

OVERVIEW

The SM6702 series are step-up DC/DC converter ICs, fabricated using NPC's Molybdenum-gate CMOS process. They incorporate reference voltage source, error amplifier, oscillator, start-up circuit, PFM (Pulse Frequency Modulation) control circuit into a single chip. The only external components required are a Coil, Diode and output smoothing capacitors to form a step-up DC/DC converter. They employ PFM voltage control circuits to achieve high efficiency, stable constant-voltage output.

FEATURES

- Power dissipation: $24\mu\text{W}$ at $V_{\text{IN}} = 1.5\text{V}$, $V_{\text{OUT}} = 3.0\text{V}$, $I_{\text{OUT}} = 100\mu\text{A}$
- Start-up input voltage: 0.9V (max) at $R_{\text{L}} = 30\text{k}\Omega$
- Output voltage: 2.2 to 3.3V , available in 0.1V step
- High efficiency: 85% at $V_{\text{IN}} = 1.5\text{V}$, $V_{\text{OUT}} = 3.0\text{V}$, $I_{\text{OUT}} = 1\text{mA}$
- Low ripple voltage
- Package: SOT89-3

APPLICATIONS

- PDA, Mobile IT equipment
- Digital Still Camera
- Pager
- Constant-voltage sources for battery-operated equipment
- Local voltage sources

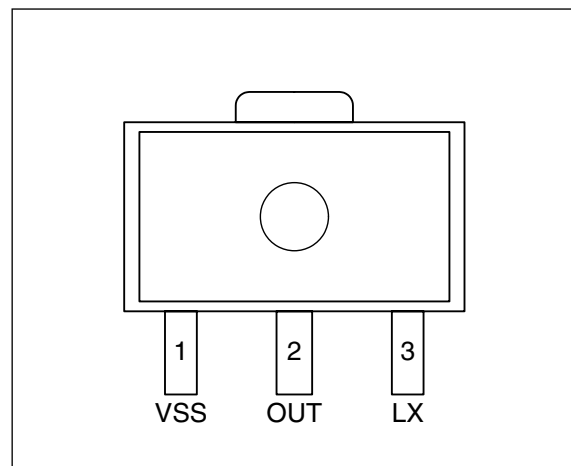
ORDERING INFORMATION

Device	Output voltage ¹	Package
SM6702-33HB1	3.3V	SOT89-3
SM6702-30HB1	3.0V	SOT89-3
SM6702-27HB1	2.7V	SOT89-3

1. Stepwise setting with a step of 0.1V in the range of 2.2V to 3.3V is available.

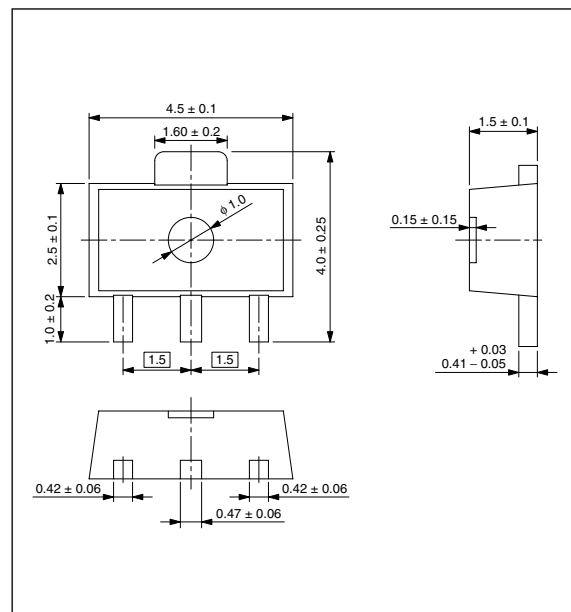
PINOUT

(Top view)

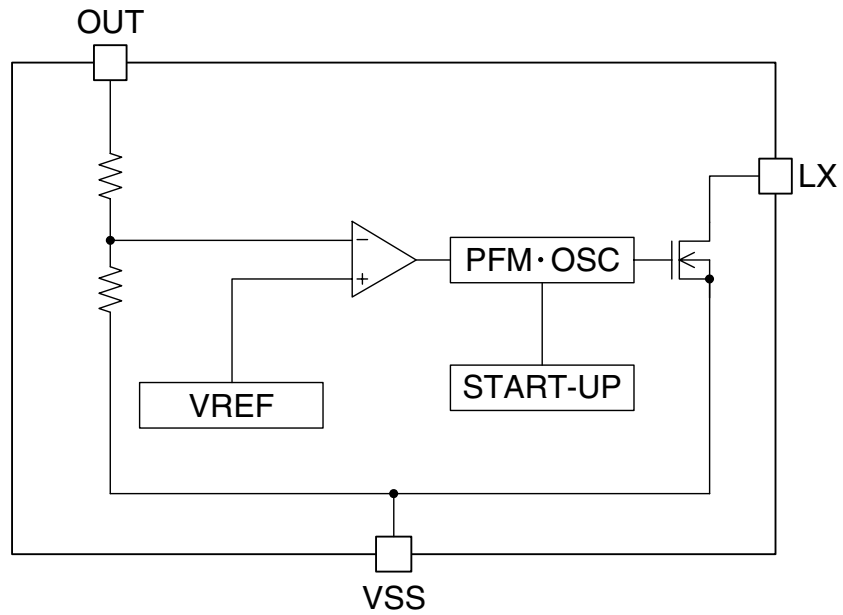


PACKAGE DIMENSIONS

(Unit: mm)



BLOCK DIAGRAM



PIN DESCRIPTION

Number	Name	Description
1	VSS	Ground
2	OUT	Output (device supply pin)
3	LX	Switching pin

SPECIFICATIONS

Absolute Maximum Ratings

T_a = 25°C

Parameter	Symbol	Condition	Rating	Unit
LX impressed voltage	V _{LX}		5	V
OUT impressed voltage	V _{OUT}		4	V
LX output current	I _{LX}		200	mA
Power dissipation	P _D		500	mW
Operating temperature	T _{opr}		– 20 to 70	°C
Storage temperature	T _{stg}		– 40 to 125	°C

Electrical Characteristics

L = 330μH, C = 22μF, T_a = 25°C, V_{SS} = 0V

Parameter	Symbol	Condition	Rating			Unit	
			min	typ	max		
Start-up voltage	V _{st}	R _L = 30kΩ	–	–	0.9	V	
Holding voltage	V _{hold}	R _L = 3kΩ	–	–	0.7	V	
Current consumption	I _{SS}	V _{IN} = 1.5V, R _L = 30kΩ	–	8	16	μA	
Output voltage	V _{OUT}	V _{IN} = 1.5V, R _L = 3kΩ	V _{target} × 0.975	V _{target}	V _{target} × 1.025	V	
LX output current	I _{LX}	V _{OUT} = V _{target} – 0.1, V _{LX} = 0.4V	2.2 ≤ V _{target} ≤ 2.7	60	–	–	mA
			2.8 ≤ V _{target} ≤ 3.3	80	–	–	
LX leakage current	I _{LXL}	V _{OUT} = V _{LX} = 3.5V	–	–	1	μA	
Maximum oscillator frequency	f _{OSC}	V _{OUT} = V _{target} – 0.1	80	100	120	kHz	
Switch ON duty cycle	Duty	V _{OUT} = V _{target} – 0.1	65	75	85	%	
Input voltage range	V _{IN}		–	–	V _{target} + 0.2	V	

V_{target}: Setting output voltage

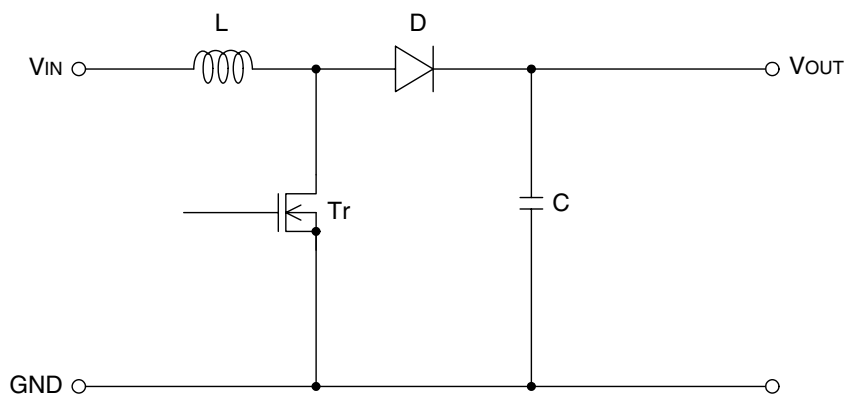
FUNCTIONAL DESCRIPTION

Step-up Principle

The SM6702 series use a transistor to switch the input supply in a non-isolated chopper switching regulator configuration. The figure below shows the basic step-up switching regulator circuit.

If the transistor is ON for an interval t_{ON} and then instantly turned OFF, the energy stored in the coil L during the interval t_{ON} generates a voltage V_L across the coil. This voltage is superimposed on the input voltage such that the peak voltage reaches $V_{IN} + V_L$ which forces the diode D to conduct and release the stored energy into the output.

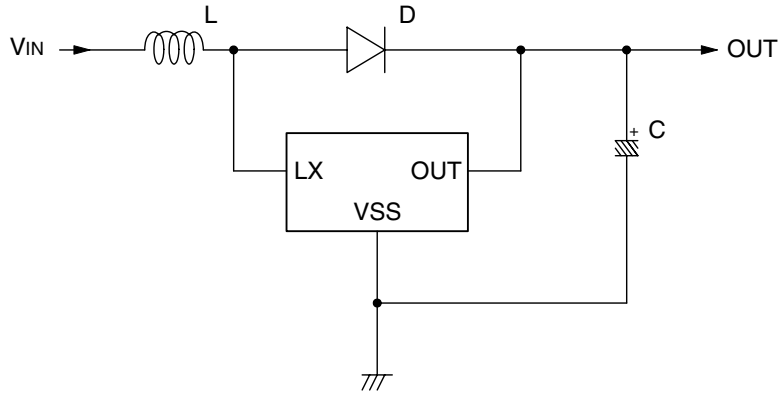
During normal operation, the above switching occurs repeatedly at a frequency controlled by an oscillator (which can change depending on the input and output load conditions), generating a square wave output which is then smoothed by the output capacitor C . Thus the output voltage ($V_{OUT} > V_{IN}$) has been stepped up.



PFM Control

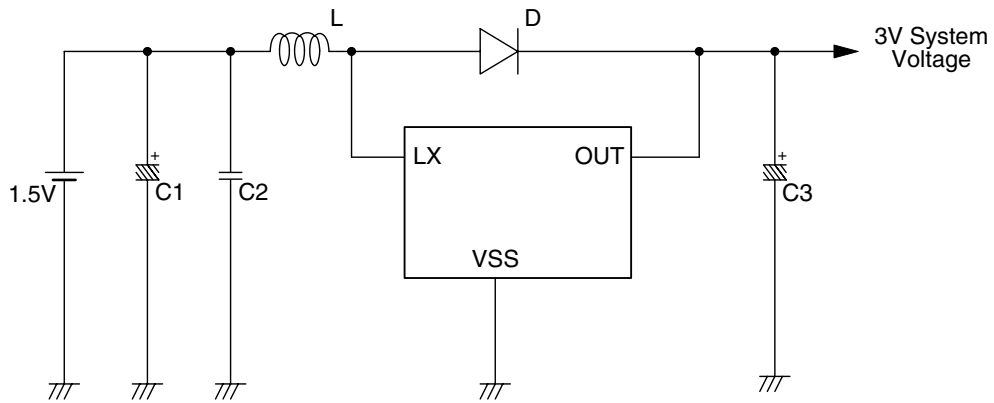
In SM6702 series, the LX transistor ON interval is fixed, and the OFF interval varies in response to the input voltage and load changes. Thus the resulting switching cycle frequency varies, called pulse frequency modulation.

BASIC CIRCUIT



Coil (L) : 330 μ H
 Diode (D) : MA721 (Matsushita Schottky diode)
 Capacitor (C_L) : 22 μ F tantalum

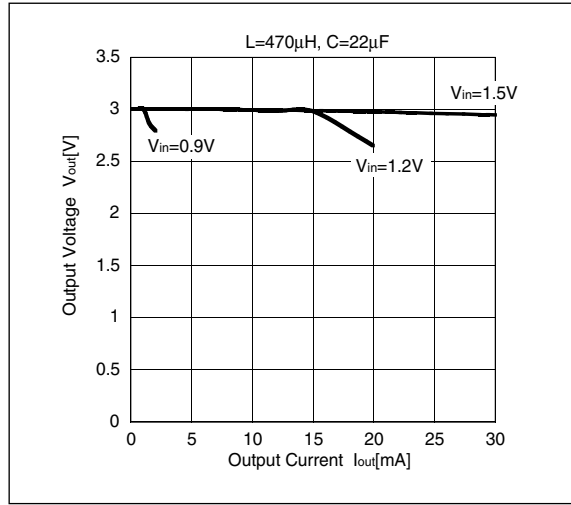
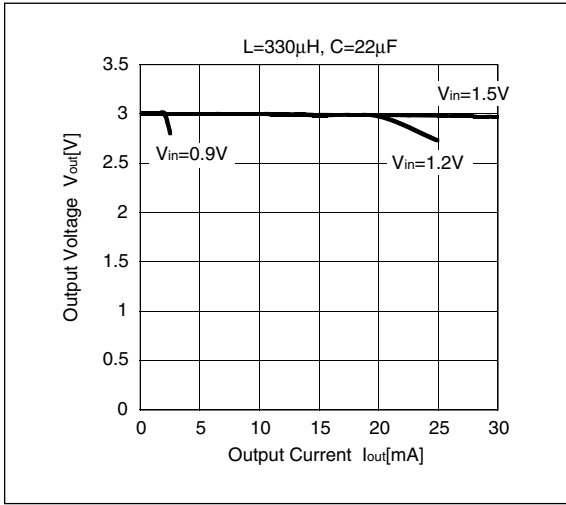
TYPICAL APPLICATION CIRCUIT



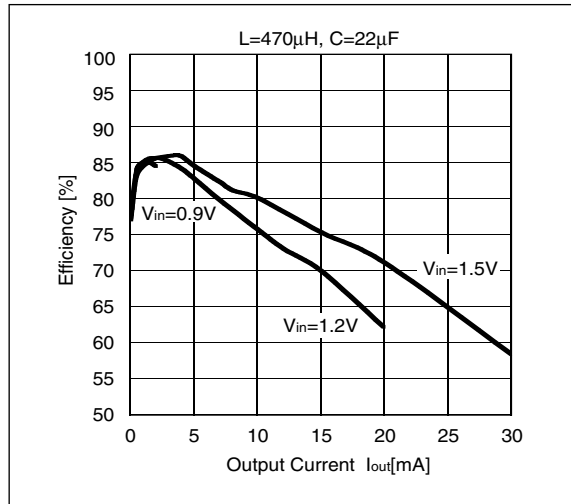
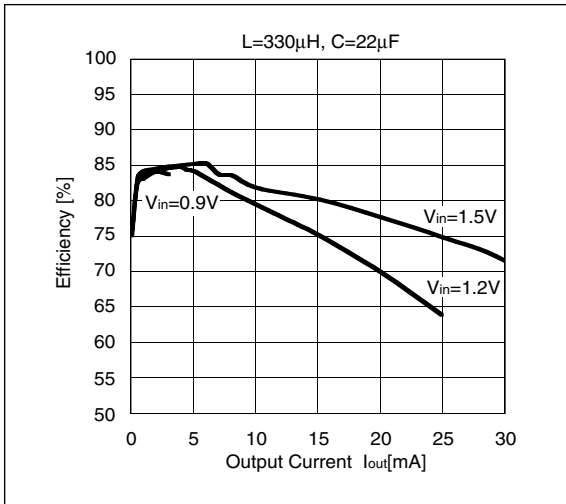
Coil (L) : 330 μ H
 Schottky Diode (D)
 Capacitor (C1) : 22 μ F tantalum
 Capacitor (C2) : 0.22 μ F ceramic
 Capacitor (C3) : 22 μ F tantalum

BASIC CHARACTERISTICS ($V_{out}: 3.0V$)

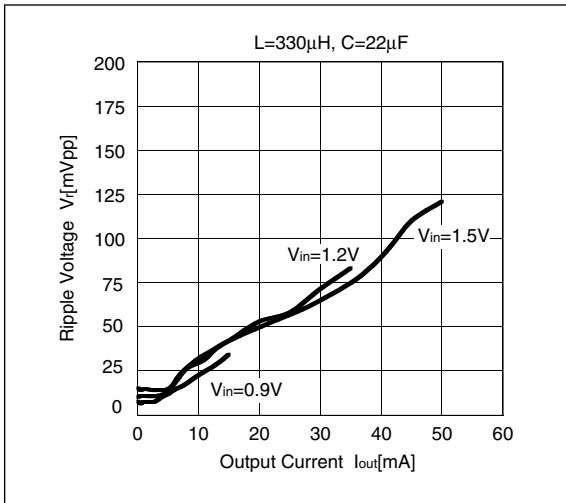
Output voltage vs. Output current



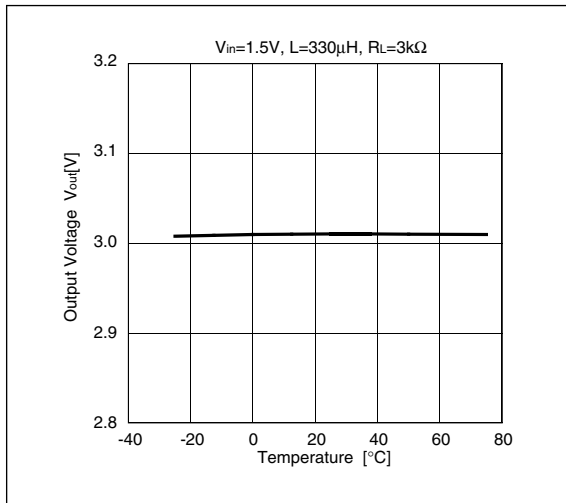
Efficiency vs. Output current



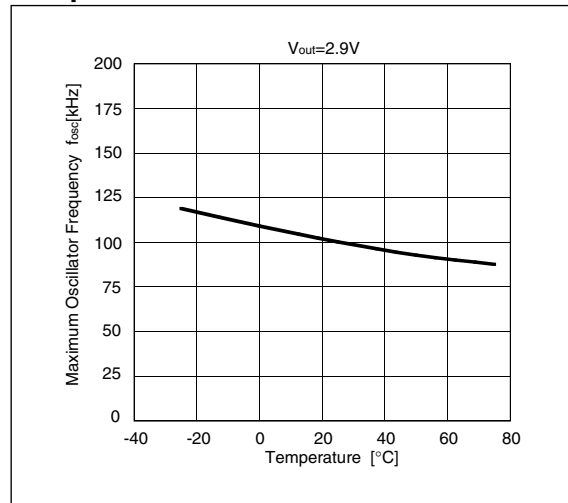
Ripple voltage vs. Output current



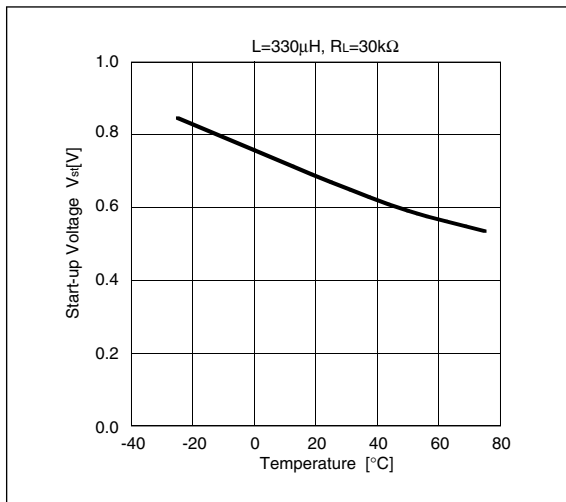
Output voltage vs. Temperature



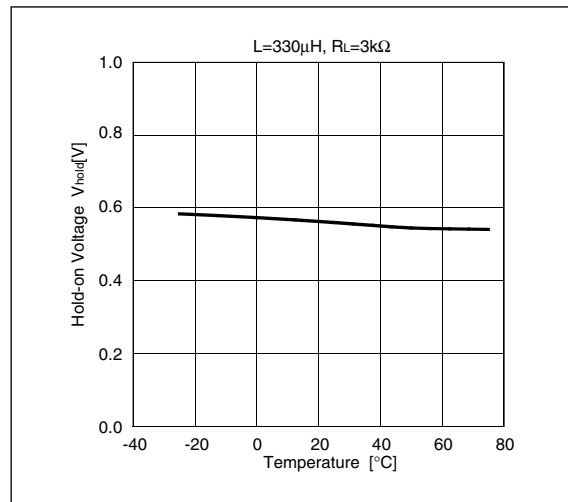
Maximum oscillator frequency vs. Temperature



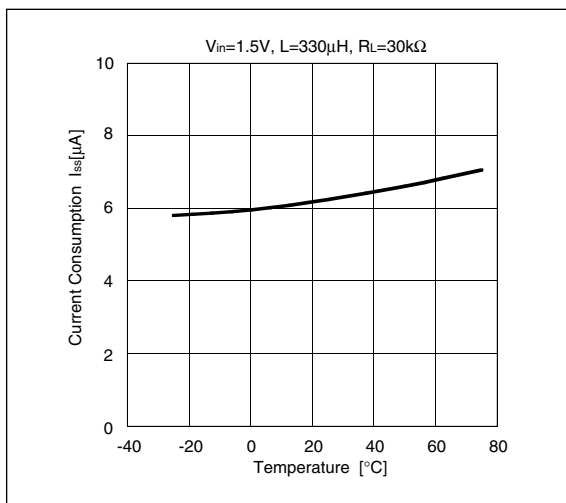
Start-up voltage vs. Temperature



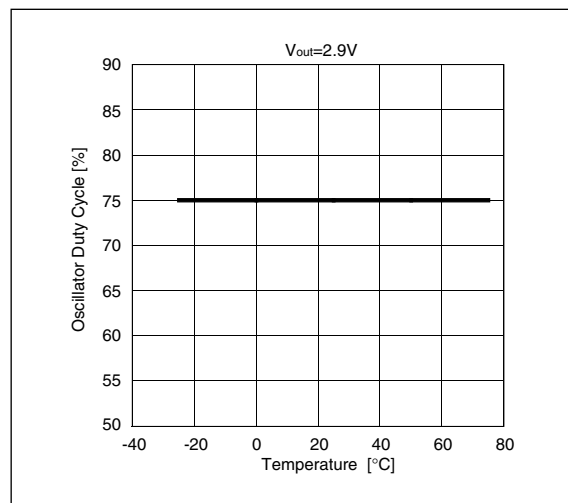
Hold-on voltage vs. Temperature



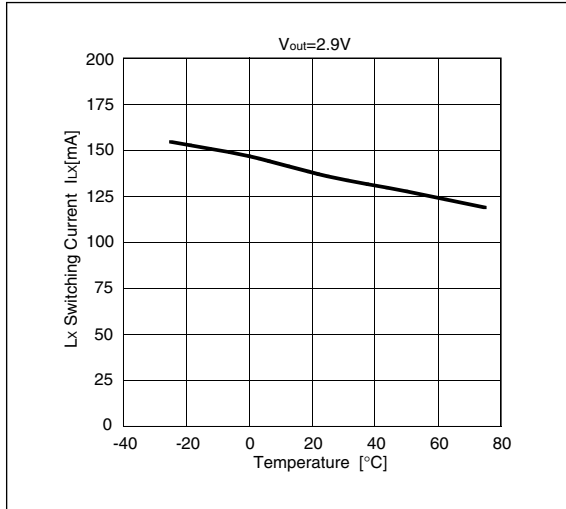
Current consumption vs. Temperature



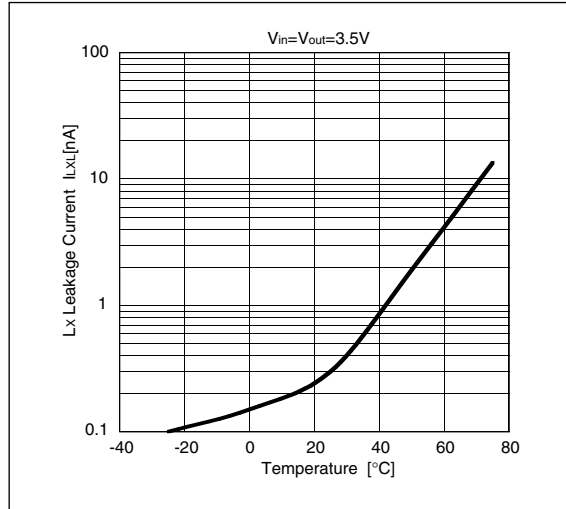
Oscillator duty cycle vs. Temperature



LX switching current vs. Temperature



LX leakage current vs. Temperature



Please pay your attention to the following points at time of using the products shown in this document.

The products shown in this document (hereinafter "Products") are not intended to be used for the apparatus that exerts harmful influence on human lives due to the defects, failure or malfunction of the Products. Customers are requested to obtain prior written agreement for such use from SEIKO NPC CORPORATION (hereinafter "NPC"). Customers shall be solely responsible for, and indemnify and hold NPC free and harmless from, any and all claims, damages, losses, expenses or lawsuits, due to such use without such agreement. NPC reserves the right to change the specifications of the Products in order to improve the characteristic or reliability thereof. NPC makes no claim or warranty that the contents described in this document dose not infringe any intellectual property right or other similar right owned by third parties. Therefore, NPC shall not be responsible for such problems, even if the use is in accordance with the descriptions provided in this document. Any descriptions including applications, circuits, and the parameters of the Products in this document are for reference to use the Products, and shall not be guaranteed free from defect, inapplicability to the design for the mass-production products without further testing or modification. Customers are requested not to export or re-export, directly or indirectly, the Products to any country or any entity not in compliance with or in violation of the national export administration laws, treaties, orders and regulations. Customers are requested appropriately take steps to obtain required permissions or approvals from appropriate government agencies.

The logo for SEIKO NPC CORPORATION, consisting of the letters 'NPC' in a bold, black, sans-serif font.

SEIKO NPC CORPORATION

15-6, Nihombashi-kabutocho, Chuo-ku,
Tokyo 103-0026, Japan
Telephone: +81-3-6667-6601
Facsimile: +81-3-6667-6611
<http://www.npc.co.jp/>
Email: sales@npc.co.jp

NC9721FE 2006.04