MIP5530MD

Silicon MOS FET type integrated circuit

■ Features

- Possible to correspond to the output about 30 W by the world wide input. (with heat sink)
- Typical LED peak current : 1.5 A
- With built-in LED short-circuit protection function.
- Input voltage detecting function is used, and the protection at a low input voltage is possible.
- Possible to correspond to the PWM dimming method and the triac light dimmer.
- Over temperature protection for IPD (Auto-restart)

■ Applications

- LED-lighting
- HB-LED drive circuit

■ Package

- Code
  TO-220IPD7-A2
- Pin Name

1. VIN	5. VDD
2. EX	6. —
3. CL	7. DRAIN
4. SOURCE	

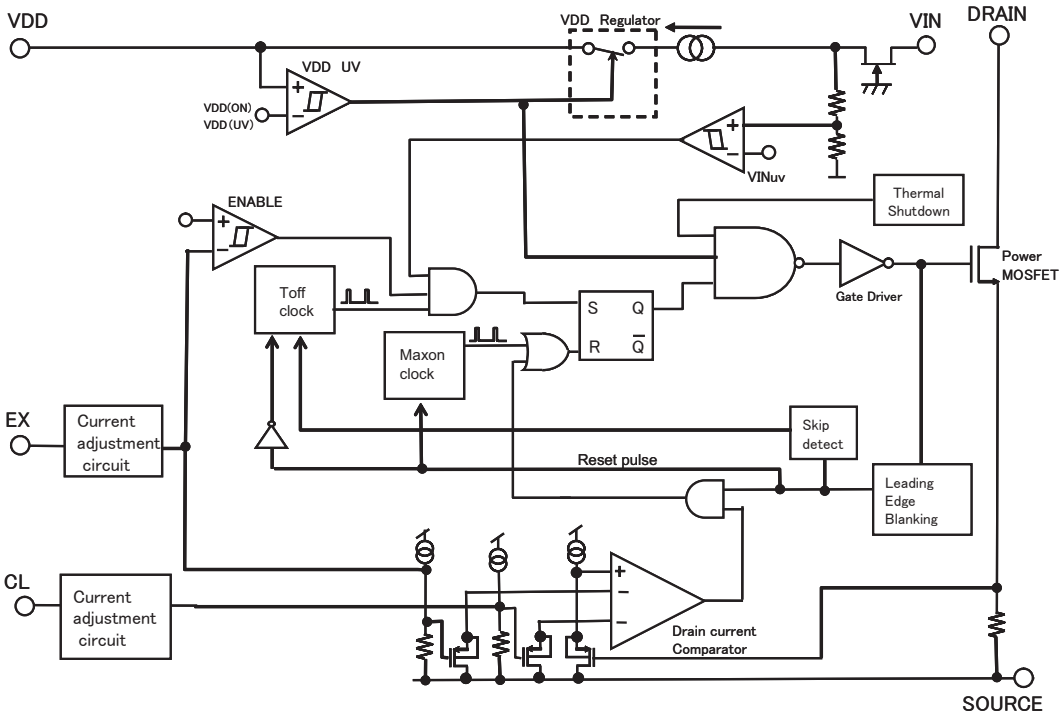
■ Marking Symbol: MIP553MD

■ Absolute Maximum Ratings $T_a = 25°C \pm 3°C$

Parameter	Symbol	Rating	Unit
DRAIN voltage	VD-S	– 0.3 to +700	V
VIN voltage	VIN-S	– 0.3 to +440	V
VDD voltage	VDD-S	– 0.3 to +8.0	V
EX voltage	VEX-S	– 0.3 to +7.2	V
CL voltage	VCL-S	– 0.3 to +7.2	V
Peak drain current *	IDP	3.5	A
Channel temperature	Tch	150	°C
Storage temperature	Tstg	−55 to +150	°C

Note) *: IDP is guaranteed at the pulse width narrower than MIN(PW).

■ Block Diagram



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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Control functions						
Constant OFF time	Toff	VDD = VDD(ON) + 0.1 V, VD = 5 V, VIN = 50 V, IEX = 0 µA, ICL = ICLmax + 50 µA	14.4	16	17.6	µs
Skip mode constant OFF time	Toff_skip		3.75 × Toff	5.0 × Toff	6.25 × Toff	µs
Maximum ON time	MAXon		69.6	80	90.4	µs
VDD start voltage	VDD(ON)	VD = 5 V, VIN = 50 V, IEX = 0 µA, ICL = ICLmax + 50 µA	6.00	6.50	7.00	V
VDD stop voltage	VDD(UV)		5.00	5.50	6.00	V
Circuit current before start	IS1	VDD = VDD(ON) – 0.2 V, VD = 5 V, VIN = 50 V, IEX = 0 µA, ICL = ICLmax + 50 µA	0.61	1.02	1.43	µA
Circuit current under switching	IS2	VDD = VDD(ON) + 0.1 V, VD = 5 V, VIN = 50 V, IEX = 0 µA, ICL = ICLmax + 50 µA	0.62	1.03	1.44	µA
EX pin current for setting ILIMITmin *	IEXH	VDD = VDD(ON) + 0.1 V, ICL = ICLmax + 50 µA, VIN = 50 V, ILIMIT = ILIMITmin *Fig. 2		260		µA
EX pin current at oscillation stop	IEXoff	VDD = VDD(ON) + 0.1 V, ICL = ICLmax + 50 µA, VIN = 50 V *Fig. 2	300	420	560	µA
EX pin current hysteresis at oscillation restart	IEXhys			50		µA
EX pin voltage	VEXM	VDD = VDD(ON) + 0.1 V, ICL = ICLmax + 50 µA, IEX = 150 µA, VIN = 50 V	1.94	2.55	3.16	V
	VEXH	VDD = VDD(ON) + 0.1 V, ICL = ICLmax + 50 µA, IEX = IEXH, VIN = 50 V	2.08	2.75	3.42	V
	VEXoff	VDD = VDD(ON) + 0.1 V, ICL = I CLmax+50 µA, IEX = IEXoff, VIN = 50 V	2.43	3.20	3.97	V
EX pin short current	IEXSVDD	VDD = VDD(ON) + 0.1 V, ICL = ICLmax + 50 µA, VEX = VDD, VIN = 50 V	0.52	0.95	1.38	mA
	IEX0	VDD = VDD(ON) + 0.1 V, ICL = ICLmax + 50 µA, VEX = 0 V, VIN = 50 V		0		µA
CL pin current for setting ILIMITmax	ICLmax	VDD = VDD(ON) + 0.1 V, IEX = 0 µA, VIN = 50 V, ILIMIT = ILIMITmax *Fig. 3	264	300	336	µA
CL Pin Voltage	VCLmax	VDD = VDD(ON) + 0.1 V, IEX = 0 µA, VIN = 50 V, ICL = ICLmax	2.20	2.90	3.60	V
CL pin short current	ICLSVDD	VDD = VDD(ON) + 0.1 V, IEX = 0 µA, VIN = 50 V, VCL = VDD	0.72	1.3	1.89	mA
	ICL0	VDD = VDD(ON) + 0.1 V, IEX = 0 µA, VIN = 50 V, VCL = 0 V		0		µA

Note) *: Design guaranteed item

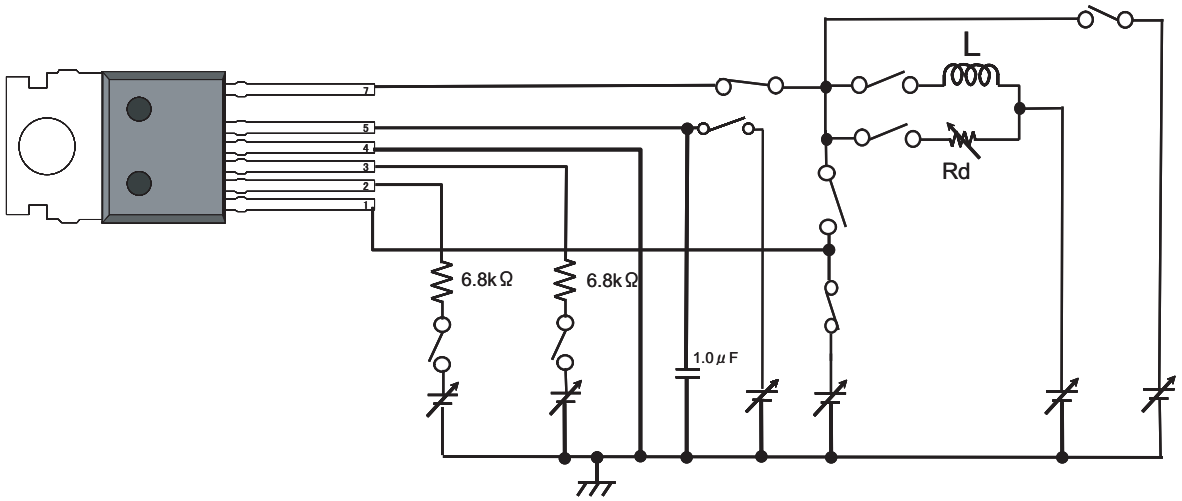
■ Electrical Characteristics (continued) T_a = 25°C±3°C

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Circuit protections						
Maximum peak current LIMIT	ILIMITmax	VDD = VDD(ON) + 0.1 V, ICL = ICLmax + 50 µA, VIN = 50 V, IEX= 0 µA *Fig. 1, 2, 3	1.395	1.50	1.605	A
ILIMIT ICL100 *	ILIMITCLL	VDD = VDD(ON) + 0.1 V, IEX = 0 µA, VIN = 50 V, ICL = 100 µA *Fig. 1, 3		0.57		A
ILIMIT IEX150	ILIMITexm	VDD = VDD(ON) + 0.1 V, ICL = ICLmax + 50 µA, VIN = 50 V, IEX = 150 µA *Fig. 1, 2	0.69	0.75	0.81	A
Minimum clamp ILIMIT	ILIMITmin	VDD = VDD(ON) + 0.1 V, ICL = ICLmax + 50 µA, VIN = 50 V, IEX = IEXH + 20 µA *Fig. 1, 2	0.10	0.20	0.35	A
Leading edge blanking delay *	$t_{on(BLK)}$	VDD = VDD(ON) + 0.1 V, ICL = ICLmax + 50 µA, VIN = 50 V, IEX = 0 µA	150	200	250	ns
Peak current limit delay *	$t_{d(OCL)}$			200		ns
Minimum on-pulse width	MIN(PW)	VIN = 50 V, VD = 35 V, IEX = 0 µA, ICL = ICLmax + 50 µA		410	570	ns
Skip detect on-pulse width *	Skip(PW)			MIN(PW) +100		ns
Thermal shutdown junction temperature *	TOTPJ		130	140	150	°C
Thermal shutdown hysteresis *	TOTPJ(hys)			70		°C
Output						
ON-state resistance	RDS(ON)	VDD = VDD(ON) + 0.1 V, ICL = ICLmax + 50 µA, VIN = 50 V, IEX = 0 µA, IDS = 300 mA		3.5	4.25	Ω
OFF-state leakage current of DRAIN pin	IDSS	VDD = VDD(ON)+0.1 V, IEX = IEXoff + 20 µA, VD = 630 V		1.0	10	µA
Breakdown voltage of DRAIN pin	VDSS	VDD = VDD(ON) + 0.1 V, IEX = IEXoff + 20 µA, ID = 100 µA	700			V
Rise time	t_r	VDD = VDD(ON) + 0.1 V, ICL = ICLmax + 50 µA, VIN = 50 V, IEX = 0 µA, VD = 5 V *Fig. 4		90		ns
Fall time	t_f			30		ns
High Voltage Input						
OFF-state leakage current of VIN pin	IIN(LEAK)	VDD = VDD(ON) + 0.1 V, IEX = IEXoff + 20 µA, VIN = 400 V		26	50	µA
Breakdown voltage of VIN pin	BVVIN	VDD = VDD(ON) + 0.1 V, IEX = IEXoff + 20 µA, IIN = 100 µA,	440			V
VDD charging current	CHRG10	VIN = 40 V, VDD = 0 V, EX, CL: open	–14.6	–10.0	–5.4	mA
	CHRG15	VIN = 40 V, VDD = 5 V, EX, CL: open	–9.8	–6.5	–3.3	mA
VIN start voltage	VINuv	VDD: open, VD = 5 V, IEX = 0 µA, ICL=ICLmax+50 µA,	17	23	33	V
VIN start voltage hysteresis	VINhys			4.0		V

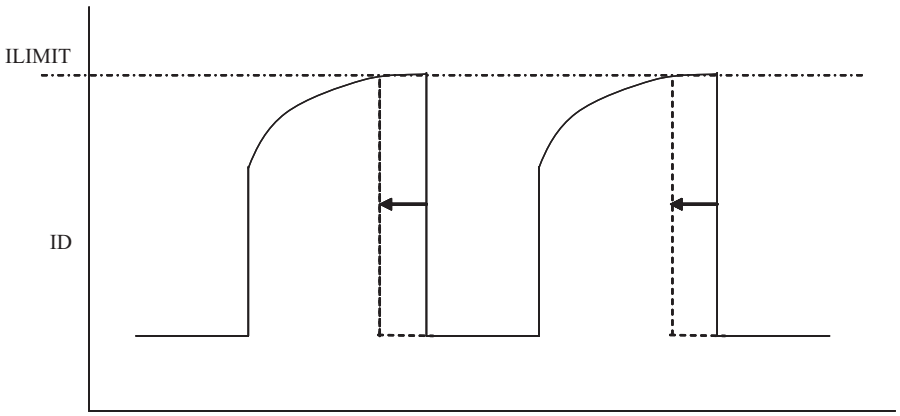
Note) *: Design guaranteed item

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

1. Measurement circuit

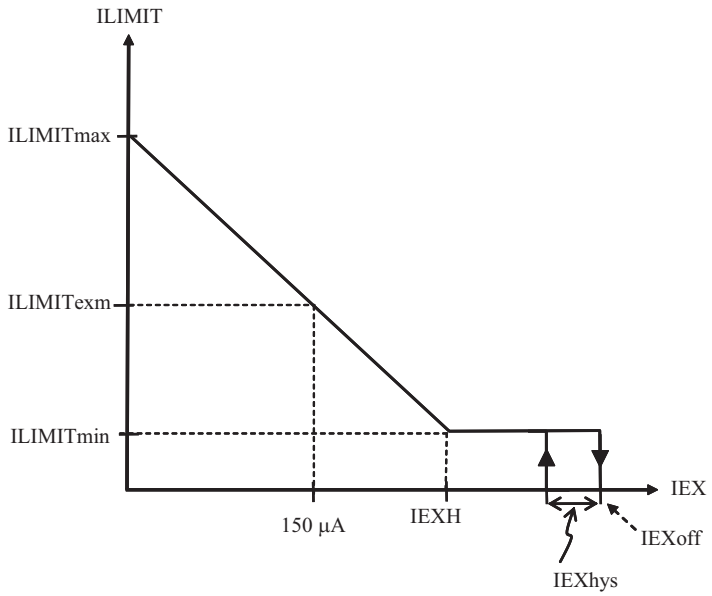


2. Figure.1 ILIMIT measurement



*The load condition of ILIMIT measurement is L = 100 μH, Rd = 130 Ω

Figure2 IEX-ILIMIT characteristic



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

Figure. 3 ICL-ILIMIT characteristic

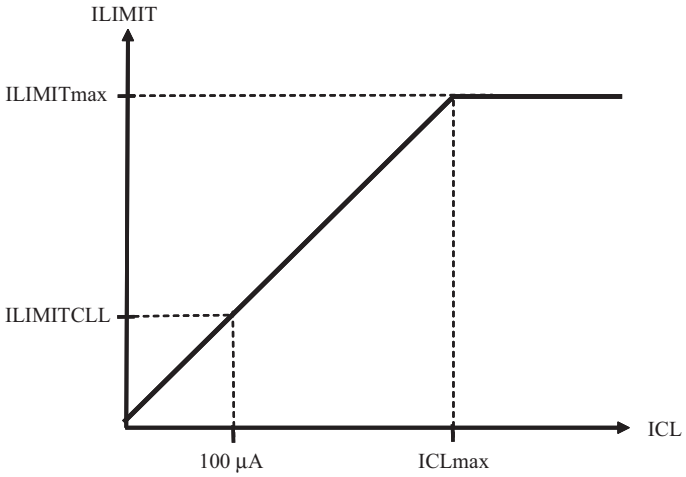
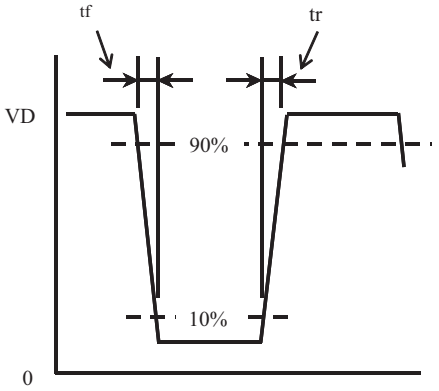


Figure. 4 t_r , t_f characteristic



■ Usage Notes

Connect a ceramic capacitor with value >1.0 µF between VDD pin and GND.

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, EX, CL).
(2) VIN pin short to low voltage pin (VDD, EX, CL).
(3) VIN pin short to DRAIN pin under switching.
(4) DRAIN pin short to SOURCE pin.

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