

Ultra Fast High PSRR

Low Noise CMOS Voltage Regulator

LR5216 Series

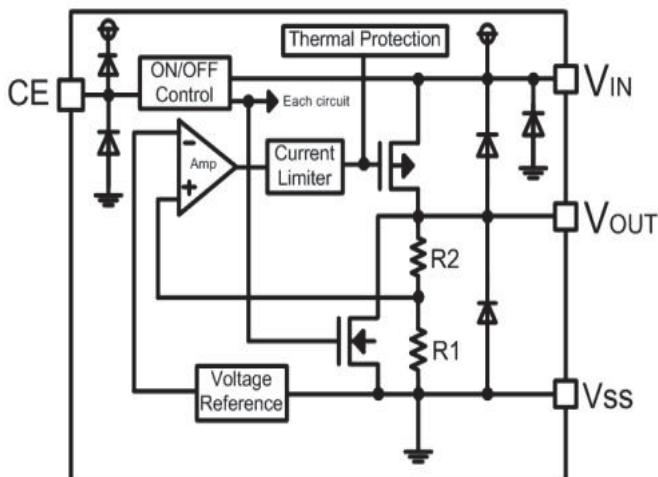
■ INTRODUCTION

The LR5216 series are a group of positive voltage regulators manufactured by CMOS technologies with high ripple rejection, ultra low noise, low power consumption and low dropout voltage, which can prolong battery life in portable electronics. The LR5216 series work with low-ESR ceramic capacitors, reducing the amount of board space necessary for power applications. The LR5216 series consume less than 0.1 μ A in shutdown mode and have fast turn-on time less than 50 μ s. The series are very suitable for the battery-powered equipments, such as RF applications and other systems requiring a quiet voltage source.

■ APPLICATIONS

- Cellular and Smart Phones
- Laptop, Palmtops and PDA
- Digital Still and Video Cameras

■ BLOCK DIAGRAM



■ FEATURES

- Low Dropout Voltage: 55mV@100mA
- Low Quiescent Current: 50 μ A
- High Ripple Rejection: 80dB@1kHz
- Excellent Line and Load Transient Response
- Operating Voltage Range: 1.8V~6.0V
- Output Voltage Range: 0.8V ~ 5.0V
- High Accuracy: $\pm 2\%$ (Typ.)
- Built-in Current Limiter, Short-Circuit Protection
- TTL- Logic-Controlled Shutdown Input
- Over-Temperature Protection
- Portable Audio Video Equipments
- Radio control systems
- Battery-Powered Equipments

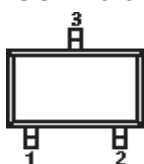
■ ORDER INFORMATION

LR5216①②③④⑤

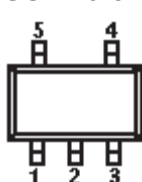
DESIGNATOR	SYMBOL	DESCRIPTION
①	A	Without EN
	B	High Active, pull-down resistor R4 built in, with C _{OUT} discharge resistor
	C	High Active, No pull-down resistor No C _{OUT} discharge resistor
②	Integer	Output Voltage e.g. 1.8V= 18
③	M/MA/MC/MY	Package:SOT-23-3
	M/MF/ML	Package:SOT-23-5
	P/PT	Package:SOT-89-3
	F	Package:DFN1 $\times$ 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

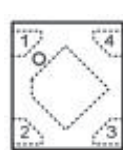
SOT-23-3



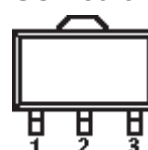
SOT-23-5



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

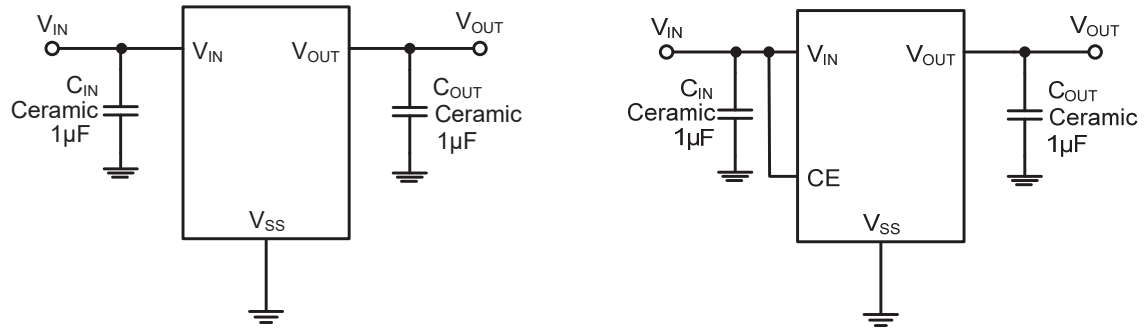
DFN1×1-4

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 APPLICATION



■ ABSOLUTE MAXIMUM RATINGS⁽¹⁾

(Unless otherwise specified, $T_A=25^{\circ}\text{C}$)

PARAMETER		SYMBOL	RATINGS	UNITS
Input Voltage ⁽²⁾		V_{IN}	-0.3~7	V
Output Voltage ⁽²⁾		V_{OUT}	-0.3~ $V_{IN}+0.3$	V
Output Current		I_{OUT}	700	mA
Power Dissipation	SOT-23	P_D	300	mW
	DFN1×1-4		400	mW
	SOT-89		500	mW
Operating free air temperature range		T_A	-40~85	$^{\circ}\text{C}$
Operating Junction Temperature Range ⁽³⁾		T_j	-40~125	$^{\circ}\text{C}$
Storage Temperature		T_{stg}	-40~125	$^{\circ}\text{C}$
Lead Temperature(Soldering, 10 sec)		T_{solder}	260	$^{\circ}\text{C}$

(1) Stresses beyond those listed under *absolute maximum ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *recommended operating conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) All voltages are with respect to network ground terminal.

(3) This IC includes over temperature protection that is intended to protect the device during momentary overload. Junction temperature will exceed 125°C when over temperature protection is active. Continuous operation above the specified maximum operating junction temperature may impair device reliability.

■ ELECTRICAL CHARACTERISTICS

LR5216 Series ($V_{IN}=V_{OUT}+1V$, $C_{IN}=C_{OUT}=1\mu F$, $T_A=25^\circ C$, unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP. ⁽⁴⁾	MAX.	UNITS
Output Voltage	$V_{OUT(E)}^{(5)}$	$I_{OUT}=1mA$	$V_{OUT}^{(6)} \times 0.98$	$V_{OUT}^{(6)}$	$V_{OUT}^{(6)} \times 1.02$	V
Supply Current	I_{SS}	$I_{OUT}=0$		50	90	μA
Standby Current	I_{STBY}	$CE = V_{SS}$		0.1	1	μA
Output Current	I_{OUT}	$V_{OUT} \geq 1.8V$	500	700		mA
		$V_{OUT} \geq 0.8V$	300	500		
Dropout Voltage	$V_{DO}^{(7)}$	$I_{OUT} = 100mA$		55		mV
Load Regulation	ΔV_{OUT}	$V_{IN} = V_{OUT} + 1V$, $1mA \leq I_{OUT} \leq 100mA$		1		mV
Line Regulation	$\frac{\Delta V_{OUT}}{V_{OUT} \times \Delta V_{IN}}$	$I_{OUT} = 10mA$ $V_{OUT} + 1V \leq V_{IN} \leq 6V$		0.01	0.2	%/V
Output Voltage Temperature	$\frac{\Delta V_{OUT}}{\Delta T \times V_{OUT}}$	$I_{OUT} = 10mA$ $-40 \leq T \leq +85$		50		ppm
Short Current	I_{Short}	$V_{OUT} = V_{SS}$		100		mA
Input Voltage	V_{IN}	—	1.8		6.0	V
Power Supply Rejection Rate	100Hz	PSRR	$I_{OUT}=50mA$	75		dB
	1kHz			80		
	10kHz			70		
CE "High" Voltage	$V_{CE"H"}$		1.5		V_{IN}	V
CE "Low" Voltage	$V_{CE"L"}$				0.3	V
Thermal Shutdown	T_{SD}			160		$^\circ C$
Thermal Shutdown	ΔT_{SD}			20		$^\circ C$
C_{OUT} Auto-Discharge	$R_{DISCHRG}$	$V_{IN}=5V$,		100		Ω

(4) Typical numbers are at $25^\circ C$ and represent the mostlikely norm.

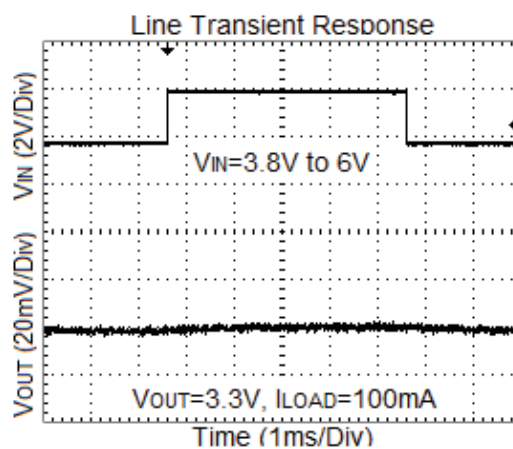
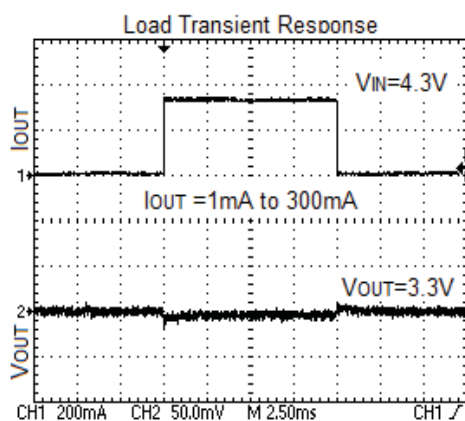
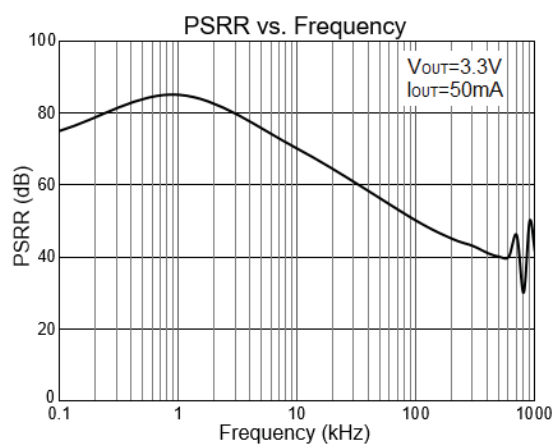
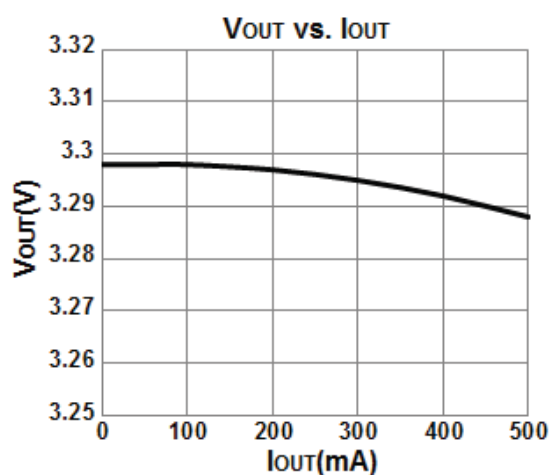
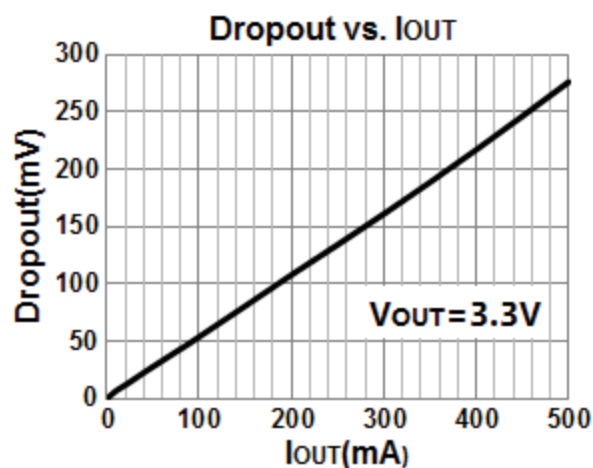
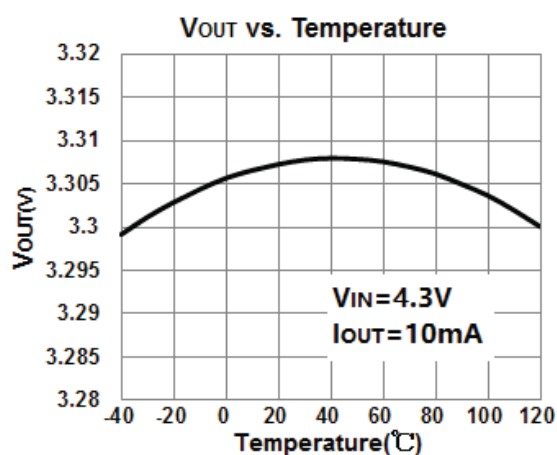
(5) $V_{OUT(E)}$: Effective Output Voltage (Ie. The output voltage when $V_{IN}= (V_{OUT} + 1.0V)$ and maintain acertain I_{OUT} Value).

(6) V_{OUT} : Specified Output Voltage.

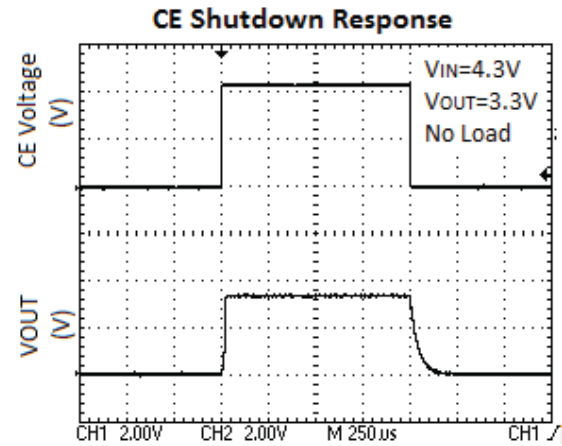
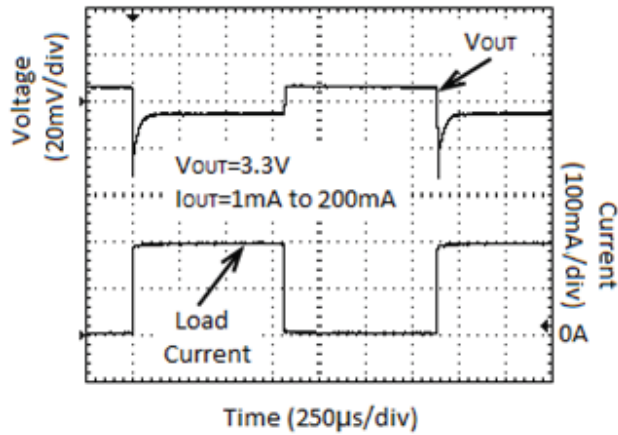
(7) V_{DO} : The Difference Of Output Voltage And Input Voltage When Input Voltage Is Decreased Gradually Till Output Voltage Equals To 98% Of V_{OUT} (E).

■ TYPICAL PERFORMANCE CHARACTERISTICS

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



■ TYPICAL PERFORMANCE CHARACTERISTICS



C_{OUT} Auto-Discharge Function

LR5216B series can discharge the electric charge in the output capacitor (C_{OUT}), when a low signal to the CE pin, which enables a whole IC circuit turn off, is inputted via the N-channel transistor located between the V_{OUT} pin and the V_{SS} pin (cf. BLOCK DIAGRAM). The C_{OUT} auto-discharge resistance value is set at 60Ω ($V_{OUT}=3.0V$ @ $V_{IN}=5.0V$ at typical). The discharge time of the output capacitor (C_{OUT}) is set by the C_{OUT} auto-discharge resistance (R) and the output capacitor (C_{OUT}). By setting time constant of a C_{OUT} auto-discharge resistance value [$R_{DISCHRG}$] and an output capacitor value (C_{OUT}) as $\tau (\tau = C \times R_{DISCHRG})$, the output voltage after discharge via the N-channel transistor is calculated by the following formulas.

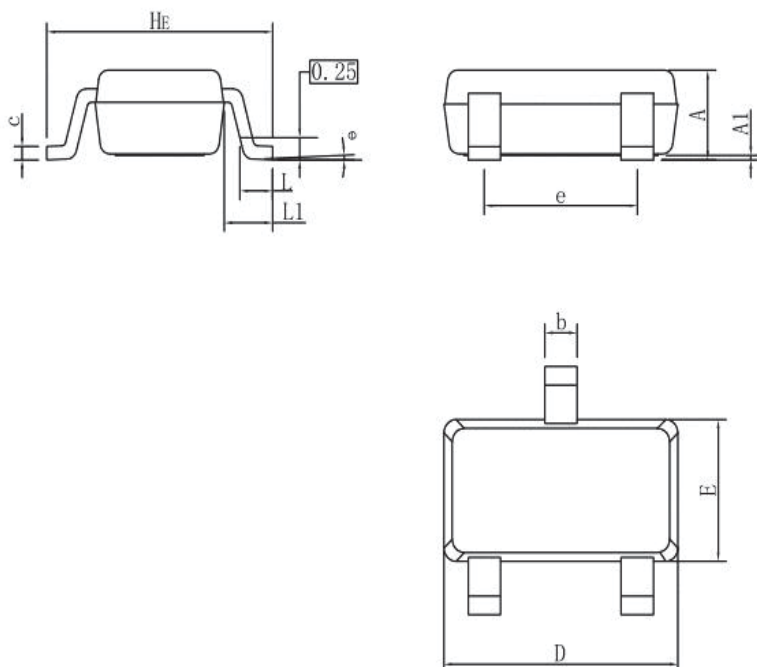
$$V = V_{OUT(E)} \times e^{-t/\tau}, \text{ or } t = \tau \ln (V / V_{OUT(E)})$$

(V : Output voltage after discharge, $V_{OUT(E)}$: Output voltage, t : Discharge time,

τ : C_{OUT} auto-discharge resistance $R_{DISCHRG}$ × Output capacitor (C_{OUT}) value C)

■ PACKAGING INFORMATION

● SOT-23-3 PACKAGE OUTLINE DIMENSIONS

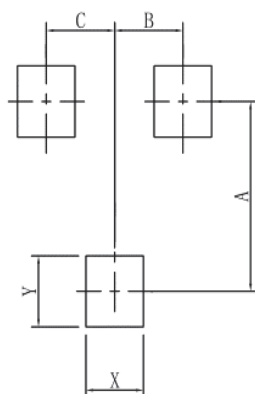


DIM	MIN	NOR	MAX
A	0.90	1.00	1.10
A1	0.01	0.06	0.10
b	0.30	0.40	0.50
c	0.10	0.17	0.20
D	2.80	2.90	3.00
E	1.50	1.60	1.70
e	1.80	1.90	2.00
L	0.20	0.40	0.60
L1	0.60REF		
HE	2.60	2.80	3.00
θ	0°	-	10°
All Dimensions in mm			

GENERAL NOTES

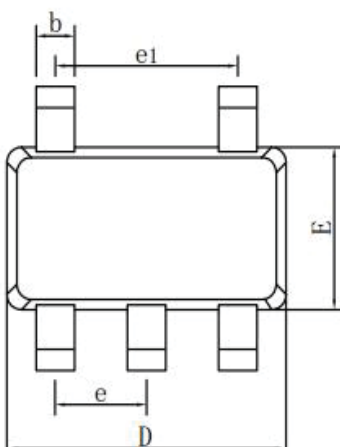
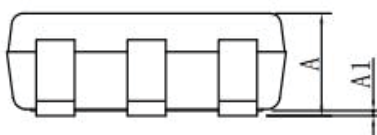
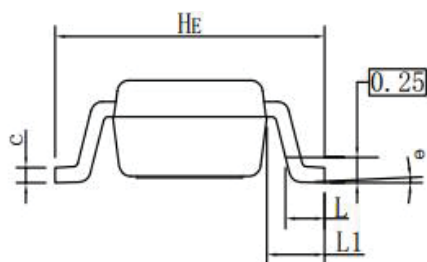
- 1.Top package surface finish Ra0.4±0.2um
- 2.Bottom package surface finish Ra0.7±0.2um
- 3.Side package surface finish Ra0.4±0.2um

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

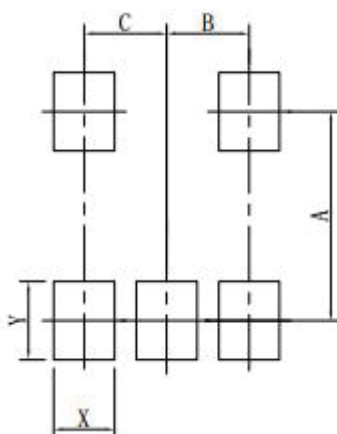


DIM	MIN	NOR	MAX
A	0.90	1.00	1.10
A1	0.01	0.06	0.10
b	0.30	0.40	0.50
c	0.10	0.17	0.20
D	2.80	2.90	3.00
E	1.50	1.60	1.70
e	0.85	0.95	1.05
e1	1.80	1.90	2.00
L	0.20	0.40	0.60
L1	0.60REF		
HE	2.60	2.80	3.00
θ	0°	-	10°

GENERAL NOTES

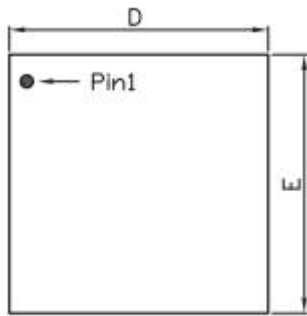
- 1.Top package surface finish Ra0.4±0.2um
- 2.Bottom package surface finish Ra0.7±0.2um
- 3.Side package surface finish Ra0.4±0.2um

SOLDERING FOOTPRINT

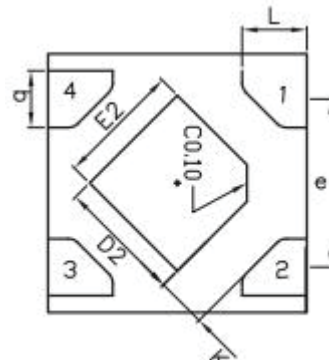


DIM	(mm)
X	0.70
Y	0.90
A	2.40
B	0.95
C	0.95

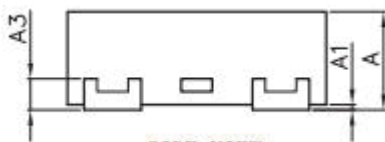
● DFN1×1-4 PACKAGE OUTLINE DIMENSIONS



TOP VIEW



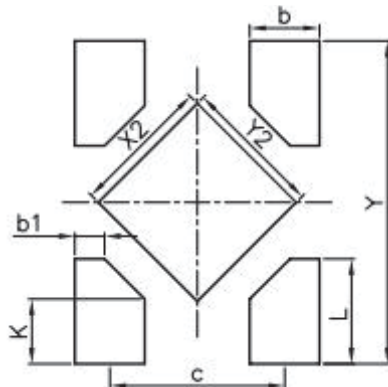
BOTTOM VIEW



SIDE VIEW

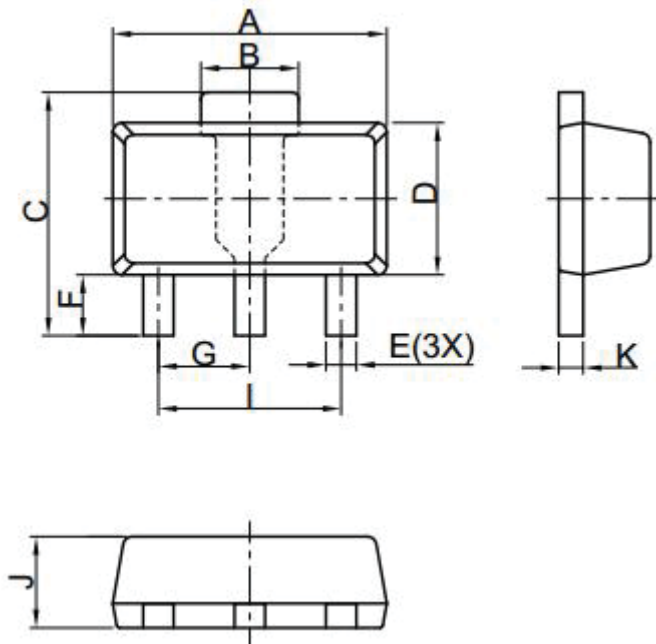
DFN1010			
DIM	MIN	NOR	MAX
A	0.34	0.37	0.40
A1	0.01	0.02	0.05
b	0.17	0.22	0.25
L	0.20	0.25	0.30
D	0.95	1.00	1.05
E	0.95	1.00	1.05
D2	0.43	0.48	0.53
E2	0.43	0.48	0.53
e	0.65		
A3	0.127REF.		
K	0.15	-	-
All Dimensions in mm			

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

● SOT-89-3 PACKAGE OUTLINE DIMENSIONS

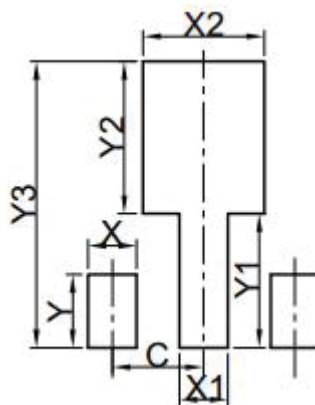


DIM	MIN	NOR	MAX
A	4.40	4.50	4.60
B	1.40	1.60	1.80
C	3.90	4.00	4.25
D	2.40	2.50	2.60
E	0.40	0.50	0.58
F	0.90	1.00	1.20
G	1.50 BSC		
I	3.00 BSC		
J	1.40	1.50	1.60
K	0.34	0.40	0.50
All Dimensions in mm			

GENERAL NOTES

1. Top package surface finish $Ra0.4\pm0.2\mu m$
2. Bottom package surface finish $Ra0.7\pm0.2\mu m$
3. Side package surface finish $Ra0.4\pm0.2\mu m$
4. Protrusion or Gate Burrs shall not exceed 0.10mm per side.

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

■ DEVICE MARKING AND REEL SPECTION

Device ⁽⁸⁾	Package	Output Voltage ⁽⁹⁾	Marking ⁽¹⁰⁾⁽¹¹⁾	Shipping
LR5216AxxM	SOT-23-3	0.8V~5.0V	BAX	3K/Reel
LR5216AxxMA	SOT-23-3	0.8V~5.0V	BMX	3K/Reel
LR5216AxxMC	SOT-23-3	0.8V~5.0V	BCX	3K/Reel
LR5216AxxMY	SOT-23-3	0.8V~5.0V	BYX	3K/Reel
LR5216AxxMF	SOT-23-5	0.8V~5.0V	BFX	3K/Reel
LR5216BxxM	SOT-23-5	0.8V~5.0V	BBX	3K/Reel
LR5216BxxMR	SOT-23-5	0.8V~5.0V	BRX	3K/Reel
LR5216AxxP	SOT-89-3	0.8V~5.0V	BDX	1K/Reel
LR5216AxxPT	SOT-89-3	0.8V~5.0V	BTX	1K/Reel
LR5216BxxFT5AG	DFN1X1-4	0.8V~5.0V	BX	10K/Reel
LR5216BxxF	DFN1X1-4	0.8V~5.0V	BX	10K/Reel

(8) : "xx" represents output voltage, eg "18" express that the output voltage is 1.8V

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

(10): The last letter "X" changes along with the output voltage, as figure below

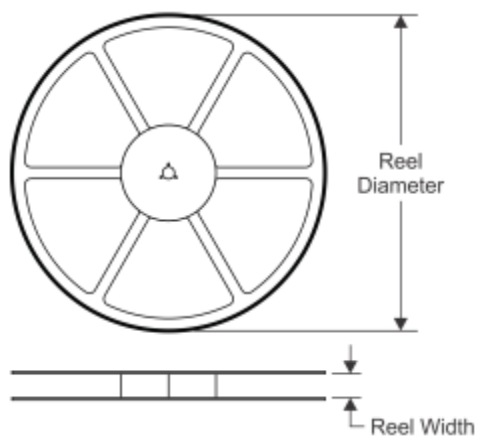
(11): There are additional marking , which relates to the date code, not list above.

For Package DFN1x1-4,one letter(month code), for SOT-23-3, SOT-23-5, SOT-89-3,
two letters(Year and week)

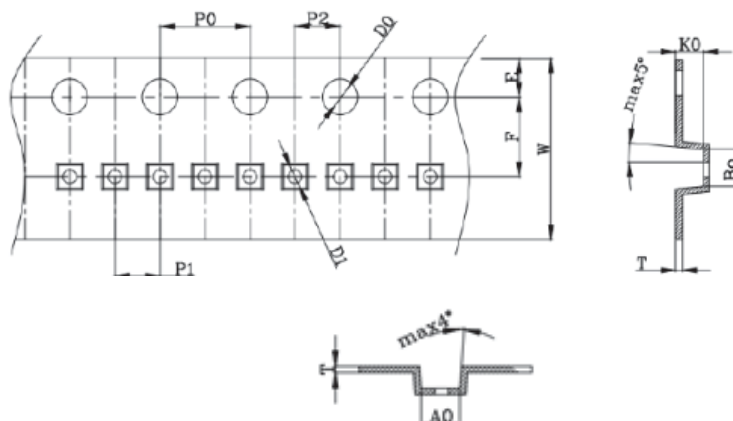
Voltage		1.0	1.2	1.5	1.8	2.5	2.7	2.8	3.0	3.3	3.6	4.0	4.2	5.0	
Symble		D	E	F	G	H	I	J	K	L	M	N	T	P	

■ TAPE AND REEL INFORMATION

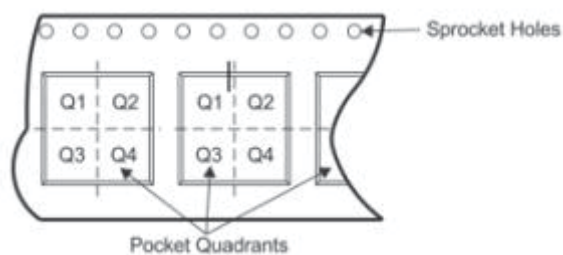
REEL DIMENSIONS



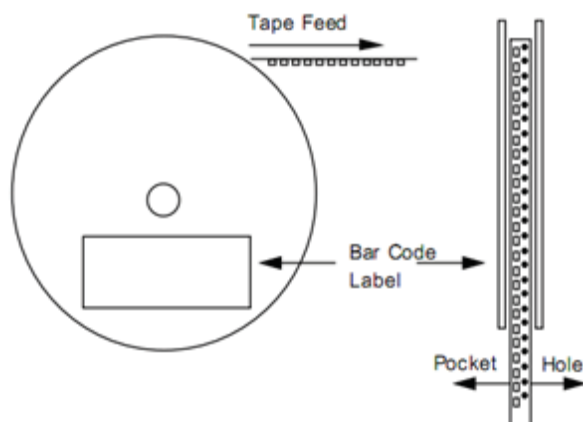
TAPE DIMENSIONS



PIN1 ORIENTATION



ROLLING ORIENTATION



Device	Package	Reel Diameter (mm)	Reel width (mm)	P0 (mm)	P1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	W (mm)	PIN1
LR5216AxxM	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
LR5216AxxMC	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
LR5216AxxMY	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
LR5216AxxMF	SOT-23-5	178±1	9.6±1.2	4.00±0.1	4.00±0.1	3.25±0.05	3.15±0.05	1.5±0.05	8.0±0.1	Q3
LR5216BxxM	SOT-23-5	178±1	9.6±1.2	4.00±0.1	4.00±0.1	3.25±0.05	3.15±0.05	1.5±0.05	8.0±0.1	Q3
LR5216BxxML	SOT-23-5	178±1	9.6±1.2	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}	Q3
LR5216AxxP	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
LR5216AxxPT	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
LR5216BxxFT5AG	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
LR5216BxxF	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

■ DISCLAIMER

- Before you use our Products, you are requested to carefully read this document and fully understand its contents. LRC shall not be in any way responsible or liable for failure, malfunction or accident arising from the use of any LRC's Products against warning, caution or note contained in this document.
- All information contained in this document is current as of the issuing date and subject to change without any prior notice. Before purchasing or using LRC's Products, please confirm the latest information with a LRC sales representative.