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How to design PCBs

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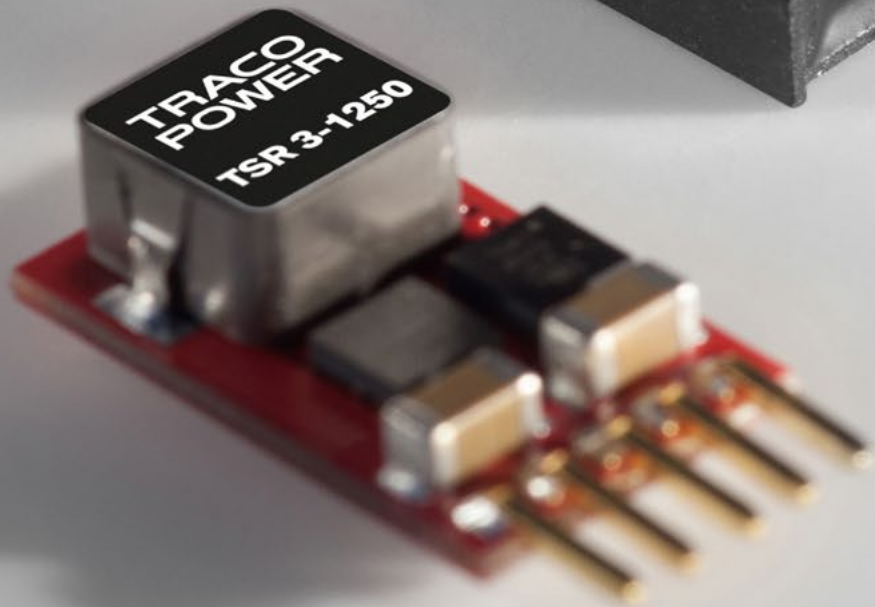
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ready for embedding CE and FCC certified module



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1–3 Ampere non-isolated Step-down Switching regulators. A high efficient alternative to linear voltage regulators.



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ADDITION SOSnews eXtra

PCBs design



Ján Michalko
head of international sales

Dear readers,

our company is very well known in our local markets in Slovakia, the Czech Republic and Hungary. Past decade brought many changes. SOS electronic has changed from local to international, stable and prosperous company.

When we, nearly 12 years ago, started to serve customers out of our traditional markets, we couldn't even imagine how important this decision was considering our future. As in most cases, beginning was difficult. But it was important to keep up, have faith in what we do and of course, work hard. Since the world is big, we started to add new markets to our portfolio, such as Romania 9 years ago and a year after that, Poland. Although the Eastern European markets have long been the fastest growing markets within the European Union, we expanded our operations in the opposite direction -to the west. 5 years ago we actively entered German market and this year, we've added Austrian one. In addition to that, we continue to develop our cooperation with customers from all over the world and now our portfolio consists of customers from all continents, from more than 100 countries of the world. Apart from traditional markets such as Western Europe or USA, we also supply the goods to non-traditional destinations such as Australia, Singapore, South Africa and Chile. By this, we became a member of the club of few companies that are able to trade internationally on this scale.

What have these activities brought and are going to bring for our customers? With size and market coverage, we became a perspective partner for many new suppliers and thanks to that we could bring you new products, solutions and services. I'll mention just some of them – IoT products, webinars and workshops, customers' visits with manufacturers, new web with responsive design (i.e. one application for desktop and mobile devices) or e-cube portal that can be used by our customers to promote their products for free. We will continue in this trend in the future so we can be a perspective and reliable partner for you.

I wish you many stimulating ideas while reading this edition of SOS News.

Read your SOS news with mobile!

You can read this issue of SOS news using so-called QR codes. At the end of every article you can find a picture with encrypted address of the Internet website to this article.



SLOVAKIA
SOS electronic s.r.o.
Pri prachárni 16
040 11 Košice
tel.: +421 55 78 604 44
fax: +421 55 78 604 45
www.soselectronic.sk

CZECH REPUBLIC
SOS electronic s.r.o.
Hybešova 42
602 00 Brno
tel.: +420 54 342 71 11
fax: +420 54 342 71 10
www.soselectronic.cz

HUNGARY
SOS electronic Kft.
József Attila út 74.
H-3527 Miskolc
tel.: +36 46 501 380
fax: +36 46 501 389
www.soselectronic.hu

GERMANY
SOS electronic GmbH
Klaus-Conrad-Str. 1
92242 Hirschau
tel.: +49 962 26 09 16 90
fax: +49 962 26 09 16 99
www.soselectronic.de

POLAND
SOS electronic
ul. Tatarzewicza 17
92-753 Łódź
tel.: +48 42 203 23 94
fax: +48 42 648 45 76
www.soselectronic.pl

ROMANIA
SOS electronic
Bucharest, Șos. Mihai Bravu
no.294, Bl.6, Sc.B, et. 9,
Ap.75, District 3, cod 030319
tel.: +40 31 221 02 09
fax: +421 55 786 04 45
www.soselectronic.ro

Industry 4.0

Are you ready for the 4. industrial revolution?

Simplified guidance for small and medium-sized companies...

I'm sure you've heard those magic words. What is Industry 4.0? And how it's going to affect me or my company? Do we really need to think about changing our work processes or even mass reorganizational changes in company? Or is it just a "trendy" word with nothing but technological marketing behind it and we are good to ignore it?

What is Industry 4.0?

Why are we then talking about 4. industrial revolution? What are the milestones that give us the right to pretentiously name it as the fourth in a row? After steam-powered machines in production, subsequent mass production based on electronic energy and computer-controlled automated lines we have one homogeneous so-called cyber-physical system (cyber-physical system =CPS). It is essentially a combination of elements of hardware / software / communication and we should stress the importance of communication here. Simply put, machines are becoming smarter. They will communicate with each other and share common data. In fact, they will create their own "social networks" :-). And it is said that this intelligent "community" of machines will increase production by 30% and make it cheaper by 25%.

This is difficult to understand, let's simplify it!

Since majority of our customers are from small or medium-sized companies, let's forget about the possibility of applying the concept of Industry 4.0 in large industrial automated productions such as automobile industry. And it doesn't even have to be production company in order to get ready for the new industrial revolution. In my opinion, it will affect everybody on the market, either those who produce something or those who provide services. Probably an inevitable heart of everything is intelligent machines. It's important to understand that they are not here to replace us or take out jobs. Think about our and

machines' strengths and then divide the activities into those that we can do better and those that are better performed by machines. Let's not think about machines as something big, it can be anything (even something intangible) that can independently perform certain tasks.

Machines are faster and more effective in mathematical and statistical operations; they can accurately and consistently repeat thousands of operations. They are certainly better in logic "if-then-else" and they can even faster analyze answers to the closed questions and respond to them. On the other hand, emotions and a smile, personal meetings and talks are "people-things". Try to look at your business this way, at each of its department, employee or work activity.

Which steps need to be taken and what we can advise from our own experience?

If you want to get ready for Industry 4.0 and you are ok with the idea of presence of intelligent machines, the first step is to create good "working environment" for them.

1. DATA, DATA, DATA...

First of all, the machines have to have SOMETHING to share. They need to have data, so digitalize your company. Don't keep the information in people's heads or on papers. Transform them into magical 0 and. And of course, keep it in structured form in some database. And also, think about the fact that these machines will produce a lot of data and records during their work so you need to let them store those data somewhere.



Industry 1.0

- water, steam
- first machines



Industry 2.0

- electricity, fuels
- mass production



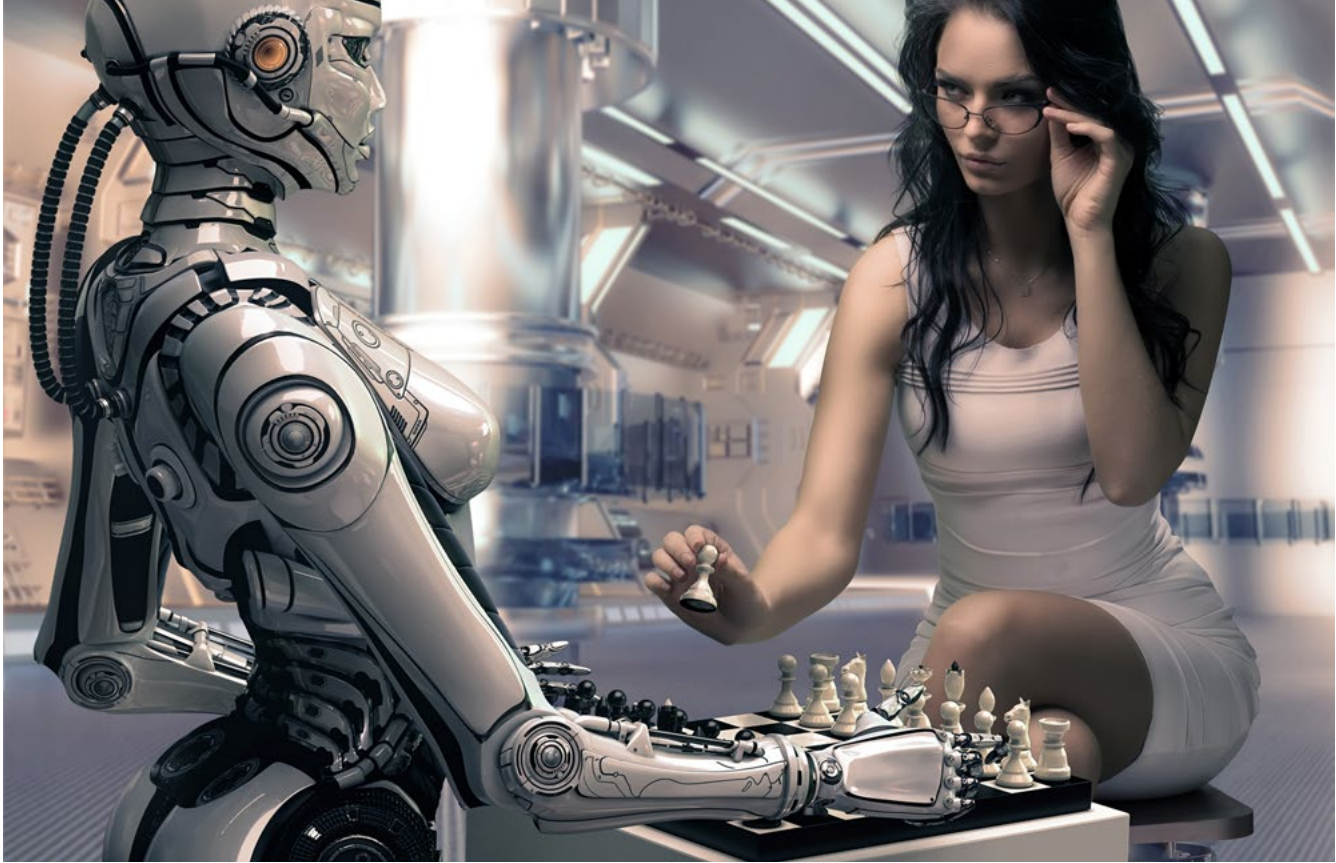
Industry 3.0

- computers
- automatization of production



Industry 4.0

- cyber-physical systems (CPS)
- personalization and customization



Our experience: Almost certainly you won't have just one data storage or one database. After all, you have the information in economic software, CRM, from web, etc. It depends on type of data and what I am going to use it for (so-called relational and non-relational databases). Don't worry about it, it doesn't matter how many databases you have. Interface is important. And here we come to the next step...

2. COMMUNICATION

How will the machines communicate with each other? How will they exchange data? Create (literally program) the communication interface. Here in SOS electronic, we have created our own API (Application Programming Interface) that knows how to communicate with various databases and additional machines/applications (no matter how you call them) are then only referring to API (via GET or PUT). So simply put, there's API in the middle, it doesn't have data but it can find them out from the individual databases or via other connected devices. So the machines communicate with each other via the API.

After creating a working environment we need to divide roles. What will be performed by humans and what will be done by machines. Be creative and do not be afraid to give the machines all the work that they can do better than people. Of course, let some machine check how efficient other machines and people work and respond to that with new ideas and measures. It is a cyclical process.

1. Environment

- WHAT: Data, Digitalization
- HOW: Communication Interface

3. Control

- Measure everything
- Analyze (new ideas, measures)

2. Tasks

- People: emotions, ideas, scenarios for machines etc.
- Machines: if-then-else

And what is it good for?

The aim of Industry 4.0 is personalization and adaptation to individual needs of customers. You can already order running shoes that you design yourself using wizard over the Internet. And they will be produced without the need for laborious readjustment of the production line.

Or another example ...

You can send a newsletter to all customers with the same content, or ... you can let one machine analyze customer behaviour and needs and based on that let different machine prepare email content specifically for a particular customer so they read only what interests them. A third machine then measures what and if customer read anything from this newsletter and subsequently modifies the data in a way that the next newsletter is even more relevant. Could this be done by human for x-thousands of customers?

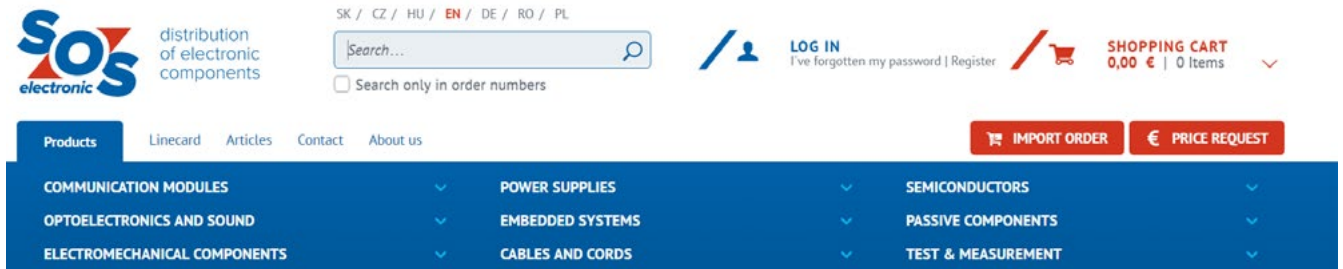
Epilogue :-)

In this article, we tried to show you in a simplified way how to get ready for Industry 4.0 mainly in small and medium-sized companies. Thus, if you will digitalize your company, work with data, constantly think about how to divide work among people and machines correctly and effectively, constantly measure and analyze if it really is effective, may I say that you are not only ready but you are already part of the Industry 4.0 :-)

And if you (as an electro-technical company) see this as an inspiration for your new products, point for you! We'll be happy to help you with our range of electronic components and our additional services.

Rastislav Talárovič
manager of marketing department

Review and confirm the price offer *within just few clicks*



We've introduced something new to our e-shop – option to order based on the provided price offer. You can select which items from the offer you want to order and place the order within just a few clicks.

Until now, you could only request the offer in e-shop. This option, of course, still remains. You can select not only from our offer of 200 000 products but also send the request for any other component. After finding out the lead time and price from our suppliers, we are sending the offer via email and place it in your account after login.

What is new?

Your offers are now divided into two parts – current offers and offers archive. Current offers – this is obviously the most interesting part. You can see any price offers, also those that were requested over the phone or email. Once they are completed, they automatically appear on the web.

Current offers

At the time we send you the offer over the email, it also appears in your ac-

count in e-shop. Typically we provide offered price, delivery lead times and any note from our supplier. Apart from this, additional information such as transport, payment method, delivery address, who created price offer and also who requested it are visible. Offer is valid for 7 days unless specified differently.

Immediate order option

If you are interested in price offer provided, you can order products immediately. There's a check box on the left for each item. It means that you don't have to order all of the items; you can also order just one item from the offer. Continue with the order recap (similar to classic e-shop shopping cart) where you will see just those items you were interested in. Now, all you need to do is confirm the order.

Price offer export to XLS

If you need to process the price offer first and don't want to copy-paste item by item, use the option to export the offer to XLS format. This way, you can easily get into your information system.

Not completed offers

If our offer is still not completed, it is marked as "in process". But these are also worth checking – it is possible that price and delivery lead time for particular items will already be present. This way you can see the offer before we officially send it to you via email. That's what we do only once the whole offer is completed.

Offers archive

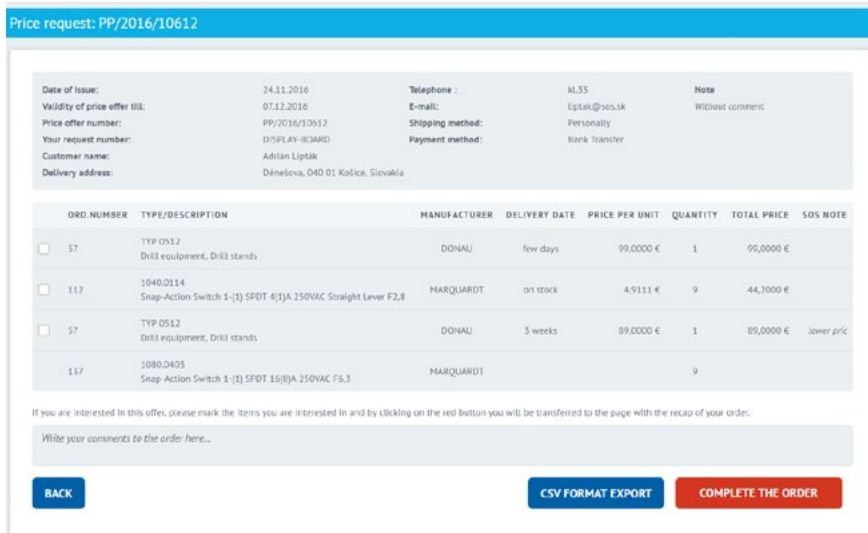
Offers archive provides offers older than 7 days. However, you can also search for offers created within last 2 years.

Faster processing of your order

If you order products from the price offer via web, your request gets into our system within just 1 minute and our purchaser can order products immediately. This removes the downtime that can be caused in case your email is read later.

Loyalty points

These orders are also covered by our loyalty program. Since with price offers we often have special, lower prices, the number of loyalty points will also be lower – half. It is however still interesting benefit since with offers it is usually higher financial value and thus more points.



Latest articles to read...

NerO - Arduino UNO R3 Compatible Board with Enhancements



NerO is dealing with the fundamental drawbacks of the widely-used Arduino UNO R3 – inefficient onboard linear voltage regulator.



Quectel enters the market with Narrow-Band modules for the IoT in a small coat



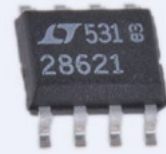
BC95 – ultra small size, ultra-low power consumption. As an authorized distributor and a major partner of Quectel, we are giving you the possibility to pre-order sample for free right now!



LTC2862– The Next Step Towards to the Perfect RS485 Transceiver



HW design engineers are no longer required to choose between robust fault tolerance and high performance in a RS485 transceivers - the LTC2862 offers both.



Apacer SMART SSD and memory cards



SMART (Self-Monitoring, Analysis and Reporting Technology) is a monitoring system used in Apacer industrial solid-state drives (SSDs), SD and microSD memory cards, PATA and CF products that detects and reports on various information about their status in order to prevent the data loss due to hardware failures.



LTE Antenna for demanding applications



More and more applications use LTE connection nowadays. To meet a strong market demand for LTE antennas, 2J released a 2JW0124, which is a high gain, universal antenna.



The SUNNY side of life - Reliable manufacturer of adapters and power supplies



Technically every application needs a power supply. It matters which adapter or power supply we use. It needs to be durable and have low power consumption in an idle state, it needs to have interesting design and its manufacturer needs to have all the required certificates.



New product family FOX (FRIWO One-click Xchangeable)



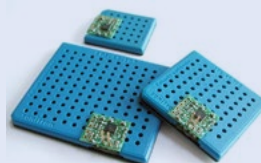
Efficiency according to DoE 2016 - even for medical applications!



Sonitron flat loudspeakers will surprise you by a clean sound



Several flat loudspeakers from Sonitron prove that a piezo loudspeaker is capable of having a balanced frequency response.



Weller WT– a station in the „GT“ version for the price of a basic version



New WT soldering stations are interesting answer if you want a top quality for a reasonable price.



Bluetooth LE (SMART) with nRF51822 onboard

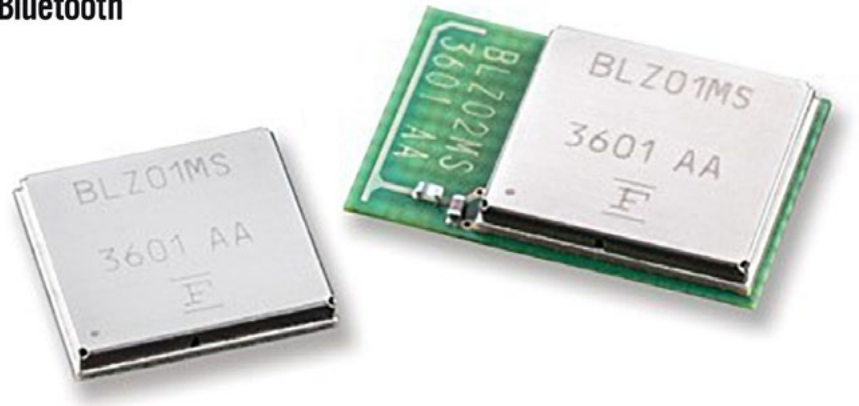
If you are looking for a powerful BLE module capable of a standalone operation, probably the MBH7BLZ0X module is the right choice for you.

Fujitsu is a well known Japanese manufacturer of electronic devices for decades. Some of their products deserve special attention. For example Bluetooth Low Energy or also known as Bluetooth Smart modules are state of the art in their category. Equipped with a industry standard Nordic Semiconductor's nRF51 chip under the hood, Fujitsu MHB7BLZ0X modules delivers a Bluetooth radio combined with a powerful ARM core and Flash memory available for your application. No external MCU is necessary, because embedded power is more than enough to run almost all.

If it is a home automation project or a smart weighing machine, coffee machine or a wearable gadget, all these devices can run from the MHB7BLZ0X's embedded MCU while sending measured data to user's smartphone or even to the internet cloud.

And the good news are, that Fujitsu will bring to the market an even more sophisticated and powerful module this year with the new nRF52832 with ARM Cortex-M4F embedded core running on a stunning 64MHz with a total link budget of 100dBm, -96dBm sensitivity and +4dBm output power. This chip will deliver an extended communication range and whats more, it is NFC capable, that means "touch-to-pair" with a smartphone is possible. For more information on the new nRF52 SoC please visit <https://www.nordicsemi.com/Products/nRF52-Series-SoC>.

SOS electronic became an authorized paneuropean distributor for Fujitsu Wireless modules.



Features

- module embedded with Fujitsu Components' Data Communication (FDC) profile
- FDC is a SPP (serial port profile) like profile ideally suited for sensing, monitoring, & wearable applications
- 60+ simple text commands ensure quick & easy module integration
- Bluetooth specification version 4.1 (single mode, Peripheral module)
- output Power: +4dBm max.
- receiver sensitivity: basic rate -88dBm typical
- host interface: UART (115.2kbps)
- storage temperature: -40 to +85 degrees C
- supply voltage: 1.9 to 3.6VDC
- dimensions: 15.7 x 9.8 x 2.0mm
- module has embedded 16MHz clock
- RAM: 16K bytes
- connection to external 32kHz clock available
- LGA package
- CE Certified

Order no.	Type	Description	Guide price
211179	MBH7BLZ02	Bluetooth module BLE v4.1 Embedded Software w/Antenna	17,30 €
211180	MBH7BLZ02-109004	Bluetooth BLE v4.1 Module 'Blank' w/Antenna	15,10 €



This is a short version of the article. The whole article can be found at web. Decode the link in QR code.

UHF RFID readers from TSS COMPANY

The number of UHF RFID applications is rising exponentially. SOS electronic has a new partner for UHF RFID products with a comprehensive product line and deep expertise in UHF RFID.

TSS COMPANY is a young team of designers from Slovakia with a clear idea and growing product portfolio. Their product line is built around a very sophisticated and powerful UHF RFID module, the mURM v 2.0, which is already the second generation of such module with enhanced parameters.



This module is available for OEM manufacturers and can be used as a complete solution for every RFID

reader manufacturer or system integrator. Development kit for short time to market is available for mURM v 2.0.

High level end user RFID readers are also available for software companies and system integrators: the Gold Reader industrial UHF RFID reader features a 4-port RF amplifier, 865-868MHz (ETSI) frequency band, 33dbm software adjustable output power, a power over Ethernet option and Windows, Linux OS compatibility. Applications are in logistics, inventory management or transportation.

The HUR120USB is a handheld reader targeting documents tracking applications, inventory management or point-of-sales applications. It features USB port connection,

keyboard emulation mode, a built-in push button, ergonomic design and Windows or Android compatibility.



The DUR120USB is a desktop UHF RFID reader could be used for assets tracking, documents tracking, in point-of-sales applications or for access control applications. The DUR120 ETHERNET is an Ethernet version of DUR120USB and can be connected directly to the company's LAN network.

mURM v 2.0 Technical Specifications

- air interface protocol: EPC global UHF Class 1 Gen 2
- frequency: 865-868 MHz
- number of channels: 4 channels
- supported region: ETSI (Europe) – ETSI EN 302 208
- RF power output: max. 14dBm
- tag communication rate: 40 kbps
- read range: Up to 1,3 m
- tag read rate: Up to 50 tags/second
- interfaces: 2 x UART, SPI
- I/O: 9 GPIOs
- power supply: 3.3 VDC
- operating temperature: -20°C to +55°C
- dimensions: 38.1 mm L x 38.1 mm W x 6.68 mm H



Order no.	Type	Description	Guide price
214917	mURM UHF RFID module	UHF RFID reader module	138,00 €
214921	mURM UHF RFID Evaluation Board	UHF RFID Evaluation Board	299,00 €
214925	DUR 120 ETHERNET UHF RFID READER	UHF RFID Ethernet Reader	298,00 €
214927	Gold Reader PoE UHF RFID READER	4-Port UHF RFID reader	875,00 €

This is a short version of the article. The whole article can be found at web. Decode the link in QR code.



The smaller the better, TDN5WI compact DC/DC converter

The TDN5WI Series sets a new level of the power density in high performance DC/DC converter class.

If you need for your upcoming project a reliable compact 5W compact DC/DC converter with wide input range please consider to use the new TDN5WI family from TRACO POWER.

The cubical package of only 1.23 cm³ encloses a sophisticated circuit which provides 5 Watt output power without any compromise regarding reliability and functionality. This tiny converters operate

up to 50°C environment temperature at full load or up to 75°C with a 50% load derating. With 1500 VDC I/O-isolation voltage, external On/Off, short current protection and EMC according EN55022 class A, they cover a wide range of application when space is limited.

The input of the converters is designed for a wide voltage range (4:1) and minimum load is not required.



Features

- ultra compact DIP package 0.52 x 0.36 x 0.40 inch
- I/O-isolation 1500 VDC
- fully regulated outputs
- operating temperature range -40°C to +75°C
- short circuit protection
- remote On/Off

Order no.	Type	Description	Guide price
208398	TDN5-0912WI	DC/DC Module 5W 4,5-12V/12V/0,42A DIP	25,00 €
208400	TDN5-0915WI	DC/DC Module 5W 4,5-12V/24V/0,21A DIP	25,00 €
208407	TDN5-2415WI	DC/DC Module 5W 9-36V/24V/0,21A DIP	25,00 €



AC/DC isn't only name of a famous rock band



Myrra adds more power, 7.5W and 10W AC/DC converters for PCB mounting with 3.3-24VDC output voltage now available.



Every device needs to be powered, either it is a battery or or AC/DC converter. Some years ago Myrra came to the market with small AC/DC converters up to 5W output power. This step was very successful and many customers switched to these AC/DC converters instead of bulky, heavy and power inefficient 50Hz transformers. Over the years became clear that there is a strong demand from the market for such AC/DC converters with higher power output. To meet these requirements 14 new converters were added with 7.5W and 10W output power. Dimensions for a 7.5W models are 41x35x24.5mm and 48x40x26mm for 10W models.

Electrical Specifications:

- Input voltage range 85 to 265 Volts AC 120 to 370 Volts DC
- Input Frequency 47 to 63 Hz
- Line output voltage regulation $\pm 0,5\%$
- Load output voltage regulation
- No load input power < 150mW (COC level 5 stage 1)

Safety:

- Prepared for Class II – reinforced insulation
- Input / Output Isolation test voltage: 4000 Vac

- Operating ambient temperature: -25°C to (see table)
- Storage temperature: -40°C / +85°C
- Input protection by integrated fuse
- Output short circuit protection : automatic restarts when fault condition is removed
- Thermal shutdown with automatic recovery if internal temperature exceeds allowable value

Order no.	Type	Description	Guide price
181068	47212	AC/DC napájecí zdroj do DPS 10W 12V/0,83A	10,80 €
217214	47206	AC/DC napájecí zdroj do DPS 7,5W 3,3V/2,27A	10,30 €
217235	47210	AC/DC napájecí zdroj do DPS 10W 5V/2,1A	8,29 €



SDP31 – a miniature sensor for your big projects

Sensirion digital differential pressure sensor SDP31 is based on the next generation of CMOSens® technology.



Sensor size 8x5x5mm opens a new possibilities in space constrained applications which were not available until now due to sensor size. SDP31 is member of the next generation of sensors building on success of SDP600 series. SDP 600 features describes our previous article.

The most important improvements over SDP600 series are:

1. Size 8x5x5mm only, reflow soldering process compatibility.
2. Continuous measuring mode. In this mode the sensor is measuring at the highest speed (1000 measurements per second) and writes the measurement values to the I2C results buffer, where the I2C master can read out the value when it requires
3. Average till read. Measured values are averaged until I2C master read it out. This has the benefit that the user can read out the sensor at its own de-

sired speed and also make measurement more precise. During the first 25 ms (25 measurements) of averaging the averaged value is obtained as the arithmetic mean. If I2C master doesn't read out measured value is after 25 ms, the sensor will continue to average, but with another algorithm. In this algorithm exponential smoothing is used.

4. The SDP31 is temperature compensated both for differential pressure and for mass flow compensated differential pressure. Thus the same sensor can measure differential pressure and mass flow. In use cases where the SDP31 is used to measure mass flow it is advised to use mass flow temperature compensation.

Order no.	Type	Description	Guide price
212104	SDP31-500Pa	Digital Differential Pressure Sensor -500...500Pa I2C	14,60 €
217283	SDP36-500pa	Differential Pressure Sensor -500...500Pa Analog output	14,60 €



Quectel EC21 and EC25 or how to connect „things“ to Internet via LTE?



Today more and more applications require high data rate transmission. LTE modules can be found not only e.g. in trucks but more and more vehicles are connected through LTE modules to the service centers and sends data for vehicle manufacturers to avoid damages and help new product development.

EC21 is a Multi-Mode LTE CAT1 module from QUECTEL optimized specially for M2M and IoT applications. Delivering optimized speeds of 10Mbit/s download and 5M-bit/s uplink, and featuring low-power, low-cost LTE connectivity make it ideally suitable for numerous IoT

applications that are not rely on highest speed connectivity but still require the longevity and reliability of LTE networks.

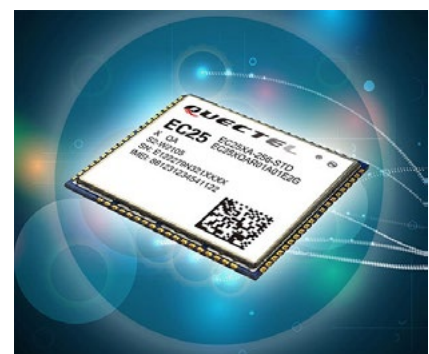
EC25 is a Multi-Mode LTE CAT4 module. It delivers 150Mbps downlink and 50Mbps uplink data rates. Targeted for applications requiring high-speed data

and backward-compatible with existing EDGE and GSM/GPRS networks to ensure that it can connect even in remote areas devoid of 4G or 3G coverage.

Features

- maximum data rate of 150Mbps downlink
- worldwide LTE and UMTS/HSPA+ and GSM/GPRS/EDGE coverage
- MIMO technology meets demands for data rate and link reliability in modem wireless communication systems
- GNSS receiver available for applications requiring fast and accurate fixes in any environments

Order no.	Type	Description	Guide price
214954	EC21-E	IoT/M2M-Optimized Cat.1 LTE Module 32x29x2,4mm	65,20€
215601	EC25-E	Multi-mode LTE Module 51,0x30,0x4,9mm	69,86 €



ePaper, e-Ink, ...we have for you a display that can replace a paper



Would you like to have a display with zero power consumption in a rest status and with ideal viewing angles?

For those of you, who are not familiar with this type of displays yet, we'll mention, that it's a so called electrophoretic display, i.e. Display containing white particles in micro-capsules dispersed in a thin layer of a dark high-viscosity liquid. These particles can be moved or turned by a short voltage impulse, what will cause a given pixel to appear as white. Similarly an impulse of a reverse polarity will cause a given pixel to appear as black. High viscosity of a liquid causes that micro particles remain their position practically forever (years).

That means, that this type of displays is also ideal for battery powered devices, as it only needs an electric energy to change a displayed content. A display is reflexive, i.e. doesn't require backlight but for a good legibility at least a low ambient light is necessary. It's advantageous that the display is easily readable even on a direct sunlight. A charm of ePaper display is also in the fact, that a displayed content

is really similar to that sketched/ written on a paper – even as for viewing angles.

To the previous several types we newly added 3 universal graphic ePaper types from company ThingWell:

- 2,13" - TINK-EPD29A01 - 250x122px
- 2,9" - TINK-EPD213A01 - 296x128 px



- 4,3" - TINK-EPD42A03 - 400x300 px

All 3 displays are COG (TFT active matrix) with SPI interface. The displays are ultra thin with thickness of only approx. 1,5mm.

Features

- e-paper displays with a high contrast
- display content remains even without a power supply
- power is only needed for a display content change
- high contrast, ultra wide viewing angle
- extra thin (approx. 1.2 mm)
- operating temperatures range 0...+60°C

Order no.	Type	Description	Guide price
218004	TINK-EPD154A01	E-paper Display Module 1.54" 36,3x31,8x-1,05mm	24,70 €
218005	TINK-EPD213A01	E-paper Display Module 2.13" 59,2x29,2x-1,05mm	21,40 €
218007	TINK-EPD29A01-0629	E-paper Display Module 2.9" 79,0x36,7x-1,05mm	32,39 €

Is it super bright even to you?

Super bright TFT displays from Winstar are the right choice for a sunlight readable display.




Standard displays had a brightness of approx. only 200 Cd/m². That was fully sufficient for indoor use, however when using at a strong ambient light or even a sunlight, the readability went rapidly down. New more efficient white LEDs enabled construction of substantially more powerful backlight while keeping a low power consumption, that's why nowadays TFT displays usually feature brightness of approx. 300-400 Cd/m².

Why is a more powerful backlight necessary for outdoor use?

The answer is relatively simple. Contrast of a display is simply said ratio of a white surface brightness (white pixels) to a black surface brightness. The problem is, that a black surface is never fully black, what in praxis means, that small portion

of backlight leaks through (contrast drop in a dark environment). At the same time the black surface also reflects some light portion falling from outside (contrast drop in a strong-light environment). When we realize, that a light intensity outdoor can be in order of magnitude higher than indoor, especially on a direct sunlight, so even in case that a black surface would reflect only 2% of a falling light, the resulting brightness of black pixels will rise significantly. Finally, white to black pixels brightness ratio will substantially fall, what's a main reason of a poor contrast

of TFT displays at a strong ambient light.

A solution of this problem can be a usage of high brightness displays. „Super bright“ TFT displays commonly feature brightness of 600-1000 Cd/m². Company Winstar offers super bright TFT displays in 3,5/4,3/5,7 a 7,0" sizes with resolution of 320x240 to 1024x600 pixels. All are with enhanced operating temperatures range (-20...+70°C) and also available is a 4,3" type, which besides a high brightness features enhanced viewing angles range (O-film TFT display).

Features

- quality TFT LCD from a well proven producer
- high brightness – also readable at strong ambient light
- versions without or with a touch panel
- available in 3.5"/ 4.3"/ 5.7"/ 7.0" and 10.1" sizes

Order no.	Type	Description	Guide price
210102	WF43HSIAEDNT0#	TFT-LCD 4,3" module 480x272 RGB + RTP	34,90 €
227493	WF35LSIACDNN0	TFT-LCD 3,5" module 320x240 + 24Bits	30,30 €
227503	WF70BSIAHLNNO	TFT-LCD 7,0" module 1024x600 + LVDS	45,60 €

PremierWave 2050- the "Golden Gate Bridge" into IoT world

If you need an industry grade, reliable and feature rich WiFi to Ethernet bridge for your application, the PW2050 is the right choice for you.

Delivering reliable and always on 5G Wi-Fi® (802.11ac) connectivity, the Lantronix® PremierWave® 2050 is a series of embedded modules designed specifically for sensitive, mission critical, industrial and commercial applications. Many applications are in medical and industrial area for connecting wireless equipment to enterprise network.

Three strong reasons for demanding applications:

1. Integrated Enterprise Security - Secure Wi-Fi connectivity requires supporting scalable enterprise class Wi-Fi via Extensible Authentication Protocol (EAP) methods and secure AES (CCMP) ciphers. To protect management interfaces, PremierWave 2050 uses SSL/TLS and SSH for data

encryption and PKI/Certificate Management for authentication and key management. In addition, PremierWave 2050 offers firewall features to block ports and has NIST-certified AES encryption.



2. Designed for Industrial and Commercial Applications - Enterprise and industrial IoT applications are mission critical in nature and require robust, always-on, secure connectivity. PW2050 offers a robust application stack and connection management, antenna diversity, 5 GHz Wi-Fi bands support, and the ability to operate in extended temperature environments.

3. Easy Integration - with its small dimensions only 45x45x3,5mm and SMD package, PW2050 can fit almost any PCB.



Features

- IEEE 802.11ac (1x1) up to 433 Mbps; IEEE 802.11n (1x1) up to 150 Mbps • dual band 2.4 GHz and 5 GHz, channels 1-14, UNII-1, 2, 2e and 3 • bluetooth/WLAN coexistence • soft access point with DHCP Server, DNS Proxy, Wi-Fi Direct • simultaneous AP and client mode

Order no.	Type	Description	Guide price
213750	PW205020001S	Wi-Fi Module 802.11ac Chip Antenna + U.FL	11,00 €
213758	PW205010001S	Wi-Fi Module 802.11ac Dual U.FL	26,30 €
213759	PW205020001B	Wi-Fi Module 802.11ac Chip Antenna + U.FL	19,63 €

2G=2J! 3G=2J! 4G=2J!

2J, a well known antennae manufacturer introduces a new 3G/4G LTE PIFA antenna.

2JE11 is a new member of 2JE embedded PIFA ceramic antenna family in SMT package.

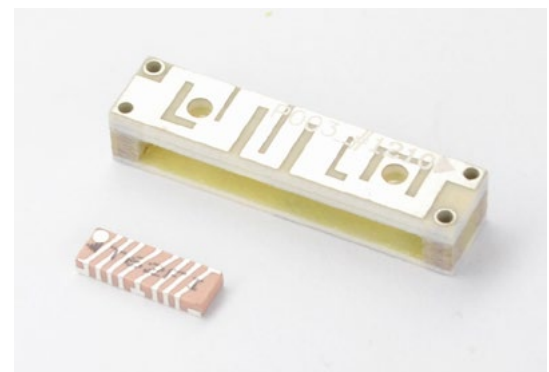
Other members of that family are 2JE03 – GSM and 2JE05 -ISM. We can supply also 2JE07c - WiFi, this antenna is a non stocking type.

SMT package as several advantages over classic wire antenna: easy mounting and soldering thus lower losses and low mounting cost. Especially the lack of RF connector and RF cable makes the

final product more reliable and resistant to vibrations.

A special care must be taken during PCB design process in order to get as much as possible power from the antenna, all design rules can be found in the data-sheet of 2JE11.

The disadvantage of SMT antenna is a bigger PCB and more complex approach to PCB design comparing to wire antennas.



Features

- easy mounting • small dimensions • wide working frequency • embedded solution • no connector, no cable • wide operating temperature range

Order no.	Type	Description	Guide price
124389	2JE03	Embedded Dielectric Quad Band Antenna SMT	81,90 €
126089	2JE05	ISM Chip Antenna 9x3x1,2mm	57,10 €
221218	2JE11	LTE Antenna PIFA Ceramic 698-960MHz, 1700-2700MHz	18,80 €



CleO35 - ready for embedding CE and FCC certified module



FTDI's CleO35 is simple to program, 3.5 inch 320x480 TFT display with resistive touch panel that allows the construction of human machine interfaces (HMIs) with much higher performance than conventional Arduino display shields are able to deliver.

CleO35 is based on FTDI's FT810 - Advanced Embedded Video Engine (EVE2) and FT903 - 32-bit FT903 Super Bridging Microcontroller.

FT810 controls display and senses 4-wire resistive touch panel. It can recognize touch tags and track touch movement. Built-in sound synthesizer generates notification sounds which are played through PWM audio output. FT810 can also play audio recorded in RAM. FT810 can play audio and video in AVI container (MJPEG (Motion Encoded JPEG) video and 4 Bit IMA ADPCM, 8 Bit signed PCM, 8 Bit u-Law audio).

FT903 takes care about data to be displayed. It processes data from SPI slave interface which is pin configurable to support both 5V and 3,3V voltage levels. Typical source of data is NerO or

other Arduino UNO compatible board. FT903 can also process data from microSD memory card, camera or on-board 8MB Q-SPI Flash and send them to FT810 through Q-SPI interface.



Features

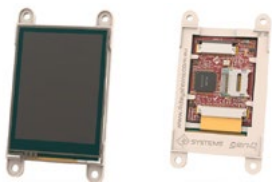
- anti-aliased graphics throughout for much finer image quality with no artifacts in raster images, objects are rendered with 1/16th of a pixel resolution
- fast direct file transfers between micro-SD/Q-SPI flash and the graphics subsystem without using Arduino UNO resources
- module with panel mountable bezel ready for embedding
- built in 8MByte Q-SPI flash memory
- built in 1,25W/80hm speaker amplifier

Order no.	Type	Description	Guide price
222703	CleO35	Smart 3,5" TFT Display Shield for Arduino	63,60 €

Gen4 displays from 4D Systems bring several improvements



Fourth generation of displays will probably make designers and producers of electronics happy thanks to easier usage, availability of several versions and also thanks to a lower price.



Newer components are almost always better than older ones and in case of „gen4“ displays it brings several improvements.

What's new / changed?

- thinner design, modules are thinner and also thanks to a lack of pin header they require substantially less space from a bottom side
- pin header for power supply and programming is replaced by an FFC connector, which also contains many other processor pins
- extra high brightness displays
- integrated design cover lens bezel. Displays with a „CLB“ suffix (cover lens bezel) have at production integrated glass bezel as we know it for example from tablets. Such a display is also easy to integrate into an end device. Bottom of the

bezel also features a thin double-sided sticking tape.

- 5" display. A new 5" display was added into the gen4 family (800x480 px)
- mechanical support for mounting of a

PCB with your application

The last benefit of a new series is a feelingly lower price, i.e. a module of the same size and of same features is in a new series feelingly cheaper.

Features

- all I/O and programming pins are available on one connector
- thinner design
- new 5" type (800x480 px)
- possibility of increased EMC immunity
- compatibility with Workshop4 IDE SW

Order no.	Type	Description	Guide price
218166	gen4-uLCD-43DCT-CLB	DIABLO16 4,3" 480x272 Intelligent Display Module CTC	106,00 €
218167	gen4-uLCD-32DT	DIABLO16 3,2" 240x320 Intelligent Display Module RTP	45,00 €
218174	gen4-uLCD-43DT	DIABLO16 4,3" 480x272 Intelligent Display Module R	86,00 €
218175	gen4-uLCD-70DT	DIABLO16 7,0" 800x480 Intelligent Display Module RTP	116,00 €

Are you producing a USB device? Hammond enclosures give it a face



Then you'll probably welcome a new family of quality enclosures for USB devices from Hammond.

USB is currently perhaps the most widely used communication interface for periphery devices connectable to a PC. Similarly, various data loggers and other small mobile devices benefit from the USB protocol. These are exactly the ones, for which Hammond brings the 1551 USB enclosure series. This Canadian producer produces a huge number of enclosure types in various modifications; however, no enclosures designated strictly for the USB devices were produced till now. This has

changed by introducing the 1551 USB series, containing up to 15 models (three sizes in five colours):

- **1551 USB1** – 35*20*15,5 mm (LxWxH)
- **1551 USB2** – 50*25*15,5 mm
- **1551 USB3** – 65*30*15,5 mm

As it can be seen, enclosures cover the most frequently used range of sizes from length of 3.5cm up to 6.5 cm. All sizes are available in five modifications (colours):

- BK – black (RAL 9011 Black)
- GY – light grey (RAL 7035 Grey)
- TCL – Translucent clear
- TSK – Translucent smoke
- TRD – Translucent red



Features

- plastic enclosures suitable for USB devices
- available in 3 sizes
- available in 5 colours
- including a cut-out for USB A connector
- inner standoffs for PCB mounting

Order no.	Type	Description	Guide price
218435	1551USB1GY	Enclosure USB ABS 35x20x15,5mm Grey IP54	1,99 €
218442	1551USB2BK	Enclosure USB ABS 50x25x15,5mm Black IP54	2,11 €
218448	1551USB3GY	Enclosure USB ABS 65x30x15,5mm Grey IP54	2,30 €

Soft Shell Power and Signal Connectors - huge amount of versions



Soft shell connectors from TE Connectivity offer many options and features, economy and reliability. These families of multi-lead connectors include round (pin and socket) and rectangular (blade and receptacle) contact styles.

Soft shell power and signal interconnects TE Connectivity provide a reliable and economical means of grouping multiple-lead connections in today's appliance, computer, or industrial and commercial applications. As electrical functions and performance requirements have increased, the soft shell product selection continues to

evolve and offer new designs and features to answer these modern industry requirements. This family of connectors includes both round (pin and socket) and rectangular (blade and receptacle) contact styles that are available in a variety of housing sizes, colors, materials and keying options. The newest soft shell products include the



Power Triple Lock connectors and Grace Inertia connectors, along with expanded offerings of economy power (EP) connectors and VAL-U-LOK connectors.

Featured Product Lines:

- Power Triple Lock connectors
- VAL-U-LOK connectors
- Economy power (EP) connectors
- Universal MATE-N-LOK connectors
- 3mm low profile micro MATE-N-LOK connectors
- 2.5mm Grace Inertia connectors
- 3.3mm Grace Inertia connectors
- Signal double lock connectors
- Power double lock connectors

Features

- broad range of sizes, colors, materials and ratings
- optional terminal position assurance (TPA) devices on some products
- optional connector position assurance (CPA) devices on some products
- wire-to-wire, wire-to-panel and wire-to-board types

Order no.	Type	Description	Guide price
62638	172158-1	Housing MATE-N-LOK 3p socket pitch 4,14 mm	0,39 €
66248	282105-1	ReproKit 40Ohm 200/300W 28-25000Hz 1150x235x400 Pair	0,24 €
66249	282087-1	Diode module SOT227	0,28 €

Why I believe in Marquardt Rocker Switches



When you need a rocker switch for your equipment, you have a big problem. There are many producers on the market and you do not know which one to choose.



The cheapest, of course – you say. But everybody knows that with this one you take the biggest risk. You can be lucky but you can't rely on this solution. You should consider other ones.

The best way is to buy samples from several producers and make some

tests including long-term tests. But even better solution is to let someone else do it for you and of course, free of charge. How?

Choosing the right testers is very important. You have to trust them. We have some tips for you: Bosch and Siemens Home Appliances Group BSH,

Robert Bosch, Daimler, Volkswagen, General Motors, Chrysler.

You most likely already know what they have in common. You are right. Marquardt has been certificated by Bosch and Siemens Home Appliances Group BSH in May 2013. This award is made for the high quality work in 2012.

Do all of these use standard rocker switches?

Of course not. But if they use any

Marquardt product, then it means that we can trust standard rocker switches too.

I know it is not enough to have some Awards to prove the quality.

In fact, I believe in Marquardt rocker switches because I have visited the factory in Rietheim-Weilheim in Germany, and mainly the testing laboratory, which was really amazing – big and non-stop working.

Order no.	Type	Description	Guide price
485	1835.3108	Rocker Switch 30x22 1-0 DPST 10(4)A 250VAC Black/Green illum. F6,3	3,42 €
545	1932.3112	Rocker Switch 30x22 1-0 DPST 20(4)A 250VAC Black F6,3 O -	2,21 €
48785	1839.1407	Rocker Switch 30x22 (1)-0-(1) DPDT 6(4)A 250VAC Black F4,8 < O >	3,37 €
81391	1800.1108	Rocker Switch 19x13 1-0 SPST 10(4)A 250VAC Black/Green illum. F4,8	2,46 €

RF modules for surprising prices



HOPERF modules enable to gain a wireless data transfer or remote control of devices simply and without excessive costs.

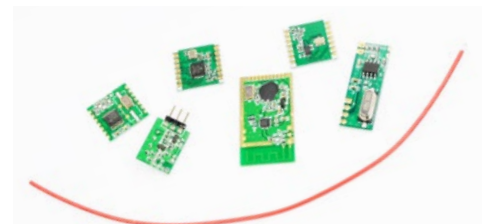
A company, which specializes over a quarter of century on a given segment usually has experience and production capacities to develop and produce quality components. HOPERF produces RF chips themselves, as well as read-made RF modules usable for virtually any application requiring a wireless control or data transfer, for example: remote keyless entry (RKE), control, security systems, telemetry, voice and data communication, control of processes and many others.

In our stock can be found for example:

- RFM65CW-433S2 and RFM-65CW-868S2 - 433/868 MHz FSK receivers. RFM65CW offers a unique possibility to use narrow-band and also wide-band communication modes.
- RFM68CW-433S2 and RFM-68CW-868S2 - 433/868 MHz FSK transmitters.

- RFM73-S - 2,4 GHz transceiver, including a high power +20dBm version RFM73P-S2.
- RFM83C-433S1 - sophisticated 433 MHz ASK/OOK receiver
- RFM85W-433D - 433 MHz ASK transmitter. Excellent features and simple usage.

- RFM12B-868S2P - multichannel 868 MHz FSK transceiver.



Features

- modern easily usable RF modules
- wide possibilities of configuration including change of output power, frequency, modulation, ...
- possibility to choose narrow-band/ wide-band mode
- low power consumption/ high sensitivity
- built-in temperature sensor and low voltage indicator

Order no.	Type	Description	Guide price
166170	RFM12B-868-S2P	Transceiver FSK 868MHz -110dBm 256Kbps +2,2÷3,8V/25mA	3,89 €
166190	RF-M65CW-868-S2	Receiver FM 868MHz -120dBm 300Kbps +1,9÷3,6V/16mA SMD	4,12 €
178438	RF-EVB_RFMXX	Test Board Pair for RFMxx Modules	10,66 €
180936	RFM95W-868-S2	LoRa module 868/915MHz +20/-123dBm 300Kbps +1,8÷3,7V	35,00 €

Zero Smog EL - there's no need to gamble with your health anymore

Weller®

New affordable soldering fumes exhausting station from Weller will provide you clean air on your workplace.



Two solutions are usually usable for a professional usage:

- fumes extraction at a soldering tip – very effective, but it's usually necessary to have a suitable adapter for various soldering tools you use

- so called "volume" fumes extraction, quite similar to a home vacuum cleaner

Volume extraction is the most universal solution independent on a type of a soldering station or tool. In contrast to a home vacuum cleaner the station doesn't have to overcome so high aerodynamic resistance, that's why the power and the noise is incomparably lower. The biggest advantage is the fact that the extraction station placed next to a table is big enough to allow usage of big

and sufficiently efficient filters usually consisting of two stages.

A pleasant novelty for everyone who cares for its health is the fumes extraction station Zero Smog EL, representing currently the most economical solution from company Weller. Despite a price affordability, the station is fully comparable to more expensive types and uses a top class brushless EC fan (turbine). Zero Smog EL is a complete set including extraction hose and a nose able to clean up to 150 m³ of air per hour. A great feature is a possibility to set the power of a station in 4 levels. After a period of usage a logical question may arise – is it already necessary to exchange a filter or not yet? No problem – the station monitors pressure difference on the input/output of the filter and if necessary indicates the necessity of filter exchange itself.

Order no.	Type	Description	Guide price
91091	T0058762701 H13 EPA	Compact H13 EPA + M5 Filter for WFE2ES Zero Smog EL	111,00 €
177344	T0058762703 Fine dust filter M5	Set of 10 pcs pre-filters for WFE 2ES/CS, Zero Smog 2, Zero Smog E	41,00 €
213060	Zero Smog EL Kit 1	Complete Fume Extraction Kit 230V 150m ³ /h	499,00 €



Fluke Connect - Display, Save and Share

Fluke announced a revolutionary wireless connectivity for DMMs and smartphones or PCs which can be used for data collection purposes.

Fluke Connect is a wireless system using Bluetooth connectivity and is widely used by teams to share measurement information everywhere and anytime.

Basic requirement is of course a DMM or thermal camera with Fluke Connect functionality which can be identified by a blue Bluetooth logo on the measurement device. Then user needs a smart-

phone, a tablet or a PC with a special Fluke Connect token, which is capable to communicate with Fluke Connect enabled devices. Measured values are automatically sent to the smart device with 5 samples/s frequency. Software can generate graphs using Grafy TredIt™ or measurements can be stored using AutoRecord™.

Order no.	Type	Description	Guide price
206707	Fluke A3002FC	FC Wireless AC/DC Current Module	112,00 €
206880	Fluke V3000FC	FC Wireless AC Voltage Module	180,00 €
206882	Fluke V3001FC	FC Wireless DC Voltage Module	180,00 €
216664	FLUKE 279FC	Wireless DMM + Thermal Imaging 80x60	959,00 €



Embedded videoconference capability similar to Skype make team collaboration very effective directly in the field.

Every measurement is automatically stored in the Fluke Cloud™, this storage is absolutely safe for you measured data.

Fluke Connect is a must functionality for servicemen and for technicians working in dangerous environments. For example a Fluke Connect enabled module (current, voltage or temperature) can be placed to the switching cabinet and measurement can be done from a safe place.



We can 100% feel your hard work. However we think that when working really hard, you shouldn't forget that we're only people with emotions and we want to have a good mood. Good mood makes the work way better. Articles in this column are about real components but they are written differently, in funnier way. And so, let's not forget: The more we smile, the nicer our lives will be.

White teeth are nicer than the light grey



- the same applies to terminal blocks

Since the October 2016, we only keep a new variant of 2060 terminal block in our stock.



Some time after launching 2060 terminal blocks series into the market, customers started to reach out to us asking for lighter shade of insulating sleeve – ideally white one. They expected such a sleeve to better reflect light and minimize the formation of shadows (which can be very useful mainly with applications with white LED – lighting technology).

It was confirmed

that customers' requirements are justified and we decided to change the colour of the terminal block body from light gray to white.

Wago's management had a justified requirement that this change should be performed as rationally as possible - with minimal material and process costs.

The aggravating circumstance was that a huge amount of light grey plastic granules has been already purchased (logically, to reduce purchase costs). These had to be inevitably used.

The process of finding the ideal solution has begun:

1. First idea was to colour grey granules with white colour before pouring them into the moulding press - the result was disastrous - spotty terminal blocks.
2. Adding lime to granulate brought even worse outcome. Spotted terminal blocks, moreover, were fragile and smudged hands (some employees had even smudged pockets – for now, they only received a reprimand).
3. A very sophisticated idea came from the graphic artists who suggested adding more granules in the RGB colours (red, green, blue) in a strictly exact proportion to achieve the desired white colour. This idea, however, was immediately assessed as materially and procedurally too expensive.



4. Adding milk was just a hopeless idea of our head of cafeteria. This idea was not even tested because of fear of expected unpleasant smell of burned milk.

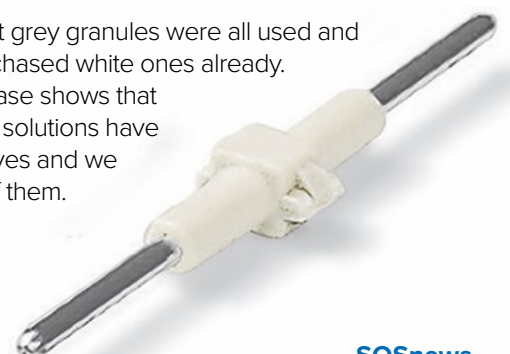
5. Finally, the project manager (the father of three (sometimes) nice children) came up with an amazing idea. Under the influence of the fresh experience of success when he managed to force his children to wash their teeth in the morning and evening which resulted in their beautiful white teeth – he got convinced that if it went fine with light grey teeth, it would also work with terminal blocks.

Moreover, he relied on the fact that he won't need to yell at employees and that they won't talk back (hence no risk to be a nervous wreck and no risk of vocal cord injury).

Experiments begun. Selected enthusiastic employees started to brush light grey terminal blocks with toothbrush twice a day (morning and evening) and after not even two weeks they enthusiastically showed their beautiful white terminal blocks - and they were all convinced that the best solution has been found.

The unwanted side-effect was that the terminal block body got extended in the back by 1mm under the pressure of brush. Finally it turned out that it allows larger tolerance in direct inserting of solid conductors with automatic and also manual installation. Moreover, a higher mechanical strength when using the control button is also apparent from this change.

Meanwhile, light grey granules were all used and production purchased white ones already. However, this case shows that unconventional solutions have a place in our lives and we are not afraid of them.



Examples of your solutions...

ELCOM, s. r. o., Prešov

UNIQU PC 190 KD



A new multimedia all-in-one computer with a 19-inch diagonal brings unique possibilities to areas with demanding operating conditions. The all-metal construction with IP 54 protection and its elegant design provide trouble-free mechanical resistance and reliable operation even in environments with splashing water or excessive dust.

Belektronik GmbH, Germany

PID temperature controller of HAT Control-Series



Individually configurable PID temperature controller with accuracies of $\pm 0.1^{\circ}\text{C}$; 0.01°C and 0.002°C . Long durability and robust designed for use in laboratory and field.

CLE Automazioni

Fiber optic converter



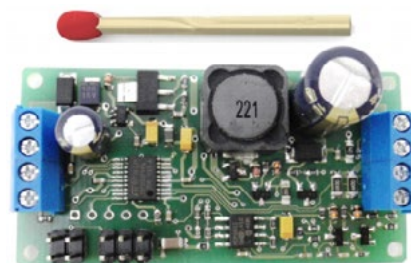
Wide range of converters for copper and fiber optic network, simple to order and easy to install.

Our RS232 / RS485 / RS422 / USB / Fiber Optic converters are available in a number of varieties and form factor, including 9 pin Port Powered and DIN rail mounting, both 9-24V and 230V power supply.

AMEX Research Corporation Technologies

Smart Charger Module for NiMH Battery Packs

The NHC-01 is a professional, processor-controlled charger module



for NiMH battery pack for AA and AAA cells (1000...2800 mAh) intended to build into mobile devices, mobile educational robots and other apparatus. It has the possibility to set different charge currents and number of cells. This charger module can charge 2..8 pcs series NiMH battery.

Hofstadtler IE GmbH

HIE JTAG Debugger

A versatile and easy to use JTAG debugger.

The HIE JTAG adapter is a FTDI® based USB JTAG debugger. It provides 3 JTAG connectors, the original 0,1" 20 pin connector, a 0,05" 20 pin connector and a 10 pin Molex Pico-blade® connector compatible with Engicam® JTAG connector.



Embedize

USB485ISO



Compact USB to RS485 converter with 4kV galvanic isolation. Based on the proven FTDI chip which drivers are usually included in most operating systems. Suitable for development or for industrial environment.

IMB-Vadkert Ltd.

Ionizing power supply



Compact size. It supplies the high voltage which produces the ionisation for foils, air, ect.

It has external connections for up to two electrode. The standard bayonet high voltage connections are simple and fast to use.



Let know about your product to more than 200 000 people from your segment.

More information can be found at www.ecubeportal.com





1553T



1599 Tablet



1593 Pi and Arduino



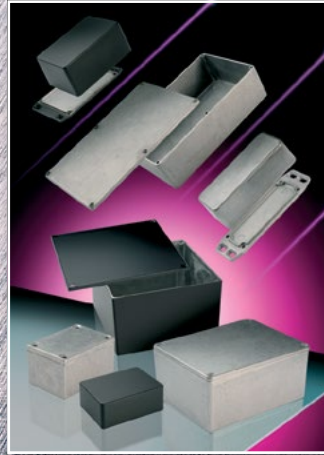
1590 TRP-STP



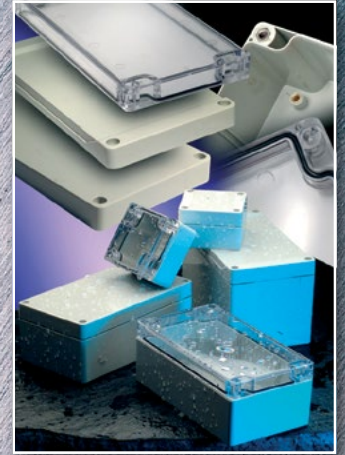
1553



1550Z / 1590Z IP66



1550 / 1590



1554 / 1555 IP66



1591 / 1591XX



Ritec



1455



1551

Standard and modified aluminium, metal and plastic enclosures

www.hammondmfg.com

www.soselectronic.com



PCB's Design

*How to design
PCBs correctly?*

PCB's Design

How to design PCBs correctly, to reach boards which are cost-effective to produce and to populate?

Which are the most important PCB design principles?

What about production technology of PCB, is it more valuable production either by etching or by milling?

How to design and produce prototype?

PCBs are integral part of all electronic devices. Their basic function is to create a conductive connection between the pins of the individual components. PCBs first appeared in late '60s, when there were the first rules for their design and production drawn up - IPC standards. The standard IPC-2221 "Generic Standards on Printed Design is standard for PCBs. So how to design PCBs effectively we asked Lubomír Livovský PhD., from the Department of Technologies in Electronics, Faculty of Electrical Engineering and Informatics, Technical University of Košice.

What is the first step when designing PCB?

In electronic praxis, 3 types of components are used and possibilities of their soldering are:

- 1. components with leads** „Through Hole“ –TH (axial, radial), can be soldered by hand or by wave,
- 2. leaded components** for a surface mount – „Surface Mount Devices“ – SMD, which can be soldered in a reflow oven or by a wave,
- 3. no-lead components** for a surface mount – „Surface Mount Devices“ – SMD, which can be soldered in reflow oven.

With these three types of components you can create an electronic device in which these components are placed on a carrier - printed circuit boards (PCB). Components can be populated on a PCB either on one side (SMD, TH or a combination of both) or on both sides (TH only on a top side, SMT on both).

When the PCB is designed, there must be placement of components on PCB and type of soldering technology considered, because different rules apply when soldering by solder

wave and different for soldering in the reflow oven.

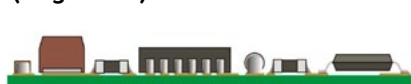
Why is this important?

If we want to solder components on bottom of PCB by solder wave, we must ensure that during the soldering process components will not fall off. SMT components on the upper side will be populated into a solder paste, then soldered in a reflow oven. SMT components on the bottom of the PCB will be bonded by a glue and then TH components will get into holes in a PCB. SMT components in a glue and TH components will be soldered by a solder wave.

Standard THT assembly (single PCB)



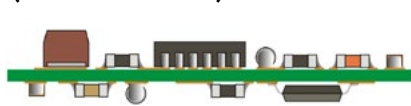
Standard SMD assembly (single PCB)



Mixed assembly (SMD on both sides)



Standard SMD assembly (double sided PCB)



Mixed SMD assembly (SMD only on the bottom)



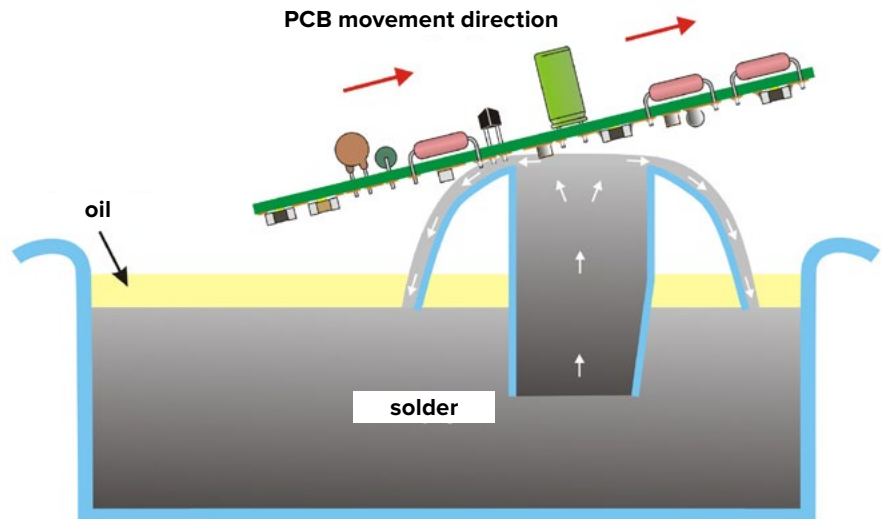
Population of PCBs.

How to access the PCB, which contains SMD components and need to be soldered by solder wave?

To populate components with leads on one side of the PCB is easy process as only leads are sink into the solder wave and conductive joint is created. Interesting is it in case of SMD components, when whole components are sink into the solder wave and therefore must withstand temperatures of waves that may be up to 260 °C. On a PCB side, which will be soldered by a wave, only such SMT components should be placed, which are recommended by producer to be soldered by a wave and they meet a condition at least 260 °C for 10 seconds heat resistance. Such as ceramic resistors, MELF, MINIMELF, monolithic capacitors, components in SOT, SOD, SOP packages with minimum pitch of 0.65 mm, in order to avoid a short circuit of the integrated circuit, as wave washes each pin of parts and may result in the creation of so-called bridge or resistive and capacitive trimmers if designed in a way to prevent solder ingress.

So if we have a mixed SMD assembly which components should be on the bottom side of the board and soldered by solder wave?

We need to put down components that can withstand temperatures of solder wave and have the necessary spacing of the leads. In respect to a way of soldering it's necessary to take into account distances among SMT components, their orientation against a solder wave as well as a height of particular components. Components should be turned so



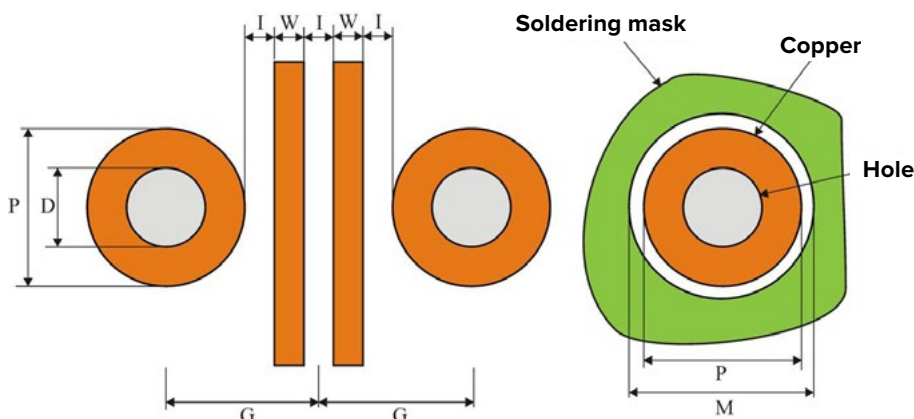
Solder wave soldering.

that their leads created a right angle with a solder wave. This way a proper flush of leads by a wave will be ensured. However, this requirement can only be met if using components with leads on only two opposite sides (SO, SOP, SOIC...). In case of integrated circuits with leads on all 4 sides, we need to place them on top of the PCB and populate in a reflow oven. It is also recommended to create robber pads behind the integrated circuit to reduce solder bridging from the last leads pair. It may prevent from short circuit, but lessen the scope for conductive connection.

So we explained wave soldering. And what about the solder paste reflow?

This is the most common way of soldering today. In this case, conductive connection is created by components placing into solder paste, which is applied before components

populating. The joint is thus created also under components. When using a solder paste for soldering, we'll avoid problems with components twisting. This method of soldering increases integration of components on a PCB. There's no need to take in mind height relations of particular SMT components (tantallum capacitors, power MELF resistors, power transistors) and this method is also the only suitable for soldering of SMT components with a heatsink pad on a bottom side of a package and also for soldering of SMT components without leads. Wave soldering can cause on some SMT components an unwanted effect called Tombstoning. By influence of imbalance of forces acting on both ends of a component, the component can „get up“ as a „Tomb stone“ (mainly at two-pin components like resistors, capacitors,...). This effect is caused by irregular temperature spread on a PCB during reflow. This can be eliminated by correct applying of the solder past using a metal template.

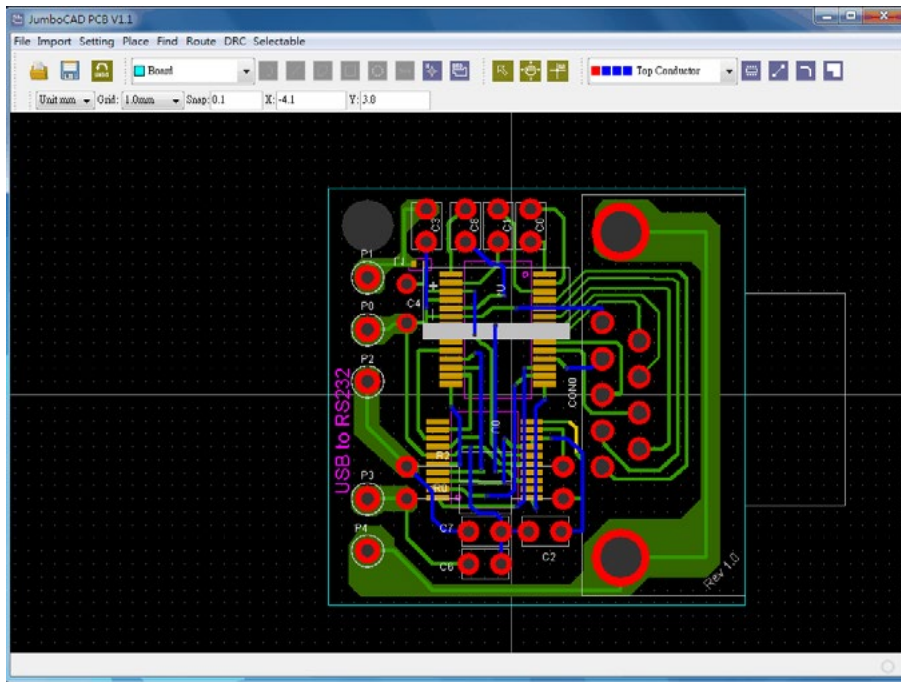


PCB parameters.

What are the rules for PCB design in terms of production technology?

First of all you need to know where the board is manufactured. Basic information, we should know are:

- The minimum track width - W ,
- The minimum isolation gap - I
- Minimum diameter of a Via (metal through-plated opening) - D



Example of PCB design software.

These parameters determines the density of PCBs that can be produced - so called accuracy class. At present it is necessary to use a standard accuracy class 6 or higher. This information need to be applied to design setting rules. The system then does not allowed to make a line that is not in accordance with these criteria.

PCB is designed. What is the next step?

An electronic device which includes a PCB may not operate, so it needs to be somehow revived - tested. In such cases it is necessary to create some space where we can connect the sensor and measure the necessary parameters (voltage, current, etc.). This means that we need to test electrical functionality of the PCB. Proper sizing of conductive tracks width and the width of the isolating gaps between conductive connections has a significant impact on the current load capacity and voltage load capacity of the PCB conductors. Therefore it is necessary to know what is on that circuit current load, so there will not be overheating. It is also necessary to know what will be the largest tension between the two pads to avoid sparks and creating short circuits. These parameters need to also be applied to the design system.

For example - current load capacity is relatively high in comparison to wire leads, because a flat conductor features much higher cooling surface than a wire conductor. Copper wire with a 0,07 mm² cross section will get melted at a current of 15 A, while a copper foil of the same cross section will get melted at a current of 60 A. This value approximately responses to 850 A/mm² current density. However a continuous current load capability is lower, approximately 100 A/mm². Maximum operating temperature of a PCB depends on a so called base material softening point what is

for the most often used material FR4 approx. 125°C. From this reason, it's necessary to size the track widths to meet this condition.

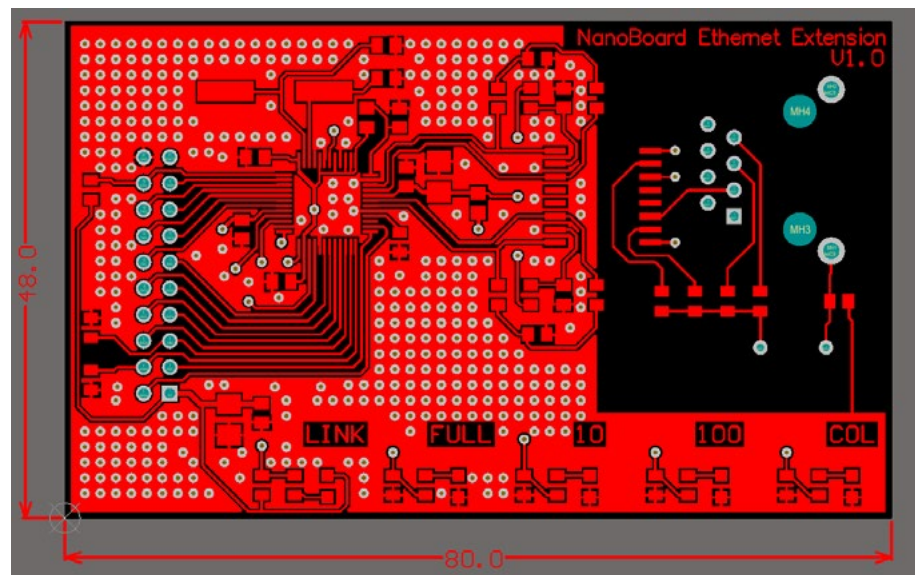
Value of a maximum allowable voltage among PCB tracks depends on many factors: isolation gap width, type of a used base material, usage of silkscreen and last but not least – operational and safety requirements for a PCB usage. Silkscreen helps maintaining basic PCB properties when exposed to harsh environment like dust and humidity. We differentiate breakthrough voltage and a maximum operation voltage.

At this parameter we should know where the board will be given to use and under what conditions. Values of these voltages and methods of their testing are subjects of regulations. Some values according to IEC512-2 are mentioned in the following table.

Isolation gap	Breakthrough voltage	Operational voltage
0,5 mm	850V	380V
0,3 mm	650V	300V
0,2 mm	520V	240V
0,1 mm	380V	170V

What needs to be taken into account when designing the PCB to avoid interference?

PCB need to be designed to keep the principle of electromagnetic compatibility (EMC). Electromagnetic compatibility of electric device is based



Example of PCB design software.

on a fact, that the electronic device mustn't interfere by its operation with other surrounded devices and that the device must be immune to interference from environment. PCB design from electromagnetic compatibility point of view is activity starting already at electrical schematics design of a design. It can be roughly said, that an electronic device, which „doesn't radiate“ is also immune to interference. PCB design from the perspective of EMC is a relatively complex operation. In general, if we comply with certain recommendations, we can say that we have done everything possible to make it right.

Among basic rules of a PCB design from EMC point of view belongs mainly:

- **Minimising of currents in electronic circuits**

– by a choice of suitable types of components, selection of circuits in respect to input impedances etc.

- **Minimising of a frequency spectrum**

– not to use unnecessarily fast components (rise and fall edges). Uselessly fast data communication.

- **Filtration and protection of input/output terminals**

– ESD protection (Electrostatic Discharge) and solution of transition effects, limitation of radiation from leads.

- **Minimising of current loops and track lengths**

– current loops can be minimised by proper components placing, track placing, earthing, power supply tracks, proper usage of filtration capacitors.

- **Shielding**

– suppression of radiation and at increasing of immunity at the same time.

How to properly layout components?

The layout of components is an important step that aims is to minimize interfering voltages, radiation and overall immunity. The basic principle is to place highly logic closer to the connector and a slower logic away

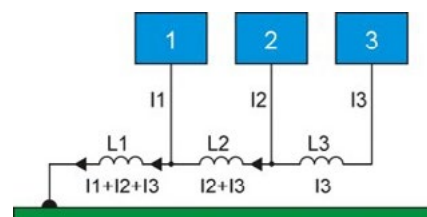
from the connector. The basic principle is places Sometimes meet all the recommendations is not possible, but always seek for a compromise and meet at least one rule, respectively as much as possible, if possible.

To basic principles of components placing belongs above all:

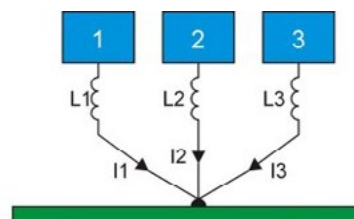
- Placing components from higher to lower bandwidths.
- Mutual physical separation of particular functional blocks (analog, digital, I/O, power line).
- Minimising of distances with aim to eliminate current loops.

Grounding is very important. There are two types of grounding given components leads to a common potential (GND):

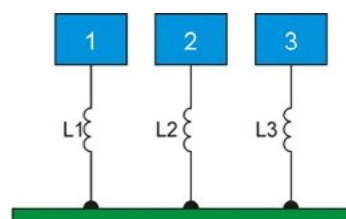
A - Single point



B - Single point parallel



C - Multi-point



Multipoint grounding is suitable for high frequency thus also digital applications. A multi-layer board is supposed to be used. Order and

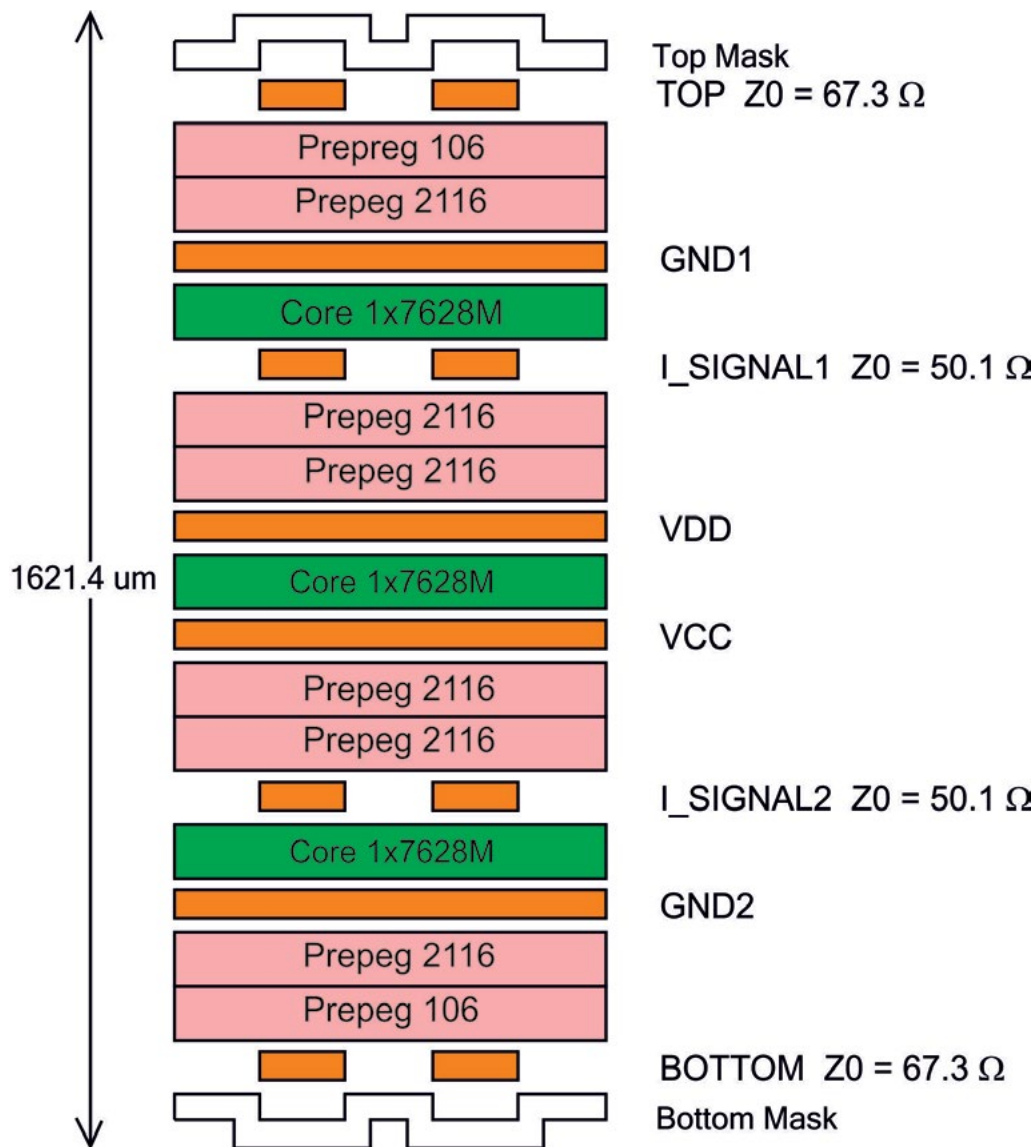
thickness of particular PCB layers is determined by overall PCB impedance (usually $Z = 50 \Omega$). It supposes existence of a continuous conductive layer- GND at least in one separate layer of PCB. The principle relies upon a fact, that every pin of a component, that has to be connected to a GND potentials connected with a conductive layer in a shortest possible way. The same recommendation should be applied at connecting the power supply pins of components. Usage of a conductive layer for a common signal (GND) results in minimizing of current loops and decreasing of a parasitic inductivity of tracks.

Filtering of power supply in electronic circuits belong together with grounding to the most important rules, which should be taken in mind at PCB design. Necessity of decoupling capacitors usage results from a assumption, that „every power supply is far from a load“.

Let's suppose that pulse power consumption of a HCMOS gate is 15 mA for 3,5 ns, delay of a signal on a PCB (and also a supply current) is higher than 0,1 ns/cm, reaction time of a regulator on a step change of power consumption is roughly $\sim 1 \mu s$. Then it's necessary to deliver power to a gate from a very near and fast voltage source, what a capacitor is. Proper functionality of decoupling capacitors depends on their capacity, ESR and its position on a PCB.

According to the function we differentiate three types of decoupling capacitors:

- **Filtering (Bypassing)** – serve as a wide band filter for power supply of a whole PCB or its part. Eliminates influence of power supply leads inductance. ($C1, C2, C8; C1 \text{ a } C8 \gg 10\text{mF to } 1000\text{mF}$). If possible always choose the largest capacity as possible.
- **Local (Decoupling)** – serve as local energy sources for components and they also reduce pulse currents, that would go through a whole PCB. These capacitors must have excellent high frequency properties. It's necessary to place them as near as possible to a component pin ($C4, C5, C6, C7 \gg 100\text{pF to } 0,1\text{mF}$).
- **Group (Bulk)** – serve as an energy source for a simultaneous charging of several capacitive loads. Near a microprocessor it is $C3 \gg 10\text{mF}$.



Grounding of multilayers PCB.

Decoupling capacitor must be always placed on a path between source and a load. All connections must be designed in a way to minimize current loops surface. Minimize tracks impedance (above all parasitic inductances L1 to L4) by shortest possible tracks and by usage of conductive surfaces. Parasitic inductances L5 and L6 are automatically eliminated.

What in case of digital circuits?

Pre-requisites for a quality PCB design for digital applications start already at a circuit design (schematics design). It is necessary minimizing of pulse currents because there is quick switching gates by digital circuits. Try at least possible amount of simultaneously switched gates of digital circuits. It's more about soft-

ware. Also choose a suitable logic as for input capacities and pulse current demands, calculate decoupling capacitors (pulse consumption, noise immunity, outputs load), treat unused inputs (avoid undefined status).

When preparing design of PCB we should minimising current loops surfaces by suitable concept of buses and power line and their placing on terminals, usage of SMT components (they're smaller than TH components), selection of components with power pins on opposite sides – possibility of decoupling by SMT capacitor directly in a place of power supply leads of a given integrated circuit. Don't use sockets at very fast circuits.

How to test the PCB?

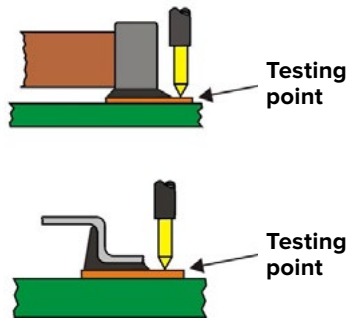
At a PCB design it's also necessary to consider possibilities of electrical

testing. It's worth to implement test pads (points), where testing jigs can be connected. If an automated test should be possible, testing points should be placed in a matrix of a testing adapter. Placing components on a PCB should also suit needs of a visual inspection. For this purpose it's necessary to maintain minimum components distances. Recommended minimum distances between components on a PCB must be kept also because of a possibility of automated components placing by machines (minimum distance to a PCB border to grip the board in a machine) or a possibility of a manual placing.

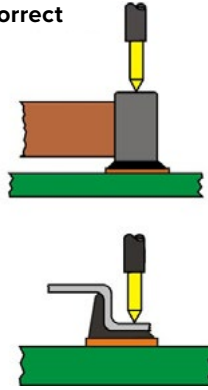
PCB is designed and tested. What is the technology of PCB manufacturing?

DPS can be divided into single (with a conductive layer on top or bottom

Correct



Incorrect



Electrical test of PCB.

side), double sided (have conductive layer on top and bottom side) and now the most commonly used multi-layer (have conductive layers also inside a PCB). For the multi-layer is very important layers layout. The PCB can be produced either by etching (i.e. Wet way) or milling (i.e. Dry way). Professional PCB production procedure can be found on internet. On web pages can be found teaching material about production of PCB by etching (wet method). First of all data need to be proceed, then film matrice is produced, then layer build-

up, panel preparation, cutting, openings drilling, metalizing through holes, transfer of a conductive pattern from a film matrice on a production panel, galvanic embossing of a conductive layer, tin resist deposition, PCB etching, tin resist removal, solder mask, silkscreen, surface treatment, HAL, NiAu, mechanical finishing by milling, scoring, metalographic micro section. Final step is optical and electrical test.

A fast way to produce a functional PCB is a production by a dry way without a need for etching and cre-

ating a chemical waste. It is suitable for prototypes and functional samples and production time is about 5-7 days. For this purpose various devices are used – enabling to process data (ODB++, Gerber, Excellon...) from CAD design software via a software application and to create a file for drilling of holes and milling of isolation lines along the conductive tracks (surfaces). Gradually a copper material is being removed by means of special engraving tools and drills with diameters of 0.1 mm to 3.0 mm. For each tool can be automatically adjusts the depth of ingress and rotations according the needs. End shape of a tool is very important. It can be flat (End Mill) or conical (Cutter).

Firstly we need to upload data from software and then define if the PCB is single or multi-layer. An important part is to identify the tools for production of PCB and placing them into the holder. Once it is ready we place a PCB on a workplace using a camera and start particular steps of milling (drilling, engraving, mill-cutting...). A control measurement of objects, track widths, holes diameters can be made on a finished board by a camera.

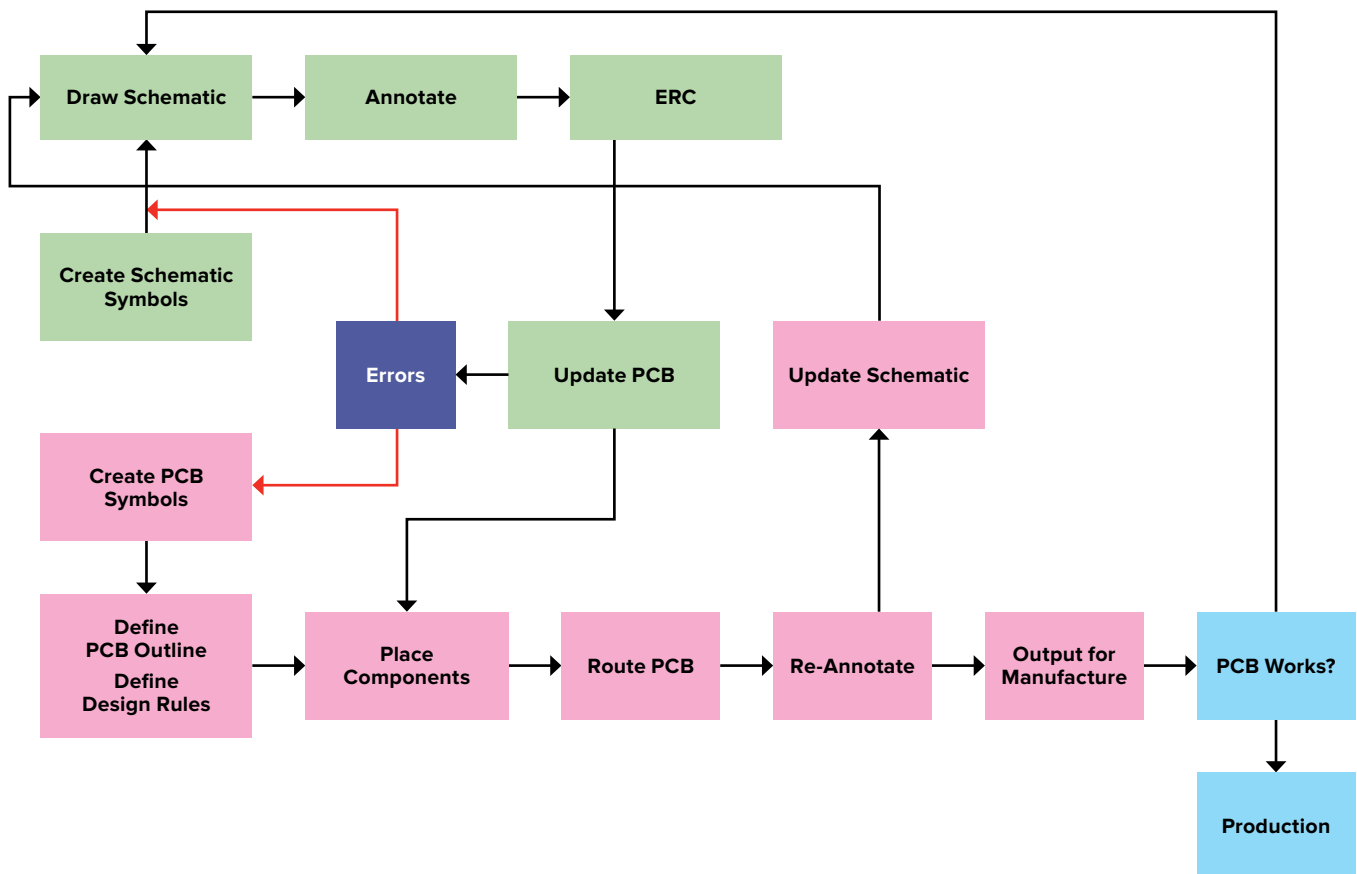


Reflow oven.



PCB production by milling.

Design and manufacture of PCBs is certainly a broad topic. Other interesting information and a demonstration of the production of PCBs can also be found in the record of the webinar "What not to forget at the PCB design?" at www.soselectronic.com/webinar.



Process of PCB design in CAD software.

Useful links

- **IPC Standards** – www.ipc.org
- **IPC Standards Tree** – www.ipc.org/4.0_Knowledge/4.1_Standards/SpecTree.pdf
- **Guide - components identification** - www.ipctraining.org/demos/pdf/drm18h.pdf
- **Calculator** - www.circuitcalculator.com/wordpress/2006/01/31/pcb-trace-width-calculator/
- www.plosnyspoj.sk