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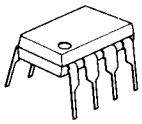
# DC/DC CONVERTER CONTROL IC

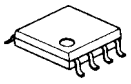
## ■ GENERAL DESCRIPTION

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



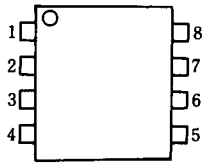
NJM2360M

## ■ 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

*Ta =25°C. At low temperature, the minimum voltage is 3.0V.

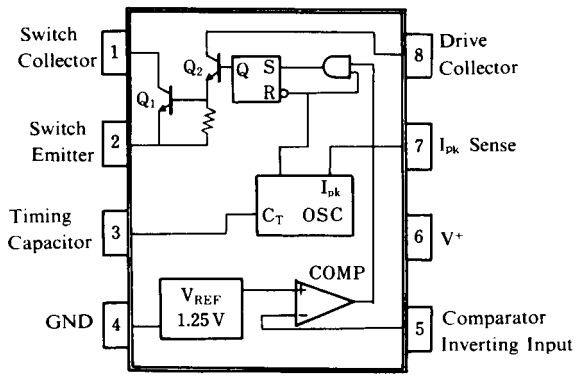
## ■ PIN CONFIGURATION




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



## ■ ABSOLUTE MAXIMUM RATINGS ($T_a$ = 25ºC)

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|---|---|---|
| Supply Voltage | $V^+$ | 40 | V |
| Comparator Input Voltage Range | $V_{IR}$ | -0.3 to $V^+$ | V |
| Power Dissipation | $P_D$ | (DIP8) 700<br>(DMP8) 600 (note1) | mW<br>mW |
| Switch Current | $I_{SW}$ | 1.5 | A |
| Operating Temperature Range | $T_{opr}$ | -40 to + 85 | ºC |
| Storage Temperature Range | $T_{stg}$ | -40 to +125 | ºC |

(note 1) At on PC board

## ■ ELECTRICAL CHARACTERISTICS

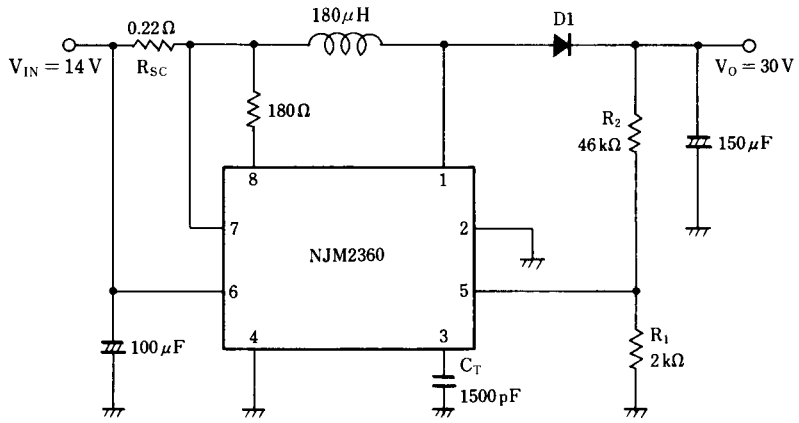
● DC Characteristics ($V^+$ = 5V, $T_a$ = 25ºC)

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Operating Current | $I_{CC}$ | 5V ≤ $V^+$ ≤ 40V, $C_T$ = 0.001µF<br>$S_I$ = $V^+$, $INV_{IN}$ > $V_{th}$, $E_S$ = GND | - | 2.4 | 3.5 | mA |
| **Oscillator** | | | | | | |
| Charge Current | $I_{chg}$ | 5V ≤ $V^+$ ≤ 40V | 20 | 35 | 50 | µA |
| Discharge Current | $I_{dischg}$ | 5V ≤ $V^+$ ≤ 40V | 150 | 200 | 250 | µA |
| Voltage Swing | $V_{OSC}$ | | - | 0.5 | - | $V_{P-P}$ |
| Discharge to Charge Current Ratio | $I_{dischg}/I_{chg}$ | $S_I$ = $V^+$ | - | 6 | - | - |
| Peak Current Sense Voltage | $V_{IPK(sense)}$ | $I_{chg}$ = $I_{dischg}$ | 250 | 300 | 350 | mV |
| **Output Switch (Note 2)** | | | | | | |
| Saturation Voltage 1 | $V_{CE(sat)}$ 1 | Darlington Connection ($C_S$ = $C_D$)<br>$I_{SW}$ = 1.0A | - | 1.0 | 1.3 | V |
| Saturation Voltage 2 | $V_{CE(sat)}$ 2 | $I_{SW}$ = 1.0A, IC(driver) = 50mA<br>(Forced β ≒ 20) | - | 0.5 | 0.7 | V |
| DC Current Gain | $h_{FE}$ | $I_{SW}$ = 1.0A, $V_{CE}$ = 5.0V | 35 | 120 | - | - |
| Collector Off-State Current | $I_{C(off)}$ | $V_{CE}$ = 40V | - | 10 | - | nA |
| **Comparator** | | | | | | |
| Threshold Voltage | $V_{th}$ | | 1.18 | 1.25 | 1.32 | V |
| Input Bias Current | $I_{IB}$ | $V_{IN}$ = 0V | - | 40 | 400 | nA |

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

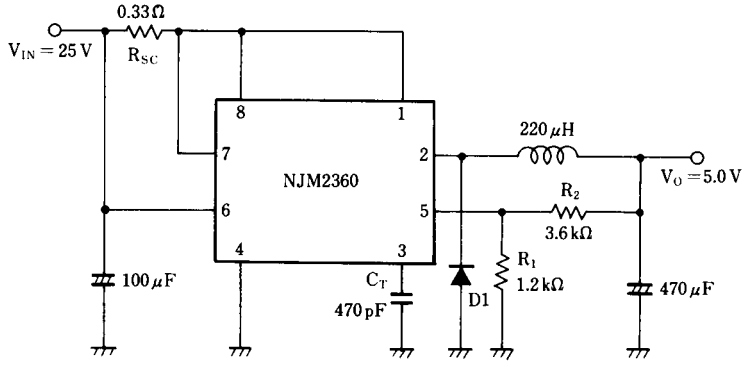
## ■ TYPICAL APPLICATION

1. Step-Up Converter




*D1 : SBD (EK14)

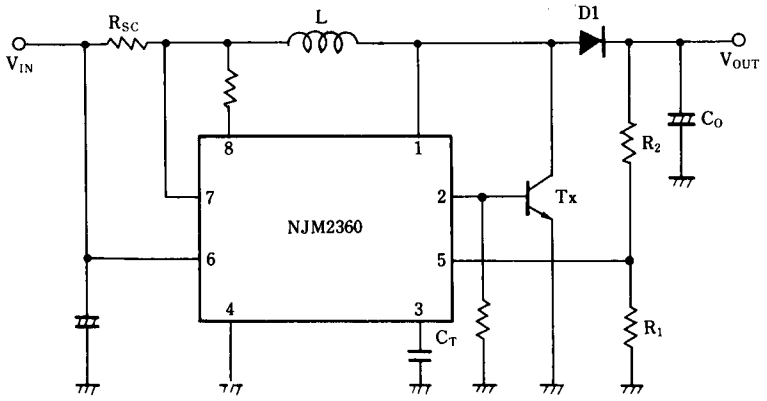
2. Step-Down Converter



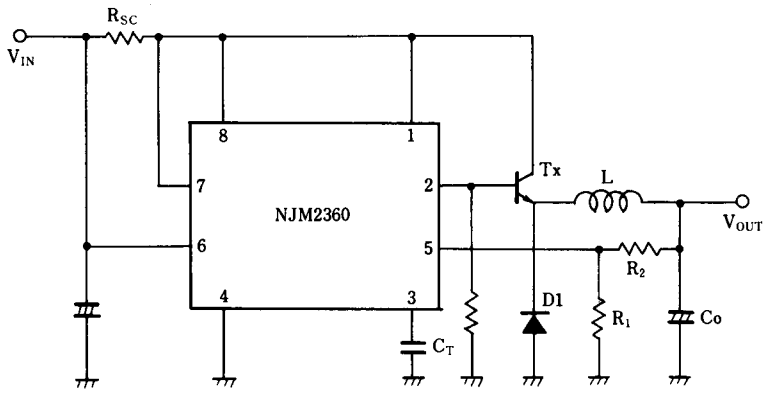

*D1 : SBD (EK14)

## ■ TYPICAL APPLICATIONS

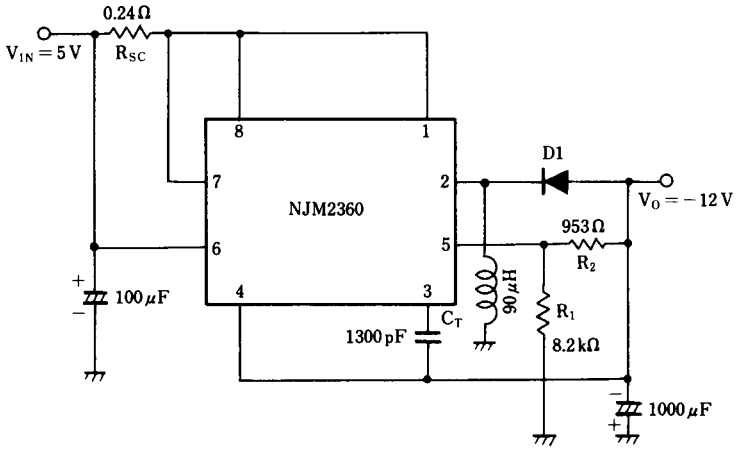
3. Step-Up Converter (High Current)




4. Step-Down Converter (High Current)




5. Inverting Converter




*D1 : SBD (EK14)

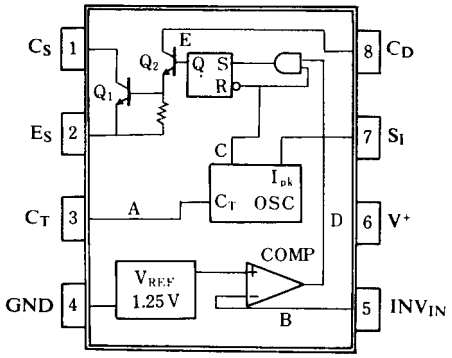



Fig. 1 Block Diagram

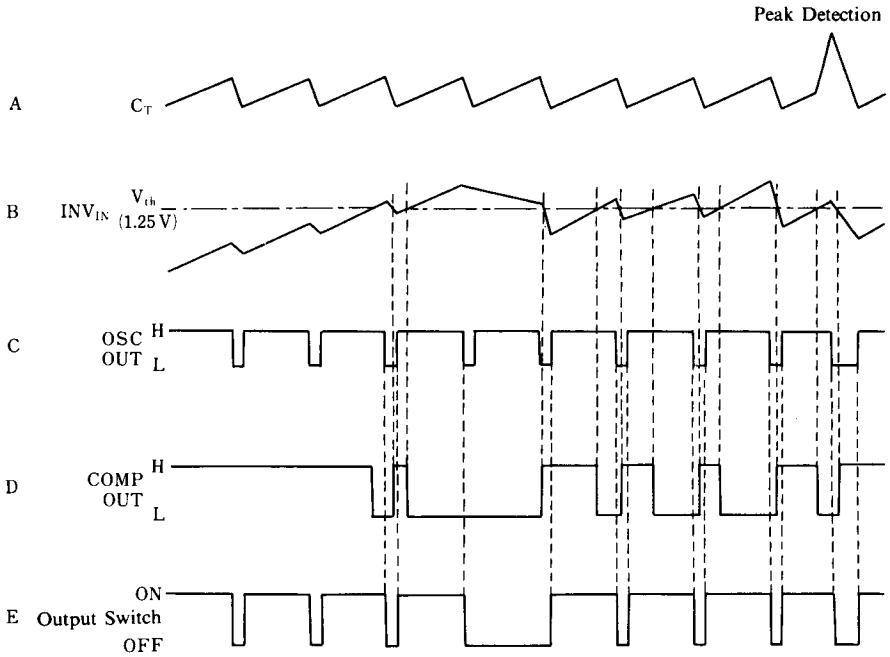
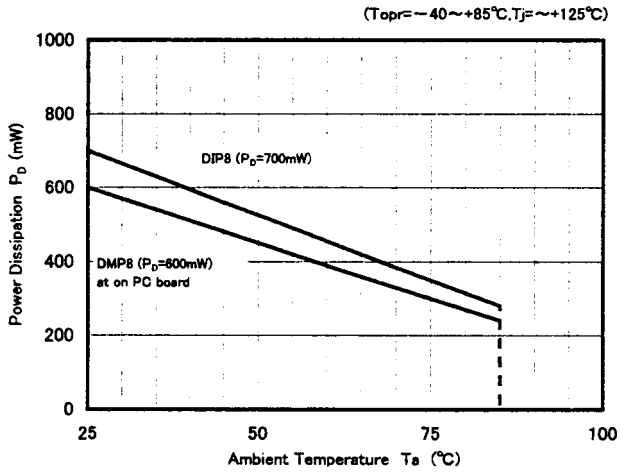


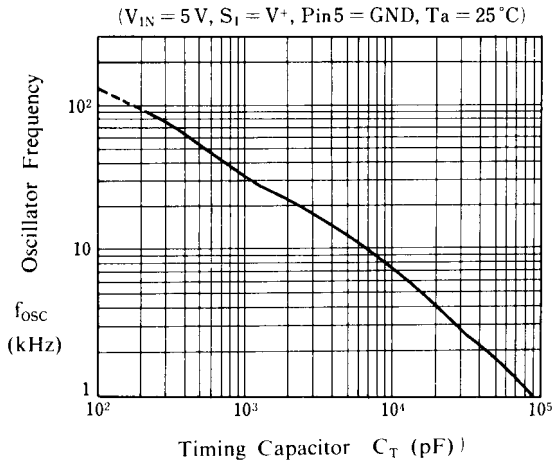

Fig. 2 Timing Chart

## ■ POWER DISSIPATION VS. TEMPERATURE

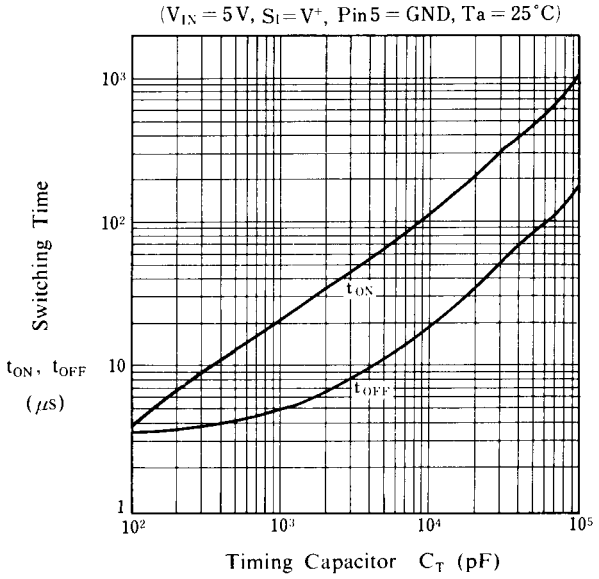


## ■ TYPICAL CHARACTERISTICS

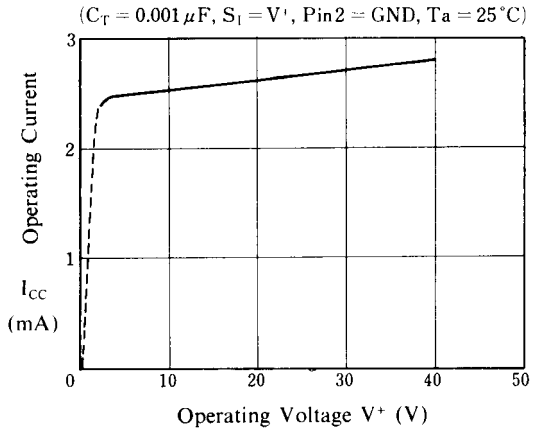
### Oscillator Frequency vs. Timing Capacitor



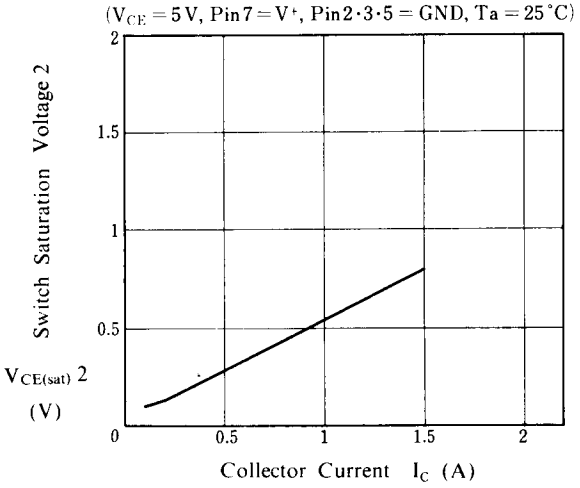

### Switching Time vs. Timing Capacitor



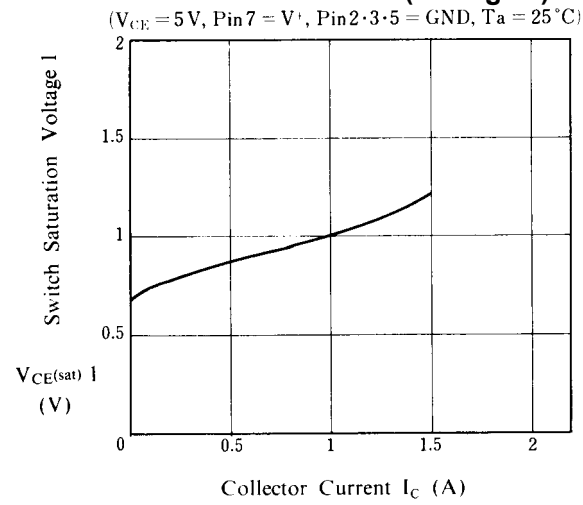

### Operating Current vs. Operating Voltage



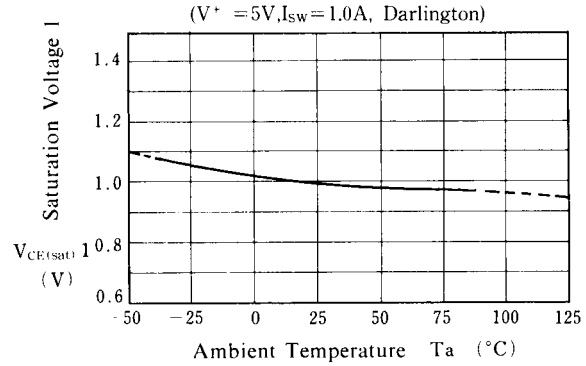

### Switch Saturatin Voltage 2 vs. Collector Current (β≒20)




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

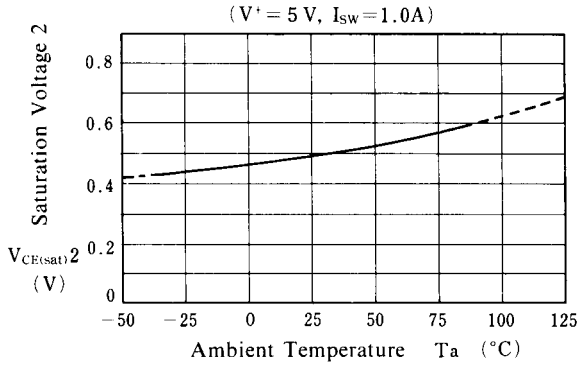



### Saturation Voltage 1 vs. Temperature

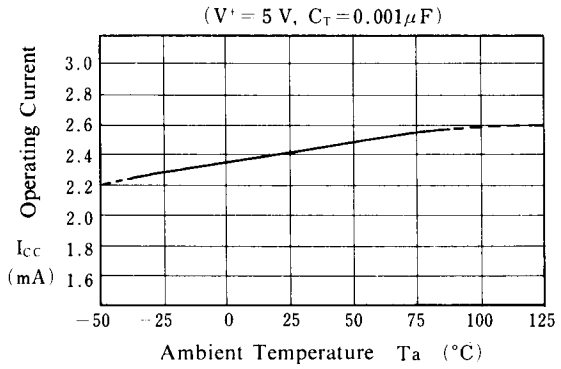


## ■ TYPICAL CHARACTERISTICS

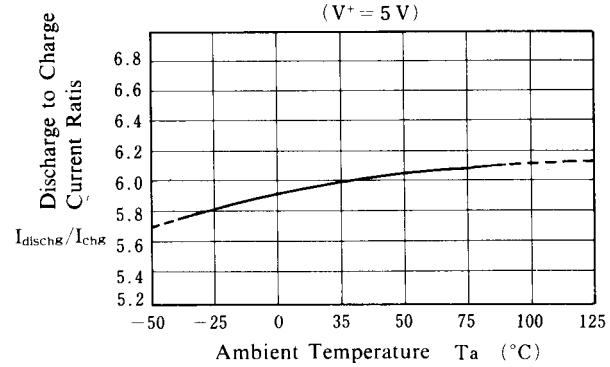
### Saturation Voltage 2 vs. Temperature



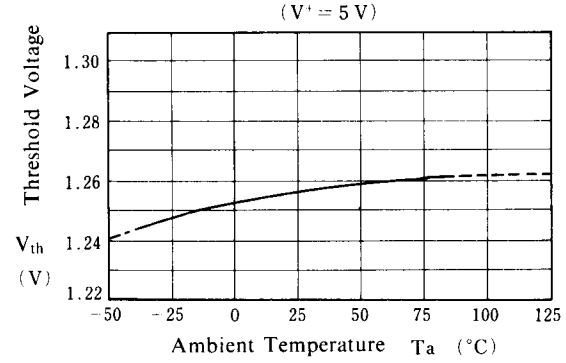

### Operating Current vs. Temperature




### Discharge to Charge Current Ratio vs. Temperature




### Threshold Voltage vs. Temperature

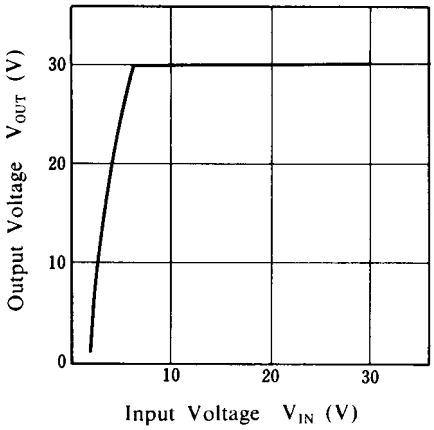


## ■ TYPICAL CHARACTERISTICS (Application)

1. Step-Up Converter

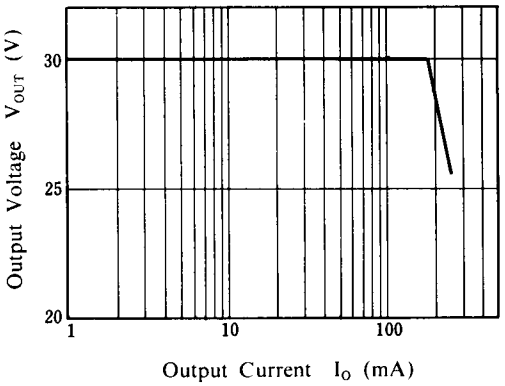
**Output Voltage vs. Input Voltage**

($V_O = 30\,V$, $I_O = 100\,mA$, $C_T = 1500\,pF$, $L = 180\,\mu H$, $Ta = 25\,°C$)




**Output Voltage vs. Output Current**

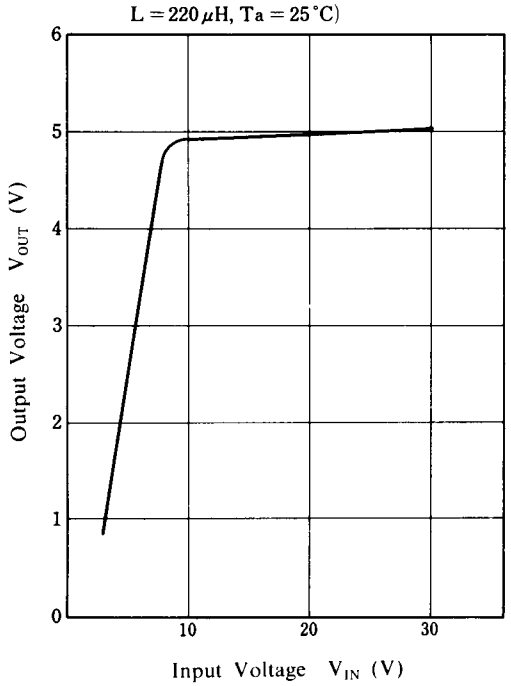
($V_{IN} = 14\,V$, $V_O = 30\,V$, $C_T = 1500\,pF$, $L = 180\,\mu H$, $Ta = 25\,°C$)




2. Step-Down Converter

**Output Voltage vs. Input Voltage**

($V_O = 5\,V$, $I_O = 500\,mA$, $C_T = 470\,pF$, $L = 220\,\mu H$, $Ta = 25\,°C$)




**Output Voltage vs. Output Current**

($V_{IN} = 25\,V$, $V_O = 5\,V$, $C_T = 470\,pF$, $L = 220\,\mu H$, $Ta = 25\,°C$)