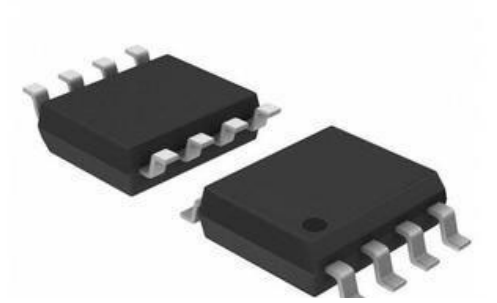
MORNSUN®

SCM3422BSA High-speed CAN transceiver

Features

- Compatible to ISO 11898
- Timing guaranteed for data rates up to 5Mbps in the CAN FD fast phase
- Suitable for 5V systems
- Loop delay less than 180ns
- Power on VCC is 50mA for bus dominant and 5mA for bus recessive
- Protection features:
  -Over-temperature protection
  -Under-voltage protection
  -Current limiting on bus pins
  -TXD-dominant time-out
- Contact Discharge ESD up to ±4KV
- ±58V fault tolerant on CANH and CANL

Package



Optional package: SOP-8, see package outline for more info

Application

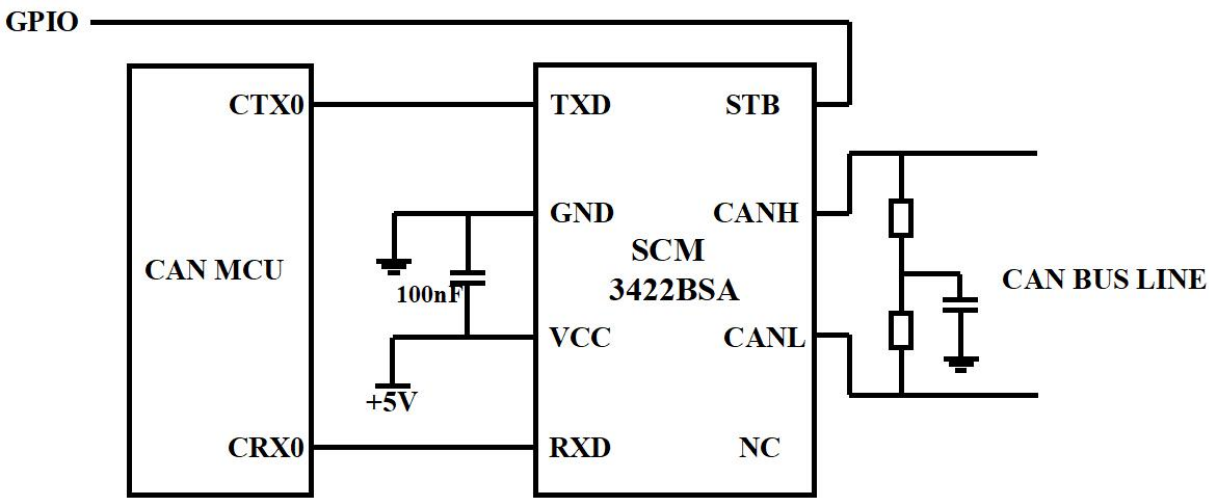
- Automation in industry
- Intelligent meter
- Security System
- Signal transmission for long distance

Functional Description

The SCM3422BSA CAN transceiver conforms to the CAN bus physical layer standard and acts as a bridge between the micro-controller and the CAN bus, with transmitting and receiving functions. In the transmitting function, the digital signal sent by the micro-controller is converted into a differential signal and sent to the CAN bus; in the receiving function, the differential signal received on the CAN bus is converted into a digital signal and transmitted to the micro-controller. The transfer rate is up to 5Mbps.

SCM3422BSA focuses on strengthening the chip reliability design on the basis of traditional IC, including under-voltage protection, over-temperature protection, over-current protection, enhanced ESD design, etc.

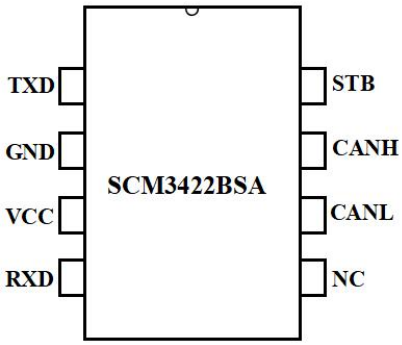
Typical Application Circuit



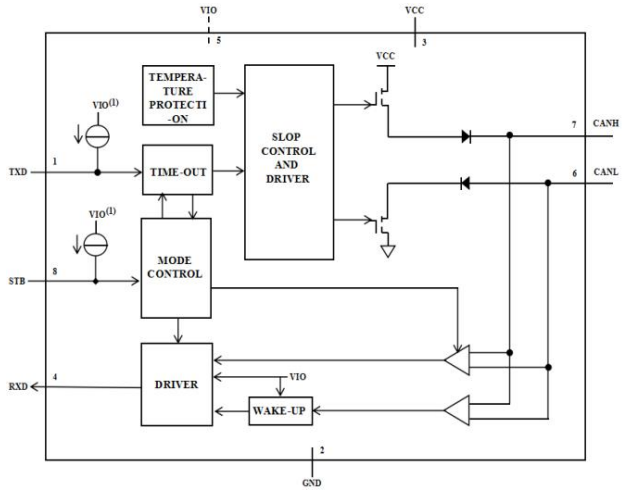
Note：GPIO indicates the universal I/O port.

Contents

Pin Package



Block Diagram



Truth Table

Mode	Inputs		Outputs	
	STB	TXD	CAN driver	RXD
Normal	LOW	LOW	Dominant	LOW
	LOW	HIGH	Recessive	LOW if the CAN bus is dominant
				HIGH if the CAN bus is recessive
Standby	HIGH	X	Floating	LOW when detected wake-up signal
	HIGH	X		HIGH when not detected wake-up signal

Pin Description

Pin	Symbol	Description
1	TXD	Transmit data input
2	GND	Ground
3	VCC	Supply voltage
4	RXD	Receive data output; reads out data from the bus lines
5	NC	Floating
6	CANL	LOW-level CAN bus line
7	CANH	HIGH-level CAN bus line
8	STB	Standby mode control input

Limiting Values

The following data are measured within the range of natural ventilation and normal operating temperatures (unless otherwise stated).

Symbol	Parameter	Value	Unit
VCC	Supply voltage	-0.3 to +6	V
TXD/RXD/STB	Voltage of MCU terminal	-0.3 to VCC+0.3	V
CANH/CANL	Voltage on CAN bus	-58 to +58	V
T_{STG}	Storage temperature	-55 to 150	℃
T_A	Virtual junction temperature	-40 to 125	℃
	Soldering temperature	300	℃

Exceeding the values listed in the Limiting values table may cause permanent damage to the device. The reliability of the device may be compromised by prolonged operation under limiting conditions. All voltage values are based on the reference ground (GND).

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Supply voltage	VCC	4.5	5.5	V
Input voltage	V_{IN}	-0.3	VCC+0.3	V
Data rate	TF	4K	5M	bps
Voltage on pin CANH and pin CANL	Vcan	-30	30	V
Differential voltage on CAN bus	Vdiff	1.5	3.0	V
Operating temperature	T_A	-40	125	℃

Electrical Characteristics

TA= -40℃ to 125℃; VCC=4.5V to 5.5V; RL=60Ω, f_{TXD}=500KHz unless specified otherwise.

Transmitter electrical characteristics						
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IH}	HIGH-level input voltage		0.7VCC		VCC+0.3	V
V_{IL}	LOW-level input voltage		-0.3		0.3VCC	
$VO_{(dif)}$	Dominant differential voltage	V_{TXD}=0V; $VO_{(dif)}$=V_{CANH}-V_{CANL}, RL=45Ω to 65Ω, VCC=4.5 to 5.5V	1.5		3	V
	Recessive differential voltage	V_{TXD}=VCC; $VO_{(dif)}$=V_{CANH}-V_{CANL}, no load, VCC=4.5 to 5.5V	-50		50	mV
$VO_{(rec)}$	Recessive output voltage	Normal mode; V_{TXD}=VCC; no load	2	0.5VCC	3	V
$VO_{(dom)}$	Dominant output voltage:Vcanh	V_{TXD}=0V, t < $T_{to(dom)TXD(Time-out)}$, RL=50Ω to 65Ω	2.75	3.5	4.5	V
	Dominant output voltage:Vcanl	V_{TXD}=0V, t < $T_{to(dom)TXD(Time-out)}$, RL=50Ω to 65Ω	0.5	1.5	2.25	V
$V_{dom(TX)sym}$	Transmitter dominant voltage symmetry	$V_{dom(TX)sym}$=VCC-V_{CANH}-V_{CANL}	-400		400	mV
V_{TXsym}	Transmitter voltage symmetry	V_{TXsym}=V_{CANH}+V_{CANL}, VCC=4.75 to 5.25V	0.9VCC		1.1VCC	V
$IO_{(sc)dom}$	Dominant short-circuit output current	V_{TXD}=0, V_{CANH}=V_{CANL}=-15 to 40V	20	40	80	mA
$IO_{(sc)rec}$	Recessive short-circuit output current	V_{TXD}=VCC, V_{CANH}=V_{CANL}= -27 to 32V	-5		5	mA
Receiver electrical characteristics						
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{rec(RX)}$	Receiver recessive voltage	△V on bus, -30V≤V_{COM}≤30V	0.4			V
$V_{dom(RX)}$	Receiver dominant voltage	△V on bus, -30V≤V_{COM}≤30V			1	V
$V_{hys(RX)dif}$	Differential receiver hysteresis voltage			120		mV
IOH	HIGH-level output current on pin RXD	V_{RXD}=VCC-0.4	-8	-4	-2	mA
IOL	LOW-level output current on pin RXD	V_{RXD}=0.4V, bus dominant	2	5	12	mA
V_{COM}	Common-mode voltage on pin CANH and CANL	Voltage on bus to GND	-30		30	V
R_{IN}	Input resistance on CAN bus	V_{TXD}=VCC, -30V≤V_{CANH}/V_{CANL}≤30V	10		40	KΩ
Power characteristics						
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
ICC	Supply current in standby mode	V_{STB}=VCC, V_{TXD}=VCC			65	uA
	Dominant supply current	V_{STB}=0, V_{TXD}=0		50	70	mA
	Recessive supply current	V_{STB}=0, V_{TXD}=VCC		5	10	mA

Switching Characteristics

TA= -40℃ to 125℃; VCC=4.5V to 5.5V; RL=60Ω, CL=100PF, f_{TXD}=500KHz unless specified otherwise.

Transmitter switching characteristics						
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
TF	Data rate		4K	500K	5M	bps
$Td_{(TXD-busdom)}$	Delay time from TXD to bus dominant	Normal mode, delay time from TXD falling edge of 30% to bus differential voltage rising edge of 0.9V		65	80	ns
$Td_{(TXD-busrec)}$	Delay time from TXD to bus recessive	Normal mode, delay time from TXD rising edge of 70% to bus differential voltage falling edge of 0.5V		90	100	ns
Tr_CAN	Rise slope of Bus output	From 10% to 90% of rising edge		60		ns
Tf_CAN	Fall slope of Bus output	From 90% to 10% of falling edge		70		ns
$T_{bit(bus)}$	Transmission bit width distortion	$T_{bit(TXD)}$=500ns, measure the bit width distortion of bus differential voltage	-65		30	ns
$Tto_{(dom)\ TXD}$	Time-out	V_{TXD}=0V; Normal mode	0.3	1	3	ms
Receiver switching characteristics						
$Td_{(busdom-RXD)}$	Delay time from bus dominant to RXD	Normal mode, delay time from bus differential voltage rising edge of 0.9V to RXD falling edge of 30%		60	80	ns
$Td_{(busrec-RXD)}$	Delay time from bus recessive to RXD	Normal mode, delay time from bus differential voltage falling edge of 0.5V to RXD rising edge of 70%		65	120	ns
$Tbit_{(RXD)}$	Bit width distortion of RXD	$T_{bit(TXD)}$=500ns, measure the bit width distortion of RXD	-100		50	ns
Loop characteristics						
$Td_{(TXDL-RXDL)}$	Delay time from TXD dominant to RXD dominant	Normal mode, delay time from TXD falling edge of 30% to RXD falling edge of 30%		110	180	ns
$Td_{(TXDH-RXDH)}$	Delay time from TXD recessive to RXD recessivet	Normal mode, delay time from TXD rising edge of 70% to RXD rising edge of 70%		110	180	ns
Wake-up characteristics						
$Td_{(wake-up)}$	Time of wake-up signal on CAN bus	Standby mode, time of wake-up signal			5	us

Other Characteristics

TA= -40℃ to 125℃; VCC=4.5V to 5.5V; RL=60Ω, f_{TXD}=500KHz unless specified otherwise.

Over-temperature protection						
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Tj(sd)	Shutdown junction temperature		150	160	170	℃
Under-voltage protection						
$V_{uvd(VCC)}$	Under-voltage value of VCC		3.5		4.5	V
ESD						
VESD	HBM mode, CANH and CANL (to GND)		±8			KV
	HBM mode, other pins		±4			KV
	Contact discharge, CANH and CANL(to GND)	IEC 61000-4-2	±4			KV

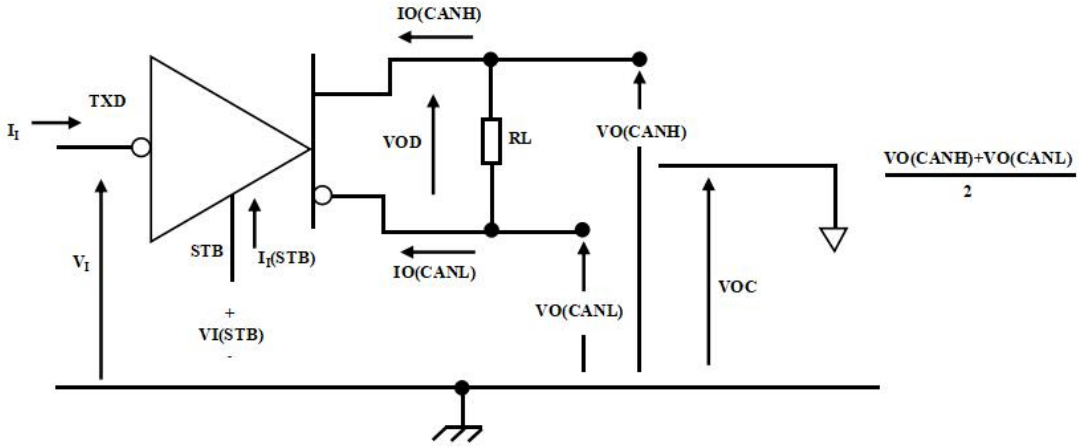


Fig 1. Definition of driver voltage and current test

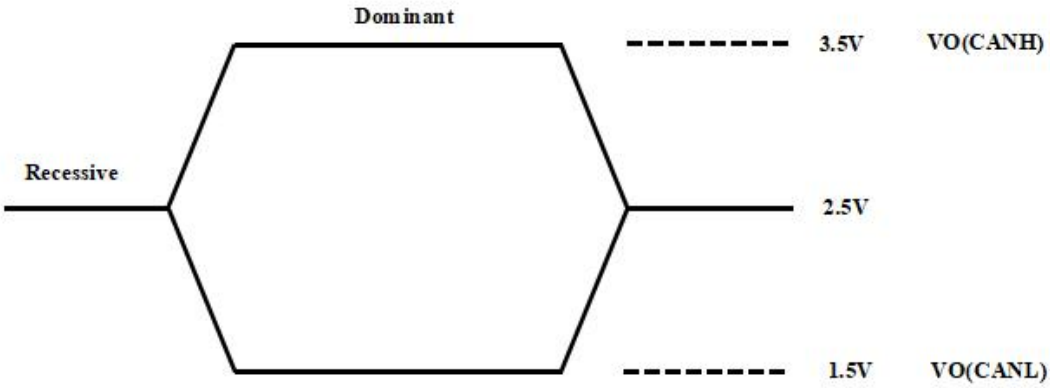


Fig 2. Definition bus logic voltage

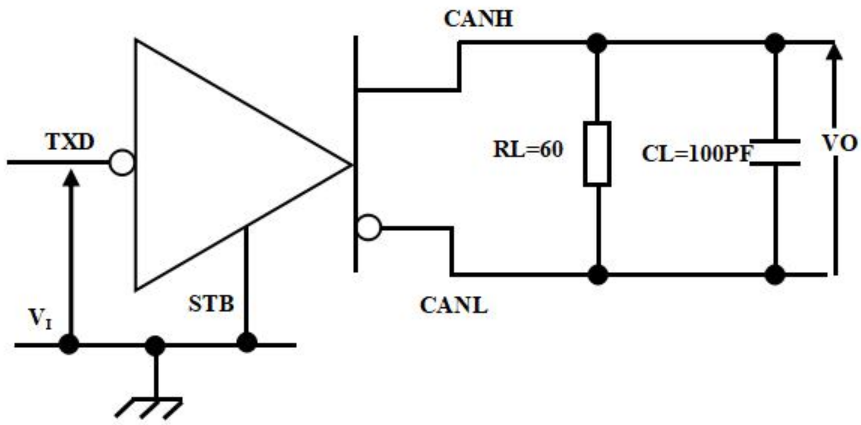


Fig 3. Driver test circuit

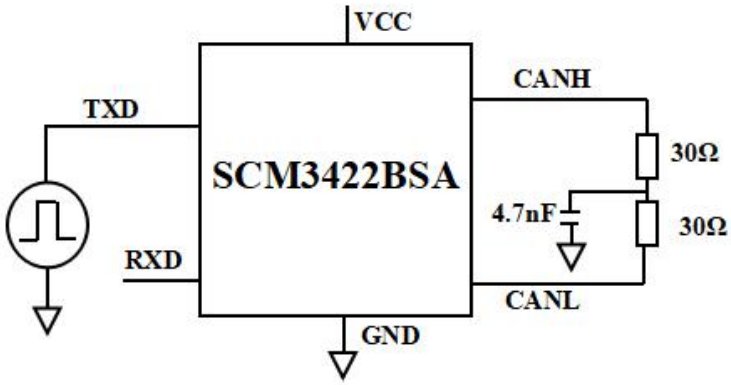


Fig 4. Test circuit for measuring transceiver driver symmetry

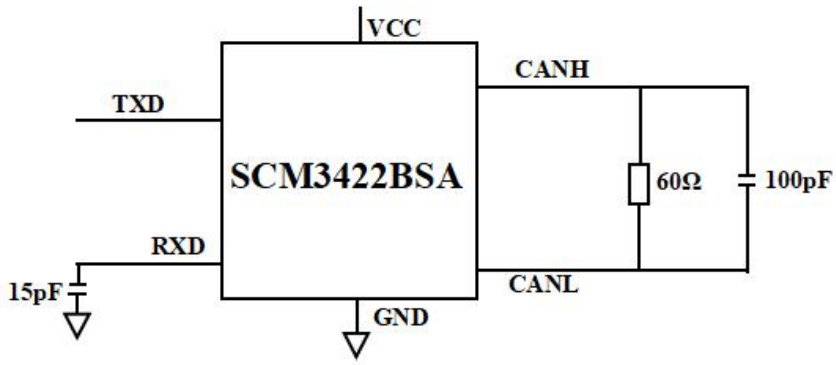


Fig 5. Timing test circuit for CAN transceiver

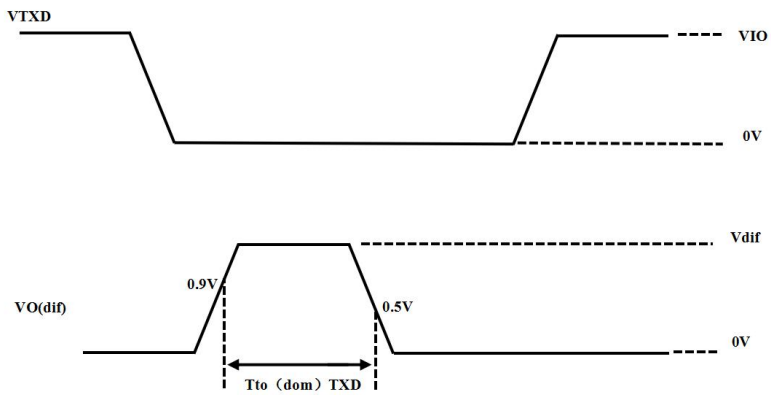


Fig 6. Waveform of test timeout

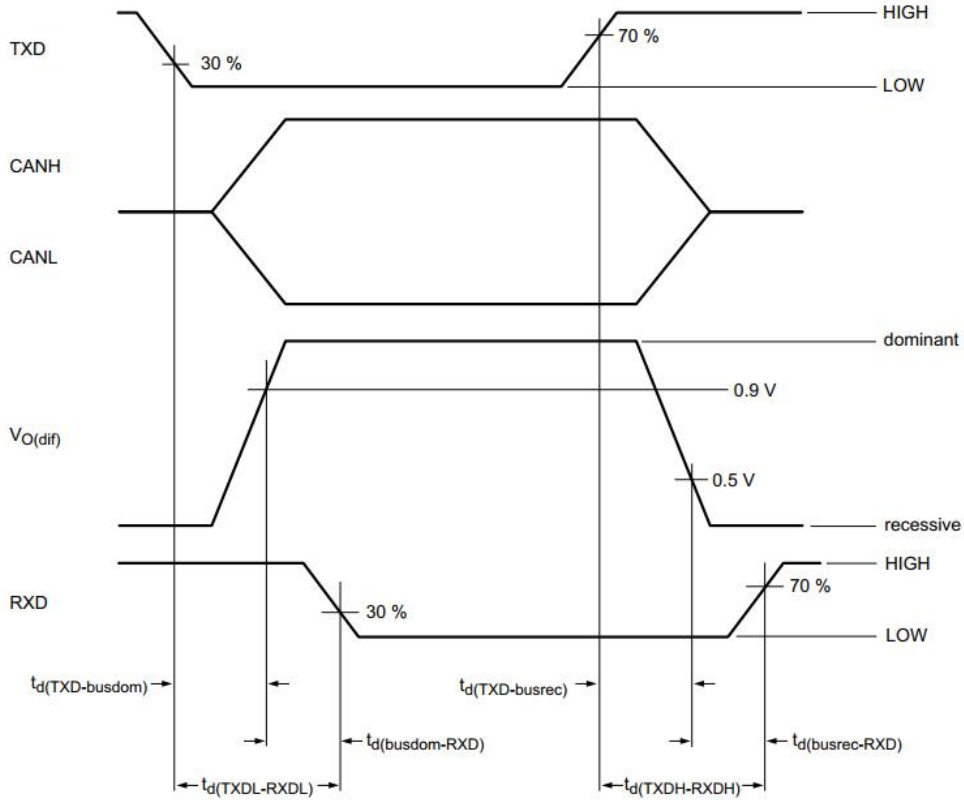


Fig 7. Waveform of switching characteristics for CAN transceiver

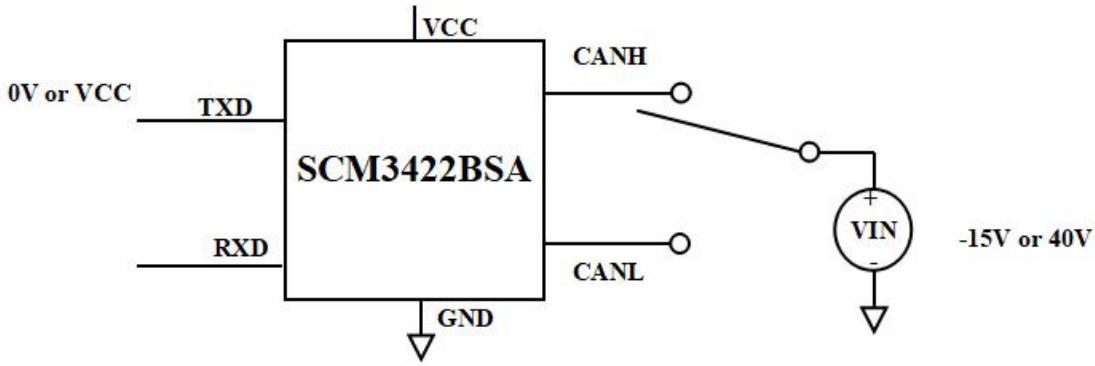


Fig 8. Test circuit of short-circuit output current

Operating Description

As a CAN transceiver chip, SCM3422BSA includes transmitting and receiving functions. The SCM3422BSA implements the CAN physical layer as defined in ISO 11898-2:2016 and SAE J2284-1 to SAE J2284-5. This implementation enables reliable communication in the CAN FD fast phase at data rates up to 5 Mbps. The SCM3422BSA supports two operating modes, normal mode and standby mode, which are controlled by the STB port.

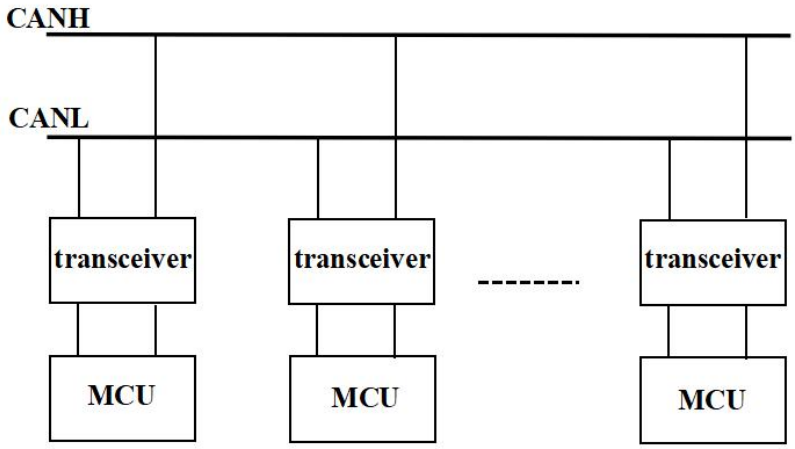
A LOW level on pin STB selects Normal mode. In this mode, the transceiver is able to transmit and receive data. The digital signal sent by the MCU to pin TXD and converted into the differential signal conforming to CAN protocol by the transmitting channel. When pin TXD is low level, the state of CAN bus is dominant, and output a differential signal; When pin TXD is high level, the state of CAN bus is recessive, and output a common mode signal. In the receiving state, CANH and CANL port receive differential signals from CAN bus, then the signals are converted into digital signals by receiving channel and output to the controller from the RXD port. When the received bus signal is differential, the RXD output is low, and when the received bus signal is common mode, the RXD output is high.

A HIGH level on pin STB selects standby mode. At this time, the transmitting channel and receiving channel are disabled, and only the wake-up channel is operating, the output of RXD is high. When a wake-up signal is detected by wake-up channel, the output of RXD changes to be low, and STB input will change to be low, the chip begins to opreate in normal mode. If not detect wake-up signal, the output of RXD is keeping high.

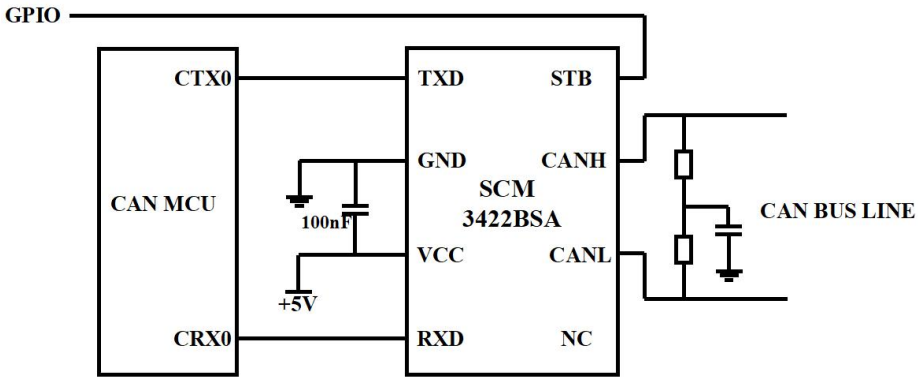
The SCM3422BSA integrates TXD dominant time-out function. When the input pin TXD continuous low level more than set time value, the dominant time-out circuit will shut off the transmitting channel and the bus pins will be released as a recessive state, so as to avoid nodes occupying the bus for too long time.

The SCM3422BSA includes over-temperature protection and under-voltage protection to enhance chip reliability, fault-tolerant voltage on CAN bus pins are up to ±58V, Contact Discharge ESD on CAN bus pins are up to ±4KV.

Application Circuit



Application circuit of CAN transceiver



Typical application circuit of SCM3422BSA

Suggestion on Power

Add capacitor on VCC to enhance power voltage stability.

Order Information

Part number	Package	Number of pins	Produce marking
SCM3422BSA	SOP	8	SCM 3422BSA YM

Product marking and date code

SCM3422XYZ:

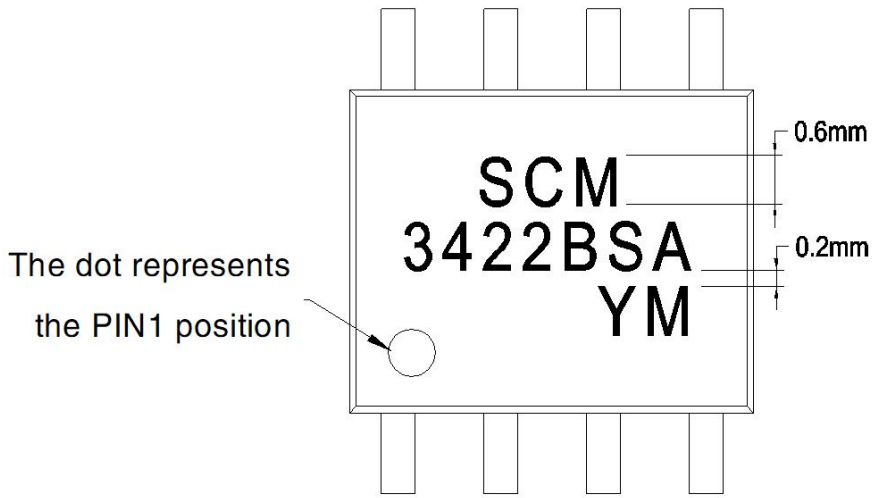
(1) SCM3422, product code.

(2) X = A-Z, version code.

(3) Y = S, package code; S: SOP package.

(4) Z = C, I, A, M, temperature grade code; C：0℃-70℃, I：-40℃-85℃, A：-40℃-125℃, M：-55℃-125℃.

(5) YM: product traceability code; Y: product production year code, M: product production month code.



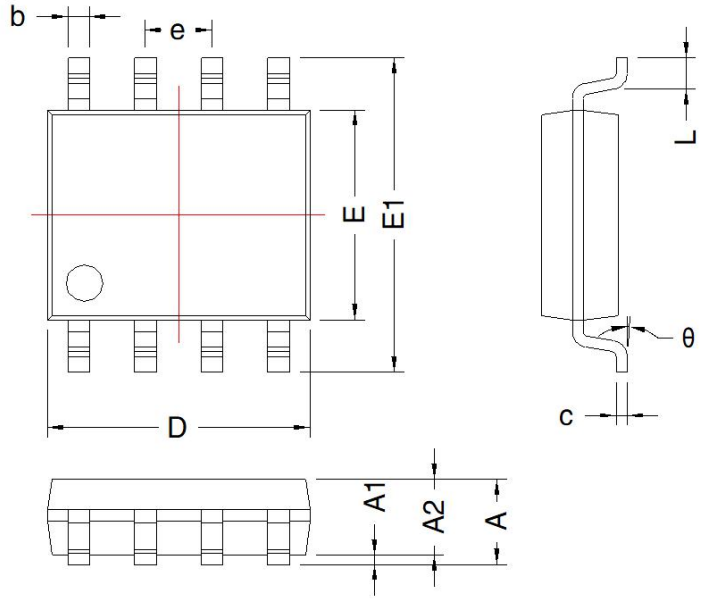
Note：

1、Typeface：Arial;

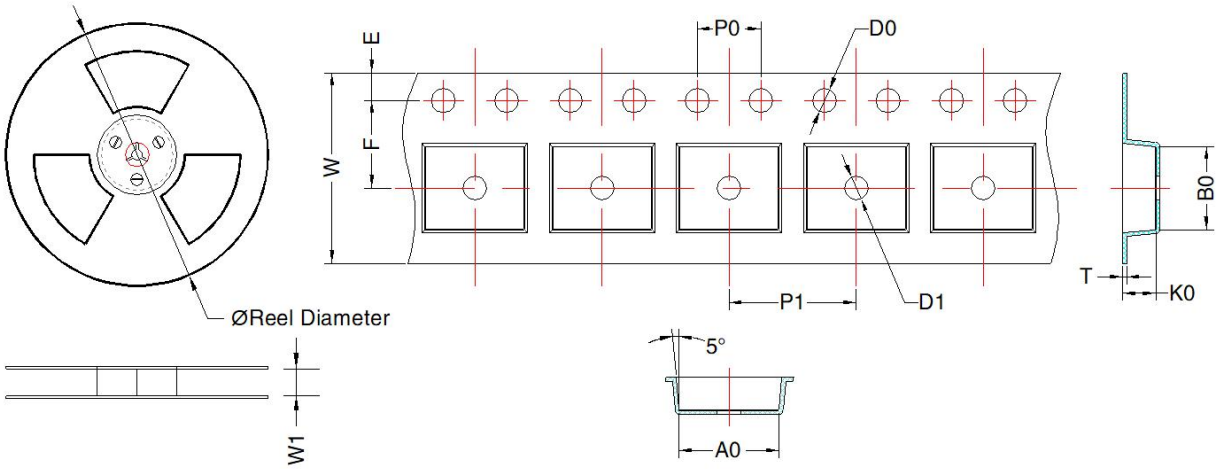
2、Character size：

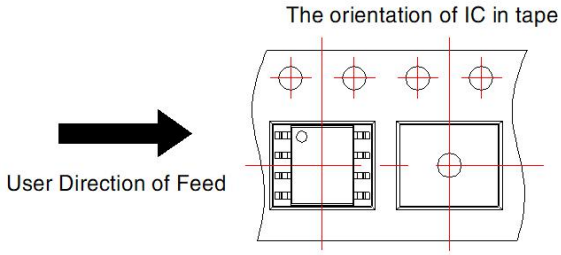
Height：0.6mm，Spacing：0.1mm，Line Spacing：0.2mm;

THIRD ANGLE PROJECTION



SOP–8				
Mark	Dimension(mm)		Dimension(inch)	
	Min	Max	Min	Max
A	1.45	1.75	0.057	0.069
A1	0.10	0.25	0.004	0.010
A2	1.35	1.55	0.053	0.061
D	4.70	5.10	0.185	0.201
E	3.80	4.00	0.150	0.157
E1	5.80	6.20	0.228	0.244
L	0.40	1.27	0.016	0.50
b	0.33	0.51	0.013	0.020
e	1.27BSC		0.05BSC	
c	0.17	0.25	0.007	0.010
θ	0°	8°	0°	8°





Device	Package Type	MPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	T (mm)	W (mm)	E (mm)	F (mm)	P1 (mm)	P0 (mm)	D0 (mm)	D1 (mm)
SCM3422BSA	SOP-8	3000	330.0	12.4	6.5 ± 0.2	5.45 ± 0.2	2.0 ± 0.2	0.3 ± 0.05	12.0 ± 0.3	1.75 ± 0.1	5.5 ± 0.1	8.0 ± 0.1	4 ± 0.1	1.5 ± 0.1	1.5 ± 0.1

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