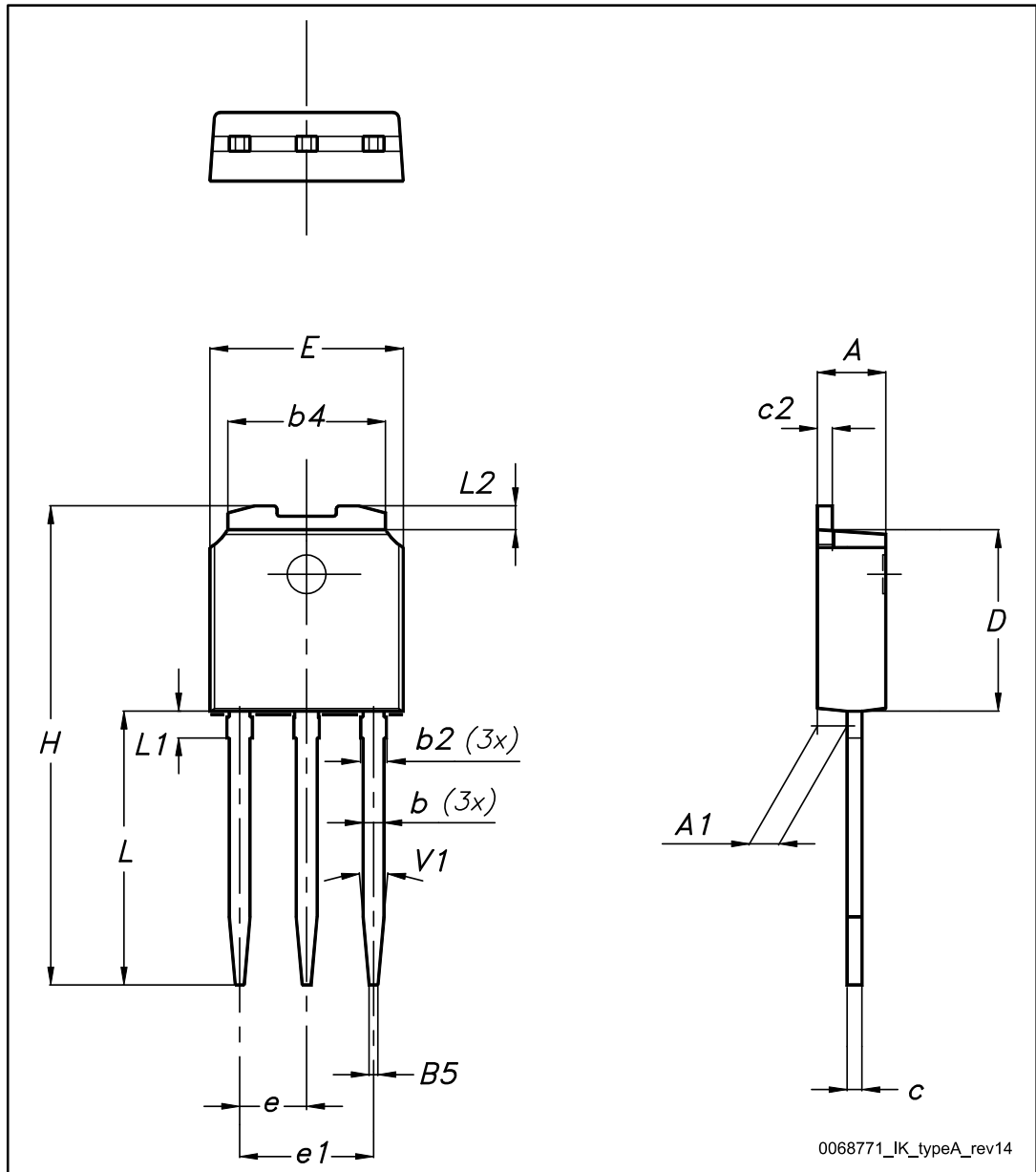


Table 10: IPAK (TO-251) type A package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
B5		0.30	
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
L1	0.80		1.20
L2		0.80	1.00
V1		10°	

4.2 TO-220 type A package information

Figure 23: TO-220 type A package outline

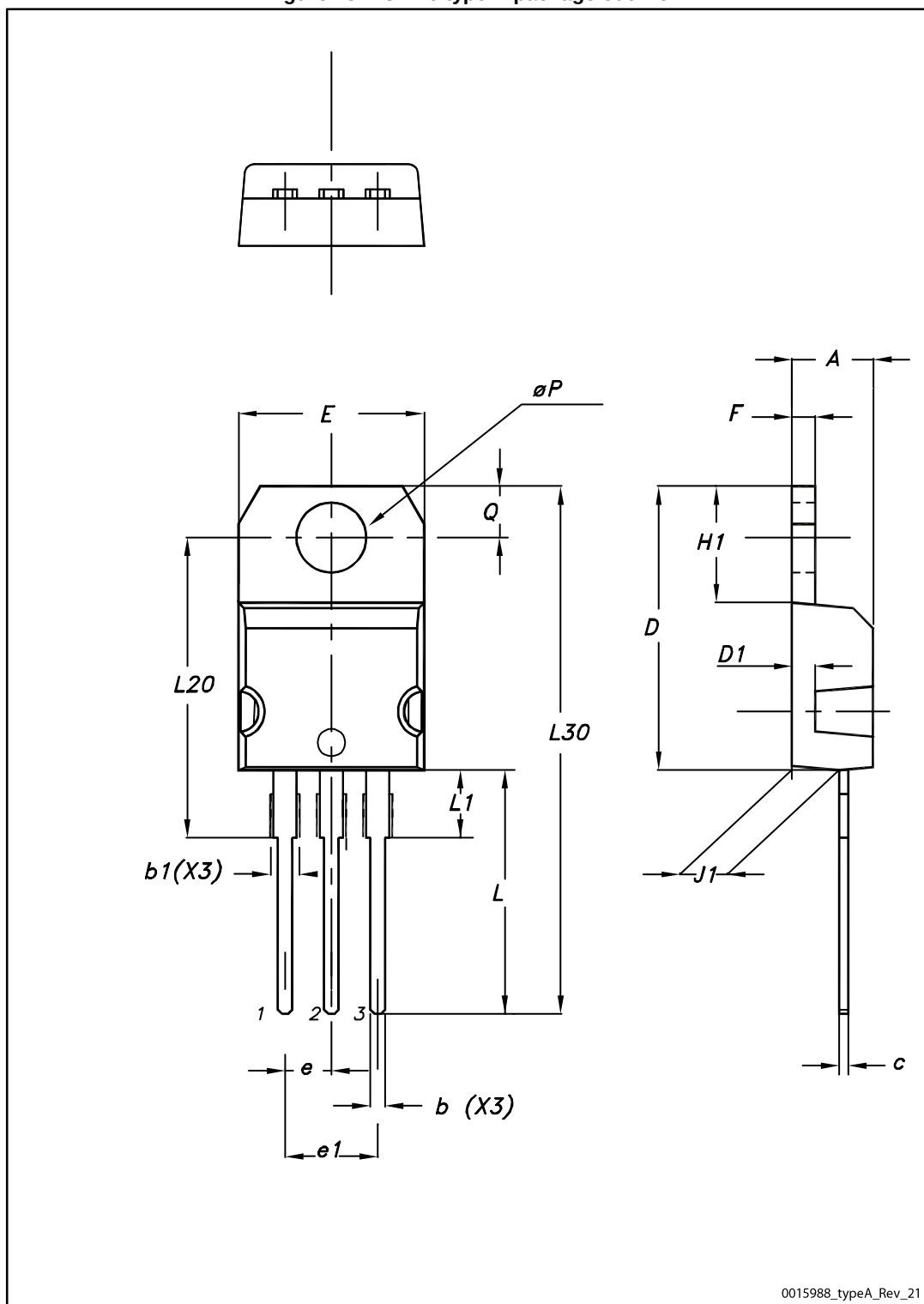


Table 11: TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.55
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10.00		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13.00		14.00
L1	3.50		3.93
L20		16.40	
L30		28.90	
øP	3.75		3.85
Q	2.65		2.95

5 Revision history

Table 12: Document revision history

Date	Revision	Changes
09-Jul-2015	1	Initial release
28-Jun-2016	2	Updated title and features in cover page. Updated Section 1: "Electrical ratings" . Updated Section 2: "Electrical characteristics" . Added Section 2.1: "Electrical characteristics (curves)" . Document status promoted from preliminary to production data. Minor text changes.

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2016 STMicroelectronics – All rights reserved

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: ocean@oceanchips.ru

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А