

## Features

- Low power operation
  - @5 V operation
  - 1.0 mA (max) /channel at 0 Mbps to 2 Mbps
  - 3.5 mA (max) /channel at 10 Mbps
  - 31 mA (max) /channel at 90 Mbps
- @3 V operation
  - 0.7 mA (max) /channel at 0 Mbps to 2 Mbps
  - 2.1 mA (max) /channel at 10 Mbps
  - 20 mA (max) /channel at 90 Mbps
- Bidirectional communication
- 3 V/5 V level translation
- High temperature operation: 125°C
- High data rate: dc to 90 Mbps (NRZ)
- Precise timing characteristics
  - 2 ns maximum pulse width distortion
  - 2 ns maximum channel-to-channel matching
- High common-mode transient immunity: >25 kV/μs
- Output enable function
- 16-lead SOP package
- RoHS-compliant models available
- Safety and regulatory approvals
  - UL recognition: 2500 V rms for 1 minute per UL 1577
  - CSA Component Acceptance Notice 5A
  - VDE Certificate of Conformity
  - DIN V VDE V 0884-10 (VDE V 0884-10):2006-12
  - $V_{IORM} = 560$  V peak
- TÜV approval: IEC/EN/UL/CSA 61010-1

## Application

- General-purpose multichannel isolation
- SPI interface/data converter isolation
- RS-232/RS-422/RS-485 transceivers
- Industrial field bus isolation
- Automotive systems

## Description

The CBMuD1400/CBMuD1401/CBMuD1402 are quad-channel digital isolators. Combining high speed CMOS and monolithic air core transformer technology, these isolation components provide outstanding performance characteristics superior to alternatives, such as optocoupler devices.

By avoiding the use of LEDs and photodiodes, Devices remove the design difficulties commonly associated with opto-couplers. The typical optocoupler concerns regarding uncertain current transfer ratios, nonlinear transfer functions, and temperature and lifetime effects are eliminated with the simple digital interfaces and stable performance characteristics.

The need for external drivers and other discrete components is eliminated with these products. Furthermore, Devices consume one tenth to one sixth of the power of optocouplers at comparable signal data rates.

The CBMuD1400/CB MuD1401/CB MuD1402 isolators provide four independent isolation channels in a variety of channel configurations and data rates (see the Ordering Guide). All models operate with the supply voltage on either side ranging from 2.7 V to 5.5 V, providing compatibility with lower voltage systems as well as enabling a voltage translation functionality across the isolation barrier. In addition, the CBMuD1400/ CB MuD1401/CB MuD1402 provide low pulse width distortion and tight channel-to-channel matching. Unlike other optocoupler alternatives, the CBMuD1400/CB MuD1401/CB MuD1402 isolators have a patented refresh feature that ensures dc correctness in the absence of input logic transitions and when power is not applied to one of the supplies.

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## Pin Configurations

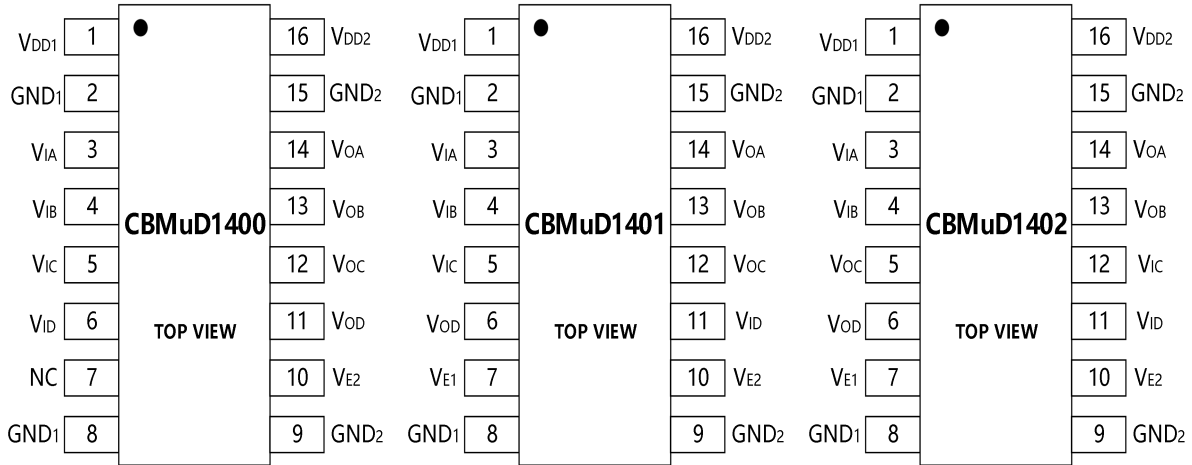


Figure 1. SOP16 Pin Configuration

Table 1. Pin description

Pin Name	Pin.no(CB MuD1400)	Pin.no(CB MuD1401)	Pin.no(CB MuD1402)	Description
V <sub>DD1</sub>	1	1	1	Supply Voltage for Isolator Side 1.
GND <sub>1</sub>	2,8	2,8	2,8	Ground 1. Ground reference for Isolator Side 1.
V <sub>IA</sub>	3	3	3	Logic Input A.
V <sub>IB</sub>	4	4	4	Logic Input B.
V <sub>IC</sub>	5	5	12	Logic Input C.
V <sub>ID</sub>	6	11	11	Logic Input D.
V <sub>E1</sub>	--	--	7	Output Enable 1. Active high logic input. V <sub>OD</sub> output is enabled when V <sub>E1</sub> is high or disconnected. V <sub>OD</sub> is disabled when V <sub>E1</sub> is low. In noisy environments, connecting V <sub>E1</sub> to an external logic high or low is recommended.
NC	7	--	--	No Connect.
GND <sub>2</sub>	9,15	9,15	9,15	Ground 1. Ground reference for Isolator Side 2.
V <sub>E2</sub>	10	10	10	Output Enable 2. Active high logic input. V <sub>OA</sub> , V <sub>OB</sub> , V <sub>OC</sub> , and V <sub>OD</sub> outputs are enabled when V <sub>E2</sub> is high or disconnected. V <sub>OA</sub> , V <sub>OB</sub> , V <sub>OC</sub> , and V <sub>OD</sub>

				outputs are disabled when $V_{E2}$ is low. In noisy environments, connecting $V_{E2}$ to an external logic high or low is recommended.
$V_{OD}$	11	6	6	Logic Output D.
$V_{OC}$	12	12	5	Logic Output C.
$V_{OB}$	13	13	13	Logic Output B.
$V_{OA}$	14	14	14	Logic Output A.
$V_{DD2}$	16	16	16	Supply Voltage for Isolator Side 2.

## Functional Block diagram

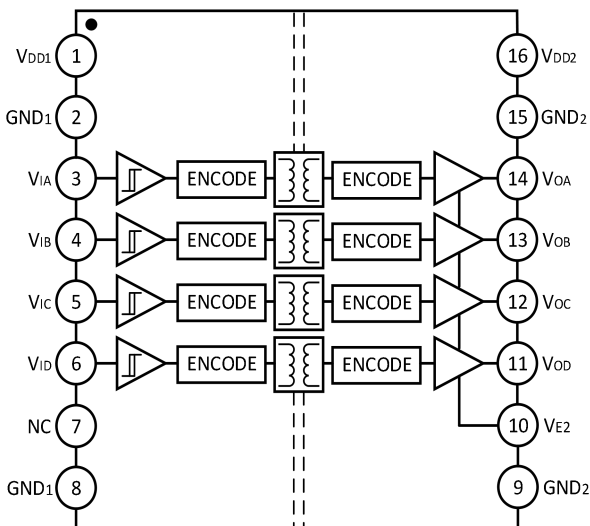


Figure 2. CBMuD1400

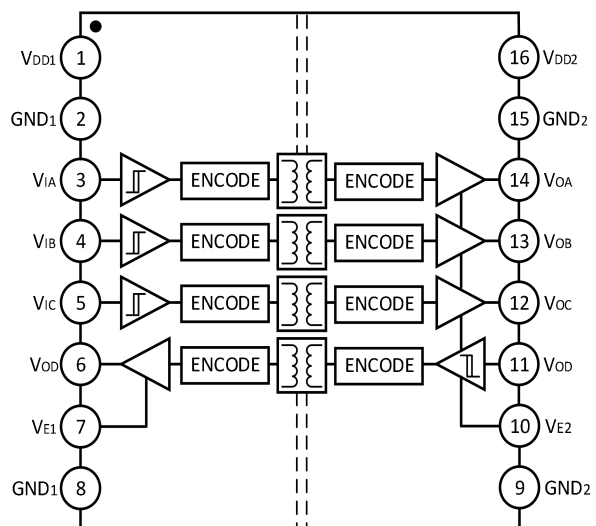


Figure 3. CBMuD1401

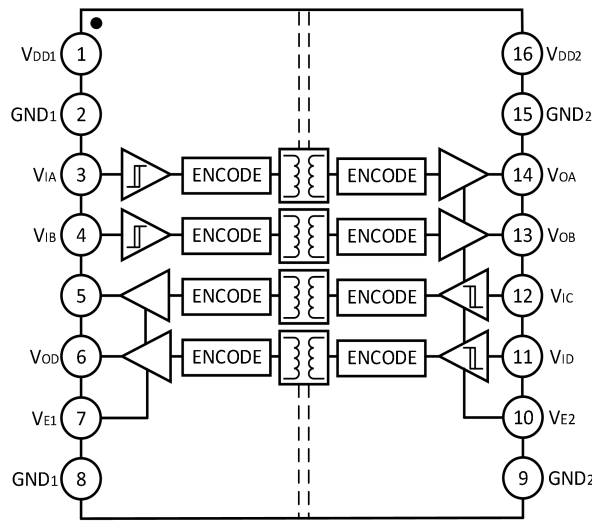


Figure 4. CBMuD1402

Table 2. Truth Table(Positive Logic)

V <sub>IX</sub> INPUT	V <sub>EX</sub> INPUT	V <sub>DDI</sub> State	V <sub>DDO</sub> State	V <sub>OX</sub> OUTPUT	Notes
H	H or NC	Powered	Powered	H	OFF
L	H or NC	Powered	Powered	L	ON
X	L	Powered	Powered	Z	--
X	H or NC	Unpowered	Powered	H	Outputs return to the input state within 1 μs of V <sub>DDI</sub> power restoration.
X	L	Unpowered	Powered	Z	-
X	X	Powered	Unpowered	Indeterminate	Outputs return to the input state within 1 μs of V <sub>DDI</sub> power restoration.

## Absolute Maximum Ratings <sup>(1)</sup>

- Supply Voltages ( $V_{DD1}$ ,  $V_{DD2}$ ) :  $-0.5\text{ V}$  to  $+7.0\text{ V}$
- Input Voltage ( $V_{IA}$ ,  $V_{IB}$ ,  $V_{IC}$ ,  $V_{ID}$ ,  $V_{E1}$ ,  $V_{E2}$ ) :  $-0.5\text{ V}$  to  $V_{DDI} + 0.5\text{ V}$
- Output Voltage ( $V_{OA}$ ,  $V_{OB}$ ,  $V_{OC}$ ,  $V_{OD}$ ) :  $-0.5\text{ V}$  to  $V_{DDO} + 0.5\text{ V}$
- Average Output Current per Pin :
  - Side 1 ( $I_{O1}$ ) :  $-18\text{ mA}$  to  $+18\text{ mA}$
  - Side 2 ( $I_{O2}$ ) :  $-22\text{ mA}$  to  $+22\text{ mA}$
- Storage Temperature Range :  $-65^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$
- Ambient Operating Temperature( $T_A$ )<sup>1</sup> :  $-40^{\circ}\text{C}$  to  $+105^{\circ}\text{C}$
- Common-Mode Transients:  $-100\text{ kV}/\mu\text{s}$  to  $+100\text{ kV}/\mu\text{s}$
- Maximum Continuous Working Voltage
  - (1) AC Voltage, Bipolar Waveform : 565V peak
  - (2) AC Voltage, Unipolar Waveform
    - Basic Insulation : 1131V peak
    - Reinforced Insulation : 560V peak
  - (3) DC Voltage
    - Basic Insulation : 1131V peak
    - Reinforced Insulation : 560V peak

## Electrical Characteristics

$4.5\text{ V} \leq V_{DD1} \leq 5.5\text{ V}$ ,  $4.5\text{ V} \leq V_{DD2} \leq 5.5\text{ V}$ ; all minimum/maximum specifications apply over the entire recommended operation range, unless otherwise noted; all typical specifications are at  $T_A = 25^\circ\text{C}$ ,  $V_{DD1} = V_{DD2} = 5\text{ V}$ .

Table 3.

PARAMETER	Symbol	$T_A = +25^\circ\text{C}$			Test Conditions	UNIT
		Min	Typ	Max		
<b>DC SPECIFICATIONS</b>						
Input Supply Current per Channel, Quiescent	$I_{DD1(Q)}$	--	0.50	0.53		mA
Output Supply Current per Channel, Quiescent	$I_{DDO(Q)}$	--	0.19	0.21		mA
CBMuD1400 Total Supply Current, Four Channels						
$V_{DD1}$ Supply Current, DC to 2 Mbps	$I_{DD1(Q)}$	--	2.2	2.8	DC to 1 MHz logic signal freq.	mA
$V_{DD2}$ Supply Current, DC to 2 Mbps	$I_{DD2(Q)}$	--	0.9	1.4	DC to 1 MHz logic signal freq.	mA
$V_{DD1}$ Supply Current, 10 Mbps	$I_{DD1(10)}$	--	8.6	10.6	5 MHz logic signal freq.	mA
$V_{DD2}$ Supply Current, 10 Mbps	$I_{DD2(10)}$	--	2.6	3.5	5 MHz logic signal freq.	mA
$V_{DD1}$ Supply Current, 90 Mbps	$I_{DD1(90)}$	--	70	100	45 MHz logic signal freq.	mA
$V_{DD2}$ Supply Current, 90 Mbps	$I_{DD2(90)}$	--	18	25	45 MHz logic signal freq.	mA
CBMuD1401 Total Supply Current, Four Channels						
$V_{DD1}$ Supply Current, DC to 2 Mbps	$I_{DD1(Q)}$	--	1.8	2.4	DC to 1 MHz logic signal freq.	mA
$V_{DD2}$ Supply Current, DC to	$I_{DD2(Q)}$	--	1.2	1.8	DC to 1 MHz logic signal freq.	mA



2 Mbps						
$V_{DD1}$ Supply Current, 10 Mbps	$I_{DD1(10)}$	--	7.1	9.0	5 MHz logic signal freq.	mA
$V_{DD2}$ Supply Current, 10 Mbps	$I_{DD2(10)}$	--	4.1	5.0	5 MHz logic signal freq.	mA
$V_{DD1}$ Supply Current, 90 Mbps	$I_{DD1(90)}$	--	57	82	45 MHz logic signal freq.	mA
$V_{DD2}$ Supply Current, 90 Mbps	$I_{DD2(90)}$	--	31	43	45 MHz logic signal freq.	mA
CBMuD1402 Total Supply Current, Four Channels						
$V_{DD1}$ Supply Current, DC to 2 Mbps	$I_{DD1(Q)}, I_{DD2(Q)}$	--	1.5	2.1	DC to 1 MHz logic signal freq.	mA
$V_{DD1}$ Supply Current, 10 Mbps	$I_{DD1(10)}, I_{DD2(10)}$	--	5.6	7.0	5 MHz logic signal freq.	mA
$V_{DD1}$ Supply Current, 90 Mbps	$I_{DD1(90)}, I_{DD2(90)}$	--	44	62	45 MHz logic signal freq.	mA
For All Models						
Input Currents	$I_{IA}, I_{IB}, I_{IC}, I_{ID}, I_{E1}, I_{E2}$	-10	+0.01	+10	$0V \leq V_{IA}, V_{IB}, V_{IC}, V_{ID} \leq V_{DD1}$ or $V_{DD2}, 0V \leq V_{E1}, V_{E2} \leq V_{DD1}$ or $V_{DD2}$	$\mu A$
Logic High Input Threshold	$V_{IH}, V_{EH}$	2.0	--	--		V
Logic Low Input Threshold	$V_{IL}, V_{EL}$	--	--	0.8		V
Logic High Output Voltages	$V_{OAH}, V_{OBH}, V_{OCH}, V_{ODH}$	$(V_{DD1}$ or $V_{DD2}) - 0.1$	5.0	--	$I_{Ox} = -20 \mu A, V_{Ix} = V_{IxH}$	V
	$V_{IL}, V_{EL}$	$(V_{DD1}$ or $V_{DD2}) - 0.4$	4.8	--	$I_{Ox} = -3.2mA, V_{Ix} = V_{IxH}$	V
Logic Low Output	$V_{OAL}, V_{OBL}$	--	0.0	0.1	$I_{Ox} = 20 \mu A, V_{Ix} = V_{IxL}$	V

Voltages	$V_{OCL}, V_{ODL}$	--	0.04	0.1	$I_{Ox} = 400\mu A, V_{Ix} = V_{IxL}$	V
		--	0.2	0.4	$I_{Ox} = 3.2mA, V_{Ix} = V_{IxL}$	V
<b>SWITCHING SPECIFICATIONS</b>	CBMuD1400A/CBMuD1401A/CBMuD1402A					
Minimum Pulse Width	PW	--	--	1000	$C_L = 15\text{ pF}$ , CMOS signal levels	ns
Maximum Data Rate	--	1	--	--	$C_L = 15\text{ pF}$ , CMOS signal levels	Mbps
Propagation Delay	$t_{PHL}, t_{PLH}$	50	70	100	$C_L = 15\text{ pF}$ , CMOS signal levels	ns
Pulse Width Distortion, $ t_{PLH} - t_{PHL} $	PWD	--	--	40	$C_L = 15\text{ pF}$ , CMOS signal levels	ns
Change vs. Temperature		--	11	--	$C_L = 15\text{ pF}$ , CMOS signal levels	ps/°C
Propagation Delay Skew <sup>6</sup>	$t_{PSK}$	--	--	50	$C_L = 15\text{ pF}$ , CMOS signal levels	ns
Channel-to-Channel Matching <sup>7</sup>	$t_{PSKCD}/t_{PSKOD}$	--	--	50	$C_L = 15\text{ pF}$ , CMOS signal levels	ns
CBMuD1400B/CBMuD1401B/CBMuD1402B						
Minimum Pulse Width	PW	--	--	100	$C_L = 15\text{ pF}$ , CMOS signal levels	ns
Maximum Data Rate	--	10	--	--	$C_L = 15\text{ pF}$ , CMOS signal levels	Mbps
Propagation Delay	$t_{PHL}, t_{PLH}$	15	35	50	$C_L = 15\text{ pF}$ , CMOS signal levels	ns
Pulse Width Distortion, $ t_{PLH} - t_{PHL} $	PWD	--	--	3	$C_L = 15\text{ pF}$ , CMOS signal levels	ns
Change vs. Temperature		--	5	--	$C_L = 15\text{ pF}$ , CMOS signal levels	ps/°C
Propagation Delay Skew <sup>6</sup>	$t_{PSK}$	--	--	22	$C_L = 15\text{ pF}$ , CMOS signal levels	ns
Channel-to-Channel Matching Codirectional Channels	$t_{PSKCD}$	--	--	3	$C_L = 15\text{ pF}$ , CMOS signal levels	ns
Channel-to-Channel Matching, Opposing-Directional Channels	$t_{PSKOD}$	--	--	6	$C_L = 15\text{ pF}$ , CMOS signal levels	ns
CBMuD1400C/CBMuD1401C/CBMuD1402C						
Minimum Pulse Width	PW	--	8.3	11.1	$C_L = 15\text{ pF}$ , CMOS signal levels	ns
Maximum Data Rate	--	90	120	--	$C_L = 15\text{ pF}$ , CMOS signal levels	Mbps
Propagation Delay	$t_{PHL}, t_{PLH}$	20	30	40	$C_L = 15\text{ pF}$ , CMOS signal levels	ns
Pulse Width Distortion, $ t_{PLH} - t_{PHL} $	PWD	--	0.5	2	$C_L = 15\text{ pF}$ , CMOS signal levels	ns

tPLH – tPHL						
Change vs. Temperature		--	3	--	$C_L = 15 \text{ pF}$ , CMOS signal levels	ps/°C
Propagation Delay Skew <sup>6</sup>	$t_{PSK}$	--	--	14	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Channel-to-Channel Matching Codirectional Channels	$t_{PSKCD}$	--	--	2	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Channel-to-Channel Matching, Opposing-Directional Channels	$t_{PSKOD}$	--	--	5	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
For All Models						
Output Disable Propagation Delay (High/Low to High Impedance)	$t_{PHZ}, t_{PLH}$	--	6	8	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Output Enable Propagation Delay (High Impedance to High/Low)	$t_{PZH}, t_{PZL}$	--	6	8	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Output Rise/Fall Time (10% to 90%)	$t_R/t_F$					
5 V/3 V Operation		--	3.0	--	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
3 V/5 V Operation		--	2.5	--	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Common-Mode Transient Immunity at Logic High Output	$CM_H$	25	35	--	$V_{IX} = V_{DD1}$ or $V_{DD2}$ , $V_{CM} = 1000 \text{ V}$ , transient magnitude = 800 V	kv/ $\mu$ s
Common-Mode Transient Immunity at Logic Low Output	$CM_L$	25	35	--	$V_{IX} = 0 \text{ V}$ , $V_{CM} = 1000 \text{ V}$ , transient magnitude = 800 V	kv/ $\mu$ s
Refresh Rate	fr					
5 V/3 V Operation		--	1.2	--		Mbps

3 V/5 V Operation		--	1.1	--		Mbps
Input Dynamic Supply Current per Channel <sup>9</sup>	$I_{DDI(D)}$					
5 V/3 V Operation		--	0.19	--		mA/ Mbps
3 V/5 V Operation		--	0.10	--		mA/ Mbps
Output Dynamic Supply Current per Channel	$I_{DDO(D)}$					
5 V/3 V Operation		--	0.03	--		mA/ Mbps
3 V/5 V Operation		--	0.05	--		mA/ Mbps

$2.7\text{ V} \leq V_{DD1} \leq 3.6\text{ V}$ ,  $2.7\text{ V} \leq V_{DD2} \leq 3.6\text{ V}$ ; all minimum/maximum specifications apply over the entire recommended operation range, unless otherwise noted; all typical specifications are at  $T_A = 25^\circ\text{C}$ ,  $V_{DD1} = V_{DD2} = 3\text{ V}$ .

Table 4.

PARAMETER	Symbol	$T_A = +25^\circ\text{C}$			Test Conditions	UNIT
		Min	Typ	Max		
<b>DC SPECIFICATIONS</b>						
Input Supply Current per Channel, Quiescent	$I_{DD1(Q)}$	--	0.26	0.31		mA
Output Supply Current per Channel, Quiescent	$I_{DDO(Q)}$	--	0.11	0.14		mA
CBMuD1400 Total Supply Current, Four Channels						
$V_{DD1}$ Supply Current, DC to 2 Mbps	$I_{DD1(Q)}$	--	1.2	1.9	DC to 1 MHz logic signal freq.	mA
$V_{DD2}$ Supply Current, DC to	$I_{DD2(Q)}$	--	0.5	0.9	DC to 1 MHz logic signal freq.	mA

2 Mbps						
V <sub>DD1</sub> Supply Current, 10 Mbps	I <sub>DD1(10)</sub>	--	4.5	6.5	5 MHz logic signal freq.	mA
V <sub>DD2</sub> Supply Current, 10 Mbps	I <sub>DD2(10)</sub>	--	1.4	2.0	5 MHz logic signal freq.	mA
V <sub>DD1</sub> Supply Current, 90 Mbps	I <sub>DD1(90)</sub>	--	37	65	45 MHz logic signal freq.	mA
V <sub>DD2</sub> Supply Current, 90 Mbps	I <sub>DD2(90)</sub>	--	11	15	45 MHz logic signal freq.	mA
CBMuD1401 Total Supply Current, Four Channels						
V <sub>DD1</sub> Supply Current,DC to 2 Mbps	I <sub>DD1(Q)</sub>	--	1.0	1.6	DC to 1 MHz logic signal freq.	mA
V <sub>DD2</sub> Supply Current,DC to 2 Mbps	I <sub>DD2(Q)</sub>	--	0.7	1.2	DC to 1 MHz logic signal freq.	mA
V <sub>DD1</sub> Supply Current, 10 Mbps	I <sub>DD1(10)</sub>	--	3.7	5.4	5 MHz logic signal freq.	mA
V <sub>DD2</sub> Supply Current, 10 Mbps	I <sub>DD2(10)</sub>	--	2.2	3.0	5 MHz logic signal freq.	mA
V <sub>DD1</sub> Supply Current, 90 Mbps	I <sub>DD1(90)</sub>	--	30	52	45 MHz logic signal freq.	mA
V <sub>DD2</sub> Supply Current, 90 Mbps	I <sub>DD2(90)</sub>	--	18	27	45 MHz logic signal freq.	mA
CBMuD1402 Total Supply Current, Four Channels						
V <sub>DD1</sub> Supply Current,DC to 2 Mbps	I <sub>DD1(Q),I<sub>DD2(Q)</sub></sub>	--	0.9	1.5	DC to 1 MHz logic signal freq.	mA
V <sub>DD1</sub> Supply Current, 10 Mbps	I <sub>DD1(10),I<sub>DD2(10)</sub></sub>	--	3.0	4.2	5 MHz logic signal freq.	mA
V <sub>DD1</sub> Supply Current, 90 Mbps	I <sub>DD1(90),I<sub>DD2(90)</sub></sub>	--	24	39	45 MHz logic signal freq.	mA
For All Models						
Input Currents	I <sub>IA</sub> , I <sub>IB</sub> , I <sub>IC</sub>	-10	+0.01	+10	0 V ≤ V <sub>IA</sub> , V <sub>IB</sub> , V <sub>IC</sub> , V <sub>ID</sub> ≤ V <sub>DD1</sub> or	μA

	$I_{ID}, I_{E1}, I_{E2}$				$V_{DD2}, 0V \leq V_{E1}, V_{E2} \leq V_{DD1} \text{ or } V_{DD2}$	
Logic High Input Threshold	$V_{IH}, V_{EH}$	1.6	--	--		V
Logic Low Input Threshold	$V_{IL}, V_{EL}$	--	--	0.4		V
Logic High Output Voltages	$V_{OAH}, V_{OBH},$ $V_{OCH}, V_{ODH}$	( $V_{DD1}$ or $V_{DD2}$ ) - 0.1	3.0	--	$I_{Ox} = -20 \mu A, V_{Ix} = V_{IxH}$	V
	$V_{IL}, V_{EL}$	( $V_{DD1}$ or $V_{DD2}$ ) - 0.4	2.8	--	$I_{Ox} = -3.2mA, V_{Ix} = V_{IxH}$	V
Logic Low Output Voltages	$V_{OAL}, V_{OBL},$	--	0.0	0.1	$I_{Ox} = 20 \mu A, V_{Ix} = V_{IxL}$	V
	$V_{OCL}, V_{ODL}$	--	0.04	0.1	$I_{Ox} = 400\mu A, V_{Ix} = V_{IxL}$	V
		--	0.2	0.4	$I_{Ox} = 3.2mA, V_{Ix} = V_{IxL}$	V
<b>SWITCHING SPECIFICATIONS</b>	CBMuD1400A/CBMuD1401A/CBMuD1402A					
Minimum Pulse Width	PW	--	--	1000	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Maximum Data Rate	--	1	--	--	$C_L = 15 \text{ pF}$ , CMOS signal levels	Mbps
Propagation Delay	$t_{PHL}, t_{PLH}$	50	75	100	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Pulse Width Distortion,  tPLH - tPHL	PWD	--	--	40	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Change vs. Temperature		--	11	--	$C_L = 15 \text{ pF}$ , CMOS signal levels	ps/°C
Propagation Delay Skew <sup>6</sup>	$t_{PSK}$	--	--	50	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Channel-to-Channel Matching <sup>7</sup>	$t_{PSKCD}/t_{PSK}$ OD	--	--	50	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
CBMuD1400B/CBMuD1401B/CBMuD1402B						
Minimum Pulse Width	PW	--	--	100	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Maximum Data Rate	--	10	--	--	$C_L = 15 \text{ pF}$ , CMOS signal levels	Mbps
Propagation Delay	$t_{PHL}, t_{PLH}$	20	38	50	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Pulse Width Distortion,  tPLH - tPHL	PWD	--	--	3	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns

Change vs. Temperature		--	5	--	$C_L = 15 \text{ pF}$ , CMOS signal levels	ps/°C
Propagation Delay Skew <sup>6</sup>	$t_{PSK}$	--	--	22	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Channel-to-Channel Matching Codirectional Channels	$t_{PSKCD}$	--	--	3	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Channel-to-Channel Matching, Opposing-Directional Channels	$t_{PSKOD}$	--	--	6	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
CBMuD1400C/CBMuD1401C/CBMuD1402C						
Minimum Pulse Width	PW	--	8.3	11.1	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Maximum Data Rate	--	90	120	--	$C_L = 15 \text{ pF}$ , CMOS signal levels	Mbps
Propagation Delay	$t_{PHL}, t_{PLH}$	20	34	45	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Pulse Width Distortion, $ t_{PLH} - t_{PHL} $	PWD	--	0.5	2	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Change vs. Temperature		--	3	--	$C_L = 15 \text{ pF}$ , CMOS signal levels	ps/°C
Propagation Delay Skew <sup>6</sup>	$t_{PSK}$	--	--	16	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Channel-to-Channel Matching Codirectional Channels	$t_{PSKCD}$	--	--	2	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Channel-to-Channel Matching, Opposing-Directional Channels	$t_{PSKOD}$	--	--	5	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
For All Models						
Output Disable Propagation Delay (High/Low to High Impedance)	$t_{PHZ}, t_{PLH}$	--	6	8	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Output Enable Propagation Delay (High Impedance to High/Low)	$t_{PZH}, t_{PZL}$	--	6	8	$C_L = 15 \text{ pF}$ , CMOS signal levels	ns
Output Rise/Fall Time (10% to 90%)	$t_R/t_F$		3		$C_L = 15 \text{ pF}$ , CMOS signal levels	ns

Common-Mode Transient Immunity at Logic High Output	$ CM_H $	25	35	--	$V_{IX} = V_{DD1}$ or $V_{DD2}$ , $V_{CM} = 1000$ V, transient magnitude = 800 V	kv/ $\mu$ s
Common-Mode Transient Immunity at Logic Low Output	$ CM_L $	25	35	--	$V_{IX} = 0$ V, $V_{CM} = 1000$ V, transient magnitude = 800 V	kv/ $\mu$ s
Refresh Rate	fr	--	1.1	--		
Input Dynamic Supply Current per Channel <sup>9</sup>	$I_{DDI(D)}$	--	0.10	--		mA/ Mbps
Output Dynamic Supply Current per Channel	$I_{DDO(D)}$	--	0.03	--		mA/ Mbps



## Typical Characteristics

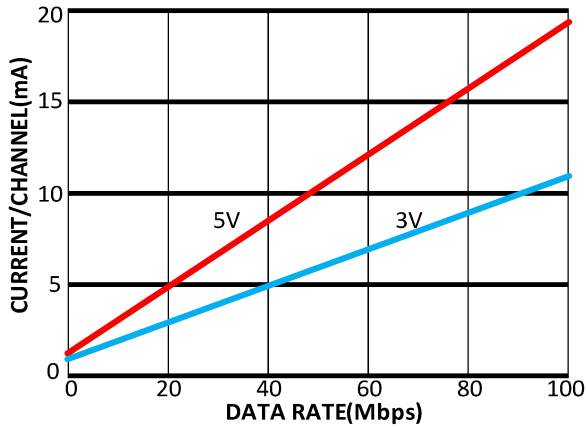


Figure 5. Typical Input Supply Current per Channel vs. Data Rate for 5V and 3V Operation

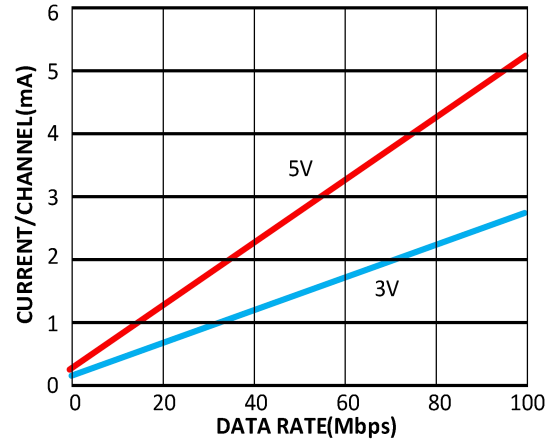


Figure 6. Typical Output Supply Current per Channel vs. Data Rate for 5V and 3V Operation (No Output Load)

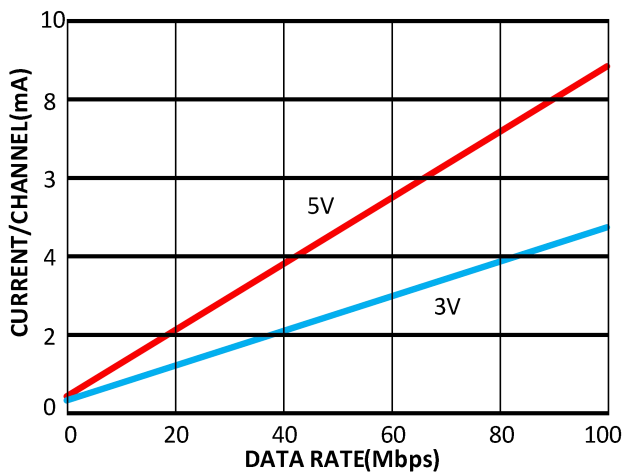


Figure 7. Typical Output Supply Current per Channel vs. Data Rate for 5 V and 3V Operation (15 pF Output Load)

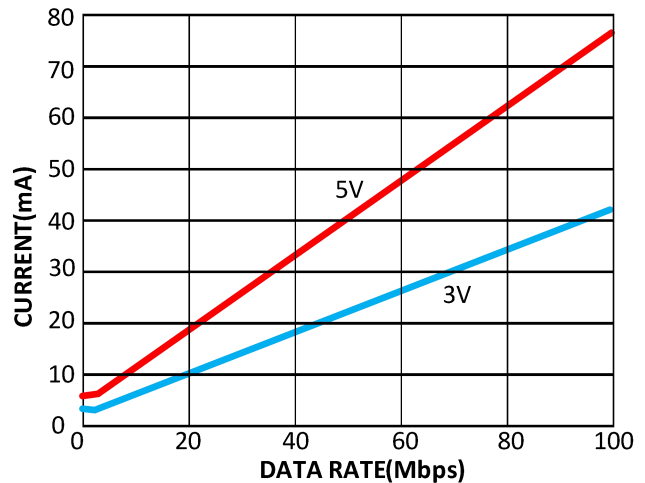


Figure 8. Typical CBMuD1400 V<sub>DD1</sub> Supply Current vs. Data Rate for 5V and 3V Operation

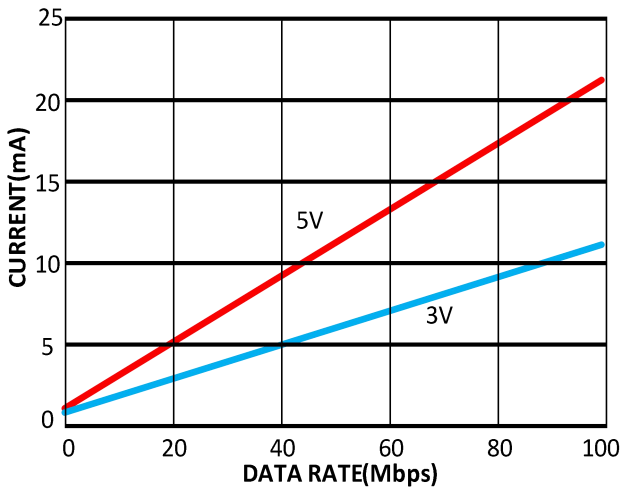


Figure 9. Typical CBMuD1400  $V_{DD2}$  Supply Current vs. Data Rate for 5V and 3V Operation

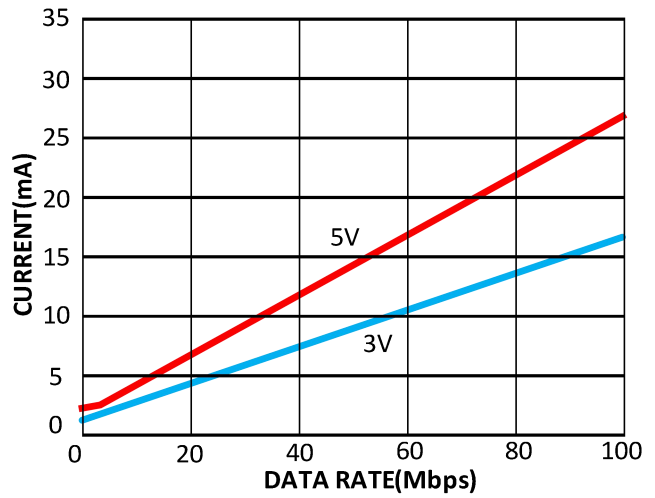


Figure 10. Typical CBMuD1401  $V_{DD1}$  Supply Current vs. Data Rate for 5V and 3V Operation

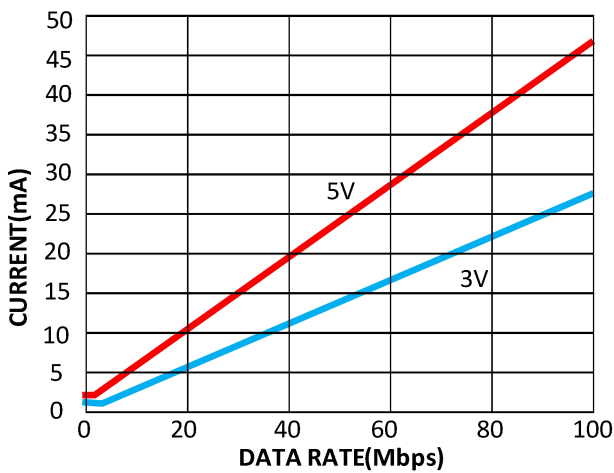


Figure 11. Typical CBMuD1401  $V_{DD2}$  Supply Current vs. Data Rate for 5V and 3V Operation

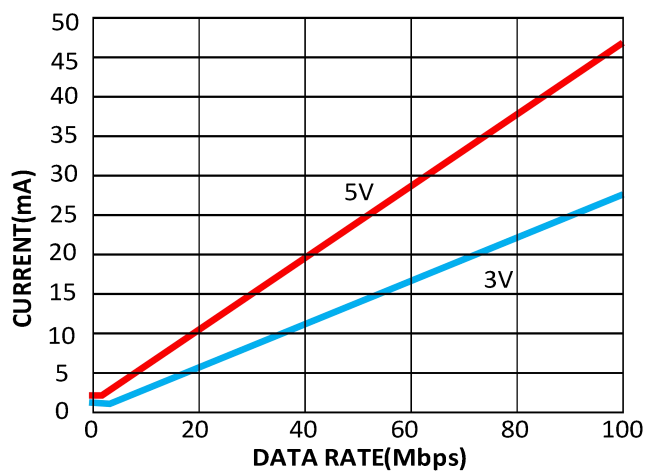


Figure 12. Typical CBMuD1402  $V_{DD1}$  or  $V_{DD2}$  Supply Current vs. Data Rate for 5V and 3V Operation

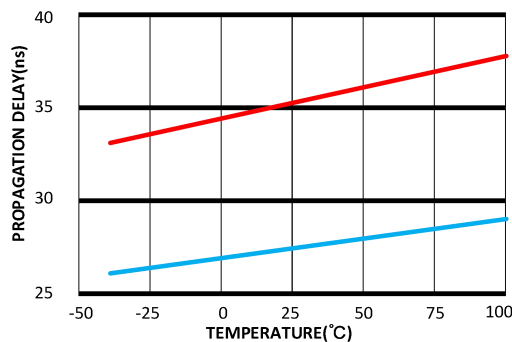


Figure 13. Propagation Delay vs. Temperature

## Package Outline Dimensions

### SOP-16

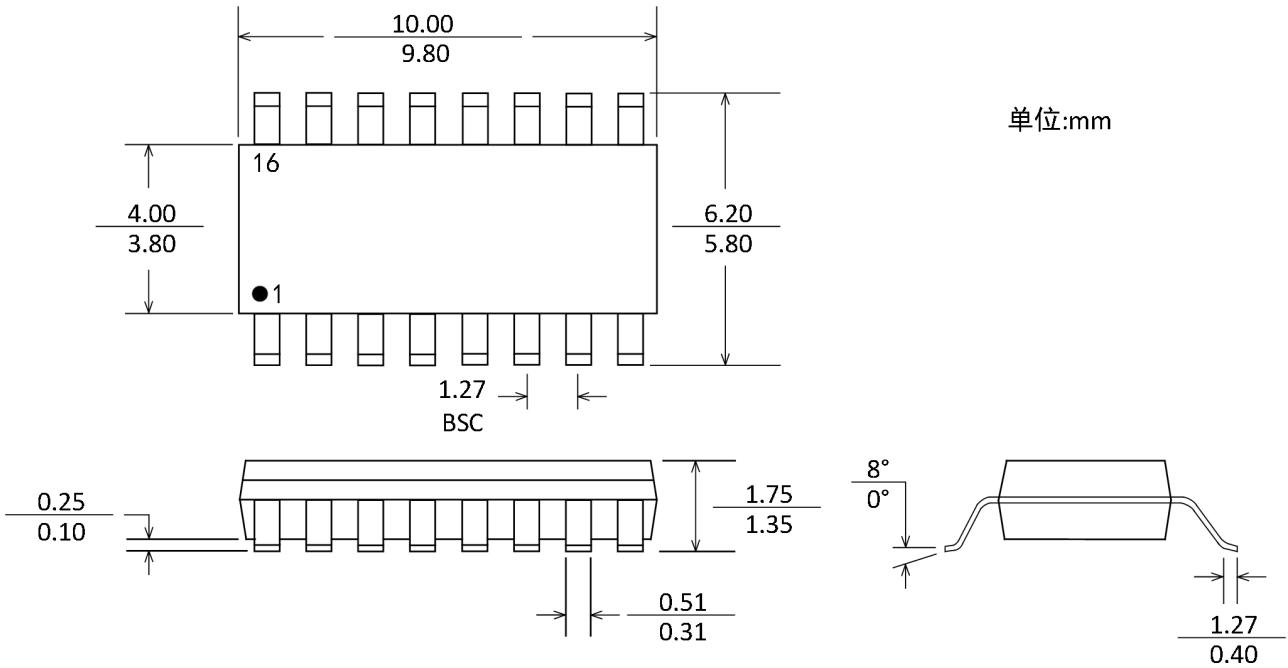


Figure 11. 16-Lead Outline Package [SOP]

## Package/Ordering Information

PRODUCT TYPE	OPERATING TEMPERTURE	PACKAGE	PAKEAGE MARKING	NUMBER OF PACKAGES
CBMuD1400HAS16	-40°C~105°C	SOP-16	CBMuD1400H	Tape and Reel, 2500
CBMuD1400LAS16	-40°C~105°C	SOP-16	CBMuD1400L	Tape and Reel, 2500
CBMuD1401HAS16	-40°C~105°C	SOP-16	CBMuD1401H	Tape and Reel, 2500
CBMuD1401LAS16	-40°C~105°C	SOP-16	CBMuD1401L	Tape and Reel, 2500
CBMuD1402HAS16	-40°C~105°C	SOP-16	CBMuD1402H	Tape and Reel, 2500
CBMuD1402LAS16	-40°C~105°C	SOP-16	CBMuD1402L	Tape and Reel, 2500