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NCP716

80 mA Ultra-Low Iq, Wide Input Voltage Low Dropout Regulator

The NCP716 is 80 mA LDO Linear Voltage Regulator. It is a very stable and accurate device with ultra−low ground current consumption (4.7 μA over the full output load range) and a wide input voltage range (up to 24 V). The regulator incorporates several protection features such as Thermal Shutdown and Current Limiting.

Features

- Operating Input Voltage Range: 2.5 V to 24 V
- Fixed Voltage Options Available: 1.2 V to 5.0 V
- Ultra Low Quiescent Current: Max. 4.7 μA over Temperature
- ±2% Accuracy over Full Load, Line and Temperature Variations
- PSRR: 60 dB at 100 kHz
- Noise: 200 μV_{RMS} from 200 Hz to 100 kHz
- Thermal Shutdown and Current Limit Protection
- Available in WDFN6, 2x2x0.8 mm Package
- This is a Pb−Free Device

Typical Applicaitons

- Portable Equipment
- Communication Systems

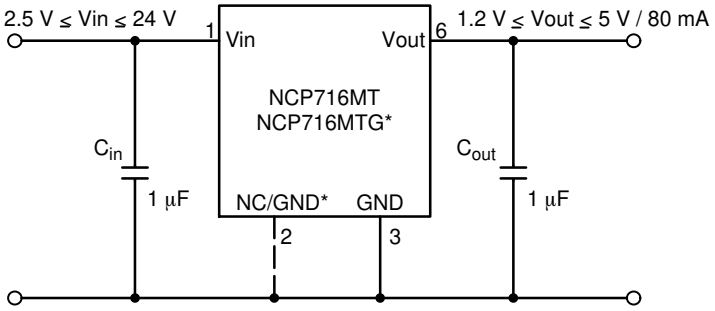

Figure 1. Typical Application Schematic

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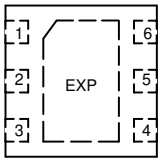
MARKING DIAGRAMS

WDFN6
CASE 511BR

XX = Specific Device Code
M = Date Code

PIN CONNECTIONS



WDFN6 2x2 mm
(Top View)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 17 of this data sheet.

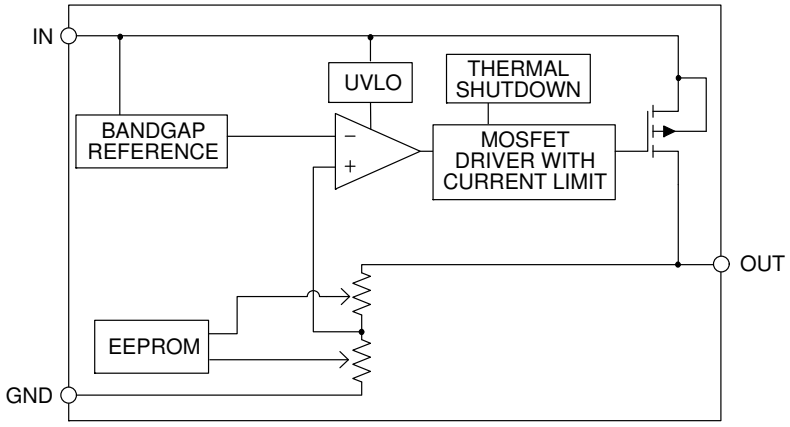


Figure 2. Simplified Block Diagram

Table 1. PIN FUNCTION DESCRIPTION

Pin No. wDFN6, 2 x 2	Pin Name	Description
6	OUT	Regulated output voltage pin. A small 0.47 μF ceramic capacitor is needed from this pin to ground to assure stability.
2	NC/GND*	No connection at NCP716MT devices. This pin can be tied to ground to improve thermal dissipation or left disconnected. *Power supply ground at NCP716MTG devices.
3, EXP	GND	Power supply ground. Exposed pad EXP must be tied with GND pin 3.
4	N/C	No connection. This pin can be tied to ground to improve thermal dissipation or left disconnected.
5	N/C	No connection. This pin can be tied to ground to improve thermal dissipation or left disconnected.
1	IN	Input pin. A small capacitor is needed from this pin to ground to assure stability.

Table 2. ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Input Voltage (Note 1)	V_{IN}	−0.3 to 24	V
Output Voltage	V_{OUT}	−0.3 to 6	V
Output Short Circuit Duration	t_{SC}	Indefinite	s
Maximum Junction Temperature	$T_{J(MAX)}$	150	°C
Operating Ambient Temperature Range	T_A	−40 to 125	°C
Storage Temperature Range	T_{STG}	−55 to 150	°C
ESD Capability, Human Body Model (Note 2)	ESD_{HBM}	2000	V
ESD Capability, Machine Model (Note 2)	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.

1. Refer to ELECTRICAL CHARACTERISTICS and APPLICATION INFORMATION for Safe Operating Area.
2. This device series incorporates ESD protection and is tested by the following methods:
   ESD Human Body Model tested per EIA/JESD22−A114
   ESD Machine Model tested per EIA/JESD22−A115
   ESD Charged Device Model tested per EIA/JESD22−C101E
   Latch up Current Maximum Rating tested per JEDEC standard: JESD78.

Table 3. THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Characteristics, WDFN6, 2 mm x 2 mm Thermal Resistance, Junction−to−Air	$R_{\theta JA}$	120	°C/W

Table 4. ELECTRICAL CHARACTERISTICS Voltage version 1.2 V
$-40°C \le T_J \le 125°C$; V_{IN} = 3.0 V; I_{OUT} = 1 mA, $C_{IN} = C_{OUT}$ = 1.0 μF, unless otherwise noted. Typical values are at T_J = +25°C. (Note 5)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	$I_{OUT} \le 10$ mA	V_{IN}	2.5		24	V
	10 mA < I_{OUT} < 80 mA		3.0		24	
Output Voltage Accuracy	3.0 V < V_{IN} < 24 V, 0 < I_{OUT} < 80 mA	V_{OUT}	1.164	1.2	1.236	V
Turn−On Time	I_{OUT} = 1 mA	t_{ON}	–	700	–	μs
Undervoltage Lock−Out	V_{IN} rising	UVLO	–	2.1	–	V
Line Regulation	3.0 V ≤ V_{IN} ≤ 24 V, I_{OUT} = 1 mA	Reg_{LINE}		30		mV
Load Regulation	I_{OUT} = 0 mA to 80 mA	Reg_{LOAD}		20		mV
Dropout voltage (Note 3)		V_{DO}			–	mV
Maximum Output Current	(Note 6)	I_{OUT}	110			mA
Ground current	0 < I_{OUT} < 80 mA, −40 < T_A < 85°C	I_{GND}		3.2	4.2	μA
	0 < I_{OUT} < 80 mA, V_{IN} = 24 V				5.8	μA
Power Supply Rejection Ratio	V_{IN} = 3.0 V, V_{OUT} = 1.2 V, V_{PP} = 200 mV modulation, I_{OUT} = 1 mA, C_{OUT} = 10 μF, f = 100 kHz	PSRR		63		dB
Output Noise Voltage	V_{OUT} = 1.2 V, I_{OUT} = 80 mA, f = 200 Hz to 100 kHz	V_N		105		μV_{rms}
Thermal Shutdown Temperature (Note 4)	Temperature increasing from T_J = +25°C	T_{SD}		155		°C
Thermal Shutdown Hysteresis (Note 4)	Temperature falling from T_{SD}	T_{SDH}	–	25	–	°C

3. Not Characterized at V_{IN} = 3.0 V, V_{OUT} = 1.2 V, I_{OUT} = 80 mA
4. Guaranteed by design and characterization.
5. Performance guaranteed over the indicated operating temperature range by design and/or characterization production tested at $T_J = T_A$ = 25°C. Low duty cycle pulse techniques are used during testing to maintain the junction temperature as close to ambient as possible.
6. Respect SOA

Table 5. ELECTRICAL CHARACTERISTICS Voltage version 1.5 V
$-40°C \le T_J \le 125°C$; V_{IN} = 3.0 V; I_{OUT} = 1 mA, $C_{IN} = C_{OUT}$ = 1.0 μF, unless otherwise noted. Typical values are at T_J = +25°C. (Note 9)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	$I_{OUT} \le 10$ mA	V_{IN}	2.5		24	V
	10 mA < I_{OUT} < 80 mA		3.0		24	
Output Voltage Accuracy	3.0 V < V_{IN} < 24 V, 0 < I_{OUT} < 80 mA	V_{OUT}	1.455	1.5	1.545	V
Turn−On Time	I_{OUT} = 1 mA	t_{ON}	–	700	–	μs
Undervoltage Lock−Out	V_{IN} rising	UVLO	–	2.1	–	V
Line Regulation	3.0 V ≤ V_{IN} ≤ 24 V, I_{OUT} = 1 mA	Reg_{LINE}		20		mV
Load Regulation	I_{OUT} = 0 mA to 80 mA	Reg_{LOAD}		20		mV
Dropout voltage (Note 7)						
Maximum Output Current	(Note 10)	I_{OUT}	110			mA
Ground current	0 < I_{OUT} < 80 mA, −40 < T_A < 85°C	I_{GND}		3.2	4.2	μA
	0 < I_{OUT} < 80 mA, V_{IN} = 24 V				5.8	μA
Power Supply Rejection Ratio	V_{IN} = 3.0 V, V_{OUT} = 1.5 V, V_{PP} = 200 mV modulation, I_{OUT} = 1 mA, C_{OUT} = 10 μF, f = 100 kHz	PSRR		60		dB
Output Noise Voltage	V_{OUT} = 1.5 V, I_{OUT} = 80 mA, f = 200 Hz to 100 kHz	V_N		120		μV_{rms}
Thermal Shutdown Temperature (Note 8)	Temperature increasing from T_J = +25°C	T_{SD}		155		°C
Thermal Shutdown Hysteresis (Note 8)	Temperature falling from T_{SD}	T_{SDH}	–	25	–	°C

7. Not Characterized at V_{IN} = 3.0 V, V_{OUT} = 1.5 V, I_{OUT} = 80 mA
8. Guaranteed by design and characterization.
9. Performance guaranteed over the indicated operating temperature range by design and/or characterization production tested at $T_J = T_A$ = 25°C. Low duty cycle pulse techniques are used during testing to maintain the junction temperature as close to ambient as possible.
10. Respect SOA

Table 6. ELECTRICAL CHARACTERISTICS Voltage version 1.8 V
$-40°C \le T_J \le 125°C$; V_{IN} = 3.0 V; I_{OUT} = 1 mA, $C_{IN} = C_{OUT}$ = 1.0 μF, unless otherwise noted. Typical values are at T_J = +25°C. (Note 13)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	$I_{OUT} \le 10$ mA	V_{IN}	2.8		24	V
	10 mA < I_{OUT} < 80 mA		3.0		24	
Output Voltage Accuracy	3.0 V < V_{IN} < 24 V, 0 < I_{OUT} < 80 mA	V_{OUT}	1.746	1.8	1.854	V
Turn−On Time	I_{OUT} = 1 mA	t_{ON}	–	700	–	μs
Undervoltage Lock−Out	V_{IN} rising	UVLO	–	2.1	–	V
Line Regulation	3.0 V ≤ V_{IN} ≤ 24 V, I_{OUT} = 1 mA	Reg_{LINE}		15		mV
Load Regulation	I_{OUT} = 0 mA to 80 mA	Reg_{LOAD}		15		mV
Dropout voltage (Note 11)						
Maximum Output Current	(Note 14)	I_{OUT}	110			mA
Ground current	0 < I_{OUT} < 80 mA, −40 < T_A < 85°C	I_{GND}		3.2	4.2	μA
	0 < I_{OUT} < 80 mA, V_{IN} = 24 V				5.8	μA
Power Supply Rejection Ratio	V_{IN} = 3.0 V, V_{OUT} = 1.8 V, V_{PP} = 200 mV modulation, I_{OUT} = 1 mA, C_{OUT} = 10 μF, f = 100 kHz	PSRR		60		dB
Output Noise Voltage	V_{OUT} = 1.8 V, I_{OUT} = 80 mA, f = 200 Hz to 100 kHz	V_N		140		μV_{rms}
Thermal Shutdown Temperature (Note 12)	Temperature increasing from T_J = +25°C	T_{SD}		155		°C
Thermal Shutdown Hysteresis (Note 12)	Temperature falling from T_{SD}	T_{SDH}	–	25	–	°C

11. Not Characterized at V_{IN} = 3.0 V, V_{OUT} = 1.8 V, I_{OUT} = 80 mA
12. Guaranteed by design and characterization.
13. Performance guaranteed over the indicated operating temperature range by design and/or characterization production tested at $T_J = T_A$ = 25°C. Low duty cycle pulse techniques are used during testing to maintain the junction temperature as close to ambient as possible.
14. Respect SOA

Table 7. ELECTRICAL CHARACTERISTICS Voltage version 2.5 V
$-40°C \le T_J \le 125°C$; V_{IN} = 3.5 V; I_{OUT} = 1 mA, $C_{IN} = C_{OUT}$ = 1.0 μF, unless otherwise noted. Typical values are at T_J = +25°C. (Note 17)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	$0 < I_{OUT} < 80$ mA	V_{IN}	3.5		24	V
Output Voltage Accuracy	3.5 V < V_{IN} < 24 V, $0 < I_{OUT} < 80$ mA	V_{OUT}	2.45	2.5	2.55	V
Turn–On Time	I_{OUT} = 1 mA	t_{ON}	–	700	–	μs
Undervoltage Lock–Out	V_{IN} rising	UVLO	–	2.1	–	V
Line Regulation	V_{OUT} + 1 V ≤ V_{IN} ≤ 24 V, I_{OUT} = 1mA	Reg_{LINE}		15		mV
Load Regulation	I_{OUT} = 0 mA to 80 mA	Reg_{LOAD}		15		mV
Dropout voltage (Note 15)	$V_{DO} = V_{IN} - (V_{OUT(NOM)} - 75$ mV) I_{OUT} = 80 mA	V_{DO}		400	640	mV
Maximum Output Current	(Note 18)	I_{OUT}	110			mA
Ground current	$0 < I_{OUT} < 80$ mA, $-40 < T_A < 85°C$	I_{GND}		3.2	4.2	μA
	$0 < I_{OUT} < 80$ mA, V_{IN} = 24 V				5.8	μA
Power Supply Rejection Ratio	V_{IN} = 3.5 V, V_{OUT} = 2.5 V, V_{PP} = 200 mV modulation, I_{OUT} = 1 mA, C_{OUT} = 10 μF, f = 100 kHz	PSRR		60		dB
Output Noise Voltage	V_{OUT} = 2.5 V, I_{OUT} = 80 mA, f = 200 Hz to 100 kHz	V_N		160		μV_{rms}
Thermal Shutdown Temperature (Note 16)	Temperature increasing from T_J = +25°C	T_{SD}		155		°C
Thermal Shutdown Hysteresis (Note 16)	Temperature falling from T_{SD}	T_{SDH}	–	25	–	°C

15. Characterized when V_{OUT} falls 75 mV below the regulated voltage and only for devices with V_{OUT} = 2.5 V
16. Guaranteed by design and characterization.
17. Performance guaranteed over the indicated operating temperature range by design and/or characterization production tested at $T_J = T_A$ = 25°C. Low duty cycle pulse techniques are used during testing to maintain the junction temperature as close to ambient as possible.
18. Respect SOA

Table 8. ELECTRICAL CHARACTERISTICS Voltage version 3.0 V
$-40°C \le T_J \le 125°C$; V_{IN} = 4.0 V; I_{OUT} = 1 mA, $C_{IN} = C_{OUT}$ = 1.0 μF, unless otherwise noted. Typical values are at T_J = +25°C. (Note 21)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	$0 < I_{OUT} < 80$ mA	V_{IN}	4.0		24	V
Output Voltage Accuracy	4.3 V < V_{IN} < 24 V, $0 < I_{OUT} < 80$ mA	V_{OUT}	2.94	3.0	3.06	V
Turn−On Time	I_{OUT} = 1 mA	t_{ON}	–	700	–	μs
Undervoltage Lock−Out	V_{IN} rising	UVLO	–	2.1	–	V
Line Regulation	V_{OUT} + 1 V ≤ V_{IN} ≤ 24 V, I_{OUT} = 1 mA	Reg_{LINE}		4	10	mV
Load Regulation	I_{OUT} = 0 mA to 80 mA	Reg_{LOAD}		10	30	mV
Dropout voltage (Note 19)	$V_{DO} = V_{IN} - (V_{OUT(NOM)} - 90$ mV) I_{OUT} = 80 mA	V_{DO}		370	580	mV
Maximum Output Current	(Note 22)	I_{OUT}	110			mA
Ground current	$0 < I_{OUT} < 80$ mA, $-40 < T_A < 85°C$	I_{GND}		3.2	4.2	μA
	$0 < I_{OUT} < 80$ mA, V_{IN} = 24 V				5.8	μA
Power Supply Rejection Ratio	V_{IN} = 4.3 V, V_{OUT} = 3.3 V, V_{PP} = 200 mV modulation, I_{OUT} = 1 mA, C_{OUT} = 10 μF, f = 100 kHz	PSRR		58		dB
Output Noise Voltage	V_{OUT} = 4.3 V, I_{OUT} = 80 mA, f = 200 Hz to 100 kHz	V_N		190		μV_{rms}
Thermal Shutdown Temperature (Note 20)	Temperature increasing from T_J = +25°C	T_{SD}		155		°C
Thermal Shutdown Hysteresis (Note 20)	Temperature falling from T_{SD}	T_{SDH}	–	25	–	°C

19. Characterized when V_{OUT} falls 90 mV below the regulated voltage and only for devices with V_{OUT} = 3.0 V
20. Guaranteed by design and characterization.
21. Performance guaranteed over the indicated operating temperature range by design and/or characterization production tested at $T_J = T_A$ = 25°C. Low duty cycle pulse techniques are used during testing to maintain the junction temperature as close to ambient as possible.
22. Respect SOA

Table 9. ELECTRICAL CHARACTERISTICS Voltage version 3.3 V
$-40°C \le T_J \le 125°C$; V_{IN} = 4.3 V; I_{OUT} = 1 mA, $C_{IN} = C_{OUT}$ = 1.0 μF, unless otherwise noted. Typical values are at T_J = +25°C. (Note 25)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	$0 < I_{OUT} < 80$ mA	V_{IN}	4.3		24	V
Output Voltage Accuracy	4.3 V < V_{IN} < 24 V, $0 < I_{OUT} < 80$ mA	V_{OUT}	3.234	3.3	3.366	V
Turn−On Time	I_{OUT} = 1 mA	t_{ON}	–	700	–	μs
Undervoltage Lock−Out	V_{IN} rising	UVLO	–	2.1	–	V
Line Regulation	V_{OUT} + 1 V ≤ V_{IN} ≤ 24 V, I_{OUT} = 1 mA	Reg_{LINE}		4	10	mV
Load Regulation	I_{OUT} = 0 mA to 80 mA	Reg_{LOAD}		10	30	mV
Dropout voltage (Note 23)	$V_{DO} = V_{IN} - (V_{OUT(NOM)} - 99$ mV) I_{OUT} = 80 mA	V_{DO}		350	560	mV
Maximum Output Current	(Note 26)	I_{OUT}	110			mA
Ground current	$0 < I_{OUT} < 80$ mA, $-40 < T_A < 85°C$	I_{GND}		3.2	4.2	μA
	$0 < I_{OUT} < 80$ mA, V_{IN} = 24 V				5.8	μA
Power Supply Rejection Ratio	V_{IN} = 4.3 V, V_{OUT} = 3.3 V, V_{PP} = 200 mV modulation, I_{OUT} = 1 mA, C_{OUT} = 10 μF, f = 100 kHz	PSRR		60		dB
Output Noise Voltage	V_{OUT} = 4.3 V, I_{OUT} = 80 mA, f = 200 Hz to 100 kHz	V_N		200		μV_{rms}
Thermal Shutdown Temperature (Note 24)	Temperature increasing from T_J = +25°C	T_{SD}		155		°C
Thermal Shutdown Hysteresis (Note 24)	Temperature falling from T_{SD}	T_{SDH}	–	25	–	°C

23. Characterized when V_{OUT} falls 99 mV below the regulated voltage and only for devices with V_{OUT} = 3.3 V
24. Guaranteed by design and characterization.
25. Performance guaranteed over the indicated operating temperature range by design and/or characterization production tested at $T_J = T_A$ = 25°C. Low duty cycle pulse techniques are used during testing to maintain the junction temperature as close to ambient as possible.
26. Respect SOA

Table 10. ELECTRICAL CHARACTERISTICS Voltage version 5.0 V
$-40°C \le T_J \le 125°C$; V_{IN} = 6.0 V; I_{OUT} = 1 mA, $C_{IN} = C_{OUT}$ = 1.0 μF, unless otherwise noted. Typical values are at T_J = +25°C. (Note 29)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	$0 < I_{OUT} < 80$ mA	V_{IN}	6.0		24	V
Output Voltage Accuracy	6.0 V < V_{IN} < 24 V, $0 < I_{OUT} < 80$ mA	V_{OUT}	4.9	5.0	5.1	V
Turn−On Time	I_{OUT} = 1 mA	t_{ON}	–	700	–	μs
Undervoltage Lock−Out	V_{IN} rising	UVLO	–	2.1	–	V
Line Regulation	V_{OUT} + 1 V ≤ V_{IN} ≤ 24 V, I_{OUT} = 1 mA	Reg_{LINE}		4	10	mV
Load Regulation	I_{OUT} = 0 mA to 80 mA	Reg_{LOAD}		10	30	mV
Dropout voltage (Note 27)	$V_{DO} = V_{IN} - (V_{OUT(NOM)} - 150$ mV) I_{OUT} = 80 mA	V_{DO}		310	500	mV
Maximum Output Current	(Note 30)	I_{OUT}	110			mA
Ground current	$0 < I_{OUT} < 80$ mA, $-40 < T_A < 85°C$	I_{GND}		3.2	4.2	μA
	$0 < I_{OUT} < 80$ mA, V_{IN} = 24 V				5.8	μA
Power Supply Rejection Ratio	V_{IN} = 6.0 V, V_{OUT} = 5.0 V, V_{PP} = 200 mV modulation, I_{OUT} = 1 mA, C_{OUT} =10 μF, f = 100 kHz	PSRR		54		dB
Output Noise Voltage	V_{OUT} = 5.0 V, I_{OUT} = 80 mA, f = 200 Hz to 100 kHz	V_N		220		μV_{rms}
Thermal Shutdown Temperature (Note 28)	Temperature increasing from T_J = +25°C	T_{SD}		155		°C
Thermal Shutdown Hysteresis (Note 28)	Temperature falling from T_{SD}	T_{SDH}	–	25	–	°C

27. Characterized when V_{OUT} falls 150 mV below the regulated voltage and only for devices with V_{OUT} = 5.0 V
28. Guaranteed by design and characterization.
29. Performance guaranteed over the indicated operating temperature range by design and/or characterization production tested at $T_J = T_A$ = 25°C. Low duty cycle pulse techniques are used during testing to maintain the junction temperature as close to ambient as possible.
30. Respect SOA

TYPICAL CHARACTERISTICS

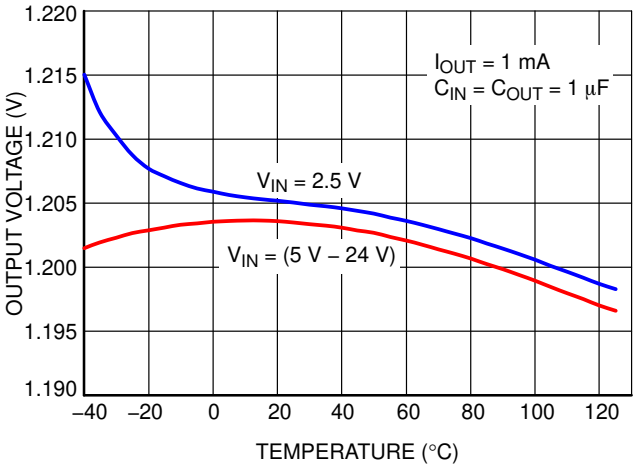


Figure 3. NCP716x12xxx Output Voltage vs. Temperature

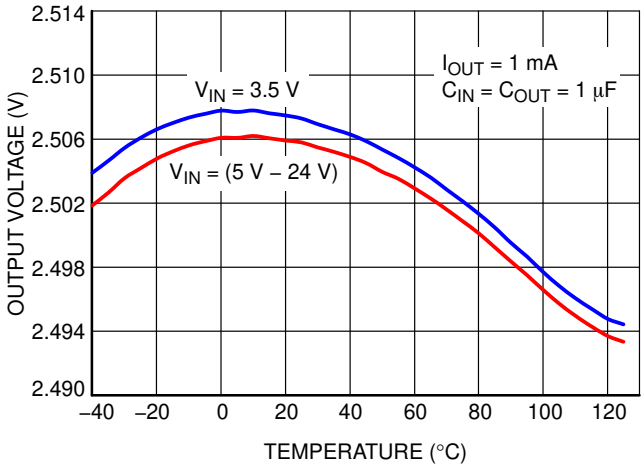


Figure 4. NCP716x25xxx Output Voltage vs. Temperature

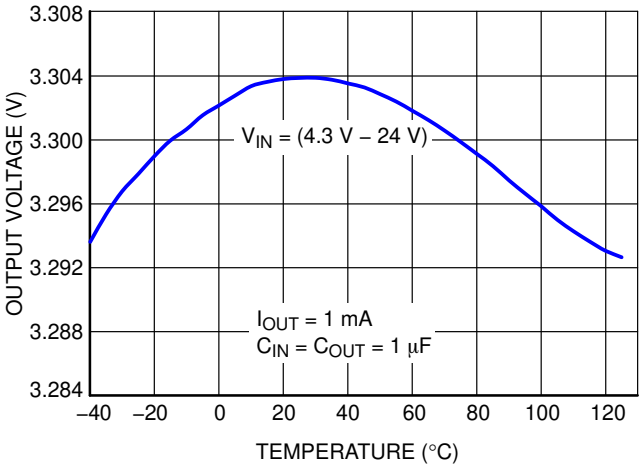


Figure 5. NCP716x33xxx Output Voltage vs. Temperature

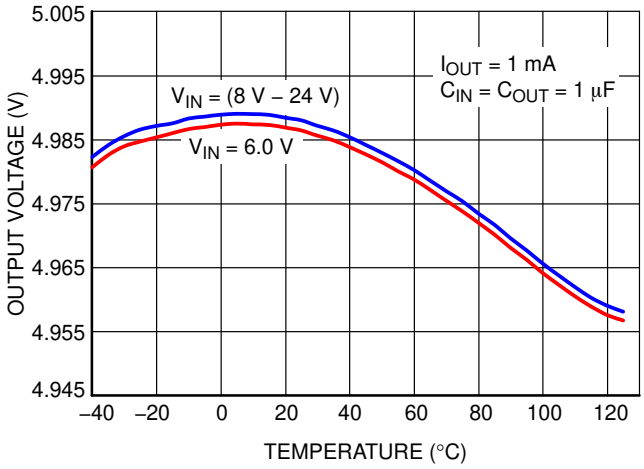


Figure 6. NCP716x50xxx Output Voltage vs. Temperature

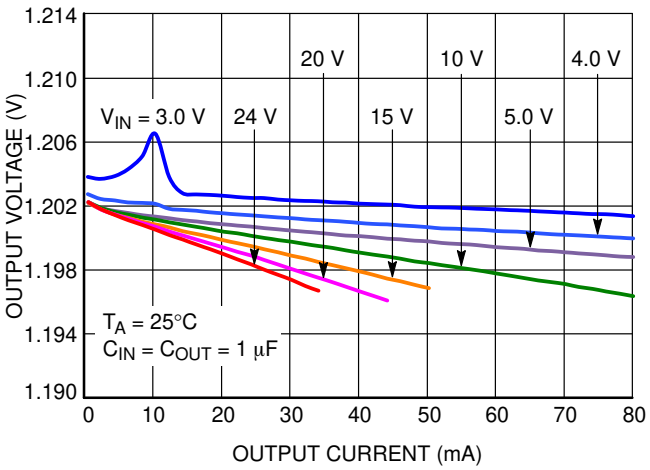


Figure 7. NCP716x12xxx Output Voltage vs. Output Current

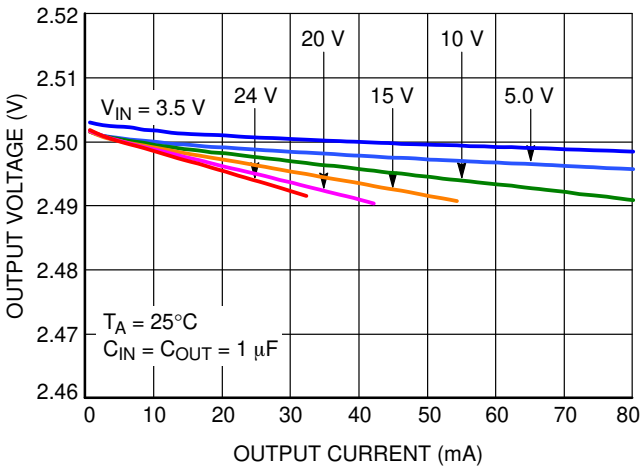


Figure 8. NCP716x25xxx Output Voltage vs. Output Current

TYPICAL CHARACTERISTICS

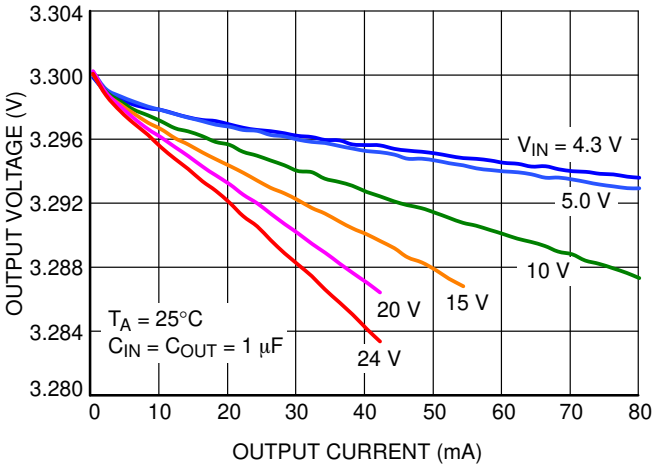


Figure 9. NCP7163V3 Output Voltage vs. Output Current

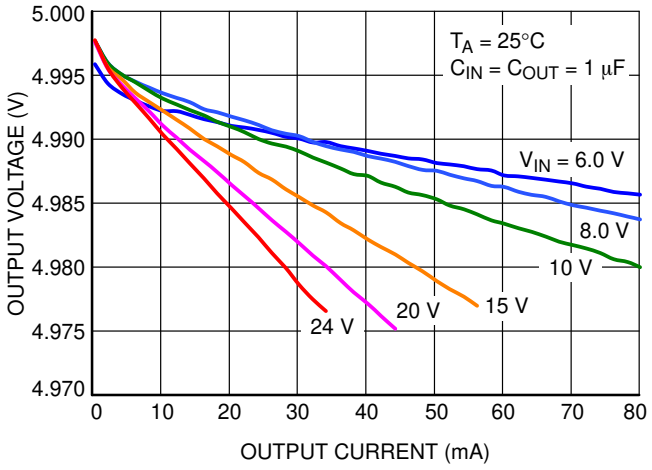


Figure 10. NCP716x50xxx Output Voltage vs. Output Current

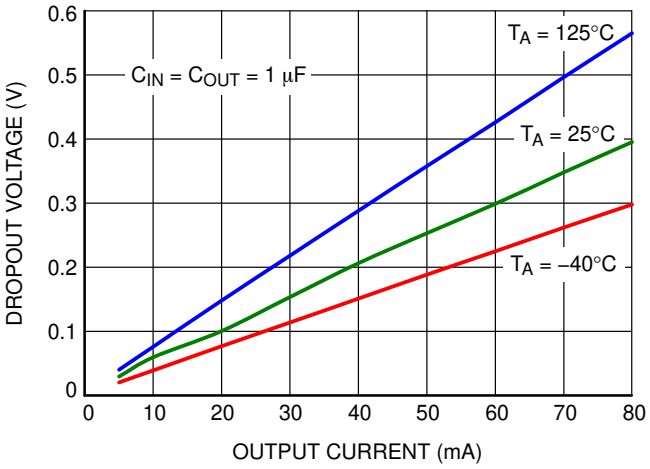


Figure 11. NCP716x25xxx Dropout Voltage vs. Output Current

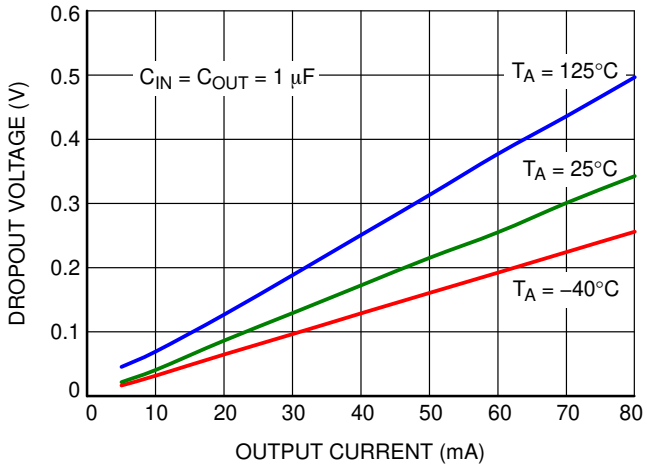


Figure 12. NCP716x33xxx Dropout Voltage vs. Output Current

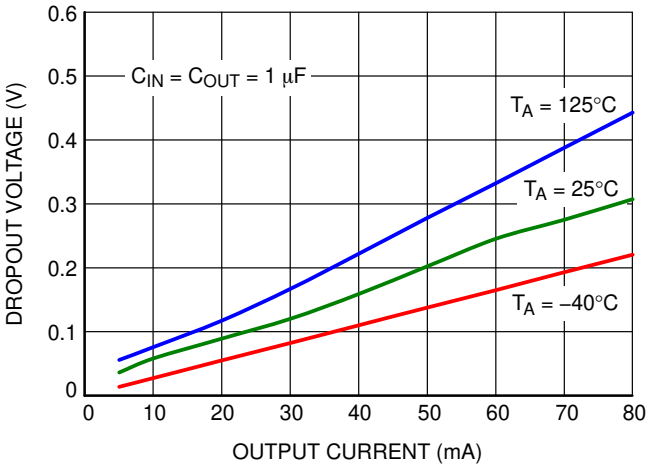


Figure 13. NCP716x50xxx Dropout Voltage vs. Output Current

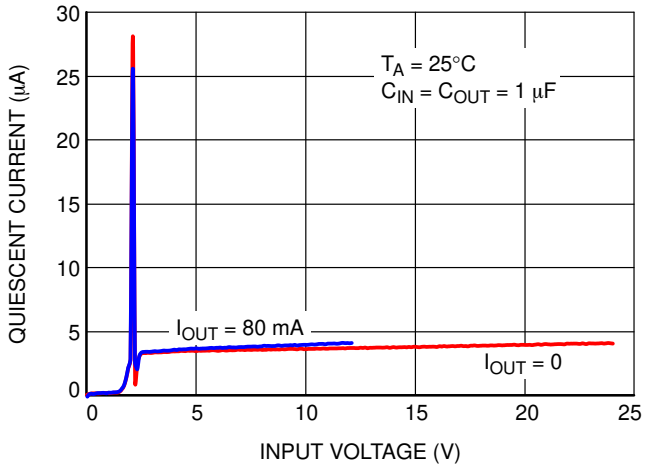


Figure 14. NCP716x12xxx Ground Current vs. Input Voltage

TYPICAL CHARACTERISTICS

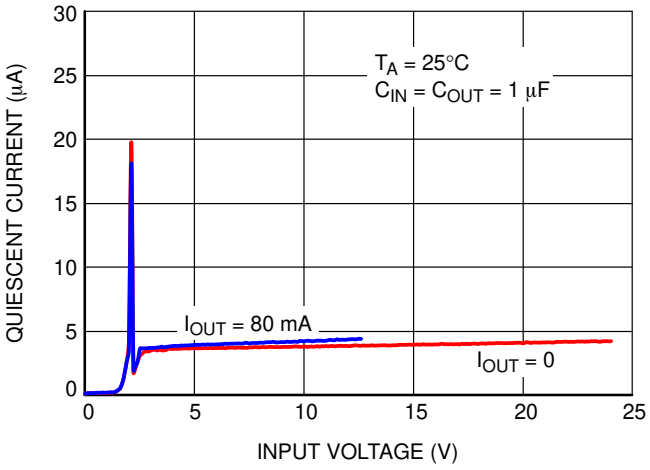


Figure 15. NCP716x25xxx Ground Current vs. Input Voltage

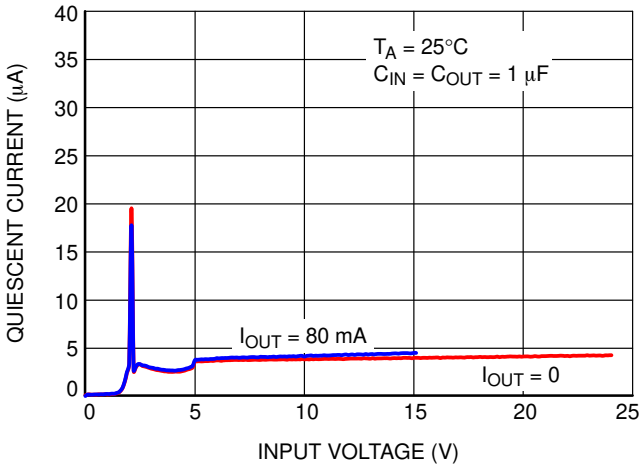


Figure 16. NCP716x50xxx Ground Current vs. Input Voltage

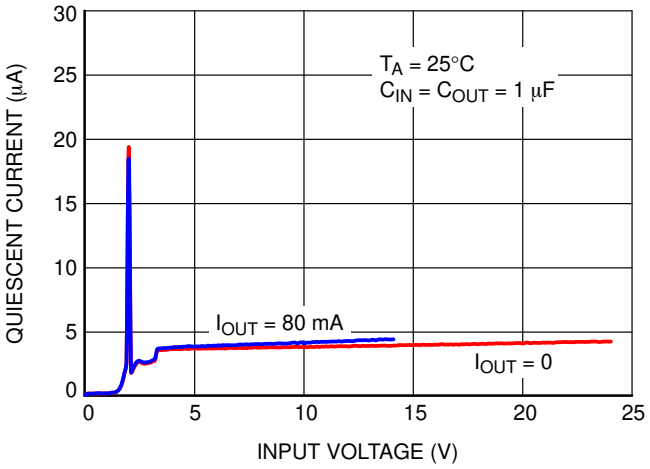


Figure 17. NCP716x33xxx Ground Current vs. Input Voltage

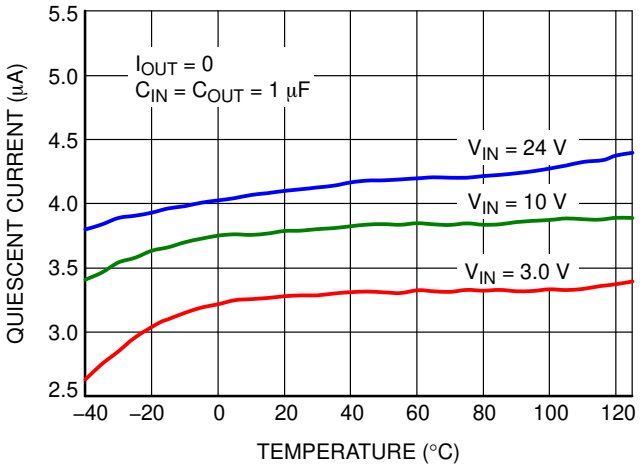


Figure 18. NCP716x12xxx Quiescent Current vs. Temperature

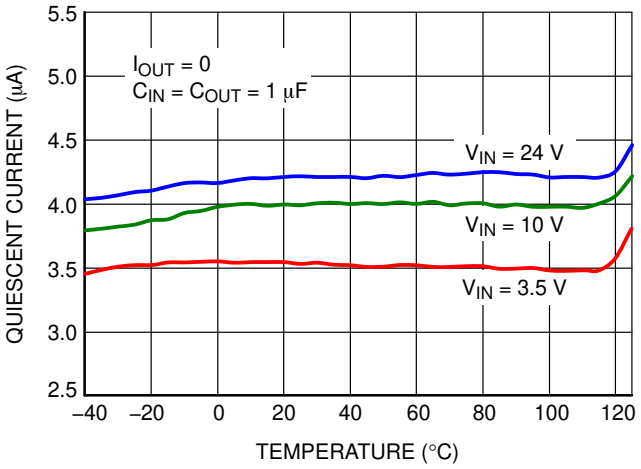


Figure 19. NCP716x25xxx Quiescent Current vs. Temperature

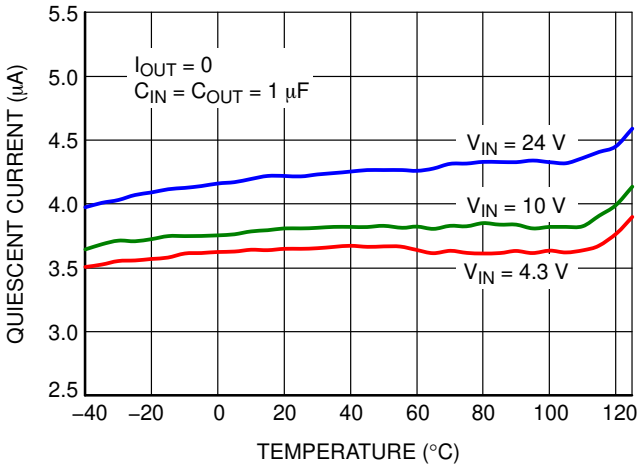


Figure 20. NCP716x33xxx Quiescent Current vs. Temperature

TYPICAL CHARACTERISTICS

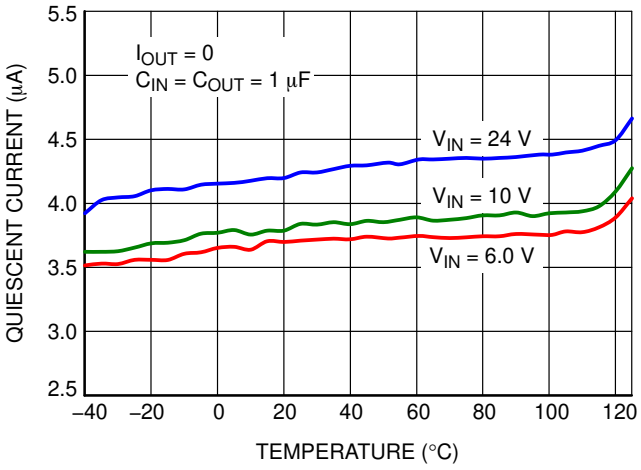


Figure 21. NVP716x50xxx Quiescent Current vs. Temperature

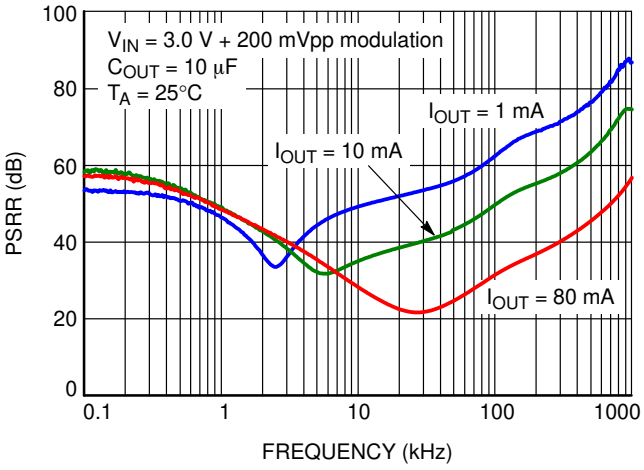


Figure 22. NCP716x12xxx PSRR vs. Frequency

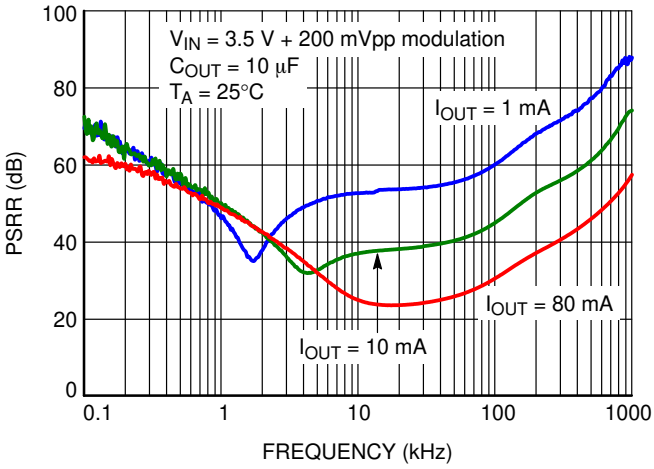


Figure 23. NCP716x25xxx PSRR vs. Frequency

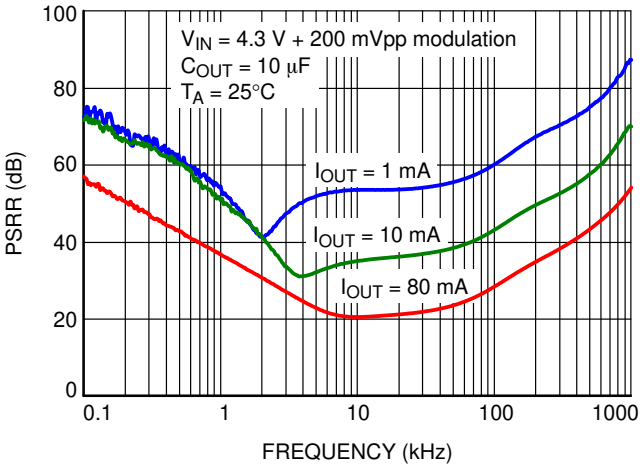


Figure 24. NCP716x33xxx PSRR vs. Frequency

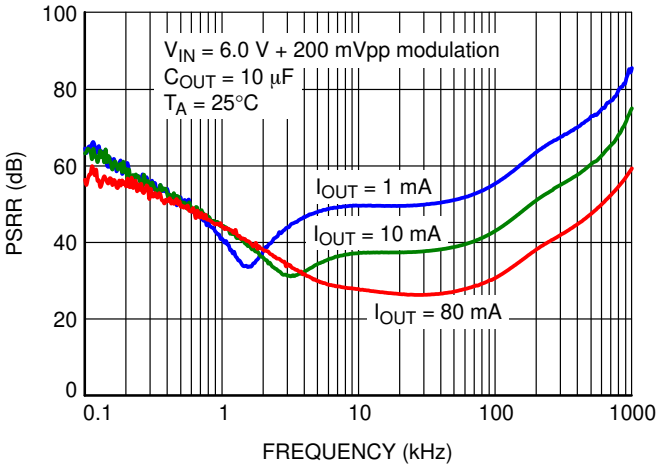


Figure 25. NCP716x50xxx PSRR vs. Frequency

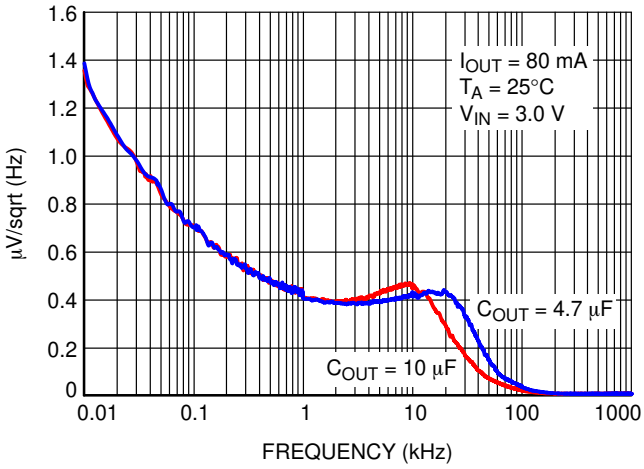


Figure 26. NCP716x12xxx Output Spectral Noise Density vs. Frequency

TYPICAL CHARACTERISTICS

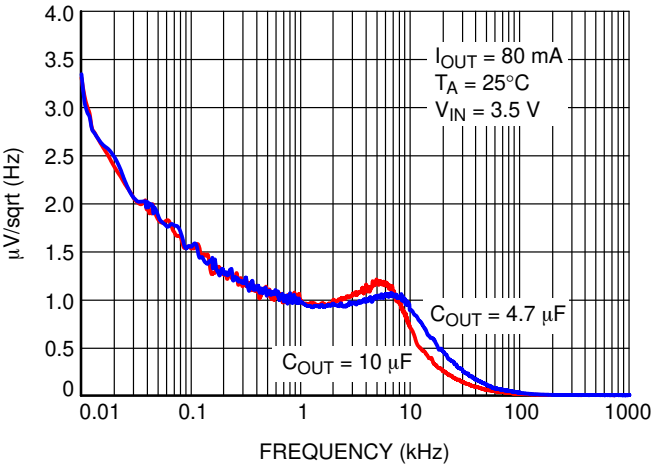


Figure 27. NCP716x25xxx Output Spectral Noise Density vs. Frequency

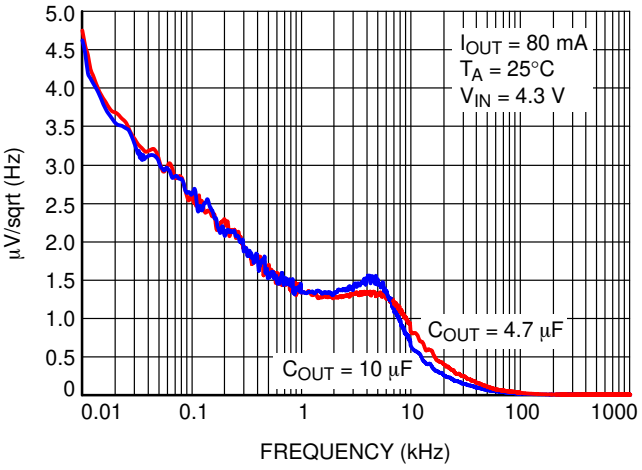


Figure 28. NCP716x33xxx Output Spectral Noise Density vs. Frequency

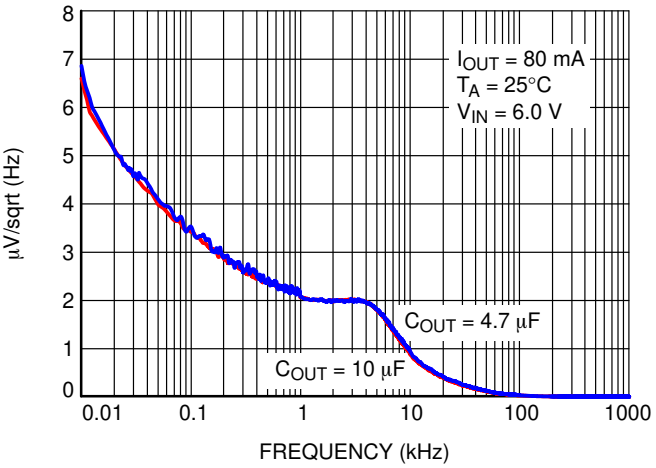


Figure 29. NCP716x50xxx Output Spectral Noise Density vs. Frequency

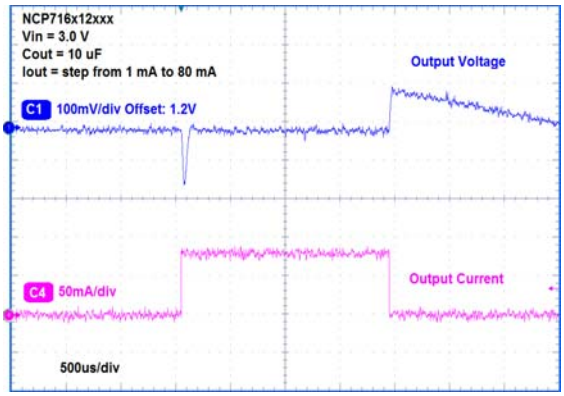


Figure 30. Load Transient Response

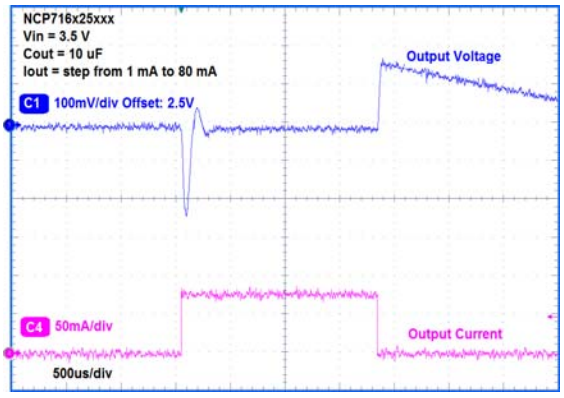


Figure 31. Load Transient Response

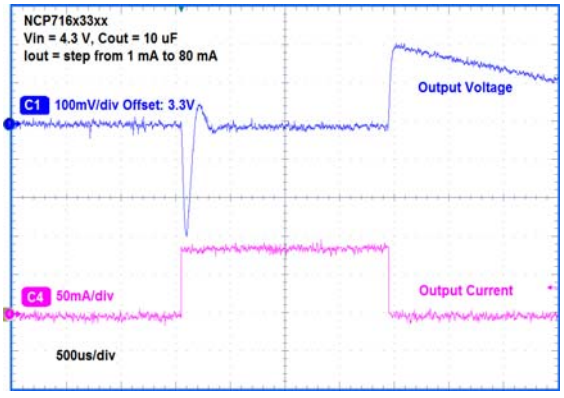


Figure 32. Load Transient Response

TYPICAL CHARACTERISTICS

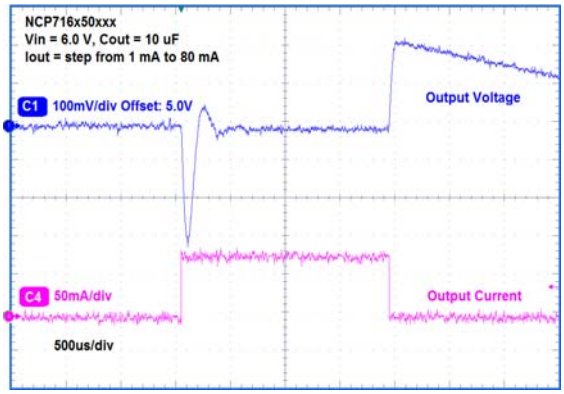


Figure 33. Load Transient Response

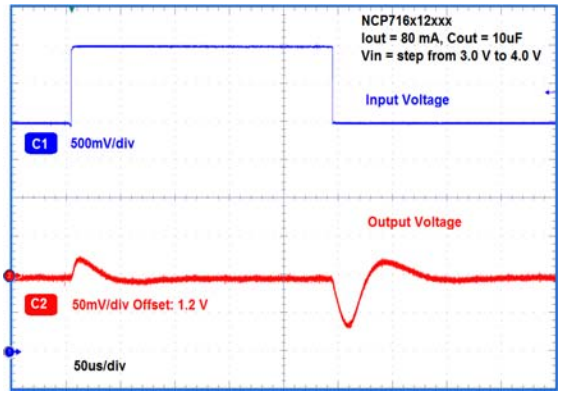


Figure 34. Line Transient Response

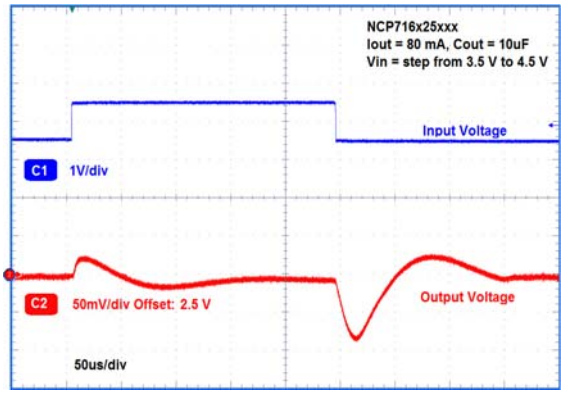


Figure 35. Line Transient Response

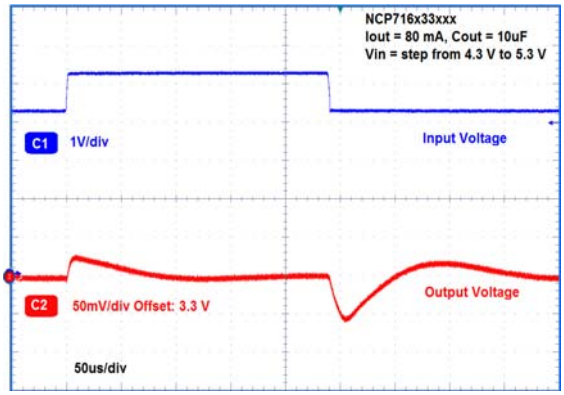


Figure 36. Line Transient Response

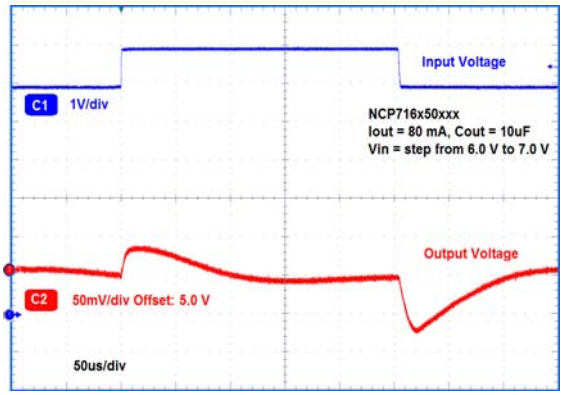


Figure 37. Line Transient Response

TYPICAL CHARACTERISTICS

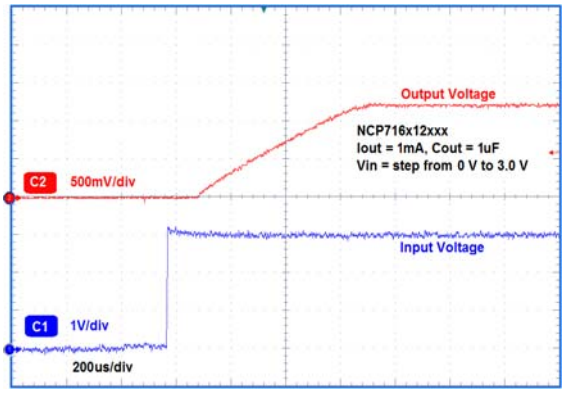


Figure 38. Input Voltage Turn−On Response

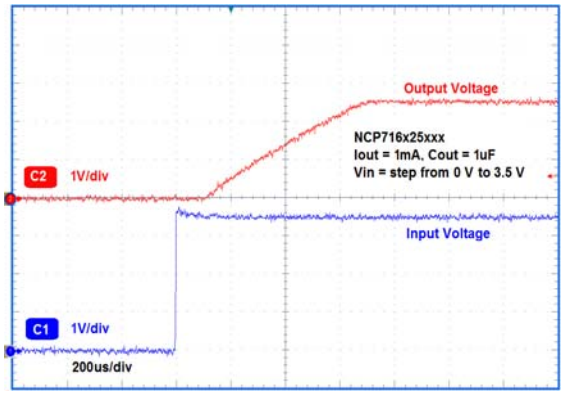


Figure 39. Input Voltage Turn−On Response

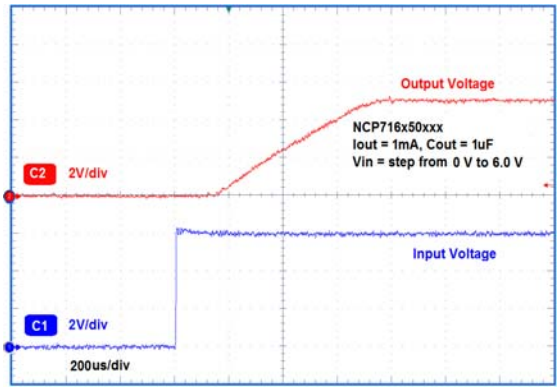


Figure 40. Input Voltage Turn−On Response

APPLICATIONS INFORMATION

The NCP716 is the member of new family of Wide Input Voltage Range Low Dropout Regulators which delivers Ultra Low Ground Current consumption, Good Noise and Power Supply Rejection Ratio Performance.

Input Decoupling (C_{IN})

It is recommended to connect at least 0.1 μF Ceramic X5R or X7R capacitor between IN and GND pin of the device. This capacitor will provide a low impedance path for any unwanted AC signals or Noise superimposed onto constant Input Voltage. The good input capacitor will limit the influence of input trace inductances and source resistance during sudden load current changes.

Higher capacitance and lower ESR Capacitors will improve the overall line transient response.

Output Decoupling (C_{OUT})

The NCP716 does not require a minimum Equivalent Series Resistance (ESR) for the output capacitor. The device is designed to be stable with standard ceramics capacitors with values of 0.47 μF or greater up to 10 μF. The X5R and X7R types have the lowest capacitance variations over temperature thus they are recommended.

Power Dissipation and Heat sinking

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. The maximum power dissipation the NCP716 can handle is given by:

$$P_{D(MAX)} = \frac{\left[T_{J(MAX)} - T_A\right]}{R_{\theta JA}} \quad \text{(eq. 1)}$$

The power dissipated by the NCP716 for given application conditions can be calculated from the following equations:

$$P_D \approx V_{IN}\left(I_{GND}(I_{OUT})\right) + I_{OUT}\left(V_{IN} - V_{OUT}\right) \quad \text{(eq. 2)}$$

or

$$V_{IN(MAX)} \approx \frac{P_{D(MAX)} + \left(V_{OUT} \times I_{OUT}\right)}{I_{OUT} + I_{GND}} \quad \text{(eq. 3)}$$

For reliable operation, junction temperature should be limited to +125°C maximum.

Hints

VIN and GND printed circuit board traces should be as wide as possible. When the impedance of these traces is high, there is a chance to pick up noise or cause the regulator to malfunction. Place external components, especially the output capacitor, as close as possible to the NCP716, and make traces as short as possible.

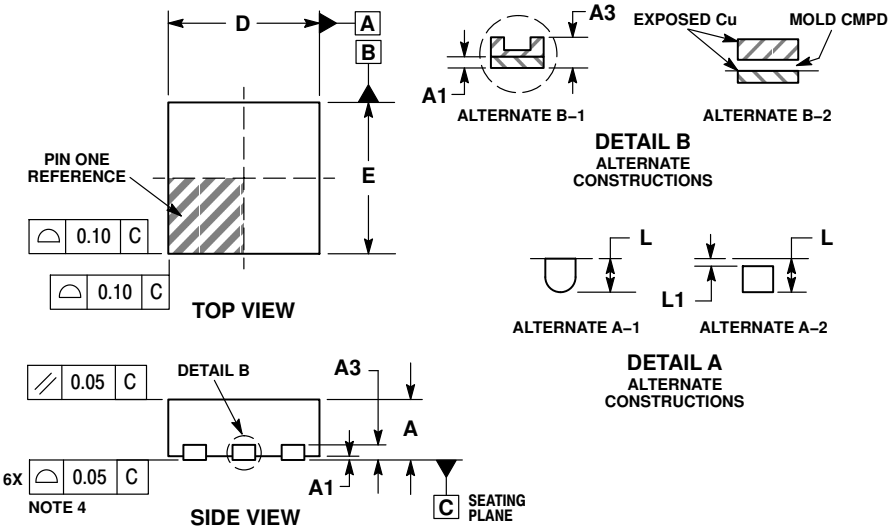
ORDERING INFORMATION

Device	Voltage Option	Marking	Package	Shipping†
NCP716MT12TBG	1.2 V	6A	WDFN6 (Pb−Free)	3000 / Tape & Reel
NCP716MT15TG	1.5 V	6C		
NCP716MT18TBG	1.8 V	6D		
NCP716MT25TBG	2.5 V	6E		
NCP716MT30TBG	3.0 V	6F		
NCP716MT33TBG	3.3 V	6G		
NCP716MT50TBG	5.0 V	6H		
NCP716MTG50TBG	5.0 V	GH		

†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.

PACKAGE DIMENSIONS

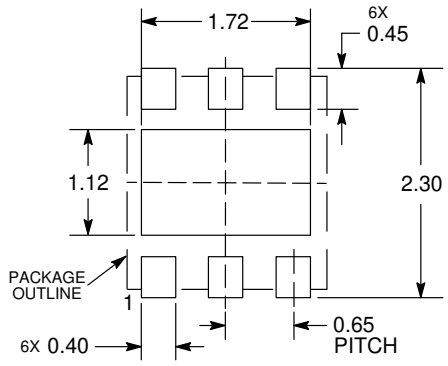
WDFN6 2x2, 0.65P
CASE 511BR
ISSUE B



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.25 mm FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
5. FOR DEVICES CONTAINING WETTABLE FLANK OPTION, DETAIL A ALTERNATE CONSTRUCTION A–2 AND DETAIL B ALTERNATE CONSTRUCTION B–2 ARE NOT APPLICABLE.

	MILLIMETERS	
DIM	MIN	MAX
A	0.70	0.80
A1	0.00	0.05
A3	0.20 REF	
b	0.25	0.35
D	2.00 BSC	
D2	1.50	1.70
E	2.00 BSC	
E2	0.90	1.10
e	0.65 BSC	
L	0.20	0.40
L1	---	0.15

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.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303–675–2175 or 800–344–3860 Toll Free USA/Canada
Fax: 303–675–2176 or 800–344–3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800–282–9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81–3–5817–1050

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

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