

Fast Ultra High-PSRR, Low-Noise, 300mA CMOS Linear Regulator

General Description

The EMP8737 features ultra-high power supply rejection ratio, low output voltage noise, low dropout voltage, low quiescent current and fast transient response. It guarantees delivery of 300mA output current for $V_{IN}=2.2V \sim 5.5V$ and supports preset output voltages ranging from 0.8V to 4.5V with 0.05V increment. It also guarantees delivery of 100mA output current for V_{IN} range lower from 1.75V $\sim$ 2.1V.

Based on its low quiescent current consumption and its less than 1 μ A shutdown mode of logical operation, the EMP8737 is ideal for battery-powered applications. The high power supply rejection ratio of the EMP8737 holds well for low input voltages typically encountered in battery-operated systems. The regulator is stable with small ceramic capacitive loads (1 μ F typical). The EMP8737 is Available in miniature SOT-23-5 package.

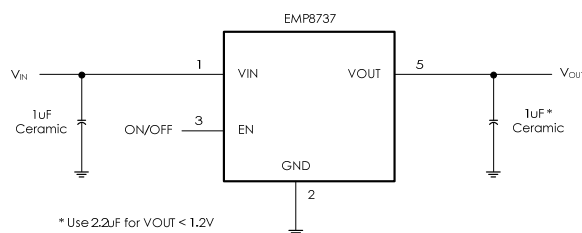
Features

- 2.2V to 5.5V input range for I_{OUT} 300mA operation
- 1.75V to 2.1V input range for I_{OUT} 100mA operation
- 62dB typical PSRR at 1kHz
- 110 μ V RMS output voltage noise (10Hz to 100kHz)
- 290mV typical dropout at 300mA
- 57 μ A typical quiescent current
- Less than 1 μ A typical shutdown mode
- Fast line and load transient response
- Auto-discharge during chip disable
- 80 μ s typical turn-on time
- Stable with small ceramic output capacitors
- Over temperature and over current protection
- $\pm 2\%$ output voltage tolerance

Applications

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

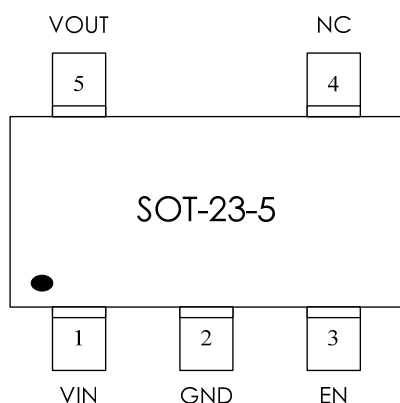
Typical Application



*Use 2.2 μ F for $V_{OUT} < 1.2V$

CONNECTION DIAGRAM

SOT-23-5(TOP View)



ORDER INFORMATION

EMP8737-XXVF05GRR

XX Output Voltage

VF05 SOT-23-5 Package

NRR RoHS & Halogen free

Commercial Grade Temperature

Rating: -40 to 85°C

Package in Tape & Reel

I

Pin Functions

Name	SOT-23-5	Function
VIN	1	Supply Voltage Input. Require a minimum input capacitor of close to 1μF to ensure stability and sufficient decoupling from the ground pin.
GND	2	Ground Pin.
EN	3	Enable Input. Enable the regulator by pulling the EN pin High. To keep the regulator on during normal operation, connect the EN pin to VIN. The EN pin must not exceed VIN + 0.5V under all operating conditions.
NC	4	No Connection
VOUT	5	Output Voltage Feedback.

Order, Mark & Packing Information

Marking	Vout	Product ID	Packing
8737 Tracking Code PIN1 DOT	1.2	EMP8737-12VF05GRR	3K units Tape & Reel

Absolute Maximum Ratings (Notes 1, 2)

V _{IN} , V _{OUT} , V _{EN}	-0.3V to 6.5V	Thermal Resistance (θ_{JA})	
Storage Temperature Range	-65°C to 160°C	SOT-23-5	250°C/W
Junction Temperature (T _J)	150°C		
Lead Temperature (10 sec.)	260°C		
ESD Rating		Operating Ratings (Note 1, 2)	
Human Body Model	2kV	Temperature Range	-40°C to 85°C
MM	200V	Supply Voltage	2.2V to 5.5V

Electrical Characteristics

Unless otherwise specified, all limits guaranteed for V_{IN} = V_{OUT} + 1V (Note 3), V_{EN} = V_{IN}, C_{IN} = C_{OUT} = 2.2μF, T_A = 25°C.

Boldface & underline limits apply for the operating temperature extremes: -40°C and 85°C.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V _{IN}	Input Voltage	I _{OUT} = 300mA (max.)	<u>2.2</u>		<u>5.5</u>	V
V _{OUT}	Output Voltage		<u>0.8</u>		<u>4.5</u>	V
ΔV _{OTL}	Output Voltage Tolerance	I _{OUT} = 10mA (Note 3)	-2		+2	% of V _{OUT (NOM)}
			<u>-3</u>		<u>+3</u>	
I _{OUT}	Maximum Output Current	V _{IN} = 2.2V ~ 5.5V	<u>300</u>			mA
I _{LIMIT}	Output Current Limit		<u>300</u>	450		mA
I _Q	Supply Current	I _{OUT} = 0mA		57		μA
		I _{OUT} = 50mA		63		
		I _{OUT} = 150mA		88		
		I _{OUT} = 300mA		130		
	Shutdown Supply Current	V _{OUT} = 0V, EN = GND		0.001	1	
V _{DO}	Dropout Voltage (Note4)	I _{OUT} = 100mA		90		mV
		I _{OUT} = 300mA		290		
ΔV _{OUT}	Line Regulation	I _{OUT} = 1mA, (V _{OUT} + 1V) ≤ V _{IN} ≤ 5.5V (Note 3)	-0.1	0.01	0.1	%/V
	Load Regulation	1mA ≤ I _{OUT} ≤ 300mA		0.0008		%/mA
e _n	Output Voltage Noise	V _{OUT} = 2.5V, I _{OUT} = 10mA, 10Hz ≤ f ≤ 100kHz		110		μV _{RMS}
T _{SD}	Thermal Shutdown Temperature			165		°C
	Thermal Shutdown Hysteresis			35		
V _{EN}	EN Input Threshold	V _{IH} , (V _{OUT} + 1V) ≤ V _{IN} ≤ 5.5V (Note 3)	<u>1.2</u>			V
		V _{IL} , (V _{OUT} + 1V) ≤ V _{IN} ≤ 5.5V (Note 3)			<u>0.4</u>	
I _{EN}	EN Input Bias Current	EN = GND or V _{IN}		0.1	100	nA
T _{ON}	Turn-On Time	V _{OUT} at 95% of Final Value		80		μs
T _{OFF}	Turn-Off Time	I _{OUT} = 0mA (Note 5)		2.4		ms

Electrical Characteristics (cont.)

Unless otherwise specified, all limits guaranteed for $V_{EN}=V_{IN}$, $C_{IN} = C_{OUT} = 2.2\mu F$, $T_A = 25^\circ C$.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_{IN}	Input Voltage	$I_{OUT} = 100mA$ (max.)	1.75		2.1	V
ΔV_{OTL}	Output Voltage Tolerance	$1mA \leq I_{OUT} \leq 100mA$, $1.75V \leq V_{IN} \leq 2.1V$	-2		+2	% of $V_{OUT(NOM)}$
I_{OUT}	Maximum Output Current	$V_{IN} = 1.75V \sim 2.1V$	50		100	mA

Note 1: Absolute Maximum ratings indicate limits beyond which damage may occur. Electrical specifications do not apply when operating the device outside of its rated operating conditions.

Note 2: All voltages are with respect to the potential at the ground pin.

Note 3: Condition does not apply to input voltages below 2.2V since this is the minimum input operating voltage.

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 2.2V.

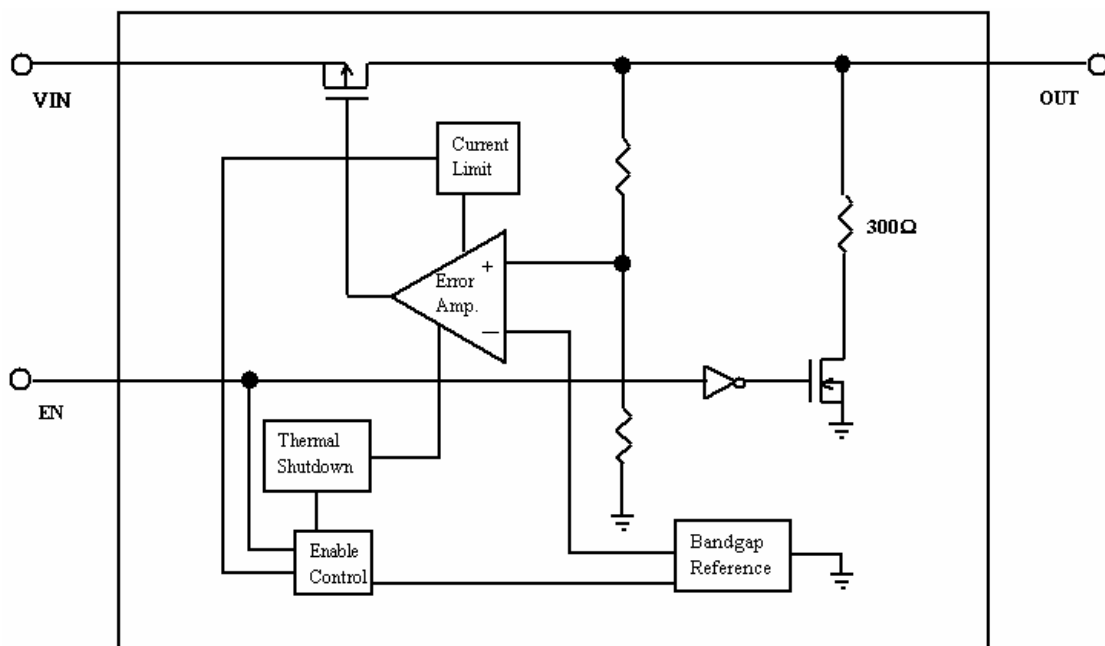
Note 5: Turn-off time is time measured between the enable input just decreasing below V_{IL} and the output voltage just decreasing to 10% of its nominal value.

Note 6: Maximum Power dissipation for the device is calculated using the following equations:

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

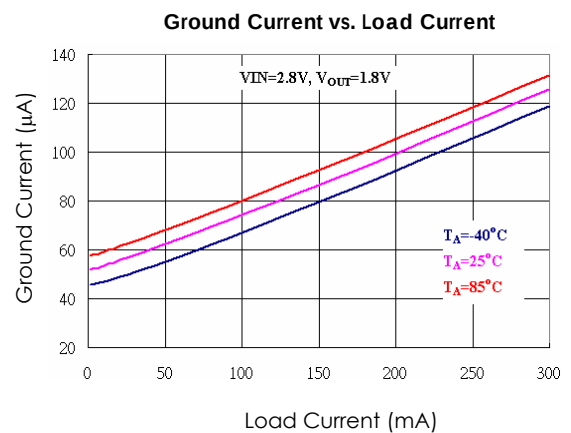
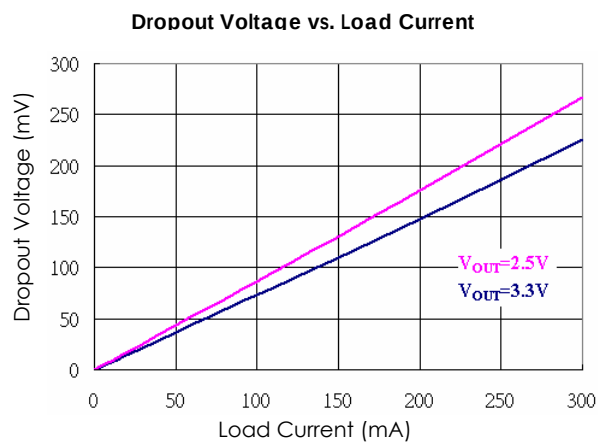
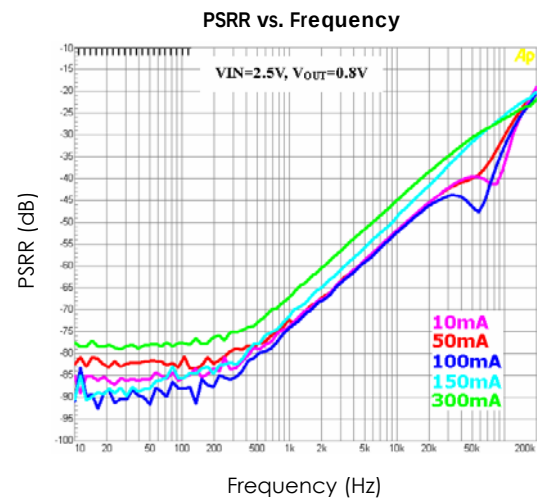
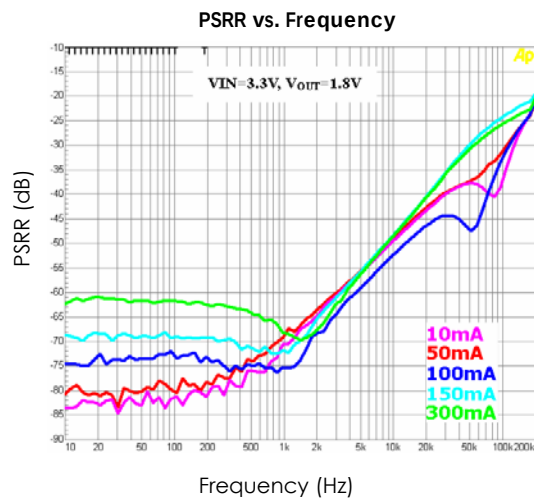
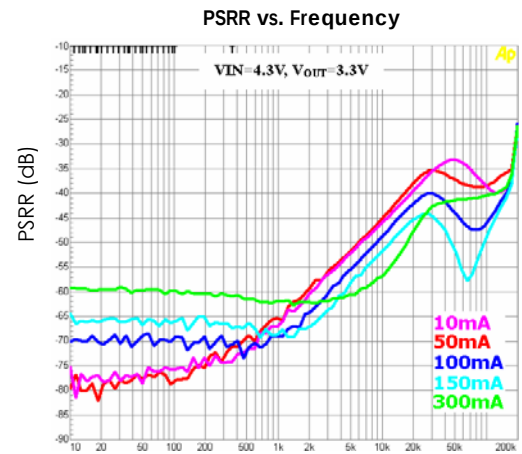
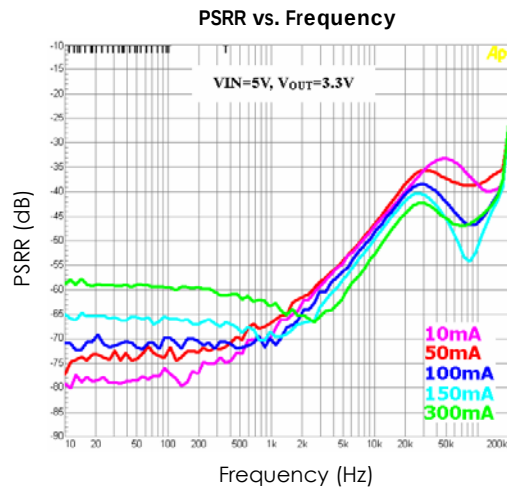
where $T_{J(MAX)}$ is the maximum junction temperature, T_A is the ambient temperature, and θ_{JA} is the junction-to-ambient thermal resistance. E.g. for the SOT-23-5 package $\theta_{JA} = 250^\circ C/W$, $T_{J(MAX)} = 150^\circ C$ and using $T_A = 25^\circ C$, the maximum power dissipation is found to be 500mW. The derating factor ($-1/\theta_{JA}$) = $-4mW/^\circ C$, thus below $25^\circ C$ the power dissipation figure can be increased by 4mW per degree, and similarly decreased by this factor for temperatures above $25^\circ C$.

Functional Block Diagram



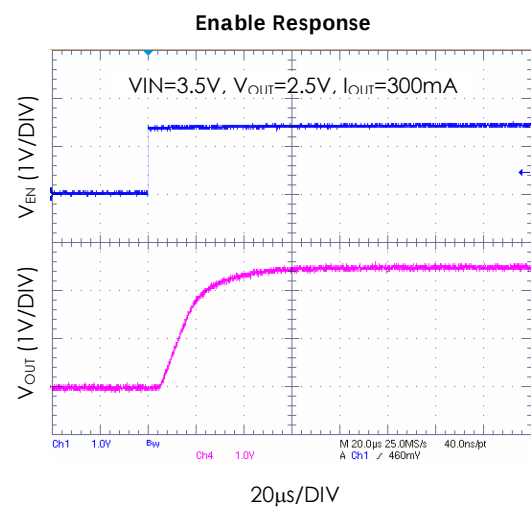
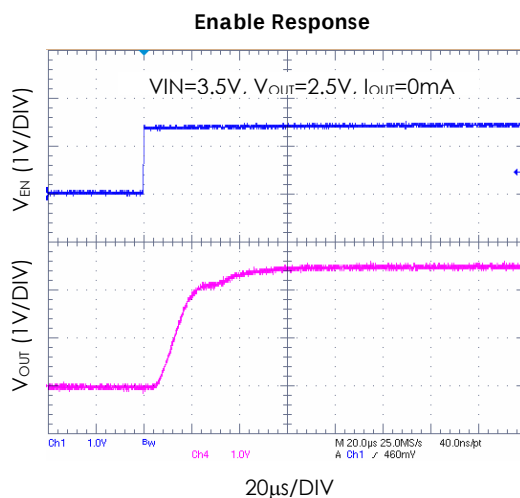
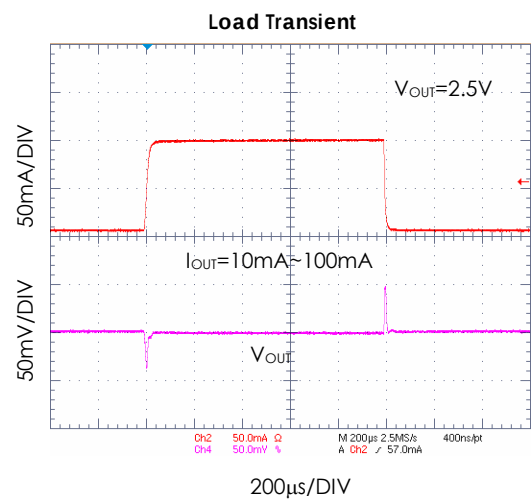
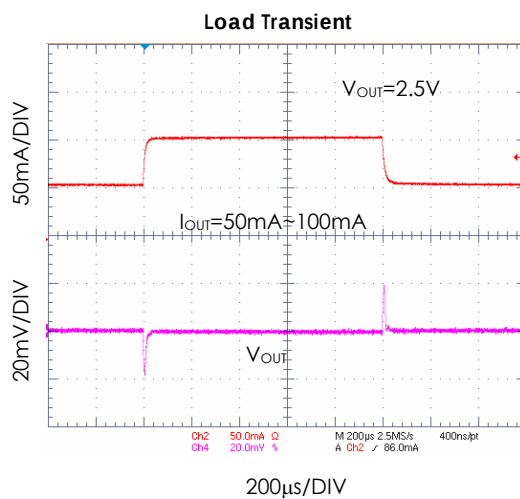
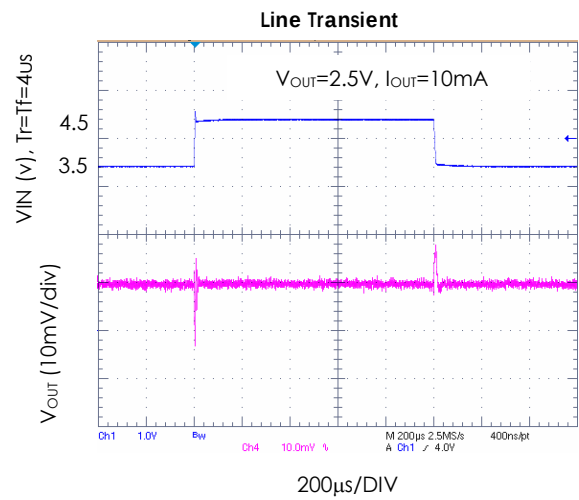
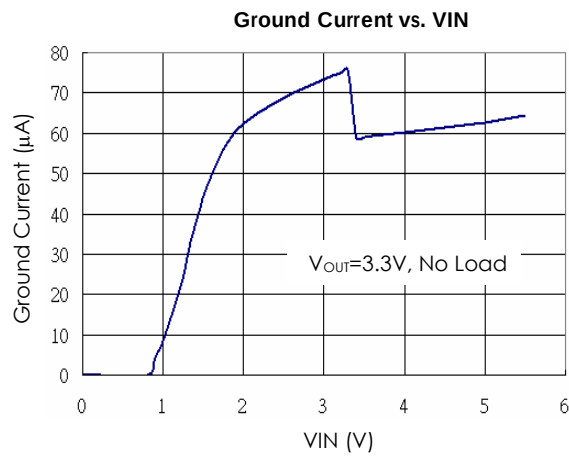
Typical Performance Characteristics

Unless otherwise specified, $V_{IN} = V_{OUT(NOM)} + 1V$, $V_{EN} = V_{IN}$, $C_{IN} = C_{OUT} = 2.2\mu F$, $T_A = 25^\circ C$.



Typical Performance Characteristics

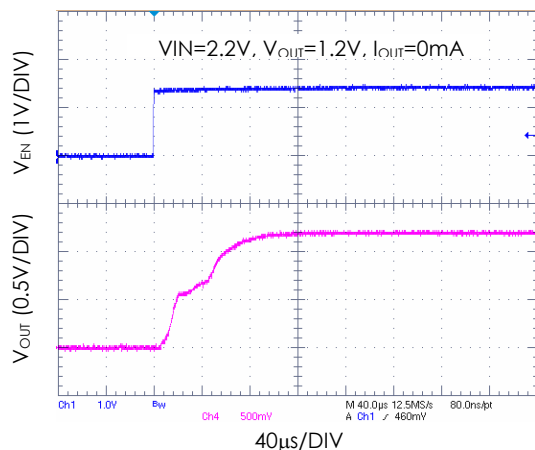
Unless otherwise specified, $V_{IN} = V_{OUT(NOM)} + 1V$, $V_{EN}=V_{IN}$, $C_{IN} = C_{OUT} = 2.2\mu F$, $T_A = 25^\circ C$. (Continued)



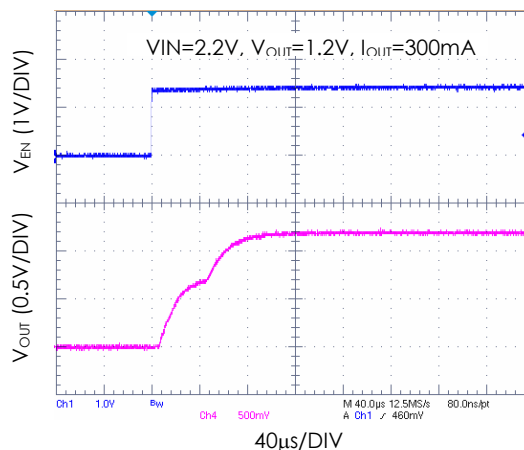
Typical Performance Characteristics

Unless otherwise specified, $V_{IN} = V_{OUT(NOM)} + 1V$, $V_{EN} = V_{IN}$, $C_{IN} = C_{OUT} = 2.2\mu F$, $T_A = 25^\circ C$. (Continued)

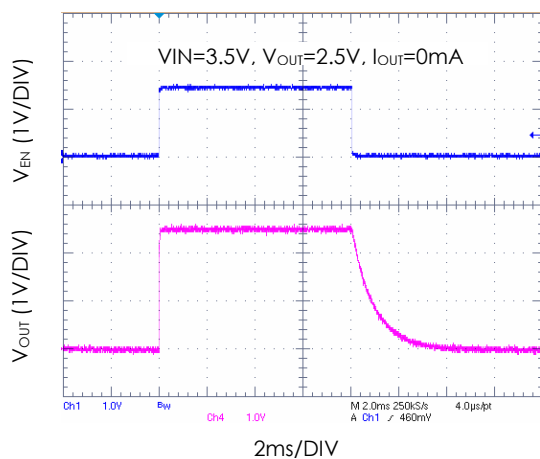
Enable Response



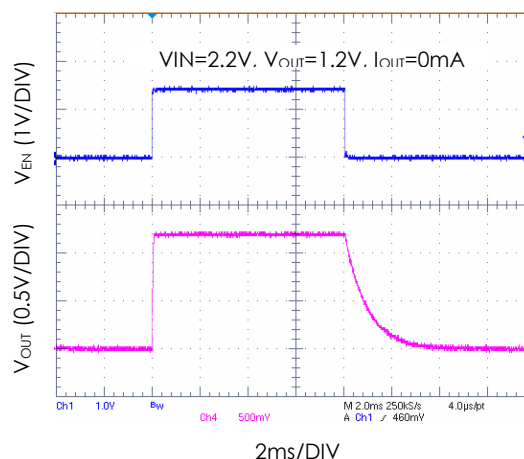
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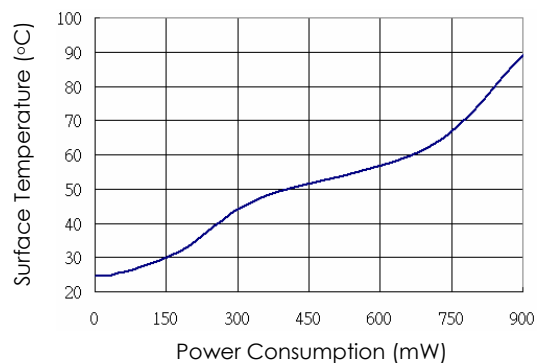
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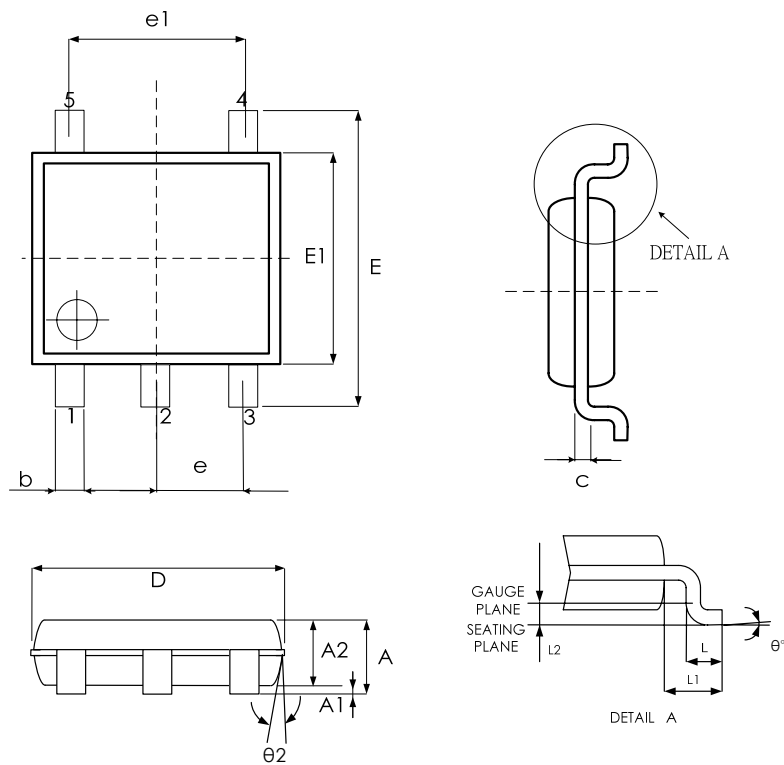
Disable Response



Power Derating (SOT-25)



SOT-23-5



SYMBPLS	MIN.	NOM.	MAX.
A	1.05	1.20	1.35
A1	0.05	0.10	0.15
A2	1.00	1.10	1.20
b	0.30	—	0.50
c	0.08	—	0.20
D	2.80	2.90	3.00
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e	0.95 BSC		
e1	1.90 BSC		
L	0.30	0.45	0.55
L1	0.60 REF		
L2	0.25 REF		
θ°	0	5	10
$\theta 2^\circ$	6	8	10

UNIT: MM

Revision History

Revision	Date	Description
1.0	2011.05.28	Original version
1.1	2011.05.28	EN pin must not exceed VIN + 0.5V under all operating conditions
1.2	2011.07.04	Modify Output Voltage Tolerance

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