

300 mA, Very Low Dropout Bias Rail CMOS Voltage Regulator

The NCV8130 is a 300 mA VLDO equipped with NMOS pass transistor and a separate bias supply voltage (V_{BIAS}). The device provides very stable, accurate output voltage with low noise suitable for space constrained, noise sensitive applications. In order to optimize performance for battery operated portable applications, the NCV8130 features low I_Q consumption. The XDFN6 1.2 mm x 1.2 mm package is optimized for use in space constrained applications.

Features

- Input Voltage Range: 0.8 V to 5.5 V
- Bias Voltage Range: 2.4 V to 5.5 V
- Fixed Output Voltage Device
- Output Voltage Range: 0.8 V to 2.1 V
- $\pm 1.5\%$ Accuracy over Temperature, 0.5% V_{OUT} @ 25°C
- Ultra-Low Dropout: 150 mV Maximum at 300 mA
- Very Low Bias Input Current of Typ. 80 μA
- Very Low Bias Input Current in Disable Mode: Typ. 0.5 μA
- Logic Level Enable Input for ON/OFF Control
- Output Active Discharge Option Available
- Stable with a 1 μF Ceramic Capacitor
- NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable; Device Temperature Grade 1: -40°C to $+125^\circ\text{C}$ Ambient Operating Temperature Range
- These are Pb-Free Devices

Typical Applications

- Automotive, Consumer and Industrial Equipment Point of Load Regulation
- Battery-powered Equipment
- FPGA, DSP and Logic Power Supplies
- Switching Power Supply Post Regulation
- Cameras, DVRs, STB and Camcorders

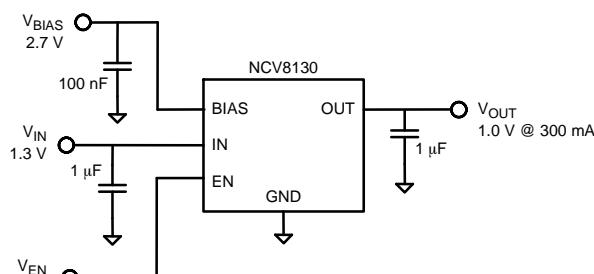


Figure 1. Typical Application Schematics



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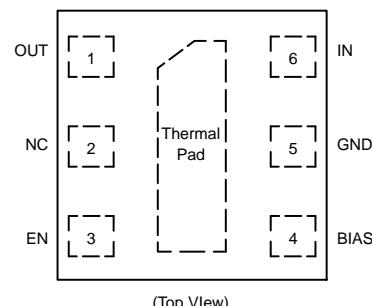
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MARKING DIAGRAM



XX = Specific Device Code
M = Date Code

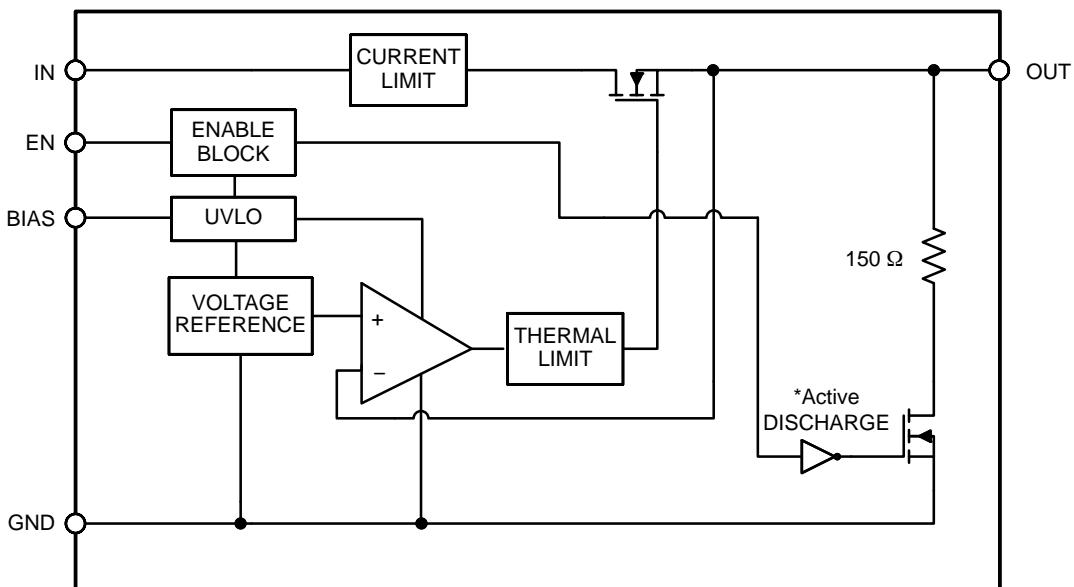
PIN CONNECTIONS



ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 9 of this data sheet.

NCV8130



*Active output discharge function is present only in NCV8130AMXyyyTCG devices.
yyy denotes the particular output voltage option.

Figure 2. Simplified Schematic Block Diagram

PIN FUNCTION DESCRIPTION

| Pin No. | Pin Name | Description |
|---------|----------|--|
| 1 | OUT | Regulated Output Voltage pin |
| 2 | N/C | Not internally connected (Note 1) |
| 3 | EN | Enable pin. Driving this pin high enables the regulator. Driving this pin low puts the regulator into shutdown mode. |
| 4 | BIAS | Bias voltage supply for internal control circuits. This pin is monitored by internal Under-Voltage Lockout Circuit. |
| 5 | GND | Ground pin |
| 6 | IN | Input Voltage Supply pin |
| Pad | | Should be soldered to the ground plane for increased thermal performance. |

1. True no connect. Printed circuit board traces are allowable

ABSOLUTE MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|--------------------|-------------------------------|------|
| Input Voltage (Note 2) | V_{IN} | −0.3 to 6 | V |
| Output Voltage | V_{OUT} | −0.3 to $(V_{IN}+0.3) \leq 6$ | V |
| Chip Enable and Bias Input | V_{EN}, V_{BIAS} | −0.3 to 6 | V |
| Output Short Circuit Duration | t_{SC} | unlimited | s |
| Maximum Junction Temperature | T_J | 150 | °C |
| Storage Temperature | T_{STG} | −55 to 150 | °C |
| ESD Capability, Human Body Model (Note 3) | ESD_{HBM} | 2000 | V |
| ESD Capability, Machine Model (Note 3) | ESD_{MM} | 200 | V |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

2. Refer to ELECTRICAL CHARACTERISTICS and APPLICATION INFORMATION for Safe Operating Area.

3. This device series incorporates ESD protection (except OUT pin) and is tested by the following methods:

ESD Human Body Model tested per AEC-Q100-002

ESD Machine Model tested per AEC-Q100-003

Latchup Current Maximum Rating ≤ 150 mA per AEC-Q100-004.

RECOMMENDED OPERATING CONDITIONS

| Rating | Symbol | Min | Max | Unit |
|----------------------|------------|-----------------------------|------|------|
| Input Voltage | V_{IN} | $(V_{OUT} + V_{DO_IN})$ | 5.5 | V |
| Bias Voltage | V_{BIAS} | $(V_{OUT} + 1.35) \geq 2.4$ | 5.5 | V |
| Junction Temperature | T_J | −40 | +125 | °C |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|--|-----------|-------|------|
| Thermal Characteristics, XDFN6 1.2 mm x 1.2 mm Thermal Resistance, Junction-to-Air | R_{BJA} | 170 | °C/W |

ELECTRICAL CHARACTERISTICS

$-40^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$; $V_{\text{BIAS}} = 2.7 \text{ V}$ or $(V_{\text{OUT}} + 1.6 \text{ V})$, whichever is greater, $V_{\text{IN}} = V_{\text{OUT}(\text{NOM})} + 0.3 \text{ V}$, $I_{\text{OUT}} = 1 \text{ mA}$, $V_{\text{EN}} = 1 \text{ V}$, unless otherwise noted. $C_{\text{IN}} = 1 \mu\text{F}$, $C_{\text{BIAS}} = 0.1 \mu\text{F}$, $C_{\text{OUT}} = 1 \mu\text{F}$ (effective capacitance) (Note 4). Typical values are at $T_J = +25^\circ\text{C}$. Min/Max values are for $-40^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$ unless otherwise noted. (Note 5)

| Parameter | Test Conditions | Symbol | Min | Typ | Max | Unit |
|-----------------------------------|--|-------------------------------|------------------------------------|------------|------|----------------------------|
| Operating Input Voltage Range | | V_{IN} | $V_{\text{OUT}} + V_{\text{DO}}$ | | 5.5 | V |
| Operating Bias Voltage Range | | V_{BIAS} | $(V_{\text{OUT}} + 1.35) \geq 2.4$ | | 5.5 | V |
| Undervoltage Lock-out | V_{BIAS} Rising Hysteresis | UVLO | | 1.6 0.2 | | V |
| Output Voltage Accuracy | $-40^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $V_{\text{OUT}(\text{NOM})} + 0.3 \text{ V} \leq V_{\text{IN}} \leq 5.0 \text{ V}$, 2.7 V or $(V_{\text{OUT}(\text{NOM})} + 1.6 \text{ V})$, whichever is greater $< V_{\text{BIAS}} < 5.5 \text{ V}$, $1 \text{ mA} < I_{\text{OUT}} < 300 \text{ mA}$ | V_{OUT} | -1.5 | | +1.5 | % |
| Output Voltage Accuracy | | V_{OUT} | | ± 0.5 | | % |
| V_{IN} Line Regulation | $V_{\text{OUT}(\text{NOM})} + 0.3 \text{ V} \leq V_{\text{IN}} \leq 5.0 \text{ V}$ | LineReg | | 0.01 | | %/V |
| V_{BIAS} Line Regulation | 2.7 V or $(V_{\text{OUT}(\text{NOM})} + 1.6 \text{ V})$, whichever is greater $< V_{\text{BIAS}} < 5.5 \text{ V}$ | LineReg | | 0.01 | | %/V |
| Load Regulation | $I_{\text{OUT}} = 1 \text{ mA}$ to 300 mA | LoadReg | | 1.5 | | mV |
| V_{IN} Dropout Voltage | $I_{\text{OUT}} = 300 \text{ mA}$ (Note 6) | V_{DO} | | 75 | 175 | mV |
| V_{BIAS} Dropout Voltage | $I_{\text{OUT}} = 300 \text{ mA}$, $V_{\text{IN}} = V_{\text{BIAS}}$ (Notes 6, 7) | V_{DO} | | 1.1 | 1.4 | V |
| Output Current Limit | $V_{\text{OUT}} = 90\% V_{\text{OUT}(\text{NOM})}$ | I_{CL} | 400 | 550 | 950 | mA |
| Bias Pin Operating Current | $V_{\text{BIAS}} = 2.7 \text{ V}$ | I_{BIAS} | | 80 | 110 | μA |
| Bias Pin Disable Current | $V_{\text{EN}} \leq 0.4 \text{ V}$ | $I_{\text{BIAS}(\text{DIS})}$ | | 0.5 | 1.5 | μA |
| Vinput Pin Disable Current | $V_{\text{EN}} \leq 0.4 \text{ V}$ | $I_{\text{VIN}(\text{DIS})}$ | | 0.5 | 1.5 | μA |
| EN Pin Threshold Voltage | EN Input Voltage "H" | $V_{\text{EN}(\text{H})}$ | 0.9 | | | V |
| | EN Input Voltage "L" | $V_{\text{EN}(\text{L})}$ | | | 0.4 | |
| EN Pull Down Current | $V_{\text{EN}} = 5.5 \text{ V}$ | I_{EN} | | 0.3 | 1.5 | μA |
| Turn-On Time | $C_{\text{OUT}} = 1 \mu\text{F}$, From assertion of V_{EN} to $V_{\text{OUT}} = 98\% V_{\text{OUT}(\text{NOM})}$, $V_{\text{OUT}(\text{NOM})} = 1.0 \text{ V}$ | t_{ON} | | 150 | | μs |
| Power Supply Rejection Ratio | $V_{\text{IN}} \text{ to } V_{\text{OUT}}$, $f = 1 \text{ kHz}$, $I_{\text{OUT}} = 300 \text{ mA}$, $V_{\text{IN}} \geq V_{\text{OUT}} + 0.5 \text{ V}$ | PSRR(V_{IN}) | | 65 | | dB |
| | $V_{\text{BIAS}} \text{ to } V_{\text{OUT}}$, $f = 1 \text{ kHz}$, $I_{\text{OUT}} = 300 \text{ mA}$, $V_{\text{IN}} \geq V_{\text{OUT}} + 0.5 \text{ V}$ | PSRR(V_{BIAS}) | | 80 | | dB |
| Output Noise Voltage | $V_{\text{IN}} = V_{\text{OUT}} + 0.5 \text{ V}$, $V_{\text{OUT}(\text{NOM})} = 1.0 \text{ V}$, $f = 10 \text{ Hz}$ to 100 kHz | V_{N} | | 40 | | μV_{RMS} |
| Thermal Shutdown Threshold | Temperature increasing | | | 160 | | $^\circ\text{C}$ |
| | Temperature decreasing | | | 140 | | |
| Output Discharge Pull-Down | $V_{\text{EN}} \leq 0.4 \text{ V}$, $V_{\text{OUT}} = 0.5 \text{ V}$, NCV8130A options only | R_{DISCH} | | 150 | | Ω |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

- Effective capacitance, including the effect of DC bias, tolerance and temperature. See the Application Information section for more information.
- Performance guaranteed over the indicated operating temperature range by design and/or characterization. Production tested at $T_A = 25^\circ\text{C}$. Low duty cycle pulse techniques are used during the testing to maintain the junction temperature as close to ambient as possible.
- Dropout voltage is characterized when V_{OUT} falls 3% below $V_{\text{OUT}(\text{NOM})}$.
- For output voltages below 0.9 V, V_{BIAS} dropout voltage does not apply due to a minimum Bias operating voltage of 2.4 V.

APPLICATIONS INFORMATION

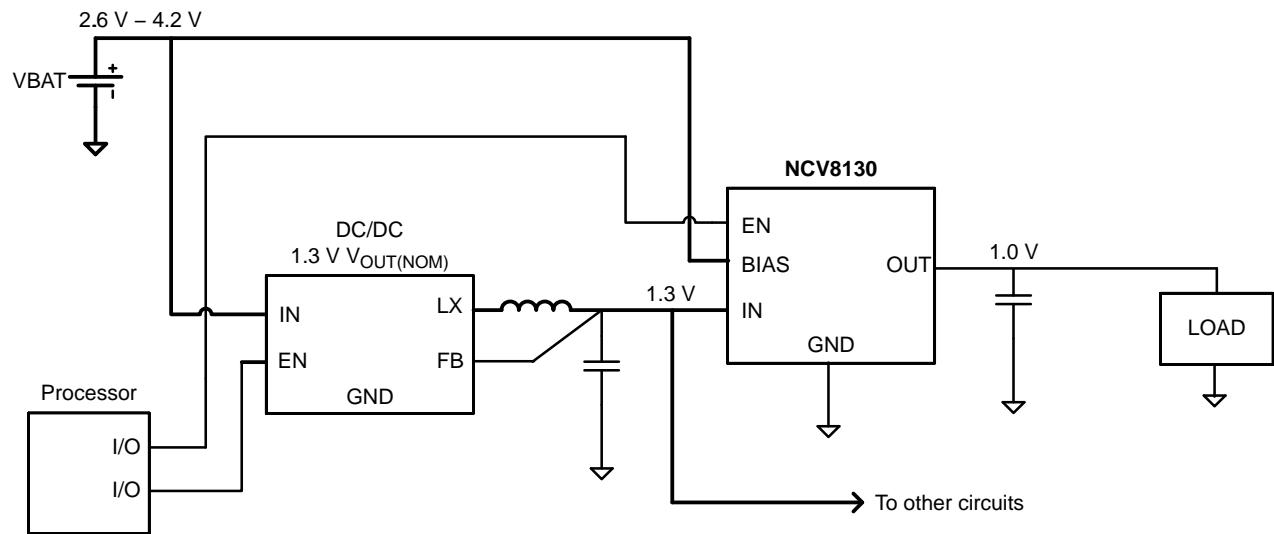


Figure 3. Typical Application: Low-Voltage Post-Regulator with ON/OFF functionality

TYPICAL CHARACTERISTICS

At $T_J = +25^\circ\text{C}$, $V_{IN} = V_{OUT(TYP)} + 0.3\text{ V}$, $V_{BIAS} = 2.7\text{ V}$, $V_{EN} = V_{BIAS}$, $V_{OUT(NOM)} = 1.0\text{ V}$, $I_{OUT} = 300\text{ mA}$, $C_{IN} = 1\text{ }\mu\text{F}$, $C_{BIAS} = 0.1\text{ }\mu\text{F}$, and $C_{OUT} = 1\text{ }\mu\text{F}$ (effective capacitance), unless otherwise noted.

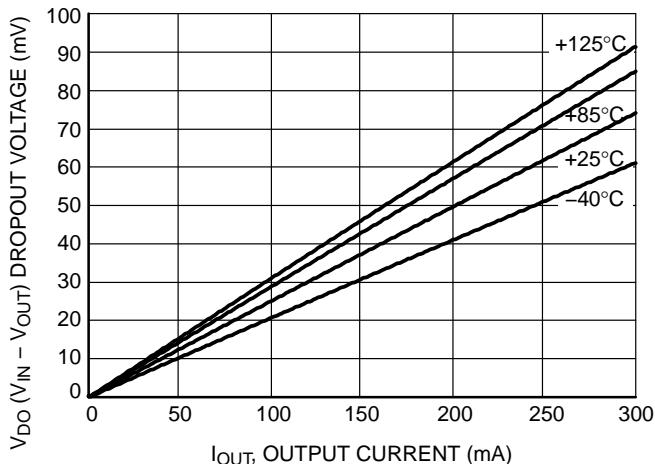


Figure 4. V_{IN} Dropout Voltage vs. I_{OUT} and Temperature T_J

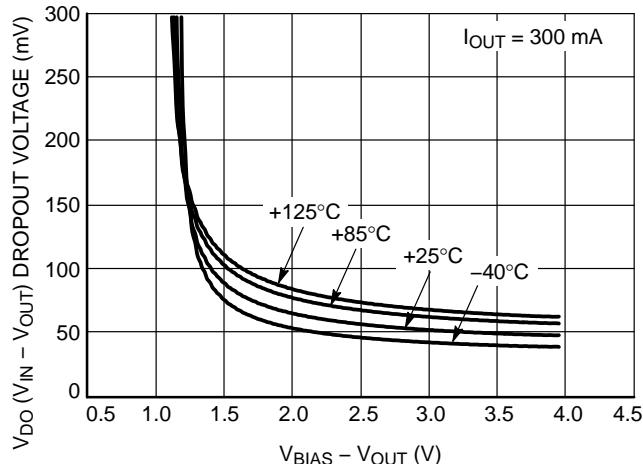


Figure 5. V_{IN} Dropout Voltage vs. $(V_{BIAS} - V_{OUT})$ and Temperature T_J

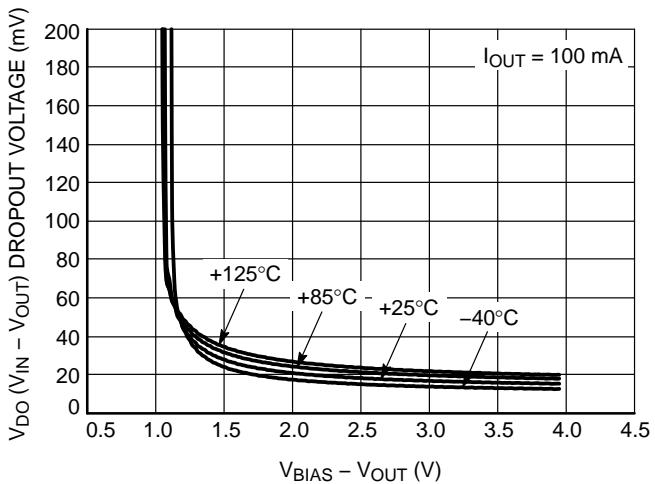


Figure 6. V_{IN} Dropout Voltage vs. $(V_{BIAS} - V_{OUT})$ and Temperature T_J

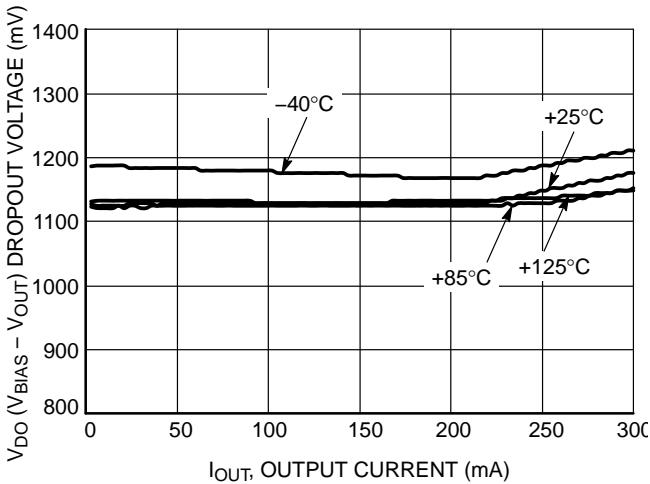


Figure 7. V_{BIAS} Dropout Voltage vs. I_{OUT} and Temperature T_J

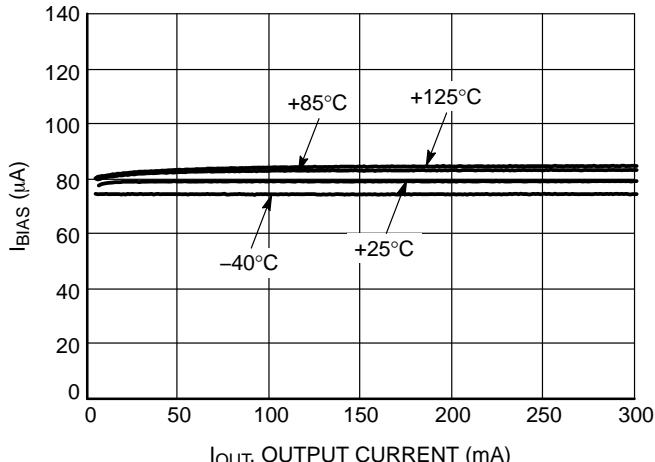


Figure 8. BIAS Pin Current vs. I_{OUT} and Temperature T_J

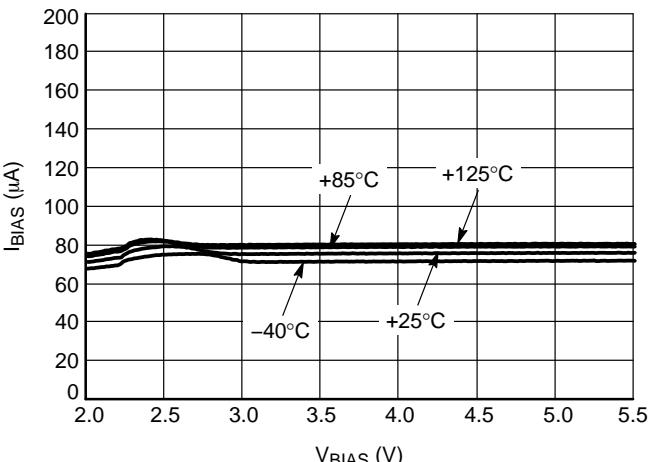


Figure 9. BIAS Pin Current vs. V_{BIAS} and Temperature T_J

TYPICAL CHARACTERISTICS

At $T_J = +25^\circ\text{C}$, $V_{IN} = V_{OUT(TYP)} + 0.3\text{ V}$, $V_{BIAS} = 2.7\text{ V}$, $V_{EN} = V_{BIAS}$, $V_{OUT(NOM)} = 1.0\text{ V}$, $I_{OUT} = 300\text{ mA}$, $C_{IN} = 1\text{ }\mu\text{F}$, $C_{BIAS} = 0.1\text{ }\mu\text{F}$, and $C_{OUT} = 1\text{ }\mu\text{F}$ (effective capacitance), unless otherwise noted.

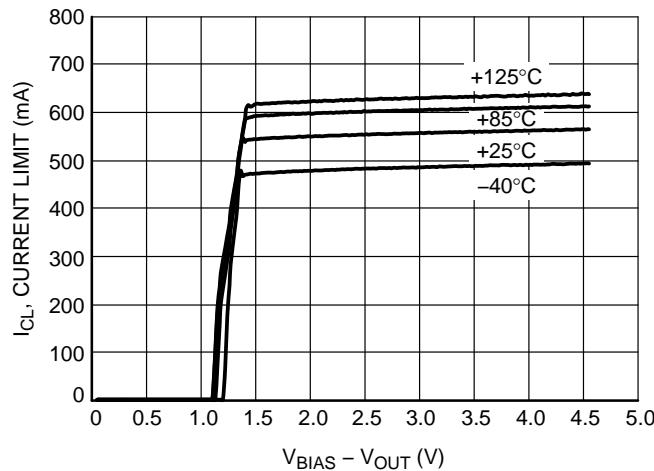


Figure 10. Current Limit vs. ($V_{BIAS} - V_{OUT}$)

APPLICATIONS INFORMATION

The NCV8130 dual-rail very low dropout voltage regulator is using NMOS pass transistor for output voltage regulation from V_{IN} voltage. All the low current internal control circuitry is powered from the V_{BIAS} voltage.

The use of an NMOS pass transistor offers several advantages in applications. Unlike a PMOS topology devices, the output capacitor has reduced impact on loop stability. V_{IN} to V_{OUT} operating voltage difference can be very low compared with standard PMOS regulators in very low V_{IN} applications.

The NCV8130 offers smooth monotonic start-up. The controlled voltage rising limits the inrush current.

The Enable (EN) input is equipped with internal hysteresis.

NCV8130 is a Fixed Voltage linear regulator.

Dropout Voltage

Because of two power supply inputs V_{IN} and V_{BIAS} and one V_{OUT} regulator output, there are two Dropout voltages specified.

The first, the V_{IN} Dropout voltage is the voltage difference ($V_{IN} - V_{OUT}$) when V_{OUT} starts to decrease by percents specified in the Electrical Characteristics table. V_{BIAS} is high enough, specific value is published in the Electrical Characteristics table.

The second, V_{BIAS} dropout voltage is the voltage difference ($V_{BIAS} - V_{OUT}$) when V_{IN} and V_{BIAS} pins are joined together and V_{OUT} starts to decrease.

Input and Output Capacitors

The device is designed to be stable for ceramic output capacitors with Effective capacitance in the range from 1 μF to 10 μF . The device is also stable with multiple capacitors in parallel, having the total effective capacitance in the specified range.

In applications where no low input supplies impedance available (PCB inductance in V_{IN} and/or V_{BIAS} inputs as example), the recommended $C_{IN} = 1 \mu F$ and $C_{BIAS} = 0.1 \mu F$ or greater. Ceramic capacitors are recommended. For the

best performance all the capacitors should be connected to the NCV8130 respective pins directly in the device PCB copper layer, not through vias having not negligible impedance.

When using small ceramic capacitor, their capacitance is not constant but varies with applied DC biasing voltage, temperature and tolerance. The effective capacitance can be much lower than their nominal capacitance value, most importantly in negative temperatures and higher LDO output voltages. That is why the recommended Output capacitor capacitance value is specified as Effective value in the specific application conditions.

Enable Operation

The enable pin will turn the regulator on or off. The threshold limits are covered in the electrical characteristics table in this data sheet. If the enable function is not to be used then the pin should be connected to V_{IN} or V_{BIAS} .

Current Limitation

The internal Current Limitation circuitry allows the device to supply the full nominal current and surges but protects the device against Current Overload or Short.

Thermal Protection

Internal thermal shutdown (TSD) circuitry is provided to protect the integrated circuit in the event that the maximum junction temperature is exceeded. When TSD activated, the regulator output turns off. When cooling down under the low temperature threshold, device output is activated again. This TSD feature is provided to prevent failures from accidental overheating.

Power Dissipation

The maximum power dissipation supported by the device is dependent upon board design and layout. Mounting pad configuration on the PCB, the board material, and the ambient temperature affect the rate of junction temperature rise for the part. For reliable operation, junction temperature should be limited to +125°C.

NCV8130

ORDERING INFORMATION

| Device | Nominal Output Voltage | Marking | Option | Package | Shipping [†] |
|------------------|------------------------|---------|----------------------|--------------------|-----------------------|
| NCV8130BMX080TCG | 0.80 V | NL | Non-Active Discharge | XDFN6 (Pb-Free) | 3000 / Tape & Reel |
| NCV8130BMX100TCG | 1.00 V | NF | | | |
| NCV8130BMX110TCG | 1.10 V | NG | | | |
| NCV8130BMX120TCG | 1.20 V | NA | | | |
| NCV8130BMX130TCG | 1.30 V | NC | | | |
| NCV8130BMX150TCG | 1.50 V | ND | | | |
| NCV8130BMX180TCG | 1.80 V | NE | | | |

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

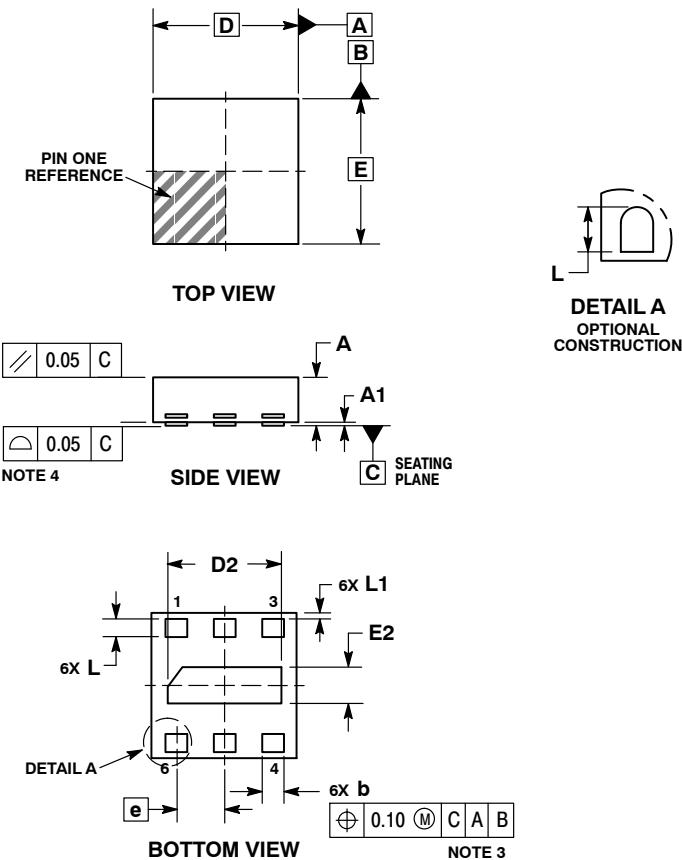
To order other package and voltage variants, please contact your ON sales representative.



SCALE 4:1

XDFN6 1.20x1.20, 0.40P
CASE 711AT
ISSUE C

DATE 04 DEC 2015



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION *b* APPLIES TO THE PLATED TERMINALS.
4. COPLANARITY APPLIES TO THE PAD AS WELL AS THE TERMINALS.

| DIM | MILLIMETERS | | |
|-----|-------------|------|------|
| | MIN | Typ | MAX |
| A | 0.30 | 0.37 | 0.45 |
| A1 | 0.00 | 0.03 | 0.05 |
| b | 0.13 | 0.18 | 0.23 |
| D | 1.15 | 1.20 | 1.25 |
| D2 | 0.84 | 0.94 | 1.04 |
| E | 1.15 | 1.20 | 1.25 |
| E2 | 0.20 | 0.30 | 0.40 |
| e | 0.40 | BSC | |
| L | 0.15 | 0.20 | 0.25 |
| L1 | 0.00 | 0.05 | 0.10 |

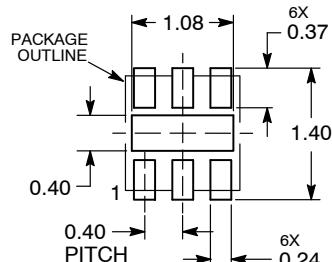
**GENERIC
MARKING DIAGRAM***



XX = Specific Device Code
M = Date Code

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "■", may or may not be present.

**RECOMMENDED
MOUNTING FOOTPRINT***



DIMENSIONS: MILLIMETERS

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

| | | |
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