高速CAN收发器

UMCAN1057NS8 *SOP8*
UMCAN1057ES8 *SOP8*
UMCAN1057VS8 *SOP8*
UMCAN1057VDA *DFN8 3.0×3.0*

1 描述

UMCAN1057 是高速 CAN 收发器，可在控制器局域网（CAN）协议控制器和物理双线式 CAN 总线之间提供接口。该收发器专用于汽车业的高速 CAN 应用，可以为（微控制器中的）CAN 协议控制器提供发送和接收差分信号的功能。

UMCAN1057 具备了增强的电磁兼容性（EMC）和静电放电（ESD）性能，并具有以下特点：

- 电源关闭时，CAN总线具有良好的无源性能
- UMCAN1057VS8和UMCAN1057VDA可直接连接电源电压为3.3V和5V的微控制器

UMCAN1057实现了ISO 11898-2:2024和SAE J2284-1至SAE J2284-5中定义CAN物理层。可在CAN FD快速相位下，以高达5 Mbit/s的数据传输速率进行可靠通信。这些特性使UMCAN1057成为各类高速CAN网络的理想选择，特别是无需总线唤醒功能的待机模式的节点。

2 应用

- 汽车行业
- 工业控制
- 无线基础设施

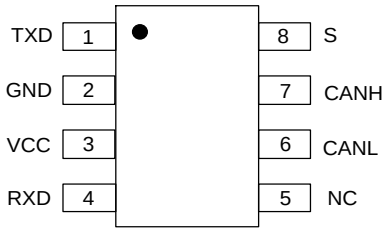
3 特性

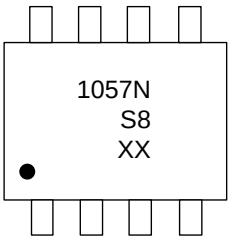
- 符合 ISO 11898-2:2024、SAE J2284-1 至 SAE J2284-5 和 SAE J1939-14 标准
- 在 CAN FD 快速相位下，数据速率高达 5 Mbit/s 时仍能保证时序精度
- 适用于 12V 系统
- UMCAN1057VS8 和 UMCAN1057VDA 的 V_{IO} 引脚可直连 3.3V 或 5V 微控制器（分别采用 SOP8 封装和超小型 DFN8 封装）。
- UMCAN1057ES8 上的 EN 引脚允许微控制器将收发器切换至超低电流的关断模式
- 收发器在未上电时脱离总线（零负载状态）
- 总线引脚具备高静电放电（ESD）防护能力
- TXD 引脚具有显性超时功能
- V_{CC} 和 V_{IO} 引脚具有欠压检测功能
- 热保护

4 Ordering Information

Part Number	Marking Code	Package Type	Shipping Qty
UMCAN1057NS8	1057NS8	SOP8	3000pcs/13Inch Tape & Reel
UMCAN1057ES8	1057ES8	SOP8	3000pcs/13Inch Tape & Reel
UMCAN1057VS8	1057VS8	SOP8	3000pcs/13Inch Tape & Reel
UMCAN1057VDA	1057V	DFN8 3.0×3.0	3000pcs/13Inch Tape & Reel

5 Pin Configuration and Function





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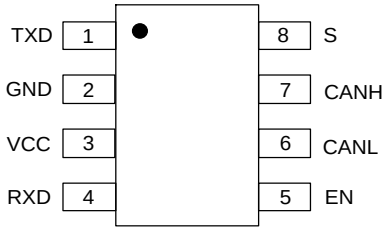

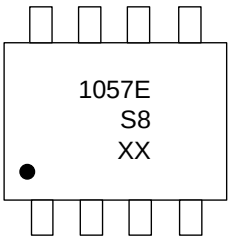

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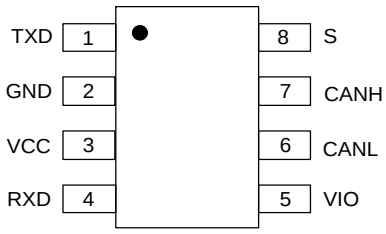

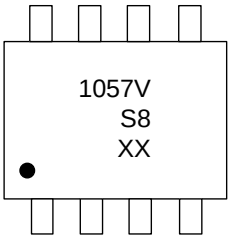

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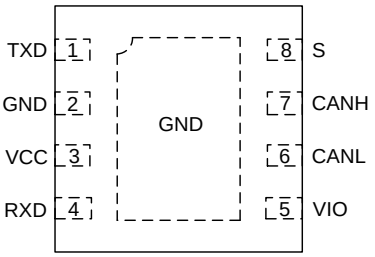
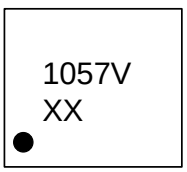




XX: Week Code
UMCAN1057VDA
DFN8 3.0×3.0

5 Pin Configuration and Function (continued)

Table 5-1. Pin Functions

Pin No.	Symbol	Description
1	TXD	Transmit data input
2	GND	Ground (Note1)
3	VCC	Supply voltage
4	RXD	Receive data output; reads out data from the bus lines
5	NC	Not connected; in UMCAN1057NS8 version
	EN	Enable control input; UMCAN1057ES8 only
	V_{IO}	Supply voltage for I/O level adapter; UMCAN1057VS8 and UMCAN1057VDA only
6	CANL	Low-level CAN bus line
7	CANH	High-level CAN bus line
8	S	Silent 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	℃

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_I	Voltage range on CANH, CANL		-40		+40	V
	Voltage range on V_{CC}, V_{IO}		-0.3		+7	V
	Voltage range on any other pin	Note 4	-0.3		V_{IO}+0.3	V
V_{DIF}	Voltage range between CANH and CANL		-40		+40	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}	Contact discharge, per IEC 61000-4-2	Bus pins		±10		kV
	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001	All pins		±8		kV
	Charged-device model (CDM), per ANSI/ESDA/JEDEC JS-002	All pins		±2		kV
I_{LU}	Latch up, per JEDEC JESD78	Class II		200		mA
T_{VJ}	Virtual junction temperature		-40		150	℃
T_{STG}	Storage temperature		-55		150	℃

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℃ to +150℃; V_{CC} = 4.5V to 5.5V; V_{IO} = 2.9V to 5.5V; R_L = 60Ω; C_L = 100pF 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_{CC}	Supply voltage		4.5		5.5	V
V_{UVD}	Undervoltage detection voltage on pin VCC		3.5	4	4.3	V
I_{CC}	Supply current	Normal mode; TXD = 0 V; short circuit on bus lines; -3V < (CANH=CANL)<18V		80	110	mA
		Normal mode; TXD = V_{IO}		1.6	5	mA
		Normal mode; TXD = 0 V	20	45	60	mA
		Silent mode; TXD = V_{IO}	0.1		2	mA
I/O level adapter supply; pin VIO						
V_{IO}	Supply voltage on pin VIO		2.9		5.5	V
V_{UVD}	Undervoltage detection voltage on pin VIO		2.1		2.8	V
I_{IO}	Supply current on pin VIO	Normal mode; TXD = 0V		165	300	uA
		Normal mode; TXD = V_{IO}		15	30	uA
		Silent mode		15	30	uA
Mode control inputs; pins S and EN (Note2)						
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	V_{IN} = V_{IO}	1		10	uA
I_{IL}	Low-level input current	V_{IN} = 0 V	-1		-1	uA

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

T_J = -40℃ to +150℃; V_{CC} = 4.5V to 5.5V; V_{IO} = 2.9V to 5.5V; R_L = 60Ω; C_L = 100pF 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	$V_{IN} = V_{IO}$	-5		5	uA
I_{IL}	Low-level input current	V_{IN} = 0 V	-270	-100	-30	uA
C_I	Input capacitance			5	10	pF
CAN receive data output; pin RXD						
I_{OH}	High-level output current	RXD = V_{IO} - 0.4 V	-9	-1.5		mA
I_{OL}	Low-level output current	RXD = 0.4 V		1.5	12	mA
Driver						
$V_{O(DOM)}$	Dominant output voltage	TXD = 0 V; t < $t_{TO(DOM)TXD}$; 50 Ω ≤ R_L ≤ 65 Ω; pin CANH	2.75	3.5	4.5	V
		TXD = 0 V; t < $t_{TO(DOM)TXD}$; 50 Ω ≤ R_L ≤ 65 Ω; pin CANL	0.5	1.5	2.25	V
$V_{OD(DOM)}$	Dominant differential output voltage	TXD = 0 V; t < $t_{TO(DOM)TXD}$; 50 Ω ≤ R_L ≤ 65 Ω;	1.5		3	V
		TXD = 0 V; t < $t_{TO(DOM)TXD}$; 45 Ω ≤ R_L ≤ 70 Ω;	1.4		3.3	V
		TXD = 0 V; t < $t_{TO(DOM)TXD}$; R_L = 2240 Ω;	1.5		5	V
$V_{O(REC)}$	Recessive output voltage	Normal or silent mode; TXD = V_{IO}; R_L = open	2	$0.5V_{CC}$	3	V
$V_{OD(REC)}$	Recessive differential output voltage	Normal or silent mode; TXD = V_{IO}; R_L = open	-50		50	mV
$V_{SYM(DOM)}$	Dominant output voltage symmetry, V_{CC}-CANH-CANL	TXD = 0 V; t < $t_{TO(DOM)TXD}$; R_L = 60 Ω	-400		400	mV

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{SYM(TX)}$	Transmitter output voltage symmetry, (CANH+CANL)/V_{CC}	TXD = 250 kHz, 1 MHz, 2.5MHz; R_L = 60 Ω; C_{SPLIT} = 4.7 nF	0.9V_{CC}		1.1V_{CC}	V
$I_{OS(DOM)}$	Dominant short-circuit output current	TXD = 0 V; t < $t_{TO(DOM)TXD}$; V_{CC} = 5 V; CANH = -15 V to 40 V; pin CANH	-100	-70		mA
		TXD = 0 V; t < $t_{TO(DOM)TXD}$; V_{CC} = 5 V; CANL = -15 V to 40 V; pin CANL		70	100	mA
$I_{OS(REC)}$	Recessive short-circuit output current	Normal mode; TXD = V_{IO}; –27 V≤ CANH = CANL ≤ 32 V	-5		5	mA
Receiver						
V_{TH}	Differential receiver threshold voltage	Normal or silent mode; -15 V≤ CANH, CANL ≤ 15 V	0.5		0.9	V
$V_{ID(REC)}$	Receiver recessive voltage	Normal or silent mode; -15 V ≤ CANH, CANL ≤ 15 V (Note3)	-4		0.5	V
$V_{ID(DOM)}$	Receiver recessive voltage	Normal or silent mode; -15 V ≤ CANH, CANL ≤ 15 V (Note3)	0.9		9	V
V_{HYS}	Differential receiver hysteresis voltage	Normal or silent mode; -15 V ≤ CANH, CANL ≤ 15 V	50		300	mV
$I_{LKG(PD)}$	Unpowered Leakage current	V_{CC} = V_{IO} = 0 V or shorted to GND via 47 kΩ; CANH = CANL = 5 V	-5		18	uA
R_I	Input resistance	-2 V ≤ CANH, CANL ≤ 7 V (Note3)	15	30	40	kΩ
ΔR_I	Input resistance deviation, [1 – ($R_{IN(CANH)}$ / $R_{IN(CANL)}$)] × 100 %	0 V ≤ CANH, CANL ≤ 5 V (Note3)	-3		3	%
R_{ID}	Differential input resistance	-2 V ≤ CANH, CANL ≤ 7 V (Note3)	30	60	80	kΩ
C_{IN}	Common-mode input capacitance to ground	Note3			20	pF

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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_{ID}	Differential input capacitance	Note3			10	pF
Thermal Protection						
$T_{J(SD)}$	Shutdown junction temperature	Note3		185		℃

Note 1: V_{IO} = V_{CC} in non-VIO product variants.
Note 2: Only UMCAN1057ES8 has an EN pin.
Note 3: Not tested in production; guaranteed by design.

6.4 Electrical Characteristics (Dynamic) (Note 1)

T_J = -40℃ to +150℃; V_{CC} = 4.5V to 5.5V; V_{IO} = 2.9V to 5.5V; R_L = 60Ω; C_L = 100pF unless otherwise specified; all voltages are defined with respect to ground.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
CAN timing characteristics; $t_{BIT(TXD)}$ ≥ 200 ns; see Figure 7-1, Figure 7-3 and Figure 7-4						
$t_{D(TXD-BUSDOM)}$	Delay time from TXD to bus dominant	Normal mode; R_L = 60 Ω, C_L = 100 pF		58	90	ns
$t_{D(TXD-BUSREC)}$	Delay time from TXD to bus recessive	Normal mode; R_L = 60 Ω, C_L = 100 pF		58	90	ns
$t_{D(BUSDOM-RXD)}$	Delay time from bus dominant to RXD	Normal mode; $C_{L(RXD)}$ = 15 pF		60	100	ns
$t_{D(BUSREC-RXD)}$	Delay time from bus recessive to RXD	Normal mode; $C_{L(RXD)}$ = 15 pF		60	110	ns
$t_{D(TXDL-RXDL)}$	Delay time from TXD LOW to RXD LOW	Normal mode; R_L = 60 Ω, C_L = 100 pF, $C_{L(RXD)}$ = 15 pF	50		195	ns
$t_{D(TXDH-RXDH)}$	Delay time from TXD HIGH to RXD HIGH	Normal mode; R_L = 60 Ω, C_L = 100 pF, $C_{L(RXD)}$ = 15 pF	50		195	ns
CAN FD timing characteristics according to ISO 11898-2:2024 parameter set B ($t_{BIT(TXD)}$) ⩾ 200 ns, up to 5 Mbit/s); See figure 7-1 and figure 7-3						
$\Delta t_{BIT(BUS)}$	Transmitted recessive bit width deviation	$\Delta t_{BIT(BUS)} = t_{BIT(BUS)} - t_{BIT(TXD)}$	-45		10	ns
Δt_{REC}	Receiver timing symmetry	$\Delta t_{REC} = t_{BIT(RXD)} - t_{BIT(BUS)}$	-45		15	ns
$\Delta t_{BIT(RXD)}$	Received recessive bit width deviation	$\Delta t_{REC} = t_{BIT(RXD)} - t_{BIT(TXD)}$	-80		20	ns
CAN FD timing characteristics according to ISO 11898-2:2024 parameter set A ($t_{BIT(TXD)}$) ⩾ 500 ns, up to 2 Mbit/s); See figure 7-1 and figure 7-3						
$\Delta t_{BIT(BUS)}$	Transmitted recessive bit width deviation	$\Delta t_{BIT(BUS)} = t_{BIT(BUS)} - t_{BIT(TXD)}$	-65		30	ns
Δt_{REC}	Receiver timing symmetry	$\Delta t_{REC} = t_{BIT(RXD)} - t_{BIT(BUS)}$	-65		40	ns
$\Delta t_{BIT(RXD)}$	Received recessive bit width deviation	$\Delta t_{REC} = t_{BIT(RXD)} - t_{BIT(TXD)}$	-100		50	ns
$t_{TO(DOM)TXD}$	TXD dominant time-out time	Normal mode; TXD = 0V (Note 2)	0.8	2.6	6.5	ms

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

Note 2: 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.

7 Parameter Measurement Information

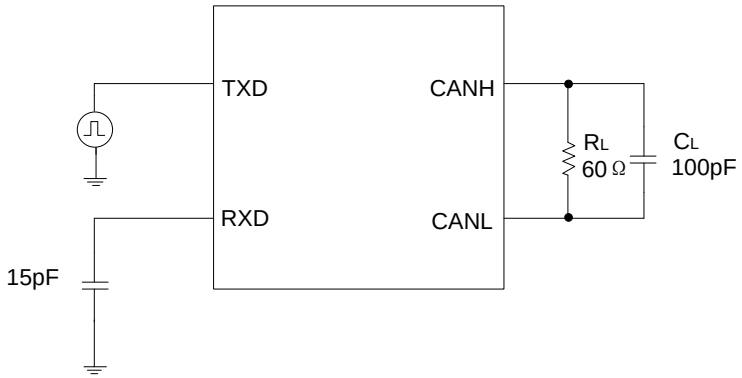


Figure 7-1. CAN transceiver timing test circuit

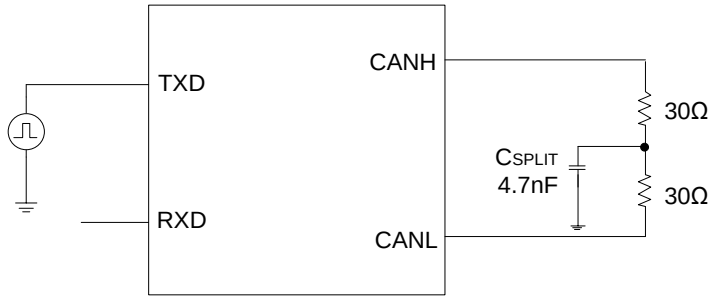


Figure 7-2. Test circuit for measuring transceiver transmitter driver symmetry

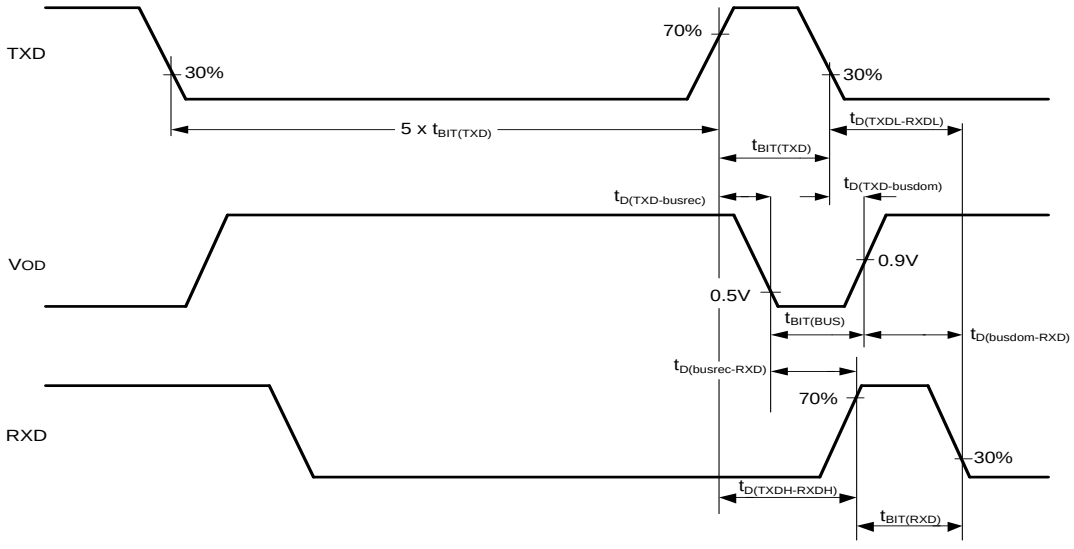


Figure 7-3. CAN FD timing definitions according to ISO 11898-2:2024

8 Block diagram

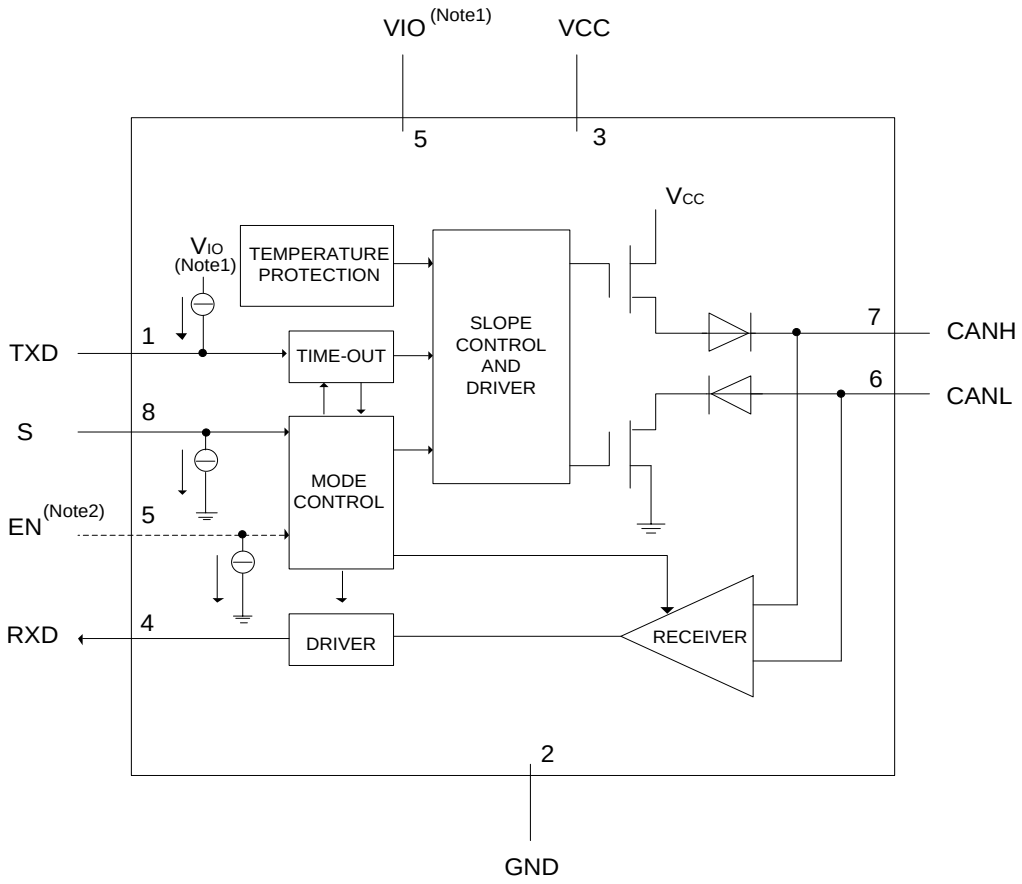


Figure 8-1. Block diagram

Note 1: $V_{IO} = V_{CC}$ in non-VIO product variants.
Note 2: Only present in the UMCAN1057ES8.

9 Detailed Description

9.1 Functional Description

The UMCAN1057 is a high-speed CAN stand-alone transceiver with Silent mode. It combines the functionality of transceiver with improved EMC and ESD handling capability. Improved slope control and high DC handling capability on the bus pins provides additional application flexibility. The UMCAN1057 is available in three versions, distinguished only by the function of pin 5:

- The UMCAN1057VS8 and UMCAN1057VDA allow for direct interfacing to microcontrollers with supply voltages down to 3.3 V.
- The UMCAN1057ES8 allows the transceiver to be switched to a very low-current Off mode.

9.2 Operating modes

The UMCAN1057 supports two operating modes, Normal and Silent, which are selected via pin S. An additional Off mode is supported in the UMCAN1057ES8 via pin EN. See Table 1 for a description of the operating modes under normal supply conditions.

Table 9-1. Operating modes

Mode	Inputs			Outputs	
	Pin EN (Note1)	**Pin S**	**Pin TXD**	**CAN driver**	**Pin RXD**
Normal	HIGH	LOW	LOW	dominant	Active (Note2)
	HIGH	LOW	HIGH	recessive	Active (Note2)
Silent	HIGH	HIGH	X (Note3)	recessive	Active (Note2)
Off (Note1)	LOW	X (Note3)	X (Note3)	floating	floating

Note1: Only available on the UMCAN1057ES8.
Note2: LOW if the CAN bus is dominant, HIGH if the CAN bus is recessive.
Note3: 'X' = Don't care.

9.2.1 Normal mode

A LOW level on pin S selects Normal mode. In this mode, the transceiver is able to 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 which is output to 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 ElectroMagnetic Emission (EME).

9.2.2 Silent mode

A HIGH level on pin S selects Silent mode. In Silent mode the transmitter is disabled, releasing the bus pins to recessive state. All other IC functions, including the receiver, continue to operate as in Normal mode. Silent mode can be used to prevent a faulty CAN controller from disrupting all network communications.

9.2.3 Off mode

A LOW level on pin EN of UMCAN1057ES8 selects Off mode. In Off mode the entire transceiver is disabled, allowing the microcontroller to save power when CAN communication is not required. The bus pins are floating in Off mode, making the transceiver invisible to the rest of the network.

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 pin TXD 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, S and EN input pins

Pin TXD has an internal pull-up to V_{IO} and pins S and EN (UMCAN1057ES8) have internal pull-downs to GND. This ensures a safe, defined state in case one or more of these pins is left floating.

9.3.3 Undervoltage detection on pins VIO

Should V_{IO} drop below the undervoltage detection levels ($V_{uvd(VIO)}$), the transceiver will switch off and disengage from the bus (zero load) until V_{IO} have recovered.

9.3.4 Overtemperature protection

The output drivers are protected against overtemperature conditions. If the operating junction temperature exceeds the shutdown junction temperature, $T_{J(SD)}$, the output drivers will be disabled until the operating junction temperature falls below $T_{J(SD)}$ and TXD becomes recessive again. Including the TXD condition ensures that output driver oscillations due to temperature drift are avoided.

9.3.5 VIO supply pin

There are three versions of the UMCAN1057 available, only differing in the function of a single pin. Pin 5 is either an enable control input (EN), a V_{IO} supply pin or is not connected. Pin V_{IO} on the UMCAN1057VS8 and UMCAN1057VDA should be connected to the microcontroller supply voltage (see Figure 10-2). This will adjust the signal levels of pins TXD, RXD and S to the I/O levels of the microcontroller. For versions of the UMCAN1057 without a V_{IO} pin, the V_{IO} input is internally connected to V_{CC}. This sets the signal levels of pins TXD, RXD and S to levels compatible with 5V microcontrollers.

10 Application Information

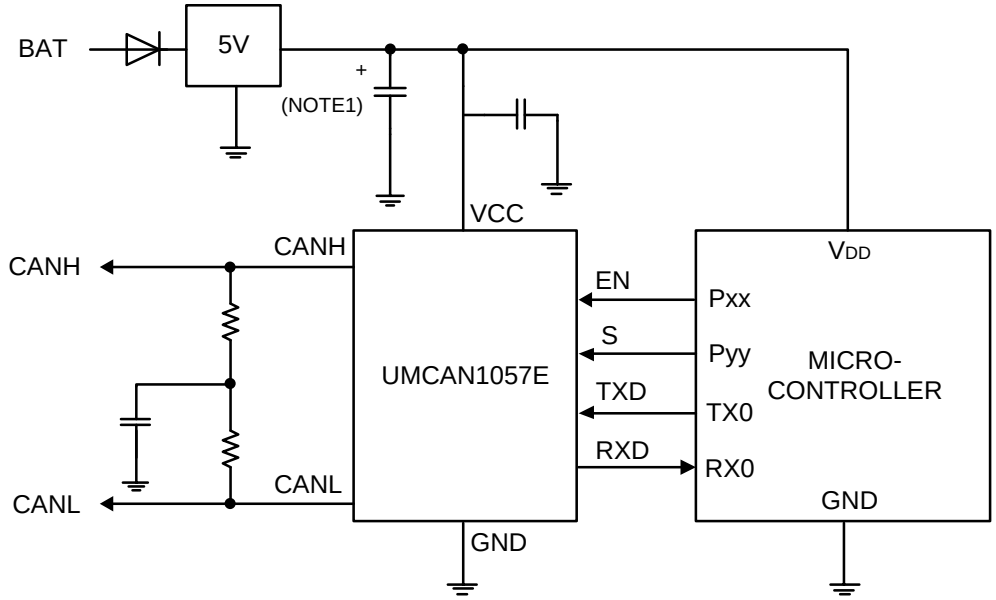


Figure 10-1. Typical application of the UMCAN1057E

Note1: Optional, depends on regulator

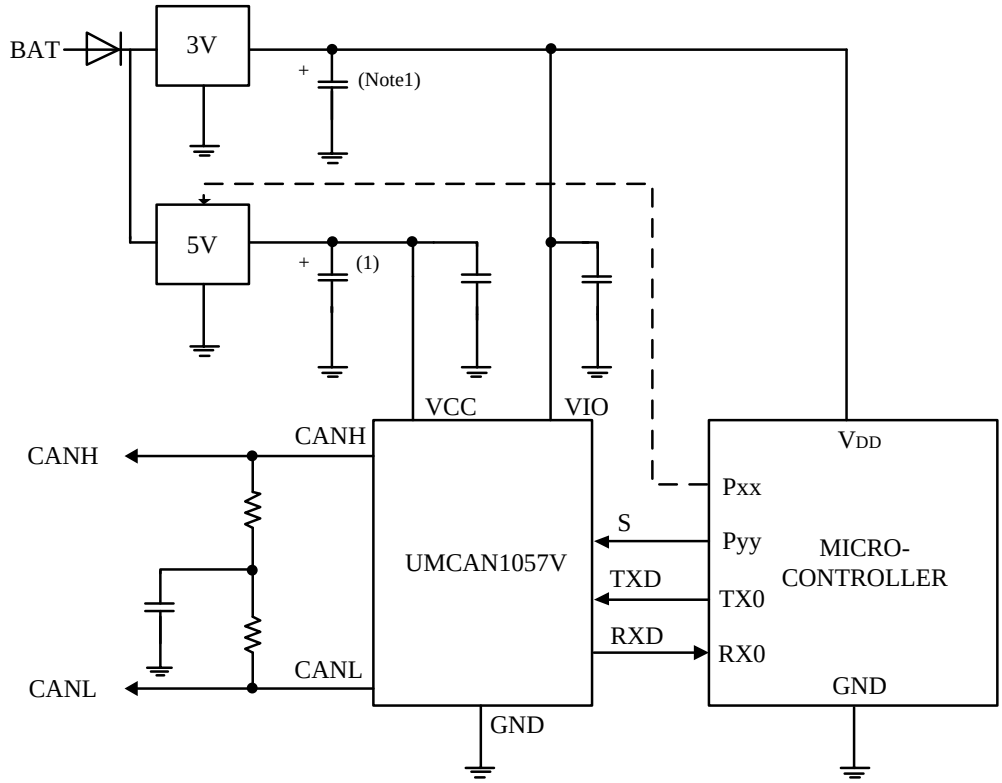


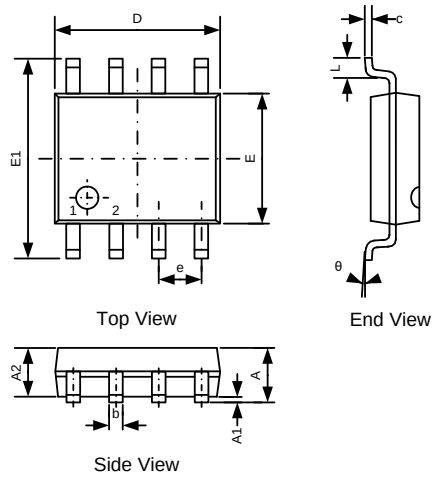
Figure 10-2. Typical application of the UMCAN1057V

Note1: Optional, depends on regulator

Package Information

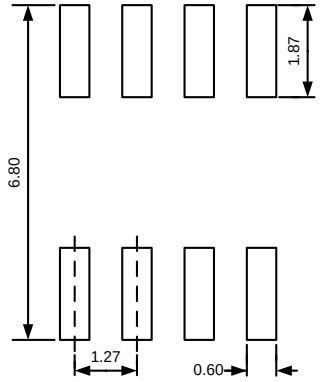
SOP8

Outline Drawing



Symbol	DIMENSIONS					
	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	1.35	1.55	1.75	0.053	0.061	0.069
A1	0.10	-	0.25	0.004	-	0.010
A2	1.25	-	1.65	0.049	-	0.065
b	0.30	-	0.51	0.012	-	0.020
c	0.15	-	0.25	0.006	-	0.010
D	4.70	4.90	5.10	0.185	0.193	0.200
E	3.80	3.90	4.00	0.150	0.154	0.157
E1	5.80	6.00	6.20	0.228	0.236	0.244
e	1.27BSC			0.050 BSC		
L	0.40	-	1.27	0.016	-	0.050
θ	0 °	-	8 °	0 °	-	8 °

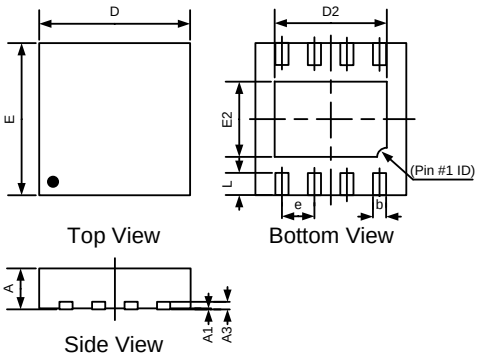
Land Pattern



NOTES:
1. Compound dimension: 4.90×3.90;
2. Unit: mm;
3. General tolerance ±0.05mm unless otherwise specified;
4. The layout is just for reference.

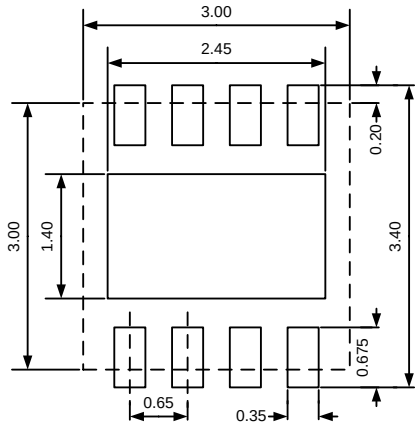
DFN8 3.0×3.0

Outline Drawing



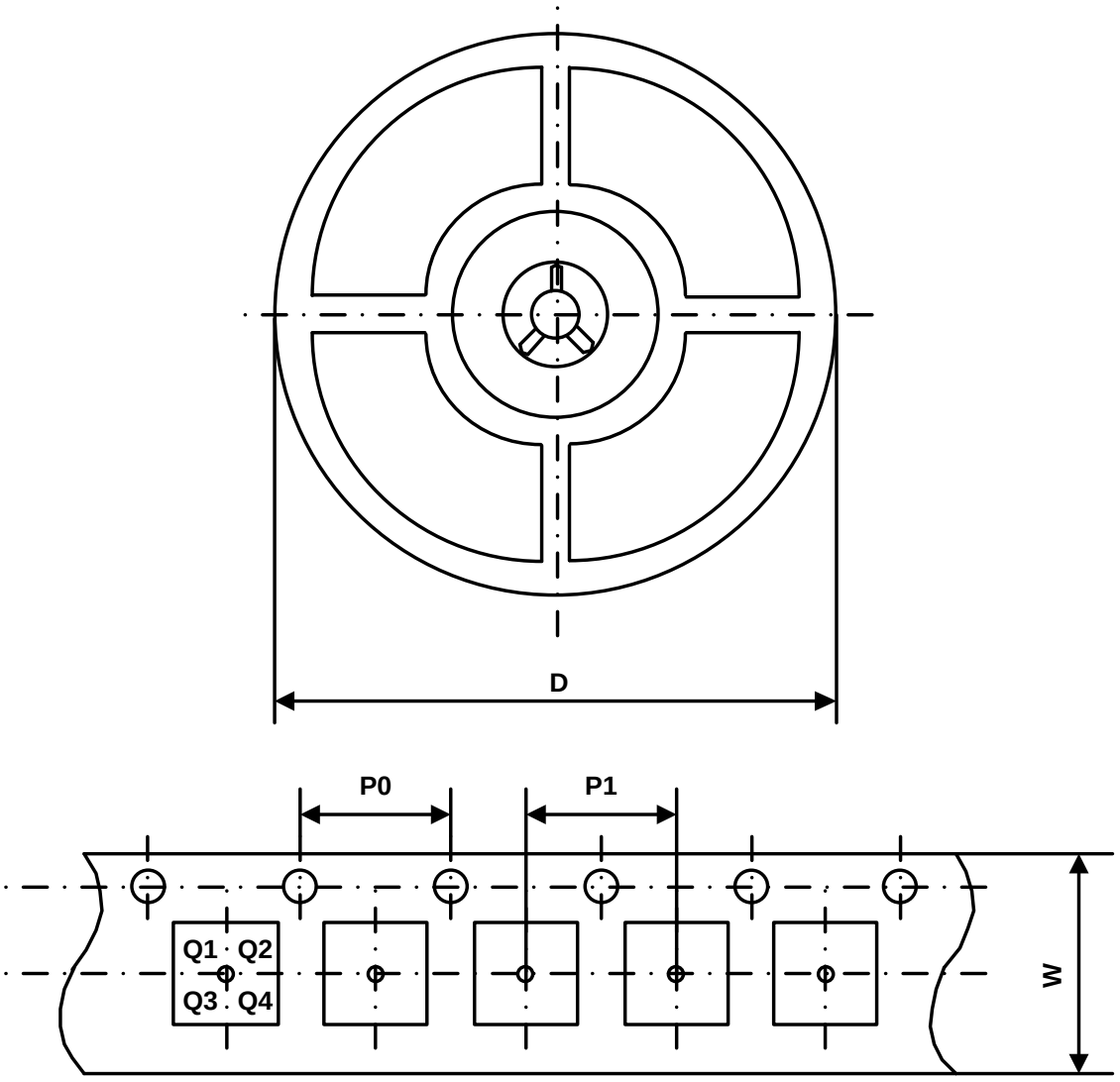
DIMENSIONS						
Symbol	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	0.57	-	0.80	0.022	-	0.031
A1	0.00	-	0.05	0.000	-	0.002
A3	0.20REF			0.008REF		
b	0.20	-	0.35	0.008	-	0.014
D	2.90	3.00	3.10	0.114	0.118	0.122
D2	2.15	-	2.55	0.085	-	0.100
E	2.90	3.00	3.10	0.114	0.118	0.122
E2	1.40	-	1.75	0.055	-	0.069
e	0.65BSC			0.026BSC		
L	0.30	-	0.60	0.012	-	0.024

Land Pattern



NOTES:
1. Compound dimension: 3.00×3.00;
2. Unit: mm;
3. General tolerance ±0.05mm unless otherwise specified;
4. The layout is just for reference.

Packing Information



Part Number	Package Type	Carrier Width (W)	Pitch (P0)	Pitch (P1)	Reel Size (D)	PIN 1 Quadrant
UMCAN1057NS8	SOP8	12 mm	4 mm	8 mm	330 mm	Q1
UMCAN1057ES8	SOP8	12 mm	4 mm	8 mm	330 mm	Q1
UMCAN1057VS8	SOP8	12 mm	4 mm	8 mm	330 mm	Q1
UMCAN1057VDA	DFN8 3.0×3.0	12 mm	4 mm	8 mm	330 mm	Q1

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https://www.union-ic.com/Quality.html

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