



MICROMEGA

CD30

## The heritage of the CD10 and CD20

CD30 is the top model in this CD player range. It shares much of its functionalities with CD10 and CD20 which are widely recognized as being best sellers in their category due to their excellent sound quality and first class reliability. At MICROMEGA we set our heart on developing a CD player whose performances would be exceptional while maintaining unbeatable value for money.

## The chassis

Made entirely out of metal, the frame's role is to provide a stable and rigid base for the CD mechanism. It also protects the CD's electronic circuits against external electromagnetic disturbances and high frequency exposure, which are very common in today's environment. The aluminum front panel adds a special touch to all of the models of this range, providing an impression of elegant soberness, where minimalism and user-friendliness combine harmoniously. The blue 10 character dot matrix display, driven by MICROMEGA software, displays all necessary information in real time. The aluminum anodized top cover, which comes in either black or silver, matches the front panel perfectly. The brushed effect of the front panel gives the product an unrivalled distinctive touch.

## The **ACTS**<sup>®</sup> power supply

Like all the players, CD30 depends on the user's mains source for its power supply. Unfortunately this source is increasingly subject to interference, especially since the arrival of switching mode power supplies used by computers as well as by numerous other consumer electronics goods, for example TV sets, DVD players, video tape recorders, and satellite devices among others. All these power supplies, even if according to CE standard, they are supposed to prevent any input or output disturbance, emit towards the mains high frequency signals likely to disturb the CD's musical reproduction. The effect is more significant the more powerful the device is. If that seems paradoxical, it should be kept in mind that the maximum output signal of a CD player is 2V RMS; therefore the weakest signal that a CD player must be capable of reproducing is about 30 micro-volts. That gives a good idea of the scale of what we are talking about. The CD30's transformer is an R-Core type for the digital section. These very specific models have very interesting characteristics from the point of view of mains interference filtering. Contrary to toroidal transformers, which have a very broad bandwidth, R-Core transformers, due to the way there are made, have a very narrow bandwidth. This makes them the ideal choice when the current requirement is low. The digital power supply provides the necessary current to the drive mechanics, the servo and decoding circuits and all of the user interface section. To generate the specific voltage to the VFD display used in CD30, we employed a specific technique making it possible to isolate the power supply from this particular element. Purists are well familiar with the negative effects this has on very high level musical reproduction. In addition, linear regulators with high power supply rejection guarantee a perfectly noise-free power supply for all of the digital elements. For the analog section, CD30 benefits from the latest MICROMEGA **ACTS**<sup>®</sup> power supply technology. A specific leaflet has been produced to cover this rather complex subject. However it is important to put things back into perspective to try to understand why such a power supply is so important and brings so much listening benefit. The maximum output voltage at full scale for most CD players is 2V RMS. CD30 follows this rule. At the nominal resolution of 16 bits the player should be able to reproduce signals with amplitude as small as 30 $\mu$ V. This is VERY small and gives immediately the perspective of what we are trying to achieve. Also, the quality of the mains supply is getting worse every day and things are not going to improve as we are already transmitting data like Internet or Digital TV through the mains supply lines. These techniques will be exploited on a much larger scale in the near future. For the music lover or the audio fanatic this is a shame and creates tremendous problems with equipment where this aspect has NOT been taken into account. We strongly believe that the **ACTS**<sup>®</sup> technology will prove its value over the years and allow audiophiles to enjoy music for many more years.

## The drive mechanism

The MICROMEGA team's wish was to be innovative in this field, and it was the case for some very good reasons. Due to the success of DVD, DVD mechanisms produced today are of top, reliable quality, simply because they are mass produced and therefore subject to extremely tough quality control procedures inherent to mass production. It is for this reason that we took the wise decision to equip the CD30 with the latest generation SONY KHM313 or SANYO SFH850 DVD mechanism. The mechanism control is ensured by a Philips SAA78247 circuit and a MICROMEGA proprietary software program featuring error correction algorithms which are particularly efficient and designed for audio reproduction. At present and in many cases, CD players are optimized to read CD ROM. Indeed, audio CD is read at nominal speed, whereas in the case of CD ROM, some players reach up to 52 times nominal speed. It's a different aspect but it is not the most significant. When reading CD ROM, it is possible, if a batch of data contains errors, to go back and to re-read the passage, before choosing the best remaining error interpolation strategy. This solution is absolutely unthinkable in audio terms, because in the event of errors the aim is to privilege continuity of the musical message so that the listener doesn't realize that the player is correcting inaccurate data. Obviously, it's impossible to stop the reading and to repeat a passage several times to remove a scratch, a finger mark or anything else which could have triggered the error correction system. In light of this, we can see how important it is to adopt a specific strategy to audio reading and why the MICROMEGA team invested so much energy and time into developing the most appropriate solution in terms of musical reproduction.

## 132 kHz oversampling: Listening rather than figures

For some time, many players arrive on the market equipped with this technique which is so attractive on paper and commonly called SRC. These three letters, **S**ample **R**ate **C**onverter are like magic and manufacturers were fast to adopt this technique allowing them to publish amazing figures to impress consumers. And how important is actual listening in all that? Before going into detailed explanation about what motivated MICROMEGA to make this choice, it's important to explain briefly without too much theory, how a SRC functions and the reasons for which this type of component came to be developed. With the advent of digital techniques in the professional audio field, it quickly became necessary to convert signals which had different sampling rates. The most outstanding example is that of the difference in sampling rate between the DAT and CD. The former is sampled at 48 kHz and the latter at 44.1 kHz. Other frequencies appeared since, for example 32 kHz for digital radio, then 96 kHz and more recently 192 kHz for DVD Audio. It is therefore important to establish a bridge which makes it possible to convert in any direction a sampling rate to another. It is what we call ASRC **S**ample **R**ate **C**onverter or **A**synchronous **S**ampling **F**requency **C**onverter. Asynchronous means that the sampling rates that are converted are not multiples of one another. In this way we can convert a sampled signal at 44.1 kHz into a sampled signal at 96 kHz and even 192 kHz. Obviously at first glance, that seems fantastic but if we dig a little deeper we quickly discover that the disadvantages far outweigh the advantages and that despite the figures which could mislead a novice, it's not the best solution. Indeed, to convert 2 frequencies which are not multiples of one another, you need to have 2 clocks. The first clock is a multiple of the first frequency and the second a multiple of the second. The circuit will operate multiplications then round-offs until it reaches its goal. However, the two clocks will create beat problems, which will be extremely difficult to eliminate and which inevitably will have harmful effects on the quality of the musical message. For all these reasons the MICROMEGA team decided to opt for a synchronous conversion. By choosing the frequency of 132.3 kHz also expressed as  $3 \times 44.1$  kHz, MICROMEGA succeeded in taking advantage of the undeniable advantages of a sampling rate conversion without having to deal with the problems of asynchronism. The ratio of 3 between the two frequencies was selected intentionally after long hours of listening which proved that an odd order had advantages over an even order. This system therefore makes it possible to have only one clock for the two frequencies because they are multiples of one another. Hence, this clock is to be treated with the greatest of care, in particular in terms of phase sound level and its spectral distribution, which

are essential factors in determining reproduction quality. We decided on a specific component whose jitter is lower than 1ps on a range of 1 kHz for any frequency lower than 52 MHz. The frequency chosen for this clock is 16.9344 MHz which is 128 times the final sampling frequency of 132.3 kHz. In addition, the SRC makes it possible to take utmost advantage of the benefits provided by current digital-analog converters. It should be remembered that the original resolution of CD is 16 bits. Under no circumstances can this native resolution be increased, but on the other hand SRC's represent an ideal interface between the audio data formatting circuit and the digital-analog converter. The formatting circuit exports its data at 44.1 kHz for words of 16 bits in length. All modern digital-analog converters accept input words of 24 bits and this is particularly true since the arrival of DVD. If CD resolution remains at 16bits, the SRC will transform its word length into 24bits and internal oversampling of the SRC will make it possible to benefit as much as possible from the digital-analog converter's capabilities.

### Digital to analog conversion: AD1853

CD30 calls upon one of the best dedicated digital-analog converters currently available. We chose the Analog Devices AD1853 because of its unbeatable value for money. This converter with its dynamics of 110dB, its signal to noise ratio of 112dB and its THD + Noise figure of < -100dB is the ideal converter for treating signals from the SAA7824 as accurately as possible. The power supply with constant current source and shunt regulators ensures total immunity from external disturbances. The local decoupling ensured by very low inductance, very low series resistance capacitors, guarantees better signal integrity for the analog stages. The signals generated by the SAA7824 enter the AD1853 at 44.1 kHz. They are converted internally and oversampled 8 times in a digital filter whose out of band rejection is higher than 115 dB, pushing very far back from the audio band the first images of the digital filters. That makes it possible to have analog filters of a relatively low order while minimizing the energy transmitted out of the band. The design of the printed circuit is critically important and the MICROMEGA team put all its know-how into this part, which represented a challenge in more ways than one. The circuit, which was designed using the most modern software, is optimized to take into account the extraordinary possibilities of the selected components. Any design error can be costly, both in terms of measurements and listening quality. The AD1853's current outputs in differential mode enable it to preserve the intrinsic dynamics of the signal and to reject in common mode any disturbance which could have affected the signal. Despite all the precautions taken in terms of the layout, it may be that at certain times some external phenomena affect the signal. In this particular case, the differential mode proves to be extremely effective. Indeed, the principle of differential mode consists of conveying a signal in two separate branches, one of which is in opposite phase to the other. If a disturbance affects the signal it will simultaneously affect the phase of the two branches. When the differentiator comes into play between the two signals, this disturbance will be totally cancelled. It is what we call in technical jargon *the common mode*. Therefore, we can affirm that a differential signal saves 6 dB of dynamics and totally rejects any signal in common mode, taking into account the differentiator's common mode rejection factor. A subject often discussed is that of symmetrical connections. These were invented in the past in the professional field to transmit low level signals such as microphone signals, to eliminate ambient disturbances and in particular, hum due to mains cable radiation at 50 Hz.

### The analog stages

Bearing in mind what has been previously discussed, the differentiating stages had to be as equally efficient as the other component's performances. The choice was difficult because, as specialists know well, measurements and listening do not always go hand in hand; there is always an empirical part which remains and experience in the audio field is thus essential. Although SMD components are often rejected by the most extreme purists, once again experience proved that it is not as simple as that. You have to be wary of taking shortcuts as they often turn out to be very limiting. Each technology has its advantages and disadvantages, but it is clear that when working with signals of very

low amplitude, the simplest way is often the best and SMD components do allow a substantial saving in space, which in our case is essential. Finally, the type of alignment of the analog output filters was not left to chance and the choice of a third-order Bessel filter turned out to produce the best results. The frequency cut-off was placed at 75 kHz, well beyond the audio band guaranteeing a perfectly linear phase from 20 Hz to 20 kHz and a constant group delay on the full audio band. For the last pole of this alignment, we deliberately selected a passive element in series with the signal in order to reject all high frequency residues which could have slipped through even the tightest of nets. The output signal is free from any DC component due to the use of a specific circuit, which allows a low impedance connection without resorting to a coupling capacitor. Very often this capacitor has to be electrolytic in order to eliminate low load impedance which is characteristic of certain amplifier inputs. Finally, a high-speed circuit which detects presence or absence of AC power supply sends the signal to the CD30 to emit DC bursts when switched on or in the event of sudden mains cut off.

**Conclusion: A challenge achieved**

To produce a CD player at a reasonable price is not easy when your aim is to achieve the highest level of musical reproduction, which is as faithful and transparent as possible. CD30 reaches that point admirably and the thousands of owners of this model are only full of praise. For once you can rightly appreciate the positive effects of a rumor. CD30 will make you love music.

## TECHNICAL CHARACTERISTICS

Drive mechanism	SONY KHM 313 or SANYO SFH 850
Servo IC	SAA7824
Servo technology	Digital
SRC IC	CS8421
Native sampling frequency	44.1 kHz
SRC sampling frequency	132.3 kHz
Native resolution	16 bits
SRC resolution	24 bits
Digital to analog converter IC	AD1853
Digital filter	Internal to AD1853
Oversampling factor	8x
Digital to analog conversion type	Multi-bit $\Sigma\Delta$
Bandwidth ( $\pm 0.1$ dB)	DC – 20 kHz
Linearity at –100dB	< 0.5 dB
Signal to Noise ratio + THD	< -100dB to 1 kHz
Crosstalk	> 100dB to 1 kHz
Output impedance	< 600 $\Omega$
Output level	2V RMS / 0 dB
<b>Power supply</b>	
Power consumption	25 W
Fuse	T 160mA / 250V (Slow blow) T 315mA / 130V (Slow blow)
<b>Dimensions:</b> (W x D x H mm)	430 x 265 x 69
<b>Weight</b>	4.5 kg

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