SC1011
PCI Hot Plug Controller

Description

The SC1011 is a PCI Hot-Plug voltage bus control IC. It is used in computer systems to facilitate hot plugging of adapter cards into and out of an active or passive back plane. Along with discrete power MOSFETs and a few passive components, the small-size SC1011 creates a complete power control solution. Four independent supplies are controlled, +5V, +3.3V, +12V and -12V. The +12V and -12V switches are integrated. For the +5V and +3.3V supplies, overcurrent protection is provided by sensing the voltage across external current-sense resistors. For the +12V and -12V supplies, overcurrent protection is provided internally. In addition, an on-chip reference is used to monitor the +5V, +3.3V and +12V outputs for undervoltage conditions. The PWRON input controls the state of the switches. During an overcurrent condition on any output, or an undervoltage condition on the +5V, +3.3V or +12V outputs, all MOSFETs are immediately latched off and a LOW (0V) is asserted on the FLTN output. The FLTN latch is cleared when the PWRON input is toggled low again. During initial power-up of the main VCC supply (+12V), the PWRON input is inhibited from turning on the switches, and the latch is held in the Reset state until the VCC input is greater than 10V.

User programmability of the overcurrent threshold and turn-on slew rate is provided. A resistor connected to the OCSET pin programs the overcurrent threshold. Capacitors connected to the gate pins set the turn-on rate. Also, a capacitor may be added to the FLTN pin to provide noise immunity.

Features

- Controls distribution of four supplies: +5V, +3.3V, +12V and -12V
- Internal MOSFET switches for +12V and -12V outputs
- Microprocessor interface for On/Off control and fault reporting
- Adjustable overcurrent protection
- Provides fault isolation
- Adjustable turn-on slew rate
- Minimum parts count solution
- Industrial temperature range
- SO 16 pin package

Applications

- PCI Hot-Plug
- CompactPCI™

Typical Application Circuit

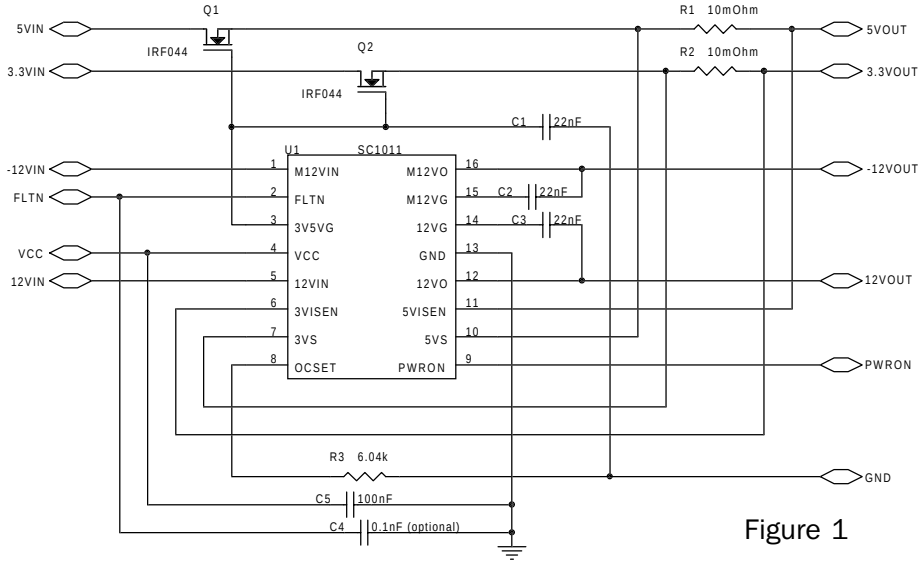


Figure 1

Absolute Maximum Ratings

Parameter	Symbol	Maximum	Units
VCC, 12VIN		-0.5 to +14.0	V
12VO		-0.5 to (12VIN + 0.5)	V
12VO, 3V5VG		-0.5 to (VCC + 0.5)	V
-12VIN		-15.0 to +0.5	V
-12VO, M12VG		(M12VIN - 0.5) to +0.5	V
3VISEN, 5VISEN		0.5 to VCC or +7.0, whichever is less	V
Unspecified Pins		-0.5 to +7.0	V
12VO Output Current		4	A
M12VO Output Current		0.8	A
Operating Ambient Temperature Range	T_A	0 to +70	°C
Operating Junction Temperature Range	T_J	0 to +125	°C
Storage Temperature Range	T_{STG}	-65 to +150	°C
Lead Temperature (Soldering) 10 Sec.	T_{LEAD}	300	°C
Thermal Resistance Junction to Case	θ_{JC}	30	°C/W
Thermal Resistance Junction to Ambient	θ_{JA}	96	°C/W
ESD Rating	ESD	2	kV
12VG		-0.5 to 12VIN	V

Electrical Characteristics

Unless specified: VCC = 12VIN = 12V; M12VIN = -12V; $T_A = T_J = 0$ to 70°C

Parameter	Symbol	Conditions	Min	Typ	Max	Units
5V/3.3V Supply Control						
5V Overcurrent Threshold	I_{OCSV}	See Figure 1	6	7.1	8.2	A
5V Overcurrent Threshold Voltage	V_{OCSV}	V_{OCSET} = 1.2V	62	71	80	mV
5V Undervoltage Trip Threshold	V_{SVUV}	C3V5VG	4.42	4.6	4.75	V
5V Undervoltage Fault Response Time	t_{SVUV}		-	150	-	ns
5V Turn-On Time (PWRON High to 5VOUT =4.75V)		C_{3V5VG} = 0.022µF, C_{SVOUT} = 2000µF, R_L = 1Ω	-	6.5	-	ms
5VS Input Bias Current	IB_{SVS}	PWRON = High	60		140	µA

Electrical Characteristics - (Cont.)

Unless specified: VCC = 12VIN = 12V; M12VIN = -12V; $T_A = T_J$ = 0 to 70°C

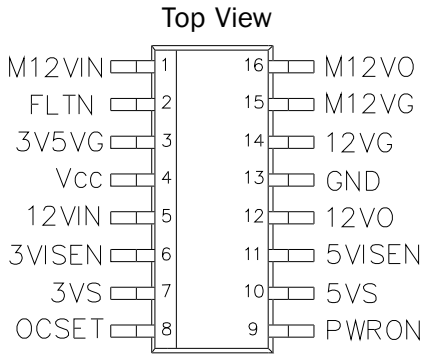
Parameter	Symbol	Conditions	Min	Typ	Max	Units
5VISEN Input Bias Current	IB_{5VISEN}	PWRON = High	0.6	1.0	1.4	mA
3V Overcurrent Threshold	I_{OC3V}	See Figure 1	8	9.0	10.5	A
3V Overcurrent Threshold Voltage	V_{OC3V}	V_{OCSET} = 1.2V	83	90	102	mV
3V Undervoltage Trip Threshold	V_{3VUV}		2.7	2.8	2.9	V
3V Undervoltage Fault Response Time	t_{3VUV}			150		ns
3V Turn-On Time (PWRON High to 3VOUT = 3.00V)		C_{3V5VG} = 0.022µF, C_{SVOUT} = 2000µF, R_L = 0.43Ω		6.5		ms
3VS Input Bias Current	IB_{3VS}	PWRON = High	60		140	µA
3VISEN Input Bias Current	IB_{3VISEN}	PWRON = High	0.6	1.0	1.4	mA
Gate Output Charge Current	IC_{3V5VG}	PWRON = High, V_{3V5VG} = 2V	22.5	25	27.5	µA
Gate Turn-On Rise Time	t_{ON3V5V}	C_{3V5VG} = 0.022µF, V_{3V5VG} 10% to 90%		10		ms
Gate Turn-Off Time	$t_{OFF3V5V}$	C_{3V5VG} = 0.022µF, 3V5VG Falling 90% to 10%		2		µs
+12V Supply Control						
On Resistance of Internal NMOS	$r_{DS(ON)12}$	PWRON = High, I_D = 0.5A, $T_A = T_J$ = 25°C	0.18	.300	0.350	Ω
Overcurrent Threshold	I_{OC12V}	V_{OCSET} = 1.2V	1.0	1.5	2.0	A
12V Undervoltage Trip Threshold	V_{12VUV}		10.3	10.6	10.9	V
Undervoltage Fault Response Time	t_{12VUV}			150		ns
Gate Charge Current	I_{C12VG}	PWRON = High, V12VG = 3V	22.5	25	27.5	µA
Output Turn-On Rise Time	t_{ON12V}	C_{12VG} = 0.022µF, R_L = 24Ω, C_L = 100µF 10% to 90%		9		ms
Turn-Off Time	t_{OFF12V}	C_{12VG} = 0.022µF, 12VG Rising 10% to 90%		3		µs
-12V Supply Control						
On Resistance of Internal NMOS	$r_{DS(ON)M12}$	PWRON = High, I_D = 0.1A, $T_A = T_J$ = 25°C	0.5	0.8	0.95	Ω
Overcurrent Threshold	I_{OCM12}	V_{OCSET} = 1.2V	0.30	0.4	0.55	A
Gate Output Charge Current	IC_{M12VG}	PWRON = High, V_{-12VG} = -4V	22.5	25	27.5	µA

Electrical Characteristics - (Cont.)

Unless specified: VCC = 12VIN = 12V; M12VIN = -12V; $T_A = T_J$ = 0 to 70°C

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Turn-On rise Time	t_{ONM12V}	C_{-12VG} = 0.022µF, C_{-12VO} = 50µF, R_L = 120Ω, M12VOUT 10% to 90%		9		ms
Turn-Off Time	$t_{OFFM12V}$	C_{-12VG} = 0.022µF, -12VG Falling 90% to 10%		5		µs
M12VIN Input bias current	IB_{M12VIN}	PWRON = High		1.4	2.6	mA
Control I/O Pins						
Supply current	I_{VCC}			7	9	mA
OCSET Current	I_{OCSET}		95	100	105	µA
Overcurrent Fault Response Time	t_{OC}			500		ns
PWRON Threshold Voltage	$V_{THPWRON}$		0.8	1.6	2.1	V
FLTN Output Low Voltage	$V_{FLTN,OL}$	I_{FLTN} = 2mA		0.3	0.9	V
FLTN Output HIgh Voltage	$V_{FLTN,OH}$	I_{FLTN} = 0 to -4mA	3.9	4.3	5.0	V
FLTN Output Latch Threshold	$V_{FLTN,TH}$		1.8	2.3	3	V
12V Power On Reset Threshold	$V_{POR.TH}$	Vcc Voltage Falling	9.4	10	10.6	V

Pin Configuration



(16-Pin SOIC)

Ordering Information

Device (1)	Package
SC1011CS.TR	SOIC-16

Note:
(1) Only available in tape and reel packaging. A reel contains 2500 devices.

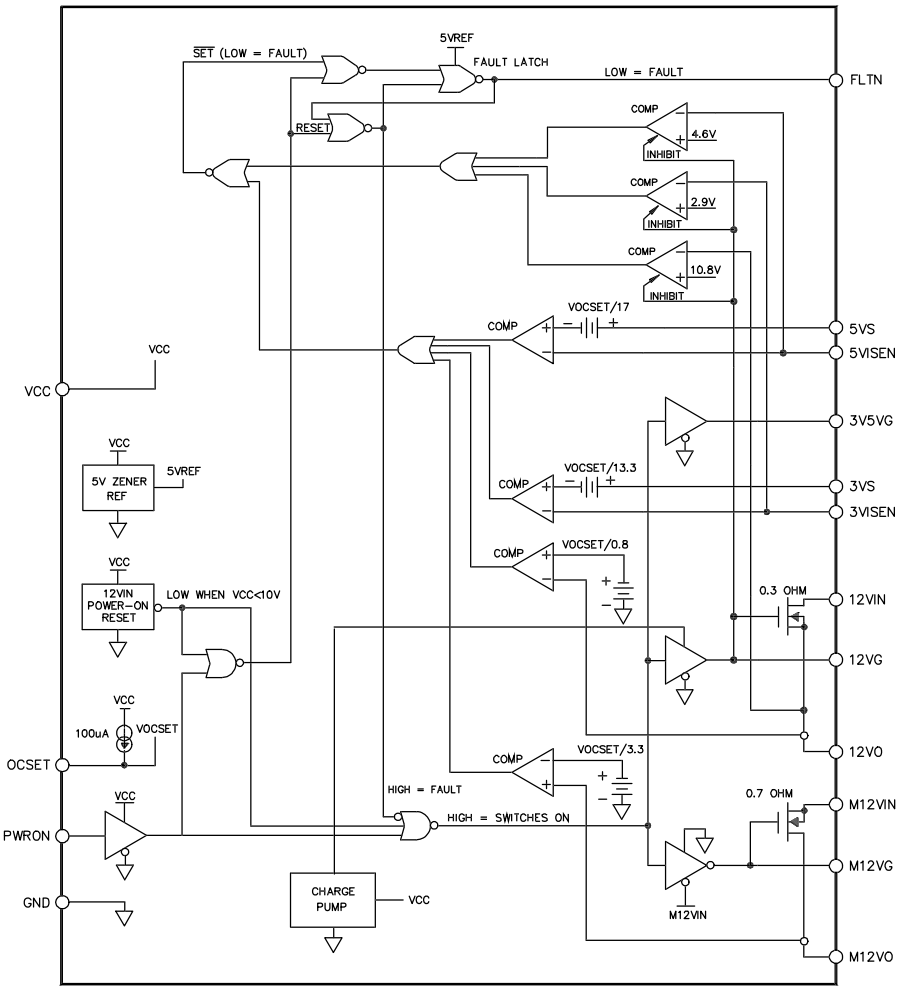
Pin Descriptions

Pin #	Pin Name	Pin Function
1	M12VIN	-12V supply input. Provides power to the -12V overcurrent circuitry.
2	FLTN	5V CMOS Fault output; LOW = FAULT. An optional capacitor may be placed from this pin to ground to provide additional immunity from power supply glitches.
3	3V5VG	Drives the gates of the 3.3V and 5V MOSFET's. Connect a capacitor to ground to set the startup ramp. During turn on, this capacitor is charged with a 25µA current source.
4	VCC	Connected to unswitched 12V supply.
5	12VIN	Switched 12V supply input
6	3VISEN	Connect to the load side of the current sense resistor in series with the source of the external 3.3V MOSFET.
7	3VS	Connect to the source of the 3.3V MOSFET. This connection along with pin 6 (3VISEN) senses the voltage drop across the sense resistor.
8	OCSET	Connect a resistor from this pin to ground to set the overcurrent trip point of all four switches. All four over current trips can be programmed by changing the value of this resistor. The default (6.04kΩ, 1%) is compatible with the maximum allowable currents as outlined in the PCI specification.
9	PWRON	Controls all four switches. HIgh to turn switches ON, Low to turn them OFF.
10	5VS	Connect to source of 5V MOSFET switch. This connection along with pin 11 (5VISNE) senses the voltage drop across the sense resistor.
11	5VISEN	Connect to the load side of the current sense resistor in series with source of external 5V MOSFET.
12	12VO	Switched 12V output. Rated for 0.5A.
13	GND	Connect to common of power supplies.

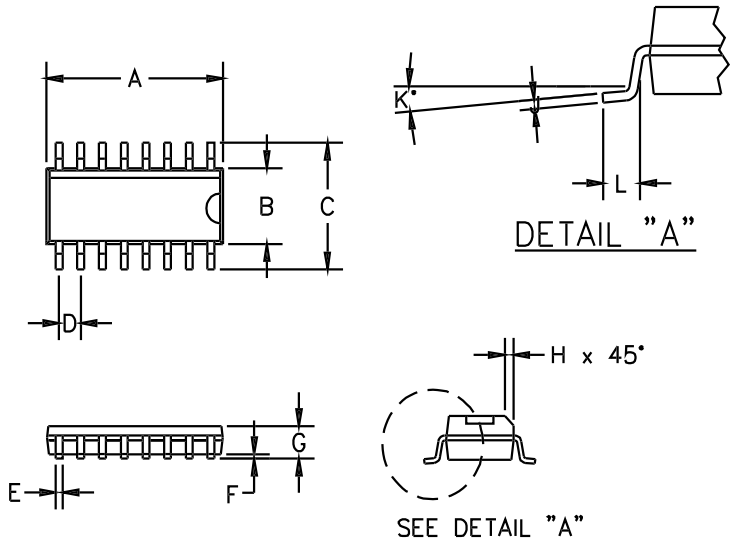
Pin Descriptions (Cont.)

Pin #	Pin Name	Pin Function
14	12VG	Connect a capacitor between 12VG and 12VO to set the start up ramp for the +12V supply. This capacitor is charged with a 25µA current source during start-up. The 3.3V and 5V UV circuitry is enabled after the voltage on 12VG is less than 400mV. Therefore, if the capacitor on the pin 3 (3V5VG) is more than 25% larger than the capacitor on pin 14 (12VG) a false UV may be detected during start-up.
15	-12VG	Connect a capacitor between M12VG and M12VO to set the start up ramp for the -12V supply. This capacitor is charged with 25µA during start up.
16	M12VO	Switched -12V output. Rated for 100mA.

Block Diagram



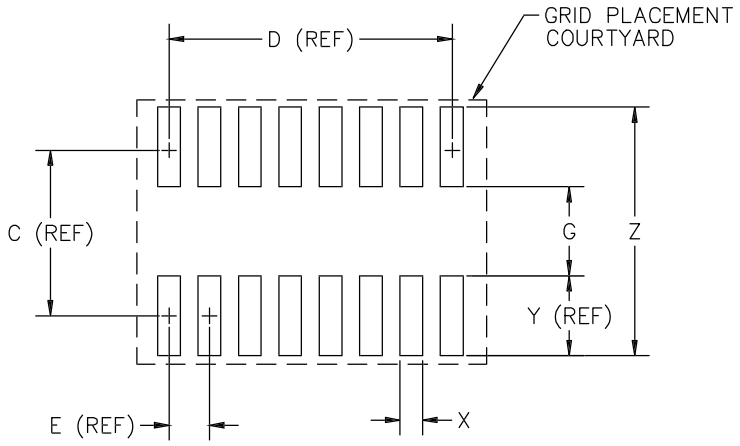
Outline Drawing - SO-16



DIMENSIONS					
DIM	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	.386	.393	9.80	10.0	[2]
B	.150	.158	3.80	4.00	[2]
C	.228	.244	5.80	6.20	–
D	.050 BSC		1.27 BSC		–
E	.013	.020	0.33	0.51	–
F	.004	.010	.10	.25	–
G	.053	.069	1.35	1.75	–
H	.010	.020	.25	.50	–
J	.007	.010	.19	.25	–
K	0°	8°	0°	8°	–
L	.016	.050	.40	1.27	–

[2] DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTUSIONS

Land Pattern - SO-16



DIMENSIONS					
DIM	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
C	–	.197	–	5.00	–
D	–	.35	–	8.89	–
E	–	.05	–	1.27	–
G	.102	.110	2.60	2.80	–
X	.02	.03	.60	.80	–
Y	–	.095	–	2.40	–
Z	.28	.29	7.20	7.40	–

[1] GRID PLACEMENT COURTYARD IS 22 X 16 ELEMENTS (11mm X 8mm) IN ACCORDANCE WITH THE INTERNATIONAL GRID DETAILED IN IEC PUBLICATION 97.

Contact Information - SO-16

Semtech Corporation
Power Management Products Division
652 Mitchell Rd., Newbury Park, CA 91320
Phone: (805)498-2111 FAX (805)498-3804