

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

### ■GENERAL DESCRIPTION

**NJU7631** is a high speed low voltage operation switching regulator control IC with power saving PWM/PFM control. Automatic PWM/PFM control improves power efficiency at light load. It features a totem pole driver that can directly drive an external MOS-FET.

Internal soft-start function, dead time control and timer latch function are included, requiring no external components. All parameters can be optimized by additional external components for design flexibility.

### ■FEATURES

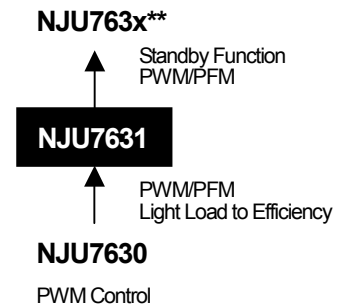
- Automatic PWM/PFM Control
- Operating Voltage           2.2V to 8V
- Wide Oscillator Range       300kHz to 1MHz
- Maximum Duty Cycle        100%
- Quiescent Current           800μA typ.
- Soft-Start Function         Internal : 16ms typ. or adjustable
- Dead Time Control
- Timer Latch for Short Circuit Protection
- C-MOS Technology
- Package Outline             NJU7631RB1 : TVSP8

### ■PACKAGE OUTLINE



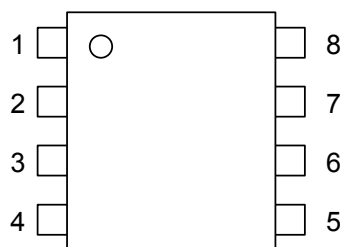
**NJU7631RB1**

### ■PRODUCT VARIATION



\*\* Planning

### ■PIN CONFIGURATION



**NJU7631RB1**

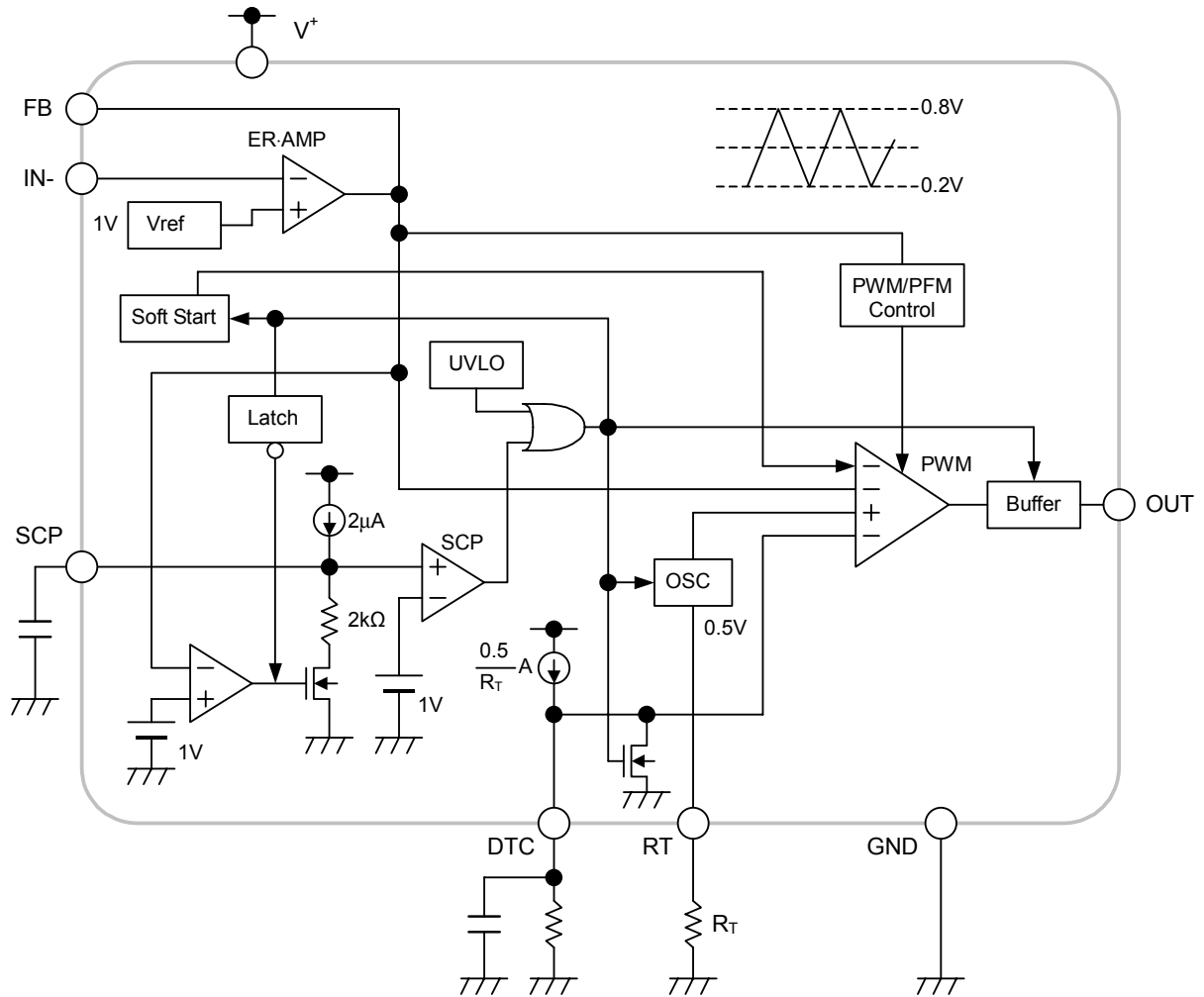
#### PIN FUNCTION

1. OUT
2. V<sup>+</sup>
3. FB
4. IN-
5. SCP
6. DTC
7. RT
8. GND

# NJU7631

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## ■BLOCK DIAGRAM



■ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	MAXIMUM RATINGS	UNIT
Supply Voltage	V <sup>+</sup>	+9	V
Output Pin Current	I <sub>O</sub>	±50	mA
Power Dissipation	P <sub>D</sub>	TVSP8 :320	mW
Operating Temperature Range	T <sub>OPR</sub>	-40 ~ +85	°C
Storage Temperature Range	T <sub>STG</sub>	-40 ~ +125	°C

■RECOMMENDED OPERATING CONDITIONS (Ta=25°C)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Operating Voltage	V <sup>+</sup>	2.2	—	8	V
Oscillator Timing Resistor	R <sub>T</sub>	30	47	120	kΩ
Oscillation Frequency	f <sub>OSC</sub>	300	700	1,000	kHz

■ELECTRICAL CHARACTERISTICS (V<sup>+</sup>=3.3V, R<sub>T</sub>=47kΩ, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
<b>Under Voltage Lockout Block</b>						
ON Threshold Voltage	V <sub>T_ON</sub>	V <sup>+</sup> = L → H	1.9	2.0	2.1	V
OFF Threshold Voltage	V <sub>T_OFF</sub>	V <sup>+</sup> = H → L	1.8	1.9	2.0	V
Hysteresis Voltage	V <sub>HYS</sub>		60	100	—	mV
<b>Soft Start Block</b>						
Soft Start Time	T <sub>SS</sub>	V <sub>T_ON</sub> → Duty=80%	8	16	24	ms
<b>Short Circuit Protection Block</b>						
Input Threshold Voltage	V <sub>T_PC</sub>	FB Pin	0.95	1.00	1.05	V
Charge Current	I <sub>CHG</sub>	V <sub>SCP</sub> =0V	1.5	2	2.5	μA
Latch Mode ON Threshold Voltage	V <sub>T_LA</sub>	SCP Pin	0.95	1.00	1.05	V
Latch Mode OFF Threshold Voltage	V <sub>T_LAOFF</sub>	SCP Pin	0.2	0.45	0.7	V
<b>Oscillator Block</b>						
RT Pin Voltage	V <sub>RT</sub>		-5%	0.5	+5%	V
Oscillation Frequency	f <sub>OSC</sub>		630	700	770	kHz
Oscillate Supply Voltage Fluctuations	f <sub>DV</sub>	V <sup>+</sup> =2.2V ~ 8V	—	1	—	%
Oscillate Temperature Fluctuations	f <sub>DT</sub>	Ta=-40°C ~ +85°C	—	3	—	%

## ■ELECTRICAL CHARACTERISTICS ( $V^+=3.3V$ , $R_T=47k\Omega$ , $T_a=25^\circ C$ )

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	$\mu A$
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 Compare Block

Input Threshold Voltage	$V_{T25}$	Duty= PFMD <sub>UTY</sub>	0.29	0.35	0.41	V
	$V_{T50}$	Duty=50%	0.44	0.5	0.56	V
Maximum Duty Cycle	$M_{AXD_{UTY1}}$	$V_{FB}=0.9V$	100	–	–	%
	$M_{AXD_{UTY2}}$	$V_{FB}=0.9V$ , $R_{DTC}=47k\Omega$	40	50	60	%
PWM/PFM Change Duty Cycle	PFMD <sub>UTY</sub>		17	25	33	%

### Output Block

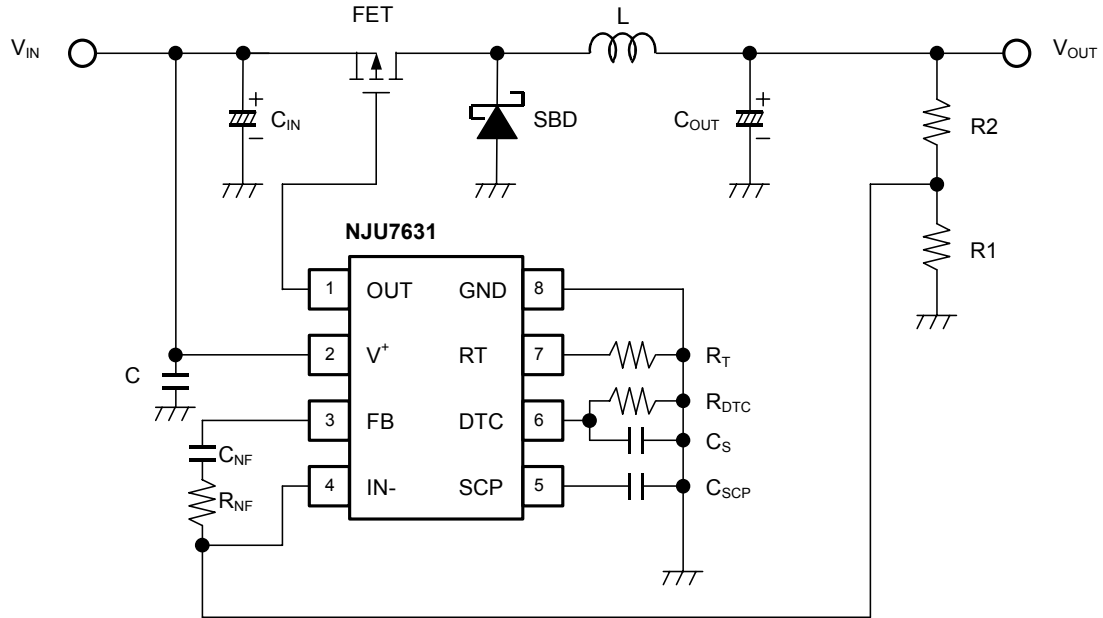
Output High Level ON Resistance	$R_{OH}$	$I_O=-20mA$	–	10	20	$\Omega$
Output Low Level ON Resistance	$R_{OL}$	$I_O=+20mA$	–	5	10	$\Omega$

### General Characteristics

Quiescent Current	$I_{DD}$	$R_L=Non\ Load$	–	800	1200	$\mu A$
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## ■ TYPICAL APPLICATIONS

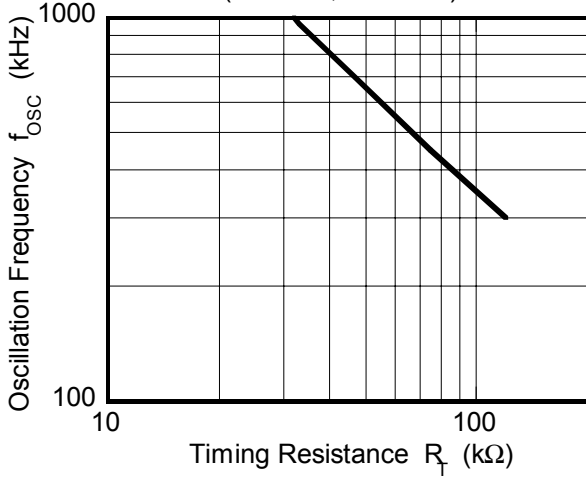
### Step-Down Converter



## ■ TYPICAL CHARACTERISTICS

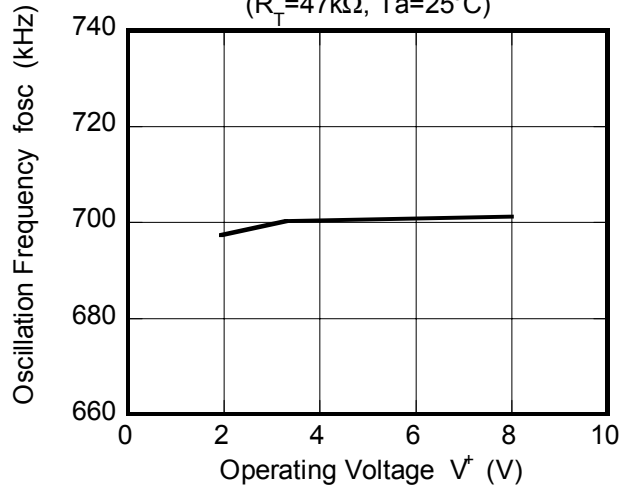
Oscillation Frequency vs. Timing Resistance

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



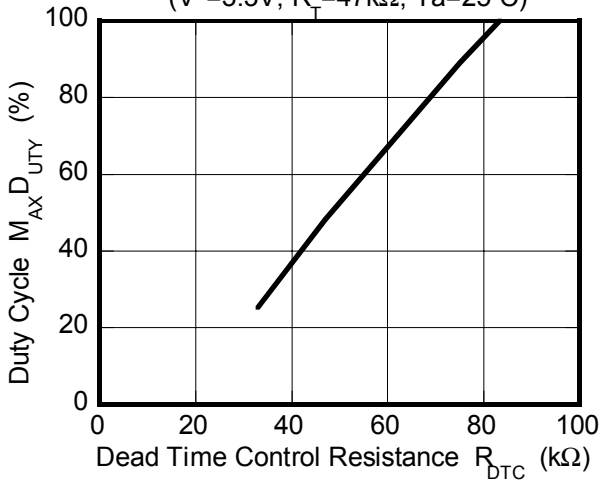
Oscillation Frequency vs. Operating Voltage

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



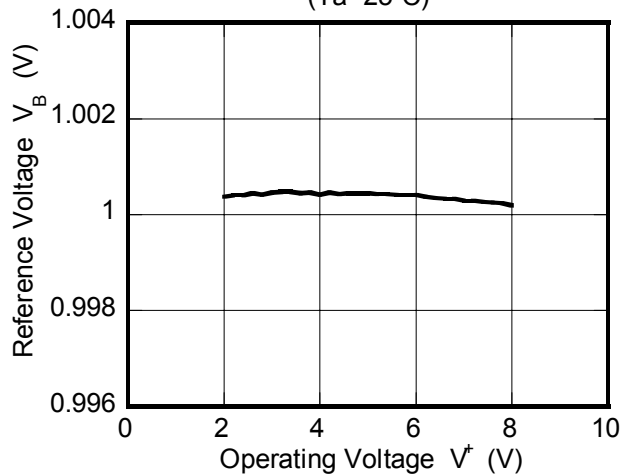
Duty Cycle vs.  $R_{DTC}$

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



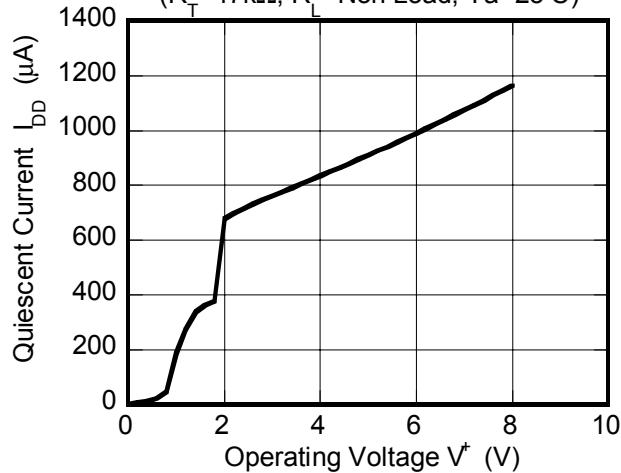
Reference Voltage vs. Operating Voltage

( $T_a = 25^\circ C$ )

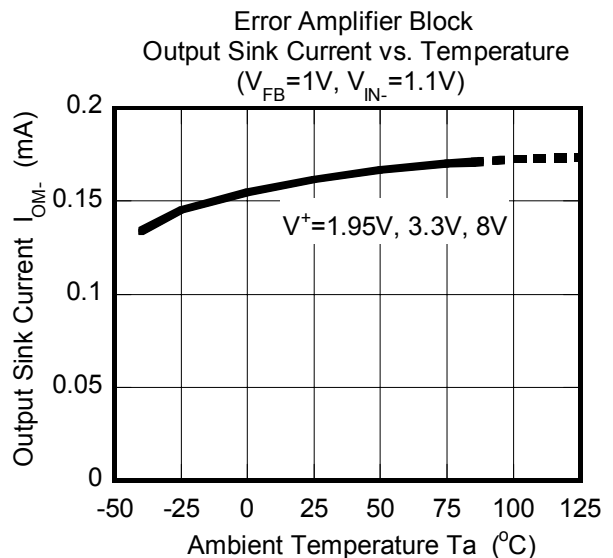
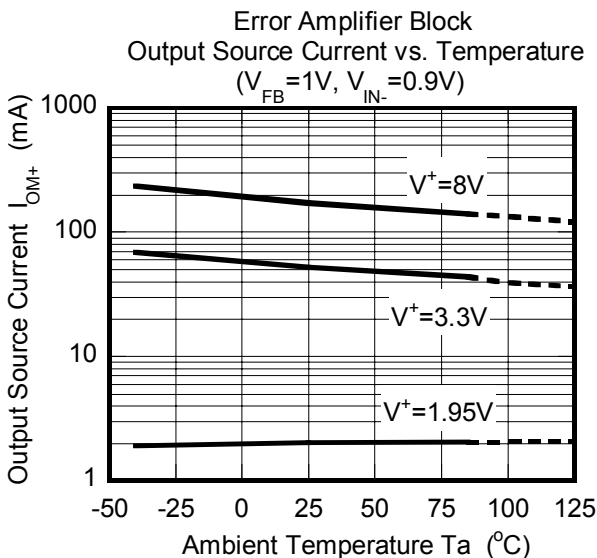
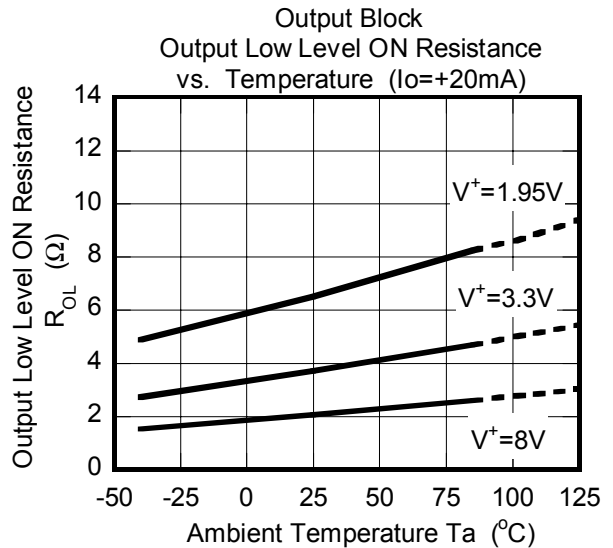
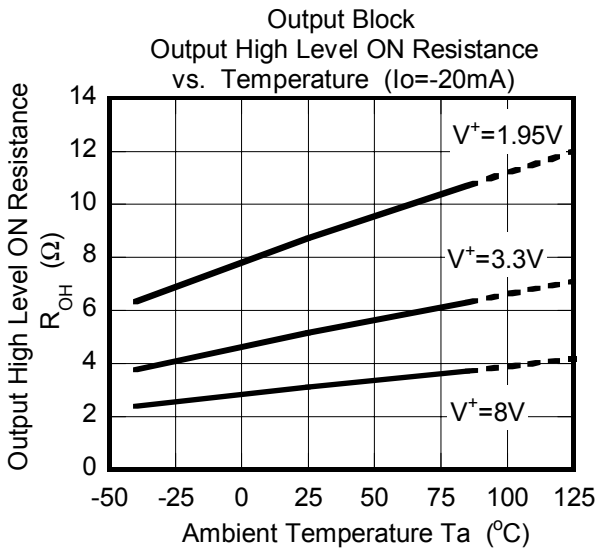
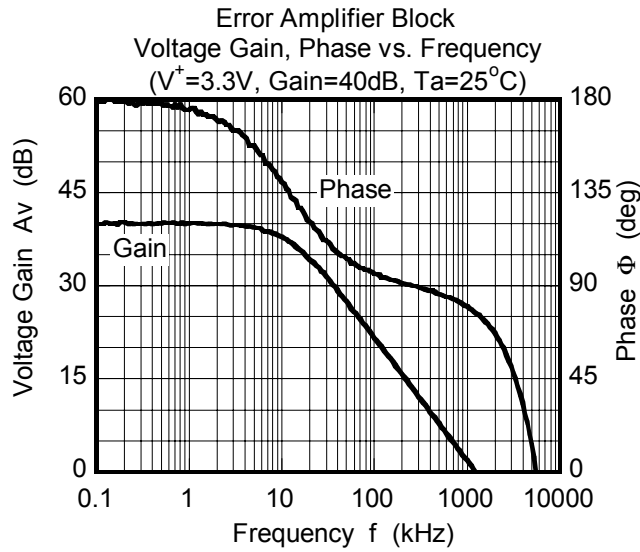


Quiescent Current vs. Operating Voltage

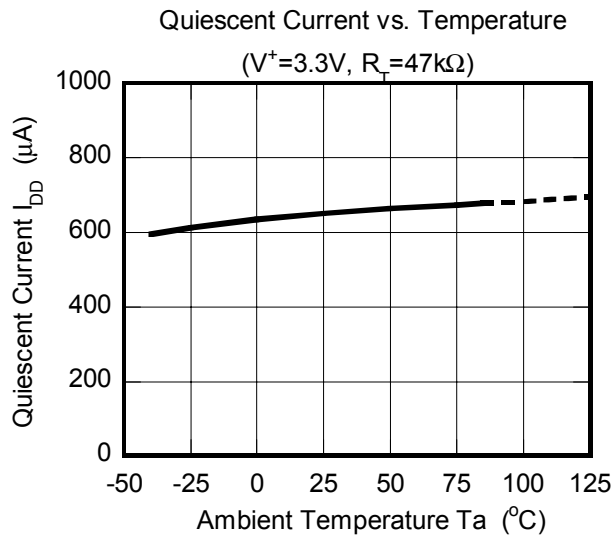
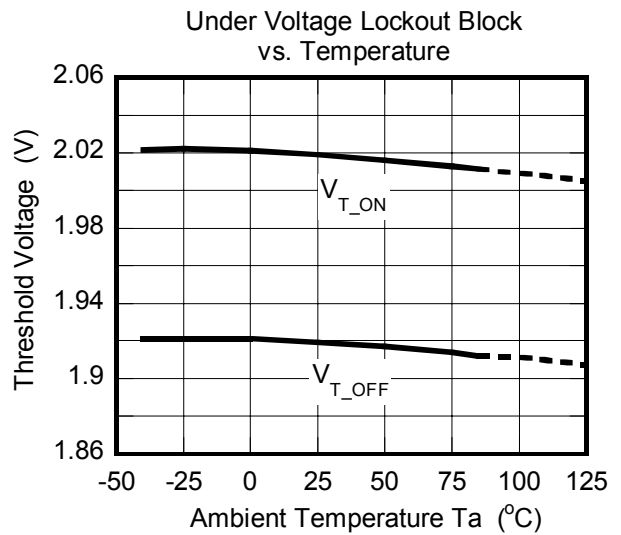
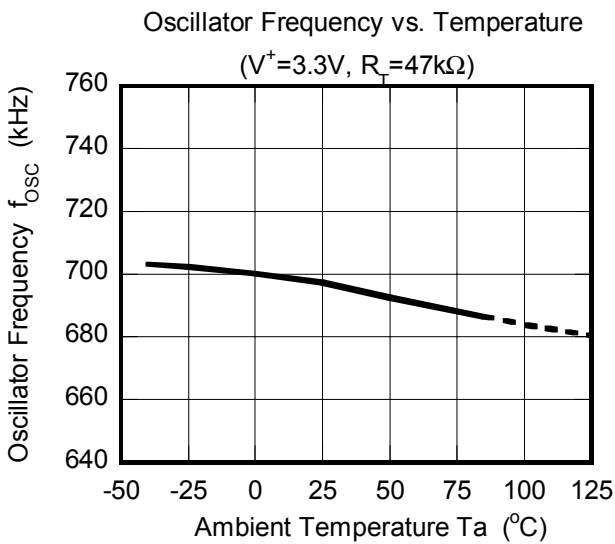
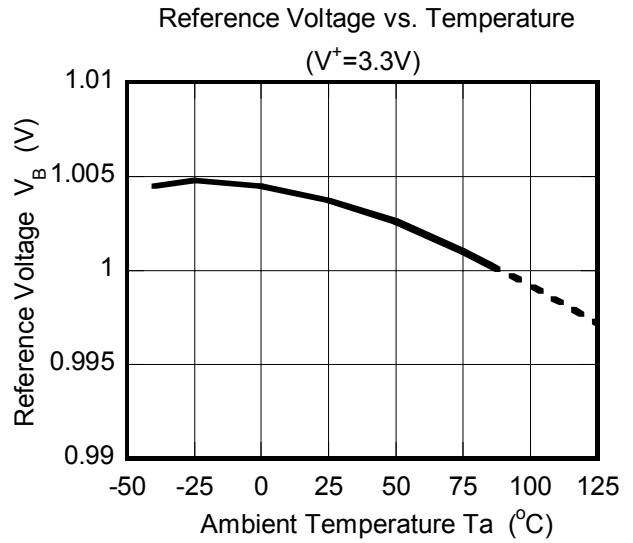
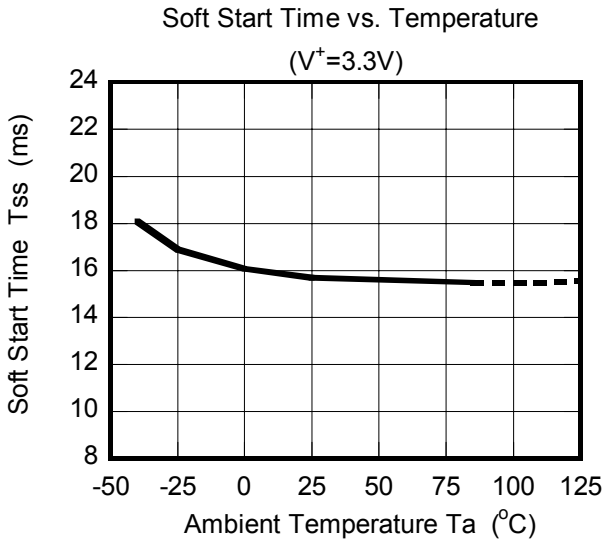
( $R_T = 47k\Omega$ ,  $R_L = \text{Non Load}$ ,  $T_a = 25^\circ C$ )



## ■ TYPICAL CHARACTERISTICS



## ■ TYPICAL CHARACTERISTICS





# MEMO

**[CAUTION]**

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