Standard of Japan Electronics and Information Technology Industries Association

1.2V±0.1V (normal range) and 0.8V to 1.3V (wide range) Power supply voltage and interface standard for non-terminated digital integrated circuits

1. Interface Standard

1.1 Purpose

To provide this standard of specification for uniformity, multiplicity of sources, elimination of confusion, and ease of device specification and design by users.

1.2 Scope

This standard defines power supply voltage ranges, DC interface parameters for a family of non-terminated digital circuits operating from a power supply of 1.2V and driving/driven by parts of the same family, or mixed families which comply with the input/output interface specifications.

The specifications in this standard represent a minimum set or "base line" set of interfaces for CMOS-compatible circuits.

2. Standard specifications

All voltages listed are referenced to ground except where noted.

2.1 Absolute maximum continuous ratings

Table 1 Absolute maximum continuous ratings Note 1

Parameter	Symbol	Test condition	Rating	Unit
Power supply voltage	V_{DD}		-0.5~1.8	V
DC input voltage	V_{IN}	excluding I/O pins	-0.5~V_{DD}+0.5(≤1.8 max)	V
DC output voltage	V_{OUT}	including I/O pins	-0.5~V_{DD}+0.5(≤1.8 max)	V
DC input current	I_{IN}	V_{IN}<0V or V_{IN}>V_{DD}	±20	mA
DC output current	I_{OUT}	V_{OUT}<0V or V_{OUT}>V_{DD}	±20	mA
Storage temperature range	T_{STG}		Note 2	° C

Note 1: Absolute maximum ratings indicate the values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond thereof may adversely affect device reliability. Even within the ratings above, no functional operation is guaranteed if the device is not operated under recommended operating conditions.

Note 2: To be specified by manufacturers.

2.2 Recommended operating conditions

2.2.1 Normal range

Table 2 Normal range

Parameter	Symbol	Operating range	Unit
Power supply voltage	V_{DD}	1.1~1.3	V
Operating temperature range	T_a	Note 3	° C

Note 3:To be specified by manufacturers.

2.2.2 Wide range

Table 3 Wide range

Parameter	Symbol	Operating range	Unit
Power supply voltage	V_{DD}	0.8~1.3	V
Operating temperature range	T_a	Note 4	° C

Note 4:To be specified by manufacturers.

2.3 DC specifications

All specifications in the following tables apply across the operating temperature range.

2.3.1 Normal range

Table 4 Normal range Note 5

Parameter	Symbol	Test condition	Min	Max	Unit
Power supply voltage	V_{DD}		1.1	1.3	V
High-level input voltage	V_{IH}	$V_{OUT} \geq V_{OH}$ (min)	0.65 V_{DD}	V_{DD} +0.3	V
Low-level input voltage	V_{IL}	$V_{OUT} \leq V_{OL}$ (max)	-0.3	0.35 V_{DD}	V
High-level output voltage	V_{OH}	I_{OH}=-2mA	0.75V_{DD}		V
Low-level output voltage	V_{OL}	I_{OL}= 2mA		0.25 V_{DD}	V

Note 5: V_{DD} of the sending and receiving devices must track within 0.1V to maintain adequate DC margins.

2.3.2 Wide range

Table 5 Wide range Note 6

Parameter	Symbol	Test condition	Min	Max	Unit
Power supply voltage	V_{DD}		0.8	1.3	V
High-level input voltage	V_{IH}	$V_{OUT} \geq V_{OH}$ (min)	0.7 V_{DD}	V_{DD} +0.3	V
Low-level input voltage	V_{IL}	$V_{OUT} \leq V_{OL}$ (max)	-0.3	0.3 V_{DD}	V
High-level output voltage	V_{OH}	I_{OH}=-100 μ A	V_{DD}-0.1		V
Low-level output voltage	V_{OL}	I_{OL}= 100 μ A		0.1	V

Note 6: V_{DD} of the sending and receiving devices must track within 0.1V to maintain adequate DC margins.

2.4 Optional DC electrical characteristics for Schmitt trigger operation

All specifications in the following tables apply across the operating temperature range.

2.4.1 Optional Schmitt trigger operation - Normal range

Table 6 Normal range Note 10 and 11

Symbol	Parameter	Test Condition	MIN	MAX	Unit
V_{DD}	Supply Voltage	---	1.1	1.3	V
Vt+ (Vp)	Positive Going Threshold Voltage	$V_{OUT} \geqq V_{OH}$ (min)	$0.4V_{DD}$	$0.7V_{DD}$	V
Vt− (Vn)	Negative Going Threshold Voltage	$V_{OUT} \leqq V_{OL}$ (max)	$0.3V_{DD}$	$0.6V_{DD}$	V
VH (⊿Vt)	Hysteresis Voltage	Vt+ − Vt−	$0.1V_{DD}$	$0.4V_{DD}$	V
V_{OH}	Output High Voltage	I_{OH}= −2mA	$0.75V_{DD}$	—	V
V_{OL}	Output Low Voltage	I_{OL}= 2mA	—	$0.25V_{DD}$	V

Note 10: VDD of the sending and receiving devices must track within 0.1 V to maintain adequate dc margins.
Note 11: For Vt+ (Vp) and Vt- (Vn), VDD refers to the receiving device. For VOH and VOL, VDD refers to the sending device.

2.4.2 Optional Schmitt trigger operation - Wide range

Table 7 Wide range Note 12 and 13

Symbol	Parameter	Test Condition	MIN	MAX	Unit
V_{DD}	Supply Voltage	---	0.8	1.3	V
Vt+ (Vp)	Positive Going Threshold Voltage	$V_{OUT} \geqq V_{OH}$ (min)	$0.35V_D$	$0.75V_{DD}$	V
Vt− (Vn)	Negative Going Threshold Voltage	$V_{OUT} \leqq V_{OL}$ (max)	$0.25V_{DD}$	$0.65V_{DD}$	V
VH (⊿Vt)	Hysteresis Voltage	Vt+ − Vt−	$0.1V_{DD}$	$0.5V_{DD}$	V
V_{OH}	Output High Voltage	I_{OH}= −100 μA	V_{DD}−0.1	—	V
V_{OL}	Output Low Voltage	I_{OL}= 100 μA	—	0.1	V

Note 12: VDD of the sending and receiving devices must track within 0.1 V to maintain adequate dc margins.
Note 13: For Vt+ (Vp) and Vt- (Vn), VDD refers to the receiving device. For VOH and VOL, VDD refers to the sending device.

3 Test conditions

3.1 Positive Going Threshold Voltage : Vt+ (Vp)

Input signal is raised from a grand level in the measurement circuit shown in Fig. 1 , and the input voltage value of which output logic changed is determined as Vt+ (Vp).

3.2 Negative Going Threshold Voltage : Vt- (Vn)

Input signal is dropped from a power supply voltage level in the measurement circuit shown in Fig. 1 , and the input voltage value of which output logic changed is determined as Vt- (Vn).

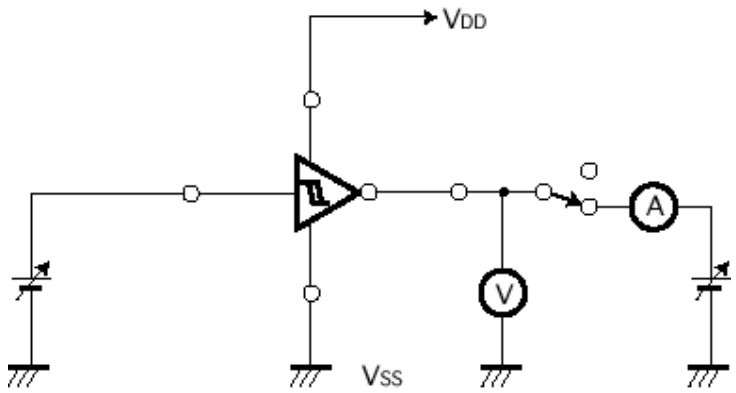

Fig. 1 DC characteristic measurement circuit of Schmitt-trigger input

Explanatory note

1. Purpose of establishment

This standard is established to achieve high speed and low voltage operation of digital integrated circuits.

It defines power supply voltage ranges, DC interface parameters for a family of non-terminated digital circuits operating from a power supply of 1.2V and driving/driven by parts of the same family, or mixed families which comply with the input/output interface specifications.

Electronic Industries Association of Japan (**EIAJ**) and the Japan Electronic Development Association (**JEIDA**) have been merged effective on November 1, 2000, and become the Japan Electronics and Information Technology Industries Association (**JEITA**).

2. Review of discussion history

JEDEC JC-16 (Low Voltage & High Speed Interface Sub-committee) in U.S.A, hereinafter called **JEDEC**, has committed to establish international standard of power supply voltage for digital circuits as a leader of the industry.

IC Low Voltage Operation Sub-committee, hereinafter called **LVSC** which was founded in 1992 as one of sub-committees of **EIAJ** and presently belongs to **JEITA** has cooperated with **JEDEC** and communicated mutually since its foundation.

For a long time, power supply voltage of digital circuits had been kept at 5V in general since 80's. However, in 90's, demand for low power supply voltage has surged to achieve low power consumption and high noise immunity of electric equipment, mainly in portable equipment (notebook PC, etc.) application, which requires longer battery life, and in high-performance equipment (WS, etc.) application, which requires faster response.

In 90's, a decade of deep sub-micron process technology (below 0.5μm process technology) has arrived. Low power supply voltage has become crucial issue to ensure reliability while offering high density and high speed.

Based on the aforementioned background, **JEDEC** started discussion on standard of low power supply voltage. First, in early 90's they started from the discussion on standard of 3.3V. As a result, 3.3V standard (**JESD8-A**) was established in June 1994 and consequently 2.5V standard (**JESD8-5**) in October 1995, 1.8V standard (**JESD8-7**) in February 1997 and 1.5V standard (**JESD8-11**) in October 2000.

LVSC also began the discussion on standard of low power supply voltage in April 1996, following **JEDEC**. It was encompassing penetration of 3.3V standard and delivery of much lower voltage standard from the second half of 90's. **JEITA** announced 3.3V standard (**EIAJ ED-5001**), 2.5V standard (**EIAJ ED-5002**) and 1.8V standard (**EIAJ ED-5003**) in May 1998 and the 1.5V standard (**EIAJ ED-5004**) in June 2000. Figures of these standards shall be identical to those of **JEDEC** in order to deliver unified symbols for above **JEDEC** standards.

Discussion on 1.2V standard was started by both **JEDEC** and **LVSC** in December 1999. **LVSC**

submitted its proposed 1.2V standard to **JEDEC** in June 2000. Accordingly **JEDEC** approved 1.2V standard, which reflects the proposal of **LVSC** at the **JEDEC** meeting in September 2000. However, regarding to absolute maximum ratings, **JEDEC**'s proposal was adopted.

Based on the result of **JEDEC** meeting, **JEITA**'s standard of 1.2V power supply voltage was finalized in February 2001.

This standard consists of normal range for regulated operation and wide range for battery operation, taking in consideration of 0.13 μ m class IC.

After standardizing the dc standard, discussion on Schmitt trigger input standard was started by JEITA / LVSC in February 2003. JEITA/LVSC submitted its proposed Schmitt trigger input standard to JEDEC in March 2004, for the first time. JEDEC's discussion on Schmitt trigger input standard was begun by this proposal. The task-group was organized by JEITA / LVSC and JEDEC at the JEDEC meeting in June 2004. It has decided that the proposal of Schmitt trigger standard to be added into existing dc standard. Finally, the proposal of Schmitt trigger input standard was approved at the JEDEC meeting in December 2004. Based on the result of JEDEC meeting, JEITA's revised standard of 1.2V power supply voltage was revised as ED-5005A in May 2005.

3. Members of discussion

This standard was discussed and determined by the IC Low Voltage Operation Sub-committee, which belongs to the Group on Integrated Circuits of Technical Standardization Committee on Semiconductor Devices.

The members are as listed below.

＜Technical Standardization Committee on Semiconductor Devices＞

Chairman	Hisao Kasuga	NEC Corp.

＜Group on Integrated Circuits＞

Chairman	Hisao Kasuga	NEC Corp.

＜IC Low Voltage Operation Sub-Committee＞

Chairman	Haruyoshi Takaoka	Fujitsu Ltd.
Vice-chairman	Kohji Hosokawa	IBM Japan, Ltd.
Member	Masahiro Kurimoto	Oki Electric Industry Co.,Ltd.
	Hidemitsu Baba	SANYO Electric Co.,Ltd.
	Koji Inoue	Sharp Corp.
	Akira Nakada	Seiko Epson Corp.
	Mitsuo Soneta	Sony Corp.
	Masanori Kinugasa	Toshiba Corp.
	Takashi Akioka	Renesas Corp.
	Takefumi Yoshikawa	Matsushita Electric Industrial Co.,Ltd.
	Akitoshi Watanabe	Rohm Co.,Ltd.
Guest	Kazuo Yamaguchi	TOSHIBA LSI System Support Corp.
	Osamu Uno	Fujitsu VLSI Ltd.