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HP 75000 SERIES B and C

Breadboard
Signal Conditioning Plug-on
HP E1504

User's Manual

The HP E150 manual also applies to HP E1413Bs as HP E1413 Option 14.

Enclosed is the User's Manual for the HP E1504 Signal Conditioning Plug-on. Insert this manual in your HP E1413/E1313 manual behind the "Signal Conditioning Plug-ons" divider.

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HP E1504
Breadboard Signal Conditioning Plug-on

Introduction

The HP E1504 Breadboard Signal Conditioning Plug-on allows you to create custom signal conditioning on up to eight HP E1413/E1313 channels.

The board is primarily designed to help you implement custom filters and attenuators. Included on the board is overvoltage input protection circuitry, and SCP identification circuitry. The rest of the board area is for your custom circuitry.

About this Manual

This manual shows you how to control the Signal Conditioning Plug-on (SCP) using SCPI commands as well as Register-Based commands, and explains the capabilities of this SCP. The contents of this manual are:

- Installation 3
- Identifying the Plug-on 3
- Programming With SCPI Commands 4
- Programming With Register Commands 5
- Parts Locator Diagram 10
- Schematic Diagram 11

Installation

Installation for this Plug-on is common to several others and is covered in Chapters 1 and 2 of your HP E1413/E1313 manual.

Identifying the Plug-on

You'll find the HP part number on the side opposite the P0 connector. For the HP E1504, the part number is : E1413-63514

Programming With SCPI Commands

The SCPI command shown here is covered in Chapters 3 and 5 of your HP E1413/E1313 manual.

Checking the ID of the SCP

To verify the SCP type(s) installed on the HP E1413/E1313 use the SYSTem:CTYPe? (@<channel>) command.

- The *channel* parameter specifies a single channel in the channel range covered by the SCP of interest. The first channel number for each of the eight SCP positions are; 0,8,16,24,32,40,48, and 56.

The value returned for the SCP in an HP E1413B is:
HEWLETT-PACKARD,E1413 Opt 14 8-Channel Breadboard SCP,0,0

The value returned for the SCP in an HP E1313A/E1413C is:
HEWLETT-PACKARD,E1415 8-Channel Breadboard SCP,0,0

To determine the type of SCP installed on channels 0 through 7 send

```
SYST:CTYP?  (@100)          query SCP type @ ch 0
enter statement here        enter response string
```

Register Based Programming

The register-based commands shown here are covered in Appendix D of the HP E1413/E1313 manual. You should read that section first to become familiar with accessing registers and executing Register-Based Commands. This section will relate those commands to the parameter values which are specific to this Plug-on.

When Register Programming this SCP, communication is through the Signal Conditioning Bus. For that you will use the Register Based Command:

SCBREAD? <*regaddr*>

HP E1504 Register Map

Read (returned value)	Write(<*regvalue*>)	SCP Register	<*regaddr*> Value
SCP ID ($D0D0_{16}$)		Whole SCP Reg 0	$00ppp000000_2$

ppp=Plug-on
ccc=SCP channel

Checking ID of SCP

To query an SCP for its ID value, write the following value to Parameter Register 1:

(*SCP number*) $\times 40_{16}$

Then write the opcode for SCBREAD? (0800_{16}) to the Command Register. The ID value will be written to the Query Response Register.

Available Resources

The following section discusses the SCP's circuits and signals

Functional Description

The Breadboard SCP consists of three major blocks or components

Static Discharge Protection	Keeps static discharges from other circuitry.
Overvoltage Protection	Detects overload voltages greater than ±28 Volts on any single input (Hi or Lo) or ±18 Volts if all inputs are at this level. The circuit signals the HP E1413/E1313's Control Processor which opens all input relays to protect the input circuitry.
Module Identification	Responds to any SCP register read with the module ID value.

Theory of Operation

The following is a simplified theory of operation for the functional blocks described above.

Static Discharge Protection	Discharge protection consists of a 1W 150 Ohm resistor in series with each input (Hi and Lo). One end of the resistor is diode clamped to a bipolar supply paralleled by a large capacitor tied to ZGND (zap ground). Your components can be tied between signal inputs from P0 and the discharge protection network or between the discharge protection network and signal outputs going to P1, or both.
Overvoltage Protection	Overvoltage protection is accomplished by sensing the current in the Static Discharge Protection Supply and when the level becomes great enough, turning on a transistor. The overvoltage level varies depending on how many inputs are in overvoltage and their levels.
Module Identification	The SCP will return $D0D0_{16}$ when reading module id or any other of its registers.

Hardware Interface

The following describes the signals available on the Breadboard SCP (y indicates a number, n indicates low true).

Analog inputs

Hy,Ly	High and Low differential inputs from terminal card
VREF	+5 Volt reference available on SCP
GRDy	Guard input from terminal card (one per SCP)

Analog outputs

HyX,LyX	High and Low differential outputs to the MUX; +-16V max.

Digital inputs

MTRGn	Triggers the SCP
MFRy	Frame signal to the SCP from the DSP subsystem
MCHN	Address line to choose Channel or Module address space
MA(5:0)	Address lines to select registers in SCP address space
MRW	Read/Write select line sourced from DSP
MDO	Serial data line sourced by the DSP to Write to the SCP
MCLK	Serial clock sourced from DSP to synch data to/from SCP
MOTDy	Sourced from the VXI Register Interface activates Open Transducer Detection
LRSTn	Local reset line

Digital outputs

MDIN	Serial data line sourced from the SCP during Reads by DSP
MOVn	Overvoltage detect, open-collector line to signal DSP in event of gross overvoltage

Power supplies

±19V	From main board regulators; +6mA/-6mA current draw nominal
+5 V	From main board digital supply; +1mA nom.

Grounds

Ground	Digital ground from main board
AGND	Analog ground from main board
ZGNDy	Zap ground from main board

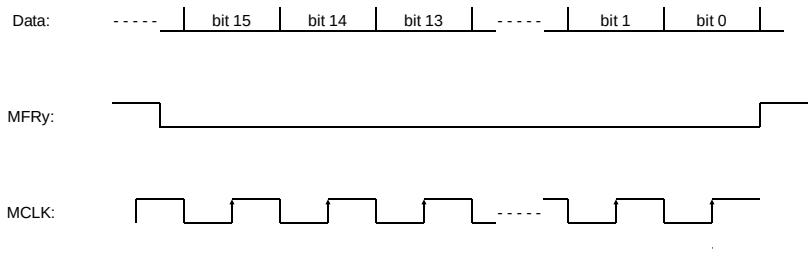
Hardware registers

There are no specific registers on this module. Any time MFRy is asserted, the module will output 0xD0D0 regardless of whether it is addressed to Read or Write.

Data Formats

The data format for Reading and Writing from/to SCPs consists of 16-bit data word sent/received MSB first after MFRy is asserted.

Summary timing diagram:



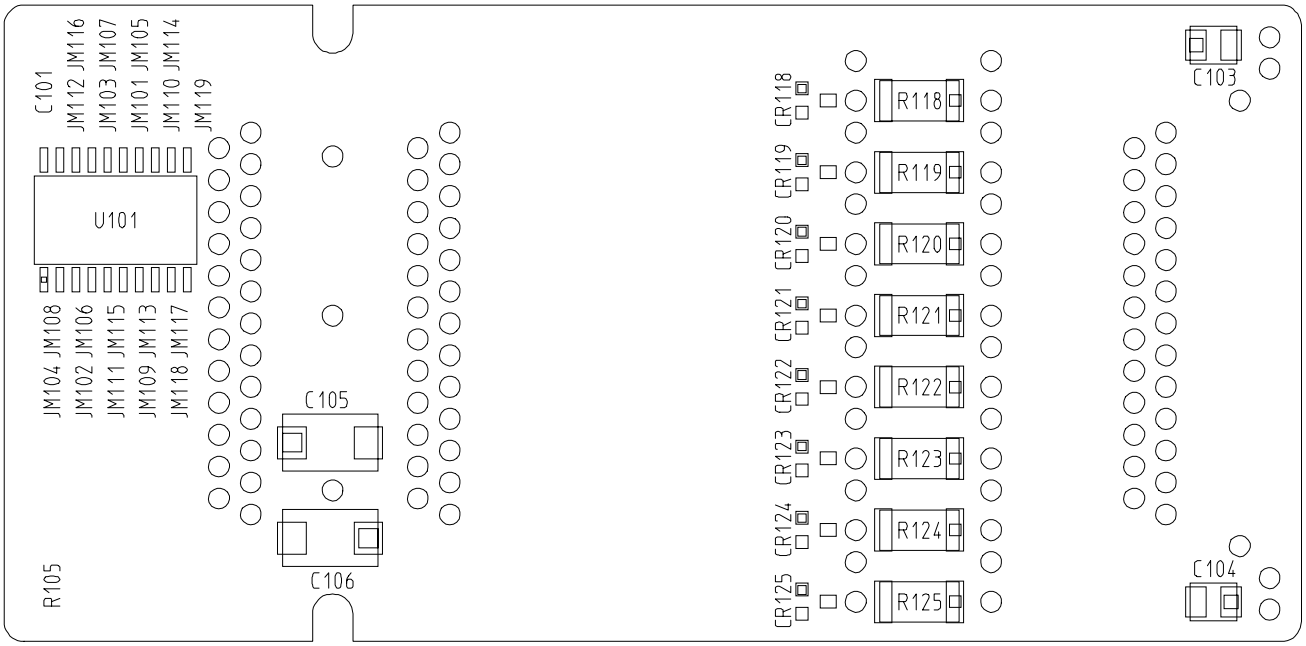
Data is clocked on the rising edge of MCLK which comes from the EU engine after MFRy is asserted. Address is valid throughout the frame cycle.

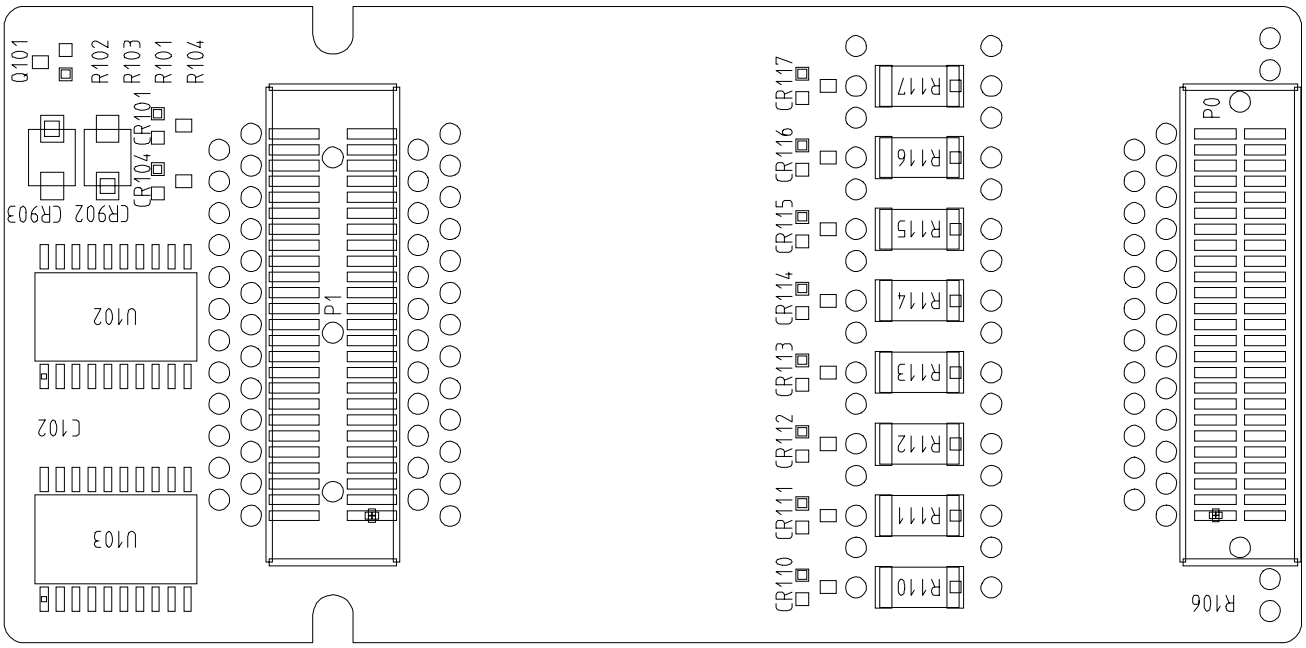
Connector Pins

Each SCP module has two connectors, P0 and P1. The P0 connector is the analog input and zap connector. The P1 connector handles all the analog outputs and digital signals. Each connector has 50 pins. The pin lists are summarized below.

P0 Connector		P1 Connector	
Pin Number	Name	Pin Number	Name
1,7,13	GRDy	1	L0X
19,25	GRDy	2,8,20	GROUND
31,37	GRDy	24,38,46	GROUND
43,49	GRDy	3	H0X
3	L0	4	LRSTn
5	H0	5,11,17	AGND
9	L1	23,29,35	AGND
11	H1	41,47	AGND
15	L2	6	MTRGn
17	H2	7	L1X
21	L3	9	H1X
23	H3	10	MFRy
27	L4	12	MCHN
29	H4	13	L2X
33	L5	14	MRW
35	H5	15	H2X
39	L6	16	MDIN
41	H6	18	MDO
45	L7	19	L3X
47	H7	21	H3X
all even #s	ZGNDy	22	MCLK
		25	L4X
		26	MA0
		27	H4X
		28	MA1
		30	MA2
		31	L5X
		32	MA3
		33	H5X
		34	MA4
		36	MA5
		37	L6X
		39	H6X
		40	+5V
		42	MOVn
		43	L7X
		44	MOTDy
		45	H7X
		48	+19v
		49	vref
		50	-19v

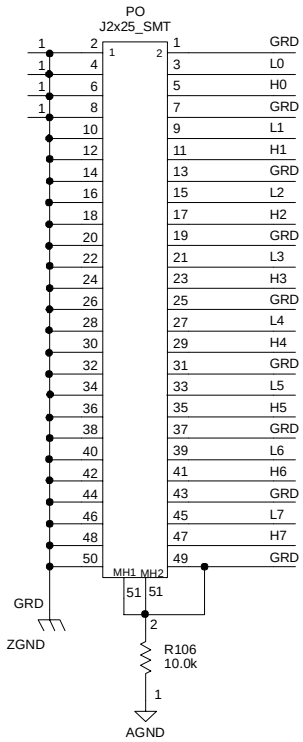
Component Locator Diagram

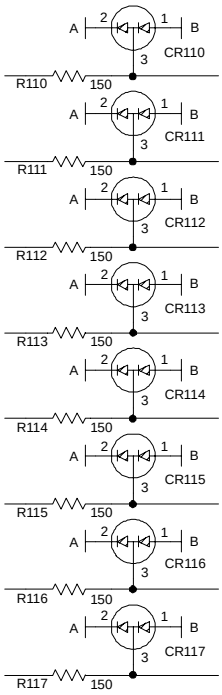


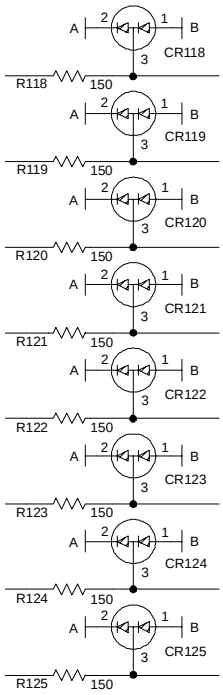


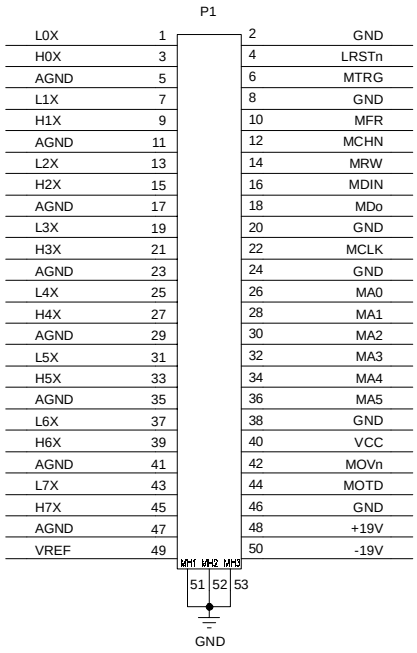
Schematic Diagram

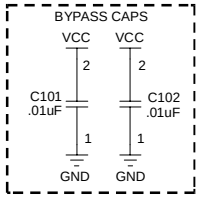
The following pages show the schematic of the HP E1504 Breadboard SCP.

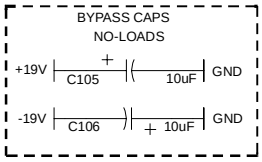

PO
J2x25_SMT
GRD
L0
H0
GRD
L1
H1
GRD
L2
H2
GRD
L3
H3
GRD
L4
H4
GRD
L5
H5
GRD
L6
H6
GRD
L7
H7
GRD
MH1 MH2
51 51
GRD
ZGND
R106
10.0k
AGND

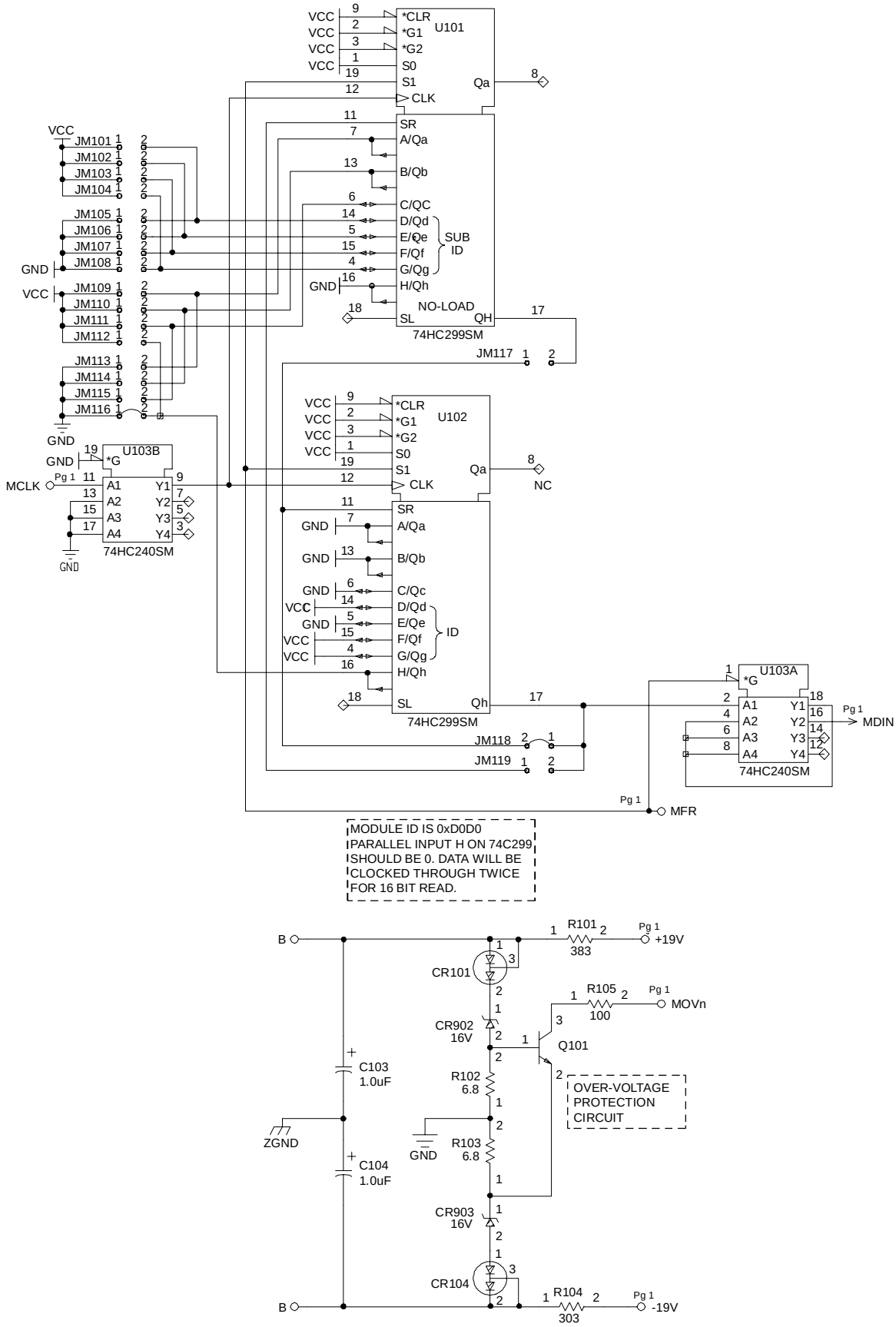

CR110
R110 150
CR111
R111 150
CR112
R112 150
CR113
R113 150
CR114
R114 150
CR115
R115 150
CR116
R116 150
CR117
R117 150


CR118
R118 150
CR119
R119 150
CR120
R120 150
CR121
R121 150
CR122
R122 150
CR123
R123 150
CR124
R124 150
CR125
R125 150


P1
L0X 1 2 GND
H0X 3 4 LRSTn
AGND 5 6 MTRG
L1X 7 8 GND
H1X 9 10 MFR
AGND 11 12 MCHN
L2X 13 14 MRW
H2X 15 16 MDIN
AGND 17 18 MDo
L3X 19 20 GND
H3X 21 22 MCLK
AGND 23 24 GND
L4X 25 26 MA0
H4X 27 28 MA1
AGND 29 30 MA2
L5X 31 32 MA3
H5X 33 34 MA4
AGND 35 36 MA5
L6X 37 38 GND
H6X 39 40 VCC
AGND 41 42 MOVn
L7X 43 44 MOTD
H7X 45 46 GND
AGND 47 48 +19V
VREF 49 50 -19V
MH1 MH2 MH3
51 52 53
GND


BYPASS CAPS
VCC VCC
C101
.01uF
C102
.01uF
GND GND


BYPASS CAPS
NO-LOADS
+19V
C105
10uF
GND
-19V
C106
10uF
GND


U101
74HC299SM
U102
74HC299SM
U103A
U103B
74HC240SM
SUB ID
ID
NO-LOAD
JM101
JM102
JM103
JM104
JM105
JM106
JM107
JM108
JM109
JM110
JM111
JM112
JM113
JM114
JM115
JM116
JM117
JM118
JM119
MCLK
MDIN
MFR
NC
MODULE ID IS 0xD0D0
PARALLEL INPUT H ON 74C299
SHOULD BE 0. DATA WILL BE
CLOCKED THROUGH TWICE
FOR 16 BIT READ.
R101
383
+19V
R104
303
-19V
R105
100
MOVn
R102
6.8
R103
6.8
C103
1.0uF
C104
1.0uF
CR101
CR902
16V
CR903
16V
CR104
Q101
OVER-VOLTAGE
PROTECTION
CIRCUIT
ZGND

Notes

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