Standard of Japan Electronics & Information Technology Industries Association

1.0V±0.1V (normal range) and 0.7V to 1.1V(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 1.0V 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}		-0.4~1.4	V
DC input voltage	V_{IN}	excluding I/O pins	-0.4~V_{DD}+0.4(≤1.4 max) Note 2	V
DC output voltage	V_{OUT}	including I/O pins	-0.4~V_{DD}+0.4(≤1.4 max) Note 2	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 3	°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:The maximum voltage allowed between any two signal (input, output or input/output) pins or any signal pin and V_{DD} must be less than 1.6V.

Note 3: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}	0.9~1.1	V
Operating temperature range	T_a	Note 4	°C

Note 4:To be specified by manufacturers.

2.2.2 Wide range

Table 3 Wide range

Parameter	Symbol	Operating range	Unit
Power supply voltage	V_{DD}	0.7~1.1	V
Operating temperature range	T_a	Note 5	°C

Note 5: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 6 and 7

Parameter	Symbol	Test condition	Min	Max	Unit
Power supply voltage	V_{DD}		0.9	1.1	V
High-level input voltage	V_{IH}	$V_{OUT} \geq V_{OH}$ (min)	0.65 V_{DD}	V_{DD} +0.2	V
Low-level input voltage	V_{IL}	$V_{OUT} \leq V_{OL}$ (max)	-0.2	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 6:V_{DD} of the sending and receiving devices must track within 0.1V to maintain adequate DC margins.

Note 7:For V_{IH} and V_{IL}, V_{DD} refers to the receiving device. For V_{OH} and V_{OL}, V_{DD} refers to the sending device.

2.3.2 Wide range

Table 5 Wide range Note 8 and 9

Parameter	Symbol	Test condition	Min	Max	Unit
Power supply voltage	V_{DD}		0.7	1.1	V
High-level input voltage	V_{IH}	$V_{OUT} \geq V_{OH}$ (min)	0.7 V_{DD}	V_{DD}+0.2	V
Low-level input voltage	V_{IL}	$V_{OUT} \leq V_{OL}$ (max)	-0.2	0.3 V_{DD}	V
High-level output voltage	V_{OH}	I_{OH}=-100 μA	V_{DD}-0.1		V
Low-level output voltage	V_{OL}	I_{OL}= 100 μA		0.1	V

Note 8:V_{DD} of the sending and receiving devices must track within 0.1V to maintain adequate DC margins.

Note 9:For V_{IH} and V_{IL}, V_{DD} refers to the receiving device. For V_{OH} and V_{OL}, V_{DD} refers to the sending device.

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	---	0.9	1.1	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	---	0.7	1.1	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.

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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).

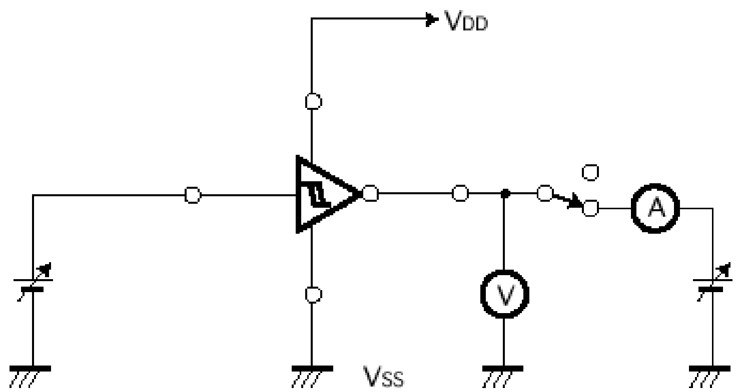

Fig. 1 DC characteristic measurement circuit of Schmitt-trigger input

Explanatory note

1. Purpose of establishment

This standard is established to achieve a high speed and a low voltage operation of digital integrated circuits. This standard defines power supply voltage ranges, DC interface parameters for a family of non-terminated digital circuits operating from a power supply of 1.0V and driving/driven by parts of the same family, or mixed families which comply with the input/output interface specifications.

2. Review of discussion history

Discussion on 1.0V standard was started by Low Voltage IC Operation Sub-committee of JEITA(Japan Electronics & Information Technology Industries Association), hereinafter called JEITA/LVSC, in August 2000. JEITA/LVSC submitted its proposed 1.0V standard to JEDEC JC-16 (Low Voltage & High Speed Interface Sub-committee) in U.S.A, hereinafter called JEDEC, in December 2000, for the first time.

JEDEC's discussion on 1.0V standard was begun by this proposal. The 1.0V task-group was organized by JEITA/LVSC and JEDEC at the JEDEC meeting in June 2001. It made the proposal of unified 1.0V standard that reflected the proposal of JEITA/LVSC and JEDEC, respectively and submitted to JEDEC. Finally, the proposal of unified 1.0V standard was approved at the JEDEC meeting in September 2001. Based on the result of JEDEC meeting, JEITA's standard of 1.0V power supply voltage was finalized in February 2002. This standard consists of normal range for high speed operation and wide range for low power consumption operation, taking in consideration of 0.1μm class IC. Figures of these standards shall be identical to those of JEDEC in order to deliver unified symbols for all the existing JEITA standards.

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 1.0V power supply voltage was revised as ED-5006A in May 2005.

3. History of JEITA's standard of power supply voltage

JEDEC JC-16 in U.S.A, has committed to establish international standard of power supply voltage for digital integrated circuits as a leader of the industry. Low Voltage IC Operation Sub-committee, which was founded in 1992 as one of sub-committees of EIAJ (Electronic Industries Association of Japan) and presently belongs to JEITA, has cooperated with JEDEC and communicated mutually since its foundation.

Power supply voltage of digital integrated circuits that had been related to the technology trend of equipment using IC and of circuits design and process technology, was changed twice, big so far.

First big change was occurred in early 90's and power supply voltage was transferred from 5V that had been kept for a long time, to 3V. In 90's, high speed and low power consumption IC was required based on the background that performance of desktop and portable equipment of the information and communication field had been growing rapidly. To reduce the power supply voltage was necessary to satisfy both reliability and high-performance of IC. From 3.3V standard in 1994 to 1.2V standard in 2001, many power supply voltage standards that consist of normal range for regulated operation and wide range for battery operation were established.

Second big change was occurred at the begging of 21 century simultaneously and generation of sub-1V power supply voltage started by the begging of a more highly speed and capacity equipment according to broadband and of sub-0.1 μ m process technology. In this sub-1V power supply voltage IC, a break through of issue for small amplitude interface between IC and for Vt fluctuation control of small transistor is very important. New concept for the standard of power supply voltage will be required which different from the generation of the first big change.

4. 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.