优尚

YOUSHANG SEMICONDUCTOR

设计研发新型功率器件

各类小信号开关

中低压及高压大电流等场效应管

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Description

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

The NK-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.

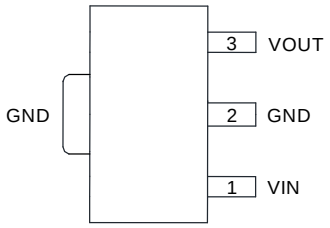
The IC consists of a voltage reference, an error amplifier, a resistor network for setting output voltage, a current limit circuit for current protection, a chip enable circuit, a low power shutdown mode for extended battery life, overcurrent protection, overtemperature protection, as well as reverse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

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

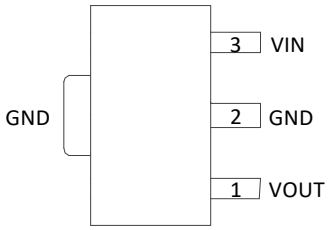
Pin Assignments

(Top View)



SOT89 (Note 4)

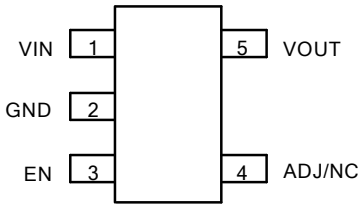
(Top View)



SOT89R (Note 4)

Note 4: The substrate/exposed pad should be connected to GND or open.

(Top View)



SOT25

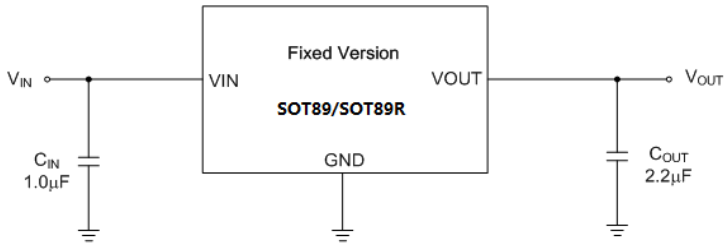
Features

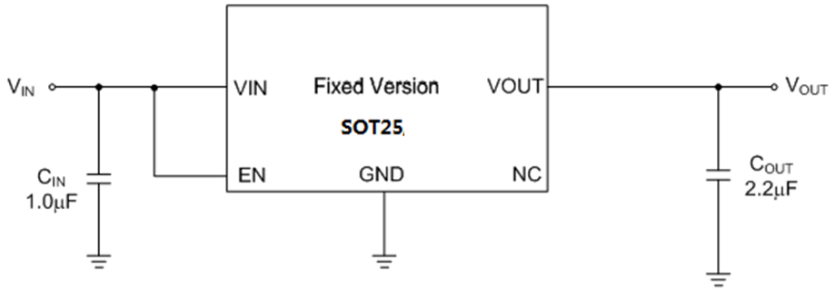
- Wide Input Voltage Range: 2.3V to 24V
- Wide Output Voltage Range: 1.24V to 22V
- Excellent Ripple Rejection: 60dB @ f = 1kHz
- Low Dropout Voltage: V_{DROP} = 100mV @ I_{OUT} = 100μA
- Low Ground Current
- High Output Voltage Accuracy
- Compatible with Low ESR Ceramic Capacitor
- Excellent Line/Load Regulation
- Thermal Shutdown Function

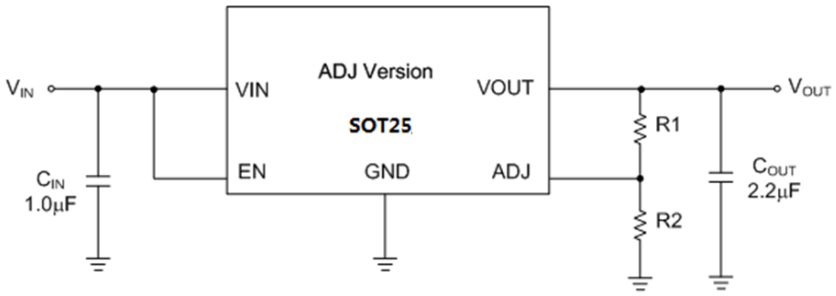
Applications

- Battery-powered equipments
- Laptops, palmtops, notebook computers
- Portable information appliances
- Industrial/Automotive applications

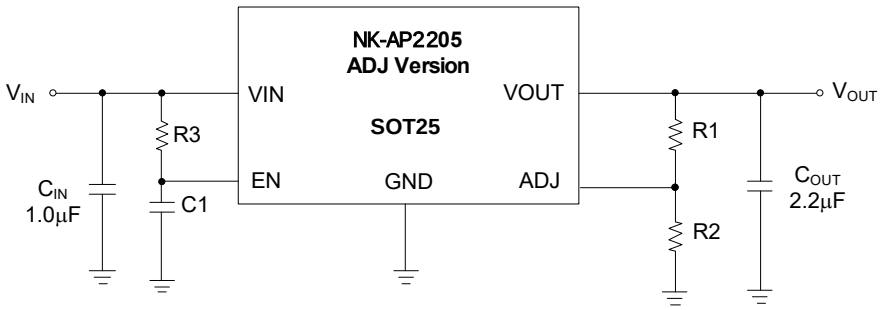
Typical Applications Circuit



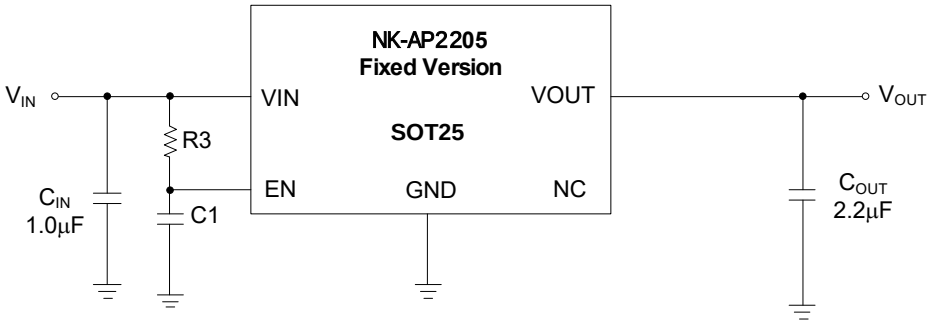




$V_{OUT} = V_{REF}(1+(R1/R2))$



Startup Time Adjustable by External R3C1 Circuit

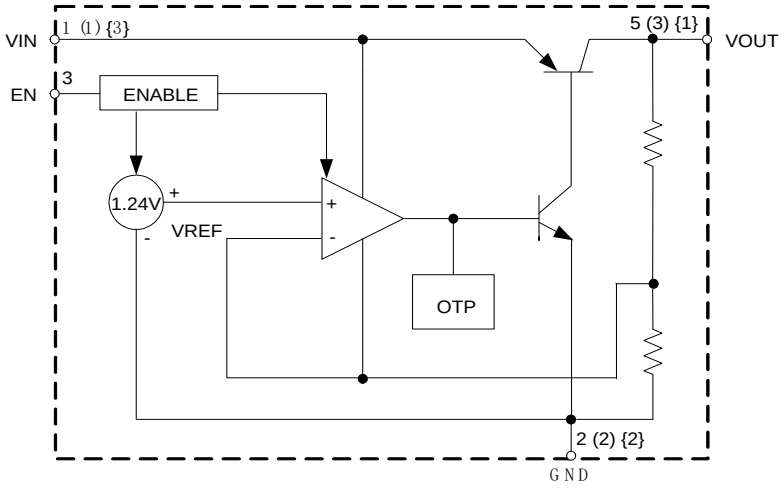


Startup Time Adjustable by External R3C1 Circuit

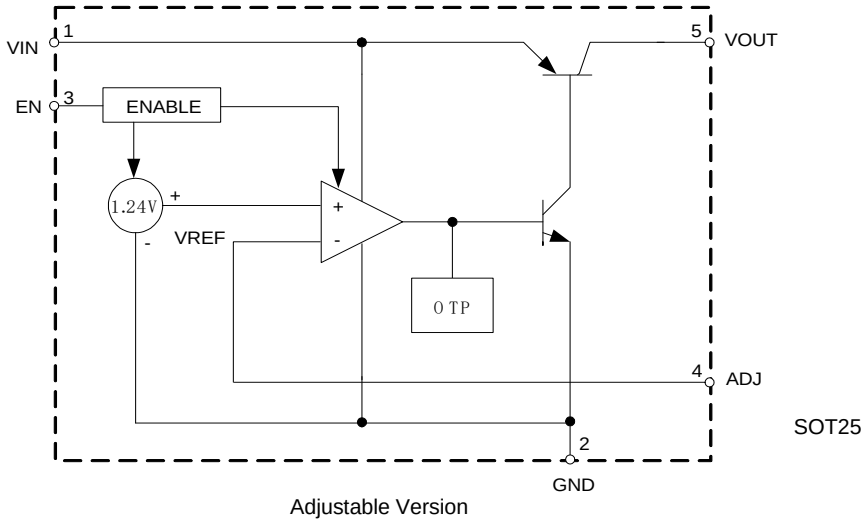
Pin Descriptions

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



Fixed Version



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"* can 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 can 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	

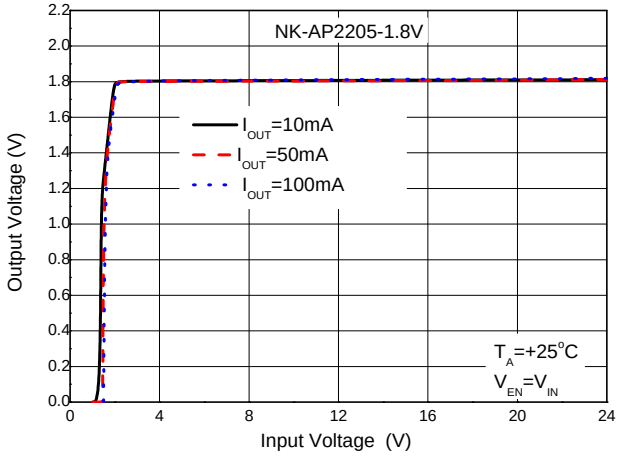
Electrical Characteristics (@ V_{IN} = V_{OUT}+1V, T_J = +25°C, I_{OUT} = 100μA, C_{IN} = 1.0μF, C_{OUT} = 2.2μF, **Bold** typeface applies over -40°C ≤ T_J ≤ +125°C, unless otherwise specified.)

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

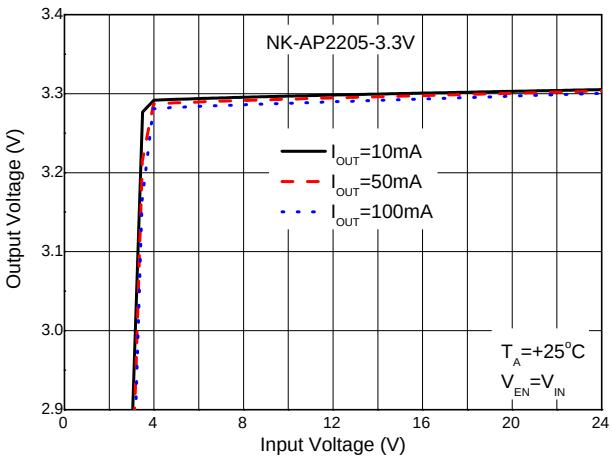
Note: 7. Dropout voltage is only valid when V_{OUT} ≥ 2.3V because of the minimum input voltage limits.

Performance Characteristics

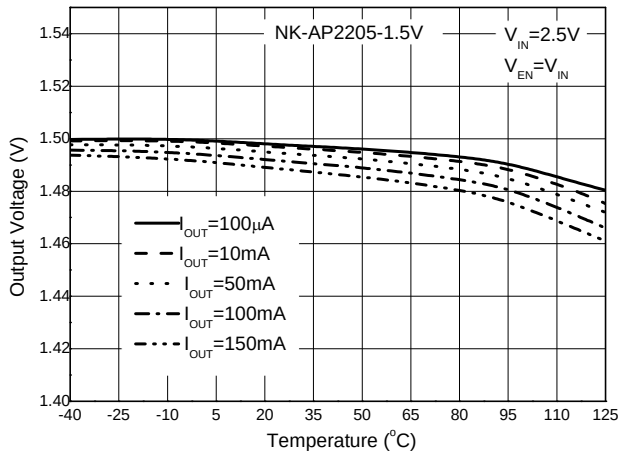
Output Voltage vs. Input Voltage



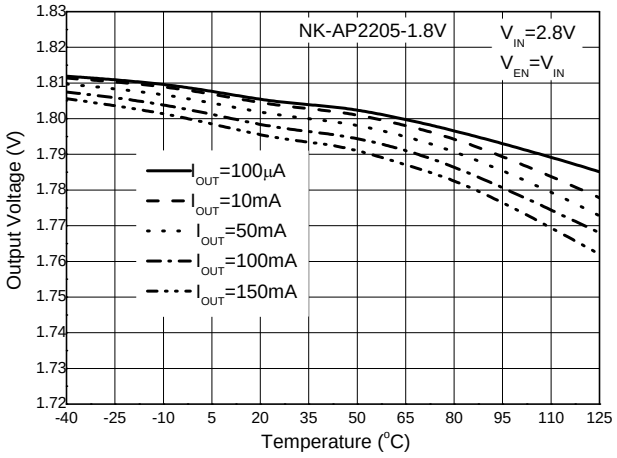
Output Voltage vs. Input Voltage



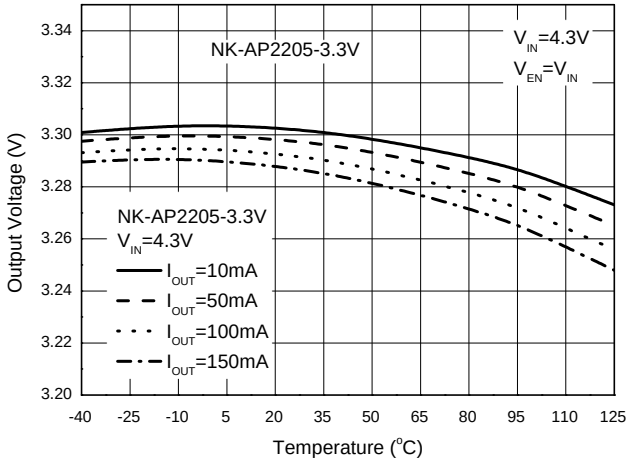
Output Voltage vs. Temperature



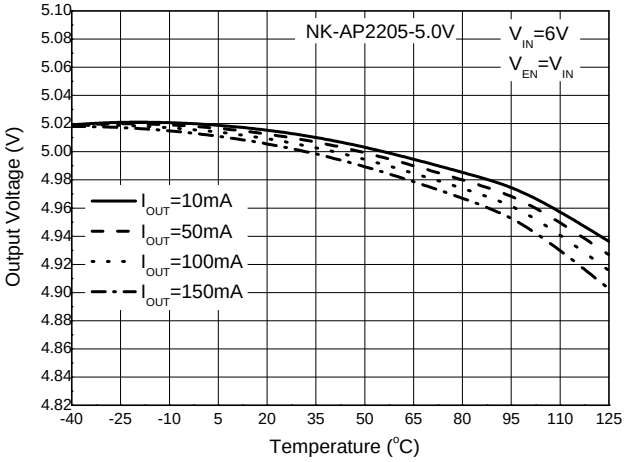
Output Voltage vs. Temperature



Output Voltage vs. Temperature

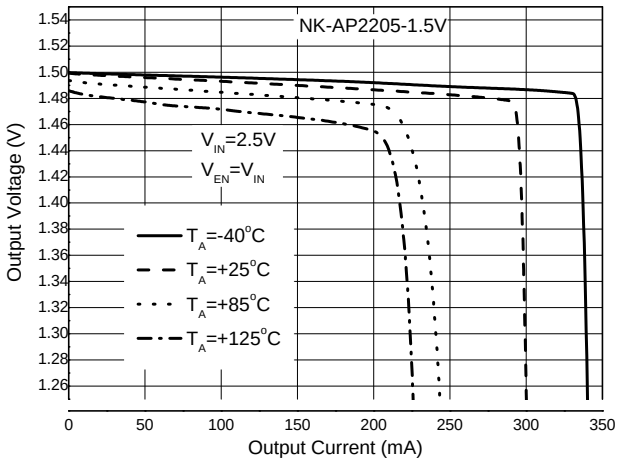


Output Voltage vs. Temperature

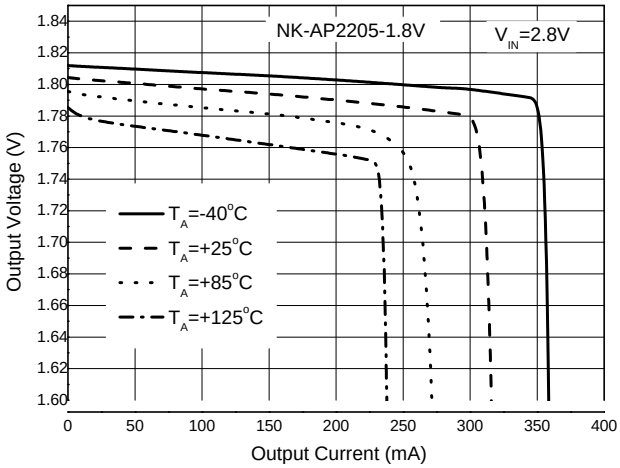


Performance Characteristics (continued)

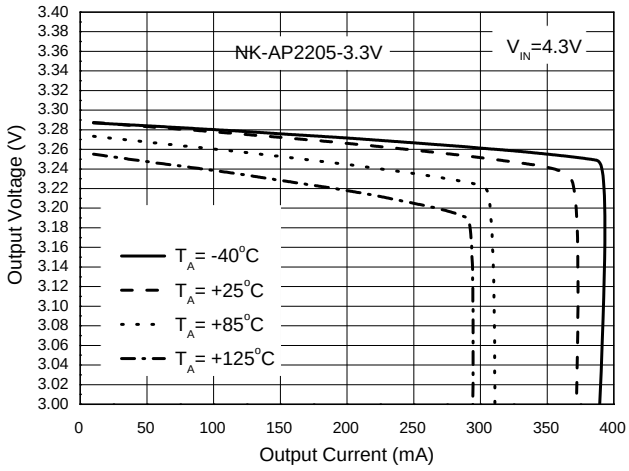
Output Voltage vs. Output Current



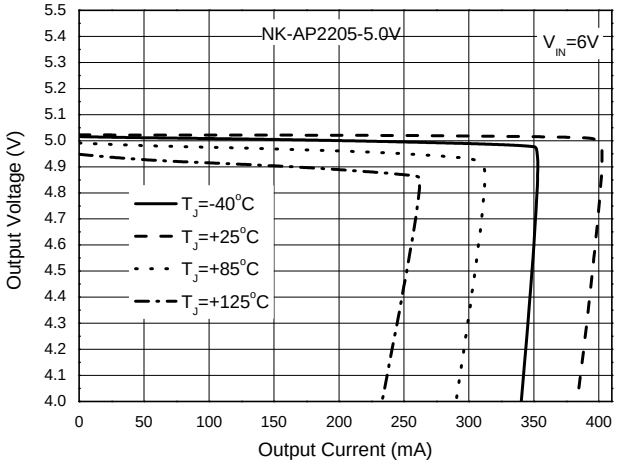
Output Voltage vs. Output Current



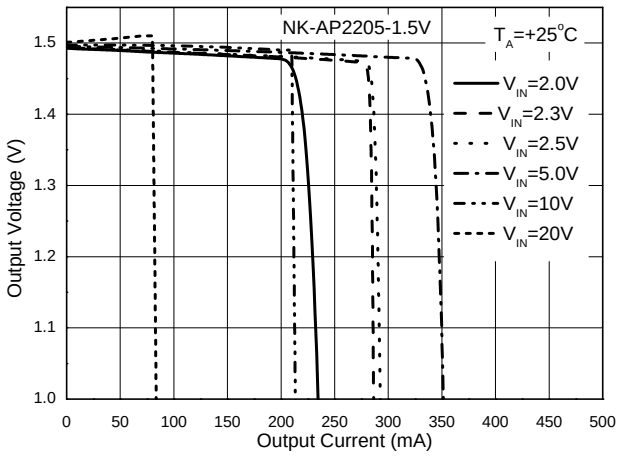
Output Voltage vs. Output Current



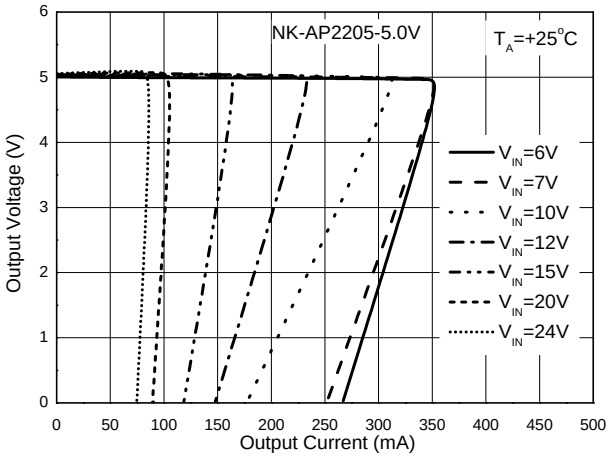
Output Voltage vs. Output Current



Output Voltage vs. Output Current

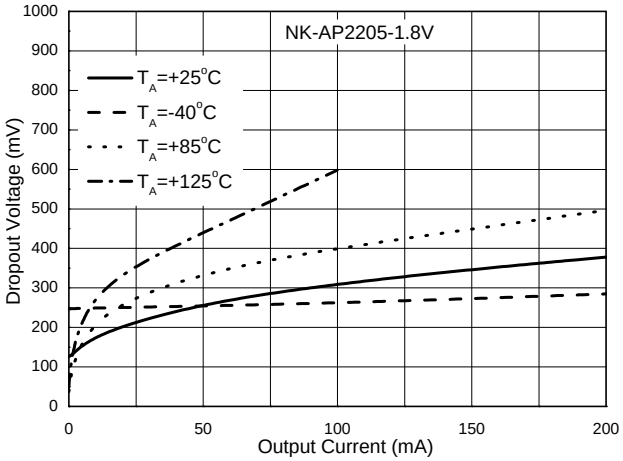


Output Voltage vs. Output Current

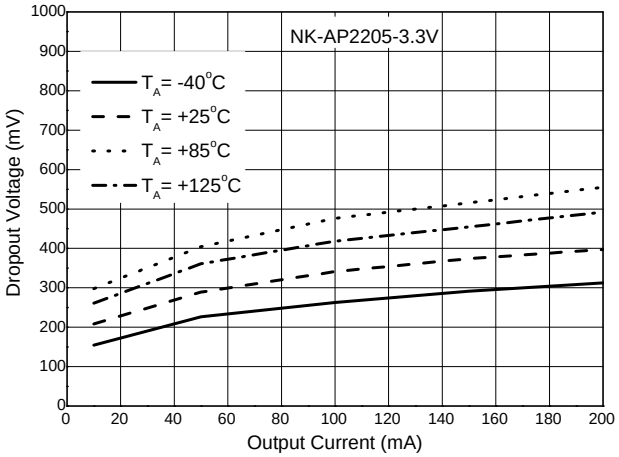


Performance Characteristics (continued)

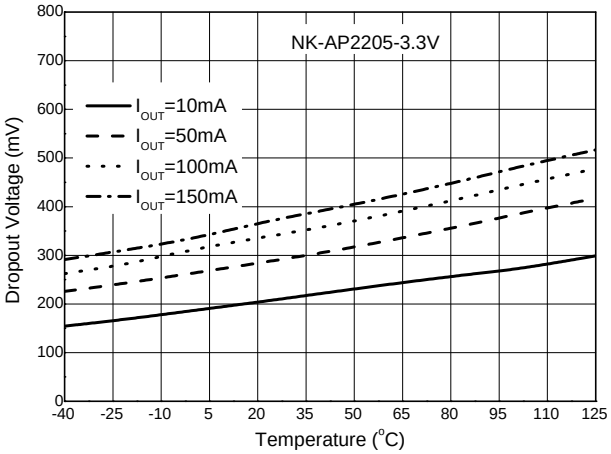
Dropout Voltage vs. Output Current



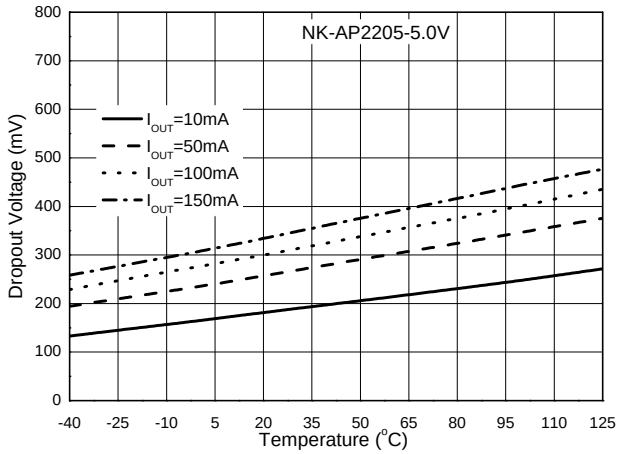
Dropout Voltage vs. Output Current



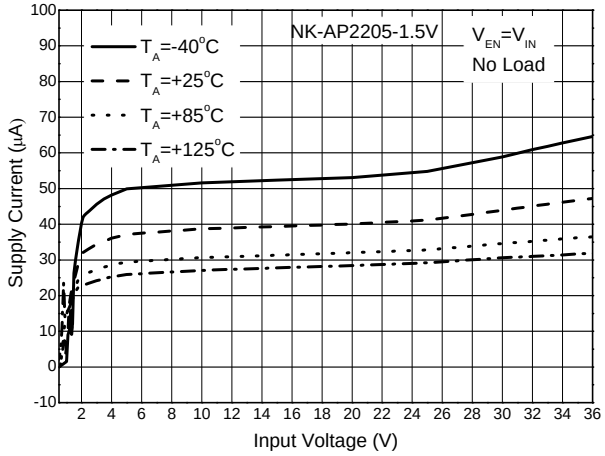
Dropout Voltage vs. Temperature



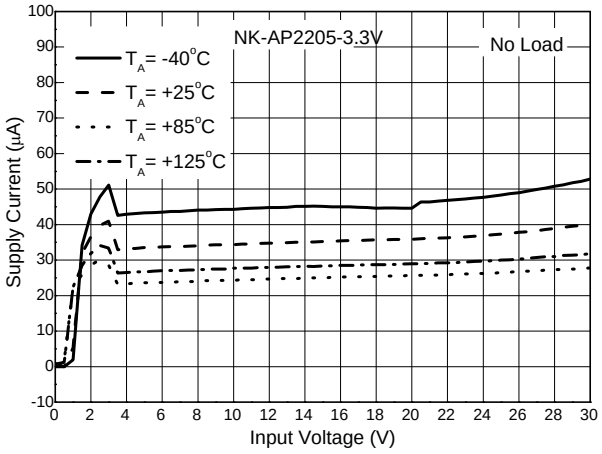
Dropout Voltage vs. Temperature



Supply Current vs. Input Voltage

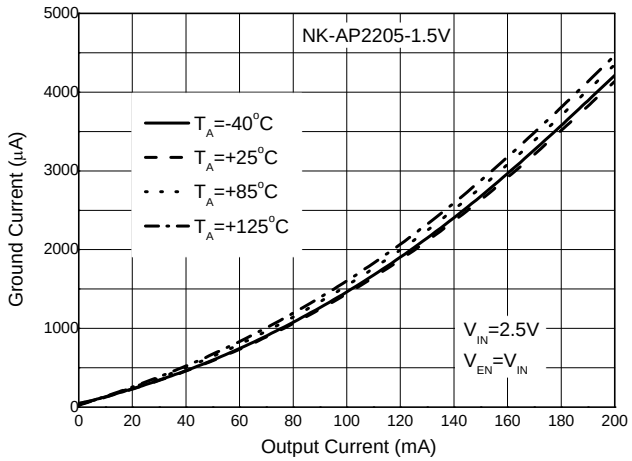


Supply Current vs. Input Voltage

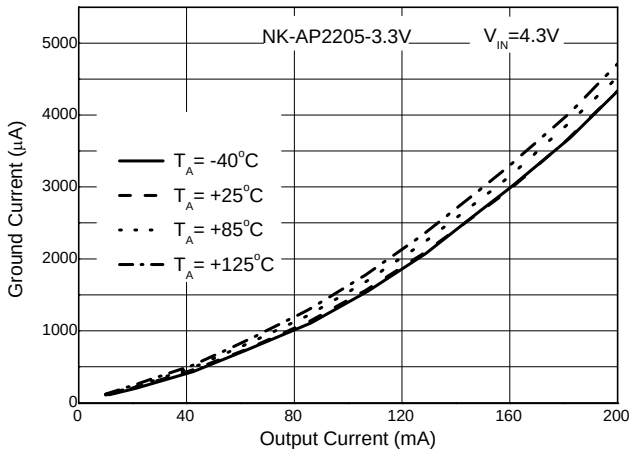


Performance Characteristics (continued)

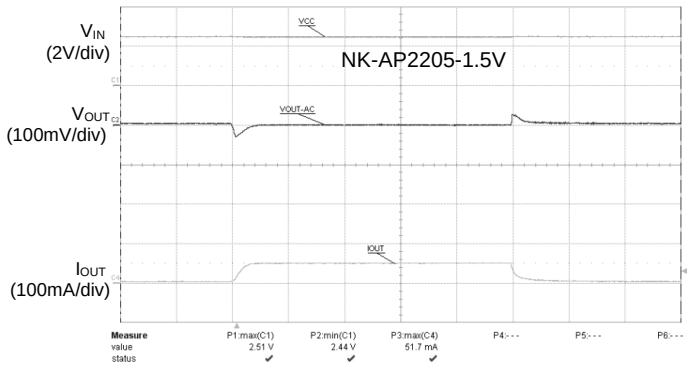
Ground Current vs. Output Current



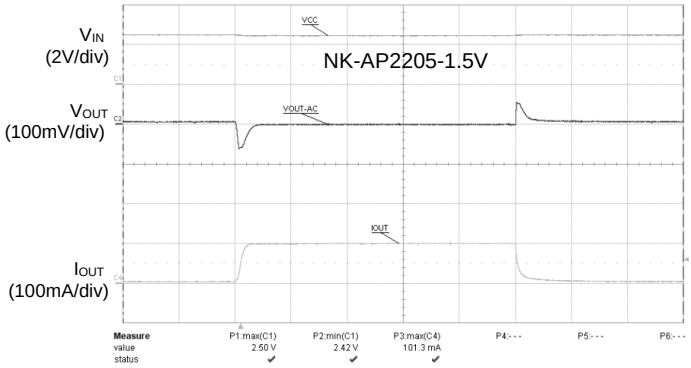
Ground Current vs. Output Current



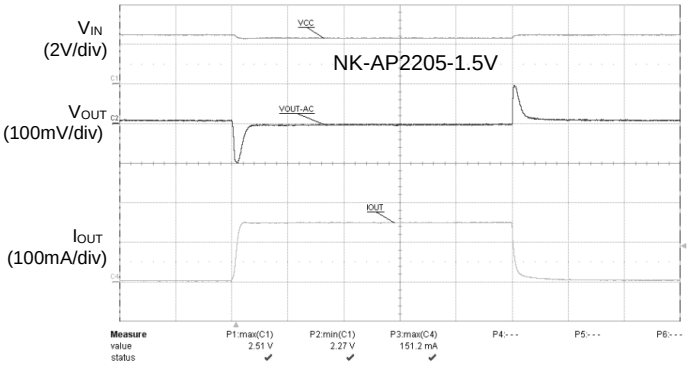
Load Transient
(Conditions: V_{IN}=2.5V, C_{IN}=1.0μF, C_{OUT}=2.2μF, I_{OUT}=1mA to 50mA)



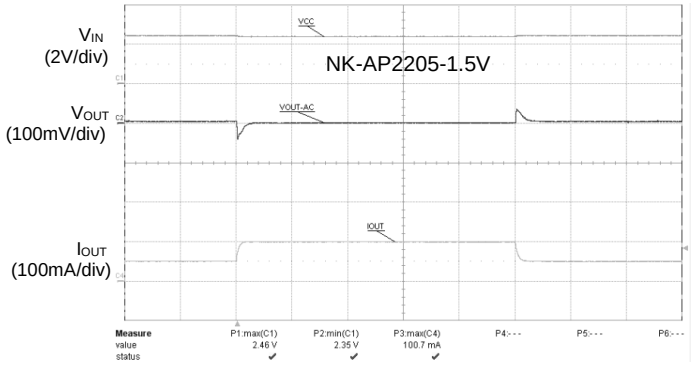
Load Transient
(Conditions: V_{IN}=2.5V, C_{IN}=1.0μF, C_{OUT}=2.2μF, I_{OUT}=1mA to 100mA)



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

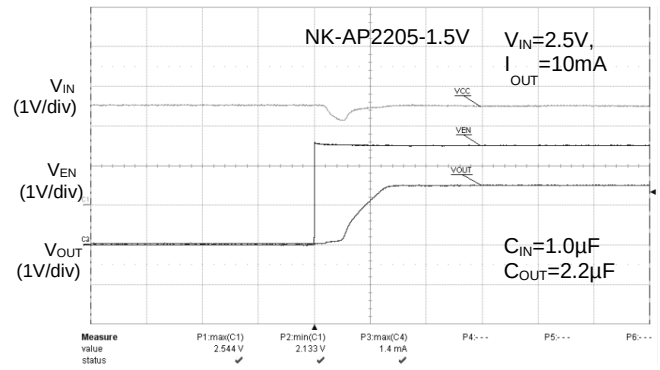


Load Transient
(Conditions: V_{IN}=2.5V, C_{IN}=1.0μF, C_{OUT}=2.2μF, I_{OUT}=50mA to 100mA)

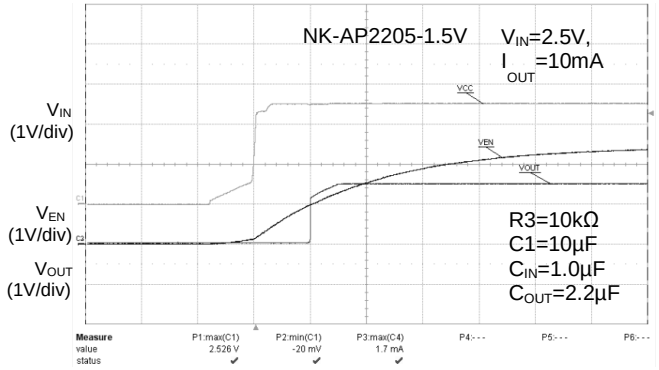


Performance Characteristics (continued)

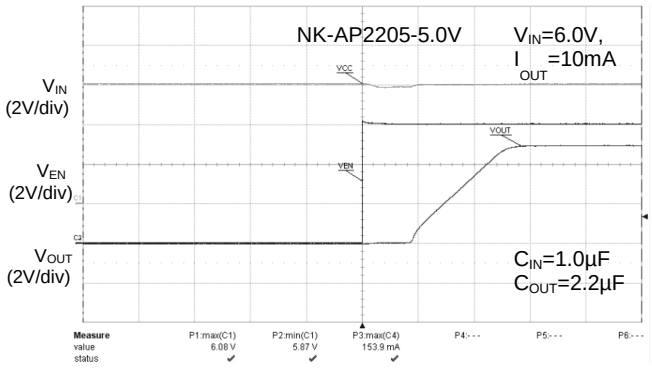
Enable Input Response



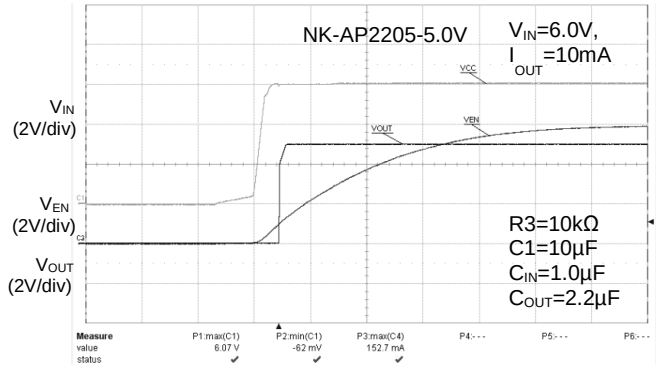
Adjustable Start-up Time by RC



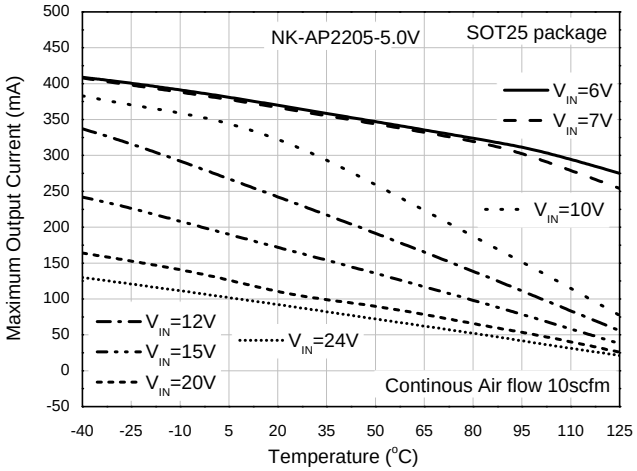
Enable Input Response



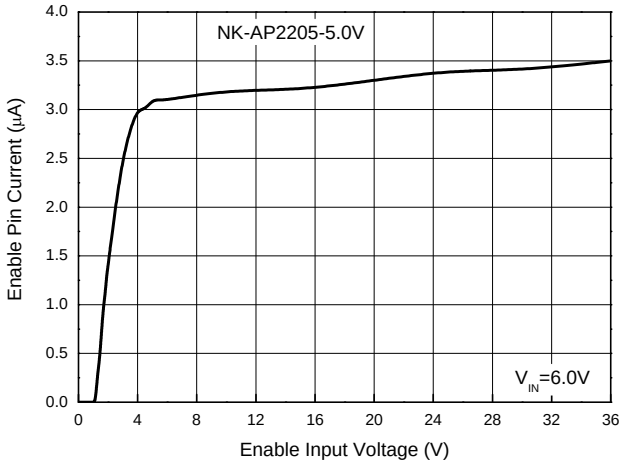
Adjustable Start-up Time by RC



Maximum Output Current vs. Ambient Temperature

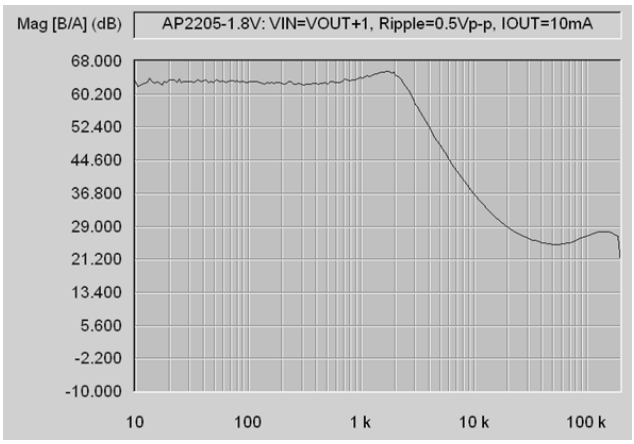


Enable Pin Current vs. Enable Input Voltage

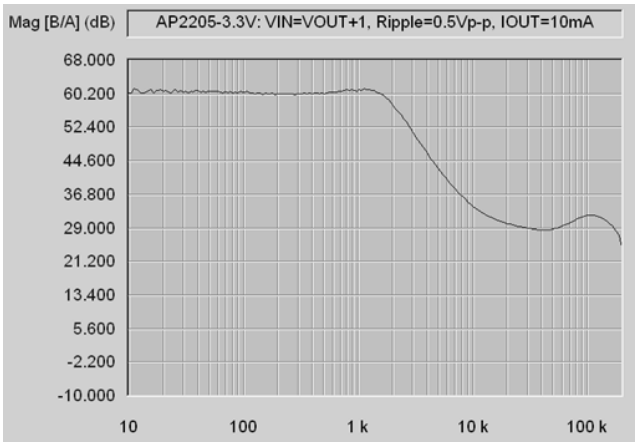


Performance Characteristics (continued)

PSRR vs. Frequency

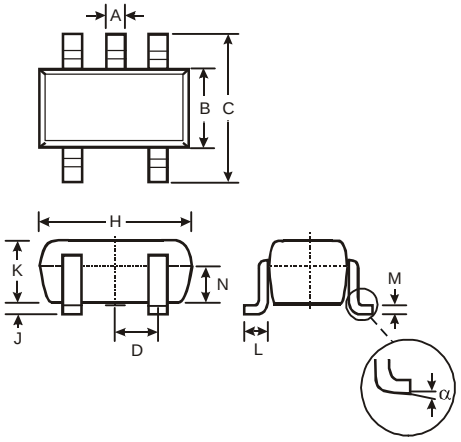


PSRR vs. Frequency



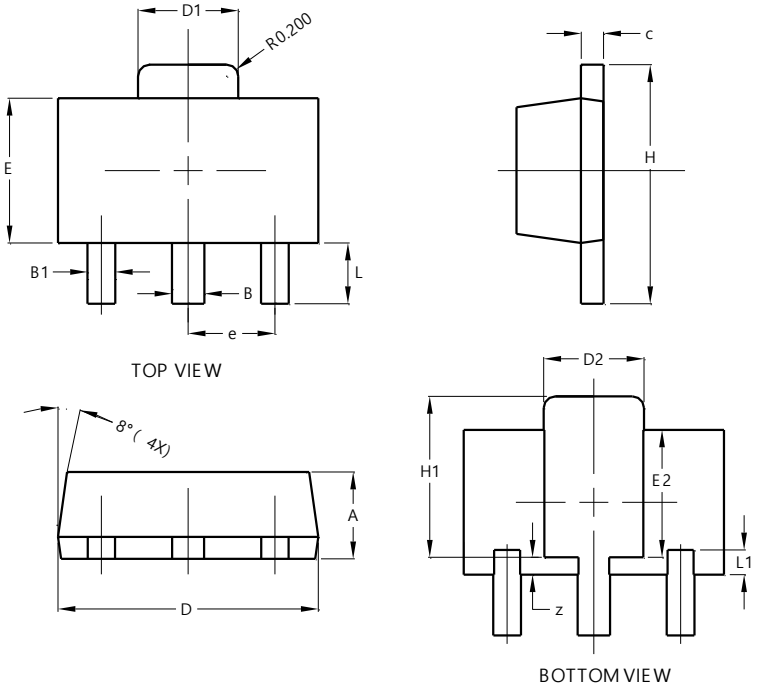
Package Outline Dimensions

(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			

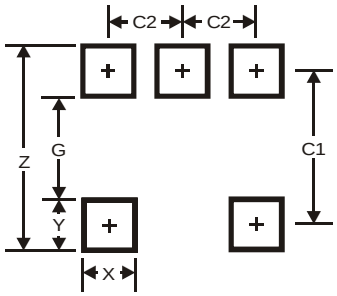
(2) Package Type: SOT89



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			

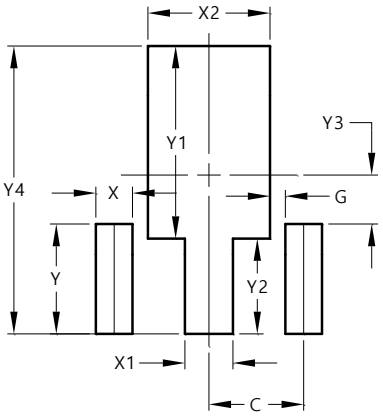
Suggested Pad Layout

(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

Mechanical Data

- 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)