

±70V Bus Fault Protection, CAN FD Transceiver with Signal Improvement Capability (SIC) and Standby Mode

UMCAN1472VS8 SOP8

UMCAN1472NS8 SOP8

UMCAN1472VDA DFN8 3.0×3.0

UMCAN1472NDA DFN8 3.0×3.0

1 Description

The UMCAN1472 is a high-speed CAN transceiver that provides an interface between a Controller Area Network (CAN) protocol controller and the physical two-wire CAN bus. The transceiver is designed for high-speed CAN applications in the automotive industry, providing the differential transmit and receive capability to (a microcontroller with) a CAN protocol controller.

The UMCAN1472 offers improved ElectroMagnetic Compatibility (EMC) and ElectroStatic Discharge (ESD) performance, and also features:

- ±70V Bus Fault Protection
- Ideal passive behavior to the CAN bus when the supply voltage is off
- A very low-current Standby mode with bus wake-up capability
- Excellent EMC performance, even without a common mode choke
- Variants with a V_{IO} pin can be interfaced directly with microcontrollers with supply voltages from 3.3 V and 5 V

The UMCAN1472 transceiver implements the CAN physical layer as defined in ISO 11898-2:2024 third edition and SAE J2284-1 to SAE J2284-5, and is fully interoperable with high-speed Classical CAN and CAN FD transceivers. The UMCAN1472 includes CAN signal improvement capability (SIC), as defined in ISO 11898-2:2024 parameter set C. CAN signal improvement significantly reduces signal ringing in a network, allowing reliable CAN FD communication to function in larger topologies. In addition, the UMCAN1472 features a much tighter bit timing symmetry performance to enable CAN FD communication up to 8 Mbit/s. These features make the UMCAN1472 an excellent choice for all types of HS-CAN networks, in nodes that require a standby mode with wake-up capability via the bus.

2 Applications

- High-speed CAN applications in the automotive industry
- Infrastructure and farm equipment
- Elevator
- Networked sensors/actuators

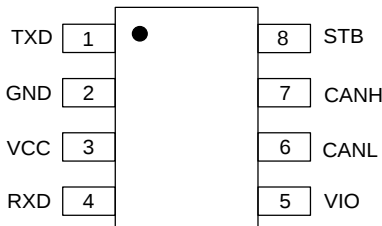
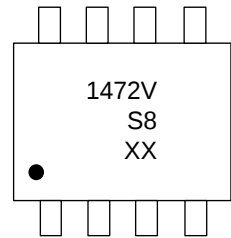
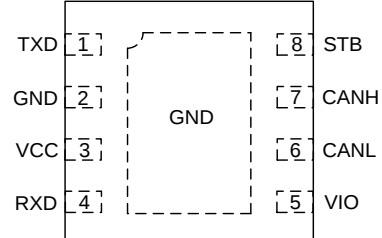
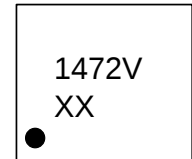
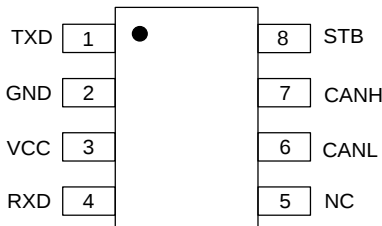
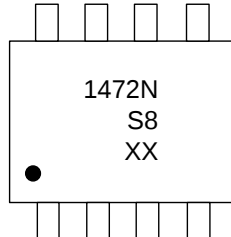
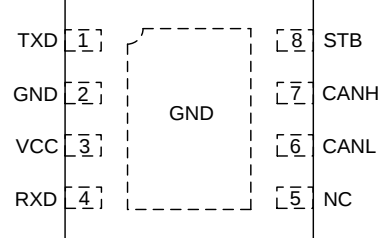
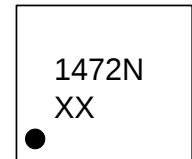
3 Features

- Fully ISO 11898-2:2024, SAE J2284-1 to SAE J2284-5 and SAE J1939-14 compliant
- Protection features:
 - ±70V Bus Fault Protection
 - ±9kV IEC 61000-4-2 contact discharge
- Very low-current Standby mode with local and bus wake-up capability
- Signal Improvement Capability (SIC)
- Low Electromagnetic Emission (EME) and high Electromagnetic Immunity (EMI), according to proposed EMC Standards IEC 62228-3 and SAE J2962-2
- Up to 8 Mbps data rates

4 Ordering Information

Part Number	Marking Code	Package Type	Shipping Qty
UMCAN1472VS8	1472VS8	SOP8	3000pcs/13Inch Tape & Reel
UMCAN1472VDA	1472V	DFN8 3.0×3.0	3000pcs/13Inch Tape & Reel
UMCAN1472NS8	1472NS8	SOP8	3000pcs/13Inch Tape & Reel
UMCAN1472NDA	1472N	DFN8 3.0×3.0	3000pcs/13Inch Tape & Reel

5 Pin Configuration and Function

	 XX: Week Code UMCAN1472VS8 SOP8
	 XX: Week Code UMCAN1472VDA DFN8 3.0×3.0
	 XX: Week Code UMCAN1472NS8 SOP8
	 XX: Week Code UMCAN1472NDA DFN8 3.0×3.0

5 Pin Configuration and Function (continued)

Table 5-1. Pin Functions

Pin Number	Symbol	Description
1	TXD	Transmit data input
2	GND	Ground (Note 1)
3	V _{CC}	Supply voltage
4	RXD	Receive data output; reads out data from the bus lines
5	NC	Not connected in UMCAN1472NS8 and UMCAN1472NDA version
	V _{IO}	Supply voltage for I/O level adapter in UMCAN1472VS8 and UMCAN1472VDA version
6	CANL	Low-level CAN bus line
7	CANH	High-level CAN bus line
8	STB	Standby mode control input

Note 1: DFN8 package die supply ground is connected to both the GND pin and the exposed center pad. The GND pin must be soldered to board ground. For enhanced thermal and electrical performance, it is recommended that the exposed center pad also be soldered to board ground.

6 Specifications

6.1 Recommended Operating Conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{CC}	Bus supply voltage		4.5		5.5	V
V _{IO}	Supply voltage I/O level shifter		2.9		5.5	V
T _A	Operating ambient temperature		-40		125	°C

6.2 Absolute Maximum Ratings (Note 1, 2, 3)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{CC}	Bus supply voltage		-0.3		+7	V
V _{IO}	Supply voltage I/O level shifter		-0.3		+7	V
V _{BUS}	Voltage range on CANH, CANL		-70		+70	V
V _{DIF}	Voltage range between CANH and CANL		-40		+40	V
V _I	Voltage range on STB	Note 4	-0.3		V _{IO} +0.3	V
	Voltage range on TXD	Note 4	-0.3		V _{IO} +0.3	V
V _O	Voltage range on RXD	Note 4	-0.3		V _{IO} +0.3	V
V _{trt}	Transient voltage on CANH, CANL pins (Note 5)	pulse 1	-100			V
		pulse 2a			+75	V
		pulse 3a	-150			V
		pulse 3b			+100	V
V _{ESD}	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001	All pins		±8		kV
		Other pins		±4		kV
	Contact discharge, per IEC 61000-4-2	Bus pins		±9		kV
I _{LU}	Latch up, per JEDEC JESD78F.01			200		mA
T _{VJ}	Virtual junction temperature		-40		150	°C
T _{STG}	Storage temperature		-55		150	°C

Note 1: Operation outside the Absolute Maximum Ratings may cause permanent device damage. Absolute Maximum Ratings do not imply functional operation of the device at these or any other conditions beyond those listed under Recommended Operating Conditions. If used outside the Recommended Operating Conditions but within the Absolute Maximum Ratings, the device may not be fully functional, and this may affect device reliability, functionality, performance, and shorten the device lifetime.

Note 2: All voltage values, except differential I/O bus voltages, are with respect to ground terminal.

Note 3: V_{IO} = V_{CC} in non-VIO product variants.

Note 4: Maximum voltage should never exceed 7 V.

Note 5: Verified by an external test house according to IEC TS 62228, Section 4.2.4; parameters for standard pulses defined in ISO 7637.

6.3 Electrical Characteristics (Static) (Note 1)

$T_J = -40^{\circ}\text{C}$ to $+150^{\circ}\text{C}$; $V_{CC} = 4.5\text{V}$ to 5.5V ; $V_{IO} = 2.9\text{V}$ to 5.5V ; $R_L = 60\Omega$; $C_L = 100\text{pF}$ unless otherwise specified; All voltages are defined with respect to ground; positive currents flow into the IC.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Supply; pin VCC						
V _{UVD(STB)}	Standby undervoltage detection voltage on pin VCC		3	3.6	4.3	V
V _{UVD(SWOFF)VCC}	Switch-off undervoltage detection voltage on pin VCC	Variants without VIO	1.3	1.6	2.5	V
I _{CC}	Supply current	Variants without a VIO pin; STB = V _{CC} ; TXD = V _{CC}		10	17.5	μA
		Variants with a VIO pin; STB = V _{IO} ; TXD = V _{IO}		0.4	1	μA
		STB = 0 V; TXD = V _{IO}		2.6	5	mA
		STB = 0 V; TXD = 0	20	40	60	mA
		STB = 0 V; TXD = 0 V; short circuit on bus lines; -3V < (CANH=CANL) < 18V	2	73	110	mA
I/O level adapter supply; pin VIO						
V _{UVD(SWOFF)VIO}	Switch-off undervoltage detection voltage on pin VIO	Variants with a VIO pin	1.3	1.6	2.5	V
I _{IO}	supply current on pin VIO	STB = V _{IO} ; TXD = V _{IO}		8.5	16.5	μA
		STB = 0 V; TXD = V _{IO}	5	10.3	30	μA
		STB = 0 V; TXD = 0V		72	300	μA
Standby mode control input; pin STB						
V _{IH}	High-level input voltage		0.7V _{IO}			V
V _{IL}	Low-level input voltage				0.3V _{IO}	V
I _{IH}	High-level input current	STB = V _{IO}	-1		1	μA
I _{IL}	Low-level input current	STB = 0 V	-15		-1	μA

6.3 Electrical Characteristics (Static)---continued (Note 1)

$T_J = -40^{\circ}\text{C}$ to $+150^{\circ}\text{C}$; $V_{CC} = 4.5\text{V}$ to 5.5V ; $V_{IO} = 2.9\text{V}$ to 5.5V ; $R_L = 60\Omega$; $C_L = 100\text{pF}$ unless otherwise specified; All voltages are defined with respect to ground; positive currents flow into the IC.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
CAN transmit data input; pin TXD						
V_{IH}	High-level input voltage		$0.7V_{IO}$			V
V_{IL}	Low-level input voltage				$0.3V_{IO}$	V
I_{IH}	High-level input current	$TXD = V_{IO}$	-5		5	μA
I_{IL}	Low-level input current	$TXD = 0\text{ V}$	-270	-61	-30	μA
C_I	Input capacitance			5	10	pF
CAN receive data output; pin RXD						
I_{OH}	High-level output current	$RXD = V_{IO} - 0.4\text{ V}$	-9	-3	-1	mA
I_{OL}	Low-level output current	$RXD = 0.4\text{V}$	1	3	12	mA
Driver						
$V_{O(DOM)}$	Dominant output voltage	STB = 0 V; TXD = 0 V; $t < t_{TO(DOM)TXD}$; $50\Omega \leq R_L \leq 65\Omega$; pin CANH	2.75	3.5	4.5	V
		STB = 0 V; TXD = 0 V; $t < t_{TO(DOM)TXD}$; $50\Omega \leq R_L \leq 65\Omega$; pin CANL	0.5	1.5	2.25	V
$V_{OD(DOM)}$	Dominant differential output voltage	STB = 0 V; TXD = 0 V; $t < t_{TO(DOM)TXD}$; $50\Omega \leq R_L \leq 65\Omega$	1.5		3	V
		STB = 0 V; TXD = 0 V; $t < t_{TO(DOM)TXD}$; $45\Omega \leq R_L \leq 70\Omega$	1.4		3.3	V
		STB = 0 V; TXD = 0 V; $t < t_{TO(DOM)TXD}$; $R_L = 2240\Omega$	1.5		5	V

6.3 Electrical Characteristics (Static)---continued (Note 1)

$T_J = -40^{\circ}\text{C}$ to $+150^{\circ}\text{C}$; $V_{CC} = 4.5\text{V}$ to 5.5V ; $V_{IO} = 2.9\text{V}$ to 5.5V ; $R_L = 60\Omega$; $C_L = 100\text{pF}$ unless otherwise specified; All voltages are defined with respect to ground; positive currents flow into the IC.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{\text{SYM(DOM)}}$	Dominant output voltage symmetry, $V_{CC} - \text{CANH} - \text{CANL}$	$\text{STB} = 0\text{ V}$; $\text{TXD} = 0\text{ V}$; $t < t_{\text{TO(DOM)TXD}}$; $R_L = 60\Omega$	-400		400	mV
$V_{\text{O(REC)}}$	Recessive output voltage	$\text{STB} = 0\text{ V}$; $\text{TXD} = V_{IO}$; $R_L = \text{open}$	2	$0.5V_{CC}$	3	V
$V_{\text{OD(REC)}}$	Recessive differential output voltage	$\text{STB} = 0\text{ V}$; $\text{TXD} = V_{IO}$; $R_L = \text{open}$	-50		50	mV
$V_{\text{O(STB)}}$	Bus output voltage, Standby Mode	$\text{STB} = V_{IO}$; $\text{TXD} = V_{IO}$; $R_L = \text{open}$	-100		100	mV
$V_{\text{OD(STB)}}$	Bus differential output voltage, Standby Mode	$\text{STB} = V_{IO}$; $\text{TXD} = V_{IO}$; $R_L = \text{open}$	-200		200	mV
$V_{\text{SYM(TX)}}$	Transmitter output voltage symmetry, $(\text{CANH} + \text{CANL})/V_{CC}$	$\text{STB} = 0\text{ V}$; $\text{TXD} = 250\text{ kHz}$, 1 MHz , 2.5 MHz ; $R_L = 60\Omega$; $C_{\text{SPLIT}} = 4.7\text{ nF}$	$0.9V_{CC}$		$1.1V_{CC}$	V
$I_{\text{OS(DOM)}}$	Dominant short-circuit output current	$\text{STB} = 0\text{ V}$; $\text{TXD} = 0\text{ V}$; $V_{CC} = 5\text{ V}$; $\text{CANH} = -15\text{ V}$ to 40 V ; $\text{CANL} = \text{open}$	-100	-70		mA
		$\text{STB} = 0\text{ V}$; $\text{TXD} = 0\text{ V}$; $V_{CC} = 5\text{ V}$; $\text{CANL} = -15\text{ V}$ to 40 V ; $\text{CANH} = \text{open}$		70	100	mA
$I_{\text{OS(REC)}}$	Recessive short-circuit output current	$\text{STB} = 0\text{ V}$; $\text{TXD} = V_{IO}$; $-27\text{ V} \leq \text{CANH} = \text{CANL} \leq 32\text{ V}$	-5		5	mA
Receiver						
V_{TH}	Differential receiver threshold voltage, Normal mode	$\text{STB} = 0\text{ V}$; $-20\text{ V} \leq \text{CANH}$, $\text{CANL} \leq 20\text{ V}$	0.5		0.9	V
$V_{\text{ID(DOM)}}$	Receiver dominant voltage, Normal mode	$\text{STB} = 0\text{ V}$; $-20\text{ V} \leq \text{CANH}$, $\text{CANL} \leq 20\text{ V}$	0.9		9	V
$V_{\text{ID(REC)}}$	Receiver recessive voltage, Normal mode	$\text{STB} = 0\text{ V}$; $-20\text{ V} \leq \text{CANH}$, $\text{CANL} \leq 20\text{ V}$	-4		0.5	V
V_{HYS}	Differential receiver hysteresis voltage, Normal mode	$\text{STB} = 0\text{ V}$; $-20\text{ V} \leq \text{CANH}$, $\text{CANL} \leq 20\text{ V}$	50		300	mV

6.3 Electrical Characteristics (Static)---continued (Note 1)

$T_J = -40^{\circ}\text{C}$ to $+150^{\circ}\text{C}$; $V_{CC} = 4.5\text{V}$ to 5.5V ; $V_{IO} = 2.9\text{V}$ to 5.5V ; $R_L = 60\Omega$; $C_L = 100\text{pF}$ unless otherwise specified; All voltages are defined with respect to ground; positive currents flow into the IC.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{TH(STB)}$	Differential receiver threshold voltage, Standby mode	$STB = V_{IO}$; $-20\text{ V} \leq \text{CANH, CANL} \leq 20\text{ V}$	0.4		1.15	V
$V_{ID(DOM)STB}$	Receiver dominant voltage, Standby mode	$STB = V_{IO}$; $-20\text{ V} \leq \text{CANH, CANL} \leq 20\text{ V}$	1.15		9	V
$V_{ID(REC)STB}$	Receiver recessive voltage, Standby mode	$STB = V_{IO}$; $-20\text{ V} \leq \text{CANH, CANL} \leq 20\text{ V}$	-4		0.4	V
$I_{LKG(PD)}$	Unpowered Leakage current	$V_{CC} = V_{IO} = 0\text{ V}$ or shorted to GND via $47\text{ k}\Omega$; $\text{CANH} = \text{CANL} = 5\text{ V}$	-5		5	μA
R_I	Input resistance	$STB = 0\text{ V}$; $\text{TXD} = V_{IO}$; $-2\text{ V} \leq \text{CANH, CANL} \leq 7\text{ V}$	15	30	40	$\text{k}\Omega$
ΔR_I	Input resistance deviation, $[1 - (R_{IN(CANH)} / R_{IN(CANL)})] \times 100\%$	$STB = 0\text{ V}$; $\text{TXD} = V_{IO}$; $-2\text{ V} \leq \text{CANH, CANL} \leq 7\text{ V}$	-3		3	%
R_{ID}	Differential input resistance	$STB = 0\text{ V}$; $\text{TXD} = V_{IO}$; $-2\text{ V} \leq \text{CANH, CANL} \leq 7\text{ V}$	30	60	80	$\text{k}\Omega$
C_{IN}	Common-mode input capacitance to ground				20	pF
C_{ID}	Differential input capacitance				10	pF
Thermal Protection						
$T_{J(SD)}$	Thermal shutdown threshold	Temperature rising		185		$^{\circ}\text{C}$

Note 1: $V_{IO} = V_{CC}$ in non-VIO product variants.

6.4 Electrical Characteristics (Dynamic) (Note 7)

$T_J = -40^{\circ}\text{C}$ to $+150^{\circ}\text{C}$; $V_{CC} = 4.5\text{V}$ to 5.5V ; $V_{IO} = 2.9\text{V}$ to 5.5V ; $R_L = 60\Omega$; $C_L = 100\text{pF}$ unless otherwise specified; all voltages are defined with respect to ground.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
CAN timing characteristics according to ISO 11898-2:2024; see Figure 7-1 and Figure 7-3						
$t_{D(TXDL-RXDL)}$	Delay time from TXD LOW to RXD LOW	STB = 0 V			255	ns
$t_{D(TXDH-RXDH)}$	Delay time from TXD HIGH to RXD HIGH	STB = 0 V			255	ns
CAN timing characteristics according to ISO 11898-2:2024; $V_{CC} = 4.75\text{ V}$ to 5.25 V; see Figure 7-1, Figure 7-3 and Figure 7-5						
$t_{D(TXD-BUSDOM)}$	Delay time from TXD to bus dominant	STB = 0 V			80	ns
$t_{D(TXD-BUSREC)}$	Delay time from TXD to bus recessive	STB = 0 V			80	ns
$t_{D(BUSDOM-RXD)}$	Delay time from bus dominant to RXD	STB = 0 V			110	ns
$t_{D(BUSREC-RXD)}$	Delay time from bus recessive to RXD	STB = 0 V			110	ns
$t_{D(TXDL-RXDL)}$	Delay time from TXD LOW to RXD LOW	STB = 0 V			190	ns
$t_{D(TXDH-RXDH)}$	Delay time from TXD HIGH to RXD HIGH	STB = 0 V			190	ns
$t_{SIC(TXD)BASE}$	delay time from TXD to bus active recessive end	STB = 0 V (Note 1)	355		480	ns
CAN FD timing characteristics according to ISO 11898-2:2024 parameter set C ($t_{BIT(TXD)} \geq 125\text{ ns}$, up to 8 Mbit/s); $V_{CC} = 4.75\text{ V}$ to 5.25 V; see Figure 7-1 and Figure 7-3; (Note 2)						
$\Delta t_{BIT(BUS)}$	Transmitted recessive bit width deviation	$\Delta t_{BIT(BUS)} = t_{BIT(BUS)} - t_{BIT(TXD)}$	-10		10	ns
Δt_{REC}	Receiver timing symmetry	$\Delta t_{REC} = t_{BIT(RXD)} - t_{BIT(BUS)}$	-20		15	ns
$\Delta t_{BIT(RXD)}$	Received recessive bit width deviation	$\Delta t_{REC} = t_{BIT(RXD)} - t_{BIT(TXD)}$	-30		20	ns

6.4 Electrical Characteristics (Dynamic) ---continued (Note 7)

$T_J = -40^{\circ}\text{C}$ to $+150^{\circ}\text{C}$; $V_{CC} = 4.5\text{V}$ to 5.5V ; $V_{IO} = 2.9\text{V}$ to 5.5V ; $R_L = 60\Omega$; $C_L = 100\text{pF}$ unless otherwise specified; all voltages are defined with respect to ground.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
CAN FD timing characteristics according to ISO 11898-2:2016 and ISO 11898-2:2024; $V_{CC} = 4.75\text{V}$ to 5.25V; see Figure 7-1 and Figure 7-3						
$t_{\text{BIT}(\text{BUS})}$	Transmitted recessive bit width	2 Mbit/s ($t_{\text{BIT}(\text{TXD})} = 500\text{ ns}$)	490		510	ns
		5 Mbit/s ($t_{\text{BIT}(\text{TXD})} = 200\text{ ns}$)	190		210	ns
$t_{\text{BIT}(\text{RXD})}$	Bit time on pin RXD (Note 1)	2 Mbit/s ($t_{\text{BIT}(\text{TXD})} = 500\text{ ns}$)	470		520	ns
		5 Mbit/s ($t_{\text{BIT}(\text{TXD})} = 200\text{ ns}$)	170		220	ns
$\Delta t_{\text{BIT}(\text{BUS})}$	Transmitted recessive bit width deviation	2 Mbit/s ($t_{\text{BIT}(\text{TXD})} = 500\text{ ns}$) $\Delta t_{\text{BIT}(\text{BUS})} = t_{\text{BIT}(\text{BUS})} - t_{\text{BIT}(\text{TXD})}$	-65		30	ns
Δt_{REC}	Receiver timing symmetry	2 Mbit/s ($t_{\text{BIT}(\text{TXD})} = 500\text{ ns}$) $\Delta t_{\text{REC}} = t_{\text{BIT}(\text{RXD})} - t_{\text{BIT}(\text{BUS})}$	-65		40	ns
$\Delta t_{\text{BIT}(\text{RXD})}$	Received recessive bit width deviation	2 Mbit/s ($t_{\text{BIT}(\text{TXD})} = 500\text{ ns}$) $\Delta t_{\text{REC}} = t_{\text{BIT}(\text{RXD})} - t_{\text{BIT}(\text{TXD})}$	-100		50	ns
$\Delta t_{\text{BIT}(\text{BUS})}$	Transmitted recessive bit width deviation	5 Mbit/s ($t_{\text{BIT}(\text{TXD})} = 200\text{ ns}$) $\Delta t_{\text{BIT}(\text{BUS})} = t_{\text{BIT}(\text{BUS})} - t_{\text{BIT}(\text{TXD})}$	-45		10	ns
Δt_{REC}	Receiver timing symmetry	5 Mbit/s ($t_{\text{BIT}(\text{TXD})} = 200\text{ ns}$) $\Delta t_{\text{REC}} = t_{\text{BIT}(\text{RXD})} - t_{\text{BIT}(\text{BUS})}$	-45		15	ns
$\Delta t_{\text{BIT}(\text{RXD})}$	Received recessive bit width deviation	5 Mbit/s ($t_{\text{BIT}(\text{TXD})} = 200\text{ ns}$) $\Delta t_{\text{REC}} = t_{\text{BIT}(\text{RXD})} - t_{\text{BIT}(\text{TXD})}$	-80		20	ns
Dominant time-out time; pin TXD; (Note 3)						
$t_{\text{TO}(\text{DOM})\text{TXD}}$	TXD dominant time-out time	STB = 0 V; TXD = 0V	0.8		9	ms
Bus wake-up times; pins CANH and CANL; see Figure 9-3; (Note 3, 4)						
$t_{\text{WK}(\text{BUSDOM})}$	Bus dominant wake-up time	STB = V_{IO}	0.5		1.8	us
$t_{\text{WK}(\text{BUSREC})}$	Bus recessive wake-up time	STB = V_{IO}	0.5		1.8	us
$t_{\text{TO}(\text{WK})\text{BUS}}$	Bus wake-up time-out time	STB = V_{IO}	0.8		9	ms
$t_{\text{FLTR}(\text{WK})\text{BUS}}$	Bus wake-up filter time	STB = V_{IO}			1.8	us
Mode transitions						
$t_{\text{D}(\text{STB-NRM})}$	Mode change time, from standby to normal				50	us
$t_{\text{STARTUP}(\text{RXD})}$	RXD start-up time	After wake-up detected (Note 5)	4		20	us

6.4 Electrical Characteristics (Dynamic) ---continued (Note 7)

$T_J = -40^{\circ}\text{C}$ to $+150^{\circ}\text{C}$; $V_{CC} = 4.5\text{V}$ to 5.5V ; $V_{IO} = 2.9\text{V}$ to 5.5V ; $R_L = 60\Omega$; $C_L = 100\text{pF}$ unless otherwise specified; all voltages are defined with respect to ground.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
IO filter; pin STB; (Note 6)						
$t_{FLTR(IO)}$	IO filter time	on pin STB	1		5	us

Note 1: Not tested in production; guaranteed by design.

Note 2: Compliance with parameter set C requirements implies compliance for parameter sets A ($t_{BIT(TXD)} \geq 500\text{ ns}$, up to 2 Mbit/s) and B ($t_{BIT(TXD)} \geq 200\text{ ns}$, up to 5 Mbit/s).

Note 3: Time-out occurs between the min and max values. Time-out is guaranteed not to occur below the min value; time-out is guaranteed to occur above the max value.

Note 4: A dominant/recessive phase shorter than the min value is guaranteed not be seen as a dominant/recessive bit; a dominant/recessive phase longer than the max value is guaranteed to be seen as a dominant/recessive bit.

Note 5: When a wake-up is detected, RXD start-up time is between the min and max values. RXD cannot be relied on below the min value; RXD can be relied on above the max value; see Figure 9-3.

Note 6: Pulses shorter than the min value are guaranteed to be filtered out; pulses longer than the max value are guaranteed to be processed.

Note 7: $V_{IO} = V_{CC}$ in non-VIO product variants.

7 Parameter Measurement Information

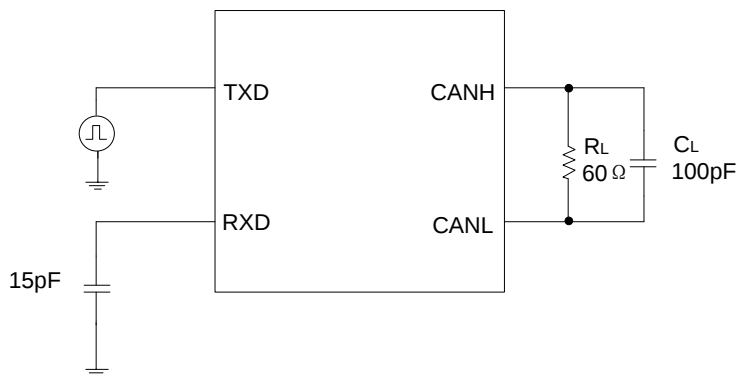


Figure 7-1. CAN transceiver timing test circuit

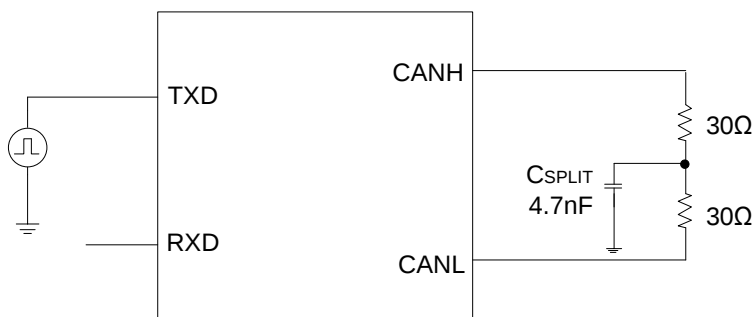


Figure 7-2. Test circuit for measuring transceiver transmitter driver symmetry

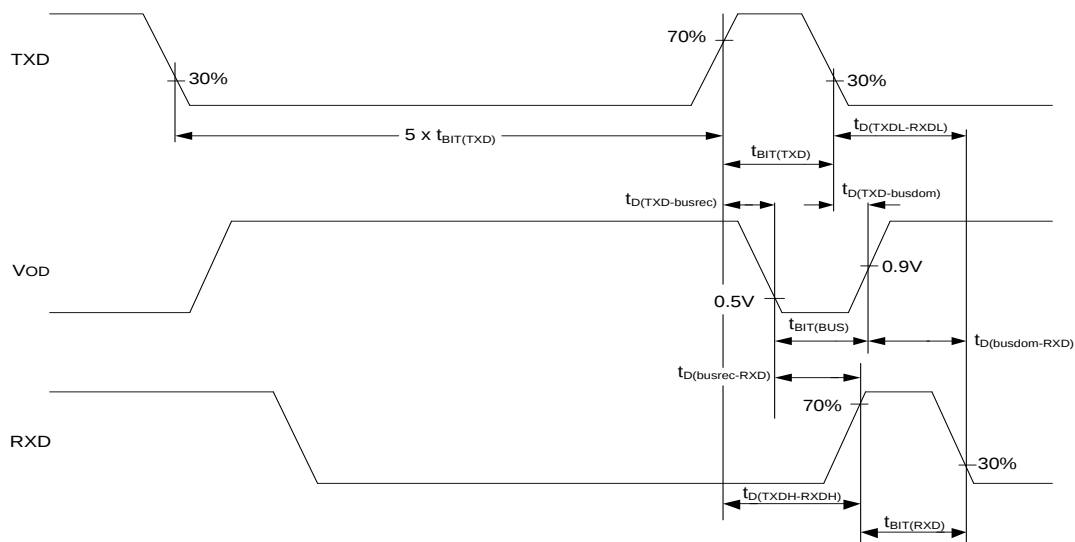


Figure 7-3. CAN transceiver timing diagram according to ISO 11898-2:2024

7 Parameter Measurement Information (continued)

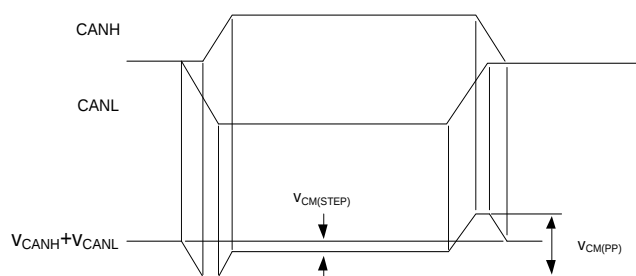


Figure 7-4. CAN bus common-mode voltage according to SAE 1939-14

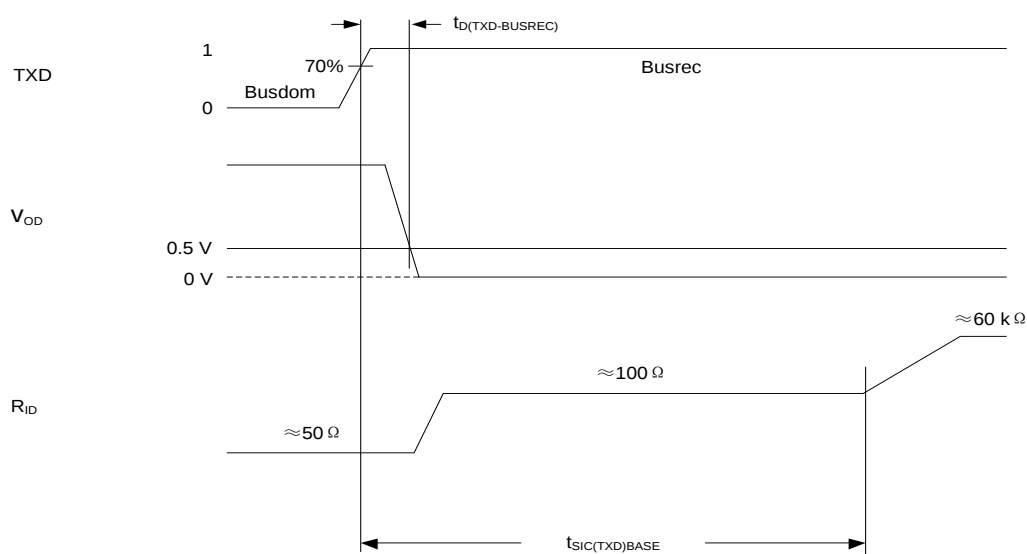


Figure 7-5. UMCAN1472 transmitter impedance and timing diagram for dominant-to-passive recessive transition

8 Block diagram

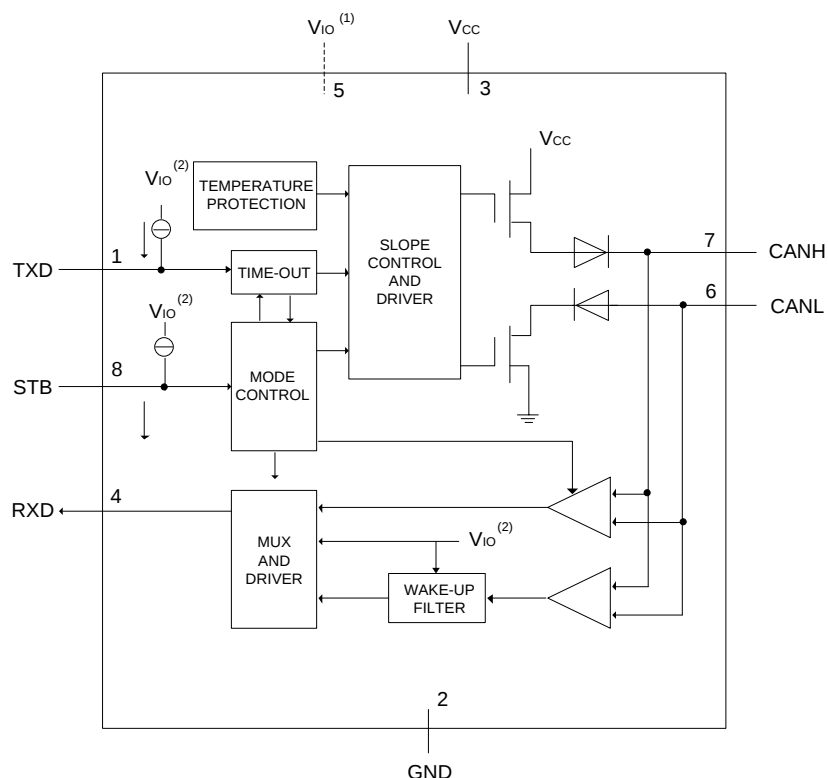


Figure 8-1. Block diagram

Note 1: Pin 5 is not connected in non-VIO product variants.

Note 2: $V_{IO} = V_{CC}$ in non-VIO product variants.

9 Detailed Description

9.1 Operating modes

The UMCAN1472 supports three operating modes, Normal, Standby and Off. The operating mode is selected via pin STB. See Table for a description of the operating modes under normal supply conditions.

Mode	Inputs		Outputs	
	Pin STB	Pin TXD	CAN driver	Pin RXD
Normal	LOW	LOW	dominant	LOW
		HIGH	recessive	LOW when bus dominant HIGH when bus recessive
Standby	HIGH	x (Note1)	biased to ground	follows BUS when wake-up detected HIGH when no wake-up detected
Off	x	x	High-Z state	High-Z state

Note1: 'x' = don't care.

9.1.1 Normal mode

A LOW level on pin STB selects Normal mode, provided the supply voltage on pin V_{CC} is above the standby undervoltage detection threshold, $V_{UVD(STB)(VCC)}$. Additionally, for the UMCAN1472V variant, V_{IO} must be above the switch-off undervoltage detection threshold $V_{UVD(SWOFF)VIO}$.

In this mode, the transceiver can transmit and receive data via the bus lines CANH and CANL (see Figure 8-1 for the block diagram). The differential receiver converts the analog data on the bus lines into digital data on pin RXD. The slopes of the output signals on the bus lines are controlled internally and are optimized in a way that guarantees the lowest possible EME. In order to support high bit rates, especially in CAN FD systems, the Signal Improvement function largely eliminates topology-related reflections and impedance mismatches. In recessive state, the output voltage on the bus pins is $V_{CC}/2$.

9.1.2 Standby mode

A HIGH level on pin STB selects Standby mode. In Standby mode, the transceiver is not able to transmit or correctly receive data via the bus lines. The transmitter and Normal mode receiver blocks are switched off to reduce supply current, and only a low-power differential receiver monitors the bus lines for activity. In Standby mode, the bus lines are biased to ground to minimize system supply current. The low-power receiver is supplied from V_{IO} and can detect CAN bus activity even if V_{IO} is the only available supply voltage. Pin RXD follows the bus after a wake-up request has been detected. A transition to Normal mode is triggered when STB is forced LOW.

9.1.3 Off mode

The UMCAN1472 switches to Off mode from any mode when the supply voltage (on pin V_{IO} in UMCAN1472V and V_{CC} in UMCAN1472N) falls below the switch-off undervoltage threshold ($V_{UVD(SWOFF)VIO}$ or $V_{UVD(SWOFF)VCC}$). This is the default mode when the supply is first connected. In Off mode, the CAN pins and pin RXD are in a High-Z state.

9.1.4 Operating modes and gap-free operation

Gap-free operation guarantees defined behavior at all voltage levels. Supply voltage-to-operating mode mapping is detailed in Figure 9-1.

UMCAN1472V			
Voltage range on VCC	5.5 V - 7V (Note 1)	off	Fully functional (Note 2, 3)
	V _{CC} operating range (4.5 V - 5.5 V)		Fully functional and characteristics guaranteed (Note 2, 5)
	V _{UVD(STB)VCC} range (Note6)		Fully functional or Standby (Note 2, 4)
	-0.3 V - 3 V		Standby or Off (Note 4)
		-0.3 V - 1.3 V	V _{UVD(SWOFF)VIO} range (Note6)
			V _{IO} operating range (2.5 V - 5.5V)
			5.5 V - 7V (Note 1)
Voltage range on VIO			

UMCAN1472N		
Voltage range on VCC	5.5 V - 7V (Note 1)	Fully functional (Note 2, 3)
	V _{CC} operating range (4.5 V - 5.5 V)	Fully functional and characteristics guaranteed (Note 2, 5)
	V _{UVD(STB)VCC} range (Note6)	Fully functional or Standby (Note 2, 4)
	2.5 V - 3 V	Standby
	V _{UVD(SWOFF)VCC} range	Standby or Off
	-0.3 V - 1.3 V	Off

Figure 9-1. Supply voltage ranges and gap-free operation

Note 1: Maximum voltage should never exceed 7 V.

Note 2: Target transceiver functionality as described in this datasheet is applicable.

Note 3: Prolonged operation of the device outside the operating range may impact reliability over lifetime. Returning to the operating range, datasheet characteristics are guaranteed provided the AMR has not been exceeded.

Note 4: For a given value of V_{IO} , a specific device will be in a single defined state determined by its undervoltage detection thresholds ($V_{UVD(STB)VCC}$ and $V_{UVD(SWOFF)VIO}$). The actual thresholds can vary between devices (within the ranges specified in this datasheet). To guarantee the device will be in a specific state, V_{IO} and V_{CC} must be either above the maximum or below the minimum thresholds specified for these undervoltage detection ranges.

Note 5: Datasheet characteristics are guaranteed within the V_{CC} and V_{IO} operating ranges. Exceptions are described in the Static and Dynamic characteristics tables.

Note 6: The following applies to UMCAN1472:

- If both V_{CC} and V_{IO} are above the undervoltage threshold, the device is fully functional.
- If V_{CC} is below and V_{IO} above the undervoltage threshold, the device is in Standby mode.
- If V_{IO} is below the undervoltage threshold, the device is in Off mode, regardless of V_{CC} .

9.2 Remote wake-up (via the CAN bus)

The UMCAN1472 wakes up from Standby mode when a dedicated wake-up pattern (specified in ISO 11898-2:2024) is detected on the bus. This filtering helps avoid spurious wake-up events. A spurious wake-up sequence could be triggered by, for example, a dominant clamped bus or by dominant phases due to noise or spikes on the bus.

The wake-up pattern consists of:

- a dominant phase of at least $t_{WK(BUSDOM)}$ followed by
- a recessive phase of at least $t_{WK(BUSREC)}$ followed by
- a dominant phase of at least $t_{WK(BUSDOM)}$

Dominant or recessive bits between the above mentioned phases that are shorter than $t_{WK(BUSDOM)}$ and $t_{WK(BUSREC)}$ respectively are ignored.

The complete dominant-recessive-dominant pattern must be received within $t_{\text{TO(WK)BUS}}$ to be recognized as a valid wake-up pattern. Otherwise, the internal wake-up logic is reset. The complete wake-up pattern will then need to be retransmitted to trigger a wake-up event. Pin RXD remains HIGH until the wake-up event has been triggered.

After a wake-up sequence has been detected, the UMCAN1472 will remain in Standby mode with the bus signals reflected on RXD after $t_{\text{STARTUP}(\text{RXD})}$. Note that dominant or recessive phases lasting less than $t_{\text{FLTR}(\text{WK})\text{BUS}}$ will not be detected by the low-power differential receiver and will not be reflected on RXD in Standby mode.

A wake-up event is not flagged on RXD if any of the following events occurs while a valid wake-up pattern is being received:

- The device switches to Normal mode
- The complete wake-up pattern was not received within $t_{TO(WK)BUS}$
- A V_{CC} or V_{IO} undervoltage is detected ($V_{CC} < V_{UVD(SWOFF)VCC}$ or $V_{IO} < V_{UVD(SWOFF)VIO}$; see 9.3.3)

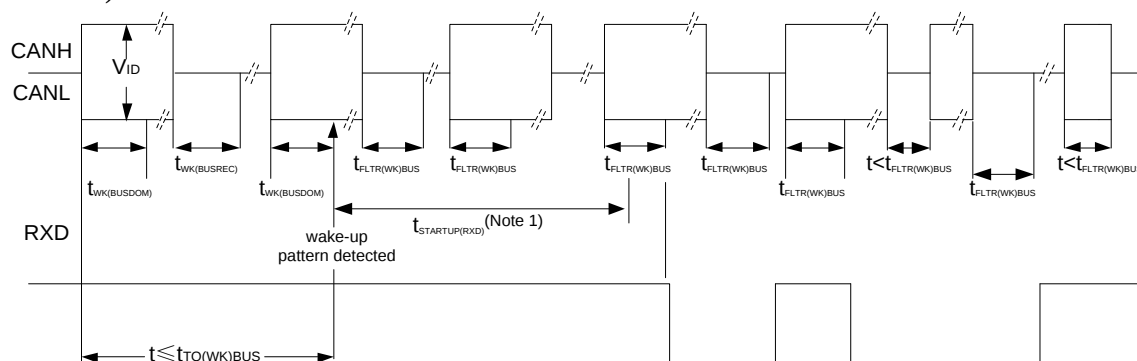


Figure 9-1. Wake-up Timing

Note 1: During $t_{\text{STARTUP}(\text{RXD})}$, the low-power receiver is on but pin RXD is not active (i.e. HIGH/recessive). The first dominant pulse of width $\geq t_{\text{FLTR}(\text{WK})\text{BUS}}$ that ends after $t_{\text{STARTUP}(\text{RXD})}$ will trigger RXD to go LOW/dominant.

9.3 Fail-safe features

9.3.1 TXD dominant time-out function

A 'TXD dominant time-out' timer is started when pin TXD is set LOW. If the LOW state on this pin persists for longer than $t_{TO(DOM)TXD}$, the transmitter is disabled, releasing the bus lines to recessive state. This function prevents a hardware and/or software application failure from driving the bus lines to a permanent dominant state (blocking all network communications). The TXD dominant time-out timer is reset when pin TXD is set HIGH.

9.3.2 Internal biasing of TXD and STB input pins

Pins TXD and STB have internal pull-ups to V_{CC} (V_{IO} for variants with a V_{IO} pin) to ensure a safe, defined state in case one or both of these pins are left floating. Pull-up currents flow in these pins in all states; both pins should be held HIGH in Standby mode to minimize supply current.

9.3.3 Undervoltage detection on pins V_{CC} and V_{IO}

If V_{CC} drops below the standby undervoltage detection level, $V_{UVD(STB)VCC}$, the transceiver switches to Standby mode. The logic state of pin STB is ignored until V_{CC} has recovered.

In versions with a V_{IO} pin, if V_{IO} drops below the switch-off undervoltage detection level ($V_{UVD(SWOFF)VIO}$), the transceiver switches off and disengages from the bus (High-Z) until V_{IO} has recovered.

In versions without a V_{IO} pin, if V_{CC} drops below the switch-off undervoltage detection level ($V_{UVD(SWOFF)VCC}$), the transceiver switches off and disengages from the bus (High-Z) until V_{CC} has recovered.

9.3.4 Overtemperature protection

The output drivers are protected against overtemperature conditions. If the virtual junction temperature exceeds the shutdown junction temperature, $T_{J(SD)}$, both output drivers are disabled. When the virtual junction temperature drops below $T_{J(SD)}$ again, the output drivers recover once TXD has been reset to HIGH. Including the TXD condition prevents output driver oscillation due to small variations in temperature.

9.3.5 V_{IO} supply pin (UMCAN1472VS8 and UMCAN1472VDA variants)

Pin V_{IO} should be connected to the microcontroller supply voltage. This will adjust the signal levels of pins TXD, RXD and STB to the I/O levels of the microcontroller. Pin V_{IO} also provides the internal supply voltage for the low-power differential receiver in the transceiver. For applications running in low-power mode, this allows the bus lines to be monitored for activity even if there is no supply voltage on pin V_{CC} .

For variants of the UMCAN1472 without a V_{IO} pin, all circuitry is connected to V_{CC} (pin 5 is not bonded). The signal levels of pins TXD, RXD and STB are then compatible with 5 V microcontrollers. This allows the device to interface with both 3.3 V and 5 V-supplied microcontrollers, provided the microcontroller I/Os are 5 V tolerant.

9.4 Signal Improvement

Signal improvement is an additional capability added to CAN FD transceiver that enhances the maximum data rate achievable in complex star topologies by minimizing signal ringing. Signal ringing is the result of reflections caused by impedance mismatch at various points in a CAN network due to the nodes that act as stubs.

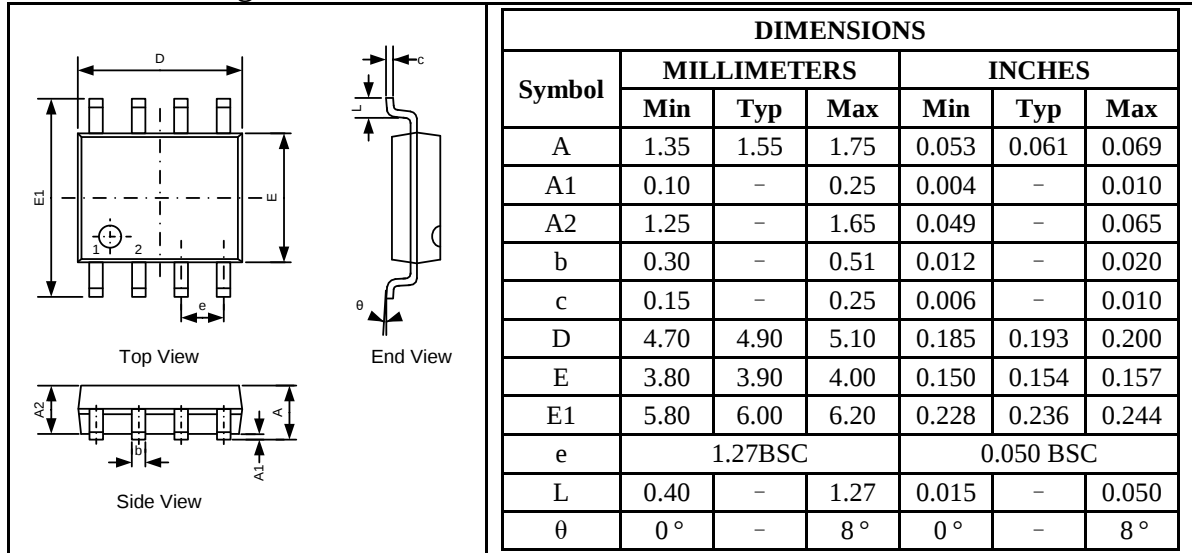
Recessive-to-dominant signal edge is usually clean as it is strongly driven by the transmitter.

Transmitter output impedance of CAN transceiver is $\approx 50 \Omega$ and matches to the network characteristic impedance. For a regular CAN FD transceiver, dominant-to-recessive edge is when the driver output impedance goes to $\approx 60 k\Omega$ and signal reflected back experiences impedance mismatch which causes ringing. UMCAN1472 resolves this issue by TX-based Signal improvement capability (SIC). The device continues to drive the bus recessive until $t_{SIC(TXD)BASE}$ so that reflections die down and recessive bit is clean at sampling point. In the active recessive phase, transmitter output impedance is low ($\approx 100 \Omega$). After this phase is over and device goes to passive recessive phase, driver output impedance goes to high-Z. This phenomenon is explained at Figure 7-5.

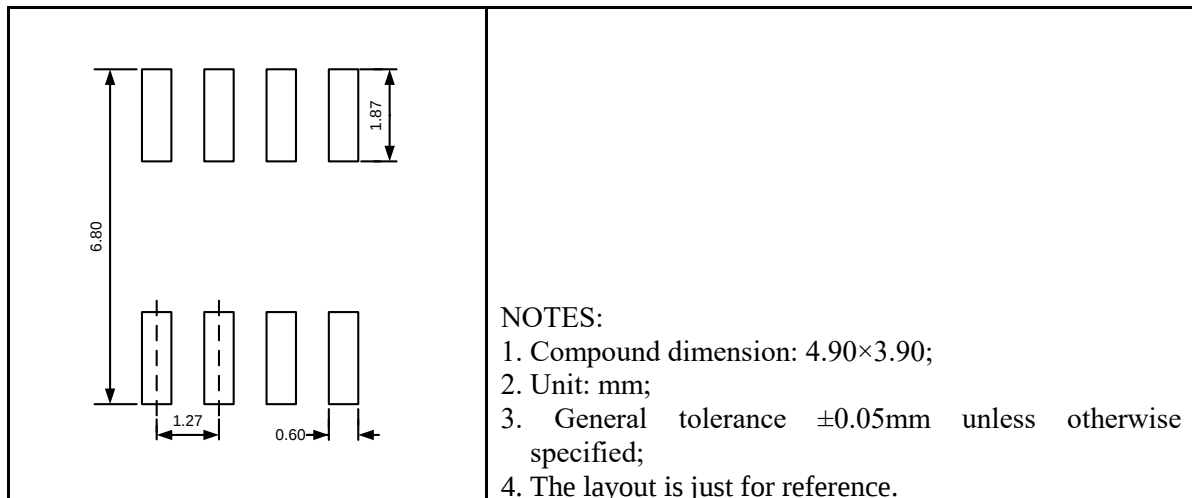
Package Information

SOP8

Outline Drawing

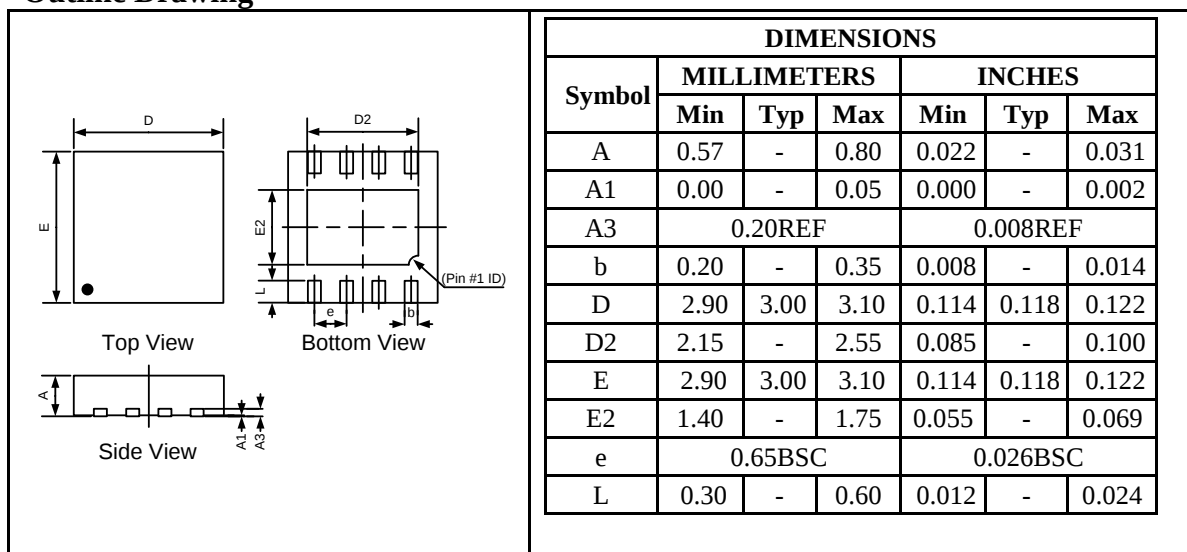


Land Pattern

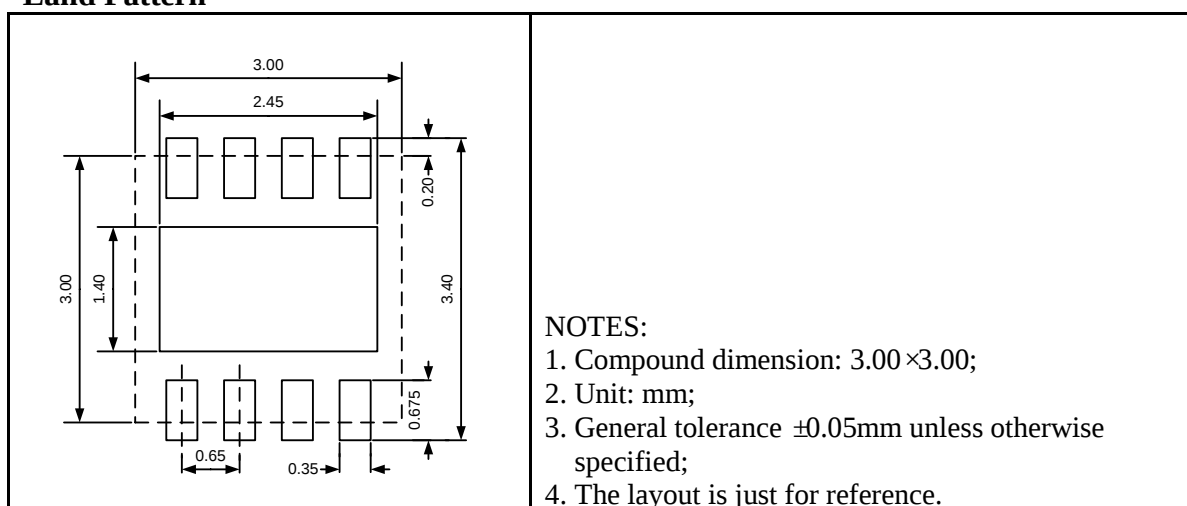


DFN8 3.0 × 3.0

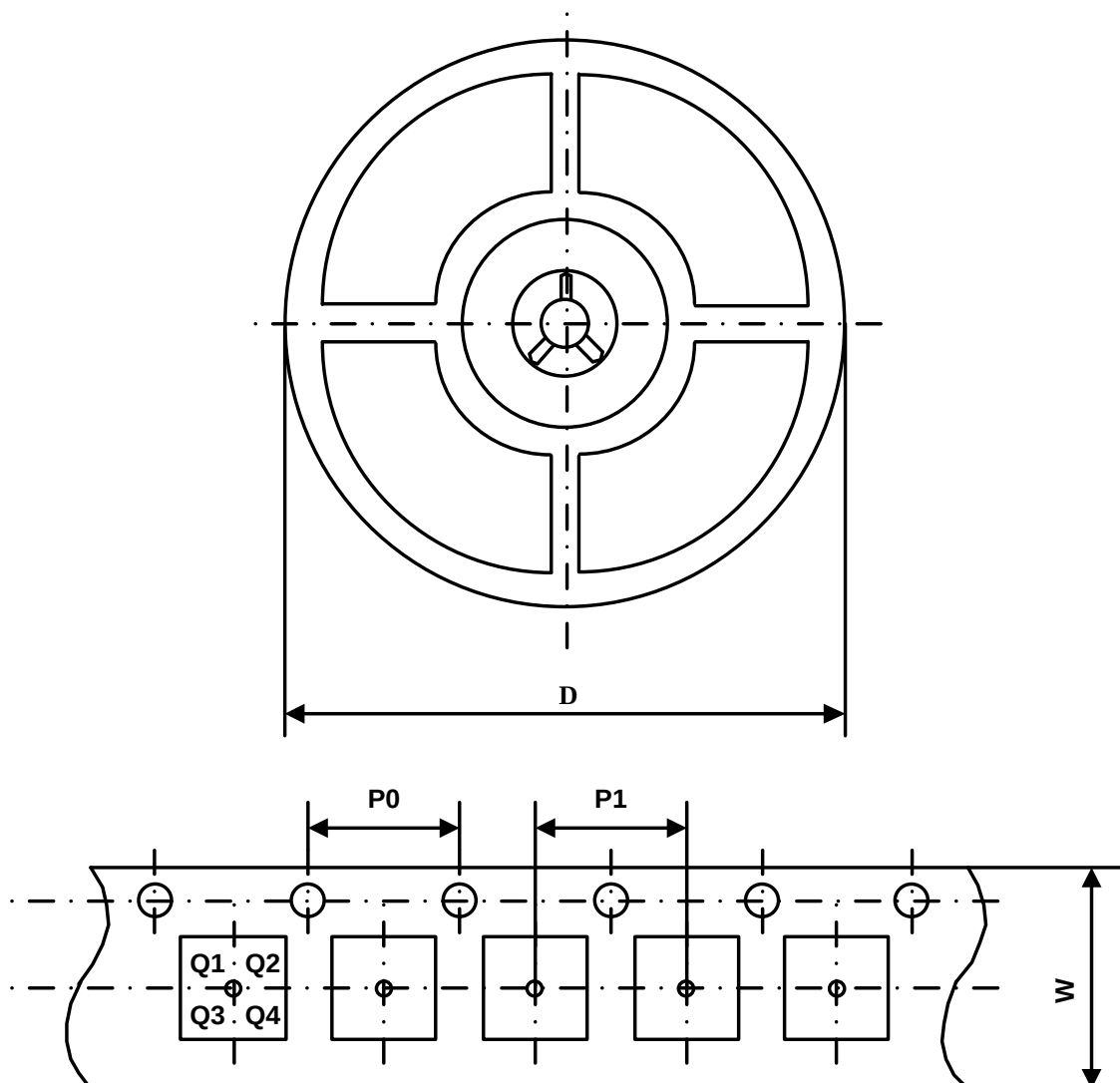
Outline Drawing



Land Pattern



Packing Information



Part Number	Package Type	Carrier Width (W)	Pitch (P0)	Pitch (P1)	Reel Size (D)	PIN 1 Quadrant
UMCAN1472VS8	SOP8	12 mm	4 mm	8 mm	330 mm	Q1
UMCAN1472VDA	DFN8 3.0×3.0	12 mm	4 mm	8 mm	330 mm	Q1
UMCAN1472NS8	SOP8	12 mm	4 mm	8 mm	330 mm	Q1
UMCAN1472NDA	DFN8 3.0×3.0	12 mm	4 mm	8 mm	330 mm	Q1

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