

Switching Regulator Control IC for Step-Down

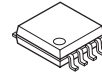
■GENERAL DESCRIPTION

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

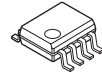
It features an open collector driver that can provide step-down applications.

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

■PACKAGE OUTLINE



**NJM2309M
(DMP8)**



**NJM2309E
(SOP8)**

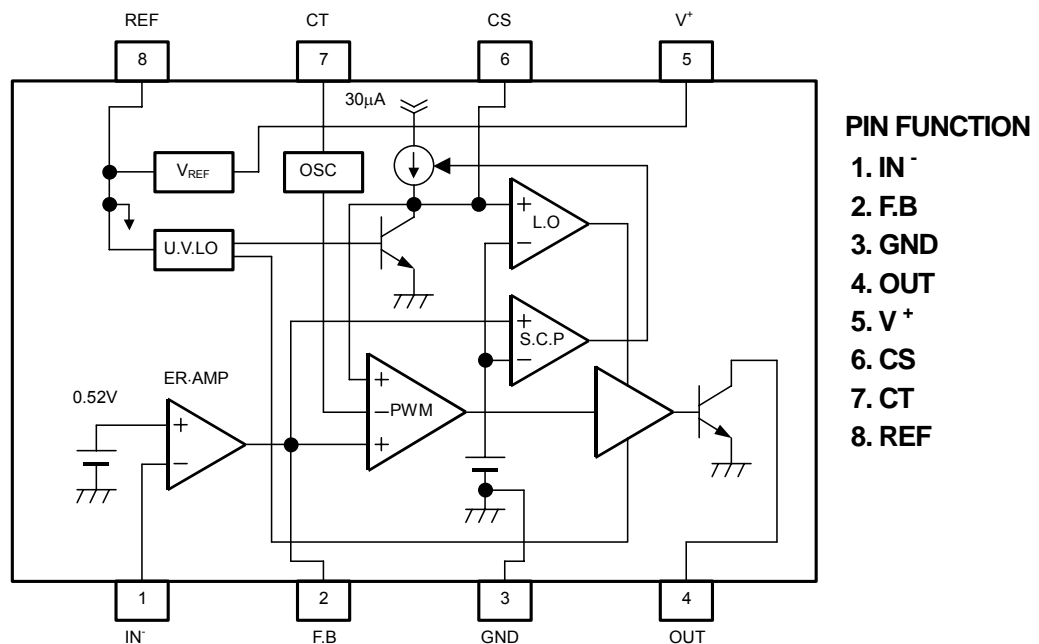


**NJM2309V
(SSOP8)**

■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



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

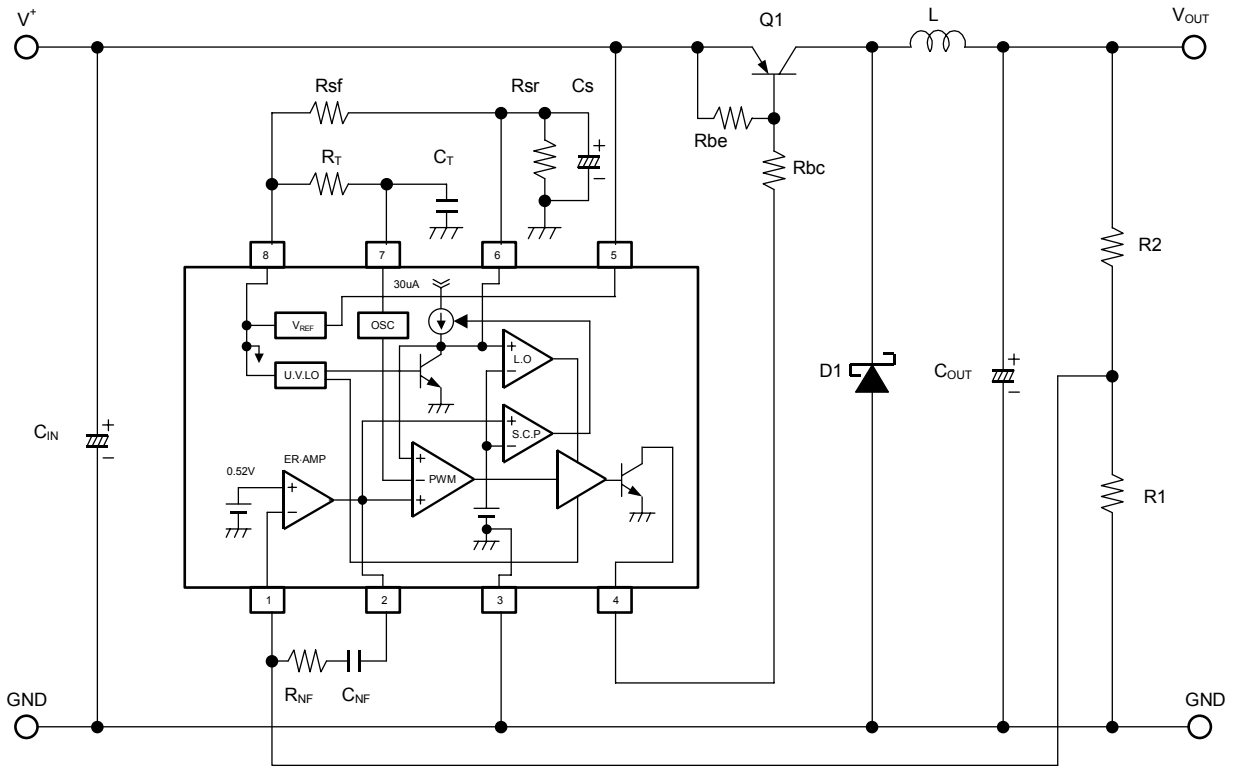
GENERAL CHARACTERISTICS

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

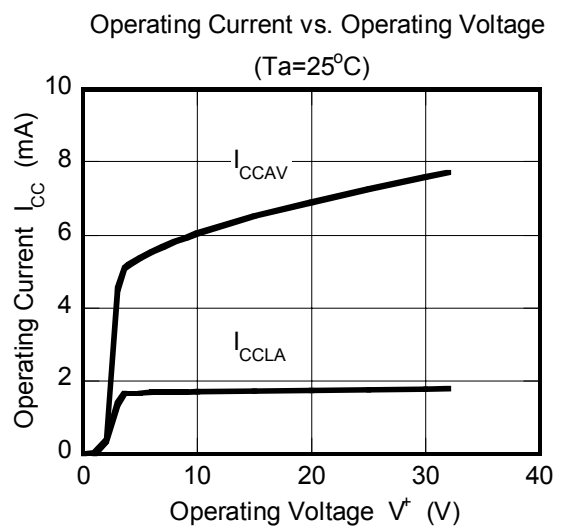
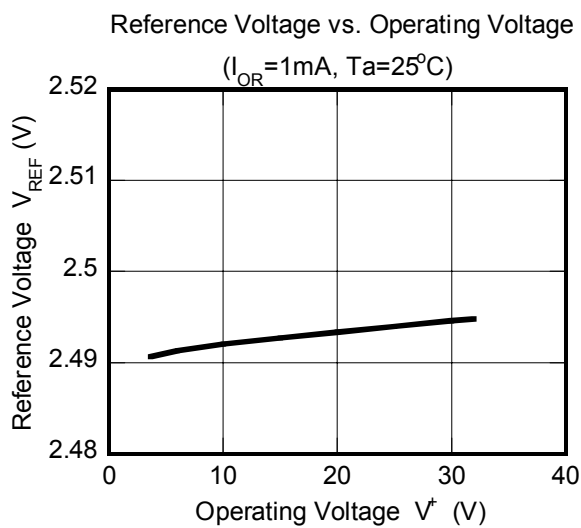
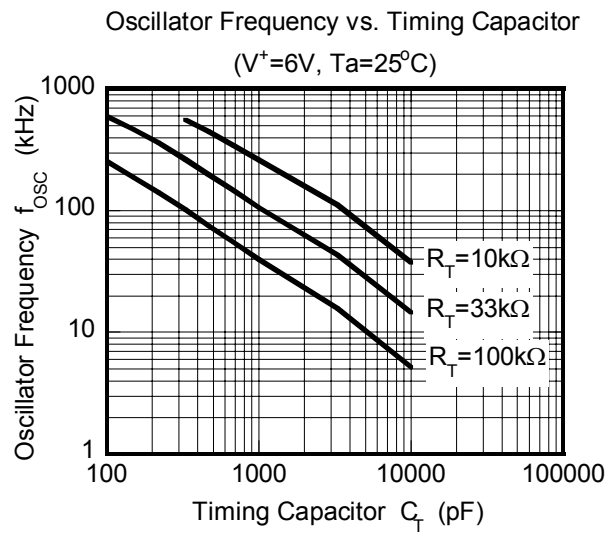
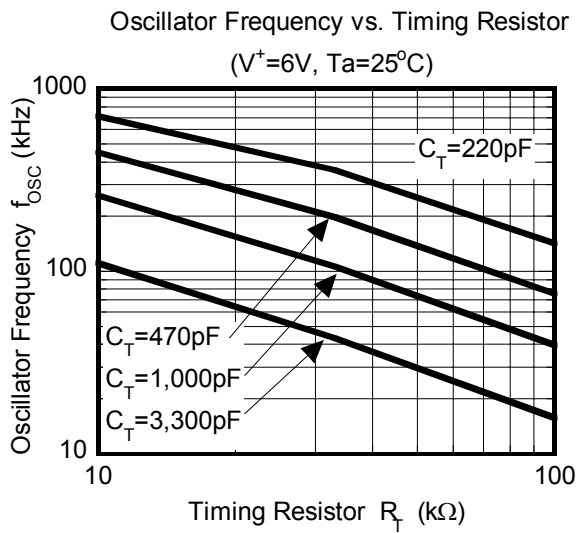
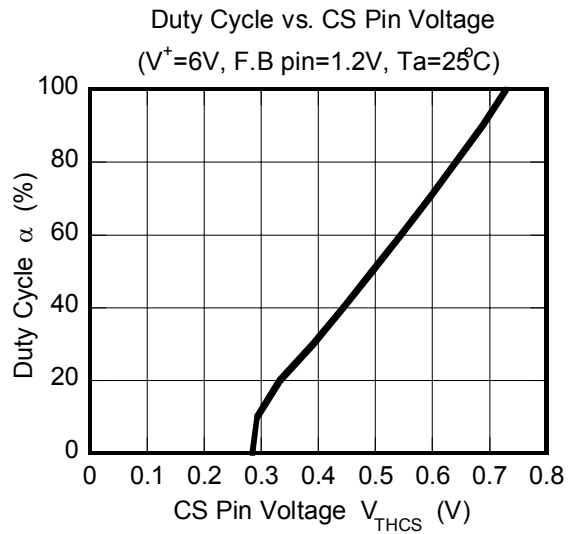
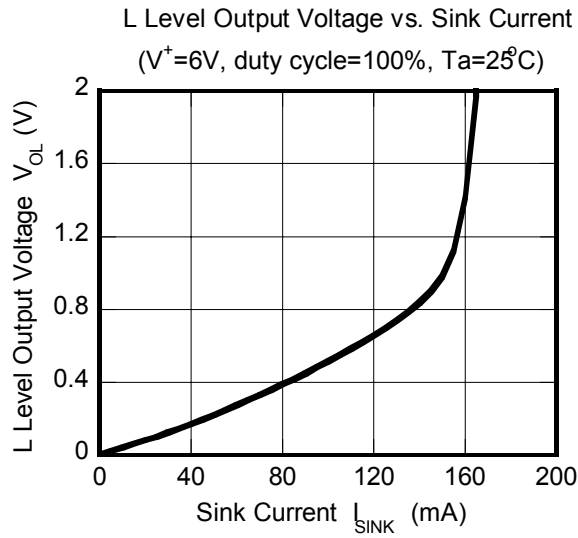
- (*) Duty-Cycle is defined as follows:
 Duty-Cycle=0%: IC output transistor is OFF.
 Duty-Cycle=100%: IC output transistor is ON.

NJM2309

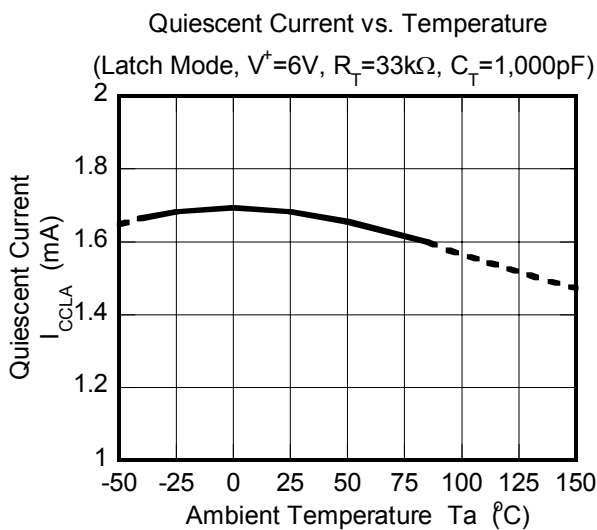
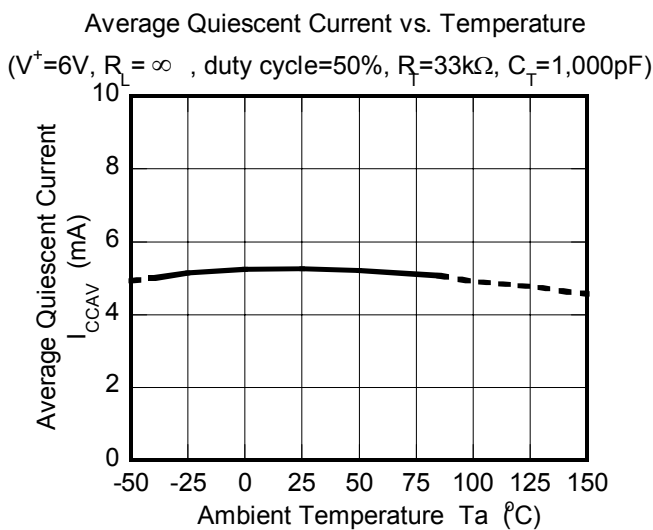
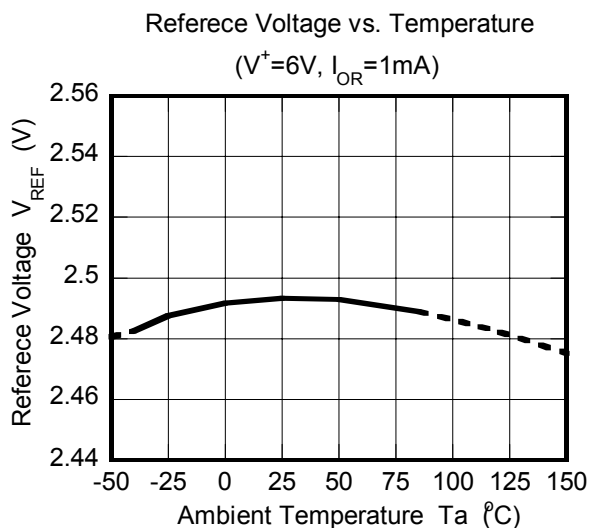
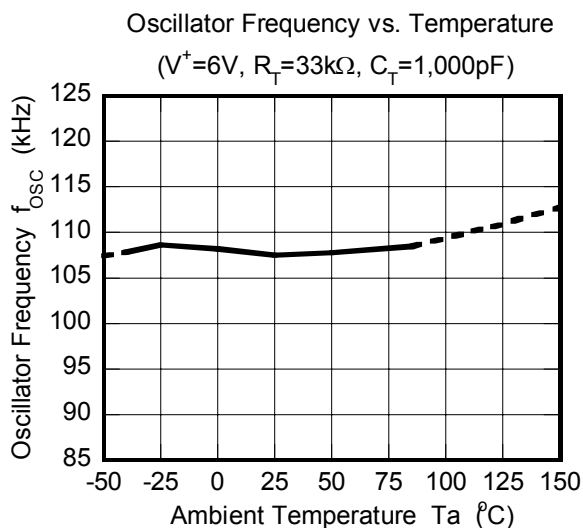
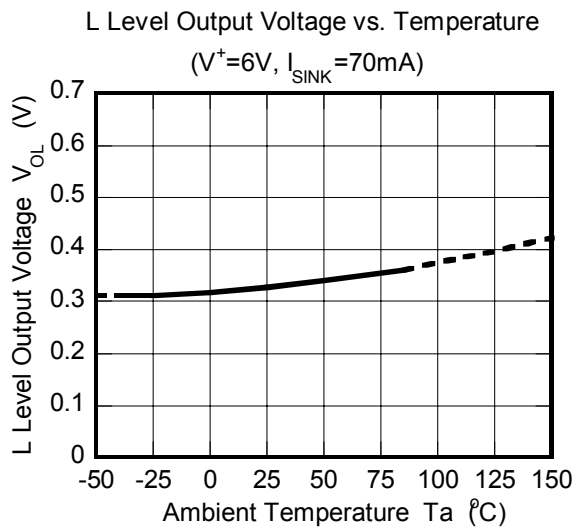
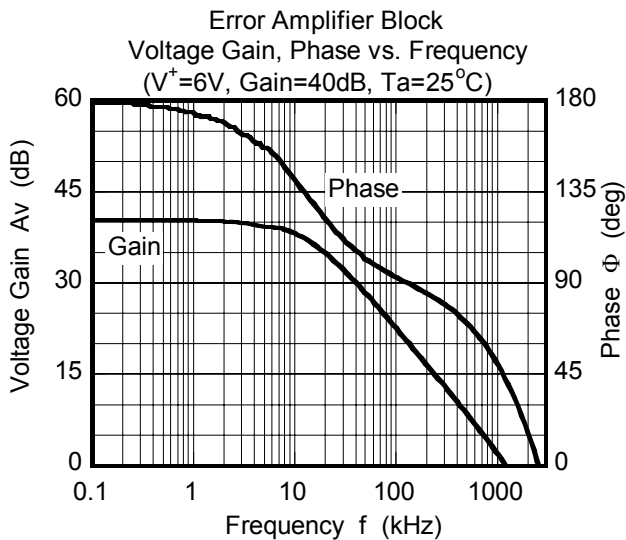
■ TYPICAL APPLICATIONS



■ TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS



MEMO

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