Step-Down Switching Regulator IC with Power Saving PWM/PFM control

■ GENERAL DESCRIPTION

The **NJU7631** is a low voltage operation high-speed switching regulator control IC for step-down converter, with PWM/PFM switching control. It can improve a switching efficiency on light load with automatically changing between PWM and PFM controls. It incorporates a totem pole output, which can drive an external MOS-FET easily. The NJU7631 also has a soft-start function, dead time control and timer latch for short circuit protection and their times are all adjustable with external parts. It is available in a small and thin 8-lead MSOP (TVSP) package.

■ PACKAGE OUTLINE

NJU7631RB1
(MSOP8 (TVSP8))

■ FEATURES

- Automatic PWM/PFM 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
- Timer Latch for Short Circuit Protection
- C-MOS Technology
- Package Outline NJU7631RB1 : MSOP8 (TVSP8)*

*MEET JEDEC MO-187-DA / THIN TYPE

■ PRODUCT VARIATION

NJU763x**

Standby Function
PWM/PFM

NJU7631

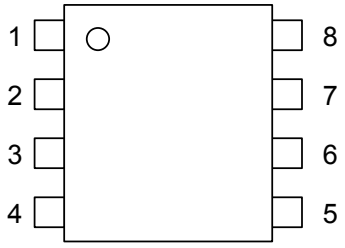
PWM/PFM
Light Load to Efficiency

NJU7630

PWM Control

** Planning

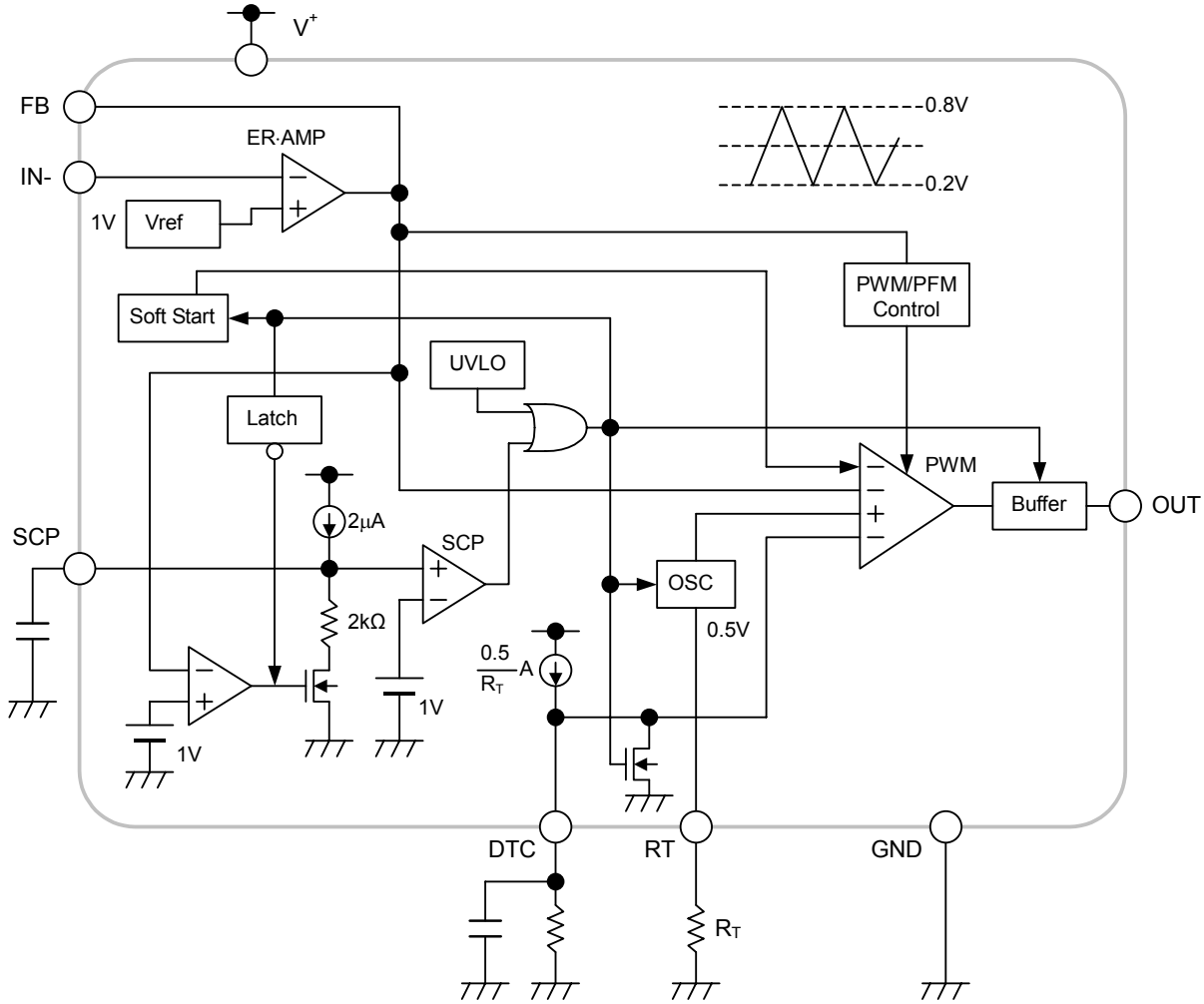
■ PIN CONFIGURATION



NJU7631RB1

PIN FUNCTION
1. OUT
2. V^+
3. FB
4. IN-
5. SCP
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	MSOP8 (TVSP8) :320	mW
Operating Temperature Range	T_{OPR}	-40 to +85	°C
Storage Temperature Range	T_{STG}	-40 to +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)

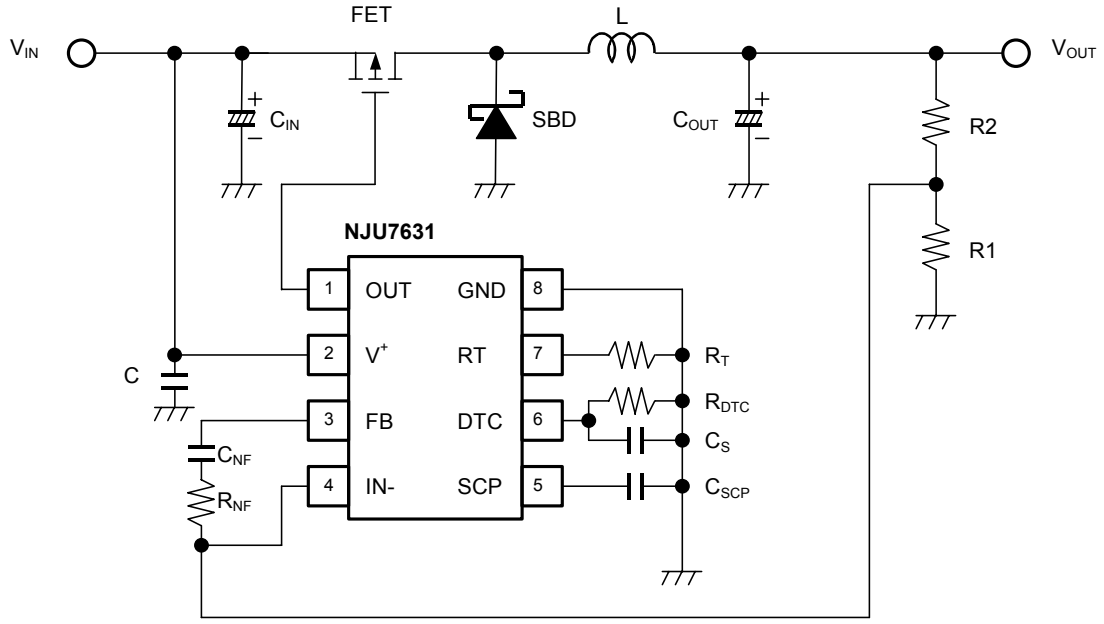
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Under Voltage Lockout Block						
ON Threshold Voltage	V_{T_ON}	V^+= L → H	1.9	2.0	2.1	V
OFF Threshold Voltage	V_{T_OFF}	V^+= H → L	1.8	1.9	2.0	V
Hysteresis Voltage	V_{HYS}		60	100	–	mV
Soft Start Block						
Soft Start Time	T_{SS}	V_{T_ON} → Duty=80%	8	16	24	ms
Short Circuit Protection Block						
Input Threshold Voltage	V_{T_PC}	FB Pin	0.95	1.00	1.05	V
Charge Current	I_{CHG}	V_{SCP}=0V	1.5	2	2.5	μA
Latch Mode ON Threshold Voltage	V_{T_LA}	SCP Pin	0.95	1.00	1.05	V
Latch Mode OFF Threshold Voltage	V_{T_LAOFF}	SCP Pin	0.2	0.45	0.7	V
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 to 8V	–	1	–	%
Oscillate Temperature Fluctuations	f_{DT}	Ta=-40°C to +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	V_B		-1.0%	1.00	+1.0%	V
Input Bias Current	I_B		-0.1	–	0.1	μA
Open Loop Gain	A_V		–	80	–	dB
Gain Bandwidth Product	G_B		–	1	–	MHz
Output Source Current	I_{OM+_1}	V_{FB}=1V, V_{IN-}=0.9V	25	55	95	mA
	I_{OM+_2}	V_{FB}=1V, V_{IN-}=0.9V, V^+=2.2V	4	9	16	mA
Output Sink Current	I_{OM-}	V_{FB}=1V, V_{IN-}=1.1V	0.10	0.16	0.22	mA
PWM Comparate Block						
Input Threshold Voltage	V_{T_25}	Duty= $PFMD_{UTY}$	0.29	0.35	0.41	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	%
PWM/PFM Change Duty Cycle	$PFMD_{UTY}$		17	25	33	%
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

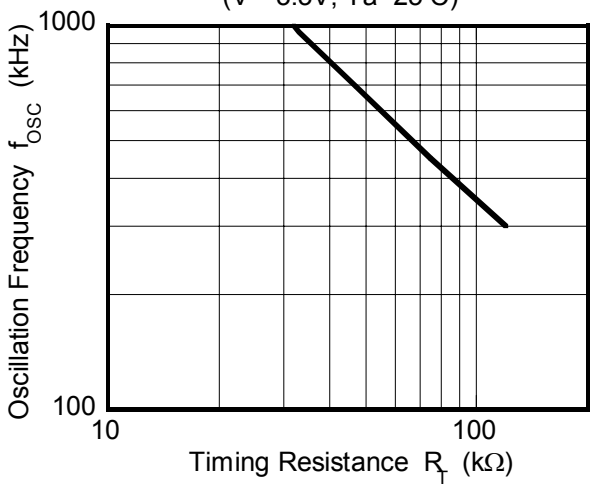
Step-Down Converter



■ TYPICAL CHARACTERISTICS

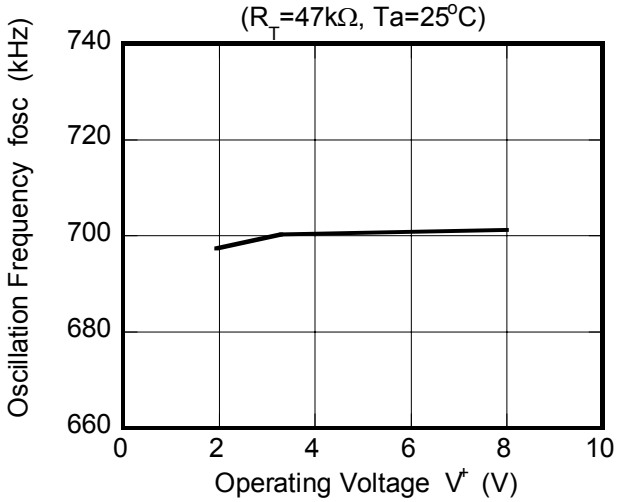
Oscillation Frequency vs. Timing Resistance

(V^+=3.3V, Ta=25°C)



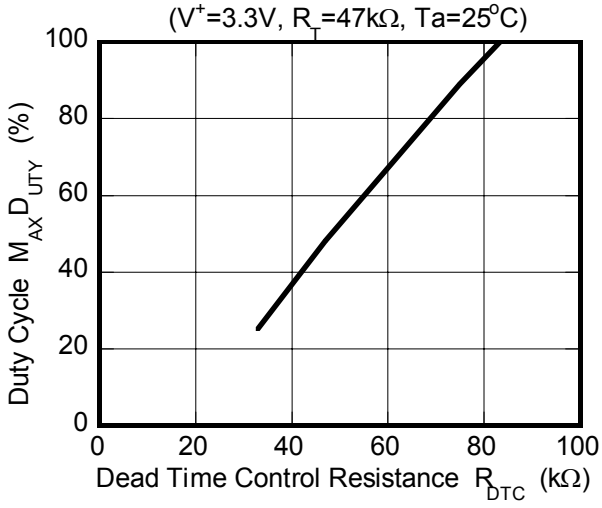
Oscillation Frequency vs. Operating Voltage

(R_T=47kΩ, Ta=25°C)



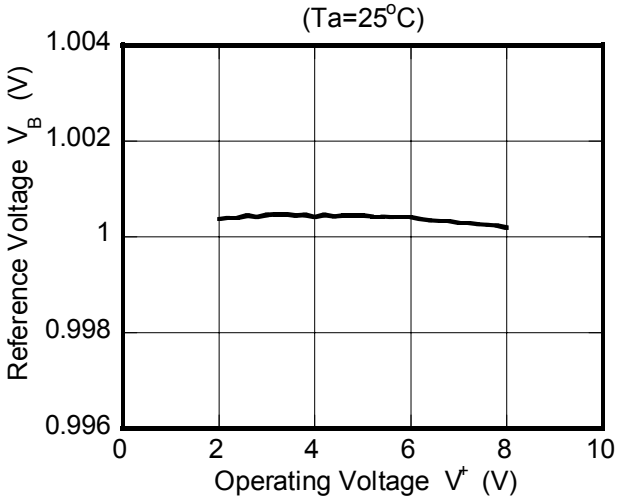
Duty Cycle vs. R_{DTC}

(V^+=3.3V, R_T=47kΩ, Ta=25°C)



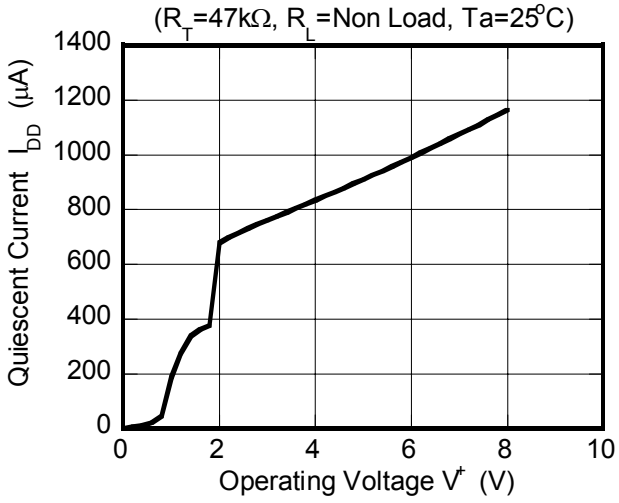
Reference Voltage vs. Operating Voltage

(Ta=25°C)



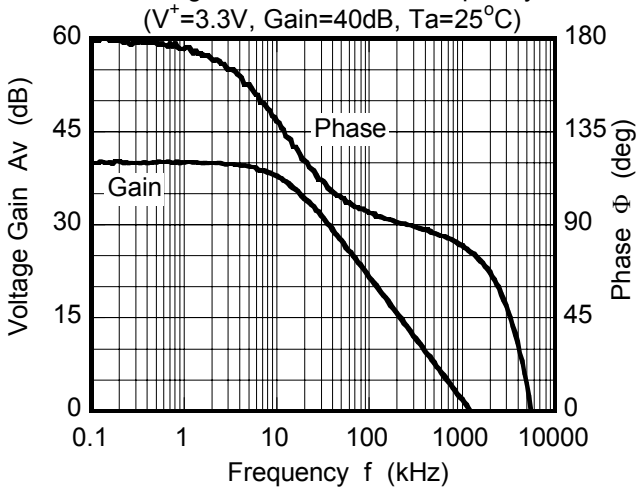
Quiescent Current vs. Operating Voltage

(R_T=47kΩ, R_L=Non Load, Ta=25°C)

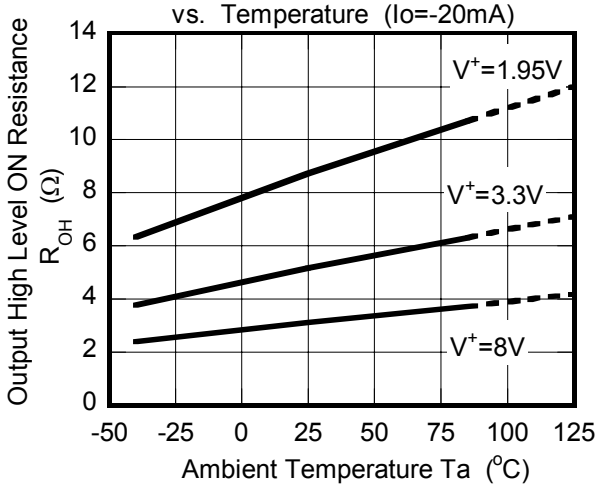


■ TYPICAL CHARACTERISTICS

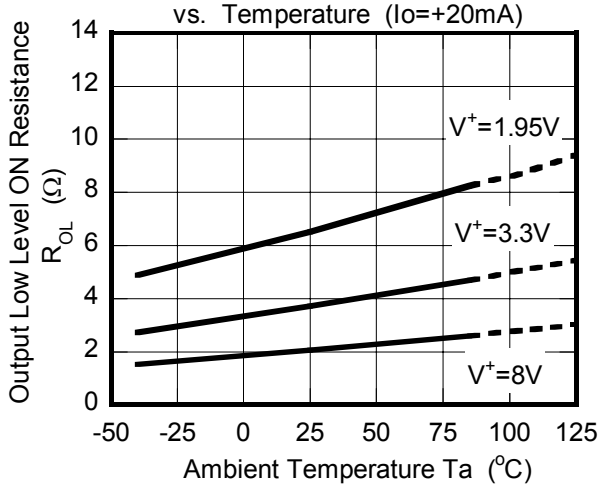
Error Amplifier Block
Voltage Gain, Phase vs. Frequency
(V^+=3.3V, Gain=40dB, Ta=25°C)



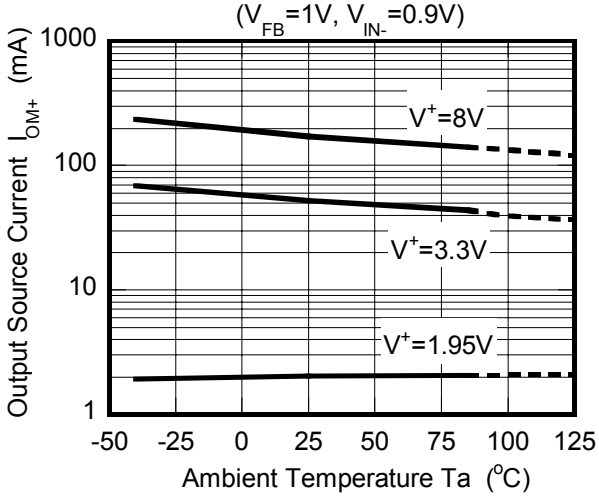
Output Block
Output High Level ON Resistance
vs. Temperature (Io=-20mA)



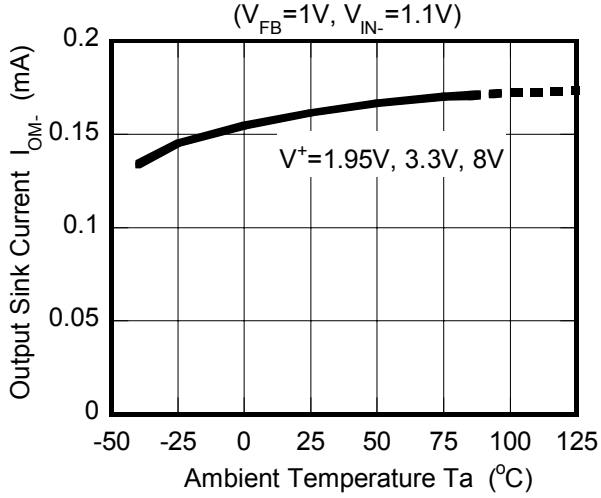
Output Block
Output Low Level ON Resistance
vs. Temperature (Io=+20mA)



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



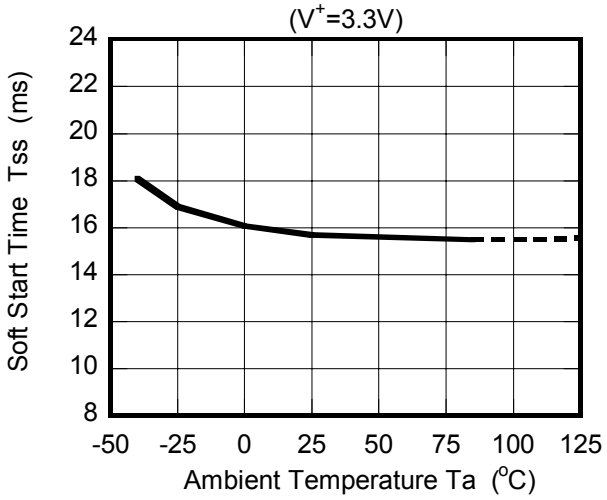
Error Amplifier Block
Output Sink Current vs. Temperature
(V_{FB}=1V, V_{IN-}=1.1V)



■ TYPICAL CHARACTERISTICS

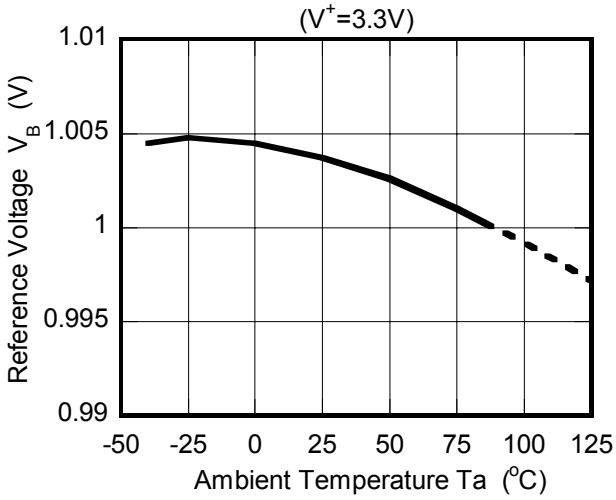
Soft Start Time vs. Temperature

(V^+=3.3V)



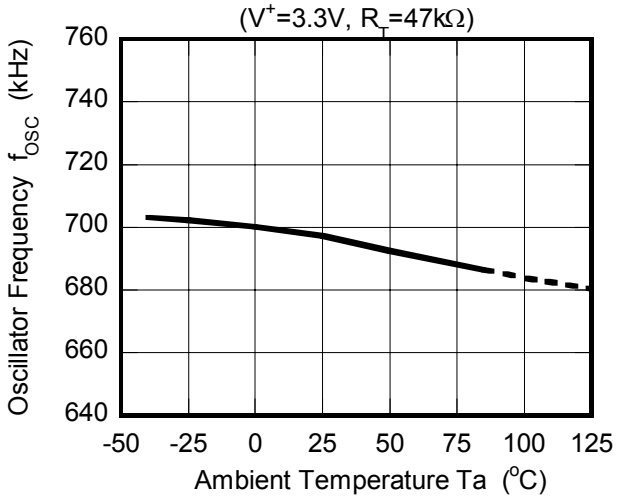
Reference Voltage vs. Temperature

(V^+=3.3V)

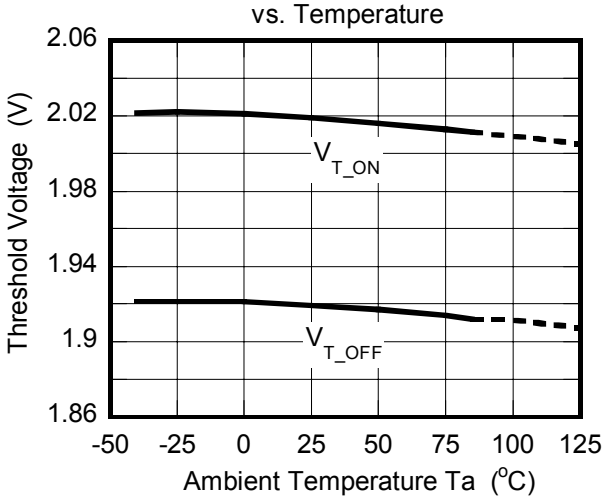


Oscillator Frequency vs. Temperature

(V^+=3.3V, R_T=47kΩ)

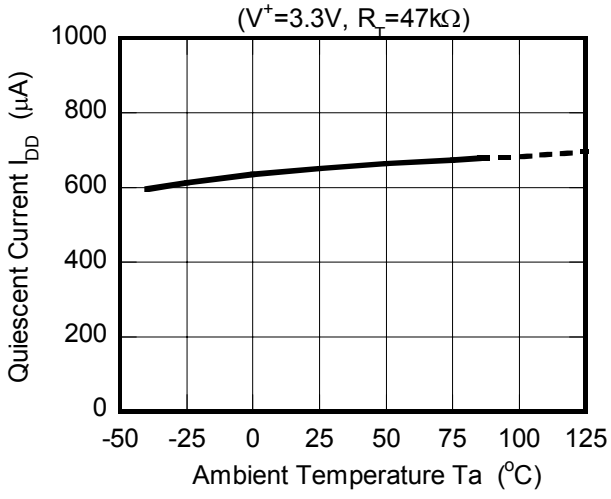


Under Voltage Lockout Block vs. Temperature



Quiescent Current vs. Temperature

(V^+=3.3V, R_T=47kΩ)



MEMO

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