TH8050

TH8050 High Speed CAN Transceiver

Preliminary Datasheet

Description

This high-speed CAN-Transceiver connects a CAN protocol controller and the physical bus lines and is intended for high speed applications up to 1 MBaud, according to ISO 11898.

Features

- ❑ Pin- and parameter compatible to Philips PCA82C250
- ❑ Fully compatible to ISO/DIS 11898 standard
- ❑ High speed connection, up to 1 MBaud
- ❑ Protection of bus outputs against automotive transients
- ❑ Short-circuit proof to battery and ground
- ❑ Standby mode with very low power consumption
- ❑ Low current consumption also in active mode
- ❑ Low radio frequency interferences
- ❑ Supply voltage: 5 V ± 10 %
- ❑ Operating temperature range: -40 .. +125 °C

Applications

High Speed CAN-Applications up to 1 Mbaud

Block Diagram

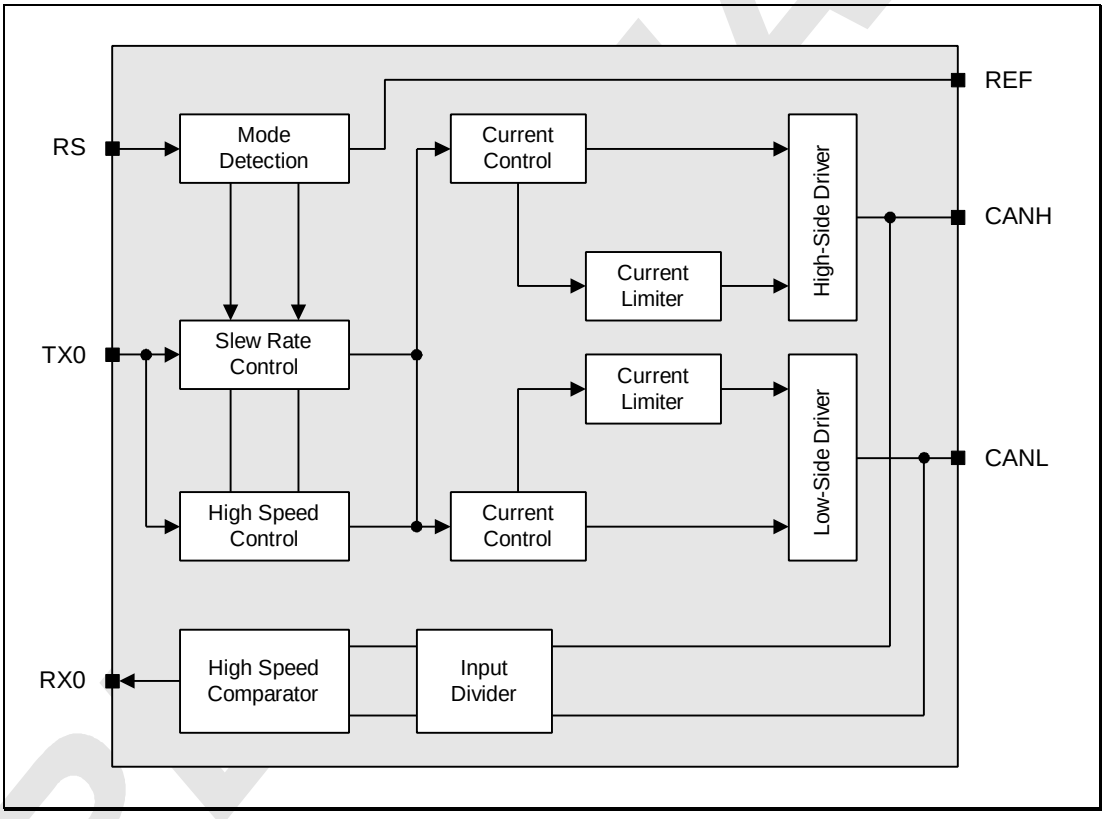


Figure. 1 - Block Diagram

Functional Description

The TH8050 conforms to the ISO/DIS 11898 standard. It is suitable for use in high-speed CAN applications up to a maximum of 1 Mbaud.
Power consumption is kept to an absolute minimum both in active operation, in the standby mode and in the event of an error by a current-limiting circuit. The outputs are short circuit-proof and equipped with an integral reverse voltage protection. In case of thermal overloading, the output drivers cut out at 165° with a hysteresis of 25°C, after which the drivers are reconnected. During thermal cut-out, only the output drivers are switched off while all other functions are retained.
The CAN bus pins CANH and CANL are protected against Schaffner pulses 1, 2, 3a and 3b.

The voltage drop at the pin R_s causes analogous output driver slope control.
Two different operating statuses can be set:

1. Slope control:
   The signal rise and fall times are controlled with the aid of a resistor (0KΩ to 50KΩ) between the pin R_s and GND. The rise time is proportional to the output current at the pin R_s.

2. Standby, connection of R_s to V_{DD}:
   Connecting V_{DD} to the pin R_s activates the standby mode.
   In this mode, the transmitter is switched off and the current consumption of the receiver markedly reduced. If a dominant bus signal is received, this is relayed to the pin RX0. The microcontroller is able to respond to this and return the TH8050 to the normal operating mode via the pin Rs. As the receiver responds very slowly in the standby mode, the first message is lost.

For EMC reasons, slope should always be kept to a minimum, as steeper edges always result in higher electromagnetic emissions.

In high-speed operation (1 Mbaud), shielded cable should always be used due to the increased flank steepness and consequent high EM emissions. For transmission at 1 Mbaud, a resistor with a range of 10 KΩ to 25 KΩ should be used at pin R_s.

For lower transmission rates or in case of short bus cables, twisted-pair or parallel conductors can be used. In this case, electromagnetic emissions are minimized by limiting the rise and fall times of the bus signal.

Electrical Characteristics

All voltages are refered to ground (GND). Positive currents flow into the IC.
The absolute maximum ratings given in the table below are limiting values that do not lead to a permanent damage of the device but exceeding any of these limits may do so. Long term exposure to limiting values may affect the reliability of the device. Reliable operation of the TH8050 is only specifed within the limits shown in "Recommended Operating Conditions".

Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
DC supply voltage	V_{DD}	-0.3	7.0	V
Input voltage, pin 1,4,5 and 8	V_{IN}	-0.3	VDD+0.3	V
Input voltage, pin 6 and 7	V_{IN}	-8.0	18	V
Input current	I_{IN}	-200	200	mA
Storage temperature range	T_{STG}	-55	150	°C
Power dissipation	P_D		250	mW

Electrical Characteristics (continued)

Operating Conditions

Parameter	Symbol	Min	Max	Unit
DC supply voltage	V_{DD}	4.5	5.5	V
Operating temperature range	T_A	-40	125	°C
Junction temperature	T_J	-40	150	°C

Static Charakteristics

VDD=4.5 ... 5.5 V, TA=-40 ... 125°C, RL=60Ω

Parameter	Sym-bol	Condition	Min	Typ	Max	Unit
Supply Current	I_S	dominant bus level			60	mA
		recessive bus level		2.5	6	mA
		standby mode		40	100	µA
Transmitter						
Voltage input low, pin TX0	V_{IL}	output dominant			0,3*V_{DD}	V
Voltage input high, pin TX0	V_{ICH}	output recessive	0,7*VDD			V
Input current low, pin TX0	I_{INL}	V_{TX0}=1V	100		600	µA
Input current high, pin TX0	I_{INH}	V_{TX0}=4V	-100		10	µA
Recessive bus voltage	V_{BUS}	V_{TX0}=4V, no load	2		3	V
Off-state output leakage current	I_{LO}	-2V < $V_{6,7}$ < 7V	-1		1	mA
		-2V < $V_{6,7}$ < 18V	-1		10	mA
CANH output voltage	V_{CANH}	dominant bus level	2.5		4.5	V
CANL output voltage	V_{CANL}	recessive bus level	0.5		2.0	V
Difference voltage between V_{CANL} and V_{CANH}	ΔV_{BUS}	dominant	1.3		3.0	V
		dominant, R_L = 45Ω	1.2			V
		recessive	-500		+50	mV
Short circuit CANH current	I_{CANHSC}	V_{CANH}=-7V V_{DD}<5V			105	mA
		V_{CANH}=-7V V_{DD}=5,5V			120	mA
Short circuit CANL current	I_{CANLSC}	V_{CANL}=18V			140	mA

Static Charakteristics (continued)

Parameter	Sym-bol	Condition	Min	Typ	Max	Unit
Receiver						
Differential input voltage, recessive	V_{diffr}	V_{TX0}=4V -2V < $V_{6,7}$ < 12V	-1		0,5	V
Differential input voltage, dominant	V_{diffd}	V_{TX0}=4V -2V < $V_{6,7}$ < 12V	0,9		5	V
Differential input hysterese	V_{diffHY}			150		mV
Output voltage high, pin RX0	V_{OH}	I_{RX0}=-2mA	V_{DD}-1		V_{DD}	V
Output voltage low, pin RX0	V_{OL}	I_{RX0}=2mA	0		1	V
CANH, CANL input resistance	R_i		5		25	kΩ
Differential input rersistance	R_{diff}		20		100	kΩ
CANH, CANL input capacitance	C_i				20	pF
Differential input capacitance	C_{diff}				10	pF
Reference						
Reference output voltage	V_{REF}	V_{RS} = 1V $\|I_{ref}\|$ < 50µA	0,45*V_{DD}		0,55*V_{DD}	V
		V_{RS} = 4V $\|I_{ref}\|$ < 5µA	0,4*V_{DD}		0,6*V_{DD}	V
Input voltage, pin RS	V_{RS}	high speed			0,3*V_{DD}	V
		slope control	0,4*V_{DD}		0,6*V_{DD}	V
		standby mode	0,75*V_{DD}			V
Input current, pin RS	I_{RS}	high speed V_{RS} = 1V			-500	µA
		slope control	-10		-200	µA

Dynamic Characteristics

VDD=4.5 ... 5.5 V, TA=-40 ... 125°C, RL=60Ω

Parameter	Sym-bol	Condition	Min	Typ	Max	Unit
Minimum bit time	t_{bit}	V_{RS} = 1V		1	0,2	µs
Delay TX0 to bus aktiv	t_{onTX0}	V_{RS} = 1V			50	ns
Delay TX0 to bus inaktiv	t_{offTX0}	V_{RS} = 1V			80	ns
Delay TX0 to RX0 aktiv	t_{onRX0}	V_{RS} = 1V			120	ns
		R_{RS} = 24kΩ	100		320	ns
		R_{RS} = 47kΩ	140		520	ns

Dynamic Characteristics (continued)

Parameter	Sym-bol	Condition	Min	Typ	Max	Unit
Delay TX0 to RX0 inaktiv	t_{onRX0}	V_{RS} = 1V			140	ns
		R_{RS} = 24kΩ	100		320	ns
		R_{RS} = 47kΩ	140		450	ns
Differential output voltage slew rate	|SR|	R_{RS} = 47kΩ	10		24	V/µs
Wake-up time from standby, via pin RS	t_{WAKE}				20	µs
Bus dominant to RX0 low, standby	t_{dRX0L}	V_{RS} = 4V			3	µs

Timing Diagram

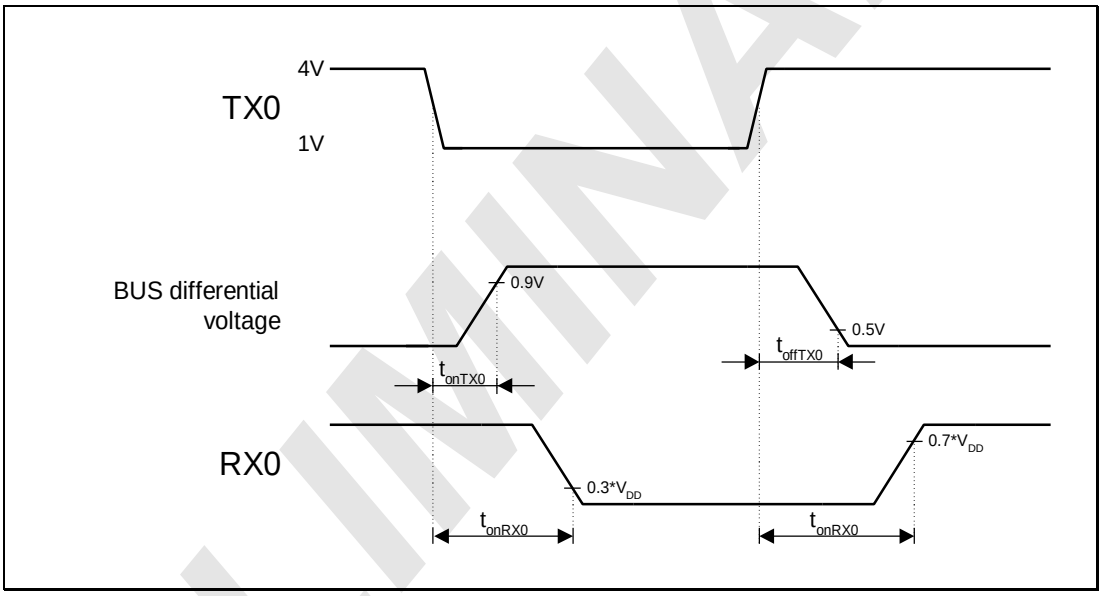


Figure. 2 - Delay timing diagram

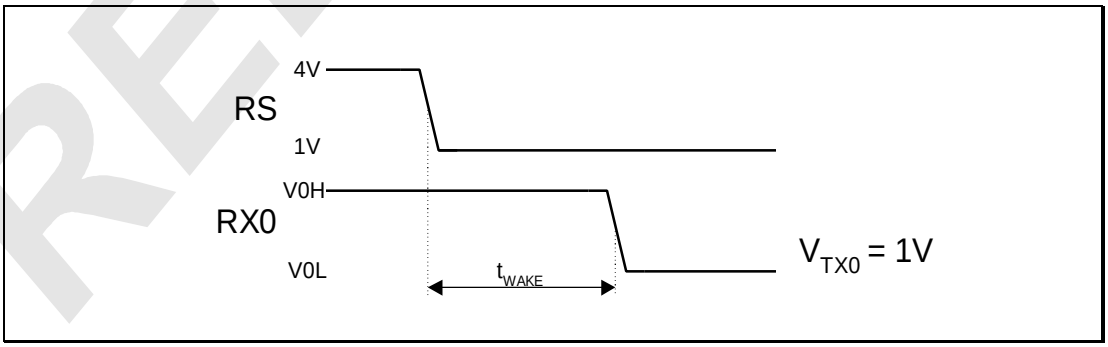


Figure. 3 - Wake-up from standby

Timing Diagram
(continued)

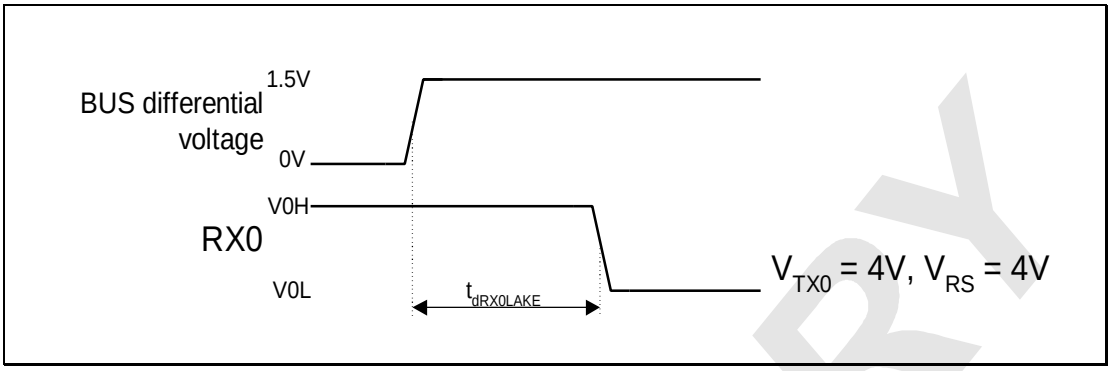
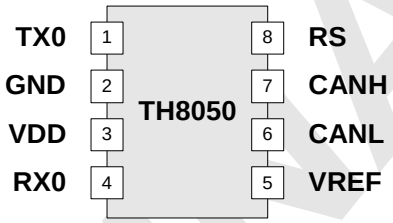


Figure. 4 - Bus dominant to RX0 low at standby

Pin Description



Pin	Name	I/O	Function
1	TX0	I	Data to transmitting (from CAN controller)
2	GND	G	Ground
3	VDD	P	Supply voltage
4	RX0	O	Data received from bus (to CAN controller)
5	VREF	O	Reference voltage output
6	CANL	I/O	Low level CAN bus connection
7	CANH	I/O	High level CAN bus connection
8	RS	I	Slope/Standby control via external resistor

Application Circuitry

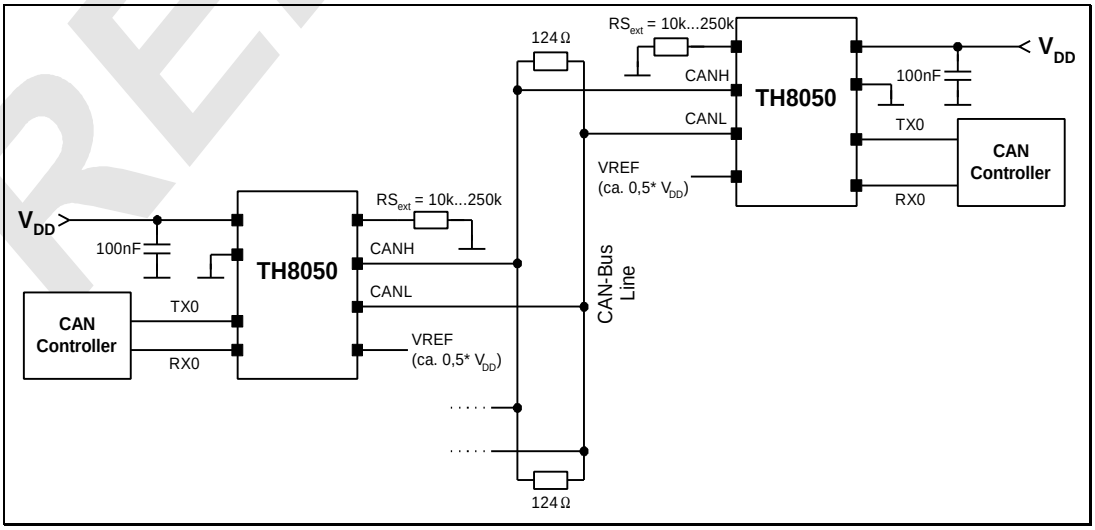
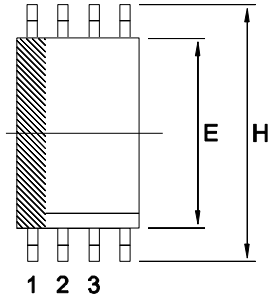
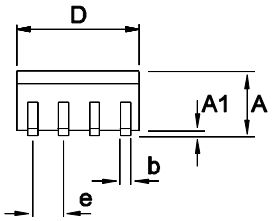
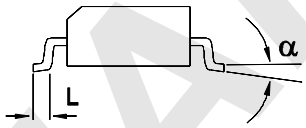


Figure. 5 - Application Circuitry

Package Information







Small Outline Package (SOP) Dimension : mm

SOP 8 150 mil

	D	E	H	A	A1	e	b	L	Copl	α
min	4.80	3.80	5.80	1.35	0.10	1.27	0.33	0.40		0°
max	5.00	4.00	6.20	1.75	0.25		0.51	1.27	0.10	8°

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Important Notice