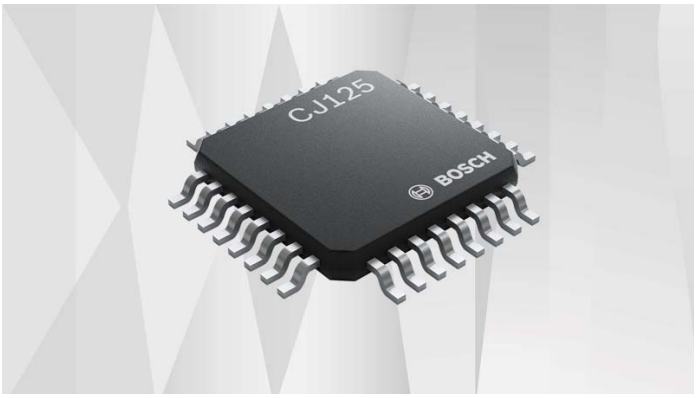
Automotive Electronics

Product Information

Oxygen sensor control and evaluation IC – CJ125

BOSCH
Invented for life



Integrated circuit for continuous lambda regulation with Ri measurement

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).

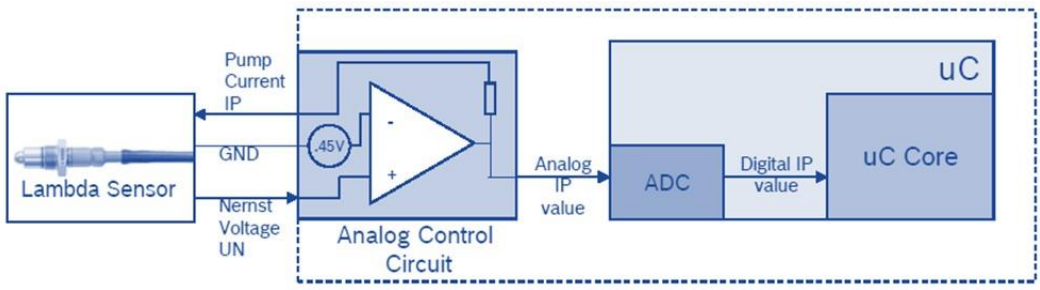
Customer benefits:

- Simple application
- Long- term availability of manufacturing processes and products
- QS9000 and ISO/TS16949 certified

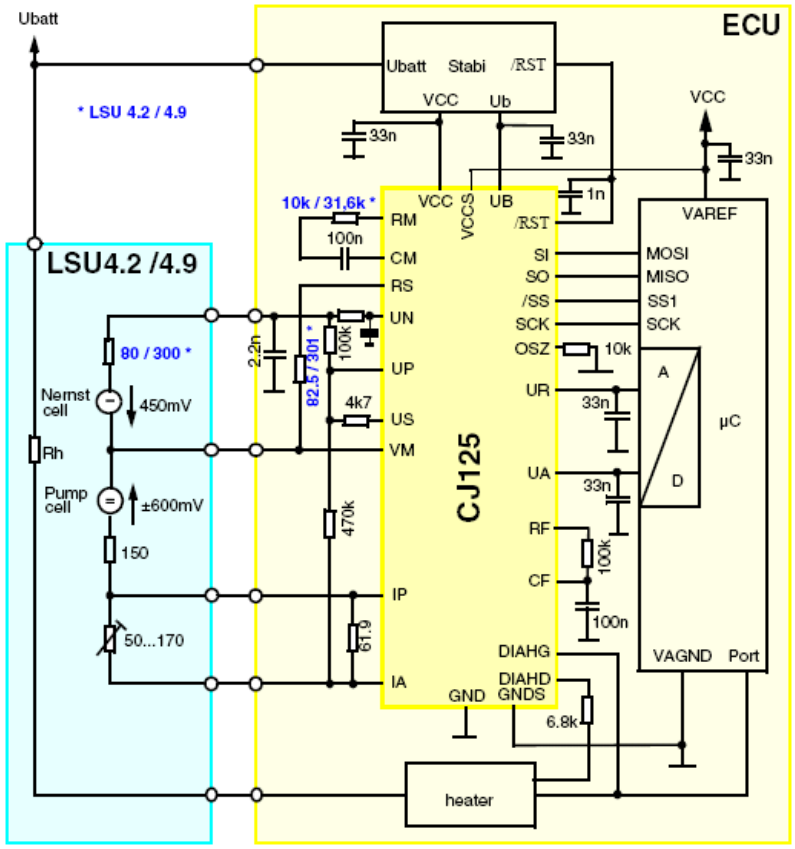
Features

- Pump current control
- Pump current sense amplifier
- Lambda output amplifier
- Virtual ground voltage source for sensor and pump current control
- Nernst cell reference voltage source
- Circuit for Ri or Rical measurement
- Diagnostic of sensor lines
- Diagnostic of external heater
- Serial-Peripheral-Interface
- Programmable reference pumping currents
- Suppression of Ri-measurement

Block Diagram



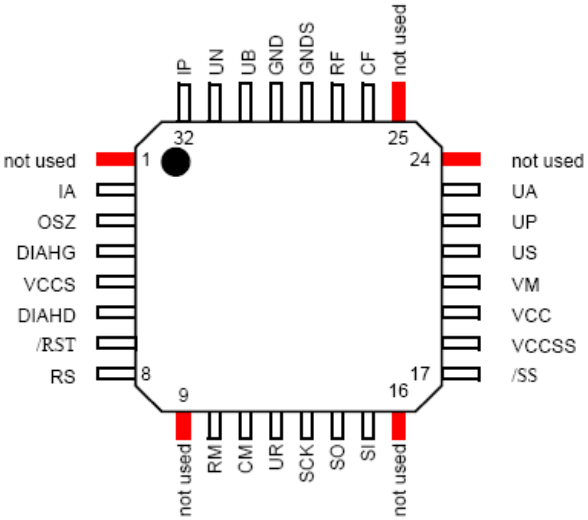
Application circuit (proposal only!)



The application circuit consists of the following parts:

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

Pin configuration



Pin description

Pin	Description
UB	Power supply input (14V)
VCC, VCCS[a)]	Power supply input (5V)
GND, GNDS[b)]	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

a.) For hybrid version it is recommended to connect VVCS with the reference VCC for the ADC

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		V_{UB}	-0.3	35	V
Supply voltage VCC		V_{VCC}	-0.3	5.5	V
Temperature	junction storage *for max 50h* ambient *for max 50h*	T_J T_{ST}	-40 -40 -40	150 150 125 125 140	°C °C °C °C °C
Maximum allowed voltages valid for pins: RM, UP, US,RF, CF, UA, UR, DIAHG, DIAHD; SCK, SI, SO, /SS, /RST, OSZ Allowed current	 ext. resistor 6.8 kΩ	V_X I_{DIAHD}	-0.3 -1	V_{VCC} + 0.3 10	V mA
Maximum allowed voltages, no destruction when ISO-pulses 3a,b are applied. Valid for board pins: RS, UN, VM, IA, IP, CM		V_X	-0.3	28	V
Offset between GND and GNDS		ΔV_{GND}	-0.25	0.25	V
Offset between VCC and VCCS		ΔV_{VCC}	-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 Operating range	V_{GND} = V_{GNDS} V_{VCC} = V_{VCCS}	V_{UB} V_{VCC}	9 4.75	18 5.25	V V
Current consumption		I_{VCC}		76	mA
Current consumption		I_{VCCS}		4	mA
Pump current control					
Offset voltage		V_{off}	-10	10	mV
Input current	-40°C ≤ T_j < 150°C	$I_{UP, UN}$	-1	1	µA
Input offset current	-40°C ≤ T_j < 150°C	I_{off}	-1	1	µA
Output current source condition	V_{UN} < V_{UP}; PA = 1; 0.5V < VIA < VCC-0.5V	$-I_A$	10	30	mA
Output current sink condition	V_{UN} > V_{UP}; PA = 1; 0.6V < V_{IA} < V_{CC}-0.5V	I_A	10	30	mA
No output current	PA = 0	I_A	-10	10	µA
Pump current sense amplifier (LA = 0: measurement mode; LA = 1: adjustment mode)					
Input current	-40°C ≤ T_j < 150°C	I_{IP}	-1	1	µA
Amplification	SPI-bit VL = 1	A_0	16.62	17.24	
Amplification	SPI-bit VL = 0	A_0	7,82	8.15	
Common mode rejection ratio	$CMRR^{-1}$= ΔV_{UA}/ ΔV_{IP} V_{IP}=V_{IA}=1...4V 0.5V < V_{UA} < V_{CC}-0.5V | I_{UA} | < 10µA	$CMRR^{-1}$		12	mV/V
Output voltage swing	| I_{UA} | < 10µA; LA = 0	V_{UA}	0.20	V_{VCC} -0.18	V
Output voltage adjustment	I_{RF} =0µA; LA = 1	V_{FR}/ V_{VCC}	0.285	0.315	
Output error offset adjust	ΔV_{UA}=V_{UA} (LA = 1) - V_{UA}(LA = 0) V_{IP}=V_{IA}=V_{VM} | I_{UA} | < 10µA	ΔV_{UA}	-3	3	mV

Electrical characteristics

Parameter	Condition	Symbol	Min.	Max.	Unit
Diagnosis of sensor lines					
Short circuit to ground		V_{VM} / V_{VCC}	0.35	0.45	
Short circuit to Vbat		V_{VM} / V_{VCC}	0.55	0.65	
Short circuit to ground		V_{UN} / V_{VCC}	0.30	0.40	
Short circuit to Vbat		V_{UN} / V_{VCC}	0.72	0.88	
Short circuit to ground		$V_{IA,IP}$	0.3	1.5	V
Short circuit to Vbat		V_{IA}	V_{VCC}	V_{VCC} + 2	V
Diagnosis of external heater					
Low level		V_{DIAHG}	-0.3	0.3 V_{VCC}	V
High level		V_{DIAHG}	0.7 V_{VCC}	V_{VCC} + 0.3	V
Input current (no pull up!)		- I_{DIAHG}	-1	1	µA
Short circuit to ground	DIAHG = low	I_{DIAHD}	-1000	-350	µA
Short circuit to Vbat	DIAHG = high	I_{DIAHD}	-100	10 000	µA
Open load	DIAHG = low	I_{DIAHD}	-100	100	µA
No failure	DIAHG = high	I_{DIAHD}	-1000	-350	µA
No failure	DIAHG = low	I_{DIAHD}	350	10 000	µA
Filter time	T = 1 / f	t_{DIAG} / T	30 / 32	32 / 32	
SPI					
Data rate				2	Mbaud
Bit-frame				16	bit
Number of read / write commands				6	
Number of register				4	

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