

Inrush Current Protection 300mA High Speed LDO Regulator

■ GENERAL DESCRIPTION

The LR5234 Series is a high speed LDO regulator that features high accurate, high ripple rejection, low dropout and low power consumption with Chip Enable Pin, The Series built-in Inrush Current Protection.

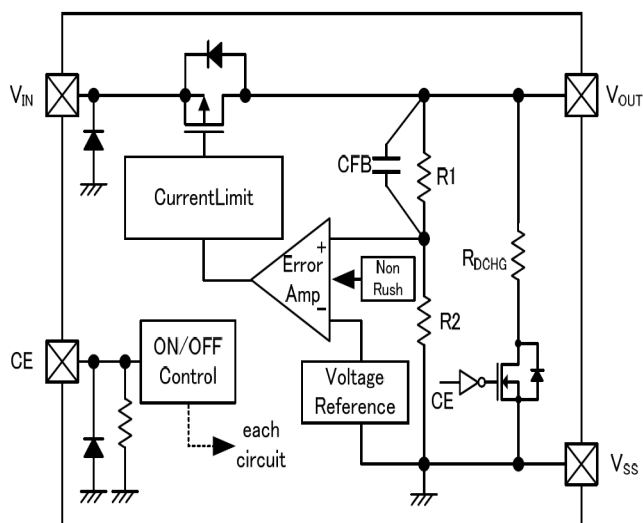
The current limiter's fold-back circuit operates as a short circuit protection as well as the output current limiter for the output pin.

The LR5234 Series features an internal soft-start to lower the inrush current, thus minimizing the input voltage drop during start up.

Output voltage is selectable from 0.8V to 5.0V which fixed by laser trimming technologies.

The LR5234 Series is available in SOT23/ SOT23-3L, SOT23-5L, SOT89-3L and DFN1x1-4L packages.

■ BLOCK DIAGRAM



■ FEATURES

- Output Accuracy: $\pm 2\%$
- Low Quiescent Current: 40uA
- Low Dropout Voltage: 42mV@100mA/3.3V
- High PSRR: 95dB@1KHz, 1mA
- Output Current: 300mA
- Excellent Line and Load Transient Response
- Operating Voltage Range: from 1.5V to 6.0V
- Output Voltage Range: from 0.8V to 5.0V
- Inrush Current Protection
- Over-Temperature Protection
- Current Limiting Protection
- Output Short-Circuit Protection
- Available in SOT23/SOT23-3L, SOT23-5L, SOT89-3L and DFN1x1-4L Packages

■ APPLICATIONS

- Battery-Powered Devices
- Reference Voltage Sources
- Other Low Voltage Power Suppliers

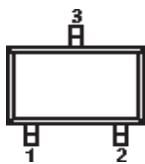
■ ORDERING INFORMATION

LR5234①②③④⑤

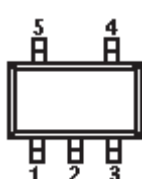
DESIGNATOR	SYMBOL	DESCRIPTION
①	A	Without EN
	B	High Active, pull-down resistor R4 built in, with C _{OUT} discharge resistor
	C	High Active, No pull-down resistor No C _{OUT} discharge resistor
②	A1/B1/C1/ D1/J2/ Integer	Output Voltage 1.05V=A1, 1.15V=B1, 1.25V=C1, 1.35V=D1, 2.85V=J2 For other voltage e.g. 1.8V=18, 3.3V=33, etc
③	M/MA/MC/MY	Package:SOT-23-3
	M/MF/ML	Package:SOT-23-5
	P/PT	Package:SOT-89-3
	F	Package:DFN1×1-4
④	T5AG	Tape information—With pin1 in Q1 quadrants (DFN1X1-4)
	-	Tape information—With pin1 in Q3 quadrants (DFN1X1-4)
	-	Other package

■ PIN CONFIGURATION

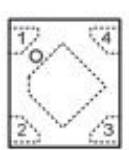
SOT-23-3



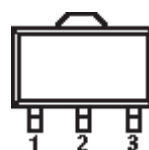
SOT-23-5



DFN1×1-4



SOT-89-3



SOT-23-3

PIN NUMBER				SYMBOL	FUNCTION
M	MA	MC	MY		
1	2	3	3	V _{SS}	Ground
2	1	2	1	V _{OUT}	Output
3	3	1	2	V _{IN}	Power Input Pin

SOT-23-5

PIN NUMBER			SYMBOL	FUNCTION
M	MF	ML		
1	1	5	V _{IN}	Power Input Pin
2	2	2	V _{SS}	Ground
3	—	1	CE	Chip Enable Pin
4	3/4	3	NC	No Connection
5	5	4	V _{OUT}	Output Pin

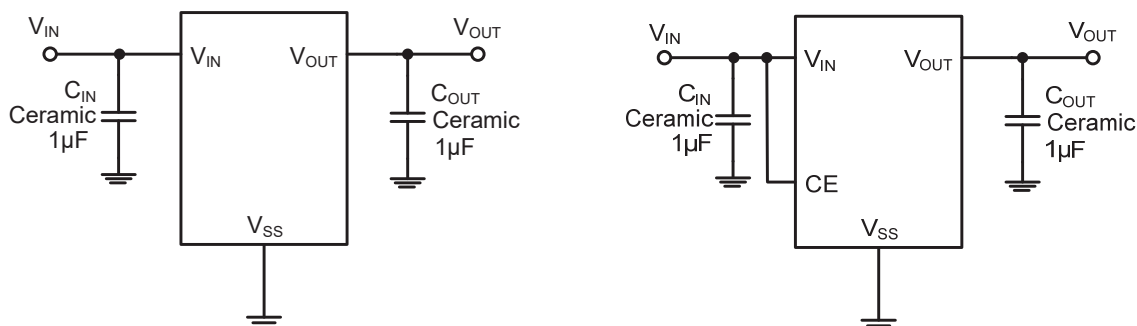
DFN1×1-4

PIN NUMBER	SYMBOL	FUNCTION
F		
1	V _{OUT}	Output Pin
2	V _{SS}	Ground
3	CE	Chip Enable Pin
4	V _{IN}	Power Input Pin
EP	Thermal PAD	Ground

SOT-89-3

PIN NUMBER		SYMBOL	FUNCTION
P	PT		
1	2	V _{SS}	Ground
3	1	V _{OUT}	Output
2	3	V _{IN}	Power Input Pin

■ TYPICAL APPLICATIONS



■ ABSOLUTE MAXIMUM RATINGS (Note1):

SYMBOL	ITEM		RATING	UNIT
V_{IN}	Supply Voltage		-0.3~7.0	V
V_{OUT}	VOUT pin Voltage		-0.3~($V_{IN}+0.3$)	V
PD	Maximum Power Dissipation	SOT23-5	675	mW
		SOT23	425	
		SOT89-3	600	
		DFN1X1-4L	580	
PTR	Package Thermal Resistance Θ_{JA} (Note 2)	SOT23-5	185	$^{\circ}\text{C}/\text{W}$
		SOT23	295	
		SOT89-3	208	
		DFN1X1-4L	215	
	Package Thermal Resistance Θ_{JC} (Note 2)	SOT23-5	40	$^{\circ}\text{C}/\text{W}$
T_J	Junction Temperature Range		-40~150	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range		-40~150	$^{\circ}\text{C}$
T_{SOLDER}	Lead Temperature (Soldering, 10 Sec)		260	$^{\circ}\text{C}$
$V_{(ESD)}$	ESD Susceptibility, HBM (Note 3)		± 4000	V

Note 1: Absolute Maximum Ratings are threshold limit values that must not be exceeded even for an instant under any condition. Moreover, such values for any two items must not be reached simultaneously. Operation above these absolute maximum ratings may cause degradation or permanent damage to the device. These are stress ratings only and do not necessarily imply functional operation below these limits.

Note 2: Thermal resistance test board size: 30.0mm×25.0mm×1.6mm (FR4); Copper foil: 35um; Standard soldering pad.

Note 3: per ANSI/ESDA/JEDEC JS 001

■ ELECTRICAL CHARACTERISTICS

($V_{IN}=V_{OUT}+1V$, $V_{OUT}=3.3V$, $C_{IN}=C_{OUT}=1\mu F$, $T_A=25^{\circ}C$, unless otherwise specified.)

Symbol	Parameter	Test Conditions	MIN	TYP	MAX	Units
V_{IN}	Input Voltage		1.5		6.0	V
V_{OUT}	Output Accuracy	$I_{OUT}=1mA$	-2		+2	%
I_{LIM}	Current Limit ⁽¹⁾	$V_{IN}=4.3V$, $V_{OUT}=3.3V$	310	380		mA
I_Q	Quiescent Current	$V_{IN}=V_{EN}=V_{OUT}+1V$, No Load		40	60	μA
I_{SHD}	Shutdown Current	$V_{IN}=6.0V$, $V_{EN}=0V$			0.1	μA
V_{DROP}	Dropout Voltage ⁽²⁾	$I_{OUT}=100mA$, $V_{OUT}=3.3V$		42		mV
		$I_{OUT}=200mA$, $V_{OUT}=3.3V$		85		
		$I_{OUT}=300mA$, $V_{OUT}=3.3V$		130		
S_{LINE}	Line Regulation	$V_{IN}=V_{OUT}+1V$ to $6.0V$, $I_{OUT}=1mA$		0.06	0.13	%/V
S_{LOAD}	Load Regulation	$1mA \leq I_{OUT} \leq 300mA$		0.001	0.01	%/mA
I_{SHORT}	Short Current	$V_{OUT}=0V$		40		mA
V_{ENH}	EN High Voltage	$V_{IN}=1.5V$ to $6.0V$, $I_{OUT}=1mA$	1.5			V
V_{ENL}	EN Low Voltage				0.5	V
PSRR	Power Supply Rejection Ratio	$C_{IN}=None$, $V_{OUT}=3.3V$, $I_{OUT}=1mA$	$f=217Hz$	93		dB
			$f=1KHz$	95		
			$f=10KHz$	73		
T_{SD}	Thermal Shutdown	Temperature rising		155		$^{\circ}C$
ΔT_{SD}	TSD Hysteresis	Temperature falling		20		$^{\circ}C$
R_{DSCHG}	R_{ON} of Discharge MOSFET	$V_{IN}=6V$, $V_{EN}=0V$		200		Ω
I_{RUSH}	Inrush Current	$V_{IN}=5.0V$, No load		180		mA

NOTES:

1. Guaranteed by design
2. The dropout voltage is defined as $V_{IN} - V_{OUT}$, when $V_{OUT}=95\%*V_{OUT(NOM)}$

■ APPLICATION INFORMATION

● Detail Operation Description

The LR5234 Series is a low power consumption low drop-out voltage regulator. It consists of a current limiter circuit, a driver transistor, a precision reference voltage and an error correction circuit, and is compatible with low ESR ceramic capacitors. The current limiter's fold-back circuit operates as a short circuit protection as well as the output current limiter.

● Input Capacitor Selection

Like any low-dropout regulator, the external capacitors used with the LR5234 Series must be carefully selected for regulator stability and performance. Using a capacitor whose value is $\geq 1\mu\text{F}$ on the LR5234 Series input and the amount of capacitance can be increased without limit. The input capacitor must be located a distance of not more than 0.5 inch from the input pin of the IC and returned to a clean analog ground. Any good quality ceramic or tantalum can be used for this capacitor. The capacitor with larger value and lower ESR (equivalent series resistance) provides better PSRR and line-transient response.

● Layout Considerations

To improve ac performance such as PSRR, output noise, and transient response, it is recommended that the PCB be designed with separate ground planes for VIN and VOUT, with each ground plane connected only at the GND pin of the device.

● Current Limiting and Short-Circuit Protection

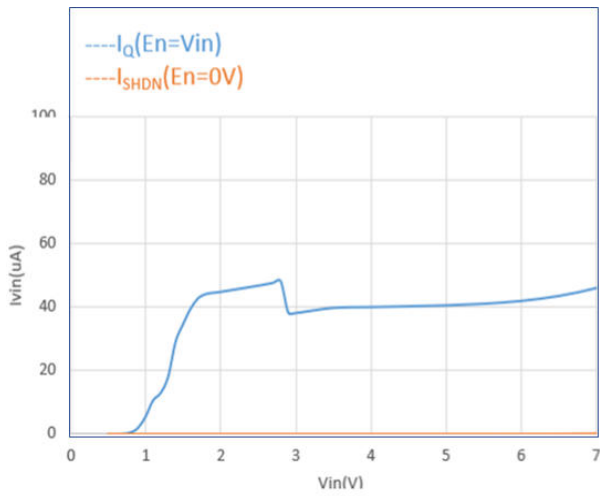
The current limit circuitry prevents damage to the MOSFET switch and the hub downstream port but can deliver load current up to the current limit threshold of typically 300mA through the switch. When a heavy load or short circuit is applied to an enabled switch, a large transient current may flow until the current limit circuitry responds. Once this current limit threshold is exceeded the device enters constant current mode until the thermal shutdown occurs or the fault is removed.

● Output Capacitor Selection

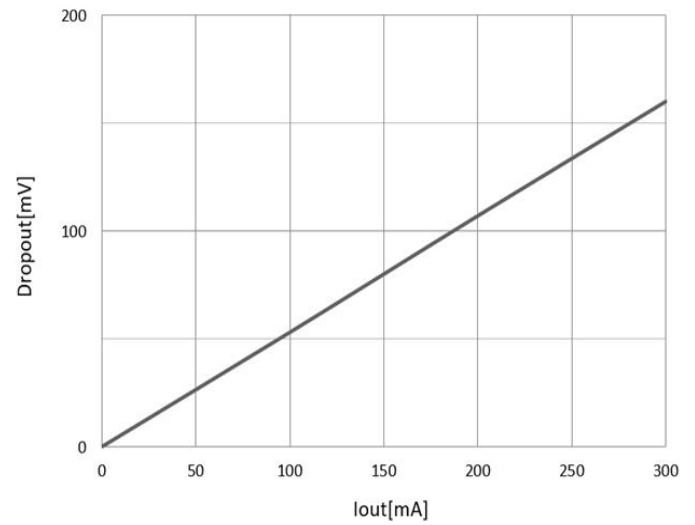
The output capacitor must meet both requirements for minimum amount of capacitance and ESR in all LDOs application. The LR5234 Series is designed specifically to work with low ESR ceramic output capacitor in space-saving and performance consideration. Using a ceramic capacitor whose value is at least $1\mu\text{F}$ on the LR5234 Series output ensures stability. Output capacitor of larger capacitance can reduce noise and improve load transient response, stability, and PSRR. The output capacitor should be located not more than 0.5 inch from the VOUT pin of the LR5234 Series and returned to a clean analog ground.

■ ELECTRICAL CHARACTERISTIC CURVES

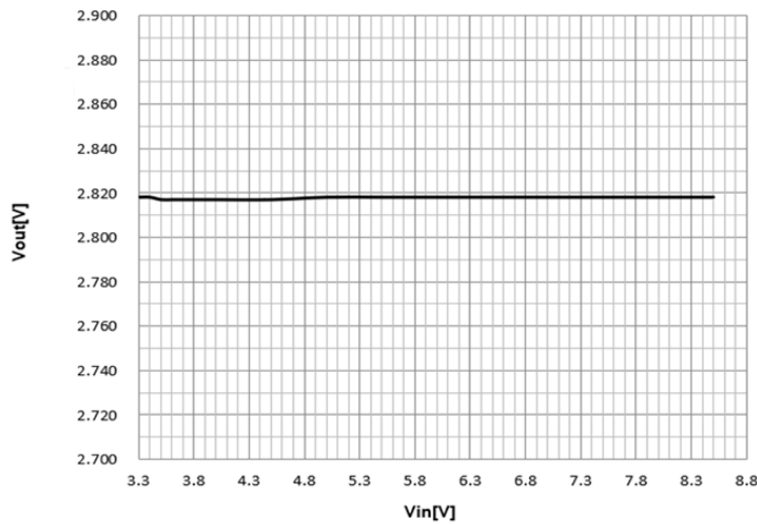
Vin VS IQ



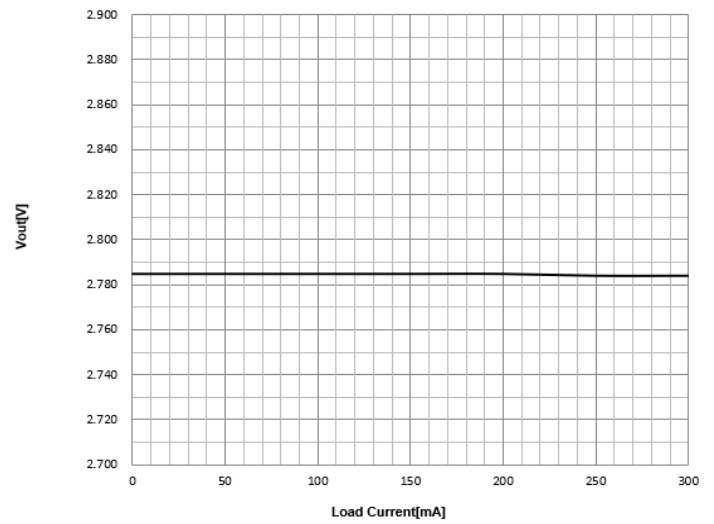
Dropout Voltage



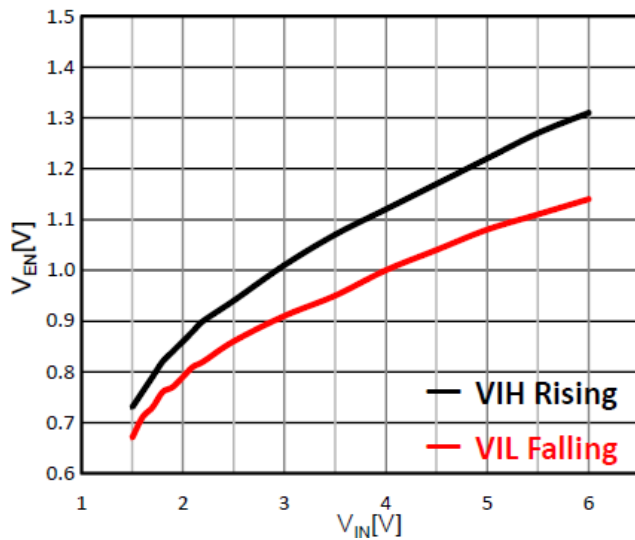
Line Regulation



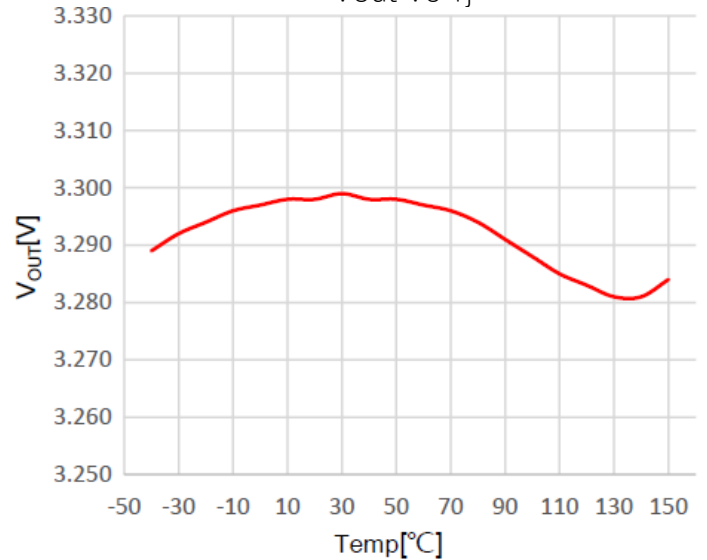
Load Regulation



Vin-VEN

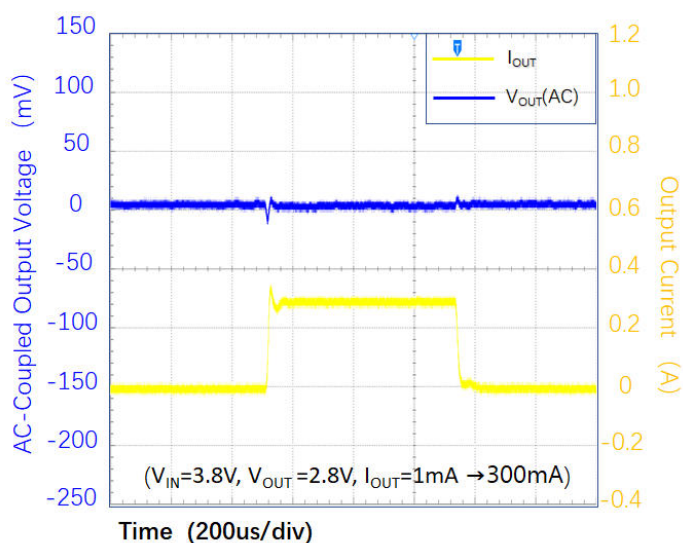


Vout VS Tj

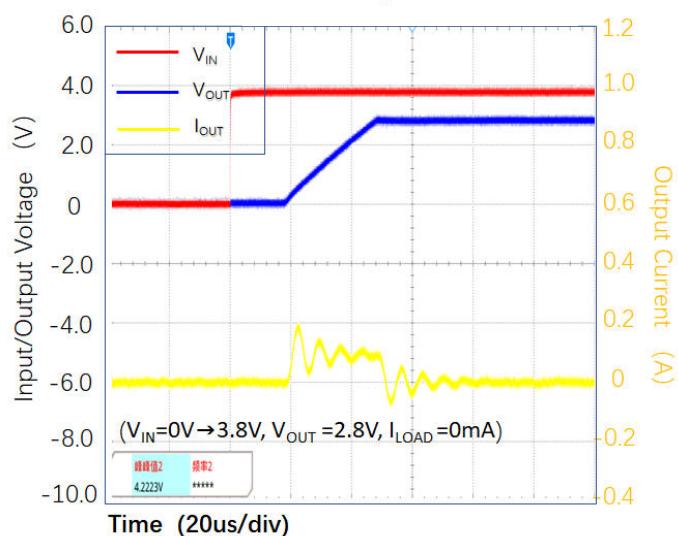


ELECTRICAL CHARACTERISTIC CURVES

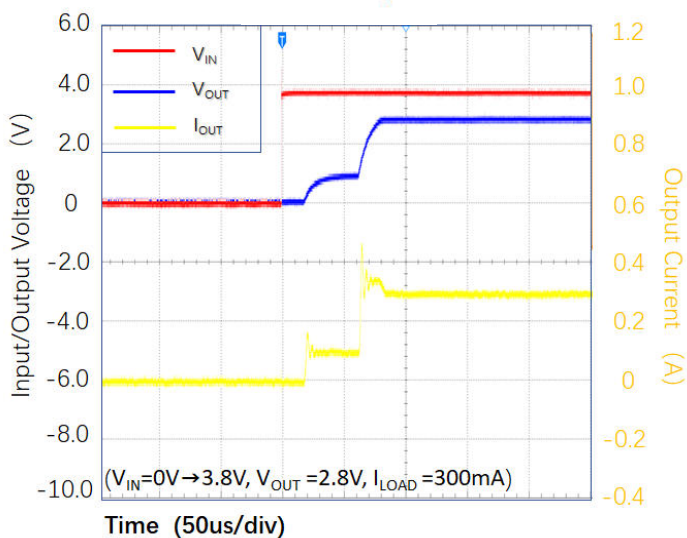
Load Transient



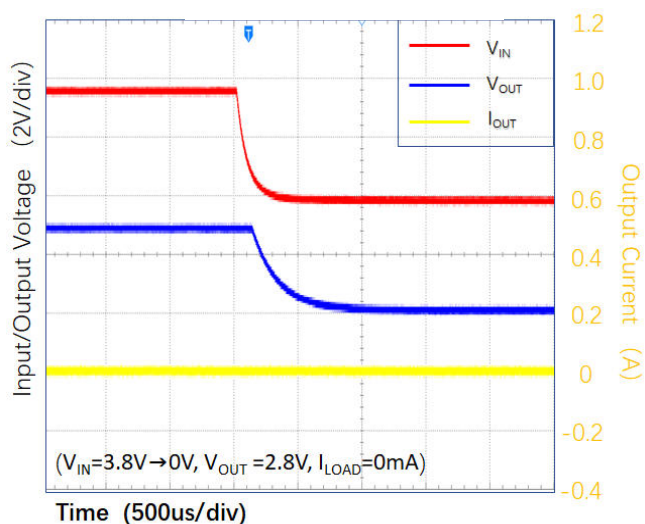
Start-Up



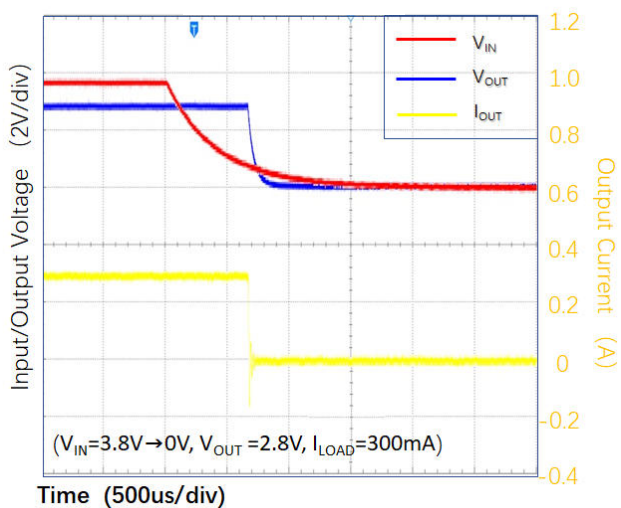
Start-Up



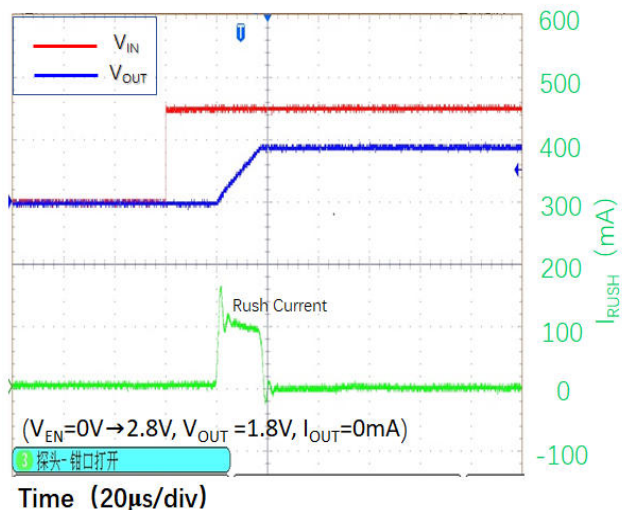
Shut-Down



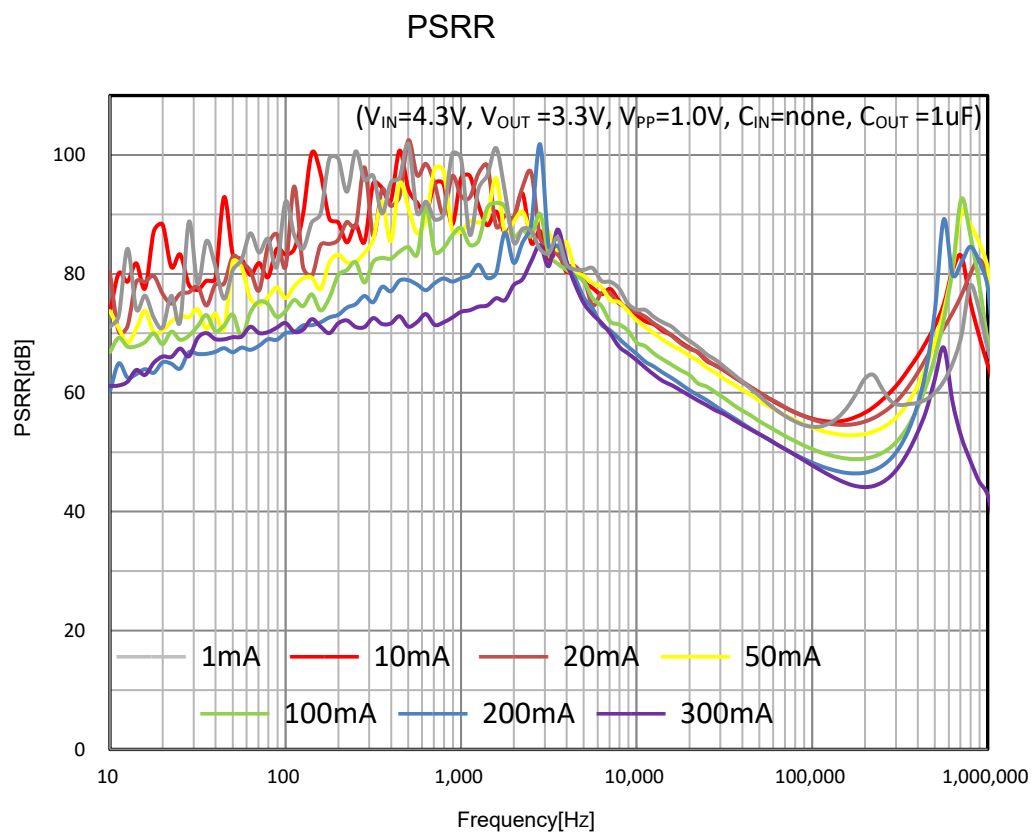
Shut-Down



INRUSH CURRENT

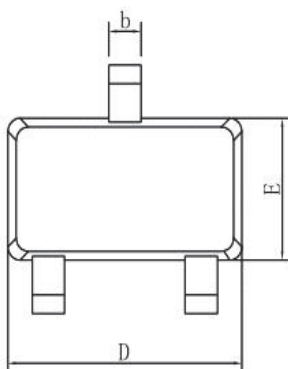
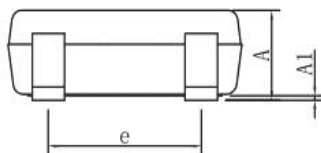
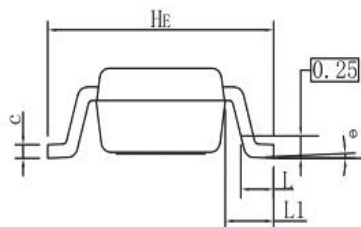


■ ELECTRICAL CHARACTERISTIC CURVES



■ PACKAGING INFORMATION

● SOT-23-3 PACKAGE OUTLINE DIMENSIONS

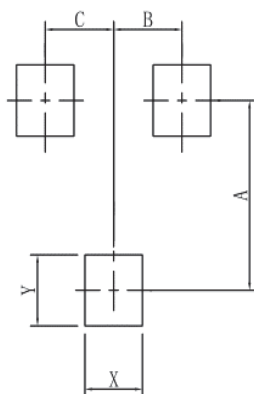


DIM	MIN	NOR	MAX
A	0.90	1.00	1.10
A1	0.01	0.06	0.10
b	0.30	0.40	0.50
c	0.10	0.17	0.20
D	2.80	2.90	3.00
E	1.50	1.60	1.70
e	1.80	1.90	2.00
L	0.20	0.40	0.60
L1	0.60REF		
HE	2.60	2.80	3.00
θ	0°	-	10°
All Dimensions in mm			

GENERAL NOTES

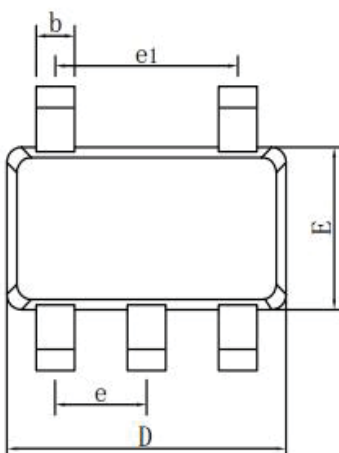
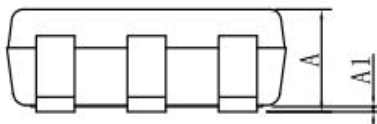
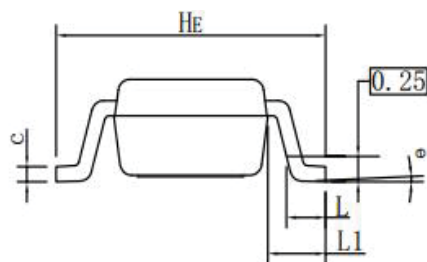
- 1.Top package surface finish Ra0.4±0.2um
- 2.Bottom package surface finish Ra0.7±0.2um
- 3.Side package surface finish Ra0.4±0.2um

SOLDERING FOOTPRINT



DIM	(mm)
X	0.80
Y	0.90
A	2.40
B	0.95
C	0.95

• SOT-23-5 PACKAGE OUTLINE DIMENSIONS

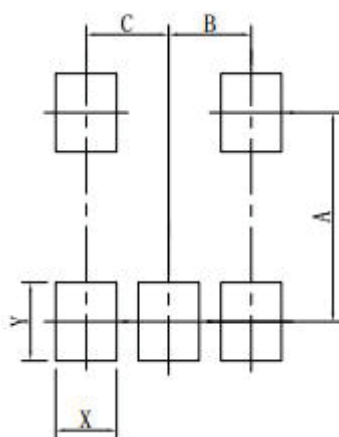


DIM	MIN	NOR	MAX
A	0.90	1.00	1.10
A1	0.01	0.06	0.10
b	0.30	0.40	0.50
c	0.10	0.17	0.20
D	2.80	2.90	3.00
E	1.50	1.60	1.70
e	0.85	0.95	1.05
e1	1.80	1.90	2.00
L	0.20	0.40	0.60
L1	0.60REF		
HE	2.60	2.80	3.00
θ	0°	-	10°

GENERAL NOTES

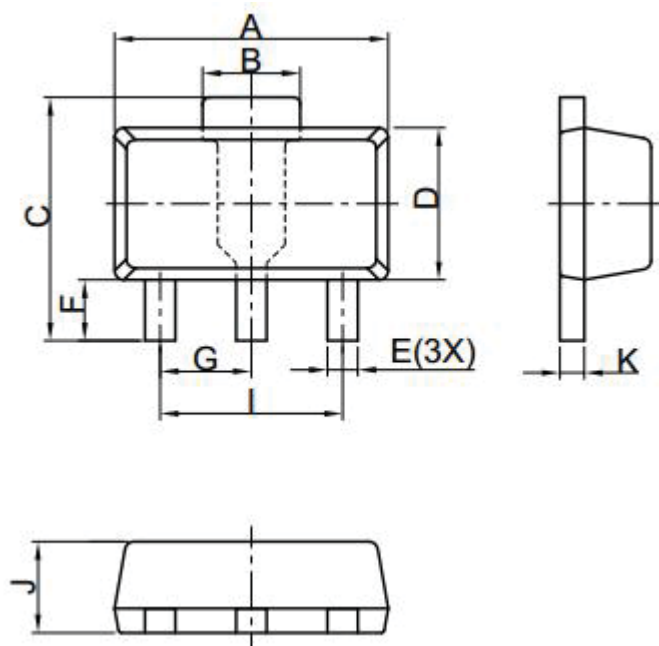
- 1.Top package surface finish Ra0.4±0.2um
- 2.Bottom package surface finish Ra0.7±0.2um
- 3.Side package surface finish Ra0.4±0.2um

SOLDERING FOOTPRINT



DIM	(mm)
X	0.70
Y	0.90
A	2.40
B	0.95
C	0.95

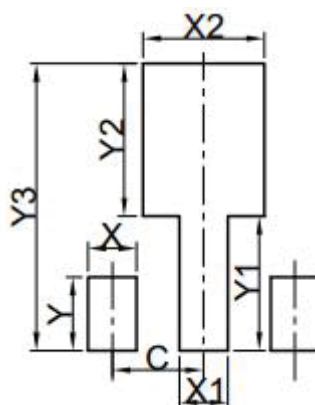
● SOT-89-3 PACKAGE OUTLINE DIMENSIONS



DIM	MIN	NOR	MAX
A	4.40	4.50	4.60
B	1.40	1.60	1.80
C	3.90	4.00	4.25
D	2.40	2.50	2.60
E	0.40	0.50	0.58
F	0.90	1.00	1.20
G	1.50 BSC		
I	3.00 BSC		
J	1.40	1.50	1.60
K	0.34	0.40	0.50
All Dimensions in mm			

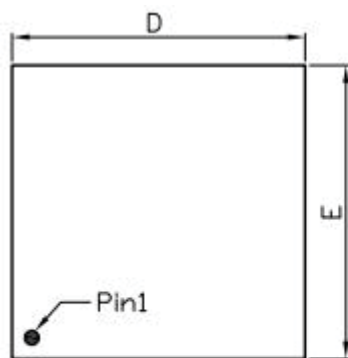
\$\$\$567689:\$7% 26/
; <2.=\$=Ä !Ä" #\$\$>?Ä #5?*)- @\$ÄA<BCD&,
D<E.' '\$=\$=Ä !Ä" #\$\$>?Ä #5?*)- @\$ÄÄFCA-D&,
G\$)#\$=Ä !Ä"#\$- &>Ä #5?*)- @\$ÄÄBCA<D&,
B\$Ä>.>&-).* \$ -5Ä#E&>@\$Ä(\$*.'\$#H# #0\$ÄA, ,
=>#0#<

SOLDERING FOOTPRINT

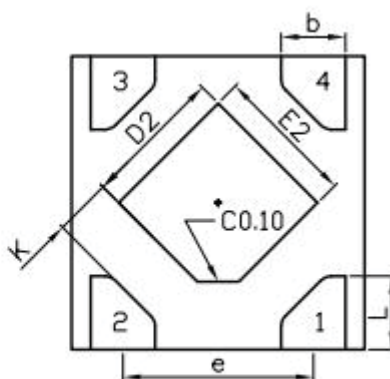


DIM	(mm)
X	0.80
Y	1.20
X1	0.80
Y1	2.20
X2	2.00
Y2	2.50
C	1.50
Y3	4.70

● DFN1×1-4 PACKAGE OUTLINE DIMENSIONS

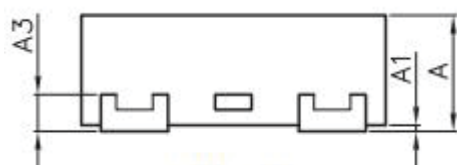


TOP VIEW



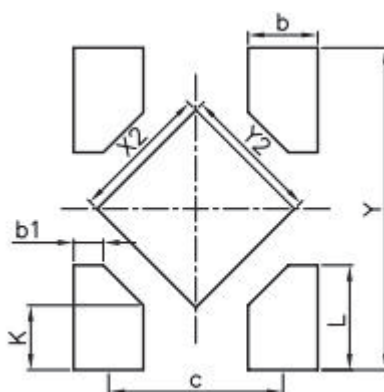
BOTTOM VIEW

DFN1010			
DIM	MIN	NOR	MAX
A	0.34	0.37	0.40
A1	0.01	0.02	0.05
b	0.17	0.22	0.25
L	0.20	0.25	0.30
D	0.95	1.00	1.05
E	0.95	1.00	1.05
D2	0.43	0.48	0.53
E2	0.43	0.48	0.53
e	0.65		
A3	0.127REF.		
K	0.15	-	-
All Dimensions in mm			



SIDE VIEW

SOLDERING FOOTPRINT



DFN1010	
DIM	(mm)
X2	0.52
Y2	0.52
L	0.39
Y	1.20
K	0.24
b	0.26
c	0.65
b1	0.11

■ ORDERING INFORMATION APPENDIX

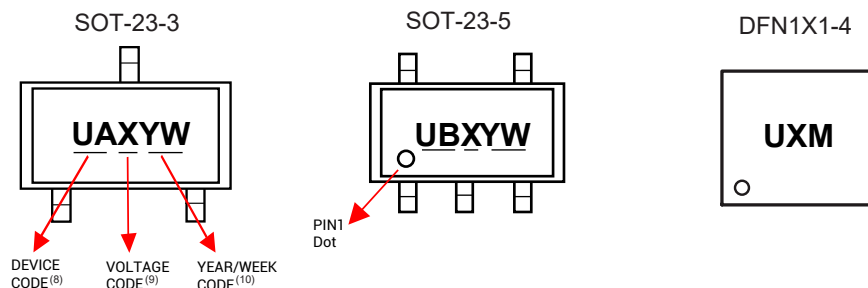
Device ⁽⁸⁾	Package	Output Voltage ⁽⁹⁾	Marking ⁽¹⁰⁾⁽¹¹⁾	Shipping
LR5234BxxF	DFN1x1-4	0.8V~5.0V	UX	10K/Reel
LR5234BxxFT5AG	DFN1x1-4	0.8V~5.0V	UX	10K/Reel
LR5234AxxM	SOT-23-3	0.8V~5.0V	UAX	3K/Reel
LR5234BxxM	SOT-23-5	0.8V~5.0V	UBX	3K/Reel

(8) The "xx" in part number represents output voltage, eg "18" = 1.8V, "50" = 5.0V.

(9) Output voltage varies from 0.8V to 5.0V, 0.1V an interval.

(10) There are additional marking , which relates to the date code. For detailed information, please refer to MARKING INFORMATION APPENDIX below.

■ MARKING INFORMATION APPENDIX



(11) The first two letters in the Marking represent DEVICE CODE.

For DFN1X1-4 package, DEVICE CODE has only one letter.

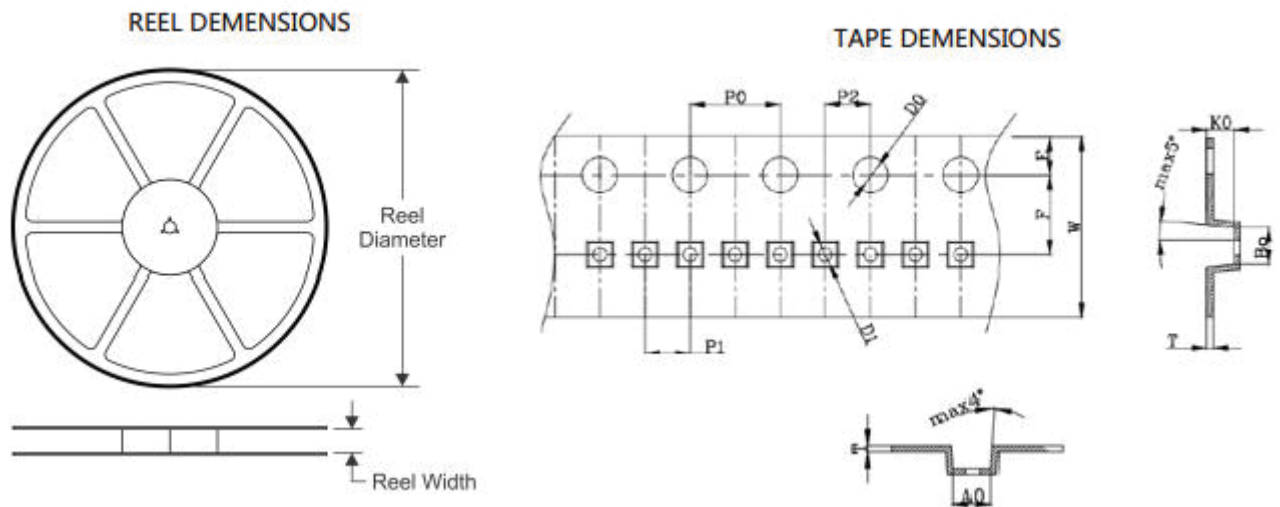
(12) The following letter "X" in the Marking changes along with the output voltage, as the chart shows below.

Voltage(V)	0.8	0.9	1.0	1.2	1.5	1.8	2.5	2.7	2.8	3.0	3.3	3.6	4.0	5.0	...
Symbol	j	O	D	E	F	G	H	I	J	K	L	M	N	P	...

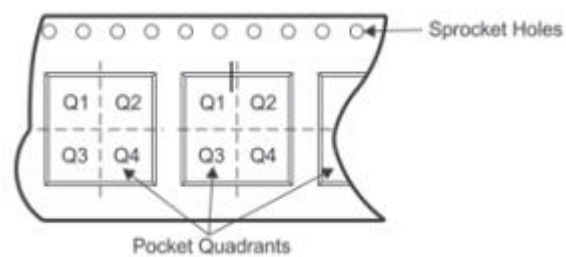
(13) The last two letters in the Marking represent YEAR/WEEK CODE.

For DFN1X1-4 package, YEAR/WEEK CODE has only one letter.

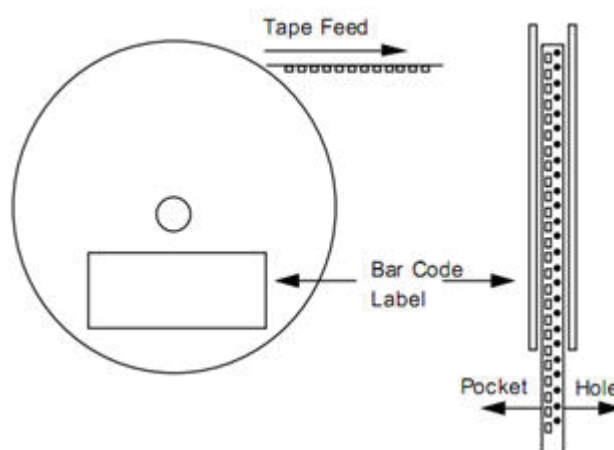
■ TAPE AND REEL INFORMATION



PIN ORIENTATION



ROLLING ORIENTATION



Device	Package	Reel Diameter (mm)	Reel width (mm)	P0 (mm)	P1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	W (mm)	PIN1
LR5233BxxF	DFN1X1-4	178±1	9.6±1.2	4.00±0.1	2.00±0.05	1.16±0.05	1.16±0.05	0.5±0.05	8.00±0.1	Q3
LR5233BxxFT5AG	DFN1X1-4	178±1	9.6±1.2	4.00±0.1	2.00±0.05	1.16±0.05	1.16±0.05	0.5±0.05	8.00±0.1	Q1
LR5233AxxM	SOT-23-3	178±1	9.6±1.2	4.00±0.1	4.00±0.1	3.1±0.1	3.28±0.05	1.32±0.05	8.0±0.1	NA
LR5233BxxM	SOT-23-5	178±1	9.6±1.2	4.00±0.1	4.00±0.1	3.25±0.1	3.15±0.05	1.5±0.05	8.0±0.1	Q3

■ REVISION HISTORY

Version	Description	Update by	Update Date
1.3	增加产品marking详细说明	Chen S	2022-11-09
1.4	增加电气特性曲线.	Chen S	2023-06-02
1.5	增加LR5234AxxM对应产品型号, 引脚顺序和marking.	Chen S	2023-07-10
1.6	根据最新芯片规格新更新部分电参数限值.	Chen S	2023-08-24
1.7	根据实测数据更新SOT23和DFN1010-A的Pd和R θ ja参数, 增加SOT25的R θ jc参数, 输出电压精度由 $\pm 1.5\%$ 改为 $\pm 2\%$.	Chen S	2023-09-06

DISCLAIMER

- Curve guarantee in the specification. The curve of test items with electric parameter is used as quality guarantee. The curve of test items without electric parameter is used as reference only.
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