

- ◇ STRUCTURE Silicon Monolithic Integrated Circuit
- ◇ PRODUCT SPI BUS Serial EEPROMs
- ◇ SERIES ADVANTAGE SERIES
- ◇ FAMILY BR25□□0 family
- ◇ TYPE Supply voltage 1.8V~5.5V/Operating temperature -40°C~+85°C type
- ◇ PART NUMBER BR25□□0-10□U-1.8

PART NUMBER	PACKAGE	DENSITY
BR25010N -10SU-1.8	8-lead JEDEC SOIC	1Kbit
BR25020N -10SU-1.8		2Kbit
BR25040N -10SU-1.8		4Kbit
BR25080N -10SU-1.8		8Kbit
BR25160N -10SU-1.8		16Kbit
BR25320N -10SU-1.8		32Kbit
BR25010 -10TU-1.8	8-lead TSSOP	1Kbit
BR25020 -10TU-1.8		2Kbit
BR25040 -10TU-1.8		4Kbit
BR25080 -10TU-1.8		8Kbit
BR25160 -10TU-1.8		16Kbit

- ◇ FEATURES SPI BUS interface
- Endurance : 1,000,000 erase/write cycles
- Data retention : 100 years
- Initial Data: Memory array FFh

◇ ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Min.	Max.	Unit
T _{STG}	Storage Temperature	-65	125	°C
V _{IN}	Input range	-0.3	V _{CC} +0.3	V
V _{CC}	Supply Voltage	-0.3	6.5	V

◇ POWER DISSIPATION (Ta=25°C)

PACKAGE	Rating	Unit
8-lead JEDEC SOIC	450 *1	mW
8-lead TSSOP	330 *2	mW

* Degradation is done at 4.5mW/°C(*1), 3.3mW/°C(*2) for operation above 25°C

◇ DC OPERATING CHARACTERISTICS

(BR25010/020/040, Unless otherwise specified, $T_A = -40^{\circ}\text{C}$ to 85°C , $V_{CC} = +1.8\text{V}$ to $+5.5\text{V}$)

Parameter	Symbol	Specification			Units	Test Conditions
		Min.	Typ.	Max.		
Supply Current	I_{CC1}	-	-	3.0	mA	$V_{CC} = 5.0\text{V}$, $f_{SCK} = 1\text{MHz}$, SO=Open, Read
Supply Current	I_{CC2}	-	-	6.0	mA	$V_{CC} = 5.0\text{V}$, $f_{SCK} = 2\text{MHz}$, SO=Open, Read, Write
Standby Current	I_{SB1}	-	-	1.0	μA	$V_{CC} = 1.8\text{V}$, $\text{CS}=\text{HOLD}$, $\text{WP}=\text{V}_{CC}$, SCK=SI=Vcc or GND, SO=OPEN
Standby Current	I_{SB2}	-	-	5.0	μA	$V_{CC} = 2.7\text{V}$, $\text{CS}=\text{HOLD}$, $\text{WP}=\text{V}_{CC}$, SCK=SI=Vcc or GND, SO=OPEN
Standby Current	I_{SB3}	-	-	10.0	μA	$V_{CC} = 5.0\text{V}$, $\text{CS}=\text{HOLD}$, $\text{WP}=\text{V}_{CC}$, SCK=SI=Vcc or GND, SO=OPEN
Input Leakage	I_L	-0.8	-	3.0	μA	$V_{IN} = 0\text{V} \sim \text{V}_{CC}$
Output Leakage	I_{OL}	-0.8	-	3.0	μA	$V_{IN} = 0\text{V} \sim \text{V}_{CC}$, $T_A = 0^{\circ}\text{C} \sim 70^{\circ}\text{C}$
Input Low Voltage	V_{IL}	-	-	$V_{CC} \times 0.3$	V	-
Input High Voltage	V_{IH}	$V_{CC} \times 0.7$	-	-	V	-
Output Low Voltage	V_{OL1}	-	-	0.4	V	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$, $I_{OL} = 2.0\text{mA}$
Output High Voltage	V_{OH1}	$V_{CC} - 0.8$	-	-	V	$I_{OH} = -1.0\text{mA}$
Output Low Voltage	V_{OL2}	-	-	0.2	V	$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$, $I_{OL} = 0.15\text{mA}$
Output High Voltage	V_{OH2}	$V_{CC} - 0.2$	-	-	V	$I_{OH} = -100\mu\text{A}$

◇ DC OPERATING CHARACTERISTICS

(BR25080/160/320, Unless otherwise specified, $T_A = -40^{\circ}\text{C}$ to 85°C , $V_{CC} = +1.8\text{V}$ to $+5.5\text{V}$)

Parameter	Symbol	Specification			Units	Test Conditions
		Min.	Typ.	Max.		
Supply Current	I_{CC1}	-	-	3.0	mA	$V_{CC} = 5.0\text{V}$, $f_{SCK} = 1\text{MHz}$, SO=Open, Read
Supply Current	I_{CC2}	-	-	5.0	mA	$V_{CC} = 5.0\text{V}$, $f_{SCK} = 2\text{MHz}$, SO=Open, Read, Write
Standby Current	I_{SB1}	-	0.1	1.0	μA	$V_{CC} = 1.8\text{V}$, $\text{CS}=\text{HOLD}$, $\text{WP}=\text{V}_{CC}$, SCK=SI=Vcc or GND, SO=OPEN
Standby Current	I_{SB2}	-	0.2	2.0	μA	$V_{CC} = 2.7\text{V}$, $\text{CS}=\text{HOLD}$, $\text{WP}=\text{V}_{CC}$, SCK=SI=Vcc or GND, SO=OPEN
Standby Current	I_{SB3}	-	2.0	5.0	μA	$V_{CC} = 5.0\text{V}$, $\text{CS}=\text{HOLD}$, $\text{WP}=\text{V}_{CC}$, SCK=SI=Vcc or GND, SO=OPEN
Input Leakage	I_L	-3.0	-	3.0	μA	$V_{IN} = 0\text{V} \sim \text{V}_{CC}$
Output Leakage	I_{OL}	-3.0	-	3.0	μA	$V_{IN} = 0\text{V} \sim \text{V}_{CC}$, $T_A = 0^{\circ}\text{C} \sim 70^{\circ}\text{C}$
Input Low Voltage	V_{IL}	-	-	$V_{CC} \times 0.3$	V	-
Input High Voltage	V_{IH}	$V_{CC} \times 0.7$	-	-	V	-
Output Low Voltage	V_{OL1}	-	-	0.4	V	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$, $I_{OL} = 3.0\text{mA}$
Output High Voltage	V_{OH1}	$V_{CC} - 0.8$	-	-	V	$I_{OH} = -1.6\text{mA}$
Output Low Voltage	V_{OL2}	-	-	0.2	V	$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$, $I_{OL} = 0.15\text{mA}$
Output High Voltage	V_{OH2}	$V_{CC} - 0.2$	-	-	V	$I_{OH} = -100\mu\text{A}$

◇ AC OPERATING CHARACTERISTICS

(BR25010/020/040, Unless otherwise specified, $T_A = -40^{\circ}\text{C}$ to 85°C , $V_{CC} = +1.8\text{V}$ to $+5.5\text{V}$, $C_i = 100\text{pF}$)

Parameter	Symbol	Specification			Unit	Test Condition
		Min.	Typ.	Max.		
SCK Clock Frequency	f_{SCK}	0	-	3.0	MHz	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$
		0	-	2.1		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$
		0	-	0.5		$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$
Input Rise Time	t_{ri}	-	-	2	μs	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$
		-	-	2		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$
		-	-	2		$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$
Input Fall Time	t_{fi}	-	-	2	μs	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$
		-	-	2		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$
		-	-	2		$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$
SCK High Time	t_{H1}	133	-	-	ns	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$
		200	-	-		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$
		800	-	-		$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$
SCK Low Time	t_{L1}	133	-	-	ns	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$
		200	-	-		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$
		800	-	-		$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$
CS High Time	t_{CH}	250	-	-	ns	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$
		250	-	-		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$
		1000	-	-		$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$
CS Setup Time	t_{CS}	250	-	-	ns	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$
		250	-	-		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$
		1000	-	-		$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$
CS Hold Time	t_{CH}	250	-	-	ns	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$
		250	-	-		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$
		1000	-	-		$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$
Data In Setup Time	t_{SI}	50	-	-	ns	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$
		50	-	-		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$
		100	-	-		$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$
Data In Hold Time	t_{HI}	50	-	-	ns	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$
		100	-	-		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$
		100	-	-		$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$
Hold Setup Time	t_{H0}	100	-	-	ns	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$
		100	-	-		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$
		400	-	-		$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$
Hold Hold Time	t_{H0}	200	-	-	ns	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$
		200	-	-		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$
		400	-	-		$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$
Output Valid	t_V	0	-	133	ns	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$
		0	-	200		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$
		0	-	800		$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$
Output Hold Time	t_{H0}	0	-	-	ns	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$
		0	-	-		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$
		0	-	-		$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$
Hold to Output Low Z	t_{LZ}	0	-	100	ns	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$
		0	-	100		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$
		0	-	100		$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$
Hold to Output High Z	t_{HZ}	-	-	100	ns	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$
		-	-	100		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$
		-	-	100		$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$
Output Disable Time	t_{DS}	-	-	250	ns	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$
		-	-	500		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$
		-	-	1000		$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$
Write Cycle Time	t_{WC}	-	-	5	ms	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$
		-	-	10		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$
		-	-	20		$1.8\text{V} \leq V_{CC} \leq 5.5\text{V}$
Endurance *1	-	1M	-	-	Write Cycles	-

*1 This parameter is characterized and is not 100% tested.

O This product is not designed for protection against radioactive rays.

◇ AC OPERATING CHARACTERISTICS

(BR25080/160/320, Unless otherwise specified, $T_A = -40^{\circ}\text{C}$ to 85°C , $V_{CC} = +1.8\text{V}$ to $+5.5\text{V}$, $C_i = 100\text{pF}$)

Parameter	Symbol	Specification			Unit	Test Condition
		Min.	Typ.	Max.		
SCK Clock Frequency	f_{SCK}	0	–	3.0	MHz	$4.5V \leq V_{CC} \leq 5.5V$
		0	–	2.1		$2.7V \leq V_{CC} \leq 5.5V$
		0	–	0.5		$1.8V \leq V_{CC} \leq 5.5V$
Input Rise Time	t_{ri}	–	–	2	μs	$4.5V \leq V_{CC} \leq 5.5V$
		–	–	2		$2.7V \leq V_{CC} \leq 5.5V$
		–	–	2		$1.8V \leq V_{CC} \leq 5.5V$
Input Fall Time	t_{fi}	–	–	2	μs	$4.5V \leq V_{CC} \leq 5.5V$
		–	–	2		$2.7V \leq V_{CC} \leq 5.5V$
		–	–	2		$1.8V \leq V_{CC} \leq 5.5V$
SCK High Time	t_{H1}	133	–	–	ns	$4.5V \leq V_{CC} \leq 5.5V$
		200	–	–		$2.7V \leq V_{CC} \leq 5.5V$
		800	–	–		$1.8V \leq V_{CC} \leq 5.5V$
SCK Low Time	t_{L1}	133	–	–	ns	$4.5V \leq V_{CC} \leq 5.5V$
		200	–	–		$2.7V \leq V_{CC} \leq 5.5V$
		800	–	–		$1.8V \leq V_{CC} \leq 5.5V$
$\overline{CS}$ High Time	t_{CH}	250	–	–	ns	$4.5V \leq V_{CC} \leq 5.5V$
		250	–	–		$2.7V \leq V_{CC} \leq 5.5V$
		1000	–	–		$1.8V \leq V_{CC} \leq 5.5V$
$\overline{CS}$ Setup Time	t_{CSS}	250	–	–	ns	$4.5V \leq V_{CC} \leq 5.5V$
		250	–	–		$2.7V \leq V_{CC} \leq 5.5V$
		1000	–	–		$1.8V \leq V_{CC} \leq 5.5V$
$\overline{CS}$ Hold Time	t_{CH}	250	–	–	ns	$4.5V \leq V_{CC} \leq 5.5V$
		250	–	–		$2.7V \leq V_{CC} \leq 5.5V$
		1000	–	–		$1.8V \leq V_{CC} \leq 5.5V$
Data In Setup Time	t_{SI}	50	–	–	ns	$4.5V \leq V_{CC} \leq 5.5V$
		50	–	–		$2.7V \leq V_{CC} \leq 5.5V$
		100	–	–		$1.8V \leq V_{CC} \leq 5.5V$
Data In Hold Time	t_{HI}	50	–	–	ns	$4.5V \leq V_{CC} \leq 5.5V$
		50	–	–		$2.7V \leq V_{CC} \leq 5.5V$
		100	–	–		$1.8V \leq V_{CC} \leq 5.5V$
Hold Setup Time	t_{H0}	100	–	–	ns	$4.5V \leq V_{CC} \leq 5.5V$
		100	–	–		$2.7V \leq V_{CC} \leq 5.5V$
		400	–	–		$1.8V \leq V_{CC} \leq 5.5V$
Hold Hold Time	t_{H0}	200	–	–	ns	$4.5V \leq V_{CC} \leq 5.5V$
		200	–	–		$2.7V \leq V_{CC} \leq 5.5V$
		400	–	–		$1.8V \leq V_{CC} \leq 5.5V$
Output Valid	t_V	0	–	133	ns	$4.5V \leq V_{CC} \leq 5.5V$
		0	–	200		$2.7V \leq V_{CC} \leq 5.5V$
		0	–	800		$1.8V \leq V_{CC} \leq 5.5V$
Output Hold Time	t_{H0}	0	–	–	ns	$4.5V \leq V_{CC} \leq 5.5V$
		0	–	–		$2.7V \leq V_{CC} \leq 5.5V$
		0	–	–		$1.8V \leq V_{CC} \leq 5.5V$
$\overline{Hold}$ to Output Low Z	t_{LZ}	0	–	100	ns	$4.5V \leq V_{CC} \leq 5.5V$
		0	–	100		$2.7V \leq V_{CC} \leq 5.5V$
		0	–	100		$1.8V \leq V_{CC} \leq 5.5V$
$\overline{Hold}$ to Output High Z	t_{HZ}	–	–	100	ns	$4.5V \leq V_{CC} \leq 5.5V$
		–	–	100		$2.7V \leq V_{CC} \leq 5.5V$
		–	–	100		$1.8V \leq V_{CC} \leq 5.5V$
Output Disable Time	t_{OD}	–	–	250	ns	$4.5V \leq V_{CC} \leq 5.5V$
		–	–	250		$2.7V \leq V_{CC} \leq 5.5V$
		–	–	1000		$1.8V \leq V_{CC} \leq 5.5V$
Write Cycle Time	t_{WC}	–	–	5	ms	$4.5V \leq V_{CC} \leq 5.5V$
		–	–	10		$2.7V \leq V_{CC} \leq 5.5V$
		–	–	20		$1.8V \leq V_{CC} \leq 5.5V$
Endurance *1 5.0V, 25°C, Page Mode	–	1M	–	–	Write Cycles	–

◆NOTES FOR POWER SUPPLY

In order to prevent an inadvertent write, the device has the feature of P.O.R.

After the power is on, the device is in the write disable mode. P.O.R. works only during power up. The noise may force the device write enable mode with $\overline{CS}$ ="H" during power ON/OFF. In the case of power up, keep the following conditions to ensure to make the function of P.O.R.

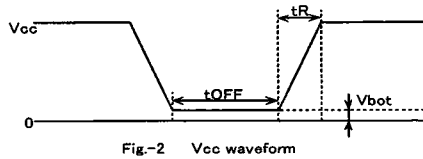


Fig-2 Vcc waveform

◆RECOMMENDED CONDITIONS OF tR, tOFF, Vbot

tR	tOFF	Vbot
Below 10ms	Above 10ms	Below 0.3V
Below 100ms	Above 10ms	Below 0.2V

Please keep $\overline{CS}$ "H" during power ON/OFF.

The device is an active state during $\overline{CS}$ is low. The extraordinary function or data collaption may occur because of noise etc., if power-up is done with $\overline{CS}$ "L". In order to prevent above errors from happening, keep $\overline{CS}$ "H" (=Vcc) during power ON. (The device does not receive any command during $\overline{CS}$ is high.)

It may continue at low Vcc by capacitance of Vcc line during power off.

Please keep $\overline{CS}$ "H" during power off because of the device may make malfunction and inadvertent write.

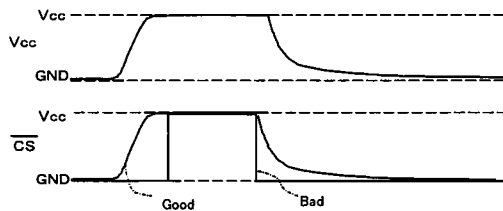


Fig-3 $\overline{CS}$ TIMING DURING POWER ON/OFF

(Good example)

$\overline{CS}$ follows Vcc. ($\overline{CS}$ is pull up to Vcc)

(Bad example)

$\overline{CS}$ is low during power ON/OFF.

Please take more than 10ms between power ON and power OFF, or the internal circuit is not always reset.

◆CAUTIONS ON USE

(1) Absolute maximum ratings

If the absolute maximum ratings such as impressed voltage and action temperature range and so forth are exceeded, LSI may be destructed. Do not impress voltage and temperature exceeding the absolute maximum ratings. In the case of fear exceeding the absolute maximum ratings, take physical safety countermeasures such as fuses, and see to it that conditions exceeding the absolute maximum ratings should not be impressed to LSI.

(2) GND electric potential

Set the voltage of GND terminal lowest at any action condition. Make sure that each terminal voltage is lower than that of GND terminal.

(3) Thermal design

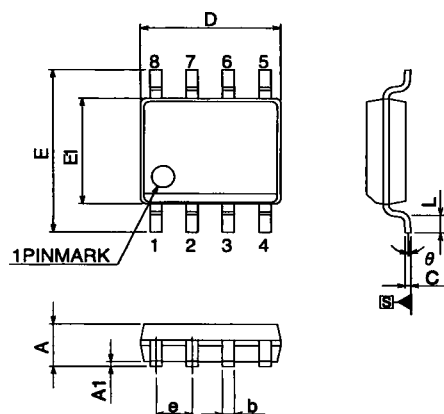
In consideration of permissible loss in actual use condition, carry out heat design with sufficient margin.

(4) Terminal to terminal shortcircuit and wrong packaging

When to package LSI onto a board, pay sufficient attention to LSI direction and displacement. Wrong packaging may destruct LSI. And in the case of shortcircuit between LSI terminals and terminals and power source, terminal and GND owing to foreign matter, LSI may be destructed.

(5) Use in a strong electromagnetic field may cause malfunction, therefore, evaluated design sufficiently.

◇ PHYSICAL DIMENSION



- Notes**
- 1.This drawing is subject to change without notice.
 - 2.Body dimensions do not include mold flash or protrusion, or gate burns.
 - 3.Reference JEDEC MS-012 variation AA.

Fig.-4 8-lead JEDEC SOIC Package Outline

◇ 8-lead JEDEC SOIC Package Size Data

Symbol	mm			inches		
	Typ.	Min.	Max	Typ.	Min.	Max
A	–	1.35	1.75	–	0.053	0.069
A1	–	0.10	0.25	–	0.004	0.010
b	–	0.31	0.51	–	0.012	0.020
c	–	0.17	0.25	–	0.007	0.010
D	–	4.80	5.00	–	0.189	0.197
e	1.27 BSC	–	–	0.050 BSC	–	–
E	–	5.79	6.20	–	0.228	0.244
E1	–	3.81	3.99	–	0.150	0.157
L	–	0.40	1.27	–	0.016	0.050
θ	–	0°	8°	–	0°	8°

◇ 8-lead TSSOP Package Size Data

Symbol	mm			inches		
	Typ.	Min.	Max	Typ.	Min.	Max
A	–	–	1.20	–	–	0.047
A2	1.00	0.80	1.05	0.039	0.031	0.041
b	–	0.19	0.30	–	0.007	0.012
D	3.00	2.90	3.10	0.118	0.114	0.122
e	0.65 BSC	–	–	0.025	–	–
E	6.40 BSC	–	–	0.252	–	–
E1	4.40	4.30	4.50	0.173	0.169	0.177
L	0.60	0.45	0.75	0.023	0.017	0.030
L1	1.00 BSC	–	–	0.039	–	–

- Notes**
- 1.This drawing is subject to change without notice.
 - 2.Body dimensions do not include mold flash or protrusion, or gate burns.
 - 3.Reference JEDEC MO-153.

Fig.-5 8-lead TSSOP Package Outline

Notes

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- The contents described herein are subject to change without notice. The specifications for the product described in this document are for reference only. Upon actual use, therefore, please request that specifications to be separately delivered.
- Application circuit diagrams and circuit constants contained herein are shown as examples of standard use and operation. Please pay careful attention to the peripheral conditions when designing circuits and deciding upon circuit constants in the set.
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