Advanced Monolithic Systems

AMS2596

SUPER SWITCHER

RoHS compliant

FEATURES

- **1.25V to 7V fixed Output Voltage in 100mV step**
- **Input voltage range up to 30V**
- **Low power standby mode, IQ typically 80µA**
- **Excellent line and load regulation specifications**
- **Thermal shutdown and current limit protection**
- **150 kHz fixed frequency internal oscillator**
- **Adjustable versions output voltage range 1.2V to 25V**

APPLICATIONS

- **LCD monitor**
- **LCD TV**
- **Positive to negative converter**
- **On-board switching regulators**
- **System Power Supply**
- **High-efficiency step-down (buck) regulator**
- **High-efficiency Pre-regulator for Linear regulator**

GENERAL DESCRIPTION

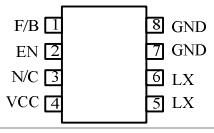
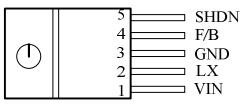
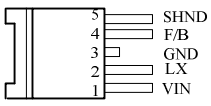
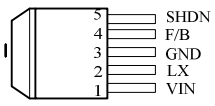
The AMS2596 series of regulators are monolithic integrated circuits that provide all the active functions for a step-down (buck) switching regulator with internal compensation and soft start .Capable of driving a 3A load with excellent line and load regulation. These devices are available in Adjustable output voltage and fixed output voltages of 1.25V to 7V in 100mV increments. The AMS2596 require a minimum number of external components and simple to use.

AMS2596 series operates at a switching frequency of 150 kHz thus allowing smaller sized filter components than what would be needed with lower frequency switching regulators. Available in 8-Leads SOIC-EDP, 5-lead TO-252, 5-lead TO-220/TO-263 packages.

ORDERING INFORMATION

PACKAGE TYPE	AMS2596 ADJUSTABLE	AMS2596 FIXEDVOLTAGE	TEMP. RANGE
TO-263	AMS2596M	AMS2596M-XX	-25ºC to -125ºC
TO-220	AMS2596T	AMS2596T-XX	-25ºC to -125ºC
TO-252	AMS2596D	AMS2596D-XX	-25ºC to -125ºC
SO-8 EDP	AMS2596S	AMS2596S-XX	-25ºC to -125ºC

PIN CONNECTIONS

8L SOIC	5 Lead TO-220	5 Lead TO-252	5 Lead TO-263
SO-Package (S)			
			
Top View	Top View	Top View	Top View

ABSOLUTE MAXIMUM RATINGS (Note 1)

Maximum Supply Voltage	30V	ESD Susceptibility	2 kV
Pin Input Voltage	-0.3 ≤ V ≤+ 30V	Storage Temperature Range	-65 ºC to +150 ºC
Feedback Pin Voltage	-0.3 ≤ V ≤+ 30V	Operating Temperature Range	-40 ºC ≤ TJ ≤ +125 ºC
Output Voltage to GND	-1V	Junction Temperature Range	+150ºC
Power Dissipation	Internally Limited	Lead Temp Range (Soldering 60sec)	+215 ºC

ELECTRICAL CHARACTERISTICS

ALL FIXED VOLTAGES

Electrical Characteristics at T_A= 25 ºC and those with boldface type apply over full Operating Temperature Range, unless otherwise noted.

PARAMETER	TEST CONDITIONS	AMS2596 Min.	AMS2596 Typ.	AMS2596 Max.	Units
Parameters					
Output Voltage (Note 2)	VIN = 12V	V_O – 3%	V_O (2)	V_O + 3%	V
Efficiency	VIN = 12V, ILoad = 3A		85		%

ADJUSTABLE

Electrical Characteristics at T_A= 25 ºC and those with boldface type apply over full Operating Temperature Range, unless otherwise noted.

PARAMETER	TEST CONDITIONS	AMS2596 Min.	AMS2596 Typ.	AMS2596 Max.	Units
Parameters					
Feedback Voltage	4.5V ≤ VIN ≤ 30V, 0.2A ≤ ILoad ≤ 3A	1.193 **1.180**	1.230	1.267 **1.280**	V
Efficiency	VIN = 12V, V_{OUT} = 3V, ILoad = 3A		85		%

ALL OUTPUT VOLTAGE VERSIONS

Electrical Characteristics at T_A= 25 ºC, VIN = 12V, ILoad = 500mA and those with boldface type apply over full Operating Temperature Range, unless otherwise noted.

PARAMETER	TEST CONDITIONS	AMS2596 Min.	AMS2596 Typ.	AMS2596 Max.	Units
Device Parameters					
Feedback Bias Current	Adjustable Versions Only, V_{FB} = 1.3V		10	50 / **100**	nA
Oscillator Frequency	(Note 6)	127	150	173	kHz
Saturation Voltage	I_{OUT} = 3A		1.16	1.4 / **1.5**	V
Max Duty Cycle (ON)	(Note 6)		100		%
Min Duty Cycle (OFF)	(Note 7)		0		%
Current Limit	Peak Current	3.6 / **3.4**	4.5	6.9 / **7.5**	A

ELECTRICAL CHARACTERISTICS (continued)

ALL OUTPUT VOLTAGE (continued)

PARAMETER	TEST CONDITIONS	AMS2596 Min.	AMS2596 Typ.	AMS2596 Max.	Units
Output Leakage Current	Output = 0V (Note 8)			50	µA
	Output = -1V		2	30	µA
Quiescent Current	(Note 6)		5	10	mA
Standby Quiescent Current	ON/OFF pin = 5V (OFF)		80	200 **250**	µA
Thermal Resistance	TO-252 Package, Junction to Ambient (Note 10)		57		ºC/W
	TO-263 Package, Junction to Ambient (Note 9)		30		ºC/W
	TO-220 Package, Junction to Ambient (Note 8)		50		ºC/W
	SO- 8 EDP Package, Junction to Ambient (Note 11)		60		ºC/W
ON/OFF Control					
ON/OFF Pin Logic Input			1.3		V
Threshold Voltage	Low (Regular ON)			**0.6**	V
	High (Regular OFF)			**2.0**	V
ON/OFF Pin Input Current	V_{LOGIC} = 2.5V (Regular OFF)		5	15	µA
	V_{LOGIC} = 0.5V (Regular ON)		0.02	5	µA

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics.
Note 2: V_O = Output Voltage specified from 1.25V to 7V in 100mV increments.
Note 3: Typical numbers are at 25ºC and represent the most likely norm.
Note 4: All limits guaranteed at room temperature (standard type face) and at temperature extremes (bold type face). All room temperature limits are 100% production tested. All limits at temperature extremes are guaranteed via correlation using standard Statistical Quality Control (SQC) methods. All limits are used to calculate Average Outgoing Quality Level (AOQL).
Note 5: Feedback pin removed from output and connected to 0V to force the output transistor switch ON.
Note 6: Feedback pin removed from output and connected to 12V for Fixed and Adjustable version, to force the output transistor switch OFF.
Note 7: With output transistor switch turned off.
Note 8: Junction to ambient thermal resistance (no external heat sink) for the TO-220 package mounted vertically, with the leads soldered to a printed circuit board with (1 oz.) and a heat sink approximately 1 in^2.
Note 9. Junction to ambient thermal resistance with the TO-263 package tab soldered to a double side printed circuit board with 2.5 in^2 of (1 oz.) copper area.
Note 10. Junction to ambient thermal resistance with the TO-252 package tab soldered to a single sided printed circuit board with 2.5 in^2 of (1 oz.) copper area.
Note 11. Junction to ambient thermal resistance with the SO-8 EDP package soldered to a double sided printed circuit board 5 via under the package paddle crossing to the other side of PCB on 2.5 in^2 1oz Cu.

PIN DESIGNATION and FUNCTION

AMS2596M, T&D packages		
Pin Number	**Pin Name**	**Pin Function**
1	V_{IN}	Supply Voltage (Input): Unregulated +4V to 30V supply voltage.
2	LX	Switch (Output): Emitter of NPN output switch. Connect to external storage inductor (LX) and Shottky diode.
3 (TAB)	GND	Ground
4	F/B	Feedback (Input): Output voltage feedback to regulator. Connect to output of supply for fixed versions. Connect to 1.23V tap of resistive divider for adjustable versions.
5	SHDN	Shutdown (Input): Logic low enables regulator. Logic high (> 2.4V) shuts down regulator.

PIN DESIGNATION and FUNCTION

AMS2596S (8-Pin SOIC)		
Pin Number	**Pin Name**	**Pin Function**
4	V_{IN}	Supply Voltage (Input): Unregulated +4V to 30V supply voltage.
5&6	LX	Switch (Output) Connect to external storage inductor (LX) and Shottky diode.
7&8	GND	Ground
1	F/B	Feedback : Output voltage feedback to regulator. Connect to tap of resistive divider for adjustable versions.
2	SHDN	Shutdown, Logic low enables regulator. Logic high shuts down regulator.

User Guidelines

In Switching Regulators applications the PCB layout is very important in order to get a stable output and minimum current loops and trace inductance. To minimize the problems associated with inductance and fast transient currents from the Input Capacitor to the device and from the Schottky diode to the device should be kept very short. Also the ground plane should be as wide as possible or use a single point of grounding. A special attention should be given to the location of the inductor, to be kept away from sensitive lines such as Feedback and Enable. If the Enable pin is not used it is recommended to have it connected to Ground. The output capacitor should be connected close to the package leads and the feedback sense point should be taken as close as possible to the loading point to eliminate the errors caused by voltage drop across the PCB traces. AMS2596 it operates with all kind of Output Capacitors including Low ESR (Equivalent Series Resistance) such as ceramic capacitors and also can take very large capacitor values. The voltage rating of the capacitor should be minimum 1.5 times the output voltage.
The input capacitor can be Aluminum or Tantalum 680µF or 470µF and should be places as close as possible to the IC input pin.

ADJUSTABLE OUTPUT

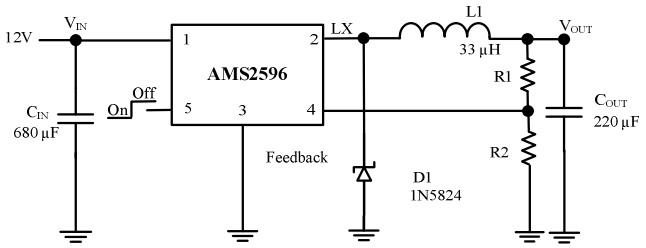
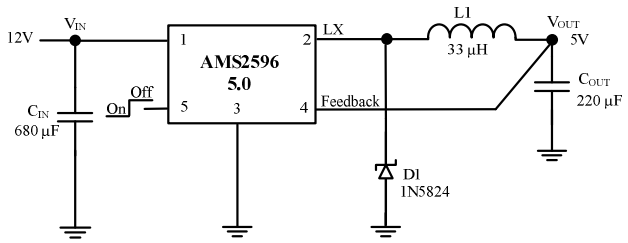


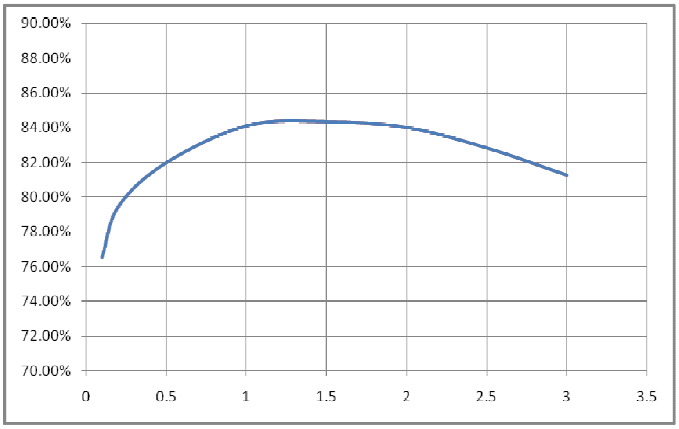
FIG. 1

$$V_{OUT} = V_{REF}\left(\frac{R_1}{R_2}+1\right)$$

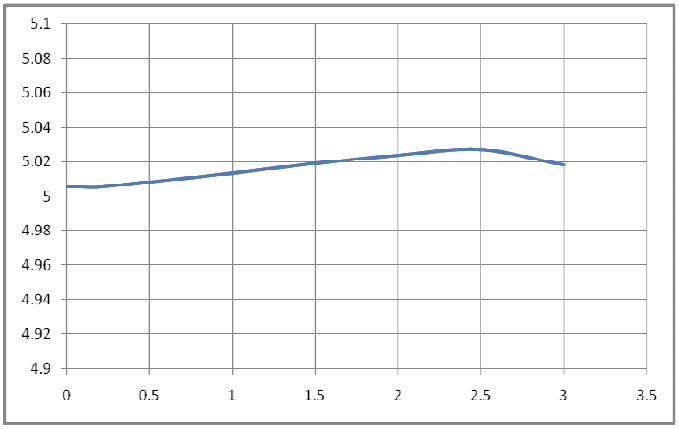
FIXED VOLTAGE OUTPUT



TYPICAL PERFORMACE

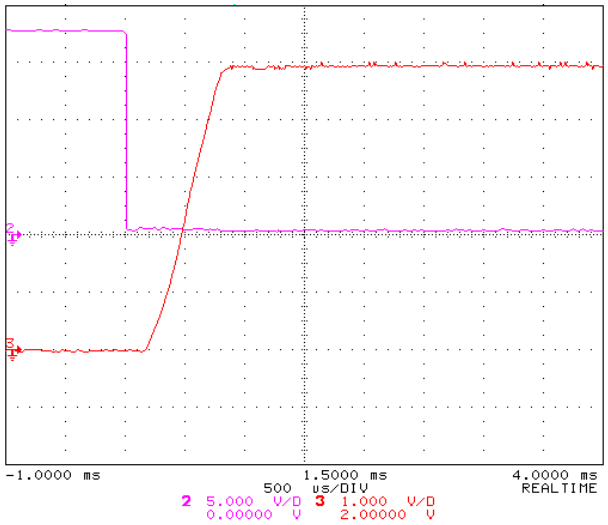


Efficiency vs Load: 12V Input, 3.3V Output

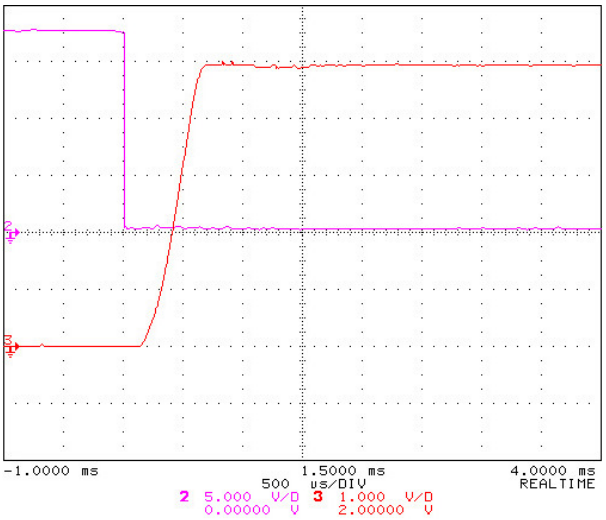


Load Regulation 5V Output

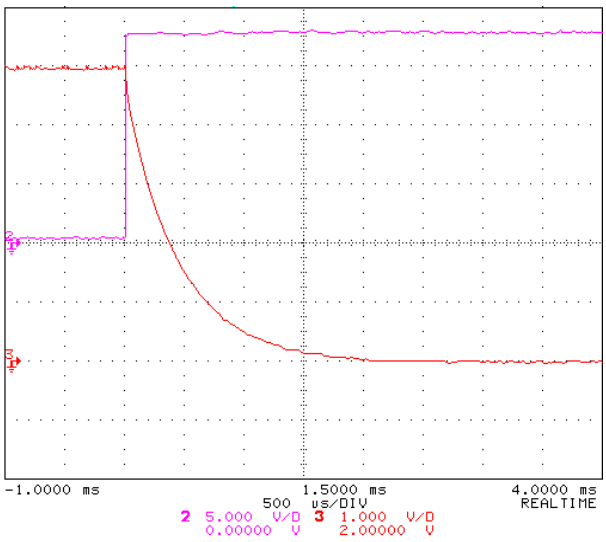
TYPICAL PERFORMACE (continued)



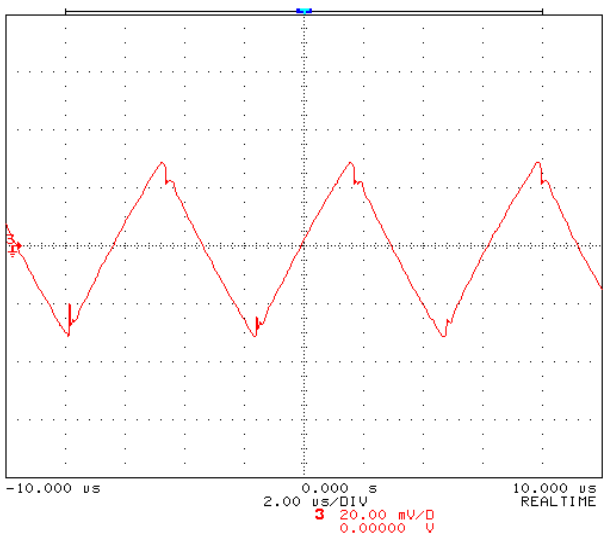
5V Output full load start up



5V Output light load start up

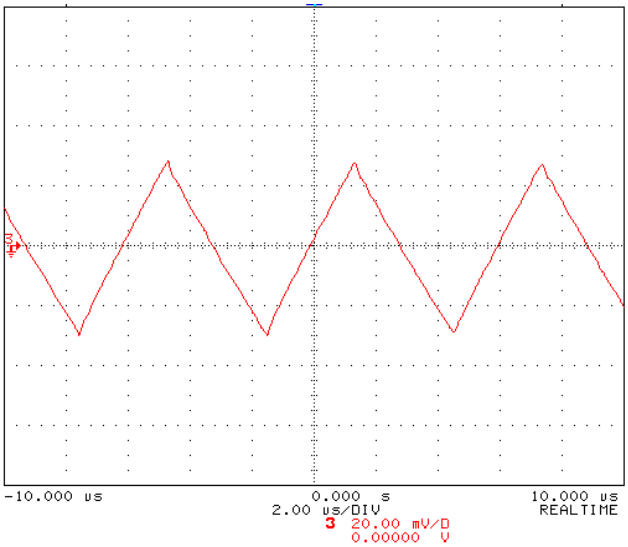


5V Output full load stop

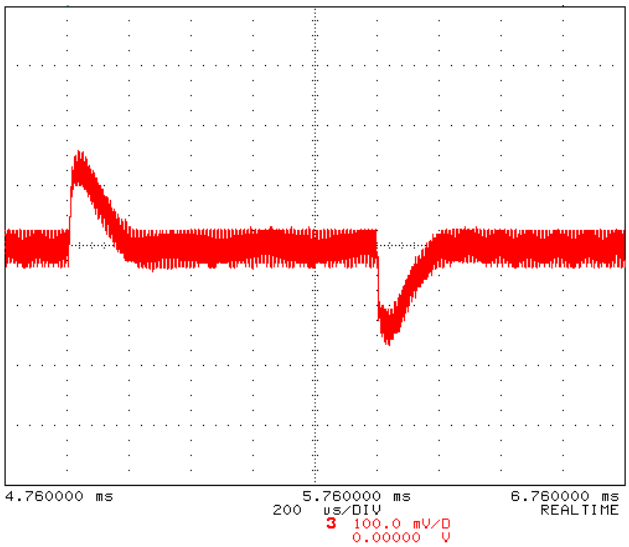


5V Output ripple full load

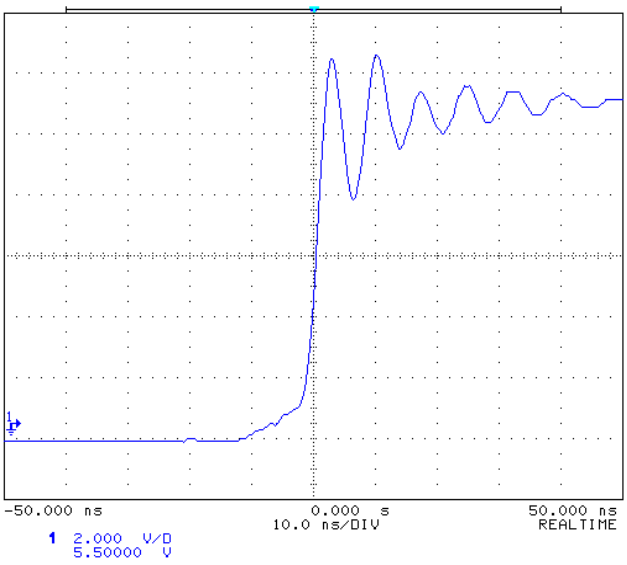
TYPICAL PERFORMACE (continued)



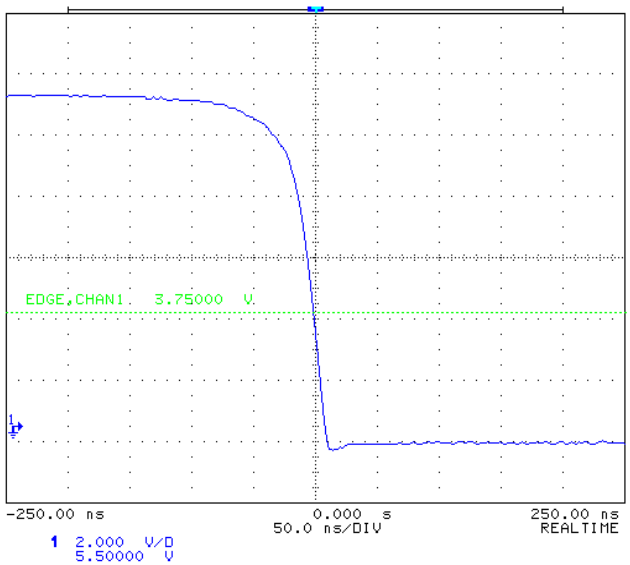
5V Output 0.5A ripple



5V Output 0.5-2A Transient test

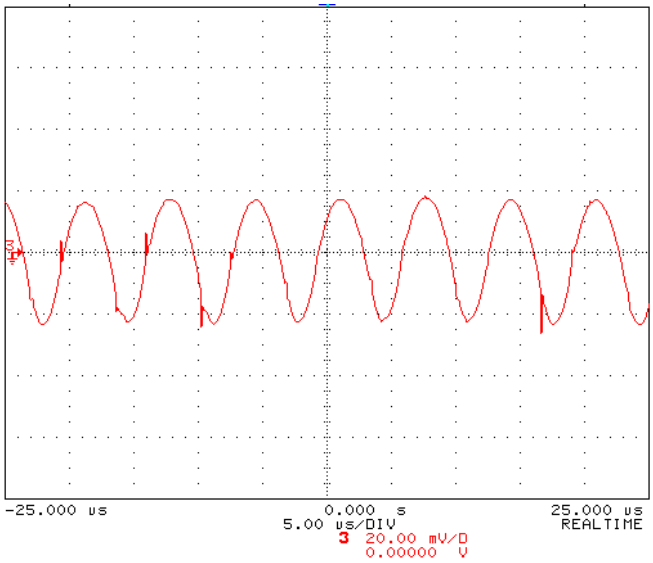


Switch Rise Time @ 3A

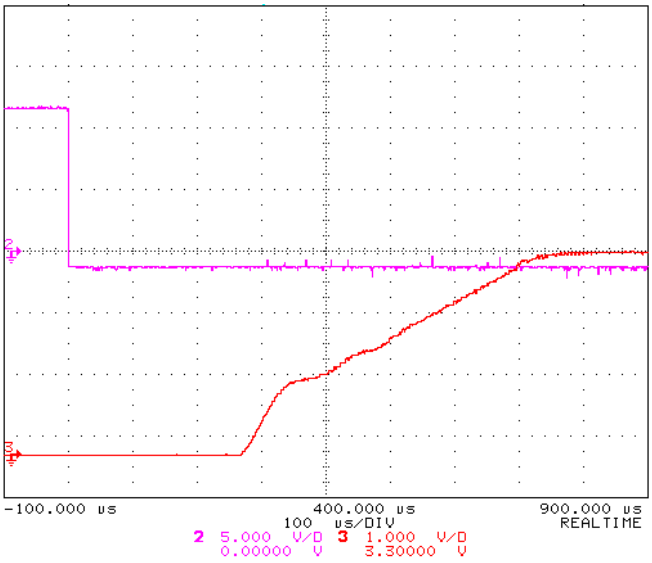


Switch Fall Time @ 3A

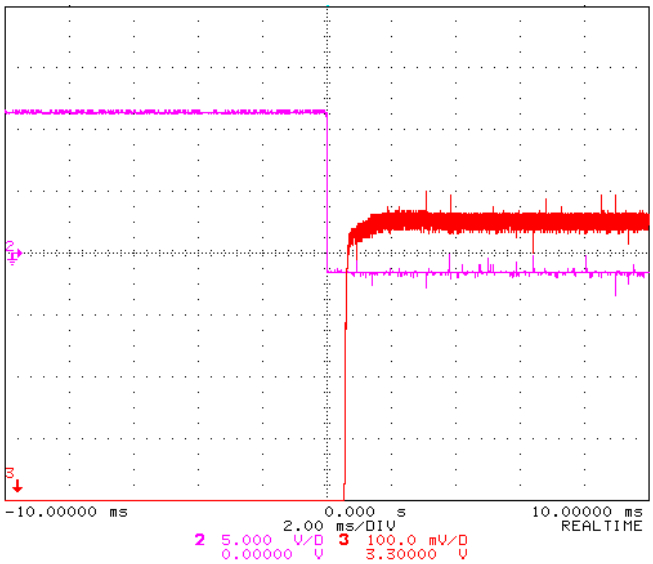
TYPICAL PERFORMACE (continued)



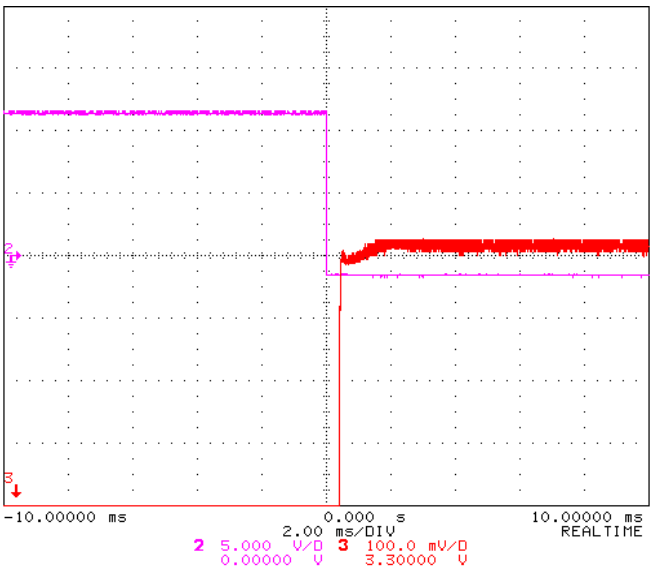
5V Output ripple full load



3.3V Output 3A Start up



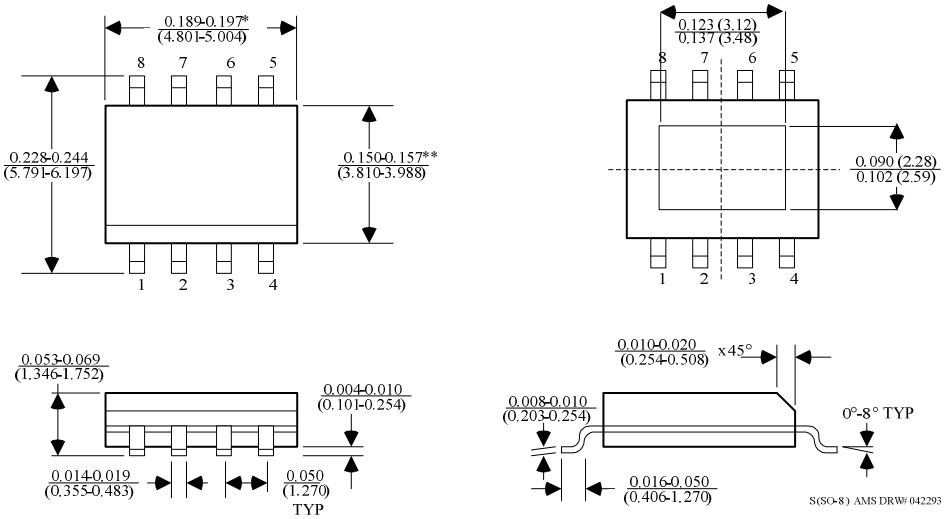
Start up 3.3V Output,
100mA Load Ceramic Output Capacitor

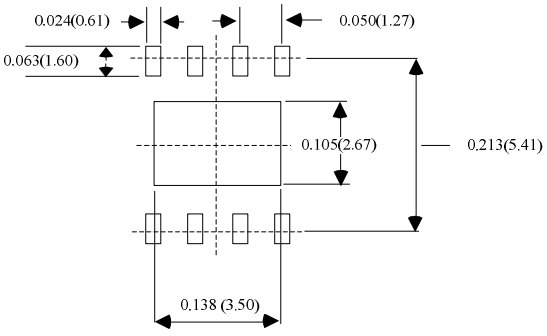


Start up 3.3V Output,
10 mA Load Ceramic Output Capacitor

PACKAGE DIMENSIONS inches (millimeters) unless otherwise noted.

8 LEAD SOIC PLASTIC PACKAGES (S)





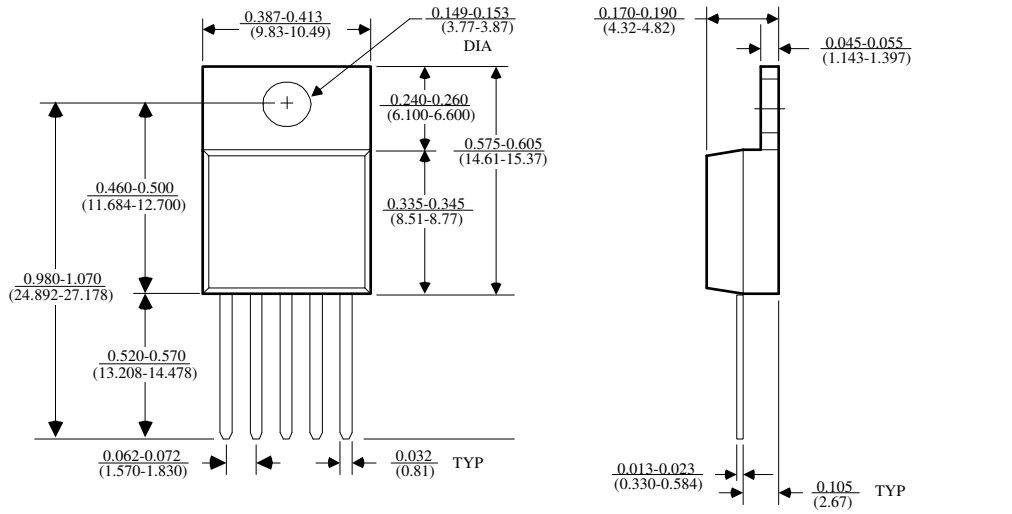
RECOMMENDED LAYOUT PATTERN

*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

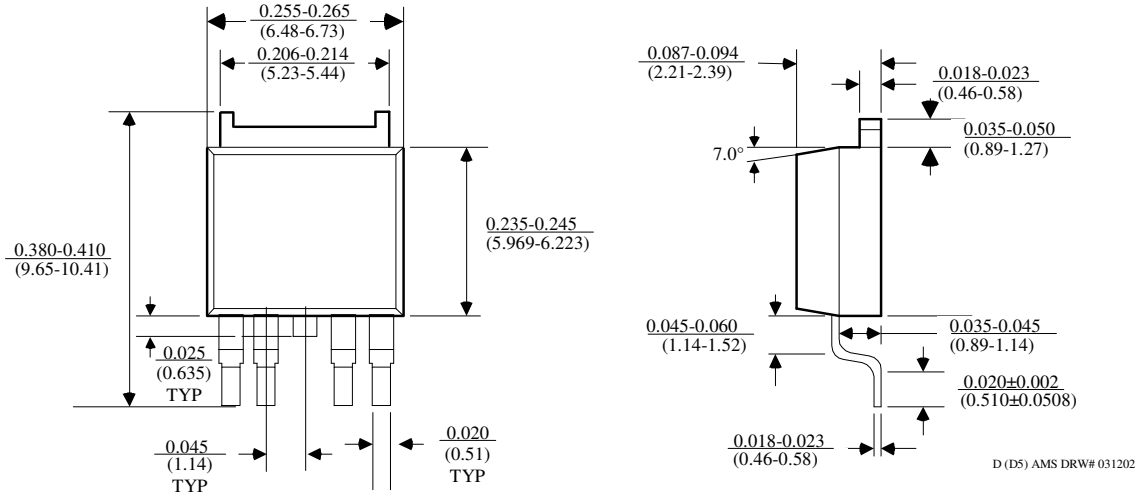
**DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE

PACKAGE DIMENSIONS (continued)

5 LEAD TO-220 PLASTIC PACKAGE (T)



5 LEAD TO-252 PLASTIC PACKAGE (D)



PACKAGE DIMENSIONS (continued)

5 LEAD TO-263 PLASTIC PACKAGE (M)