



1ch positive voltage discharge IC

MM3781 Series

Overview

This IC is a discharge IC for fast discharge the electric charge of capacitor when power supply is turned off. The IC can be used to turn off multiple power supply of microcomputer, SoC and image sensor. And it can reduce the parts, the peripheral wiring and loss current for a built-in an inverter and NMOS transistor. Package is small PLP-4C/SC-82 that contribute to reduce a space of PCB.

Features

- NMOS with low on-resistance
- Fast discharge
- Low current consumption

Main specifications

- Maximum rating supply voltage : -0.3V to 7.0V
- Operating voltage range : 1.1V to 6.5V
- Operating ambient temperature : -40°C to 85°C
- Output current : 150mA
- Input current(Active) : Typ. 0.1uA
- Input current(Non active) : Typ. 0.1uA
- CE input voltage H : Min. 1.1V
- CE input voltage L : Max.0.3V
- CE input current : Typ. 0.1uA
- Output current : Typ. 2mA (VDD=1.2V, VCE=0V, Vout=0.1V)
Typ. 8mA (VDD=1.2V, VCE=0V, Vout=5.0V)
Typ. 10mA (VDD=6.0V, VCE=0V, Vout=0.1V)
Typ. 200mA (VDD=6.0V, VCE=0V, Vout=5.0V)
- H Transfer delay time : Typ. 1us (CE=L⇒H)
- L Transfer delay time : Typ. 200us (MM3781A, CE=H⇒L)
Typ. 10us (MM3781B, CE=H⇒L)
- Vout Turn-off time : Typ. 3.0ms (MM3781A, CE=H⇒L, Vout=5V, Co=100uF)
Typ. 2.8ms (MM3781B, CE=H⇒L, Vout=5V, Co=100uF)

Packages

- SC-82ABB
- PLP-4C

Application

- Power OFF sequence control.



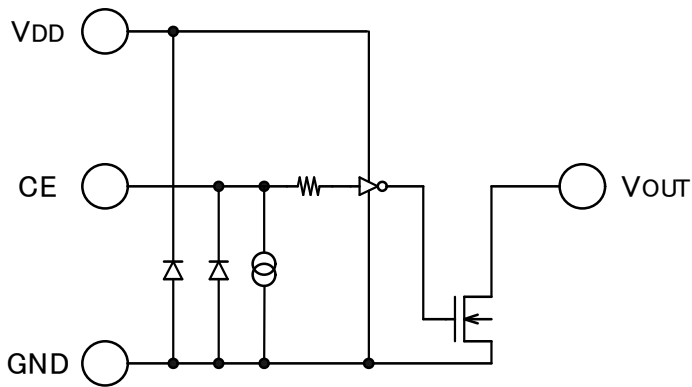


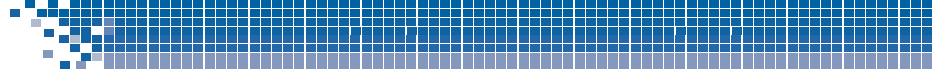
Model Name

M M 3 7 8 1 X X X X
 └──────────┘ └┘ └┘ └┘ └┘
 Series name (A) (B) (C) (D)

(A) Function Type	A	L Transfer delay time Typ. 200us
	B	L Transfer delay time Typ. 10us
(B) Package	U	SC-82ABB
	R	PLP-4C
(C) Packing specifications 1	R	R housing (Standard)
(D) Packing specifications 2	E	Embos tape / Halogencontained (SC-82ABB) Embos tape / Halogen free (PLP-4C)

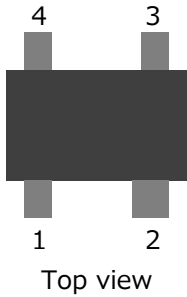
Block Diagram





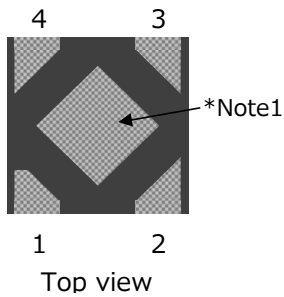
Pin Configuration

■ SC-82ABB



Pin No.	Pin name	Function
1	CE	ON/OFF-control pin CE=L ⇒ discharge ON, CE=H ⇒ discharge OFF Pull-down with constant current source
2	GND	GND pin
3	Vout	Output pin (Open-drain)
4	VDD	Voltage supply pin

■ PLP-4C



Pin No.	Pin name	Function
1	VOUT	Output pin (Open-drain)
2	GND	GND pin
3	CE	ON/OFF-control pin CE=L ⇒ discharge ON, CE=H ⇒ discharge OFF Pull-down with constant current source
4	VDD	Voltage supply pin

*Note1:Heat spreader bottom with GND.





Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	
Storage temperature	Tstg	-55	125	°C	
Junction temperature	Tj _{MAX}	-55	125	°C	
Supply voltage	VDD	-0.3	7.0	V	
CE input voltage	VCE	-0.3	7.0	V	
Output voltage	Vout	-0.3	7.0	V	
Output current	Iout	0	400	mA	
Power dissipation *Note2	SC-82ABB	Pd	-	650	mW
	PLP-4C		-	1,300	mW

*Note2:JEDEC51-7 standard

Recommended Operating Conditions

Item	Symbol	Min.	Max.	Unit
Operating junction temperature	Topr	-40	85	°C
Operating voltage	Vop	1.1	6.5	V

Electrical Characteristics

(Ta=25°C, VDD=6V, VCE=0V unless otherwise specified)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit	Test Circuit
Input current(Active)	IDD	VCE=0V	-	0.1	1.0	μA	1
Input current(Non active)	IDDoff	VCE=VDD	-	0.1	1.0	μA	1
CE input voltage H	VCE_H		1.1	-	6.5	V	2
CE input voltage L	VCE_L		0.0	-	0.3	V	2
CE input current	ICE	Vout≤2.0V	-	0.1	-	uA	1
Output current	Iout	VDD=1.2V, VCE=0V, Vout=0.1V	1	2	-	mA	3
		VDD=1.2V, VCE=0V, Vout=5.0V	5	8	-	mA	3
		VDD=6.0V, VCE=0V, Vout=0.1V	6	10	-	mA	3
		VDD=6.0V, VCE=0V, Vout=5.0V	120	200	-	mA	3





Electrical Characteristics

(Ta=25°C, VDD=6V, VCE=0V unless otherwise specified)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit	Test Circuit	
H Transfer delay time *Note3	tPLH	VCE=L→H	-	1	-	us	4	
L Transfer delay time *Note3	tPHL	VCE=H→L *Note4	MM3781A	100	200	300	us	5
			MM3781B	-	10	15	us	5
Vout Turn-off time *Note3	tf	VCE=H→L *Note4	MM3781A	2	3	4	ms	5
			MM3781B	1.8	2.8	3.8	ms	5

*Note3: The parameter is guaranteed by design.

Refer to Fig1 for measurement timing.

*Note4: L Transfer delay time(tPHL) and Vout Trun-off time(tf) is depend on VDD, Vout, Cout.

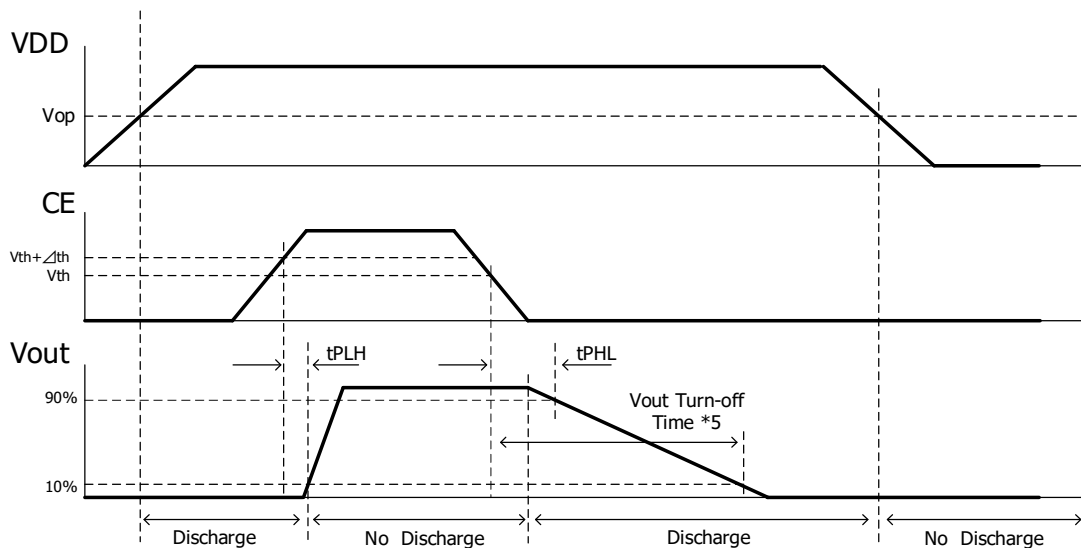
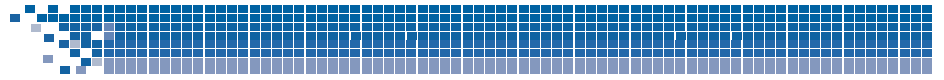


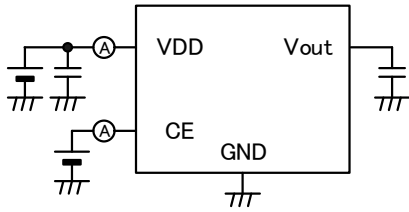
Fig1.measurement timing.



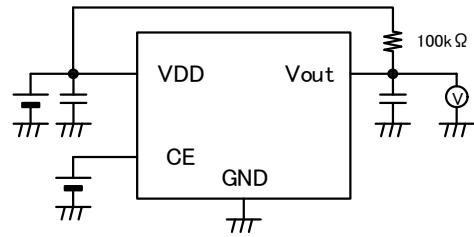


Test Circuit

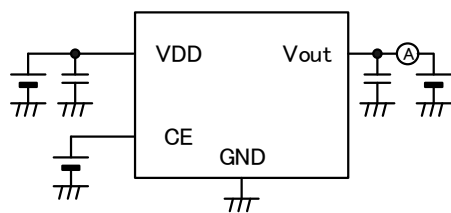
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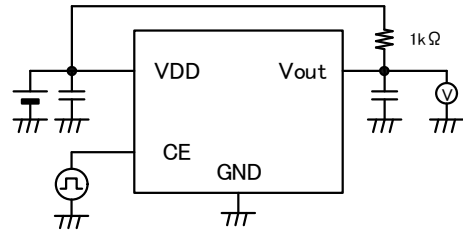
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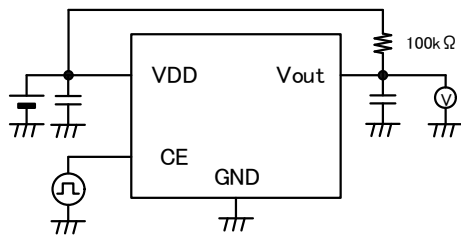
(3)



(4)

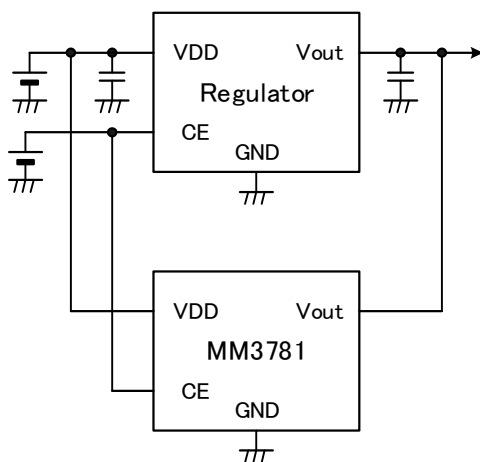


(5)



*Note5: A capacitance of 1uF is connected to VDD and Vout for measurement.
When actually using it, LDO capacity can be substituted.

Application Circuit



In the event a problem which may affect industrial property or any other rights of us or a third party is encountered during the use of information described in these circuit, we shall not be liable for any such problem, nor grant a license therefore.





Explanation About Function

- About Function

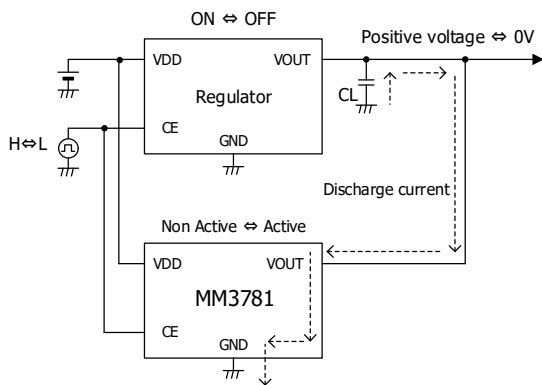
MM3781 is discharge IC for Positive voltage.

Electric charge in output capacitor(CL) discharged and voltage become 0V.

Used to output in regulator IC, voltage is turn off fast, and sequential control is easy.

MM3781 turn on When regulator IC turn off, discharge current occur.

Electric charge in output capacitor discharged and output turn off to 0V.



Operation table

VCE	Regulator Vout	MM3781 Function
High	ON	Non Active
Low	OFF	Active (Discharge)



Timing Chart

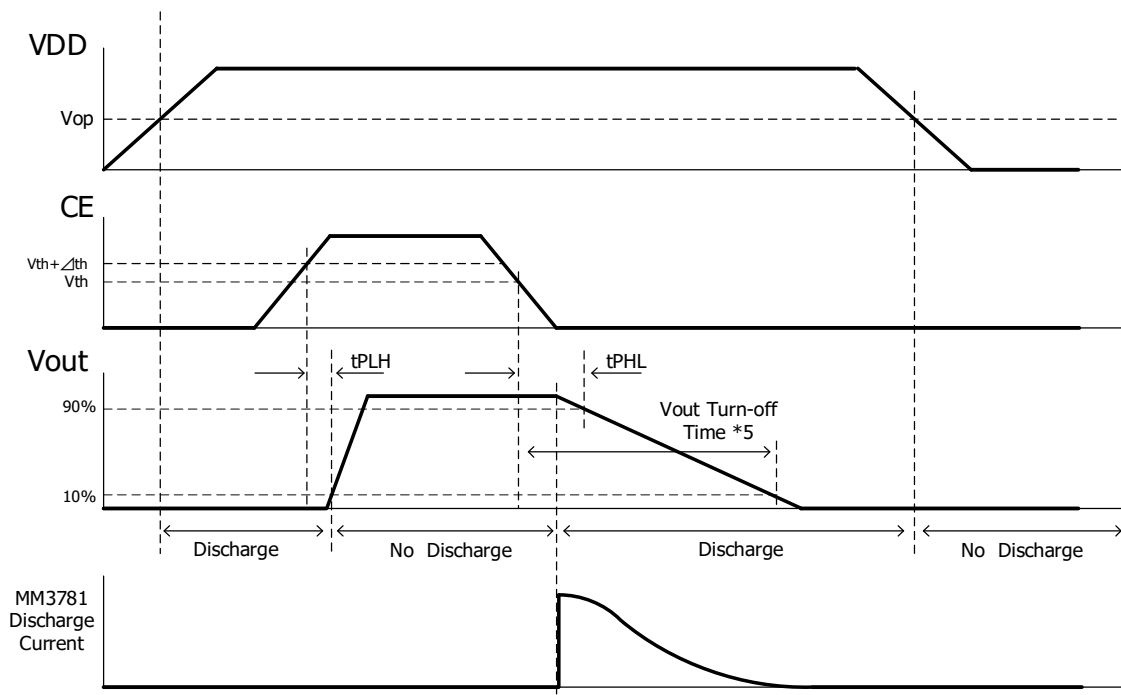


Fig2.Timing Chart

Fig2 is Timing chart by "Application circuit". Vout is the regulator output voltage.

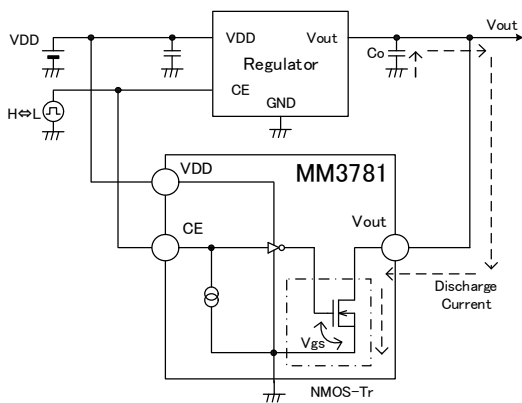


Fig3.Measurement circuit

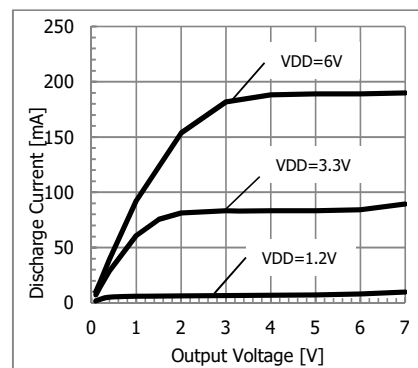


Fig4.Discharge Current characteristics (NMOS-Tr Current characteristics)

As shown in Fig3, Output device of the MM3781 is an NMOS transistor. The voltage between gate and source V_{gs} is " $V_{gs}=V_{DD}$ " when $CE=L$. From current characteristics of NMOS-Tr, discharge current change with VDD And discharge current change with output voltage Vout. Refer to Fig4 for the relationship between VDD, Vout and discharge current.



Note

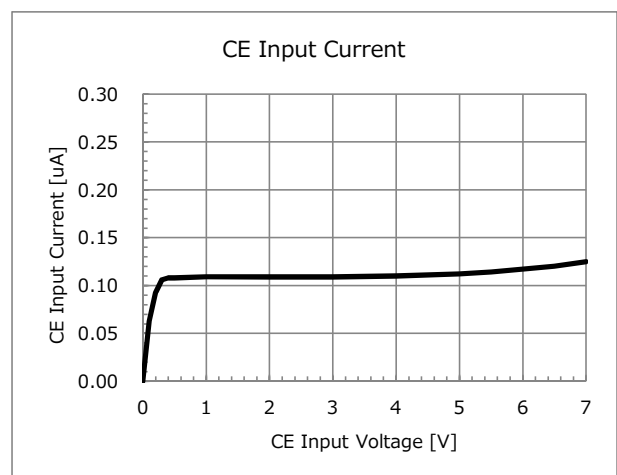
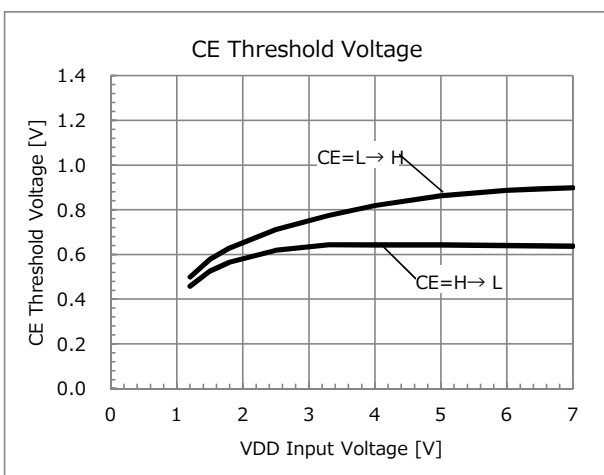
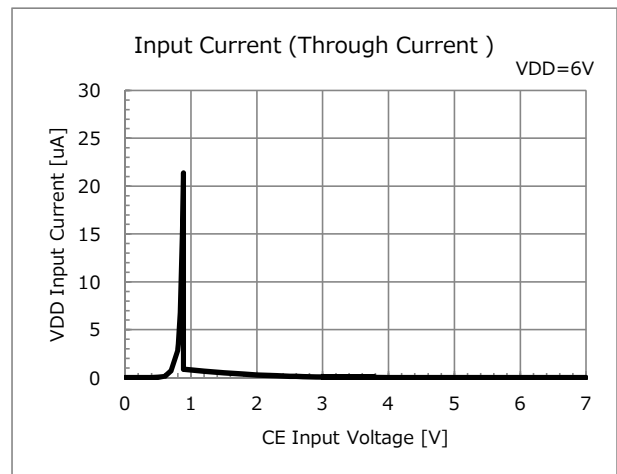
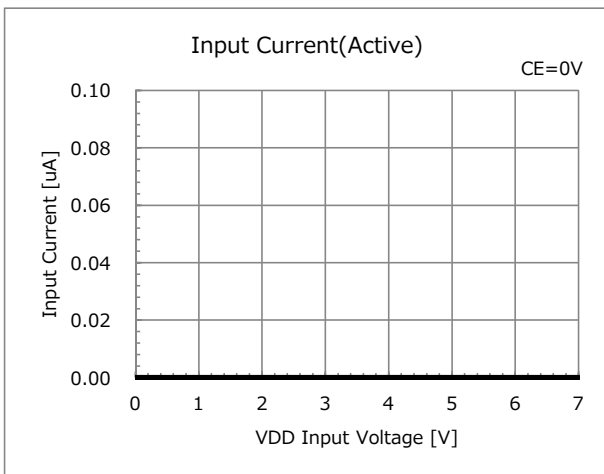
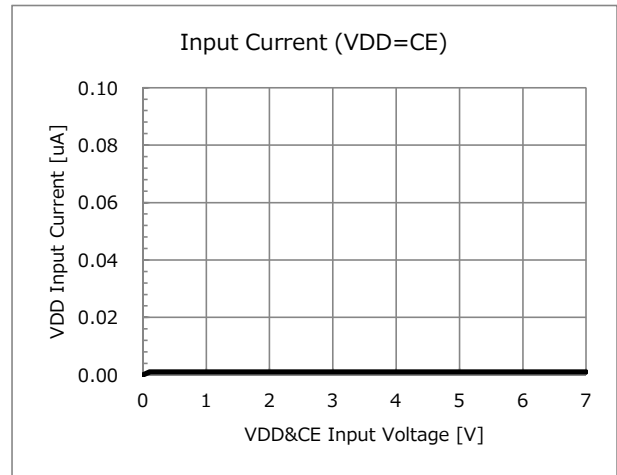
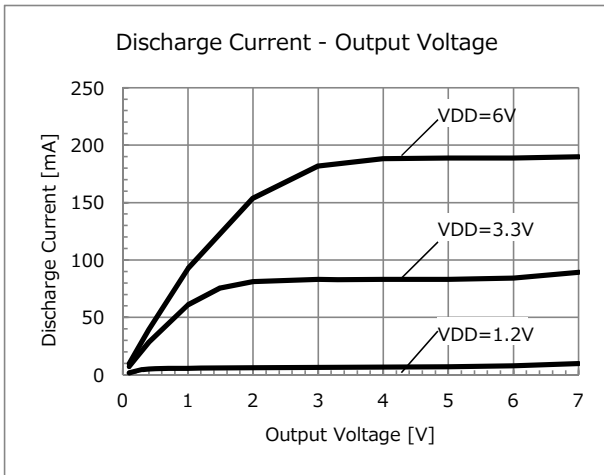
1. The IC must be used within the absolute maximum ratings.
If the IC is used over the absolute maximum ratings, it may be destroyed or deteriorated.
2. The output current may be limited by the package power dissipation.
3. The wiring routing of VDD, Vout and GND is long, it may cause noise and operation instability.
Wiring should be as short as possible.
4. If the function is not stable, it is recommended to connect an input capacitor with VDD.
5. The output voltage is active at CE=Low. (CE=Low, Vout: ON)
6. The IC can force voltage at VDD pin in condition of $VDD < Vout$.
But VDD input voltage can't be forced over the absolute maximum ratings.
7. The IC can force voltage at CE pin in condition of $CE > VDD$.
But CE input voltage can't be forced over the absolute maximum ratings.
8. The CE pin has a pull-down device.
The pull-down device characteristics refer to typical performance characteristics.
9. The IC don't has a over-current protection and a thermal protection circuits.
10. If the slew rate of the CE voltage is slow, discharge current may flow from the regulator-output to the MM3781-output due to the difference in the CE threshold voltage of the Regulator and MM3781.
11. Input current (through current) flows when the difference between VDD and CE is large. Please be careful.
Refer to the "Input Current (through current) characteristics" of 13-1.TYPICAL PERFORMANCE CHARACTERISTICS .
12. L Transfer delay time(t_{PHL}) and Vout Trun-off time(t_f) is depend on VDD, Vout, Cout.





Typical Performance Characteristics

(Ta=25°C unless otherwise specified)



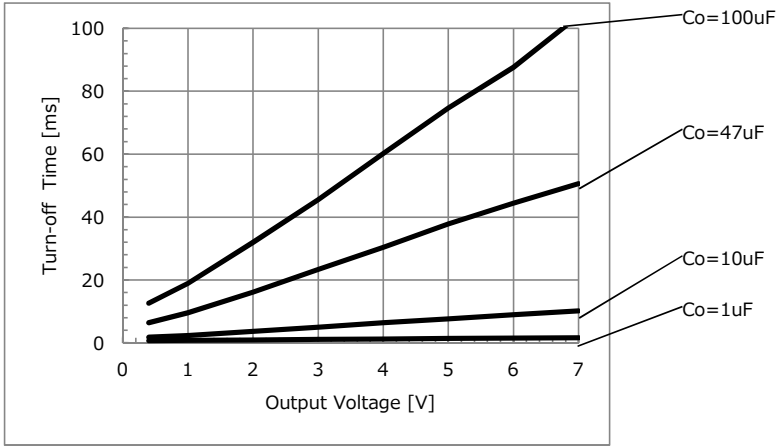


Typical Performance Characteristics (MM3781A)

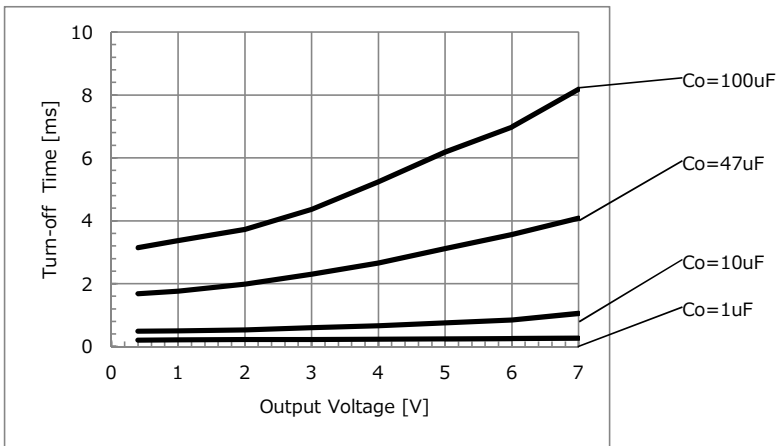
(Ta=25°C unless otherwise specified)

- Vout Turn-off Time

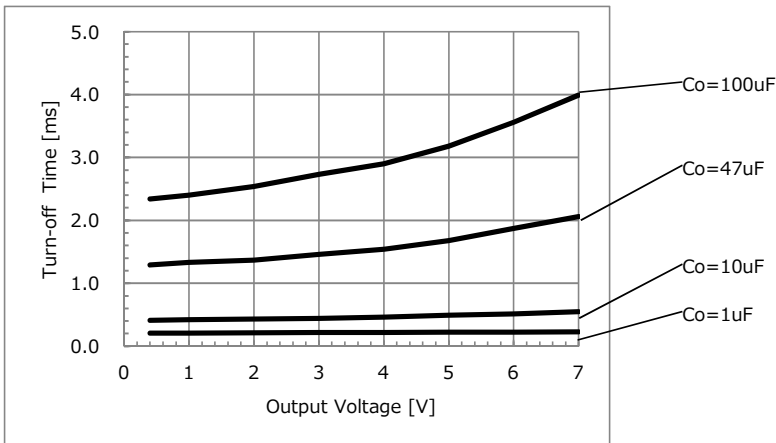
VDD=1.2V



VDD=3.3V



VDD=6.0V



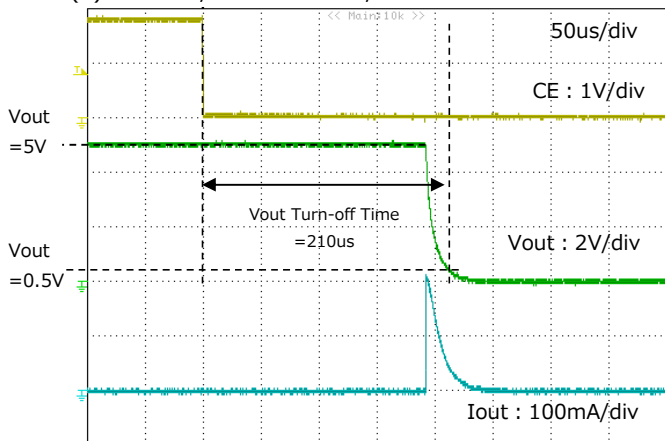
Typical Performance Characteristics (MM3781A)

(Ta=25°C unless otherwise specified)

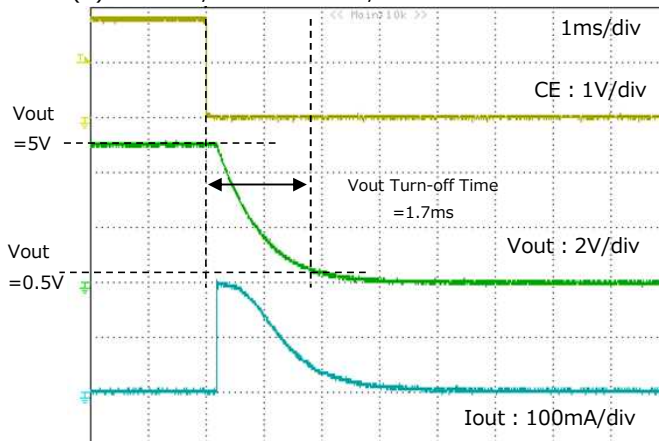
Discharge wave

Connect positive LDO (5.0V).

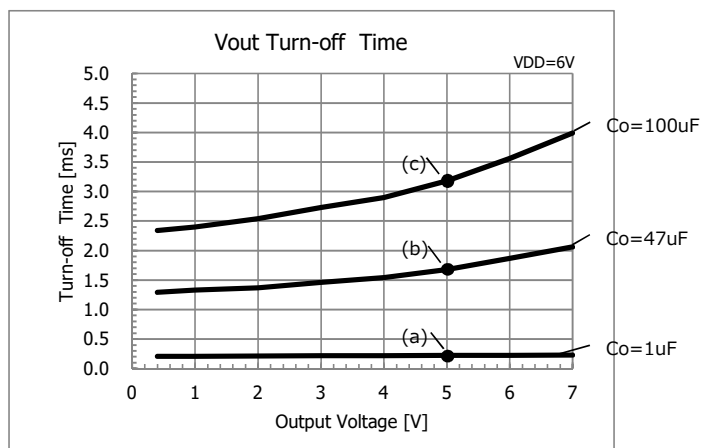
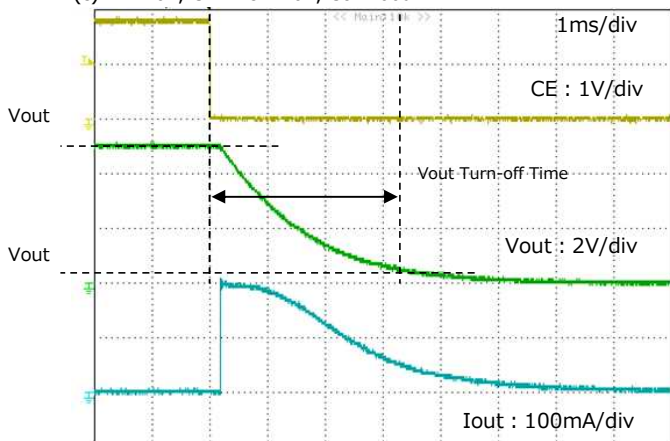
(a) VDD=6V, CE=1.8V→0V, Co=1uF



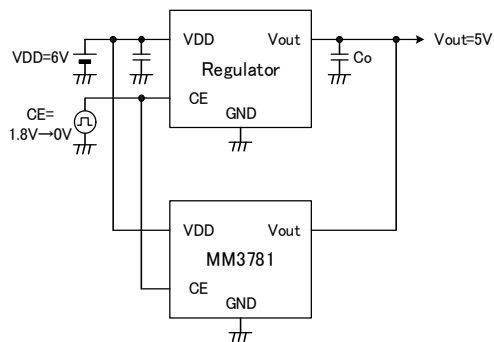
(b) VDD=6V, CE=1.8V→0V, Co=47uF



(c) VDD=6V, CE=1.8V→0V, Co=100uF



Vout turn-off time is specified by $CE=L$ to $V_{out} \times 10\%$.



Tese circuit

Measured in no load condition .

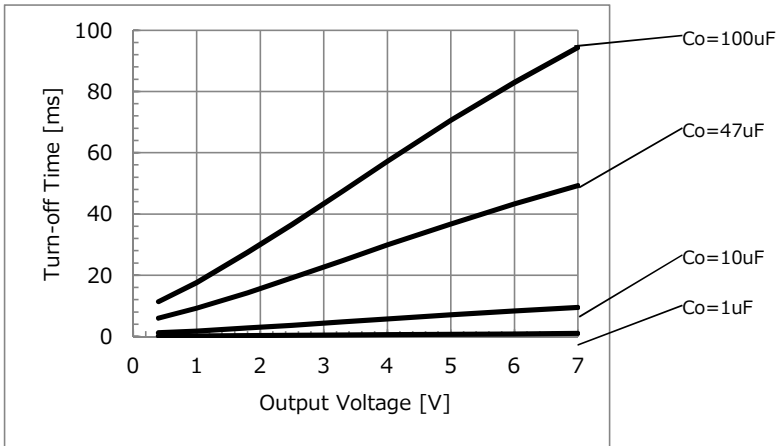


Typical Performance Characteristics (MM3781B)

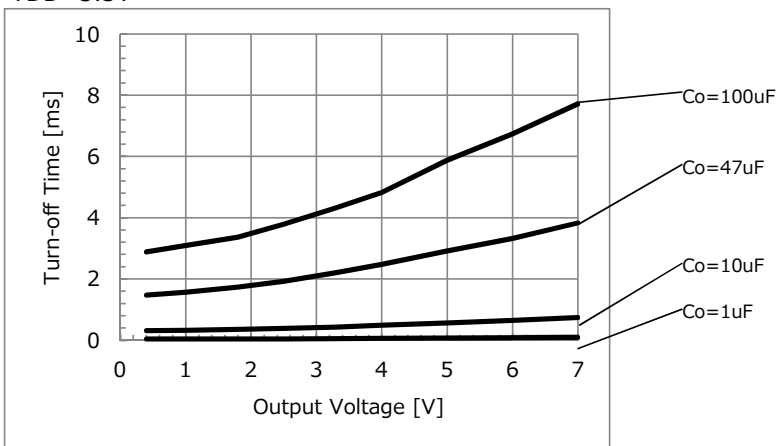
(Ta=25°C unless otherwise specified)

■ Vout Turn-off Time

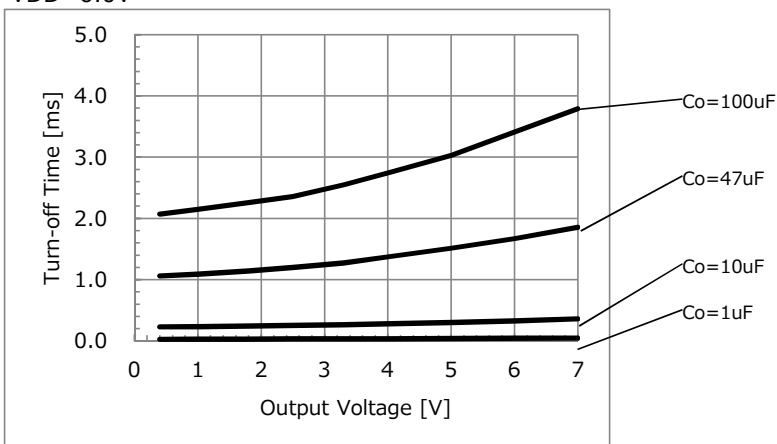
VDD=1.2V



VDD=3.3V



VDD=6.0V





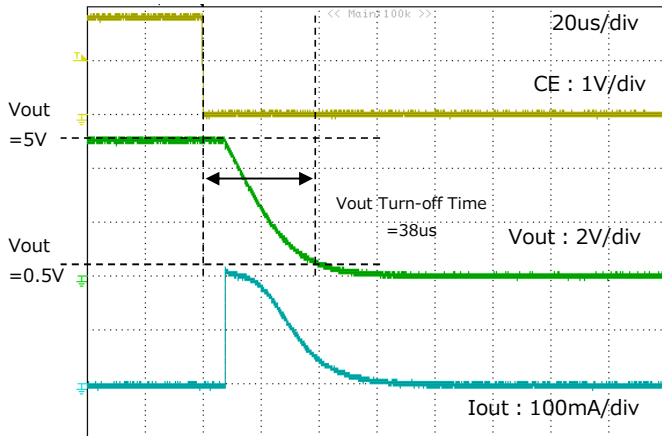
Typical Performance Characteristics (MM3781B)

(Ta=25°C unless otherwise specified)

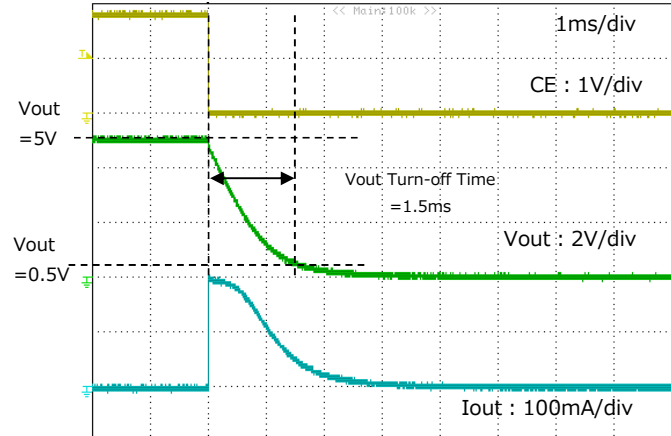
Discharge wave

Connect positive LDO (5.0V).

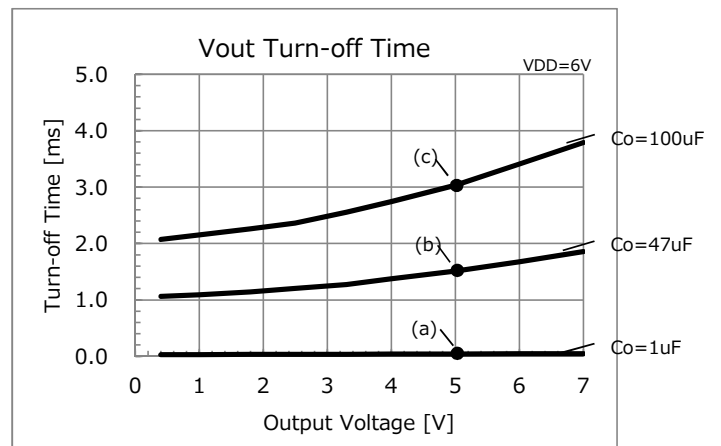
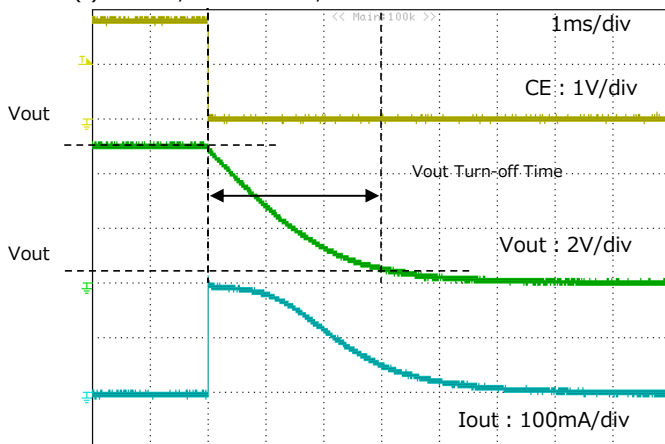
(a) VDD=6V, CE=1.8V→0V, Co=1uF



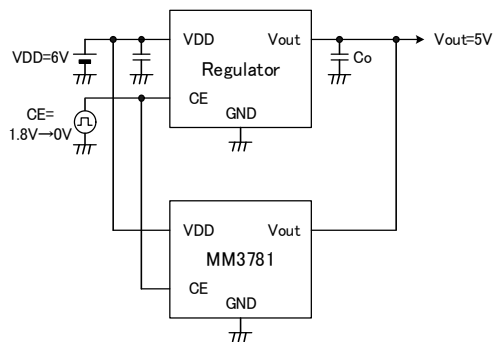
(b) VDD=6V, CE=1.8V→0V, Co=47uF



(c) VDD=6V, CE=1.8V→0V, Co=100uF



Vout turn-off time is specified by $CE=L$ to $V_{out} \times 10\%$.



Tese circuit

Measured in no load condition .

