

# MIP2K40MS

## Silicon MOS FET type integrated circuit

### ■ Features

- Built-in jitter function
- Built-in charge protection circuit
- Built-in overheating, loadshorting and overvoltage protection circuits

### ■ Applications

- Chargers (for DSC, etc.)
- AC adapter

### ■ Package

- Code  
DIP7-A1
- Pin Name
 

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

### ■ Absolute Maximum Ratings $T_a = 25^\circ\text{C} \pm 3^\circ\text{C}$

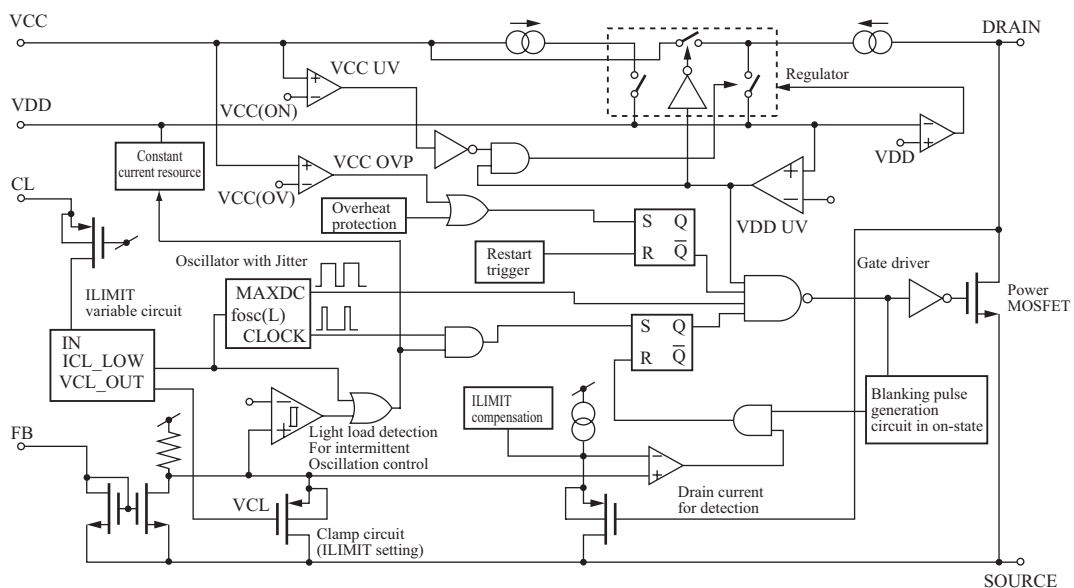
Parameter	Symbol	Rating	Unit
DRAIN voltage	VD	-0.3 to +700	V
VCC voltage	VCC	-0.3 to +45	V
VDD voltage	VDD	-0.3 to +8	V
Feedback voltage	VFB	-0.3 to +8	V
Feedback current	IFB	500	$\mu\text{A}$
CL pin voltage	VCL	-0.3 to +8	V
CL pin current	ICL	150	$\mu\text{A}$
Output peak current *	IDP	2.2	A
Channel temperature	Tch	150	$^\circ\text{C}$
Storage temperature	Tstg	-55 to +150	$^\circ\text{C}$

### ■ Marking Symbol: MIP2K4

Note) \*: The guarantee within the following pulse width.

$$\text{Leading edge blanking delay} + \text{Current limit delay} = t_{on}(\text{BLK}) + t_d(\text{OCL})$$

### ■ Block Diagram



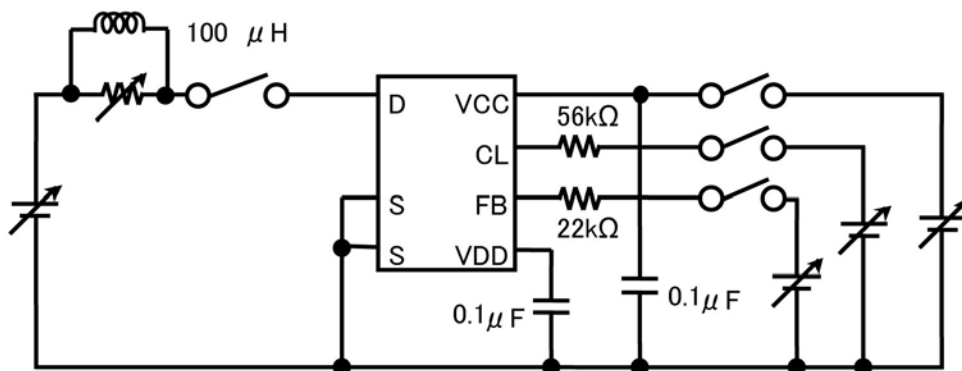
■ Electrical Characteristics  $T_C = 25^\circ\text{C} \pm 2^\circ\text{C}$

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Control functions						
Output frequency	fosc	VCC = 15 V, VD = 5 V, IFB = 20 $\mu\text{A}$ , ICL = 50 $\mu\text{A}$	90	100	110	kHz
	fosc(L)	VCC = 15 V, VD = 5 V, IFB: Open, ICL < ICL1	9	12	15	kHz
Jitter frequency deviation	$\Delta f$	VCC = 15 V, VD = 5 V, IFB = 20 $\mu\text{A}$ , ICL = 50 $\mu\text{A}$		5.5		kHz
Jitter frequency modulation rate	fM	VCC = 15 V, VD = 5 V, IFB = 20 $\mu\text{A}$ , ICL = 50 $\mu\text{A}$		260		Hz
Maximum duty cycle	MAXDC	VCC = 15 V, VD = 5 V, IFB = 20 $\mu\text{A}$ , ICL = 50 $\mu\text{A}$	45	47.5	50	%
VDD voltage	VDD	VCC = 15 V, VD = 5 V, IFB = 20 $\mu\text{A}$ , ICL = 50 $\mu\text{A}$	5.4	5.9	6.4	V
UV lockout threshold voltage	VUV	VD = 5 V, IFB = 20 $\mu\text{A}$ , ICL = 50 $\mu\text{A}$	4.6	5.1	5.6	V
VCC start voltage	VCC(ON)	VD = 5 V, IFB = 20 $\mu\text{A}$ , ICL = 50 $\mu\text{A}$	5.9	6.9	7.9	V
VCC charge stop threshold voltage	VCC1	VD = 40 V, FB: Open, CL: Open	10	11	12	V
Feedback threshold voltage	IFB1	ON $\rightarrow$ OFF VCC = 15 V, VD = 5 V, ICL = 50 $\mu\text{A}$	78	130	182	$\mu\text{A}$
Feedback hysteresis current	IFBHYS	VCC = 15 V, VD = 5 V, ICL = 50 $\mu\text{A}$		6		$\mu\text{A}$
FB pin current at heavy load	IFB0	ICC0 $\rightarrow$ ICC VCC = 15 V, VD = 5 V, ICL = 50 $\mu\text{A}$	10	15	20	$\mu\text{A}$
FB pin voltage	VFB	VCC = 15 V, VD = 5 V, IFB = 20 $\mu\text{A}$ , ICL = 50 $\mu\text{A}$	0.7	1.0	1.3	V
Supply current	ICC	VCC = 15 V, VD = 5 V, IFB = 20 $\mu\text{A}$ , ICL = 50 $\mu\text{A}$	0.27	0.47	0.57	mA
Supply current at light load	ICC(OFF)	VCC = 15 V, VD = 5 V, IFB = IFB1 + 5 $\mu\text{A}$ , ICL = 50 $\mu\text{A}$	0.28	0.35	0.43	mA
Supply current at heavy load	ICC0	VCC = 15 V, VD = 5 V, IFB: Open, ICL = 50 $\mu\text{A}$	0.48	0.63	0.78	mA
VDD charging current	Ich1	VDD = 0 V, VD = 40 V, FB: Open, CL: Open	-9	-6	-4	mA
	Ich2	VDD = 4 V, VD = 40 V, FB: Open, CL: Open	-4.5	-2.3	-1	mA
CL pin voltage	VCL	VCC = 15 V, VD = 5 V, FB: Open, ICL = ICL1	2.0	2.3	2.6	V
Dropped fosc CL pin current *2	ICL1	fosc $\rightarrow$ fosc(L) VCC = 15 V, VD = 5 V, FB: Open	16.5	22	27.5	$\mu\text{A}$
CL pin hysteresis current *2	ICLHYS	VCC = 15 V, VD = 5 V, FB: Open		1.5		$\mu\text{A}$

■ Electrical Characteristics (continued)  $T_C = 25^{\circ}C \pm 2^{\circ}C$

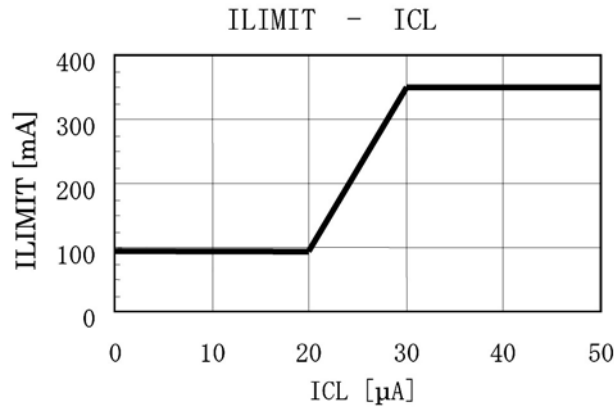
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>Circuit protections</b>						
Self protection current limit *1,3	ILIMIT	VCC = 15 V, FB: Open, ICL = 50 $\mu$ A, DUTY = 30%	0.63	0.70	0.77	A
ILIMIT modified coefficient *1,3	R_slope	VCC = 15 V, FB: Open, ICL = 50 $\mu$ A		44		mA/ $\mu$ s
Minimum ILIMIT	ILIMITmin	Ton = 3 $\mu$ s, VCC = 15 V, FB: Open, ICL = 0 $\mu$ A	110	190	270	mA
Drain current at light load	ID(OFF)	Ton = 3 $\mu$ s, VCC = 15 V, IFB = IFB1 + IFBHYS, ICL = 50 $\mu$ A	50	140	230	mA
Leading edge blanking delay	ton(BLK)	VCC = 15 V, FB: Open, ICL = 50 $\mu$ A	280	350	420	ns
Current limit delay	td(OCL)		100	150	200	ns
Over voltage protection	VCC(OV)	VD = 5 V, FB: Open, ICL = 50 $\mu$ A	21	23.5	26	V
Thermal shutdown temperature	TOTP		130	140	150	$^{\circ}C$
<b>Output</b>						
Power up reset threshold voltage	VDDreset		1.8	2.6	3.5	V
ON state resistance	RDS(ON)	ID = 100 mA		7	9.5	$\Omega$
OFF state current	IDSS	VCC = 26 V, VD = 650 V, FB: Open, CL: Open		10	20	$\mu$ A
Breakdown voltage	VDSS	VCC = 26 V, ID = 100 $\mu$ A, FB: Open, CL: Open	700			V
Rise time *4	tr	VCC = 15 V, VD = 5 V, FB: Open, ICL = 50 $\mu$ A		100		ns
Fall time *4	tf	VCC = 15 V, VD = 5 V, FB: Open, ICL = 50 $\mu$ A		50		ns
<b>Supply voltage characteristics</b>						
Drain supply voltage	VD(MIN)	VCC: Open, FB: Open, CL: Open	50			V

Note) 1. Measurement circuit

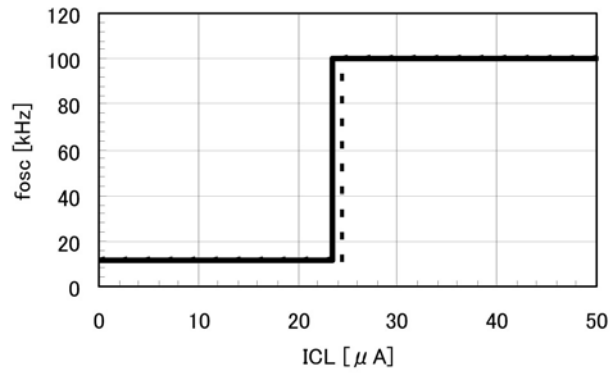


■ Electrical Characteristics (continued)  $T_C = 25^{\circ}C \pm 2^{\circ}C$

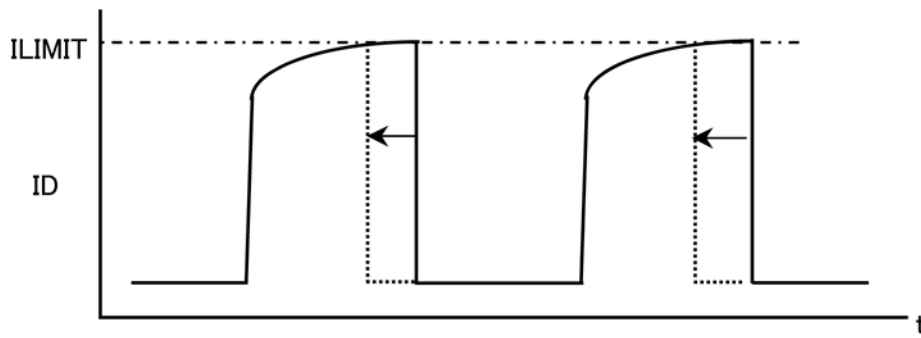
2. \*1: ILIMIT vs. ICL Typical characteristic



\*2: fosc vs. ICL Typical characteristic

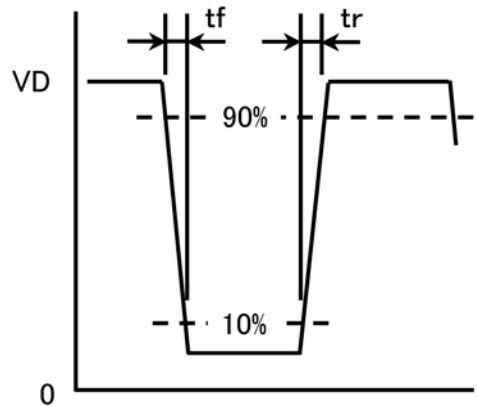


\*3: ILIMIT Measurement



$$R_{slope} ; \{ (ILIMIT \text{ at Duty}=30\%) - (ILIMIT \text{ at Duty}=10\%) \} / \{ (Ton \text{ at Duty}=30\%) - (Ton \text{ at Duty}=10\%) \}$$

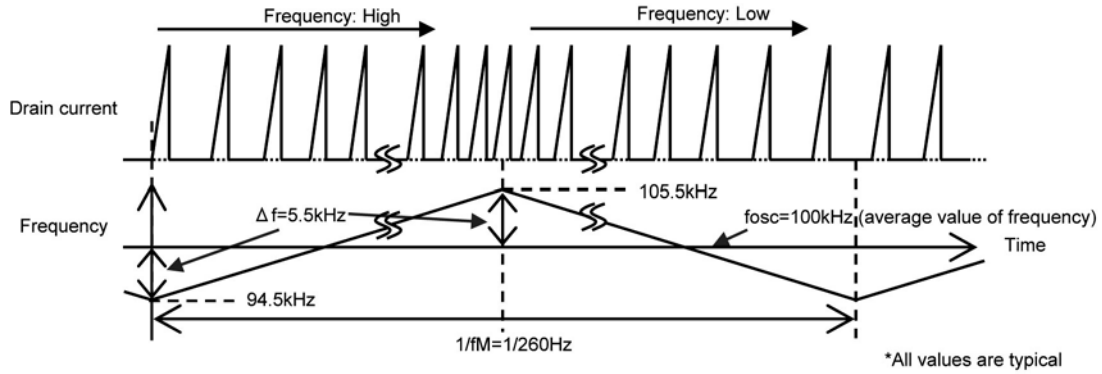
\*4: tr, tf Measurement



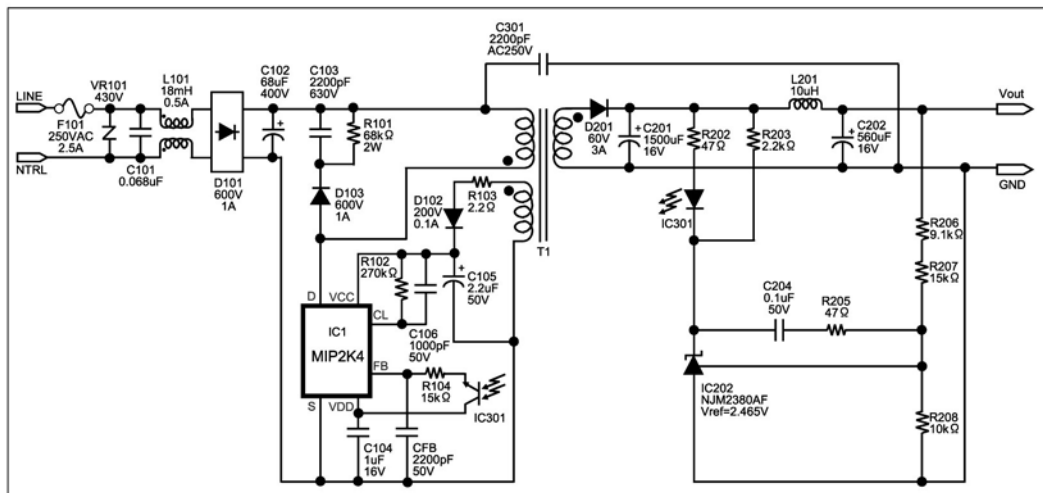
■ Frequency jitter function

By frequency jitter function, frequency jitter variation( $\Delta f$ ) changes periodically, by frequency of frequency jitter modulation factor ( $f_M$ ) as shown below.

$f_{osc} = 100 \text{ kHz (typ.)}$ ,  $\Delta f = 5.5 \text{ kHz (typ.)}$ ,  $f_M = 260 \text{ Hz (typ.)}$

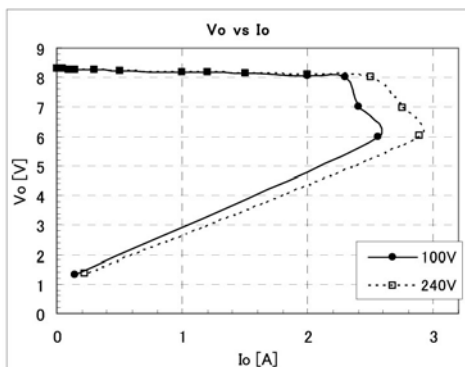


■ Adapter circuit sample (MIP2K4)

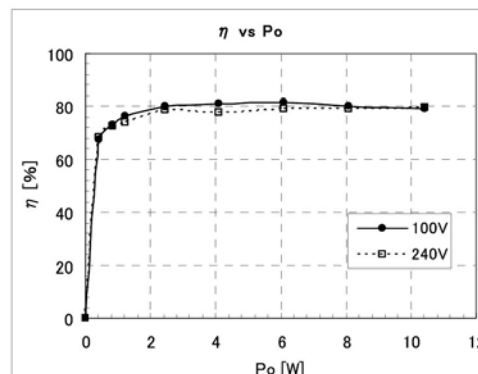


■ Electric characteristics (MIP2K4 : Worldwide input, 8.3V/1.5A output)

VI characteristics of adapter circuit



Power efficiency



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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**	<ul style="list-style-type: none"> <li>· Japanese companies in Japan</li> <li>· Japanese companies in Asia (50% or more owned)</li> </ul>	<ul style="list-style-type: none"> <li>· Companies in European and American countries</li> <li>· Asian companies in Asia</li> <li>· Other local companies</li> </ul>	<ul style="list-style-type: none"> <li>· For power supply</li> <li>· For DC-DC converter</li> </ul>
MIP00** MIP55** MIP816/826	MIP52** MIP56** MIP9E**	MIP53** MIP803/804	<ul style="list-style-type: none"> <li>· Japanese companies in Japan</li> <li>· Japanese companies in Asia (50% or more owned)</li> <li>· Asian companies in Asia</li> </ul>	<ul style="list-style-type: none"> <li>· Companies in European and American countries</li> <li>· Other local companies</li> </ul>	<ul style="list-style-type: none"> <li>· For power supply</li> <li>· For EL driver</li> <li>· For LED lighting driver</li> </ul>
MIP50**	MIP51**	MIP7**	<ul style="list-style-type: none"> <li>· No restrictions in terms of contract</li> </ul>	<ul style="list-style-type: none"> <li>· No restrictions in terms of contract</li> </ul>	<ul style="list-style-type: none"> <li>· For lamp driver/ car electronics accessories</li> </ul>

Note) For details, contact our sales division.