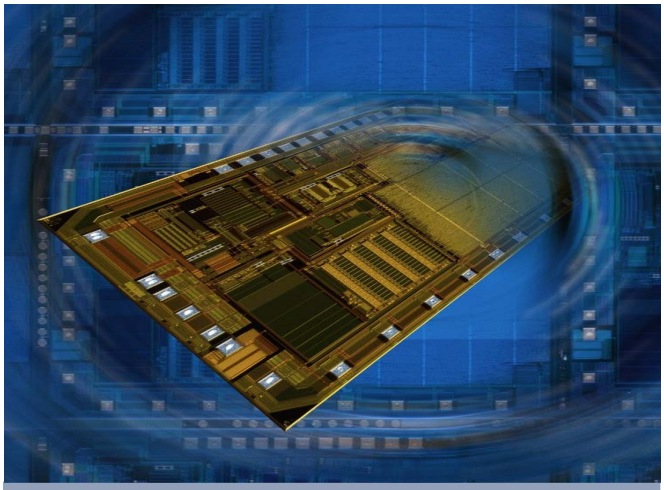
Automotive Electronics

Product Information
Smart Quad Switch - CJ406 / CJ420B

BOSCH
Invented for life



Smart Quad Switch

The CJ406/CJ420B 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, overtemperature only for CJ420B).

Customer benefits:

- Excellent system know-how
- Smart concepts for system safety
- Secured supply
- Long- term availability of manufacturing processes and products
- QS9000 and ISO/TS16949 certified

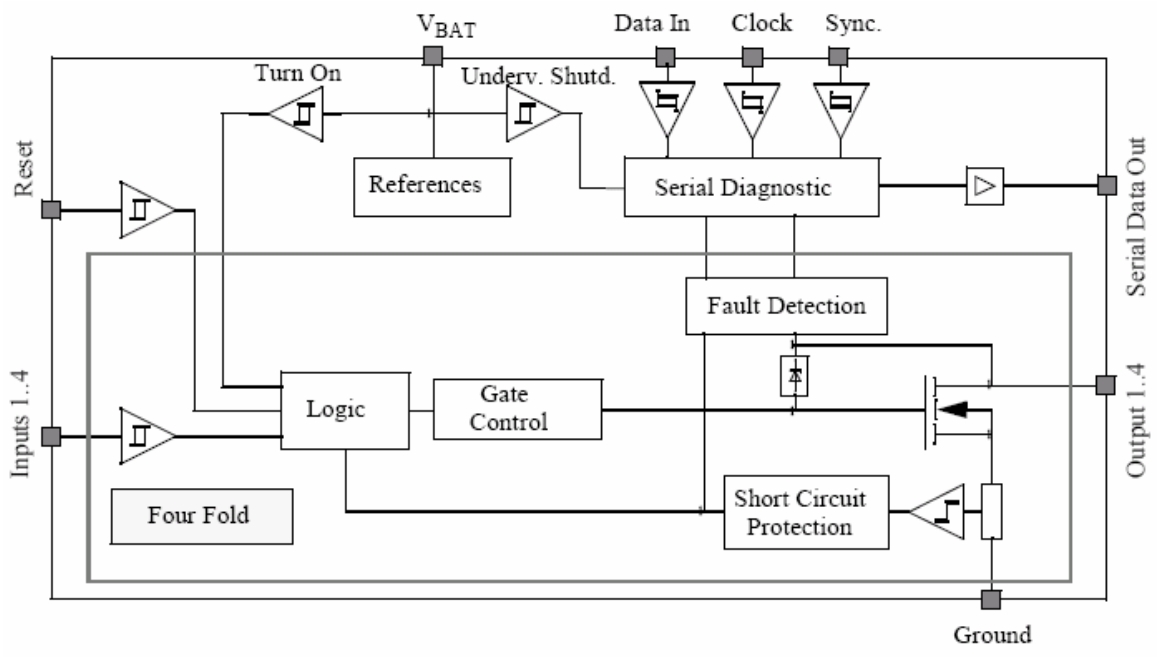
Features

- Modified VDMOS power stage - open load detection (U_{DSBR} > 80 V)
- R_{DSON} < 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

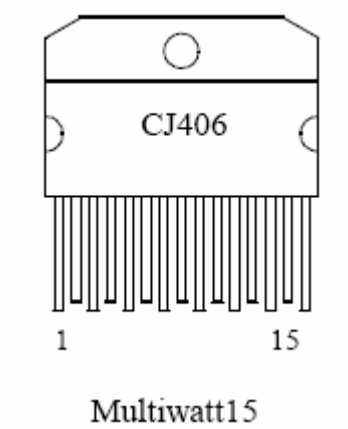
Diagnostic functions

- Open load detection (output off, 100µs- filtering time)
- Short to ground detection (output off, 100µs - filtering time)
- Short to battery detection (output on)
- Only CJ420B: overtemp. detection (output on)
- Storage of last fault in 8 Bit - seriel register
- Fault signal indication at serial data out without need to read out the serial interface
- Daisy chainable serial diagnostic
- Serial interface clock frequency up to 500kHz

Block diagram



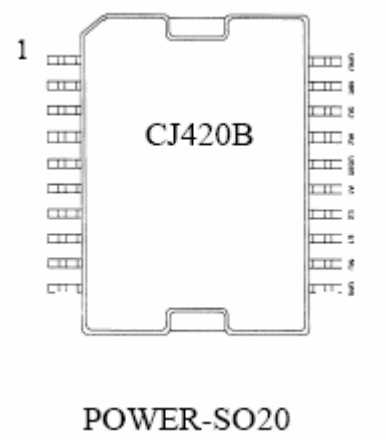
PIN configuration CJ406



Pin description CJ406

Pin	Name	Function
1	IN1	Input 1
2	IN2	Input 2
3	OUT1	Output 1
4	VBAT	Supply voltage
5	OUT2	Output 2
6	DO	Serial data out
7	CL	Clock
8	GND	Ground
9	CY	Synchronization
10	DI	Serial data in
11	OUT3	Output 3
12	R	Reset
13	OUT4	Output 4
14	IN3	Input 3
15	IN4	Input 4

PIN configuration CJ420B



Pin description CJ420B

Pin	Name	Function
1	GND	Ground
2		nc
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
10	GND	Ground
11	GND	Ground
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
19		nc
20	GND	Ground

Maximum ratings

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Storage temperature		T_{ST}	-55		150	°C
Operating junction temperature		T_J	-40		150	°C
DC supply voltage		V_{BAT}	-2		30	V
Transient supply voltage	t < 400ms	V_{BATtr}			40	V
Output voltage		V_{OUT}			65	V
Transient output voltage	during clamping	V_{OUTtr}			78	V
Output clamping energy	repetition rate < 100 Hz	E_{CL}			10	mJ
Output reverse current		$-I_{OUT}$			2	A
Control input voltage		V_R, V_{INi}, V_{DI},V_{CL} V_{SY}	-0.3		6.5	V
Control output voltage		V_{DO}	-0.3		6.5	V

Thermal resistance

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance junction – case Multiwatt 15		$R_{th\ j\text{-}c}$		2.5		K / W
Thermal resistance junction – case POWER-SO 20		$R_{th\ j\text{-}c}$		2.5		K / W

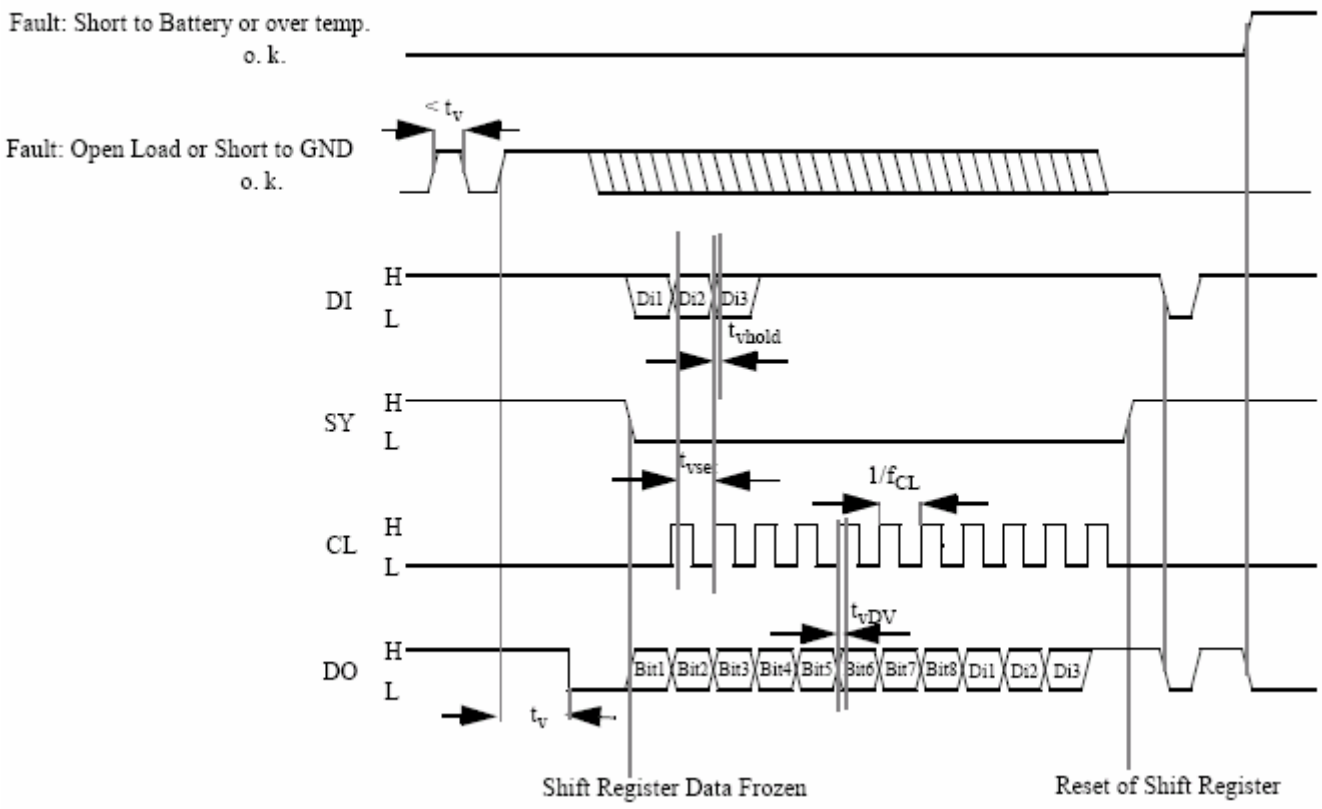
Electrical characteristics

6.5V < VBAT < 25V, -40 < TJ < 150°C

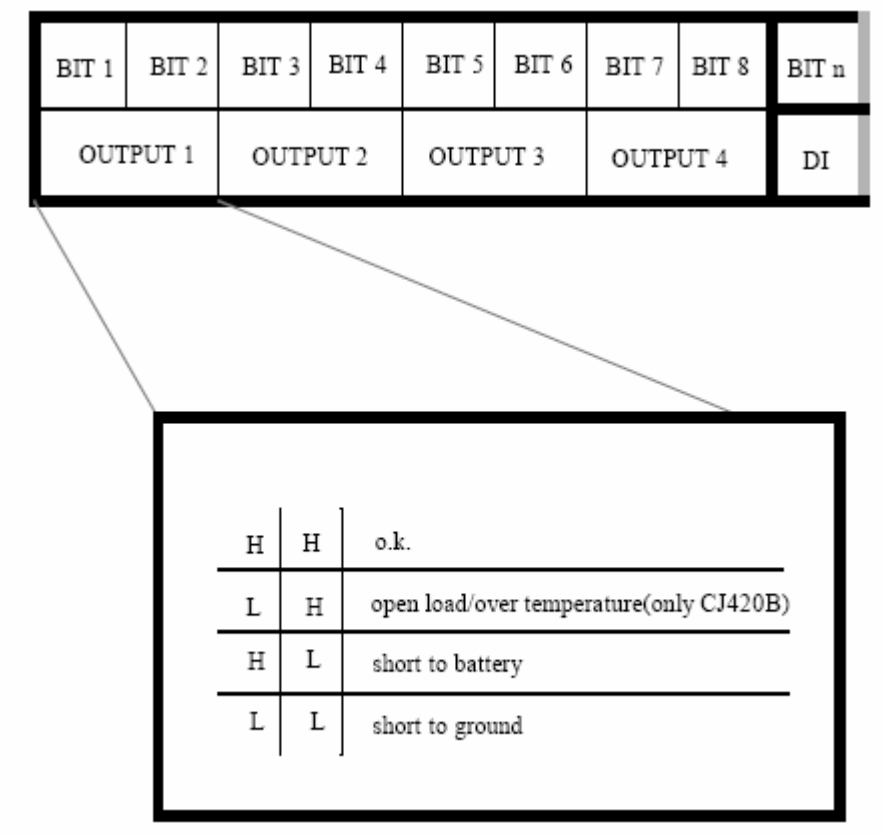
Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Supply voltage						
Turn on threshold voltage		V_{BATU}	2.0		4.7	V
Supply current	V_{BAT}= 14V V_{OUTi}> 0V	I_{BAT}	5	10	15	mA
Output stage						
On resistance	U_{BAT}= 4.7V, T_J = 25°C, I_{out}= 0.5 A	R_{DSON}			800	MΩ
	T_J = 25°C I_{out}= 1A	R_{DSON}			500	mΩ
	T_J = 150°C I_{out}= 1A	R_{DSON}			850	mΩ
Clamping voltage, inductive load	I_{out}= 0.5 A	V_{CL}	63	70	76	V
Over current shutdown (Shutdown latch resets with pos. slope at INi)	T_J = -40°C T_J = 25°C T_J = 150°C	I_{OUTi}	3.0 2.5 2.2		4.3 3.7 3.5	A A A
Output leakage current see : Open load diagnostic current						
Logic inputs IN1 ... IN4, SY, CL,DI,R						
Input high level		V_{INiHL} V_{SYHL} V_{CLHL} V_{RiHL} V_{DIHL}	3.5		6.5	V
Input low level		V_{INiLL} V_{SYHL} V_{CLHL} V_{RHL} V_{DIHL}	-0.3		1.5	V
Hysteresis		V_{INiH} V_{SYHL} V_{CLHL} V_{RHL} V_{DIHL}	0.2		1	V
Input current IN1 ... IN4, SY, CL, R (internal pull up current source)	V_{INi} = 0V V_{SY} = 0V V_{CL} = 0V V_R = 0V	- I_{INi} - I_{SY} - $I_{C\,L}$ - I_R	20	40	80	µA
Input current DI (internal pull up current source)	V_{DI} = 0V	- I_{DI}	120	220	300	µA
Timing						
Turn on delay		td_{on}		7.5		µs
Turn off delay		td_{off}		7.5		µs
Switch on slew rate		s_{on}		10		V/µs
Switch off slew rate		s_{off}		15		V/µs
Over current detection time		t_{oc}		0.5		µs
Open load fitering time		t_v	60	100	200	µs
Short to GND filtering time		t_v	60	100	200	µs
Serial clock frequency		f_{CL}	0		500	kHz
DO: Datavalidtime		t_{vDV}	0.03		1	µs
DI: Datasettlingtime		t_{vset}	0.5			µs
DI: Dataholdtime		t_{vhold}	0			µs

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Diagnostic						
Undervoltage threshold		V_{BATDU}	4.7		7.5	V
Serial Data output (External pull up required)						
Data output low voltage	I_{DO} < 1.6mA 7.5V<V_{BAT}<22V	V_{DO}	0		0.45	V
Data output leakage current		| I_{DO} |			10	µA
Output voltage monitoring Output off						
Open load threshold voltage (fault detected if V_{OUTi} < V_{OL})	7.5V<V_{BAT}<22V	V_{OL}		2/3V_{BAT}		
Short to GND threshold voltage (fault detected if V_{OUTi} < V_{SG})	7.5V<V_{BAT}<22V	V_{SG}		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}		
Output current	V_{OUT} = 1V V_{INi} = 5V	- I_{OUTi}	50	100	150	µA
Output current	V_{OUT} = V_{BAT} V_{INi} = 5V 7.5V<V_{BAT}<22V	I_{OUTi}	200	320	500	µA
Overload diagnostic						
Over temperature diagnostic (Only CJ 420B)	T_J			175		°C
Over current	T_J = -40oC T_J = 25oC T_J = 150oC	I_{OUTi}	3.0 2.5 2.2		4.3 3.7 3.5	A A A

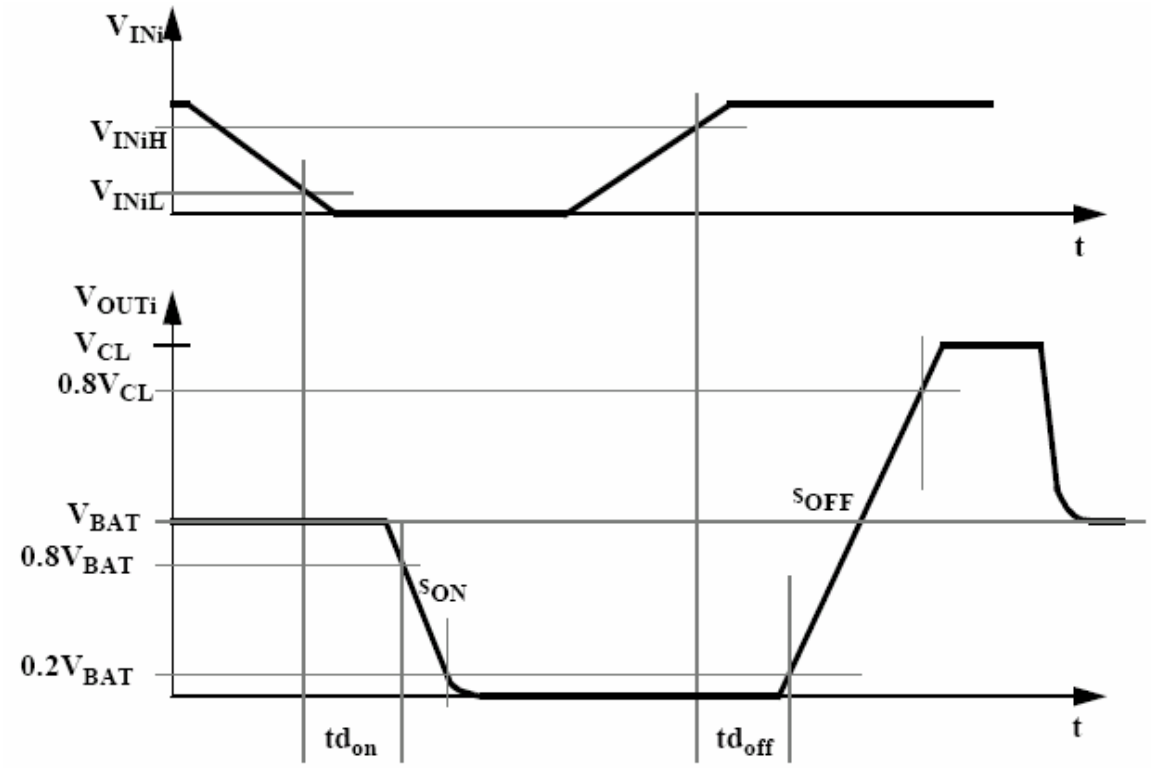
Typical timing diagram for serial diagnostic



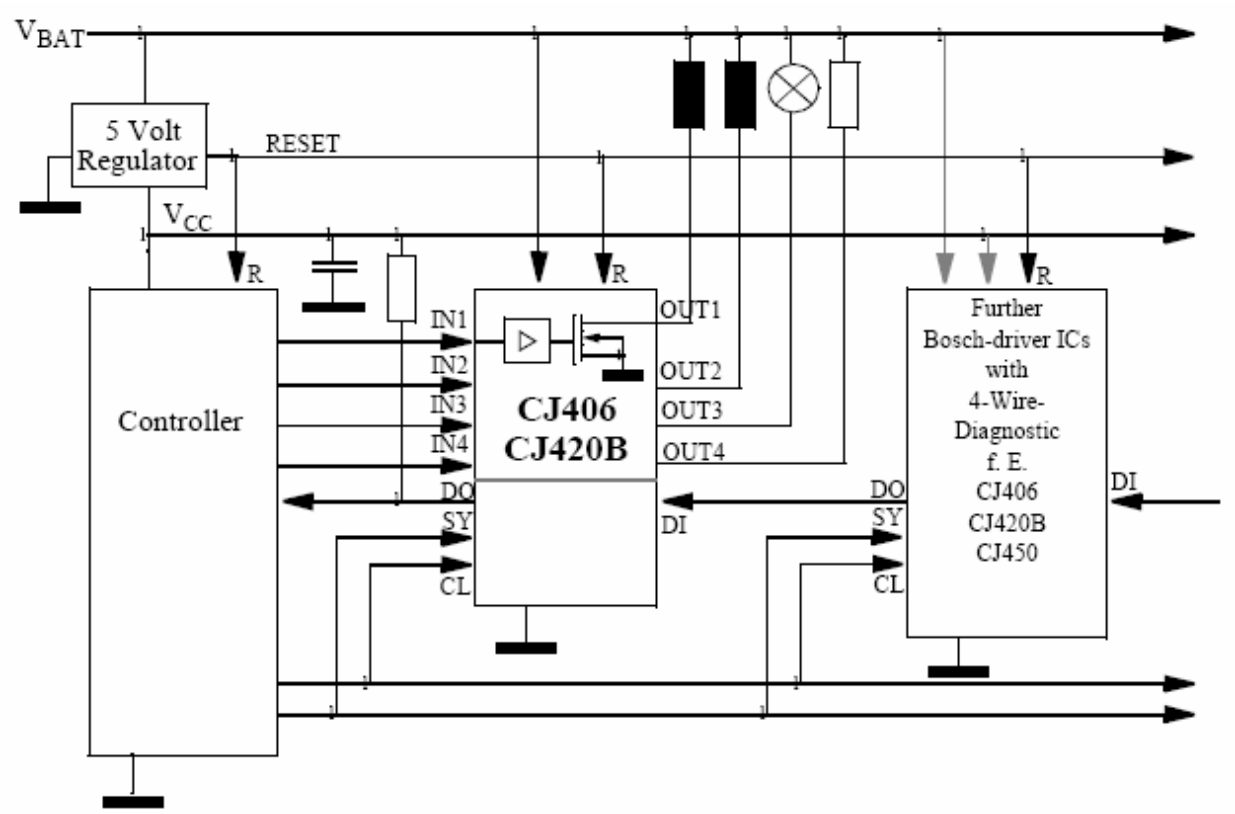
Seriel interface error coding



Output voltage timing for inductive load



Application



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