

# multi<sup>®</sup> media manufacturer

## Manager's Guide to AV Design & Development

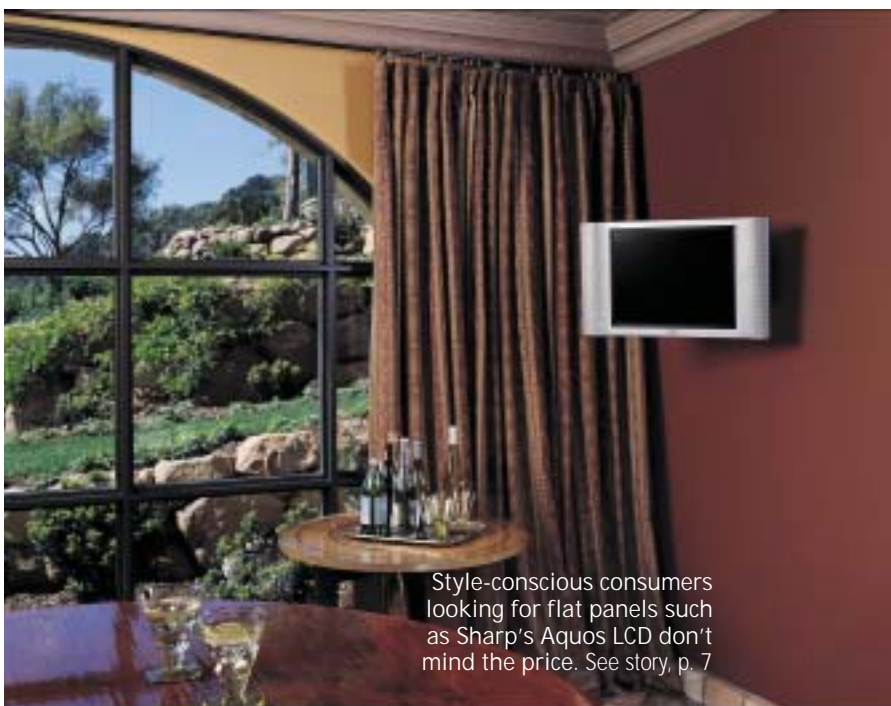
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Style-conscious consumers looking for flat panels such as Sharp's Aquos LCD don't mind the price. See story, p. 7

## Digital and Analog: TI and Burr-Brown

By Mark Florian

**M**ergers, acquisitions, and consolidations are common in the semiconductor and electronics industries, but how many retain the goals and targets that initially brought them together in the first place as time continues? Throughout the '90s and up until the present, we've witnessed many changes in the business itself, as well as with the players.

In this article, I'll focus on the acquisition of Burr-Brown by Texas Instruments, two widely-known and successful companies, each with a different

segment and expertise in the semiconductor industry. I'll discuss the overall strategy of both companies and how they complement each other. Finally I'll mention some recently released products as a result of the merger.

#### **Combining Forces**

Over the years Dallas, Tex.-based TI has established a reputation for delivering and supporting digital signal processors (DSPs) that have seen increasing use in all types of consumer, military, and commercial applications: audio, automotive, cell

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phones, laptops, palmtops, wireless, and broadband communications, video and imaging, and medical instrumentation.

Burr-Brown, headquartered in Tucson, Ariz., specializes in high-performance analog design, data converters, and mixed signal applications. In addition they have a fine reputation in the pro-audio industry as a manufacturer of analog devices used in microphone preamps, digital audio mixers and recorders, broadcast studio equipment, and high-end consumer A/V equipment.

Since nearly 85% of TI's income is from semiconductors, TI decided to focus on that industry, re-align their company, selling off businesses that were not in harmony with their new strategic goals, and replacing them with companies that were. The DRAM and defense businesses were sold off in 1998 and 1997, respectively. In October 1999, TI acquired Unirode, a manufacturer of power management semiconductors used to manage battery power. In November 1999, they acquired Power Trends, another manufacturer of power management ICs.

In March 2000, TI acquired Copenhagen, Denmark-based Toccata Technology ApS, a developer of digital audio amplifiers. This provided a good fit with TI's existing digital speaker technology. TI then announced their acquisition of Burr-Brown in June 2000 and completed the transaction the following August. TI then acquired Graychip in 2001, a manufacturer of digital down converters and up converters used in high-speed communication networks.

By acquiring Burr-Brown, TI was now able to combine their expertise in DSPs and wafer processing with Burr-Brown's expertise in high-performance, low noise data converters, mixed signal, and op amps. Thus TI was better able to serve both their analog and digital customer requirements, providing them with complete solutions from one source.

"We are as serious about analog as we are about DSP. The people of Burr-Brown are elite developers of high-performance analog products. This combination means that TI will have a leading position in essentially every high-performance analog category and the ability to offer almost any analog component that touches a DSP," said Tom Engibous, TI's Chairman, President, and CEO.

Burr-Brown was equally enthused

about the acquisition according to its President and CEO, Syrus Madavi: "I am very excited about the compelling synergies of the two companies. TI's strength in DSP will introduce our high-performance analog and data converter products into new applications . . . the makers of Internet appliances and communications systems will have the best of both worlds in one company, with complementary components to optimally meet their total signal processing requirements. Our combined force of analog and DSP technical experts in the field will deliver unmatched support as our customers develop their systems."

#### Product Development

A major benefit as a result of the acquisition has been the new HPA07 wafer process. According to TI's June 3, 2003, press release, "HPA07 incorporates high quality passive components critical to enabling the efficient design of high-performance analog products: metal-to-silicide (very low voltage coefficient) precision capacitors without hysteresis, and very precise, laser-trimmable thin-film resistors . . . the combination of a precision capacitor with less than 5ppm/V voltage coefficient, 1k $\Omega$ /square SiCr resistors, 5V analog CMOS with low 1/f noise and 30V drain extended CMOS has provided designers with high-precision components optimized for a wide range of new product designs."

TI evidently has big plans for this new process as there are currently over 30 new products in development. The OPA300, a low-noise, high-speed op amp, was the first product manufactured using the HPA07 process.

I spoke with Tim Kalthoff, Vice-President of Data Acquisition Products in the High Performance Analog Group at TI, about the markets for high-performance analog products and the acquisition of B-B by TI:

**M<sup>3</sup>:** What types of finished products are your devices used in?

**Kalthoff:** The gamut of industrial, high-end medical, communications, test and measurement, basically instrumentation type applications, and system monitoring and control.

Mark Florian is owner of West End Audio and an engineering consultant to architects, specializing in acoustics, home theater design, setup, and evaluation. In addition, he has authored numerous technical and review articles for Audio Amateur Publications and others. Mark graduated with a BSEE from the University of Texas and holds a Technician class radio operator's license, KD5PSR.

**M<sup>3</sup>:** How about the devices in the pro-audio division?

**Kalthoff:** The pro-audio division products really spread the gamut, but basically mixing console kinds of applications is probably a good example of a target. . . microphone preamps are some of the recent products we've released to market, including the PGA 2500, which is a programmable gain microphone pre-amp. We have also just released to market the PCM 4104, which is a 4-channel, 118dB d/a converter. We've done some pre-announcement of a 4-channel a/d converter; that is coming soon.

We've also got a programmable volume control circuit for the output of the d/a converter, the PGA 2310 family. And we also have a digital interface transmitter for AES/EBU output. In our product group, our counterparts also have digital interface receivers, within TI, and we also have within our business very high performance sample rate converters, highest dynamic range available at 144dB. That's a sample of some of the parts and again, very much directed towards mixing consoles, live sound venue, and recording.

**M<sup>3</sup>:** In regard to the acquisition, was B-B a private or public company at the time?

**Kalthoff:** No, they were public. Matter of fact, I believe it is still the highest-valued merger in the electronics industry to date, around \$7.6 billion.

**M<sup>3</sup>:** What kind of benefits did B-B gain by being acquired by TI?

**Kalthoff:** Access to process technology . . . I think it's been a field day for the design community in terms of access to key technology as well as the ability to shape that technology.

**M<sup>3</sup>:** From your perspective, what steps were taken to ensure that the merger of

the two companies went smoothly?

**Kalthoff:** I think it was pretty well articulated early on the strategic fit of B-B within TI product strategy and that was really from the top down . . . that's how it was carried out and carried through as well. It's really been a cohesive story . . . when you look at the real world, as you and I were talking about earlier, the real world is all analog whether it's light, sound, temperature, sound pressure, and so on, the whole world around us is analog.

At the same time, more and more of that world is getting processed digitally. And then once processed, converted back into an analog form that we can all relate to. So the high-performance analog capability within B-B was a really strong fit with TI's high-performance digital signal processing capabilities. So the (acquisition) became part of an overall comprehensive story. That's why it's been kind of easy, if you know what I mean.

**M<sup>3</sup>:** Because there was already a good fit, and that both parties at each company could see where it would be a win for both?

**Kalthoff:** Yes, exactly. This is not a cost reduction strategy by either party. This was a strategic fit.

**M<sup>3</sup>:** This acquisition sounds much more like a partnership.

**Kalthoff:** Absolutely, that's 100% the case. As a whole, I give TI credit for its attitude of leveraging the best practices of its people. I would not say that we do things the TI way—in the post B-B acquisition era, but we do things the best way. The overall objective is to do things optimally, and I think that's kept everyone straight, so to speak.

Obviously the merger has worked very well for all, as TI has released a number of high-performance analog and mixed-signal products already. In July 2003, they announced “the (SRC4192/3) industry's highest performance sample rate converters from the company's Burr-Brown Pro Audio product line, featuring a dynamic range of 144dB, a distortion level of -140dB,

THD+N, and a maximum input/output sampling rate of 212kHz.”

In December 2003, they announced the PGA2500, “the industry's first digitally controlled microphone preamp IC from the company's Burr-Brown Pro Audio product line . . . In addition to eliminating numerous components, the PGA 2500 offers higher dynamic range, lower THD+N, and lower equivalent input noise versus gain when compared to discrete designs.”

In April 2004, TI announced another product from the Burr-Brown Pro-Audio product line, the PCM4104, a four-channel, 24-bit audio DAC featuring a dynamic range of 118dB, THD+N level of -100dB, overall total power dissipation of ~200mW, and a sampling rate of 200kHz. “The PCM4104 is designed for professional audio applications, such as digital mixing consoles, digital effects processors, and multi-track recorders.”

You can find further product announcements and information on TI's website, [www.TI.com](http://www.TI.com)

Thanks to Gary Sculley and Tim Kalthoff for their assistance with this article.

In other TI news, the company has released the TAS5518 PWM processor, a pulse-width modulator processor with up to eight speaker channels and 48-bit processing for sound field enhancement. With 110dB dynamic range, the TAS5518 also provides an additional 42dB dynamic range boost, and gives a dynamic range of 134dB, and has a noise floor of as low as 10µV of output noise. The TAS5518 works in conjunction with TI's power stages including the TAS5182.

Furthermore, Harman Kardon has selected TI's Aureus audio digital signal processor and analog components for two of its new A/V receivers. The DA610, from the Aureus family of audio DSPs, is 225MHz, and delivers 1800 million instructions per second and 32/64-bit native processing. HK's AVR 635, a 7.1-channel A/V receiver, and the AVR 435, similar to the 635, both use the DA610. \*