Nuclear Physics Division
Data Acquisition Group

FANIO, TI to CAEN_TDC interface board

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1 Introduction

The FANIO board is being designed for Hall-B (Collaboration, 2009) upgrade. This module is responsible for connecting the trigger/clock/reset/busy signals between the TI (GU, TID design, 2009) and the FANIO (GU, FANIO, 2010) boards. Some extra functions are added to the board in case that the TI and/or the FANIO boards are not available when testing the CAEN TDC (1290). Figure 1 shows the diagram of the FanioDC in the setup.

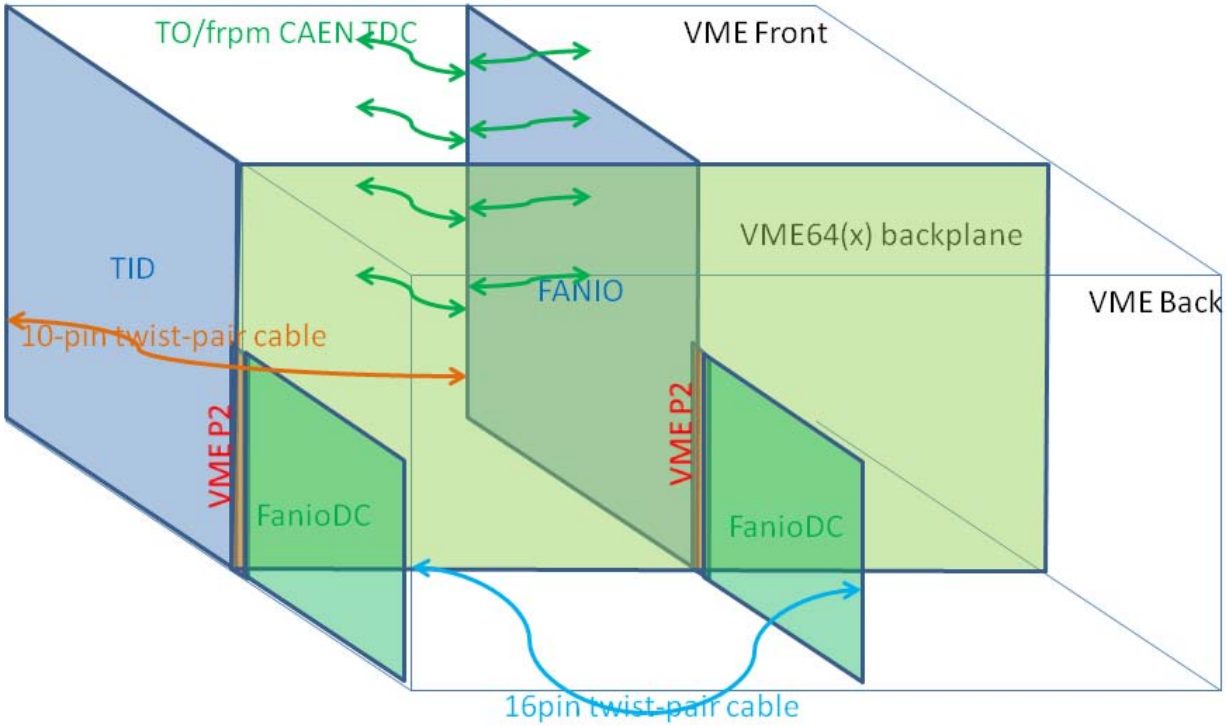


Figure 1 FanioDC board is located in the rear of VME64(x) crate

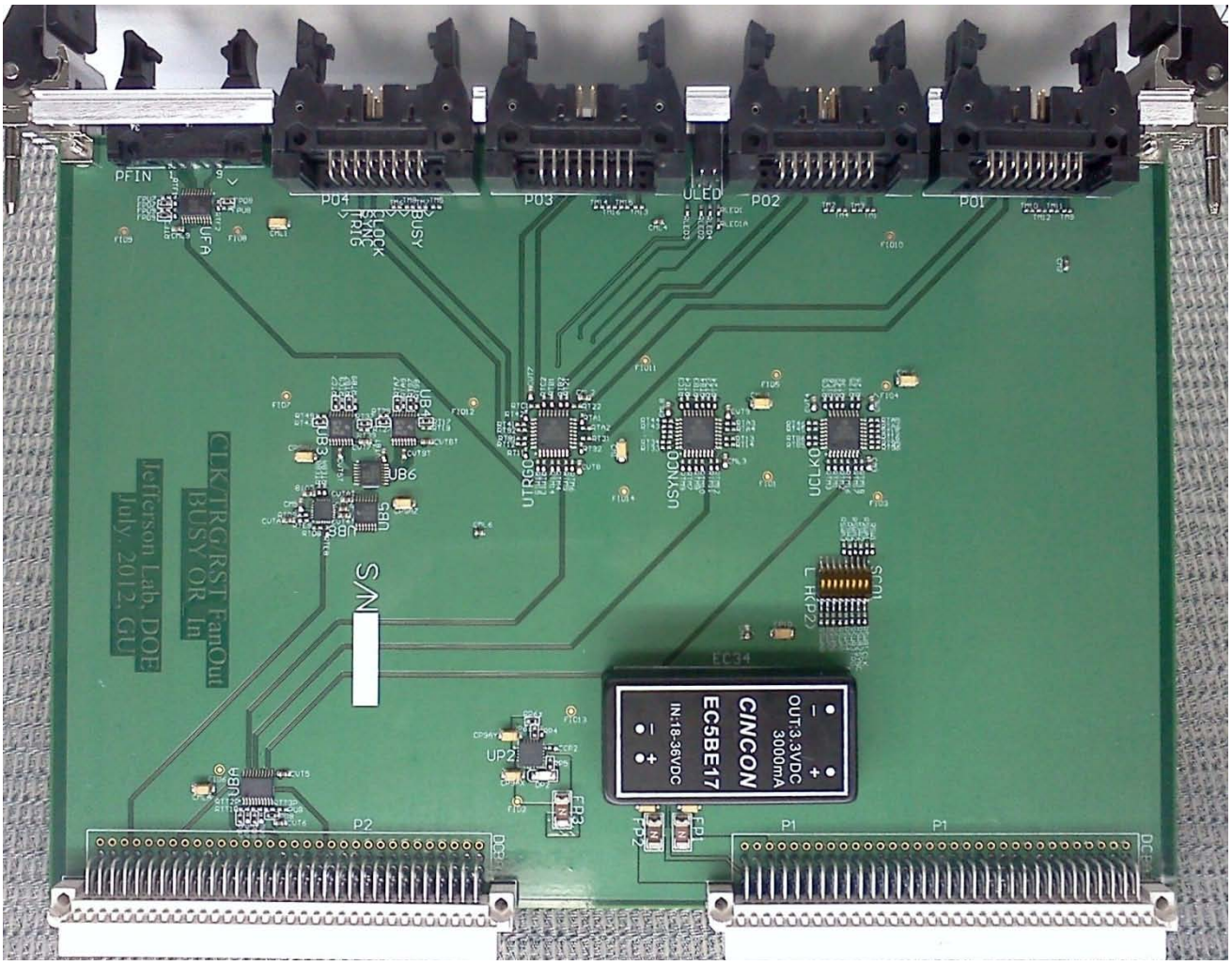


Figure 2 FANIODC board

2 Purpose of the module

The main purpose is to fan out the Trigger/Clock/Sync from Trigger Interface (TI) to CAEN TDC boards, and merge the BUSY signals from CAEN TDC boards to TI board.

Each FANIO board has four 3M 2x2x8 condo connectors, which can connect to eight CAEN TDC boards. The FANIO can connect to the TI front panel via a 10-pin twist-pair cable, or two FANIODC cards through the VME P2 connector. The front connection is easier, while the P2 connection is more versatile where the FANIODC has the option of built in signal generator.

3 Functional Descriptions

Figure 3 shows the block diagram of the FanioDC module.

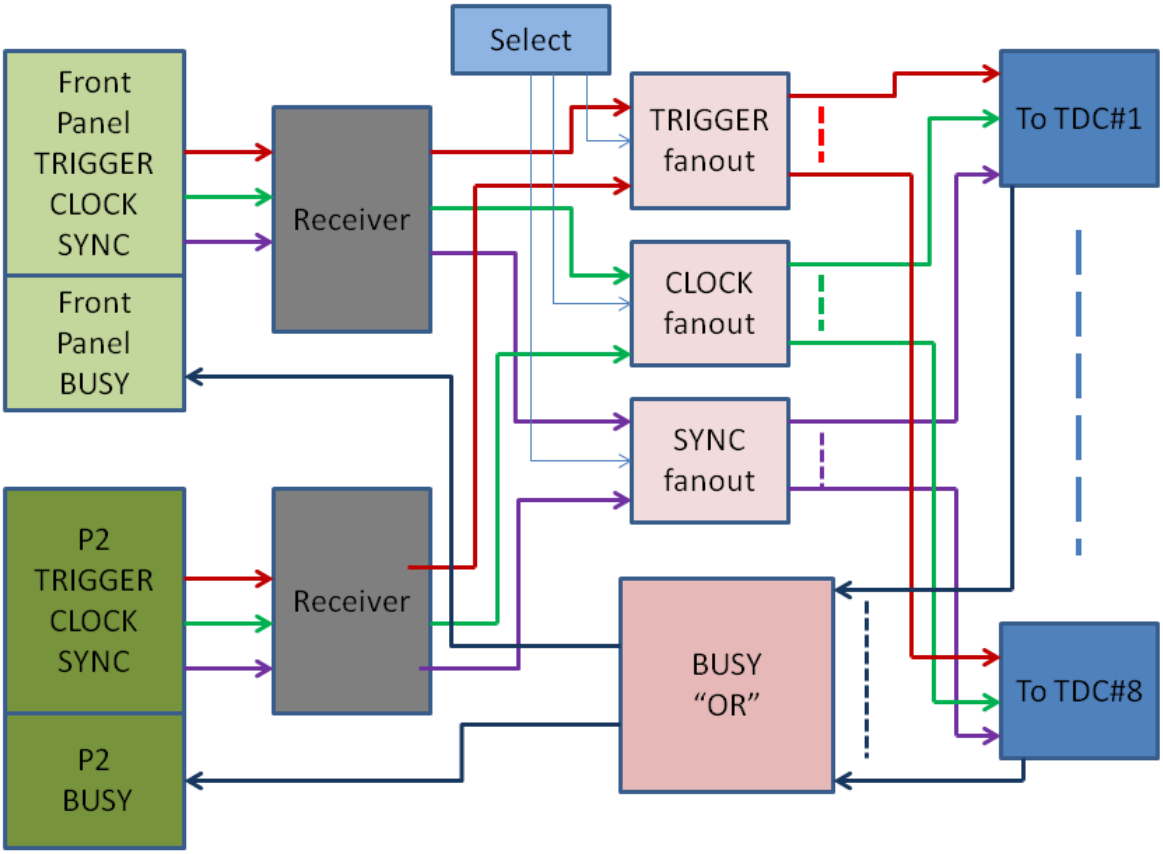


Figure 3: FanioDC functional diagram

The FANIO gets its power from the P1 connector, which has +5V, +12V and -12V. It uses a TI TPS74401 to get the +3.3V, which supply power for the LVTTL BUSY "OR" logic. It uses CINCON EC5BE17 to get -3.3V, which is the main supply for ECL logic.

The inputs are received near the connectors. On semi MC100LVEP111, which is 2:1:10 clock buffer, is used to multiplex the inputs and to fan out.

The BUSY signals from CAEN TDC boards are translated into LVTTL first, then logically ORed together. The result is output to the connector in ECL level to match with TI board.

4. Specification Sheet

4.1 Mechanical

- Single width VME board. Size: 6Ux160mm (or 233mmX160mm).

4.2 P2 inputs/outputs:

- 41.67 MHz clock ECL 100 Ohm differential;
- Trigger, ECL 100 Ohm differential;
- Reset, ECL 100 Ohm differential;
- Status (busy), ECL 100 Ohm differential.

4.3 Front panel inputs and outputs: (10 pin to TI, 16 pin to TDC)

- 41.67 MHz clock ECL 100 Ohm differential;

- Trigger, ECL 100 Ohm differential;
- Reset, ECL 100 Ohm differential;
- Status (Busy), ECL 100 Ohm differential

4.4 Power requirements:

- +5v @ 0.5 Amps;
- +12V @ 0.3 Amps;
- -12V @ 0.3 Amps;

4.5 Environment:

- Forced air cooling;
- Commercial grade components (0-75 Celsius)

5 FANIO operation procedure:

The FANIO needs be properly set, and plugged into the proper crate and slot. Damage may happen to the FANIO, the crate, or other PCBs in the crate if the right procedure is not followed.

5.1 Power supply:

The board uses DC-DC converter to generate the -3.3V from +12V and -12V supply. It uses LDO to generate the +3.3V from +5V. This board can fit in standard VME64 crate, or VME64x crate, or VXS crate.

5.2 Hardware setting (jumper etc.):

5.2.1: Clock source selection (Switch Bit#1)

OFF (low)	Front panel 10pin connector input
ON (high)	VME P2 connector input

5.2.2: RESET source selection (Switch Bit#2)

OFF (low)	Front panel 10pin connector input
ON (high)	VME P2 connector input

5.2.3: TRIGGER source selection (Switch Bit#3)

OFF (low)	Front panel 10pin connector input
ON (high)	VME P2 connector input

6 pin out tables:

6.1 VME P2 User-defined pin table

Pin name	Signal Name	Signal Level
C13	CLK+	ECL
C14	CLK-	ECL
C17	TRIG1+	ECL
C18	TRIG1-	ECL

C25	SYNC+	ECL
C26	SYNC-	ECL
C29	BUSY+	ECL
C30	BUSY-	ECL

6.2 Front panel 16-pin connector pin table

The definition is compatible with the CAEN TDC V1290.

Pin name	Signal Name	Signal Level
1, 2	Not used	N/A
3, 4	Trigger+, Trigger-	ECL, 100 ohm
5, 6	Reset+, Reset-	ECL, 100 ohm
7, 8	Clock+, Clock-	ECL, 100 Ohm
9, 10	Not Used	100 ohm
11,12	Not used	100 ohm
13, 14	Status+, Status-	ECL, 100 ohm
15,16	Not used	100 ohm

6.3 Front panel 10-pin connector pin table

The definition is compatible with the TI 10-pin connector.

Pin name	Signal Name	Signal Level
1, 2	BUSY+, BUSY-	ECL, 100 Ohm
3, 4	Trigger+, Trigger-	ECL, 100 ohm
5, 6	Reset+, Reset-	ECL, 100 ohm
7, 8	Not Used	
9, 10	Clock+, Clock-	ECL, 100 ohm

6.4 Front Panel LED indicator

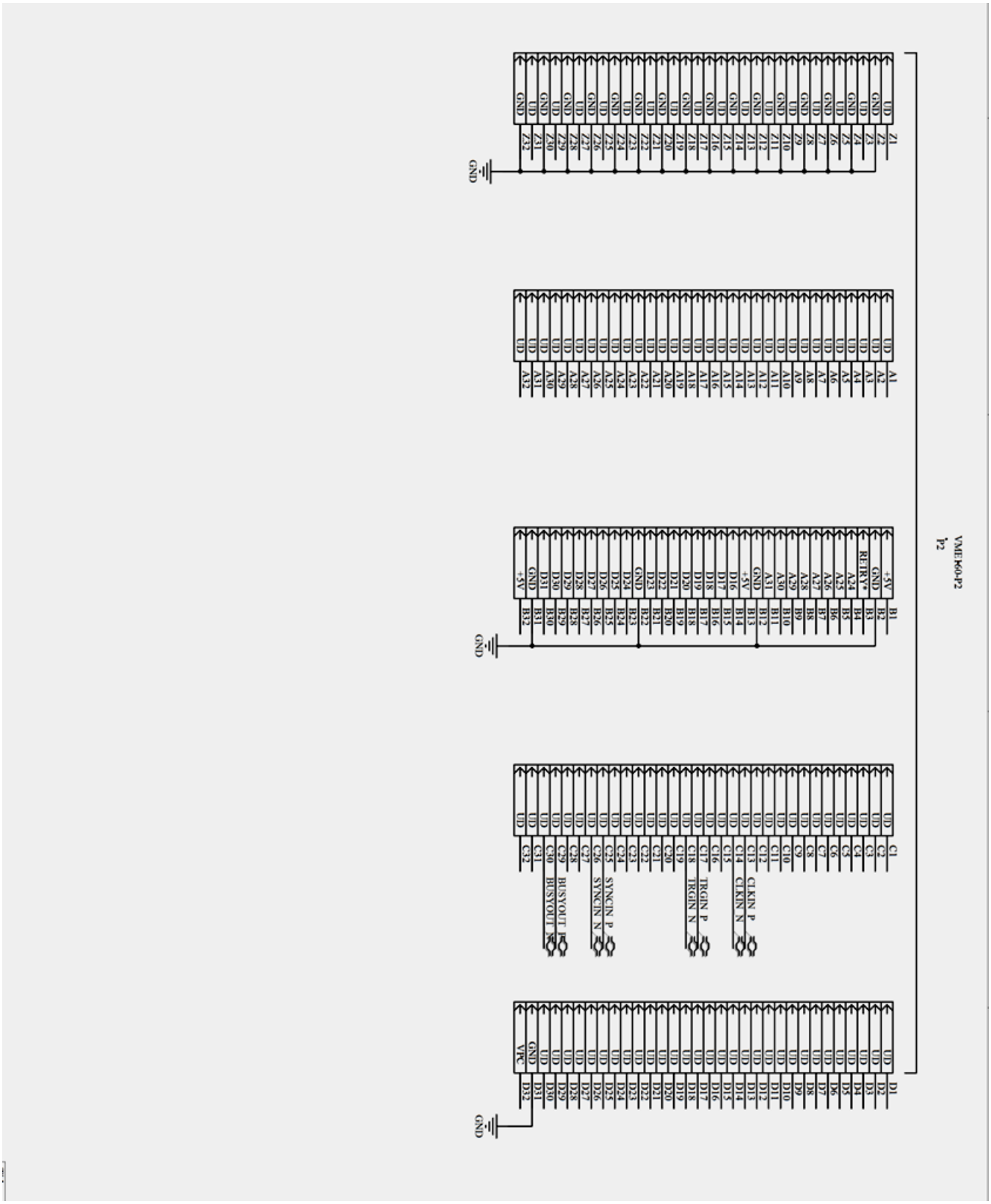
#1 (left most): +5V from VME (normally ON)
#2 (mid-left): +3V on board (normally ON)
#3 (mid-right): -3V on board (normally ON)
#4 (right most): BUSY (normally OFF)

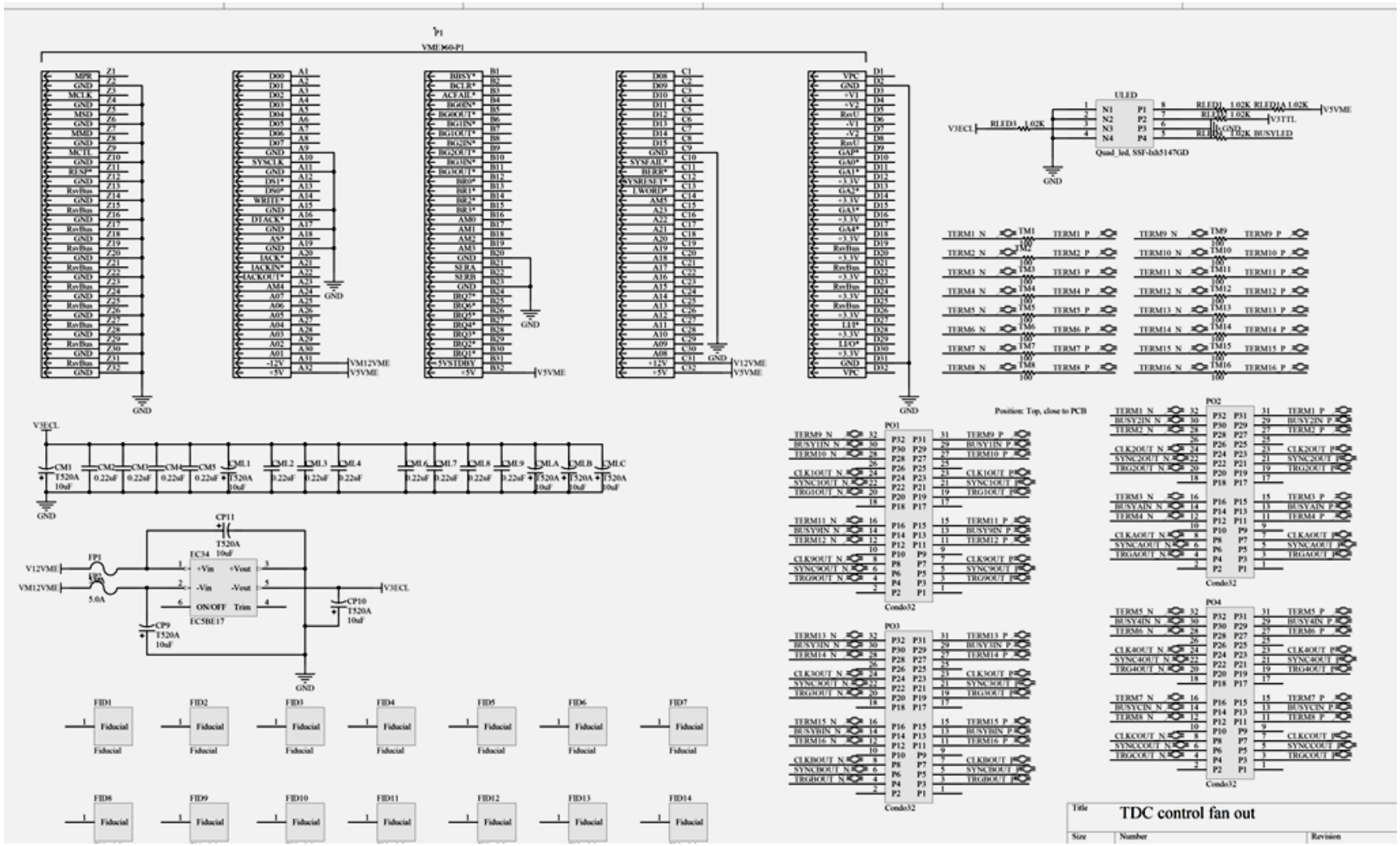
7. Citations:

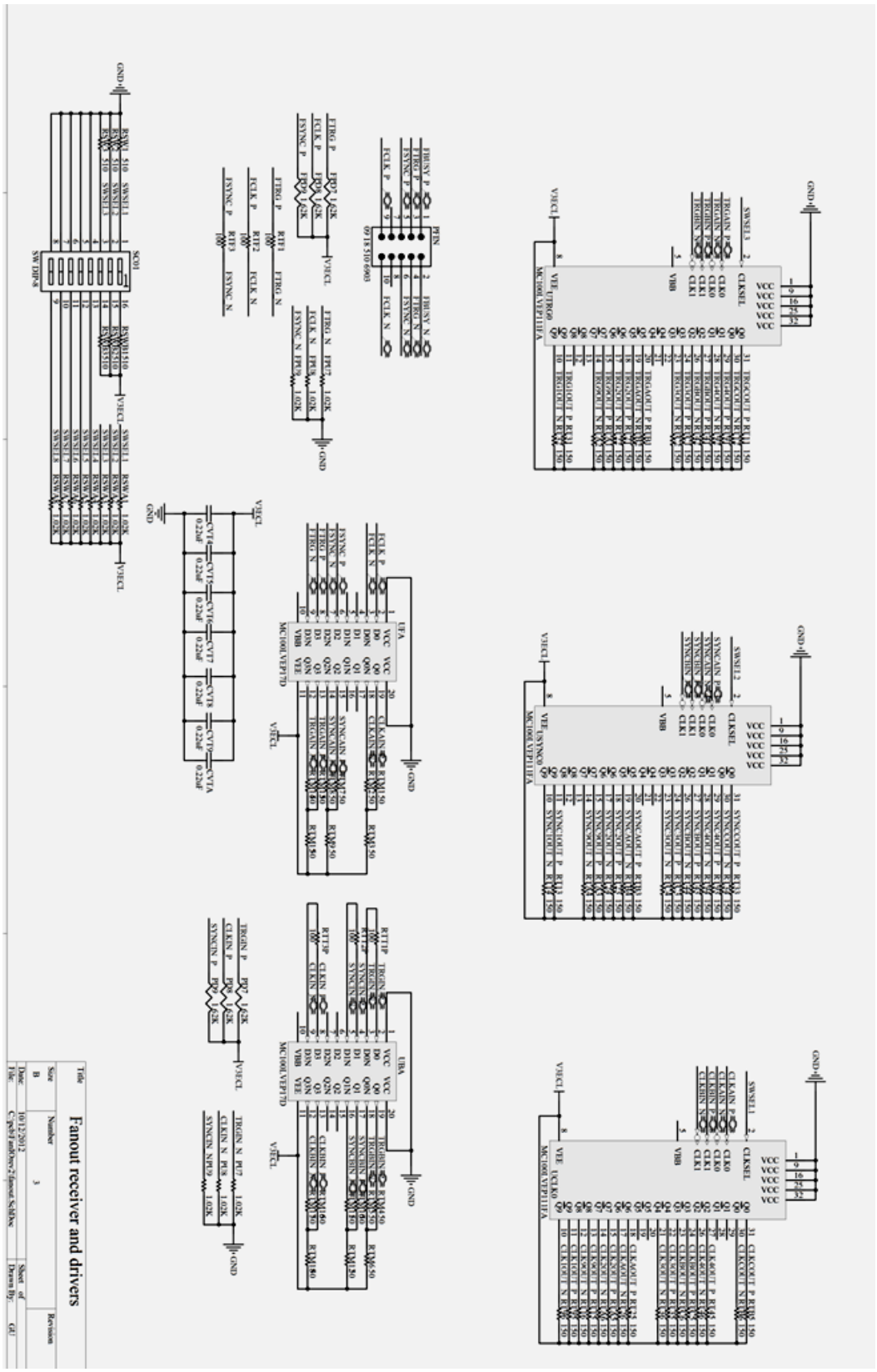
Works Cited

Collaboration, C. (2009). CLAS12 experiment. *Journal* , 1-25.
GU. (2010). *FANIO*. Retrieved from http://www.jlab.org/~gujh
GU. (2009). *TID design*.

Appendix A: design schematics




P1
VME960-P1
ULED
Quad_led, SSF-lxb5147GD
Position: Top, close to PCB
PO1
PO2
PO3
PO4
Condo32
EC5BE17
TDC control fan out


Fanout receiver and drivers
Title
Size
B
Number
3
Revision
Date:
10/12/2012
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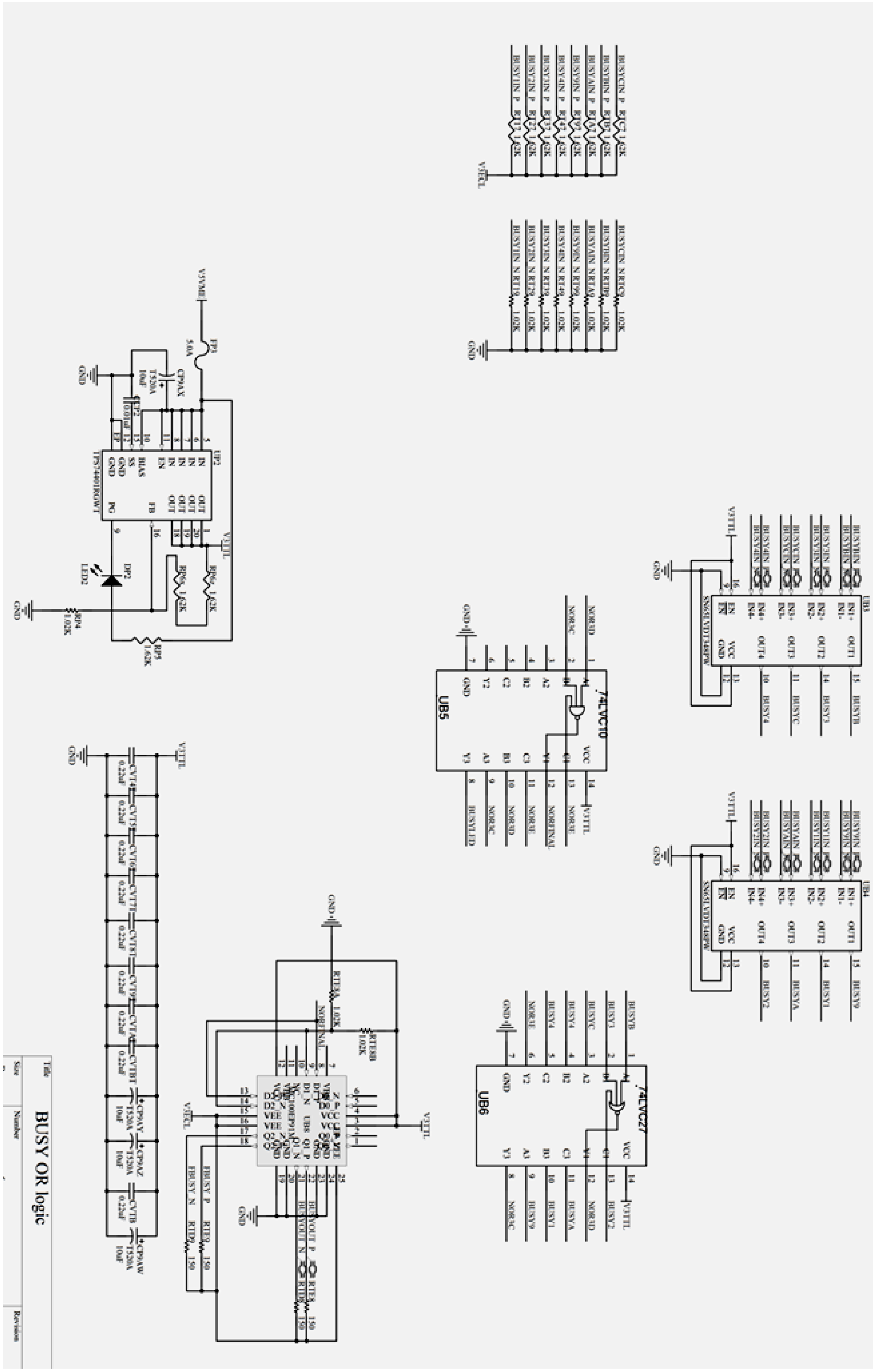
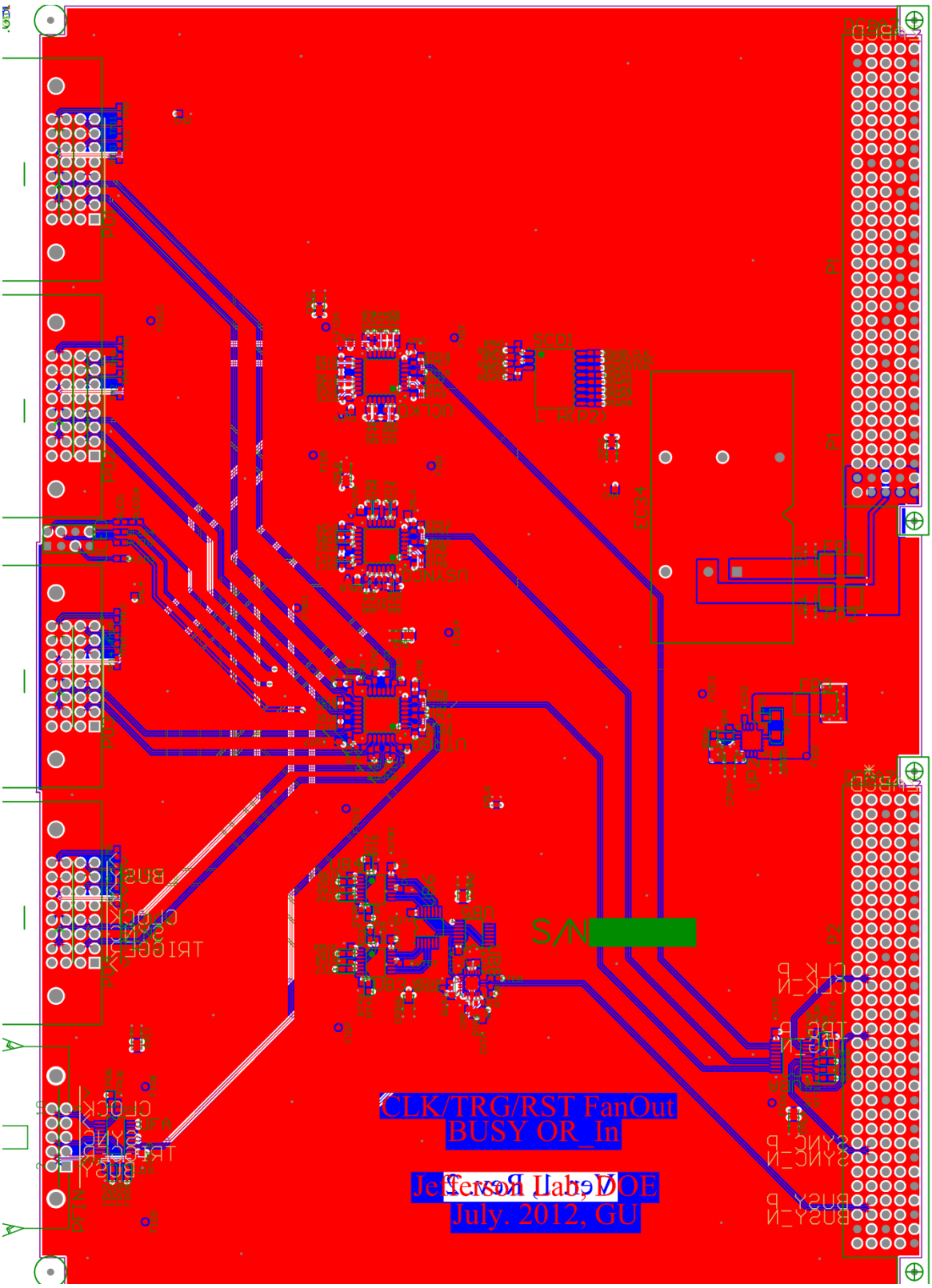
of
File:
C:\pcb\Fanout\Fanout.SchDoc
Drawn By:
GU



BUSY OR logic
UB5
74LVC10
UB6
74LVC27

Appendix B: PCB layout



Appendix C: Bill of Material

Comment	Description	Designator	Footprint	LibRef	Quantity	Value	Manufacture part ID	Assembly kit item #
T520A	Solid Tantalum Chip Capacitor,	CM1, CML1, CMLA, CMLB, CMLC, CP9, CP9AW, CP9AX, CP9AY, CP9AZ, CP10, CP11	A	T491A	12	10uF	kemet: T520A336M006ATE070	1
Cap Semi	Capacitor (Semiconductor SIM Model)	CM2, CM3, CM4, CM5, CML2, CML3, CML4, CML6, CML7, CML8, CML9, CVT4, CVT4T, CVT5, CVT5T, CVT6, CVT6T, CVT7, CVT7T, CVT8, CVT8T, CVT9, CVT9T, CVTA, CVTAT, CVTB, CVTBT	1608[0603]	Cap Semi	27	0.22uF	Taiyo Yuden: EMK107B7224KA-T	2
LED2	Typical RED, GREEN, YELLOW, AMBER GaAs LED	DP2	3.2X1.6X1.1	LED2	1		Lite-On # LTST-C150CKT	3
EC5BE17		EC34	EC5BE17	EC5BE17	1		CINCON EC5BE17	4
5.0A	FUSE 5A SLO BLO NANO 2 SMD	FP1, FP2, FP3	NANO_FUSE	Fuse 2	3		TE: 2410SFV5.00FM/125-2	5
1.62K	Resistor	FPD7, FPD8, FPD9, PD7, PD8, PD9, RP5, RP6x, RP6z, RT17, RT27, RT37, RT47, RT97, RTA7, RTB7, RTC7	0603	Res3	17	1.62K	Panasonic: ERJ-3EKF1621V	6
ERJ2GE	Thick Film Chip Resistor, 0402 Size, 0.063 W	FPU7, FPU8, FPU9, PU7, PU8, PU9, RLED1, RLED1A, RLED2, RLED3, RLED4, RP4, RSWA1, RSWA2, RSWA3, RSWA4, RSWA5, RSWA6, RSWA7, RSWA8, RT19, RT29, RT39, RT49, RT99, RTA9, RTB9, RTC9, RTE8A, RTE8B	2-0402	ERJ2GE	30	1.02K	Panasonic: ERJ-2RKF1021X	7
VME160-P1	VME160-P1	P1	VME160	VME160-P1	1		TE: 5650473-5	8
VME160-P2	VME160-P2	P2	VME160	VME160-P2	1		TE: 5650473-5	9
09 18 510 6903	Flat Cable Connector (IDC), Standard Male Header, Angled Solder Pin, 10 Contacts,	PFIN	918510x903	09 18 510 6903	1		Omron: XG4A-1034	10
Condo32		PO1, PO2, PO3, PO4	Condo32	Condo32	4		3M: N3408-D302RB	11
ERJ2GE	Thick Film Chip Resistor, 0402 Size, 0.063 W	RSW1, RSW2, RSW3, RSWB1, RSWB2, RSWB3	2-0402	ERJ2GE	6	510	Panasonic: ERJ-2RKF5100X	12
ERJ2GE	Thick Film Chip Resistor,, 0402 Size, 0.063 W	RT11, RT12, RT13, RT14, RT15, RT16, RT21, RT22, RT23, RT24, RT25, RT26, RT31, RT32, RT33, RT34, RT35, RT36, RT41, RT42, RT43, RT44, RT45, RT46, RT91, RT92, RT93, RT94, RT95, RT96, RTA1, RTA2, RTA3, RTA4, RTA5, RTA6, RTB1, RTB2, RTB3, RTB4, RTB5, RTB6, RTC1, RTC2, RTC3, RTC4, RTC5, RTC6, RTD8, RTD9, RTE8, RTE9	2-0402	ERJ2GE	52	150	Panasonic: ERJ-2RKF1500X	13
ERJ2GE	Thick Film Chip Resistor, 0402 Size, 0.063 W	RTF1, RTF2, RTF3, RTT1P, RTT2P, RTT3P, TM1, TM2, TM3, TM4, TM5, TM6, TM7, TM8, TM9, TM10, TM11, TM12, TM13, TM14, TM15, TM16	2-0402	ERJ2GE	22	100	Panasonic: ERJ-2RKF1000X	14
ERJ2GE	Thick Film Chip Resistor, 0402 Size, 0.063 W	RTM1, RTM2, RTM3, RTM4, RTM5, RTM6, RTM7, RTM8, RTM9, RTM10, RTM11, RTM12, RTM13, RTM14, RTM15, RTM16, RTM17, RTM18	2-0402	ERJ2GE	18	50	Panasonic: ERJ-2RKF51R0X	15
SW DIP-8	DIP Switch, 8 Position, SPST	SC01	SOIC16WA_L	SW DIP-8	1		C&K #TDA08H0SB1R	16
SN65LVDT348PW	4 Channel ECL/PECL/LVDS -> LVTTL	UB3, UB4	TSSOP-16	SN65LVDT348PW	2		TI: SN65LVDT348PW	17
74LVC10		UB5	TSSOP14	74LVC10.1	1	NAND3	PHILIP: 74LVC10PW	18
74LVC27		UB6	TSSOP14	74LVC27.1	1	NOR3	PHILIP: 74LVC27PW	19
MC100EP91M	On Semiconductor, Any level positive to ECL translator	UB8	QFN50P400X400-24W4M	MC100EP91M	1		OnSemi: MC100EP91MN	20
MC100LVEP17D	ON Semi LVPECL driver	UBA, UFA	948E-02	MC100LVEP17D	2		OnSemi: NB100LVEP17DT	21
MC100LVEP111FA	Low-Voltage 1:10 Differential LVECL/LVPECL/LVEP ECL/HSTL Clock Driver	UCLK0, USYNC0, UTRG0	873A-02_L	MC100LVEP111FA	3		OnSemi: MC100LVEP111FA	22
Quad_led, SSF-lxh5147GD	LUMEX, Quad pack LEDs	ULED	LED14	quad_led	1		KingBright: WP914CK/4IDT	23
TPS74401RGWT	IC LDO REG 3.0A W/SS 20-VQFN	UP2	QFN-20	TPS74401RGWT	1		TI: TPS74401RGW	24