

6.5A High Power DC/DC Converter Controller IC

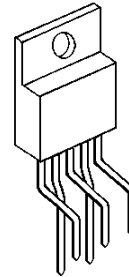
■GENERAL DESCRIPTION

The **NJM2399** is a high power step down DC/DC converter IC.

It incorporates 6.5A power transistor, $\pm 2\%$ accuracy precision voltage reference, fixed frequency PWM controller with cycle-by-cycle current limit and low power consumption stand by function.

The **NJM2399** realizes a high power step down application with minimal external components.

■PACKAGE OUTLINE



PIN FUNCTION

- 1: V_{FB}
- 2: SW_{OUT}
- 3: GND
- 4: V^+
- 5: STBY (V_{COMP})

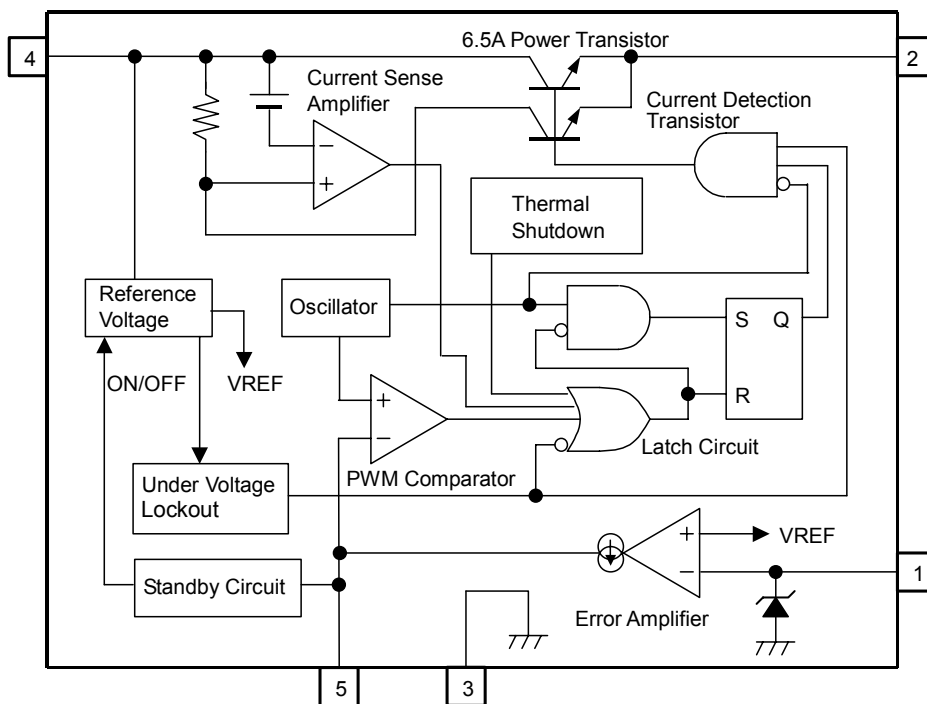
■FEATURES

- Adjustable output voltage more than 5V
- Operating Voltage 7.5V to 40V
- PWM form Switching Power Supply Control
- Internal High Power Transistor 6.5A (min.)
- Fixed Frequency Oscillator 72kHz (typ.)
- Current Sense Amplifier
- Under Voltage Lockout
- Thermal Shutdown Circuit
- Bipolar Technology
- Package Outline TO-220(5PIN)

NJM2399TLA2050

Pin 1 locates on the left side of the package drawing (top front view).

■BLOCK DIAGRAM



NJM2399

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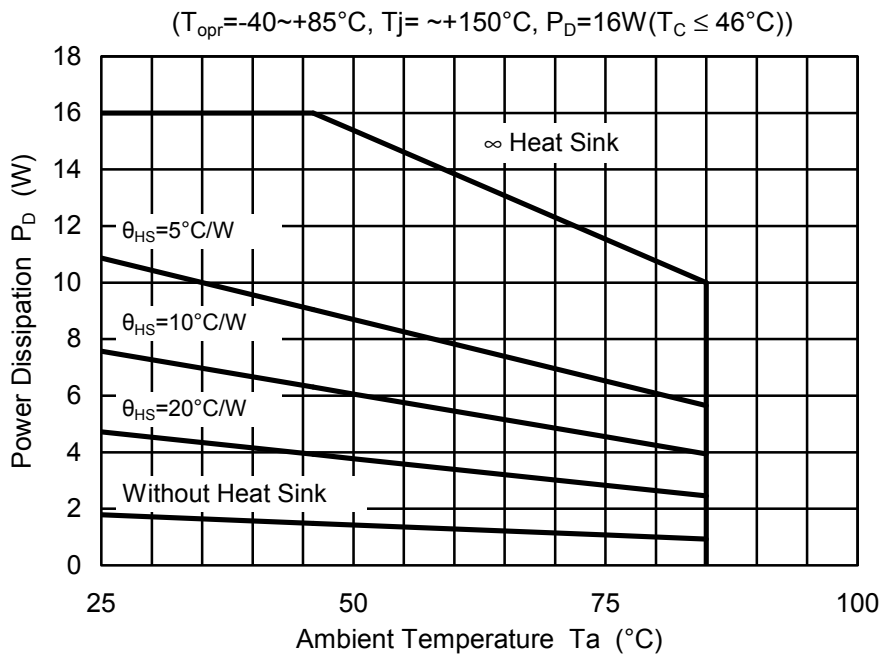
■ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	MAXIMUM RATINGS	UNIT
Maximum Supply Voltage	V ⁺	40	V
Switch Output Voltage	V _{O (SWITCH)}	-0.5 ~ +V _{in}	V
Voltage Feedback and Compensation Input Voltage Range	V _{FB} , V _{COMP}	-0.3 ~ +7.0	V
Power Dissipation	P _D	TO-220 (5PIN) 16(T _C ≤ 46°C)	W
Operating Junction Temperature	T _j	-40 ~ +150	°C
Operating Temperature Range	T _{opr}	-40 ~ +85	°C
Storage Temperature Range	T _{stg}	-50 ~ +150	°C

■THERMAL CHARACTERISTICS

Thermal Resistance	Junction-to-Ambient Temperature	θ _{ja}	70	°C/W
	Junction-to-Case	θ _{jc}	6.5	

■POWER DISSIPATION vs. AMBIENT TEMPERATURE



■ELECTRICAL CHARACTERISTICS ($V^+=12V$, $T_a=25^\circ C$)

Oscillator Block

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Frequency	fosc	$V^+=7.5V$	65	72	79	kHz

Error Amplifier Block

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Voltage Feedback Input Threshold	$V_{FB(th)}$		4.9	5.0	5.1	V
Line Regulation	REG-Line	$V^+=7.5 \sim 40V$	–	0.03	0.08	%/V
Input Bias Current	I_B	$V_{FB}=V_{FB(th)}+0.15V$	–	0.15	1.0	μA
Ripple Rejection	PSRR	$V^+=10 \sim 20V$	–	80	–	dB
Output Voltage Swing	V_{OH}	$I_{source}=75\mu A, V_{FB}=4.7V$	4.2	4.9	–	V
	V_{OL}	$I_{sink}=0.4mA, V_{FB}=5.3V$	–	1.6	1.9	V

PWM comparator Block

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Duty Cycle	$DC_{(MAX)}$ $DC_{(MIN)}$	$V_{FB}=0V$	–	95	–	%
		$V_{FB}=5.3V$	0	0	0	%

Switch Output Block

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage Saturation	V_{SAT}	$V^+=7.5V, I_{source}=6.5A$	–	$V^+-1.8$	$V^+-2.1$	V
OFF-State Leakage	$I_{sw(off)}$	$V^+=40V, SW_{OUT}=0V$	–	0	100	μA
Current Limit Threshold	$I_{pk(SWITCH)}$	$V^+=7.5V$	6.5	7.5	9.0	A
Switching Times						
Output Voltage Rise Time	tr	$V^+=40V, R_{OUT}=7.7\Omega, V_{FB}=0V$	–	100	–	ns
Output Voltage Fall Time	tf	$V^+=40V, R_{OUT}=7.7\Omega, V_{FB}=0V$	–	50	–	ns

Under Voltage Lockout Block

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Startup Threshold	$V_{TH(UVLO)}$	V^+ Increasing	5.9	6.3	6.7	V
Hysteresis	$V_H(UVLO)$	V^+ Decreasing	0.6	0.8	1.0	V

Total Device

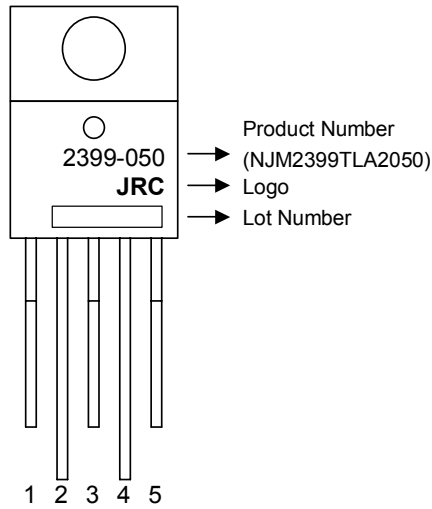
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Standby-State Power Supply Current	$I_{CC(stby)}$	$STBY \leq 0.1V$	–	36	100	μA
Operating-State Power Supply Current	I_{CC}	$V^+=40V, V_{FB}=0V$ duty cycle=MAX	–	40	53	mA

Keep the limit of maximum power dissipation not to operate thermal shutdown.

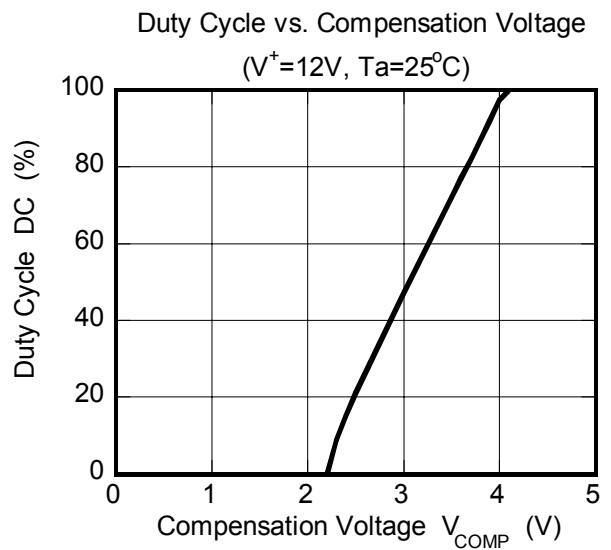
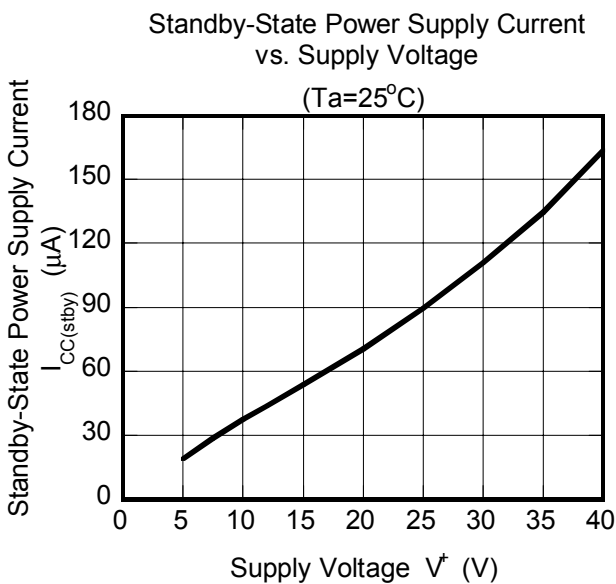
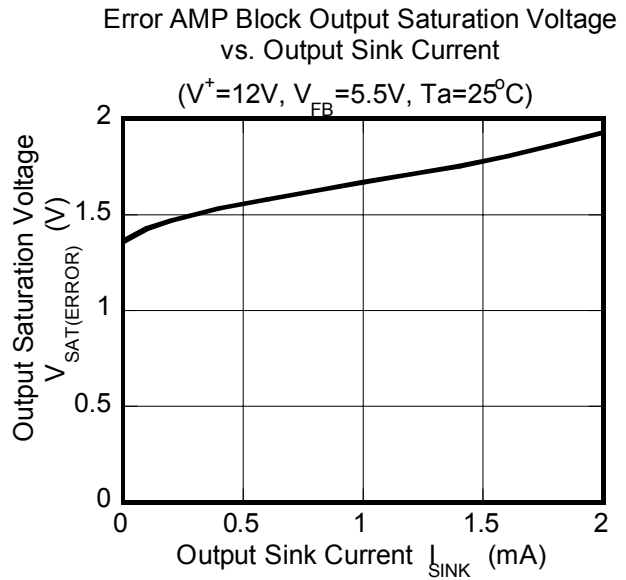
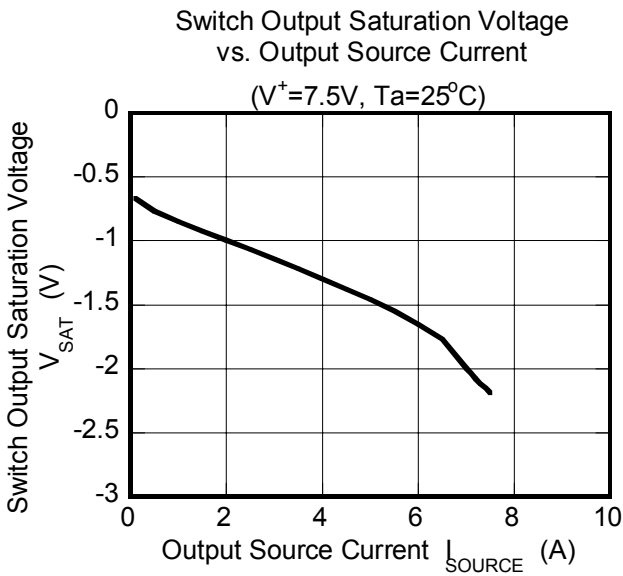
Low duty cycle pulse test is used to close its junction temperature to ambient temperature.

NJM2399

MARKING



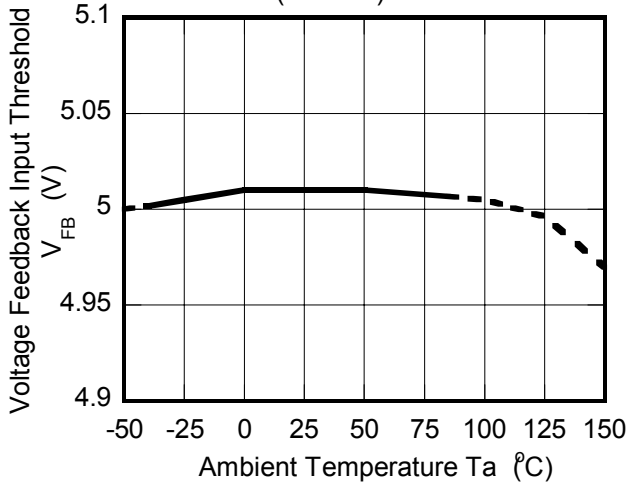
TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS

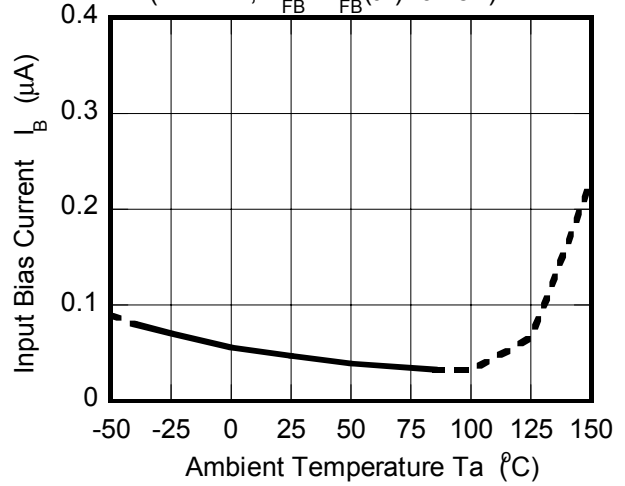
Voltage Feedback Input Threshold vs. Temperature

($V^+ = 12V$)



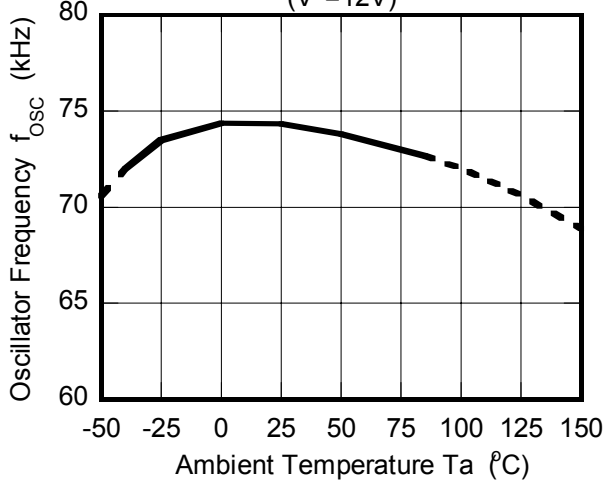
Error AMP Block Input Bias Current vs. Temperature

($V^+ = 12V, V_{FB} = V_{FB(th)} + 0.15V$)



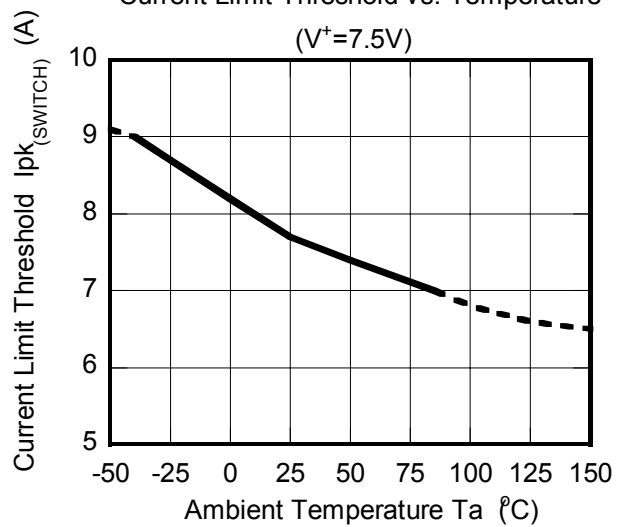
Oscillator Frequency vs. Temperature

($V^+ = 12V$)

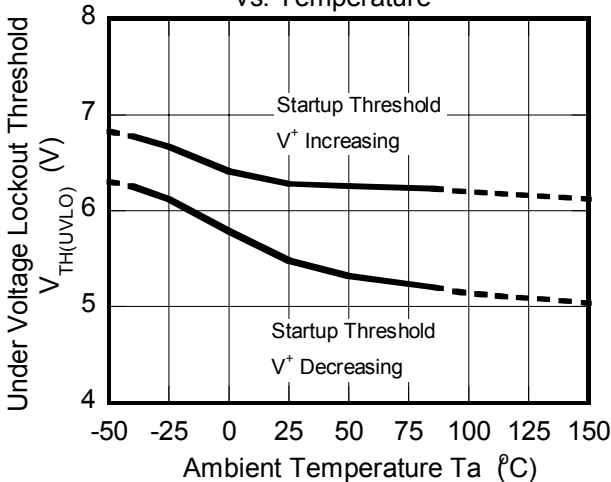


Current Limit Threshold vs. Temperature

($V^+ = 7.5V$)

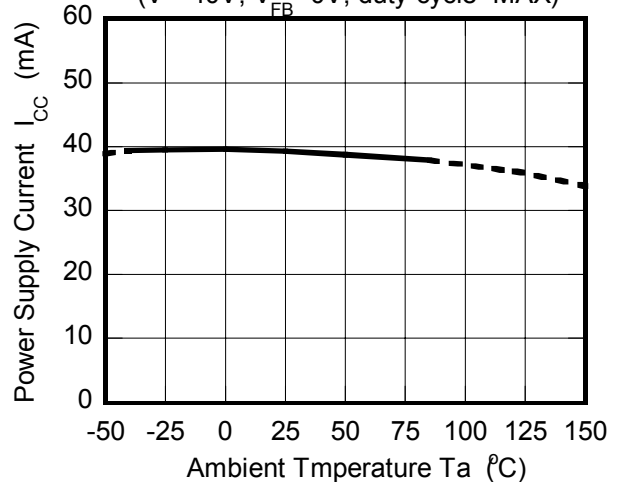


Under Voltage Lockout Threshold vs. Temperature



Operating-State Power Supply Current vs. Temperature

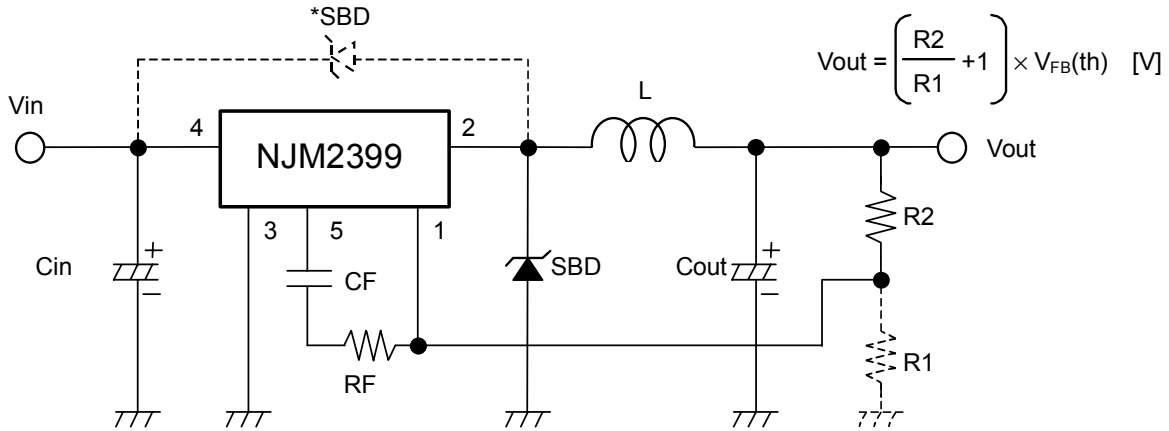
($V^+ = 40V, V_{FB} = 0V, \text{duty cycle} = \text{MAX}$)



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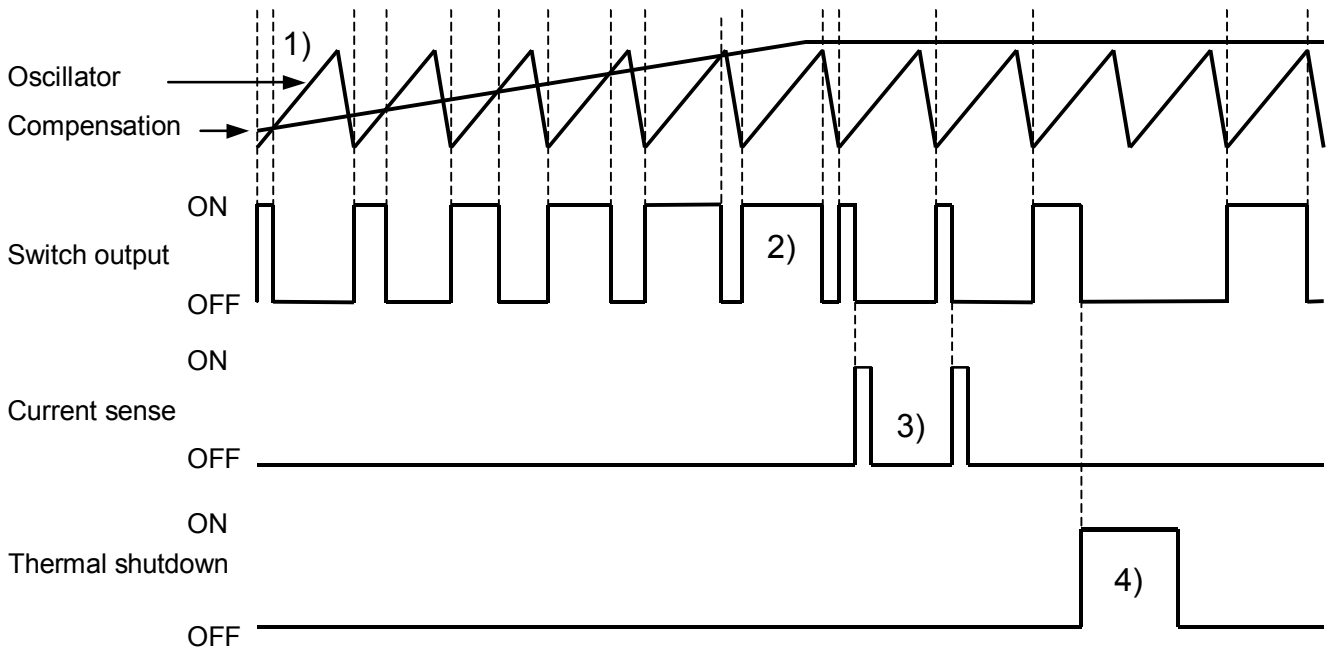
■ TYPICAL APPLICATIONS

Step-Down Converter



- 1) 5V and higher converter, the application must be connected R1 resistor according to above figure.
- 2) High current converter, the application must be placed Cin capacitor next to NJM2399, which avoid the power-line fluctuation.
- 3) The sharp fluctuation of output load cause reverse voltage for inductance and over the supply-voltage for SW_{OUT} terminal. To avoid this problem, the application must be placed SBD between terminal 2 and 4.

■ TIMING CHART



- 1) The NJM2399 generate square waves. The PWM comparator generate PWM signals to compare square waves and compensation voltage.
- 2) The switching duty is maximum 95%(typ.).
- 3) Over the 7.5A(typ.) current, the output switch will be OFF to operate current limit protection. The NJM2399 sense the switching current of power transistor.
- 4) Over the T_j=180°C(typ.), the switching will be OFF to operate thermal shutdown circuit.

MEMO

[CAUTION]

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