

consumption. This low power requirement has eliminated the darlington connection of the transistors in 5V DC power supply circuit, simplifying the circuit.

The CMOS technology adopted has lowered the minimum operating voltage of the microcomputer, which in turn has lowered the minimum operating voltage of the ECU along with the lowered voltage drop of the simplified power supply circuit. It is possible to raise the threshold voltage compared to NMOS and thus to simplify the ECU input signal interface. The '83 model TCCS (Toyota Computer Controlled System) was equipped with an ECU consisting of multi-chip LSIs which included a 12 bit micro-processor. The '85 model TCCS is the new system equipped with an additional knock control function. With the adoption of the CMOS single-chip microcomputer, however, the reliability has been improved with a reduced number of LSIs, while the size and the cost of the ECU has remained identical to those of the conventional one, as shown in Figures 4, 5 and 6.

Fig. 5 - 1983 model year TCCS ECU



Fig. 6 - 1985 model year TCCS ECU

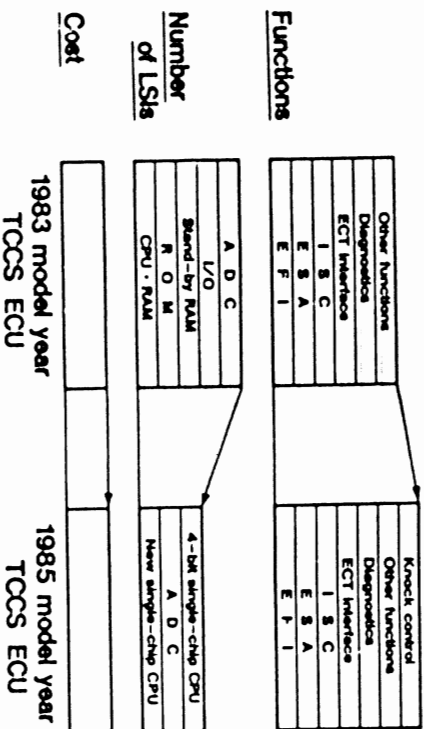


Fig. 4 - Comparison between 1983 and 1985 model year TCCS ECU

Figure 7 shows an ECU block diagram of the '85 model TCCS. Because the capabilities demanded of the A/D converter vary according to the system. This microcomputer does not contain the converter. The vane-type air-flow meter requires, for example, a 10-bit or more accuracy and 11-bit or more resolution, but the speed density system requires only 8-bit accuracy and 10-bit resolution. By mounting the A/D converter outside the microcomputer, an A/D converter with optimum cost/performance required for the system's accuracy can be selected. This has an additional advantage of being able to separate analogue and digital sections inside the ECU. The '85 model TCCS uses an 11-bit, 8-channel quadruplex integral type A/D converter, since its system uses an air-flow meter. Figure 8 shows a block diagram of the ECU using a speed density system for domestic market which combines an inexpensive single-slope type A/D converter.