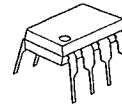


DC/DC CONVERTER CONTROL IC

■ GENERAL DESCRIPTION

The NJM2360 is a DC to DC converter control IC. Due to the internalization of a high current output switch, 1.5A switching operations are available. The NJM2360 is designed to be incorporated in step-up, step-down and inverting applications with a minimum number of external components. Output current is limited by an external resistor.

■ PACKAGE OUTLINE



NJM 2360D

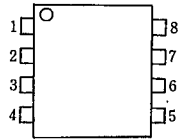


NJM2360M

■ FEATURES

- Operating Voltage (2.5V~40V)
- Low Standby Current
- Current Limiting
- Output Switch Current to 1.5A
- Supply Voltage  $V^+$  2.5~40V
- Output Voltage  $V_{OR}$  1.25~40V
- Oscillator Frequency  $f_{osc}$  100Hz~100kHz
- Package Outline DIP8, DMP8
- Bipolar Technology

■ PIN COFIGURATION

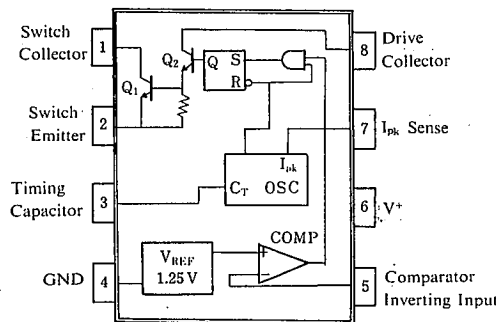


NJM2360D  
NJM2360M

PIN FUNCTION

1.  $C_S$
2.  $E_S$
3.  $C_T$
4. GND
5.  $INV_{IX}$
6.  $V^+$
7.  $S_I$
8.  $C_D$

■ BLOCK DIAGRAM



6

## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V <sup>+</sup>	40	V
Comparator Input Voltage Range	V <sub>IR</sub>	-0.3~V <sup>+</sup>	V
Power Dissipation	P <sub>D</sub>	(DIP8) 700	mW
		(DMP8) 600 (note 1)	mW
Switch Current	I <sub>sw</sub>	1.5	A
Operating Temperature Range	T <sub>opr</sub>	-40~+85	°C
Storage Temperature Range	T <sub>stg</sub>	-40~+125	°C

(note 1) At on PC board

## ■ ELECTRICAL CHARACTERISTICS

● DC Characteristics (V<sup>+</sup>=5V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I <sub>CC</sub>	5V ≤ V <sup>+</sup> ≤ 40V, C <sub>T</sub> = 0.001 μF S <sub>I</sub> = V <sup>+</sup> , INV <sub>IN</sub> > V <sub>th</sub> , E <sub>S</sub> = GND	—	2.4	3.5	mA

### Oscillator

Charge Current	I <sub>chg</sub>	5V ≤ V <sup>+</sup> ≤ 40V	20	35	50	μA
Discharge Current	I <sub>dischg</sub>	5V ≤ V <sup>+</sup> ≤ 40V	150	200	250	μA
Voltage Swing	V <sub>osc</sub>		—	0.5	—	V <sub>P-P</sub>
Discharge to Charge Current Ratio	I <sub>dischg</sub> /I <sub>chg</sub>	S <sub>I</sub> = V <sup>+</sup>	—	6	—	—
Peak Current Sense Voltage	V <sub>IPK(sense)</sub>	I <sub>chg</sub> = I <sub>dischg</sub>	250	300	350	mV

### Output Switch (Note 2)

Saturation Voltage 1	V <sub>CE(sat)1</sub>	Darlington Connection (C <sub>S</sub> = C <sub>D</sub> ) I <sub>sw</sub> = 1.0A	—	1.0	1.3	V
Saturation Voltage 2	V <sub>CE(sat)2</sub>	I <sub>sw</sub> = 1.0A, I <sub>C(driver)</sub> = 50mA (Forced β ≈ 20)	—	0.5	0.7	V
DC Current Gain	h <sub>FE</sub>	I <sub>sw</sub> = 1.0A, V <sub>CE</sub> = 5.0V	35	120	—	—
Collector Off-State Current	I <sub>C(off)</sub>	V <sub>CE</sub> = 40V	—	10	—	nA

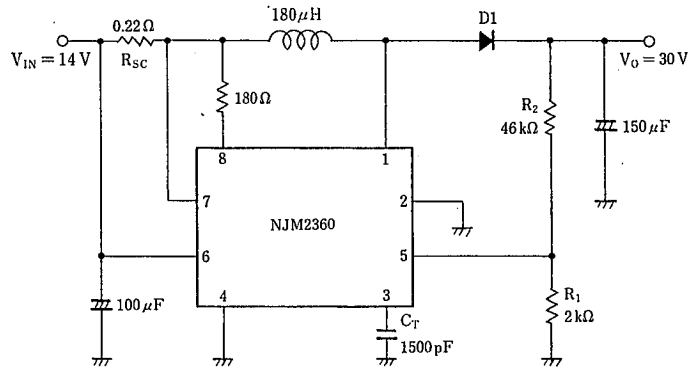
### Comparator

Threshold Voltage	V <sub>th</sub>		1.18	1.25	1.32	V
Input Bias Current	I <sub>IB</sub>	V <sub>IN</sub> = 0V	—	40	400	nA

Note 2 : Output switch tests are performed under pulsed conditions to minimize power dissipation.

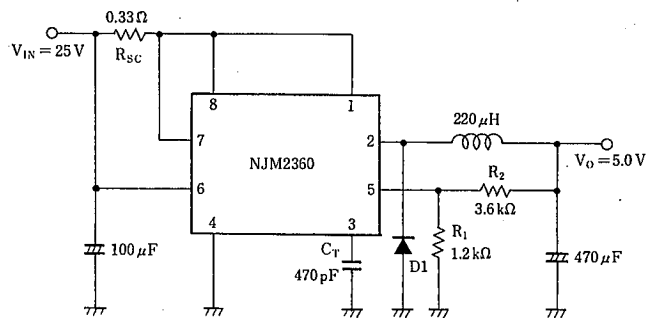
## ■ TYPICAL APPLICATIONS

### 1. Step-Up Converter.



\* D1 : SBD(EK14)

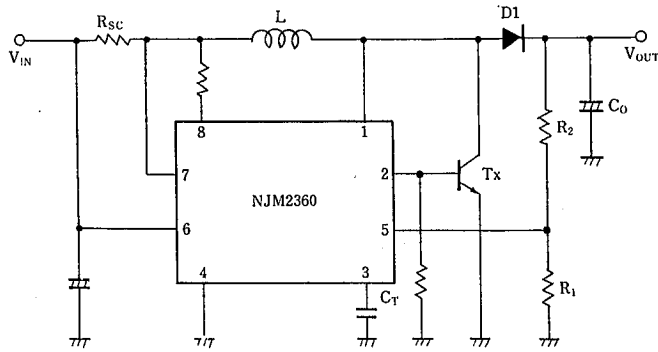
### 2. Step-Down Converter



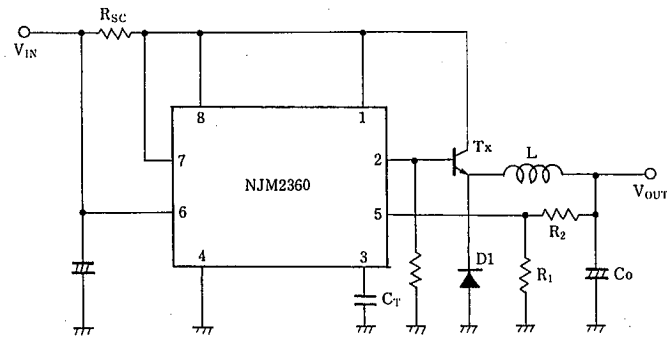
\* D1 : SBD(EK14)

## TYPICAL APPLICATIONS

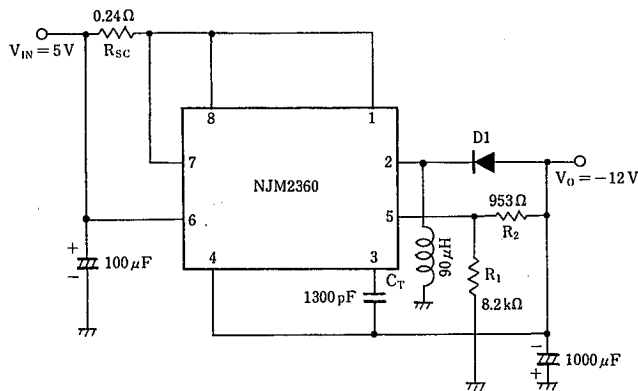
### 3. Step-Up Converter (High Current)



### 4. Step-Down Converter (High Current)



### 5. Inverting Converter



\* D1 : SBD(EK14)

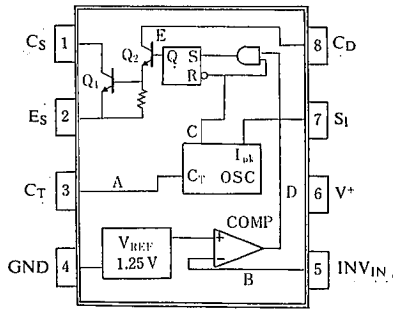


Fig.1 Block Diagram

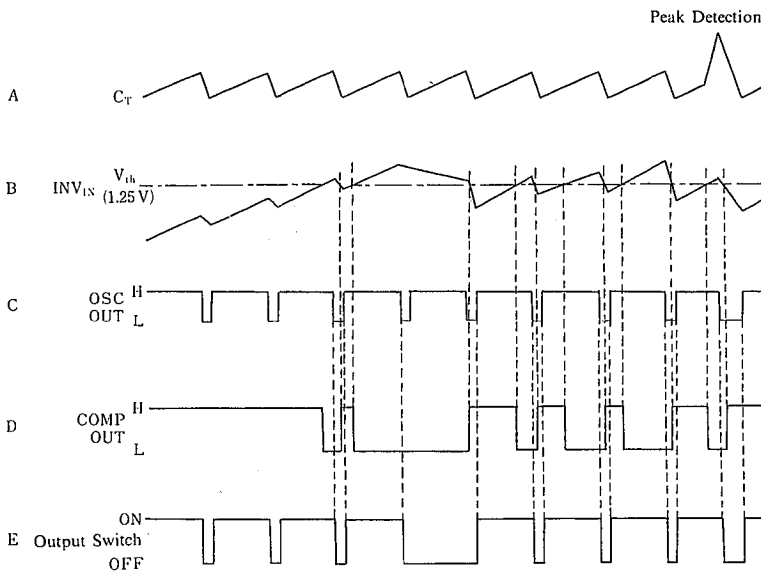
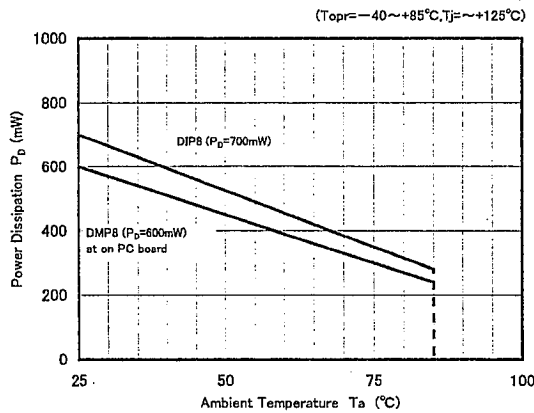


Fig. 2 Timing Chart

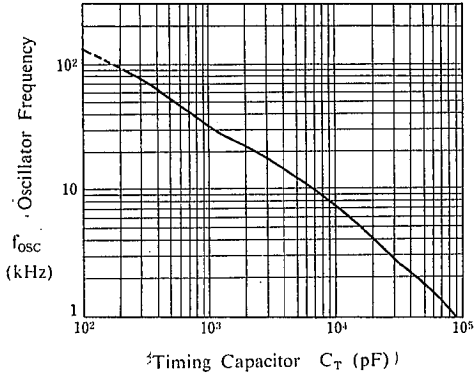
■ POWER DISSIPATION VS. TEMPERATURE



## TYPICAL CHARACTERISTICS

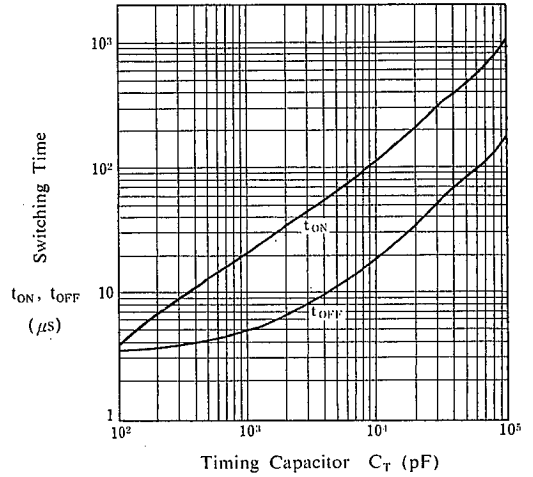
### Oscillator Frequency vs. Timing Capacitor

( $V_{IN} = 5V, S_1 = V^+, Pin5 = GND, T_a = 25^\circ C$ )



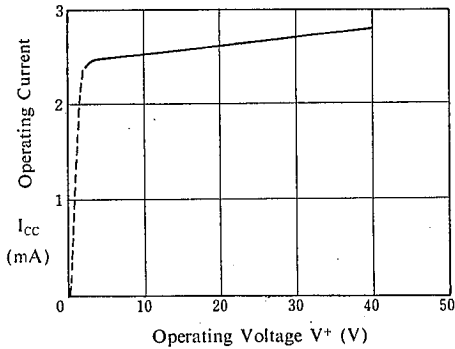
### Switching Time vs. Timing Capacitor

( $V_{IN} = 5V, S_1 = V^+, Pin5 = GND, T_a = 25^\circ C$ )



### Operating Current vs. Operating Voltage

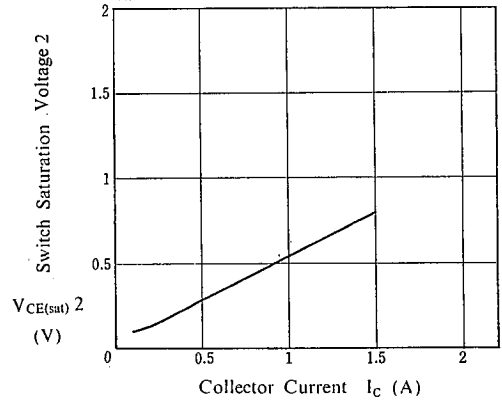
( $C_T = 0.001 \mu F, S_1 = V^+, Pin2 = GND, T_a = 25^\circ C$ )



### Switch Saturation Voltage 2 vs. Collector Current

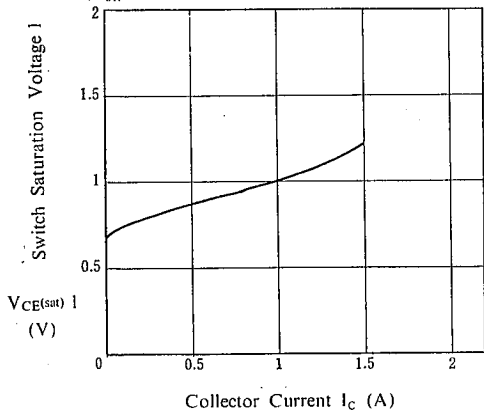
( $\beta \approx 20$ )

( $V_{CE} = 5V, Pin7 = V^+, Pin2 \cdot 3 \cdot 5 = GND, T_a = 25^\circ C$ )



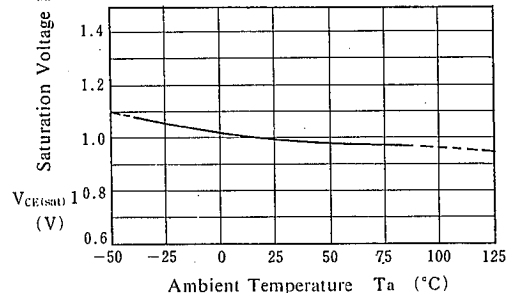
### Switch Saturation Voltage 1 vs. Collector Current (Darlington)

( $V_{CE} = 5V, Pin7 = V^+, Pin2 \cdot 3 \cdot 5 = GND, T_a = 25^\circ C$ )



### Saturation Voltage 1 vs. Temperature

( $V^+ = 5V, I_{sw} = 1.0A, Darlington$ )

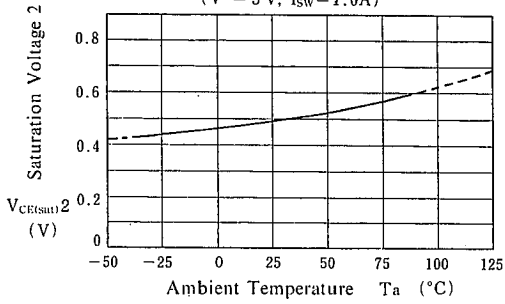


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■ TYPICAL CHARACTERISTICS

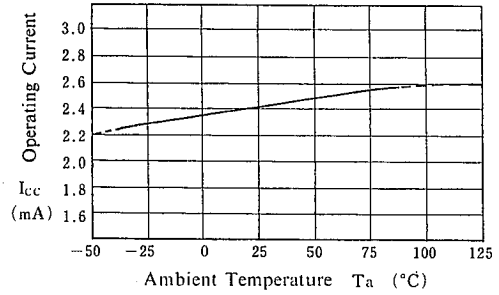
Saturation Voltage 2 vs. Temperature

( $V^+ = 5\text{ V}$ ,  $I_{SW} = 1.0\text{ A}$ )



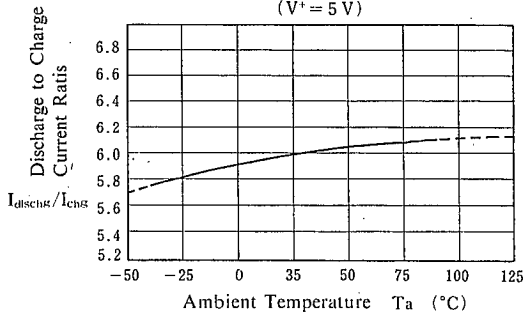
Operating Current vs. Temperature

( $V^+ = 5\text{ V}$ ,  $C_T = 0.001\mu\text{F}$ )



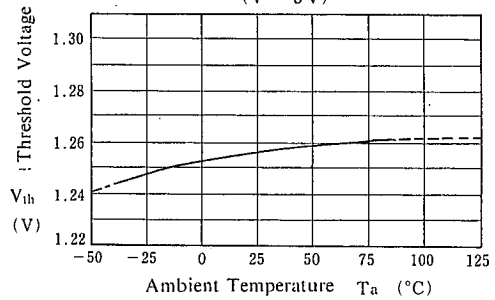
Discharge to Charge Current Ratio vs. Temperature

( $V^+ = 5\text{ V}$ )



Threshold Voltage vs. Temperature

( $V^+ = 5\text{ V}$ )

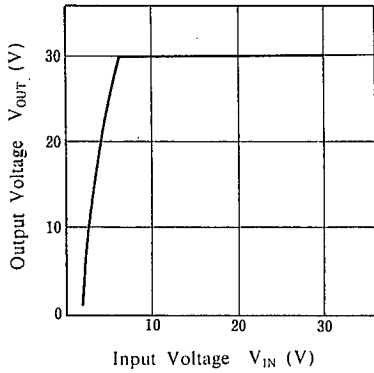


## ■ TYPICAL CHARACTERISTICS (Application)

### 1. Step-Up Converter

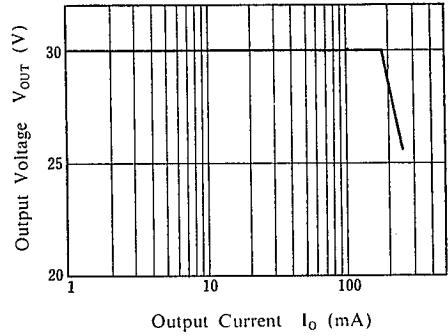
#### Output Voltage vs. Input Voltage

( $V_O = 30\text{ V}$ ,  $I_O = 100\text{ mA}$ ,  $C_T = 1500\text{ pF}$ ,  
 $L = 180\text{ }\mu\text{H}$ ,  $T_a = 25\text{ }^\circ\text{C}$ )



#### Output Voltage vs. Output Current

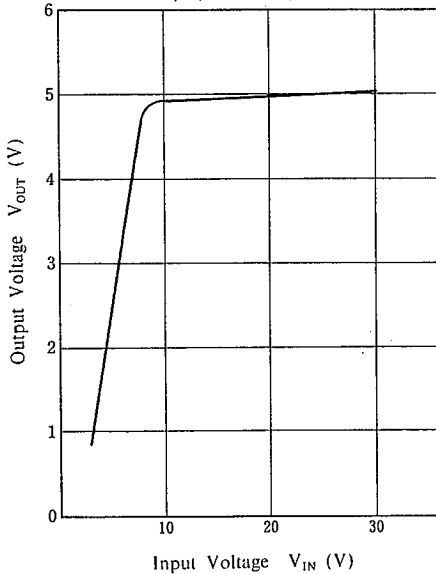
( $V_{IN} = 14\text{ V}$ ,  $V_O = 30\text{ V}$ ,  $C_T = 1500\text{ pF}$ ,  
 $L = 180\text{ }\mu\text{H}$ ,  $T_a = 25\text{ }^\circ\text{C}$ )



### 2. Step-Down Converter

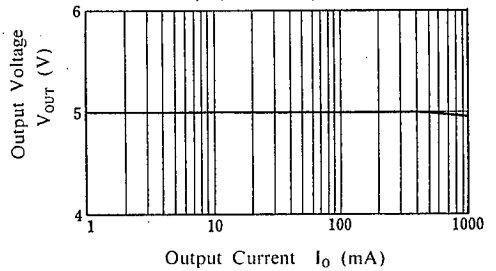
#### Output Voltage vs. Input Voltage

( $V_O = 5\text{ V}$ ,  $I_O = 500\text{ mA}$ ,  $C_T = 470\text{ pF}$ ,  
 $L = 220\text{ }\mu\text{H}$ ,  $T_a = 25\text{ }^\circ\text{C}$ )



#### Output Voltage vs. Output Current

( $V_{IN} = 25\text{ V}$ ,  $V_O = 5\text{ V}$ ,  $C_T = 470\text{ pF}$ ,  
 $L = 220\text{ }\mu\text{H}$ ,  $T_a = 25\text{ }^\circ\text{C}$ )





## MEMO

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