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	$V_{IN} \leqq V_{BB}$
Output current	Io	±0.8	A	
	IoPeak	±1.0		$T_w < 1$mS
Flag terminal withstand voltage	V_{Flag}	7	V	$V_{Flag} \leqq V_{BB}$
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		For Tc (Ttab) = 25°C
Junction temperature	Tj	150	°C	
Operating temperature	Top	–40 to 110	°C	
Storage temperature	Tstg	–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

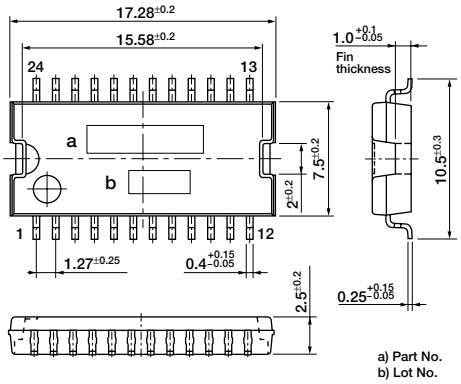
Parameter	Symbol	Ratings	Unit	Remarks
Main power supply voltage	V_{BB}	6 to 18	V	
Input voltage	V_{IN}	–0.3 to 7.0	V	$V_{IN} \leqq V_{BB}$
Output current	Io	±0.5	A	Continuous
Flag terminal withstand voltage	V_{Flag}	0 to 7.0	V	$V_{Flag} \leqq V_{BB}$
Flag terminal current	I_{Flag}	0 to 1.0	mA	
Detect voltage	V_{Rs}	–1 to 1	V	
Operating temperature	Top	–40 to 110	°C	

Electrical Characteristics

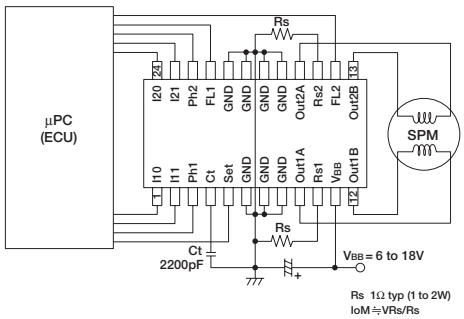
Parameter		Symbol	Ratings min	Ratings typ	Ratings max	Unit	Conditions
Main power supply current		I_{BB}			50	mA	In ordinary operation (no load)
		I_{BBS}			50	μA	At sleep
Low voltage protection operation voltage		V_{UVLO}	3.5		4.5	V	
UVLO hysteresis voltage		$V_{UVLOhys}$		0.5		V	
Output leak current		IoleakL	–100			μA	V_{BB} = 40V, Vo = 0V
		IoleakH			100	μA	V_{BB} = Vo = 40V
Output saturation voltage		VsatL			0.5	V	Io = 0.5A
					0.8	V	Io = 0.8A
		VsatH			1.2	V	Io = –0.5A
					1.5	V	Io = –0.8A
Recovery diode forward voltage		V_FL			1.2	V	Io = 0.5A
		V_FH			1.3	V	Io = –0.5A
		V_FGO	1.2			V	Io = –0.5A
Input terminal	Input voltage	V_{IL}			0.8	V	
		V_{IH}	2.0			V	
	Hysteresis voltage	V_{Ihys}		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	VIL = 0.8V
		I_{IH}			50	μA	VIH = 2.0V
Detect voltage		VRs	660	700	740	mV	Ix0 = High, Ix1 = High
			420	450	480	mV	Ix0 = Low, Ix1 = High
			40	70	90	mV	Ix0 = High, Ix1 = Low
Oscillation frequency		Fosc	28.8	48	72	kHz	Ct = 2200pF±20%
PWM frequency		F_{PWM}	14.4	24	36	kHz	Ct = 2200pF±20%
Ct terminal threshold voltage		VctL		0.5		V	*1
		VctH		1.5		V	
Ct terminal current		Ictsink		720		μA	
		Ictsouce		–120		μA	
Overcurrent detection voltage		VocpL	1.5	3.0	4.2	V	Out voltage
		VocpH	V_{BB}–2.5	V_{BB}–2.0	V_{BB}–1.7	V	Out voltage
		VocpL	1.0		1.85	V	V_{BB} = 5.5V
		VocpH	V_{BB}–2.3		V_{BB}–1.5	V	V_{BB} = 5.5V
Open detection voltage		Vopen		–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	Tpw	10			μS	In ordinary operation
		Tpws	100			μS	At sleep
	Pulse rate	Fclock	17	24	31	Hz	Ct = 2200pF
	Pulse number	Pulse		256		—	
Flag response time	OCP operation	tocp1	2.5	5.0	10.0	μS	In ordinary operation; Ct = 2200pF
		tocp2	5.0	10.0	20.0	μS	At switching the phase
		tocp3	5.0	10.0	20.0	μS	When Ixx shifts from L to H
	Open operation	topen1	2.5	5.0	10.0	μS	In ordinary operation
		topen2	2.5	5.0	10.0	μS	When Ixx shifts from L to H
I/O propagation time		tonH1		1.5		μS	
		toffH1		1.5		μS	
		tonH2	100			μS	
		toffH2	100			μS	
		tonL1		2.0		μS	
		toffL1		0.5		μS	
		tonL2	100			μS	
		toffL2	100			μS	
Thermal protection temperature		Tj	150			°C	*2
Thermal protection hysteresis		ΔTj		20		°C	
Thermal alarm temperature		Talarm	120	130	140	°C	
Thermal alarm hysteresis		ΔTalarm		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	0	1
Ph1	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

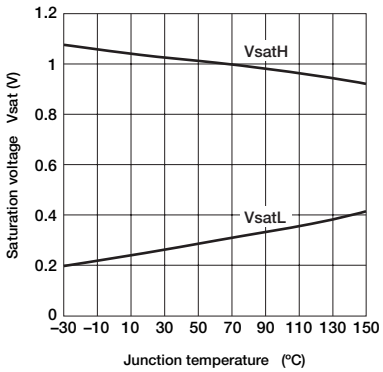
1 to 2-phase excitation

Clock	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	H	H
Ph2	L	L	L	H	H	H	H	L	L	L	L	H
I20, I21	H	H	H	L	H	H	H	L	H	H	H	L

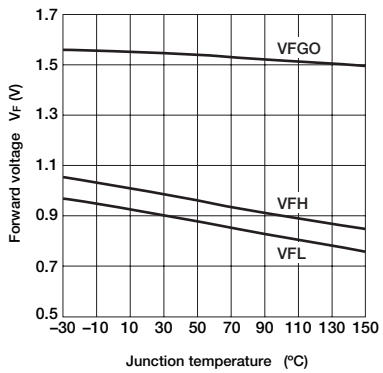
* For the 1 to 2-phase excitation application, switch the Ph signal in the step of 1-ph excitation (Ixx turns from high to low).
The OPEN detection function is invalid except in this sequence.

Electrical Characteristics

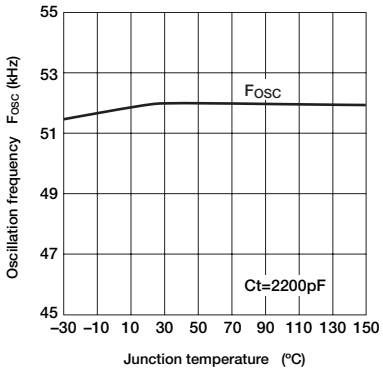
■ Vsat Temperature Characteristics (Io=0.5A)



■ Diode V_F Characteristics (I_F=0.5A)



■ OSC Temperature Characteristics



■ Ta-P_D Characteristics