

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 μ A typ.
- Soft-Start Function Internal : 16ms typ. or adjustable
- Dead Time Control
- C-MOS Technology
- Package Outline NJU7640RB1 : MSOP8 (TVSP8)*

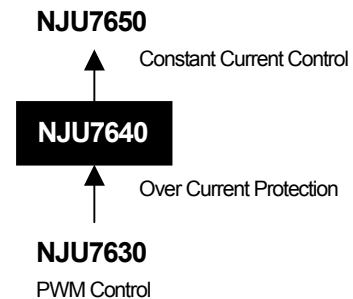
*MEET JEDEC MO-187-DA / THIN TYPE

■ PACKAGE OUTLINE

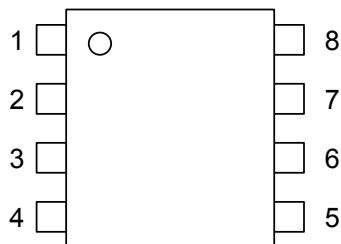


NJU7640RB1
(MSOP8 (TVSP8))

■ PRODUCT VARIATION



■ PIN CONFIGURATION



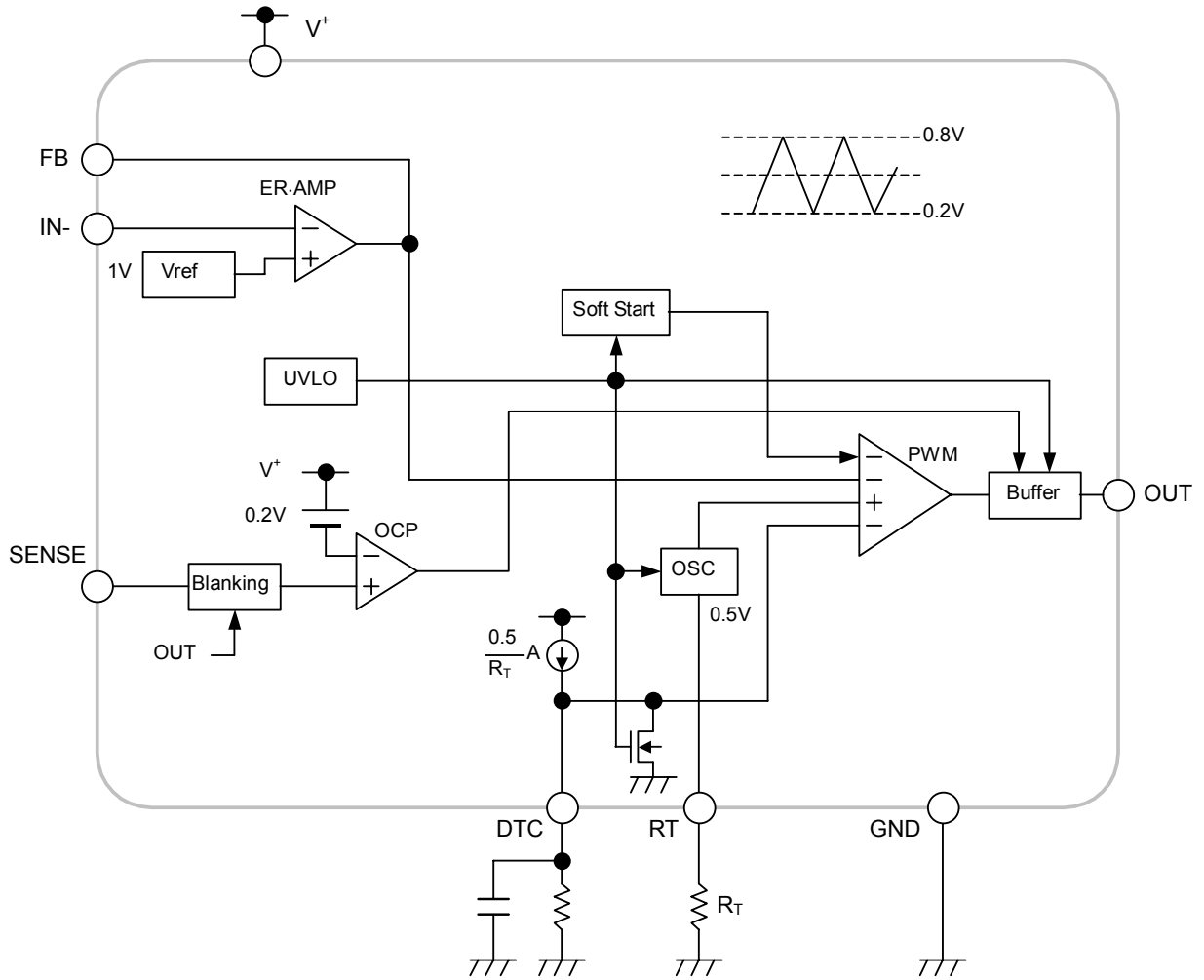
NJU7640RB1

PIN FUNCTION

1. OUT
2. V⁺
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 ⁺ | +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 |
| Over Current Protection Block | | | | | | |
| Current Limit Sense Voltage | V _{SENSE} | Voltage between V ⁺ -SENSE pin | 0.17 | 0.2 | 0.23 | V |
| Delay Time | T _{DELAY} | V _{SENSE} +0.1V Delay time to OUT | – | 160 | – | ns |
| Sense Blanking Time | T _{BLANK} | | – | 90 | – | ns |
| 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 | – | % |

NJU7640

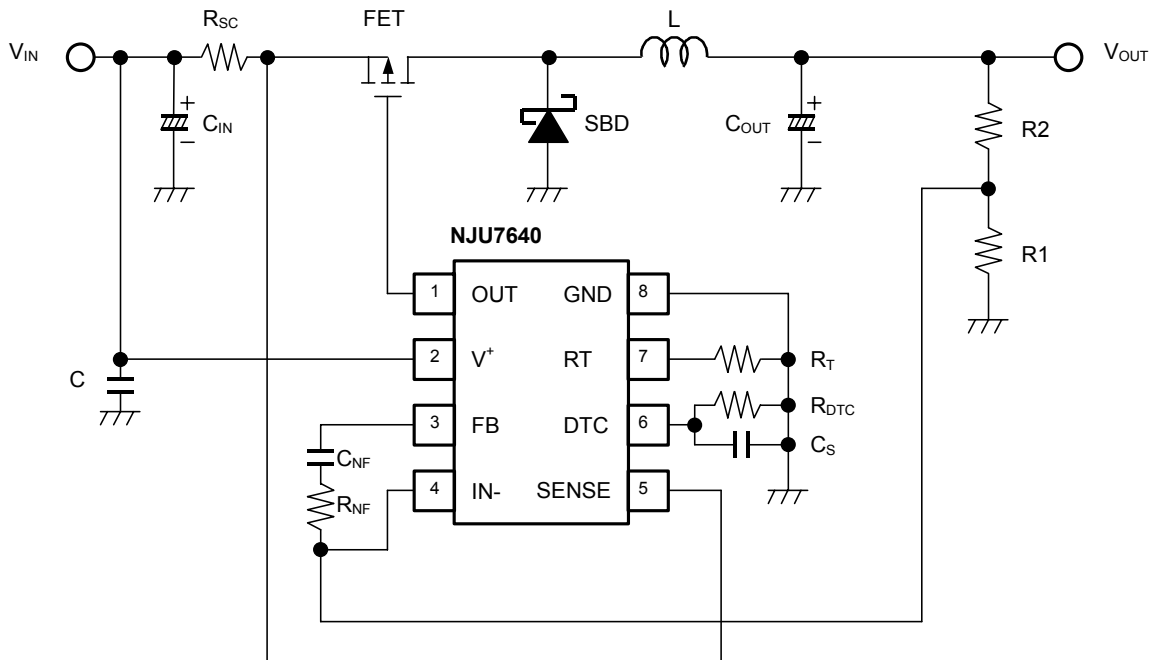
■ ELECTRICAL CHARACTERISTICS

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

| 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 Compare 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_{AXDUTY_1} | $V_{FB}=0.9V$ | 100 | – | – | % |
| | M_{AXDUTY_2} | $V_{FB}=0.9V, R_{DTC}=47k\Omega$ | 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 |
| General Characteristics | | | | | | |
| Quiescent Current | I_{DD} | $R_L=Non\ Load$ | – | 800 | 1200 | μA |

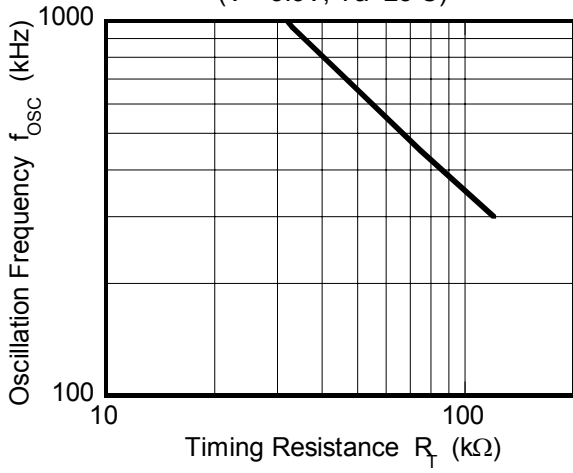
■ TYPICAL APPLICATIONS

Step-Down Converter

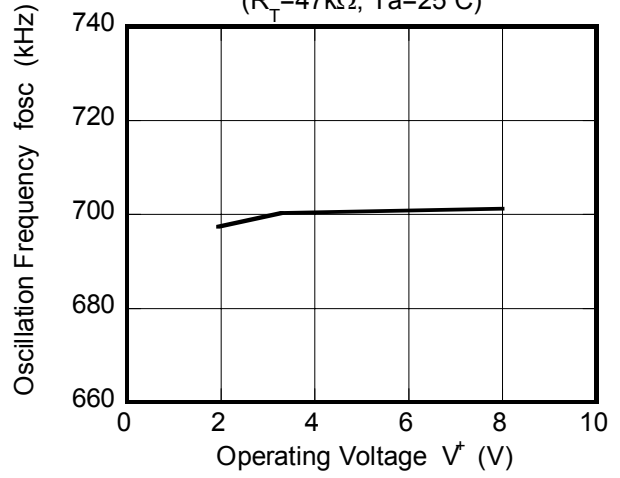


■ TYPICAL CHARACTERISTICS

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

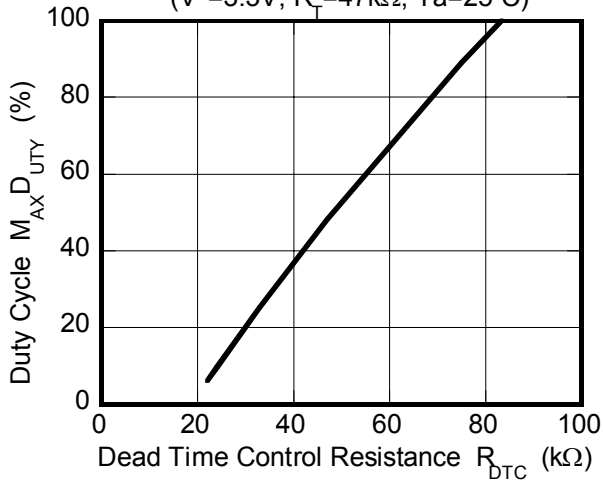


Oscillation Frequency vs. Operating Voltage
($R_T = 47k\Omega$, $T_a = 25^\circ C$)



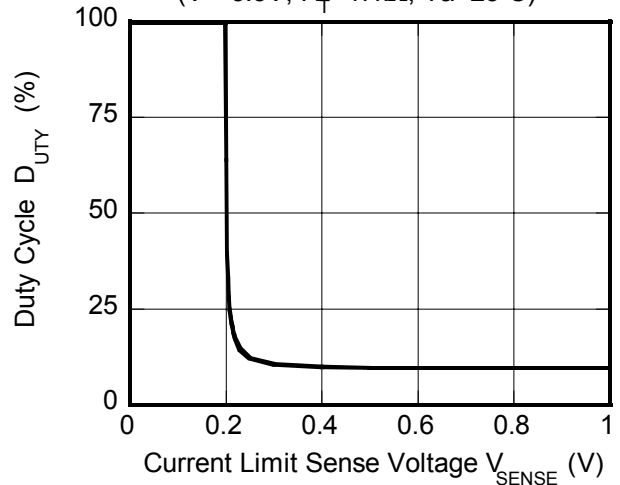
Duty Cycle vs. R_{DTC}

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

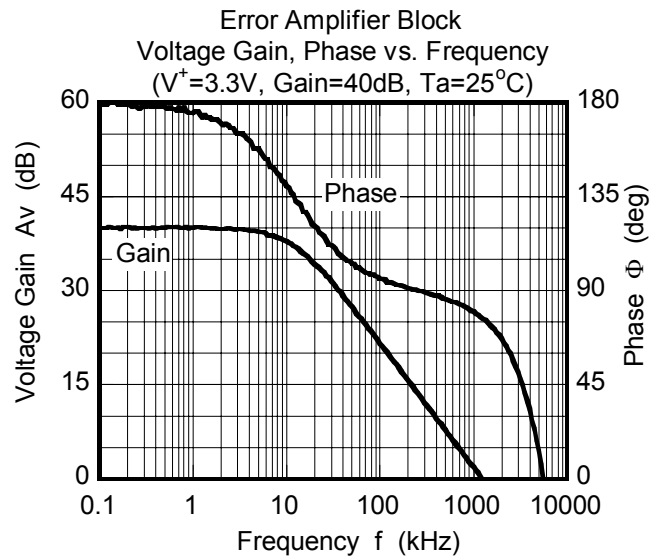
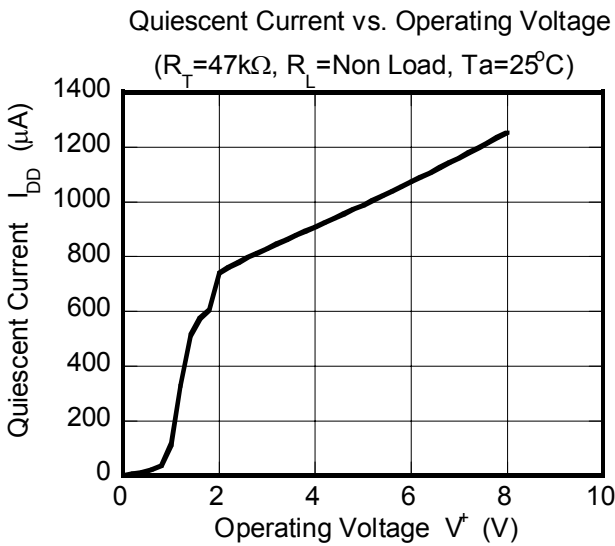
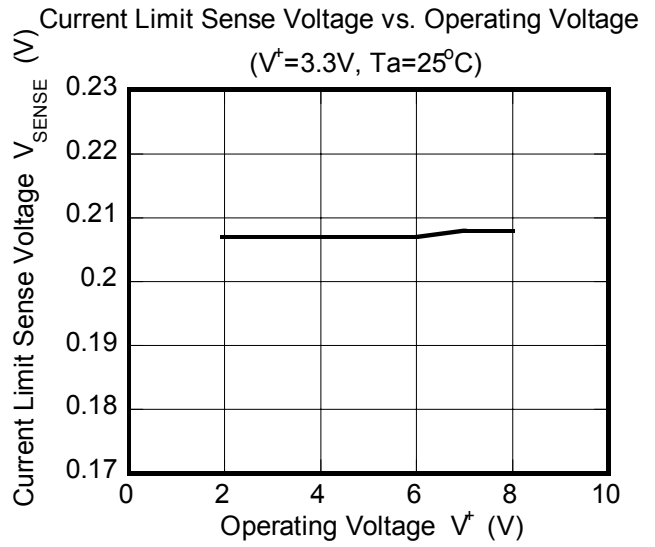
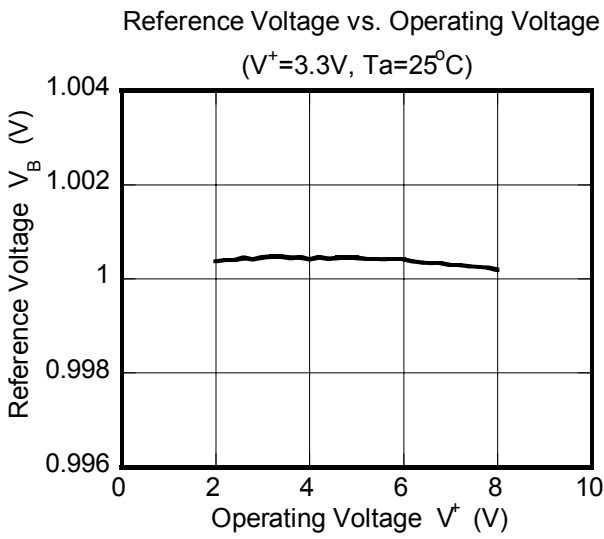


Duty Cycle vs. Current Limit Sense Voltage

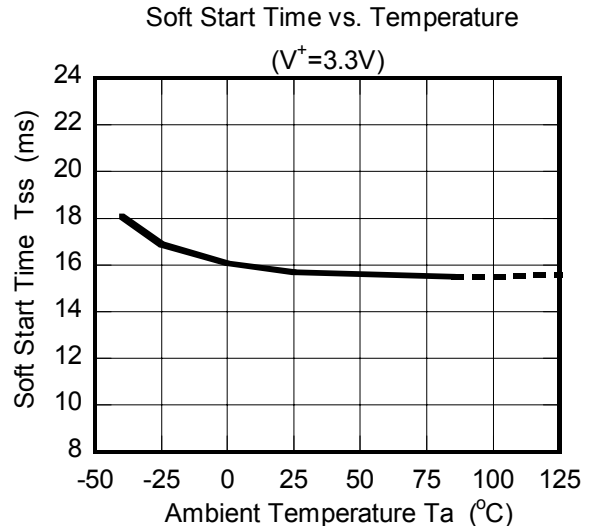
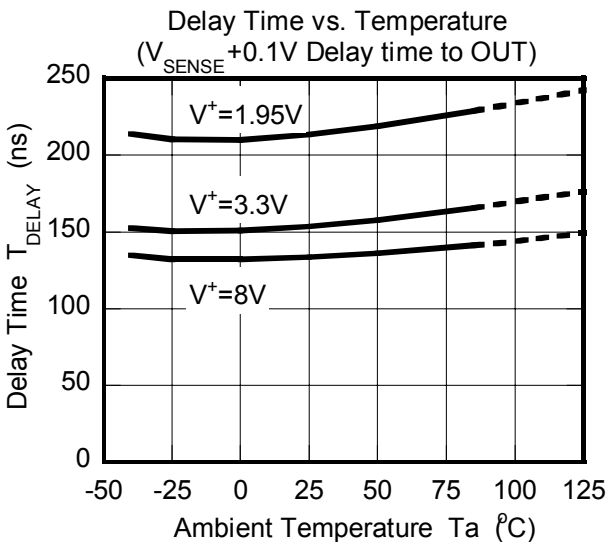
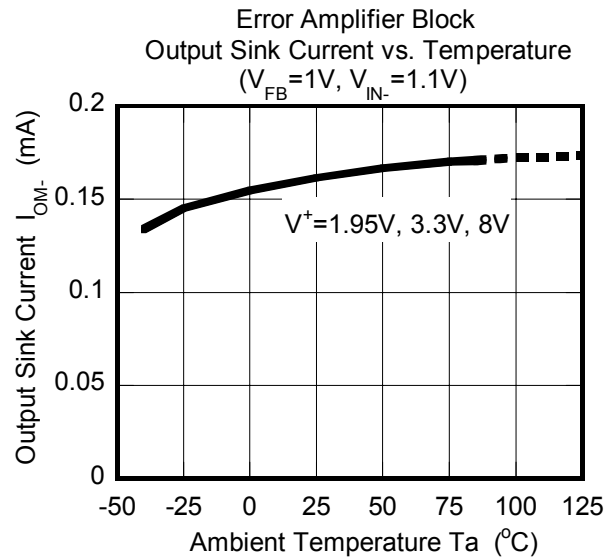
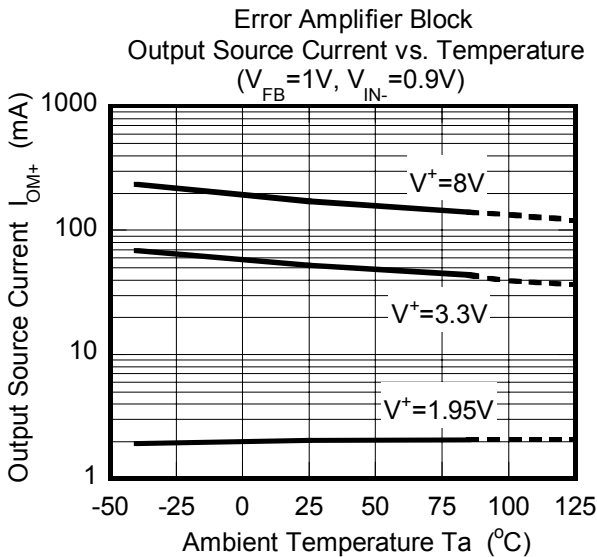
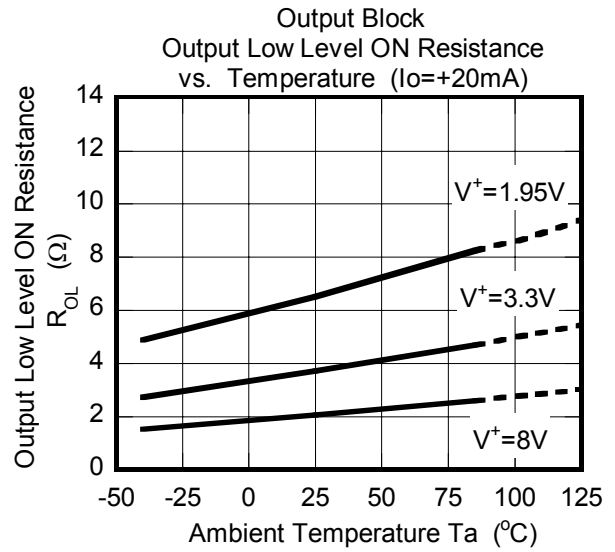
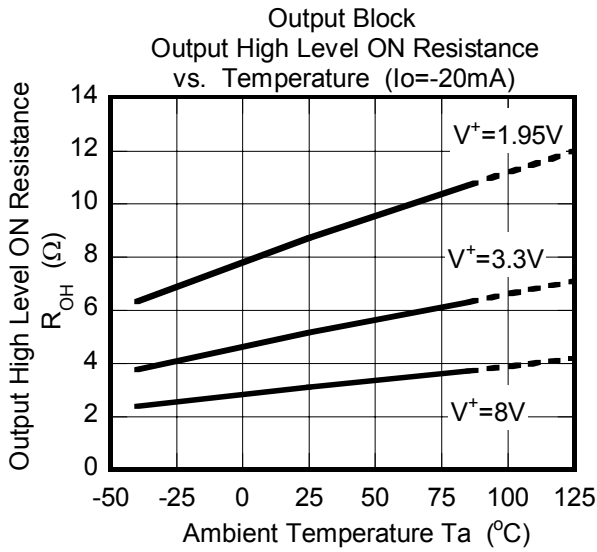
($V^+ = 3.3V$, $R_T = 47k\Omega$, $T_a = 25^\circ C$)



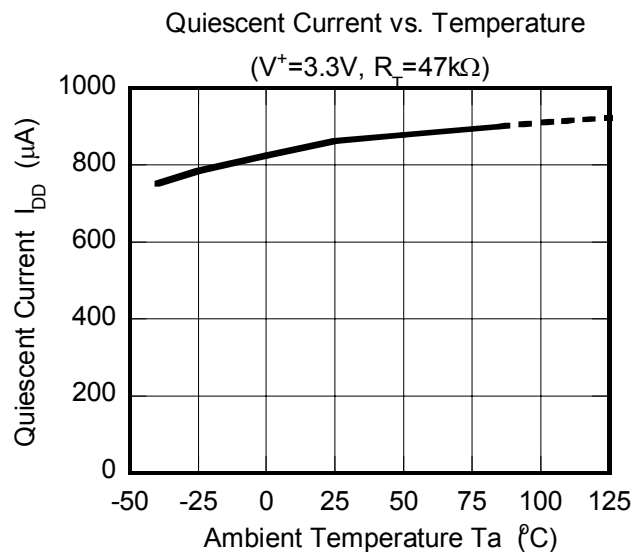
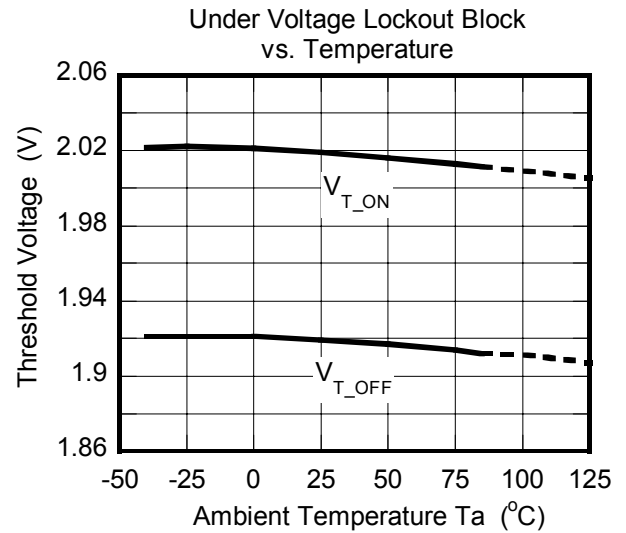
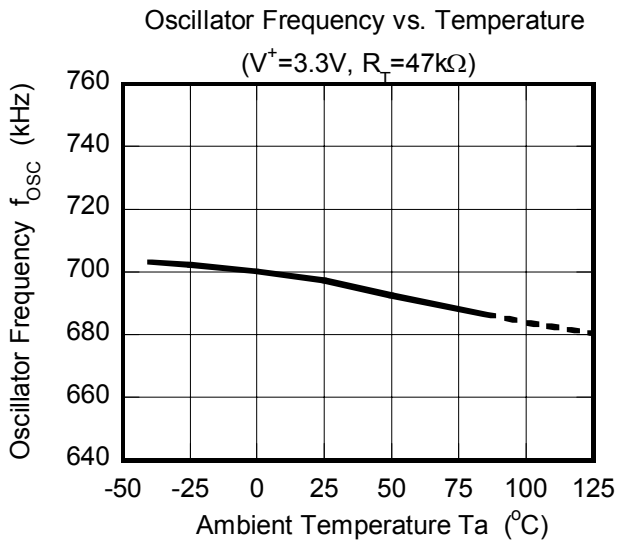
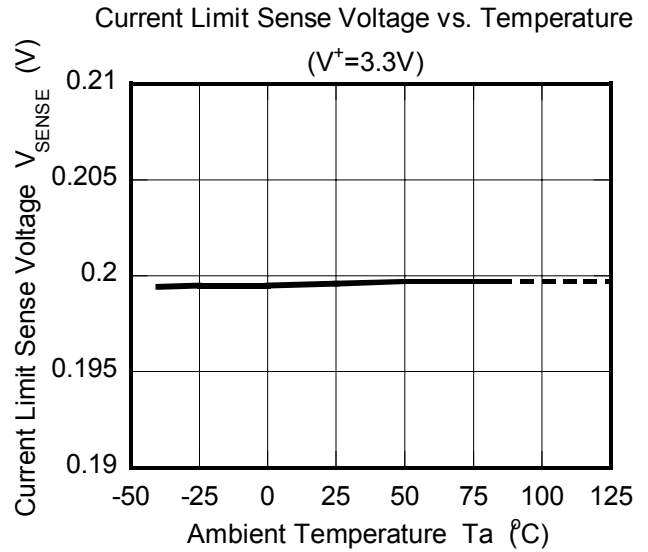
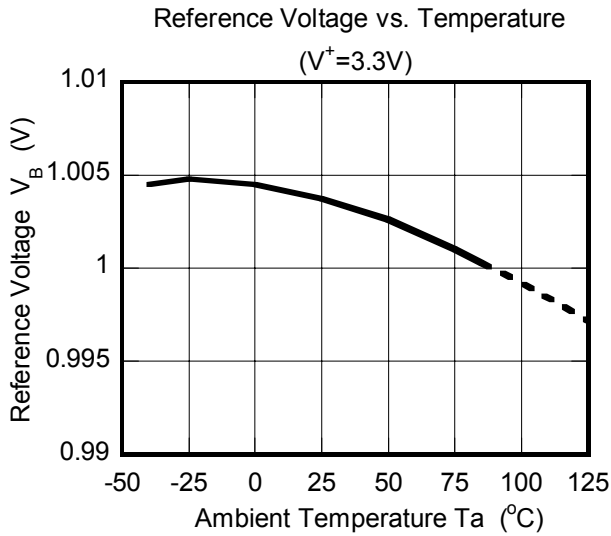
■ TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS



MEMO

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