

# IC for CMOS Regulator+Reset

## Monolithic IC MM3173/3174 Series

### Outline

This IC is a reset+regulator combined IC developed using a CMOS process. Output voltage of the regulator and detection voltage of the reset are fixed, while regulator output voltage and reset detection voltage are programmable ranging from 1.2V to 5.0V, and 1.2V to 5.0V respectively upon request.

### Features

1. Output voltage accuracy                     $\pm 2\%$
2. Incorporates a current limit circuit
3. Output current                                150mA max.
4. Reset detection voltage                    1.2 to 5.0V
5. Delay time from voltage detection to reset release can be easily programmed.

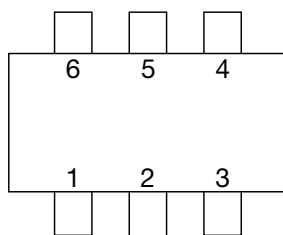
### Packages

1. SOT-25A
2. SOT-26A

### Applications

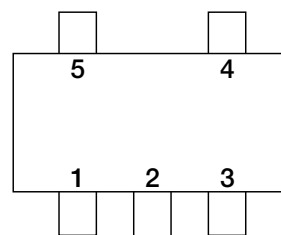
1. Reset circuit for microcomputers, CPU, and MPU
2. Reset circuit for logic circuits
3. Battery voltage check
4. Switch circuit for backup circuits
5. Mechanical reset circuit

### Pin Assignment



SOT-26A  
(TOP VIEW)

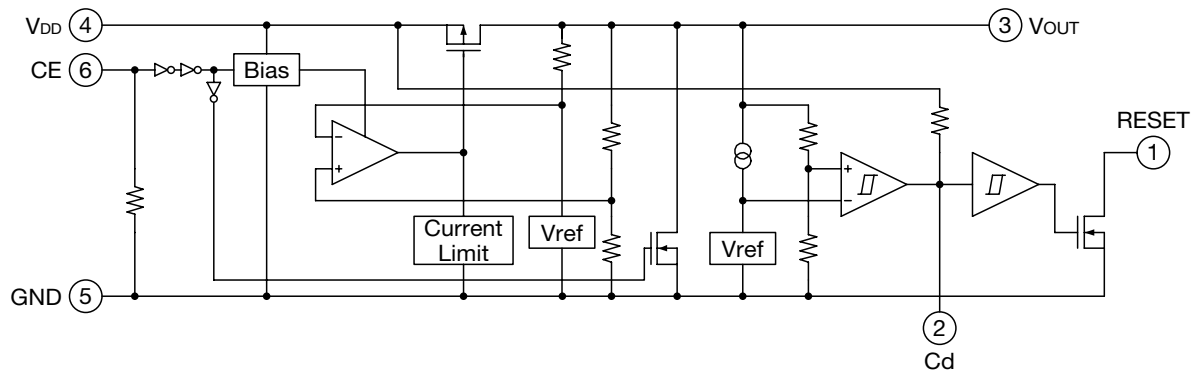
1	RESET
2	Cd
3	V <sub>OUT</sub>
4	V <sub>DD</sub>
5	GND
6	CE



SOT-25A  
(TOP VIEW)

1	V <sub>DD</sub>
2	GND
3	Cd
4	RESET
5	V <sub>OUT</sub>

Block Diagram



Pin Description

Pin No. SOT-26A	Pin name	Function						
3	V <sub>OUT</sub>	Output pin						
2	Cd	Capacitor connect pin with delay Delay time is decided by the internal resistance (2MΩ) and the capacitor.						
1	RESET	Reset output pin <table border="1" style="margin-left: 20px;"> <tr> <td></td> <td>RESET</td> </tr> <tr> <td>V<sub>OUT</sub>&lt;V<sub>s</sub></td> <td>L</td> </tr> <tr> <td>V<sub>OUT</sub>&gt;V<sub>s</sub></td> <td>H</td> </tr> </table>		RESET	V <sub>OUT</sub> <V <sub>s</sub>	L	V <sub>OUT</sub> >V <sub>s</sub>	H
	RESET							
V <sub>OUT</sub> <V <sub>s</sub>	L							
V <sub>OUT</sub> >V <sub>s</sub>	H							
6	CE	ON/OFF-control pin <table border="1" style="margin-left: 20px;"> <tr> <td>CE</td> <td>V<sub>OUT</sub></td> </tr> <tr> <td>L</td> <td>OFF</td> </tr> <tr> <td>H</td> <td>ON</td> </tr> </table> <p>Connect CE pin with V<sub>DD</sub> pin, when it is not used.</p>	CE	V <sub>OUT</sub>	L	OFF	H	ON
CE	V <sub>OUT</sub>							
L	OFF							
H	ON							
5	GND	Ground						
4	V <sub>DD</sub>	Voltage-supply pin						

Absolute Maximum Ratings (T<sub>a</sub>=25°C)

Item	Symbol	Ratings	Units
Storage temperature	T <sub>STG</sub>	-55~+125	°C
Supply voltage	V <sub>DD</sub>	6.5	V
CE input voltage	V <sub>CE</sub>	-0.3~V <sub>DD</sub> +0.3	V
Cd pin voltage	V <sub>Cd</sub>	-0.3~V <sub>DD</sub> +0.3	V
RESET pin voltage	V <sub>RST</sub>	6.5	V
Output voltage	V <sub>OUT</sub>	-0.3~V <sub>DD</sub> +0.3	V
Power dissipation *2	P <sub>d</sub>	350 *1	mW

Note1: \*1 With PC Board of glass epoxy. (25×25×1.6mm, Copper foil area 60%)

Note2: \*2 The Absolute Maximum power dissipation depends on the PC board and temperature.

**Recommended Operating Conditions** (Ta=25°C)

Item	Symbol	Ratings	Units
Operating ambient temperature	T <sub>JOP</sub>	-40~85	°C
Operating voltage	V <sub>OP</sub>	2~6	V
Output current	I <sub>O</sub>	0~200	mA

**Electrical Characteristics 1** (Except where noted otherwise, Ta=25°C, V<sub>DD</sub>=V<sub>OUT</sub> (typ.) +1V, V<sub>CE</sub>=V<sub>DD</sub>)

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units
Input current (OFF)	I <sub>DDoff</sub>	V <sub>CE</sub> =0V		0.1	1.0	μA
No-load input current	I <sub>DD</sub>	I <sub>OUT</sub> =0mA		50	75	μA
<b>Voltage regulator</b>						
Output voltage	V <sub>OUT</sub>	1mA ≤ I <sub>OUT</sub> ≤ 30mA	×0.98		×1.02	V
Line regulation	V <sub>LINE</sub>	V <sub>DD</sub> =V <sub>O</sub> (Typ.) +0.5~6V, I <sub>OUT</sub> =30mA (V <sub>OUT</sub> ≤ 1.6V, V <sub>DD</sub> =2.2~6V)		0.02	0.10	%/V
Load regulation	V <sub>LOAD</sub>	1mA ≤ I <sub>OUT</sub> ≤ 150mA		22	40	mV
Dropout voltage	V <sub>IO</sub>	Please refer to another page				V
Ripple rejection 1 *1	RR1	f=1kHz, V <sub>ripple</sub> =0.5V, I <sub>OUT</sub> =30mA (V <sub>OUT</sub> ≤ 1.7V, V <sub>DD</sub> =V <sub>OUT</sub> +1.2V)		70		dB
Ripple rejection 2 *1	RR2	f=10kHz, V <sub>ripple</sub> =0.5V, I <sub>OUT</sub> =30mA (V <sub>OUT</sub> ≤ 1.7V, V <sub>DD</sub> =V <sub>OUT</sub> +1.2V)		60		dB
V <sub>OUT</sub> temperature coefficient *1	ΔV <sub>OUT</sub> /ΔT	I <sub>OUT</sub> =30mA -40 ≤ T <sub>OP</sub> ≤ 85°C		±100		ppm/°C
Output noise voltage *1	V <sub>n</sub>	f <sub>BW</sub> =10~100kHz		30		μV <sub>rms</sub>
Output short-circuit current *1	I <sub>lim</sub>	V <sub>OUT</sub> =0V		40		mA
CE pull-down resistance	R <sub>pd</sub>		0.7	2	8	MΩ
CE high threshold voltage	V <sub>CEH</sub>		1.5		V <sub>DD</sub>	V
CE low threshold voltage	V <sub>CEL</sub>		0		0.3	V
Output NMOS ON resistance	R <sub>DON</sub>	V <sub>CE</sub> =0V V <sub>DD</sub> =4V (V <sub>OUT</sub> <3V)		60		Ω
<b>V<sub>OUT</sub> RESET</b>						
Detecting voltage	V <sub>s</sub>	V <sub>OUT</sub> =H→L R <sub>pu</sub> =100kΩ	×0.98		×1.02	V
V <sub>s</sub> temperature coefficient *1	ΔV <sub>s</sub> /ΔT	V <sub>OUT</sub> =H→L -40 ≤ T <sub>OP</sub> ≤ 85°C		±100		ppm/°C
Hysteresis voltage	ΔV <sub>s</sub>	V <sub>OUT</sub> =H→L→H	56	140	224	mV
Reset output current	I <sub>ORST</sub>	V <sub>DD</sub> =2V V <sub>RST</sub> =0.5V	3.0	6.0		mA
		V <sub>DD</sub> =3V V <sub>RST</sub> =0.5V	4.0	8.0		mA
		V <sub>DD</sub> =4V V <sub>RST</sub> =0.5V	5.0	10.0		mA
		V <sub>DD</sub> =5V V <sub>RST</sub> =0.5V	6.0	12.0		mA
		V <sub>DD</sub> =6V V <sub>RST</sub> =0.5V	10.0	15.0		mA
Resistance for Delay	R <sub>d</sub>	V <sub>DD</sub> =1.5V V <sub>RST</sub> =0.5V	1	2	3.5	MΩ

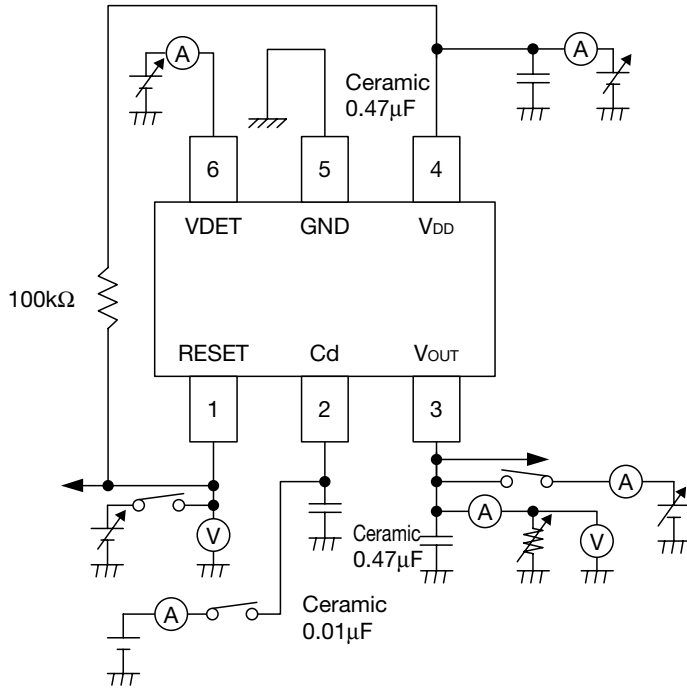
Note1: \*1 The parameter is guaranteed by design.

**Electrical Characteristics 2** (Except where noted otherwise, Ta=25°C, VDD=VOUT (typ.) +1V, VCE=VDD)

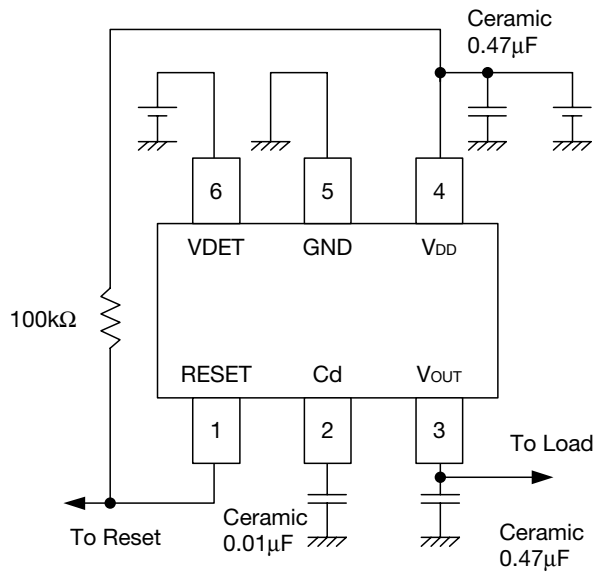
Item													
Output voltage				Detecting voltage				Dropout voltage					
Vo (V)				Vs (V)				Vio (V)					
Test conditions	Min.	Typ.	Max.	Test conditions	Min.	Typ.	Max.	Test conditions	Min.	Typ.	Max.		
1mA ≤ Io ≤ 30mA	1.170	1.200	1.230	VOUT=H→L Rpu=100kΩ	1.170	1.200	1.230	*2					
	1.270	1.300	1.330		1.270	1.300	1.330						
	1.370	1.400	1.430		1.370	1.400	1.430						
	1.470	1.500	1.530		1.470	1.500	1.530		Io=150mA		0.38	0.70	
	1.568	1.600	1.632		1.568	1.600	1.632				0.36	0.65	
	1.666	1.700	1.734		1.666	1.700	1.734				0.34	0.60	
	1.764	1.800	1.836		1.764	1.800	1.836		1.8V ≤ Vo ≤ 2.0V		0.32	0.55	
	1.862	1.900	1.938		1.862	1.900	1.938						
	1.960	2.000	2.040		1.960	2.000	2.040						
	2.058	2.100	2.142		2.058	2.100	2.142		2.1V ≤ Vo ≤ 2.7V				
	2.156	2.200	2.244		2.156	2.200	2.244						
	2.254	2.300	2.346		2.254	2.300	2.346						
	2.352	2.400	2.448		2.352	2.400	2.448				0.28	0.50	
	2.450	2.500	2.550		2.450	2.500	2.550						
	2.548	2.600	2.652		2.548	2.600	2.652						
	2.646	2.700	2.754		2.646	2.700	2.754						
	2.744	2.800	2.856		2.744	2.800	2.856						
	2.842	2.900	2.958		2.842	2.900	2.958						
	2.940	3.000	3.060		2.940	3.000	3.060						
	3.038	3.100	3.162		3.038	3.100	3.162			2.5V ≤ Vo ≤ 5.0V			
	3.136	3.200	3.264		3.136	3.200	3.264						
	3.234	3.300	3.366		3.234	3.300	3.366						
	3.332	3.400	3.468		3.332	3.400	3.468						
	3.430	3.500	3.570		3.430	3.500	3.570						
	3.528	3.600	3.672		3.528	3.600	3.672						
	3.626	3.700	3.774		3.626	3.700	3.774						
	3.724	3.800	3.876		3.724	3.800	3.876						
	3.822	3.900	3.978		3.822	3.900	3.978				0.22	0.35	
	3.920	4.000	4.080		3.920	4.000	4.080						
	4.018	4.100	4.182		4.018	4.100	4.182						
	4.116	4.200	4.284		4.116	4.200	4.284						
	4.214	4.300	4.386		4.214	4.300	4.386						
	4.312	4.400	4.488		4.312	4.400	4.488						
	4.410	4.500	4.590		4.410	4.500	4.590						
	4.508	4.600	4.692		4.508	4.600	4.692						
	4.606	4.700	4.794		4.606	4.700	4.794						
4.704	4.800	4.896	4.704	4.800	4.896								
4.802	4.900	4.998	4.802	4.900	4.998								
4.900	5.000	5.100	4.900	5.000	5.100								

Note2: \*2 The parameter is not guaranteed in the model less than 1.4V (VOUT).

Measuring Circuit



Application Circuit



(reference example of external parts)

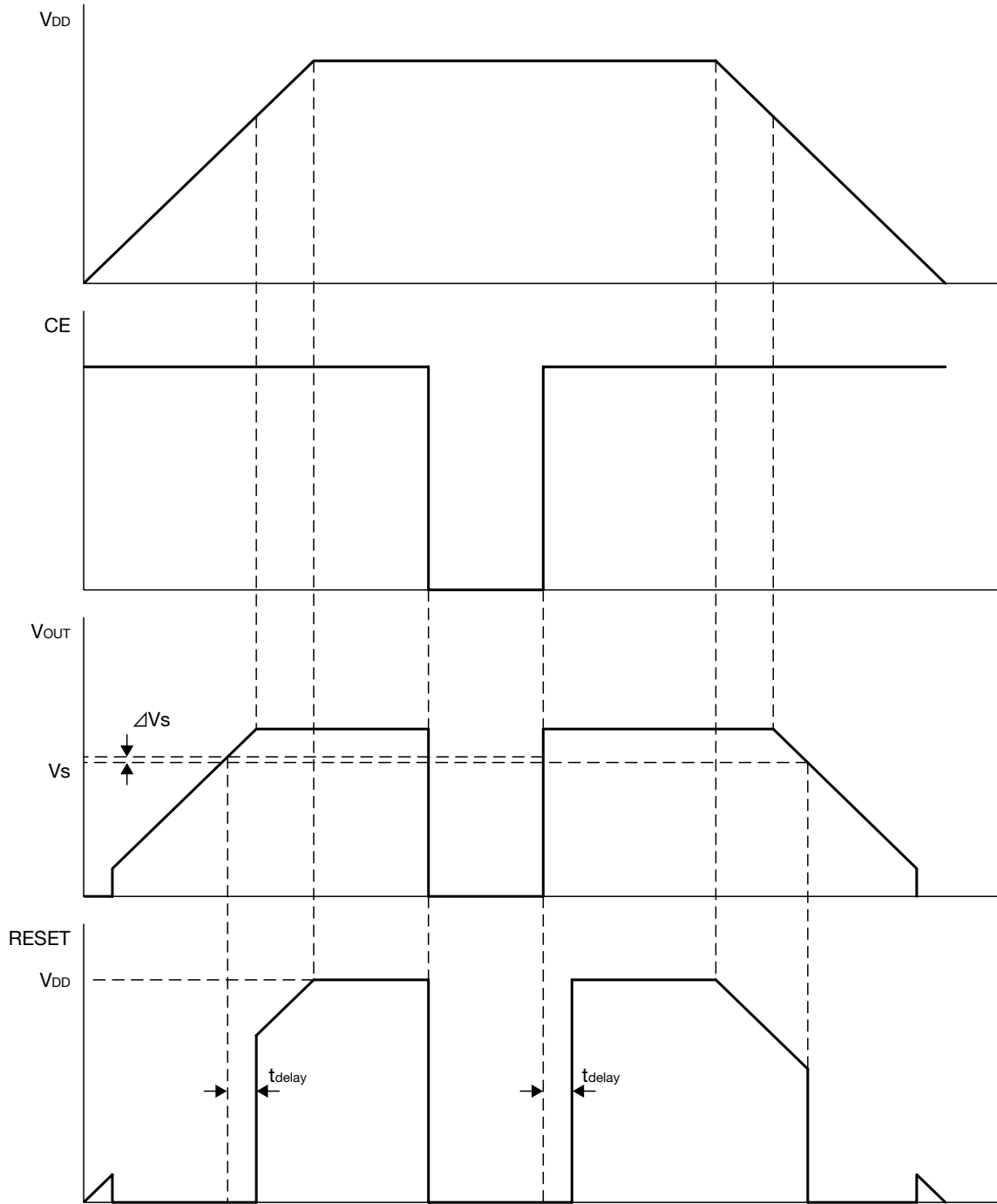
- Output capacitor Ceramic capacitor 0.47μF
- Input Capacitor Ceramic capacitor 0.47μF

\*Temperature Characteristics : B

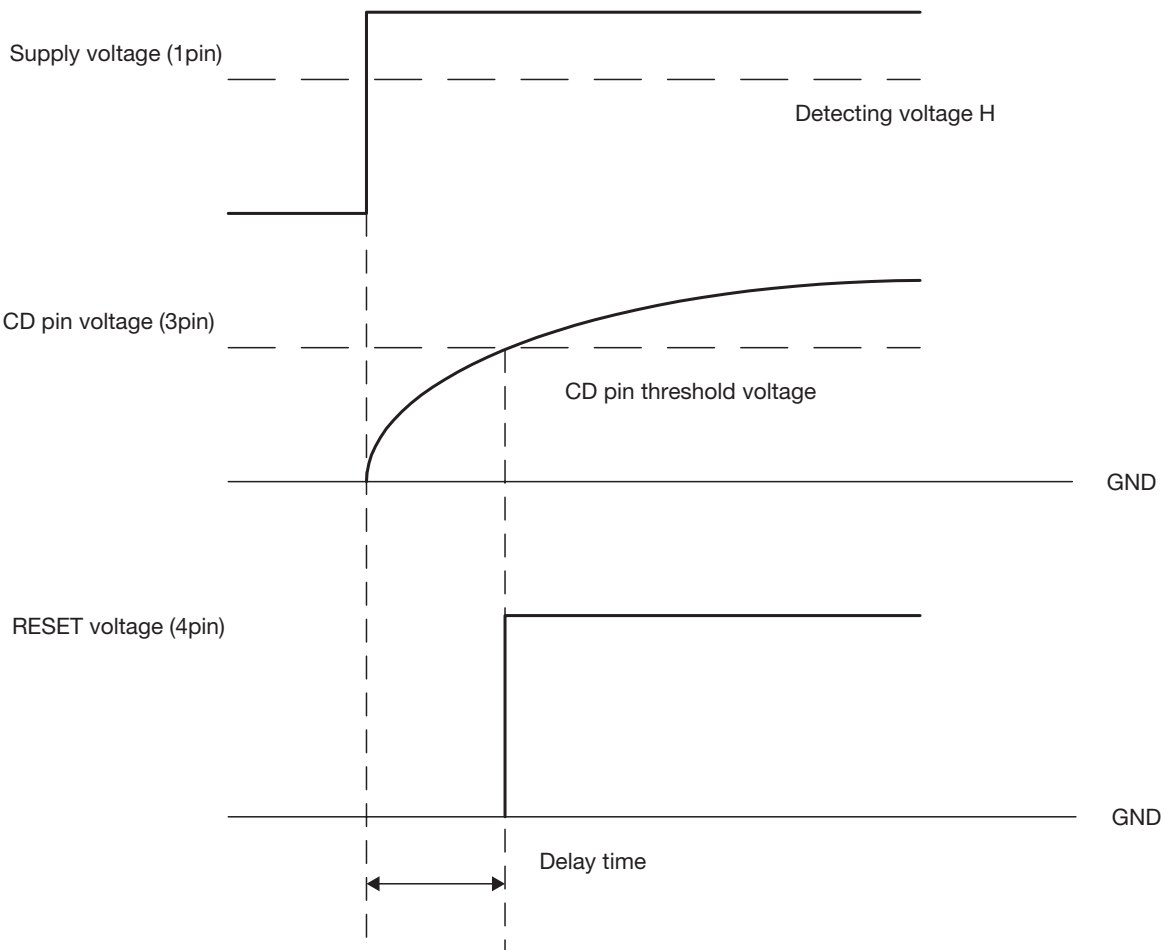
Note

1. The output capacitor is required between output and GND to prevent oscillation.
2. The output capacitor must be used in ESR stable area.  
It is possible to use a ceramic capacitor without ESR resistance for output.  
The ceramic capacitor must be used more than 0.47μF and B temperature characteristics.
3. The wire of V<sub>CC</sub> and GND is required to print full ground plane for noise and stability.
4. The input capacitor must be connected in 1cm from input pin.
5. In case the output voltage is above the input voltage, the overcurrent flows by internal parasitic diode from output to input.

# Timing Chart



**Delay Time**



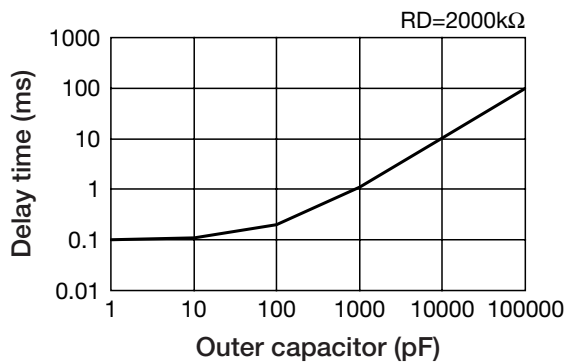
Delay Time ( $t_{PLH}$ )  $t_{PLH} \approx 0.50 \times RD (\Omega) \times CD (F) + IC's \text{ delay time}$

RD: CD pin resistance

CD: Outer capacitor

IC's delay time : 100 $\mu$ s

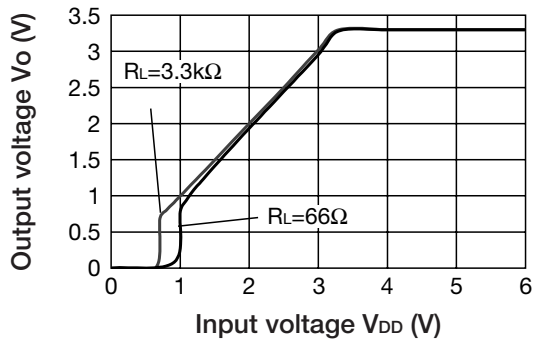
**Outer Capacitor-Delay Time**



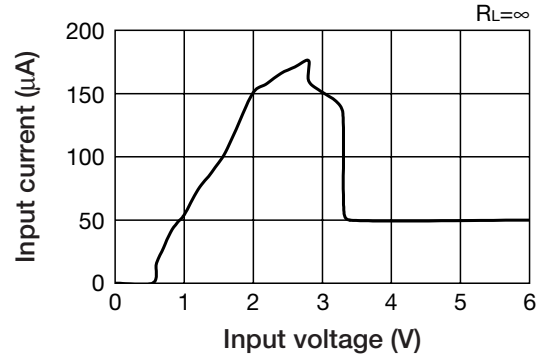
Note: These are typical characteristics.

**Characteristics** ( $V_o=3.3V$  Except where noted otherwise,  $T_a=25^\circ C$ ,  $V_{DD}=V_{OUT}$  (typ.) +1V,  $V_{CE}=V_{DD}$ )

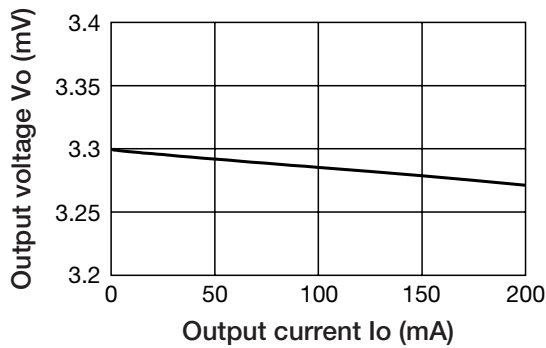
■ Output-Input Voltage



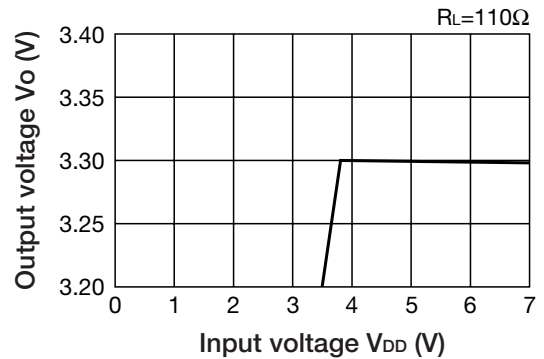
■ Input Current-Input Voltage



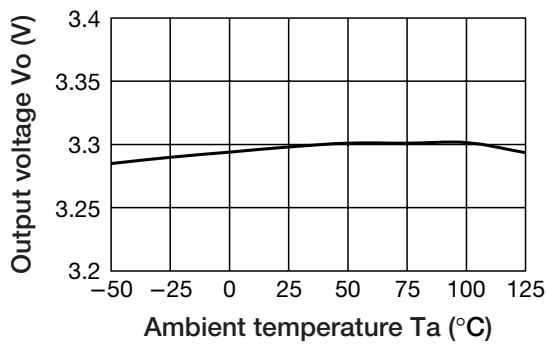
■ Load Regulation



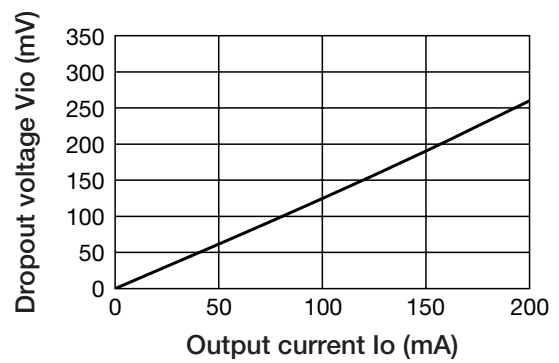
■ Line Regulation



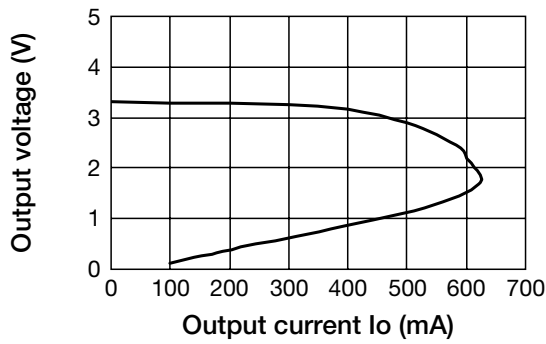
■ Output Voltage-Ambient Temperature



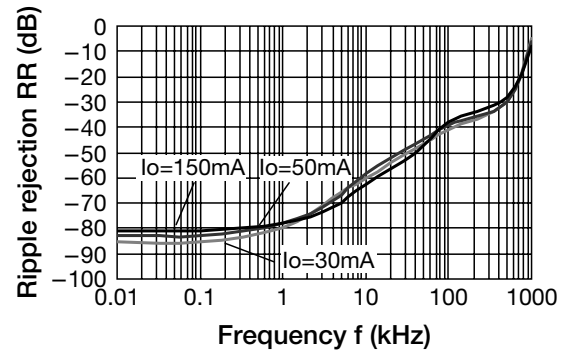
■ Dropout Voltage



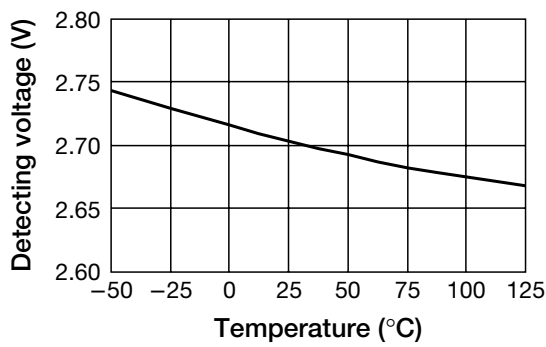
■ Output Voltage-Output Current



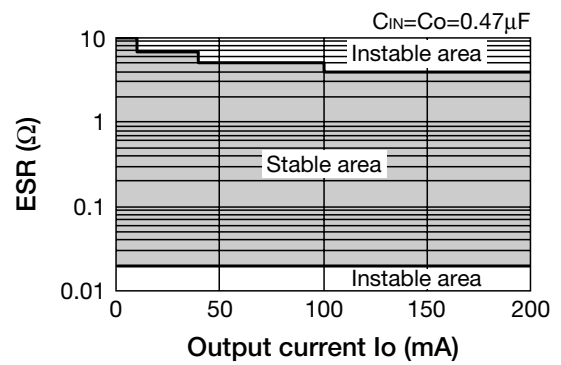
■ Ripple Rejection



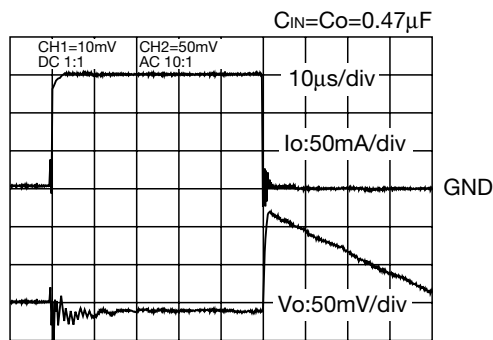
■ Detecting Voltage (H → L)-Temperature



■ ESR Stable Area



■ Load transient response (Io=10 → 150mA)



■ Turn-On & Turn-Off Transient Responses

