

CURRENT MODE FLYBACK PWM SWITCHING REGULATOR

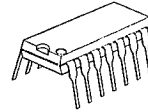
■ GENERAL DESCRIPTION

NJM2362 is the current mode flyback type, switching supply voltage IC.

Totempole type output, which can drive MOSFET in high speed operation directly.

As to the functional protection, internalizing UVLO that can prevent from miss motion at low input voltage operation, pulse by pulse current limit for primary current of transformer, remote off circuit that can stop the entire motions by the external voltage, the over saturate protection circuit that stops the output by detecting the saturated state of the transformer.

■ PACKAGE OUTLINE

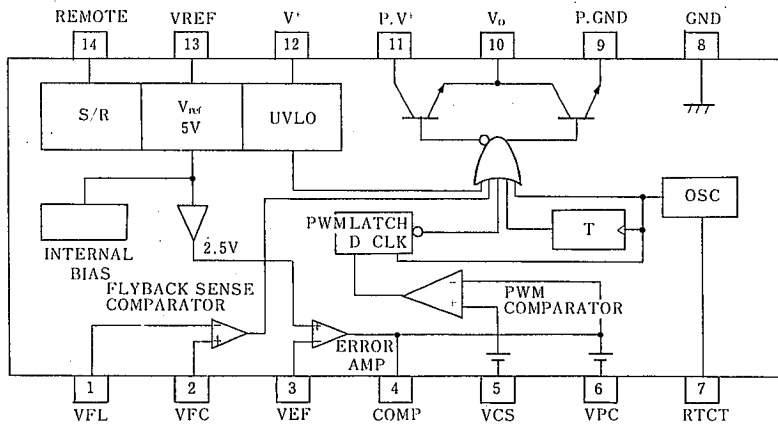


NJM2362D

■ FEATURES

- Operating Voltage (9V~20V)
- Latching PWM for Cycle-By-Cycle Current Limiting
- Under Voltage Lockout (UVLO)
- Internal Remote Shut-Down Circuit
- Package Outline DIP14
- Bipolar Technology

■ BLOCK DIAGRAM & PIN CONFIGURATION



NJM2362D

## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V <sup>+</sup>	20	V
Power Dissipation	P <sub>d</sub>	700	mW
Operating Temperature Range	T <sub>opr</sub>	-20~+75	°C
Storage Temperature Range	T <sub>stg</sub>	-40~+125	°C

## ■ ELECTRICAL CHARACTERISTICS

(Ta=25°C, V<sup>+</sup>=15V)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I <sub>CC</sub>	—	—	14.0	18.0	mA
Start up Current	I <sub>CS</sub>	V <sup>+</sup> =6.5V	—	1.0	1.5	mA

## ■ REFERENCE VOLTAGE

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V <sub>R</sub>	I <sub>REF</sub> =1mA	4.80	5.00	5.20	V
Line Regulation	ΔV <sub>R</sub> -V <sup>+</sup>	10≤V <sup>+</sup> ≤20V	—	12.0	35.0	mV
Load Regulation	ΔV <sub>R</sub> -I <sub>O</sub>	1≤I <sub>O</sub> ≤20mA	—	6.0	25.0	mV
Temperature Stability	T <sub>R</sub>	0≤T <sub>h</sub> ≤75°C	—	0.5	—	mV/°C
Short Circuit Current	I <sub>S</sub>	*1	50	80	120	mA

## ■ UVLO

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Start Threshold Voltage	V <sub>STH</sub>		7.80	8.40	9.00	V
Minimum Operating Voltage	V <sub>MIN</sub>		7.00	7.60	8.20	V
Hysteresis width	V <sub>HYS</sub>		—	0.8	—	V

## ■ OSILLATION

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Oscillating Frequency	F <sub>O</sub>	C <sub>I</sub> =3.3nF, R <sub>I</sub> =10.4kΩ	45	50	55	kHz
Temperature Stability	ΔF <sub>O</sub> -T <sub>h</sub>	0≤T <sub>h</sub> ≤75°C	—	5	—	%
Output Amplitude	V <sub>F</sub>	7Pin Peak TO Peak	—	1.7	—	V

## ■ ERROR AMPLIFIER

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Bias Current	I <sub>EB</sub>	*1	—	0.3	2.0	μA
Open Loop Gain	A <sub>EO</sub>	2≤V <sub>O</sub> ≤4V	—	90	—	dB
Gain Bandwidth	GB <sub>E</sub>		—	1	—	MHz
Output Sink Current	I <sub>EK</sub>	V <sub>EF</sub> =2.7V, COMP=1.1V	2.0	6.0	—	mA
Output Source Current	I <sub>ES</sub>	V <sub>EF</sub> =2.3V, COMP=5.0V	0.5	0.8	—	mA

■ CURRENT DETECTOR

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Bias Current	I <sub>CB</sub>	*1	—	2.0	10.0	μA
Gain	G <sub>c</sub>	V <sub>EF</sub> =0V, *2	2.85	3.00	3.15	V
Current Limit Voltage Input Capacitance Range	V <sub>CLR</sub>	V <sub>PC</sub> =0.5V, R <sub>S</sub> =0.5Ω, I <sub>S</sub> =5A	0.42	0.50	0.58	V

■ FLYBACK COMPARATOR

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Bias Current	I <sub>FB</sub>	*1	—	0.3	2.0	μA
Input Voltage Range	V <sub>FR</sub>		0	—	V <sup>+</sup> -2	V

■ PWM

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Maximum Duty Cycle	T <sub>PMAX</sub>		—	48	—	%
Minimum Duty Cycle	T <sub>PMIN</sub>		—	—	0	%

■ REMOTE

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Remote Off Threshold	V <sub>RTH</sub>	*3	—	—	2.0	V
Remote Off Operating Supply Current	I <sub>RQ</sub>	V <sub>RTH</sub> =2V	—	1.5	2.0	mA

■ OUTPUT

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Low Level	V <sub>OL</sub> (1)	I <sub>sink</sub> =20mA	—	0.1	0.4	V
Output Low Level	V <sub>OL</sub> (2)	I <sub>sink</sub> =200mA	—	1.5	2.2	V
Output High Level	V <sub>OH</sub> (1)	I <sub>source</sub> =20mA	13.0	13.5	—	V
Output High Level	V <sub>OH</sub> (2)	I <sub>source</sub> =200mA	12.0	13.5	—	V
Fall up Time	t <sub>or</sub>	CL=1000PF	—	100	—	nS
Fall down Time	t <sub>or</sub>	CL=1000PF	—	100	—	nS

\*1 Displaying by the direction, Coming from IC.

\*2  $G_c = \Delta V_{COMP} / \Delta V_{CS}$ ;  $OV < V_{CS} < 0.8V$

\*3 Please apply the remote threshold Voltage under 20V, on normal operation.

## ■ TERMINAL FUNCTION

PIN NO.	SYMBOL	FUNCTION	INSIDE EQUIVALENT CIRCUIT
1 2	$V_{FL}$ $V_{FC}$	Comparator - Input Comparator + Input	
3	$V_{EF}$	Error Amplifier -Input	
4	COMP	Error Amplifier Output	
5 6	$V_{CS}$ $V_{PC}$	Comparator - Input Comparator + Input	

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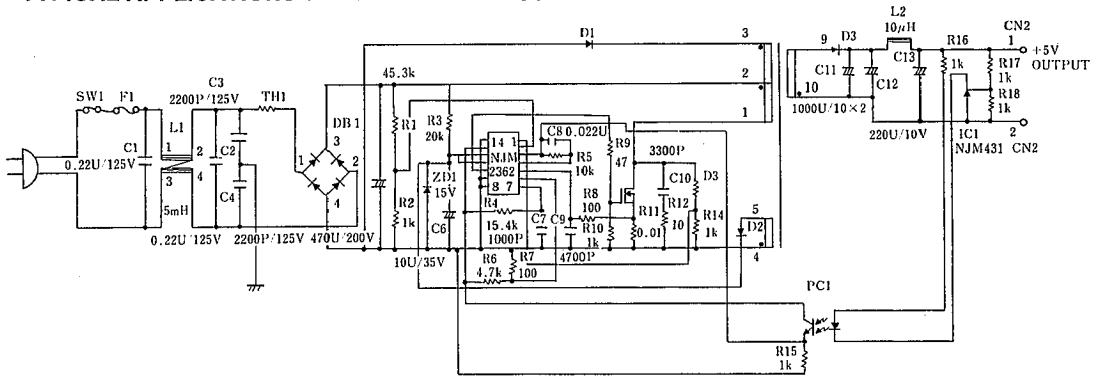
■ TEMINAL FUNCTION

PIN NO.	SYMBOL	FUNCTION	INSIDE EQUIVALENT CIRCUIT
7	RTCT	Connect the resistor, and capacitor and decide the oscillating Frequency $F_o = 1.72 / (RT * CT)$	
8	GND	Ground	
9	P. GND	Ground Connect to pin 8 when operation	
10	V0	Output It is totempole type output, and it can drive MOS FET directly	
11	V+	Supply Voltage	
12	P. V+	Supply Voltage Please Connect to pin 11 when application	
13	VREF	5V Reference Voltage Output	

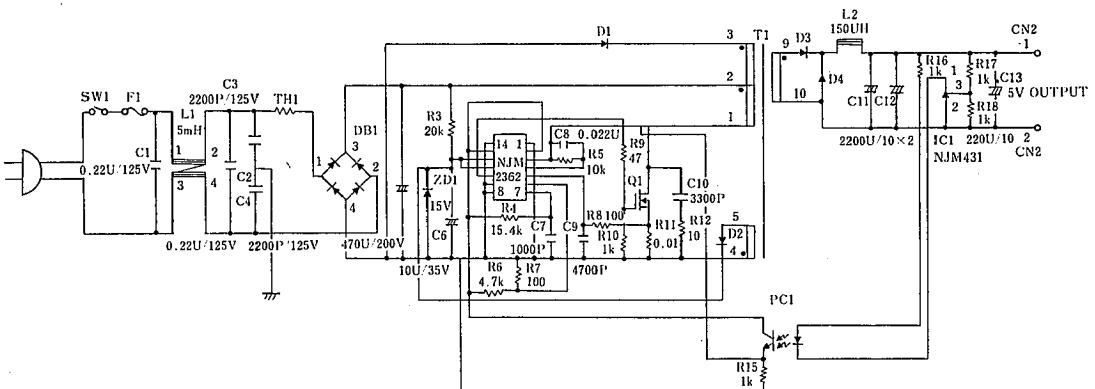
## ■ TERMINAL FUNCTION

PIN NO.	SYMBOL	FUNCTION	INSIDE EQUIVALENT CIRCUIT
14	Remote	Remote	

## ■ TYPICAL APPLICATIONS 1 FLYBACK FORM CONVERTER



## ■ TYPICAL APPLICATIONS 2 FORWARD FORM CONVERTER

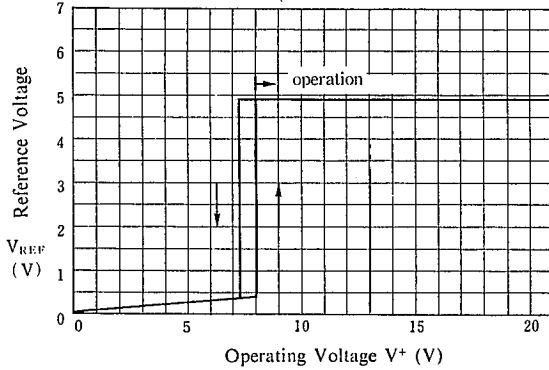




## ■ TYPICAL CHARACTERISTICS

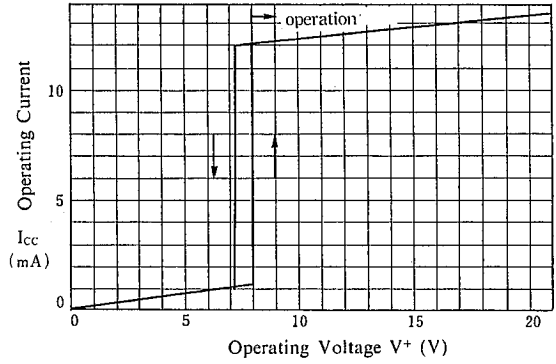
### Reference Voltage vs. Operating Voltage

( $T_a = 25^\circ\text{C}$ )



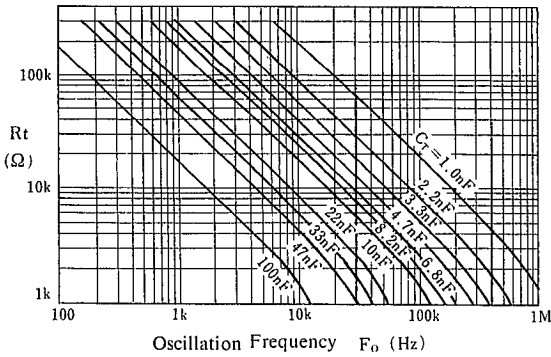
### Operating Current vs. Operating Voltage

( $T_a = 25^\circ\text{C}$ )



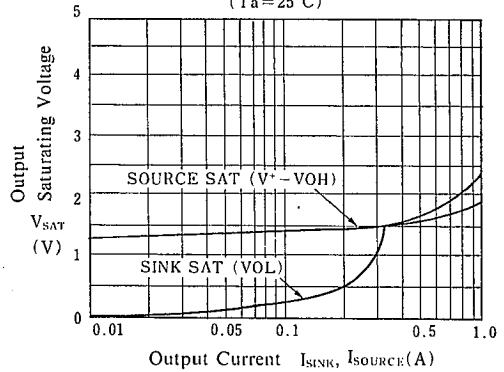
### Oscillation Frequency vs. Rt Ct

( $T_a = 25^\circ\text{C}$ )



### Output Saturating Voltage vs. Output Current

( $T_a = 25^\circ\text{C}$ )



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## MEMO

[CAUTION]

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