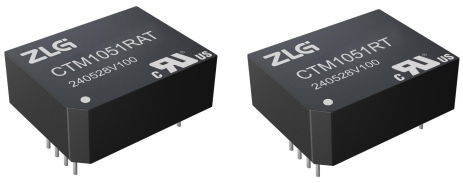
Product Manual

CTM1051R(A)T

Data Sheet

High Isolation CAN/CANFD Transceiver



UL 62368-1 EN 62368-1 IEC 62368-1 RoHS

Product Series

Product Series	Temperature Range	Isolated Voltage	Package
CTM1051RAT	-40℃～+105℃	5000VAC	DIP8
CTM1051RT	-40℃～+105℃	5000VAC	DIP8

Features

- Conforms to "ISO 11898-2" standard
- Maximum baud rate up to 5Mbps
- 5kVAC isolation voltage
- A single network can connect up to 110 nodes
- Low electromagnetic radiation, high electromagnetic interference resistance
- The shell and potting materials meet the UL94 V-0 standard.
- Integrated isolation and ESD bus protection

Applications

- Photovoltaic system
- BMS
- Charging Station
- Automobile electronics
- Electric power monitoring
- Industrial control
- Petrochemical industry, etc

Product Model

Part Number	Supply Voltage (Range) (VDC)	Quiescent Current (mA,Typ)	Maximum Operating Current (mA)	Baud Rate (bps)	Nodes (pcs)	Type
CTM1051RAT	3.3 (3.15-3.45)	17	110	40k~5M	110	High-speed
CTM1051RT	5 (4.75-5.25)	15	80	40k~5M		

Input Characteristics

Parameter		Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage		V_{CC}	CTM1051RAT	3.15	3.3	3.45	VDC
			CTM1051RT	4.75	5	5.25	
TXD Input	High Level	V_{IH}		$0.7V_{CC}$	--	V_{CC}+0.5	
	Low Level	V_{IL}		0	--	$0.3V_{CC}$	
RXD Output	High Level	V_{OH}	I_{RXD}=-1.5mA	V_{CC}-0.4	V_{CC}-0.2	--	
	Low Level	V_{OL}	I_{RXD}=1.5mA	--	0.2	0.4	
TXD Driving Current		I_T		2	--	--	mA
RXD Output Current		I_R		--	--	10	
TXD Pull-up Resistor		R_{TXD}		--	10	--	kΩ
Serial Interface		CTM1051RAT		3.3V standard CAN controller interface			
		CTM1051RT		5V standard CAN controller interface			

Output Characteristics

Parameter		Symbol	Conditions	Min	Typ	Max	Unit
Dominant Output Voltage	CANH	$V_{(OD)CANH}$	R_L=60Ω	2.75	3.5	4.5	VDC
	CANL	$V_{(OD)CANL}$	R_L=60Ω	0.5	1.5	2.25	
Recessive Output Voltage	CANH	$V_{(OR)CANH}$	no load	2	2.5	3	
	CANL	$V_{(OR)CANL}$	no load	2	2.5	3	
Differential Output Voltage	Dominant	$V_{diff(d)}$	R_L=60Ω	1.5	2	3	
	Recessive	$V_{diff(r)}$	no load	-0.05	0	0.05	
Maximum Voltage On Bus Pin		V_X	CANH、CANL	-42	--	+42	
CAN bus Interface		Conform to the ISO 11898-2 standard, twisted pair output					

Transmission Characteristics

Parameter		Symbol	Conditions	Min	Typ	Max	Unit
Data Delay	TXD Transmitting Delay	t_T	R_L=60Ω	--	60	--	ns
	RXD Receiving Delay	t_R	R_L=60Ω	--	80	--	
	Loop Delay	$t_{PD(TXD-RXD)}$	R_L=60Ω	--	140	250	
TXD Dominant Timeout		$t_{to(dom)TXD}$	V_{TXD}=0V	0.3	1.35	5	ms

Limit Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Input Inrush Voltage (1) （1s，max）	CTM1051RAT	-0.7	--	5	VDC
	CTM1051RT	-0.7	--	7	
Lead Soldering Temperature	The distance of soldering joint from the shell is 1.5mm,10 seconds	--	--	300	℃
Hot Swap		N/A			

General Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Isolated Withstand Voltage	Input-output,1minute,leakage current less than 1mA	5000	--	--	VAC
Working Isolation Voltage	Input-output	--	--	1500	VDC
Insulation Resistance	Input-output,isolation voltage 500VDC	1	--	--	GΩ
Package Size		22.60×16.90×12.80			mm
Package Material		Black flame retardant plastic shell, comply with UL94V-0 standard			

Environmental Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Operating Temperature		-40	--	+105	℃
Storage Temperature		-55	--	+125	
Shell Temperature Rise	Ta=25℃	--	15	25	
Storage Humidity	No condensation	--	--	95	%
Cooling Method		Natural air cooling			

EMC Characteristics			
EMS	ESD	IEC/EN 61000-4-2 Contact ±4kV /Air ±8kV(bare, CAN bus) (2)	Perf.Criteria B
	EFT	IEC/EN 61000-4-4 ±2kV(bare, Bus) (2)	Perf.Criteria B
	Surge	IEC/EN 61000-4-5 Common-mode ±2kV(bare,CAN bus) (2)	Perf.Criteria B
		IEC/EN 61000-4-5 Differential-mode ±2kV，common-mode ±4kV (Figure 4/ Figure 5)(3)	Perf.Criteria B
	CS	IEC/EN 61000-4-6 3Vr.m.s(bare)	Perf.Criteria A

Notes:

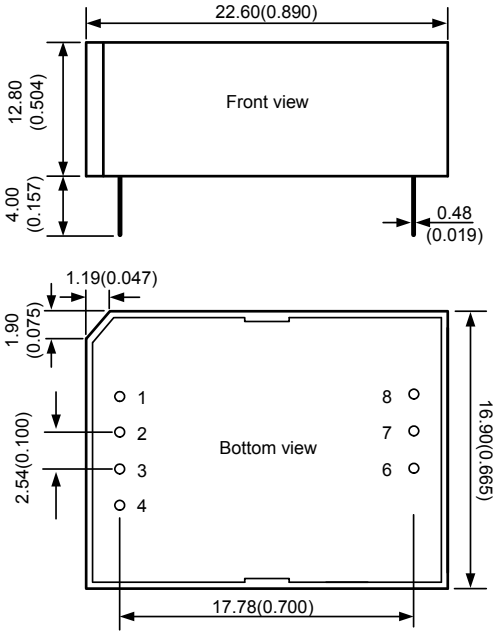
(1) Stresses beyond those listed maximum values may cause permanent damage to the device.

(2) This parameter only conforms to CAN bus terminals, CANH, CANL or CANG; All CAN bus terminals are suspended during the test. In addition, the surge immunity is tested with composite waves of 1.2/50μS open-circuit voltage and 8/20μS short-circuit current, the source impedance is 2Ω .

(3) This parameter is limited to CAN bus terminals, and the earth in application circuit must be connected.The surge immunity is tested according to the test configuration of unshielded symmetrical communication line.

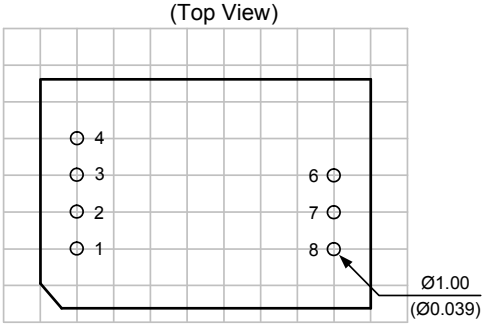
(4) Unless specified specially, parameters in this manual are measured under the conditions of 25℃, 40%~75% humidity, input nominal voltage and 60Ω CAN interface load.

Appearance and Packaging Dimensions

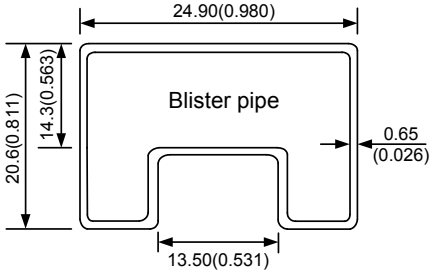


Pin	Name	Function
1	VCC	Power supply
2	GND	Ground
3	TXD	Transmitting input
4	RXD	Receiving output
6	CANH	CANH
7	CANL	CANL
8	CANG	Isolated power ground

PCB Silkscreen Diagram
(Top View)



Notes：
Size in mm：mm(inch)
Unlabeled talerance：±0.25(±0.010)
Grid distance：2.54×2.54mm



Notes：
Size in mm：mm(inch)
Unlabeled tolerance：±0.50(±0.020)
L=282(11.102)，15pieces/pallet
Carton Size：304×120×40mm
75pieces/carton

Function Description

1. TXD dominant timeout

When TXD is set to low, the "dominant timeout" timer inside the module will start. If the low duration of the TXD pin is longer than $t_{to(dom)TXD}$, the internal transmitter will be disabled and the bus will be released to the recessive level. This function prevents a constant dominant level on the bus caused by hardware or software errors, which can avoid bus paralysis. When the TXD pin is set high, the "dominant timeout" timer will be reset. Figure 1 is a timing diagram of the dominant timeout function.

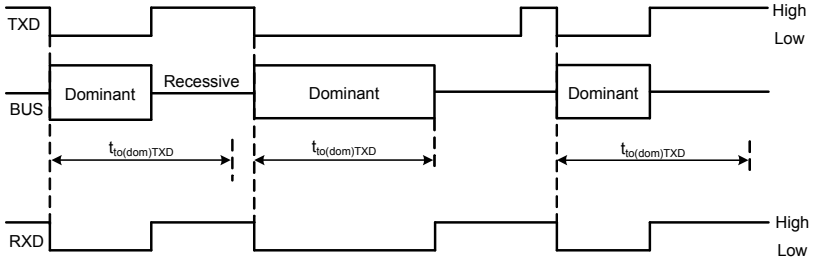


Figure 1 Timing diagram of dominant timeout function

Circuit Design and Application

1. Typical Circuit

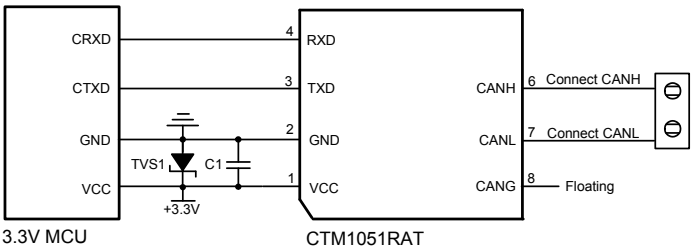


Figure 2 Typical application

In simple applications where the environment is good, such as function test, short-distance communication test,etc., the module can works directly after it is powered up and its terminals are connected with MCU and CAN-bus network. No additional devices are required,as show in Figure 2.

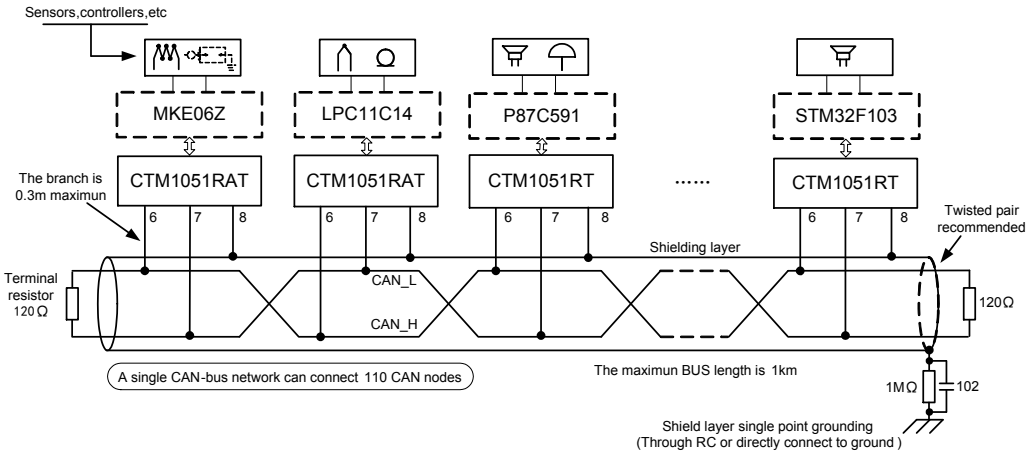


Figure 3 Recommended networking for single CAN bus network

The recommended networking for a single CAN bus network is shown in Figure 3. Up to 110 nodes can be connected to the same network. The longest communication distance is 1km when using the CTM1051R(A)T series modules. If more nodes or longer communication is required, it can be extended by devices such as CAN repeaters.

2. Recommended Protection Circuit

The module is vulnerable to high-energy lightning strike when being applied in outdoor and other harsh field environments. Accordingly, a protection circuit with a higher protection level must be added to CAN signal ports to ensure the module is not damaged and the bus communication is performed reliably. Figure 4 and Figure 5 show two recommended protection circuits for high-energy lightning strike surge. Under the test based on the non-shielded communication line configuration,it can meet the requirements of the IEC/EN61000-4-5 differential-mode ±2kV, and common-mode ±4kV surge level.

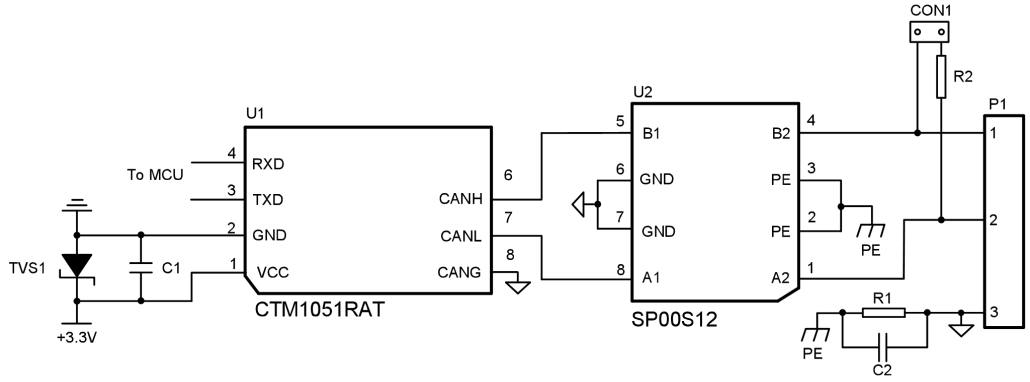


Figure 4 Recommended port protection circuit 1

Figure 4 shows the circuit diagram in which the CTM1051RAT module is used with the SP00S12 signal surge suppressor from ZHIYUAN Electronics.The connection between SP00S12 and CTM1051RAT is simple, easy to use and covers small area. For more details, please refer to the datasheet of SP00S12.

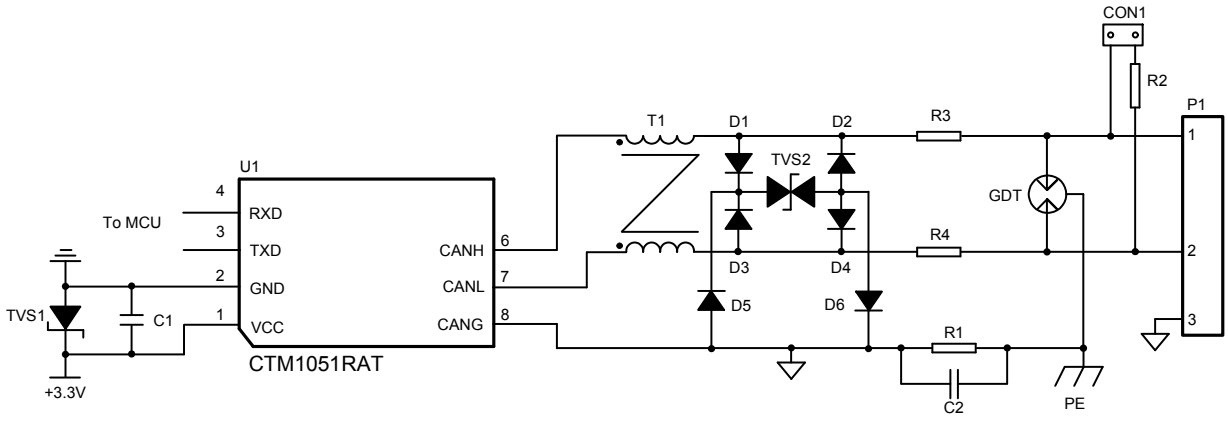


Figure 5 Recommended port protection circuit 2

Table 1 Recommended port protection circuit parameters

Symbol	Model	Symbol	Model
C1	10μF，25V	TVS1	SMBJ5.0A
C2	102，2kV	TVS2	SMBJ12CA
R1	1MΩ，1206	GDT	B3D090L
R2	120Ω，1206	T1	B82793S0513N201
R3,R4	SMD1812P014TF	D1~D6	HFM107
CON1	Jumper	U1	CTM1051RAT

The recommended port protection circuit for specific surge level requirements is shown in Figure 5, and the parameters of the circuit can be adjusted accordingly. CON1 is a short circuit jumper. You only need to short-circuit the head and the tail nodes and add terminal resistors to the bus in a single CAN bus network, and other nodes can be left open. Table 1 lists recommended component parameters. Under the test based on the non-shielded communication line configuration, it can meet the requirements of IEC61000-4-5 differential mode ±2kV, and common-mode ±4kV surge. In addition, it is recommended to use a shielded twisted pair and reliable single point grounding for the shielding layer in the network. In the case with serious electromagnetic interference, it is recommended to use double shielded twisted-pair and connect CANH, CANL and CANG. CANG is connected to the inner shield, and the outer shield is grounded to a single point.

Table 1 lists the recommended values. the actual values can be adjusted according to the protection level and the device cost. PTC is recommended for R3 and R4, and quick recovery diodes is recommended for D1~D6.

3. Considerations

(1) Terminal resistors should always be connected to the CAN bus terminals whatever CAN node quantity,bus length or communication baud rate;

(2) The logic level of CAN controller should adapt to the level of the product, otherwise it may result in communication failure;

(3) The network communication distance and baud rate are related to the field application and they can be designed according to the practical application and reference standards.The communication cable can be either twisted pair or shielded twisted pair cable and should be kept away from interference sources. In long-distance network application, the terminal resistors should be selected according to the communication distance, the cable impedance and the node quantity.

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