

UT64CAN333x

Features

- Single 3.3 V supply voltage
- 5 V tolerant digital I/O
- Compatible with ISO 11898-2 and 11898-5 standards
- 10 kbps to 8 Mbps baud rates
- Class 2 ESD for non-CAN bus pins
- Class 3A ESD for CAN bus pins (CANL, CANH)
- Bus-Pin fault protection:
 - ± 36 V terrestrial
 - ± 16 V in orbit
- Common-mode range: -7 to +12 V
- Over current protection
- Low current standby mode: $I_{DD} \leq 1500 \mu\text{A}$
- Cold spare of digital I/O
- Product options:
 - Sleep mode (Figure 1)
 - Diagnostic loopback mode (Figure 2)
 - Loopback for auto-baud mode (Figure 3)
- Packaging: 8-lead ceramic flat pack
- Standard Microelectronics Drawing (SMD)
 - 5962-15232
- QML Q and QML V qualified
- Evaluation board available (UT64CANEVB333x)

Operational Environment

- Total dose: up to 100 krad(Si)
- Single-Event Latch-up immune ($\text{LET} \leq 141 \text{ MeV}\cdot\text{cm}^2/\text{mg}$)

Applications

- Avionic/Aerospace sensor monitoring
- Avionic/Aerospace system telemetry
- Avionic/Aerospace command and control
- Utility Plane Communication
- Smart Sensor Communication
- ARINC825 applications
- Time Triggered (TTP/C and TTP/A) applications

LeanREL

- Now offered in CAES *LeanREL*[™] processing flow
- *LeanREL*[™] includes tri-temp testing, radiation assurance and similar package offering as our QML variants

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Introduction

CAES Semiconductor Solutions UT64CAN333x series of Controller Area Network (CAN) transceivers are developed in accordance with the ISO 11898-2 standard. The CAN transceiver provides the physical layer that permits operation on a differential CAN bus. This series of CAN transceivers are capable of baud rates between 10 kbps to 8 Mbps and include a slope-control mode to control the slew rate of the transmissions for baud rates of up to 500 kbps. A standby mode disables the transmitter circuit to conserve power while monitoring the bus for activity. The UT64CAN333x series of transceivers can support up to 120 nodes.

The three transceiver options are:

- The UT64CAN3330 provides a low power sleep mode of operation
- The UT64CAN3331 supports a bus isolated diagnostic loopback
- The UT64CAN3332 offers the ability to monitor bus traffic enabling the local controller to change its baud rate to match the operations of the bus

Overview

The UT64CAN333x series CAN transceivers are low power serial communications devices developed to handle the demands of harsh space and terrestrial environments. The UT64CAN333x transceivers are compatible with the ISO 11898-2 and 11898-5 standards, operating as the physical layer between the bus and the CAN controller. All of the transceivers operate on a single +3.3 V power supply and receive data with an input common-mode in the range of -7 V to +12 V. The CANH and CANL outputs are fault protected against short-circuits by over-current shutdown circuitry. Each UT64CAN333x CAN transceiver is capable of:

- Operations on any 5 V bus or 3 V bus
 - The CAN bus is not actively driven during recessive (logic high) transmission and actively driven during the dominant (logic low) transmission. During this time, the differential voltage of both 5 V and 3.3 V devices is the same; however, the common mode output voltage will vary between the 5 V and 3.3 V devices. Since the common mode output voltage may vary slightly, CAES recommends that system level testing be performed to understand and maximize the performance of operations when using mixed supply CAN buses. CAES also recommends using split termination to filter common mode high frequency noise from bus lines to reduce emissions.
- Being a cold spare back-up to an active transceiver
- Programmable slew control on the bus driver
- Operating at baud rates up to 8 Mbps
- Low-power standby mode. The standby mode permits the transceiver to enter a low-current, listen only, mode by disabling the driver while the receiver remains active. The local controller has the option to disable low-power standby mode when bus activity resumes
- The RS pin on the UT64CAN333x series CAN transceivers provides three functional modes of operation:
 - High-speed: The high-speed mode of operation is selected by connecting RS (pin 8) directly to ground, allowing the driver output to achieve a baud rate up to 8 Mbps
 - Slope control: The rise and fall slopes are adjusted by connecting a resistor to ground at RS (pin 8). The slope of the driver output signal is proportional to the pin's output current. This slope control is implemented with an external resistor value between 10 k Ω to 100 k Ω , where these resistor values control the slew rates between ~ 2.0 V/ μ s to ~ 20 V/ μ s, respectively
 - Low-power standby mode: If RS is set to a high-level input ($> 0.75 \cdot V_{DD}$), the transceiver enters a low-current, listen only mode of operation. In this mode, the CAN bus driver is disabled and the receiver remains active. The CAN controller has ability to disable low-power standby mode once bus activity resumes

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Along with the common functionality described, the UT64CAN333x family of transceivers includes three members, each with a unique mode of operation.

The UT64CAN3330, Figure 1, provides the option to place the transceiver into a low power sleep mode to conserve power when CAN activity is suspended. Sleep mode disables the driver and receiver circuit when the \overline{ZZ} pin is biased $\leq V_{IL}$. The part resumes operations when the \overline{ZZ} pin is biased $\geq V_{IH}$.

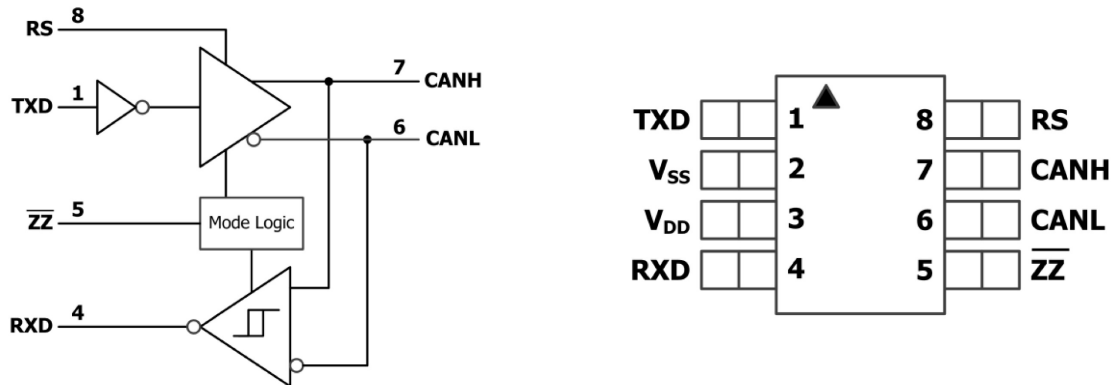


Figure 1: UT64CAN3330 (Sleep)

The UT64CAN3331, Figure 2, provides the option to isolate the transceiver bus connections to permit local node diagnostics, without interrupting operations on the bus. Diagnostic Loopback mode is enabled when the LBK pin is biased $\geq V_{IH}$. Diagnostic Loopback mode is disabled when the LBK pin is biased $\leq V_{IL}$. In the Diagnostic Loopback mode, the CANH/CANL output is placed in the recessive mode. Also, the connection between TXD and RXD is made through the mode logic and connection and the connections for TXD and RXD are isolated from CANH/CANL.

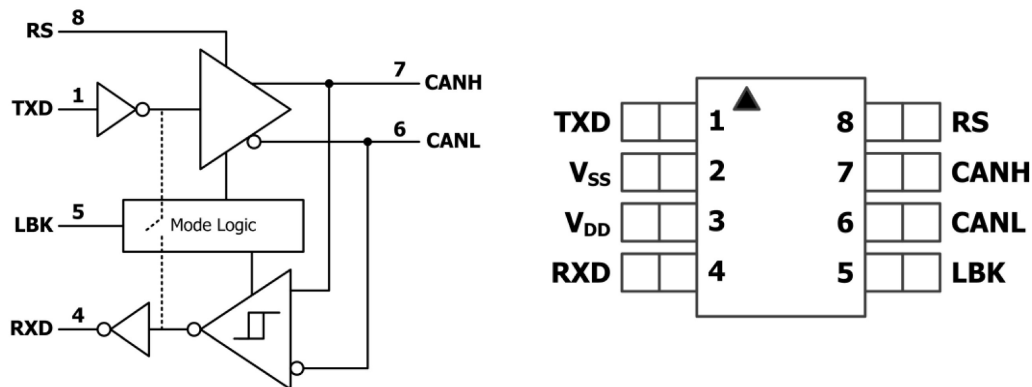


Figure 2: UT64CAN3331 (Diagnostic Loopback)

The UT64CAN3332, Figure 3, provides the option to automatically synchronize the baud rate of the transceiver by matching the bit timing to the traffic on the bus. The Auto Baud Loopback mode is enabled when the AB pin is biased $\geq V_{IH}$. Auto Baud Loopback mode is disabled when the AB pin is biased $\leq V_{IL}$. In the Auto-Baud mode, the CANH/CANL output is placed in the recessive mode.

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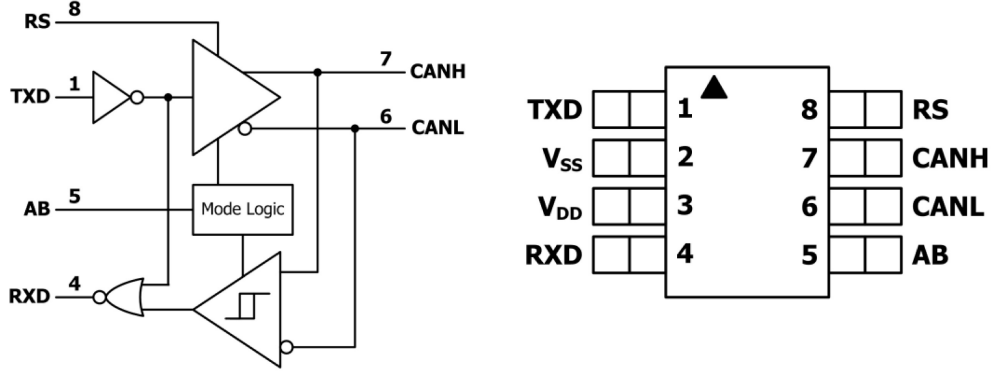


Figure 3: UT64CAN3332 (Auto-Baud Loopback)

Equivalent Input and Output Schematic Diagrams

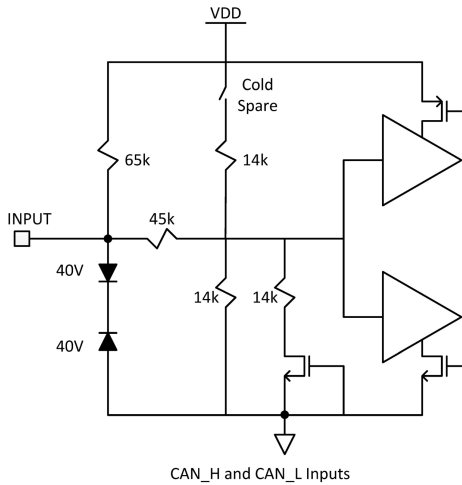


Figure 4. CANH and CANL Inputs

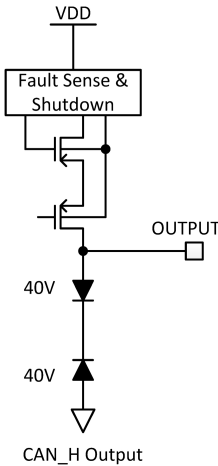


Figure 5. CANH Output

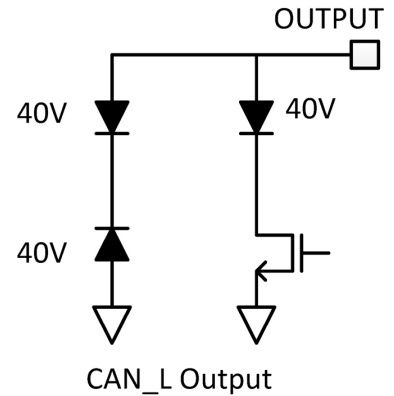


Figure 6. CANL Output

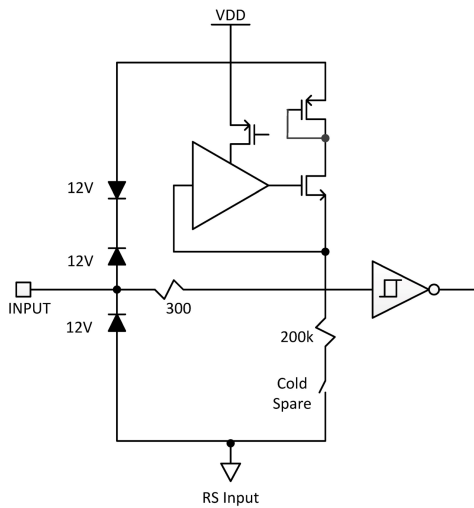


Figure 7. RS Input

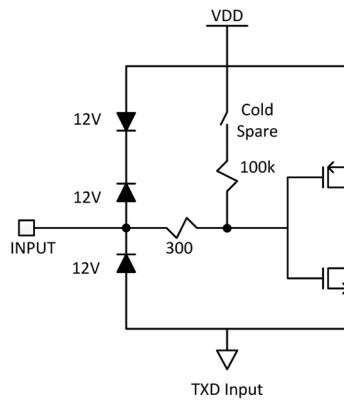


Figure 8. TXD Input

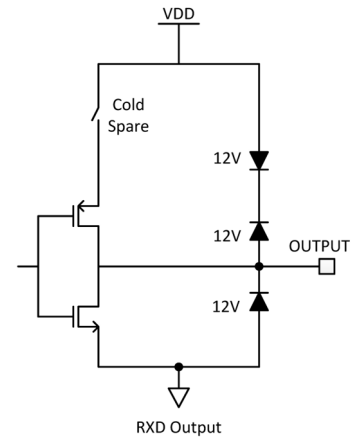


Figure 9. RXD Output

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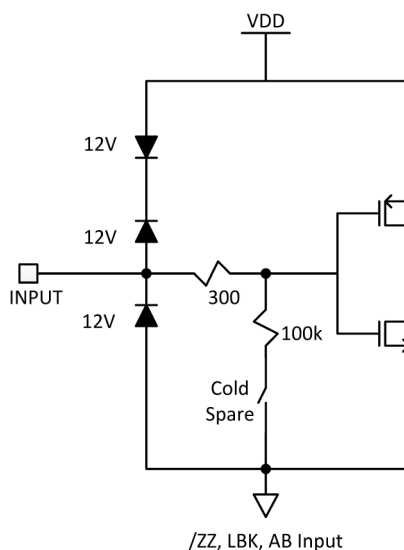


Figure 10. /ZZ, LBK, or AB Input

Pinlist

- I = LVTTTL Compatible Input
- IPU = LVTTTL Compatible Input with Internal Pull-up
- IPD = LVTTTL Compatible Input with Internal Pull-down
- O = LVTTTL Compatible Output
- I/O = LVTTTL Compatible Bi-Direct
- AI = Analog Multi-Function Input
- AO = Analog Output
- DIO = Differential Input/Output

Table 1: Pinlist

Number	Name	Type	Default	Description
1	TXD	IPU	--	Driver Input Data
4	RXD	O	*	Receiver Output Data
7	CANH	DIO	*	High-Level CAN Voltage Input/Output
6	CANL	DIO	*	Low-Level CAN Voltage Input/Output
5	\overline{ZZ}	IPD	--	Active LOW, low-current sleep mode - driver/receiver circuits deactivate (UT64CAN3330 only)
	LBK	IPD	--	Active High, diagnostic loopback mode pin (UT64CAN3331 only)
	AB	IPD	--	Active HIGH, bus listen-only loopback mode pin (UT64CAN3332 only)
8	RS	AI	0.7V	Operational Mode Select: <ul style="list-style-type: none"> Slope Control High speed Standby
3	VDD	POWER	--	Supply voltage
2	VSS	POWER	--	Ground

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Note:

*Output follows the input (TXD = Logic Low (Dominant) causes CANH-CANL = 3.0V (Dominant) and RXD = Logic Low (Dominant) or input (TXD = Logic High (Recessive) causes CANH-CANL = 0V (Recessive) and RXD = Logic High (Recessive))

Absolute Maximum Ratings ^(1, 2)**Table 2: Absolute Maximum Ratings**

Symbol	Parameter	MIN	MAX	Units
V _{DD}	Supply Voltage Range	-0.3	6.0	V
V _{I/O}	Voltage on TTL pins during operation RXD, TXD, RS, AB, \overline{ZZ} , LBK	-0.3	5.5	V
V _{CANH/L}	Voltage on CANH and CANL bus terminal pin (On-orbit) ⁽³⁾	-16	+16	V
	Voltage on CANH and CANL bus terminal pin (Terrestrial) ⁽³⁾	-36	+36	V
I _{I/O}	LVTTL Input/Output DC Current	-10	+10	mA
θ _{JC}	Thermal resistance, junction-to-case	--	15	°C/W
T _J	Junction Temperature	--	+150	°C
T _{STG}	Storage Temperature	-65	+165	°C
P _D	Maximum package power dissipation permitted at T _C =125°C ⁽⁴⁾	--	1.67	W
ESD _{HBM}	ESD Protection (CANL, CANH) ⁽⁵⁾	--	4000	V
ESD _{HBM}	ESD Protection (TXD, RXD, RS, \overline{ZZ} , AB, LBK) ⁽⁵⁾	--	2000	V

Notes:

- 1) Stresses outside the listed absolute maximum ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond limits indicated in the operational sections of this specification are not recommended. Exposure to absolute maximum rating conditions for extended periods may affect device reliability and performance.
- 2) All voltages referenced to V_{SS}
- 3) Radiation effects can adversely affect the reliability and performance of the device during this condition. Contact a factory representative to evaluate the reliability based on the exposure to radiation.
- 4) Per MIL-STD-883, method 1012, section 3.4.1, P_D=(T_J(max)-T_C(max))/θ_{JC}
- 5) Per MIL-STD-883, method 3015, Table 3

Operational Environment ⁽¹⁾**Table 3: Operational Environment**

Symbol	Parameter	Limit	Units
TID	Total Ionizing Dose ⁽²⁾	100	krad(Si)
SEL	Single Event Latchup Immunity ⁽³⁾	≤ 141	MeV-cm ² /mg

Notes:

- 1) For devices procured with a total ionizing dose tolerance guarantee, post-irradiation performance is guaranteed at 25°C per MIL-STD-883 Method 1019, Condition A up to maximum TID level procured.
- 2) Per MIL-STD-883, method 1019, condition A
- 3) SEL is performed at VDD = 3.6V at 125°C

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Recommended Operating Conditions ⁽¹⁾

Table 4: Recommended Operating Conditions

Symbol	Parameter	MIN	MAX	Units		
V _{DD}	Supply Voltage Range	3.0	3.6	V		
V _{CANH}	Voltage on CANH bus terminal pin	-7.0	+12.0	V		
V _{CANL}	Voltage on CANL bus terminal pin	-7.0	+12.0	V		
T _C	Case Temperature Range	-55	+125	°C		
V _{I/O}	Voltage on TTL pins during operation RXD, TXD, RS, AB, \overline{ZZ} , LBK	0	5.5	V		
V _{ID}	Differential input voltage	-6	6	V		
RS _{BIAS}	Bias input to RS pin for standby	0.75*V _{DD}	V _{DD}	V		
	Resistor value between the RS pin and ground for slope control	10	100	kΩ		
	Bias input to RS pin for high speed (8 Mbps)	V _{SS}	0.3	V		
I _{OHC}	High-level output current	CANH, CANL		-50	--	mA
I _{OLC}	Low-level output current	CANH, CANL		--	50	mA
I _{IHC}	High-level input current	CANH, CANL		-10	--	mA
I _{ILC}	Low-level input current	CANH, CANL		--	10	mA

Note:

1) All voltages referenced to V_{SS}.

DC Electrical Characteristics ⁽¹⁾

(V_{DD}= 3.3V ± 0.3V, -55°C < T_C < +125°C); Unless otherwise noted, T_C is per the temperature range ordered

Table 5: DC Electrical Characteristics

Symbol	Parameter	Conditions	MIN	MAX	Units
I _{DD1}	Supply current maintaining a dominant output	TXD = 0V, R _L = ∞, RS = 0V, AB = 0V or \overline{ZZ} = V _{DD} or LBK = 0V See Figure 11	--	18	mA
I _{DD2}		TXD = 0V, R _L = 60Ω ±1%, RS = 0V, AB = 0V or \overline{ZZ} = V _{DD} or LBK = 0V See Figure 11	--	60	
I _{DD3}	Supply current receiving a dominant bus input	TXD = V _{DD} , R _L = 60Ω ±1%, RS = 0V, AB = 0V or \overline{ZZ} = V _{DD} or LBK=0V, V _{ID} = 1.4V, V _{IC} = 2.5V See Figure 11	--	3	mA
I _{DD4}	Supply current maintaining a Recessive output	TXD = V _{DD} , R _L = ∞, RS = 0V, AB = 0V or \overline{ZZ} = V _{DD} or LBK = 0V See Figure 11	--	3	mA
I _{DD5}		TXD = V _{DD} , R _L = 60Ω ±1%, RS = 0V, AB = 0V or \overline{ZZ} = V _{DD} or LBK = 0V See Figure 11	--	3	
I _{DD6}		TXD = V _{DD} , R _L = 60Ω ±1%, RS = 0V, AB = 0V or \overline{ZZ} = V _{DD} or LBK = 0V, V _{ID} = 0V, V _{IC} = 2.5V See Figure 11	--	3	

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Symbol	Parameter	Conditions	MIN	MAX	Units
I _{DD7}	Sleep supply current (UT64CAN 3330 only)	TXD = V _{DD} , R _L = ∞, RS = 0V or V _{DD} , $\overline{\text{ZZ}}$ = 0V See Figure 11	--	60	μA
I _{DD7A}		TXD = V _{DD} , R _L = 60Ω ±1%, RS = 0V or V _{DD} , $\overline{\text{ZZ}}$ = 0V See Figure 11		60	
I _{DD8}		TXD = V _{DD} , R _L =60Ω ±1%, RS = 0V or V _{DD} , $\overline{\text{ZZ}}$ = 0V, V _{ID} = 0V, V _{IC} = 2.5V See Figure 11	--	115	
I _{DD9}	Standby supply current	TXD = V _{DD} , R _L = ∞, RS = V _{DD} , AB = 0V or $\overline{\text{ZZ}}$ = V _{DD} or LBK = 0V See Figure 11	--	1.6	mA
I _{DD10}		TXD = V _{DD} , R _L = 60Ω ±1%, RS = V _{DD} , AB = 0V or $\overline{\text{ZZ}}$ = V _{DD} or LBK = 0V See Figure 11	--	1.65	
I _{DD11}		TXD = V _{DD} , R _L = 60Ω ±1%, RS = V _{DD} , AB = 0V or $\overline{\text{ZZ}}$ = V _{DD} or LBK = 0V, V _{ID} = 0V, V _{IC} = 2.5V See Figure 11	--	1.6	
I _{DD12}	Supply Current Under High Voltage Fault ⁽²⁾	TXD = V _{DD} , R _L = ∞, RS = 0V, AB = 0V or $\overline{\text{ZZ}}$ = V _{DD} or LBK = 0V, V _{CANH/L} = +/-24 See Figure 11	--	6	mA
I _{DD13}	Supply Current Operating in Auto Loopback (UT64CAN 3332 only)	TXD = 0V, R _L = ∞, RS = 0V, AB = V _{DD} See Figure 11	--	3	mA
I _{DD13A}		TXD = 0V, R _L = 60Ω ±1%, RS = 0V, AB = V _{DD} See Figure 11	--	3	
I _{DD13B}		TXD = 0V, R _L = 60Ω ±1%, RS = 0V, AB = V _{DD} , V _{ID} =1.4V, V _{IC} =2.5V See Figure 11	--	3	
I _{DD14}	Supply Current Operating in Diagnostic Loopback (UT64CAN 3331 only)	TXD = 0V, R _L = ∞, RS = 0V, LBK = V _{DD} See Figure 11	--	3	mA
I _{DD14A}		TXD = 0V, R _L = 60Ω ±1%, RS = 0V, LBK = V _{DD} See Figure 11	--	3	

Notes:

- 1) All voltages referenced to V_{SS}
- 2) Guaranteed by characterization for V_{CANH/L} = +/-36V

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Driver ⁽¹⁾

(V_{DD} = 3.3V ± 0.3V, -55°C < T_c < +125°C); Unless otherwise noted, T_c is per the temperature range ordered

Table 6: DC Electrical Characteristics

Symbol	Parameter	Conditions	MIN	MAX	Units
V _{CANH1}	Bus output voltage (dominant) CANH	TXD = 0V, R _L = 60Ω ±1%, RS = 0V, AB=0V or $\overline{\overline{Z}}$ = V _{DD} or LBK=0V See Figure 12 and Figure 13	2.25	V _{DD}	V
V _{CANL1}	Bus output voltage (dominant) CANL	TXD = 0V, R _L = 60Ω ±1%, RS = 0V, AB = 0V or $\overline{\overline{Z}}$ = V _{DD} or LBK = 0V See Figure 12 and Figure 13	0.50	1.25	V
V _{CANH2}	Bus output voltage (recessive) CANH	TXD = V _{DD} , R _L = 60Ω ±1%, RS = 0V, AB = 0V or $\overline{\overline{Z}}$ = V _{DD} or LBK = 0V See Figure 12 and Figure 13	2.0	3.0	V
V _{CANL2}	Bus output voltage (recessive) CANL	TXD = V _{DD} , R _L = 60Ω ±1%, RS = 0V, AB = 0V or $\overline{\overline{Z}}$ = V _{DD} or LBK = 0V See Figure 12 and Figure 13	2.0	3.0	V
V _{ODD1}	Differential output voltage (dominant)	TXD = 0V, R _L = 60Ω ±1%, RS = 0V, AB = 0V or $\overline{\overline{Z}}$ = V _{DD} or LBK = 0V See Figure 12 and Figure 13	1.5	3.0	V
V _{ODD2}		TXD = 0V, RS = 0V, V _{TEST} = -7 to +12V, AB = 0V or $\overline{\overline{Z}}$ = V _{DD} or LBK = 0V See Figure 13 and Figure 14	1.2	3.0	
V _{ODR1}	Differential output voltage (recessive)	TXD = V _{DD} , R _L = 60Ω ±1%, RS = 0V, AB = 0V or $\overline{\overline{Z}}$ = V _{DD} or LBK = 0V See Figure 12 and Figure 13	-120	12	mV
V _{ODR2}		TXD = V _{DD} , R _L = ∞, RS = 0V, AB = 0V or $\overline{\overline{Z}}$ = V _{DD} or LBK = 0V See Figure 12 and Figure 13	-500	50	mV
I _{OSH1}	Short-circuit output ⁽²⁾	V _{CANH} = -7V, CANL = ∞, TXD = 0V, RS = 0V, AB = 0V or $\overline{\overline{Z}}$ = V _{DD} or LBK = 0V See Figure 15	-250	--	mA
I _{OSH2}		V _{CANH} = 12V, CANL=∞, TXD = 0V, RS = 0V, AB = 0V or $\overline{\overline{Z}}$ = V _{DD} or LBK=0V See Figure 15	--	3	
I _{OSL1}		V _{CANL} = -7V, CANH = ∞, TXD = 0V, RS = 0V, AB = 0V or $\overline{\overline{Z}}$ = V _{DD} or LBK=0V See Figure 15	-1	--	
I _{OSL2}		V _{CANL} = 12V, CANH = ∞, TXD = 0V, RS = 0V, AB = 0V or $\overline{\overline{Z}}$ = V _{DD} or LBK = 0V See Figure 15	--	250	

Notes:

- 1) All voltages referenced to V_{SS}
- 2) Guaranteed by characterization

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Receiver ⁽¹⁾

(V_{DD} = 3.3V ± 0.3V, -55°C < T_C < +125°C); Unless otherwise noted, T_C is per the temperature range ordered

Table 7: DC Electrical Characteristics

Symbol	Parameter	Conditions	MIN	MAX	Unit
V _{IT+}	Positive-going input threshold voltage	AB = 0V or $\overline{\overline{Z}}$ = V _{DD} or LBK = 0V, V _{IC} = 2.5V See Figure 16 and Table 13	--	900	mV
V _{IT-}	Negative-going input threshold voltage		500	--	
V _{HST}	Hysteresis voltage	V _{HST} = V _{IT+} - V _{IT-}	20	--	
I _{IR1}	Bus input current	V _{CANH} or V _{CANL} = 12V	--	500	μA
I _{IR2}		V _{CANH} or V _{CANL} = 12V and V _{DD} ≤ V _{SS} + 0.3V	--	600	
I _{IR3}		V _{CANH} or V _{CANL} = -7V	-610	--	
I _{IR4}		V _{CANH} or V _{CANL} = -7V and V _{DD} ≤ V _{SS} + 0.3V	-450	--	
C _H	CANH capacitance ⁽²⁾	CANH to V _{SS} , V _I = 0.025*Sin(2E6πt) + 2.3V, TXD = V _{DD} , AB = 0V or $\overline{\overline{Z}}$ = V _{DD} or LBK = 0V	--	50	pF
C _L	CANL capacitance ⁽²⁾	CANL to V _{SS} , V _I = 0.025*Sin(2E6πt) + 2.3V, TXD = V _{DD} , AB = 0V or $\overline{\overline{Z}}$ = V _{DD} or LBK = 0V	--	50	
C _{ID}	Differential capacitance ⁽²⁾	CANH to CANL, V _I = 0.025*Sin(2E6πt), TXD = V _{DD} , AB = 0V or $\overline{\overline{Z}}$ = V _{DD} or LBK = 0V	--	25	
R _{ID}	Differential input resistance	AB = 0V or $\overline{\overline{Z}}$ = V _{DD} or LBK = 0V	40	100	kΩ
R _H	Single ended input resistance CANH		20	50	
R _L	Single ended input resistance CANL		20	50	
R _M	Percent difference between R _H and R _L	$\frac{2 * (R_L - R_H) }{(R_L + R_H)} * 100$	--	3.0	%

Notes:

- 1) All voltages referenced to V_{SS}
- 2) Capacitance is measured for initial qualification and when design changes might affect the input/output capacitance

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Analog Input (RS) ⁽¹⁾

($V_{DD} = 3.3V \pm 0.3V$, $-55^{\circ}C < T_c < +125^{\circ}C$); Unless otherwise noted, T_c is per the temperature range ordered

Table 8: DC Electrical Characteristics

Symbol	Parameter	Conditions	MIN	MAX	Unit
V_{RS1}	Input voltage for enabling High-speed mode (8Mbps operation)	$TXD = V_{DD}$, $R_L = 60\Omega \pm 1\%$, $AB = 0V$ or $\overline{ZZ} = V_{DD}$ or $LBK = 0V$	V_{SS}	300	mV
V_{RS2}	Input Voltage for enabling Standby mode	$TXD = V_{DD}$, $RL = 60\Omega \pm 1\%$, $AB = 0V$ or $\overline{ZZ} = V_{DD}$ or $LBK = 0V$	$0.75 \cdot V_{DD}$	5.5	V
I_{RS1}	High-Speed mode input current	$V_{RS} = 0V$	-500	-100	μA
I_{RS2}	Standby mode input current	$V_{RS} = 0.75 \cdot V_{DD}$	--	30	μA
I_{RS3}	Standby mode input current	$V_{RS} = 5.5V$	--	50	μA
I_{RS4}	Cold sparing leakage current	$V_{RS} = 5.5V$ or $V_{RS} \leq 0.3V$, $V_{DD} \leq V_{SS} + 0.3V$	-20	20	μA

Note:

- 1) All voltages referenced to V_{SS}

TTL I/O (TXD, \overline{ZZ} , AB, RXD, LBK) ⁽¹⁾

($V_{DD} = 3.3V \pm 0.3V$, $-55^{\circ}C < T_c < +125^{\circ}C$); Unless otherwise noted, T_c is per the temperature range ordered

Table 9: DC Electrical Characteristics

Symbol	Parameter	Conditions	MIN	MAX	Unit
V_{IH}	Input Voltage High		2.0	--	V
V_{IL}	Input Voltage Low		--	0.8	V
I_{IOD}	Input leakage current on TXD	$V_{in} = 0V$ or $V_{in} = 5.5V$	-60	100	μA
I_{IO}	Input leakage current on pins (\overline{ZZ} , AB, LBK)	$V_{in} = 0V$ or $V_{in} = 5.5V$	-10	100	μA
I_{CS}	Cold sparing leakage current (TXD, \overline{ZZ} , AB, RXD, LBK)	$V_{in} = 0V$ and $V_{in} = 5.5V$, $V_{DD} \leq V_{SS} + 0.3V$	-20	20	μA
V_{OH}	Output high voltage on RXD	$I_{OH} = -4mA$	2.4	--	V
V_{OL}	Output Low voltage on RXD	$I_{OL} = 4mA$	--	0.4	V
C_{IO}	Input Capacitance ⁽²⁾	TXD or \overline{ZZ} or AB or RXD or LBK to V_{SS} , $V_I = 0.025 \cdot \sin(2E6\pi t)$, $RS = 0V$	--	10	pF

Notes:

- 1) All voltages referenced to V_{SS}
- 2) Guaranteed by characterization

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AC Electrical Characteristics

Driver ⁽¹⁾

($V_{DD} = 3.3V \pm 0.3V$, $-55^{\circ}C < T_C < +125^{\circ}C$); Unless otherwise noted, T_C is per the temperature range ordered

Table 10: DC Electrical Characteristics

Symbol	Parameter	Conditions	MIN	MAX	Unit
t_{PLHT1}	Propagation delay time (TXD input dominant to CAN dominant) ⁽²⁾	RS = 0V, $R_L = 60\Omega \pm 1\%$, AB = 0V or $\overline{\overline{Z}} = V_{DD}$ or LBK = 0V, $V_{TXD} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_0=50\Omega$), See Figure 17	--	85	ns
t_{PLHT2}		RS with 10k Ω to V_{SS} , $R_L = 60\Omega \pm 1\%$, AB = 0V or $\overline{\overline{Z}} = V_{DD}$ or LBK = 0V, $V_{TXD} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_0=50\Omega$), See Figure 17	--	260	
t_{PLHT3}		RS with 100k Ω to V_{SS} , $R_L = 60\Omega \pm 1\%$, AB = 0V or $\overline{\overline{Z}} = V_{DD}$ or LBK = V, $V_{TXD} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_0=50\Omega$), See Figure 17	--	1200	
t_{PHLT1}	Propagation delay time, (TXD recessive to CAN recessive) ⁽²⁾	RS = 0V, $R_L = 60\Omega \pm 1\%$, AB = 0V or $\overline{\overline{Z}} = V_{DD}$ or LBK = 0V, $V_{TXD} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_0=50\Omega$), See Figure 17	--	120	ns
t_{PHLT2}		RS with 10k Ω to V_{SS} , $R_L = 60\Omega \pm 1\%$, AB = 0V or $\overline{\overline{Z}} = V_{DD}$ or LBK = 0V, $V_{TXD} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_0=50\Omega$), See Figure 17	--	485	
t_{PHLT3}		RS with 100k Ω to V_{SS} , $R_L = 60\Omega \pm 1\%$, AB = 0V or $\overline{\overline{Z}} = V_{DD}$ or LBK = 0V, $V_{TXD} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_0=50\Omega$), See Figure 17	--	1650	
t_{SKPT1}	Pulse skew ($ t_{PHL} - t_{PLH} $) ⁽²⁾	RS = 0V, $R_L = 60\Omega \pm 1\%$, AB = 0V or $\overline{\overline{Z}} = V_{DD}$ or LBK = 0V, $V_{TXD} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_0=50\Omega$), See Figure 17	--	75	ns
t_{SKPT2}		RS with 10k Ω to V_{SS} , $R_L = 60\Omega \pm 1\%$, AB = 0V or $\overline{\overline{Z}} = V_{DD}$ or LBK = 0V, $V_{TXD} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_0=50\Omega$), See Figure 17	--	450	
t_{SKPT3}		RS with 100k Ω to V_{SS} , $R_L = 60\Omega \pm 1\%$, AB = 0V or $\overline{\overline{Z}} = V_{DD}$ or LBK = 0V, $V_{TXD} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_0=50\Omega$), See Figure 17	--	1250	

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Symbol	Parameter	Conditions	MIN	MAX	Unit
t_{RT1}		RS = 0V, $R_L = 60\Omega \pm 1\%$, AB = 0V or $\overline{\overline{Z}} = V_{DD}$ or LBK = 0V, $V_{TXD} \leq 125\text{kHz}$ (Square wave, 50% duty cycle, $t_r \leq 6\text{ns}$, $t_f \leq 6\text{ns}$, $Z_O=50\Omega$), See Figure 17	5	80	
t_{RT2}	Differential CAN signal rise time ^{(2) (3)}	RS with 10k Ω to V_{SS} , $R_L=60\Omega \pm 1\%$, AB = 0V or $\overline{\overline{Z}} = V_{DD}$ or LBK = 0V, $V_{TXD} \leq 125\text{kHz}$ (Square wave, 50% duty cycle, $t_r \leq 6\text{s}$, $t_f \leq 6\text{ns}$, $Z_O=50\Omega$), See Figure 17	14	250	ns
t_{RT3}		RS with 100k Ω to V_{SS} , $R_L = 60\Omega \pm 1\%$, AB = 0V or $\overline{\overline{Z}} = V_{DD}$ or LBK = 0V, $V_{TXD} \leq 125\text{kHz}$ (Square wave, 50% duty cycle, $t_r \leq 6\text{ns}$, $t_f \leq 6\text{ns}$, $Z_O=50\Omega$), See Figure 17	40	1000	
t_{FT1}		RS=0V, $R_L=60\Omega \pm 1\%$, AB=0V or $\overline{\overline{Z}}=V_{DD}$ or LBK=0V, $V_{TXD} \leq 125\text{kHz}$ (Square wave, 50% duty cycle, $t_r \leq 6\text{ns}$, $t_f \leq 6\text{ns}$, $Z_O=50\Omega$), See Figure 17	20	75	
t_{FT2}	Differential CAN signal fall time ^{(2) (3)}	RS with 10k Ω to V_{SS} , $R_L = 60\Omega \pm 1\%$, AB = 0V or $\overline{\overline{Z}} = V_{DD}$ or LBK = 0V, $V_{TXD} \leq 125\text{kHz}$ (Square wave, 50% duty cycle, $t_r \leq 6\text{ns}$, $t_f \leq 6\text{ns}$, $Z_O=50\Omega$), See Figure 17	30	185	
t_{FT3}		RS with 100k Ω to V_{SS} , $R_L = 60\Omega \pm 1\%$, AB = 0V or $\overline{\overline{Z}} = V_{DD}$ or LBK = 0V, $V_{TXD} \leq 125\text{kHz}$ (Square wave, 50% duty cycle, $t_r \leq 6\text{ns}$, $t_f \leq 6\text{ns}$, $Z_O=50\Omega$), See Figure 17	40	800	
t_{ENS}	Enable time from standby deactivate to CAN dominant	TXD = 0V, $R_L = 60\Omega \pm 1\%$, AB = 0V or $\overline{\overline{Z}} = V_{DD}$ or LBK = 0V, $V_{RS} \leq 125\text{kHz}$ (Square wave, 50% duty cycle, $t_r \leq 6\text{ns}$, $t_f \leq 6\text{ns}$, $Z_O=50\Omega$, $RS < 0.75 \cdot V_{DD}$), See Figure 18	--	1.50	μs
t_{ENZ}	Enable time from sleep deactivate to CAN dominant	RS=0V, TXD=0V, $R_L=60\Omega \pm 1\%$, $V_{\overline{\overline{Z}}} \leq 50\text{kHz}$ (Square wave, 50% duty cycle, $t_r \leq 6\text{ns}$, $t_f \leq 6\text{ns}$, $Z_O=50\Omega$), See Figure 19 (UT64CAN3330 Only)	--	7	μs
t_{DISS}	Disable time from standby assert to CAN recessive	TXD = 0V, $R_L = 60\Omega \pm 1\%$, AB = 0V or $\overline{\overline{Z}} = V_{DD}$ or LBK = 0V, $V_{RS} \leq 125\text{kHz}$ (Square wave, 50% duty cycle, $t_r \leq 6\text{ns}$, $t_f \leq 6\text{ns}$, $Z_O=50\Omega$, $RS \geq 0.75 \cdot V_{DD}$), See Figure 18	--	150	ns
t_{DISZ}	Disable time from sleep assert to CAN recessive	TXD = 0V, RS = 0V, $R_L = 60\Omega \pm 1\%$, $V_{\overline{\overline{Z}}} \leq 50\text{kHz}$ (Square wave, 50% duty cycle, $t_r \leq 6\text{ns}$, $t_f \leq 6\text{ns}$, $Z_O=50\Omega$), See Figure 19 (UT64CAN3330 Only)	--	100	ns

Notes:

- 1) Per MIL-STD-883, method 3012
- 2) $C_L = 50\text{pF}$ or equivalent on the ATE or $15\text{pF} \pm 20\%$ for bench test characterization
- 3) Guaranteed by characterization

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Receiver (1)

($V_{DD} = 3.3V \pm 0.3V$, $-55^{\circ}C < T_C < +125^{\circ}C$); Unless otherwise noted, T_C is per the temperature range ordered

Table 11: DC Electrical Characteristics

Symbol	Parameter	Conditions	MIN	MAX	Unit
t_{PLHR}	Propagation delay time (CANH recessive to RXD recessive) ⁽²⁾	TXD= V_{DD} , RS=0V, $R_L = \infty$, AB=0V or $\overline{ZZ} = V_{DD}$ or LBK=0V, $V_{CANH} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_O = 50\Omega$), $V_{CANL} = 1.5V$, See Figure 20	--	60	ns
t_{PHLR}	Propagation delay time (CANH dominant to RXD dominant) ⁽²⁾	TXD= V_{DD} , RS=0V, $R_L = \infty$, AB=0V or $\overline{ZZ} = V_{DD}$ or LBK=0V, $V_{CANH} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_O = 50\Omega$), $V_{CANL} = 1.5V$, See Figure 20	--	60	ns
t_{SKPR}	Pulse skew	$t_{SKPR} = (t_{PHLR} - t_{PLHR})$, See Figure 20	--	25	ns
t_{RR}	RXD output signal rise time ^{(2) (3)}	TXD= V_{DD} , RS=0V, $R_L = 60\Omega \pm 1\%$, AB=0V or $\overline{ZZ} = V_{DD}$ or LBK=0V, $V_{CANH} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_O = 50\Omega$), $V_{CANL} = 1.5V$, See Figure 20	--	5	ns
t_{FR}	RXD output signal fall time ^{(2) (3)}	TXD= V_{DD} , RS=0V, $R_L = 60\Omega \pm 1\%$, AB=0V or $\overline{ZZ} = V_{DD}$ or LBK=0V, $V_{CANH} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_O = 50\Omega$), $V_{CANL} = 1.5V$, See Figure 20	--	5	ns

Notes:

- 1) Per MIL-STD-883, method 3012
- 2) $C_L = 50$ pF or equivalent on the ATE or 15 pF $\pm 20\%$ for bench test characterization
- 3) Guaranteed by characterization

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Transceiver Loopback ⁽¹⁾

($V_{DD} = 3.3V \pm 0.3V$, $-55^{\circ}C < T_c < +125^{\circ}C$); Unless otherwise noted, T_c is per the temperature range ordered

Table 12: DC Electrical Characteristics

Symbol	Parameter	Conditions	MIN	MAX	Unit
t_{LOOPD1}	Total loop delay, TXD to RXD, dominant ⁽²⁾	$R_S = 0V$, $R_L = 60\Omega \pm 1\%$, $AB = 0V$ or $\overline{\overline{Z}} = V_{DD}$ or $LBK = 0V$, $V_{TXD} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_0 = 50\Omega$), See Figure 21	--	125	ns
t_{LOOPD2}		R_S with $10k\Omega$ to V_{SS} , $R_L = 60\Omega \pm 1\%$, $AB = 0V$ or $\overline{\overline{Z}} = V_{DD}$ or $LBK = 0V$, $V_{TXD} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_0 = 50\Omega$), See Figure 21	--	800	
t_{LOOPD3}		R_S with $100k\Omega$ to V_{SS} , $R_L = 60\Omega \pm 1\%$, $AB = 0V$ or $\overline{\overline{Z}} = V_{DD}$ or $LBK = 0V$, $V_{TXD} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_0 = 50\Omega$), See Figure 21	--	1500	
t_{LOOPR1}	Total loop delay, TXD to RXD, recessive ⁽²⁾	$R_S = 0V$, $R_L = 60\Omega \pm 1\%$, $AB = 0V$ or $\overline{\overline{Z}} = V_{DD}$ or $LBK = 0V$, $V_{TXD} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_0 = 50\Omega$), See Figure 21	--	125	ns
t_{LOOPR2}		R_S with $10k\Omega$ to V_{SS} , $R_L = 60\Omega \pm 1\%$, $AB = 0V$ or $\overline{\overline{Z}} = V_{DD}$ or $LBK = 0V$, $V_{TXD} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_0 = 50\Omega$), See Figure 21	--	800	
t_{LOOPR3}		R_S with $100k\Omega$ to V_{SS} , $R_L = 60\Omega \pm 1\%$, $AB = 0V$ or $\overline{\overline{Z}} = V_{DD}$ or $LBK = 0V$, $V_{TXD} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_0 = 50\Omega$), See Figure 21	--	1650	
t_{LBK}	Loopback delay, TXD to RXD ⁽²⁾	$R_S = 0V$, $R_L = 60\Omega \pm 1\%$, $LBK = V_{DD}$, $V_{TXD} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_0 = 50\Omega$), See Figure 22 (UT64CAN3331 Only)	--	20	ns
t_{AB1}	Loopback delay, TXD to RXD ⁽²⁾	$R_S = 0V$, $R_L = 60\Omega \pm 1\%$, $AB = V_{DD}$, $V_{TXD} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_0 = 50\Omega$), See Figure 23 (UT64CAN3332 Only)	--	20	ns
t_{AB2}	Loopback delay, CAN input to RXD ⁽²⁾	$TXD = V_{DD}$, $R_S = 0V$, $R_L = \infty$, $AB = V_{DD}$, $V_{CANH} \leq 125kHz$ (Square wave, 50% duty cycle, $t_r \leq 6ns$, $t_f \leq 6ns$, $Z_0 = 50\Omega$), See Figure 24 (UT64CAN3332 Only)	--	60	

Notes:

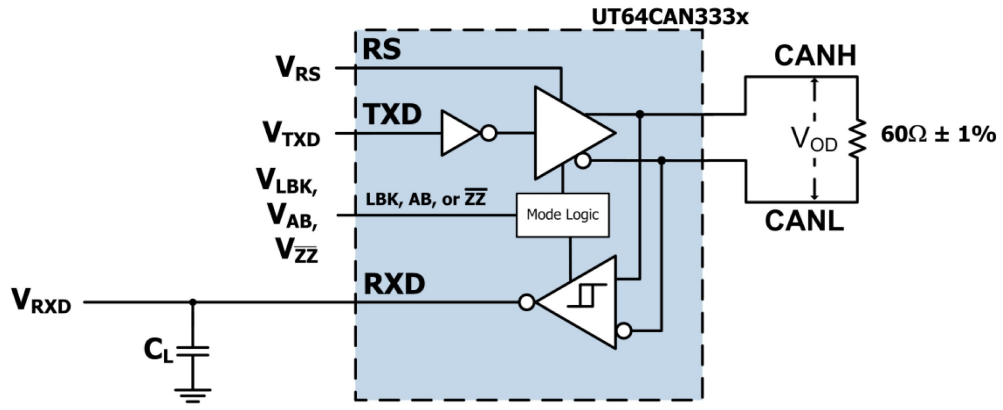
- 1) Per MIL-STD-883, method 3012
- 2) $C_L = 50$ pF or equivalent on the ATE or 15 pF $\pm 20\%$ for bench test characterization

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Tables and Figures

Table 13: Differential Input Voltage Threshold Test

Input (V)		Output		Measured (V)
V_{CANH}	V_{CANL}	RXD		$ V_{ID} $
-6.1	-7.0	L	V_{OL}	0.9
12.0	11.1	L		0.9
-1.0	-7.0	L		6.0
12.0	6.0	L		6.0
-6.5	-7.0	H	V_{OH}	0.5
12.0	11.5	H		0.5
-7.0	-1.0	H		6.0
6.0	12.0	H		6.0
Open	Open	H		X



$C_L = 50\text{pF}$ or equiv. ATE load or $15\text{pF} \pm 20\%$ Bench test load

Figure 11: DC Test Configuration

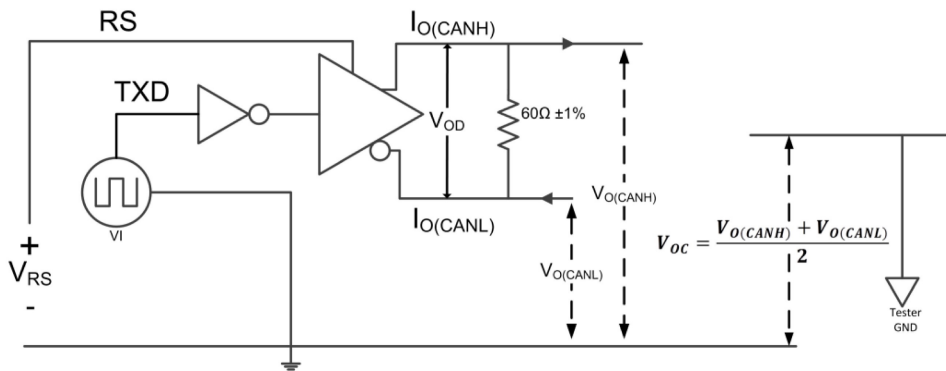


Figure 12: Driver Voltage, Current, and Test Definition

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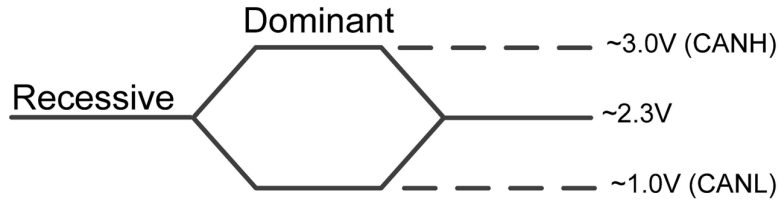


Figure 13: Bus Logic State Voltages Definitions

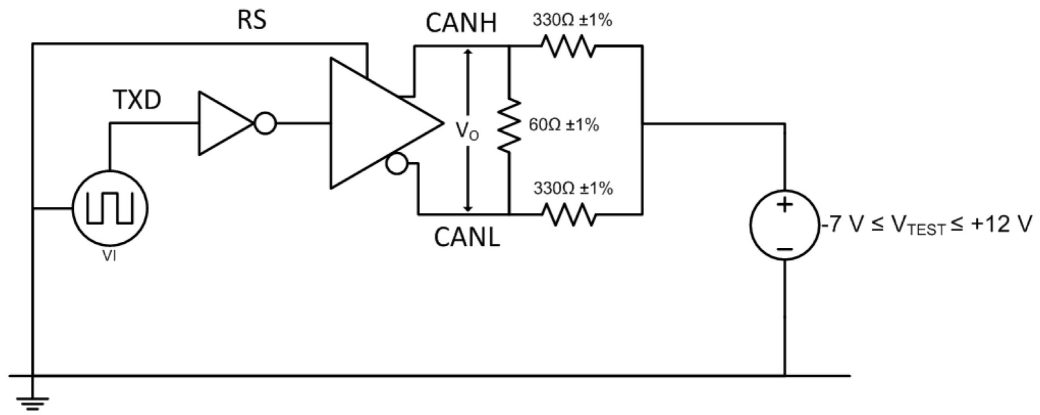


Figure 14: Driver V_{OD}

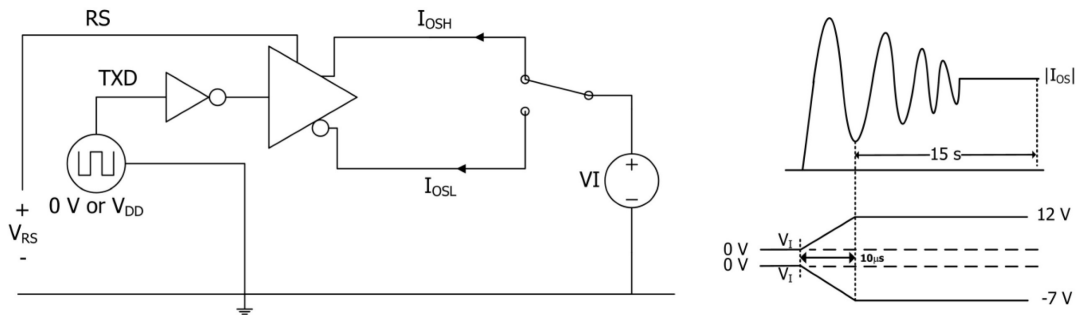


Figure 15: IOS Test Circuit and Waveforms

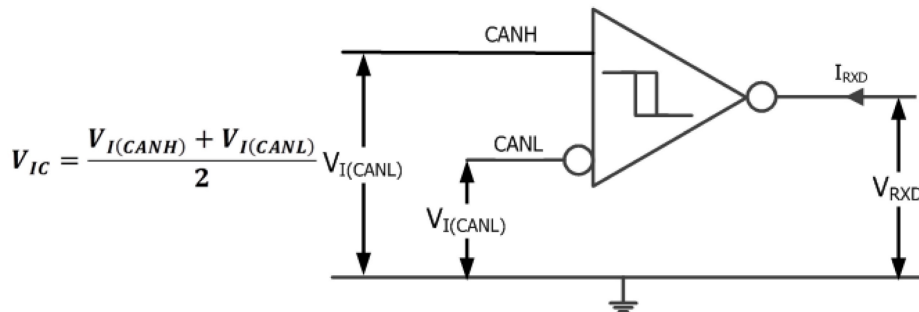


Figure 16: Receiver Voltage and Current Definitions

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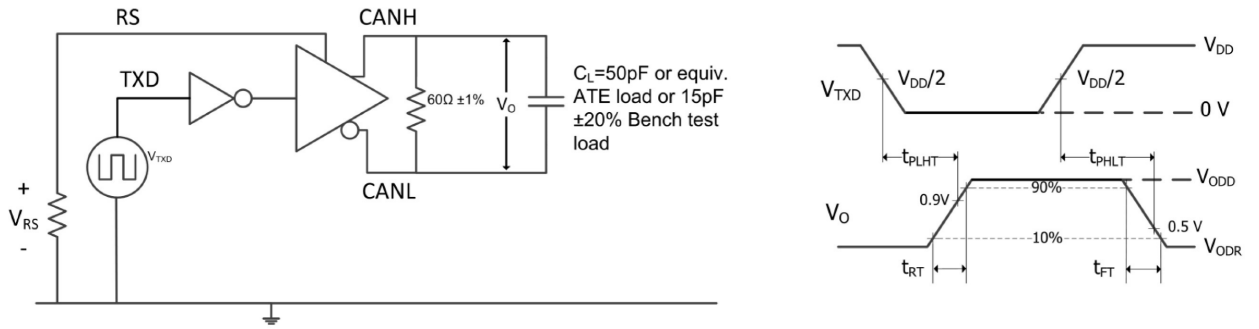


Figure 17: Drive Test Circuit and Voltage Waveforms

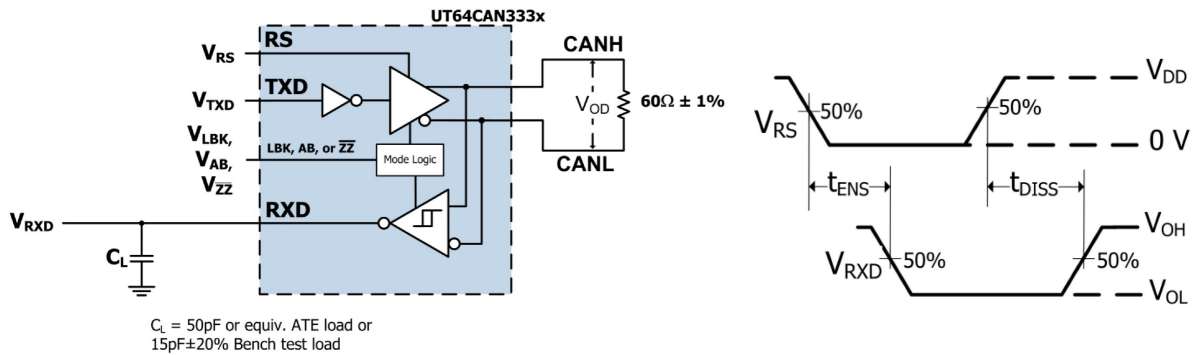


Figure 18: t_{ENS} and t_{DIS} Test Circuit and Voltage Waveforms

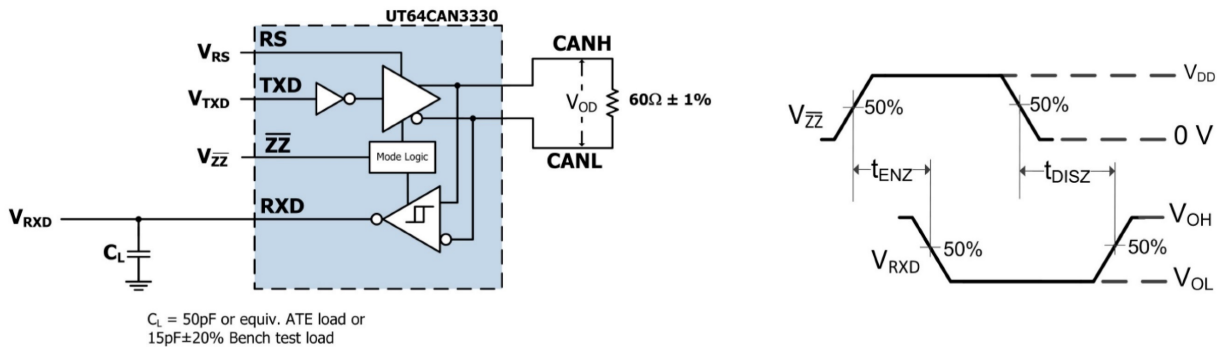


Figure 19: t_{ENZ} Test Circuit and Voltage Waveforms

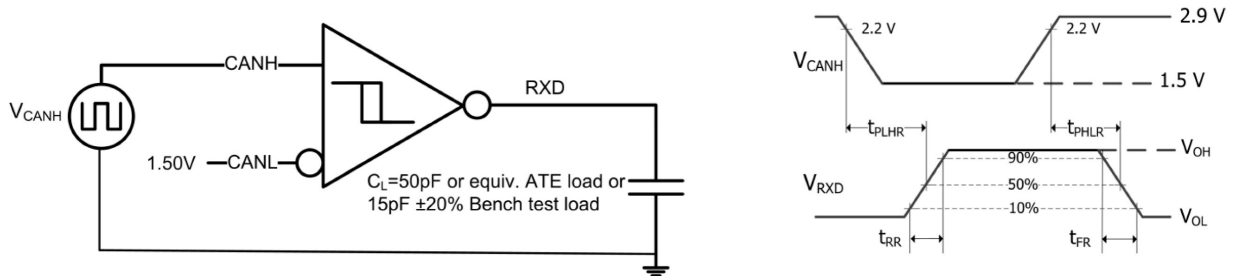


Figure 20: Receiver Test Circuit and Voltage Waveforms

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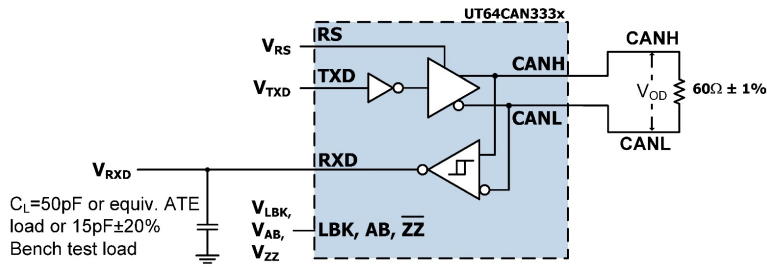


Figure 21: t_{LOOP} Test Circuit and Voltage Waveforms

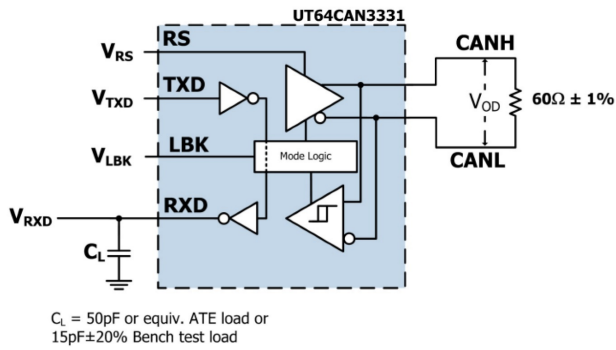


Figure 22: t_{LBK} Test Circuit and Voltage Waveforms

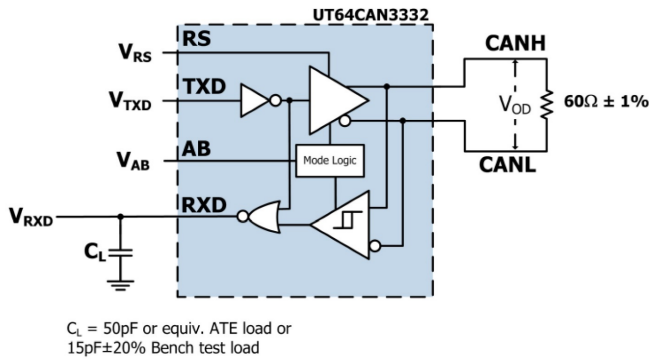


Figure 23: t_{AB1} Test Circuit and Voltage Waveforms

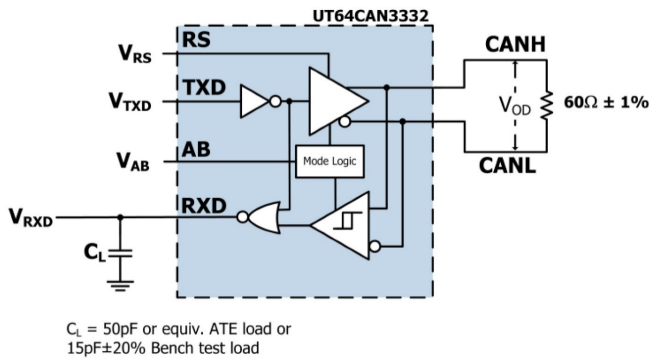


Figure 24: t_{AB2} Test Circuit and Voltage Waveforms

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Typical Performance Curves

($V_{DD}= 3.3V$, $C_L = 15pF$, $T_c = +25^\circ C$); Unless otherwise noted.

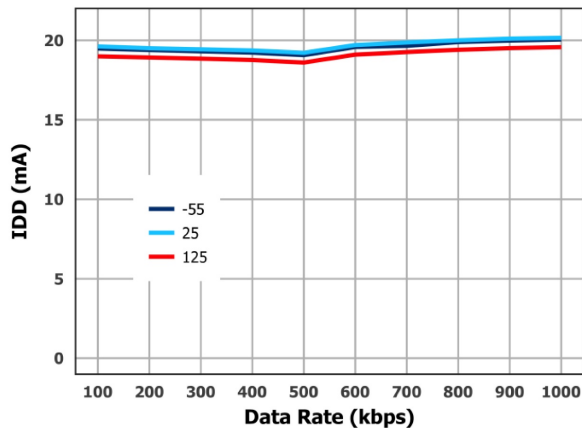


Figure 25: Supply Current vs Data Rate vs Temperature at Fast Speed ($R_S=GND$, $R_{DIFF}=60\Omega$)

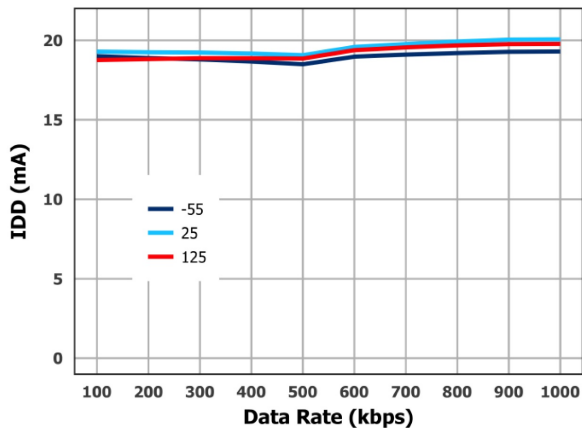


Figure 26: Supply Current vs Data Rate vs Temperature at Medium Speed ($R_S=10\text{ kohm}$, $R_{DIFF}=60\Omega$)

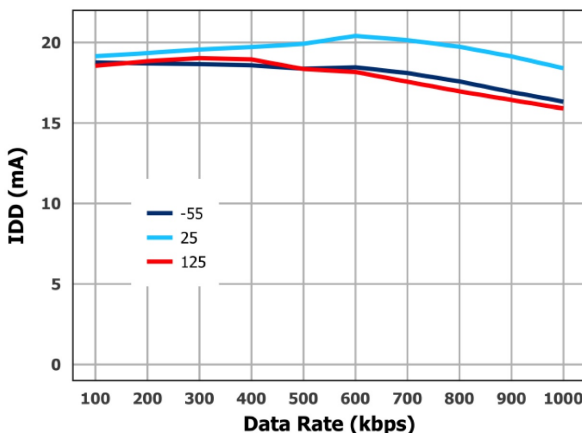


Figure 27: Supply Current vs Data Rate vs Temperature at Slow Speed ($R_S=100\text{ kohm}$, $R_{DIFF}=60\Omega$)

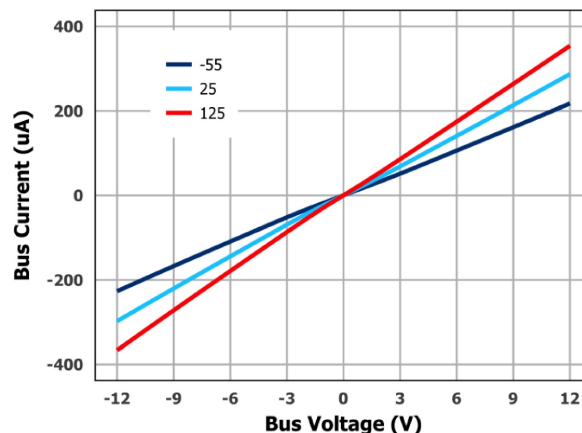


Figure 28: Bus Pin Leakage vs VCM at $V_{DD}=R_S=GND$, with other bus pin = GND

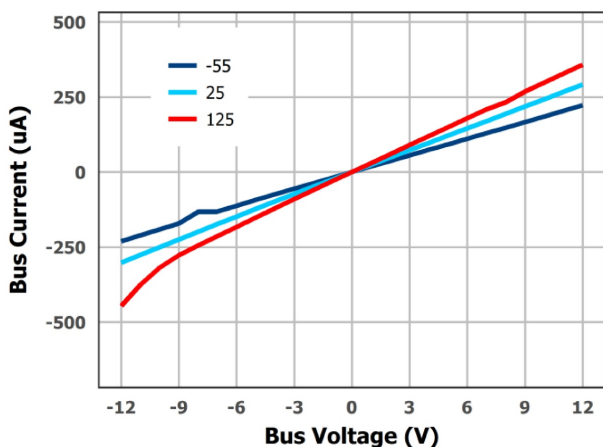


Figure 29: Bus Pin Leakage vs VCM at $V_{DD}=3V$ or $3.6V$, $R_S=GND$, with other bus pin = GND

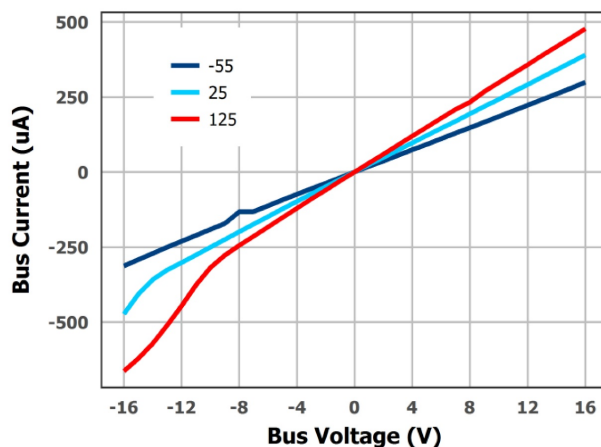


Figure 30: Bus Pin Leakage vs VCM, $V_{DD}=3V$ or $3.6V$, $R_S=GND$, with other bus pin = GND

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Typical Performance Curves (Continued)

($V_{DD} = 3.3V$, $C_L = 15pF$, $T_c = +25^\circ C$); Unless otherwise noted.

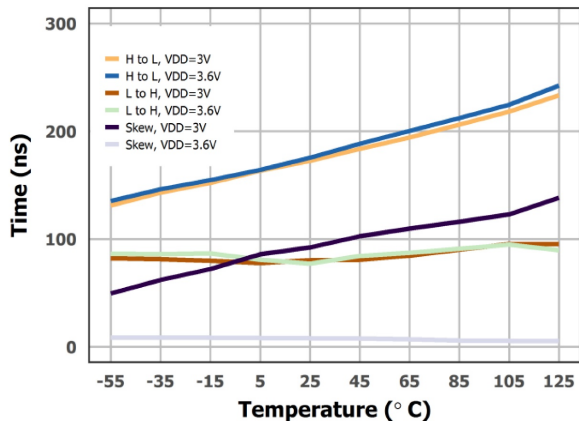


Figure 31: Transmitter Propagation delay and Skew vs Temperature at Fast Speed ($R_S = GND$, $R_{DIFF} = 60\Omega$)

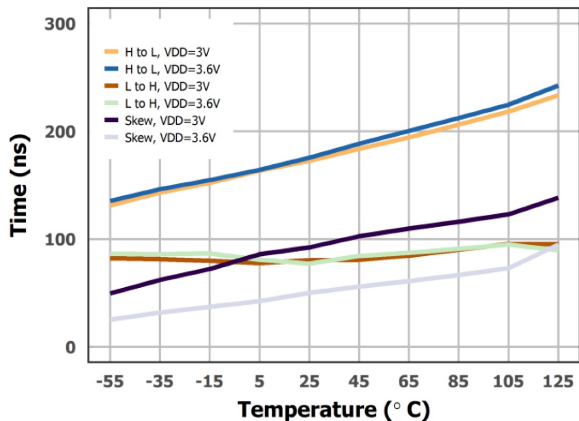


Figure 32: Transmitter Propagation delay and Skew vs Temperature at Medium Speed ($R_S = 10\text{ k}\Omega$, $R_{DIFF} = 60\Omega$)

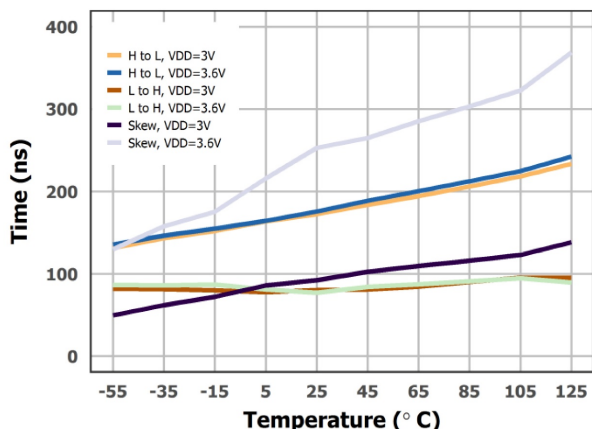


Figure 33: Transmitter Propagation Delay and Skew vs Temperature at Slow Speed ($R_S = 100\text{ k}\Omega$, $R_{DIFF} = 60\Omega$)

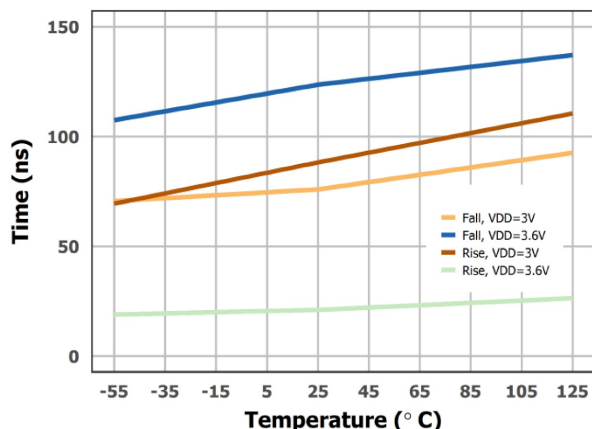


Figure 34: Transmitter Rise and Fall times vs Temperature at Fast Speed ($R_S = GND$, $R_{DIFF} = 60\Omega$)

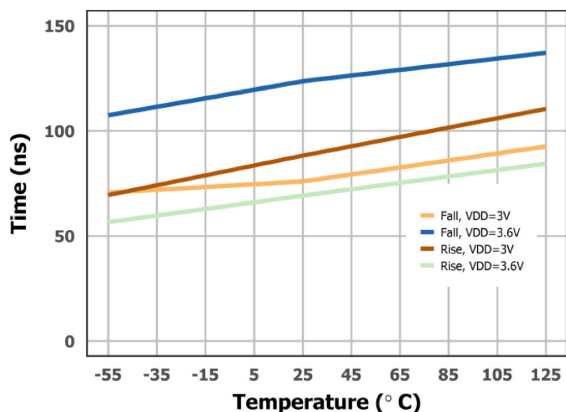


Figure 35: Transmitter Rise and Fall Times vs Temperature at Medium Speed ($R_S = 10\text{ kohm}$, $R_{DIFF} = 60\Omega$)

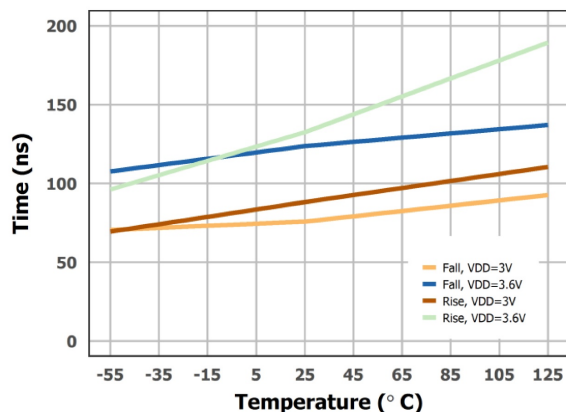


Figure 36: Transmitter Rise and Fall Times vs Temperature at Slow Speed ($R_S = 100\text{ kohm}$, $R_{DIFF} = 60\Omega$)

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Typical Performance Curves (Continued)

($V_{DD} = 3.3V$, $C_L = 15pF$, $T_c = +25^\circ C$); Unless otherwise noted.

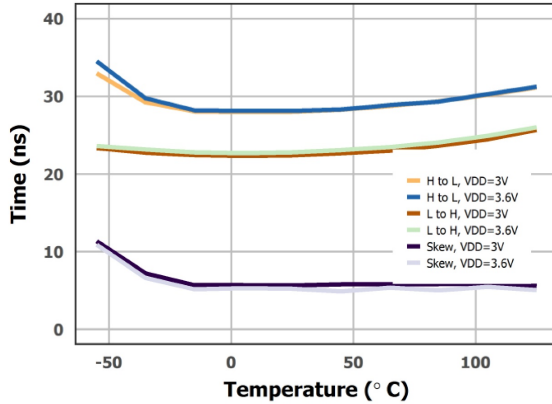


Figure 37: Receiver Propagation delay and Skew vs Temperature

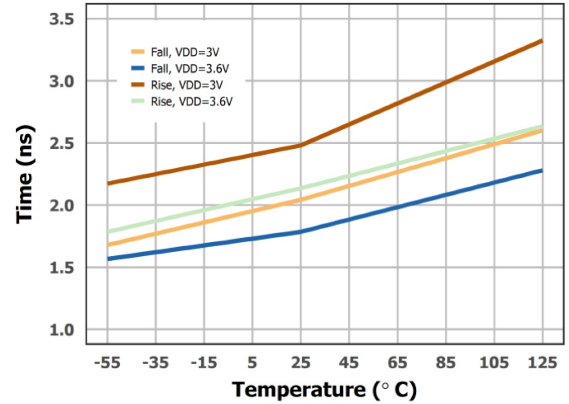


Figure 38: Receiver Rise and Fall Times vs Temperature

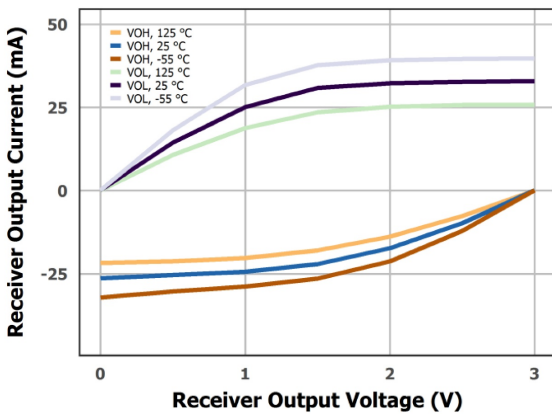


Figure 39: Receiver Output Current vs Receiver Output Voltage at $V_{DD} = 3V$

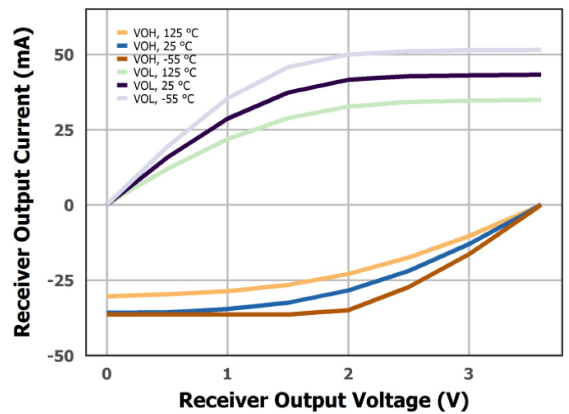


Figure 40: Receiver Output Current vs Receiver Output Voltage at $V_{DD} = 3.6$

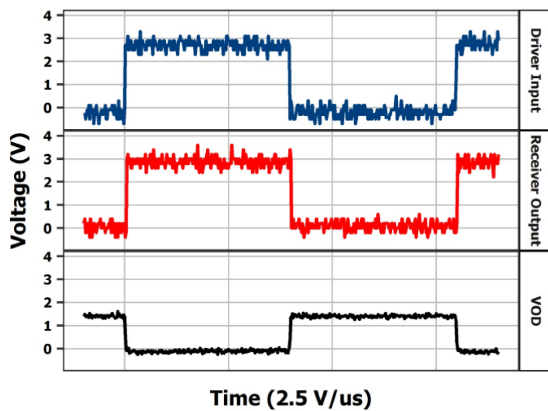


Figure 41: Fast ($R_S = GND$) Driver and Receiver Waveforms.
 $R_{DIFF} = 60\Omega$.

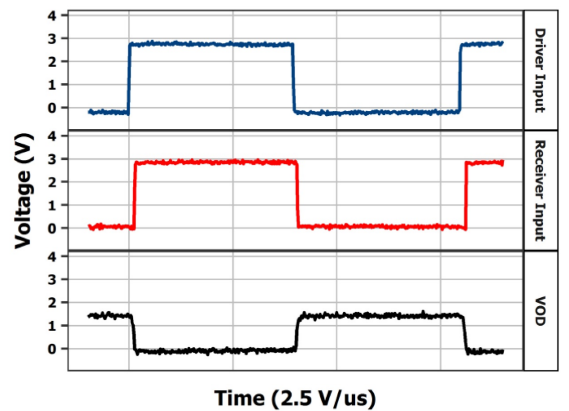


Figure 42: Medium ($R_S = 10k\Omega$) Driver and Receiver Waveforms.
 $R_{DIFF} = 60\Omega$.

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Typical Performance Curves (Continued)

(V_{DD}= 3.3V, C_L = 15pF, T_c = +25°C); Unless otherwise noted.

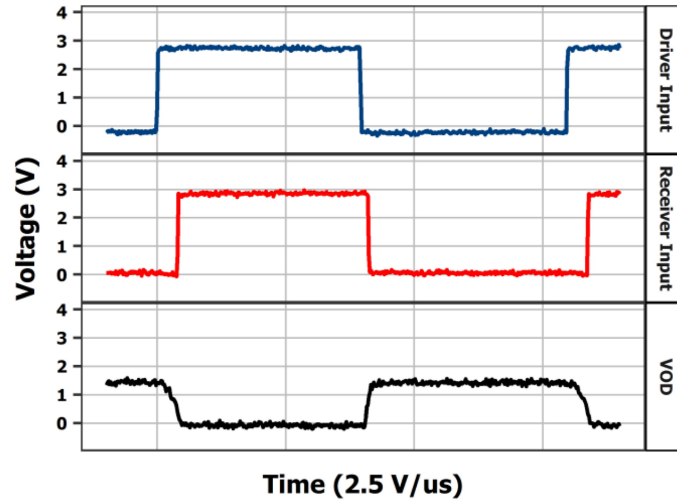


Figure 43: Slow (RS=100kΩ) Driver and Receiver Waveforms. R_{DIFF} = 60Ω.

Typical Performance Curves (Continued)

(V_{DD}= 3.3V, C_L = 15pF, T_c = +25°C); Unless otherwise noted.

Bus Pin	VDD (V)	Temp (C)	Bus Current (mA)	
			(VCM = -7V)	(VCM = 12V)
CANH	3	-55	-103.5	2.49
		25	-110.7	2.07
		125	-93.2	1.81
	3.3	-55	-111.0	2.49
		25	-125.5	2.09
		125	-110.6	1.78
	3.6	-55	-117.1	2.50
		25	-105.3	2.12
		125	-124.8	1.84
CANL	3	-55	-0.34	206.5
		25	-0.37	203.0
		125	-0.46	172.8
	3.3	-55	-0.36	211.5
		25	-0.39	208.4
		125	-0.45	177.8
	3.6	-55	-0.39	215.9
		25	-0.37	213.0
		125	-0.47	182.1

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Test Loads

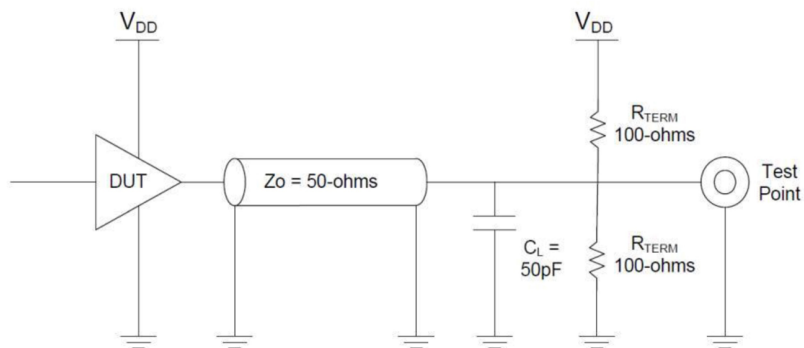


Figure 44: Standard Test Load

Notes:

- 1) $C_L = 50 \text{ pF}$ minimum or equivalent (includes scope probe and test socket)
- 2) Measurement of data output occurs at the low to high or high to low transition mid-point, typically $V_{DD}/2$

Packaging

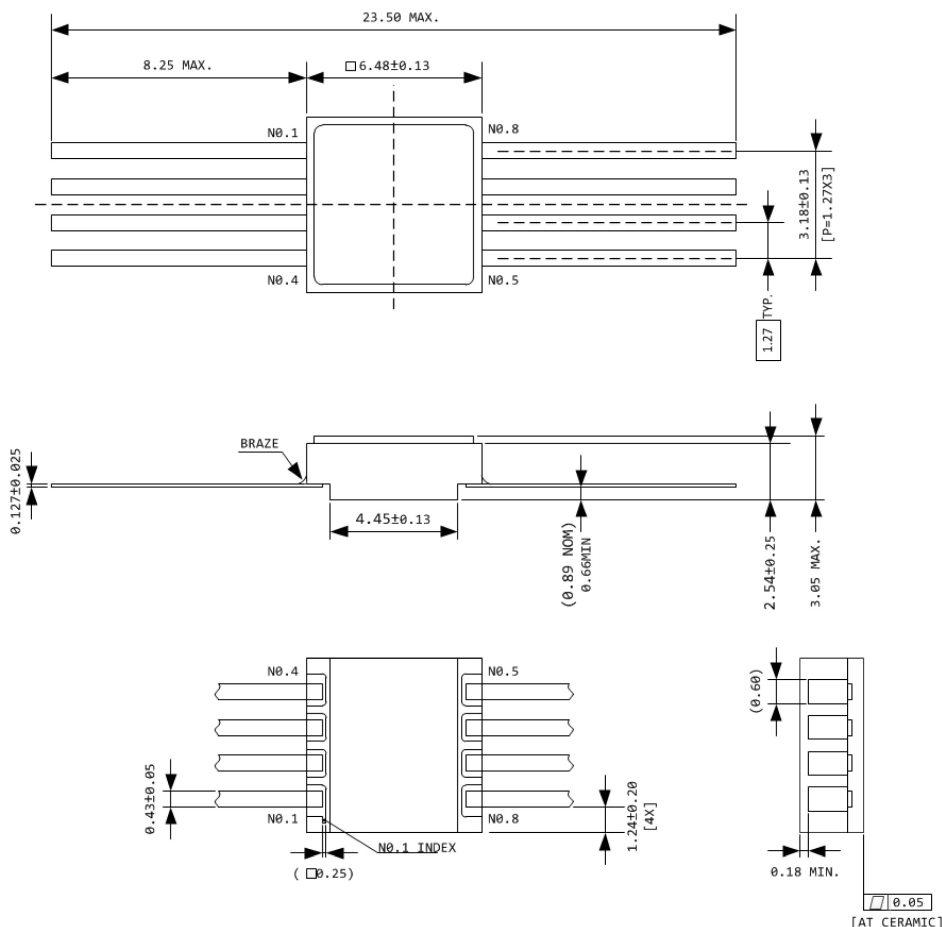


Figure 45: 8-lead Ceramic Flatpack (Units in mm)

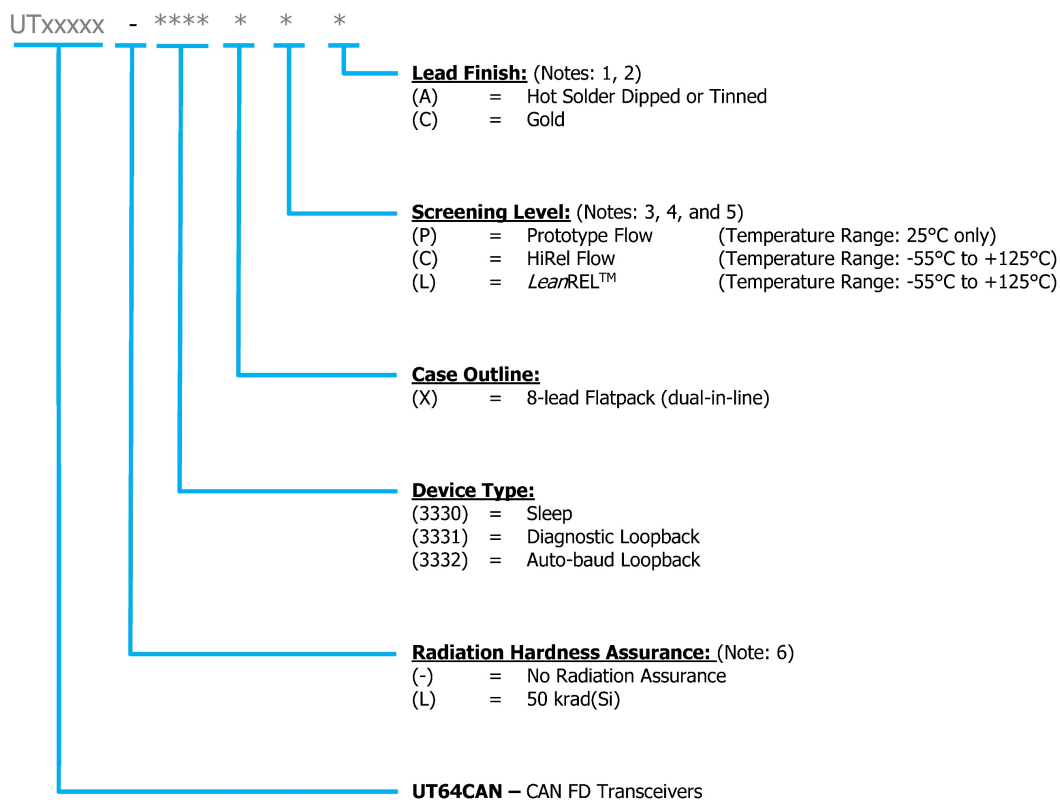
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Notes:

- 1) Package Material: Opaque 90% Minimum Alumina Ceramic.
- 2) All Exposed metal areas must be gold plated 100 to 225 microinches thick over electroplated nickel undercoating 100 to 350 microinches thick per MIL-PRF-38535.
- 3) The seal ring is electrically connected to V_{SS}.
- 4) Finished Package Weight: 450 mg (maximum)

Ordering Information

Generic Datasheet Part Numbering



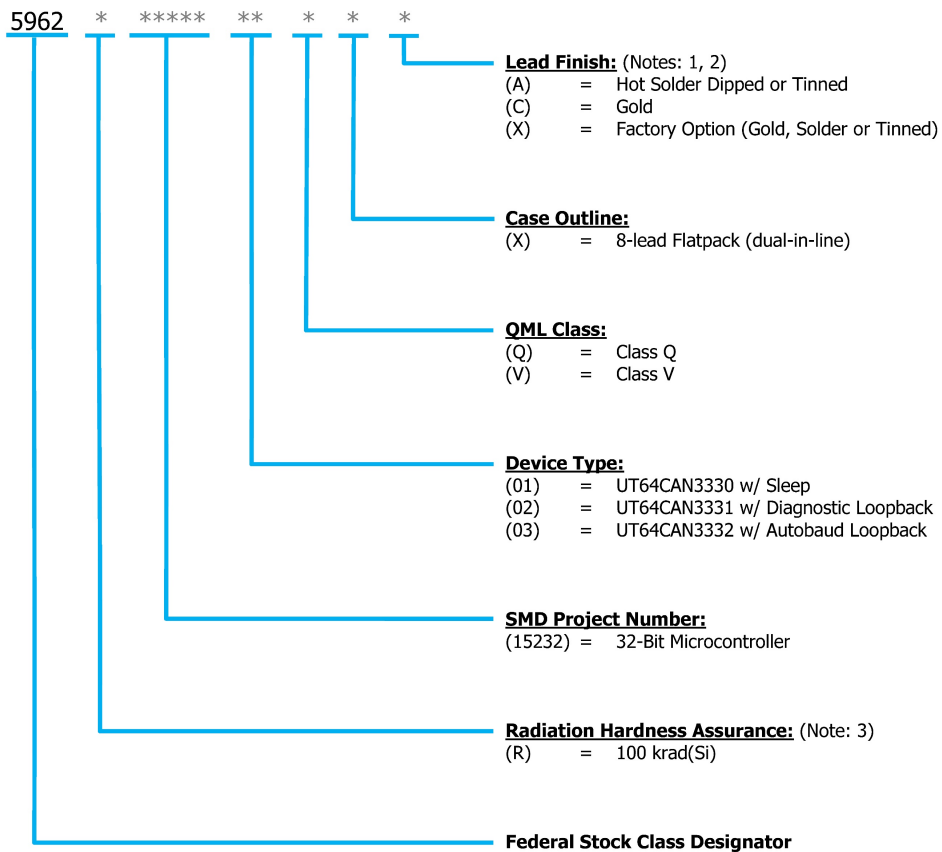
Notes:

- 1) Lead finish (A,C, or X) must be specified.
- 2) If an "X" is specified when ordering, then the part marking will match the lead finish applied to the device shipped
- 3) Prototype Flow per CAES Manufacturing Flows Document. Lead finish is GOLD "C" only. Radiation is neither tested nor guaranteed.
- 4) HiRel Flow per CAES Manufacturing Flows Document. Radiation TID tolerance may not be ordered.
- 5) *Learn*REL™ Flow Per CAES Manufacturing Flows Document. Available in a 8-lead Ceramic Flat Pack (FP) package.
- 6) 50krad radiation tolerance only available for the "L" *Learn*Rel™

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Ordering Information

SMD Part Numbering



Notes:

- 1) Lead finish (A,C, or X) must be specified.
- 2) If an "X" is specified when ordering, then the part marking will match the lead finish applied to the device shipped
- 3) Total dose radiation must be specified when ordering. QML Q and QML V are not available without radiation hardening. For prototype inquiries, contact factory.

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Revision History

Table 14: Revision History

Date	Rev. #	Change Description
11/17/15	2.0.0	Initial release of Preliminary Datasheet
12/15/15	2.1.0	Removed VOCPP spec, corrected typos, updated RXD rise and fall time spec, and updated figure 13.
12/17/15	2.2.0	Updated SEL limit on feature page, Changed note 3 in table 2, changed note 3 and SEL limit in table 3, updated figures and tables, updated RXD rise and fall time spec, removed transient overvoltage spec, removed I/O capacitance minimum
1/28/15	2.3.0	QML Q approved. Minor updates to formatting and added ATE equivalent circuit. Added mixed signal bus operation and split termination verbiage.
05/01/16	2.4.0	Changed tPLHT3 from 870ns to 1200ns.
05/17/16	2.5.0	Removed the Recommended PCB Footprint
10/07/16	2.5.1	Revised Iosh2 specification from 1 mA to 3 mA. Updated the VCANH1 minimum specification to 2.25. Updated figures to show CL=50pF. Updated Tables 2 and 4 with LBK signal. Updated Figures 2, 3, 11, 12, 13, 14, and 17.
06/27/17	2.6.0	Added equivalent circuits for I/O Added plots for typical performance characteristics Minor edits
05/06/19	2.7.0	Added <i>LeanREL</i> ™ flow as an option

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Datasheet Definitions

	DEFINITION
Advanced Datasheet	CAES reserves the right to make changes to any products and services described herein at any time without notice. The product is still in the development stage and the datasheet is subject to change . Specifications can be TBD and the part package and pinout are not final .
Preliminary Datasheet	CAES reserves the right to make changes to any products and services described herein at any time without notice. The product is in the characterization stage and prototypes are available.
Datasheet	Product is in production and any changes to the product and services described herein will follow a formal customer notification process for form, fit or function changes.

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