Notification about the transfer of the semiconductor business

The semiconductor business of Panasonic Corporation was transferred on September 1, 2020 to Nuvoton Technology Corporation (hereinafter referred to as "Nuvoton"). Accordingly, Panasonic Semiconductor Solutions Co., Ltd. became under the umbrella of the Nuvoton Group, with the new name of Nuvoton Technology Corporation Japan (hereinafter referred to as "NTCJ").

In accordance with this transfer, semiconductor products will be handled as NTCJ-made products after September 1, 2020. However, such products will be continuously sold through Panasonic Corporation.

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※ Except below description page
“Request for your special attention and precautions in using the technical information and semiconductors described in this book”

Nuvoton Technology Corporation Japan

Panasonic

MIP2M20MTSCF

Type	Silicon MOSFET type Integrated Circuit		
Application	For Switching Power Supply Control		
Structure	CMOS type		
Circuit Block Diagram	Figure 8		
Out Line	DIP7-A1-B	Marking	MIP2M2

A. ABSOLUTE MAXIMUM RATINGS (Ta=25℃±3℃)

NO.	Item	Symbol	Ratings	Unit	Note
1	DRAIN Voltage	VD	−0.3 ～ 700	V	VFB is guaranteed at VDD=6 V. VSO is guaranteed at VSO=VDD. ※ 1: IDP is guaranteed at the pulse width narrower than ton(BLK) + td(OCL)
2	VCC Voltage	VCC	−0.3 ～ 45	V	
3	VDD Voltage	VDD	−0.3 ～ 9	V	
4	FB Voltage	VFB	−0.3 ～ 6.4	V	
5	FB Current	IFB	-500	μA	
6	LS Voltage	VLS	−0.3 ～ 9	V	
7	SO Voltage	VSO	−0.3 ～ 9	V	
8	Output Peak Current	IDP	0.76(※1)	A	
9	Recommended Operating Temperature	Tj	−30 ～ +125	℃	
10	Channel Temperature	Tch	150	℃	
11	Storage Temperature	Tstg	−55 ～ +150	℃	

B. ELECTRICAL CHARACTERISTICS Measure condition (TC=25℃±3℃)

No.	Item	Symbol	Measure Condition (Figure 1)	Typ	Min	Max	Unit
【CONTROL FUNCTIONS】 ***Design guaranteed item**							
1	Output Frequency	fosc	※Figure 7 V4=15 V, V3=2 V, I2=−20 μA, V5=5 V	67.0	60.3	73.7	kHz
2	Jitter Frequency Deviation	d_fosc	※Figure 7 V4=15 V, V3=2 V, I2=−20 μA, V5=5 V	5.0	2.4	7.6	kHz
*3	Jitter Frequency Modulation Rate	fM	※Figure 7 V4=15 V, V3=2 V, I2=−20 μA, V5=5 V	360	−	−	Hz
4	Maximum Duty Cycle	MAXDC	V4=15 V, V3=2 V, I2=−20 μA, V5=5 V	54	50	58	%
5	VDD Voltage	VDD	V4=15 V, V3=6 V, I2=−20 μA, V5=5 V, V6=1 V	5.9	5.4	6.4	V
6	VCC Start Voltage	VCC(ON)	V3=6 V, I2=−20 μA, V5=5 V, V6=1 V	12	11	13	V
7	VCC Stop Voltage	VCC(OFF)	V3=6 V, I2=−20 μA, V5=5 V, V6=1 V	8.20	7.45	8.95	V
8	VCC start/stop Hysteresis	VCC(HYS)	VCC(ON) − VCC(OFF)	3.8	3.1	4.5	V
9	Feedback Threshold Current	IFB1	ON→OFF V4=15 V, V3=6 V, V5=5 V, V6=1 V	−57	−81	−34	μA
10	Feedback Current Hysteresis	IFB(HYS)	OFF→ON V4=15 V, V3=6 V, V5=5 V, V6=1 V	1.5	−	−	μA
11	FB Pin Voltage	VFB1	V4=15 V, V3=6 V, I2= IFB1, V5=5 V, V6=1 V	1.9	1.6	2.2	V
12	Circuit Current before start	ICC(SB)	V4=6.5 V, V3=6 V, I2=−20 μA, V5=5 V, V6=1 V	0.25	0.20	0.30	mA
13	Circuit Current	ICC	V4=15 V, V3=6 V, I2=−20 μA, V5=5 V, V6=1 V	0.36	0.23	0.49	mA
14	VDD Charging Current	Ich1	V1=0 V, V5=40 V	−2.2	−3.3	−1.1	mA
		Ich2	V1=4 V, V5=40 V	−1.3	−2.1	−0.6	mA
15	LS start voltage	VLSH	V4=VCC(OFF)→VCC(ON), V3=6 V, I2=−20 μA, V5=5 V	540	486	594	mV
16	LS stop voltage	VLSL	V4=15 V, V3=6 V, I2=−20 μA, V5=5 V	395	355	435	mV
17	LS detect Hysteresis	VLS(HYS)	VLSH − VLSL	145	−	−	mV
18	LS start/stop mode filter time	TLSstop	V4=15 V, V3=6 V, I2=−20 μA, V5=5 V V6=VLSH→VLSL	5.85	4.20	7.50	ms
19	LS detect SO signal mode filter time	TLSSO	V4=15 V, V3=6 V, I2=−20 μA, V5=5 V	3.15	1.85	4.45	ms
20	SO output voltage	VSO	V4=15 V, I2=−20 μA, V5=5 V V6=VLSH→VLSL	4.2	3.2	5.2	V
21	SO output current	ISO	V4=15 V, V3=1 V, I2=−20 μA, V5=5 V V6=0 V	−0.8	−1.2	−0.4	mA

No.	Item	Symbol	Measure Condition (Figure 1)	Typ	Min	Max	Unit
22	SO Disable Threshold	VSOTH	V4=15 V, I2=−20 μA, V5=5 V, V6=0 V	5.2	4.6	5.8	V
23	SO Disable Threshold margin	D_VSO	VSOTH−VSO	1.0	0.7	1.3	V
24	SO pull down current	ISO_down	V4=15 V, V3=1 V, I2=−20 μA, V5=5 V V6=0 V	0.7	0.3	1.1	μA
25	Soft start time	Tsoft	V4=VCC(OFF)→VCC(ON) I2=−20 μA, V5=5 V, V6=1 V	8.5	5.0	12.0	ms
【CIRCUIT PROTECTIONS】							
26	Self Protection Current Limit	ILIMIT	※Figure 5 Duty=30 % V4=15 V, V3=2 V, V2=2.6 V, V5=adjusted	0.350	0.315	0.385	A
27	ILIMIT Compensation slope	R_slope	※Figure 5 Duty=10 % V4=15 V,V3=2 V, V2=2.6 V, V5=adjusted	10	−	−	mA/μs
*28	Drain Current at Light Load	ID(OFF)	Ton=4.5 μsec, V4=15 V, V3=2 V, I2=IFB1+2 μA, V5=adjusted	100	40	160	mA
29	FB current at heavy load	IFBOLP	V5=ILIMIT condition V4=15 V, V3=2 V, V2=3 V, V6=1 V	−10	−13	−7	μA
30	FB Over Load Protection detect voltage	VFBOLP	V5=ILIMIT condition V4=15 V, V3=2 V, V6=1 V	3.85	3.50	4.20	V
31	FB Over Load Protection Hysteresis	HYSVFBOLP		0.65	−	−	V
32	FB discharge current at timer intermittent	IFBOLPP	V5=ILIMIT condition, V4=VCC(OFF) V3=2 V, V2=25 V, V6=1 V	1.0	0.6	1.4	mA
33	FB current at MAXDC detect	IFBMAXDC	V4=15 V, V3=6 V, V2=3 V, V5=5 V, V6=1 V	−	−	0.2	μA
34	Timer intermittent function	TIMER	※Figure 3 V4=VCC(ON)⇔VCC(OFF), V5=ILIMIT condition, V3=6 V, I2=−20 μA, V6=1 V	4			−
35	Timer intermittent function disabled at MAXDC	TIMER2	※Figure 4 V4=VCC(ON)⇔VCC(OFF), V5=5 V, V3=6 V, I2=−20 μA, V6=1 V	1			−
*36	Leading Edge Blanking Delay	ton(BLK)		290	230	350	ns
*37	Current Limit Delay	td(OCL)		150	100	200	ns
38	VCC Over Voltage Protection	VCC(OV)	V3=6 V, I2=−20 μA, V5=5 V, V6=1 V	29	26	32	V
39	VDD Latch Voltage	VDD(OV)	V4=15 V, I1=IDD(OV), V3=0 V, I2=−20 μA, V5=5 V, V6=6 V	7.00	6.40	7.50	V
40	VDD Latch Current	IDD(OV)	V4=15 V, V3=0 V, I2=−20 μA, V5=5 V, V6=6 V	3.5	2.4	4.6	mA
41	VDD Latch Voltage margin	D_VDDOV	VDD(OV)−VDD	0.9	0.4	1.5	V
*42	Thermal Shutdown Temperature	TOTP		140	130	150	℃
43	Latch Reset VDD Threshold	VDDreset		2.7	1.8	3.5	V

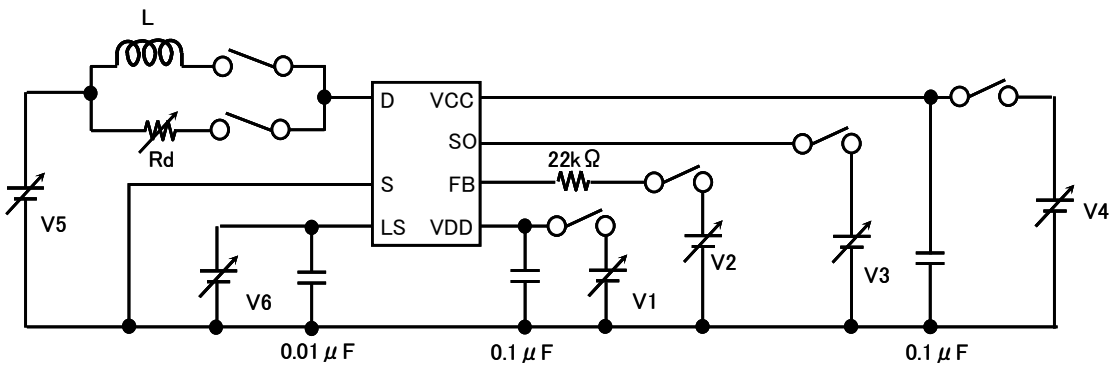
【OUTPUT】

No.	Item	Symbol	Measure Condition (Figure 1)	Typ	Min	Max	Unit
44	ON-State Resistance	RDS(ON)	V4=15 V, V3=2 V I5=100 mA, I2=-20 μA, V6=1 V	16	-	21	Ω
45	OFF-State leakage Current	IDSS	V4=35 V, I2=-20 μA, V3=6 V, V5=650 V, V6=1 V	10	-	20	μA
46	Breakdown Voltage	VDSS	V4=35 V, I2=-20 μA, V3=6 V, I5=100 μA, V6=1 V	-	700	-	V
*47	Rise Time	tr	※Figure 6 V4=15 V, V3=1 V, I2=-20 μA, V5=5 V	70	-	-	ns
*48	Fall Time	tf	※Figure 6 V4=15 V, V3=1 V, I2=-20 μA, V5=5 V	35	-	-	ns

【SUPPLY VOLTAGE】

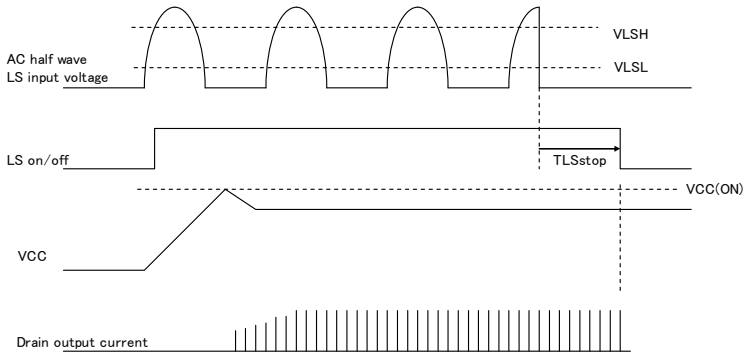
49	Drain Supply Voltage	VD(MIN)		-	50	-	V

【Figure 1： Measure circuit】

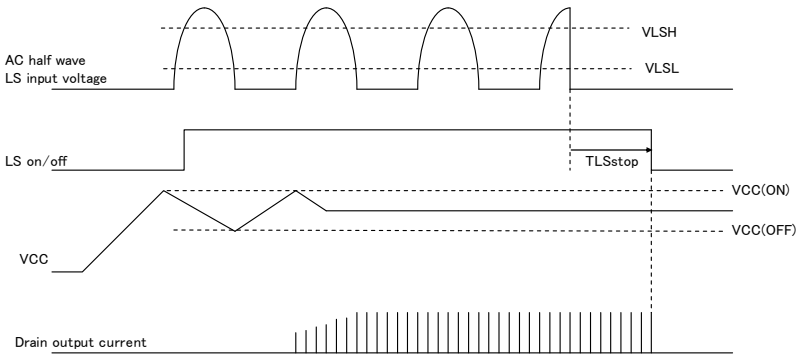


【Figure 2： Start up and Stop diagram】

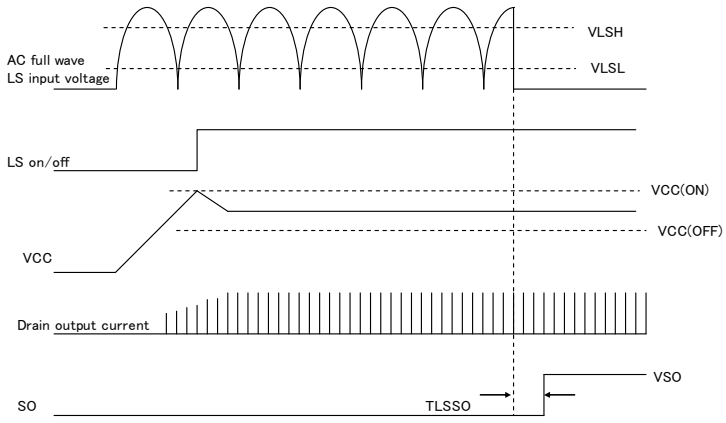
(A) Normal start and stop of LS start/stop mode (SO is connected to VDD)



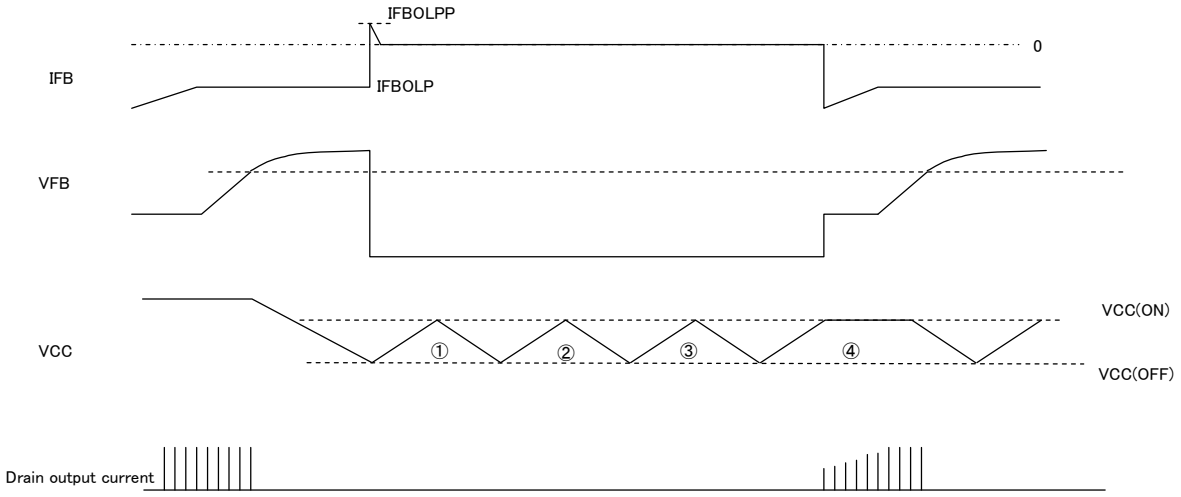
(B) Slow start and stop of LS start/stop mode (SO is connected to VDD)



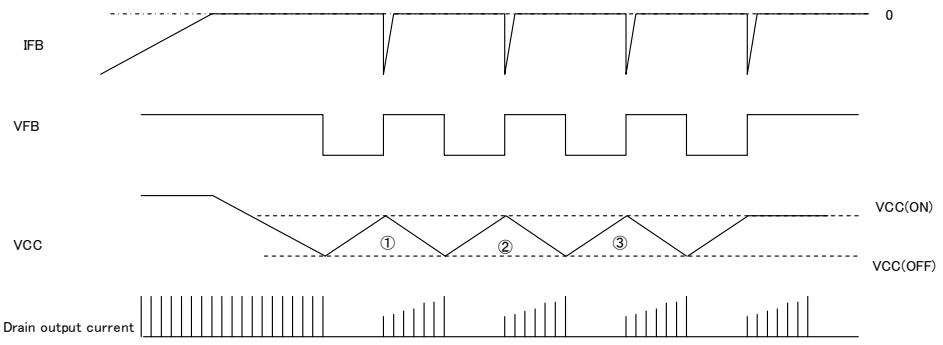
(C) Normal start and stop of LS detect SO signal mode (SO is connected to external parts)



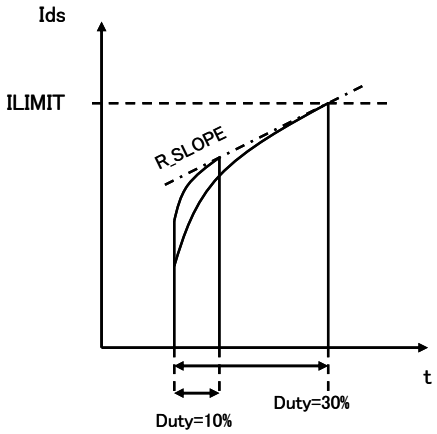
【Figure 3： Timer intermittent Over load protection diagram】



【Figure 4： OLP is disabled when MAXDC operation】

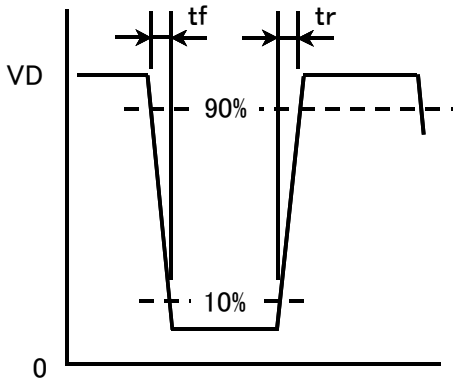


【Figure 5： ILIMIT、R_Slope measurement】

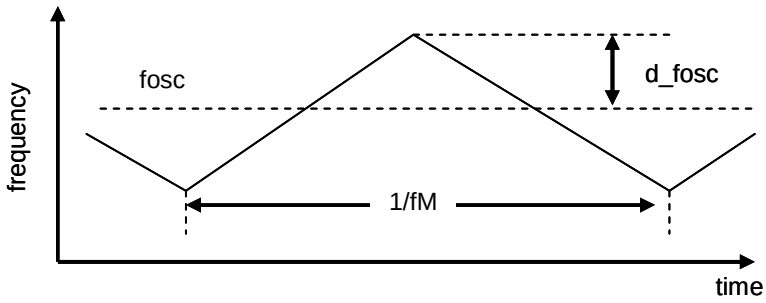


R_slope ; {(ILIMIT at Duty=30%) - (ILIMIT at Duty=10%)} / {(Ton at Duty=30%) - (Ton at Duty=10%)}

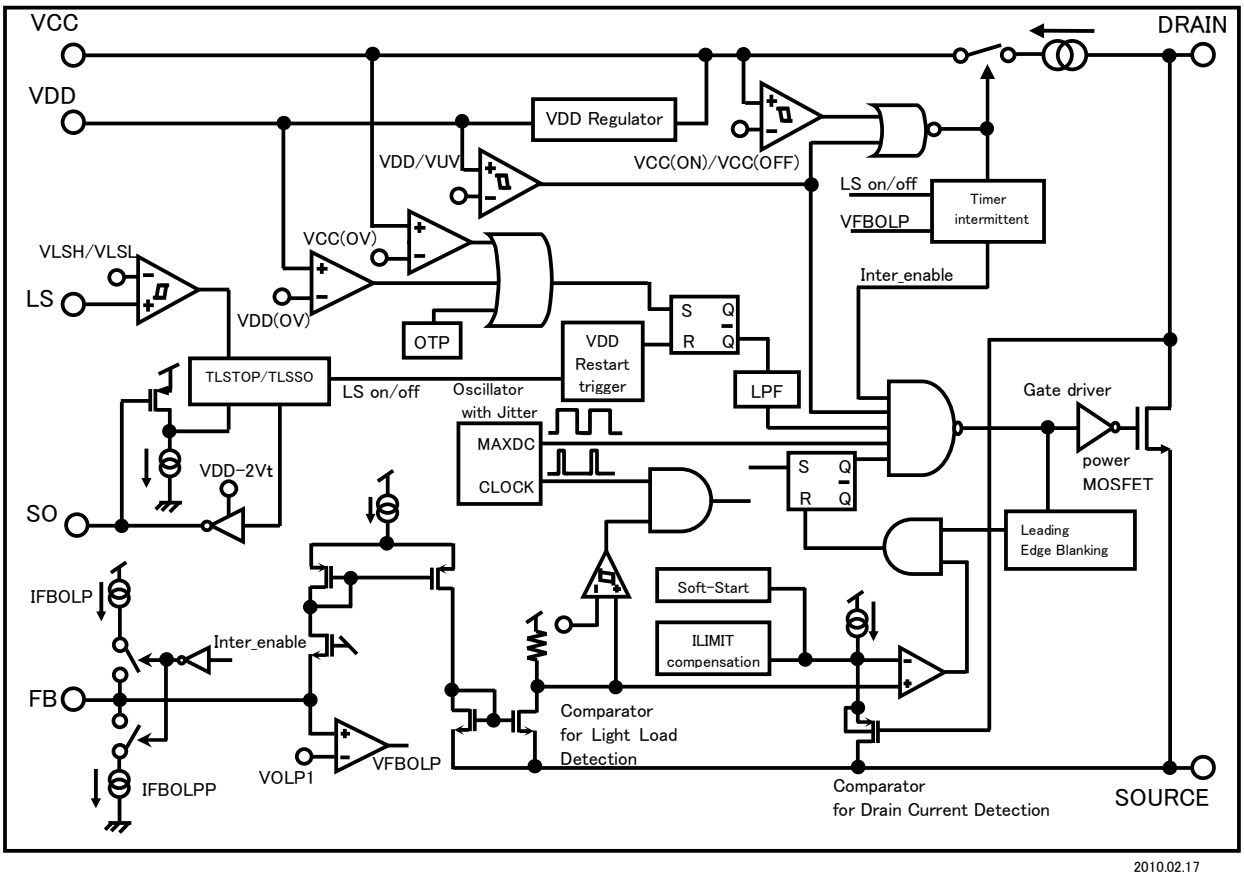
【Figure 6： tr, tf measurement】



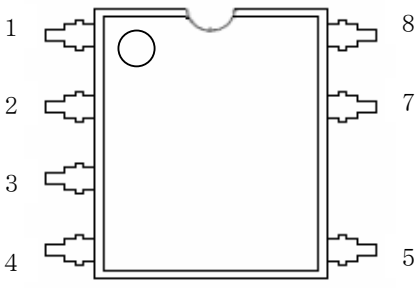
【Figure 7： d_fosc, fM measurement】



【Figure 8： Circuit Block Diagram】



【Figure 9： Pin Layout】



Pin No.	Terminal Name
1	VDD
2	FB
3	SO
4	VCC
5	Drain
6	—
7	Source
8	LS

【Precautions for Use 1】
Connect a ceramic capacitor with value >0.1 μF between VDD pin and GND.

【Precautions for Use 2】
The IPD has risks for break-down or burst or giving off smoke in following conditions. Avoid the following use.
Fuse should be added at the input side or connect zener diode between control pin and GND, etc as a countermeasure to pass regulatory Safety Standard. Concrete countermeasure could be provided individually. However, customer should make the final judgment.

(1) Reverse the DRAIN pin and VDD pin connection to the power supply board.
(2) DRAIN pin short to VDD pin.
(3) DRAIN pin short to FB pin.
(4) DRAIN pin short to SO pin.
(5) DRAIN pin short to VCC pin.
(6) DRAIN pin short to LS pin.
(7) VCC pin short to VDD pin.
(8) VCC pin short to FB pin.
(9) VCC pin short to SO pin.
(10) VCC pin short to LS pin.

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