



# STD40N2LH5 STU40N2LH5

N-channel 25 V, 0.01  $\Omega$ , 40 A, DPAK, IPAK  
STripFET™ V Power MOSFET

Preliminary Data

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STD40N2LH5	25 V	0.012 $\Omega$	40 A
STU40N2LH5	25 V	0.0126 $\Omega$	40 A

- R<sub>DS(on)</sub> \* Q<sub>g</sub> industry benchmark
- Extremely low on-resistance R<sub>DS(on)</sub>
- Very low switching gate charge
- High avalanche ruggedness
- Low gate drive power losses

## Application

- Switching applications

## Description

This product utilizes the 5<sup>th</sup> generation of design rules of ST's proprietary STripFET™ technology. The lowest available R<sub>DS(on)</sub>\*Q<sub>g</sub>, in the standard packages, makes this device suitable for the most demanding DC-DC converter applications, where high power density is to be achieved.

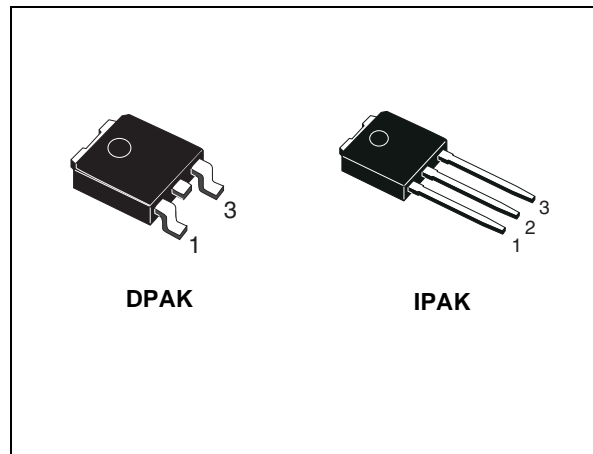


Figure 1. Internal schematic diagram

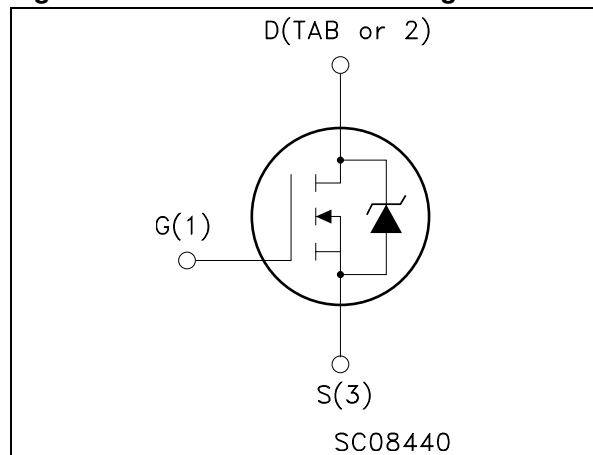


Table 1. Device summary

Order codes	Marking	Package	Packaging
STD40N2LH5	40N2LH5	DPAK	Tape and reel
STU40N2LH5	40N2LH5	IPAK	Tube

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS}=0$ )	25	V
$V_{GS}$	Gate-Source voltage	$\pm 22$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	40	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	28	A
$I_{DM}^{(1)}$	Drain current (pulsed)	160	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	35	W
	Derating factor	0.23	W/ $^\circ\text{C}$
$E_{AS}^{(2)}$	Single pulse avalanche energy	TBD	mJ
$T_j$ $T_{stg}$	Operating junction temperature Storage temperature	-55 to 175	$^\circ\text{C}$

1. Pulse width limited by safe operating area

2. Starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_D = 24\text{ A}$ ,  $V_{DD} = 12\text{ V}$

**Table 3. Thermal resistance**

Symbol	Parameter	Value	Unit
Rthj-case	Thermal resistance junction-case max	4.3	$^\circ\text{C}/\text{W}$
Rthj-amb	Thermal resistance junction-case max	100	$^\circ\text{C}/\text{W}$
$T_l$	Maximum lead temperature for soldering purpose	275	$^\circ\text{C}$

## 2 Electrical characteristics

( $T_{CASE} = 25^{\circ}C$  unless otherwise specified)

**Table 4. Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown Voltage	$I_D = 250 \mu A, V_{GS} = 0$	25			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 25 V$ $V_{DS} = 25 V, T_C = 125^{\circ}C$			1 10	$\mu A$ $\mu A$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 22 V$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250 \mu A$	1			V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10 V, I_D = 20 A$ SMD version		0.01	0.012	$\Omega$
		$V_{GS} = 10 V, I_D = 20 A$		0.0106	0.0126	$\Omega$
		$V_{GS} = 5 V, I_D = 20 A$ SMD version		0.0135	0.017	$\Omega$
		$V_{GS} = 5 V, I_D = 20 A$		0.0141	0.0176	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25 V, f = 1 MHz,$ $V_{GS} = 0$		840		pF
$C_{oss}$	Output capacitance			180		pF
$C_{rss}$	Reverse transfer capacitance			29		pF
$Q_g$	Total gate charge	$V_{DD} = 15 V, I_D = 40 A$		8		nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 5 V$		TBD		nC
$Q_{gd}$	Gate-drain charge	(Figure 3)		TBD		nC
$Q_{gs1}$	Pre $V_{th}$ gate-to-source charge	$V_{DD} = 15 V, I_D = 40 A$		TBD		nC
$Q_{gs2}$	Post $V_{th}$ gate-to-source charge	$V_{GS} = 5 V$ (Figure 8)		TBD		nC
$R_G$	Gate input resistance	f=1 MHz gate bias Bias= 0 test signal level=20 mV open drain		1.1		$\Omega$

**Table 6. Switching on/off (resistive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on delay time Rise time	$V_{DD}= 10\text{ V}$ , $I_D= 20\text{ A}$ , $R_G= 4.7\ \Omega$ , $V_{GS}= 10\text{ V}$ <i>(Figure 2 and Figure 7)</i>		TBD TBD		ns ns
$t_{d(off)}$ $t_f$	Turn-off delay time Fall time	$V_{DD}= 10\text{ V}$ , $I_D= 20\text{ A}$ , $R_G= 4.7\ \Omega$ , $V_{GS}= 10\text{ V}$ <i>(Figure 2 and Figure 7)</i>		TBD TBD		ns ns

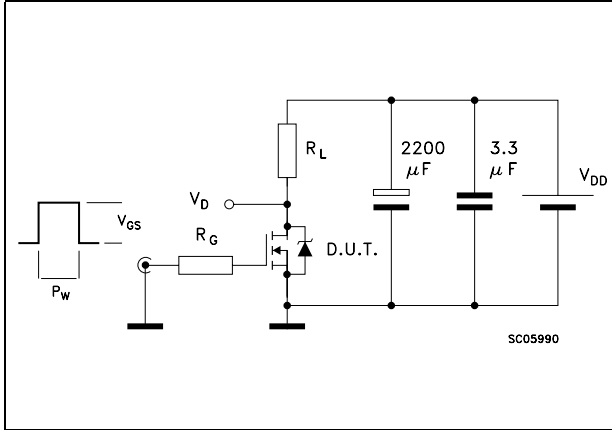
**Table 7. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current				40	A
$I_{SDM}$	Source-drain current (pulsed) <sup>(1)</sup>				160	A
$V_{SD}$	Forward on voltage	$I_{SD}= 20\text{ A}$ , $V_{GS}=0$			1.1	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD}= 40\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD}= 20\text{ V}$ , $T_J = 25\text{ }^\circ\text{C}$ <i>(Figure 4)</i>		TBD TBD TBD		ns nC A

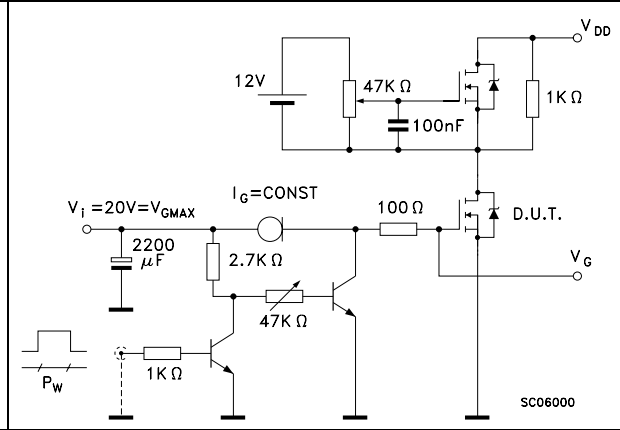
1. Pulsed: pulse duration = 300µs, duty cycle 1.5%

### 3 Test circuits

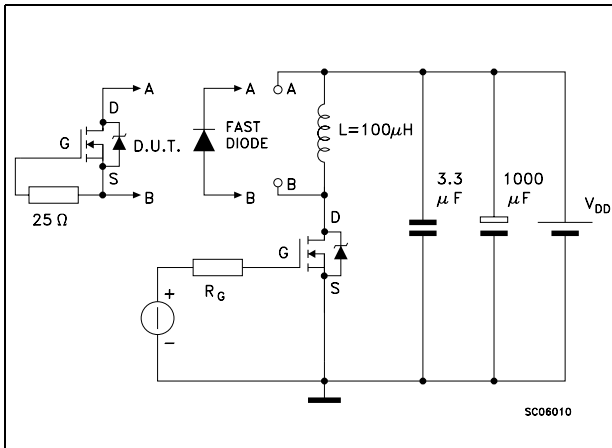
**Figure 2. Switching times test circuit for resistive load**



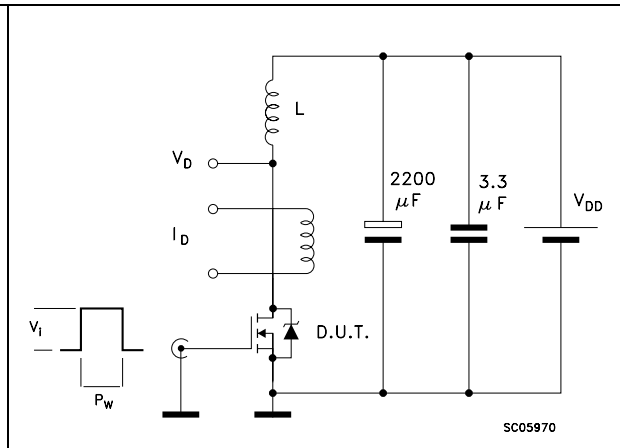
**Figure 3. Gate charge test circuit**



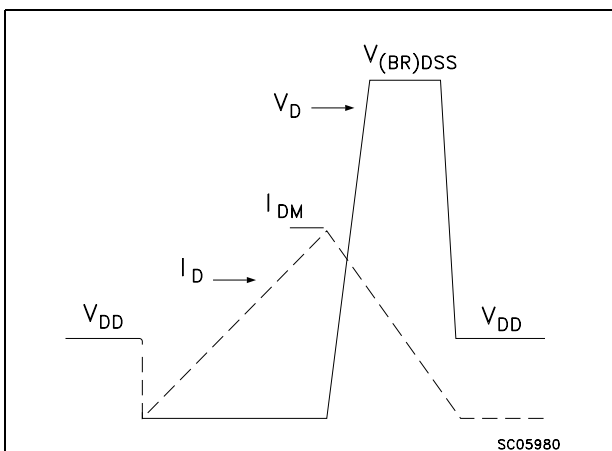
**Figure 4. Test circuit for inductive load switching and diode recovery times**



**Figure 5. Unclamped Inductive load test circuit**



**Figure 6. Unclamped inductive waveform**



**Figure 7. Switching time waveform**

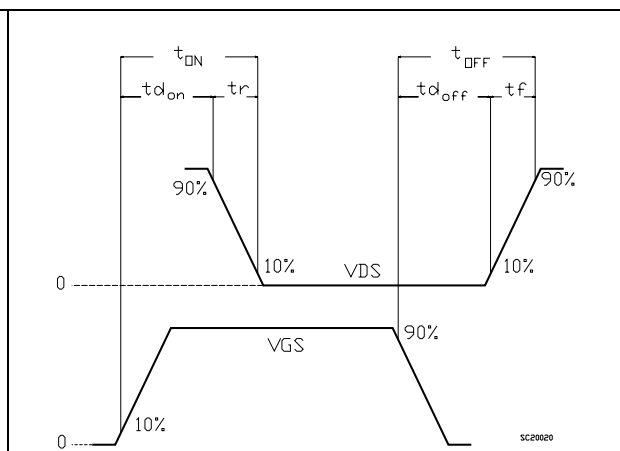
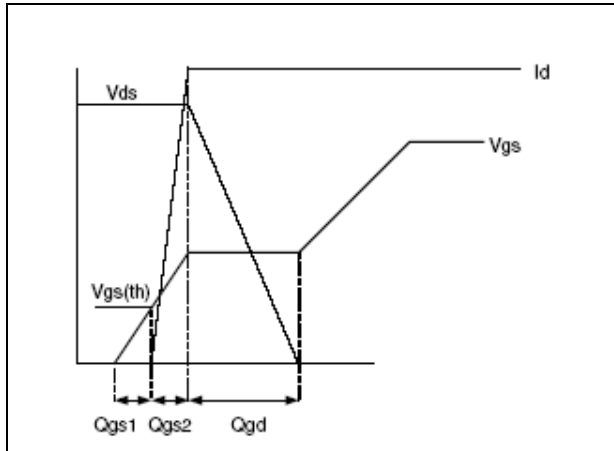


Figure 8. Gate charge waveform

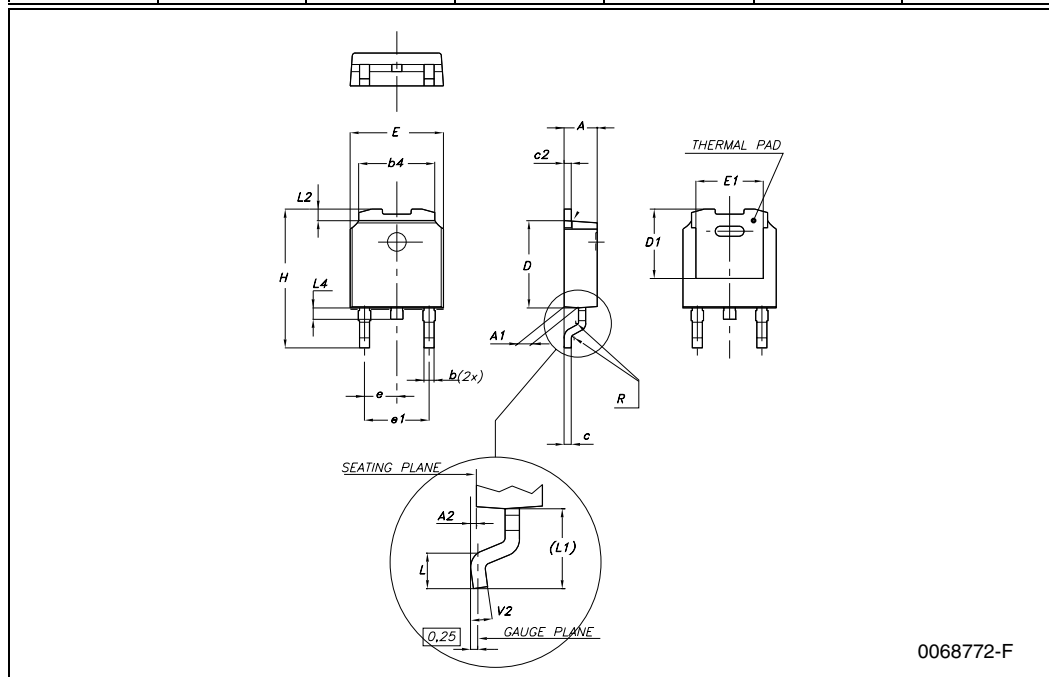


## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)

**DPAK MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.9	0.025		0.035
b4	5.2		5.4	0.204		0.212
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
D1		5.1			0.200	
E	6.4		6.6	0.252		0.260
E1		4.7			0.185	
e		2.28			0.090	
e1	4.4		4.6	0.173		0.181
H	9.35		10.1	0.368		0.397
L	1			0.039		
(L1)		2.8			0.110	
L2		0.8			0.031	
L4	0.6		1	0.023		0.039
R		0.2			0.008	
V2	0°		8°	0°		8°

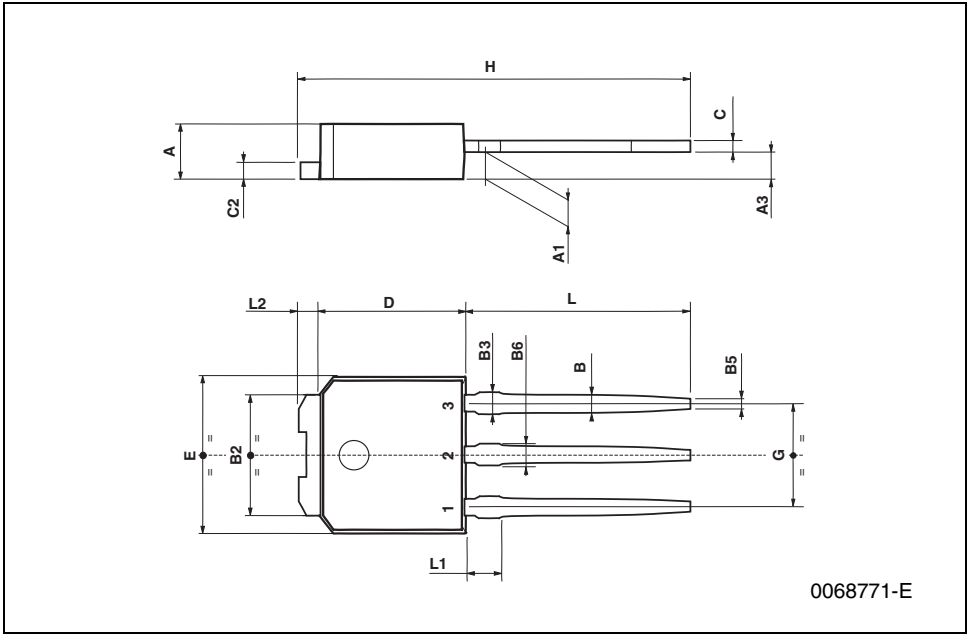


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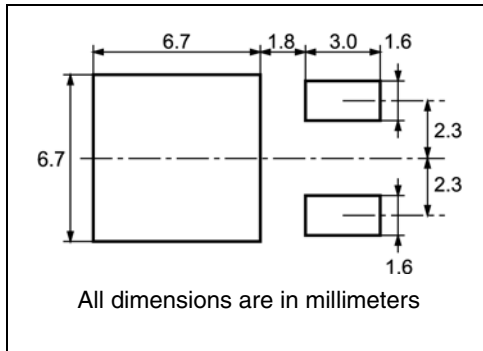
**TO-251 (IPAK) MECHANICAL DATA**

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A3	0.7		1.3	0.027		0.051
B	0.64		0.9	0.025		0.031
B2	5.2		5.4	0.204		0.212
B3			0.85			0.033
B5		0.3			0.012	
B6			0.95			0.037
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
E	6.4		6.6	0.252		0.260
G	4.4		4.6	0.173		0.181
H	15.9		16.3	0.626		0.641
L	9		9.4	0.354		0.370
L1	0.8		1.2	0.031		0.047
L2		0.8	1		0.031	0.039



# 5 Packaging mechanical data

## DPAK FOOTPRINT



## TAPE AND REEL SHIPMENT

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	16.4	18.4	0.645	0.724
N	50		1.968	
T		22.4		0.881

BASE QTY		BULK QTY	
2500		2500	

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	6.8	7	0.267	0.275
B0	10.4	10.6	0.409	0.417
B1		12.1		0.476
D	1.5	1.6	0.059	0.063
D1	1.5		0.059	
E	1.65	1.85	0.065	0.073
F	7.4	7.6	0.291	0.299
K0	2.55	2.75	0.100	0.108
P0	3.9	4.1	0.153	0.161
P1	7.9	8.1	0.311	0.319
P2	1.9	2.1	0.075	0.082
R	40		1.574	
W	15.7	16.3	0.618	0.641

## 6 Revision history

**Table 8. Document revision history**

Date	Revision	Changes
24-Jul-2008	1	Initial release
23-Sep-2008	2	$V_{GS}$ value has been changed on <a href="#">Table 2</a> and <a href="#">Table 5</a>

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