

## Description

The AP2205 series is a positive voltage regulator IC fabricated by high voltage EPNP process.

The AP2205 has features of wide input voltage range, high accuracy, high ripple rejection, low dropout voltage, low noise, 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, a low power shutdown mode for extended battery life, over current protection, over temperature protection, as well as reversed-battery protection.

The AP2205 has 1.5V, 1.8V, 2.5V, 2.8V, 3.0V, 3.3V, 5.0V fixed voltage versions and adjustable voltage version.

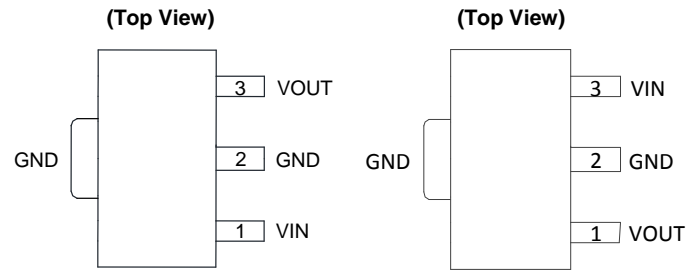
The AP2205 is available in space-saving SOT25 and SOT89 packages.

## Features

- Wide Input Voltage Range: 2.3V to 24V
- Wide Output Voltage Range: 1.24V to 22V
- Excellent Ripple Rejection: 60dB@ f = 1kHz
- Low Dropout Voltage:  $V_{DRO} = 100\text{mV} @ I_{OUT} = 100\mu\text{A}$
- Low Ground Current
- High Output Voltage Accuracy
- Compatible with Low ESR Ceramic Capacitor
- Excellent Line/Load Regulation
- Thermal Shutdown Function
- **Totally Lead-Free & Fully RoHS Compliant (Notes 2 & 3)**
- **Halogen and Antimony Free. "Green" Device (Note 4)**

- Notes:
2. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
  3. 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.
  4. 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

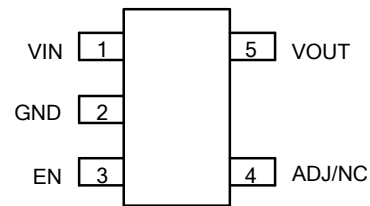


**SOT89 (Note 1)**

**SOT89R (Note 1)**

Note 1: The substrate/exposed pad should be connected to GND or open.

(Top View)

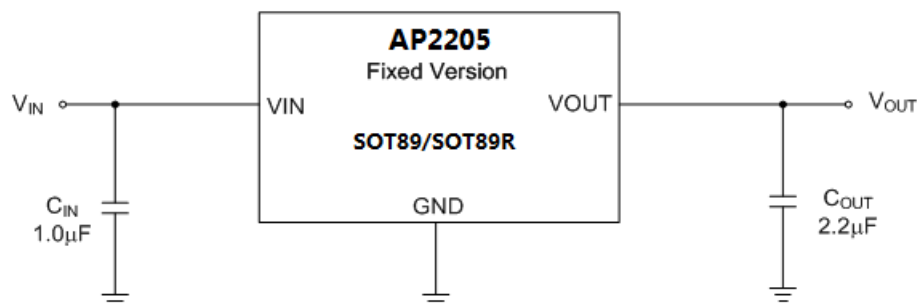


**SOT25**

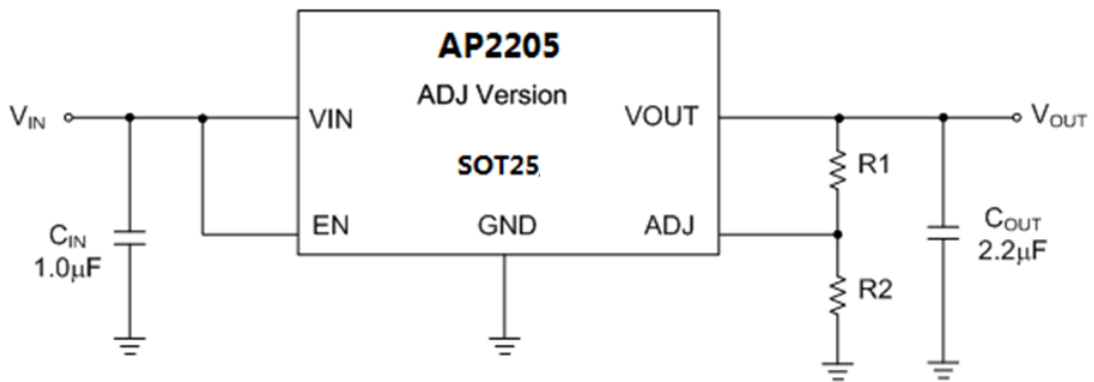
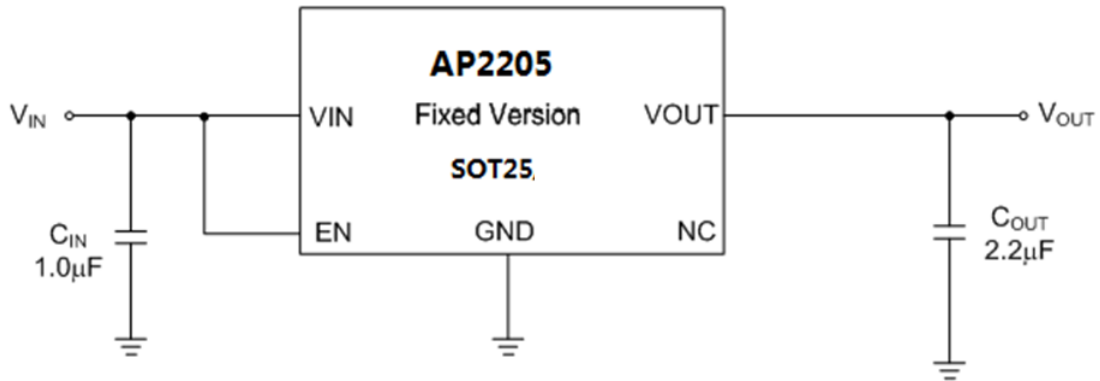
## Applications

- Battery-powered Equipment
- Laptop, Palmtops, Notebook Computers
- Portable Information Appliances
- Industrial/Automotive Applications

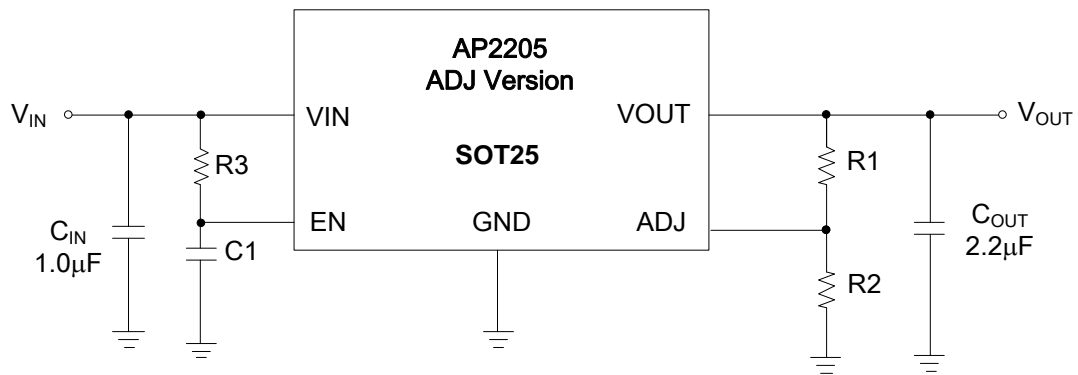
## Typical Applications Circuit



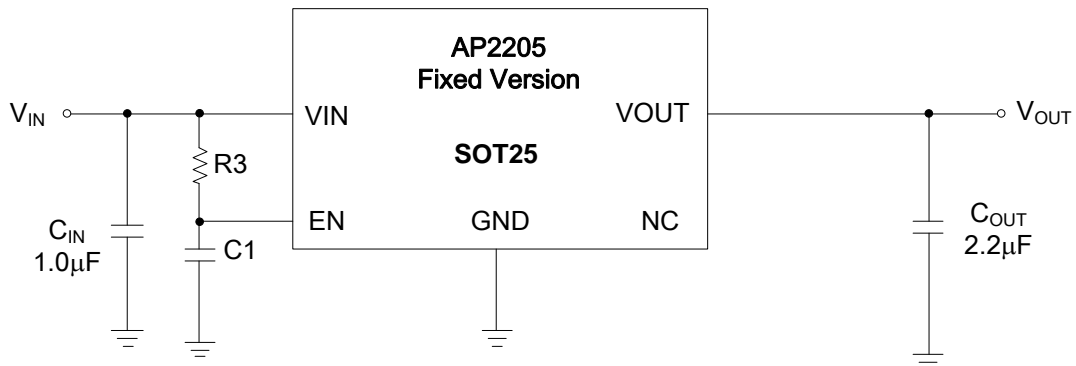
Typical Applications Circuit (Cont.)



$$V_{OUT} = V_{REF}(1+(R1/R2))$$



Startup Time Adjustable by External R3C1 Circuit

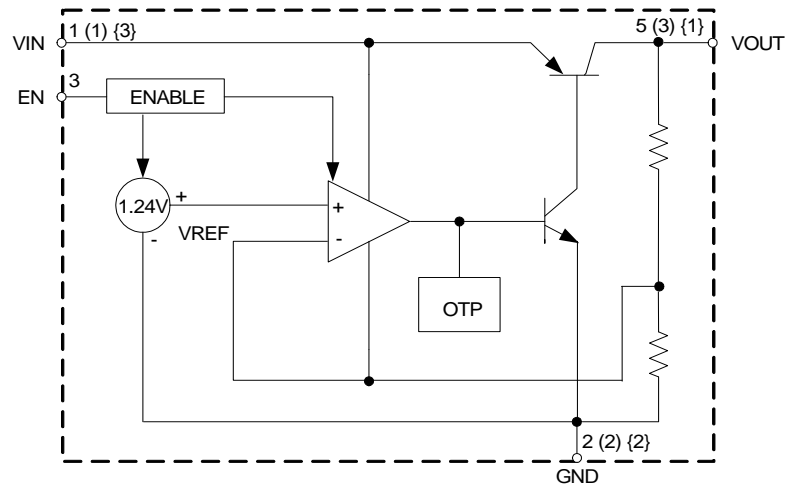


Startup Time Adjustable by External R3C1 Circuit

**Pin Descriptions**

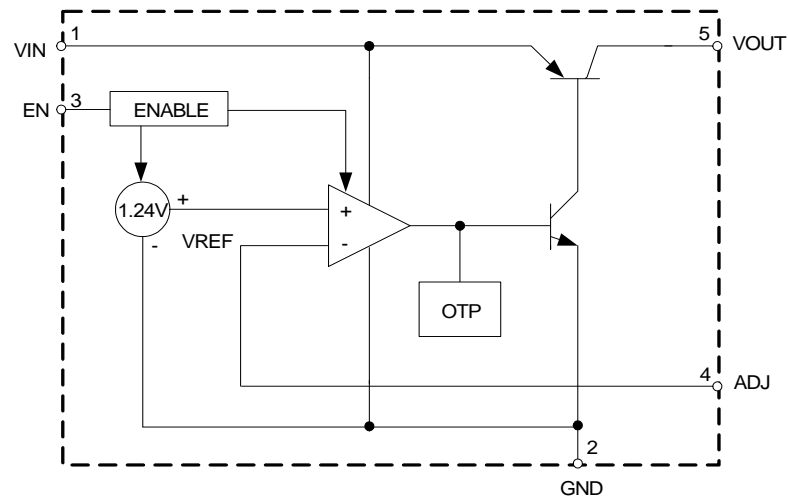
SOT25	Pin Number		Pin Name	Function
	SOT89	SOT89R		
	Y	YR		
1	1	3	VIN	Input voltage
2	2	2	GND	Ground
3	—	—	EN	Enable input
4	—	—	ADJ/NC	Adjust output for ADJ version/Not connected for fixed version
5	3	1	VOUT	Regulated output voltage

**Functional Block Diagram**



A(B)(C)  
A: SOT25  
B: SOT89  
C: SOT89R

Fixed Version



SOT25

Adjustable Version

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## Absolute Maximum Ratings (Note 5)

Symbol	Parameter	Rating		Unit
$V_{IN}$	Supply Input Voltage	36		V
$V_{CE}$	Enable Input Voltage	36		V
$I_{OUT}$	Output Current	250		mA
$T_{LEAD}$	Lead Temperature (Soldering, 10sec)	+260		°C
$T_J$	Operating Junction Temperature	+150		°C
$\theta_{JA}$	Thermal Resistance (Note 6)	SOT25	160	°C/W
		SOT89/SOT89R	129	
$\theta_{JC}$	Thermal Resistance	SOT25	29	°C/W
		SOT89/SOT89R	26	
$T_{STG}$	Storage Temperature Range	-65 to +150		°C
—	ESD (Charge Device Model)	1000		V
—	ESD (Human Body Model)	2000		V

Notes: 5. Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

6.  $\theta_{JA}$  is measured with the component mounted on a 2-Layer FR-4 PCB board with 1.5cm\*1.5cm thermal sink pad in free air.

## Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
$V_{IN}$	Supply Input Voltage	2.3	24	V
$T_J$	Operating Junction Temperature	-40	+125	°C

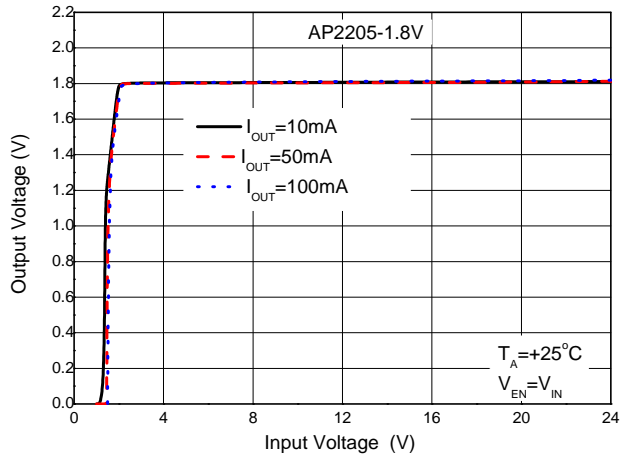
**Electrical Characteristics** (@ $V_{IN} = V_{OUT} + 1V$ ,  $T_J = +25^\circ C$ ,  $I_{OUT} = 100\mu A$ ,  $C_{IN} = 1.0\mu F$ ,  $C_{OUT} = 2.2\mu F$ , **Bold** typeface applies over  $-40^\circ C \leq T_J \leq +125^\circ C$ , unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$V_{OUT}$	Output Voltage	Variation from Specified $V_{OUT}$	$V_{OUT} \times 98\%$	—	$V_{OUT} \times 102\%$	V	
$V_{REF}$	Reference Voltage	—	1.215	1.24	1.265	V	
$V_{IN}$	Input Voltage	—	2.3	—	24	V	
$I_{OUT(Max)}$	Maximum Output Current	$V_{IN} - V_{OUT} = 1V$ , $V_{OUT} = 98\% \times V_{OUT}$	200	250	—	mA	
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	$V_{OUT} + 1V \leq V_{IN} \leq 24V$	—	0.05	—	%	
$\Delta V_{OUT}/V_{OUT}$	Load Regulation	$1mA \leq I_{OUT} \leq 200mA$	—	0.5	—	%	
$V_{DROP}$	Dropout Voltage (Note 7)	$I_{OUT} = 100\mu A$	—	100	150	mV	
		$I_{OUT} = 50mA$	—	270	350		
		$I_{OUT} = 100mA$	—	320	460		
		$I_{OUT} = 150mA$	—	360	500		
$I_{GND}$	Ground Current	$I_{OUT} = 100\mu A$	—	36	—	$\mu A$	
		$I_{OUT} = 50mA$	—	0.5	—	mA	
		$I_{OUT} = 100mA$	—	1.3	—		
		$I_{OUT} = 150mA$	—	2.5	—		
$I_{STD}$	Standby Current	$V_{IN} = V_{OUT} + 1V$ $V_{EN}$ in OFF Mode	—	0.01	1.0	$\mu A$	
PSRR	Power Supply Rejection Ratio	Ripple 0.5V <sub>P-P</sub> $V_{IN} = V_{OUT} + 1V$	f = 100Hz	—	60	—	dB
			f = 1kHz	—	60	—	
$\Delta V_{OUT}/(V_{OUT} \times \Delta T)$	Output Voltage Temperature Coefficient	$I_{OUT} = 100\mu A$ , $-40^\circ C \leq T_J \leq +125^\circ C$	—	<b><math>\pm 100</math></b>	—	ppm/ $^\circ C$	
$V_{NOI}$	RMS Output Noise	$T_J = +25^\circ C$ , $10Hz \leq f \leq 100kHz$	—	30	—	$\mu V_{rms}$	
$I_{ADJ}$	ADJ Pin Current	$I_{OUT} = 100\mu A$	—	0.5	—	$\mu A$	
$I_{EN}$	EN Pin Current	$V_{EN} = V_{OUT} + 1V$	—	3	—	$\mu A$	
—	EN "High" Voltage	EN Input Voltage "High"	2.0	—	—	V	
—	EN "Low" Voltage	EN Input Voltage "Low"	—	—	0.4	V	

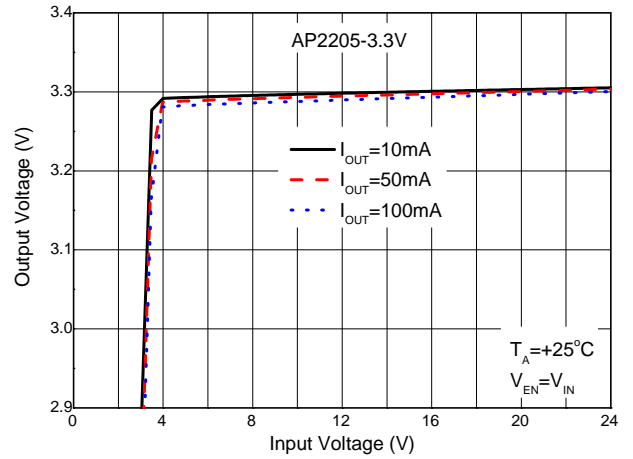
Note 7: Dropout voltage is only valid when  $V_{OUT} \geq 2.3V$  because of the minimum input voltage limits.

**Performance Characteristics**

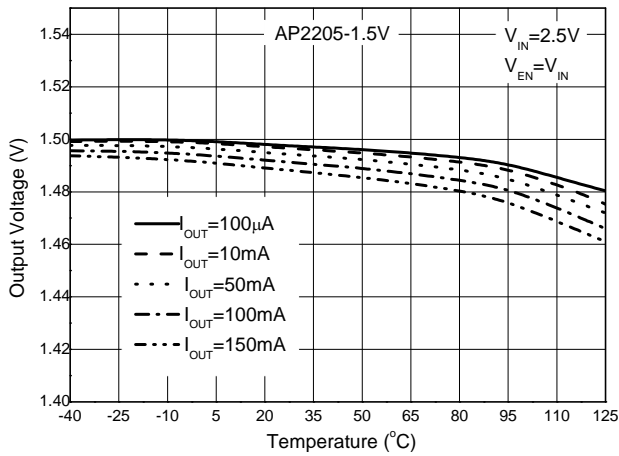
**Output Voltage vs. Input Voltage**



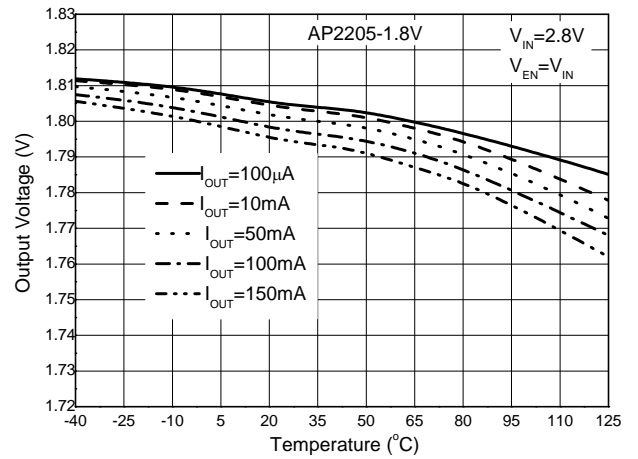
**Output Voltage vs. Input Voltage**



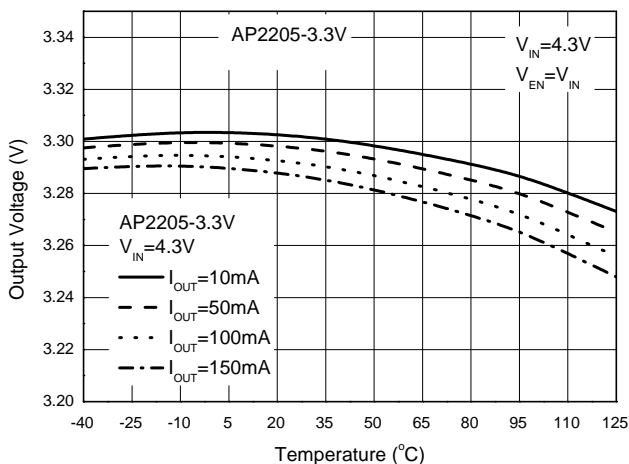
**Output Voltage vs. Temperature**



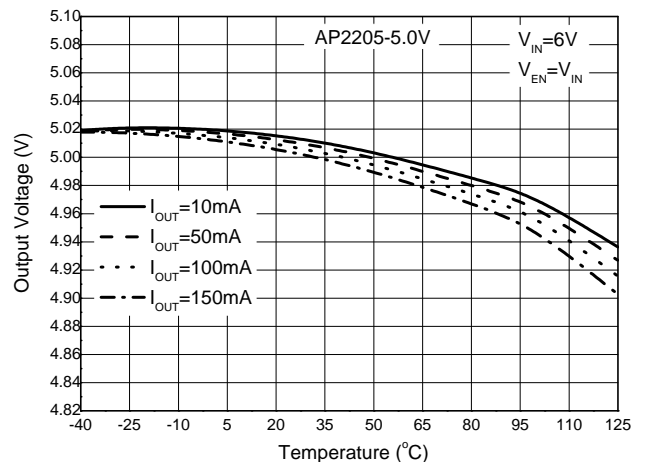
**Output Voltage vs. Temperature**



**Output Voltage vs. Temperature**



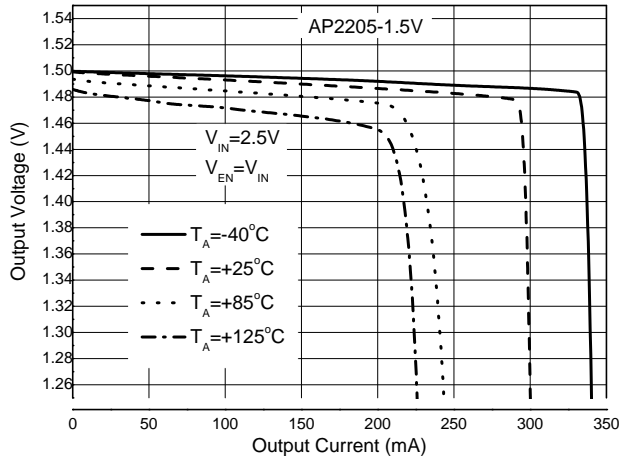
**Output Voltage vs. Temperature**



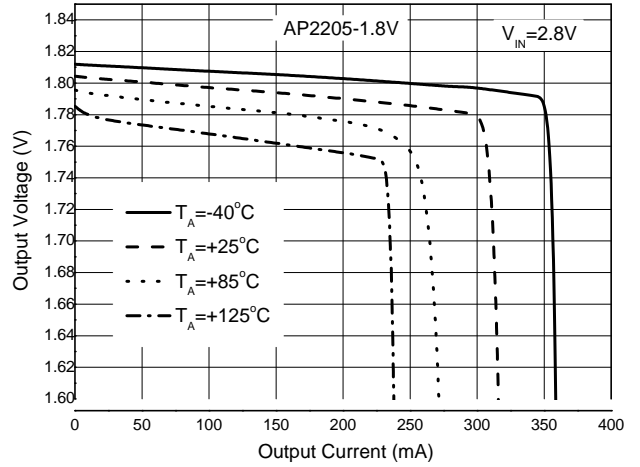
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**Performance Characteristics (Cont.)**

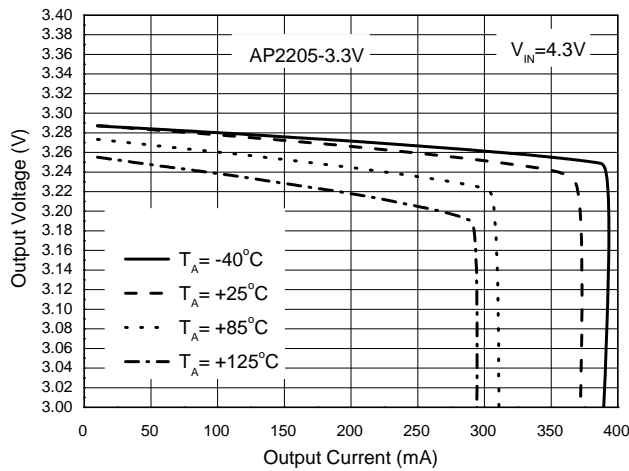
**Output Voltage vs. Output Current**



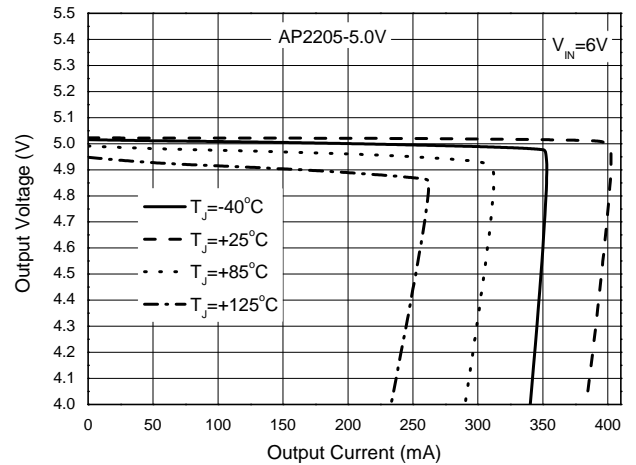
**Output Voltage vs. Output Current**



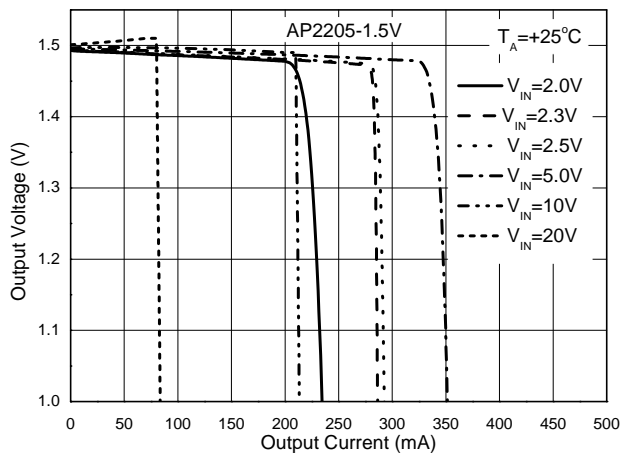
**Output Voltage vs. Output Current**



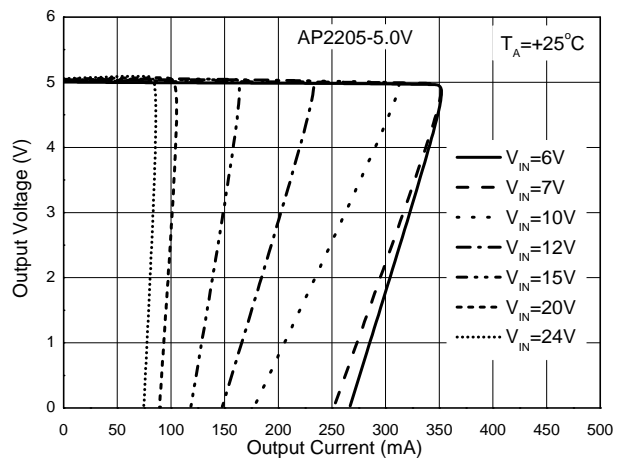
**Output Voltage vs. Output Current**



**Output Voltage vs. Output Current**

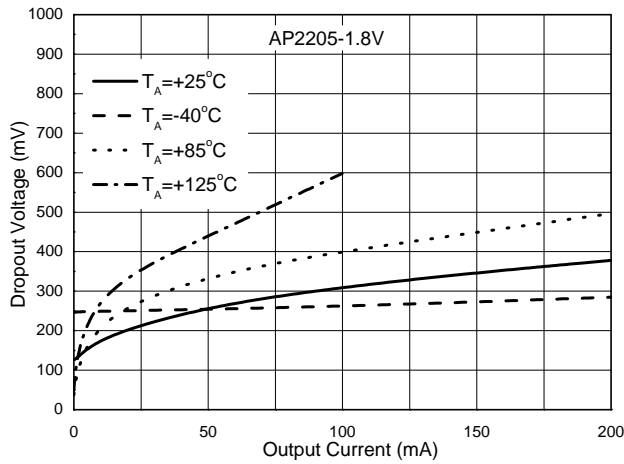


**Output Voltage vs. Output Current**

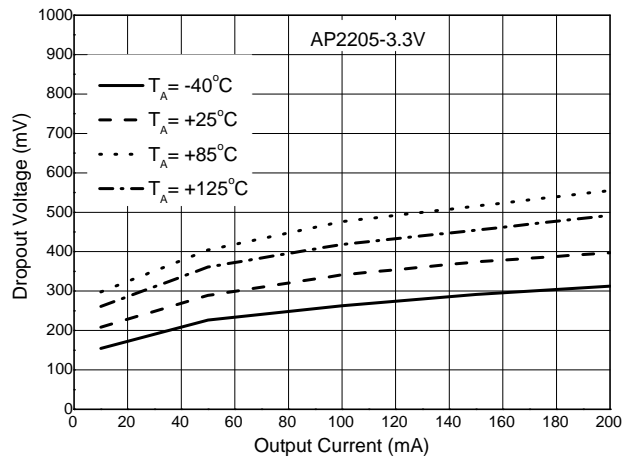


**Performance Characteristics (Cont.)**

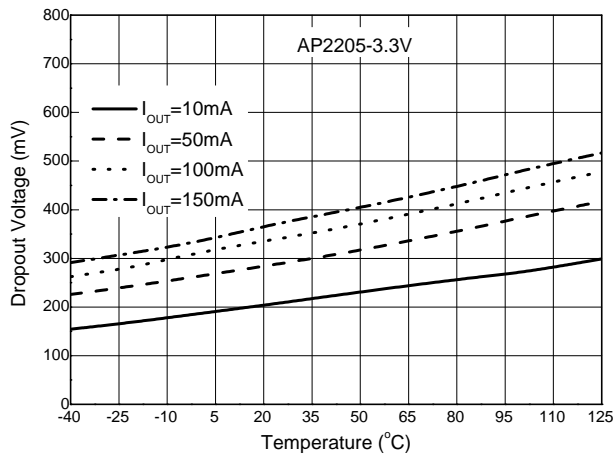
**Dropout Voltage vs. Output Current**



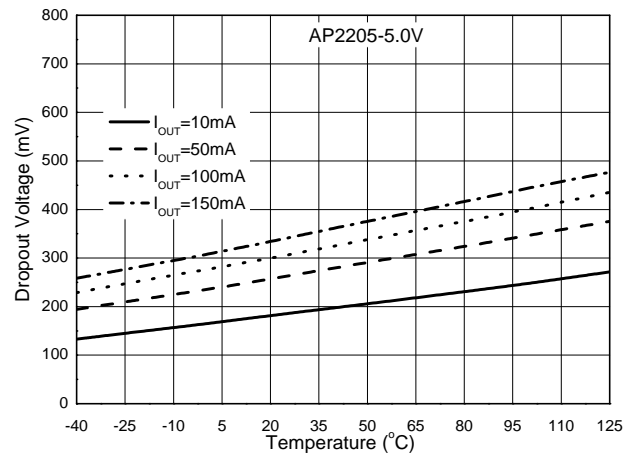
**Dropout Voltage vs. Output Current**



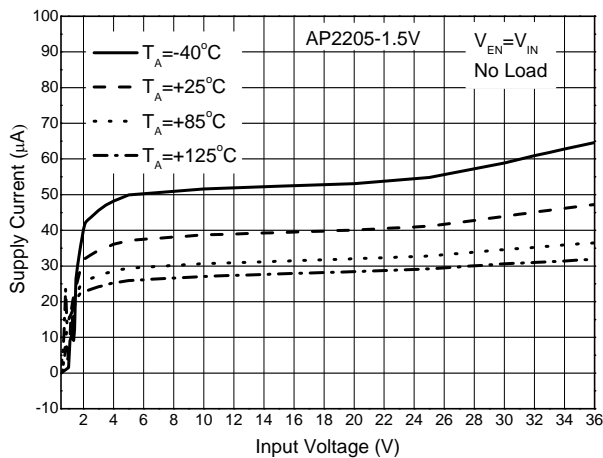
**Dropout Voltage vs. Temperature**



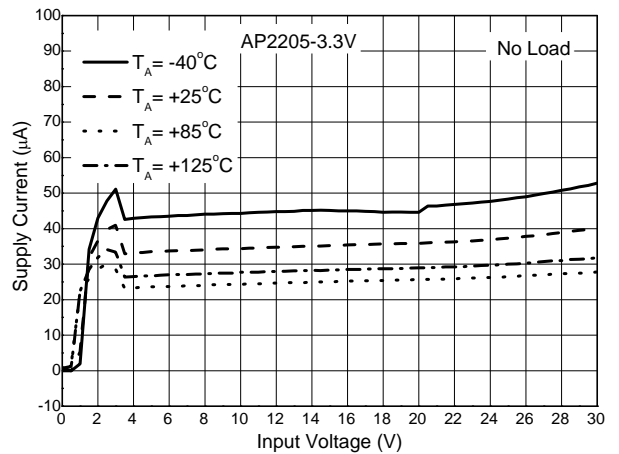
**Dropout Voltage vs. Temperature**



**Supply Current vs. Input Voltage**



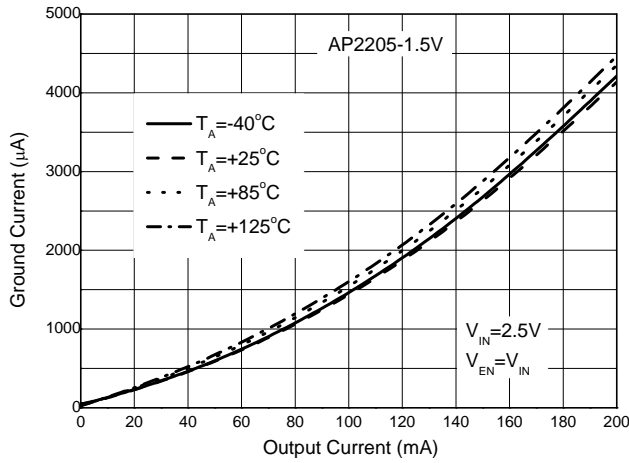
**Supply Current vs. Input Voltage**



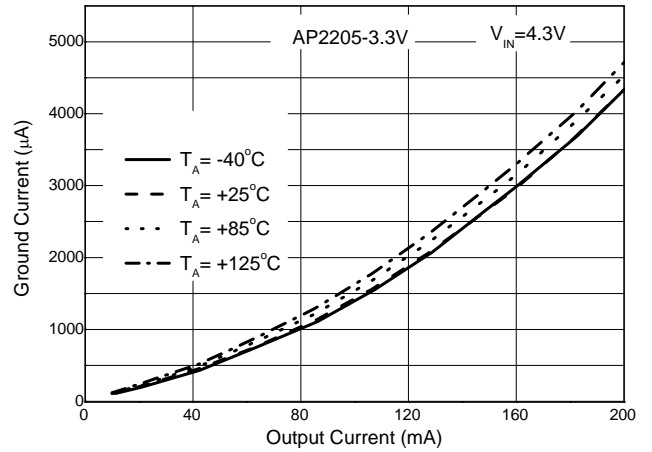


**Performance Characteristics (Cont.)**

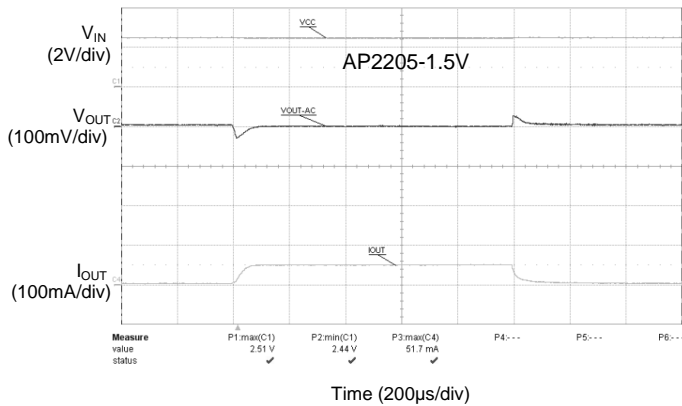
**Ground Current vs. Output Current**



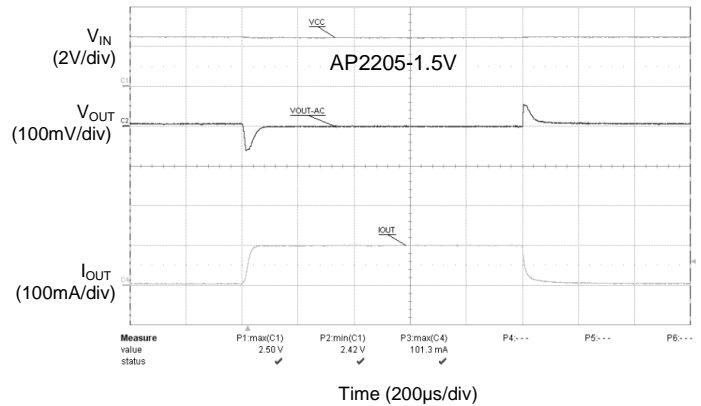
**Ground Current vs. Output Current**



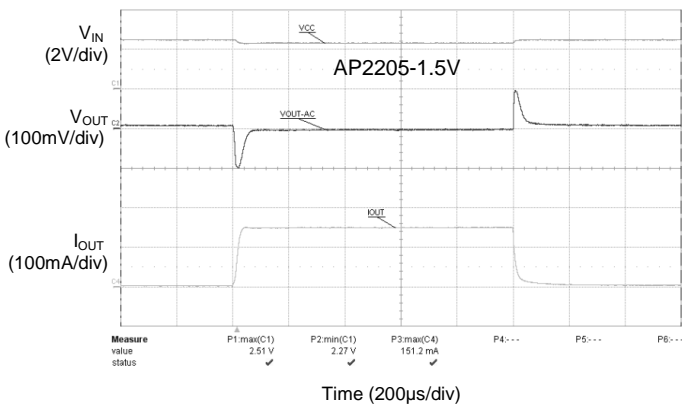
**Load Transient**  
(Conditions:  $V_{IN}=2.5V$ ,  $C_{IN}=1.0\mu F$ ,  $C_{OUT}=2.2\mu F$ ,  $I_{OUT}=1mA$  to  $50mA$ )



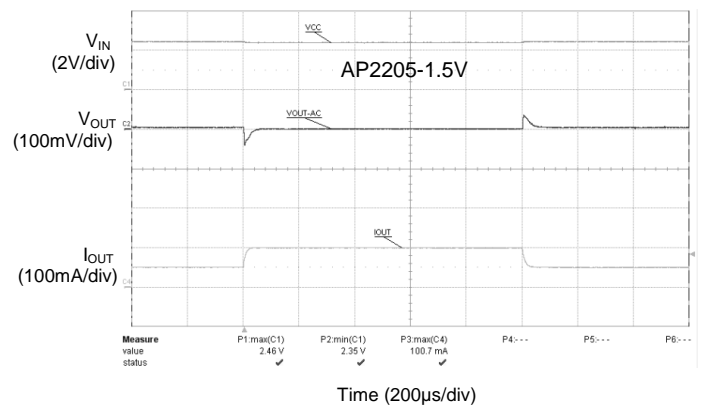
**Load Transient**  
(Conditions:  $V_{IN}=2.5V$ ,  $C_{IN}=1.0\mu F$ ,  $C_{OUT}=2.2\mu F$ ,  $I_{OUT}=1mA$  to  $100mA$ )



**Load Transient**  
(Conditions:  $V_{IN}=2.5V$ ,  $C_{IN}=1.0\mu F$ ,  $C_{OUT}=2.2\mu F$ ,  $I_{OUT}=1mA$  to  $150mA$ )



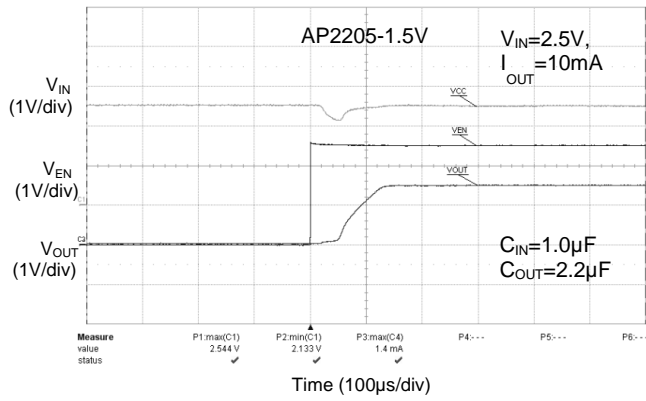
**Load Transient**  
(Conditions:  $V_{IN}=2.5V$ ,  $C_{IN}=1.0\mu F$ ,  $C_{OUT}=2.2\mu F$ ,  $I_{OUT}=50mA$  to  $100mA$ )



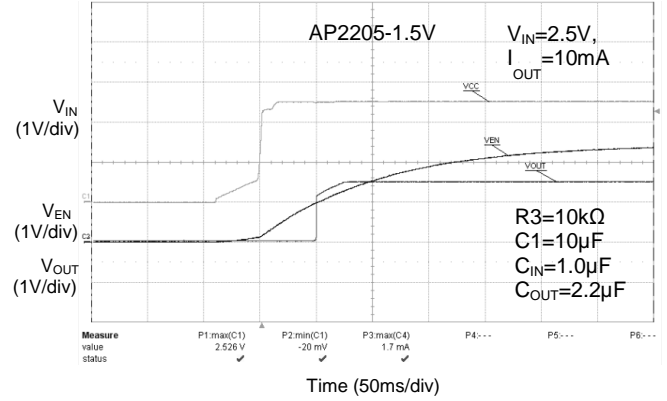
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**Performance Characteristics (Cont.)**

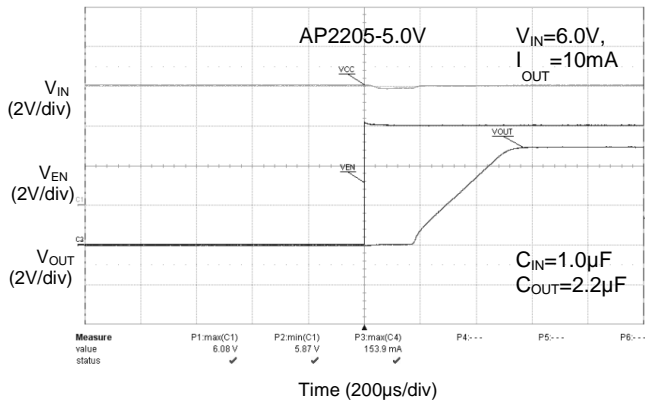
**Enable Input Response**



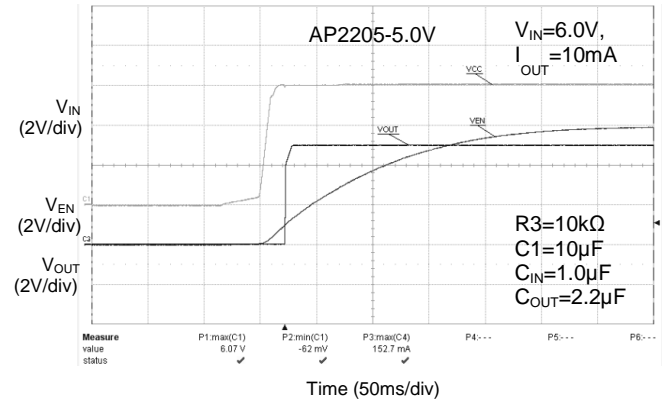
**Adjustable Start-up Time by RC**



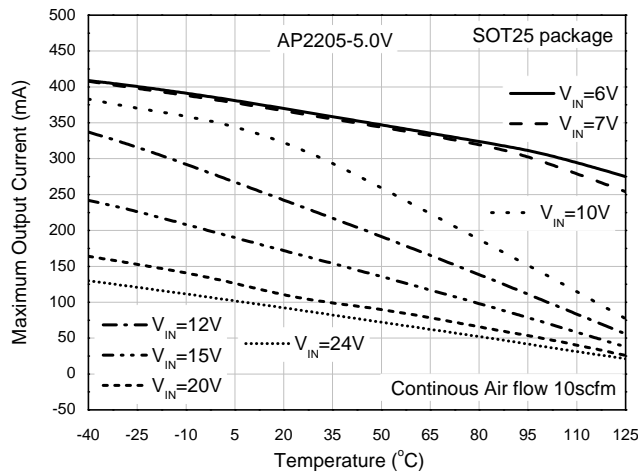
**Enable Input Response**



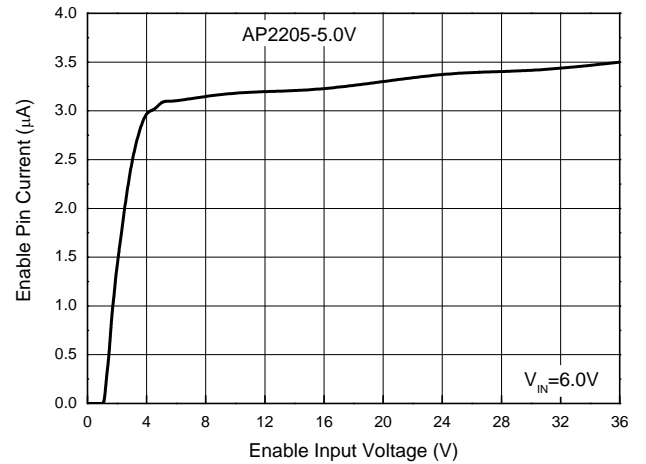
**Adjustable Start-up Time by RC**



**Maximum Output Current vs. Ambient Temperature**

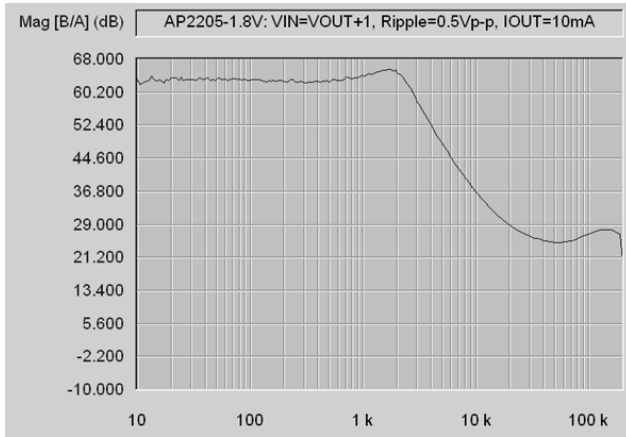


**Enable Pin Current vs. Enable Input Voltage**

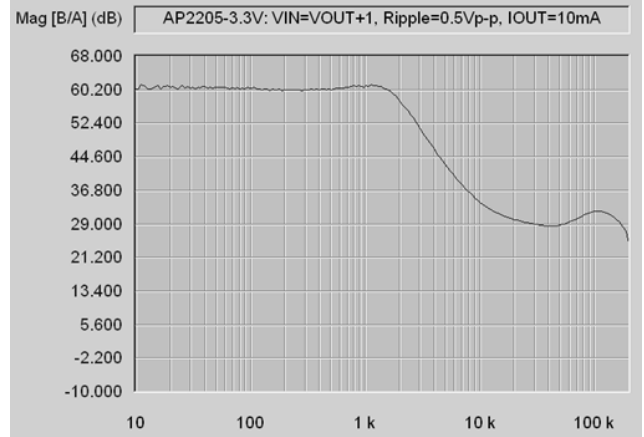


**Performance Characteristics (Cont.)**

**PSRR vs. Frequency**

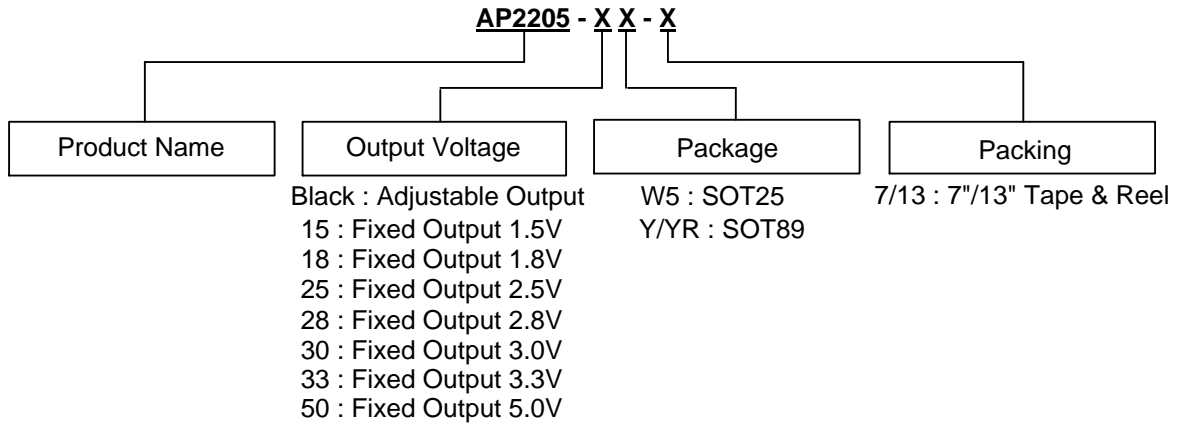


**PSRR vs. Frequency**



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**Ordering Information**

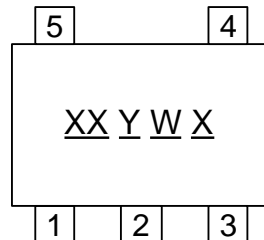


Part Number	Package Code	Package	13"/7" Tape and Reel	
			Quantity	Part Number Suffix
AP2205-XXY-13	Y	SOT89	2,500/Tape & Reel	-13
AP2205-XXYR-13	YR	SOT89	2,500/Tape & Reel	-13
AP2205-W5-7	W5	SOT25	3,000/Tape & Reel	-7
AP2205-XXW5-7	W5	SOT25	3,000/Tape & Reel	-7

**Marking Information**

(1) SOT25

(Top View)



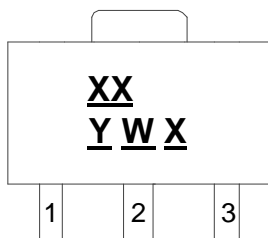
XX : Identification Code  
Y : Year 0 to 9  
W : Week : A to Z : 1 to 26 week;  
 a to z : 27 to 52 week; z represents  
 52 and 53 week  
X : Internal Code

Part Number	Package	Identification Code
AP2205-W5-7	SOT25	5A
AP2205-15W5-7	SOT25	5B
AP2205-18W5-7	SOT25	5C
AP2205-25W5-7	SOT25	5D
AP2205-28W5-7	SOT25	5E
AP2205-30W5-7	SOT25	5F
AP2205-33W5-7	SOT25	5G
AP2205-50W5-7	SOT25	5H

**Marking Information** (Cont.)

(2) SOT89

(Top View)

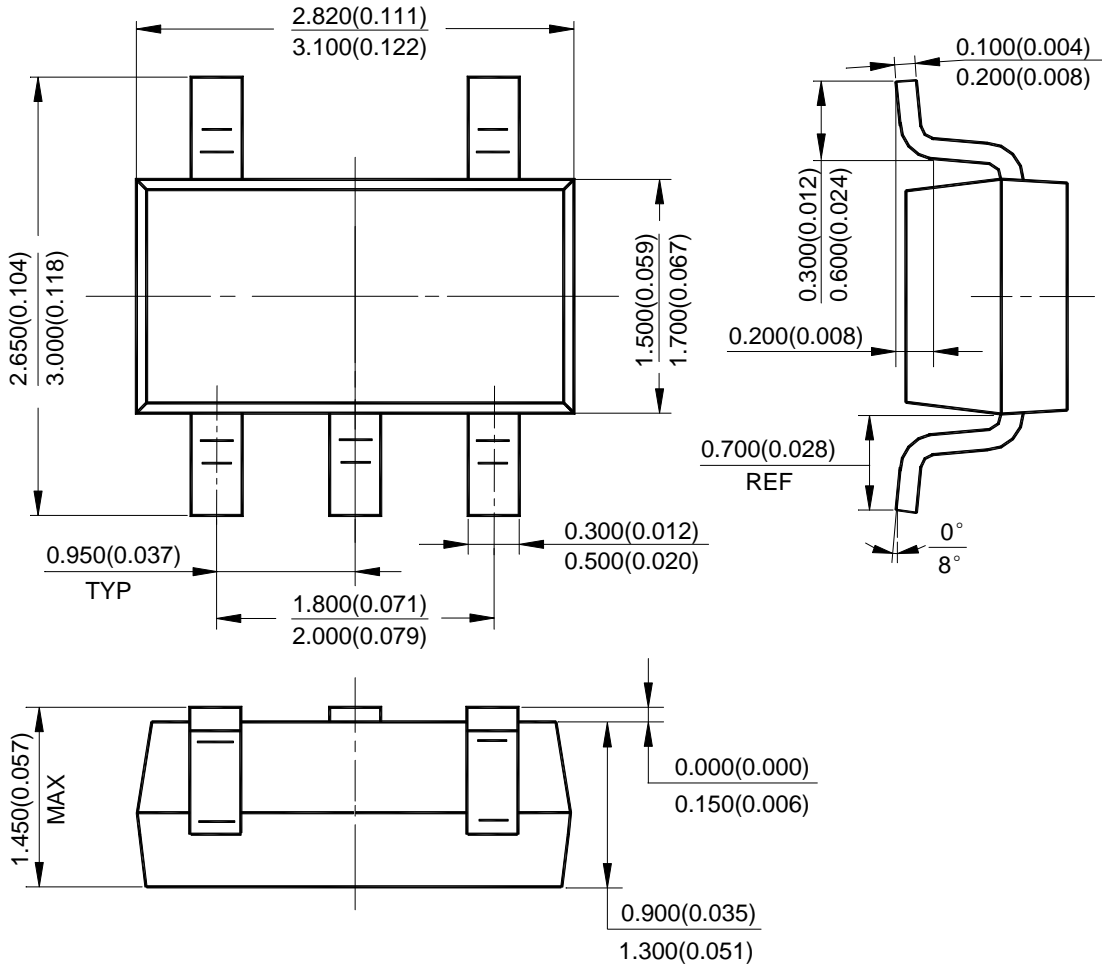


XX : Identification code  
Y : Year : 0~9  
W : Week : A~Z : 1~26 week;  
 a~z : 27~52 week;  
 z represents 52 and 53 week  
X : Internal code

Part Number	Package	Identification Code
AP2205-15Y-13	SOT89	5B
AP2205-18Y-13	SOT89	5C
AP2205-25Y-13	SOT89	5D
AP2205-28Y-13	SOT89	5E
AP2205-30Y-13	SOT89	5F
AP2205-33Y-13	SOT89	5G
AP2205-50Y-13	SOT89	5H
AP2205-15YR-13	SOT89	6B
AP2205-18YR-13	SOT89	6C
AP2205-25YR-13	SOT89	6D
AP2205-28YR-13	SOT89	6E
AP2205-30YR-13	SOT89	6F
AP2205-33YR-13	SOT89	6G
AP2205-50YR-13	SOT89	6H

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

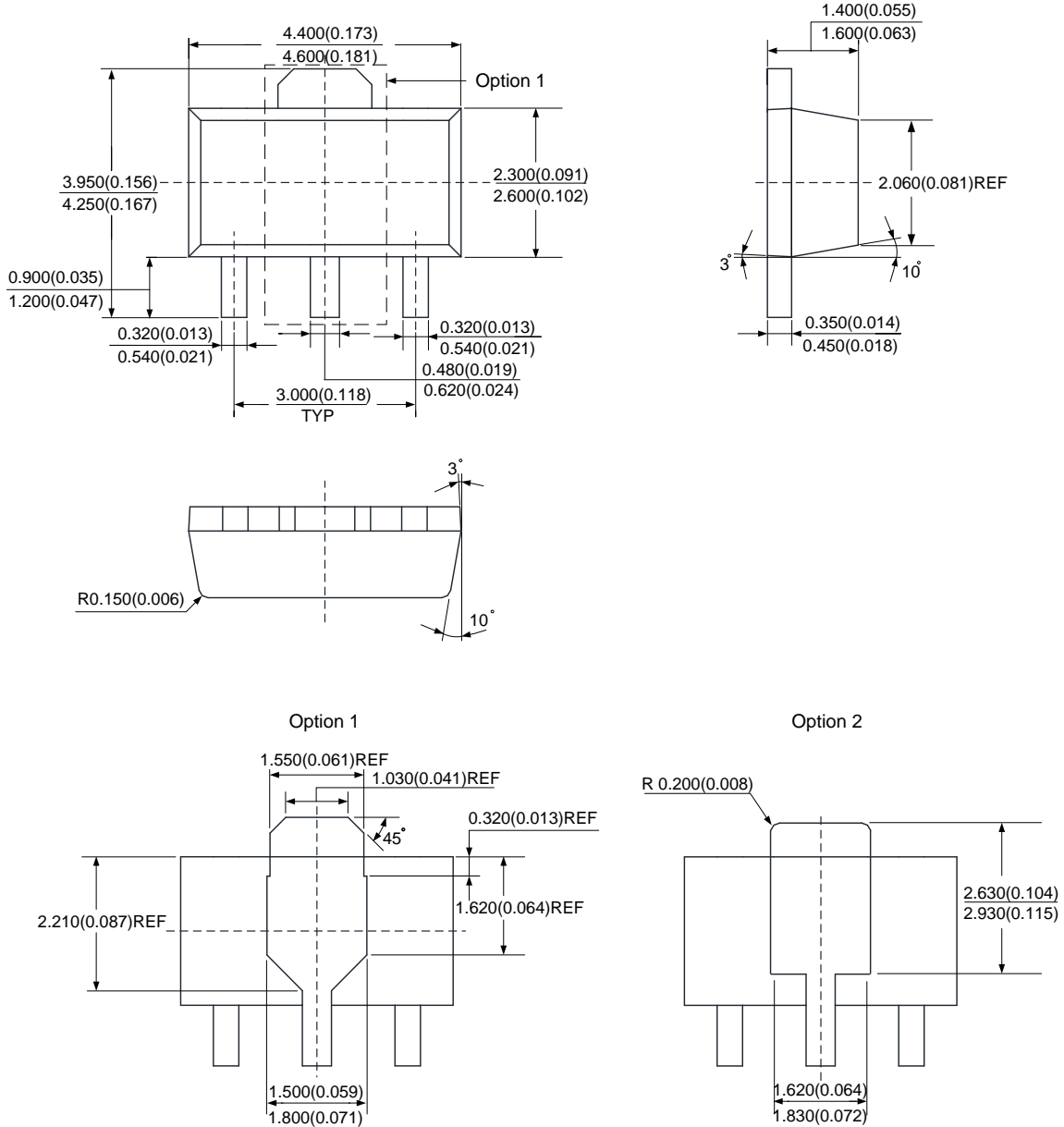
(1) Package Type: SOT25



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**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

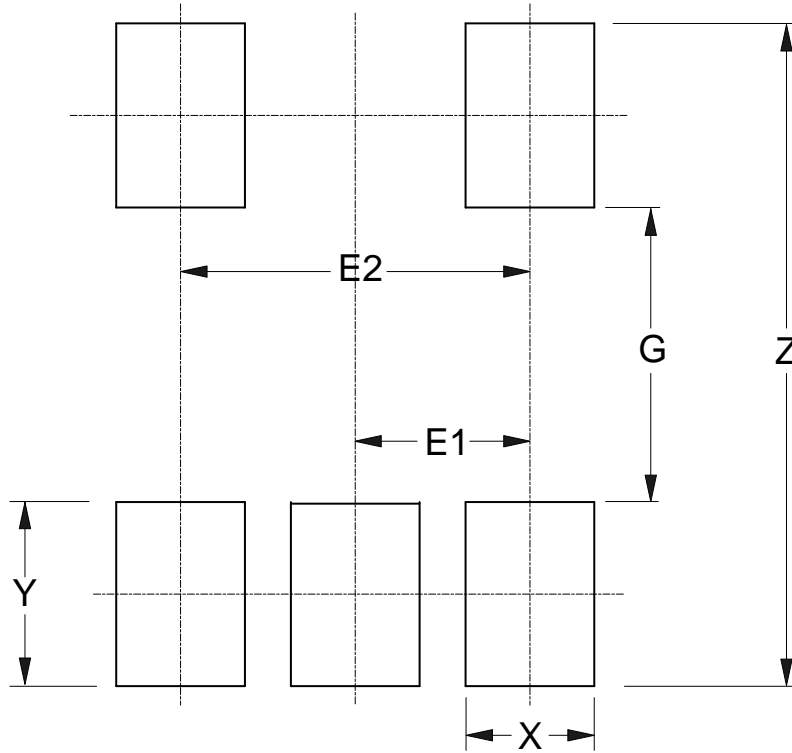
(2) Package Type: SOT89



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**Suggested Pad Layout**

(1) Package Type: SOT25



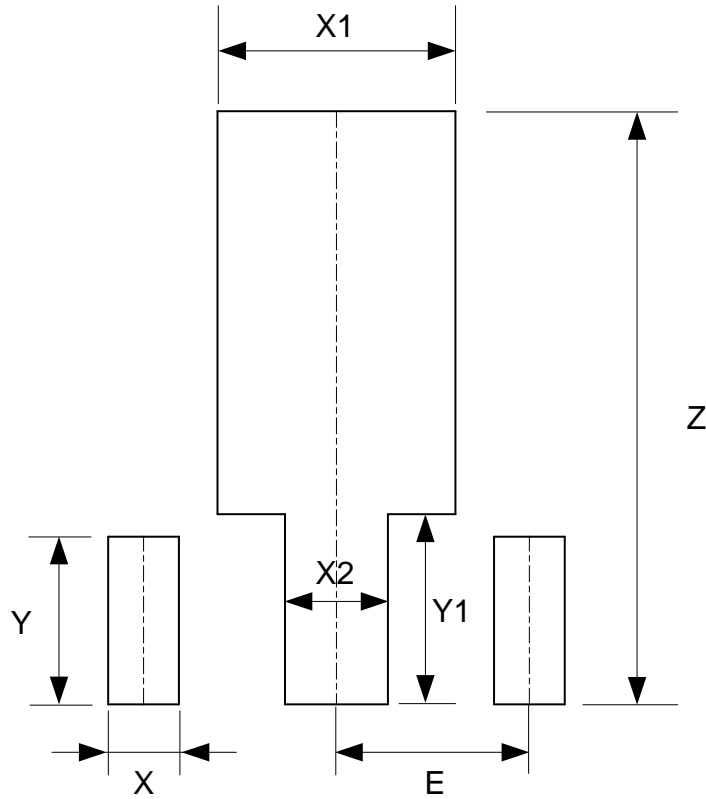
Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E1 (mm)/(inch)	E2 (mm)/(inch)
Value	3.600/0.142	1.600/0.063	0.700/0.028	1.000/0.039	0.950/0.037	1.900/0.075

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**Suggested Pad Layout (Cont.)**

(2) 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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