

High Efficiency Synchronous Step-Down switching regulator IC

■ GENERAL DESCRIPTION

The **NJU7690** is a high efficiency synchronous step-down switching regulator control IC. It offers high efficiency power supply circuits in applications by synchronous rectification. The NJU7690 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 10-lead MSOP (TVSP) package. It is suitable for battery powered applications.

■ PACKAGE OUTLINE

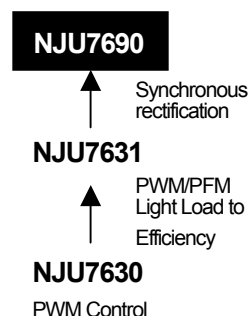


NJU7690RB2
(MSOP10 (TVSP10))

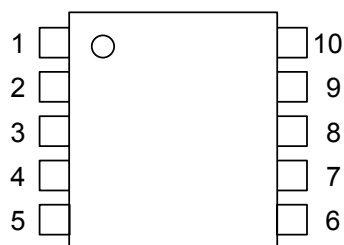
■ FEATURES

- Synchronous Rectification
- PWM switching control
- Standby Function
- Operating Voltage 2.2V to 8V
- Wide Oscillator Range 300kHz to 1MHz
- Maximum Duty Cycle 100%
- Quiescent Current Operating :800 μ A typ.
 Standby :1 μ A max.
- Soft-Start Function Internal : 16ms typ. or adjustable
- Dead Time Control
- Timer Latch for Short Circuit Protection
- C-MOS Technology
- Package Outline NJU7690RB2 : TVSP10

■ PRODUCT VARIATION



■ PIN CONFIGURATION

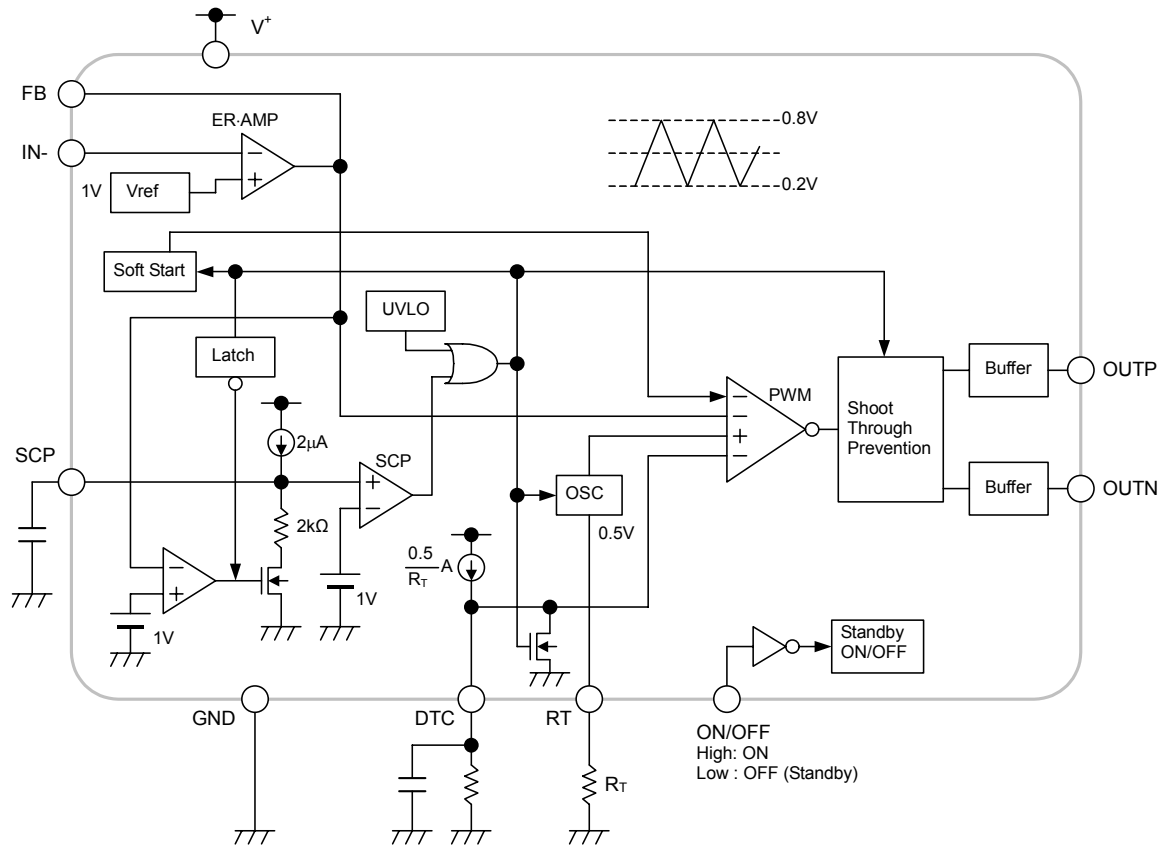


NJU7690RB2

PIN FUNCTION

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

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

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
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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
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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	0.20	0.45	0.70	V

Oscillator Block

RT Pin Voltage	V _{RT}		-10%	0.5	+10%	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

($V^+ = V_{ON/OFF} = 3.3V$, $R_T = 47k\Omega$, $T_a = 25^\circ C$)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
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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}	$V_{FB}=1V$, $V_{IN-}=0.9V$	12	40	70	mA
	I_{OM+2}	$V_{FB}=1V$, $V_{IN-}=0.9V$, $V^+=2.2V$	2.5	9	16	mA
Output Sink Current	I_{OM-}	$V_{FB}=1V$, $V_{IN-}=1.1V$	0.10	0.16	0.22	mA

PWM Compare Block

Input Threshold Voltage	V_{T0}	Duty=0%	0.10	0.16	0.22	V
	V_{T50}	Duty=50%	0.4	0.5	0.6	V
Maximum Duty Cycle	$M_{AXDUTY1}$	$V_{FB}=0.9V$	100	—	—	%
	$M_{AXDUTY2}$	$V_{FB}=0.9V$, $R_{DTC}=47k\Omega$	35	50	65	%

Output Block

OUTP Output High Level ON Resistance	R_{OPH}	$I_O=-20mA$	—	10	20	Ω
OUTP Output Low Level ON Resistance	R_{OPL}	$I_O=+20mA$	—	5	10	Ω
OUTN Output High Level ON Resistance	R_{ONH}	$I_O=-20mA$	—	10	20	Ω
OUTN Output Low Level ON Resistance	R_{ONL}	$I_O=+20mA$	—	5	10	Ω
OUTP-OUTN Rise Dead Time	t_{dr}		55	85	120	ns
OUTN-OUTP Fall Dead Time	t_{df}		45	75	110	ns

ON/OFF Block

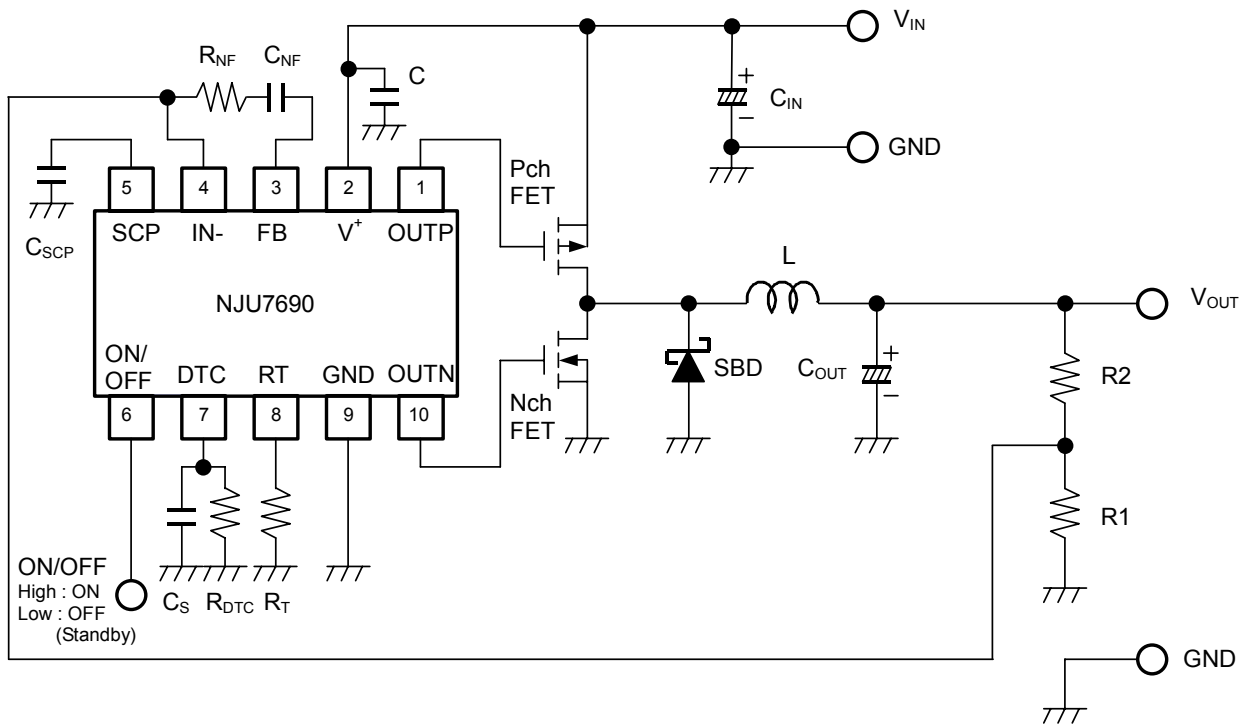
ON Control Voltage	V_{ON}	$V_{ON/OFF} = L \rightarrow H$	1.6	—	V^+	V
OFF Control Voltage	V_{OFF}	$V_{ON/OFF} = H \rightarrow L$	0	—	0.3	V

General Characteristics

Quiescent Current	I_{DD}	$R_L = \text{Non Load}$	—	800	1200	μA
Standby Current	I_{DD_STB}	$V_{ON/OFF}=0V$	—	—	1.0	μA

■ TYPICAL APPLICATIONS

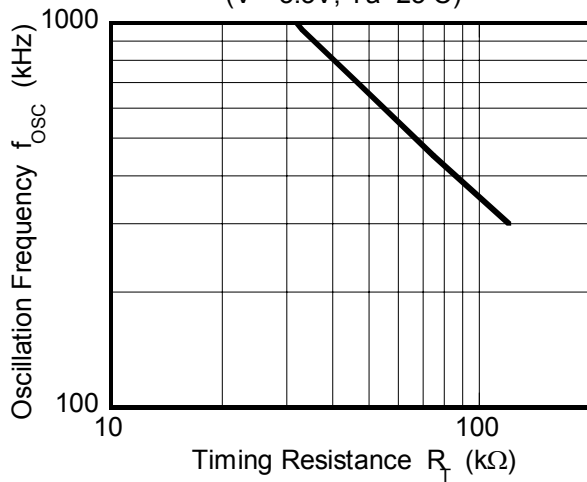
Step-Down Converter



■ TYPICAL CHARACTERISTICS

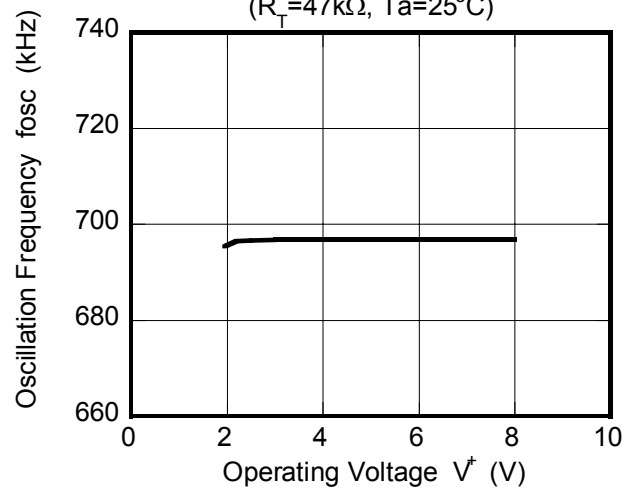
Oscillation Frequency vs. Timing Resistance

($V^+ = 3.3\text{V}$, $T_a = 25^\circ\text{C}$)



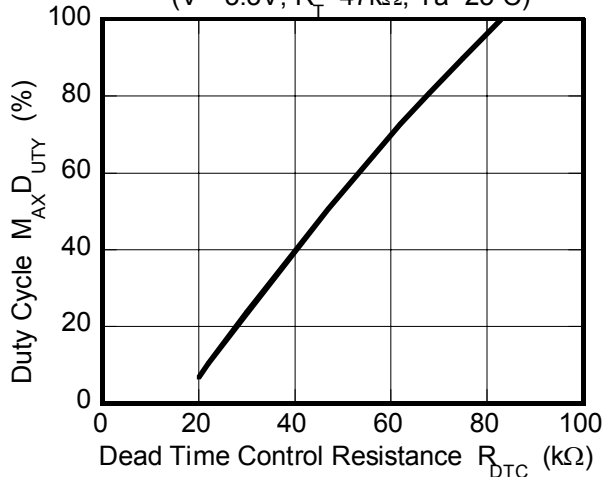
Oscillation Frequency vs. Operating Voltage

($R_T = 47\text{k}\Omega$, $T_a = 25^\circ\text{C}$)



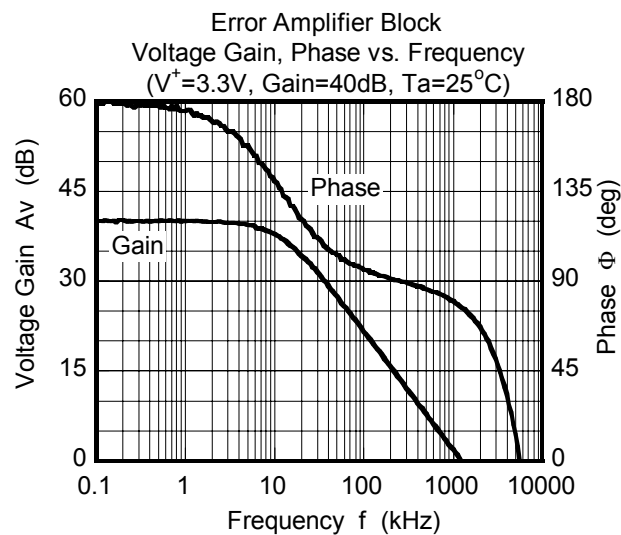
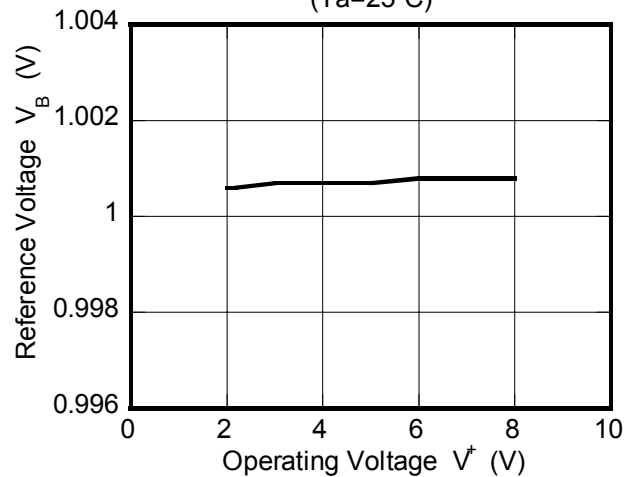
Duty Cycle vs. R_{DTC}

($V^+ = 3.3\text{V}$, $R_T = 47\text{k}\Omega$, $T_a = 25^\circ\text{C}$)



Reference Voltage vs. Operating Voltage

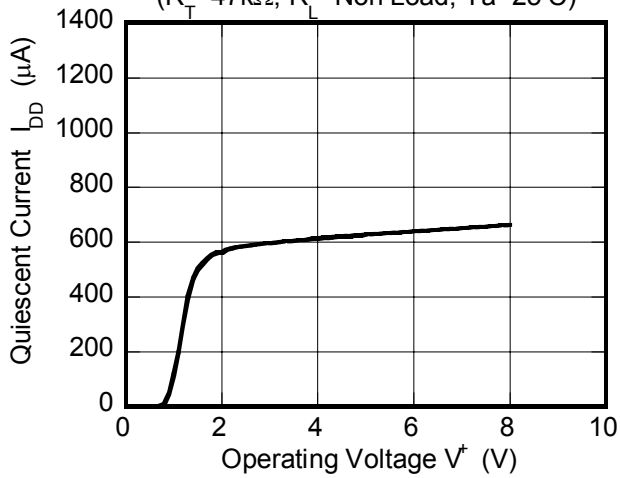
($T_a = 25^\circ\text{C}$)



■ TYPICAL CHARACTERISTICS

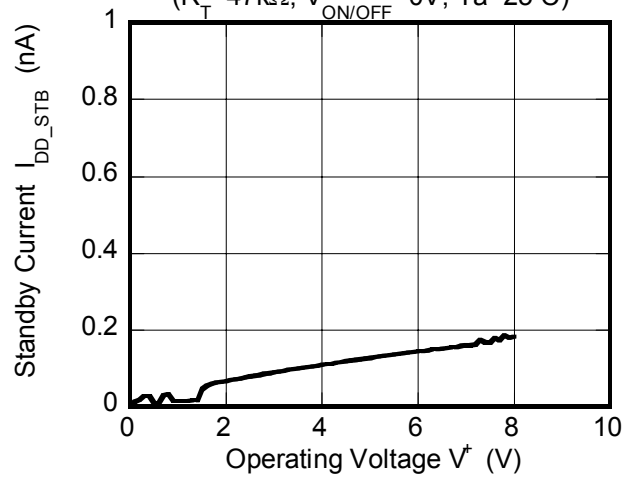
Quiescent Current vs. Operating Voltage

($R_T=47k\Omega$, R_L =Non Load, $T_a=25^\circ\text{C}$)

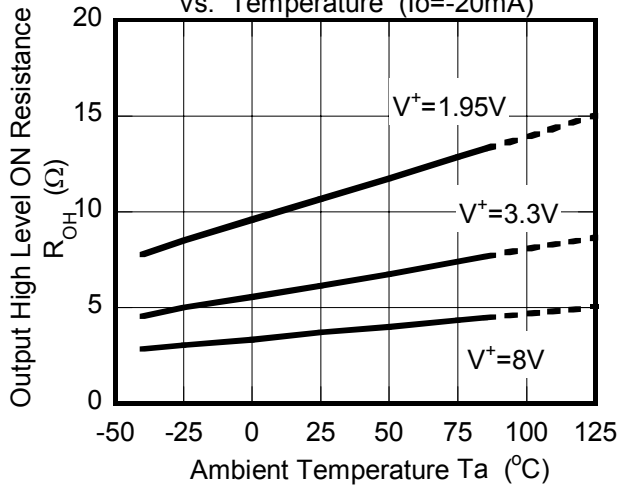


Standby Current vs. Operating Voltage

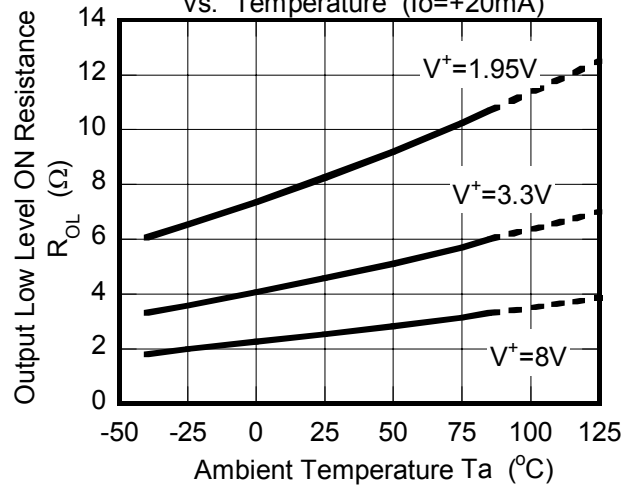
($R_T=47k\Omega$, $V_{ON/OFF}=0V$, $T_a=25^\circ\text{C}$)



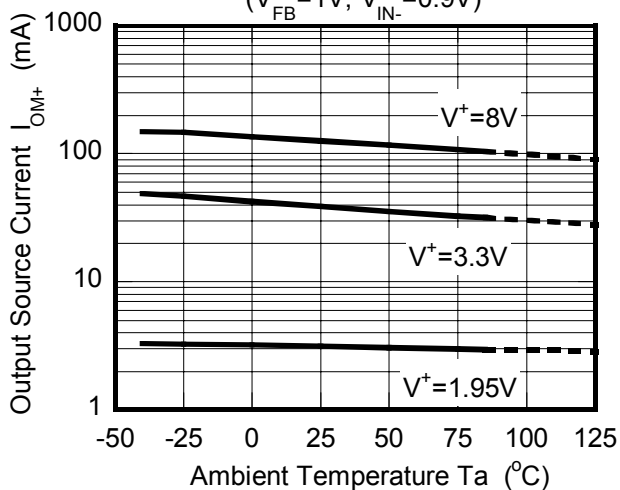
Output Block (P&N)
Output High Level ON Resistance
vs. Temperature ($I_o=-20\text{mA}$)



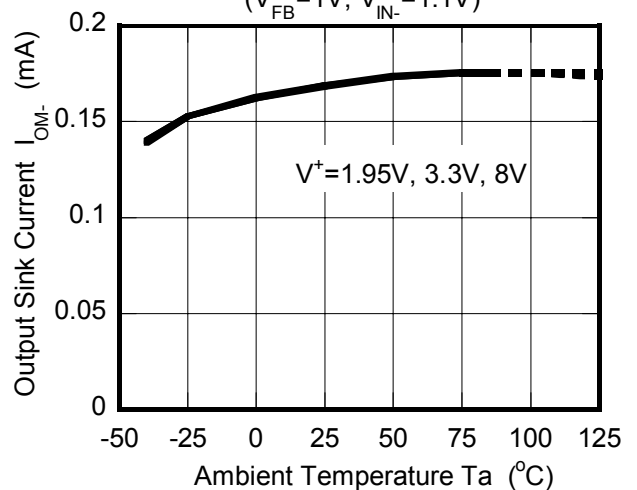
Output Block (P&N)
Output Low Level ON Resistance
vs. Temperature ($I_o=+20\text{mA}$)



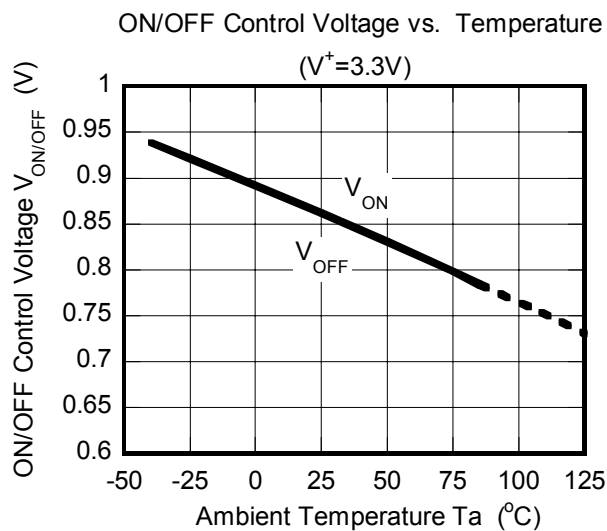
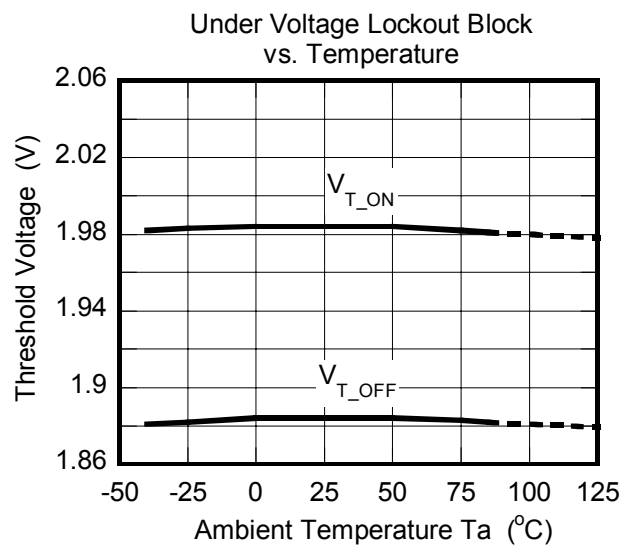
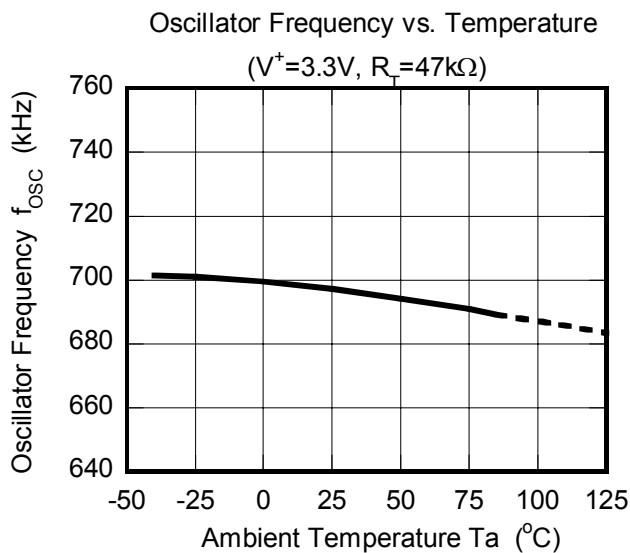
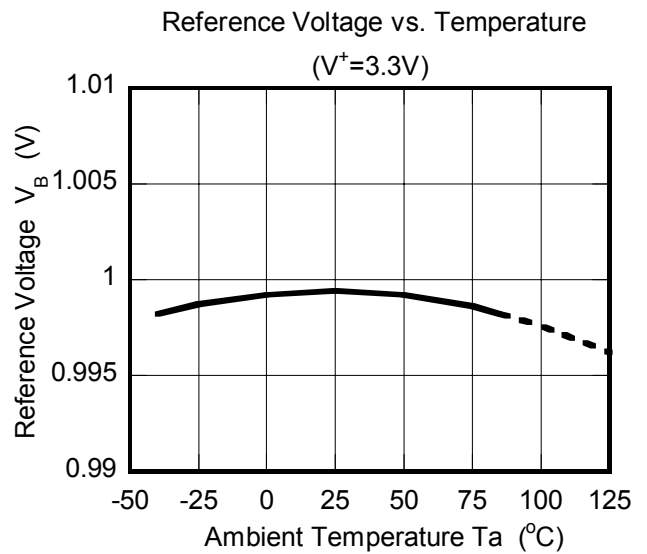
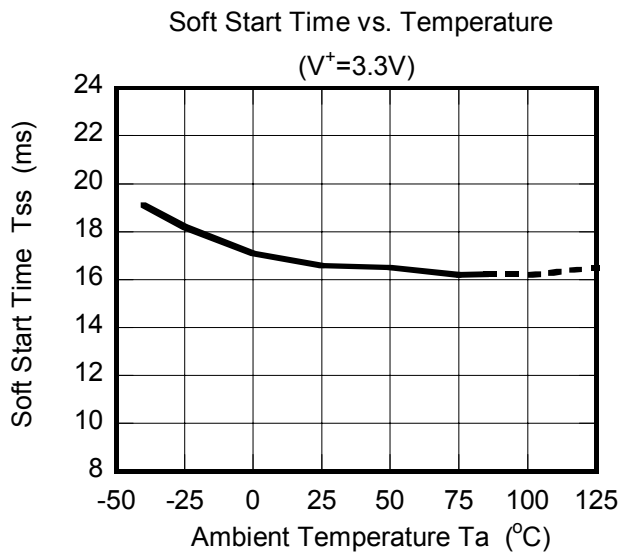
Error Amplifier Block
Output Source Current vs. Temperature
($V_{FB}=1V$, $V_{IN-}=0.9V$)



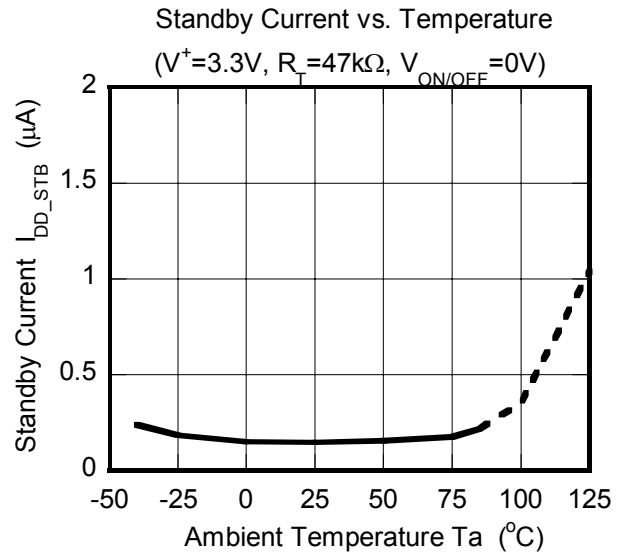
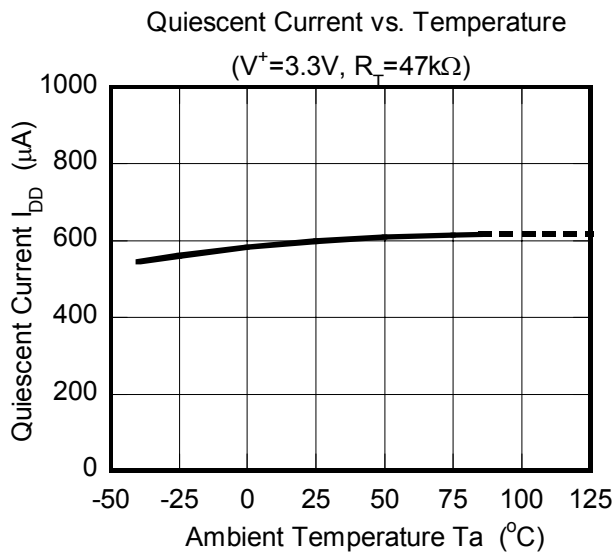
Error Amplifier Block
Output Sink Current vs. Temperature
($V_{FB}=1V$, $V_{IN-}=1.1V$)



■ TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS



[CAUTION]

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