

NRCGA Series

Automotive Surge Withstanding

Thick Film Chip Resistor



FEATURES

- HIGH POWER RATING
- 1.0Ω ~ 20MΩ RESISTANCE RANGE
- IMPROVED WORKING VOLTAGE RATINGS
- LOW TCR OPTIONS DOWN TO ±25 PPM/°C
- CONSTRUCTION TO WITHSTAND HIGH SULFUR ENVIRONMENT EIA-977
- AEC-Q200 QUALIFIED FOR AUTOMOTIVE APPLICATIONS
- OPERATING TEMPERATURE UP TO 155°C FOR 1000 HOURS
- SIZES 0402 (0.200W) ~ 2512 (1.5W)



STANDARD POWER RATING SPECIFICATIONS

Type	EIA Size	Power Rating At 70°C	Temperature Range	Max.*1 Working Voltage	Max.*2 Overload Voltage	Resistance Tolerance (Code)	Temperature Coefficient (ppm/°C)	Resistance Range (Ω)
NRCGA04	0402	0.20W	-55 °C ~ +155 °C	50V	100V	±5% (J), ±10%(K), ±20% (M)	±300 ±100	1Ω ~ 20Ω 22Ω ~ 1MΩ
NRCGA06	0603	0.125W		50V	100V	±5% (J), ±10%(K), ±20% (M)	±200 ±100	1Ω ~ 270Ω 300Ω ~ 1MΩ
NRCGA10	0805	0.25W		150V	300V	±5% (J), ±10%(K), ±20% (M)	±200 ±100	1Ω ~ 270Ω 300Ω ~ 20MΩ
NRCGA12	1206	0.33W		200V	400V	±5% (J), ±10%(K), ±20% (M)	±200 ±100	1Ω ~ 20Ω 22Ω ~ 20MΩ
NRCGA25	1210	0.50W		200V	400V	±5% (J), ±10%(K), ±20% (M)	±200 ±100	1Ω ~ 20Ω 22Ω ~ 20MΩ
NRCGA50	2010	0.75W		400V	800V	±5% (J), ±10%(K), ±20% (M)	±200 ±100	1Ω ~ 20Ω 22Ω ~ 20MΩ
NRCGA100	2512	1.50W		500V	1000V	±5% (J), ±10%(K), ±20% (M)	±200 ±100	1Ω ~ 20Ω 22Ω ~ 20MΩ

*Please refer to page 3 for information regarding max working and overload voltage ratings

HIGH POWER AND ULTRA HIGH POWER RATING SPECIFICATIONS

Type	EIA Size	Power Rating At 70°C	Temperature Range	Max.*1 Working Voltage	Max.*2 Overload Voltage	Resistance Tolerance (Code)	Temperature Coefficient (ppm/°C)	Resistance Range (Ω)
NRCGA06	0603	0.25W (H) 0.33W (U)	-55 °C ~ +155 °C	75V	150V	±5% (J), ±10%(K), ±20% (M)	±200	1Ω ~ 270Ω
							±100	300Ω ~ 1MΩ
NRCGA10	0805	0.40W (H)		150V	300V	±5% (J), ±10%(K), ±20% (M)	±200	1Ω ~ 270Ω
							±100	300Ω ~ 1MΩ
NRCGA10	0805	0.50W* (U)		400V	600V	±5% (J), ±10%(K), ±20% (M)	±200	1Ω ~ 270Ω
							±100	300Ω ~ 1MΩ
NRCGA12	1206	0.50W (H)		200V	400V	±5% (J), ±10%(K), ±20% (M)	±200	1Ω ~ 20Ω
							±100	22Ω ~ 1MΩ
NRCGA12	1206	0.75W* (U)		500V	1000V	±5% (J), ±10%(K), ±20% (M)	±200	1Ω ~ 20Ω
							±100	22Ω ~ 1MΩ
NRCGA25	1210	0.75W (H) 1.00W (U)	200V	400V	±5% (J), ±10%(K), ±20% (M)	±200	1Ω ~ 20Ω	
						±100	22Ω ~ 1MΩ	
NRCGA50	2010	1.00W (H) 1.25W (U)	400V	800V	±5% (J), ±10%(K), ±20% (M)	±200	1Ω ~ 20Ω	
						±100	22Ω ~ 1MΩ	
NRCGA100	2512	2.00W* (H)	500V	1000V	±5% (J), ±10%(K), ±20% (M)	±350	1Ω ~ 10Ω	
						±100	11Ω ~ 200KΩ	

*: Ultra High Power: double side printed resistor element

NRCGA Series

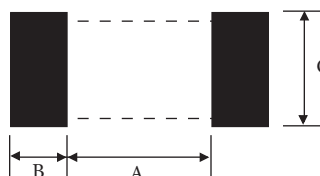
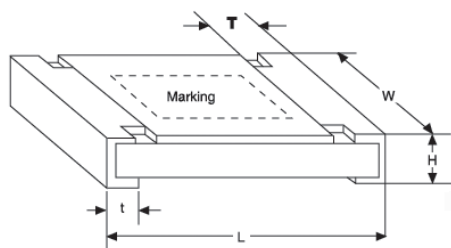
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DIMENSIONS (mm) & LAND PATTERNS (mm)

	Type	L	W	H	T	t	A	B	C
NRCGA04	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.50	0.45	0.60
NRCGA06 (All)	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	0.90	0.60	0.90
NRCGA10	0805	2.00±0.15	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	1.20	0.70	1.30
NRCGA10U	0805	2.00±0.10	1.25±0.10	0.55±0.10	0.35±0.20	0.40±0.20	1.20	0.70	1.30
NRCGA12 (Std & H)	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	2.00	0.90	1.60
NRCGA12U	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.60±0.25	0.55±0.25	2.00	0.90	1.60
NRCGA25 (All)	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.25	0.50±0.20	2.00	0.90	2.80
NRCGA50 (All)	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	3.80	0.90	2.80
NRCGA100	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	4.90	1.00	3.40
NRCGA100H	2512	6.35±0.20	3.15±0.15	0.60±0.10	0.80±0.25	0.60±0.40	4.90	1.00	3.40



PART NUMBER SYSTEM

NRCGA 10 J U 103 TR Q Y E

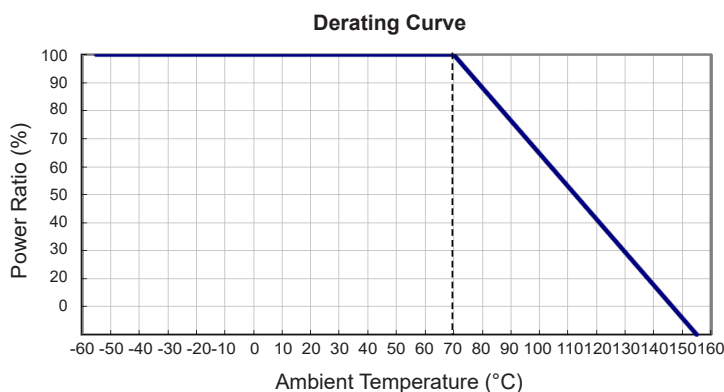
- Series
- Size Code: 04=0402, 06=0603, 10=0805, 12=1206, 25=1210, 50=2010, 100=2512
- Tolerance Code: J = ±5%, K = ±10%, M = ±20%
- Power Rating Code: Blank = Standard, H = High Power, U = Ultra High Power
- Resistance Code: First 2 digits are significant figures, 3th digit is the multiplier, "R" indicates a decimal point.
- Tape & Reel Packaging: TR = Standard Tape & Reel, TR1K = Optional 1,000 quantity
- AEC-Q200 Qualified
- RoHS compliant

"Y" denotes suitable for automotive equipment, sourced to special production and inspection at IATF-16949 certified production site

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

Note *1 - Maximum allowable continuous Working Voltage for all resistors is the lower of the two values:

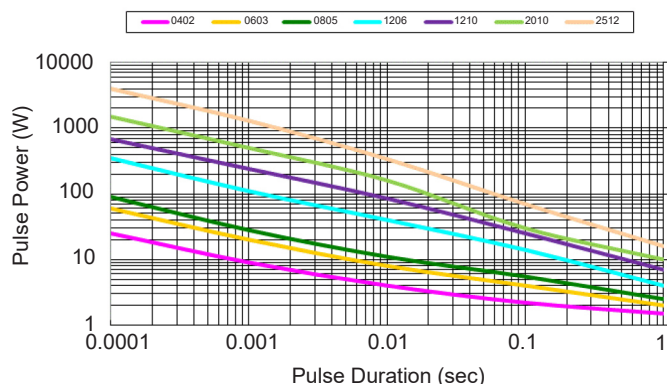
"Maximum Working Voltage" as specified above or:
 $\sqrt{\text{Power rating (Watts)} \times \text{Resistance (Ohms)}}$

Note *2 - Maximum Overload Voltage for all resistors is the lower of the two values:

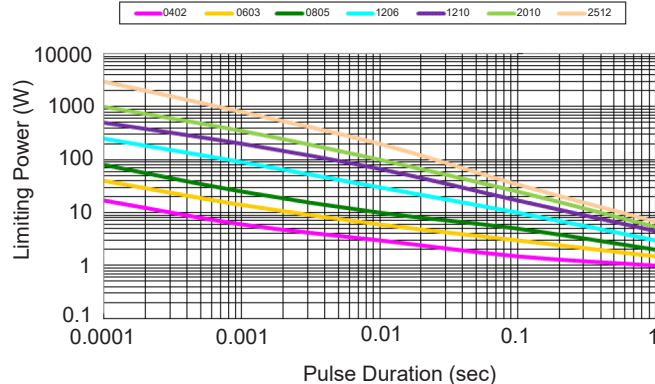
"Maximum Overload Voltage" as specified above or
 $2.5 \times \sqrt{\text{Power rating (Watts)} \times \text{Resistance (Ohms)}}$

The power rating depends on the maximum temperature of the resistive element. Due to the power dissipation of the resistor, the temperature of the resistive element will rise depending on the condition of heat dissipation from PCB. The maximum power rating in application only applies if the temperature of the resistive element is not exceed 155°C.

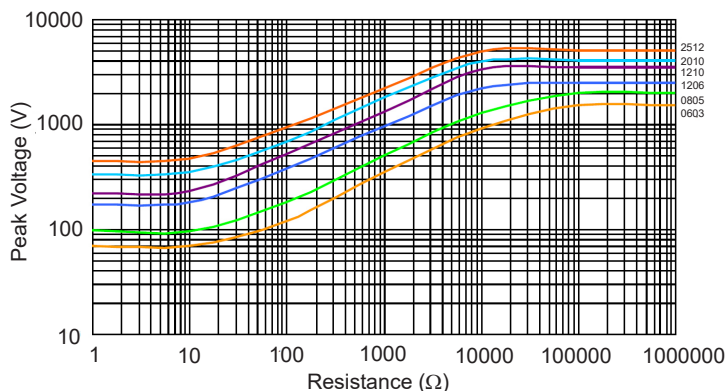
SINGLE PULSE POWER (100 Ohm)



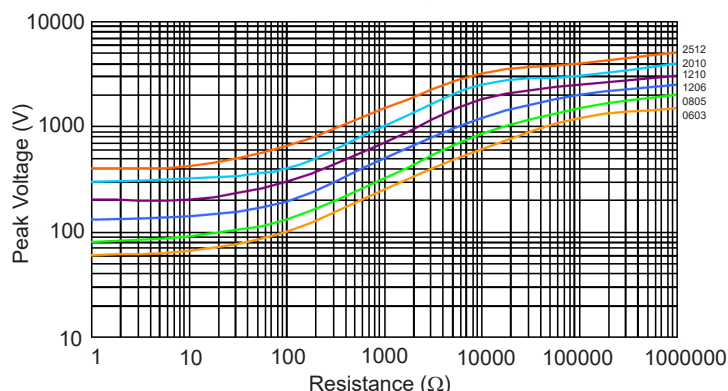
CONTINUOUS PULSE POWER (100 Ohm)



1.2/50μs Lighting Surge



10/700μs Lighting Surge



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ENVIRONMENTAL CHARACTERISTICS

Item	Requirement	Test Method
Temperature Coefficient of Resistance	As specified	JISC 5201 14.8 IEC60115 14.8 At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload (Power Operating Mode)	$\Delta\pm(1.0\%+0.05\Omega)$	JISC 5201 14.13 IEC60115 14.13 RCWV*2.5 or Max.Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	$\geq 10G\Omega$	JISC 5201 14.6 IEC60115 14.6 Max.Overload Voltage for 1 minute
Operational Life	$\Delta\pm(3.0\%+0.05\Omega)$	MIL-STD 202 Method 108 Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
Biased Humidity	$\Delta\pm(3.0\%+0.05\Omega)$	MIL-STD 202 Method 103 1000 hrs 85°C/85%RH 10% of operating power (≤ 100 V)
High Temperature Exposure	$\Delta\pm(1.0\%+0.05\Omega)$	MIL-STD 202 Method 108 at +155°C for 1000 hrs
Board Flex	$\Delta\pm(1.0\%+0.05\Omega)$	AEC-Q200-005 Bending once for 60 sec. 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% Minimum Coverage	JISC 5201 14.17 IEC60115 14.17 245°C $\pm 5^\circ\text{C}$ for 3 seconds
Resistance to Soldering Heat	$\Delta\pm(1.0\%+0.05\Omega)$	JISC 5201 1 4.18 IEC60115 1 4.18 260°C $\pm 5^\circ\text{C}$ for 10 seconds
Voltage Proof	No breakdown or flashover	JISC 5201 14.7 IEC60115 14.7 1.42 times Max. Operat ing Voltage for 1 minute
Leaching	Individual leaching area $\leq 5\%$ Total leaching area $\leq 10\%$	JISC 5201 14.18 IEC60068-2-58 8.2.1 260°C $\pm 5^\circ\text{C}$ for 30 seconds
Temperature Cycling	$\Delta\pm(1.0\%+0.05\Omega)$	JESD22 Method JA-104 -55°C to +125°C, 1000 cycles
Mechanical Shock	$\Delta\pm(1.0\%+0.05\Omega)$	MIL-STD 202 Method 213 Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	$\Delta\pm(1.0\%+0.05\Omega)$	MIL-STD 202 Method 204 5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000Hz
ESD	$\Delta\pm(3.0\%+0.05\Omega)$	AEC-Q200-002 Human body model 0402/0603: 1KV, 0805 and above: 2KV
Resistance to Solvents	No visible damage on appearance and marking.	MIL-STD 202 Method 215 Add Aqueous wash chemical OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	None broken	AEC-Q200-006 Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board	UL-94V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	$\Delta R \pm 5.0\%$	EIA-977 (Condition A) 60°C $\pm 2^\circ\text{C}$, no power rating for 500 hrs.

Performance Passives By Design

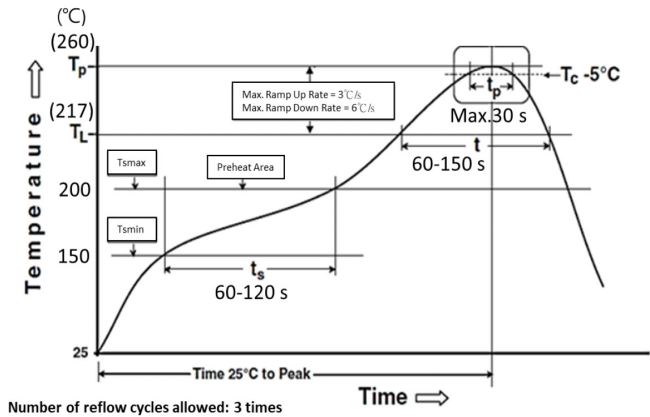
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SOLDERING CONDITIONS (IPC/JEDEC J-STD-020)



Pb-Free Assembly	Time
Preheat Temp min (T _{smin})	150°C
Preheat Temp max (T _{smax})	200°C
Preheat time (t _s)	60 - 120 seconds
Ramp-up rate (T _L to T _p)	3°C/second max.
Liquidous temperature (T _L)	217°C
Time (t _L) maintained above T _L	60 - 150 seconds
Peak Temperature min (T _p min)	235°C
Peak Temperature max (T _p max)	260°C
Time (T _p) within 5°C of the specified classification temperature (T _c)	30 seconds max.
Ramp-down rate (T _p to T _L)	6°C/second max.
Time 25°C to peak temperature	8 minutes max.

STORAGE CONDITIONS

Storage Temperature: 15 ~28 °C; Humidity < 80%RH

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STANDARD E-24 RESISTANCE CODES

E-24 Value & Code
10
11
12
13
15
16
18
20
22
24
27
30
33
36
39
43
47
51
56
62
68
75
82
91

MULTIPLIER CODE

Code	A	B, b	C	D, d	E	F	G	H	X	Y	Z
Multiplier	10 ⁰	10 ¹	10 ²	10 ³	10 ⁴	10 ⁵	10 ⁶	10 ⁷	10 ⁻¹	10 ⁻²	10 ⁻³

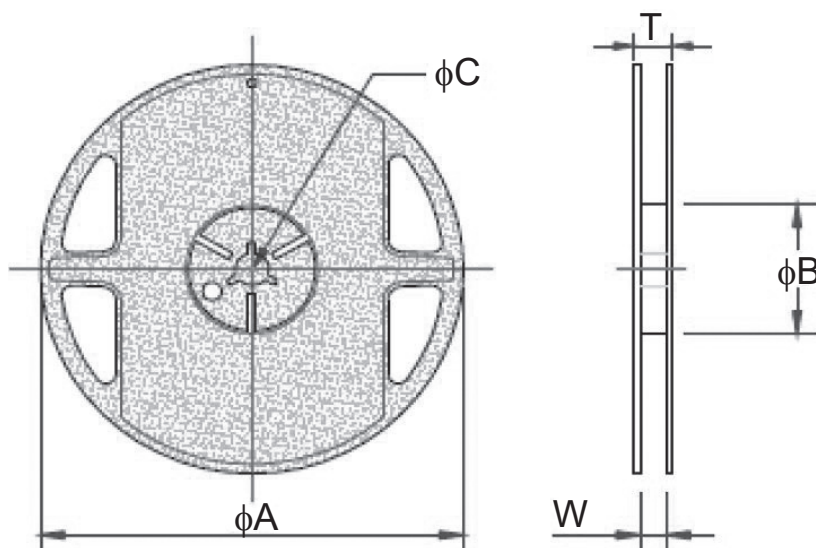
PART MARKINGS

0402 Size	0603	0805, 1206, 1210, 2010 & 2512
No Marking	3 Digit Marking System: 2 digit value code + 1 digit multiplier code $\begin{array}{c} \text{XX} \quad \text{X} \\ \text{Resistance Code} \quad \text{Multiplier Code} \end{array}$ E24 0603 Multiplier Code: 10e multiplier Marking Examples: 101 = 100 Ω (E24) 103 = 10 KΩ (E24)	4 Digit Marking System: 3 digit value code + 1 digit multiplier code E24 Code & Multiplier Code: 10e multiplier Marking Examples: 1000 = 100 Ω (E24) 1002 = 10 KΩ (E24)

REEL SPECIFICATIONS

Type	EIA Size	A	B	C	W	T	Paper Tape (EA)
NRCGA04	0402	178 $\pm$ 0.5	60.0 $\pm$ 1.0	13.0 $\pm$ 0.2	9.5 $\pm$ 1.0	12.5 $\pm$ 1.0	10,000
NRCGA06	0603						5,000
NRCGA10	0805						5,000
NRCGA12	1206						5,000
NRCGA25	1210						5,000
NRCGA50	2010			13.5 $\pm$ 0.5	13.0 $\pm$ 0.5	15.5 $\pm$ 0.5	4,000
NRCGA100	2512						4,000

REEL DIMENSIONS (mm)



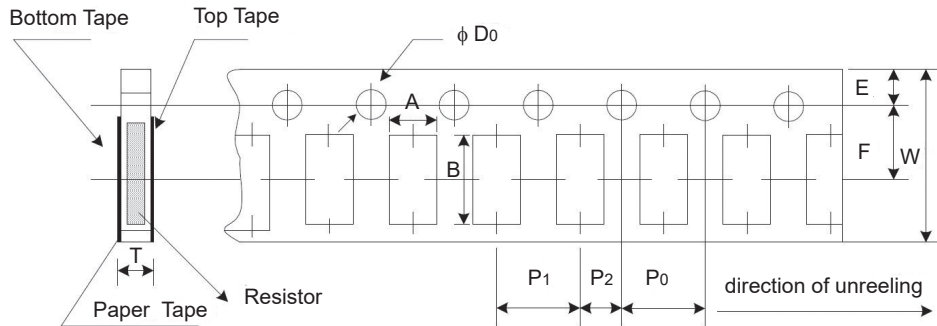
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PAPER TAPE DIMENSIONS (mm)

Type	EIA Size	A	B	D	E	F	P ₀	P ₁	P ₂	W	T
NRCGA04	0402	0.65 ± 0.10	1.15 ± 0.10	1.50+0.1/-0	1.75 ± 0.10	3.5 ± 0.05	4.00 ± 0.10	2.00 ± 0.05	2.00 ± 0.05	8.00 ± 0.20	0.45 ± 0.10
NRCGA06	0603	1.10 ± 0.10	1.90 ± 0.10	1.50+0.1/-0	1.75 ± 0.10	3.5 ± 0.05	4.00 ± 0.10	4.00 ± 0.05	2.00 ± 0.05	8.00 ± 0.20	0.70 ± 0.10
NRCGA10	0805	1.60 ± 0.10	2.40 ± 0.20	1.50+0.1/-0	1.75 ± 0.10	3.5 ± 0.05	4.00 ± 0.10	4.00 ± 0.05	2.00 ± 0.05	8.00 ± 0.20	0.85 ± 0.10
NRCGA12	1206	1.90 ± 0.10	3.50 ± 0.20	1.50+0.1/-0	1.75 ± 0.10	3.5 ± 0.05	4.00 ± 0.10	4.00 ± 0.05	2.00 ± 0.05	8.00 ± 0.20	0.85 ± 0.10
NRCGA25	1210	2.90 ± 0.10	3.50 ± 0.20	1.50+0.1/-0	1.75 ± 0.10	3.5 ± 0.05	4.00 ± 0.10	4.00 ± 0.05	2.00 ± 0.05	8.00 ± 0.20	0.85 ± 0.10



EMBOSSED PLASTIC CARRIER DIMENSIONS (mm)

Type	EIA Size	A	B	D	E	F	P ₀	P ₁	P ₂	W	T
NRCGA50	2010	2.80 ± 0.10	5.40 ± 0.10	1.50 +0.1/-0	1.75 ± 0.10	5.5 ± 0.05	4.00 ± 0.10	4.00 ± 0.10	2.00 ± 0.05	12.0 ± 0.10	1.20 +0
NRCGA100	2512	3.50 ± 0.10	6.70 ± 0.10	1.50 +0.1/-0	1.75 ± 0.10	5.5 ± 0.05	4.00 ± 0.10	4.00 ± 0.10	2.00 ± 0.05	12.0 ± 0.10	1.20 +0

