Type	Silicon MOSFET type Integrated Circuit		
Application	For Switching Power Supply Control		
Structure	CMOS type		
Equivalent Circuit	Figure 8		
Out Line	DIP7-A1	Marking	MIP004

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

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

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

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
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 = 20 V, 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 = 20 V, 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	Td(OFF)1	VDD = VDD(CNT) – 0.3 V *Figure 3	5	-	-	µs

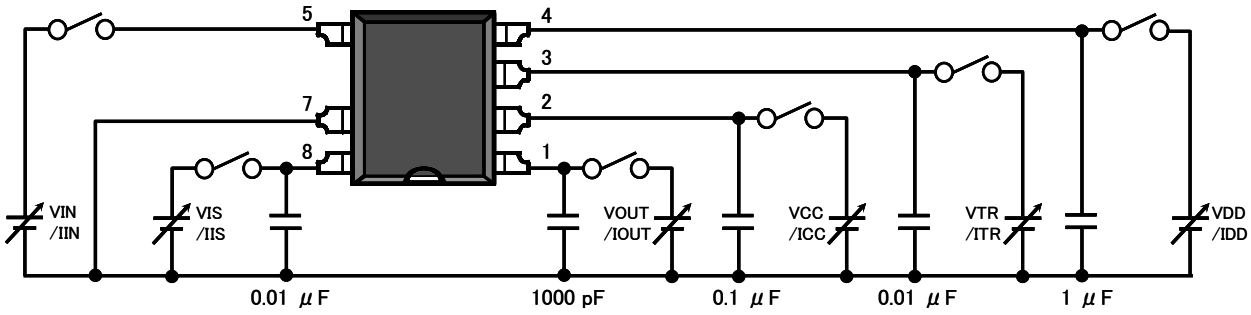
B. ELECTRICAL CHARACTERISTICS (continued) Measure condition (Ta= 25°C±3°C)

No.	Item	Symbol	Measure Condition (Figure 1)	Typ.	Min.	Max.	Unit
24	Mask Time after Turn-off at Light Load	Td(OFF)2	VDD = VDD(CNT) *Figure 3	12	-	-	ms
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
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

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

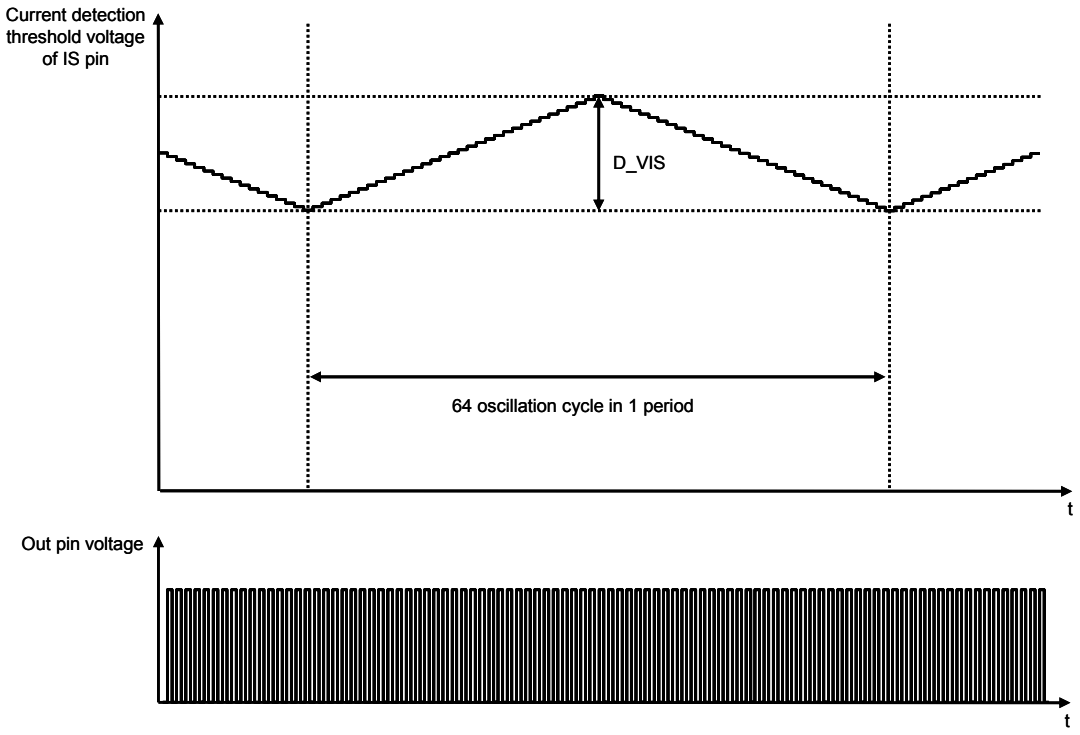
No.	Item	Symbol	Measure Condition (Figure 1)	Typ.	Min.	Max.	Unit
*45	High Level Output Minimum Voltage	VOUT(MIN)	VCC = VCC(OFF) *Figure 6	9.9	9	11	V
46	Rise Time	tr	VCC = 20 V, COUT = 1 nF *Figure 7	275	-	-	ns
47	Fall Time	tf	VCC = 20 V, COUT = 1 nF *Figure 7	50	-	-	ns
[HIGH VOLTAGE INPUT]							
48	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]

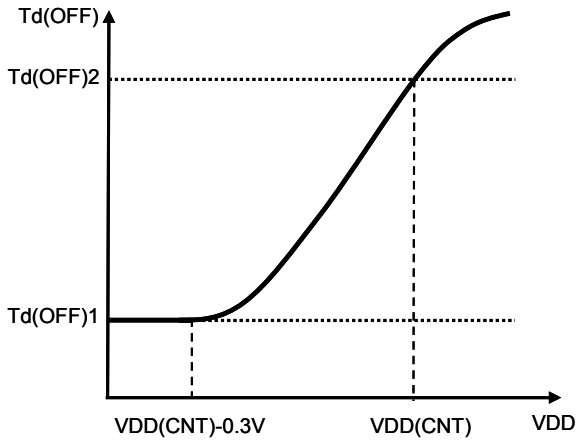


Pin No.	Pin Name
1	OUT
2	VCC
3	TR
4	VDD
5	VIN
6	—
7	GND
8	IS

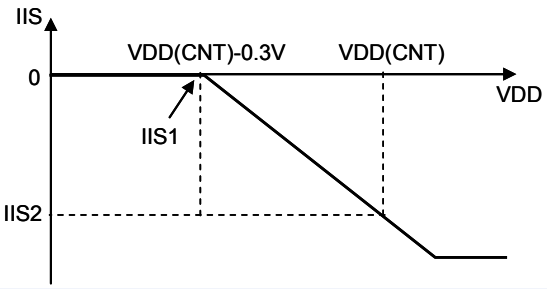
[Figure 2: D_VIS measurement]



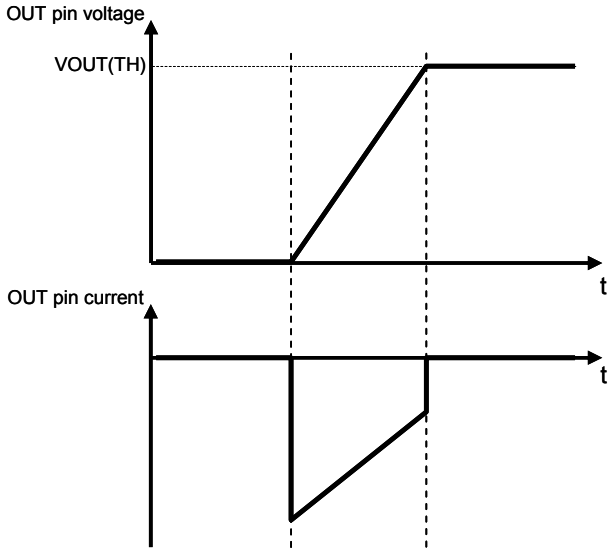
[Figure 3: VDD – Td(OFF) Characteristics]



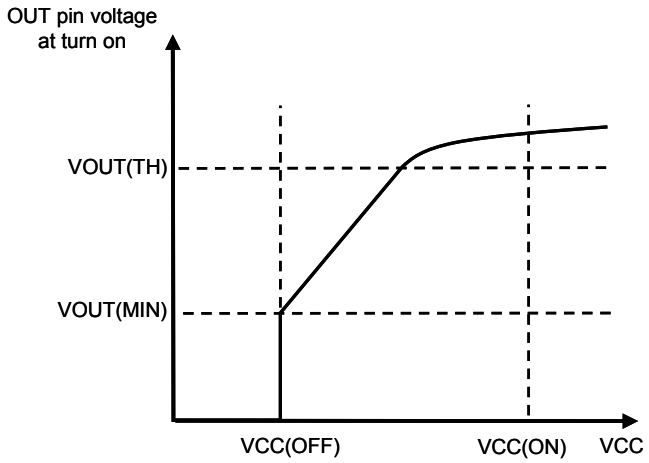
[Figure 4: VDD – IIS Characteristics]



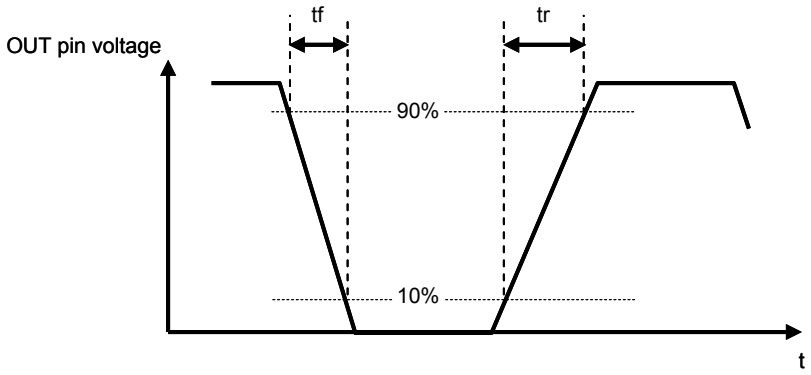
[Figure 5: VOUT(TH) measurement]



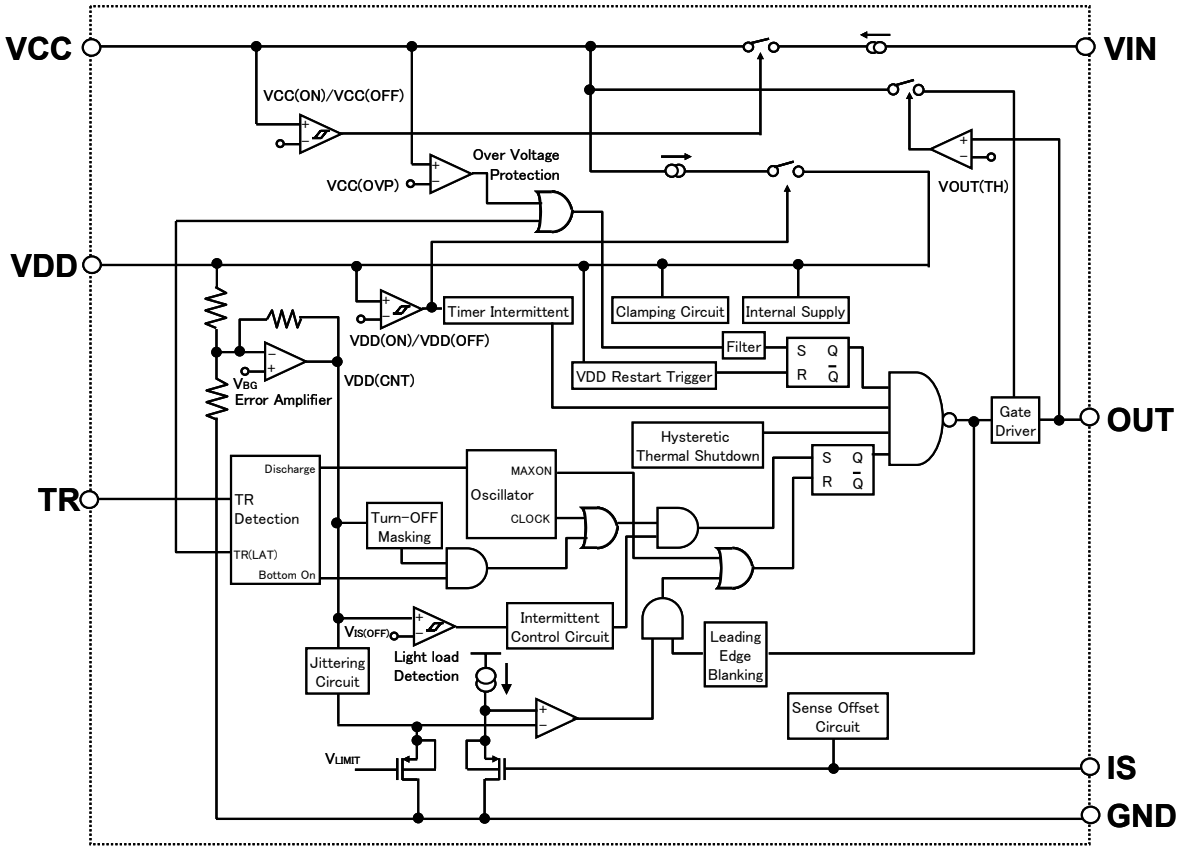
[Figure 6: VOUT(MIN) measurement]



[Figure 7: tr, tf measurement]



[Figure 8: Block Diagram]



[Precautions for Use 1]

Connect a ceramic capacitor with value > 0.1μF 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.

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(3) The products described in this book are intended to be used for general applications (such as office equipment, communications equipment, measuring instruments and household appliances), or for specific applications as expressly stated in this book.
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- Special applications (such as for airplanes, aerospace, automotive equipment, traffic signaling equipment, combustion equipment, life support systems and safety devices) in which exceptional quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or harm the human body.

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(4) The products and product specifications described in this book are subject to change without notice for modification and/or improvement. At the final stage of your design, purchasing, or use of the products, therefore, ask for the most up-to-date Product Standards in advance to make sure that the latest specifications satisfy your requirements.

(5) When designing your equipment, comply with the range of absolute maximum rating and the guaranteed operating conditions (operating power supply voltage and operating environment etc.). Especially, please be careful not to exceed the range of absolute maximum rating on the transient state, such as power-on, power-off and mode-switching. Otherwise, we will not be liable for any defect which may arise later in your equipment.
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.

(6) Comply with the instructions for use in order to prevent breakdown and characteristics change due to external factors (ESD, EOS, thermal stress and mechanical stress) at the time of handling, mounting or at customer's process. 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.

Precautions on the Sales of IPDs

1) The sale and/or the export of IPD products to customers located in certain countries is restricted by the Agreement made and executed by and between Power Integrations, Inc. and Panasonic Corporation. For details, refer to the following Attached table "IPD availability by customer."
2) IPD products purchased from our company, or its authorized agents, hereinafter referred to as our company, shall be used only for production purposes by those parties who have duly purchased IPD products. Those who have purchased IPD products shall not use such IPD products in unmodified form for re-sale, loan, or sample shipment for evaluation purposes to any other parties.
3) If a party who has duly purchased IPD products subcontracts its production to any other parties, including its subsidiaries or any other third parties inside and/or out of Japan, and the IPD products are consigned to such subcontracting parties thereat, such party is obligated to monitor and control the quantity of IPD products to prevent any of the aforementioned re-sale, loan or sample shipments from taking place.
4) In the event that any actual or threatened breach or violation of any of the above mentioned 2) or 3) has occurred or is about to occur, our company will hold all shipments of IPD products and may request the customer to disclose necessary documentation describing the status of our end-users and/or distribution channels.
Note) The products of MIP50**, MIP51**, and MIP7** are excluded from above-mentioned precautions, 1) to 3).

Attached table "IPD availability by customer"

Parts No.			Companies/areas to which products can be sold	Companies/areas to which products cannot be sold	Application
MIP01** MIP2** MIP9A**	MIP02** MIP3** MIP9L**	MIP1** MIP4**	· Japanese companies in Japan · Japanese companies in Asia (50% or more owned)	· Companies in European and American countries · Asian companies in Asia · Other local companies	· For power supply · For DC-DC converter
MIP00** MIP55** MIP816/826	MIP52** MIP56** MIP9E**	MIP53** MIP803/804	· Japanese companies in Japan · Japanese companies in Asia (50% or more owned) · Asian companies in Asia	· Companies in European and American countries · Other local companies	· For power supply · For EL driver · For LED lighting driver
MIP50**	MIP51**	MIP7**	· No restrictions in terms of contract	· No restrictions in terms of contract	· For lamp driver/ car electronics accessories

Note) For details, contact our sales division.