



# CMUcam4

## Electrical Characteristics

For the Lextronic CMUcam4 Rev A

### Electrical Characteristics

**Table 1: Current and Power Dissipation** – Data in all columns taken at room temperature (25 °C) with 5 V input

Parameter	Min	Typical	Max	Units	Conditions			
Camera Board Idle Current	32	33	34	mA	Assuming the power and auxiliary LED are disabled – see Table 2 (below) for more information			
Camera Board Idle Power Dissipation	160	165	170	mW				
Camera Board Active Current	42	43	44	mA				
Camera Board Active Power Dissipation	210	215	220	mW	Assuming the power LED is disabled – see Table 2 (below) for more information			
Camera Board “SL” Current	32	33	34	mA				
Camera Board “SL” Power Dissipation	160	165	170	mW				
Camera Board “SD” Current	0.080	0.085	0.090	mA				
Camera Board “SD” Power Dissipation	0.400	0.425	0.450	mW				
Camera Module Idle Current	56	57	58	mA	XCLK = 48 MHz, PCLK = 24 MHz			
Camera Module Idle Power Dissipation	280	285	290	mW				
Camera Module Active Current	56	57	58	mA	XCLK = 48 MHz, PCLK = 24 MHz			
Camera Module Active Power Dissipation	280	285	290	mW				
Camera Module “SL” Current	0.5	1.0	1.5	mA	SCCB-Initiated Standby			
Camera Module “SL” Power Dissipation	2.5	5.0	7.5	mW				
Camera Module “SD” Current	0.010	0.015	0.020	mA	PWDN-Initiated Standby			
Camera Module “SD” Power Dissipation	0.050	0.075	0.100	mW				
μSD Card Idle Current	0.2	0.5	0.8	mA	While the μSD card is not being accessed			
μSD Card Idle Power Dissipation	1.0	2.5	4.0	mW				
μSD Card Active Current	2	5	8	mA	Current and power consumption may spike up to 10X while writing data			
μSD Card Active Power Dissipation	10	25	40	mW				
μSD Card “SL” Current	0.2	0.5	0.8	mA	-			
μSD Card “SL” Power Dissipation	1.0	2.5	4.0	mW	-			
μSD Card “SD” Current	0.2	0.5	0.8	mA	-			
μSD Card “SD” Power Dissipation	1.0	2.5	4.0	mW	-			
TV Generator Idle Current	11	12	13	mA	See the “M1” (Monitor On) command – tested in a no-load scenario			
TV Generator Idle Power Dissipation	55	60	65	mW				
TV Generator Active Current	11	12	13	mA				
TV Generator Active Power Dissipation	55	60	65	mW	See the “M0” (Monitor Off) command - tested in a no-load scenario			
TV Generator “SL” Current	0	0	0	mA				
TV Generator “SL” Power Dissipation	0	0	0	mW				
TV Generator “SD” Current	0	0	0	mA				
TV Generator “SD” Power Dissipation	0	0	0	mW				
<b>Parameter Totals</b>					<b>With a μSD Card</b>	<b>Without a μSD Card</b>		
Total Idle Current	99.2	102.5	105.8	mA	99	102	105	mA
Total Idle Power Dissipation	496.0	512.5	529.0	mW	495	510	525	mW
Total Active Current	111	117	123	mA	109	112	115	mA
Total Active Power Dissipation	555	585	615	mW	545	560	575	mW
Total “SL” Current	32.7	34.5	36.3	mA	32.5	34.0	35.5	mA
Total “SL” Power Dissipation	163.5	172.5	181.5	mW	162.5	170.0	177.5	mW
Total “SD” Current	0.29	0.60	0.91	mA	0.09	0.10	0.11	mA
Total “SD” Power Dissipation	1.45	3.00	4.55	mW	0.45	0.50	0.55	mW

**Note 1:** “SL” (Sleeping Lightly) – Please see the “SL” (Sleep Lightly) command.

**Note 2:** “SD” (Sleeping Deeply) – Please see the “SD” (Sleep Deeply) command.

**Table 2: Current and Power Dissipation** – Data in all columns taken at room temperature (25 °C) with 5 V input

Parameter	Min	Typical	Max	Units	Conditions
Power LED Current	2.5	2.75	3	mA	Please see <a href="#">Note 3</a>
Power LED Power Dissipation	12.5	13.75	15	mW	
Auxiliary LED Current	2.5	2.75	3	mA	Please see <a href="#">Note 4</a>
Auxiliary LED Power Dissipation	12.5	13.75	15	mW	

**Note 3:** If the power LED is not disabled, increase the total current and power consumption for the camera board in Table 1 by the amount in Table 2 for the power LED. The power LED can be disabled by cutting the trace on the camera board located right next to “PWR” label inside of the copper solder jumper. To re-enable the power LED, bridge the copper solder jumper using a ball of solder.

**Note 4:** If the auxiliary LED is not disabled, increase the total current and power consumption for the camera board in Table 1 by the amount in Table 2 for the auxiliary LED. The auxiliary LED can be disabled by using the “L0” (LED Off) command or by cutting the trace on the camera board located right next to the “AUX” label inside of the copper solder jumper. To re-enable the auxiliary LED, bridge the copper solder jumper using a ball of solder.

**Table 3: Electrical Characteristics** – Data in all columns taken at room temperature (25 °C) with 5 V input

Parameter	Min	Typical	Max	Units	Notes
Operating Temperature Range	10	25	40	°C	Can be 12 V at or around room temperature – 25 °C
Supply Voltage Range	4	5	9	V	
Pan and Tilt Pin Maximum Short-circuit Current	-	-	7	mA	A 430 Ω resistor is in series with both the pan and tilt pins to prevent shorts
Pan and Tilt Pin Maximum Power Dissipation	-	-	35	mW	
Pan Pin Output High	2.8	2.9	3.0	V	-
Pan Pin Output Low	0.0	0.2	0.4	V	-
Pan Pin Input High	1.8	-	3.3	V	-
Pan Pin Input Low	0.0	-	0.6	V	-
Tilt Pin Output High	2.8	2.9	3.0	V	-
Tilt Pin Output Low	0.0	0.2	0.4	V	-
Tilt Pin Input High	1.8	-	3.3	V	-
Tilt Pin Input Low	0.0	-	0.6	V	-
TX Out Pin Output High	2.8	2.9	3.0	V	3.3 V and 5 V tolerant
TX Out Pin Output Low	0.0	0.2	0.4	V	
RX In and DTR Pin Input High	0.0	3.3	12.0	V	3.3 V and 5 V tolerant
RX In and DTR Pin Input Low	-0.2	0.0	0.2	V	

## Component Characteristics

**Table 4: Component Characteristics** – Data in all columns taken at room temperature (25 °C) with 5 V input

Parameter	Min	Typical	Max	Units	Notes
P8X32A Processor Frequency	-	96	-	MHz	20 KHz while “SD” (Sleeping Deeply)
P8X32A Processor Instructions per Second	-	192	-	MIPS	Split among 8 cores (24 MIPS per core)
P8X32A Processor RAM	-	32	-	KB	-
P8X32A Processor ROM	-	32	-	KB	64 KB EEPROM
OV9665 Camera Horizontal Resolution	-	640	-	pixels	Down-sampled by 4X to 160 pixels
OV9665 Camera Vertical Resolution	-	480	-	pixels	Down-sampled by 4X to 120 pixels
OV9665 Color Depth	-	16	-	bits	5-bits (R/V) : 6-bits (G/Y) : 5-bits (B/U)
OV9665 Frame Rate	-	30	-	FPS	-
Servo Controller Frequency	-	50	-	Hz	-
Servo Controller Resolution	-	1	-	μS	-
Serial Baud Rate	1	19,200	250,000	BPS	See “BM” (Baud Mode) command
Serial Stop Bits	1	1	2 <sup>31</sup>	Bits	See “DM” (Delay Mode) command