

## Step-Down switching regulator IC with Over Current Protection

### ■ GENERAL DESCRIPTION

The **NJU7640** is a low voltage operation high-speed switching regulator control IC for step-down converter, with a pulse-by-pulse over-current protection. The pulse-by-pulse over-current protection circuit can limit the over current in switching operation.

It incorporates a totem pole output, which can drive an external MOS-FET easily. It also has a soft-start function and dead time control and their times are all adjustable with external parts.

The NJU7640 is available in a small and thin 8-lead MSOP (TVSP) package.

### ■ FEATURES

- PWM switching control
- Pulse-by-pulse over current protection
- Operating Voltage           2.2V to 8V
- Wide Oscillator Range       300kHz to 1MHz
- Maximum Duty Cycle        100%
- Quiescent Current           800 $\mu$ A typ.
- Soft-Start Function         Internal : 16ms typ. or adjustable
- Dead Time Control
- C-MOS Technology
- Package Outline             NJU7640RB1 : MSOP8 (TVSP8)\*

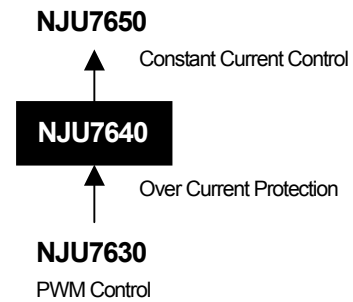
\*MEET JEDEC MO-187-DA / THIN TYPE

### ■ PACKAGE OUTLINE

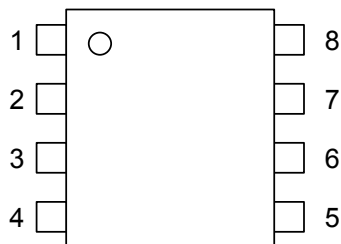


**NJU7640RB1**  
(MSOP8 (TVSP8))

### ■ PRODUCT VARIATION



### ■ PIN CONFIGURATION



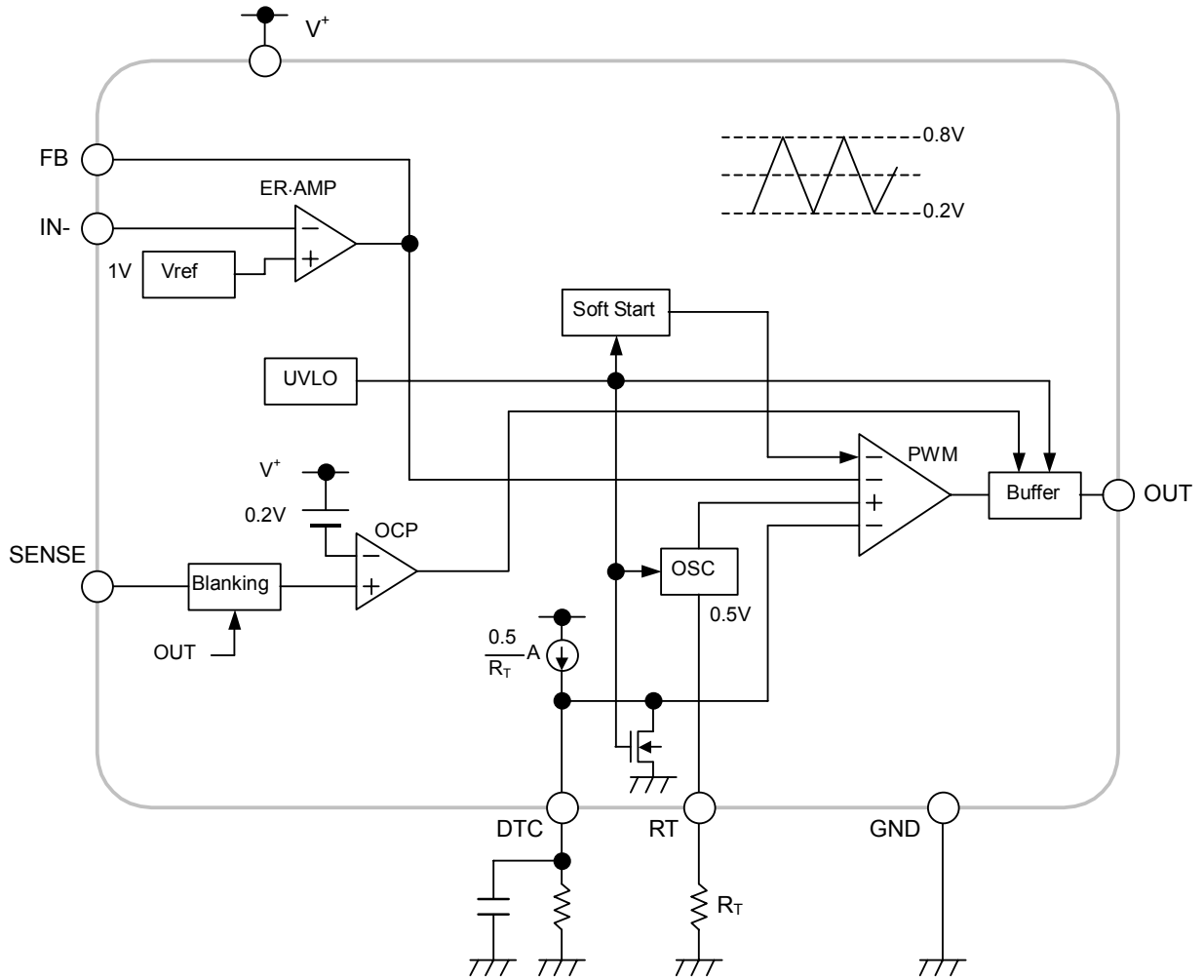
**NJU7640RB1**

#### PIN FUNCTION

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

# NJU7640

## ■ 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>   | MSOP8 (TVSP8) :320 | mW   |
| Operating Temperature Range | T <sub>OPR</sub> | -40 to +85         | °C   |
| Storage Temperature Range   | T <sub>STG</sub> | -40 to +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>Over Current Protection Block</b>  |                    |   |      |      |      |      |
| Current Limit Sense Voltage           | V <sub>SENSE</sub> | Voltage between V <sup>+</sup> -SENSE pin     | 0.17 | 0.2  | 0.23 | V    |
| Delay Time                            | T <sub>DELAY</sub> | V <sub>SENSE</sub> +0.1V<br>Delay time to OUT | –    | 160  | –    | ns   |
| Sense Blanking Time                   | T <sub>BLANK</sub> |   | –    | 90   | –    | ns   |
| <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 to 8V                    | –    | 1    | –    | %    |
| Oscillate Temperature Fluctuations    | f <sub>DT</sub>    | Ta=-40°C to +85°C                             | –    | 3    | –    | %    |

# NJU7640

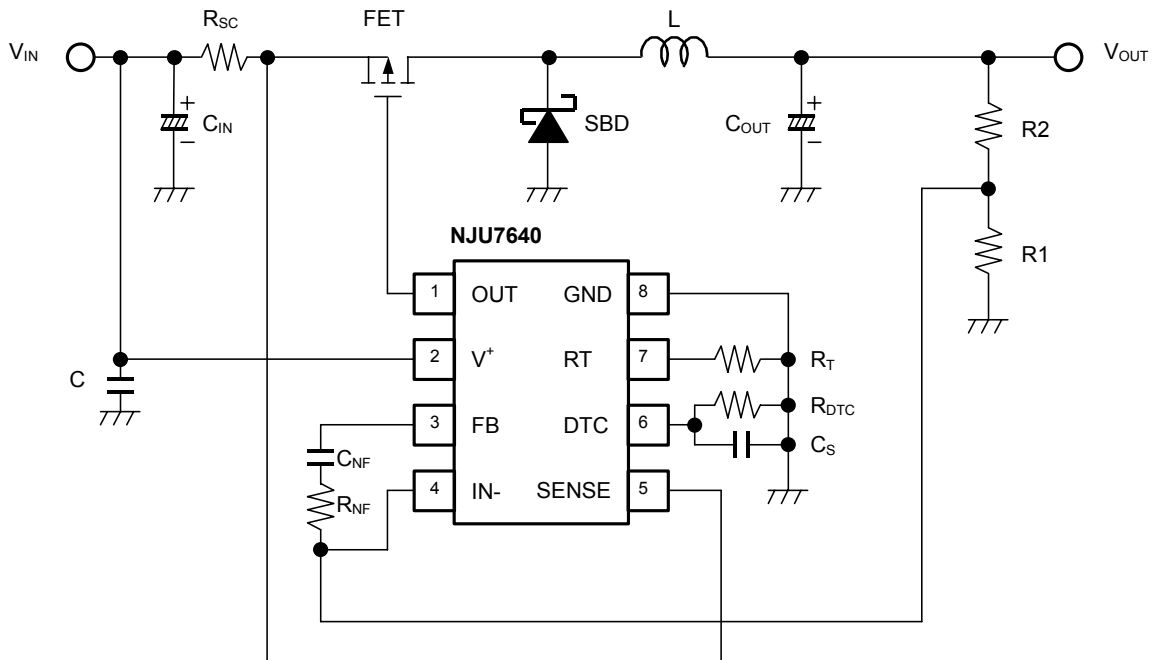
## ■ ELECTRICAL CHARACTERISTICS

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

| PARAMETER                       | SYMBOL         | TEST CONDITION                      | MIN.  | TYP. | MAX.  | UNIT     |
|---------------------------------|----------------|-------------------------------------|-------|------|-------|----------|
| <b>Error Amplifier Block</b>    |                |                                     |       |      |       |          |
| 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       |
| <b>PWM Compare Block</b>        |                |                                     |       |      |       |          |
| 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              | $M_{AXDUTY_1}$ | $V_{FB}=0.9V$                       | 100   | –    | –     | %        |
|                                 | $M_{AXDUTY_2}$ | $V_{FB}=0.9V, R_{DTC}=47k\Omega$    | 40    | 50   | 60    | %        |
| <b>Output Block</b>             |                |                                     |       |      |       |          |
| 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    | $\Omega$ |
| <b>General Characteristics</b>  |                |                                     |       |      |       |          |
| Quiescent Current               | $I_{DD}$       | $R_L=Non\ Load$                     | –     | 800  | 1200  | $\mu A$  |

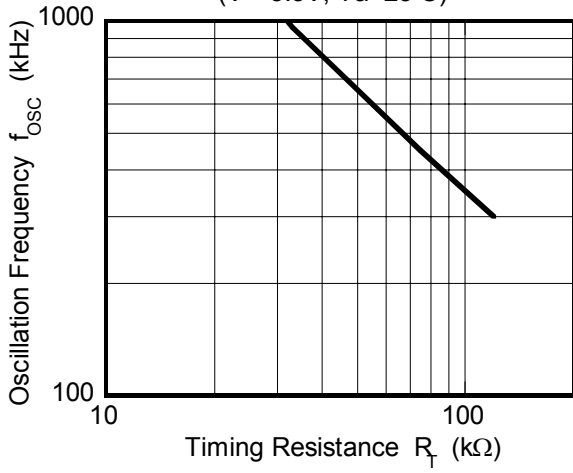
## ■ TYPICAL APPLICATIONS

### Step-Down Converter

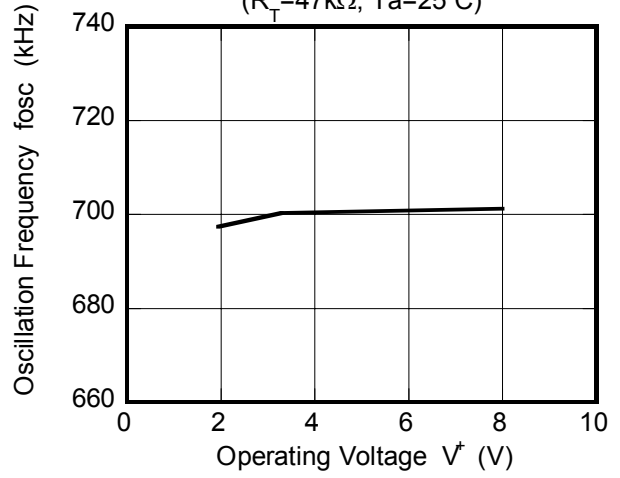


## ■ TYPICAL CHARACTERISTICS

Oscillation Frequency vs. Timing Resistance  
( $V^+ = 3.3V$ ,  $T_a = 25^\circ C$ )

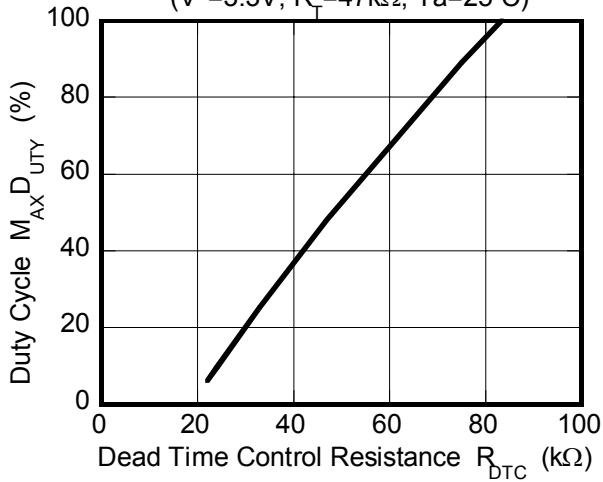


Oscillation Frequency vs. Operating Voltage  
( $R_T = 47k\Omega$ ,  $T_a = 25^\circ C$ )



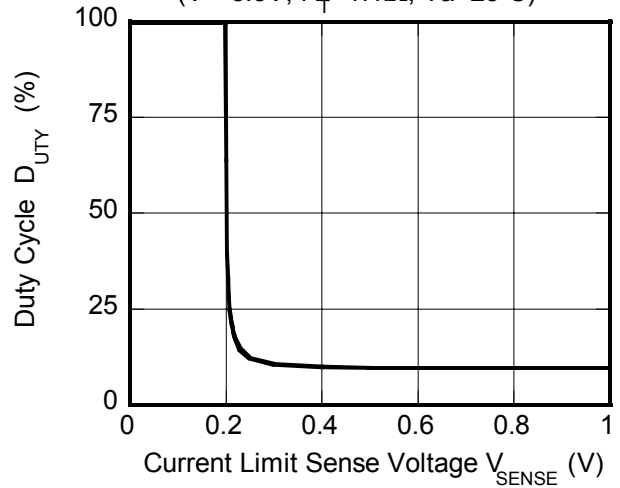
Duty Cycle vs.  $R_{DTC}$

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

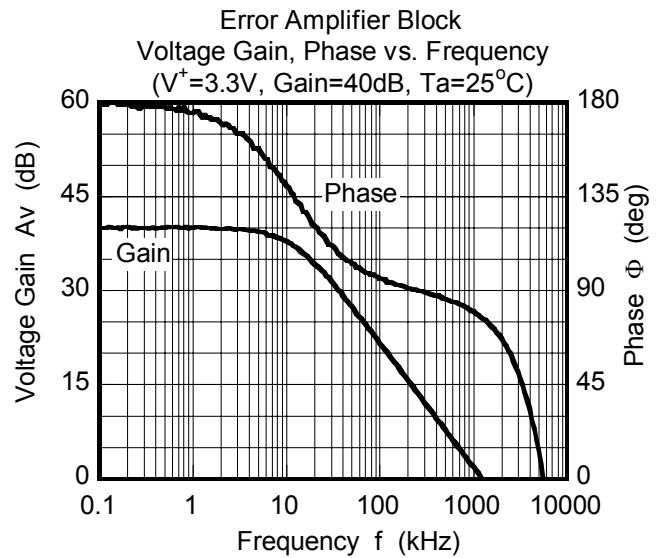
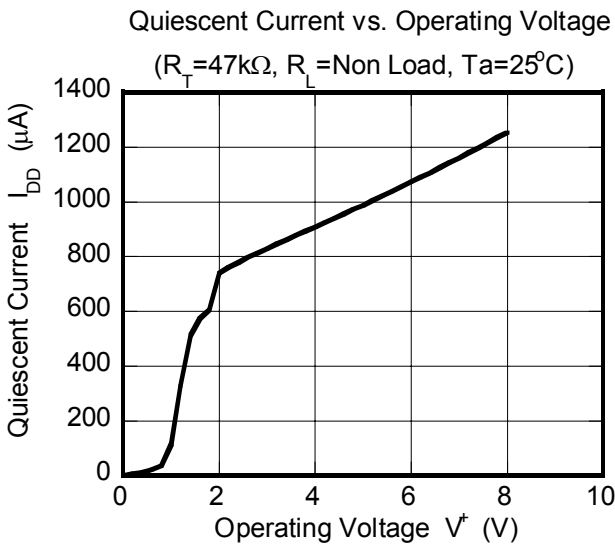
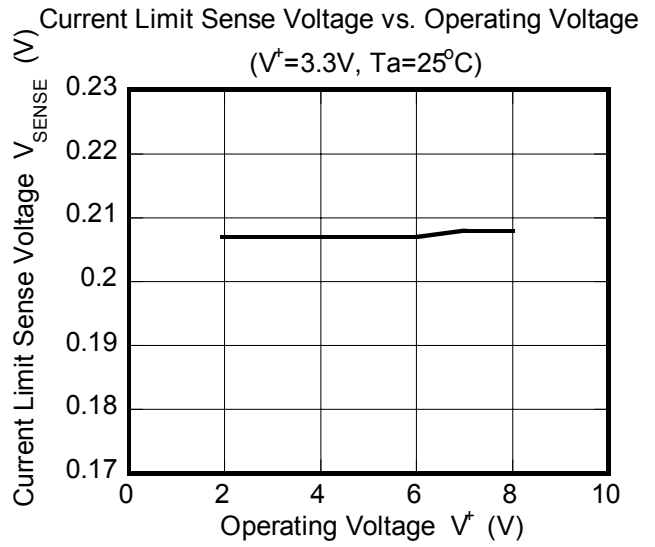
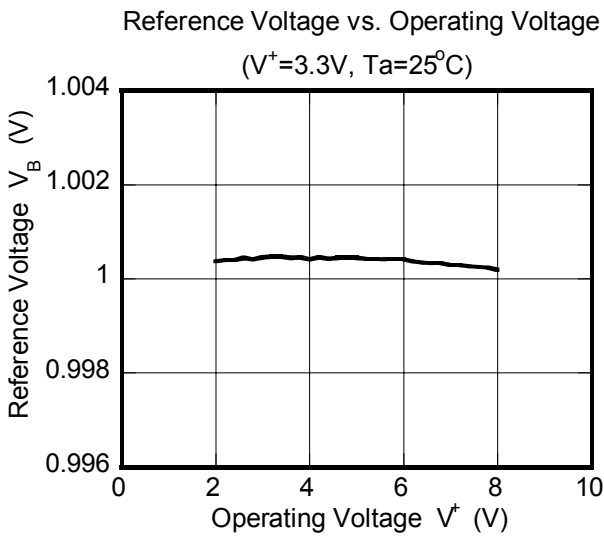


Duty Cycle vs. Current Limit Sense Voltage

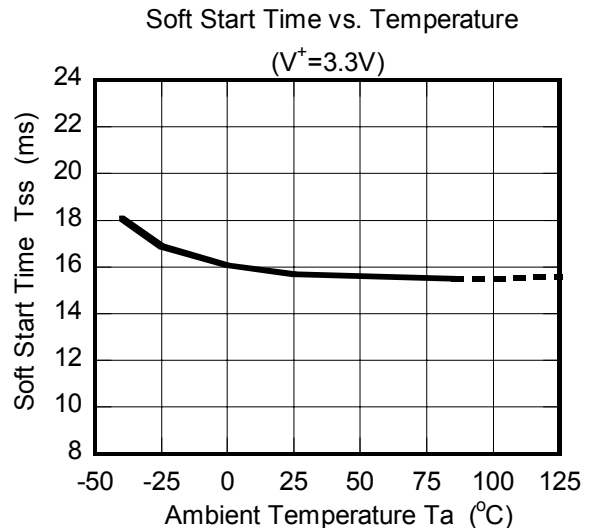
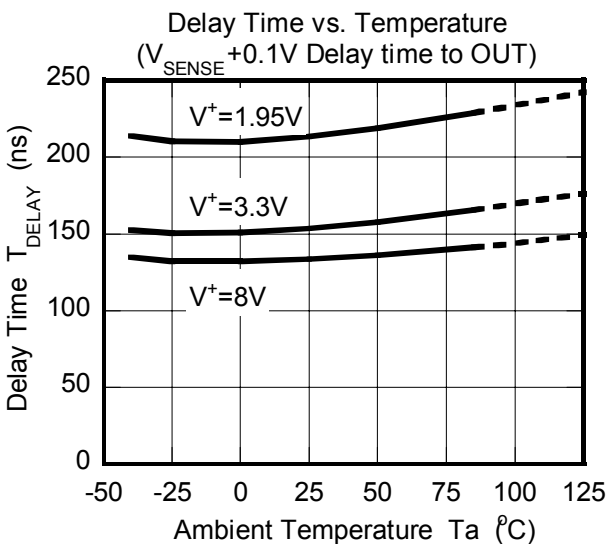
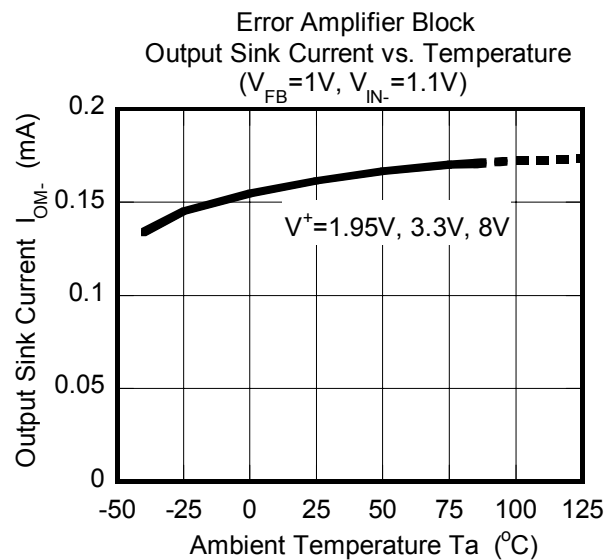
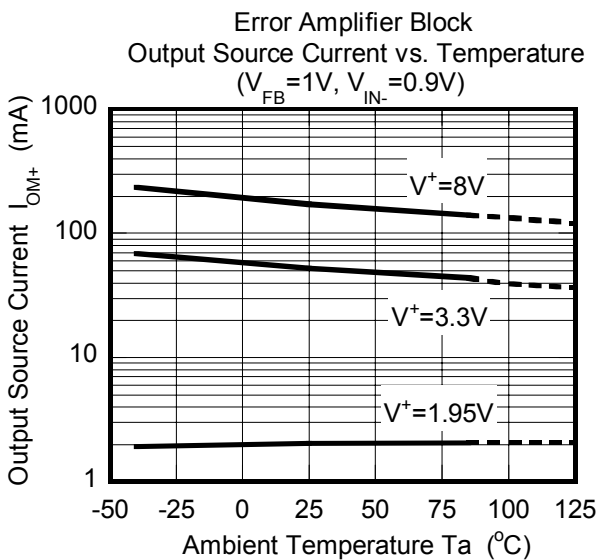
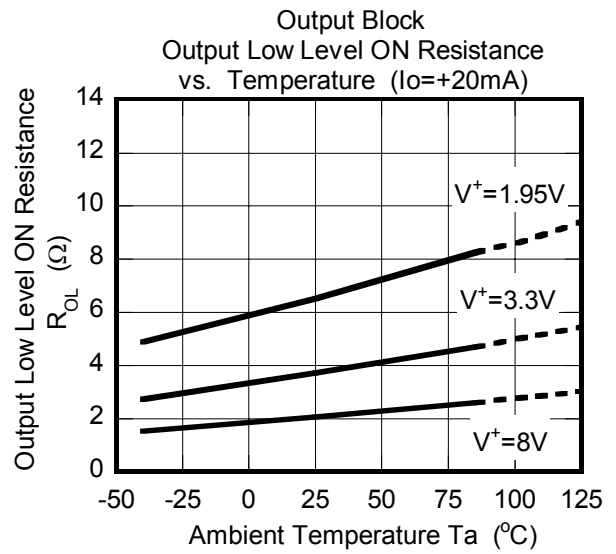
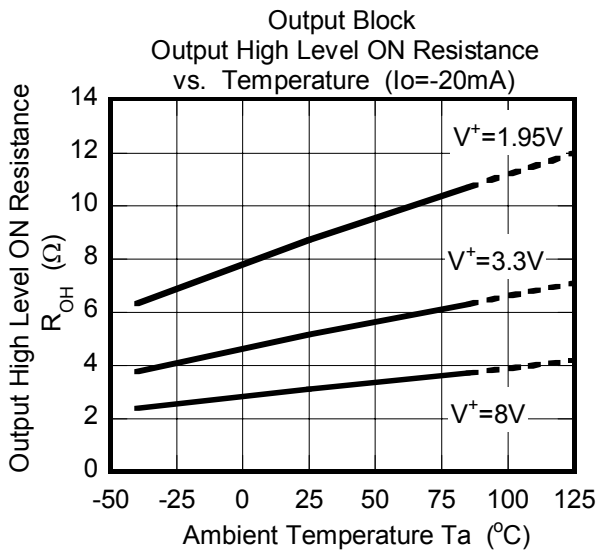
( $V^+ = 3.3V$ ,  $R_T = 47k\Omega$ ,  $T_a = 25^\circ C$ )



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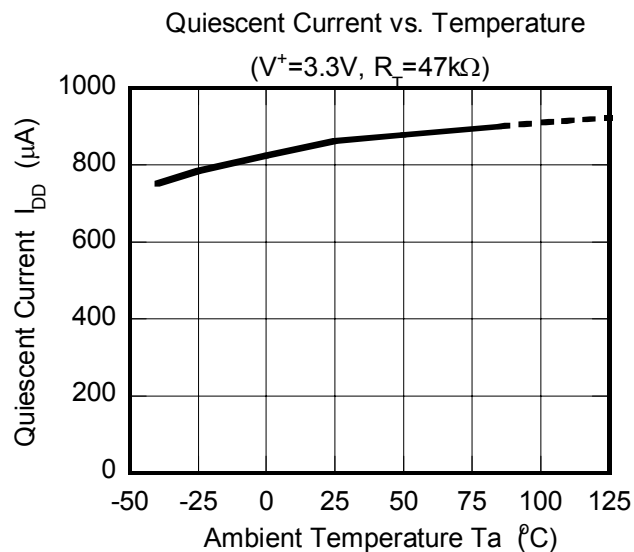
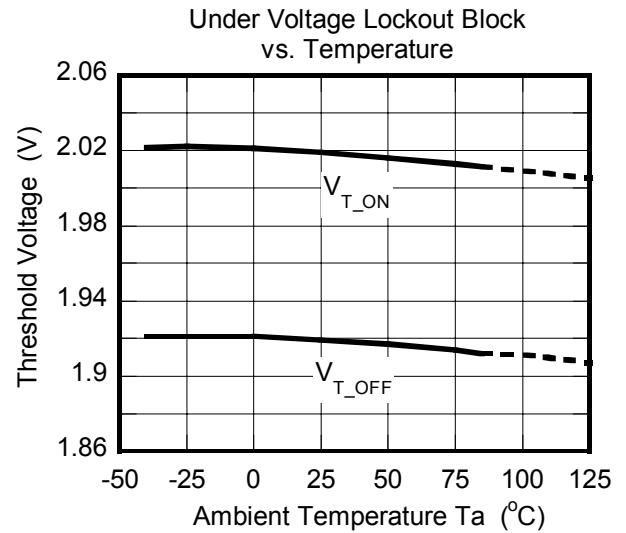
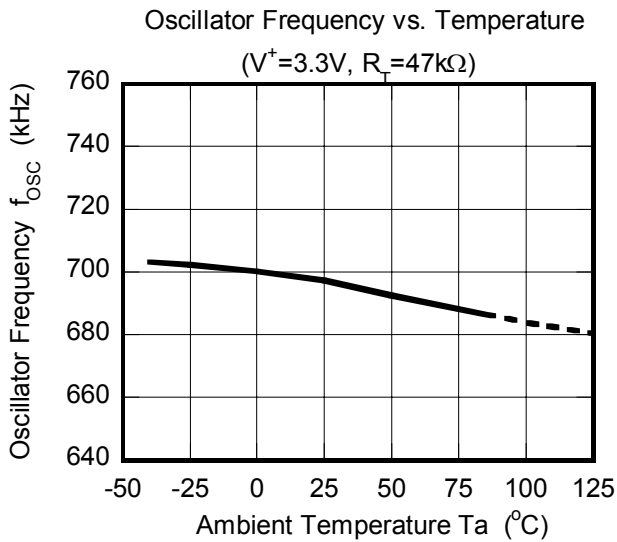
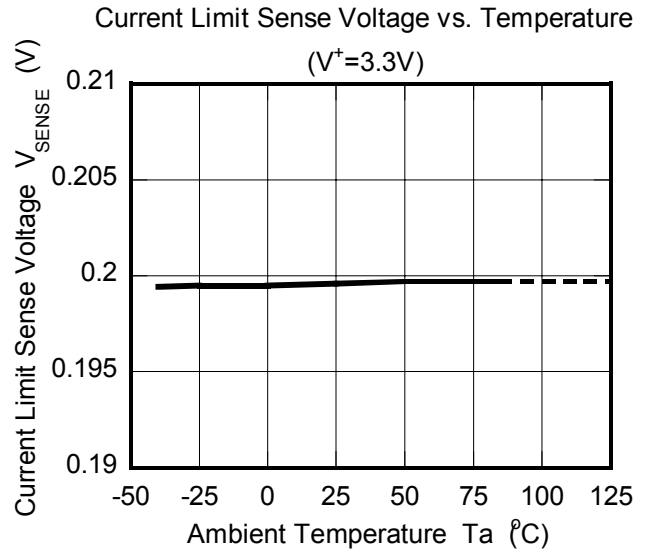
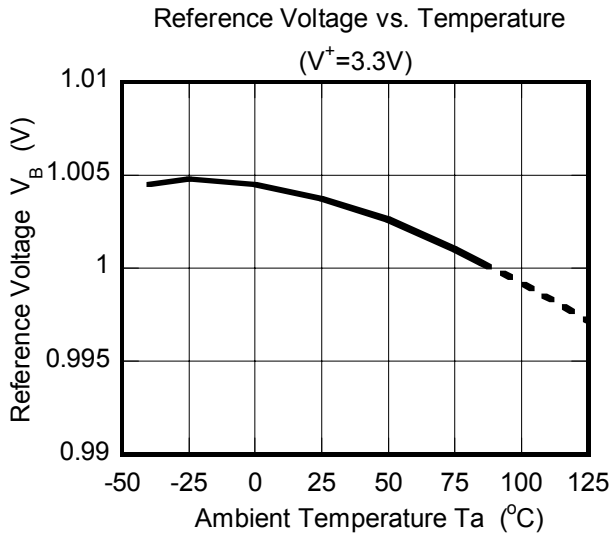


## ■ TYPICAL CHARACTERISTICS





## ■ TYPICAL CHARACTERISTICS



## MEMO

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