LOW VOLTAGE POWER SUPPLY

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TIDI

REQUIREMENTS OVERVIEW

- **TIDI PS is intended to meet specifications put forth in TIMED Component Environmental Specification 7363-9010 and TIMED EMC Control Plan and EMI Performance Requirements Specification 7363-9038**
  - **Key Requirements:**

    Bus Voltage +22VDC to +35VDC

    Transients: +/-28V peak for <200mS (+56V max., -2V min.)

    Fault: 0 to 40V

    In-rush current 10A max for 10uS, 2.5A for 200mS

    Survive short circuit across primary power inputs

    1Megohm isolation between Primary Power, Secondary Power, Heaters and Chassis Ground

    Separate EMI/EMC control for Heater Power

REQUIREMENTS OVERVIEW (CONT.)

- **Output Requirements**
  - **Provide low voltage outputs**
    - **+/-15 Volts - Pulsed Loads**
    - **+/-15 Volts - Quiet**
    - **+5 Volts - Logic**
    - **+26 Volts - CCD FET Boost**
    - **+28 Volts - Calibration Supply**
    - **+/-6 Volts - Servo Supply**
  - **Temperature monitor**
  - **Current sense for Primary Power and Heater Power**
  - **Provide Power On Reset signal**

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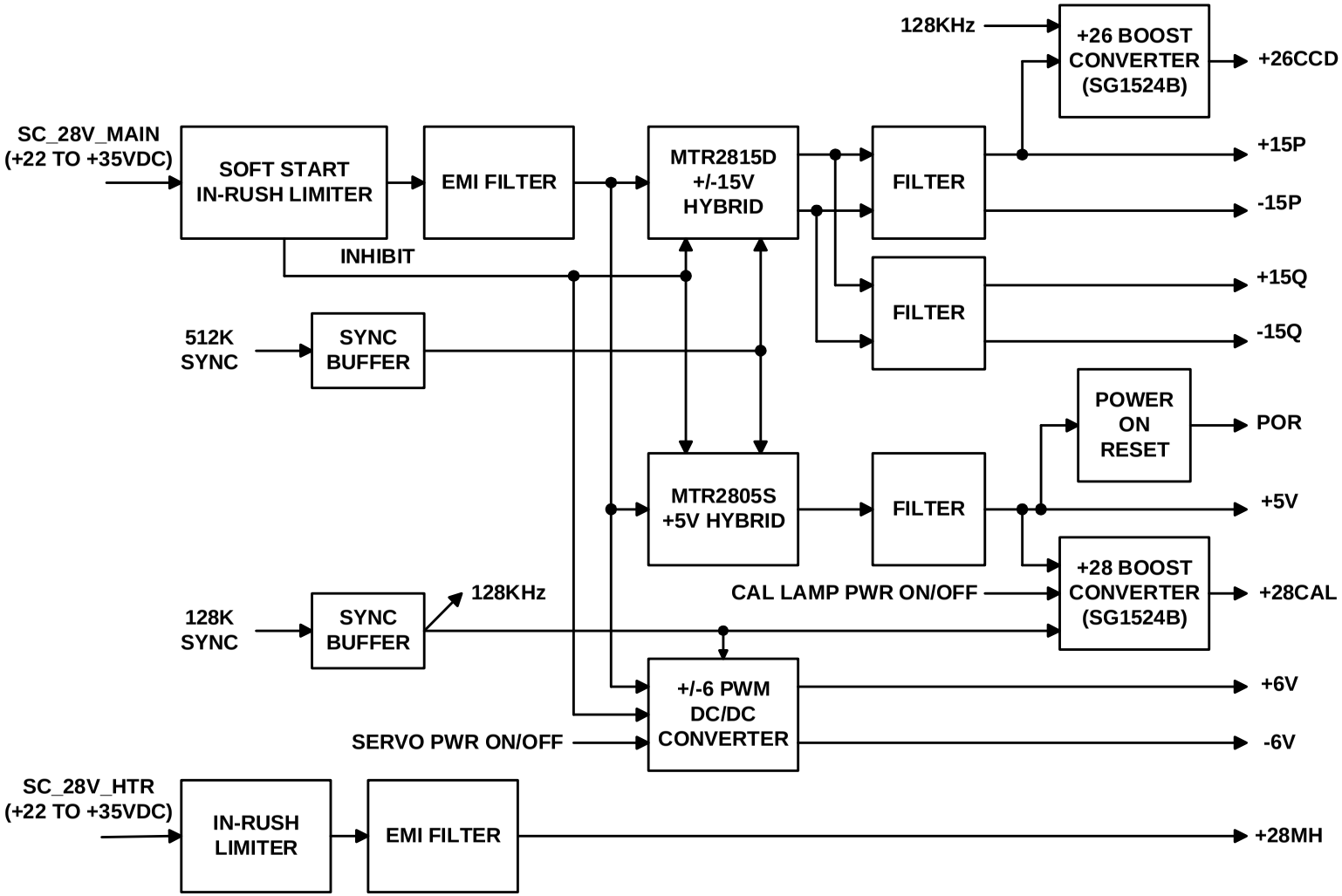
OUTPUT PEAK LOAD REQUIREMENTS

				OUTPUT VOLTAGE			Note 3	Note 3	Note 3	
Polarity	Plus	Minus	Plus	Minus	Plus	Plus	Plus	Plus	Minus	
Value	15	15	15	15	5	26	28	6	6	
Type	Pulsed	Pulsed	Quiet	Quiet	Logic	CCD-B	Cal Lmp	Servo	Servo	
Electronic Subsystem										
CCD Controller (CD)			28.0	35.0	41.0	4.0				
Flight Computer (FC)		260.0			270.0					Note 4
Data Acquisition (DA)			22.0	22.5	30.0					
Filter Wheel/Motor/Heater (MH)	662.0				113.0					
Telescope Servo Controller (TS)			78.5	76.5	20.0			4440.0	0.0	Note 1
Calibration Lamp PS (CAL)					50.0		150.0			Note 2
Total Load Current (mA)	662.0	260.0	128.5	134.0	524.0	4.0	150.0	4440.0	0.0	
								Note 5		
Total Load Power (W)	9.93	3.90	1.93	2.01	2.62	0.10	4.20	26.64	0.00	
					Note 1: Peak servo motor current is drawn					
Grand Total PS Peak Load Power	51.33	Watts			from either +6 or -6, not simultaneous					
Peak PS Input Power @ .7 Eff	73.33	Watts			4.44 amps assumes 4 telescopes slewing, scan mode					
Operational Heater Power	13.87	Watts	(Cold Case, 100% DF, 26V)							
Total TIDI Peak Load Power @ 26V	87.20	Watts			Note 2: Cal lamp peak current may be drawn					
TIDI Peak Input Current @ 22V	3.78	Amps			continuously during ground testing/calibration					
TIDI Peak Input Current @ 26V	3.35	Amps			Note 3: Voltage is On/Off Commandable					
TIDI Peak Input Current @ 35V	2.81	Amps			Note 4: Normal peak -15V current (260 ma) for 1553 activity					
					lasts 3 ms each second (0.3% DF). The value shown					
SC Input Voltage	22	26	35		would represent 100% activity by 1553 ie babbling					
Instrument Peak Current	3.33	2.82	2.10	Amps	Note 5: Peak current is duty cycled, 6.5 sec on,					
Operational Heater Peak Current	0.45	0.53	0.72	Amps	6.5 sec off so maximum "average" peak power is					
Total Peak Current	3.78	3.35	2.81	Amps	26.64/2=13.32W					

DESIGN STRATEGY

- **Input filter includes common mode and EMI filters**
  - **Soft start control used to restrict in-rush current and ensure filter is fully charged prior to PWM start-up**
- **Switching frequencies synchronized with CCD sample clock for system noise suppression**
- **Interpoint DC/DC converters for +5, +/-15V outputs**
- **Boost converters for +26CCD, +28Cal supplies**
  - **+26CCD derived from +15**
  - **+28Cal derived from +5**
- **Custom PWM supply for +/-6 Servo**
  - **Similar in concept to design used on TOMS**

LVPS BLOCK DIAGRAM



DESIGN DETAILS

- **+5, +/-15V outputs generated by Interpoint hybrids MTR2805SF and MTR2815DF**
  - **Two hybrids used due to peak load demands; ensures adequate margin over load and temperature**
  - **Synchronized to 512KHz provided by CCD Controller**
  - **Hybrids inhibited at turn-on by soft start circuit until input filter charged**
  - **Separate output filters for +/-15V Quiet and +/-15V Pulse outputs**
- **Boost converters used for +26CCD, +28CAL**
  - **+26CCD derived from +15V**
  - **+28CAL derived from +5V**
  - **Each synchronized to 128KHz provided by CCD Controller**
- **Power On Reset is an active low signal; clears 160mS after +5V output reaches 4.7V; triggers when +5V output drops below 4.5V**

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DESIGN DETAILS (CONT.)

- **+/-6 Servo power supply is a custom PWM design**
  - **Power stage consists of 128KHz PWM pre-regulator followed by a phase-locked 64KHz driven inverter**
    - **128KHz clock provided by CCD Controller**
  - **SG1524B control chips used for PWM and inverter**
  - **Transformer is custom built on ferrite torroid**
    - **Same construction techniques as used on MSX-CEMS, Cassini INMS, Huygens Probe GCMS, TOMS EP**
    - **Control power and regulator feedback provided by dedicated winding**
  - **Design similar in concept to power supply built for TOMS**

CHANGES SINCE PDR

- **+/-12V output changed to +/-15V for adequate margin for 10V references, op-amps**
- **Separate EMI/EMC filters provided for SC_28V_MAIN and SC_28V_HTR**
- **Power On Reset signal added**

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IMPLEMENTATION PLANS

- **Breadboard Testing complete** — **Mid-late May**
- **PCB Layout Complete** — **Mid June**
- **Magnetics Manufacture Start** — **June**
- **Manufacture Flight PCB**
- **Flight Unit Assembly Complete** — **Late July**
  - **Contingency plan calls for installation of prototype hybrids if flight hybrids are not available**
- **Flight Unit Testing Complete** — **Mid August**
  - **Contingent upon flight hybrid delivery**

INTERPOINT CONCERNS

- **Use of multilayer ceramic capacitor in hybrid**
  - **Input capacitor for MTR series is a 6uF “high-fire” Presidio multilayer ceramic (PN HRS301X7R605M2J3HA)**
- **Use of opto-isolators**
  - **MTR series does not use opto-isolators; magnetic feedback is utilized for regulation/isolation**
- **Stability margin**
  - **Converter stability will be rigorously tested on the breadboard model over load, line, and temperature. Inhibit will be set to ensure EMI filter is fully charged prior to converter start-up.**
- **Sync signal failure**
  - **In the event of a sync signal failure (high or low) converters will free run at their nominal frequency (625KHz typical)**