



# DATA SHEET

## **SPIF301**

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### **USB to Serial-ATA Controller**

JUL. 14, 2008

Version 1.0

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## USB 2.0 TO SERIAL-ATA HOST BRIDGE CONTROLLER

### 1. GENERAL DESCRIPTION

#### 1.1. Introduction

The SunplusIT SPIF301 is a high-quality single-chip solution for USB to Serial-ATA (SATA) host bridge controller. It features an USB high-speed device port and a SATA 1.5Gb/s host port which leads it to carry out elementary function to receive standard Mass Storage Device Class (MSDC) SCSI command from USB host and translate into ATA/ATAPI command to SATA device.

#### 1.2. Features

##### 1.2.1. Overall Features

- Single 5V power source.
- Fabricated in CMOS process with 1.8V core and 3.3V I/Os.
- Available in LQFP48-pin package.
- Integrated Memory, USB PHY and SATA PHY have isolated BIST.
- Full scan for high production test coverage
- Supports Window 2000/XP/Vista, Linux, Mac 10 OS platform.

#### 1.3. USB Features

- Compliant with USB 2.0 specification and passed USB certification.
- Supports USB high speed (480Mbps) and full speed transfer rate (12Mbps).
- Supports Mass Storage Device Class bulk only transfer.
- Supports the USB host controller for UHCI, OHCI, EHCI mode.

#### 1.4. Serial-ATA Features

- Compliant with Serial-ATA 1.0a specification.
- Supports Serial-ATA generation 1 transfer rate of 1.5Gb/s
- Supports spread spectrum in receiver

#### 1.5. Application Field

- USB External HDD
- Enclosures
- Mobil Rack
- Docking Station

### 2. REFERENCES

For more detailed information about the USB and SATA technology, please refer to the following industry specifications:

- Serial-ATA / High Speed Serialized ATA Attachment specification, Revision 1.0a.
- Universal Serial Bus Specification Revision 2.0.

### 3. BLOCK DIAGRAM

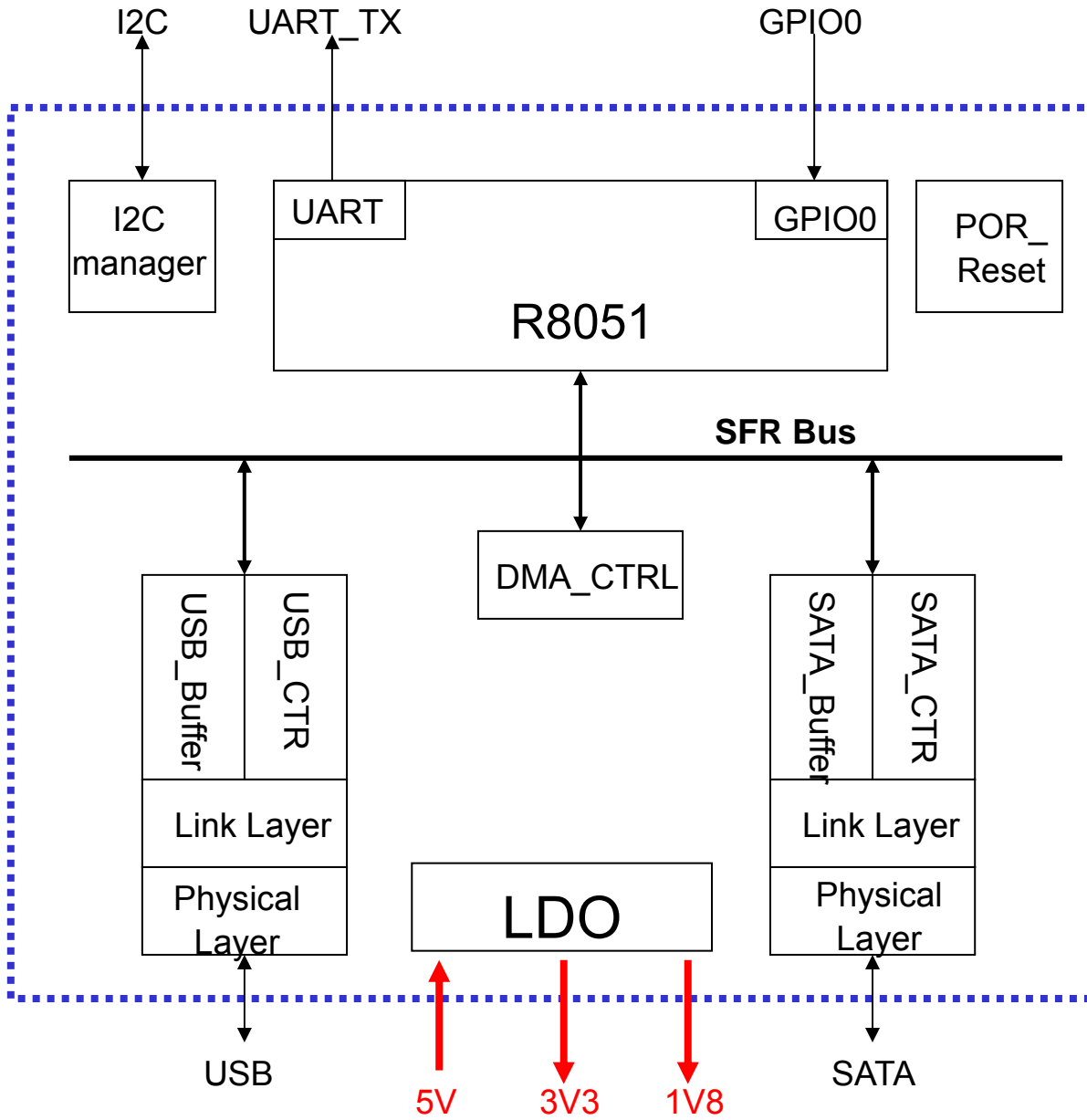


Fig 3-1: SPIF301 Functional Block Diagram

### 4. SIGNAL DESCRIPTIONS

#### 4.1. Pin Diagram

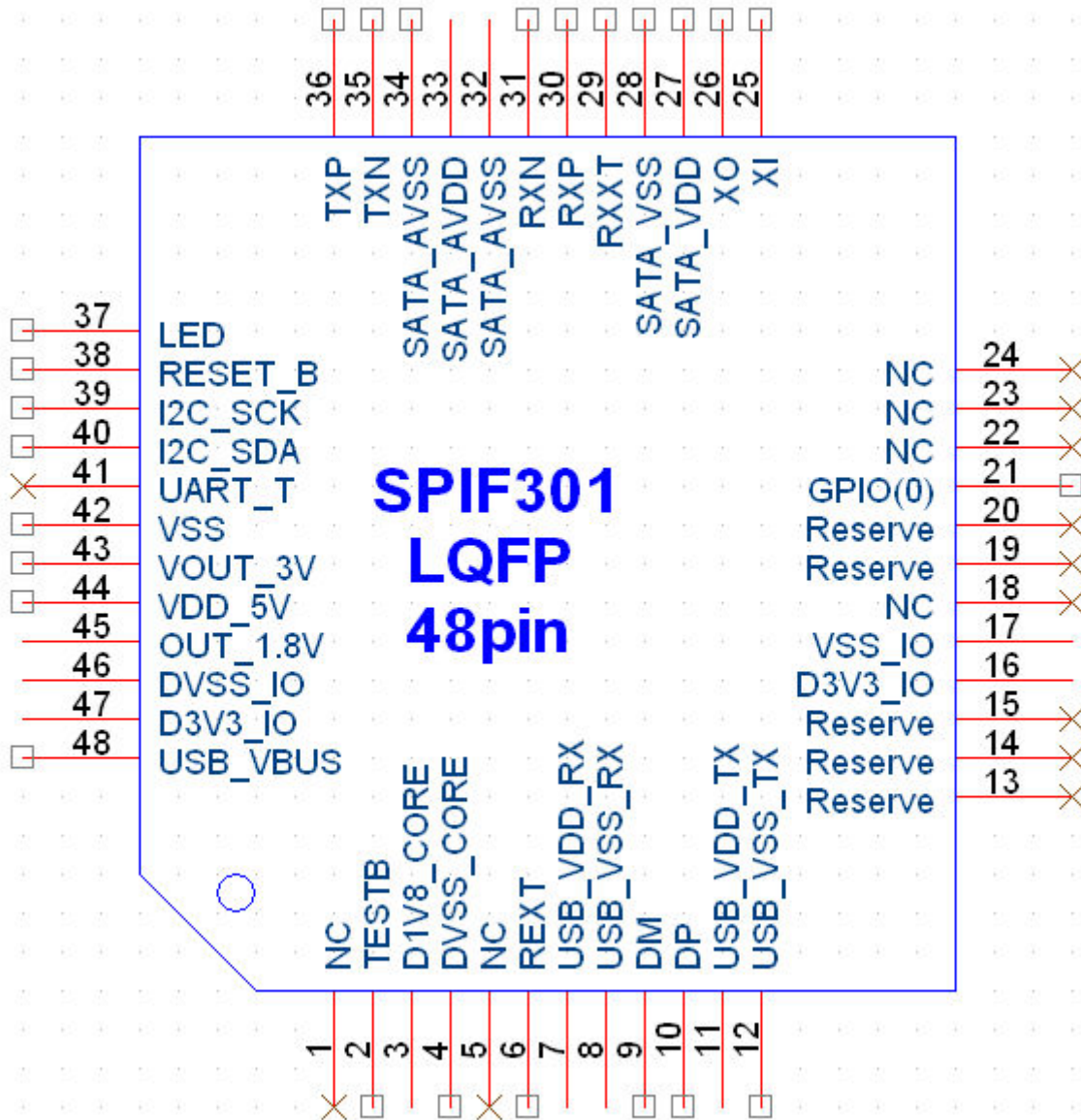


Figure 4-1 SPIF301 Pin Diagram

## 4.2. Pin Descriptions

Table 4-1: Pin Types

Pin Type	Pin Description
I/O	Bi-directional Pin
I	Input Pin
O	Output Pin
OD	Open Drain output Pin
A	Analog pin
USB	USB D+ D-
SATA	SATA TX+ TX- RX+ RX-
PWR_I	Power input
PWR_O	LDO power output
NC	NO connection

### 4.3. SPIF301 Pin Listing

Table 4-2: SPIF301 Pin Listing

Pin	Pin Name	Type	Internal resistor	Level	Pin Description
1	NC	---	---	---	
2	TESTB	I	Pull High	3.3V	Low active TEST Mode 1 (default): Normal mode    0: TEST Mode
3	D1V8_CORE	PWR_I	---	+1.8V	Digital Core Power 1.8v
4	DVSS_CORE	GND	---	0V	Digital Core Ground
5	NC	---	---	---	
6	REXT	A	---	---	USB external reference resistor input. Connect 12K ohm pull low resistor
7	USB_VDD_RX	PWR_I	---	+3.3V	USB Analog power 3.3V for PHY RX
8	USB_VSS_RX	GND	---	0 V	USB Analog ground for PHY RX
9	DM	USB	---	---	USB High Speed D-
10	DP	USB	---	---	USB High Speed D+
11	USB_VDD_TX	PWR_I	---	+3.3V	USB Analog power 3.3V for PHY TX
12	USB_VSS_TX	GND	---	0 V	USB Analog Ground for PHY TX
13	Reserve	---	---	---	
14	Reserve	---	---	---	
15	Reserve	---	---	---	
16	D3V3_IO	PWR_I	---	+3.3V	Digital 3.3V Power for IO
17	VSS_IO	GND	---	0 V	Digital Ground for IO
18	NC	---	---	---	
19	Reserve	---	---	---	
20	Reserve	---	---	---	
21	GPIO(0)	I	Pull Low	+3.3V	General purpose I/O 0
		O	---	+3.3V	
22	NC	---	---	---	
23	NC	---	---	---	
24	NC	---	---	---	
25	XI	A	---	---	SATA Crystal Oscillator Input / External Clock Input
26	XO	A	---	---	SATA Crystal Oscillator Output
27	SATA_VDD	PWR_I	---	+1.8V	SATA 1.8V Digital Power
28	SATA_VSS	GND	---	0 V	SATA Digital Ground
29	RXXT	A	---	---	SATA external reference resistor Input Connect 1K(1%) ohm pull low resistor
30	RXP	SATA	---	---	SATA Differential Receive +
31	RXN	SATA	---	---	SATA Differential Receive -
32	SATA_AVSS	GND	---	0 V	SATA Analog Ground
33	SATA_AVDD	PWR_I	---	+1.8V	SATA 1.8V Analog Power
34	SATA_AVSS	GND	---	0 V	SATA Analog Ground
35	TXN	SATA	---	---	SATA Differential Transmit -
36	TXP	SATA	---	---	SATA Differential Transmit +
37	LED	OD	---	+3.3V	HDD active LED (low active)
38	RESET B	I	Pull High	+3.3V	Low Active Reset

Pin	Pin Name	Type	Internal resistor	Level	Pin Description
39	I2C_SCL	OD	Pull High	+3.3V	I2C Clock
40	I2C_SDA	I	Pull High	+3.3V	I2C Data
		OD	Pull High	+3.3V	
41	UART_TX	O	---	+3.3V	UART TX
42	VSS	GND	---	0 V	LDO Ground
43	VOUT_3V	PWR_O	---	+3.3V	LDO 3.3 voltage output
44	VDD_5V	PWR_I	---	+5V	LDO 5 voltage input
45	VOUT_1.8V	PWR_O	---	+1.8V	LDO 1.8 voltage output (For IC internal use only)
46	DVSS_IO	PWR_I	---	0 V	Digital Ground for IO
47	D3V3_IO	GND	---	+3.3V	Digital 3.3V Power for IO
48	USB_VBUS	I	---	+3.3V	USB VBUS detect pin

Note1: Internal pull high resistor is 45Kohm in typical, internal pull low resistor is 55Kohm in typical



## 5. ELECTRICAL SPECIFICATIONS

### 5.1. Power Requirement

**Table 5-1:** Total Power Dissipation (Typical ,  $T_A = 25^\circ\text{C}$ )

Symbol	Parameter	Condition	Limits			Unit
			Min.	Typ.	Max.	
$I_{IO}$	Absolute digital I/O pad power supply	3.3V	1.0	4.5	6.0	mA
$I_{CORE}$	Absolute digital core power supply	1.8V	8	18	25	mA
$I_{AUSB}$	Absolute analog power supply for USB PHY	3.3V	0	25	30	mA
$I_{ASATA}$	Absolute analog power supply for SATA PHY	1.8V	64	68	80	mA

### 5.2. LDO DC Characteristics

**Table 5-2:** LDO DC Characteristics (Typical ,  $T_A = 25^\circ\text{C}$ )

Symbol	Parameter	Condition	Limits			Unit
			Min.	Typ.	Max.	
VDD_5V	Input voltage		4.5	5	5.5	V
VOUT_33V	3.3V output voltage	@VDD_5 = 5V	2.97	3.3	3.63	V
VOUT_1.8V	1.8V output voltage	@VDD_5 = 5V	1.71	1.8	1.91	V
I(VOUT_3.3V)	3.3V Output current	@VDD_5 = 5V, VOUT_3.3V = 3.3V			50	mA
I(VOUT_1.8V)	1.8V output current	@VDD_5 = 5V VOUT_1.8V = 1.8V			150	mA
I(VDD_5V)	5V input current	@I(VOUT_3.3V) = 50mA; I(VOUT_1.8V) = 150mA	250			mA

### 5.3. Absolute Maximum Ratings

**Table 5-3:** Absolute Maximum Ratings (Typical ,  $T_A = 25^\circ\text{C}$ )

Symbol	Parameter	Limits			Unit
		Min.	Typ.	Max.	
$V_{IO}$	Absolute digital I/O pad power supply voltage	2.97	3.3	3.63	V
$V_{CORE}$	Absolute digital power supply	1.71	1.8	1.91	V
$V_{AUSB}$	Absolute analog power supply voltage for USB PHY	2.97	3.3	3.63	V
$V_{ASATA}$	Absolute analog power supply voltage for SATA PHY	1.71	1.8	1.91	V
$T_{STR}$	Absolute storage temperature	-20	25	105	$^\circ\text{C}$

### 5.4. Recommended/Typical Operating Conditions

**Table 5-4:** Recommended/Typical Operating Conditions

Symbol	Parameter	Limits			Unit
		Min.	Typ.	Max.	
$V_{CORE}$	Operating digital power supply voltage	1.71	1.8	1.91	V
$V_{IO}$	Operating digital I/O pad supply voltage	2.97	3.3	3.63	V
$V_{AUSB}$	Operating analog power supply voltage for USB PHY	2.97	3.3	3.63	V
$V_{ASATA}$	Operating analog power supply voltage for SATA PHY	1.71	1.8	1.91	V
$T_{STR}$	Operating temperature	0	25	70	$^\circ\text{C}$

## 5.5. IO DC Characteristics

**Table 5-5: IO DC Characteristics**

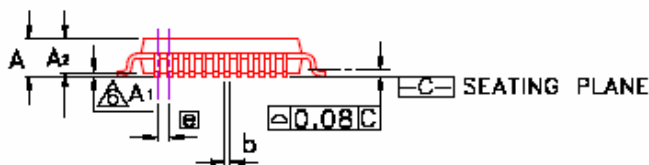
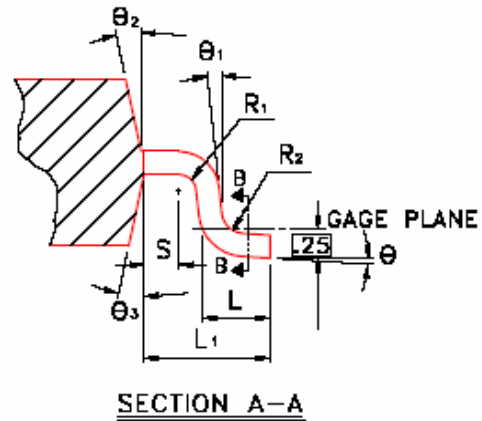
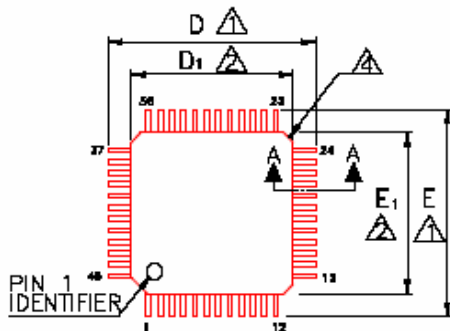
(Testing condition:  $V_{CORE} = 1.8V$ ,  $V_{AUSB} = 3.3V$ ,  $V_{ASATA} = 1.8V$ ,  $T_a = 25^{\circ}C$ , unless otherwise noted)

Symbol	Parameter	Condition	Limits			Unit
			Min.	Typ.	Max.	
$V_{IL}$	Input low voltage	CMOS	-0.3	-	0.8	V
$V_{IH}$	Input high voltage	CMOS	2.0	-	$V_{IO}+0.3$	V
$V_{TH}$	Threshold point	CMOS	1.45	1.59	1.77	V
$V_T^+$	Schmitt trig. Low to High threshold point	CMOS	1.9			V
$V_T^-$	Schmitt trig. high to low threshold point	CMOS			1.3	V
$I_I$	Input leakage current	CMOS			$\pm 10$	$\mu A$
$I_{OZ}$	Tri-state output leakage current	CMOS			$\pm 10$	$\mu A$
$R_{PU}$	Pull-up resistor	CMOS		45		$K\Omega$
$R_{PD}$	Pull-down resistor	CMOS		55		$K\Omega$
$V_{OL}$	Output low voltage	CMOS, @ $I_{OL} = 2mA$	-	-	0.4	V
$V_{OH}$	Output high voltage	CMOS @ $I_{OH} = 5mA$	2.4	-	-	V
$I_{OL}$	Low level output current	@ $V_{OL} = 0.4v$	2			mA
$I_{OH}$	High level output current	@ $V_{OH} = 2.4v$	5			mA

### 6. PACKAGE/PAD LOCATIONS

#### 6.1. Package Information

##### 6.1.1. 48 pin LQFP



Symbol	Dimension in mm			Dimension in inch		
	Min	Norm	Max	Min	Norm	Max
A	—	—	1.60	—	—	0.063
A <sub>1</sub>	0.05	—	0.15	0.002	—	0.006
A <sub>2</sub>	1.35	1.40	1.45	0.053	0.055	0.057
b	0.17	0.22	0.27	0.007	0.009	0.011
b <sub>1</sub>	0.17	0.20	0.23	0.007	0.008	0.009
c	0.09	—	0.20	0.004	—	0.008
c <sub>1</sub>	0.09	—	0.16	0.004	—	0.006
D	9.00 BSC			0.354 BSC		
D <sub>1</sub>	7.00 BSC			0.276 BSC		
E	9.00 BSC			0.354 BSC		
E <sub>1</sub>	7.00 BSC			0.276 BSC		
⊠	0.50 BSC			0.020 BSC		
L	0.45	0.60	0.75	0.018	0.024	0.030
L <sub>1</sub>	1.00 REF			0.039 REF		
R <sub>1</sub>	0.08	—	—	0.003	—	—
R <sub>2</sub>	0.08	—	0.20	0.003	—	0.008
S	0.20	—	—	0.008	—	—
θ	0°	3.5°	7°	0°	3.5°	7°
θ <sub>1</sub>	0°	—	—	0°	—	—
θ <sub>2</sub>	12°TYP			12°TYP		
θ <sub>3</sub>	12°TYP			12°TYP		

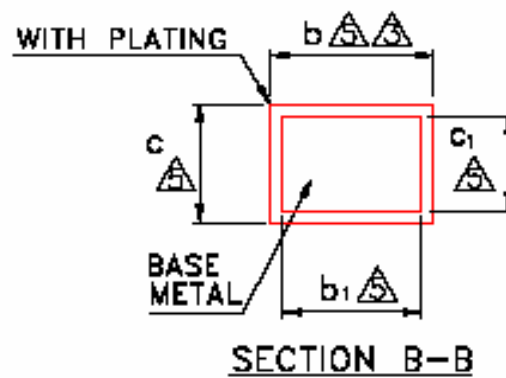
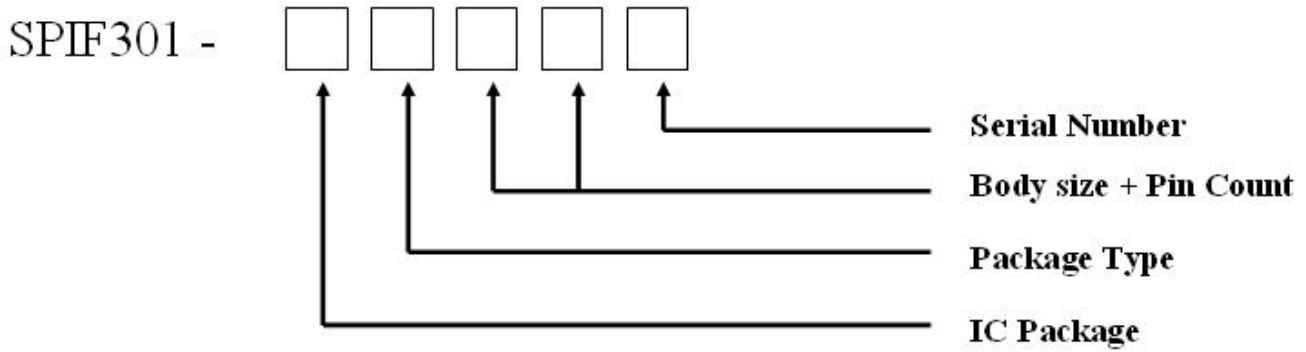


Fig 6-1: SPIF301 in LQFP-48 package

### 6.2. Ordering Information



#### IC package:

H = Green Package

#### Package Type:

L = LQFP

#### Body Size + Pin count:

23 = 48 pins (7 x 7 x 1.4 mm)

#### Serial Number: [= 1 ~ 9 ]

#### Example:

Product Number	Package Type
SPIF301 - HL23X	Green Package form - LQFP 48

### 6.3. Storage Condition and Period for Package

Package	Moisture sensitivity level	Max. Reflow temperature	Floor life storage condition	Dry pack
LQFP48	LEVEL 3	255 +5/-0°C	168Hrs @ ≤30°C/ 60% R.H.	Yes

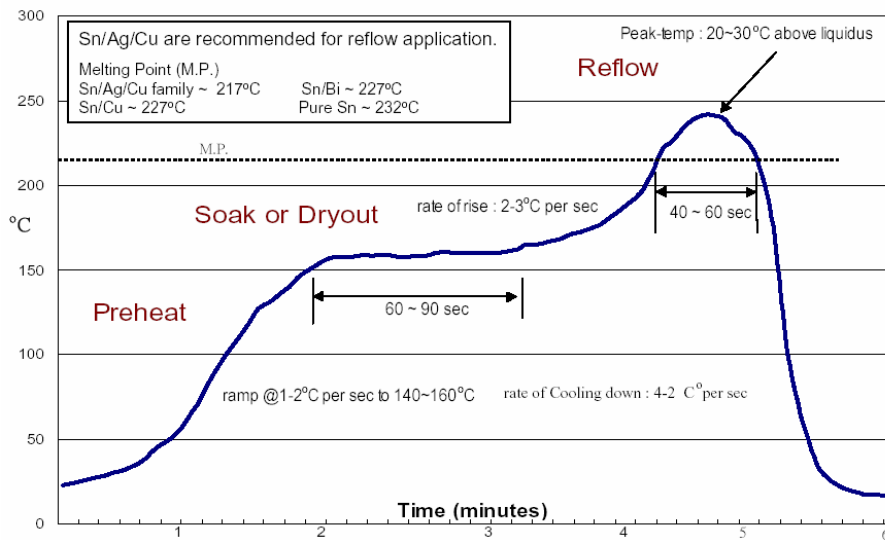
**Note1:** Please refer to the IPC/JEDEC standard J-STD-020A and the EIA JEDEC stand JESD22-A112, or the "CAUTION Note" on dry pack bag.

### 6.4. Recommended SMT Temperature Profile

This "Recommended" temperature profile is a rough guideline for SMT process reference. Most of SUNPLUSIT lead frame based product choice Matte Tin and Sn/Bi for plating recipe. For

PPF(Pre-Plated Frame) product with 63/37 solder paste, we recommend 240°C~245°C for peak temperature.

### Recommended Reflow Profile for Lead-free Solder Paste or PPF lead frame



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### 8. REVISION HISTORY

Date	Revision #	Description	Page
2008/07/14	1.0	SPIF301 data sheet initial version	16