User's Guide

TCAN1167EVM User's Guide

ABSTRACT

This user's guide details the TCAN1167EVM features and operation. The TCAN1167EVM is configurable to work with TCAN1164-Q1 and TCAN1167-Q1 CAN transceivers. Different termination options, configurations for basic CAN evaluation, and connections for different power supply configurations are all available on the evaluation module. All of the options and the overall operation of the EVM are explained in this user's guide

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1 Trademarks

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2 Introduction

2.1 Features

This EVM supports the following features:

- Standard and split termination on the CAN bus.
- Footprints for filter capacitors, common-mode choke, and TVS diode for CAN bus protection from RF noise and transient pulses.
- DSUB9 connector with the CAN bus signals, VBAT, and GND for typical automotive cable harness connections.
- All digital signals for configuration and control brought out to a header for easy access.
- Pushbutton WAKE circuit for easy local wake.
- Transceiver status indicator LED for monitoring fault conditions.

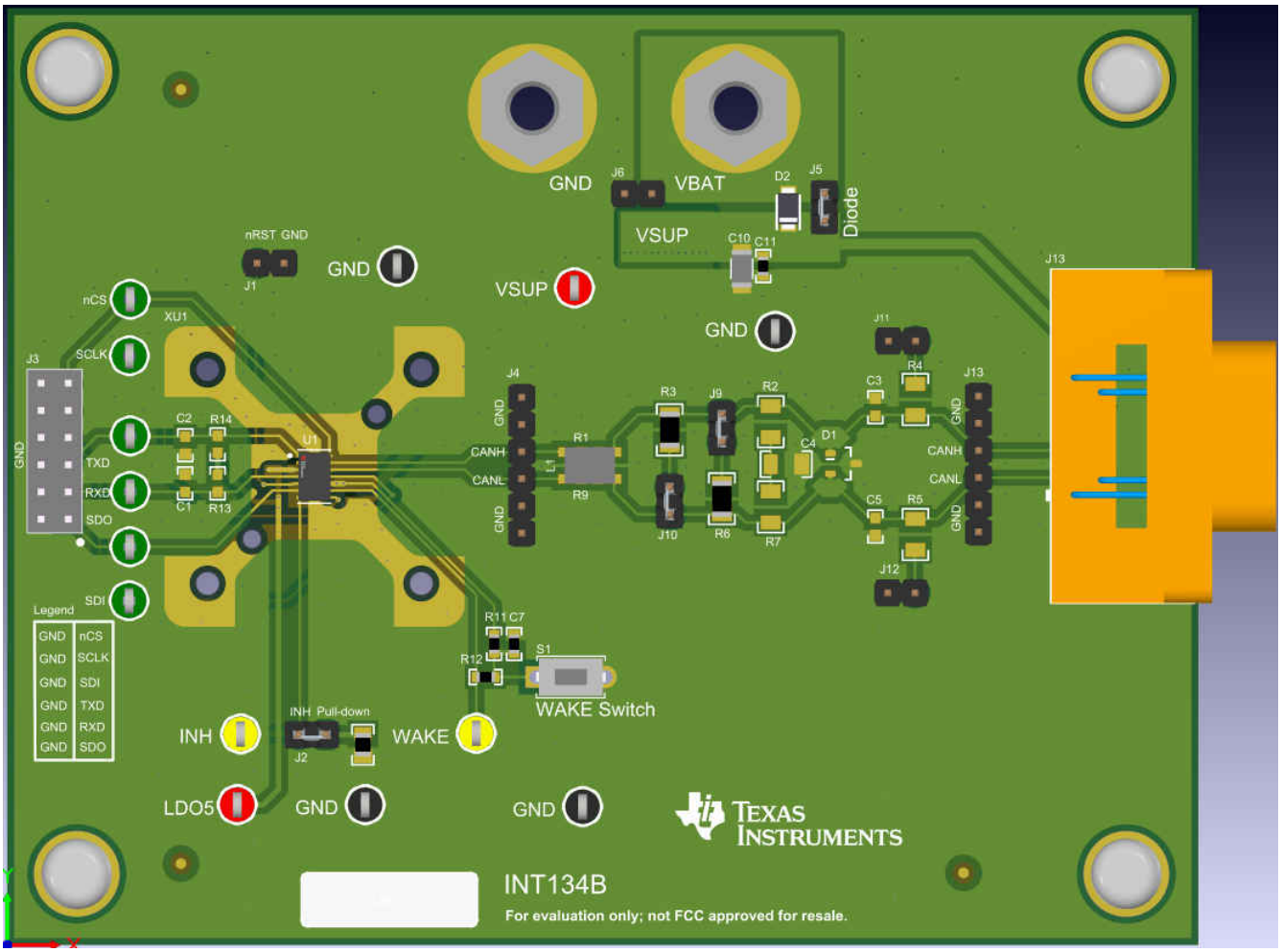

Figure 2-1. EVM Photo

2.2 Description

The TCAN1167EVM provides users with the ability to evaluate the TCAN1164-Q1 and TCAN1167-Q1 CAN transceivers. The only difference between these two devices is the use of pins 7 and 9. TCAN1167-Q1 uses these pins for the INH and WAKE features respectively. TCAN1164-Q1 does not have these features so the pins are left as no connects (NC).

The EVM allows for two termination schemes through a single jumper to select between just split termination configuration, or split with 120-Ω resistor as well.

The primary digital pin signals are available through the J3 header. This allows the user to connect in their own processor to configure and control the transceiver.

The TCAN1164-Q1 and TCAN1167-Q1 support 12-V automotive applications and are operated with a single supply voltage:

- VSUP: 5.5 V to 28 V

The CAN bus also has extended fault protection range of ±58 V. Along with a wide bus fault protection range, there are also footprints for a common-mode choke, TVS diode for ESD protection, and capacitors for further EMC protection or signal conditioning if needed. A DSUB9 connector is included to allow the evaluation and use of the CAN bus in larger systems.

3 EVM Setup and Features Explained

3.1 Evaluation Equipment

Use the following equipment to evaluate the performance of the TCAN1164-Q1 and TCAN1167-Q1:

- Power supply capable of supplying the desired and/or necessary supply voltages
  - VSUP can be supplied through the J7 banana jack.
- An oscilloscope to observe any logic signal or CAN bus signal. Make sure to verify the voltage tolerance of the probes, as well as the impedance and capacitance. These can significantly affect what is seen on the oscilloscope screen.
- A function generator capable of 0 V to 5 V, square wave with a frequency up to 2.5 MHz.
- A multimeter to measure the LDO output voltage.

3.2 Jumpers, Connectors, and Test Points

Table 3-1 lists the jumper configurations and test points on the EVM.

Table 3-1. TCAN1167EVM Jumper, Connector, and Test Point Description

Designator	Description	Function
J1	2x1 TH header	Reset jumper. Manually reset the IC by populating a shunt.
J2	2x1 TH header	INH Pull-down. Includes 110kΩ pull-down when shunted.
J3	6x2 TH header	Main digital IO breakout. Includes all SPI and CAN signal lines. Connect to an offboard processor for mode control and CAN data interfacing.
J4, J13	6x1 TH header	CAN bus access. Monitor CAN bus or connect with offboard transceiver.
J5	2x1 TH header	Vbat diode bypass. Bypass reverse protection diode when shunted.
J6	2x1 TH header	Vbat jumper connection. Supply Vbat from a small cable connection.
J9, J10	2x1 TH header	Termination control. Include 120Ω terminatino resistor when shunted.
J11, J12	2x1 TH header	Noise injection point. Populate series resistor to inject noise onto a signle CAN signal through a fixed impedance.
J13	D9 Connector	Cable connector. Easily connect to a cable harness which utilizes the standard CAN pinout.
TP1	Red multipurpose test point	VSUP test point. Supply the board with VSUP
TP2	Red multipurpose test point	LDO5 test point. Monitor or draw from 5V LDO.
TP3, TP4, TP13, TP14	Black multipurpose test point	GND test point.
TP5	Green multipurpose test point	SCLK test point. Monitor SPI clock input.
TP6	Green multipurpose test point	SDI test point. Montior SPI data in.
TP7	Green multipurpose test point	SDO test point. Monitor SPI data out.
TP8	Green multipurpose test point	nCS test point. Monitor SPI chip select input.
TP9	Green multipurpose test point	RXD test point. Monitor CAN RXD output.
TP10	Green multipurpose test point	TXD test point. Monitor CAN TXD input.
TP11	Yellow multipurpose test point	WAKE test point. Monitor WAKE input signal.
TP12	Yellow multipurpose test point	INH test point. Monitor INH output signal.

3.3 Mode Control

3.3.1 Wake Pushbutton

There is a WAKE pushbutton circuit to easily wake the transceiver from sleep mode. The WAKE pin by default is biased to VSUP on startup. The WAKE pushbutton circuit works by pulling the WAKE pin to ground, causing a logic state change on the pin. To verify the function, place the device into sleep mode, then push down S1, and monitor the INH pin. The INH pin should be in a low logic state before the button is pushed, then pulled up to battery after the button is pushed.

3.3.2 SPI Interface

The SPI interface is used to control the mode and configuration of TCAN1164-Q1 and TCAN1167-Q1. The the device datasheet for SPI format requirements and register map information.

3.4 TXD Input

The TXD input pin is how messages are transmitted to the bus through the transceiver. TXD can be accessed using the main digital IO jumper. There is an optional pull-up resistor for this signal that may be populated to bias the pin state when the transceiver is not active. There is also a footprint for a filter capacitor if desired by the user.

3.5 RXD Output

The RXD output pin is how messages are received from the bus through the transceiver. RXD can be accessed using the main digital IO jumper. There is an optional pull-up resistor for this signal that may be populated to bias the pin state when the signal driver is not active. There is also a footprint for a filter capacitor if desired by the user.

3.6 INH Pull-Down

The INH pin is typically used as a power supply enable for the system. Because INH is a logic high in standby and normal mode, and low in sleep mode, this is used to shut off the entire system into low-power mode via the transceiver sleep mode. When INH is disabled in sleep mode, the pin actually goes into a high-impedance state, not driven low. This can cause the INH high-voltage output to discharge slowly if the device it is connected to does not have a strong path to ground. Populating the INH Pull-down shunt applies a stronger pull-down resistance to INH, forcing the voltage to discharge quickly when the function is disabled. The INH pin can be accessed via INH test point.

4 Schematic and Bill of Materials

The EVM schematic and bill of materials can be referenced for circuit design or component questions.

4.1 Schematic

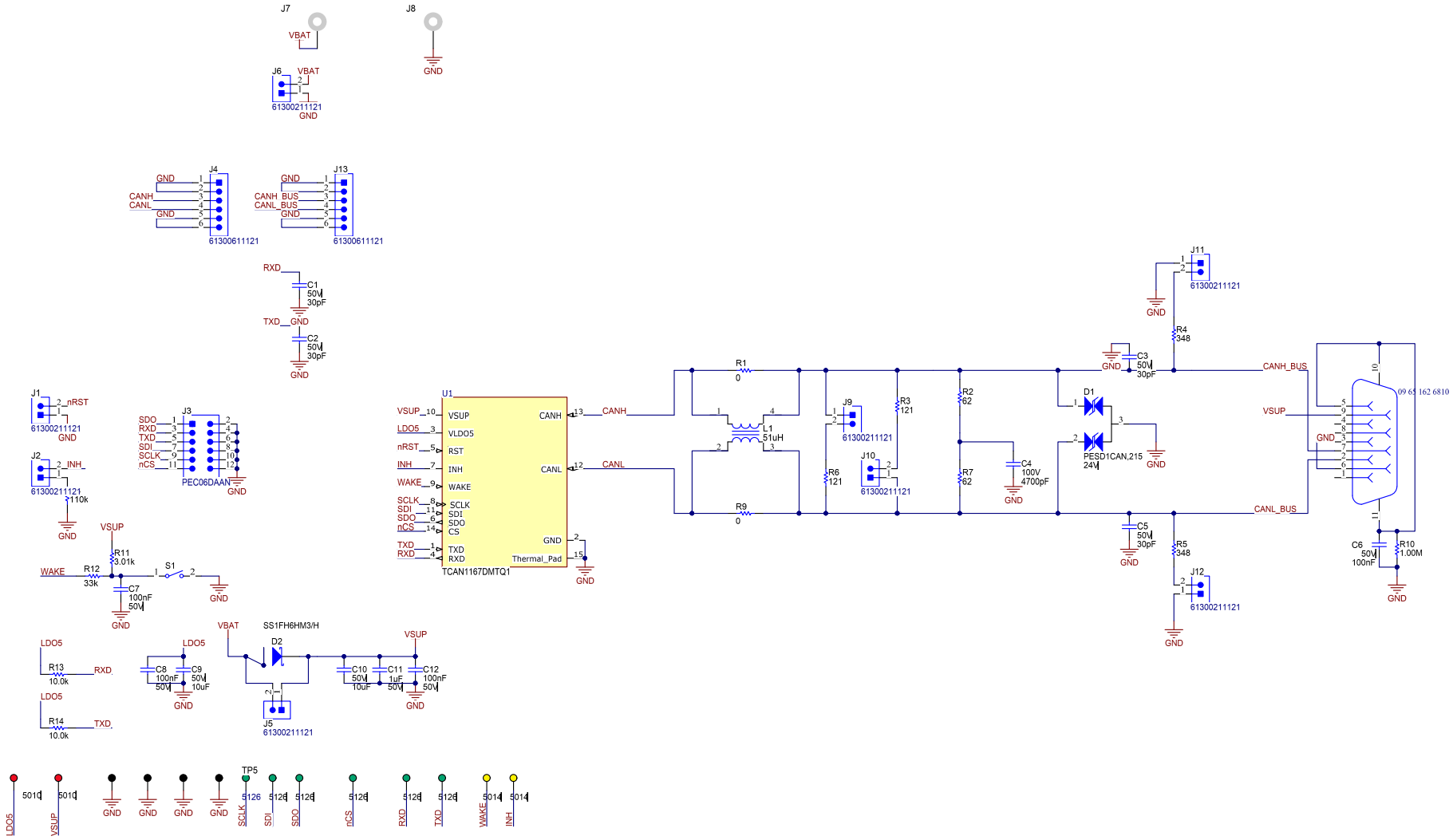

Figure 4-1. TCAN1167EVM CAN Schematic

4.2 Bill of Materials

Table 4-1. Bill of Materials

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
C1, C12	2	10uF	CAP, CERM, 10 uF, 50 V, +/- 10%, X7R, 1206	1206	CL31B106KBHNNNE	Samsung
C8	1	0.1uF	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, 0603	0603	GCM188R71H104KA57D	MuRata
C9, C14	2	0.1uF	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, 0603	0603	C0603C104K5RACTU	Kemet
C13	1	1uF	CAP, CERM, 1 uF, 50 V, +/- 10%, X7R, 0603	0603	UMK107AB7105KA-T	Taiyo Yuden
D3	1	60V	Diode, Schottky, 60 V, 1 A, AEC-Q101, DO-219AB	DO-219AB	SS1FH6HM3/H	Vishay-Semiconductor
H1, H2, H3, H4	4		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	4		Standoff, Hex, 0.5"L #4-40 Nylon	Standoff	1902C	Keystone
J1, J3	2		Standard Banana Jack, Uninsulated	Keystone_6095	6095	Keystone
J4, J12, J13, J14, J15, J16, J17	7		Header, 100mil, 2x1, Gold, TH	Header, 2x1, 100mil	5-146261-1	TE Connectivity
J7	1		Header, 100mil, 6x1, TH	Header, 6x1, 100mil, TH	800-10-006-10-001000	Mill-Max
J10	1		D-Sub-9, 11Pos, Male, TH	D-Sub-9, 2rows, Male, TH	09 65 162 6810	Harting
J11	1		Header, 100mil, 6x2, Tin, TH	Header, 6x2, 100mil, Tin	PEC06DAAN	Sullins Connector Solutions
L1	1	51uH	Coupled inductor, 51 µH, 0.2 A, 1 ohm, AEC-Q200 Grade 0, SMD	SMD, 4-Leads, Body 4.7 x 3.7 mm	ACT45B-510-2P-TL003	TDK
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650 x 0.200 inch	THT-14-423-10	Brady
R5, R8	2	121	RES, 121, 1%, 0.25 W, AEC-Q200 Grade 0, 1206	1206	CRCW1206121RFKEA	Vishay-Dale
R6, R7	2	348	RES, 348, 1%, 0.25 W, AEC-Q200 Grade 0, 1206	1206	CRCW1206348RFKEA	Vishay-Dale
R10	1	110k	RES, 110 k, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW0805110KFKEA	Vishay-Dale
R12	1	1.00Meg	RES, 1.00 M, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	RMCF0603FG1M00	Stackpole Electronics Inc
R13	1	3.01k	RES, 3.01 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06033K01FKEA	Vishay-Dale
R14	1	33k	RES, 33 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060333K0JNEA	Vishay-Dale
S1	1		Switch, Tactile, SPST-NO, 0.05A, 12V, TH	SW, SPST 3.5x5 mm	PTS635SL50LFS	C&K Components
SH-J1, SH-J2, SH-J3, SH-J4, SH-J5	5		CONN SHUNT 1.27MM BLACK		M50-1900005	Harwin
TP2, TP12	2		Test Point, Multipurpose, Red, TH	Red Multipurpose Testpoint	5010	Keystone
TP3, TP4	2		Test Point, Multipurpose, Black, TH	Black Multipurpose Testpoint	5011	Keystone
TP5, TP6, TP7, TP8, TP11, TP13	6		Test Point, Multipurpose, Green, TH	Green Multipurpose Testpoint	5126	Keystone
TP9, TP10	2		Test Point, Multipurpose, Yellow, TH	Yellow Multipurpose Testpoint	5014	Keystone
U1	1		CAN FD System Basis Chip with Watchdog, INH, and WAKE	VSON14	TCAN1167DMTQ1	Texas Instruments
C2, C4, C5, C7	0	30pF	CAP, CERM, 30 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	06035A300JAT2A	AVX
C6	0	4700pF	CAP, CERM, 4700 pF, 100 V, +/- 5%, X7R, 1206	1206	12061C472JAT2A	AVX
D2	0	24V	Diode, TVS, Bi, 24 V, 70 Vc, AEC-Q101, SOT-23	SOT-23	PESD1CAN,215	NXP Semiconductor
FID1, FID2, FID3, FID4, FID5, FID6	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A

Table 4-1. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
R3, R11	0	0	RES, 0, 0%, 0.25 W, AEC-Q200 Grade 0, 0603	0603	RCS06030000Z0EA	Vishay-Dale
R4, R9	0	62	RES, 62, 5%, 0.25 W, AEC-Q200 Grade 0, 1206	1206	CRCW120662R0JNEA	Vishay-Dale
R15, R16	0	10.0k	RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	RMCF0603FT10K0	Stackpole Electronics Inc

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