

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 (Ttab) = 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	

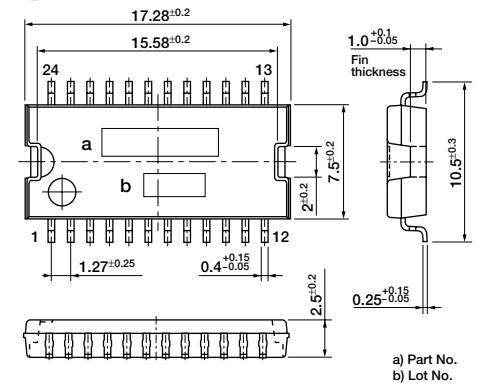
Electrical Characteristics

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 _{VULO}	3.5		4.5	V		
UVLO hysteresis voltage	V _{VULOHys}		0.5		V		
Output leak current	I _{oLeakL}	-100		100	μA	V _{BB} = 40V, V _o = 0V	
	I _{oLeakH}			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	
Input terminal	Input voltage	V _{IL}		0.8	V		
	Hysteresis voltage	V _{thys}	2.0		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		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			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 I _{xx} shifts from L to H
	Open operation	t _{open1}	2.5	5.0	10.0	μS	In ordinary operation
		t _{open2}	2.5	5.0	10.0	μS	When I _{xx} shifts from L to H
		t _{onH1}		1.5		μS	
I/O propagation time	toffH1		1.5		μS		
				1.5	μS		
	tonH2		100		μS		
			100		μS		
	toffL1			2.0	μS		
				0.5	μS		
	tonL2		100		μS		
			100		μS		
	Thermal protection temperature	T _J	150			°C	
		ΔT _J		20		°C	*2
Thermal alarm temperature	T _{alarm}	120	130	140	°C		
Thermal alarm hysteresis	ΔT _{alarm}		20		°C		

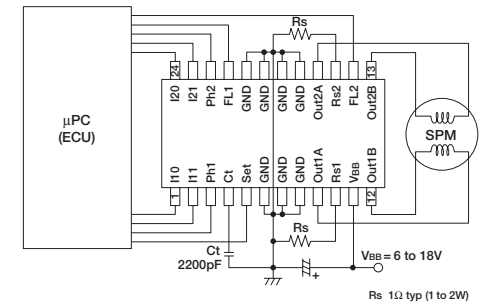
Note:

- *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

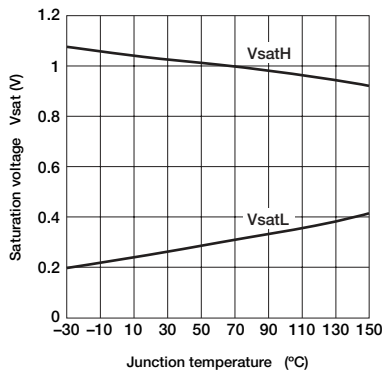
2-phase excitation		0	1	2	3	0	1
Clock		L	H	H	L	L	H
I10, I11		H	H	H	H	H	H
Ph2		L	L	H	H	L	L
I20, I21		H	H	H	H	H	H

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

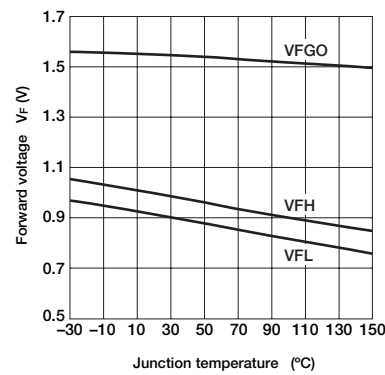
* For the 1 to 2-phase excitation application, switch the Ph signal in the step of 1-ph excitation (I_{xx} turns from high to low).
 The OPEN detection function is invalid except in this sequence.

Electrical Characteristics

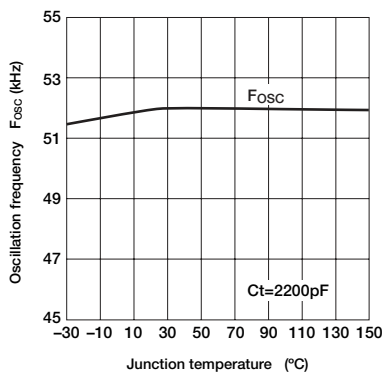
■ Vsat Temperature Characteristics (Io=0.5A)



■ Diode Vf Characteristics (If=0.5A)



■ OSC Temperature Characteristics



■ Ta-Pd Characteristics

