STU7LN80K5

N-channel 800 V, 0.95 Ω typ., 5 A MDmesh™ K5 Power MOSFET in a IPAK package

Datasheet - production data

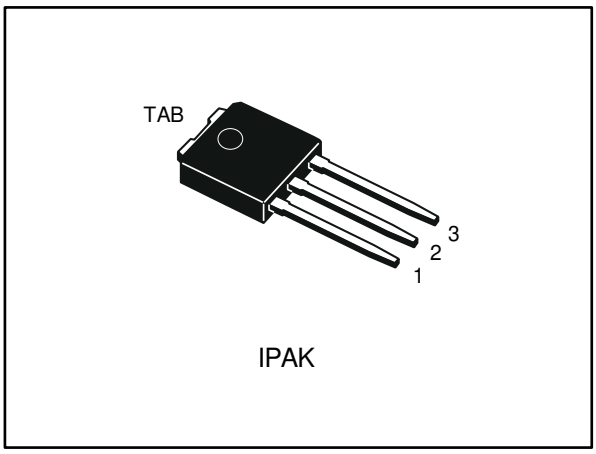
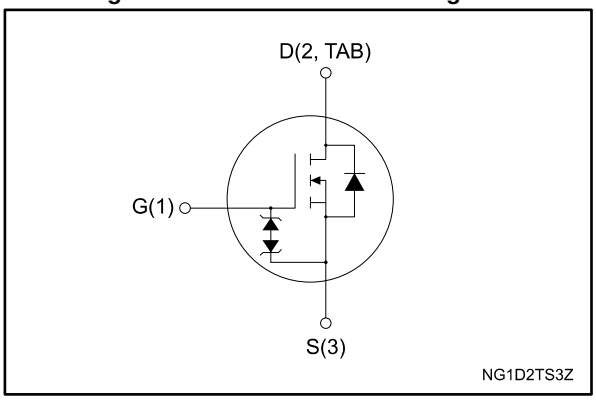


Figure 1: Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STU7LN80K5	800 V	1.15 Ω	5 A

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

Applications

- Switching applications

Description

This very high voltage N-channel Power MOSFET is 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
STU7LN80K5	7LN80K5	IPAK	Tube

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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 °C	5	A
I_D	Drain current (continuous) at T_C = 100 °C	3.4	A
I_D (1)	Drain current (pulsed)	20	A
P_{TOT}	Total dissipation at T_C = 25 °C	85	W
dv/dt (2)	Peak diode recovery voltage slope	4.5	V/ns
dv/dt (3)	MOSFET dv/dt ruggedness	50	V/ns
T_{stg}	Storage temperature	- 55 to 150	°C
T_j	Operating junction temperature		

Notes:

(1) Pulse width limited by safe operating area.

(2) I_{SD} ≤ 5 A, di/dt ≤100 A/µs; V_{DS} peak ≤ $V_{(BR)DSS}$, V_{DD} = 400 V

(3) V_{DS} ≤ 640 V

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	1.47	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	100	°C/W

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetetive or not repetetive (pulse width limited by T_{jmax})	1.5	A
E_{AS}	(Single pulse avalanche energy (starting T_j = 25 °C, I_D = I_{AR}; V_{DD} = 50 V)	200	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	V_{GS} = 0 V, I_D = 1 mA	800			V
I_{DSS}	Zero gate voltage Drain current	V_{GS} = 0 V, V_{DS} = 800 V			1	µA
		V_{GS} = 0 V, V_{DS} = 800 V, T_C = 125 °C			50	µA
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = ±20 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 = 2.5 A		0.95	1.15	Ω

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	-	270	-	pF
C_{oss}	Output capacitance		-	22	-	pF
C_{rss}	Reverse transfer capacitance		-	0.5	-	pF
$C_{o(er)}$ (1)	Equivalent capacitance energy related	V_{DS} = 0 to 640 V, V_{GS} = 0 V	-	17	-	nC
$C_{o(tr)}$ (2)	Equivalent capacitance time related		-	48	-	nC
R_G	Intrinsic gate resistance	f = 1 MHz, open drain	-	7.5	-	Ω
Q_g	Total gate charge	V_{DD} = 640 V, I_D = 5 A, V_{GS} = 10 V (see *Figure 15: "Test circuit for gate charge behavior"*)	-	12	-	nC
Q_{gs}	Gate-source charge		-	2.6	-	nC
Q_{gd}	Gate-drain charge		-	8.6	-	nC

Notes:

(1)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}

(2)Time 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 V, I_D = 2.5 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 14: "Test circuit for resistive load switching times"* and *Figure 19: "Switching time waveform"*)	-	9.3	-	ns
t_r	Rise time		-	6.7	-	ns
$t_{d(off)}$	Turn-off-delay time		-	23.6	-	ns
t_f	Fall time		-	17.4	-	ns

Table 8: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		5	A
I_{SDM} (1)	Source-drain current (pulsed)		-		20	A
V_{SD} (2)	Forward on voltage	I_{SD}= 5 A, V_{GS} = 0 V	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 5 A, di/dt = 100 A/µs, V_{DD} = 60 V (see *Figure 16: "Test circuit for inductive load switching and diode recovery times"*)	-	276		ns
Q_{rr}	Reverse recovery charge		-	2.13		µC
I_{RRM}	Reverse recovery current		-	15.4		A
t_{rr}	Reverse recovery time	I_{SD} = 5 A, di/dt = 100 A/µs, V_{DD} = 60 V, T_j = 150 °C (see *Figure 16: "Test circuit for inductive load switching and diode recovery times"*)	-	402		ns
Q_{rr}	Reverse recovery charge		-	2.79		µC
I_{RRM}	Reverse recovery current		-	13.9		A

Notes:

(1)Pulse width is 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} = ±1 mA, I_D = 0 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.

2.2 Electrical characteristics (curves)

Figure 2: Safe operating area

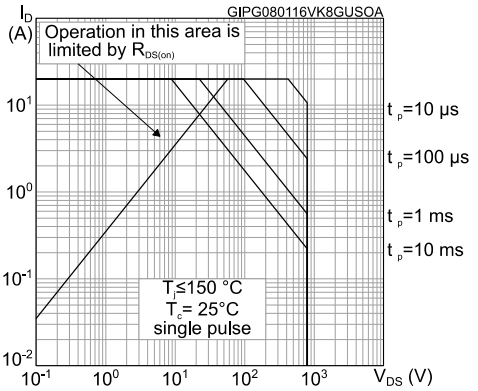


Figure 3: Thermal impedance

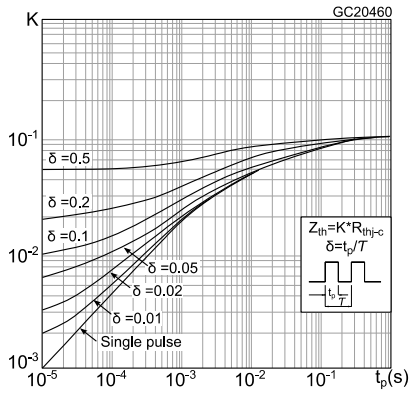


Figure 4: Output characteristics

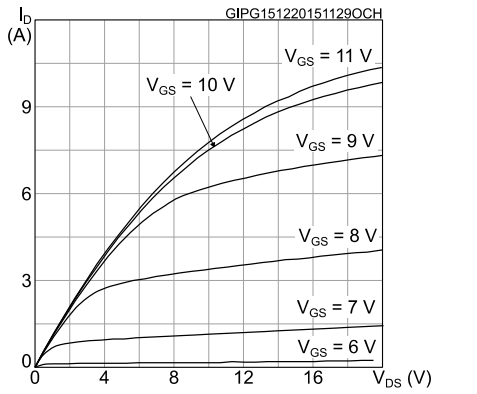


Figure 5: Transfer characteristics

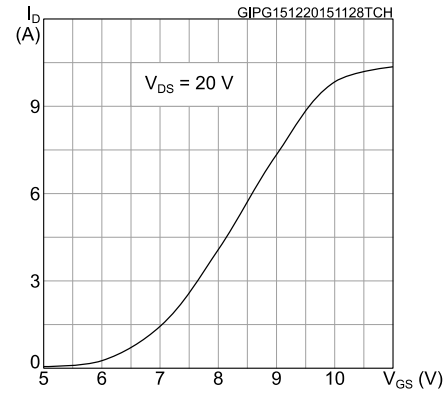


Figure 6: Gate charge vs gate-source voltage

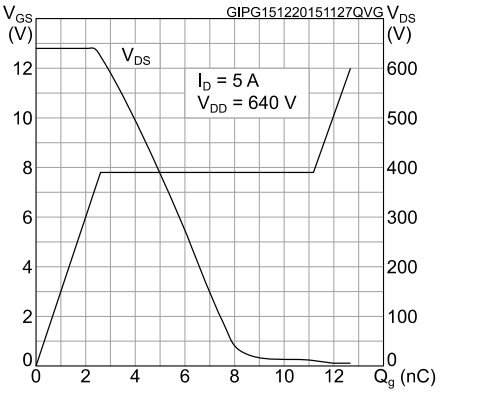


Figure 7: Static drain-source on-resistance

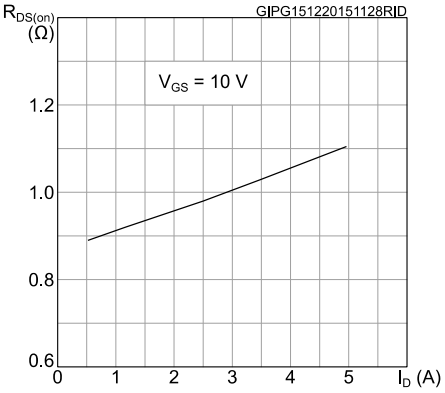


Figure 8: Capacitance variations

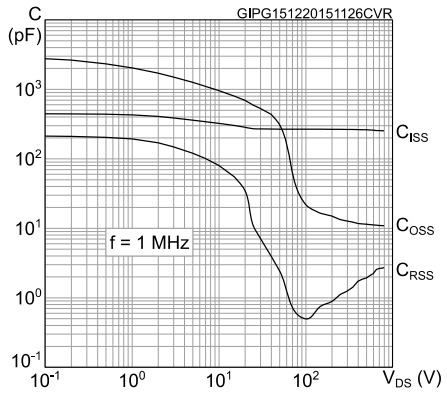


Figure 9: Normalized gate threshold voltage vs temperature

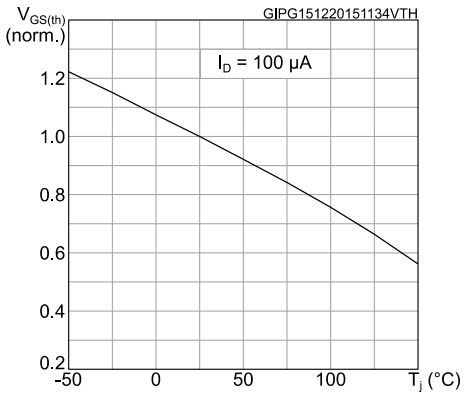


Figure 10: Normalized $V_{(BR)DSS}$ vs temperature

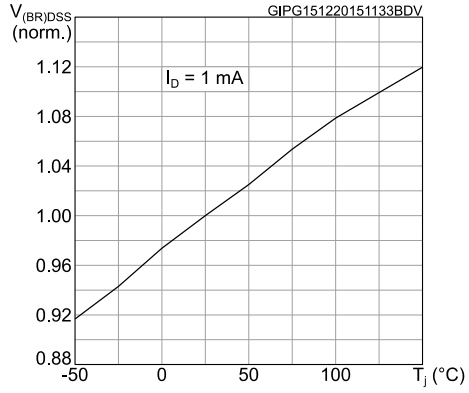


Figure 11: Normalized on-resistance vs temperature

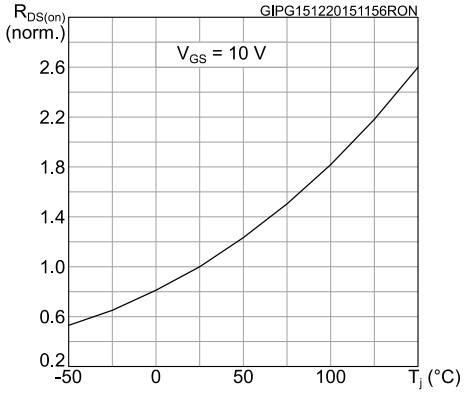


Figure 12: Source-drain diode forward characteristics

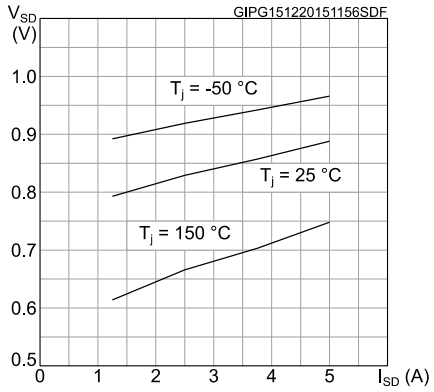
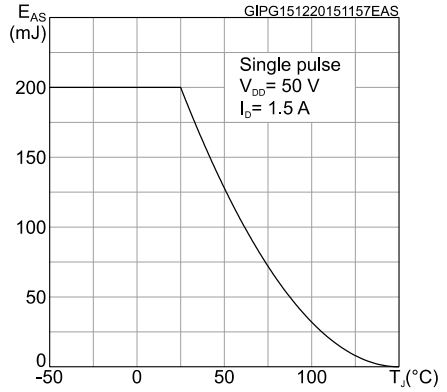


Figure 13: Maximum avalanche energy vs starting T_J



3 Test circuits

Figure 14: Test circuit for resistive load switching times

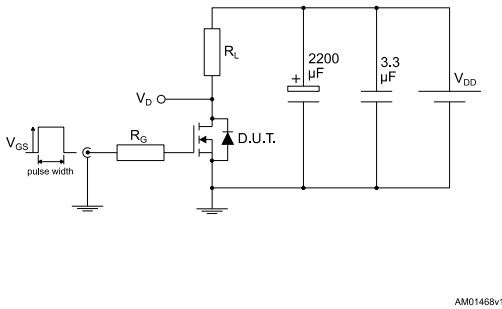


Figure 15: Test circuit for gate charge behavior

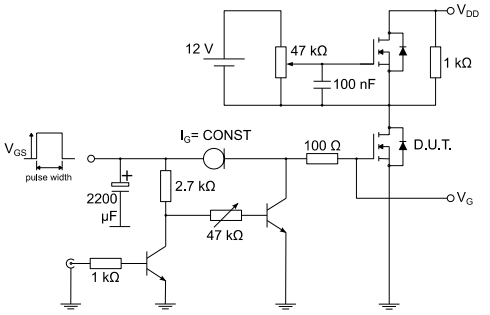


Figure 16: Test circuit for inductive load switching and diode recovery times

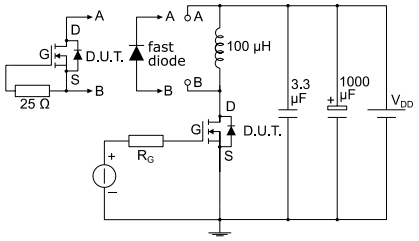


Figure 17: Unclamped inductive load test circuit

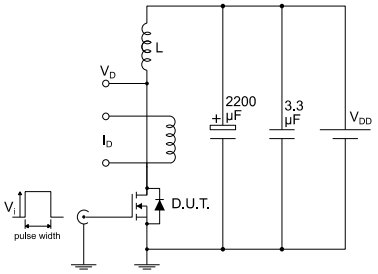


Figure 18: Unclamped inductive waveform

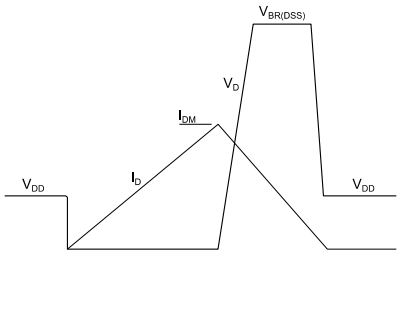
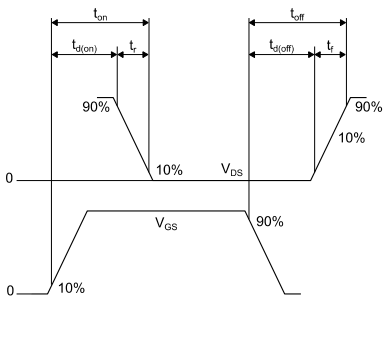


Figure 19: Switching time waveform



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 IPAK type C package information

Figure 20: IPAK (TO-251) type C package outline

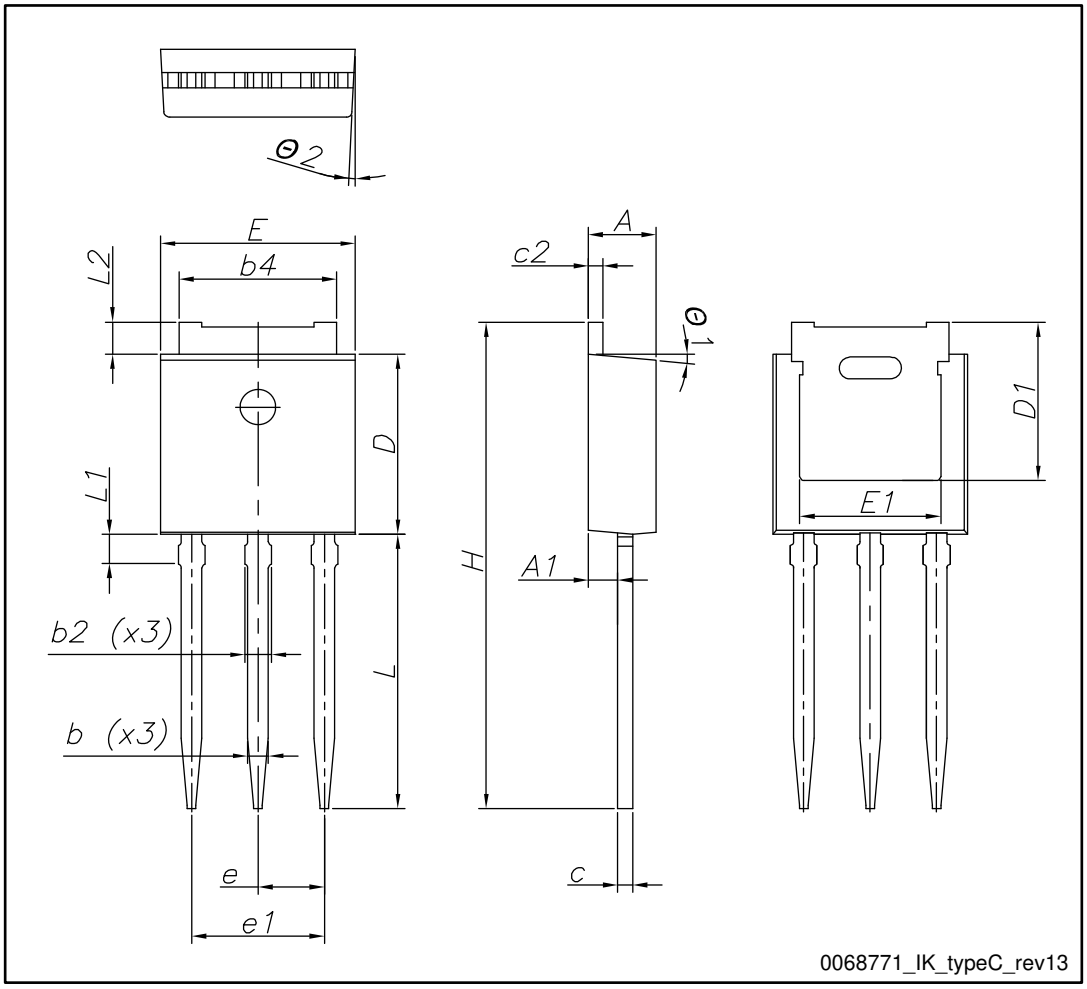


Table 10: IPAK (TO-251) type C package mechanical data

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	5.20	5.37	5.55
E	6.50	6.60	6.70
E1	4.60	4.78	4.95
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	0.90	1.00	1.20
L2	0.90	1.08	1.25
θ1	3°	5°	7°
θ2	1°	3°	5°

5 Revision history

Table 11: Document revision history

Date	Revision	Changes
08-Jan-2016	1	First release.

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