

## Magnetics modules for LAN applications

Important notes	2
Overview	3
Introduction	4
Terms and definitions	5
10/100 Base-T magnetics modules	7
1000 Base-T magnetics modules	25
Cautions and warnings	41
Addresses	42

## Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule, EPCOS is either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether an EPCOS product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or lifesaving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet ([www.epcos.com/material](http://www.epcos.com/material)). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order. We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available. The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.
6. Unless otherwise agreed in individual contracts, **all orders are subject to the current version of the "General Terms of Delivery for Products and Services in the Electrical Industry" published by the German Electrical and Electronics Industry Association (ZVEI)**.
7. The trade names EPCOS, BAOKE, Alu-X, CeraDiode, CSSP, CTVS, DSSP, MiniBlue, MKK, MLSC, MotorCap, PCC, PhaseCap, PhaseMod, SIFERRIT, SIF1, SIKOREL, SilverCap, SIMDAD, SIMID, SineFormer, SIOV, SIP5D, SIP5K, ThermoFuse, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at [www.epcos.com/trademarks](http://www.epcos.com/trademarks).

**Magnetics modules for LAN applications**
**Overview**

Temperature	PoE	Ports	Turns ratio Primary : Secondary	V <sub>test</sub> V AC	EPCOS ordering code	Page
<b>10/100 Base-T</b>						
0 °C ... +70 °C	–	1	1CT : 1CT	1500	B78476A8067A003	7
	–	1	1CT : 1CT	1500	B78476A7694A003	9
	–	1	1CT : 1CT	1500	B78476A8065A003	11
	–	4	1CT : 1CT	1500	B78476A8068A003	13
	PoE	1	1CT : 1CT	1500	B78476A8245A003	15
	PoE	2	1CT : 1CT	1500	B78476A1889A003	17
	PoE	4	1CT : 1CT	1500	B78476A8246A003	19
–40 °C ... +85 °C	–	1	1CT : 1CT	1500	B78476A8247A003	21
	PoE	1	1CT : 1CT	1500	B78476A8248A003	23
<b>1000 Base-T</b>						
0 °C ... +70 °C	–	1	1CT : 1CT	1500	B78476A8317A003	25
	–	1	1CT : 1CT	1500	B78476A8249A003	27
	–	2	1CT : 1CT	1500	B78476A8250A003	29
	PoE	1	1CT : 1CT	1500	B78476A8253A003	31
	PoE	2	1CT : 1CT	1500	B78476A8066A003	33
–40 °C ... +85 °C	–	1	1CT : 1CT	1500	B78476A8251A003	35
	–	1	1CT : 1CT	1500	B78476A8135A003	37
	–	2	1CT : 1CT	1500	B78476A8252A003	39

## Introduction

EPCOS introduces a new range of magnetics modules for Local Area Networks (LAN). They are optimized for use in hubs, switches, and routers but also for use in PCs and modems.

Ethernet Protocol is the common basis for data communication in LANs. The physical layer of the Ethernet is standardized in IEEE 802.3. Depending on the technology, different transmission speeds can be distinguished: 10 Base-T with 10 Mbit/s, 100 Base-T with 100 Mbit/s and 1000 Base-T with 1 Gbit/s transmission speed. IEEE 802.3af describes transmission of power via the Ethernet port. This technology is called Power over Ethernet (PoE) and is necessary to implement applications like Voice over IP (VoIP) where the phone is powered via the Ethernet connection.

The transceiver chip side (PHY) and the medium side (connecting cable) must be galvanically isolated. EPCOS magnetic modules provide minimum 1500 V dielectric isolation combined with excellent insertion and return loss as well as crosstalk and differential to common-mode rejection.

EPCOS Magnetics modules support not only the standard temperature range from 0 °C to +70 °C, they are also available with an extended temperature range from –40 °C to +85 °C for industrial applications.

Electrical characteristics and circuits are given in the detailed specification.

### Applications

- 10/100 Base-T
- 1000 Base-T
- Power over Ethernet

### Features

- Single, dual and quad port solutions
- Standard temperature range from 0 °C to +70 °C
- Extended temperature range from –40 °C to +85 °C
- Fully compliant with IEEE 802.3
- Fully compliant with IPC / JEDEC J-STD-020C
- Optimized for all major transceiver ICs
- Industry standard footprint
- RoHS-compatible

## Terms and definitions

<b>10 Base-T</b>	IEEE 802.3 physical layer specification for a 10 Mbit/s CSMA/CD local area network over two twisted-pair telephone wires (IEEE 802.3 clause 14).
<b>100 Base-T</b>	IEEE 802.3 physical layer specification for a 100 Mbit/s CSMA/CD local area network. 100 Base-T summarizes specifications using different cables. The most commonly used specification is 100 Base-TX, which works over two pairs of Category 5 unshielded twisted pair (UTP) or shielded twisted pair (STP) wire.
<b>1000 Base-T</b>	IEEE 802.3 physical layer specification for 1000 Mbit/s CSMA/CD local area network using four pairs of Category 5 unshielded twisted pair cable (UTP).
<b>Auto MDIX</b>	Automated detection of MDI and MDIX devices
<b>CAT5</b>	Category 5 cable – balanced 100 $\Omega$ and 120 $\Omega$ cables and associated connecting hardware with specified transmission characteristics up to 100 MHz (ISO/IEC 11801).
<b>Crosstalk</b>	Crosstalk is a phenomenon which occurs on signal paths. The signal transmitted on one path is coupled into the other path. Crosstalk is specified as the ratio between the power coupled into the nearby path and the power of the source and is given in dB.
<b>CSMA/CD</b>	Carrier Sense Multiple Access with Collision Detection – access method used in Ethernet networks.
<b>DCMR</b>	Differential to Common Mode Rejection – the voltage difference between two wires of a signal path causes a current in the load. This voltage is called differential mode voltage and carries the information transmitted on the signal path. If both wires of a signal path have equal voltage in reference to ground, a current is flowing via the impedances between the wires of the signal path and ground. This voltage is called common mode voltage.  Due to asymmetries in the signal path, part of the differential-mode voltage is converted into a common-mode voltage. DCMR is defined as the ratio between the common-mode and the differential-mode voltage and is expressed in dB.
<b>Ethernet</b>	Ethernet is a family of computer network technologies for local area networks standardized in IEEE 802.3. The first standard was published in 1985 for a transmission speed of 10 Mbit/s using CSMA/CD as media access protocol. The standard was continuously extended to make it suitable for various transmission media as e.g. coaxial cable, unshielded twisted pairs or fibre optics. Also the transmission speed increased continuously. Ethernet with 100 Mbit/s is also known as Fast Ethernet. Gigabit Ethernet provides 1000 Mbit/s. Meanwhile, speeds up to 10 Gbit/s are possible.
<b>Inductance L</b>	L specifies the inductance of the primary winding of a transformer (OCL – Open Circuit Inductance).
<b>Insertion loss</b>	Insertion loss represents the loss in power delivered to a load when a magnetic component, e.g. a transformer or common-mode choke, is inserted between source and load. It is measured as the ratio of power with the component inserted to the power without the component. Insertion loss is expressed in dB.
<b>MDI</b>	Medium Dependant Interface – the mechanical and electrical interface between the PHY and the transmission media

## Terms and definitions

<b>MDIX</b>	Medium Dependent Interface Cross-Over – in an Ethernet network transmitting and receiving of two devices must be connected. Transmit and receive pins of MDIX devices are switched internally to ensure the use of standard cables. For example, PCs are MDI devices, and switches and hubs are MDIX devices according to the convention.
<b>MSL</b>	MSL stands for Moisture Sensitivity Level and is specified in JEDEC J-STD-020C as well as the solder profile applicable to magnetics modules.
<b>PHY</b>	Physical Layer Entity – the PHY contains the functions that transmit, receive and manage the encoded signals that are recorded on and recovered from the physical medium.
<b>PoE</b>	Power over Ethernet – ethernet network capable to provide power to connected devices. PoE is standardized in IEEE 802.3af (IEEE 802.3 clause 33). Connected devices are powered with 48 V and up to 15.4 W.
<b>Return loss</b>	Part of the power delivered to a load is reflected if the impedance of the source and the load are not perfectly matched. Return loss is defined as the ratio between the reflected power and the power of the source. Return loss is expressed in dB.
<b>RJ-45</b>	Register Jack-45 – an eight-wire connector used for the connection of devices in Ethernet networks.
<b>Turns ratio</b>	The turns ratio is defined as the ratio between the number of turns of the primary and secondary winding of a transformer. A transformer with a center tap winding and a turns ratio of 1 is specified in the data sheets with 1CT:1CT.
<b>UTP</b>	Unshielded twisted pair – an electrically conducting cable, comprising one or more twisted pairs, none of which are shielded.
<b>VoIP</b>	Voice over internet – transmission of voice signals over the internet. PoE technology is necessary to power the phone via the network.
<b>Voltage test <math>V_{\text{test}}</math></b>	$V_{\text{test}}$ specifies the maximum voltage between primary and secondary winding of a transformer which does not cause a breakdown. For AC voltages the frequency as well as the duration time of the voltage test are specified.

**Features**

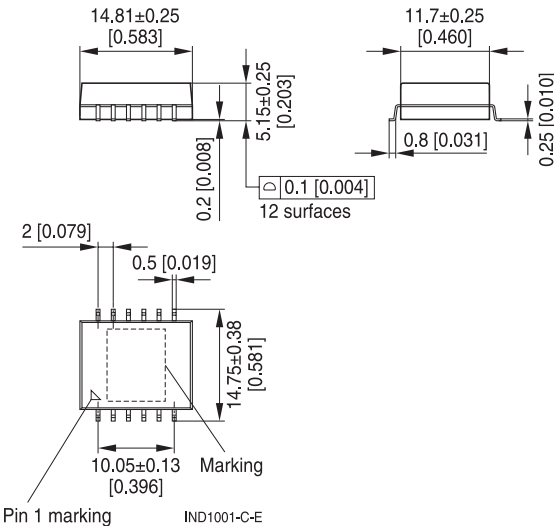
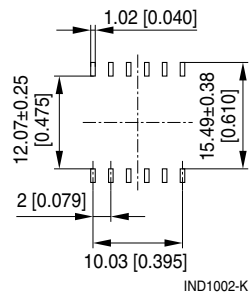
- Ferrite toroid, case and potting (UL 94 V-0)
- Compliant with IPC/JEDEC J-STD-020C
- Compliant with IEEE 802.3
- MSL level 2
- Auto MDIX capable
- RoHS-compatible

**Marking**

- EPCOS, middle block of ordering code, date code

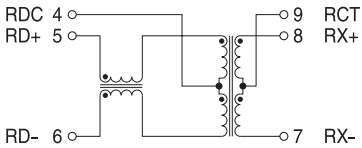
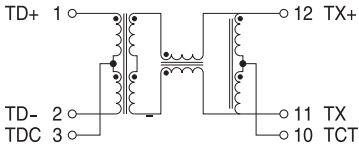
**Delivery mode and packing unit**

- 24-mm blister tape,  
330-mm  $\varnothing$  reel (cardboard packaging)
- Packing unit: 400 pcs./reel

**Dimensional drawing**

**Layout recommendation**


Units: mm [inch]

Values without tolerances are nominal values for reference.

**Pinning**


IND1003-T

**Characteristics and ordering code**

(electrical specifications at 25 °C)

Ordering code	B78476A8067A003	
Turns ratio (primary : secondary)	1CT : 1CT ±3%	
Inductance L	350 µH min.	100 kHz, 100 mV, 8 mA DC bias
Voltage test $V_{test}$	1500 V AC	50 Hz, 1 min
Insertion loss	-1.2 dB max.	0.1 MHz ... 100 MHz
Return loss	-16 dB min. -14 dB min. -13 dB min. -12 dB min.	1 MHz ... 30 MHz 40 MHz 50 MHz 60 MHz ... 80 MHz
Crosstalk	-40 dB min. -40 dB min. -35 dB min.	30 MHz 60 MHz 100 MHz
Differential to common-mode rejection (DCMR)	-45 dB min. -40 dB min. -37 dB min.	30 MHz 60 MHz 100 MHz
Operating temperature range	0 °C ... +70 °C	
Weight	Approx. 1.3 g	



**Features**

- Ferrite toroid, case and potting (UL 94 V-0)
- Compliant with IPC/JEDEC J-STD-020C
- Compliant with IEEE 802.3
- MSL level 2
- Auto MDIX capable
- RoHS-compatible

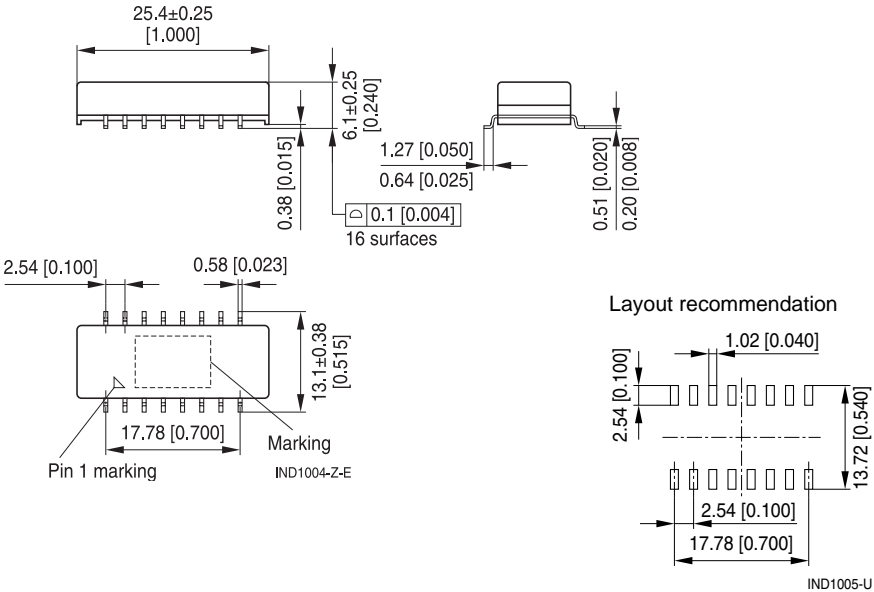
**Marking**

- EPCOS, middle block of ordering code, date code

**Delivery mode and packing unit**

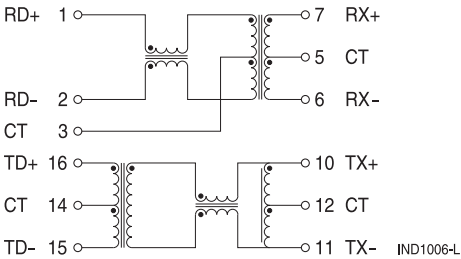
- 44-mm blister tape,  
330-mm  $\varnothing$  reel (cardboard packaging)
- Packing unit: 400 pcs./reel

**Dimensional drawing**



Units: mm [inch]

Values without tolerances are nominal values for reference.

**Pinning**

**Characteristics and ordering code**

(electrical specifications at 25 °C)

Ordering code	B78476A7694A003	
Turns ratio (primary : secondary)	1CT : 1CT ±3%	
Inductance L	350 µH min.	100 kHz, 100 mV, 8 mA DC bias
Voltage test $V_{test}$	1500 V AC	50 Hz, 1 min
Insertion loss	-1.1 dB max.	0.1 MHz ... 100 MHz
Return loss	-20 dB min. -17 dB min. -16 dB min. -12 dB min.	1 MHz ... 30 MHz 40 MHz 50 MHz 60 MHz ... 80 MHz
Crosstalk	-43 dB min. -37 dB min. -33 dB min.	30 MHz 60 MHz 100 MHz
Differential to common-mode rejection (DCMR)	-40 dB min. -35 dB min. -30 dB min.	30 MHz 60 MHz 100 MHz
Operating temperature range	0 °C ... +70 °C	
Weight	Approx. 1.5 g	

**Features**

- Ferrite toroid, case and potting (UL 94 V-0)
- Compliant with IPC/JEDEC J-STD-020C
- Compliant with IEEE 802.3
- MSL level 2
- RoHS-compatible

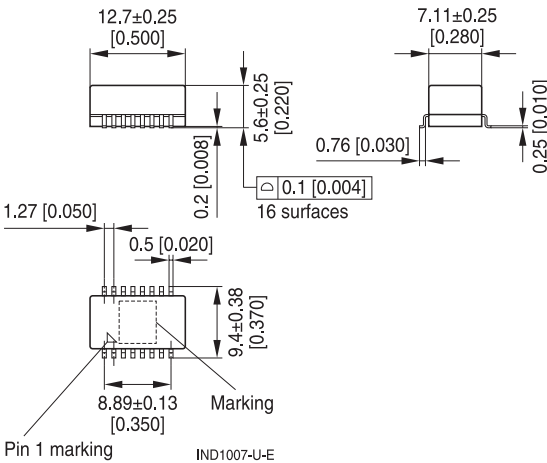
**Marking**

- EPCOS, middle block of ordering code, date code

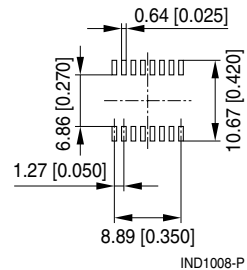
**Delivery mode and packing unit**

- 24-mm blister tape,  
330-mm Ø reel (cardboard packaging)
- Packing unit: 500 pcs./reel

**Dimensional drawing**

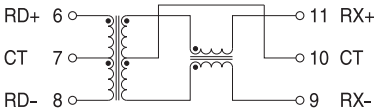
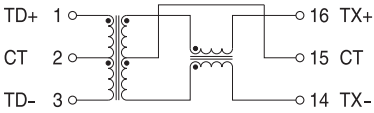


**Layout recommendation**



Units: mm [inch]

Values without tolerances are nominal values for reference.

**Pinning**


IND1009-B

**Characteristics and ordering code**

(electrical specifications at 25 °C)

Ordering code	B78476A8065A003	
Turns ratio (primary : secondary)	1CT : 1CT $\pm$ 3%	
Inductance L	350 $\mu$ H min.	100 kHz, 100 mV, 8 mA DC bias
Voltage test $V_{test}$	1500 V AC	50 Hz, 1 min
Insertion loss	-1.0 dB max.	0.1 MHz ... 100 MHz
Return loss	-20 dB min.	1 MHz ... 30 MHz
	-18 dB min.	40 MHz
	-16 dB min.	50 MHz
	-12 dB min.	60 MHz ... 80 MHz
Crosstalk	-45 dB min.	30 MHz
	-40 dB min.	60 MHz
	-35 dB min.	100 MHz
Differential to common-mode rejection (DCMR)	-42 dB min.	30 MHz
	-37 dB min.	60 MHz
	-33 dB min.	100 MHz
Operating temperature range	0 °C ... +70 °C	
Weight	Approx. 0.8 g	

**Features**

- Ferrite toroid, case and potting (UL 94 V-0)
- Compliant with IPC/JEDEC J-STD-020C
- Compliant with IEEE 802.3
- MSL level 2
- Auto MDIX capable
- RoHS-compatible

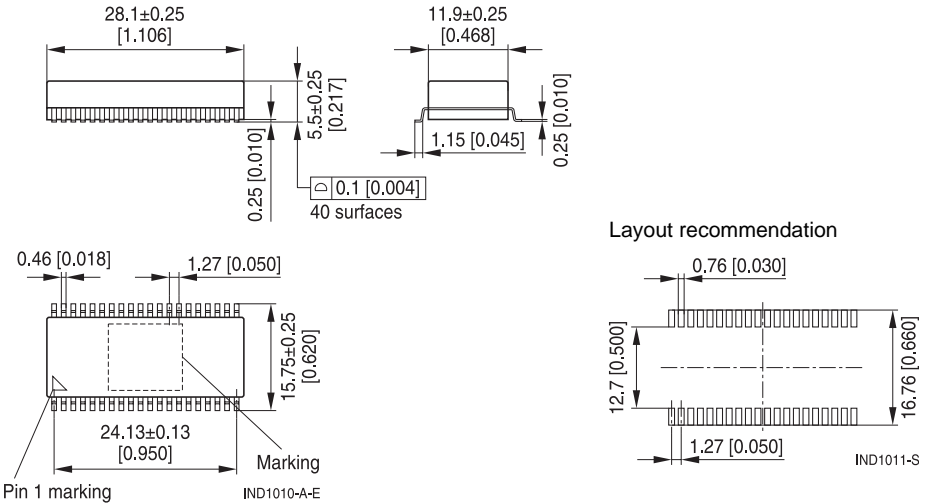
**Marking**

- EPCOS, middle block of ordering code, date code

**Delivery mode and packing unit**

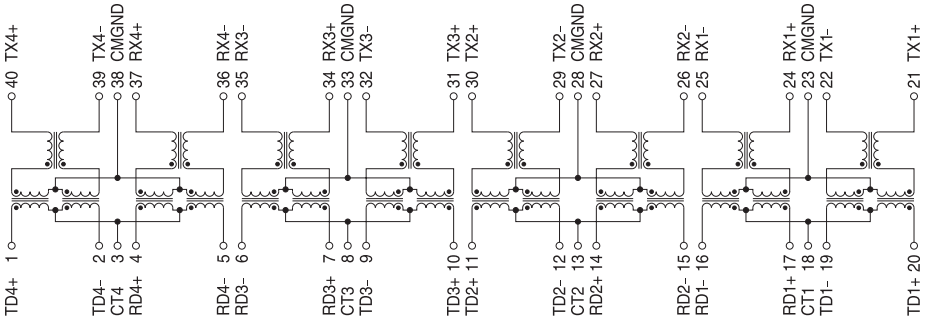
- 44-mm blister tape,  
330-mm  $\varnothing$  reel (cardboard packaging)
- Packing unit: 350 pcs./reel

**Dimensional drawing**



Units: mm [inch]

Values without tolerances are nominal values for reference.

**Pinning**


IND1012-V

**Characteristics and ordering code**

(electrical specifications at 25 °C)

Ordering code	B78476A8068A003	
Turns ratio (primary : secondary)	1CT : 1CT ±3%	
Inductance L	350 µH min.	100 kHz, 100 mV, 8 mA DC bias
Voltage test $V_{test}$	1500 V AC	50 Hz, 1 min
Insertion loss	-1.0 dB max.	0.1 MHz ... 100 MHz
Return loss	-18 dB min. -14 dB min. -13 dB min. -12 dB min.	1 MHz ... 30 MHz 40 MHz 50 MHz 60 MHz ... 80 MHz
Crosstalk	-45 dB min. -40 dB min. -33 dB min.	30 MHz 60 MHz 100 MHz
Differential to common-mode rejection (DCMR)	-37 dB min. -37 dB min. -25 dB min.	30 MHz 60 MHz 100 MHz
Operating temperature range	0 °C ... +70 °C	
Weight	Approx. 2.7 g	

**Features**

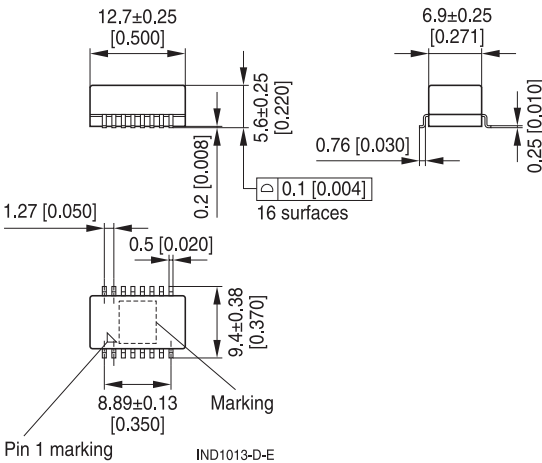
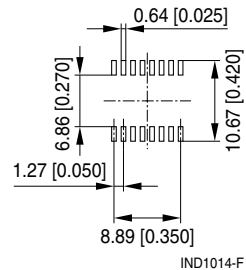
- Ferrite toroid, case and potting (UL 94 V-0)
- Compliant with IPC/JEDEC J-STD-020C
- Compliant with IEEE 802.3af
- MSL level 2
- RoHS-compatible

**Marking**

- EPCOS, middle block of ordering code, date code

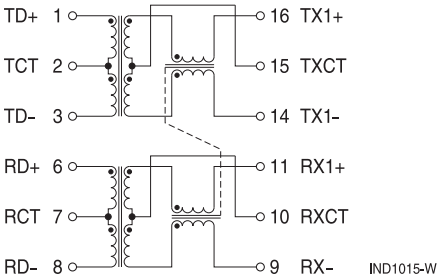
**Delivery mode and packing unit**

- 24-mm blister tape,  
330-mm  $\varnothing$  reel (cardboard packaging)
- Packing unit: 500 pcs./reel

**Dimensional drawing**

**Layout recommendation**


Units: mm [inch]

Values without tolerances are nominal values for reference.

**Pinning**

**Characteristics and ordering code**

(electrical specifications at 25 °C)

Ordering code	B78476A8245A003	
Turns ratio (primary : secondary)	1CT : 1CT $\pm 3\%$	
Inductance L	350 $\mu$ H min.	100 kHz, 100 mV, 8 mA DC bias
Voltage test $V_{test}$	1500 V AC	50 Hz, 1 min
Insertion loss	-1.2 dB max.	0.1 MHz ... 100 MHz
Return loss	-16 dB min.	1 MHz ... 30 MHz
	-14 dB min.	40 MHz
	-13 dB min.	50 MHz
	-12 dB min.	60 MHz ... 80 MHz
Crosstalk	-45 dB min.	30 MHz
	-40 dB min.	60 MHz
	-35 dB min.	100 MHz
Differential to common-mode rejection (DCMR)	-43 dB min.	30 MHz
	-37 dB min.	60 MHz
	-33 dB min.	100 MHz
Operating temperature range	0 °C ... +70 °C	
Weight	Approx. 0.8 g	



**Features**

- Ferrite toroid, case and potting (UL 94 V-0)
- Compliant with IPC/JEDEC J-STD-020C
- Compliant with IEEE 802.3af
- MSL level 2
- RoHS-compatible

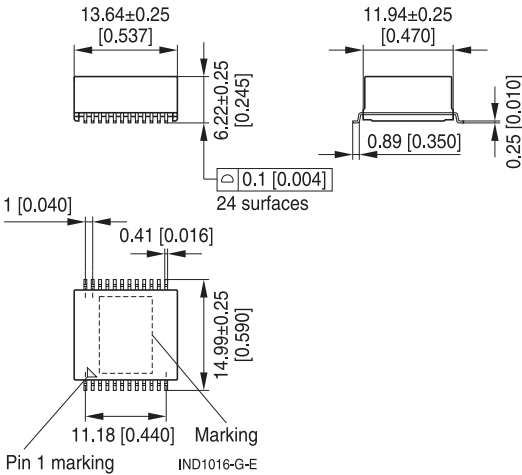
**Marking**

- EPCOS, middle block of ordering code, date code

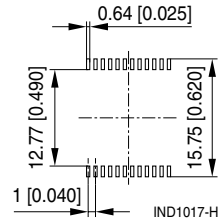
**Delivery mode and packing unit**

- 24-mm blister tape,  
330-mm Ø reel (cardboard packaging)
- Packing unit: 400 pcs./reel

**Dimensional drawing**

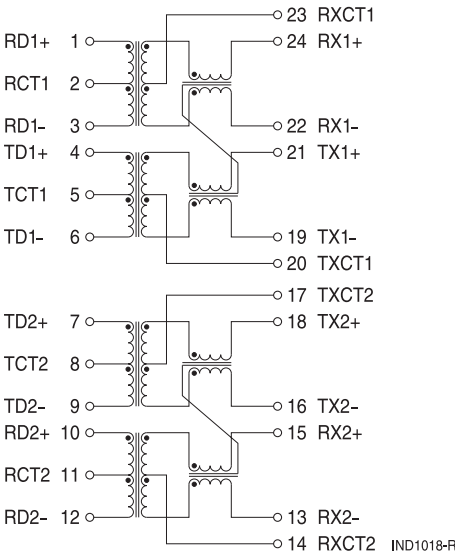


**Layout recommendation**



Units: mm [inch]

Values without tolerances are nominal values for reference.

**Pinning**

**Characteristics and ordering code**  
 (electrical specifications at 25 °C)

Ordering code	B78476A1889A003	
Turns ratio (primary : secondary)	1CT : 1CT ±3%	
Inductance L	350 µH min.	100 kHz, 100 mV, 8 mA DC bias
Voltage test $V_{test}$	1500 V AC	50 Hz, 1 min
Insertion loss	-1.2 dB max.	0.1 MHz ... 100 MHz
Return loss	-16 dB min.	1 MHz ... 30 MHz
	-14 dB min.	40 MHz
	-13 dB min.	50 MHz
	-12 dB min.	60 MHz ... 80 MHz
Crosstalk	-43 dB min.	30 MHz
	-37 dB min.	60 MHz
	-31 dB min.	100 MHz
Differential to common-mode rejection (DCMR)	-43 dB min.	30 MHz
	-37 dB min.	60 MHz
	-33 dB min.	100 MHz
Operating temperature range	0 °C ... +70 °C	
Weight	Approx. 1.8 g	

**Features**

- Ferrite toroid, case and potting (UL 94 V-0)
- Compliant with IPC/JEDEC J-STD-020C
- Compliant with IEEE 802.3af
- MSL level 2
- RoHS-compatible

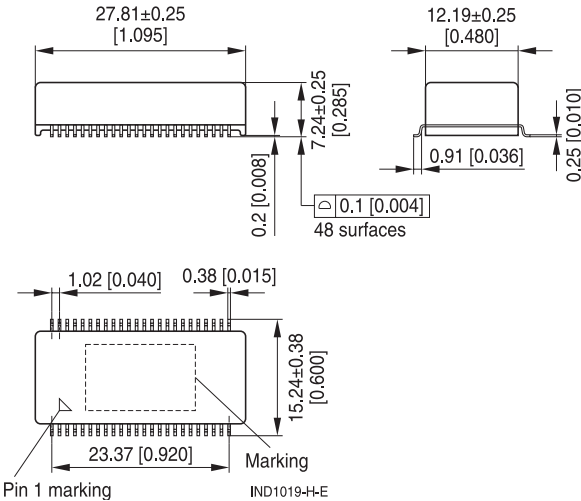
**Marking**

- EPCOS, middle block of ordering code, date code

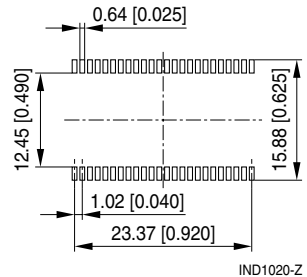
**Delivery mode and packing unit**

- 44-mm blister tape,  
330-mm Ø reel (cardboard packaging)
- Packing unit: 350 pcs./reel

**Dimensional drawing**

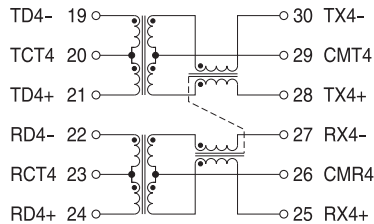
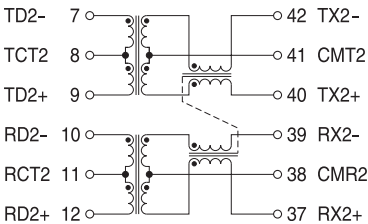
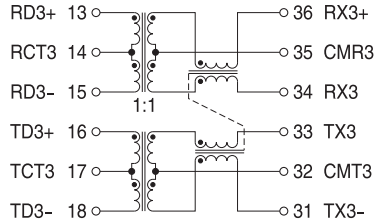
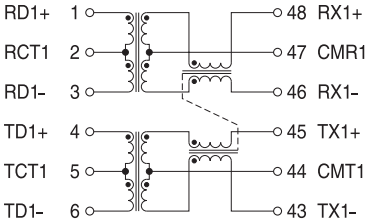


**Layout recommendation**



Units: mm [inch]

Values without tolerances are nominal values for reference.

**Pinning**


IND1021-C

**Characteristics and ordering code**

(electrical specifications at 25 °C)

Ordering code	B78476A8246A003	
Turns ratio (primary : secondary)	1CT : 1CT ±3%	
Inductance L	350 µH min.	100 kHz, 100 mV, 8 mA DC bias
Voltage test $V_{test}$	1500 V AC	50 Hz, 1 min
Insertion loss	-1.1 dB max.	0.1 MHz ... 100 MHz
Return loss	-16 dB min. -14 dB min. -13 dB min. -12 dB min.	1 MHz ... 30 MHz 40 MHz 50 MHz 60 MHz ... 80 MHz
Crosstalk	-45 dB min. -40 dB min. -35 dB min.	30 MHz 60 MHz 100 MHz
Differential to common-mode rejection (DCMR)	-43 dB min. -37 dB min. -33 dB min.	30 MHz 60 MHz 100 MHz
Operating temperature range	0 °C ... +70 °C	
Weight	Approx. 3.2 g	

**Features**

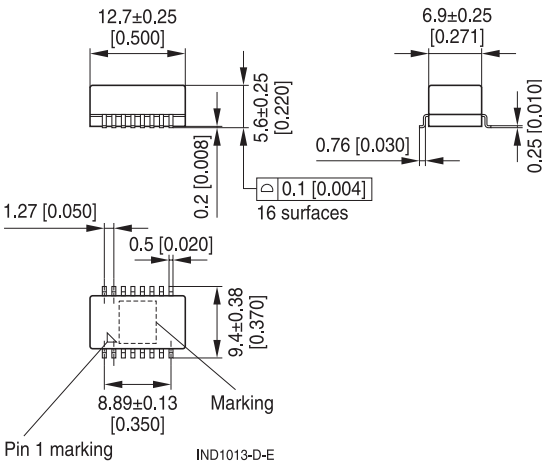
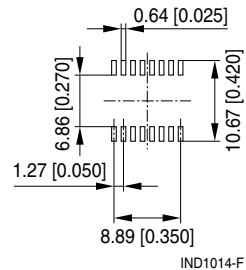
- Ferrite toroid, case and potting (UL 94 V-0)
- Compliant with IPC/JEDEC J-STD-020C
- Compliant with IEEE 802.3
- MSL level 2
- RoHS-compatible

**Marking**

- EPCOS, middle block of ordering code, date code

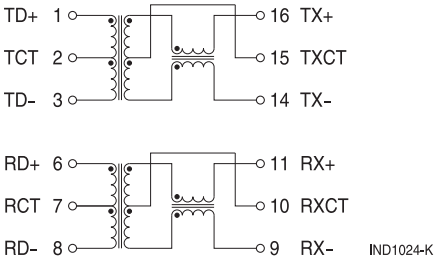
**Delivery mode and packing unit**

- 24-mm blister tape,  
330-mm  $\varnothing$  reel (cardboard packaging)
- Packing unit: 500 pcs./reel

**Dimensional drawing**

**Layout recommendation**


Units: mm [inch]

Values without tolerances are nominal values for reference.

**Pinning**

**Characteristics and ordering code**

(electrical specifications at 25 °C)

Ordering code	B78476A8247A003	
Turns ratio (primary : secondary)	1CT : 1CT ±3%	
Inductance L	350 µH min.	100 kHz, 100 mV, 8 mA DC bias
Voltage test $V_{test}$	1500 V AC	50 Hz, 1 min
Insertion loss	-1.0 dB max.	0.1 MHz ... 100 MHz
Return loss	-18 dB min. -16 dB min. -14 dB min. -12 dB min.	1 MHz ... 30 MHz 40 MHz 50 MHz 60 MHz ... 80 MHz
Crosstalk	-43 dB min. -37 dB min. -33 dB min.	30 MHz 60 MHz 100 MHz
Differential to common-mode rejection (DCMR)	-43 dB min. -37 dB min. -33 dB min.	30 MHz 60 MHz 100 MHz
Operating temperature range	-40 °C ... +85 °C	
Weight	Approx. 0.8 g	

**Features**

- Ferrite toroid, case and potting (UL 94 V-0)
- Compliant with IPC/JEDEC J-STD-020C
- Compliant with IEEE 802.3af
- MSL level 2
- RoHS-compatible

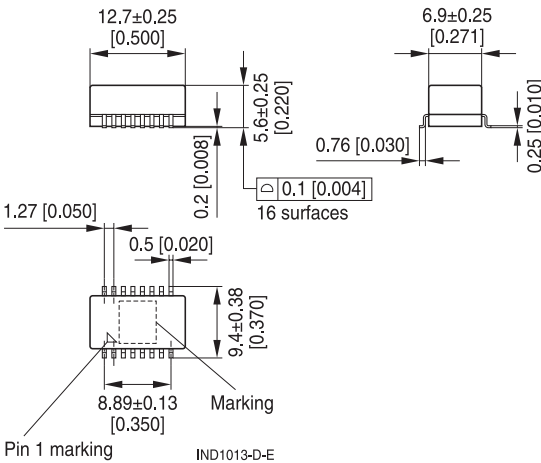
**Marking**

- EPCOS, middle block of ordering code, date code

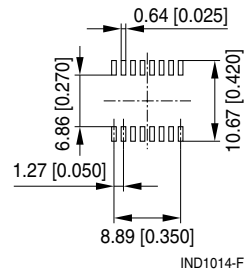
**Delivery mode and packing unit**

- 24-mm blister tape,  
330-mm Ø reel (cardboard packaging)
- Packing unit: 500 pcs./reel

**Dimensional drawing**

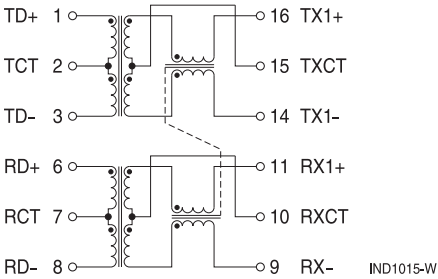


**Layout recommendation**



Units: mm [inch]

Values without tolerances are nominal values for reference.

**Pinning**

**Characteristics and ordering code**

(electrical specifications at 25 °C)

Ordering code	B78476A8248A003	
Turns ratio (primary : secondary)	1CT : 1CT $\pm 3\%$	
Inductance L	350 $\mu$ H min.	100 kHz, 100 mV, 8 mA DC bias
Voltage test $V_{test}$	1500 V AC	50 Hz, 1 min
Insertion loss	-1.2 dB max.	0.1 MHz ... 100 MHz
Return loss	-16 dB min.	1 MHz ... 30 MHz
	-14 dB min.	40 MHz
	-13 dB min.	50 MHz
	-12 dB min.	60 MHz ... 80 MHz
Crosstalk	-45 dB min.	30 MHz
	-40 dB min.	60 MHz
	-35 dB min.	100 MHz
Differential to common-mode rejection (DCMR)	-43 dB min.	30 MHz
	-37 dB min.	60 MHz
	-33 dB min.	100 MHz
Operating temperature range	-40 °C ... +85 °C	
Weight	Approx. 0.8 g	



**Features**

- Ferrite toroid, case and potting (UL 94 V-0)
- Compliant with IPC/JEDEC J-STD-020C
- Compliant with IEEE 802.3
- MSL level 2
- Optimized for full duplex applications
- RoHS-compatible

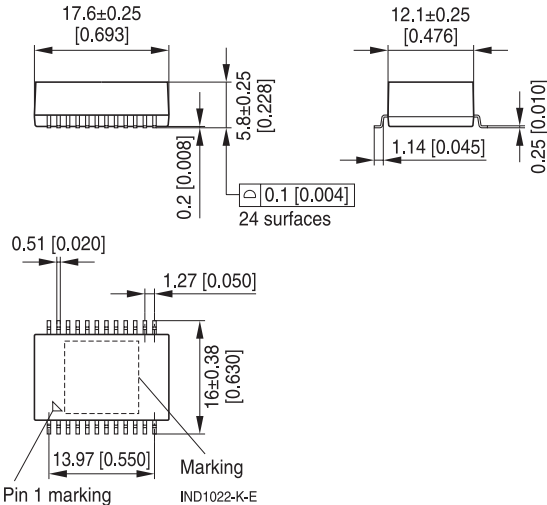
**Marking**

- EPCOS, middle block of ordering code, date code

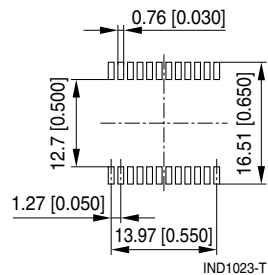
**Delivery mode and packing unit**

- 32-mm blister tape,
- 330-mm Ø reel (cardboard packaging)
- Packing unit: 400 pcs./reel

**Dimensional drawing**

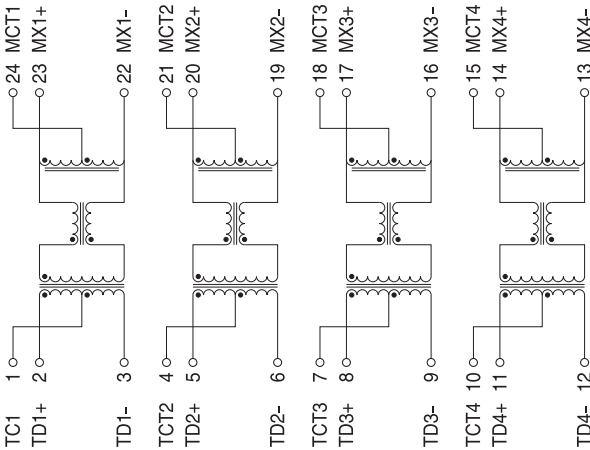


**Layout recommendation**



Units: mm [inch]

Values without tolerances are nominal values for reference.

**Pinning**


IND1025-B

**Characteristics and ordering code**

(electrical specifications at 25 °C)

Ordering code	B78476A8317A003	
Turns ratio (primary : secondary)	1CT : 1CT $\pm 3\%$	
Inductance L	350 $\mu$ H min.	100 kHz, 100 mV, 8 mA DC bias
Voltage test $V_{test}$	1500 V AC	50 Hz, 1 min
Insertion loss	-1.0 dB max.	1 MHz ... 100 MHz
Return loss	-18 dB min.	1 MHz ... 40 MHz
	-16 dB min.	50 MHz
	-12 dB min.	60 MHz ... 80 MHz
	-10 dB min.	100 MHz
Crosstalk	-43 dB min.	30 MHz
	-37 dB min.	60 MHz
	-33 dB min.	100 MHz
Differential to common-mode rejection (DCMR)	-43 dB min.	30 MHz
	-37 dB min.	60 MHz
	-33 dB min.	100 MHz
Operating temperature range	0 °C ... +70 °C	
Weight	Approx. 2.2 g	

**Features**

- Ferrite toroid, case and potting (UL 94 V-0)
- Compliant with IPC/JEDEC J-STD-020C
- Compliant with IEEE 802.3
- MSL level 2
- Optimized for full duplex applications
- RoHS-compatible

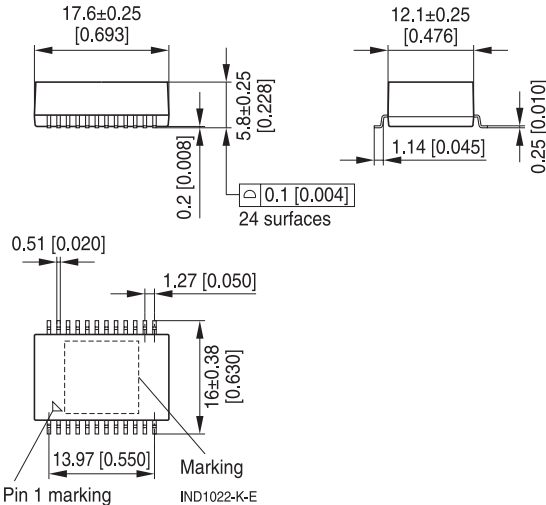
**Marking**

- EPCOS, middle block of ordering code, date code

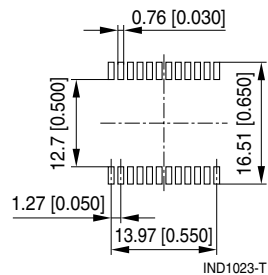
**Delivery mode and packing unit**

- 32-mm blister tape,
- 330-mm Ø reel (cardboard packaging)
- Packing unit: 400 pcs./reel

**Dimensional drawing**

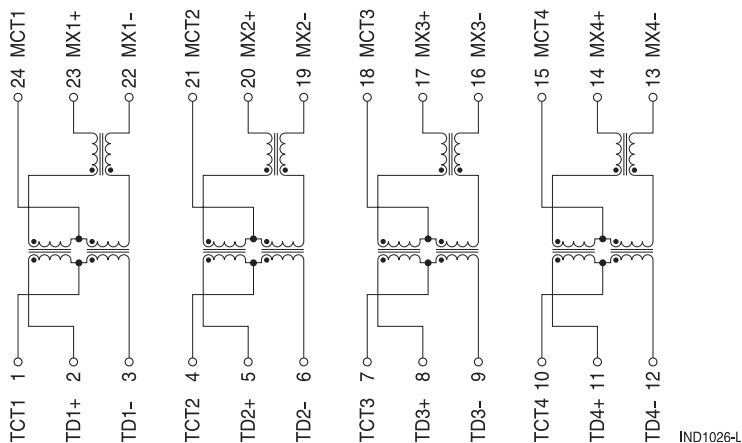


**Layout recommendation**



Units: mm [inch]

Values without tolerances are nominal values for reference.

**Pinning**

**Characteristics and ordering code**

(electrical specifications at 25 °C)

Ordering code	B78476A8249A003	
Turns ratio (primary : secondary)	1CT : 1CT $\pm$ 3%	
Inductance L	350 $\mu$ H min.	100 kHz, 100 mV, 8 mA DC bias
Voltage test $V_{test}$	1500 V AC	50 Hz, 1 min
Insertion loss	-1.0 dB max.	1 MHz ... 100 MHz
Return loss	-18 dB min. -16 dB min. -12 dB min. -10 dB min.	1 MHz ... 40 MHz 50 MHz 60 MHz ... 80 MHz 100 MHz
Crosstalk	-43 dB min. -37 dB min. -35 dB min.	30 MHz 60 MHz 100 MHz
Differential to common-mode rejection (DCMR)	-43 dB min. -37 dB min. -33 dB min.	30 MHz 60 MHz 100 MHz
Operating temperature range	0 °C ... +70 °C	
Weight	Approx. 1.8 g	

**Features**

- Ferrite toroid, case and potting (UL 94 V-0)
- Compliant with IPC/JEDEC J-STD-020C
- Compliant with IEEE 802.3
- MSL level 2
- Optimized for full duplex applications
- RoHS-compatible

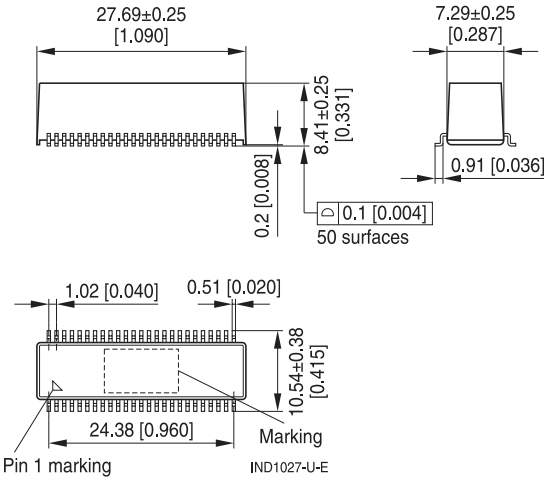
**Marking**

- EPCOS, middle block of ordering code, date code

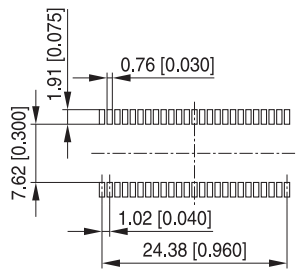
**Delivery mode and packing unit**

- 44-mm blister tape,  
330-mm  $\varnothing$  reel (cardboard packaging)
- Packing unit: 350 pcs./reel

**Dimensional drawing**

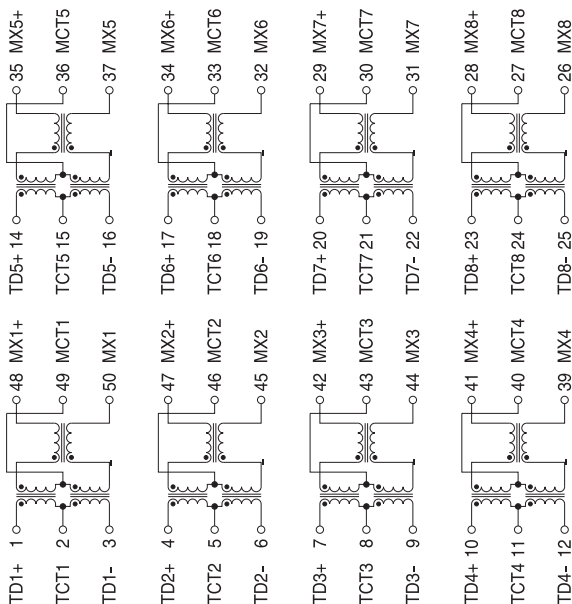


**Layout recommendation**



Units: mm [inch]

Values without tolerances are nominal values for reference.

**Pinning**


IND1029-B

**Characteristics and ordering code**

(electrical specifications at 25 °C)

Ordering code	B78476A8250A003	
Turns ratio (primary : secondary)	1CT : 1CT ±3%	
Inductance L	350 µH min.	100 kHz, 100 mV, 8 mA DC bias
Voltage test $V_{test}$	1500 V AC	50 Hz, 1 min
Insertion loss	-1.0 dB max.	1 MHz ... 100 MHz
Return loss	-18 dB min.	1 MHz ... 40 MHz
	-16 dB min.	50 MHz
	-12 dB min.	60 MHz ... 80 MHz
	-10 dB min.	100 MHz
Crosstalk	-40 dB min.	30 MHz
	-33 dB min.	60 MHz
	-28 dB min.	100 MHz
Differential to common-mode rejection (DCMR)	-40 dB min.	30 MHz
	-35 dB min.	60 MHz
	-30 dB min.	100 MHz
Operating temperature range	0 °C ... +70 °C	
Weight	Approx. 2.9 g	

**Features**

- Ferrite toroid, case and potting (UL 94 V-0)
- Compliant with IPC/JEDEC J-STD-020C
- Compliant with IEEE 802.3af
- MSL level 2
- Optimized for full duplex applications
- RoHS-compatible

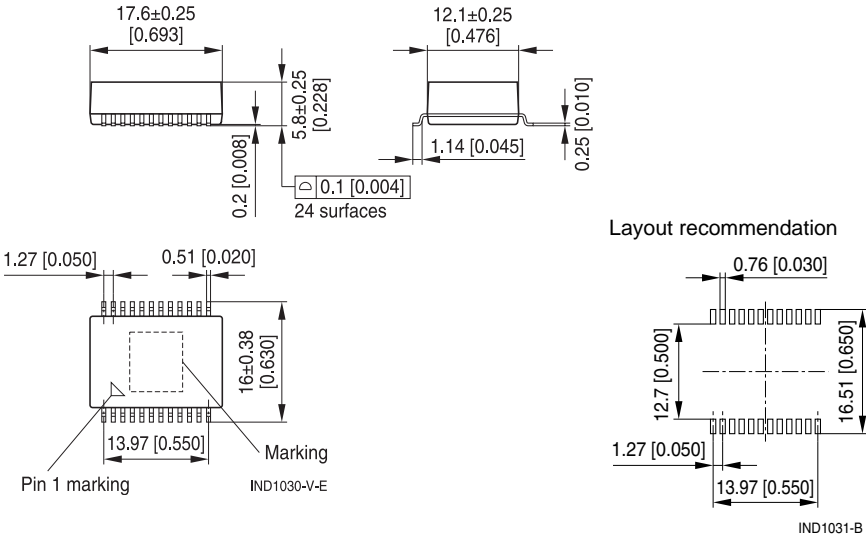
**Marking**

- EPCOS, middle block of ordering code, date code

**Delivery mode and packing unit**

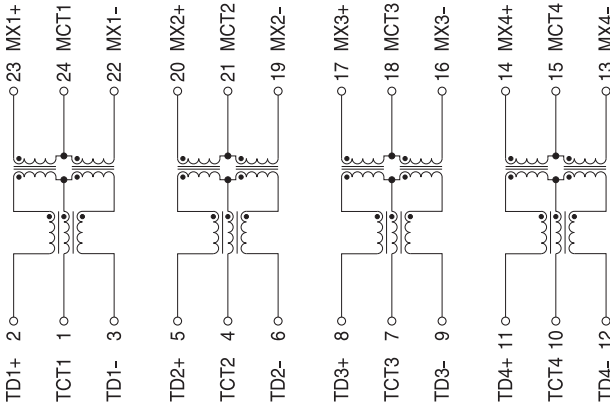
- 32-mm blister tape,  
330-mm  $\varnothing$  reel (cardboard packaging)
- Packing unit: 400 pcs./reel

**Dimensional drawing**



Units: mm [inch]

Values without tolerances are nominal values for reference.

**Pinning**


IND1036-C

**Characteristics and ordering code**

(electrical specifications at 25 °C)

Ordering code	B78476A8253A003	
Turns ratio (primary : secondary)	1CT : 1CT ±3%	
Inductance L	350 µH min.	100 kHz, 100 mV, 8 mA DC bias
Voltage test $V_{test}$	1500 V AC	50 Hz, 1 min
Insertion loss	-1.1 dB max.	0.1 MHz
	-1.0 dB max	100 MHz
	-2.0 dB max	125 MHz
Return loss	-18 dB min.	1 MHz ... 40 MHz
	-16 dB min.	50 MHz
	-12 dB min.	60 MHz ... 80 MHz
	-10 dB min.	100 MHz
Crosstalk	-43 dB min.	30 MHz
	-37 dB min.	60 MHz
	-33 dB min.	100 MHz
Differential to common-mode rejection (DCMR)	-33 dB min.	30 MHz
	-33 dB min.	60 MHz
	-33 dB min.	100 MHz
Operating temperature range	0 °C ... +70 °C	
Weight	Approx. 1.8 g	



**Features**

- Ferrite toroid, case and potting (UL 94 V-0)
- Compliant with IPC/JEDEC J-STD-020C
- Compliant with IEEE 802.3af
- MSL level 2
- Optimized for full duplex applications
- RoHS-compatible

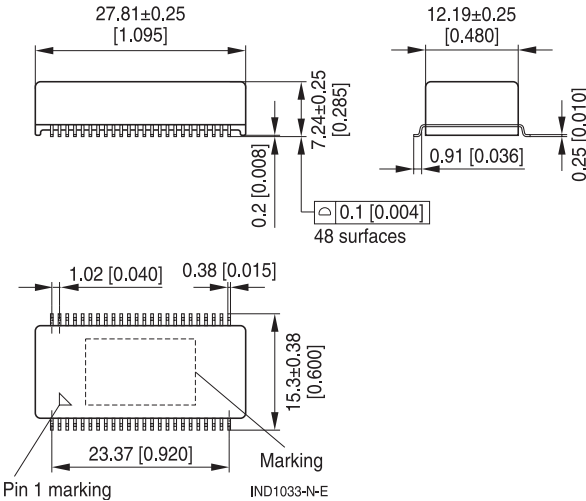
**Marking**

- EPCOS, middle block of ordering code, date code

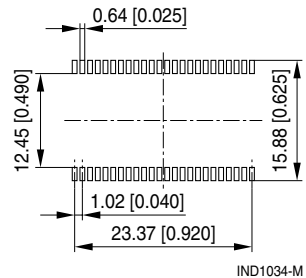
**Delivery mode and packing unit**

- 44-mm blister tape,  
330-mm  $\varnothing$  reel (cardboard packaging)
- Packing unit: 350 pcs./reel

**Dimensional drawing**

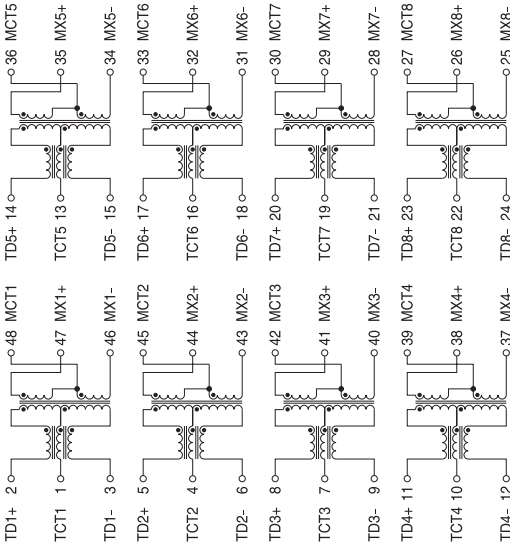


**Layout recommendation**



Units: mm [inch]

Values without tolerances are nominal values for reference.

**Pinning**


IND1035-W

**Characteristics and ordering code**  
 (electrical specifications at 25 °C)

Ordering code	B78476A8066A003	
Turns ratio (primary : secondary)	1CT : 1CT ±3%	
Inductance L	350 µH min.	100 kHz, 100 mV, 8 mA DC bias
Voltage test $V_{test}$	1500 V AC	50 Hz, 1 min
Insertion loss	-1.1 dB max.	0.1 MHz
	-1.0 dB max	100 MHz
	-2.0 dB max	125 MHz
Return loss	-18 dB min.	1 MHz ... 40 MHz
	-16 dB min.	50 MHz
	-12 dB min.	60 MHz ... 80 MHz
	-10 dB min.	100 MHz
Crosstalk	-43 dB min.	30 MHz
	-37 dB min.	60 MHz
	-33 dB min.	100 MHz
Differential to common-mode rejection (DCMR)	-43 dB min.	30 MHz
	-37 dB min.	60 MHz
	-33 dB min.	100 MHz
Operating temperature range	0 °C ... +70 °C	
Weight	Approx. 3.7 g	

**Features**

- Ferrite toroid, case and potting (UL 94 V-0)
- Compliant with IPC/JEDEC J-STD-020C
- Compliant with IEEE 802.3
- MSL level 2
- Optimized for full duplex applications
- RoHS-compatible

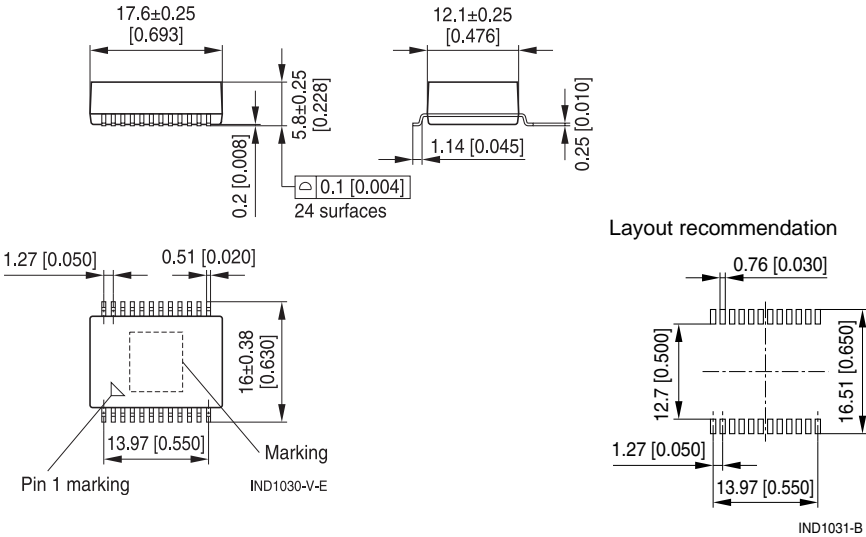
**Marking**

- EPCOS, middle block of ordering code, date code

**Delivery mode and packing unit**

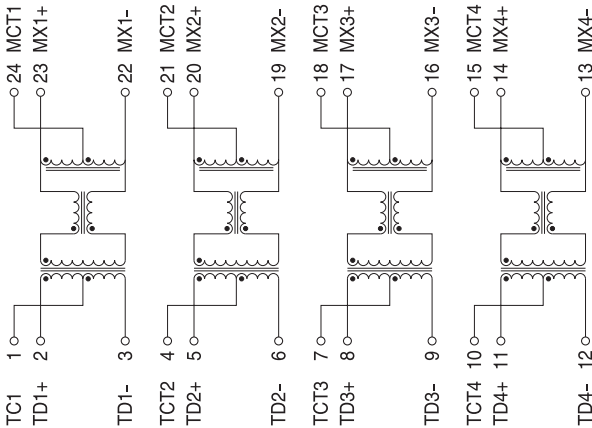
- 32-mm blister tape,  
330-mm  $\varnothing$  reel (cardboard packaging)
- Packing unit: 400 pcs./reel

**Dimensional drawing**



Units: mm [inch]

Values without tolerances are nominal values for reference.

**Pinning**


IND1032-V

**Characteristics and ordering code**

(electrical specifications at 25 °C)

Ordering code	B78476A8251A003	
Turns ratio (primary : secondary)	1CT : 1CT ±3%	
Inductance L	350 µH min.	100 kHz, 100 mV, 8 mA DC bias
Voltage test $V_{test}$	1500 V AC	50 Hz, 1 min
Insertion loss	-1.0 dB max.	1 MHz ... 100 MHz
Return loss	-18 dB min.	1 MHz ... 40 MHz
	-16 dB min.	50 MHz
	-12 dB min.	60 MHz ... 80 MHz
	-10 dB min.	100 MHz
Crosstalk	-33 dB min.	30 MHz
	-33 dB min.	60 MHz
	-33 dB min.	100 MHz
Differential to common-mode rejection (DCMR)	-33 dB min.	30 MHz
	-33 dB min.	60 MHz
	-33 dB min.	100 MHz
Operating temperature range	-40 °C ... +85 °C	
Weight	Approx. 2.1 g	

**Features**

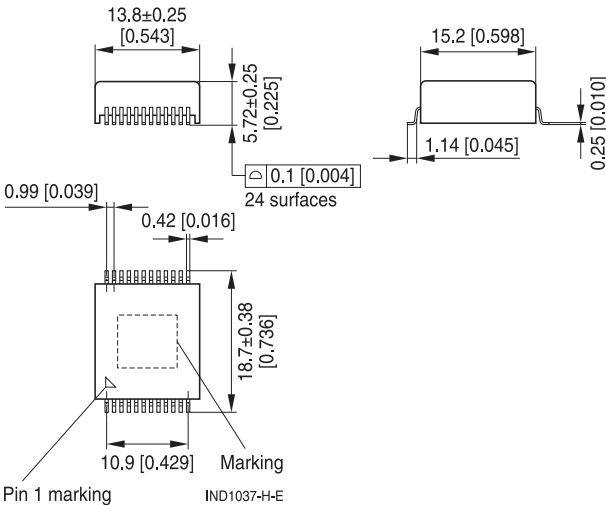
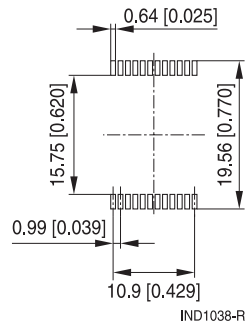
- Ferrite toroid, case and potting (UL 94 V-0)
- Compliant with IPC/JEDEC J-STD-020C
- Compliant with IEEE 802.3
- MSL level 2
- Optimized for full duplex applications
- RoHS-compatible

**Marking**

- EPCOS, middle block of ordering code, date code

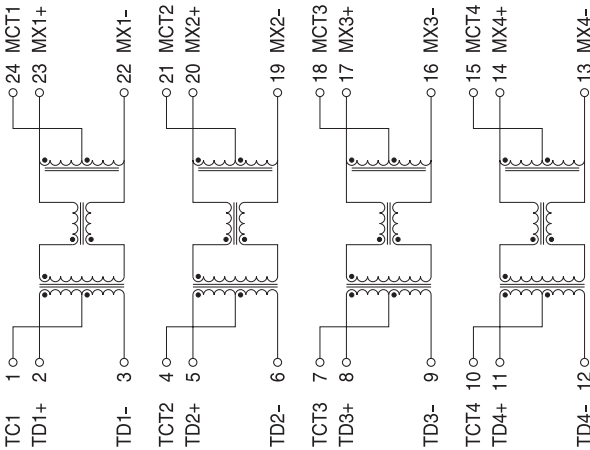
**Delivery mode and packing unit**

- 24-mm blister tape,  
330-mm  $\varnothing$  reel (cardboard packaging)
- Packing unit: 350 pcs./reel

**Dimensional drawing**

**Layout recommendation**


Units: mm [inch]

Values without tolerances are nominal values for reference.

**Pinning**


IND1039-W

**Characteristics and ordering code**

(electrical specifications at 25 °C)

Ordering code	B78476A8135A003	
Turns ratio (primary : secondary)	1CT : 1CT $\pm 3\%$	
Inductance L	350 $\mu$ H min.	100 kHz, 100 mV, 8 mA DC bias
Voltage test $V_{test}$	1500 V AC	50 Hz, 1 min
Insertion loss	-1.0 dB max.	1 MHz ... 100 MHz
Return loss	-18 dB min.	1 MHz ... 40 MHz
	-16 dB min.	50 MHz
	-12 dB min.	60 MHz ... 80 MHz
	-10 dB min.	100 MHz
Crosstalk	-43 dB min.	30 MHz
	-37 dB min.	60 MHz
	-33 dB min.	100 MHz
Differential to common-mode rejection (DCMR)	-43 dB min.	30 MHz
	-37 dB min.	60 MHz
	-33 dB min.	100 MHz
Operating temperature range	-40 °C ... +85 °C	
Weight	Approx. 1.9 g	

**Features**

- Ferrite toroid, case and potting (UL 94 V-0)
- Compliant with IPC/JEDEC J-STD-020C
- Compliant with IEEE 802.3
- MSL level 2
- Optimized for full duplex applications
- RoHS-compatible

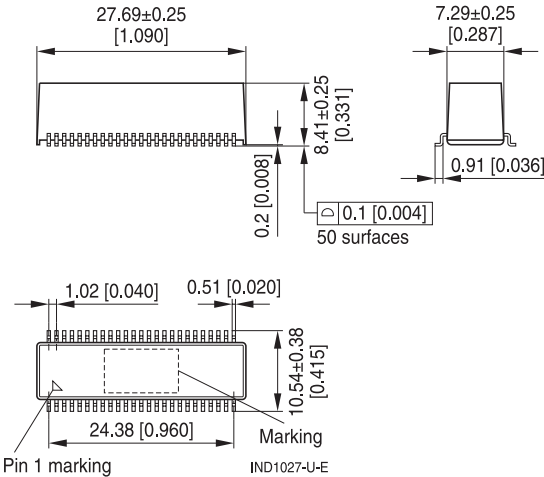
**Marking**

- EPCOS, middle block of ordering code, date code

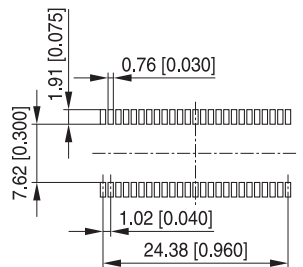
**Delivery mode and packing unit**

- 44-mm blister tape,  
330-mm  $\varnothing$  reel (cardboard packaging)
- Packing unit: 350 pcs./reel

**Dimensional drawing**

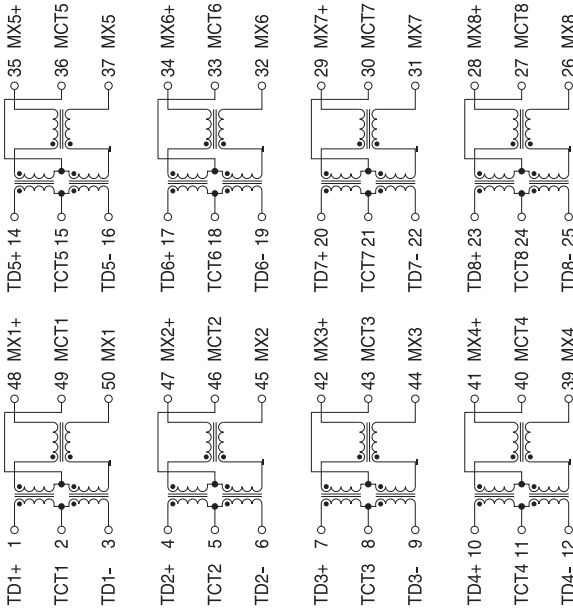


**Layout recommendation**



Units: mm [inch]

Values without tolerances are nominal values for reference.

**Pinning**


IND1029-B

**Characteristics and ordering code**

(electrical specifications at 25 °C)

Ordering code	B78476A8252A003	
Turns ratio (primary : secondary)	1CT : 1CT ±3%	
Inductance L	350 µH min.	100 kHz, 100 mV, 8 mA DC bias
Voltage test $V_{test}$	1500 V AC	50 Hz, 1 min
Insertion loss	-1.0 dB max.	1 MHz ... 100 MHz
Return loss	-18 dB min. -16 dB min. -12 dB min. -10 dB min.	1 MHz ... 40 MHz 50 MHz 60 MHz ... 80 MHz 100 MHz
Crosstalk	-40 dB min. -33 dB min. -28 dB min.	30 MHz 60 MHz 100 MHz
Differential to common-mode rejection (DCMR)	-40 dB min. -35 dB min. -30 dB min.	30 MHz 60 MHz 100 MHz
Operating temperature range	-40 °C ... +85 °C	
Weight	Approx. 2.9 g	



## Cautions and warnings

- For soldering conditions please refer to JEDEC J-STD-020C.
- If the components are to be washed varnished it is necessary to check whether the washing varnish agent that is used has a negative effect on the wire insulation, any plastics that are used, or on glued joints. In particular, it is possible for washing varnish agent residues to have a negative effect in the long-term on wire insulation.
- The following points must be observed if the components are potted in customer applications:
  - Many potting materials shrink as they harden. They therefore exert a pressure on the plastic housing or core. This pressure can have a deleterious effect on electrical properties, and in extreme cases can damage the core or plastic housing mechanically.
  - It is necessary to check whether the potting material used attacks or destroys the wire insulation, plastics or glue.
  - The effect of the potting material can change the high-frequency behaviour of the components.
- Ferrites are sensitive to direct impact. This can cause the core material to flake, or lead to breakage of the core.
- Even for customer-specific products, conclusive validation of the component in the circuit can only be carried out by the customer.

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