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STK20N75F3

N-channel 75 V, 0.0065 Ω , 20 A, PolarPAK[®]
STripFET[™] Power MOSFET

Features

Type	V _{DSS}	R _{DS(on)} max
STK20N75F3	75 V	< 0.0079 Ω

- Ultra low top and bottom junction to case thermal resistance
- 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

Application

- Switching applications

Description

This STripFET[™] III Power MOSFET technology is among the latest improvements, which have been especially tailored to minimize on-state resistance providing superior switching performances.

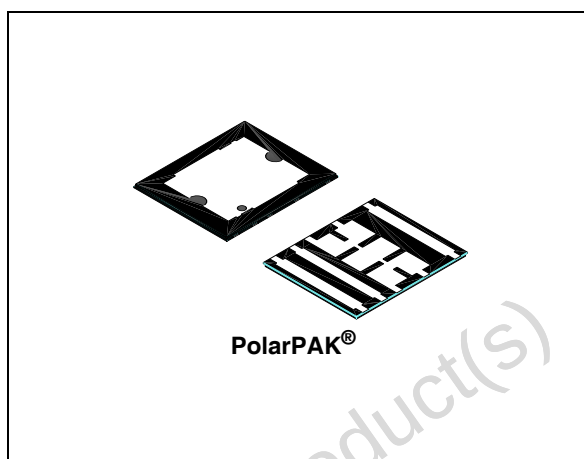


Figure 1. Internal schematic diagram

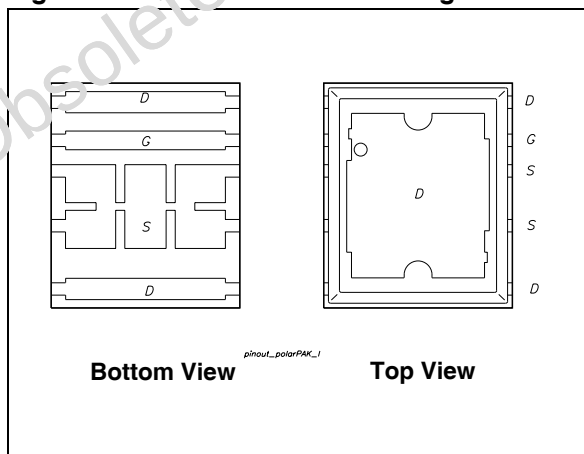


Table 1. Device summary

Order code	Marking	Package	Packaging
STK20N75F3	20753	PolarPAK [®]	Tape and reel

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Electrical ratings

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	75	V
V_{GS}	Gate-source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	20	A
I_D	Drain current (continuous) at $T_C = 100^\circ\text{C}$	12.5	A
$I_{DM}^{(2)}$	Drain current (pulsed)	80	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25^\circ\text{C}$	5.2	W
	Derating factor	0.0416	W/ $^\circ\text{C}$
$E_{AS}^{(3)}$	Single pulse avalanche energy	600	mJ
T_j T_{stg}	Operating junction temperature Storage temperature	-55 to 150	$^\circ\text{C}$

1. When mounted on FR-4 board of 1inch², 2 oz Cu and ≤ 10 sec
2. Pulse width limited by package
3. Starting $T_j = 25^\circ\text{C}$, $I_D = 20$ A, $V_{DD} = 50$ V

Table 3. Thermal data

Symbol	Parameter	Typ.	Max.	Unit
$R_{thj-amb}^{(1)}$	Thermal resistance junction-amb	20	24	$^\circ\text{C}/\text{W}$
$R_{thj-c}^{(2)}$	Thermal resistance junction-case (top drain)	0.8	1	$^\circ\text{C}/\text{W}$
$R_{thj-c}^{(3)}$	Thermal resistance junction-case (source)	2.2	2.7	$^\circ\text{C}/\text{W}$

1. When mounted on FR-4 board of 1inch², 2 oz Cu and ≤ 10 sec
2. Steady state
3. Measured at source pin when the device is mounted on FR-4 board in steady state

Electrical characteristics

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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	75			V
I _{DSS}	Zero gate voltage drain current (V _{GS} = 0)	V _{DS} = Max rating, V _{DS} = Max rating, T _C = 125°C			1 10	μA μA
I _{GSS}	Gate body leakage current (V _{DS} = 0)	V _{GS} = ± 20V			±100	nA
V _{GS(th)}	Gate threshold voltage	V _{DS} = V _{GS} , I _D = 250 μA	2		4	V
R _{DS(on)}	Static drain-source on resistance	V _{GS} = 10 V, I _D = 10 A		0.0065	0.0079	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	-	2480 446 41	-	pF pF pF
Q _g Q _{gs} Q _{gd}	Total gate charge Gate-source charge Gate-drain charge	V _{DD} = 38 V, I _D = 20 A V _{GS} = 10 V (see Figure 14)	-	40.4 11.6 9.9	-	nC nC nC
R _G	Gate input resistance	f = 1 MHz Gate DC Bias = 0 Test signal level = 20 mV open drain	-	0.85	-	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} = 37.5 V, I _D = 10 A, R _G = 4.7 Ω, V _{GS} = 10 V (see Figure 13)	-	15.6 16.2	-	ns ns
t _{d(off)} t _f	Turn-off delay time Fall time	V _{DD} = 37.5 V, I _D = 10 A, R _G = 4.7 Ω, V _{GS} = 10 V (see Figure 13)	-	37.8 4	-	ns ns

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Electrical characteristics

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		20	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		80	A
$V_{SD}^{(2)}$	Forward on Voltage	$I_{SD}=20\text{ A}$, $V_{GS}=0$	-		1.2	V
t_{rr}	Reverse recovery time	$I_{SD}=20\text{ A}$, $di/dt=100\text{ A}/\mu\text{s}$, $V_{DD}=60\text{ V}$, $T_j=150^\circ\text{C}$	-	49.7		ns
Q_{rr}	Reverse recovery charge	(see Figure 18)	-	103.6		nC
I_{RRM}	Reverse recovery current			4.2		A

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

Electrical characteristics

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2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

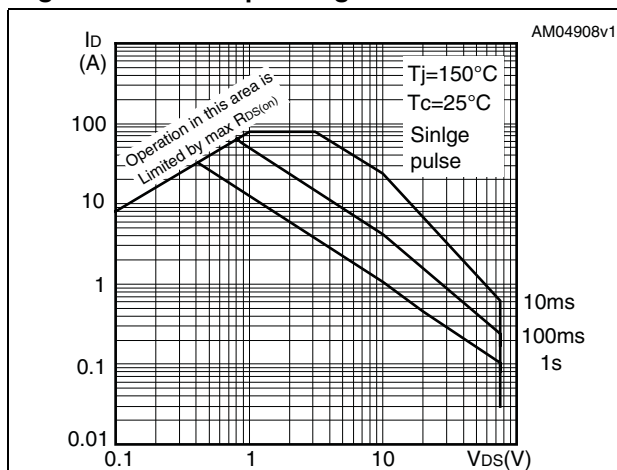


Figure 3. Thermal impedance

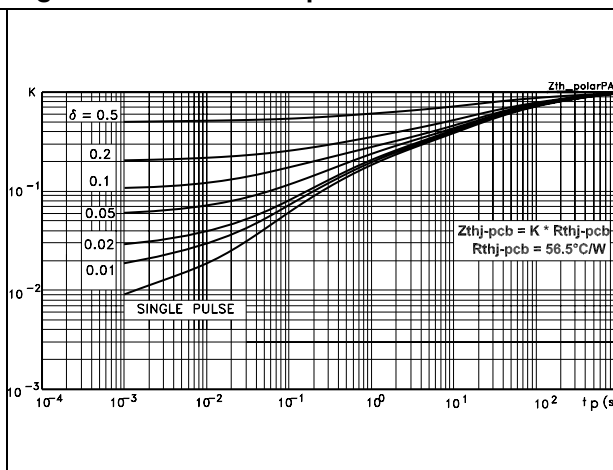


Figure 4. Output characteristics

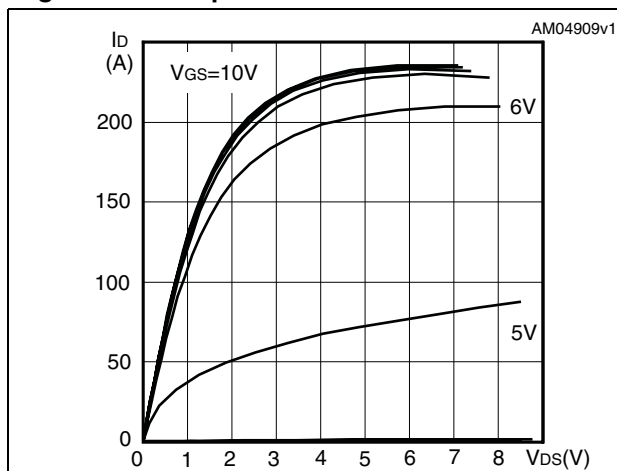


Figure 5. Transfer characteristics

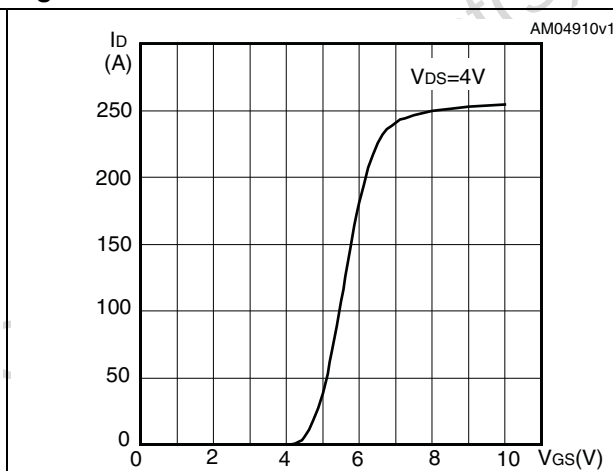


Figure 6. Normalized BV_{DSS} vs temperature

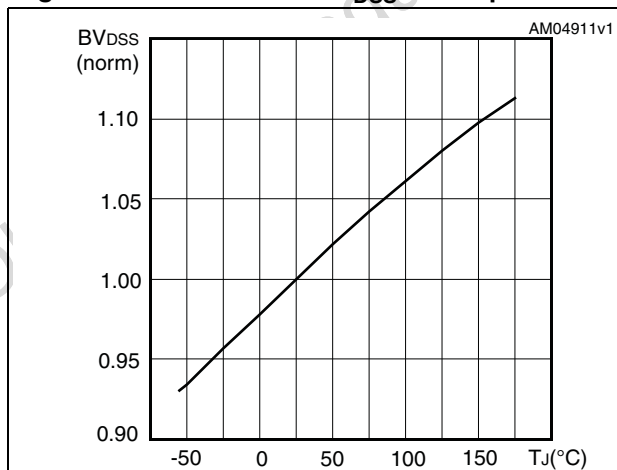
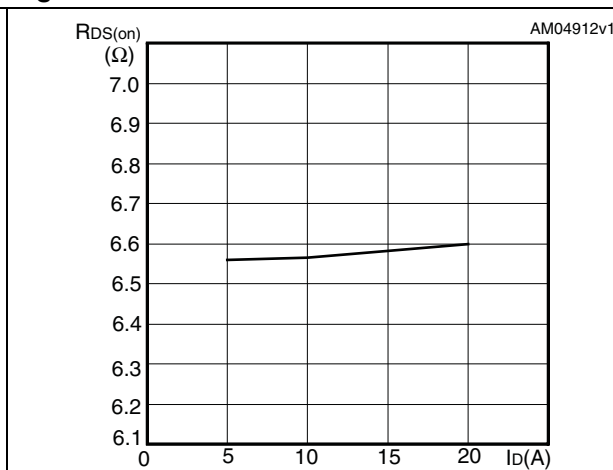


Figure 7. Static drain-source on resistance



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Electrical characteristics

Figure 8. Gate charge vs gate-source voltage **Figure 9. Capacitance variations**

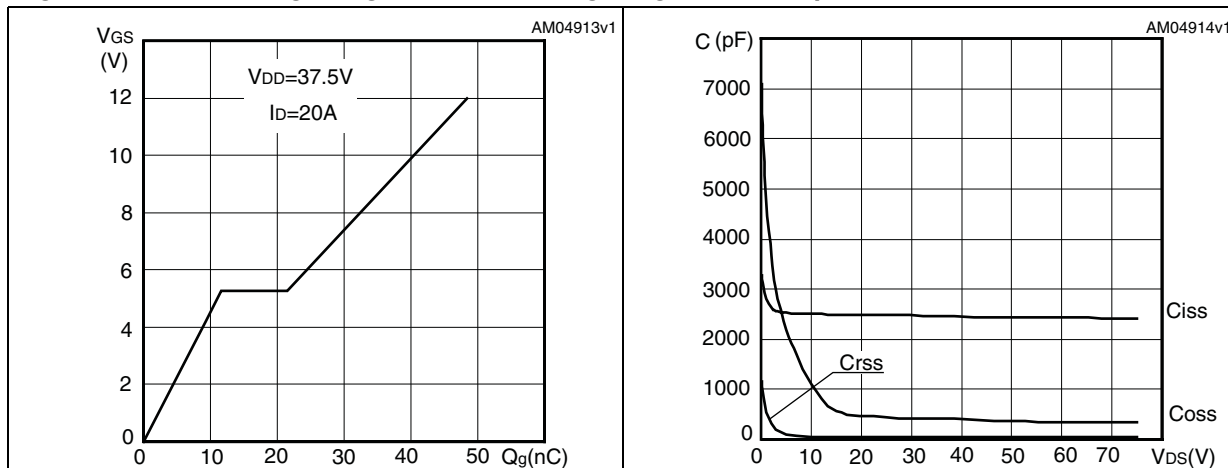


Figure 10. Normalized gate threshold voltage vs temperature **Figure 11. Normalized on resistance vs temperature**

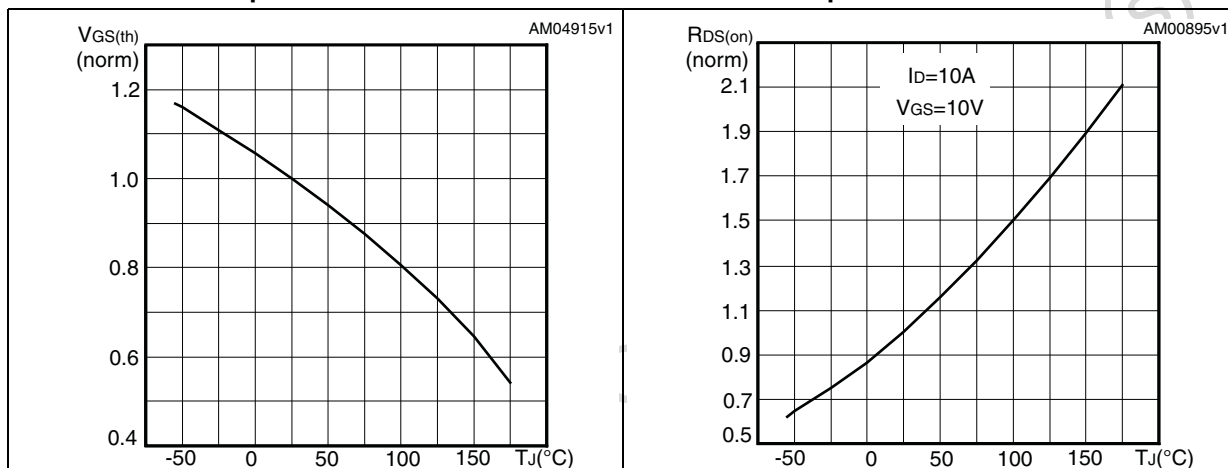
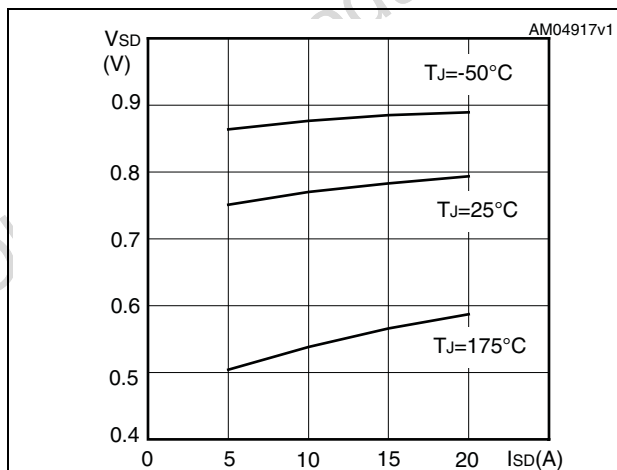


Figure 12. Source-drain diode forward characteristics



Test circuits

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3 Test circuits

Figure 13. Switching times test circuit for resistive load

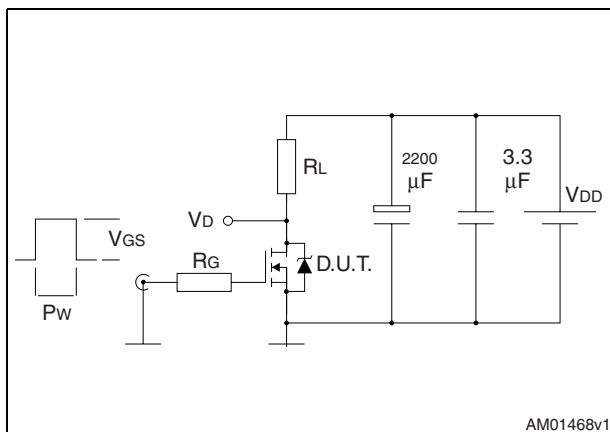


Figure 14. Gate charge test circuit

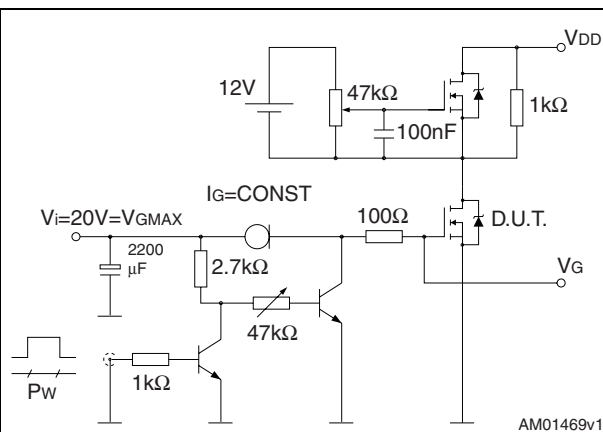


Figure 15. Test circuit for inductive load switching and diode recovery times

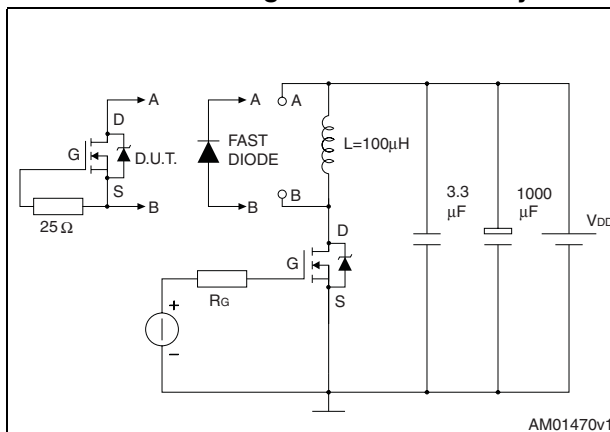


Figure 16. Unclamped inductive load test circuit

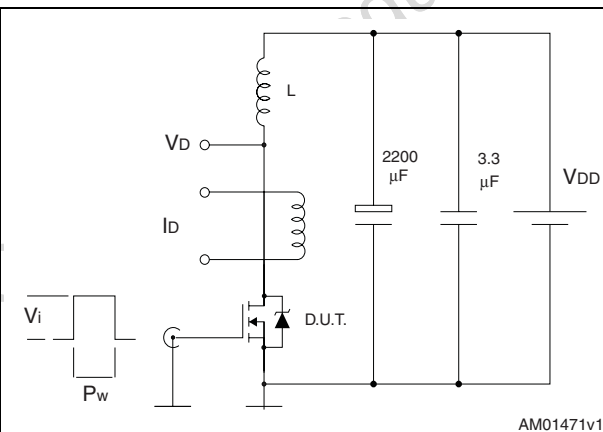


Figure 17. Unclamped inductive waveform

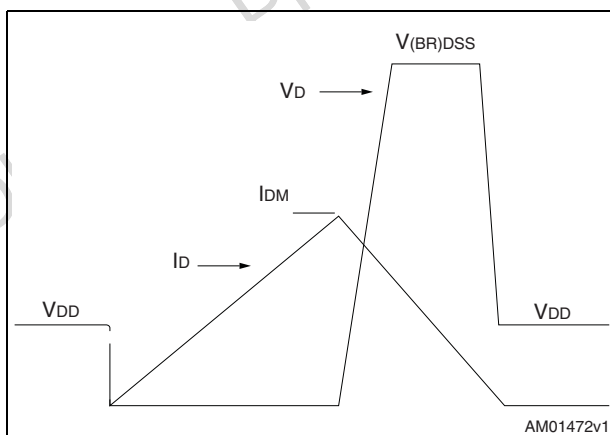
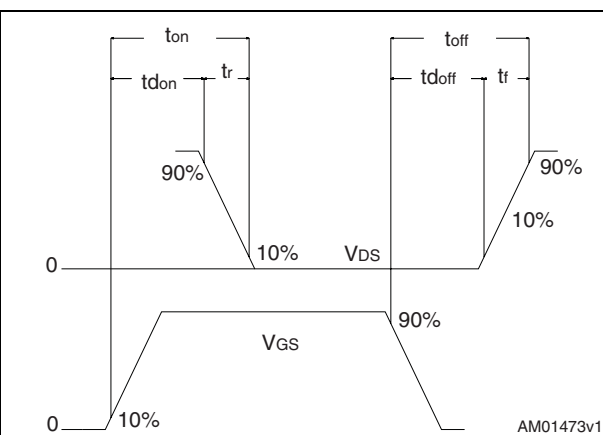


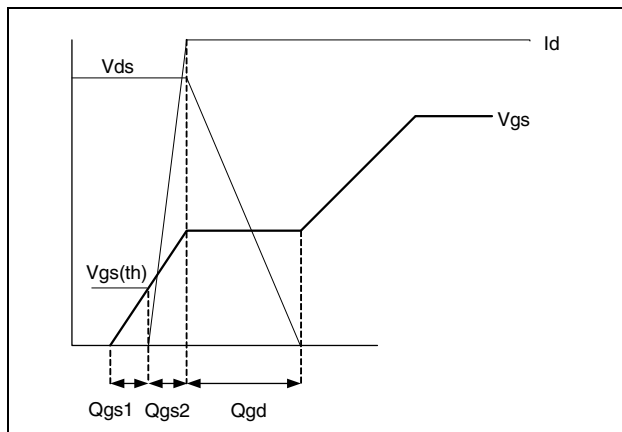
Figure 18. Switching time waveform



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Test circuits

Figure 19. 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.

Obsolete Product(s) - Obsolete Product(s)

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Package mechanical data

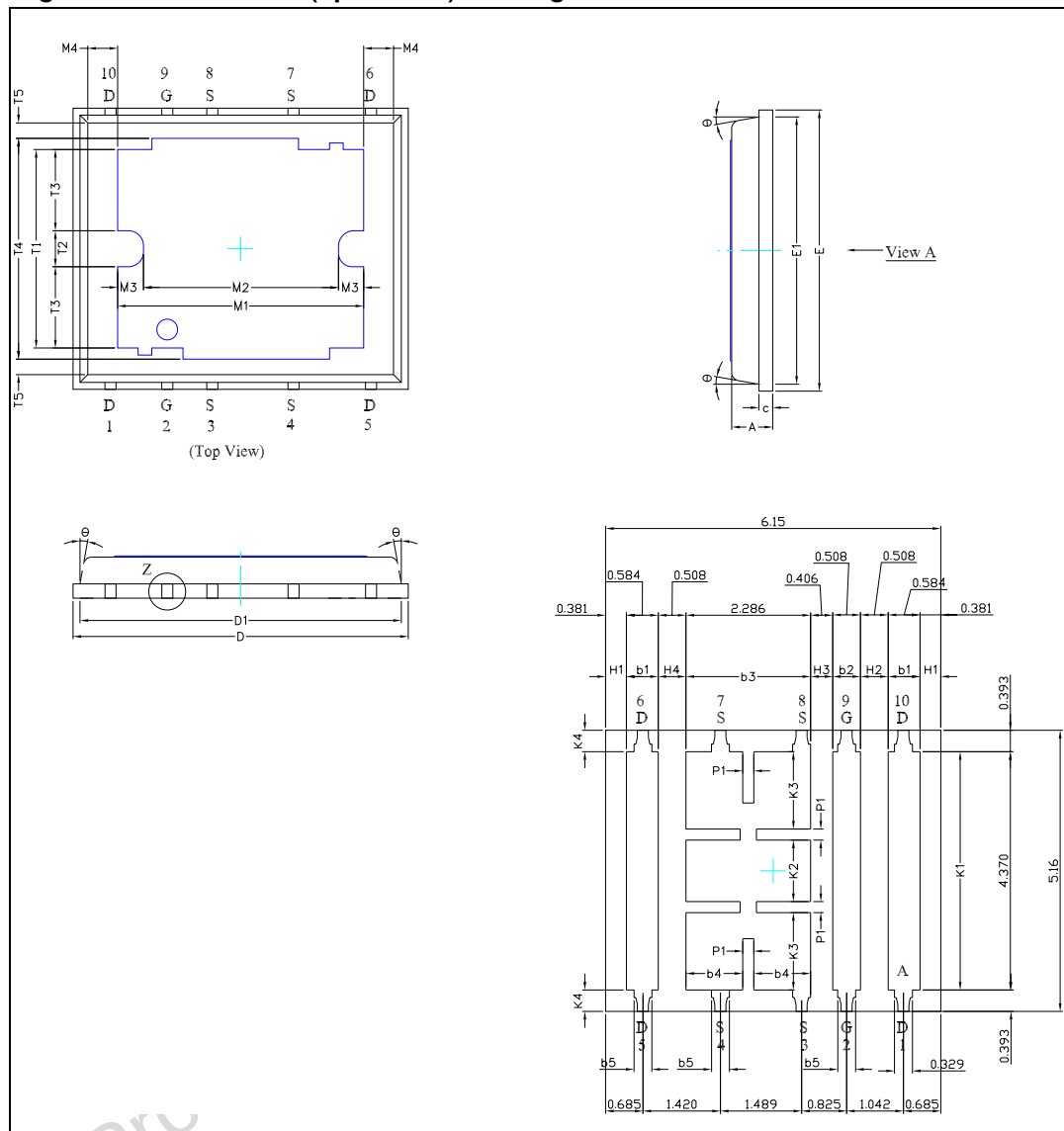
Table 8. PolarPAK® (option "L") mechanical data

Ref.	mm			inch		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.75	0.80	0.85	0.030	0.031	0.033
A1			0.05			0.002
b1	0.48	0.58	0.68	0.019	0.023	0.027
b2	0.41	0.51	0.61	0.016	0.020	0.024
b3	2.19	2.29	2.39	0.086	0.090	0.094
b4	0.89	1.04	1.19	0.035	0.041	0.047
b5	0.23	0.33	0.43	0.009	0.013	0.017
c	0.20	0.25	0.30	0.008	0.010	0.012
D	6	6.15	6.30	0.236	0.242	0.248
D1	5.74	5.89	6.04	0.226	0.232	0.238
E	5.01	5.16	5.31	0.197	0.203	0.209
E1	4.75	4.90	5.05	0.187	0.193	0.199
H1	0.23			0.009		
H2	0.45		0.56	0.018		0.022
H3	0.31	0.41	0.51	0.012	0.016	0.020
H4	0.45		0.56	0.018		0.022
K1	4.22	4.37	4.52	0.166	0.172	0.178
K2	1.08	1.13	1.18	0.043	0.044	0.046
K3	1.37			0.054		
K4	0.24			0.009		
M1	4.30	4.50	4.70	0.169	0.177	0.185
M2	3.43	3.58	3.73	0.135	0.141	0.147
M3	0.22			0.009		
M4	0.05			0.002		
P1	0.15	0.20	0.25	0.006	0.008	0.010
T1	3.48	3.64	4.10	0.137	0.143	0.161
T2	0.56	0.76	0.95	0.022	0.030	0.037
T3	1.20			0.047		
T4	3.90			0.154		
T5		0.18	0.36		0.007	0.014
<	0°	10°	12°	0°	10°	12°

Package mechanical data

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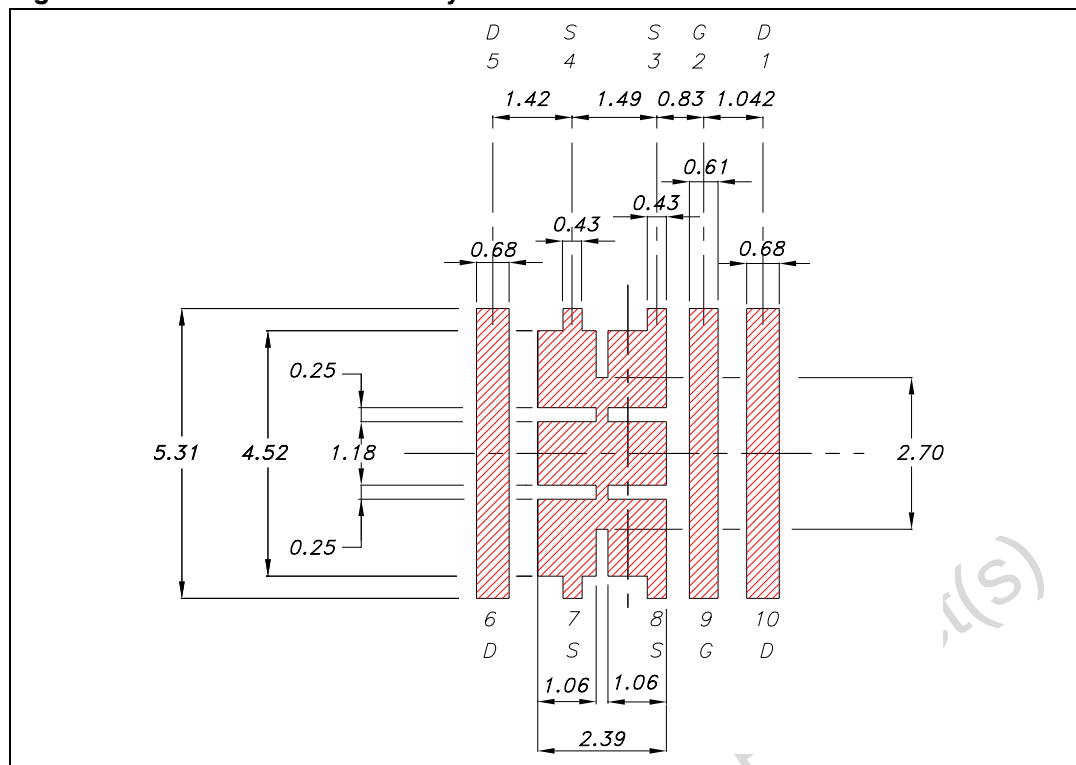
Figure 20. PolarPAK® (option “L”) drawings



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Package mechanical data

Figure 21. Recommended PAD layout



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
01-Jul-2008	1	First release
22-Jun-2009	2	Document status promoted from preliminary data to datasheet.

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