BOSCH
Microelectronics

preliminary Technical Data CF175

CAN BUS TRANSCEIVER

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

FEATURES

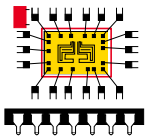
General
- Based on ISO 11898 standard
- Data rates of up to 1MBaud possible
- Busvoltages 42V compatible
- Compatible with 5V - CAN controller
- RFI and EMI improved
- Standby-mode (VDD = 0)
- ESD- performance improved

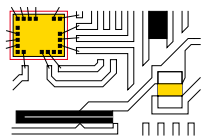
Transmitter
- Differential output signals
- Short-circuit-protection of C_L, C_H
- TX dominant timeout

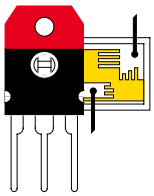
Receiver
- Differential input with high interference suppression
- Common mode input voltage range from -5 V to 12 V

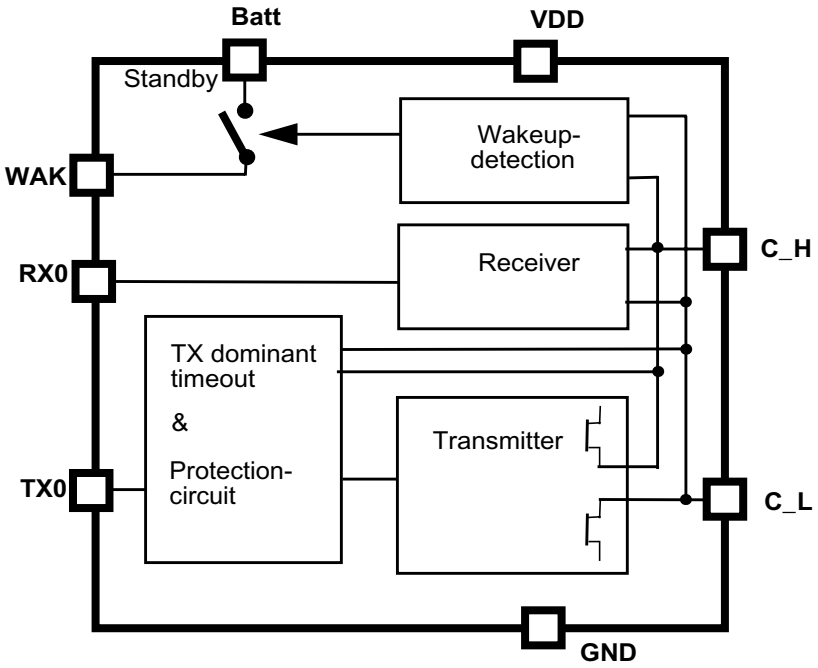
Wakeup-detection
- Differential input with high interference suppression
- Common mode input voltage range wakeup from -0.3 V to 6 V

Package: SOIC 8

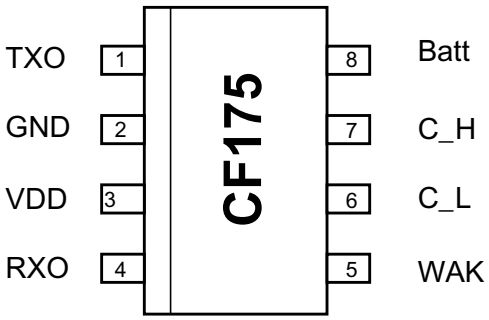








PINNING



PIN DESCRIPTION

Pin	Name	Description
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	Standbysupply

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 necassary 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
1. Thermal resistance		$R_{th\ j\text{-}amb}$		200		K/W
2. Voltagelimit V_{Batt} CAN function	no inversion of RX and BUS - signal	V_{Batt}	5			V
3. Voltagelimit V_{Batt} Wakeup function		V_{Batt}	7.7			V
4. Supply current VDD Dominant	Dominant, RL=60 Ohm	I_{VDD}		50	80	mA
5. Supply current VDD Recessive	Recessive	I_{VDD}		8	16	mA
6. Supply current VDD Short circuit to GND	Dominant V_{C_H} = 0	I_{VDD}		120		mA

Rating	Conditions	Symbol	Min.	Typ.	Max.	Unit
7. 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
8. 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
1. TXO Input capacitance	0 <V_{TXO} < V_{VDD}	C_{TXO}		5		pF
2. TXO High level input voltage		V_{TXO}	0.45 V_{VDD}		V_{VDD}	
3. TXO Low level input voltage		V_{TXO}	0		0.17 V_{VDD}	
4. TXO input current source	0 <V_{TX0} < 0.45V_{VDD}	- I_{TXO}	10	30	100	uA
5. 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}	
6. Bus voltage recessive Standby	VDD = 0 I_{C_L} = I_{C_H} = 0	V_{C_H} V_{C_L}	0		1	V
7. 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
8. 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**
9. 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**
10. Differential output voltage Dominant	Dominant, RL= 60 Ohm	V_{Diff}= V_{C_H}-V_{C_L}	1.5		3	V
11. Differential output voltage Recessive	Recessive	V_{Diff}= V_{C_H}-V_{C_L}	-200	0	50	mV
12. Output capacitance CH Recessive	Recessive 1V < V_{C_H} < 3.5V	C_{C_H}		13		pF
13. 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
1. TX dominant timeout time (transmitter switches off after tdom and TX0 = low)		t_{dom}	0.5	1	2	ms
2. Shortcircuit 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
1. 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}	
2. 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
3. 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	
4. 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
1. Poweron level		V_{VDD}	2.9	3.5	4.2	V
2. Poweron hysteresis		ΔV_{VDD}		0.2		V
3. Wakeup detection level Vwake	$-0.3 < V_{C_L} < 6V$ VDD = 0 Vwake = $V_{C_H} - V_{C_L}$	Vwake	400	800	1200	mV
4. 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	µs

POWERON AND WAKEUP SECTION

Rating	Conditions	Symbol	Min.	Typ.	Max.	Unit
5. Wakeup timeout	$-0.3 < V_{C_L} < 6V$ VDD = 0	t_{Woff}	128		512	ms
6. Wakeup output current (on) $V_{Diff} = V_{C_H} - V_{C_L} > Vwake$	$-0.3 < V_{C_L} < 6V$ $V_{Diff} > Vwake$ VDD = 0 $V_{WAK} = V_{Batt}-2V$	$-I_{WAK}$	0.5			mA
7. Wakeup output current (off) $V_{Diff} = V_{C_H} - V_{C_L} < Vwake$	$V_{Diff} < Vwake$ 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
1. Signal delay TX to C_H,C_L		t_T		80		ns
2. Differential output slew rate		dV_{Diff}/dt		50		V/µs
3. Signal delay C_H,C_L to RX		t_R		50		ns
4. 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 t_{dom} .

A shortcircuit-protection will switch off the transmitter if $V_{C_L} > V_{Short}$ or $V_{C_H} > V_{Short}$

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

During standby mode, a wakeup-signal ($V_{Diff} > Vwake$ for $t > t_{WAK}$) sets WAK to high level .
WAK will go to tristate again, after the wakeup timeout (t_{Woff}) .

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

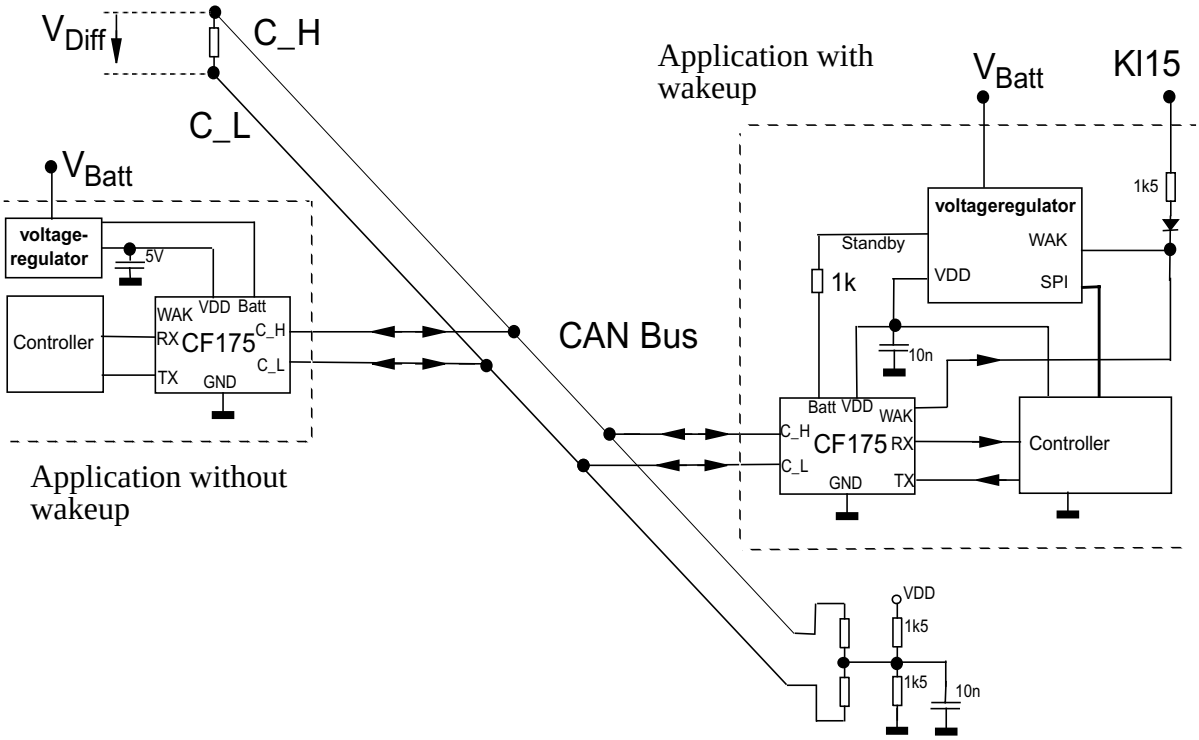
FUNCTIONAL TABLE

Bussignal CH-CL	VDD	mode	WAK
high	high	Poweron	tristate
low	high	Poweron	tristate
high	low	standby	high puls
low	low	standby	tristate

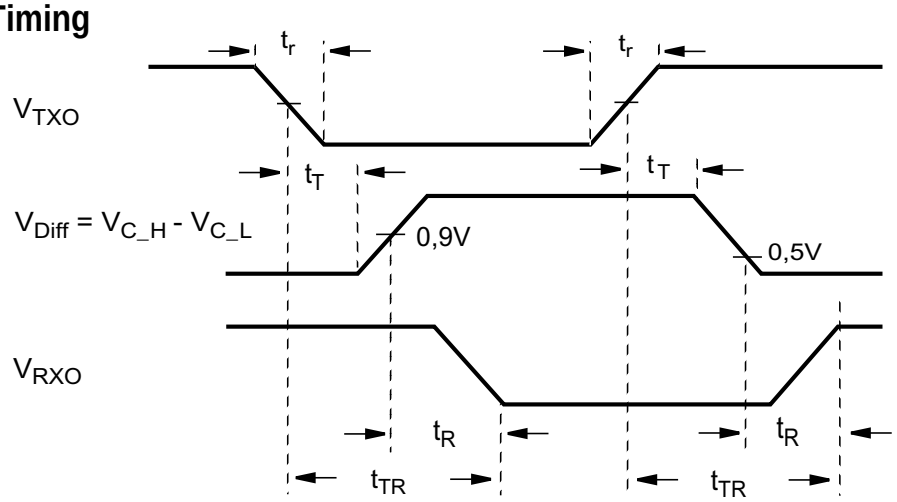
The transmitter is dominant if all of the following conditions are fulfilled :

1. Tx = low
2. $V_{C_L} < V_{Short}$ and $V_{C_H} < V_{Short}$
3. $t_{Tx = low} < t_{dom}$
4. $4.75V < V_{VDD} < 5.25V$

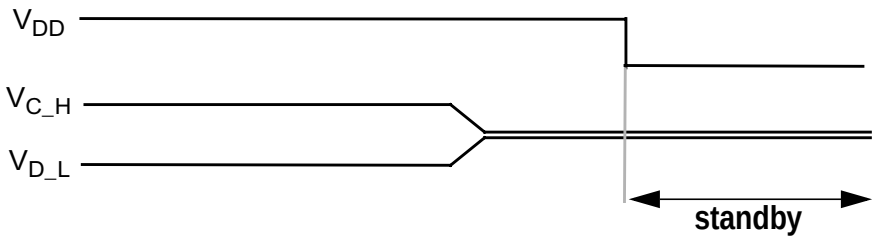
APPLICATION NOTE



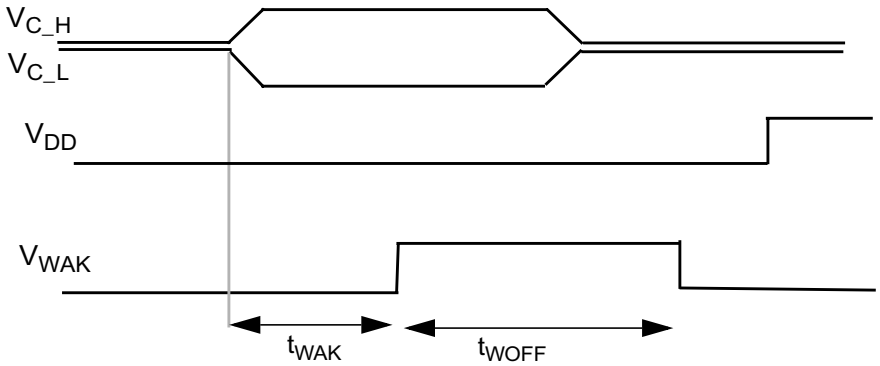
Timing



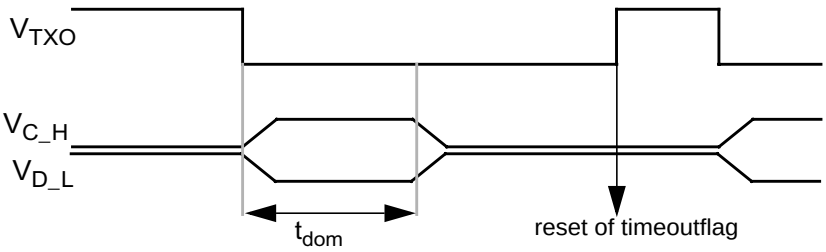
Transition to standby-mode



Wakeup



TX dominant timeout



Robert Bosch Corporation
Bosch Technical Center
9-1, Ushikubo 3-chome
Tsuzuki-ku, Yokohama 224
Tel.: 045 912 8282
Fax: 045 912 9573

Robert Bosch Corporation
Automotive Group (UO/SAM)
38000 Hills Tech Drive
Farmington Hills, MI 48331-3417
Tel.: (248) 553-1390
Fax: (248) 553-7926

Robert Bosch GmbH
Abteilung AE/VKF
Postfach 1342
72703 Reutlingen
Tel.: (07121) 35-2979
Fax: (07121) 35-2170