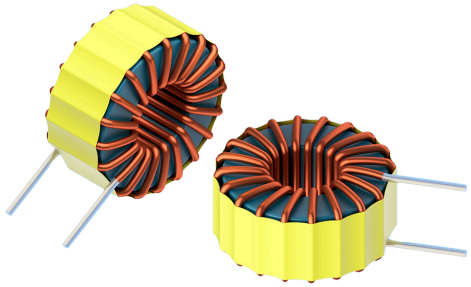
# Iron Powder Toroid Inductors for Power Applications

Application Information



## 1 Introduction

The **ITP Series** of high-current toroidal inductors from ICE Components are designed for use in power applications such as **DC/DC converters**, **EMI filters**, and **energy storage systems**. These inductors feature iron powder toroidal cores with a single winding, optimized for handling high currents. They are a cost-effective choice for power designs that need a compact form factor.

## 2 Core Characteristics and Material Selection

**Iron powder cores** are a composite of insulated iron particles, which creates a distributed air gap within the material. This distributed gap allows the core to store significant energy before saturating, resulting in a gradual, or "soft," decrease in inductance as the DC bias current increases. This contrasts with gapped ferrite cores, which have a sharp saturation characteristic. The soft saturation makes iron powder cores well-suited for switch-mode power supply (SMPS) applications where a minor drop in inductance under high load is acceptable.

The ITP Series uses a single, heavy-gauge winding to achieve its specified current rating while minimizing DC resistance (DCR). This low DCR contributes to high efficiency.

## 3 Key Features and General Data

- **Operating Temperature**: −40°C to +105°C
- **Inductance Range**: 10 µH to 1000 µH
- **Current Handling**: Up to 20A
- **Design**: Low loss self-shielding design and a soft roll-off characteristic that reduces the risk of saturation
- **Compliance**: The series is RoHS compliant and meets REACH standards.
- **Flammability**: The materials used have a flammability rating of UL-94 V-0.

*Specification Table*

| Part Number | L@ 0A (µH, +/-15%) | IDC (A) | L@IDC (µH, +/-15%) | DCR (Ω, Max.) | K Factor | Dim A (mm, Nom.) | Dim B (mm, Nom.) |
|---|---|---|---|---|---|---|---|
| ITP-0010-020-V | 10 | 20.0 | 6.7 | 0.005 | 1.94 | 14.22 | 1.68 |
| ITP-0012-019-V | 12 | 19.1 | 7.8 | 0.005 | 2.13 | 14.22 | 1.68 |
| ITP-0015-018-V | 15 | 18.0 | 9.5 | 0.006 | 2.52 | 14.22 | 1.68 |
| ITP-0018-017-V | 18 | 17.2 | 11.1 | 0.006 | 2.71 | 14.22 | 1.68 |
| ITP-0022-016-V | 22 | 16.4 | 13.2 | 0.007 | 2.90 | 14.22 | 1.68 |
| ITP-0027-016-V | 27 | 15.6 | 15.7 | 0.008 | 3.29 | 14.22 | 1.68 |
| ITP-0033-012-V | 33 | 11.7 | 21.3 | 0.013 | 3.68 | 13.46 | 1.35 |
| ITP-0039-011-V | 39 | 11.2 | 24.7 | 0.014 | 3.87 | 13.46 | 1.35 |
| ITP-0047-011-V | 47 | 10.7 | 29.0 | 0.016 | 4.26 | 13.46 | 1.35 |
| ITP-0056-010-V | 56 | 10.2 | 33.7 | 0.017 | 4.65 | 13.46 | 1.35 |
| ITP-0068-008-V | 68 | 7.7 | 45.2 | 0.030 | 5.23 | 13.21 | 1.07 |
| ITP-0100-007-V | 100 | 7.0 | 63.1 | 0.037 | 6.20 | 13.21 | 1.07 |
| ITP-0120-007-V | 120 | 6.7 | 73.9 | 0.040 | 6.97 | 13.21 | 1.07 |
| ITP-0150-005-V | 150 | 5.0 | 101.4 | 0.071 | 7.74 | 12.95 | 0.86 |
| ITP-0180-005-V | 180 | 4.8 | 118.9 | 0.078 | 8.52 | 12.95 | 0.86 |
| ITP-0220-006-V | 220 | 5.8 | 123.8 | 0.054 | 9.29 | 14.22 | 1.07 |
| ITP-0270-006-V | 270 | 5.5 | 147.2 | 0.060 | 10.30 | 14.22 | 1.07 |
| ITP-0330-005-V | 330 | 5.2 | 174.1 | 0.067 | 11.40 | 14.22 | 1.07 |
| ITP-0390-005-V | 390 | 5.0 | 200.2 | 0.072 | 12.40 | 14.22 | 1.07 |
| ITP-0470-004-V | 470 | 3.8 | 271.4 | 0.130 | 13.60 | 13.72 | 0.86 |
| ITP-0560-004-V | 560 | 3.6 | 314.8 | 0.140 | 14.90 | 13.72 | 0.86 |
| ITP-0680-003-V | 680 | 3.4 | 370.7 | 0.150 | 16.50 | 13.72 | 0.86 |
| ITP-0820-003-V | 820 | 2.6 | 500.9 | 0.270 | 18.00 | 13.46 | 0.69 |
| ITP-1000-002-V | 1000 | 2.4 | 593.6 | 0.300 | 19.90 | 13.46 | 0.69 |

The specification table provides detailed data for various part numbers, including inductance at 0A and at the rated DC current (L@IDC), DC Resistance (DCR), and K Factor. The DC Bias Inductance, as a percentage of the nominal inductance, can be calculated using the K factor and the following formula:

$$\%L = \frac{0.95}{0.01 + 4.657 \times 10^{-6} \, (K \cdot I_{DC})^{1.84}}$$

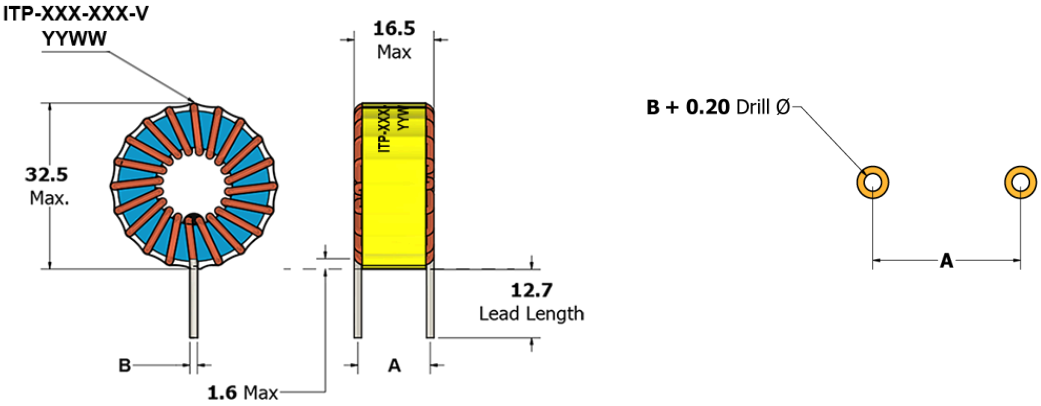
*Where: **%L** is the percent of nominal inductance • **K** is the K Factor from the table • $I_{DC}$ is the DC current in A*

## 4 Performance and Design Considerations

*Thermal Management*

The **current rating** is determined by a **temperature rise of 30°C**. To ensure the inductor operates within its safe parameters, the total operating temperature, encompassing both the ambient temperature and the heat generated during operation, **should not exceed 105°C**.

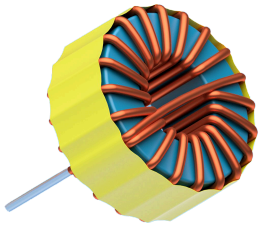
## 5 Mechanical and Packaging Information




The ITP series inductors are designed for **through-hole mounting**. The dimensions are in millimeters (mm).

- **Dimensions:** Max Height: 32.5 mm | Max Diameter: 16.5 mm | Lead length: 12.7 mm
- **Leads:** Tinned to within 1.6 mm above the mounting plane.
- **Packaging:** 30 Pcs/Box | 12 Boxes/Carton | 360 Pcs/Carton

## 6 Custom Mounting and Inductance Options



Custom configurations including **horizontal mounting** and **custom inductances** are available.

For more information, you can visit the ICE Components website at https://www.icecomponents.com/product/itp-v-series/.