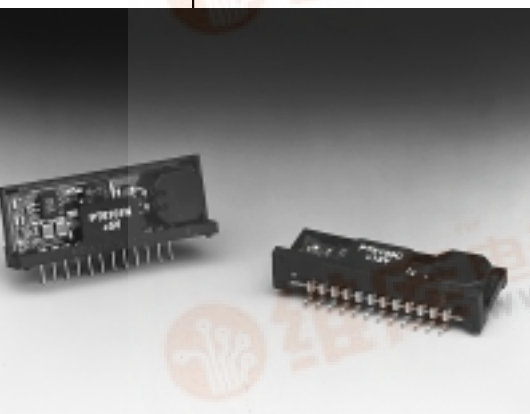


## PT6100 Series

1 AMP ADJUSTABLE POSITIVE STEP-DOWN  
INTEGRATED SWITCHING REGULATOR

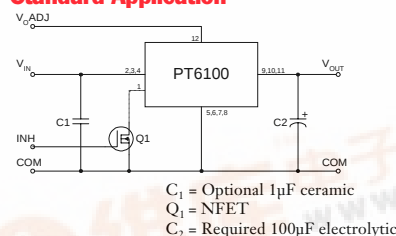
Revised 5/15/98



- 90% Efficiency
- Adjustable Output Voltage
- Internal Short Circuit Protection
- Over-Temperature Protection
- On/Off Control (Ground Off)
- Small SIP Footprint
- Meets Requirements for FCC Part 15; Class B limits for Radiated Emissions
- Wide Input Range

The PT6100 Series is a line of High-Performance 1 Amp, 12-Pin SIP (Single In-line Package) Integrated Switching Regulators (ISRs) designed to meet the on-board power conversion needs of battery powered or other equipment requiring high efficiency and small size. This high performance ISR family offers a unique combination of features combining 90% typical efficiency with open-collector on/off control and adjustable output voltage. Quiescent current in the shutdown mode is less than 100 $\mu$ A.

## Standard Application



## Specifications

## Pin-Out Information

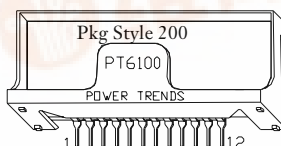
| Pin | Function             |
|-----|----------------------|
| 1   | Inhibit (30V max)    |
| 2   | V <sub>in</sub>      |
| 3   | V <sub>in</sub>      |
| 4   | V <sub>in</sub>      |
| 5   | GND                  |
| 6   | GND                  |
| 7   | GND                  |
| 8   | GND                  |
| 9   | V <sub>out</sub>     |
| 10  | V <sub>out</sub>     |
| 11  | V <sub>out</sub>     |
| 12  | V <sub>out</sub> Adj |

## Ordering Information

|         |              |
|---------|--------------|
| PT6101□ | = +5 Volts   |
| PT6102□ | = +3.3 Volts |
| PT6103□ | = +12 Volts  |

## PT Series Suffix (PT1234X)

| Case/Pin Configuration   |   |
|--------------------------|---|
| Vertical Through-Hole    | N |
| Horizontal Through-Hole  | A |
| Horizontal Surface Mount | C |



| Characteristics<br>(T <sub>a</sub> = 25°C unless noted)                                        | Symbols                            | Conditions                                                                                                                                                                                          | PT6100 SERIES          |                |                            |                          |
|------------------------------------------------------------------------------------------------|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------------|----------------------------|--------------------------|
|                                                                                                |                                    |                                                                                                                                                                                                     | Min                    | Typ            | Max                        | Units                    |
| Output Current                                                                                 | I <sub>O</sub>                     | Over V <sub>in</sub> range                                                                                                                                                                          | 0.1*                   | —              | 1.0                        | A                        |
| Short Circuit Current                                                                          | I <sub>sc</sub>                    | V <sub>in</sub> = V <sub>in</sub> min                                                                                                                                                               | —                      | 3.5            | —                          | A <sub>pk</sub>          |
| Input Voltage Range<br>(Note: inhibit function cannot be used with V <sub>in</sub> above 30V.) | V <sub>in</sub>                    | 0.1 ≤ I <sub>O</sub> ≤ 1.0 A<br>V <sub>O</sub> = 3.3V<br>V <sub>O</sub> = 5V<br>V <sub>O</sub> = 12V                                                                                                | 9<br>9<br>16           | —<br>—<br>—    | 26<br>30/38**<br>30/38**   | V<br>V<br>V              |
| Output Voltage Tolerance                                                                       | ΔV <sub>O</sub>                    | Over V <sub>in</sub> Range, I <sub>O</sub> = 1.0 A<br>T <sub>a</sub> = 0°C to +60°C                                                                                                                 | —                      | ±1.0           | ±2.0                       | % V <sub>O</sub>         |
| Line Regulation                                                                                | Reg <sub>line</sub>                | Over V <sub>in</sub> range                                                                                                                                                                          | —                      | ±0.25          | ±0.5                       | % V <sub>O</sub>         |
| Load Regulation                                                                                | Reg <sub>load</sub>                | 0.1 ≤ I <sub>O</sub> ≤ 1.0 A                                                                                                                                                                        | —                      | ±0.25          | ±0.5                       | % V <sub>O</sub>         |
| V <sub>O</sub> Ripple/Noise                                                                    | V <sub>n</sub>                     | V <sub>in</sub> =V <sub>in</sub> min, I <sub>O</sub> =1.0 A                                                                                                                                         | —                      | ±2             | —                          | % V <sub>O</sub>         |
| Transient Response with C <sub>O</sub> = 100μF                                                 | t <sub>tr</sub><br>V <sub>os</sub> | 50% load change<br>V <sub>O</sub> over/undershoot                                                                                                                                                   | —<br>—                 | 100<br>5.0     | 200<br>—                   | μSec<br>% V <sub>O</sub> |
| Efficiency                                                                                     | η                                  | V <sub>in</sub> =9V, I <sub>O</sub> =0.5A, V <sub>O</sub> =3.3V<br>V <sub>in</sub> =9V, I <sub>O</sub> =0.5A, V <sub>O</sub> =5V<br>V <sub>in</sub> =16V, I <sub>O</sub> =0.5A, V <sub>O</sub> =12V | —<br>—<br>—            | 84<br>89<br>91 | —<br>—<br>—                | %<br>%<br>%              |
| Switching Frequency                                                                            | f <sub>O</sub>                     | Over V <sub>in</sub> and I <sub>O</sub> ranges                                                                                                                                                      | 400                    | 500            | 600                        | kHz                      |
| Shutdown Current                                                                               | I <sub>sc</sub>                    | V <sub>in</sub> = 15V                                                                                                                                                                               | —                      | 100            | —                          | μA                       |
| Quiescent Current                                                                              | I <sub>nl</sub>                    | I <sub>O</sub> = 0A, V <sub>in</sub> = 10V                                                                                                                                                          | —                      | 10             | —                          | mA                       |
| Output Voltage Adjustment Range                                                                | V <sub>O</sub>                     | Below V <sub>O</sub><br>Above V <sub>O</sub>                                                                                                                                                        | See Application Notes. |                |                            |                          |
| Absolute Maximum Operating Temperature Range                                                   | T <sub>a</sub>                     |                                                                                                                                                                                                     | -40                    | —              | +85                        | °C                       |
| Recommended Operating Temperature Range                                                        | T <sub>a</sub>                     | Free Air Convection, V <sub>O</sub> = 3.3V (40-60LFM)<br>V <sub>in</sub> =24V, I <sub>O</sub> =0.75A<br>V <sub>O</sub> = 5V<br>V <sub>O</sub> = 12V                                                 | -40<br>-40<br>-40      | —<br>—<br>—    | +85***<br>+85***<br>+80*** | °C                       |
| Thermal Resistance                                                                             | θ <sub>ja</sub>                    | Free Air Convection (40-60LFM)<br>V <sub>O</sub> = 3.3V<br>V <sub>O</sub> = 5V<br>V <sub>O</sub> = 12V                                                                                              | —<br>—<br>—            | 50<br>40<br>40 | —<br>—<br>—                | °C/W                     |
| Storage Temperature                                                                            | T <sub>s</sub>                     |                                                                                                                                                                                                     | -40                    | —              | +125                       | °C                       |
| Mechanical Shock                                                                               |                                    | Per Mil-STD-883D, Method 2002.3<br>1 msec, Half Sine, mounted to a fixture                                                                                                                          | —                      | 500            | —                          | G's                      |
| Mechanical Vibration                                                                           |                                    | Per Mil-STD-883D, Method 2007.2<br>20-2000 Hz, Soldered in a PC board                                                                                                                               | —                      | 10             | —                          | G's                      |
| Weight                                                                                         |                                    |                                                                                                                                                                                                     | —                      | 5.0            | —                          | grams                    |

\*ISR will operate down to no load with reduced specifications.

\*\* Input voltage cannot exceed 30V when the inhibit function is used. \*\*\*See Thermal Derating chart.

Note: The PT6100 Series requires a 100 $\mu$ F electrolytic or tantalum output capacitor for proper operation in all applications.

For assistance or to order, call **(800) 531-5782**

## CHARACTERISTIC DATA

# PT6100 Series

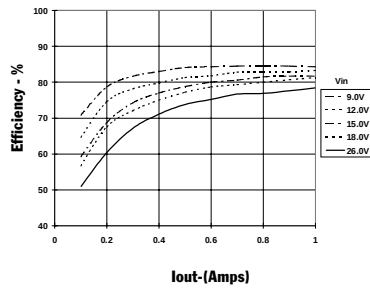
Wide Input Range Products

DATA SHEETS

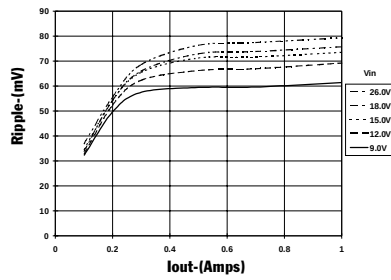
### PT6102, 3.3 VDC

(See Note 1)

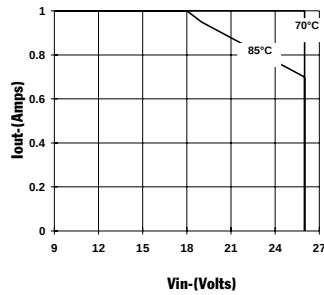
#### Efficiency vs Output Current



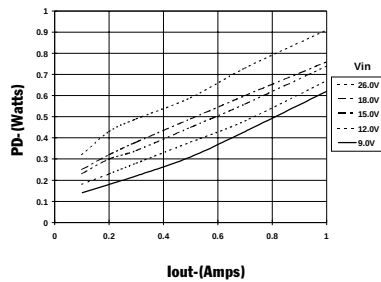
#### Ripple vs Output Current



#### Thermal Derating (T<sub>a</sub>) (See Note 2)



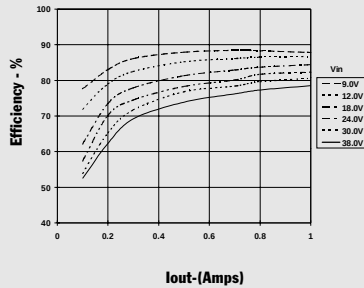
#### Power Dissipation vs Output Current



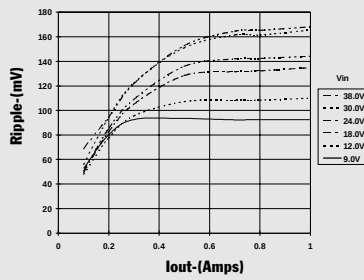
### PT6101, 5.0 VDC

(See Note 1)

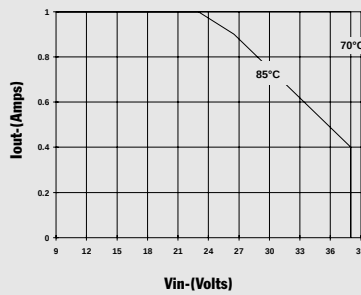
#### Efficiency vs Output Current



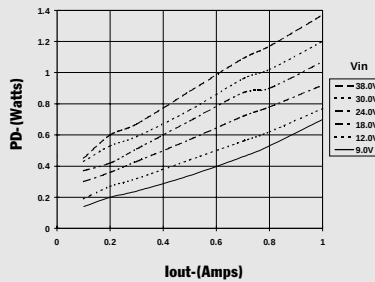
#### Ripple vs Output Current



#### Thermal Derating (T<sub>a</sub>) (See Note 2)



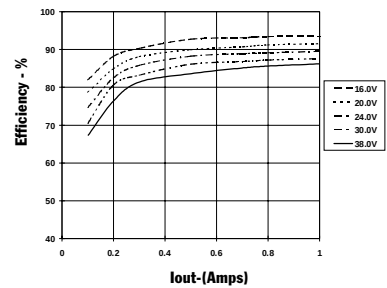
#### Power Dissipation vs Output Current



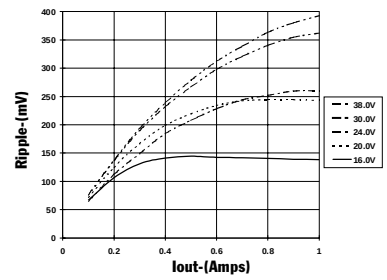
### PT6103, 12.0 VDC

(See Note 1)

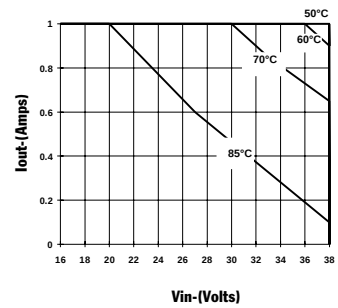
#### Efficiency vs Output Current



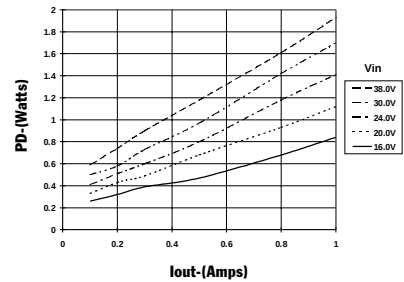
#### Ripple vs Output Current



#### Thermal Derating (T<sub>a</sub>) (See Note 2)



#### Power Dissipation vs Output Current



Note 1: All data listed in the above graphs, except for derating data, has been developed from actual products tested at 25°C. This data is considered typical data for the ISR.

Note 2: Thermal derating graphs are developed in free air convection cooling of 40-60 LFM. (See Thermal Application Notes.)

**Application****Notes****PT6100/6120/6210/6220/6300/6320 Series**[More Application Notes](#)**Adjusting the Output Voltage of the Wide Input Range Bus ISRs**

The output voltage of the Power Trends' Wide Input Range Series ISRs may be adjusted higher or lower than the factory trimmed pre-set voltage with the addition of a single external resistor. Table 1 accordingly gives the allowable adjustment range for each model for either series as  $V_a$  (min) and  $V_a$  (max).

**Adjust Up:** An increase in the output voltage is obtained by adding a resistor R2, between pin 12 ( $V_o$  adjust) and pins 5-8 (GND).

**Adjust Down:** Add a resistor (R1), between pin 12 ( $V_o$  adjust) and pins 9-11 ( $V_{out}$ ).

Refer to Figure 1 and Table 2 for both the placement and value of the required resistor; either (R1) or R2 as appropriate.

**Notes:**

1. Use only a single 1% resistor in either the (R1) or R2 location. Place the resistor as close to the ISR as possible.
2. Never connect capacitors from  $V_o$  adjust to either GND or  $V_{out}$ . Any capacitance added to the  $V_o$  adjust pin will affect the stability of the ISR.
4. Adjustments to the output voltage may place additional limits on the maximum and minimum input voltage for the part. The revised maximum and minimum input voltage limits must comply with the following requirements. Note that the minimum input voltage limits are also model dependant.

$$V_{in}(\text{max}) = (8 \times V_a)V \text{ or } *30/38V, \text{ whichever is less.}$$

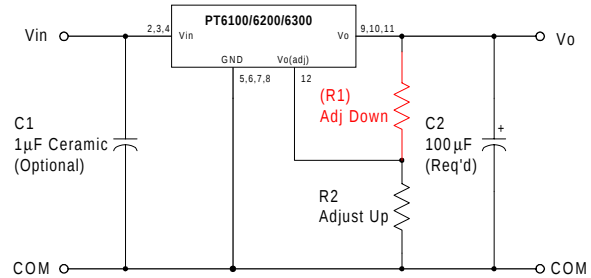
**PT6x0x/PT6x1x series:**

$$V_{in}(\text{min}) = (V_a + 4)V \text{ or } 9V, \text{ whichever is highest.}$$

**PT6x2x series:**

$$V_{in}(\text{min}) = (V_a + 2.5)V \text{ or } 7.5V, \text{ whichever is highest.}$$

\* Limit is 30V when inhibit function is used.

**Figure 1**

The values of (R1) [adjust down], and R2 [adjust up], can also be calculated using the following formulae.

$$(R1) = \frac{R_o (V_a - 1.25)}{V_o - V_a} \quad k\Omega$$

$$R2 = \frac{1.25 R_o}{V_a - V_o} \quad k\Omega$$

Where:  $V_o$  = Original output voltage  
 $V_a$  = Adjusted output voltage  
 $R_o$  = The resistance value from Table 1

**Table 1****ISR ADJUSTMENT RANGE AND FORMULA PARAMETERS**

| 1A dc Rated         | PT6102 | PT6101 |        | PT6103 |
|---------------------|--------|--------|--------|--------|
|                     | PT6122 | PT6121 |        |        |
| 2A dc Rated         | PT6213 |        | PT6212 | PT6214 |
|                     | PT6223 |        | PT6222 |        |
| 3A dc Rated         | PT6303 |        | PT6302 | PT6304 |
|                     | PT6323 |        | PT6322 |        |
| $V_o$ (nom)         | 3.3    | 5.0    | 5.0    | 12.0   |
| $V_a$ (min)         | 1.89   | 1.88   | 2.18   | 2.43   |
| $V_a$ (max)         | 6.07   | 11.25  | 8.5    | 22.12  |
| $R_o$ (k $\Omega$ ) | 66.5   | 150.0  | 90.9   | 243.0  |

For assistance or to order, call **(800) 531-5782**

**PT6100/6120/6210/6220/6300/6320 Series**

**A p p l i c a t i o n**

**N o t e s**

**Table 2**

**ISR ADJUSTMENT RESISTOR VALUES**

| 1Adc Rated                   | PT6102     | PT6101     |            | PT6103      |
|------------------------------|------------|------------|------------|-------------|
|                              | PT6122     | PT6121     |            |             |
| 2Adc Rated                   | PT6213     |            | PT6212     | PT6214      |
|                              | PT6223     |            | PT6222     |             |
| 3Adc Rated                   | PT6303     |            | PT6302     | PT6304      |
|                              | PT6323     |            | PT6322     |             |
| <b>V<sub>o</sub> (nom)</b>   | <b>3.3</b> | <b>5.0</b> | <b>5.0</b> | <b>12.0</b> |
| <b>V<sub>a</sub> (req.d)</b> |            |            |            |             |
| 1.9                          | (30.9)kΩ   | (31.5)kΩ   |            |             |
| 2.0                          | (38.4)kΩ   | (37.5)kΩ   |            |             |
| 2.1                          | (47.1)kΩ   | (44.0)kΩ   |            |             |
| 2.2                          | (57.4)kΩ   | (50.9)kΩ   | (30.8)kΩ   |             |
| 2.3                          | (69.8)kΩ   | (58.3)kΩ   | (35.4)kΩ   |             |
| 2.4                          | (85.0)kΩ   | (66.3)kΩ   | (40.2)kΩ   |             |
| 2.5                          | (104.0)kΩ  | (75.0)kΩ   | (45.5)kΩ   | (32.0)kΩ    |
| 2.6                          | (128.0)kΩ  | (84.4)kΩ   | (51.1)kΩ   | (34.9)kΩ    |
| 2.7                          | (161.0)kΩ  | (94.6)kΩ   | (57.3)kΩ   | (37.9)kΩ    |
| 2.8                          | (206.0)kΩ  | (106.0)kΩ  | (64.0)kΩ   | (40.9)kΩ    |
| 2.9                          | (274.0)kΩ  | (118.0)kΩ  | (71.4)kΩ   | (44.1)kΩ    |
| 3.0                          | (388.0)kΩ  | (131.0)kΩ  | (79.5)kΩ   | (47.3)kΩ    |
| 3.1                          | (615.0)kΩ  | (146.0)kΩ  | (88.5)kΩ   | (50.5)kΩ    |
| 3.2                          | (1300.0)kΩ | (163.0)kΩ  | (98.5)kΩ   | (53.8)kΩ    |
| 3.3                          |            | (181.0)kΩ  | (110.0)kΩ  | (57.3)kΩ    |
| 3.4                          | 831.0kΩ    | (202.0)kΩ  | (122.0)kΩ  | (60.8)kΩ    |
| 3.5                          | 416.0kΩ    | (225.0)kΩ  | (136.0)kΩ  | (64.3)kΩ    |
| 3.6                          | 227.0kΩ    | (252.0)kΩ  | (153.0)kΩ  | (68.0)kΩ    |
| 3.7                          | 208.0kΩ    | (283.0)kΩ  | (171.0)kΩ  | (71.7)kΩ    |
| 3.8                          | 166.0kΩ    | (319.0)kΩ  | (193.0)kΩ  | (75.6)kΩ    |
| 3.9                          | 139.0kΩ    | (361.0)kΩ  | (219.0)kΩ  | (79.5)kΩ    |
| 4.0                          | 119.0kΩ    | (413.0)kΩ  | (250.0)kΩ  | (83.5)kΩ    |
| 4.1                          | 104.0kΩ    | (475.0)kΩ  | (288.0)kΩ  | (87.7)kΩ    |
| 4.2                          | 92.4kΩ     | (533.0)kΩ  | (335.0)kΩ  | (91.9)kΩ    |
| 4.3                          | 83.1kΩ     | (654.0)kΩ  | (396.0)kΩ  | (96.3)kΩ    |
| 4.4                          | 75.6kΩ     | (788.0)kΩ  | (477.0)kΩ  | (101.0)kΩ   |
| 4.5                          | 69.3kΩ     | (975.0)kΩ  | (591.0)kΩ  | (105.0)kΩ   |
| 4.6                          | 63.9kΩ     | (1260.0)kΩ | (761.0)kΩ  | (110.0)kΩ   |
| 4.7                          | 59.4kΩ     | (1730.0)kΩ | (1050.0)kΩ | (115.0)kΩ   |
| 4.8                          | 55.4kΩ     |            | (1610.0)kΩ | (120.0)kΩ   |
| 4.9                          | 52.0kΩ     |            |            | (125.0)kΩ   |
| 5.0                          | 48.9kΩ     |            |            | (130.0)kΩ   |
| 5.1                          | 46.2kΩ     | 1880.0kΩ   | 1140.0kΩ   | (136.0)kΩ   |
| 5.2                          | 43.8kΩ     | 937.0kΩ    | 568.0kΩ    | (141.0)kΩ   |
| 5.3                          | 41.6kΩ     | 625.0kΩ    | 379.0kΩ    | (147.0)kΩ   |
| 5.4                          | 39.6kΩ     | 469.0kΩ    | 284.0kΩ    | (153.0)kΩ   |
| 5.5                          | 37.8kΩ     | 375.0kΩ    | 227.0kΩ    | (159.0)kΩ   |
| 5.6                          | 36.1kΩ     | 313.0kΩ    | 189.0kΩ    | (165.0)kΩ   |
| 5.7                          | 34.6kΩ     | 268.0kΩ    | 162.0kΩ    | (172.0)kΩ   |
| 5.8                          | 33.3kΩ     | 234.0kΩ    | 142.0kΩ    | (178.0)kΩ   |
| 5.9                          | 32.0kΩ     | 208.0kΩ    | 126.0kΩ    | (185.0)kΩ   |
| 6.0                          | 30.8kΩ     | 188.0kΩ    | 114.0kΩ    | (192.0)kΩ   |

R1 = (Red) R2 = Black

**ISR ADJUSTMENT RESISTOR VALUES (Cont)**

| 1Adc Rated                   | PT6101     |            | PT6103      |
|------------------------------|------------|------------|-------------|
|                              | PT6121     |            |             |
| 2Adc Rated                   |            | PT6212     | PT6214      |
|                              |            | PT6222     |             |
| 3Adc Rated                   |            | PT6302     | PT6304      |
|                              |            | PT6322     |             |
| <b>V<sub>o</sub> (nom)</b>   | <b>5.0</b> | <b>5.0</b> | <b>12.0</b> |
| <b>V<sub>a</sub> (req.d)</b> |            |            |             |
| 6.2                          | 156.0kΩ    | 94.7kΩ     | (207.0)kΩ   |
| 6.4                          | 134.0kΩ    | 81.2kΩ     | (223.0)kΩ   |
| 6.6                          | 117.0kΩ    | 71.0kΩ     | (241.0)kΩ   |
| 6.8                          | 104.0kΩ    | 63.1kΩ     | (259.0)kΩ   |
| 7.0                          | 93.8kΩ     | 56.8kΩ     | (279.0)kΩ   |
| 7.2                          | 85.2kΩ     | 51.6kΩ     | (301.0)kΩ   |
| 7.4                          | 78.1kΩ     | 47.3kΩ     | (325.0)kΩ   |
| 7.6                          | 72.1kΩ     | 43.7kΩ     | (351.0)kΩ   |
| 7.8                          | 67.0kΩ     | 40.6kΩ     | (379.0)kΩ   |
| 8.0                          | 62.5kΩ     | 37.9kΩ     | (410.0)kΩ   |
| 8.2                          | 58.6kΩ     | 35.5kΩ     | (444.0)kΩ   |
| 8.4                          | 55.1kΩ     | 33.4kΩ     | (483.0)kΩ   |
| 8.6                          | 52.1kΩ     |            | (525.0)kΩ   |
| 8.8                          | 49.3kΩ     |            | (573.0)kΩ   |
| 9.0                          | 46.9kΩ     |            | (628.0)kΩ   |
| 9.5                          | 41.7kΩ     |            | (802.0)kΩ   |
| 10.0                         | 37.5kΩ     |            | (1060.0)kΩ  |
| 10.5                         | 34.1kΩ     |            | (1500.0)kΩ  |
| 11.0                         | 31.3kΩ     |            |             |
| 11.5                         |            |            |             |
| 12.0                         |            |            |             |
| 12.5                         |            |            | 608.0kΩ     |
| 13.0                         |            |            | 304.0kΩ     |
| 13.5                         |            |            | 203.0kΩ     |
| 14.0                         |            |            | 152.0kΩ     |
| 14.5                         |            |            | 122.0kΩ     |
| 15.0                         |            |            | 101.0kΩ     |
| 15.5                         |            |            | 86.8kΩ      |
| 16.0                         |            |            | 75.9kΩ      |
| 16.5                         |            |            | 67.5kΩ      |
| 17.0                         |            |            | 60.8kΩ      |
| 17.5                         |            |            | 55.2kΩ      |
| 18.0                         |            |            | 50.6kΩ      |
| 18.5                         |            |            | 46.7kΩ      |
| 19.0                         |            |            | 43.4kΩ      |
| 19.5                         |            |            | 40.5kΩ      |
| 20.0                         |            |            | 38.0kΩ      |
| 20.5                         |            |            | 35.7kΩ      |
| 21.5                         |            |            | 33.8kΩ      |
| 21.5                         |            |            | 32.0kΩ      |
| 22.0                         |            |            | 30.4kΩ      |

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