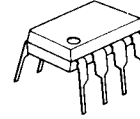


## DC/DC CONVERTER CONTROL IC

### ■ 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



NJM2360D



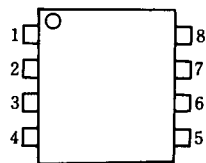
NJM2360M

### ■ FEATURES

- Output Switch Current 1.5A(MAX)
- Operating Voltage 2.5V\* to 40V
- Internal Over Current Limit Circuit
- Supply Voltage  $V^+$  2.5V\* to 40V
- Output Voltage  $V_{OR}$  1.25V to 40V
- Oscillator Frequency  $f_{OSC}$  100Hz to 100kHz
- Package Outline DIP8, DMP8

\* $T_a = 25^\circ\text{C}$ . At low temperature, the minimum voltage is 3.0V.

### ■ PIN CONFIGURATION



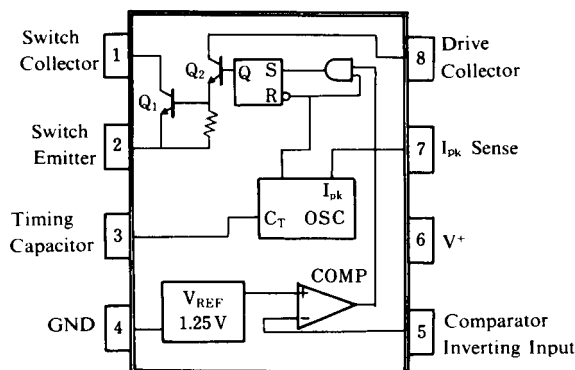
NJM2360D

NJM2360M

#### PIN FUNCTION

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

### ■ BLOCK DIAGRAM



# NJM2360

## ■ ABSOLUTE MAXIMUM RATINGS

(T<sub>a</sub> = 25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V <sup>+</sup>	40	V
Comparator Input Voltage Range	V <sub>IR</sub>	-0.3 to V <sup>+</sup>	V
Power Dissipation	P <sub>D</sub>	(DIP8) 700 (DMP8) 600 (note1)	mW mW
Switch Current	I <sub>SW</sub>	1.5	A
Operating Temperature Range	T <sub>opr</sub>	-40 to +85	°C
Storage Temperature Range	T <sub>stg</sub>	-40 to +125	°C

(note 1) At on PC board

## ■ ELECTRICAL CHARACTERISTICS

● DC Characteristics (V<sup>+</sup> = 5V, T<sub>a</sub> = 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> = 0.001μF 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

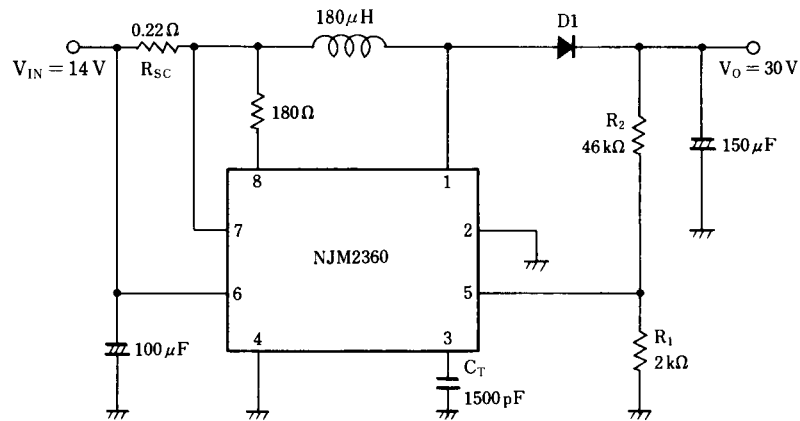
### Comparator

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.

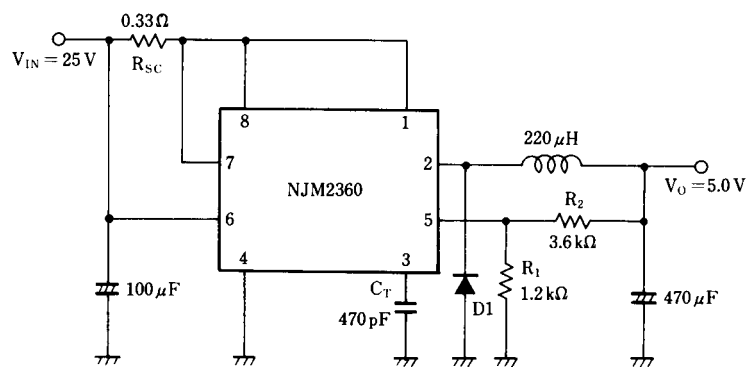
## ■ TYPICAL APPLICATION

### 1. Step-Up Converter



\*D1 : SBD (EK14)

### 2. Step-Down Converter

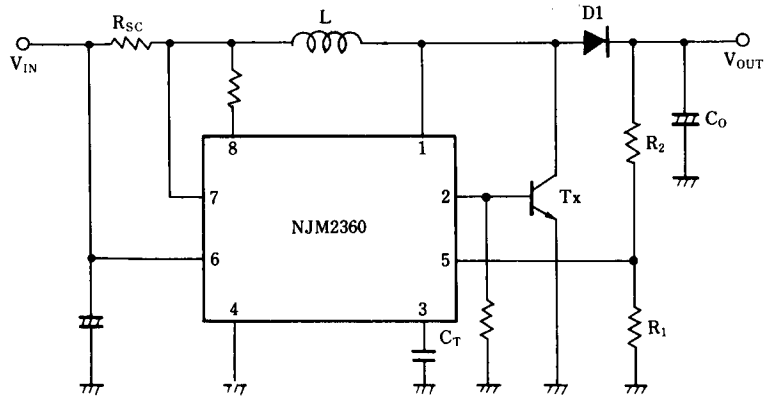


\*D1 : SBD (EK14)

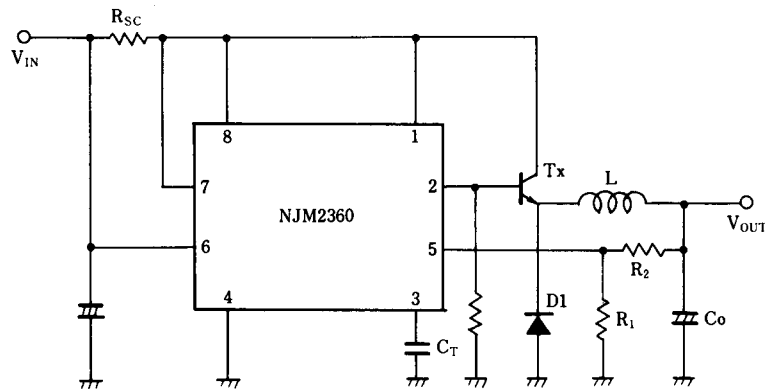
# NJM2360

## ■ TYPICAL APPLICATIONS

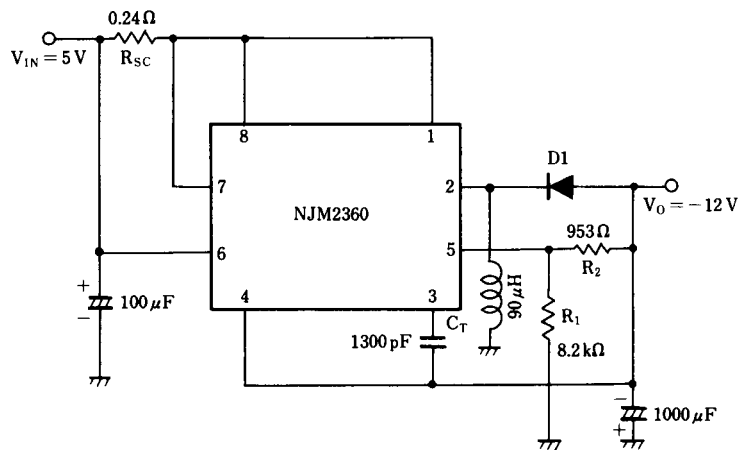
### 3. Step-Up Converter (High Current)



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



### 5. Inverting Converter



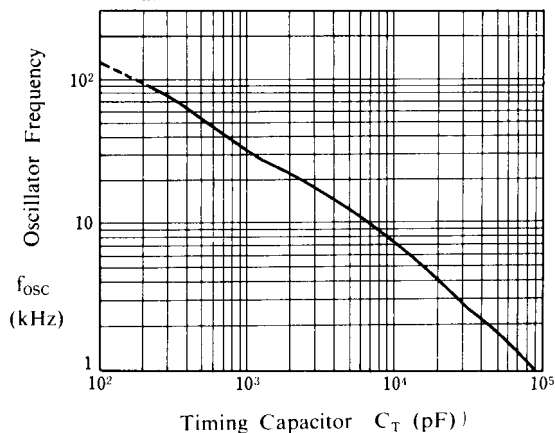
\*D1 : SBD (EK14)



## ■ TYPICAL CHARACTERISTICS

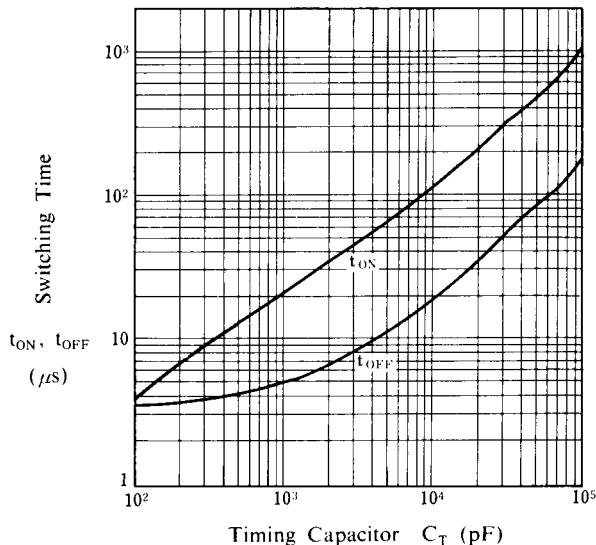
### Oscillator Frequency vs. Timing Capacitor

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



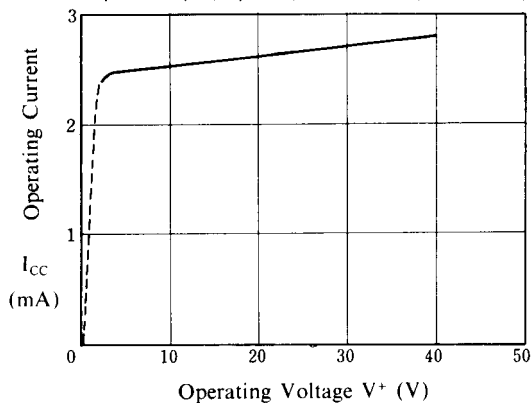
### Switching Time vs. Timing Capacitor

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



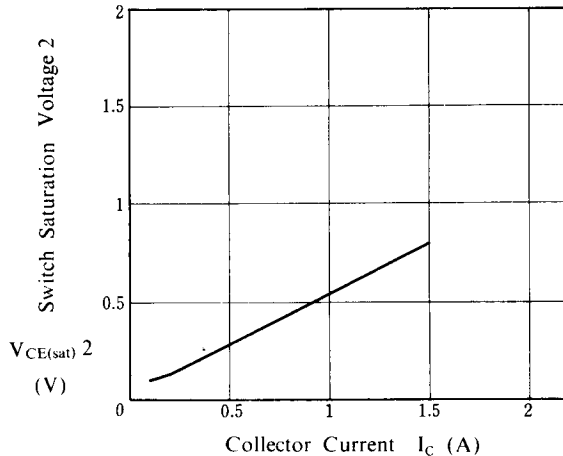
### Operating Current vs. Operating Voltage

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



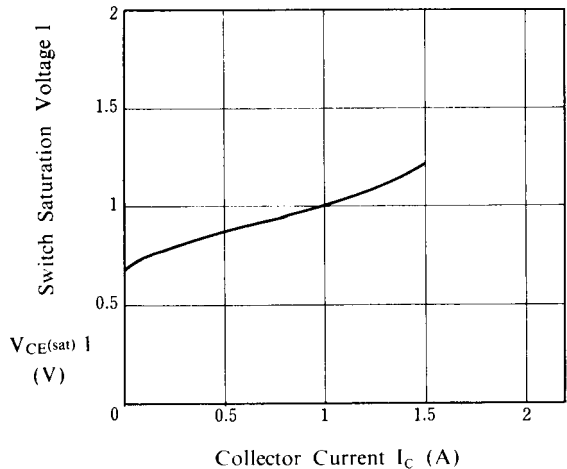
### Switch Saturation Voltage 2 vs. Collector Current ( $\beta \approx 20$ )

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



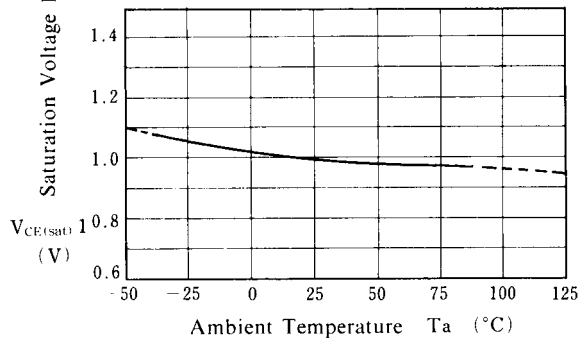
### Switch Saturation Voltage 1 vs. Collector Current (Darlington)

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



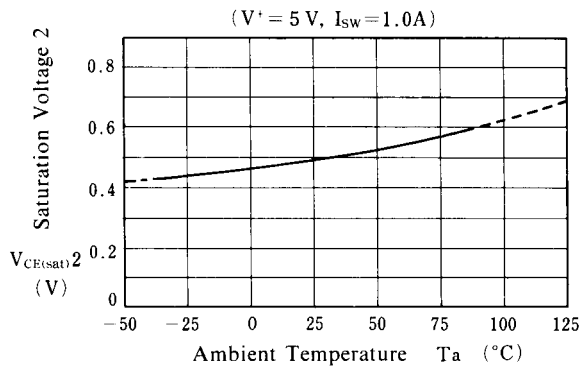
### Saturation Voltage 1 vs. Temperature

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

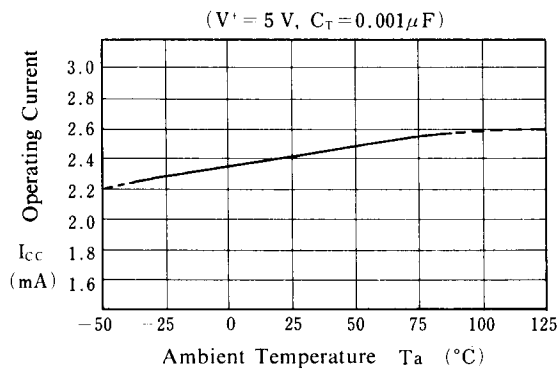


## ■ TYPICAL CHARACTERISTICS

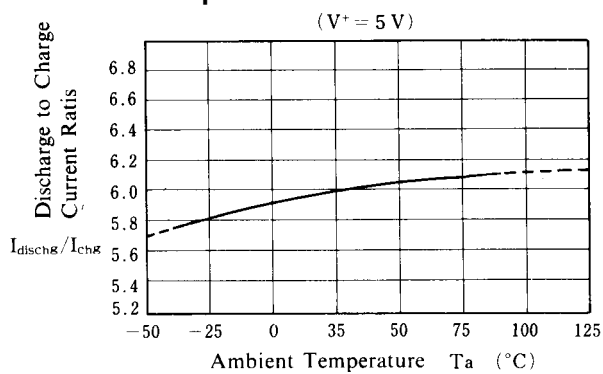
### Saturation Voltage 2 vs. Temperature



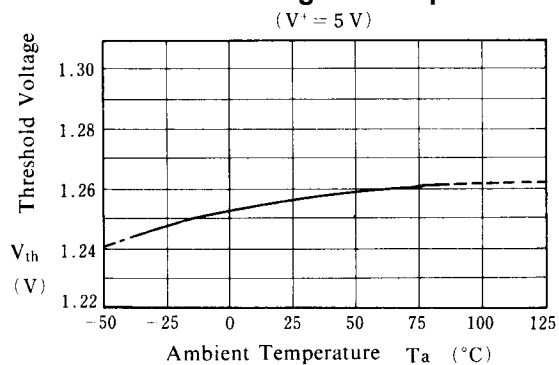
### Operating Current vs. Temperature



### Discharge to Charge Current Ratio vs. Temperature



### Threshold Voltage vs. Temperature

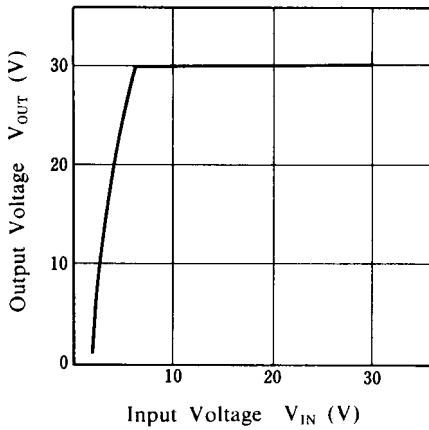


## ■ TYPICAL CHARACTERISTICS (Application)

### 1. Step-Up Converter

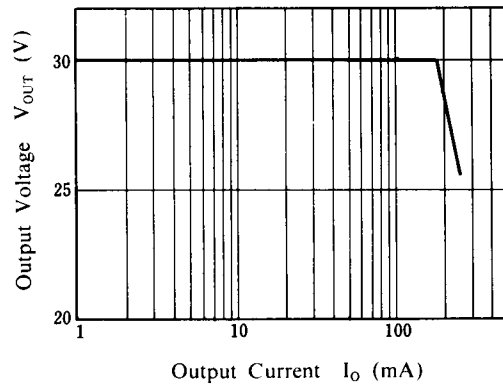
#### Output Voltage vs. Input Voltage

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



#### Output Voltage vs. Output Current

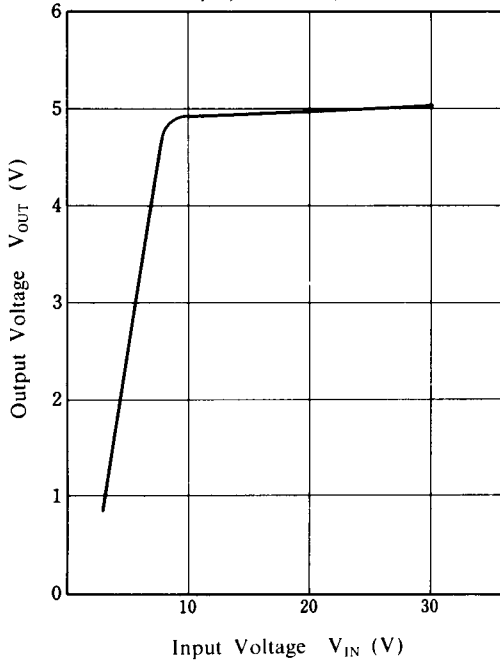
( $V_{IN} = 14\text{ V}$ ,  $V_O = 30\text{ V}$ ,  $C_T = 1500\text{ pF}$ ,  
 $L = 180\text{ }\mu\text{H}$ ,  $T_a = 25\text{ }^\circ\text{C}$ )



### 2. Step-Down Converter

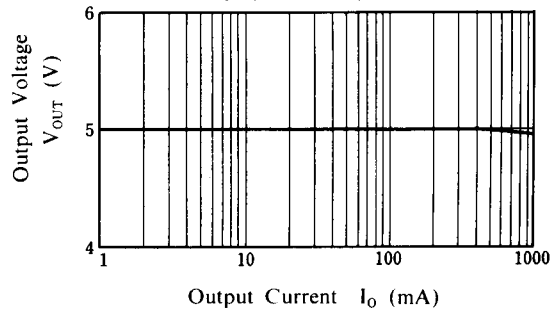
#### Output Voltage vs. Input Voltage

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



#### Output Voltage vs. Output Current

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



**[CAUTION]**

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