

## 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:  $V_{DRO} = 1000\text{mV}@I_{OUT} = 100\text{mA}@V_{OUT} = 3.3\text{V}$
- 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 @3
- 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/>**

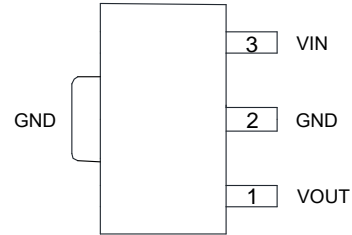
## Applications

- 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.

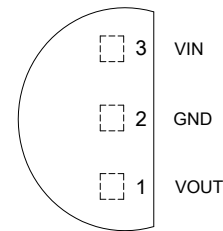
## Pin Assignments

(Top View)



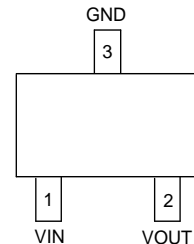
SOT89

(Top View)



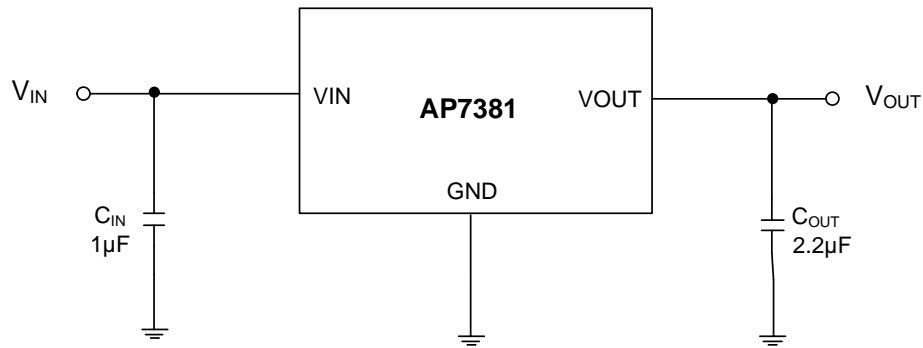
TO92 (Ammo Packing)

(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 <sub>IN</sub>	Supply Input Voltage	-0.3 to 45	V	
V <sub>OUT</sub>	Output Voltage	-0.3 to 8	V	
I <sub>OUT</sub>	Output Current	150	mA	
T <sub>LEAD</sub>	Lead Temperature (Soldering, 10s)	+260	°C	
T <sub>J</sub>	Operating Junction Temperature	+150	°C	
θ <sub>JA</sub>	Thermal Resistance	SOT89	125	°C/W
		TO92 (Ammo Packing)	165	
		SOT23	167	
T <sub>STG</sub>	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 <sub>IN</sub>	Supply Input Voltage	3.3	40	V
T <sub>J</sub>	Operating Junction Temperature	-40	+125	°C

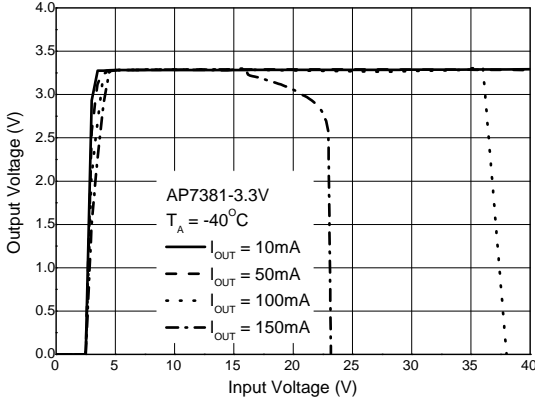
**Electrical Characteristics** ( $T_J = +25^\circ\text{C}$ ,  $I_{OUT} = 1\text{mA}$ ,  $C_{IN} = 1.0\mu\text{F}$ ,  $C_{OUT} = 2.2\mu\text{F}$ ,  $V_{IN} = V_{OUT} + 2\text{V}$ , **Bold** typeface applies over  $-40^\circ\text{C} \leq T_J \leq +125^\circ\text{C}$ , unless otherwise specified.)

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	—	$\mu\text{A}$
		$I_{OUT} = 100\text{mA}$	—	25	—	
$\Delta V_{OUT} / (V_{OUT} \Delta T)$	Output Voltage Temperature Coefficient	$I_{OUT} = 100\mu\text{A}$ , $-40^\circ\text{C} \leq T_J \leq +125^\circ\text{C}$	—	<b><math>\pm 100</math></b>	—	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

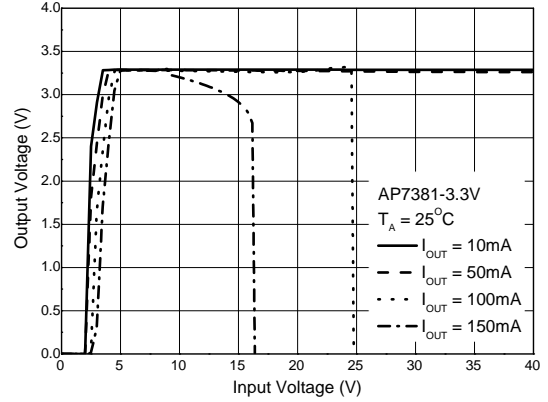
**Performance Characteristics**

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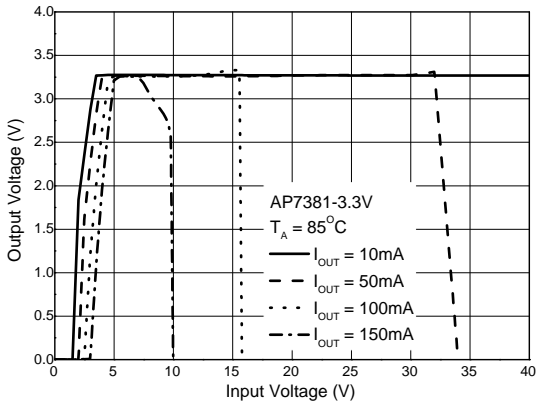
**Output Voltage vs. Input Voltage @-40°C**



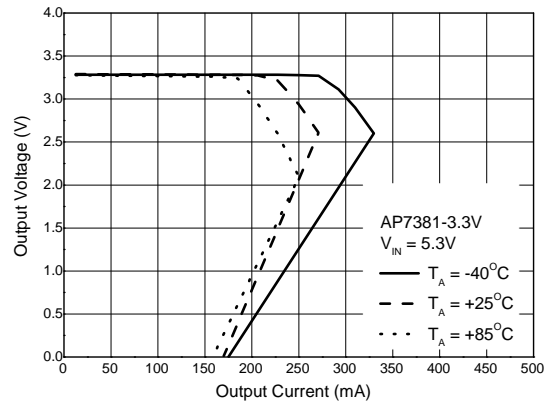
**Output Voltage vs. Input Voltage @+25°C**



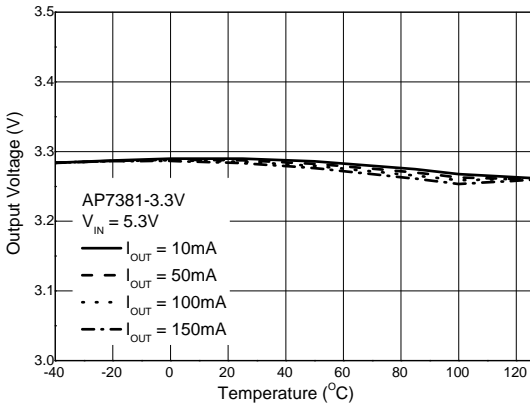
**Output Voltage vs. Input Voltage @+85°C**



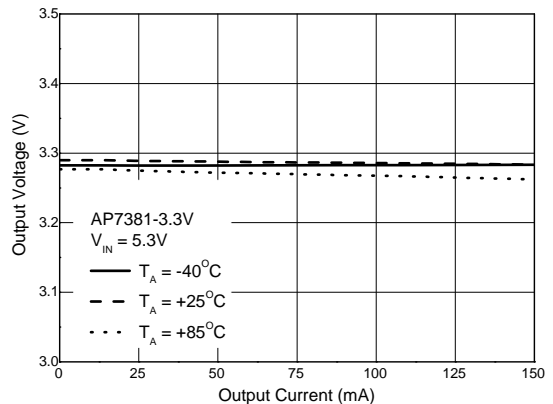
**Output Voltage vs. Output Current**



**Output Voltage vs. Temperature**

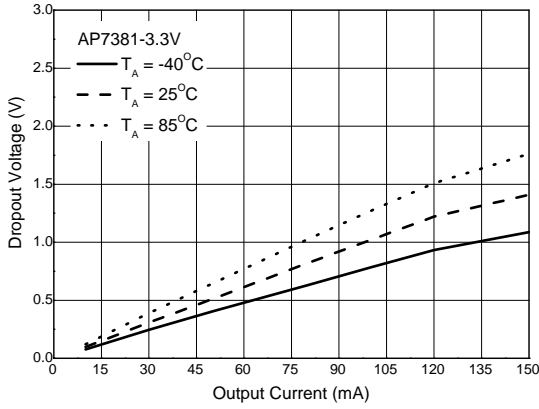


**Output Voltage vs. Output Current**

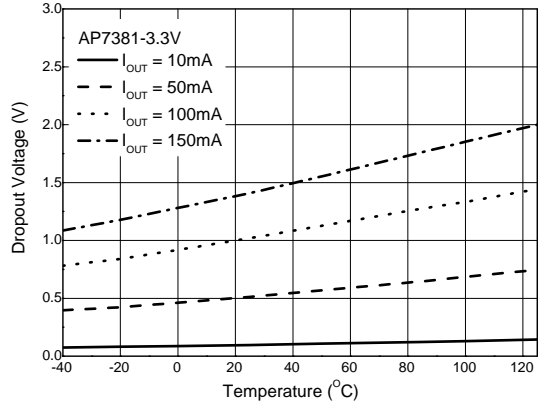


**Performance Characteristics** (continued)

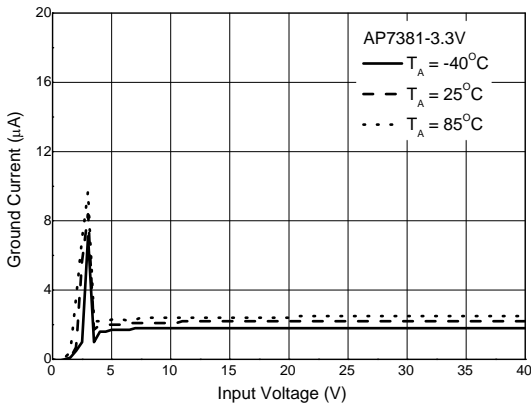
**Dropout Voltage vs. Output Current**



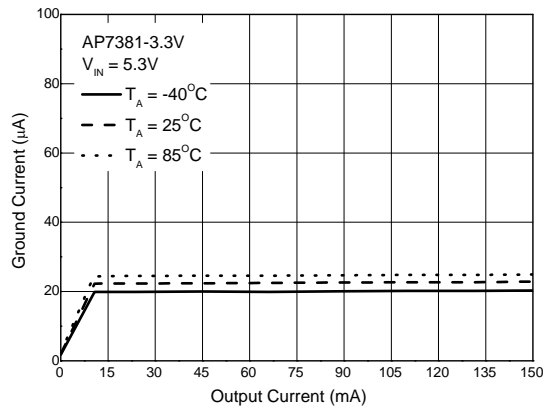
**Dropout Voltage vs. Temperature**



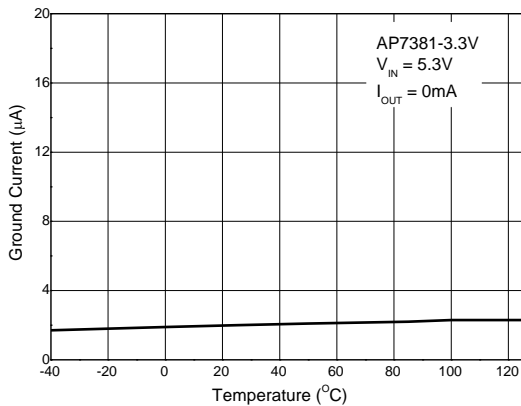
**$I_{GND}$  vs. Input Voltage**



**$I_{GND}$  vs. Output Current**

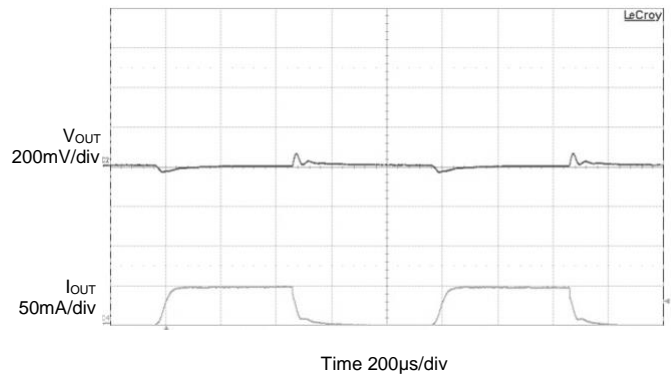


**$I_{GND}$  vs Temperature**

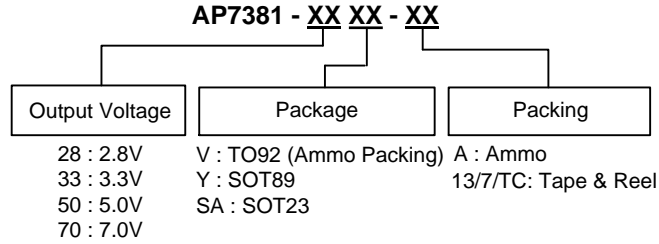


**Load Transient**

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



**Ordering Information** (Note 5)



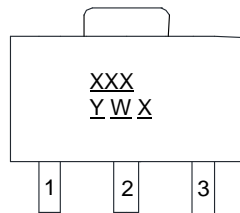
Part Number	Package Code	Packaging	Tape and Reel/Ammo	
			Quantity	Part Number Suffix
AP7381-28V-A	V	TO-92 (Ammo Packing)	2000/Ammo	-A
AP7381-33V-A	V	TO92 (Ammo Packing)	2000/Ammo	-A
AP7381-50V-A	V	TO92 (Ammo Packing)	2000/Ammo	-A
AP7381-70V-A	V	TO92 (Ammo Packing)	2000/Ammo	-A
AP7381-28Y-13	Y	SOT89	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)



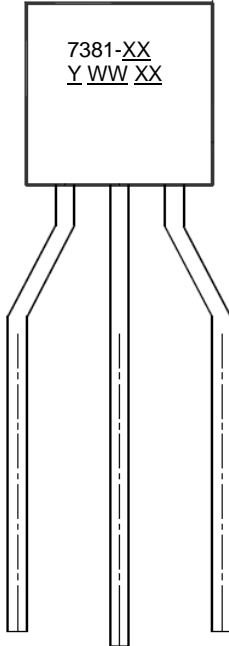
XXX : Identification Code  
 Y : Year : 0 ~ 9  
 W : Week : A ~ Z : 1 ~ 26 Week;  
       a ~ z : 27 ~ 52 Week;  
       z Represents 52 and 53 Week  
 X : Internal Code

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)

(Front View)

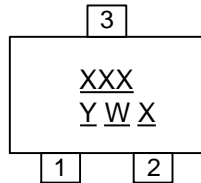


7381-XX : Identification Code  
Y : Year : 0 ~ 9  
WW : Week : 01 ~ 52; 52  
 Represents 52 and 53 Week  
XX : Internal Code

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

(Top View)

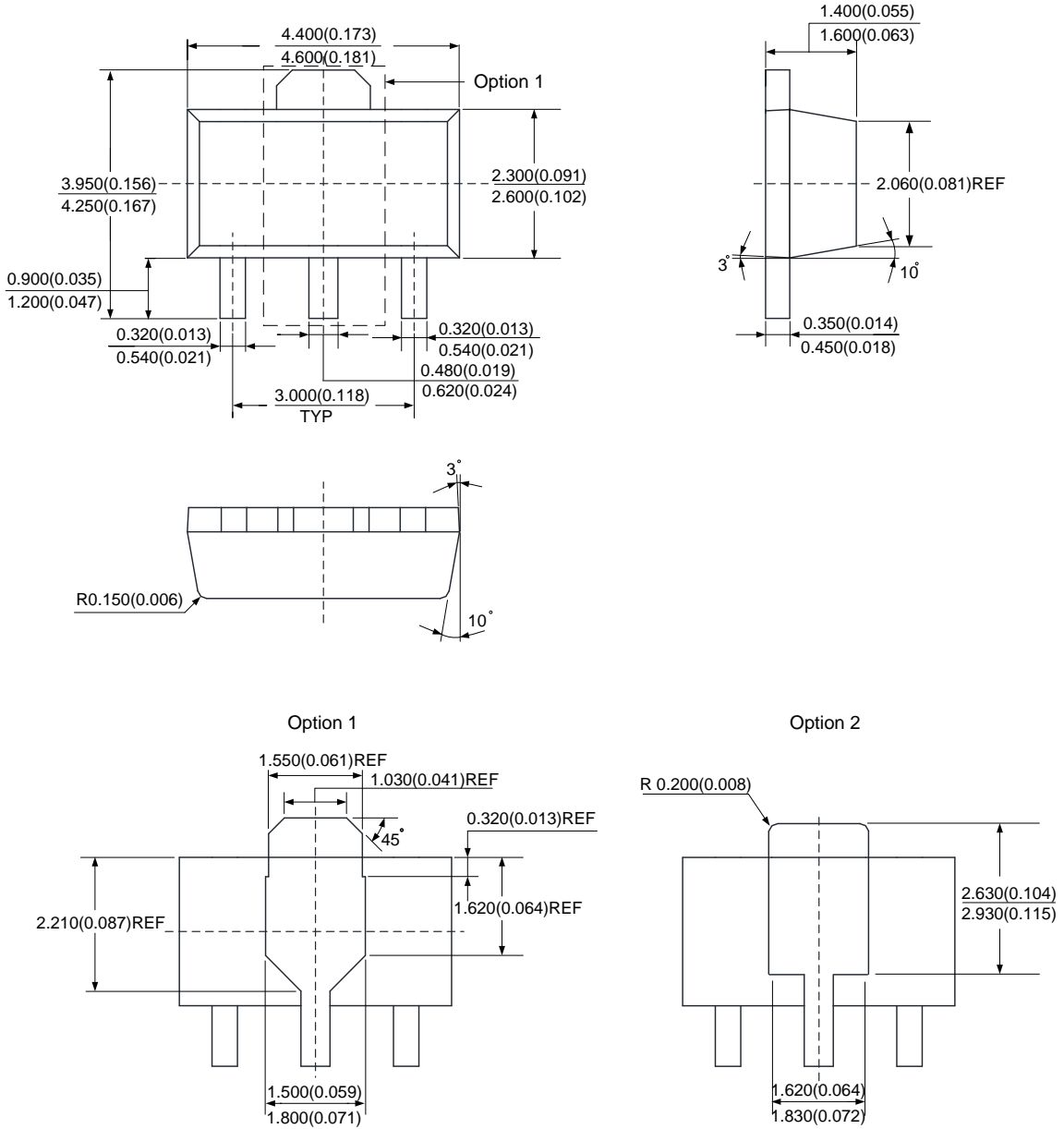


XXX : Identification Code  
Y : Year 0 to 9  
W : Week : A to Z : 1 to 26 week;  
 a to z : 27 to 52 week; z represents  
 52 and 53 week  
X : Internal Code

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

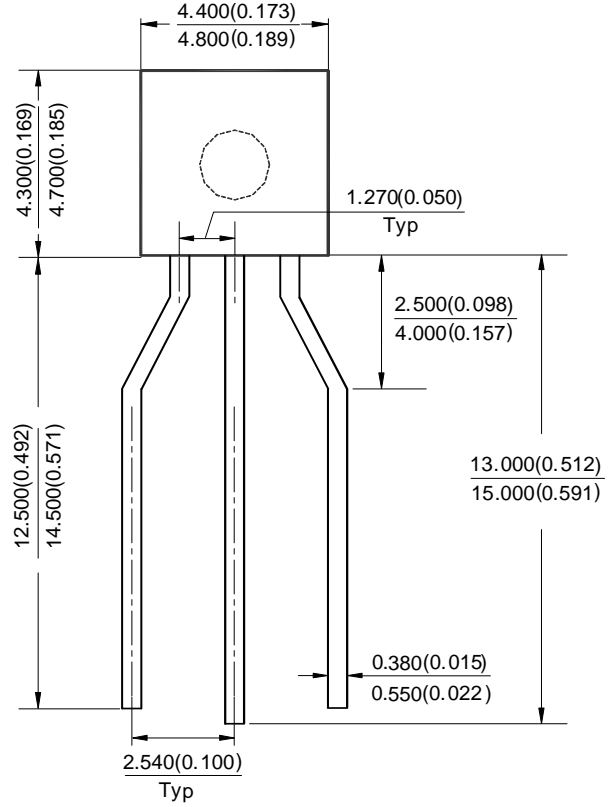
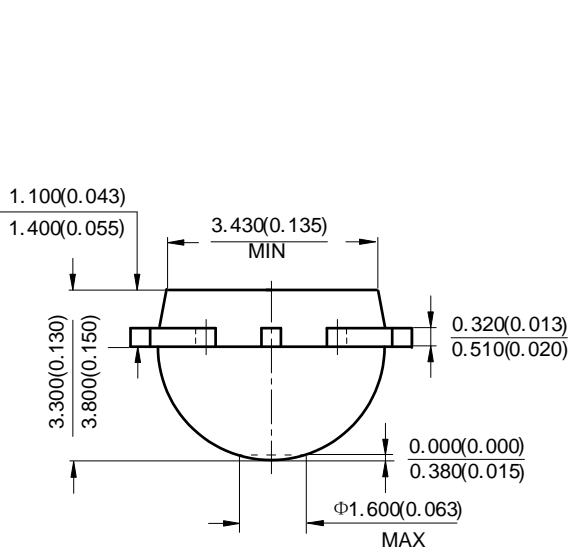


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**Package Outline Dimensions** (All dimensions in mm.) (continued)

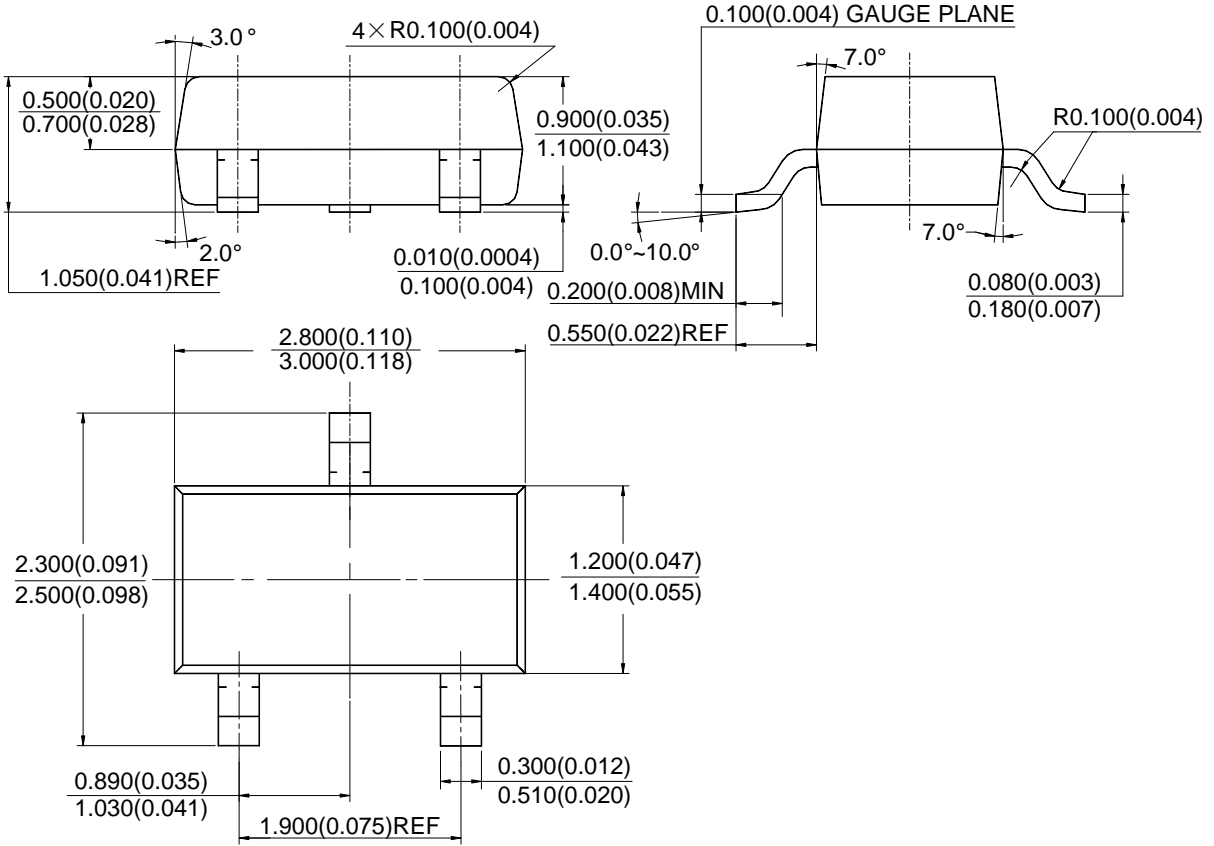
(2) Package Type: TO92 ( Ammo Packing)



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

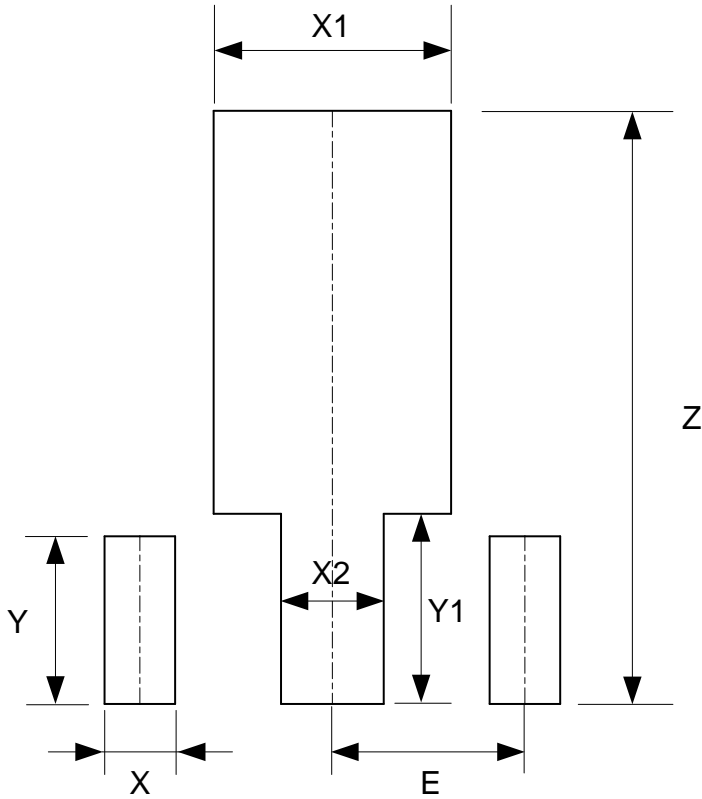
(3) Package Type: SOT23



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**Suggested Pad Layout**

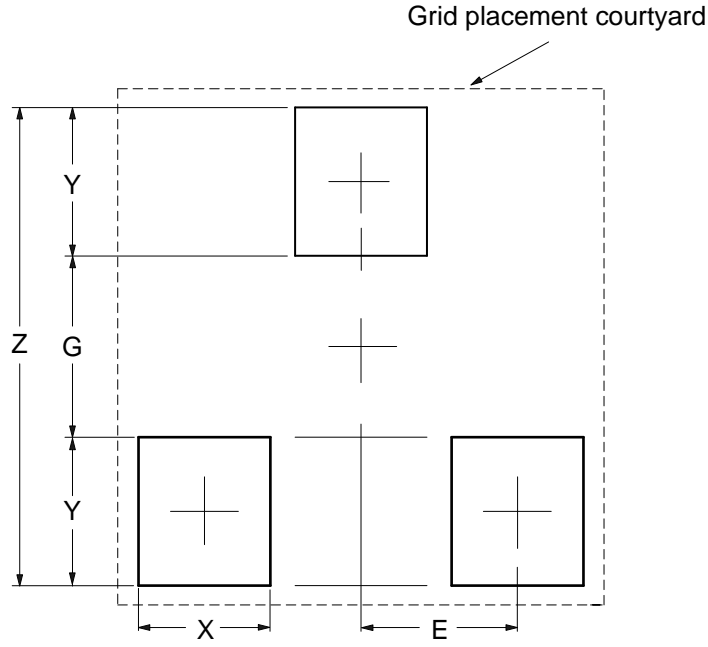
(1) Package Type: SOT89



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

**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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