

## Product Overview

The NCA1051A is a high-speed CAN transceiver that provides an interface between a Controller Area Network (CAN) protocol controller and the physical two-wire CAN bus. The NCA1051A 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 Mbit/s. The NCA1051A provides thermal protection and transmit data dominant time out function.

## Key Features

- Fully compatible with the ISO11898-2 standard
- Ideal passive behavior to the CAN bus when the supply voltage is off
- I/O voltage range supports 3.3V and 5V MCU
- Power supply voltage
- $V_{IO}$ : 2.8V to 5.5V
- $V_{CC}$ : 4.5V to 5.5V
- Bus fault protection of -70V to +70V
- Bus common-mode voltage of -30V to +30V
- Transmit data (TXD) dominant time out function
- Over current and over temperature protection
- Data rate: up to 5Mbps
- Low loop delay: <250ns
- Operation temperature: -40°C to +125°C
- RoHS & REACH compliant

## Applications

- CAN bus standards such as CANopen, DeviceNet, NMEA2000, ARNIC825, ISO11783 and CANaerospace
- Highly loaded CAN networks down to 10 kbps networks using TXD DTO
- Industrial automation, control, sensors, and drive systems
- Building, security, and climate control automation

## Device Information

Part Number	Package	Body Size
NCA1051A-DSPR	SOP8	4.90mm × 3.90mm
NCA1051AN-DSPR	SOP8	4.90mm × 3.90mm

## Functional Block Diagrams

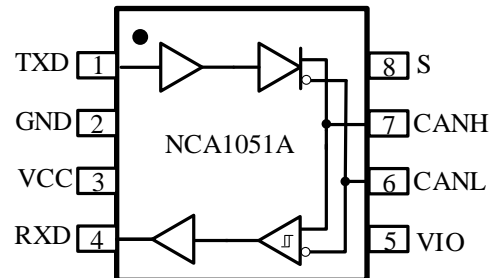


Figure 1. NCA1051A Block Diagram

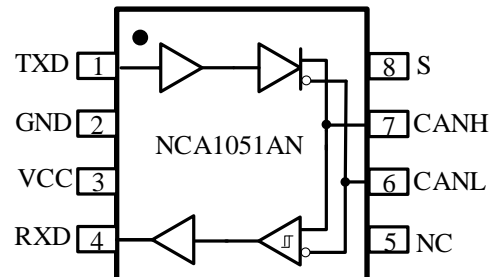


Figure 2. NCA1051AN Block Diagram

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### 1. Pin Configuration and Functions

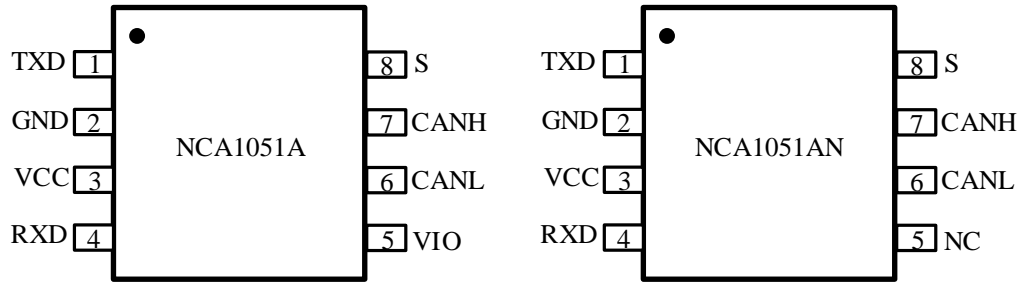


Figure 1-1 NCA1051A, NCA1051AN Package

Table 1-1 NCA1051A Pin Configuration and Description

<i>NCA1051A</i> <i>PIN NO.</i>	<i>NCA1051AN</i> <i>PIN NO.</i>	<i>SYMBOL</i>	<i>FUNCTION</i>
1	1	TXD	CAN transmit data input (LOW for dominant and HIGH for recessive bus states)
2	2	GND	Ground
3	3	VCC	Power Supply
4	4	RXD	CAN receive data output (LOW for dominant and HIGH for recessive bus states)
5	\	VIO	Logic I/O supply voltage
\	5	NC	Not connected
6	6	CANL	Low-level CAN bus line
7	7	CANH	High-level CAN bus line
8	8	S	S (silent mode) select pin (active high)

## 2. Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted)<sup>[1][2]</sup>.

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Power Supply Voltage	VCC, VIO	-0.3		7	V	
Logic I/O Voltage	TXD, RXD, S	-0.3		7	V	
Maximum bus Pin Voltage	V <sub>CANH</sub> , V <sub>CANL</sub>	-70		70	V	
Voltage between pin CANH and pin CANL	V <sub>CANH</sub> - V <sub>CANL</sub>	-70		70	V	
Junction temperature	T <sub>J</sub>	-40		150	°C	
Storage Temperature	T <sub>stg</sub>	-65		150	°C	

<sup>[1]</sup> Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to Absolute Maximum Rating condition for extended periods may affect device reliability.

<sup>[2]</sup> All voltage values, except for “Voltage between pin CANH and pin CANL”, are with respect to GND terminal.

## 3. EMC Ratings

Parameters	Ratings	Value	Unit
Electrostatic discharge	Human Body Model (HBM), per ANSI/ ESDA/ JEDEC JS-001 <ul style="list-style-type: none"> <li>● CANH and CANL</li> <li>● Other pins</li> </ul>	±8	kV
	Charged Device Model (CDM), per ANSI/ ESDA/ JEDEC JS-002 <ul style="list-style-type: none"> <li>● All pins</li> </ul>	±2	kV
	Machine Model (MM), per JESD22-A115C <ul style="list-style-type: none"> <li>● All pins</li> </ul>	±600	V
Electrical disturbances	Electrical transient conduction, per ISO 7637-2, on CANH and CANL		
	● Pulse 1	-100	V
	● Pulse 2a	75	V
	● Pulse 3a	-150	V
	● Pulse 3b	100	V

#### 4. Recommended Operating Conditions

<i>Parameters</i>	<i>Symbol</i>	<i>Min</i>	<i>Typ</i>	<i>Max</i>	<i>Unit</i>
Power Supply Voltage	VCC	4.5	5	5.5	V
I/O Level-Shifting Voltage	VIO	2.8	3.3	5.5	V
Operating Temperature	T <sub>opr</sub>	-40		125	°C

#### 5. Thermal Characteristics

<i>Parameters</i>	<i>Symbol</i>	<i>SOP8</i>	<i>Unit</i>
IC Junction-to-Air Thermal Resistance	R <sub>θJA</sub>	145	°C /W
Junction-to-case (top) thermal resistance	R <sub>θJC(top)</sub>	50	°C /W
Junction-to-board thermal resistance	R <sub>θJB</sub>	45	°C /W

## 6. Specifications

### 6.1. Electrical Characteristics

$V_{CC}=4.5V$  to  $5.5V$ ,  $V_{IO}=2.8$  to  $5.5V$  <sup>[1]</sup>,  $T_a=-40^{\circ}C$  to  $125^{\circ}C$ . Unless otherwise noted, Typical values are at  $V_{CC}=5V$ ,  $V_{IO}=3.3V$ ,  $T_a = 25^{\circ}C$ .

Symbol	Parameters	Conditions	Min	Typ	Max	Unit
<b>Supply; pin VCC</b>						
$V_{CC}$	Supply voltage		4.5	-	5.5	V
$I_{CC}$	Supply current	Normal mode, recessive, $V_{TXD}=V_{IO}$ <sup>[2]</sup> , $V_S=0V$	2.5	3.5	10	mA
		Normal mode, dominant, $V_{TXD}=0V$	20	40	70	mA
		Normal mode, dominant, $V_{TXD}=0$ , short circuit on bus lines, $-3V < (V_{CANH} = V_{CANL}) < 18V$	2.5	56	110	mA
		Silent mode, $V_{TXD}=V_{IO}$ <sup>[2]</sup>	0.1	1.95	2.5	mA
$V_{UVD(VCC)}$	Undervoltage detection voltage on pin VCC	Rising	3.5	4.15	4.5	V
		Falling	3.5	4.05	4.5	V
<b>I/O level adapter supply; pin VIO; only for NCA1051A</b>						
$V_{IO}$	Supply voltage on pin VIO		2.8	-	5.5	V
$I_{IO}$	Supply current on pin VIO	Normal/ silent mode, recessive, $V_{TXD}=V_{IO}$	2	14	200	$\mu A$
		Normal mode, dominant, $V_{TXD}=0V$	-	175	1000	$\mu A$
$V_{UVD(VIO)}$	Undervoltage detection voltage on pin VIO	Rising	1.3	2.1	2.7	V
		Falling	1.3	2.0	2.7	V
<b>Silent mode control input; pin S</b>						
$V_{IH}$	High level input voltage		$0.7 \cdot V_{IO}$ <sup>[2]</sup>	-	$V_{IO}+0.3$ <sup>[2]</sup>	V
$V_{IL}$	Low level input voltage		-0.3	-	$0.3 \cdot V_{IO}$ <sup>[2]</sup>	V
$I_{IH}$	High level input current	$V_S=V_{IO}$ <sup>[2]</sup>	1	4.5	10	$\mu A$
$I_{IL}$	Low level input current	$V_S=0V$	-1	-	1	$\mu A$
<b>CAN transmit data input; pin TXD</b>						
$V_{IH}$	High level input voltage		$0.7 \cdot V_{IO}$ <sup>[2]</sup>	-	$V_{IO}+0.3$ <sup>[2]</sup>	V
$V_{IL}$	Low level input voltage		-0.3	-	$0.3 \cdot V_{IO}$ <sup>[2]</sup>	V
$I_{IH}$	High level input current	$V_{TXD}=V_{IO}$ <sup>[2]</sup>	-5	-	5	$\mu A$

$I_{IL}$	Low level input current	$V_{TXD}=0V$	-260	-150	-30	$\mu A$
$C_i$	Input capacitance	<sup>[3]</sup>	-	5	10	$\mu F$
<b>CAN receive data output; pin RXD</b>						
$I_{OH}$	High level output current	$V_{RXD} = V_{IO} - 0.4V$ <sup>[2]</sup>	-8	-3	-1	$mA$
$I_{OL}$	Low level output current	$V_{RXD} = 0.4V$ ; bus dominant	2	5	12	$mA$
<b>Bus lines; pins CANH and CANL; Driver</b>						
$V_{OH(D)}$	CANH output voltage (Dominant)	$V_{TXD}=0V, R_L=50\Omega$ to $65\Omega$	2.75	3.4	4.5	$V$
$V_{OL(D)}$	CANL output voltage (Dominant)	$V_{TXD}=0V, R_L=50\Omega$ to $65\Omega$	0.5	1.2	2.25	$V$
$V_{OH(R)}$	CANH output voltage (Recessive)	Normal/ silent mode, no load	2	$0.5 \cdot V_{CC}$	3	$V$
$V_{OL(R)}$	CANL output voltage (Recessive)	Normal/ silent mode, no load	2	$0.5 \cdot V_{CC}$	3	$V$
$V_{OD(D)}$	Differential output voltage (Dominant)	Normal mode				
		$R_L = 45\Omega$ to $65\Omega$	1.5	-	3	$V$
		$R_L = 45\Omega$ to $70\Omega$	1.5	-	3.3	$V$
		$R_L = 2240\Omega$	1.5	-	5	$V$
$V_{OD(R)}$	Differential output voltage (Recessive)	Normal mode, no load	-50	-	50	$mV$
$V_{TXsym}$	Transmitter voltage symmetry	$V_{TXsym} = V_{CANH} + V_{CANL}$ , <sup>[3]</sup> $f_{TXD} = 1MHz$ , $R_L=60\Omega, C_{SPLIT} = 4.7nF$ , $V_{CC} = 4.75V$ to $5.25V$ <sup>[4]</sup>	$0.9 \cdot V_{CC}$	-	$1.1 \cdot V_{CC}$	$V$
$I_{OSH(R)}$	CANH short-circuit output current, recessive	Normal mode, $V_{CANH} = V_{CANL} = -27V$ to $32V$	-5	-	5	$mA$
$I_{OSL(R)}$	CANL short-circuit output current, recessive	Normal mode, $V_{CANH} = V_{CANL} = -27V$ to $32V$	-5	-	5	$mA$
$I_{OSH(D)}$	CANH short-circuit output current, dominant	Normal mode, $V_{CANH} = -15V$ to $18V$ , CANL open	-115	-70	115	$mA$
$I_{OSL(D)}$	CANL short-circuit output current, dominant	Normal mode, $V_{CANL} = -15V$ to $18V$ , CANH open	-115	70	115	$mA$
<b>Bus lines; pins CANH and CANL; Receiver</b>						
$V_{ID(R)}$	Differential input threshold voltage, recessive	Normal/ silent mode $-12V < V_{CANH} < 12V$ ,	0.5	0.7	0.9	$V$

		-12V < V <sub>CANL</sub> < 12V				
V <sub>ID(D)</sub>	Differential input threshold voltage, dominant	Normal/ silent mode -12V < V <sub>CANH</sub> < 12V, -12V < V <sub>CANL</sub> < 12V	0.5	0.8	0.9	V
V <sub>hys</sub>	Differential input hysteresis voltage	Normal/ silent mode -12V < V <sub>CANH</sub> < 12V, -12V < V <sub>CANL</sub> < 12V	50	80	200	mV
V <sub>RX(R)</sub>	Receiver recessive voltage	Normal/ silent mode -12V < V <sub>CANH</sub> < 12V, -12V < V <sub>CANL</sub> < 12V	-4	-	0.5	V
V <sub>RX(D)</sub>	Receiver dominant voltage	Normal/ silent mode -12V < V <sub>CANH</sub> < 12V, -12V < V <sub>CANL</sub> < 12V	0.9	-	9	V
I <sub>LKG(OFF)</sub>	Power-off (unpowered) bus input leakage current	V <sub>CANH</sub> = V <sub>CANL</sub> = 5V, V <sub>CC</sub> = V <sub>IO</sub> = 0V <sup>[2]</sup>	-5	-	5	μA
R <sub>i</sub>	Input resistance	-2V ≤ V <sub>CANH</sub> ≤ 7V, -2V ≤ V <sub>CANL</sub> ≤ 7V [3]	9	16	28	kΩ
R <sub>i(match)</sub>	Input resistance matching	V <sub>CANH</sub> = 5V, V <sub>CANL</sub> = 5V, R <sub>i(match)</sub> = 2 * (R <sub>CANH</sub> - R <sub>CANL</sub> ) / (R <sub>CANH</sub> + R <sub>CANL</sub> ) [3]	-1	-	1	%
R <sub>ID</sub>	Differential input resistance	-2V ≤ V <sub>CANH</sub> ≤ 7V, -2V ≤ V <sub>CANL</sub> ≤ 7V, R <sub>ID</sub> = R <sub>CANH</sub> + R <sub>CANL</sub> [3]	19	33	52	kΩ
C <sub>i</sub>	Input capacitance to ground	CANH or CANL [3]	-	13	-	pF
C <sub>ID</sub>	Differential input	[3]	-	5	-	pF
<b>Temperature detection</b>						
T <sub>SD</sub>	Thermal shutdown threshold	[3]	-	193	-	°C
T <sub>SD(hys)</sub>	Thermal shutdown hysteresis	[3]	-	11	-	°C

<sup>[1]</sup> Only NCA1051A has a VIO pin. For NCA1051AN, the VIO input is internally connected to VCC.

<sup>[2]</sup> V<sub>IO</sub>=V<sub>CC</sub> for the version without VIO pin.

<sup>[3]</sup> Not tested in production; guaranteed by design.

<sup>[4]</sup> The test circuit used to measure the bus output voltage symmetry (which includes C<sub>SPLIT</sub>) is shown in Figure 6-1, Figure 6-3.



**6.2. Switching Electrical Characteristics**

$V_{CC}=4.5V\sim 5.5V$ ,  $V_{IO}=2.8\sim 5.5V$ ,  $T_a=-40^{\circ}C$  to  $125^{\circ}C$ . Unless otherwise noted, Typical values are at  $V_{CC} = 5V$ ,  $V_{IO} = 3.3V$ ,  $T_a = 25^{\circ}C$ .

Symbol	Parameters	Comments	Min	Typ	Max	Unit
<b>Driver</b>						
$t_{d(TXD-bus, dom)}$	Delay time from TXD to bus dominant	Normal mode	-	40	-	ns
$t_{d(TXD-bus, rec)}$	Delay time from TXD to bus recessive	Normal mode	-	60	-	ns
$t_{r(bus)}$	Differential output signal rise time		-	45	-	ns
$t_{f(bus)}$	Differential output signal fall time		-	30	-	ns
$t_{bit(bus)}$	Transmitted recessive bit width	$t_{bit(TXD)} = 500\text{ ns}$	435	495	530	ns
		$t_{bit(TXD)} = 200\text{ ns}$	155	195	210	ns
$t_{TXD\_DTO}$	TXD dominant time-out time		0.8	2.2	5	ms
<b>Receiver</b>						
$t_{d(bus-RXD, dom)}$	Delay time from bus to RXD dominant	Normal/ silent mode	-	40	-	ns
$t_{d(bus-RXD, rec)}$	Delay time from bus to RXD recessive	Normal/ silent mode	-	35	-	ns
$t_{d(TXD-RXD, dom)}$	Delay time from TXD to RXD dominant	Normal mode	-	80	220	ns
$t_{d(TXD-RXD, rec)}$	Delay time from TXD to RXD recessive	Normal mode	-	95	220	ns
$t_{r(RXD)}$	RXD signal rise time		-	5	-	ns
$t_{f(RXD)}$	RXD signal fall time		-	5	-	ns
$t_{bit(RXD)}$	Bit time on pin RXD	$t_{bit(TXD)} = 500\text{ ns}$	400	490	550	ns
		$t_{bit(TXD)} = 200\text{ ns}$	120	190	220	ns
$\Delta t_{rec}$	Receiver timing symmetry	Distortion of RXD relative to bus				
		$t_{bit(TXD)} = 500\text{ ns}$	-65	-35	40	ns
		$t_{bit(TXD)} = 200\text{ ns}$	-45	-20	15	ns

6.3. Parameter Measurement Information

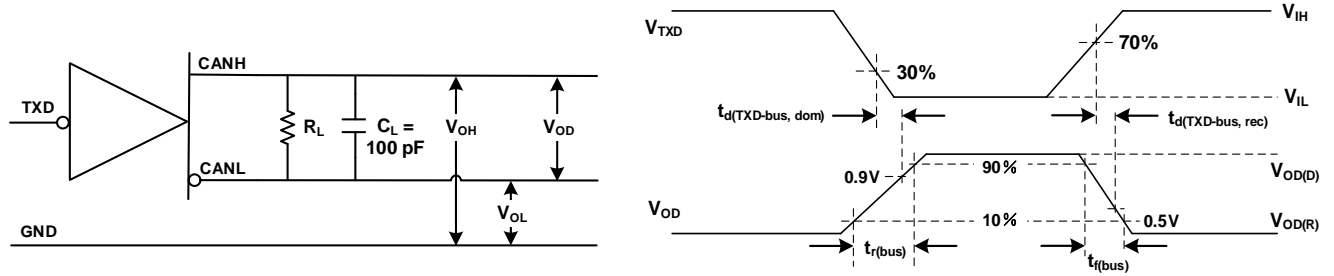


Figure 6-1 Driver Test Circuit and Voltage Waveforms

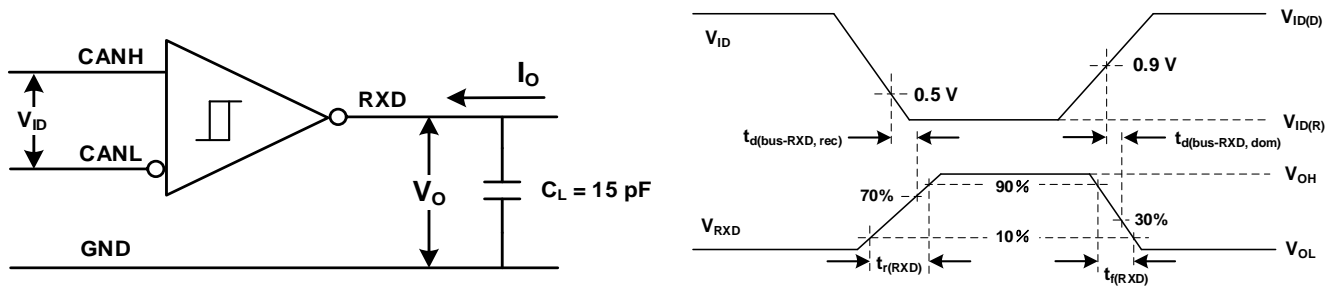


Figure 6-2 Receiver Test Circuit and Voltage Waveforms

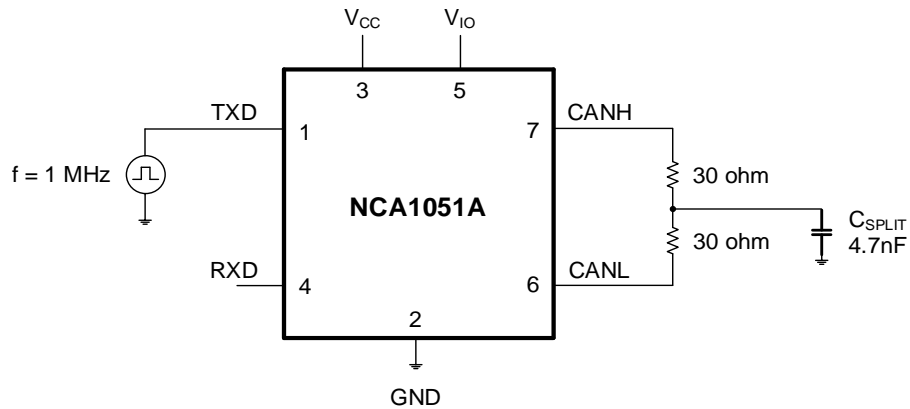


Figure 6-3 Transceiver Driver Symmetry Test Circuit

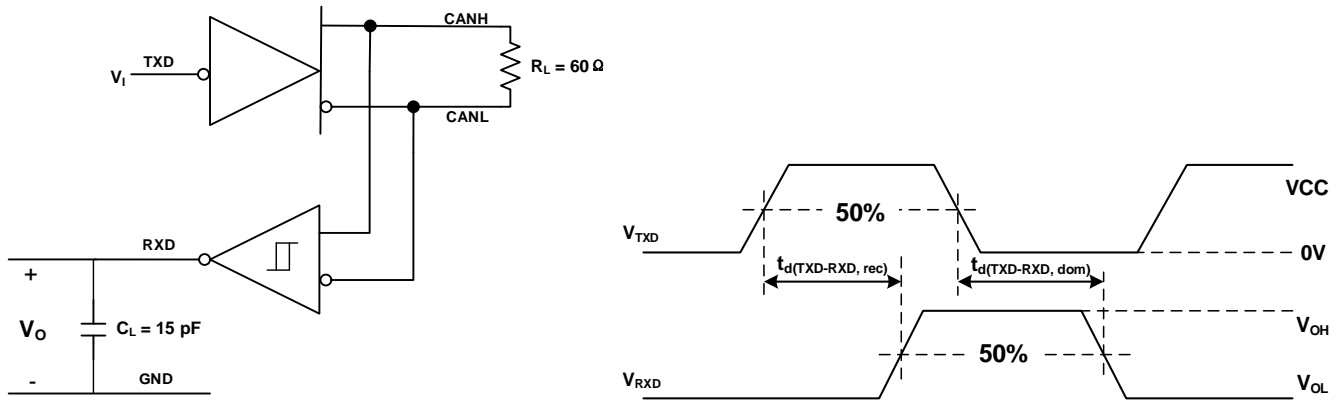


Figure 6-4 Loop Time Test Circuit and Voltage Waveforms

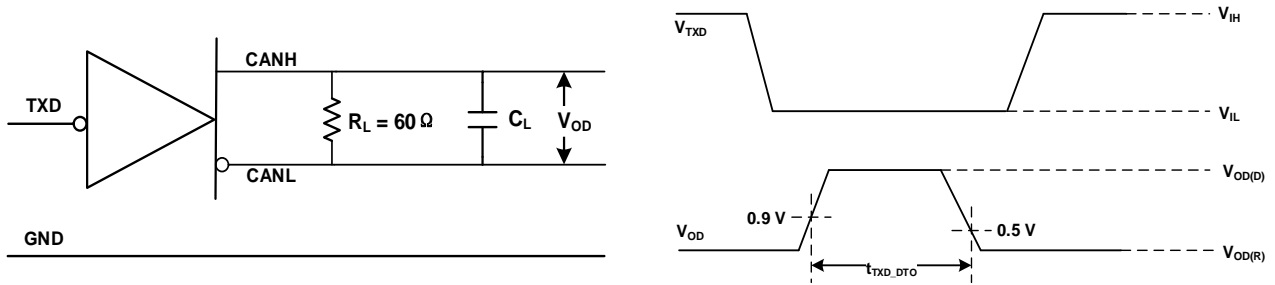


Figure 6-5 TXD Dominant Time-out Test Circuit and Voltage Waveforms

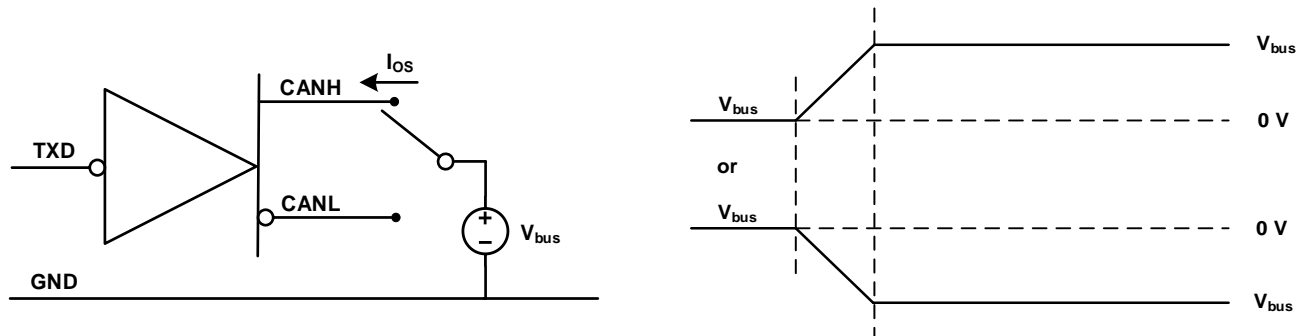


Figure 6-6 Driver Short-Circuit Current Test Circuit and Waveforms

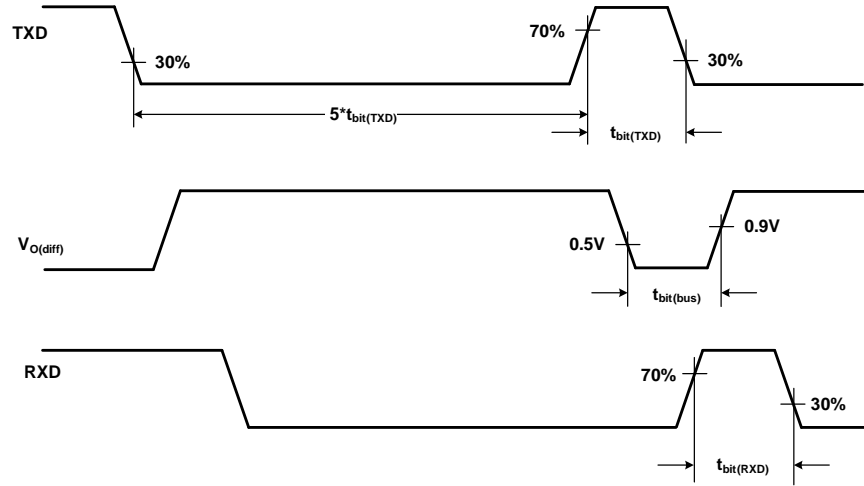


Figure 6-7  $t_{bit(RXD)}$  Test Circuit and Waveforms

**6.4. Typical Characteristics**

$V_{CC}=4.5V\sim 5.5V$ ,  $V_{IO}=2.8\sim 5.5V$ ,  $R_L=45\sim 70\text{ ohm}$ ,  $T_a=-40^\circ C$  to  $125^\circ C$ . Unless otherwise noted, Typical values are at  $V_{CC}=5V$ ,  $V_{IO}=3.3V$ ,  $R_L=60\text{ ohm}$ ,  $T_a=25^\circ C$ .

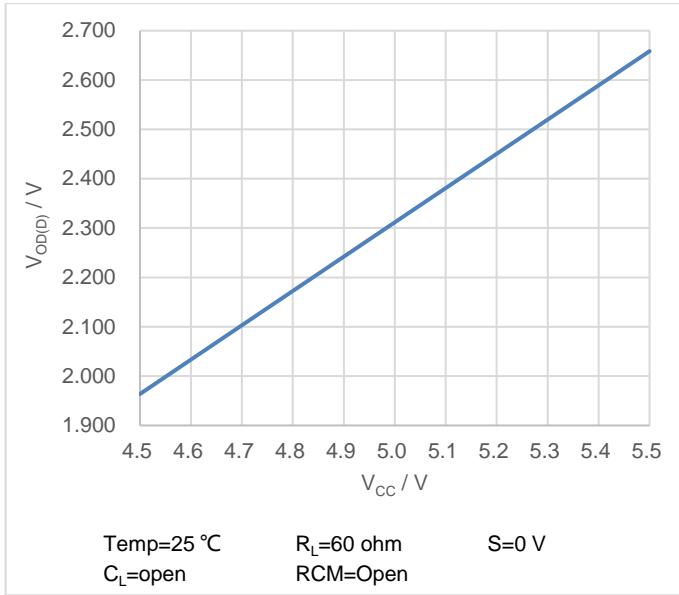


Figure 6-8  $V_{OD(D)}$  vs  $V_{CC}$

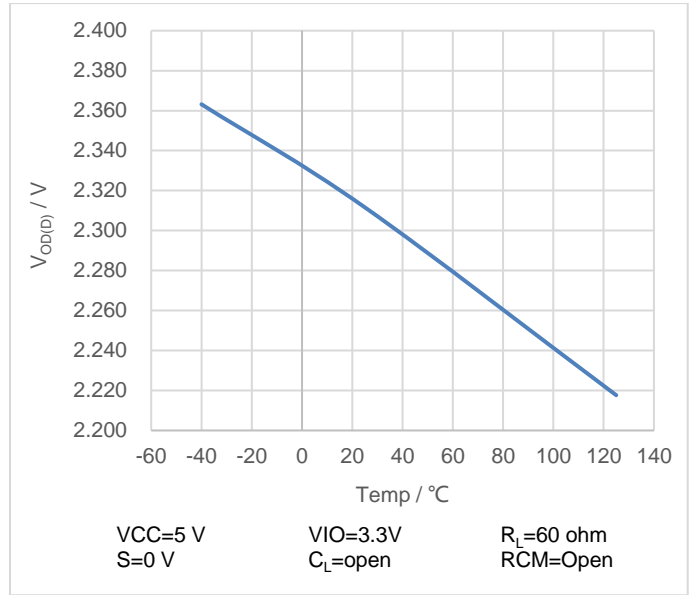


Figure 6-10  $V_{OD(D)}$  vs Temperature

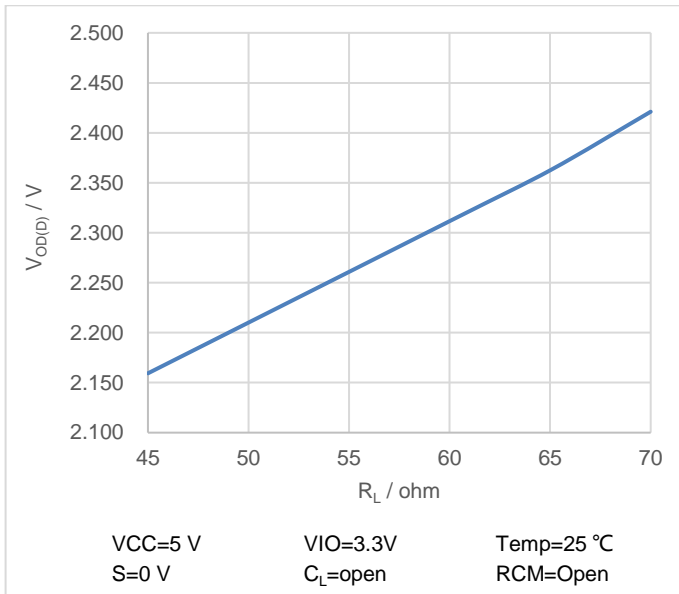


Figure 6-9  $V_{OD(D)}$  vs  $R_L$

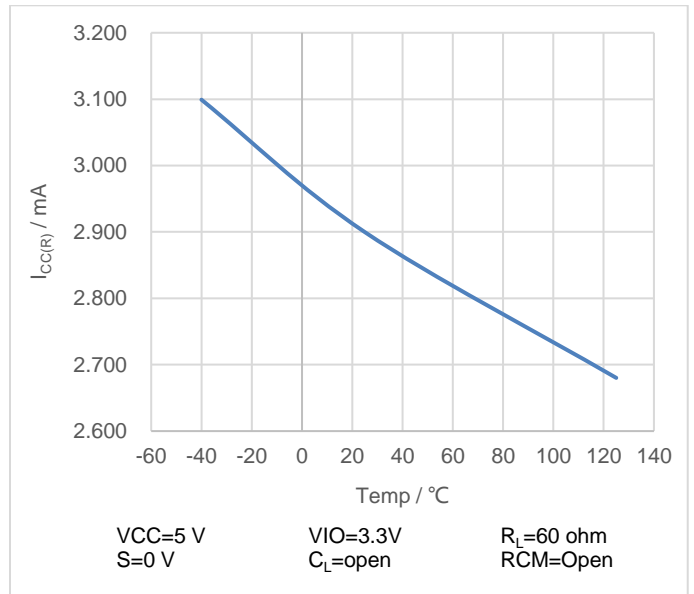


Figure 6-11  $I_{CC(R)}$  vs Temperature

## 7. Function Description

### 7.1. Overview

The NCA1051A is a CAN transceiver which fully compatible with the ISO11898-2 standard. The data rate of the NCA1051A is up to 5Mbps, and it can support up to 110 CAN nodes. Meanwhile, the maximum transmission rate of the CAN bus is limited by the bus load, the quantity of nodes, the cable length, and other factors. The NCA1051A has a  $\pm 30V$  input common-mode range, enabling reliable communication between bus nodes with large ground potential deviations.

Comprehensive protection features are designed to enhance the device and network robustness in harsh operating conditions. The transmit data dominant time-out function prevents the bus from lock-up by the faults on micro-controller. Moreover, the NCA1051A provides thermal protection and short-circuit protection.

### 7.2. Functional Block Diagram

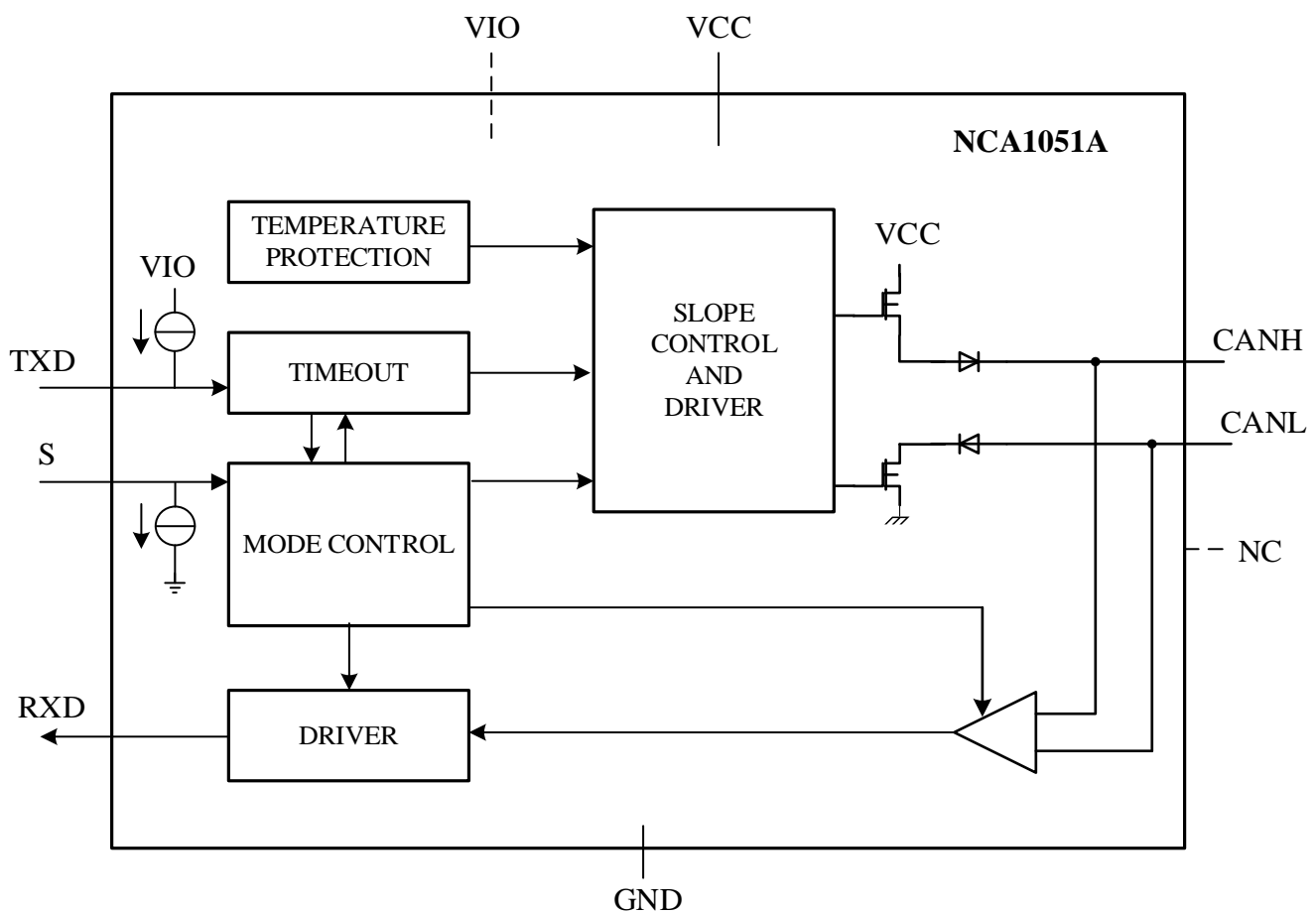


Figure 7-1 Block diagram of NCA1051A

### 7.3. Feature Description

#### 7.3.1. TXD Dominant Time-Out Function (TXD DTO)

A 'TXD dominant time-out' timer circuit prevents the bus lines from 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 ( $t_{TXD\_DIO}$ ), the transmitter is disabled, driving the bus lines into a recessive state. The timer is reset by a positive edge on pin TXD. The TXD dominant time-out time also defines the minimum possible bit rate of 10 kbit/s.

**7.3.2.Undervoltage Detection on Pins VCC and VIO**

The supply terminals have undervoltage detection that places the device in protected mode. This protects the bus during an undervoltage event on either the VCC or VIO supply terminals.

After an undervoltage condition is cleared and the supplies have returned to valid levels, the device typically resumes normal operation within 50  $\mu$ s.

Table 7-1 Undervoltage Lockout 5V Only Devices (NCA1051AN)

VCC	Device State	Bus Output	RXD
>UV <sub>VCC</sub>	Normal	Per TXD	Mirrors Bus <sup>[1]</sup>
<UV <sub>VCC</sub>	Protected	High Impedance	High Impedance

<sup>[1]</sup> Mirrors bus state: low if CAN bus is dominant, high if CAN bus is recessive.

Table 7-2 Undervoltage Lockout I/O Level Shifting Devices (NCA1051A)

VCC	VIO	Device State	Bus Output	RXD
>UV <sub>VCC</sub>	>UV <sub>VIO</sub>	Normal	Per TXD	Mirrors Bus <sup>[1]</sup>
<UV <sub>VCC</sub>	>UV <sub>VIO</sub>	Protected	High Impedance	High (Recessive)
>UV <sub>VCC</sub>	<UV <sub>VIO</sub>	Protected	High Impedance	High Impedance
<UV <sub>VCC</sub>	<UV <sub>VIO</sub>	Protected	High Impedance	High Impedance

<sup>[1]</sup> Mirrors bus state: low if CAN bus is dominant, high if CAN bus is recessive.

**7.3.3.Unpowered Device**

The device is designed to be 'ideal passive' or 'no load' to the CAN bus if it is unpowered. The bus terminals (CANH, CANL) have extremely low leakage currents when the device is unpowered to avoid loading down the bus. This is critical if some nodes of the network are unpowered while the rest of the of network remains in operation. The logic terminals also have extremely low leakage currents when the device is unpowered to avoid loading down other circuits that may remain powered.

**7.3.4.Internal Biasing of TXD and S Input Pins**

Pin TXD has an internal pull-up to VIO, and pin S has an internal pull-down to GND. This ensures a safe, defined state in case one or both of these pins are left floating.

**7.3.5.Over-Temperature Protection (OTP)**

The output drivers are protected against over-temperature conditions. If the virtual junction temperature exceeds the shutdown junction temperature T<sub>SD</sub>, the output drivers will be disabled until the virtual junction temperature becomes lower than T<sub>SD</sub> and TXD becomes recessive again. By including the TXD condition, the occurrence of output driver oscillation due to temperature drifts is avoided.

**7.3.6.Over-Current Protection (OCP)**

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.

**7.4. VIO Supply Pin**

Two versions of the NCA1051A are available, only differing in the function of a single pin. Pin 5 is either a VIO supply pin or is not connected (NC).

Pin VIO should be connected to the microcontroller supply voltage (see Figure 8-1). This will adjust the signal levels of pins TXD, RXD and S to the I/O levels of the microcontroller. For versions of the NCA1051AN without a VIO pin, the VIO input is internally connected to VCC. This sets the signal levels of pins TXD, RXD and S to levels compatible with 5 V microcontrollers.

### 7.5. Device Functional Modes

The device has two main operating modes: Normal mode and Silent mode. Operating mode is selected via the S input pin.

Table 7-3 Operating Modes

S	Mode	Driver	Receiver	RXD Terminal
L	Normal Mode	Enabled (ON)	Enabled (ON)	Mirrors Bus State <sup>1</sup>
H	Silent Mode	Disabled (OFF)	Enabled (ON)	Mirrors Bus State <sup>1</sup>

<sup>1</sup> Mirrors bus state: low if CAN bus is dominant, high if CAN bus is recessive.

#### 7.5.1. CAN Bus States

The CAN bus has two states during powered operation: dominant and recessive. A dominant bus state is when the bus is driven differentially, corresponding to a logic LOW on the TXD and RXD terminal. A recessive bus state is when the bus is biased to  $V_{CC}/2$  via the high-resistance internal input resistors  $R_i$  of the receiver, corresponding to a logic HIGH on the TXD and RXD terminals.

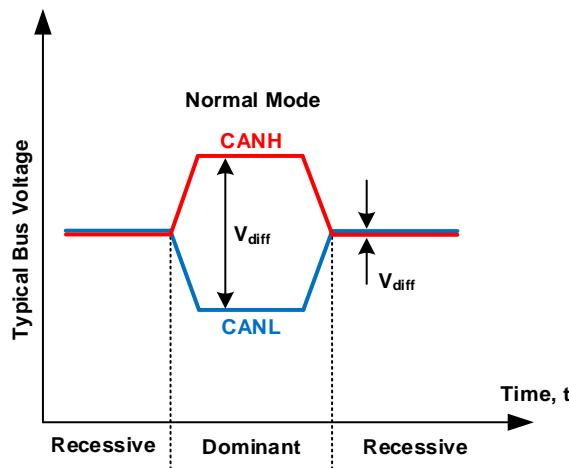


Figure 7-2 Bus States

#### 7.5.2. Normal Mode

A LOW level on pin S selects Normal mode. In this mode, the transceiver can transmit and receive data via the bus lines CANH and CANL (see Figure 7-1). The differential receiver converts the analog data on the bus lines into digital data which is output to pin RXD. The slopes of the output signals on the bus lines are controlled internally and are optimized in a way that guarantees the lowest possible Electromagnetic Emission (EME).

#### 7.5.3. Silent Mode

A HIGH level on pin S selects Silent mode. In Silent mode, the transmitter is disabled, releasing the bus pins to recessive state. All other IC functions, including the receiver, continue to operate as in Normal mode. Silent mode can be used to prevent a faulty CAN controller from disrupting all network communications.



7.5.4.Driver and Receiver Function Tables

Table 7-4 Driver Function Table

Inputs		Outputs		Driven Bus State
S <sup>[1]</sup>	TXD <sup>[1] [2]</sup>	CANH <sup>[1]</sup>	CANL <sup>[1]</sup>	
L or Open	L	H	L	Dominant
	H or Open	Z	Z	Recessive
H	X	Z	Z	Recessive

<sup>[1]</sup> H= high level; L=low level; X=irrelevant; Z= common mode(recessive) bias to  $V_{CC}/2$ .

<sup>[2]</sup> Devices have an internal pull up to VCC or VIO on TXD terminal. If the TXD terminal is open, the terminal is pulled HIGH and the transmitter remain in recessive (non-driven) state.

Table 7-5 Receiver Function Table

Device Mode	CAN Differential Inputs	Bus State	RXD Terminal <sup>[1]</sup>
	$V_{ID} = V_{CANH} - V_{CANL}$		
Normal or Silent	$V_{ID} \geq V_{ID(D)}$	Dominant	L
	$V_{ID(R)} < V_{ID} < V_{ID(D)}$	Uncertain	Uncertain
	$V_{ID} \leq V_{ID(R)}$	Recessive	H
	Open	Recessive	H

<sup>[1]</sup> H= high level; L=low level.

## 8. Application Information

### 8.1. Typical Application

The NCA1051A requires a 0.1  $\mu\text{F}$  bypass capacitors between VCC and GND. The capacitor should be placed as close as possible to the package. The Figure 8-1 and Figure 8-2 are the typical applications of NCA1051A.

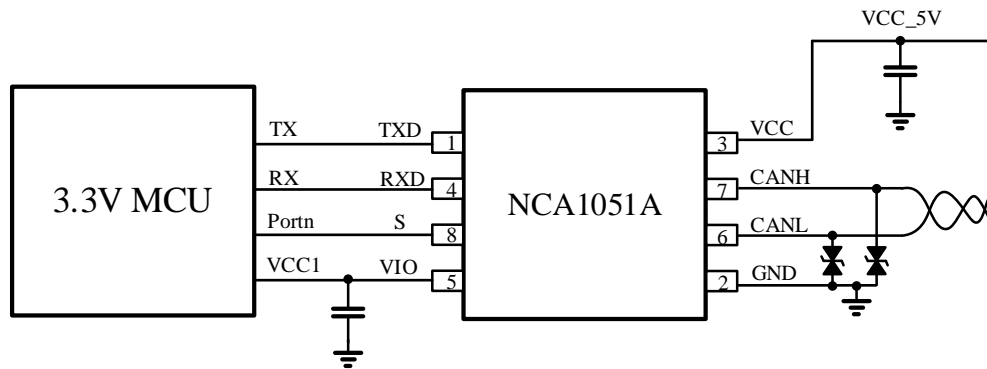


Figure 8-1 Typical CAN Bus Application Using 3.3V CAN Controller

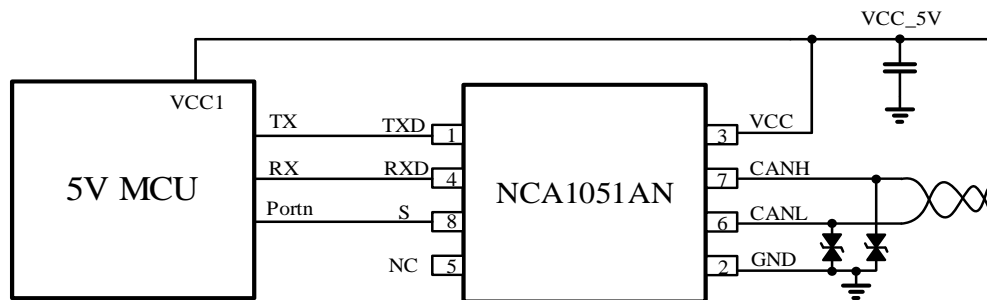


Figure 8-2 Typical CAN Bus Application Using 5V CAN Controller

### 9. Package Information

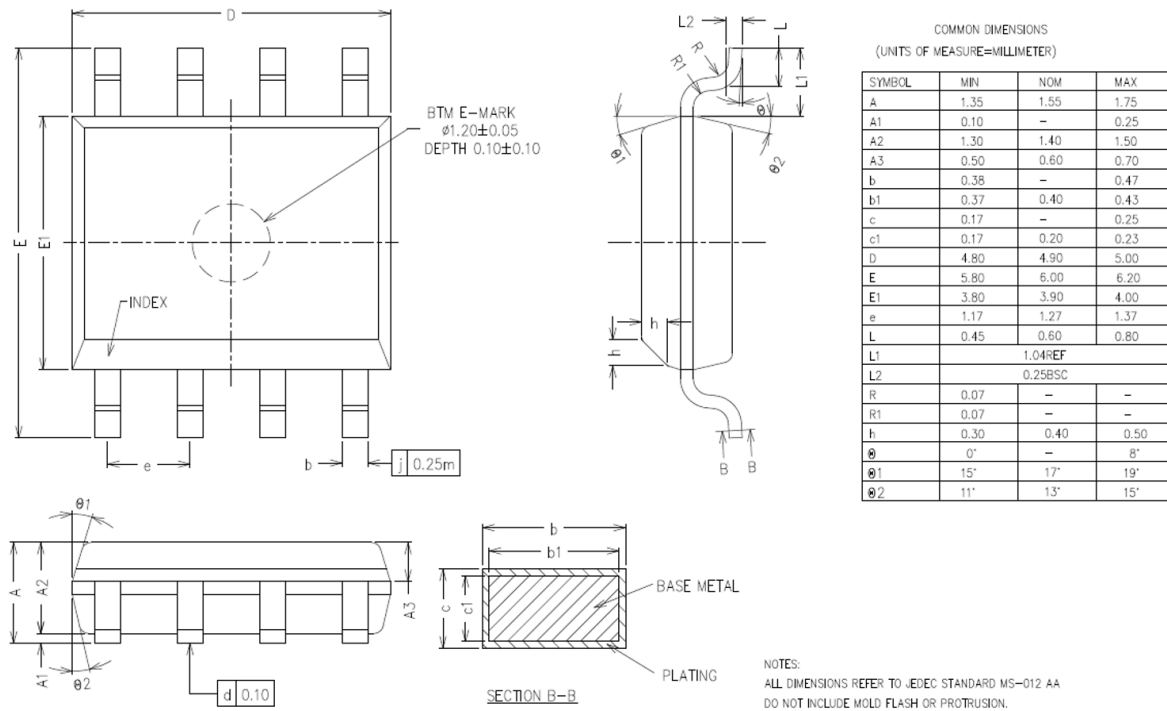


Figure 9-1 SOP8 Package Shape and Dimension

### 10. Order Information

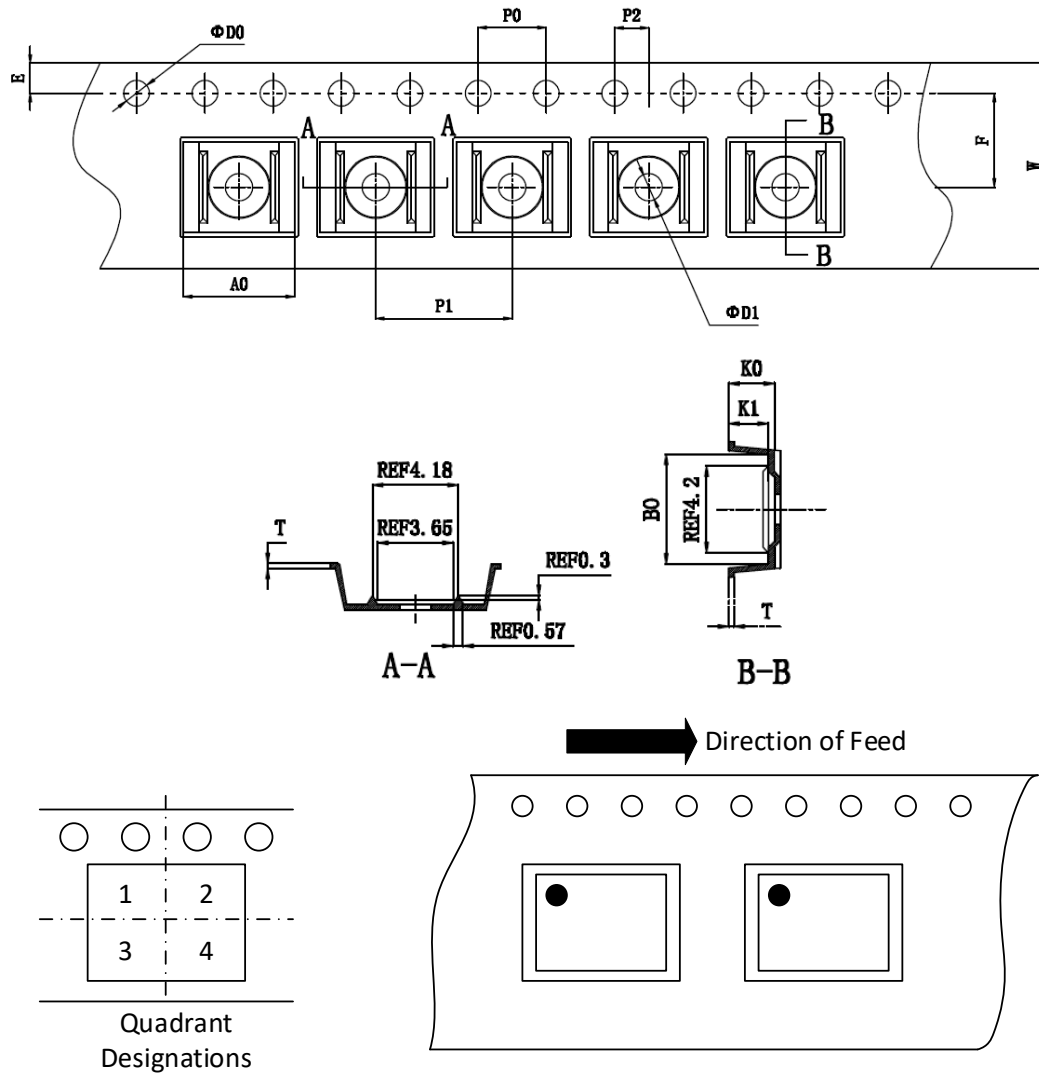
Part Number	Max Data Rate (Mbps)	Operation Temperature	MSL	Package Type	Package Drawing	SPQ
NCA1051A-DSPR	5	-40 to 125°C	1	SOP8	SOP8	2500
NCA1051AN-DSPR	5	-40 to 125°C	1	SOP8	SOP8	2500

NOTE: All packages are RoHS-compliant with peak reflow temperatures of 260 °C according to the JEDEC industry standard classifications and peak solder temperatures.

### 11. Documentation Support

Part Number	Product Folder	Datasheet	Technical Documents
NCA1051A	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>

### 12. Tape and Reel Information



Parameter	Dimension (mm)
E	1.75±0.10
F	5.5±0.10
P2	2.00±0.10
D0	1.55±0.05
D1	1.6±0.10
P0	4.00±0.10
10P0	40.00±0.20

Parameter	Dimension (mm)
W	12.00±0.30
P1	8.00±0.10
A0	6.50±0.10
B0	5.30±0.10
K0	2.20±0.10
K1	1.90±0.10
T	0.30±0.05

Figure 12-1 Tape and Reel Information of SOP8

### 13. Revision History

<i>Revision</i>	<i>Description</i>	<i>Date</i>
1.0	Initial version	2023/8/3
1.1	One-page information update; figure update; table format update; function description update	2023/8/25
1.2	Function description update	2024/2/19

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