杰力科技股份有限公司
Excelliance MOS Corporation

EM5111

150mA Wide Input Range Low IQ Linear Regulator

General Description

The EM5111 has features of wide input voltage range, high accuracy, high ripple rejection, low dropout voltage, low noise, current limit and low quiescent current.

The EM5111 is a CMOS 150mA (LDO) voltage regulator which is suitable for always on and keep alive applications. The EM5111 operates from an input voltage of 3V to 30V under normal operating conditions.

Ordering Information

Part Number	Package	XXX: Output Voltage
		ADJ: Adjustable
EM5111VA-XXX	DFN2.0X2.0-06	180: 1.8V
EM5111J5-XXX	SOT23-5(A)	250: 2.5V
EM5111AJ5-XXX	SOT23-5(B)	280: 2.8V
EM5111AP-XXX	SOT89-3(AP)	300: 3.0V
EM5111BP-XXX	SOT89-3(BP)	330: 3.3V
EM5111GE-XXX	PSOP-8	360: 3.6V
		500: 5.0V

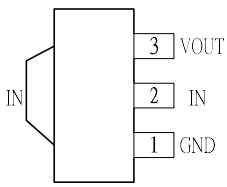
Features

- Operating Input Range: 3V to 30V
- Adjustable Output Range from 1.8V to 12V
- Fixed Output Voltage from 1.8V to 5V
- Output current: min 150mA
- 10uA Low Ground Current at no load
- Low Shutdown Current < 1uA
- Only 1uF Ceramic Capacitor required for stability
- Over Temperature Protection
- Current Limit Protection
- Available in SOT23-5, DFN2.0X2.0-06, PSOP-8 and SOT89-3 Package
- RoHS Compliant and 100% Lead (Pb)-Free and Halogen Free

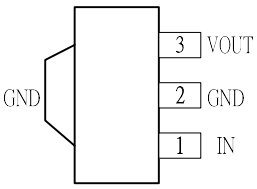
Applications

- Cellular Handsets
- Battery-Powered Equipment
- Portable Information Applications
- USB PD

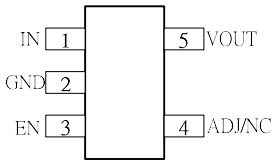
Pin Configuration



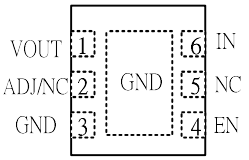
SOT89-3(AP)



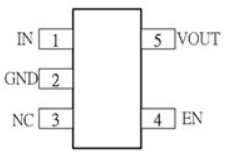
SOT89-3(BP)



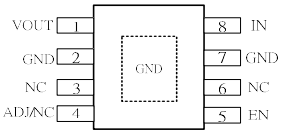
SOT23-5(A)



DFN2.0X2.0-06

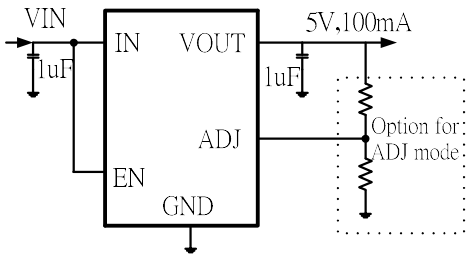


SOT23-5(B)



PSOP-8

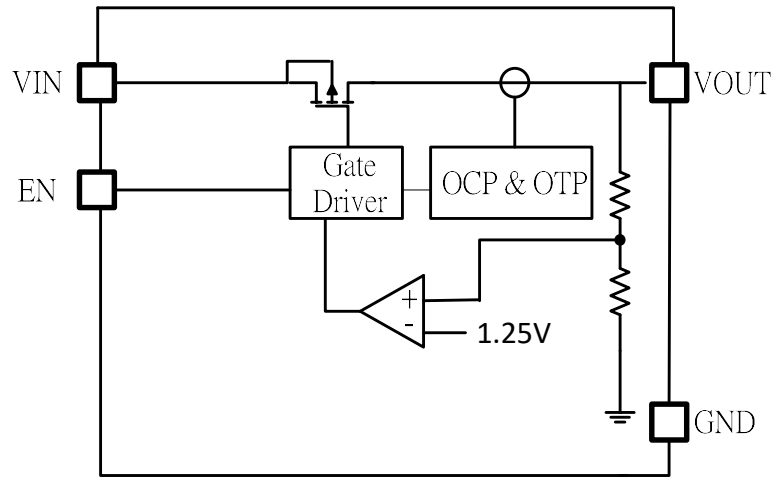
Typical Application Circuit



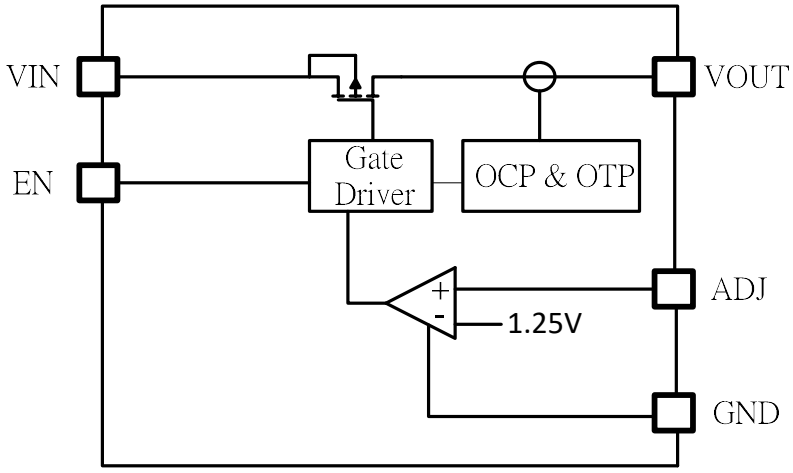
Pin Assignment

Pin Name	Pin Number						Pin Function
	SOT23-5		PSOP-8	SOT89-3		DFN2.0X 2.0-06	
	A	B		AP	BP		
IN	1	1	8	2	1	6	Input Voltage. This is the source input to the power device that supplies current to the output pin.
GND	2	2	2,7	1	2	3	Ground.
EN	3	4	5	-	-	4	Chip Enable Input (Active high).
VOUT	5	5	1	3	3	1	Output Voltage. VOUT is power output pin Minimum 1uF low ESR ceramic capacitor is required at this pin for stabilizing VOUT voltage.
NC	-	-	3,6	-	-	5	No Connection.
ADJ	4	-	4	-	-	2	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)

- IN, EN, VOUT to GND ---------- -0.3V to +36V
- ADJ to GND ---------- -0.3V to +6V
- Power Dissipation, PD @ TA = 25°C
  - DFN2.0X2.0-06 ---------- 2.20 W
  - SOT23-5 ---------- 0.45 W
  - PSOP-8 ---------- 3.26 W
  - SOT89-3 ---------- 0.60 W
- Package Thermal Resistance, θ_{JA} (Note 2)
  - DFN2.0X2.0-06 ---------- 45.5°C/W
  - SOT23-5 ---------- 222°C/W
  - PSOP-8 ---------- 30.7°C/W
  - SOT89-3 ---------- 167°C/W
- Package Thermal Resistance, θ_{JC}, (Note 2)
  - DFN2.0X2.0-06 ---------- 5.10°C/W
  - SOT23-5 ---------- 24.7°C/W
  - PSOP-8 ---------- 3.40°C/W
  - SOT89-3 ---------- 18.5°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} ---------- +4.5 to +30V
- Junction Temperature ---------- -40°C to 125°C
- Ambient Temperature ---------- -40°C to 85°C

Electrical Characteristics

V_{IN}=V_{OUT}+2V, C_{IN}=C_{OUT}=1uA, T_A=25℃, unless otherwise specified

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Power Input Voltage	V_{IN}		3	-	30	V
Reference Voltage	V_{REF}	V_{OUT}=V_{REF}, I_{OUT}=1mA	-	1.25	-	V
Feedback Leakage Current	I_{ADJ}	-	-	0.1		uA
Output Voltage	V_{OUT}	I_{OUT}=10mA	V_{OUT}* 98%	-	V_{OUT}* 102%	V
Output Voltage Accuracy	V_{OUT}	I_{OUT}=30mA	-2	-	2	%
Line Regulation	$V_{OUT(LINE)}$	V_{OUT}+2V < V_{IN} < 30V, I_{OUT}=30mA	-	-	0.5	%/V
Load Regulation	$V_{OUT(LOAD)}$	10mA < I_{OUT} < 150mA, V_{IN}=V_{OUT}+2V	-1	-	1	%
Dropout Voltage	V_{DROP}	I_{OUT}=150mA	-	700		mV
Quiescent Current	I_Q	V_{IN}=V_{EN}, I_{OUT}=0A	-	10	-	uA
Shutdown Current	I_{SD}	V_{EN}=0V	-	0.1		uA
OCP Threshold Level	I_{OCP}	V_{OUT} Drop to 50% V_{OUT} (Target)	200	-	500	mA
Fold-Back Current	$I_{Fold-Back}$		-	I_{OCP} / 3	-	mA
Power Supply Rejection Ration	PSRR	f=100Hz, I_{OUT}=30mA	-	70	-	dB
Enable High Level	V_{EN}	-	2.2	-	-	V
Disable Low Level	V_{SD}	-	-	-	0.3	V
Enable Input Current	I_{EN}	V_{EN}=30V	-1	-	1	uA
Output Voltage Ramp Up Time	T_{SS}	C_{OUT}=1uF, V_{OUT}=V_{REF}, I_{OUT}=50mA	-	100	-	us
Thermal Shutdown Temperature	T_{SD}	I_{OUT}=30mA	-	160	-	°C
Thermal Shutdown Hysteresis	T_{SDHYS}		-	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.

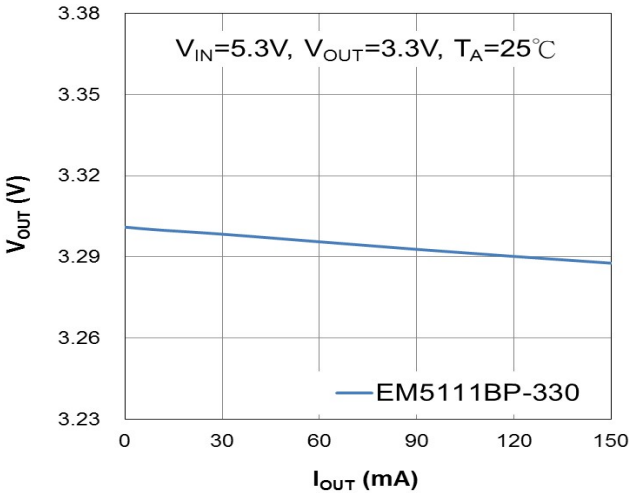
Note 2. θ_{JA} is measured in the natural convection at T_A=25°C on a low effective thermal conductivity test board (2Layer PCB) of JEDEC 51-3 thermal measurement standard.

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

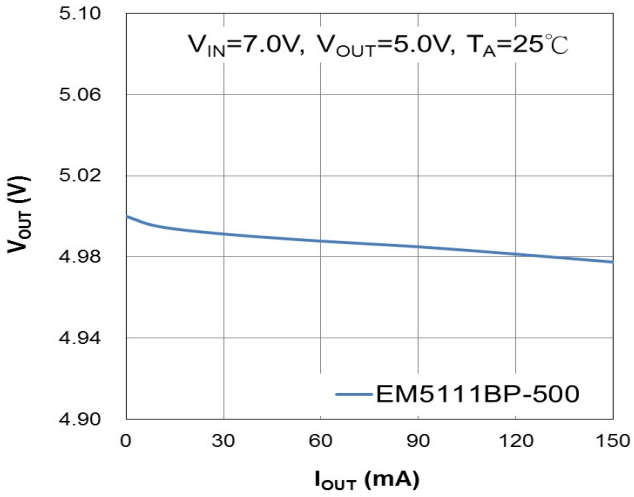
Note 4. The device is not guaranteed to function outside its operating conditions.

Typical Operating Characteristics

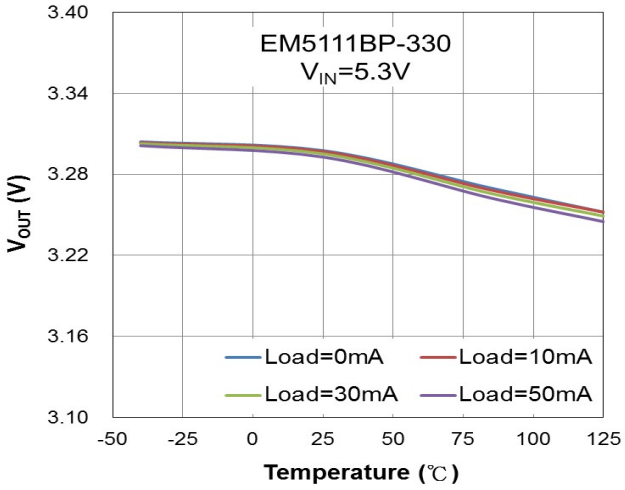
Output Voltage vs. Output Current



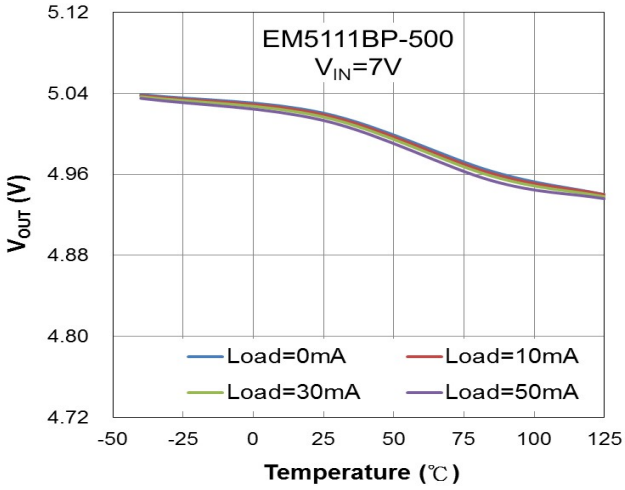
Output Voltage vs. Output Current



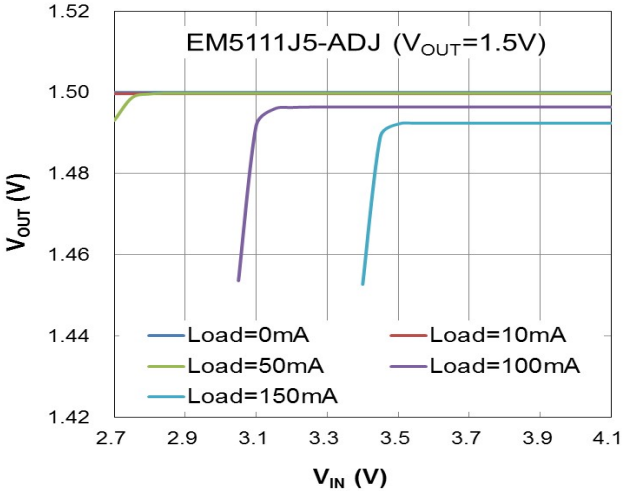
Output Voltage vs. Temperature



Output Voltage vs. Temperature



Output Voltage vs. Input Voltage



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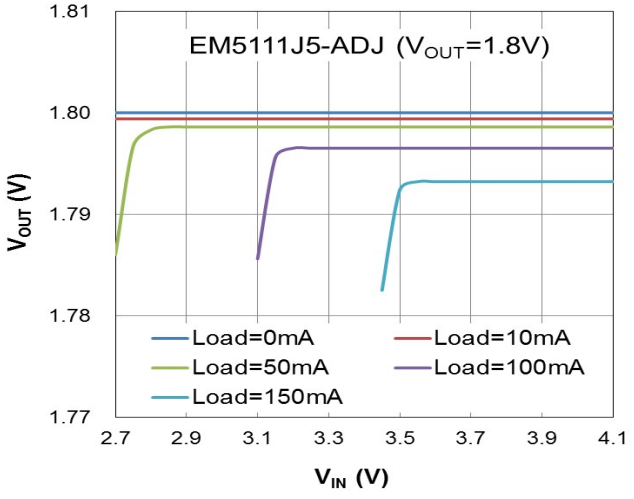

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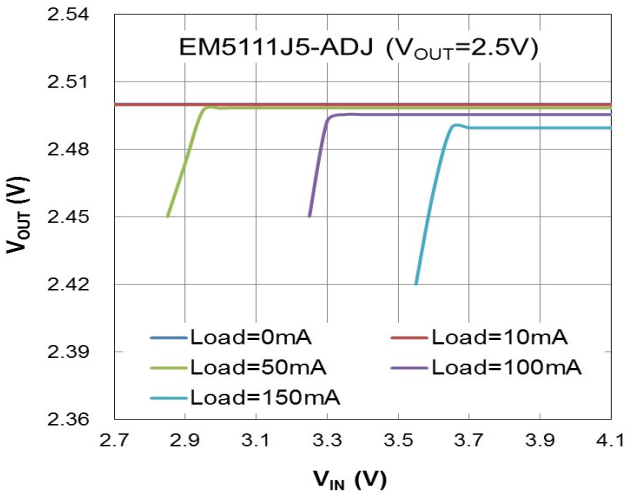

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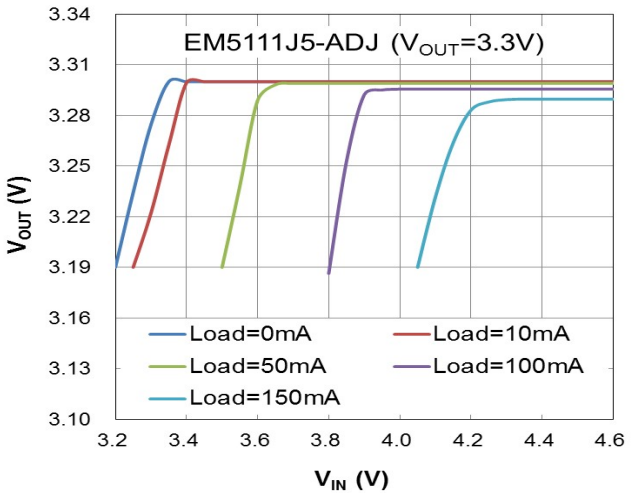

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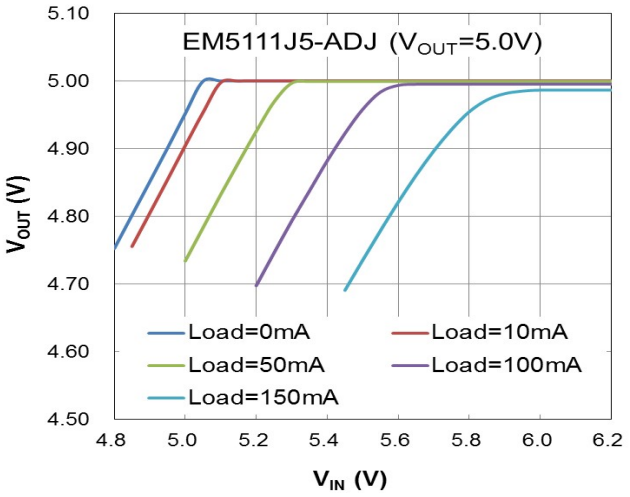

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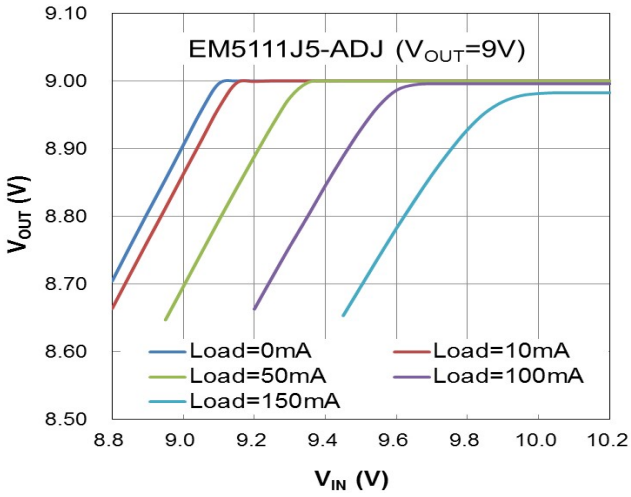

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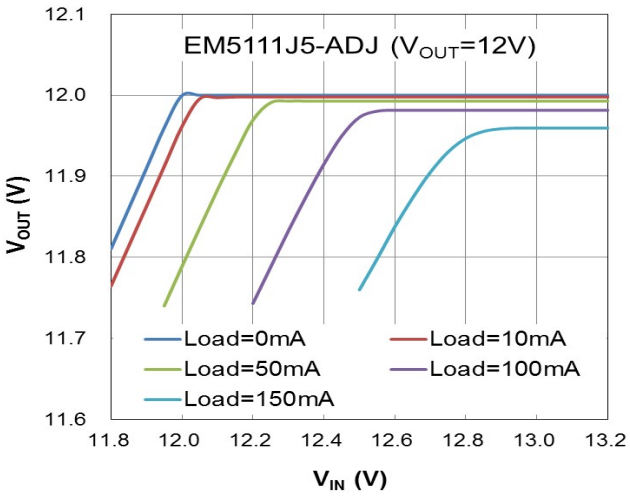

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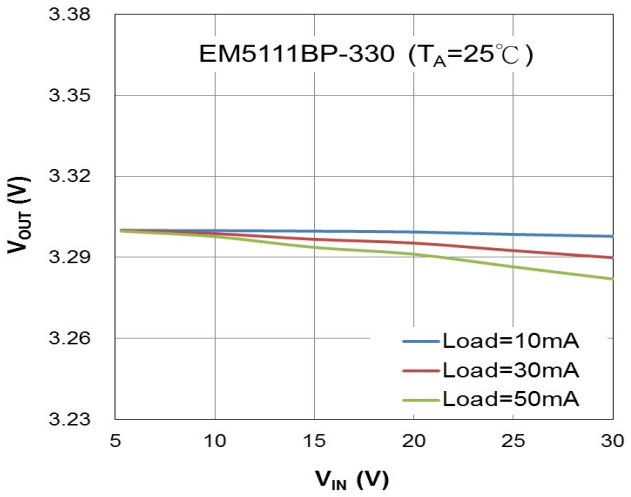

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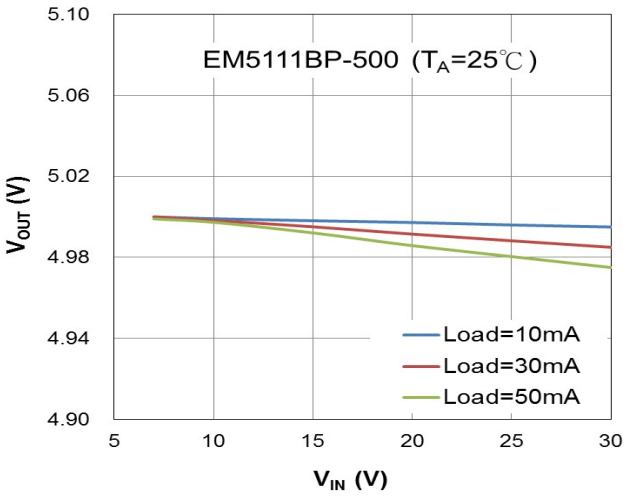
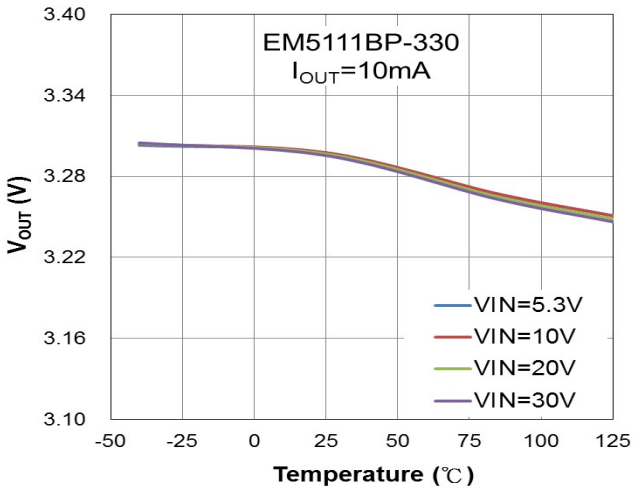
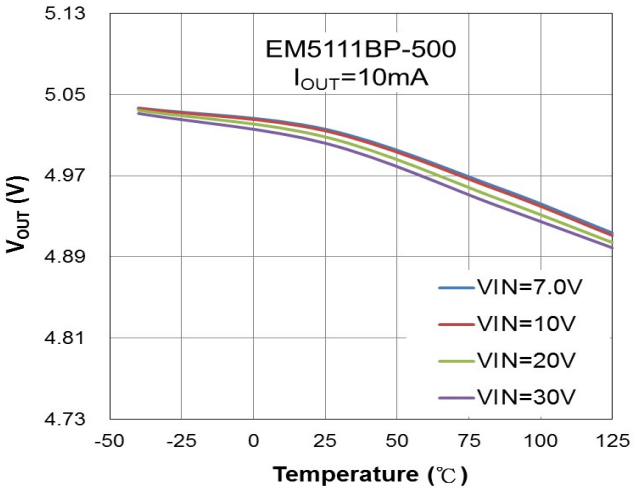


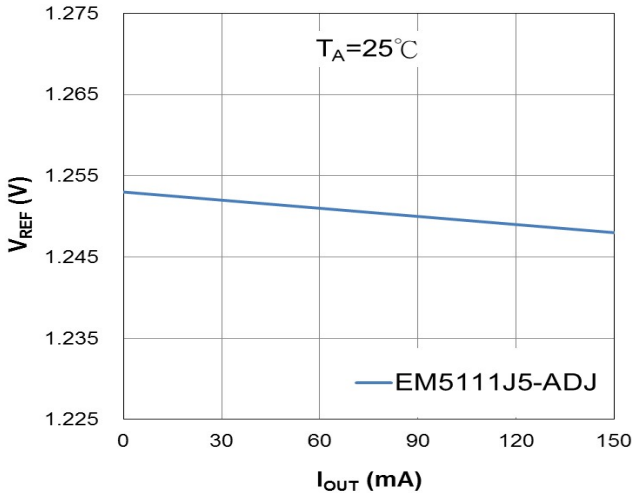
Output Voltage vs. Temperature



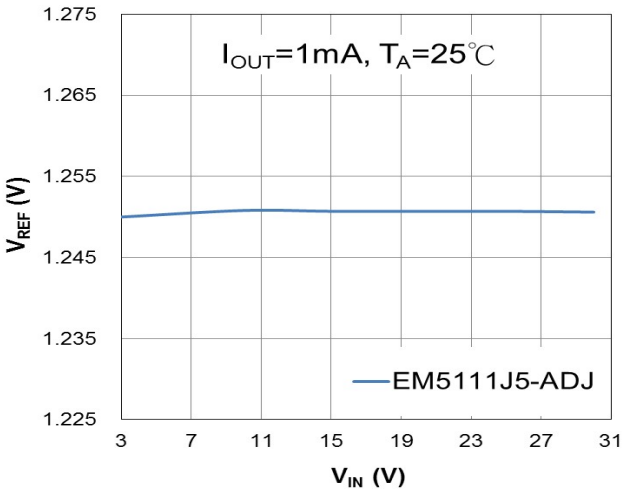
Output Voltage vs. Input Voltage



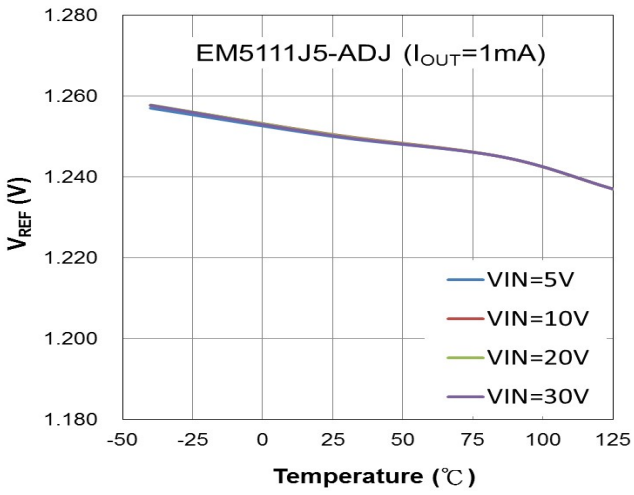
Reference Voltage vs. Output Current



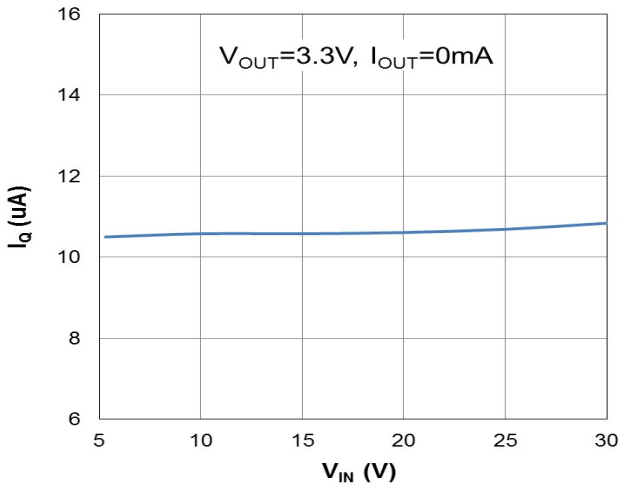
Reference Voltage vs. Input Voltage



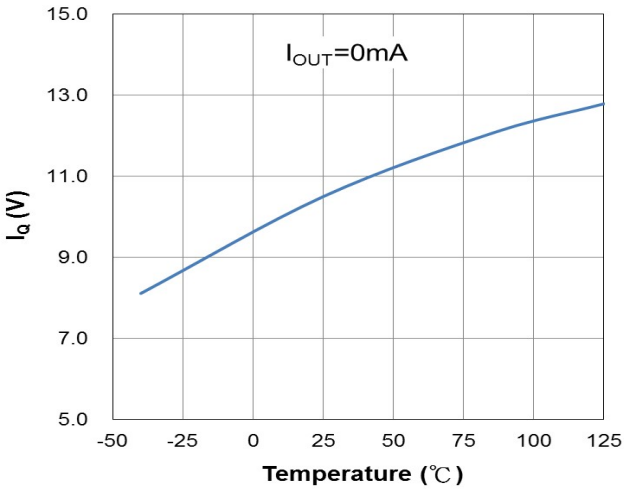
Reference Voltage vs. Temperature



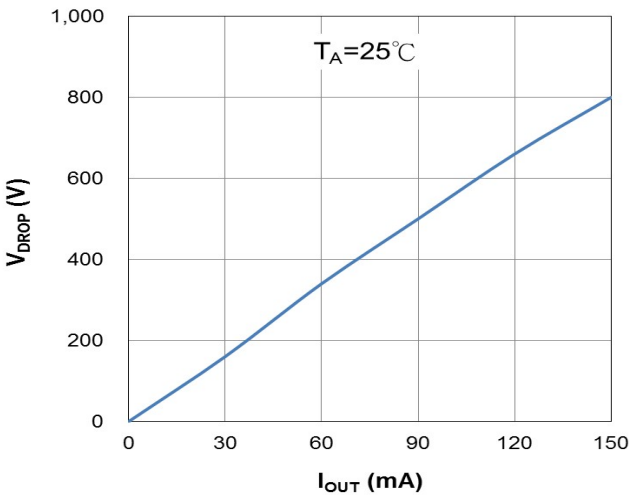
Quiescent Current vs. Input Voltage



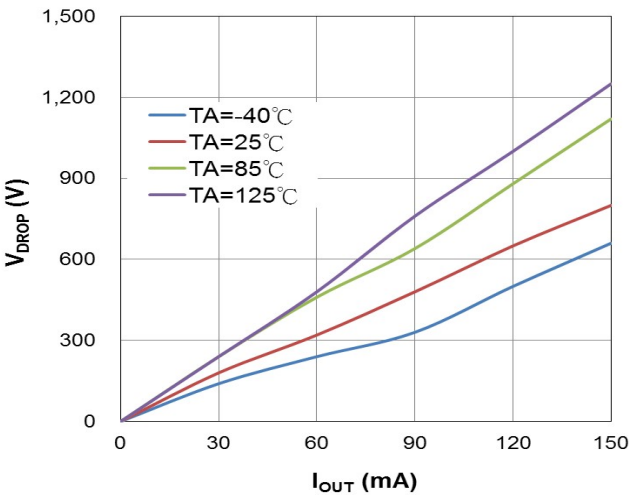
Quiescent Current vs. Temperature



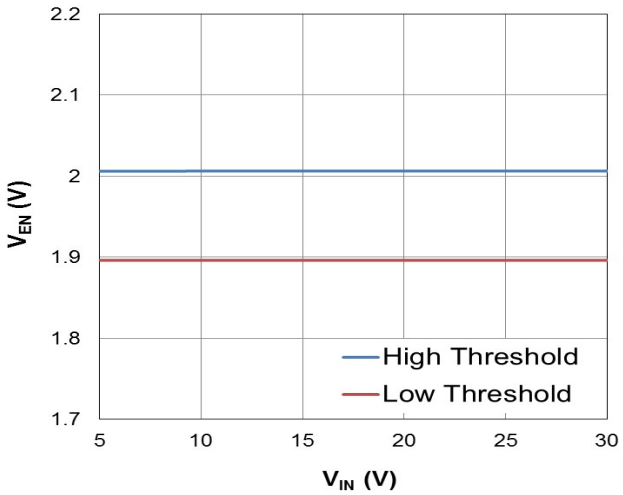
Dropout Voltage vs. Output Current



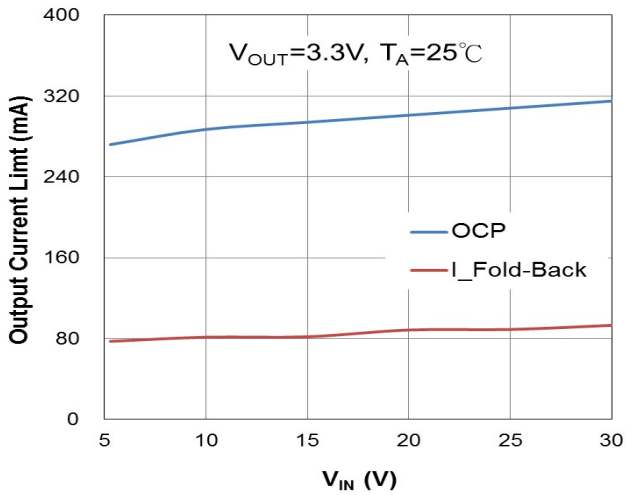
Dropout Voltage vs. Temperature



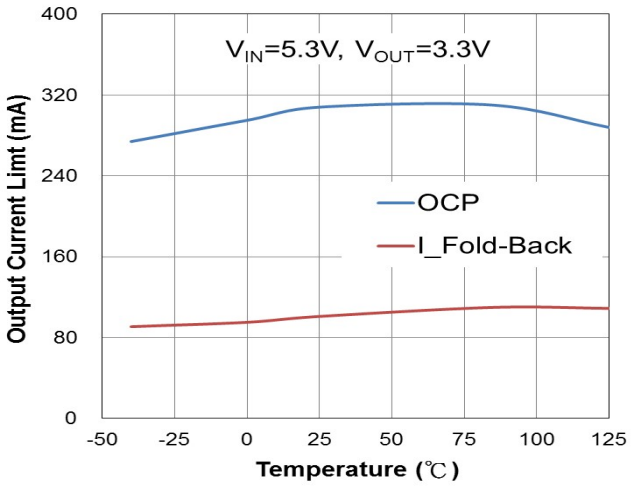
Enable Threshold vs. Input Voltage



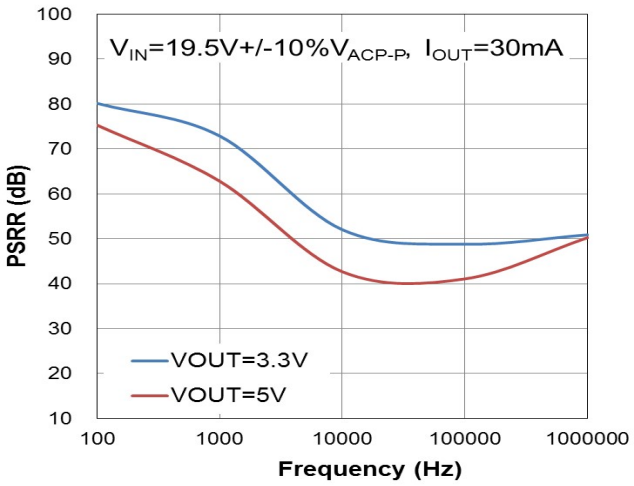
Current Limit vs. Input Voltage



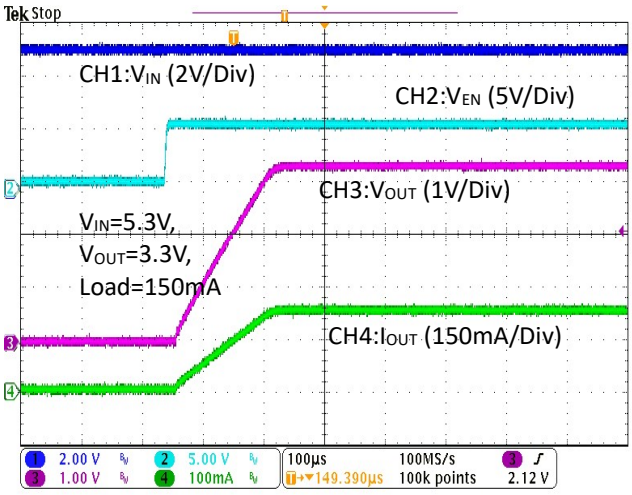
Current Limit vs. Temperature



PSRR vs. Frequency



Power On From Enable



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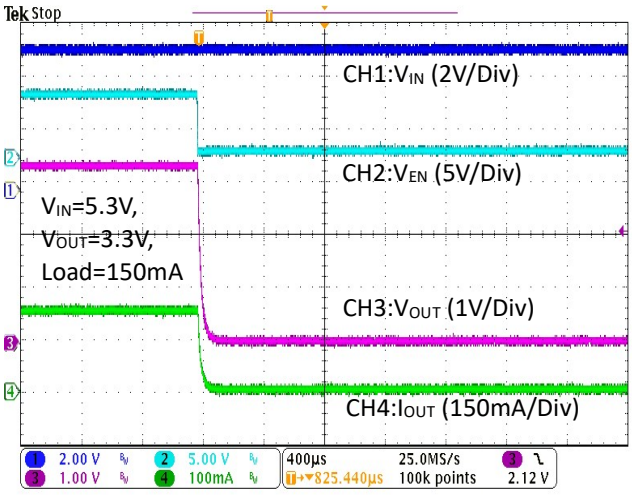
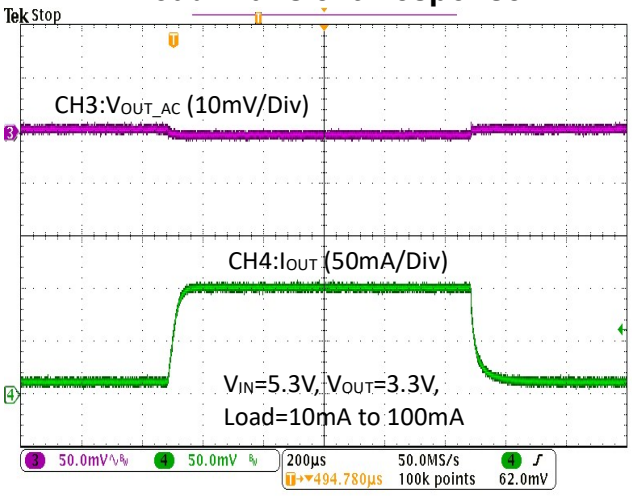


Load Transient Response



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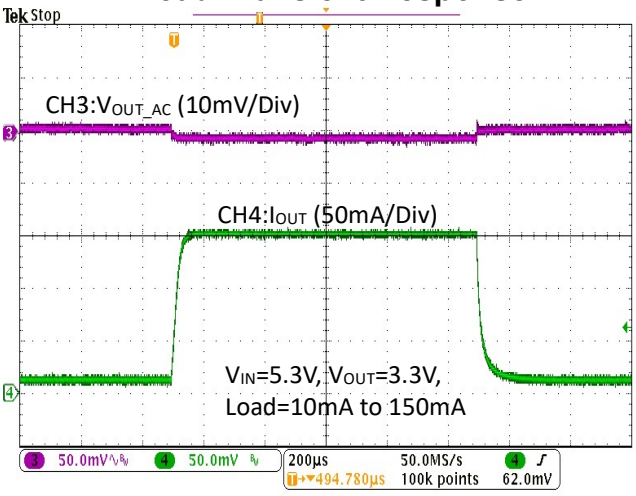

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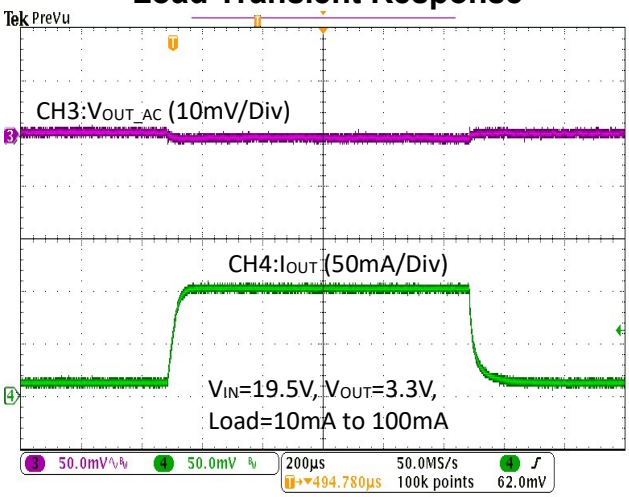

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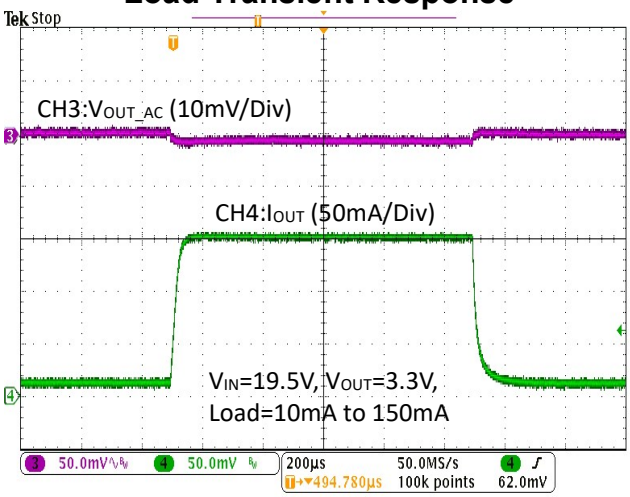

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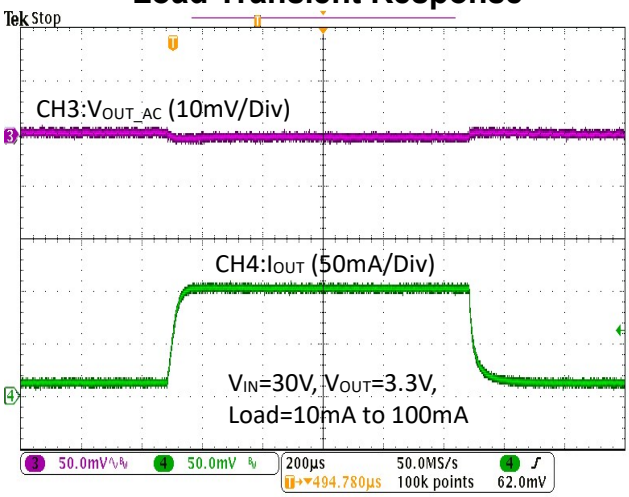

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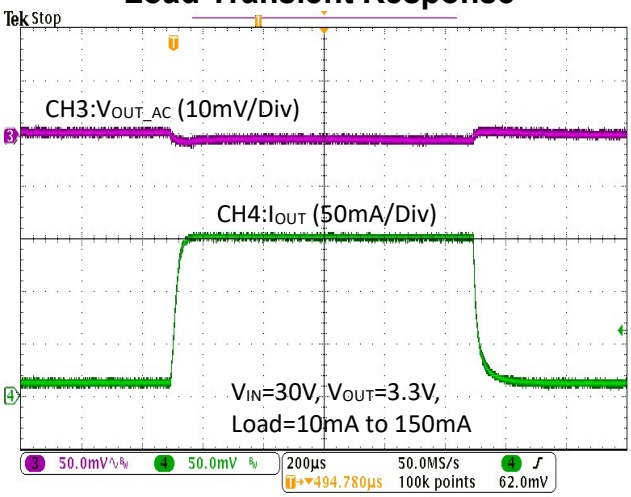
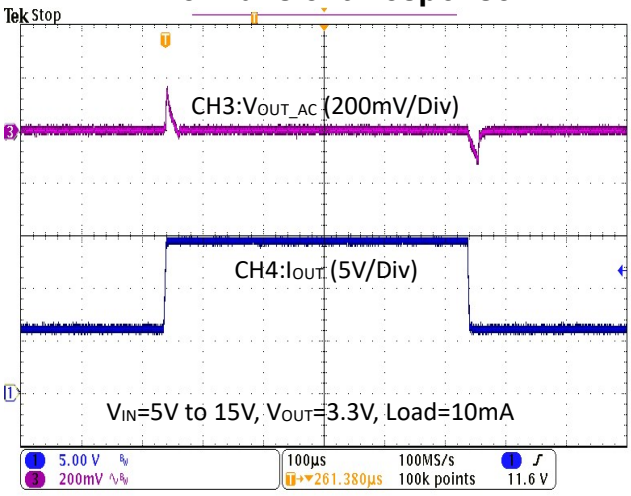
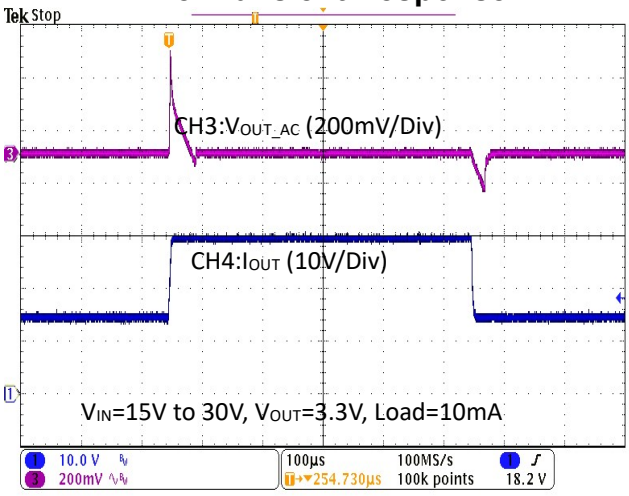


Line Transient Response



Line Transient Response



Functional Description

Enable Function

EM5111 is enabled if the voltage of the EN pin is greater than 2.2V. If the voltage of the EN pin is less than 0.3V, the IC will be disabled.

Over Current Limit Function

EM5111 features over current limiting function which can limit its output current to 0.2A.

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 1uF or larger ceramic capacitor to be stable and reduce the VOUT voltage dip when fast loading transient is happened.

Thermal and Layout Consideration

EM5111 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 150mA.

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:

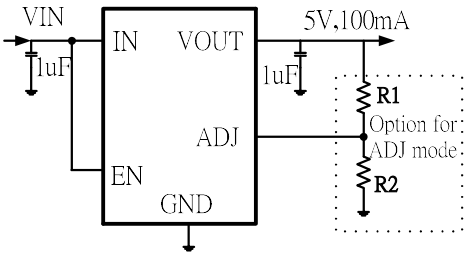
$P_{D(MAX)}$=Maximum allowable power dissipation

$T_{J(MAX)}$=Maximum allowable junction temperature (125 ℃ for the EM5111)

T_A=Ambient Temperature of the device

Output Voltage Setting

The EM5111 output voltage is programmed using an external resistor divider as shown in below Figure.



The output voltage is calculated using below Equation :

$$V_{OUT} = 1.25V \times \left(\frac{R1}{R2} + 1 \right)$$

Ordering & Marking Information

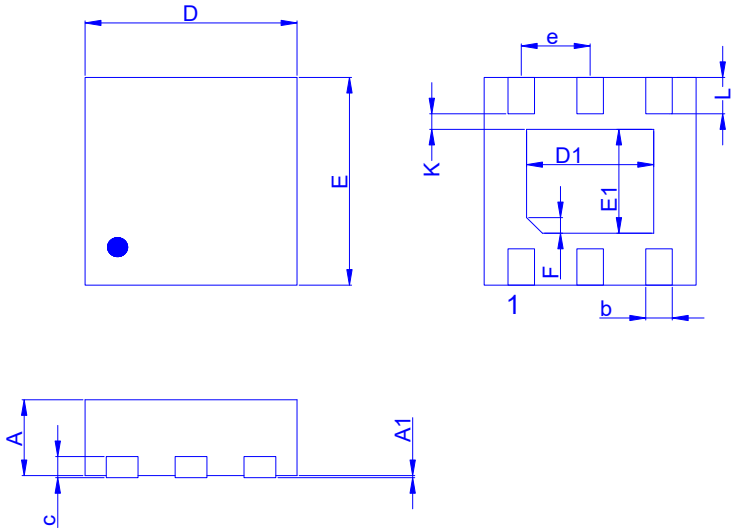
Device Name: EM5111VA-XXX for DFN2.0X2.0-06

XX: Device Code

Device	Code
EM5111VA-ADJ	D1
EM5111VA-180	D2
EM5111VA-250	D3
EM5111VA-280	D4
EM5111VA-300	D5
EM5111VA-330	D6
EM5111VA-360	D7
EM5111VA-500	D8

YWW: Date Code

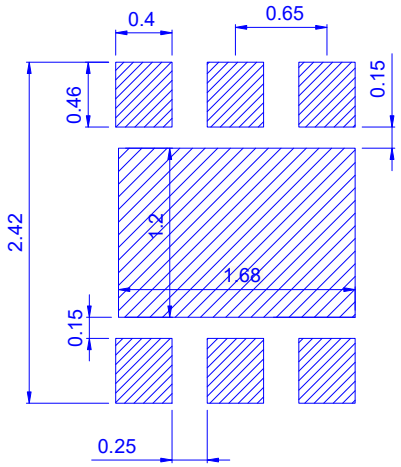
Outline Drawing



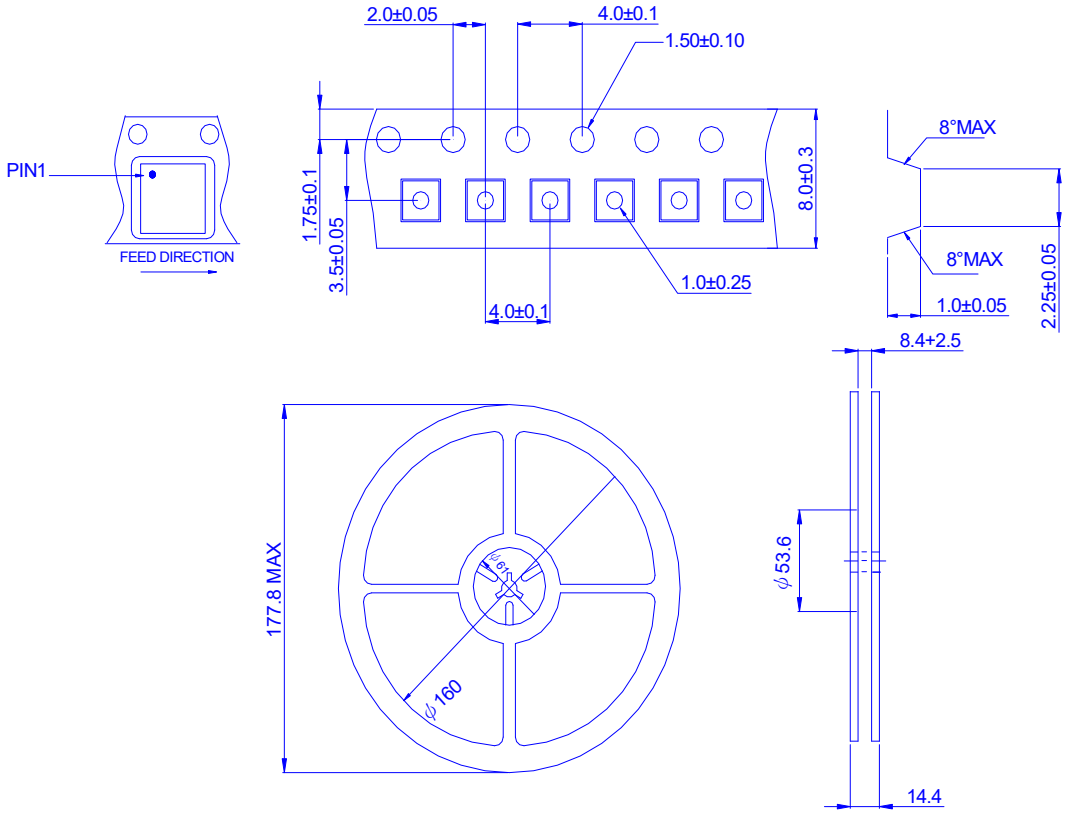
Dimension in mm

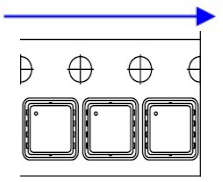
Dimension	A	A1	A2	b	D	D1	E	E1	e	F	K1	L
Min.	0.8	0	0.15	0.18	1.9	1.2	1.9	0.9			0.2	0.3
Typ.		0.02	0.2	0.25	2	1.3	2	0.8	0.65	0.25		0.35
Max.	0.9	0.05	0.25	0.3	2.1	1.4	2.1	0.7				0.4

Recommended minimum pads

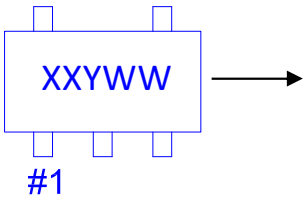


◆ Tape&Reel Information:3000pcs/Reel(Dimension in millimeter)



產品別	DFN2.0X2.0-06
Reel 尺寸	7”
編帶方式	FEED DIRECTION 
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

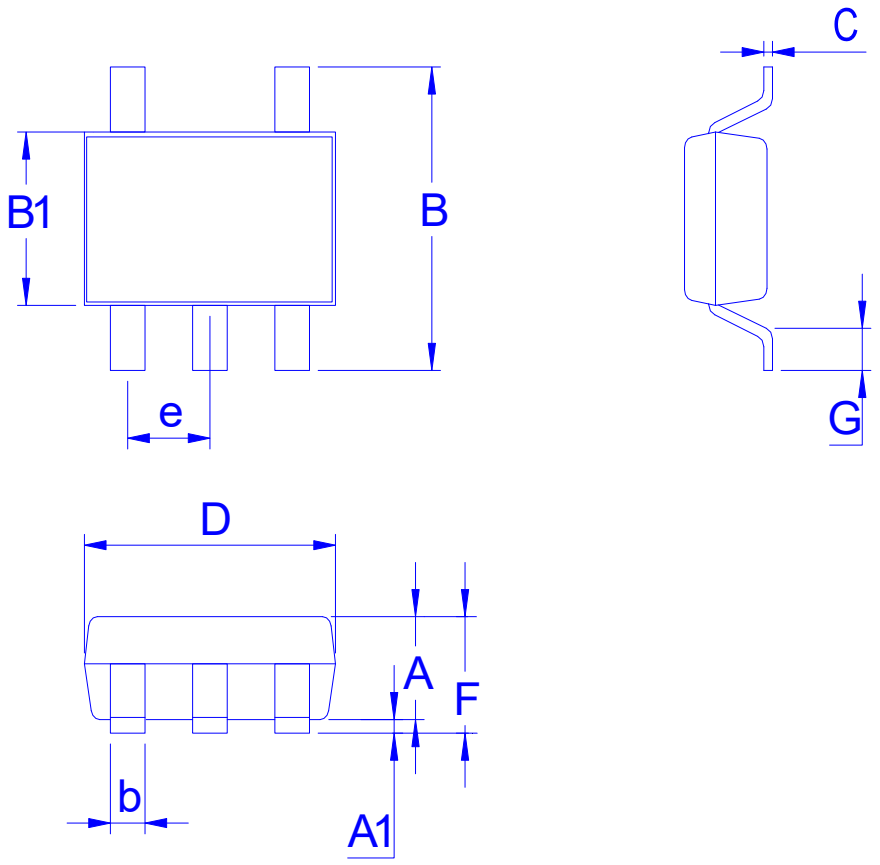
Device Name: EM5111J5-XXX for SOT23-5



XX: Device Code

Device	Code	Device	Code
EM5111J5 -ADJ	D1	EM5111AJ5 -ADJ	DA
EM5111J5 -180	D2	EM5111AJ5 -180	DB
EM5111J5 -250	D3	EM5111AJ5 -250	DC
EM5111J5 -280	D4	EM5111AJ5 -280	DD
EM5111J5 -300	D5	EM5111AJ5 -300	DE
EM5111J5 -330	D6	EM5111AJ5 -330	DF
EM5111J5-360	D7	EM5111AJ5-360	DG
EM5111J5-500	D8	EM5111AJ5-500	DH
YWW: Date Code		YWW: Date Code	

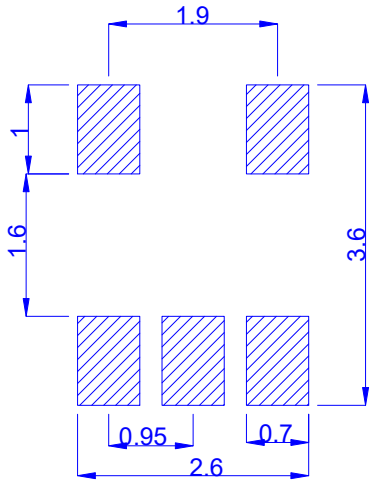
Outline Drawing



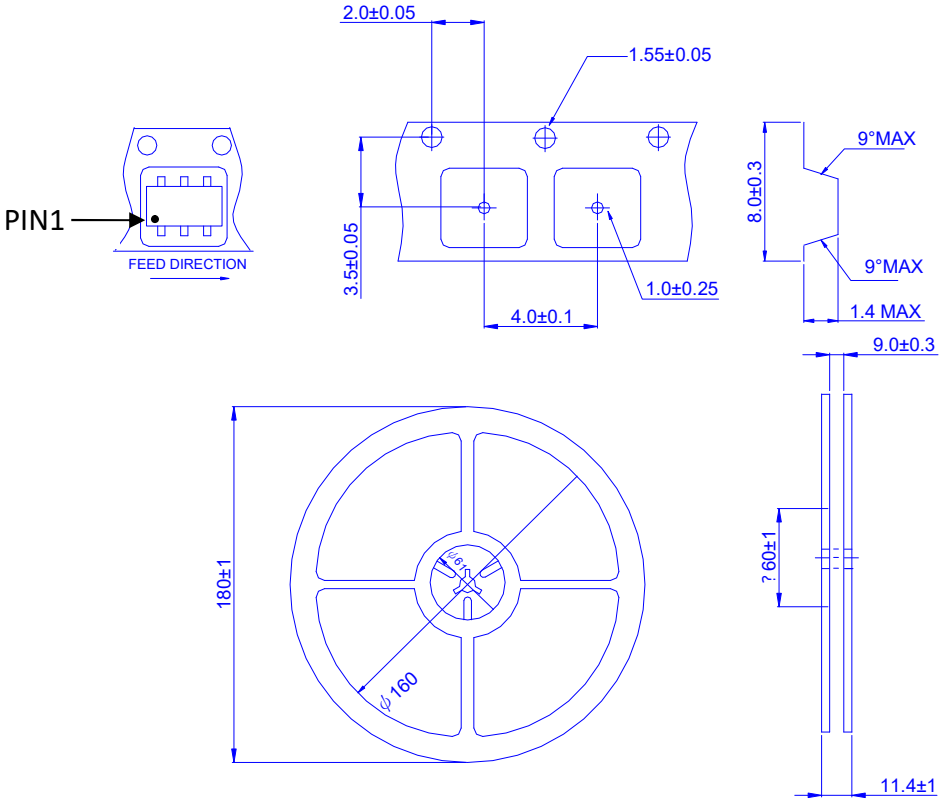
Dimension in mm

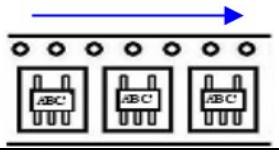
Dimension	A	A1	B	B1	b	C	D	e	F	G
Min.	0.9	0			0.3	0.08				0.3
Typ.	1.15		2.8	1.6			2.9	0.95		0.45
Max.	1.3	0.15			0.5	0.22			1.45	0.6

Recommended minimum pads

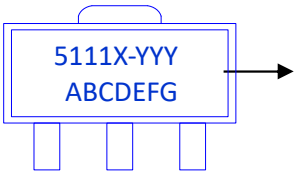


Tape&Reel Information:3000pcs/Reel(Dimension in millimeter)



產品別	SOT23-6
Reel 尺寸	7”
編帶方式	FEED DIRECTION 
50	50
50	50
裝箱數	
3K	3K
5：1	5：1
15K	15K
12：1	12：1
180K	180K

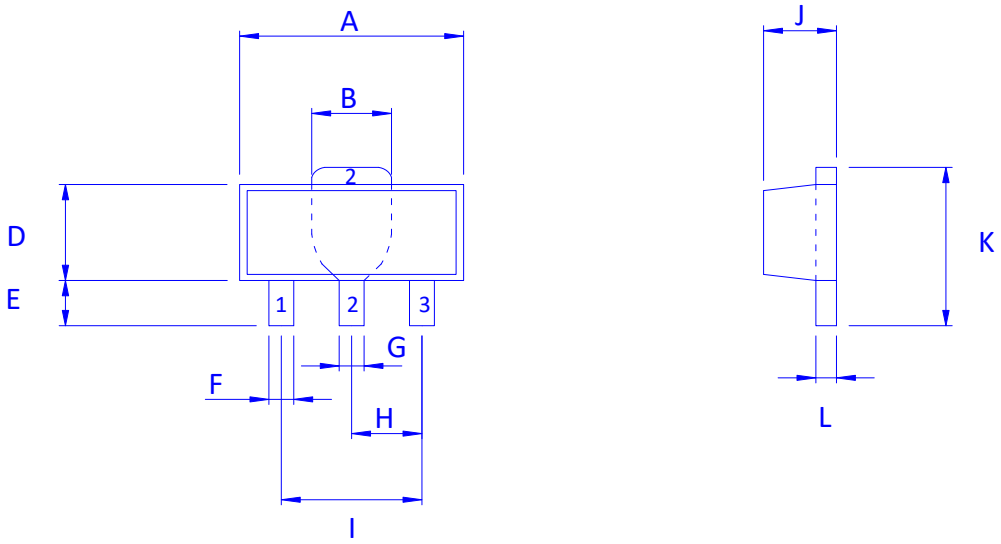
Device Name: EM5111AP/BP-YYY for SOT89-3



X	YYY	output ltage
SOT89-A	ADJ	Adjust
SOT89-B	180	1.8V
	250	2.5V
	280	2.8V
	300	3.0V
	330	3.3V
	360	3.6V
	500	5.0V

ABCDEFG: Date Code

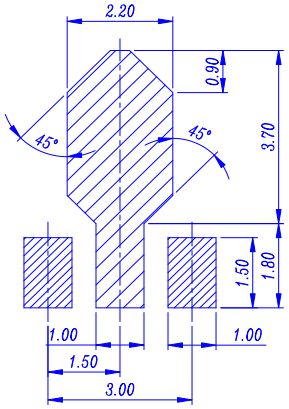
Outline Drawing



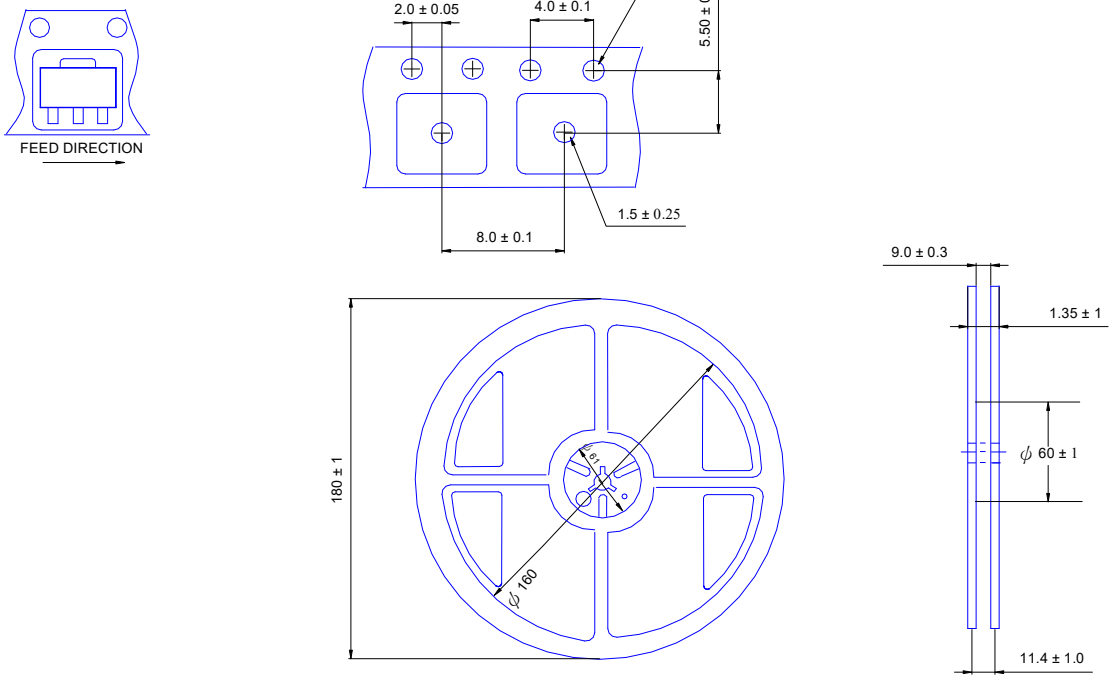
Dimension in mm

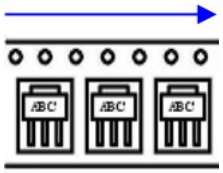
Dimension	A	B	D	E	F	G	H	I	J	K	L
Min.	4.3	1.35	2.29	0.8	0.32	0.4	1.4	2.8	1.3	3.8	0.3
Typ.	4.5	1.59	2.445	1.1	0.42	0.5	1.5	3	1.5	4.2	0.4
Max.	4.7	1.83	2.6	1.4	0.52	0.6	1.6	3.2	1.7	4.6	0.5

Recommended minimum pads

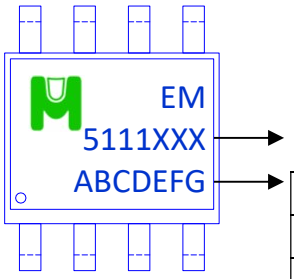


Tape&Reel Information:1000pcs/Reel



產品別	SOT89-3
Reel 尺寸	7”
編帶方式	FEED DIRECTION 
前空格	25
後空格	50
裝箱數	
滿捲數量	1K
捲/內盒比	5 : 1
內盒滿箱數	5K
內/外箱比	8 : 1
外箱滿箱數	40K

Device Name: EM5111GE-XXX for PSOP-8

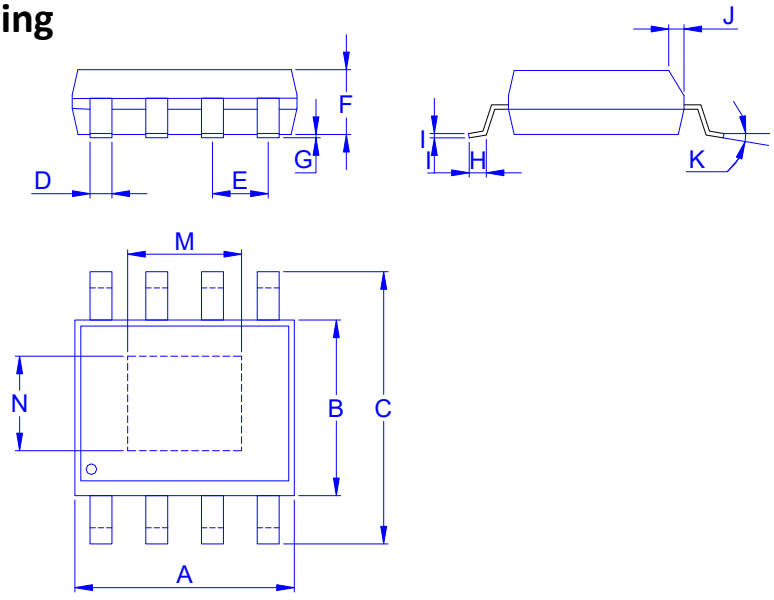


EM5111GE Device Name

XXX	output ltage
ADJ	Adjust
180	1.8V
250	2.5V
280	2.8V
300	3.0V
330	3.3V
360	3.6V
500	5.0V

ABCDEFG: Date Code

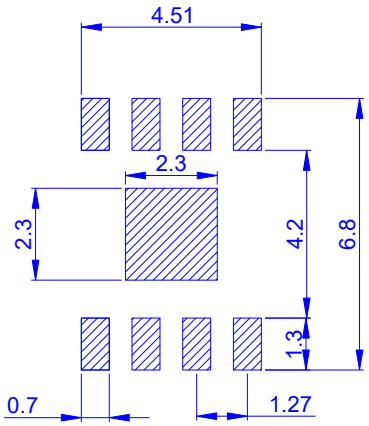
Outline Drawing



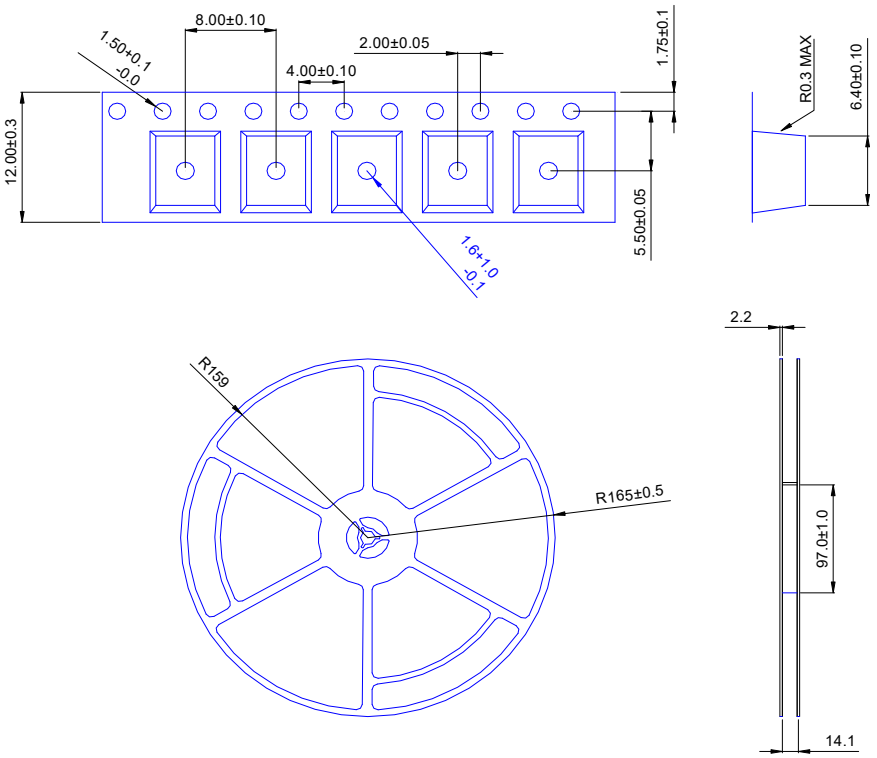
Dimension in mm

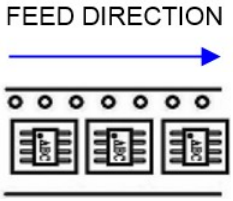
Dimension	A	B	C	D	E	F	G	H	I	J	K	M	N
Min.	4.7	3.7	5.8	0.33		1.2	0.02	0.4	0.19	0.25	0°	1.94	1.94
Typ.					1.27								
Max.	5.1	4.1	6.2	0.51		1.62	0.15	0.83	0.26	0.5	8°	2.49	2.49

Recommended minimum pads



◆ Tape&Reel Information:2500pcs/Reel



產品別	PSOP-8
Reel 尺寸	13”
編帶方式	
前空格	25
後空格	50
裝箱數	
滿捲數量	2.5K
捲/內盒比	1 : 1
內盒滿箱數	2.5K
內/外箱比	10 : 1
外箱滿箱數	25K