Features

- Single input dual output (ch1: 5V/0.4A, ch2: 3.3V/0.2A)
- Power on reset function
- Watchdog timer
- Built-in drooping type overcurrent and thermal protection circuits (ch1)

Absolute Maximum Ratings

(Ta=25ºC)

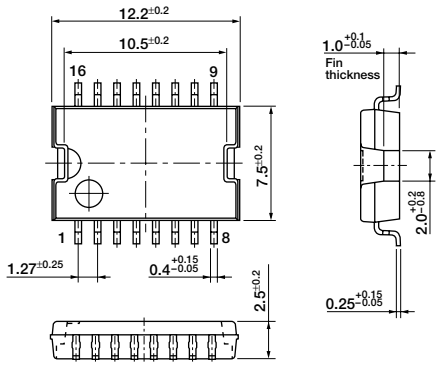
Parameter		Symbol	Ratings	Unit	Remarks
DC input voltage		V_{IN}	–13 to 35	V	Reverse connection 1 min max.
			40		＜400mS
Output control terminal voltage		EN	–0.3 to 35	V	
			40		＜400mS
Output current	CH1	I_{o1}	0.4	A	
	CH2	I_{o2}	0.2		
MODE terminal input voltage		MODE	–0.3 to 7	V	
W/D/C terminal input voltage		W/D/C			
TC terminal input voltage		TC			
CK terminal input voltage		CK			
Vo1-fail terminal output voltage		Vo1-fail			
Reset terminal output voltage		RESET			
Junction temperature		Tj	–40 to 150	°C	
Storage temperature		Tstg	–40 to 150	°C	
Thermal resistance (junction to case)		θj-c	4.1	°C/W	With infinite heatsink
Thermal resistance (junction to ambient air)		θj-a	38	°C/W	With glass epoxy + copper foil board (size 5.0 x 7.4cm; t: glass epoxy = 1.6mm/copper foil = 18μm)

Electrical Characteristics

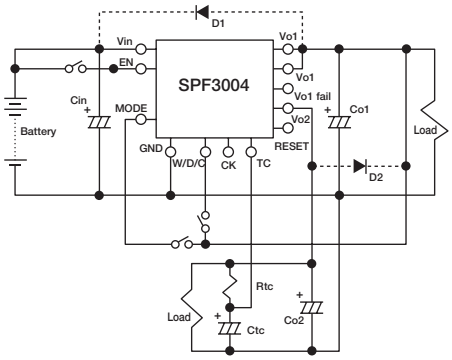
Parameter		Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Input voltage		V_{IN}	Vo1+V_{DIF1} *3		35 *4	V	
Output voltage	CH1	Vo1	4.90	5.00	5.10	V	V_{IN}=Vo1+V_{DIF1} to 18V, Io1=0 to 0.4A, Tj=–40 to 125°C
	CH1	Vo1	4.85	5.00	5.15		V_{IN}=Vo1+V_{DIF1} to 18V, Io1=0 to 0.4A, Tj=–40 to 150°C
	CH2	Vo2	3.15	3.30	3.45		V_{IN}=Vo2+V_{DIF1}+V_{DIF2} to 18V, Io1=0 to 0.2A
Dropout voltage	CH1	V_{DIF11}			0.5	V	Io1=0.4A
	CH1	V_{DIF12}			0.25		Io1=0.2A, Tj=25°C
	CH2	V_{DIF2}			0.5		Io2=0.2A
Ripple rejection	CH1	R_{REJ1}		54		db	f=100 to 200Hz
	CH2	R_{REJ2}		54			
Quiescent circuit current		Iq		10	50	μA	V_{IN}=16V, EN=0V
				50	250		V_{IN}=35V, EN=0V
				5	10	mA	
GND current		I_{GND}		70	100	mA	Io1=Io2=0.2A
Overcurrent protection starting current	CH1	Is11	0.402		1.80	A	Vo1=4.5V
	CH2	Is21	0.201		0.80		Vo2=2.8V
Residual current at a short	CH1	Is21	0.402		1.80	A	Vo1=0V
	CH2	Is22	0.201		0.80		Vo2=0V
EN output control voltage		V_{ENth}	1.0		3.5	V	Tj=–40 to 125°C
			0.9		3.5		*8
EN output control current	ON	I_{ENH1}			50	μA	EN=6.4V, Tj=–40 to 125°C
		I_{ENH2}			30		EN=3.51V, Tj=–40 to 125°C
	OFF	I_{ENL}	–1.0		1.0		EN=0V, Tj=–40 to 125°C
Vo1-fail terminal LOW voltage		V_{failL}			0.5	V	Isink=250μA, (Pull-up resistance 20kΩ typ)
Vo1-fail terminal HI voltage		V_{failH}	Vo1–0.8V *5			V	Isource=15μA
Reset terminal LOW voltage		V_{RSL}			0.5	V	Isink=250μA, (Pull-up resistance 20kΩ typ)
Reset terminal HI voltage		V_{RSH}	Vo1–0.8V *5			V	Isource=15μA
Reset detect voltage	CH1	Vo1thH			Vo1•0.97	V	Vrs, Vfail ＞4.5V
		Vo1thL	4.05			V	Vrs, Vfail ＜0.8V
	CH2	Vo2thH			Vo2•0.985	V	Vrs ＞3.0V
		Vo2thL	3.00			V	Vrs ＜0.8V
Reset detect voltage hysteresis width	CH1	ΔVo1th			0.255	V	ΔVo1th=Vo1thH-Vo1thL
	CH2	ΔVo2th			0.105	V	ΔVo2th=Vo2thH-Vo2thL
Power on reset delay time		t_{dly}	0.70•Rtc•Ctc	0.72•Rtc•Ctc	0.74•Rtc•Ctc	S	Min. set time: 6mS
W/D time		t_{wd}	0.52•Rtc•Ctc	0.54•Rtc•Ctc	0.56•Rtc•Ctc	S	Min. set time: 4mS
W/D pulse time		t_{wdp}	0.04•Rtc•Ctc	0.06•Rtc•Ctc	0.08•Rtc•Ctc	S	Min. set time: 400μS
MODE terminal control voltage		Vmodeth	1.0		3.0	V	
MODE terminal control current	ON	ImodeH			200	μA	MODE=5V
	OFF	ImodeL	–1.0		1.0		MODE=0V, Tj=–40 to 125°C
W/D/C terminal control voltage		Vw/d/cth	1.0		3.0	V	*7
W/D/C terminal control current	ON	Iw/d/cH			200	μA	W/D/C=5V
	OFF	Iw/d/cL	–1.0		1.0		W/D/C=0V, Tj=–40 to 125°C
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	CK=5V
	OFF	IckL	–1.0		1.0		CK=0V, Tj=–40 to 125°C

Notes:
*3: Refer to dropout voltage.
*4: Since $P_{D(max)} = \{(V_{IN}–V_{O1}) \bullet (I_{O1}+I_{O2})\} + (V_{IN} \bullet Iq) + \{(V_{O1}–V_{O2}) \bullet I_{O2}\} = 30W$, V_{IN}(max), I_{O1}(max) and I_{O2}(max) may be limited depending on operating conditions.
*5: The Vo1-fail and RESET terminals are 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 155 °C (min.) and 165°C (typ). These values represent the design warranty.
*7: The threshold voltage at the W/D/C terminals is determined by the presence/absence of WD operation (occurrence of RESET signal pulses). The W/D/C function is assumed to be OFF during the period when RESET pulses occur.
*8: The TOFF-EN operation (VEN: 5V⇒0V) for Tj=150°C is 16mS (0.32V/mS) max.

External Dimensions (unit: mm)

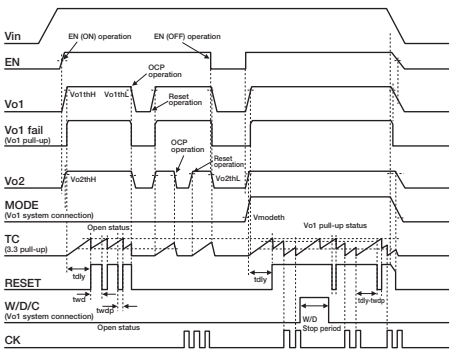


Standard Connection Diagram



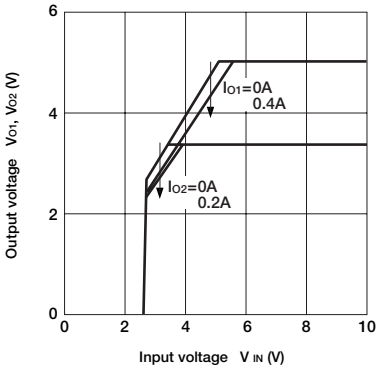
Cin: Capacitor (39μF) for oscillation prevention
C_O1: Output capacitor (39μF)
C_O2: Output capacitor (39μF)
Tantalum capacitors are recommended especially for low temperatures.
D1, D2: Protection diodes.
Required as protection against reverse biasing between input and output (Recommended diode: SANKEN EU2Z).

Timing Chart

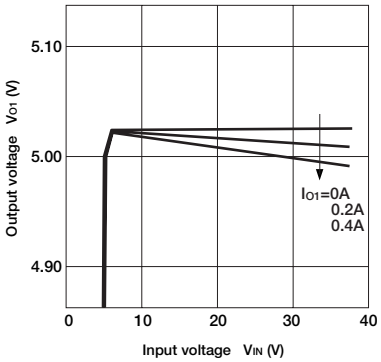


Electrical Characteristics

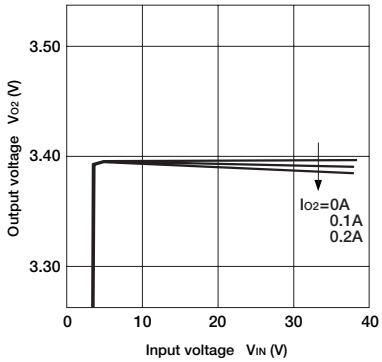
■ Rise Characteristics of Output Voltage



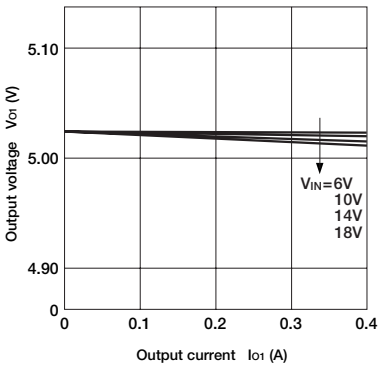
■ Line Regulation (V_{01})



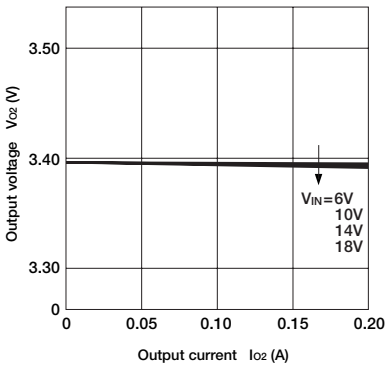
■ Line Regulation (V_{02})



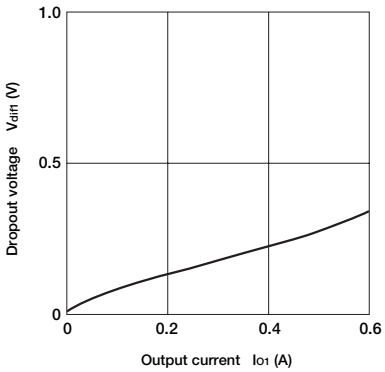
■ Load Regulation (V_{01})



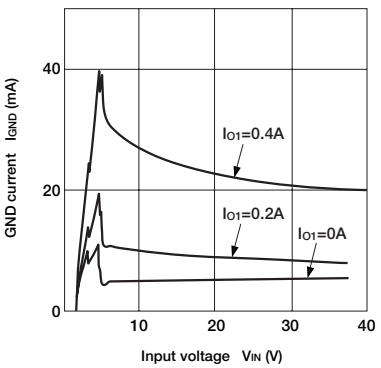
■ Load Regulation (V_{02})



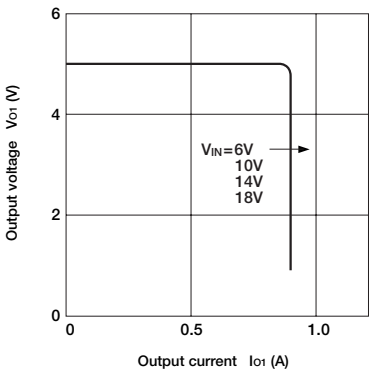
■ Dropout Voltage (V_{01})



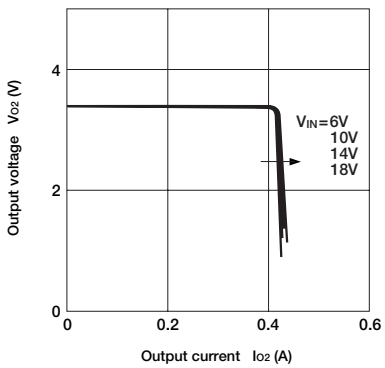
■ GND Current



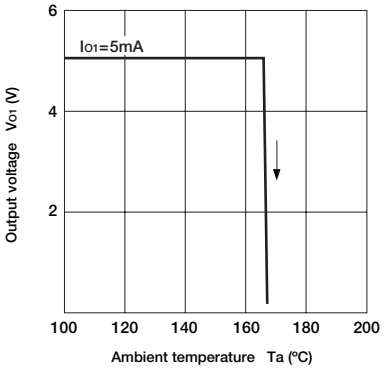
■ Overcurrent Protection Characteristics (V_{01})



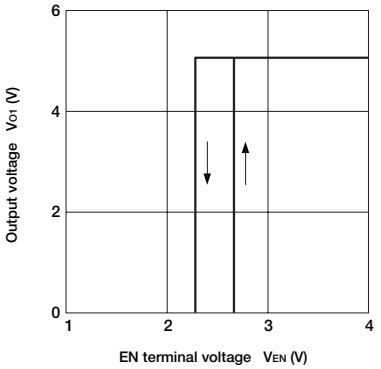
■ Overcurrent Protection Characteristics (V_{02})



■ Thermal Protection Characteristics



■ EN Terminal Output Voltage



■ Ta—P_D Characteristics