

ASSP Power Supply

BIPOLAR

Power Management Switching IC (with flash memory power switching function)

MB3807A

■ DESCRIPTION

When data is written to or read from flash memory, it requires that the voltage at its power supply (V_{PP}) be switched (to 12 V for writing and to 3.3 or 5.0 V for reading).

The MB3807A is a power management switching IC, designed to be compatible with the PCMCIA digital controller, to switch the V_{PP} voltage of flash memory.

When the switch is turned on, optimum voltage is applied to the gate of the internal charge pump N-ch MOS switch, providing a constant amount of ON resistance. The ON resistance is also kept to be low to reduce voltage drop at the V_{PP} pin that is caused by large current flowing when data is written.

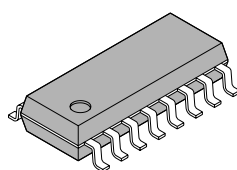
In addition, the OFF time is much shorter than the ON time to prevent short-circuiting between the reading and writing power supplies when the device switches the V_{PP} voltage for reading or writing data (break-before-make operation).

■ FEATURES

- Switching at low ON resistance
 - For writing data: $SWIN1 = 12\text{ V}$, $R_{on} = 0.3\ \Omega$
 - For reading data: $SWIN2 = 5\text{ V}$, $R_{on} = 6.0\ \Omega$
 $SWIN2 = 3.3\text{ V}$, $R_{on} = 8.5\ \Omega$
- Wide range of supply voltages: $V_{CC} = 2.7\text{ to }5.5\text{ V}$
- Prevention of reverse current from the load at switch-off time
- ON time controllable with external pin
- Break-before-make operation

■ PACKAGE

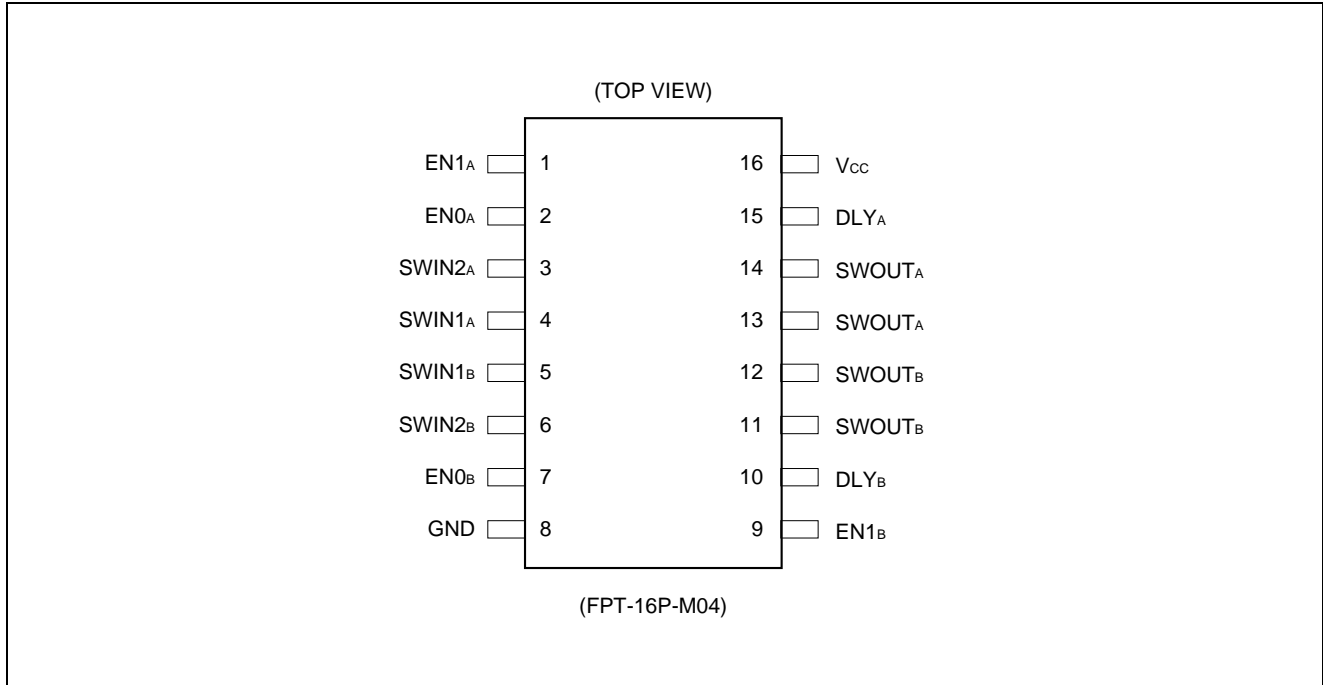
16 pin Plastic SOP



(FPT-16P-M04)

MB3807A

■ PIN ASSIGNMENT



■ LOGICAL OPERATION TABLE

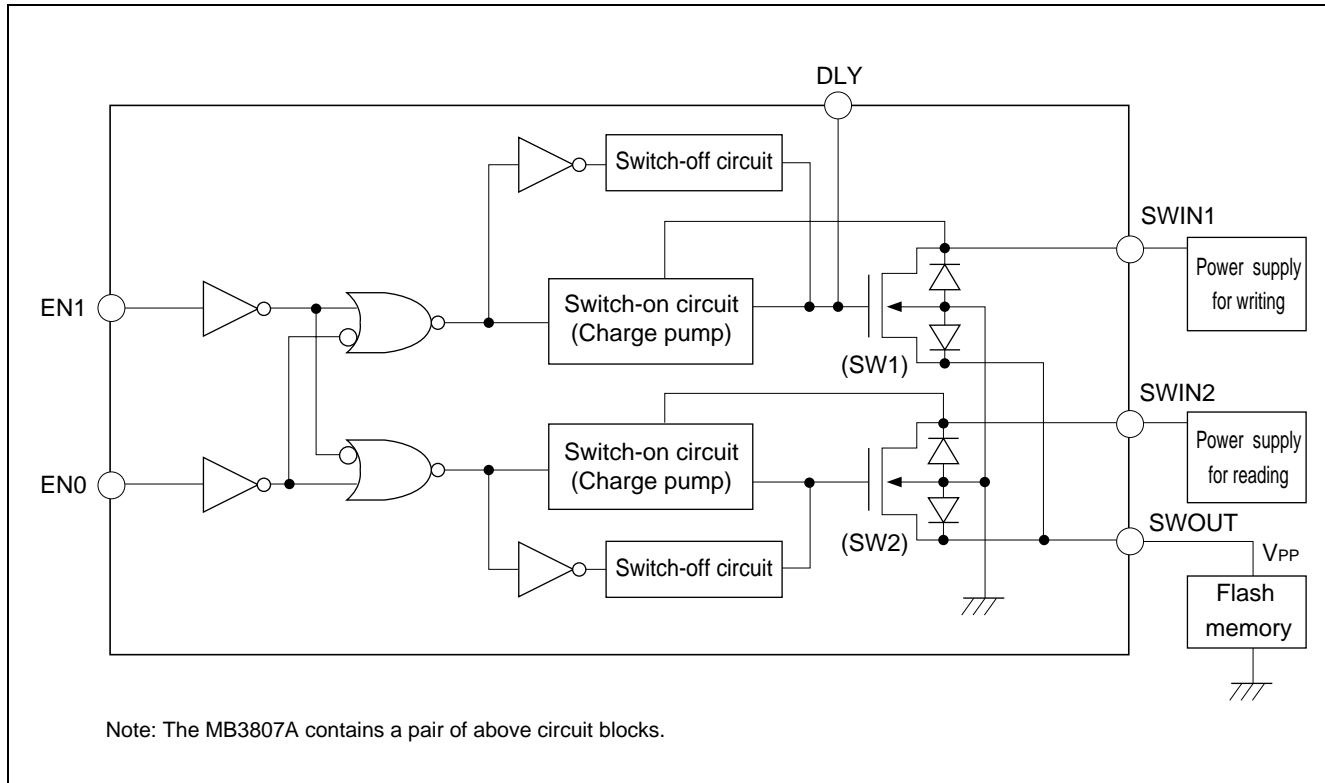
EN1	EN0	SW1	SW2
0	0	OFF	OFF
0	1	OFF	ON
1	0	ON	OFF
1	1	OFF	OFF

■ PIN DESCRIPTION

Pin No.	Pin name	Function
1	EN1 _A	These pins turn the corresponding switches on and off depending on the PCMCIA compatible signals, as shown in "LOGICAL OPERATION TABLE."
9	EN1 _B	
2	EN0 _A	
7	EN0 _B	
4	SWIN1 _A	These pins connect the 12-V power supply for writing data to flash memory. When the SW1 is turned on, the voltage at the SWIN1 pin is output to the SWOUT pin. These pins also serve as power supply pins for the charge pump on the SW1 side. For switching, the pins require a voltage higher than V _{CC} .
5	SWIN1 _B	
3	SWIN2 _A	These pins connect the 3.3/5.0-V power supply for reading data from flash memory. When the SW2 is on, the voltage at the SWIN2 pin is output to the SWOUT pin. These pins also serve as power supply pins for the charge pump on the SW2 side. For switching, the pins require a voltage higher than V _{CC} .
6	SWIN2 _B	
13, 14	SWOUT _A	These pins are output pins of the switch. A pair of two pins are used commonly as either SWOUT _A or SWOUT _B pins. These pins are connected to the V _{PP} pin of the flash memory.
11, 12	SWOUT _B	
15	DLY _A	These pins control the switch ON time. The ON time is controllable using an external capacitor. Leave these pins open when not in use. Note that a voltage of about 25 V is generated when the pins are open. Since high impedance is required, be careful when mounting the device not to generate current leakage.
10	DLY _B	
16	V _{CC}	Power supply pin
8	GND	Ground pin

MB3807A

■ BLOCK DIAGRAM



■ BLOCK DESCRIPTION

The SWIN1 and SWIN2 pins are connected to the 12-V and 3.5/5.0-V power supplies, respectively. The SWOUT pin is connected to the V_{PP} power supply pin of the flash memory.

When conditions, EN1 = "H" and EN0 = "L" are established in an attempt to write data to flash memory, the switch-on circuit (charge pump) on the SW1 side is activated.

The charge pump applies optimum voltage to the SW1 gate to turn the switch on, causing the SWOUT pin to supply 12-V power from the SWIN1 pin to the V_{PP} pin of the flash memory. On the SW2 side, the switch-off circuit discharges the SW2 gate voltage to the GND to turn the switch off.

Reading data from flash memory assume the conditions EN1 = "L" and EN0 = "H." When the conditions are established, the switch-on circuit (charge pump) on the SW2 side and the switch-off circuit on the SW1 side are activated to cause the SWOUT pin to supply 3.3/5.0-V power from the SWIN2 pin to the V_{PP} pin of the flash memory.

Since the switch-on circuits are powered from the SWIN1 and SWIN2 pins, 80 to 350 μ A current flows from the SWIN1 and SWIN2 pins to the GND when the switch is turned on.

The back gate of the N-channel MOS is connected to the GND. This prevents reverse current from flowing at switch-off time, regardless of the high potential of SWIN1 or SWIN2 pin and the SWOUT pin.

The DLY pin is an external capacitance connector to delay turning the switch on. Controlling the switch ON time minimizes surge current flowing to the capacitor connected to the load when the switch is turned on.

■ ABSOLUTE MAXIMUM RATINGS (See WARNING)

Parameter	Symbol	Conditions	Ratings		Unit
			Min.	Max.	
Input voltage	V_{IN}	—	-0.3	7	V
Switching voltage	V_{SWIN1}	—	-0.3	18	V
	V_{SWIN2}	—	-0.3	18	V
Switching current	I_{SWIN1}	Switch-on peak	—	1.5	A
	I_{SWIN2}		—	0.3	A
Permissible loss	P_D	$T_a \leq +75^\circ\text{C}$	—	290	mW
Storage temperature	T_{stg}	—	-55	+125	$^\circ\text{C}$

WARNING: Permanent device damage may occur if the above Absolute Maximum Ratings are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

■ RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Conditions	Values		Unit
			Min.	Max.	
Supply voltage	V_{CC}	—	2.7	5.5	V
High-level input voltage	V_{IH}	—	$V_{CC} \times 0.8$	V_{CC}	V
Low-level input voltage	V_{IL}	—	0	$V_{CC} \times 0.2$	V
Switching voltage	V_{SWIN1}	—	V_{CC}	15.0	V
		Switch OFF state	0	15.0	V
	V_{SWIN2}	—	V_{CC}	6.0	V
		Switch OFF state	0	6.0	V
Switching current	I_{SWIN1}	Switch ON state	—	500	mA
	I_{SWIN2}	Switch ON state	—	100	mA
DLY pin capacitance for connection	C_{DLY}	—	—	10	nF
DLY pin leakage current	I_{DLY}	—	-0.1	0.1	μA
Operating temperature	T_{op}	—	-40	+75	$^\circ\text{C}$

MB3807A

■ ELECTRIC CHARACTERISTICS

1. DC Characteristics

(Ta = -40°C to +75°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typical*1	Max.	
Switch resistance (SW1)	R _{ON1}	V _{SWIN1} = 12 V, I _{SWIN1} = 500 mA V _{CC} = 3 V, 5 V, Ta = +25°C	—	300	450	mΩ
Switch resistance (SW2)	R _{ON2}	V _{SWIN2} = 3 to 5 V, I _{SWIN2} = 100 mA V _{CC} = 3 V, 5 V, Ta = +25°C	—	6	10	Ω
Switch resistance	R _{ONT1}	V _{SWIN1} = 12 V, I _{SWIN1} = 500 mA V _{CC} = 3 V, 5 V	—	—	610	mΩ
	R _{ONT2}	V _{SWIN2} = 3 to 5 V, I _{SWIN2} = 100 mA V _{CC} = 3 V, 5 V	—	—	14	Ω
High-level input current	I _{IH}	V _{CC} = 5.5 V, V _{IH} = 5.5 V	—	0	10	μA
Low-level input current	I _{IL}	V _{CC} = 5.5 V, V _{IL} = 0 V	-10	0	—	μA
Switch-off leakage current	I _{L1}	EN0 = 0 V, EN1 = 0 V or EN0 = 3 V, EN1 = 3 V V _{SWIN1} = 15 V, V _{CC} = 3 V	—	0	10	μA
	I _{L2}	EN0 = 0 V, EN1 = 0 V or EN0 = 3 V, EN1 = 3 V V _{SWIN2} = 6 V, V _{CC} = 3 V	—	0	10	μA
Charge pump driving current*2	I _{SWON1}	EN0 = 0 V, EN1 = 5 V V _{CC} = 5 V, V _{SWIN1} = 12 V	175	350	700	μA
	I _{SWON2}	EN0 = 5 V, EN1 = 0 V V _{CC} = 5 V, V _{SWIN2} = 5 V	30	80	200	μA
DLY output voltage	V _{DLY}	V _{CC} = 5 V, V _{SWIN2} = 12 V	—	24	35	V
Supply current	I _{CC}	EN0 = 5 V, EN1 = 0 V or EN0 = 5 V, EN1 = 0 V V _{CC} = 5 V	50	100	300	μA

*1: Typical values assume V_{CC} = TYP, Ta = +25°C.

*2: The charge pump driving current flows from SWIN to GND when the switch is turned on.

2. AC Characteristics

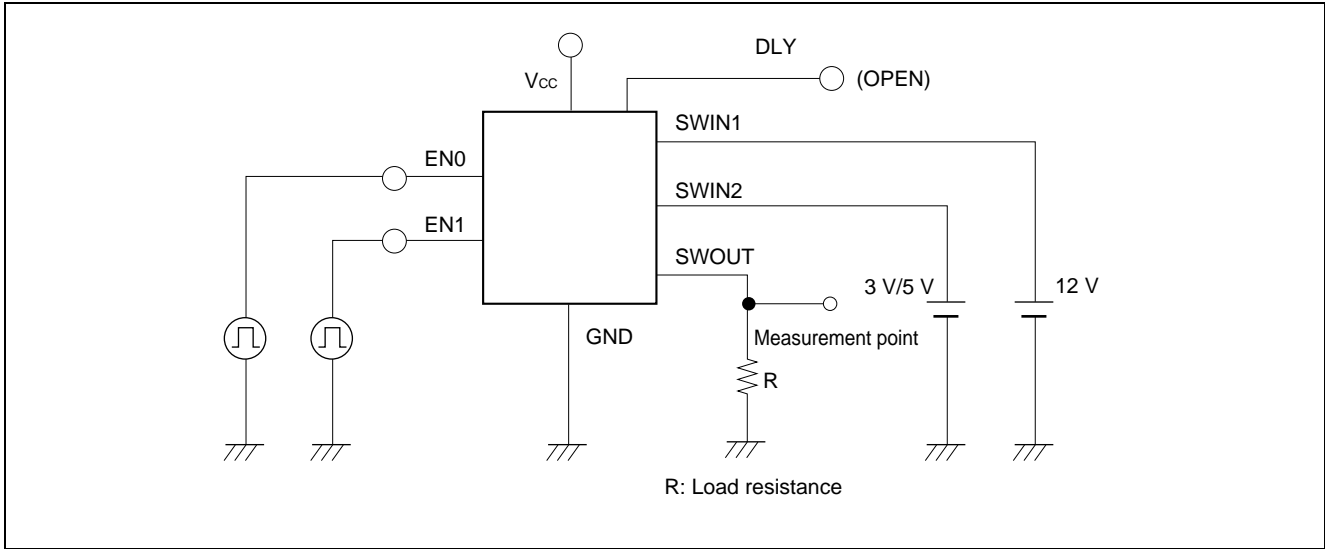
(Ta = -40°C to +75°C)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typical	Max.	
ON time	t _{ON1}	V _{SWIN1} = 12 V, R = 24 Ω, V _{CC} = 5 V	30	60	140	μs
	t _{ON2}	V _{SWIN1} = 12 V, R = 24 Ω, V _{CC} = 3 V	30	60	140	μs
	t _{ON3}	V _{SWIN2} = 5 V, R = 50 Ω, V _{CC} = 5 V	40	90	200	μs
	t _{ON4}	V _{SWIN2} = 3 V, R = 30 Ω, V _{CC} = 3 V	200	400	1200	μs
OFF time	t _{OFF1}	V _{SWIN1} = 12 V, R = 24 Ω, V _{CC} = 5 V	10	30	60	μs
	t _{OFF2}	V _{SWIN1} = 12 V, R = 24 Ω, V _{CC} = 3 V	10	40	70	μs
	t _{OFF3}	V _{SWIN2} = 5 V, R = 50 Ω, V _{CC} = 5 V	1	7	20	μs
	t _{OFF4}	V _{SWIN2} = 3 V, R = 30 Ω, V _{CC} = 3 V	1	7	20	μs
ON/OFF time difference	t _{HYS1}	—	29	53	130	μs
	t _{HYS2}	—	29	53	130	μs
	t _{HYS3}	—	30	60	190	μs
	t _{HYS4}	—	190	360	12000	μs

Note: ON/OFF time difference: t_{HYS1} = t_{ON1} - t_{OFF3}
t_{HYS2} = t_{ON2} - t_{OFF4}
t_{HYS3} = t_{ON3} - t_{OFF1}
t_{HYS4} = t_{ON4} - t_{OFF2}

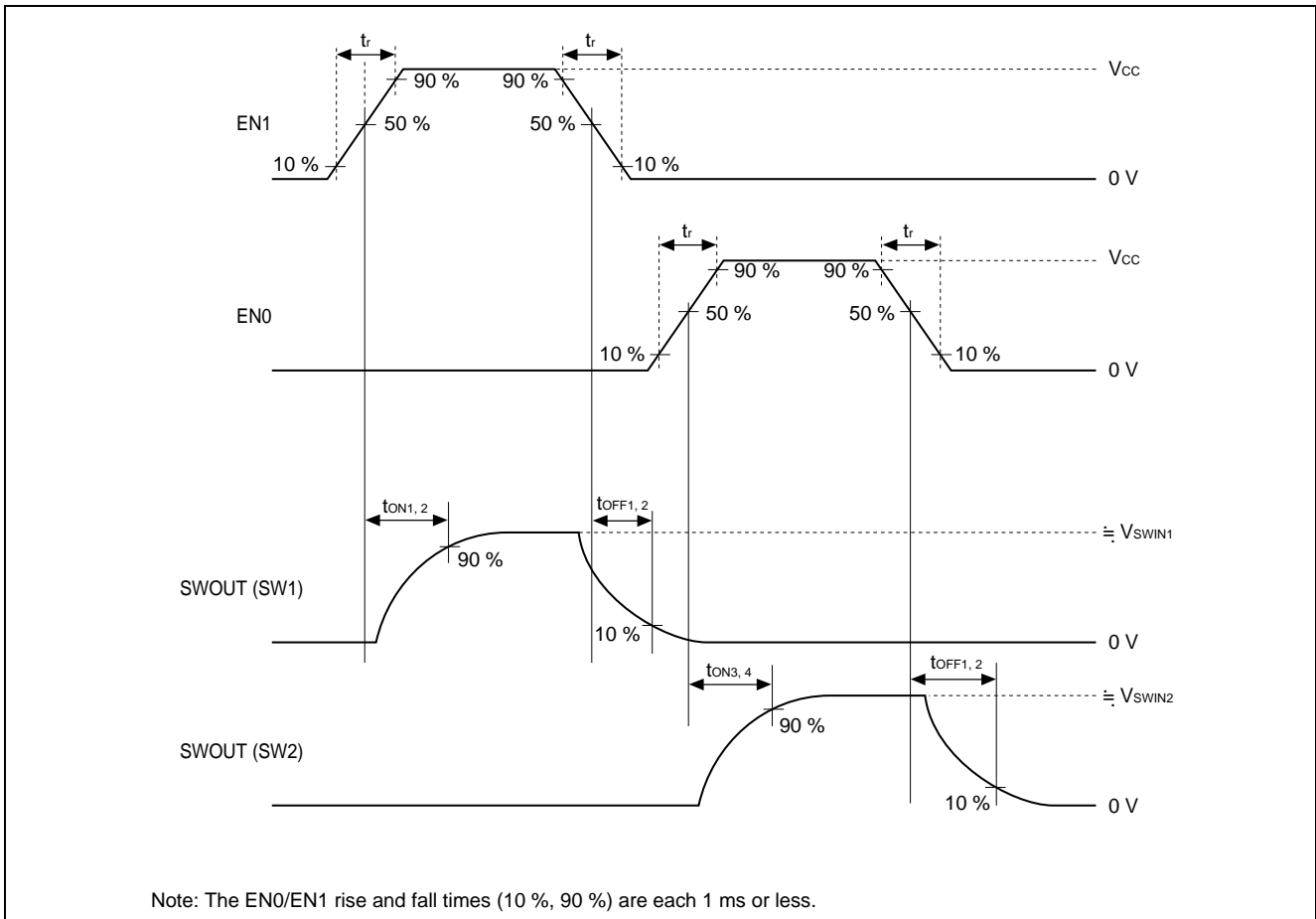
AC SPECIFICATION TEST DIAGRAM

- Measurement Conditions



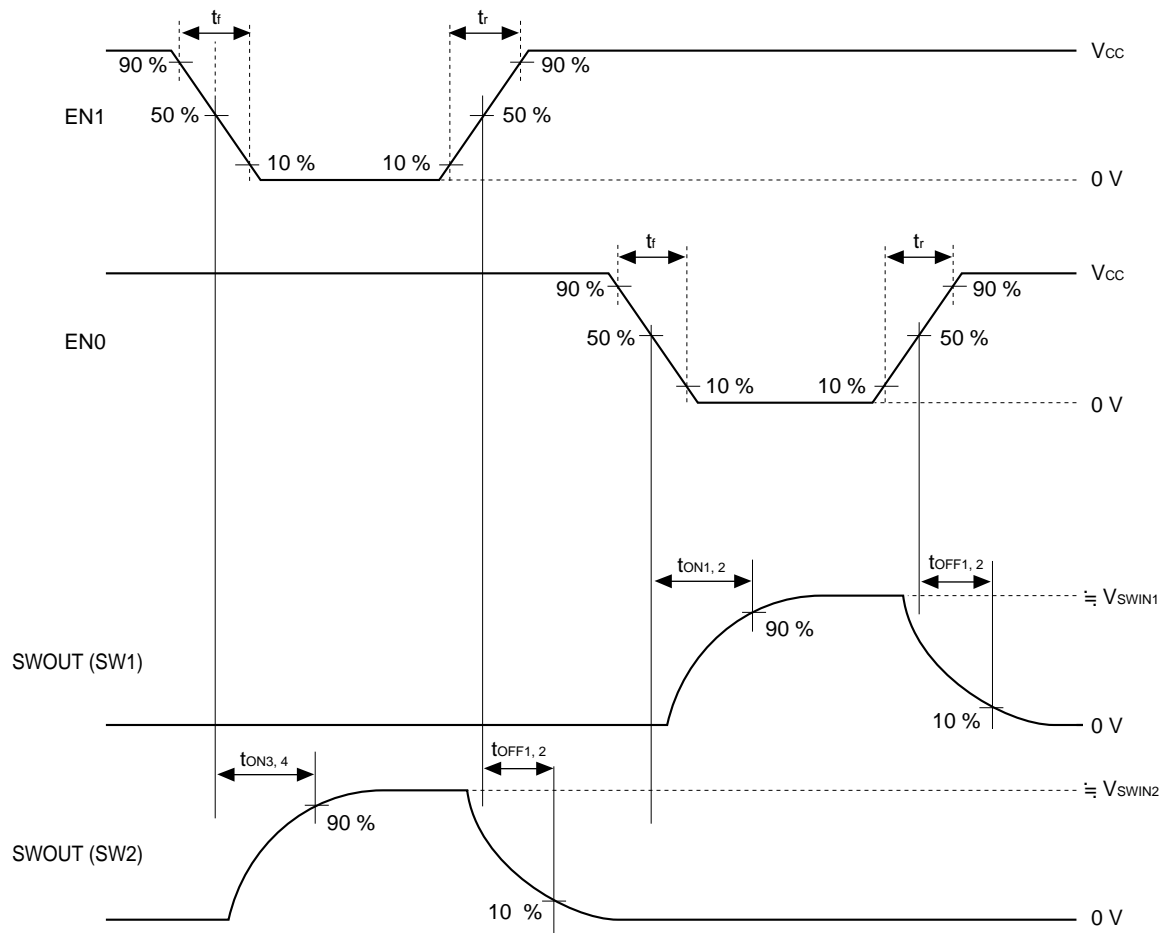
TIMING DIAGRAM

- ON-time and OFF-time Waveforms



(Continued)

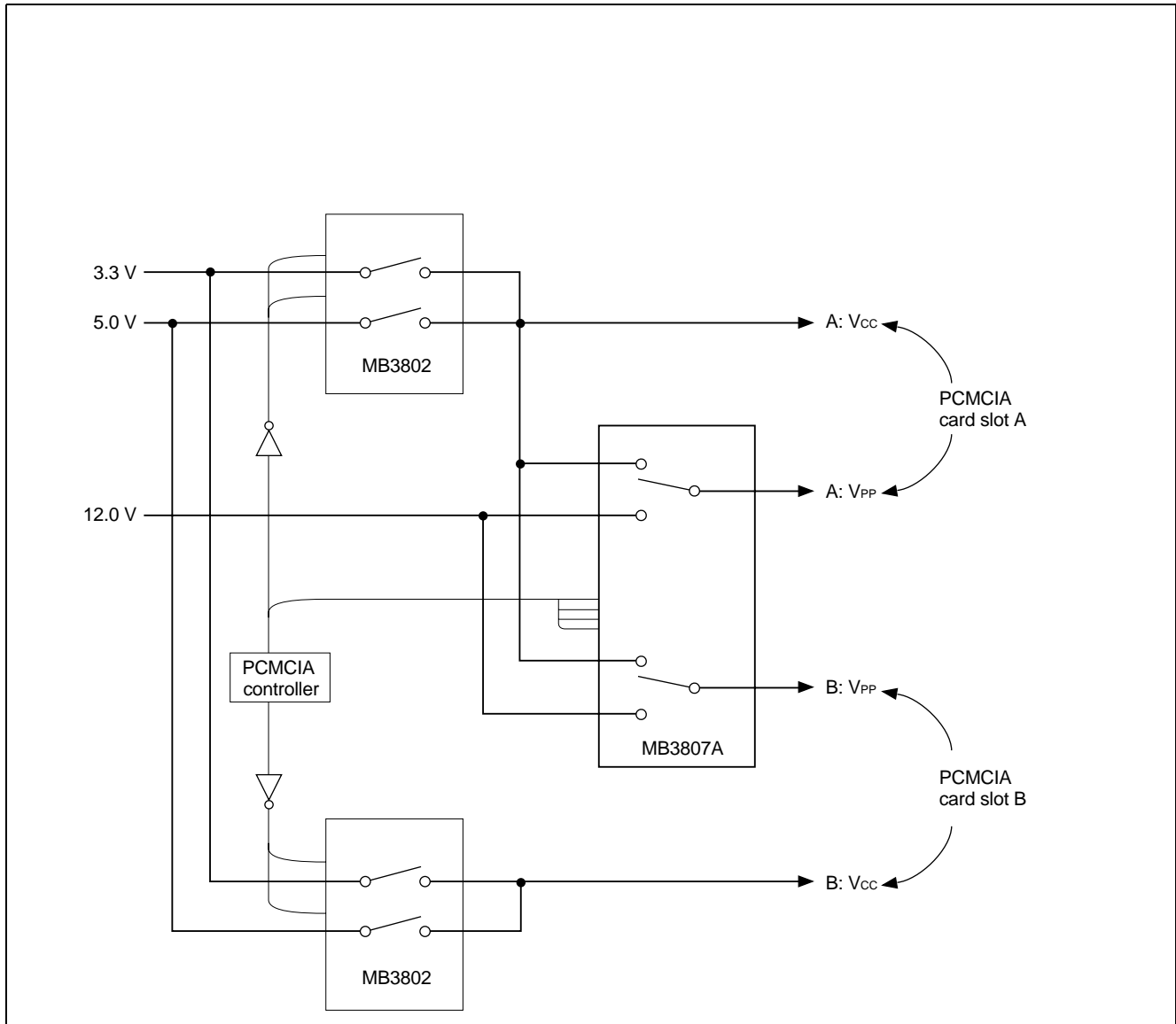
(Continued)



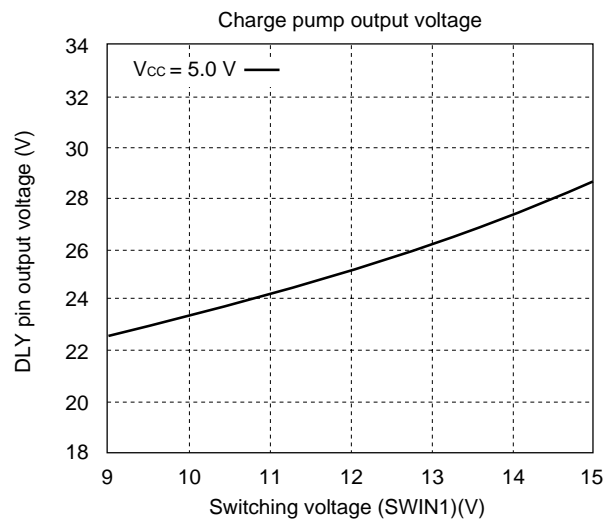
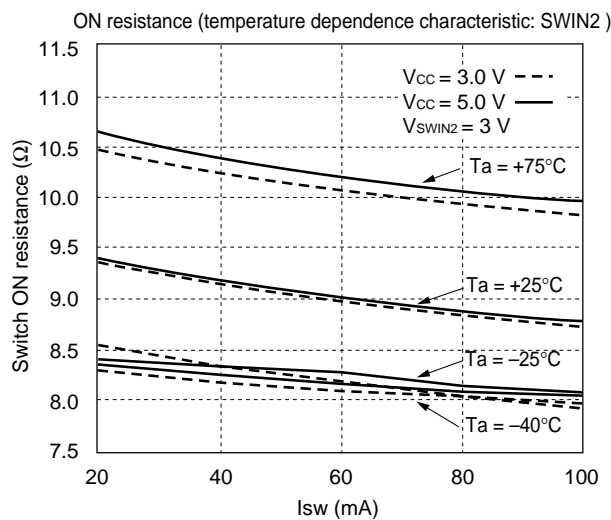
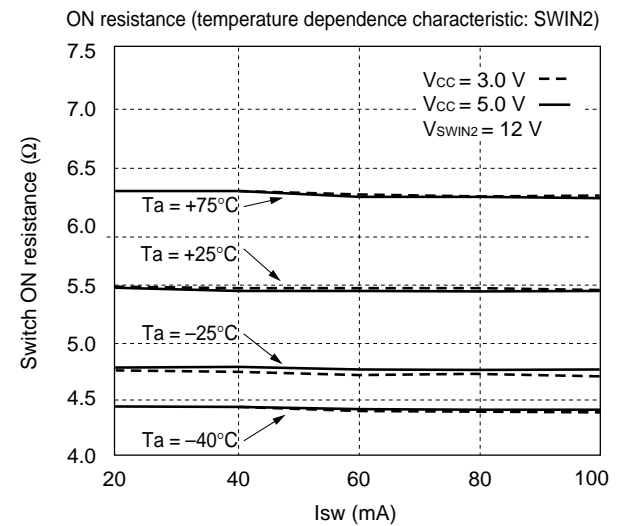
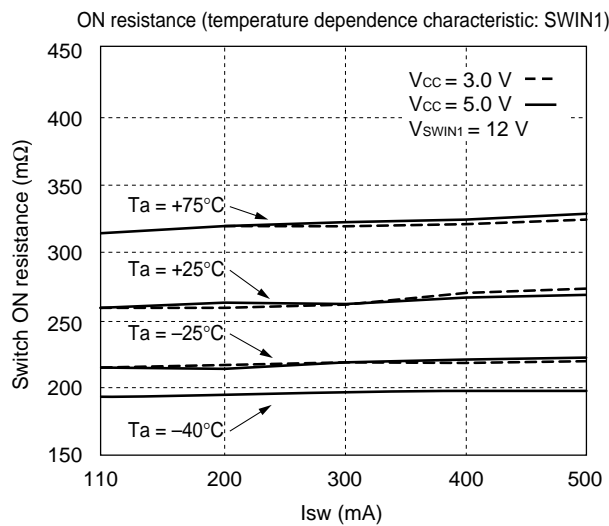
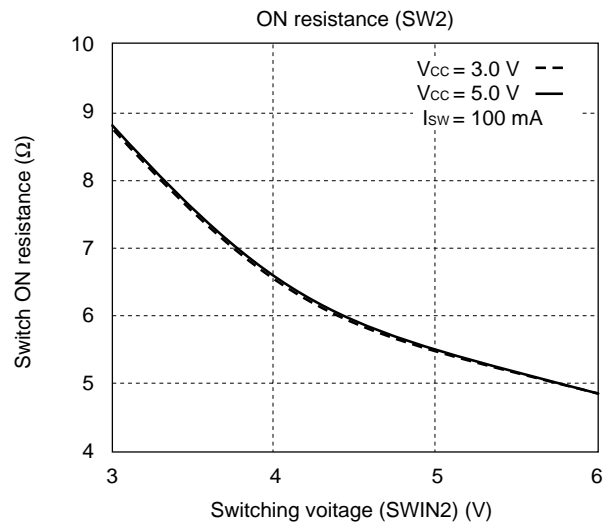
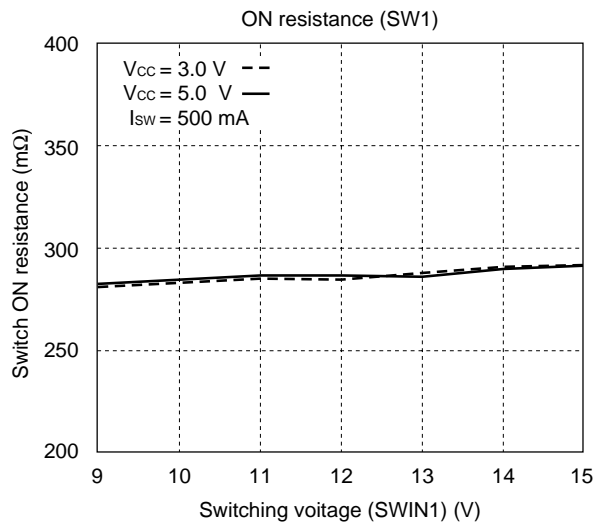
Note: The EN0/EN1 rise and fall times (10 %, 90 %) are each 1 ms or less.

MB3807A

■ APPLICATION



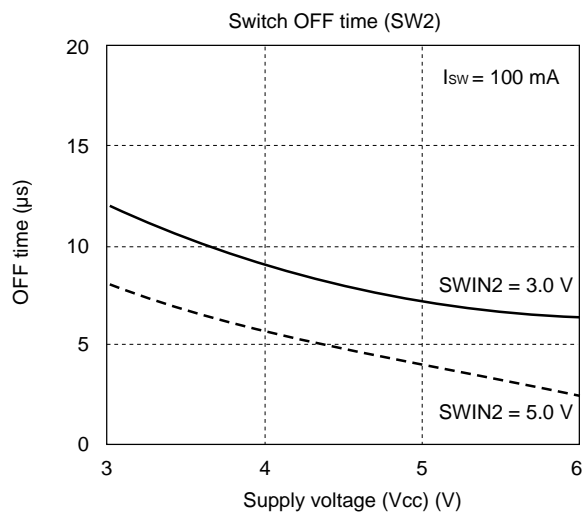
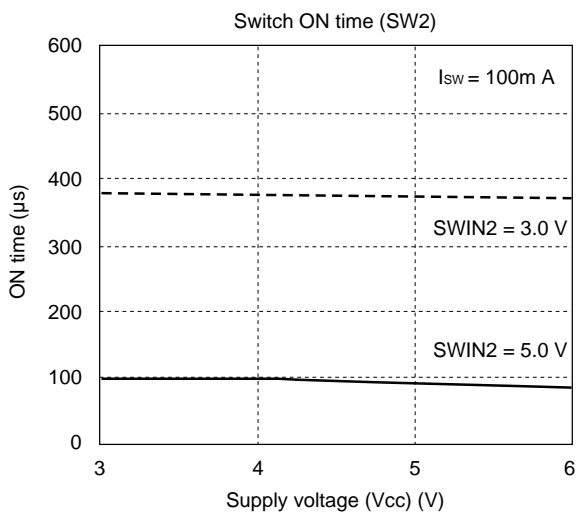
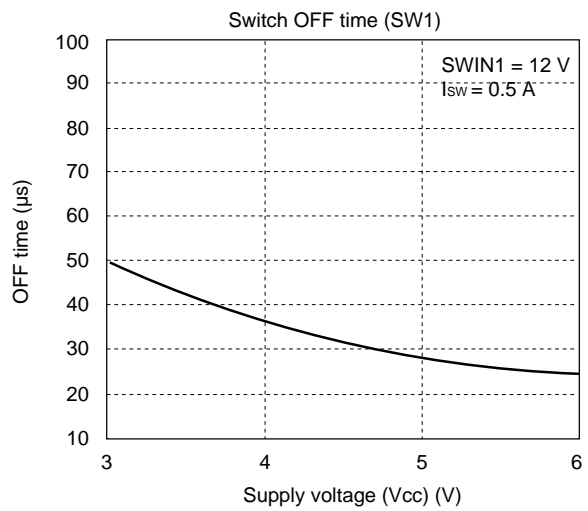
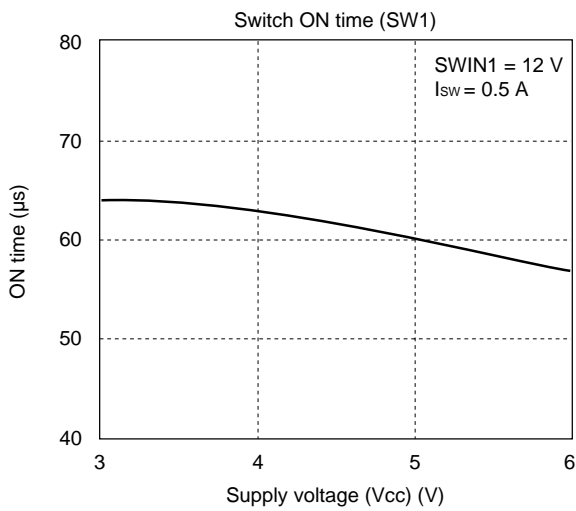
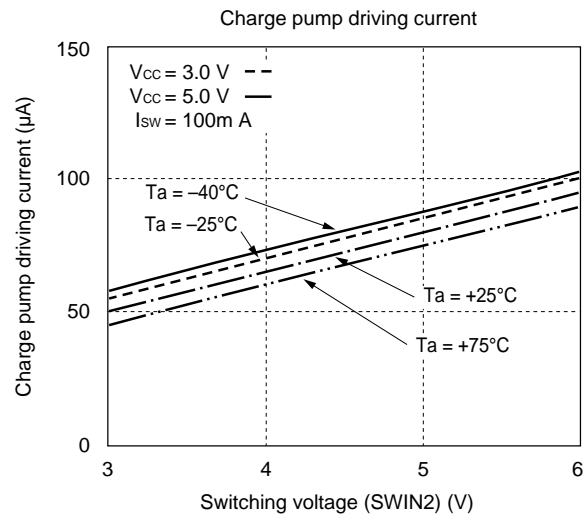
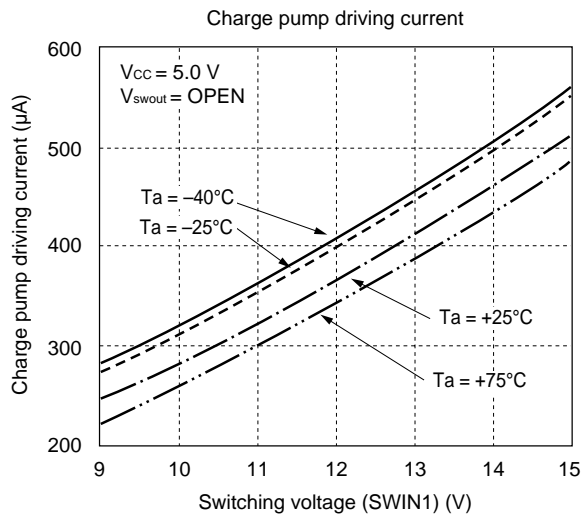
TYPICAL CHARACTERISTIC CURVES



(Continued)

MB3807A

(Continued)



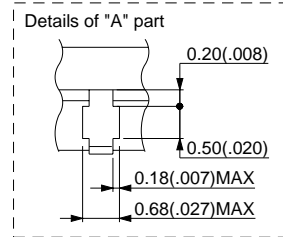
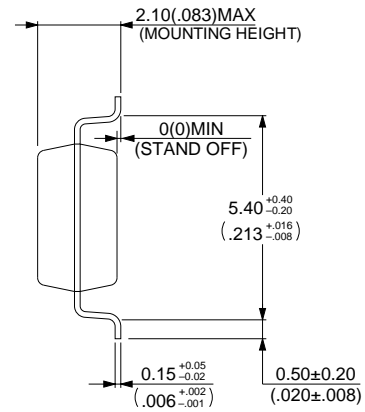
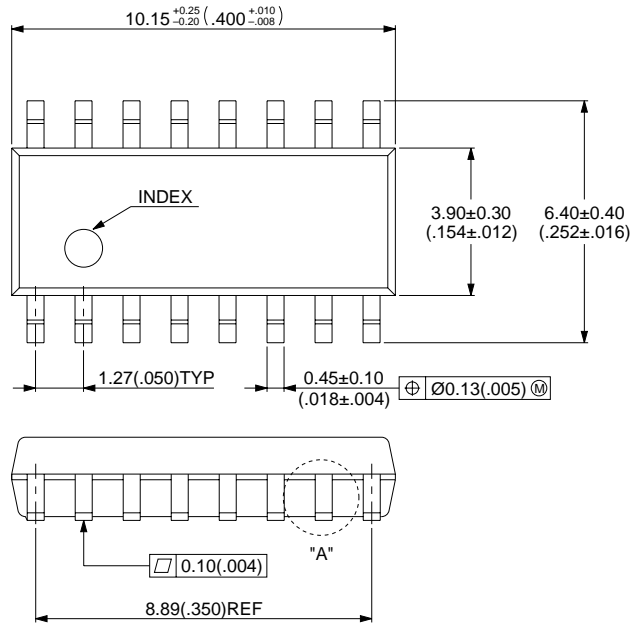
■ ORDERING INFORMATION

Part number	Package	Remarks
MB3807APF	16 pin Plastic SOP (FPT-16P-M04)	

MB3807A

■ PACKAGE DIMENSION

16 pin Plastic SOP
(FPT-16P-M04)



© 1994 FUJITSU LIMITED F16012S-4C-4

Dimensions in mm (inches)

FUJITSU LIMITED

For further information please contact:

Japan

FUJITSU LIMITED
Corporate Global Business Support Division
Electronic Devices
KAWASAKI PLANT, 4-1-1, Kamikodanaka
Nakahara-ku, Kawasaki-shi
Kanagawa 211-8588, Japan
Tel: (044) 754-3763
Fax: (044) 754-3329

<http://www.fujitsu.co.jp/>

North and South America

FUJITSU MICROELECTRONICS, INC.
Semiconductor Division
3545 North First Street
San Jose, CA 95134-1804, USA
Tel: (408) 922-9000
Fax: (408) 922-9179

Customer Response Center
Mon. - Fri.: 7 am - 5 pm (PST)
Tel: (800) 866-8608
Fax: (408) 922-9179

<http://www.fujitsumicro.com/>

Europe

FUJITSU MIKROELEKTRONIK GmbH
Am Siebenstein 6-10
D-63303 Dreieich-Buchsschlag
Germany
Tel: (06103) 690-0
Fax: (06103) 690-122

<http://www.fujitsu-edc.com/>

Asia Pacific

FUJITSU MICROELECTRONICS ASIA PTE LTD
#05-08, 151 Lorong Chuan
New Tech Park
Singapore 556741
Tel: (65) 281-0770
Fax: (65) 281-0220

<http://www.fmap.com.sg/>

F9803

© FUJITSU LIMITED Printed in Japan

All Rights Reserved.

The contents of this document are subject to change without notice. Customers are advised to consult with FUJITSU sales representatives before ordering.

The information and circuit diagrams in this document presented as examples of semiconductor device applications, and are not intended to be incorporated in devices for actual use. Also, FUJITSU is unable to assume responsibility for infringement of any patent rights or other rights of third parties arising from the use of this information or circuit diagrams.

FUJITSU semiconductor devices are intended for use in standard applications (computers, office automation and other office equipment, industrial, communications, and measurement equipment, personal or household devices, etc.).

CAUTION:

Customers considering the use of our products in special applications where failure or abnormal operation may directly affect human lives or cause physical injury or property damage, or where extremely high levels of reliability are demanded (such as aerospace systems, atomic energy controls, sea floor repeaters, vehicle operating controls, medical devices for life support, etc.) are requested to consult with FUJITSU sales representatives before such use. The company will not be responsible for damages arising from such use without prior approval.

Any semiconductor devices have inherently a certain rate of failure. You must protect against injury, damage or loss from such failures by incorporating safety design measures into your facility and equipment such as redundancy, fire protection, and prevention of over-current levels and other abnormal operating conditions.

If any products described in this document represent goods or technologies subject to certain restrictions on export under the Foreign Exchange and Foreign Trade Control Law of Japan, the prior authorization by Japanese government should be required for export of those products from Japan.