Linear Regulator - Dual Output, Low Dropout

250 mA

NCP5504, NCV5504

The NCP5504/NCV5504 are dual output low dropout linear regulators with ±2.0% accuracy over the operating temperature range. They feature a fixed output voltage of 3.3 V (contact factory for other fixed output voltage options) and an adjustable output that ranges from 1.25 V to 5.0 V. It is available in a 5 pin DPAK Pb−Free package.

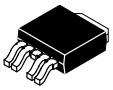
The NCP5504/NCV5504 employs an architecture that offers low noise without a bypass capacitor for the fixed output. This device along with a ripple rejection of 75 dB and a dropout of 250 mV @ 250 mA, suits post−regulation and power sensitive battery−operated applications.

Features

- One Fixed and One Adjustable Output Pin
- 250 mA Each Output
- Adjustable Output Voltage from 1.25 V to 5.0 V
- Low Dropout Voltage of 250 mV typical at 250 mA
- Low Quiescent Current of 370 μA typical
- Ripple Rejection of 75 dB
- Temperature Range of NCP5504 −25°C to +85°C
  Temperature Range of NCV5504 −40°C to +125°C
- Low Noise Without Bypass Capacitor; 90 μVrms
- Line Regulation < 15 mV
- Load Regulation; V_{out1} < 15 mV, V_{out2} < 10 mV
- Accuracy of ±2% Overtemperature Range
- Thermal Protection and Current Limit
- Short Circuit Protection
- NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q100 Qualified and PPAP Capable
- These are Pb−Free Devices

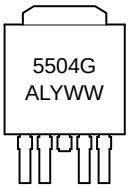
Typical Applications

- Audio Visual Equipment
- Battery Powered Consumer Products
- Instrumentation
- Computing and Networking Applications
- Automotive Electronics



DPAK−5
DT SUFFIX
CASE 175AA

MARKING DIAGRAM



Pin 1. Adjust for V_{out}
2. V_{out2}
3. GND
4. V_{in}
5. V_{out1}

A	= Assembly Location
L	= Wafer Lot
Y	= Year
WW	= Work Week
G	= Pb−Free Package

ORDERING INFORMATION

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

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 9.

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PIN FUNCTION DESCRIPTION

Pin No.	Pin Name	Description
1	Adjust for V_{out2}	This pin is connected to the resistor divider on the output. For a 1.25 V output, connect directly to the V_{out2} pin.
2	V_{out2}	Adjustable Regulated Output Voltage.
3	GND	Power Supply Ground
4	V_{in}	Positive Power Supply Input Voltage.
5	V_{out1}	Fixed Regulated Output Voltage. See selector guide for options.

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Input Voltage	V_{in}	18	V
Operating Input Voltage for Power Considerations	V_{in}	9.0	V
Output Pin Voltage	V_{out}	−0.3 to V_{in} +0.3	V
Adjust Pin Voltage	V_{adj}	−0.3 to V_{in} +0.3	V
Maximum Junction Temperature NCP5504 NCV5504	T_J	 125 150	°C
Operating Ambient Temperature NCP5504 NCV5504	T_A	 −25°C to +85°C −40°C to +125°C	°C
Package Thermal Resistance Thermal Resistance, Junction−to−Air Thermal Resistance, Junction−to−Case	 $R_{\theta JA}$ $R_{\theta JC}$	 100 8	°C/W
Storage Temperature Range	T_{stg}	−55 to +150	°C
Electrostatic Discharge Sensitivity Human Body Model (HBM) Machine Model (MM) Charge Device Model (CDM)	ESD	 2000 200 2000	V
Latchup Performance (JESD78) Positive Negative	$I_{Latchup}$	 100 100	mA

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.

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NCP5504 ELECTRICAL CHARACTERISTICS

(V_{in} = V_{out} + 1.0 V, where V_{out} is the larger of V_{out1} or V_{out2}, T_A = 25°C, unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage NCP5504 (T_A = −25°C to 85°C), I_O = 250 mA V_{out1} V_{out2}	V_{out}	 −2% −2%	 3.30 1.25	 +2% +2%	V
Adjustable Pin Current	I_{adj}	−	50	100	nA
Line Regulation (V_{out} + 1.0 V < V_{in} < 7.0 V), I_O = 250 mA	Reg_{line}	−	5	15	mV
Load Regulation (1.0 mA < I_O< 250 mA) for V_{out1} Load Regulation (1.0 mA < I_O < 250 mA) for V_{out2}	Reg_{load}	−	10 5	15 10	mV mV
Dropout Voltage (I_O = 250 mA)	V_{DO}	−	250	400	mV
Ripple Rejection Ratio (I_O = 250 mA) 120 Hz 1 kHz	RR	 − −	 75 60	 − −	dB
Quiescent Current (I_{O1}, I_{O2} = 0 mA)	I_q	−	370	450	μA
Fixed Output Noise Voltage (10 Hz − 100 kHz V_{out} = 3.3 V, I_O = 100 mA, C_O = 1.0 μF)	V_n	−	90	−	μVrms
Ground Current (I_{O1}, I_{O2} = 250 mA)	I_{gnd}	−	10	20	mA
Thermal Shutdown (Guaranteed by design)	T_{Jmax}	150	165	−	°C
Current Limit on V_{out1} and V_{out2}	I_{lim}	350	450	−	mA

NCV5504 ELECTRICAL CHARACTERISTICS

(V_{in} = V_{out} + 1.0 V, where V_{out} is the larger of V_{out1} or V_{out2}, −40°C ≤ T_J ≤ 150°C, −40°C ≤ T_A ≤ 125°C, unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage NCV5504, I_O = 250 mA V_{out1} V_{out2}	V_{out}	 −2% −2%	 3.30 1.25	 +2% +2%	V
Adjustable Pin Current	I_{adj}	−	50	100	nA
Line Regulation (V_{out} + 1.0 V < V_{in} < 7.0 V), I_O = 250 mA	Reg_{line}	−	5	15	mV
Load Regulation (1.0 mA < I_O< 250 mA) for V_{out1} Load Regulation (1.0 mA < I_O < 250 mA) for V_{out2}	Reg_{load}	−	10 5	15 10	mV mV
Dropout Voltage (I_O = 250 mA)	V_{DO}	−	250	400	mV
Ripple Rejection Ratio (I_O = 250 mA) 120 Hz 1 kHz	RR	 − −	 75 60	 − −	dB
Quiescent Current (I_{O1}, I_{O2} = 0 mA)	I_q	−	370	450	μA
Fixed Output Noise Voltage (10 Hz − 100 kHz V_{out} = 3.3 V, I_O = 100 mA, C_O = 1.0 μF)	V_n	−	90	−	μVrms
Ground Current (I_{O1}, I_{O2} = 250 mA)	I_{gnd}	−	10	20	mA
Thermal Shutdown (Guaranteed by design)	T_{Jmax}	150	165	−	°C
Current Limit on V_{out1} and V_{out2}	I_{lim}	320	450	−	mA

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.

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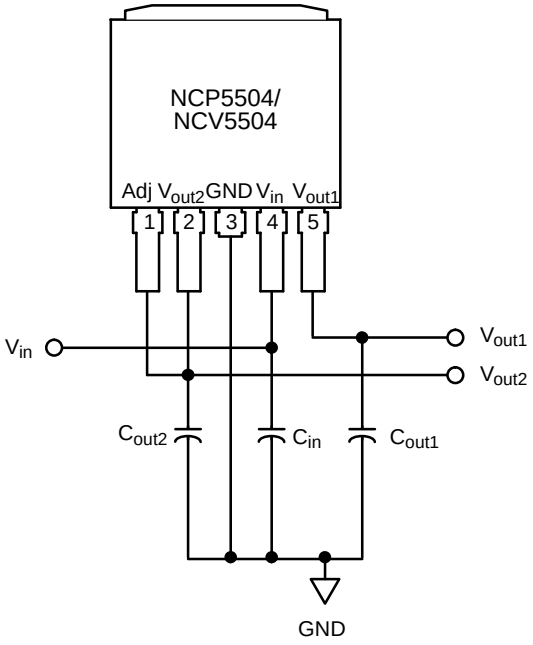


Figure 1. Application Schematic, Fixed Output Version. V_{out1} = 3.3 V, V_{out2} = 1.25 V

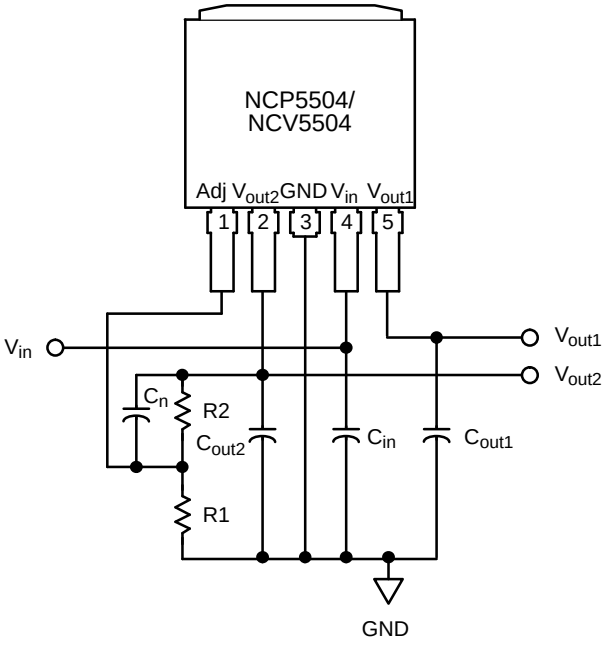


Figure 2. Application Schematic, Adjustable Version. V_{out1} = 3.3 V, V_{out2} = 1.25 V to 5.0 V, Where V_{out2} = 1.25 V * (1+R2/R1)

NOTE: Please note that in order to maintain high accuracy on the adjustable output (V_{out2}), use R1 values < 30 kΩ in the resistor divider. The recommended capacitor type and values are as follows:

C_{in} (Tantalum or Aluminum Electrolytic) = 4.7 μF to 100 μF
C_{out1}, C_{out2} = Low ESR, 1.0 μF to 22 μF
C_n = 200 pF to 1.0 nF.

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TYPICAL CHARACTERISTICS

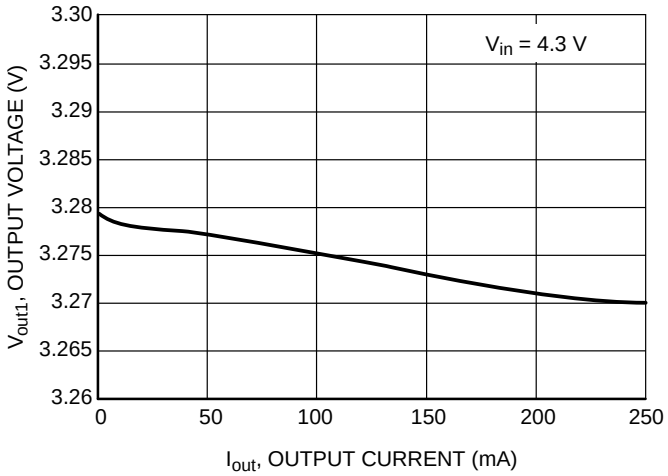


Figure 3. Output Voltage vs. Output Load Current for V_{out1}

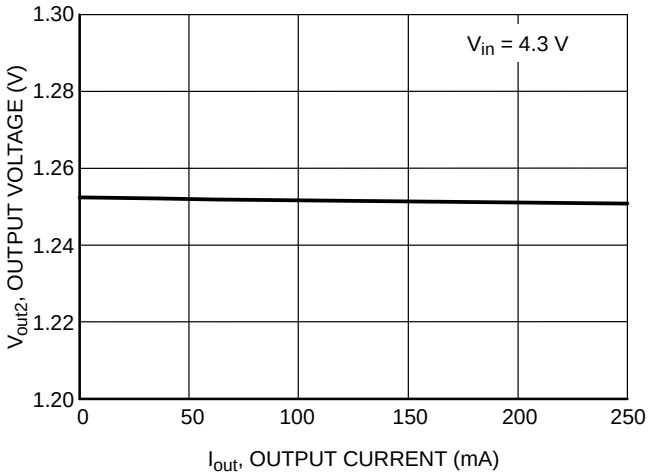


Figure 4. Output Voltage vs. Output Load Current for V_{out2}

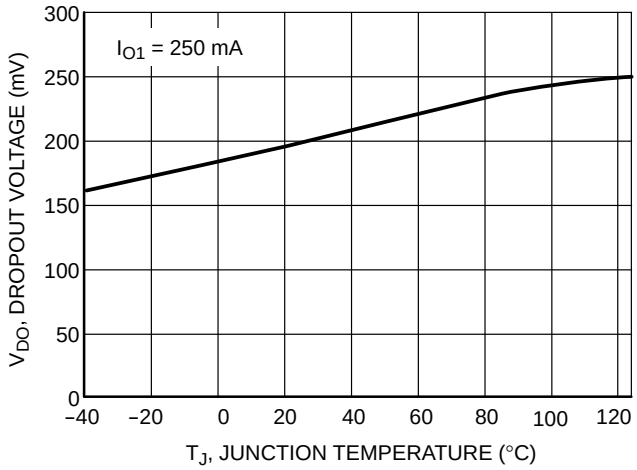


Figure 5. Dropout Voltage vs. Temperature for V_{out1}

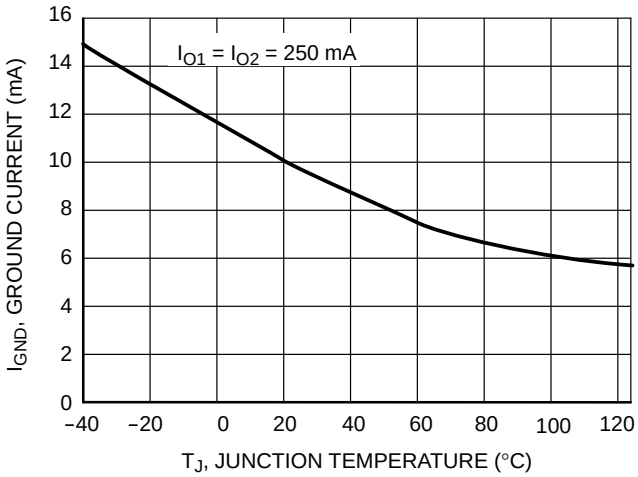


Figure 6. Ground Current vs. Temperature

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TYPICAL CHARACTERISTICS

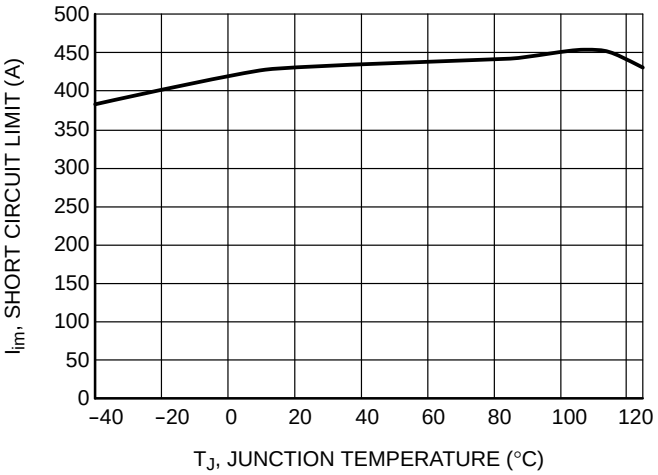


Figure 7. Short Circuit Current Limit vs. Temperature for V_{out1}

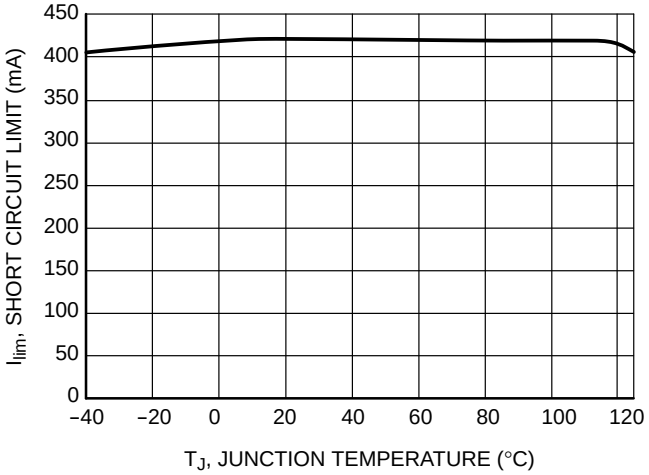


Figure 8. Short Circuit Current Limit vs. Temperature for V_{out2}

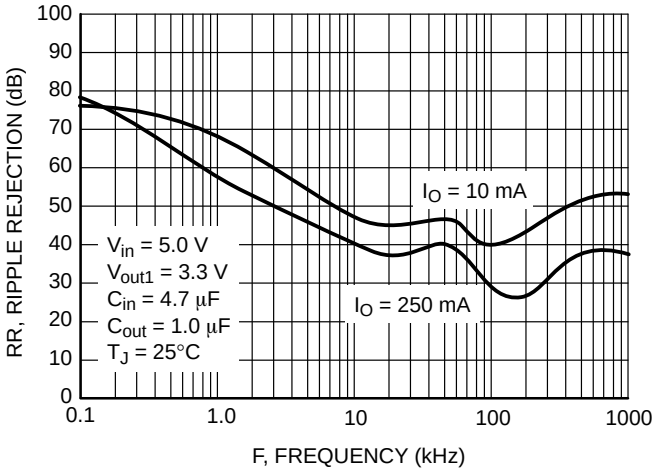


Figure 9. Ripple Rejection vs. Frequency for V_{out1}

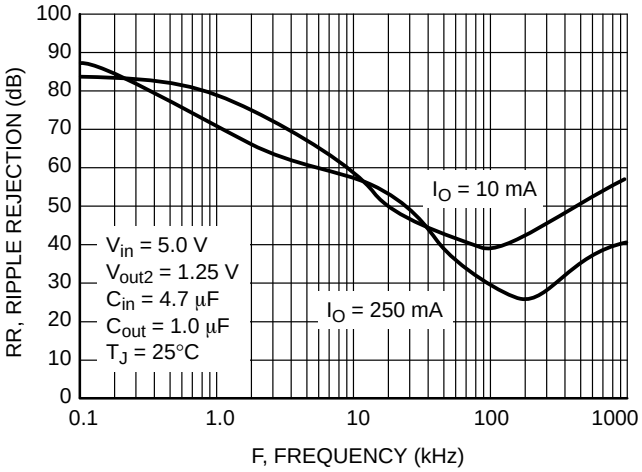


Figure 10. Ripple Rejection vs. Frequency for V_{out2}

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TYPICAL CHARACTERISTICS

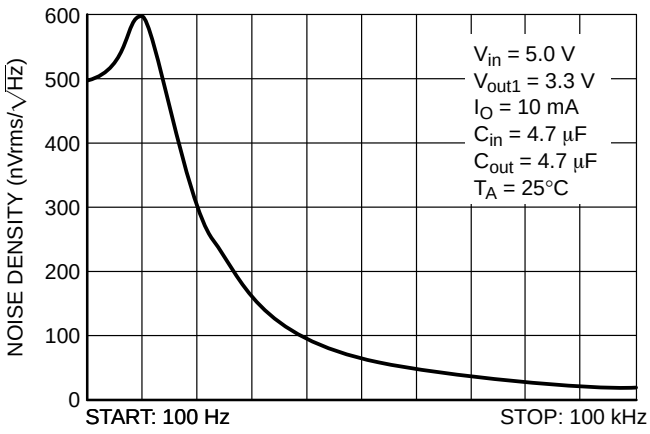


Figure 11. Noise Density vs. Frequency

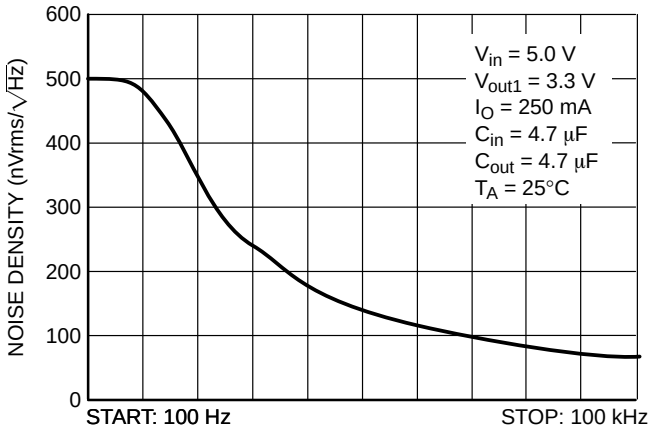


Figure 12. Noise Density vs. Frequency

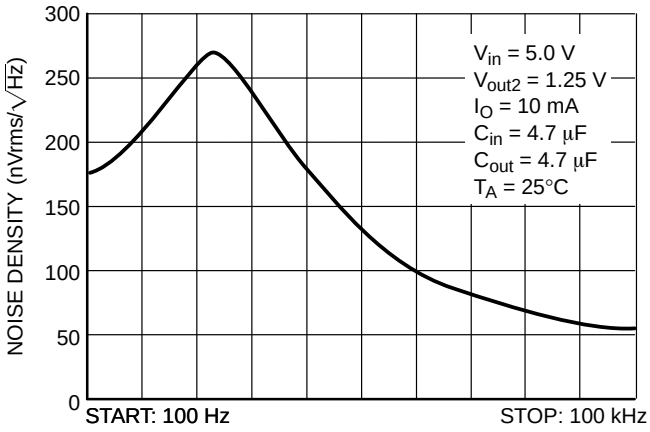


Figure 13. Noise Density vs. Frequency

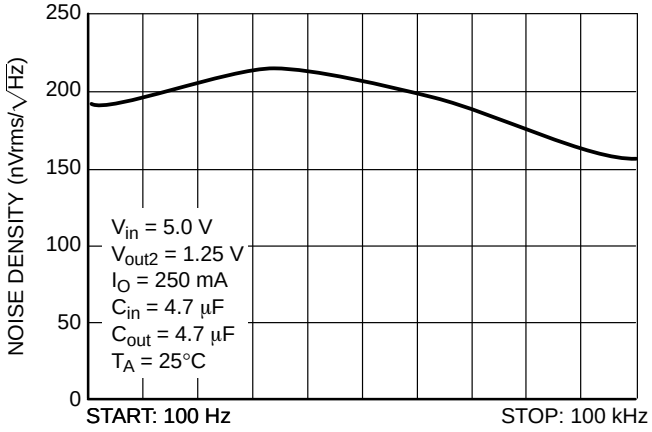


Figure 14. Noise Density vs. Frequency

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TYPICAL CHARACTERISTICS

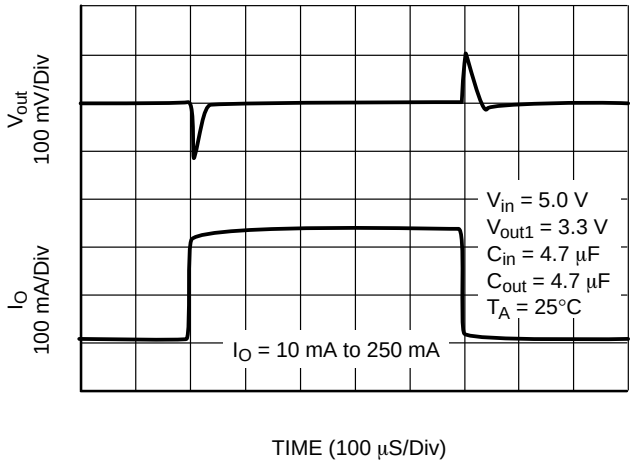


Figure 15. Load Transient Response for V_{out1}

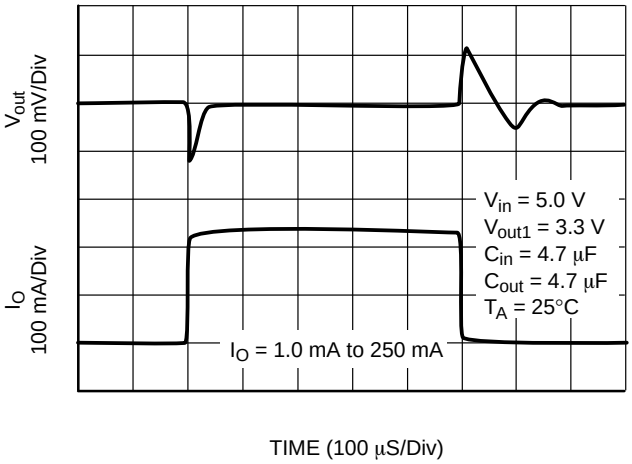


Figure 16. Load Transient Response for V_{out1}

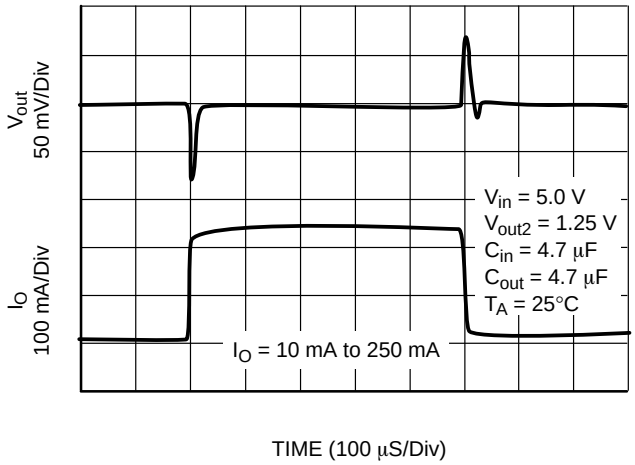


Figure 17. Load Transient Response for V_{out2}

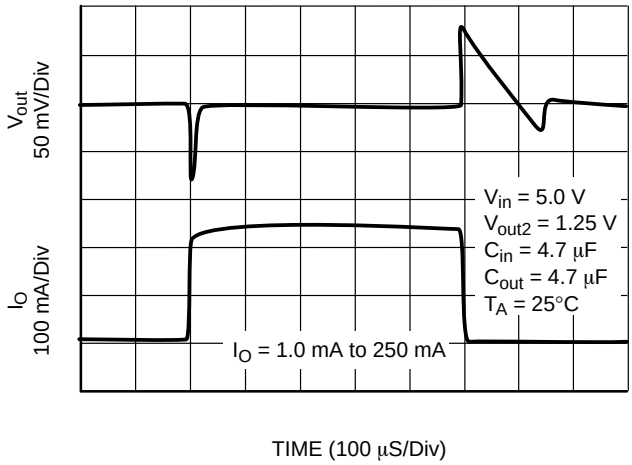


Figure 18. Load Transient Response for V_{out2}

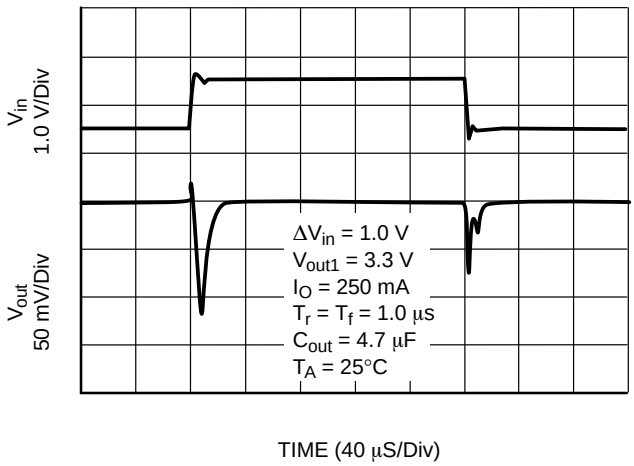


Figure 19. Line Transient Response for V_{out1}

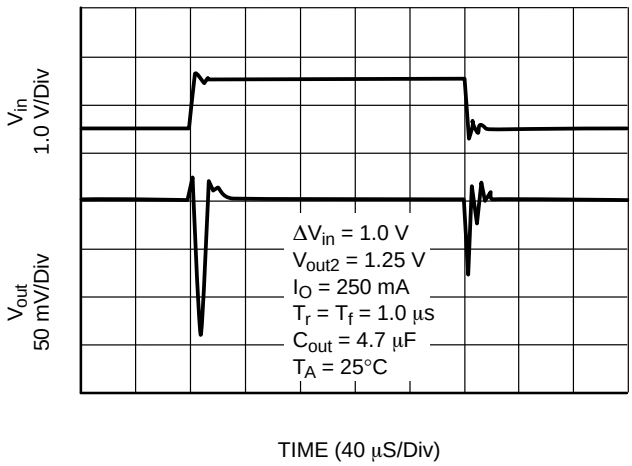


Figure 20. Line Transient Response for V_{out2}

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APPLICATION INFORMATION

Introduction

The NCP5504/NCV5504 are high performance dual output, 250 mA linear regulators suitable for post regulation and power sensitive battery−operated applications. They feature ±2.0% accuracy over the operating temperature range. With one fixed output voltage at 3.3 V, and one adjustable output voltage ranging from 1.25 V to 5.0 V, the dropout voltage is 250 mV typical. Additional features, such as an architecture that allows for low noise on the fixed output without a bypass capacitor, provides for an attractive LDO solution for audio visual equipment, instrumentation, computing and networking applications, and automotive electronics. It is thermally robust and is offered in a 5 pin DPAK Pb−Free package.

Capacitor Selection

The recommended input capacitor types are tantalum and aluminum electrolytic ranging from 4.7 μF to 100 μF. It is especially required if the power source is located more than a few inches from the NCP5504/NCV5504. This capacitor will reduce device sensitivity and enhance the output transient response time. The PCB layout is very important and in order to obtain the optimal solution, the V_{in} and GND traces should be sufficiently wide to minimize noise and unstable operation.

For the adjustable output pin, C_n ranges from 200 pF and 1.0 nF.

The output capacitor range is between 1.0 μF and 22 μF. For PCB layout considerations, place the capacitor close to the output pin and keep the leads short.

Adjustable Output Operation

The application circuit for the adjustable output version is shown in Figure 2. V_{out2} is calculated based on the following equation:

$$V_{out2} = 1.25\ V * \left(1 + \frac{R2}{R1}\right)$$

In order to maintain high accuracy on the adjustable output, R1 values should be < 30 kΩ.

ORDERING INFORMATION

Device	Package	Shipping†
NCV5504DTRKG*	DPAK (Pb−Free)	2500 / Tape and Reel

DISCONTINUED (Note 1)

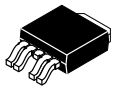
NCP5504DTRKG	DPAK (Pb−Free)	2500 / Tape and Reel

†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.

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

1. **DISCONTINUED:** This device is not recommended for new design. Please contact your **onsemi** representative for information. The most current information on this device may be available on www.onsemi.com.

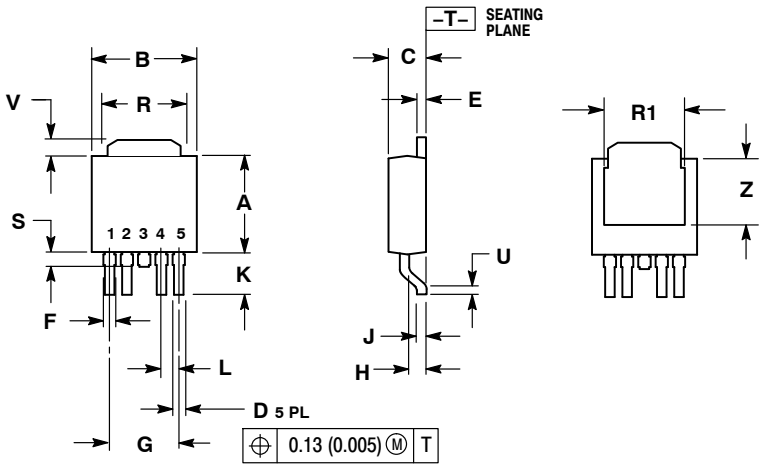
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SCALE 1:1

DPAK−5, CENTER LEAD CROP
CASE 175AA
ISSUE B

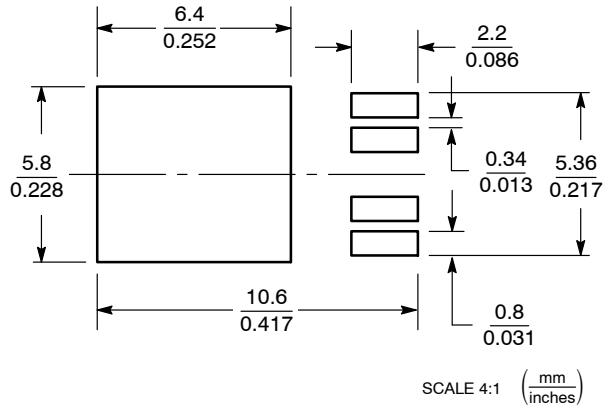
DATE 15 MAY 2014



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

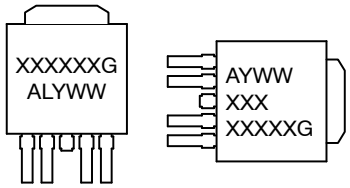
	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.235	0.245	5.97	6.22
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.020	0.028	0.51	0.71
E	0.018	0.023	0.46	0.58
F	0.024	0.032	0.61	0.81
G	0.180 BSC		4.56 BSC	
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.102	0.114	2.60	2.89
L	0.045 BSC		1.14 BSC	
R	0.170	0.190	4.32	4.83
R1	0.185	0.210	4.70	5.33
S	0.025	0.040	0.63	1.01
U	0.020	−−−	0.51	−−−
V	0.035	0.050	0.89	1.27
Z	0.155	0.170	3.93	4.32

RECOMMENDED SOLDERING FOOTPRINT*



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

GENERIC MARKING DIAGRAMS*



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. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present.

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DESCRIPTION:	**DPAK−5 CENTER LEAD CROP**	**PAGE 1 OF 1**

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