The TCR2EF and TCR2EE series are CMOS single output voltage regulators with an on/off control input, featuring low dropout voltage, low output noise voltage and fast load transient response. These voltage regulators are available in fixed output voltages between 1.0 V and 5.0 V and capable of driving up to 200 mA. They feature overcurrent protection, an Auto-discharge function.

The TCR2EF and TCR2EE series has a low dropout voltage of 180 mV (2.5 V output, IOUT = 150 mA) with low output noise voltage of 35 $\mu$Vrms (2.5 V output) and a load transient response of only $\Delta V_{\text{OUT}} = \pm 60$ mV (IOUT = 1 mA ⇒ 150 mA, COUT = 1.0 $\mu$F).

Thus, the TCR2EF and TCR2EE series are suitable for sensitive power supply such as Analog and RF applications.

### Features
- **Low dropout voltage**
  - $V_{\text{DO}} = 150$ mV (typ.) at 3.0 V output, IOUT = 150 mA
  - $V_{\text{DO}} = 180$ mV (typ.) at 2.5 V output, IOUT = 150 mA
  - $V_{\text{DO}} = 230$ mV (typ.) at 1.8 V output, IOUT = 150 mA
  - $V_{\text{DO}} = 380$ mV (typ.) at 1.2 V output, IOUT = 150 mA
  - $V_{\text{DO}} = 510$ mV (typ.) at 1.0 V output, IOUT = 150 mA
- **Low output noise voltage** ($V_{\text{NO}} = 35$ $\mu$Vrms (typ.) at 2.5 V output, IOUT = 10 mA, 10 Hz < f < 100 kHz)
- **Fast load transient response** ($\Delta V_{\text{OUT}} = \pm 60$ mV (typ.) at IOUT = 1 mA ⇒ 150 mA, COUT = 1.0 $\mu$F)
- **Low quiescent bias current** (Iq = 35 $\mu$A (typ.) at IOUT = 0 mA)
- **High ripple rejection ratio** (73 dB (typ.) at 2.5 V output, IOUT = 10 mA, f = 1 kHz)
- **Wide range output voltage line up** ($V_{\text{OUT}} = 1.0$ to 5.0 V)
- **High $V_{\text{OUT}}$ accuracy** ±1.0 % (1.8 V ≤ $V_{\text{OUT}}$)
- **Overcurrent protection**
- **Auto-discharge**
- **Pull down connection between CONTROL and GND**
- **Ceramic capacitors can be used** ($C_{\text{IN}} = 0.1$ $\mu$F, $C_{\text{OUT}} = 1.0$ $\mu$F)
- **Small package ESV (SOT-553) (1.6 mm x 1.6 mm x 0.55 mm)**
  - General package SMV (SOT-25) (2.8 mm x 2.9 mm x 1.1 mm)

Start of commercial production
2012-10
Absolute Maximum Ratings (Ta = 25°C)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
<td>VIN</td>
<td>6.0</td>
<td>V</td>
</tr>
<tr>
<td>Control voltage</td>
<td>VCT</td>
<td>-0.3 to 6.0</td>
<td>V</td>
</tr>
<tr>
<td>Output voltage</td>
<td>VOUT</td>
<td>-0.3 to VIN + 0.3</td>
<td>V</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>PD</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SMV</td>
<td>200</td>
<td>(Note 1) mW</td>
</tr>
<tr>
<td></td>
<td>ESV</td>
<td>150</td>
<td>(Note 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>320</td>
<td>(Note 3)</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>Tj</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>Tstg</td>
<td>-55 to 150</td>
<td>°C</td>
</tr>
</tbody>
</table>

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions="/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: Unit Rating
Note 2: Rating at mounting on a board
(FR4 board dimension: 25.4 mm × 25.4 mm × 1.6 mm)
Note 3: Rating at mounting on a board
(FR4 board dimension: 30 mm × 30 mm × 0.8 mm)

Operating Ranges

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
<td>VIN</td>
<td>1.5 to 5.5 V (Note 4)</td>
<td>V</td>
</tr>
<tr>
<td>Control voltage</td>
<td>VCT</td>
<td>0 to 5.5 V</td>
<td>V</td>
</tr>
<tr>
<td>Output voltage</td>
<td>VOUT</td>
<td>1.0 to 5.0 V</td>
<td>V</td>
</tr>
<tr>
<td>Output current</td>
<td>IOUT</td>
<td>DC 200</td>
<td>mA</td>
</tr>
<tr>
<td>Operation Temperature</td>
<td>Topr</td>
<td>-40 to 85</td>
<td>°C</td>
</tr>
<tr>
<td>Output Capacitance</td>
<td>COUT</td>
<td>≥ 1.0 μF</td>
<td>—</td>
</tr>
<tr>
<td>Input Capacitance</td>
<td>CIN</td>
<td>≥ 0.1 μF</td>
<td>—</td>
</tr>
</tbody>
</table>

Note 4: \( I_{OUT} = 1 \ mA \).
Please refer to Dropout voltage (Page 5) and use it within Absolute Maximum Ratings Junction temperature and Operation Temperature Ranges.

Note 5: Do not operate at or near the maximum ratings of operating ranges for extended periods of time. Exposure to such conditions may adversely impact product reliability and results in failures not covered by warranty.
Pin Assignment (top view)

SMV(SOT-25)(SC-74A)

VOUT  NC
5  4
1  2  3  CONTROL

ESV(SOT-553)

NC  VOUT
5  4
1  2  3  CONTROL  GND  VIN
## List of Products Number, Output voltage and Marking

<table>
<thead>
<tr>
<th>Product No.</th>
<th>VOUT (V) (typ.)</th>
<th>Marking</th>
<th>Product No.</th>
<th>VOUT (V) (typ.)</th>
<th>Marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMV(SOT-25)</td>
<td>ESV(SOT-553)</td>
<td></td>
<td>SMV(SOT-25)</td>
<td>ESV(SOT-553)</td>
<td></td>
</tr>
<tr>
<td>TCR2EF10</td>
<td>1.0</td>
<td>1N0</td>
<td>TCR2EF28</td>
<td>2.8</td>
<td>2N8</td>
</tr>
<tr>
<td>TCR2EF105</td>
<td>1.05</td>
<td>1NA</td>
<td>TCR2EF285</td>
<td>2.85</td>
<td>2ND</td>
</tr>
<tr>
<td>TCR2EF11</td>
<td>1.1</td>
<td>1N1</td>
<td>TCR2EF29</td>
<td>2.9</td>
<td>2N9</td>
</tr>
<tr>
<td>TCR2EF115</td>
<td>1.15</td>
<td>1NB</td>
<td>TCR2EE295</td>
<td>2.95</td>
<td>2NE</td>
</tr>
<tr>
<td>TCR2EF12</td>
<td>1.2</td>
<td>1N2</td>
<td>TCR2EF30</td>
<td>3.0</td>
<td>3N0</td>
</tr>
<tr>
<td>TCR2EF125</td>
<td>1.25</td>
<td>1NC</td>
<td>TCR2EE305</td>
<td>3.05</td>
<td>3NA</td>
</tr>
<tr>
<td>TCR2EF13</td>
<td>1.3</td>
<td>1N3</td>
<td>TCR2EF31</td>
<td>3.1</td>
<td>3N1</td>
</tr>
<tr>
<td>TCR2EF135</td>
<td>1.35</td>
<td>1ND</td>
<td>TCR2EE32</td>
<td>3.2</td>
<td>3N2</td>
</tr>
<tr>
<td>TCR2EF14</td>
<td>1.4</td>
<td>1N4</td>
<td>TCR2EF33</td>
<td>3.3</td>
<td>3N3</td>
</tr>
<tr>
<td>TCR2EF145</td>
<td>1.45</td>
<td>1NE</td>
<td>TCR2EE335</td>
<td>3.35</td>
<td>3ND</td>
</tr>
<tr>
<td>TCR2EF15</td>
<td>1.5</td>
<td>1N5</td>
<td>TCR2EE34</td>
<td>3.4</td>
<td>3N4</td>
</tr>
<tr>
<td>TCR2EF17</td>
<td>1.7</td>
<td>1N7</td>
<td>TCR2EE35</td>
<td>3.5</td>
<td>3N5</td>
</tr>
<tr>
<td>TCR2EF18</td>
<td>1.8</td>
<td>1N8</td>
<td>TCR2EF36</td>
<td>3.6</td>
<td>3N6</td>
</tr>
<tr>
<td>TCR2EF185</td>
<td>1.85</td>
<td>1NF</td>
<td>TCR2EE39</td>
<td>3.9</td>
<td>3N9</td>
</tr>
<tr>
<td>TCR2EF19</td>
<td>1.9</td>
<td>1N9</td>
<td>TCR2EF40</td>
<td>4.0</td>
<td>4N0</td>
</tr>
<tr>
<td>TCR2EF20</td>
<td>2.0</td>
<td>2N0</td>
<td>TCR2EF41</td>
<td>4.1</td>
<td>4N1</td>
</tr>
<tr>
<td>TCR2EE24</td>
<td>2.4</td>
<td>2N4</td>
<td>TCR2EE42</td>
<td>4.2</td>
<td>4N2</td>
</tr>
<tr>
<td>TCR2EE25</td>
<td>2.5</td>
<td>2N5</td>
<td>TCR2EE45</td>
<td>4.5</td>
<td>4N5</td>
</tr>
<tr>
<td>TCR2EE27</td>
<td>2.7</td>
<td>2N7</td>
<td>TCR2EE48</td>
<td>4.8</td>
<td>4N8</td>
</tr>
<tr>
<td>TCR2EE275</td>
<td>2.75</td>
<td>2NF</td>
<td>TCR2EF50</td>
<td>5.0</td>
<td>5N0</td>
</tr>
</tbody>
</table>

Please ask your local retailer about the devices with other output voltages.

### Marking (top view)

**Example:** TCR2EF33 (3.3 V output)  
**Example:** TCR2EE33 (3.3 V output)
Electrical Characteristics
(Unless otherwise specified,
\[ V_{IN} = V_{OUT} + 1 \text{ V}, \ I_{OUT} = 50 \text{ mA}, \ C_{IN} = 0.1 \mu F, \ C_{OUT} = 1.0 \mu F, \ T_j = 25°C \])

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output voltage accuracy</td>
<td>( V_{OUT} )</td>
<td>( I_{OUT} = 50 \text{ mA} ) (Note 6)</td>
<td>( V_{OUT} &lt; 1.8 \text{ V} )</td>
<td>-18</td>
<td>—</td>
<td>+18</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>( 1.8 \text{ V} \leq V_{OUT} )</td>
<td>-1.0</td>
<td>—</td>
<td>+1.0</td>
</tr>
<tr>
<td>Input voltage</td>
<td>( V_{IN} )</td>
<td>( I_{OUT} = 1 \text{ mA} )</td>
<td>1.5</td>
<td>—</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>Line regulation</td>
<td>Reg:line</td>
<td>( V_{OUT} + 0.5 \text{ V} \leq V_{IN} \leq 5.5 \text{ V}, \ I_{OUT} = 1 \text{ mA} )</td>
<td>—</td>
<td>1</td>
<td>15</td>
<td>mV</td>
</tr>
<tr>
<td>Load regulation</td>
<td>Reg:load</td>
<td>1 mA \leq I_{OUT} \leq 150 mA</td>
<td>—</td>
<td>15</td>
<td>30</td>
<td>mV</td>
</tr>
<tr>
<td>Quiescent current</td>
<td>( I_B )</td>
<td>( I_{OUT} = 0 \text{ mA} )</td>
<td>—</td>
<td>35</td>
<td>60</td>
<td>\mu A</td>
</tr>
<tr>
<td>Stand-by current</td>
<td>( I_B ) (OFF)</td>
<td>( V_{CT} = 0 \text{ V} )</td>
<td>—</td>
<td>0.1</td>
<td>1.0</td>
<td>\mu A</td>
</tr>
<tr>
<td>Dropout voltage</td>
<td>( V_{DO} )</td>
<td>( I_{OUT} = 150 \text{ mA} ) (Note 7)</td>
<td>—</td>
<td>180</td>
<td>230</td>
<td>mV</td>
</tr>
<tr>
<td>Temperature coefficient</td>
<td>( T_{COV} )</td>
<td>( -40°C \leq T_{OP} \leq 85°C )</td>
<td>—</td>
<td>100</td>
<td>—</td>
<td>ppm/°C</td>
</tr>
<tr>
<td>Output noise voltage</td>
<td>( V_{NO} )</td>
<td>( V_{IN} = V_{OUT} + 1 \text{ V}, \ I_{OUT} = 10 \text{ mA}, \ 10 \text{ Hz} \leq f \leq 100 \text{ kHz} ) (Note 7)</td>
<td>—</td>
<td>35</td>
<td>—</td>
<td>\mu V_{rms}</td>
</tr>
<tr>
<td>Ripple rejection ratio</td>
<td>R.R. ( V_{IN} = V_{OUT} + 1 \text{ V}, \ I_{OUT} = 10 \text{ mA}, \ f = 1 \text{ kHz}, \ V_{Ripple} = 500 \text{ mV}_{p-p} ) (Note 7)</td>
<td>—</td>
<td>73</td>
<td>—</td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>Load transient response</td>
<td>( \Delta V_{OUT} )</td>
<td>( I_{OUT} = 1 \text{ mA} \Rightarrow 150 \text{ mA}, \ C_{OUT} = 1.0 \mu F )</td>
<td>—</td>
<td>±60</td>
<td>—</td>
<td>mV</td>
</tr>
<tr>
<td>Control voltage (ON)</td>
<td>( V_{CT \ (ON)} )</td>
<td>—</td>
<td>1.0</td>
<td>—</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>Control voltage (OFF)</td>
<td>( V_{CT \ (OFF)} )</td>
<td>—</td>
<td>0.0</td>
<td>—</td>
<td>0.4</td>
<td>V</td>
</tr>
</tbody>
</table>

Note 6: Stable state with fixed \( I_{OUT} \) condition
Note 7: The 2.5 V output product
Note 8: All characteristics of over 4.5 V output products are measured at \( V_{IN} = V_{OUT} + 0.5 \text{ V} \) conditions.

Dropout voltage (\( I_{OUT} = 150 \text{ mA}, \ C_{IN} = 0.1 \mu F, \ C_{OUT} = 1.0 \mu F, \ T_j = 25°C \))

<table>
<thead>
<tr>
<th>Output voltages</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 V, 1.05 V</td>
<td>( V_{DO} )</td>
<td>—</td>
<td>510</td>
<td>770</td>
<td>mV</td>
</tr>
<tr>
<td>1.1 V, 1.15 V</td>
<td></td>
<td>—</td>
<td>440</td>
<td>670</td>
<td></td>
</tr>
<tr>
<td>1.2 V, 1.25 V</td>
<td></td>
<td>—</td>
<td>380</td>
<td>570</td>
<td></td>
</tr>
<tr>
<td>1.3 V</td>
<td></td>
<td>—</td>
<td>350</td>
<td>470</td>
<td></td>
</tr>
<tr>
<td>1.4 V</td>
<td></td>
<td>—</td>
<td>310</td>
<td>420</td>
<td></td>
</tr>
<tr>
<td>1.5 V \leq V_{OUT} &lt; 1.8 V</td>
<td>—</td>
<td>290</td>
<td>390</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.8 V \leq V_{OUT} &lt; 2.5 V</td>
<td>—</td>
<td>230</td>
<td>310</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5 V \leq V_{OUT} &lt; 3.0 V</td>
<td>—</td>
<td>180</td>
<td>230</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0 V \leq V_{OUT} \leq 5.0 V</td>
<td>—</td>
<td>150</td>
<td>200</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Application Note

1. Examples of Application Circuit

The figures above show the examples of configuration for using a Low dropout regulator. Insert a capacitor at VOUT and VIN pins for stable input/output operation. (Ceramic capacitors can be used).

2. Power Dissipation

Both unit and board mounted power dissipation ratings for TCR2EF series and TCR2EE series are available in the Absolute Maximum Ratings table. Power dissipation is measured on the board shown below.

Test Board for Thermal Resistance

SMV

*Board material: FR4 board
Board dimension: 25.4 mm × 25.4 mm × 1.6 mm
Copper area: 645 mm²

ESV

*Board material: FR4 board
Board dimension: 30 mm × 30 mm × 0.8 mm
Copper area: 20 mm²
Attention in Use

● Output Capacitors
  Ceramic capacitors can be used for these devices. However, because of the type of the capacitors, there might be unexpected thermal features. Please consider application condition for selecting capacitors. And Toshiba recommends the ESR of ceramic capacitor be under 10 Ω.

● Mounting
  The long distance between IC and output capacitor might affect phase compensation by impedance in wire and inductor. For stable power supply, output capacitor need to mount near IC as much as possible. Also Vin and GND pattern need to be large and make the wire impedance small as possible.

● Permissible Loss
  Please have enough design patterns for expected maximum permissible loss. And under consideration of ambient temperature, input voltage, and output current etc., we recommend proper dissipation ratings for maximum permissible loss; in general maximum dissipation rating is 70 to 80 percent.

● Overcurrent Protection
  Overcurrent protection is designed in these products, but this does not assure for the suppression of uprising device operation. If output pins and GND pins are shorted out, these products might break down.
  In use of these products, please read through and understand dissipation idea for absolute maximum ratings from the above mention or our ’Semiconductor Reliability Handbook’. Then use these products under absolute maximum ratings in any condition. Furthermore, Toshiba recommends inserting failsafe system into the design.
Representative Typical Characteristics (Note)

1) Output voltage vs. Input voltage

- **V\text{OUT} = 1.2 V**
  - Input voltage $V_{\text{IN}}$ (V)
  - Output voltage $V_{\text{OUT}}$ (V)
  - $I_{\text{OUT}} = 1\text{mA}$
  - $I_{\text{OUT}} = 50\text{mA}$
  - $I_{\text{OUT}} = 150\text{mA}$

- **V\text{OUT} = 2.5 V**
  - Input voltage $V_{\text{IN}}$ (V)
  - Output voltage $V_{\text{OUT}}$ (V)
  - $I_{\text{OUT}} = 1\text{mA}$
  - $I_{\text{OUT}} = 50\text{mA}$
  - $I_{\text{OUT}} = 150\text{mA}$

- **V\text{OUT} = 3.0 V**
  - Input voltage $V_{\text{IN}}$ (V)
  - Output voltage $V_{\text{OUT}}$ (V)
  - $I_{\text{OUT}} = 1\text{mA}$
  - $I_{\text{OUT}} = 50\text{mA}$
  - $I_{\text{OUT}} = 150\text{mA}$

2) Output voltage vs. Output current

- **V\text{OUT} = 1.2 V**
  - Output current $I_{\text{OUT}}$ (mA)
  - Output voltage $V_{\text{OUT}}$ (V)
  - $V_{\text{IN}} = 2.2\text{ V}$,
  - $C_{\text{IN}} = 0.1\mu\text{F}$,
  - $C_{\text{OUT}} = 1\mu\text{F}$

- **V\text{OUT} = 1.8 V**
  - Output current $I_{\text{OUT}}$ (mA)
  - Output voltage $V_{\text{OUT}}$ (V)
  - $V_{\text{IN}} = 2.8\text{ V}$,
  - $C_{\text{IN}} = 0.1\mu\text{F}$,
  - $C_{\text{OUT}} = 1\mu\text{F}$
3) Output voltage vs. Ambient temperature

- **V<sub>OUT</sub> = 2.5 V**
  - $V_I = 3.5 \text{ V}$,
  - $C_{IN} = 0.1 \mu\text{F}$, $C_{OUT} = 1 \mu\text{F}$
  - $I_{OUT} = 50 \text{ mA}$

- **V<sub>OUT</sub> = 3.0 V**
  - $V_I = 4.0 \text{ V}$,
  - $C_{IN} = 0.1 \mu\text{F}$, $C_{OUT} = 1 \mu\text{F}$
  - $I_{OUT} = 50 \text{ mA}$

- **V<sub>OUT</sub> = 1.2 V**
  - $V_I = 2.2 \text{ V}$,
  - $C_{IN} = 0.1 \mu\text{F}$, $C_{OUT} = 1 \mu\text{F}$
  - $I_{OUT} = 50 \text{ mA}$

- **V<sub>OUT</sub> = 1.8 V**
  - $V_I = 2.8 \text{ V}$,
  - $C_{IN} = 0.1 \mu\text{F}$, $C_{OUT} = 1 \mu\text{F}$
  - $I_{OUT} = 50 \text{ mA}$

- **V<sub>OUT</sub> = 2.5 V**
  - $V_I = 3.5 \text{ V}$,
  - $C_{IN} = 0.1 \mu\text{F}$, $C_{OUT} = 1 \mu\text{F}$
  - $I_{OUT} = 50 \text{ mA}$

- **V<sub>OUT</sub> = 3.0 V**
  - $V_I = 4.0 \text{ V}$,
  - $C_{IN} = 0.1 \mu\text{F}$, $C_{OUT} = 1 \mu\text{F}$
  - $I_{OUT} = 50 \text{ mA}$
4) Dropout voltage vs. Output current

\[ V_{\text{OUT}} = 1.2 \text{ V} \]

\[ V_{\text{OUT}} = 1.8 \text{ V} \]

\[ V_{\text{OUT}} = 2.5 \text{ V} \]

\[ V_{\text{OUT}} = 3.0 \text{ V} \]

5) Quiescent current vs. Input voltage

\[ V_{\text{OUT}} = 1.2 \text{ V} \]

\[ V_{\text{OUT}} = 1.8 \text{ V} \]
6) Quiescent current vs. Ambient temperature

**V\text{OUT} = 1.2 V**

\[ V_{\text{IN}} = 2.2 \text{ V} \]

\[ C_{\text{IN}} = 0.1 \mu\text{F}, \ C_{\text{OUT}} = 1 \mu\text{F} \]

\[ I_{\text{OUT}} = 0 \text{ mA} \]

**V\text{OUT} = 1.8 V**

\[ V_{\text{IN}} = 2.8 \text{ V} \]

\[ C_{\text{IN}} = 0.1 \mu\text{F}, \ C_{\text{OUT}} = 1 \mu\text{F} \]

\[ I_{\text{OUT}} = 0 \text{ mA} \]

**V\text{OUT} = 2.5 V**

\[ V_{\text{IN}} = 3.5 \text{ V} \]

\[ C_{\text{IN}} = 0.1 \mu\text{F}, \ C_{\text{OUT}} = 1 \mu\text{F} \]

\[ I_{\text{OUT}} = 0 \text{ mA} \]

**V\text{OUT} = 3.0 V**

\[ V_{\text{IN}} = 4.0 \text{ V} \]

\[ C_{\text{IN}} = 0.1 \mu\text{F}, \ C_{\text{OUT}} = 1 \mu\text{F} \]

\[ I_{\text{OUT}} = 0 \text{ mA} \]
7) Output voltage vs. Output current

**V_{OUT} = 1.2 V**

- **V_{IN} = 2.2 V**
- **V_{IN} = 5.5 V**

**V_{OUT} = 1.8 V**

- **V_{IN} = 2.8 V**
- **V_{IN} = 5.5 V**

**V_{OUT} = 2.5 V**

- **V_{IN} = 3.5 V**

**V_{OUT} = 3.0 V**

- **V_{IN} = 4.0 V**

8) Ripple rejection ratio vs. Frequency

**V_{OUT} = 1.2 V**

- **V_{IN} = 2.2 V**, \(V_{ripple} = 500 \text{ mV}_{pp}\)
- \(C_{IN} = \text{none}, C_{OUT} = 1 \mu F\)
- \(I_{OUT} = 10 \text{ mA}, T_a = 25^\circ C\)

**V_{OUT} = 3.0 V**

- **V_{IN} = 4.0 V**, \(V_{ripple} = 500 \text{ mV}_{pp}\)
- \(C_{IN} = \text{none}, C_{OUT} = 1 \mu F\)
- \(I_{OUT} = 10 \text{ mA}, T_a = 25^\circ C\)
9) Control Transient Response

\[ V_{\text{OUT}} = 1.2 \text{ V} \]

- \( V_{\text{IN}} = 2.2 \text{ V}, \ C_{\text{IN}} = 0.1 \mu\text{F}, \ C_{\text{OUT}} = 1 \mu\text{F} \)
- \( I_{\text{OUT}} = 50\text{ mA} \)
- \( I_{\text{OUT}} = 150\text{ mA} \)

\[ V_{\text{OUT}} = 1.8 \text{ V} \]

- \( V_{\text{IN}} = 2.8 \text{ V}, \ C_{\text{IN}} = 0.1 \mu\text{F}, \ C_{\text{OUT}} = 1 \mu\text{F} \)
- \( I_{\text{OUT}} = 50\text{ mA} \)
- \( I_{\text{OUT}} = 150\text{ mA} \)

\[ V_{\text{OUT}} = 2.5 \text{ V} \]

- \( V_{\text{IN}} = 3.5 \text{ V}, \ C_{\text{IN}} = 0.1 \mu\text{F}, \ C_{\text{OUT}} = 1 \mu\text{F} \)
- \( I_{\text{OUT}} = 50\text{ mA} \)
- \( I_{\text{OUT}} = 150\text{ mA} \)

\[ V_{\text{OUT}} = 3.0 \text{ V} \]

- \( V_{\text{IN}} = 4.0 \text{ V}, \ C_{\text{IN}} = 0.1 \mu\text{F}, \ C_{\text{OUT}} = 1 \mu\text{F} \)
- \( I_{\text{OUT}} = 50\text{ mA} \)
- \( I_{\text{OUT}} = 150\text{ mA} \)
10) Control Transient Response

(Note) The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Package Dimensions

SMV (SOT-25)(SC-74A)  Unit: mm

Weight: 16 mg (typ.)
TCR2EF series, TCR2EE series

Package Dimensions

ESV (SOT-553)  
Unit: mm

Weight: 3.0 mg (typ.)
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