THICK FILM CHIP RESISTOR

CAL-CHIP ELECTRONICS INC.

CAL-CHIP SERIES: **RM SERIES**

• INTRODUCTION

SCOPE Applies to all sizes of rectangular-type fixed chip resistors with Ruthenium base as material.

FEATURES
- Small size and light weight
- Highly reliable multilayer electrode construction
- Compatible with all soldering process

APPLICATIONS
- Telecommunication Equipments
- Radio and Tape Recorders, TV Tuners
- Digital Cameras, Watches, Pocket Calculators
- Computers, Instruments
- Medical and Military Equipment

• CONSTRUCTION

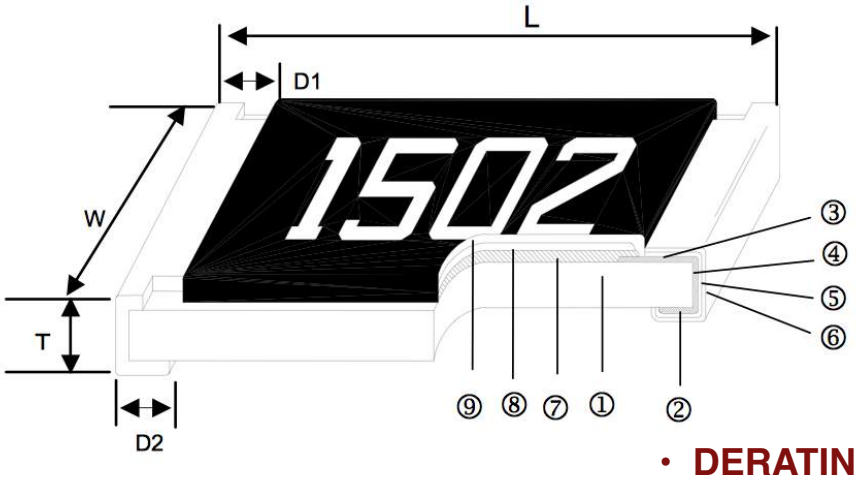
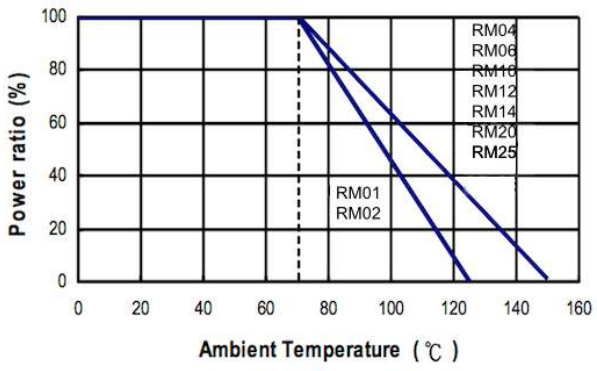


Table 2-2

1	Alumina Substrate	4	Edge Electrode (NiCr)	7	Resistor Layer
2	Bottom Electrode (Ag)	5	Barrier Layer (Ni)	8	Primary Overcoat (glass)
3	Top Electrode (Ag-Pd)	6	External Electrode (Sn)	9	Secondary Overcoat (Epoxy)

• DERATING CURVE



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• DIMENSIONS

Type	Size (Inch)	L (mm)	W (mm)	T (mm)	D1 (mm)	D2 (mm)	Weight (g) (1000 pcs)
RM01	.01005	0.40±0.02	0.20±0.02	0.13±0.02	0.10±0.03	0.10±0.03	0.037
RM02	.0201	0.60±0.03	0.30±0.03	0.23±0.03	0.15±0.05	0.15±0.05	0.150
RM04	.0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.620
RM06	.0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.042
RM10	.0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.368
RM12	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.947
RM14	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.25	0.50±0.20	15.959
RM15	1218	3.10±0.10	4.6±0.10	0.55±0.10	0.45±0.20	0.40±0.20	10.124
RM20	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24.241
RM25	2512	6.34±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39.448

• PART NUMBERING GUIDE

RM	06	J	100	CT	-H	
TYPE	**DIMENSIONS**	**RESISTANCE TOLERANCE**	**NOMINAL RESISTANCE**	**PACKAGING**	**FUNCTION CODE**	
RM Series	01: 01005 02: 0201 04: 0402 06: 0603 10: 0805 12: 1206 14: 1210 15: 1218 20: 2010 25: 2512	B: ±0.1% C: ±0.25% D: ±0.5% F: ±1% J: ±5%	5% - 3 Digit: 1st 2 are significant, 3rd is multiplier (10x), "R" indicates decimal on value <10ohm, 000 jumper "0" ohm .1%, .25%, .5%, 1% - 4 digit: 1st 3 are significant, 4th is multiplier (10x), "R" indicates decimal on value <100 ohm	CT: Taping Reel CTD: Package Designator page 9. CTG: Package Designator page 9. CTQ: Package Designator page 9.	__: Standard -H: High Power -U: Ultra High Power -X: High Precision	___: Standard TCR 50: TCR50 (Optional)

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• STANDARD ELECTRICAL SPECIFICATIONS

Type / Item	Power Rating at 70°C Jumper Rated Current	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range		TCR (PPM/°C)
					±1%	±5%	
RM01 (01005)	1/32W	-55 ~ + 125°C	15V	30V	10Ω - 1MΩ		±300
	Jumper: 0.5A				0Ω (<50mΩ)		-
RM02 (0201)	1/20W	-55 ~ + 125°C	25V	50V	10Ω - 1MΩ		±200
	Jumper: 1A				0Ω (<50mΩ)		-
RM04 (0402)	1/16W	-55 ~ + 155°C	50V	100V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 20MΩ 20.5MΩ - 100MΩ		±200 ±100 ±200 ±400
	Jumper: 1A				0Ω (<50mΩ)		-
RM06 (0603)	1/10W	-55 ~ + 155°C	75V	150V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 20MΩ 20.5MΩ - 100MΩ		±200 ±100 ±200 ±400
	Jumper: 1A				0Ω (<50mΩ)		-
RM10 (0805)	1/8W	-55 ~ + 155°C	150V	300V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 20MΩ 20.5MΩ - 100MΩ		±200 ±100 ±200 ±400
	Jumper: 2A				0Ω (<50mΩ)		-
RM12 (1206)	1/4W	-55 ~ + 155°C	200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 20MΩ 20.5MΩ - 100MΩ		±200 ±100 ±200 ±400
	Jumper: 2A				0Ω (<50mΩ)		-
RM14 (1210)	1/3W	-55 ~ + 155°C	200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 20MΩ 20.5MΩ - 100MΩ		±200 ±100 ±200 ±400
	Jumper: 2.5A				0Ω (<50mΩ)		-
RM15 (1218)	1W	-55 ~ + 155°C	500V	500V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 20MΩ 20.5MΩ - 100MΩ		-
					0Ω (<50mΩ)		-
RM20 (2010)	1/2W	-55 ~ + 155°C	200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 20MΩ 20.5MΩ - 100MΩ		±200 ±100 ±200 ±400
	Jumper: 3.5A				0Ω (<50mΩ)		-
RM25 (2512)	1W	-55 ~ + 155°C	250V	500V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 20MΩ 20.5MΩ - 100MΩ		±200 ±100 ±200 ±400
	Jumper: 4A				0Ω (<50mΩ)		-

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• HIGH PRECISION ELECTRICAL SPECIFICATIONS

Type / Item	Power Rating at 70°C Jumper Rated Current	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.1%	±0.25%	±0.5%	
RM04 (0402)	1/16W	-55 ~ + 155°C	50V	100V	-		10Ω - 1MΩ	±100
					-		1.02Ω - 10MΩ	±200
RM06 (0603)	1/10W		75V	150V	10Ω - 1MΩ			±100
					-	1.02Ω - 10MΩ		±200
RM10 (0805)	1/8W		150V	300V	10Ω - 1MΩ			±100
					-	1.02Ω - 10MΩ		±200
RM12 (1206)	1/4W		200V	400V	10Ω - 1MΩ			±100
					-	1.02Ω - 10MΩ		±200
RM14 (1210)	1/3W		200V	400V	10Ω - 1MΩ			±100
					-	1.02Ω - 10MΩ		±200
RM20 (2010)	3/4W		200V	400V	10Ω - 1MΩ			±100
					-	1.02Ω - 10MΩ		±200
RM25 (2512)	1W		250V	500V	10Ω - 1MΩ			±100
					-	1.02Ω - 10MΩ		±200

• HIGH POWER & ULTRA HIGH POWER RATING ELECTRICAL SPECIFICATIONS

Type / Item	Power Rating at 70°C Jumper Rated Current	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range		TCR (PPM/°C)	
					±1%	±5%		
RM04 (0402)	1/10 *1/8W	-55 ~ + 155°C	50V	100V	10Ω - 9.76Ω 10Ω - 1MΩ		±200	±100
RM06 (0603)	1/4W		75V	150V				
RM10 (0805)	1/3W		150V	300V				
RM12 (1206)	1/3 *1/2W		200V	400V				
RM14 (1210)	1/2 *3/4W		200V	400V				
RM20 (2010)	3/4 *1W		200V	400V				
RM25 (2512)	2W		300V	600V				

Operating Voltage = √(P*R) or Max. operating voltage listed above, whichever is lower
Overload Voltage = 2.5*√(P*R) or Max. overload voltage listed above, whichever is lower
Cal-Chip is capable of manufacturing the optional spec based on customer's requirement

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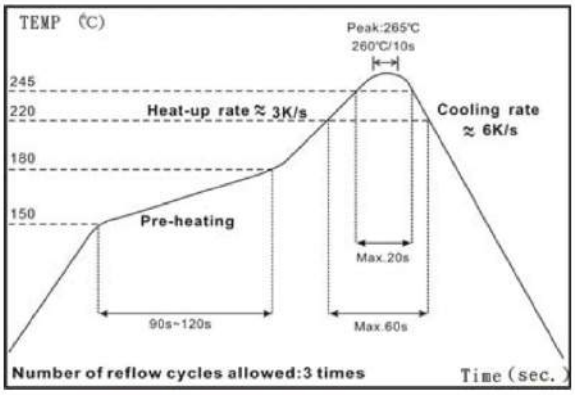
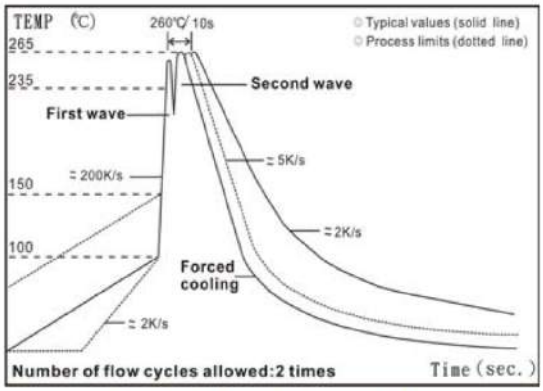
• TC50 ELECTRICAL SPECIFICATIONS

Type / Item	Power Rating at 70°C Jumper Rated Current	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range				TCR (PPM/°C)
					±0.1%	±0.25%	±0.5%	±1%	
RM04 (0402)	1/16W	-55 ~ + 155°C	50V	100V	-		100Ω - 1MΩ		±50
RM06 (0603)	1/10W		75V	150V	10Ω - 1MΩ	10Ω - 10MΩ			
RM10 (0805)	1/8W		150V	300V					
RM12 (1206)	1/4W		200V	400V					
RM14 (1210)	1/3W		200V	400V					
RM20 (2010)	3/4W		200V	400V					
RM25 (2512)	1W		250V	500V					

• SOLDERING CONDITION



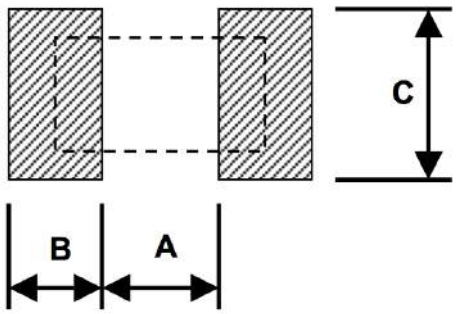
IR Reflow Soldering



Wave Soldering (Flow Soldering)

1. Time of IR Reflow soldering at maximum temperature point 260°C : 10s
2. Time of wave soldering at maximum temperature point 260°C : 10s
3. Time of soldering iron at maximum temperature point 410°C : 5s

• RECOMMENDED LAND PATTERN



Type	A (mm)	B (mm)	C (mm)
RM01	0.14	0.18	0.25
RM02	0.30	0.25	0.30
RM04	0.50	0.45	0.60
RM06	0.90	0.60	0.90
RM10	1.20	0.70	1.30
RM12	2.00	0.90	1.60
RM14	2.00	0.90	2.80
RM15	2.20	1.00	4.80
RM20	3.80	0.90	2.80
RM25	3.80	1.60	3.50

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• ENVIRONMENTAL CHARACTERISTICS

Item	Requirement			Test Method
	±1% and Below	±5%	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.			**JIS-C-5201-1 4.8** **IEC-60115-1 4.8** -55°C~+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	<50mΩ	**JIS-C-5201-1 4.13** **IEC-60115-1 4.13** RCWV*2.5 or Max. Overload voltage; whichever is lower for 5 seconds, 2 seconds for high power series
Insulation Resistance	≥10G			**JIS-C-5201-1 4.6** **IEC-60115-1 4.6** Max. Overload voltage for 1 minute
Endurance	±(1.0%+0.10Ω)	±(2.0%+0.10Ω)	<100mΩ	**JIS-C-5201-1 4.25** **IEC-60115-1 4.25.1** 70±2°C, RCWV for 1000 hours with 1.5 hrs "ON" and 0.5 hrs "OFF"
Damp Heat with Load	±(1.0%+0.10Ω)	±(2.0%+0.10Ω)	<100mΩ	**JIS-C-5201-1 4.24** **IEC-60115-1 4.24** 40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Dry Heat	±(1.0%+0.05Ω)	±(1.50%+0.05Ω)	<50mΩ	**JIS-C-5201-1 4.23** **IEC-60115-1 4.23.2** at +125/+155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	±(1.00%+0.05Ω)	<50mΩ	**JIS-C-5201-1 4.33** **IEC-60115-1 4.33** Bending once for 5 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage			**JIS-C-5201-1 4.17** **IEC-60115-1 4.17** 245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.00%+0.05Ω)	<50mΩ	**JIS-C-5201-1 4.18** **IEC-60115-1 4.18** 260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover			**JIS-C-5201-1 4.7** **IEC-60115-1 4.7** 1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤5% Total leaching area ≤10%			**JIS-C-5201-1 4.18** **IEC-60068-2-58 8.2.1** 260±5°C for 30 seconds
Rapid Change of Temperature	±(0.5%+0.05Ω)	±(1.00%+0.05Ω)	<50mΩ	**JIS-C-5201-1 4.19** **IEC-60115-1 4.19** -55°C to +125/+155°C, 5 cycles

RCWV (Rated continuous working voltage)=√(P*R) or Max. Operating voltage whichever is lower.
Storage Temperature: 25±3°C, Humidity < 80%RH

• MARKING

No marking for 01005, 0201 and 0402
Jumper for all: Letter "0"

1% for 0805 / 1206 / 1210 / 2010 /2512 : 4 digit marking

Ex:

Resistance	100Ω	2.2KΩ	10KΩ	49.9KΩ	100KΩ
Marking	1000	2201	1002	4992	1003

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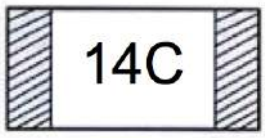
5% for 0603 / 0805 / 1206 / 1210/ 2010 / 2512 : 3 digit marking in E24

Example: 101 = 100Ω 102 = 1KΩ (1st and 2nd are E24 code and 3rd code is multiplier)

E24 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

1% for 0603: 3 digit marking in E96



Example: 14C = 13K7Ω 13C = 13K3Ω
68B = 4K99Ω 68X = 49.9Ω

Please Note: 1% E24 values will be marked the same as 5% E24

MARKING TABLE

Code	E96	Code	E96	Code	E96	Code	E96
01	100	25	178	49	316	73	562
02	102	26	182	50	324	74	576
03	105	27	187	51	332	75	590
04	107	28	191	52	340	76	604
05	110	29	196	53	348	77	619
06	113	30	200	54	357	78	634
07	115	31	205	55	365	79	649
08	118	32	210	56	374	80	665
09	121	33	215	57	383	81	681
10	124	34	221	58	392	82	698
11	127	35	226	59	402	83	715
12	130	36	232	60	412	84	732
13	133	37	237	61	422	85	750
14	137	38	243	62	432	86	768
15	140	39	249	63	442	87	787
16	143	40	255	64	453	88	806
17	147	41	261	65	464	89	825
18	150	42	267	66	475	90	845
19	154	43	274	67	487	91	866
20	158	44	280	68	499	92	887
21	162	45	287	69	511	93	909
22	165	46	294	70	523	94	931
23	169	47	301	71	536	95	952
24	174	48	309	72	549	96	976

Code	A	B	C	D	E	F	G	X	Y	
Multiplier	10	10	10	10	10	10	10	10	10	

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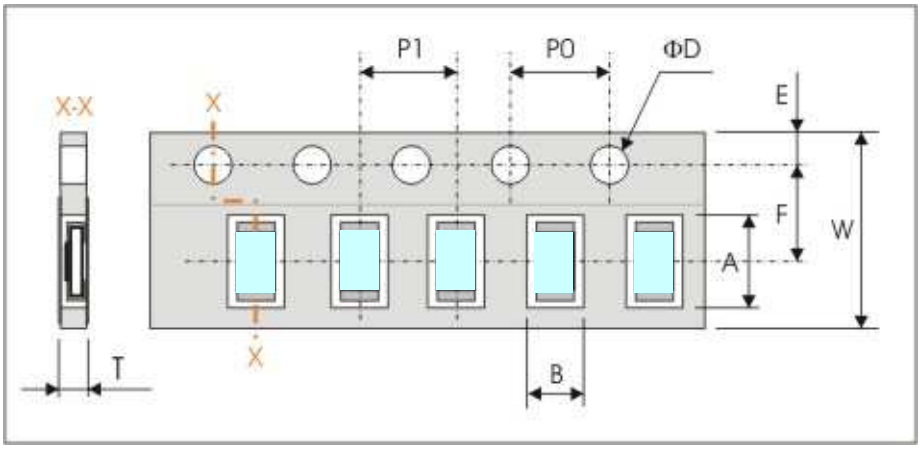
PACKAGING

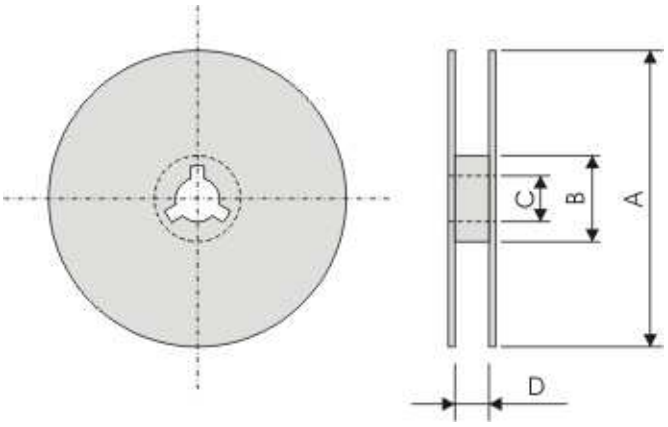
Paper Tape specifications (unit :mm)



Size	B	A	W	F	E	P1	P2	P0	D
0201	0.37±0.05	0.67±0.05	8.00±0.20	3.50±0.05	1.75±0.10	2.00±0.05	2.00±0.05	4.00±0.10	1.50+0.10/-0
0402	0.70±0.10	1.20±0.10	8.00±0.30	3.50±0.05	1.75±0.10	2.00±0.10	2.00±0.05	4.00±0.10	1.50+0.10/-0
0603	1.10±0.20	1.90±0.20	8.00±0.30	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.05	4.00±0.10	1.50+0.10/-0
0805	1.65±0.20	2.40±0.20	8.00±0.30	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.05	4.00±0.10	1.50+0.10/-0
1206	2.00±0.20	3.60±0.20	8.00±0.30	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.05	4.00±0.10	1.50+0.10/-0
1210	3.00±0.20	3.60±0.20	8.00±0.30	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.05	4.00±0.10	1.50+0.10/-0
2010	2.80±0.20	5.50±0.20	12.00±0.30	5.50±0.05	1.75±0.10	4.00±0.10	2.00±0.05	4.00±0.10	1.50+0.10/-0
2512	3.50±0.20	6.70±0.20	12.00±0.30	5.50±0.05	1.75±0.10	4.00±0.10	2.00±0.05	4.00±0.10	1.50+0.10/-0

(unit: mm)

7" Reel dimensions



Symbol	A	B	C	D
(unit : mm)	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	9.0±0.5

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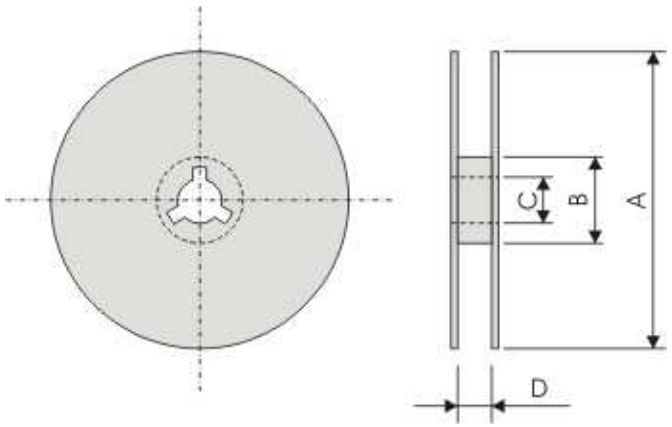
PACKAGING

7" Reel dimensions

12mm Tape



Symbol	A	B	C	D
(unit : mm)	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	13.5±1.0

RM PACKAGING DESIGNATORS

Type	D	G	Q
RM01	20K	35K	
RM02	20K	50K	70K
RM04	20K	50K	70K
RM06	10K	20K	
RM10	10K	20K	
RM12	10K	20K	
RM14	10K		
RM20			
RM25			

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