Step-Down switching regulator IC with Constant Current Control

■GENERAL DESCRIPTION

NJU7650 is a high speed low voltage operation switching regulator control IC with constant current control. It features a totem pole driver that can directly drive an external MOS-FET.

Internal error amplifier and current sense amplifier provide Constant Voltage/Constant Current control.

It is applicable for LED driver, battery charger and other CCCV applications.

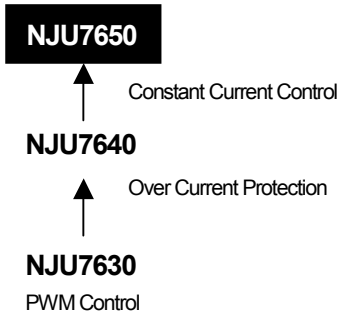
■PACKAGE OUTLINE

NJU7650RB1

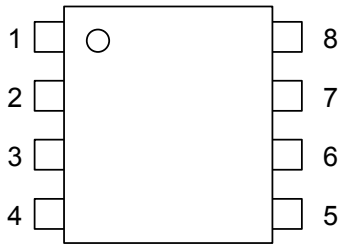
■FEATURES

- PWM switching control
- Constant Current Control
- Operating Voltage 2.2V to 8V
- Wide Oscillator Range 300kHz to 1MHz
- Maximum Duty Cycle 100%
- Quiescent Current 800μA typ.
- Soft-Start Function Internal : 16ms typ. or adjustable
- Dead Time Control
- C-MOS Technology
- Package Outline NJU7650RB1 : TVSP8

■PRODUCT VARIATION



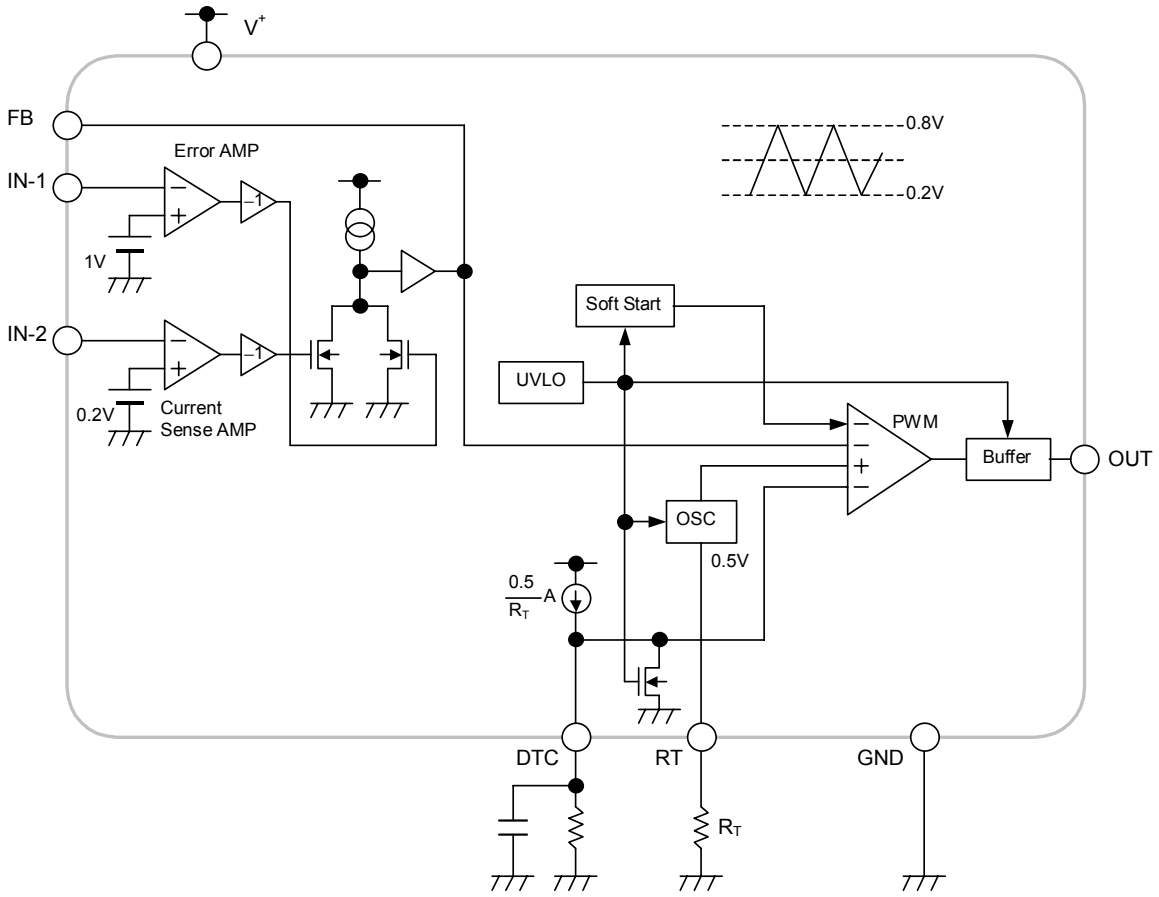
■PIN CONFIGURATION



NJU7650RB1

PIN FUNCTION
1. OUT
2. V^+
3. FB
4. IN-1
5. IN-2
6. DTC
7. RT
8. GND

■BLOCK DIAGRAM



■ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	MAXIMUM RATINGS	UNIT
Supply Voltage	V^+	+9	V
Output Pin Current	I_O	±50	mA
Power Dissipation	P_D	TVSP8 :320	mW
Operating Temperature Range	T_{OPR}	-40 ~ +85	°C
Storage Temperature Range	T_{STG}	-40 ~ +125	°C

■RECOMMENDED OPERATING CONDITIONS (Ta=25°C)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Operating Voltage	V^+	2.2	–	8	V
Oscillator Timing Resistor	R_T	30	47	120	kΩ
Oscillation Frequency	f_{OSC}	300	700	1,000	kHz

■ELECTRICAL CHARACTERISTICS (V^+=3.3V, R_T=47kΩ, Ta=25°C)

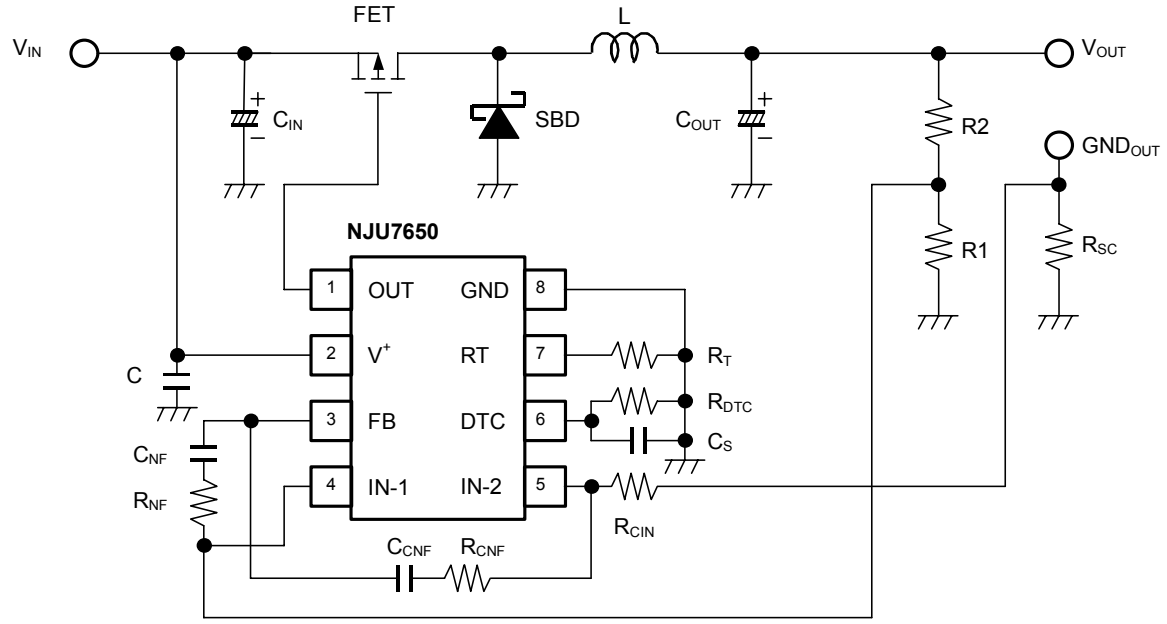
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Under Voltage Lockout Block						
ON Threshold Voltage	V_{T_ON}	V^+= L → H	1.9	2.0	2.1	V
OFF Threshold Voltage	V_{T_OFF}	V^+= H → L	1.8	1.9	2.0	V
Hysteresis Voltage	V_{HYS}		60	100	–	mV
Soft Start Block						
Soft Start Time	T_{SS}	V_{T_ON} → Duty=80%	8	16	24	ms
Oscillator Block						
RT Pin Voltage	V_{RT}		-5%	0.5	+5%	V
Oscillation Frequency	f_{OSC}		630	700	770	kHz
Oscillate Supply Voltage Fluctuations	f_{DV}	V^+=2.2V ~ 8V	–	1	–	%
Oscillate Temperature Fluctuations	f_{DT}	Ta=-40°C ~ +85°C	–	3	–	%

■ELECTRICAL CHARACTERISTICS (V^+=3.3V, R_T=47kΩ, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Error Amplifier Block						
Reference Voltage 1	V_{B1}		-1.0%	1.00	+1.0%	V
Input Bias Current 1	I_{B1}		-0.1	–	0.1	μA
Open Loop Gain 1	A_{V1}		–	80	–	dB
Gain Bandwidth Product 1	G_{B1}		–	1	–	MHz
Output Source Current 1	I_{OM+_1}	V_{FB}=1V, V_{IN-1}=0.9V, V_{IN-2}=0.1V	25	55	95	mA
	I_{OM+_2}	V_{FB}=1V, V_{IN-1}=0.9V, V_{IN-2}=0.1V, V^+=2.2V	4	9	16	mA
Output Sink Current 1	I_{OM1-}	V_{FB}=1V, V_{IN-1}=1.1V, V_{IN-2}=0.1V	0.10	0.16	0.22	mA
Current Sense Amplifier Block						
Reference Voltage 2	V_{B2}		-10%	0.2	+10%	V
Input Bias Current 2	I_{B2}		-0.1	–	0.1	μA
Open Loop Gain 2	A_{V2}		–	70	–	dB
Gain Bandwidth Product 2	G_{B2}		–	1	–	MHz
Output Sink Current 2	I_{OM2-}	V_{FB}=1V, V_{IN-1}=0.9V, V_{IN-2}=0.3V	0.10	0.16	0.22	mA
PWM Comparate Block						
Input Threshold Voltage	V_{T_0}	Duty=0%	0.16	0.22	0.28	V
	V_{T_50}	Duty=50%	0.44	0.5	0.56	V
Maximum Duty Cycle	$M_{AX}D_{UTY\_1}$	V_{FB}=0.9V	100	–	–	%
	$M_{AX}D_{UTY\_2}$	V_{FB}=0.9V, R_{DTC}=47kΩ	40	50	60	%
Output Block						
Output High Level ON Resistance	R_{OH}	I_O=-20mA	–	10	20	Ω
Output Low Level ON Resistance	R_{OL}	I_O=+20mA	–	5	10	Ω
General Characteristics						
Quiescent Current	I_{DD}	R_L=Non Load	–	800	1200	μA

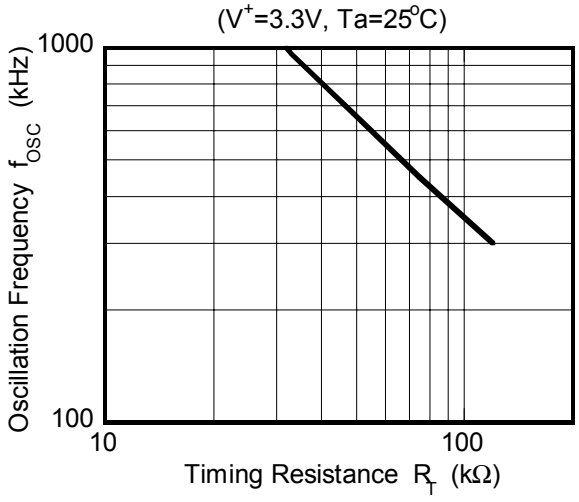
■ TYPICAL APPLICATIONS

Step-Down Converter

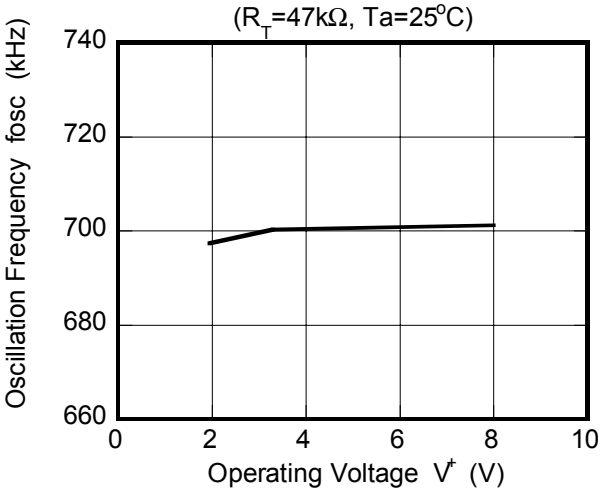


■TYPICAL CHARACTERISTICS

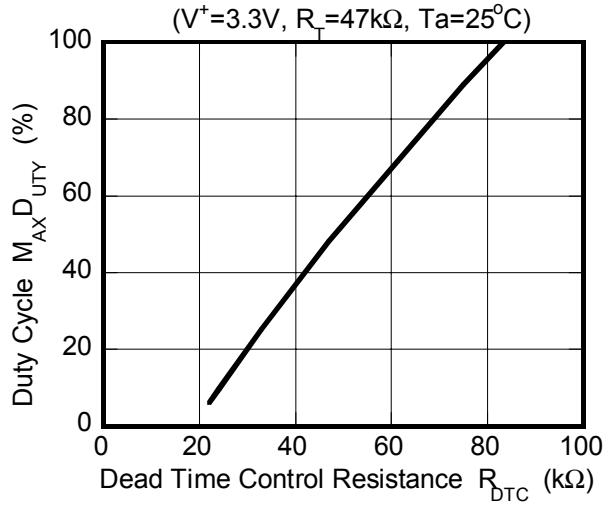
Oscillation Frequency vs. Timing Resistance
(V^+=3.3V, Ta=25°C)



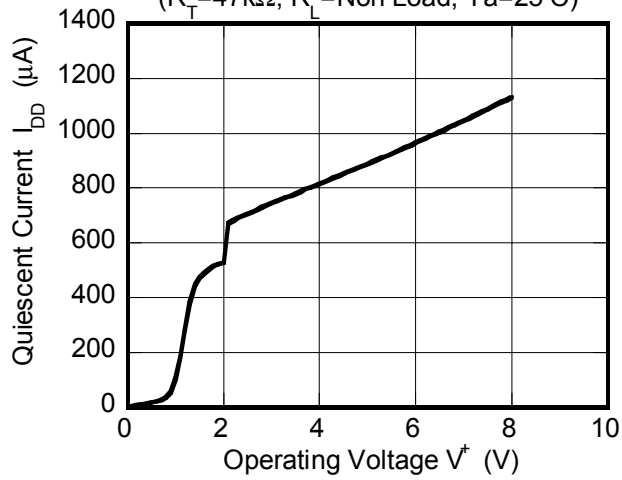
Oscillation Frequency vs. Operating Voltage
(R_T=47kΩ, Ta=25°C)



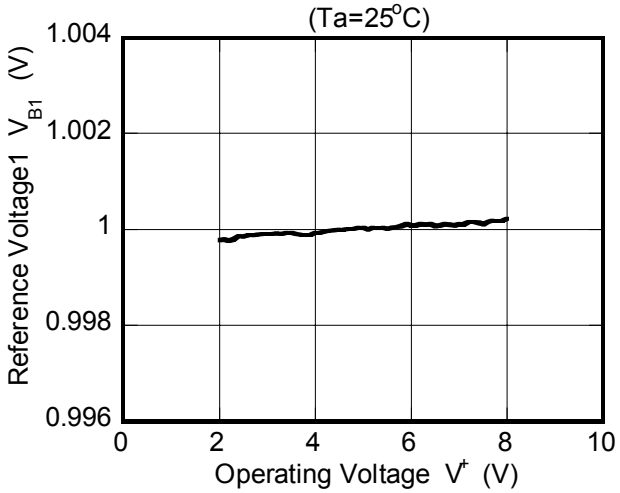
Duty Cycle vs. R_{DTC}
(V^+=3.3V, R_T=47kΩ, Ta=25°C)



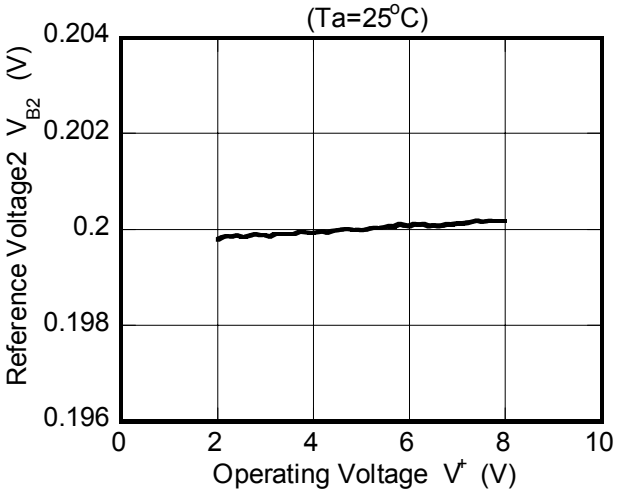
Quiescent Current vs. Operating Voltage
(R_T=47kΩ, R_L=Non Load, Ta=25°C)



Error Amplifier Block
Reference Voltage1 vs. Operating Voltage
(Ta=25°C)

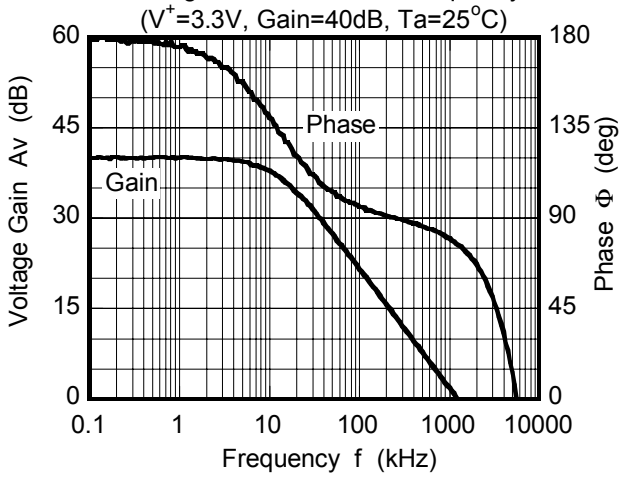


Current Sense Amplifier Block
Reference Voltage2 vs. Operating Voltage
(Ta=25°C)

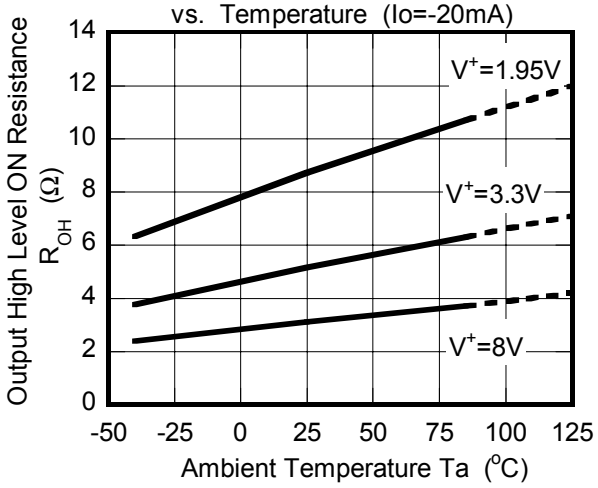


■TYPICAL CHARACTERISTICS

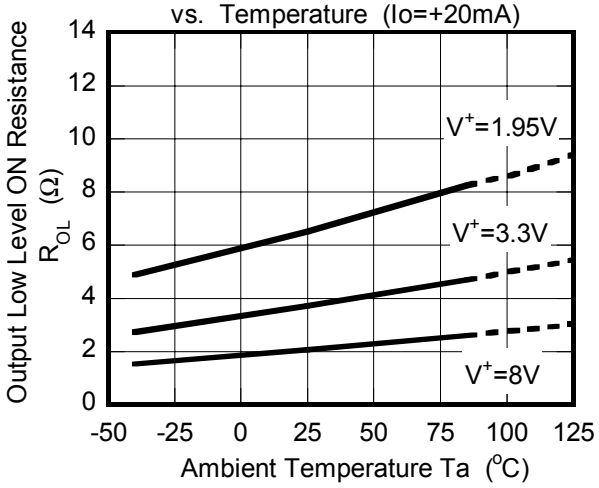
Error Amplifier Block
Voltage Gain, Phase vs. Frequency
(V^+=3.3V, Gain=40dB, Ta=25°C)



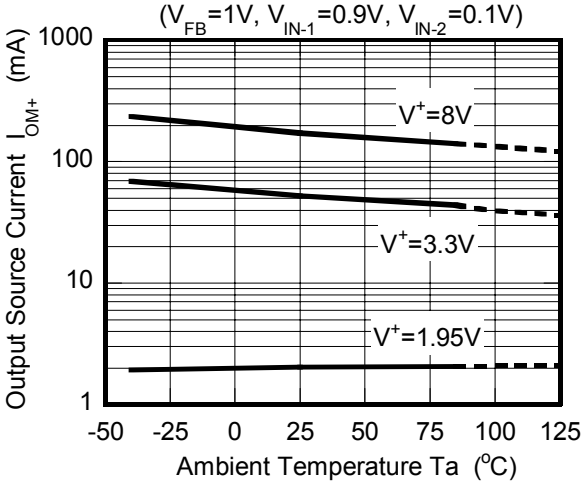
Output Block
Output High Level ON Resistance
vs. Temperature (Io=-20mA)



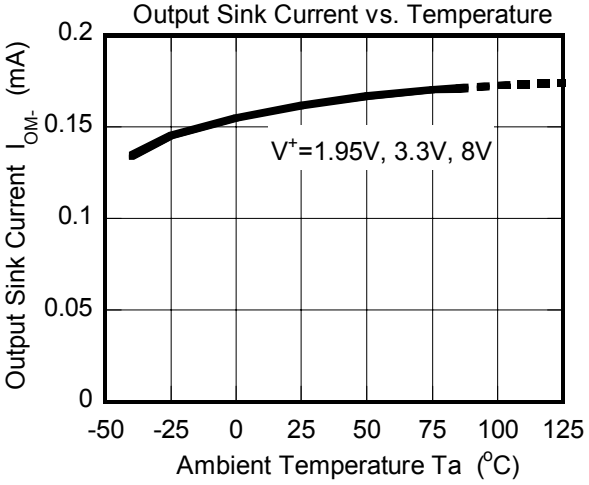
Output Block
Output Low Level ON Resistance
vs. Temperature (Io=+20mA)



Error Amplifier Block
Output Source Current1 vs. Temperature
(V_{FB}=1V, V_{IN-1}=0.9V, V_{IN-2}=0.1V)

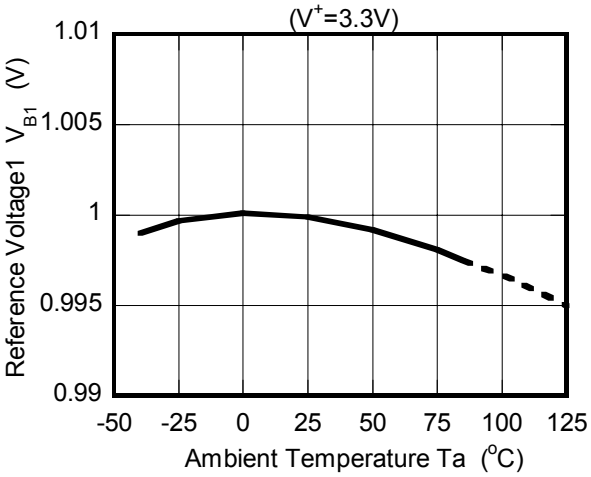


Error Amplifier, Current Sense Amplifier Block
Output Sink Current vs. Temperature

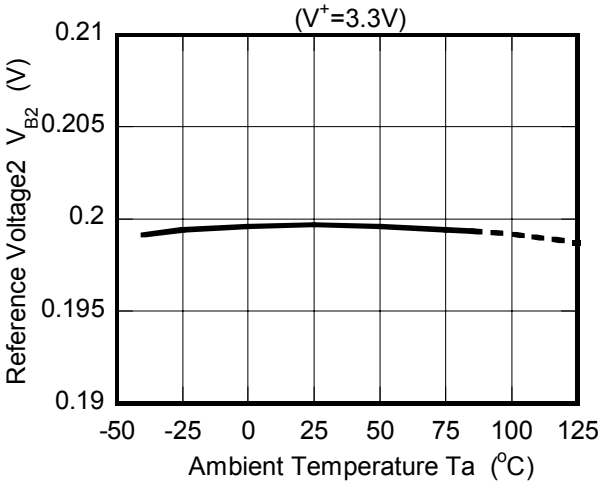


■TYPICAL CHARACTERISTICS

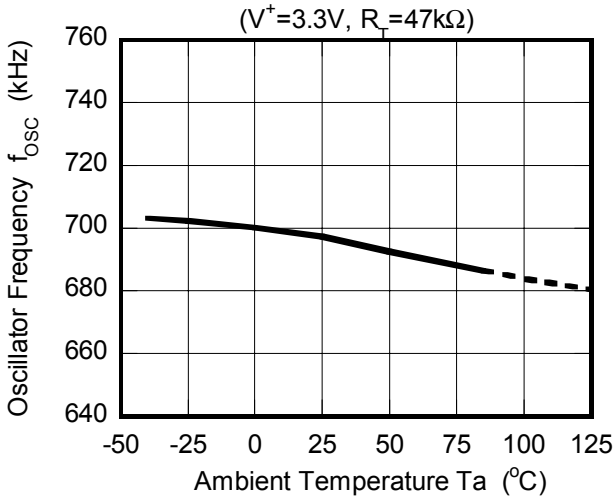
Error Amplifier Block
Reference Voltage1 vs. Temperature
(V^+=3.3V)



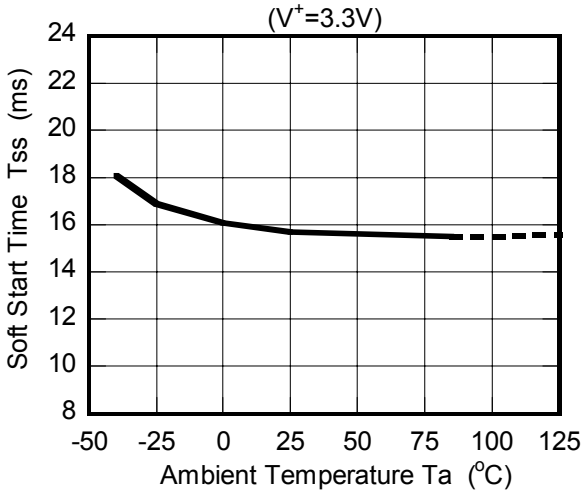
Current Sense Amplifier Block
Reference Voltage2 vs. Temperature
(V^+=3.3V)



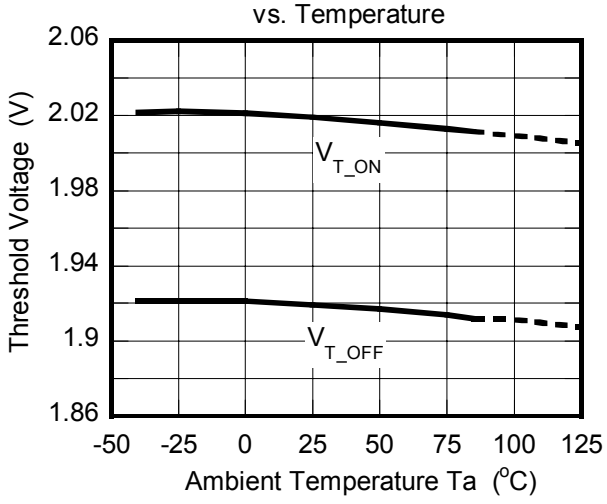
Oscillator Frequency vs. Temperature
(V^+=3.3V, R_T=47kΩ)



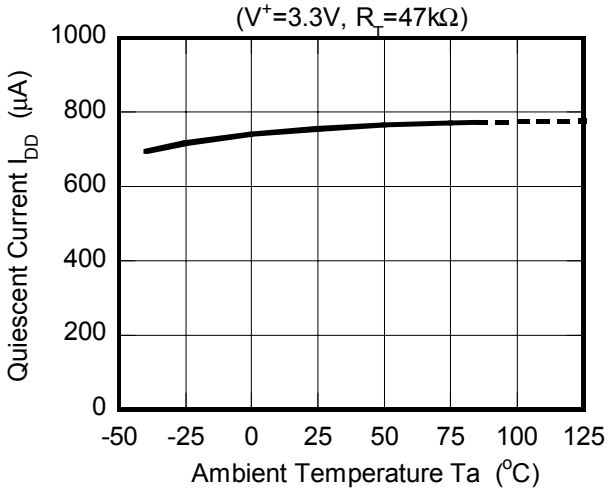
Soft Start Time vs. Temperature
(V^+=3.3V)



Under Voltage Lockout Block
vs. Temperature



Quiescent Current vs. Temperature
(V^+=3.3V, R_T=47kΩ)



MEMO