

2-ph Stepper-motor Driver ICs SPF7211

Features

- Low output saturation voltage (high-side: 1.5V max.; low-side: 0.8V max.)
- Built-in recovery diode
- Built-in standby function
- Built-in overcurrent and thermal protection circuits and low voltage input shutoff function
- Built-in overload and disconnection detection function

Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit	Remarks
Main power supply voltage	V _{BB}	40	V	
Input voltage	V _{IN}	-0.3 to 15	V	V _{IN} ≤ V _{BB}
Output current	I _O	±0.8	A	
	I _{OPeak}	±1.0	A	T _w < 1mS
Flag terminal withstand voltage	V _{Flag}	7	V	V _{Flag} ≤ V _{BB}
Flag terminal current	I _{Flag}	3	mA	
Detect voltage	V _{Rs}	-2 to 2	V	
Power dissipation	P _D	4.1	W	For Ta = 25°C *1
		39	W	For Tc (T _{tab}) = 25°C
Junction temperature	T _J	150	°C	
Operating temperature	Top	-40 to 110	°C	
Storage temperature	T _{stg}	-40 to 150	°C	

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

Recommended Operation Range

Parameter	Symbol	Ratings	Unit	Remarks
Main power supply voltage	V _{BB}	6 to 18	V	
Input voltage	V _{IN}	-0.3 to 7.0	V	V _{IN} ≤ V _{BB}
Output current	I _O	±0.5	A	Continuous
Flag terminal withstand voltage	V _{Flag}	0 to 7.0	V	V _{Flag} ≤ V _{BB}
Flag terminal current	I _{Flag}	0 to 1.0	mA	
Detect voltage	V _{Rs}	-1 to 1	V	
Operating temperature	Top	-40 to 110	°C	

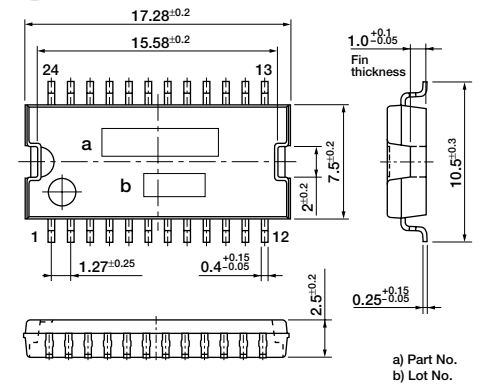
Electrical Characteristics

Parameter		Symbol	Ratings			Unit	Conditions
			min	typ	max		
Main power supply current		I _{BB}			50	mA	In ordinary operation (no load)
		I _{BBS}			50	μA	At sleep
Low voltage protection operation voltage		V _{UVLO}	3.5		4.5	V	
UVLO hysteresis voltage		V _{UVLOHys}		0.5		V	
Output leak current		I _{leakL}	-100			μA	V _{BB} = 40V, V _O = 0V
		I _{leakH}			100	μA	V _{BB} = V _O = 40V
Output saturation voltage		V _{satL}			0.5	V	I _O = 0.5A
					0.8	V	I _O = 0.8A
		V _{satH}			1.2	V	I _O = -0.5A
					1.5	V	I _O = -0.8A
Recovery diode forward voltage		V _F L			1.2	V	I _O = 0.5A
		V _F H			1.3	V	I _O = -0.5A
		V _F GO	1.2			V	I _O = -0.5A
						V	
Input terminal	Input voltage	V _{IL}			0.8	V	
	Hysteresis voltage	V _{Ihys}	2.0	0.5		V	
Ph terminal	Input current	I _{IL}	-5		5	μA	
		I _{IH}	-5		5	μA	
Ixx, Set terminals	Input current	I _{IL}	-30			μA	V _{IL} = 0.8V
		I _{IH}			50	μA	V _{IH} = 2.0V
Detect voltage		V _{Rs}	660	700	740	mV	I _{x0} = High, I _{x1} = High
			420	450	480	mV	I _{x0} = Low, I _{x1} = High
			40	70	90	mV	I _{x0} = High, I _{x1} = Low
Oscillation frequency		F _{osc}	28.8	48	72	kHz	Ct = 2200pF ±20%
PWM frequency		F _{PWM}	14.4	24	36	kHz	Ct = 2200pF ±20%
Ct terminal threshold voltage		V _{ctL}		0.5		V	
		V _{ctH}		1.5		V	
Ct terminal current		I _{ctsink}		720		μA	*1
		I _{ctsource}		-120		μA	
Overcurrent detection voltage		V _{ocpL}	1.5	3.0	4.2	V	Out voltage
		V _{ocpH}	V _{BB} -2.5	V _{BB} -2.0	V _{BB} -1.7	V	Out voltage
		V _{ocpL}	1.0		1.85	V	V _{BB} = 5.5V
		V _{ocpH}	V _{BB} -2.3		V _{BB} -1.5	V	V _{BB} = 5.5V
Open detection voltage		V _{open}		-60		mV	Sence voltage
Flag terminal leak current		I _{leakFlag}			10	μA	V _{Flag} = 7V
Flag terminal saturation voltage		V _{FlagL}			0.5	V	I _{Flag} = 1mA
Flag terminal current		I _{Flag}			3	mA	
Set terminal	Response pulse width	T _{pw}	10			μS	In ordinary operation
		T _{pws}	100			μS	At sleep
	Pulse rate	F _{clock}	17	24	31	Hz	Ct = 2200pF
	Pulse number	Pulse		256		—	
Flag response time	OCP operation	t _{ocp1}	2.5	5.0	10.0	μS	In ordinary operation; Ct = 2200pF
		t _{ocp2}	5.0	10.0	20.0	μS	At switching the phase
		t _{ocp3}	5.0	10.0	20.0	μS	When Ixx shifts from L to H
		t _{open1}	2.5	5.0	10.0	μS	In ordinary operation
	Open operation	t _{open2}	2.5	5.0	10.0	μS	When Ixx shifts from L to H
		tonH1		1.5		μS	
		toffH1		1.5		μS	
		tonH2	100			μS	
I/O propagation time		toffH2	100			μS	
		tonL1		2.0		μS	
		toffL1		0.5		μS	
		tonL2	100			μS	
		toffL2	100			μS	
		T _J	150			°C	
		ΔT _J		20		°C	*2
		T _{alarm}	120	130	140	°C	
Thermal alarm hysteresis		ΔT _{alarm}		20		°C	

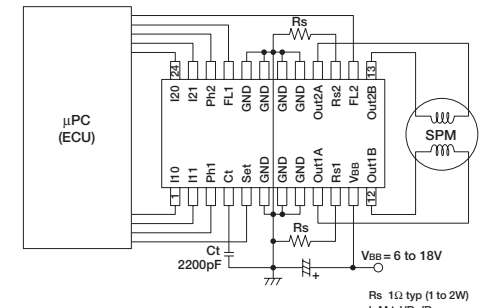
Note:

- *1: The Ct terminal threshold voltage and current are the design values. Warranty is based on the oscillation frequency.
 *2: Thermal protection and alarm temperatures are design values.

External Dimensions (unit: mm)



Standard Circuit Diagram



Excitation Signal Time Chart

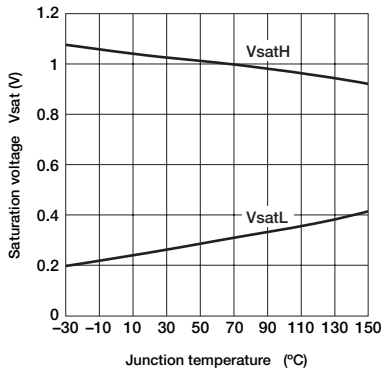
2-phase excitation											
Clock	0	1	2	3	4	5	6	7	8	9	10
Ph1	L	H	H	H	H	L	L	L	L	H	H
I10, I11	H	L	H	H	H	L	L	L	L	H	H
Ph2	L	L	L	L	L	H	H	H	H	L	L
I20, I21	H	H	H	H	H	L	L	L	L	H	H

1 to 2-phase excitation											
Clock	0	1	2	3	4	5	6	7	8	9	10
Ph1	L	H	H	H	H	L	L	L	L	H	H
I10, I11	H	L	H	H	H	L	L	L	L	H	H
Ph2	L	L	L	L	L	H	H	H	H	L	L
I20, I21	H	H	H	H	H	L	L	L	L	H	H

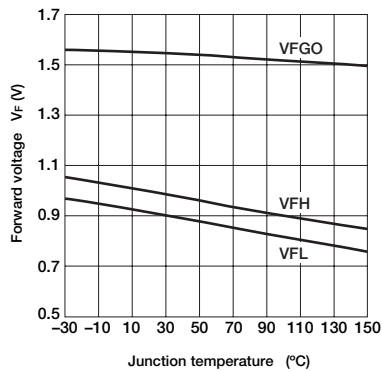
* For the 1 to 2-phase excitation application, switch the Ph signal in the step of 1-ph excitation (Ixx turns from high to low).
 The OPEN detection function is invalid except in this sequence.

Electrical Characteristics

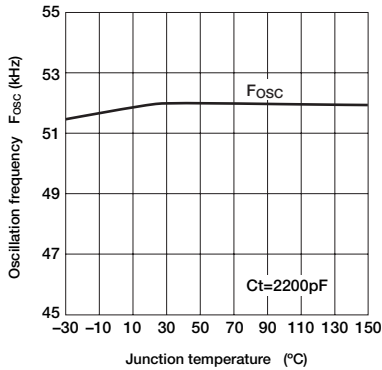
■ Vsat Temperature Characteristics (Io=0.5A)



■ Diode Vf Characteristics (If=0.5A)



■ OSC Temperature Characteristics



■ Ta-PD Characteristics

