Dual, High-PSRR, Low-Noise, Low-Dropout, 300mA CMOS Linear Regulator

General Description

The EMP5523 series is a family of dual-channel CMOS linear regulators featuring ultra-high power supply rejection ratio (PSRR), low output voltage noise, low dropout voltage, low quiescent current and fast transient response. It guarantees delivery of 300mA output current per regulator, and supports preset output voltages ranging from 1.2V to 3.3V with 0.1V increment (except for 1.85V and 2.85V).

The EMP5523 is well suited for portable battery-powered application which requires high efficiency, low noise and small board space. With 170mV low dropout voltage at 300mA output current, EMP5523 sustains high PSRR at very low input voltage which is common in battery-powered application. The EMP5523 also features 120μVRMS low output voltage noise without the presence of a noise bypass capacitor, which fits the application where noise and board space are both concerned. Other features include thermal protection and over-current protection. The EMP5523 is available in SOP-8 package.

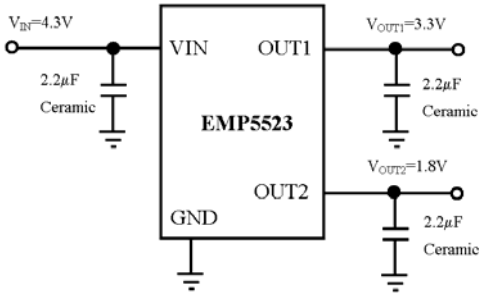
Features

- 300mA guaranteed output current
- 72dB typical PSRR at 1kHz (60dB typical at 10KHz)
- 120μV_{RMS} output voltage noise (10Hz to 100kHz)
- 170mV typical dropout at 300mA
- 150μA typical quiescent current
- Fast line and load transient response
- 2.5V to 5.5V input range
- Stable with small ceramic output capacitors
- Over temperature and over current protection
- ±2% output voltage tolerance
- SOP-8 package available
- RoHS compliant and Pb-free

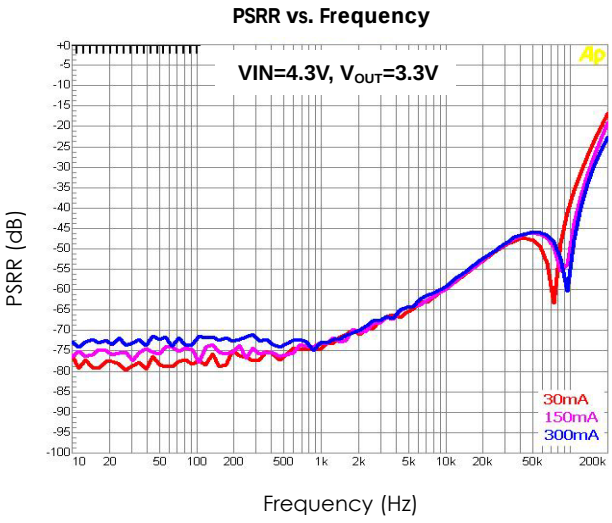
Applications

- Wireless handsets
- PCMCIA cards
- DSP core power
- Hand-held instruments
- Battery-powered systems
- Portable information appliances

Typical Application Diagram

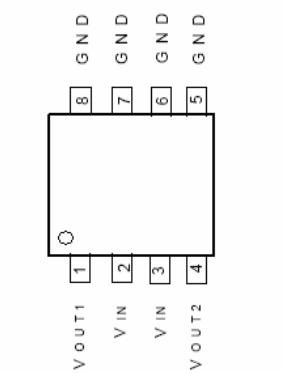


Typical Performance Characteristics



Connection Diagrams

SOP–8 (Top View)



Order information

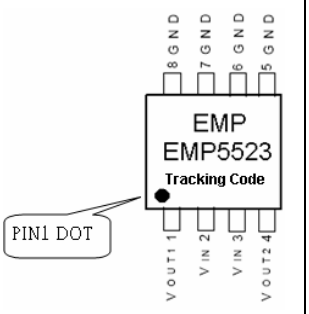
EMP5523-XXSA08GRR/NRR

XX	Output Operation
SA08	SOP-8 Package
GRR	RoHS (Pb Free)
	Rating: -40 to 85°C
	Package in Tape & Reel
NRR	RoHS & Halogen free (By Request)
	Rating: -40 to 85°C
	Package in Tape & Reel

Pin Functions

Name	SOP-8	Function
OUT1	**1**	**Output Voltage Feedback of Regulator 1**
VIN	**2, 3**	**Supply Voltage Input**. Require a minimum input capacitor of close to 1μF to ensure stability and sufficient decoupling from the ground pin. **Pins 2 and 3 must be shorted together**.
OUT2	**4**	**Output Voltage Feedback of Regulator 2**
GRND	**5~8**	**Ground Pin**.

Order, Mark & Packing Information

No. of PIN	Package	Vout1	Vout2	Marking	Product ID
8	SOP-8	3.3	1.8		EMP5523-05SA08GRR

Absolute Maximum Ratings (Notes 1, 2)

VIN, V_{OUT1}, V_{OUT2}	-0.3V to 6.0V
Power Dissipation	(Note 3)
Storage Temperature Range	-65°C to160°C
Junction Temperature (TJ)	150°C
Lead Temperature (10 sec.)	260°C
ESD Rating	
HBM (Note 5)	2kV
MM	200V
Thermal Resistance (θ_{JA})	
SOP-8	150°C/W

Operating Ratings (Note 1, 2)

Temperature Range	-40°C to 85°C
Supply Voltage	2.5V to 5.5V

Electrical Characteristics

Unless otherwise specified, all limits guaranteed for $V_{IN} = V_{OUT}$ +1V (Note 6), $C_{IN} = C_{OUT}$ = 2.2µF, T_J = 25°C. **Boldface** limits apply for the operating temperature extremes: -40°C and 85°C.

Symbol	Parameter	Conditions	Min	Typ (Note 7)	Max	Units
V_{IN}	Input Voltage		**2.5**		**5.5**	V
ΔV_{OTL}	Output Voltage Tolerance	I_{OUT} = 30mA	-2		+2	% of
		$V_{IN} = V_{OUT (NOM)}$ +1V, (Note 6)	**-3**		**+3**	$V_{OUT (NOM)}$
I_{OUT}	Maximum Output Current	Average DC Current Rating	**300**			mA
I_{LIMIT}	Output Current Limit			600		mA
I_Q	Supply Current	$I_{OUT1} = I_{OUT2}$ = 0mA	50	150	250	µA
		$I_{OUT1} = I_{OUT2}$ = 300mA	50	250	400	
V_{DO}	Dropout Voltage (Note 4), (Note 6)	I_{OUT} = 30mA	5	16	32	mV
		I_{OUT} = 100mA		55		
		I_{OUT} = 300mA	50	170	320	
PSRR	Power-supply rejection ratio VIN=4.3V, V_{OUT}=3.3V	f = 1kHz		72		dB
		f = 10kHz		60		
		f = 100kHz		45		
ΔV_{OUT}	Line Regulation	I_{OUT} = 30mA, (V_{OUT} + 1V) ≤ V_{IN} ≤ 5.5V, (Note 6)	-0.1	0.01	0.1	%/V
	Load Regulation	1mA ≤ I_{OUT} ≤ 100mA		13		mV
		1mA ≤ I_{OUT} ≤ 300mA		40	100	
e_n	Output Voltage Noise	V_{OUT}=2.8V, I_{OUT} = 30mA, 10Hz ≤ f ≤ 100kHz (Note 8)		120		μV_{RMS}
V_{EN}	Enable Input Threshold	V_{IH}, (V_{OUT} + 0.5V) ≤ V_{IN} ≤ 5.5V (Note 6)	**1.2**			V
		V_{IL}, (V_{OUT} + 0.5V) ≤ V_{IN} ≤ 5.5V (Note 6)			**0.4**	
T_{SD}	Thermal Shutdown Temperature			170		℃
	Thermal Shutdown Hysteresis			30		

Note 1: Absolute Maximum ratings indicate limits beyond which damage may occur. Electrical specifications are not applicable when the device is operated outside of its rated operating conditions.
Note 2: All voltages are defined and measured with respect to the potential at the ground pin.

Note 3: Maximum Power dissipation for the device is calculated using the following equations:

$$P_D = \frac{T_{J(MAX)} - T_A}{\theta_{JA}}$$

where $T_{J(MAX)}$ is the maximum junction temperature, T_A is the ambient temperature, and θ_{JA} is the junction-to-ambient thermal resistance.

Note 4: Dropout voltage is measured by reducing V_{IN} until V_{OUT} drops 100mV from its nominal value at V_{IN} -V_{OUT} =1V. Dropout voltage does not apply to the regulator versions with V_{OUT} less than 2.5V.

Note 5: Human body model: 1.5kΩ in series with 100pF.

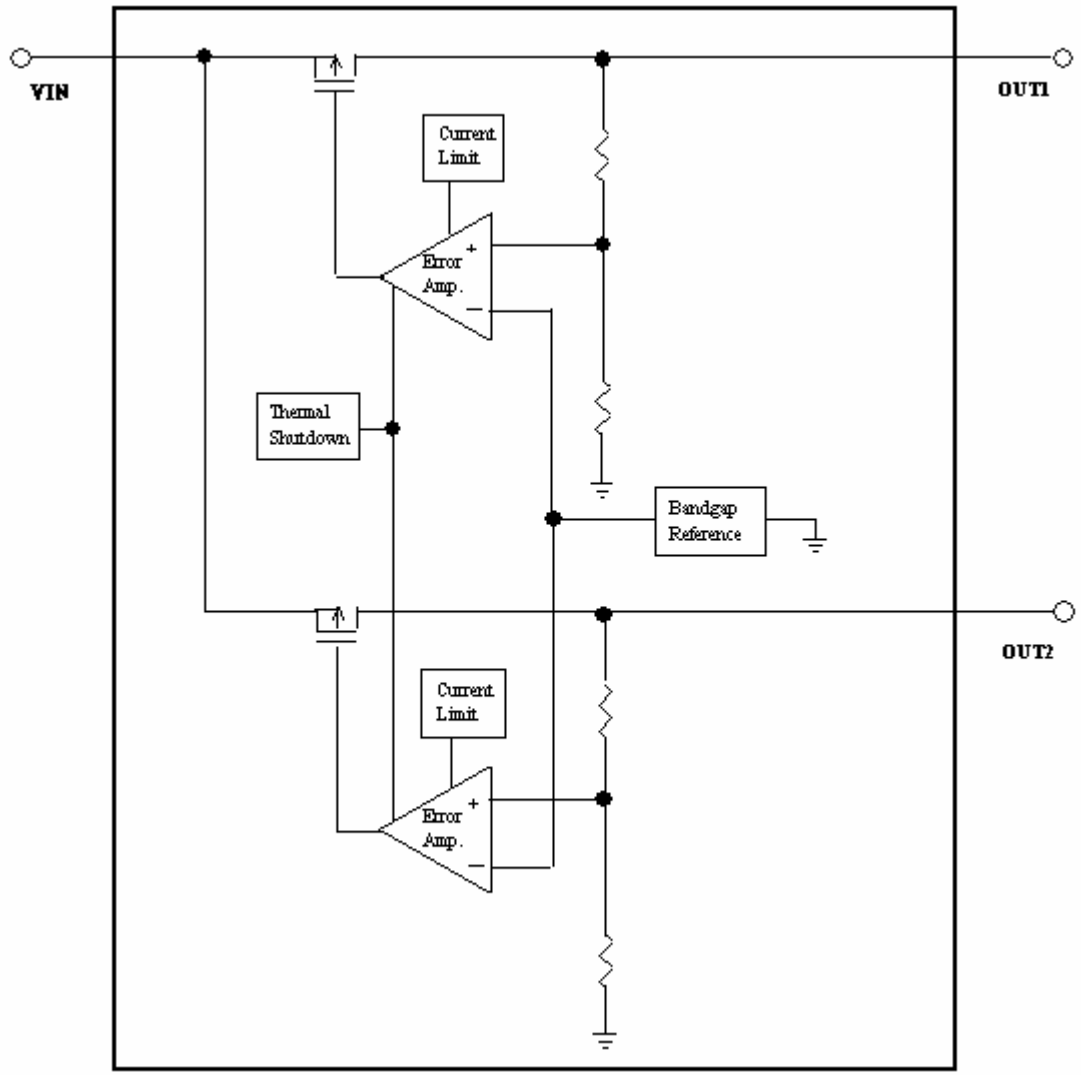
Note 6: Condition does not apply to input voltages below 2.5V since this is the minimum input operating voltage.

Note 7: Typical Values represent the most likely parametric norm.

Note 8: For different output voltage, the noise can be approximately calculated using the following formula:

$$Noise = V_{OUT} \times 42\ (\mu V_{RMS})$$

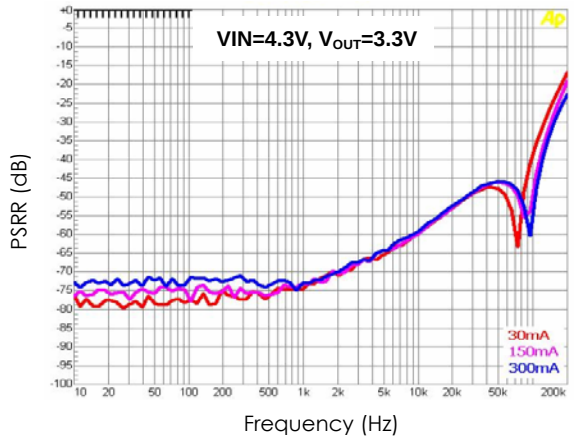
Functional Block Diagram



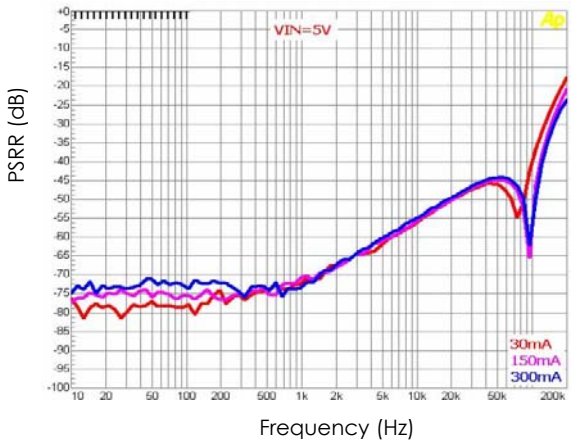
Typical Performance Characteristics

Unless otherwise specified, VIN = $V_{OUT\ (NOM)}$ + 1V, C_{IN} = C_{OUT} = 2.2µF, T_A = 25°C.

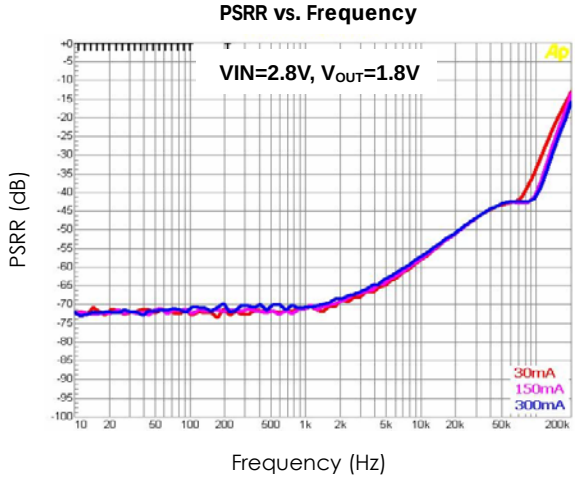
PSRR vs. Frequency



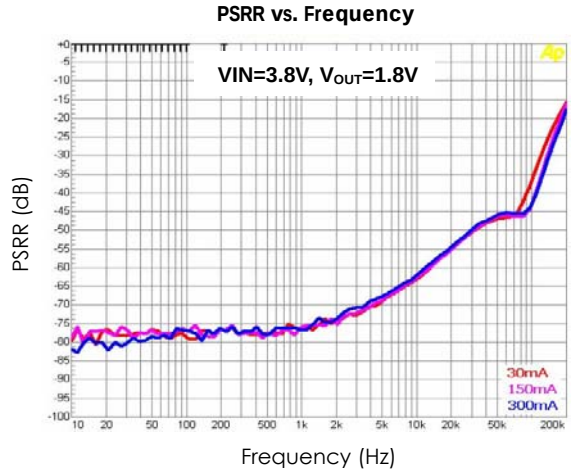
PSRR vs. Frequency



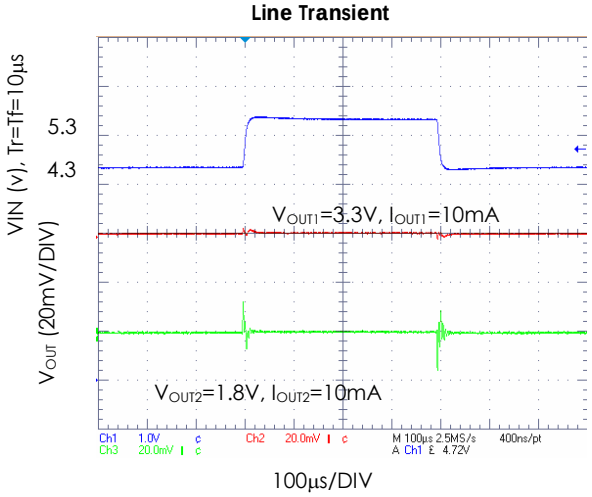
PSRR vs. Frequency



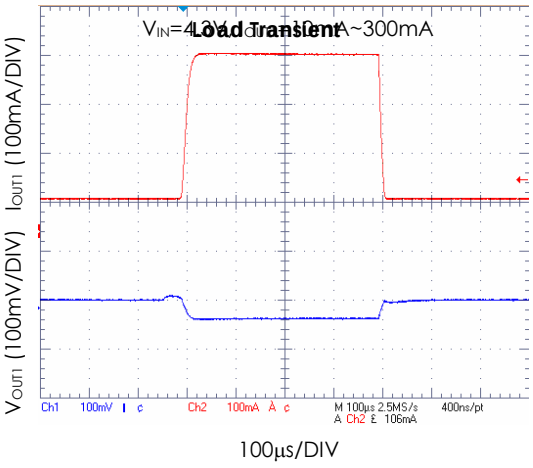
PSRR vs. Frequency



Line Transient



Load Transient

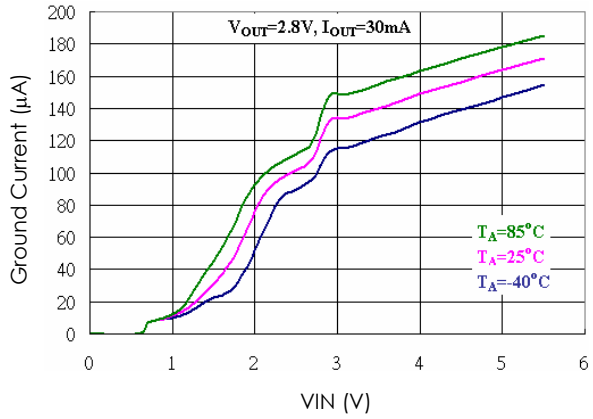


VIN=5V, V_{OUT}=3.3V

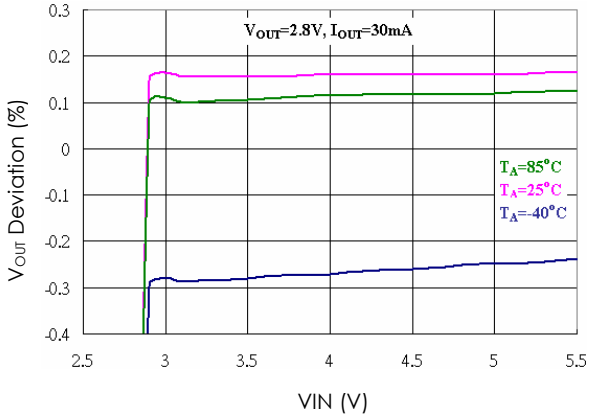
Typical Performance Characteristics

Unless otherwise specified, VIN = $V_{OUT\ (NOM)}$ + 1V, C_{IN} = C_{OUT} = 2.2μF, T_A = 25°C. (Continued)

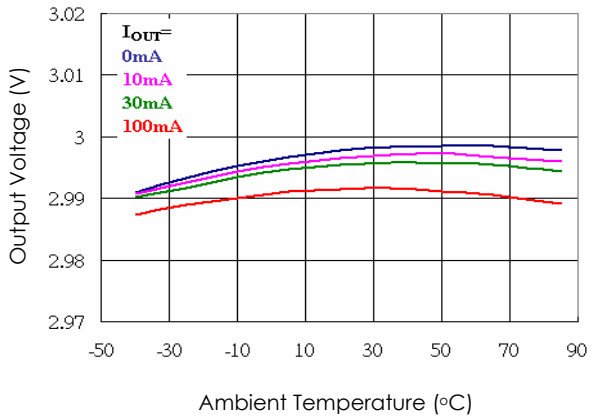
Ground Current vs. VIN



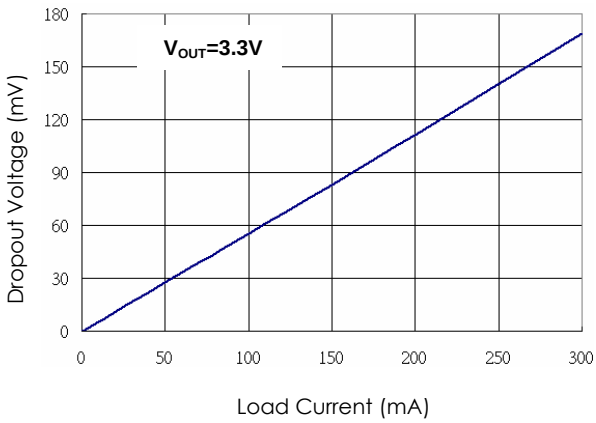
Line Regulation



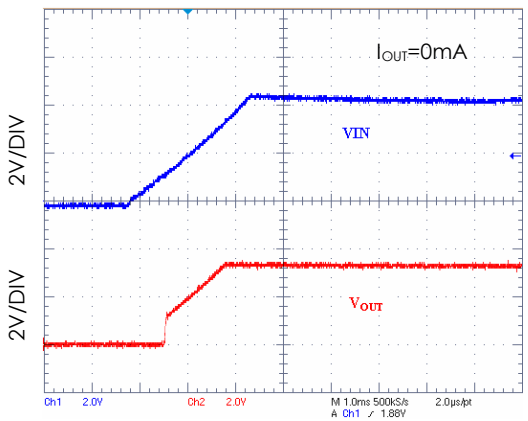
Temperature Stability



Dropout Voltage vs. Load Current

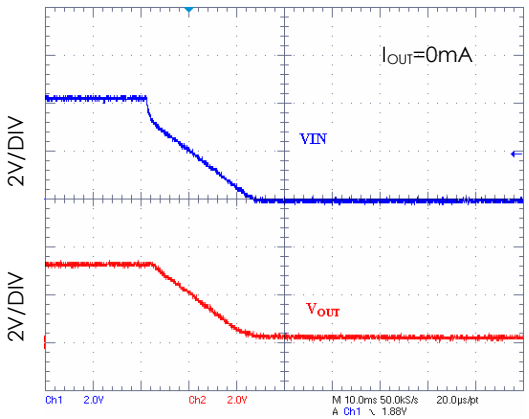


Power on Transient



1ms/DIV

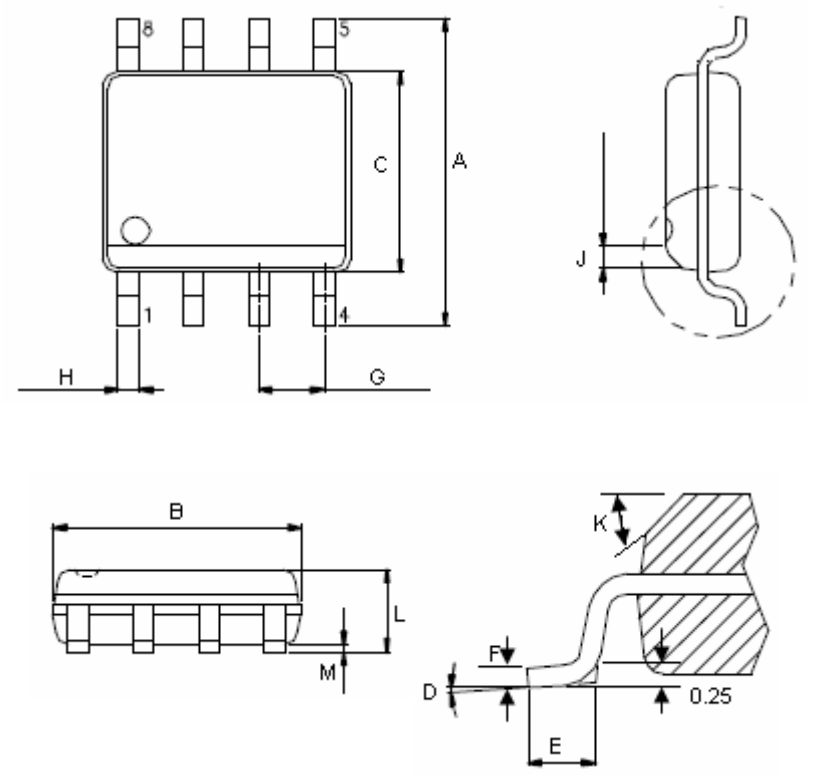
Power off Transient



10ms/DIV

Physical Dimensions

SOP-8



SYMBOLS	MIN.	MAX.
A	5.80	6.20
B	4.80	5.00
C	3.80	4.00
D	0°	8°
E	0.40	0.90
F	0.19	0.25
G	1.27 TYP.	
M	0.10	0.25
H	0.35	0.49
L	1.35	1.75
J	0.375 REF.	
K	45°	

UNIT: Millimeters

Revision History

Revision	Date	Description
2.0	2009.06.08	EMP transferred from version 1.0

Important Notice

The contents contained in this document are believed to be accurate at the time of publication. ESMT assumes no responsibility for any error in this document, and reserves the right to change the products or specification in this document without notice.

The information contained herein is presented only as a guide or examples for the application of our products. No responsibility is assumed by ESMT for any infringement of patents, copyrights, or other intellectual property rights of third parties which may result from its use. No license, either express , implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of ESMT or others.

Any semiconductor devices may have inherently a certain rate of failure. To minimize risks associated with customer's application, adequate design and operating safeguards against injury, damage, or loss from such failure, should be provided by the customer when making application designs.

ESMT's products are not authorized for use in critical applications such as, but not limited to, life support devices or system, where failure or abnormal operation may directly affect human lives or cause physical injury or property damage. If products described here are to be used for such kinds of application, purchaser must do its own quality assurance testing appropriate to such applications.