

Data Sheet

Customer:

Product: Metal Film Leaded Precision Resistor—MFR Series

Sizes.: 0318/0623/0932/1145/1550

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Metal Film Leaded Precision Resistor

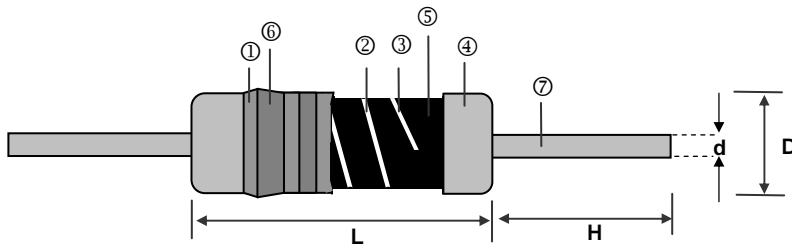
■ Features

- Excellent overall stability
- Very tight tolerance down to $\pm 0.05\%$
- Extremely low TCR down to ± 5 PPM/ $^{\circ}\text{C}$
- High power rating up to 3 Watts
- Excellent ohmic contact

■ Applications

- Automotive
- Telecommunication
- Medical Equipment

■ Construction



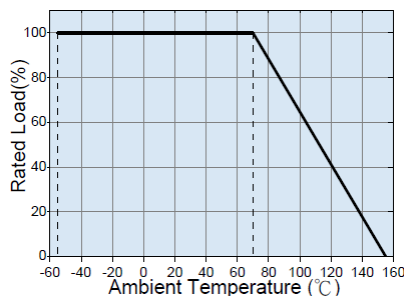
① Insulation Coating (Expose resin)	⑤ Resistor Layer (Nickel alloy)
② Trimming Line	⑥ Marking (Expose)
③ Ceramic Core (Alumina ceramic)	⑦ Lead Wire (Tinned annealed copper wire)
④ Electrode Cap (Tinned iron cap)	

■ Dimensions

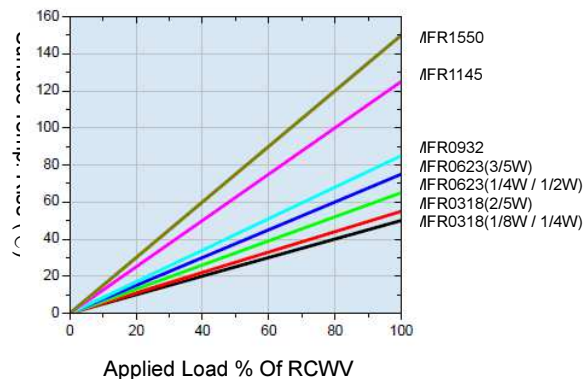
Unit: mm

Type	L	D	H	d	Weight (g) (1000pcs)
MFR0318	3.3+0.7/-0.2	1.8 \pm 0.3	29 \pm 2.0	0.45 \pm 0.03	90
MFR0623	6.3 \pm 0.5	2.3 \pm 0.3	28 \pm 2.0	0.55 \pm 0.03	150
MFR0932	9.0 \pm 0.5	3.2 \pm 0.5	26 \pm 2.0	0.65 \pm 0.03	350
MFR1145	11.5 \pm 1.0	4.5 \pm 0.5	35 \pm 2.0	0.78 \pm 0.03	770
MFR1550	15.5 \pm 1.0	5.0 \pm 0.5	32 \pm 2.0	0.78 \pm 0.03	1040

■ Derating Curve



■ Hot-Spot Temperature



Part Numbering

MFR	0318	B	T	N	W	1001	
Product Type	Dimensions (LxD)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Special
	0318: 3.3x1.8 0623: 6.3x2.3 0932: 9.0x3.2 1145: 11.5x4.5 1550: 15.5x5.0	A: ±0.05% B: ±0.1% C: ±0.25% D: ±0.5% F: ±1%	A: Ammo B: Bulk T: Taping Reel	S: ±5 B: ±10 N: ±15 C: ±25 D: ±50 E: ±100	R: 3W S: 2W T: 1W F: 3/5W U: 1/2W G: 2/5W V: 1/4W W: 1/8W	R100: 0.1Ω 0010: 1Ω 1000: 100Ω 2201: 2200Ω 1001: 1KΩ 1004: 1MΩ	: Standard MA: MA-type MB: MB-type MC: MC-type FA: FA-type FB: FB-type FC: FC-type FD: FD-type

Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Resistance Range				TCR (PPM/°C)
						±0.05%	±0.1%	±0.25%	±0.5%	
0318	1/8W	-55 ~ +155°C	150V	300V	300V	-	10Ω-1MΩ	10Ω-4.99MΩ		±15
						-	10Ω-1MΩ	10Ω-10MΩ		±25 ±50
						-	1Ω-1MΩ	1Ω-10MΩ	0.1Ω-10MΩ	±100
0623	1/4W	-55 ~ +155°C	250V	500V	400V	-	10Ω-1MΩ	-		±5
						-	10Ω-1MΩ	-		±10
						-	10Ω-1MΩ	10Ω-10MΩ		±15 ±25
						-	10Ω-1MΩ	10Ω-10MΩ		±50
						-	1Ω-1MΩ	1Ω-10MΩ	0.1Ω-10MΩ	±100
0932	1/2W	-55 ~ +155°C	350V	500V	500V	-	10Ω-1MΩ	-		±5
						-	10Ω-1MΩ	-		±10
						-	10Ω-1MΩ	10Ω-10MΩ		±15 ±25
						-	10Ω-1MΩ	10Ω-10MΩ		±50
						-	1Ω-1MΩ	1Ω-10MΩ	0.1Ω-10MΩ	±100
1145	1W	-55 ~ +155°C	500V	700V	700V	-	10Ω-1MΩ	10Ω-4.99MΩ		±15
						-	10Ω-1MΩ	10Ω-10MΩ		±25 ±50
						-	1Ω-1MΩ	1Ω-10MΩ	0.1Ω-10MΩ	±100
1550	2W	-55 ~ +155°C	500V	1000V	1000V	-	10Ω-1MΩ	10Ω-4.99MΩ		±15
						-	10Ω-1MΩ	10Ω-10MΩ		±25 ±50
						-	1Ω-1MΩ	1Ω-10MΩ	0.1Ω-10MΩ	±100

High Power & Ultra High Power Rating Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Resistance Range					TCR (PPM/°C)
						±0.05%	±0.1%	±0.25%	±0.5%	±1%	
0318	1/4W	-55 ~ +155°C	200V	400V	300V	-	10Ω-1MΩ		10Ω-4.99MΩ		±15
						-	10Ω-1MΩ		10Ω-10MΩ		±25 ±50
						-	1Ω-1MΩ	1Ω-10MΩ	0.1Ω-10MΩ	±100	
	2/5W		-	10Ω-1MΩ		10Ω-4.99MΩ		±15			
			-	10Ω-1MΩ		10Ω-10MΩ		±25 ±50			
			-	1Ω-1MΩ	1Ω-10MΩ	0.1Ω-10MΩ	±100				
0623	1/2W	-55 ~ +155°C	300V	500V	400V	10Ω-1MΩ					±5
						10Ω-1MΩ					±10
						10Ω-1MΩ		10Ω-4.99MΩ			±15
						10Ω-1MΩ		10Ω-10MΩ			±25
						-	10Ω-1MΩ		10Ω-10MΩ		±50
						-	1Ω-1MΩ	1Ω-10MΩ	0.1Ω-10MΩ	±100	
	3/5W		-	10Ω-1MΩ		10Ω-4.99MΩ		±15			
			-	10Ω-1MΩ		10Ω-10MΩ		±25			
			-	10Ω-1MΩ		10Ω-10MΩ	1Ω-10MΩ	±50			
			-	1Ω-1MΩ	1Ω-10MΩ	0.1Ω-10MΩ	±100				
			10Ω-1MΩ					-	±5		
			10Ω-1MΩ					-	±10		
0932	1W	-55 ~ +155°C	400V	600V	500V	10Ω-1MΩ		10Ω-10MΩ			±15 ±25
						-	10Ω-1MΩ		10Ω-10MΩ		±50
						-	1Ω-1MΩ	1Ω-10MΩ	0.1Ω-10MΩ	±100	
						-	10Ω-1MΩ		10Ω-4.99MΩ		±15
						-	10Ω-1MΩ		10Ω-10MΩ		±25 ±50
						-	1Ω-1MΩ	1Ω-10MΩ	0.1Ω-10MΩ	±100	
1145	2W	-55 ~ +155°C	500V	700V	700V	-	10Ω-1MΩ		10Ω-4.99MΩ		±15
						-	10Ω-1MΩ		10Ω-10MΩ		±25 ±50
						-	1Ω-1MΩ	1Ω-10MΩ	0.1Ω-10MΩ	±100	
						-	10Ω-1MΩ		10Ω-4.99MΩ		±15
1550	3W	-55 ~ +155°C	500V	1000V	1000V	-	10Ω-1MΩ		10Ω-4.99MΩ		±15
						-	10Ω-1MΩ		10Ω-10MΩ		±25 ±50
						-	1Ω-1MΩ	1Ω-10MΩ	0.1Ω-10MΩ	±100	

Operating Voltage= $\sqrt{(P \cdot R)}$ or Max. operating voltage listed above, whichever is lower.
 Overload Voltage= $2.5 \cdot \sqrt{(P \cdot R)}$ or Max. overload voltage listed above, whichever is lower.

Environmental Characteristics

Item	Requirement	Test Method
Short Time Overload	±(0.25%+0.05Ω)	JIS-C-5201-1 5.5 RCWV*2.5 or Max. overload voltage whichever is lower for 5 seconds
Insulation Resistance	> 10000MΩ	MIL-STD-202F Method 302 Apply 100V _{DC} for 1 minute
Endurance	±(1.5%+0.05Ω)	MIL-STD-202F Method 108A 70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Damp Heat with Load	±(1.5%+0.05Ω)	MIL-STD-202F Method 103B 40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Solderability	95% min. Coverage	MIL-STD-202F Method 208H 260±5°C for 2±0.5 seconds
Dielectric Withstanding Voltage	By Type	MIL-STD-202F Method 301 Apply Max. Overload Voltage for 1 minute
Temperature Coefficient	By Type	Resistance value at room temperature and room Temperature+100°C
Pulse Overload	±(0.75%+0.05Ω)	JIS-C-5201-1 5.8 4 times RCWV for 10000 cycles with 1sec "ON" and 25 sec "OFF"
Resistance To Solvent	No deterioration of coatings and markings	JIS-C-5201-1 6.9 Trichroethane for 1 min. with ultrasonic
Terminal Strength	Tensile: ≥ 2.5kg	Direct Load for 10 sec. In the direction off the terminal leads
Resistance to Soldering Heat	±(0.25%+0.05Ω)	The solder iron heated to 350°C±10°C and applied to the termination for a duration of 4 seconds to 5 seconds
Temperature Cycling	±(0.75%+0.05Ω)	-40°C/85°C with 1000 cycles. (20min for both low and high temperature, transfer time less 30s)

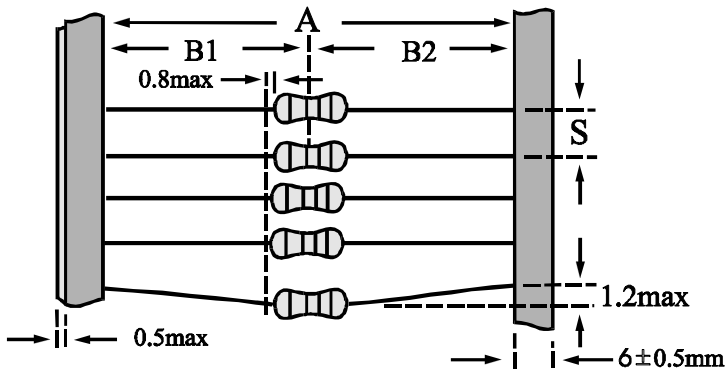
RCWV(Rated continuous working voltage)= $\sqrt{(P \cdot R)}$ or Max. Operating voltage whichever is lower

Storage Temperature: 25±3°C; Humidity < 80%RH

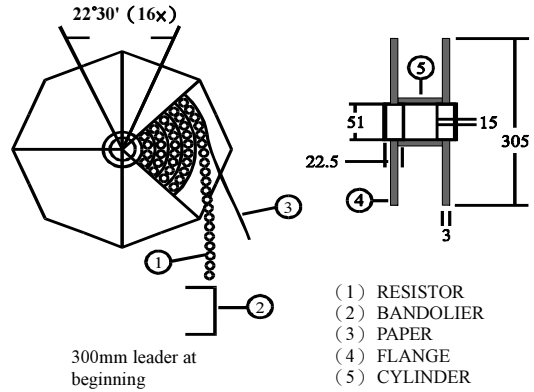
■ Taping/Packing Specifications

1. Standard Type (Reel & Ammo)

Packing Methods



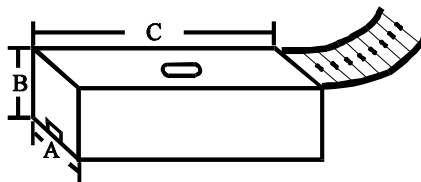
Reel Packing



Unit: mm

Type	Packaging	Packing Methods			Reel Packing	
		A	B1-B2 Max	S	Across Flange (A)	Qty
0318		52+1/-0	1.2	5	72	5,000
		26+1/-0	1.0			
0623		52+1/-0	1.2	5	72	5,000
		26+1/-0	1.0			
0932		52+1/-0	1.2	5	72	2,500
1145		52+1/-0	1.5	5	95	2,000
		73+1/-0				
1550		52+1/-0	1.5	10	95	1,000
		73+1/-0				

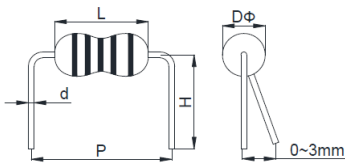
Ammo Packing



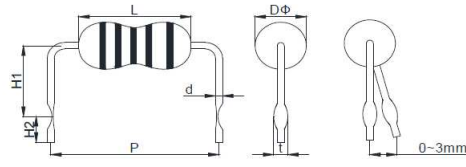
Unit: mm

Type	Packaging	Packing Methods			Ammo Packing			
		A	B1-B2 Max	S	A	B	C	Qty
0318		52+1/-0	1.2	5	80	75	264	5,000
		26+1/-0	1.0					
0623		52+1/-0	1.2	5	80	105	264	5,000
		26+1/-0	1.0					
0932		52+1/-0	1.2	5	80	46	264	1,000
1145		52+1/-0	1.5	5	103	82	265	1,000
		73+1/-0						
1550		52+1/-0	1.5	10	103	96	265	1,000
		73+1/-0						

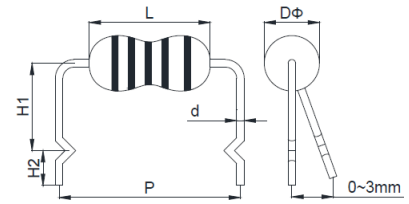
2. Special Type (Bulk)



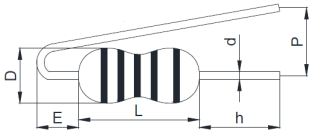
MA Type



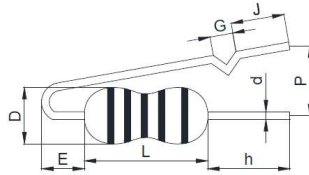
MB Type



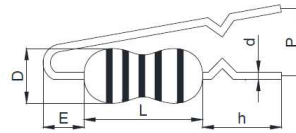
MC Type



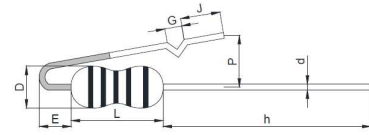
FA Type



FB Type



FC Type



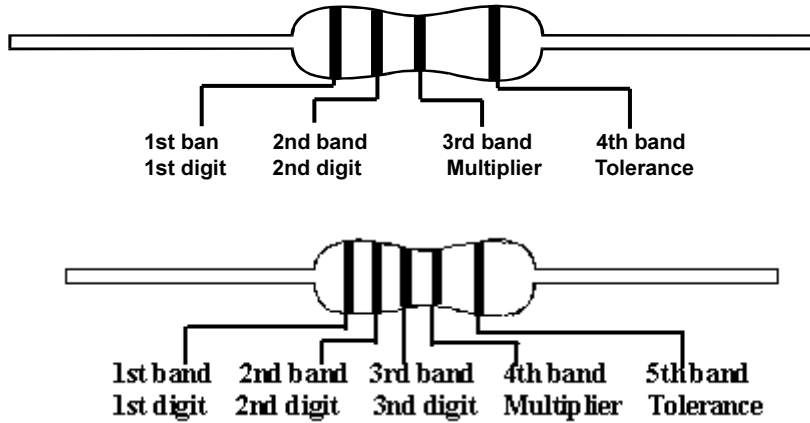
FD Type

Unit: mm

Codes	Type	P	H /H1/h	H2/G	J	t	D	L	d	E
0623	MA	10±1	10.0±1	-	-	-	2.3±0.3	6.3±0.5	0.55±0.03	-
	MC	10±1	5.0±1	6.0±2	-	-	2.3±0.3	6.3±0.5	0.55±0.03	-
	FA	5~15	5.0±2	-	-	-	2.3±0.3	6.3±0.5	0.55±0.03	3±1
	FB	5~15	4.0±2	3.0±0.5	3±1	-	2.3±0.3	6.3±0.5	0.55±0.03	3±1
	FD	5~15	27.0±2	3.0±0.5	3±1	-	2.3±0.3	6.3±0.5	0.55±0.03	3±1
0932	MA	12.5±1	10.0±1	-	-	-	3.2±0.5	9.0±0.5	0.65±0.03	-
	MC	12.5±1	5.0±1	4.0±2	-	-	3.2±0.5	9.0±0.5	0.65±0.03	-
	FA	5~15	5.0±2	-	-	-	3.2±0.5	9.0±0.5	0.65±0.03	3±1
	FB	5~15	4.0±2	3.0±0.5	3±1	-	3.2±0.5	9.0±0.5	0.65±0.03	3±1
	FC	5~15	10.0±3	-	-	-	3.2±0.5	9.0±0.5	0.65±0.03	-
1145	MA	15±1	12.5±1	-	-	-	4.5±0.5	11.5±1.0	0.78±0.03	-
	MC	15±1	8.0±1	6.0±1.0	-	-	4.5±0.5	11.5±1.0	0.78±0.03	-
	FA	5~15	5.0±2	-	-	-	4.5±0.5	11.5±1.0	0.78±0.03	3±1
	FB	5~15	4.0±2	3.0±0.5	3±1	-	4.5±0.5	11.5±1.0	0.78±0.03	3±1
	FC	5~15	10.0±3	-	-	-	4.5±0.5	11.5±1.0	0.78±0.03	-
1550	MA	20±1	15.0±1	-	-	-	5.0±0.5	15.5±1.0	0.78±0.03	-
	MC	20±1	12.0±1	5.0±1.0	-	-	5.0±0.5	15.5±1.0	0.78±0.03	-
	FA	5~15	5.0±2	-	-	-	5.0±0.5	15.5±1.0	0.78±0.03	3±1
	FB	5~15	4.0±2	3.0±0.5	3±1	-	5.0±0.5	15.5±1.0	0.78±0.03	3±1
	FC	5~15	10.0±3	-	-	-	5.0±0.5	15.5±1.0	0.78±0.03	-

Metal Film Leaded Precision Resistor

■ Marking & Resistance Tolerance



Color	Digit	Multiplier	Tolerance	
Without	-	-	±20%	M
Silver	-	10 ⁻²	±10%	K
Gold	-	10 ⁻¹	±5.0%	J
Black	0	10 ⁰	-	-
Brown	1	10 ¹	±1.0%	F
Red	2	10 ²	±2.0%	G
Orange	3	10 ³	-	-
Yellow	4	10 ⁴	-	-
Green	5	10 ⁵	±0.50%	D
Blue	6	10 ⁶	±0.25%	C
Violet	7	10 ⁷	±0.10%	B
Grey	8	10 ⁸	±0.05%	A
White	9	10 ⁹	-	-

±10%	E-6	1.0	-	-	-	1.5	-	-	-	2.2	-	-	-	3.3	-	-	-	4.7	-	-	-	6.8	-	-	-	
	±5.0%	E-12	1.0	-	1.2	-	1.5	-	1.8	-	2.2	-	2.7	-	3.3	-	3.9	-	4.7	-	5.6	-	6.8	-	8.2	-
	±2.0%	E-24	1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.2	2.4	2.7	3.0	3.3	3.6	3.9	4.3	4.7	5.1	5.6	6.2	6.8	7.5	8.2	9.1
±2.0%	E-48	1.00	1.05	1.10	1.15	1.21	1.27	1.33	1.40	1.47	1.54	1.62	1.69	1.78	1.87	1.96	2.05	2.15	2.26	2.37	2.37	2.61	2.74	2.87	3.01	
		3.16	3.32	3.48	3.65	3.83	4.02	4.22	4.42	4.64	4.87	5.11	5.36	5.62	5.90	6.19	6.49	6.81	7.15	7.50	7.87	8.25	8.66	9.09	9.53	
	E-96	1.00	1.02	1.05	1.07	1.10	1.13	1.15	1.18	1.21	1.24	1.27	1.30	1.33	1.37	1.40	1.43	1.47	1.50	1.54	1.58	1.62	1.65	1.69	1.74	
		1.78	1.82	1.87	1.91	1.96	2.00	2.05	2.10	2.15	2.21	2.26	2.32	2.37	2.43	2.49	2.55	2.61	2.67	2.74	2.80	2.87	2.94	3.01	3.09	
		3.16	3.24	3.32	3.40	3.48	3.57	3.65	3.74	3.83	3.92	4.02	4.12	4.22	4.32	4.42	4.53	4.64	4.75	4.87	4.99	5.11	5.23	5.36	5.49	
±1.00%	E-192	5.62	5.76	5.90	6.04	6.19	6.34	6.49	6.65	6.81	6.98	7.15	7.32	7.50	7.68	7.87	8.06	8.25	8.45	8.66	8.87	9.09	9.31	9.53	9.76	
		10.0	10.1	10.2	10.4	10.5	10.6	10.7	10.9	11.0	11.1	11.3	11.4	11.5	11.7	11.8	12.0	12.1	12.3	12.4	12.6	12.7	12.9	13.0	13.2	
		13.3	13.5	13.7	13.8	14.0	14.2	14.3	14.5	14.7	14.9	15.0	15.2	15.4	15.6	15.8	16.0	16.2	16.4	16.5	16.7	16.9	17.2	17.4	17.6	
		17.8	18.0	18.2	18.4	18.7	18.9	19.1	19.3	19.6	19.8	20.0	20.3	20.5	20.8	21.0	21.3	21.5	21.8	22.1	22.3	22.6	22.9	23.2	23.4	
		23.7	24.0	24.3	24.6	24.9	25.2	25.5	25.8	26.1	26.4	26.7	27.1	27.4	27.7	28.0	28.4	28.7	29.1	29.4	29.8	30.1	30.5	30.9	31.2	
		31.6	32.0	32.4	32.8	33.2	33.6	34.0	34.4	34.8	35.2	35.7	36.1	36.5	37.0	37.4	37.9	38.3	38.8	39.2	39.7	40.2	40.7	41.2	41.7	
		42.2	42.7	43.2	43.7	44.2	44.8	45.3	45.9	46.4	47.0	47.5	48.1	48.7	49.3	49.9	50.5	51.1	51.7	52.3	53.0	53.6	54.2	54.9	55.6	
		56.2	56.9	57.6	58.3	59.0	59.7	60.4	61.2	61.9	62.6	63.4	64.2	64.9	65.7	66.5	67.3	68.1	69.0	69.8	70.6	71.5	72.3	73.2	74.1	
75.0	75.9	76.8	77.7	78.7	79.6	80.6	81.6	82.5	83.5	84.5	85.6	86.6	87.6	88.7	89.8	90.9	92.0	93.1	94.2	95.3	96.5	97.6	98.8			