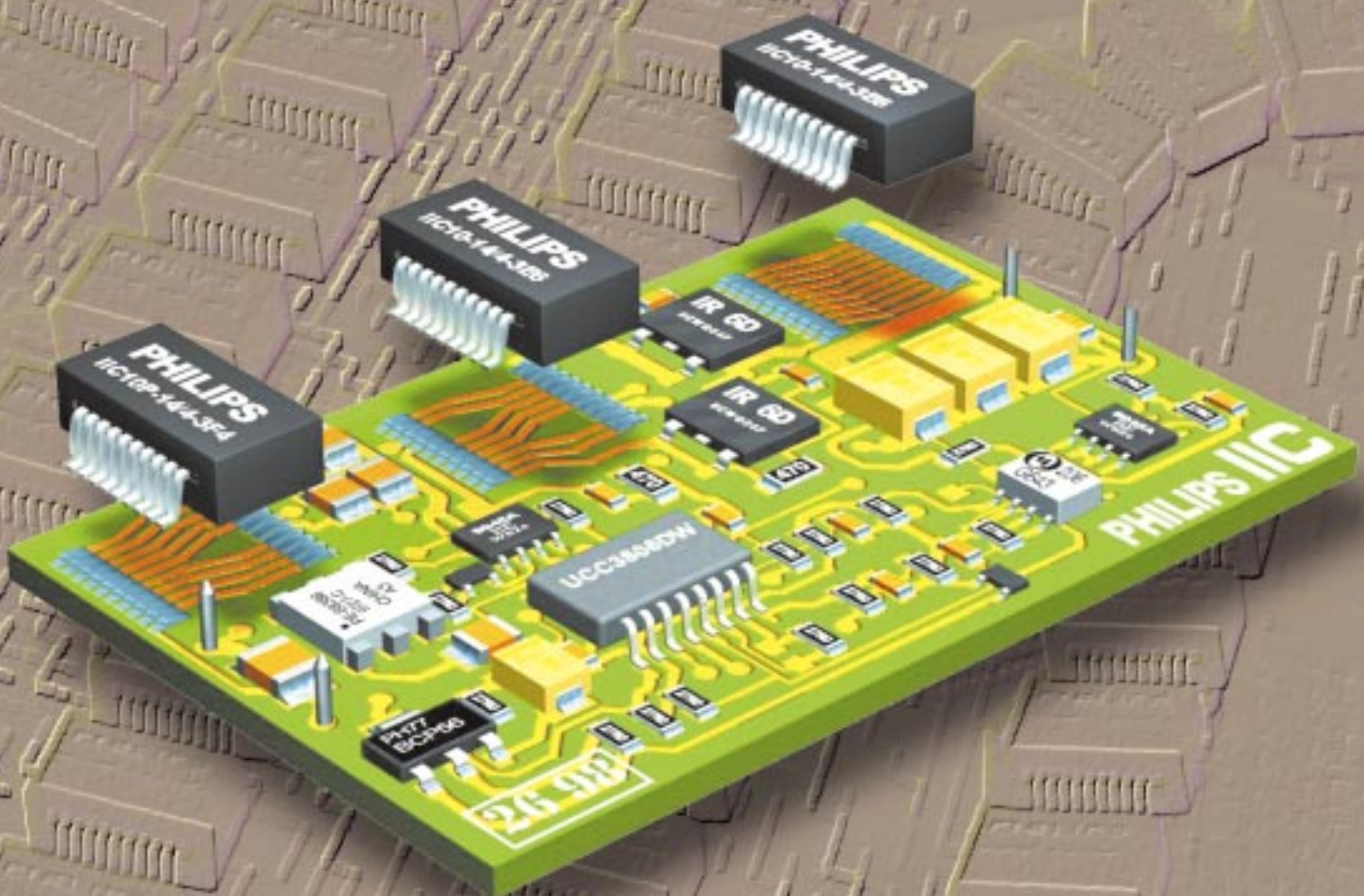
Integrated Inductive Components
Ready to come on board



Philips Components
Advanced Ceramics & Modules

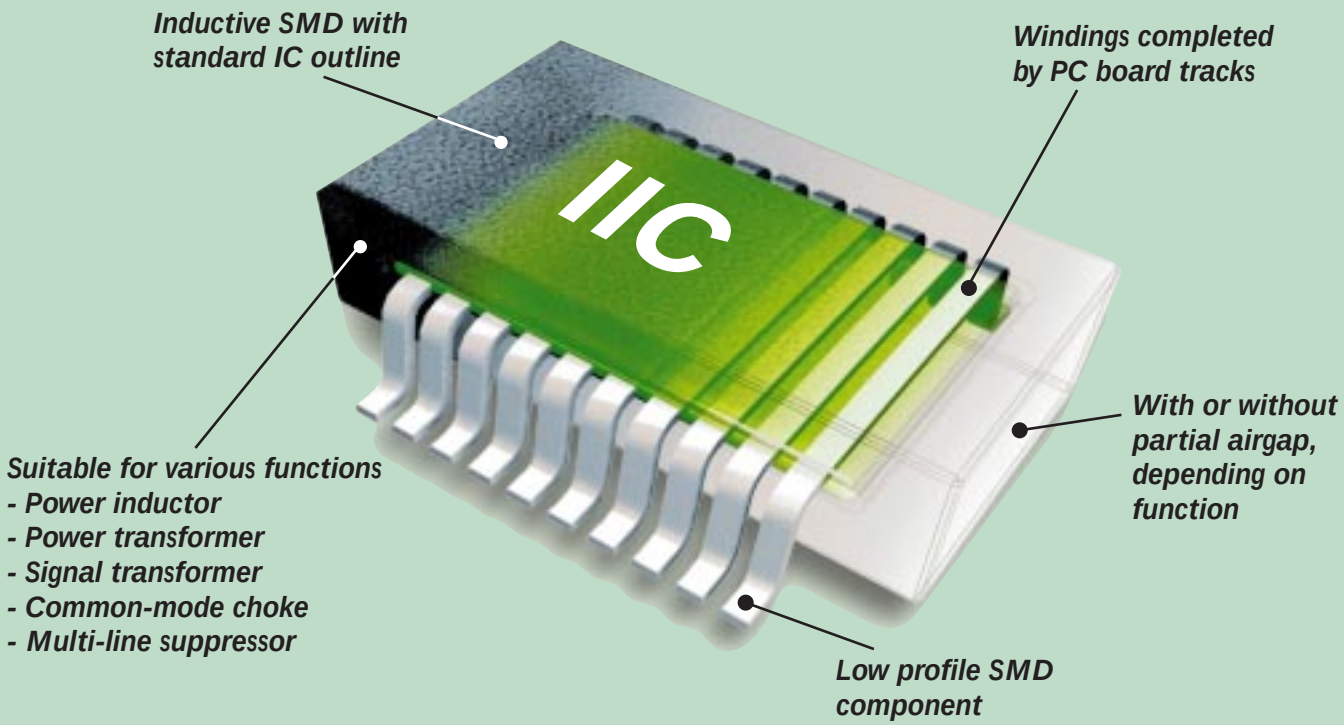
PHILIPS

Let's make things better.

Philips' Integrated Inductive Components are ready to come on board

To help meet the growing demands on functionality and integration in modern equipment, Philips Components has developed a new range of surface-mount inductive components.

Philips' Integrated Inductive Components (IICs) integrate most inductive functions required of a circuit into a compact IC-like surface-mount package. Ready to come on board to offer you as an equipment manufacturer maximum design freedom to achieve maximum functionality in minimum space. To provide you with the vital support you need to stay competitive in today's demanding markets.



The IIC design

For the majority of today's designs it is desirable to have low profile inductive components. This allows designers not only to make low profile equipment, but also to place the component anywhere on the PC board without need to adapt the equipment housing. This is especially true when the inductive component matches the height of other components on the board, for instance ICs.
A possible way to reach this goal is demonstrated in the new Integrated Inductive Component (IIC). This consists of a rectangular ferrite sleeve with a copper lead frame inserted. The lead frame is moulded with a high-tech resin to secure the leads and insulate them from the ferrite core. After insertion the leads are bent into a 'gull wing' shape to form contact pads as with most surface-mount ICs.
The finished product looks like an IC from the outside (SOT). It can be handled by standard pick-and-place equipment and soldered on the board along with other ICs . The leads in the moulding form one half of a winding which is completed by a track on the PC board. In this way, depending on the board layout, core material and configuration, several magnetic functions can be realized.

Features and Benefits:

- *Inductive surface-mount component that looks like a standard IC outline (SOT).*
- *Windings are completed by PC board tracks.*
- *Automatic placement and soldering together with other ICs on the board.*
- *Suitable for reflow soldering.*
- *Wide range of magnetic functions can be realized with the same product, depending on track layout.*
- *Superior physical properties.*
- *Available in standard EIA and EIAJ tape-and-reel.*
- *Operating temperature -55 ˚C to +150 ˚C.*

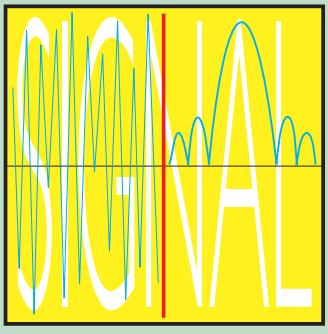
Survey of magnetic functions

IIC

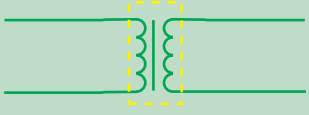
- EMC → **EM-IIC**
- SIGNAL → **S-IIC**
- POWER → **P-IIC**

1	2	3	4	5	6	7
multi-line choke	common-mode choke	differential-mode choke	pulse and wideband transformer	inductor	transformer	saturable inductor
IIC10-14/4-3S4	**IIC10-14/4-3S4** **IIC10-14/4-3E6**	**IIC10P-14/4-3C30** **IIC10P-14/4-3F4**	**IIC10-14/4-3E6**	**IIC10P-14/4-3C30** **IIC10P-14/4-3F4**	**IIC10-14/4-3F4**	**IIC10-14/4-3R1**
⊕ low profile SMD closed magnetic circuit robust and reliable repeatable properties	⊕ low profile SMD closed magnetic circuit robust and reliable repeatable properties	⊕ low profile SMD closed magnetic circuit robust and reliable repeatable properties	⊕ low profile SMD closed magnetic circuit robust and reliable repeatable properties	⊕ low profile SMD closed magnetic circuit robust and reliable repeatable properties	⊕ low profile SMD closed magnetic circuit robust and reliable repeatable properties	⊕ low profile SMD closed magnetic circuit robust and reliable repeatable properties
⊖ low Z per turn 90% common-mode	⊖ low numberof turns isolation 500 Vmax. no safety isolation	⊖ low number of turns	⊖ low number of turns isolation 500 Vmax. no safety isolation	⊖ lower energy storage than products with open circuits or larger airgaps	⊖ low number of turns isolation 500 Vmax. no safety isolation	⊖ max.current 4 A for N=10, 6 A for N=7 (parallel tracks)
compare with: Coilcraft: SDLF TDK: ZBDS Murata: BLA	***compare with:*** TDK: ZJYS ZCYS ACM	***compare with:*** TDK: NLC SLF NL	***compare with:*** E8.8/4.1/2 EFD10 P9/5 EP7	***compare with:*** EFD10 E8.8/4.1/2 Coilcraft:DT3316	***compare with:*** EFD12 EP10 planE14 P11/7 RM5/ILP TN10/6/4	***compare to:*** TN10/6/4

For more detailed information please refer to: - Technical note "IIC Integrated Inductive Components" (9398 083 53011)
- Application note "10 Watt DC/DC Converter using IIC Magnetics" (9398 239 03011)
- Internet site: **www.acm.components.philips.com**



S-IIC



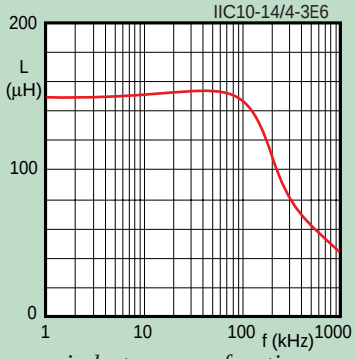
signal transformer

Signal transformer

For signal transformers (pulse or wideband), high primary inductance is essential for good low-frequency performance. Our high permeability 3E6 helps to achieve this even with a low number of turns.

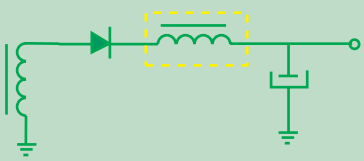
Required low leakage inductances can be obtained by means of a bifilar winding configuration.

Also in this application IIC10 is not suitable if a safety barrier is required.

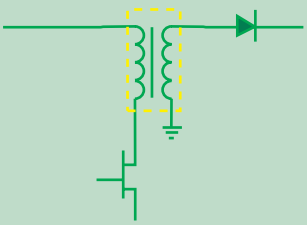


inductance as a function of frequency for N=5

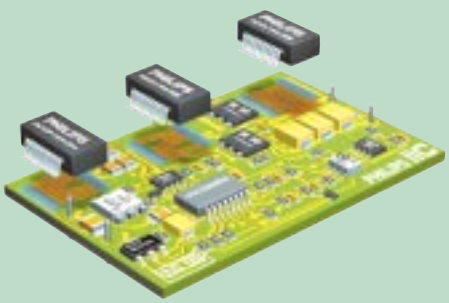
P-IIC



output choke



power transformer



example of DC/DC converter with IICs

IIC with partial airgap

This product type has a partial airgap to improve energy storage capability. Its performance has all the characteristics of a stepped choke. Possible magnetic functions are:

· *power inductor*
· *output choke*
· *EMI-choke with bias*

Power inductors are used in modern high-frequency DC/DC buck/boost converters or resonant converters. Because operating frequencies are usually high (≥ 200 kHz), inductors with a lower number of turns can be used. This makes IIC10 suitable for these applications.
The curves of L as a function of DC bias show the effect of its partial airgap. For most applications, high saturation flux density and low power losses are key requirements. Therefore 3C30 is the ideal material here. However for very high frequencies (≥ 500 kHz), 3F4 would be a better choice.

EMI-chokes often suffer from saturation when used without current compensation in lines with DC or AC bias currents. The partial airgap avoids complete saturation to a large extend. The suppression effect remains at an acceptable level for high current levels.

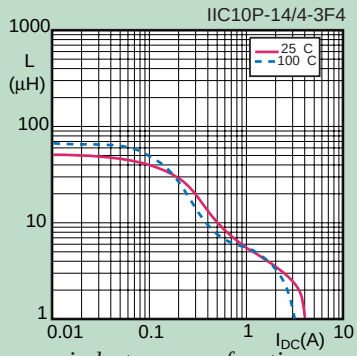
IIC without partial airgap

This design is suitable for the following magnetic functions:

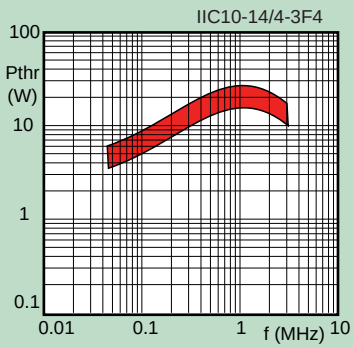
· *power transformer*
· *signal transformer*
· *common-mode choke*

The IIC can be used as a low profile power transformer in high-frequency DC/DC converters, especially those working with low voltage and power levels.

Although isolation voltage is specified at 500 V, the IIC10 should not be used in AC/DC applications as a safety isolation transformer. The short distance between the leads makes it unsuitable for that function.

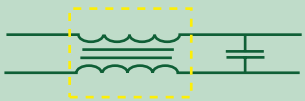


inductance as a function of bias current



throughput power as a function of frequency

EM-IIC



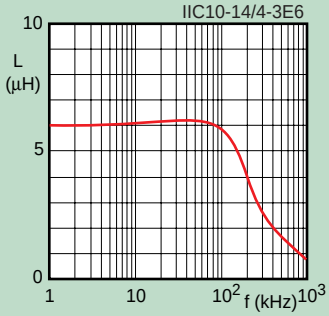
common-mode choke

Common-mode choke

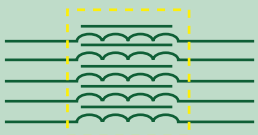
Made in our top-quality 3S4 suppression material or the high-permeability 3E6, the design is ideal for common- mode choke in signal or supply lines, especially if these carry large currents. The sturdy lead frame will take almost any current surge without damage.

All kinds of signal lines in telecom and EDP equipment require suppression of HF noise generated by internal digital processing.

Requirements are a common-mode impedance of at least 100 Ω over a very wide frequency range (10 - 1000 MHz) combined with a differential impedance of less than 10 Ω at 1 MHz to allow the real signal to pass without too much damping. In this application, the IIC offers excellent coupling, especially with a bifilar winding, and low differential damping.



inductance as a function of frequency

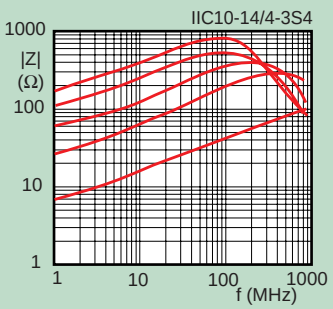


multi-line suppressor

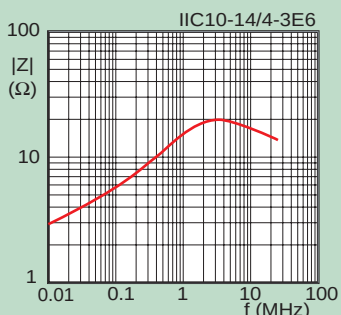
Multi-line choke

As expected, 3S4 is the best material to obtain high impedance over a wide frequency range. With 3E6, damping is already effective between 1 and 10 MHz. Moreover, combined with capacitors, IIC can be effective as supply-line filter even for even lower frequencies.

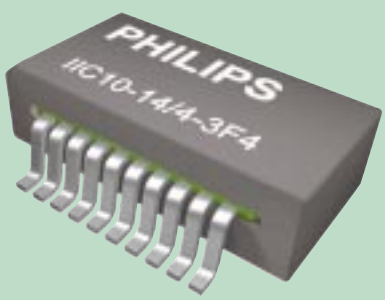
For common-mode chokes and multi-line suppressors, build height is very important since they are often used on boards carrying ICs. The 3S4 product can be produced with a height of 3 mm, equivalent to most ICs, upon request.

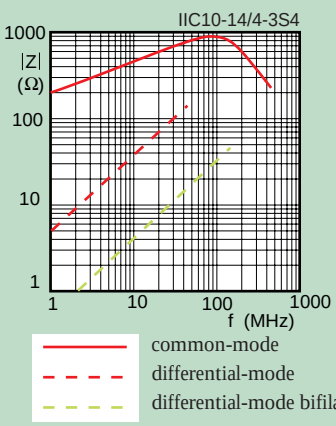


impedance as a function of frequency for different numbers of turns



impedance as a function of frequency





impedance as a function of frequency for N=5

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