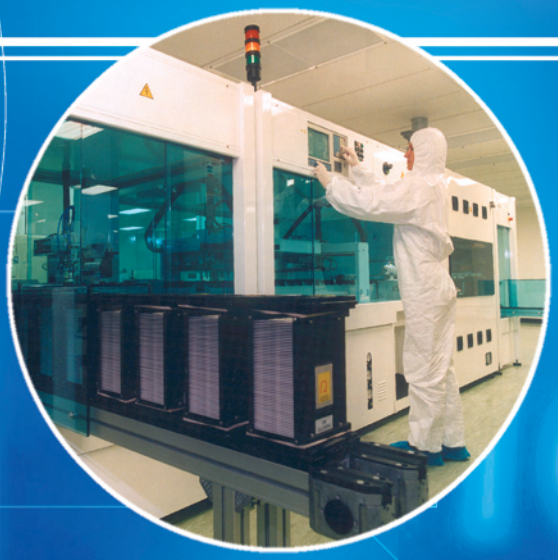
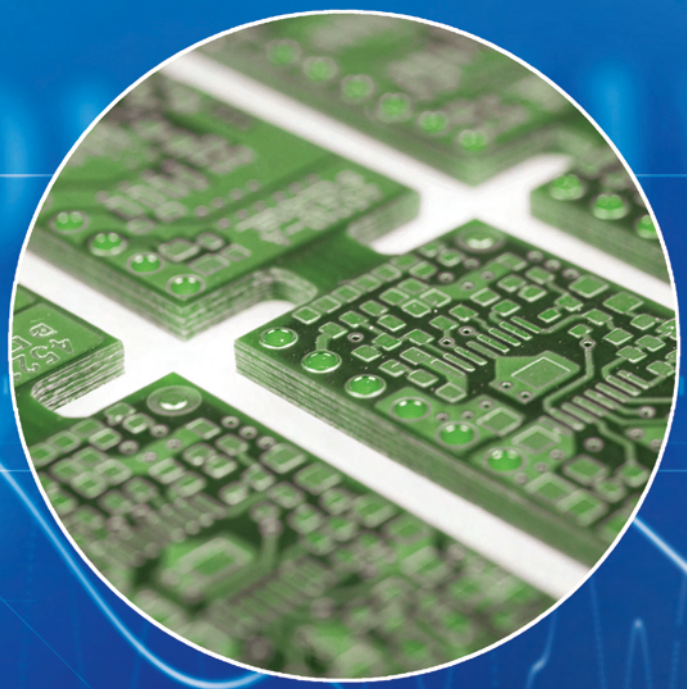




Electronic Components and Assemblies.
Advancing Future Designs.

TT electronics

Leading in Tomorrow's Technology

Electronic components and assemblies designed to perform

Automotive

Computer

Military/
Aerospace

Lighting

Medical

Industrial

Instrumentation

Telecommunications

TT electronics

ab | Bi technologies | OPTEK | IRC | Welwyn

TT electronics delivers Total Technology

Contents

TT electronics is a global supplier of leading edge electronic components and assemblies for a wide range of applications, including lighting systems, automotive electronics, communications and computer technology, aerospace/defense systems, instrumentation, industrial equipment and commercial products. Through its divisions, the company provides a comprehensive range of advanced technology, application-specific engineered solutions and standard products, supported by world-class manufacturing facilities and application engineering teams.

Worldwide manufacturing, engineering and sales support facilities include those in North America, Europe, the UK, Mexico, Barbados, Malaysia, Japan, Singapore, Hong Kong, India and China, with sales to major OEMs/ODMs (original design manufacturers) and CEMs (contract electronic manufacturers) through manufacturers' representatives and the world's leading electronic distributors.

Individual divisions of TT electronics specialize in visible and infrared LED components; optoelectronic, potentiometric and magnetic sensors; microcircuits and hybrids; fixed and variable resistors and resistor networks; resistive heaters and thermal management substrates; potentiometers and trimmers; and magnetic components. As a combined company, TT electronics can serve as a single-vendor source for this wide range of standard products, as well as application-specific technologies to develop innovative custom solutions tailored to meet customer requirements.

Advanced technology, application-specific engineered solutions and standard products, supported by world-class manufacturing and application engineering.

Custom LED assemblies

High power Lednium™ Series

Surface mount LEDs

High flux LEDs

Visible LED lighting solutions

High-reliability LEDs

High-brightness through-hole LEDs

Facilities

Wafer processing

Molding

Die processing

A bright future in LED lighting technology

TT electronics is a leading supplier of innovative high-brightness LEDs and LED lighting assemblies for automotive lighting; displays and signage; backlighting and indicators; as well as commercial, architectural, and residential lighting applications. In addition to a full color spectrum of power LEDs and white LEDs in various color temperatures, the company also offers the Lednium™ Series of LED assemblies and discretes – a unique packaging design that provides the industry's best thermal resistance of 2.5°C/W; as well as superior substrate materials, including Anotherm® and Anotherm Plus® - developed specifically for thermal management in LED applications. TT electronics also has a complete in-house test and development lab dedicated to the design and analysis of LED components and assemblies.

Product highlights

- Lednium™ Series
  - 10-watt and 1-watt devices
- LED Assemblies on Anotherm® and Anotherm Plus® substrates
  - Light bars, light rings and single-LED spotlights
- Surface mount power LEDs
  - PLCCs and single-chip packages
- R/G/B LEDs
  - Multi-chip packages
- High-brightness through-hole LEDs
  - Round, oval and cylindrical packages
- High-flux power LEDs
  - Four-pin square packages
- High reliability LEDs
  - Hermetic metal cans and pill packs
- Custom assemblies and lighting solutions

Technical capabilities

- InGaN and AlInGaP visible LEDs
- UV and IR LEDs
- LED die attach and packaging facility
- LED assembly manufacturing services
- Thermal imaging camera
- Scanning electron microscope with PGT for validation analysis
- Luminous flux and wavelength test capability
- Spectroradiometer system with 6" and 1 meter integrating spheres
- LED lighting design kit available

Qualifications

- ISO/TS 16949:2002
- ISO 9001:2002

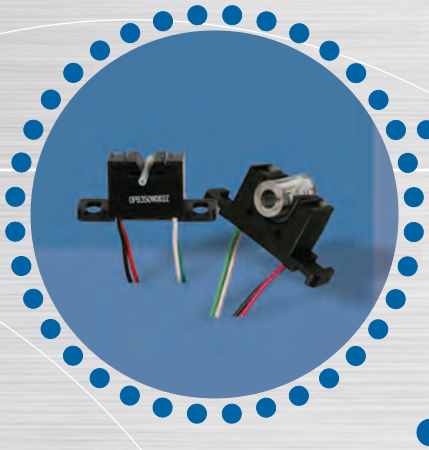
APPLICATIONS IN ACTION

A leading commercial aircraft lighting manufacturer needed a high-reliability solid-state light source to replace wingtip landing lights. TT electronics engineers developed a LED assembly using their 10-Watt Lednium module to provide a higher light output with fewer components and a projected 10x decrease in maintenance and replacement costs over the life of the aircraft.

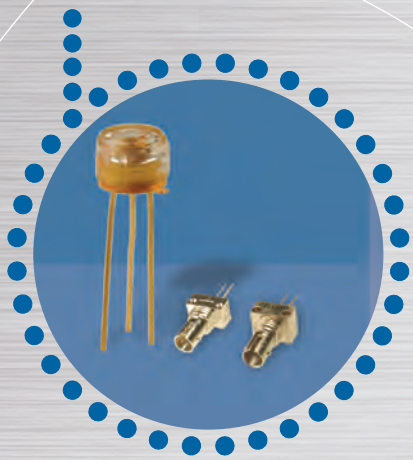
Market Applications

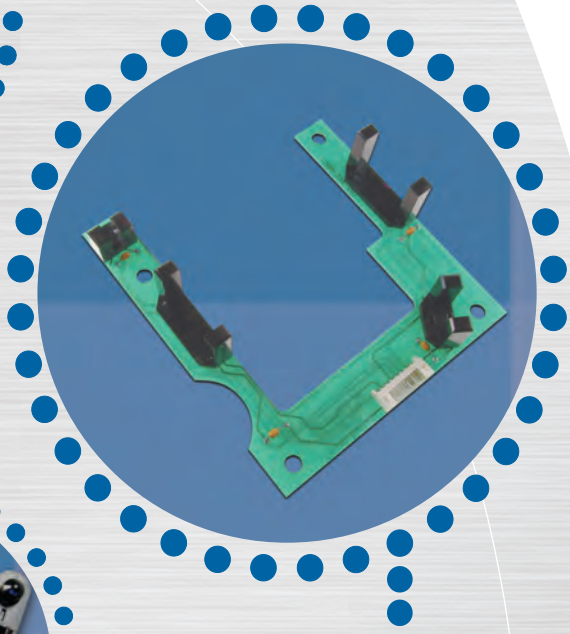
Communications	Automotive	Industrial	Medical	Consumer	Instrumentation	Military/Aerospace	Computer
• Power indication • Mobile phone backlighting • Indoor/outdoor displays • Message boards	• Interior lighting • Exterior lighting • Accent lighting • Dashboard instrumentation	• Safety lighting • UV curing • Power indication • Vision systems	• Fluid analysis • Surgical lighting • Patient call lighting • Instrument backlighting • Indication	• Vending machines • Gaming machines • Cameras and video recorders • Display backlighting • Flashlights • Lighting fixtures • Appliances/ white goods	• Color matching systems • Indication	• Exterior lights • Interior lights • Cockpit control illumination	• Display backlighting • Power indication • Office equipment

Fluid sensors



Fiber optics





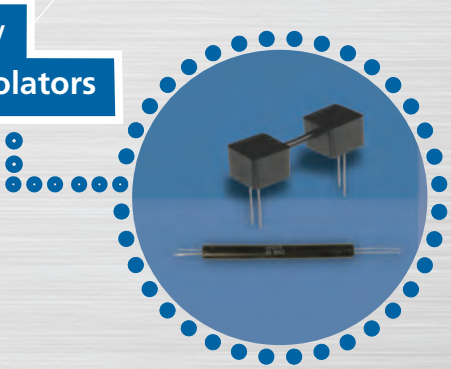
Optoelectronic custom sensor assemblies

Industrial sensors

High-reliability optoelectronics

Surface mount infrared components

Optocouplers/ optoisolators



Facilities

Visual inspection station

Furnace

Quality inspection station

Surface mount line

Advanced optoelectronic sensors and assemblies

TT electronics is a world leader in developing advanced infrared optoelectronic sensors and assemblies for automotive electronics; office equipment; industrial machinery; medical and diagnostic systems; and aerospace, defense and high-reliability applications. With the industry's most comprehensive range of infrared LED and VCSEL (vertical cavity surface-emitting laser) emitters/detectors and fiber optic transmitters/receivers available as individual components or as part of a wide variety of standard and custom assemblies, TT electronics' experienced team of application engineers can offer customers innovative optoelectronic solutions to their most challenging applications.

Product highlights

- Infrared LEDs (emitters)
  - 880nm and 940nm LEDs; 850nm VCSELs
- Infrared sensors (detectors)
  - Analog sensors (photodiodes, phototransistors, photodarlingtons)
  - Digital sensors (Photologic®)
- Optoisolators
- Phototransistors and Photologic®
- Sensor assemblies
  - Reflective, proximity, flag and slotted switches
- Fiber optic components
  - 850nm LED and 850nm VCSEL transmitters
  - PIN and TIA photodiode receivers
- High reliability optoelectronics
  - Hermetic package optoisolators and metal can sensors
- Custom assemblies available

Technical capabilities

- Infrared LED and VCSEL technology
- Silicon and III-V design capability
- Reflective and transmissive designs
- Fiber optic component designs
- High-reliability manufacturing
- Comprehensive in-house testing and failure analysis lab
- 100% parametric testing
- Automated packaging and assembly
- Custom assembly/contract manufacturing capability
- Mechanical packaging design and molding

Qualifications

- ISO/TS 16949:2002
- ISO 9001:2000
- 100% in-house screening and QCI testing (Group A, B, C, D) per MIL-PRF-19500 method of MIL-STD-750 and MIL-STD-83t3, method 5005
- TX, TXV, B, S and ESA-level capabilities
- TSAT
- ITAR Registration

APPLICATIONS IN ACTION

A manufacturer of specialty coffee vending machines required a solid-state sensor to automatically select the correct coffee packet by detecting its color. Pairing a self-adjusting white LED with a color-sensing array that measures the hue, saturation and luminance value of reflected light, TT electronics engineers developed a sensor that recognizes 256+ colors, delivering a new level of accuracy for color matching/sorting, color continuity and quality control applications.

Market Applications

Communications
- Routers
- Switches

Automotive
- Camshaft/crankshaft
- Speed/RPM sensing
- Seat position controls
- Door controls
- Fluid detection

Industrial
- Limit switches
- Safety systems/light curtains
- Edge detection
- Proximity sensors

Medical
- Fluid detection
- Fluid analysis
- Radiology
- Dialysis machines
- Pharmaceutical dispensers
- Pulse oxymetry
- IV pumps

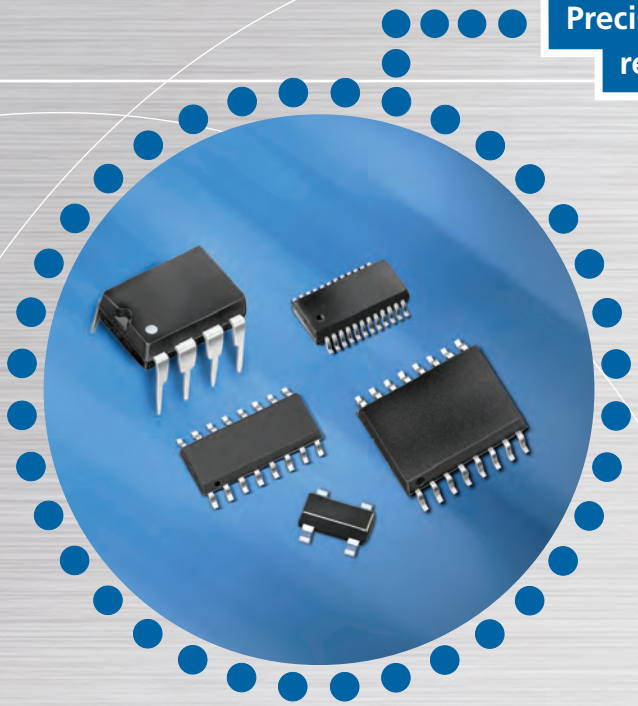
Instrumentation
- Color/pigment matching
- Equipment sensors
- Test equipment

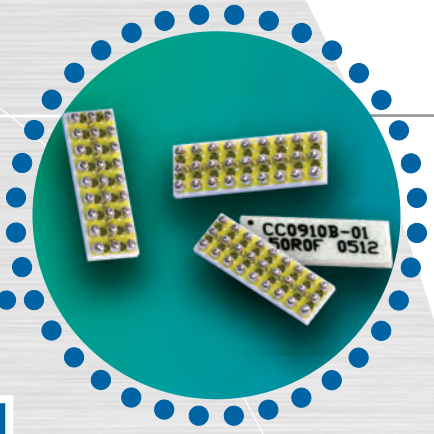
Military/Aerospace
- Missile guidance systems
- Satellite communication

Computer
- Printers
- LAN transceivers
- Office equipmeant
- Mail processing machines

Computer
- Security
- IR Illumination
- Transmission equipment
- Intrusion detection

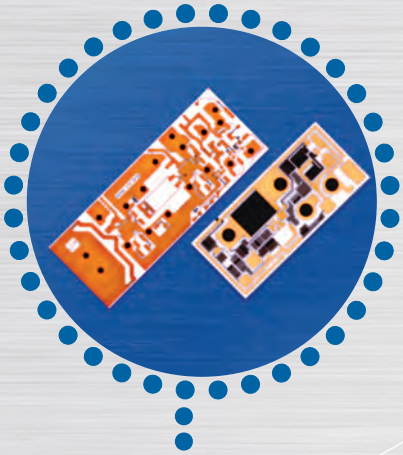
Precision resistor networks





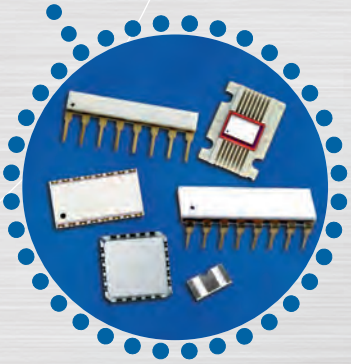
Ball grid array termination networks

Wire-bondable products

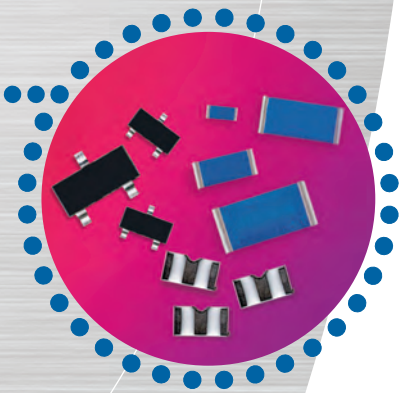


Thin film substrates

High-reliability thin film products



Precision chip resistors and voltage dividers



Facilities

Automated high speed laser tailoring

Spin coaters

Four tube furnace for dielectric films

Sputter equipment for thin film metalization

Precision thin film technology delivers reliable performance

TT electronics provides the industry's most comprehensive range of precision thin film technologies for discrete, network, and integrated passive components used in communications systems; portable electronics; automotive electronics; instrumentation; test and measurement equipment; medical electronics; and military/aerospace applications. Ultra-reliable TaNFilm®, TaNSil®, and precision Nichrome resistive elements are available on ceramic or silicon substrates in a wide variety of surface mount, through-hole and ball grid array packages, as well as wire bondable die for use in hybrid assemblies.

Product highlights

- Precision TaNFilm and TaNSil networks on silicon or ceramic substrates
- Precision Nichrome resistor networks on silicon or ceramic substrates
- Precision voltage dividers on 1206 size ceramic chips and SOT-23/SOT-143 packages
- Precision BGA (ball grid array) packaged networks
- Integrated passive components
- Resistor-capacitor and resistor-capacitor-diode networks in IDEC packages
- High stability platinum temperature sensors
- High temperature TaNFilm chip resistors for operation up to 200°C
- Quick response, stable resistance TaNFilm airbag igniters
- Wire bondable resistor and capacitor chips on ceramic or silicon
- High reliability/MIL-qualified precision chip resistors and networks
- Thin film substrates for thermal management
- Custom thin film substrates available

Technical capabilities

- Precision tolerances to ±0.01% absolute; ±0.005% ratios
- TCRs to ±5ppm/°C absolute; ±1ppm°C tracking
- Resistance range from 0.5Ω to 2MΩ
- Precision films include tantalum nitride, platinum, titanium, aluminum, copper, palladium, nickel, gold, tungsten and nickel chromium
- Class 100, 1,000 and 10,000 clean rooms
- Precision photolithography to 2 microns
- Plasma chemical vapor deposition/ silicon dioxide and silicon nitride (PECVD) and low pressure chemical vapor silicon nitride (LPCVD) processes
- Automated packaging and assembly

Qualifications

- ISO9000/ ISO9001/QS9000
- ISO/TS16949
- SSQ100 (International Space Station)
- VDA 6.1
- CECC
- MIL-PRF-83401
- MIL-PRF-55342
- MIL-PRF-38354
- MIL-STD-883 screening
- Class H QML listed
- DSCC drawings

APPLICATIONS IN ACTION

To ensure reliable operation in its mission-critical avionics systems, a major international aerospace contractor asked TT electronics to provide ultra-stable precision thin film resistor networks for cockpit control electronics. TT electronics engineers developed a unique process that enabled the networks to meet the contractor's stringent stability and precision requirements.

Market Applications

Communications
- Transmission line termination
- RF/Microwave links
- EMI/RFI filtering
- High speed digital

Automotive
- Battery management
- Engine controls
- Mass airflow sensors
- Air bag/ seat belt controls
- Cruise control
- Infotainment systems

Industrial
- Power management
- Motor control
- Process control equipment
- Elevator controls
- Temperature sensors

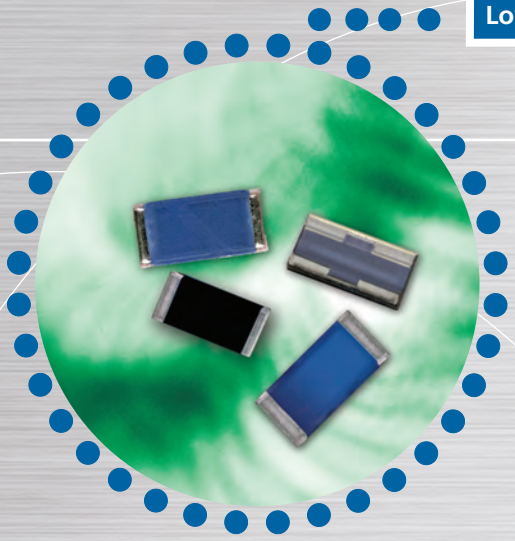
Medical
- Defibrillators
- Patient monitoring systems
- Ultrasound equipment
- MRI and CT scanners
- Blood analyzers

Consumer
- Set-top boxes
- Scales and balances
- HDTV
- Audio equipment

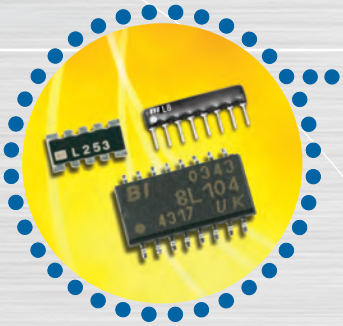
Instrumentation
- Automatic test equipment
- Test and measurement equipment
- Microwave test systems
- Load cells

Military/Aerospace
- Guidance systems
- Satellite communication
- Radar systems
- Avionics

Computer
- Voltage dividers
- I/O line terminators
- Signal filtering
- Bus termination
- EMI/RFI filtering
- Memory termination



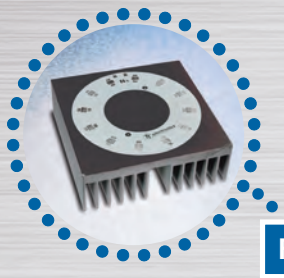
Low ohmic value chip resistors



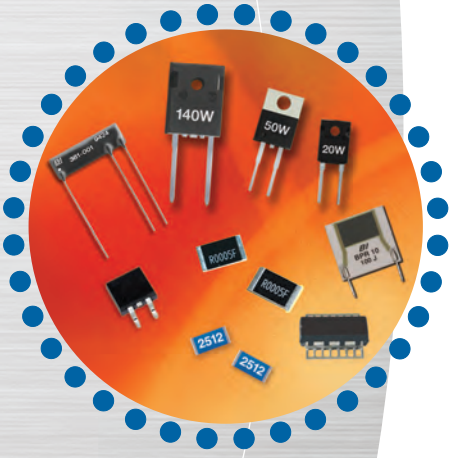
Resistors, RCs, diodes: arrays/networks

Ball grid array networks

Metal Glaze® surge and current sense cylindrical resistors

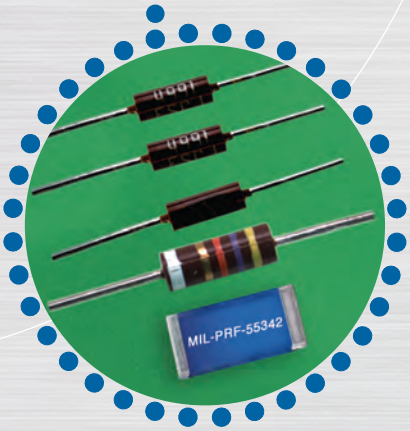


Finned Anotherm® substrate technology



High voltage and power current sense

High reliability military thick film resistors



Axial leaded high voltage metal film resistors

Facilities

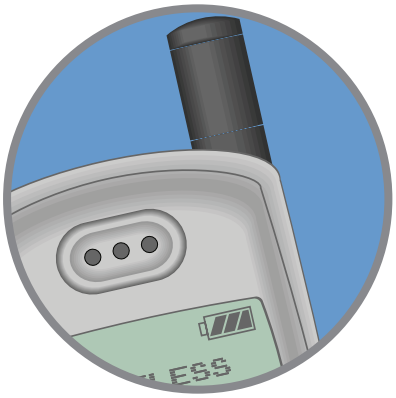
Automatic printers

Automatic chip resistor sorting equipment

Automatic termination plating lines

Thick film technology for power management

TT electronics has developed an extensive range of thick film resistive technologies for electronic circuits in power supplies; telecommunications; industrial equipment; control systems; industrial electronics; automotive control systems; lighting controls; medical electronics; audio circuits; test and measurement; and military/aerospace applications. Proven thick film technologies from TT electronics provide critical battery management, line termination and current sense functions in a variety of packages and form factors, including surface mount chip resistors, cylindrical surface mount resistors, BGA (ball grid array) devices, axial leaded through-hole resistors, surface mount arrays, custom thick film substrates, and molded networks.



Product highlights

- Low ohmic value current sense resistors
- Lightning strike surface mount resistors for aircraft
- Standard Metal Glaze®, unspiralled and capped devices
- Transistor-packaged power current sense resistors
- TO-263, TO-220, TO-247, QSOP packages
- High voltage thick film resistors
- Surface mount and axial leaded devices
- High ohmic value thick film resistors
- Surge/pulse withstanding resistors
- Commercial grade power resistors
- Power thick film resistors on ceramic and metal substrates
- Custom thick film substrates available
- High power devices
- Network BGAs
- Resistor/capacitor terminations
- High density diode networks

Technical capabilities

- Resistive tolerances to ±0.1%
- TCRs to ±25ppm/°C
- Resistance range from 0.0005Ω to 100TΩ
- Power ratings from 0.125W to 600W
- Voltage ratings to 100kV
- Resistor-capacitor networks
- Planar resistors on ceramic substrates
- SIP and BGA packaging available
- In-house thick film composition/ blending capability

Qualifications

- ISO16949/ TS16949:2002
- ISO9000:2000 ISO9001
- VDA 6.1
- CECC
- UL
- MIL-PRF-38354 MIL-15XXX
- MIL-R-22684
- MIL-R-10509
- MIL-R-39017 MIL-R-55182
- Multiple DSCC drawings
- MIL-STD-883 screening
- MIL-PRF-55342

APPLICATIONS IN ACTION

When customers required rugged surface mount devices specifically designed for surge/pulse applications and extreme thermal cycling, TT electronics engineers adapted their patented Metal Glaze® technology in two ways – an unspiralled thick film cylindrical resistor that provides 10x the surge rating of conventional flat chips; and one with metal caps to provide exceptional thermal compliance with the PC board. Both cylindrical surface mount resistors de-livered superior performance levels while providing significant cost savings.

Market Applications

Communications
- Hot-swap insertion
- Surge protection
- Switching power supplies

Automotive
- Climate control
- Engine control
- Braking systems
- HVAC controls
- Audio systems

Industrial
- Power management
- Motor controls
- Logic controllers
- Power supplies

Medical
- Defibrillators
- Analytical/ diagnostic equipment
- ECG/EKG systems
- Patient monitors
- IV and fluid pumps

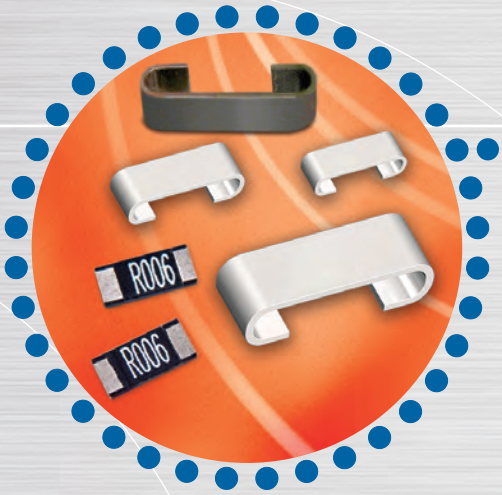
Consumer
- Televisions/ monitors
- Smoke detectors
- Video games
- Lighting controls
- Ozone generators/ air purifiers

Instrumentation
- Electrical test equipment
- Flow measurement systems
- Power metering

Military/Aerospace
- Guidance systems
- Telemetry systems
- Communications equipment
- Avionics
- Ordnance

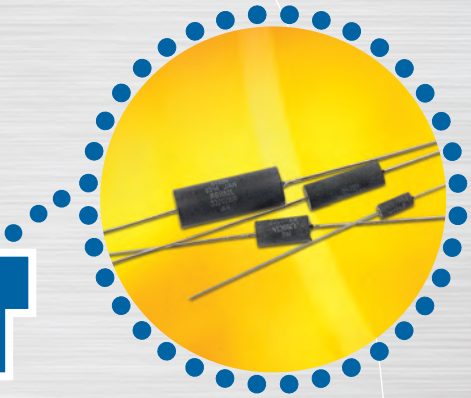
Computer
- Power supply regulation
- Current sense circuits
- Over voltage protection
- Surge protection

Surface mount wirewound resistors

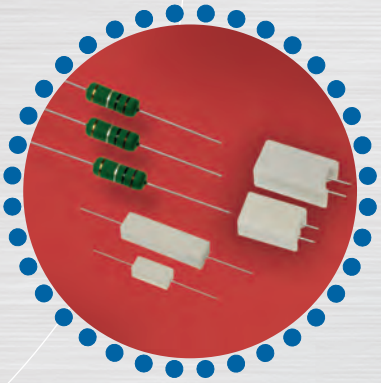


Surface mount current sense resistors

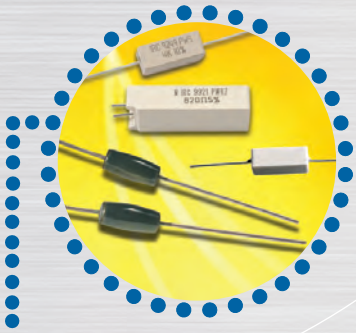
Through-hole current sense resistors



Military and high-reliability wirewound resistors

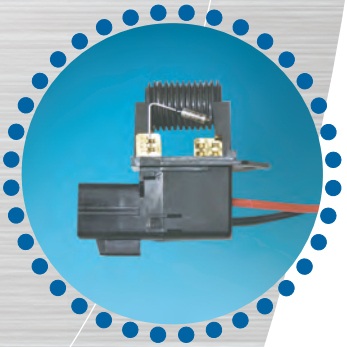


Commercial wirewound resistors



Precision and power wirewound resistors

Fan speed control assemblies



Facilities

Automatic winding machines

Automatic current sense resistor manufacturing equipment

Automatic inline packaging machines

Proven wirewound and metal element technology

TT electronics is a leading manufacturer of wirewound and metal element resistors for precision, power and current sense circuits in telecommunications equipment; consumer electronics; power supplies; industrial drive systems; computers; automotive controls; laboratory equipment; medical electronics; and military/aerospace applications. TT electronics' wirewound and metal element technologies deliver proven reliability, ruggedness and precision performance in a wide variety of configurations, including open air devices, surface mount packages, axial leaded through-hole resistors, fusible resistors, and high-reliability devices for military and medical applications.

Product highlights

- Open air and encapsulated metal element current sense resistors
- Ceramic, silicone and cement-coated power wirewound resistors
- Axial, vertical and radial leaded devices
- Vitreous enameled tubular and axial wirewound resistors
- High voltage wirewound resistors
- Fusible wirewound resistors
- Precision wirewound resistors
- Commercial grade wirewound resistors
- High-reliability/MIL-qualified wirewound resistors
- Custom wirewound assemblies available

Technical capabilities

- Resistive tolerances to ±0.01%
- TCRs to ±5ppm/°C
- Resistance range from 0.00025Ω to 12MΩ
- Power ratings from 0.125W to 375W
- Voltage ratings to 350V
- J-lead and Z-lead formed devices for surface mount
- Comprehensive in-house testing facilities
- Multiple manufacturing locations

Qualifications

- ISO9000/ QS9000
- ISO9001
- ISO16949/ TS16949
- DSCC-approved test laboratory
- BS9450
- CECC
- UL1412
- VDA6.1
- MIL-15XXX
- MIL-R-93
- MIL-R-39005
- MIL-Q-9858
- S-level qualification

APPLICATIONS IN ACTION

A manufacturer of portable defibrillation equipment needed to discharge energy safely if no defibrillation is required. The resistor needed to withstand energy pulses up to 200 joules during operation, as well as repeated pulses that occur when the unit undergoes daily self-test diagnostic cycles.
TT electronics' engineers developed a proprietary winding design using a heavy-gauge wire element capable of withstanding power surges with reliable long term performance.

Market Applications

Communications
- Central office switch
- SLIC equipment
- ADSL/HDSL/ T1 systems
- Wireless handsets
- Radio base stations

Automotive
- Fan controls
- Engine controls
- Braking systems
- Daylight running lamps
- HVAC controls
- Window lift controls
- Seat belt pretensioners

Industrial
- Metering
- Motor controls
- Ground fault interrupt
- Power supplies
- Power transmission

Medical
- Defibrillators
- Analytical/ diagnostic equipment
- ECG equipment
- Patient monitors
- MRI/X-ray systems
- Power supplies

Consumer
- Televisions/ monitors
- Smoke detectors
- Video games
- Appliances/ white goods

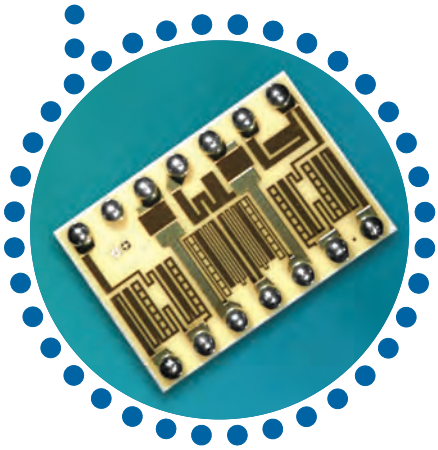
Instrumentation
- Precision test equipment
- Laboratory equipment
- Measurement systems

Military/Aerospace
- Ordnance control
- Communications equipment
- Radar systems
- Avionics

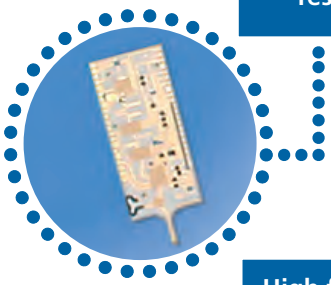
Computer
- Power supply regulation
- Laptop and desktop computers
- Voltage regulation
- Servers/routers
- Monitors

High frequency technology for high speed communications

HIgh speed digital termination networks



Microwave resistors



High frequency terminators and attenuators

TT electronics has developed an extensive range of high frequency components for microwave, wireless and high speed digital communications systems in computer, server, set-top box, HDTV, satellite and military/aerospace applications. TT electronics combines thin film precision and high frequency performance characterized up to 40GHz to deliver the industry's most reliable terminators, attenuators and converters.

Product highlights

- High frequency terminators characterized to 40GHz
- High frequency attenuators characterized to 40GHz and 25pS rise time
- High frequency RF power terminators characterized to 250W
- High frequency impedance converters
- BGA (ball grid array) packaged termination networks
- Custom high frequency thin film substrates available

Technical capabilities

- Frequency characterization to 40GHz
- High-speed digital characterization to 25pS rise time
- Power ratings to 250W
- Attenuation values from 0 to 40dB

Qualifications

- ISO9000/ISO9001/QS9000
- ISO/TS16949

APPLICATIONS IN ACTION

A leading manufacturer of digital set-top boxes for home entertainment centers needed to redesign the terminations for its high speed digital transmission lines to eliminate the potential for signal piracy through exposed conductors on the top side of the terminators. TT electronics engineers developed a BGA package for its termination network that placed all the resistive elements and connection points on the underside of the package to prevent signal theft.

Market Applications

Communications	Industrial	Medical	Consumer	Instrumentation	Military/Aerospace	Computer
• Wireless • Broadband RF • Satellite • Cell base stations • Microwave telecom links	• High frequency circuits • Power splitters • High energy electromagnetic devices	• High frequency circuits	• Wireless devices • Cell phone base stations	• Metering • RF test equipment • Circulators • Isolators • Set-top boxes	• High frequency circuits • Radar systems • Satellites	• Memory termination • High speed routers • Data switches • Servers • Networking equipment

Resistive heating technology for thermal management

Tubular and planar heaters

TT electronics is a leading supplier of resistive heating technology for thermal management and temperature control in automotive and heavy vehicle systems; industrial machinery; consumer electronics; medical electronics; and military/aerospace applications. TT electronics' resistive heater technologies use a wide range of substrates to precisely control temperature through specially designed thick film resistive elements.

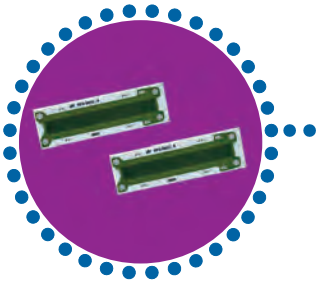
Thick film on steel heaters

Product highlights

- Thick film on steel heaters
  - Tubular or planar stainless steel
- Anotherm® heaters
  - Tubular or planar anodized aluminum
- Planar ceramic heaters

Technical capabilities

- Precision tolerances to ±1%
- TCRs to ±50ppm/°C
- Operating temperature range to 300°C
- Power rating from 2W to 25KW
- Resistance range from 0.1Ω to 100KΩ
- Voltage drop source
- Instant-on/instant-off capabilities
- Precise temperature control



Ceramic heaters

Qualifications

- ISO9000/ISO9001/QS9000
- ISO16949/TS16949
- CECC
- VDA6.1

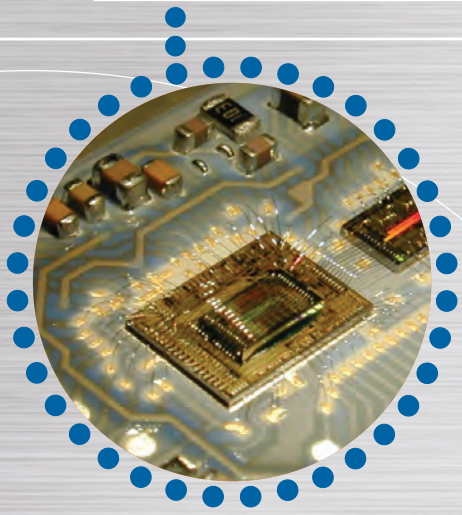
APPLICATIONS IN ACTION

A U.S. automaker sought an energy-efficient alternative to provide heated windshield washer fluid to replace their conventional "reservoir style" heating system. Employing the applications experience of several different divisions, TT electronics engineers combined their patented Anotherm® technology with a thick film resistive element and advanced electronic controls to produce an "on-demand" fluid heater with energy efficiency of more than 95%.

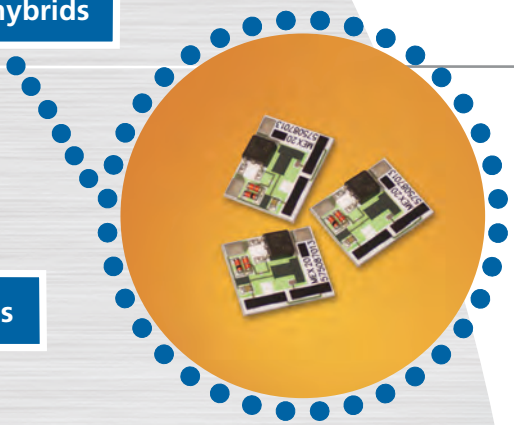
Market Applications

Communications	Automotive	Industrial	Medical	Consumer	Instrumentation	Military/Aerospace
• Enclosure temperature control	• Oil pan/engine block heaters • Fluid heaters • Cabin air pre-warmers • Fuel pre-heaters • Windshield washer fluid heaters	• Process control • Injection molding • Thermal management	• Blood/fluid analysis • Diagnostic systems • Surgical instruments	• Parking meters • Appliances/white goods • ATM displays • Hair dryers/ straighteners	• Precision test equipment • Laboratory equipment	• Fluid/fuel heating • Vehicle heating • Space thermal management

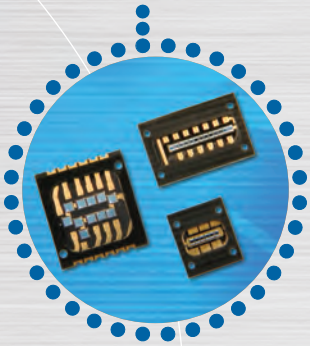
Custom "chip-on-chip" microelectronic assemblies

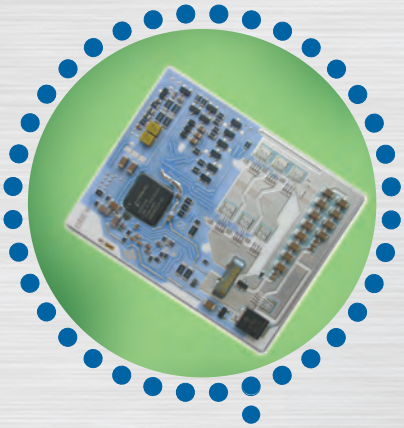


Commercial microcircuits and hybrids

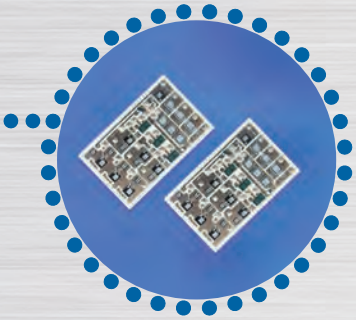


Optoelectronic microcircuits and hybrids



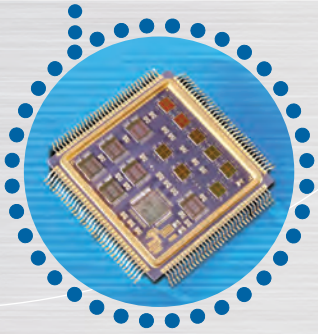


Standard power modules

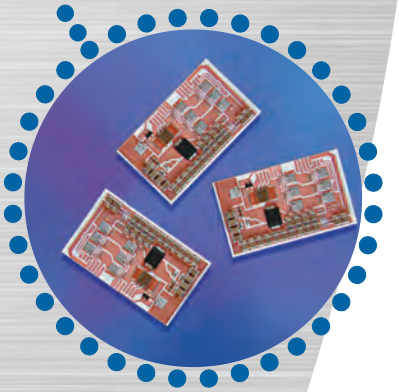


Automotive microcircuits and hybrids

High-reliability microcircuits and hybrids

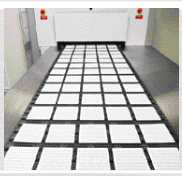


Custom power electronic microcircuits and hybrids



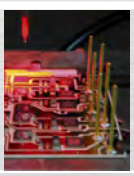
Military microcircuits and hybrids

Facilities



High volume dual atmosphere furnaces

Inline automatic optical inspection systems



Aluminum thick wire bonders

Automated printers

Automatic assembly

Hybrid microcircuit technology offers superior space saving and reliability

TT electronics' microcircuits and custom hybrid assemblies are designed to perform a wide range of digital and analog control functions in telecommunications, automotive, industrial, medical and military/aerospace applications. They provide superior reliability and space savings over larger circuit boards, and are less expensive to design than custom ICs for lower-volume applications. From miniaturized basic circuits to complex multi-function controls, TT electronics' microcircuit design engineers use a variety of advanced substrate, interconnect and packaging technologies to deliver reduced footprints, improved thermal management, and enhanced electrical and noise performance.

Product highlights

- Patchwork® technology for integration of power and control circuitry on ceramic or metal substrates
- Integrated solid state lighting control and thermal management microcircuits
- Hermetic and encapsulated chip and wire microelectronic assemblies
- Power modules for high current/high voltage applications
- Standard power factor correction and H-bridge power modules
- Optoelectronic hybrid assemblies
- Extended temperature assemblies (-55°C to +175°C)
- Custom thin film and thick film printed substrates and assemblies
- Ceramic, beryllia, silicon nitride, aluminum and steel substrates in a range of thicknesses

Technical capabilities

- Conductive ink systems include Au, Ag, PdAg, thick film copper (TFC®), platinum
- Comprehensive range of printed resistors (-55°C to +160°C)
- Clean room manufacturing capabilities
- Photo-defined thick films down to 1 mil
- Hermetic seal and local encapsulation
- Die attach (conductive/non-conductive epoxy, eutectic, solder)
- Ultrasonic wirebonding up to 20 mils
- Ultrasonic ribbon bonding up to 80x8 mils
- RoHS compliant manufacturing capability (Sn/Pb also available)
- Multi-site manufacturing – Europe, North America, Malaysia, China
- Gold and aluminum wirebonding

Qualifications

- ISO9000/QS9000/ ISO9001:2001
- ISO16949/TS16949
- BS9450
- ISO14001
- VDA6.1
- MIL-PRF-38534
- MIL-15XXX
- MIL-STD-883
- TX, TXV, B, S, and ESA level
- MUHAG

APPLICATIONS IN ACTION

A European automaker needed an electronic control module for the industry's first on-demand electrically-driven water pump. Using advanced microelectronics, including MOSFET drivers, copper conductors, ASIC control and combined logic and power circuits on ceramic substrates, TT electronics' engineers developed an integrated control module capable of reliable operation in the harsh underhood environment, while saving up to 6% in fuel consumption.

Market Applications

Communications	Automotive	Industrial	Medical	Consumer	Instrumentation	Military/Aerospace	Computer
• Surge protection • Current management • Power distribution • High frequency controls • AC/DC and DC/DC conversion • Accelerometers	• Steering controls • Electronic ECUs • Braking systems • Lighting controls • HVAC controls • Fuel and oil sensors • AC compressor controls • Decentralized actuators	• Utility metering • Motor drive controls • Access control systems • Power management • Power factor correction • Power tool speed control	• Defibrillators • Pacemakers • Diagnostic systems • Patient monitors • MRI/X-ray systems • Heating elements	• Home entertainment • Multi-media systems • Battery charge controllers • Appliances/ white goods • Hand tool controls	• Test equipment • Precision power supplies • Signal filtering	• Flight data recorder • Radar and navigation systems • Communications equipment • Avionics • Missile guidance/ fin control	• Data conversion • Space systems • Fuel monitoring • Accelerometers	• Power management • Printers/scanners • SCSI termination • DDR/SDRAM termination • Current sense circuits

Linear potentiometers

Precision potentiometers

Sealed multi-turn trimmers

Custom potentiometric assemblies

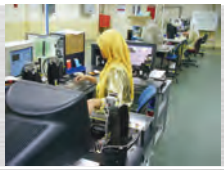
Turns-counting dials

Sealed single-turn trimmers

Facilities

Automated potentiometer production

In process inspection



100% final test

Precision potentiometer technology for position sensing and control

TT electronics is an industry leader in developing standard and custom precision potentiometers and trimmers for position sensing, control and adjustment applications in telecommunications equipment; automotive and vehicle controls; industrial equipment; test equipment; medical diagnostic systems; and military/aerospace applications. In many cases, TT electronics application engineers have taken standard potentiometer products and worked with customer design teams to develop a custom device to meet the demanding requirements of specific applications.

Product highlights

- Conductive plastic potentiometers
- Wirewound potentiometers
- Hybrid potentiometers
- Single- and multi-turn potentiometers
- Spring-return linear potentiometers
- Custom potentiometer assemblies
- Surface mount cermet trimming potentiometers
- Through-hole cermet trimming potentiometers
- Single- and multi-turn sealed trimming potentiometers
- Rotary and linear potentiometers

Technical capabilities

- Extensive range of models, contacts and pin configurations
- Rotational life in excess of 25 million cycles
- Linearity to ±0.02%
- Operating temperature range from -65°C to +175°C
- Miniature types down to 3mm case sizes
- Manufacturing capabilities in Europe, China, Malaysia, Mexico and United States
- Proprietary CP inks and rotor designs
- Space-level capability

Qualifications

- ISO9000/QS9000
- ISO9001:2001
- ISO/TS16949
- Meet or exceed MIL-PRF-12934 and 39023 standards

APPLICATIONS IN ACTION

A leading aerospace contractor needed a precision sensor for a critical circuit in the braking system of its latest military aircraft. After evaluating linear variable differential transformer (LVDT) non-contact sensors, they came to TT electronics for a custom potentiometric linear sensor that employed proprietary conductive materials and an advanced design to deliver a lifecycle of 5 million actuations; dual independent outputs; light weight (2 ounces) as well as superior sealing capability.

Market Applications

Communications	Automotive	Industrial	Medical	Consumer	Instrumentation	Military/Aerospace
• Base stations • Radar	• Motorcycle throttle controls • Snowmobile suspension controls • Golf cart pedal controls • Truck braking systems	• Printing presses • Security systems • Joystick controls • Fluid level sensing • Video monitors • Coin exchangers	• X-ray systems • Dental chair positioning • Hospital bed controls • Portable defibrillation • Injection systems • MRI/CT systems	• Guitar foot pedals • Amplifier controls • Exercise equipment • Appliances/ white goods	• Test equipment • Semiconductor processing equipment • Weather instruments • Altimeters • Chemical analysis systems	• Radar and navigation systems • Radio equipment • Aircraft temperature controls • Aircraft control surface positioning • Helicopter stabilizer controls

Open type trimmers

Panel potentiometers

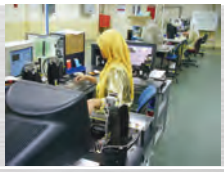
Tactile switches

Rotary mechanical encoders

Facilities

Automated potentiometer production

In process inspection



100% final test

Panel pot and switch technology for sensing and control applications

TT electronics offers a wide range of standard and custom panel potentiometers, tactile switches and open-frame trimmers for high volume applications in white goods and consumer electronics; automotive entertainment systems; industrial controls; test and measurement systems; musical instruments and audio equipment; medical devices; and military/aerospace applications. By providing a complete range of solutions in potentiometers, switches and trimmers, TT electronics can deliver the right technology to meet customers' application requirements.

Product highlights

- Conductive plastic potentiometers
- Sealed potentiometers
- Washable surface mount and through-hole tactile switches
- Surface mount and through-hole open type trimmers
- Mechanical incremental encoders

Technical capabilities

- Extensive range of models, contacts and package configurations
- Standard rotational life from 10,000 to 2 million cycles
- Carbon, cermet and conductive plastic elements
- Miniature types down to 3mm case sizes

Qualifications

- ISO9000/QS9000
- ISO9001:2001
- ISO/TS16949

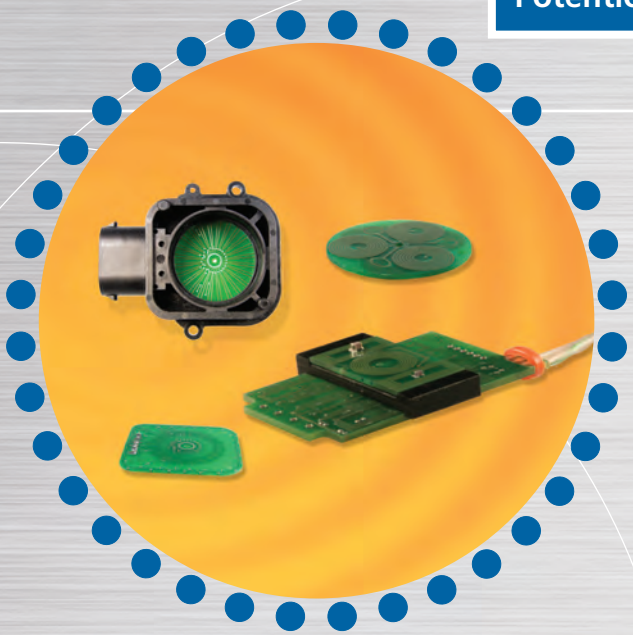
APPLICATIONS IN ACTION

A leading video game manufacturer needed a robust position sensor to translate the joysticks' position for the game controller. Using proprietary conductive plastic element technology, a robust contact mechanism and housing designed for long life operation, TT electronics engineers delivered a potentiometer that met the requirement for a reliable joystick interface with a life cycle of more than 7 million actuations.

Market Applications

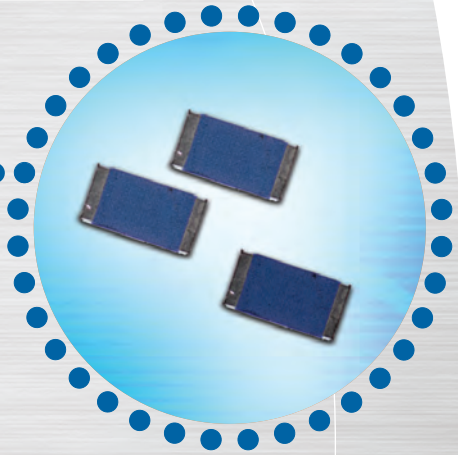
Automotive	Industrial	Medical	Consumer	Instrumentation	Military/Aerospace
• Temperature controls • Audio controls	• Operator interface controls • Safety systems • Hydraulic controls	• MRI/CT Scan equipment • Diagnostic/ analysis systems	• Security • Mixers • White goods	• Process control • Machine control • Weights and measurement	• Aircraft and missile control • Satellite position sensing

Potentiometric sensors

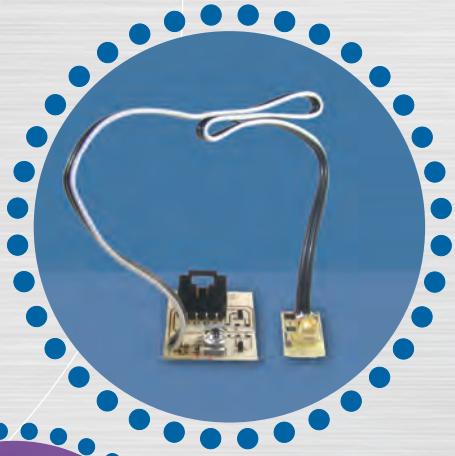


Autopad™ inductive non-contact sensor

Resistive temperature sensors



Hall-effect magnetic sensors



Optoelectronic sensors and assemblies

DAPS non-contact position sensor

Facilities

Clean room with automated screen printing lines

Custom, product specific laser tailoring

High temperature testing

Advanced sensor technology for applications in motion

TT electronics is an industry leader in the design, development and production of advanced sensor technology for automotive and transportation/off-road vehicles; industrial equipment; medical electronics; and military/aerospace control applications. With a comprehensive range of sensing technologies, including optoelectronics, Autopad, Hall-effect, non-contacting magnetic, DAPS (Digital Angular Position Sensor), and contacting potentiometric sensors, TT electronics design engineering teams combine their application experience with these advanced technologies to provide high reliability and precision performance sensing solutions for a wide variety of applications.

Product highlights

- AutoPad™ inductive contactless sensing technology
  - Absolute position, 360° angle sensing, and linear displacement measurement
- Hall-effect sensors and assemblies
  - Lockset security/cam and crank sensing/ precision, harsh environment position sensing for hi-rel applications
- Steering sensors
  - Redundant output position sensors
  - Combined position/torque steering sensors
  - Contacting and non-contacting technology
- Optoelectronic infrared sensors and assemblies
- LED and VCSEL technology
- Precision potentiometric sensors
  - Rotary and linear position torque and counting sensor assemblies
- Resistive temperature sensors
  - Platinum film, wirewound and thermistor technology
- Magnetic, capacitive, inductive and optoelectronic sensor technologies
- Custom sensor assemblies

Technical capabilities

- AutoPad contactless sensor technology delivers linearity performance <1% with 0.1% resolution at 10 bits
- DAPS contactless steering position sensors with <0.5% linearity & better than 0.1% resolution
- Magnetorque contactless customer programmable steering torque sensor for optimal performance
- Hall-effect magnetic sensors (bipolar and magnetoresistive) achieve linearity performance to 0.025%
- Infrared LED and VCSEL technology (850nm to 940nm wavelengths)
- Silicon and III-V design capability

Qualifications

- TS 16949/ISO9001
- VDA 6.1
- IEC751
- DIN 43760
- 100% in-house screening and QCI testing (Group A, B, C, D) per MIL-PRF-19500 method of MIL-STD-750 and MIL-STD-833, method 5005
- TX, TXV, B, S, and ESA-level process capabilities

APPLICATIONS IN ACTION

When a North American automaker required an economical non-contacting sensing technology for the chassis height sensors in vehicles with active suspension, TT electronics engineers delivered a solution based on the company's patented AutoPad™ technology. The non-contact precision inductive sensing system is capable of providing absolute position as well as relative displacement feedback with accuracy and linearity within 1%; and provides analog, ratiometric, PWM and digital outputs.

Market Applications

Automotive

- Chassis height control
- Vehicle suspension systems
- Driver interface control
- Pedal/throttle sensors
- Gearbox/transfer case boxes
- Steering, torque and position

Industrial

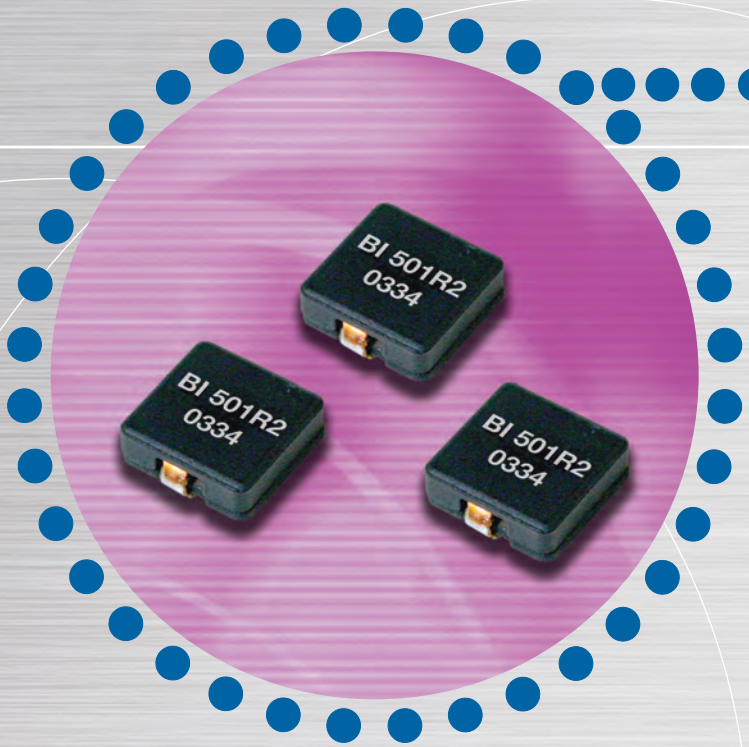
- Operator interface controls
- Safety systems
- Hydraulic controls

Medical

- MRI/CT Scan equipment
- Diagnostic/ analysis systems

Instrumentation

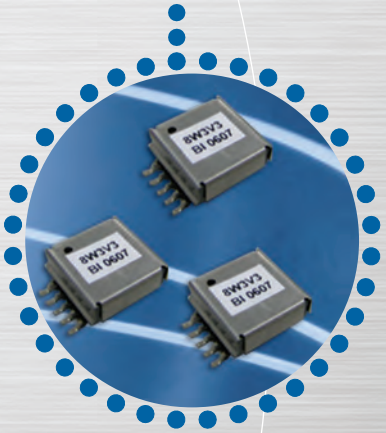
- Machine control
- Process control



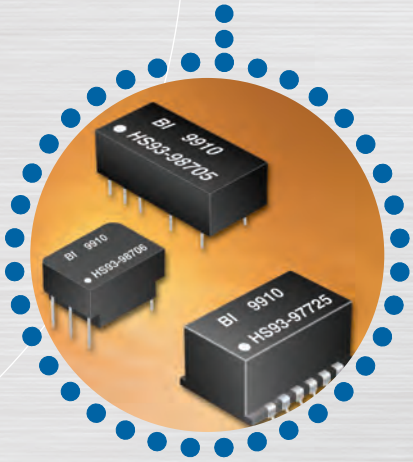
High current inductors

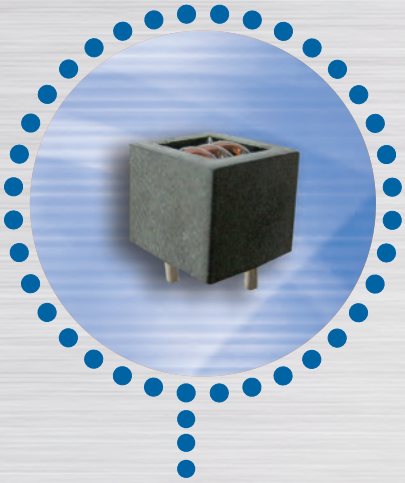
Chip inductors and beads

Power inductors/chokes

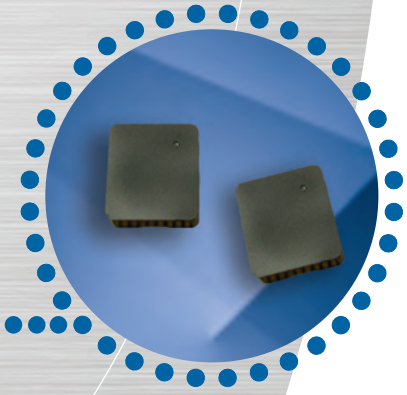


Network and telecommunications transformers





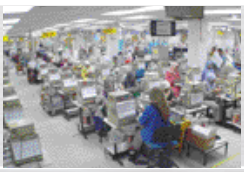
High frequency inductors



Molded inductors

Facilities

Lamination transformer assembly lines



Continuous flow transformer manufacturing

Computerized multi-testing stations

Magnetic components

TT electronics has developed a comprehensive range of innovative magnetic components to provide power control and signal integrity for telecommunications and networking equipment; automotive electronics; industrial electronic systems; portable computing and power electronics; medical diagnostic equipment; and military/aerospace applications. Working closely with customers' design teams, TT electronics engineers have pioneered magnetic component designs to deliver high frequency, high temperature, and high current performance using a variety of core materials and package designs to help meet challenging application requirements in both signal and power magnetics.

Product highlights

- High current inductors
  - Shielded and unshielded designs
- High frequency inductors
  - Rated to 5MHz
- High temperature inductors
  - Rated to +180°C
- Common mode chokes
- Current sense transformers
- Chip beads and inductors
- Telecommunications transformers
  - ADSL/HDSL/ISDN
- Network transformers
  - Gigabit Ethernet/Ethernet/T1/E1/CEPT RJ45/USB

Technical capabilities

- Core materials include proprietary ferrite, iron powder and MPP designs
- Surface mount bobbin designs for low profile devices
- Flexible manufacturing capabilities for high volume standard production or short-run special designs
- Design and manufacturing in multiple locations
- Custom magnetic designs available

Qualifications

- ISO9000
- ISO9001:2001
- ISO/TS16949
- UL Class B/H insulation

APPLICATIONS IN ACTION

A leading computer manufacturer was having problems with the memory boards in their PCs overheating. TT electronics engineers developed a uniquely-shaped, self-shielding toroid inductor that delivered better heat dissipation and shielding properties than traditional toroids, providing reduced power consumption and improved efficiency.

Market Applications

Communications
- Transformers
- Power supplies
- Antenna systems
- Splitters
- Line filters
- High frequency systems
- ISDN transformers

Automotive
- Position sensors
- Motor controls
- Keyless entry systems
- EMI protection
- Proximity switches
- Lighting controls

Industrial
- Power supplies
- Motor controls
- Actuators
- EMI protection
- Transformers
- Output filters

Medical
- Power management
- Power filtering
- Output power transformers

Consumer
- Appliances/ white goods
- Audio equipment
- Cameras/VCRs
- Battery chargers
- Radar detectors
- Set-top boxes
- Portable electronics

Instrumentation
- EMI filtering
- Power transformers
- Power filters

Military/Aerospace
- Power supplies
- EMI protection
- Motor controls
- Communications systems

Computer
- Power supplies
- LAN cards
- Data communications
- Modems
- High frequency communications
- Wireless communications

Global Company Headquarters

AB Mikroelektronik

Company Profile

AB Mikroelektronik provides technology development and manufacturing services for advanced application-specific microelectronic assemblies on ceramic, metallic and alternative substrates. Power modules and custom thick film circuits from AB Mikroelektronik are used in automotive, industrial and medical electronics applications ranging from motor control to lighting control systems.

Product Range

- Thick film hybrid circuits and sensors on a variety of substrates
- Power modules for high current/high voltage applications
- Chip and wire microelectronic assemblies
- Patchwork® hybrid circuits integrating power and control on a single substrate
- LED submounts/modules
- Printed thick film resistive heating elements on ceramic substrates

Contact Information

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BI Technologies ECD

Company Profile

BI Technologies' Electronic Components Division is a leading supplier of thick and thin film resistive components, potentiometers, trimmers, contacting and non-contacting automotive and industrial sensors and hybrid microelectronic assemblies. BI-ECD's thin film resistor networks provide precision performance on either ceramic or silicon substrates, and the company offers one of the industry's most extensive lines of precision and trimming potentiometers, panel pots and tactile switches. BI-ECD also has the capability to design, develop and manufacture custom precision potentiometers, and microelectronic assemblies for advanced sensing and control applications.

Product Range

- Precision potentiometers
- Trimming potentiometers
- Panel potentiometers
- Tactile switches
- Turns-counting dials
- Rotary binary encoders
- Custom contacting and non-contacting sensors
- Hybrid microelectronic assemblies and custom integrated assemblies
- Precision thin film resistor networks
- Integrated passive components and networks
- Steering sensors

Contact Information

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BI Technologies MCD

Company Profile

BI Technologies' Magnetic Components Division supplies miniature surface mount power inductors and transformers with high current ratings, signal transformers, common mode chokes, and toroidal inductors, as well as innovative design solutions to meet custom inductor and transformer needs. In addition to its headquarters' location in Fullerton, California, the company maintains a manufacturing facility in Kuantan, Malaysia, with global sales support offices in Singapore, India, and China, as well as additional sales support from BI Technologies' sister divisions in Europe and the USA.

Product Range

- Surface mount power inductors and transformers
- Toroidal surface mount and through-hole inductors
- Telecommunication and network transformer modules
- Common-mode chokes and filters
- Surface mount inductor chips and beads

Contact Information

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BI Technologies SMT

Company Profile

BI Technologies' Surface Mount Technology Division is one of Europe's leading worldwide suppliers of thick film passive components for high volume applications, including surface mount chip resistor arrays and networks, resistor-capacitor arrays and networks, diode and capacitor networks and arrays, power resistors for pulse, surge and high power applications, current sense circuits, as well as resistive heaters.

Product Range

- Surface mount chip resistors
- Surface mount thick film resistor networks and arrays
- Surface mount resistor-capacitor arrays and networks
- SIP and DIP packaged thick film resistors, capacitors, diode networks and arrays
- Power current sense resistors
- Planar power resistors
- Resistive heaters on ceramic substrate
- Screened sensors

Contact Information

BI Technologies Surface Mount Technology Division

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IRC AFD

Company Profile

IRC's Advanced Film Division is a leading supplier of thin and thick film resistive technologies on ceramic, silicon and metallized substrates for a wide range of applications. IRC's moisture-resistant TaNFilm® tantalum nitride thin film resistive elements provide the industry's only "self-passivating" resistor material for ultra-stable performance in high reliability applications. IRC offers a range of thick film power and current sense resistors; high frequency resistors and attenuators characterized to 40GHz; and Anotherm® anodized aluminum substrates are used extensively for LED thermal management.

Product Range

- Precision thin film resistors and networks
- Power thick film and current sense resistors
- MIL-qualified precision resistors and networks
- Wire bondable chip resistors and networks
- Anotherm® substrates for LED thermal management
- High speed digital ball grid resistor arrays
- RTD temperature sensors
- RF/Microwave components
- Precision BGAs

Contact Information

IRC Advanced Film Division

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IRC WAFT

Company Profile

IRC-WAFT provides a comprehensive range of wirewound, thick film and metal element resistive technologies for a wide variety of applications. WAFT's advanced thick film on steel (TFS) technology, as well as Anotherm® aluminum substrates, provide "on-demand" heating, dynamic braking and thermal management. IRC offers surface mount cylindrical power and metal element current sense resistors for high wattage power management and voltage regulation. The company also offers commercial-grade wirewound and film resistors for high volume applications.

Product Range

- Precision wirewound resistors
- Power wirewound, thick film and metal element current sense resistors
- High voltage commercial and military thick film resistors
- MIL-qualified precision wirewound and film resistors
- Cylindrical surface mount power resistors
- Anotherm® and TFS
- Commercial-grade film and wirewound resistors
- Custom resistor assemblies

Contact Information

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OPTEK Technology

Company Profile

OPTEK Technology is a leading supplier of visible LEDs and solid state lighting assemblies; as well as infrared optoelectronic and magnetic sensing technology for automotive, industrial, medical, consumer and military/aerospace applications. In addition to its headquarters in Carrollton, Texas, the company operates a manufacturing facility in Juarez, Mexico. OPTEK has comprehensive in-house test capabilities for both IR and visible LEDs.

Product Range

- Visible LEDs and LED lighting assemblies on Anotherm® substrates
- Infrared optoelectronic components: LEDs, VCSELs, photodiodes, phototransistors, photologic®
- Optoelectronic sensor assemblies and switches: slotted and reflective
- Fiber optic components: LEDs, VCSELs, receivers, transceivers
- Magnetic sensors: Hall-effect, uni-polar, and bi-polar
- AutoPad™ inductive contactless sensors

Contact Information

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Welwyn Components

Company Profile

Welwyn Components is Europe's leading supplier of advanced resistive technologies and custom microelectronic assemblies. Welwyn provides a wide range of resistive components, including power and precision wirewound and film components in a variety of packages and lead configurations, as well as comprehensive microelectronic design, development and manufacturing capabilities with extensive application engineering and technical support for customers.

Product Range

- Microelectronic assemblies and thick film substrates
- Chip and wire assemblies
- High-frequency/high density microelectronic assemblies
- Power wirewound, thick film and metal element current sense resistors
- Precision wirewound and thin film resistors
- Patchwork® hybrid circuits integrating power and control on a single substrate
- Custom resistor assemblies

Contact Information

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