

Switching Regulator Control IC for Step-Down

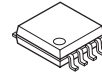
■GENERAL DESCRIPTION

The NJM2309 is a step-down Switching regulator IC with a wide operating voltage range.

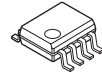
It features an open collector driver that can provide step-down applications.

Internal soft-start function and timer latch function for short circuit protection are included, requiring no external components.

■PACKAGE OUTLINE



NJM2309M
(DMP8)



NJM2309E
(SOP8)

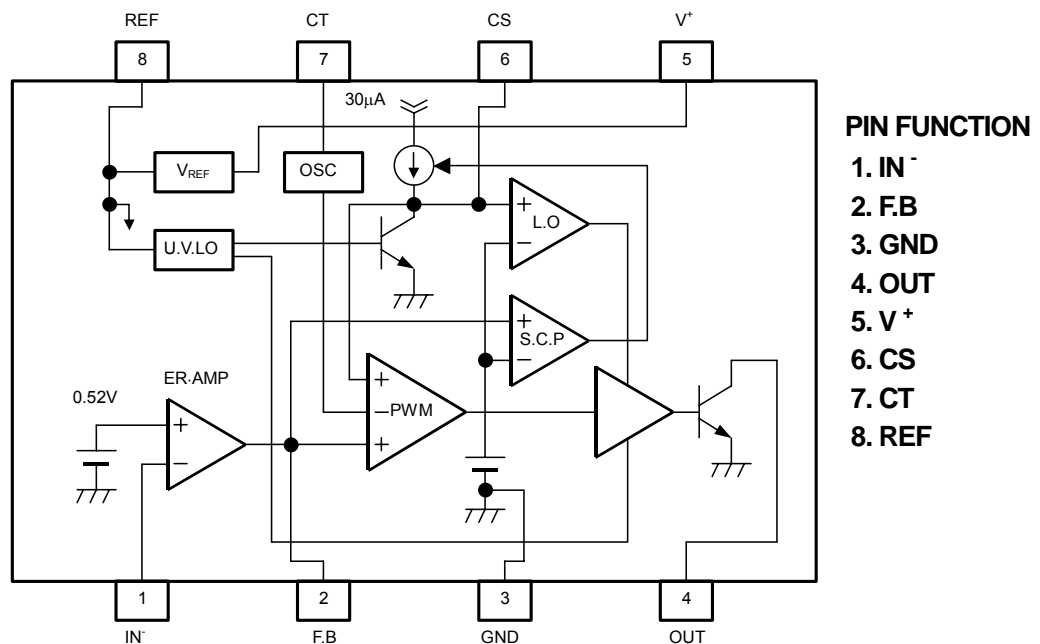


NJM2309V
(SSOP8)

■FEATURES

- PWM switching control
- Operating Voltage 3.6V to 32V
- Wide Oscillator Range 5kHz to 500 kHz
- Duty Cycle 0% to 100%
- Soft Start function
- Timer Latch for Short Circuit Protection
- Under Voltage Lockouts (U.V.LO)
- Bipolar Technology
- Package Outline NJM2309M : DMP8
 NJM2309E : SOP8 JEDEC 150mil
 NJM2309V : SSOP8

■BLOCK DIAGRAM



- PIN FUNCTION**
1. IN⁻
 2. FB
 3. GND
 4. OUT
 5. V⁺
 6. CS
 7. CT
 8. REF

NJM2309

■ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	MAXIMUM RATINGS	UNIT
Input Voltage	V^+	36	V
Out pin Voltage	$V_{O\text{ PIN}}$	36	V
Reference Output Current	I_{OR}	10	mA
Output Current	I_O	200	mA
Power Dissipation	P_D	DMP8 : 375 SOP8 : 375 SSOP8 : 312	mW
Operating Temperature Range	T_{opr}	-40 ~ +85	°C
Storage Temperature Range	T_{stg}	-50 ~ 150	°C

■RECOMMENDED OPERATING CONDITIONS

($V^+=6V$, Ta=25°C)

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Operating Voltage	V^+	3.6	32	V
OUT pin Voltage	$V_{O\text{ PIN}}$	-	32	V
Feed Back Resistor	R_{NF}	100	-	kΩ
Oscillator Timing Capacitor	C_T	220	22,000	pF
Oscillator Timing Resistor	R_T	10	100	kΩ
Oscillation Frequency	f_{OSC}	5	500	kHz

■ELECTRICAL CHARACTERISTICS

($V^+=6V$, $R_T=33k\Omega$, $C_T=1,000pF$, Ta=25°C)

REFERENCE VOLTAGE BLOCK

PARAMETER	SYMBOL	RATINGS	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_{REF}	$I_{OR}=1mA$	2.45	2.50	2.55	V
Line Regulation	L_{LINE}	$V^+=3.6V \sim 32V$, $I_{OR}=1mA$	-	6.8	20.7	mV
Load Regulation	L_{LOAD}	$I_{OR}=0.1mA \sim 5.0mA$	-	5	30	mV

OSCILLATOR BLOCK

PARAMETER	SYMBOL	RATINGS	MIN.	TYP.	MAX.	UNIT
Oscillation Frequency	f_{osc}	$C_T=1,000pF$, $R_T=33k\Omega$	85	105	125	kHz
Oscillate Fluctuations1 (Line Fluctuations)	f_{dv}	$V^+=3.6V$ to 32V	-	1	-	%
Oscillate Fluctuations2 (Temp Fluctuations)	f_{dt}	Ta=-40°C to +85°C	-	5	-	%

ERROR AMPLIFIER BLOCK

PARAMETER	SYMBOL	RATINGS	MIN.	TYP.	MAX.	UNIT
Reference Voltage	V_B		0.51	0.52	0.53	V
Input Bias Current	I_B		-	5	100	nA
Open Loop Gain	A_V		-	90	-	dB
Gain Band width Product	G_B		-	0.6	-	MHz
Maximum Output Voltage (F.B Pin)	V_{OM+}	$R_{NF}=100k\Omega$	$V_{REF}-0.2$	-	-	V
	V_{OM-}	$R_{NF}=100k\Omega$	-	-	200	mV
Output Source Current (F.B Pin)	I_{OM+}	$V_{OM}=1V$	40	85	200	μA

■ELECTRICAL CHARACTERISTICS

($V^+=6V$, $R_T=33k\Omega$, $C_T=1,000pF$, $T_a=25^\circ C$)

PWM COMPARATE BLOCK

PARAMETER	SYMBOL	RATINGS	MIN.	TYP.	MAX.	UNIT
Input Threshold Voltage (F.B Pin)	V_{TH0}	duty:cycle=0%*	–	0.40	0.50	V
Input Threshold Voltage (F.B Pin)	V_{TH100}	duty:cycle=100%*	–	0.85	–	V

SOFT START CIRCUIT BLOCK

PARAMETER	SYMBOL	RATINGS	MIN.	TYP.	MAX.	UNIT
Input Bias Current (CS Pin)	I_{BCS}		–	250	650	nA
Input Threshold Voltage (CS Pin)	V_{THCS0}	duty:cycle=0%*	–	0.25	0.35	V
Input Threshold Voltage (CS Pin)	$V_{THCS100}$	duty:cycle=100%*	–	0.7	–	V

SHORT CIRCUIT PROTECTION BLOCK

PARAMETER	SYMBOL	RATINGS	MIN.	TYP.	MAX.	UNIT
Input Threshold Voltage (F.B Pin)	V_{THPC}		1.20	1.50	1.80	V
Charge Current (CS Pin)	I_{CHG}	CS Pin=0V, F.B Pin=2V	10	30	50	μA
Latch mode Threshold Voltage (CS Pin)	V_{THLA}		1.20	1.50	1.80	V

UNDER VOLTAGE LOCKOUT BLOCK

PARAMETER	SYMBOL	RATINGS	MIN.	TYP.	MAX.	UNIT
ON Threshold Voltage	V_{THON}		–	2.70	–	V
OFF Threshold Voltage	V_{THOFF}		–	2.52	–	V
Hysteresis Voltage	V_{HYS}		60	180	–	mV

OUTPUT BLOCK

PARAMETER	SYMBOL	RATINGS	MIN.	TYP.	MAX.	UNIT
L Level Output Voltage (OUT Pin)	V_{OL}	Output Sink Current =70mA	–	0.35	0.75	V
Leak Current	I_{O_LEAK}	$V^+=32V$, $V_{O_PIN}=32V$	–	–	1	μA

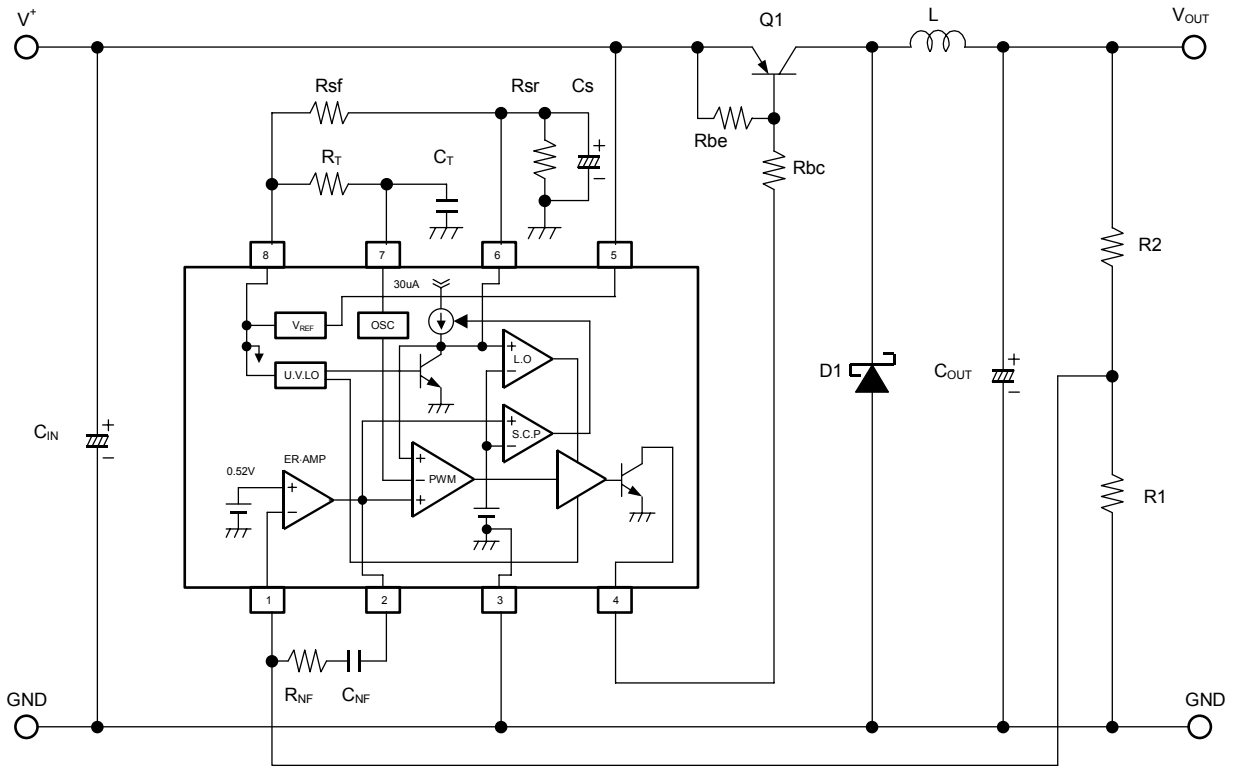
GENERAL CHARACTERISTICS

PARAMETER	SYMBOL	RATINGS	MIN.	TYP.	MAX.	UNIT
Quiescent Current	I_{CCLA}	Latch Mode	–	1.6	2.2	mA
Average Quiescent Current	I_{CCAV}	$R_L = \infty$, duty:cycle=50%	–	5.5	10	mA

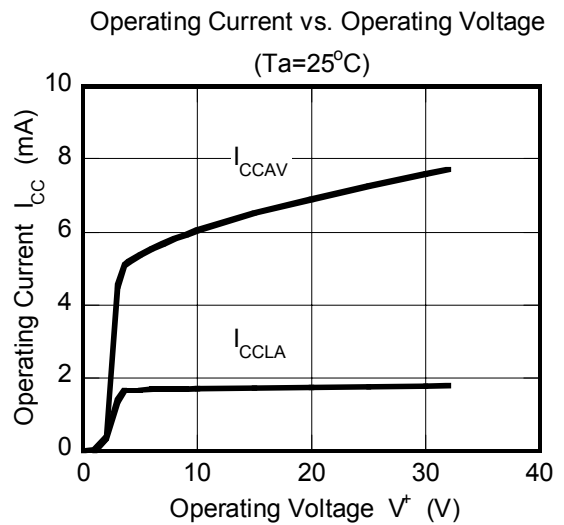
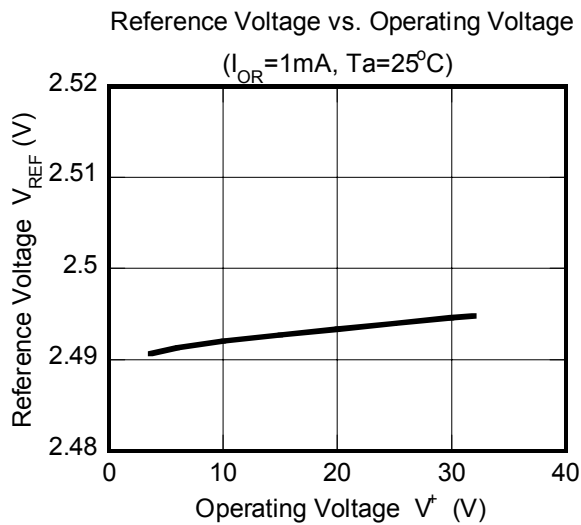
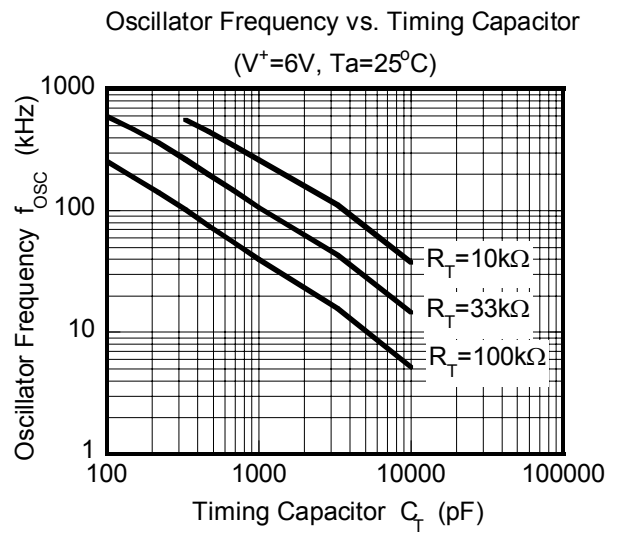
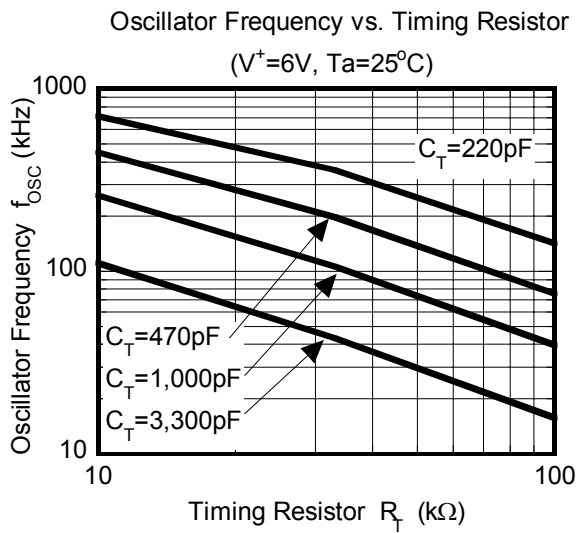
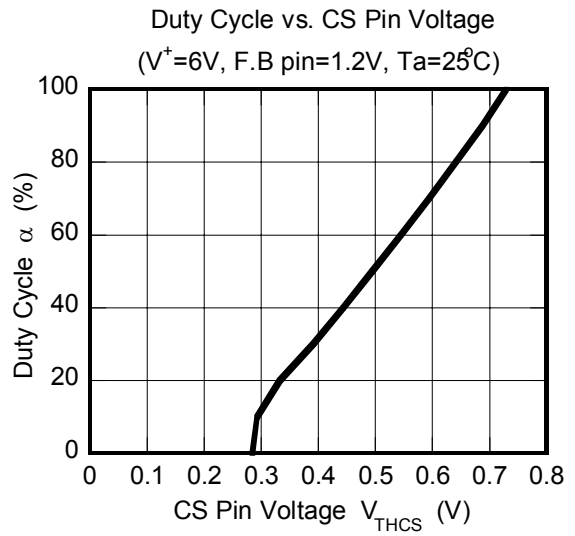
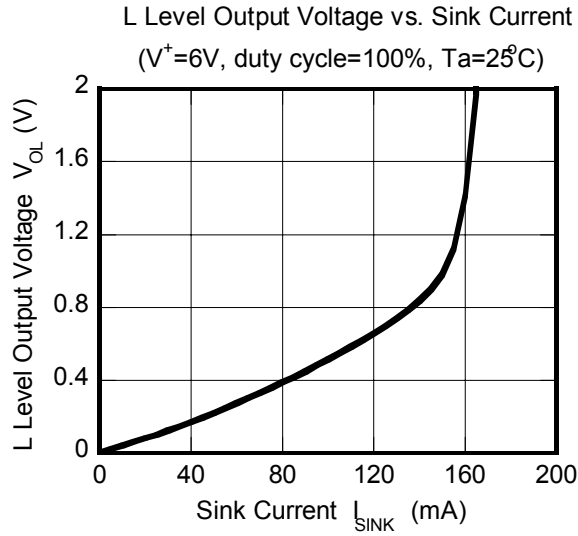
- (*) Duty-Cycle is defined as follows:
 Duty-Cycle=0%: IC output transistor is OFF.
 Duty-Cycle=100%: IC output transistor is ON.

NJM2309

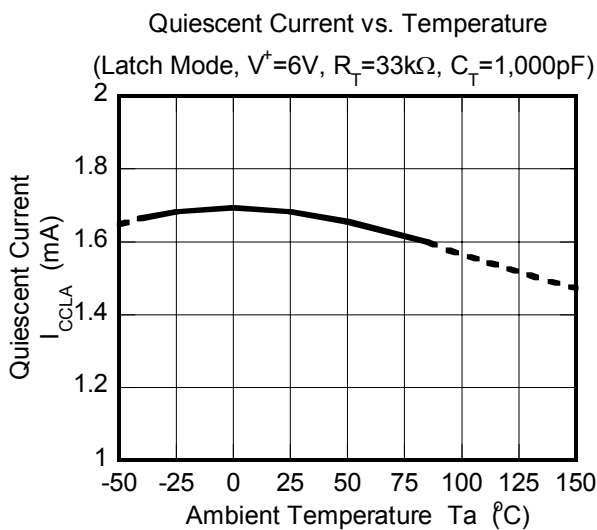
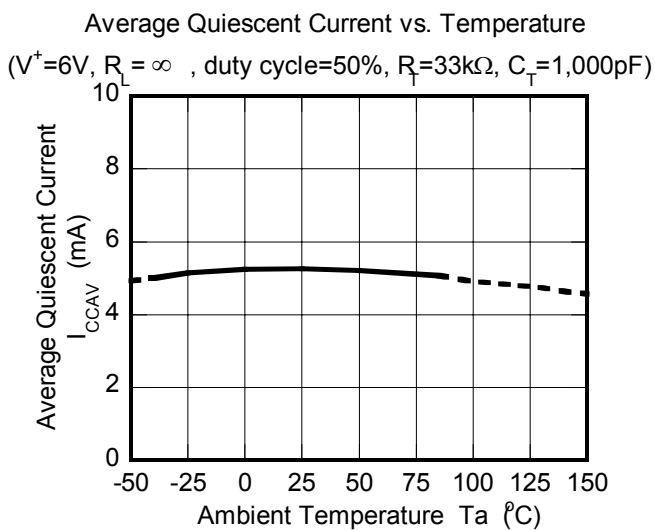
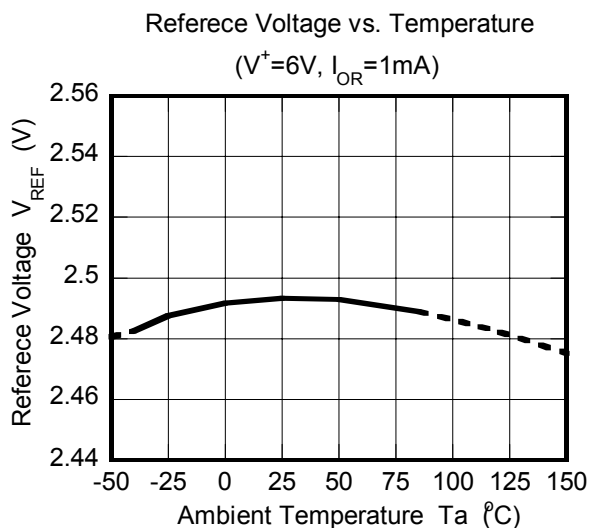
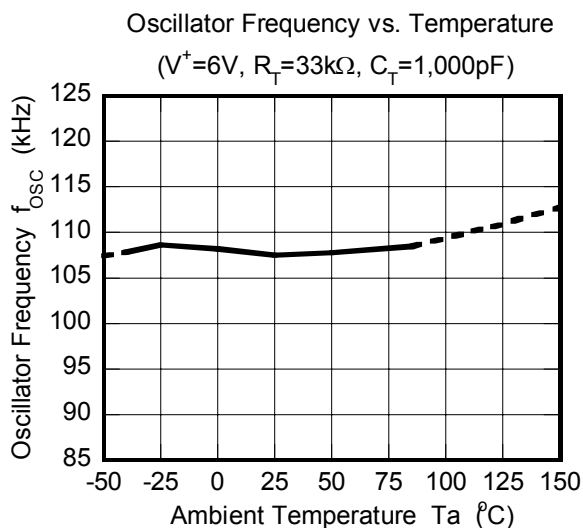
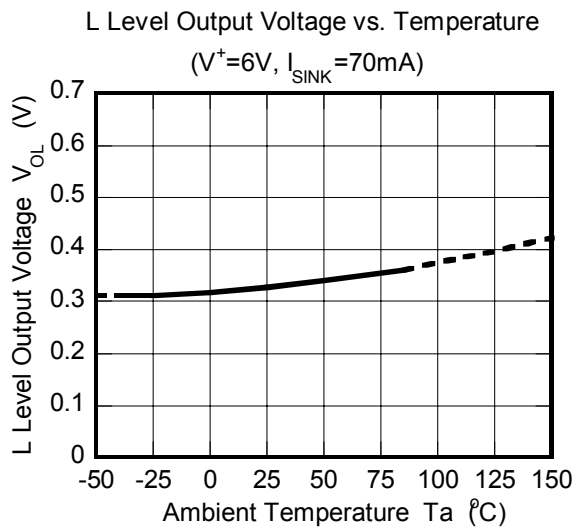
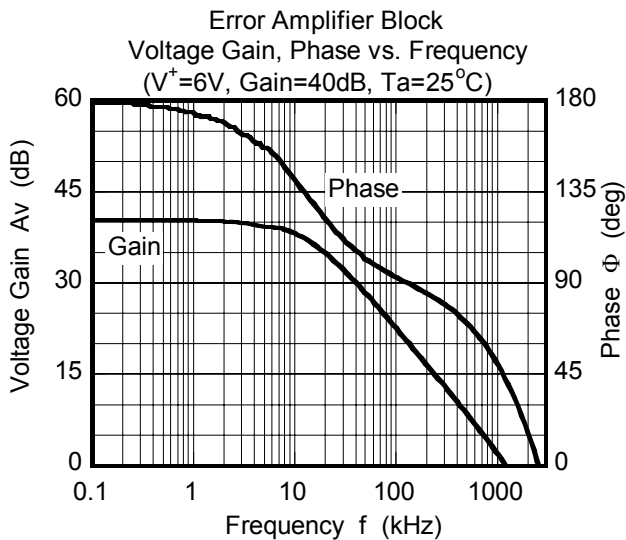
■ TYPICAL APPLICATIONS



■ TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS



MEMO

[CAUTION]

The specifications on this databook are only given for information, without any guarantee as regards either mistakes or omissions. The application circuits in this databook are described only to show representative usages of the product and not intended for the guarantee or permission of any right including the industrial rights.