Description

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

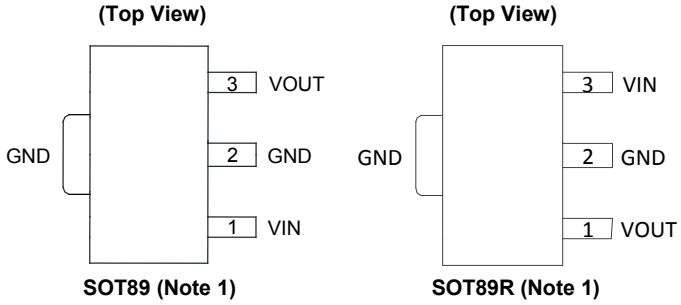
The AP2205 has various features such as a wide input voltage range, high accuracy, high ripple rejection, low dropout voltage, low noise, current limit, and ultra-low quiescent current—which make it ideal for use in various USB and portable devices.

The IC consists of a voltage reference, an error amplifier, a resistor network for setting output voltage, a current limit circuit for current protection, a chip enable circuit, a low power shutdown mode for extended battery life, over-current protection, over-temperature protection, as well as reverse current protection.

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

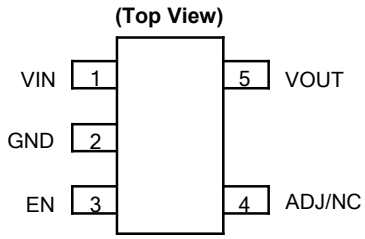
The AP2205 is available in the space-saving SOT25 and SOT89 packages.

Pin Assignments



SOT89 (Note 1) **SOT89R (Note 1)**

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



SOT25

Features

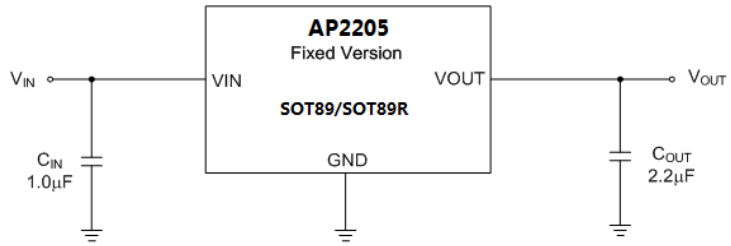
- Wide Input Voltage Range: 2.3V to 24V
- Wide Output Voltage Range: 1.24V to 22V
- Excellent Ripple Rejection: 60dB@ f = 1kHz
- Low Dropout Voltage: V_{DROP} = 100mV@ I_{OUT} = 100μA
- Low Ground Current
- High Output Voltage Accuracy
- Compatible with Low ESR Ceramic Capacitor
- Excellent Line/Load Regulation
- Thermal Shutdown Function
- Moisture Sensitivity:
  - SOT89: Level 3 Per J-STD-020
  - SOT25: Level 1 Per J-STD-020
- Terminals: SOT89/ SOT25: Finish—Mate Tin Plated Leads, Solderable per MIL-STD-202, Method 208 (e3)
- Weight:
  - SOT89: 0.062 grams (Approximate)
  - SOT25: 0.0157 grams (Approximate)
- **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 or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen- and Antimony-Free. "Green" Device (Note 3)**

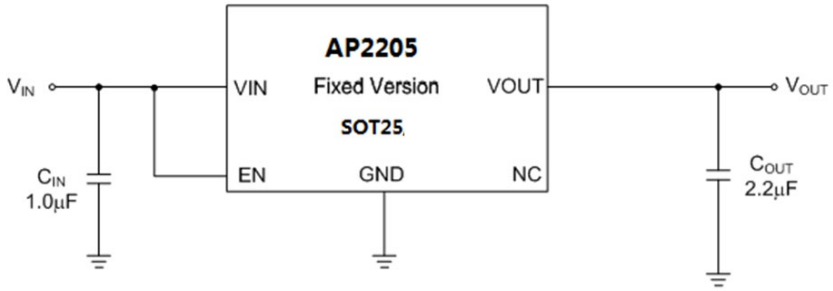
Applications

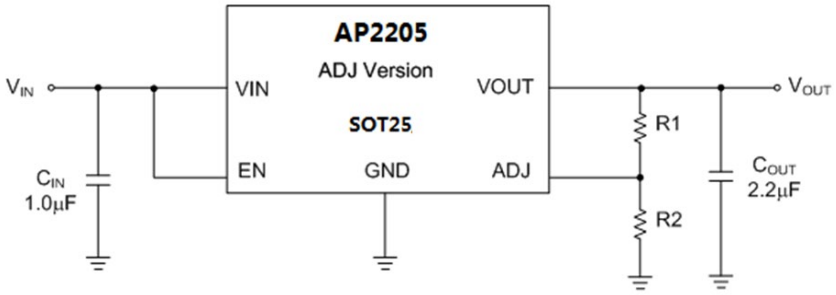
- Battery-powered Equipment
- Laptop, Palmtops, Notebook Computers
- Portable Information Appliances
- Industrial/Automotive Applications

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.

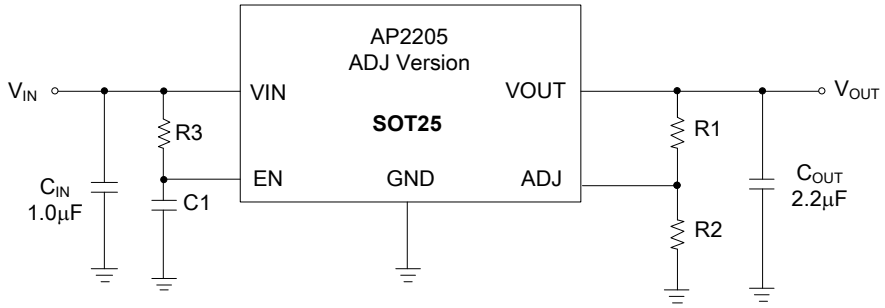
Typical Applications Circuit



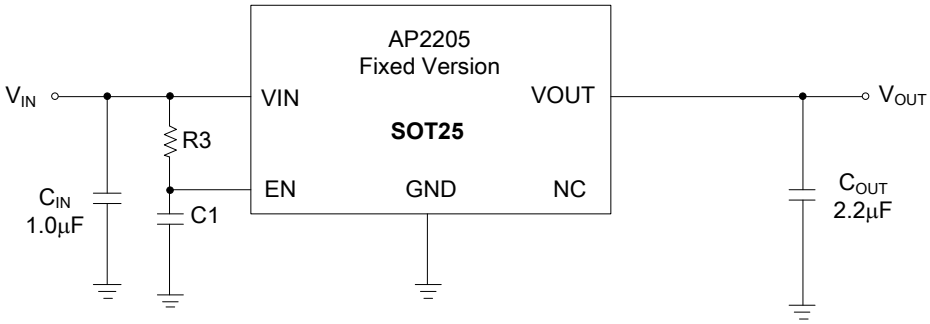




$V_{OUT} = V_{REF}(1+(R1/R2))$



Startup Time Adjustable by External R3C1 Circuit

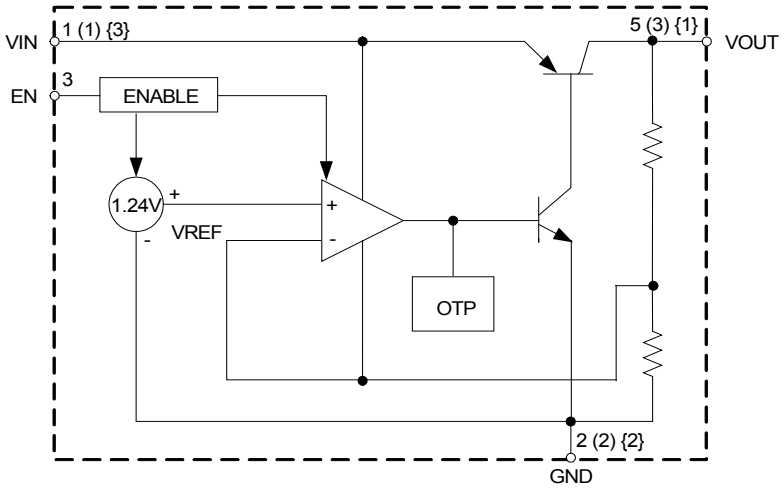


Startup Time Adjustable by External R3C1 Circuit

Pin Descriptions

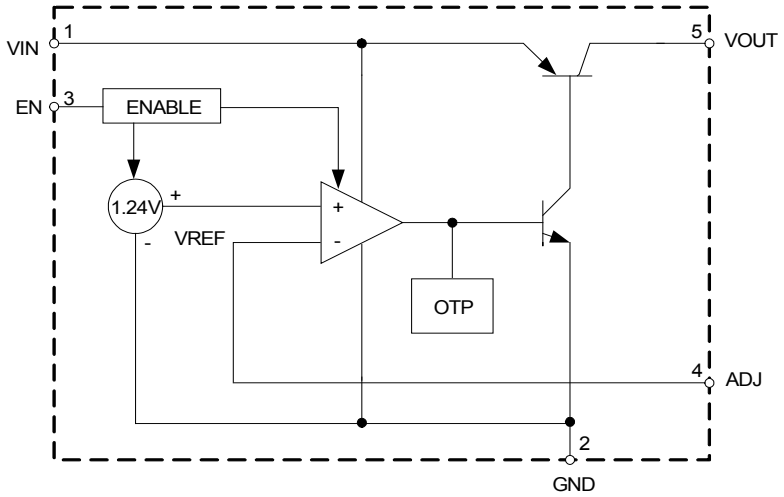
Pin Number			Pin Name	Function
SOT25	SOT89	SOT89R		
	Y	YR		
1	1	3	VIN	Input voltage
2	2	2	GND	Ground
3	—	—	EN	Enable input
4	—	—	ADJ/NC	Adjust output for ADJ version/Not connected for fixed version
5	3	1	VOUT	Regulated output voltage

Functional Block Diagram



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

Fixed Version



SOT25

Adjustable Version

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
θ_{JA}	Thermal Resistance (Note 6)	SOT25	160	°C/W
		SOT89/SOT89R	129	
θ_{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. θ_{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
I_{OUT}	Output Current	$V_{OUT} \leqq 1.8V$		150	mA
		$V_{OUT} > 1.8V$		200	

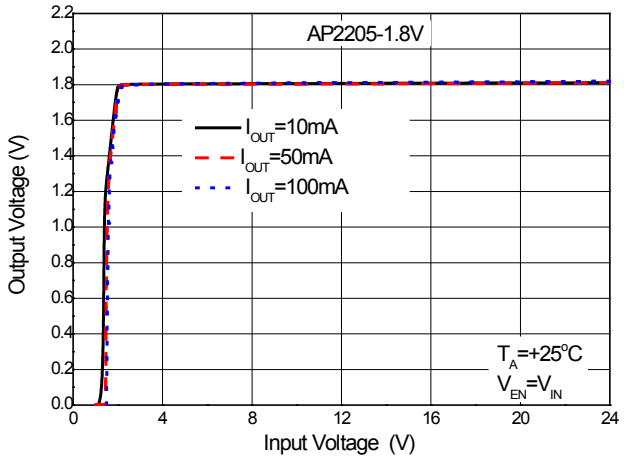
Electrical Characteristics (@ V_{IN} = V_{OUT}+1V, T_J = +25°C, I_{OUT} = 100μA, C_{IN} = 1.0μF, C_{OUT} = 2.2μF, **Bold** typeface applies over -40°C ≤ T_J ≤ +125°C, unless otherwise specified.)

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{OUT}	Output Voltage	Variation from Specified V_{OUT}		V_{OUT} ×98%	—	V_{OUT} ×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% × V_{OUT}		200	250	—	mA
$\Delta V_{OUT}/\Delta V_{IN}$	Line Regulation	V_{OUT}+1V ≤ V_{IN} ≤ 24V		—	0.05	—	%
$\Delta V_{OUT}/V_{OUT}$	Load Regulation	1mA ≤ I_{OUT} ≤ 200mA		—	0.5	—	%
V_{DROP}	Dropout Voltage (Note 7)	I_{OUT} = 100μA		—	100	150	mV
		I_{OUT} = 50mA		—	270	350	
		I_{OUT} = 100mA		—	320	460	
		I_{OUT} = 150mA		—	360	500	
I_{GND}	Ground Current	I_{OUT} = 100μA		—	36	—	μA
		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	μA
PSRR	Power Supply Rejection Ration	Ripple 0.5V_{P-P} 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} = 100μA, -40°C ≤ T_J ≤ +125°C		—	**±100**	—	ppm/°C
V_{NOI}	RMS Output Noise	T_J = +25°C, 10Hz ≤ f ≤ 100kHz		—	30	—	μV_{rms}
I_{ADJ}	ADJ Pin Current	I_{OUT} = 100μA		—	0.5	—	μA
I_{EN}	EN Pin Current	V_{EN} = V_{OUT}+1V		—	3	—	μA
—	EN “High” Voltage	EN Input Voltage “High”		2.0	—	—	V
—	EN “Low” Voltage	EN Input Voltage “Low”		—	—	0.4	V

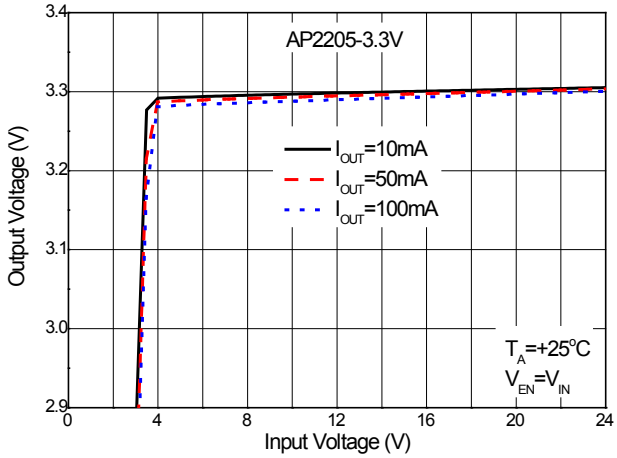
Notes: 7. Dropout voltage is only valid when V_{OUT} ≥ 2.3V because of the minimum input voltage limits.

Performance Characteristics

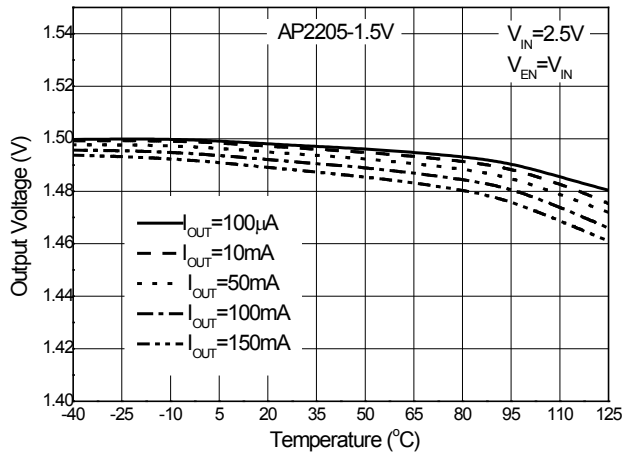
Output Voltage vs. Input Voltage



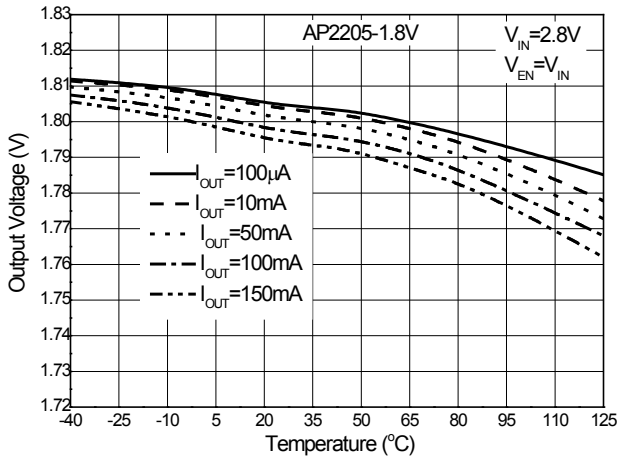
Output Voltage vs. Input Voltage



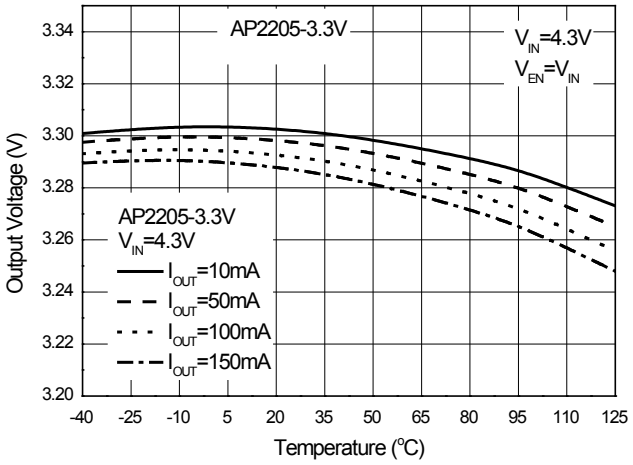
Output Voltage vs. Temperature



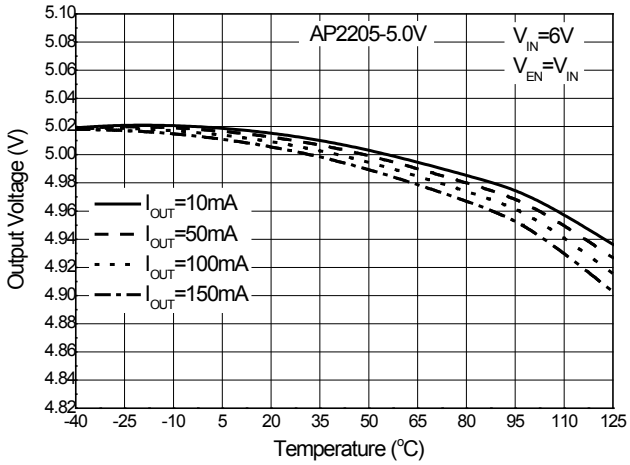
Output Voltage vs. Temperature



Output Voltage vs. Temperature

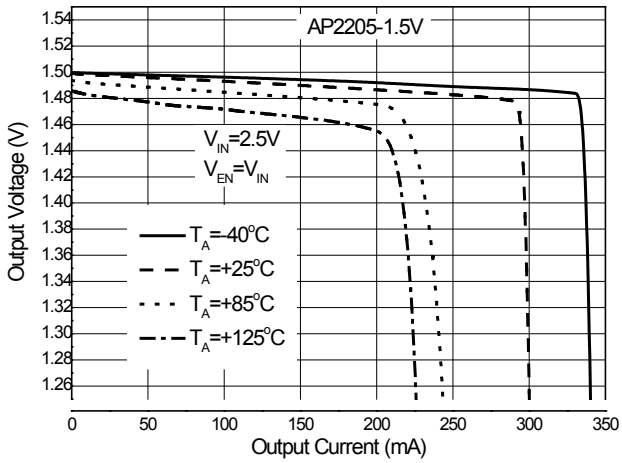


Output Voltage vs. Temperature

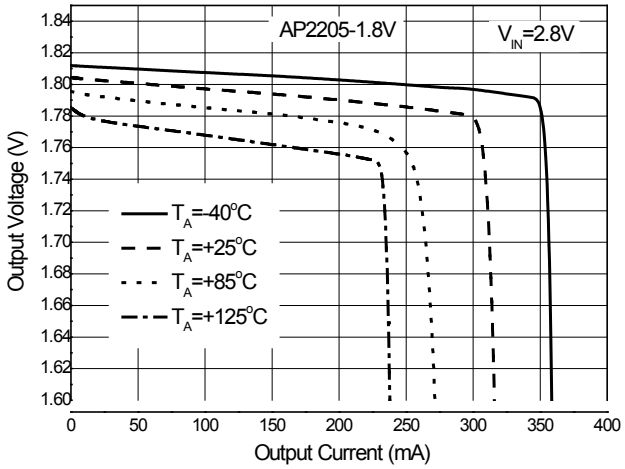


Performance Characteristics (Cont.)

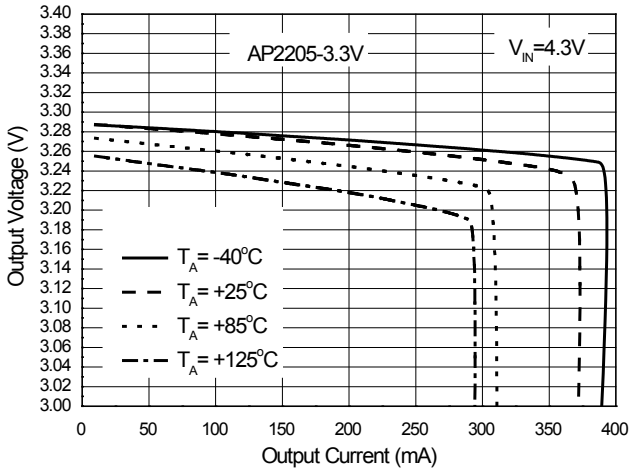
Output Voltage vs. Output Current



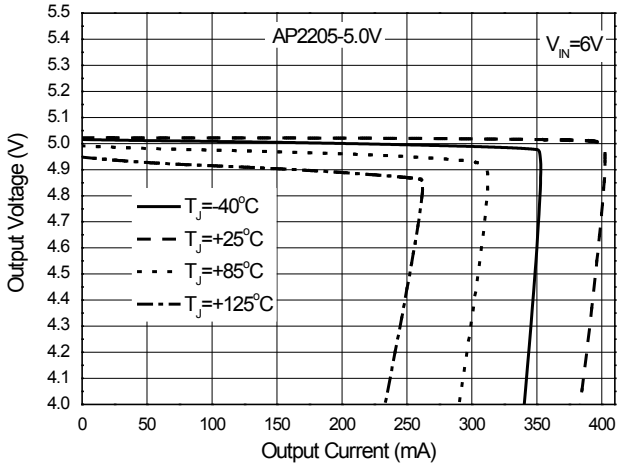
Output Voltage vs. Output Current



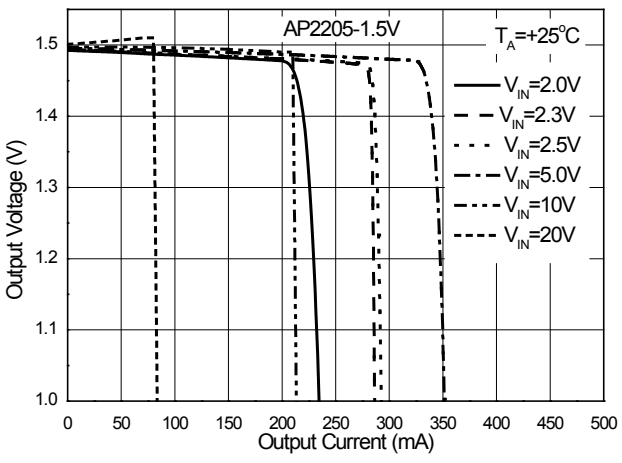
Output Voltage vs. Output Current



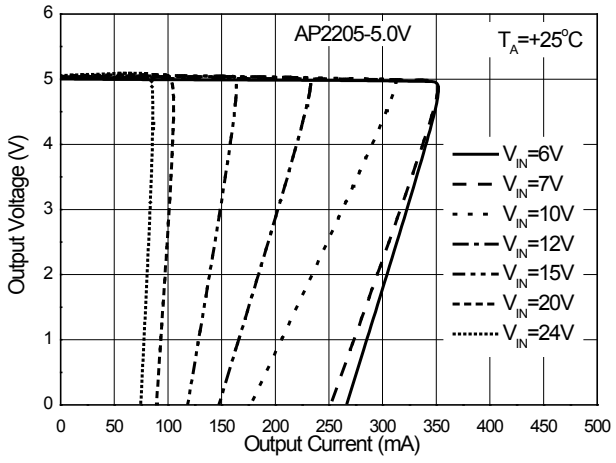
Output Voltage vs. Output Current



Output Voltage vs. Output Current

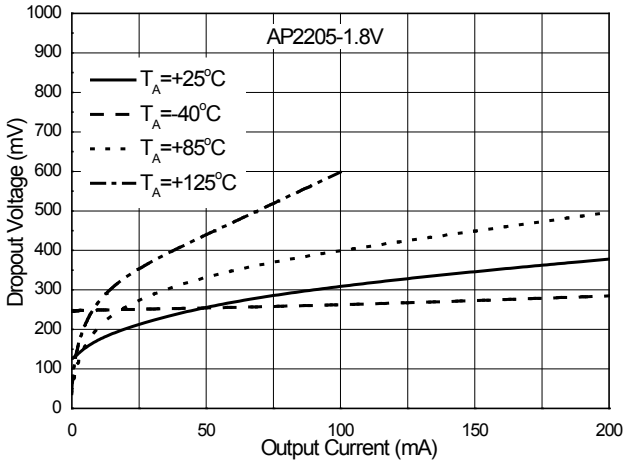


Output Voltage vs. Output Current

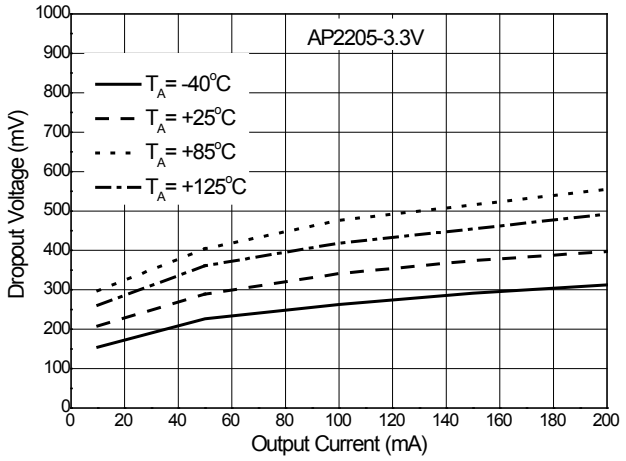


Performance Characteristics (Cont.)

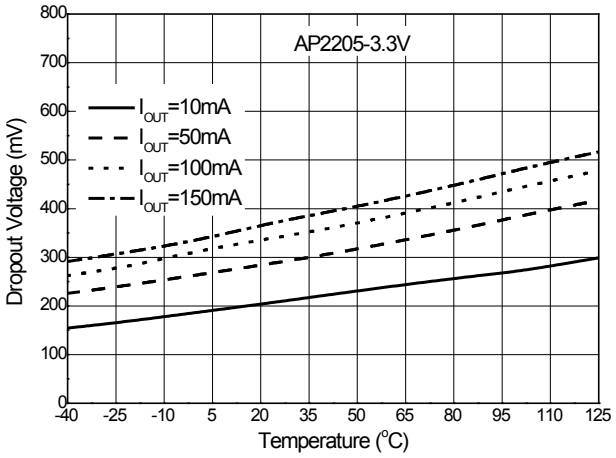
Dropout Voltage vs. Output Current



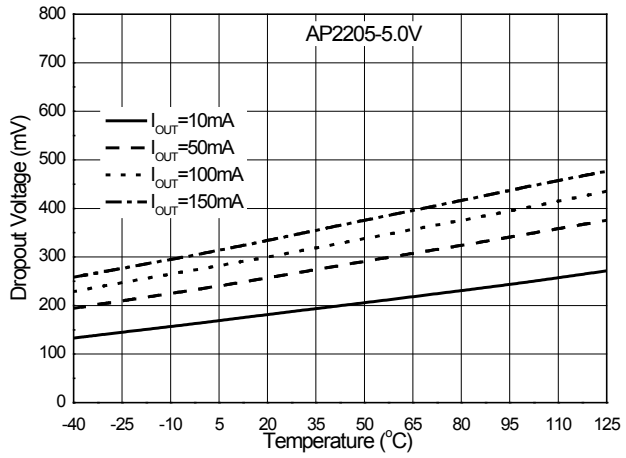
Dropout Voltage vs. Output Current



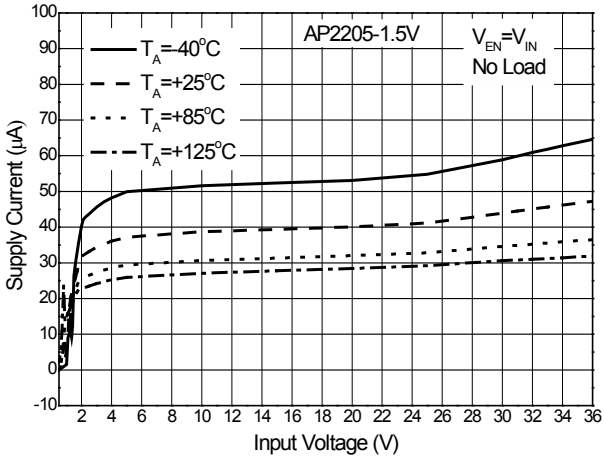
Dropout Voltage vs. Temperature



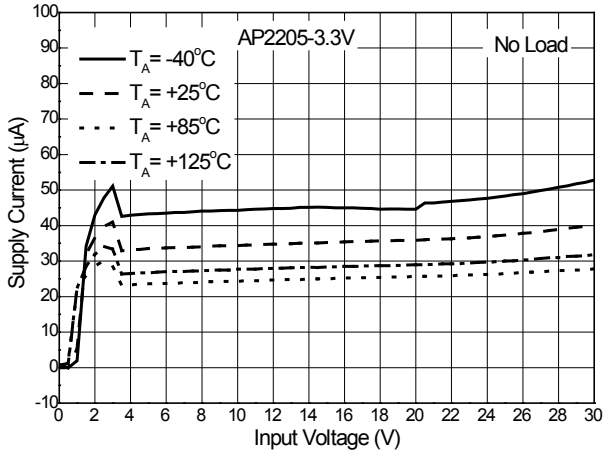
Dropout Voltage vs. Temperature



Supply Current vs. Input Voltage

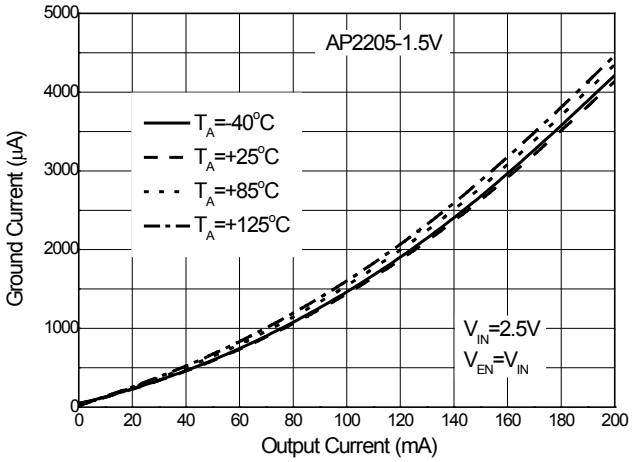


Supply Current vs. Input Voltage

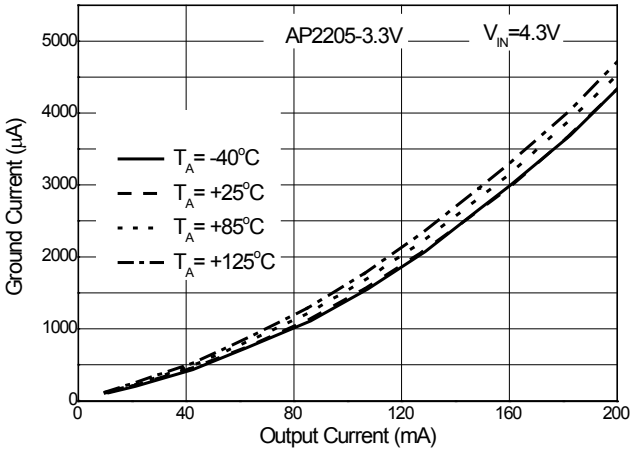


Performance Characteristics (Cont.)

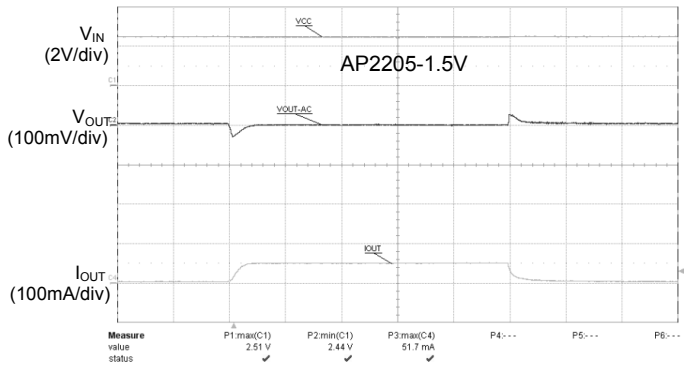
Ground Current vs. Output Current



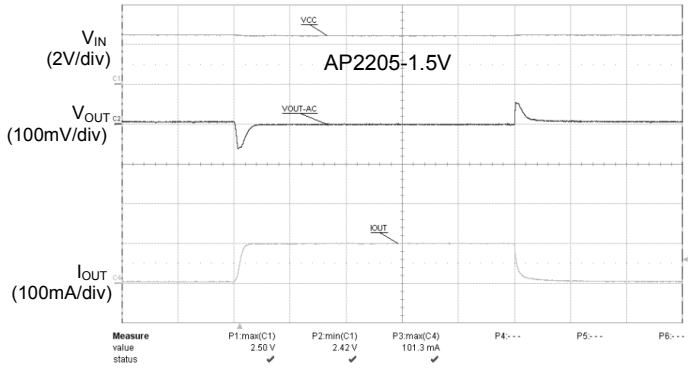
Ground Current vs. Output Current



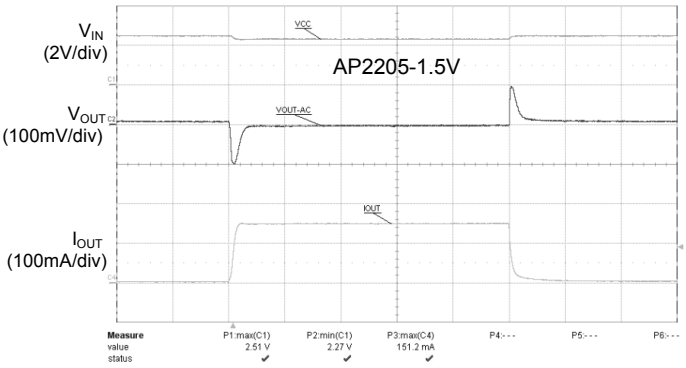
Load Transient
(Conditions: V_{IN}=2.5V, C_{IN}=1.0µF, C_{OUT}=2.2µF, I_{OUT}=1mA to 50mA)



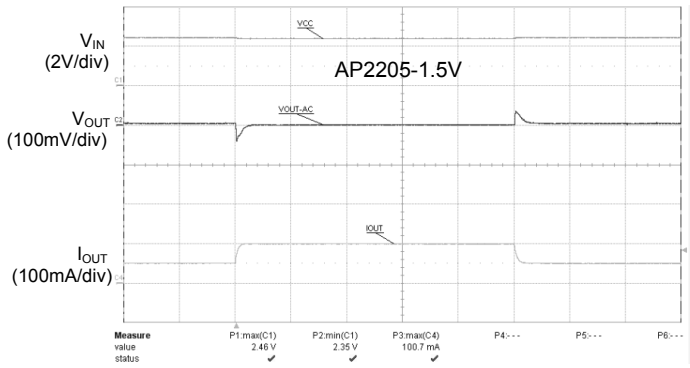
Load Transient
(Conditions: V_{IN}=2.5V, C_{IN}=1.0µF, C_{OUT}=2.2µF, I_{OUT}=1mA to 100mA)



Load Transient
(Conditions: V_{IN}=2.5V, C_{IN}=1.0µF, C_{OUT}=2.2µF, I_{OUT}=1mA to 150mA)

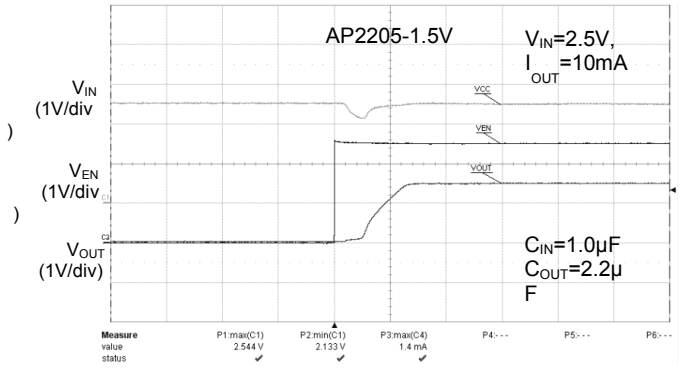


Load Transient
(Conditions: V_{IN}=2.5V, C_{IN}=1.0µF, C_{OUT}=2.2µF, I_{OUT}=50mA to 100mA)



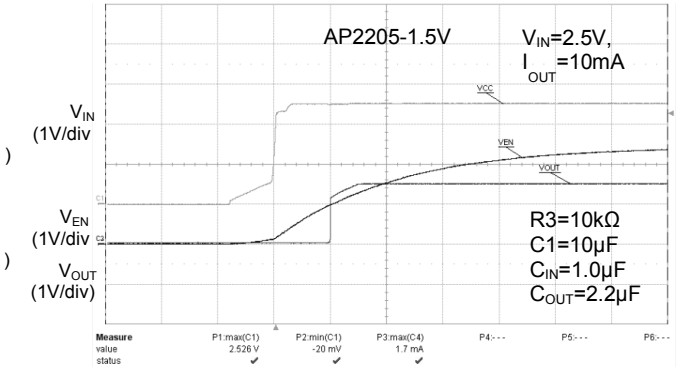
Performance Characteristics (Cont.)

Enable Input Response



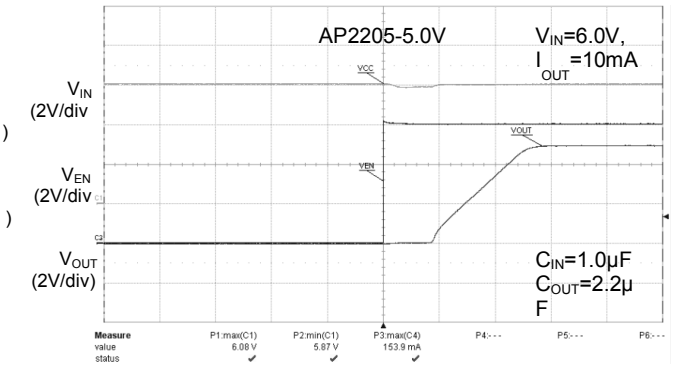
Time (100μs/div)

Adjustable Start-up Time by RC



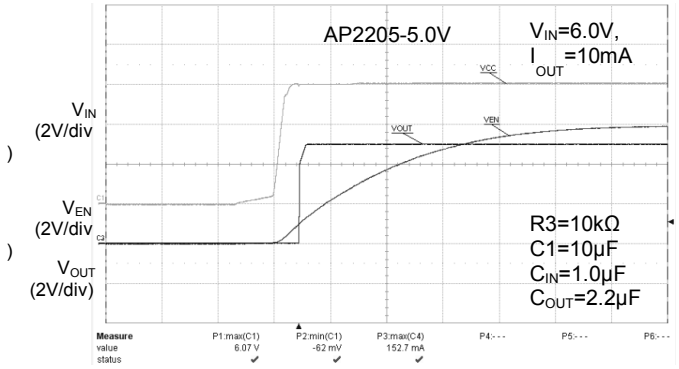
Time (50ms/div)

Enable Input Response



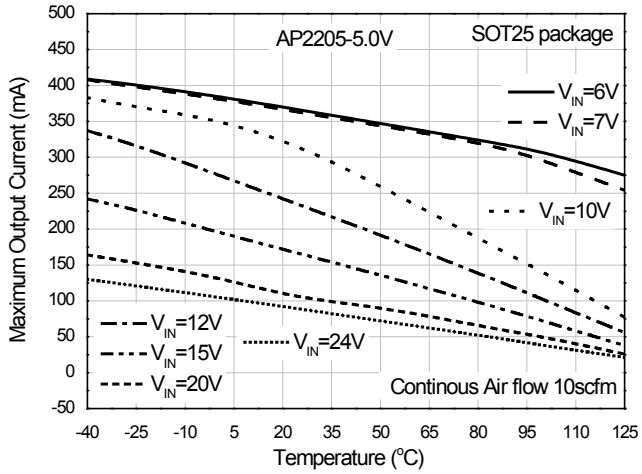
Time (200μs/div)

Adjustable Start-up Time by RC

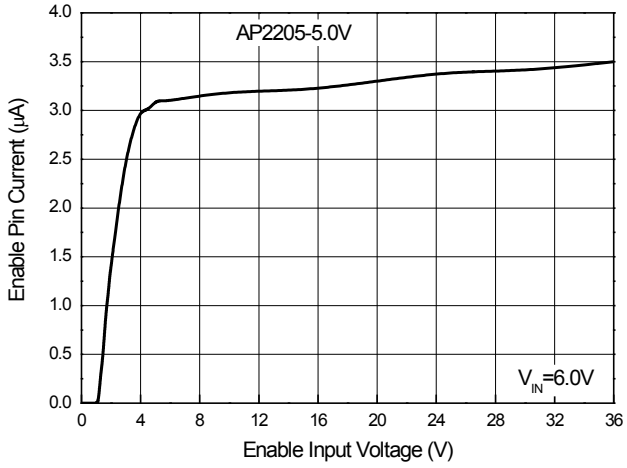


Time (50ms/div)

Maximum Output Current vs. Ambient Temperature

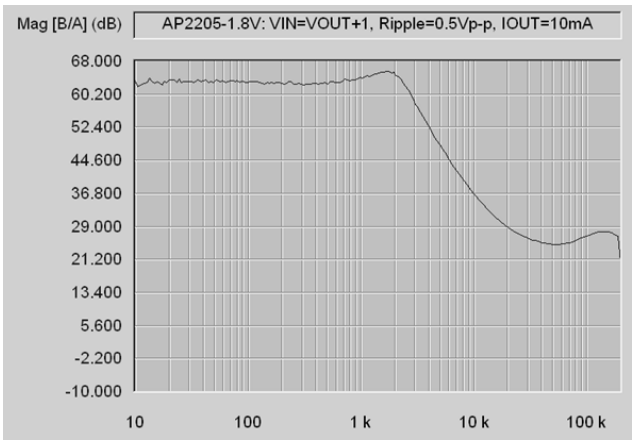


Enable Pin Current vs. Enable Input Voltage

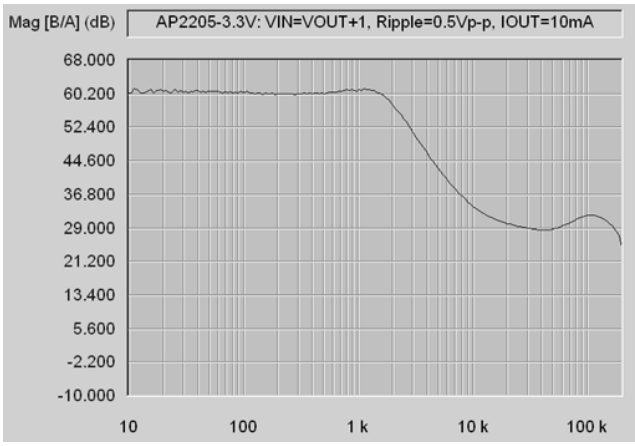


Performance Characteristics (Cont.)

PSRR vs. Frequency



PSRR vs. Frequency



Ordering Information

AP2205 - X X - X

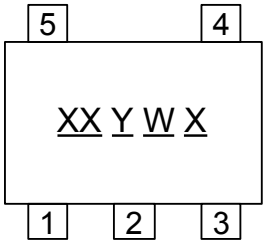
Product Name	Output Voltage	Package	Packing
	Black : Adjustable Output 15 : Fixed Output 1.5V 18 : Fixed Output 1.8V 25 : Fixed Output 2.5V 28 : Fixed Output 2.8V 30 : Fixed Output 3.0V 33 : Fixed Output 3.3V 50 : Fixed Output 5.0V	W5 : SOT25 Y/YR : SOT89	7/13 : 7"/13" Tape & Reel

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)



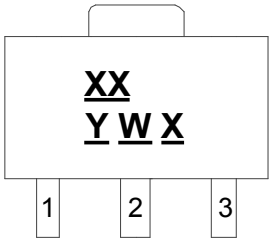
XX : Identification Code
Y : Year 0 to 9
W : Week : A to Z : 1 to 26 week;
a to z : 27 to 52 week; z represents 52 and 53 week
X : Internal Code

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)

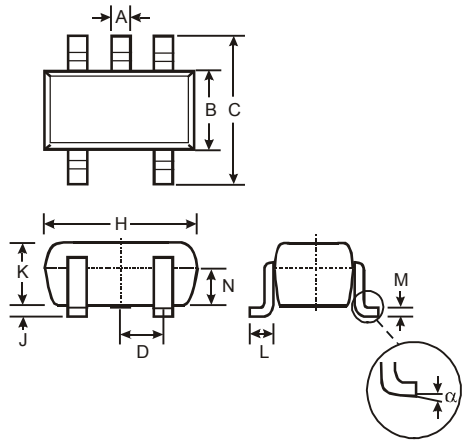


XX : Identification code
Y : Year : 0~9
W : Week : A~Z : 1~26 week;
a~z : 27~52 week;
z represents 52 and 53 week
X : Internal code

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

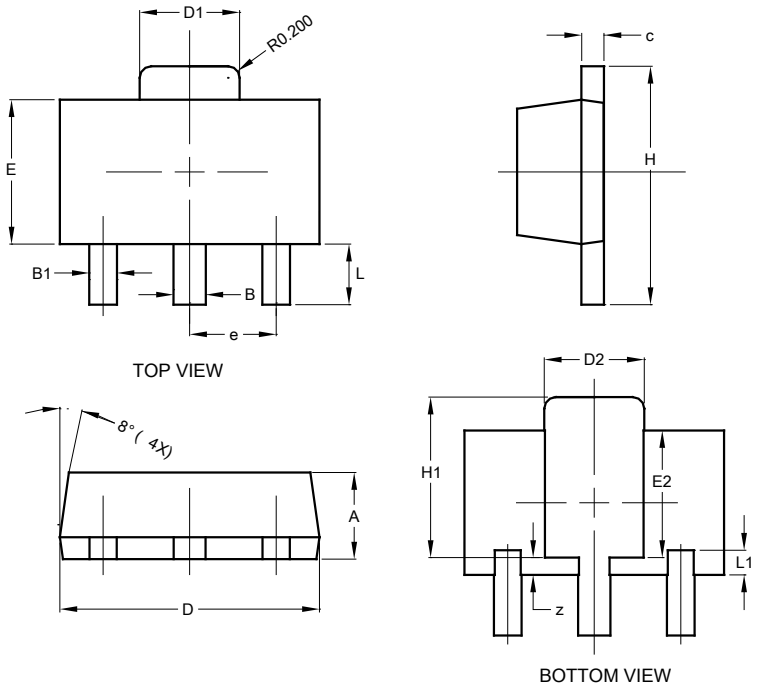
Package Outline Dimensions (All dimensions in mm(inch).)

(1) Package Type: SOT25



SOT25			
Dim	**Min**	**Max**	**Typ**
A	0.35	0.50	0.38
B	1.50	1.70	1.60
C	2.70	3.00	2.80
D	-	-	0.95
H	2.90	3.10	3.00
J	0.013	0.10	0.05
K	1.00	1.30	1.10
L	0.35	0.55	0.40
M	0.10	0.20	0.15
N	0.70	0.80	0.75
α	0°	8°	-
All Dimensions in mm			

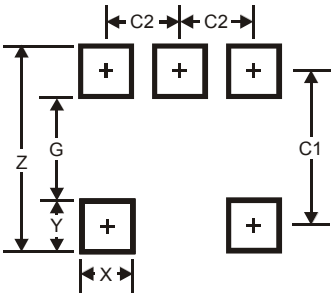
(2) Package Type: SOT89



SOT89			
Dim	**Min**	**Max**	**Typ**
A	1.40	1.60	1.50
B	0.50	0.62	0.56
B1	0.42	0.54	0.48
c	0.35	0.43	0.38
D	4.40	4.60	4.50
D1	1.62	1.83	1.733
D2	1.61	1.81	1.71
E	2.40	2.60	2.50
E2	2.05	2.35	2.20
e	-	-	1.50
H	3.95	4.25	4.10
H1	2.63	2.93	2.78
L	0.90	1.20	1.05
L1	0.327	0.527	0.427
z	0.20	0.40	0.30
All Dimensions in mm			

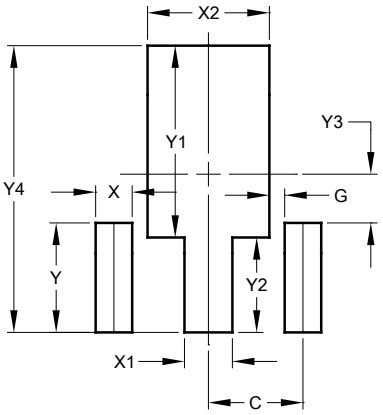
Suggested Pad Layout

(1) Package Type: SOT25



Dimensions	Value
Z	3.20
G	1.60
X	0.55
Y	0.80
C1	2.40
C2	0.95

(2) Package Type: SOT89



Dimensions	Value (in mm)
C	1.500
G	0.244
X	0.580
X1	0.760
X2	1.933
Y	1.730
Y1	3.030
Y2	1.500
Y3	0.770
Y4	4.530

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