FUJITSU SEMICONDUCTOR
DATA SHEET

DS04-27602-1E

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.

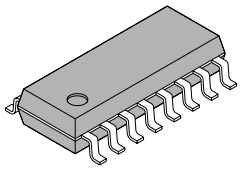
In addition, the OFF time is much shorter than the ON time to prevent short-circuiting between the reading and writing power supplies when the device switches the V_{PP} voltage for reading or writing data (break-before-make operation).

■ FEATURES

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

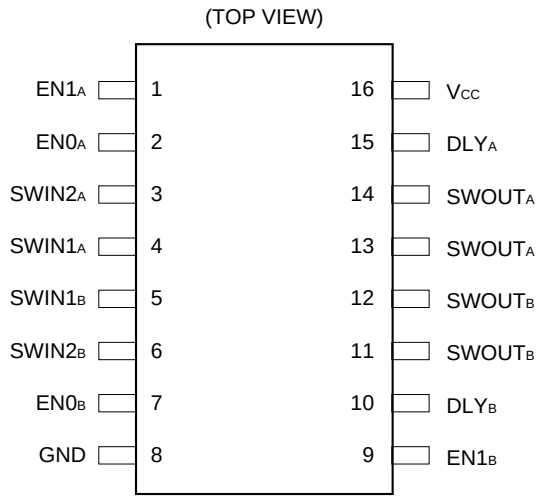
■ PACKAGE

16 pin Plastic SOP



(FPT-16P-M04)

■ PIN ASSIGNMENT



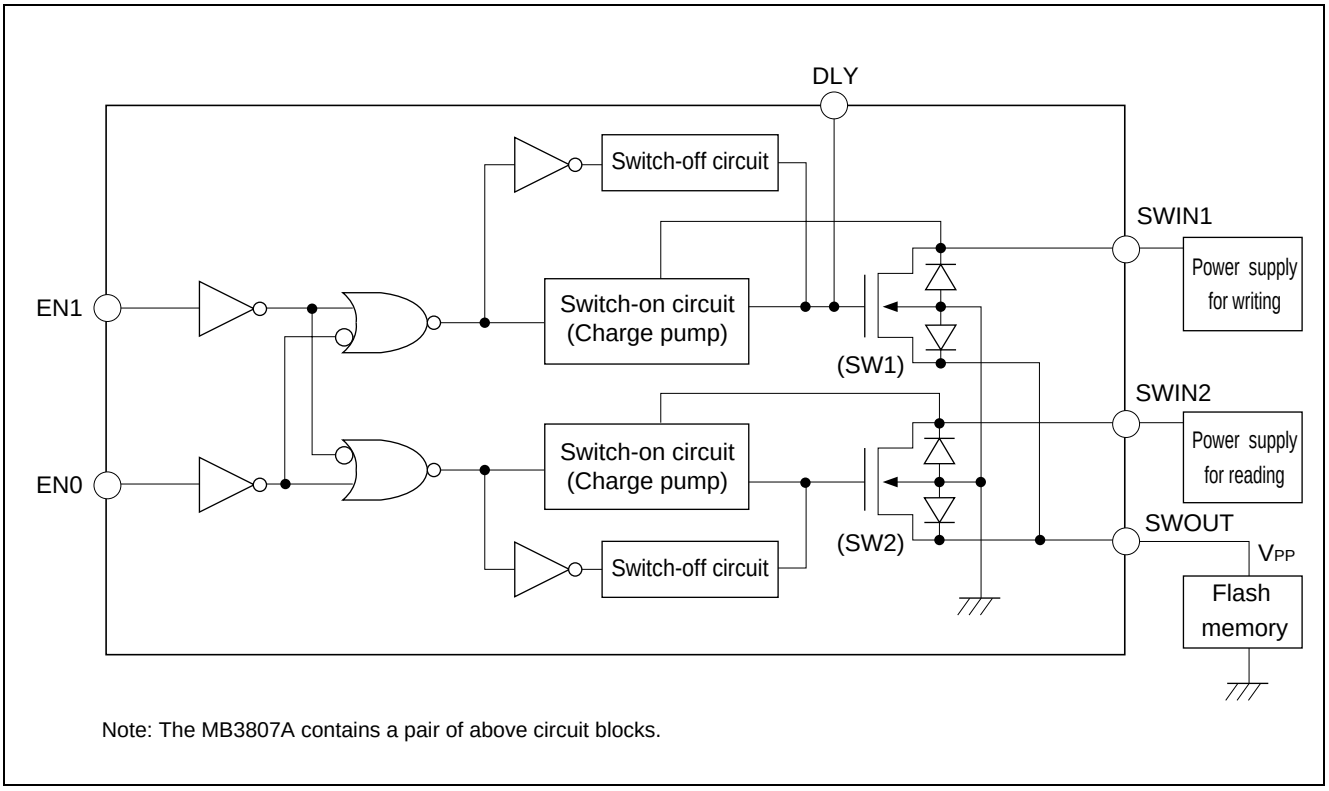
■ LOGICAL OPERATION TABLE

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

■ BLOCK DIAGRAM



Note: The MB3807A contains a pair of above circuit blocks.

■ 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 µA 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	Ta ≤ +75°C	—	290	mW
Storage temperature	Tstg	—	–55	+125	°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	Top	—	–40	+75	°C

■ 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

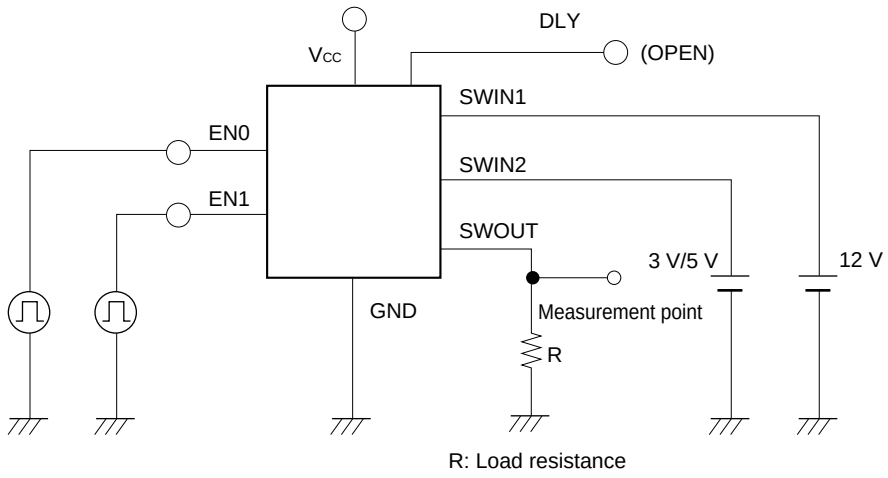
(Ta = –40°C to +75°C)

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: $t_{HYS1} = t_{ON1} - t_{OFF3}$
$t_{HYS2} = t_{ON2} - t_{OFF4}$
$t_{HYS3} = t_{ON3} - t_{OFF1}$
$t_{HYS4} = t_{ON4} - t_{OFF2}$

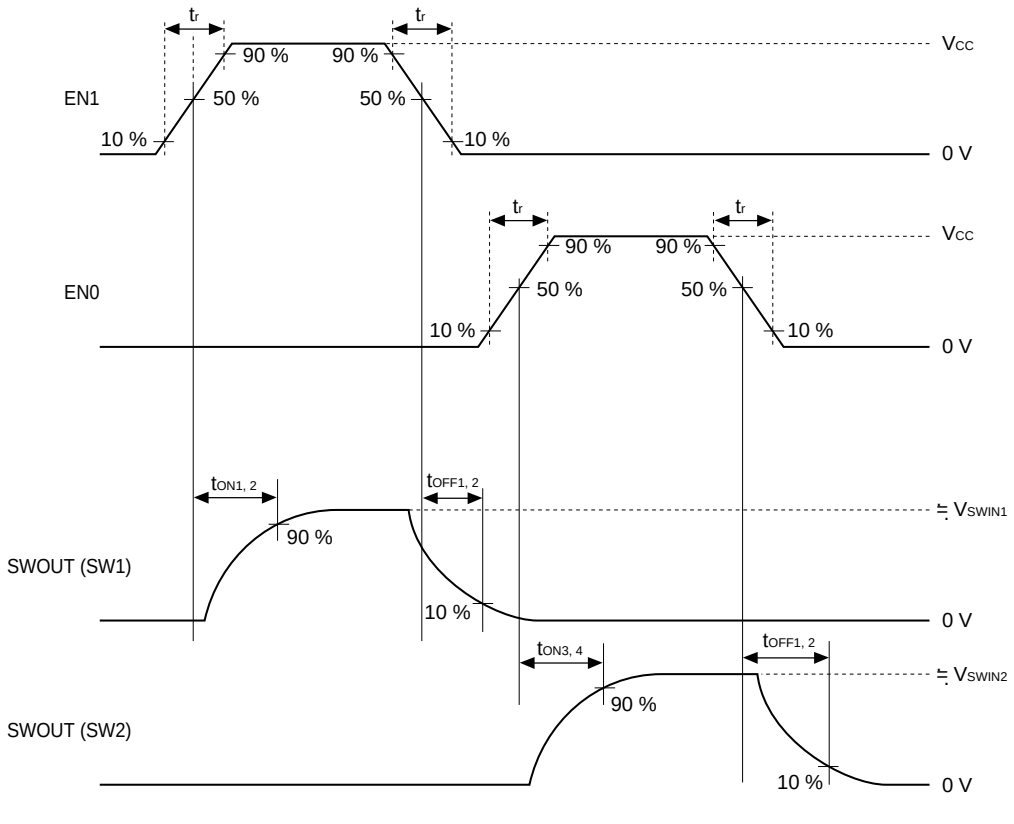
■ AC SPECIFICATION TEST DIAGRAM

- **Measurement Conditions**



■ TIMING DIAGRAM

- **ON-time and OFF-time Waveforms**



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

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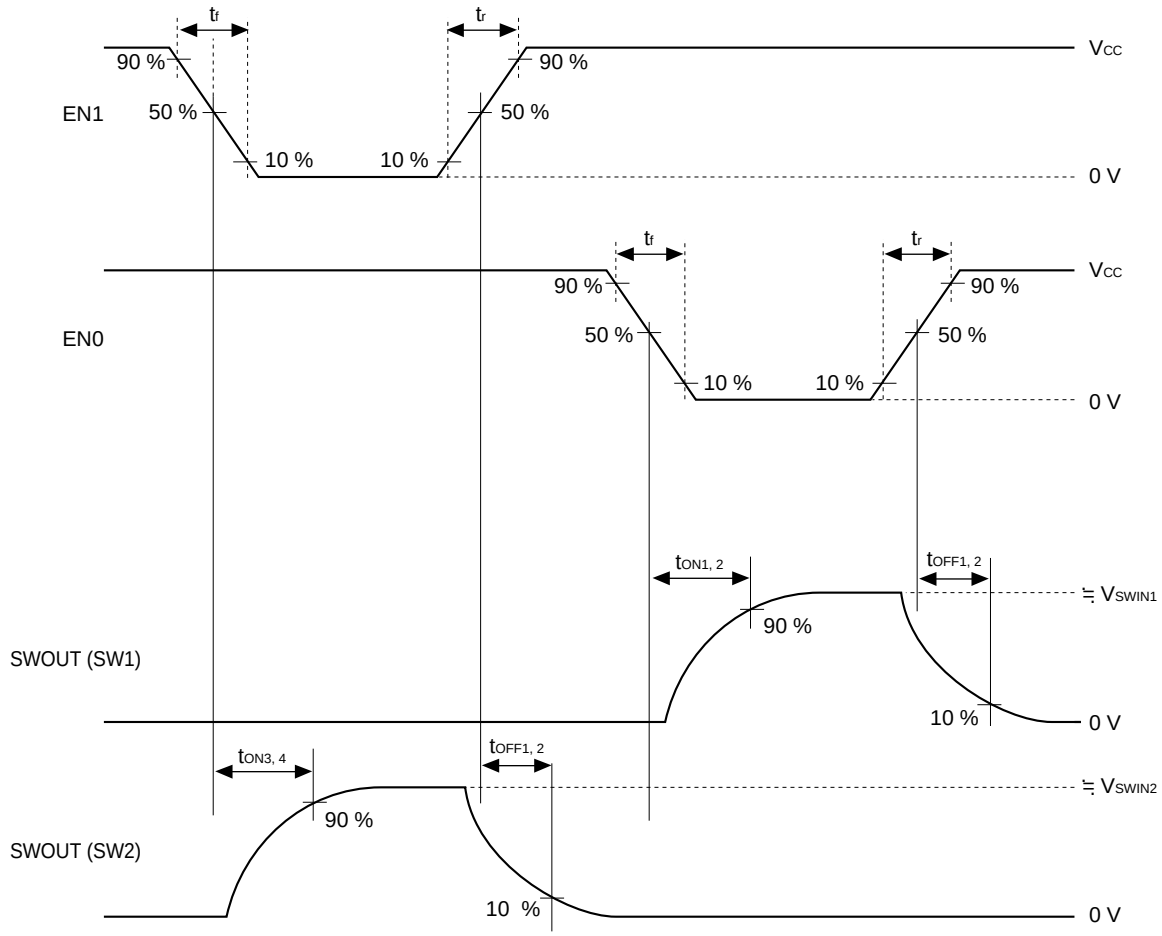
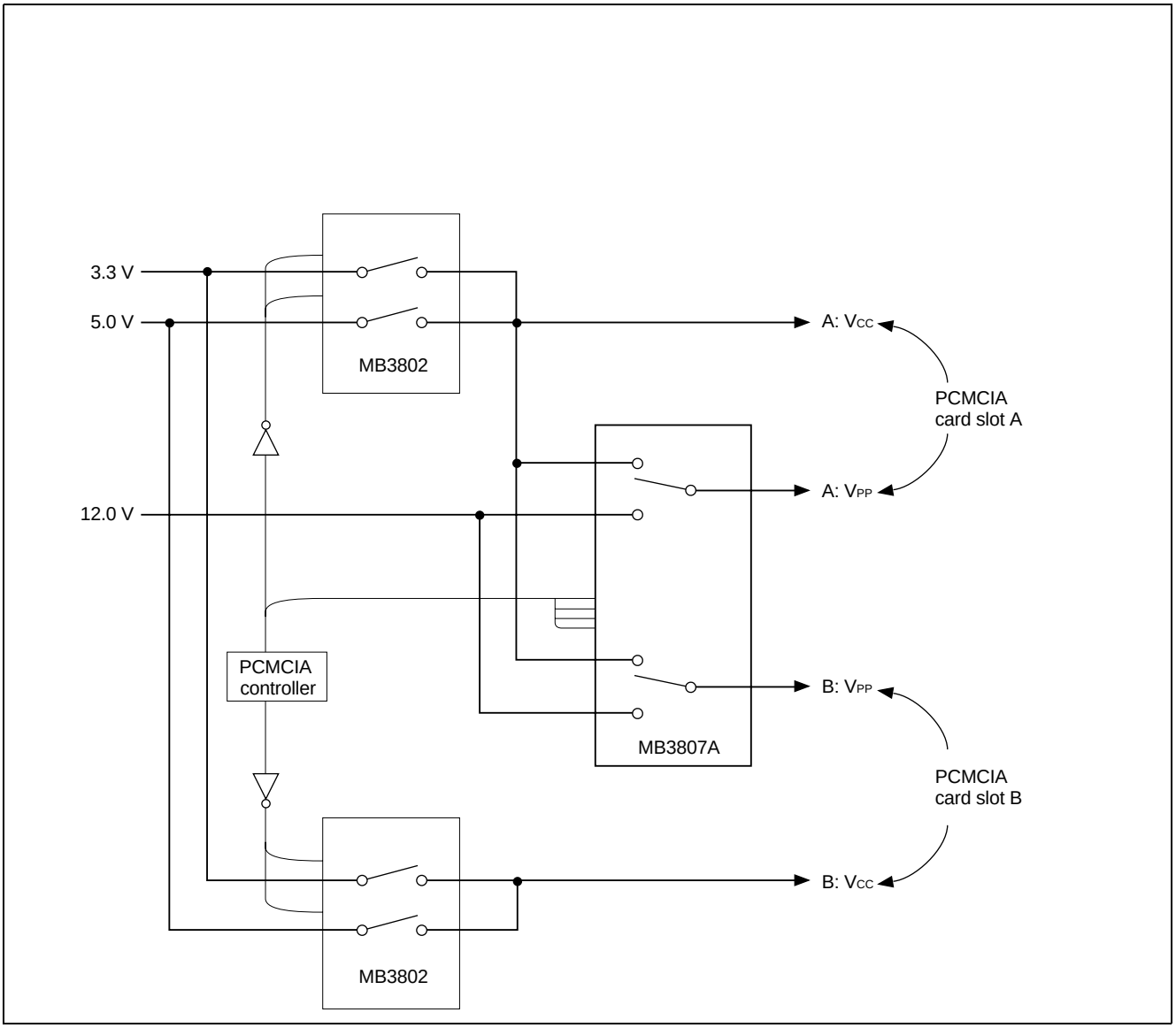


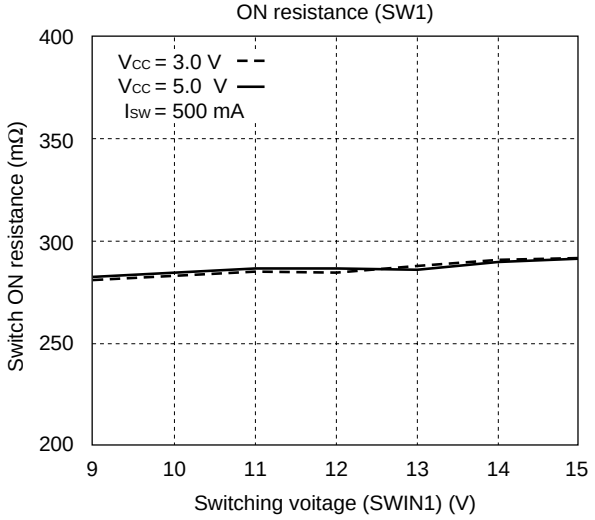
Note: The EN0/EN1 rise and fall times (10 %, 90 %) are each 1 ms or less.

■ APPLICATION

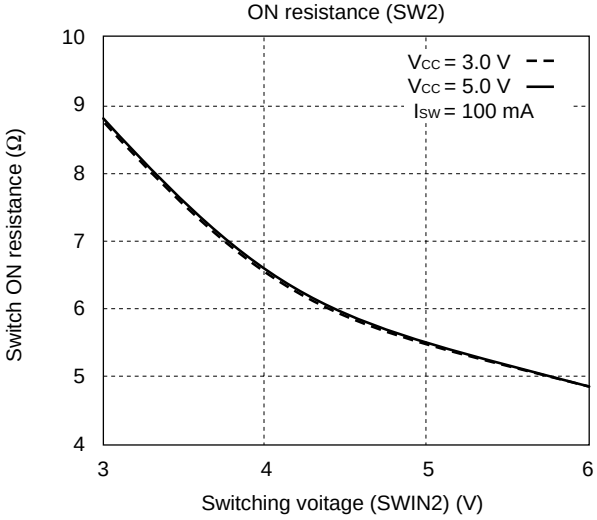


■ TYPICAL CHARACTERISTIC CURVES

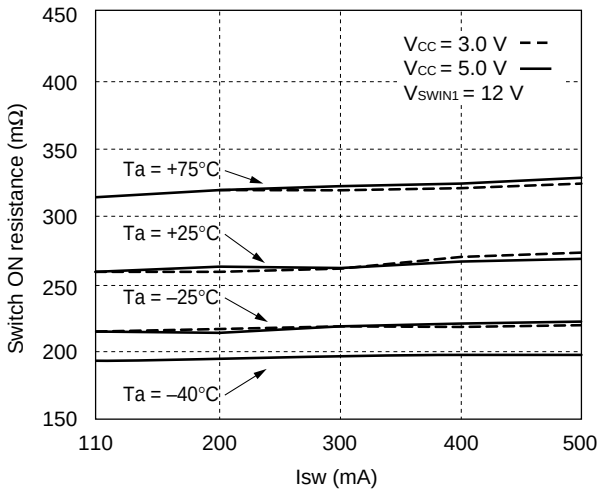
ON resistance (SW1)



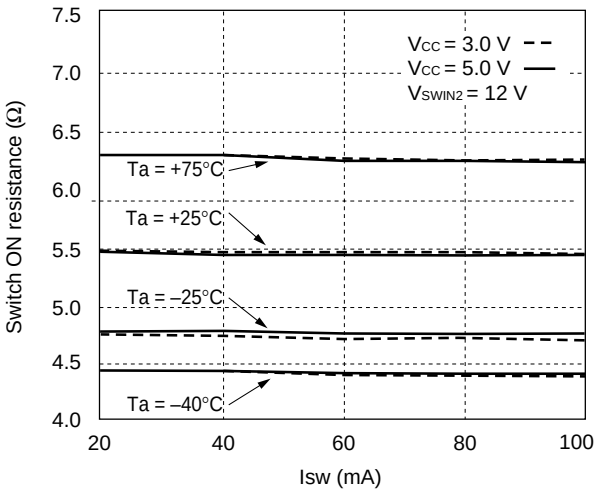
ON resistance (SW2)



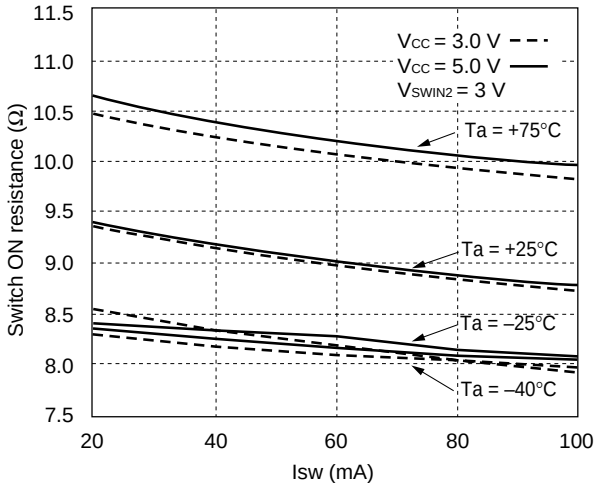
ON resistance (temperature dependence characteristic: SWIN1)



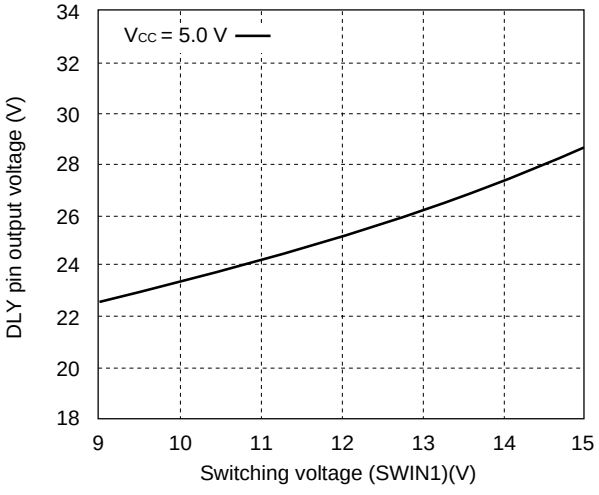
ON resistance (temperature dependence characteristic: SWIN2)



ON resistance (temperature dependence characteristic: SWIN2)



Charge pump output voltage



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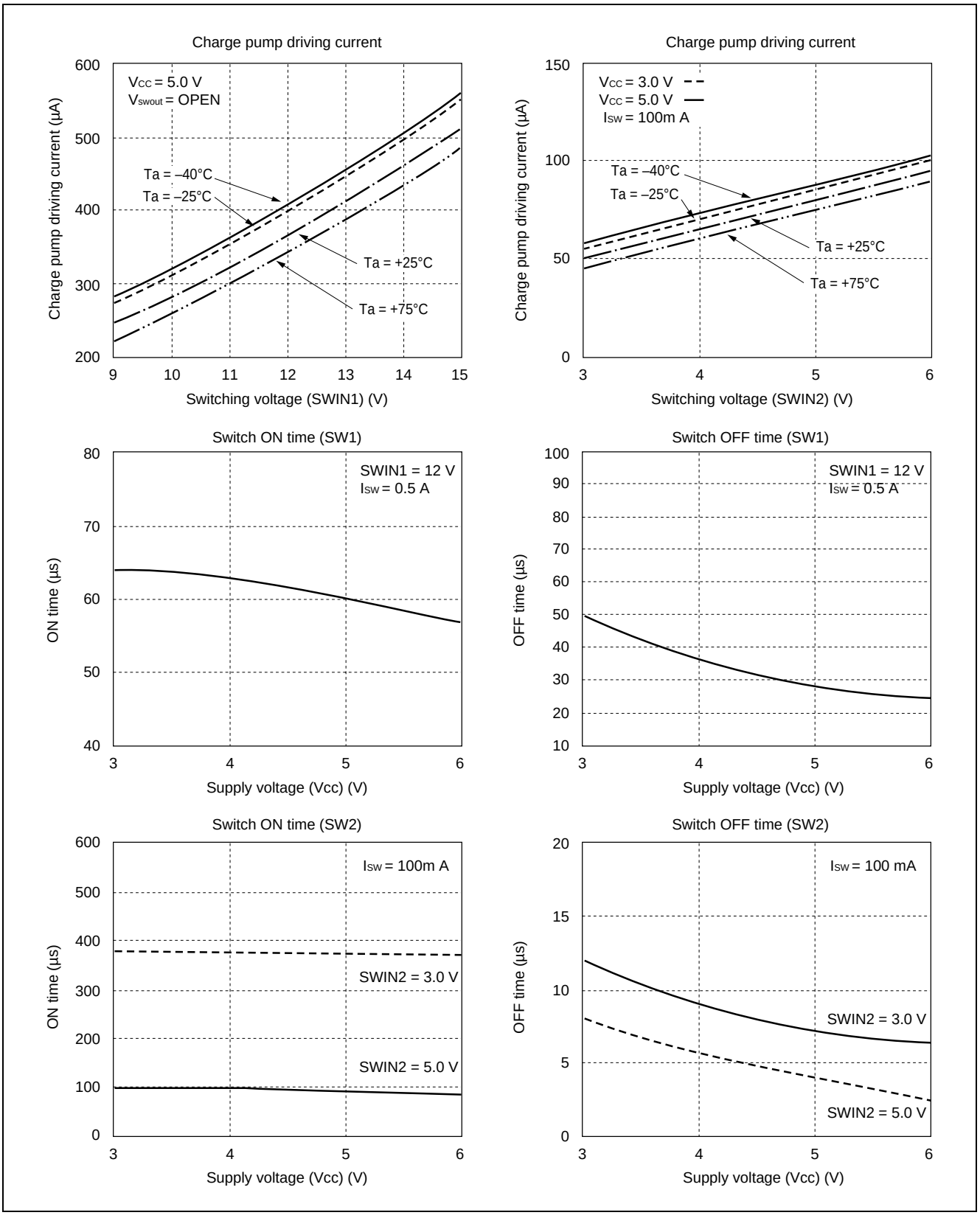
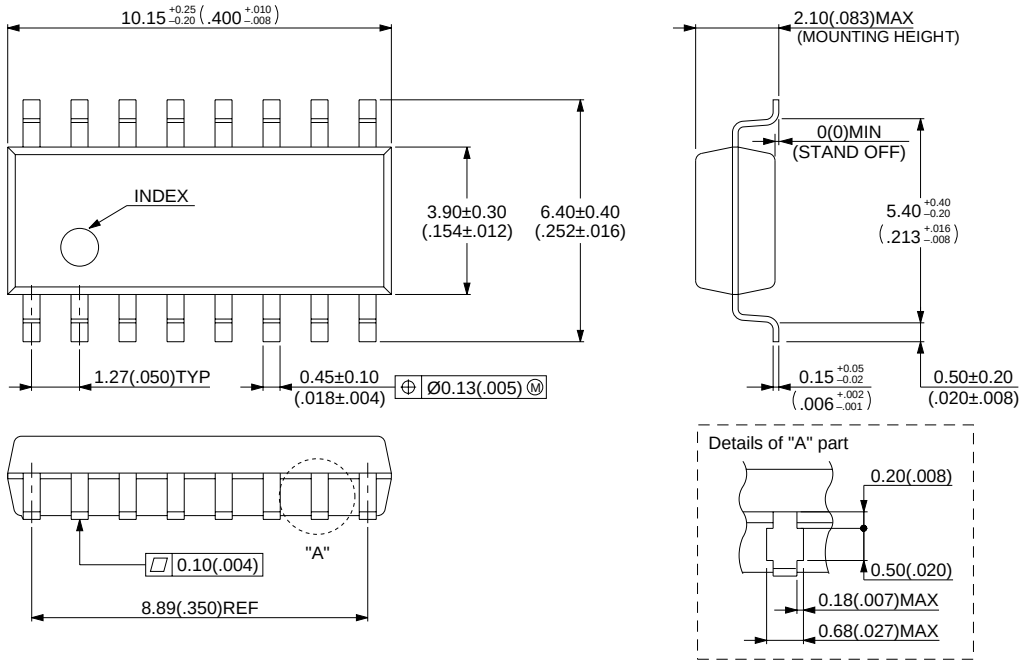

Charge pump driving current
Charge pump driving current (µA)
600
500
400
300
200
9
10
11
12
13
14
15
Switching voltage (SWIN1) (V)
VCC = 5.0 V
Vswout = OPEN
Ta = –40°C
Ta = –25°C
Ta = +25°C
Ta = +75°C
Charge pump driving current
150
100
50
0
3
4
5
6
Switching voltage (SWIN2) (V)
VCC = 3.0 V
VCC = 5.0 V
ISW = 100m A
Ta = –40°C
Ta = –25°C
Ta = +25°C
Ta = +75°C
Switch ON time (SW1)
ON time (µs)
80
70
60
50
40
Supply voltage (Vcc) (V)
SWIN1 = 12 V
ISW = 0.5 A
Switch OFF time (SW1)
OFF time (µs)
100
90
80
70
60
50
40
30
20
10
Supply voltage (Vcc) (V)
SWIN1 = 12 V
ISW = 0.5 A
Switch ON time (SW2)
ON time (µs)
600
500
400
300
200
100
0
Supply voltage (Vcc) (V)
ISW = 100m A
SWIN2 = 3.0 V
SWIN2 = 5.0 V
Switch OFF time (SW2)
OFF time (µs)
20
15
10
5
0
Supply voltage (Vcc) (V)
ISW = 100 mA
SWIN2 = 3.0 V
SWIN2 = 5.0 V

■ ORDERING INFORMATION

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

■ PACKAGE DIMENSION

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



Dimensions in mm (inches)

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