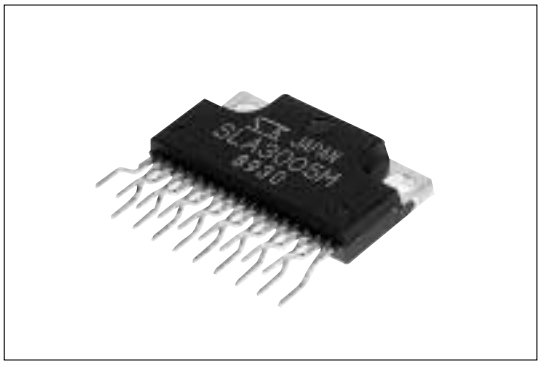
SLA3005M/3006M

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



■Features

- 4 regulators combined in one package
- Insulated single inline package
- Output (5V/0.5A×4 output)
- 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 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°C)

Parameter	Symbol	Ratings	Unit
DC Input Voltage	V_{IN}	20	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	°C
Ambient Operating Temperature	T_{OP}	–30 to +100	°C
Storage Temperature	T_{stg}	–30 to +125	°C
Thermal Resistance (junction-to-case)	$R_{t(j-c)}$	9.0	°C/W
Thermal Resistance (junction-to-ambient air)	$R_{th(j-a)}$	29.8(Without heatsink, stand-alone operation)	°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	°C
Ambient Operating Temperature Range	T_{aop}	–20 to +85	°C

■Electrical Characteristics

(T_a=25°C unless otherwise specified)

Parameter		SYmbol	Ratings						Unit
			SLA3005M			SLA3006M			
			min.	typ.	max.	min.	typ.	max.	
Output Voltage		V_O	4.85	5.00	5.15	4.85	5.00	5.15	V
		Conditions	V_{IN}=7V, I_O=0.1A			V_{IN}=7V, I_O=0.1A			
Dropout Voltage		V_{DIF}			0.5			0.5	V
		Conditions	I_O≤0.5A			I_O≤0.5A			
Line Regulation		ΔV_{OLINE}			30			30	mV
		Conditions	V_{IN}=6 to 15V, I_O=0.1A			V_{IN}=6 to 15V, I_O=0.1A			
Load Regulation		ΔV_{OLOAD}			50			50	mV
		Conditions	V_{IN}=7V, I_O=0 to 0.5A			V_{IN}=7V, I_O=0 to 0.5A			
Temperature Coefficient of Output Voltage		$\Delta V_O/\Delta T_a$		±0.5			±0.5		mV/°C
		Conditions	V_{IN}=7V, I_O=5mA, T_j=–10 to 100°C			V_{IN}=7V, I_O=5mA, T_j=–10 to 100°C			
Quiescent Circuit Current*3		I_q			20			20	mA
		Conditions	V_{IN}=7V, I_O=0A			V_{IN}=7V, I_O=0A			
Quiescent Circuit Current (Output OFF)*3		$I_{q(off)}$			0.5			0.5	mA
		Conditions	V_{IN}=7V, V_C1 to 4=0V			V_{IN}=7V, V_C1 to 4=0V			
Overcurrent Protection Starting Current*1		I_{S1}	0.55		0.65	0.75		0.96	A
		Conditions	V_{IN}=7V			V_{IN}=7V			
V_C Terminal*2	Control Voltage (Output ON)	$V_{C.}$ IH	2.0			2.0			V
	Control Voltage (Output OFF)	$V_{C.}$ IL			0.7			0.7	V
	Control Current (Output ON)	$I_{C.}$ IH			50			50	µA
		Conditions	V_C=2.7V			V_C=2.7V			
	Control Current (Output OFF)	$I_{C.}$ IL			–100			–100	µA
		Conditions	V_C=0V			V_C=0V			
OCP Detection Voltage Level		V_{oth}	3.7	4.0	4.3	3.7	4.0	4.3	V
Delay Threshold Voltage		V_{DLYth}	2.1	2.3	2.5	2.1	2.3	2.5	V
Delay Terminal Runoff Current		I_{DLY}	35	50	65	35	50	65	µA
Flag Output Terminal	Before OCP Detection	V_{FLGh}	V_{IN}–0.4			V_{IN}–0.4			V
		Conditions	R_{FLG} connected between FLG and V_{IN}			R_{FLG} connected between FLG and V_{IN}			
	After OCP Detection	V_{FLGl}			0.5			0.5	V
		Conditions	I_{FLG}=1mA			I_{FLG}=1mA			

*1 I_{S1} is specified at –5(%) drop point of output voltage V_O on the condition that V_{IN} = 7V, I_O = 0.1A.

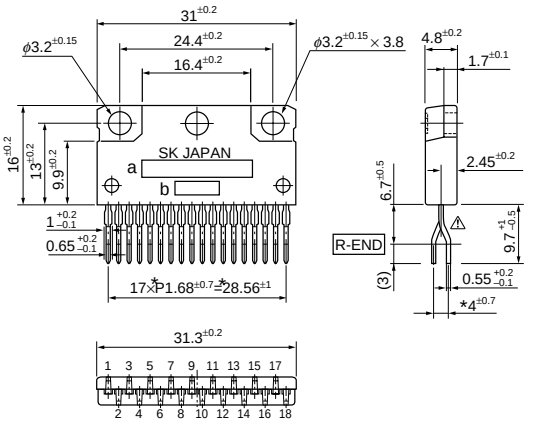
*2 Output is ON even when output control terminal V_C is open. Each input level is equivalent to LS-TTL. Therefore, it may be directly driven by an LS-TTL circuit.

*3 Total of four circuits

*4 The FLG output latched by delay DLY after OCP detection. (SLA3005M shuts down the output voltage simultaneously at latching.) Set the V_{IN} or V_C to low to reset latching. Leave a time lag of $C_d \times 600$s or more before restart.

■Outline Drawing

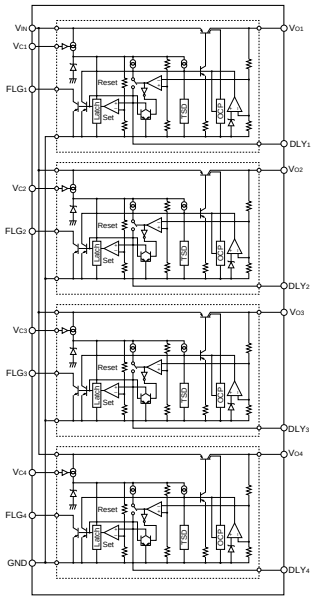
(unit:mm)



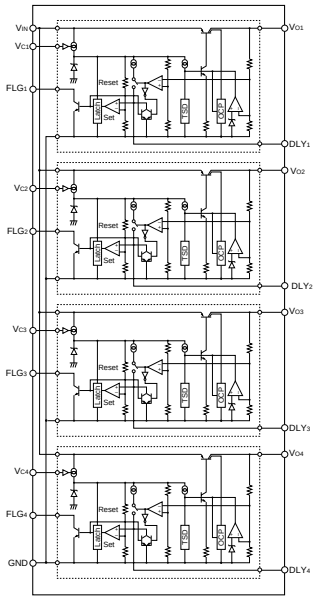
① V_{C1}	⑩ FLG3	a. Part Number
② FLG1	⑪ DLY	b. Lot Number
③ DLY1	⑫ V_{O3}	
④ V_{O1}	⑬ GND	
⑤ V_{C2}	⑭ V_{C4}	
⑥ FLG2	⑮ FLG4	
⑦ DLY2	⑯ DLY4	
⑧ V_{O2}	⑰ V_{O4}	
⑨ V_{C3}	⑱ V_{IN}	

■Block Diagram

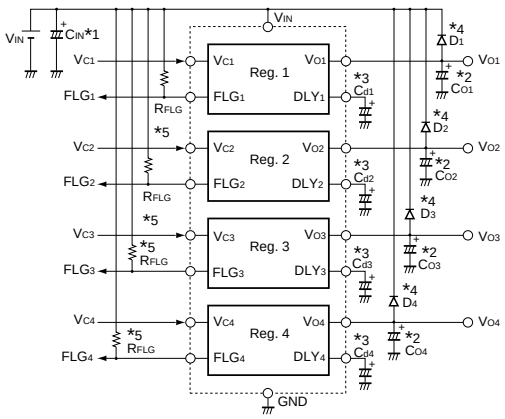
SLA3005M



SLA3006M



■Standard External Circuit



*1 C_{IN} : Input capacitor (Approx. 47µF)
This capacitor is required if the input line is inductive and in the case of long wiring.

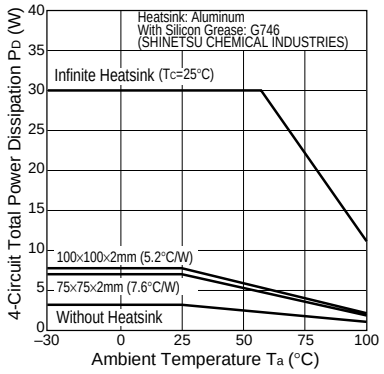
*2 C_O : Output capacitor (47 to 220µF)

*3 C_d : Delay setting capacitor (0.1µF 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: $t_{DLY} \fallingdotseq (C_d \times V_{DLYth})/I_{DLY}$[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 Cd and do not use it for other applications, such as short circuiting Cd.

*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



■Calculating the internal dissipation

P_D is calculated as follows:

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

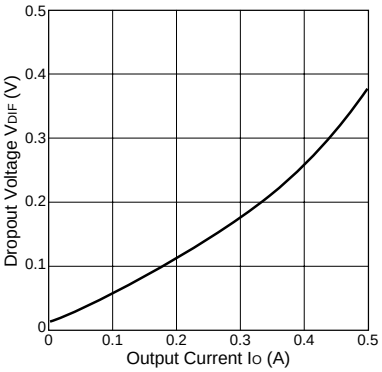
■Estimating Tj by heat measurement

1. Measuring position: At the root of pin 13
2. Add the thermal resistance "θj-L" between the junction and pin 13 and the Pd product of each channel to the measured temperature.
   θj-L is as follows : θj-L1:8°C/W, θj-L2:7°C/W, θj-L3:5°C/W, θj-L4:8°C/W
   The calculation formula is as follows :Tj=θj-L1•Pd1+θj-L2•Pd2+θj-L3•Pd3+θj-L4•Pd4+T13pin

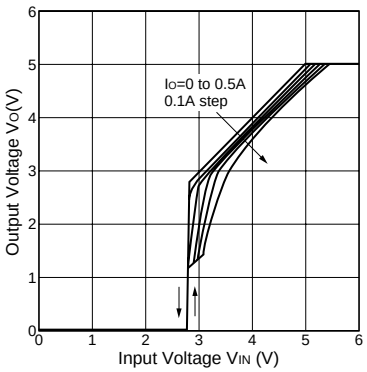
■Typical Characteristics SLA3005M

(T_a=25°C)

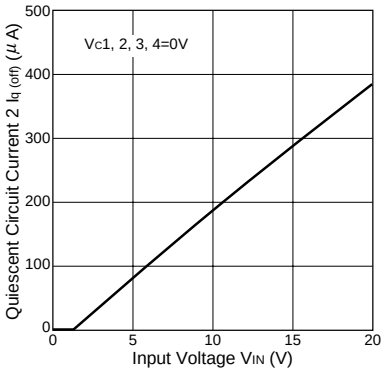
I_O vs. V_{DIF} Characteristics



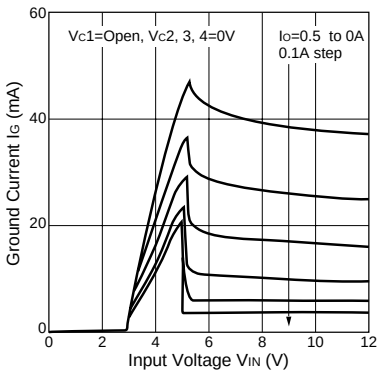
Rise Characteristics



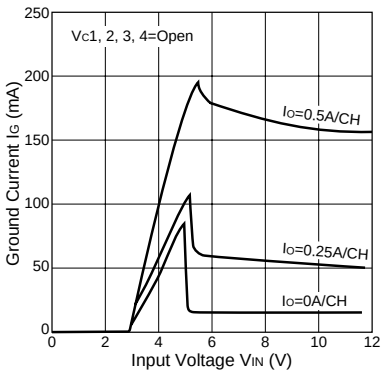
Quiescent Circuit Current



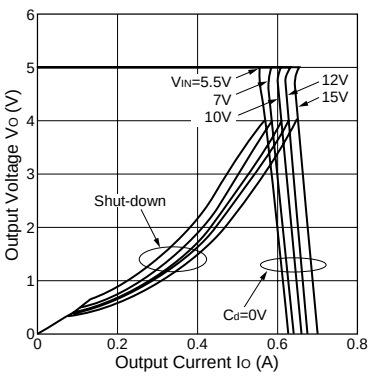
Circuit Current 1-Circuit



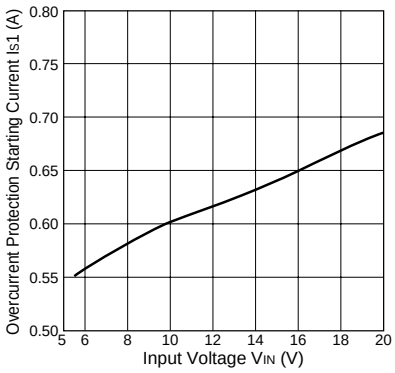
Circuit Current 4-Circuits



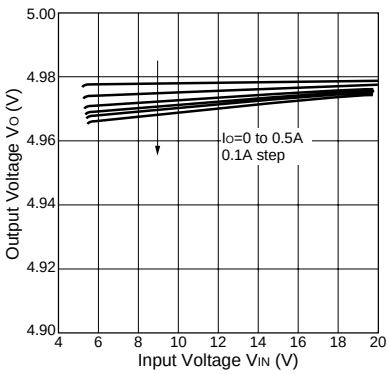
Overcurrent Protection Characteristics



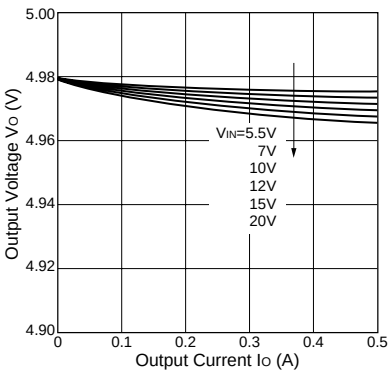
VIN vs. IS1 Characteristics



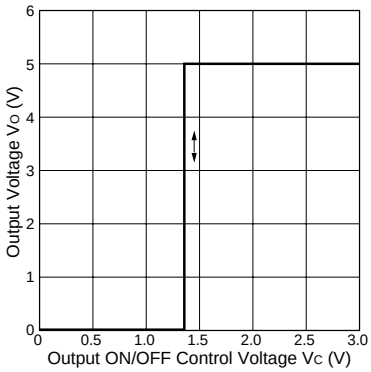
Line Regulation



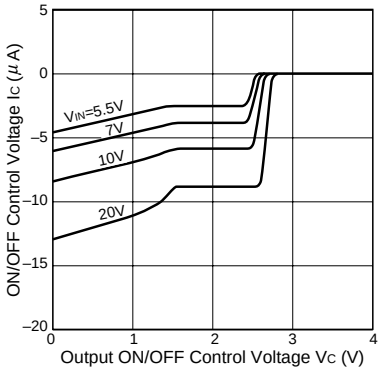
Load Regulation



ON/OFF Control Characteristics



VC Terminal Characteristics



Thermal Protection Characteristics