

MAX828, MAX829

MAXIMUM RATINGS*

| Rating | Symbol | Value | Unit |
|---|-----------------|-------------|------|
| Input Voltage Range (V_{in} to GND) | V_{in} | -0.3 to 6.0 | V |
| Output Voltage Range (V_{out} to GND) | V_{out} | -6.0 to 0.3 | V |
| Output Current (Note 1) | I_{out} | 100 | mA |
| Output Short Circuit Duration (V_{out} to GND, Note 1) | t_{SC} | Indefinite | sec |
| Operating Junction Temperature | T_J | 150 | °C |
| Power Dissipation and Thermal Characteristics | | | |
| Thermal Resistance, Junction to Air | $R_{\theta JA}$ | 256 | °C/W |
| Maximum Power Dissipation @ $T_A = 70^\circ\text{C}$ | P_D | 313 | mW |
| Storage Temperature | T_{stg} | -55 to 150 | °C |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

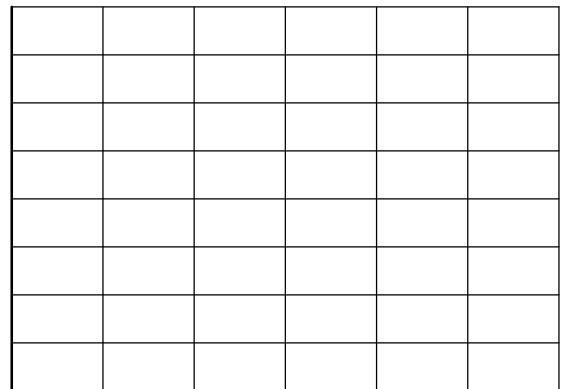
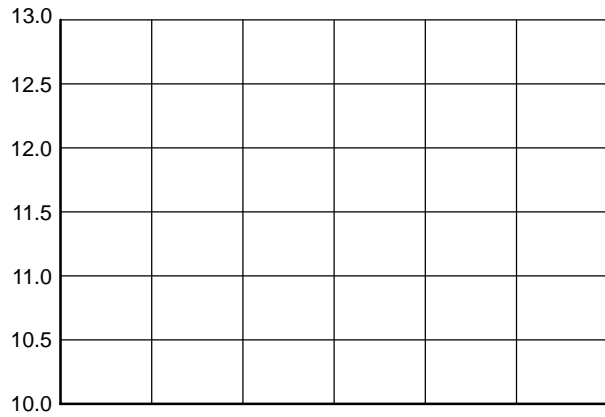
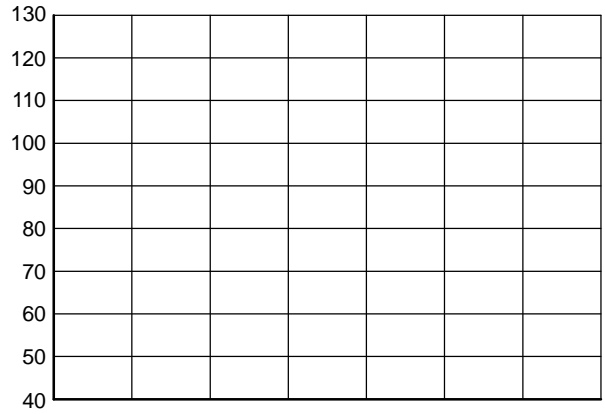
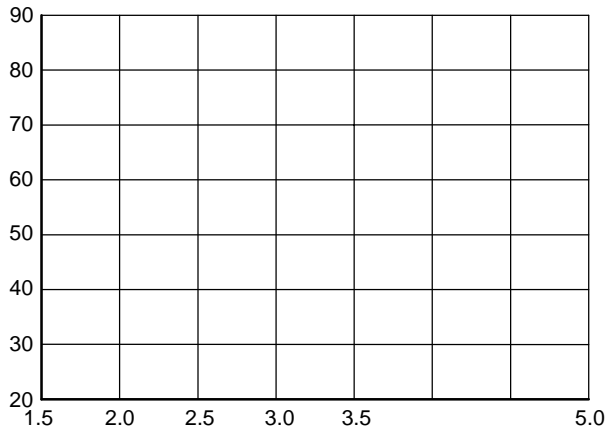
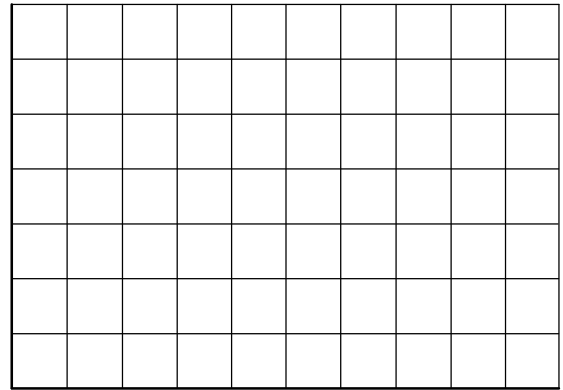
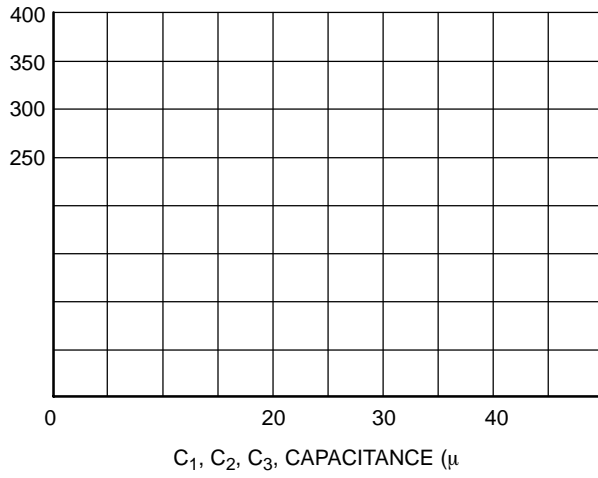
*ESD Ratings

ESD Machine Model Protection up to 200 V, Class B
ESD Human Body Model Protection up to 2000 V, Class 2

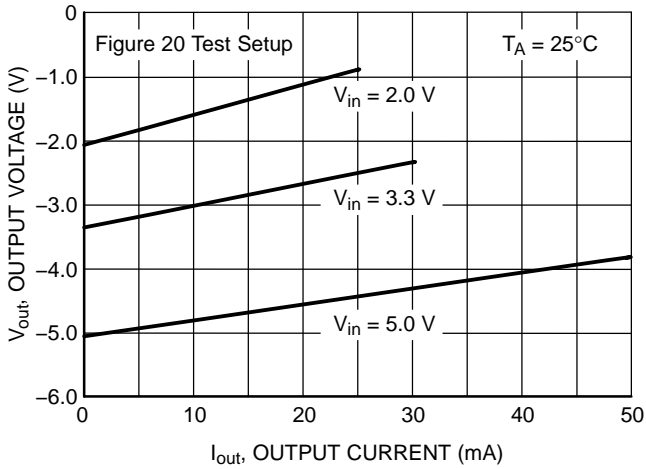
ELECTRICAL CHARACTERISTICS ($V_{in} = 5.0$ V for MAX828 $C_1 = C_2 = 10$ μF , for MAX829 $C_1 = C_2 = 3.3$ μF , $T_A = -40^\circ\text{C}$ to 85°C , typical values shown are for $T_A = 25^\circ\text{C}$ unless otherwise noted. See Figure 20 for test setup.)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|--|----------|---------------------------------------|-------------|-----|---------------|
| Operating Supply Voltage Range ($R_L = 10$ k) | V_{in} | 1.5 to 5.5 | 1.15 to 6.0 | - | V |
| Supply Current Device Operating ($R_L = \infty$) | I_{in} | | | | μA |
| $T_A = 25^\circ\text{C}$ | | | | | |
| MAX828 | | - | 68 | 90 | |
| MAX829 | | - | 118 | 200 | |
| $T_A = 85^\circ\text{C}$ | | | | | |
| MAX828 | | - | 73 | 100 | |
| MAX829 | | - | 128 | 200 | |
| Oscillator Frequency | | $f_{6.6\ 364.08\ 5.96\ -1.24\ 0\ 85}$ | | | |
| $T_A = 25^\circ\text{C}$ | | | | | |
| MAX828 | | | | | |
| MAX829 | | | | | |
| $T_A = -40^\circ\text{C}$ to 85°C | | | | | |
| MAX828 | | | | | |
| MAX829 | | | | | |

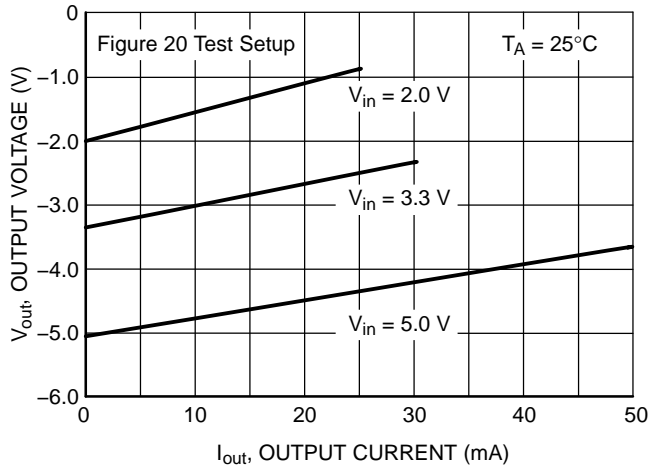
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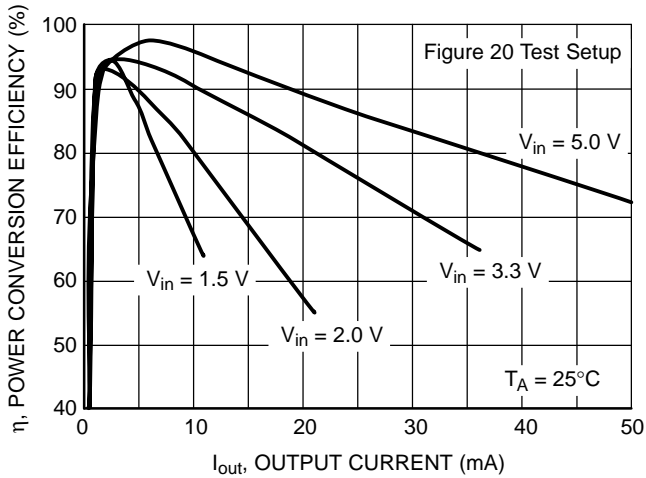
MAX828, MAX829



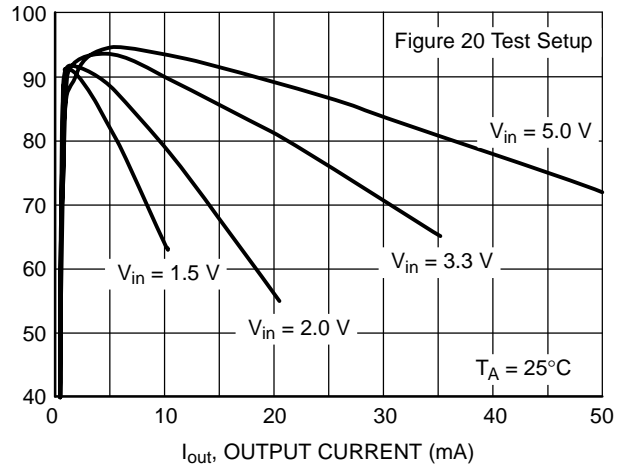
**Figure 14. Output Voltage vs. Output Current
MAX828**



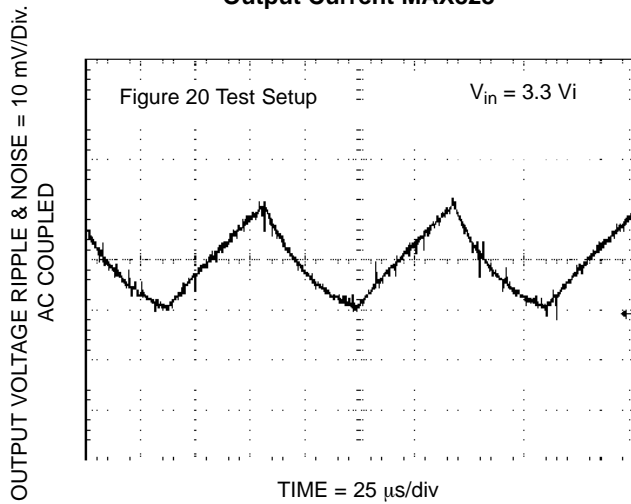
**Figure 15. Output Voltage vs. Output Current
MAX829**



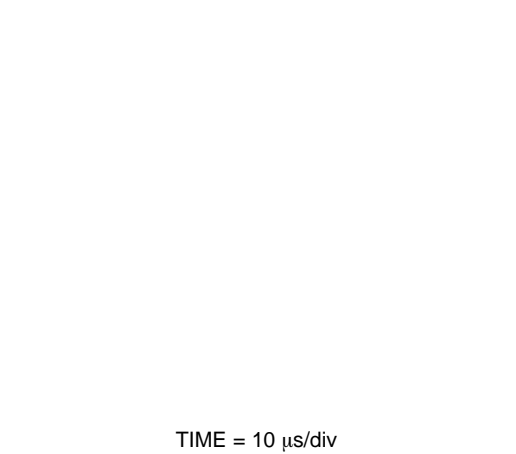
**Figure 16. Power Conversion Efficiency vs.
Output Current MAX828**



**Figure 17. Power Conversion Efficiency vs.
Output Current MAX829**



**Figure 18. Output Voltage Ripple and Noise
MAX828**



**Figure 19. Output Voltage Ripple and Noise
MAX829**

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MAX828: $C_1 = C_2 = C_3 = 10 \mu\text{F}$

MAX829: $C_1 = C_2 = C_3$

Capacitor Selection

In order to maintain the lowest output resistance and output ripple voltage, it is recommended that low ESR capacitors be used. Additionally, larger values of C_1 will lower the output resistance and larger values of C_2 will reduce output voltage ripple. (See Equation 3).

Table 1 shows various values of C_1 , C_2 and C_3 with the corresponding output resistance values at 25°C. Table 2 shows the output voltage ripple for various values of C_1 , C_2 and C_3 . The data in Tables 1 and 2 was measured not calculated.

Table 1. Output Resistance vs. Capacitance
($C_1 = C_2 = C_3$), V

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The MAX828 / 829 primary function is a voltage inverter. The device will convert 5.0 V into -5.0 V with light loads. Two capacitors are required for the inverter to function. A third capacitor, the input bypass capacitor, may be required depending on the power source for the inverter. The performance for this device is illustrated below.

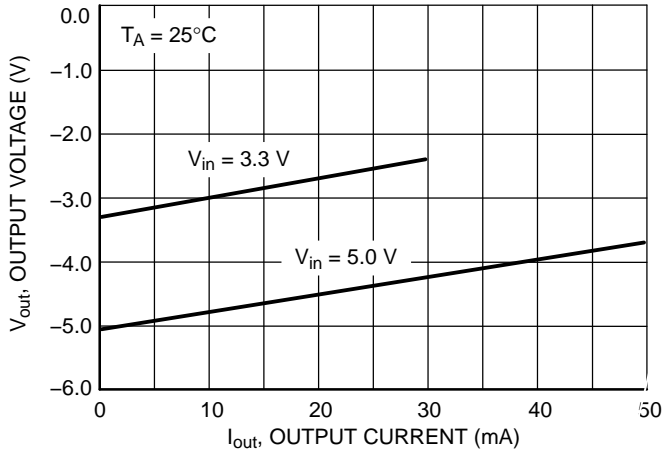


Figure 25. Voltage Inverter Load Regulation Output Voltage vs. Output Current MAX828

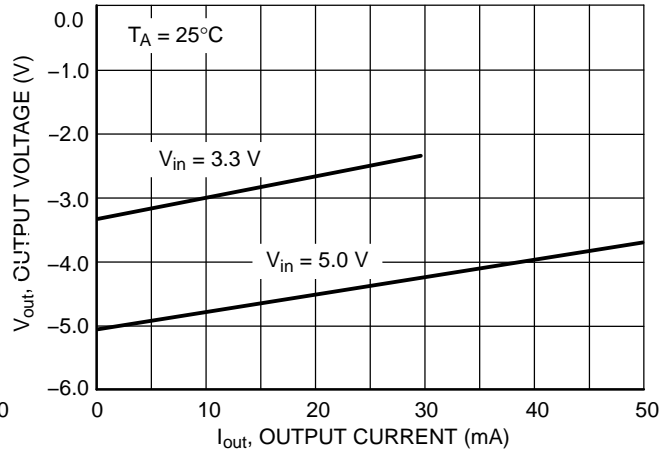
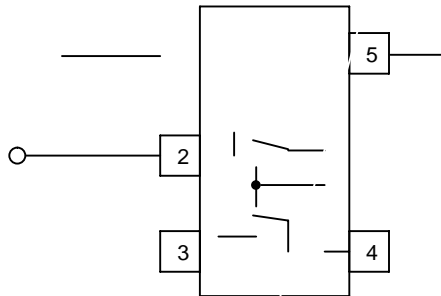


Figure 26. Voltage Inverter Load Regulation Output Voltage vs. Output Current MAX829



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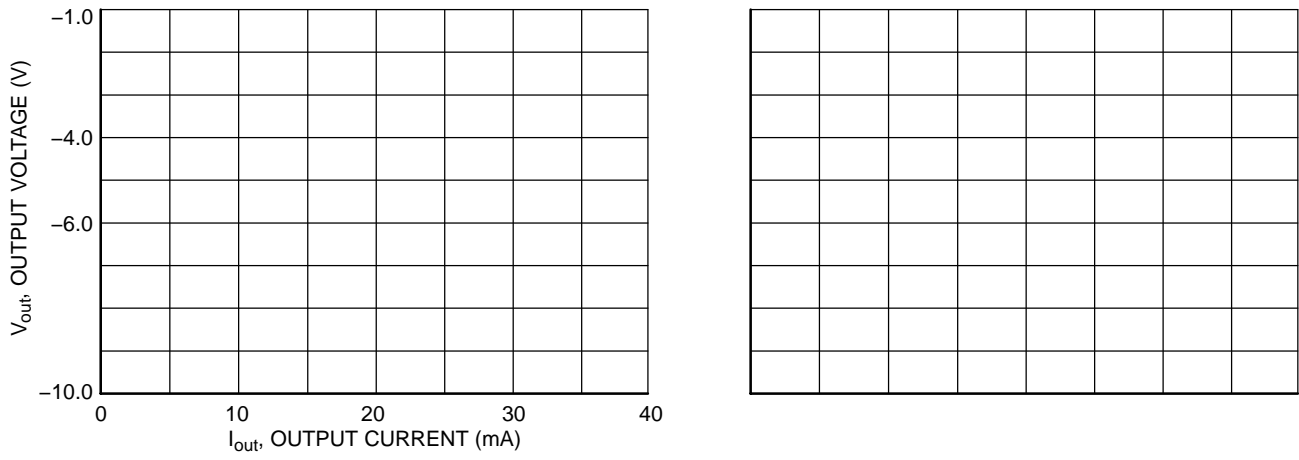


Figure 28. Cascade Load Regulation,

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| Curve | V _{in} (V) | Diodes |
|-------|---------------------|----------|
| A | 3.0 | 1N4148 |
| B | 3.0 | MBRA120E |

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| Curve | V _{in} (V) | Diodes | MAX828 R _{out} |
|-------|---------------------|----------|----------------------------|
| A | 3.0 | 1N4148 | 32.5 |
| B | 3.0 | MBRA120E | 27.1 |

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| Curve | V_{in} (V) | Diodes | MAX828 R_{out} (Ω) | MAX829 R_{out} (Ω) |
|-------|--------------|----------|-------------------------------|-------------------------------|
| A | 3.0 | 1N4148 | 110 | 111 |
| B | 3.0 | MBRA120E | 96.5 | 96.7 |
| C | 5.0 | 1N4148 | 84.5 | 87.3 |
| D | 5.0 | MBRA120E | 78.2 | 77.1 |

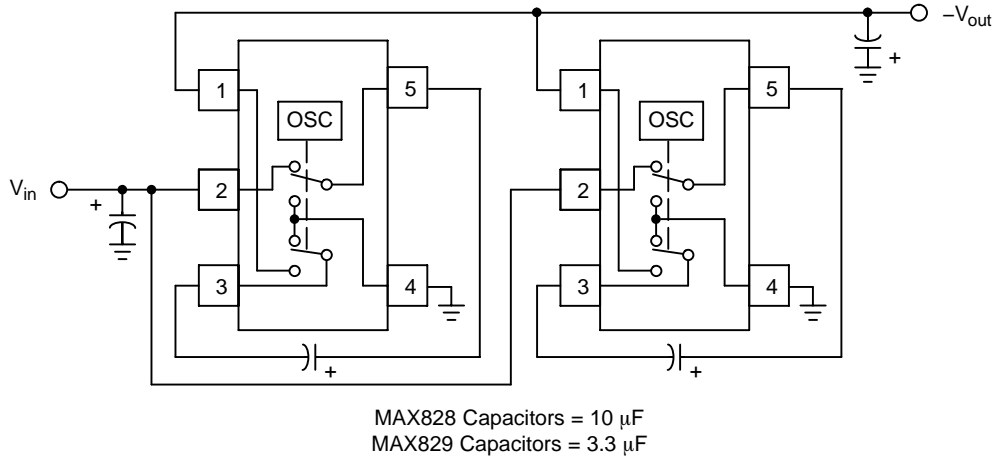


Figure 42. Paralleling Devices for Increased Negative Output Current

An increase in converter output current capability with a reduction in output resistance can be obtained by paralleling two or more devices. The output current capability is approximately equal to the number of devices paralleled. A single shared output capacitor is sufficient for proper operation but each device does require its own pump capacitor. Note that the output ripple frequency will be complex since the oscillators are not synchronized. The output resistance is approximately equal to the output resistance of one device divided by the total number of devices paralleled. The performance characteristics for a converter consisting of two paralleled devices is shown below.

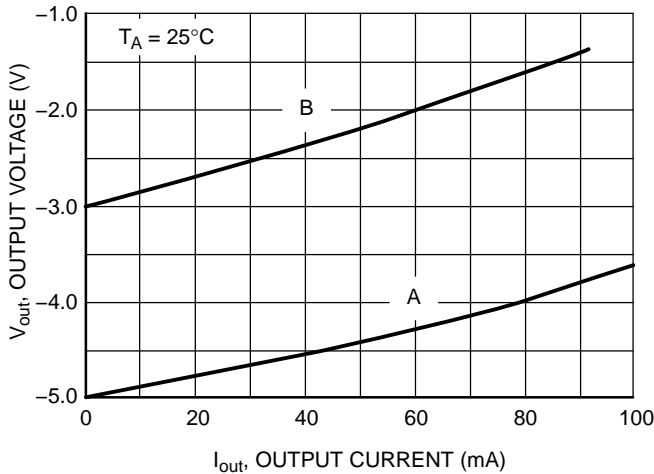


Figure 43. Parallel Load Regulation, Output Voltage vs. Output Current MAX828

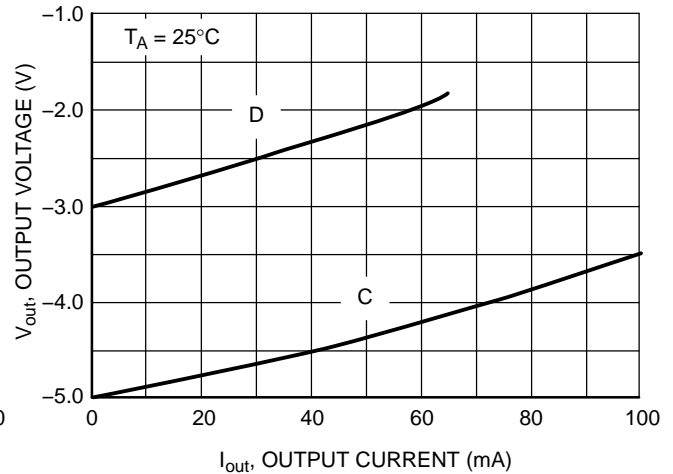


Figure 44. Parallel Load Regulation, Output Voltage vs. Output Current MAX829

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| Curve | V_{in} (V) | R_{out} (Ω) |
|-------|--------------|------------------------|
| A | 5.0 | 13.3 |
| B | 3.0 | 17.3 |
| C | 5.0 | 14.4 |
| D | 3.0 | 17.3 |

—○
+



Figure 48. Positive Output Voltage Doubler with High Current Capability

All of the previously shown converter circuits have been constructed by incorporating combinations of the form of a negative output inverter with a positive output doubler. In Figures 52 and 53 the positive doubler has a constant I_{out} and 55 the negative inverter has the constant $I_{out} = 15$

outputs. Applications requiring multiple outputs can be constructed. The converter shown above combines Figures 24 and 36 to form a dual output converter. Different combinations of load regulation are shown below. In Figure 54 the negative inverter has the variable load. In Figure 55 the positive doubler has the variable load.

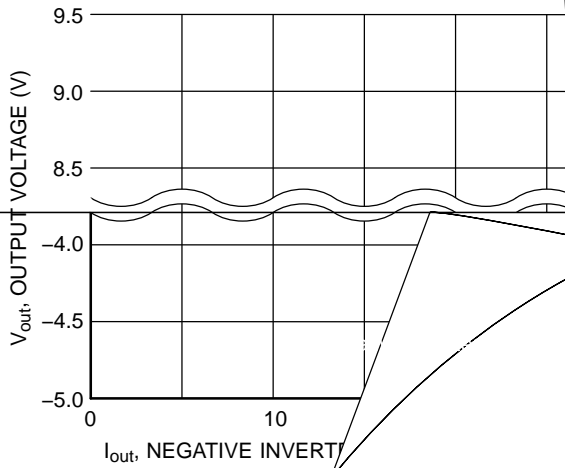


Figure 52. Negative Output Voltage vs. Output Current

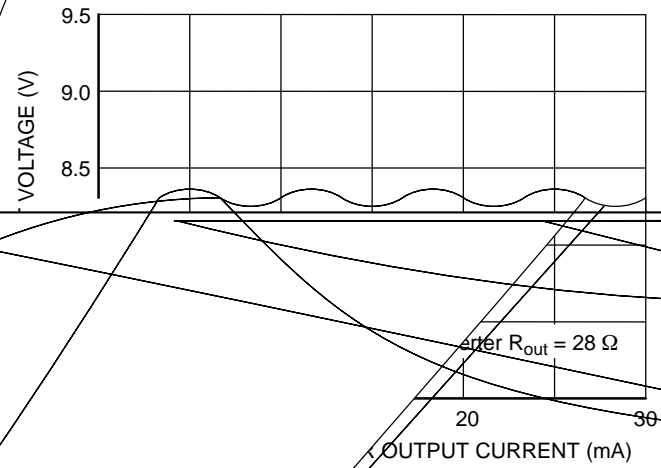
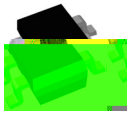
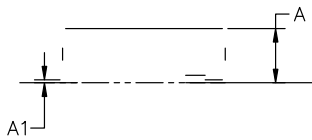
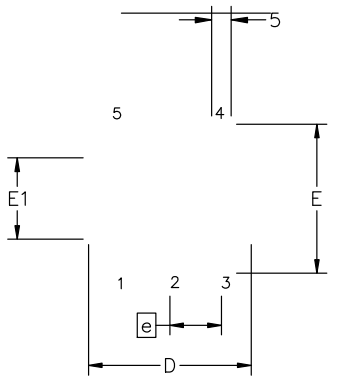


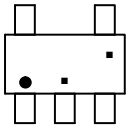
Figure 53. Positive Output Voltage vs. Output Current, MAX829
 Inverter $R_{out} = 28 \Omega$



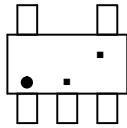
TSOP-5 3.00x1.50x0.95, 0.95P



GENERIC MARKING DIAGRAM*



Analog



Discrete/Logic



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