

# 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.

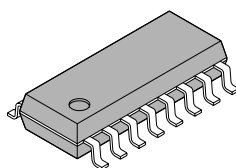
In addition, the OFF time is much shorter than the ON time to prevent short-circuiting between the reading and writing power supplies when the device switches the  $V_{PP}$  voltage for reading or writing data (break-before-make operation).

### ■ 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

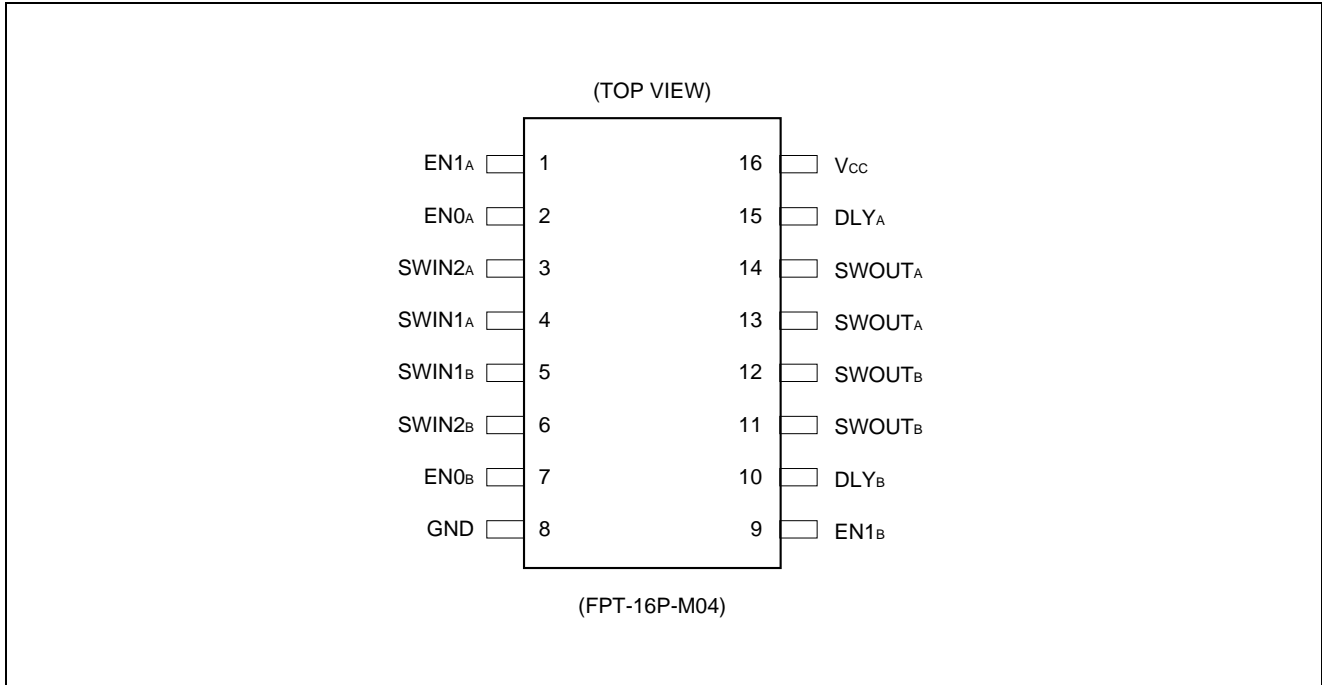
16 pin Plastic SOP



(FPT-16P-M04)

# MB3807A

## ■ PIN ASSIGNMENT



## ■ LOGICAL OPERATION TABLE

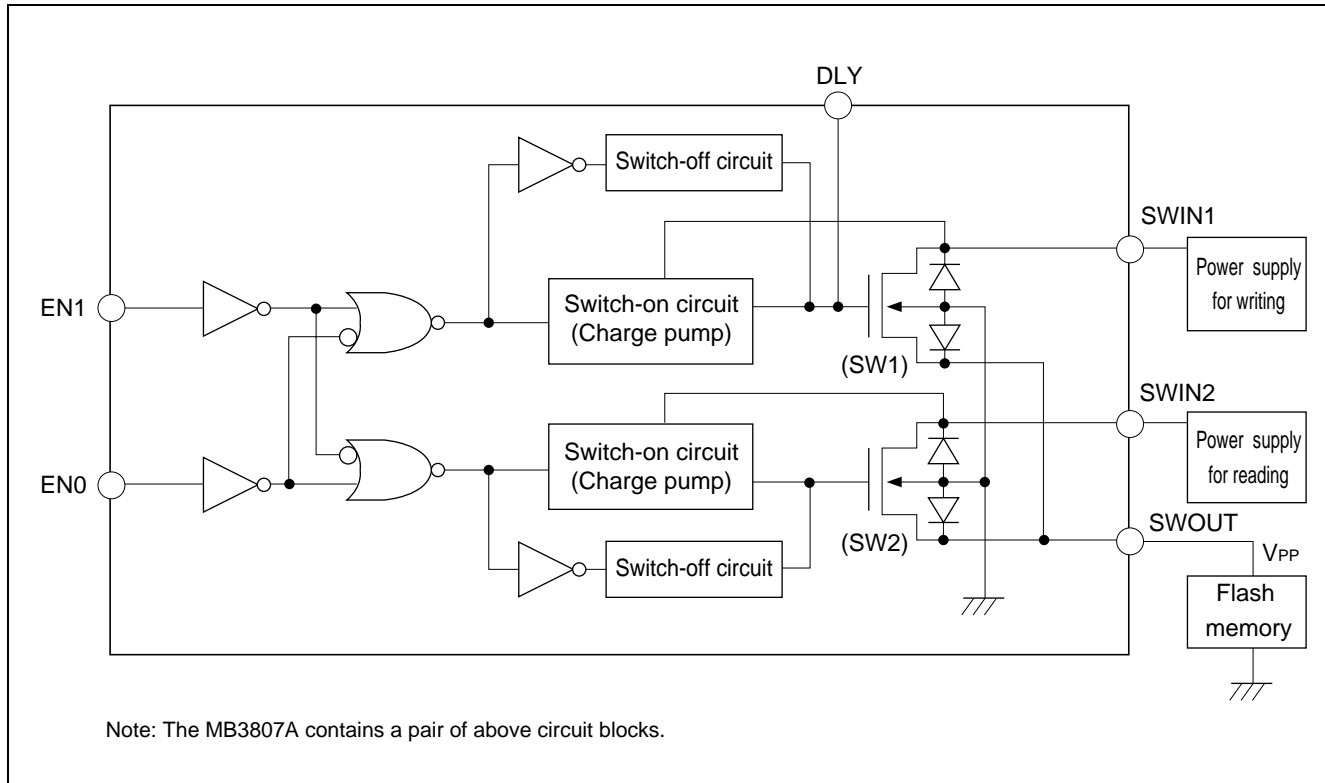
EN1	EN0	SW1	SW2
0	0	OFF	OFF
0	1	OFF	ON
1	0	ON	OFF
1	1	OFF	OFF

## ■ PIN DESCRIPTION

Pin No.	Pin name	Function
1	EN1 <sub>A</sub>	These pins turn the corresponding switches on and off depending on the PCMCIA compatible signals, as shown in "LOGICAL OPERATION TABLE."
9	EN1 <sub>B</sub>	
2	EN0 <sub>A</sub>	
7	EN0 <sub>B</sub>	
4	SWIN1 <sub>A</sub>	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 <sub>CC</sub> .
5	SWIN1 <sub>B</sub>	
3	SWIN2 <sub>A</sub>	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 <sub>CC</sub> .
6	SWIN2 <sub>B</sub>	
13, 14	SWOUT <sub>A</sub>	These pins are output pins of the switch. A pair of two pins are used commonly as either SWOUT <sub>A</sub> or SWOUT <sub>B</sub> pins. These pins are connected to the V <sub>PP</sub> pin of the flash memory.
11, 12	SWOUT <sub>B</sub>	
15	DLY <sub>A</sub>	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 <sub>B</sub>	
16	V <sub>CC</sub>	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  $\mu$ 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	$\mu\text{A}$
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 <sub>ON1</sub>	V <sub>SWIN1</sub> = 12 V, I <sub>SWIN1</sub> = 500 mA V <sub>CC</sub> = 3 V, 5 V, Ta = +25°C	—	300	450	mΩ
Switch resistance (SW2)	R <sub>ON2</sub>	V <sub>SWIN2</sub> = 3 to 5 V, I <sub>SWIN2</sub> = 100 mA V <sub>CC</sub> = 3 V, 5 V, Ta = +25°C	—	6	10	Ω
Switch resistance	R <sub>ONT1</sub>	V <sub>SWIN1</sub> = 12 V, I <sub>SWIN1</sub> = 500 mA V <sub>CC</sub> = 3 V, 5 V	—	—	610	mΩ
	R <sub>ONT2</sub>	V <sub>SWIN2</sub> = 3 to 5 V, I <sub>SWIN2</sub> = 100 mA V <sub>CC</sub> = 3 V, 5 V	—	—	14	Ω
High-level input current	I <sub>IH</sub>	V <sub>CC</sub> = 5.5 V, V <sub>IH</sub> = 5.5 V	—	0	10	μA
Low-level input current	I <sub>IL</sub>	V <sub>CC</sub> = 5.5 V, V <sub>IL</sub> = 0 V	-10	0	—	μA
Switch-off leakage current	I <sub>L1</sub>	EN0 = 0 V, EN1 = 0 V or EN0 = 3 V, EN1 = 3 V V <sub>SWIN1</sub> = 15 V, V <sub>CC</sub> = 3 V	—	0	10	μA
	I <sub>L2</sub>	EN0 = 0 V, EN1 = 0 V or EN0 = 3 V, EN1 = 3 V V <sub>SWIN2</sub> = 6 V, V <sub>CC</sub> = 3 V	—	0	10	μA
Charge pump driving current*2	I <sub>SWON1</sub>	EN0 = 0 V, EN1 = 5 V V <sub>CC</sub> = 5 V, V <sub>SWIN1</sub> = 12 V	175	350	700	μA
	I <sub>SWON2</sub>	EN0 = 5 V, EN1 = 0 V V <sub>CC</sub> = 5 V, V <sub>SWIN2</sub> = 5 V	30	80	200	μA
DLY output voltage	V <sub>DLY</sub>	V <sub>CC</sub> = 5 V, V <sub>SWIN2</sub> = 12 V	—	24	35	V
Supply current	I <sub>CC</sub>	EN0 = 5 V, EN1 = 0 V or EN0 = 5 V, EN1 = 0 V V <sub>CC</sub> = 5 V	50	100	300	μA

\*1: Typical values assume V<sub>CC</sub> = TYP, Ta = +25°C.

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

## 2. AC Characteristics

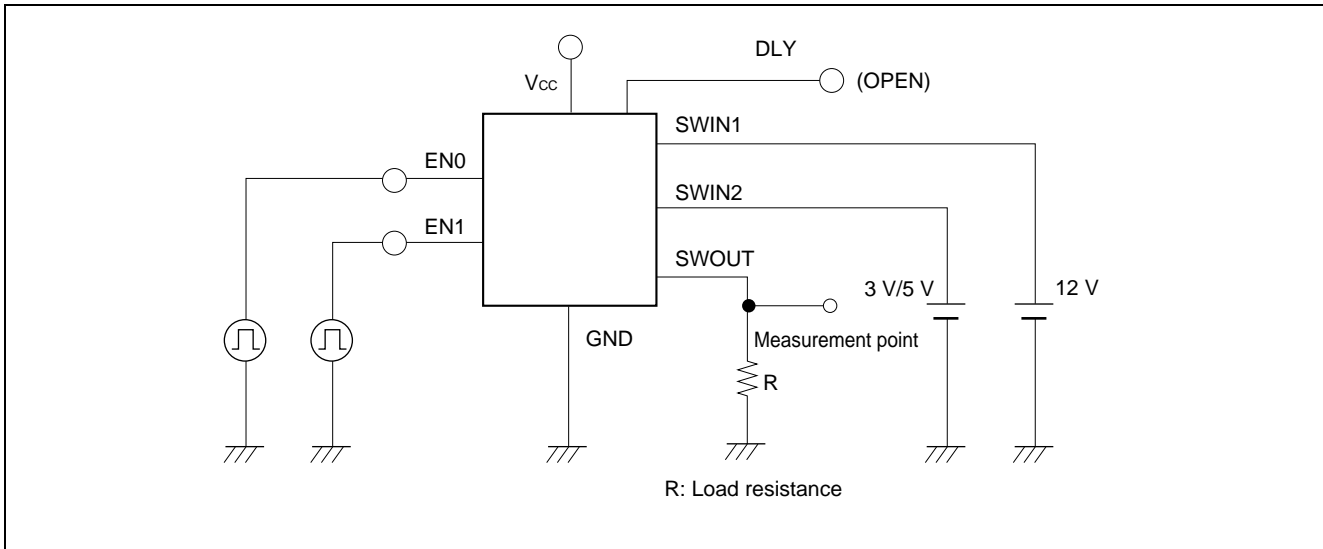
(Ta = -40°C to +75°C)

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

Note: ON/OFF time difference: t<sub>HYS1</sub> = t<sub>ON1</sub> - t<sub>OFF3</sub>  
t<sub>HYS2</sub> = t<sub>ON2</sub> - t<sub>OFF4</sub>  
t<sub>HYS3</sub> = t<sub>ON3</sub> - t<sub>OFF1</sub>  
t<sub>HYS4</sub> = t<sub>ON4</sub> - t<sub>OFF2</sub>

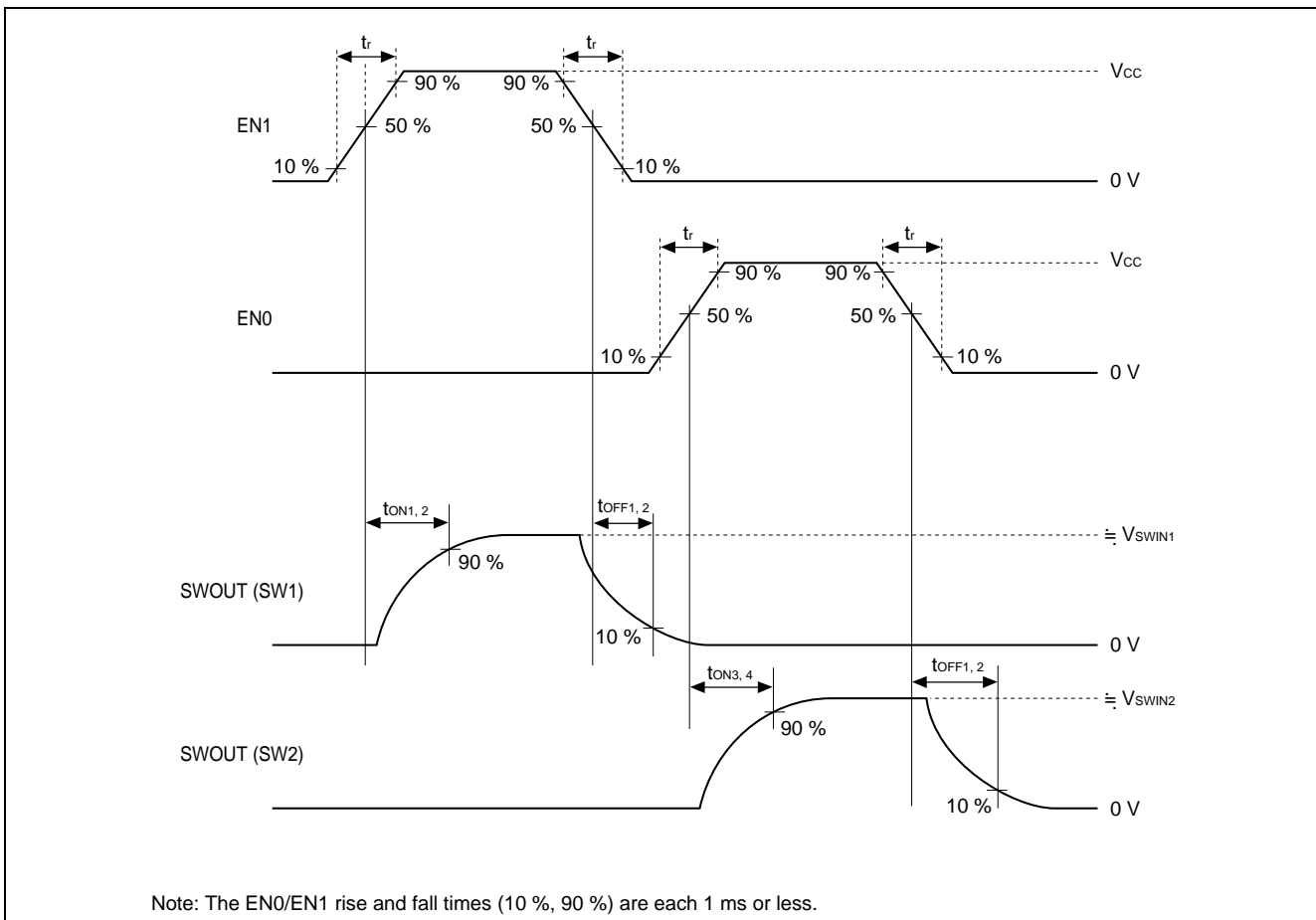
## ■ AC SPECIFICATION TEST DIAGRAM

- Measurement Conditions



## ■ TIMING DIAGRAM

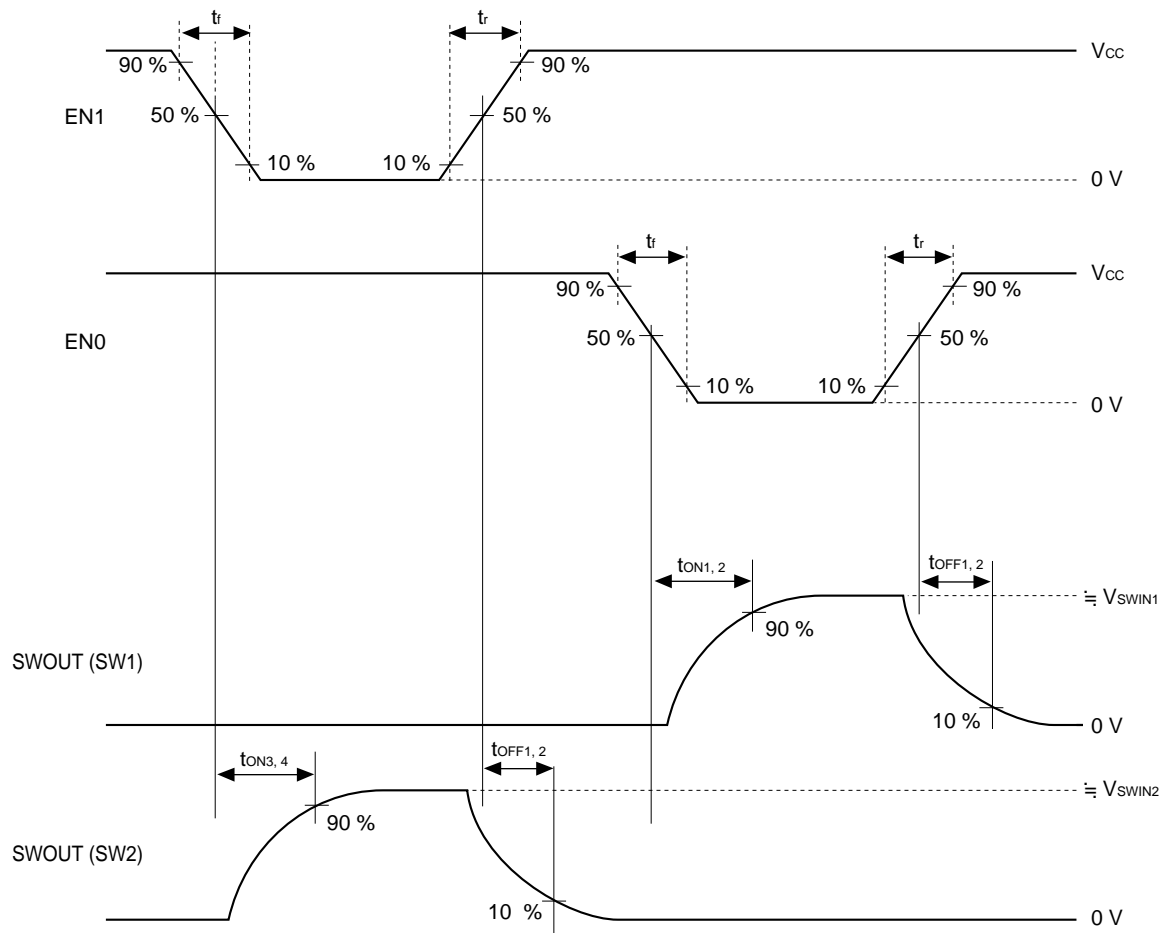
- ON-time and OFF-time Waveforms



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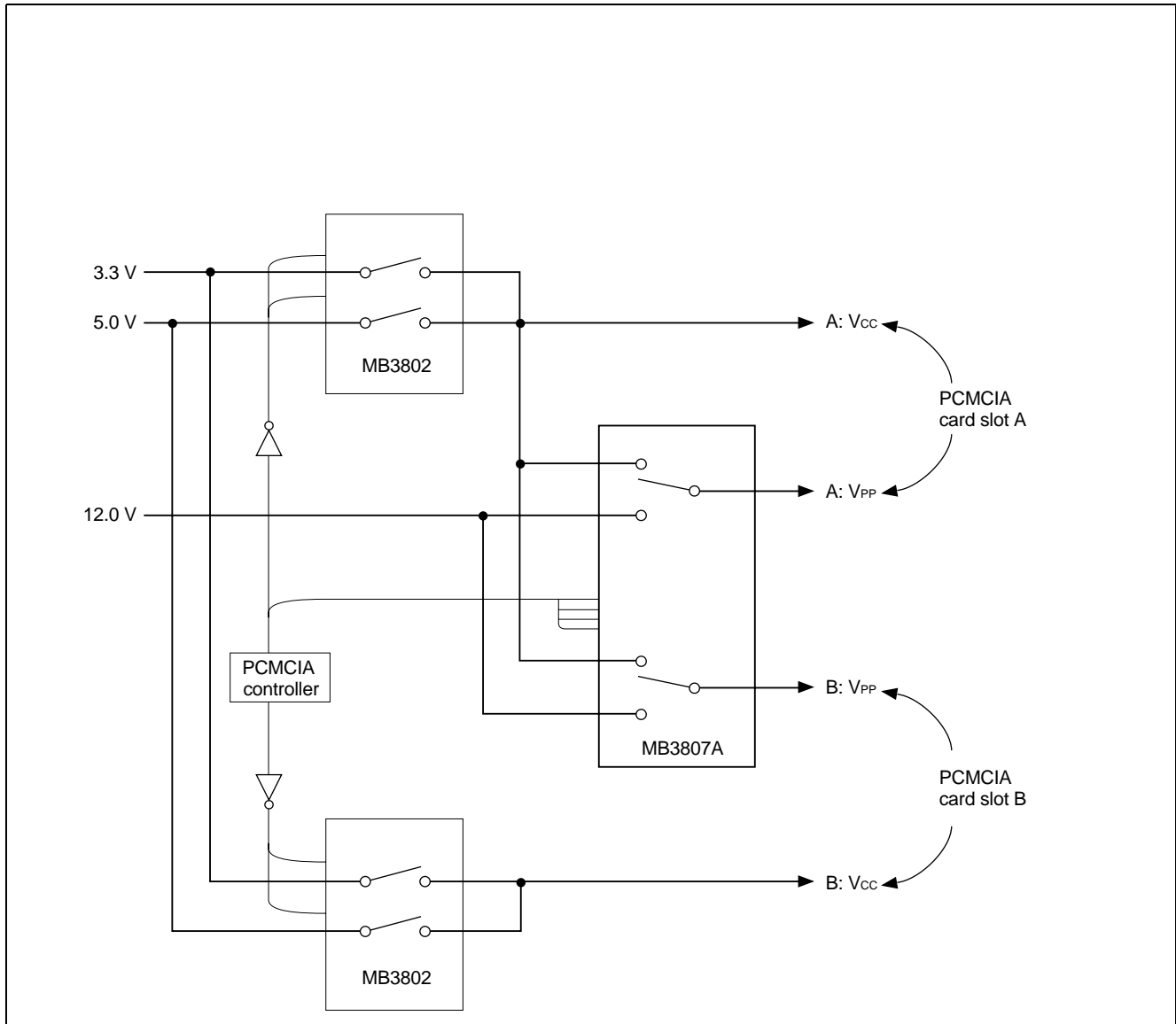
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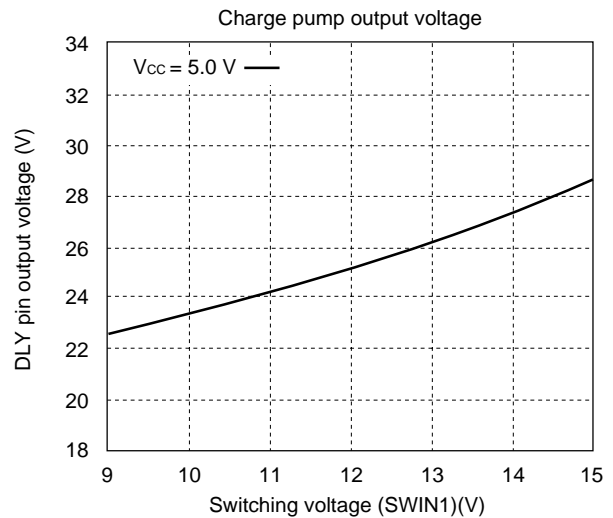
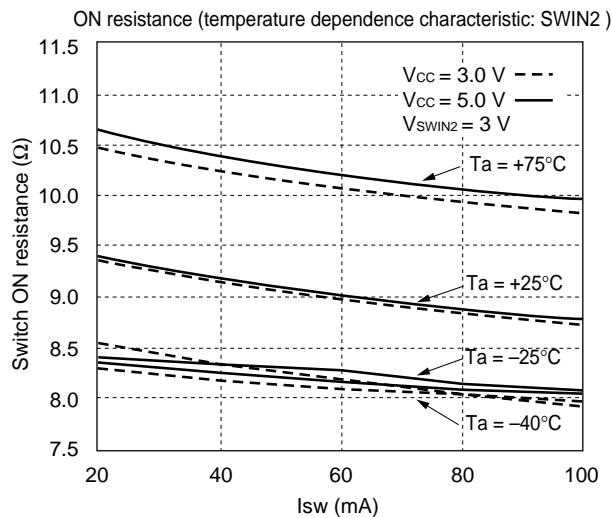
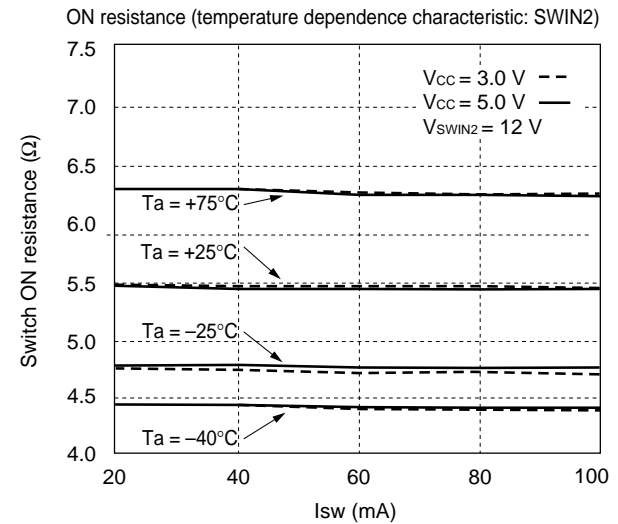
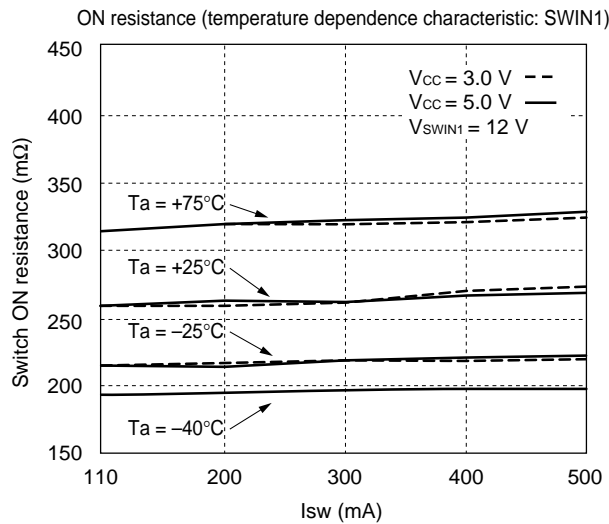
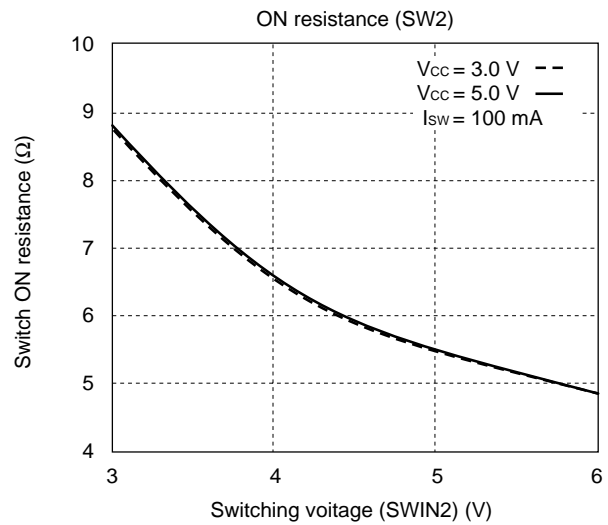
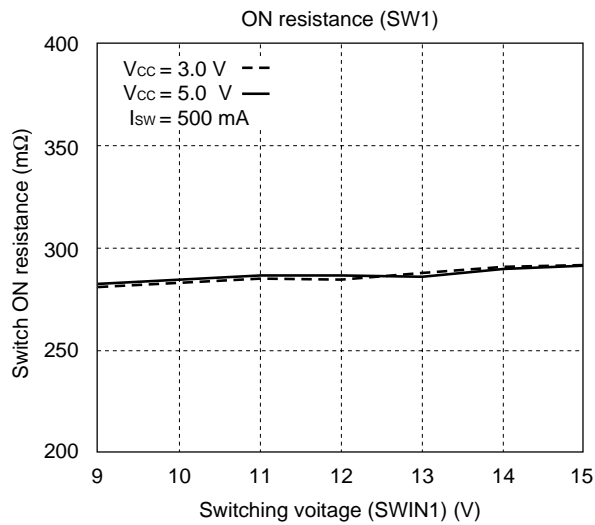
Note: The EN0/EN1 rise and fall times (10 %, 90 %) are each 1 ms or less.

# MB3807A

## ■ APPLICATION



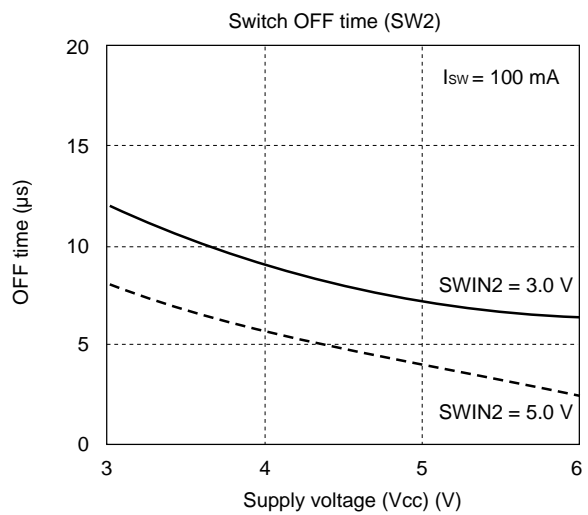
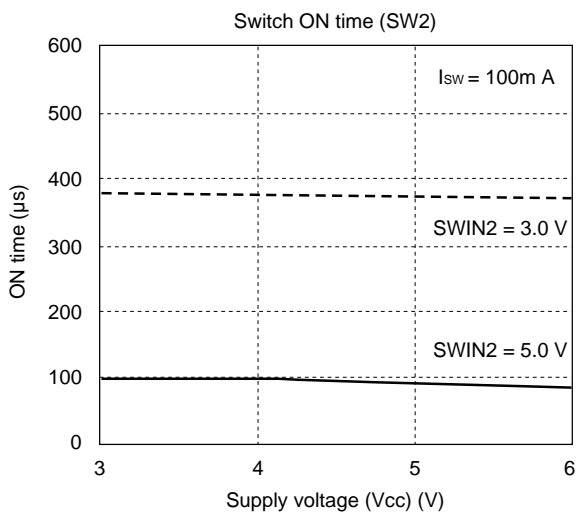
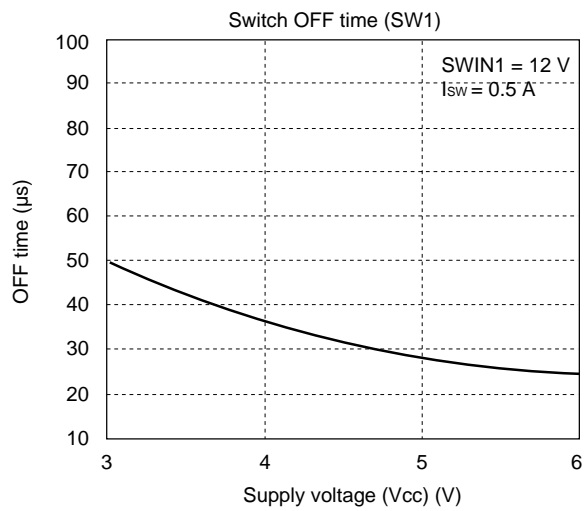
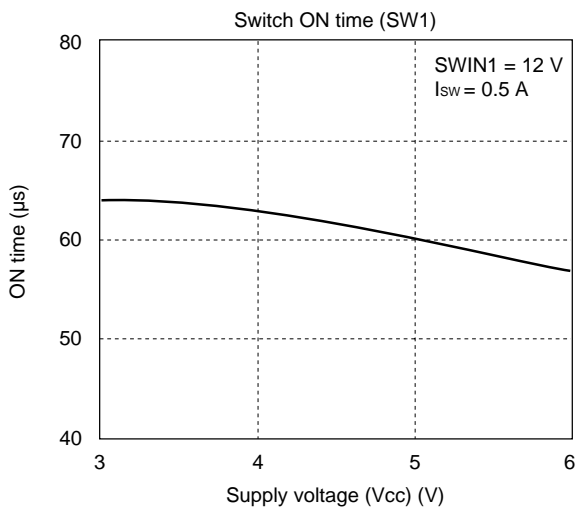
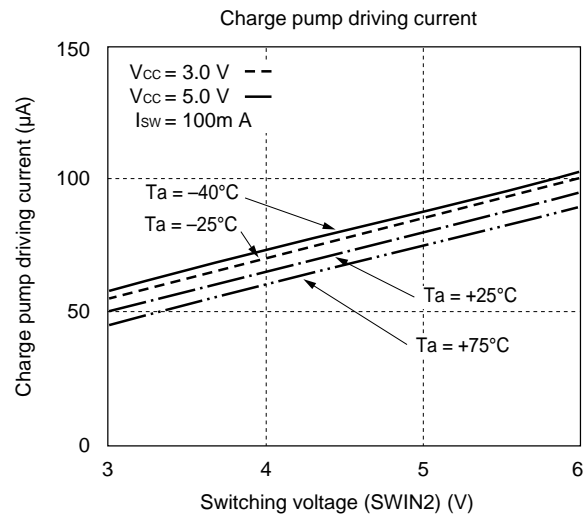
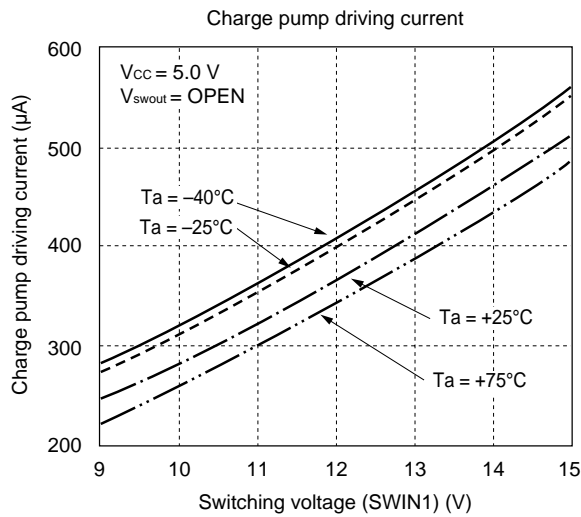
## TYPICAL CHARACTERISTIC CURVES



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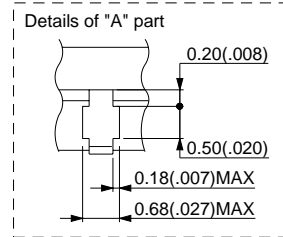
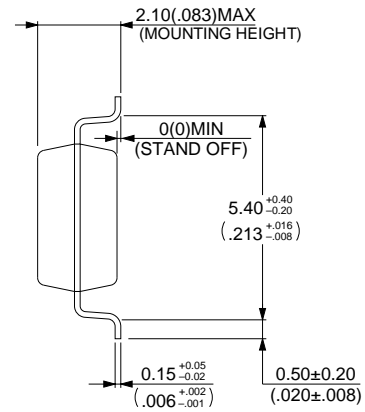
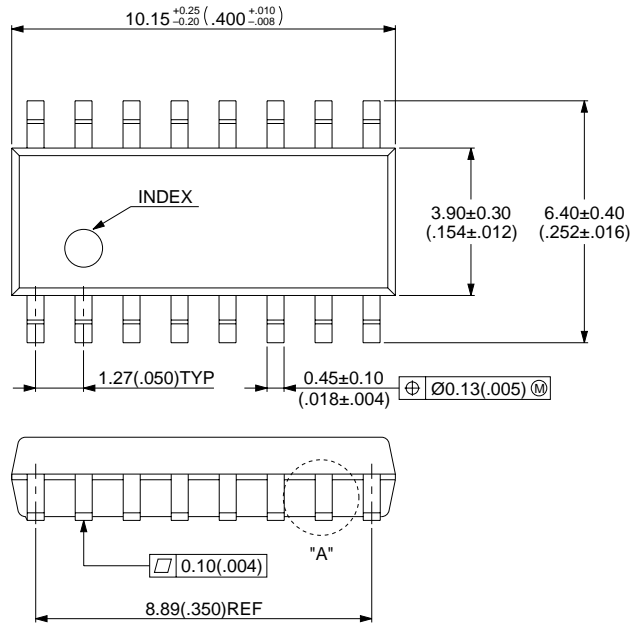
## ■ ORDERING INFORMATION

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

# MB3807A

## ■ PACKAGE DIMENSION

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



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Dimensions in mm (inches)

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