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.

Publisher of this Document is NTCJ.
If you would find description “Panasonic” or “Panasonic semiconductor solutions”, please replace it with NTCJ.

※ 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

MIP0040MFL

Type	Silicon MOSFET type Integrated Circuit		
Application	For Switching Power Supply Control		
Structure	CMOS type		
Equivalent Circuit	Figure 8		
Package	SO8-G2-B	Marking	MIP004

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

NO.	Item	Symbol	Ratings	Unit	
1	VIN Voltage	VIN	−0.3 ～ 500	V	
2	VCC Voltage	VCC	−0.3 ～ 45	V	
3	VDD Voltage	VDD	−0.3 ～ 9	V	
4	OUT Voltage	VOUT	−0.3 ～ 30	V	
5	IS Voltage	VIS	−0.3 ～ 5	V	
6	TR Voltage	VTR	10	V	
7	TR Current	ITR	−5	mA	
8	Channel Temperature	Tch	150	℃	
9	Storage Temperature	Tstg	−55 ～ +150	℃	

B. RECOMMENDED OPERATING CONDITIONS

NO.	Item	Symbol	Conditions	Unit	Note
1	Junction Temperature	Tj	−40 ～ +125	℃	

C. ELECTRICAL CHARACTERISTICS

Measure condition (Ta=25℃±3℃)

No.	Item	Symbol	Measure Condition (Figure 1)	Typ.	Min.	Max.	Unit
【CONTROL FUNCTIONS】 *Design guaranteed item							
1	VCC Start Voltage	VCC(ON)		20	18	22	V
2	VCC Stop Voltage	VCC(OFF)		13	12	14	V
3	VCC Start/Stop Hysteresis	D_VCC	VCC(ON) − VCC(OFF)	7	6	8	V

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C. ELECTRICAL CHARACTERISTICS Measure condition (Ta=25°C±3°C)

No.	Item	Symbol	Measure Condition (Figure 1)	Typ.	Min.	Max.	Unit
4	VDD Start Voltage	VDD(ON)		6.0	5.4	6.6	V
5	VDD Stop Voltage	VDD(OFF)		4.8	4.3	5.3	V
6	VDD Clamp Voltage	VDD(CLP)	IDD = 5 mA	6.7	5.9	7.5	V
7	VDD Control Voltage	VDD(CNT)	ON → OFF	5.7	5.1	6.3	V
8	VDD Control Hysteresis	VDDCNTHYS	OFF → ON	10	–	–	mV
9	VDD Start/Stop Hysteresis	D_VDD1	VDD(ON) – VDD(OFF)	1.2	0.9	1.5	V
10	Deference between VDD(ON) and VDD(CNT)	D_VDD2	VDD(ON) – VDD(CNT)	0.3	0.05	0.6	V
11	Deference between VDD(CNT) and VDD(OFF)	D_VDD3	VDD(CNT) – VDD(OFF)	0.9	0.6	1.2	V
12	Deference between VDD(ON) and VDD(CNT)	D_VDD4	VDD(CLP) – VDD(CNT)	1.0	0.6	1.4	V
13	VCC Current at Start-up	ICC(SB)	VCC = VCC(ON) – 0.5 V, VDD = VDD(ON) + 0.2 V	0.18	0.08	0.18	mA
14	VCC Current at Off-state	ICC(OFF)	VCC = 15 V VDD = VDD(CNT) + 0.2 V	0.17	0.07	0.27	mA
15	VCC Current at Operating	ICC(OP)	VCC = 20V, COUT = 1nF, VDD = VDD(CNT) – 0.3 V	0.60	0.40	0.80	mA
16	VDD Current at Start-up	IDD(SB)	VCC = VDD(ON) + 0.5 V VDD = VDD(ON) – 0.2 V	0.63	0.52	0.77	mA
17	VDD Current at Off-state	IDD(OFF)	VCC = 15 V VDD = VDD(CNT) + 0.2 V	0.65	0.55	0.75	mA
18	VDD Current at Operating	IDD(OP)	VCC = 20V, VDD = VDD(CNT) – 0.3 V	0.58	0.46	0.70	mA
19	Output Frequency at Start-up	fosc		25	22	28	kHz
20	Jitter IS Voltage Deviation	D_VIS	VDD = VDD(CNT) – 0.1 V ※Figure 2	32	–	–	mV
*21	Transformer Reset Voltage	VTH(TR)		65	5	125	mV
22	Transformer Reset Detection Delay Time	Td(TR)		150	–	–	ns
23	Mask Time after Turn-off at Heavy Load	Td(OFF)1	VDD = VDD(CNT) – 0.3 V ※Figure 3	5	–	–	μs
24	Mask Time after Turn-off at Light Load	Td(OFF)2	VDD = VDD(CNT) ※Figure 3	12	–	–	μs
25	VCC Charge Current	ICCH1	VCC = 0 V, VDD = open, VIN = 50 V	–9.0	–13.0	–5.4	mA
		ICCH2	VCC = 18 V, VDD = open, VIN = 50 V	–3.20	–5.00	–1.92	mA

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C. ELECTRICAL CHARACTERISTICS Measure condition (Ta=25°C±3°C)

No.	Item	Symbol	Measure Condition (Figure 1)	Typ.	Min.	Max.	Unit
26	VDD Charge Current	IDCH1	VCC = VCC(ON), VDD = 0 V, VIN = 50 V	−25	−35	−15	mA
		IDCH2	VCC = VCC(ON), VDD = 5 V, VIN = 50 V	−20	−30	−10	mA
【CIRCUIT PROTECTIONS】 *Design guaranteed item							
27	Current Limit Detection Voltage	VLIMIT	VDD = VDD(CNT) − 0.3 V	800	744	856	mV
*28	Current Detection Voltage at Light Load	VIS(OFF)	VDD = VDD(CNT)	160	100	220	mV
29	Sense Offset Current at Heavy Load	IIS1	VDD = VDD(CNT) − 0.3 V, VIS = 0 V ※Figure 4	0	−0.2	0.2	μA
30	Sense Offset Current at Light Load	IIS2	VDD = VDD(CNT), VIS = 0 V ※Figure 4	−65	−	−	μA
31	Minimum On Time	Ton(MIN)	VCC = 20 V, COUT = 1 nF	700	−	−	ns
32	Maximum On Time	Ton(MAX)		26	22	30	μs
33	Current Limit Detection Delay	Td(OCL)		200	−	−	ns
34	Timer Intermittent Cycle	TIMER	VDD = VDD(ON) ⇔VDD(OFF), VIS > VLIMIT		8		−
35	VCC Overvoltage Protection Detection	VCC(OV)		34	31	37	V
36	TR Latch Threshold Voltage	VTH(LAT)		VDD−0.8	VDD−1.3	VDD−0.3	V
*37	TR Latch Detection Filter Time	Td(LAT)		120	70	170	μs
38	Latch Reset VDD Threshold	VDDreset		2.7	1.7	3.7	V
*39	Thermal Shutdown Temperature	TOTP		140	130	150	°C
*40	Thermal Shutdown Temperature Hysteresis	TOTPHYS		70	−	−	°C
【OUTPUT】 *Design guaranteed item							
41	Output Sink Current	IOUTL	VCC = 20 V, VOUT = 12 V	0.45	−	−	A
42	Output Source Current	IOUTH	VCC = 20 V, VOUT = 0 V	−0.22	−	−	A
43	Low Level Output Voltage	VOUTL	VCC = 20 V, IOUT = 10 mA	0.1	−	0.3	V
*44	High Level Output Threshold Voltage	VOUT(TH)	※Figure 5	12.4	10.9	13.9	V
*45	High Level Output Minimum Voltage	VOUT(MIN)	VCC = VCC(OFF) ※Figure 6	9.9	9	11	V

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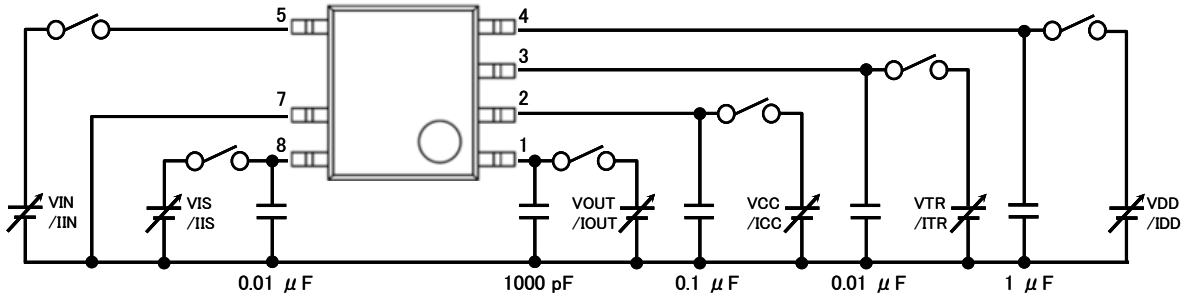
C. ELECTRICAL CHARACTERISTICS Measure condition (Ta=25℃±3℃)

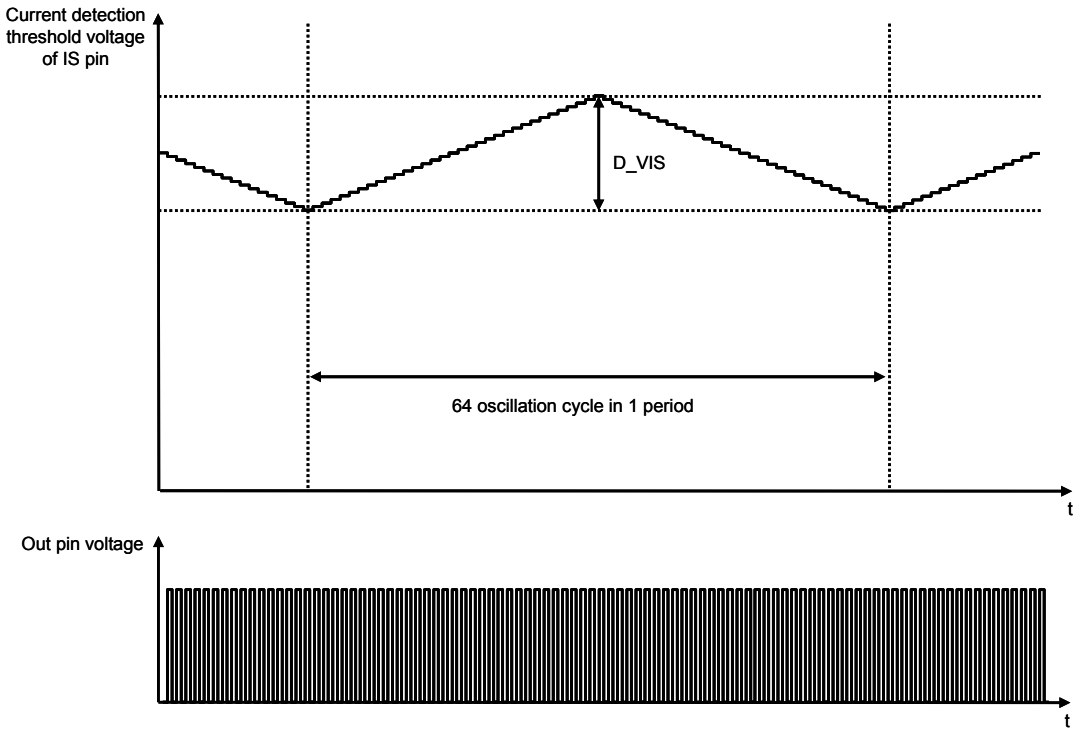
No.	Item	Symbol	Measure Condition (Figure 1)	Typ.	Min.	Max.	Unit
46	Rise Time	tr	VCC = 20 V, COUT = 1 nF ※Figure 7	275	–	–	ns
47	Fall Time	tf	VCC = 20 V, COUT = 1 nF ※Figure 7	50	–	–	ns
【HIGH VOLTAGE INPUT】							
48	VIN pin OFF-State Leakage Current	IIN(LEAK)	VIN = 450 V, VCC > VCC(ON), VDD > VDD(ON)	5	–	20	μA
49	VIN pin Breakdown Voltage	BVVIN	IIN = 100 μA, VCC > VCC(ON), VDD > VDD(ON)	–	500	–	V
50	Minimum VIN Supply Voltage	VIN(MIN)		28	23	33	V

【Figure 1: Measure circuit／Pin Layout】

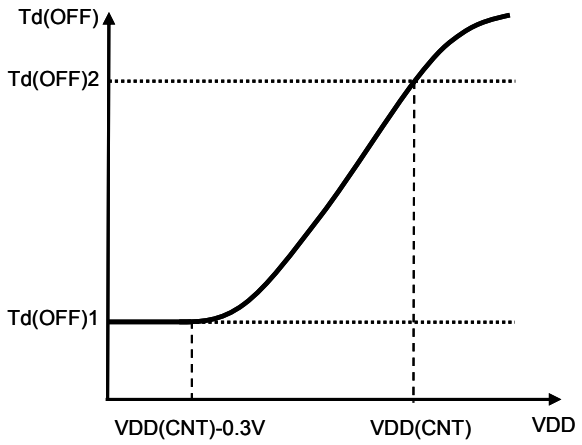


Pin No.	Pin Name
1	OUT
2	VCC
3	TR
4	VDD
5	VIN
6	—
7	GND
8	IS

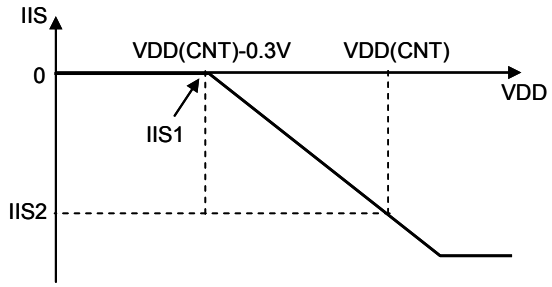
【Figure 2: D_VIS measurement】



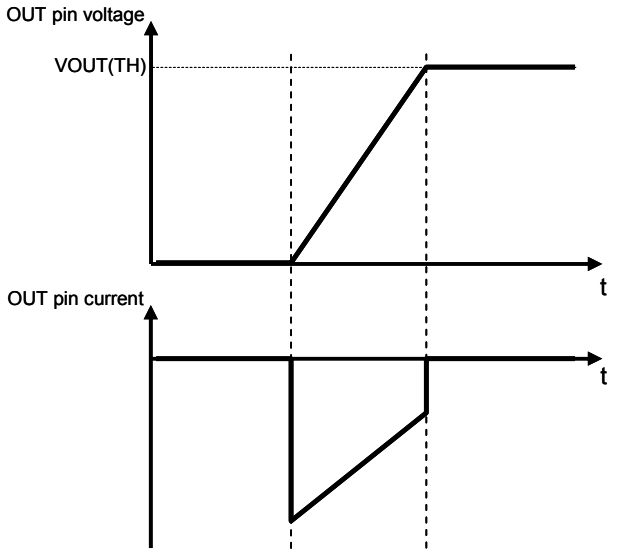
【Figure 3: VDD – Td(OFF) Characteristics】



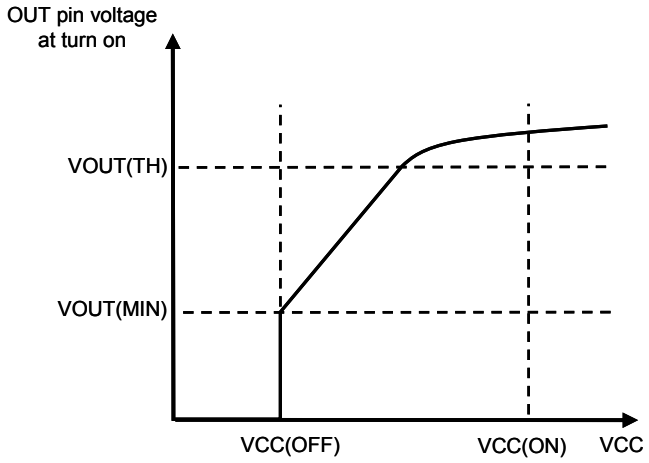
【Figure 4： VDD – IIS Characteristics】



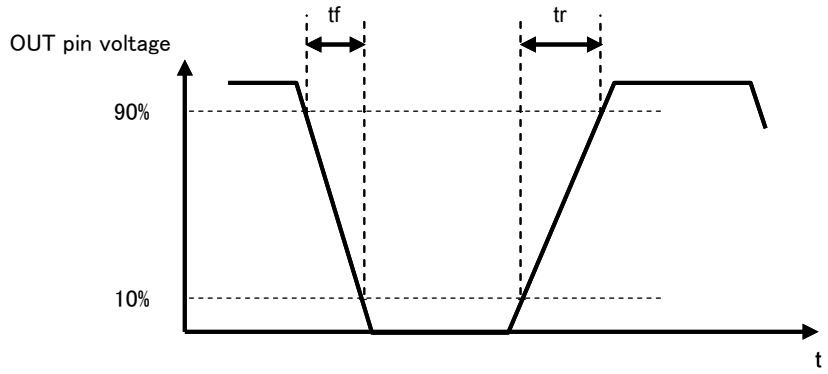
【Figure 5： VOUT(TH) measurement】



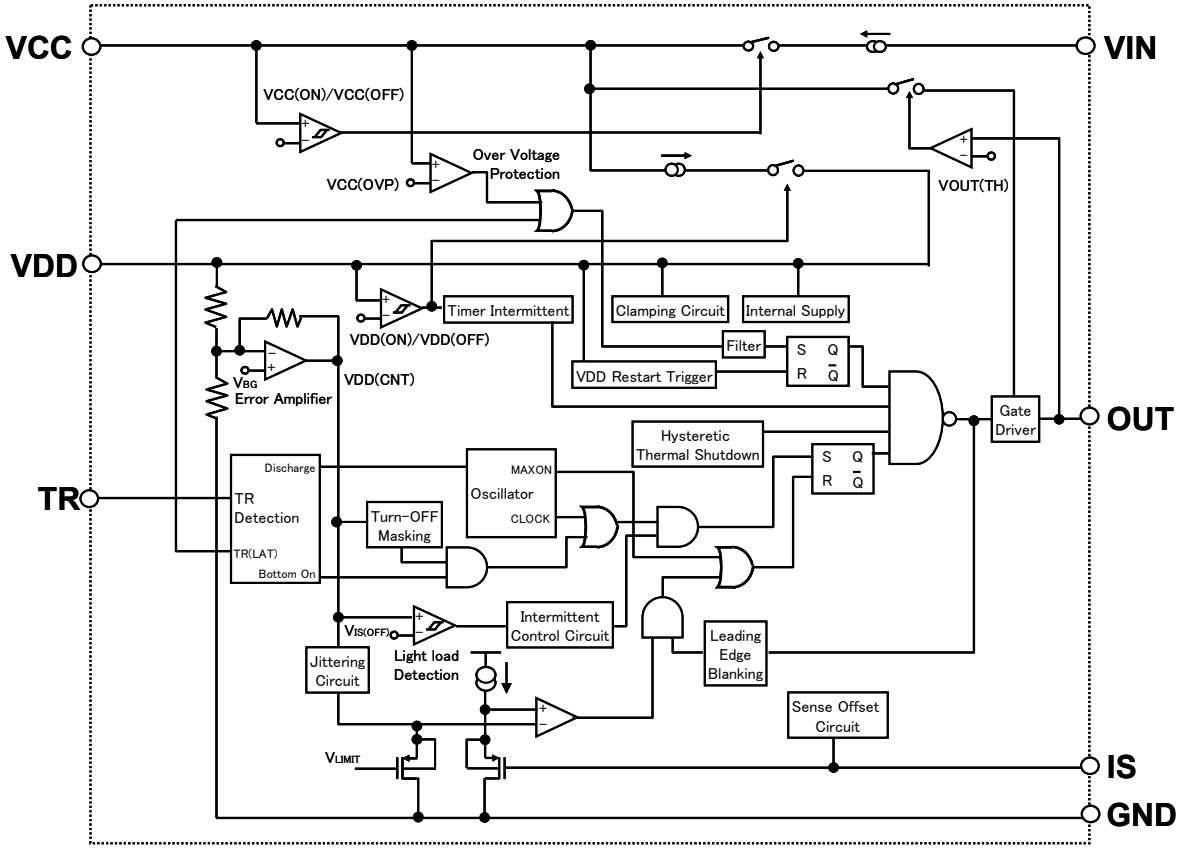
【Figure 6： VOUT(MIN) measurement】



【Figure 7: tr, tf measurement】



【Figure 8: Block Diagram】



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

【Precautions for Use 2】
The product 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 VIN pin and OUT pin connection to the power supply board.
(2) VIN pin short to OUT pin.
(3) VIN pin short to VCC pin.
(4) VIN pin short to TR pin.
(5) VIN pin short to VDD pin.
(6) VIN pin short to IS pin.
(7) VCC pin short to TR pin.
(8) VCC pin short to VDD pin.
(9) VCC pin short to IS pin.

Request for your special attention and precautions in using the technical information and semiconductors described in this book

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Even when the products are used within the guaranteed values, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.

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When using products for which damp-proof packing is required, satisfy the conditions, such as shelf life and the elapsed time since first opening the packages.

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