# 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.
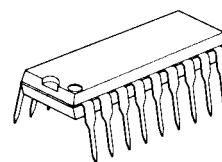
■ FEATURES

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

■ PACKAGE OUTLINE

NJM2362D

■ BLOCK DIAGRAM & PIN CONFIGURATION
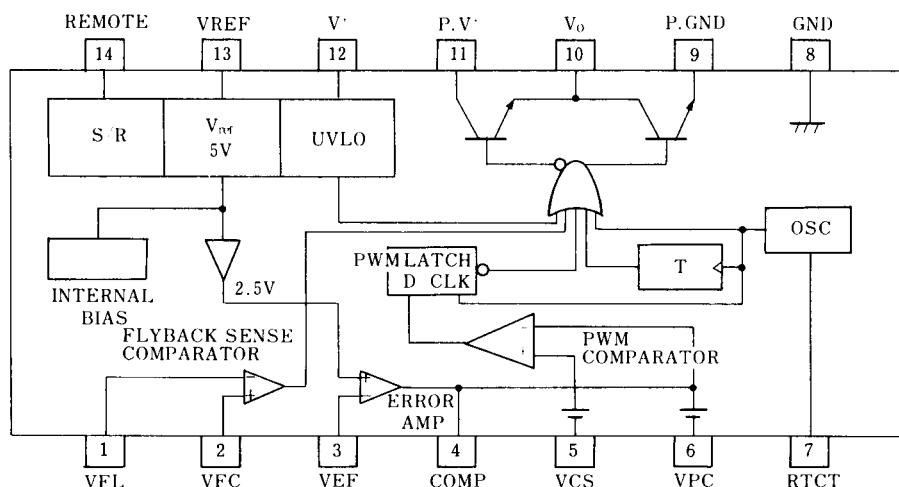
NJM2362D

NJM2362

■ ABSOLUTE MAXIMUM RATINGS (Ta = 25ºC)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V^+	20	V
Power Dissipation	P_D	700	mW
Operating Temperature Range	T_{opr}	-20 to + 75	ºC
Storage Temperature Range	T_{stg}	-40 to +125	ºC

■ ELECTRICAL CHARACTERISTICS (T_a = 25ºC, V^+ = 15V)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I_{CC}	-	-	14.0	18.0	mA
Start up Current	I_{CS}	V^+ = 6.5V	-	1.0	1.5	mA

■ REFERENCE VOLTAGE

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_R	I_{REF} = 1mA	4.80	5.00	5.20	V
Line Ragulation	ΔV_R - V^+	$10 \leq V^+ \leq 20V$	-	12.0	35.0	mV
Load Regulation	ΔV_R - I_O	$1 \leq I_O \leq 20mA$	-	6.0	25.0	mV
Temperature Stability	T_R	$0 \leq T_a \leq 75ºC$	-	0.5	-	mV/ºC
Short Circuit Current	I_S	*1	50	80	120	mA

■ UVLO

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Start Threshold Voltage	V_{STH}		7.80	8.40	9.00	V
Minimum Operating Voltage	V_{MIN}		7.00	7.60	8.20	V
Hysterisis width	V_{HIS}		-	0.8	-	V

■ OSILLATION

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Osillating Frequency	F_O	C_t = 3.3NF, R_t =10.4kΩ	45	50	55	kHz
Temperature Stability	ΔF_O-T_a	$0 \leq T_a \leq 75ºC$	-	5	-	%
Output Amplitude	V_F	7Pin Peak TO Peak	-	1.7	-	V

■ ERROR AMPLIFIER

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Bias Current	I_{EB}	*1	-	0.3	2.0	µA
Open Loop Gain	A_{EO}	$2 \leq V_O \leq 4V$	-	90	-	dB
Gain Bandwidth	GB_E		-	1	-	MHz
Output Sink Current	I_{EK}	V_{EF} = 2.7V, COMP = 1.1V	2.0	6.0	-	mA
Output Source Current	I_{ES}	V_{EF} = 2.3V, COMP = 5.0V	0.5	0.8	-	mA

■ CURRENT DETECTOR

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Bias Current	I_{CB}	*1	-	2.0	10.0	µA
Gain	G_C	V_{EF} = OV, *2	2.85	3.00	3.15	V
Current Limit Voltage Input Capacitance Range	V_{CLR}	V_{PC} = 0.5V, R_S = 0.5Ω, I_S = 5A	0.42	0.50	0.58	V

■ FLYBACK COMPARATOR

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Bias Current	I_{FB}	*1	-	0.3	2.0	µA
Input Voltage Range	V_{FR}		0	-	V^+-2	V

■ PWM

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Maximum Duty Cycle	T_{PMAX}		-	48	-	%
Minimum Duty Cycle	T_{PMIN}		-	-	0	%

■ REMOTE

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Remote Off Threshold	V_{RTH}	*3	-	-	2.0	V
Remote Off Operating Supply Current	I_{RQ}	V_{RTH} = 2V	-	1.5	2.0	mA

■ OUTPUT

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Low Level	V_{OL}(1)	Isink = 20mA	-	0.1	0.4	V
Output Low Level	V_{OL}(2)	Isink = 200mA	-	1.5	2.2	V
Output High Level	V_{OH}(1)	Isource = 20mA	13.0	13.5	-	V
Output High Level	V_{OH}(2)	Isource = 200mA	12.0	13.5	-	V
Fall up Time	t_{or}	CL = 1000PF	-	100	-	nS
Fall down Time	t_{or}	CL = 1000PF	-	100	-	nS

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

*2   Gc = ΔVCOMP/ΔVCS ; OV<VCS < 0.8V

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

NJM2362

■ **TERMINAL FUNCTION**

PIN NO.	SYMBOL	FUCTION	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	

NJM2362

■ TERMINAL FUNCTION

PIN NO.	SYMBOL	FUCTION	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	
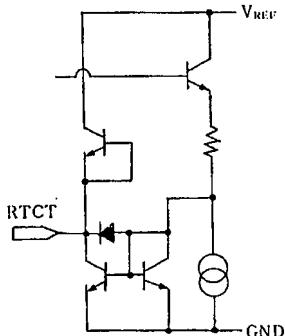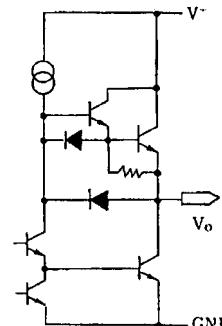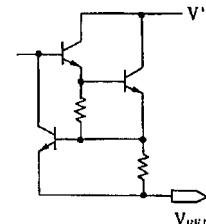
NJM2362

■ TERMINAL FUNCTION

PIN NO.	SYMBOL	FUCTION	EQUIVALENT CIRCUIT
14	Remote	Remote	

## ■ TYPICAL APPLICATIONS 1 FLYBACK FORM CONVERTER

■ TYPICAL APPLICATIONS 2 FORWARD FORM CONVERTER
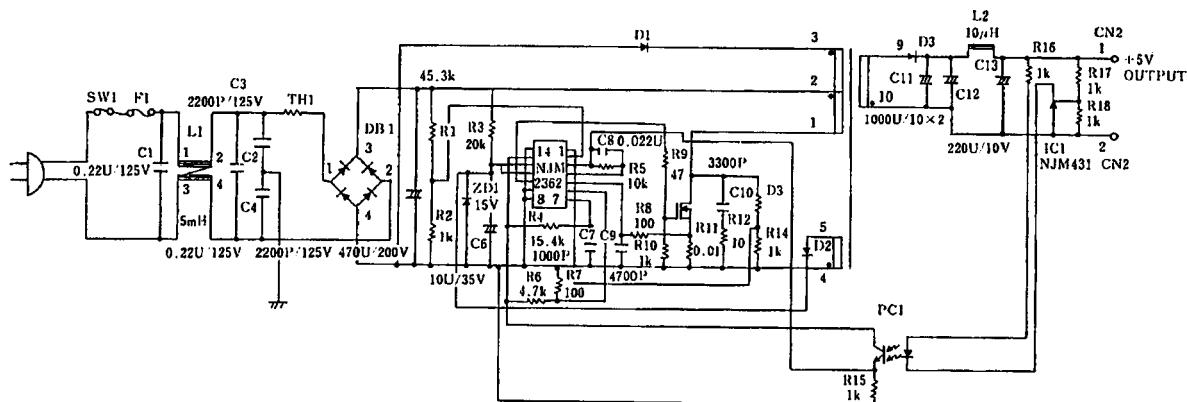
■ TYPICAL APPLICATIONS 3 DC/DC/ CONVERTER
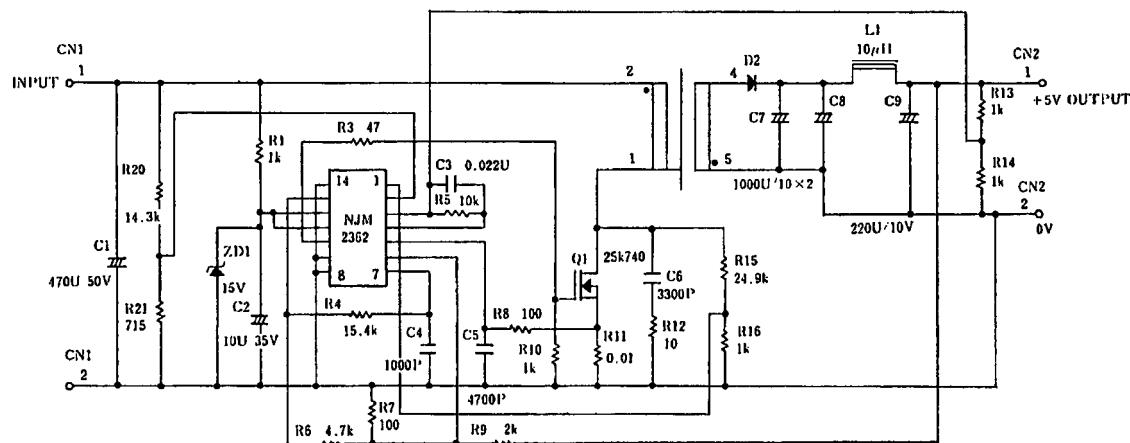
■ TYPICAL APPLICATIONS 4 2-OUTPUT TYPE DC/DC/ CONVERTER

NJM2362
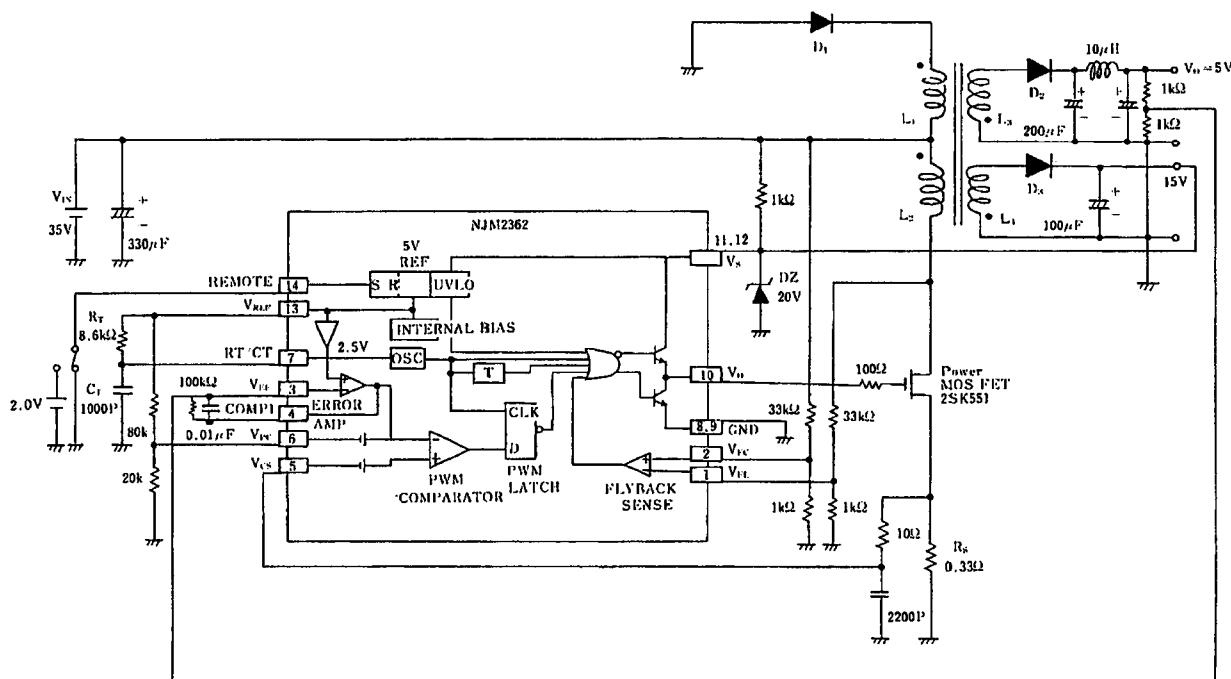
■ TYPICAL CHARACTERISTICS

Reference Voltage vs. Operating Voltage

$(Ta=25°C)$

Reference Voltage
V_{REF} (V)

operation

Operating Voltage V+ (V)
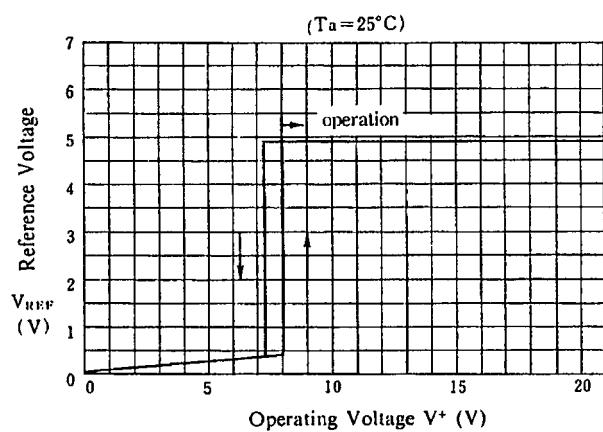
Operating Current vs. Operating Voltage

$(Ta=25°C)$

Operating Current
I_{CC} (mA)

operation

Operating Voltage V+ (V)
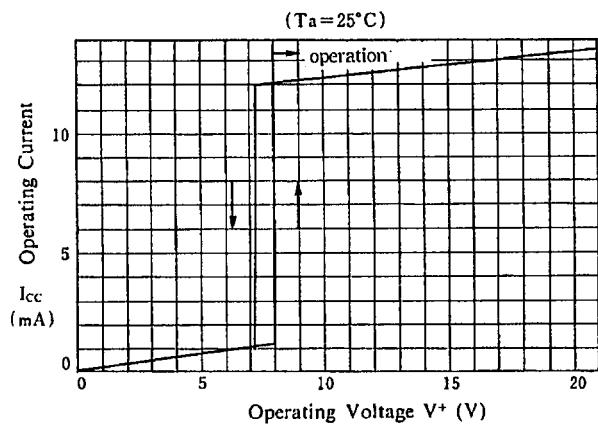
Oscillation Frequency vs. Rt Ct

$(Ta=25°C)$

Rt (Ω)

$Ct=1.0nF$
2.2nF
3.3nF
4.7nF
22nF
33nF
6.8nF
10nF
47nF
100nF

Oscillation Frequency F_o (Hz)
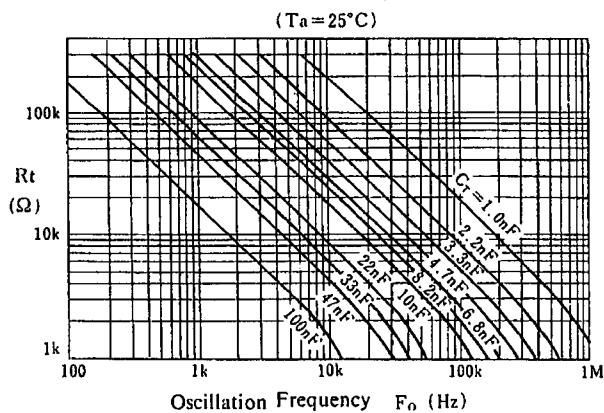
Output Saturating Voltage vs. Output Current

$(Ta=25°C)$

Output Saturating Voltage
V_{SAT} (V)

SOURCE SAT (V+ −VOH)

SINK SAT (VOL)

Output Current I_{SINK}, I_{SOURCE}(A)