the inherent delay due to carrier storage. Operational speeds of one megacycle are possible with this mode of operation by using alloy junction transistors. All logic must be performed by the transistors because the voltage swings are insufficient to operate additional resistor or diode logic. Current mode circuits are especially useful for line-drive functions, sensing and control circuits.

Line Terminology and Voltage Swings. Voltage swings of at least ±0.4 volts about ground are referred to as N lines and are used to drive N-type transistor bases. Voltage swings of at least ±0.4 volts, about −6 volts, are called P lines and are used to drive P-type transistor bases. The −6v and ground potentials are the transistor reference voltages used for NPN and PNP transistor blocks, respectively.

Outputs. Two outputs are usually available from the current mode logic circuits, an in-phase output and an inverter or out-of-phase output. When used in a system, the P line output of a PNP circuit drives a NPN circuit. The N line output of an NPN circuit always drives a PNP circuit. Convert blocks are used to drive a PNP load with a PNP output or an NPN load with an NPN output. Outputs not used must be terminated to the proper output reference voltage.

Delays. The delays for these circuits are a combination of both the transistor delays and transition times within the circuit. Delays are defined as the elapsed time from the time the input signal has reached the switching threshold of the circuit being driven to the time the output signal of the driven stage has reached the switching threshold of the following stage. Nominal delay values for most logic blocks are about 0.06 microseconds.

Diffused Junction Transistor Circuits

Use of the diffused junction transistors in current switching circuits permits this group of component cards to function at increased speeds above 7.0 megacycles. Circuit operation, line terminology, voltage swings, outputs and delay considerations are similar to those of alloy junction current switching circuits. The delay encountered per stage in these circuits, however, is approximately 0.02 microseconds, and is measured from the 10% input value to the 10% value of the output signal.

Complemented Transistor Diode Logic (CTDL)

Complemented transistor diode logic (CTDL) provides a complete system of solid-state logic for use in intermediate speed systems (near 250 kc). This system of circuitry uses a large number of diodes and large signal swings to control saturating alloy-junction type transistors. Component cards in this group are capable of performing all the necessary logic economically and with a high degree of reliability. This mode of operation uses circuitry designed around existing voltages and is compatible with the standard voltage mode or current mode of operation. Use of the large signal swings (−12 volts) compensates for the diode drops and allows a greater cascading factor. CTDL circuits are also less sensitive to noise than other circuit modes.

Line Terminology and Voltage Swings. Reference voltages used in CTDL circuits are −6 volts and ground. A signal that swings ±6 volts (maximum) about ground is referred to as a T line and is used to drive N-type transistor bases. Signal swings ±6 volts (maximum) about −6 volts are referred to as U lines and drive P-type transistor bases. In order to make sure that the diodes are reverse biased when the transistor is on, the input and output voltage references differ by 6 volts.

Outputs. An inverted output is available from the basic logic blocks. The output from a PNP block is a U line and drives a NPN transistor. The output from a NPN block is a T line and drives a PNP. Convert blocks are used when a PNP block has to be driven by a PNP block or a NPN block by a NPN block. Suitable current mode outputs are also available from some CTDL circuit cards. Because loading conditions greatly affect the output voltage swings of the transistor, minimum and maximum voltage levels are indicated on the diagram for CTDL circuits. Voltage levels used with CTDL card descriptions are usually shown as ±6 volts about a 0 or −6 voltage reference.

Power Supply Voltage. This mode of operation requires five standard voltages, +6, −6, −12, +6M and −12M. The +6M and −12M voltages are used in marginal checking of the circuits.

Delays. The delay of the signal in the basic CTDL logic block is a function of the transistor delays plus the loading effects of the input and output circuits. Delays for several stages in cascade are numerically equal to the sum of individual stages. Unless otherwise stated in the card description, delays are measured from the time the input signal crosses its reference voltage to the time the output signal crosses its reference voltage. Nominal values for basic logic stages are approximately 0.2 microseconds.

Magnetic Core Logic Circuits

Cards in this group contain magnetic core positions and associated circuitry. Line terminology, function and output information are dependent on the use of the particular card. These cards are used in shift registers, and in input-output buffer applications.

Special Purpose Cards

Special purpose cards such as coupling circuits, bias and load resistors, integrator circuits and converting networks, are found in this group. These cards are normally identified with a specific application. E.g., the QS- - load card is used with the drum driver (GS- -) card.

Standard Modular System Packaging

The Standard Modular System (SMS) provides a moderate number of standard building blocks to facilitate the manufacturing of solid-state data processing equipment. Two modular type units and pluggable printed circuit cards are available to provide for flexible packaging of all electronic components required in a system. Some of the more important advantages offered by the use of SMS packaging are:

1. Standardization of circuits and packaging methods, that reduce parts stockage in the field and parts handling in the manufacturing process.
2. Increased serviceability by allowing rapid access to cards and test points and elimination of the cover removal and storage problem.
3. Use of latest production techniques such as Wire-Wrap* and automated production lines.
4. Data processing equipment that requires a reduced amount of space, power and air conditioning.

*Trademark of Gardner-Denver Company.