STK24N4LLF5

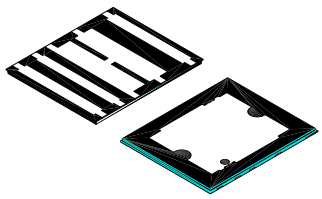
N-channel 40 V, 0.0046 Ω, 24 A, PolarPAK® STripFET™V Power MOSFET

Preliminary Data

Features

Type	V_{DSS}	$R_{DS(on)}$ max	$R_{DS(on)}*Q_g$
STK24N4LLF5	40 V	< 0.0055 Ω	96 nC*mΩ

- Ultra low top and bottom junction to case thermal resistance
- $R_{DS(on)}$ * Q_g industry benchmark
- Extremely low on-resistance $R_{DS(on)}$
- Very low switching gate charge
- Fully encapsulated die
- 100% matte tin finish (in compliance with the 2002/95/EC european directive)
- High avalanche ruggedness
- PolarPAK® is a trademark of VISHAY



PolarPAK®

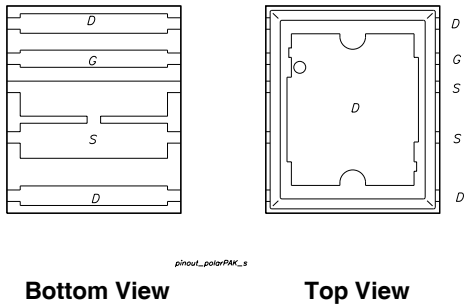
Application

- Switching applications

Description

This product utilizes the 5th generation of design rules of ST's proprietary STripFET™ technology. The lowest available $R_{DS(on)}*Q_g$, in this chip scale package, 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



Bottom View Top View

Table 1. Device summary

Order code	Marking	Package	Packaging
STK24N4LLF5	244L5	PolarPAK®	Tape and reel

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage (V_{GS} = 0)	40	V
V_{GS}	Gate-source voltage	± 22	V
I_D (1)	Drain current (continuous) at T_C = 25 °C	24	A
I_D	Drain current (continuous) at T_C = 100 °C	15.3	A
I_{DM} (2)	Drain current (pulsed)	96	A
P_{TOT} (1)	Total dissipation at T_C = 25 °C	5.2	W
	Derating factor	0.0416	W/°C
E_{AS} (3)	Single pulse avalanche energy	TBD	J
T_j T_{stg}	Operating junction temperature Storage temperature	-55 to 150	°C

1. When mounted on FR-4 board of 1inch^2, 2 oz Cu and ≤ 10sec
2. Pulse width limited by package
3. Starting T_J = 25 °C, I_D = 12 A, V_{DD} = 25 V

Table 3. Thermal data

Symbol	Parameter	Typ.	Max.	Unit
Rthj-amb(1)	Thermal resistance junction-amb	20	24	°C/W
Rthj-c(2)	Thermal resistance junction-case (top drain)	1	1.2	°C/W
Rthj-c(3)	Thermal resistance junction-case (source)	2.8	3.4	°C/W

1. When mounted on FR-4 board of 1inch^2, 2 oz Cu and ≤ 10sec
2. Steady state
3. Measured at source pin when the device is mounted on FR-4 board in steady state

2 Electrical characteristics

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

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 250 µA, V_{GS}= 0	40			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max rating, V_{DS} = Max rating,Tc=125°C			1 10	µA µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ±22 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS}= V_{GS}, I_D = 250 µA	1		2.5	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS}= 10 V, I_D= 12 A V_{GS}= 4.5 V, I_D= 12 A		0.0046 0.0058	0.0055 0.0065	Ω Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} =25 V, f=1 MHz, V_{GS}=0		2350 335 50		pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD}=15 V, I_D = 24 A V_{GS} =4.5 V *(see Figure 3)*		20 TBD TBD		nC nC nC
R_G	Gate input resistance	f=1 MHz Gate DC Bias = 0 Test signal level = 20 mV open drain		TBD		Ω

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time Rise time	V_{DD}= 15 V, I_D= 12 A, R_G=4.7 Ω, V_{GS}=4.5 V *(see Figure 2)*		TBD TBD		ns ns
$t_{d(off)}$ t_f	Turn-off delay time Fall time	V_{DD}=15 V, I_D= 12 A, R_G=4.7 Ω, V_{GS}=4.5 V *(see Figure 2)*		TBD TBD		ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM}(1)	Source-drain current Source-drain current (pulsed)				24 96	A A
V_{SD}(2)	Forward on Voltage	I_{SD}= 24 A, V_{GS}=0			1.1	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD}= 24 A, di/dt = 100 A/µs, V_{DD}=20 V, Tj=150 °C *(se Figure 7)*		TBD TBD TBD		ns nC A

1. Pulse width limited by package
2. Pulsed: pulse duration = 300µs, duty cycle 1.5%

3 Test circuits

Figure 2. Switching times test circuit for resistive load

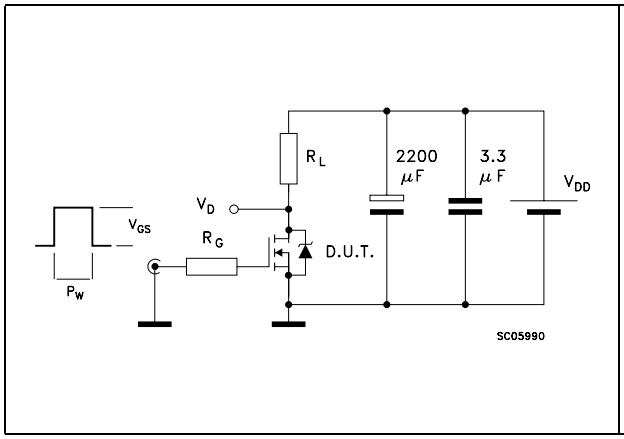


Figure 3. Gate charge test circuit

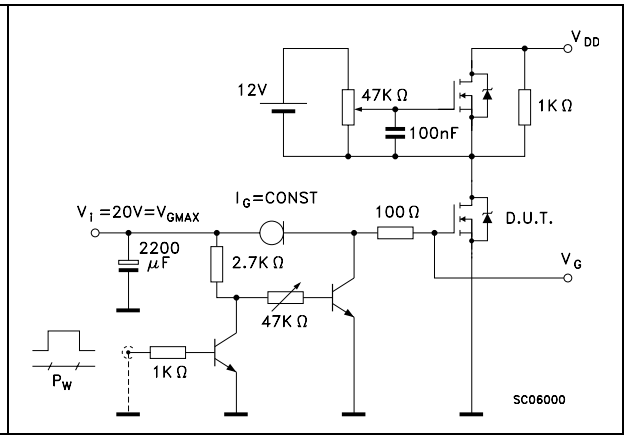


Figure 4. Test circuit for inductive load switching and diode recovery times

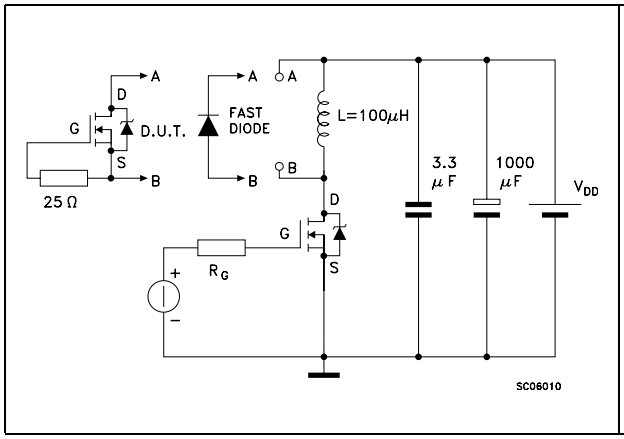


Figure 5. Unclamped inductive load test circuit

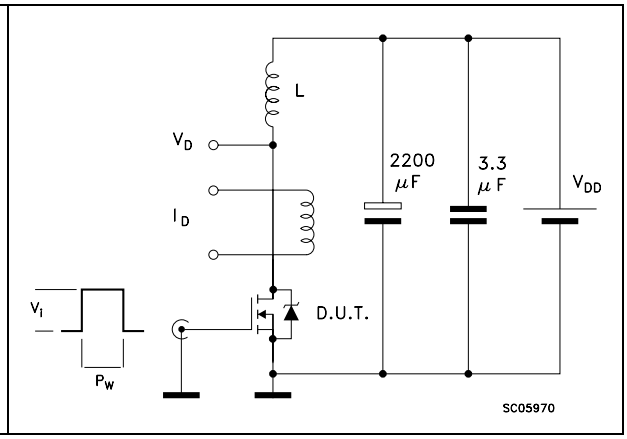


Figure 6. Unclamped inductive waveform

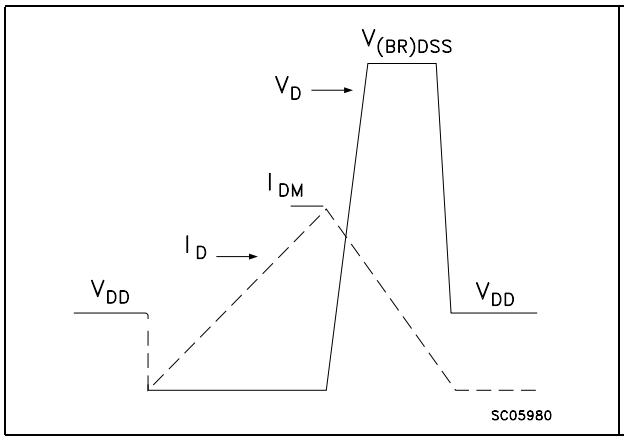


Figure 7. Switching time waveform

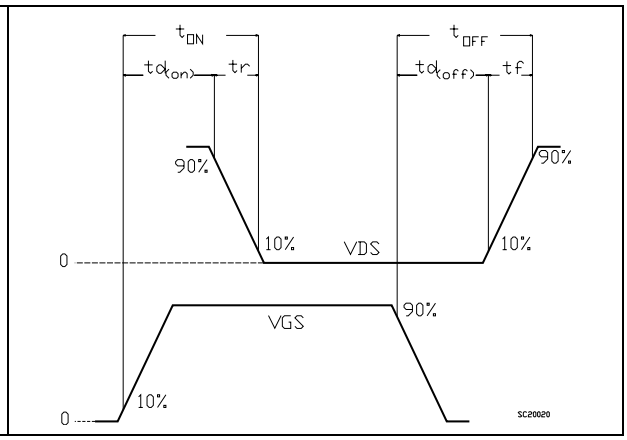
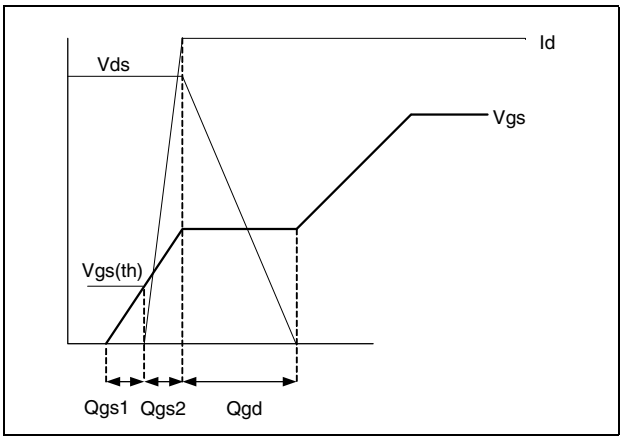


Figure 8. Gate charge waveform



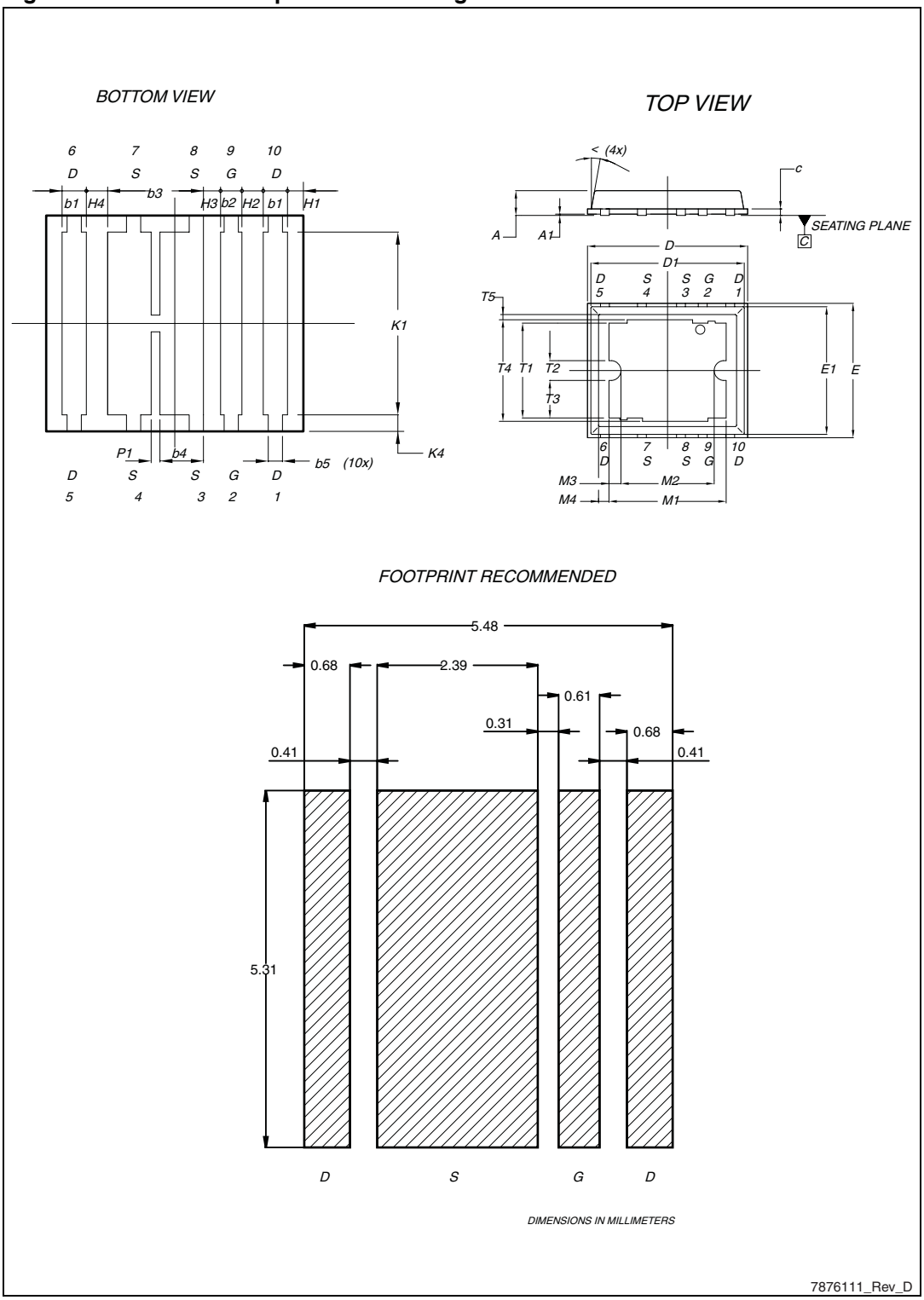
4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in 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.

Table 8. PolarPAK® option “S” mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.75	0.80	0.85
A1			0.05
b1	0.48	0.58	0.68
b2	0.41	0.51	0.61
b3	2.19	2.29	2.39
b4	0.89	1.04	1.19
b5	0.23	0.33	0.43
c	0.20	0.25	0.30
D	6	6.15	6.30
D1	5.74	5.89	6.04
E	5.01	5.16	5.31
E1	4.75	4.90	5.05
H1	0.23	0.38	
H2	0.45	0.51	0.56
H3	0.31	0.41	0.51
H4	0.45	0.51	0.56
K1	4.22	4.37	4.52
K2	1.08	1.13	1.18
K3	1.37		
K4	0.24		
M1	4.30	4.50	4.70
M2	3.43	3.58	3.73
M3	0.22		
M4	0.05		
P1	0.15	0.20	0.25
T1	3.48	3.64	4.10
T2	0.56	0.76	0.95
T3	1.20		
T4	3.90		
T5		0.18	0.36
<	0°	10°	12°

Figure 9. PolarPAK® option "S" drawing



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
19-Jan-2009	1	First release

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