MIP2M20MS

Silicon MOS FET type integrated circuit

■ Features

- AC input detecting function
  By connecting SO terminal, it is able to select functions as below:
  1) Boot up and stop operation according to AC input or output (short-circuit SO teminal to VDD terminal)
  2) Signal output form SO terminal when AC input is low and transmit to the secondary side (connect an external element to SO terminal)
- Built-in jitter function
- Power consumption 30 mW or less at a no load is achieved
- Protection function is built into.
  (over load protection, over voltage protection, over heat protection)

■ Applications

- Thin TVs and othes

■ Absolute Maximum Ratings T_a = 25°C±3°C

Parameter	Symbol	Rating	Unit
DRAIN voltage	VD	– 0.3 to +700	V
VCC voltage	VCC	– 0.3 to +45	V
VDD voltage	VDD	– 0.3 to +8	V
FB voltage	VFB	– 0.3 to +6.4	V
FB current	IFB	–500	μA
LS voltage	VLS	– 0.3 to +10	V
SO voltage	VSO	– 0.3 to +7	V
Output peak current *	IDP	0.76	A
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

Note) *: The guarantee within the following pulse width.
Leading edge blanking delay + Current limit delay ton(BLK) + td(OCL)

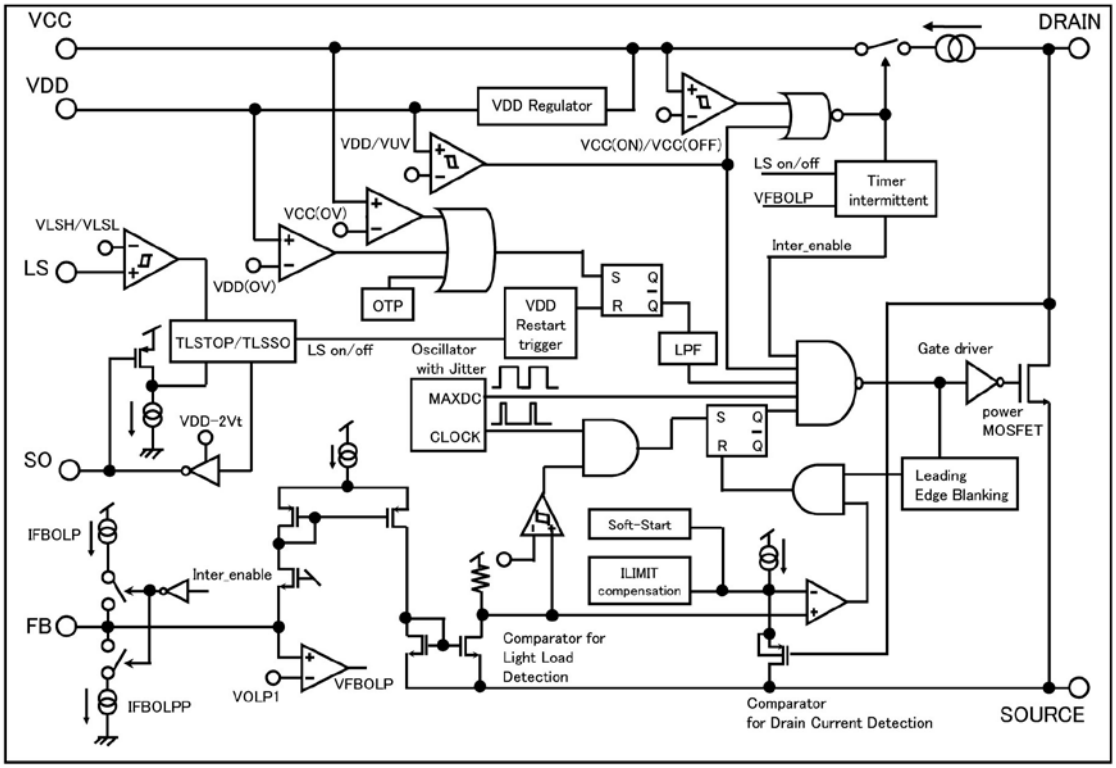
■ Package

- Code
  DIP7-A1
- Pin Name

1. VDD	5. DRAIN
2. FB	6. —
3. SO	7. SOURCE
4. VCC	8. LS

■ Marking Symbol: MIP2M2

■ Block Diagram



■ Electrical Characteristics T_C = 25°C±3°C

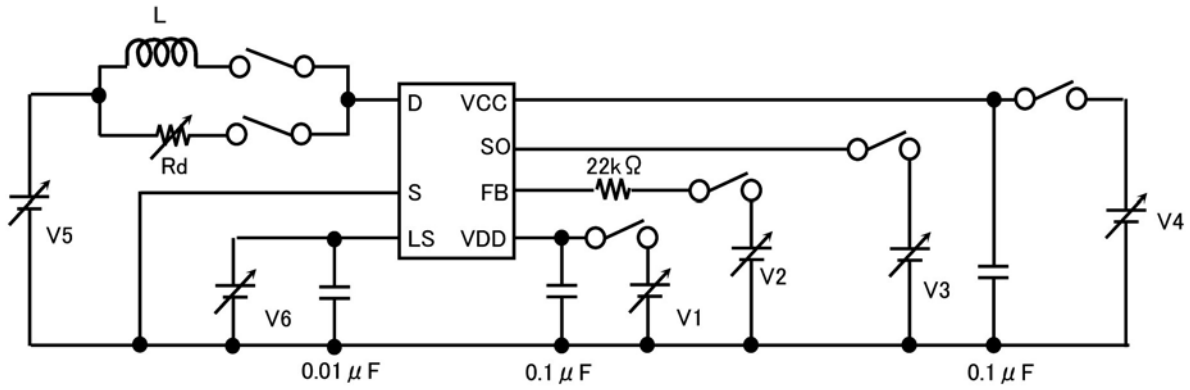
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Control functions						
Output frequency *1	fosc	V4 = 15 V, V3 = 2 V, I2 = –20 µA, V5 = 5 V	60.3	67	73.7	kHz
Jitter frequency deviation *1	Δf	V4 = 15 V, V3 = 2 V, I2 = –20 µA, V5 = 5 V	2.4	5.0	7.6	kHz
Jitter frequency modulation rate *1	fM	V4 = 15 V, V3 = 2 V, I2 = –20 µA, V5 = 5 V		360		Hz
Maximum duty cycle	MAXDC	V4 = 15 V, V3 = 2 V, I2 = –20 µA, V5 = 5 V	50	54	58	%
VDD voltage	VDD	V4 = 15 V, V3 = 6 V, I2 = –20 µA, V5 = 5 V, V6 = 1 V	5.4	5.9	6.4	V
VCC start voltage	VCC(ON)	V3 = 6 V, I2 = –20 µA,V5 = 5 V, V6 = 1 V	11	12	13	V
VCC stop voltage	VCC(OFF)	V3 = 6 V, I2 = –20 µA,V5 = 5 V, V6 = 1 V	7.45	8.2	8.95	V
VCC start / stop hysteresis	VCC(HYS)	VCC(ON) → VCC(OFF)	3.1	3.8	4.5	V
FB threshold voltage	IFB1	ON → OFF V4 = 15 V, V3 = 6 V, V5 = 5 V, V6 = 1 V	–81	–57	–34	µA
FB hysteresis current	IFB(HYS)	OFF → ON V4 = 15 V, V3 = 6 V, V5 = 5 V, V6 = 1 V		1.5		µA
FB pin voltage	VFB1	V4 = 15 V, V3 = 6 V, I2 = IFB1, V5 = 5 V, V6 = 1 V	1.6	1.9	2.2	V
Circuit current before start	ICC(SB)	V4 = 15 V, V3 = 6 V, I2 = –20 µA, V5 = 5 V, V6 = 1 V	0.20	0.25	0.30	mA
Circuit current	ICC	V4 = 15 V, V3 = 6 V, I2 = –20 µA, V5 = 5 V, V6 = 1 V	0.23	0.36	0.49	mA
VDD charging current	Ich1	V1 = 0 V, V5 = 40 V	–3.3	–2.2	–1.1	mA
	Ich2	V1 = 4 V, V5 = 40 V	–2.1	–1.3	– 0.6	mA
LS start voltage	VLSH	V4 = VCC(OFF) → VCC(ON), V3 = 6 V, I2 = –20 µA, V5 = 5 V	486	540	594	mV
LS stop voltage	VLSL	V4 = 15 V, V3 = 6 V, I2 = –20 µA, V5 = 5 V	355	395	435	mV
LS detect hysteresis	VLS(HYS)	VLSH – VLSL		145		mV
LS start / stop mode filter time	TLSstop	V4 = 15 V, V3 = 6 V, I2 = –20 µA, V5 = 5 V, V6 = VLSH → VLSL	4.2	5.85	7.5	ms
LS detect SO signal mode filter time	TLSSO	V4 = 15 V, V3 = 6 V, I2 = –20 µA, V5 = 5 V	1.85	3.15	4.45	ms
SO output voltage	VSO	V4 = 15 V, I2 = –20 µA, V5 = 5 V, V6 = VLSH → VLSL	3.2	4.2	5.2	V
SO output current	ISO	V4 = 15 V, V3 = 1 V, I2 = –20 µA, V5 = 5 V, V6 = 0 V	–1.2	– 0.8	– 0.4	mA
SO disable threshold	VSOTH	V4 = 15 V, I2 = –20 µA,V5 = 5 V, V6 = 0 V	4.6	5.2	5.8	V
SO disable threshold difference	D_VSO	VSOTH – VSO	0.7	1.0	1.3	V
SO pull down current	ISO_down	V4 = 15 V, V3 = 1 V, I2 = –20 µA, V5 = 5 V, V6 = 0 V	0.3	0.7	1.1	µA
Soft start time	Tsoft	V4 = VCC(OFF) → VCC(ON), I2 = –20 µA, V5 = 5 V, V6 = 1 V	5	8.5	12	ms

■ Electrical Characteristics (continued) T_C = 25°C±3°C

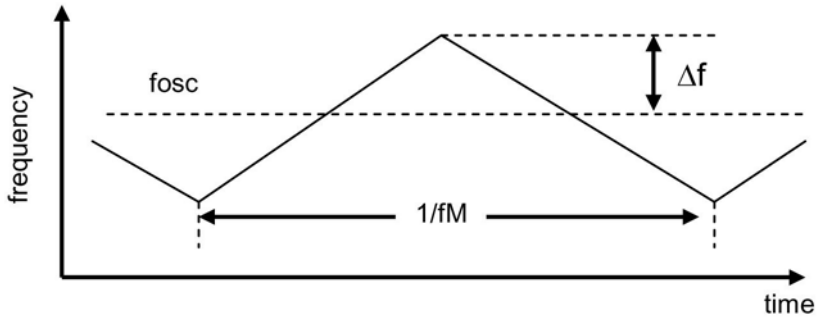
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Circuit protections						
Self protection current limit *2	ILIMIT	V4 = 15 V, V3 = 2 V, V2 = 2.6 V, V5 = adjusted, Duty = 30%	0.315	0.35	0.385	A
ILIMIT modified coefficient *2	R_slope	V4 = 15 V, V3 = 2 V, V2 = 2.6 V, V5 = adjusted, Duty = 10%		10		mA/µs
Drain current at light load	ID(OFF)	Ton = 4.5 µs, V4 = 15 V, V3 = 2 V, I2 = IFB1+2 µA, V5 = adjusted	40	100	160	mA
FB current at heavy load	IFBOLP	V5 = ILIMIT conditon V4 = 15 V, V3 = 2 V, V2 = 3 V, V6 = 1 V	–10	–13	–7	µA
FB over load protection detect voltage	VFBOLP	V5 = ILIMIT conditon V4 = 15 V, V3 = 2 V, V6 = 1 V	3.5	3.85	4.2	V
FB over load protection hysteresis	HYSVFBOLP			0.65		V
FB discharge current at timer intermittent	IFBOLPP	V5 = ILIMIT conditon, V4 = VCC(OFF), V3 = 2 V, V2 = 25 V, V6 = 1 V	0.6	1.0	1.4	mA
FB current at MAXDC detect	IFBMAXDC	V4 = 15 V, V3 = 6 V, V2 = 3 V,V5 = 5 V, V6 = 1 V			0.2	µA
Timer intermittent function *3	TIMER	V4 = VCC(ON) → VCC(OFF), V5 = ILIMIT condition, V3 = 6 V, I2 = –20 µA, V6 = 1 V		4		—
Timer intermittent function disabled at MAXDC *4	TIMER2	V4 = VCC(ON) → VCC(OFF), V5 = 5 V, V3 = 6 V, I2 = –20 µA, V6 = 1 V		1		—
Leading edge blanking delay	ton(BLK)		230	290	350	ns
Current limit delay	td(OCL)		100	150	200	ns
VCC over voltage protection	VCC(OV)	V3 = 6 V, I2 = –20 µA, V5 = 5 V, V6 = 1 V	26	29	32	V
VDD over voltage protection	VDD(OV)	V4 = 15 V, I1 = IDD(OV), V3 = 0 V, I2 = –20 µA, V5 = 5 V, V6 = 6 V	6.2	7.0	7.8	V
VDD current at VDD over voltage protection	IDD(OV)	V4 = 15 V, V3 = 0 V, I2 = –20 µA, V5 = 5 V, V6 = 6 V	2.4	3.5	4.6	mA
VDD(OV) difference	D_VDDOV	VDD(ON) – VDD	0.4	0.9	1.5	V
Thermal shutdown temperature	TOTP		130	140	150	°C
Latch reset VDD threshold	VDDreset		1.8	2.7	3.5	V
Output						
ON-state resistance	RDS(ON)	V4 = 15 V, V3 = 2 V, I5 = 100 mA, I2 = –20 µA, V6 = 1 V		16	21	Ω
OFF-state leakage current	IDSS	V4 = 35 V, I2 = –20 µA, V3 = 6 V, V5 = 650 V, V6 = 1 V		10	20	µA
Breakdown voltage	VDSS	V4 = 35 V, I2 = –20 µA, V3 = 6 V, I5 = 100 µA, V6 = 1 V	700			V
Rise time *5	tr	V4 = 15 V, V3 = 1 V, I2 = –20 µA, V5 = 5 V		70		ns
Fall time *5	tf	V4 = 15 V, V3 = 1 V, I2 = –20 µA, V5 = 5 V		35		ns
Supply voltage characteristics						
Drain supply voltage	VD(MIN)	V1, V2, V3, V4, V6 OPEN	50			V

■ Electrical Characteristics (continued) T_C = 25°C±3°C

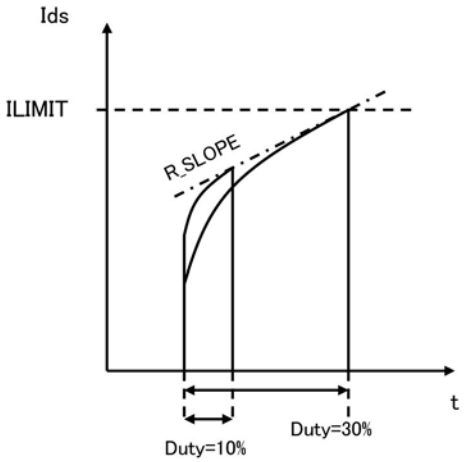
1. Measurement circuit



2. *1:Δf, fM measurement



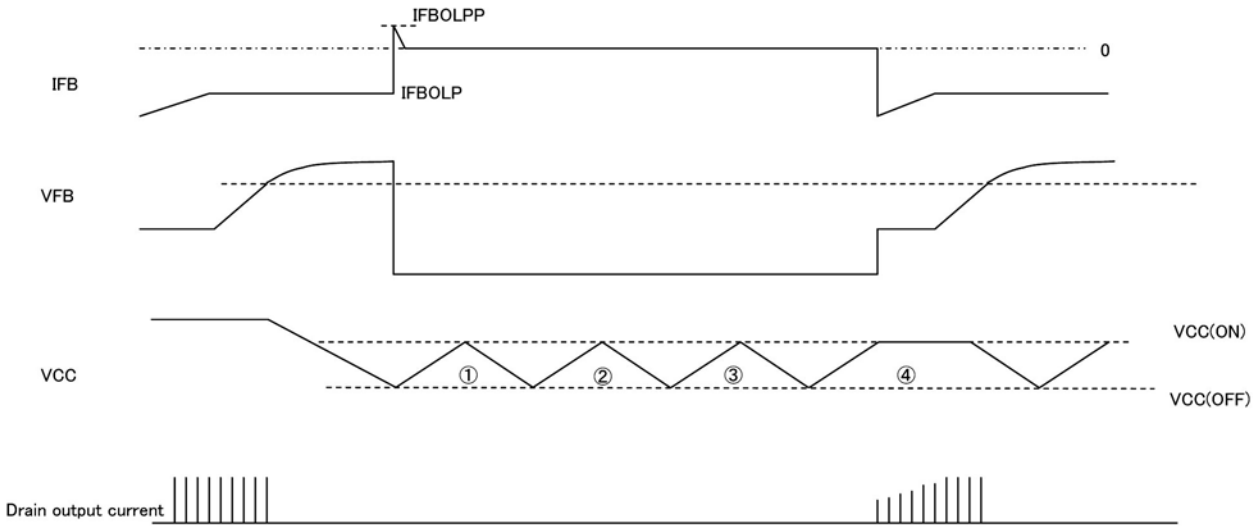
*2: ILIMIT、R_Slope measurement



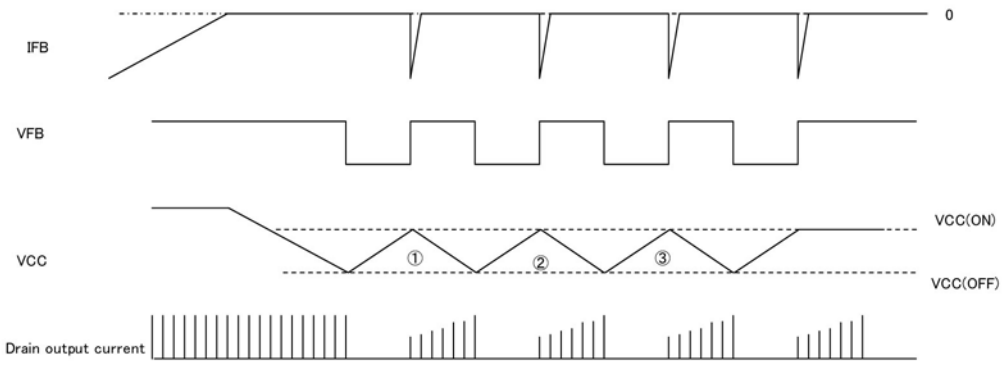
R_slope ; {(ILIMIT at Duty=30%) - (ILIMIT at Duty=10%)} / {(Ton at Duty=30%) - (Ton at Duty=10%)}

■ Electrical Characteristics (continued) T_C = 25°C±3°C

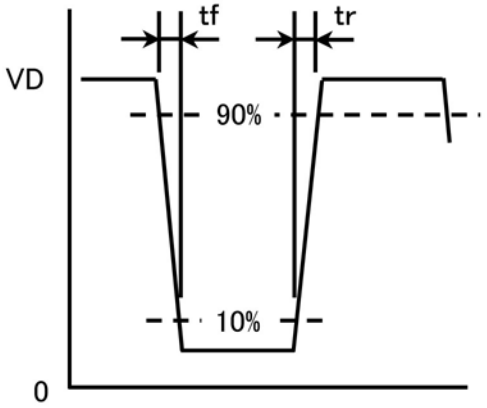
2. *3: Timer intermittent over load protection diagram



*4: OLP is disabled when MAXDC operation



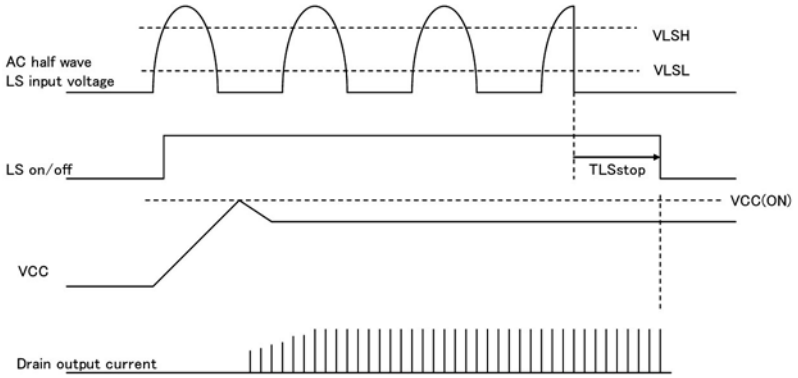
*5: tr, tf measurement



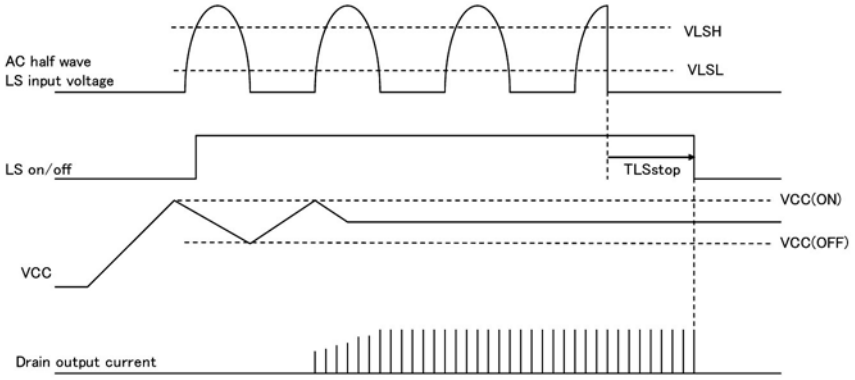
■ Electrical Characteristics (continued) $T_C = 25°C \pm 3°C$

3. Start up and Stop diagram

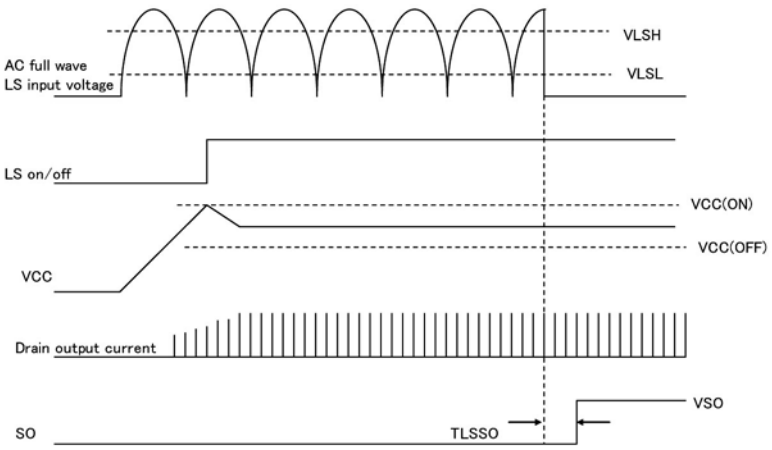
(A) Usual start and stop of LS start/stop mode (SO is connected to VDD)



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



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



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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

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