CD1050

High speed CAN transceiver

Version: Rev 1.0.0 Date: 2025-6-25

Features

- Fully compatible with the ISO 11898 standard
- High speed (up to 1 MBaud)
- Very low ElectroMagnetic Emission (EME)
- Differential receiver with high common-mode range for ElectroMagnetic Immunity (EMI)
- An unpowered node does not disturb the bus lines
- Transmit Data (TXD) dominant time-out function
- Silent mode in which the transmitter is disabled
- Bus pins protected against transients in an automotive environment
- Input levels compatible with 3.3 V and 5 V devices
- Thermally protected
- Short-circuit proof to battery and to ground
- At least 110 nodes can be connected.

Application

- Automotive Electronics

Description

The CD1050 is the interface between the Controller Area Network (CAN) protocol controller and the physical bus. The device provides differential transmit capability to the bus and differential receive capability to the CAN controller.

CD1050 is a high-speed CAN transceiver. The main characteristics are:

- Much lower electromagnetic emission due to optimal matching of the output signals CANH and CANL
- Improved behaviour in case of an unpowered node
- No standby mode.

This makes the CD1050 eminently suitable for use in nodes that are in a power-down situation in partially powered networks.

The CD1050 is available in 8-lead SOP packages.

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Pin Configurations

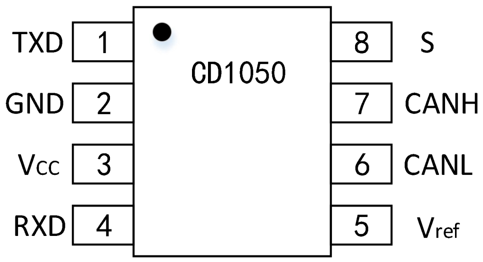


Figure 1. SOP8 Pin Configuration

Pin Description

Table 1. Pin description

Pin No.	Pin Name	Description
1	TXD	transmit data input; reads in data from the CAN controller to the bus line drivers
2	GND	ground supply
3	V_{CC}	supply voltage
4	RXD	receive data output; reads out data from the bus lines to the CAN controller
5	V_{ref}	reference voltage output
6	CANL	LOW-level CAN bus line
7	CANH	HIGH-level CAN bus line
8	S	select input for high-speed mode or silent mode

Notes:

1. The waveforms of the applied transients shall be in accordance with “ISO 7637 part 1”, test pulses 1, 2, 3a and 3b(see Fig.4).
2. Human body model: C = 100 pF and R = 1.5 kΩ.
3. Machine model: C = 200 pF, R = 10 Ω and L = 0.75 μH.
4. In accordance with “IEC 60747-1”. An alternative definition of Tvj is: Tvj = Tamb + P × Rth(vj-a), where Rth(vj-a) is a fixed value to be used for the calculation of Tvj. The rating for Tvj limits the allowable combinations of power dissipation (P) and ambient temperature (Tamb).

Functional Block diagram

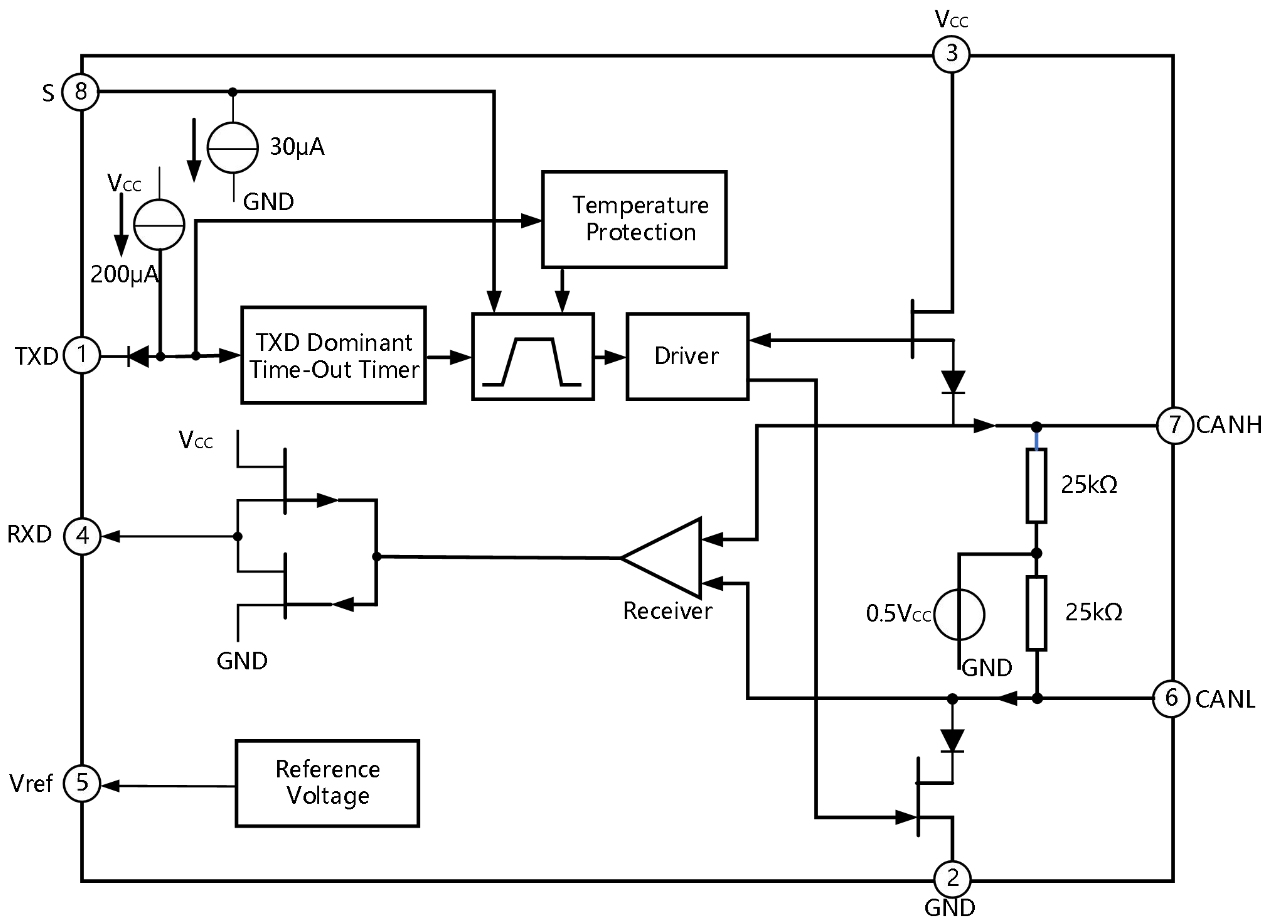


Figure 2. Functional Block Diagram

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Numerical range	Units
supply voltage	V_{CC}	no time limit	-0.3~6	V
		operating range	4.75~5.25	V
DC voltage on pin TXD	V_{TXD}		-0.3~VCC+0.3	V
DC voltage on pin RXD	V_{RXD}		-0.3~VCC+0.3	V
DC voltage on pin S	V_S		-0.3~VCC+0.3	V
DC voltage on pin CANH	V_{CANH}	0<VCC<5.25V, no time limit	-27~40	V
DC voltage on pin CANL	V_{CANL}	0<VCC<5.25V, no time limit	-27~40	V
Transient voltages on pins CANH, CANL	V_{TRT}	Note1	-200~200	V
Electrostatic discharge voltage at all pins	V_{ESD}	all other pins;see note2	-4~4	kV
		Machine Model (MM); note 3	-200~200	V
virtual junction temperature	T_{VJ}	note 4	-40~150	℃
Storage temperature	T_{STG}		-55~150	℃
thermal resistance from junction to ambient in SO8 package	$R_{th(vj-a)}$	in free air	145	K/W
thermal resistance from junction to substrate of bare die	$R_{th(vj-s)}$	in free air	50	K/W

Electrical Characteristics

VCC = 4.75 to 5.25 V, T_{vj} = −40 to +150 °C and R_L = 60 Ω unless specified otherwise; all voltages are defined with respect to ground; positive currents flow into the IC; note 1 and 2.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply (pin V_{CC})						
supply current	I_{CC}	normal mode : recessive $V_{TXD}=V_{CC}$	25	50	75	mA
		normal mode : dominant $V_{TXD}=0V$	2.5	5	10	mA
Transmit data input (pin TXD)						
HIGH-level input voltage	V_{IH}	output recessive	2	--	$V_{CC}+0.3$	V
LOW-level input voltage	V_{IL}	output dominant	-0.3	--	0.8	V
HIGH-level input current	I_{IH}	$V_{TXD}=V_{CC}$	-5	0	5	μA
LOW-level input current	I_{IL}	normal mode: $V_{TXD}=0V$	-100	-200	-300	μA
input capacitance	C_I	not tested	--	5	10	pF
Mode select input (pin S)						
HIGH-level input voltage	V_{IH}	silent mode	2	--	$V_{CC}+0.3$	V
LOW-level input voltage	V_{IL}	high-speed mode	-0.3	--	0.8	V
HIGH-level input current	I_{IH}	$V_S=2V$	20	30	50	μA
LOW-level input current	I_{IL}	$V_S=0.8V$	15	30	45	μA
Receive data output (pin RXD)						
HIGH-level output current	I_{OH}	normal mode: $V_{RXD}=0.7V_{CC}$	-2	-6	-15	mA
LOW-level output current	I_{OL}	$V_{RXD}=0.45V$	2	8.5	20	mA
Reference voltage output (pin Vref)						
Reference output voltage	V_{ref}	normal mode: $-50μA<I_{Vref}<+50μA$	$0.45V_{CC}$	0.5VCC	$0.55V_{CC}$	V

Bus lines (pins CANH and CANL)						
recessive bus voltage at pin CANH	$V_{O(reces)(CANH)}$	V_{TXD} = V_{CC}; no load	2.0	2.5	3.0	V
recessive bus voltage at pin CANL	$V_{(reces)(CANL)}$	V_{TXD} = V_{CC}; no load	2.0	2.5	3.0	V
recessive output current at pin CANH	$I_{o(reces)(CANH)}$	−27 V < V_{CANH} < +32 V; 0V<V_{CC} < 5.25 V	-2.0	--	2.5	V
recessive output current at pin CANL	$I_{o(reces)(CANL)}$	−27 V < V_{CANL} < +32 V; 0V<V_{CC} < 5.25 V	-2.0	--	2.5	V
dominant output voltage at pin CANH	$V_{o(dom)(CANH)}$	V_{TXD} = 0 V	3.0	3.6	4.25	V
dominant output voltage at pin CANL	$V_{o(dom)(CANL)}$	V_{TXD} = 0 V	0.5	1.4	1.75	V
differential bus input voltage (V_{CANH} − V_{CANL})	$V_{i(dif)(bus)}$	V_{TXD} = 0 V; dominant;42.5 Ω <R_L<60 Ω	1.5	2.25	3.0	V
		V_{TXD} = V_{CC}; recessive;no load	-50	0	50	mV

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Bus lines (pins CANH and CANL)						
short-circuit output current at pin CANH	$I_{o(sc)(CANH)}$	V_{CANH} = 0 V; V_{TXD} =0V	-45	-70	-95	mA
short-circuit output current at pin CANL	$I_{o(sc)(CANL)}$	V_{CANL} = 36 V; V_{TXD} =0V	45	70	100	mA
differential receiver threshold voltage	$V_{i(dif)(th)}$	−12 V < V_{CANL} < +12 V; −12 V < V_{CANH} < +12 V;see Fig.5	0.5	0.7	0.9	V
differential receiver input voltage hysteresis	$V_{i(dif)(hys)}$	−12 V < V_{CANL} < +12 V; −12 V < V_{CANH} < +12 V;see Fig.5	50	70	100	mV
common mode input resistance at pin CANH	$R_{i(cm)(CANH)}$		15	25	35	kΩ
common mode input resistance at pin CANL	$R_{i(cm)(CANL)}$		15	25	35	kΩ
matching between pin CANH and pin CANL common mode input	$R_{i(cm)(m)}$	V_{CANH} = V_{CANL}	-3	0	3	%

resistance						
differential input resistance	$R_{i(dif)}$		25	50	75	kΩ
input capacitance at pin CANH	$C_{i(CANH)}$	V_{TXD} = V_{CC}; not tested	--	7.5	20	pF
input capacitance at pin CANL	$C_{i(CANL)}$	V_{TXD} = V_{CC}; not tested	--	7.5	20	pF
differential input capacitance	$C_{i(dif)}$	V_{TXD} = V_{CC}; not tested	--	3.75	10	pF
input leakage current at pin CANH	$I_{LI(CANH)}$	V_{CC} = 0 V; V_{CANH} = 5 V	100	170	250	μA
input leakage current at pin CANL	$I_{LI(CANL)}$	V_{CC} = 0 V; V_{CANH} = 5 V	100	170	250	μA
Timing characteristics;						
delay TXD to bus active	$t_{d(TXD-BUSon)}$	V_S=0V	25	55	110	ns
delay TXD to bus inactive	$t_{d(TXD-BUSoff)}$		25	60	95	ns
delay bus active to RXD	$t_{d(BUSon-RXD)}$		20	50	110	ns
delay bus inactive to RXD	$t_{d(BUSoff-RXD)}$		45	95	155	ns
TXD dominant time-out	$t_{dom(TXD)}$	V_{TXD} = 0V	250	450	7500	μs
Thermal shutdown						
shutdown junction temperature	$T_{j(sd)}$		155	165	180	℃

FUNCTIONAL DESCRIPTION

The CD1050 is the interface between the CAN protocol controller and the physical bus. It is primarily intended for high-speed automotive applications using baud rates from 60 kbaud up to 1 Mbaud. It provides differential transmit capability to the bus and differential receiver capability to the CAN protocol controller. It is fully compatible to the " ISO 11898 " standard. A current-limiting circuit protects the transmitter output stage from damage caused by accidental short-circuit to either positive or negative supply voltage, although power dissipation increases during this fault condition.A thermal protection circuit protects the IC from damage by switching off the transmitter if the junction temperature exceeds a value of approximately 165 °C. Because the transmitter dissipates most of the power, the power dissipation and temperature of the IC is reduced. All other IC functions continue to operate. The transmitter off-state resets when pin TXD goes HIGH. The thermal protection circuit is particularly needed when a bus line short-circuits.

Control pin S allows two operating modes to be selected: high-speed mode or silent mode.

The high-speed mode is the normal operating mode and is selected by connecting pin S to ground. It is the default mode if pin S is not connected. However, to ensure EMI performance in applications using only the high-speed mode, it is recommended that pin S is connected to ground. In the silent mode, the transmitter is disabled. All other IC functions continue to operate. The silent mode is selected by connecting pin S to VCC and can be used to prevent network communication from being blocked, due to a CAN controller which is out of control.A ‘TXD dominant time-out’ timer circuit prevents the bus lines being driven to a permanent dominant state (blocking all network communication) if pin TXD is forced permanently LOW by a hardware and/or software application failure. The timer is triggered by a negative edge on pin TXD. If the duration of the LOW-level on pin TXD exceeds the internal timer value, the transmitter is disabled, driving the bus into a recessive state. The timer is reset by a positive edge on pin TXD. The pins CANH and CANL are protected from automotive electrical transients (according to “ISO 7637”; see Fig.4).

VCC	TXD	S	CANH	CANL	BUS State	RXD
4.75 V to 5.25 V	Low	Low (or floating)	High	Low	dominant	Low
4.75 V to 5.25 V	X	High	$0.5V_{CC}$	$0.5V_{CC}$	recessive	High
4.75 V to 5.25 V	High (or floating)	X	$0.5V_{CC}$	$0.5V_{CC}$	recessive	High
<2 V (not powered)	X	X	$0V < V_{CANH} < V_{CC}$	$0V < V_{CANL} < V_{CC}$	recessive	X
2V<VCC < 4.75 V	>2V	X	$0V < V_{CANH} < V_{CC}$	$0V < V_{CANL} < V_{CC}$	recessive	X

Typical Application

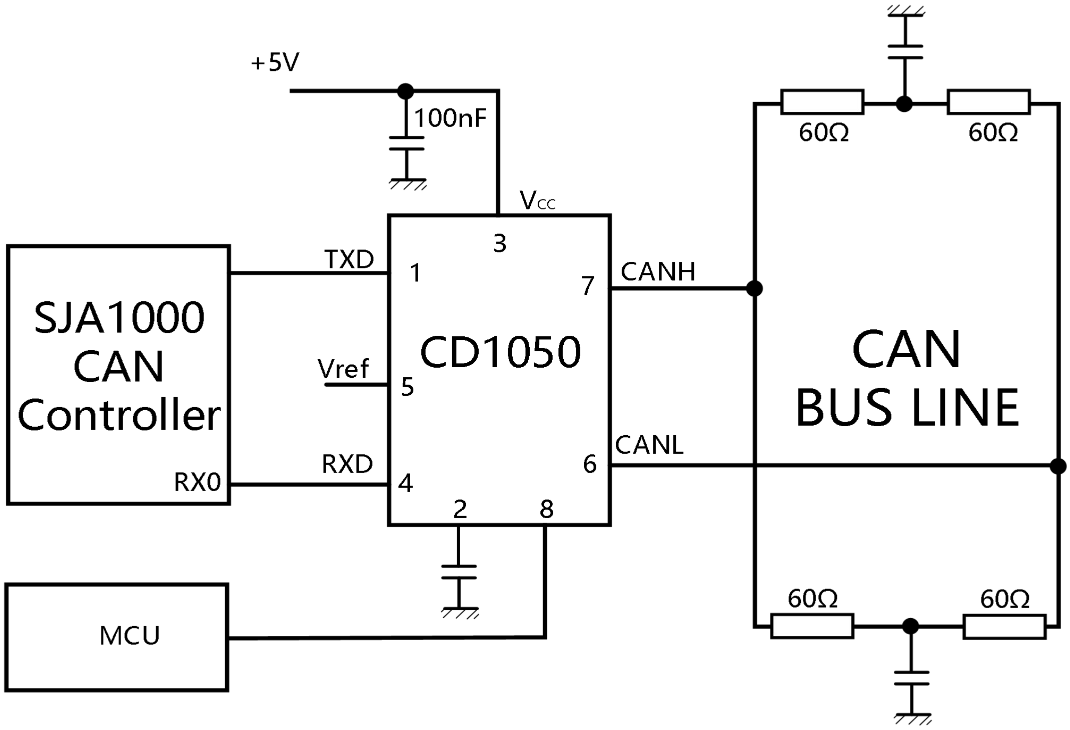


Figure 3. Typical application

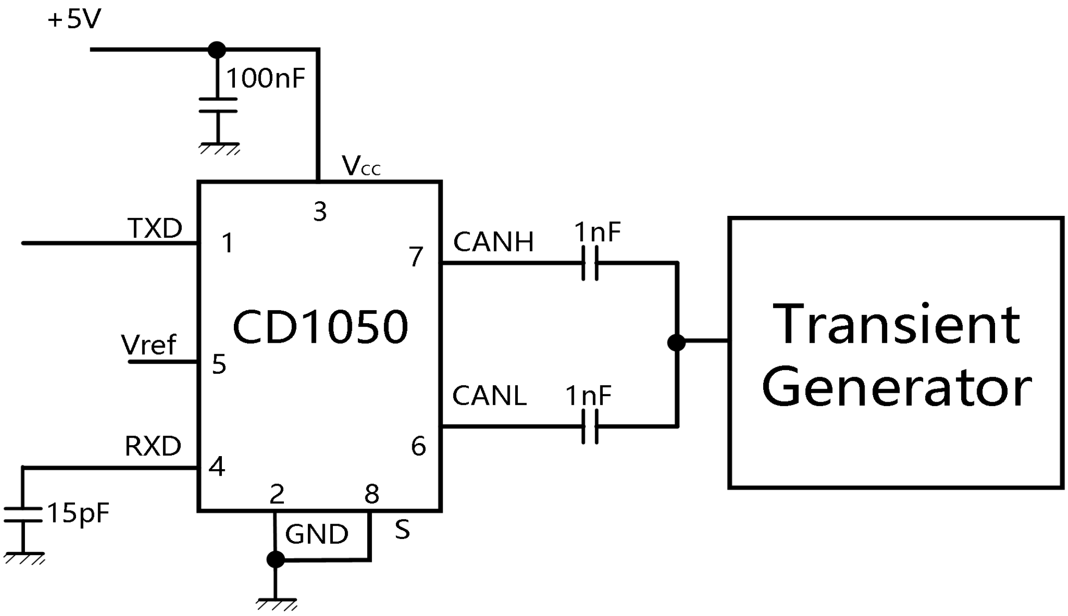


Figure 4. Test circuit for automotive transients

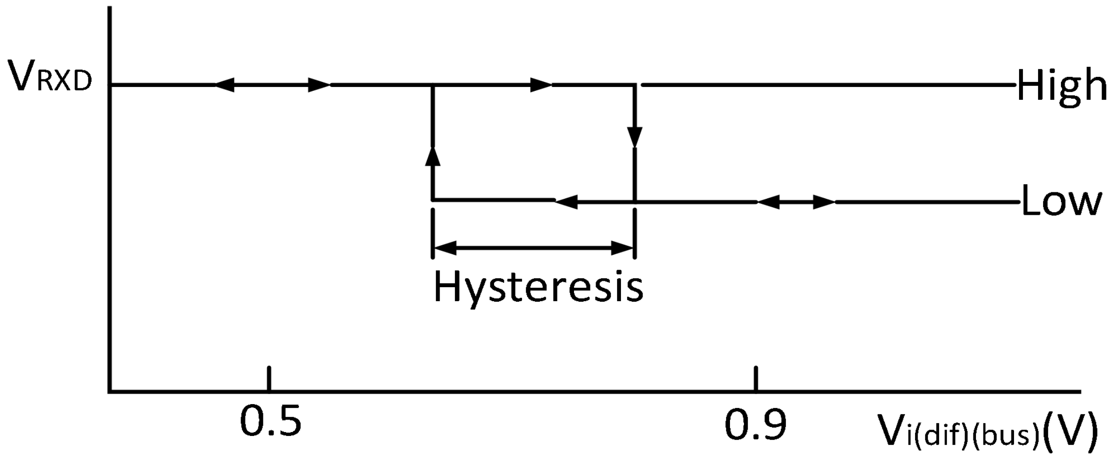


Figure 5. Hysteresis of the receiver.

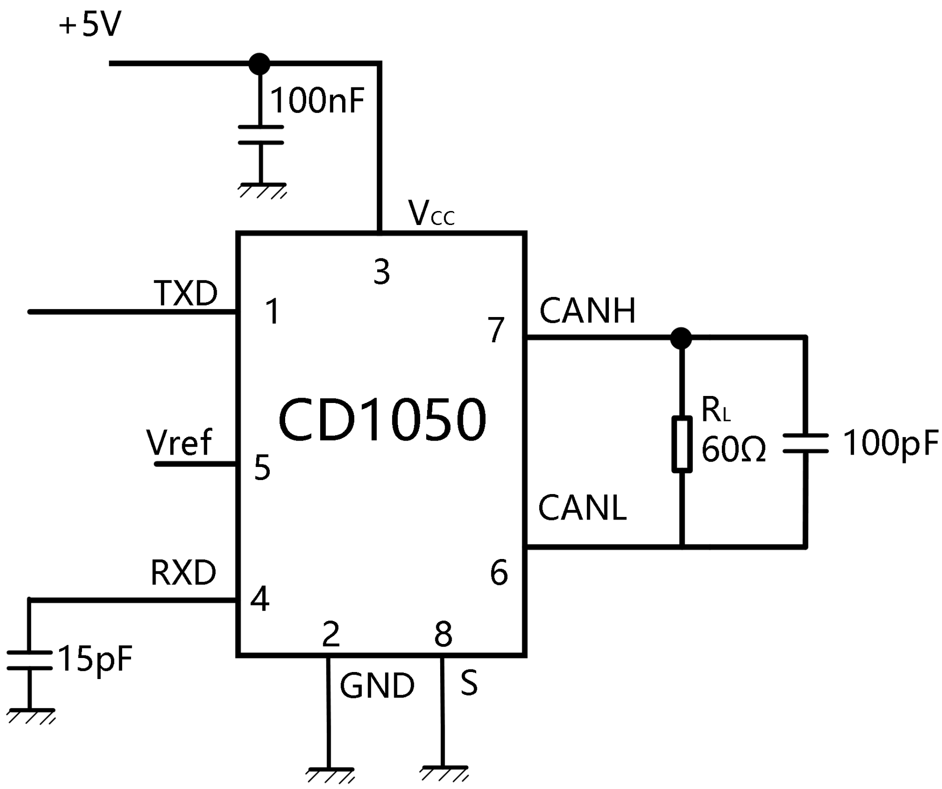


Figure 6. Test circuit for timing characteristics.

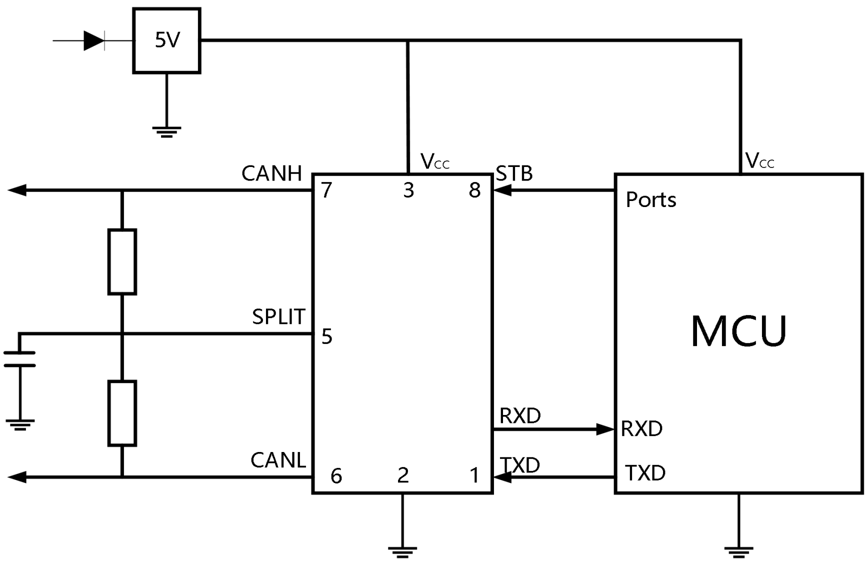


Figure 3. Typical application for 5 V microcontroller

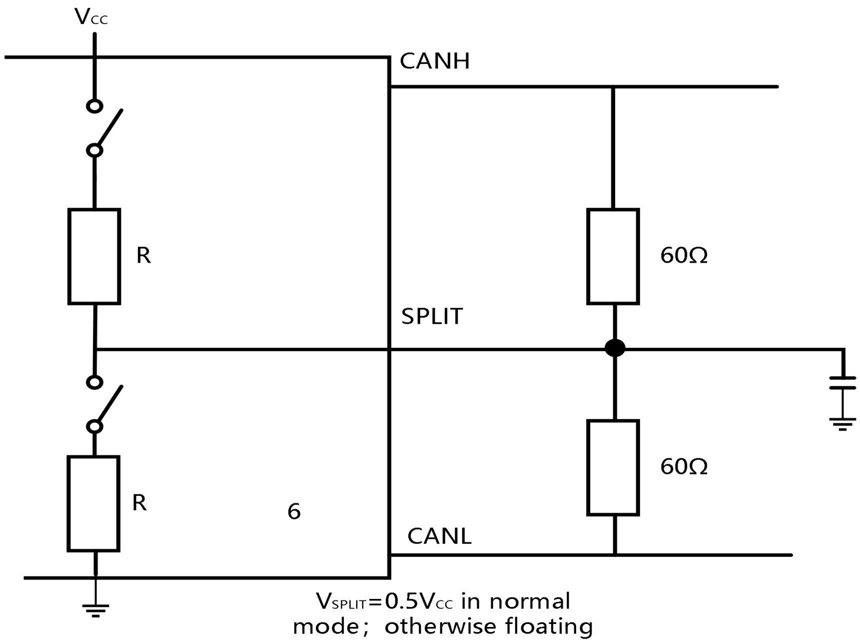
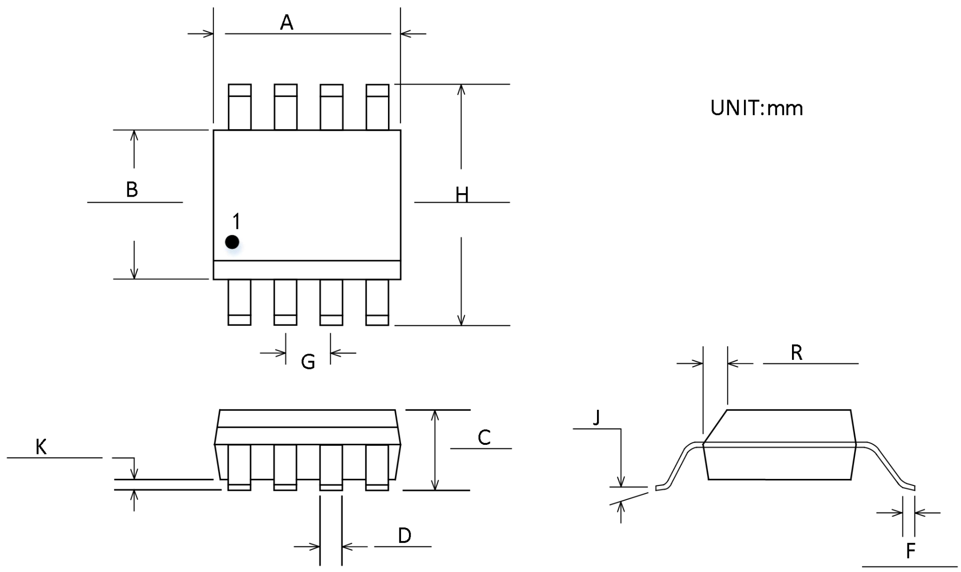


Figure 4. Stabilization circuitry and application

Package Outline Dimensions

SOP-8



Symbol	Dimensions (mm)	
	Min	Max
A	4.80	5.00
B	3.80	4.00
C	1.35	1.75
D	0.31	0.51
F	0.40	1.27
G	1.27BSC	
H	5.80	6.20
J	0°	8°
K	0.10	0.25
R	0.25	0.50

Figure 5 . 8-Lead Outline Package [SOP-8]

Package/Ordering Information

MODEL	TEMPERATURE	PACKAGE DESCRIPTION	PACKAGE OPTION
CD1050AS8	-40℃~150℃	SOP-8	Tape and Reel, 2500
CD1050AS8	-40℃~150℃	SOP-8	Tape and Reel, 3000
CD1050AS8	-40℃~150℃	SOP-8	Tape and Reel, 4000

Revision Log

Version	Revision date	Change content	Reason for Change	Modified by	Reviewed By	Note
V1.0	2025.6.25	Initial version	Regular update	WW	LYL	