User's Guide

TCAN1162EVM User's Guide

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ABSTRACT

This user's guide details the TCAN1162EVM features and operation. The TCAN1162EVM is configurable to work with TCAN1162-Q1, TCAN11623-Q1, and TCAN11625-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.
- Monitoring points for CAN bus common-mode.
- Option to supply VIO with integrated LDO on the TCAN11625-Q1 and TCAN11623-Q1.
- Transceiver status indicator LED for monitoring fault conditions.

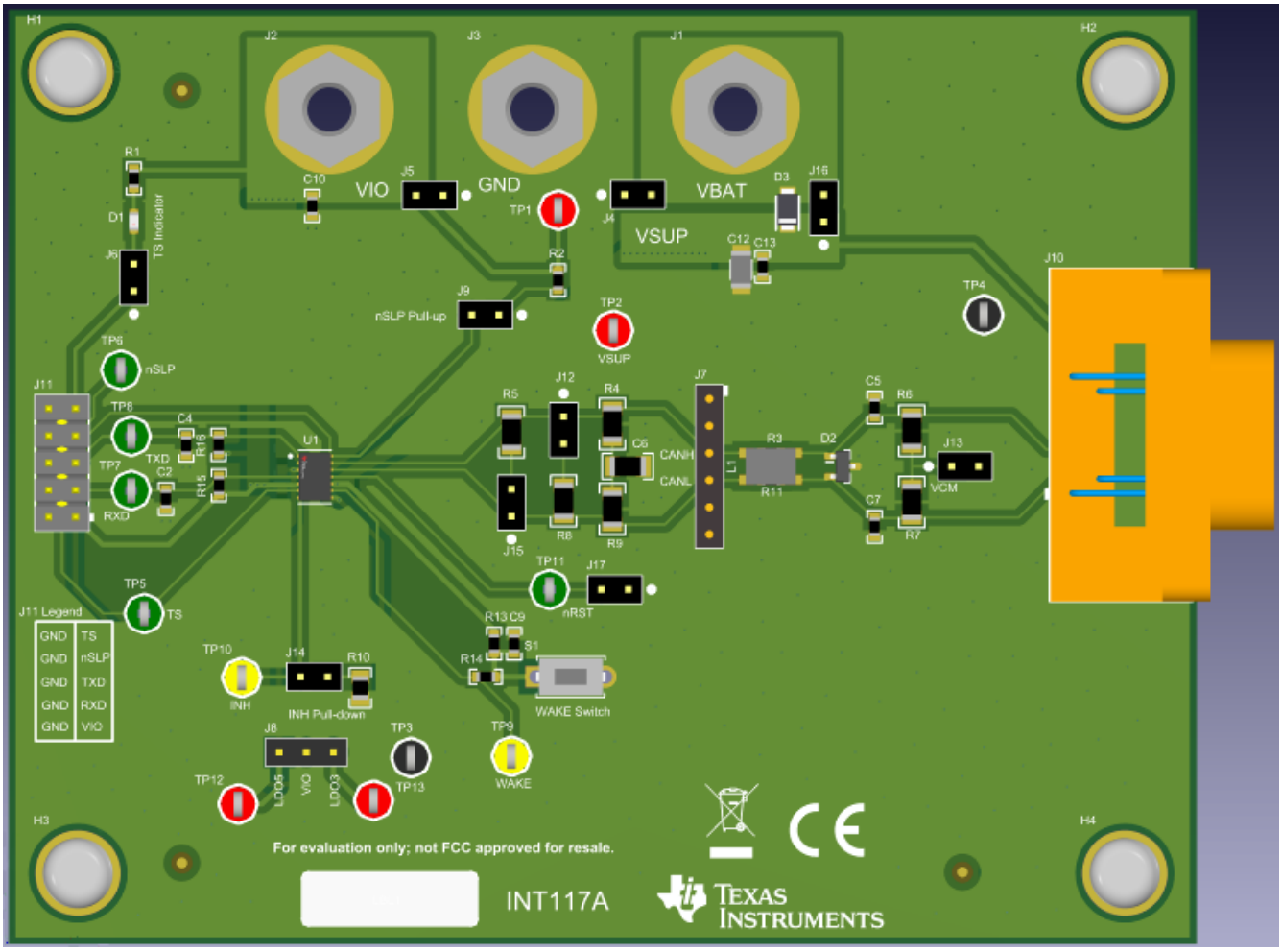

Figure 2-1. EVM Photo

2.2 Description

The TCAN1162EVM provides users with the ability to evaluate the TCAN1162-Q1, TCAN11623-Q1, and TCAN11625-Q1 CAN transceivers. The only difference between these three devices is the integrated LDO supply feature. TCAN1162-Q1 has an integrated LDO to supply the CAN bus from VSUP, but no output, while TCAN11623-Q1 has a 3.3V integrated LDO output, and TCAN11625-Q1 has a 5V integrated LDO output.

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.

All digital pin signals as well as VIO are available through the J11 header. This allows the user to connect in their own processor to configure and control the TCAN1145 device. The TCAN1162 family of devices support IO levels from 1.8 V to 5 V, allowing operation with a variety of processors with common IO voltage levels.

The TCAN1162 family supports 12-V automotive applications and is operated with three supply voltages:

- VSUP: 5 V to 28 V
- VIO: 1.71 V to 5.5 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.

An onboard microprocessor is available to monitor and control the device through SPI ports. A GUI has been written and is available on the web to easily perform different tasks and guide the user through using the different features of the TCAN114X family. Visit the product page on TI.com to gain access to this GUI software.

3 EVM Setup and Features Explained

3.1 Evaluation Equipment

Use the following equipment to evaluate the performance of the TCAN1162 family:

- Power supply capable of supplying the desired and/or necessary supply voltages
  - VIO can be supplied through the J2 banana jack.
  - VSUP can be supplied through the J3 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 if the TCAN11623-Q1 or the TCAN11625-Q1 is being evaluated.

3.2 Jumpers, and Test Points

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

Table 3-1. TCAN1162EVM Jumper and Test Point Description

Designator	Description	Function
J6	2x1 TH header	J6 connects D1 to the TS pin. This enables the indicator LED to illuminate when the TS pin is low.
J8	2x1 TH header	J8 allows the connection of LDO3 (TCAN11623-Q1) or LDO5 (TCAN11625-Q1) to VIO, supplying the IO voltage directly from the integrated LDO on these devices.
J9	2x1 TH header	J9 connects nSLP to VIO through a pull-up resistance. Shorting this jumper with a shunt keeps nSLP high indefinitely, leaving the device out of sleep mode.
J12	2x1 TH header	J12 connects one 120-Ω resistance to the CAN bus.
J14	2x1 TH header	J14 connects INH to GND through a pull-down resistor.
J15	2x1 TH header	J15 connects one 120-Ω resistor to the CAN bus.
J16	2x1 TH header	J16 shorts VBAT and VSUP together, bypassing the reverse-protection diode.
TP1	Red multipurpose test point	TP1 allows the user to probe the VIO pin of the TCAN1162-Q1 device.
TP2	Red multipurpose test point	TP2 allows the user to probe the VSUP pin of the TCAN1162-Q1 device.
TP3, TP4	Black multipurpose test point	TP3 and TP4 are connected to GND.
TP5	Green multipurpose test point	TP5 allows the user to probe the TS pin of the TCAN1162-Q1 device.
TP6	Green multipurpose test point	TP6 allows the user to probe the nSLP pin of the TCAN1162-Q1 device.
TP7	Green multipurpose test point	TP7 allows the user to probe the RXD pin of the TCAN1162-Q1 device.
TP8	Green multipurpose test point	TP8 allows the user to probe the TXD pin of the TCAN1162-Q1 device.
TP9	Yellow multipurpose test point	TP9 allows the user to probe the WAKE pin of the TCAN1162-Q1 device.
TP10	Yellow multipurpose test point	TP10 allows the user to probe the INH pin of the TCAN1162-Q1 device.
TP11	Green multipurpose test point	TP11 allows the user to probe the nRST pin of the TCAN1162-Q1 device.
TP12	Red multipurpose test point	TP12 allows the user to probe the LDO5 pin if the TCAN11625-Q1 device is populated on the PCB.
TP13	Red multipurpose test point	TP13 allows the user to probe the LDO3 pin oi the TCAN11623-Q1 device is populated on the PCB.

3.3 Connectors

Table 3-2 lists the connectors available on the TCAN1162EVM.

Table 3-2. TCAN1162EVM Connector Description

Designator	Description	Function
J1	Banana Jack	VSUP supply connection for EVM
J2	Banana Jack	VIO supply connection for EVM
J3	Banana Jack	Power return (GND) supply connection for EVM
J4	2x1 Header	Two-pin header for VSUP and GND connection
J5	2x1 Header	Two-pin header for VIO and GND connection
J7	6x1 Header	Pins 1 & 2 - GND Pin 3 - CANH Pin 4 - CANL Pins 5 & 6 - GND
J10	DSUB9 Connector	Pin 1 - No connect Pin 2 - CANL Pin 3 - GND Pin 4 - No connect Pin 5 - High impedance connection to GND Pin 6 - GND Pin 7 - CANH Pin 8 - No connect Pin 9 - VSUP
J11	5x2 Header	Pins 2, 4, 6, 8, 10 - GND Pin 1 - VIO Pin 3 - RXD Pin 5 - TXD Pin 7 - nSLP Pin 9 - TS
J13	2x1 Header	Pin 1 - CAN bus common-mode signal Pin 2 - GND
J17	2x1 Header	Pin 1 - nRST pin GND

3.4 TS Indication

The TCAN1162-Q1 family of devices have the transceiver status (TS) pin that indicates any faults detected by the transceiver. This pin goes low when a fault is detected; otherwise, it is a logic high. The TCAN1162EVM has an LED connected to the TS pin which illuminates when the TS pin goes low. The J6 jumper must be shunted for this LED to work; otherwise, it will not be connected to the TS pin. Please see the TCAN1162x-Q1 datasheet for more information on the faults detected by the TCAN1162-Q1 family of devices, and what the TS pin indicates specifically.

3.5 Mode Control

3.5.1 Wake Pushbutton

There is a WAKE pushbutton circuit to easily wake the TCAN1162-Q1 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.

3.5.2 nSLP Pull-Up

The nSLP pin controls the mode transitions on the TCAN1162 family of devices.

3.6 TXD Input

The TXD input pin is how messages are transmitted to the bus through the TCAN1145-Q1 CAN transceiver. TXD can be accessed on pin 5 of the J11 jumper, and has a pull-up to VIO populated by default. This pull-up is not necessary for proper function, but if needed can be added by populating R16. There is also a footprint for a filter capacitor if desired by the user.

3.7 RXD Output

The RXD output pin is how messages are received from the bus through the TCAN1145-Q1 CAN transceiver. RXD can be accessed on pin 3 of the J11 jumper, and has a pull-up to VIO populated by default. This pull-up is not necessary for proper function, but if needed can be added by populating R15. There is also a footprint for a filter capacitor if desired by the user

3.8 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 shunt on J14 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 TP10, or J14.

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

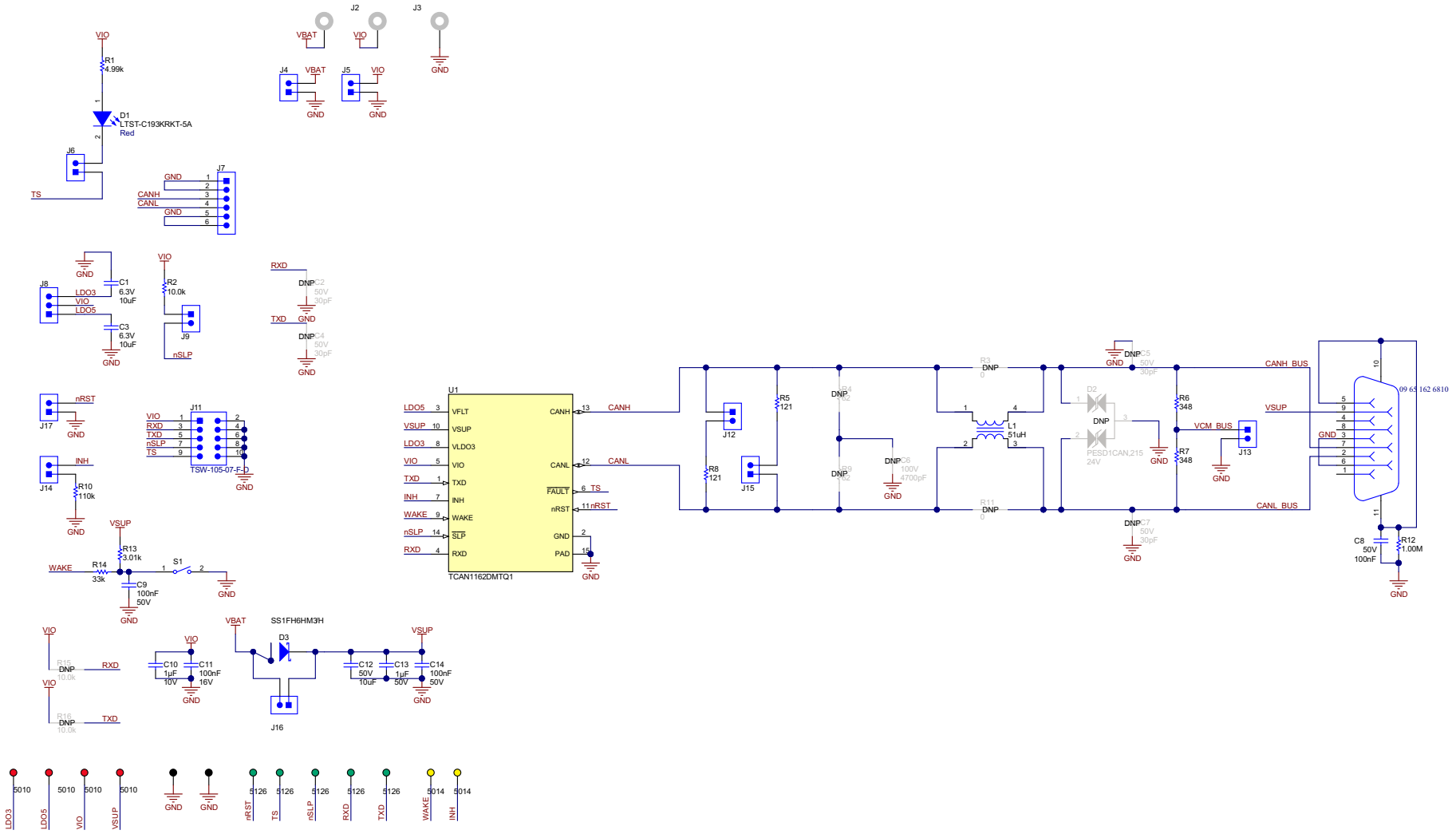

Figure 4-1. TCAN1162EVM CAN Schematic

4.2 Bill of Materials

Table 4-1. Bill of Materials

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
C1, C3	2	10uF	CAP, CERM, 10 uF, 6.3 V, +/- 20%, X7S, 0603	0603	C1608X7S0J106M080AC	TDK
C2, C4, C5, C7	4	30pF	CAP, CERM, 30 pF, 50 V, +/-5%, C0G/NP0, 0603	0603	06035A300JAT2A	AVX
C6	1	4700pF	CAP, CERM, 4700 pF, 100 V, +/-5%, X7R, 1206	1206	12061C472JAT2A	AVX
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, +/- 5%, X7R, 0603	0603	C0603C104K5RACTU	Kemet
C10	1	1uF	CAP, CERM, 1 uF, 10 V, +/- 5%, X7R, AEC-Q200 Grade 1, 0603	0603	C0603X105J8RAC7867	Kemet
C11	1	0.1uF	CAP, CERM, 0.1 uF, 16 V, +/- 10%, X7R, 0603	0603	C0603C104K4RACTU	Kemet
C12	1	10uF	CAP, CERM, 10 uF, 50 V, +/- 10%, X7R, 1206	1206	CL31B106KHBNNNE	Samsung
C13	1	1uF	CAP, CERM, 1 uF, 50 V,+/- 10%, X7R, 0603	0603	UMK107AB7105KA-T	Taiyo Yuden
D1	1	Red	LED, Red, SMD	1.6x0.8mm	LTST-C193KRKT-5A	Lite-On
D2	1	24V	Diode, TVS, Bi, 24 V, 70 Vc, AEC-Q101, SOT-23	SOT-23	PESD1CAN,215	NXP Semiconductor
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, J2, J3	3		Standard Banana Jack, Uninsulated	Keystone_6095	6095	Keystone
J4, J5, J6, J9, J12, J13, J14, J15, J16, J17	10		Header, 100mil, 2x1, Gold, TH	Header, 2x1, 100 mil	5-146261-1	TE Connectivity
J7	1		Header, 100mil, 6x1, TH	Header, 6x1, 100mil, TH	800-10-006-10-0010000	Mill-Max
J8	1		Header, 100mil, 3x1, Gold, TH	PBC03SAAN	PBC03SAAN	Sullins Connector Solutions
J10	1		D-Sub-9, 11Pos, Male, TH	D-Sub-9, 2rows, Male, TH	09 65 162 6810	Harting
J11	1		Header, 2.54mm, 5x2, Gold, Black, TH	Header, 2.54mm, 5x2, TH	TSW-105-05-F-D	Samtec
L1	1	51uH	Coupled inductor, 51 uH, 0.2A, 1 ohm, AEC-Q200 Grade 0, SMD	SMD, 4-Leads, Body 4.7 x 3.7 mm	ACT45B-510-2P-TL003	TDK
R1	1	4.99k	RES, 4.99 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06034K99FKEA	Vishay-Dale
R2	1	10.0k	RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	RMCF0603FT10K0	Stackpole Electronics Inc.
R3, R11	2	0	RES, 0, 0%, 0.25 W, AEC-Q200 Grade 0, 0603	0603	RCS06030000Z0EA	Vishay-Dale
R4, R9	2	62	Res, 62, 5%, 0.25 W, AEC-Q200 Grade 0, 1206	1206	CRCW120662R0JNEA	Vishay-Dale
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

Table 4-1. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
R15, R16	2	10.0k	RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	RMCF0603FT10K0	Stackpole Electronics Inc.
S1	1		Switch, Tactile, SPST-NO, 0.05A, 12V, TH	SW, SPST 3.5x5mm	PTS635SL50LFS	C&K Components
TP1, TP2, TP12, TP13	4		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	5		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 Sleep Mode, WAKE, INH, and Reset	VSON14	TCAN11623DMTQ1	Texas Instruments

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