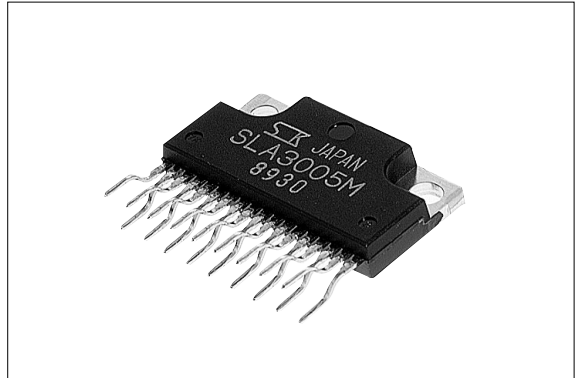


SLA3005M/3006M/3007M

4-Output, Low Dropout Voltage Dropper Type for USB Hub

■Features

- 4 regulators combined in one package
- Insulated single inline package
- SLA3005M/3006M with 5V/0.5A × 4 outputs and SLA3007M with 5V/0.5A × 3, 3.3V/0.5A × 1 outputs
- Low dropout voltage: $V_{DIF} \leq 0.5V$ (at $I_o = 0.5A$)
- Output-independent ON/OFF control terminal compatible with LS-TTL (Active High)
- Output-independent overcurrent and thermal protection circuits built in
- Open collector flag-output terminals built in to output OCP operation to each output terminal (Active Low)
- SLA3005M/3007M (excluding Reg4) for V_o shutdown after OCP operation and SLA3006M for continuous OCP operation
- Built-in anti-malfunction delay circuit whose time can be set with an external capacitor



■Applications

- USB hub power supplies
- Electronic equipment

■Absolute Maximum Ratings

($T_a = 25^\circ C$)

Parameter	Symbol	Ratings		Unit
		SLA3005M/3006M	SLA3007M	
DC Input Voltage	V_{IN}	20	18	V
Voltage of Output Control Terminal	V_C	V_{IN}		V
DC Output Current	I_o	0.5		A
Power Dissipation	P_{D1}	30(With infinite heatsink)		W
	P_{D2}	3.36(Without heatsink, stand-alone operation)		W
Junction Temperature	T_j	-30 to +125		$^\circ C$
Ambient Operating Temperature	T_{OP}	-30 to +100		$^\circ C$
Storage Temperature	T_{stg}	-30 to +125		$^\circ C$
Thermal Resistance (junction-to-case)	$R_{t(j-c)}$	9.0		$^\circ C/W$
Thermal Resistance (junction-to-ambient air)	$R_{th(j-a)}$	29.8(Without heatsink, stand-alone operation)5V/0.5A × 4		$^\circ C/W$

■Recommended Operating Conditions

Parameter	Symbol	Ratings	Unit
DC Input Voltage Range	V_{IN}	5.5 to 10	V
Output Current Range	I_o	0 to 0.5	A
Operating Junction Temperature Range	T_{jop}	-20 to +100	$^\circ C$
Ambient Operating Temperature Range	T_{aop}	-20 to +85	$^\circ C$

■Electrical Characteristics

(Ta=25°C unless otherwise specified)

Parameter	SYMBOL	Ratings											Unit		
		SLA3005M			SLA3006M			SLA3007M							
		min.	typ.	max.	min.	typ.	max.	Regulator1, 2, 3			Regulator4				
							min.	typ.	max.	min.	typ.	max.			
Output Voltage	Vo	4.85	5.00	5.15	4.85	5.00	5.15	4.85	5.00	5.15	3.234	3.300	3.366	V	
	Conditions	VIN=7V, Io=0.1A			VIN=7V, Io=0.1A			VIN=7V, Io=0.1A			VIN=7V, Io=0.1A				
Dropout Voltage	VDIF			0.5			0.5			0.5			2.0	V	
	Conditions	Io≤0.5A			Io≤0.5A			Io≤0.5A			Io≤0.5A				
Line Regulation	ΔVLINE			30			30			30			30	mV	
	Conditions	VIN=6 to 15V, Io=0.1A			VIN=6 to 15V, Io=0.1A			VIN=6 to 15V, Io=0.1A			VIN=6 to 15V, Io=0.1A				
Load Regulation	ΔVLOAD			50			50			50			30	mV	
	Conditions	VIN=7V, Io=0 to 0.5A			VIN=7V, Io=0 to 0.5A			VIN=7V, Io=0 to 0.5A			VIN=7V, Io=0 to 0.2A				
Temperature Coefficient of Output Voltage	ΔVo/ΔTa		±0.5			±0.5			±0.5			±0.3		mV/°C	
	Conditions	VIN=7V, Io=5mA, Tj=-10 to 100°C			VIN=7V, Io=5mA, Tj=-10 to 100°C			VIN=7V, Io=5mA, Tj=-10 to 100°C			VIN=7V, Io=5mA, Tj=-10 to 100°C				
Quiescent Circuit Current*3	Iq			20			20			20	—			mA	
	Conditions	VIN=7V, Io=0A			VIN=7V, Io=0A			VIN=7V, Io=0A			VIN=7V, Io=0A				
Quiescent Circuit Current (Output OFF)*3	Iq(off)			0.5			0.5			0.5	—			mA	
	Conditions	VIN=7V, Vc1 to 4=0V			VIN=7V, Vc1 to 4=0V			VIN=7V, Vc1 to 4=0V			VIN=7V, Vc1 to 4=0V				
Overcurrent Protection Starting Current*1	Is1	0.55		0.65	0.75		0.96	0.55		0.65	0.55		0.65	A	
	Conditions	VIN=7V			VIN=7V			VIN=7V			VIN=7V				
Vc Terminal ²	Control Voltage (Output ON)	Vc IH	2.0		2.0			2.0			2.0			V	
	Control Voltage (Output OFF)	Vc IL			0.7					0.7			0.7		
	Control Current (Output ON)	Ic IH			50			50			50			μA	
	Conditions	Vc=2.7V			Vc=2.7V			Vc=2.7V			Vc=2.7V				
	Control Current (Output OFF)	Ic IL			-100			-100			-100			-100	μA
Conditions	Vc=0V			Vc=0V			Vc=0V			Vc=0V					
OCP Detection Voltage Level	Voth	3.7	4.0	4.3	3.7	4.0	4.3	3.7	4.0	4.3	—			V	
Delay Threshold Voltage	VDLYth	2.1	2.3	2.5	2.1	2.3	2.5	2.1	2.3	2.5	—			V	
Delay Terminal Runoff Current	IDLY	35	50	65	35	50	65	35	50	65	—			μA	
Flag Output Terminal	Before OCP Detection	VFLGh	VIN-0.4			VIN-0.4			VIN-0.4			—			V
	Conditions	RFLG connected between FLG and VIN			RFLG connected between FLG and VIN			RFLG connected between FLG and VIN			RFLG connected between FLG and VIN				
After OCP Detection	VFLGi			0.5			0.5			0.5	—			V	
	Conditions	IFLG=1mA			IFLG=1mA			IFLG=1mA			IFLG=1mA				

*1 Is1 is specified at -5(%) drop point of output voltage Vo on the condition that VIN = 7V, Io = 0.1A.

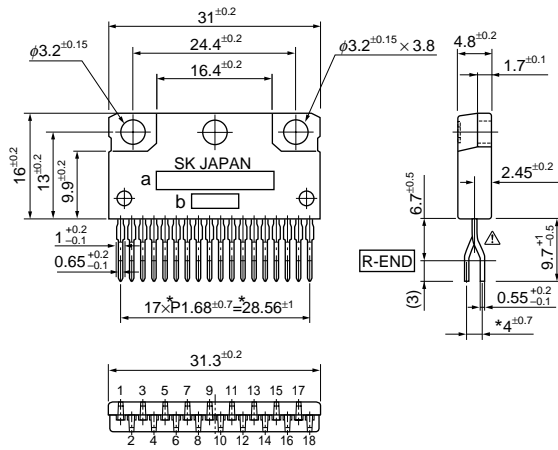
*2 Output is ON even when output control terminal Vc is open. Each input level is equivalent to LS-TTL. Therefore, it may be directly driven by an LS-TTL circuit.

*3 Total of four circuits

*4 The FLG output latched by delay DLY after OCP detection. (SLA3005M/3007M(Reg1 to 3) shuts down the output voltage simultaneously at latching.) Set the VIN or Vc to low to reset latching. Leave a time lag of Cd × 600s or more before restart.

■Outline Drawing

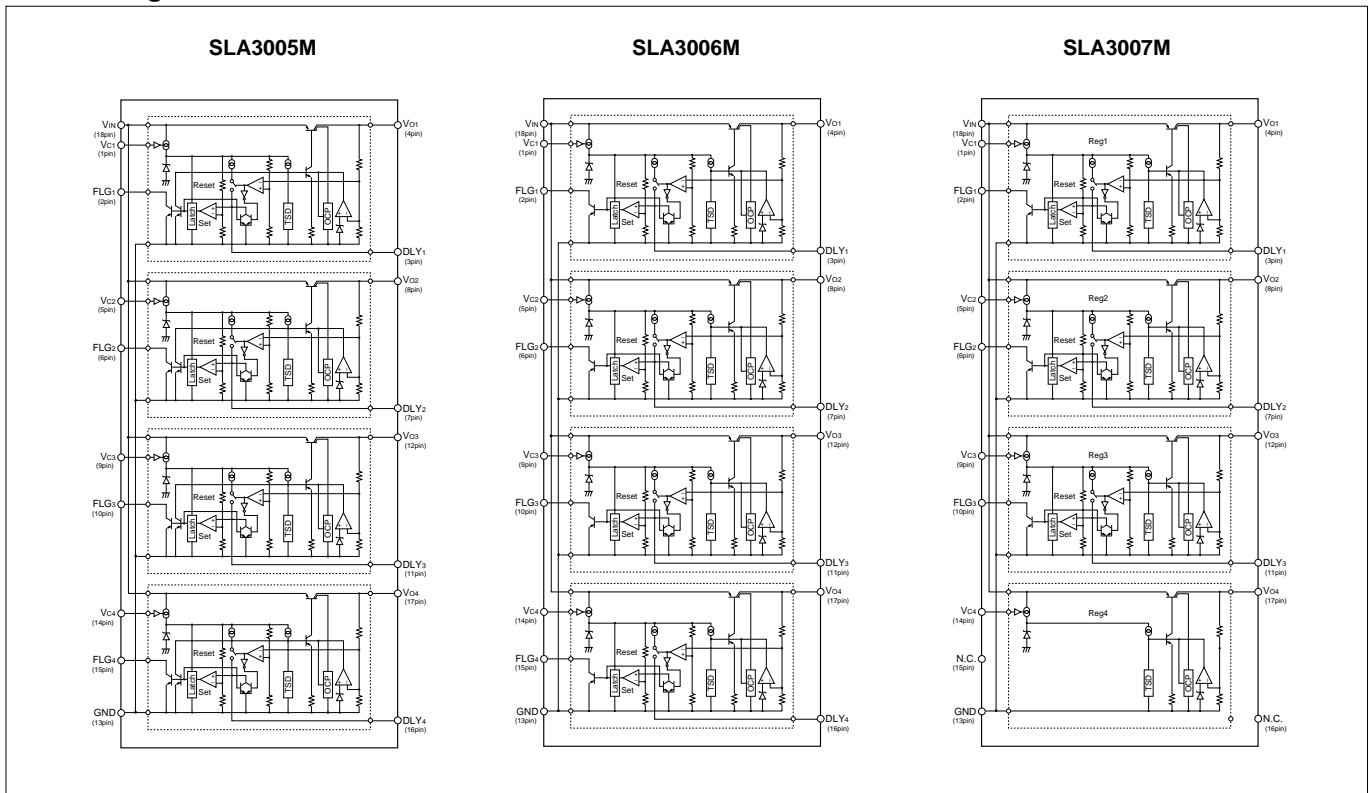
(unit:mm)



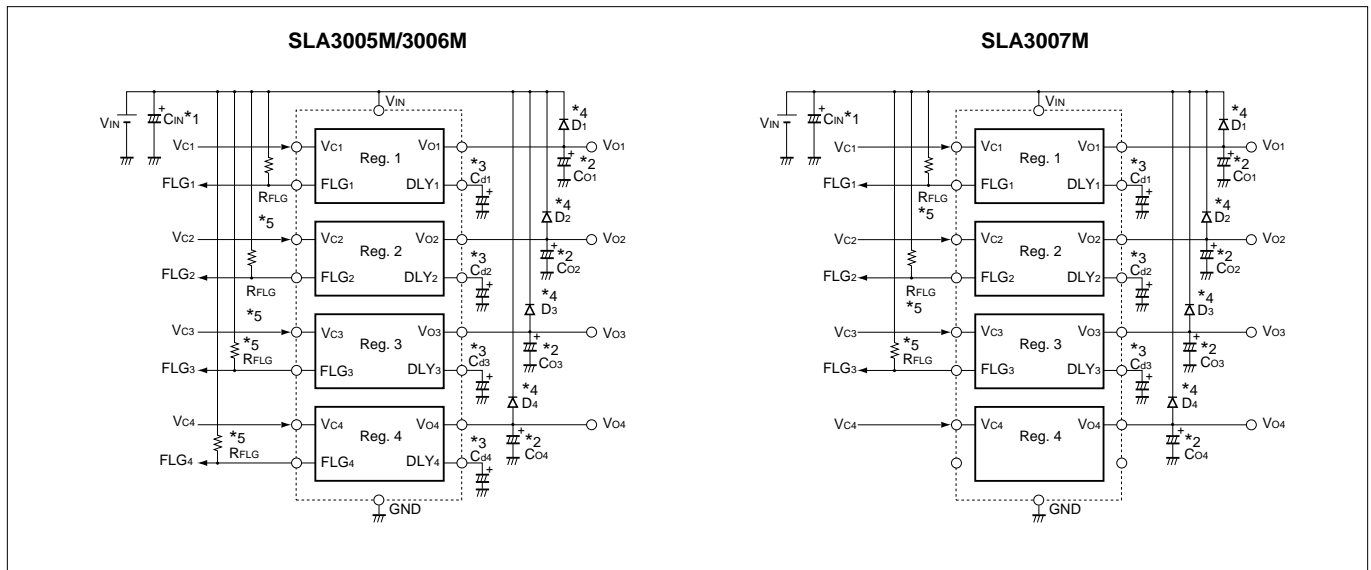
- | | | |
|--------|--------------------------|----------------|
| ① Vc1 | ⑩ FLG3 | a. Part Number |
| ② FLG1 | ⑪ DLY | b. Lot Number |
| ③ DLY1 | ⑫ Vo3 | |
| ④ Vo1 | ⑬ GND | |
| ⑤ Vc2 | ⑭ Vc4 | |
| ⑥ FLG2 | ⑮ FLG4(N. C on SLA3007M) | |
| ⑦ DLY2 | ⑯ DLY4(N. C on SLA3007M) | |
| ⑧ Vo2 | ⑰ Vo4 | |
| ⑨ Vc3 | ⑱ VIN | |

Weight: Approx. 6g

■Block Diagram

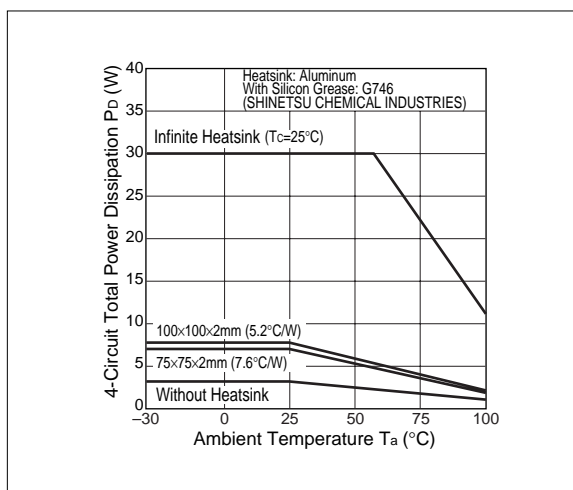


■Standard External Circuit

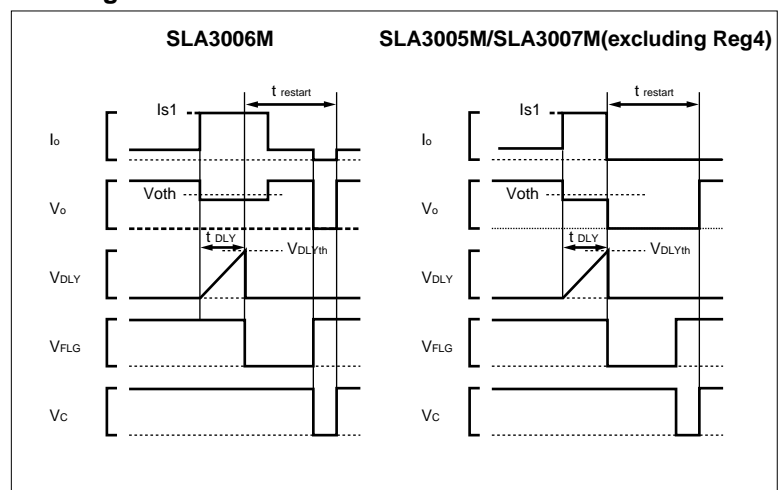


- *1 C_{IN} : Input capacitor (Approx. 47 μ F)
This capacitor is required if the input line is inductive and in the case of long wiring.
- *2 C_o : Output capacitor (47 to 220 μ F)
- *3 C_d : Delay setting capacitor (0.1 μ F or more)
Use C_d to set the delay time (t_{DLY}) from when a low V_o level due to OCP operation is detected until a flag signal is output. This prevents a rush current from causing malfunction.
Approximate calculation: $t_{DLY} \approx (C_d \times V_{DLYth}) / I_{DLY}$ [sec]
When using soft start on V_{IN} or if C_{IN} has a large capacitance, set t_{DLY} long enough for the output voltage to rise sufficiently. Be sure to connect C_d and do not use it for other applications, such as short circuiting C_d .
- *4 D_1 to D_4 : Reverse biasing protection diode
This diode is required for protection against reverse biasing of the input and output.
- *5 R_{FLG} : Set this to limit the inflow current into the FLG terminal to 1mA or less.

■ T_a - P_D Characteristics



■Timing Charts



■Calculating the internal dissipation

P_D is calculated as follows:

$$P_D = [I_{O1} \cdot (V_{IN} - V_{O1})] + [I_{O2} \cdot (V_{IN} - V_{O2})] + [I_{O3} \cdot (V_{IN} - V_{O3})] + [I_{O4} \cdot (V_{IN} - V_{O4})] + V_{IN} \cdot I_G$$

■Estimating T_j by heat measurement

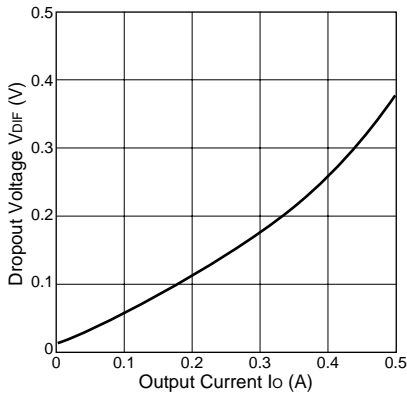
1. Measuring position: At the root of pin 13
2. Add the thermal resistance " θ_j -L" between the junction and pin 13 and the P_d product of each channel to the measured temperature.
 θ_j -L is as follows : θ_j -L1:8°C/W, θ_j -L2:7°C/W, θ_j -L3:5°C/W, θ_j -L4:8°C/W
The calculation formula is as follows : $T_j = \theta_j$ -L1 $\cdot P_{d1} + \theta_j$ -L2 $\cdot P_{d2} + \theta_j$ -L3 $\cdot P_{d3} + \theta_j$ -L4 $\cdot P_{d4} + T_{13pin}$

Typical Characteristics

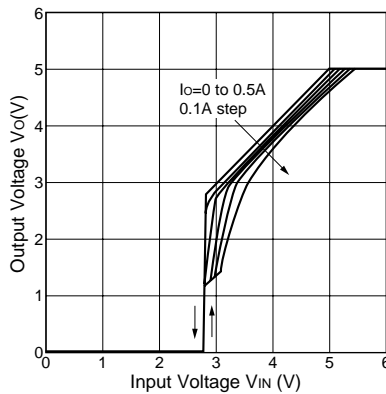
($T_a=25^\circ\text{C}$)

SLA3005M

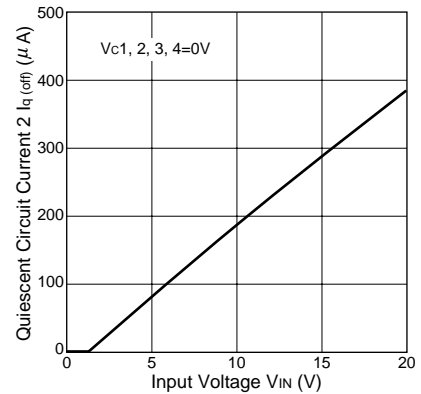
Io vs. VDIF Characteristics



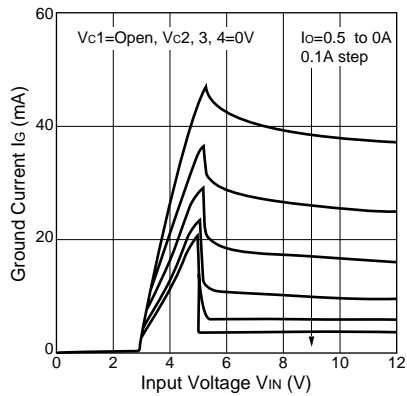
Rise Characteristics



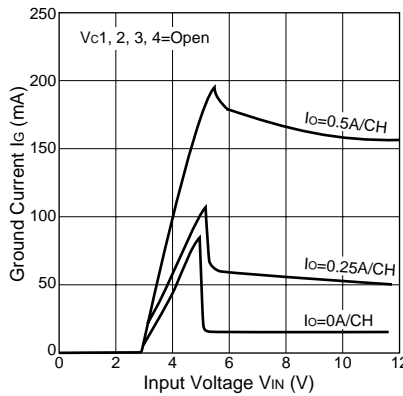
Quiescent Circuit Current



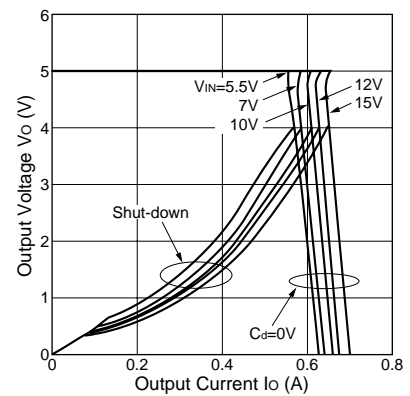
Circuit Current 1-Circuit



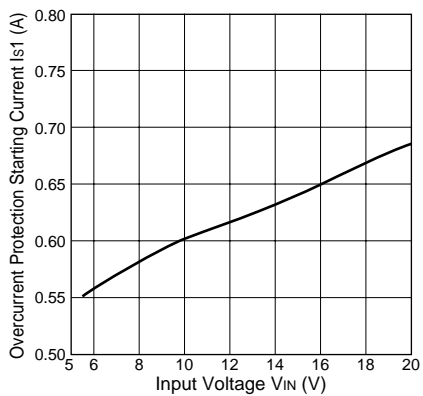
Circuit Current 4-Circuits



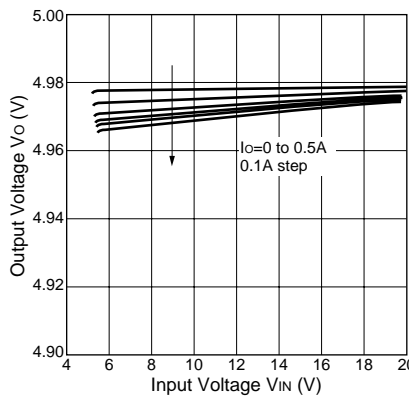
Overcurrent Protection Characteristics



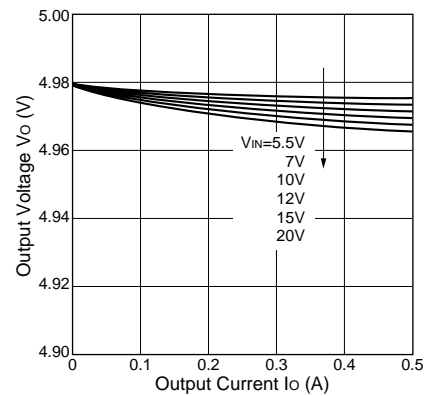
VIN vs. IS1 Characteristics



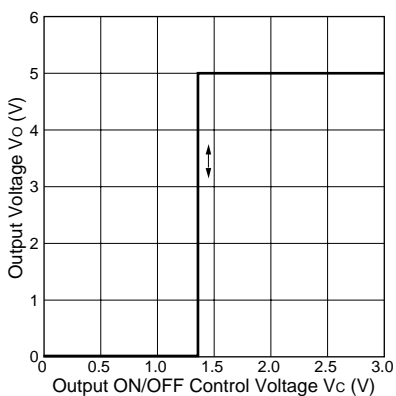
Line Regulation



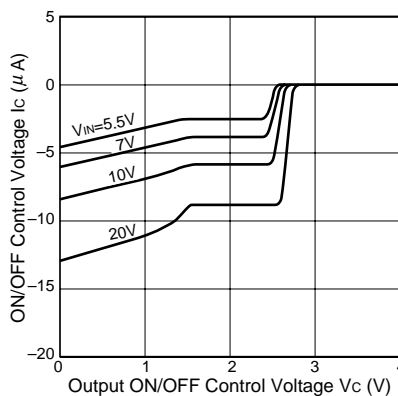
Load Regulation



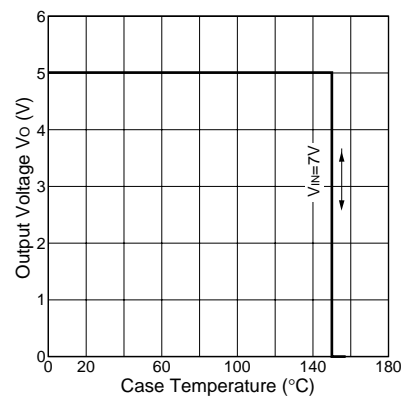
ON/OFF Control Characteristics



VC Terminal Characteristics



Thermal Protection Characteristics

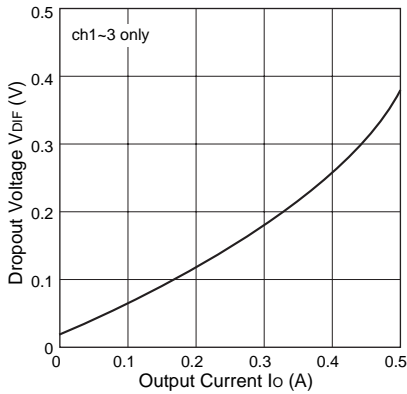


Typical Characteristics

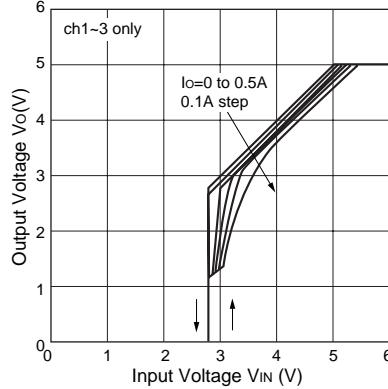
($T_a=25^\circ\text{C}$)

SLA3007M

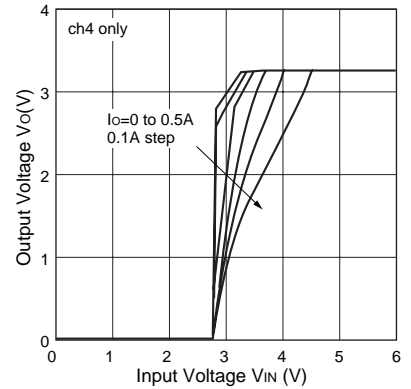
Io vs. VDIF Characteristics



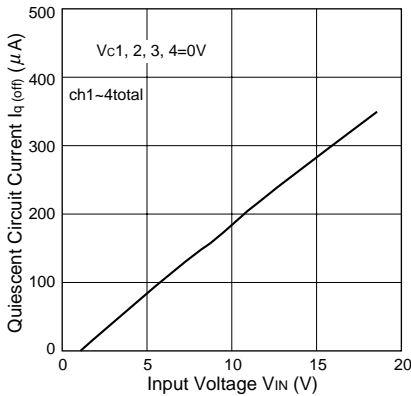
Rise Characteristics



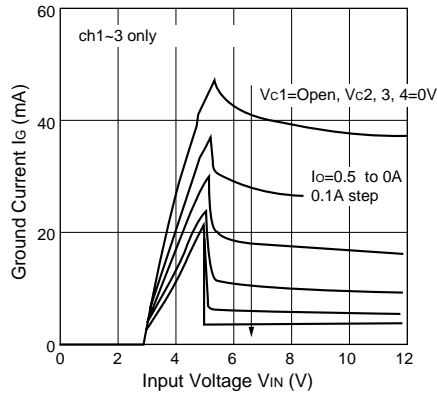
Rise Characteristics



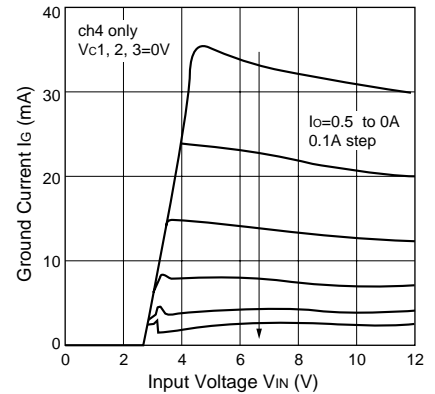
Quiescent Circuit Current



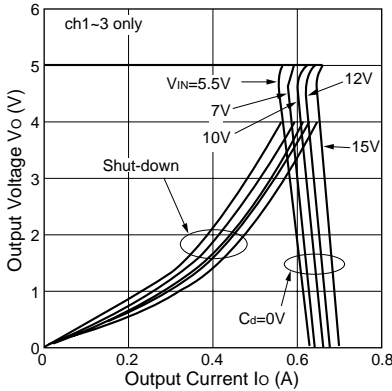
Circuit Current (ch1 operating)



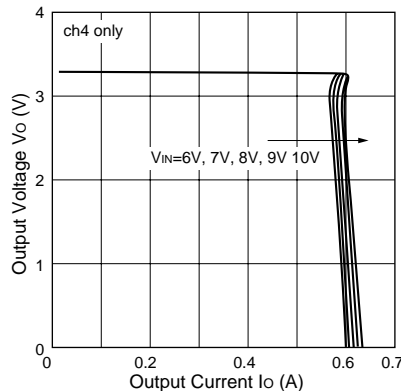
Circuit Current (ch4 operating)



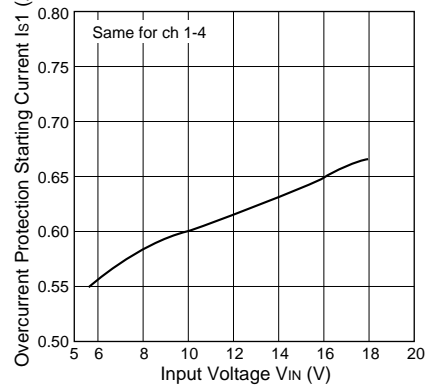
Overcurrent Protection Characteristics



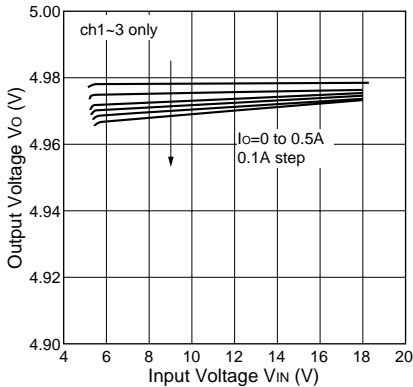
Overcurrent Protection Characteristics



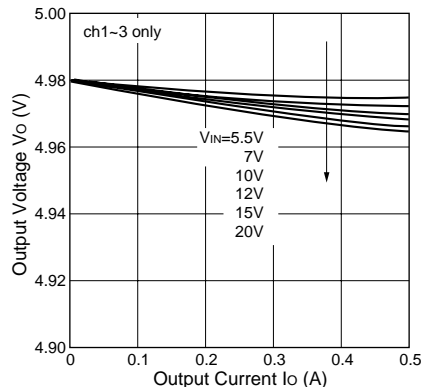
VIN vs. IS1 Characteristics



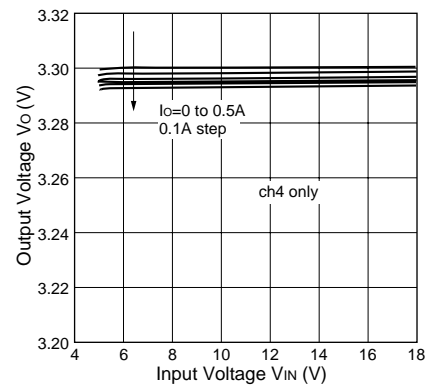
Line Regulation



Load Regulation



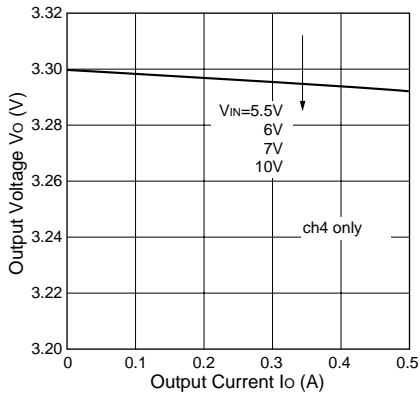
Line Regulation



■Typical Characteristics

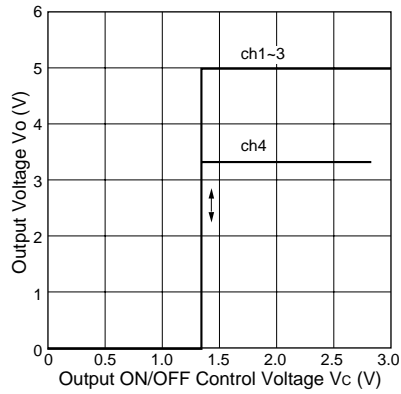
($T_a=25^\circ\text{C}$)

Load Regulation

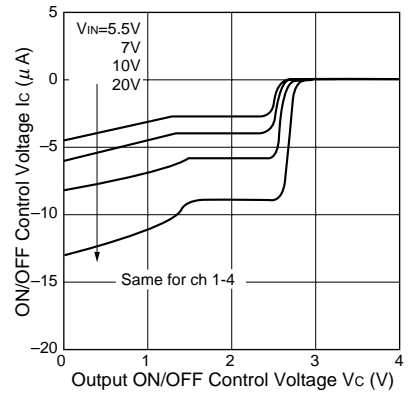


SLA3007M

ON/OFF Control Characteristics



VC Terminal Characteristics



Thermal Protection Characteristics

