SURFACE MOUNT RESISTORS
LRMA Series: Metal Alloy, Very Low Resistance

RoHS

FEATURES

- Low Resistance, Low TCR
- Precision current sensing
- Precision voltage division
- AEC - Q200

APPLICATION

- Battery Management systems
- Power supply
- Precision Measuring equipment
- Replaces RFE LR series

PART NUMBER EXAMPLE

LRMA	2512	20	F	R001	M	Z
Product Type	Size Code	Rated Power	Tolerance	Resistance	Material	Optional
	0805 1206 2512 2725 2728 4527	05=0.50W 07=0.75W 10=1.00W 20=2.00W 30=3.00W 40=4.00W 50=5.00W	D = ±0.5% F = ±1% G = ±2% J = ±5% 0 = Zero Ω	0m20 = 0.2mR 2m50 = 2.5mR R005 = 5.0mR R100 = 100mR R500 = 500mR	S : MnCuSn M : MnCu F : FeCrAl C : Cu	A : For Automotive Grade Z : Default

ELECTRICAL CHARACERISTICS & DIMENSION

Size Code	Rating Power at 70°C	T.C.R. (ppm/°C)	Max. Rating Current (A)	Max. Overload Current (A)	Resistance Range (mΩ) 0.5% (D)	Resistance Range (mΩ) 1.0% (F) 2.0% (G) 5.0% (J)	Material	Operation Temperature Range (°C)
0805	0.5W	≤ ±100	31.62	70.71	---	0.5~1	0m50~R002 : MnCuSn 2m50~R008 : MnCu R009~R013 : FeCrAl	-55 ~ +170
		≤ ±75	18.26	40.82	---	1.5~2		
		≤ ±50	14.14	31.62	7~13	2.5~13		
	1W	≤ ±100	44.72	89.44	---	0.5~1		
		≤ ±75	25.81	51.63	---	1.5~2		
		≤ ±50	20.00	40.00	7~13	2.5~13		
1206	0.5W	≤ ±50	22.60	50.00	5~75	1~75	R001 : MnCuSn R002~R007 : MnCu R008~R075 : FeCrAl	
	0.75W		27.38	61.23				
	1W		31.62	70.71	5~50	1~50	R001 : MnCuSn R002~R007 : MnCu R008~R050 : FeCrAl	
	1.5W		38.72	86.60	5~10	1~10	R001 : MnCuSn R002~R007 : MnCu R008~R010 : FeCrAl	

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2022.03.23

Size Code	Rating Power at 70°C	T.C.R. (ppm/°C)	Max. Rating Current (A)	Max. Overload Current (A)	Resistance Range (mΩ)		Material	Operation Temperature Range (°C)
					0.5% (D)	1.0% (F) 2.0% (G) 5.0% (J)		
2512	1W	≤ ±75	77.72	100.00	---	0.5~0.75	0m50~0m75 : MnCuSn	-55 ~ +170
		≤ ±50	31.62	70.71	5~450	1~450	R001~R006 : MnCu R007~R450 : FeCrAl	
	2W	≤ ±75	63.24	141.42	---	0.5~0.75	0m50~0m75 : MnCuSn	
		≤ ±50	44.72	100.00	5~450	1~450	R001~R006 : MnCu R007~R450 : FeCrAl	
	3W	≤ ±75	77.45	173.20	---	0.5~0.75	0m50~0m75 : MnCuSn	
		≤ ±50	54.77	122.47	5~100	1~100	R001~R006 : MnCu R007~R100 : FeCrAl	
2725	4W	≤ ±100	141.42	282.84	---	0.2	0m20~0m40 : MnCuSn 0m50~2m50 : MnCu R003 : FeCrAl	
		≤ ±50	126.49	252.98		0.25~3		
2728	4W	≤ ±50	31.62	63.24	7~450	4~450	R004~R450 : FeCrAl	
4527	2W	≤ ±75	63.24	141.42	---	0.5	0m50 : MnCuSn	
		≤ ±50	44.72	100.00	5~100	1~100	R001~R040 : MnCu R041~R100 : FeCrAl	
	3W	≤ ±75	77.45	173.20	---	0.5	0m50 : MnCuSn	
		≤ ±50	54.77	122.47	5~60	1~60	R001~R040 : MnCu R041~R60 : FeCrAl	
	5W	≤ ±75	100.00	173.20	---	0.5	0m50 : MnCuSn	
		≤ ±50	70.71	122.47	5~500	1~500	R001~R040 : MnCu R041~R500 : FeCrAl	

JUMPER SPECIFICATION

Size Code	Rating Power at 70°C	Max. Rating Current (A)	Resistance Range (mΩ)	Material	Operation Temperature Range (°C)
0805	0.5W	50A	≤ 0.20	Jumper : Cu	-55 ~ +170
	1W	70.7A	≤ 0.20		
1206	1W	70.7A	≤ 0.20	Jumper : Cu	
2512	2W	100A	≤ 0.20		

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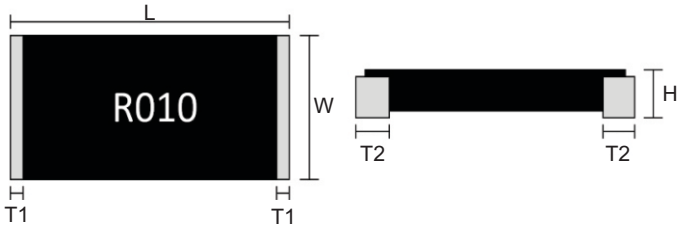
DIMENSION (unit : mm)

Size : 0805

Size : 1206 ~4527



Size Code	Rating Power	Resistance Range (mΩ)	L	W	H	T1	T2
0805	0.5W 1W	0.5	2.05 ± 0.25	1.30 ± 0.30	0.60 ± 0.20	-----	0.75 ± 0.20
		1			0.55 ± 0.20		0.40 ± 0.20
		1.5			0.45 ± 0.20		
		2			0.35 ± 0.20		
		2.5			0.45 ± 0.20		
		3 ~ 8			0.35 ± 0.20		
		9 ~ 13			0.37 ± 0.20		
1206	0.5W 0.75W	1	3.20 ± 0.254	1.65 ± 0.254	0.82 ± 0.254	0.508 ± 0.254	0.508 ± 0.254
		2			0.70 ± 0.254		
		3			0.60 ± 0.254		
		4 ~ 20			0.55 ± 0.254		
		21 ~ 50			0.47 ± 0.254		
		51 ~ 75			0.40 ± 0.254		
	1W	1			0.82 ± 0.254		
		2			0.70 ± 0.254		
		3			0.60 ± 0.254		
		4 ~ 20			0.55 ± 0.254		
		21 ~ 50			0.47 ± 0.254		
	1.5W	1			0.82 ± 0.254		
		2			0.70 ± 0.254		
		3			0.60 ± 0.254		
		4 ~ 10			0.55 ± 0.254		
2512	1W 2W	0.5	6.35 ± 0.254	3.05 ± 0.254	0.82 ± 0.254	1.98 ± 0.254	2.00 ± 0.254
		0.75			0.70 ± 0.254	1.15 ± 0.254	1.98 ± 0.254
		1			0.72 ± 0.254		2.20 ± 0.254
		1.5					1.40 ± 0.254
		2 ~ 5					1.15 ± 0.254
		6			0.55 ± 0.254		1.10 ± 0.254
		7 ~ 10			0.60 ± 0.254		
		11 ~ 75				1.05 ± 0.254	
		76 ~ 100			0.55 ± 0.254	0.75 ± 0.254	
		101 ~ 135			0.47 ± 0.254		
		136 ~ 200			0.40 ± 0.254		
		201 ~ 450					0.85 ± 0.254
	3W	0.5	6.35 ± 0.254	3.05 ± 0.254	0.82 ± 0.254	1.98 ± 0.254	2.00 ± 0.254
		0.75			0.70 ± 0.254	1.15 ± 0.254	1.98 ± 0.254
		1			0.72 ± 0.254		2.20 ± 0.254
		1.5					1.40 ± 0.254
		2 ~ 5					1.15 ± 0.254
		6			0.55 ± 0.254	0.75 ± 0.254	1.10 ± 0.254
		7 ~ 10			0.60 ± 0.254	1.15 ± 0.254	
		11 ~ 75				0.75 ± 0.254	
		76 ~ 100			0.55 ± 0.254		

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Size Code	Rating Power	Resistance Range (mΩ)	L	W	H	T1	T2
2725	4W	0.2	6.90 ± 0.254	6.35 ± 0.254	1.10 ± 0.254	1.20 ± 0.254	2.150 ± 0.254
		0.25			0.95 ± 0.254		2.287 ± 0.254
		0.3					1.975 ± 0.254
		0.35					1.710 ± 0.254
		0.4					1.440 ± 0.254
		0.5			0.85 ± 0.254		2.080 ± 0.254
		0.6					1.780 ± 0.254
		0.8					1.300 ± 0.254
		1	6.80 ± 0.254		0.65 ± 0.254	1.15 ± 0.254	1.80 ± 0.254
		1.5 ~ 1.6					1.50 ± 0.254
		2 ~ 3			0.55 ± 0.254		
2728	4W	4 ~ 450	6.60 ± 0.254	6.70 ± 0.254	0.58 ± 0.254	0.40 ± 0.254	1.05 ± 0.254
4527	2W	0.5	11.30 ± 0.50	6.60 ± 0.50	0.77 ± 0.254	0.90 ± 0.254	3.00 ± 0.254
		1			0.65 ± 0.254		2.00 ± 0.254
		1.5 ~ 20					
		21 ~ 100			0.55 ± 0.254		
	3W	0.5			0.77 ± 0.254		3.00 ± 0.254
		1			0.65 ± 0.254		2.00 ± 0.254
		1.5 ~ 20					
		21 ~ 60			0.55 ± 0.254		
	5W	0.5			0.80 ± 0.254	0.65 ± 0.254	3.00 ± 0.254
		1			0.68 ± 0.254		2.00 ± 0.254
		1.5 ~ 20					
		21 ~ 500			0.58 ± 0.254		

JUMPER DIMENSION (unit : mm)

Size Code	Rating Power	Resistance Range (mΩ)	L	W	H	T1	T2
0805	0.5W 1W	≤ 0.20	2.05 ± 0.25	1.30 ± 0.30	0.45 ± 0.20	-----	0.40 ± 0.20
1206	1W	≤ 0.20	3.20 ± 0.254	1.65 ± 0.254	0.65 ± 0.254	0.508 ± 0.254	0.508 ± 0.254
2512	2W 3W	≤ 0.20	6.35 ± 0.254	3.05 ± 0.254	0.65 ± 0.254	1.15 ± 0.254	1.10 ± 0.254

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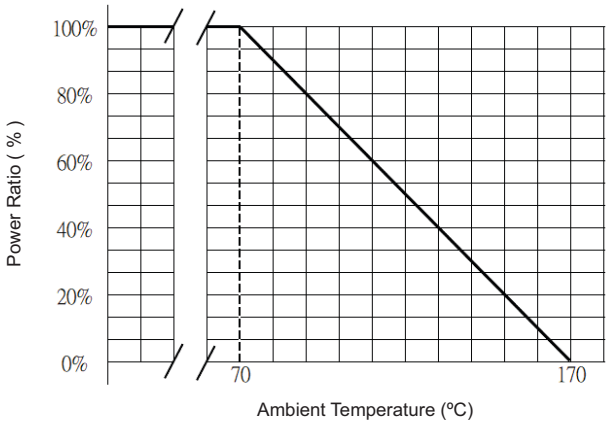
POWER DERATING CURVE

The Operating Temperature Range : -55ºC ~ +170ºC
For resistors operated in ambient temperature above 70ºC, power rating must be derating in accordance with the curve below.



RATING CURRENT

The following equation may be used to determine the DC (Direct Current) or AC (Alternating Current) (RMS, root mean square value) of normal rated power. However, if the result value exceeds the highest current of regulated standards (paragraph 5), the highest normal rated power is to be used.

$$I = \sqrt{P/R}$$

I = Rating Current (A)
P = Rating Power (W)
R = Resistance (Ω)

MARKING FORMAT

- All the other products marking are 4 digits
- “R” designates the decimal location in ohms
  e.g. 1mΩ=R001, 25mΩ=R025, 100mΩ=R100
- “m” designates the decimal location in milli-ohms
  e.g. 0.25mΩ=0m25, 0.5mΩ=0m50, 25.5mΩ=25m5
- 0Ω marking as 0R

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TEST PROCEDURES : except Jumper

Test Item	Test Method	Procedure	Requirement
Temperature Coefficient of Resistance (T.C.R)	JIS-C-5201-1 4.8 IEC-60115-1 4.8	At 25°C / +150°C, 25°C is the reference temperature	As Spec.
Short Time Overload	JIS-C-5201-1 4.13 IEC-60115-1 4.13	The number of rated power as follows: (for 5 seconds) • 0805 - 0.5W : 5 times • 0805 - 1W : 4 times • 1206 - 0.5W to 1.5W : 5 times • 2512 - 1W to 3W : 5 times • 2725 - 4W : 4 times • 2728 - 4W : 4 times • 4527 - 2W & 3W : 5 times • 4527 - 5W : 3 times	• Size 0805 : ΔR/R1 ≤ ±1.0% • Size 4527 : ΔR/R1 ≤ ±2.0% • The others : ΔR/R1 ≤ ±0.5%
High Temperature Exposure (Storage)	MIL-STD-202 Method 108	Size 0805 : 1000 hours @ 170°C, Unpowered, measured at 24±4 hours after test conclusion	• Size 0805 : ΔR/R1 ≤ ±1.0%
	JIS-C-5201-1 4.25 IEC-60068-2-2	Other sizes : 1000 hours @ 170°C	• Size 4527 : ΔR/R1 ≤ ±2.0% • The others : ΔR/R1 ≤ ±1.0%
Resistance to Soldering Heat	JIS-C-5201-1 4.18 IEC-60115-1 4.18	260 ± 5°C for 10 seconds	ΔR/R1 ≤ ±0.5%
Temperature Cycling	JESD22 Method JA-104	1000 Cycles (-55°C to 155°C), Measured at 24±4 hours after test conclusion. 30 minutes maximum dwell time at each temperature extreme	ΔR/R1 ≤ ±0.5%
Biased Humidity	MIL-STD-202 Method 103	1000 hours, 85°C / 85% RH, 10% of operating power. Measurement at 24±4 hours after test conclusion	ΔR/R1 ≤ ±0.5%
Load Life (Endurance)	JIS-C-5201-1 4.25 IEC-60115-1 4.25.1	70±2°C, RCWV or Max. working voltage whichever is less for 1000 hours with 1.5hrs "ON" and 0.5hr "OFF"	• Size 0805 : ΔR/R1 ≤ ±1.0% • Size 4527 : ΔR/R1 ≤ ±2.0% • The others : ΔR/R1 ≤ ±1.0%
Solderability	J-STD-002	Size 0805 : 1) 4 hours 155°C dry heat 2) 245 ± 5°C 3 seconds	> 95% Coverage
	JIS-C-5201-1 4.17 IEC-60115-1 4.17	245 ± 5°C 3 seconds	
Dielectric Withstanding Voltage	JIS-C-5201-1 4.7	Applied 500VAC for 1 minute, and limit surge current 50mA (max.)	No short or burned on the appearance
Board Flex (Bending Strength)	AEC Q200-005 JIS-C-5201-1 4.33 IEC-60115-1 4.33	Size 0805 : bend once 2mm for 60 seconds Other size : bend once 2mm for 10 seconds	ΔR/R1 ≤ ±0.5% no broken
Terminal Strength (SMD)	AEC Q200-006	Pressurizing force 17.7N for 60 seconds	ΔR/R1 ≤ ±0.5% no broken
Moisture Resistance	MIL-STD-202 Method 106	24 hours / Cycle, 10 cycles. Steps 7a & 7b not required. Unpowered. (Figure 1)	• Size 0805 : ΔR/R1 ≤ ±1.0% • The others : ΔR/R1 ≤ ±0.5%

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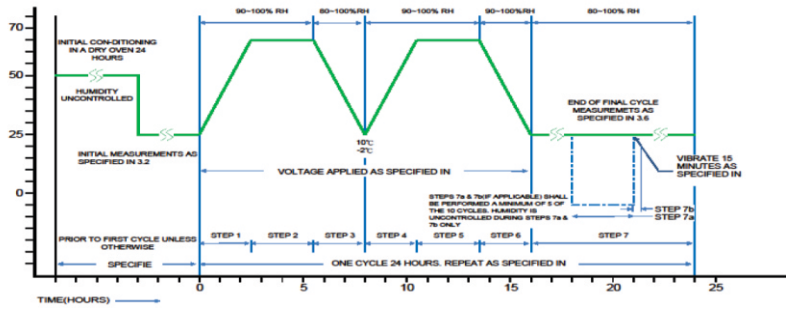
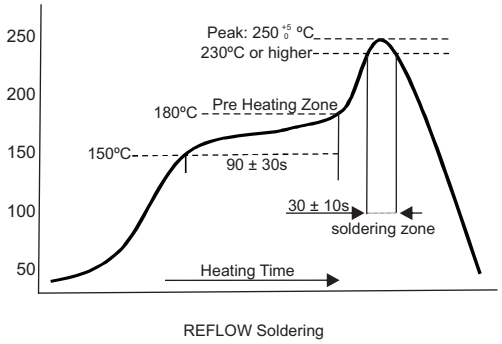
TEST PROCEDURES : for Jumper

Test Item	Test Method	Procedure	Requirement
Short Time Overload	JIS-C-5201-1 4.13 IEC-60115-1 4.13	4 times of rated power for 5 seconds.	≤ 0.2mΩ
Temperature Cycling	JESD22 Method JA-104	1000 Cycles (-55°C to 155°C). Measurement at 24±4 hours after test conclusion. 30 minutes maximum dwell time at each temperature extreme	≤ 0.2mΩ
High Temperature Exposure (Storage)	JIS-C-5201-1 4.25 IEC-60068-2-2	At 170°C for 1,000 hours	≤ 0.2mΩ
Biased Humidity	MIL-STD-202 Method 103	1000 hours, 85°C / 85% RH, 10% of operating power. Measurement at 24±4 hours after test conclusion	≤ 0.2mΩ
Load Life (Endurance)	JIS-C-5201-1 4.25 IEC-60115-1 4.25.1	70±2°C, RCWV or Max. working voltage whichever is less for 1000 hours with 1.5hrs "ON" and 0.5hr "OFF"	≤ 0.2mΩ
Solderability	JIS-C-5201-1 4.17 IEC-60115-1 4.17	245 ± 5°C for 3 seconds	> 95% Coverage

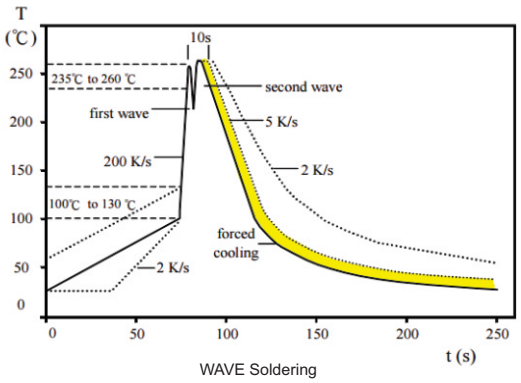
Figure 1



SOLDERING PROFILE



REFLOW Soldering



WAVE Soldering

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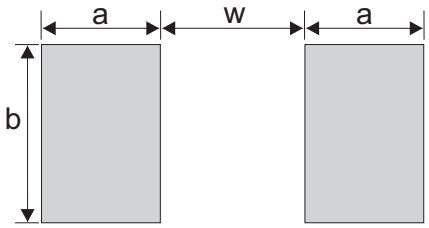
RECOMMEND LAND PATTERN DESIGN : Dimension (unit: mm)



Plating Thickness :
Ni : ≥ 2μm
Sn(Tin) : ≥ 3μm

Size Code	Rating Power	Resistance Range (mΩ)	a	b	w
0805	0.5W 1W	0.5	1.35	1.80	0.30
		0 / 1~13	1.00	1.80	1.00
1206	0.75W 1W	Jumper : 0.2mΩ	1.00	1.90	1.40
		1 ~ 100	1.60	2.18	0.66
2512	1W 2W 3W	Jumper : 0.2mΩ	2.11	3.68	3.18
		0.5 ~ 1.5	3.05		1.27
		2 ~ 3.5	2.11		3.18
		3.6 ~ 500	1.90		3.58
2725	4W	0.25 ~ 0.5	3.18	6.86	1.32
		1 ~ 3	2.34		3.00
2728	4W	4 ~ 450	2.75	7.82	3.51
4527	2W 3W 5W	0.5 ~ 3	4.50	8.47	4.50
		3.5 ~ 100	3.40		6.43
		101 ~ 500	2.93		7.63

PACKAGE QUANTITY

Size	PCS / REEL
0805	5000
1206	5000
1206 R001	4000
2512	4000
2725	2000
2728	2000
4527	1000

STORAGE TEMPERATURE

Temperature: 25ºC ± 5ºC
Humidity: 60 ± 20%

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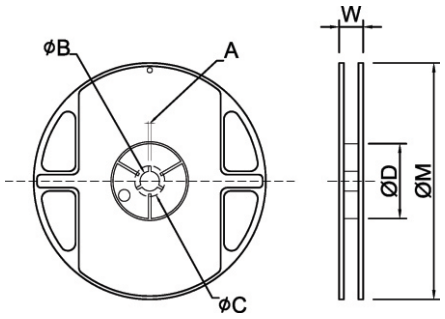
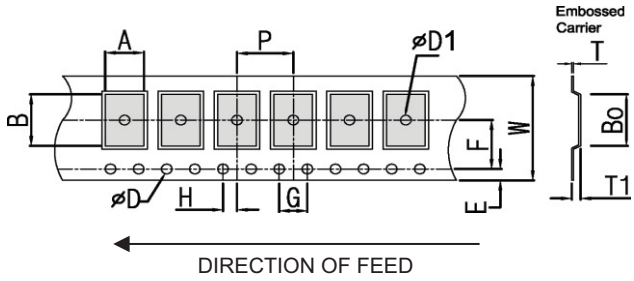
PACKING DIMENSION (mm)

Tape & Reel



Reel Type / Tape	A	øB	øC	øD	W	øM
7" reel for 8 mm embossed (for 0805 & 1206 only)	2.0 ± 0.5	13.2 ± 0.5	17.7 ± 0.5	60.0 ± 0.5	12.00± 0.5	178 ± 1.0
7" reel for 12 mm embossed	2.5 ± 0.5	13.5 ± 0.5	17.7 ± 0.5	60.0 ± 0.5	16.2 ± 0.5	178 ± 1.0
7" reel for 24 mm embossed	2.0 ± 0.5	13.5 ± 0.5	17.7 ± 0.5	60.0 ± 0.5	24.4 +2.0	178 ± 1.0

Embossed



Size	Resistance Range (mΩ)	Measurement (±0.10)				D	Measurement (±0.10)					T1	T
		W	P	E	F		D1	G	H	A	B		
0805	0 ~ 2.5	8.0	4.0	1.75	3.5	$1.50^{+0.1}_{-0}$	1.00	4.0	2.0	1.70	2.45	0.90±0.25	0.20±0.05
	3 ~ 13	8.0	4.0	1.75	3.5		1.00	4.0	2.0	1.70	2.45	0.55±0.25	0.20±0.05
1206	1	8.0	4.0	1.75	3.5		1.00	4.0	2.0	2.03	3.55	1.10±0.10	0.20±0.05
	2 ~ 75	8.0	4.0	1.75	3.5		1.00	4.0	2.0	2.03	3.55	0.85±0.10	0.20±0.05
2512	0.5 ~ 2	12.0	4.0	1.75	5.5		1.55	4.0	2.0	3.50	6.75	1.10±0.10	0.20±0.05
	3 ~ 450	12.0	4.0	1.75	5.5		1.55	4.0	2.0	3.50	6.75	0.90±0.10	0.20±0.05
2725	0.2 ~ 0.8	12.0	8.0	1.75	5.5		1.55	4.0	2.0	6.81	7.16	1.30±0.10	0.25±0.05
	1 ~ 3	12.0	8.0	1.75	5.5		1.55	4.0	2.0	6.81	7.16	1.05±0.10	0.25±0.05
2728	4 ~ 450	12.0	8.0	1.75	5.5		1.55	4.0	2.0	7.10	7.06	0.95±0.10	0.20±0.05
4527	0.5 ~ 500	24.0	12.0	1.75	11.5		1.50	4.0	2.0	7.38	12.00	1.05±0.10	0.30±0.10

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