



# **MosChip Security Processor MCS1000**

## **VPN/Firewall/Gateway Application Note**

**Version 2.0**

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**Introduction**

The VPN appliance market is growing rapidly and new requirements such as the Advanced Encryption Standard (AES) and higher IPsec bandwidth are placing large demands on VPN hardware vendors. In addition to these new requirements there is significant pricing pressure on the lower-priced VPN boxes. MosChip Semiconductor has recently introduced the MCS1000 which is a high performance System-On-a-Chip IPsec solution that can replace multiple components in a typical VPN/firewall/gateway application.

The electronic components in a typical VPN/firewall/gateway consist of a 32-bit microprocessor, a cryptographic coprocessor and multiple Ethernet interfaces (see Figure A). This system typically can offer performance of 1 Megabit per second to 20 Megabits per second. The MCS1000 integrates all of these components into one chip (see Figure B). A VPN appliance with a MCS1000 is lower cost, lower power and offers a higher level of performance than the VPN appliance available today. The VPN<sup>Now</sup>™ Hardware Module inside the MCS1000 can offer up to 512Mbps of 3DES processing without additional costly processors or co-processors added. See the MCS1000 Hardware Manual for more details.

The MCS1000 can operate in standalone mode for a market leading low-cost system or as a peripheral to a host processor (on a PCI bus) in a higher-end system that implements additional features such as virus protection.

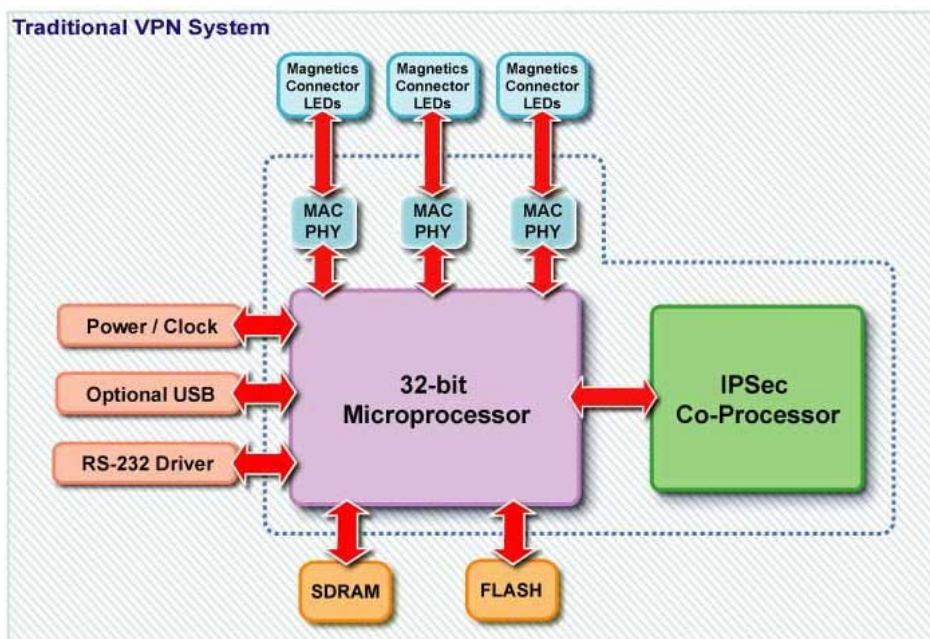


Figure A. Typical VPN/firewall/gateway system.

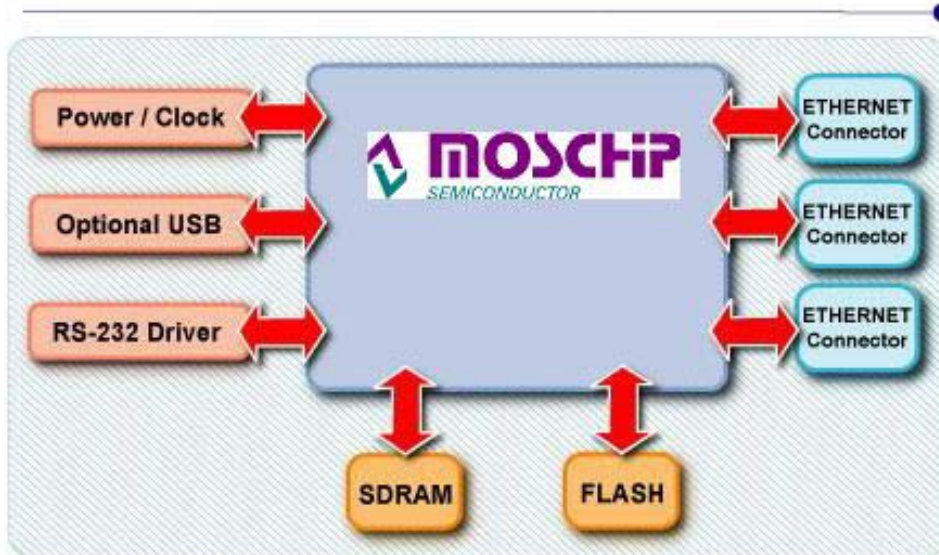


Figure B. MCS1000-based VPN/firewall/gateway system.

**MCS1000 Architecture**

The MCS1000 is a highly integrated VPN System-On-a-Chip with three 10/100 Ethernet interfaces (see Figure C). The MCS1000 can run in peripheral mode and perform as a secure Fast Ethernet controller or it can operate in standalone mode and perform all VPN, firewall, and gateway functions independently. The MCS1000 consists of three functional blocks: a CPU Subsystem, VPN<sup>TM</sup> Hardware Module, and General Interface Blocks. The CPU Subsystem contains an ARM926EJ-S, 200MHz, 32-bit RISC microprocessor delivering approximately 1.1 MIPS per MHz. The core processor handles all housekeeping functions on the MCS1000 and it is tightly integrated to the VPN<sup>TM</sup> Hardware Module (cryptographic co-processor). The VPN<sup>TM</sup> Hardware Module handles all IPsec functions. It has been designed around the IPsec specification and implements DES, 3DES, AES, MD5, and SHA algorithms. The maximum bandwidth through the VPN<sup>TM</sup> Hardware Module is 400Mbps. Code execution by the processor and the VPN<sup>TM</sup> Hardware Module can be fetched using the internal memory controller or via the PCI bus.

The General Interface Blocks consists of a Memory Controller, PCI Controller, Ethernet interface, Serial Port and General Purpose I/O.

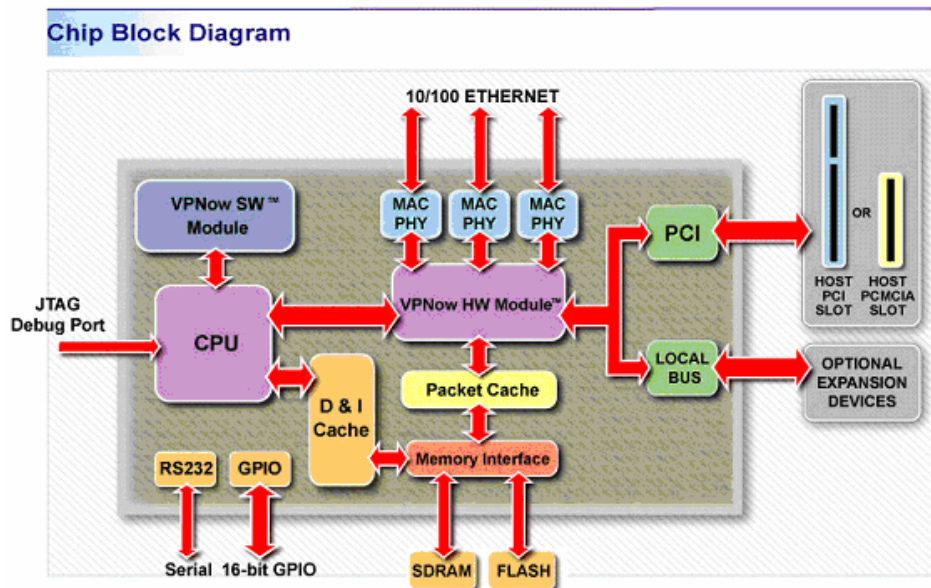


Figure C. MCS1000 Block Diagram

There are many applications in which the MCS1000 can enhance performance and security. It can perform all IPsec functionality and off-load a host processor of the math intensive IPsec cryptography and authentication processing. It can add encryption to any Ethernet-based system that would benefit from added security and requires no degradation of system performance. It also can be a low-cost high performance VPN/firewall/gateway System-On-a-Chip.

**Reference Design**

Appended to this document is a schematic and bill of materials (BOM) for a three Ethernet port system using the MCS1000 (the schematic and BOM come from the MCS1000 Development Board, but have been simplified for lower cost).

**Reference Design Features**

- 200 MHz ARM926EJ-S processor
- Hardware-based cryptography and authentication
- Three (3) Ethernet ports
- RS-232 port
- 32 Megabytes of SDRAM
- 8 Megabytes of Flash
- Linux Operating System

**Development Board**

The development board is PCI-based and is configured to be used in either standalone or peripheral mode. In standalone mode the development board can boot and load Linux. See the MCS1000 Development Board User's Manual for more details. In peripheral mode the development board would be placed in a host's PCI bus. The host could be running Windows or Linux.

**Price and Availability**

Production Development systems will be available in Q1 of 2004 and production quantities of the MCS1000 will be available in Q2 of 2004. Please contact the factory for pricing and more complete information on availability.

**General Information**

If you have any questions regarding the MCS1000 or MosChip Semiconductor, please contact the MosChip Technical Marketing Group at (408) 737-7141 x124 or e-mail [info@moschip.com](mailto:info@moschip.com).

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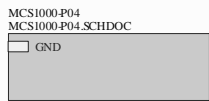
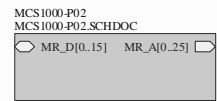
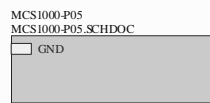
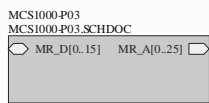
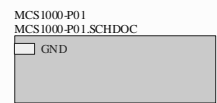
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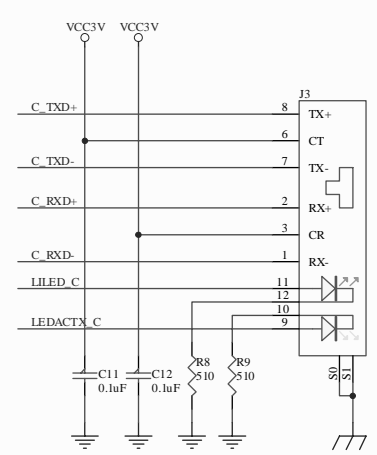
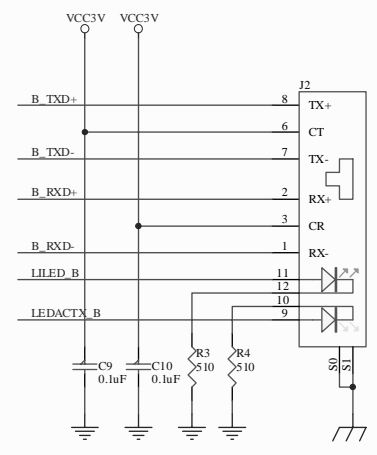
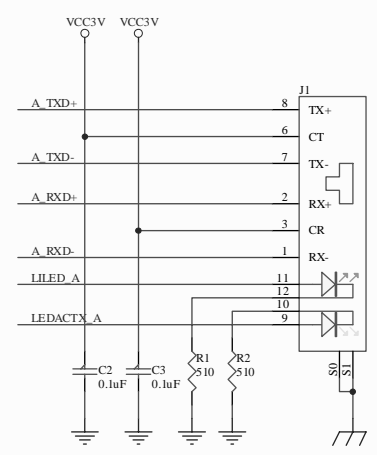
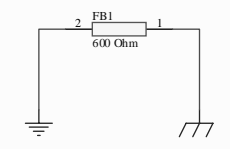
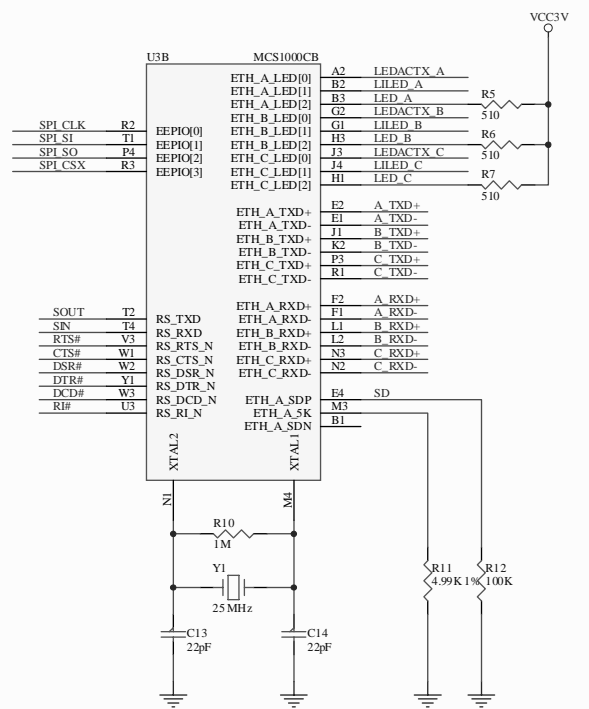
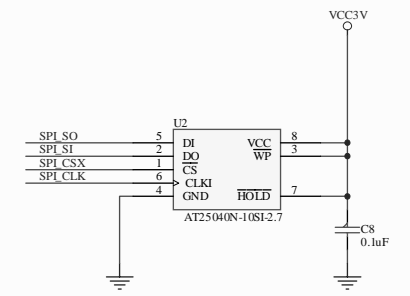
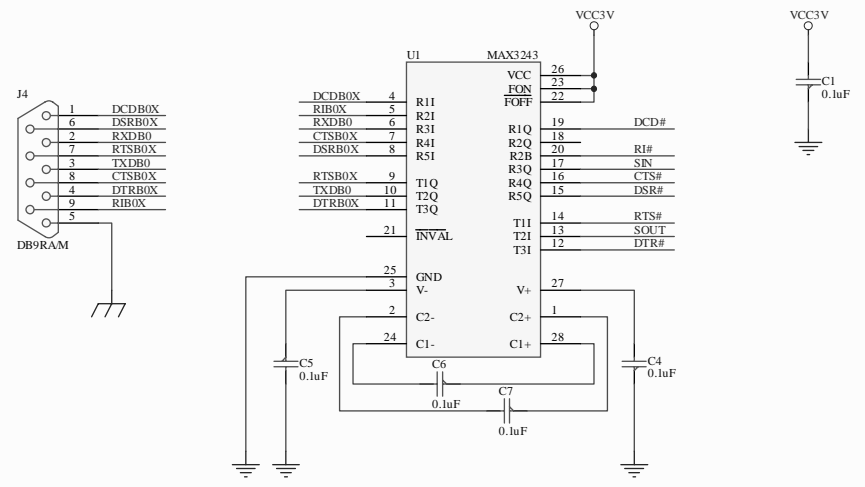
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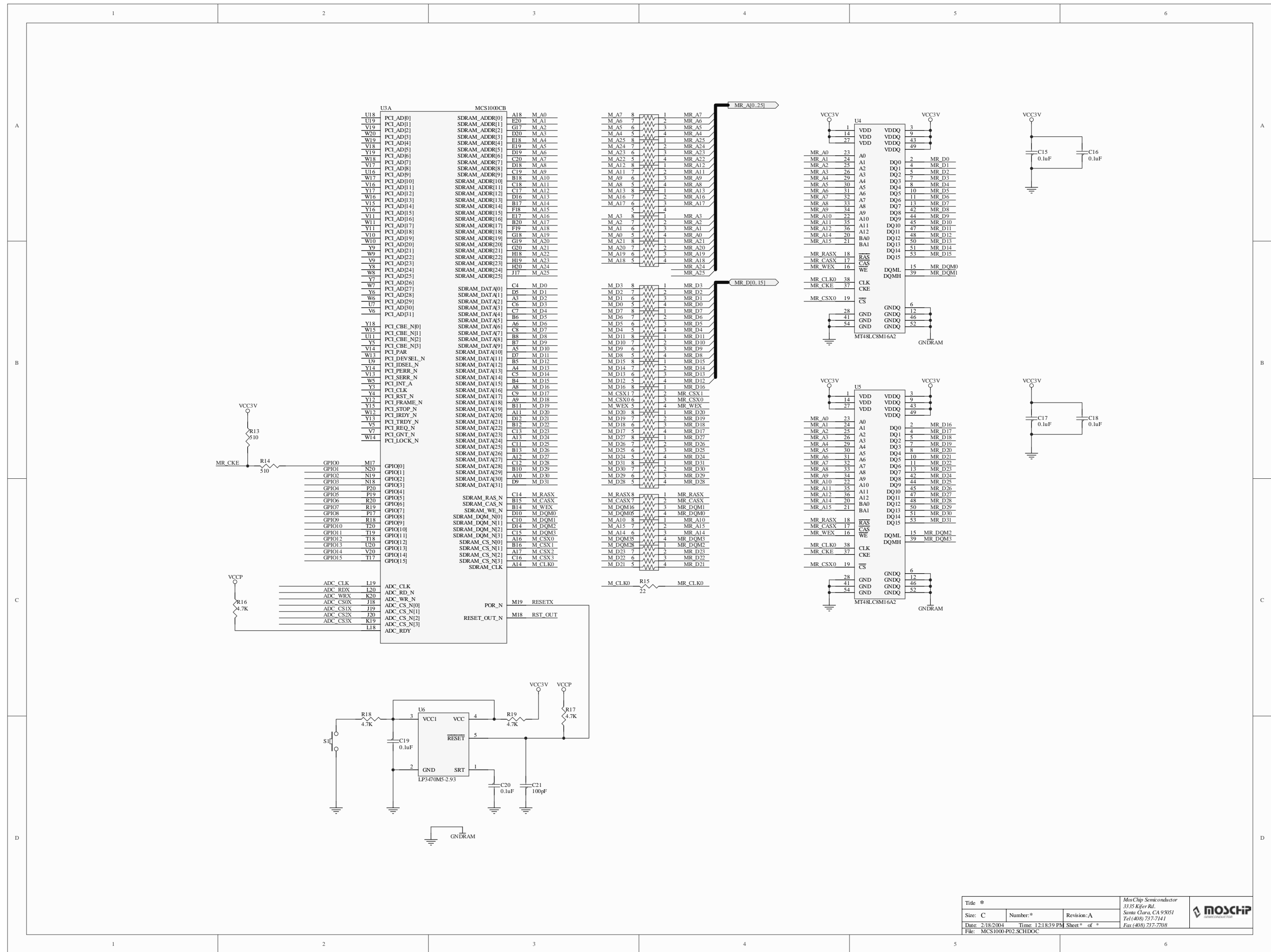
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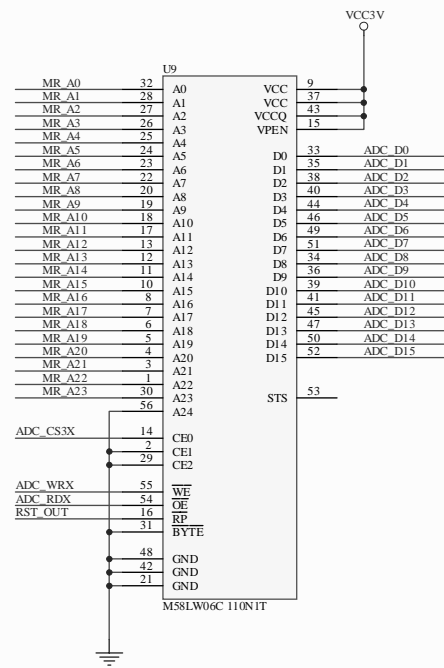
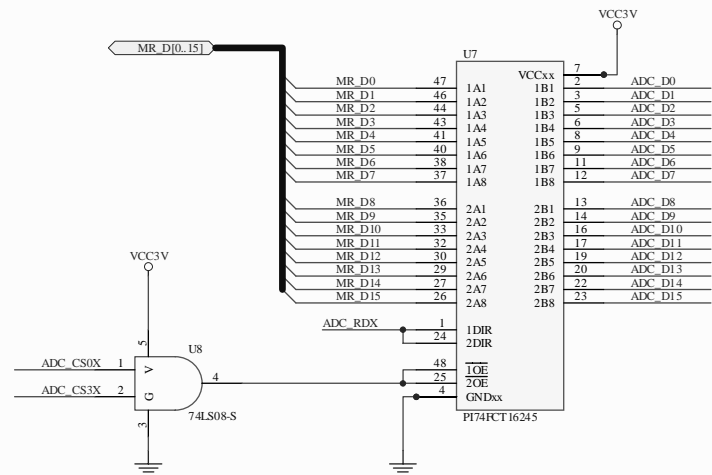
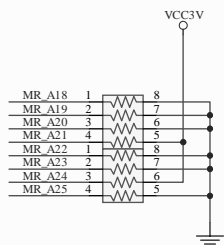
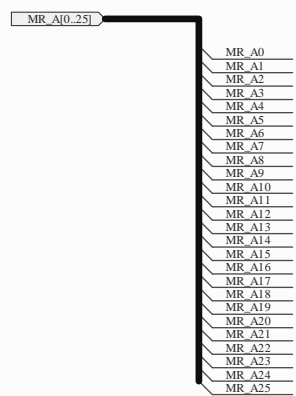
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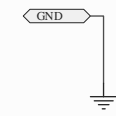
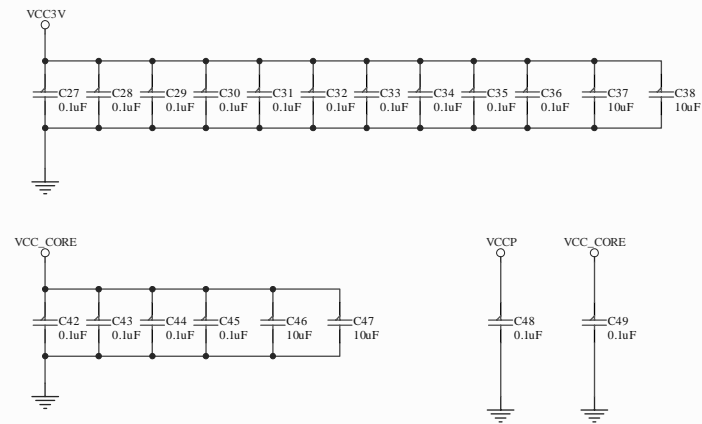
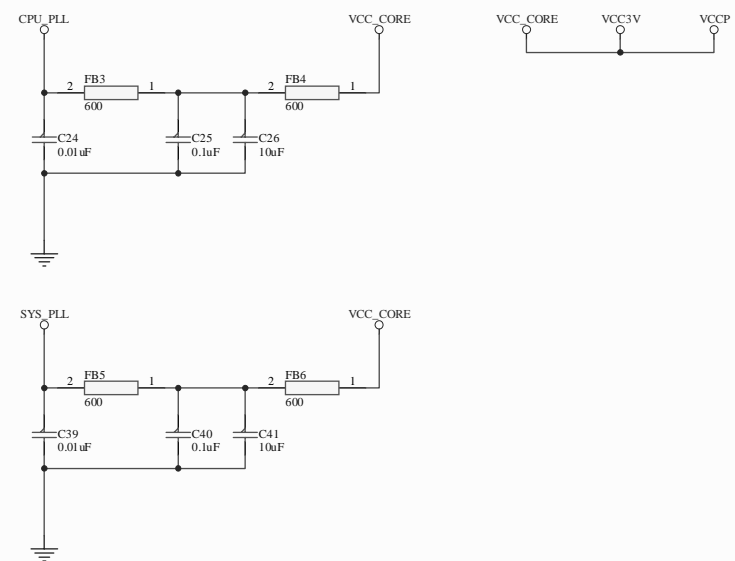
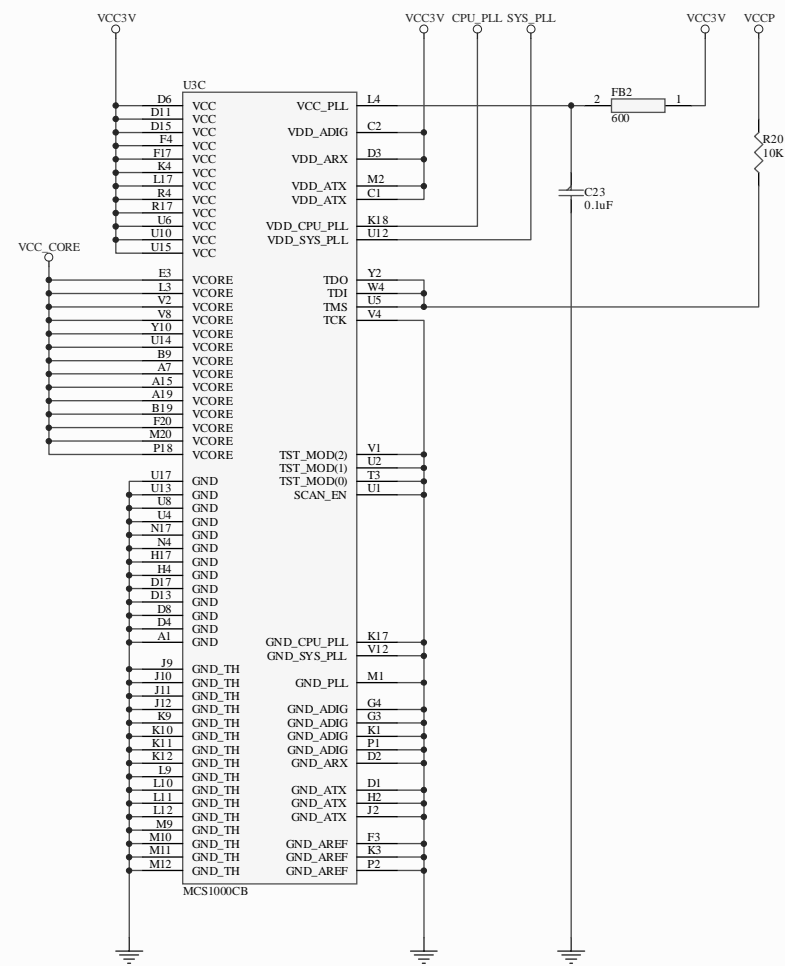
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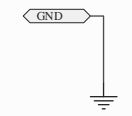
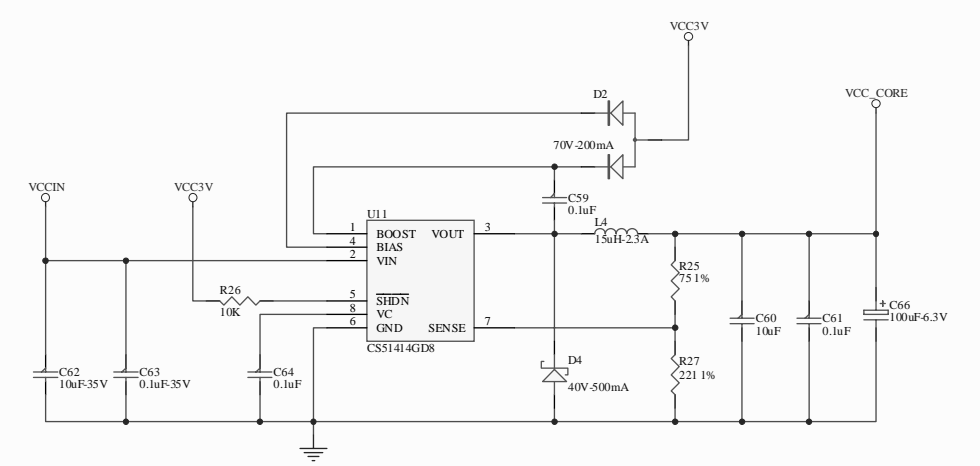
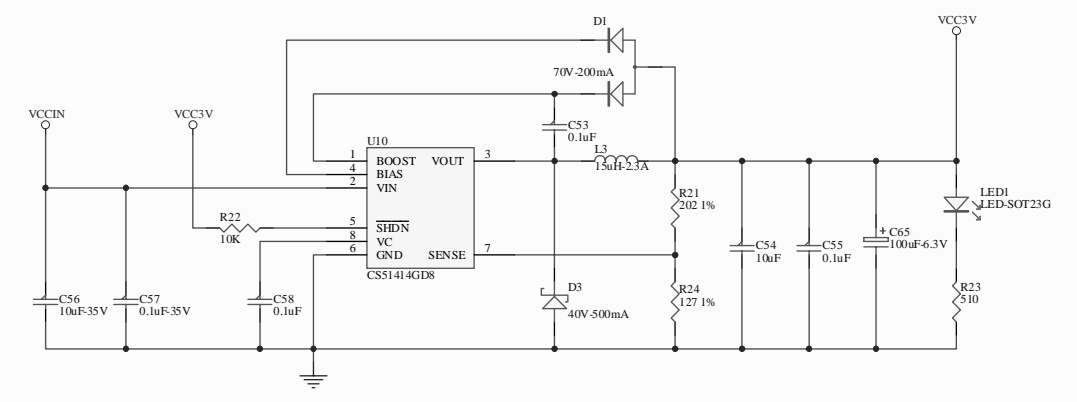
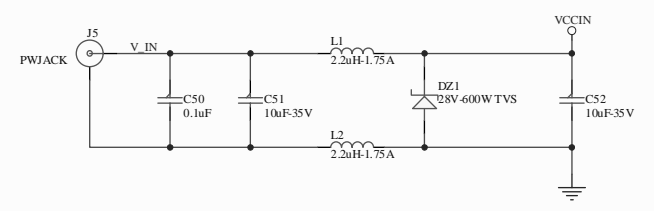
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Bill of Material for MCA1000-MIN.PrjPCB  
 On 2/19/2004 at 5:04:05 PM

Comment	Pattern	Quantity	Components	
0.01uF	603RC	2	C24, C39	Capacirtor
			C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C15, C16, C17, C18, C19, C20, C22, C23, C25, C27, C28, C29, C30, C31, C32, C33, C34, C35, C36, C40, C42, C43, C44, C45, C48, C49, C50, C53, C55,	
0.1uF	603RC	45	C58, C59, C61, C64	Capacirtor
0.1uF-35V	603RC	2	C57, C63	Capacirtor
100K	805C-ARRAY	2	RP18, RP19	8-Pin SMD Resistor Pack
100K 1%	603RC	1	R12	Resistor
100pF	603RC	1	C21	Capacirtor
100uF	E-CASE-D	2	C65, C66	Electrolytic Capacitor
10K	603RC	3	R20, R22, R26	Resistor
10uF	1206RC	8	C26, C37, C38, C41, C46, C47, C54, C60	Capacirtor
10uF-35V	1210RC	4	C51, C52, C56, C62	Capacirtor
127 1%	603RC	1	R24	Resistor
15uH-2.3A	SDR74-153	2	L3, L4	Inductor
1M	603RC	1	R10	Resistor
2.2uH-1.75A	SDR74-153	2	L1, L2	Inductor
202 1%	603RC	1	R21	Resistor
			R15, RP1, RP2, RP3, RP4, RP5, RP6, RP7, RP8, RP9, RP10, RP11,	
22	603RC	18	RP12, RP13, RP14, RP15, RP16, RP17	Resistor
221 1%	603RC	1	R27	Resistor
22pF	603RC	2	C13, C14	Capacirtor
25 MHz	HCM49	1	Y1	Crystal
28V-600W TVS	DO-214AA	1	DZ1	Zener diode
4.7K	603RC	4	R16, R17, R18, R19	Resistor
4.99K 1%	603RC	1	R11	Resistor
40V-500mA	SOD-123W	2	D3, D4	Schottky diode
510	603RC	12	R1, R2, R3, R4, R5, R6, R7, R8, R9, R13, R14, R23	Resistor
600	603RC	6	FB1, FB2, FB3, FB4, FB5, FB6	Ferrite Beads
70V-200mA	SOT-23	2	D1, D2	Diode with Common Anode
74LS08-S	SOT-23-5	1	U8	5-Pin SMT 74LS08
75 1%	603RC	1	R25	Resistor
AT25040N-10SI-2.7	SO8C	1	U2	AT25040 4K (512X8)
CS51414GD8	SO8C	2	U10, U11	CS51414G
DB9RA/M	DB9RA/M	1	J4	D-Sub 9 Pin Male Connector
LED-SOT23G	LED-SMD-3	1	LED1	LED SOT23 (GREEN)
LP3470M5-2.93	SOT-23-5	1	U6	LP3470M5
M58LW06C 110N1T	TSSOP56C	1	U9	M58LW06C 4MX16 Flash
MAX3243	TSSOP28C	1	U1	MAX3243CUI
MCS1000CB	BGA-272-1.27	1	U3	MCS1000CB
MT48LC8M16A2	TSSOP54C	2	U4, U5	MT48LC8M16A2TG SYN DRAM 2MX16X4
PI74FCT16245	TSSOP48C	1	U7	PI74FCT16245
Push button switch Nor	PB-SMD-SS-4	1	S1	Push button switch Normall Open
PWJACK	PWJACK2	1	J5	Power Jack Connector 2.5MM
RJ45-T-B	RJ45-T-B	3	J1, J2, J3	RJ45 with Transformer Tyco 1605011