



Single-chip dot matrix LCD driver  
 On-chip display RAM: 65 x 166 = 10790 bits  
 Connects directly to 80-series or 68-series MPU  
 Display dots: 65 x 102 dots (maximum)  
 On-chip LCD power supply logic  
 Chip size: 8.08 x 5.28 mm

### Product Features

The SED1560 Series, which went into full production in July 1993, was the world's first single-chip dot matrix LCD driver to feature on-chip energy-saving power supply logic. At the time, power circuits for LCDs drained a lot of power, but most manufacturers did not integrate their LCD drivers, and instead added the power supply logic to the board as an afterthought. However, with the ongoing miniaturization and greater sophistication of IT equipment, there was a steadily growing demand for low-power components integrated onto a single chip (for further miniaturization). In response, Epson continued to seek new advances in power-saving technologies, and developed an optimal logic configuration for LCD drivers, along with power supply logic that drives LCDs while using only one-tenth the current consumed by most other power supply units. Epson has successfully integrated these power-saving power supply units into its LCD driver products. Products in the SED1560 Series managed to drive a 65 x 102 dot display with unprecedented low current consumption of only 150 to 180  $\mu$ A, which made them the only LCD driver ICs that met the requirement for pagers that the LCD must operate for at least one month using only one AAA-size battery.

An SED1560 chip provided a high level of display flexibility. The chip can be directly connected to an 80-series or 68-series MPU bus, so display data could be stored in internal RAM, whose memory bits had a 1:1 correspondence to the LCD panel's display dots. Consequently, the individual dots could be turned on or off digitally, i.e., by using a "0" or "1".

### Background

Epson took its first opportunity to enter the semiconductor business when it developed CMOS ICs for quartz watches. Since then, the company has focused most of its chip development efforts on low-power ICs. In particular, after it won acclaim for the usability of its SED1520 Series of energy-saving LCD drivers with on-chip RAM, the company decided to add several new products to this lineup. One goal was to develop an LCD driver IC that surpassed the SED1520 Series' display size (16 x 61 dots) by supporting display sizes up to 64 x 100 dots. With a competitor's products already on the market when Epson inaugurated its development program in 1991, Epson tried to gain distinction by using its strengths in low-power consumption devices. At that time, the company accepted the difficult challenge of creating an IC that could contain the power supply logic for an LCD panel. The first samples were a big disappointment: only four of the six power supply blocks needed to drive the LCD were operational. Epson's engineers overcame this obstacle by determining how LCDs can be driven at low power by optimizing the routing of current through the various power supply blocks. After a series of trial-and-error experiments and studies of logic configurations, the SED1560 Series of LCD drivers featuring low power consumption was born.

### Impact

The SED1560 Series was well received in the marketplace as a product that managed to simultaneously support both larger display sizes and lower power consumption. By helping to spur the trend toward larger LCD panels in pagers, SED1560 Series products were long-selling hit products that have kept pace with the rapid market growth of personal communication devices.

The power-saving technology that was originally developed for this SED1560 Series has been used as a base concept for Epson's subsequent development of several other energy-saving drivers, such as the successor SED1565 Series that has helped Epson maintain its solid position as a manufacturer of drivers for mobile phones, as well as the world's first MLS (Multi Line Selection) type LCD driver.