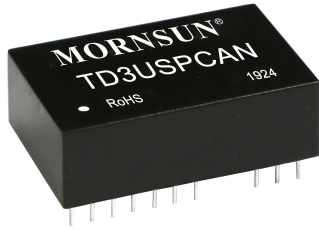**MORNSUN®**

Isolated UART/SPI T to CAN Module

CE Report   RoHS
EN62368-1

FEATURES

● Built-in high efficiency isolated power supply

● Two-port isolation test voltage （3kVDC）

● UART baud rate up to 921.6kbps

● SPI rate up to 1.5Mbps

● CAN baud rate up to 1Mbps

● Supporting transparent conversion, transparent tape identification conversion, custom protocol conversion

● Supports two-way data communication between UART/SPI and CAN interface

● Operating ambient temperature range: - 40℃ to + 85℃

● The bus supports maximum 110 nodes

● Set isolation and ESD bus protection in one

The main function of TD5(3)USPCAN series is to convert UART/SPI signal into CAN bus differential level to realize signal interface expansion and isolation. TD5(3)USPCAN is a communication conversion module that integrates microprocessor, CAN transceiver, power isolation and signal isolation.

The product is compatible with UART/SPI interface, can be directly embedded into the device with UART/SPI interface, and expands more CAN communication interface on UART/SPI device to realize data communication between UART/SPI device and CAN bus network.

Selection Guide

Certification	Part No.	Power input (VDC)	Static Current (mA) (Max.)	Maximum Operating Current (mA)	UART Baud rate (bps)	SPI Rate (Mbps)	Can Baud rate (bps)	Number of Nodes
EN	TD3USPCAN	3.3	40	110	300 - 921600	0 - 1.5	5k - 1M	110
	TD5USPCAN	5	40	105	300 - 921600	0 - 1.5	5k - 1M	110

Absolute Limits

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Supply Voltage	3.3V series	--	--	3.6	VDC
	5.0V series	--	--	5.5	
Pin Soldering Temperature	Soldering spot is 1.5mm away from case for 10 seconds	--	--	300	℃

Input Specifications

Item		Symbol	Min.	Typ.	Max.	Unit
TD3USPCAN Power Supply Input Voltage		VCC	3.15	3.3	3.45	
TD5USPCAN Power Supply Input Voltage			4.75	5.0	5.25	
TXD Logic Level	High-level	V_{OH}	2.75	--	--	VDC
	Low-level	V_{OL}	--	--	0.4	
RXD Logic Level	High-level	V_{IH}	2.31	--	5	
	Low-level	V_{IL}	0	--	0.99	
Serial Interface		Standard UART interface				

Time Specifications[1]

Item	Symbol	Min.	Typ.	Max.	Unit
Reset Low Hold Time	t_{RST_HOLD}	100	-	-	us
Initialization Wait Time	t_{INIT_WAIT}	3	-	-	ms
UART Frame Interval[2]	$t_{FRAM\_INTER\_UART}$	$10*n / f_{CLK\_UART}$	-	-	s

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			Min.	Typ.	Max.	Unit
SPI Frame Interval		$t_{FRAM\_INTER\_SPI}$	40	-	-	us
SPI State Switching Operation Delay		t_{SWITCH_WAIT}	50	-	-	us
State Hold Time after SPI Write Operation		t_{WRITE_HOLD}	5	-	-	us
Waiting Time after Configuration	Read Configuration	t_{CFG_WAIT}	150	—	—	ms
	Read Configuration		3	—	—	
	Verify Product Identification		3	—	—	

Note: (1) Timing diagram with reference to Figure 1 ~ Figure 5
(2) n is the number of UART frame interval characters actually configured by the user.

Output Specifications

Item		Symbol	Min.	Typ.	Max.	Unit
Dominant Level (Logic 0)	CANH	$V_{(OD)CANH}$	2.75	3.5	4.5	VDC
	CANL	$V_{(OD)CANL}$	0.5	1.5	2	
Recessive Level (Logic 1)	CANH	$V_{(OR)CANH}$	2	2.5	3	
	CANL	$V_{(OR)CANL}$	2	2.5	3	
Differential Level	Dominant Level (Logic 0)	$V_{diff(d)}$	1.5	2	3	
	Recessive Level (Logic 1)	$V_{diff(r)}$	-0.05	0	0.05	
Bus Pin Maximum Withstand Voltage		V_x	-36	--	+36	
Load Resistance Differential		R_L	45	60	65	Ω
Input Impedance Differential		R_{diff}	40	--	100	kΩ
CAN Bus Interface		Meets ISO/DIS 11898-2 standard Twisted-pair output				

General Specifications

Item	Operating Conditions	Value
Isolation Test	Electric strength test for 1 min., leakage current <1mA	3 kVDC
Insulation Resistance	At 500VDC	1000MΩ (CAN bus - others)
Operating Temperature		- 40℃ to + 85℃
Transportation and Storage Temperature		- 50℃ to + 105℃
Operating Humidity	Non-condensing	10% - 90%
Safety Standard		EN62368-1 (Report)

Mechanical Specifications

Case Material	WH9100-F (UL94 V-0)
Package	DIP24
Weight	11.4g(Typ.)
Cooling Method	Free air convection

Electromagnetic Compatibility (EMC)

Immunity	ESD	IEC/EN 61000-4-2 Contact±2kV/ Air±4kV	Perf. Criteria B
	EFT	IEC/EN 61000-4-4 ±2kV	Perf. Criteria B
	Surge	IEC/EN 61000-4-5 ±2kV(line to ground)	Perf. Criteria B
	CS	IEC/EN 61000-4-6 3Vr.m.s	Perf. Criteria A

Note：Only for the CAN communication port, CANH, CANL or CGND, the CAN bus port is left floating during the test.
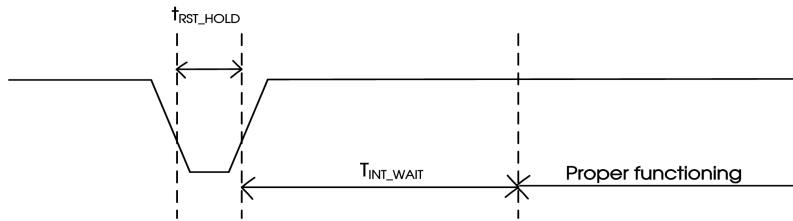
Working Sequence Diagram
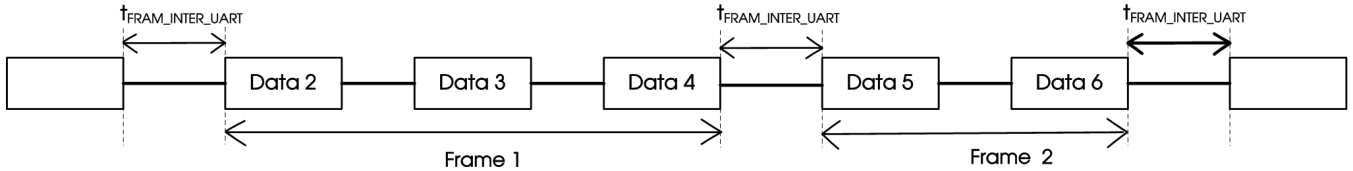

Fig. 1 Reset timing diagram
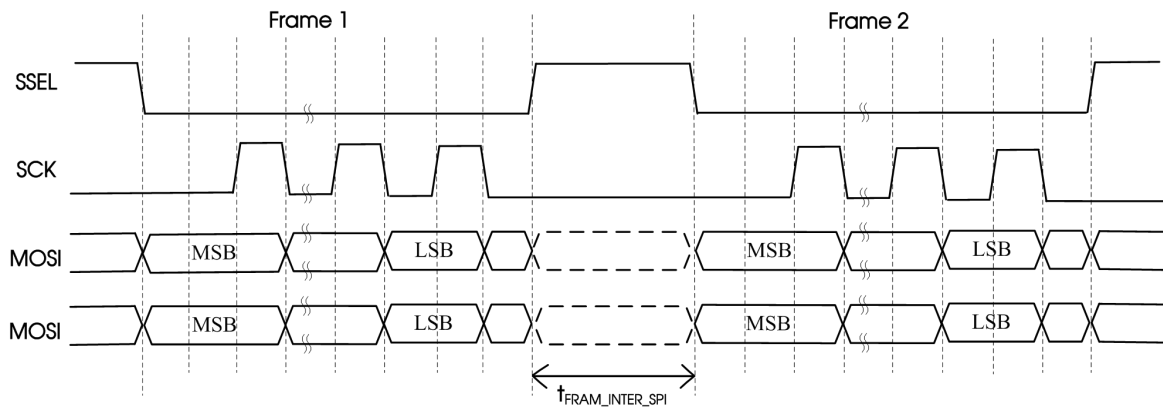

Fig. 2 UART frame interval
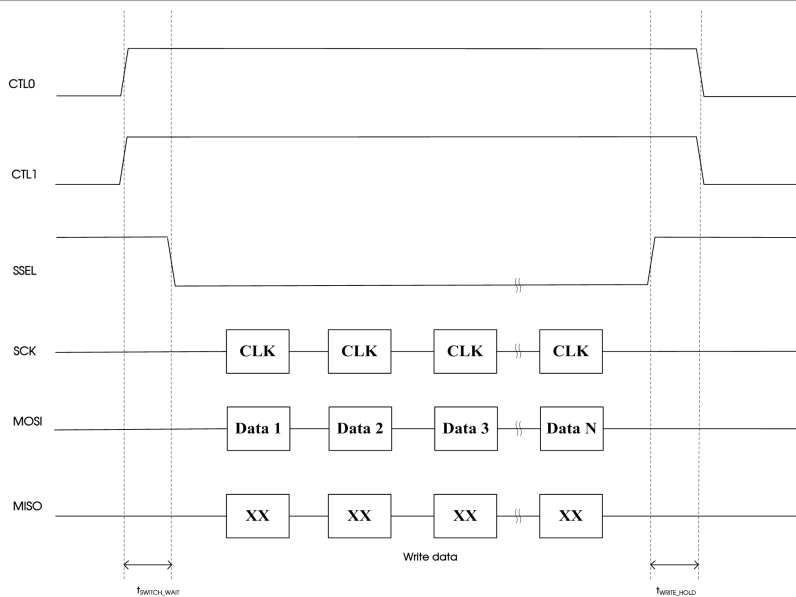

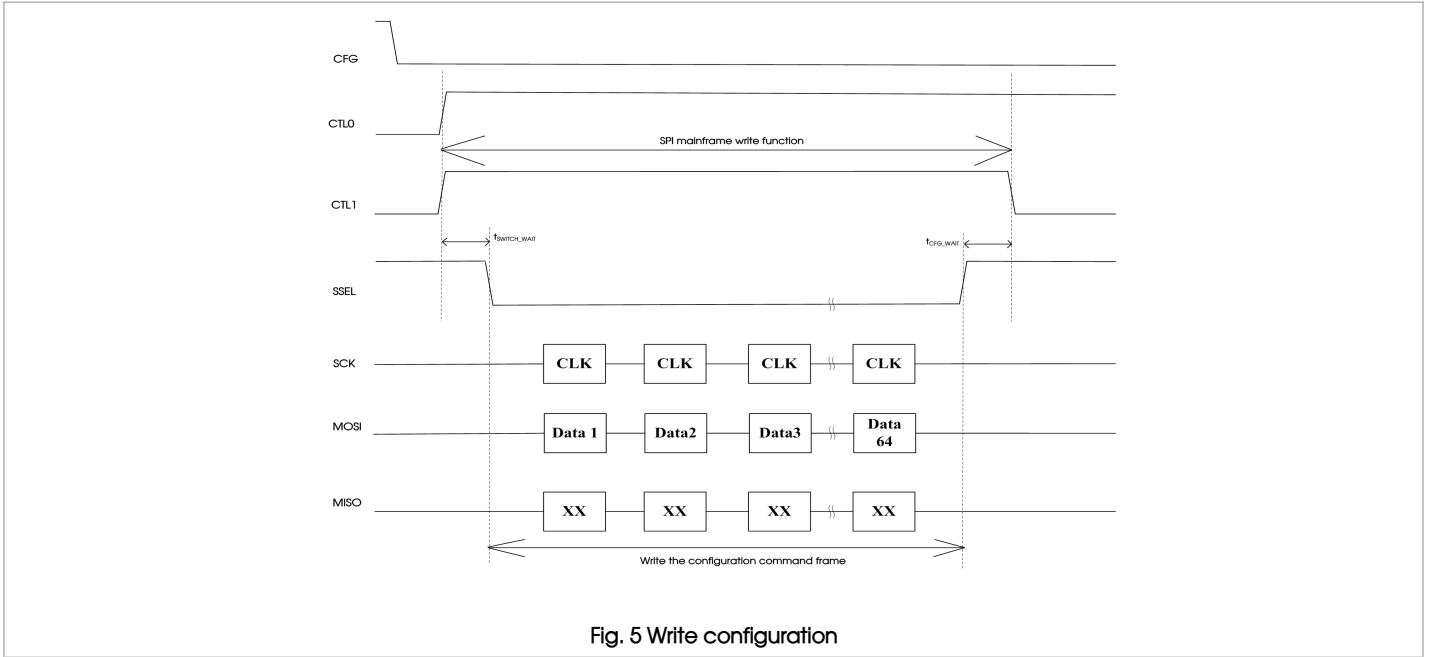Fig. 3 SPI frame interval

Fig. 4 SPI state switching

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Fig. 5 Write configuration

Application Precautions

1. Carefully read and follow the instructions before use; contact our technical support if you have any question;
2. Do not use the product in hazardous areas;
3. Use only DC power supply source for this product. 220V AC power supply is prohibited;
4. It is strictly forbidden to disassemble the product privately in order to avoid product failure or malfunction.
5. Hot-swap is not supported.

After-sales service

1. Factory inspection and quality control are strictly enforced before shipping any product; please contact your local representative or our technical support if you experience any abnormal operation or possible failure of the module;
2. The products have a 3-year warranty period, from the date of shipment. The product will be repaired or exchanged free of charge within the warranty period for any quality problem that occurs under normal use.

Design Reference

1. SPI to CAN hardware circuit

When using the SPI to CAN function, the MODE pin needs to be tied high. The SPI interface of the MCU is connected to the SPI interface of the TD5(3)USPCAN. At the same time, the MCU needs to provide GPIO connection with RST, INT, CTL0 and CTL1 pins to realize effective monitoring and control of TD5(3)USPCAN. If the TD5(3)USPCAN needs to be configured through the MCU, an additional GPIO is required to connect to the CFG pin. Figure 6 and Figure 7 are the reference circuits of TD3USPCAN and TD5USPCAN, respectively.
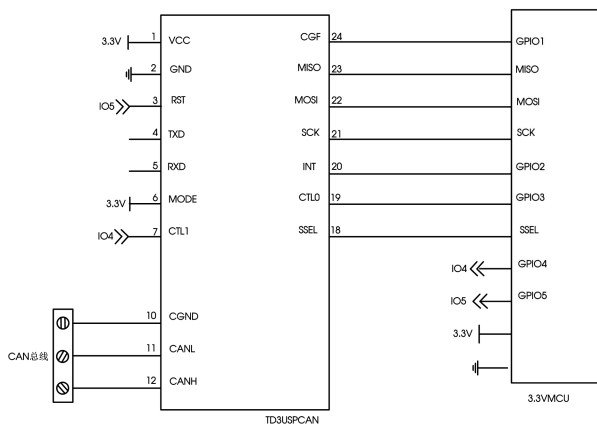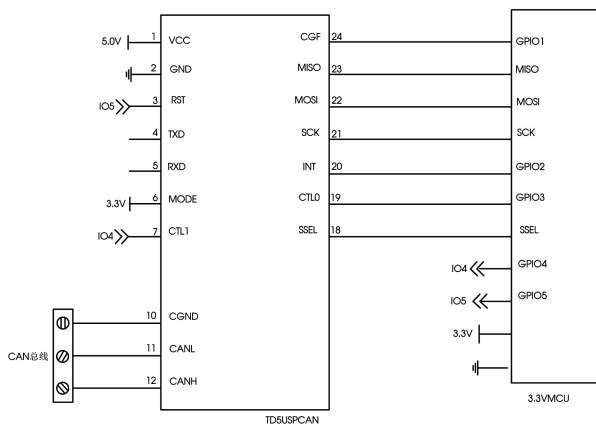

Fig. 6

Fig. 7

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2. UART to CAN hardware circuit

When using the UART to CAN function, the MODE pin needs to be tied low. The UART of the MCU is connected to the UART interface of the TD5(3)USPCAN, and a GPIO is connected to the RST pin. If the TD5(3)USPCAN needs to be configured through the MCU, an additional GPIO is required to be connected to the CFG pin. Figure 8 and Figure 9 are the reference circuits of TD3USPCAN and TD5USPCAN, respectively.
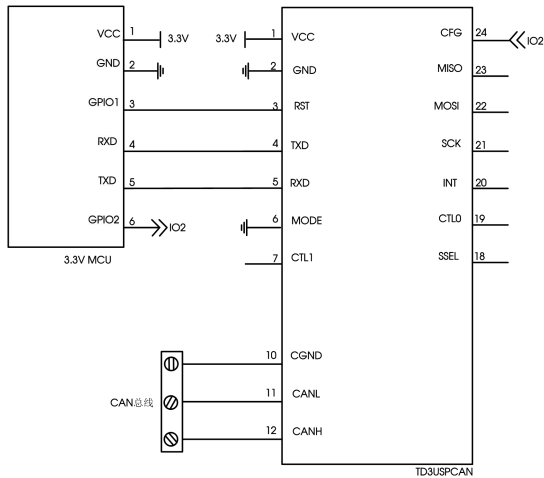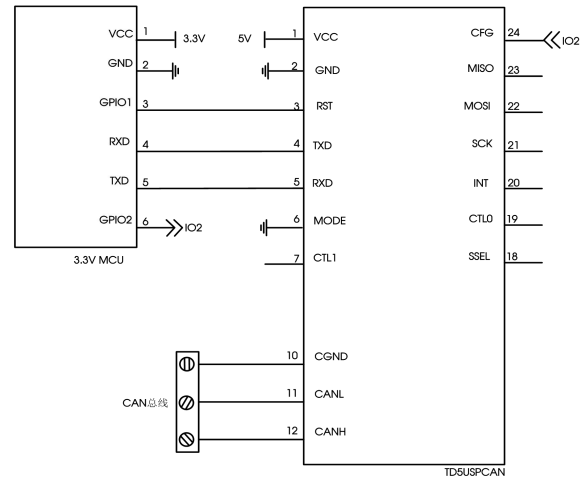

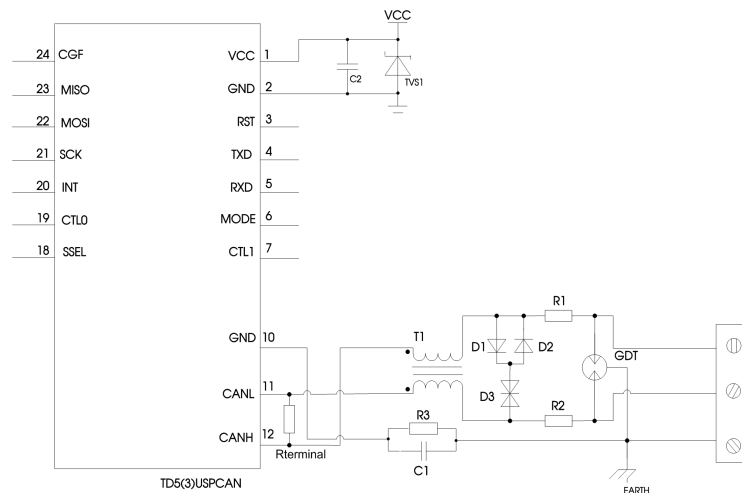Fig. 8

Fig. 9

3. Recommended port protection circuit

Fig. 10

Note: Ground shield of twisted wire pair reliably.
Recommended components and values:

Component	Recommended part, value	Component	Recommended part, value
R3	1MΩ	R1、R2	2.7Ω /2W
C1	1nF, 2kV	D1、D2	1N4007
T1	ACM2520-301-2P	D3	SMBJ30CA
GDT	B3D090L	TVS1	SMBJ5.0A(TD3USPCAN)/SMBJ6.5A（TD5USPCAN）
C2	10uF,25V	Rterminal	120Ω

When the module is used in applications with harsh environment, it can be susceptible to large energy like lightning strike, etc. in which case, it is essential to add an adequate protection circuit to the CAN signal ports to protect the system from failure and maintain a reliable bus communication. Figure 10 provides a recommended protection circuit design for high-energy lightning surges, with a degree of protection related to the selected protection device. Parameter description lists a set of recommended circuit parameters, which can be adjusted according to the actual application situation. Also, when using the shielded cable, the reliable single-point grounding of the shield must be achieved.

Note: The recommended components that will change the Specifications of Bus Pin Maximum Withstand Voltage by D3 and its values is a general guideline only. It must be verified for the actual user's application. We recommended using PTC's for R1 and R2 and to use fast recovery diodes for D1 and D2.

4. Recommended networking mode

The CAN bus generally uses a linear wiring method. The maximum number of nodes per network is 110, the longest communication distance of the universal module is 10km, and the high-speed support minimum baud rate is 5kbps. Figure 11 is a schematic diagram of the recommended networking.

Note: The communication distance of the bus is related to the communication speed and its field application. It can be designed according to the actual application and reference standard. We recommended the use of a twisted pair or shielded twisted pair as the communication cable and it should be kept away from any sources of interference. For long-distance communication, the terminal resistance value needs to be selected in accordance with the communication distance, the cable impedance and the number of nodes.
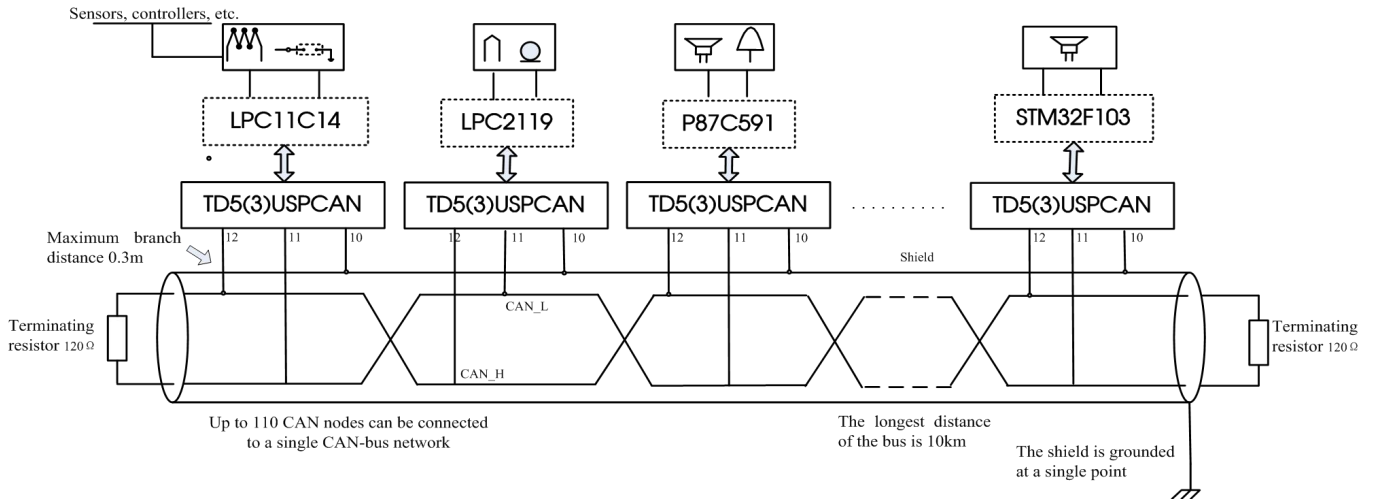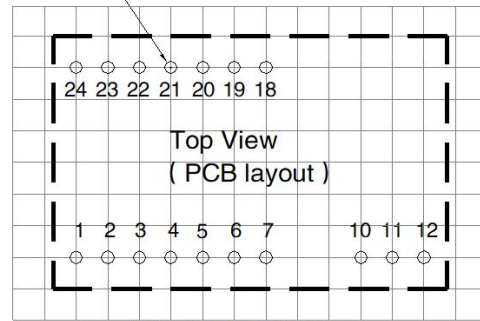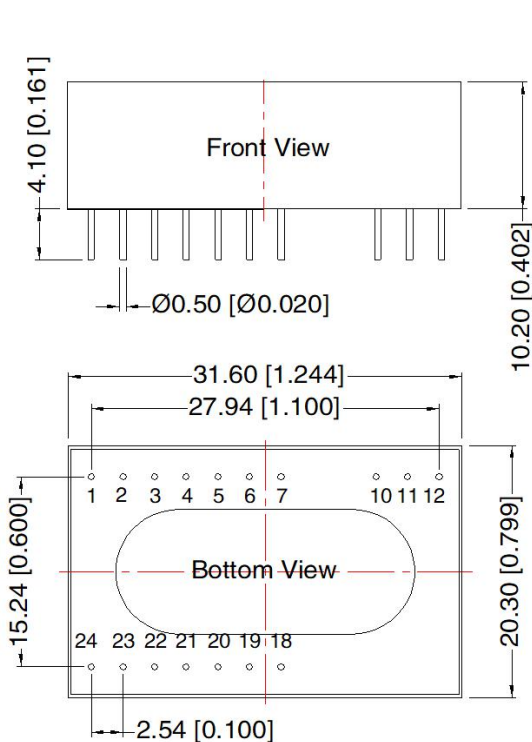
Fig.11

5. Precautions

1)   TD5USPCAN and TD3USPCAN are for 3.3V TTL level only (not compatible with 5V).

6. For additional information, please refer to our application note on www.mornsun-power.com

Dimensions and Recommended Layout

THIRD ANGLE PROJECTION

Ø1.00 [Ø0.039]

Front View

4.10 [0.161]

Ø0.50 [Ø0.020]

10.20 [0.402]

31.60 [1.244]

27.94 [1.100]

15.24 [0.600]

Bottom View

1 2 3 4 5 6 7   10 11 12

24 23 22 21 20 19 18

20.30 [0.799]

2.54 [0.100]

Top View
(PCB layout)

24 23 22 21 20 19 18

1 2 3 4 5 6 7   10 11 12

Note: Grid 2.54*2.54mm

Note:
Unit: mm[inch]
Pin diameter tolerances: ± 0.10[± 0.004]
General tolerances: ± 0.50[± 0.020]

Pin-Out		
Pin	Mark	Function
1	VCC	Input Power+
2	GND	GND
3	RST	Reset Pin
4	TXD	UART Send Pin
5	RXD	UART Receive Pin
6	MODE	Mode Control Pin
7	CTL1	SPI Master Control Pin 1
10	CGND	Isolated Power Output CGND
11	CANL	CANL Pin
12	CANH	CANH Pin
18	SSEL	SPI Chip Select Pin
19	CTL0	SPI Master Control Pin 0
20	INT	Slave Feedback Pin
21	SCK	SPI SCK Pin
22	MOSI	SPI MOSI Pin
23	MISO	SPI MISO Pin
24	CFG	Configuration Pin

Notes:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. The Packaging bag number: 58210008;

2. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity<75%RH with nominal input voltage and rated output load;

3. All index testing methods in this datasheet are based on company corporate standards;

4. The above are the performance indicators of the product models listed in this datasheet. Some indicators of non-standard models will exceed the above requirements. For details, please contact our technical staff;

5. We can provide product customization service, please contact our technicians directly for specific information;

6. Products are related to laws and regulations: see "Features" and "EMC";

7. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.