

JEITA

Standard of Japan Electronics and Information Technology Industries Association

ED-5006A

**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**

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Standard of Japan Electronics and 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

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

1. 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 Absolute maximum continuous ratings give in table 1.

Table 1 Absolute maximum continuous ratings ⁽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 ~ $V_{DD}+0.4(\leq 1.4 \text{ max})$ ⁽²⁾	V
DC output voltage	V_{OUT}	including I/O pins	–0.4 ~ $V_{DD}+0.4(\leq 1.4 \text{ max})$ ⁽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}	–	⁽³⁾	°C

Note⁽¹⁾: Absolute maximum continuous ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute maximum conditions is not implied, if it is beyond 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 Normal range of recommended operating conditions give in table 2.

Table 2 Normal range of recommended operating conditions

Parameter	Symbol	Operating range	Unit
Power supply voltage	V_{DD}	0.9 ~ 1.1	V
Operating temperature range	T_a	⁽⁴⁾	°C

Note⁽⁴⁾: To be specified by manufacturers.

2.2.2 Wide range Wide range of recommended operating conditions give in table 3.

Table 3 Wide range of recommended operating conditions

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

Note(⁵): To be specified by manufacturers.

2.3 DC specifications All voltages listed are referenced to ground except where noted.

2.3.1 Normal range Normal range of DC specifications give in table 4.

Table 4 Normal range of DC specifications(⁶)(⁷)

Parameter	Symbol	Test condition	Min	Max	Unit
Power supply voltage	V_{DD}	–	0.9	1.1	V
High-level input voltage	V_{IH}	$V_{OUT} \geq V_{OH} \text{ (min)}$	$0.65V_{DD}$	$V_{DD} + 0.2$	V
Low-level input voltage	V_{IL}	$V_{OUT} \leq V_{OL} \text{ (max)}$	–0.2	$0.35V_{DD}$	V
High-level output voltage	V_{OH}	$I_{OH} = -2\text{mA}$	$0.75V_{DD}$	–	V
Low-level output voltage	V_{OL}	$I_{OL} = 2\text{mA}$	–	$0.25V_{DD}$	V

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

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

2.3.2 Wide range Wide range of DC specifications give in table 5.

Table 5 Wide range of DC specifications(⁸)(⁹)

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

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

Note(⁹): For V_{IH} and V_{IL} , V_{DD} refer to the receiving device. For V_{OH} and V_{OL} , V_{DD} refer 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 Normal range of optional schmitt trigger

operation give in table 6.

Table 6 Normal range of optional schmitt trigger operation ⁽¹⁰⁾⁽¹¹⁾

Symbol	Parameter	Test Condition	Min	Max	Unit
V_{DD}	Supply Voltage	–	0.9	1.1	V
$V_{t+} (V_p)$	Positive Going Threshold Voltage	$V_{OUT} \geq V_{OH} \text{ (min)}$	$0.4V_{DD}$	$0.7V_{DD}$	V
$V_{t-} (V_n)$	Negative Going Threshold Voltage	$V_{OUT} \leq V_{OL} \text{ (max)}$	$0.3V_{DD}$	$0.6V_{DD}$	V
$V_h (V_t)$	Hysteresis Voltage	$V_{t+} - V_{t-}$	$0.1V_{DD}$	$0.4V_{DD}$	V
V_{OH}	Output High Voltage	$I_{OH} = -2\text{mA}$	$0.75V_{DD}$	–	V
V_{OL}	Output Low Voltage	$I_{OL} = 2\text{mA}$	–	$0.25V_{DD}$	V

Note⁽¹⁰⁾: V_{DD} of the sending and receiving devices must track within 0.1 V to maintain adequate dc margins.

Note⁽¹¹⁾: For $V_{t+} (V_p)$ and $V_{t-} (V_n)$, V_{DD} refers to the receiving device. For V_{OH} and V_{OL} , V_{DD} refers to the sending device.

2.4.2 Optional Schmitt trigger operation – Wide range Wide range of optional schmitt trigger operation give in table 7.

Table 7 Wide range of optional schmitt trigger operation ⁽⁹⁾⁽¹⁰⁾

Symbol	Parameter	Test Condition	Min	Max	Unit
V_{DD}	Supply Voltage	–	0.7	1.1	V
$V_{t+} (V_p)$	Positive Going Threshold Voltage	$V_{OUT} \geq V_{OH} \text{ (min)}$	$0.35V_{DD}$	$0.75V_{DD}$	V
$V_{t-} (V_n)$	Negative Going Threshold Voltage	$V_{OUT} \leq V_{OL} \text{ (max)}$	$0.25V_{DD}$	$0.65V_{DD}$	V
$V_h (V_t)$	Hysteresis Voltage	$V_{t+} - V_{t-}$	$0.1V_{DD}$	$0.5V_{DD}$	V
V_{OH}	Output High Voltage	$I_{OH} = -100\mu\text{A}$	$V_{DD}-0.1$	–	V
V_{OL}	Output Low Voltage	$I_{OL} = 100\mu\text{A}$	–	0.1	V

Note⁽¹²⁾: V_{DD} of the sending and receiving devices must track within 0.1 V to maintain adequate dc margins.

Note⁽¹³⁾: For $V_{t+} (V_p)$ and $V_{t-} (V_n)$, V_{DD} refers to the receiving device. For V_{OH} and V_{OL} , V_{DD} refers to the sending device.

3. Test conditions

3.1 Positive Going Threshold Voltage [$V_{t+} (V_p)$] Input signal is raised from a grand level in the measurement circuit shown in Figure 1 , and the input voltage value of which output logic changed is determined as $V_{t+} (V_p)$.

3.2 Negative Going Threshold Voltage [$V_{t-} (V_n)$] Input signal is dropped from a power supply voltage level in the measurement circuit shown in Figure 1 , and the input voltage value of which output logic changed is determined as $V_{t-} (V_n)$.

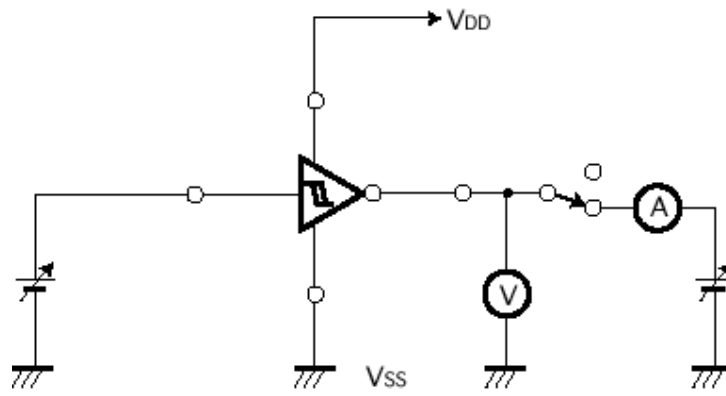


Figure 1 DC characteristic measurement circuit of Schmitt-trigger input

Explanation for 1.0V $\pm$ 0.1V (normal range) and 0.7V to 1.1V (wide range) Power supply voltage and interface standard for non-terminated digital integrated circuits

This explanation is not part of this JEITA standard. The discussion that follows provides descriptions of items defined or detailed in the standard body or in the Annex as well as other related topics.

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 0.1 μ m 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 April 2006.

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 V_t 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 has been discussed by the IC Low Voltage Operation Sub-committee which belongs to Group on Integrated Circuits of Technical Standardization Committee on Semiconductor Devices.

The members are shown as following.

< Technical Standardization Committee on Semiconductor Devices >

Chairman	Hisao Kasuga	NEC Electronics Corp.
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< Group on Integrated Circuits >

Chairman	Hisao Kasuga	NEC Electronics Corp.
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< IC Low Voltage Operation Sub-Committee >

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