

1.0 A低ドロップアウト固定型 および可変型正電圧レギュレータ

NCP1117, NCP1117I, NCV1117

NCP1117シリーズは、全温度範囲で最大ドロップアウト電圧を1.2 V (800 mA時)に抑え、1.0 Aを上回る出力電流を供給する能力のある低ドロップアウト正電圧レギュレータです。このシリーズは、安定性維持のための最小負荷を必要としない9種類の固定出力電圧(1.5 V、1.8 V、1.9 V、2.0 V、2.5 V、2.85 V、3.3 V、5.0 V、12 V)を用意しています。さらにこのシリーズには、2つの外部抵抗によって1.25~18.8 Vの範囲で設定可能な可変出力バージョンも含まれています。搭載されているトリミング回路によって、リファレンス電圧および出力電圧を±1.0%以内の精度で調整します。内蔵された保護機能は、出力電流制限、安全動作領域補償、およびサーマル・シャットダウンから成ります。NCP1117シリーズは、最大入力電圧20 Vで動作可能です。このデバイスは、SOT-223パッケージおよびDPAKパッケージで供給されます。

特長

- 1.0 Aを超える出力電流
- 全温度範囲での最大ドロップアウト電圧1.2 V (800 mA時)
- 固定出力電圧：1.5 V、1.8 V、1.9 V、2.0 V、2.5 V、2.85 V、3.3 V、5.0 V、12 V
- 可変出力電圧オプション
- 固定電圧出力デバイスのための最小負荷要件なし
- ±1.0%の精度でトリミングされる参照電圧および出力電圧
- 電流制限、安全動作、およびサーマル・シャットダウンから成る保護機能
- 最大入力電圧20 Vで動作
- NCVで始まる製品番号は特有の工場および変更管理を必要とする車載およびその他の用途に対応； AEC-Q100認定，PPAP対応可
- 鉛フリー・パッケージを提供

アプリケーション

- 民生用機器および産業用機器の安定化ポイント
- 2.85 VバージョンのアクティブSCSIターミネータ
- スイッチング電源のポスト・レギュレータ
- ハード・ドライブ・コントローラ
- バッテリ充電器

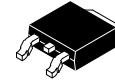


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SOT-223
ST SUFFIX
CASE 318H

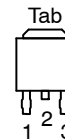


DPAK
DT SUFFIX
CASE 369C

PIN CONFIGURATION



SOT-223
(Top View)



DPAK
(Top View)

Pin: 1. Adjust/Ground
2. Output
3. Input

Heatsink tab is connected to Pin 2.

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 12 of this data sheet.

DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 14 of this data sheet.

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TYPICAL APPLICATIONS

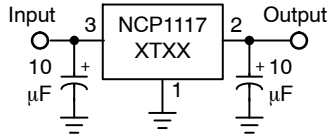


Figure 1. Fixed Output Regulator

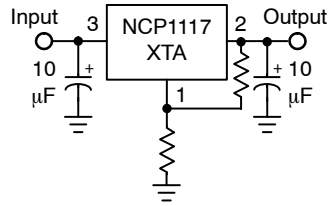


Figure 2. Adjustable Output Regulator

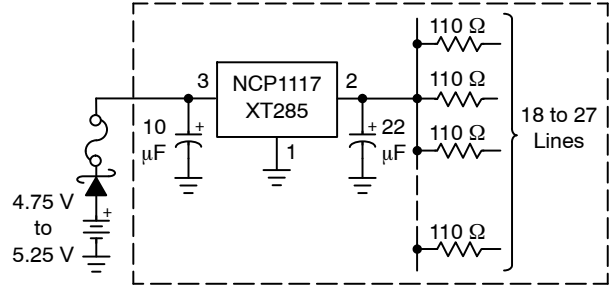


Figure 3. Active SCSI Bus Terminator

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Input Voltage (Note 1)	V_{in}	20	V
Output Short Circuit Duration (Notes 2 and 3)	–	Infinite	–
Power Dissipation and Thermal Characteristics			
Case 318H (SOT-223)			
Power Dissipation (Note 2)	P_D	Internally Limited	W
Thermal Resistance, Junction-to-Ambient, Minimum Size Pad	$R_{\theta JA}$	160	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	15	$^{\circ}\text{C}/\text{W}$
Case 369A (DPAK)			
Power Dissipation (Note 2)	P_D	Internally Limited	W
Thermal Resistance, Junction-to-Ambient, Minimum Size Pad	$R_{\theta JA}$	67	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	6.0	$^{\circ}\text{C}/\text{W}$
Maximum Die Junction Temperature Range	T_J	–55 to 150	$^{\circ}\text{C}$
Storage Temperature Range	T_{stg}	–65 to 150	$^{\circ}\text{C}$
Operating Ambient Temperature Range			
NCP1117	T_A	0 to +125	$^{\circ}\text{C}$
NCP1117I		–40 to +125	
NCV1117		–40 to +125	

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.

(参考訳)

最大定格を超えるストレスは、デバイスにダメージを与える危険性があります。これらの定格値を超えた場合は、デバイスの機能性を損ない、ダメージが生じたり、信頼性に影響を及ぼす危険性があります。

1. This device series contains ESD protection and exceeds the following tests:

Human Body Model (HBM), Class 2, 2000 V

Machine Model (MM), Class B, 200 V

Charge Device Model (CDM), Class IV, 2000 V.

2. Internal thermal shutdown protection limits the die temperature to approximately 175 $^{\circ}\text{C}$. Proper heatsinking is required to prevent activation.

The maximum package power dissipation is:

$$P_D = \frac{T_{J(max)} - T_A}{R_{\theta JA}}$$

3. The regulator output current must not exceed 1.0 A with V_{in} greater than 12 V.

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ELECTRICAL CHARACTERISTICS

($C_{in} = 10 \mu\text{F}$, $C_{out} = 10 \mu\text{F}$, for typical value $T_A = 25^\circ\text{C}$, for min and max values T_A is the operating ambient temperature range that applies unless otherwise noted.) (Note 4)

Characteristic	Symbol	Min	Typ	Max	Unit
Reference Voltage, Adjustable Output Devices ($V_{in}-V_{out} = 2.0 \text{ V}$, $I_{out} = 10 \text{ mA}$, $T_A = 25^\circ\text{C}$) ($V_{in}-V_{out} = 1.4 \text{ V to } 10 \text{ V}$, $I_{out} = 10 \text{ mA to } 800 \text{ mA}$) (Note 4)	V_{ref}	1.238 1.225	1.25 –	1.262 1.270	V
Output Voltage, Fixed Output Devices 1.5 V ($V_{in} = 3.5 \text{ V}$, $I_{out} = 10 \text{ mA}$, $T_A = 25^\circ\text{C}$) ($V_{in} = 2.9 \text{ V to } 11.5 \text{ V}$, $I_{out} = 0 \text{ mA to } 800 \text{ mA}$) (Note 4) 1.8 V ($V_{in} = 3.8 \text{ V}$, $I_{out} = 10 \text{ mA}$, $T_A = 25^\circ\text{C}$) ($V_{in} = 3.2 \text{ V to } 11.8 \text{ V}$, $I_{out} = 0 \text{ mA to } 800 \text{ mA}$) (Note 4) 1.9 V ($V_{in} = 3.9 \text{ V}$, $I_{out} = 10 \text{ mA}$, $T_A = 25^\circ\text{C}$) ($V_{in} = 3.3 \text{ V to } 11.9 \text{ V}$, $I_{out} = 0 \text{ mA to } 800 \text{ mA}$) (Note 4) 2.0 V ($V_{in} = 4.0 \text{ V}$, $I_{out} = 10 \text{ mA}$, $T_A = 25^\circ\text{C}$) ($V_{in} = 3.4 \text{ V to } 12 \text{ V}$, $I_{out} = 0 \text{ mA to } 800 \text{ mA}$) (Note 4) 2.5 V ($V_{in} = 4.5 \text{ V}$, $I_{out} = 10 \text{ mA}$, $T_A = 25^\circ\text{C}$) ($V_{in} = 3.9 \text{ V to } 10 \text{ V}$, $I_{out} = 0 \text{ mA to } 800 \text{ mA}$,) (Note 4) 2.85 V ($V_{in} = 4.85 \text{ V}$, $I_{out} = 10 \text{ mA}$, $T_A = 25^\circ\text{C}$) ($V_{in} = 4.25 \text{ V to } 10 \text{ V}$, $I_{out} = 0 \text{ mA to } 800 \text{ mA}$) (Note 4) ($V_{in} = 4.0 \text{ V}$, $I_{out} = 0 \text{ mA to } 500 \text{ mA}$) (Note 4) 3.3 V ($V_{in} = 5.3 \text{ V}$, $I_{out} = 10 \text{ mA}$, $T_A = 25^\circ\text{C}$) ($V_{in} = 4.75 \text{ V to } 10 \text{ V}$, $I_{out} = 0 \text{ mA to } 800 \text{ mA}$) (Note 4) 5.0 V ($V_{in} = 7.0 \text{ V}$, $I_{out} = 10 \text{ mA}$, $T_A = 25^\circ\text{C}$) ($V_{in} = 6.5 \text{ V to } 12 \text{ V}$, $I_{out} = 0 \text{ mA to } 800 \text{ mA}$) (Note 4) 12 V ($V_{in} = 14 \text{ V}$, $I_{out} = 10 \text{ mA}$, $T_A = 25^\circ\text{C}$) ($V_{in} = 13.5 \text{ V to } 20 \text{ V}$, $I_{out} = 0 \text{ mA to } 800 \text{ mA}$) (Note 4)	V_{out}	1.485 1.470 1.782 1.755 1.872 1.862 1.970 1.960 2.475 2.450 2.821 2.790 2.790 3.267 3.235 4.950 4.900 11.880 11.760	1.500 – 1.800 – 1.900 1.900 2.000 – 2.500 – 2.850 – – 3.300 – 5.000 – 12.000 –	1.515 1.530 1.818 1.845 1.929 1.938 2.030 2.040 2.525 2.550 2.879 2.910 2.910 3.333 3.365 5.050 5.100 12.120 12.240	V
Line Regulation (Note 5) Adjustable ($V_{in} = 2.75 \text{ V to } 16.25 \text{ V}$, $I_{out} = 10 \text{ mA}$) 1.5 V ($V_{in} = 2.9 \text{ V to } 11.5 \text{ V}$, $I_{out} = 0 \text{ mA}$) 1.8 V ($V_{in} = 3.2 \text{ V to } 11.8 \text{ V}$, $I_{out} = 0 \text{ mA}$) 1.9 V ($V_{in} = 3.3 \text{ V to } 11.9 \text{ V}$, $I_{out} = 0 \text{ mA}$) 2.0 V ($V_{in} = 3.4 \text{ V to } 12 \text{ V}$, $I_{out} = 0 \text{ mA}$) 2.5 V ($V_{in} = 3.9 \text{ V to } 10 \text{ V}$, $I_{out} = 0 \text{ mA}$) 2.85 V ($V_{in} = 4.25 \text{ V to } 10 \text{ V}$, $I_{out} = 0 \text{ mA}$) 3.3 V ($V_{in} = 4.75 \text{ V to } 15 \text{ V}$, $I_{out} = 0 \text{ mA}$) 5.0 V ($V_{in} = 6.5 \text{ V to } 15 \text{ V}$, $I_{out} = 0 \text{ mA}$) 12 V ($V_{in} = 13.5 \text{ V to } 20 \text{ V}$, $I_{out} = 0 \text{ mA}$)	Reg_{line}	– – – – – – – – – –	0.04 0.3 0.4 0.5 0.5 0.8 0.8 0.9 1.0	0.1 1.0 1.0 2.5 2.5 3.0 4.5 6.0 7.5	% mV
Load Regulation (Note 5) Adjustable ($I_{out} = 10 \text{ mA to } 800 \text{ mA}$, $V_{in} = 4.25 \text{ V}$) 1.5 V ($I_{out} = 0 \text{ mA to } 800 \text{ mA}$, $V_{in} = 2.9 \text{ V}$) 1.8 V ($I_{out} = 0 \text{ mA to } 800 \text{ mA}$, $V_{in} = 3.2 \text{ V}$) 1.9 V ($I_{out} = 0 \text{ mA to } 800 \text{ mA}$, $V_{in} = 3.3 \text{ V}$) 2.0 V ($I_{out} = 0 \text{ mA to } 800 \text{ mA}$, $V_{in} = 3.4 \text{ V}$) 2.5 V ($I_{out} = 0 \text{ mA to } 800 \text{ mA}$, $V_{in} = 3.9 \text{ V}$) 2.85 V ($I_{out} = 0 \text{ mA to } 800 \text{ mA}$, $V_{in} = 4.25 \text{ V}$) 3.3 V ($I_{out} = 0 \text{ mA to } 800 \text{ mA}$, $V_{in} = 4.75 \text{ V}$) 5.0 V ($I_{out} = 0 \text{ mA to } 800 \text{ mA}$, $V_{in} = 6.5 \text{ V}$) 12 V ($I_{out} = 0 \text{ mA to } 800 \text{ mA}$, $V_{in} = 13.5 \text{ V}$)	Reg_{line}	– – – – – – – – – –	0.2 2.3 2.6 2.7 3.0 3.3 3.8 4.3 6.7 16	0.4 5.5 6.0 6.0 6.0 7.5 8.0 10 15 28	% mV
Dropout Voltage (Measured at $V_{out} - 100 \text{ mV}$) ($I_{out} = 100 \text{ mA}$) ($I_{out} = 500 \text{ mA}$) ($I_{out} = 800 \text{ mA}$)	$V_{in}-V_{out}$	– – –	0.95 1.01 1.07	1.10 1.15 1.20	V
Output Current Limit ($V_{in}-V_{out} = 5.0 \text{ V}$, $T_A = 25^\circ\text{C}$, Note 6)	I_{out}	1000	1500	2200	mA
Minimum Required Load Current for Regulation, Adjustable Output Devices ($V_{in} = 15 \text{ V}$)	$I_{L(min)}$	–	0.8	5.0	mA

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ELECTRICAL CHARACTERISTICS (continued)

($C_{in} = 10 \mu\text{F}$, $C_{out} = 10 \mu\text{F}$, for typical value $T_A = 25^\circ\text{C}$, for min and max values T_A is the operating ambient temperature range that applies unless otherwise noted.) (Note 4)

Characteristic	Symbol	Min	Typ	Max	Unit
Quiescent Current 1.5 V ($V_{in} = 11.5 \text{ V}$) 1.8 V ($V_{in} = 11.8 \text{ V}$) 1.9 V ($V_{in} = 11.9 \text{ V}$) 2.0 V ($V_{in} = 12 \text{ V}$) 2.5 V ($V_{in} = 10 \text{ V}$) 2.85 V ($V_{in} = 10 \text{ V}$) 3.3 V ($V_{in} = 15 \text{ V}$) 5.0 V ($V_{in} = 15 \text{ V}$) 12 V ($V_{in} = 20 \text{ V}$)	I_Q	–	3.6 4.2 4.3 4.5 5.2 5.5 6.0 6.0 6.0	10 10 10 10 10 10 10 10 10	mA
Thermal Regulation ($T_A = 25^\circ\text{C}$, 30 ms Pulse)		–	0.01	0.1	%/W
Ripple Rejection ($V_{in}-V_{out} = 6.4 \text{ V}$, $I_{out} = 500 \text{ mA}$, 10 V_{pp} 120 Hz Sinewave) Adjustable 1.5 V 1.8 V 1.9 V 2.0 V 2.5 V 2.85 V 3.3 V 5.0 V 12 V	RR	67 66 66 66 64 62 62 60 57 50	73 72 70 72 70 68 68 64 61 54	– – – – – – – – – –	dB
Adjustment Pin Current ($V_{in} = 11.25 \text{ V}$, $I_{out} = 800 \text{ mA}$)	I_{adj}	–	52	120	μA
Adjust Pin Current Change ($V_{in}-V_{out} = 1.4 \text{ V}$ to 10 V, $I_{out} = 10 \text{ mA}$ to 800 mA)	ΔI_{adj}	–	0.4	5.0	μA
Temperature Stability	S_T	–	0.5	–	%
Long Term Stability ($T_A = 25^\circ\text{C}$, 1000 Hrs End Point Measurement)	S_t	–	0.3	–	%
RMS Output Noise ($f = 10 \text{ Hz}$ to 10 kHz)	N	–	0.003	–	% V_{out}

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.

(参考訳)

製品パラメータは、特別な記述が無い限り、記載されたテスト条件に対する電気的特性で示しています。異なる条件下で製品動作を行った時には、電気的特性で示している特性を得られない場合があります。

4. NCP1117: $T_{low} = 0^\circ\text{C}$, $T_{high} = 125^\circ\text{C}$

NCP1117I: $T_{low} = -40^\circ\text{C}$, $T_{high} = 125^\circ\text{C}$

NCV1117: $T_{low} = -40^\circ\text{C}$, $T_{high} = 125^\circ\text{C}$

5. Low duty cycle pulse techniques are used during testing to maintain the junction temperature as close to ambient as possible.

6. The regulator output current must not exceed 1.0 A with V_{in} greater than 12 V.

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Figure 4. Output Voltage Change vs. Temperature

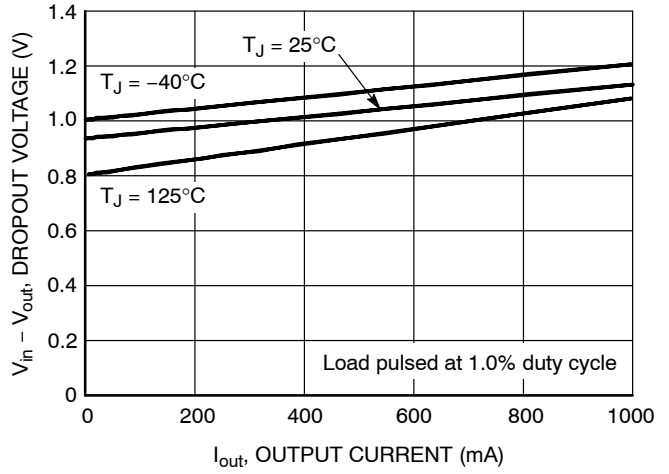


Figure 5. Dropout Voltage vs. Output Current



Figure 6. Output Short Circuit Current vs. Differential Voltage



Figure 7. Output Short Circuit Current vs. Temperature

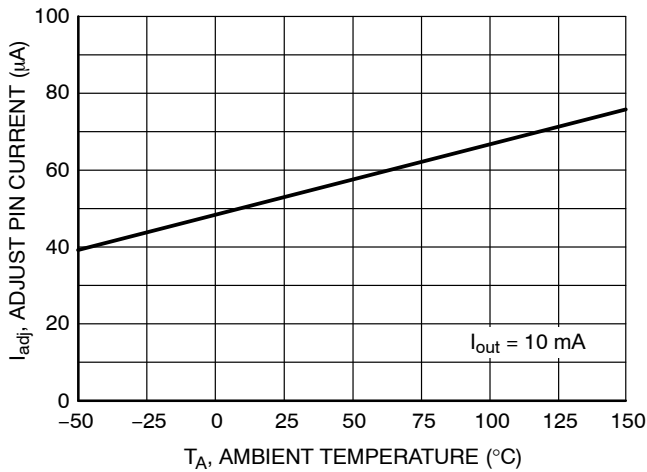


Figure 8. Adjust Pin Current vs. Temperature

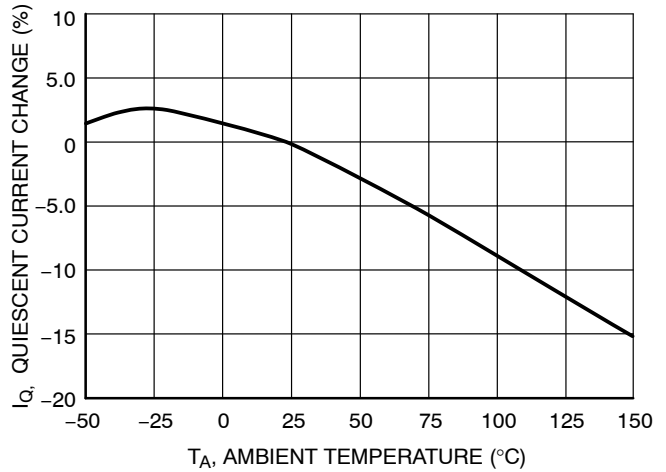


Figure 9. Quiescent Current Change vs. Temperature

NCP1117, NCP1117I, NCV1117

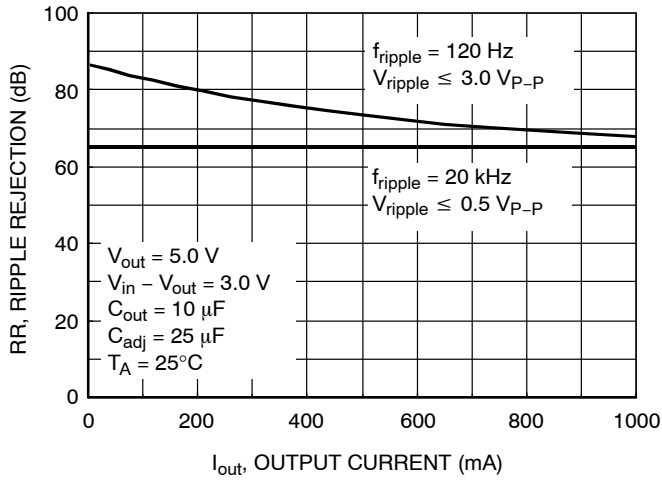


Figure 10. NCP1117XTA Ripple Rejection vs. Output Current

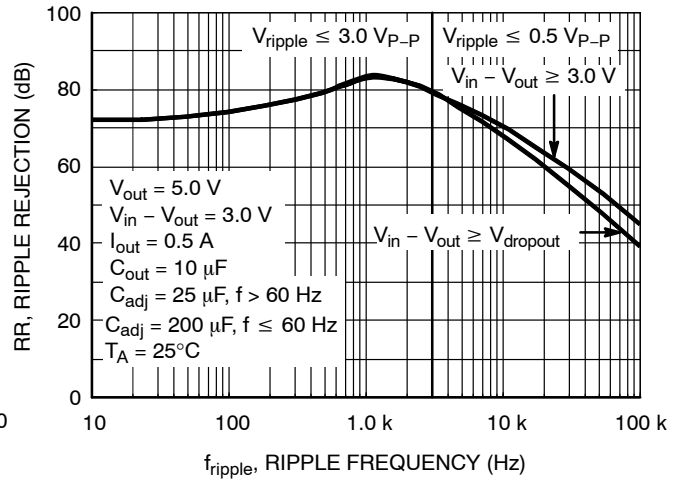


Figure 11. NCP1117XTA Ripple Rejection vs. Frequency

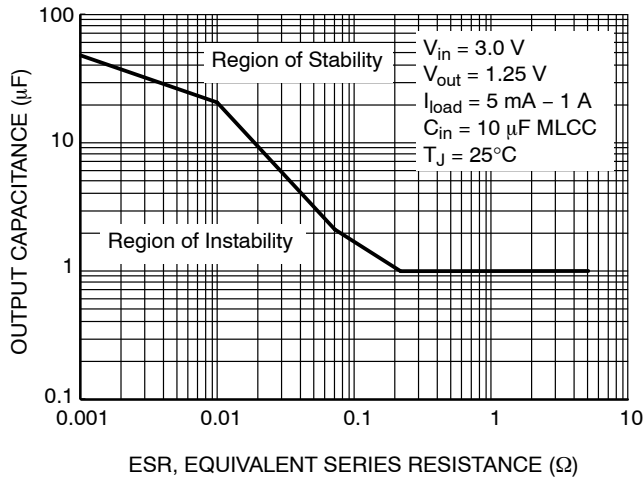


Figure 12. Output Capacitance vs. ESR

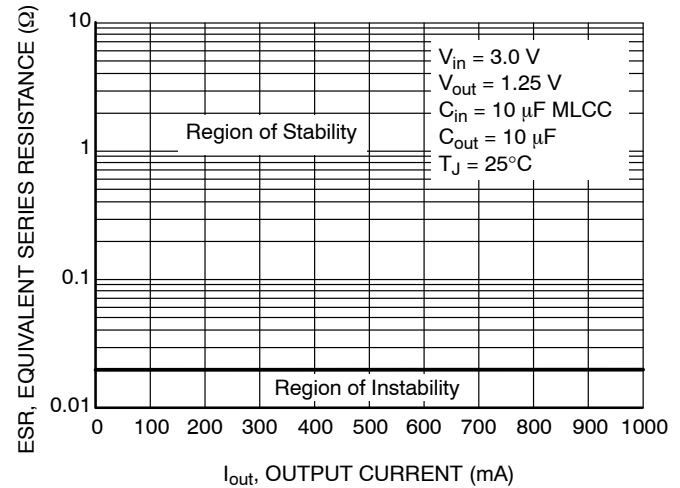


Figure 13. Typical ESR vs. Output Current

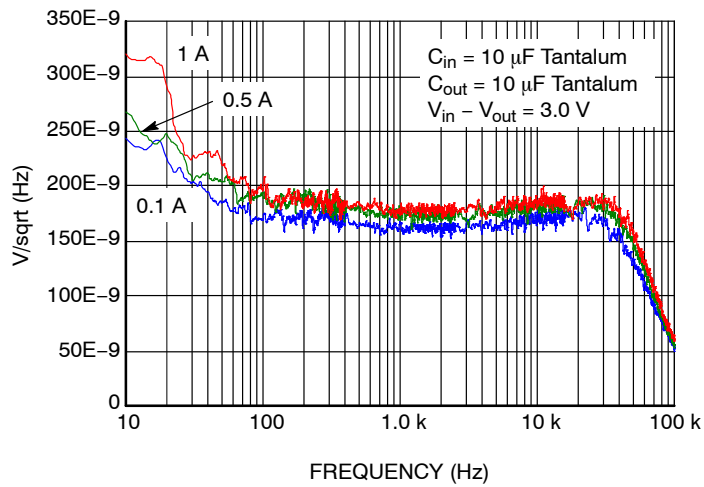
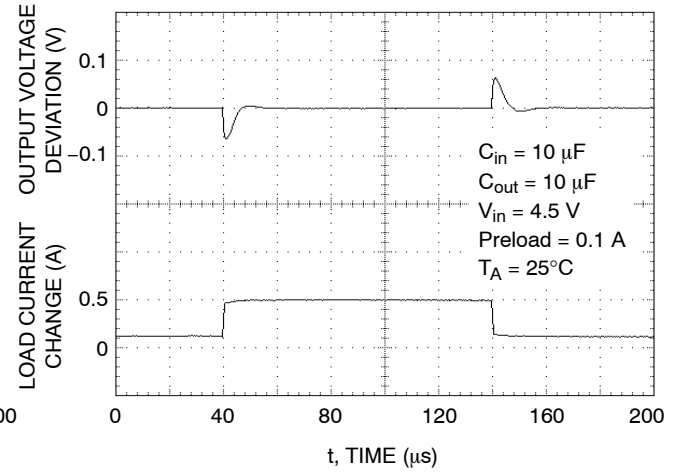


Figure 14. Output Spectral Noise Density vs. Frequency, $V_{out} = 1V5$

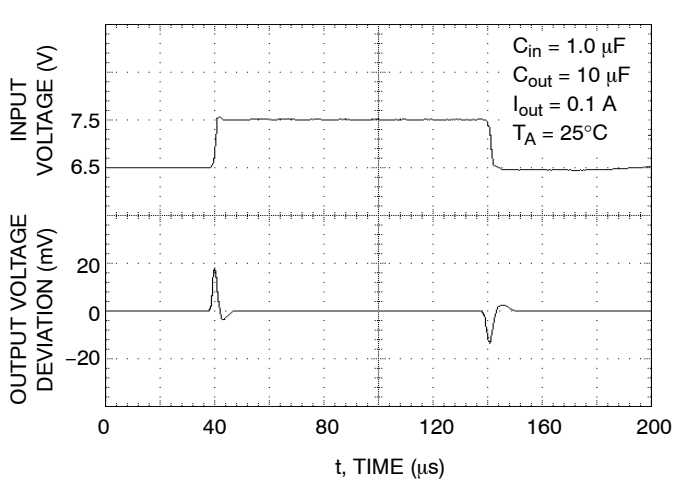
NCP1117, NCP1117I, NCV1117



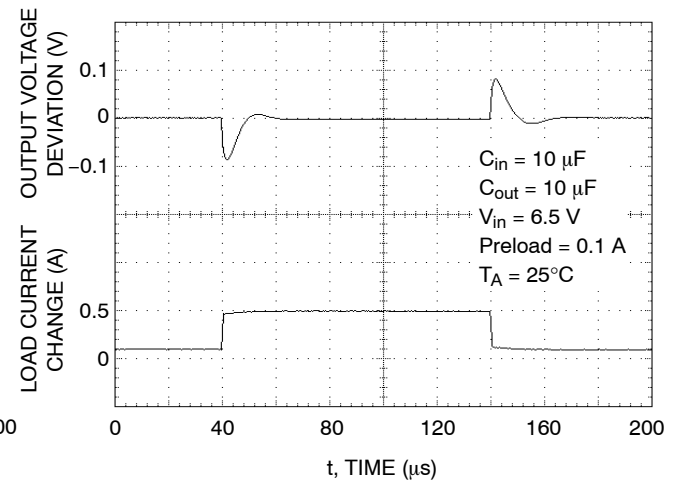
**Figure 15. NCP1117XT285
Line Transient Response**



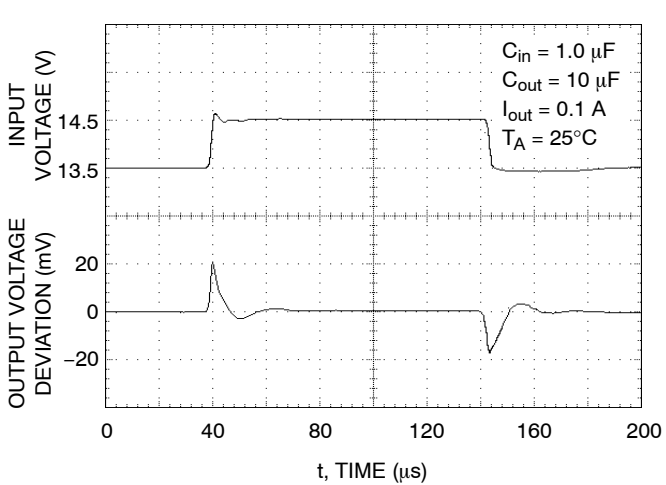
**Figure 16. NCP1117XT285
Load Transient Response**



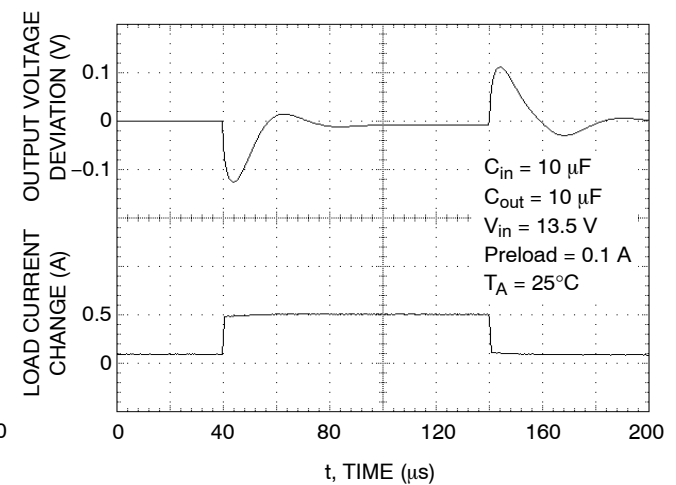
**Figure 17. NCP1117XT50
Line Transient Response**



**Figure 18. NCP1117XT50
Load Transient Response**



**Figure 19. NCP1117XT12 Line
Transient Response**



**Figure 20. NCP1117XT12 Load
Transient Response**

NCP1117, NCP1117I, NCV1117

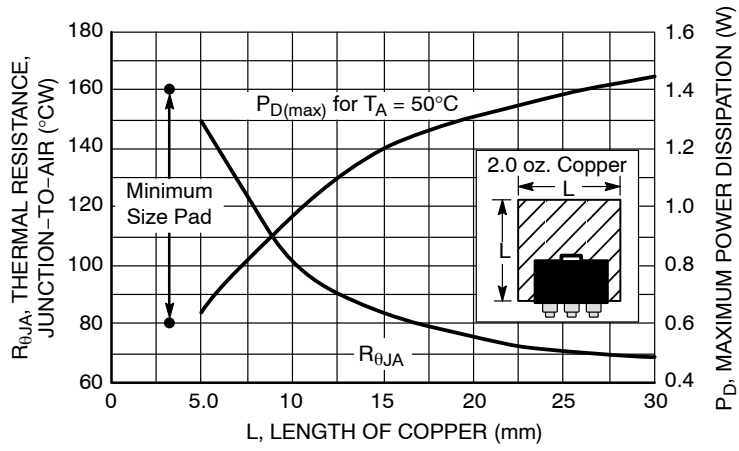


Figure 21. SOT-223 Thermal Resistance and Maximum Power Dissipation vs. P.C.B. Copper Length

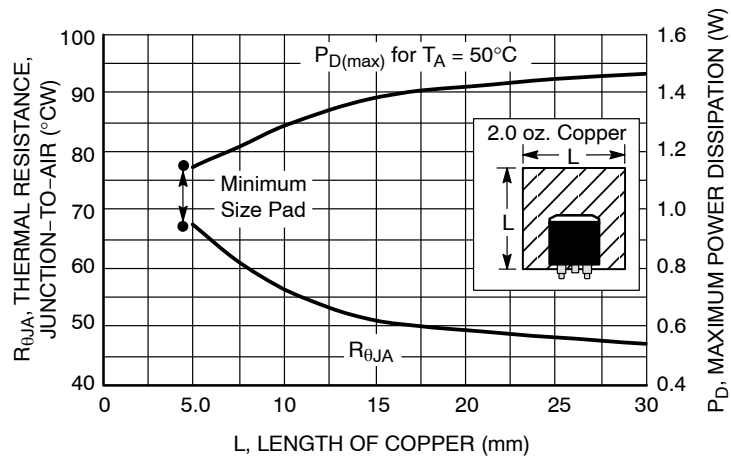


Figure 22. DPAK Thermal Resistance and Maximum Power Dissipation vs. P.C.B. Copper Length

アプリケーション情報

はじめに

NCP1117は、業界標準である従来の可変型3端子レギュレータと比較して、出力電圧の精度と温度安定性を向上させたことに加え、ドロップアウト電圧を大幅に低減させたことを特徴としています。これらのデバイスには出力電流制限、安全動作領域補償、サーマル・シャットダウンなどの保護機能が備わっており、これによって数多くの民生機器用電源および産業機器用電源の設計が容易になります。NCP1117シリーズはこれまでのLM317から派生したデバイス・タイプであり、LM317とピン互換です。

出力電圧

固定出力レギュレータおよび可変出力レギュレータの代表的なアプリケーション回路をFigure 23と24に示します。可変型のデバイスは、フローティング電圧レギュレータです。この回路は、出力ピンと調整ピンの間に公称1.25 Vのリファレンス電圧を発生させ、これを維持します。このリファレンス電圧は抵抗R1によって設定されて定電流源となり、この電流は抵抗R2を通してグラウンドに流れ、出力電圧を設定します。設定される電流レベルは、通常、安定化に必要なとされる最小規定電流5.0 mAよりも大きくなるように選択します。調整ピンの電流I_{adj}は、設定される負荷電流と比べて極めて小さく一定であるため、これによって発生する出力電圧の誤差は小さく、通常は無視できます。固定出力のデバイスについては、R1およびR2はデバイス内部に含まれており、接地電流I_{gnd}は出力電圧に応じて3.0~5.0 mAの範囲で変化します。

外付けコンデンサ

デバイスが電源から数インチ以上離れた場所に設置された場合、レギュレータを安定させるために入力バイパス・コンデンサC_{in}が必要になる可能性があります。このコンデンサは、複雑な入力インピーダンスを通じて電力が供給される場合に回路が過敏に反応するのを抑制し、出力過渡応答を大幅に改善させます。入力バイパス・コンデンサは、できるだけ配線長が短くなるように、レギュレータの入力端子とグラウンド端子の間に直接取り付ける必要があります。10 μFのセラミック・コンデンサまたはタンタル・コンデンサであれば、ほとんどのアプリケーションに対して十分な効果があります。

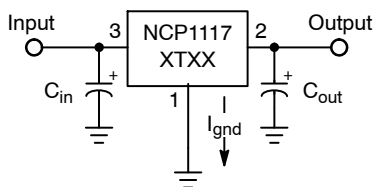
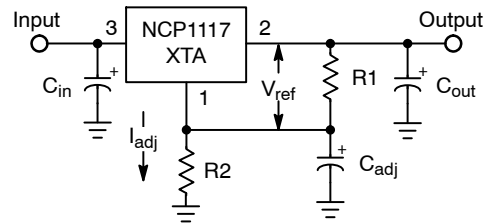


Figure 23. Fixed Output Regulator

コンデンサC_{out}によってレギュレータの周波数補償が行われるため、出力を安定させるには、このコンデンサの使用は必須です。33 mΩ(標準値)~2.2 Ωという制限内の等価直列抵抗(ESR)を持つ、4.7 μFの最小容量値が必要です。Figure 12および13を参照してください。回路の全動作温度範囲において最小容量値とESR制限を満たすことを条件に、セラミック・コンデンサ、タンタル・コンデンサ、またはアルミ電解コンデンサを使用することが可能です。大きな出力容量値を使用することで、ループの安定性と過渡応答が改善し、さらに出力ノイズが低減するという追加効果があります。



$$V_{out} = V_{ref} \left(1 + \frac{R2}{R1} \right) + I_{adj} R2$$

Figure 24. Adjustable Output Regulator

固定型と可変型のデバイスの出力リップルは、リファレンス電圧に対する出力電圧の比率が増加するに従って線形に増加します。例えば、12 Vのレギュレータでは、出力リップルは12 V/1.25 V、すなわち9.6に増加し、リップル除去率はこの比率のlog(常用対数)の20倍、すなわち19.6 dBだけ減少します。リップル除去率の損失(減少)は、バイパス・コンデンサC_{adj}(参照)を追加すると(Figure 24参照)、表に示した値に回復できます。リップル周波数におけるC_{adj}のリアクタンスは、R1の抵抗値よりも低くする必要があります。安定性を維持するために必要な最小負荷電流が流れるようR1の値を選択することができ、その範囲は通常100 Ω~200 Ωです。

$$C_{adj} > \frac{1}{2 \pi \text{fripple} R1}$$

上記の式から、必要な最小容量を計算できます。ACラインからトランスと全波ブリッジを介して電力の供給を受けるアプリケーションでこのデバイスを使用する場合、C_{adj}の値は次のようになります。

$$\text{fripple} = 120 \text{ Hz}, R1 = 120 \Omega, \text{ then } C_{adj} > 11.1 \mu\text{F}$$

入力リップル周波数の高いアプリケーションでは、C_{adj}の値を大幅に小さくします。デバイスをスイッチング・コンバータのポスト・レギュレータとして、以下の条件で使用する場合、値は次のようになります。

$$\text{fripple} = 50 \text{ kHz}, R1 = 120 \Omega, \text{ then } C_{adj} > 0.027 \mu\text{F}$$

Figure 10と11に、適切にバイパスされた調整ピンにより得ることができるリップル除去率のレベルを示します。

保護ダイオード

NCP1117ファミリは、2つの低インピーダンス・ダイオード・パスを内蔵しているため、標準的なレギュレータ・アプリケーションで使用する場合は、通常は保護を必要としません。第1のパスは、 V_{out} と V_{in} の間を接続し、約15 Aのピーク・サージ電流に耐えることができます。通常の V_{in} のサイクルでは、この大きさのサージ電流が発生することはありません。このサージ電流は、 C_{out} が50 μ Fよりも大きく、かつ V_{in} がクローバ回路などによってグランドに短絡した場合にのみ発生し、その場合デバイスを損傷する恐れがあります。そのような条件においてデバイスを保護するには、ダイオードD1が必要になります。第2のパスは、 C_{adj} と V_{out} の間を接続し、約150 mAのピーク・サージ電流に耐えることができます。 C_{adj} が1.0 μ Fよりも大きく、かつ出力がクローバ回路などによってグランドに短絡する場合には、保護ダイオードD2が必要になります。

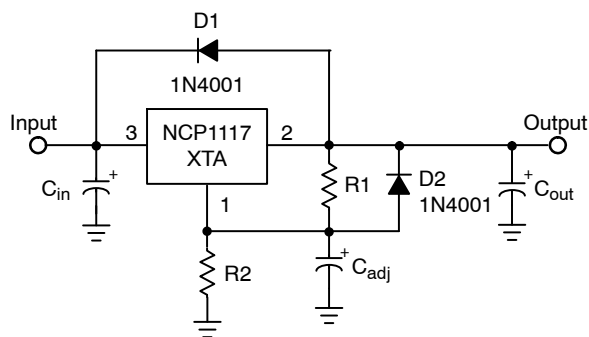


Figure 25. Protection Diode Placement

C_{adj} が50 μ Fよりも大きく、かつ V_{in} がグランドに短絡するような場合には、保護ダイオードD1とD2の組み合わせが必要になる可能性があります。内部ダイオードに対して規定されたピーク電流能力は、接合部温度25°C、100 μ sの場合の値です。これらの値は変動する可能性があるため、参考値として使用してください。

ロード・レギュレーション

NCP1117シリーズは、優れたロード・レギュレーションを提供することができますが、3端子デバイスであるため、離れた負荷を検知する能力は限られています。提供されている最大のロード・レギュレーション性能を引き出すには、満たすべき2つの条件があります。第1の条件は、調整抵抗R1の上側を、できるだけレギュレータ・ケースの近くで接続するという

ものです。これによって、配線抵抗 R_{W+} によって発生する電圧降下が最小化され、R1の両端に印加されるリファレンス電圧に対して直列に生じることを防止できます。第2の条件は、R2のグランド側を負荷に直接接続するというものです。これにより、配線抵抗 R_{W-} で発生する電圧降下をレギュレータが補償する、真のケルビン・センスが可能になります。

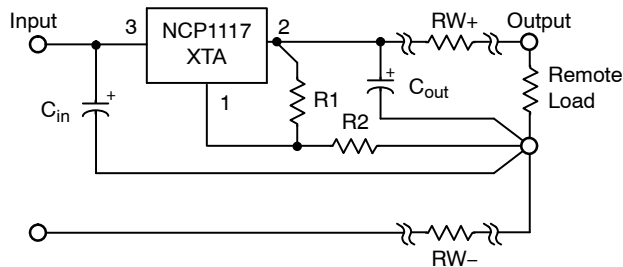


Figure 26. Load Sensing

発熱に対する考慮事項

このシリーズは、最大接合部温度を超えるような事態に備え、レギュレータを保護するために設計された熱制限回路を内蔵しています。この回路が175°C (標準値)でアクティブになると、レギュレータの出力はオフになり、ダイ温度が下がるとオンに戻ります。その結果、過熱状態でデバイスが動作し続けると、出力が発振しているように見えます。この機能は、思わぬ過熱によって起きる致命的な故障から保護するためのものです。適切なヒートシンクの代わりに使用するためのものではありません。デバイスの最大消費電力は、次式より計算できます。

$$P_D = \frac{T_{J(max)} - T_A}{R_{\theta JA}}$$

デバイスは、表面実装のSOT-223パッケージおよびDPAKパッケージで供給されます。各パッケージには、プリント基板の銅箔を放熱器として利用することで接合部-大気間熱抵抗($R_{\theta JA}$)を小さくするように特別に設計された、露出した金属タブがあります。Figure 21と22に、2.0オンスの銅箔を使用した経済的な片面基板で、正方形パターンから得られる $R_{\theta JA}$ の標準値を示します。受け入れ可能な性能と信頼性を保証するために、最終製品の熱制限を試験および定量化する必要があります。実際の $R_{\theta JA}$ は、グラフに示した値とは大きく異なる可能性があります。これは、最終レイアウトにおける銅箔の縦横比、隣接する熱源、通気などの違いによるものです。

NCP1117, NCP1117I, NCV1117



Figure 27. Constant Current Regulator



Figure 28. Slow Turn-On Regulator



Figure 29. Regulator with Shutdown



Resistor R2 sets the maximum output voltage. Each transistor reduces the output voltage when turned on.

Figure 30. Digitally Controlled Regulator



The 50 Ω resistor that is in series with the ground pin of the upper regulator level shifts its output 300 mV higher than the lower regulator. This keeps the lower regulator off until the input source is removed.

Figure 31. Battery Backed-Up Power Supply

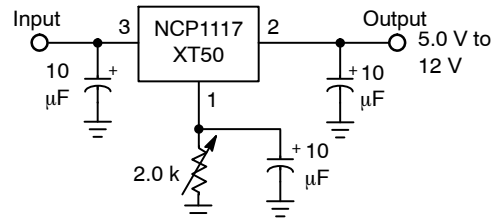


Figure 32. Adjusting Output of Fixed Voltage Regulators

NCP1117, NCP1117I, NCV1117

ORDERING INFORMATION – (NCP1117)

Device	Nominal Output Voltage	Package	Shipping [†]
NCP1117STAT3G	Adjustable	SOT-223 (Pb-Free)	4000 / Tape & Reel
NCP1117ST15T3G	1.5		
NCP1117ST18T3G	1.8		
NCP1117ST20T3G	2.0		
NCP1117ST25T3G	2.5		
NCP1117ST33T3G	3.3		
NCP1117ST50T3G	5.0		
NCP1117ST12T3G	12		
NCP1117DTAG	Adjustable	DPAK (Pb-Free)	75 Units / Rail
NCP1117DTARKG	Adjustable		2500 / Tape & Reel
NCP1117DTAT5G	Adjustable		2500 / Tape & Reel
NCP1117DT15G	1.5		75 Units / Rail
NCP1117DT15RKG	1.5		2500 / Tape & Reel
NCP1117DT18G	1.8		75 Units / Rail
NCP1117DT18RKG	1.8		2500 / Tape & Reel
NCP1117DT18T5G	1.8		2500 / Tape & Reel
NCP1117DT19RKG	1.9		2500 / Tape & Reel
NCP1117DT20G	2.0		75 Units / Rail
NCP1117DT20RKG	2.0		2500 / Tape & Reel
NCP1117DT25G	2.5		75 Units / Rail
NCP1117DT25RKG	2.5		2500 / Tape & Reel
NCP1117DT25T5G	2.5		2500 / Tape & Reel
NCP1117DT285G	2.85		75 Units / Rail
NCP1117DT285RKG	2.85		2500 / Tape & Reel
NCP1117DT33G	3.3		75 Units / Rail
NCP1117DT33RKG	3.3		2500 / Tape & Reel
NCP1117DT33T5G	3.3		2500 / Tape & Reel
NCP1117DT50G	5.0		75 Units / Rail
NCP1117DT50RKG	5.0	2500 / Tape & Reel	
NCP1117DT12G	12	75 Units / Rail	
NCP1117DT12RKG	12	2500 / Tape & Reel	

†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.

ORDERING INFORMATION – (NCP1117I)

Device	Nominal Output Voltage	Package	Shipping [†]
NCP1117I STAT3G	Adjustable	SOT-223 (Pb-Free)	4000 / Tape & Reel
NCP1117I ST18T3G	1.8		
NCP1117I ST33T3G	3.3		
NCP1117I ST50T3G	5.0		
NCP1117I DTAT4G	Adjustable	DPAK (Pb-Free)	2500 / Tape & Reel
NCP1117I DT33T4G	3.3		
NCP1117I DT50T4G	5.0		

†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.

NCP1117, NCP1117I, NCV1117

ORDERING INFORMATION – (NCV1117)

Device	Nominal Output Voltage	Package	Shipping [†]
NCV1117STAT3G*	Adjustable	SOT-223 (Pb-Free)	4000 / Tape & Reel
NCV1117ST15T3G*	1.5		
NCV1117ST18T3G*	1.8		
NCV1117ST20T3G*	2.0		
NCV1117ST25T3G*	2.5		
NCV1117ST33T3G*	3.3		
NCV1117ST50T3G*	5.0		
NCV1117ST12T3G*	12		
NCV1117DTARKG*	Adjustable	DPAK (Pb-Free)	2500 / Tape & Reel
NCV1117DT15RKG*	1.5		
NCV1117DT18RKG*	1.8		
NCV1117DT18T5G*	1.8		
NCV1117DT20RKG*	2.0		
NCV1117DT25RKG*	2.5		
NCV1117DT33T4G*	3.3		
NCV1117DT33T5G*	3.3		
NCV1117DT50RKG*	5.0		
NCV1117DT12RKG*	12		

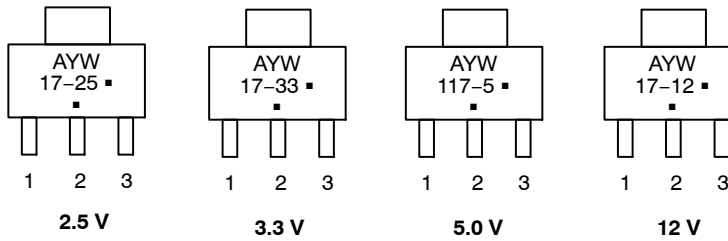
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable

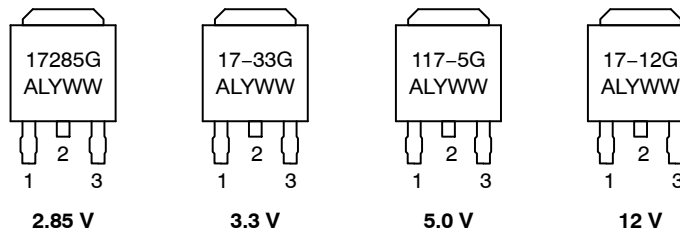
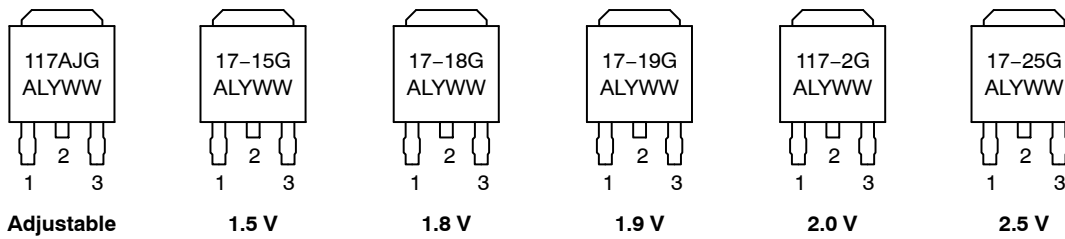
NCP1117, NCP1117I, NCV1117

MARKING DIAGRAMS – NCP1117

SOT-223 ST SUFFIX CASE 318H



DPAK DT SUFFIX CASE 369C

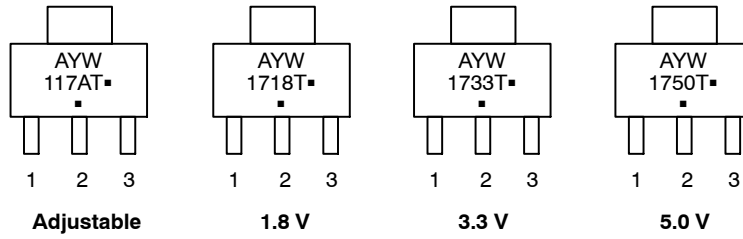


A = Assembly Location
 L = Wafer Lot
 Y = Year
 WW, W = Work Week
 ■ or G = Pb-Free Package
 (Note: Microdot may be in either location)

NCP1117, NCP1117I, NCV1117

MARKING DIAGRAMS – NCP1117I

SOT-223
ST SUFFIX
CASE 318H



DPAK
DT SUFFIX
CASE 369C



A = Assembly Location

L = Wafer Lot

Y = Year

WW, W = Work Week

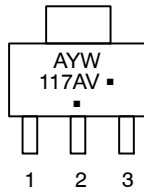
▪ or G = Pb-Free Package

(Note: Microdot may be in either location)

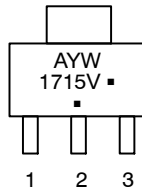
NCP1117, NCP1117I, NCV1117

MARKING DIAGRAMS – NCV1117

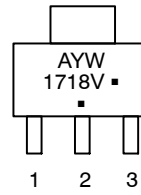
SOT-223 ST SUFFIX CASE 318H



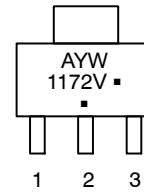
Adjustable



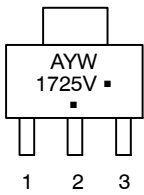
1.5 V



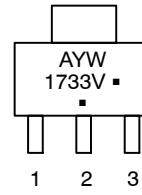
1.8 V



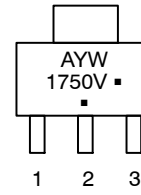
2.0 V



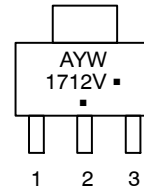
2.5 V



3.3 V



5.0 V

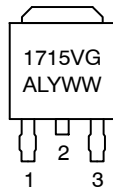


12 V

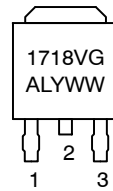
DPAK DT SUFFIX CASE 369C



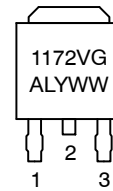
Adjustable



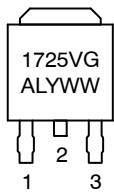
1.5 V



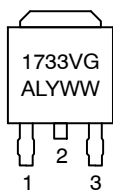
1.8 V



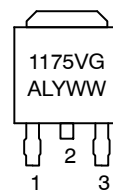
2.0 V



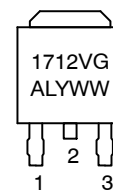
2.5 V



3.3 V



5.0 V



12 V

A = Assembly Location

L = Wafer Lot

Y = Year

WW, W = Work Week

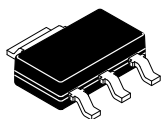
▪ or G = Pb-Free Package

(Note: Microdot may be in either location)

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

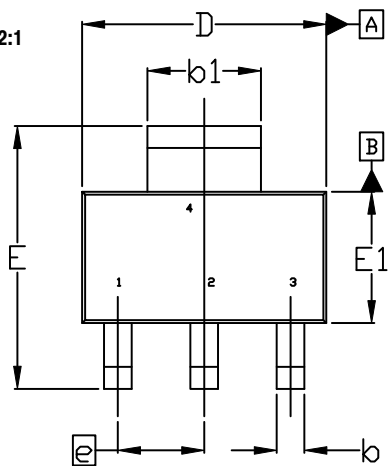
ON Semiconductor®



SOT-223
CASE 318H
ISSUE B

DATE 13 MAY 2020

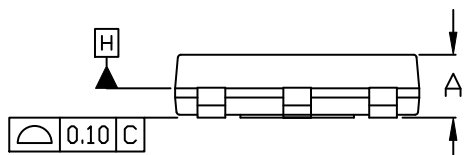
SCALE 2:1



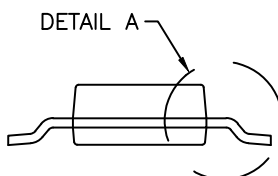
TOP VIEW

$\Phi 0.10 \text{ (M)}$ C A B

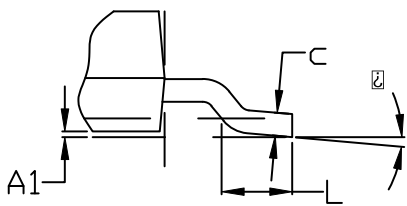
NOTE 7



SIDE VIEW



END VIEW

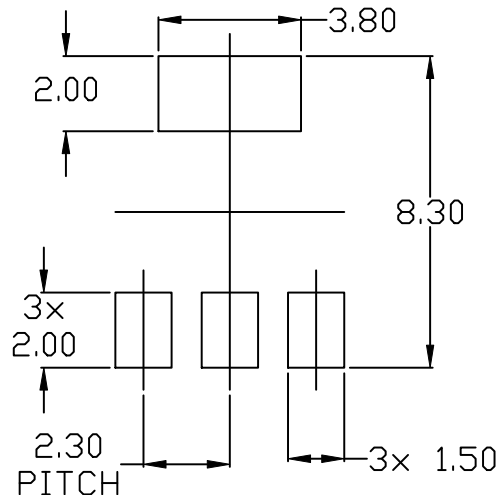


DETAIL A

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS D & E1 ARE DETERMINED AT DATUM H. DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. SHALL NOT EXCEED 0.23mm PER SIDE.
4. LEAD DIMENSIONS b AND b1 DO NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION IS 0.08mm PER SIDE.
5. DATUMS A AND B ARE DETERMINED AT DATUM H.
6. A1 IS DEFINED AS THE VERTICAL DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT OF THE PACKAGE BODY.
7. POSITIONAL TOLERANCE APPLIES TO DIMENSIONS b AND b1.

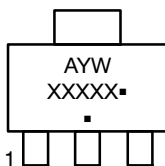
DIM	MILLIMETERS		
	MIN.	NDM.	MAX.
A	---	---	1.80
A1	0.02	0.06	0.11
b	0.60	0.74	0.88
b1	2.90	3.00	3.10
c	0.24	---	0.35
D	6.30	6.50	6.70
E	6.70	7.00	7.30
E1	3.30	3.50	3.70
e	2.30 BSC		
L	0.25	---	---
\square	0°	---	10°



RECOMMENDED MOUNTING FOOTPRINT

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

GENERIC MARKING DIAGRAM*



- A = Assembly Location
- Y = Year
- W = Work Week
- XXXXX = Specific Device Code
- = Pb-Free Package

(Note: Microdot may be in either location)

*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. Some products may not follow the Generic Marking.

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DESCRIPTION:	SOT-223	PAGE 1 OF 1

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MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

ON Semiconductor®



SCALE 1:1

DPAK (SINGLE GAUGE)

CASE 369C

ISSUE F

DATE 21 JUL 2015

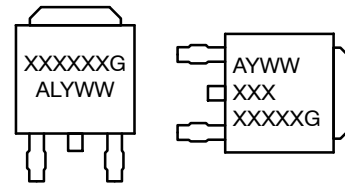


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
5. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
6. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.
7. OPTIONAL MOLD FEATURE.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.086	0.094	2.18	2.38
A1	0.000	0.005	0.00	0.13
b	0.025	0.035	0.63	0.89
b2	0.028	0.045	0.72	1.14
b3	0.180	0.215	4.57	5.46
c	0.018	0.024	0.46	0.61
c2	0.018	0.024	0.46	0.61
D	0.235	0.245	5.97	6.22
E	0.250	0.265	6.35	6.73
e	0.090 BSC		2.29 BSC	
H	0.370	0.410	9.40	10.41
L	0.055	0.070	1.40	1.78
L1	0.114 REF		2.90 REF	
L2	0.020 BSC		0.51 BSC	
L3	0.035	0.050	0.89	1.27
L4	---	0.040	---	1.01
Z	0.155	---	3.93	---

GENERIC MARKING DIAGRAM*



IC

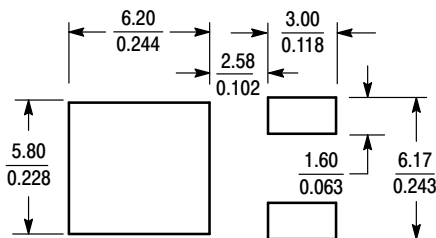
Discrete

- XXXXXX = Device Code
- A = Assembly Location
- L = Wafer Lot
- Y = Year
- WW = Work Week
- G = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking.

- | | | | | |
|--|--|---|---|--|
| <p>STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR</p> | <p>STYLE 2:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN</p> | <p>STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE</p> | <p>STYLE 4:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE</p> | <p>STYLE 5:
PIN 1. GATE
2. ANODE
3. CATHODE
4. ANODE</p> |
| <p>STYLE 6:
PIN 1. MT1
2. MT2
3. GATE
4. MT2</p> | <p>STYLE 7:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR</p> | <p>STYLE 8:
PIN 1. N/C
2. CATHODE
3. ANODE
4. CATHODE</p> | <p>STYLE 9:
PIN 1. ANODE
2. CATHODE
3. RESISTOR ADJUST
4. CATHODE</p> | <p>STYLE 10:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. ANODE</p> |

SOLDERING FOOTPRINT*



SCALE 3:1 (mm / inches)

*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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