Automotive Electronics

Product Information
CAN Bus Transceiver – CF175

BOSCH
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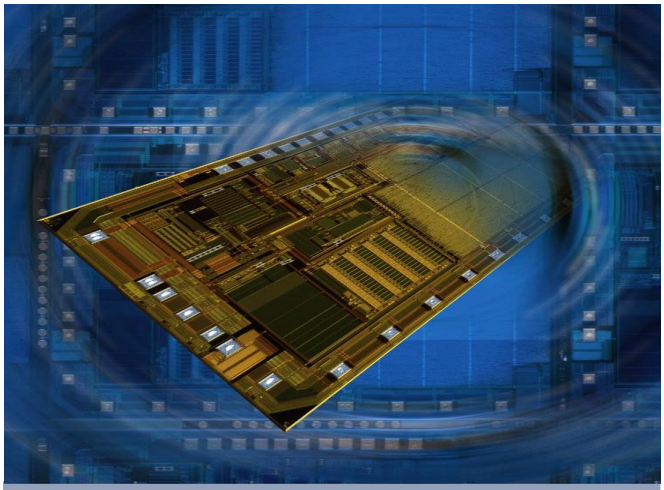


CAN Bus Transceiver

Customer benefits:

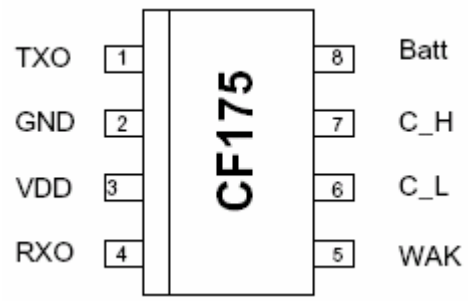
- Excellent system know-how
- Smart concepts for system safety
- Secured supply
- Long- term availability of manufacturing processes and products
- QS9000 and ISO/TS16949 certified

The CF175 is a bidirectional transceiver for signal conditioning and processing in connection with a CAN controller.

Features

- General
  - Based on ISO 11898 standard
  - Data rates of up to 1MBaud possible
  - Busvoltages 42V compatible
  - Compatible with 5V - CAN controller
  - RFI and EMI improved
  - Standby-mode (VDD = 0)
  - ESD- performance improved
- Transmitter
  - Differential output signals
  - Short-circuit-protection of C_L, C_H
  - TX dominant timeout
- Receiver
  - Differential input with high interference suppression
  - Common mode input voltage range from -5 V to 12 V
- Wakeup-detection
  - Differential input with high interference suppression
  - Common mode input voltage range wakeup from 0.3 V to 6 V
- Package: SOIC 8

PIN Configuration



Pin Description

Pin	Name	Function
1	TXO	Transmitter input
2	GND	Ground
3	VDD	Supply (5V)
4	RXO	Receive output
5	WAK	Wakeup output
6	C_L	CAN bus low side
7	C_H	CAN bus high side
8	Batt	Standby supply

Maximum ratings

All voltages, except bus voltage, are defined with respect to pin GND. Positive currents flow into the IC.

Rating	Condition	Symbol	Min.	Max.	Unit
1. Supply voltage (VDD)	static	V_{VDD}	0	5.5	V
2. Supply voltage (VDD)	for less than a total of 5h over entire lifetime	V_{VDD}	0	6	V
3. Supply voltage standby	for V_{Batt} > 28V (e.g.42V-application) 1kOhm serial resistor necessary s. application note	V_{Batt}	0	58	V
4. Bus voltage (C_H,C_L)		V_{C_H}, V_{C_L}	-10V	V_{Batt}+2V	
5. Voltage at TXO		V_{TX0}	-0.3 V	V_{VDD}+0.3V	
6. Output current at RXO		I_{RXO}	-0.3	1	mA
7. Voltage at RXO		V_{RXO}	-0.3 V	V_{VDD}+0.3V	
8. Output current at WAK		- I_{WAK}	-0.1	0.5	mA
9. Output voltage at WAK		V_{WAK}	-0.3 V	V_{Batt}	
10. Storage temperature		T_{ST}	-40	150	°C
11. Ambient temperature		T_{amb}	-40	125	°C
12. Junction temperature		T_J	-40	150	°C
13. Electro static discharge voltage C_H, C_L to GND	Human Body Model 100pF, 1.5KOhm RX0=TX0=WAK= Batt = GND	V_{C_H}, V_{C_L}	-4	4	kV
14. Electro static discharge voltage RX0, TX0, WAK, VDD,Batt,C_H, C_L ,GND	Human Body Model 100pF, 1.5KOhm	V_{RX0}, V_{TX0},V_{WAK}, V_{VDD},V_{C_H}, V_{C_L},V_{Batt}	-2	2	kV

Characteristics

All voltages are defined with respect to pin GND. Positive currents flow into the IC.
If not otherwise defined the following conditions should be fulfilled:
-40×°C < T_{OP} < 125°C and 4.75V < V_{VDD} < 5.25V and 7.7V < V_{Batt} < 42V
Dominant: both switches in the transmitter are conducting
Recessive: both switches in the transmitter are nonconducting
RL = Resistor between C_H and C_L

Rating	Conditions	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance		$R_{th\ j\text{-}amb}$		200		K/W
Voltage limit V_{Batt} CAN function	no inversion of RX and BUS – signal	V_{Batt}	5			V
Voltage limit V_{Batt} Wakeup function		V_{Batt}	7.7			V
Supply current VDD Dominant	Dominant, RL=60 Ohm	I_{VDD}		50	80	mA
Supply current VDD Recessive	Recessive	I_{VDD}		8	16	mA
Supply current VDD Short circuit to GND	Dominant V_{C_H} = 0	I_{VDD}		120		mA
Supply current Batt	-0.3V < V_{C_L} -0.3V < V_{C_H} $I_{Batt.int}$ = I_{Batt} - |I_wak| V_{Batt} = 12V V_{Batt} = 42V	 $I_{Batt.int}$ $I_{Batt.int}$			 0.95 1.30	 mA mA
Supply current Batt standby (VDD = 0 , no wakeup)	-0.3V < V_{C_L} -0.3V < V_{C_H} V_{Batt} = 12V V_{Batt} = 42V	 I_{Batt} I_{Batt}		 30 60	 65 140	 uA uA

Transmitter section

Rating	Conditions	Symbol	Min.	Typ.	Max.	Unit
TXO Input capacitance	$0 < V_{TXO} < V_{VDD}$	C_{TXO}		5		pF
TXO High level input voltage		V_{TXO}	$0.45\ V_{VDD}$		V_{VDD}	
TXO Low level input voltage		V_{TXO}	0		$0.17\ V_{VDD}$	
TXO input current source	$0 < V_{TX0} < 0.45V_{VDD}$	$-I_{TXO}$	10	30	100	uA
Bus voltage recessive Poweron	Recessive $I_{C\_L} = I_{C\_H} = 0$	V_{C_H}, V_{C_L}	$0.4\ V_{VDD}$		$0.6\ V_{VDD}$	
Bus voltage recessive Standby	$V_{DD} = 0\ I_{C\_L} = I_{C\_H} = 0$	V_{C_H}, V_{C_L}	0		1	V
Leakage current recessive	$0V < V_{C\_L} < V_{VDD}$, $0V < V_{C\_H} < V_{VDD}$	I_{C_H}, I_{C_L}	-0.3		0.3	mA
Input resistance	Recessive or Standby $0V < V_{C\_L} < V_{VDD}$, $0V < V_{C\_H} < V_{VDD}$	R_{IN} (C_H,C_L)		20		kΩ
Differential input resistance	Recessive or Standby $0V < V_{C\_L} < V_{VDD}$, $0V < V_{C\_H} < V_{VDD}$	R_{Diff} (C_H,C_L)		40		kΩ
Differential output voltage dominant	Dominant, RL= 60 Ohm	$V_{Diff} = V_{C\_H} - V_{C\_L}$	1.5		3	V
Differential output voltage recessive	Recessive	$V_{Diff} = V_{C\_H} - V_{C\_L}$	-200	0	50	mV
Output capacitance CH recessive	Recessive $1V < V_{C\_H} < 3.5V$	C_{C_H}		13		pF
Output capacitance CL recessive	Recessive $1V < V_{C\_L} < 3.5V$	C_{C_L}		7		pF

Protection and Tx dominant timeout section

Rating	Conditions	Symbol	Min.	Typ.	Max.	Unit
TX dominant timeout time (transmitter switches off after t_{dom} and TX0 = low)		t_{dom}	0.5	1	2	ms
Short circuit detection level (transmitter switches off if $V_{C\_L} > V_{Short}$ or $V_{C\_H} > V_{Short}$)		V_{Short}	7	8.5	11	V

Receiver section

Rating	Conditions	Symbol	Min.	Typ.	Max.	Unit
RXO High level output voltage $V_{Diff} = V_{C\_H} - V_{C\_L}$	$V_{Diff} < 0{,}4V$ $I_{RXO} = -0{,}3mA$ $-2V < V_{C\_H} < 7V$ $-2V < V_{C\_L} < 7V$	V_{RXO}	$0.9\ V_{VDD}$		V_{VDD}	
RXO Low level output voltage $V_{Diff} = V_{C\_H} - V_{C\_L}$	$V_{Diff} > 1V$ $I_{RXO} = 1mA$ $-2V < V_{C\_H} < 7V$ $-2V < V_{C\_L} < 7V$	V_{RXO}	0		0.5	V
Input signal threshold $V_{Diff} = V_{C\_H} - V_{C\_L}$	$-2V < V_{C\_H} < 7V$ $-2V < V_{C\_L} < 7V$	V_{Diff} / V_{VDD}	0.106		0.171	
Differential input hysteresis $V_{Diff} = V_{C\_H} - V_{C\_L}$ $\Delta V_{Diff} = V_{Diff.high} - V_{Diff.low}$		ΔV_{Diff}		120		mV

Poweron and wakeup section

Rating	Conditions	Symbol	Min.	Typ.	Max.	Unit
Poweron level		V_{VDD}	2.9	3.5	4.2	V
Poweron hysteresis		ΔV_{VDD}		0.2		V
Wakeup detection level Vwake	-0.3 < V_{C_L} < 6V V_{DD} = 0 Vwake = V_{C_H} - V_{C_L}	Vwake	400	800	1200	mV
Wakeup detection time (time required to detect wakeup)	-0.3 < V_{C_L} < 6V VDD = 0 V_{C_H} - V_{C_L} = 1.5V	t_{WAK}	0.5	2	3.5	ms
Wakeup timeout	-0.3 < V_{C_L} < 6V VDD = 0	t_{Woff}	128		512	ms
Wakeup output current (on) VD_{iff} = V_{C_H} - V_{C_L} > Vwake	-0.3 < VC_L < 6V V_{Diff} > Vwake VDD = 0 V_{WAK}= V_{Batt}-2V	- I_{WAK}	0.5			mA
Wakeup output current (off) V_{Diff} = V_{C_H} - V_{C_L} < Vwake	VDiff < Vwake VDD = 0 0 < V_{WAK}< V_{Batt}	I_{WAK}	-10	0	10	µA

Dynamic characteristics

General conditions:

C_{VDD}: 47 pF between C_H and C_L, V_{VDD} = 5V, V_{Batt} = 14V, t_r < 5ns

C_{RXO}: 20 pF between RXO and GND, R_L: =60 Ω

Rating	Conditions	Symbol	Min.	Typ.	Max.	Unit
Signal delay TX to C_H,C_L		t_T		80		ns
Differential output slew rate		dV_{Diff} /dt		50		V/µs
Signal delay C_H,C_L to RX		t_R		50		ns
Signal delay TX to RX		t_{TR}		130	210	ns

Functional description

The CF175 is used as an interface between a CAN controller and the physical bus.

A TX dominant timeout function will switch off the transmitter if it is dominant for longer than tdom.

A shortcircuit-protection will switch off the transmitter if VC_L > VShort or VC_H > VShort.

The standby-mode is achieved if VDD is set low while VDiff < Vwake. In this mode the transmitter is off and the current-consumption at Batt is low.

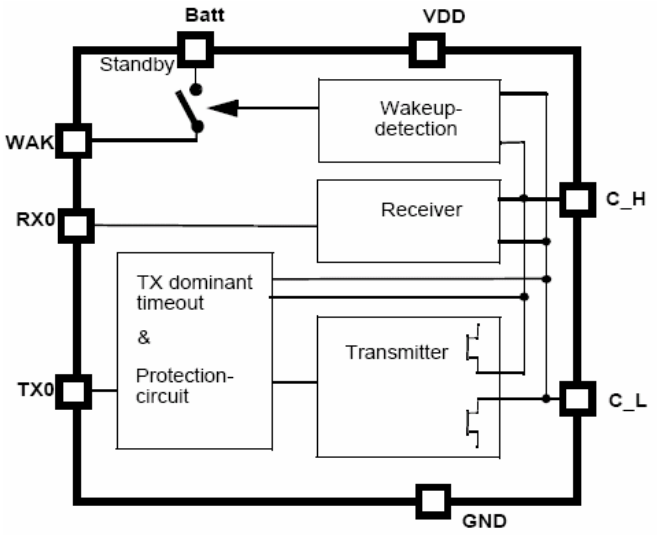
During standby mode, a wakeup-signal (VDiff > Vwake for t > tWAK) sets WAK to high level.
WAK will go to tristate again, after the wakeup timeout (tWoff) .

After the switch on of the standby-supply the WAK-output is in tristate until the first dominant-puls at the bus.

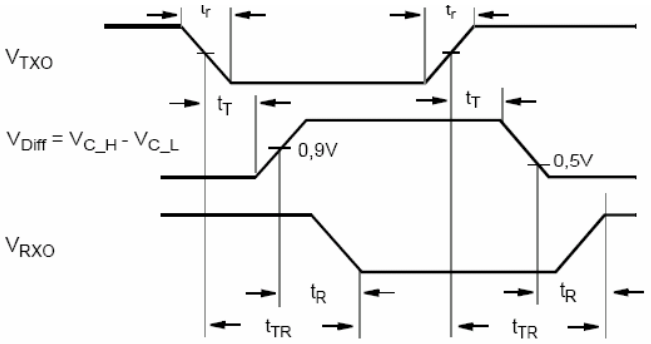
Functional table

Bussignal CH_CL	VDD	mode	WAK
high	high	Poweron	tristate
low	high	Poweron	tristate
high	low	Standby	high plus
low	low	Standby	tristate

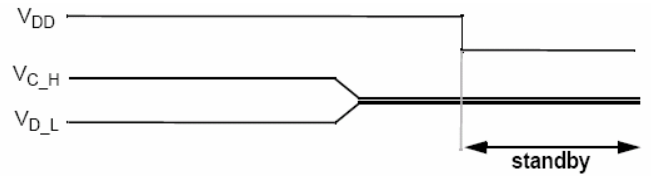
Package: SOIC 8



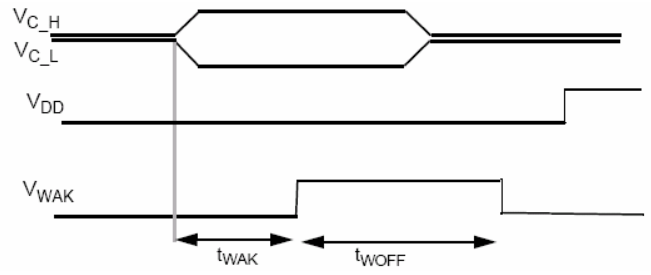
Timing



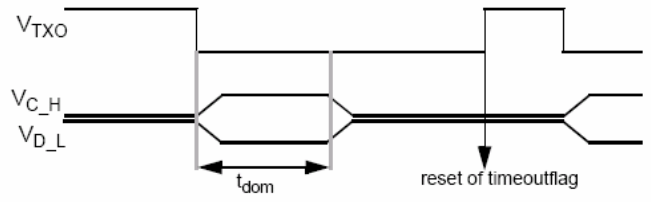
Transition to standby- mode

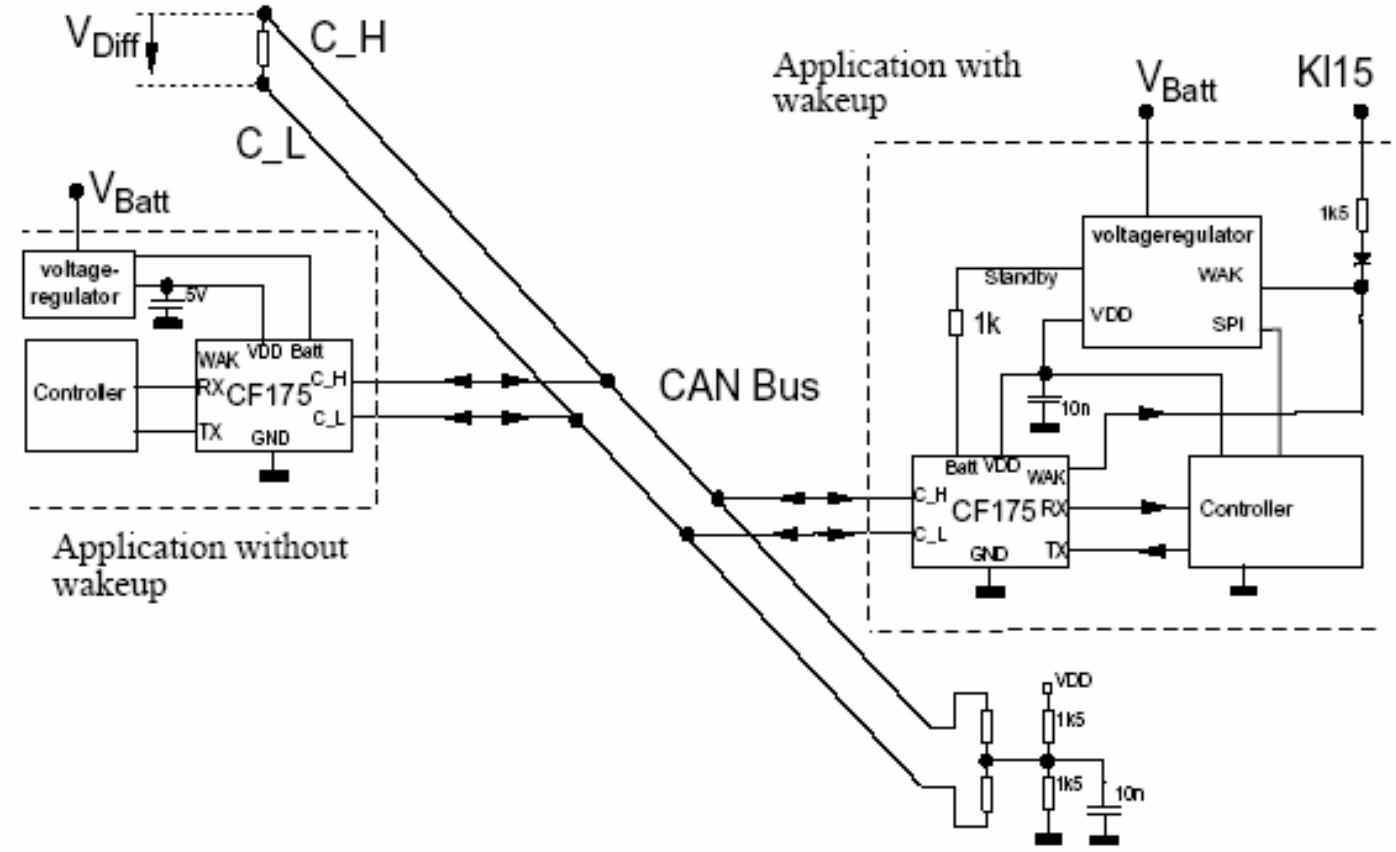


Wakeup



TX Dominant timeout





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