◇ STRUCTURE Silicon Monolithic Integrated Circuit
◇ PRODUCT Microwire BUS 16Kbit(1,024×16bit) EEPROM
◇ PART NUMBER BR93L86-W Series

PART NUMBER	PACKAGE
BR93L86F-W	SOP8
BR93L86RF-W	SOP8
BR93L86FJ-W	SOP-J8
BR93L86RFJ-W	SOP-J8
BR93L86RFV-W	SSOP-B8
BR93L86RFVT-W	TSSOP-B8
BR93L86RFVM-W	MSOP8
BR93L86RFVJ-W	TSSOP-B8J

◇ FEATURES
Microwire BUS EEPROM
Wide operating supply voltage range(1.8V～5.5V)
1,000,000 erase/write cycles endurance

◇ ABSOLUTE MAXIMUM RATING (Ta=25℃)

Parameter	Symbol	Rating		Unit
Supply Voltage	Vcc	−0.3～6.5		V
Power Dissipation	Pd	450 (BR93L86F-W)	*1	mW
		450 (BR93L86RF-W)	*2	
		450 (BR93L86FJ-W)	*3	
		450 (BR93L86RFJ-W)	*4	
		300 (BR93L86RFV-W)	*5	
		330 (BR93L86RFVT-W)	*6	
		310 (BR93L86RFVM-W)	*7	
		310 (BR93L86RFVJ-W)	*8	
Storage Temperature	Tstg	−65～125		℃
Operating Temperature	Topr	−40～85		℃
Terminal Voltage	—	−0.3～Vcc+0.3		V

* Degradation is done at 4.5mW/℃(*1,*2,*3,*4), 3.0mW/℃(*5), 3.3mW/℃(*6), 3.1mW/℃(*7,*8) for operation above 25℃

◇ RECOMMENDED OPERATING CONDITION

Parameter	Symbol	Rating	Unit
Supply Voltage	Vcc	1.8～5.5	V
Input Voltage	VIN	0～Vcc	V

Status of this document
The Japanese version of this document is the formal specification.
A customer may use this translation version only for a reference to help reading the formal version.
If there are any differences in translation version of this document, formal version takes priority.

◇ MEMORY CELL CHARACTERISTICS(Ta=25℃, Vcc=1.8～5.5V)

Parameter		Specification			Unit
		Min.	Typ.	Max	
Erase/Write Cycle	*1	1,000,000	–	–	Cycles
Data Retention	*1	40	–	–	Years

○Initial Data FFFFh in all address. *1 Not 100% TESTED

◇ DC OPERATING CHARACTERISTICS
(Unless otherwise specified Ta=−40～85℃, Vcc=1.8～5.5V)

Parameter	Symbol	Specification			Unit	Test Condition
		Min.	Typ.	Max		
"L" Input Voltage1	VIL1	−0.3	–	0.8	V	4.0≦Vcc≦5.5
"L" Input Voltage2	VIL2	−0.3	–	0.2×Vcc	V	1.8≦Vcc≦4.0
"H" Input Voltage1	VIH1	2.0	–	Vcc+0.3	V	4.0≦Vcc≦5.5
"H" Input Voltage2	VIH2	0.7×Vcc	–	Vcc+0.3	V	1.8≦Vcc≦4.0
"L" Output Voltage1	VOL1	0	–	0.4	V	IOL=2.1mA , 4.0≦Vcc≦5.5
"L" Output Voltage2	VOL2	0	–	0.2	V	IOL=100μA , 1.8≦Vcc≦4.0
"H" Output Voltage1	VOH1	2.4	–	Vcc	V	IOH=−0.4mA , 4.0≦Vcc≦5.5
"H" Output Voltage2	VOH2	Vcc−0.2	–	Vcc	V	IOH=−100μA , 1.8≦Vcc≦4.0
Input Leakage Current	ILI	−1	–	1	μA	VIN=0～Vcc
Output Leakage Current	ILO	−1	–	1	μA	VOUT=0～Vcc , CS=0V
Operating Current	ICC1	–	–	3.0	mA	fSK=2MHz , tE/W=5ms (WRITE)
	ICC2	–	–	1.5	mA	fSK=2MHz (READ)
	ICC3	–	–	4.5	mA	fSK=2MHz , tE/W=5ms (WRAL,ERAL)
	ICC4	–	–	1.5	mA	fSK=500kHz , tE/W=5ms (WRITE)
	ICC5	–	–	0.5	mA	fSK=500kHz (READ)
	ICC6	–	–	2	mA	fSK=500kHz (WRAL,ERAL)
Standby Current	ISB		–	2	μA	CS=0V , DO=OPEN

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

◇ AC OPERATING CHARACTERISTICS
(Unless otherwise specified Ta=−40～85℃, Vcc=1.8～5.5V)

Parameter	Symbol	1.8V≦Vcc≦2.5V			Unit	2.5V≦Vcc≦5.5V			Unit
		Min.	Typ.	Max		Min.	Typ.	Max	
SK Clock Frequency	fSK	0	–	500	kHz	–	–	2	MHz
SK High Time	tSKH	0.8	–	–	μs	230	–	–	ns
SK Low Time	tSKL	0.8	–	–	μs	230	–	–	ns
CS Low Time	tCS	1	–	–	μs	200	–	–	ns
CS Setup Time	tCSS	200	–	–	ns	50	–	–	ns
DI Setup Time	tDIS	100	–	–	ns	100	–	–	ns
CS Hold Time	tCSH	0	–	–	ns	0	–	–	ns
DI Hold Time	tDIH	100	–	–	ns	100	–	–	ns
Data "1" Output Delay Time	tPD1	–	–	0.7	μs	–	–	200	ns
Data "0" Output Delay Time	tPD0	–	–	0.7	μs	–	–	200	ns
CS to Status Valid	tSV	–	–	0.7	μs	–	–	150	ns
CS to Output High-Z	tDF	–	–	200	ns	–	–	150	ns
Write Cycle time	tE/W	–	–	5	ms	–	–	5	ms

◇ BLOCK DIAGRAM

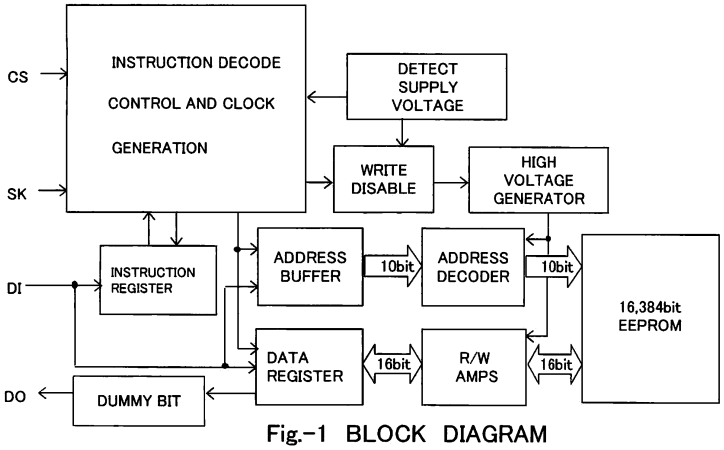

Fig.-1 BLOCK DIAGRAM

◇ PIN No. / PIN NAME

PIN No.	PIN NAME	
1	CS	N.C.
2	SK	Vcc
3	DI	CS
4	DO	SK
5	GND	DI
6	N.C.	DO
7	N.C.	GND
8	Vcc	N.C.
PART NUMBER	BR93L86RF-W BR93L86RFJ-W BR93L86RFV-W BR93L86RFVT-W BR93L86RFVM-W BR93L86RFVJ-W	BR93L86F-W BR93L86FJ-W

◇ NOTES FOR POWER SUPPLY

This IC has a POR (Power On Reset) circuit as mistake write countermeasure.
After POR action, it gets in write disable status. The POR circuit is valid only when power is ON, and does not work when power is OFF. However, if CS is "H" at power ON/OFF, it may become write enable status owing to noises and the likes. For secure operations, observe the following conditions.

1. Set CS = "L".
2. Turn on power so as to satisfy the recommended conditions of tR, tOFF, Vbot for POR circuit operation.

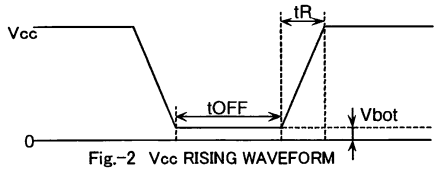

Fig.-2 Vcc RISING WAVEFORM

◇Recommended conditions of tR, tOFF, Vbot

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

◇ 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 not lower than that of GND terminal in consideration of transition status.

(3) Heat design

In consideration of allowable 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

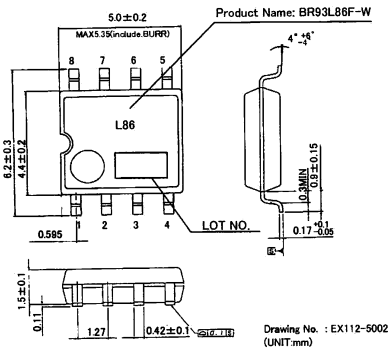

Fig4-(a) PHYSICAL DIMENSION
SOP8(BR93L86F-W)

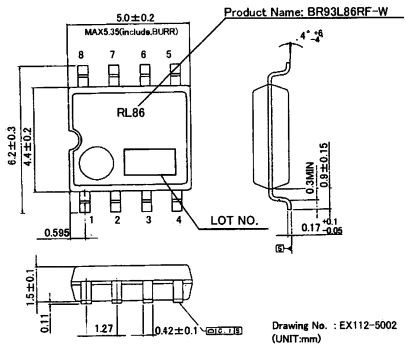

Fig4-(b) PHYSICAL DIMENSION
SOP8(BR93L86RF-W)

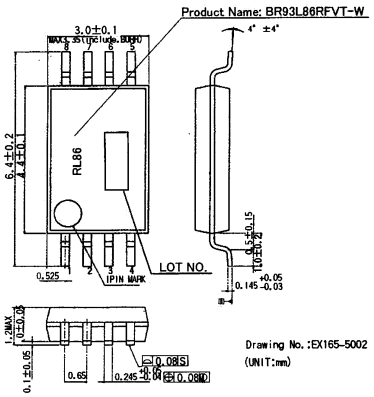

Fig-4(c) PHYSICAL DIMENSION
TSSOP-B8(BR93L86RFVT-W)

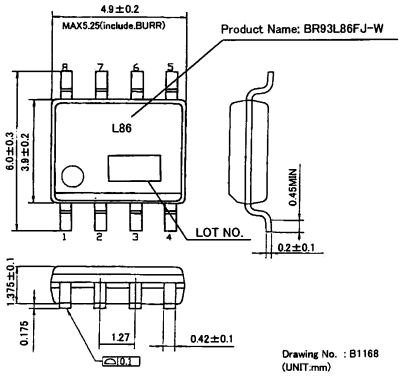

Fig4-(d) PHYSICAL DIMENSION
SOP-J8(BR93L86FJ-W)

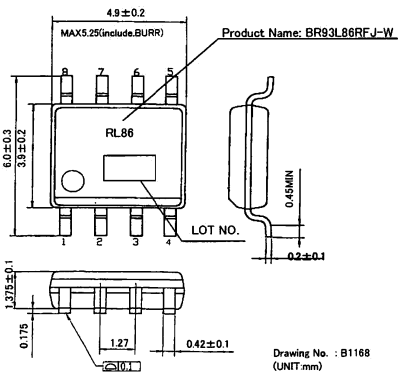

Fig4-(e) PHYSICAL DIMENSION
SOP-J8(BR93L86RFJ-W)

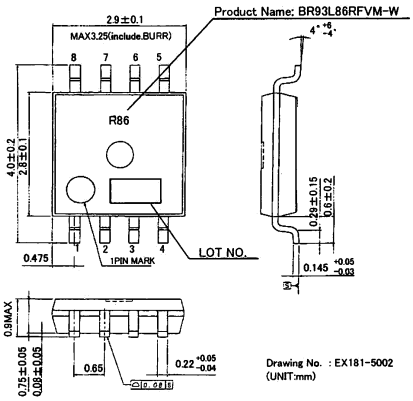

Fig4-(f) PHYSICAL DIMENSION
MSOP8(BR93L86RFVM-W)

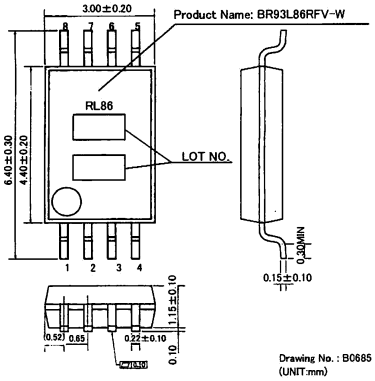

Fig4-(g) PHYSICAL DIMENSION
SSOP-B8(BR93L86RFV-W)

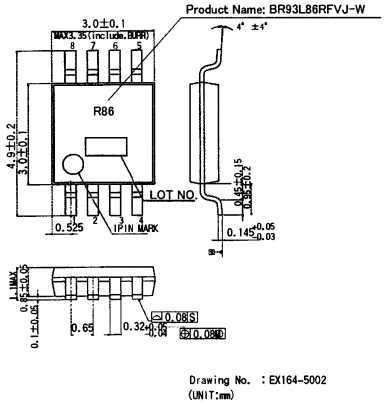

Fig4-(h) PHYSICAL DIMENSION
TSSOP-B8J(BR93L86RFVJ-W)

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As of 18th. April 2005