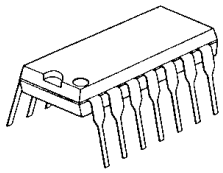
DC/DC CONVERTER CONTROL IC
WITH CURRENT SENSE AMPLIFIER

■GENERAL DESCRIPTION

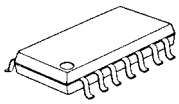
The **NJM2384** is a low voltage operation DC/DC converter control IC featuring high side current protection and soft start functions.

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

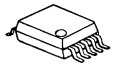
■PACKAGE OUTLINE



NJM2384D



NJM2384M

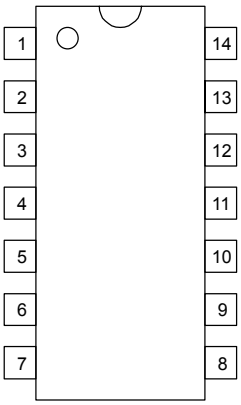


NJM2384V

■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

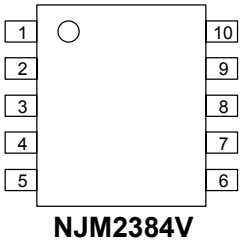
■PIN CONFIGURATION



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

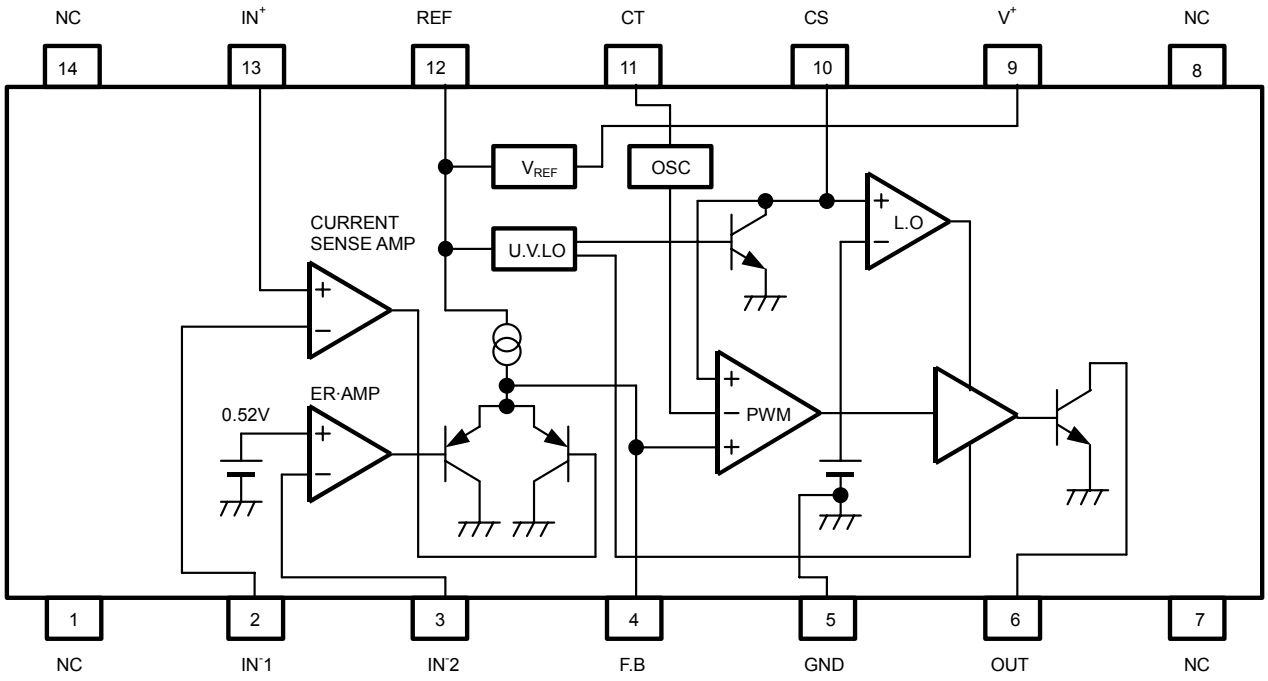


NJM2384V

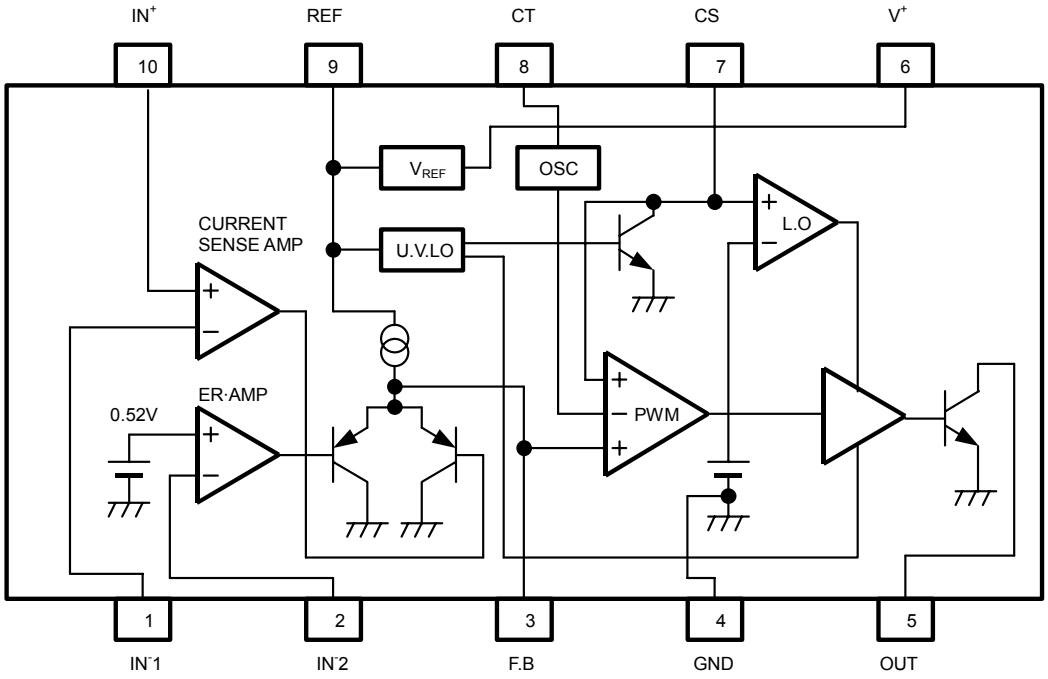
PIN FUNCTION

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

■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_{IO}1		–	2	7	mV
Input Offset Current1	I_{IO}1		–	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_{ICM}1		–	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

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

ERROR AMPLIFIER BLOCK

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Reference Voltage2	V_B2		0.51	0.52	0.53	V
Input Bias Current2	I_B2		–	5	100	nA
Open Loop Gain2	A_V2		–	90	–	dB
Gain Bandwidth Product2	G_B2		–	0.6	–	MHz
Maximum Output Voltage2 (F.B Pin)	$V_{OM-}2$	R_{NF}=100kΩ	–	–	1	V
Maximum Source Current2 (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

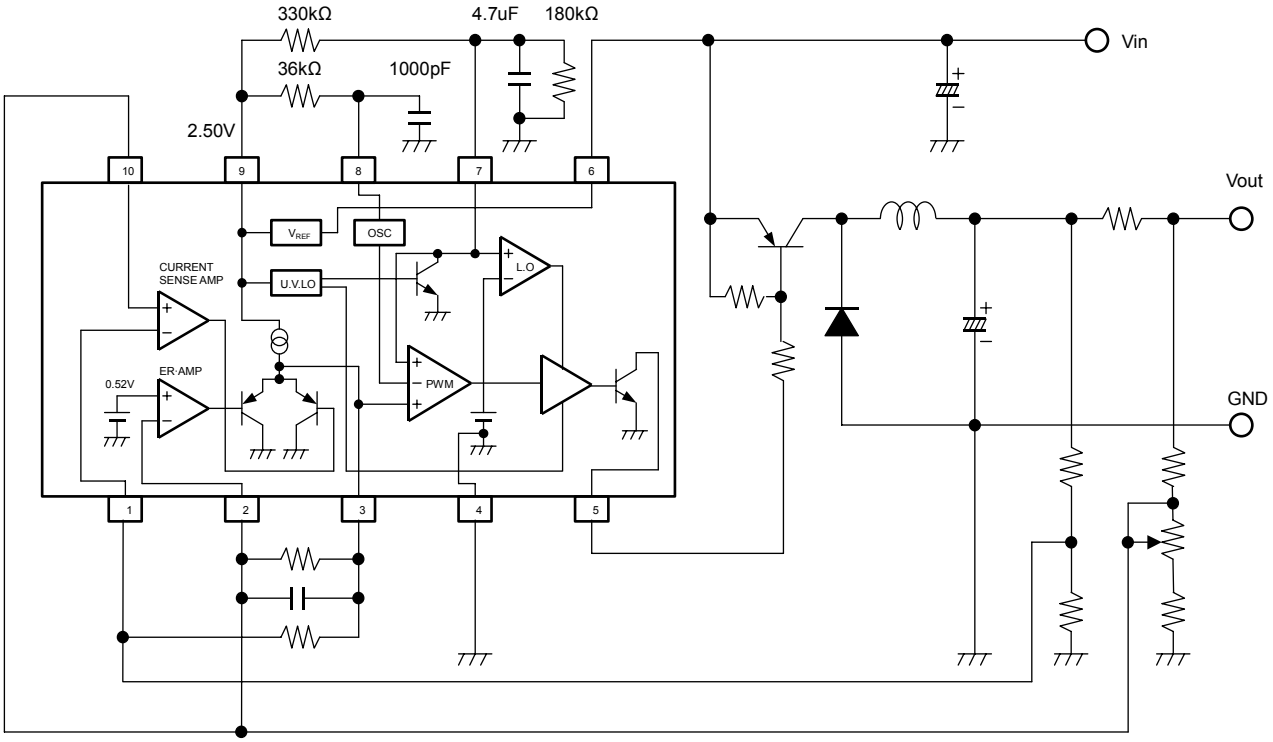
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Latch Mode Threshold Voltage (CS Pin)	V_{THLA}		1.2	1.5	1.8	V
Quiescent Current	I_{CCLA}	Latch Mode	–	1.6	2.2	mA
Average Quiescent Current	I_{CCAV}	RL= ∞ , duty·cycle=50%	–	5.5	10	mA

(note) Duty·Cycle is defined as follows:

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

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

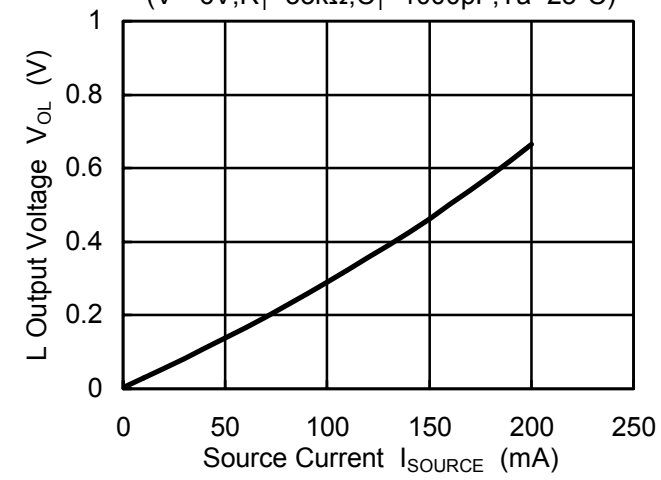
■ TYPICAL APPLICATIONS



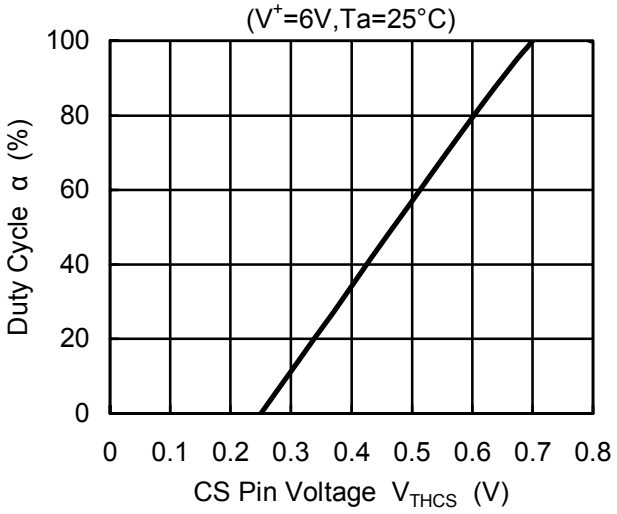
(Package:SSOP10)

■TYPICAL CHARACTERISTICS

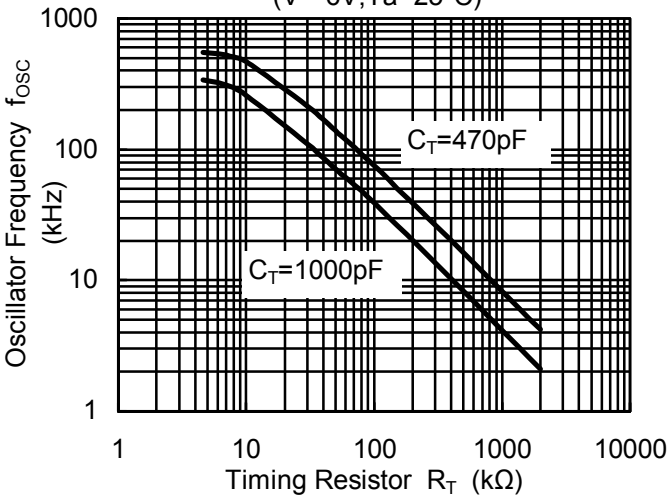
L Output Voltage vs. Source Current
(V^+=6V,R_T=33kΩ,C_T=1000pF,Ta=25°C)



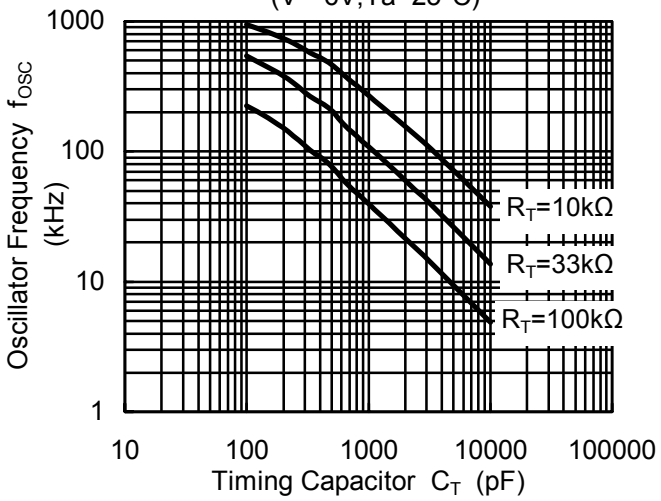
Duty Cycle vs. CS Pin Voltage
(V^+=6V,Ta=25°C)



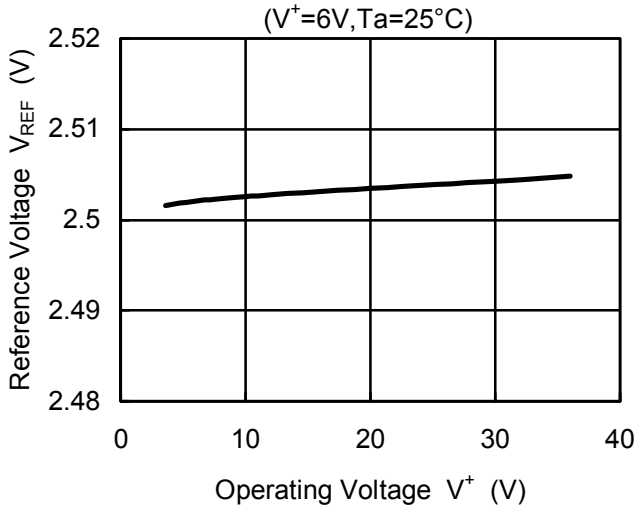
Oscillator Frequency vs. Timing Resistor
(V^+=6V,Ta=25°C)



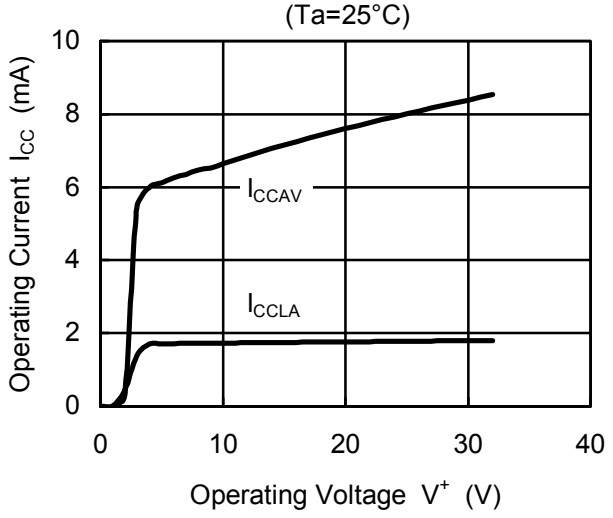
Oscillator Frequency vs. Timing Capacitor
(V^+=6V,Ta=25°C)



Reference Voltage vs. Operating Voltage
(V^+=6V,Ta=25°C)

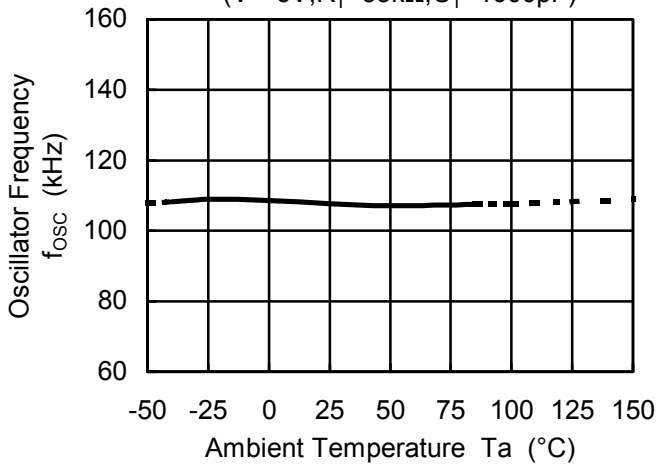


Operating Current vs. Operating Voltage
(Ta=25°C)

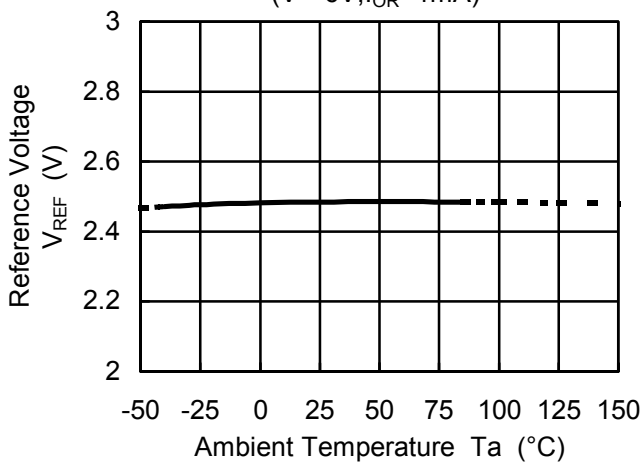


■TYPICAL CHARACTERISTICS

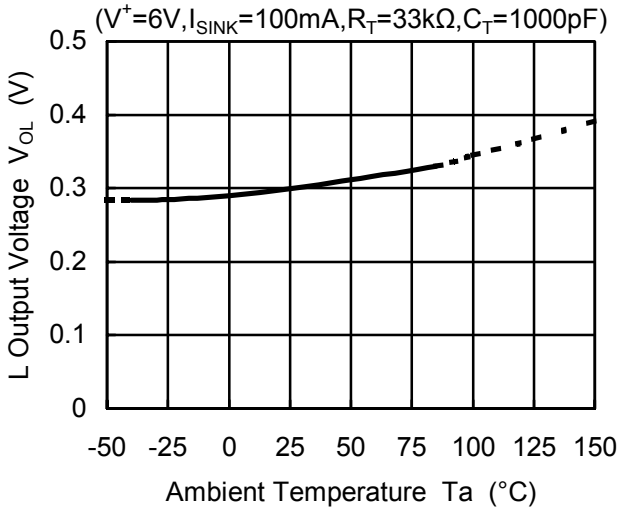
Oscillator Frequency vs. Temperature
(V^+=6V,R_T=33kΩ,C_T=1000pF)



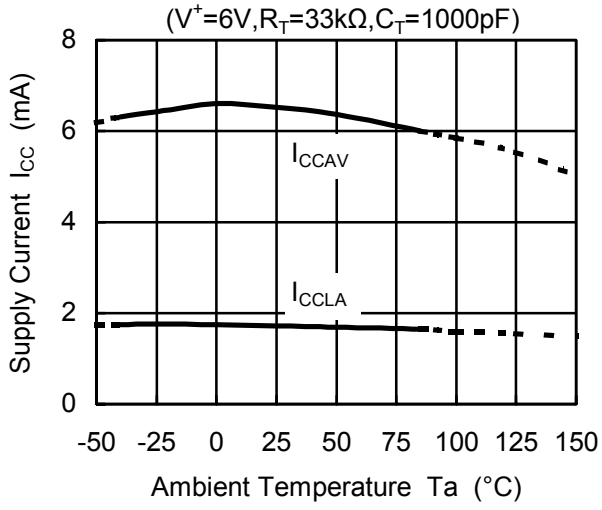
Reference Voltage vs. Temperature
(V^+=6V,I_{OR}=1mA)



L Output Voltage vs. Temperature
(V^+=6V,I_{SINK}=100mA,R_T=33kΩ,C_T=1000pF)



Supply Current vs. Temperature
(V^+=6V,R_T=33kΩ,C_T=1000pF)



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