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Mechanical Part PWB Fab

REVISION HISTORY

LTR	DESCRIPTION	CLASS	DWN	CHK	STRUCT	MATL	THRM CONT			ENGR	DSGN SUPV	DATA MGT	RELEASE DATE
A	INITIAL RELEASE	E	SEE PRODUCT DATA MANAGEMENT SYSTEM (PDMS) FOR APPROVAL SIGNATURES AND DATES										
B	UPDATED LIBRARIES AND DATABASE	E	SEE PRODUCT DATA MANAGEMENT SYSTEM (PDMS) FOR APPROVAL SIGNATURES AND DATES										
C	CHANGED EXPORT NOTICE AND ADDED COPYRIGHT	E	SEE PRODUCT DATA MANAGEMENT SYSTEM (PDMS) FOR APPROVAL SIGNATURES AND DATES										

Sheet Listing

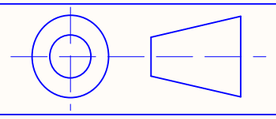
1 Title page and contents
2 Processor and memory
3 Encoder
4 Analog to digital conversion
5 Digital to analog conversion
6 Serial communication
7 Voice coil and motor PWM drivers
8 Power supplies

THIS DOCUMENT HAS BEEN REVIEWED AND DETERMINED NOT TO CONTAIN EXPORT CONTROLLED TECHNICAL DATA.

10364583	TMT
NEXT ASSEMBLY	USED ON
APPLICATION	

MATERIAL:

THIRD ANGLE PROJECTION



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

LINEAR TOLERANCES:

.XX ± .03
.XXX ± .010

ANGULAR TOLERANCES: ± 0.5°

MACHINE FINISH

DO NOT SCALE DRAWING
INTERPRET DWG PER ASME Y14.100

CONTRACT NO

APPD DATE

DWN
CHK
STRUCT
MATL
THRM CONT
ENGR
DSGN SUPV

SEE PDMS FOR APPROVAL SIGNATURES AND DATES

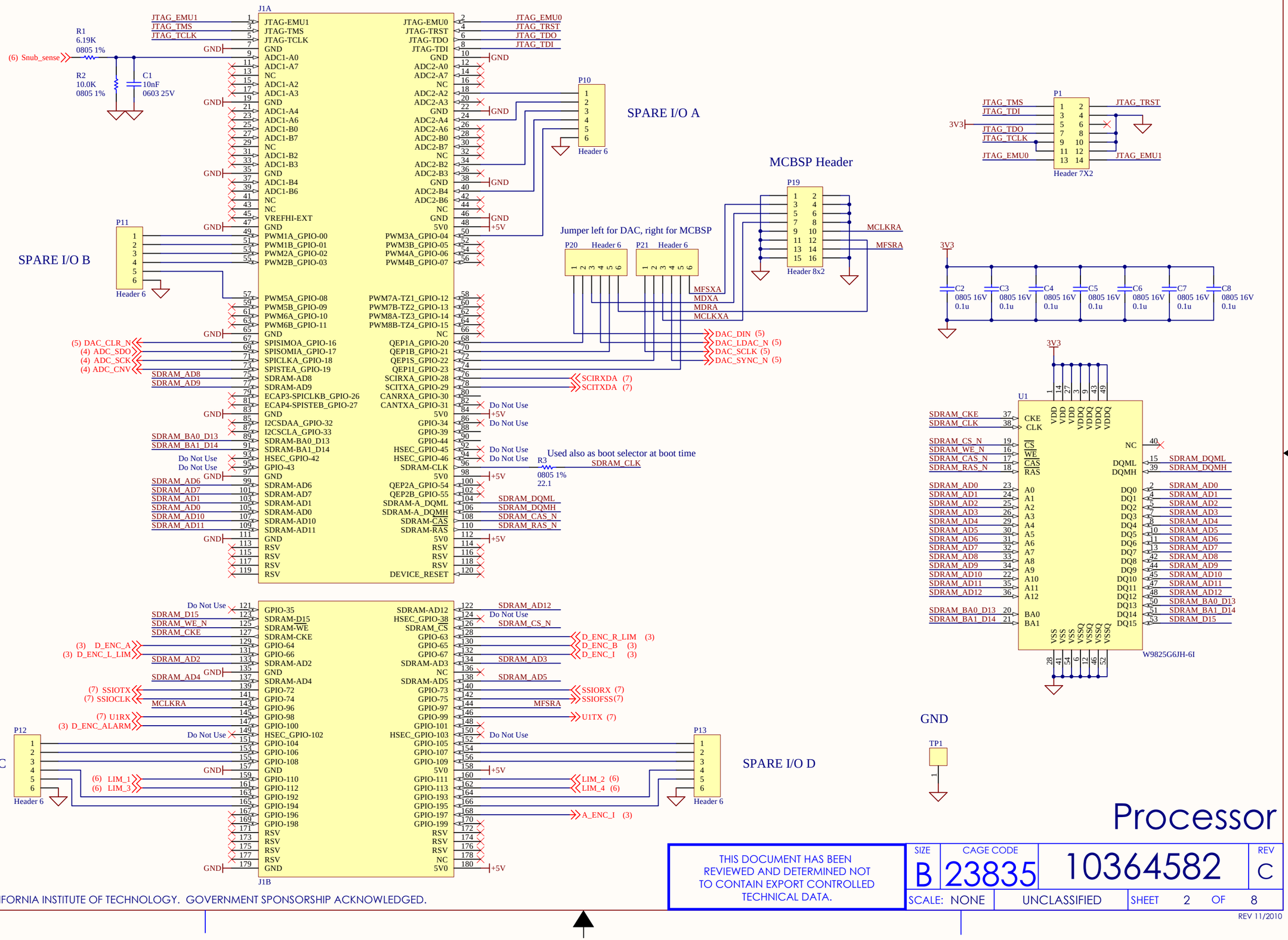
JET PROPULSION LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CA 91109

THIRTY METER TELESCOPE M1 ACTUATOR DRIVER

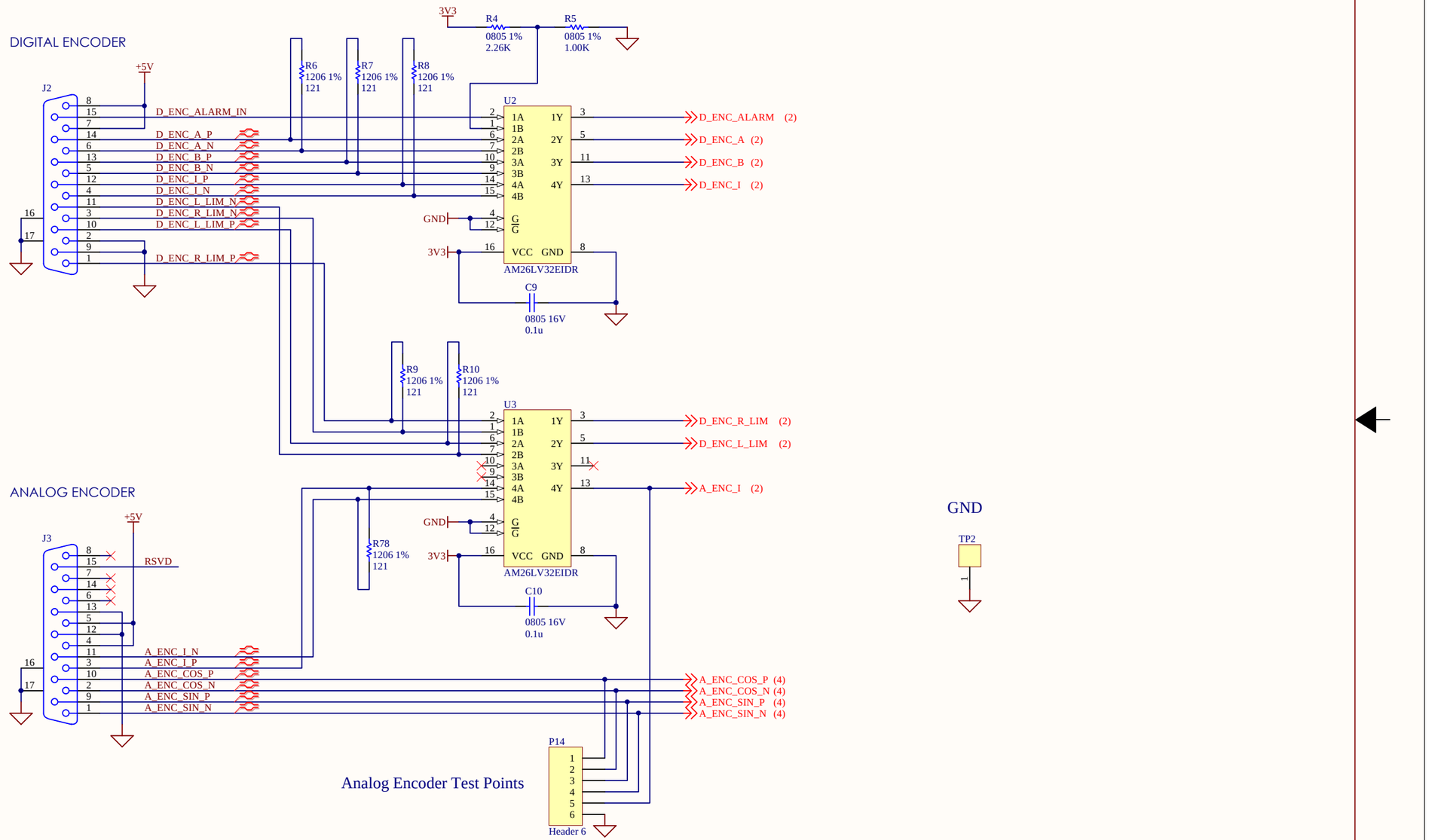
SIZE	CAGE CODE		REV
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SCALE: NONE | UNCLASSIFIED | SHEET 1 OF 8

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Encoders

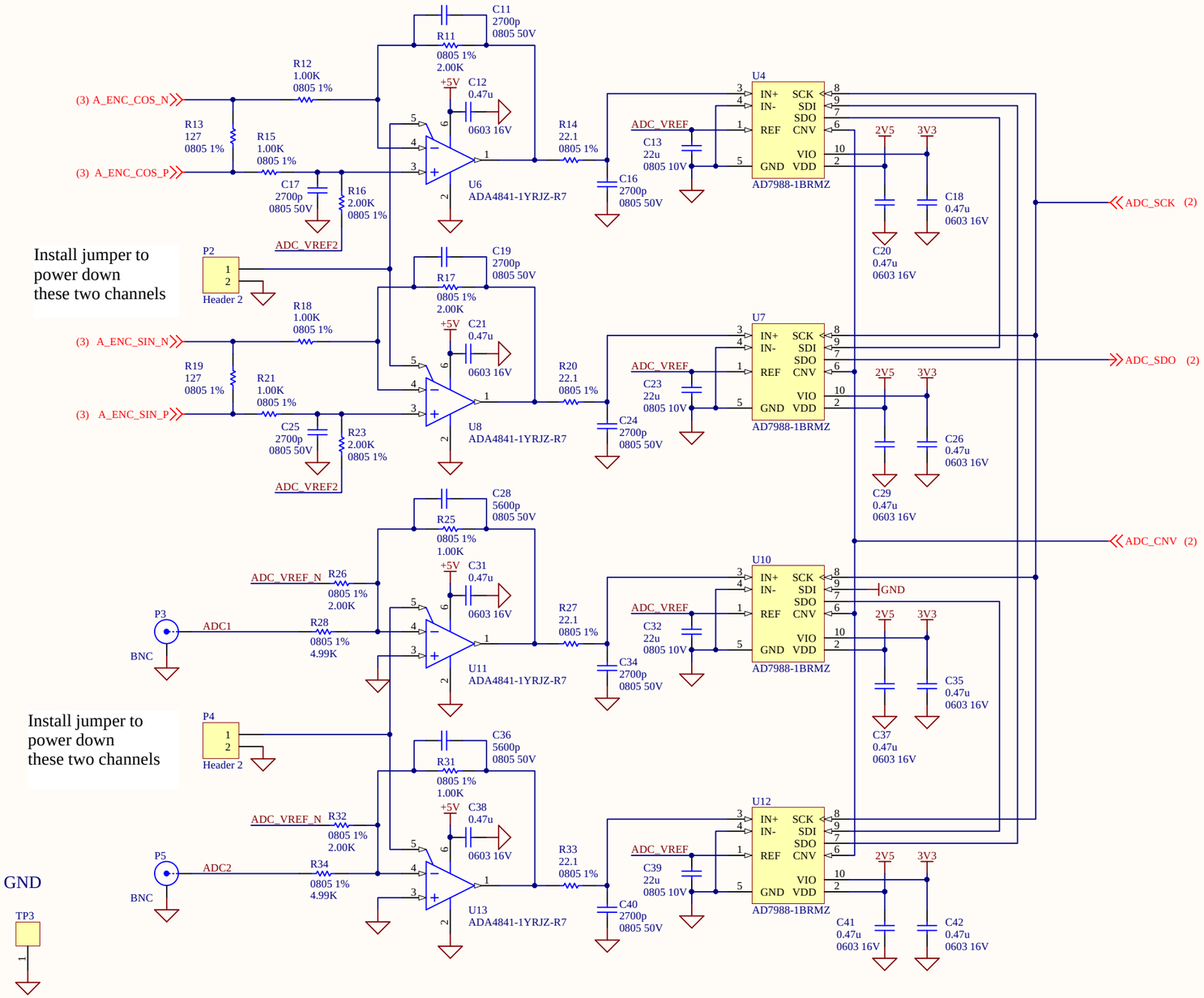
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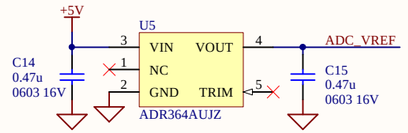
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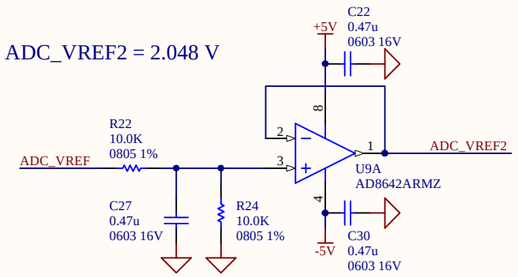
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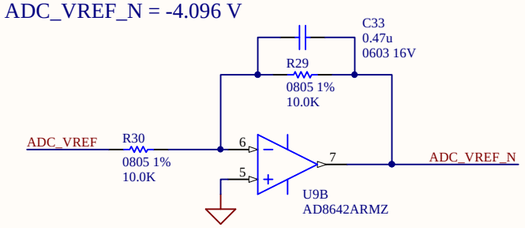
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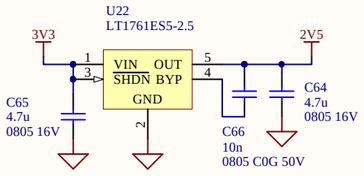


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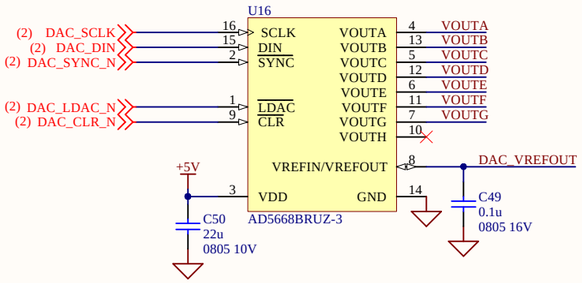
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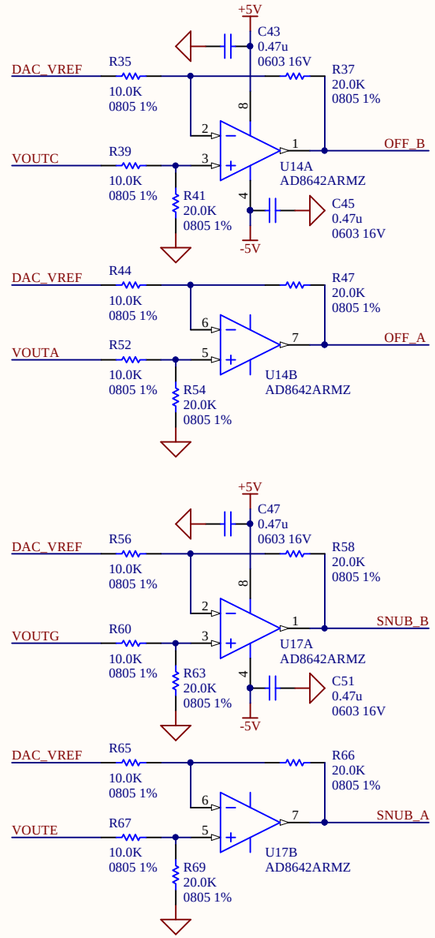
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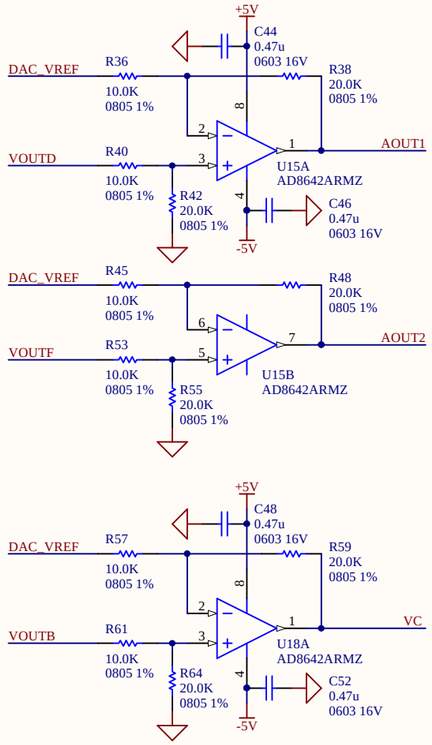
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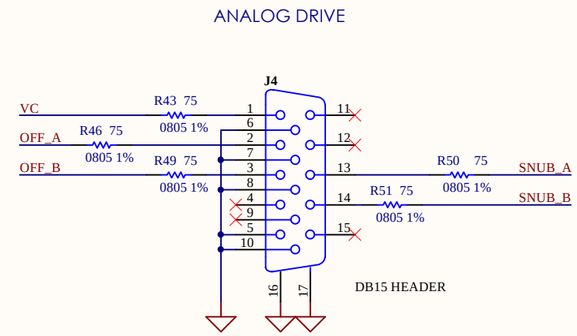
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SCALE: NONE	UNCLASSIFIED	SHEET 4 OF 8	

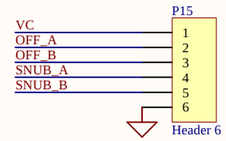
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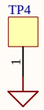




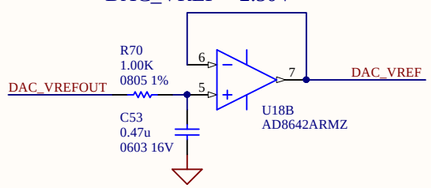


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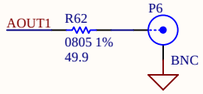
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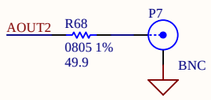
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AOUT1



AOUT2



DAC

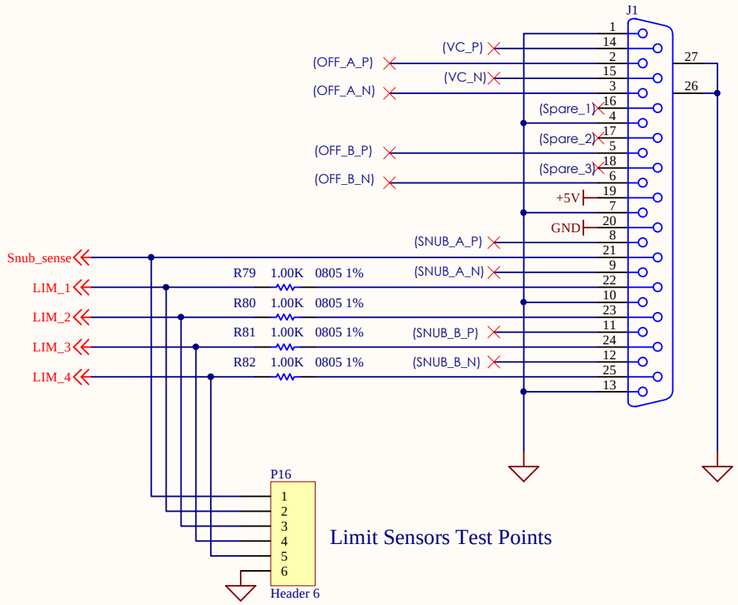
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PWM/H-BRIDGE DRIVE



Limit Sensors Test Points

GND

TP5

1

PWM

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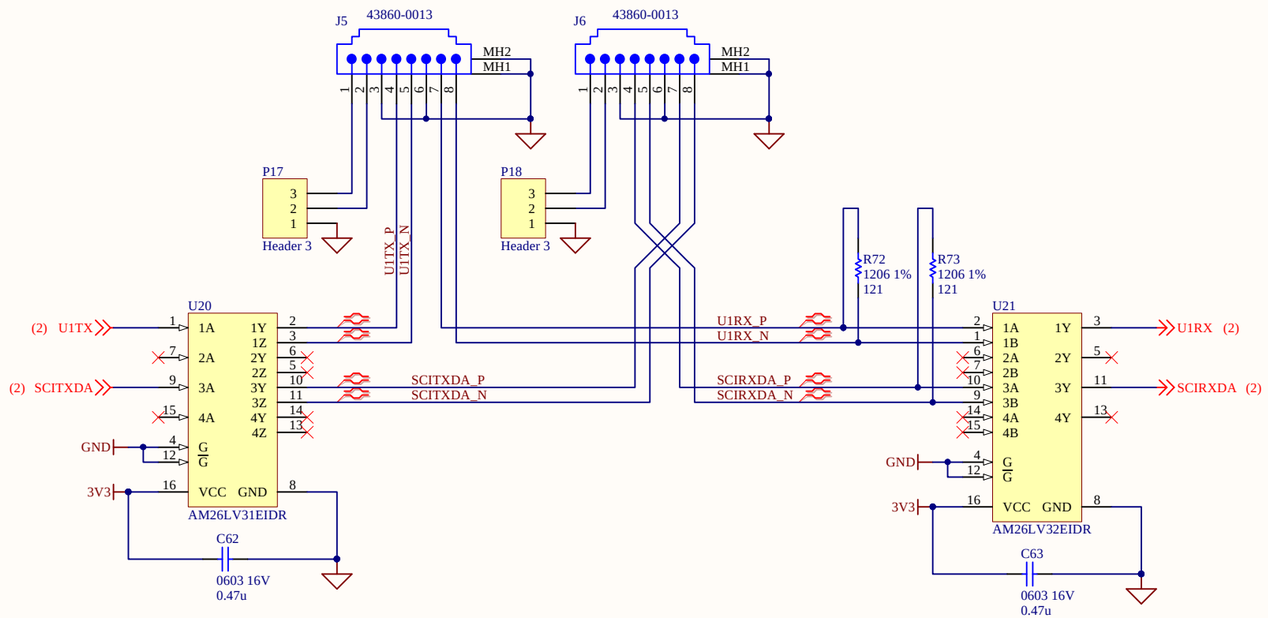
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B	23835	10364582	C
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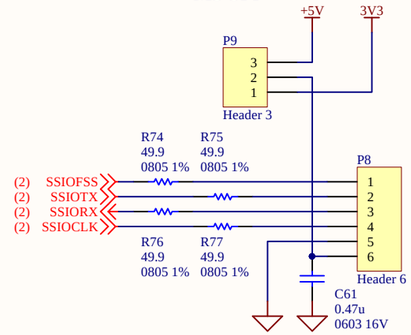
REV 11/2010

M3 Core RS-422

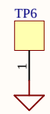
C28 Core RS-422



M3 SPI



GND



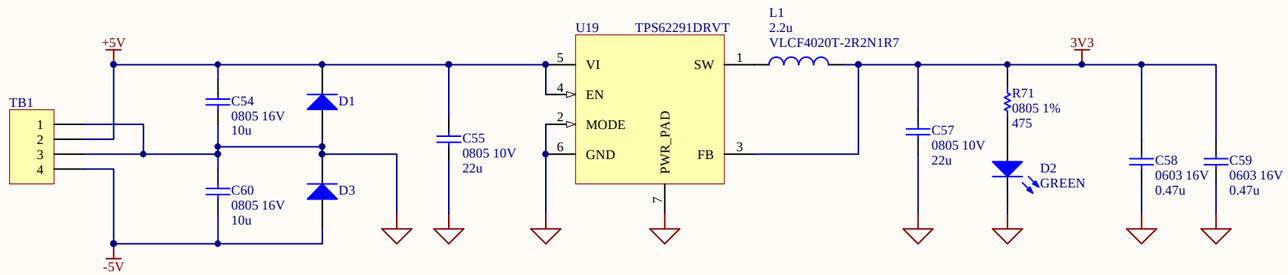
Comm

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REV 11/2010



Power

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B	23835	10364582	C
SCALE: NONE	UNCLASSIFIED	SHEET 8 OF 8	

REV 11/2010

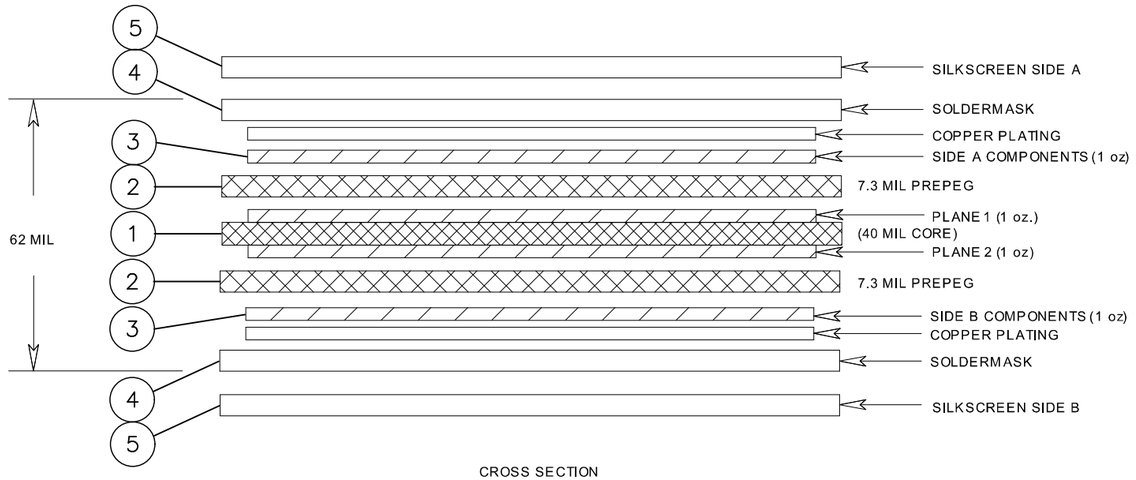
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REVISION HISTORY

LTR	DESCRIPTION	CLASS	DWN	CHK	STRUCT	MATL	THRM CONT			ENGR	DSGN SUPV	DATA MGT	RELEASE DATE
A	INITIAL RELEASE	E	SEE TITLE BLOCK									JLM	2013/11/12
B	FLIPPED J1A and J1B AND CORRECTED U16 FOOTPRINT	E										JLM	2014/05/21
C	CHANGED ITAR NOTICE, ADDED COPYRIGHT AND PARTS LIST	E											

11. ELECTRICAL TEST: CONTINUITY SHORT AND OPEN TESTING ON ALL AVAILABLE EXPOSED TERMINAL PADS USING IPC–D–356A NETLIST DATA. CONTINUITY TEST SHALL BE AT 5 OHMS MAX. SHORTS TESTING SHALL BE PERFORMED AT 250V. MINIMUM ISOLATION OF 20M OHMS.
10. BOW AND TWIST: SHALL NOT EXCEED .007 IN PER INCH
△9 SILKSCREEN: BOTH SIDES WITH WHITE NON–CONDUCTIVE EPOXY INK. LANDS AND EXPOSED PLATED AREAS TO BE FREE OF INK.
△8 SOLDER MASK: PHOTO–IMAGED LIQUID POLYMER, GREEN COLOR, ON BOTH SIDES OF BOARD IN ACCORDANCE WITH IPC–SM–840, TYPE B, CLASS 2, OVER BARE COPPER.
7. FABRICATION TOLERANCES: END PRODUCT TRACE WIDTHS AND LANDS SHALL NOT VARY MORE THAN THE SMALLER OF .002 IN OR 10% OF THE TRACE WIDTH FROM THE GERBER DATA.
6. ALL HOLES SPECIFIED IN THE DRILL CHART ARE FINISHED HOLE DIAMETERES. HOLE TOLERANCE +/– 0.002 IN FOR NON–PLATED HOLES AND +/– 0.003 IN FOR PLATED HOLES.
5. SURFACE FINISH TO BE ELECTROLESS NICKEL/IMMERSION GOLD (ENIG) PLATING PER IPC–6013. ALL PLATED HOLES AND CONDUCTIVE SURFACES SHALL BE PLATED WITH 0.001 IN COPPER MINIMUM. ALL Ni/Au PLATED AREA SHOULD HAVE MIMIMUM THICKNESS 0.0001 IN FOR Ni AND 0.000002 IN FOR Au.
4. MATERIAL: .062 IN (+/– 10%) THICK GLASS EPOXY, NATURAL COLOR, LAMINATED NEMA GRADE FR4.
3. FABRICATE AND INSPECT PER IPC–6012.
2. THIS DOCUMENT AND RELATED ARTWORK ARE COM–PUTER GENERATED. CHANGES ARE TO BE PERFORMED ON THE ORIGINAL DATABASE IN SECTION 383.
1. THE FINISHED PRINTED WIRING BOARD SHALL MEET THE REQUIREMENTS OF IPC–A–600–X (LATEST REVISION).

NOTES: UNLESS OTHERWISE SPECIFIED



CROSS SECTION

EXPLODED VIEW

QTY REQD		ITEM NO	REF DES	CAGE CODE	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	MATERIAL OR NOTE
	AR	5			HYSOL SERIES M. CATALYST 20/A	INK, WHITE EPOXY	IPC–4781	△9
	AR	4			LPI, SM P41	SOLDERMASK, PROBIMER 52	IPC–SM–840 CL A	△8
	AR	3			3 CU E3	COPPER FOIL, 1 OZ.	IPC–4562	
	AR	2			P 26–E2116 TW RE VC	GLASS BASE EPOXY RESIN PREPREG, B–STAGE	IPC–4104/26	
	AR	1			L 26–0400–C1/C1	GLASS BASE EPOXY RESIN CU CLAD 1 OZ / 1 OZ	IPC–4104/26	

PARTS LIST

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10364584	TMT
NEXT ASSEMBLY	USED ON
APPLICATION	

MATERIAL:

MATERIAL PER SPECIFICATION

THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
LINEAR TOLERANCES:

.XX .03
.XXX .010

ANGULAR TOLERANCES: 0.5

MACHINE FINISH

DO NOT SCALE DRAWING
INTERPRET DWG PER ASME Y14.100

CONTRACT NO

APPD		DATE
DWN	D. PALMER	2013/11/11
CHK		
STRUCT		
MATL		
THRM CONT		
ENGR		
DSGN SUPV		

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PASADENA, CA 91109

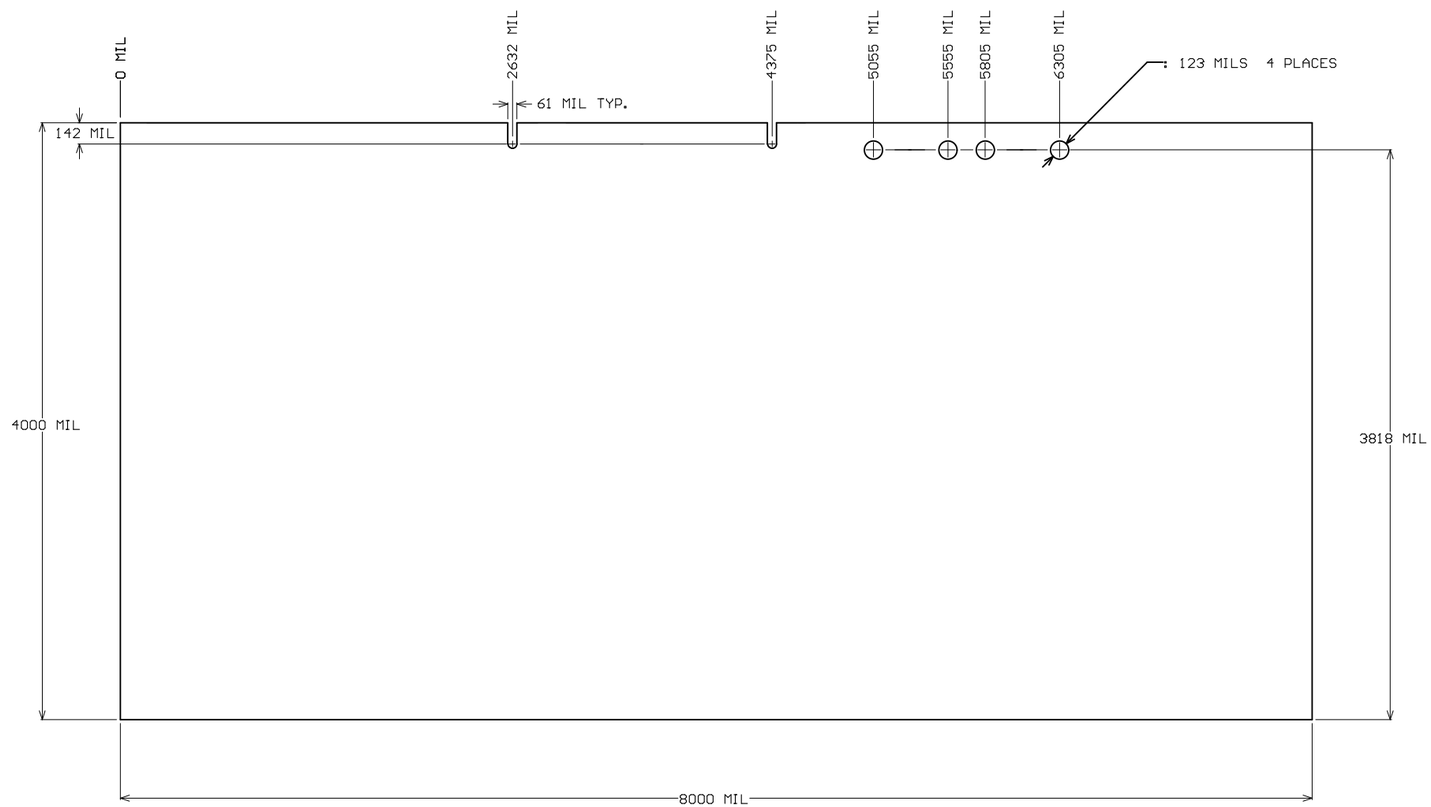
TMT ACTUATOR BASE BOARD PCB FABRICATION

SIZE	CAGE CODE		REV
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SCALE: 1/1 | UNCLASSIFIED | SHEET 1 OF 14

REV 01/2013

DBASE NAME: ANSI_B–SH1/A5



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B	23835	10364583	C
SCALE: 1/1	UNCLASSIFIED	SHEET 2 OF 14	

REV 02/2013

DBASE NAME: ANSI_B-SH2/A5

TABLE A / ARTWORK FILE DESIGNATION

SN NO.	FILE:	LOGICAL LAYER	PHYSICAL LAYER	DESCRIPTION
4	10364583.GTP	-	OUTER LAYER 1	PASTE MASK SIDE A
5	10364583.GTO	-	OUTER LAYER 2	OVERLAY SIDE A
6	10364583.GTS	-	OUTER LAYER 3	SOLDER MASK SIDE A
7	10364583.GTL	COPPER SIDE A	OUTER LAYER COPPER	COMPONENTS SIDE A
8	10364583.GP1	COPPER LAYER 2	INNER LAYER	PLANE - GND
9	10364583.GP2	COPPER LAYER 2	INNER LAYER	PLANE - +5V/3V3 SPLIT
10	10364583.GBL	COPPER SIDE B	OUTER LAYER COPPER	COMPONENTS SIDE B
11	10364583.GBS	-	OUTER LAYER 4	SOLDER MASK SIDE B
12	10364583.GBO	-	OUTER LAYER 5	OVERLAY SIDE B
13	10364583.GBP	-	OUTER LAYER 6	PASTE MASK SIDE B
14	10364583.GD1	-	DRILL LOCATIONS	DRILL DRAWING

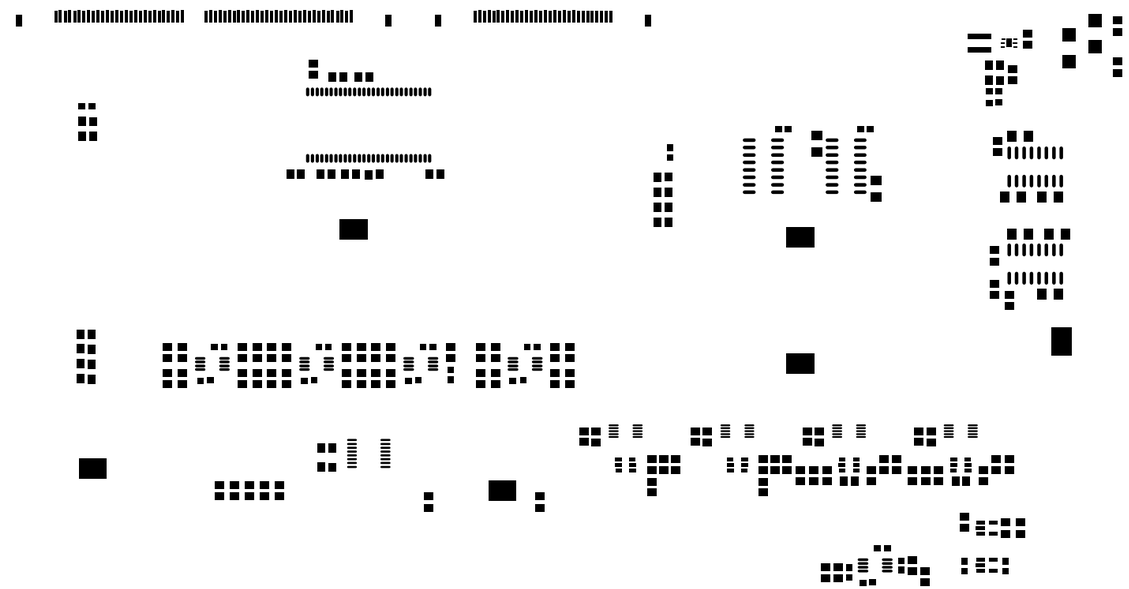
TABLE B / APERATURE SIZES

SN NO.	FILE:	APERTURE TYPE	EMBEDDED D-CODE
4	10364583.GTP	RS274-X STANDARD	YES
5	10364583.GTO		YES
6	10364583.GTS		YES
7	10364583.GTL		YES
8	10364583.GP1		YES
9	10364583.GP2		YES
10	10364583.GBL		YES
11	10364583.GBS		YES
12	10364583.GBO		YES
13	10364583.GBP		YES
14	10364583.GD1		YES

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B	23835	10364583	C
SCALE: 1/1	UNCLASSIFIED	SHEET 3 OF 14	



PASTEMASK – SIDE A

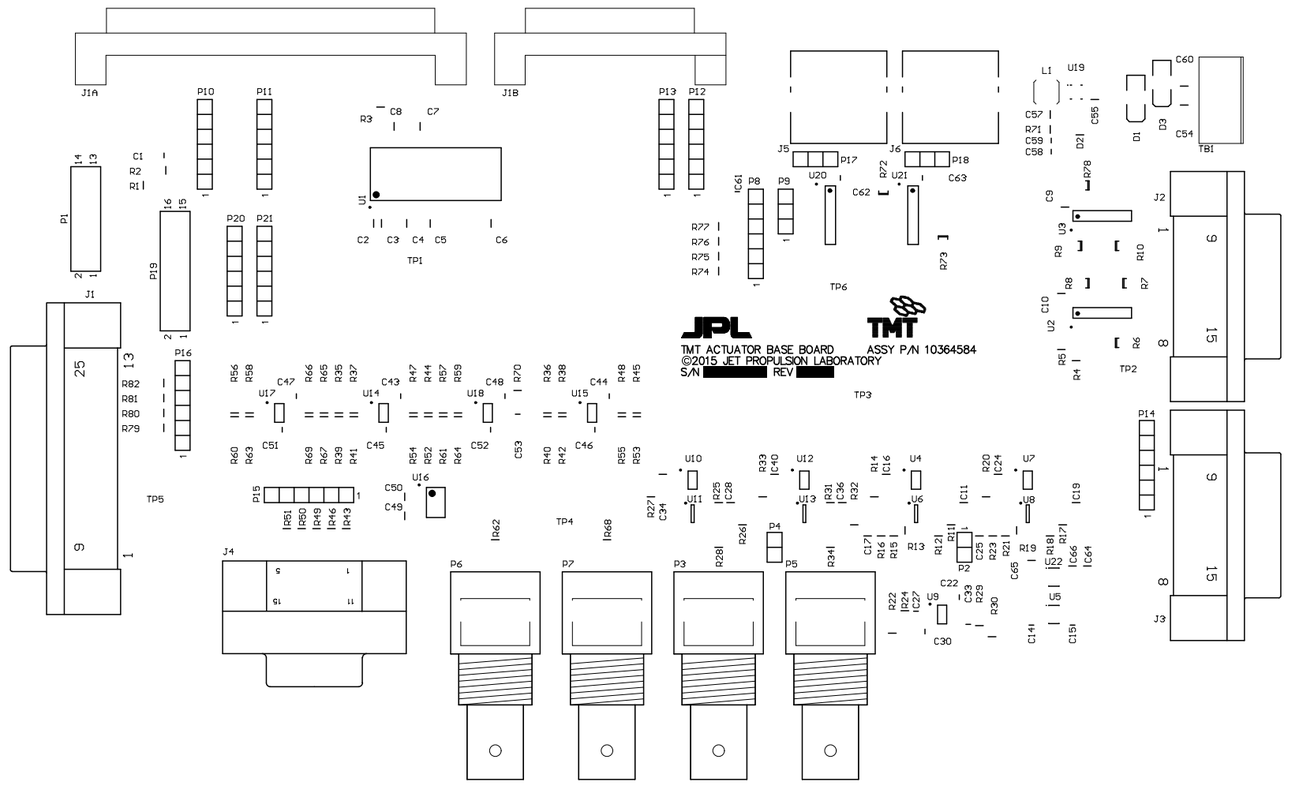
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SILKSCREEN – SIDE A

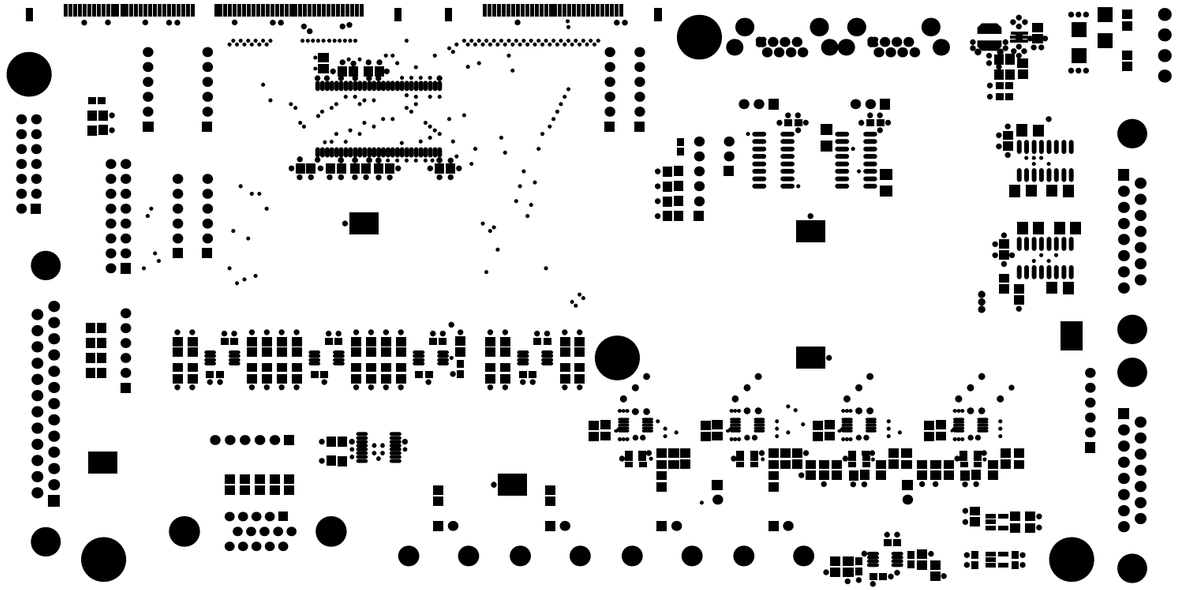
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SCALE: 1/1	UNCLASSIFIED	SHEET 5 OF 14	

REV 02/2013

DBASE NAME: ANSI_B–SH2/A5



SOLDERMASK – SIDE A

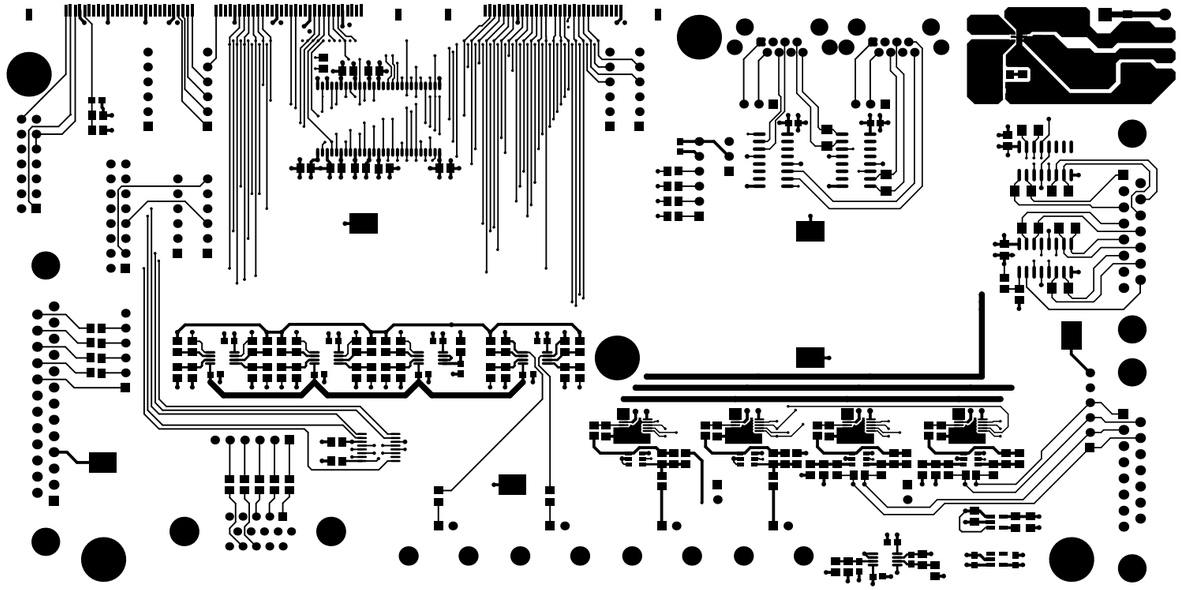
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B	23835	10364583	C
SCALE: 1/1	UNCLASSIFIED	SHEET 6 OF 14	

REV 02/2013

DBASE NAME: ANSI_B–SH2/A5



COPPER LAYER 1 – SIDE A

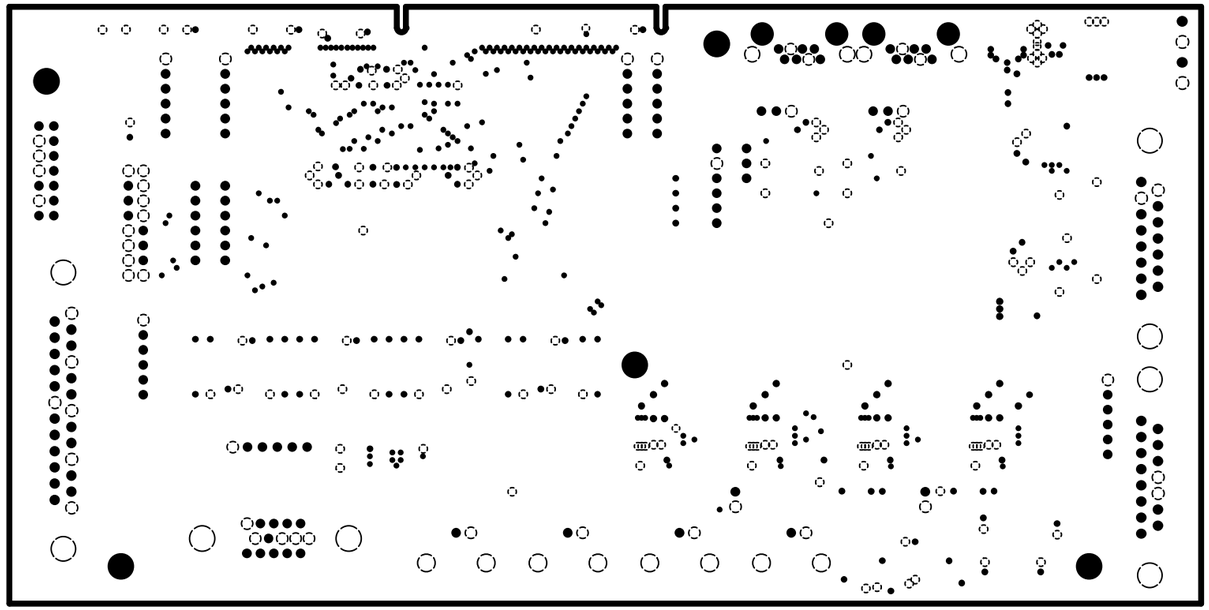
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B	23835	10364583	C
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DBASE NAME: ANSI_B–SH2/A5



PLANE 1 – GND

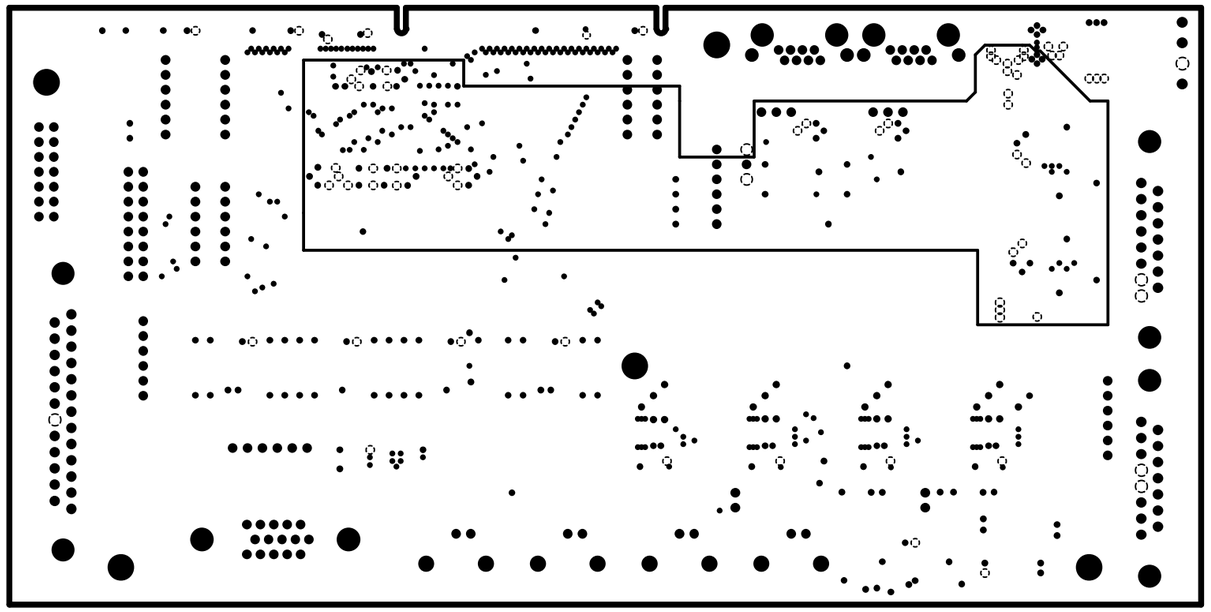
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SCALE: 1/1	UNCLASSIFIED	SHEET 8 OF 14	

REV 02/2013

DBASE NAME: ANSI_B-SH2/A5



PLANE 2 – +5V/3V3 SPLIT

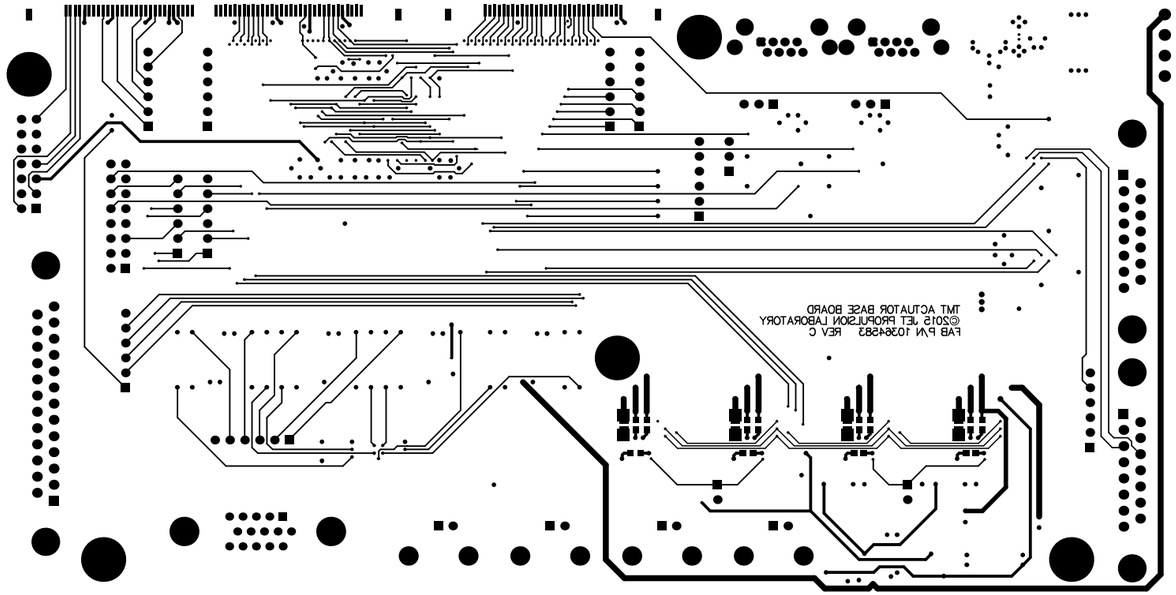
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SIZE	CAGE CODE		REV
B	23835	10364583	C
SCALE: 1/1	UNCLASSIFIED	SHEET 9 OF 14	

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DBASE NAME: ANSI_B–SH2/A5



COPPER LAYER 2 – SIDE B

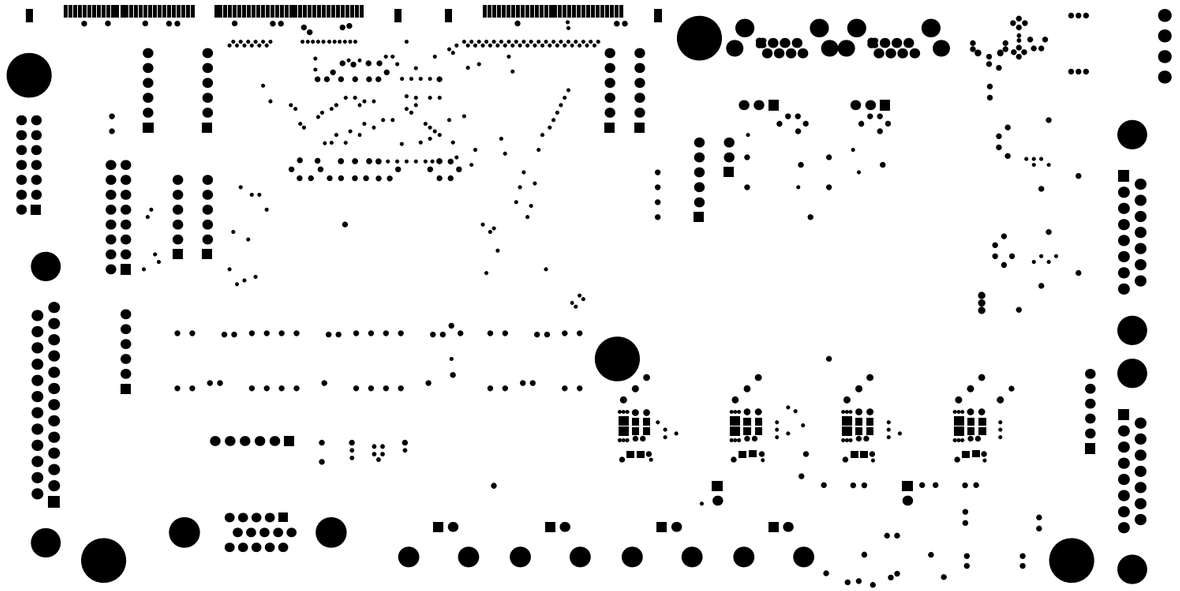
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REV 02/2013

DBASE NAME: ANSI_B-SH2/A5



SOLDERMASK – SIDE B

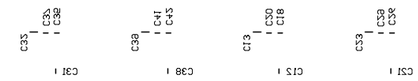
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SILKSCREEN – SIDE B

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SIZE	CAGE CODE		REV
B	23835	10364583	C
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DBASE NAME: ANSI_B–SH2/A5





PASTEMASK – SIDE B

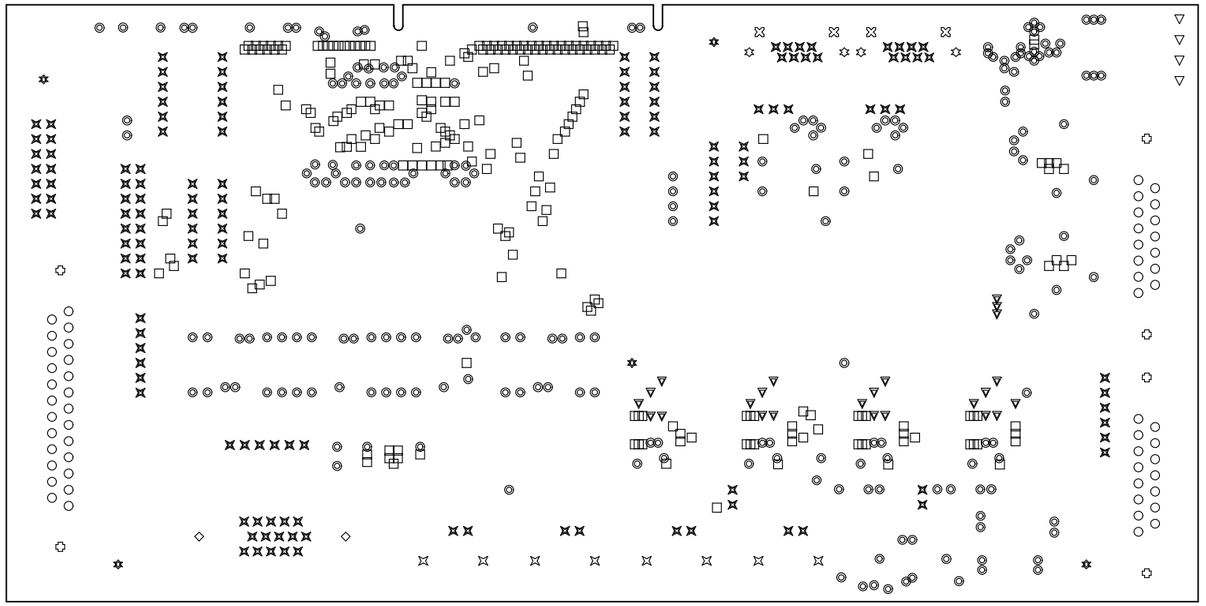
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SIZE	CAGE CODE		REV
B	23835	10364583	C
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DBASE NAME: ANSI_B-SH2/A5



DRILL DRAWING

Symbol	Hit Count	Finished Hole Size	Plated	Hole Type
◇	2	129.92mil (3.300mm)	PTH	Round
▽	4	43.31mil (1.100mm)	PTH	Round
✡	4	62.99mil (1.600mm)	PTH	Round
⊠	4	127.95mil (3.250mm)	NPTH	Round
✱	5	150.00mil (3.810mm)	PTH	Round
⌬	6	125.00mil (3.175mm)	PTH	Round
⌑	8	78.74mil (2.000mm)	PTH	Round
▼	24	20.00mil (0.508mm)	PTH	Round
○	55	41.00mil (1.041mm)	PTH	Round
✖	142	35.43mil (0.900mm)	PTH	Round
◎	216	16.00mil (0.406mm)	PTH	Round
□	246	10.00mil (0.254mm)	PTH	Round
	716 Total			

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REVISION HISTORY

LTR	DESCRIPTION	CLASS	DWN	CHK	STRUCT	MATL	THRM CONT			ENGR	DSGN SUPV	DATA MGT	RELEASE DATE
A	INITIAL RELEASE	E	SEE TITLE BLOCK									JLM	2013/11/14
B	FLIPPED J1A AND J1B AND UPDATED U16 FOOTPRINT	E										JLM	2014/05/21
C	CHANGED ITAR NOTICE, ADDED COPYRIGHT AND PARTS LIST	E											

NOTES: UNLESS OTHERWISE SPECIFIED

1. WORKMANSHIP STANDARDS AND ACCEPTABILITY REQUIREMENTS SHALL MEET IPC–A–610 (LATEST VERSION)
2. THIS DOCUMENT AND RELATED ARTWORK ARE COMPUTER GENERATED. CHANGES ARE TO BE PERFORMED ON THE ORIGINAL DATABASE IN SECTION 383.
3. SOLDER COMPONENTS USING LEAD FREE SOLDER, ITEM 3.
4. MARK OR INK STAMP REVISION LETTER AND SERIAL NUMBER USING INK, ITEM 2. CHARACTERS TO BE 50mil HIGH MINIMUM.
5. FOR ELECTRONIC PARTS LIST SEE PL10364584 Rev B.
6. FOR SCHEMATIC DIAGRAM SEE JPL DRAWING 10364582.
7. THIS PRINTED WIRING BOARD ASSEMBLY CONSISTS OF BOTH SMT AND THROUGH–HOLE TECHNOLOGY.

SEE SEPARATE PARTS LIST

QTY REQD	ITEM NO	REF DES	CAGE CODE	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	MATERIAL OR NOTE
AR	3			Sn96.5/Ag3.0/ Cu0.5	SOLDER	J–STD–005A	3
AR	2			HYSOL SERIES M CATALYST 20A	INK, WHITE EPOXY		4
1	1			10364583–1	PRINTED WIRING BOARD		REV C

PARTS LIST

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NEXT ASSEMBLY	USED ON
APPLICATION	TMT

MATERIAL: MATERIAL PER SPECIFICATION

THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
LINEAR TOLERANCES:
.XX .03
.XXX .010
ANGULAR TOLERANCES: 0.5
MACHINE FINISH
DO NOT SCALE DRAWING
INTERPRET DWG PER ASME Y14.100

CONTRACT NO
APPD DATE
DWN D. PALMER 2013/11/14
CHK
STRUCT
MATL
THRM CONT
ENGR
DSGN SUPV

JET PROPULSION LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CA 91109

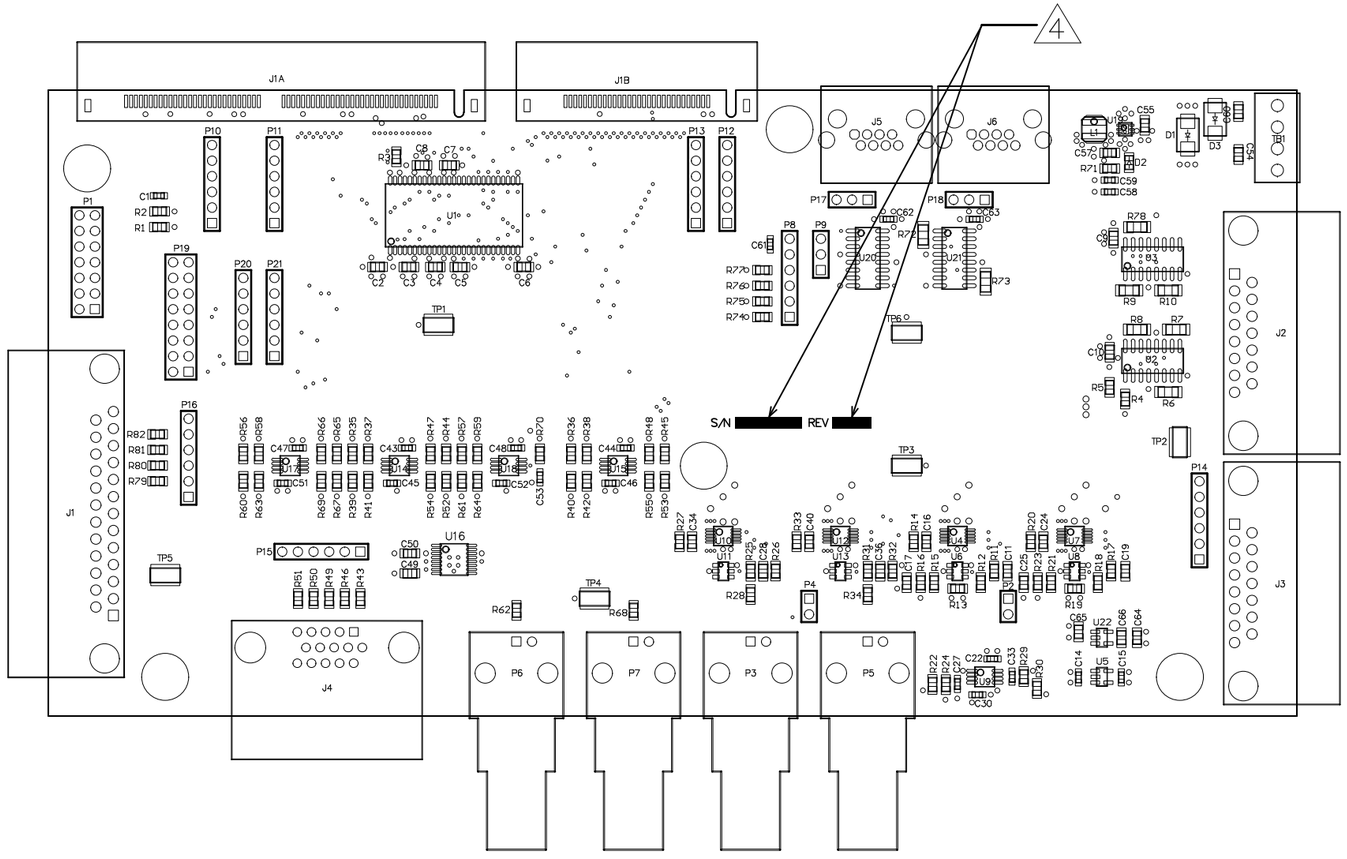
TMT ACTUATOR BASE BOARD PWB ASSEMBLY

SIZE	CAGE CODE		REV
B	23835	10364584	C

SCALE: 1/1 | UNCLASSIFIED | SHEET 1 OF 3

REV 01/2013

DBASE NAME: ANSI_B–SH1/A5



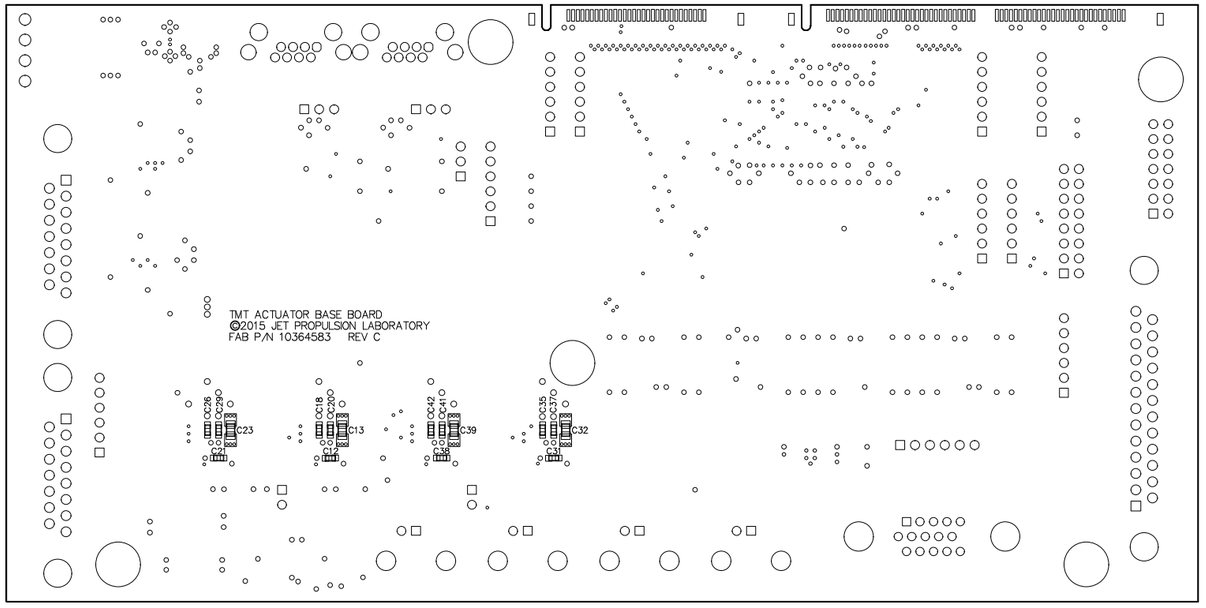
TOP ASSEMBLY

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	SCALE: 1/1	UNCLASSIFIED	SHEET 2 OF 3

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DBASE NAME: ANSI_B-SH2/A5



BOTTOM ASSEMBLY

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SIZE	CAGE CODE		REV
B	23835	10364584	C
SCALE: 1/1	UNCLASSIFIED	SHEET 3 OF 3	

REV 02/2013

DBASE NAME: ANSI_B-SH2/A5

PL10364584-B Bill of Materials For TMT Actuator Base Board PWB Assembly

Source Data From: base_brd.PrjPCB
Project: base_brd.PrjPCB
Report Date: 11/14/2013 1:13:42 PM
Print Date: 8/13/2015 2:52:01 PM

Item	Quantity	Designator	Description	Footprint	Manufacturer	ManufacturerPN	Supplier	SupplierPN
1.	10	C2, C3, C4, C5, C6, C7, C8, C9, C10, C49	capacitor, 0.1uF ±10% 16V size 0805 X7R ceramic chip	CAPCP2012X09N	Kemet	C0805C104K4RACTU	Digikey	399-1167-1-ND
2.	32	C12, C14, C15, C18, C20, C21, C22, C26, C27, C29, C30, C31, C33, C35, C37, C38, C41, C42, C43, C44, C45, C46, C47, C48, C51, C52, C53, C58, C59, C61, C62, C63	capacitor, 0.47uF ±10% 16V size 0603 X7R ceramic chip	CAPCP1608X09N	Murata	GCM188R71C474KA55D	Digikey	490-4775-1-ND
3.	2	C64, C65	capacitor, 4.7uF ±10% 16V size 0805 X5R ceramic chip	CAPCP2012X14N	Murata	GRM21BR61C475KA88L	Digikey	490-3338-1-ND
4.	1	C66	capacitor, 10nF ±5% 50V size 0805 COG ceramic chip	CAPCP2012X09N	Murata	GRM2195C1H103JA01D	Digikey	490-1642-1-ND
5.	1	C1	capacitor, 10nF ±10% 25V size 0603 X7R ceramic chip	CAPCP1608X09N	Murata	GRM188R71E103KA01D	Digikey	490-1520-1-ND
6.	2	C54, C60	capacitor, 10uF ±10% 10V size 0805 X5R ceramic chip	CAPCP2012X14N	Kemet	C0805C106K8RACTU	Digikey	399-7411-1-ND
7.	7	C13, C23, C32, C39, C50, C55, C57	capacitor, 22uF ±20% 10V size 0805 X5R ceramic chip	CAPCP2012X14N	TDK	C2012X5R1A226M125AB	Digikey	445-7665-1-ND
8.	8	C11, C16, C17, C19, C24, C25, C34, C40	capacitor, 2700pF ±5% 50V size 0805 NPO ceramic chip	CAPCP2012X07N	Murata	GRM2165C1H272JA01D	Digikey	490-1630-1-ND
9.	2	C28, C36	capacitor, 5600pF ±5% 50V size 0805 NPO ceramic chip	CAPCP2012X09N	Murata	GRM2195C1H562JA01D	Digikey	490-1636-1-ND
10.	1	TB1	connector, 4-position screw terminal block	1751264	Phoenix Contact	1751264	Digikey	277-5744-ND
11.	2	J5, J6	connector, 8P-8C R/A shielded modular jack	43860-0013	Molex	43860-0013	Digikey	WM5435-ND
12.	1	J4	connector, 15-socket right-angle PCB mount high-density D-Sub receptacle	09561525612	Harting	09561525612	Digikey	1195-2302-ND
13.	2	J2, J3	connector, 15-socket right-angle PCB mount Subminiature-D receptacle	5747845-3	TE Connectivity	5747845-3	Digikey	A32120-ND
14.	1	J1	connector, 25-socket right-angle PCB mount Subminiature-D receptacle	5747846-3	TE Connectivity	5747846-3	Digikey	A32125-ND
15.	1	J1B	connector, 60-pin edge mount high-speed edge card	HSEC8-130-01-X-D-EM2	Samtec	HSEC8-130-01-S-D-EM2	Samtec	HSEC8-130-01-S-D-EM2
16.	1	J1A	connector, 120-pin edge mount high-speed edge card	HSEC8-160-01-X-D-EM2	Samtec	HSEC8-160-01-S-D-EM2	Samtec	HSEC8-160-01-S-D-EM2
17.	4	P3, P5, P6, P7	connector, right-angle PCB mount BNC	5227161-7	TE Connectivity	5227161-7	Digikey	A32260-ND
18.	2	D1, D3	diode, 100V 2A fast recovery	SMB	Fairchild Semiconductor	ES2B	Digikey	ES2BFSCT-ND
19.	1	D2	diode, size 0805 green light-emitting	0805	Stanley Electric	PG1112H-TR	Digikey	404-1021-1-ND
20.	1		fab, TMT Actuator Base Board PWB			10364583		
21.	2	P2, P4	header, .100 2-position straight	9-146285-0-02	TE Connectivity	9-146285-0-02	Digikey	A32700-02-ND
22.	3	P9, P17, P18	header, .100 3-position straight	9-146285-0-03	TE Connectivity	9-146285-0-03	Digikey	A32700-03-ND
23.	10	P8, P10, P11, P12, P13, P14, P15, P16, P20, P21	header, .100 6-position straight	9-146285-0-06	TE Connectivity	9-146285-0-06	Digikey	A32700-06-ND
24.	1	P1	header, 2-row x 7 .100 14 position straight	9-146261-0-07	TE Connectivity	9-146261-0-07	Digikey	A34268-07-ND
25.	1	P19	header, 2-row x 8 .100 16 position straght	9-146261-0-08	TE Connectivity	9-146261-0-08	Digikey	A34268-08-ND
26.	1	U22	ic, 2.5V 0.1A LDO regulator	SOT23-5	Linear Technology	LT1761ES5-2.5#TRMPBF	Digikey	LT1761ES5-2.5#TRMPBFCT-ND
27.	1	U19	ic, 3.3V 1A synchronous buck regulator	DRV6-1600X1000TP	Texas Instruments	TPS62291DRVT	Digikey	296-23330-1-ND
28.	1	U5	ic, 4.096V precision voltage referernce	sot23-5	Analog Devices	ADR364AUJZ-REEL7	Digikey	ADR364AUJZ-REEL7CT-ND
29.	1	U1	ic, 256Mb Synchronous High-Speed CMOS DRAM, 16Mb x 16Bit x 4 Banks	TSOP2-54_N	Winbond Electronics	W9825G6JH-6I	Digikey	W9825G6JH-6I-ND
30.	5	U9, U14, U15, U17, U18	ic, dual-channel very low input bias current opamp, 3.5 MHz BW, 3 V/us SR	ADI-RM-8_N	Analog Devices	AD8642ARMZ	Digikey	AD8642ARMZ-ND
31.	1	U20	ic, low-voltage high-speed quad differential line driver with +/-15-kV IEC ESD protection	D16_N	Texas Instruments	AM26LV31EIDR	Digikey	296-24690-1-ND
32.	3	U2, U3, U21	ic, low-voltage high-speed quad differential line receiver with +/-15-kV IEC ESD protection	D16_N	Texas Instruments	AM26LV32EIDR	Digikey	296-24694-1-ND
33.	1	U16	ic, octal 16-Bit voltage output denseDAC with SPI interface and on-chip reference	RW-16_N	Analog Devices	AD5668BRUZ-3	Digikey	AD5668BRUZ-3-ND
34.	4	U4, U7, U10, U12	ic, single 16-Bit PulSAR analog-to-digital converter with SPI interface, 100KSPS	RM-10_N	Analog Devices	AD7988-1BRMZ	Digikey	AD7988-1BRMZ-ND
35.	4	U6, U8, U11, U13	ic, single channel low wide-band-noise opamp, 80 MHz BW, 13 V/us SR	ADI-RJ-6_N	Analog Devices	ADA4841-1YRJZ-R7	Digikey	ADA4841-1YRJZ-R7CT-ND
36.	1	L1	inductor, 2.2uH 1.7A SMD power	VLCF4020	TDK	VLCF4020T-2R2N1R7	Digikey	445-3182-1-ND
37.	12	R5, R12, R15, R18, R21, R25, R31, R70, R79, R80, R81, R82	resistor, 1.00K ohm ±1% 1/8W size 0805 thick-film chip	RES0805	Panasonic	ERJ-6ENF1001V	Digikey	P1.00KCCT-ND
38.	6	R11, R16, R17, R23, R26, R32	resistor, 2.00K ohm ±1% 1/8W size 0805 thick-film chip	RES0805	Panasonic	ERJ-6ENF2001V	Digikey	P2.00KCCT-ND
39.	1	R4	resistor, 4.02K ohm ±1% 1/8W size 0805 thick-film chip	RES0805	Panasonic	ERJ-6ENF2261V	Digikey	P2.26KCCT-ND
40.	2	R28, R34	resistor, 4.99K ohm ±1% 1/8W size 0805 thick-film chip	RES0805	Panasonic	ERJ-6ENF4991V	Digikey	P4.99KCCT-ND
41.	1	R1	resistor, 6.19K ohm ±1% 1/8W size 0805 thick-film chip	RES0805	Panasonic	ERJ-6ENF6191V	Digikey	P6.19KCCT-ND
42.	19	R2, R22, R24, R29, R30, R35, R36, R39, R40, R44, R45, R52, R53, R56, R57, R60, R61, R65, R67	resistor, 10.0K ohm ±1% 1/8W size 0805 thick-film chip	RES0805	Panasonic	ERJ-6ENF1002V	Digikey	P10.0KCCT-ND
43.	14	R37, R38, R41, R42, R47, R48, R54, R55, R58, R59, R63, R64, R66, R69	resistor, 20.0K ohm ±1% 1/8W size 0805 thick-film chip	RES0805	Panasonic	ERJ-6ENF2002V	Digikey	P20.0KCCT-ND
44.	5	R3, R14, R20, R27, R33	resistor, 22.1 ohm ±1% 1/8W size 0805 thick-film chip	RES0805	Panasonic	ERJ-6ENF22R1V	Digikey	P22.1CCT-ND
45.	6	R62, R68, R74, R75, R76, R77	resistor, 49.9 ohm ±1% 1/8W size 0805 thick-film chip	RES0805	Panasonic	ERJ-6ENF49R9V	Digikey	P49.9CCT-ND
46.	5	R43, R46, R49, R50, R51	resistor, 75.0 ohm ±1% 1/8W size 0805 thick-film chip	RES0805	Panasonic	ERJ-6ENF75R0V	Digikey	P75.0CCT-ND
47.	8	R6, R7, R8, R9, R10, R72, R73, R78	resistor, 121 ohm ±1% 1/8W size 1206 thick-film chip	RES1206	Panasonic	ERJ-8ENF1210V	Digikey	P121FCT-ND
48.	2	R13, R19	resistor, 127 ohm ±1% 1/8W size 0805 thick-film chip	RES0805	Panasonic	ERJ-6ENF1270V	Digikey	P127CCT-ND
49.	1	R71	resistor, 475 ohm ±1% 1/8W size 0805 thick-film chip	RES0805	Panasonic	ERJ-6ENF4750V	Digikey	P475CCT-ND
50.	6	TP1, TP2, TP3, TP4, TP5, TP6	test point, compact SMT	TP_5016	Keystone	5016	Digikey	5016KCT-ND

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