CMT810BN, CMT810BW High Reliability Bidirectional I2C Isolators

Features

- Up to 5000 Vrms insulation voltage
- I2C Clock rate: up to 2 MHz
- Power supply voltage: 2.5 V to 5.5 V
- AEC-Q100 Grade 1 qualified
- High CMTI: 150 kV/us
- Chip level ESD: HBM: ± 8 kV
- High system level EMC performance:
  - Enhanced system level ESD, EFT, surge immunity
- Isolation barrier life: > 60 years
- Low power consumption: 1.5mA/ch (1 Mbps)
- Low propagation delay: <15 ns
- Operation temperature: -40℃~125℃
- RoHS-compliant packages:
  - SOIC-8 narrow body
  - SOW-8 wide body
- Safety regulatory approvals
  - UL recognition: up to 5000 Vrms for 1 minute per UL1577
  - CQC certification per GB4943.1-2011
  - CSA component notice 5A
  - DIN VDE V 0884-11:2017-01

Applications

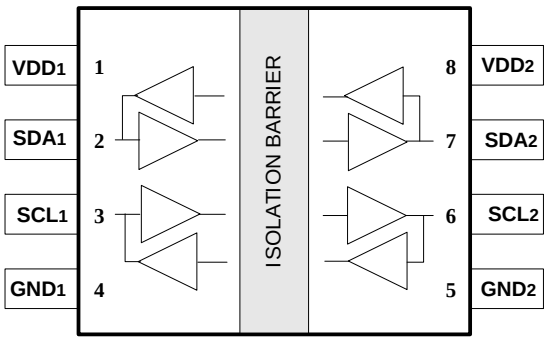
- Power over Ethernet
- Isolated I2C, SMBus, or PMBus interface
- I2C level shifting
- Battery management

Description

The devices are high reliability bidirectional isolators that are compatible with I2C interface. The CMT810X devices are AEC-Q100 qualified. The CMT810X devices are safety certified by UL1577 supporting several insulation withstand voltages (3.75kVrms, 5kVrms), while providing high electromagnetic immunity and low emissions at low power consumption. The I2C clock of the CMT810X is up to 2 MHz, and the common-mode transient immunity (CMTI) is up to 150 kV/us. Wide supply voltage of the CMT810X devices supports to connect with most digital interfaces directly, easy to do the level shift. High system level EMC performance enhances device reliability and stability.

Device Information

Part No.	Package	Body Size (mm x mm)
CMT810X	NB(N) SOIC-8	5.0 x 4.0
	WB(W) SOW-8	5.85 x 7.5
Refer to section 8 for ordering information.		



CMT810BX NB SOIC-8/ WB SOW-8

Table of Contents

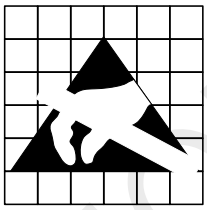
1 Absolute Maximum Ratings

Table 1. Absolute Maximum Ratings[1]

Parameters	Symbol	Condition	Min.	Typ	Max	Unit
Power supply voltage	VDD1, VDD2		-0.5		6.5	V
Maximum input voltage	SDA1, SDA2, SCL1, SCL2		-0.4		VDD+0.4[1]	V
Maximum input pulse voltage	SDA1, SDA2, SCL1, SCL2	Pulse width should be less than 100 ns, and the duty cycle should be less than 10%	-0.8		VDD+0.8	V
Common-Mode transients	CMTI				±150	kV/us
Output current	Io		-15		15	mA
Maximum surge isolation voltage	VIOSM				5.3	kV
Operating temperature	Topr		-40		125	℃
Storage temperature	Tstg		-40		150	℃
Electrostatic discharge	HBM				±8000	V
	CDM				±2000	V

Notes:

[1]. The maximum voltage must not exceed 6.5 V.



Caution! ESD sensitive device. Precaution should be used when handling the device in order to prevent performance degradation or loss of functionality.

2 Pin Description

Narrow-body (N) 8-pin and wide-body(W) 8-pin SOW packages are available for the series part number. The pin lists are shown as follows.

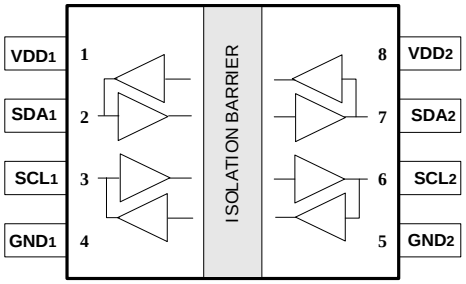


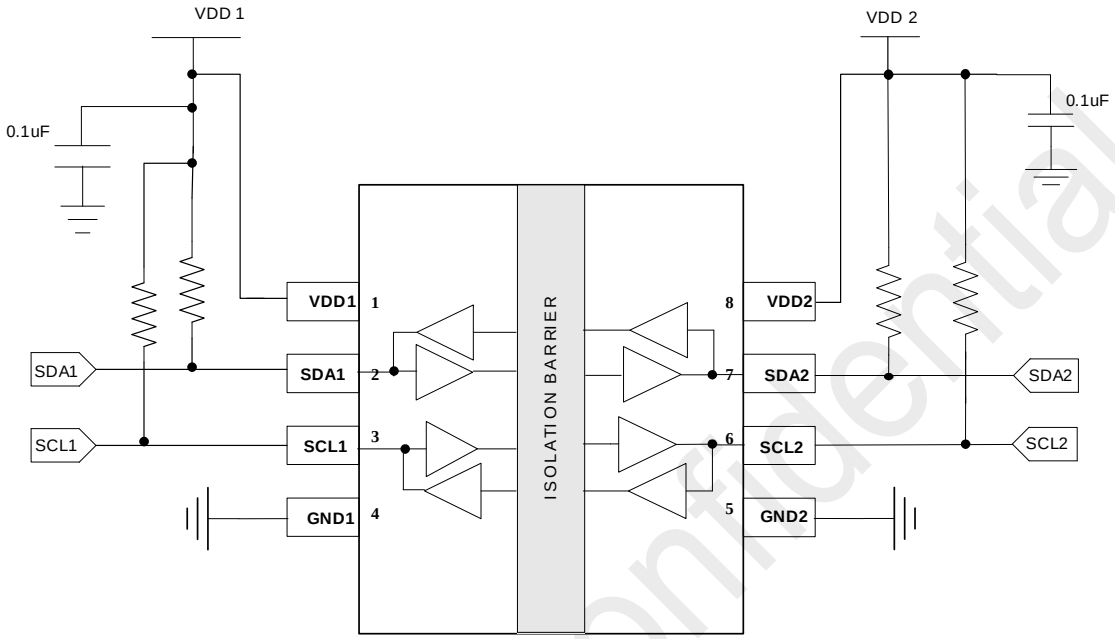
Figure 1. CMT810BN/CMT810BW Pin List of SOIC-8 NB/ SOW-8 WB

Table 2. Pin Description

Pin #	Pin Name	I/O	Description
1	VDD_1	-	Power supply for isolator side 1.
2	SDA_1	I/O	Serial data input /output, side 1
3	SCL_1	I/O	Serial clock input /output, side 1.
4	GND_1	-	The ground reference for isolator side 1.
5	GND_2	-	The ground reference for isolator side 2.
6	SCL_2	I/O	Serial clock input /output, side 2.
7	SDA_2	I/O	Serial data input /output, side 2
8	VDD_2	-	Power supply for isolator side 2.

3 Typical Application

3.1 Typical Application Schematic



3.2 PCB Layout Guidelines

The CMT810X requires a 0.1 µF bypass capacitor between VDD1 and GND1, VDD2 and GND2. The capacitor should be placed as close as possible to the package. The figure below shows the recommended PCB layout. Make sure the space under the chip should keep free from planes, traces, pads and via. The pull-up resistors are required for both side 1 and side 2 buses. And the value of the resistors depends on the number of I2C devices on the bus.

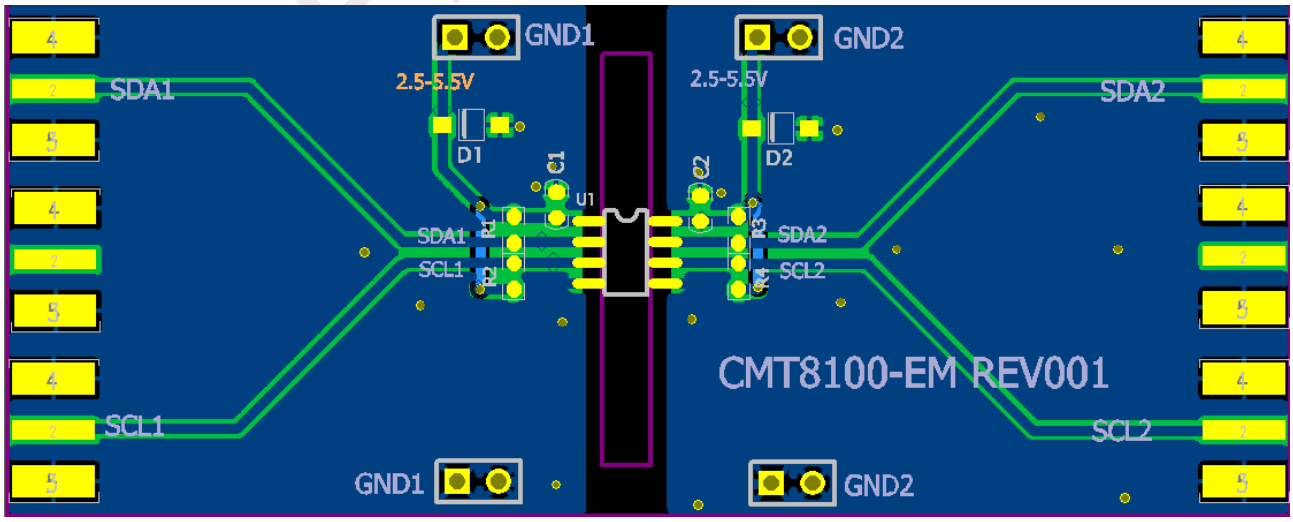


Figure 2. Recommended PCB Layout

4 Specifications

VDD1 = 2.5 ~ 5.5 V, VDD2 = 2.5 ~ 5.5 V, Ta = -40℃ to 125℃. Unless otherwise noted, typical values are at VDD1 = 5 V, VDD2 = 5 V, Ta = 25℃.

4.1 Electrical Characteristics

Table 3. Electrical Characteristics

Parameters	Symbol	Condition	Min	Typ	Max	Unit
Power on reset	VDD_{POR}	POR threshold as during power-up		2.2		V
	VDD_{HYS}	POR threshold Hysteresis		0.1		V
Start up time after POR	t_{rbs}			10		sec
Common mode transient immunity	CMTI		±100		±150	kV/us
Side 1 logic level						
Input threshold	V_{ILT1}	Input threshold at rising edge	400			mV
	V_{IHT1}				600	mV
	V_{IT_HYS1}	Input threshold hysteresis		100		mV
Low level output voltage	V_{OL1}	I_{OL} ≤ 4mA，$R_{PULL\ UP}$=1K	650		800	mV
Low-level output voltage to high-level input voltage threshold difference	ΔV_{OIT1}		70			mV
Side 2 Logic Level						
Input threshold	V_{ILT2}	Input threshold at rising edge		1.6		V
	V_{IT_HYS2}	Input threshold hysteresis		0.4		V
High level input voltage	V_{IH2}		2.0			V
Low level input voltage	V_{IL2}				0.8	V
Low level output voltage	V_{OL}	I_{OL} ≤ 30mA			0.5	V

4.2 Supply Current Characteristics with 5 V Supply

VDD1 = 5 V ± 10%, VDD2 = 5 V ± 10%, Ta = -40 ℃ to 125 ℃. Unless otherwise noted, Typical values are at VDD1 = 5 V, VDD2 = 5 V, Ta = 25 ℃.

Table 4. Supply Current Characteristics with 5 V Supply

Parameter	Symbol	Condition	Min.	Typ.	Unit
CMT810B					
Supply current All Input 0 V	I_{DD1}(Q0)			4.89	mA
	I_{DD2}(Q0)			3.99	mA

Parameter	Symbol	Condition	Min.	Typ.	Unit
Supply current: All Input at supply	I_{DD1}(Q1)			2.56	mA
	I_{DD2}(Q1)			1.97	mA
Supply current: All Input with 2MHz, C_L=15pF	I_{DD1}(2M)			3.72	mA
	I_{DD2}(2M)			2.64	mA
	I_{DD2}			2.37	mA
Clock rate	DR		0	2	MHz
Propagation delay	t_{PLH12}	See figure .6, R1=1500 Ω, R2= 500Ω, no load		46.66	ns
	t_{PHL12}	See figure .6, R1=1500 Ω, R2= 500Ω, no load		66.66	ns
	t_{PLH21}	See figure .6, R1=1500 Ω, R2= 500Ω, no load		38.34	ns
	t_{PHL21}	See figure .6, R1=1500 Ω, R2= 500Ω, no load		72.34	ns
Pulse width distortion	PWD_{12}	$\lvert t_{PHL12} - t_{PLH12} \rvert$		34	ns
	PWD_{21}	$\lvert t_{PHL21} - t_{PLH21} \rvert$		20	ns
Falling time	t_{f1}	C_L = 30pF		17.1	ns
	t_{f2}	C_L = 300pF		26.2	ns

4.3 Supply Current Characteristics with 3.3 V Supply

VDD1 = 3.3 V ± 10%, VDD2 = 5 V ± 10%, Ta = -40 ℃ to 125 ℃. Unless otherwise noted, Typical values are at VDD1 = 3.3 V, VDD2 = 3.3 V, Ta = 25 ℃.

Table 5. Supply Current Characteristics with 3.3 V Supply

Parameter	Symbol	Condition	Min.	Typ.	Unit
CMT810B					
Supply current All Input 0V	I_{DD1}(Q0)			4.87	mA
	I_{DD2}(Q0)			3.98	mA
Supply current: All Input at supply,	I_{DD1}(Q1)			2.53	mA
	I_{DD2}(Q1)			1.95	mA
Supply current: All Input with 2MHz, C_L=15pF	I_{DD1}(2M)			3.51	mA
	I_{DD2}(2M)			2.78	mA
Clock rate	DR		0	2	MHz
Propagation delay	t_{PLH12}	See figure 6, R1=1500 Ω, R2= 500Ω, no load		46.66	ns
	t_{PHL12}	See figure 6, R1=1500 Ω, R2= 500Ω, no load		66.66	ns

Parameter	Symbol	Condition	Min.	Typ.	Unit
	t_{PLH21}	See figure 6, R1=1500 Ω, R2= 500Ω, no load		38.34	ns
	t_{PHL21}	See figure 6, R1=1500 Ω, R2= 500Ω, no load		72.34	ns
Pulse width distortion	PWD_{12}	$\lvert t_{PHL12} - t_{PLH12} \rvert$		34	ns
	PWD_{21}	$\lvert t_{PHL21} - t_{PLH21} \rvert$		20	ns
Falling time	t_{f1}	C_L = 30pF		17.1	ns
	t_{f2}	C_L = 300pF		26.2	ns

4.4 Supply Current Characteristics with 2.5 V Supply

VDD1 = 2.5 V ± 10%, VDD2 = 2.5 ± 10%, Ta = -40 ℃ to 125 ℃. Unless otherwise noted, Typical values are at VDD1 = 2.5 V, VDD2 = 2.5 V, Ta = 25 ℃.

Table 6. Supply Current Characteristics with 2.5 V Supply

Parameter	Symbol	Condition	Min.	Typ.	Unit
CMT810B					
Supply current All Input 0V	I_{DD1}(Q0)			4.85	mA
	I_{DD2}(Q0)			3.96	mA
Supply current: All Input at supply,	I_{DD1}(Q1)			2.53	mA
	I_{DD2}(Q1)			1.94	mA
Supply current: All Input with 2MHz, C_L=15pF	I_{DD1}(2M)			3.43	mA
	I_{DD2}(2M)			2.85	mA
Clock rate	DR		0	2	MHz
Propagation delay	t_{PLH12}	See figure 6, R1=1500 Ω, R2= 500Ω, no load		47.5	ns
	t_{PHL12}	See figure .6, R1=1500 Ω, R2= 500Ω, no load		89.5	ns
	t_{PLH21}	See figure .6, R1=1500 Ω, R2= 500Ω, no load		40.84	ns
	t_{PHL21}	See figure .6, R1=1500 Ω, R2= 500Ω, no load		96.64	ns
Pulse width distortion	PWD_{12}	$\lvert t_{PHL12} - t_{PLH12} \rvert$		42	ns
	PWD_{21}	$\lvert t_{PHL21} - t_{PLH21} \rvert$		55.8	ns
Falling time	t_{f1}	C_L = 30pF		31	ns
	t_{f2}	C_L = 300pF		42	ns

4.5 Parameter Measurement Circuit Setup

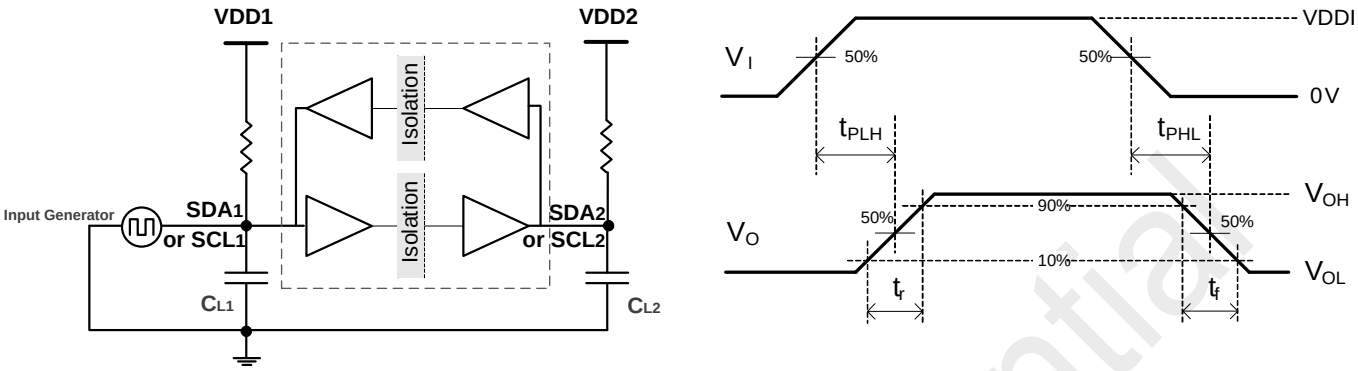


Figure 3. Switching Characteristic Test Circuit and Voltage Waveforms

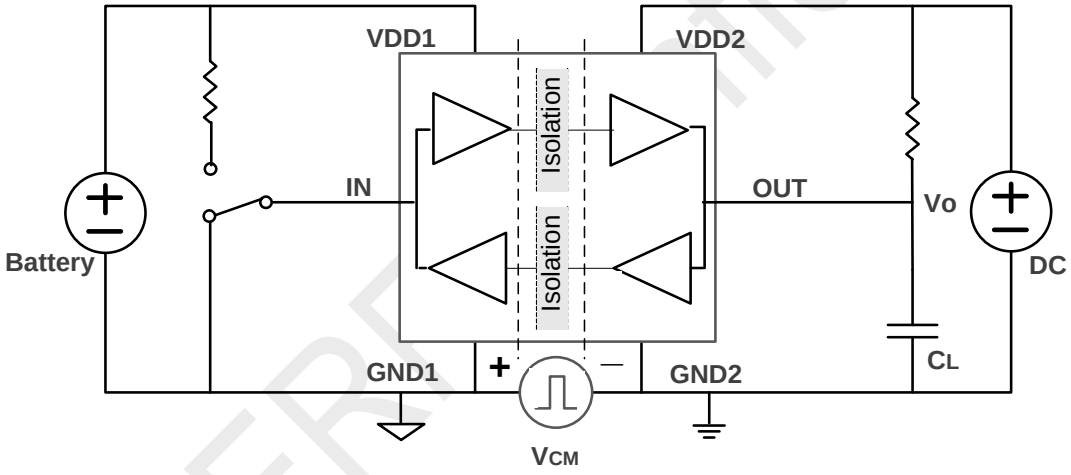


Figure 4. Common-Mode Transient Immunity Test Circuit

5 High Voltage Feature Specifications

5.1 Insulation and Safety Related Specifications

Table 7. Insulation and Safety Related Specifications

Parameter	Symbol	Condition	Value		Unit
			SOIC-8	SOW-8	
Minimum External Air Gap (Clearance)	L(I01)	Shortest terminal-to-terminal distance through air	4.0	8.0	mm
Minimum External Tracking (Creepage)	L(I02)	Shortest terminal-to-terminal distance across the package surface	4.0	8.0	mm

Minimum internal gap	DTI	Distance through insulation	25	um
Tracking Resistance (Comparative Tracking Index)	CTI	DIN EN 60112 (VDE 0303-11); IEC 60112	>400	V
Material Group			1	

5.2 DIN VDE V 0884-11(VDE V 0884-11):2017-01 Insulation Characteristics

Table 8. DIN VDE V 0884-11(VDE V 0884-11):2017-01 Insulation Characteristics

Description	Symbol	Test Condition	Value		Unit
			SOIC-8	SOW-8	
Installation classification per DIN VDE 0110					
For rated mains voltage ≤ 150 V_{rms}			I to IV	I to IV	
For rated mains voltage ≤ 300 V_{rms}			I to Ⅲ	I to IV	
For rated mains voltage ≤ 400 V_{rms}			I to Ⅲ	I to IV	
Climatic classification			10/105/21	10/105/21	
Pollution degree per DIN VDE 0110, table 1			2	2	
Maximum repetitive isolation voltage	V_{IORM}		565	849	Vpeak
Input to output test voltage, method B1	$V_{pd\ (m)}$	V IORM × 1. 5 = $V_{pd\ (m)}$, 100% production test, t_{ini} = t_m = 1 sec, partial discharge < 5 pC	847	1273	Vpeak
Input to output test voltage, method A					
After environmental tests subgroup 1	$V_{pd\ (m)}$	V_{IORM} × 1.2 = $V_{pd\ (m)}$, t_{ini} = 60 sec, t_m = 10 sec, partial discharge < 5 pC	678	1019	Vpeak
After Input and /or safety test subgroup 2 and subgroup 3	$V_{pd\ (m)}$	V_{IORM} × 1.2= $V_{pd\ (m)}$, t_{ini} = 60 sec, t_m = 10 sec, partial discharge < 5 pC	678	1019	Vpeak
Maximum transient isolation voltage	V_{IOTM}	t = 60 sec	5300	7000	Vpeak
Maximum surge isolation voltage	V_{IOSM}	Test method per IEC 60065,1.2/50us waveform, VTEST=1.3×VIOSM	5300	7000	Vpeak
Isolation resistance	R_{IO}	V_{IO} =500V	$>10^9$	$>10^9$	Ω
UL1577					
Isolation withstand voltage	V_{ISO}	V_{TEST} = V_{ISO}, t = 60 s (certified); V_{TEST} = 1.2 × V_{ISO}, t = 1 s (100% mass production)	3750	5000	Vrms
Isolation capacitance	C_{IO}	f = 1MHz	0.6	0.6	pF
Input capacitance	C_I		2	2	pF
Total power dissipation at 25℃	Ps			1499	mW
Case temperature	Ts		150	150	℃

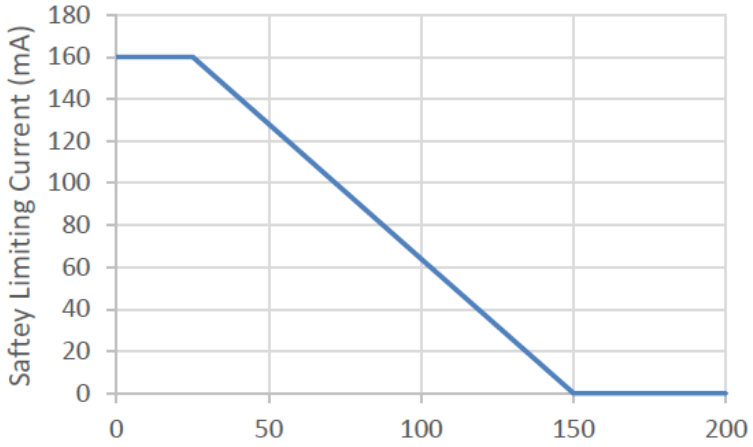


Figure 5. CMT810BN Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN VDE V 0884-11

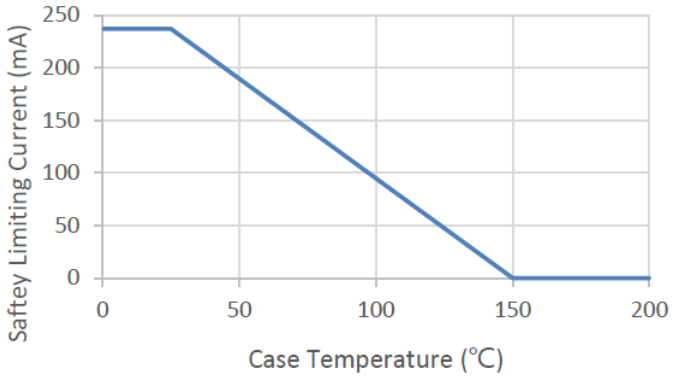


Figure 6. CMT810BW Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN VDE V 0884-11

5.3 Regulation Information

Table 9. CMT810BN Regulation Conformation

UL		VDE	CQC
UL 1577 Component Recognition Program	Approved under CSA Component Acceptance Notice 5A	DIN VDE V 0884- 11(VDE V 0884-11):2017-01[2] (Applying)	Certified by CQC11- 471543-2012 GB4943.1-2011
Certificate number: UL-US-2439077-1	Certificate number: UL-CA-2429797-0	File (pending)	File: CQC23001382478

Table 10. CMT810BW Regulation Conformation

UL		VDE	CQC
UL 1577 Component Recognition Program	Approved under CSA Component Acceptance Notice 5A	DIN VDE V 0884- 11(VDE V 0884-11):2017-012 (Applying)	Certified by CQC11- 471543-2012 GB4943.1-2011

Certificate number: UL-US-2439077-1	Certificate number: UL-CA-2429797-0	File (pending)	File: CQC23001385762

6 Function Description

6.1 Function Overview

The CMT810X is a bidirectional isolator based on a capacitive isolation barrier technique. The CMT810X devices are compatible with I2C interface. Internally, the I2C interface is split into two unidirectional channels communicating in opposite directions via a dedicate capacitive isolation channel for each. The digital signal is modulated with RF carrier generated by the internal oscillator at the Transmitter side. Then it is transferred through the capacitive isolation barrier and demodulated at the Receiver side.

The CMT810B devices are high reliability dual-channel bidirectional isolators for clock and data lines while CMT8101 has a bidirectional data and a unidirectional clock channel. The CMT810B is suitable for multi-master application while CMT8101 is useful in a single master application.

The side 2 logic levels of CMT810X are standard I2C value, and the maximum load for side 2 is $\leqslant$ 400 pF. So multiple CMT810X devices connected to a bus by their Side 2 pins can communicate with each other and with other I2C compatible devices.

The side 1 logic levels of CMT810X are not standard value. The output low level of CMT810X is 650mV, while low-level output voltage to high-level input voltage threshold is 50 mV. This prevents an output logic low at Side 1 being transmitted back to Side 2 and pulling down the I2C bus.

The CMT810X devices are AEC-Q100 qualified. The CMT810X device is safety certified by UL1577 support several insulation withstand voltages (3.75 kVrms, 5 kVrms), while providing high electromagnetic immunity and low emissions at low power consumption. The I2C clock of the CMT810X is up to 2 MHz, and the common-mode transient immunity (CMTI) is up to 150 kV/us. Wide supply voltage of the CMT810X device supports to connect with most digital interfaces directly, easy to do the level shift. High system level EMC performance enhances reliability and stability.

The table below shows the functional status of CMT810X. The CMT810X is high impedance output when VDDIN is unready and VDDOUT is ready as shown in the table below.

Table 11. Output Status vs. Power Status

Input	VDD1 Status	VDD2 Status	Output	Comment
H	Ready	Ready	Z	Normal operation.
L	Ready	Ready	L	
X	Unready	Ready	Z	The output follows the same status with the input within 60 us after input side VDD1 is powered on.
X	Ready	Unready	X	The output follows the same status with the input within 60 us after output side VDD2 is powered on.

7 Packaging Information

The packaging information of the CMT810X is shown in the figures below.

7.1 CMT810BN Narrow Body SOIC-8 Package

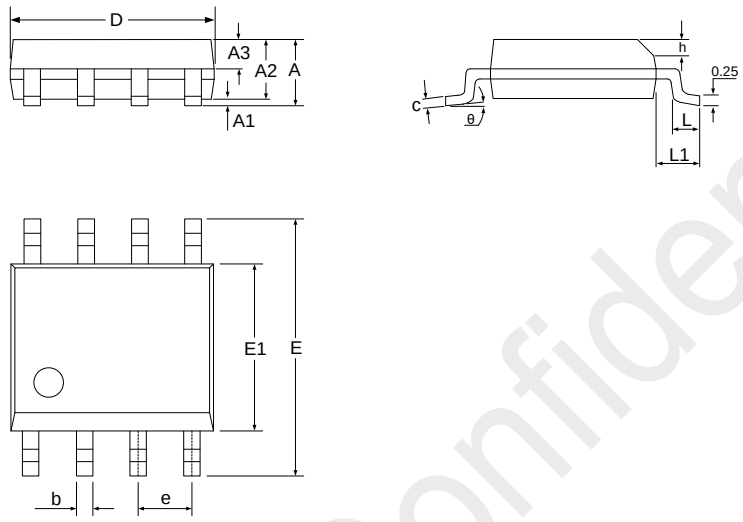


Figure 7. Narrow Body SOIC-8 Packaging

Table 12. Narrow Body SOIC-8 Packaging Scale

Symbol	Size (mm)		
	Min	Typ	Max
A	-	-	1.75
A1	0.10	0.18	0.25
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.33	0.42	0.51
c	0.17	0.21	0.25
D	4.80	5.00	5.20
E	5.80	6.00	6.20
E1	3.90	4.00	4.10
e	1.27 BSC		
h	0.25	-	0.50
L	0.40	0.60	0.80
L1	1.05 BSC		
θ	0	-	8°

7.2 CMT810BW Wide Body SOW-8 Package

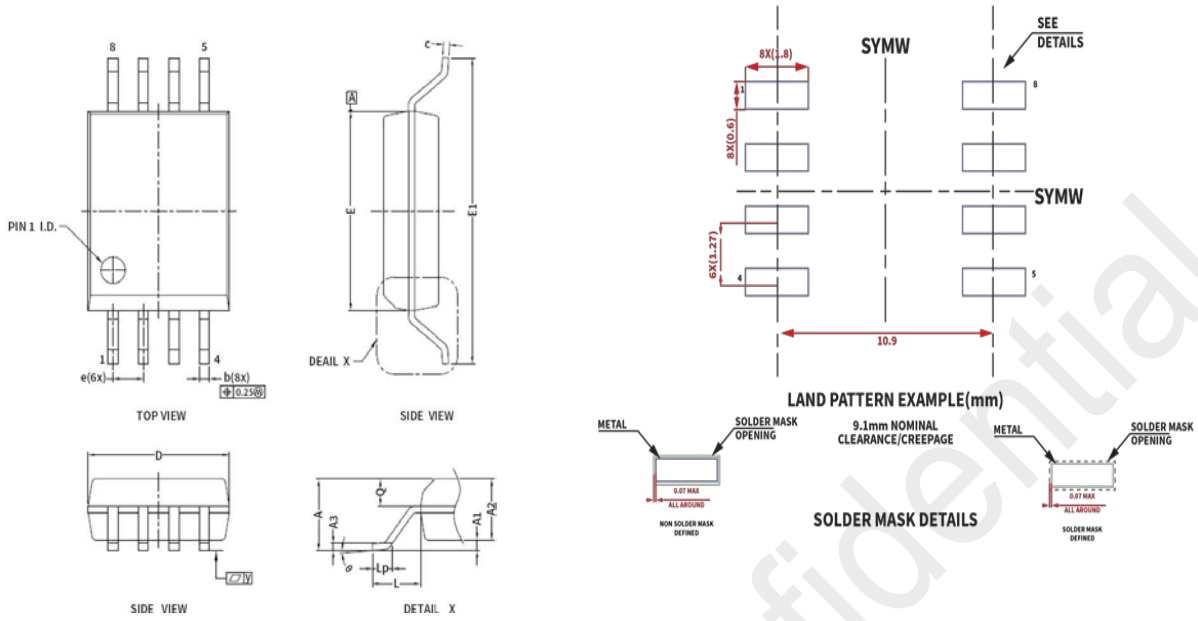


Figure 8. CMT810X SOW-8 WB Packaging

Table 13. CMT810X SOW-8 WB Packaging Scale

Symbol	Scale (mm)		
	Min.	Typ.	Max.
A	-	-	2.80
A1	0.36	-	0.46
A2	2.20	2.30	2.40
A3	-	0.25	-
Q	0.97	1.02	1.07
b	0.31	0.41	0.51
c	0.13	-	0.33
D	5.75	5.85	5.95
E	7.40	7.50	7.60
E1	11.25	11.50	11.75
e	1.27 bsc		
L	2.00 bsc		
Lp	0.50	-	1.00
Y	-	0.10	-
θ	0	-	8°

8 Ordering Information

Table 14. Part Number Information List

Part No.	Isolation Rating(kV)	MOQ	Numbers of input channel	Max Clock Rate (MHz)	Temperature	Automotive	Package	MSL
CMT810BN	3.75	3000	2	2	-40 to 125℃	NO	NB SOIC8	1
CMT810BW	5	1000	2	2	-40 to 125℃	NO	WB SOW8	3

Please visit www.hoperf.com for more product/product line information.

Please contact sales@hoperf.comor your local sales representative for sales or pricing requirements.

9 Tape and Reel Information

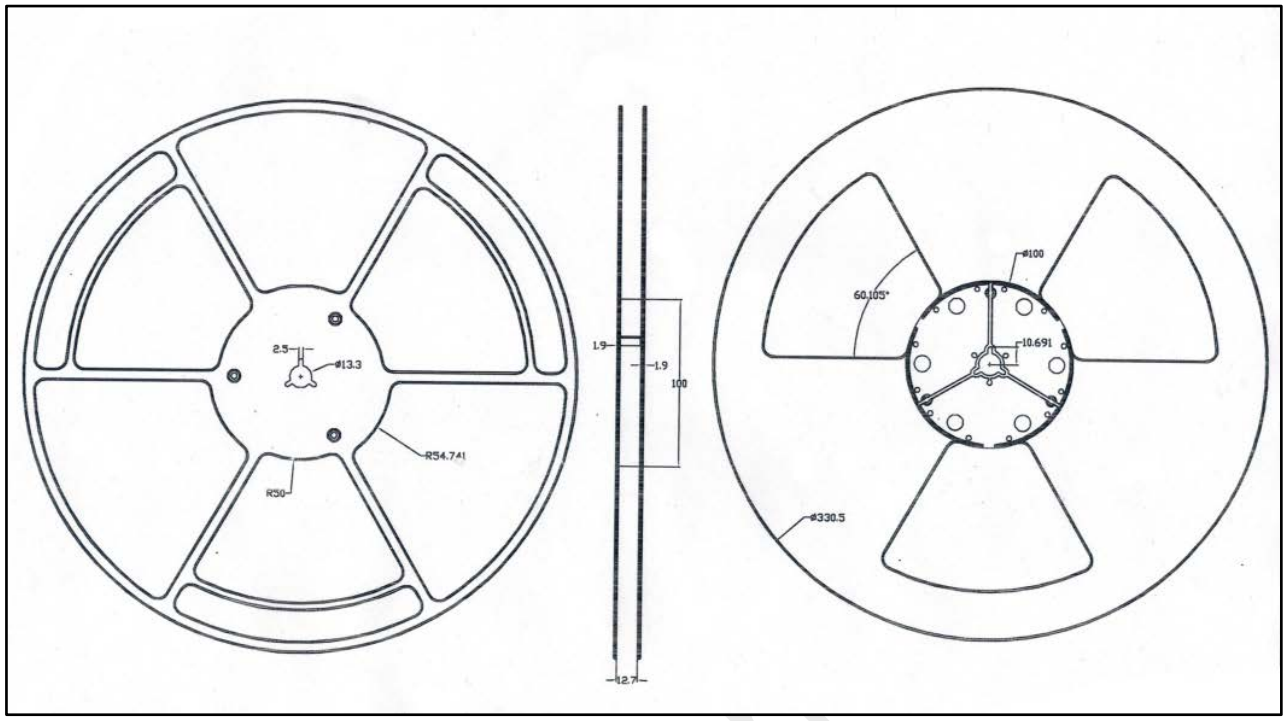
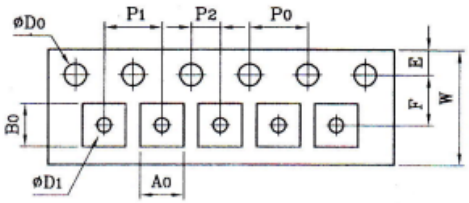


Figure 9. CMT810X NB SOIC-8 Tape and Reel Information

產品尺寸規格 (UNIT:mm)

規格	W	P1	E	F	D0	D1	P0	P2	10P0
尺寸	12.0 $^{+0.30}_{-0.10}$	8.0±0.1	1.75±0.1	5.5±0.05	1.5 $^{+0.10}_{-0}$	1.5 $^{+0.25}_{-0}$	4±0.1	2±0.05	40±0.2
規格	A0	A1	B0	B1	K0	K1	T		
尺寸	6.40±0.10		5.40±0.10		2.10±0.10		0.25±0.03		



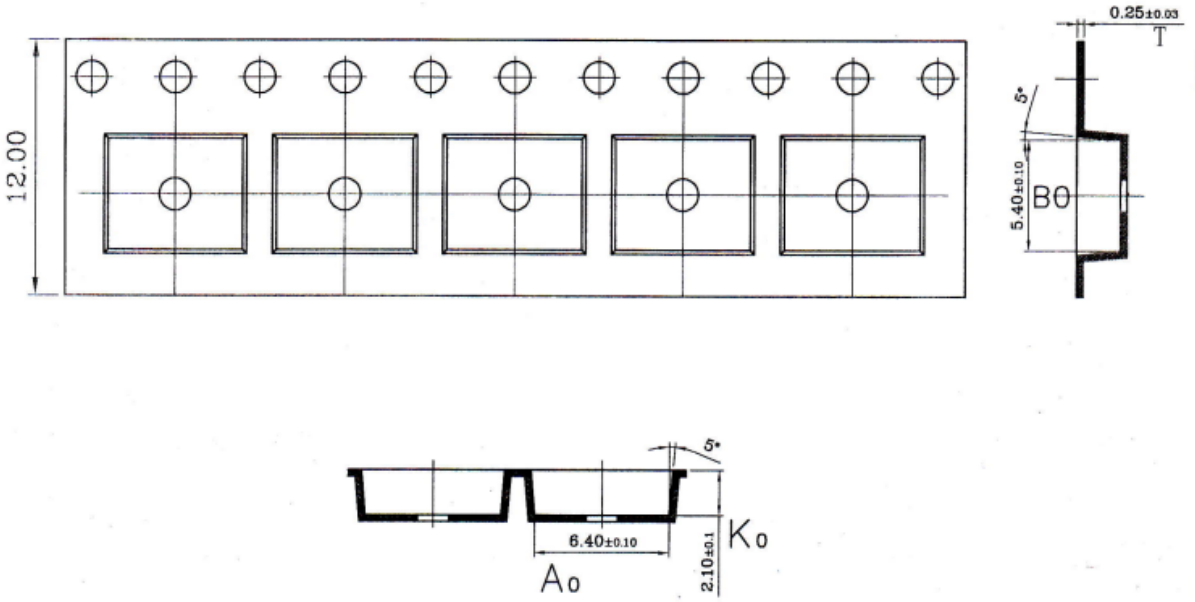


Figure 10. CMT810X NB SOIC-8 Tape and Reel Information

10 Revise History

Table 15. Revise History Records

Version No.	Chapter	Description	Date
0.1	All	Initial version	2021/11/02
0.2	4	Update the supply current characteristic data	2022/08/31
0.3	All	Revise the NB SOIC-8 package size	2022/10/24
0.4	8	Update silver print information	2023/03/29
	10	Added tape information	
0.5	All	Delete the silver printing section	2023/04/20
		Added the CQC certificate number	
0.6	All	Revise the 8th pin of NC to NC/GND in package SOIC16.	2023/09/11
0.7	All	Added package of SOW8 WB	2024/5/21
		Add MSL level in order information	2024/12/3

11 Contacts

Shenzhen Hope Microelectronics Co., Ltd.
Address: 30th floor of 8th Building, C Zone, Vanke Cloud City, Xili Sub-district, Nanshan, Shenzhen, GD, P.R. China

Tel: +86-755-82973805 / 4001-189-180
Fax: +86-755-82973550
Post Code: 518052
Sales: sales@hoperf.com
Website: www.hoperf.com