

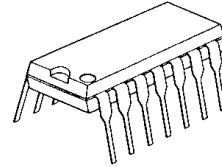
DC/DC CONVERTER CONTROL IC WITH CURRENT SENSE AMPLIFIER

■GENERAL DESCRIPTION

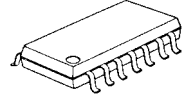
The **NJM2384** is a low voltage operation DC/DC converter control IC featuring high side current protection and soft start functions.

It is suitable for battery charger, power module application and on-board regulators.

■PACKAGE OUTLINE



NJM2384D



NJM2384M

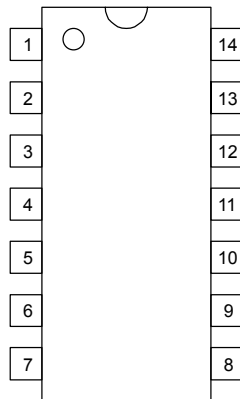
■FEATURES

- PWM switching control
- Operating Voltage 3.6V to 32V
- Wide Oscillator Range 5kHz to 500 kHz
- Current Sensing Amplifier
- Soft-Start Function
- UVLO (Under Voltage Lockouts)
- Bipolar Technology
- Package Outline DIP14, DMP14, SSOP10



NJM2384V

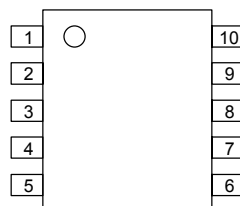
■PIN CONFIGURATION



NJM2384D
NJM2384M

PIN FUNCTION

1.NC	8.NC
2.IN ⁻ 1	9. V ⁺
3.IN ⁻ 2	10.CS
4.F.B	11.CT
5.GND	12.REF
6.OUT	13.IN ⁺
7.NC	14.NC



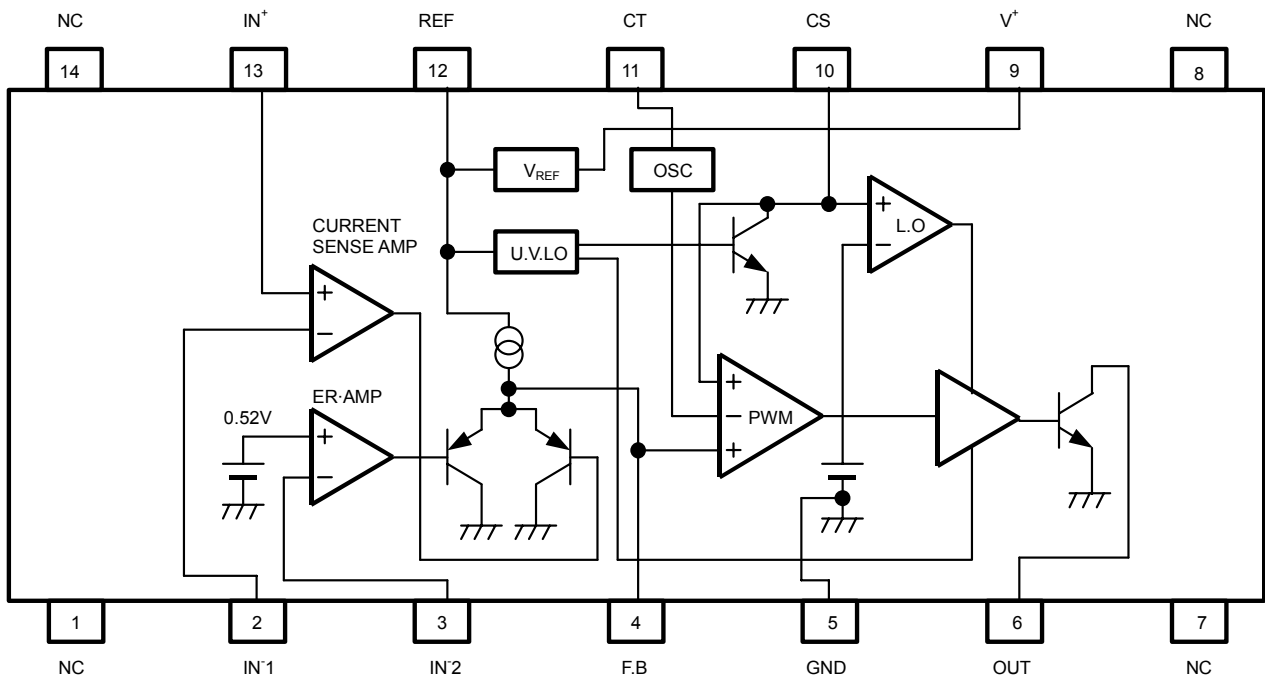
NJM2384V

PIN FUNCTION

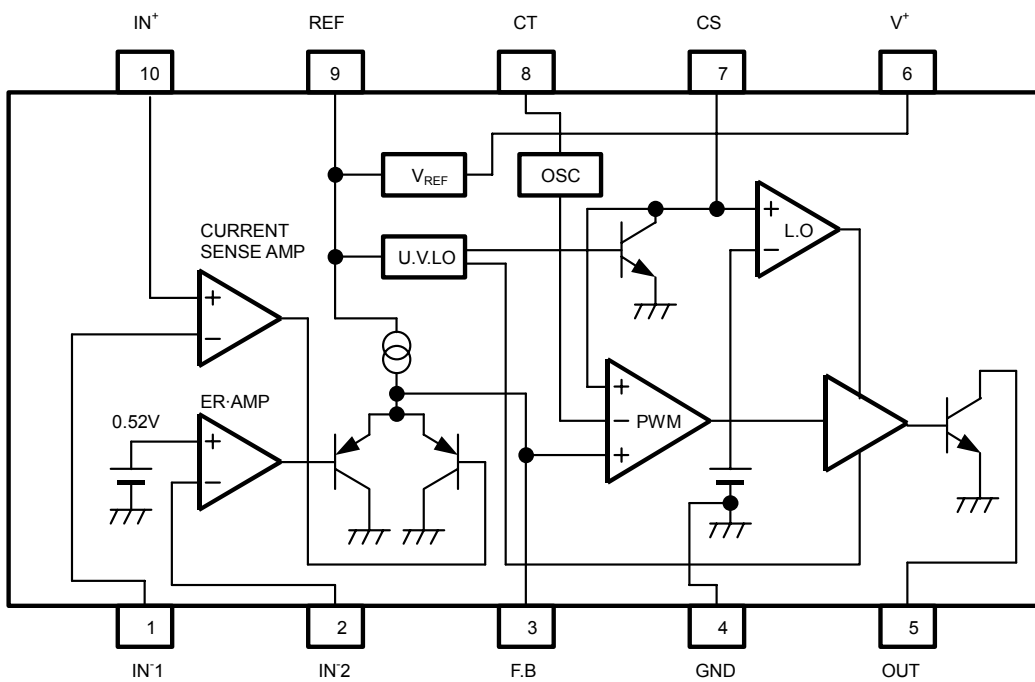
1.IN ⁻ 1	6. V ⁺
2.IN ⁻ 2	7.CS
3.F.B	8.CT
4.GND	9.REF
5.OUT	10.IN ⁺

NJM2384

■BLOCK DIAGRAM



(Package: DIP14, DMP14)



(Package: SSOP10)

■ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	MAXIMUM RATINGS	UNIT
Input Voltage	V ⁺	36	V
Reference Output Current	I _{OR}	10	mA
Output Sink Current	I _{SINK}	200	mA
Differential Input Voltage	V _{ID}	2.5	V
Common Mode Input Voltage	V _{IC}	-0.3 ~ 2.5	V
Power Dissipation	P _D	(DIP 14) 700 (DMP 14) 300 (SSOP 10) 250	mW
Operating Temperature Range	T _{OPR}	-40 ~ +85	°C
Storage Temperature Range	T _{STG}	-50 ~ +150	°C

■ELECTRICAL CHARACTERISTICS (V⁺=6V, R_T=33kΩ, C_T=1000pF, Ta=25°C)

REFERENCE VOLTAGE BLOCK

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V _{REF}	I _{OR} =1mA	2.45	2.50	2.55	V
Line Regulation	L _{INE}	V ⁺ =3.6 ~ 32V, I _{OR} =1mA	-	6.8	20.7	mV
Load Regulation	L _{OAD}	I _{OR} =0.1 ~ 5.0mA	-	5	30	mV

OSCILLATOR BLOCK

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Oscillation Frequency	f _{OSC}	R _T =33kΩ, C _T =1000pF	85	105	125	kHz
Oscillate Fluctuations1 (Line Fluctuations)	f _{dV}	V ⁺ =3.6 ~ 32V	-	1	-	%
Oscillate Fluctuations2 (Temp Fluctuations)	f _{dT}	Ta=-40°C ~ 85°C	-	5	-	%

CURRENT SENSE AMPLIFIER BLOCK

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Offset Voltage1	V _{IO1}		-	2	7	mV
Input Offset Current1	I _{IO1}		-	5	50	nA
Input Bias Current1	I _{B1}		-	5	100	nA
Open Loop Gain1	A _{V1}		-	90	-	dB
Gain Bandwidth Product1	G _{B1}		-	0.6	-	MHz
Input Common Mode Voltage Ratio1	V _{ICM1}		-	0 ~ V _{REF} -0.8	-	V
Maximum Output Voltage1 (F.B Pin)	V _{OM-1}	R _{NF} =100kΩ	-	-	1	V
Maximum Source Current1 (F.B Pin)	I _{OM+1}	V _{OM} =0.5V	40	85	200	μA

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■ ELECTRICAL CHARACTERISTICS ($V^+=6V, R_T=33k\Omega, C_T=1000pF, T_a=25^\circ C$)

ERROR AMPLIFIER BLOCK

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Reference Voltage ₂	V_{B2}		0.51	0.52	0.53	V
Input Bias Current ₂	I_{B2}		–	5	100	nA
Open Loop Gain ₂	A_{V2}		–	90	–	dB
Gain Bandwidth Product ₂	G_{B2}		–	0.6	–	MHz
Maximum Output Voltage ₂ (F.B Pin)	V_{OM-2}	$R_{NF}=100k\Omega$	–	–	1	V
Maximum Source Current ₂ (F.B Pin)	I_{OM+2}	$V_{OM}=0.5V$	40	85	200	μA

PWM COMPARATE BLOCK

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Threshold Voltage (F.B Pin)	V_{TH0}	duty·cycle=0% (note)	–	1.65	1.75	V
Input Threshold Voltage (F.B Pin)	V_{TH100}	duty·cycle=100% (note)	–	2.10	–	V

SOFT START CIRCUIT BLOCK

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Bias Current (CS Pin)	I_{BCS}	CS Pin=1.8V	–	250	650	nA
Input Threshold Voltage (CS Pin)	V_{THCS0}	duty·cycle=0% (note)	–	0.25	0.35	V
Input Threshold Voltage (CS Pin)	V_{THCS50}	duty·cycle=100% (note)	–	0.7	–	V

UNDER VOLTAGE LOCKOUT BLOCK

PARAMETER	SYMBOL	TEST CONDITION	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	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
L Output Voltage (OUT Pin)	V_{OL}	Output Sink Current=100mA	–	0.25	0.65	V

GENERAL CHARACTERISTICS

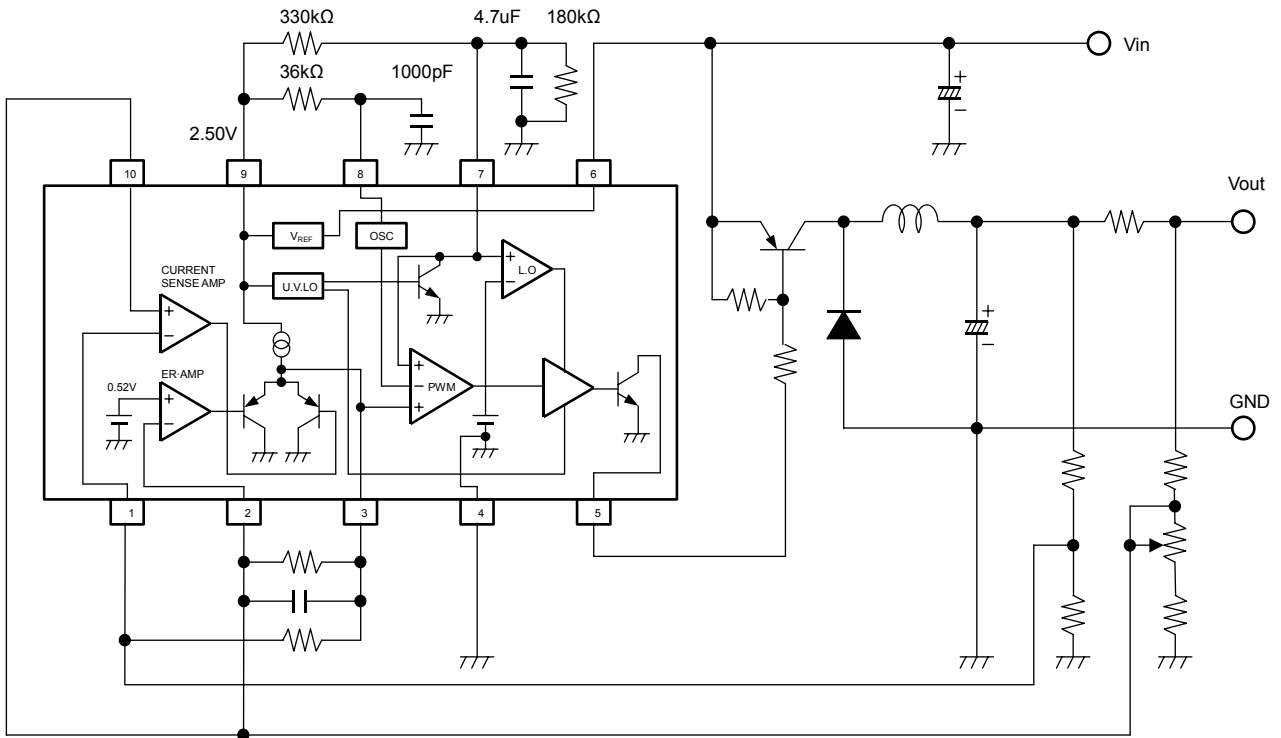
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Latch Mode Threshold Voltage (CS Pin)	V_{THLA}		1.2	1.5	1.8	V
Quiescent Current	I_{CCLA}	Latch Mode	–	1.6	2.2	mA
Average Quiescent Current	I_{CCAV}	$R_L = \infty$, duty·cycle=50%	–	5.5	10	mA

(note) Duty·Cycle is defined as follows:

Duty·Cycle=0%: IC output transistor is OFF.

Duty·Cycle=100%: IC output transistor is ON.

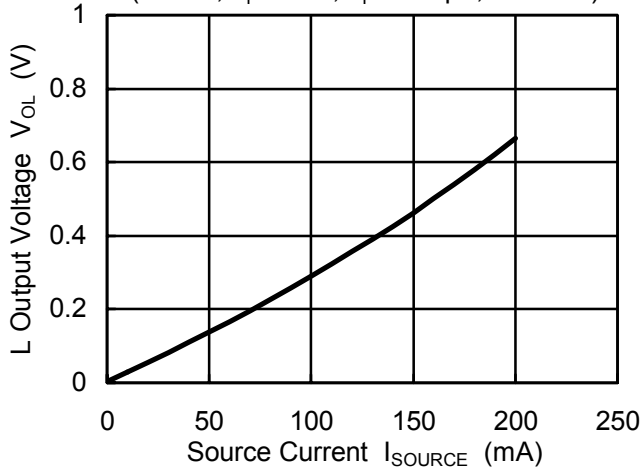
■ TYPICAL APPLICATIONS



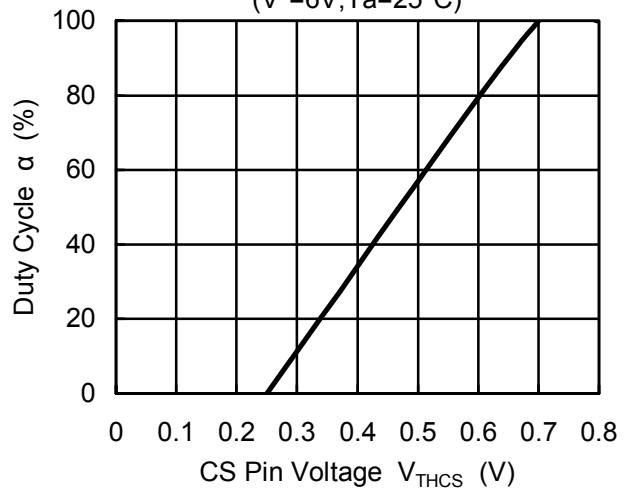
(Package:SSOP10)

■ TYPICAL CHARACTERISTICS

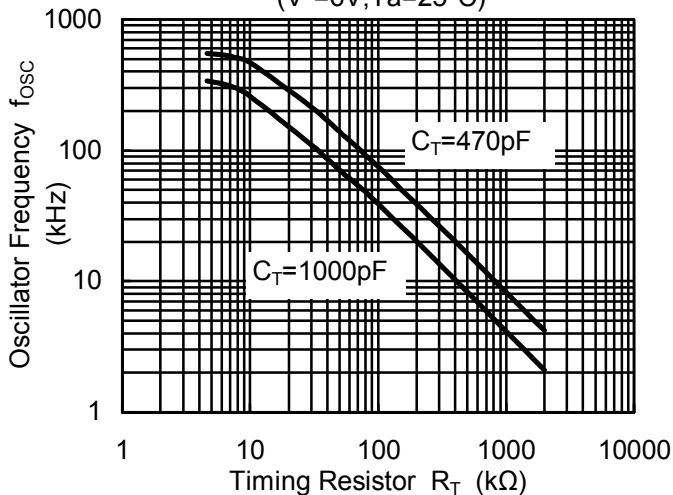
L Output Voltage vs. Source Current
($V^+=6V, R_T=33k\Omega, C_T=1000pF, T_a=25^\circ C$)



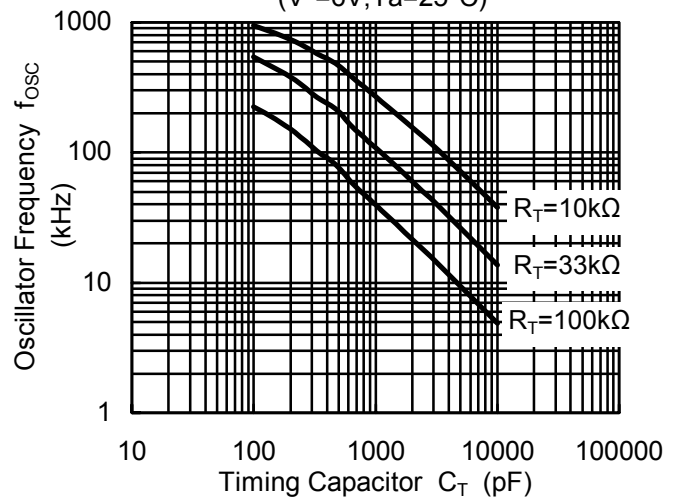
Duty Cycle vs. CS Pin Voltage
($V^+=6V, T_a=25^\circ C$)



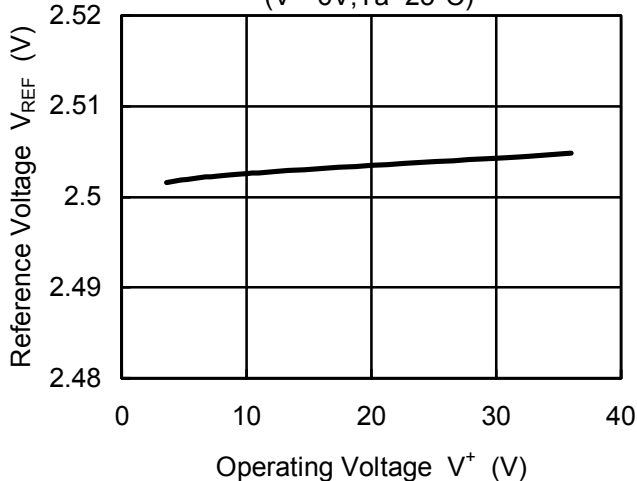
Oscillator Frequency vs. Timing Resistor
($V^+=6V, T_a=25^\circ C$)



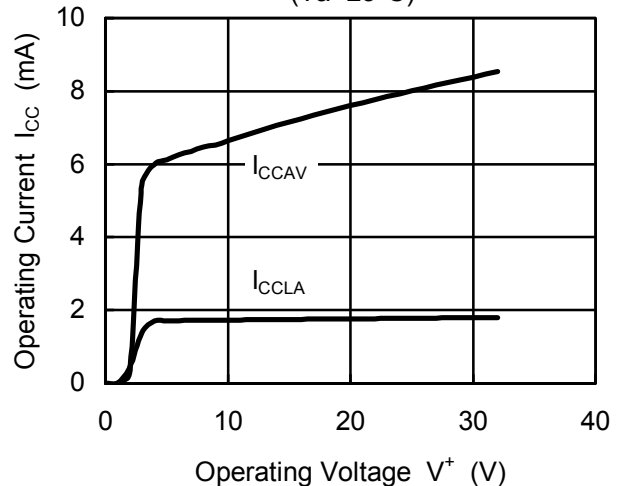
Oscillator Frequency vs. Timing Capacitor
($V^+=6V, T_a=25^\circ C$)



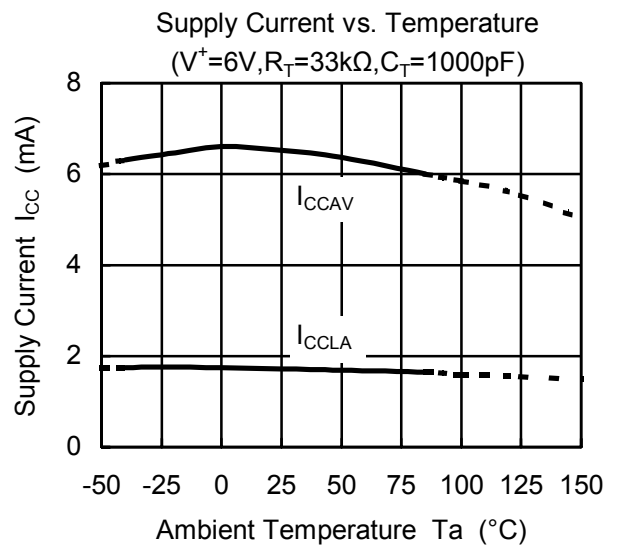
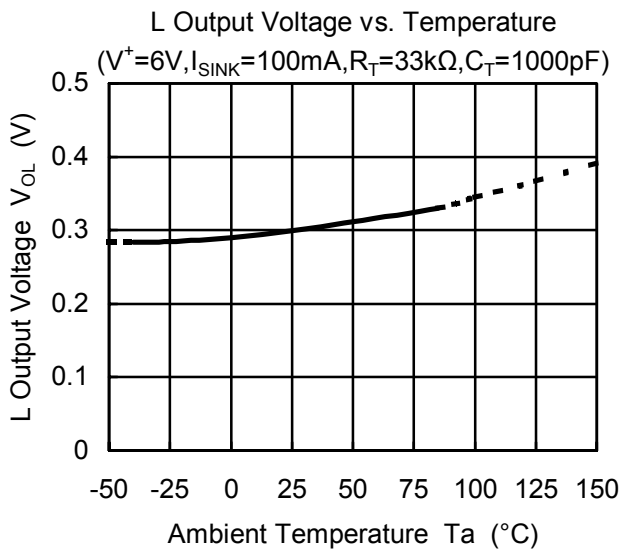
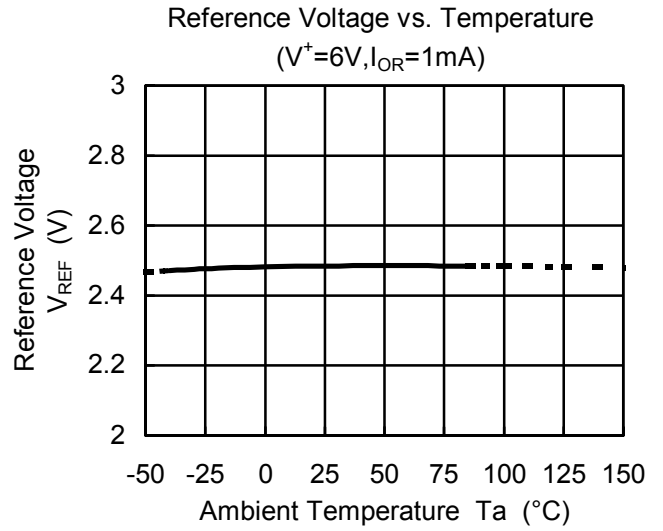
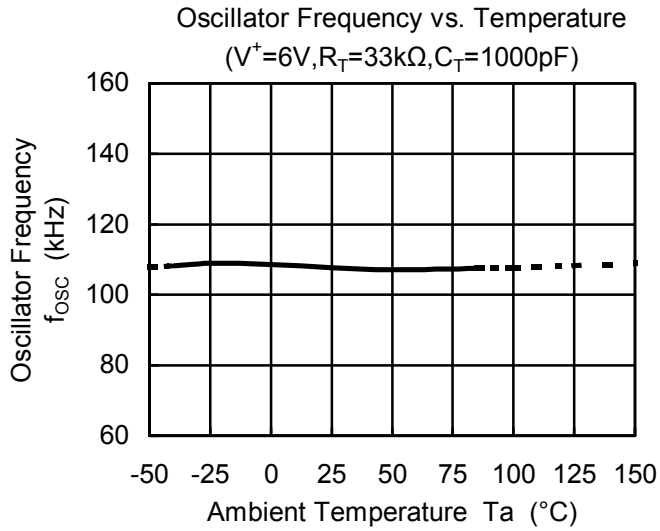
Reference Voltage vs. Operating Voltage
($V^+=6V, T_a=25^\circ C$)



Operating Current vs. Operating Voltage
($T_a=25^\circ C$)



■ TYPICAL CHARACTERISTICS



[CAUTION]

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