Step-Up / Flyback Switching Regulator IC with Load Switch Function

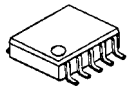
■GENERAL DESCRIPTION

The NJU7606 are low voltage operation high speed switching regulator control ICs for step-up and flyback converter, with a load switch function.

The load switch function can disrupt the current flow to the load in standby mode and latch mode. The NJU7606 also have a soft-start function, dead time control and timer latch for short circuit protection and their times are all adjustable with external parts. The NJU7606 is available in 10-lead MSOP (TVSP) package.

They are suitable for battery powered applications.

■PACKAGE OUTLINE



NJU7606RB2
(MSOP10(TVSP10))

■FEATURES

- PWM switching control
- Load Switch Function
- Operating Voltage 2.2V to 8V
- Wide Oscillator Range 300kHz to 1MHz
- Maximum Duty Cycle 90% typ.
- Quiescent Current Operating: 800μA typ.
  Standby: 1μA max.
- Soft-Start Function Internal : 16ms typ. or adjustable
- Dead Time Control
- Timer Latch for Short Circuit Protection
- C-MOS Technology
- Package Outline NJU7606RB2 : MSOP10 (TVSP10)*

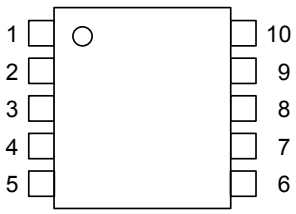
*MEET JEDEC MO-187-DA / THIN TYPE

■PRODUCT VARIATION

NJU7606
Load SW,
Standby Function

NJU7602
Standby Function

■PIN CONFIGURATION

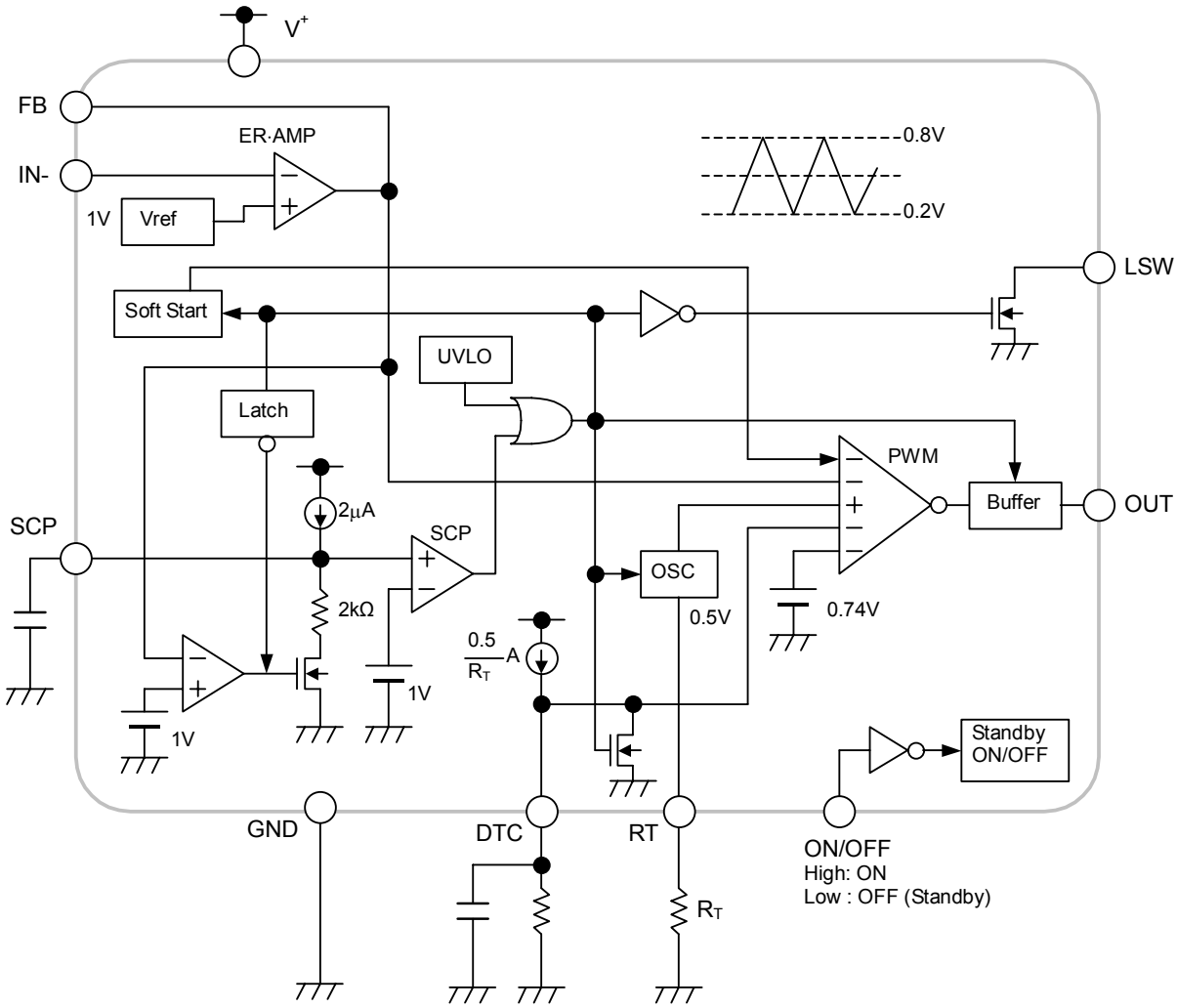


NJU7606RB2

PIN FUNCTION

1. V^+
2. LSW
3. FB
4. IN-
5. SCP
6. ON/OFF
7. DTC
8. RT
9. GND
10. OUT

■BLOCK DIAGRAM



■**ABSOLUTE MAXIMUM RATINGS** (Ta=25°C)

PARAMETER	SYMBOL	MAXIMUM RATINGS	UNIT
Supply Voltage	V^+	+9	V
LSW Output Voltage	V_{LSW}	+9	V
Output Pin Current	I_O	±50	mA
LSW Output Current	I_{LSW}	-10	mA
ON/OFF Pin Voltage	$V_{ON/OFF}$	+9 (*1)	V
Power Dissipation	P_D	320	mW
Operating Temperature Range	T_{OPR}	-40 to +85	°C
Storage Temperature Range	T_{STG}	-40 to +125	°C

*1: When input voltage is less than 9V, the absolute maximum control voltage is equal to the input voltage.

■**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^+=$V_{ON/OFF}$=3.3V, R_T=47kΩ, Ta=25°C)

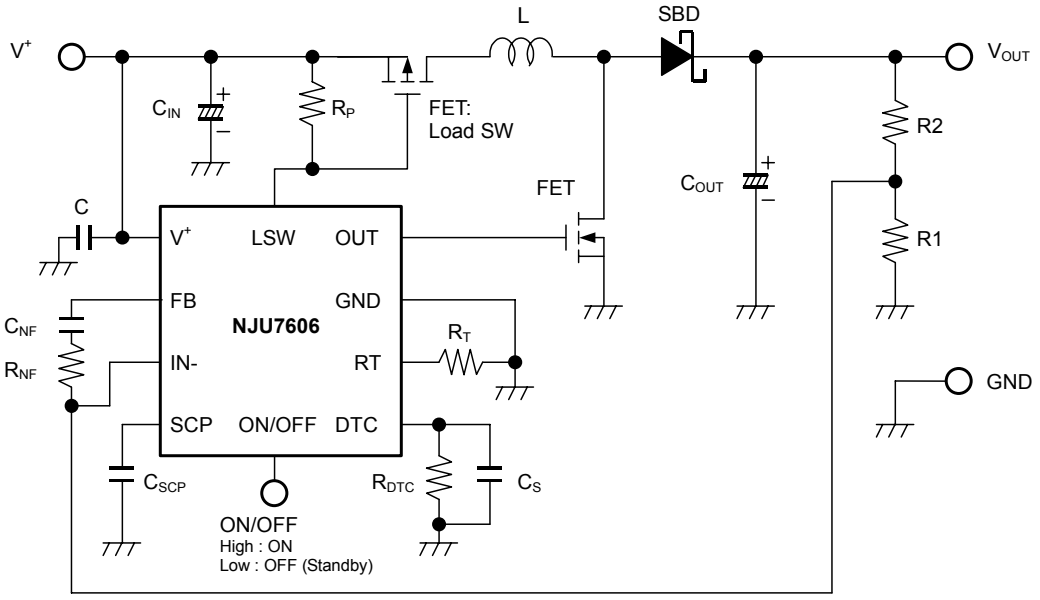
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Under Voltage Lockout Block						
ON Threshold Voltage	V_{T_ON}	V^+= L → H	1.9	2.0	2.1	V
OFF Threshold Voltage	V_{T_OFF}	V^+= H → L	1.8	1.9	2.0	V
Hysteresis Voltage	V_{HYS}		60	100	–	mV
Soft Start Block						
Soft Start Time	T_{SS}	V_{T_ON} → Duty=80%	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^+=$V_{ON/OFF}$=3.3V, R_T=47kΩ, Ta=25°C)

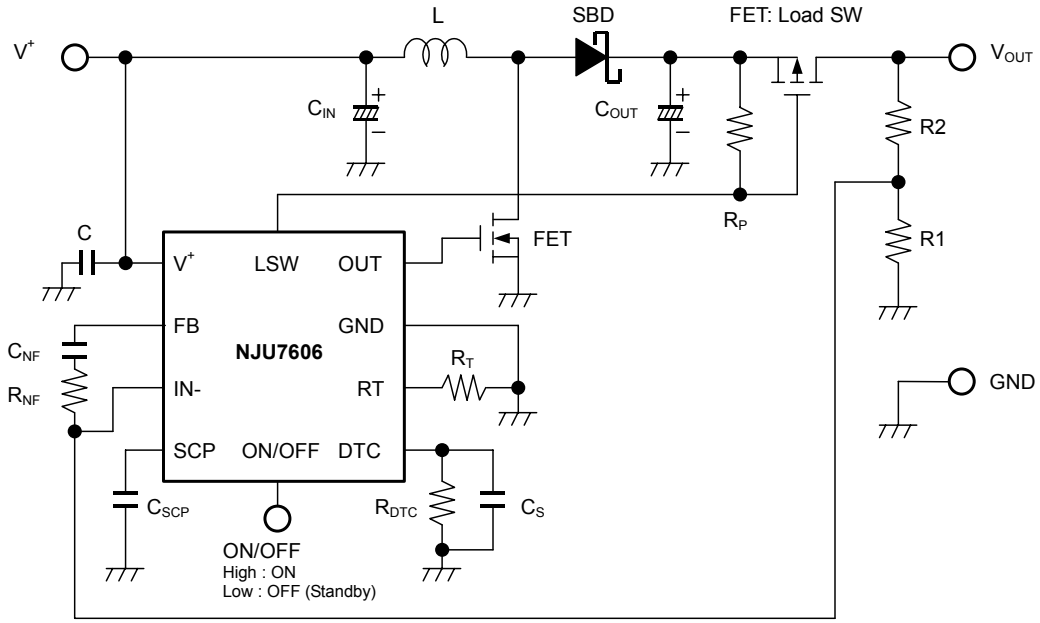
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Error Amplifier Block						
Reference Voltage	V_B		-1.5%	1.00	+1.5%	V
Input Bias Current	I_B		-0.1	–	0.1	μA
Open Loop Gain	A_V		–	80	–	dB
Gain Bandwidth Product	G_B		–	1	–	MHz
Output Source Current	I_{OM+_1}	V_{FB}=1V, V_{IN-}=0.9V	20	45	70	mA
	I_{OM+_2}	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_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	85	90	95	%
	$M_{AX}D_{UTY\_2}$	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
Load SW Output Block						
LSW Output ON Resistance	R_{LSW}	I_{LSW}=1mA	–	55	100	Ω
LSW Output Leak Current	I_{LEAK_LSW}	V_{LSW}=9V, $V_{ON/OFF}$=0V	–	–	0.1	μA
ON/OFF Block						
ON Control Voltage	V_{ON}	$V_{ON/OFF}$= L → H	1.6	–	V^+	V
OFF Control Voltage	V_{OFF}	$V_{ON/OFF}$= H → L	0	–	0.3	V
General Characteristics						
Quiescent Current	I_{DD}	R_L=Non Load	–	800	1200	μA
Standby Current	I_{DD_STB}	$V_{ON/OFF}$=0V	–	–	1.0	μA

■ TYPICAL APPLICATIONS

Step-Up Converter (Input Line Load SW)



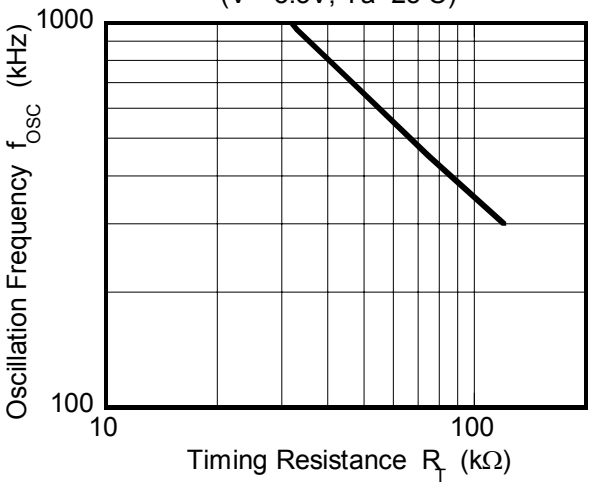
Step-Up Converter (Onput Line Load SW)



■TYPICAL CHARACTERISTICS

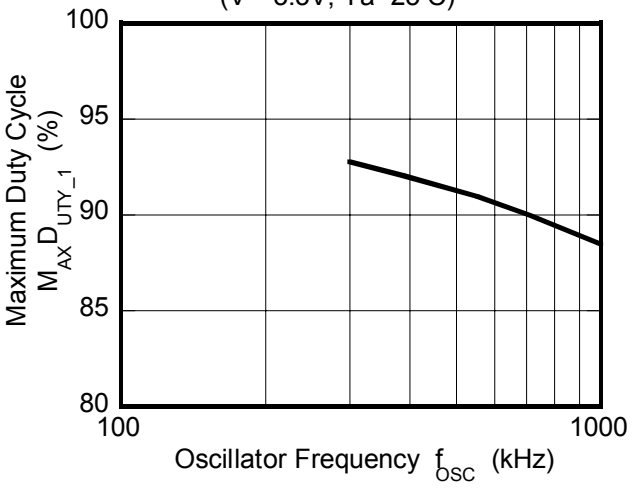
Oscillation Frequency vs. Timing Resistance

(V^+=3.3V, Ta=25°C)



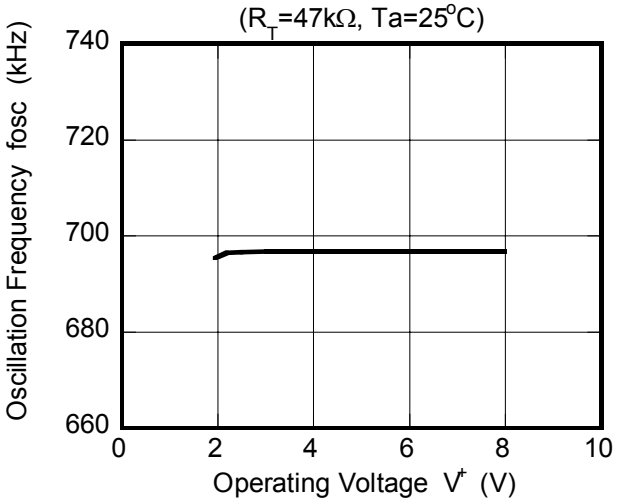
Maximum Duty Cycle vs. Oscillator Frequency

(V^+=3.3V, Ta=25°C)



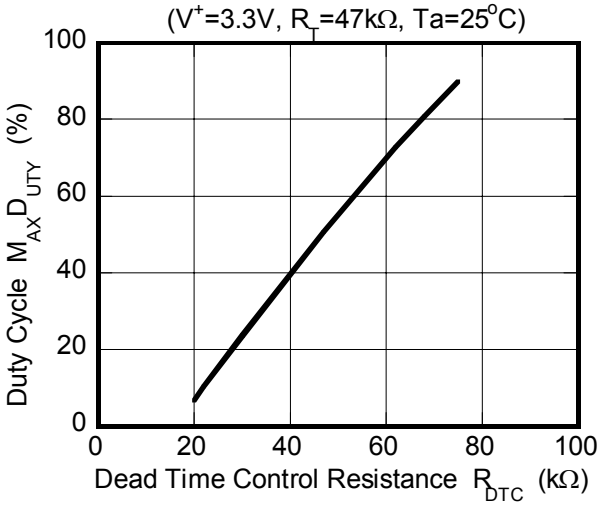
Oscillation Frequency vs. Operating Voltage

(R_T=47kΩ, Ta=25°C)



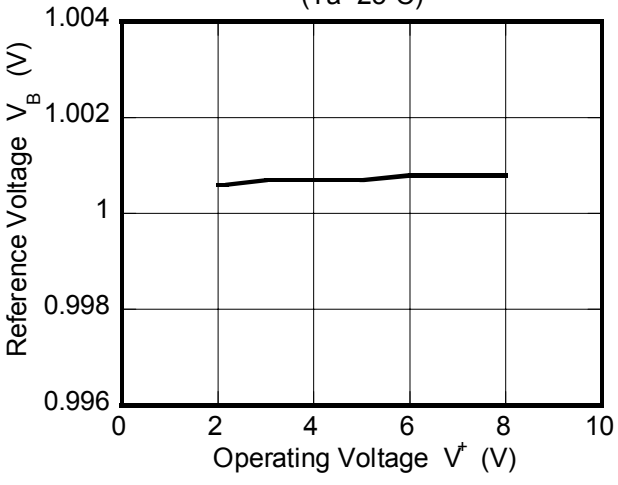
Duty Cycle vs. R_{DTC}

(V^+=3.3V, R_T=47kΩ, Ta=25°C)



Reference Voltage vs. Operating Voltage

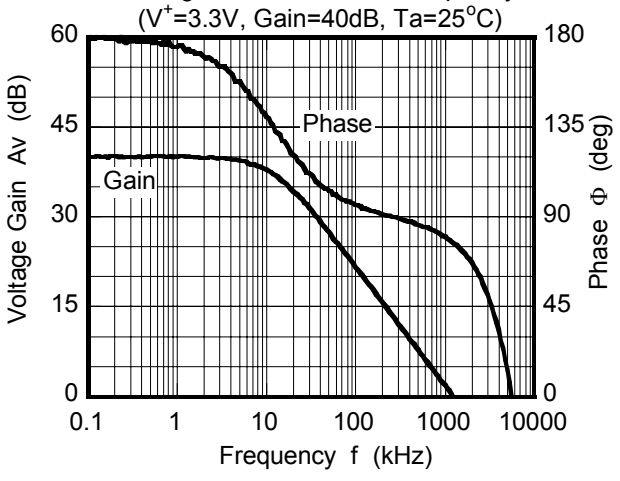
(Ta=25°C)



Error Amplifier Block

Voltage Gain, Phase vs. Frequency

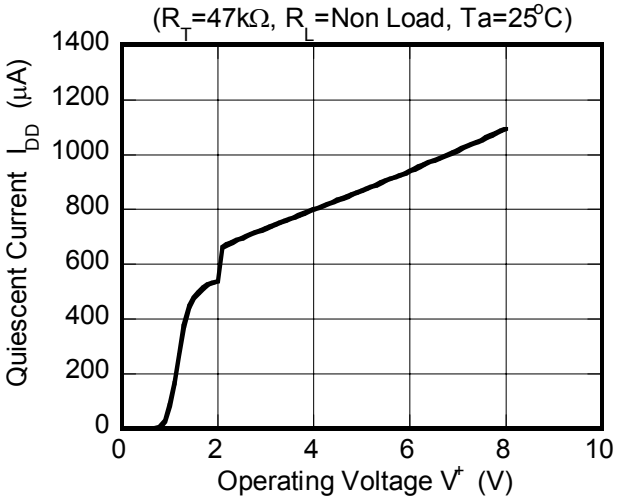
(V^+=3.3V, Gain=40dB, Ta=25°C)



■TYPICAL CHARACTERISTICS

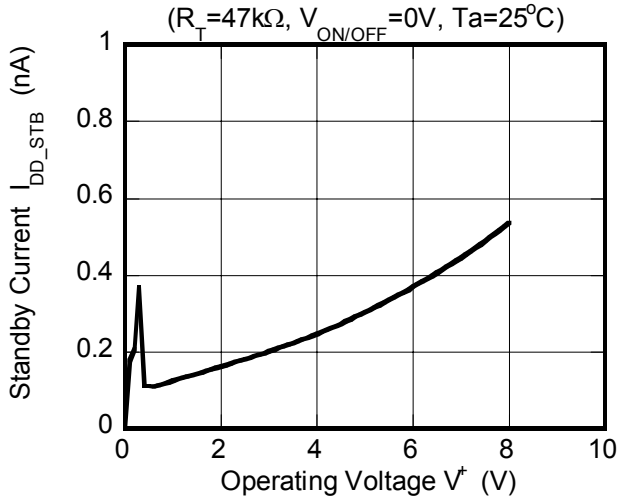
Quiescent Current vs. Operating Voltage

(R_T=47kΩ, R_L=Non Load, Ta=25°C)



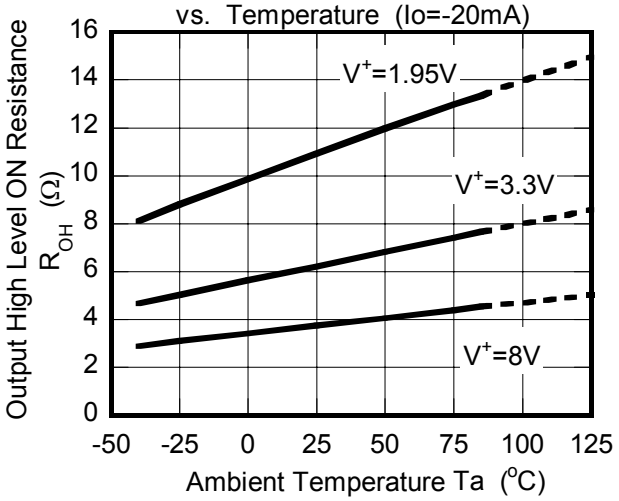
Standby Current vs. Operating Voltage

(R_T=47kΩ, $V_{ON/OFF}$=0V, Ta=25°C)



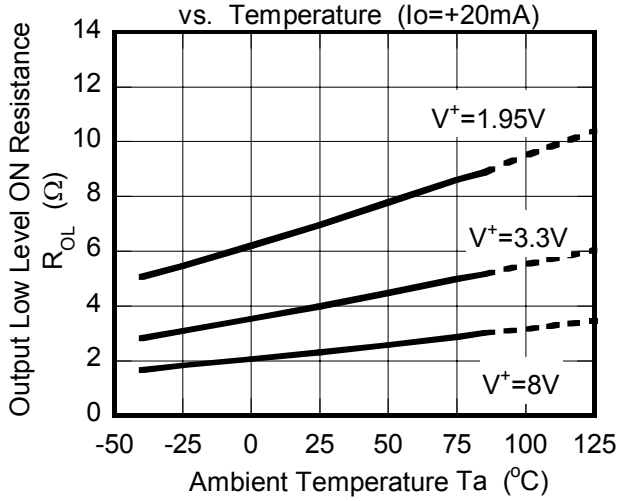
Output Block

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



Output Block

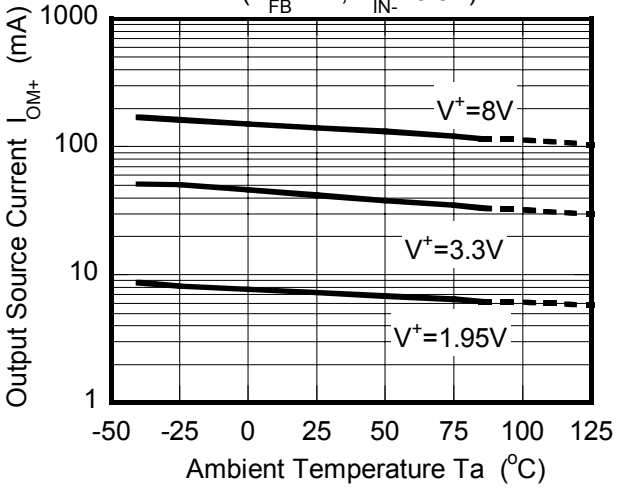
Output Low Level ON Resistance vs. Temperature (Io=+20mA)



Error Amplifier Block

Output Source Current vs. Temperature

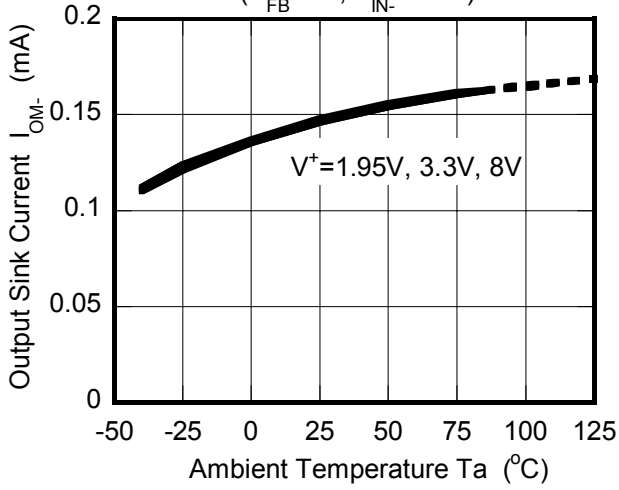
(V_{FB}=1V, V_{IN-}=0.9V)



Error Amplifier Block

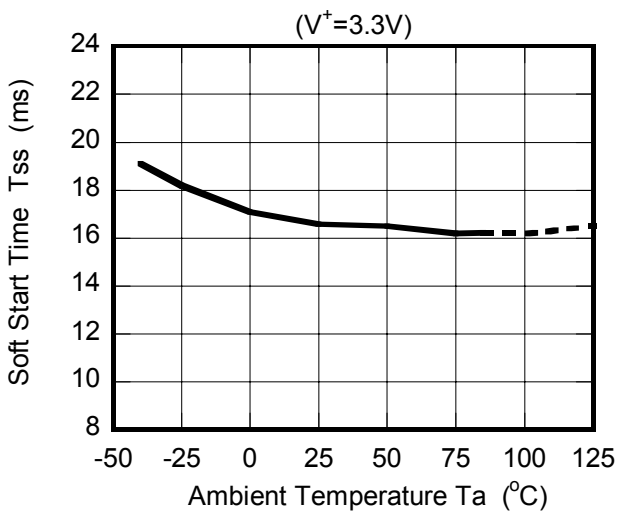
Output Sink Current vs. Temperature

(V_{FB}=1V, V_{IN-}=1.1V)

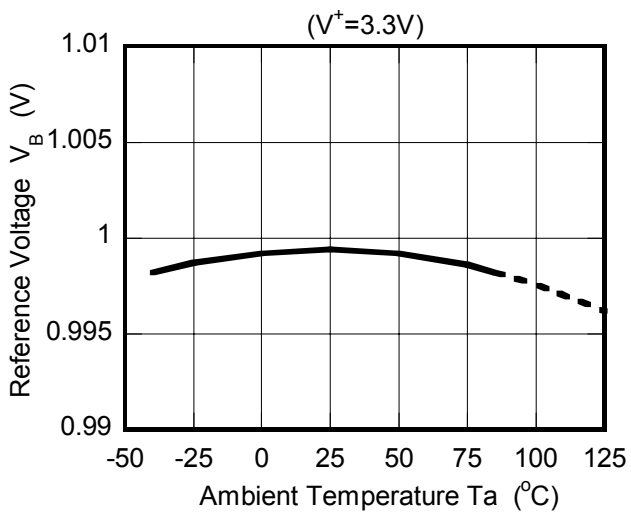


■TYPICAL CHARACTERISTICS

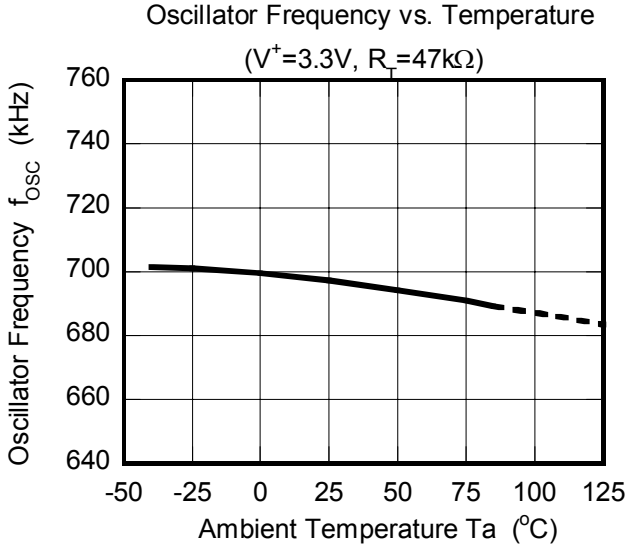
Soft Start Time vs. Temperature



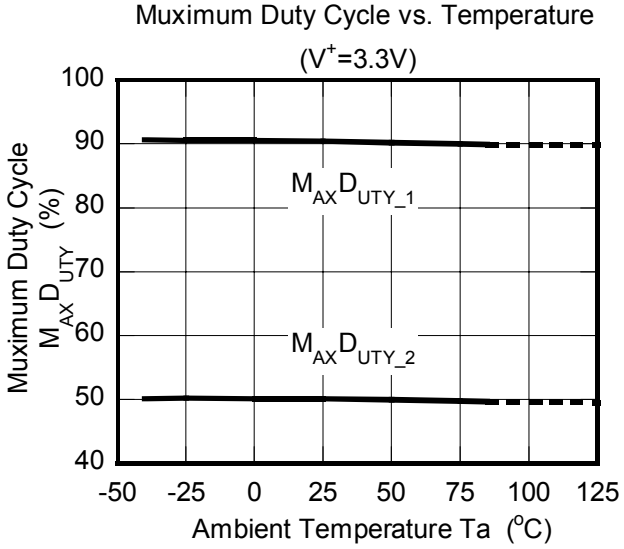
Reference Voltage vs. Temperature



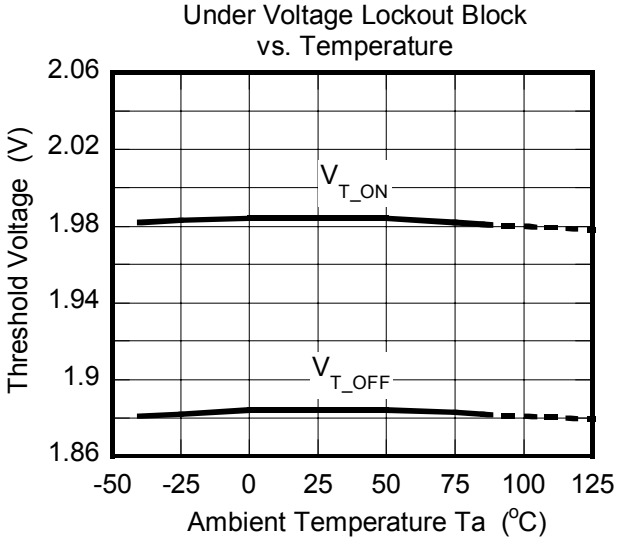
Oscillator Frequency vs. Temperature



Muximum Duty Cycle vs. Temperature

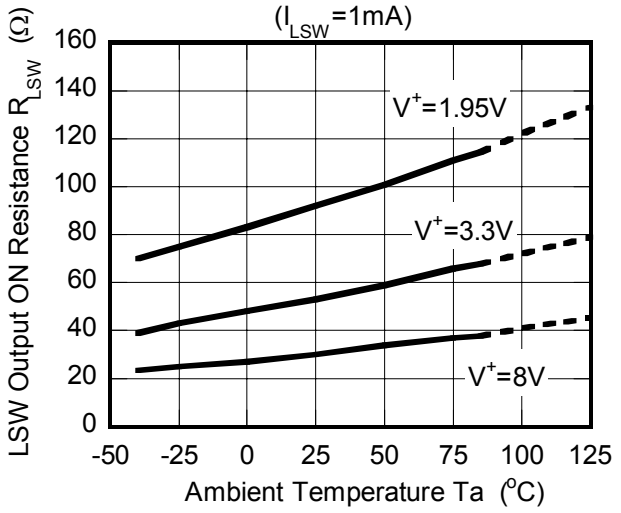


Under Voltage Lockout Block vs. Temperature

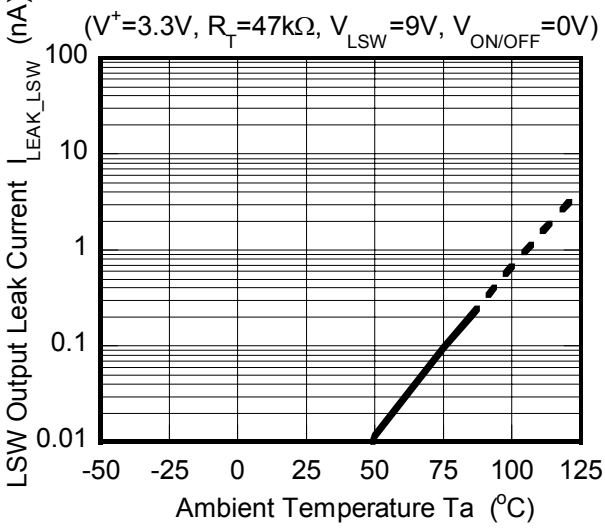


■TYPICAL CHARACTERISTICS

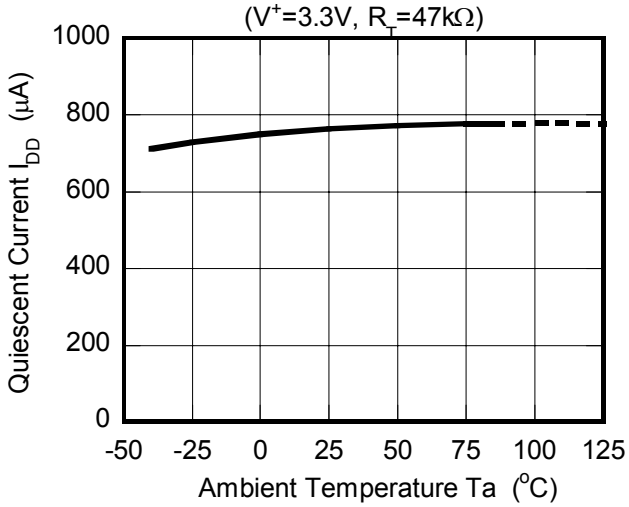
LSW Output ON Resistance vs. Temperature
(I_{LSW}=1mA)



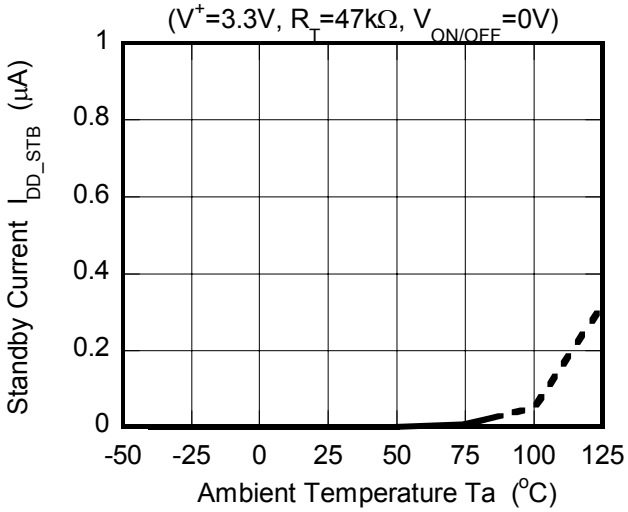
LSW Output Leak Current vs. Temperature
(V^+=3.3V, R_T=47kΩ, V_{LSW}=9V, $V_{ON/OFF}$=0V)



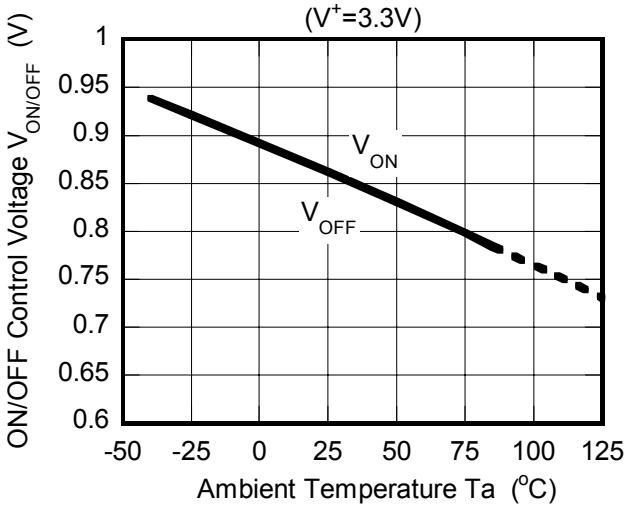
Quiescent Current vs. Temperature
(V^+=3.3V, R_T=47kΩ)



Standby Current vs. Temperature
(V^+=3.3V, R_T=47kΩ, $V_{ON/OFF}$=0V)



ON/OFF Control Voltage vs. Temperature
(V^+=3.3V)



MEMO