# CMT812X High-Speed, Dual-Channel Digital Isolator

## 1 Features

- Safety-related certifications
  - DIN VDE V 0884-11: 2017-01
  - UL 1577 component recognition program
  - CSA certification according to IEC 60950-1, IEC 62368-1, IEC 61010-1 and IEC 60601-1 end equipment standards
  - CQC approval per GB4943.1-2022
  - TUV certification according to EN 60950-1, EN 62368-1 and EN 61010-1
- Robust electromagnetic compatibility
  - System-level ESD, EFT, and surge immunity
  - ±8 kV IEC 61000-4-2 contact discharge protection across isolation barrier
  - Low emissions
- Data rate: up to 150 Mbps
- Wide supply range: 2.5 to 5.5 V
- Operation temperature: -40°C to 125°C
- Robust isolation barrier
  - More than 40-year projected lifetime
  - Up to 5 $kV_{RMS}$ isolation rating
  - Up to 8 kV surge capability
  - ±200 kV/μs typical CMTI
- Default output high or low options
- Low power consumption, typical 1.5 mA per channel at 1 Mbps
- Low propagation delay: 9 ns typical (5V supplies)
- SOIC-16 package (wide body), WB(N) SOW8L and SOIC-8 (narrow body)

## 2 Applications

- Industrial automatic control
- New energy vehicles
- Solar inverters
- Motor control
- Isolated SPI
- General purpose multichannel isolation

## 3 Description

The CMT812X series devices are high-performance, quad channel digital isolators with as high as 5 $kV_{rms}$ isolation voltage by means of silicon-dioxide (SiO2) insulation barrier.

The digital isolator is used to communicate between two different power supply domains while prevents noise currents on a data bus or other circuits from entering the local ground and interfering with or damaging sensitive circuitry.

This device comes with enable pins that can be used to put the respective outputs in high impedance for multi-master driving applications and to reduce power consumption. The CMT812X device has four forward and up to two reverse-direction channels. If the input power or signal is lost, the default output is high for the CMT812X1 device and low for the CMT812X0 device. See the Device Functional Modes section for further details.

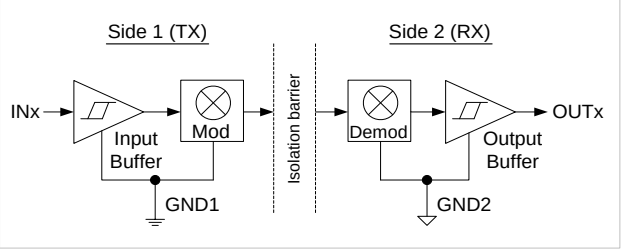
The isolator provides high electromagnetic immunity and low emissions at low-power consumption. Through innovative chip design and layout techniques, electromagnetic compatibility of the CMT812X device has been significantly enhanced to ease system-level ESD, EFT, surge, and emissions compliance.

The CMT812X series device is available in both narrow-body (NB) and (WB) SOW8L / (WB) 16-pin SOIC packages.

### Device Information

| Part No. | Package | Body Size (mm x mm) |
|---|---|---|
| CMT812X | NB(N) SOIC-8 | 5.0 x 3.9 |
| | WB(N) SOW8L | 5.85 x 7.5 |
| | WB(W) SOIC-16 | 10.4 x 7.5 |
| Refer to section 14 for ordering information. | | |

### Simplified Schematic



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# 4 Absolute Maximum Ratings

**Table 1. Absolute Maximum Ratings[1]**

| Parameters | Symbol | Condition | Min. | Max. | Unit |
|---|---|---|---|---|---|
| Power supply voltage[2] | VDD1, VDD2 | | -0.5 | 6.5 | V |
| Maximum input voltage | INx | x = A, B | -0.4 | VDD+0.4 | V |
| Maximum output voltage | OUTx | x = A, B | -0.4 | VDD+0.4 | V |
| Maximum Input / output pulse voltage | - | 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 transient immunity | CMTI | | | ±200 | kV/us |
| Output current | $I_O$ | | -15 | 15 | mA |
| Maximum surge immunity | - | | | 8 | kV |
| Operating temperature | $T_A$ | | -40 | 125 | ℃ |
| Storage temperature | $T_{STG}$ | | -40 | 150 | ℃ |

Notes:

[1]. Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

[2]. All voltage values except differential I/O bus voltages are with respect to the local ground terminal (GND1 or GND2) and are peak voltage values.

# 5 Recommended Operating Conditions

**Table 2. Recommended Operating Conditions**

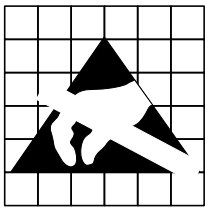
| Parameters | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Power supply voltage | VDD1, VDD2 | | 2.5 | 5 | 5.5 | V |
| High level input voltage | $V_{IH}$ | VDDI: input side VDD | 0.7*VDD | | VDDI | V |
| Low level input voltage | $V_{IL}$ | VDDI: input side VDD | 0 | | 0.3VDD | V |
| Data rate | DR | | 0 | | 150 | Mbps |
| Operating temperature | $T_A$ | | -40 | 25 | 125 | ℃ |
| Junction temperature | $T_J$ | | -40 | | 150 | ℃ |

# 6 ESD Ratings

**Table 3. ESD Ratings**

| Parameter | Symbol | Condition | Max. | Unit |
|---|---|---|---|---|
| Electrostatic discharge | $V_{ESD}$ | Human-body model (HBM) | ±8000 | V |
| | | Charged-device model (CDM) | ± 2000 | |

Notes:
1. IEC ESD strike is applied across the barrier with all pins on each side tied together creating a two-terminal device.
2. Testing is carried out in air or oil to determine the intrinsic contact discharge capability of the device.



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

# 7 Pin Description

Both narrow-body (N) and wide-body (W) 16-pin SOIC packages are available for the series part number CMT8120x, CMT8121x and CMT8122x. The pin lists are shown as below.

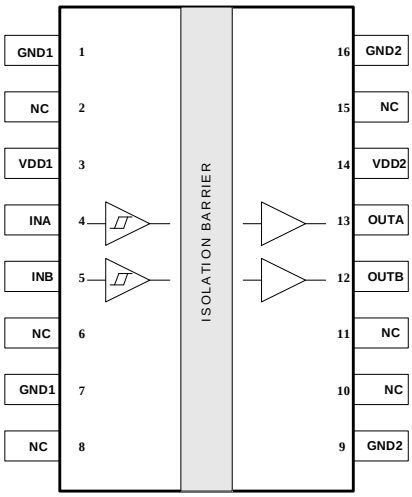



**Figure 1. CMT8120WXM Pin List**

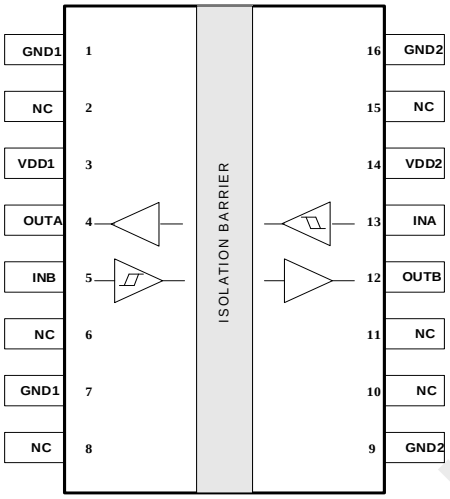



**Figure 2. CMT8121WXM Pin List**

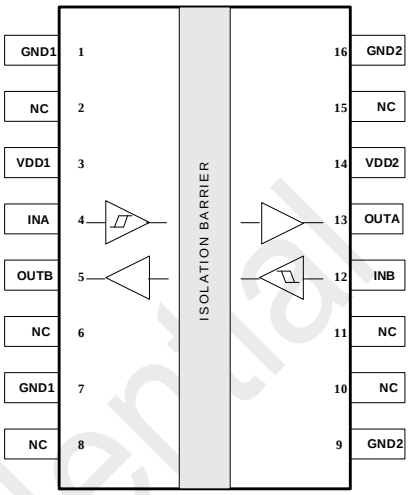



**Figure3. CMT 8122WXM Pin List**

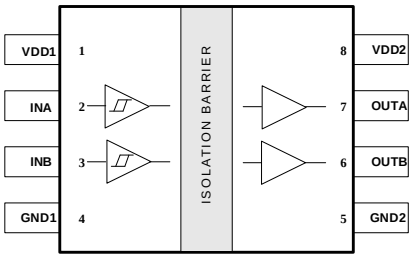



**Figure 4. CMT8120NX / CMT8120WX Pin List**

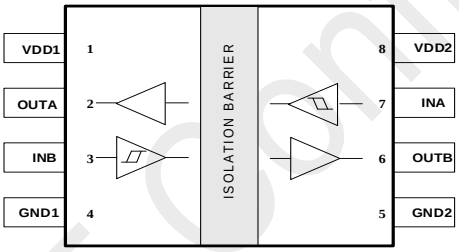



**Figure 5. CMT8121NX/ CMT8121WX Pin List**

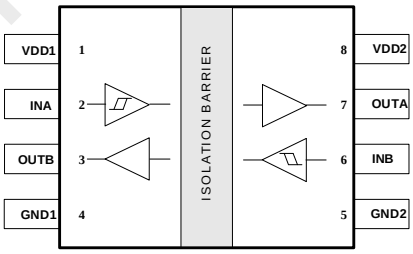



**Figure 6. CMT8122NX / CMT8122WX Pin List**

**Table 4. CMT8120 / 21 / 22X Pin Description**

| Pin Name | Pin Nmuber | | | | | | I/O | Description |
|---|---|---|---|---|---|---|---|---|
| | WB SOIC-16 | | | NB SOIC-8/ SOW8L | | | | |
| | CMT8120W | CMT8121W | CMT8122W | CMT8120N | CMT8121N | CMT8122N | | |
| GND1 | 1<br>7 | 1<br>7 | 1<br>7 | 4 | 4 | 4 | - | Left ground |
| GND2 | 9<br>16 | 9<br>16 | 9<br>16 | 5 | 5 | 5 | - | Right ground |
| INA | 4 | 13 | 4 | 2 | 7 | 2 | I | Input, channel A |
| INB | 5 | 5 | 12 | 3 | 3 | 6 | I | Input, channel B |
| NC | 2, 6, 8, 10,11,15 | 2, 6, 8, 10,11,15 | 2, 6, 8, 10,11,15 | - | - | - | - | Disconnect / connect to the GND |
| OUTA | 13 | 4 | 13 | 7 | 2 | 7 | O | Output, channel A |
| OUTB | 12 | 12 | 5 | 6 | 6 | 3 | O | Output, channel B |
| $V_{DD1}$ | 3 | 3 | 3 | 1 | 1 | 1 | - | Power supply for left side |
| $V_{DD2}$ | 14 | 14 | 14 | 8 | 8 | 8 | - | Power supply for right side |

# 8 Typical Application

## 8.1 Typical Application Schematic

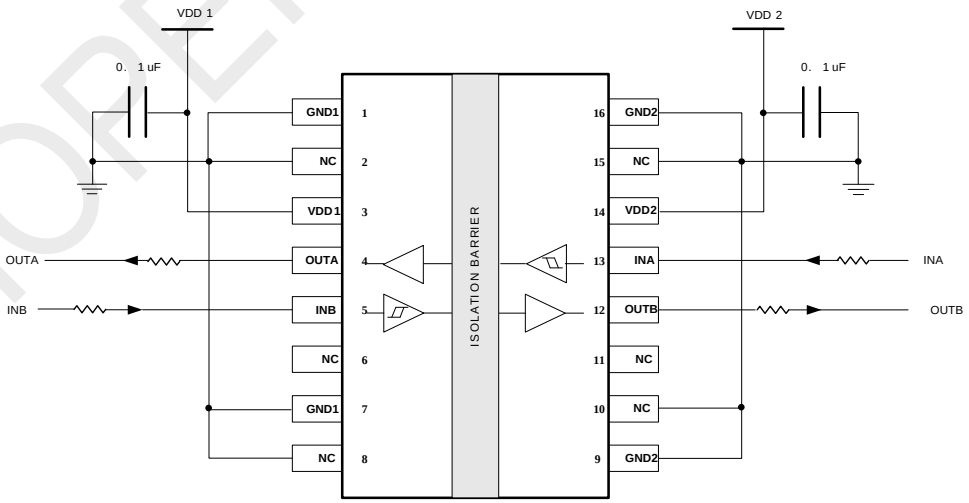



**Figure 7. Typical Application Schematic (Take the CMT8121WXM as an example)**

***Note:*** *users should be careful not to connect ground and VDD reversely.*

## 8.2 PCB Layout Guidelines

The CMT812X requires a 0.1 μF bypass capacitor in both input side and output side. The capacitor should be placed as close as possible to the package pin of VDD1 and VDD2 respectively. The figures below show the recommended PCB layout. Please make sure the space under the chip keeps free from planes, traces, pads and via. To enhance the robustness of design, users may also include resistors (50 ~ 300 Ω) in series with the inputs and outputs if the system is excessively noisy. The series resistors also improve the system reliability such as latch-up immunity.

The typical output impedance of an isolator driver channel is approximately 50 Ω ± 40%. When driving loads where transmission line effects will be a factor, output pins should be appropriately terminated with controlled impedance PCB traces.

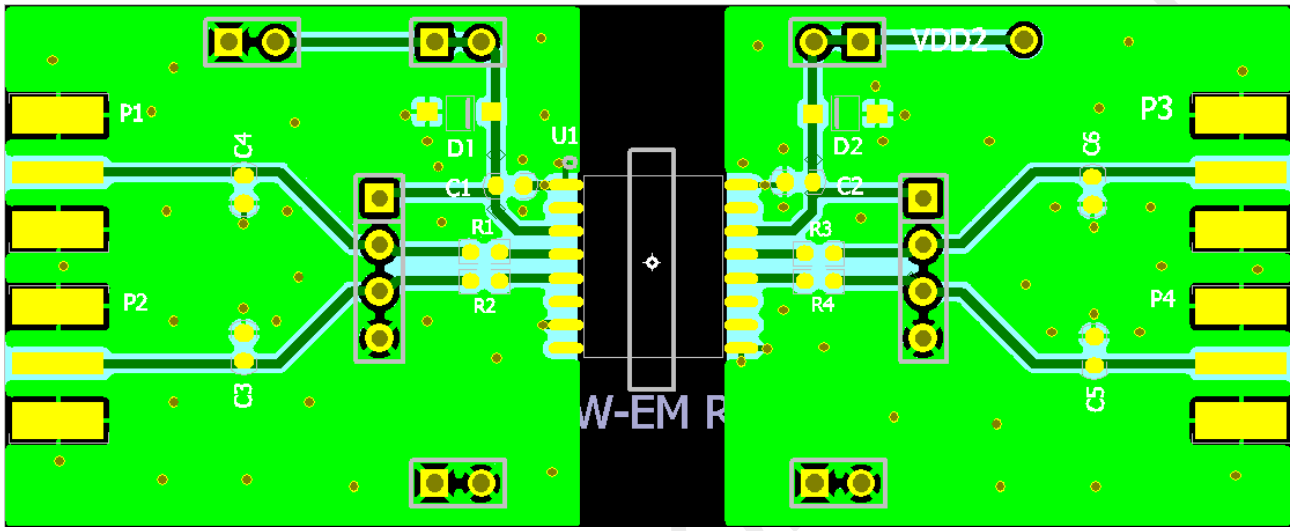



**Figure 8. Recommended PCB Layout**

# 9 Parameter Measurement Circuit Setup

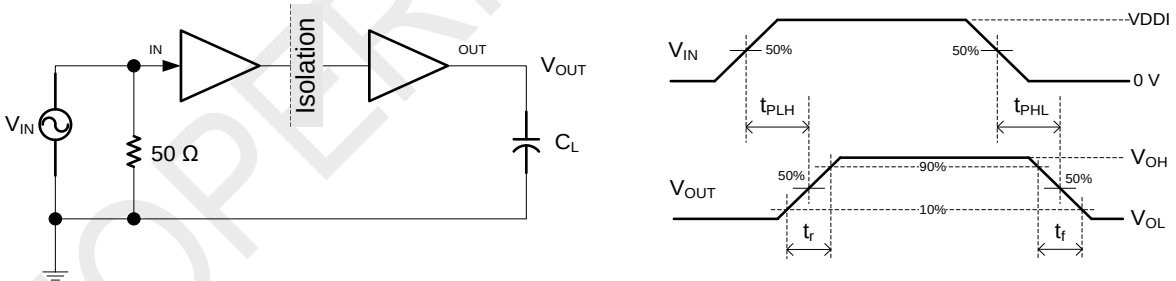



**Figure 9. Switching Characteristics Test Circuit and Voltage Waveforms**

**Notes:**

1. The input pulse is supplied by a generator $V_{IN}$ having the following characteristics: $f_{PULSE}$ ≤ 100 kHz, 50% duty cycle, $t_r$ ≤ 3 ns, $t_f$ ≤ 3 ns, $Z_O$ = 50 Ω. At the input, 50 Ω resistor is required to terminate input generator signal. It is not needed in actual application.
2. Load capacitance influences the measurement results quite a lot, including instrumentation and fixture capacitance, totally no more than 15 pF loading is preferred.

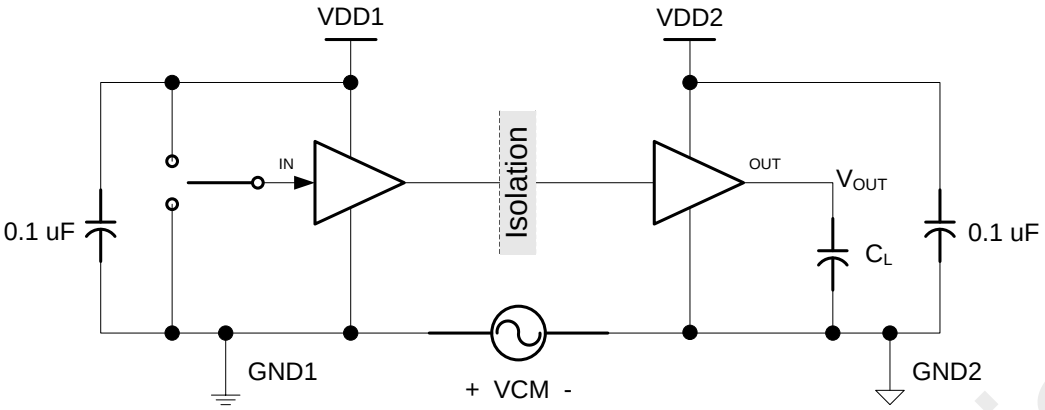



**Figure 10. Common-Mode Transient Immunity Test Circuit**

Notes:

1. CL = 15 pF, the total instrumentation and connection is within ±20%.

# 10 Electrical Specifications

## 10.1 Electrical Characteristics with 5 V Supply

VDD1 =VDD2= 5V, $T_A$= -40 to 125 ℃.

**Table 5. Electrical Characteristics with 5 V Supply**

| Parameters | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Poweron reset | $V_{POR}$ | POR threshold as during power- up | | 2.3 | | V |
| | $V_{HYS}$ | POR threshold hysteresis | | 0.1 | | V |
| Input threshold | $V_{IT}$ | Input threshold at rising edge | | | 0.7*VDD1 | V |
| | $V_{IT-}$ | Input threshold at falling edge | 0.3*VDD1 | | | V |
| | $V_{ITHYS}$ | Input threshold hysteresis | | 0.2*VDD1 | | V |
| High level input voltage | $V_{IH}$ | | 2 | | | V |
| Low level input voltage | $V_{IL}$ | | | | 0.8 | V |
| High level output voltage | $V_{OH}$ | $I_{OH}$ = -4mA | VDD- 0.3 | | | V |
| Low level output voltage | $V_{OL}$ | $I_{OL}$ = 4mA | | | 0.3 | V |
| Output impedance | $R_O$ | | | 50 | | Ω |
| Input pull high or low current | Ipull | | | 10 | 15 | uA |
| Start-up time after POR | trbs | | | 10 | | us |
| Common mode transient | CMTI | | | 200 | 150 | kV/us |

## 10.2 Supply Current Characteristics with 5 V Supply

VDD1 = VDD2 = 5V, $T_A$= -40 to 125 ℃.

**Table 6. Supply Current Characteristics with 5 V Supply**

| Parameter | Symbol | Typ. | Max. | Unit |
|---|---|---|---|---|
| CMT8120 | | | | |
| Supply current<br>EN = VDDI,$V_{IN}$ =0 V | $I_{DD1}$ | 0.67 | | mA |
| | $I_{DD2}$ | 1.14 | | mA |
| Supply current: device is disabled.<br>EN = VDDI,$V_{IN}$ =VDDI, | $I_{DD1}$ | 2.96 | | mA |
| | $I_{DD2}$ | 1.19 | | mA |
| Supply current: 1 Mbps square wave clock input AC signal.<br>All channels switching with 1 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 1.82 | | mA |
| | $I_{DD2}$ | 1.34 | | mA |
| Supply current: 10 Mbps square wave clock input AC signal.<br>All channels switching with 10 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 1.85 | | mA |
| | $I_{DD2}$ | 2.84 | | mA |
| Supply current: 100 Mbps square wave clock input AC signal.<br>All channels switching with 100 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 2.29 | | mA |
| | $I_{DD2}$ | 9.82 | | mA |
| CMT8121 | | | | |
| Supply current<br>EN = VDDI, $V_{IN}$ =0 V | $I_{DD1}$ | 1.12 | | mA |
| | $I_{DD2}$ | 1.14 | | mA |
| Supply current: device is disabled.<br>EN = VDDI,$V_{IN}$ =VDDI, | $I_{DD1}$ | 2.27 | | mA |
| | $I_{DD2}$ | 2.30 | | mA |
| Supply current: 1 Mbps square wave clock input AC signal.<br>All channels switching with 1 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 1.79 | | mA |
| | $I_{DD2}$ | 1.83 | | mA |
| Supply current: 10 Mbps square wave clock input AC signal.<br>All channels switching with 10 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 2.21 | | mA |
| | $I_{DD2}$ | 2.25 | | mA |
| Supply current: 100 Mbps square wave clock input AC signal.<br>All channels switching with 100 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 6.33 | | mA |
| | $I_{DD2}$ | 6.62 | | mA |
| CMT8122 | | | | |
| Supply current<br>EN = VDDI, $V_{IN}$ =0 V | $I_{DD1}$ | 1.13 | | mA |
| | $I_{DD2}$ | 1.13 | | mA |
| Supply current: device is disabled.<br>EN = VDDI, $V_{IN}$ =VDDI, | $I_{DD1}$ | 2.35 | | mA |
| | $I_{DD2}$ | 2.30 | | mA |
| Supply current: 1 Mbps square wave clock input AC signal.<br>All channels switching with 1 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 1.83 | | mA |
| | $I_{DD2}$ | 1.82 | | mA |
| Supply current: 10 Mbps square wave clock input AC signal.<br>All channels switching with 10 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 2.25 | | mA |
| | $I_{DD2}$ | 2.24 | | mA |
| Supply current: 100 Mbps square wave clock input AC signal.<br>All channels switching with 100 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 6.32 | | mA |
| | $I_{DD2}$ | 6.60 | | mA |

**Table 7-1. Supply Current with 5 V Supply- Characteristics of CMT812X**

| Parameters | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Data rate | DR | | 0 | 150 | | Mbps |
| Minimum pulse width | PW | See figure 6, $C_L$ = 15 pF | | 5 | 5 | ns |
| Propagation delay rising | $t_{PLH}$ | See figure 6, $C_L$ = 15 pF | | 9 | 15 | ns |
| Propagation delay falling | $t_{PHL}$ | See figure 6, $C_L$ = 15 pF | | 9 | 15 | ns |
| Pulse width distortion \|t PHL – t PLH \| | PWD | See figure 6, $C_L$ = 15 pF | | | 5 | ns |
| Rising time | tr | See figure 6, $C_L$ = 15 pF | | | 5 | ns |
| Falling time | tf | See figure 6, $C_L$ = 15 pF | | | 5 | ns |
| Peak eye diagram Jitter | $t_{JIT}$(PK) | | | 400 | | ps |
| Channel-to-channel delay Skew | $t_{SK}$(c2c) | | | 1.5 | 2.5 | ns |
| Part-to-part delay skew | $t_{SK}$(p2p) | | | | 5 | ns |

## 10.3 Supply Current Characteristics with 3.3 V Supply

VDD1 = VDD2 = 3.3V, $T_A$= -40 to 125 ℃.

**Table 8. Supply Current Characteristics with 3.3 V Supply**

| Parameter | Symbol | Typ. | Max. | Unit |
|---|---|---|---|---|
| CMT8120 | | | | |
| Supply current EN = VDDI,$V_{IN}$ =0 V | $I_{DD1}$ | 0.67 | | mA |
| | $I_{DD2}$ | 1.14 | | mA |
| Supply current: device is disabled. EN = VDDI,$V_{IN}$ =VDDI, | $I_{DD1}$ | 2.94 | | mA |
| | $I_{DD2}$ | 1.18 | | mA |
| Supply current: 1 Mbps square wave clock input AC signal. All channels switching with 1 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 1.80 | | mA |
| | $I_{DD2}$ | 1.27 | | mA |
| Supply current: 10 Mbps square wave clock input AC signal. All channels switching with 10 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 1.83 | | mA |
| | $I_{DD2}$ | 2.26 | | mA |
| Supply current: 100 Mbps square wave clock input AC signal. All channels switching with 100 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 2.34 | | mA |
| | $I_{DD2}$ | 7.03 | | mA |
| CMT8121 | | | | |
| Supply current EN = VDDI,$V_{IN}$ =0 V | $I_{DD1}$ | 1.12 | | mA |
| | $I_{DD2}$ | 1.13 | | mA |
| Supply current: device is disabled. EN = VDDI,$V_{IN}$ =VDDI, | $I_{DD1}$ | 2.25 | | mA |
| | $I_{DD2}$ | 2.29 | | mA |
| Supply current: 1 Mbps square wave clock input AC signal. All channels switching with 1 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 1.71 | | mA |
| | $I_{DD2}$ | 1.75 | | mA |
| Supply current: 10 Mbps square wave clock input AC signal. All channels switching with 10 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 2.01 | | mA |
| | $I_{DD2}$ | 2.05 | | mA |

| Parameter | Symbol | Typ. | Max. | Unit |
|---|---|---|---|---|
| Supply current: 100 Mbps square wave clock input AC signal.<br>All channels switching with 100 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 4.92 | | mA |
| | $I_{DD2}$ | 4.91 | | mA |
| CMT8122 | | | | |
| Supply current<br>EN = VDDI,$V_{IN}$ =0 V | $I_{DD1}$ | 1.14 | | mA |
| | $I_{DD2}$ | 1.14 | | mA |
| Supply current: device is disabled.<br>EN = VDDI,$V_{IN}$ =VDDI, | $I_{DD1}$ | 2.33 | | mA |
| | $I_{DD2}$ | 2.31 | | mA |
| Supply current: 1 Mbps square wave clock input AC signal.<br>All channels switching with 1 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 1.75 | | mA |
| | $I_{DD2}$ | 1.74 | | mA |
| Supply current: 10 Mbps square wave clock input AC signal.<br>All channels switching with 10 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 2.04 | | mA |
| | $I_{DD2}$ | 2.03 | | mA |
| Supply current: 100 Mbps square wave clock input AC signal.<br>All channels switching with 100 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 4.93 | | mA |
| | $I_{DD2}$ | 4.90 | | mA |

**Table 9-1. Supply Current with 3.3 V Supply - Characteristics of CMT812X**

| Parameters | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Data rate | DR | | 0 | 150 | | Mbps |
| Minimum pulse width | PW | See figure 9, CL = 15 pF | | | 5 | ns |
| Propagation delay rising | $t_{PLH}$ | See figure 9, CL = 15 pF | | 9.15 | 15 | ns |
| Propagation delay falling | $t_{PHL}$ | See figure 9, CL = 15 pF | | 7.8 | 15 | ns |
| Pulse width distortion<br>\|t PHL – t PLH \| | PWD | See figure 9, CL = 15 pF | | 1.35 | 5 | ns |
| Rising time | tr | See figure 9, CL = 15 pF | | 1.01 | 5 | ns |
| Falling time | tf | See figure 9, CL = 15 pF | | 1.05 | 5 | ns |
| Peak eye diagram Jitter | $t_{JIT}$(PK) | | | 400 | | ps |
| Channel-to-channel<br>Delay Skew | $t_{SK}$(c2c) | | | 0.8 | 2.5 | ns |
| Part-to-part delay skew | $t_{SK}$(p2p) | | | | 5 | ns |

## 10.4 Supply Current Characteristics with 2.5 V Supply

VDD1 = VDD2 = 2.5 V, $T_A$= -40 to 125 ℃.

**Table 10. Supply Current Characteristics with 2.5 V Supply**

| Parameter | Symbol | Typ. | Max. | Unit |
|---|---|---|---|---|
| CMT8120 | | | | |
| Supply current<br>EN = VDDI,$V_{IN}$ =0 V | $I_{DD1}$ | 0.66 | | mA |
| | $I_{DD2}$ | 1.13 | | mA |
| Supply current: device is disabled.<br>EN = VDDI,$V_{IN}$ =VDDI, | $I_{DD1}$ | 2.93 | | mA |
| | $I_{DD2}$ | 1.18 | | mA |
| Supply current: 1 Mbps square wave clock input AC signal.<br>All channels switching with 1 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 1.79 | | mA |
| | $I_{DD2}$ | 1.24 | | mA |
| Supply current: 10 Mbps square wave clock input AC signal.<br>All channels switching with 10 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 1.82 | | mA |
| | $I_{DD2}$ | 2.00 | | mA |
| Supply current: 100 Mbps square wave clock input AC signal.<br>All channels switching with 100 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 2.30 | | mA |
| | $I_{DD2}$ | 5.57 | | mA |
| CMT8121 | | | | |
| Supply current<br>EN = VDDI,$V_{IN}$ =0 V | $I_{DD1}$ | 1.11 | | mA |
| | $I_{DD2}$ | 1.13 | | mA |
| Supply current: device is disabled.<br>EN = VDDI,$V_{IN}$ =VDDI, | $I_{DD1}$ | 2.24 | | mA |
| | $I_{DD2}$ | 2.28 | | mA |
| Supply current: 1 Mbps square wave clock input AC signal.<br>All channels switching with 1 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 1.65 | | mA |
| | $I_{DD2}$ | 1.69 | | mA |
| Supply current: 10 Mbps square wave clock input AC signal.<br>All channels switching with 10 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 1.86 | | mA |
| | $I_{DD2}$ | 1.90 | | mA |
| Supply current: 100 Mbps square wave clock input AC signal.<br>All channels switching with 100 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 3.94 | | mA |
| | $I_{DD2}$ | 3.64 | | mA |
| CMT8122 | | | | |
| Supply current<br>EN = VDDI,$V_{IN}$ =0 V | $I_{DD1}$ | 1.14 | | mA |
| | $I_{DD2}$ | 1.13 | | mA |
| Supply current: device is disabled.<br>EN = VDDI,$V_{IN}$ =VDDI, | $I_{DD1}$ | 2.32 | | mA |
| | $I_{DD2}$ | 2.30 | | mA |
| Supply current: 1 Mbps square wave clock input AC signal.<br>All channels switching with 1 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 1.74 | | mA |
| | $I_{DD2}$ | 1.72 | | mA |
| Supply current: 10 Mbps square wave clock input AC signal.<br>All channels switching with 10 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 1.94 | | mA |
| | $I_{DD2}$ | 1.92 | | mA |
| Supply current: 100 Mbps square wave clock input AC signal.<br>All channels switching with 100 Mbps square wave input, $C_L$ = 15 pF | $I_{DD1}$ | 3.98 | | mA |
| | $I_{DD2}$ | 3.63 | | mA |

**Table 11-1. Supply Current with 2.5 V Supply - Characteristics of CMT812X**

| Parameters | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Data rate | DR | | 0 | 150 | | Mbps |
| Minimum pulse width | PW | See figure 6, $C_L$ = 15 pF | | 5 | 5 | ns |
| Propagation delay rising | $t_{PLH}$ | See figure 6, $C_L$ = 15 pF | | 9 | 15 | ns |
| Propagation delay falling | $t_{PHL}$ | See figure 6, $C_L$ = 15 pF | | 9 | 15 | ns |
| Pulse width distortion \|t PHL – t PLH \| | PWD | See figure 6, $C_L$ = 15 pF | | | 5 | ns |
| Rising time | $t_r$ | See figure 6, $C_L$ = 15 pF | | | 5 | ns |
| Falling time | $t_f$ | See figure 6, $C_L$ = 15 pF | | | 5 | ns |
| Peak eye diagram Jitter | $t_{JIT}$(PK) | | | 400 | | ps |
| Channel-to-channel Delay Skew | $t_{SK}$(c2c) | | | 2.5 | 2.5 | ns |
| Part-to-part delay skew | $t_{SK}$(p2p) | | | 5 | 5 | ns |

## 10.5 Typical Characteristics

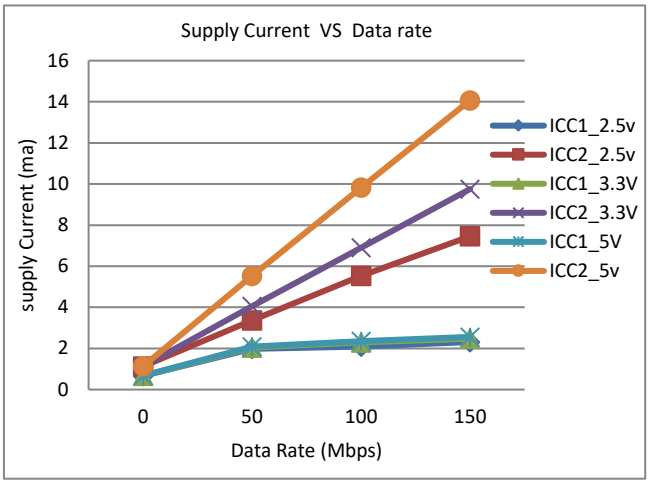



**Figure 11. Supply Current vs. Data Rate (with 15-pF Load) $T_A$=25℃ $C_L$=15pF**

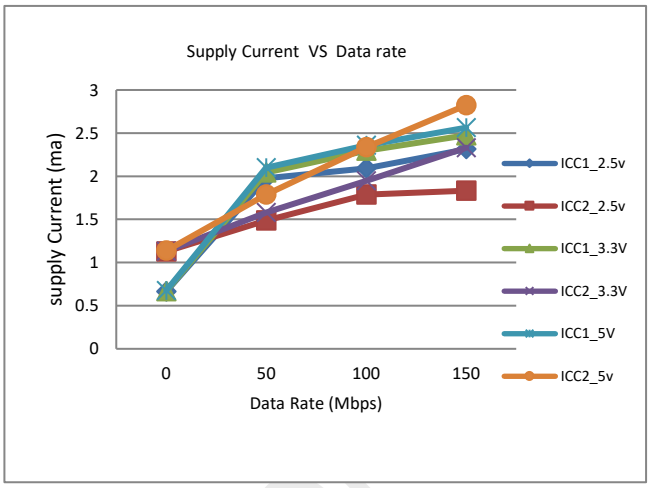



**Figure 12. Supply Current vs. Data Rate (with No Load) $T_A$=25℃ $C_L$=No Load**

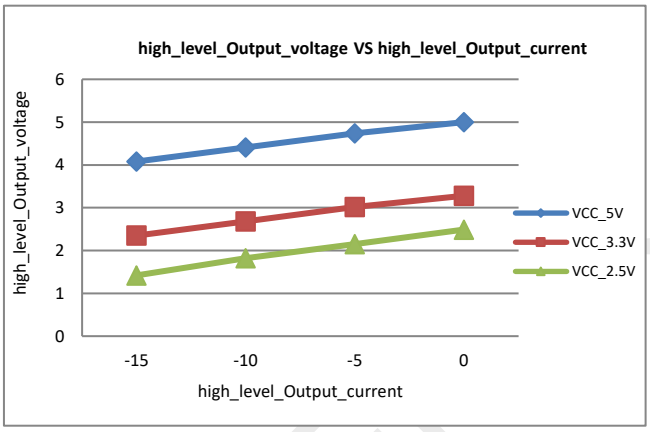



**Figure 13. High-Level Output Voltage vs. High-Level Output Current ($T_A$=25℃)**

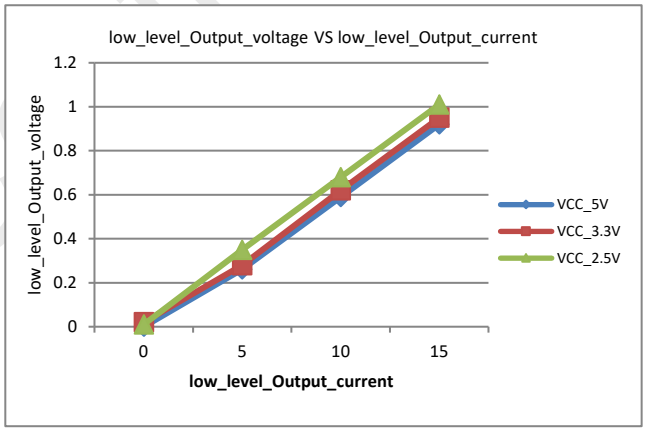



**Figure 14. Low-Level Output Voltage vs. Low-Level Output Current($T_A$=25℃)**

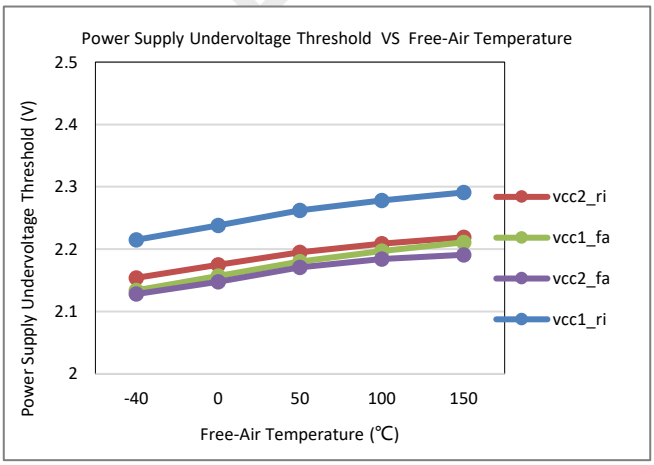



**Figure 15. Power Supply Under-voltage Threshold vs. Free-Air Temperature**

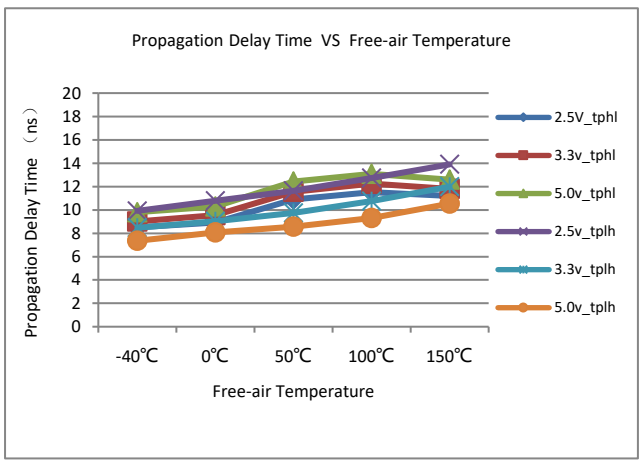



**Figure 16. Propagation Delay Time vs. Free-Air Temperature**

## 10.6 Insulation Specifications

**Table 12. Insulation Specifications**

| Parameters | Sym. | Condition | Value | | Unit |
|---|---|---|---|---|---|
| | | | NB SOIC-8 | WB SOIC-16/SOW8L | |
| External clearance[1] | CLR | The shortest terminal-to-terminal distance through air | 4.0 | 8.0 | mm |
| External creepage[1] | CRP | The shortest terminal-to-terminal distance across the package surface | 4.0 | 8.0 | mm |
| Distance through insulation | DTI | Minimum internal gap | 20 | 20 | um |
| Comparative tracking index | CTI | DIN EN 60112 (VDE 0303-11);IEC 60112 | > 400 | > 400 | V |
| Material group | - | | 1 | 1 | - |
| Overvoltage category per IEC 60664-1 | - | Rated mains voltage ⩽ 300 $V_{RMS}$ | I | I | - |
| | | Rated mains voltage ⩽ 600 $V_{RMS}$ | I-IV | I-IV | - |
| | | Rated mains voltage ⩽ 1000 $V_{RMS}$ | I-III | I-III | - |
| **DIN VDE V 0884-11:2017-01**[2] | | | | | |
| Maximum repetitive isolation voltage | $V_{IORM}$ | | 565 | 1176 | $V_{pk}$ |
| Maximum isolation working voltage | $V_{IOWM}$ | AC voltage (sine wave); Time dependent dielectric breakdown (TDDB) test | 400 | 831 | $V_{RMS}$ |
| | | DC voltage | 565 | 1176 | $V_{DC}$ |
| Maximum transient isolation voltage | $V_{IOTM}$ | $V_{TEST} = V_{IOTM}$,t = 60 s (qualification); t = 1 s (100% production) | 5300 | 7000 | $V_{pk}$ |
| Maximum surge isolation voltage[3] | $V_{IOSM}$ | Test method per IEC60065, 1.2/50 us waveform, $V_{TEST} = 1.6 \times V_{IOSM}$ | 5384 | 5384 | $V_{pk}$ |
| Apparent charge[4] | $q_{pd}$ | Method a: After I/O safety test subgroup 2/3, $V_{ini} = V_{IOTM}$, $t_{ini}$ = 60 s; $V_{pd(m)} = 1.2 \times V_{IORM}$, $t_m$ = 10 s | ⩽5 | ⩽5 | ⩽5pC |
| | | Method a: After environmental tests subgroup 1, $V_{ini} = V_{IOTM}$, $t_{ini}$ = 60 s; $V_{pd(m)} = 1.6 \times V_{IORM}$, $t_m$ = 10 s | ⩽5 | ⩽5 | |
| | | Method b1: At routine test (100% production) and preconditioning (type test) $V_{ini} = V_{IOTM}$, $t_{ini}$ = 1 s; | ⩽5 | ⩽5 | |
| Isolation capacitance, input to output[5] | $C_{IO}$ | $V_{IO}$ = 0.4 x sin (2πft), f = 1 MHz | 0.6 | 0.6 | pF |
| Isolation resistance, input to output[5] | $R_{IO}$ | $V_{IO}$ = 500 V | $>10^{10}$ | $>10^{10}$ | Ω |
| **UL 1577** | | | | | |
| Withstand isolation voltage | $V_{ISO}$ | $V_{TEST} = V_{ISO}$, t = 60 s (qualification); $V_{TEST} = 1.2 \times V_{ISO}$, t = 1 s (100% production) | | 5000 | $V_{RMS}$ |

Notes:

[1]. Creepage and clearance requirements should be applied according to the specific equipment isolation standards of an application. Care should be taken to maintain the creepage and clearance distance of a board design to ensure that the mounting pads of the isolator on the printed-circuit board do not reduce this distance. Creepage and clearance on a printed-circuit board become equal in certain cases. Techniques such as inserting grooves and/or ribs on a printed-circuit board are used to help increase these specifications.

[2]. This coupler is suitable for safe electrical insulation only within the safety ratings. Compliance with the safety ratings shall be ensured by means of suitable protective circuits.

[3]. Testing is carried out in air or oil to determine the intrinsic surge immunity of the isolation barrier.

[4]. Apparent charge is electrical discharge caused by a partial discharge (pd).

[5]. All pins on each side of the barrier are tied together creating a two-terminal device.

## 10.7 Safety-related Certifications

**Table 13. Safety-related Certifications**

| VDE | CSA | UL | CQC | TUV |
|---|---|---|---|---|
| DIN VDE V0884-11:2017-01 （Patents pending） | IEC 60950-1, IEC 62368-1 and IEC 61010-1 （Patents pending） | Recognized under UL 1577 Component Recognition Program （Patents pending） | GB 4943.1-2011 | EN 61010-1:2010 (3rd Ed) and EN 60950-1:2006/A2: 2013 （Patents pending） |
| Certificate number: pending | Master contract number: pending | File number: pending | Certificate number: CQC11-471543-2022 | Client ID number: pending |

## 10.8 Safety Limiting Values

Safety limiting intends to minimize potential damage to the isolation barrier upon failure of input or output circuitry. A failure of the I/O can allow low resistance to ground or the supply and, without current limiting, dissipate sufficient power to overheat the die and damage the isolation barrier potentially leading to secondary system failures

**Table 14. Safety Limiting Values**

| Parameters | Symbol | Test Condition | Value | | Unit |
|---|---|---|---|---|---|
| | | | NB SOIC-16 | WB SOIC-16/SOW8L | |
| Safety input, output, or supply current | Is | $R_{\theta JA}$ = 140 °C/W, $V_I$ = 5.5 V, $T_J$ = 125 °C, $T_A$ = 25 °C | 160 | | mA |
| | | $R_{\theta JA}$ = 84 °C/W, $V_I$ = 5.5 V, $T_J$ = 125 °C, $T_A$ = 25 °C | | 237 | mA |
| Total power dissipation at 25℃ | Ps | | | 1499 | W |
| Case temperature | Ts | | 125 | 125 | ℃ |

## 10.9 Thermal Information

**Table 15. Thermal Information**

| Parameter | Symbol | Value | | Unit |
|---|---|---|---|---|
| | | NB SOIC-8 | WB SOIC-16/ SOW8L | |
| Junction-to-ambient thermal resistance | $\theta_{JA}$ | 78.9 | 78.9 | °C/W |
| Junction-to-case (top) thermal resistance | $\theta_{JC(top)}$ | 41.1 | 41.6 | °C/W |
| Junction-to-board thermal resistance | $\theta_{JB}$ | 49.5 | 43.6 | °C/W |

# 11 Function Description

## 11.1 Function Overview

The CMT812X device is a high-performance, quad-channel digital isolator with 5000 $V_{RMS}$ isolation rating. The CMT812X has an On-Off keying (OOK) modulation scheme to transmit the digital data across a silicon dioxide based isolation barrier. The transmitter sends a high-frequency carrier across the barrier to represent one digital state and sends no signal to represent the other digital state. The receiver demodulates the signal after advanced signal conditioning and produces the output through a buffer stage. If the ENx pin is low then the output goes to high impedance. The CMT812X also incorporates advanced circuit techniques to maximize the CMTI performance and minimize the radiated emissions due to the high frequency carrier and IO buffer switching. The figure below shows a conceptual detail of how the On-Off keying scheme works.

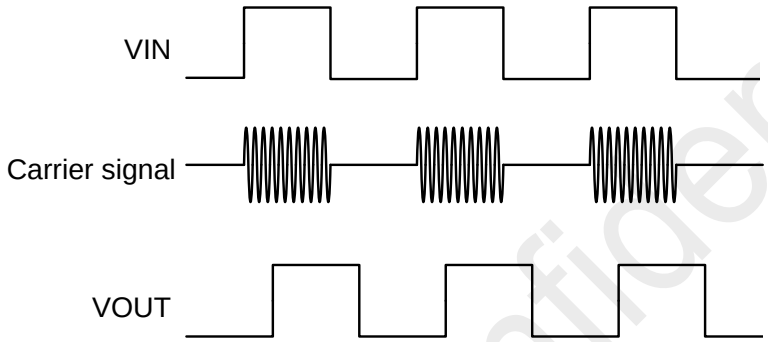



**Figure 17. On-Off Keying Based Modulation Scheme**

## 11.2 Functional Modes

The table below lists the functional modes of the CMT812X.

**Table 16. Function Table[1]**

| $V_{DD1}$ | $V_{DD2}$ | Input (INx)[2] | Output (OUTx) | Comment |
|---|---|---|---|---|
| PU | PU | H | H | Normal operation: A channel output assumes the logic state of its input |
| | | L | L | |
| | | Open | Default | Default mode: when INx is open, the corresponding channel output goes to its default logic state |
| PD | PU | X | Default | Default mode: when VDDI is unpowered, a channel output assumes the logic state based on the selected default option.<br>When VDD1 transitions from unpowered to powered-up, a channel output assumes the logic state of the input.<br>When VDD1 transitions from powered-up to unpowered, channel output assumes the selected default state |
| X | PD | X | Undetermined | When VDD2 is unpowered, a channel output is undetermined[3]. When VDD2 transitions from unpowered to powered-up, a channel output assumes the logic state of the input |

## 11.3 Insulation Lifetime

Insulation lifetime projection data is collected by using industry-standard Time Dependent Dielectric Breakdown (TDDB) test method. In this test, all pins on each side of the barrier are tied together creating a two-terminal device and high voltage applied between the two sides; See the figure below for TDDB test setup. The insulation breakdown data is collected at various high voltages switching at 60 Hz over temperature. For reinforced insulation, VDE standard requires the use of TDDB projection line

with failure rate of less than 1 part per million (ppm). Even though the expected minimum insulation lifetime is 20 years at the specified working isolation voltage, VDE reinforced certification requires additional safety margin of 20% for working voltage and 87.5% for lifetime which translates into minimum required insulation lifetime of 37.5 years at a working voltage that's 20% higher than the specified value.

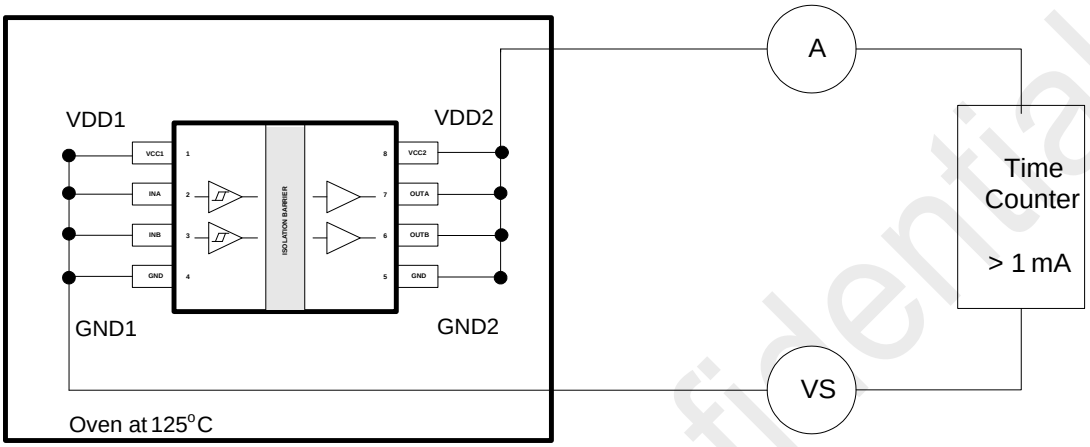



**Figure 18. Test Setup for Insulation Lifetime Measurement**

# 12 Packaging Information

The packaging information of the CMT812X SOIC16 is shown in the figures below.

## 12.1 CMT812X Narrow Body SOIC-8 Packaging

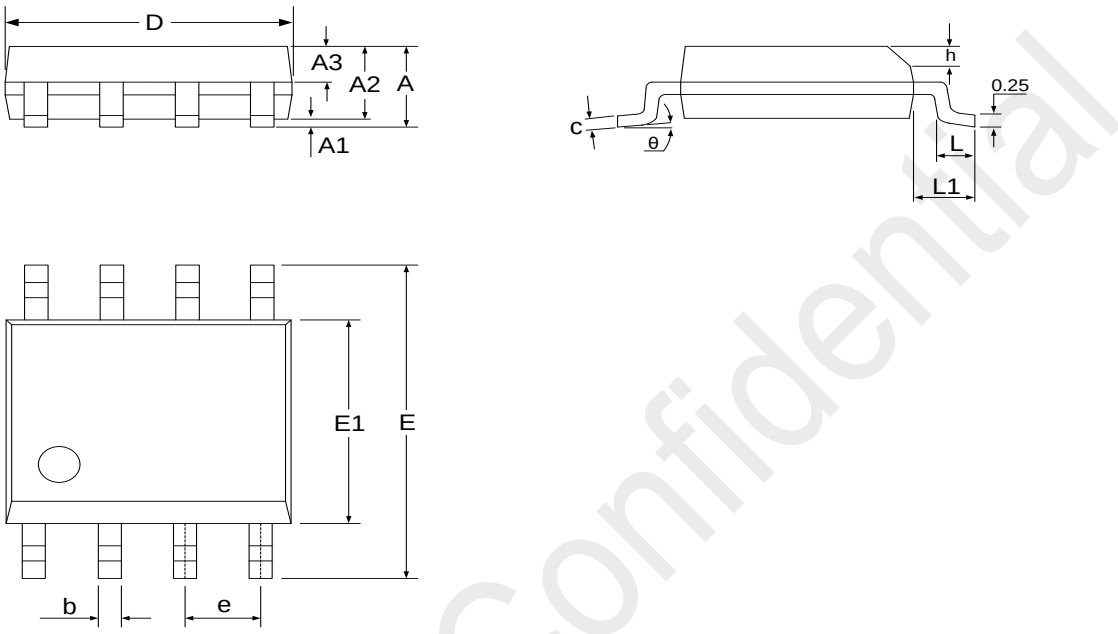
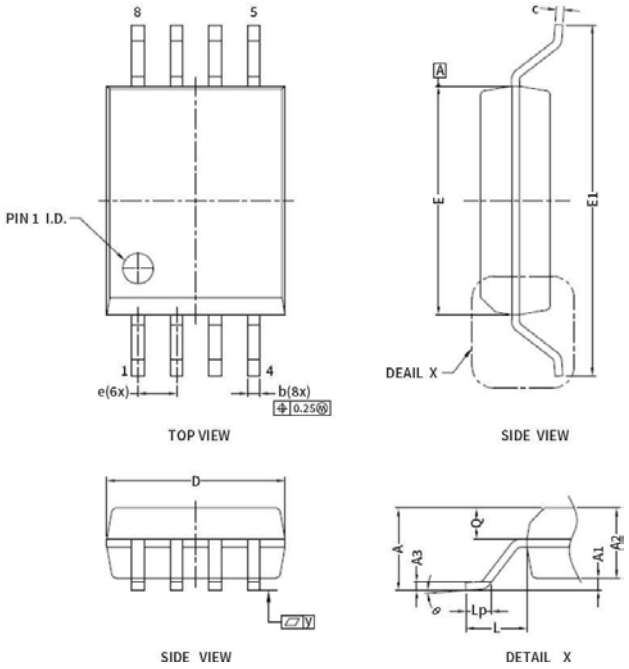



**Figure 19. Narrow Body SOIC-8 Packaging**

**Table 17.Narrow Body SOIC-8 Packaging Scale**

| Symbol | Scale (mm) | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | - | - | 1.75 |
| A1 | 0.10 | - | 0.225 |
| A2 | 1.30 | 1.40 | 1.50 |
| A3 | 0.60 | 0.65 | 0.70 |
| b | 0.39 | - | 0.48 |
| c | 0.21 | - | 0.26 |
| D | 4.70 | 4.90 | 5.10 |
| E | 5.80 | 6.00 | 6.20 |
| E1 | 3.70 | 3.90 | 4.10 |
| e | 1.27 BSC | | |
| h | 0.25 | - | 0.50 |
| L | 0.50 | - | 0.80 |
| L1 | 1.05 BSC | | |
| θ | 0 | - | 8° |

## 12.2 CMT812X Wide Body SOW8L Packaging




CONTROLLING DIMENSION:MM

| Symbol | MM | | |
|---|---|---|---|
| | MIN. | NOM. | 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° |

NOTES
1.0 COPLANCRITY APPLIES TO LEADS, CORNER LEADS AND DIE ATTAACH PAD.

**Figure 20. CMT812X SOW8L Package**

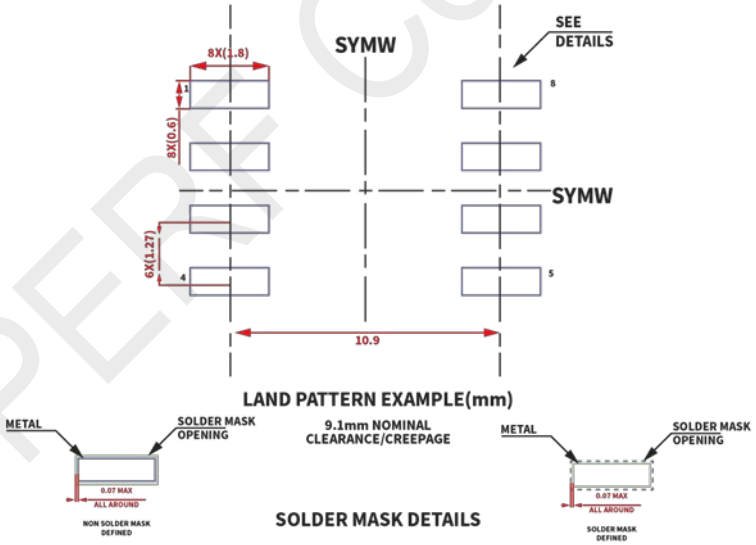



**Figure 21. CMT812X SOW8L Package Board Layout Example**

## 12.3 CMT812X Wide Body SOIC-16 Packaging

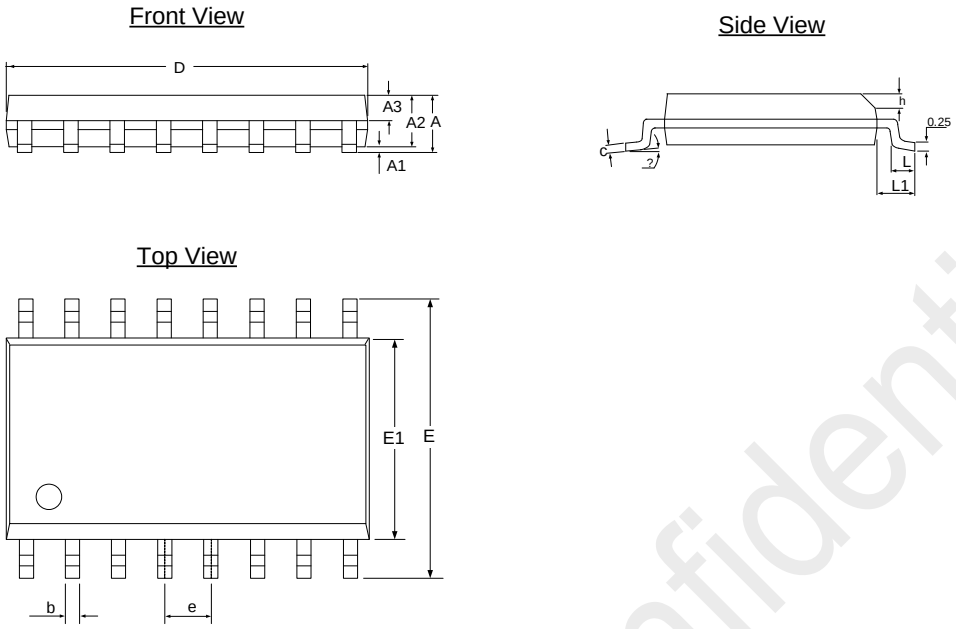



**Figure 22. Wide Body SOIC-16 Packaging**

**Table 18. Wide Body SOIC-16 Packaging Scale**

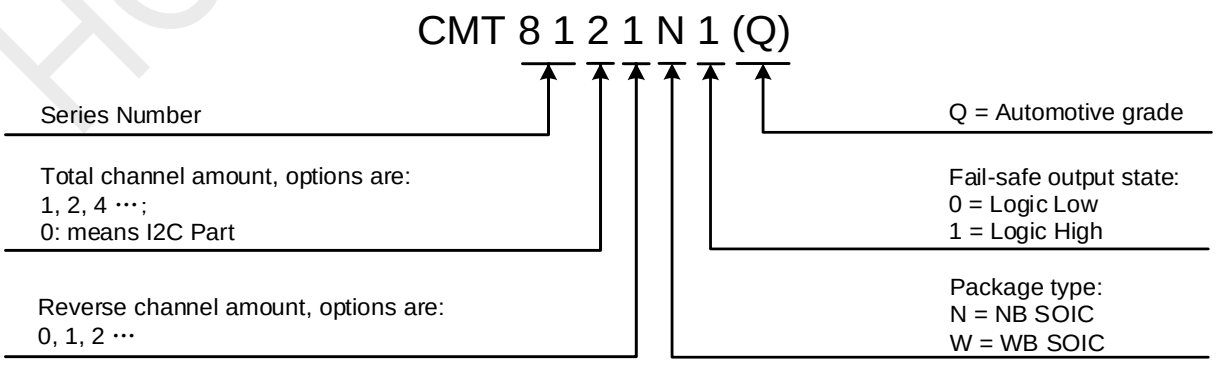
| Symbol | Scale (mm) | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | - | - | 2.65 |
| A1 | 0.10 | 0.20 | 0.30 |
| A2 | 2.25 | 2.30 | 2.35 |
| A3 | 1.00 | 1.05 | 1.10 |
| b | 0.35 | 0.37 | 0.43 |
| c | 0.15 | 0.20 | 0.30 |
| D | 10.30 | 10.40 | 10.50 |
| E | 10.10 | 10.30 | 10.50 |
| E1 | 7.40 | 7.50 | 7.60 |
| e | 1.14 | 1.27 | 1.40 |
| L | 0.65 | 0.70 | 0.85 |
| L1 | 1.40 | | |
| θ | 0 | - | 8° |

# 13 Ordering Information

**Table 19. Part Number List**

| Part Number | Min. Order Quantity | Withstand Voltage（rms） | Numbers of Total Channels | Numbers of Forward Channel | Numbers of Reversed Channel | Digital Rate (MHz) | Default Output State | Package |
|---|---|---|---|---|---|---|---|---|
| CMT8120W0 | 1000 | 5000 | 2 | 2 | 0 | 150 | Low | WB SOIC-16 |
| CMT8120W0M | 1000 | 5000 | 2 | 2 | 0 | 150 | Low | WB SOIC-16 |
| CMT8120W1M | 1000 | 5000 | 2 | 2 | 0 | 150 | High | WB SOIC-16 |
| CMT8121W0M | 1000 | 5000 | 2 | 1 | 1 | 150 | Low | WB SOIC-16 |
| CMT8121W1M | 1000 | 5000 | 2 | 1 | 1 | 150 | High | WB SOIC-16 |
| CMT8122W0M | 1000 | 5000 | 2 | 1 | 1 | 150 | Low | WB SOIC-16 |
| CMT8122W1M | 1000 | 5000 | 2 | 1 | 1 | 150 | High | WB SOIC-16 |
| CMT8120W0 | 1000 | 5000 | 2 | 2 | 0 | 150 | Low | SOW8L |
| CMT8120W1 | 1000 | 5000 | 2 | 2 | 0 | 150 | Low | SOW8L |
| CMT8121W0 | 1000 | 5000 | 2 | 1 | 1 | 150 | Low | SOW8L |
| CMT8121W1 | 1000 | 5000 | 2 | 1 | 1 | 150 | Low | SOW8L |
| CMT8122W0 | 1000 | 5000 | 2 | 1 | 1 | 150 | Low | SOW8L |
| CMT8122W0 | 1000 | 5000 | 2 | 1 | 1 | 150 | Low | SOW8L |
| CMT8120N0 | 3000 | 3750 | 2 | 2 | 0 | 150 | High | NB SOIC-8 |
| CMT8120N1 | 3000 | 3750 | 2 | 2 | 0 | 150 | High | NB SOIC-8 |
| CMT8121N0 | 3000 | 3750 | 2 | 1 | 1 | 150 | High | NB SOIC-8 |
| CMT8121N1 | 3000 | 3750 | 2 | 1 | 1 | 150 | Low | NB SOIC-8 |
| CMT8122N0 | 3000 | 3750 | 2 | 1 | 1 | 150 | Low | NB SOIC-8 |
| CMT8122N1 | 3000 | 3750 | 2 | 1 | 1 | 150 | High | NB SOIC-8 |

**Part Number Naming Rule:**



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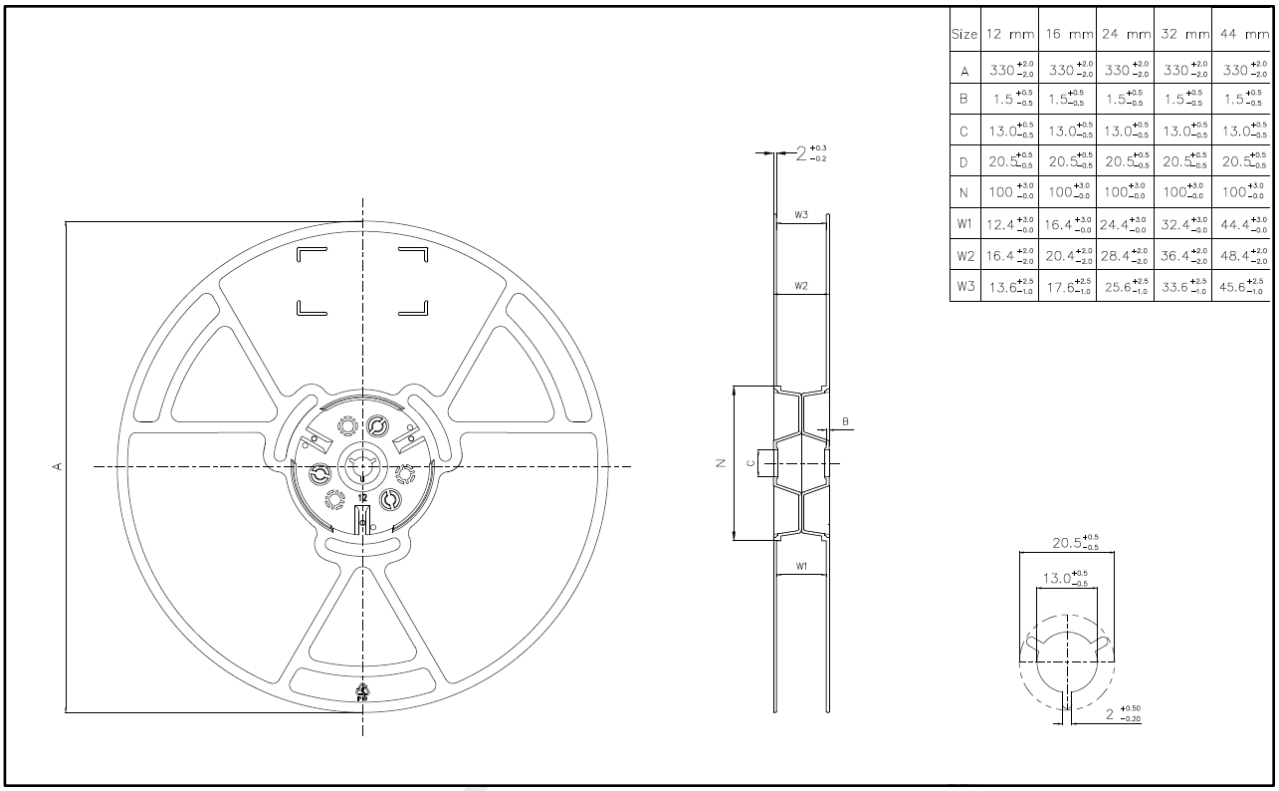
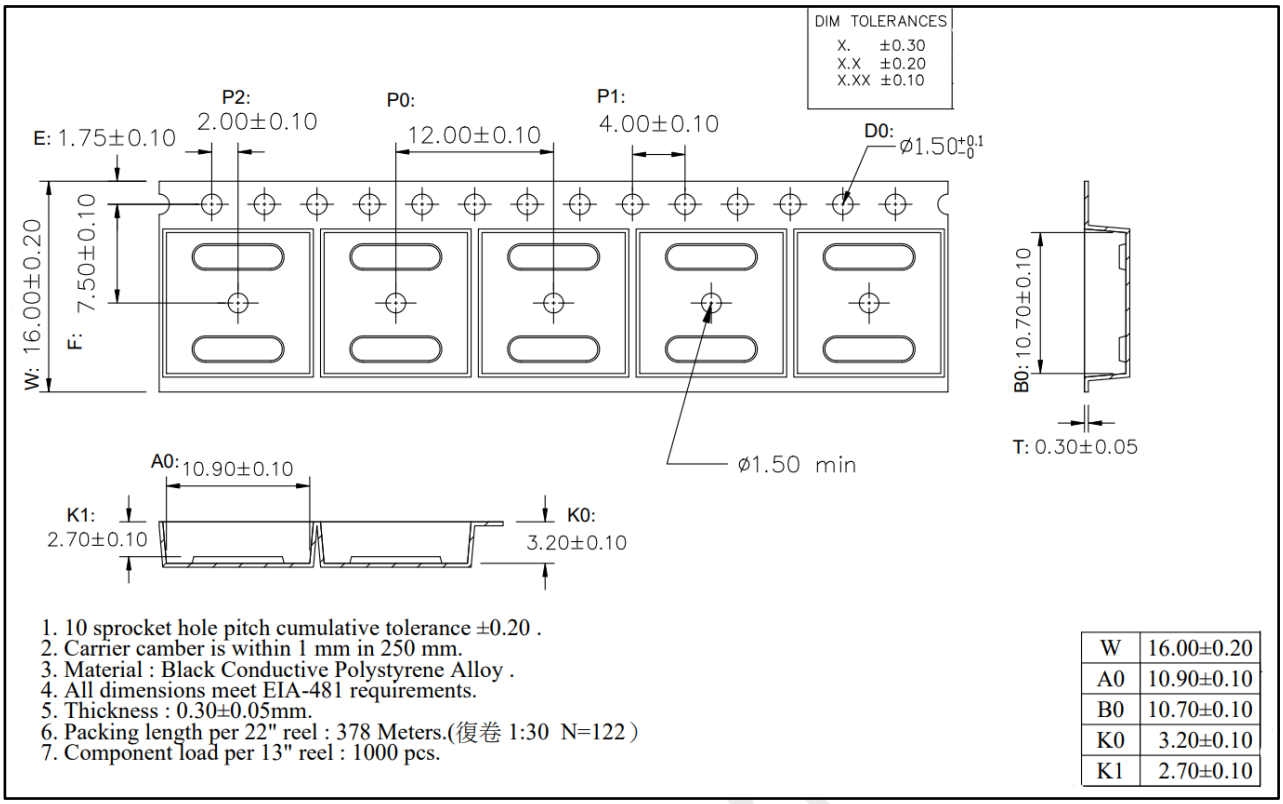
Please contact sales@hoperf.com or your local sales representative for sales or pricing requirements.

# 14 Tape and Reel Information




| Size | 12 mm | 16 mm | 24 mm | 32 mm | 44 mm |
|---|---|---|---|---|---|
| A | 330 +2.0 −2.0 | 330 +2.0 −2.0 | 330 +2.0 −2.0 | 330 +2.0 −2.0 | 330 +2.0 −2.0 |
| B | 1.5 +0.5 −0.5 | 1.5 +0.5 −0.5 | 1.5 +0.5 −0.5 | 1.5 +0.5 −0.5 | 1.5 +0.5 −0.5 |
| C | 13.0 +0.5 −0.5 | 13.0 +0.5 −0.5 | 13.0 +0.5 −0.5 | 13.0 +0.5 −0.5 | 13.0 +0.5 −0.5 |
| D | 20.5 +0.5 −0.5 | 20.5 +0.5 −0.5 | 20.5 +0.5 −0.5 | 20.5 +0.5 −0.5 | 20.5 +0.5 −0.5 |
| N | 100 +3.0 −0.0 | 100 +3.0 −0.0 | 100 +3.0 −0.0 | 100 +3.0 −3.0 | 100 +3.0 −0.0 |
| W1 | 12.4 +3.0 −0.0 | 16.4 +3.0 −0.0 | 24.4 +3.0 −0.0 | 32.4 +3.0 −0.0 | 44.4 +3.0 −0.0 |
| W2 | 16.4 +2.0 −2.0 | 20.4 +2.0 −2.0 | 28.4 +2.0 −2.0 | 36.4 +2.0 −2.0 | 48.4 +2.0 −2.0 |
| W3 | 13.6 +2.5 −1.0 | 17.6 +2.5 −1.0 | 25.6 +2.5 −1.0 | 33.6 +2.5 −1.0 | 45.6 +2.5 −1.0 |

**Figure 23. CMT812X WB SOIC-16 Tape & Reel Information**




| | |
|---|---|
| W | 16.00±0.20 |
| A0 | 10.90±0.10 |
| B0 | 10.70±0.10 |
| K0 | 3.20±0.10 |
| K1 | 2.70±0.10 |

**Figure 24. CMT812X WB SOIC-16 Tape & Reel Information**

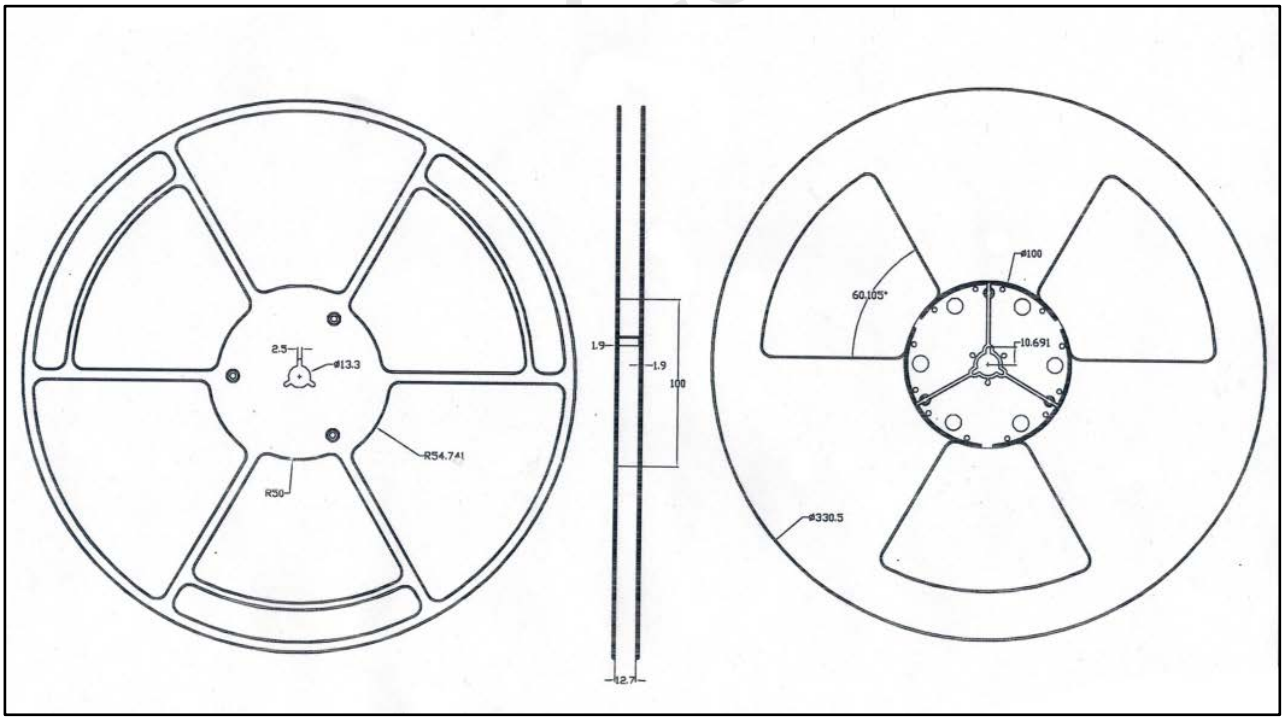
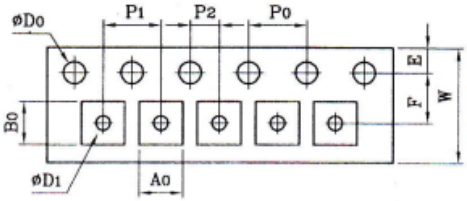



**Figure 25. CMT812X NB SOIC-8 Tape & Reel Information**

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 | | |



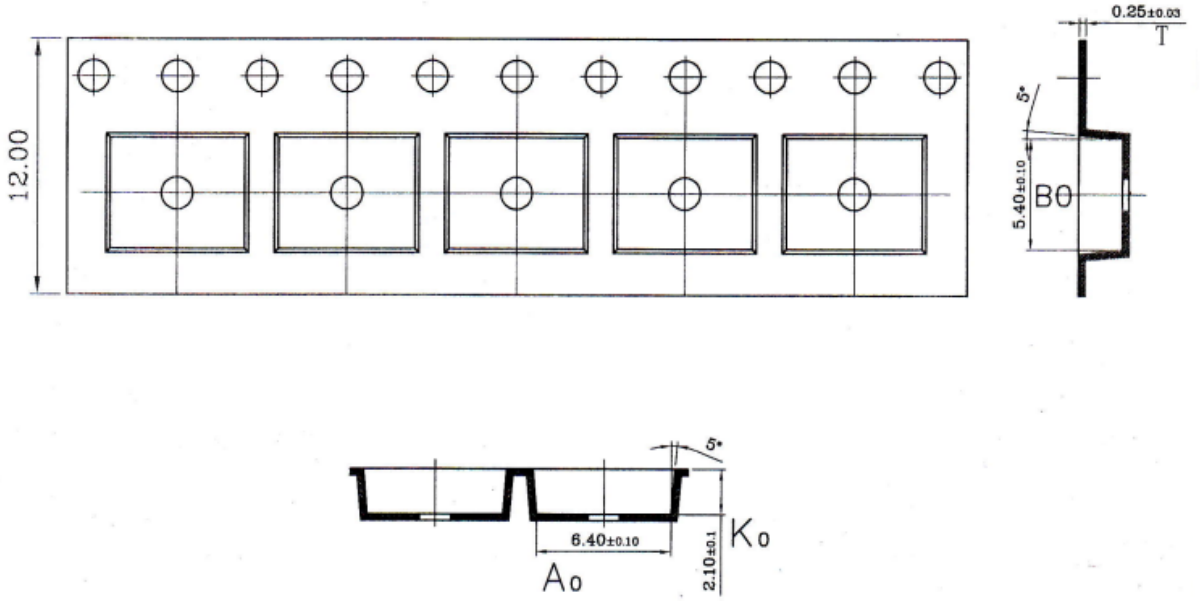




**Figure 26. CMT812X NB SOIC-8 Tape & Reel Information**

# 15 Revise History

**Table 20. Revise Record**

| Version No. | Chapter | Description | Date |
|---|---|---|---|
| 0.1 | All | Initial version | 2023/02/22 |
| 0.2 | 15 | Added Tape information in Chapter 15 | 2023/03/09 |
| | 14 | Update order information | |
| 0.3 | All | Delete the silver printing part | 2023/04/19 |
| | | Added the CQC certificate number | |
| 0.4 | All | Added package information of SOW8L | 2023/11/07 |
| 0.5 | All | Update the surge immunity value to 8 kV | 2024/01/16 |

# 16 Contacts

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