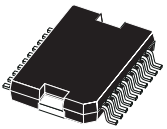
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L9651

SMART QUAD SWITCH

- Modified VDMOS Power Stage (U_{DSBR} > 80V)
- RDSON < 500 mOhm (T_j = 25°C)
- CMOS Compatible Inputs
- Enable Input (Reset)
- Outputs Capable of up to 2.2 Amperes
- Outputs Internally Clamped at 70V for Fast Inductive Load Switch Off
- Wide operating supply voltage from 4.7V up to 30V
- DIAGNOSTIC FUNCTIONS
- Open Load Detection (Output off, 100µs-filtering time)
- Short to Ground Detection (Output off, 100µs - filtering time)
- Short to Battery Detection (Output on)
- Over temperature detection (Output on)
- Storage of last fault in 8 Bit - Serial Register
- Fault Signal Indication at Serial Data Out without need to read out the Serial Interface
- Daisy Chainable Serial Diagnostic



PowerSO-20

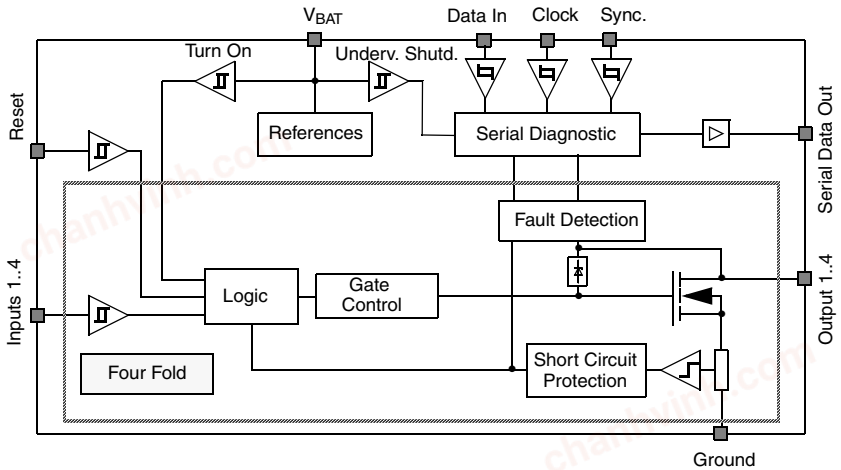
ORDERING NUMBER: L9651

- Serial Interface Clock Frequency up to 500kHz

DESCRIPTION

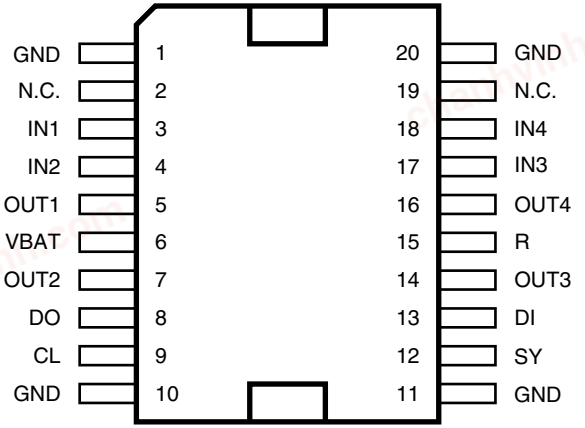
The L9651 consists of four identical low side power switches. A serial diagnostic interface indicates failure mode of each switch (short circuit to V_{BAT} or ground and open load or over temperature).

BLOCK DIAGRAM



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PIN CONNECTION (Top view)



SO20POW

PIN FUNCTION

N°	Pin	Function
1, 10, 11, 20	GND	Ground
2, 19	N.C.	Not Connected
3	IN1	Input 1
4	IN2	Input 2
5	OUT1	Output 1
6	VBAT	Supply Voltage
7	OUT2	Output 2
8	DO	Serial Data Out
9	CL	Clock
12	SY	Synchronization
13	DI	Serial Data In
14	OUT3	Output 3
15	R	Reset
16	OUT4	Output 4
17	IN3	Input 3
18	IN4	Input 4

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ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
T_{STG}	Storage Temperature	-55 to 150	°C
T_J	Operating Junction Temperature	-40 to 150	°C
V_{BAT}	DC Supply Voltage	-2 to 30	V
V_{BATtr}	Transient Supply Voltage; t < 400ms	40	V
V_{OUT}	Output Voltage	65	V
V_{OUTtr}	Transient Output Voltage; during clamping	78	V
E_{CL}	Output Clamping energy; repetition rate < 100 Hz	10	mJ
$-I_{OUT}$	Output reverse current	2	A
$V_R, V_{INi}, V_{DI}, V_{CL}V_{SY}$	Control Input voltage	-0.3 to 6.5	V
V_{DO}	Control Output voltage	-0.3 to 6.5	V

THERMAL DATA

Symbol	Parameter	Value	Unit
$R_{th\ j\text{-}case}$	Thermal Resistance Junction to Case	2.5	°C/W

ELECTRICAL CHARACTERISTCS ($6.5V < V_{BAT} < 25V$, $-40 < T_J < 150°C$)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
Supply Voltage						
V_{BATU}	Turn on threshold voltage		2.0		4.7	V
I_{BAT}	Supply current	V_{BAT} = 14V V_{OUTi} > 0V	4	10	15	mA
Output stage						
R_{DSON}	On resistance	V_{BAT} = 14V T_J = 25°C; I_{out} = 1A			500	mΩ
		V_{BAT} = 14V T_J = 150°C; I_{out} = 1A			850	mΩ
V_{CL}	Clamping voltage, inductive load	I_{out} = 0.5 A	63	70	76	V
I_{OUTi}	Over current shutdown (Shutdown latch resets with pos. slope at INi)	T_J = -40°C	3.0		4.3	A
		T_J = 25°C	2.5		3.7	A
		T_J = 150°C	2.2		3.5	A
Output leakage current see: Open load diagnostic current						

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ELECTRICAL CHARACTERISTCS (continued)

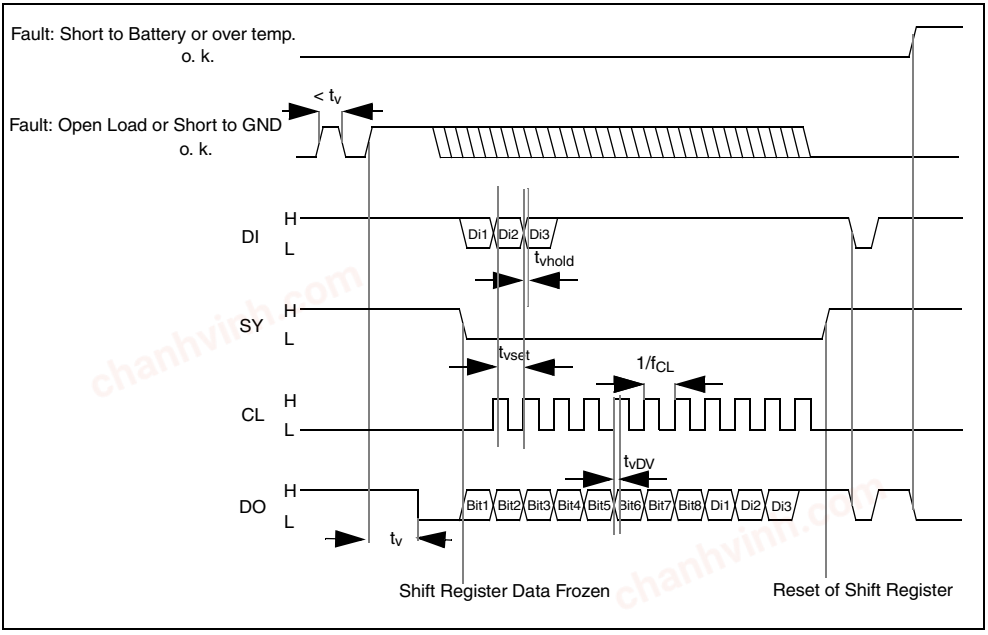
Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
Logic Inputs IN1...IN4, SY, CL, DI, R						
V_{INiLH} V_{SYLH} V_{CLLH} V_{RLH} V_{DILH}	Input High level		3.5		6.5	V
V_{INiHL} V_{SYHL} V_{CLHL} V_{RHL} V_{DIHL}	Input Low level		-0.3		1.5	V
V_{INih} V_{SYh} V_{CLh} V_{Rh} V_{DIh}	Hysteresis		0.2		1	V
- I_{INi} - I_{SY} - $I_{C\,L}$ - I_R	Input current IN1 ... IN4, SY, CL, R (Internal pull up current source)	V_{INi} = 0V	10	40	120	µA
		V_{SY} = 0V V_{CL} = 0V V_R = 0V	10		80	
- I_{DI}	Input current DI (Internal pull up current source)	V_{DI} = 0V	120	220	250	µA
Timing						
t_{don}	Turn on delay			7.5		µs
t_{doff}	Turn off delay			7.5		µs
s_{on}	Switch on slew rate			10		V/µs
s_{off}	Switch off slew rate			15		V/µs
t_{oc}	Over current detection time			0.5		µs
t_v	Open load filtering time		60	100	200	µs
t_v	Short to GND filtering time		60	100	200	µs
f_{CL}	Serial clock frequency		0		500	kHz
t_{vDV}	DO: Datavalidtime		0.03		1	µs
t_{vset}	DI: Datasettlingtime		0.5			µs
t_{vhold}	DI: Dataholdtime		0			µs
Diagnostic						
V_{BATDU}	Under voltage threshold		4.7		7.5	V
Serial Data output (External pull up required)						
V_{DO}	Data output low voltage	I_{DO} < 1.6mA 7.5V < V_{BAT} < 22V	0		0.45	V
$\lvert I_{DO} \rvert$	Data output leakage current				10	µA

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ELECTRICAL CHARACTERISTCS (continued)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
Output voltage monitoring Output off						
V_{OL}	Open load threshold voltage (fault detected if $V_{OUTi} < V_{OL}$)	$7.5V < V_{BAT} < 22V$		$2/3V_{BAT}$		
V_{SG}	Short to GND threshold voltage (fault detected if $V_{OUTi} < V_{SG}$)	$7.5V < V_{BAT} < 22V$		$1/3V_{BAT}$		
Open load diagnostic current Output off						
	Open load output voltage	$I_{OUT} = 0$ A $V_{INi} = 5V$ $7.5V < V_{BAT} < 22V$		$1/2V_{BAT}$		
$- I_{OUTi}$	Output current	$V_{OUT} = 1V$ $V_{INi} = 5V$	50	100	150	µA
I_{OUTi}	Output current	$V_{OUT} = V_{BAT}$ $V_{INi} = 5V$ $7.5V < V_{BAT} < 22V$	200	320	500	µA
Overload Diagnostic						
	Over temperature diagnostic	T_J		175		°C
I_{OUTi}	Over current	$T_J = -40°C$	3.0		4.3	A
		$T_J = 25°C$	2.5		3.7	A
		$T_J = 150°C$	2.2		3.5	A

Figure 1. Typical Timing Diagram for Serial Diagnostic



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Figure 2. Serial Interface Error Coding

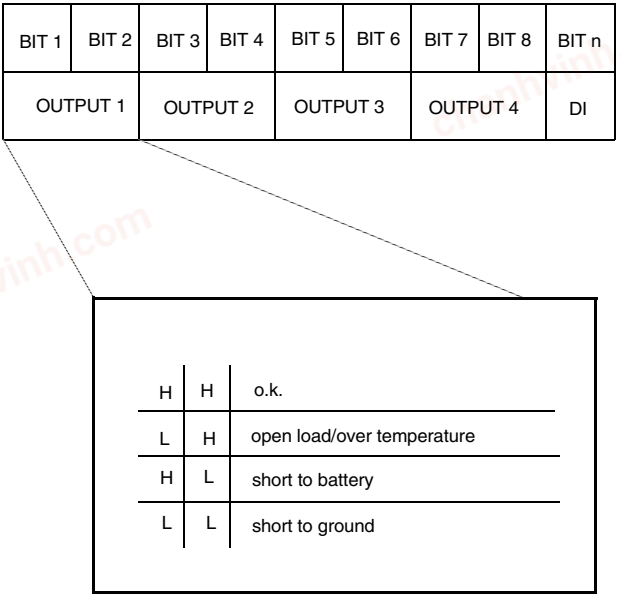
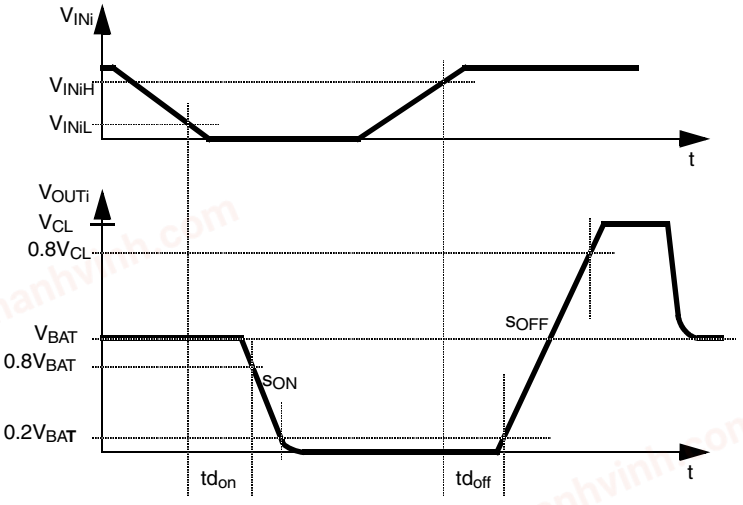
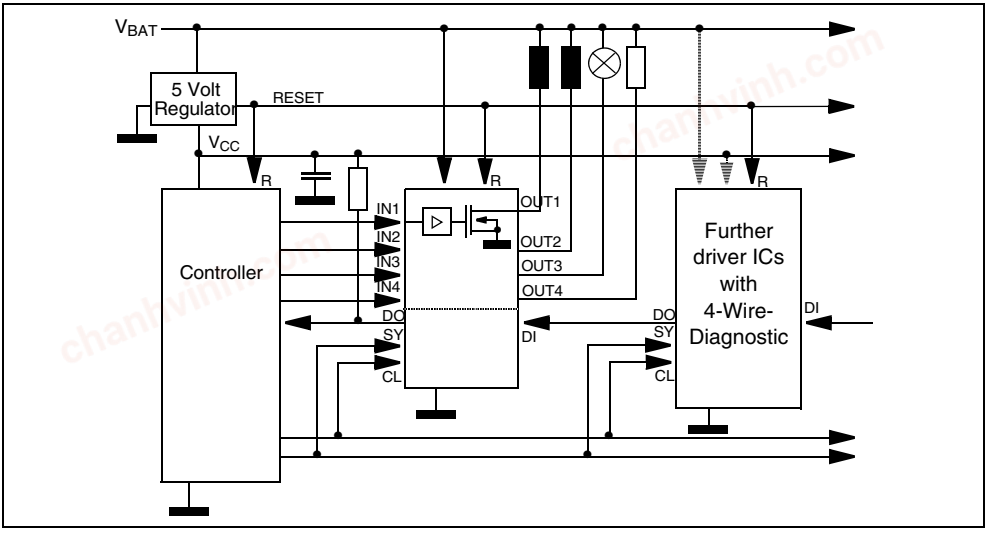


Figure 3. Output voltage TIMING for inductive load



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Figure 4. Application Circuit



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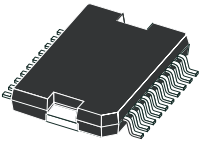
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			3.6			0.142
a1	0.1		0.3	0.004		0.012
a2			3.3			0.130
a3	0		0.1	0.000		0.004
b	0.4		0.53	0.016		0.021
c	0.23		0.32	0.009		0.013
D (1)	15.8		16	0.622		0.630
D1 (2)	9.4		9.8	0.370		0.386
E	13.9		14.5	0.547		0.570
e		1.27			0.050	
e3		11.43			0.450	
E1 (1)	10.9		11.1	0.429		0.437
E2			2.9			0.114
E3	5.8		6.2	0.228		0.244
G	0		0.1	0.000		0.004
H	15.5		15.9	0.610		0.626
h			1.1			0.043
L	0.8		1.1	0.031		0.043
N	8°(typ.)					
S	8°(max.)					
T		10			0.394	

(1) "D and E1" do not include mold flash or protusions.
- Mold flash or protusions shall not exceed 0.15mm (0.006")
- Critical dimensions: "E", "G" and "a3".

(2) For subcontractors, the limit is the one quoted in jedec MO-166

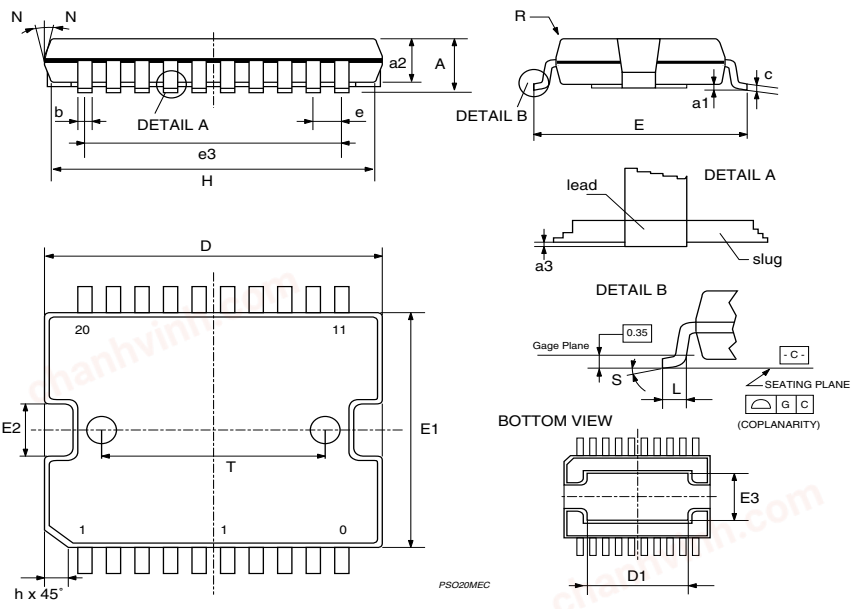
OUTLINE AND MECHANICAL DATA

Weight: 1.9gr



JEDEC MO-166

PowerSO-20



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