L. Trasatti: A PROM PROGRAMMER FOR CANDI.
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Bipolar PROM's (Programmable Read Only Memories) are becoming more and more popular, due to their speed and to the possibilities of economy and flexibility they offer the hardware designer (they have been described as "the hardware's software").

Typical examples of their use are memory decoding (with the possibility to change addresses by simply replacing a chip) or generation of complicated timing sequences with minimal chip count.

We have built a PROM programmer for CANDI\(^{(1-5)}\) which, using the TM990/302 EPROM programming facility with a minimal addition of hardware is capable of programming the entire family of Texas Instruments Series 14 and series 18 PROM's.

The circuit diagram is shown in Figg. 1, 2 and 3. Two 8-bit three state latches (SN74LS373) service the bidirectional data bus, and a series of eight reed relays pull the input corresponding to the bit to be programmed to OV. The necessary power is supplied by the CANDI system. Five different I.C. sockets provide the different pin assignments for the 10 different PROM's to be programmed. Table I shows the correspondence between sockets and PROM's.

**TABLE I - Correspondence between sockets and PROM's.**

<table>
<thead>
<tr>
<th>Socket</th>
<th>PROM</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>TBP18SA030, TBP18S030 (SN74S188, SN74S288)</td>
</tr>
<tr>
<td>S2</td>
<td>TBP14S10, TBP14SA10 (SN74S287, SN74S387)</td>
</tr>
<tr>
<td>S3</td>
<td>TBP18SA22, TBP18S22 (SN74S470, SN74S471)</td>
</tr>
<tr>
<td>S4</td>
<td>TBP18S42, TBP18SA42 (SN74S472, SN74S473)</td>
</tr>
<tr>
<td>S5</td>
<td>TBP18S46, TBP18SA46 (SN74S474, SN74S475)</td>
</tr>
</tbody>
</table>
An interactive BASIC program allows simple use of the programmer. The program asks for the type of PROM, establishing the necessary default values, then defines a memory area corresponding to an area of the PROM. The area need not coincide with the entire contents of the PROM, thus allowing partial programming.

Other possibilities include Memory Input (input from keyboard the values to be programmed into the PROM), Memory Display (decimal and hexadecimal display of memory contents), Verify PROM Erased (check that no PROM locations have already been programmed), Read PROM to Memory (copy PROM contents to memory area), Program PROM and compare PROM to Memory.

During programming, a bit at a time is programmed and then verified. If a bit results not programmed, the programming is interrupted and a message is displayed. During verification and comparison, only the PROM locations not equal to the corresponding memory locations are displayed.

An example of a programming sequence is shown in Fig. 4.

A printed circuit board version of the programmer, which simply plugs into connector P3 of the TM990/302 board, is under construction in the P.C. Board facility of LNF.

References.

(1) - O. Ciaffoni et al., A CAMAC system controller using the TEXAS TMS9900 microprocessor as stand-alone and PDP 11 connected unit, Frascati report LNF-80/27 (1980).


(3) - O. Ciaffoni et al., Data acquisition system for cosmic ray muon background tests under the Gran Sasso tunnel, Frascati report LNF-81/36 (1981).


FIG. 1 - PROM Programmer schematics (1 of 3).
FIG. 2 - PROM Programmer schematics (2 of 3).
FIG. 3 - PROM Programmer schematics (3 of 3).
FIG. 4 - Programming example.

RUN
DO YOU WANT TO:
   INPUT FROM PARAMETERS (TYPE I) OR
   INPUT MEMORY (TYPE M) OR
   DISPLAY MEMORY (TYPE D) OR
   VERIFY FROM ERASED (TYPE V) OR
   READ FROM MEMORY (TYPE R) OR
   PROGRAM FROM (TYPE F) OR
   COMPARE FROM TO MEM (TYPE C)  ? : I

INPUT PARAMETERS (CR=NO CHANGE)
FROM TYPE=74287:
MEMORY START = 0:
MEMORY END = 255:
FROM START = 0:

DO YOU WANT TO:
   INPUT FROM PARAMETERS (TYPE I) OR
   INPUT MEMORY (TYPE M) OR
   DISPLAY MEMORY (TYPE D) OR
   VERIFY FROM ERASED (TYPE V) OR
   READ FROM MEMORY (TYPE R) OR
   PROGRAM FROM (TYPE F) OR
   COMPARE FROM TO MEM (TYPE C)  ? : V

VERIFYING FROM FROM 0000 0000
FROM OK.

DO YOU WANT TO:
   INPUT FROM PARAMETERS (TYPE I) OR
   INPUT MEMORY (TYPE M) OR
   DISPLAY MEMORY (TYPE D) OR
   VERIFY FROM ERASED (TYPE V) OR
   READ FROM MEMORY (TYPE R) OR
   PROGRAM FROM (TYPE F) OR
   COMPARE FROM TO MEM (TYPE C)  ? : I

INPUT PARAMETERS (CR=NO CHANGE)
FROM TYPE=74287:
MEMORY START = 01 60H
MEMORY END = 255 7FH
FROM START = 01 60H

DO YOU WANT TO:
   INPUT FROM PARAMETERS (TYPE I) OR
   INPUT MEMORY (TYPE M) OR
   DISPLAY MEMORY (TYPE D) OR
   VERIFY FROM ERASED (TYPE V) OR
   READ FROM MEMORY (TYPE R) OR
   PROGRAM FROM (TYPE F) OR
   COMPARE FROM TO MEM (TYPE C)  ? : M
**INPUT MEMORY CONTENT** (\(<\text{CR}>=\text{NO CHANGE}, \ -\text{CR}\rangle=\text{GO BACK}\)

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>MEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEC</td>
<td>HEX</td>
</tr>
<tr>
<td>96</td>
<td>060H</td>
</tr>
<tr>
<td>97</td>
<td>061H</td>
</tr>
<tr>
<td>98</td>
<td>062H</td>
</tr>
<tr>
<td>99</td>
<td>063H</td>
</tr>
<tr>
<td>100</td>
<td>064H</td>
</tr>
<tr>
<td>101</td>
<td>065H</td>
</tr>
<tr>
<td>102</td>
<td>066H</td>
</tr>
<tr>
<td>103</td>
<td>067H</td>
</tr>
<tr>
<td>104</td>
<td>068H</td>
</tr>
<tr>
<td>105</td>
<td>069H</td>
</tr>
<tr>
<td>106</td>
<td>06AH</td>
</tr>
<tr>
<td>107</td>
<td>06BH</td>
</tr>
<tr>
<td>108</td>
<td>06CH</td>
</tr>
<tr>
<td>109</td>
<td>06DH</td>
</tr>
<tr>
<td>110</td>
<td>06EH</td>
</tr>
<tr>
<td>111</td>
<td>06FH</td>
</tr>
<tr>
<td>112</td>
<td>070H</td>
</tr>
<tr>
<td>113</td>
<td>071H</td>
</tr>
<tr>
<td>114</td>
<td>072H</td>
</tr>
<tr>
<td>115</td>
<td>073H</td>
</tr>
<tr>
<td>116</td>
<td>074H</td>
</tr>
<tr>
<td>117</td>
<td>075H</td>
</tr>
<tr>
<td>118</td>
<td>076H</td>
</tr>
<tr>
<td>119</td>
<td>077H</td>
</tr>
<tr>
<td>120</td>
<td>078H</td>
</tr>
<tr>
<td>121</td>
<td>079H</td>
</tr>
<tr>
<td>122</td>
<td>07AH</td>
</tr>
<tr>
<td>123</td>
<td>07BH</td>
</tr>
<tr>
<td>124</td>
<td>07CH</td>
</tr>
<tr>
<td>125</td>
<td>07DH</td>
</tr>
<tr>
<td>126</td>
<td>07EH</td>
</tr>
<tr>
<td>127</td>
<td>07FH</td>
</tr>
</tbody>
</table>

**DO YOU WANT TO:**

- **INPUT FROM PARAMETERS** (TYPE I) OR
- **INPUT MEMORY** (TYPE M) OR
- **DISPLAY MEMORY** (TYPE D) OR
- **VERIFY FROM ERASED** (TYPE V) OR
- **READ FROM MEMORY** (TYPE R) OR
- **PROGRAM FROM** (TYPE P) OR
- **COMPARE FROM TO MEM** (TYPE C)

**MEMORY CONTENT**

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>MEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEC</td>
<td>HEX</td>
</tr>
<tr>
<td>96</td>
<td>060H</td>
</tr>
<tr>
<td>104</td>
<td>068H</td>
</tr>
<tr>
<td>112</td>
<td>070H</td>
</tr>
<tr>
<td>120</td>
<td>078H</td>
</tr>
</tbody>
</table>

**DO YOU WANT TO:**

- **INPUT FROM PARAMETERS** (TYPE I) OR
- **INPUT MEMORY** (TYPE M) OR
- **DISPLAY MEMORY** (TYPE D) OR
- **VERIFY FROM ERASED** (TYPE V) OR
- **READ FROM MEMORY** (TYPE R) OR
- **PROGRAM FROM** (TYPE P) OR
- **COMPARE FROM TO MEM** (TYPE C)
PROGRAMMING FROM FROM 040H TO 07FH
USING MEMORY FROM 060H TO 07FH

ADDRESS BIT

060H 0
060H 1
060H 3
062H 0
062H 1
062H 3
064H 0
064H 1
064H 3
064H 9
066H 1
066H 3
068H 3
06AH 3
06CH 3
070H 1
070H 2
070H 3
072H 1
072H 2
074H 1
074H 3
076H 1
078H 2
078H 3
07AH 0
07AH 2
07CH 3

FROM PROGRAMMED O.K.

DO YOU WANT TO :
INPUT FROM PARAMETERS (TYPE I) OR
INPUT MEMORY (TYPE M) OR
DISPLAY MEMORY (TYPE D) OR
VERIFY FROM ERASED (TYPE V) OR
READ FROM TO MEMORY (TYPE R) OR
PROGRAM FROM (TYPE P) OR
COMPARE FROM TO MEM (TYPE C) ?

COMPARING FROM FROM 060H TO 07FH
TO MEMORY FROM 060H TO 07FH

FROM O.K.