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

MIP5610MSSCF

Type	Silicon MOSFET type Integrated Circuit		
Application	For Green Lighting driving		
Structure	CMOS type		
Block diagram	Figure 5		
Out Line	DIP7-A1	Marking	MIP561

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

NO.	Item	Symbol	Ratings	Unit	Note
1	DRAIN Voltage	VD-S	−0.3 ～ 700	V	
2	VIN Voltage	VIN-S	−0.3 ～ 550	V	
3	VDD Voltage	VDD-S	−0.3 ～ 9.5	V	
4	FB Voltage	VFB-S	−0.3 ～ 7.0	V	
5	FB Current	IFB	-200	μA	
6	Output Peak Current	IDP	2.0 (※1)	A	※1 : IDP is guaranteed at the pulse width narrower than MIN(PW).
7	Junction Temperature	Tj	150	℃	
8	Storage Temperature	Tstg	−55 ～ +150	℃	

B. RECOMMENDED OPERATING CONDITIONS

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

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C. ELECTRICAL CHARACTERISTICS
【CONTROL FUNCTIONS】

Measure condition(Ta=25℃±3℃, Figure1)
*Design Guarantee Item, **Reference Item

No.	Item	Symbol	Measure Condition (Figure 1)	Typ.	Min	Max	Unit
1	VDD Start Voltage	VDD(ON)	VD=5 V, VFB=0 V	6.0	5.5	6.5	V
2	VDD Stop Voltage	VDD(UV)	VD=5 V, VFB=0 V	5.0	4.5	5.5	V
3	Circuit Current before start	IS1	VDD=VDD(ON)-0.1 V, VD=5 V VFB=VFB-lo-5 mV	0.57	0.37	0.77	mA
4	Circuit Current under switching	IS2	VDD=VDD(ON)+0.1 V, VD=5 V VFB=VFB-lo-5 mV	0.72	0.47	0.97	mA
5	Maximum output frequency	fPFM-hi	VFB=VFB_hi+5 mV ※Figure3 VD=5 V, VDD=VDD(ON)+0.1 V,	128.5	120.8	–	kHz
6	Minimum output frequency	fPFM-lo	VFB=VFB_lo-5 mV ※Figure3 VD=5 V, VDD=VDD(ON)+0.1 V,	19.3	–	27	kHz
7	Output frequency at skip mode	fskip	VD=5 V, VDD=VDD(ON)+0.1 V, Ton<Skip(PW),	13	9.1	16.9	kHz
8	Maximum on duty	MAXDC	VFB=VFB_hi+5 mV VD=5 V, VDD=VDD(ON)+0.1 V	70	63	77	%
** 9	Feedback pin reference voltage	VFB-c	※Figure3 VFB-c=(VFB-hi + VFB-lo)/2	15	–	–	mV
** 10	FB voltage at fPFM-hi	VFB-hi	※Figure3	25	–	–	mV
** 11	FB voltage at fPFM-lo	VFB-lo	※Figure3	5	–	–	mV
** 12	Gain of fosc-VFB	GainFB	GainFB=(fPFM-hi − fPFM-lo)/(VFB-hi − VFB-lo)	5.46	–	–	kHz/mV
** 13	The feedback dummy maximum current	IFBdm(max)		-100	–	–	μA
14	Output current accuracy	Io	-(VFB-c + 3.15×IFBdm(max))/300×100 -100	–	-3.5	3.5	%

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【PROTECT FUNCTION】 *Design Guarantee Item, **Reference Item

No.	Item	Symbol	Measure Condition (Figure 1)	Typ.	Min	Max	Unit
15	Maximum Peak Current Limit	ILIMITmax	VDD=VDD(ON)+0.1 V, VFB=VFB-Io-30 mV Duty=30 % ※Figure2	0.4	0.364	0.436	A
16	Power-up Reset Threshold Voltage	VDDrst		2.6	1.6	3.6	V
17	VDD latch stop voltage	VDD(OV)	ON→OFF VD=5 V, VFB=0 V	7.4	6.4	8.4	V
18	VDD latch stop current	IDD(OV)	ON→OFF VD=5 V, VFB=0 V	3.7	2.2	5.2	mA
19	VFB latch stop voltage	VFB(OV)	ON→OFF VD=5 V, VDD=VDD(ON)+0.1 V	3.5	3.0	4.0	V
** 20	Leading Edge Blanking Delay	ton(BLK)		200	–	–	ns
** 21	Peak Current Limit Delay	td(OCL)		200	–	–	ns
22	Minimum on-pulse width	MIN(PW)	VIN=50 V, VD=35 V	320	–	440	ns
23	Skip detect on-pulse width	Skip(PW)	VIN=50 V, VD=35 V	450	–	570	ns
* 24	Thermal Shutdown Junction Temperature	TOTPJ		140	130	150	℃
* 25	Thermal Shutdown Hysteresis	TOTPJhys		70	–	–	℃

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【OUTPUT】 *Design Guarantee Item, **Reference Item

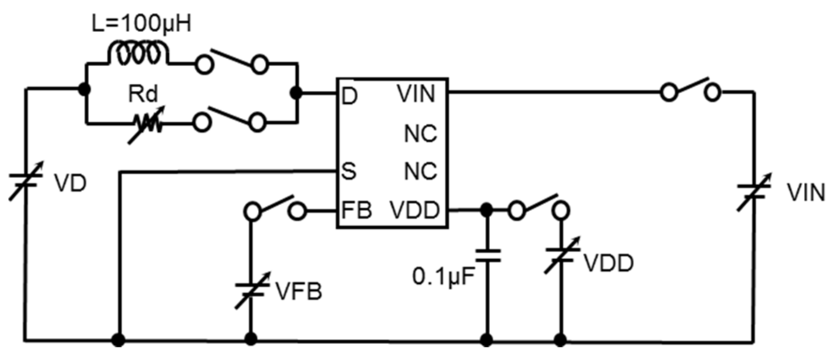
No.	Item	Symbol	Measure Condition (Figure 1)	Typ.	Min	Max	Unit
26	ON-State Resistance	RDS(ON)	VDD=VDD(ON)+0.1 V IDS=300 mA	6.9	–	8.6	Ω
27	OFF-State leakage Current of DRAIN Pin	IDSS	VDD=VDD(ON)+0.1 V, VFB= 4 V VD=630 V	1.0	–	10	μA
28	Breakdown Voltage of DRAIN Pin	VDSS	VDD=VDD(ON)+0.1 V, VFB= 4 V IDS=20 μA	–	700	–	V
** 29	Rise Time	tr	VDD=VDD(ON)+0.1 VIN=50 V VD=5 V ※Figure4	80	–	–	ns
** 30	Fall Time	tf	VDD=VDD(ON)+0.1 VIN=50 V VD=5 V ※Figure4	25	–	–	ns

【HIGH VOLTAGE INPUT】

No.	Item	Symbol	Measure Condition (Figure 1)	Typ.	Min	Max	Unit
31	OFF-State leakage Current of VIN Pin	IIN(LEAK)	VDD=VDD(ON)+0.1 V, VFB= 4 V VIN=500 V	48	–	80	μA
32	Breakdown Voltage of VIN Pin	BVVIN	VDD=VDD(ON)+0.1 V, VFB= 4 V IIN=100 μA	–	550	–	V
33	VDD Charging Current 1	CHRG10	VIN=40 V, VDD=0 V, FB : open	-10.6	-15.9	-5.3	mA
34	VDD Charging Current 2	CHRG15	VIN=40 V, VDD=5 V, FB : open	-7.2	-10.8	-3.6	mA
35	VIN start Voltage	VIN(MIN)	VDD : open, VD=5 V ※VIN voltage when an oscillation starts	10	–	20	V

【Figure1 : Measure circuit】

※The characteristic is measured by a SORCE pin as a reference pin.



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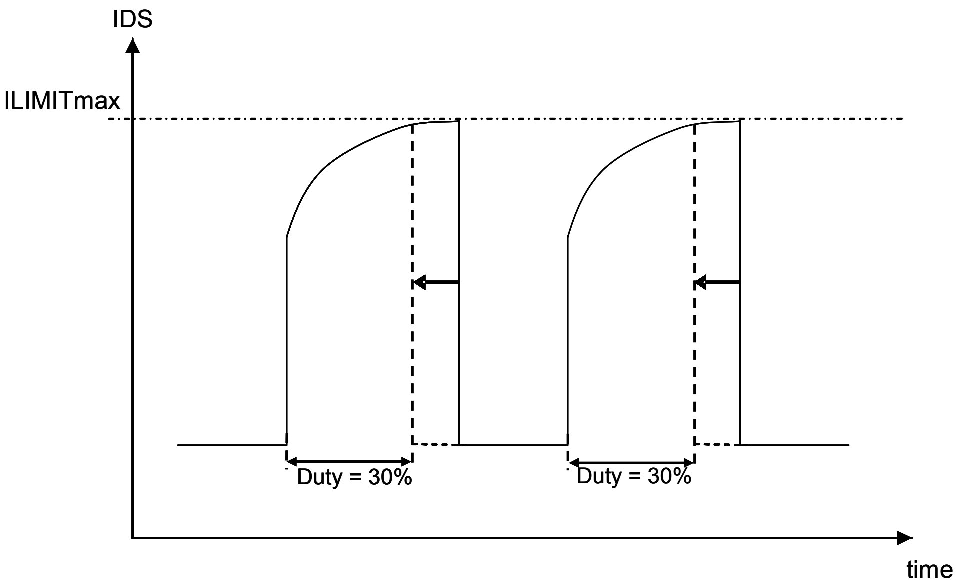
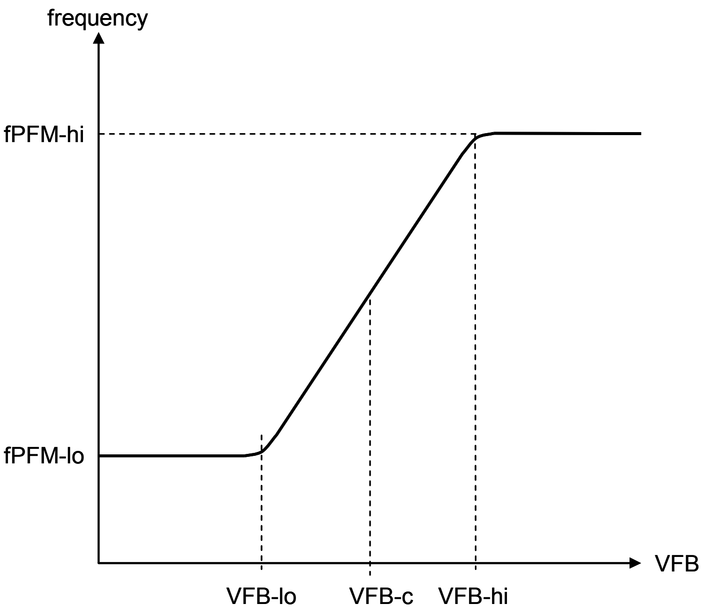
【Figure2 : ILIMIT measurement】



【Figure3 : frequency vs VFB characteristic】



＊ VFB−c=(VFB−hi ＋ VFB−lo)/2

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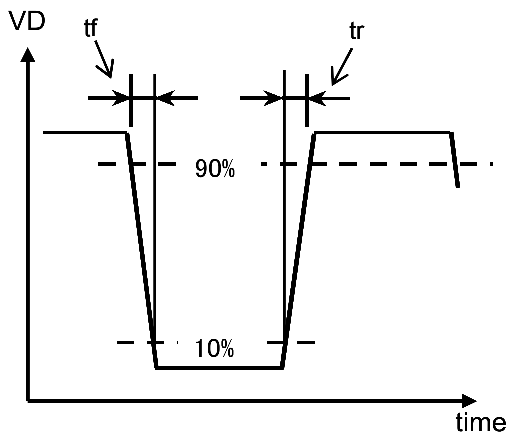
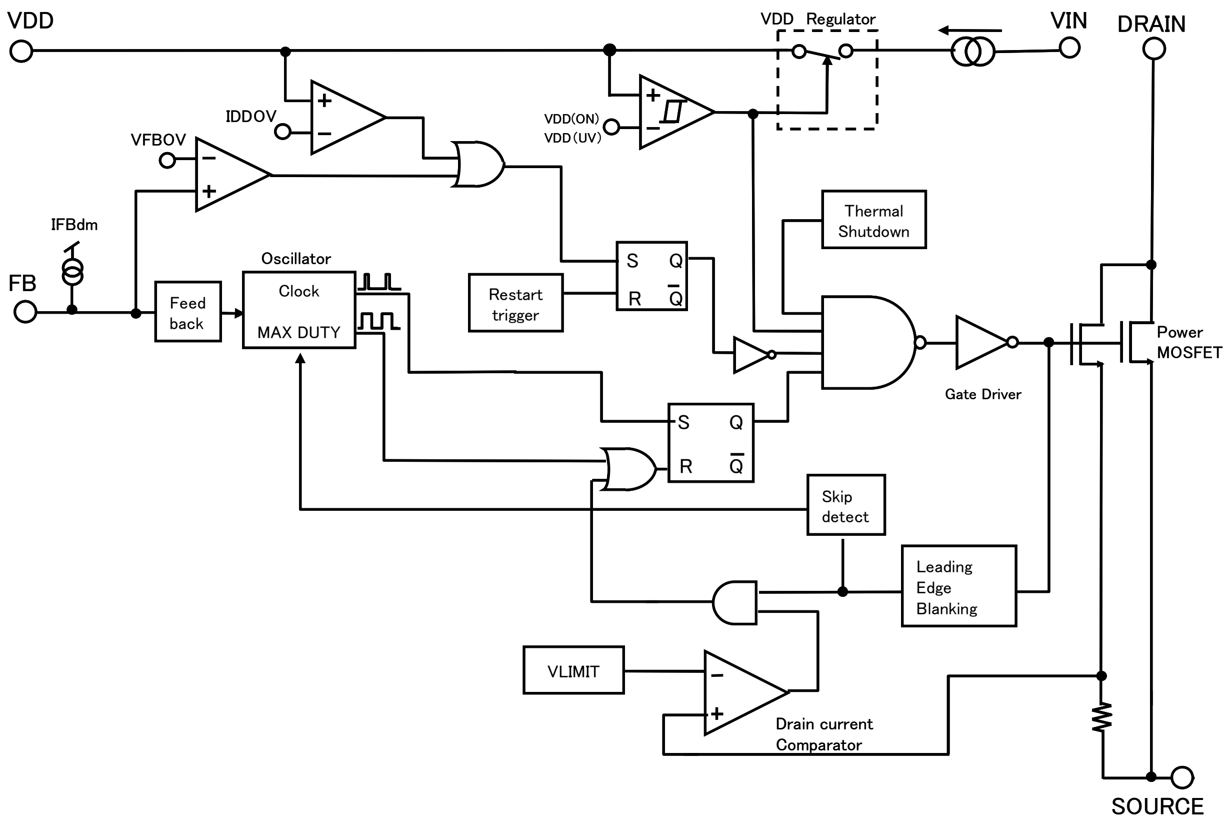
【Figure4 : tr, tf characteristic 】



【Figure5 : Block Diagram】



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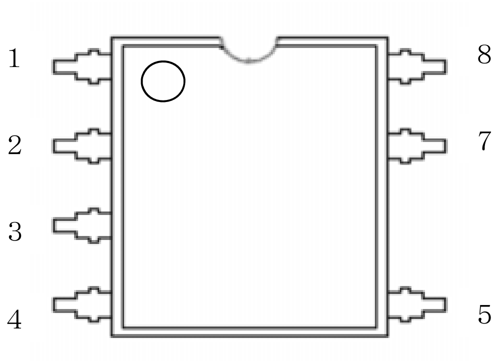
【Figure6 : Pin Layout】



Pin No.	Terminal Name
1	VDD
2	NC
3	NC
4	VIN
5	Drain
6	—
7	Source
8	FB

【Precautions for Use 1】

Connect a ceramic capacitor with value >0.1μF between VDD pin and SOURCE.

【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) DRAIN pin short to low voltage pin (VDD, FB).
(2) VIN pin short to low voltage pin (VDD, FB).
(3) VIN pin short to DRAIN pin under switching.
(4) DRAIN pin short to SOURCE pin.
(5) DRAIN Pin and VDD Pin reversely connect into power board.

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