FEATURES

➢ Fully compatible with the ISO 11898-2:2016 standard

➢ Thermally protected

➢ ±40V BUS Protection

➢ Transmit Data (TXD) dominant time-out function

➢ silent mode

➢ SIT1057QT/3 and SIT1057QTK/3 can be interfaced directly to microcontrollers with supply voltages from 3.3V to 5V

➢ Under-voltage protection

➢ Timing guaranteed for data rates up to 5 Mbps in the (CAN FD) fast phase

➢ Very low ElectroMagnetic Emission (EME)

➢ Transceiver in unpowered state disengages from the bus （zero load）

➢ The typical loop delay from TXD to RXD is less than 100ns

PRODUCT APPEARENCE
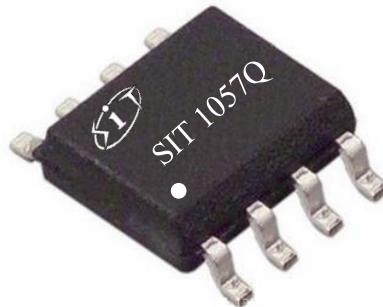
Provide Green and Environmentally Friendly Lead-free package

*Provide HVSON8 / DFN3*3-8, Small Outline, Leadless Package

DESCRIPTION

SIT1057Q is an interface chip used between the CAN protocol controller and the physical bus. It can be used in trucks, buses, cars, industrial control and other fields. It supports 5Mbps (CAN FD) flexible data rate, and has a connection between the bus and the CAN protocol controller. The ability to perform differential signal transmission between the bus and the CAN protocol controller.

PARAMETER	SYMBOL	CONDITION	MIN.	MAX.	UNIT
Supply voltage	VCC		4.75	5.25	V
VIO voltage	VIO		2.95	5.25	V
Maximum transmission rate	$1/t_{bit}$	Non-return to zero code	5		Mbaud
CANH/CANL input or output voltage	V_{can}		-40	+40	V
Bus differential voltage	V_{diff}		1.5	3.0	V
Virtual junction temperature	T_j		-40	150	℃

PIN CONFIGURATION
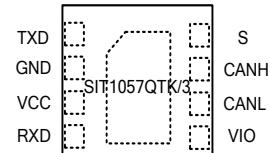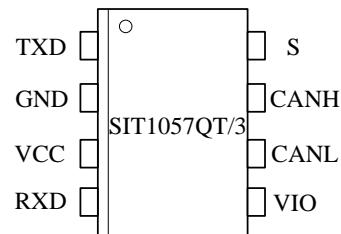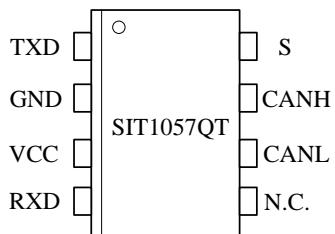
LIMITING VALUES

PARAMETER	SYMBOL	VALUE	UNIT
Supply voltage	VCC	-0.3~+7	V
MCU side port	TXD, RXD, STB, VIO	-0.3~+7	V
Bus side input voltage	CANL, CANH	-40~+40	V
Bus differential breakdown voltage	$V_{CANH-CANL}$	-27~27	V
Storage temperature		-55~150	°C
Virtual junction temperature		-40~150	°C
Welding temperature range		300	°C

The maximum limit parameters means that exceeding these values may cause irreversible damage to the device. Under these conditions, it is not conducive to the normal operation of the device. The continuous operation of the device at the maximum allowable rating may affect the reliability of the device. The reference point for all voltages is ground.

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	VIO	transceiver I/O level conversion power supply voltage (SIT1057QT/3)
5	N.C.	not connected (SIT1057QT)
6	CANL	LOW-level CAN bus line
7	CANH	HIGH-level CAN bus line
8	STB	High-speed and silent mode selection, low level is high-speed

Note: The metal pad on the back of the SIT1057QTK/3 package is recommended to be grounded

FUNCTIONAL BLOCK DIAGRAM

SIT1057Q functional module diagram

(1) VIO=VCC in SIT1057QT
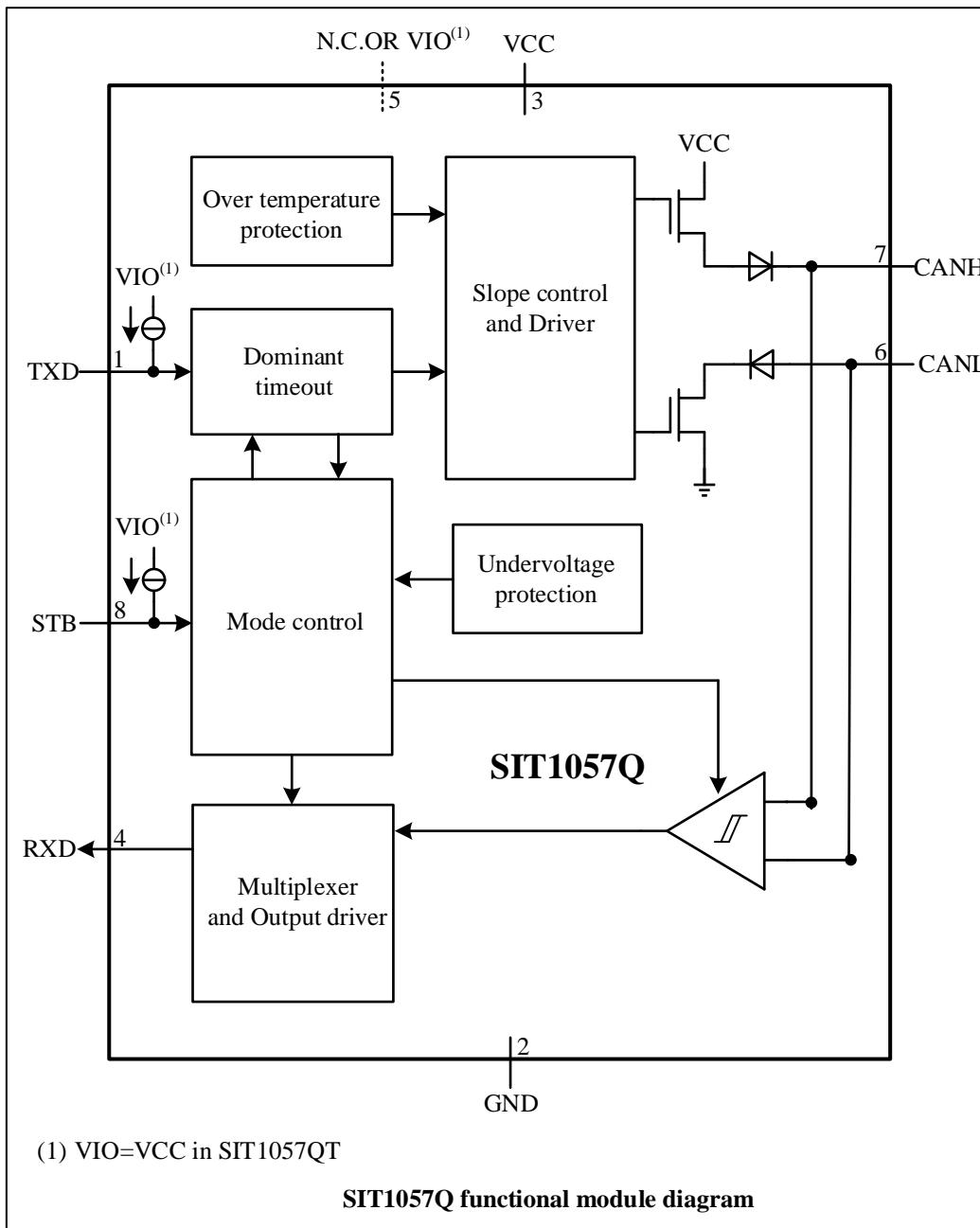
DRIVER ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
CANH dominant output voltage	$V_{OH(D)}$	TXD=0V, STB=0V, R_L=50Ω to 65Ω, Fig.1, Fig.2	2.75	3.5	4.5	V
CANL dominant output voltage	$V_{OL(D)}$		0.5	1.5	2.25	V
Bus dominant differential output voltage	$V_{OD(D)}$	TXD=0V,STB=0V,t<t_{dom_TXD}				
		R_L=50Ω to 65Ω	1.5		3	V
		R_L=45Ω to 70Ω	1.4		3.3	
		R_L=2240Ω	1.5		5	
Bus recessive output voltage	$V_{O(R)}$	STB=0V; TXD=VIO; no load	2	0.5VCC	3	V
Bus recessive differential output voltage	$V_{OD(R)}$	TXD=VIO, STB=0V, no load	-0.5		0.05	V
Transmitter dominant voltage symmetry	$V_{dom(TX)sym}$	$V_{dom(TX)sym}$=VCC- V_{CANH} - V_{CANL}	-400		400	mV
Transmitter voltage symmetry	V_{TXsym}	V_{TXsym}=V_{CANH}+V_{CANL}[1]; f_{TXD}=250kHz,1MHz or 2.5MHz; C_{SPLIT}=4.7nF, Fig.7	0.9VCC		1.1VCC	V
Common-mode output voltage	V_{OC}	STB=0V, Fig.2	2	0.5VCC	3	V
Dominant short-circuit output current	I_{OS_dom}	VTXD=0V; t<t_{dom_TXD}; VCC=5V				
		Pin CANH; VCANH= -15V to 40V	-100		100	mA
		Pin CANL; VCANL= -15V to 40V	-100		100	mA
Recessive short-circuit output current	$I_{O(R)}$	TXD=VIO; -27V< CANH=CANL<32V	-5		5	mA

[1] Not tested in production; guaranteed by design.

（VCC=5V±5% and Temp=T_{MIN}~T_{MAX} unless specified otherwise; typical in VCC=+5V, VIO=+5V and Temp＝25℃）

DRIVER SWITCHING CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Driver timing; pins CANH, CANL, RXD; see Fig.3 and Fig.5 and Fig.6; R_L=60Ω; C_L=100pF; C_{RXD}=15pF;						
Propagation delay time,TXD to bus recessive	$t_{d(TXD\_busrec)}$	STB=0V, Fig.3,Fig.6		90		ns
Propagation delay time, TXD to bus dominant	$t_{d(TXD\_busdom)}$	STB=0V, Fig.3,Fig.6		65		ns
Differential output signal rise time	t_r	STB=0V, Fig.3,Fig.6		45		ns
Differential output signal fall time	t_f	STB=0V, Fig.3,Fig.6		45		ns
TXD dominant time-out	t_{dom_TXD}	Fig.4	0.8	3	6.5	ms

（VCC=5V±5% and Temp=T_{MIN}~T_{MAX} unless specified otherwise; typical in VCC=+5V, VIO=+5V and Temp＝25℃）

RECEIVER ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Positive-going input threshold voltage	V_{TH+_dif}	Normal mode/ silent mode; -12 V≤V_{CANL} ≤+12 V -12 V≤V_{CANH}≤ +12V;			900	mV
Negative-going input threshold voltage	V_{TH-_dif}	Normal mode;/ silent mode -12 V≤V_{CANL} ≤+12 V -12 V≤V_{CANH}≤ +12V;	500			mV
Hysteresis voltage (V_{TH+_dif} −V_{TH-_dif})	V_{HYS}	Normal mode/ silent mode; -12 V≤V_{CANL} ≤+12 V -12 V≤V_{CANH}≤ +12V;		120		mV
Receiver dominant differential input voltage	V_{dom_Diff}	Normal mode/ silent mode; -12 V≤V_{CANL} ≤+12 V; -12 V≤V_{CANH}≤ +12 V;	0.9		8.0	V
Receiver recessive differential input	V_{rec_Diff}	Normal mode/ silent mode;	-3		0.5	V

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
voltage		-12 V≤V_{CANL} ≤+12 V; -12 V≤V_{CANH}≤ +12 V;				
Power-off bus input current	$I_{(OFF)}$	CANH=CANL=5V, GND=VCC=VIO=0V	-5		5	μA
Input capacitance to ground, (CANH or CANL)	C_I	[1]			24	pF
Differential input capacitance	C_{ID}	[1]			12	pF
Slew Rate	SR	Edge dominant to recessive[1]			70	V/μs
Input resistance, (CANH or CANL)	R_{IN}	TXD=VIO,STB=0V; [1] -2 V≤VCANL ≤+7 V; -2 V≤VCANH≤ +7 V;	9	15	28	kΩ
Differential input resistance	R_{ID}		19	30	52	kΩ
Input resistance matching	RI_{match}	CANH=CANL; [1] 0 V≤VCANL ≤+5 V; 0 V≤VCANH≤ +5 V;	-2		2	%
The range of commen-mode voltage	V_{COM}		-12		12	V

[1] Not tested in production; guaranteed by design.

（VCC=5V±5% and Temp=T_{MIN}~T_{MAX} unless specified otherwise; typical in VCC=+5V, VIO=+5V and Temp＝25℃）

RECEIVER SWITCHING CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Receive timing; pins CANH, CANL, RXD; see Fig.3 and Fig.5 and Fig.6; R_L=60Ω; C_L=100pF; C_{RXD}=15pF;						
Propagation delay time,bus recessive to RXD	$t_{d(busrec\_RXD)}$	STB=0V, Fig3,Fig.6		65		ns
Propagation delay time, bus dominant to RXD	$t_{d(busdom\_RXD)}$	STB=0V, Fig.3,Fig.6		60		ns

RXD signal rise time	t_r	STB=0V, Fig.3,Fig.6		10		ns
RXD signal fall time	t_f	STB=0V, Fig.3,Fig.6		10		ns

（VCC=5V±5% and Temp=T_{MIN}~T_{MAX} unless specified otherwise; typical in VCC=+5V, VIO=+5V and Temp＝25℃）

DEVICE SWITCHING CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Transceiver timing; pins CANH, CANL, TXD and RXD; see Fig.3 and Fig.5 and Fig.6; R_L=60Ω; C_L=100pF; C_{RXD}=15pF;						
Loop delay1, driver input to receiver output, Recessive to Dominant	t_{loop1}	STB=0V, Fig.3, Fig.6		80	220	ns
Loop delay 2, driver input to receiver output, Dominant to Recessive	t_{loop2}	STB=0V, Fig.3, Fig.6		90	220	ns
Bit time of BUS output pin	$t_{bit(BUS)}$	$t_{bit(TXD)}$=500ns[1], Fig.5,Fig.6	435		530	ns
		$t_{bit(TXD)}$=200ns[2], Fig.5,Fig.6	155		210	ns
Bit time of RXD output pin	$t_{bit(RXD)}$	$t_{bit(TXD)}$=500ns[1], Fig.5,Fig.6	400		550	ns
		$t_{bit(TXD)}$=200ns[2], Fig.5,Fig.6	120		220	ns
Receiver timing symmetry	Δtrec	$t_{bit(TXD)}$=500ns[1], Fig.5,Fig.6	-65		+40	ns
		$t_{bit(TXD)}$=200ns[2], Fig.5,Fig.6	-45		+15	ns

[1] Transmitted recessive bit width at 2Mbit/s.

[2] Transmitted recessive bit width at 5Mbit/s.

（VCC=5V±5% and Temp=T_{MIN}~T_{MAX} unless specified otherwise; typical in V_{CC}=+5V, V_{IO}=+5V and Temp＝25℃）

OVER TEMPERATURE PROTECTION

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Shutdown junction temperature	$T_j(sd)$			190		°C

（VCC=5V±5% and Temp=T_{MIN}~T_{MAX} unless specified otherwise; typical in V_{CC}=+5V, VIO=+5V and Temp＝25℃）

UNDER-VOLATAGE PROTECTION

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
VCC under-voltage protection	V_{uvd_VCC}		3.5	3.9	4.3	V
VIO under-voltage protection	V_{uvd_VIO}		2.1	2.5	2.7	V

（VCC=5V±5% and Temp=T_{MIN}~T_{MAX} unless specified otherwise; typical in V_{CC}=+5V, VIO=+5V and Temp＝25℃）

TXD PIN CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
HIGH-level input current	$I_{IH}(TXD)$	TXD=VIO	-5		5	μA
LOW-level input current	$I_{IL}(TXD)$	TXD=0V	-260	-150	-30	μA
When VCC=0V，current on TXD pin	$I_O(off)$	VCC=VIO=0V, TXD=VIO	-1		1	μA
HIGH-level input voltage	V_{IH}		$0.7V_{IO}$[1]		V_{IO}[1]+0.3	V
LOW-level input voltage	V_{IL}		-0.3		$0.3V_{IO}$[1]	V
Open voltage on TXD pin	TXD_O		H			logic

[1] SIT1057QT model V_{IO}=V_{CC}

（VCC=5V±5% and Temp=T_{MIN}~T_{MAX} unless specified otherwise; typical in V_{CC}=+5V V_{IO}=5V and Temp＝25℃）

STB PIN CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
HIGH-level input current	$I_{IH}(STB)$	STB=VIO	-1		1	μA
LOW-level input current	$I_{IL}(STB)$	STB=0V	-15		-1	μA
When VCC=0V, current on STB pin	$I_O(off)$	VCC=VIO=0V, STB=VIO	-1		1	μA
HIGH-level input voltage	V_{IH}		$0.7V_{IO}$[1]		V_{IO}[1]+0.3	V
LOW-level input voltage	V_{IL}		-0.3		$0.3V_{IO}$[1]	V
Open voltage on STB pin	STB_O		H			logic

[1] SIT1057QT model $V_{IO}=V_{CC}$

（VCC=5V±5% and Temp=T_{MIN}~T_{MAX} unless specified otherwise; typical in VCC=+5V, VIO=5V and Temp＝25℃）

RXD PIN CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
HIGH-level input current	$I_{OH}(RXD)$	VIO=VCC, RXD=VIO-0.4V	-8	-3	-1	mA
LOW-level input current	$I_{OL}(RXD)$	RXD=0.4V, bus dominant	1		12	mA
When VCC=0V, current on STB pin	$I_O(off)$	VCC=VIO=0V, RXD=VIO	-1		1	μA

（VCC=5V±5% and Temp=T_{MIN}~T_{MAX} unless specified otherwise; typical in VCC=+5V, VIO=5V and Temp＝25℃）

SUPPLY CURRENT

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
VCC current (silent mode)	I_{CC}	S=VCC, TXD=VIO, SIT1057QT SIT1057QT/3	0.1		1.2	mA

VCC current (Dominant)		TXD=VIO, S=0V, load=60Ω		45	70	mA
VCC current (Recessive)		TXD=VIO, S=0V, no load		5	10	mA
VIO current (silent mode)	I_{IO}	S=TXD=VIO		3	16	μA
VIO current (Dominant)		TXD=0V, S=0V		110	320	μA
VIO current (Recessive)		TXD=VIO, S=0V		7	30	μA

（VCC=5V±5% and Temp=T_{MIN}~T_{MAX} unless specified otherwise; typical in VCC=+5V, VIO=5V and Temp＝25℃）

ESD PERFORMANCE

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
CAN bus pin contact discharge model （IEC）	V_{ESD_IEC}	IEC 61000-4-2: Contact discharge	-4		+4	kV
CAN bus pin human body discharge model （HBM）	V_{ESD_HBM}		-8		+8	kV

FUNCTION TABLE

Table1. CAN TRANSCEIVER TRUTH TABLE

TXD[1]	STB[1]	CANH[1]	CANL[1]	BUS STATE	RXD[1]
L	L	H	L	Dominate	L
H or Open	L	0.5VCC	0.5VCC	Recessive	H
X	H or Open	0.5VCC	0.5VCC	Recessive	H
X	H or Open	H	L	Dominate	L

（1）H=high level; L=low level; X=irrelevant

Table 2. RECEIVER FUNCTION TABLE

V_{ID}=CANH-CANL	RXD[1]	Bus State[1]
$V_{ID} \geq 0.9V$	L	Dominate
$0.5 < V_{ID} < 0.9V$	?	?
$V_{ID} \leq 0.5V$	H	Recessive
Open	H	Recessive

（1）H=high-level; L=low-level; ?=uncertain

Table 3. Under-voltage protection status table

| VCC	VIO[1]	BUS STATE	BUS OUT[2]	RXD[2]
VCC>V_{uvd_VCC}	VIO>V_{uvd_VIO}	normal	According to STB and TXD	Follow the bus
VCC<V_{uvd_VCC}	VIO>V_{uvd_VIO}	Protected state	Z	H
VCC>V_{uvd_VCC}	VIO<V_{uvd_VIO}	Protected state	Z	H
VCC<V_{uvd_VCC}	VIO<V_{uvd_VIO}	Protected state	Z	H

(1) Only SIT1057QT/3 version;

(2) H=high level; Z=high impedance state;

TEST CIRCUIT
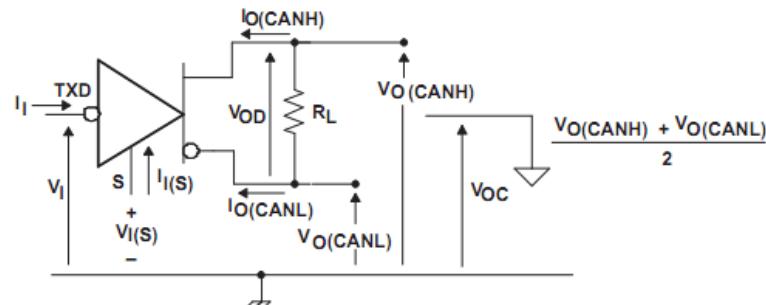
Fig.1 Driver Voltage, Current, and Test Definition
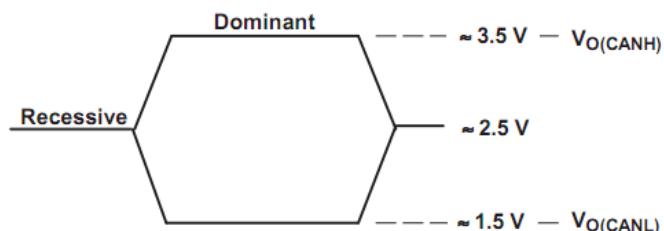
Fig.2 Bus Logic State Voltage Definition
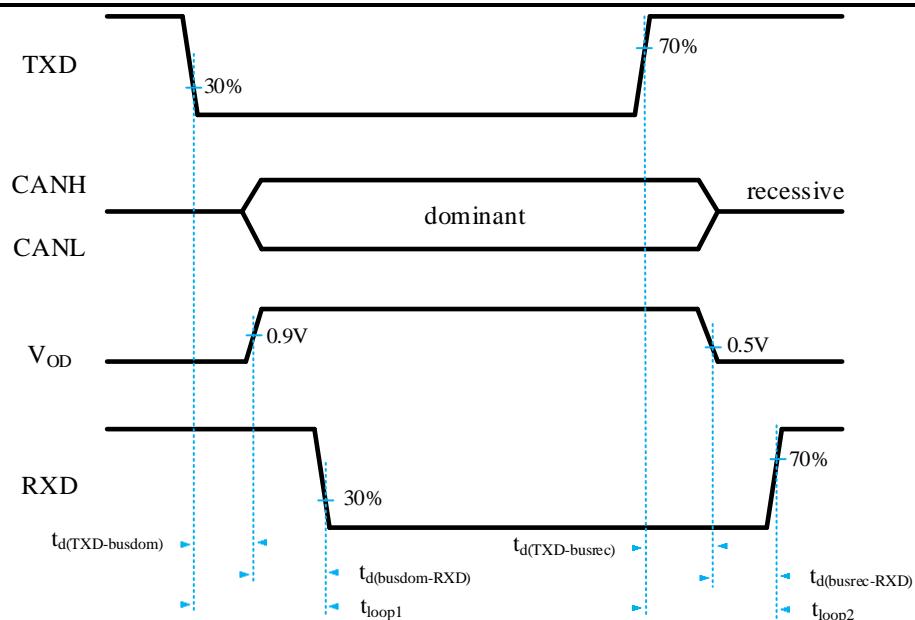
Fig.3 Transceiver timing diagram
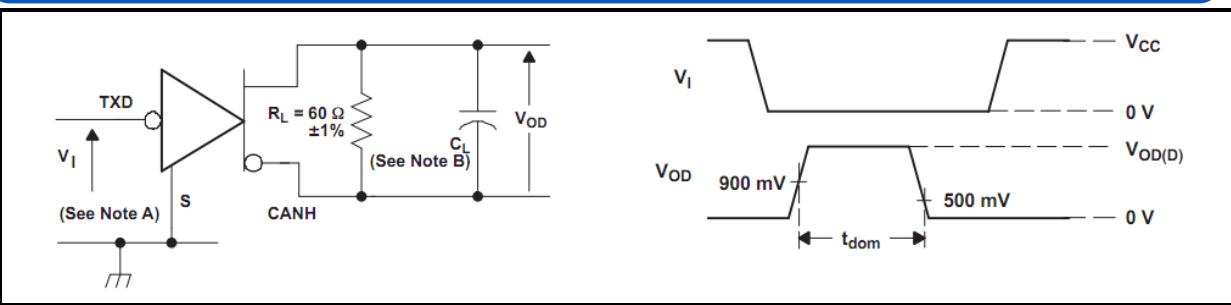
Fig.4 Dominant overtime test circuit and waveform
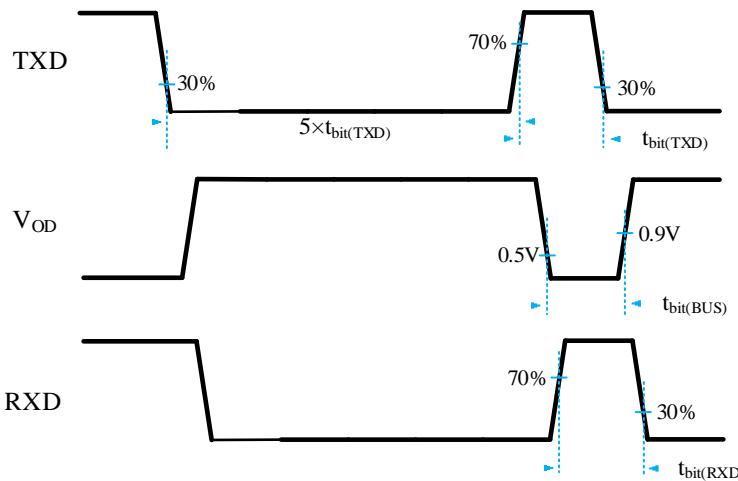
Fig.5 t_{bit} test circuit and waveform
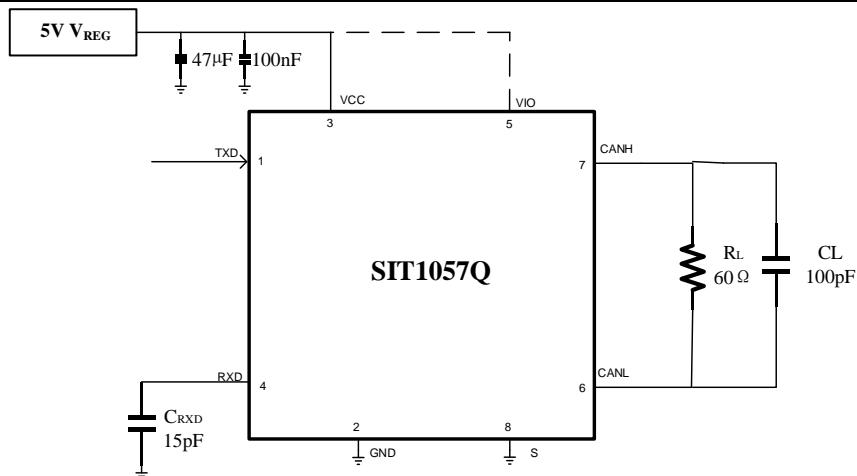
SIT1057QT internal VIO connected to VCC

Fig.6 CAN transceiver timing test circuit

Fig.7 Test circuit for measuring transmitter driver symmetry
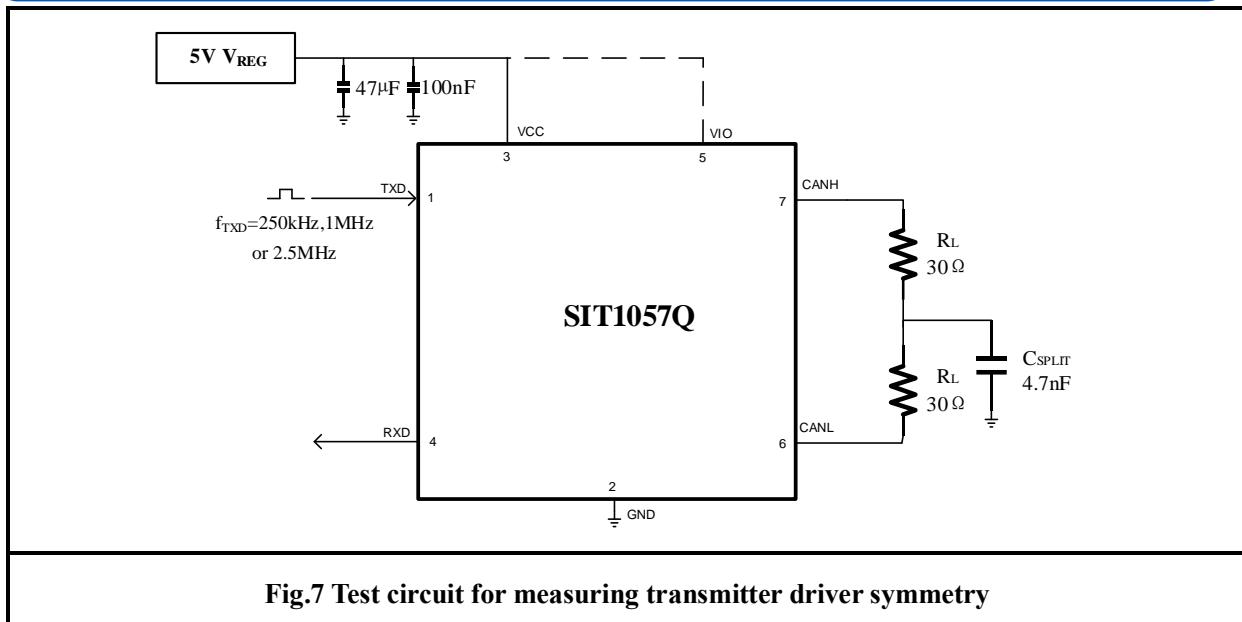
TYPICAL APPLICATION TEST
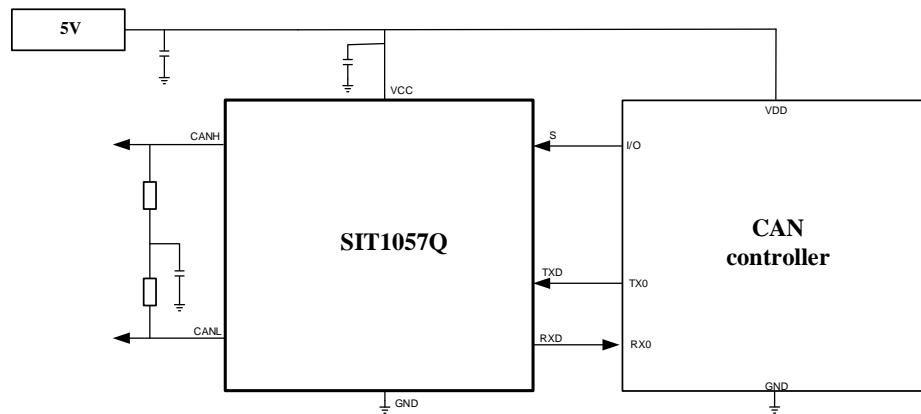
Typical application diagram of SIT1057Q
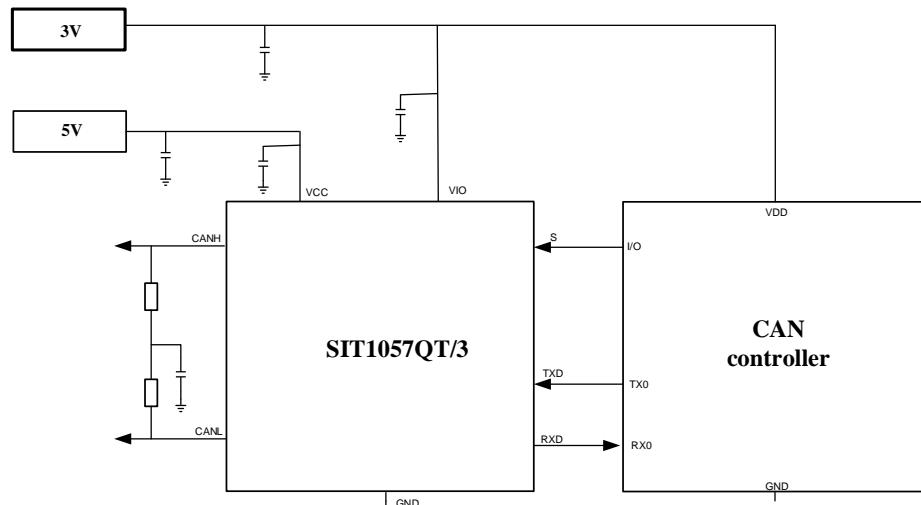
Typical application diagram of SIT1057QT/3
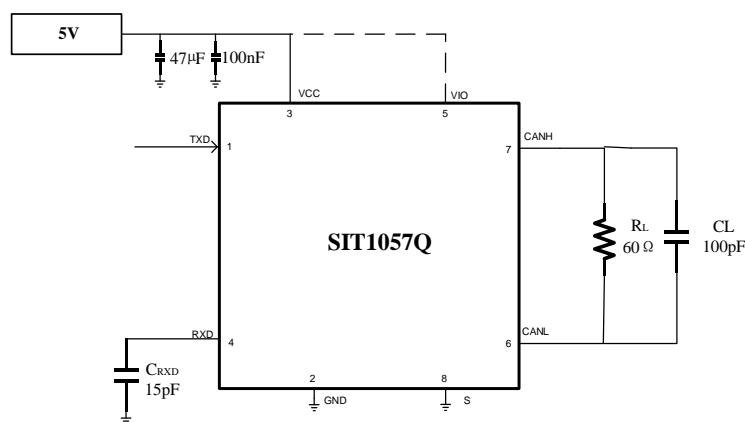
(1) VIO is limited to SIT1057QT/3, in SIT1057QT VIO=VCC

SIT1057Q typical high-speed mode test chart

ADDITIONAL DESCRIPTION

1 Sketch

SIT1057Q is an interface chip applied between the CAN protocol controller and the physical bus. It can be used in trucks, buses, cars, industrial control and other fields. It supports 5Mbps (CAN FD) flexible data rate, and has a connection between the bus and the CAN protocol controller. The ability to perform differential signal transmission between them is fully compatible with the "ISO 11898-2: 2016" standard.

2 Over temperature protection

SIT1057Q has an over-temperature protection function. After the over-temperature protection is triggered, the drive tube will be turned off, because the drive tube is the main energy-consuming component. Turning off the drive tube can reduce power consumption and thus reduce the chip temperature. At the same time, other parts of the chip are still working normally.

3 Under-voltage protection

The SIT1057Q power supply pin has an under-voltage detection function, which can put the device in a protected mode. This protects the bus when VCC is lower than V_{uvd_VCC} or VIO is lower than V_{uvd_VIO} (if applicable).

4 Operating modes

The control pin STB allows two working modes to be selected: high-speed mode and silent mode.

The high-speed mode is a normal operating mode and is selected by grounding the pin STB. Both the CAN driver and the receiver can operate normally and CAN communication is carried out in both directions.

In silent mode, the transmitter is disabled and the receiver operates normally. Silent mode can be selected by connecting pin S to VCC and can be used to prevent network signal blocking due to a runaway CAN controller.

5 Explicit timeout function

In high-speed mode, if the low-level duration on pin TXD exceeds the internal timer value (tdom_BUS), the transmitter will be disabled and drive the bus into a recessive state. It can prevent the pin TXD from being forced to a permanent low level due to a hardware or software application failure, causing the bus line to be driven to a permanent dominant state (blocking all network communications). A rising edge signal on pin TXD can be reset.

SOP8 DIMENSIONS

PACKAGE SIZE

SYMBOL	MIN./mm	TYP./mm	MAX./mm
A	1.40	-	1.80
A1	0.10	-	0.25
A2	1.30	1.40	1.50
b	0.38	-	0.51
D	4.80	4.90	5.00
E	3.80	3.90	4.00
E1	5.80	6.00	6.20
e		1.27BSC	
L	0.40	0.60	0.80
c	0.20	-	0.25
θ	0°	-	8°
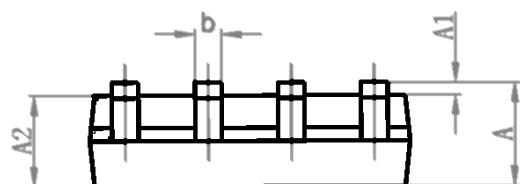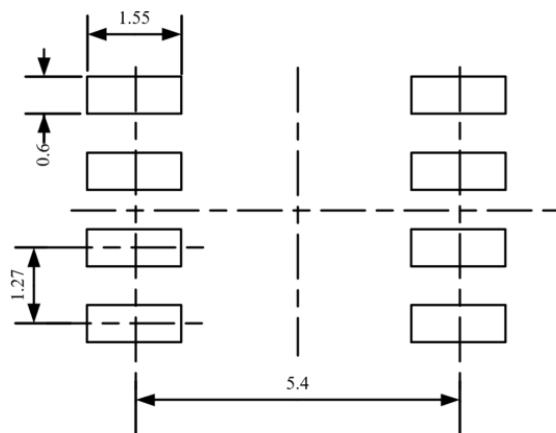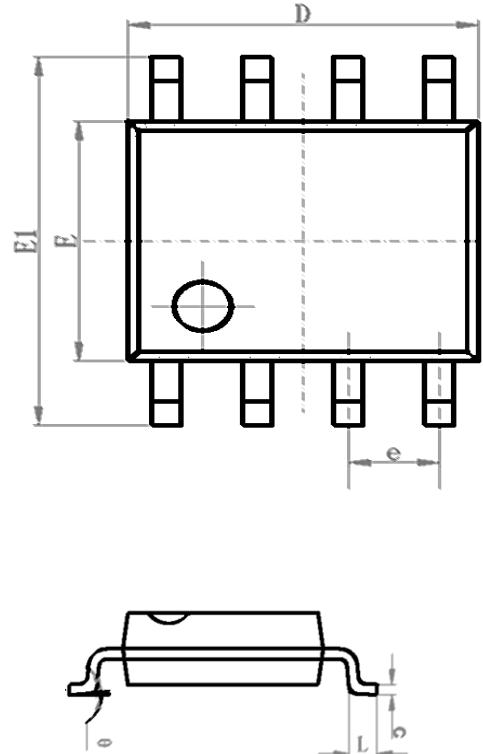
LAND PATTERN EXAMPLE (Unit: mm)

DFN3*3-8 /HVSON8 DIMENSIONS

PACKAGE SIZE

SYMBOL	MIN/mm	TYP /mm	MAX/mm
A	0.70	0.75	0.80
A1	0	0.02	0.05
A3	0.203 REF		
D	2.90	3.00	3.10
E	2.90	3.00	3.10
D1	2.05	2.15	2.25
E1	1.10	1.20	1.30
b	0.25	0.30	0.35
e	0.65 TYP		
L	0.35	0.4	0.45
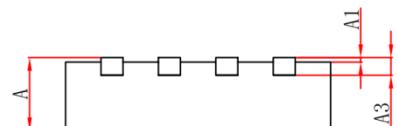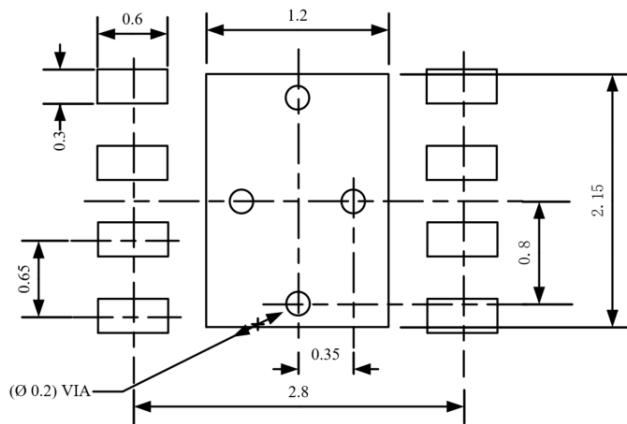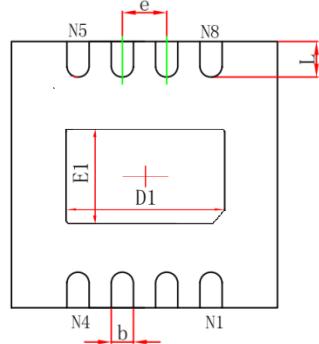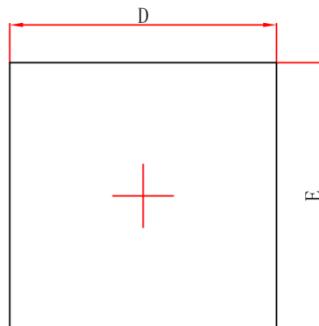
LAND PATTERN EXAMPLE (Unit: mm)

ORDERING INFORMATION

| TYPE NUMBER	PACKAGE	PACKING
SIT1057QT	SOP8	Tape and reel
SIT1057QT/3	SOP8	Tape and reel
SIT1057QTK/3	HVSON8 / DFN3*3-8， Small shape, no leads, 8 terminals	Tape and reel

SOP8 package is 2500 pieces/disc. HVSON8 / DFN3*3-8 package is 6000 pieces/disc.

TAPE AND REEL INFORMATION
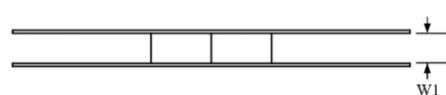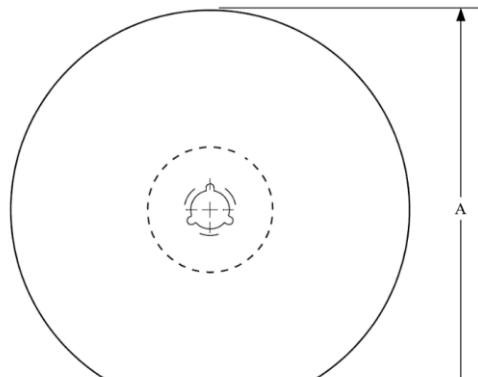
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

Direction of Feed

PIN1 is in quadrant 1
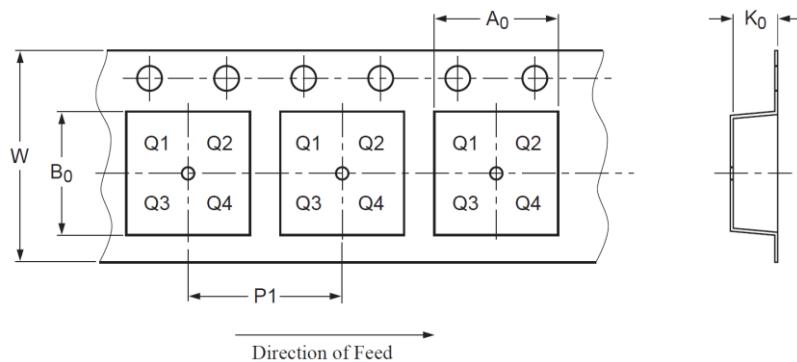
Package Type	Reel Diameter A (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)
SOP8	330±1	12.4	6.60±0.1	5.30±0.10	1.90±0.1	8.00±0.1	12.00±0.1
DFN3*3-8	329±1	12.4	3.30±0.1	3.30±0.1	1.10±0.1	8.00±0.1	12.00±0.3

REFLOW SOLDERING
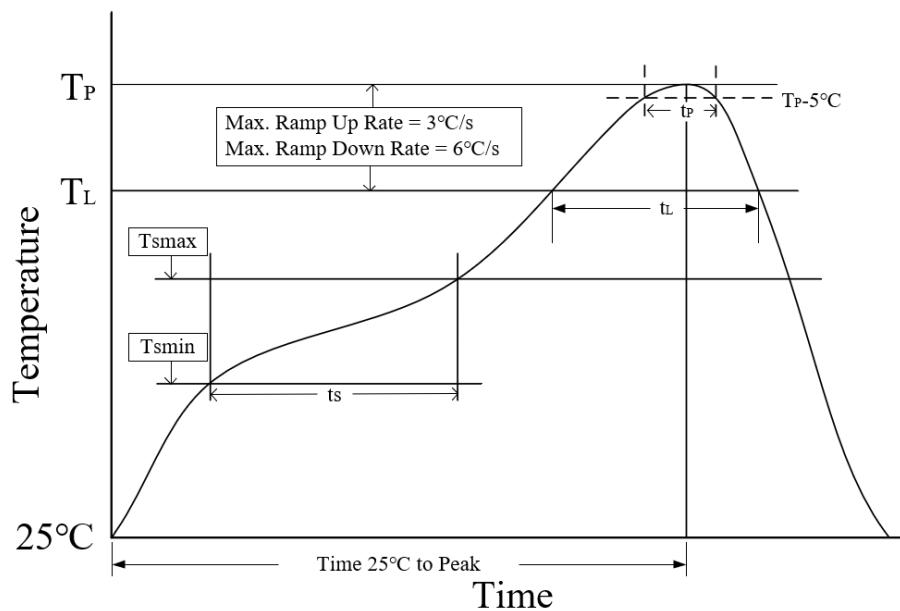
Parameter	Lead-free soldering conditions
Ave ramp up rate (T_L to T_P)	3 ℃/second max
Preheat time ts (T_{smin}=150 ℃ to T_{smax}=200 ℃)	60-120 seconds
Melting time t_L (T_L=217 ℃)	60-150 seconds
Peak temp T_P	260-265 ℃
5℃ below peak temperature t_P	30 seconds
Ave cooling rate (T_P to T_L)	6 ℃/second max
Normal temperature 25℃ to peak temperature TP time	8 minutes max

Important statement

SIT reserves the right to change the above-mentioned information without prior notice.

REVISION HISTORY

Version number	Data sheet status	Revision time
V1.0	Initial version	2022.06