## Features

- Dual input and dual output (ch1: 5V/0.4A, ch2: 5V/0.2A)
- Power on reset function
- Watchdog timer
- Built-in drooping type overcurrent and thermal protection circuits (ch1)

## Absolute Maximum Ratings

(Ta=25°C)

| Parameter | | Symbol | Ratings | Unit | Remarks |
|---|---|---|---|---|---|
| DC input voltage | | $V_{IN}1$ | –13 to 35 | V | Reverse connection 1 min max. |
| | | $V_{IN}2$ | | | |
| Vo1, Vo2 output control terminal voltage | | EN | –0.3 to 35 | V | |
| Vo2 output control terminal voltage | | VC | –0.3 to 35 | V | |
| Output current | CH1 | Io1 | 0.4 | A | |
| | CH2 | Io2 | 0.2 | | |
| TC terminal input voltage | | TC | –0.3 to 7 | V | |
| CK terminal input voltage | | CK | | | |
| W/D/C terminal input voltage | | W/D/C | | | |
| Reset terminal output voltage | | RESET | | | |
| Power dissipation | | $P_D1$ | 18.6 | W | With an infinite heatsink mounted. |
| | | $P_D2$ | 2.97 | | *1 |
| Junction temperature | | Tj | –40 to 150 | °C | |
| Operating temperature | | Top | –40 to 105 | °C | |
| Storage temperature | | Tstg | –40 to 150 | °C | |
| Thermal resistance (junction to case) | | $\theta$j-c | 6.7 | °C/W | With an infinite heatsink mounted. |
| Thermal resistance (junction to ambient air) | | $\theta$j-a | 42 | °C/W | *1 |

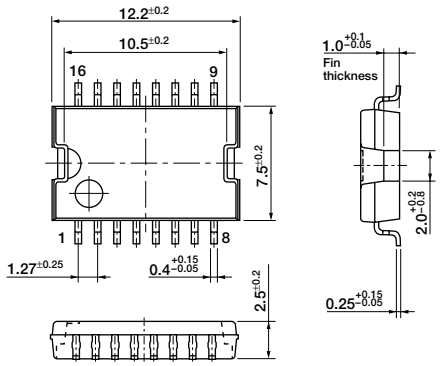
Notes: *1: With glass epoxy + copper foil board (size 5.0•7.4cm; t: glass epoxy=1.6mm / copper foil=18μm)

## Electrical Characteristics

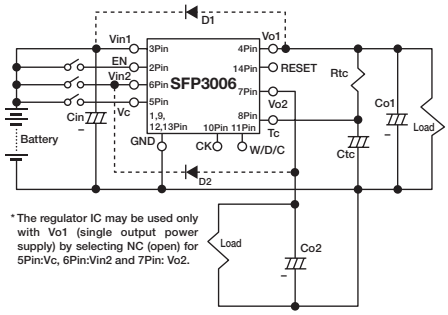
| Parameter | | Symbol | Ratings min | Ratings typ | Ratings max | Unit | Conditions |
|---|---|---|---|---|---|---|---|
| Input voltage | | $V_{IN}1, 2$ | $V_{O}1+V_{DIF}1$ | | 35 | V | *2, 3 |
| Output voltage | CH1 | Vo1 | 4.85 | 5.00 | 5.15 | V | $V_{IN}1$=6 to 18V, Io=0 to 0.3A |
| | CH2 | Vo2 | 4.85 | 5.00 | 5.15 | | $V_{IN}2$=6 to 18V, Io=0 to 0.3A |
| Dropout voltage | CH1 | $V_{DIF}1$ | | | 0.5 | V | |
| | CH2 | $V_{DIF}2$ | | | 0.5 | | |
| Ripple rejection | CH1 | $R_{REJ}1$ | | 54 | | db | f=100 to 120Hz |
| | CH2 | $R_{REJ}2$ | | 54 | | | |
| Quiescent circuit current | | Iq | | 10 | 50 | μA | $V_{IN}1$=16V, $V_{EN}$=0V |
| | | | | 50 | 250 | | $V_{IN}1$=35V, $V_{EN}$=0V |
| | | | | 5 | 10 | mA | |
| GND current | | $I_{GND}$ | | 70 | 100 | mA | Io1=Io2=0.2A |
| Overcurrent protection starting current | CH1 | Is11 | 0.402 | | 1.8 | A | Vo1=4.5V |
| | CH2 | Is21 | 0.201 | | 0.8 | | Vo2=4.5V |
| Residual current at a short | CH1 | Is21 | 0.402 | | 1.8 | A | Vo1=0V |
| | CH2 | Is22 | 0.201 | | 0.8 | | Vo2=0V |
| EN output control voltage | | $V_{EN}$th | 0.9 | | 3.5 | V | |
| EN output control current | ON | $I_{EN}$H | | | 50 | μA | EN=5V |
| | OFF | $I_{EN}$L | –1.0 | | 1.0 | | EN=0V |
| Reset terminal LOW voltage | | $V_{RS}$L | | | 0.5 | V | Isink=250μA (Pull-up resistance 20kΩ typ) |
| Reset terminal HI voltage | | $V_{RS}$H | Vo1-0.8V | | | V | Isource=15μA *4 |
| Reset detect voltage | CH | Vo1thH | | | Vo1•0.97 | V | Vrs＞4.5V |
| | | Vo1thL | 4.05 | | | V | Vrs＜0.8V |
| Power on reset delay time | | $t_{dly}$ | 1.18•Rtc•Ctc | 1.26•Rtc•Ctc | 1.35•Rtc•Ctc | S | Min. set time: 6mS |
| W/D time | | $t_{wd}$ | 0.93•Rtc•Ctc | 1.03•Rtc•Ctc | 1.13•Rtc•Ctc | S | Min. set time: 4mS |
| W/D pulse time | | $t_{wdp}$ | 0.07•Rtc•Ctc | 0.13•Rtc•Ctc | 0.19•Rtc•Ctc | S | Min. set time: 400μS |
| CK terminal control voltage | | Vckth | 1.0 | | 3.0 | V | Min. clock pulse time: 5μs (Duty 50%) |
| CK terminal control current | ON | IckH | | | 200 | μA | $V_{CK}$=5V |
| | OFF | IckL | –1.0 | | 1.0 | | $V_{CK}$=0V |
| Vc output control voltage | | Vcth | 1.0 | | 3.5 | V | |
| Vc output control current | | IcH | | | 300 | μA | Vc=5V |
| | | IcL | –1.0 | | 1.0 | | Vc=0V |
| W/D/C terminal control voltage | | Vw/d/cth | 1.0 | | 3.0 | V | |
| W/D/C terminal control current | ON | Iw/d/cH | | | 200 | μA | $V_{W/D/C}$=5V |
| | OFF | Iw/d/cL | –1.0 | | 1.0 | | $V_{W/D/C}$=0V |

Notes:
*2: Refer to Dropout Voltage.
*3: Since $P_D(max) = (V_{IN}–V_O1) • I_O1 + (V_{IN}2–V_O2) • I_O2 + (V_{IN} • Iq) = 22W$, $V_{IN}(max)$, $I_O1(max)$ and $I_O2(max)$ may be limited depending on operating conditions.
*4: The RESET terminal is pulled up in the IC; may be directly connected to logic circuits.
*6: The thermal protection function is built in $V_{O1}$ (CH1 side) only. The design thermal protection starting temperature is 151 °C (min.) and 165°C (typ). These values represent the design warranty.

## External Dimensions (unit: mm)




## Standard Connection Diagram

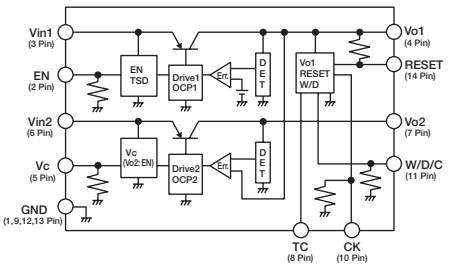



*The regulator IC may be used only with Vo1 (single output power supply) by selecting NC (open) for 5Pin:Vc, 6Pin:Vin2 and 7Pin: Vo2.

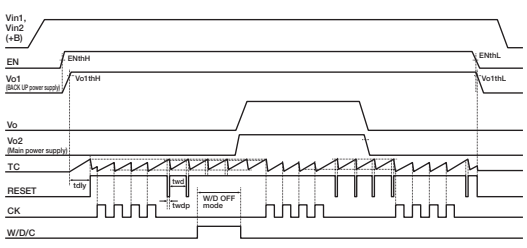



Cin: Capacitor (39μF) for oscillation prevention
$C_O1$: Output capacitor (39μF)
$C_O2$: Output capacitor (39μF)
Tantalum capacitors are recommended particularly for low temperatures (tantalum capacitors of about 0.47μ F in parallel).
D1, D2: Protection diodes.
Required for protection against reverse biasing between input and output (Recommended diode: SANKEN EU2Z).

## Circuit Block Diagram

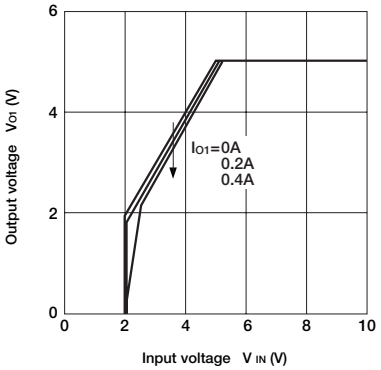



## Timing Chart

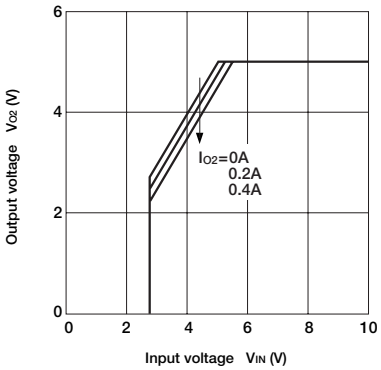


## Electrical Characteristics

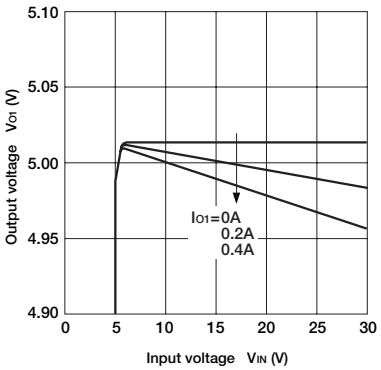
■ Rise Characteristics of Output Voltage ($V_{O1}$)



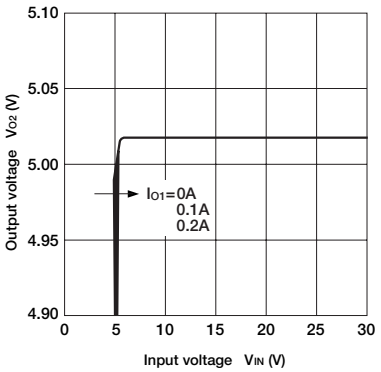

■ Rise Characteristics of Output Voltage ($V_{O2}$)



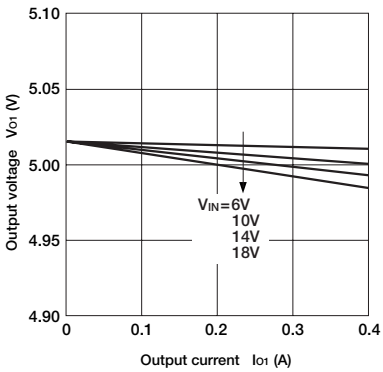

■ Line Regulation ($V_{O1}$)



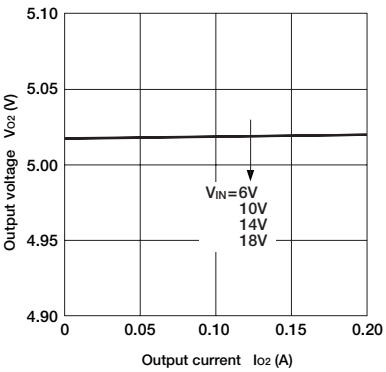

■ Line Regulation ($V_{O2}$)



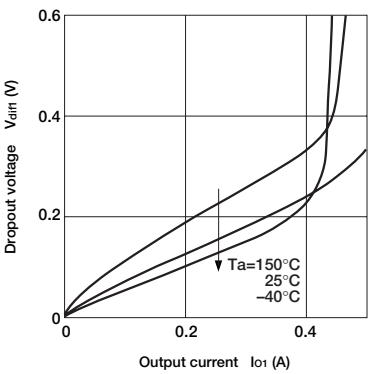

■ Load Regulation ($V_{O1}$)



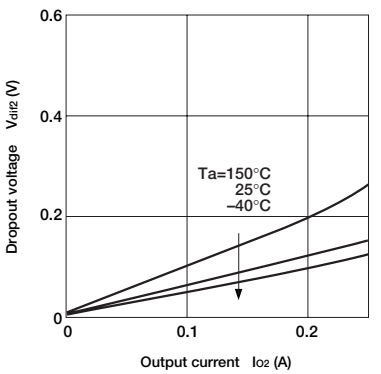

■ Load Regulation ($V_{O2}$)



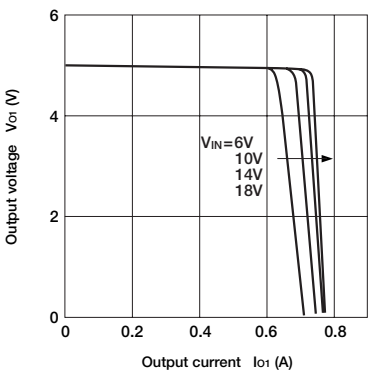

■ Dropout Voltage ($V_{O1}$)



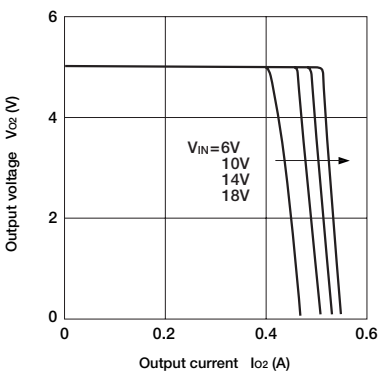

■ Dropout Voltage ($V_{O2}$)



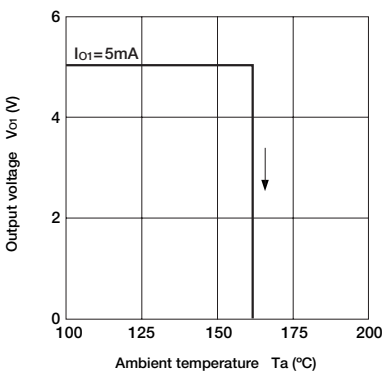

■ Overcurrent Protection Characteristics ($V_{O1}$)




■ Overcurrent Protection Characteristics ($V_{O2}$)




■ Thermal Protection Characteristics




■ Ta—$P_D$ Characteristics