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Electronic Design Starts Here.

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# Semiconductor Manufacturers are driving Industrial Sensing



**Industry 4.0 has made a significant impact on the electronics industry. A part of the broader fourth industrial revolution bringing digital principles to the world of manufacturing.**

With this, revenue from semiconductor sensing devices has increased, when coupled with continuing advancements in sensor technology and the emergence of 5G, AI and Machine Learning, semiconductor manufacturers look set to continue to benefit from a wider scale implementation of Industry 4.0 via the IIoT.

There are many drivers to support this, the continued development of consumables such as smartwatches and wearables, but ultimately the area for compound growth will come from the industrial markets, such as medical, health care, automotive & insurance, manufacturing and energy utility management. The predicted market growth for industrial sensing is 7% until 2026. Source: Global Market Insights, Inc.

The birth of Industry 4.0, which was initially formed as a high-tech strategy by the German government in 2011, came at a time when the internet of things (IoT) concept was also in its infancy. Today, the founding tenets of Industry 4.0 have found

adoption around the globe, and Industry 4.0 and the industrial application of the internet of things (IIoT) are well-suited.

Two of the founding principles of Industry 4.0 are interconnection and information transparency. The IIoT is at the very heart of interconnection. The basic premise behind

interconnection is to be able to digitally link manufacturing and production assets together via monitoring, control and analysis applications. The interconnection meant that any item of industrial automation or process equipment could provide data in real-time about its operational status and performance. Interconnection is also a two-way communication, allowing control of machinery and plant automatically or through human intervention.

The collection of data across a

whole production facility creates masses of data points, which when aggregated would yield the critical manufacturing management metrics of operational efficiency (OE) and overall equipment effectiveness (OEE) with ease.

Keeping any factory or production process running, with high levels of efficiency and effectiveness depends on reliable machinery. Unfortunately, anything mechanical tends to have parts that wear or fail over time. For a linear production process, the failure of one item of machinery can stop the whole factory, so over the years formal maintain, repair, and operate (MRO) regimes have become necessary to ensure production equipment keeps running. Thanks to the IIoT, implementation of a preventive maintenance routine is possible that gives plant management early warning to potential equipment failures and to be able to schedule maintenance intervention for when it is operationally most effective.

Acquisition of the critical data required for both operational and maintenance purposes comes from sensors deployed on production assets. This is where the semiconductor manufacturers come into force, the sensor development they have undertaken can be used to detect the common key indicators of performance levels through signature analysis. Sensors can detect vibration, temperature, humidity, sound and a whole host of other environmental factors. Many of these can be used to determine the operation life of assets, but more

importantly flag any issues that arise before unexpected costly breakdown occurs.

Also, inspection sensors such as camera sensors function as inputs to image recognition systems that check, for example, if a brand label affixed to a bottle does not conform to correct placement tolerances.

STMicroelectronics is helping customers to evaluate predictive maintenance implementation with the release of their STWIN prototyping evaluation board for IIoT applications (RS Stock No. 193-9794). This ultimately allows the user to deliver the benefits of condition monitoring on key critical industrial assets.

### STWIN from STMicroelectronics



There is a wide range of different sensor technologies in use today, from simple discrete thermistors to detect temperature, to complex micro-electromechanical (MEMS) sensors used to detect acceleration forces. The vast majority of sensor outputs today are processed into the digital domain within the sensor and then transmitted across wired or wireless networks to the host control and monitoring system.

### Technology innovations will drive Industry 5.0

Before many manufacturing organisations have even completed their Industry 4.0 deployments, the industry has started talking about Industry 5.0. Industry 5.0 offers the potential to bring the human back into the manufacturing loop, a notable omission in Industry 4.0.

Implementing Industry 4.0 hasn't been without its challenges. Factory floor space is at a premium across the world, so many manufacturing operations found themselves having to squeeze more and more electronics-based systems into existing control cabinets. In most cases, these were already nearly full, so packing more tech into a space-constrained cabinet required more innovation. Established industrial automation equipment manufacturers needed to make their PLCs and control cards more functionally dense, more power-efficient, and slimmer. Thankfully, the semiconductor industry provided the answers with innovations that offered higher levels of functional integration; for example, a four-channel analogue-to-digital converter (ADC) complete with a low noise isolated DC/DC converter compared to a

previous single-channel ADC. Intelligent power management ICs, and driving higher power conversion efficiencies by using wide-bandgap process technologies, reduce the amount of waste heat requiring dissipation, further reducing overall system size.

For Industry 5.0, innovations from the semiconductor industry will continue to be in demand. One aspect of Industry 5.0 is that for some processes, robots will work alongside skilled human counterparts. There has been a lot of research into the use of collaborative robots and how they need to interact with humans nearby. Safety barriers usually surround industrial robots to prevent accidents; however, to be productive cobots will need to work beside humans, introducing more sensing requirements.

Another lesson learnt from Industry 4.0 and its use of IIoT centres around the amount of data transmitted, latency, and cloud-compute capabilities. Many sensors do not include any control element; they send data to the production management system at a set frequency. Aggregated together with hundreds and potentially thousands of sensors in a single site, this can represent a significant data bandwidth requirement. Also, the communications node-cloud-control latency involved in receiving sensor data to taking action can be substantial, removing the possibility of cloud-based control for some tasks. New types of sensors need to not only sense but also infer a control action. Likewise, local gateway aggregators could have a degree of devolved autonomy passed to them to control specific tasks within predefined bounds.

The semiconductor industry is responding with low power microcontrollers that include sensing elements and enough compute resource to run task-specific artificial intelligence algorithms. These devices contain a computer hardware architecture optimised for inference at the edge. Sensors are becoming more intelligent, being able to predict, for example, if a human's hand might be within the path of the cobot's intended movement. Another example is using a machine learning algorithm to listen to the output from an audio sensor mounted within a motor housing to detect early signs of bearing wear.

### Constant innovation

Our rapidly changing environment together with technological developments is giving rise to the connected philosophy of Industry 4.0 and beyond. The ability to act on data gathered from sensors cuts across all aspects of our life, from consumables and wearables to healthcare and industry. The realisation of the founding principles of 4th (and 5th) industrial revolution is attributed to the growing adoption of industrial automation. With this, the part that semiconductor manufacturers play in the world of industrial sensing is only set to grow.

**Motor Driver Solution Kit for LV8548MC**

- Featuring Simple DC Motors & Stepper Drive
- Capable of easily driving 2 brushed DC motors
- Motor driving is made easy with Arduino Micro( compatibility)
- Comes with a Baseboard for facilitated plug-and-play connectivity with an Arduino Micro



**178-4398** Evaluation Board

**NUCLEO-H743Z12, uP & uC Dev Kit**

- An affordable and flexible way for users to try out new concepts and build prototypes by choosing from the various combinations of performance and power consumption features
- Provided by the STM32 microcontroller



**193-9787** Device Core ARM

**STM32G081B-EVAL Evaluation Board**

- A high-end development platform, for Arm Cortex-M0+ core-based STM32G081RBT6 microcontroller
- With USB Type-C and power delivery controller interfaces (UCPD)



**196-1916** Device Core ARM Cortex-M0+

**PAC1934 USB C Power Meter**

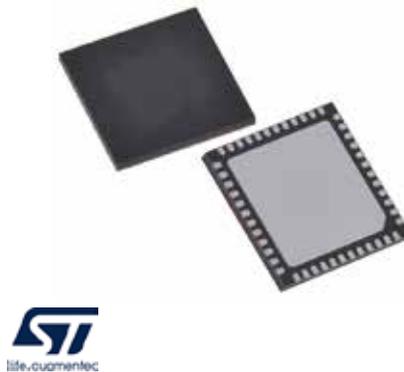
- USB Type C Power and Energy Meter based on Microchip's PAC1934, a Quad DC Power/Energy Monitor with Accumulation IC
- Provides a high precision approach for measuring the power consumption over an USB Type-C bus
- On-board OLED display and navigation switch make it easy to swap between different measurement screens



**187-7666** Development Board

**STM32L431CCU6, STM32 Microcontroller**

- Embed high-speed memories (Flash memory up to 256 Kbyte, 64 Kbyte of SRAM), a Quad SPI flash memories interface (available on all packages) and an extensive range of enhanced I/Os and peripherals connected to two APB buses, two AHB buses and a 32-bit multi-AHB bus matrix



**196-1466** ARM Cortex M4

**Analog Discovery 2™**

- A multi-function instrument that allows users to measure, visualize, generate, record, and control mixed signal circuits of all kinds



**194-6464** 14 bit Resolution

**SAM E70 Xplained Ultra Evaluation Kit**

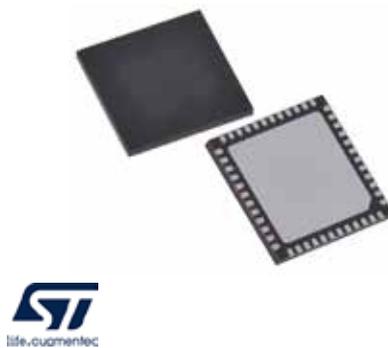
- A modular development system for Microchip's line of 32-bit Cortex® microcontrollers
- Contains: One SAM E70 Xplained Ultra Development Kit, One KSZ8061 Ethernet PHY and One Graphics card set up for 565 (16-bit color) graphics



**188-4854** 32-bit Cortex

**STM32F413CGU6, STM32 Microcontroller**

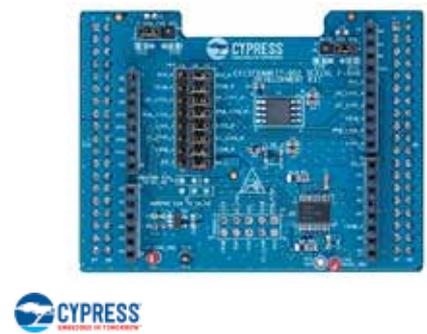
- Based on the high-performance Arm® Cortex®-M4 32-bit RISC core operating at a frequency of up to 100 MHz
- Their Cortex®-M4 core features a Floating point unit (FPU) single precision which supports all Arm single-precision data-processing instructions and data types



**196-1478** ARM Cortex M4

**CY15FRAMKIT-002 Serial F-RAM Development Kit**

- Excelon 108MHz OSPI F-RAM
- ST NUCLEO-433LC-P compatible Morpho headers (J9, J10)
- Arduino UNO R3 compatible I/O Header (J1 - J4)
- Headers J8 (1A-8A), J8 (1B-8B), J8 (1C-8C) to select Arduino or Morpho connector signal connectivity to F-RAM device
- J5 header for 1.8-V/3.3-V F-RAM device VDD power supply selection, and J6 header for 1.8-V/3.3-V selection for level shifters



**189-0538** On-board 4-Mbit (512Kx8)

## MAX17055ETB+T Battery Management

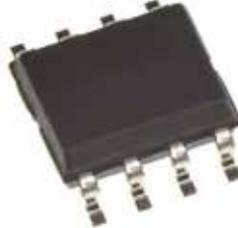
- ModelGauge m5 EZ
- No Characterization Required for EZ Performance
- Robust Against Battery Variation
- Eliminates Error Near Empty Voltage
- Eliminates Coulomb Counter Drift



**191-3254** Battery Type: Lithium-Ion

## M41T82RM6F Serial-12C bus RTC

- Ultra-low battery supply current of 365 nA
- Factory-calibrated accuracy of  $\pm 5$  ppm typical after 2 reflows [SOX18]
- Much better accuracies achievable using built-in programmable analog and digital calibration circuits
- 2.0 V to 5.5 V clock operating voltage



**188-9206** Alarm, Battery Backup, Calendar, Watchdog Timer

## MS4 Series AmbiMate Sensor Module

- Suitable for Building Automation and Connected Home applications onto a PCB assembly
- The pre-engineered multi-sensor modules are easily integrated onto a host product



**193-2018** MS4, CAST, WITH MIC

## MAX4533EAP+ Analogue Switch IC

- Rail-to-Rail Signal Handling
- $\pm 40$ V Fault Protection with Power Off
- $\pm 25$ V Fault Protection with  $\pm 15$ V Supplies
- All Switches Off with Power Off
- No Power-Supply Sequencing Required During Power-Up or Power-Down



**191-3268** Configuration: Quad SPDT

## ISL80103IRAJZ 2A and 3A Linear Regulator

- Stable with ceramic capacitors
- 2A and 3A output current ratings
- 2.2V to 6V input voltage range
- Very low 120mV dropout voltage at 3A



**196-8993** 3A, 0.8  $\rightarrow$  5.5 V, 120mV

## LSM6DSOX Adapter Board for a Standard DIL24 Socket

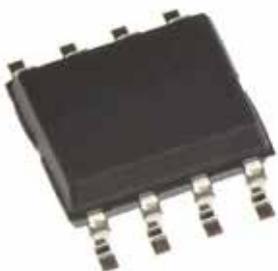
- Complete LSM6DSOX pinout for a standard DIL 24 socket
- Fully compatible with STEVAL-MK1109V3 motherboard
- Changing the resistor settings is also compatible with the STEVAL-MK1109V2 motherboard
- WEEE compliant
- RoHS compliant



**196-2595** Standard DIL24 Socket

## NCV8402AD Dual Self-Protected Low-Side Driver with Temperature and Current Limit

- A dual protected Low-Side Smart Discrete device
- The protection features include overcurrent, overtemperature, ESD and integrated Drain-to-Gate clamping for overvoltage protection



**186-9123** Surface Mount

## STM32F334R8T6, STM32 Microcontroller

- Incorporates the high-performance Arm<sup>®</sup> Cortex<sup>®</sup>-M4 32-bit RISC core operating at up to 72 MHz frequency
- Embedding a floating point unit (FPU), high-speed embedded memories (up to 64 Kbytes of Flash memory, up to 12 Kbytes of SRAM), and an extensive range of enhanced I/Os and peripherals connected to two APB buses



**196-2025** Family Name: STM32

## MAX9925AUB+ Sensor Interface

- Differential Input Stage Provides Enhanced Noise Immunity
- Precision Amplifier and Comparator Allows Small-Signal Detection
- User-Enabled Internal Adaptive Peak Threshold or Flexible External Threshold
- Zero-Crossing Detection Provides Accurate Phase Information



**191-4764**  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ , 10  $\mu\text{MAX}$

**Discovery Kit for STM32F746NG Microcontroller**

- AXI and multi-AHB bus matrices for interconnecting core, peripherals and memories
- Double-Precision Floating-Point maths unit on some variants
- Up to 16KB +16KB of I-cache and D-cache
- Up to 2MB of embedded Flash memory, with Read-While-Write capability on certain devices
- Up to 512KB of data memory



**882-0278** Device Core: ARM Cortex M7

**J-Link BASE Probe**

- A JTAG programming and debug probe supporting a large number of processor cores
- Supported by all major IDEs such as IAR EWARM, Keil MDK, Rowley CrossWorks, Atollic TrueSTUDIO, IAR EWVRX, Renesas HEW, Renesas e2studio, and many others



**131-1319** For Use With Flash microcontrollers

**Zynq®-7000 ZedBoard Development Kit**

- Zynq-7000 SoC XC7Z020-CLG484-1
- Onboard MT41K128M16HA-15E:D 512MB DDR3 SDRAM memory
- Onboard S25FL265S 256Mbit Quad-SPI serial flash memory
- 30 × 11mm 128 × 32px OLED display panel



**134-6457** For Xilinx Zynq-7000 SoC

**Discovery Kit for STM32F429ZI Microcontroller**

- STM32F429ZIT6 Cortex-M4F core microcontroller with 2MB Flash memory, 256KB RAM
- On-board 64MB (4M x 16-bit) SDRAM memory
- Use the kit as a standalone with the on-board ST-LINK/V2-B
- USB functions: Debug port, Virtual COM port, Mass storage
- 2.4in 240 × 320pixel QVGA TFT LCD display panel



**909-3660** Device Core: ARM Cortex M4F

**J-Link ULTRA+ Probe**

- A JTAG/SWD programming and debug probe supporting a large number of processor cores
- Features seamless integration into the IAR Embedded Workbench IDE and comes with integrated licenses for unlimited breakpoints in Flash memory, RDI / RDDI and J-Flash



**131-1321** For Use With Flash microcontrollers

**Altera USB Blaster**

- Links your PC to a 10-pin header connected to your FPGA
- Allows you to send configuration data from your PC to the FPGA during prototyping or to program data into the system during production
- Compatible with Windows and Linux machines
- The 10-pin being integrated into the device makes for effortless using



**690-4093** Programming modes: JTAG, Passive Serial & Active Serial

**Discovery Kit for STM32F407VG Microcontroller**

- 168MHz STM32F407VGT6 Cortex-M4F core microcontroller with 1MB Flash memory, 192KB RAM
- On-board LIS302DL or LIS3DSH MEMS 3-axis accelerometer
- On-board MP45DT02 MEMS audio omnidirectional digital microphone
- On-board CS43L22 stereo audio DAC



**910-7951** Device Core: ARM Cortex M4F

**J-Link PRO Probe**

- A JTAG/SWD programming and debug probe supporting a large number of processor cores
- Comes with integrated licenses for unlimited breakpoints in Flash memory, RDI/RDDI, GDB Server and J-Flash
- An Ethernet connection allows use of the debug probe far away from the PC, over a hard-wired or wireless network



**131-1322** For Use With Flash microcontrollers

**USB Flywire Cable Programmer**

- Used for 2-way communication with software tools like the Reveal logic analyser, and MicoSystem debugger
- The programming cables connect to either USB or PC parallel ports and use flywire connectors to the target board
- The functions provided by the programming cables correspond with available functions on Lattice programmable devices



**863-3526** Operating voltage: 1.2V to 3.3V

**2.5V Voltage Reference**

- Precision Fixed and Adjustable Voltage Reference ICs utilising series, shunt or series/shunt topologies and available in both through-hole and surface mount packages
- Initial Accuracy  $\pm 0.04\%$ , 8-Pin, SOIC



**759-0459** 2.5V

**LTC6409 Differential Amplifier/ADC Driver**

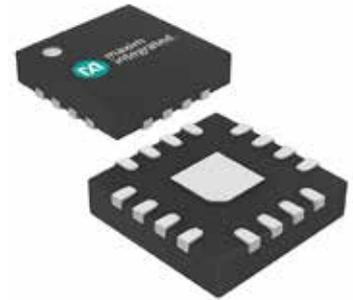
- 10GHz Gain-Bandwidth Product
- 88dB SFDR at 100MHz, 2VP-P
- 1.1nV/√Hz Input Noise Density
- Input Range Includes Ground
- External Resistors Set Gain (Min 1V/V)



**146-9100** 10GHz GBW

**MAX3748HETE+ Multirate Limiting Amplifier**

- SFP Reference Design Available
- 16-Pin TOFN Package with 3mm x 3mm Footprint
- Single 3.3V Supply Voltage
- 86ps Rise and Fall Time
- Loss of Signal with Programmable Threshold



**191-3314** 155Mbps to 4.25Gbps

**16 Bit Digital to Analogue Converter**

- Low power, octal, 12-/16-bit buffered voltage output digital-to-analog converters (DACs)
- Include a 2.5 V, 2 ppm/°C internal reference (enabled by default) and a gain select pin giving a full-scale output of 2.5 V (gain = 1) or 5 V (gain = 2)



**915-6483** 8-Channel 16 bit DAC, 20-Pin TSSOP

**High Accuracy Instrumentation Amplifier**

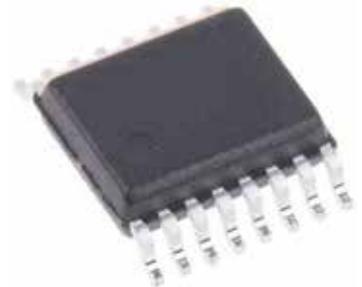
- Low Offset Voltage: 100  $\mu$ V max
- Low Drift: 2  $\mu$ V/C max
- Wide Gain Range: 1 to 10,000
- High Common-Mode Rejection: 115 dB min
- High Bandwidth (G = 1000): 200 kHz typ



**111-1111** 0.2mV Offset 1.2MHz, 8-Pin PDIP

**MAX3645EEE+ Limiting Amplifier**

- Pin Compatible with the Mindspeed
- MC2045-2/MC2045-2Y
- 500 $\mu$ V Input Sensitivity (BER = 10-12)
- Compatible with 4B/5B Data Coding
- Programmable LOS Threshold



**732-9519** +2.97V to +5.5V, 125Mbps to 200Mbps

**OP07/27/37 Precision Op Amps**

- Low offset voltages generally eliminate the need for external nulling
- Bias-current cancellation circuitry for low input bias and offset currents
- Outstanding noise performance with low 1/f noise corner frequency



**759-0617** 8MHz, 8-Pin CDIP

**AD595AQ Monolithic Thermocouple Amplifier**

- Pretrimmed for Type J (AD594) or Type K (AD595) Thermocouples
- Can Be Used with Type T Thermocouple Inputs
- Low Impedance Voltage Output: 10 mV/8C



**106-6379** 15kHz, 5 V, 14-Pin CDIP

**MAX3747AEUB+ Low-Power SFP Limiting Amplifier**

- Pin Compatible with Micrel SY88993V
- 155Mbps to 3.2Gbps Operation
- > 57dB of Gain
- < 10-12 BER with 2mV-P Input Amplitude
- 18mA Supply Current



**191-4738** 155Mbps to 3.2Gbps

**0603 (1608M) 100nF Multilayer Ceramic Capacitor**

- Highly reliable tolerance and high speed automatic chip placement on PCBs
- Wide capacitance range
- Wide temperature compensation and voltage range: from COG to Y5V and from 6.3V to 50V
- Highly reliable performance
- Highly resistant termination metal



**766-5443** CAP CER 0.1UF 50V X7R 0603

**154 (x3) $\mu$ F Polypropylene Capacitor, B25667C Series**

- Three-phase, delta connected
- Self-healing technology
- Naturally air cooled (or forced air cooling)
- Dry type, gas impregnated, non-PCB
- Suitable for use in power factor correction applications



**EPCOS**  
**460-376** PP 440V ac -5 → +10% Tolerance Screw Terminal

**PME 271Y Series Paper Capacitor**

- Internationally approved
- Rated voltage 250 V ac 50/60 Hz
- Capacitance range 0.001 – 0.1  $\mu$ F
- Lead spacing 10.2 mm to 25.4 mm
- Capacitance tolerance:  $\pm$ 20%



**Electronic Components KEMET**  
**210-594** 4.7nF 250V ac  $\pm$ 20% Tolerance PME271Y Through Hole +100°C

**CK06 Series Radial Leaded Capacitor**

- Provide industry standard models to your applications
- Available in a wide variety of Voltages, capacitance and tolerance
- All ceramic models are highly reliable and excellent quality
- X7R Dielectric suitable for bypass, decoupling, filtering, sample and hold and timing circuits



**AVX**  
**172-6468** 1 $\mu$ F MLCC 50V dc  $\pm$ 10% Axial

**2200 $\mu$ F 400V dc Aluminium Electrolytic Capacitor, ALS30/31 Series**

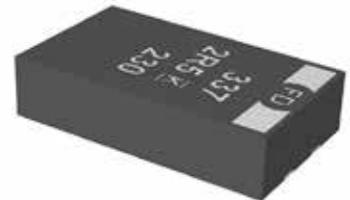
- Compact size
- Long life expectancy up to 20000 h
- High ripple current
- Excellent surge voltage capability
- Aluminium insert terminals with M5 threads



**Electronic Components KEMET**  
**381-9346** Chassis Mount 66 × 105mm +85°C 66mm 105mm

**Polymer Electrolytic (KO-CAP<sup>®</sup>) Tantalum Capacitor T523 Series**

- Preferred solutions for applications requiring power loss protection (hold-up) or maximum power efficiency of a circuit when board space is limited
- Polymer Tantalum, Reduced Volume, 470  $\mu$ F, 20%, 16 VDC, SMD
- Polymer, Molded, Face Down Terminals, 70 mOhms, 7360, Height Max = 2mm



**Electronic Components KEMET**  
**179-3172** 470 $\mu$ F 16V dc Polymer Solid  $\pm$ 20% Tolerance

**28 (x3) $\mu$ F Polypropylene Capacitor, B25667C Series**

- Three-phase, delta connected
- Self-healing technology
- Naturally air cooled (or forced air cooling)
- Dry type, gas impregnated, non-PCB
- Suitable for use in power factor correction applications



**EPCOS**  
**775-4757** PP 690V ac -5 → +10% Tolerance

**PMR 209 Series RC Network Capacitor**

- Metallised Paper X2, 250Vac
- RC unit suitable for use in DC & AC applications for contact protection interference suppression of contacts and transient suppression
- Small dimensions
- Self-extinguishing encapsulation
- 1-way Through Hole



**Electronic Components KEMET**  
**206-7881** 100nF 100Q Tolerance  $\pm$ 20% 250 V ac, 630 V dc

**Type C2012 [0805 inch] Multilayer Ceramic Chip Capacitor**

- High capacitance through precision technologies that enable the use of multiple thinner ceramic dielectric layers
- A monolithic structure ensures superior mechanical strength and reliability
- Low ESL and excellent frequency characteristics allow for a circuit design that closely conforms to theoretical values
- Low self-heating and high ripple resistance due to low ESR



**TDK**  
**111-0428** 0805 (2012M) 22 $\mu$ F MLCC 10V dc  $\pm$ 20% SMD

## RF Power Transistor, N-Channel MOSFET

- Gold metallization
- Excellent thermal stability
- Common source configuration
- P-OUT = 150 W min. with 14 dB gain @ 175 MHz
- Thermally enhanced packaging for lower junction temperatures



**917-3356** N-Channel MOSFET, 20 A, 125 V, 4-Pin M174

## VS-T70HF40 Silicon Junction Diode

- Electrically isolated base plate
- Types up to 1200 VRRM
- 3500 VRMS isolating voltage
- Simplified mechanical designs, rapid assembly
- High surge capability



**395-9163** 400V 70A, Diode, 2-Pin T-Module

## VS-FB190SA10 N-Channel MOSFET

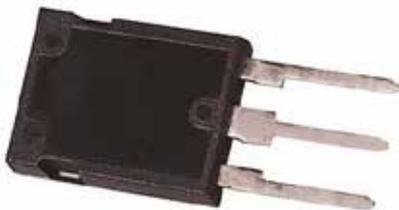
- Fully isolated package
- Very low on-resistance
- Fully avalanche rated
- Dynamic dV/dt rating
- Low drain to case capacitance



**919-0953** 190 A, 100 V, 4-Pin SOT-227

## STGY50NC60WD IGBT

- A 3-terminal power semiconductor device, noted for high efficiency and fast switching
- Low C-RES / C-IES ratio (no cross-conduction susceptibility)
- Very soft ultra fast recovery antiparallel diode



**170-2164** 50 A, 600 V, Max247

## VS-GB100TS60NPBF INT-A-PAK Series IGBT

- Generation 5 Non Punch Through (NPT) technology
- Ultrafast: Optimized for hard switching speed 8 kHz to 60 kHz
- Low VCE(on)
- 10  $\mu$ s short circuit capability
- Square RBSOA



**159-6607** 108 A max, 600 V, Surface Mount

## ST110S16P1PBF Phase Control Thyristor

- Center gate
- International standard case TO-209AC (TO-94)
- Compression bonded encapsulation for heavy duty operations such as severe thermal cycling
- Hermetic glass-metal case with ceramic insulator



**169-5959** 1600V 110A, 150mA 3-Pin, TO-94

## STH3N150-2 Power MOSFETs

- 100% avalanche tested
- Intrinsic capacitances and Qg minimized
- High speed switching
- Fully isolated TO-3PF plastic package, creepage distance path is 5.4 mm (typ.)
- H2PAK-2 package



**792-5861** N-channel 1500 V, 6 Ohm typ., 2.5 A PowerMESH™

## VS-26MB160A Bridge Rectifier

- Universal, 3 way terminals: push-on, wrap around or solder
- High thermal conductivity package, electrically insulated case
- Center hole fixing
- Excellent power/volume ratio



**227-8716** 25A 1600V, 4-Pin D 34

## BA159GP-E3/54 Switching Diode

- Superefficient structure for high reliability condition
- Cavity-free glass-passivated junction
- Fast switching for high efficiency
- Low leakage current, typical IR less than 0.1  $\mu$ A
- High forward surge capability



**815-1178** 1A 1000V, 2-Pin DO-204AL

**OptiMOS™5 Power MOSFETs**

- Optimized for synchronous rectification
- 100% avalanche tested
- Superior thermal resistance
- N-channel, normal level
- Qualified according to JEDEC1) for target applications



**178-7445** 180 A, 60 V OptiMOS 5, 7-Pin D2PAK

**OptiMOSTMPower-MOSFET,30V**

- Optimized for e-fuse and ORing application
- Very low on-resistance
- 100% avalanche tested
- Superior thermal resistance
- N-channel



**168-5941** 300 A, 30 V OptiMOS, 8+Tab-Pin HSOF

**32-bit ARM Cortex M3 Microcontrollers**

- 72MHz, 256 kB Flash, 64-Pin LQFP
- 32-bit RISC
- Pin to pin software compatible
- SRAM up to 96 Kb
- Flash up to 1MB



**145-9607** In a Tray of 160

**714-1079** Each

**62mm Module Series IGBT Module**

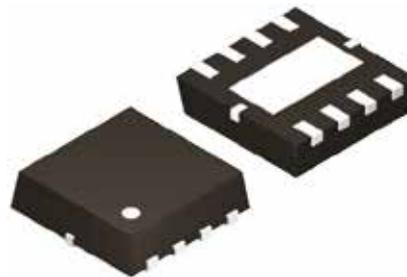
- Dual NPN, 580 A, 1.75 V, 2.4 kW, 1.2 kV, Module
- Extended Operation Temperature
- Low Switching Losses
- 4kVAC 1min Insulation
- Package with CTI>400



**124-9045** 580 A max, 1200 V, Panel Mount

**PowerTrench® N-Channel MOSFET**

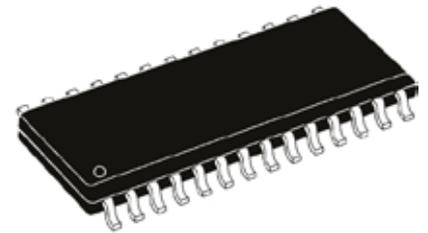
- Advanced Package and Silicon combination for low rDS(on) and high efficiency
- MSL1 robust package design
- 100% UIL tested



**166-2155** 130 A, 80 V, 2.4 mΩ

**8-bit Microcontroller**

- 40 MHz Max. CPU Speed
- 75 Instructions – 83 with Extended Instruction Set Enabled
- 31 Level Hardware Stack
- Configurable Internal Oscillator – Selectable Frequency Range 8 MHz to 31 kHz



**145-9382** 40MHz, 16 kB Flash, 28-Pin SOIC

**40V OptiMOSTMPower-MOSFET**

- Optimized for synchronous rectification
- Very low on-state resistance RDS(on)
- 100% avalanche tested
- Superior thermal resistance
- N-channel, logic level



**171-1961** 40V 100A 1.4m

**Schottky Barrier Diode**

- Low Loss and Soft Recovery
- Parallel legs
- Very low Vf
- Extremely low switching losses
- Low Irm values



**193-048** 100V 120A, 4-Pin SOT-227B

**ATTINY3217-MN Microcontroller**

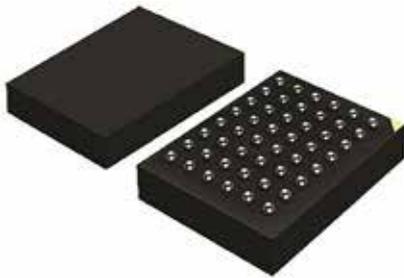
- Members of the tinyAVR® 1-series of microcontrollers
- Using the AVR® processor with hardware multiplier
- Running at up to 20 MHz, with 16/32 KB Flash, 2 KB of SRAM, and 256 bytes of EEPROM in a 24-pin package



**193-6222** 24pin, 8-bit data bus width

**CY62187EV30 MoBL® 64-Mbit Static RAM**

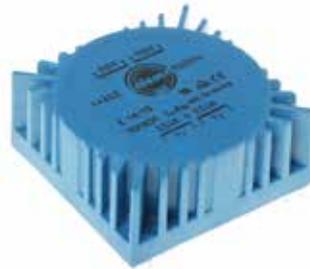
- Very high speed - 55 ns
- Wide voltage range - 2.2 V to 3.7 V
- Ultra low standby power
- Ultra low active power



**171-0985** 64-Mbit (4 M x 16)

**Miniature Encapsulated PCB Mount 115/230Vac Primary Transformers**

- Low profile compact design
- Fully encapsulated to UL94-V0
- Extremely low level of radiated magnetic field
- Extremely low level of hum and noise
- High efficiency and low temperature rise



**223-9317** 15VA, 2 x 7V ac

**CM33002 Single Phase Portable Isolation Transformer**

- Double-wound construction
- Secondary centre-tap earthed to minimise shock risk
- Thermal safety fuse embedded into primary winding
- Resettable thermal cut-out in primary circuit to prevent overload
- Approx. 2m mains cable fitted with UK 13A plug



**260-4294** 1.65kVA, 230V ac, 10A, dual socket

**AT27C1024 1-Megabit (64K x 16) OTP EPROM**

- Fast Read Access Time - 45 ns
- Low-Power CMOS Operation
- JEDEC Standard Packages
- Direct Upgrade from 512K (AT27C516) EPROM



**127-6553** 1Mbit 64K x 16 bit 70ns 44-Pin PLCC

**Encapsulated with Leads 230Vac Primary Transformer**

- 50VA Encapsulated Style, with Leads
- 230V Primary, Dual Secondaries
- High quality encapsulated toroidal transformers with a single 230V/50-60Hz primary winding
- Twin secondary windings may be connected in series or parallel, or used independently



**223-8623** 50VA, 2 x 18V ac

**CM10K36 3 Phase Isolation Transformer**

- Safety isolating transformers for building and construction site applications having continuous ratings of 5kVA and 10kVA
- Heavy duty sheet steel enclosure with lifting handles to withstand arduous building site conditions IP23 rating
- Double wound with safety earth screen between windings



**436-8855** 10kVA, 400V ac, 90A

**1 Mb I2C CMOS Serial EEPROM**

- Supports Standard, Fast and Fast-Plus I2C Protocol
- 1.8 V to 5.5 V Supply Voltage Range
- 256-Byte Page Write Buffer
- Hardware Write Protection for Entire Memory



**121-6321** 1Mbit, 400ns 8-Pin UDFN I2C

**Open Style Toroidal Transformer with Twin Primary Windings**

- 500VA Open Style, with Leads
- Dual 115V Primaries, Dual Secondaries
- High quality open style toroidal transformers with dual 115V/50-60Hz primary windings
- Twin secondary windings may be connected in series or parallel, or used independently



**420-9201** 500VA, 2 x 40V ac

**RKD Toroidal Transformers with Dual 115Vac Input**

- High quality open style toroidal transformers with dual 115Vac 50/60Hz primary and secondary windings which may be connected in series or parallel or used independently



**752-9246** 1000VA, 2 x 50V ac

**MAX3485EESA+ RS-485 Line Transceiver**

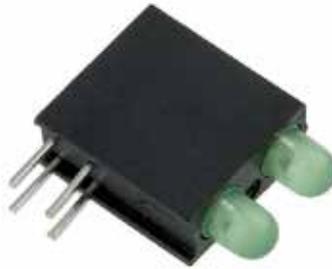
- Operate from a Single 3.3V Supply— No Charge Pump!
- Interoperable with +5V Logic
- 8ns Max Skew
- 2nA Low-Current Shutdown Mode



**103-9962** RS-422, RS-485, 3 → 3.6 V, 8-Pin SOIC

**5553-0122F Green Right Angle CBI® LED PCB Indicator**

- 2 × 3mm (T-1) LEDs
- Bi-level black plastic housing
- Right angle package
- Variety of LED colours
- High reliability



**917-0763** 2 LEDs 3mm (T-1), Through Hole

**DEHNguard Modular Surge Arrester Type 2**

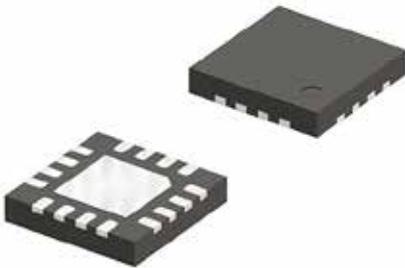
- Energy coordinated with other Dehn Redline products in accordance with BS7671 amendment 1
- High discharge capacity using heavy duty metal oxide varistors and spark gaps
- Status indication using Thermo Dynamic Control for monitoring of the SPD
- Tool less replacement of the plugs for repair and test functions



**808-7932** 1000 V 40kA DG, DIN Rail Mounting

**DG9408EDN-T1-GE4 Multiplexer Switch IC**

- Break-before-make guaranteed
- Low leakage
- TTL, CMOS, LV logic (3 V) compatible
- 2500 V ESD protection (HBM)
- Fast switching speed



**164-8302** Single 8:1, 3 → 16 V, 16-Pin QFN

**571-01 Series LED Circuit Board Indicator**

- 2 × 2mm (T-¾) LEDs
- Variety of LED colours
- Black plastic housing
- Bi-level
- DIN 41494 compatible



**546-1113** 2 LEDs, Through Hole 2.1V

**22 mm Servo Mount 157 Series Precision Potentiometer**

- 1 W conductive plastic
- Precision servo mount potentiometers
- Available with a linearity of 0.5% or 2.0%



**294-3684** 3.18 mm Dia. Shaft, 5kΩ, ±20%, 1W, Linear

**Isolated, Single-Channel RS-232 Line Driver/Receiver**

- 2.5 kV fully isolated (power and data) RS-232 transceiver
- isoPower integrated, isolated dc-to-dc converter
- 460 kbps data rate
- 1 Tx and 1 Rx



**912-9456** EIA/TIA-232-E, RS-232, 5 V, 20-Pin SOIC W

**ESP415 M1 Mains Surge Protector**

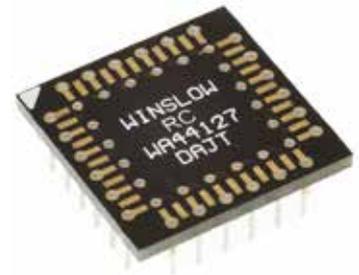
- Very low let-through voltage between all lines (L-E, L-N, N-E)
- LED status indication with pre-failure warning
- Remote indication through volt-free contact
- Robust steel housing
- Neutral to Earth voltage warning



**456-8099** 280 V 6.25 kA, 80 kA, Panel Mount

**Straight Through Hole Mount 1.27mm Pitch IC Socket Adapter**

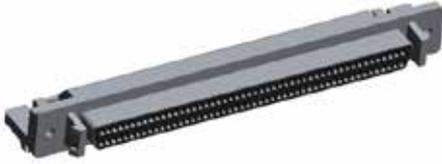
- Converts a PLCC package to a PGA thru hole footprint
- Can be supplied with or without PLCC production sockets
- 1.6mm above board height



**741-9350** 84 Pin Female PLCC to 84 Pin Male PGA

### AMPLIMITE .050 Series III D-Sub Shielded Receptacle Header Connector

- Compact, space saving design
- Full shielding for EMI/RFI protection
- Compatible with surface mount reflow solder process
- Integral board locks secure PCB connection and grounding
- Rails and latch blocks for secure mating connection



**684-1361** 100 Contacts, Female

### AMPLIMITE HDP-20 pin Crimp Contact

- Contact size: 20DF
- Pin diameter: 0.04 (1.02)
- Gold plated for quality
- Available in both pin and socket options



**191-8238** 20 DF

**NEW**

### AMPLIMITE Shielded Cable Clamp

- Die cast 90° exit, two-piece
- For use with HDE Metal-Shell and HDP Metal-Shell (tin plated only) d-sub cable connectors
- Nickel over copper plated zinc alloy shields
- Supplied with 3 × zinc plated steel 4-40 pan head screws and 2 × latch head screws and a stainless steel one-piece slide-latch



**191-8363** Size 3

**NEW**

### ADK Series Zinc D-sub Connector

- Nickel plated die-cast zinc ADK backshells come as a complete kit comprising Shells, jackscrews and cable grommets to suit 4, 5, 7 and 9mm cable diameters



**446-0866** 9 Way, Strain Relief

### AMPLIMITE HD-20 Series GD-Zn Angled D-sub Connector Backshells

- High quality diecast backshells with dual cable entry
- Ideal for 'daisy-chaining' connection within, e.g. industrial BUS systems applications
- Provided with a blanking plate to maintain screening integrity at the end of a cable run



**472-6879** 25 Way

**472-6885** 37 Way

### AMPLIMITE HDP-20 Series D-sub Connector Contacts

- Gold over Nickel Plated Signal
- Contact size: 20DF
- Pin diameter: 0.04 (1.02)



**680-9695** Size 20 Female Crimp

**680-9689** Size 20 Male Crimp

### AMPLIMITE D-Sub Connectors, Series 109 Contacts

- AMPLIMITE series 109 MIL-C-24308 and MIL-C-39029 d-sub connectors
- Screw-machined with a copper alloy body material with gold plating on the contact area
- Insulation diameter 1.83mm



**680-9210** Crimp snap-in pin contact 24-20 awg

**680-9222** Crimp snap-in socket contact 24-20 awg

**782-6250** Crimp snap-in pin contact 28-26 awg

### AMPLIMITE Series D-sub Connector Backshell

- RFI / EMI shielding
- Design comprises two shell halves
- Metal cover caps are specially designed for shielded cables
- Screws are supplied as a set with 2 units



**454-3696** Size 1

### AMPLIMITE Female Crimp D-sub Connector Contacts

- Socket, 20 D-Sub Contact Size
- Phosphor Bronze, Gold, Crimp
- Wire Size 24 - 20 AWG, Wire Size .2 - .6 mm<sup>2</sup>, Cable-to-Cable



**192-0349** Size 20, A Pack of 50

**192-0038** A Reel of 10000

**NEW**

## MHDTZK-RA Series Zinc D-sub Connector Backshells

- 2 piece diecast zinc backshells with plastic strain relief inserts and earth connection
- Nickel plate finish. Meets VDE0781 and FCC207 shielding regs
- Attenuation; >40dB (30MHz to 1GHz)
- Accepts 3.5mm to 13mm cable



**460-985** 9 Way, Strain Relief, Plastic screws, Silver

**460-979** 25 Way, Strain Relief, Silver

## MHDTZK-BK Series Zinc D-sub Connector Backshell

- 2 piece diecast zinc backshells with plastic strain relief inserts and earth connection
- Nickel plate finish
- Meets VDE0781 and FCC207 shielding regs
- Attenuation; >40dB (30MHz to 1GHz)
- Accepts 3.5mm to 13mm cable



**180-7206** 9 Way, Strain Relief, Black

## MHDM Series Zinc D-sub Connector Backshell

- 2-piece die-cast hoods
- Exceptional RFI/EMI shielding
- Designed for quick and easy assembly of cable to hood
- Cable is held in place whilst the rest of the assembly is completed



**447-7369** 25 Way, Strain Relief

## MHDTZK Series Zinc Nickel Plated Hood

- Rapid Assembly Backshells, re-openable
- A multi diameter ABS grommet Strain Relief provides a secure termination to the Hood for cables up to 13 mm Outside Diameter
- Supplied with full metal UNC 4-40 threaded Jackscrews



**821-2737** 15 Way, Strain Relief

## MHDTPK Series ABS D-sub Connector Backshell

- Nickel plated ABS hoods to UL94-V0 with conductive plastic strain relief grommet
- Meets FCC20780 and European screening requirements
- Accepts 4-12mm foil, lap or braided cable



**322-9759** 9 Way, Strain Relief, Black

## MHDPK-SLIM Series 9 Way D-Sub Socket Connector Kit With Contact Insert

- Straight 180° PA66 backshells with either Pin or Socket connectors
- Gold plated with the Solder Bucket terminations being Tin plated
- With Quick-Lock system that can be re-opened and are suitable for any common D-Sub connector
- Cable with upto 11.5 mm outside diameter can be accommodated



**765-9555** Hood, UNC 4-40 Thumb Screws

## SCSI Series PCB Mounted I/O Plug

- Male 68 Pin Right Angle Through Hole SCSI Connector
- 2.54mm Pitch, Solder



**813-3313** 68 Contacts

## MHDTZK-RA Series Zinc D-sub Connector Backshell

- 2 piece diecast zinc backshells with plastic strain relief inserts and earth connection
- Nickel plate finish. Meets VDE0781 and FCC207 shielding regs
- Attenuation; >40dB (30MHz to 1GHz)
- Accepts 3.5mm to 13mm cable



**454-930** 15 Way, Strain Relief

## MHDTZK Series Zinc D-Sub 9 Way Connector Kits

- Straight 180° Die Cast Zinc nickel plated backshells and unplated compression inserts with either Pin or Socket connectors
- The mating part of the contacts are Gold plated with the Solder Bucket terminations being Tin plated



**765-9432** Socket kit 9 way stamped

**765-9438** Plug kit 9 way stamped contacts

### DL 96 Way Heavy Duty Power Connector Plugs

- Any number of contacts can be loaded into individual cavities, up to the maximum stated
- Current rating is 5A
- Voltage rating is 1.2kVAC
- Long life - 10000 mating cycles
- Moulded alpha numeric cavity grid reference



**406-616** 96 Way

**406-622** 156 Way

**406-739** 260 Way

### DL, DLM Series Metal, Polymer Right Angle D-sub Connector Backshell

- 96 Way, Strain Relief
- Long life - 10000 mating cycles
- Cam actuated zero insertion force coupling
- Backshell/strain relief and polarisation options
- Metal and plastic plug and socket bodies



**341-9019** 96 Way, Strain Relief

### Metal D-sub Connector Backshell

- Full metal hoods, knurled screw
- Zinc die-cast, Screw locking
- 1 top entry
- Crimp flange or screw clamp
- IP 40



**692-7263** 9 Way

### DL Series Metal Right Angle D-sub Connector Backshell

- 260 Way, Strain Relief
- Long life - 10000 mating cycles
- Cam actuated zero insertion force coupling
- Backshell/strain relief and polarisation options
- Metal and plastic plug and socket bodies



**406-767** 260 Way, Strain Relief

### har-port USB Couplers

- Compact and well-shaped service interface in a timeless attractive design
- Number of ports: 2x USB Typ A
- Mounting: Screwable in cover plates
- Degree of protection: IP 20
- Mating cycles: min. 1500



**765-8748** USB 2.0 Female

**765-8757** USB 3.0 Female

### D-sub Hood Metallized Connector Backshells

- Thermoplastic, strain relief connector backshell
- Complete with knurled screws and internal cable clamp
- Ambient temperature range from -20°C to +90°C
- RoHS compliant with exemption

**NEW**



**200-6430** 9-PIN ND

**200-6431** 15-PIN ND

**200-6433** 25-PIN ND

**200-6434** 37-PIN ND

### DL Series Metal D-sub Connector Backshell, 360 Way, Strain Relief

- 360 Way, Strain Relief
- Long life - 10000 mating cycles
- Cam actuated zero insertion force coupling
- Backshell/strain relief and polarisation options
- Metal and plastic plug and socket bodies



**295-3546** 360 Way, Strain Relief

### D-Sub Mixed Series DIN 41652 T1 Connector Coaxial Contact

- Coaxial contact, Straight, for cables RG-174 U, 188 AU, 316 U, Female
- Copper alloy, PBFE / PBTP / PI, Gold plated, Impedance: 50 Ω



**865-8326** Female

### D-sub Plastic hood Connector Backshells

- Black Hood 180° E Shell Size Thermoplastic
- With short locking screws
- Straight, Black colour

**NEW**



**200-6435** 9-PIN ND

**200-6436** 15-PIN ND

**200-6437** 25-PIN ND

**200-6438** 37-PIN ND

## FMK Series Die Cast Metal Zinc D-sub Connector Backshells

- Large internal space, particularly suitable for D-sub connectors with special contacts
- Suitable for heavy-duty use
- Cable outlet with strain-relief
- Can be used with engagement hooks or locking or knurled screws
- Easy assembly with catch spring system and pre-assembled locking screws



**molex**

- 291-6187** 9 Way, Strain Relief, Straight Cable Outlet
- 291-6193** 15 Way, Strain Relief, Straight Cable Outlet
- 291-6216** 25 Way, Strain Relief, Straight Cable Outlet
- 291-6238** 25 Way, Strain Relief, Straight, Large Cable Outlet
- 291-6250** 37 Way, Strain Relief, Straight, Large Cable Outlet
- 291-6288** 50 Way, Strain Relief, Straight, Large Cable Outlet, supplied without anti-kink feature

## FWA Series ABS, PC D-sub Connector Backshells

- Suitable for use in conjunction with D-sub standard, mixed layout and high density plug connectors
- IP 67 protection level in accordance with DIN 40050
- Low-profile design
- Cable diameter 6 → 8 mm
- FWA version for rear-mounted mating plug



**molex**

- 517-7587** 9 Way, Strain Relief
- 517-7593** 15 Way, Strain Relief

## FM Series Panel Mount D-sub Connector Sockets

- Mixed contact connectors suitable for making combined signal and power connections
- Plug and socket options with solder bucket or 90° PCB terminations
- Shell definition: 17W2 shell can have 17 mixed contacts in total
- Shell is supplied with 15 signal contacts and has 2 cavities for power or coaxial contacts
- Suitable for military, industrial or commercial applications and computer interfacing etc



**molex**

- 484-975** Contacts: 3 (Power)
- 484-981** Contacts: 2 (Power), 5 (Signal)

## FKH Series ABS, PC D-sub Connector Backshell

- Supplied with short and long jack screws, as well as anti-kink sleeving
- The two halves of the hood lock into one another
- The jack screws can also be fitted

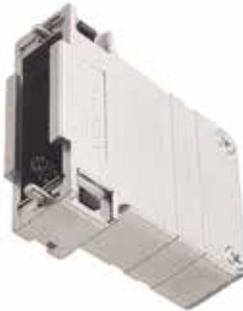


**molex**

- 100-7456** 15 Way

## FKC Series ABS Angled D-sub Connector Hood

- Shielded, Shell Size 2
- Straight Cable Outlet
- Large Inner Chamber, with Locking Screws



**molex**

- 812-6267** 15 Way, Strain Relief

## FMP Series Solder D-Sub Connector Power Contacts

- PCB holes for coax plug and socket: 4 holes 1.3mm dia. on 5.08mm ctrs, plus centre hole 1.3mm dia.
- PCB holes for 20A and 40A PCB contacts are 2.85mm and 3.75mm respectively



**molex**

- 812-6428** Female, Gold over Nickel Plated, Socket
- 270-6687** Male, Gold over Nickel Plated, Coaxial

## FWH Series ABS, PC D-sub Connector Backshell

- Designed for use with solder bucket sockets [stock no. 215-5922] etc. to provide IP67 protection between cable and connector
- Metallised types feature internal contact plate
- 9 and 15-way accept 6-8mm dia. cable (max)
- 15-way accepts 8-10.5mm dia. Cable



**molex**

- 195-7222** 15 Way, Strain Relief

## FWD Series D-sub Connector Socket, IP67

- Female, Straight, Solder Cup, Gold Plating
- Front Panel Mount
- Plastic Watertight Frame
- 9 Circuits

**NEW**



**molex**

- 195-7395** 9 Pin, Waterproof, Shell Size E

## FME Series Solder D-Sub Connector Coaxial Contact

- Power and coax contacts matching "D" hybrid contact plug housings
- Contacts snap into housing
- Can be removed using the ejection tool
- Power contacts have soldered terminals



**molex**

- 309-4159** Female, Gold over Nickel Plated, Coaxial

### SUBCON-PLUS PROFIBUS D-Sub Connector

- 35° angled cable entry and an internal connection unit which can be turned around enabling cable insertion from the left or the right and a screw connection
- 9 Copper alloy contacts
- Pitch of 2.77mm
- Metal plated ABS housing



**493-1964** 2.77mm Pitch 9 Way Right Angle Male Screw Terminal

### KSG 200 Series PC Right Angle D-sub Connector Backshell

- Ideally suited for use with ITT Cannon D\*JK filter 'D' connectors
- Provide an excellent solution for the D\*W series as depth of the shell accommodates the extended insulator length of this range
- EMI/RFI shielding obtained with integrated shielding sheets
- ESD protected



**224-1540** 9 Way

### Buccaneer Sealed USB Data Connector

- IP68 Rating (Provided it's mated or has a dust cap)
- Plug and play system for efficiency
- Low and high speed bus connections - 1.5Mbps to 480Mbps
- High noise and immunity with EMI protection



**468-6311** Panel Mount, Version 2.0 Type A, Receptacle

### 178 Series Right Angle Dual-Port D-Sub | .750" Spacing

- Dual-Port d-sub in 9-pin, 2.77mm Pitch, with 4-40 StandOffs/Board Lock
- Low cost, high performance stamped contacts
- Stacked d-sub provides proper mating while maximizing board space
- Nickel plated shells have ground indents to provide better grounding & retention
- Metal shell for improved shielding



**174-8480** Male/Female, 9 pin, 4-40 hex standoffs/fork board locks

**174-8670** Male/Female, 9 pin, 4-40 flush insert/fork board locks

### Filtered D-Sub Adapter Filtered Adapter

- Designed for telecomms to provide EMC and minimise EMI
- Integral discrete capacitive elements provide protection against EMI/RFI interference
- Incorporates a capacitive substrate
- 1000pf ceramic capacitor filtration



**244-3695** For use with 9 Way D-Sub Connector

### Econo D Series Female Crimp D-sub Connector Contact

- To suit the D\*U series D-Sub connectors
- Copper alloy machined contacts with a gold flash contact plating
- 20-24 AWG



**885-8933** Female, Copper Alloy, Gold Flash over Nickel

### SEAL-D 780 High Density IP67 Sealed D-Sub Connector

- Sealing to IEC-529-IP67 requirements
- Sealing technology maintains standard D-sub profile
- Reliable screw machined contacts
- Nickel plated steel shell for improved shielding
- Ground indents for improved grounding and retention



**135-4240** Plug-In Mount, 15 Pin High Density

### USB Type A r/a thru-hole Stacked Socket

- USB 2.0 for up to 480 MBPS speed transfer
- Integrated locking mechanism provides superior locking strength
- Right angle orientation
- Plug & Play capability
- 40 N retention force, IP20 Rating

**NEW**



**191-8250** 2.0 USB Type A, standard size, Receptacle, 2 ports

### Male Solder D-Sub Connector Coaxial Contact

- Impedance: 50OHMS
- Working frequency: 1GHz max
- Dielectric with standing voltage: 600V
- Insulation resistance 5000: 14 OHMS



**251-829** Male, RG179 B/U, Coaxial, Solder

# Our Electronic Components brands at a glance

Every technology – and who supplies them

We bring you the newest technologies and latest innovations from the world's foremost electronic component manufacturers.

## Semiconductors, Development Kits and Single Board Computers



## Interconnect, Cable & Wire



## Passive Components



## ElectroMechanical



## Industrial Sensing



## Test & Measurement



## Tools & Consumables



# Reliable Sensors for IIOT from TE Connectivity



**Sensors are the ‘eyes’ of our industrial processes, we rely on them to interpret the physical world and translate it into electrical signals which enable our machines make decisions to operate safely and efficiently. The emergence of IIoT has drawn increasing attention to the communication technologies between our machines and the analysis of our sensor data, however without accurate, precise and reliable sensors – the data is worthless.**

TE Connectivity offer a wide portfolio of industrial sensors optimised for high-reliability even in the harshest of industrial conditions. Whether you are looking for board-level devices to integrate into your own OEM design or fully packaged solutions, TE connectivity have a solution.

## Temperature Sensors

Temperature sensors are critical to maintaining optimal conditions for industrial processes, monitoring and protecting machinery and maintaining a safe working environment for staff. Selection of a temperature sensor depends on a number of factors, contact or non-contact, operating temperature range of the sensor, accuracy, reliability, sensitivity, power consumption and cost.

TE Connectivity’s Temperature System Sensors (TSYS) series of digital temperature sensors (RS Stock no.: 187-9068) offer very precise readings with an average accuracy of  $\pm 0.1^{\circ}\text{C}$ . This makes the TSYS sensors extremely useful for applications, where the changes in process temperature must be detected very quickly. It is available in ultra-small package allowing to use it in space constrained environment. The sensor’s circuitry has been optimized to consume a very low current for maximum battery life.

## Pressure Sensors

Pressure sensors are used in a variety of application to convert physical pressure, of a liquid or gas, into an electrical signal. Application areas vary from airflow measurement in medical devices such as ventilators, to altitude measurement in aircraft and depth measurement for underwater vehicles.

TE Connectivity offers pressure sensors that measure pressure from 5mBar to 7Kbar, and their sensors are based on piezoresistive MEMS and silicon strain gauge technology. There is a possibility to configure pressure sensor to a certain range depending on the application. Pressure sensors from TE are available as board-level devices read to be integrated into your OEM design or as packaged solutions ready for an industrial environment.

If you need to capture data fast – the TE M5600 (RS Stock No.: 187-9061) and M3200 series offer a fully-packaged solution ready for installation. The M5600 is a Bluetooth 4.0 wireless pressure transducer with stainless steel and polycarbonate enclosure to satisfy harsh industrial environmental conditions. The M3200 is perfect measuring gas or liquid pressure, particularly in difficult media as such as contaminated water, steam, and mildly corrosive fluids within industrial machinery. This device offers analogue or digital output making it ideal for integration into existing or new designs.

## Position Sensors

Position sensors are used in industrial automation and control to understand and verify the position to system components. Reliable position sensing is important to enable motors and actuators to be controlled appropriately at the right time. Position sensors measures mechanical position of a component based on a chosen point of reference. TE Connectivity’s position sensing solutions include linear, rotational, tilt and fluid level sensors. They base their solutions around core technologies such as inductive, potentiometric, magneto-

resistive, hall effect, reed switch, electrolytic and capacitive sensing. One of the key solutions from TE is Anisotropic Magneto-resistive (AMR) Linear Position Sensors (RS Stock No.: 189-7256) suitable for harsh environments where dirt, dust and oil may be present. This non-contact technology is particularly suited to harsh conditions which make other sensing technologies unreliable. Some of the other features of this product are high precision of 10-50 $\mu\text{m}$  accuracy with sub  $\mu\text{m}$  resolution for linear use as well as ability to operate at high temperatures ranges up to 150 $^{\circ}\text{C}$ .

## Ambient Light Module Sensors

Ambient light sensor are used to measure the level of light present in the device’s environment. The value detected by the ambient light sensor is known as illuminance. It is measured by sensing the amount of light that reaches the surface of the sensor.

Organisations are increasingly attempting to reduce heating, cooling and lighting costs to comply with environmentally focussed initiatives. Smart HVAC systems can make effective use of ambient light sensors to understand building occupancy and outside environmental conditions to more efficiently control heating and cooling, as well as lighting conditions throughout the day and night.

The latest product from TE connectivity AmbiMate sensor module MS4 series (RS Stock No.: 187-6131) features not only ambient light sensor, but three other core sensors, including temperature, humidity and motion sensors. The board can be further customized to include VOC (Volatile Organic Compound), CO2 and sound detection sensors. The AmbiMate sensor module shortens the design cycle for Building Automated and Connected Home solutions, by providing seven industry-standard sensors on a single board.

## Ultrasonic Sensors

Ultrasonic sensing is based on measuring the time it takes for ultrasonic sound wave to travel to the target and back. The most common application of ultrasonic sensors is to measure the distance between objects. However, the same technology can be used for detecting air bubbles in liquids. Infusion pumps, haemodialysis and blood flow monitoring are just few examples of where the presence of air bubbles is not only not desirable, but it could be dangerous.

The AD-101 (RS Stock No.: 187-9059) air bubble detector from TE connectivity is specifically designed for non-invasive continuous monitoring of fluid. The sensor can detect air bubbles as small as 70 percent of tube diameter. Standard tube sizing of 4mm and 6mm are available, but customization between 3 and 10 mm is also possible. AD-101 air bubble detector offers a user-friendly interface with TTL (transistor-transistor logic) output for two possible states: pass if fluid is ok and fault if air bubble is present. Power-on and continuous self-diagnostic tests run by the device ensure its functionality.

## ACS712ELCTR-20A-T Hall Effect-Based Linear Current Sensor IC

- Low-noise analog signal path
- Device bandwidth is set via the new FILTER pin
- 5  $\mu$ s output rise time in response to step input current
- 80 kHz bandwidth
- 3000 Vrms galvanic isolation



**680-7135** 5V, 8-Pin SOIC

## AD590 2-Terminal IC Temperature Transducer

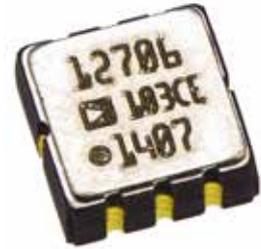
- Linear current output: 1  $\mu$ A/K
- Wide temperature range: -55°C to +150°C
- Probe-compatible ceramic sensor package
- 2-terminal device: voltage in/current out



**709-2924** -55  $\rightarrow$  +150 °C  $\pm$ 5°C, 3-Pin TO-52

## ADX103CE Single-/Dual-Axis iMEMS® Accelerometer

- High performance, single-/dual-axis accelerometer on a single IC chip
- 5 mm  $\times$  5 mm  $\times$  2 mm LCC package
- 1 mg resolution at 60 Hz
- Low power: 700  $\mu$ A at VS = 5 V (typical)



**496-7581** 8-Pin CLCC

## A1104EUA-T Unipolar Hall Effect Sensor Switch

- Continuous-time operation with fast power-on time and low noise
- Stable operation over full operating temperature range
- Reverse battery protection
- Solid-state reliability



**680-7488** 3-Pin Ultra Mini SIP

## AD590JF 2-Terminal IC Temperature Transducer

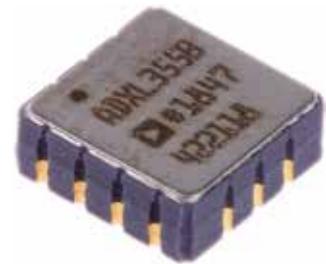
- Linear current output: 1  $\mu$ A/K
- Wide temperature range: -55°C to +150°C
- Probe-compatible ceramic sensor package
- 2-terminal device: voltage in/current out



**427-341** -55  $\rightarrow$  +150 °C  $\pm$ 5°C, 2-Pin FPAK

## ADXL355BEZ 3-Axis Accelerometer

- Hermetic package offers excellent long-term stability
- 0 g offset vs. temperature (all axes): 0.15 mg/°C maximum
- Low power; V\_SUPPLY (LDO enabled) in measurement mode: 200  $\mu$ A
- Digital output features



**135-1032** SPI, 14-Pin LCC

## AS5601-ASOM 12-bit Magnetic Rotary Position Sensor

- An easy-to-program 12-bit On-Axis Magnetic Rotary Position Sensor with quadrature incremental and push button output
- This contactless Encoder measures the absolute angle of a diametric magnetised on-axis magnet



**102-4168** 3  $\rightarrow$  3.6 V, 4.5  $\rightarrow$  5.5 V, 8-Pin SOIC

## AD592 Low Cost, Precision IC Temperature Transducer

- High Precalibrated Accuracy: 0.58C max @ +258C
- Excellent Linearity: 0.158C max (08C to +708C)
- Wide Operating Temperature Range: -258C to +1058C
- Single Supply Operation: +4 V to +30 V



**912-7066** -25  $\rightarrow$  +105 °C  $\pm$ 0.3°C, 3-Pin TO-92

## ADXL356CEZ 3-Axis Accelerometer

- Hermetic package offers excellent long-term stability
- 0 g offset vs. temperature (all axes): 0.75 mg/°C maximum
- Ultralow noise density (all axes): 80  $\mu$ g/ $\sqrt$ Hz
- Low power; V\_SUPPLY (LDO enabled) in measurement mode: 150  $\mu$ A



**139-1746** I2C, SPI, 14-Pin LCC

## 162PC Ultra Low Differential Pressure Sensor

- Low pressure measurement, Gage, Vacuum Gage/Amplified
- PCB terminals on opposite side from the ports
- Fully signal conditioned
- Response time 1ms



**Honeywell**

**395-229** 1psi Max Pressure Reading , 6 → 12 V dc

## MPX5999D Integrated Silicon Pressure Sensor

- Temperature Compensated Over 0 to 85°C
- Ideally Suited for Microprocessor or Microcontroller-Based Systems
- Patented Silicon Shear Stress Strain Gauge
- Durable Epoxy Unibody Element



**NXP**

**922-7364** 0 to 1000 kPa (0 to 150 psi), 0.2 to 4.7 V Output

## LSM303AGR Ultra-compact eCompass Module

- 16 bit data output
- Analog supply voltage 1.71 V to 3.6 V
- Embedded FIFO, self test and temperature sensor
- Operating temperature range between -40°C and 85°C

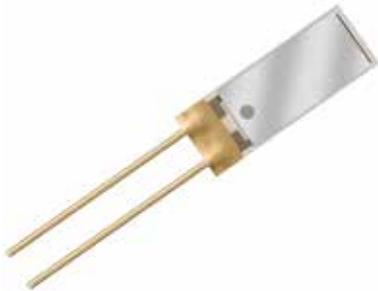


**ST**  
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**163-9802** 12-Pin LGA

## MK33-W Capacitive Humidity Sensor

- High chemical resistance
- Very low drift
- Wide temperature range, High humidity stability
- Ideal for oil measurement applications



**IST**  
INNOVATIVE SENSOR TECHNOLOGY

**121-8002** 40 → +190 °C, 2-Pin

## MPXA6115A Absolute for Air Pressure Sensor

- Resistant to High Humidity and Common Automotive Media
- Improved Accuracy at High Temperature
- Available in Small and Super Small Outline Packages
- Ideally suited for Microprocessor or Microcontroller-Based Systems



**NXP**

**922-7377** 4.75 → 5.25 V dc

## LSM9DS1 iNEMO Inertial Module

- Contains a 9-kbyte FIFO that can store more data
- Adds a MIPI I3C serial interface to the Serial Peripheral Interface
- Enhanced developed pedometer algorithm
- 'Always-On' motion sensing for reduced power consumption



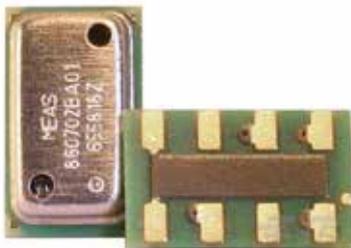
**ST**  
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**110-6555** 24-Pin LGA

## MS8607-02BA01 PHT Digital Combination Sensor

**NEW**

- Integrated pressure, humidity and temperature sensor
- QFN package 5 × 3 × 1 mm<sup>3</sup>
- Operating range: 10 to 2000 mbar, 0%RH to 100%RH, -40 to 85°C



**TE**  
connected by

**200-6131** 8 pin, -40 to 85°C

## D6T Proximity Sensor IC Thermal Sensor

- High Sensitivity Enables Detection of Stationary Human Presence
- OMRON's unique MEMS and ASIC technology achieve a high SNR
- Superior noise immunity with a digital output
- High-precision area temperature detection with low cross-talk field of view characteristics



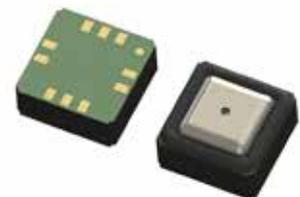
**OMRON**

**176-0821** 4-Pin, 0 to 60°C

**176-0825** 4-Pin, -40 to 80°C

## LPS35HW MEMS Pressure Sensor

- Pressure sensor with water resistant package
- 260 to 1260 hPa absolute pressure range
- Current consumption down to 3 μA
- High overpressure capability: 20× full scale



**ST**  
life.eu.ameritec

**163-9790** 10-Pin CCLGA

## SCD30 Sensor Module

- NDIR CO2 sensor technology
- Integrated temperature and humidity sensor
- Best performance-to-price ratio
- Dual-channel detection for superior stability



**SENSIRION**  
THE SENSIRION COMPANY

**172-0552** 0 → +50 °C

## SDP1000 Low Range Differential Pressure Sensor

- For Air and Non-Aggressive Gases, and HVAC and medical OEM applications
- Unsurpassed performance thanks to CMOSens® technology
- Offset and hysteresis free
- Excellent accuracy and reproducibility even below 10 Pa

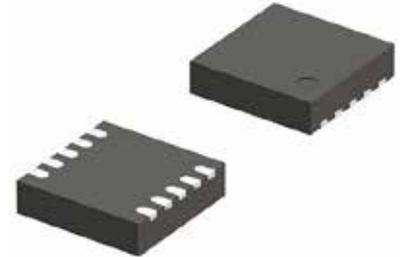


**SENSIRION**  
THE SENSIRION COMPANY

**774-4085** 500Pa Max Pressure Reading, 4.75 → 5.25 V

## Si1145-M01-GMR Proximity Sensor Module with I2C Interface

- Has 1 LED driver with an Integrated IR LED - RS
- Combines an active optical reflectance proximity detector, an ambient light sensor, UV index sensor and an infrared LED into a single 10-Pin QFN package
- Dual port operation enables reliable proximity detection for moving as well as stationary objects



**SILICON LABS**

**892-0022** 1 → 50cm, 1.71 → 3.6 V 10-Pin QFN

## SDP816-500PA Analog Differential Pressure Sensor

- Designed for high-volume applications
- Measure the pressure of air and non-aggressive gases with superb accuracy and no offset drift
- Cover a pressure range of up to ±500 Pa (±2 inch H2O / ±5 mbar)



**SENSIRION**  
THE SENSIRION COMPANY

**133-1915** +500Pa 0.1 → 0.9 V Output, 4-Pin

## SDP2000-L Differential Pressure Sensor with Analog Output

- Covers a measurement range of 3500 Pa (14 inch H2O)
- Mounted in a PPS housing the SDP2000-L differential pressure sensor features a unique dynamic range, zero offset and unsurpassed long term stability
- Ideal fit for demanding yet cost sensitive OEM applications in HVAC and medical equipment



**SENSIRION**  
THE SENSIRION COMPANY

**774-4091** 3500Pa Max Pressure Reading, 4.75 → 5.25 V

## 26PC Series Differential Pressure Sensor

- Compact SMT mounting package
- Wet/Wet capability (i.e. liquids on both ports)
- Compensated/Unamplified
- RoHS compliant

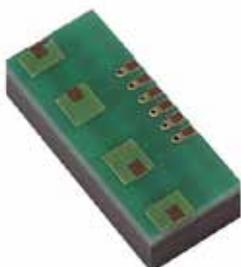


**Honeywell**

**286-686** 10 V dc

## AL796 Magneto Resistive Fix Pitch Sensor (2 mm)

- Based on the Anisotropic Magneto Resistive (AMR) effect
- Contains two Wheatstone bridges on Chip
- Sine and Cosine output
- Adapted to 2 mm poles
- PurePitch design (2 poles)



**SENSITEC**  
Sensitec Group

**792-4196** -9 → +9 V, 10-Pin SMD

## VL53L0CXV0DH/1 Time-of-Flight Ranging and Gesture Detection Sensor

- Fully integrated miniature module
- 940 nm laser VCSEL
- VCSEL driver
- Ranging sensor with advanced embedded micro controller
- 4.4 × 2.4 × 1.0 mm



**ST**  
life.cuarentec

**192-0973** 940 nm laser VCSEL

## SDX01G2 Plastic Silicon Pressure Sensor

- For use with non corrosive, non ionic media, e.g. air and dry gases
- Internally calibrated and temperature compensated
- 100µs response time
- DIP, 0 psi to 1 psi pressure reading



**Honeywell**

**177-5947** 0-1psig

# What new electronic components are needed in the 5G era?



**Driven by the dual driving of 5G technology and demand, the market demand for electronic components is growing rapidly, and the speed of replacement of electronic components is increasing.**

## **The number and price of antennas**

5G gave birth to mobile phones and base station antennas into the Massive MIMO era, and the price of antennas rose. 5G needs to be deployed in multiple frequency bands, so it needs to communicate in a millimeter-wave band with a wider spectrum and wider bandwidth, using large-scale antenna technology. Therefore, the number of mobile phone antennas has increased in the 5G era, array antennas have become mainstream, and antenna package materials will also change. LCP antennas are expected to become mainstream. In 2020, its market space is expected to reach more than \$2.4-3.0 billion. In terms of communication base stations, antenna technology such as MIMO in the 5G era has been upgraded, not only the number of antennas has increased, but also the number and performance of radiating elements have been higher.

## **Drive RF front-end acceleration**

The 5G era communication standard was further upgraded, bringing the continuous value of the mobile phone RF front-end single-machine value, and its value is expected to grow to more than 22 US dollars in the 5G era. It is estimated that the mobile phone RF front-end market will reach 22.7 billion US dollars in 2022, and the average annual compound growth rate will reach 14%. The filter is the largest business segment in the RF front-end market. The number of mobile phone band support in the 5G era will increase significantly, driving the rapid growth of the value of single-machine filters. The market size will increase from US\$5.2 billion in 2016 to US\$16.3 billion in 2022. The average annual compound growth rate reached 21%.

## **The base station upgrade increased, driving the number and price of the PCB**

With the advent of 5G commercialization, the development of millimeter wave has promoted the construction of millions of small-scale base stations. The mass construction and upgrading of communication base stations will create a huge demand for enterprise communication boards, and PCBs will meet the upgrade and replacement requirements. The increase in PCB price in the 5G era is manifested in the following aspects:

1. On the one hand, the number of PCBs used by a single antenna of a base station may be increased. On the other hand, the low-loss and ultra-low-loss high-frequency PCB shall be used and the average price will also rise.
2. The size of the PCB used by the RRU will be larger, and the material is a high-speed material, and its value is also higher.
3. The area and number of layers used by the BBU will increase, and low loss or ultra-low loss is required. The PCB performance has certain requirements and the added value is improved.

## **High-frequency high-speed substrate demand**

The high-frequency signal has a wider frequency band than the low-frequency signal, and the frequency of communication transmission is higher in the 5G era, so the demand for the high-frequency PCB board and the high-speed PCB board is higher. Therefore, the high-frequency substrate and the high-speed substrate of the copper-clad board are required. In the 5G base station, the antenna reflector, the backplane, and the TPXPA circuit in the DU and AAU are both high-frequency substrates, and the performance requirements for the high-frequency substrate are higher. The high-frequency substrate is required to maintain the dielectric constant stability while keeping the dielectric loss minimized. Therefore, the demand and added value of high-frequency copper clad laminates in the 5G era will be expanded.

### BeagleBone® AI

- Built on the proven BeagleBoard.org® open source Linux approach, BeagleBone® AI fills the gap between small SBCs and more powerful industrial computers
- Based on the Texas Instruments AM5729, developers have access to the powerful SoC with the ease of BeagleBone® Black header and mechanical compatibility



#beaglebone

**190-1825** Processor: Sitara AM5729

### 1EDI3012MFXUMA1 Dual Galvanic Isolated MOSFET Power Driver

- Input to output isolation voltage
- Operating voltage with wide input
- Separate source and sink outputs
- Applications in AC Motor and Brushless DC Motor Drives



**133-6559** -6.2 A, 5.9 A, 3.1 → 17 V 8-Pin, DSO

### L293E Push-Pull Four Channel Driver

- Overtemperature Protection
- Output Current 1a Per Channel
- Inhibit Facility
- Peak Output Current 2a Per Channel (Non Repetitive)
- Separate Logic Supply



**880-5298** 36 V 1A 20-Pin, PowerDIP

### BeagleBone® Black Wireless

- BA development board based on the AM335x Arm Cortex-A8 processor, with additional wireless networking functionality
- A single board computer (SBC) which is supplied with Debian Linux OS pre-installed and can be used as a stand-alone computer or embedded into a system

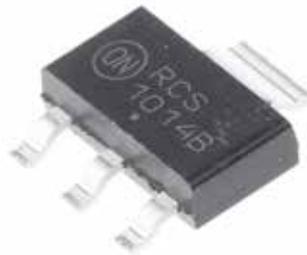


#beaglebone

**125-2412** Processor: Octavo Systems OSD3358 1GHz ARM® Cortex-A8

### NCP1014ST100T3G Self-Supplied Monolithic Switcher

- Integrates a fixed-frequency current-mode controller and a 700 V MOSFET
- Housed in a PDIP-7 or SOT-223 package, offers everything needed to build a rugged and low-cost power supply, including soft-start, frequency jittering, short-circuit protection, skip-cycle, a maximum peak current setp



**162-9468** 3 + Tab-Pin, SOT-223

### VNH3SP30-E Automotive H-bridge Motor Driver

- Output current: 30A
- 5V logic level compatible inputs
- Undervoltage and overvoltage shutdown
- Overvoltage clamp



**920-6285** 40 V 30A 30-Pin, MultiPowerSO

### Air Quality IoT Starter Kit

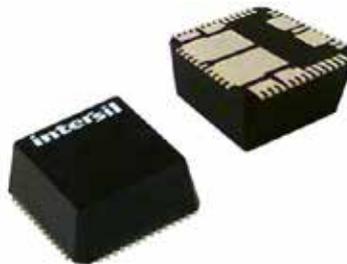
- A perfect tool for collecting and visualising data by connecting to a Cloud, sharing and comparing collated information in a community setting
- Consists of a Wio Link board, a gas sensor and a temperature/humidity sensor



**181-8207** ESP8266 based

### ISL8240MIRZ, Dual, Step Down DC-DC Power Supply Module

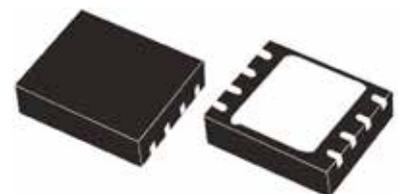
- Complete switch mode power supply
- Input voltage from 4.5 V to 20 V
- Resistor programmable output voltage from 0.6 V to 2.5 V (default 1.0 V)
- 20A output current if voltage output is below 1.5V
- Up to 94% conversion efficiency



**121-7244** Adjustable, 0.6 → 2.5 V, 0A 26-Pin, QFN

### LED2001 4A Monolithic Step-down DC-DC Converter

- Current source with synchronous rectification
- 3.0 V to 18 V operating input voltage range
- 850 kHz fixed switching frequency
- 100 mV typ. current sense voltage drop



**791-9172** -1 → 18 V 8-Pin, VFQFPN

### KMF Series Flange Mount EMI Filter

- With Terminal Block Termination, 3 Phase
- Voltage 500vac
- Frequency 50/60hz
- Current 70a @ 40°C



**761-5820** 70A 500 V ac 60Hz

### B84111 Series Flange Mount RFI Filters

- With Tab Terminals, Single Phase
- Constructed in a metal case with 2 line filters
- Optimized leakage current <0.5mA
- Rated voltage VR: 250 V AC/DC
- Rated current IR: 1 A to 20 A



**213-6971** 10A 250 V ac 60Hz

**213-6987** 20A 250 V ac 60Hz

### FN2030 Series General Purpose EMI Filter

- Chassis Mount, with Tab Terminals
- Rated currents from 1 to 30 A
- High performance filter attenuation
- High differential-mode attenuation



**292-868** 6A 250 V ac 400Hz

### DLT4 Series Signal Filter

- Panel Mount, 36mm length
- Ceramic dielectric RFI suppression filters that combine two reactive filtering elements, a miniature discoidal capacitor and ferrite inductor



**239-185** 200 V dc 10000MHz, 10A

### B84113H Chassis Mount RFI Filter

- With Tab Terminals, Single Phase
- SIFI-H for very high insertion loss
- Terminals; (case B) up to 16A tab connectors 6.3 × 0.8 mm
- (case G) Threaded M5 studs for filters from 20A to 36A
- Polyurethane potting (UL 94 V-0)



**167-0389** 6A 250 V ac/dc 50 → 60Hz

### FN 3280 Series High-end Line Filter

- With Screw Terminals
- Now available up to 600 A
- Compact, space-saving design, optimized for industrial machinery
- Combines exceptional attenuation with low leakage current



**708-4327** 36A 300 V ac 60Hz

### RES10 Series Chassis Mount RFI Filter

- With Fast-On Terminals
- Compact size for rated current
- For use from DC to 400Hz
- Quick and easy chassis mounting



**806-8253** 16A 250 V ac DC → 400Hz

### B84776 Series Panel Mount RFI Filter

- 2 Line filter with IEC connector fuseholder and switch in metal case
- Medical version with low leakage current
- For use with Switched mode power supplies, DC applications and Measurement instruments
- Load side connections 6.3mm tab



**780-5076** 6A 250 V ac/dc 50 → 60Hz

### Three Phase dv/dt Reactor for Efficient Motor Protection

- Reduction of excessive dv/dt
- Protection of the motor windings
- Less disturbances of neighbouring equipment
- Standard catalog reactors up to 1100 A



**457-6264** 400 V ac 10A 2 → 16kHz

**PX0833 Cat5e 8-Way Female Coupler**

- Standard RJ45 patchcord can be plugged into rear
- Version with earth wire available
- Single hole fixing
- Complete with panel sealing gasket


**468-6232** Cat5e 8-Way Female

**Cat5e 8-Way Sealed Panel Mounting Shielded RJ45 Socket**

- RJ45, With PCB and RJ45 port from the back
- Meet IP67 rating when mated with RJLnxx plugs and patch leads
- Has solder pads for wire connection to the socket


**385-1362** Cat5e 8-Way Female

**E2EX Shielded DC 3-wire Sensor**

- LED indication, 3 wire DC
- M30 x 1.5, IO-Link PNP-NO/NC Inductive Sensor
- 60mm Length
- PBT sensing face material
- IP67 Rating


**124-4441** 10 → 30 V dc supply voltage

**TM21P Series Cat 5e RJ45 Shielded Modular Plug**

- Supports High-Speed LAN transmission Full 360° shielding for EMI protection
- Snap together cover for latch tab protection
- Can terminate solid or stranded wire
- Guide plate to assist with assembly


**436-1387** Cat5e 8P8C-Way Male

**DS35 Mid-range Photoelectric Distance Sensor**

- NPN/PNP IO-Link IP65, IP67 Block Style
- Infrared or red emitted light in laser class 1 or 2
- Precise and reliable detection measurement regardless of object colour extends run time and process quality
- Small size and blind zone make flexible mounting possible when space is limited


**818-0299** 50 → 3100 mm Detection Range

**NX Series I/O Link Master Unit**

- 4 Inputs, 4 Outputs
- 1 A 24 V dc
- For Use With EtherCAT Coupler Unit, NX Series CPU Unit
- Dimension (LxWxD): 12 x 71 x 100 mm


**136-2808** 1 A 24 V dc, 12 x 71 x 100 mm

**MFP8 Cat 6A Shielded Field Assembly RJ45 Plug**

- MFP8-4x90 T568B Cat.6A AWG24-22/1, AWG27-22/7
- Designed for fast and reliable repair of cable links and connection of peripheral devices in existing networks


**878-7421** Cat6a 4P4C-Way Male

**W16 Retro-Reflective Photoelectric Sensor**

- NPN, PNP IP66, IP67, IP69K Rectangular Style
- Facilitates the alignment of the PinPoint LED to the reflector and monitors the sensor performance even during operation


**180-6350** 0 → 10 m Detection Range

**White Light Monochrome IO-Link PNP Vision Sensor**

- Compact design to fit into confined spaces
- Over 100 camera options
- Adjustable lens
- The sensor has an IP67 rating, allowing it to be used in wet environments
- Flexible cables for safe use on moving parts


**146-6112** 200 mA, 21.6 → 26.4 V dc

## 287 Digital Multimeter

- Add the wireless capabilities of Fluke Connect with Share-Live™ video call with the i3000 FC connector
- True-rms ac bandwidth 100 kHz; dBV/dBm; dc mV resolution 1  $\mu$ V; M $\Omega$  range up to 500 M $\Omega$
- Conductance 50.00 Ns
- Voltage to 1000 V, resistance to 500 M $\Omega$  and temperature to 1350°C
- Optimised for R & D, maintenance, manufacture and design of electronic circuits or systems



FLUKE

**156-724** 10A ac 1000V ac 10A dc 1000V dc

## 2042 Cable Tracer

- Traces cables & metal pipes in walls and floors
- Locates fuses and assignment to circuits
- Locates concealed sockets and distribution boxes
- Locates interruptions and short-circuits in unshielded electrical cables
- Tracing depth up to 2.5m – dependant on material (concrete etc.)



FLUKE

**513-1799** Cable Detection Depth 2.5m CAT III 300 V

## VT04A Non-Contact Visual IR Thermometer

- The visual advantage of an infrared heat map, combined with the convenience of a spot thermometer for surface temperature
- Featuring Pyroblend Plus optic it produces a 4x sharper image than the VT02 enabling users to easily detect potential problems and troubleshoot early
- Includes all the great features of the VT04 but is powered by AA batteries, ideal for technicians in the field



FLUKE

**810-3891** Temperature range -10°C to +250°C

## 289 Digital Multimeter

- 50 000 Count, 320 x 240 dot-matrix LCD display with white backlight
- 0.025% basic DC accuracy
- Voltage to 1000 V, resistance to 500 M $\Omega$  and temperature to 1350°C
- Low input impedance (LoZ) function to prevent false readings due to 'ghost voltage'
- Low ohms mode and a low pass filter which allows for accurate measurements of motor drives



FLUKE

**156-730** 10A ac 1000V ac 10A dc 1000V dc

## 1503 Insulation Tester

- 200mA Continuity
- AC/DC voltage ranges between 0.1V and 600V
- Accepts optional Fluke TPAK magnetic hanging system to free your hands for other work
- Auto discharge of capacitive voltage for added user protection
- Insulation test ranges between 0.1M $\Omega$  and 2000M $\Omega$



FLUKE

**518-5998** 2G $\Omega$  CAT III 600 V, CAT IV 600 V

## 376 True RMS AC/DC Clampmeter with iFlex

- Voltage measurement is 1000V AC/DC
- Frequency measurement up to 500Hz with body jaw and iFlex
- Resistance measurement up to 60kohm with continuity detection
- Minimum, maximum, average and inrush recording to capture variations automatically
- 500mVDC measurement range to interface with other accessories



FLUKE

**914-5424** Max Current 999.9A ac, 999.9A dc CAT III 1000 V, CAT IV 600 V

## Ti401 Pro Thermal Imager

- LaserSharp™ Auto Focus uses a built-in laser distance meter that calculates and displays the distance from your designated target and immediately adjusts the focus
- See small details in the image and discover anomalies faster with 640 x 480 resolution thermal images



FLUKE

**186-4696** 640x480 9Hz

## 1507 Insulation Resistance Tester

- Accepts optional fluke TPAK magnetic hanging system
- Auto discharge of capacitive voltage for added user protection
- Auto power OFF
- Automatic calculation of polarisation index and dielectric absorption ratio
- Compare (Pass/Fail) function



FLUKE

**518-6008** 10G $\Omega$  CAT III 600 V, CAT IV 600 V

## Complete Fiber Verification Kit with FI-500 FiberInspector Micro

- PortBright™ a built-in flashlight illuminates dark areas and dense panels
- AutoFocus for stable images in few seconds
- Large display to view single-mode and multimode fiber endfaces
- Includes 4 UPC tips (LC, SC, 1.25 mm and 2.50 mm)
- APC tips available



FLUKE networks

**123-6405** Copper & Fiber Basic Technician's Kit

## MTR105 Rotating Machine Tester

- Guard terminal, to eliminate any surface leakage current.
- Detachable test leads with interchangeable clips and probes for different applications.
- Stores test results for up to 256 motors, which can be downloaded to a USB mass storage device



**Megger.**

**193-8409** CAT III 600V

## 200 MHz/100 MHz Mixed-signal Oscilloscopes

- Real Time Sample Rate Per Channel : 1GSa/s (2 Channel Models); Maximum Real
- Time Sample Rate : 1 GSa/s (4 Channel Models)
- Equips with a 16 Channel Logic Analyzer and a Dual Channel 25 MHz
- Arbitrary Waveform Generator
- Per Channel 10M Memory Depth and VPO Waveform Display Technology



**180-4790** 100MHz, 2 + 16 Channel

**180-4791** 100MHz, 4 + 16 Channel

**180-4792** 200MHz, 2 + 16 Channel

**180-4793** 200MHz, 4 + 16 Channel

## InfiniiVision 2 ch, 50 MHz Oscilloscopes

- 100,000 waveforms/sec update rate
- 7-inch TFT LCD WVGA
- Maximum sample rate of 1GSa/s

**NEW**



**200-5274** 2 channels

**200-5275** 2 channels with function generator

## MIT480/2 Insulation Tester

- Insulation testing up to 500 V and 100 GΩ range in a hand held instrument
- 3 wire connection for A, B and E (Tip, Ring and Earth) connection
- Gated access to 500 V to prevent accidental damage



**Megger.**

**122-6799** 100GΩ CAT IV 600 V

## Digital Storage Oscilloscopes TPS2000B Series

- Sample rate is 1gsa/s
- 2.5k point record length on all channels
- Input impedance of 1mohm
- 1/2in VGA LCD colour display
- 8 hours of continuous battery operation with two batteries installed, hot swappable for virtually unlimited freedom from ac line power



**Tektronix**

**734-5000** 4 Channels, 100MHz

**734-5004** 4 Channels, 200MHz

## 33500B Series Waveform Generators

- Waveform generator with arb capability
- Variable bandwidth noise
- Waveform sequencing
- Pseudo-random binary sequence pattern generation
- Waveform summing and combining capability



**763-9129** 20MHz Ethernet, GPIB, LAN, USB

**763-9144** 30MHz Ethernet, GPIB, LAN, USB

## MIT310A Insulation Tester

- Extremely easy to use
- Tough rubber armoured case
- Self contained protective cover
- Live circuit warning
- Weatherproof to IP54



**Megger.**

**516-7704** 999MΩ CAT III 600 V

## Mixed Signal Oscilloscope DPO2000B Series

- Sample rate is 1GSa/s
- 1 Mega point's record length on all channels
- Input impedance of 1Mohm
- Wave Inspector® controls provide easy navigation and automated search of waveform data
- 7in (180mm) wide screen TFT-LCD colour display



**Tektronix**

**768-3371** Bench, 4 Channels, 200MHz

## InfiniiVision 2000 X Series Oscilloscope

- Bandwidth is 70MHz
- The sample rate is 1GSa/s per channel and 2GSa/s per half-channel
- Input impedance of 1Mohm
- Max memory depth of 1Mpts
- Function Generator is 20MHz



**725-0491** 2 Channels, 70MHz

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## ESD-Safe Dissipative Brushes

- Allows thorough cleaning of ESD sensitive assemblies without the danger of high charges generated by conventional brushes
- Conductive carbon loaded polypropylene handle
- Permanent static dissipative bristles, made of Nylon 6.12
- Yellow bristles, 0.4mm in diameter
- Highly resilient, durable and abrasion resistant



**MENDA**

**719-9845** Round Handle, 15.5cm overall length

**719-9854** Flat Handle, 15cm overall length

**719-9857** Flat Handle, 16.8cm overall length

**719-9851** Long Handle, 17.8cm overall length

**719-9860** Curved Handle, 10cm overall length

## 4mm Anti-Static Wrist Strap

- Unique dual test circuit design which improves accuracy
- Equipped with 750kΩ and 35MΩ circuit
- Accuracy is ±20%
- Operating temperature ranges between 0°C and 40°C



**SCS**  
Stronic General Solutions

**838-0786** Adjustable Wrist Strap, 1.5m Cord Length

## Class H 180°C Glass Cloth Tapes

- Silicone adhesive
- Flame retardant to UL510
- Conforms to BS EN 60454-3-8 Type 3
- Extremely high temperature resistance
- High mechanical strength



**ADVANCE**

**408-9473** 25mm x 33m, White

**408-9467** 19mm x 33m, White

**408-9451** 12mm x 33m, White

## ESD Safe Brush, Nylon

- Made from black conductive polypropylene and are designed to absorb the charge generated and pass it to the ground
- Temperature range 0°C to 105°C
- Tensile strength 3000 psi ASTM D368



**RS PRO**

**125-0302** Flat Handle, 16.4cm overall length

## 4mm ESD Grounding Wrist Strap & Cord Sets

- The exterior of the wrist strap is manufactured from plastic that is encapsulated in metal.
- The wrist strap is adjustable by adding or removing snap links which allow it fit most people.
- The coiled cord is Insulated with Polyurethane (PU) material and can withstand 20,000 cycles of the bending life test.
- One end of the coiled cord is molded with 4 mm socket snap and the other end is molded with standard 4 mm banana plug



**RS PRO**

**798-9284** Blue

**798-9272** Black

## 51408 Flame Retardant Polyimide Masking Tapes

- Flame retardant
- Chemical resistance
- High temperature resistance (up to 260°C in continuous and up to 315°C in short term, intermittent usage)



**tesa**

**436-2762** 25mm x 33m, Orange

**436-2778** 19mm x 33m, Orange

**436-2784** 12mm x 33m, Orange

## Heel Grounder with D-Ring

- D-ring style strap and an elastic hook and loop for adjustability
- Contains a current limiting resistor, which protects the operator from accidental exposure to electricity
- Must be worn on both feet to maintain ground contact while walking
- Cord length is 1.8288m, Lead resistance is 1Mohm



**SCS**  
Stronic General Solutions

**838-1209** Red

## AT7 PVC Electrical Insulation Tapes

- Lead free PVC Electrical Insulation tape coated with cross-linked solvent based rubber resin adhesive
- Manufactured to BS EN 60454 / Type 2 specification
- Flame retardant and self extinguishing
- 19mm x 33m, 1 Reel of 33 meters



**ADVANCE**

**494-382** Black

**494-398** Red

**227-2976** White

**227-2926** Green

**227-2960** Yellow

## High Temperature Masking Dots

- Ideal for masking gold fingers of printed circuit boards during wave solder or solder dip process, as well as for solder wave masking and electrical insulation
- Polyimide, pressure sensitive, adhesive tape with silicon resin



**RS PRO**

**184-6696** 8mm, Roll of 1000

## 80-Series Diagonal Cutters, Oval Head

- Ultra flush bevel for precision flat cuts on PCB and wire
- High performance Ball Bearing Steel for excellent strength
- Black oxidised finish for corrosion protection and minimal light reflection
- Machine ground edges for an accurate consistent edge angle
- Return spring for a smooth cut and increased cutting power



► LINDSTROM

**400-8474** 1mm cutting capacity, 108mm overall length, Micro-Bevel cut

**361-3069** 0.8mm cutting capacity, 108mm overall length, Ultra-Flush cut

**603-441** 1.2mm cutting capacity, 110mm overall length, Micro-Bevel cut

**361-2224** 1.2mm cutting capacity 112mm overall length, Ultra-Flush cut

## 8152 Diagonal Cutter, Tapered and Relieved Head

- Made from high performance alloy steel, ideal for high-stress applications and has a screw joint that minimizes friction and maximized alignment of cutting edges
- ESD safe handles in synthetic material with return spring
- The edges are precision induction hardened to 63-65 HRC



► LINDSTROM

**361-2218** 0.8mm cutting capacity, 110mm overall length, Ultra-Flush cut

## RX Series Diagonal Cutters Oval Head

- Developed according to the scientific ERGO™ process, Oval head
- ERGO™ handles with two-component combination, thermoplastic surface, for comfortable grip, on tough polypropylene core for rigidity
- Micro-bevel, flush and ultra-cut
- Cutting capacity: 0.1 mm-0.8 mm to 0.4 mm-2mm
- High performance alloyed steel, Phosphate finish



► LINDSTROM

**228-3982** 133mm overall length, 1.0mm cutting capacity, Micro-Bevel cut

**190-6741** 133.5mm overall length, 0.8mm cutting capacity, Ultra-Flush cut

**228-3998** 135mm overall length, 1.2mm cutting capacity, Micro-Bevel cut

**228-4014** 135mm overall length, 1.2mm cutting capacity, Flush cut

**228-4020** 135mm overall length, 1.0mm cutting capacity, Ultra-Flush cut

**228-4036** 138mm overall length, 1.6mm cutting capacity, Micro-Bevel cut

**190-6703** 138mm overall length, 1.6mm cutting capacity, Flush cut

**190-6710** 138mm overall length, 1.25mm cutting capacity, Ultra-Flush cut

**361-2252** 147mm overall length, 2.0mm cutting capacity, Micro-Bevel cut

**361-2274** 147mm overall length, 2.0mm cutting capacity, Flush cut

**361-2280** 147mm overall length, 1.6mm cutting capacity, Ultra-Flush cut

## Stainless Steel Tweezers

- ESD safe for secure use in electronics assembly
- High-quality Swiss workmanship
- Anti-acid, anti-magnetic stainless steel for durable performance



► LINDSTROM

**476-8198** Straight, 110mm

## 9 pieces Hex Key Set

- Made up from a chrome vanadium molybdenum steel
- Make use of both ends of the hex key
- Hex Key Size: 1.5 mm, 2 mm, 2.5 mm, 3 mm, 4 mm, 5 mm, 6 mm, 8 mm, 10mm
- Metric



**222-2482** L Shape 1.5mm Ball End

## SoftFinish® Slotted/Phillips Screwdriver Set, 6 Pieces

- Blade: High quality chrome-vanadium-molybdenum steel, through hardened, chrome-plated
- Wiha ChromTop™ finish on tip for a perfect fit every time
- Handle: Ergonomic Wiha SoftFinish® multi-component handle with roll-off protection
- Application: Especially for dry and general applications



**342-6871** Round blades

## 6 Piece Precision Screwdriver Set

- For slotted and cross-recess screws, Phillips
- Multi-component Kraftform Micro handle for fast and ergonomic screwdriving
- Anti-roll feature and swivel cap for rapid twisting
- The Wera Black Point tip offers an exact fit and optimum corrosion protection



**323-2604** Slotted: 1.8; 2; 2.5; 3 mm; Phillips: PH00; PH0

**323-2610** Slotted: 2.5; 3; 3.5; 4 mm; Phillips: PH0; PH1

## 11-piece Socket Spanner Set with Colour-coded Grips

- Handles more jobs with fewer tools, saves bench space and lightens service kit
- Equipped with remarkable black, "piggyback" torque amplifier handle
- Set housed in attractive, easy to open, clear plastic case



**538-836** Blade length 90 mm, with grip 135 mm, Inch

## WXD 2020 2-Channel Solder- and Desoldering Station Set

- Energy effective: automatic stand-by mode for tools
- Connection to external compressed air supply required
- Soldering- and desoldering tools with intelligent WX technology
- Patented, ESD safe glass display
- Soldering and desoldering station WXD 2, 2 channels with WXDP 120 and soldering iron WXP 120



**764-2897** 230V

### 4W Enclosed Miniature Speaker

- High power speaker with quality sound generation
- Sound Level 100dB
- 8Ω Coil Resistance, 4W Power, 400mm Lead
- Length 80 × 31.1 × 14.9mm (LxWxD)



817-9135 8Ω

### EFNF Series Chassis Mount Power Line Filters

- Chassis mounting RFI filters providing good attenuation in both differential and common mode over the frequency range 600 KHz to 100MHz
- With Tab Terminals



210-443 1A, 250 V ac, 400Hz

210-459 3A, 250 V ac, 400Hz

210-465 6A, 250 V ac, 400Hz

209-257 10A, 250 V ac, 400Hz

### Waterproof USB-A Panel Mount Connectors, Receptacle

- IP65/IP67 rated
- Rugged construction
- RoHS compliant
- Suitable for harsh environments



111-6749 Standard USB-A panel mount jack-dip lock

111-6753 Square flange duel USB-A receptacle and integral cap

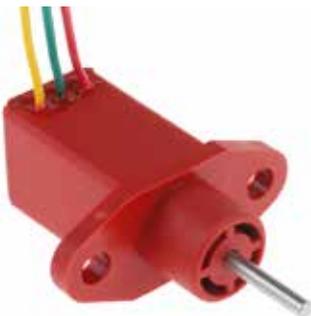
111-6754 Square flange duel USB-A receptacle integral cap and 2 m of cable

111-6759 Standard USB-A panel mount jack coupler

111-6760 Standard USB-A panel mount jack-dip screw

### Conductive Rotary Potentiometer

- Glass filled nylon bodied sensor with 10mm electrical stroke and spring loaded plunger
- For best results, use as a potential divider (not variable resistor) and buffer the resulting output with a high impedance amplifier
- Output Smoothness 0.5% (Max)
- Resistance 5kΩ linear (±20%)



317-780 3 mm Dia. Shaft, 5kΩ, ±20%, Linear

### 1.32mm Terminal Posts

- Phosphor bronze terminals solder tinned
- Spring action prevents through hole damage and ensures a solid fit prior to soldering
- Borosilicate sintered high temperature glass beads in 5 colours, ideal for prototyping
- Suitable for attaching probes/discrete wires



262-2062 White

262-2220 Red

262-2056 Yellow

262-2236 Green

262-2214 Black

### RJ45 Coupler

- Enables connectors to be patched together straight through
- Can be implemented as a temporary feature within the network patching architecture
- 2-port
- UTP shielded



186-3149 2 Port, UTP, Depth 26.96 mm

### MA05/10 Series Chassis Mount RFI Filters, with Fast-on Terminals

- A self-contained RFI suppression filter that provides high attenuation to unwanted RFI and protects against harmful transient voltage spikes
- With Fast-On Terminals



206-7904 10A, 240 V dc, 3 stages, 50/60Hz

240-696 5A, 240 V dc, 3 stages, 50/60Hz

### D-Sub Connectors with Solder Cups

- Conforms to BS9523 F0010 and F0018
- Standards RS232 interface
- Bright tin finish and granding indents available for EMI/RFI shielding
- Meets dimensional requirements of MIL-C-24308, BS9523 F0018 and DIN 41652
- UL 94V-0 rated insulators



473-896 9 Way D Socket

473-903 15 Way D Plug

470-910 25 Way Machine Cont Straight D Plug, 750VAC

472-871 37 Way Machine Cont Straight D Plug, 750VAC

### Straight 50Ω Panel Mount Bulkhead Fitting BNC Connector

- Nickel plated brass and ABS body, nut, washer and gold plated centre contact
- Solder termination method
- Female connector
- Suitable for a variety of applications including video signalling and test equipment



546-4910 50Ω

### Brass Bristle PCB and Flux Brush

- Brass refill brush, 4 mm diameter bristles
- Ideal for cleaning small areas and components such as printed circuit boards (PCB), battery contacts and fixings
- Can be used to add texture to soft metals


**514-880** 4mm Diameter

### Diagonal Cable Cutters

- Constructed from high grade steel with mirror polish and slip guard
- Two component handle for ease of use
- VDE tested and conforms to IEC 900 1000V
- Made in Germany


**161-170** 3.5mm cutting capacity 160mm overall length

### AFG-30022 Function Generator

- 20 MHz, 2 channels
- Arbitrary waveform 250MSa/s
- 16-bit resolution with 1 mVpp to 10 Vpp amplitude
- Pulse waveform parameters can be set independently for more precise timing


**122-5621** 20MHz LAN, USB

### Fibreglass Bristle PCB and Flux Brush

- This Propelling style pencil holds a 4mm diameter fibreglass brush which can be moved in or out of the holder by rotating the end knob
- Most suitable for cleaning and abrading small areas on engineering components and PCB tracks
- Adjustable propelling pencil/pen style fibre glass abrasive cleaning brush with option for brass refills


**514-868** 4mm Diameter

### Flush Type Cable Cutters

- Cutting force 3.5 kg
- Can cut through 1.02 mm diameter copper wire
- Delivers a flush cut
- Sharp edges for delicate work


**606-484** 133mm overall length, 1.02mm cutting capacity

### IDS-2000E Series Visual Persistence Digital Oscilloscopes

- 10 M depth of memory
- VPO waveform display technology
- Waveform update rate 120 000 wfms/sec
- 8 inch 800 x 480 TFT LCD display
- Maximum 1 Mpts FFT


**124-1956** 200 MHz, 2 Channels

**123-3553** 200 MHz, 4 Channels

**124-1955** 100 MHz, 2 Channels

**123-3551** 70 MHz, 2 Channels

### 125mm Small Bevel Cut End Cutters

- Cutting edges suitable for soft and medium wires
- Ergonomic soft grip handles
- Small bevel edge for fast and efficient cutting
- Made with stainless steel
- Box-joint design for enhanced security and load capacity


**182-9796** Jaw Length 8.5mm

### Ratchet Crimping Tool for Crimp Terminal

- High pin counts - 60, 96, 156, 260 and 360 ways
- Provides long life of 10000 mating cycles
- Cam actuated zero insertion force coupling
- Back shell/strain relief and polarisation options
- Metal and plastic plug and socket bodies


**821-611** 38AWG to 18AWG

### RSMSO-2000E Series Mixed-Signal Oscilloscopes

- Real Time Sample Rate Per Channel : 1GSa/s (2 Channel Models); Maximum Real
- Time Sample Rate : 1 GSa/s (4 Channel Models)
- RSMSO-2000E Equips with a 16 Channel Logic Analyzer
- Arbitrary Waveform Generator
- Per Channel 10M Memory Depth and VPO Waveform Display Technology


**180-4786** 2 Analogue. Ch., 16 Digital. Ch., 100MHz

**180-4787** 4 Analogue. Ch., 16 Digital. Ch., 100MHz

**180-4788** 2 Analogue. Ch., 16 Digital. Ch., 200MHz

**180-4789** 4 Analogue. Ch., 16 Digital. Ch., 200MHz

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