

Description

The AP7381 series is a positive voltage regulator IC.


The AP7381 has features of wide input voltage range, high accuracy, low dropout voltage, current limit and ultra-low quiescent current which make it ideal for use in various USB and portable devices.

The IC consists of a voltage reference, an error amplifier, a resistor network for setting output voltage, a current limit circuit for current protection, and a chip enable circuit.

The AP7381 has 2.8V, 3.3V, 5V and 7V fixed voltage version.

The AP7381 is available in space-saving SOT23, SOT89 and TO92 (Ammo Packing) packages.

Features

- Wide Input Voltage Range: Up to 40V
- Low Dropout Voltage: $V_{DRO} = 1000mV @ I_{OUT} = 100mA @ V_{OUT} = 3.3V$
- Low Ground Current
- High Output Voltage Accuracy
- Compatible with Low ESR Ceramic Capacitor
- Excellent Line/Load Regulation
- Thermal Shutdown Function
- Short Current Protection Function
- Moisture Sensitivity:
 - SOT23: Level 1 per J-STD-020
 - SOT89/TO92 (Ammo Packing): Level 3 per J-STD-020
- Terminals: Finish Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 
- Weight:
 - SOT89: 0.062 grams (Approximate)
 - TO92 (Ammo Packing): 0.157 grams (Approximate)
 - SOT23: 0.009 grams (Approximate)
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please [contact us](mailto:contact@diodes.com) or your local Diodes representative. <https://www.diodes.com/quality/product-definitions/>**

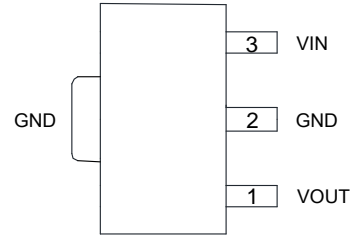
Applications

- E-Meter
- Battery-powered Equipment
- Laptop, Palmtops, Notebook Computers
- Portable Information Appliances

Notes: 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
 2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

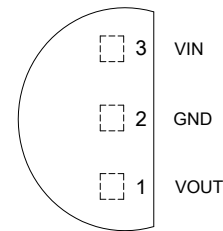
Pin Assignments

(Top View)



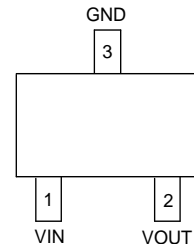
SOT89

(Top View)



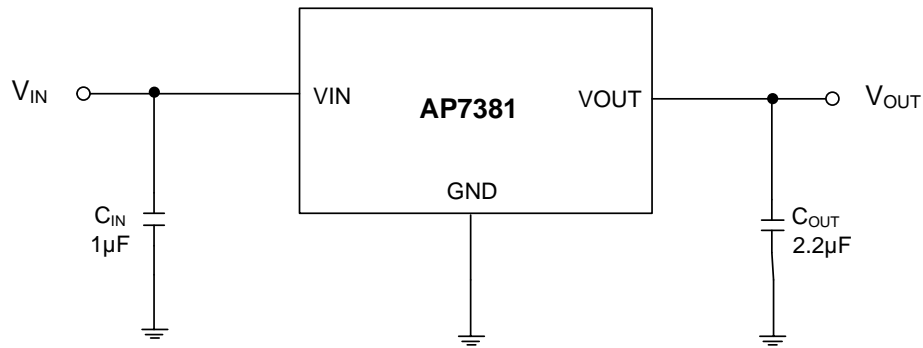
TO92 (Ammo Packing)

(Top View)



SOT23

Typical Applications Circuit



Pin Descriptions

| Pin Number | | | Pin Name | Function |
|---------------------|-------|-------|----------|--------------------------|
| TO92 (Ammo Packing) | SOT89 | SOT23 | | |
| 3 | 3 | 1 | VIN | Input voltage |
| 2 | 2 | 3 | GND | Ground |
| 1 | 1 | 2 | VOUT | Regulated output voltage |

Absolute Maximum Ratings (Note 4)

| Symbol | Parameter | Rating | Unit | |
|-------------------|-----------------------------------|---------------------|------|------|
| V _{IN} | Supply Input Voltage | -0.3 to 45 | V | |
| V _{OUT} | Output Voltage | -0.3 to 8 | V | |
| I _{OUT} | Output Current | 150 | mA | |
| T _{LEAD} | Lead Temperature (Soldering, 10s) | +260 | °C | |
| T _J | Operating Junction Temperature | +150 | °C | |
| θ _{JA} | Thermal Resistance | SOT89 | 125 | °C/W |
| | | TO92 (Ammo Packing) | 165 | |
| | | SOT23 | 167 | |
| T _{STG} | Storage Temperature Range | -65 to +150 | °C | |
| CDM | ESD (Change Device Model) | 2000 | V | |
| HBM | ESD (Human Body Model) | 4000 | V | |

- Note: 4. a). Stresses beyond those listed under *Absolute Maximum Ratings* can cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods can affect device reliability.
 b). Ratings apply to ambient temperature at +25°C. The JEDEC High-K board design used to derive this data is a 2inch x 2inch multi-layer board with 1oz internal power and ground planes and 2oz copper traces on the top and bottom of the board.

Recommended Operating Conditions

| Symbol | Parameter | Min | Max | Unit |
|-----------------|--------------------------------|-----|------|------|
| V _{IN} | Supply Input Voltage | 3.3 | 40 | V |
| T _J | Operating Junction Temperature | -40 | +125 | °C |

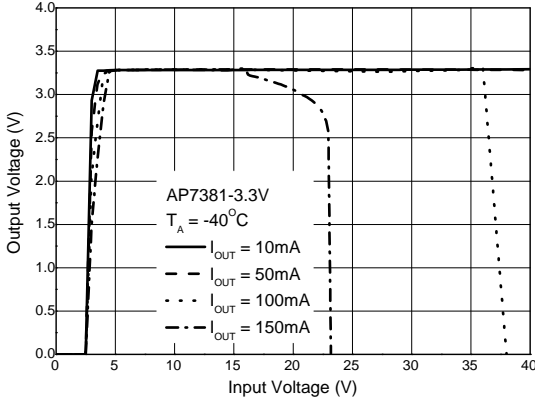
Electrical Characteristics ($T_J = +25^\circ\text{C}$, $I_{OUT} = 1\text{mA}$, $C_{IN} = 1.0\mu\text{F}$, $C_{OUT} = 2.2\mu\text{F}$, $V_{IN} = V_{OUT} + 2\text{V}$, **Bold** typeface applies over $-40^\circ\text{C} \leq T_J \leq +125^\circ\text{C}$, unless otherwise specified.)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|--|--|---|-----------------------|-----------------------------|------------------------|-----------------------|
| V_{OUT} | Output Voltage | Variation from Specified V_{OUT} | $V_{OUT} \times 98\%$ | — | $V_{OUT} \times 102\%$ | V |
| V_{IN} | Input Voltage | — | 3.3 | — | 40 | V |
| I_{LIMIT} | Current Limit | $V_{OUT} = 98\% \times V_{OUT}$, $V_{IN} = V_{OUT} + 2\text{V}$ | 150 | — | — | mA |
| $\Delta V_{OUT} / \Delta V_{IN}$ | Line Regulation | $V_{OUT} + 2\text{V} \leq V_{IN} \leq 40\text{V}$, $I_{OUT} = 10\text{mA}$ | — | 0.05 | — | %/V |
| $\Delta V_{OUT} / I_{OUT}$ | Load Regulation | $1\text{mA} \leq I_{OUT} \leq 150\text{mA}$ | — | 0.5 | — | % |
| V_{DROP} | Dropout Voltage | $I_{OUT} = 100\text{mA}$ @ $V_{OUT} = 3.3\text{V}$ | — | 1000 | — | mV |
| I_{GND} | Ground Current | $I_{OUT} = 0\text{A}$ | — | 2.5 | — | μA |
| | | $I_{OUT} = 100\text{mA}$ | — | 25 | — | |
| $\Delta V_{OUT} / (V_{OUT} \times \Delta T)$ | Output Voltage Temperature Coefficient | $I_{OUT} = 100\mu\text{A}$, $-40^\circ\text{C} \leq T_J \leq +125^\circ\text{C}$ | — | ± 100 | — | ppm/ $^\circ\text{C}$ |
| T_{OTSD} | Thermal Shutdown Temperature | — | — | +160 | — | $^\circ\text{C}$ |
| T_{HYOTSD} | Thermal Shutdown Hysteresis | — | — | +20 | — | $^\circ\text{C}$ |
| PSRR | Power Supply Rejection Ratio | $I_{OUT} = 1\text{mA}$, $V_{OUT} = 3.3\text{V}$ | — | 60 | — | dB |

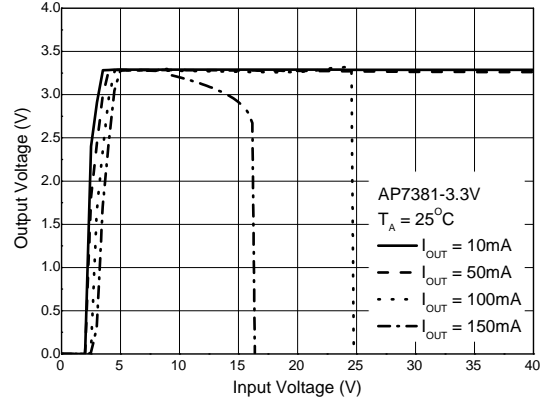
Performance Characteristics

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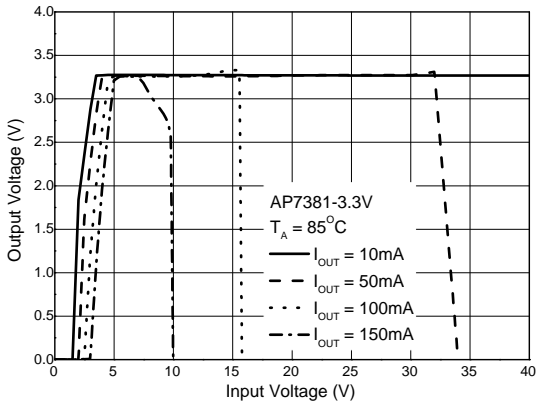
Output Voltage vs. Input Voltage @-40°C



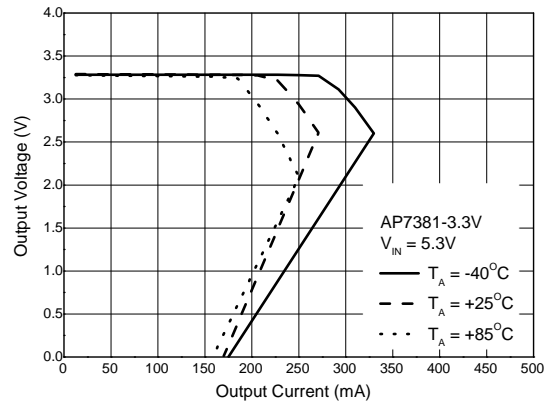
Output Voltage vs. Input Voltage @+25°C



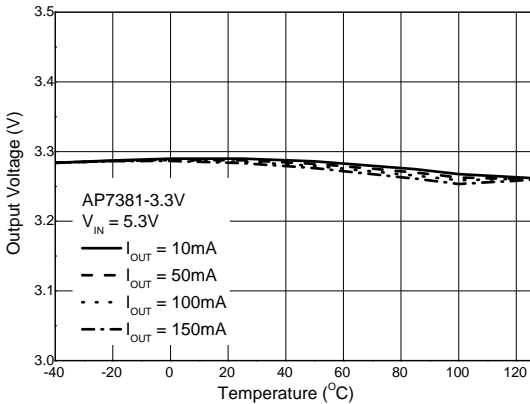
Output Voltage vs. Input Voltage @+85°C



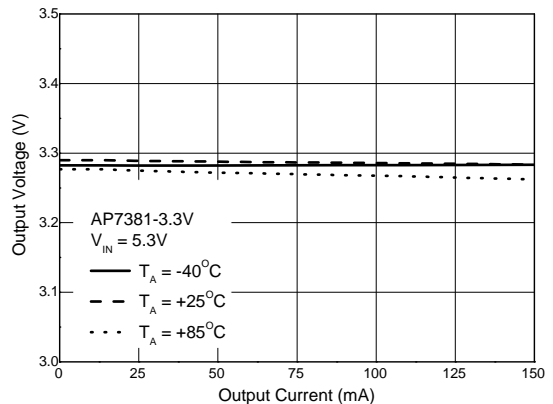
Output Voltage vs. Output Current



Output Voltage vs. Temperature

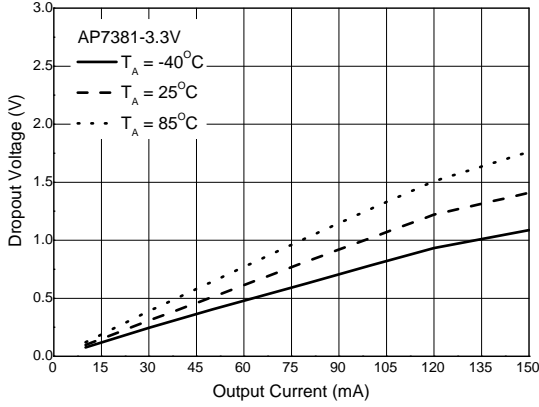


Output Voltage vs. Output Current

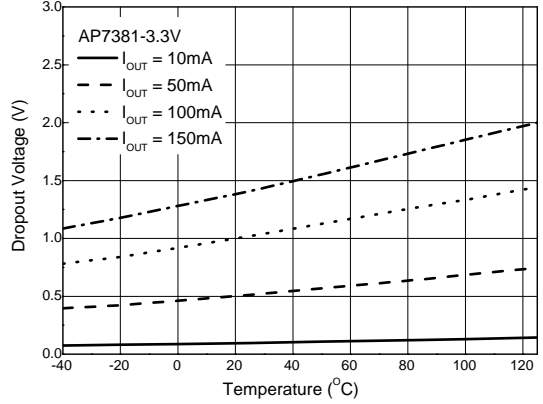


Performance Characteristics (continued)

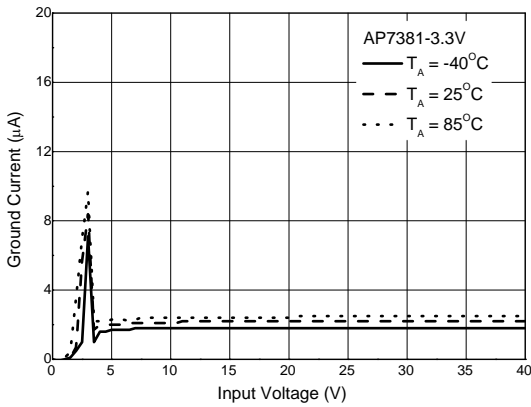
Dropout Voltage vs. Output Current



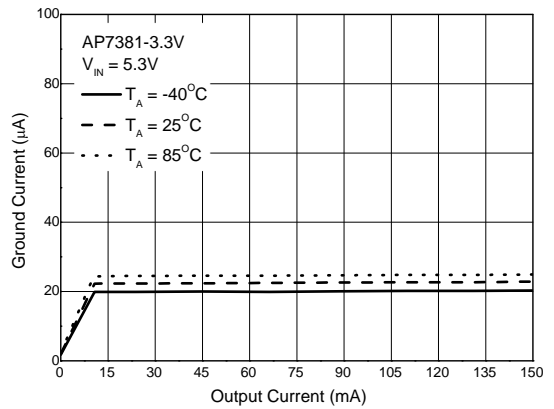
Dropout Voltage vs. Temperature



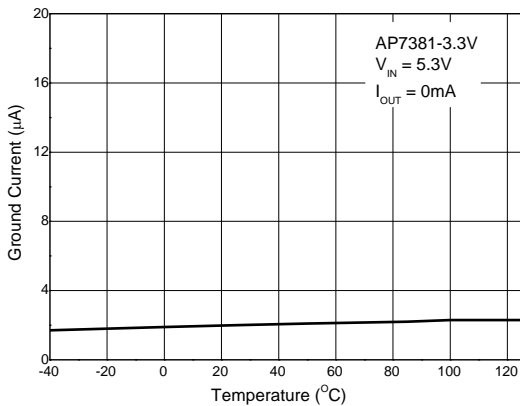
I_{GND} vs. Input Voltage



I_{GND} vs. Output Current

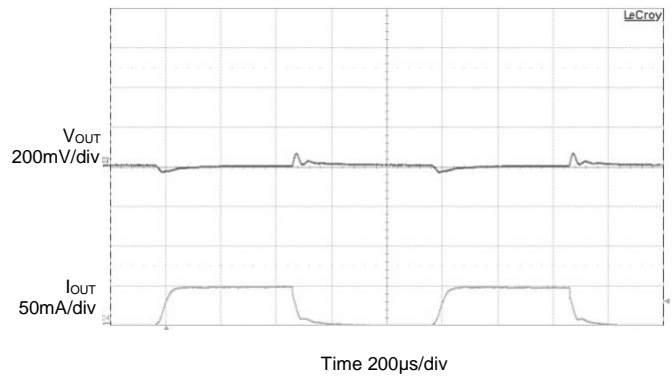


I_{GND} vs. Temperature

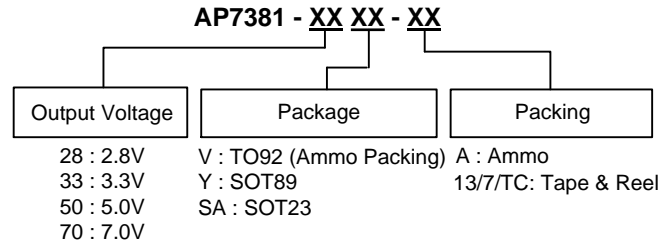


Load Transient

$C_{IN} = 1\mu\text{F}$, $C_{OUT} = 2.2\mu\text{F}$, $V_{IN} = V_{OUT} + 2\text{V}$, $I_{OUT} = 0$ to 50mA



Ordering Information (Note 5)



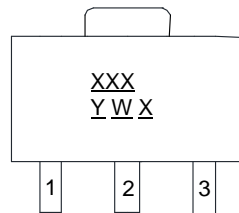
| Part Number | Package Code | Packaging | Tape and Reel/Ammo | |
|---------------|--------------|----------------------|--------------------|--------------------|
| | | | Quantity | Part Number Suffix |
| AP7381-28V-A | V | TO-92 (Ammo Packing) | 2000/Ammo | -A |
| AP7381-33V-A | V | TO92 (Ammo Packing) | 2000/Ammo | -A |
| AP7381-50V-A | V | TO92 (Ammo Packing) | 2000/Ammo | -A |
| AP7381-70V-A | V | TO92 (Ammo Packing) | 2000/Ammo | -A |
| AP7381-28Y-13 | Y | SOT89 | 2500/Tape & Reel | -13 |
| AP7381-33Y-13 | Y | SOT89 | 2500/Tape & Reel | -13 |
| AP7381-50Y-13 | Y | SOT89 | 2500/Tape & Reel | -13 |
| AP7381-70Y-13 | Y | SOT89 | 2500/Tape & Reel | -13 |
| AP7381-33Y-TC | Y | SOT89 | 4000/Tape & Reel | -TC |
| AP7381-28SA-7 | SA | SOT23 | 3000/Tape & Reel | -7 |
| AP7381-33SA-7 | SA | SOT23 | 3000/Tape & Reel | -7 |
| AP7381-50SA-7 | SA | SOT23 | 3000/Tape & Reel | -7 |
| AP7381-70SA-7 | SA | SOT23 | 3000/Tape & Reel | -7 |

Note: 5. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

Marking Information

(1) SOT89

(Top View)

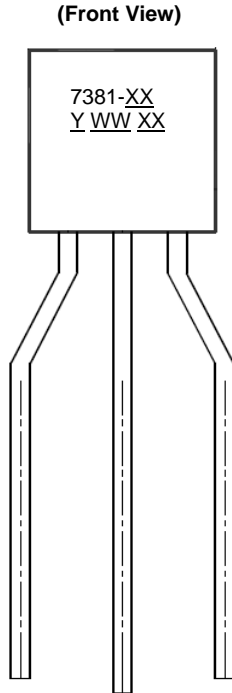


XXX : Identification Code
Y : Year : 0 ~ 9
W : Week : A ~ Z : 1 ~ 26 Week;
 a ~ z : 27 ~ 52 Week;
 z Represents 52 and 53 Week
X : Internal Code

| Part Number | Package | Identification Code |
|---------------|---------|---------------------|
| AP7381-28Y-13 | SOT89 | D9C |
| AP7381-33Y-13 | SOT89 | D9A |
| AP7381-50Y-13 | SOT89 | D9B |
| AP7381-70Y-13 | SOT89 | D9D |
| AP7381-33Y-TC | SOT89 | D9A |

Marking Information (continued)

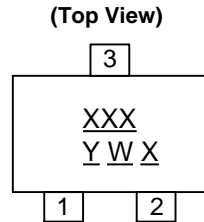
(2) TO92 (Ammo Packing)



7381-XX : Identification Code
Y : Year : 0 ~ 9
WW : Week : 01 ~ 52; 52
 Represents 52 and 53 Week
XX : Internal Code

| Part Number | Package | Identification Code |
|--------------|---------------------|---------------------|
| AP7381-28V-A | TO92 (Ammo Packing) | 7381-28 |
| AP7381-33V-A | TO92 (Ammo Packing) | 7381-33 |
| AP7381-50V-A | TO92 (Ammo Packing) | 7381-50 |
| AP7381-70V-A | TO92 (Ammo Packing) | 7381-70 |

(3) SOT23

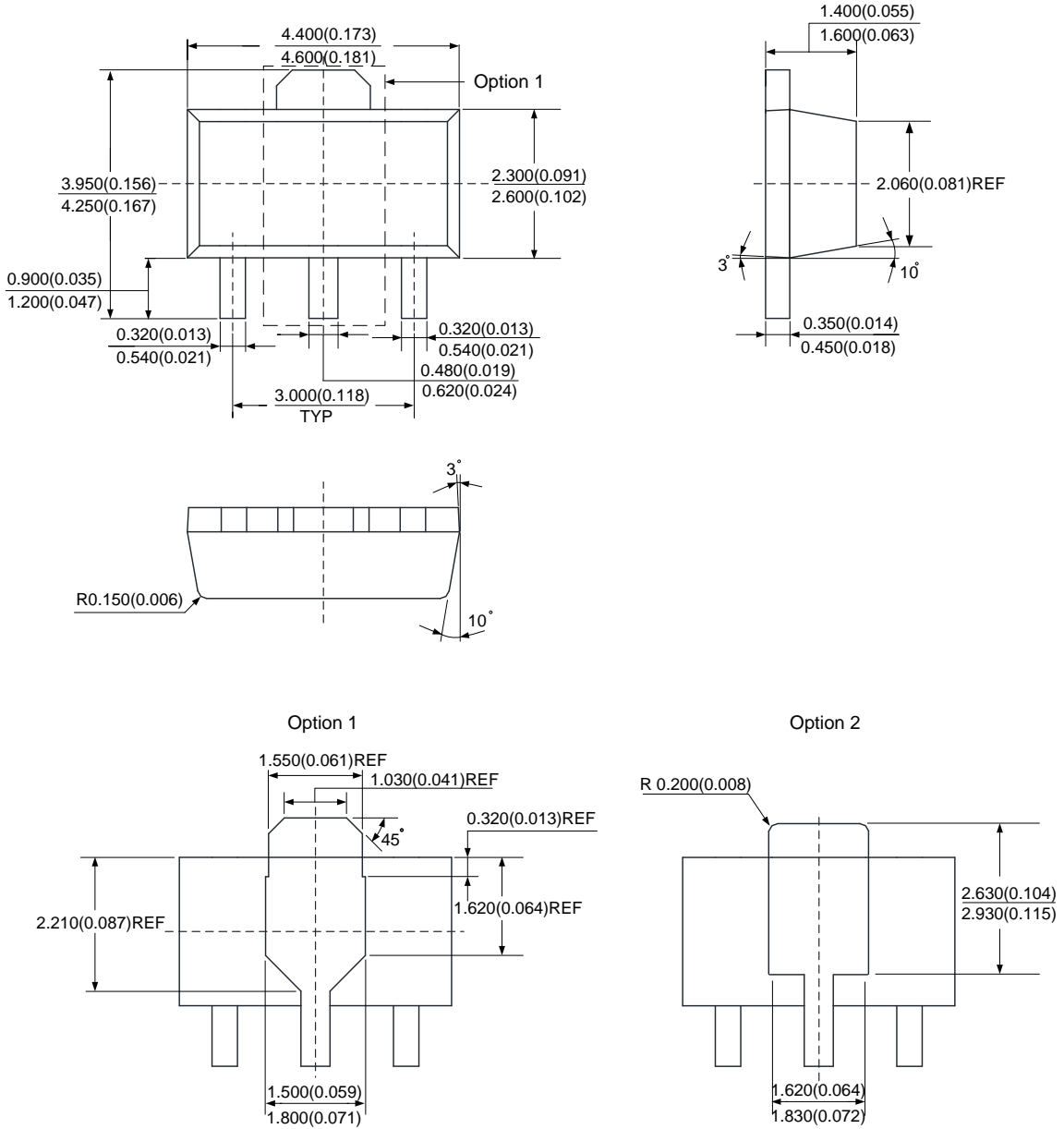


XXX : Identification Code
Y : Year 0 to 9
W : Week : A to Z : 1 to 26 week;
 a to z : 27 to 52 week; z represents
 52 and 53 week
X : Internal Code

| Part Number | Package | Identification Code |
|---------------|---------|---------------------|
| AP7381-28SA-7 | SOT23 | D9C |
| AP7381-33SA-7 | SOT23 | D9A |
| AP7381-50SA-7 | SOT23 | D9B |
| AP7381-70SA-7 | SOT23 | D9D |

Package Outline Dimensions (All dimensions in mm.)

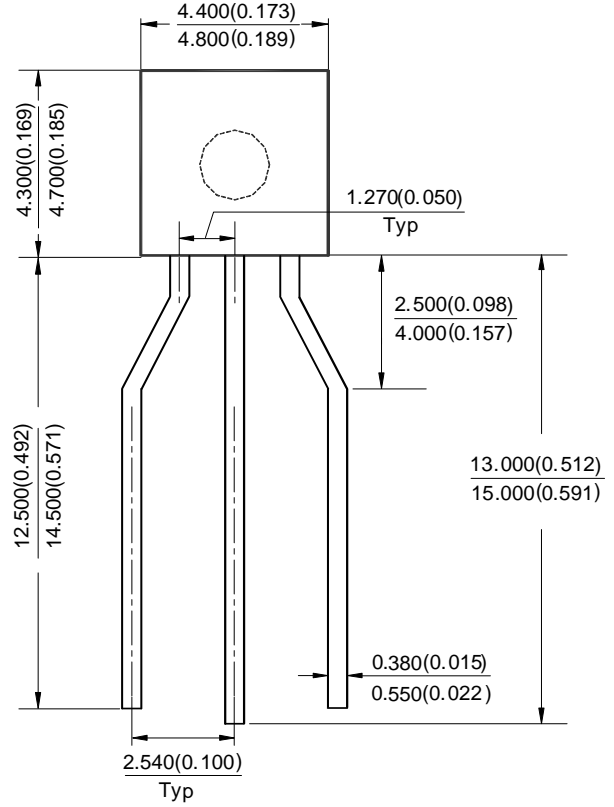
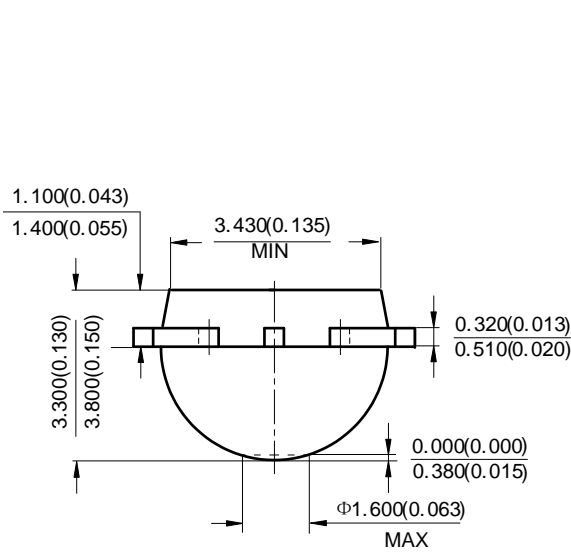
(1) Package Type: SOT89



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Package Outline Dimensions (All dimensions in mm.) (continued)

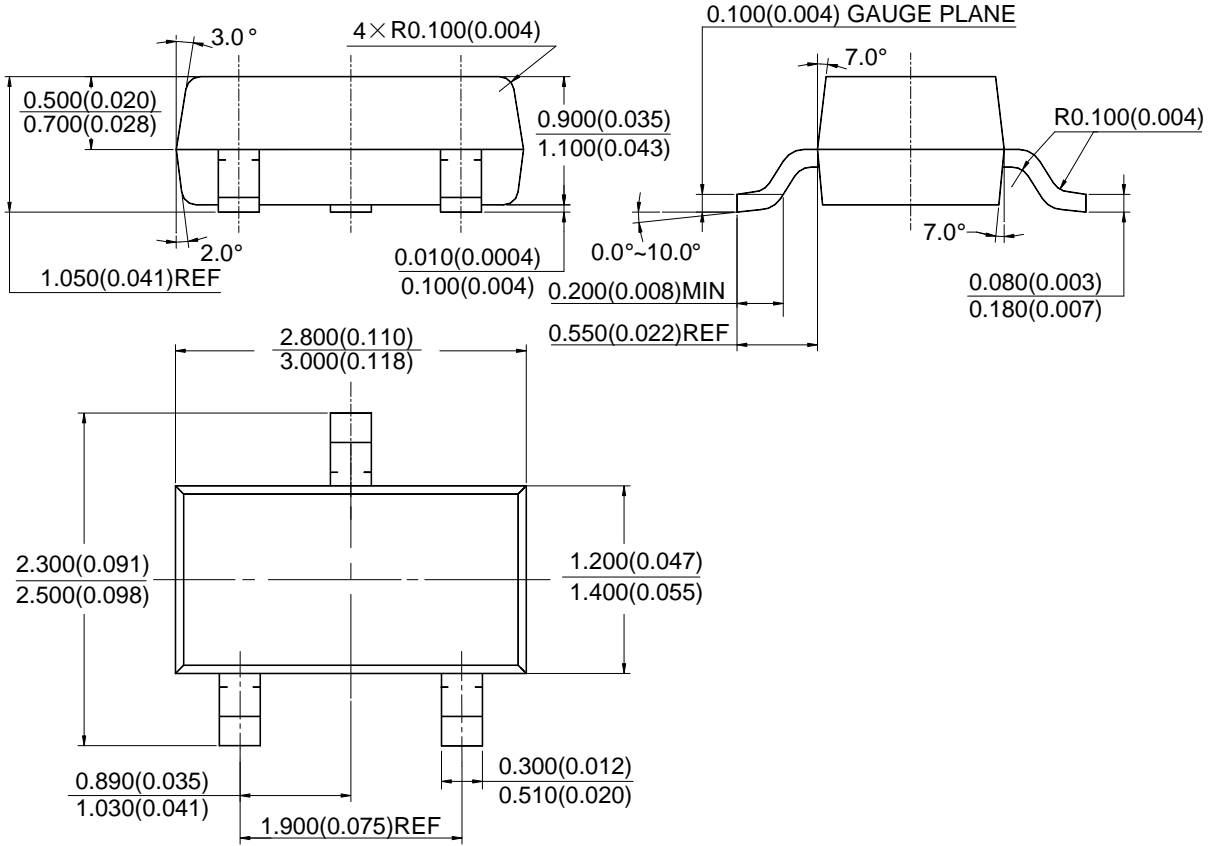
(2) Package Type: TO92 (Ammo Packing)



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Package Outline Dimensions (All dimensions in mm.) (continued)

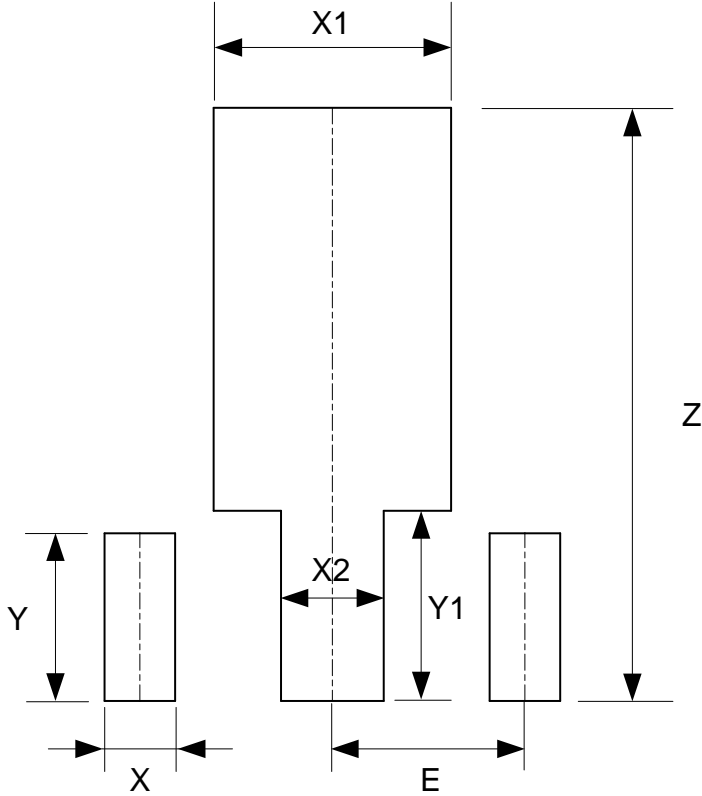
(3) Package Type: SOT23



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Suggested Pad Layout

(1) Package Type: SOT89

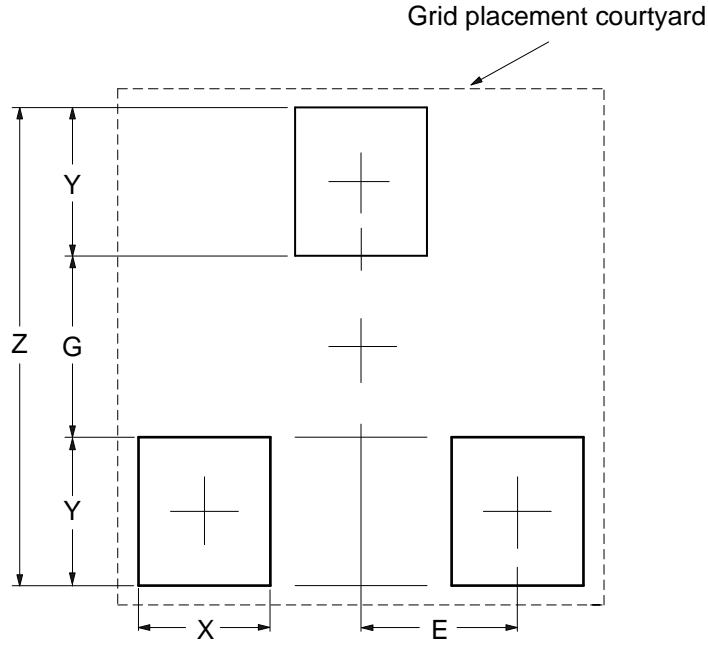


| Dimensions | Z (mm)/(inch) | X (mm)/(inch) | X1 (mm)/(inch) | X2 (mm)/(inch) | Y (mm)/(inch) | Y1 (mm)/(inch) | E (mm)/(inch) |
|------------|------------------|------------------|-------------------|-------------------|------------------|-------------------|------------------|
| Value | 4.600/0.181 | 0.550/0.022 | 1.850/0.073 | 0.800/0.031 | 1.300/0.051 | 1.475/0.058 | 1.500/0.059 |

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Suggested Pad Layout (continued)

(2) Package Type: SOT23



| Dimensions | Z (mm)/(inch) | G (mm)/(inch) | X (mm)/(inch) | Y (mm)/(inch) | E (mm)/(inch) |
|------------|------------------|------------------|------------------|------------------|------------------|
| Value | 2.900/0.114 | 1.100/0.043 | 0.800/0.031 | 0.900/0.035 | 0.950/0.037 |

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