

ADVANCE INFORMATION

All information in this data sheet is preliminary and subject to change.

7/95



Dual-Channel Cardbus and PCMCIA VCC/VPP Power-Switching Network

MAX1600

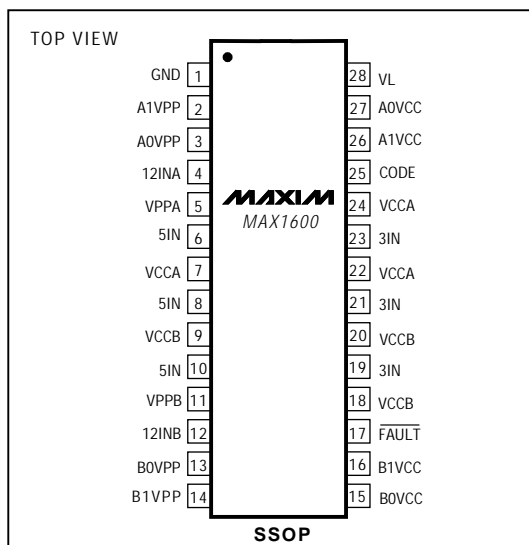
General Description

The MAX1600 DC power-switching IC contains a network of low-resistance MOSFET switches that deliver selectable VCC and VPP voltages to two Cardbus or PCMCIA host sockets. Key features include very low-resistance switches, small packaging, soft-switching action, and compliance with PCMCIA specifications for 3V/5V switching. 3.3V-only power switching for fast, 32-bit Cardbus applications is supported in two ways: stiff, low-resistance 3.3V switches allow high 3.3V load currents (up to 1A); and completely independent internal charge pumps let the 3.3V switch operate normally, even if the 5V and 12V supplies are disconnected or turned off in order to conserve power. The internal charge pumps are regulating types that draw reduced input current when the VCC switches are static. Also, power consumption is automatically reduced to 10 μ A when the control logic inputs are programmed to high-Z or GND states, unlike other solutions that may require a separate shutdown control input.

Other key features include guaranteed specifications for output current limiting level, and guaranteed specifications for output rise/fall times (in compliance with PCMCIA specifications). Reliability is enhanced by thermal overload protection, accurate current limiting, overcurrent fault flag output, undervoltage lockout, and extra ESD protection at the VCC/VPP outputs. The CMOS/TTL-logic interface is flexible, and works properly with logic input levels in excess of the positive supply rail.

The MAX1600 fits two complete Cardbus/PCMCIA switches into a space-saving, narrow (0.2", 5mm wide) shrink small-outline package.

Pin Configuration



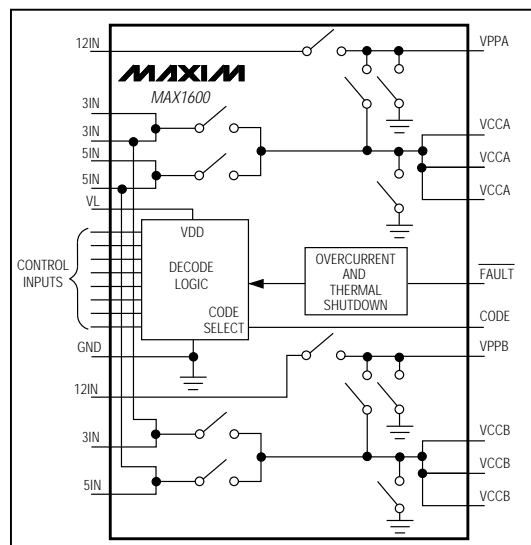
Features

- ◆ Supports Two PCMCIA/Cardbus Sockets
- ◆ 1A, 0.08 Ω Max 3.3V VCC Switch
- ◆ 1A, 0.14 Ω Max 5V VCC Switch
- ◆ Soft Switching for Low Inrush Surge Current
- ◆ Overcurrent Protection
- ◆ Overcurrent/Thermal Fault Flag Output
- ◆ Thermal Shutdown at T_J = 150°C
- ◆ Independent Internal Charge Pumps
- ◆ Break-Before-Make Switching Action
- ◆ 10 μ A Max Standby Supply Current
- ◆ 5V and 12V Not Required for Low-R_{DS(ON)} 3.3V Switching
- ◆ Complies with PCMCIA 3V/5V Switching Specifications
- ◆ Super-Small 28-Pin SSOP Package (0.2" or 5mm wide)
- ◆ Code Compatible with:
 - Cirrus CL-PD67XX Family
 - Databook DB86184
 - Intel 82365SL (industry-standard coding for most PCMCIA controller ICs)

Applications

Desktop Computers	Data Loggers
Notebook Computers	Digital Cameras
Docking Stations	Printers
Handy-Terminals	PCMCIA Read/Write Drives

Simplified Block Diagram



Dual-Channel Cardbus and PCMCIA VCC/VPP Power-Switching Network

MAX1600

ABSOLUTE MAXIMUM RATINGS

Inputs/Outputs to GND	VPPA, VPPB Short Circuit to GND.....Continuous
(VL, 3IN, 5IN, VCCA, VCCB) (Note 1)-0.3V, +6V	ESD Protection (VCC/VPP outputs)4000V Minimum
VPP Inputs/Outputs to GND	ESD Protection (other pins)2000V Minimum
(12INA, 12INB, VPPA, VPPB) (Note 1)-0.3V, +15V	Continuous Power Dissipation (T _A = +70°C)
Logic Inputs to GND (A0VCC, A1VCC, B0VCC, B1VCC,	SSOP (derate 9.52mW/°C above +70°C)762mW
A0VPP, A1VPP, B0VPP, B1VPP) (Note 1)-0.3V, +6V	Operating Temperature Ranges
CODE Input to GND.....-0.3V, (VL + 0.3V)	MAX1600CAI0°C to +70°C
VCCA, VCCB Output Current (Note 2).....2A	MAX1600EAI.....-40°C to +85°C
VPPA, VPPB Output Current (Note 2)250mA	Storage Temperature Range-65°C to +160°C
VCCA, VCCB Short Circuit to GND.....Continuous	Lead Temperature (soldering, 10sec)+300°C

Note 1: There are no parasitic diodes between any of these pins, so there are no power-up sequencing restrictions (for example, logic input signals can be applied even if all of the supply voltage inputs are grounded).

Note 2: VCC and VPP outputs are internally current-limited to safe values. See the *Electrical Characteristics* table.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

(VL = 3IN = 3.3V, 5IN = 5V, 12INA = 12INB = 12V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
POWER-SUPPLY SECTION					
Input Voltage Range	3IN, 5IN or VL	3		5.5	V
	12INA, 12INB	11		13	
Undervoltage Lockout Threshold	Falling edge, hysteresis = 1%, 3IN or 5IN	2.3	2.5	2.8	V
Standby Supply Current	3IN or 5IN, all switches 0V or high-Z, control inputs = 0V or VL	T _A = +25°C	1	10	μA
		T _A = T _{MIN} to T _{MAX}	1	20	
3IN Quiescent Supply Current	Any combination of 3IN switches on, control inputs = 0V or VL, no VCC loads		30	200	μA
5IN Quiescent Supply Current	Any combination of 5IN switches on, control inputs = 0V or high-Z, no VCC loads		35	200	μA
12IN_ Standby Supply Current	12INA tied to 12INB, all switches 0V or high-Z, control inputs = 0V or VL	T _A = +25°C	1	10	μA
		T _A = T _{MIN} to T _{MAX}		20	
12IN_ Quiescent Supply Current	12INA tied to 12INB, VPPA and VPPB 12V switches on, control inputs = 0V or VL, no VPP loads		15	100	μA
VL Standby Supply Current	All switches 0V or high-Z, control inputs = 0V or VL		3.8	10	μA
VL Quiescent Supply Current	Any combination of switches on		25	300	μA
VL Fall Rate	When using VL as shutdown pin	0.25			V/sec
VCC SWITCHES					
Operating Output Current Range	VCCA or VCCB, 3IN = 5IN = 3V to 5.5V	0		1	A
On-Resistance, 3V Switches	3IN = VL = 3V, I _{SWITCH} = 1A, T _A = +25°C		0.06	0.08	Ω
On-Resistance, 5V Switches	5IN = 4.5V, 3IN = 3V to 3.6V, I _{SWITCH} = 1A, T _A = +25°C		0.10	0.14	Ω
Output Current Limit	VCCA or VCCB	1.5		3	A
Output Sink Current	VCCA or VCCB < 0.4V, programmed to 0V state	20			mA
Output Leakage Current	VCCA or VCCB forced to 0V, high-Z state			10	μA

Dual-Channel Cardbus and PCMCIA VCC/VPP Power-Switching Network

MAX1600

ELECTRICAL CHARACTERISTICS (continued)

(VL = 3IN = 3.3V, 5IN = 5V, 12IN_A = 12IN_B = 12V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Output Propagation Delay Plus Rise Time	VCCA or VCCB, 0V to 3IN or 5IN, C _L = 30μF, R _L = 25Ω, 50% of input to 90% of output (Note 3)			10	ms
Output Rise Time	VCCA or VCCB, 0V to 3IN or 5IN, C _L = 1μF, R _L = open circuit, 10% to 90% points (Note 3)	100			μs
Output Propagation Delay Plus Fall Time	VCCA or VCCB, 3IN or 5IN to 0V, C _L = 30μF, R _L = open circuit, 50% of input to 10% of output (Note 3)			60	ms
Output Fall Time	VCCA or VCCB, 3IN or 5IN to 0V, C _L = 1μF, R _L = 25Ω, 90% to 10% points (Note 3)	3			ms
VPP SWITCHES					
Operating Output Current Range	VPPA or VPPB	0		120	mA
On-Resistance, 12V Switches	12IN = 11.6V, I _{SWITCH} = 100mA, T _A = +25°C		0.65	1	Ω
On-Resistance, VPP = VCC Switches	Programmed to 5IN (5V) or 3IN (3.3V)		1	3	Ω
Output Current Limit	VPPA or VPPB	130	200	260	mA
Output Sink Current	VPPA or VPPB < 0.4V, programmed to 0V state	10			mA
Output Leakage Current	VPPA or VPPB forced to 0V, high-Z state			10	μA
Output Propagation Delay Plus Rise Time	VPPA or VPPB, 0V to 12IN ₋ , C _L = 0.1μF, 50% of input to 90% of output (Note 3)			30	ms
Output Rise Time	VPPA or VPPB, 0V to 12IN ₋ , C _L = 0.1μF, 10% to 90% points (Note 3)	1			ms
Output Propagation Delay Plus Fall Time	VPPA or VPPB, 12IN ₋ to 0V, C _L = 0.1μF, 50% of input to 10% of output (Note 3)			60	ms
Output Fall Time	VPPA or VPPB, 12IN ₋ to 0V, C _L = 0.1μF, 90% to 10% points (Note 3)	1			ms
INTERFACE AND LOGIC SECTION					
FAULT Signal Propagation Delay	VCC ₋ or VPP ₋ , load step to FAULT output, 50% point to 50% point (Note 4)			2	μs
FAULT Output Low Voltage	I _{SINK} = 1mA, low state			0.4	V
FAULT Output Leakage Current	V _{FAULT} = 5.5V, high state	-0.5		0.5	μA
Thermal Shutdown Threshold	Hysteresis = 20°C		150		°C
Logic Input Low Voltage	__VCC, __VPP			0.6	V
Logic Input High Voltage	__VCC, __VPP	1.5			V
Code Input Low Voltage	"Cirrus" code	0		0.4	V
Code Input High Voltage	"Intel" code	VL - 0.4		VL	V
Code Input Mid-Level Voltage	"Databook" code	1.2		VL - 1.2	V
Logic Input Bias Current	__VCC, __VPP, code	-1		1	μA

Note 3: VCC/VPP timing specifications are 100% tested.

Note 4: Design target value, not production tested.

Dual-Channel Cardbus and PCMCIA VCC/VPP Power-Switching Network

Pin Description

MAX1600

PIN	NAME	FUNCTION
1	GND	Ground
2, 3	A1VPP, A0VPP	VPP Control Inputs, channel A. See <i>Logic Truth Tables</i> .
4	12INA	12V Supply Voltage Input, internally connects to channel A VPP switch. Tie to VPPA if not used.
5	VPPA	0V/VCC/12V/high-Z VPP Output (channel A). Bypass to GND with 0.01 μ F for ESD protection.
6, 8, 10	5IN	5V Supply Voltage Inputs. 5IN pins must be connected together. Input range is 3V to 5.5V.
7, 22, 24	VCCA	0V/3.3V/5V/high-Z VCC Output (channel A). Bypass to GND with 0.01 μ F for ESD protection.
9, 18, 20	VCCB	0V/3.3V/5V/high-Z VCC Output (channel B). Bypass to GND with 0.01 μ F for ESD protection.
11	VPPB	0V/VCC/12V/high-Z VPP Output (channel B). Bypass to GND with 0.01 μ F for ESD protection.
12	12INB	12V Supply Voltage Input, internally connects to channel B VPP switch. Tie to VPPB if not used.
13, 14	B0VPP, B1VPP	VPP Control Inputs, channel B. See <i>Logic Truth Tables</i> .
15, 16	B0VCC, B1VCC	VCC Control Inputs, channel B. See <i>Logic Truth Tables</i> .
17	$\overline{\text{FAULT}}$	Fault-Detection Output. $\overline{\text{FAULT}}$ goes low if either channel VCC or VPP switch is current limiting or if the thermal protection circuit is activated. $\overline{\text{FAULT}}$ is an open-drain output that requires an external pull-up resistor.
19, 21, 23	3IN	3.3V Supply Voltage Inputs. 3IN pins must be connected together. Input range is 3V to 5.5V.
25	CODE	Three-Level Code-Select Input. Reconfigures the logic decoder to one of three different code formats. See <i>Logic Truth Tables</i> . An additional 1 μ A (3 μ A max) of VL supply current will flow if CODE = mid-supply (VL/2). Low = Standard code (82365SL) High = "Cirrus" code Mid-supply = "Databook" code (tie CODE to a 1M Ω + 1M Ω resistor divider between VL and GND for "Databook" coding).
26, 27	A1VCC, A0VCC	VCC Control Inputs, channel A. See <i>Logic Truth Tables</i> .
28	VL	Logic Supply Voltage Input, usually connected to the 3.3V host system supply. Input range is 3V to 5.5V. If VL is disconnected or grounded, the device will enter standby mode. VL can be supplied via the output of a CMOS-logic gate, in order to produce an overriding shutdown. When being used as a shutdown input, VL should have an additional 0.01 μ F bypass capacitor to GND.

Dual-Channel Cardbus and PCMCIA VCC/VPP Power-Switching Network

Logic Truth Tables

MAX1600

**Table 1. "Standard" Code (82365SL),
CODE = GND**

_1VCC	_0VCC	_1VPP	_0VPP	VCC_	VPP_	MODE
0	0	0	0	GND	GND	STBY
0	0	0	1	GND	GND	STBY
0	0	1	0	GND	GND	STBY
0	0	1	1	GND	GND	STBY
0	1	0	0	3IN	GND	—
0	1	0	1	3IN	VCC_	—
0	1	1	0	3IN	12IN	—
0	1	1	1	3IN	High-Z	—
1	0	0	0	5IN	GND	—
1	0	0	1	5IN	VCC_	—
1	0	1	0	5IN	12IN	—
1	0	1	1	5IN	High-Z	—
1	1	0	0	3IN	GND	—
1	1	0	1	3IN	VCC_	—
1	1	1	0	3IN	12IN	—
1	1	1	1	3IN	High-Z	—

STBY = Standby Mode

**Table 2. "Cirrus" Code,
CODE = High (VL)**

_1VCC	_0VCC	_1VPP	_0VPP	VCC_	VPP_	MODE
0	0	0	0	High-Z	High-Z	STBY
0	0	0	1	High-Z	High-Z	STBY
0	0	1	0	High-Z	High-Z	STBY
0	0	1	1	High-Z	High-Z	STBY
0	1	0	0	5IN	GND	—
0	1	0	1	5IN	VCC_	—
0	1	1	0	5IN	12IN	—
0	1	1	1	5IN	High-Z	—
1	0	0	0	3IN	GND	—
1	0	0	1	3IN	VCC_	—
1	0	1	0	3IN	12IN	—
1	0	1	1	3IN	High-Z	—
1	1	0	0	GND	GND	STBY
1	1	0	1	GND	GND	STBY
1	1	1	0	GND	GND	STBY
1	1	1	1	GND	GND	STBY

STBY = Standby Mode

**Table 3. "Databook" Code,
CODE = Mid-Supply (VL/2)**

_1VCC	_0VCC	_1VPP	_0VPP	VCC_	VPP_	MODE
0	0	0	X	GND	High-Z	STBY
0	0	1	X	3IN	12IN	—
0	1	0	X	GND	GND	STBY
0	1	1	X	5IN	12IN	—
1	0	0	X	3IN	VCC_	—
1	0	1	X	3IN	GND	—
1	1	0	X	5IN	VCC_	—
1	1	1	X	5IN	GND	—

STBY = Standby Mode

Dual-Channel Cardbus and PCMCIA VCC/VPP Power-Switching Network

MAX1600

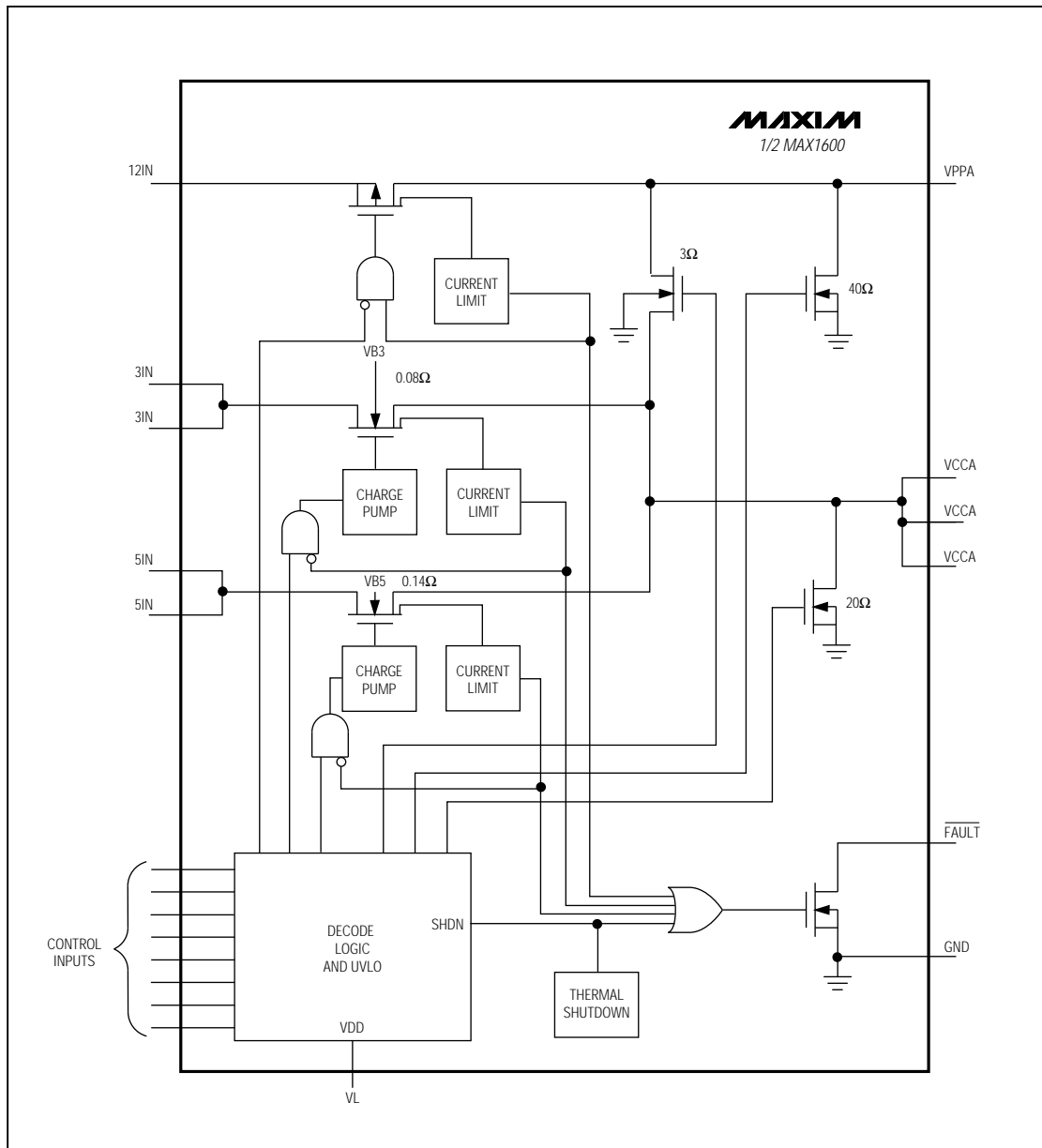


Figure 1. Detailed Block Diagram (one channel of two)

Dual-Channel Cardbus and PCMCIA VCC/VPP Power-Switching Network

MAX1600

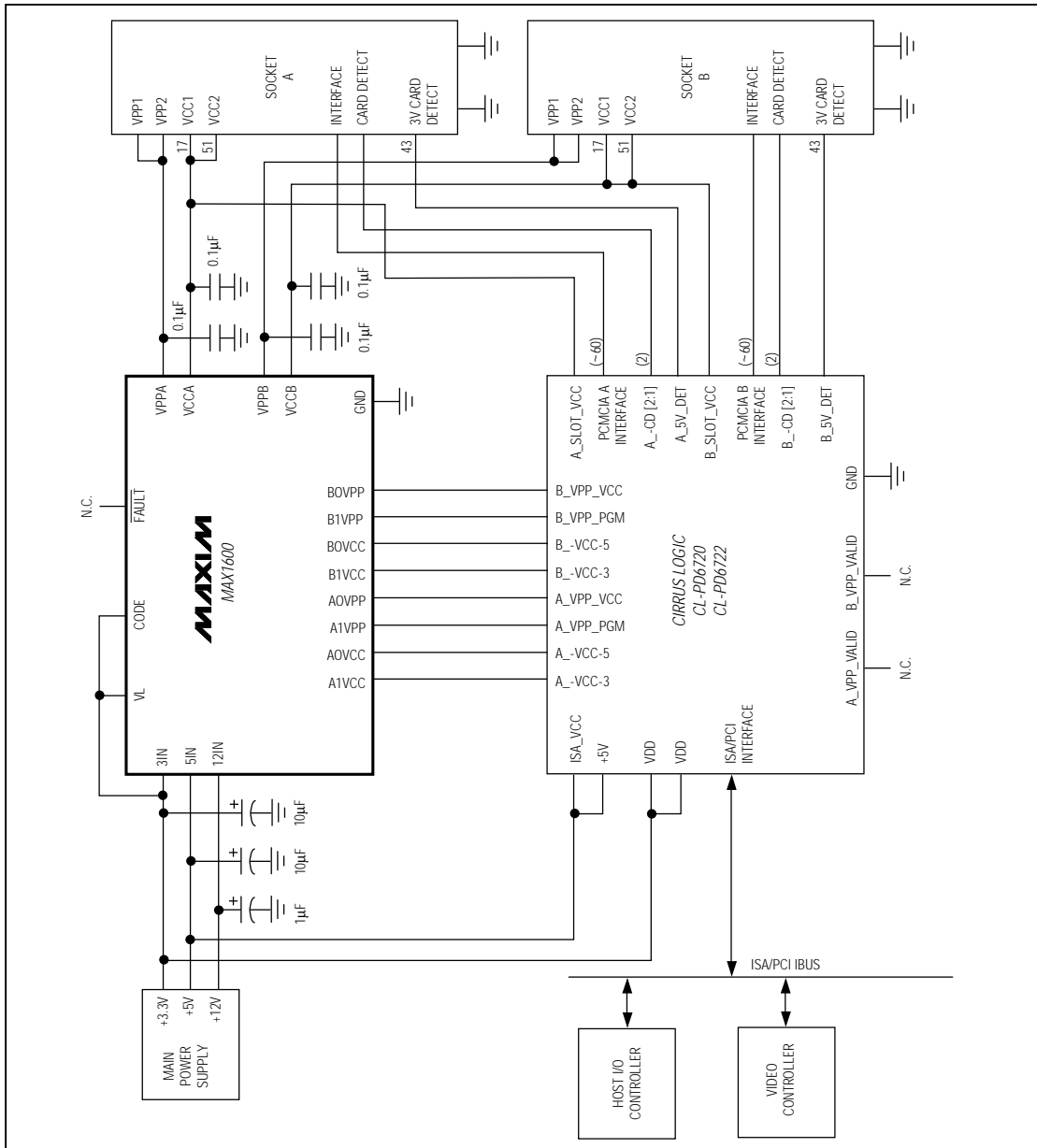


Figure 2. Application with Cirrus Logic Interface

MAX1600

Dual-Channel Cardbus and PCMCIA VCC/VPP Power-Switching Network

Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
MAX1600CAI	0°C to +70°C	28 SSOP
MAX1600C/D	0°C to +70°C	Dice*
MAX1600EAI	-40°C to +85°C	28 SSOP

* Contact factory for dice specifications.

Maxim cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim product. No circuit patent licenses are implied. Maxim reserves the right to change the circuitry and specifications without notice at any time.

8 Maxim Integrated Products, 120 San Gabriel Drive, Sunnyvale, CA 94086 (408) 737-7600

© 1995 Maxim Integrated Products

Printed USA

MAXIM is a registered trademark of Maxim Integrated Products.