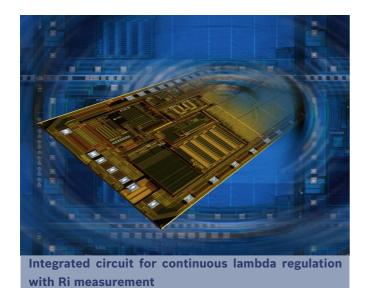
Automotive Electronics

Product Information Lambda Probe Interface IC - CJ125





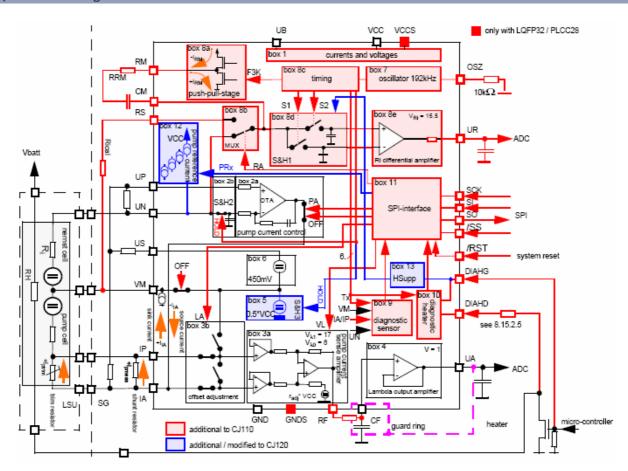
The integrated circuit CJ125 is a control and amplifier circuit for a wide range λ -Sensor LSU4.x for the continuous regulation of λ in combination with the sensor in the range of λ = 0.65... • (air).

Customer benefits:

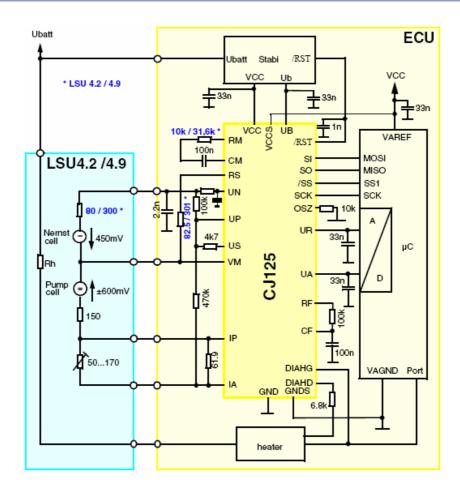
- Excellent system know-how
- Smart concepts for system safety
- Secured supply
- Long- term availability of manufacturing processes and products
- QS9000 and ISO/TS16949 certified

Features

- Currents and Voltages (box 1)
- Pump current control (boxes 2a to 2b)
- Pump current sense amplifier (boxes 3a to 3b)
- Lambda output amplifier (box 4)
- Virtual ground voltage source for sensor and pump current control (box 5)
- Nernst cell reference voltage source (box 6)
- Oscillator (box 7)
- Circuit for Ri or Rical measurement (boxes 8a to 8d)
- Diagnostic of sensor lines (box 9)
- Diagnostic of external heater (box 10)
- Serial-Peripheral-Interface (SPI; box 11)
- Programmable reference pumping currents (box 12)
- Suppression of Ri-measurement (box 13)



Application circuit (only proposal!)



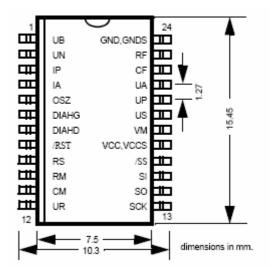
The application circuit of the CJ125 consists of the

 Capacitor between [VCC] and [GND] to stabilize the supply voltage VCC

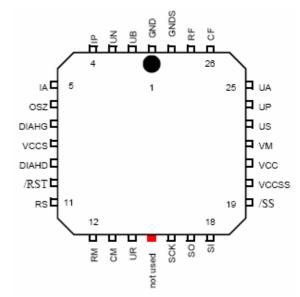
following parts:

- Capacitor between [UB] and [GND] to stabilize the supply voltage VUB
- Capacitor between [CF] and [GND] to filter the lambda signal
- Capacitor between [UA] and [GND] to stabilize lambda signal output
- Capacitor between [UN] and [GND] to stabilize nernst signal
- Capacitor between [/RST] and [GND] to stabilize reset signal
- Shunt between [IA] and [IP] for pump current sensing
- Resistor between [IA] and [UP] to compensate parasitic effects of the lambda sensor
- Resistor between [US] and [UP] to feed the nernst cell reference voltage into the pump current control circuit
- Resistor between [UP] and [UN] for leakage detection
- Resistor between [RF] and [CF] to filter the lambda signal
- Capacitor between [UR] and [GND] to stabilize the output signal for ADC
- Capacitor between [UN] and [GND] for filtering
- Resistor between [RM] and capacitor at [CM] for adjustment of Ri measurement current
- Capacitor between [CM] and resistance at [RM] for DC filtering
- Resistor between [RS] and [VM] for adjustment
- Resistor between [DIAHD] and Drain of the external heater
- Resistor and capacitor before [UN] for filtering

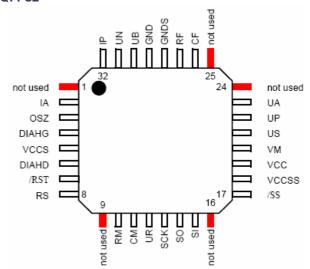
SOIC24



PLCC28



LQFP32



Pin description

Pin	Description
UB	Power supply input (14V)
VCC, VCCSa)	Power supply input (5V)
GND, GNDSb)	Ground
VM	Virtual ground of pump current control and of the LSU (0.5VCC)
US	Nernst cell reference voltage (450mV)
IP	Inverting input of pump current amplifier (shunt voltage)
IA	Non inverting input of pump current amplifier and output of the pump current control
RF	Output of pump current amplifier (-> external filter)
CF	Input of lambda output amplifier (after external filter)
UA	Output of lambda output amplifier
UP	Non inverting input of pump current control
UN	Inverting input of pump current control respective in-/output for Ri-measurement (LSU)

Pin	Description
RM	Output Ri-measurement current (DC)
CM	Input Ri-measurement current (AC, DC free)
RS	In-/output Ri-calibration measurement
UR	Output Ri-signal (analogous)
DIAHG	Diagnosis input (gate of external transistor)
DIAHD	Diagnosis input (drain of external
	transistor)
SCK	Input SPI-clock (from μC)
SI	Input serial data (SPI, from μC)
SO	Output serial data (SPI, to µC)
/SS	Slave select (SPI, from μC)
/RST	Input Reset
OSZ	R _{extern} = 10kΩ

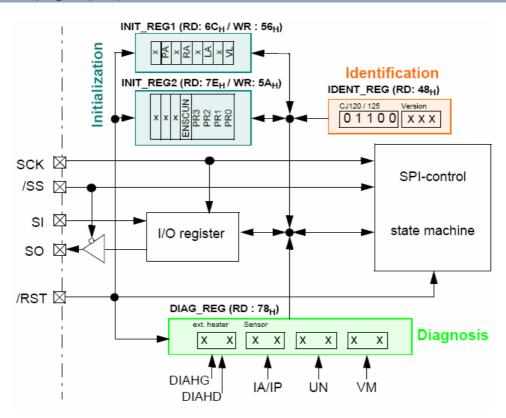
- $^{\rm a.)}$ For hybrid version it is recommended to connect $\,$ VVCS with the reference VCC for the ADC $\,$
- $^{\mathrm{b.)}}$ For hybrid version it is recommended to connect GNDS with the reference ground for the ADC

Maximum Ratings

Parameter	Condition	Symbol	Min.	Max.	Unit
Supply voltage UB		VuB	-0.3	35	V
Supply voltage VCC		Vvcc	-0.3	5.5	V
	junction	TJ	-40	150	°C
	storage	Тѕт	-40	150	°C
Temperature	ambient for SOIC/PLCC	TA	-40	110	°C
remperature	for max 50h		-40	125	°C
	ambient for LQFP			125	°C
	for max 50h			140	°C
Maximum allowed voltages valid for pins: RM, UP, US,RF, CF, UA, UR, DIAHG, DIAHD; SCK, SI, SO, /SS, /RST, OSZ		Vx	-0.3	Vvcc + 0.3	V
Allowed current	ext. resistor 6.8 k Ω	IDIAHD	-1	10	mA
Maximum allowed voltages, no destruction when ISO-pulses 3a,b are applied. Valid for board pins: RS, UN, VM, IA, IP, CM		Vx	-0.3	28	V
Offset between GND and GNDS		ΔV GND	-0.25	0.25	V
Offset between VCC and VCCS		ΔVvcc	-0.25	0.25	V
ESD	Human Body Model R=1.5kΩ, C=100pF		-2	2	kV

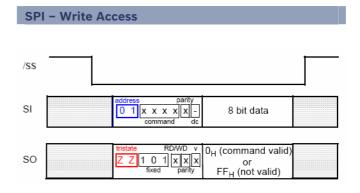
Electrical Characteristics

Parameter	Condition	Symbol	Min.	Max.	Unit
Power Supply					
Power supply	VGND = VGNDS	VuB	9	18	V
Operating range	Vvcc = VVccs	Vvcc	4.75	5.25	V
Current consumption		lvcc		76	mA
Current consumption		Ivccs		4	mA
Pump current control			·		
Offset voltage		Voff	-10	10	mV
Input current	-40°C • T _i < 150°C	lup, un	-1	1	μА
Input offset current	-40°C • T _i < 150°C	loff	-1	1	μA
0.4.4	Vun < Vup; PA = 1;		10	00	
Output current source condition	0.5V < VIA < VCC-0.5V	-la	10	30	mA
Outroot comment state and the con-	Vun > Vup; PA = 1;		10	20	
Output current sink condition	0.6V < VIA < Vcc-0.5V	IA	10	30	mA
No output current	PA = 0	IA	-10	10	μA
Pump current sense amplifier (LA = 0:	measurement mode: LA = 1: adjus	stment mode)			
Input current	-40°C • T _j < 150°C	IIP	-1	1	μΑ
Amplification	SPI-bit VL = 1	Ao	16.62	17.24	μπ
Amplification	SPI-bit VL = 0	Ao	7,82	8.15	
Ampimeation	CMRR-1= Δ Vua/ Δ Vip	CMRR-1	7,02	12	mV/V
	VIP=VIA=14V	Civil (1 -		12	1117/7
Common mode rejection ratio	0.5V < Vua < Vcc-0.5V				
Output voltage swing	Iua < 10µA; LA = 0	Vua	0.20	Vvcc -0.18	V
Output voltage swing Output voltage adjustment	IRF = 0μA; LA = 1	VFR/ VVCC	0.285	0.315	V
Output voitage aujustillellt	$\Delta V_{UA} = V_{UA}$ (LA = 1) - V_{UA} (LA = 0)	•Vua	-3	3	mV
Output error offset adjust	V _{IP} =V _{IA} =V _{VM}	•VUA	-5	3	IIIV
Output error onset adjust					
Vistual ground valtage course	Ιυά < ΙΌμΑ				
Virtual ground voltage source		1	1 0	1 .0	A
Output current operating range	1 1 4 4 4	Ivm	-I _{IA} -2	-I _{IA} +2	mA
Output voltage ratio	-IIA-1mA < IVM < -IIA +1mA	Vvm/ Vvcc	0.48	0.52	
Nernst cell reference voltage source					
Output current operating range		IUS	-0.4	0.4	mA
Oscillator			1		
Frequency	external 10kΩ	f	2.49	3.51	kHz
Measurement current for Ri (RA = 0 me					
Output resistor of push-pull-stage	-1mA • IRM • 1mA	R	5	200	Ω
Ri amplifier					
Leakage current when switch is open		ILEAK	-500	500	nA
Amplification		Ao	15	16.3	
Ron for a switch					
		Ron		200	Ω
Input voltage range at CM, UN and RS		Ron V _{RI}	2		Ω V
Input voltage range at CM, UN and RS Output voltage range			2 0.06 Vvcc	200	
		VRI		200 Vvcc -1.1	V
Output voltage range Zero point for output trace		V _{RI} V _{UR}	0.06 Vvcc	200 Vvcc -1.1 Vvcc - 0.2	V
Output voltage range Zero point for output trace Pump reference current	programmable with SPI-bits	Vri Vur Vur/ Vvcc	0.06 Vvcc 0.05	200 Vvcc -1.1 Vvcc - 0.2 0.063	V
Output voltage range Zero point for output trace	programmable with SPI-bits PRx; x = 0 to 3	V _{RI} V _{UR}	0.06 Vvcc	200 Vvcc -1.1 Vvcc - 0.2	V
Output voltage range Zero point for output trace Pump reference current Current range	programmable with SPI-bits PRx; x = 0 to 3	Vri Vur Vur/ Vvcc	0.06 Vvcc 0.05	200 Vvcc -1.1 Vvcc - 0.2 0.063	V
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines		VRI VUR VUR/ VVCC	0.06 Vvcc 0.05	200 Vvcc -1.1 Vvcc - 0.2 0.063	V
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground		VRI VUR VUR/ VVCC - IUn VVM / VVCC	0.06 Vvcc 0.05	200 Vvcc -1.1 Vvcc - 0.2 0.063 150	V
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat		VRI VUR VUR/ VVCC - IUn VVM / VVCC VVM / VVCC	0.06 Vvcc 0.05 0	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65	V
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat Short circuit to ground		VRI VUR VUR/ VVCC - IUn VVM / VVCC VVM / VVCC VUN / VVCC	0.06 Vvcc 0.05 0 0 0.35 0.55 0.30	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65 0.40	V
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat Short circuit to ground Short circuit to Vbat Short circuit to Vbat		VRI VUR VUR/ VVCC - IUn VVM / VVCC VVM / VVCC VUN / VVCC VUN / VVCC	0.06 Vvcc 0.05 0 0 0.35 0.55 0.30 0.72	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65 0.40 0.88	νν
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat Short circuit to Vbat Short circuit to Vbat Short circuit to Vbat Short circuit to ground		VRI VUR VUR/ VVCC - IUn VVM / VVCC VVM / VVCC VUN / VVCC VUN / VVCC VIA,IP	0.06 Vvcc 0.05 0 0 0.35 0.55 0.30 0.72 0.3	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65 0.40 0.88 1.5	νν
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat Short circuit to Vbat Short circuit to Vbat Short circuit to Vbat Short circuit to ground Short circuit to Vbat Short circuit to Vbat Short circuit to Vbat		VRI VUR VUR/ VVCC - IUn VVM / VVCC VVM / VVCC VUN / VVCC VUN / VVCC	0.06 Vvcc 0.05 0 0 0.35 0.55 0.30 0.72	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65 0.40 0.88	νν
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat Short circuit to Vbat Short circuit to Vbat Short circuit to Vbat Short circuit to ybat Short circuit to Vbat Short circuit to Vbat Diagnosis of external heater		VRI VUR VUR/ VVCC - IUn VVM / VVCC VVM / VVCC VUN / VVCC VUN / VVCC VIA,IP VIA	0.06 Vvcc 0.05 0 0 0.35 0.55 0.30 0.72 0.3 Vvcc	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65 0.40 0.88 1.5 Vvcc + 2	ν ν ν ν ν
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat Diagnosis of external heater Low level		VRI VUR VUR/VVCC - IUn VVM / VVCC VVM / VVCC VUN / VVCC VUN / VVCC VIA,IP VIA	0.06 Vvcc 0.05 0 0 0.35 0.55 0.30 0.72 0.3 Vvcc	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65 0.40 0.88 1.5 Vvcc + 2	ν ν ν ν ν
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat Diagnosis of external heater Low level High level		VRI VUR VUR/VVCC - IUn VVM / VVCC VVM / VVCC VUN / VVCC VUN / VVCC VIA,IP VIA VDIAHG VDIAHG	0.06 Vvcc 0.05 0 0.35 0.55 0.30 0.72 0.3 Vvcc -0.3 0.7 Vvcc	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65 0.40 0.88 1.5 Vvcc + 2 0.3 Vvcc Vvcc + 0.3	ν ν ν ν ν
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat Diagnosis of external heater Low level High level Input current (no pull up!)	PRx; x = 0 to 3	VRI VUR VUR/VVCC - IUn VVM / VVCC VVM / VVCC VUN / VVCC VUN / VVCC VIA,IP VIA VDIAHG - IDIAHG	0.06 Vvcc 0.05 0 0.35 0.55 0.30 0.72 0.3 Vvcc -0.3 0.7 Vvcc -1	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65 0.40 0.88 1.5 Vvcc + 2 0.3 Vvcc Vvcc + 0.3 1	V V V V V V
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat Diagnosis of external heater Low level High level Input current (no pull up!) Short circuit to ground	PRx; x = 0 to 3	VRI VUR VUR/VVCC - IUn VVM / VVCC VVM / VVCC VUN / VVCC VUN / VVCC VIA,IP VIA VDIAHG VDIAHG - IDIAHG IDIAHD	0.06 Vvcc 0.05 0 0.35 0.55 0.30 0.72 0.3 Vvcc -0.3 0.7 Vvcc -1 -1000	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65 0.40 0.88 1.5 Vvcc + 2 0.3 Vvcc Vvcc + 0.3 1 -350	V V V V V V µА µА
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat Diagnosis of external heater Low level High level Input current (no pull up!) Short circuit to Vbat Short circuit to ground	PRx; x = 0 to 3 DIAHG = low DIAHG = high	VRI VUR VUR/VVCC - IUn VVM / VVCC VVM / VVCC VUN / VVCC VUN / VVCC VIA,IP VIA VDIAHG VDIAHG - IDIAHG IDIAHD IDIAHD	0.06 Vvcc 0.05 0 0.35 0.55 0.30 0.72 0.3 Vvcc -0.3 0.7 Vvcc -1 -1000 -100	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65 0.40 0.88 1.5 Vvcc + 2 0.3 Vvcc Vvcc + 0.3 1 -350 10 000	V V V V V V µА µА
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat Diagnosis of external heater Low level High level Input current (no pull up!) Short circuit to Vbat Open load	PRx; x = 0 to 3 DIAHG = low DIAHG = high DIAHG = low	VRI VUR VUR/VVCC - IUn VVM / VVCC VVM / VVCC VUN / VVCC VUN / VVCC VIA,IP VIA VDIAHG VDIAHG - IDIAHG IDIAHD IDIAHD IDIAHD	0.06 Vvcc 0.05 0 0.35 0.55 0.30 0.72 0.3 Vvcc -0.3 0.7 Vvcc -1 -1000 -100	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65 0.40 0.88 1.5 Vvcc + 2 0.3 Vvcc Vvc + 0.3 1 -350 10 000 100	V V V V V V µА µА
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat Diagnosis of external heater Low level High level Input current (no pull up!) Short circuit to Vbat Open load No failure	DIAHG = low DIAHG = high DIAHG = low DIAHG = high DIAHG = high	VRI VUR VUR/VVCC - IUn VVM / VVCC VVM / VVCC VUN / VVCC VUN / VVCC VIA,IP VIA VDIAHG VDIAHG - IDIAHG IDIAHD IDIAHD	0.06 Vvcc 0.05 0 0.35 0.55 0.30 0.72 0.3 Vvcc -0.3 0.7 Vvcc -1 -1000 -100 -1000	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65 0.40 0.88 1.5 Vvcc + 2 0.3 Vvcc Vvcc + 0.3 1 -350 10 000 100 -350	V V V V V V µА µА
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat Diagnosis of external heater Low level High level Input current (no pull up!) Short circuit to Vbat Open load	PRx; x = 0 to 3 DIAHG = low DIAHG = high DIAHG = low	VRI VUR VUR/VVCC - IUn VVM / VVCC VVM / VVCC VUN / VVCC VUN / VVCC VIA,IP VIA VDIAHG VDIAHG - IDIAHG IDIAHD IDIAHD IDIAHD	0.06 Vvcc 0.05 0 0.35 0.55 0.30 0.72 0.3 Vvcc -0.3 0.7 Vvcc -1 -1000 -100	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65 0.40 0.88 1.5 Vvcc + 2 0.3 Vvcc Vvc + 0.3 1 -350 10 000 100 -350 10 000	V V V V V V µА µА µА
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat Diagnosis of external heater Low level High level Input current (no pull up!) Short circuit to Vbat Open load No failure	DIAHG = low DIAHG = high DIAHG = low DIAHG = high DIAHG = high	VRI VUR VUR/VVCC - IUn VVM / VVCC VVM / VVCC VUN / VVCC VUN / VVCC VIA,IP VIA VDIAHG VDIAHG - IDIAHG IDIAHD IDIAHD IDIAHD IDIAHD	0.06 Vvcc 0.05 0 0.35 0.55 0.30 0.72 0.3 Vvcc -0.3 0.7 Vvcc -1 -1000 -100 -1000	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65 0.40 0.88 1.5 Vvcc + 2 0.3 Vvcc Vvcc + 0.3 1 -350 10 000 100 -350	V V V V V V µА µА µА µА
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat Diagnosis of external heater Low level High level Input current (no pull up!) Short circuit to Vbat Open load No failure No failure	DIAHG = low DIAHG = high DIAHG = low DIAHG = high DIAHG = low	VRI VUR VUR/VVCC - IUn VVM / VVCC VVM / VVCC VUN / VVCC VUN / VVCC VIA,IP VIA VDIAHG - IDIAHG IDIAHD IDIAHD IDIAHD IDIAHD IDIAHD IDIAHD	0.06 Vvcc 0.05 0 0.35 0.55 0.30 0.72 0.3 Vvcc -0.3 0.7 Vvcc -1 -1000 -1000 -1000 350	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65 0.40 0.88 1.5 Vvcc + 2 0.3 Vvcc Vvc + 0.3 1 -350 10 000 100 -350 10 000	V V V V V V µА µА µА µА
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat Diagnosis of external heater Low level High level Input current (no pull up!) Short circuit to Vbat Open load No failure No failure Filter time	DIAHG = low DIAHG = high DIAHG = low DIAHG = high DIAHG = low	VRI VUR VUR/VVCC - IUn VVM / VVCC VVM / VVCC VUN / VVCC VUN / VVCC VIA,IP VIA VDIAHG - IDIAHG IDIAHD IDIAHD IDIAHD IDIAHD IDIAHD IDIAHD	0.06 Vvcc 0.05 0 0.35 0.55 0.30 0.72 0.3 Vvcc -0.3 0.7 Vvcc -1 -1000 -1000 -1000 350	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65 0.40 0.88 1.5 Vvcc + 2 0.3 Vvcc Vvc + 0.3 1 -350 10 000 100 -350 10 000	V V V V V V µА µА µА µА
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat Diagnosis of external heater Low level High level Input current (no pull up!) Short circuit to Vbat Open load No failure No failure Filter time SPI	DIAHG = low DIAHG = high DIAHG = low DIAHG = high DIAHG = low	VRI VUR VUR/VVCC - IUn VVM / VVCC VVM / VVCC VUN / VVCC VUN / VVCC VIA,IP VIA VDIAHG - IDIAHG IDIAHD IDIAHD IDIAHD IDIAHD IDIAHD IDIAHD	0.06 Vvcc 0.05 0 0.35 0.55 0.30 0.72 0.3 Vvcc -0.3 0.7 Vvcc -1 -1000 -1000 -1000 350	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65 0.40 0.88 1.5 Vvcc + 2 0.3 Vvcc Vvcc + 0.3 1 -350 10 000 100 -350 10 000 32 / 32	V V V V V V V V V V V V V V V V V V V
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat Diagnosis of external heater Low level High level Input current (no pull up!) Short circuit to Vbat Open load No failure No failure Filter time SPI Data rate Bit-frame	DIAHG = low DIAHG = high DIAHG = low DIAHG = high DIAHG = low	VRI VUR VUR/VVCC - IUn VVM / VVCC VVM / VVCC VUN / VVCC VUN / VVCC VIA,IP VIA VDIAHG - IDIAHG IDIAHD IDIAHD IDIAHD IDIAHD IDIAHD IDIAHD	0.06 Vvcc 0.05 0 0.35 0.55 0.30 0.72 0.3 Vvcc -0.3 0.7 Vvcc -1 -1000 -1000 -1000 350	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65 0.40 0.88 1.5 Vvcc + 2 0.3 Vvcc Vvcc + 0.3 1 -350 10 000 100 -350 10 000 32 / 32	V V V V V V V PA
Output voltage range Zero point for output trace Pump reference current Current range Diagnosis of sensor lines Short circuit to ground Short circuit to Vbat Diagnosis of external heater Low level High level Input current (no pull up!) Short circuit to Vbat Open load No failure No failure Filter time SPI Data rate	DIAHG = low DIAHG = high DIAHG = low DIAHG = high DIAHG = low	VRI VUR VUR/VVCC - IUn VVM / VVCC VVM / VVCC VUN / VVCC VUN / VVCC VIA,IP VIA VDIAHG - IDIAHG IDIAHD IDIAHD IDIAHD IDIAHD IDIAHD IDIAHD	0.06 Vvcc 0.05 0 0.35 0.55 0.30 0.72 0.3 Vvcc -0.3 0.7 Vvcc -1 -1000 -1000 -1000 350	200 Vvcc -1.1 Vvcc - 0.2 0.063 150 0.45 0.65 0.40 0.88 1.5 Vvcc + 2 0.3 Vvcc Vvcc + 0.3 1 -350 10 000 100 -350 10 000 32 / 32	V V V V V V V PA



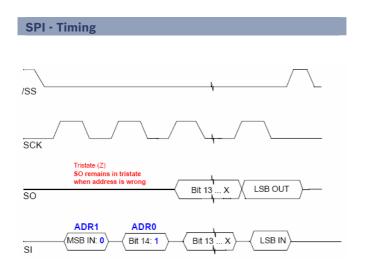
Failure bits ^{a)}	Ext. heater	Sensor ^{b)}
0.0	Short circuit to	Short circuit to
0 0	ground	ground
0 1	Open load	Low battery c)
1 0	Short circuit to Vbat	Short circuit to Vbat
1 1 ^{d)}	No failure	No failure

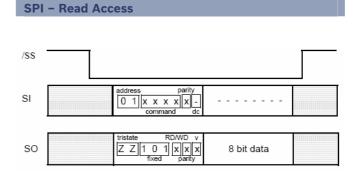
- a) Only each failure of the sensor leads to a switch off of pump current and virtual ground
- b) Failure identification at UN must be enabled with ENSCUN
- c) Open load is not recognizable; bits used for low battery
- d) After RD_DIAG or if no failure is present; Failure bits will be restored if failure is still present

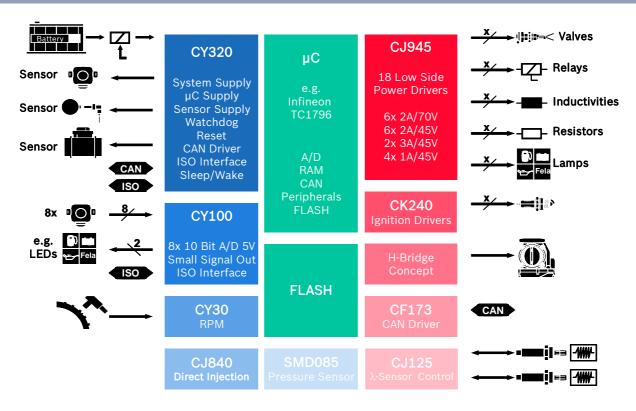


v: command valid/not valid; dc: don't care ("-")

x: 0 or 1; Z: tristate







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