1A Low Dropout and Adjustable Mode Regulator

General Description

The EM1109BV performs ultra- low drop voltage, high power supply rejection ratio (PSRR), fast response, low noise linear regulator, and designed to continuously deliver up to 1A output current. The EM1109BV has wide adjustable output voltage range and high output accuracy to 1.0%.

No by-pass capacitor is needed for this device and only 4.7uF ceramic capacitor is required for stability in any loading conditions. It reduces the amount of board space necessary for power applications.

The other features include soft start, current limit protection, Power-On-Reset function, and over temperature protection. The EM1109BV is available in DFN3X3-08L package.

Ordering Information

Part Number	Package	XX: Output Voltage
EM1109BV-XX	DFN3X3-08L	AJ: Adjust 10: 1.00V 12: 1.20V 15: 1.50V 18: 1.80V 25: 2.50V 30: 3.00V 33: 3.30V

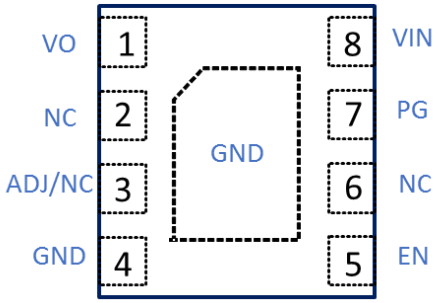
Features

- Wide V_{IN} Range from 2.5V to 5.5V
- Adjustable Output Voltage from 1V to 4.5V
- Fixed Option: 1V,1.2V,1.5V,1.8V,2.5V to 3.3V
- Ultra Low Dropout Voltage: 450mV @1A
- Low Shutdown Current < 1uA
- Only 4.7uF Ceramic Capacitor required for stability
- Over Temperature Protection
- Current Limit Protection
- RoHS Compliant and 100% Lead (Pb)-Free

Applications

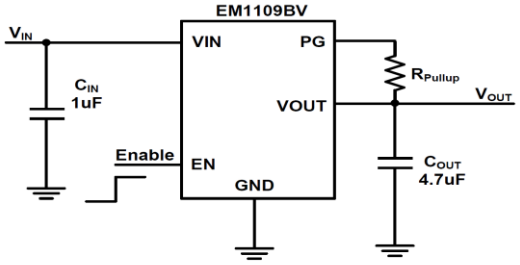
- Cellular Handsets
- Battery-Powered Equipment
- Laptop, Palmtops, Notebook Computers
- Hand-Held Instruments
- PCMCIA Cards
- Portable Information Applications

Pin Configuration

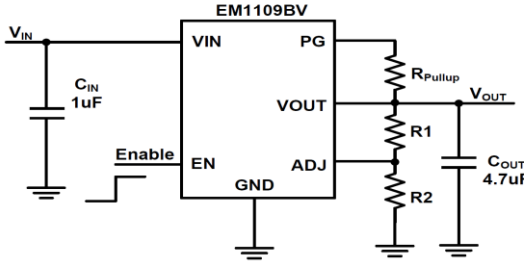


DFN3X3-08

Typical Application Circuit



Fixed Version Output

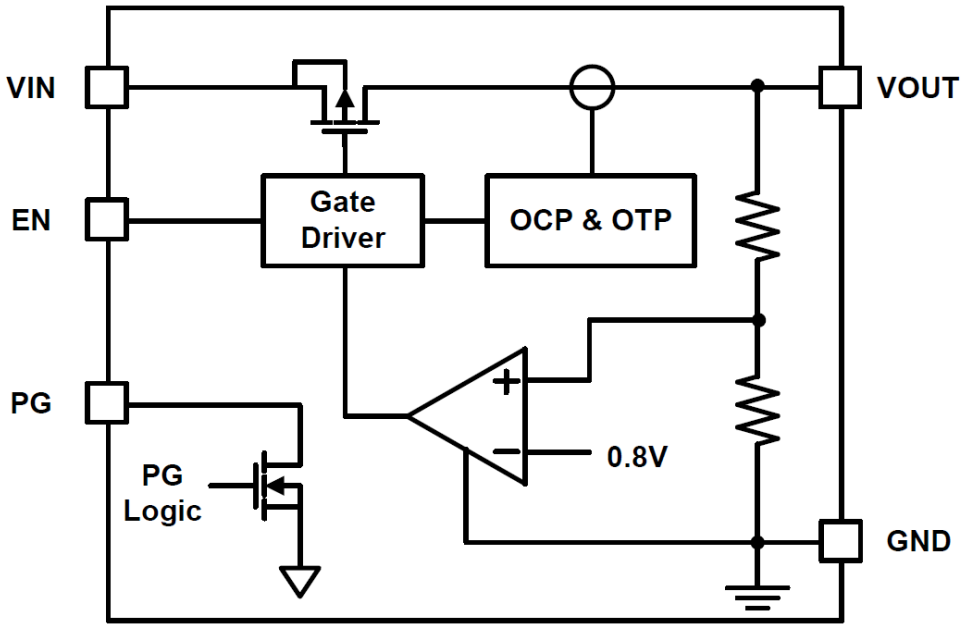


Adjustable Output

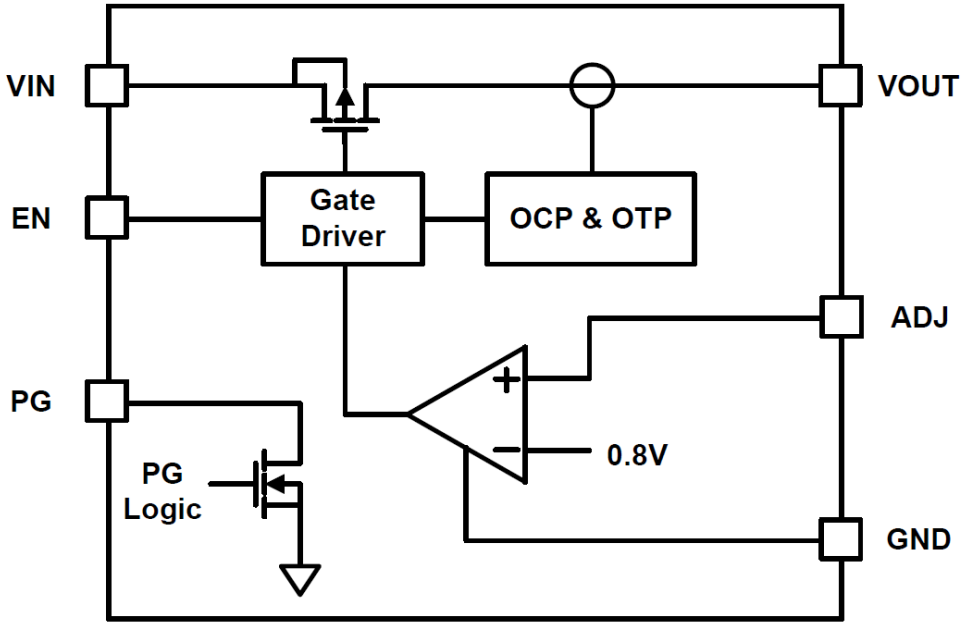
Pin Assignment

Pin Name	Pin No DFN3.0X3.0-08	Pin Function
VIN	8	**Input Voltage.** This is the source input to the power device that supplies current to the output pin.
GND	4	**Ground.**
EN	5	**Chip Enable Input** (Active high)**.**
VO	1	**Output Voltage.** VOUT is power output pin. An internal pull low resistance exists when the device is disabled. Minimum 4.7uF low ESR ceramic capacitor is required at this pin for stabilizing VOUT voltage.
NC	2,6	**No Connection.**
PG	7	**Open Drain Power Good Indicator**
ADJ	3	**Feedback.** Error amplifier input. This pin should be connected to external resistive divider from output voltage.

Function Block Diagram



Fixed Output Voltage



Adjustable Output Voltage

Absolute Maximum Ratings (Note1)

- V_{IN} ---------- -0.3V to +6.0V
- Other Pins ---------- 6V
- Power Dissipation, P_D @ T_A = 25°C, DFN3X3-8L ---------- 1.7W
- Package Thermal Resistance, θ_{JA}, DFN3X3-08L (Note 2) ---------- 70°C/W
- Package Thermal Resistance, θ_{JC}, DFN3X3-08L (Note 2) ---------- 5°C/W
- Junction Temperature ---------- 150°C
- Lead Temperature (Soldering, 10 sec.) ---------- 260°C
- Storage Temperature Range ---------- -65°C to 150°C
- ESD susceptibility (Note3)

  HBM (Human Body Mode) ---------- 2KV

  MM (Machine Mode) ---------- 200V

  CDM (Charge Device Mode) ---------- 1KV

Recommended Operating Conditions (Note4)

- Supply Input Voltage, V_{IN} ---------- +2.5 to +5.5V
- Junction Temperature ---------- –40°C to 125°C
- Ambient Temperature ---------- –40°C to 85°C

Electrical Characteristics

V_{IN}=V_{OUT}+1V, T_A=25℃, unless otherwise specified

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reference Voltage	V_{REF}	V_{OUT}=V_{REF}, I_{OUT}=1mA	0.788	0.8	0.812	V
Feedback Leakage Current	I_{ADJ}	-	-	0.1	0.5	uA
Power Input Voltage	V_{IN}	I_{OUT}=0 to 1A	2.5	-	5.5	V
POR Threshold	V_{PORTH}	I_{OUT}=0 to 1A	-	2.1	2.4	V
POR Hysteresis	V_{PORHYS}	I_{OUT}=0 to 1A	-	0.2	-	V
Quiescent Current	I_Q	V_{IN}=V_{EN}=5V, I_{OUT}=0A	-	90	-	uA
Shutdown Current	I_{SD}	V_{IN}=5V, V_{EN}=0V	-	0.1	1	uA
Line Regulation	$V_{OUT(LINE)}$	I_{OUT}=1mA	-	-	0.2	%/V
Load Regulation	$V_{OUT(LOAD)}$	1mA < I_{OUT} < 1A, V_{IN}=V_{OUT}+0.5V	-	0.5	1	%/A
Power Supply Rejection Ratio	PSRR	I_{OUT}=10mA,1kHz	-	70	-	dB
		I_{OUT}=10mA,10kHz	-	60	-	
		I_{OUT}=10mA,100kHz	-	40	-	
Dropout Voltage (I_{OUT}=300mA)	V_{DROP}	2V ≤ V_{OUT} ≤ 2.5V	-	200	250	mV
		2.6V ≤ V_{OUT} ≤ 3.5V	-	100	150	
Dropout Voltage (I_{OUT}=1A)	V_{DROP}	2V ≤ V_{OUT} ≤ 2.5V	-	450	-	mV
		2.6V ≤ V_{OUT} ≤ 3.5V	-	360	-	
Enable High Level	V_{EN}	-	1.2	-	-	V
Disable Low Level	V_{SD}	-	-	-	0.3	V
Enable Input Current	I_{EN}	V_{EN}=5V or 0V	-1	-	1	uA
OCP Threshold Level	I_{OCP}	For Adjustable Output	1.3	-	-	A
		For Fixed Version Output	1.1	-	-	
Output Turn On Delay Time	T_D	V_{EN} high to V_{OUT} Rising 10%	-	50	-	uS
Output Voltage Ramp Up Time	T_{SS}	V_{OUT} Rising 10% to 90%	-	200	-	uS
PG React Time	T_{PG}	V_{OUT} 90% to PG active	55	90	150	uS
PG OFF deglitch time	T_{PGF}	ADJ Falling to PG low	-	5	-	uS
		EN goes low to PG low				
PG Threshold	V_{PGR}	ADJ Rising	90	92	94	%
	V_{PGF}	ADJ Falling	80	82	84	
PG Sinking Voltage	V_{POK}	Sinking current= 5mA	-	-	0.4	V
Thermal Shutdown Temperature	T_{SD}	V_{IN}=V_{EN}=5V, V_{OUT}=V_{REF}, I_{OUT}=0A	-	160	-	°C
Thermal Shutdown Hysteresis	T_{SDHYS}	V_{IN}=V_{EN}=5V, V_{OUT}=V_{REF}, I_{OUT}=0A	-	30	-	°C

Note 1. Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

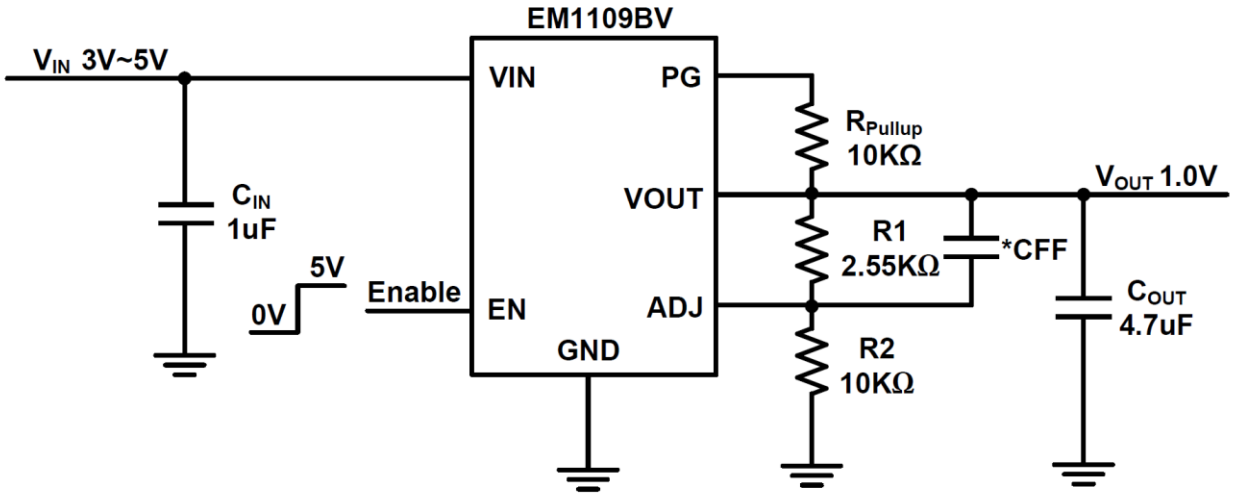
Note 2. θ_{JA} is measured in the natural convection at T_A=25°C on a low effective thermal conductivity test board (2Layer PCB) of JEDEC 51-3 thermal measurement standard.

Note 3. Devices are ESD sensitive. Handling precaution is recommended.

Note 4. The device is not guaranteed to function outside its operating conditions.

Note 5. EMC will review datasheet by quarter, and update new version.

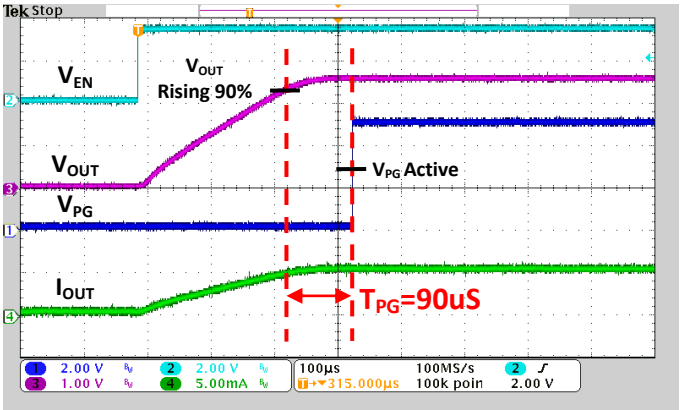
Reference Values of Feedback Network



VIN	VOUT	R1	R2	COUT	*CFF
3V	1.0V	2.55KΩ	10KΩ	4.7uF~22uF	0pF~1nF
3V	1.2V	5.11KΩ	10KΩ	4.7uF~22uF	
3V	1.5V	8.87KΩ	10KΩ	4.7uF~22uF	
3V	1.8V	12.7KΩ	10KΩ	4.7uF~22uF	
3.5V	2.5V	21.5KΩ	10KΩ	4.7uF~22uF	
5V	3.3V	31.6KΩ	10KΩ	4.7uF~22uF	

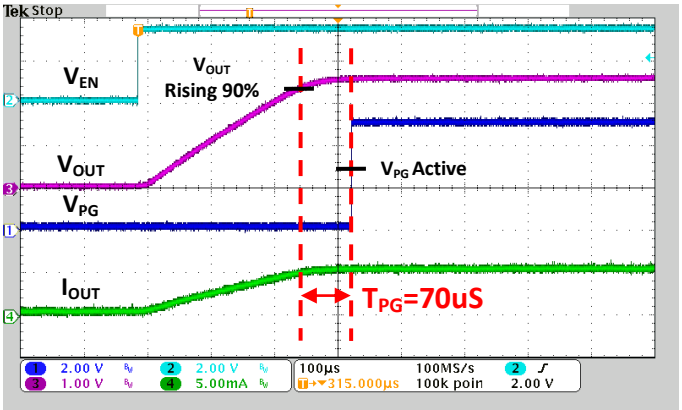
* CFF is chosen for improving the transient load response

PG React Time Without CFF



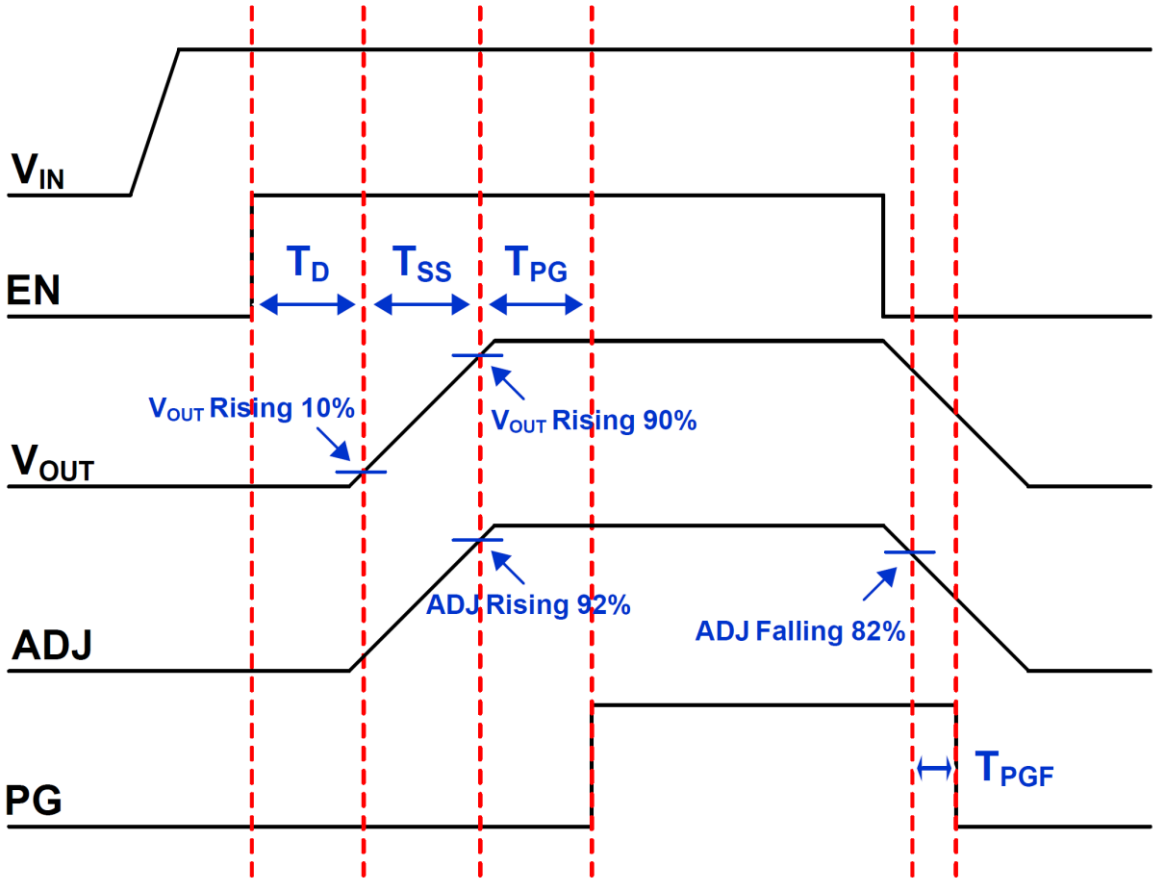
CH1:V_{PG}, CH2:V_{EN}, CH2:V_{OUT}, CH4:I_{OUT}
V_{IN}=3.3V, V_{EN}=3.3V, V_{OUT}=2.5V, I_{OUT}=50mA

PG React Time With CFF=1nF



CH1:V_{PG}, CH2:V_{EN}, CH2:V_{OUT}, CH4:I_{OUT}
V_{IN}=3.3V, V_{EN}=3.3V, V_{OUT}=2.5V, I_{OUT}=50mA

Timing Diagram



Functional Description

Enable Function

EM1109BV is enabled if the voltage of the EN pin is greater than 1.2V. If the voltage of the EN pin is less than 0.3V, the IC will be disabled.

POR – Power ON Reset

To let EM1109BV start to operation, input voltage must be higher than its POR voltage even when EN voltage is pulled higher than enable high voltage. Typical POR voltage is 2.1V.

Over Current Limit Function

EM1109BV-AJ features over current limiting function which can limit its output current to 1.3A.

Input and Output Capacitor Selection

For VIN pin, 1uF or larger ceramic capacitor is required to provide bypass path in transient current demand. VOUT pin is also recommended to have 4.7uF or larger ceramic capacitor to be stable and reduce the VOUT voltage dip when fast loading transient is happened.

Thermal and Layout Consideration

EM1109BV is designed to maintain a constant output load current. Due to physical limitations of the chip layout and assembly of the device the maximum switch current is 1A. All copper traces for the VIN and Vo pin should be widely and short to carry the maximum continuous current and obtain the best effect. The maximum IC junction temperature should be restricted to 125℃ under normal operating conditions. To calculate the maximum allowable dissipation, $P_{D(MAX)}$ for a given output current and ambient temperature, used the following equation:

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

Where:

$P_{D(MAX)}$=Maximum allowable power dissipation

$T_{J(MAX)}$=Maximum allowable junction temperature (125 ℃ for the EM1109BV)

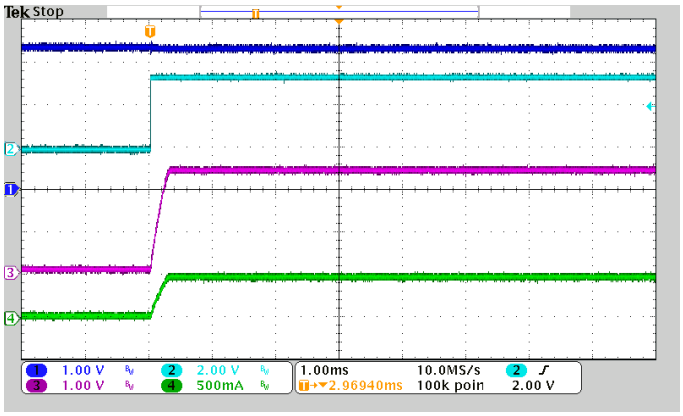
T_A=Ambient Temperature of the device

Power Good Function

The power good circuit monitors the feedback voltage at output. When the ADJ voltage falls below the PG threshold, the control circuit pull this to pin to GND. When the ADJ voltage rising above the PG threshold, this pin becomes high impedance. By connecting a pullup resistor to an external supply, any downstream device can receive power good signal that can be used for managing any fault event and sequencing. Using the pullup resistor from 10KΩ to 100KΩ is recommended. The state of PG is only valid when the device is operating above the minimum input voltage. When the input voltage falls below 1V, there is not enough driver to keep the open drain and power good device turned on so that the PG output is pulled up. Connecting the PG pull up to the output can help minimize the effect.

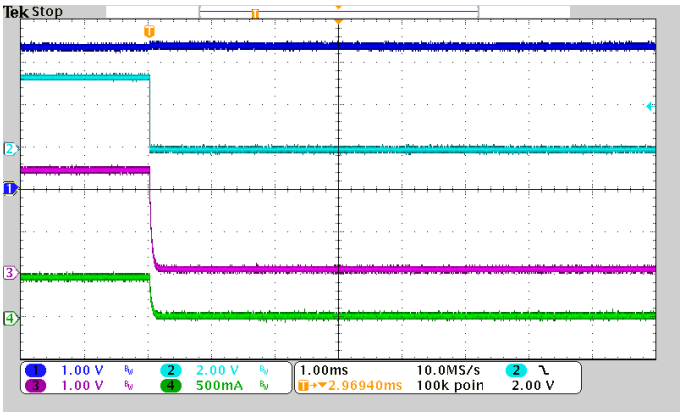
Typical Operating Characteristics

Power On Form Enable



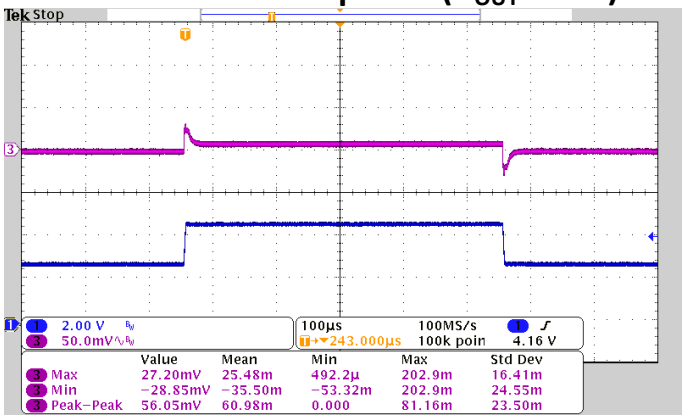
CH1:V_{IN}, CH2:V_{EN}, CH2:V_{OUT}, CH4:I_{OUT}
V_{IN}=3.3V, V_{EN}=3.3V, V_{OUT}=2.5V, I_{OUT}=500mA

Power Off Form Enable



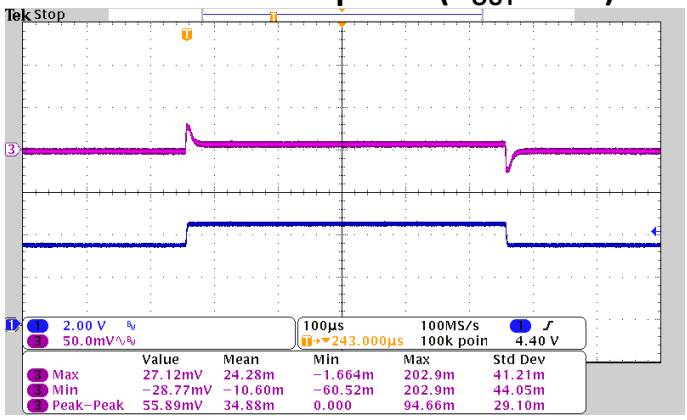
CH1:V_{IN}, CH2:V_{EN}, CH2:V_{OUT}, CH4:I_{OUT}
V_{IN}=3.3V, V_{EN}=3.3V, V_{OUT}=2.5V, I_{OUT}=500mA

Line Transient Response (V_{OUT}=1.2V)



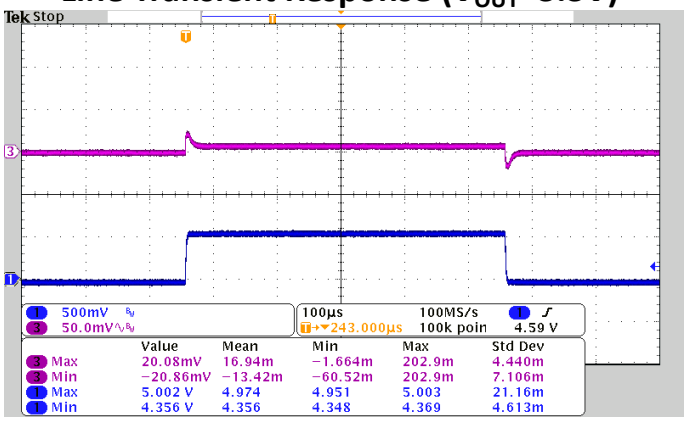
CH1:V_{IN}, CH3:V_{OUT}
V_{IN}=2.5~5.5V, I_{OUT}=500mA

Line Transient Response (V_{OUT}=2.5V)



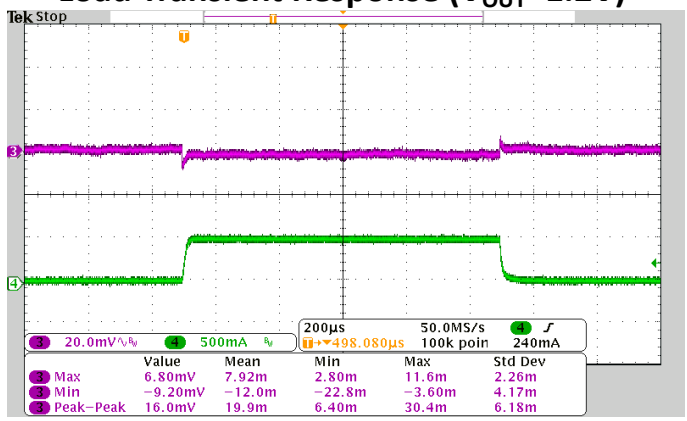
CH1:V_{IN}, CH3:V_{OUT}
V_{IN}=2.5~5.5V, I_{OUT}=500mA

Line Transient Response (V_{OUT}=3.3V)



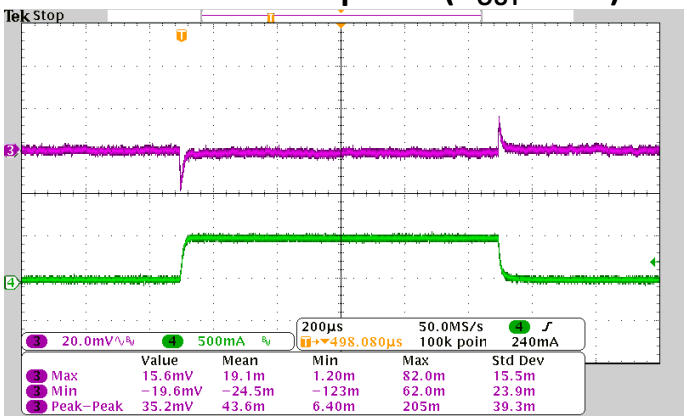
CH1:V_{IN}, CH3:V_{OUT}
V_{IN}=2.5~5.5V, I_{OUT}=500mA

Load Transient Response (V_{OUT}=1.2V)



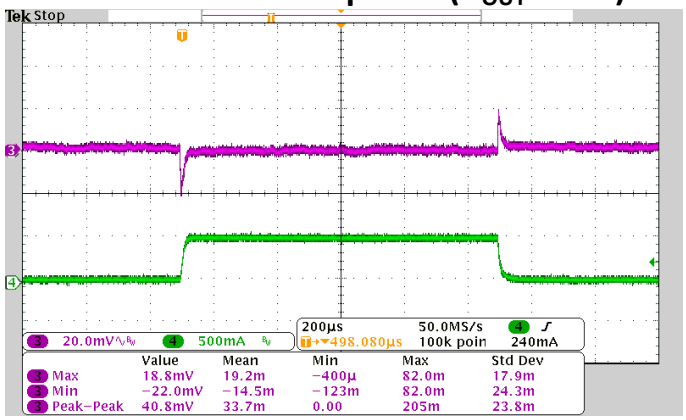
CH1:V_{OUT}, CH4:I_{OUT}
V_{IN}=2.5V, I_{OUT}=10mA~500mA

Load Transient Response (V_{OUT}=2.5V)



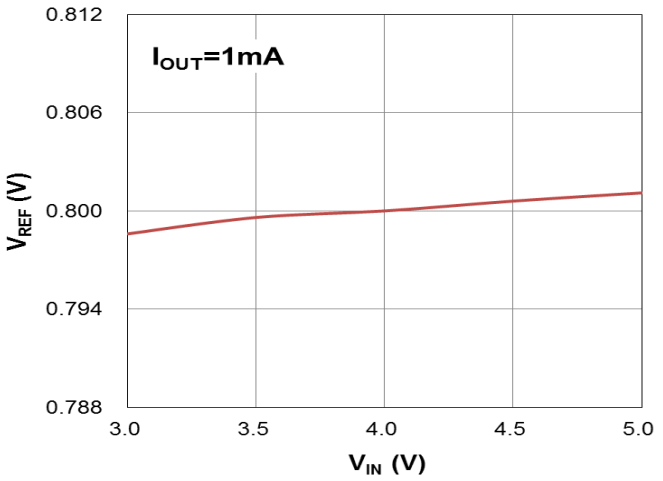
CH1:V_{OUT}, CH4:I_{OUT}
V_{IN}=3.5V, I_{OUT}=10mA~500mA

Load Transient Response (V_{OUT}=3.3V)

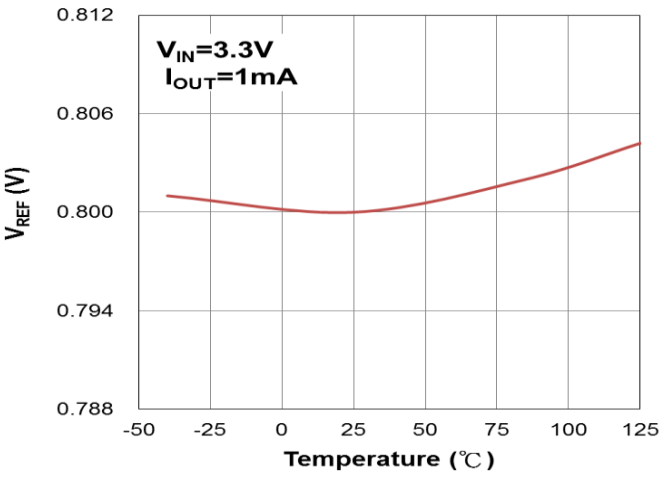


CH1:V_{OUT}, CH4:I_{OUT}
V_{IN}=4.3V, I_{OUT}=10mA~500mA

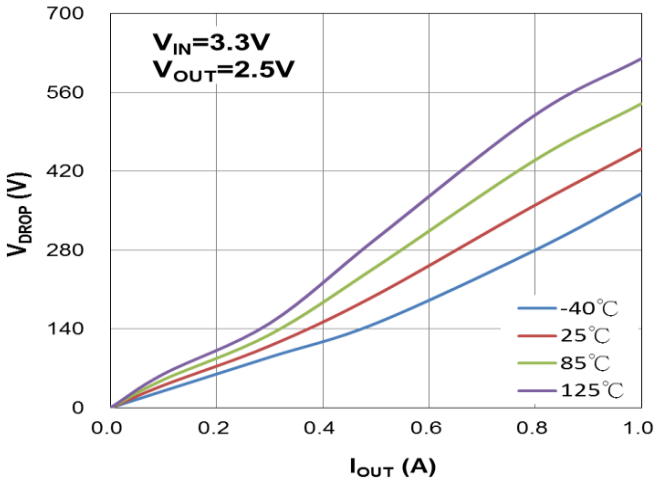
Reference Voltage VS Input Voltage



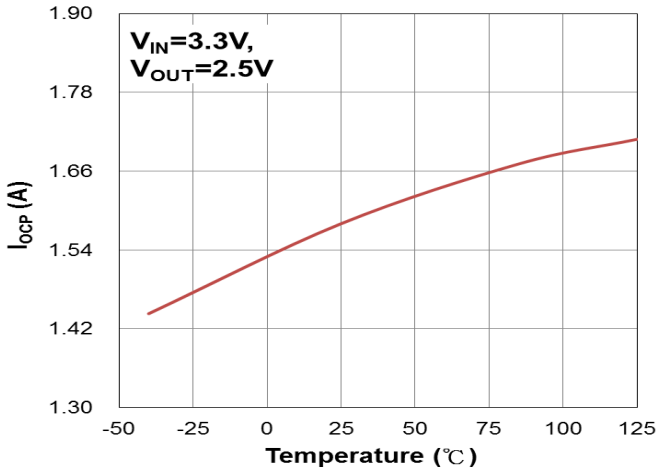
Reference Voltage VS Temperature



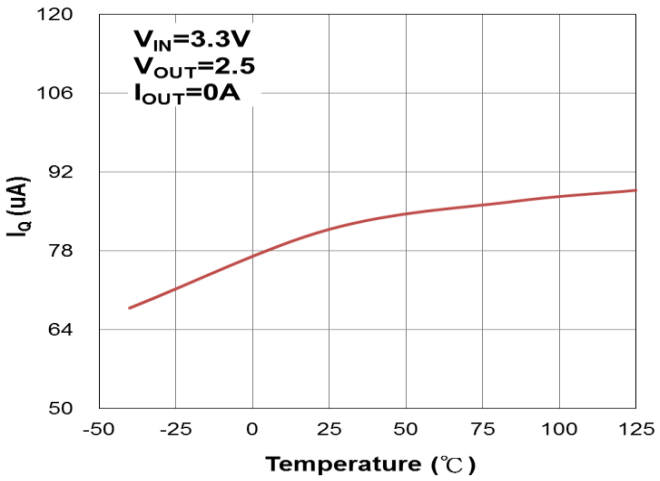
Dropout Voltage VS Output Current



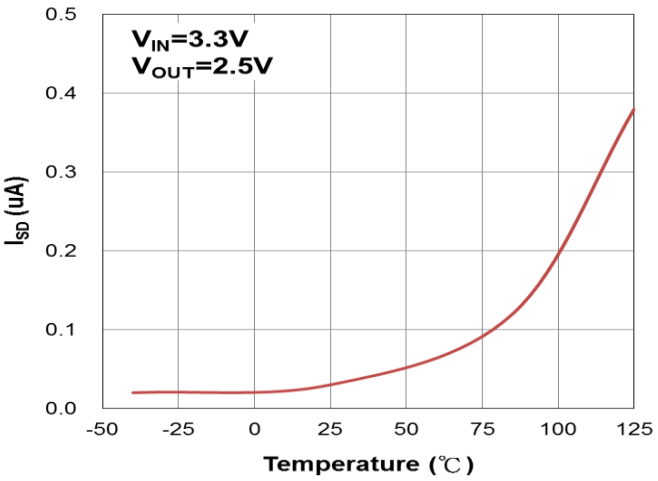
Current Limit VS Temperature



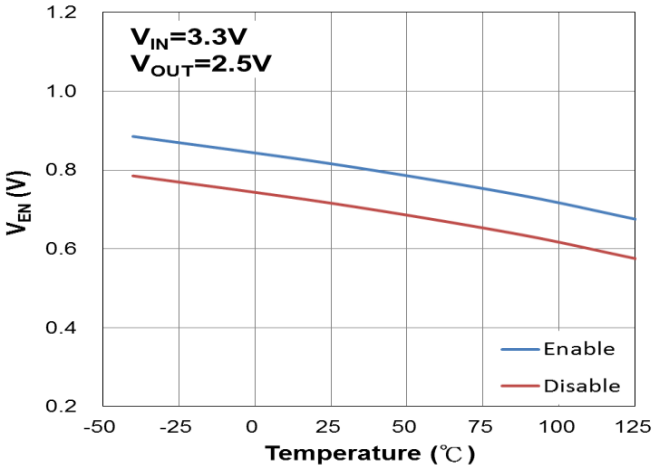
Quiescent Current VS Temperature



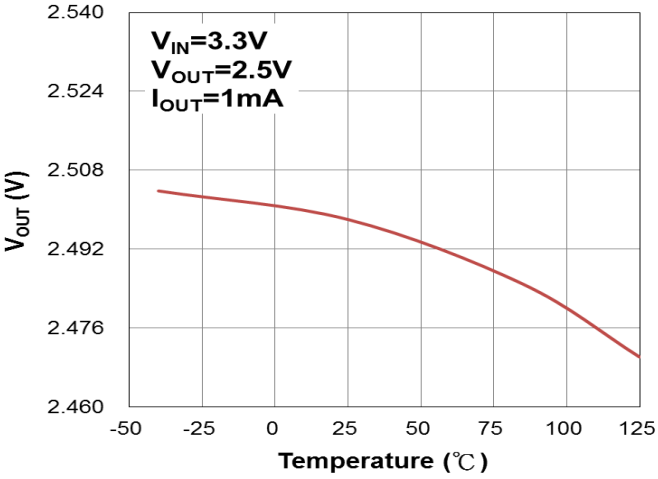
Shutdown Current VS Temperature



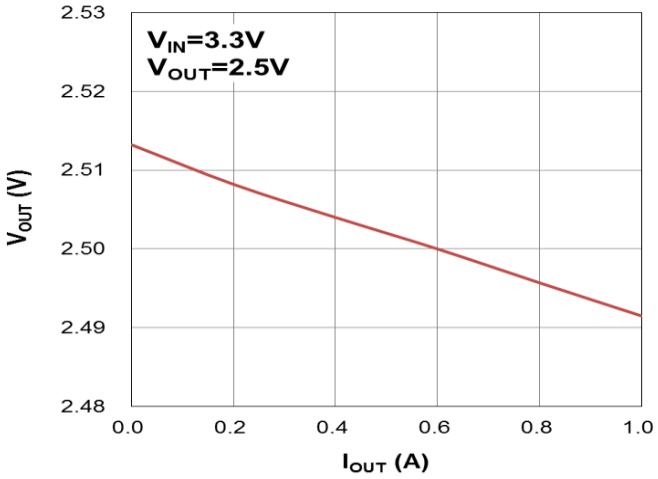
Enable Threshold VS Temperature



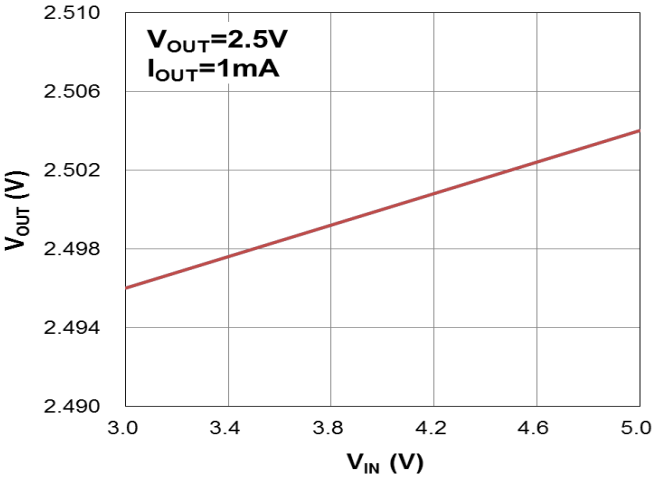
Output Voltage VS Temperature



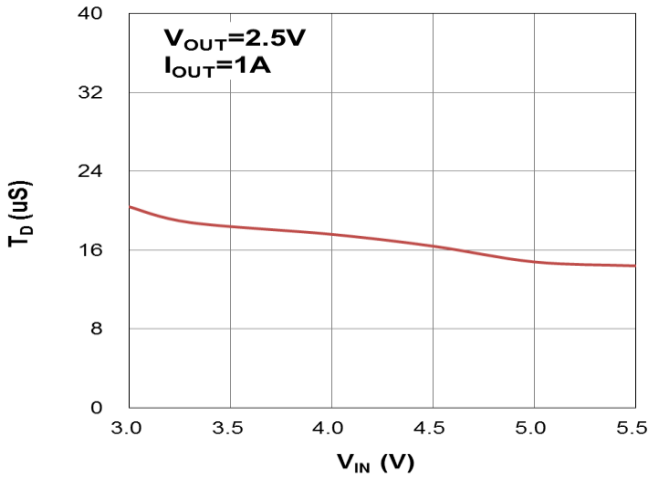
Load Regulation (V_{OUT} VS I_{OUT})



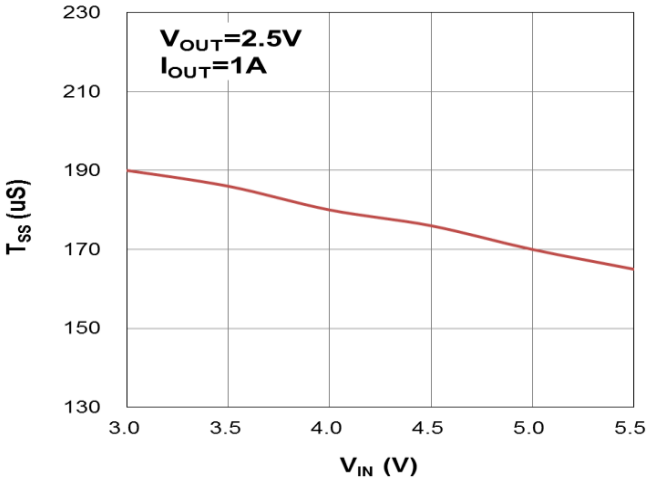
Line Regulation (V_{OUT} VS V_{IN})



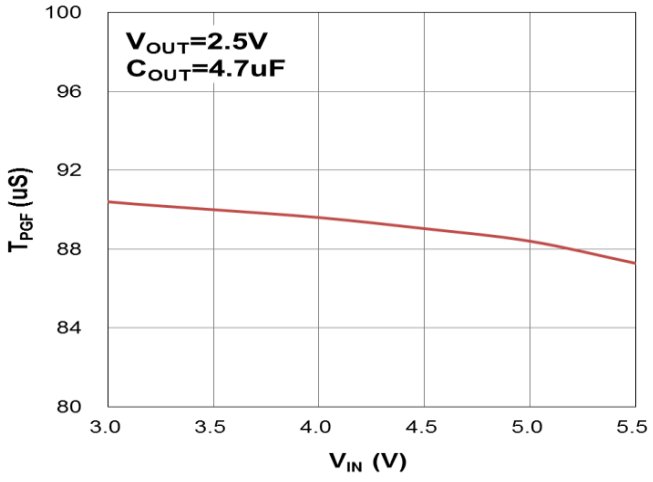
V_{OUT} Turn On Delay Time VS Input Voltage



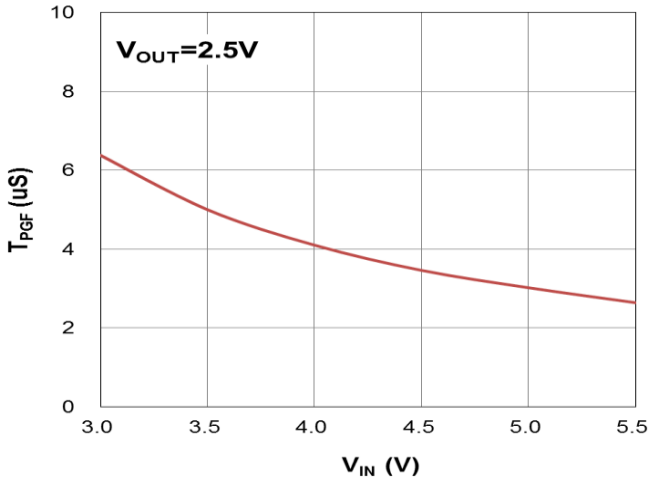
V_{OUT} Ramp Up Time VS Input Voltage



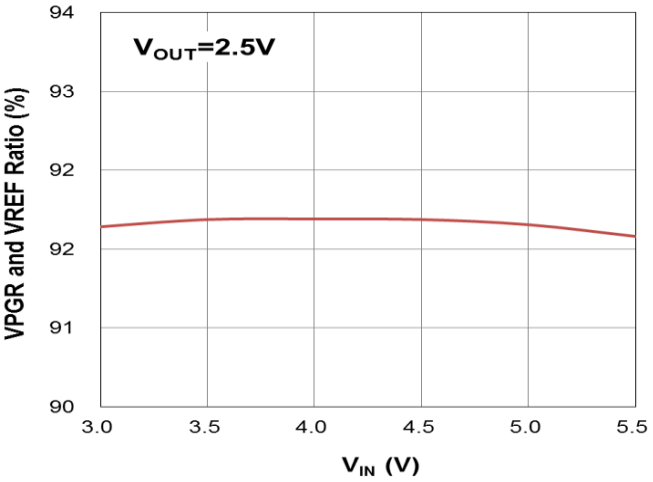
PG React Time VS Input Voltage



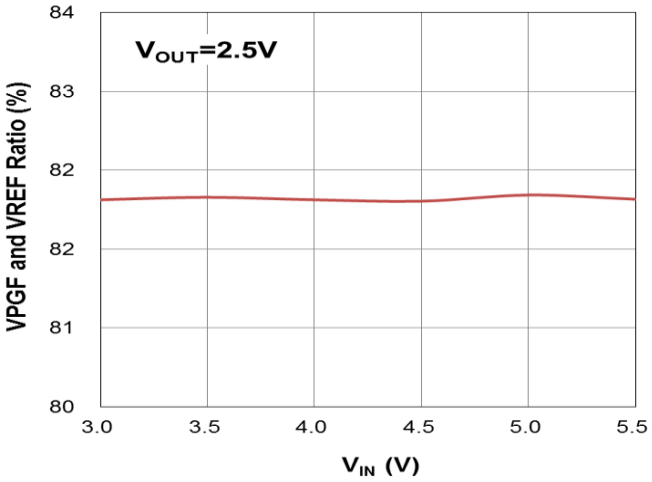
PG OFF deglitch time VS Input Voltage



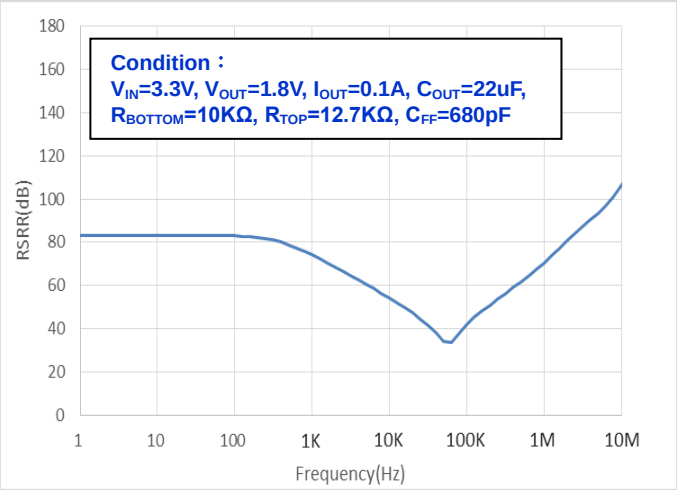
V_{PG} Threshold VS V_{IN} (ADJ Rising)



V_{PG} Threshold VS V_{IN} (ADJ Falling)

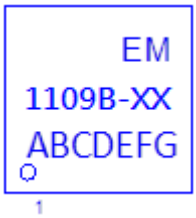


PSRR Simulation Curve



Ordering & Marking Information

Device Name: EM1109BV for DFN3.0X3.0-08

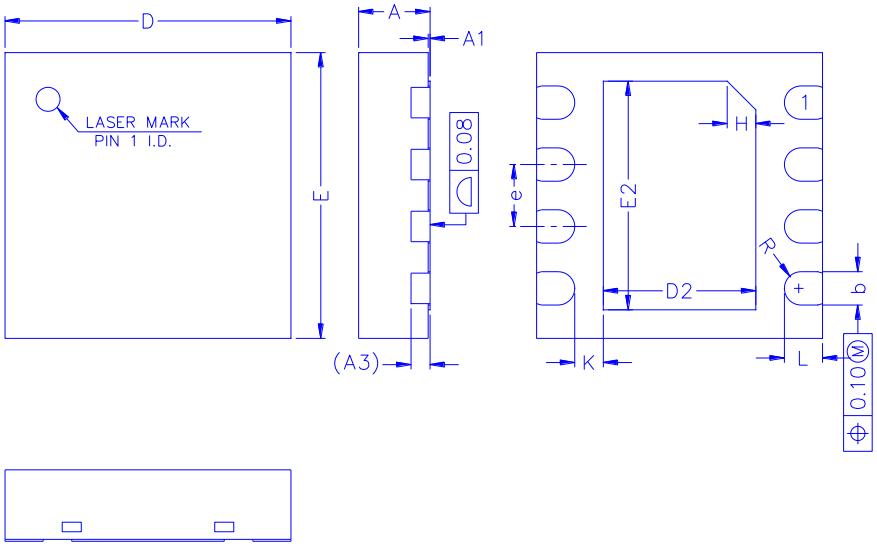


→ EM1109BV Device Name

→ ABCDEFG: Date Code

XX	output Voltage
AJ	Adjust
10	1.0V
12	1.2V
15	1.5V
18	1.8V
25	2.5V
30	3.0V
33	3.3V

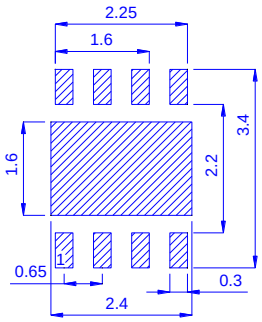
Outline Drawing



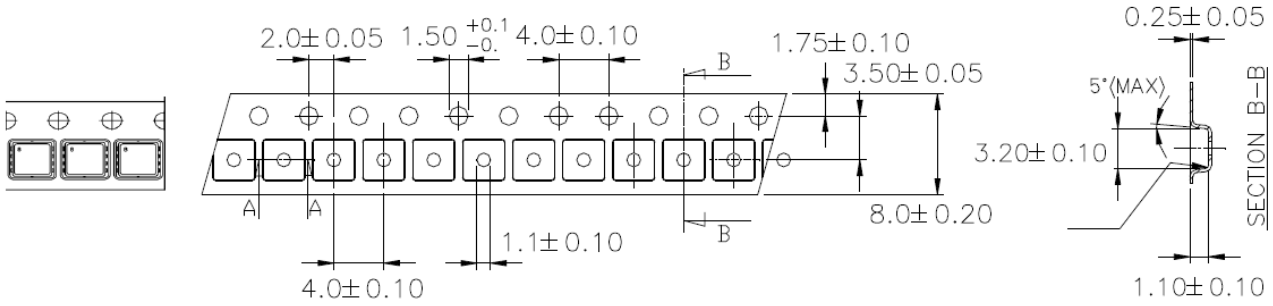
Dimension in mm

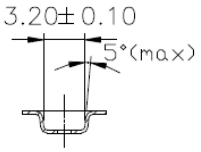
Dimension	A	A1	A3	b	D	E	D2	E2	e	H	K	L	R
Min.	0.7	0.00	0.2 REF	0.3	2.9	2.9	1.5	2.3	0.55	0.3REF	0.2	0.3	0.16
Typ.	0.75	0.02		0.35	3.0	3.0	1.6	2.4	0.65		0.3	0.4	
Max.	0.8	0.05		0.4	3.1	3.1	1.7	2.5	0.75		0.4	0.5	

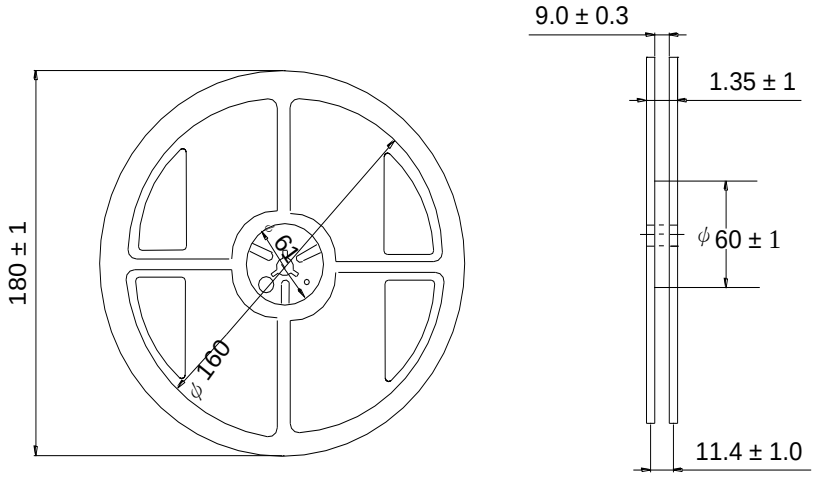
Recommended minimum pads

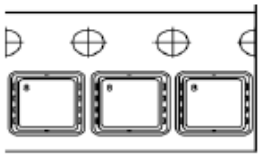


Tape&Reel Information: 3000pcs/Reel







產品別	DFN3.0X3.0-08 (EM1109BV)
Reel 尺寸	7”
編帶方式	
前空格	50
後空格	50
裝箱數	
滿捲數量	3K
捲/內盒比	5 : 1
內盒滿箱數	15K
內/外箱比	12 : 1
外箱滿箱數	180K