Ultra Low Consumption Current High PSRR 300mA CMOS Voltage Regulator

LR6231 Series

■ INTRODUCTION

The LR6231 series are a group of positive voltage regulators manufactured by CMOS technologies with ultra low power consumption and low dropout voltage, which provide large output currents even when the difference of the input-output voltage is small. The LR6231 series can deliver 300mA output current and allow an input voltage as high as 7V. The series are very suitable for the battery-powered equipments, such as RF applications and other systems requiring a quiet voltage source.

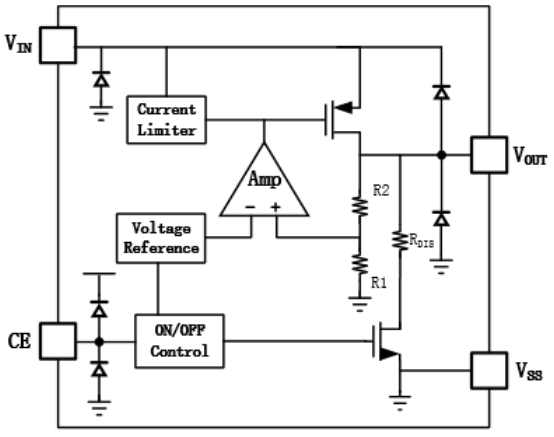
■ FEATURES

- Operating Voltage:1.8V~7.0V
- Output Voltage:1.2V ~ 3.6V
- High Accuracy: ±2 %/±1%(Typ.)
- Low Quiescent Current:0.8μA
- Output Current: 300mA
- Low Dropout Voltage: 110mV@100mA(V_{OUT}=3.0V)
- High Ripple Rejection:70dB@1kHz
- Excellent Line and Load Transient Response
- Built-in Current Limiter, Short-Circuit Protection
- TTL- Logic-Controlled Shutdown Input

■ APPLICATIONS

- Portable consumer equipments
- Radio control systems
- Laptop, Palmtops and PDAs
- Wireless Commumication Equipments
- Portable Audio Video Equipments
- Ultra Low Power Microcontroller

■ BLOCK DIAGRAM



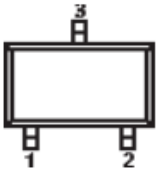
■ ORDER INFORMATION

LR6231①②③④⑤

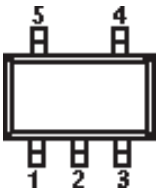
DESIGNATOR	SYMBOL	DESCRIPTION
①	A	**Standard**
	B	**With Shutdown Function**
②③	Integer	**Output Voltage e.g.1.8V=②:1, ③:8**
④	MT/MA/MC/MY	**Package:SOT-23-3**
	M	**Package:SOT-23-5**
	F	**Package:DFN1×1-4**
	P/PT	**Package:SOT89**
⑤	-	Vout tolerance: 2%
	1	Vout tolerance: 1%

■ PIN CONFIGURATION

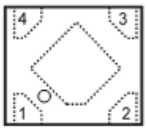
SOT23-3



SOT25-5



DFN1X1-4



SOT-89-3

PIN NUMBER						PIN NAME	FUNCTION
SOT-23-3				SOT-89-3			
MT	MA	MC	MY	P	PT		
1	2	3	3	1	2	V_{SS}	Ground
2	1	2	1	3	1	V_{OUT}	Output pin
3	3	1	2	2	3	V_{IN}	Power Input Pin

SOT-23-5

PIN NUMBER	SYMBOL	FUNCTION
1	V_{IN}	Power Input Pin
2	V_{SS}	Ground
3	CE	Chip Enable Pin
4	NC	No Connection
5	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

■ ABSOLUTE MAXIMUM RATINGS (Unless otherwise specified, Ta=25°C)

PARAMETER		SYMBOL	RATINGS	UNITS
Input Voltage		V_{IN}	V_{SS} -0.3~V_{SS}+7	V
Output Current		I_{OUT}	600	mA
Output Voltage		V_{OUT}	V_{SS} -0.3~V_{IN}+0.3	V
Power Dissipation	SOT-23	Pd	400	mW
	DFN1X1-4	Pd	400	mW
	SOT-89	Pd	500	mW
Operating Temperature		T_{opr}	-40~+85	℃
Storage Temperature		T_{stg}	-40~+150	℃
Soldering Temperature & Time		T_{solder}	260℃ , 10s	—
ESD rating(1)		Human Body Model-(HBM)	4000	V

Note: (1) ESD testing is performed according to the respective AEC-Q100 standard

■ ELECTRICAL CHARACTERISTICS

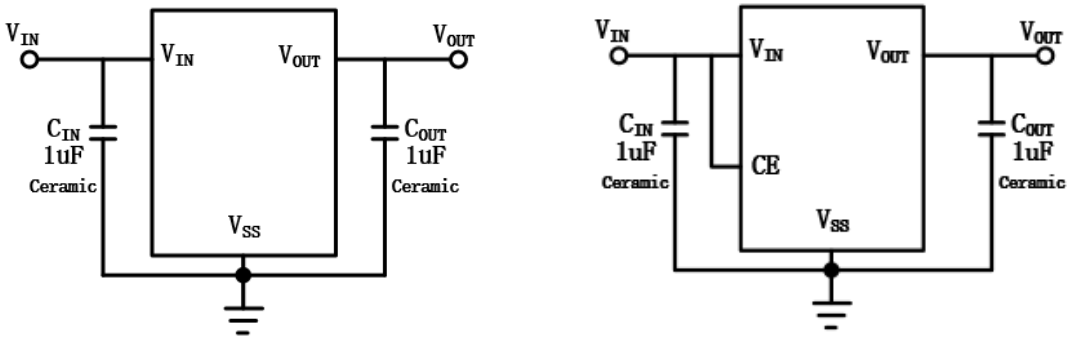
LR6231 Series (V_{IN}=V_{OUT}+1V, C_{IN}=C_{OUT}=1uF, Ta=25°C,unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS		MIN.	TYP.(3)	MAX.	UNITS
Input Voltage	V_{IN}	—		1.8	—	7.0	V
Output Voltage	V_{OUT}	—		1.2	—	3.6	V
DC Output Accuracy	—	I_{OUT}=1mA		-2	—	2	%
				-1	—	1	%
Output Current	I_{OUT}	V_{IN}=1.8V		150	—	—	mA
		V_{IN}=4.3V		350	—	—	
Dropout Voltage	V_{dif} (2)	I_{OUT} =100mA,V_{OUT}=3.0V		—	110	—	mV
Supply Current	I_{SS}	I_{OUT}=0		0.45	0.8	1.3	μA
Standby Current	I_{STBY}	CE=V_{SS}		—	—	0.1	μA
Load Regulation	ΔV_{OUT}	V_{IN}= V_{OUT} +1V 1mA≤I_{OUT}≤100mA		—	5	—	mV
Line Regulation	$\frac{\Delta V_{OUT}}{V_{OUT}\times\Delta V_{IN}}$	I_{OUT} =10mA V_{OUT} +1V≤V_{IN}≤6V		—	0.03	0.2	%/V
Temperature Coefficient	$\frac{\Delta V_{OUT}}{V_{OUT}\times\Delta T_A}$	I_{OUT}=10mA -40°C<T_A<85°C		—	50	—	ppm
Output Current Limit	I_{LIM}	V_{OUT}=90%xV_{OUT} (V_{OUT}≥3.0V)		500	650	—	mA
Short Current	I_{SHORT}	V_{OUT} =V_{SS}		—	10	—	mA
Power Supply Rejection Ratio	PSRR	I_{OUT}=50mA	100Hz	—	65	—	dB
			1kHz	—	70	—	
			10kHz	—	50	—	
			100kHz	—	35	—	
CE "High" Voltage	V_{CE}"H"	—		1.5	—	V_{IN}	V
CE "Low" Voltage	V_{CE}"L"	—		—	—	0.3	V
COUT Auto-Discharge Resistance	$R_{DISCHRG}$	V_{IN}=5V, V_{OUT}=3.0V V_{CE}=V_{SS}		—	200	—	Ω

NOTE:

（2）. V_{dif} = The Difference Of Output Voltage And Input Voltage When Input Voltage Is Decreased Gradually Till Output Voltage Equals To 98% Of V_{OUT} .

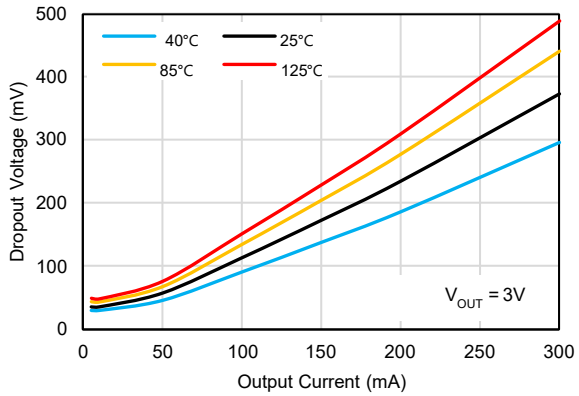
■ TYPICAL APPLICATION



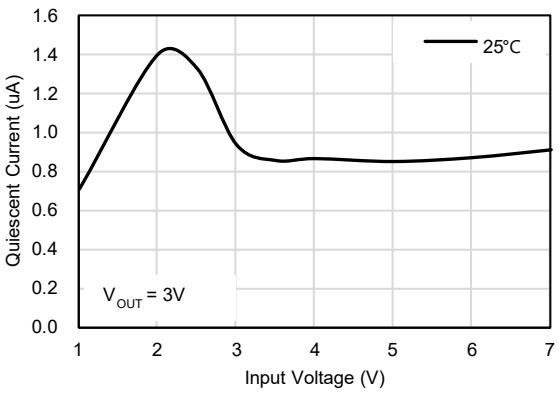
■ TYPICAL PERFORMANCE CHARACTERISTICS

(V_{IN}=V_{OUT}+1V, C_{IN}=C_{OUT}=1uF, Ta=25°C,unless otherwise specified)

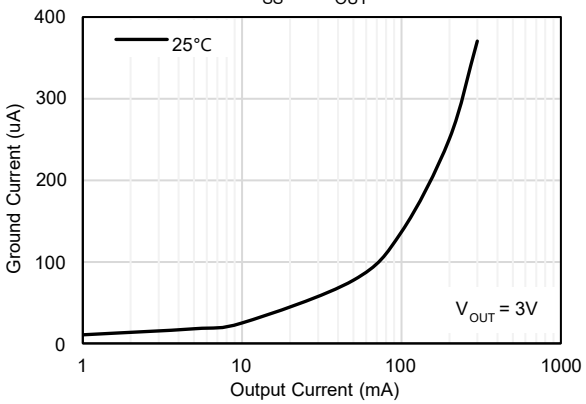
Dropout Voltage vs. I_{OUT}



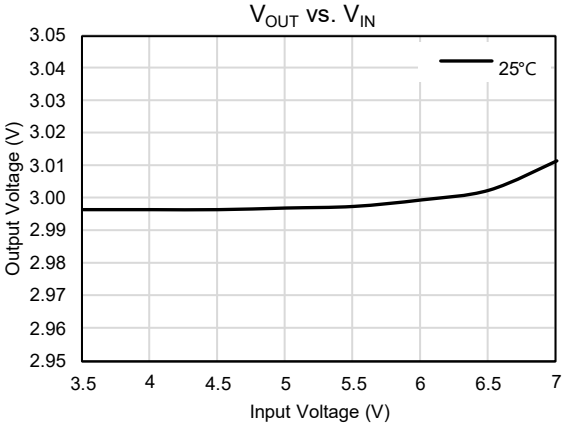
I_Q vs. V_{IN}



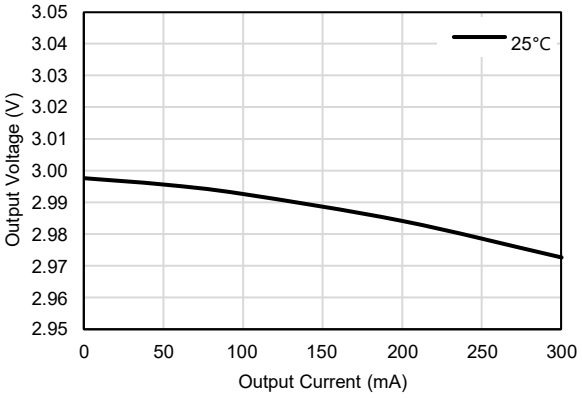
I_{SS} vs. I_{OUT}



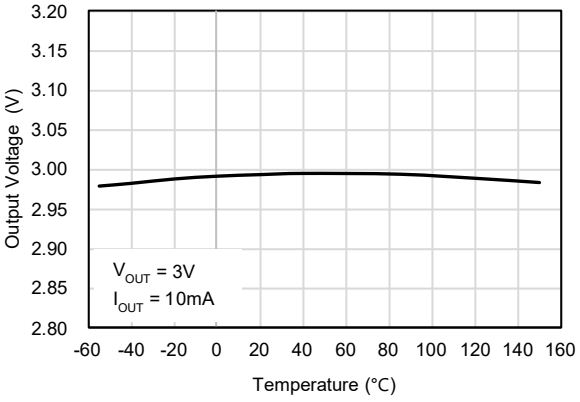
V_{OUT} vs. V_{IN}



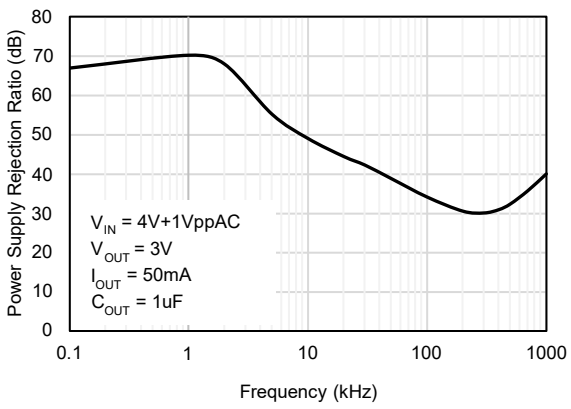
V_{OUT} vs. I_{OUT}



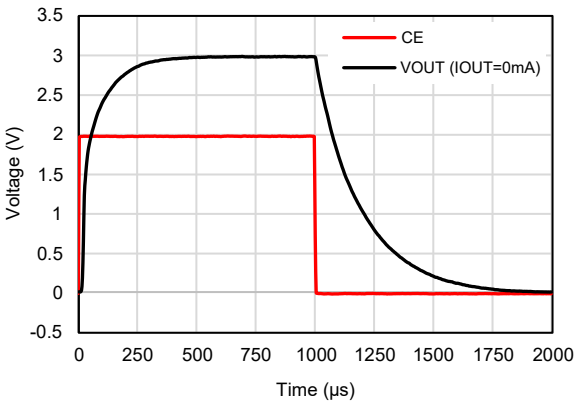
Temperature Coefficient



PSRR

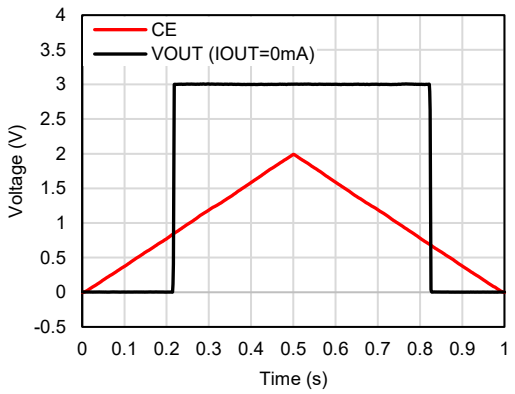


CE On/Off Response

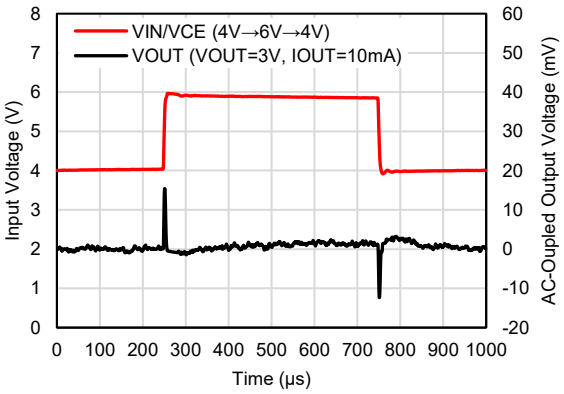


■ TYPICAL PERFORMANCE CHARACTERISTICS (continued)

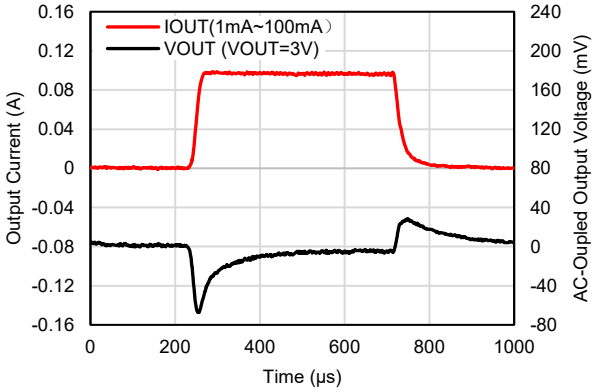
CE Threshold



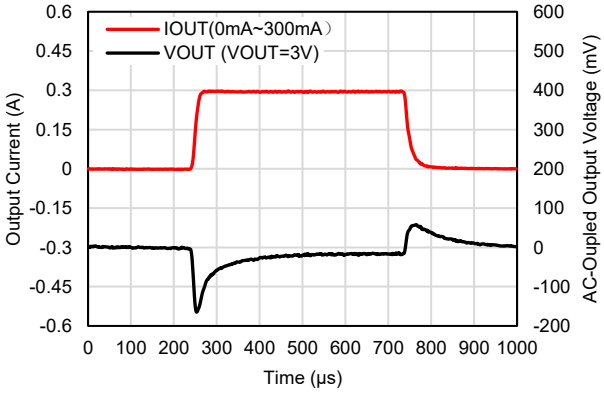
Line Transient



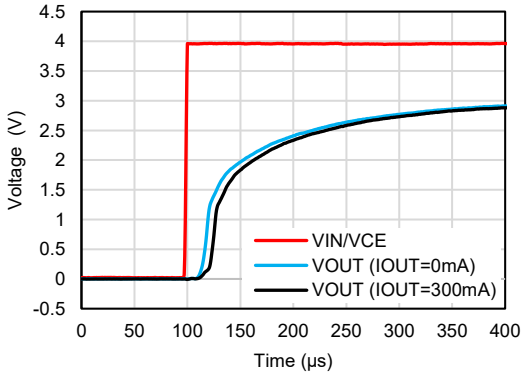
Load Transient



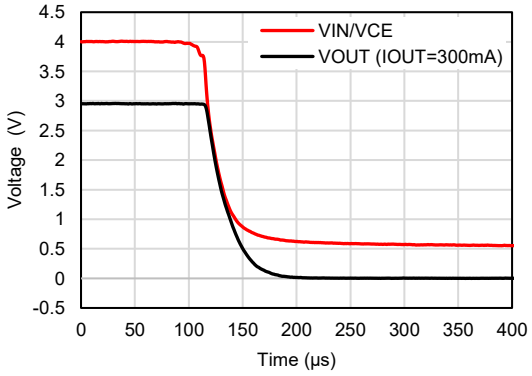
Load Transient



Power Up Response

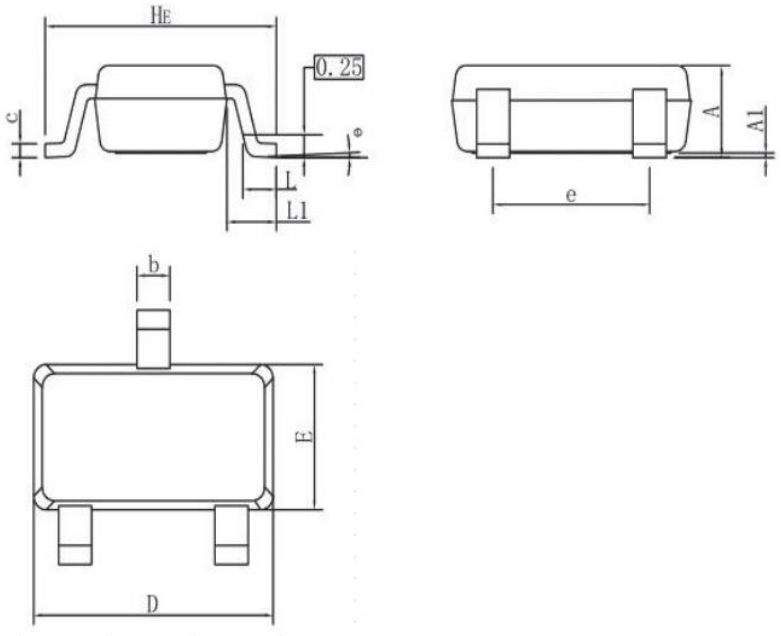


Power Down Response



■ PACKAGING INFORMATION

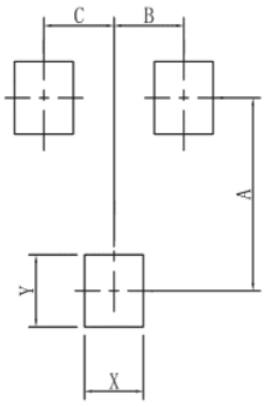
- **SOT-23-3 PACKAGE OUTLINE DIMENSIONS**



SOT23-3			
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
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

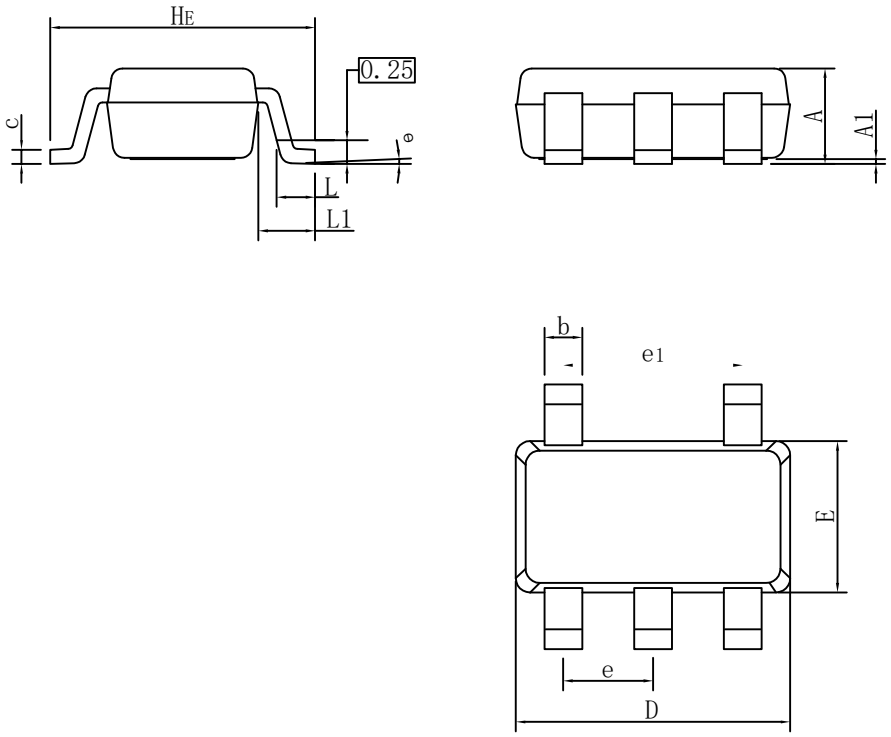
■ RECOMMENDED PAD LAYOUT



SOT23-3	
DIM	(mm)
X	0.80
Y	0.90
A	2.40
B	0.95
C	0.95

■ PACKAGING INFORMATION

- **SOT-23-5 PACKAGE OUTLINE DIMENSIONS**

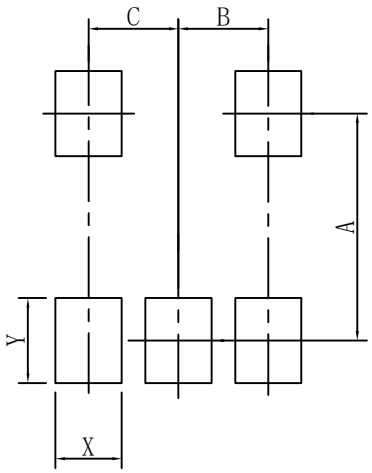


SOT25			
DIM	MIN	NOR	MAX
A	0.90	1.00	1.10
A1	0.01	0.06	0.10
b	0.30	0.40	0.50
c	0.10	0.17	0.20
D	2.80	2.90	3.00
E	1.50	1.60	1.70
e	0.85	0.95	1.05
e1	1.80	1.90	2.00
L	0.20	0.40	0.60
L1	0.60REF		
HE	2.60	2.80	3.00
θ	0°	-	10°

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

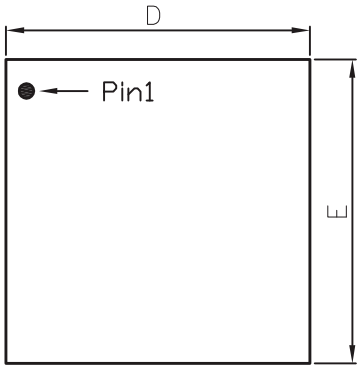
■ RECOMMENDED PAD LAYOUT



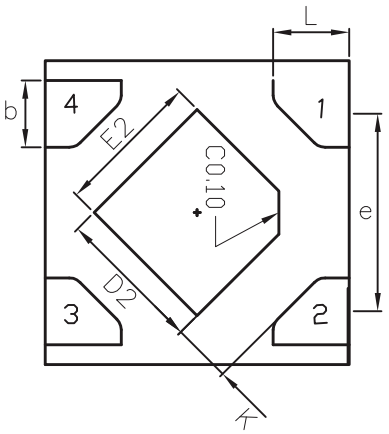
SOT25	
DIM	(mm)
X	0.70
Y	0.90
A	2.40
B	0.95
C	0.95

■ PACKAGING INFORMATION

- **DFN1010-4 PACKAGE OUTLINE DIMENSIONS**

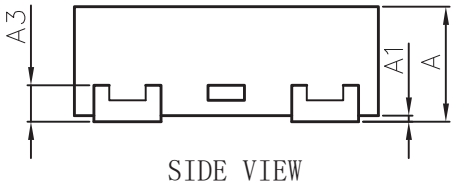


TOP VIEW



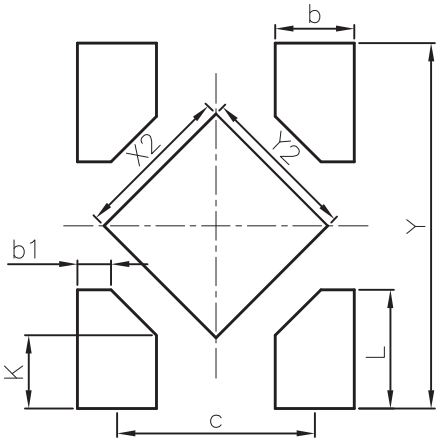
BOTTOM VIEW

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

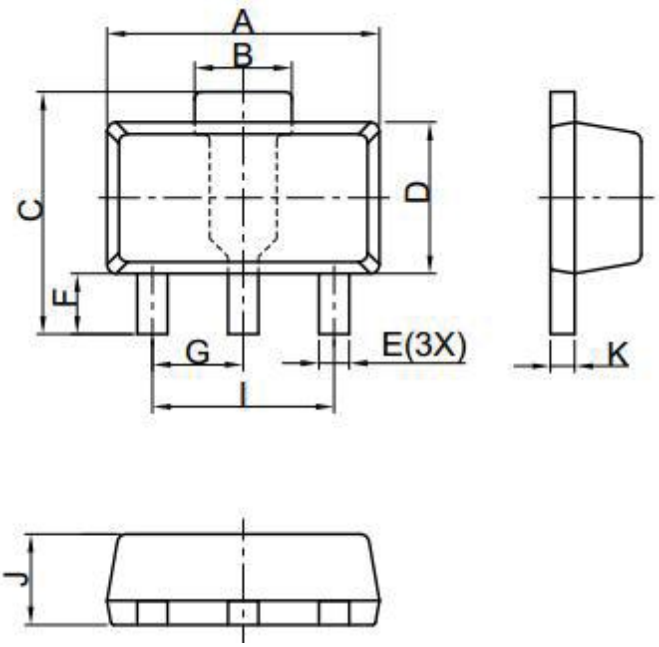
■ RECOMMENDED PAD LAYOUT



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

■ PACKAGING INFORMATION

- **SOT-89-3 PACKAGE OUTLINE DIMENSIONS**

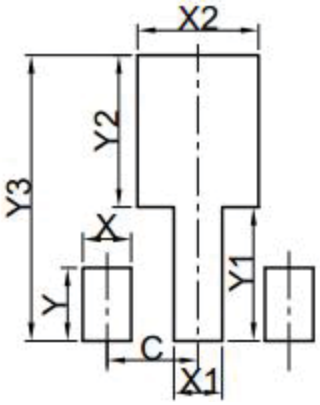


SOT89-3			
DIM	MIN	NOR	MAX
A	4.40	4.50	4.60
B	1.40	1.60	1.80
C	3.90	4.00	4.25
D	2.40	2.50	2.60
E	0.40	0.50	0.58
F	0.90	1.00	1.20
G	1.50BSC		
I	3.00BSC		
J	1.40	1.50	1.60
K	0.34	0.40	0.50
All Dimensions in mm			

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
4. Protrusion or Gate Burrs shall not exceed 0.10mm per side

■ RECOMMENDED PAD LAYOUT



SOT89-3	
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

■ ORDERING INFORMATION APPENDIX

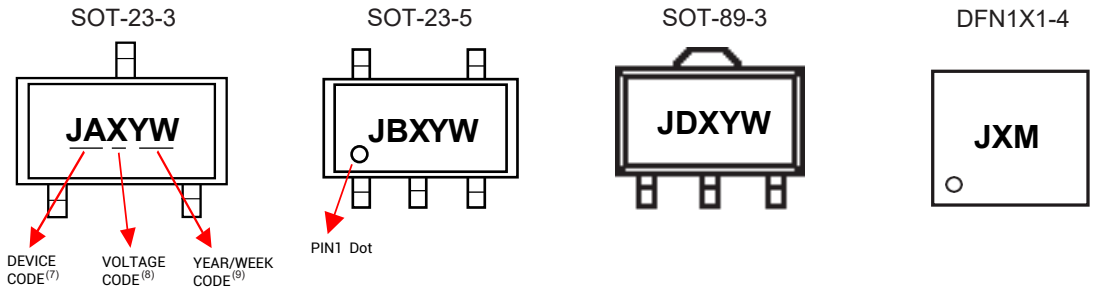
Part Number(5)	Package	Output Voltage(6)	Marking(7)	Shipping
LR6231AxxMT	SOT-23-3	1.2V~3.6V	JAX	3K/Reel
LR6231BxxM	SOT-23-5	1.2V~3.6V	JBX	3K/Reel
LR6231BxxF	DFN1X1-4	1.2V~3.6V	JX	10K/Reel
LR6231AxxP	SOT-89-3	1.2V~3.6V	JDX	1K/Reel

(5) The "xx" in part number represents output voltage, eg "18" = 1.8V, "30" = 3.0V.

(6) Output voltage varies from 1.2V to 3.6V, 0.1V an interval.

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

■ MARKING INFORMATION APPENDIX



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

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

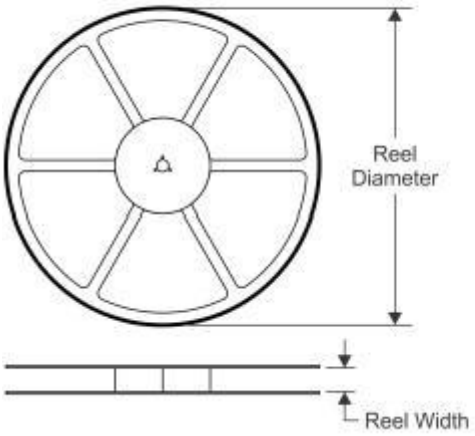
Voltage(V)	...	1.2	1.5	1.8	2.5	2.7	2.8	3.0	3.3	3.6	...
Symbol	...	E	F	G	H	I	J	K	L	M	...

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

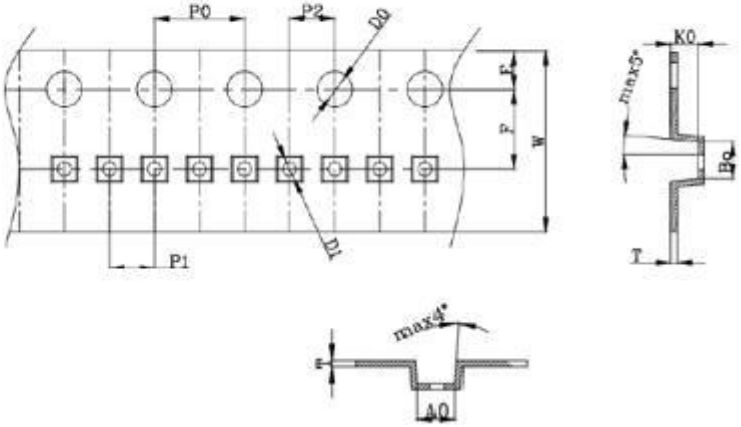
For DFN1010-4 packages, the YEAR/WEEK CODE has only one letter.

■ TAPE AND REEL INFORMATION

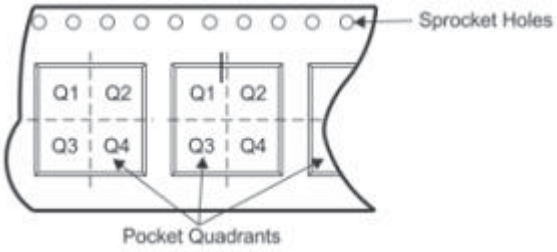
REEL DEMENSIONS



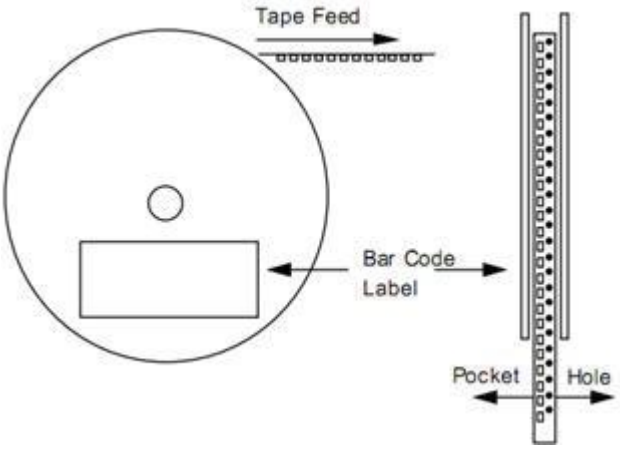
TAPE DEMENSIONS



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
LR6231AxxMT	SOT-23-3	178±1	9.6±1.2	4.00±0.1	4.00±0.1	3.1±0.1	3.28±0.1	1.32±0.1	8.0±0.1	NA
LR6231BxxM	SOT-23-5	178±1	9.6±1.2	4.00±0.1	4.00±0.1	3.25±0.1	3.15±0.1	1.5±0.05	8.0±0.1	NA
LR6231BxxF	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	8.0±0.1	Q3
LR6231AxxP	SOT-89-3	178±1	$13.0^{+1}_{-0.5}$	4.00±0.1	8.00±0.1	4.75±0.1	4.2±0.1	1.75±0.1	$12.0^{+0.3}_{-0.1}$	NA

■ REVISION HISTORY

Version	Description	Update by	Update Date
1.0	LRC ORIGINAL RELEASE.	Chen S	2022-05-22
1.1	Add marking diagram; Update electrical characteristics according to LR6232	Chen S	2023-09-05
1.2	Add SOT23-3 and SOT89-3 packages and part numbers; Add electrical characteristic curves.	Chen S	2023-10-18
1.3	Update storage temperature range from -40~125°C to -40~150°C	Chen S	2023-12-07
1.4	Update output voltage from 1.2V~3.6V to 1.2V~3.6V	Chen S	2024-01-10

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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