

Description

CNR thermally cut-off varistors T series and F series are thermal protective MOVs designed according to the standard of UL1449. They comprise varistors and combustion-proof devices which will cut off the power when they are overheated in the circumstance of over-voltage limited current listed in UL1449.

CNR thermal cut-off varistors T series and F series, for the proximity of the combustion-proof device and the body of MOV, can realize the thermal cut-off function. Comparing with most thermal fuse and MOV assemblies, this production has much lower inductance, so it is better in clamping of rapid over-voltage change.

CNR thermal cut-off varistors T series and F series are able to wave soldered, this may decrease the charge and repeated labor related to hand soldering process and simplify the production's assembling process.

CNR thermal cut-off varistors T series are different from F series, the former is furnished with a central second lead wire, whose function is to indicate MOV's disconnection from the circuit in order to monitor whether the circuit is connected.



Features

1. Conform to the requirement test of abnormal over-voltage limited current in UL1449.
2. Can be wave soldered/hand soldered.
3. The central second lead wire of T series can indicate circuit's connection.
4. Low leakage current.
5. The range of operation temperature is from -20°C to +85°C.
6. Has applied for a patent.

Applications

1. Power supply
2. Home appliance
3. Industrial equipment
4. Telecommunication or telephone system
5. Smart meter
6. PLC (Power line communication)
7. Lighting products
8. Photovoltaic industry

Max. Rating

	T&F-Series	Units
AC Voltage Range (Vac),Uc	35 to 1000	V
Peak Current for 8/20μS Current Wave, I _{max}	4500 to 10,000	A
Energy Range For 10/1000μS Current Wave	0.4 to 620	J
Operation Ambient Temperature Range	-20 to +85	°C
Storage Temperature Range	-20 to +105	°C
Varistor Voltage Range V _n (Vdc)	130 to 580	V
Insulation Resistance	>1000	MΩ
Typical Response Time	<25	ns

Protection principle of CNR thermal cut-off varistor:

CNR thermal cut-off varistor owns MOV's characteristics that it can protect MOV's over-voltage and cut off the circuit when suffering overheat to prevent fire. MOV's over-voltage protective characteristic lies in the varistor's stand-by state has a high impedance (several mega-ohms) in relation to the component to be protected and does not affect the characteristic of the electric circuit. In the presence of transient voltage (over the breakdown voltage of varistor), the varistor then has a low impedance (a few ohms) and short circuits, so electronic productions and valuable elements are to be protected.

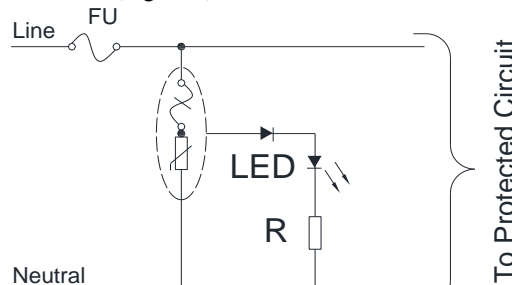
Figure and construction of CNR thermal cut-off varistors T series and F series



Note: MOV is a non-polarized passive element

T series productions' typical application examples:

T series production has an additional third lead that can monitor the connection of circuit, the following figure shows how the monitoring circuit indicates the open of the circuit. (Figure 1)



Note: the figure is just a typical application example, this production can be applied to many over-voltage protective area, and the design in actual application depends on the designers' desirability, to meet the appointed need when choosing elements.

Soldering directions:

CNR thermal cut-off varistor T series and F series have thermal protective device, so it is important to take care when soldering. When hand soldering, use heat-transmitting proof device. When wave soldering, strictly control the preheating and soldering furnace's temperature, soldering tin strip is recommended.

Directions on thermal cut-off circuit to prevent MOV's combustion

CNR thermal cut-off varistors T series and F series are thermal protective MOVs designed according to the standard of UL1449. So it should be tested on the condition of meeting the requirement of UL1449, according to the rated voltage and connection method, we choose test voltage (Table 37.1 in UL1449) which is double phase voltage or equal to line voltage, then get 4 samples and orderly adjust the changeable assistance to make short current 5A, 2.5A, 0.5A, 0.125A, energize for 7 hours, or until the samples become disconnected from circuit because of current or temperature (for the over-voltage or over-current protective device make the circuit open), test circuit (shown in Figure 37.2 in UL1449)

Note: Because the breaking degree can be different when the production is subjected to actual application, the designer should take into consideration that the production may exist the circumstances of aperture, out-gas and smoking. If customer has stricter requirement, please contact the factory.

Device Ratings and Characteristics											
Part No.	Device Marking	Maximum Allowable Voltage	Varistor Voltage (@ 1mA)			Clamping Voltage @ Test Current (@ 8/20µs)		Maximum Energy (@ 10/1000µs)	Maximum Peak Current (@ 8/20µs)	Rated Power	Typical Capacitance (@ 1KHz)
			Vn(Vdc)	Min.	Max.	Vc(V)	Ip(A)				
CNR-14T201K	14T201K	130	205	185	225	340	50	70	6000	0.6	770
CNR-14T221K	14T221K	140	220	198	242	360	50	78	6000	0.6	740
CNR-14T241K	14T241K	150	240	216	264	395	50	84	6000	0.6	700
CNR-14T271K	14T271K	175	275	247	303	455	50	99	6000	0.6	640
CNR-14T301K	14T301K	195	300	270	330	500	50	108	6000	0.6	600
CNR-14T331K	14T331K	210	330	297	363	550	50	115	6000	0.6	580
CNR-14T361K	14T361K	230	360	324	396	595	50	130	6000	0.6	540
CNR-14T391K	14T391K	250	390	351	429	650	50	140	6000	0.6	500
CNR-14T431K	14T431K	275	430	387	473	710	50	155	6000	0.6	450
CNR-14T471K	14T471K	300	470	423	517	775	50	175	6000	0.6	400
CNR-14T511K	14T511K	320	510	459	561	845	50	190	6000	0.6	350
CNR-14T561K	14T561K	350	560	504	616	915	50	190	6000	0.6	350
CNR-14T621K	14T621K	385	620	558	682	1025	50	125	4500	0.6	350
CNR-14T681K	14T681K	420	680	612	748	1120	50	130	4500	0.6	350
CNR-14T751K	14T751K	460	750	675	825	1240	50	143	4500	0.6	330
CNR-14T781K	14T781K	485	780	702	858	1290	50	148	4500	0.6	330
CNR-14T821K	14T821K	510	820	738	902	1355	50	157	4500	0.6	330
CNR-14T911K	14T911K	550	910	819	1001	1500	50	175	4500	0.6	300
CNR-14T102K	14T102K	625	1000	900	1100	1650	50	190	4500	0.6	300
CNR-14T112K	14T112K	680	1100	990	1210	1815	50	213	4500	0.6	200

Device Ratings and Characteristics											
Part No.	Device Marking	Maximum Allowable Voltage ACrms(V)	Varistor Voltage (@ 1mA)			Clamping Voltage @ Test Current (@ 8/20µs)		Maximum Energy (@ 10/1000µs) (J)	Maximum Peak Current (@ 8/20µs) (A)	Rated Power (W)	Typical Capacitance (@ 1KHz) (pF)
			Vn(Vdc)	Min.	Max.	Vc(V)	Ip(A)				
CNR-20T201K	20T201K	130	205	185	225	340	100	140	10000	1	1700
CNR-20T221K	20T221K	140	220	198	242	360	100	155	10000	1	1600
CNR-20T241K	20T241K	150	240	216	264	395	100	170	10000	1	1500
CNR-20T271K	20T271K	175	275	247	303	455	100	190	10000	1	1300
CNR-20T301K	20T301K	195	300	270	330	500	100	215	10000	1	1200
CNR-20T331K	20T331K	210	330	297	363	550	100	228	10000	1	1100
CNR-20T361K	20T361K	230	360	324	396	595	100	255	10000	1	1100
CNR-20T391K	20T391K	250	390	351	429	650	100	275	10000	1	1100
CNR-20T431K	20T431K	275	430	387	473	710	100	303	10000	1	1000
CNR-20T471K	20T471K	300	470	423	517	775	100	350	10000	1	900
CNR-20T511K	20T511K	320	510	459	561	845	100	382	10000	1	800
CNR-20T561K	20T561K	350	560	504	616	915	100	382	10000	1	800
CNR-20T621K	20T621K	385	620	558	682	1025	100	220	6500	1	570
CNR-20T681K	20T681K	420	680	612	748	1120	100	230	6500	1	550
CNR-20T751K	20T751K	460	750	675	825	1240	100	255	6500	1	530
CNR-20T781K	20T781K	485	780	702	858	1290	100	265	6500	1	500
CNR-20T821K	20T821K	510	820	738	902	1355	100	282	6500	1	500
CNR-20T911K	20T911K	550	910	819	1001	1500	100	310	6500	1	480
CNR-20T102K	20T102K	625	1000	900	1100	1650	100	342	6500	1	460
CNR-20T112K	20T112K	680	1100	990	1210	1815	100	383	6500	1	400

Device Ratings and Characteristics											
Part No.	Device Marking	Maximum Allowable Voltage ACrms(V)	Varistor Voltage (@ 1mA)			Clamping Voltage @ Test Current (@ 8/20µs)		Maximum Energy (@ 10/1000µs) (J)	Maximum Peak Current (@ 8/20µs) (A)	Rated Power (W)	Typical Capacitance (@ 1KHz) (pF)
			Vn(Vdc)	Min.	Max.	Vc(V)	Ip(A)				
CNR-14F201K	14F201K	130	205	185	225	340	50	70	6000	0.6	770
CNR-14F221K	14F221K	140	220	198	242	360	50	78	6000	0.6	740
CNR-14F241K	14F241K	150	240	216	264	395	50	84	6000	0.6	700
CNR-14F271K	14F271K	175	275	247	303	455	50	99	6000	0.6	640
CNR-14F301K	14F301K	195	300	270	330	500	50	108	6000	0.6	600
CNR-14F331K	14F331K	210	330	297	363	550	50	115	6000	0.6	580
CNR-14F361K	14F361K	230	360	324	396	595	50	130	6000	0.6	540
CNR-14F391K	14F391K	250	390	351	429	650	50	140	6000	0.6	500
CNR-14F431K	14F431K	275	430	387	473	710	50	155	6000	0.6	450
CNR-14F471K	14F471K	300	470	423	517	775	50	175	6000	0.6	400
CNR-14F511K	14F511K	320	510	459	561	845	50	190	6000	0.6	350
CNR-14F561K	14F561K	350	560	504	616	915	50	190	6000	0.6	350
CNR-14F621K	14F621K	385	620	558	682	1025	50	125	4500	0.6	350
CNR-14F681K	14F681K	420	680	612	748	1120	50	130	4500	0.6	350
CNR-14F751K	14F751K	460	750	675	825	1240	50	143	4500	0.6	330
CNR-14F781K	14F781K	485	780	702	858	1290	50	148	4500	0.6	330
CNR-14F821K	14F821K	510	820	738	902	1355	50	157	4500	0.6	330
CNR-14F911K	14F911K	550	910	819	1001	1500	50	175	4500	0.6	300
CNR-14F102K	14F102K	625	1000	900	1100	1650	50	190	4500	0.6	300
CNR-14F112K	14F112K	680	1100	990	1210	1815	50	213	4500	0.6	200

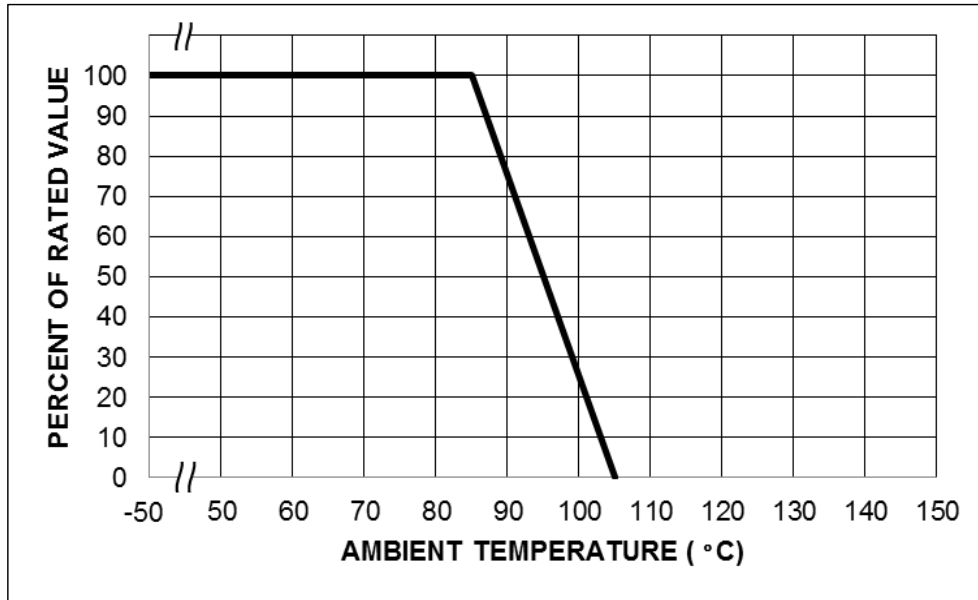
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Part No.	Device Marking	Maximum Allowable Voltage	Varistor Voltage (@ 1mA)			Clamping Voltage @ Test Current (@ 8/20 μ s)		Maximum Energy (@ 10/1000 μ s)	Maximum Peak Current (@ 8/20 μ s)	Rated Power	Typical Capacitance (@ 1KHz)
			ACrms(V)	Vn(Vdc)	Min.	Max.	Vc(V)				
CNR-20F201K	20F201K	130	205	185	225	340	100	140	10000	1	1700
CNR-20F221K	20F221K	140	220	198	242	360	100	155	10000	1	1600
CNR-20F241K	20F241K	150	240	216	264	395	100	170	10000	1	1500
CNR-20F271K	20F271K	175	275	247	303	455	100	190	10000	1	1300
CNR-20F301K	20F301K	195	300	270	330	500	100	215	10000	1	1200
CNR-20F331K	20F331K	210	330	297	363	550	100	228	10000	1	1100
CNR-20F361K	20F361K	230	360	324	396	595	100	255	10000	1	1100
CNR-20F391K	20F391K	250	390	351	429	650	100	275	10000	1	1100
CNR-20F431K	20F431K	275	430	387	473	710	100	303	10000	1	1000
CNR-20F471K	20F471K	300	470	423	517	775	100	350	10000	1	900
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CNR-20F102K	20F102K	625	1000	900	1100	1650	100	342	6500	1	460
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Reliability

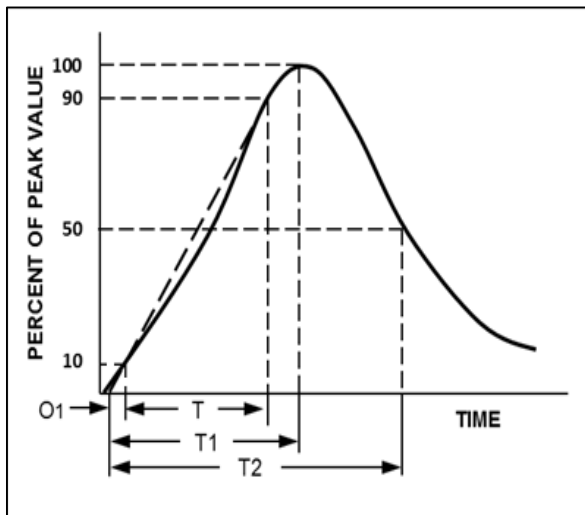
Characteristics	Standard	Test condition / Methods	Specifications
Single peak current	IEC61051-1	The maximum current within the varistor voltage change of $\pm 10\%$ with the standard impulse current (8/20 μ s) applied one times.	$\Delta V_{1mA}/V_{1mA} \leq \pm 10\%$
Energy	IEC61051-1	The maximum energy within the varistor voltage change of $\pm 10\%$ when one impulse of 2 ms or 10/1000 μ s is applied	$\Delta V_{1mA}/V_{1mA} \leq \pm 10\%$
Robustness of Terminations (Tensile)	IEC60068-2-21	After Gradually applying the specified force and keep the unit fixed for 10 \pm 1 sec. Terminal diameter Force \emptyset 0.6 mm 9.8 N (1.0Kgf) \emptyset 0.8 mm 9.8 N (1.0Kgf) \emptyset 1.0 mm 19.6 N (2.0Kgf)	No visible damage
Robustness of Terminations (Bending)	IEC60068-2-21	Hold specimen and apply the force specified below to each lead. Bend the specimen to 90°, then return to the original position. Repeat the procedure in the opposite direction. Terminal diameter Force \emptyset 0.6 mm 9.8 N (0.5Kgf) \emptyset 0.8 mm 9.8 N (0.5Kgf) \emptyset 1.0 mm 19.6 N (1.0Kgf)	No visible damage
Solderability	IEC60068-2-20	After dipping the terminals to a depth of approximately 3mm from the body in a soldering bath of 260 \pm 5°C for 2 \pm 0.5 seconds, the terminal shall be visually examined.	Approximately 95% of the terminal shall be covered with solder uniformly
Resistance to Soldering Heat	IEC60068-2-20	260 \pm 5°C , 10 \pm 1 sec.	$\Delta V_{1mA}/V_{1mA} \leq \pm 5\%$, No visible damage
Vibration	IEC60068-2-6	Frequency range: 10-55Hz Amplitude: 0.75mm or 98 m/s ² Direction: 3 mutually perpendicular directions, 2 hrs each.	$\Delta V_{1mA}/V_{1mA} \leq 5\%$ No visible damage
High Temperature Storage	IEC60068-2-2	125 \pm 2 °C x 1000 \pm 24hrs	$\Delta V_{mA}/V_{mA} \leq \pm 5\%$
High Humidity Storage	IEC60068-2-2	40 \pm 2 °C , 90 to 95% RH 1000 hrs	$\Delta V_{1mA}/\Delta V_{1mA} \leq \pm 5\%$
Temperature Cycle	IEC60068-2-14	The conditions shown below shall be repeated 5 cycles. Step Temperature (°C) Period (minutes) 1. -40 \pm 3 30 \pm 3 2. Room temperature 15 \pm 3 3. 125 \pm 2 30 \pm 3 4. Room temperature 15 \pm 3	$\Delta V_{1mA}/V_{1mA} \leq \pm 5\%$ No visible damage
High Temp Load	IEC61051-1	85 \pm 2 °C , 1000 \pm 24hrs. At Vdc or Vrms (MAX. Allowable Voltage)	$\Delta V_{1mA}/V_{1mA} \leq \pm 10\%$
Withstanding Voltage (Body Insulation)	IEC61051-1	The specified voltage shall be applied both terminals of the specimen connected together and metal foil closely wrapped round its body for 1 minute. Electrical breakdown shall be examined. Classification Test Voltage V _{1mA} \geq 130V 2500Vrms	No visible damage

Power Derating Curve

Should transients occur in rapid succession, the average power dissipation is the energy (watt-seconds) per pulse times the number of pulses per second. The power so developed must be with the specifications shown on the Device Ratings and Specifications Table for the specific device. The operating values of a MOV need to be derated at high temperatures as shown above. Because varistors only dissipate a relatively small amount of average power they are not suitable for repetitive applications that involve substantial amounts of average power dissipation.

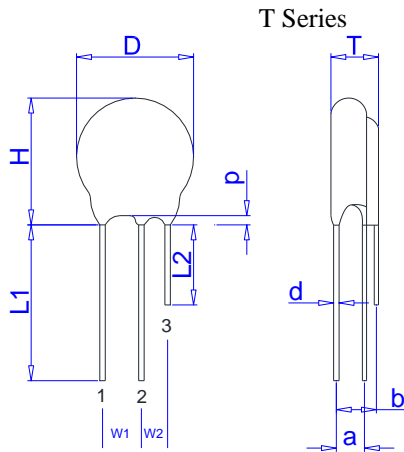


Surge Current Standard Waveform



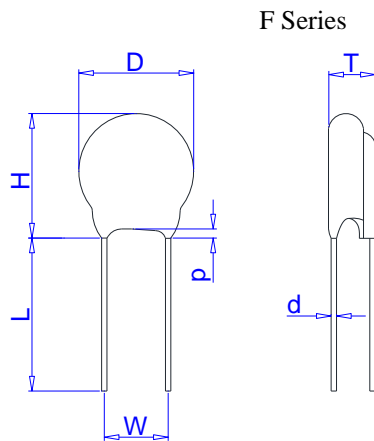
O1 = Virtual Origin of Wave
 T = Time from 10% to 90% of Peak
 T1 = Rise Time = 1.25 x T
 T2 = Decay Time
 Example - For an 8/20 μs Current Waveform:
 8μs = T1 = Rise Time
 20μs = T2 = Decay Time

Dimension of Component



Dimension table

Symbol	Model size	14T	20T
D(max)		17.5	25
H(max)		20.5	28
W1(±1.0)		7.5	7.5(10.0)
W2(±1.0)		5	5(6.0)
Φd		0.8	0.8(1.0)
P(max.)		3	3
L1(min)		25	25
L2(min)		5	5



Dimension table

Symbol	Model size	14T	20T
D(max)		17.5	25
H(max)		20.5	28
W1(±1.0)		7.5	7.5(10.0)
W2(±1.0)		5	5(6.0)
Φd		0.8	0.8(1.0)
P(max.)		3	3
L1(min)		25	25
L2(min)		5	5

Unit: mm

Bulk Packing

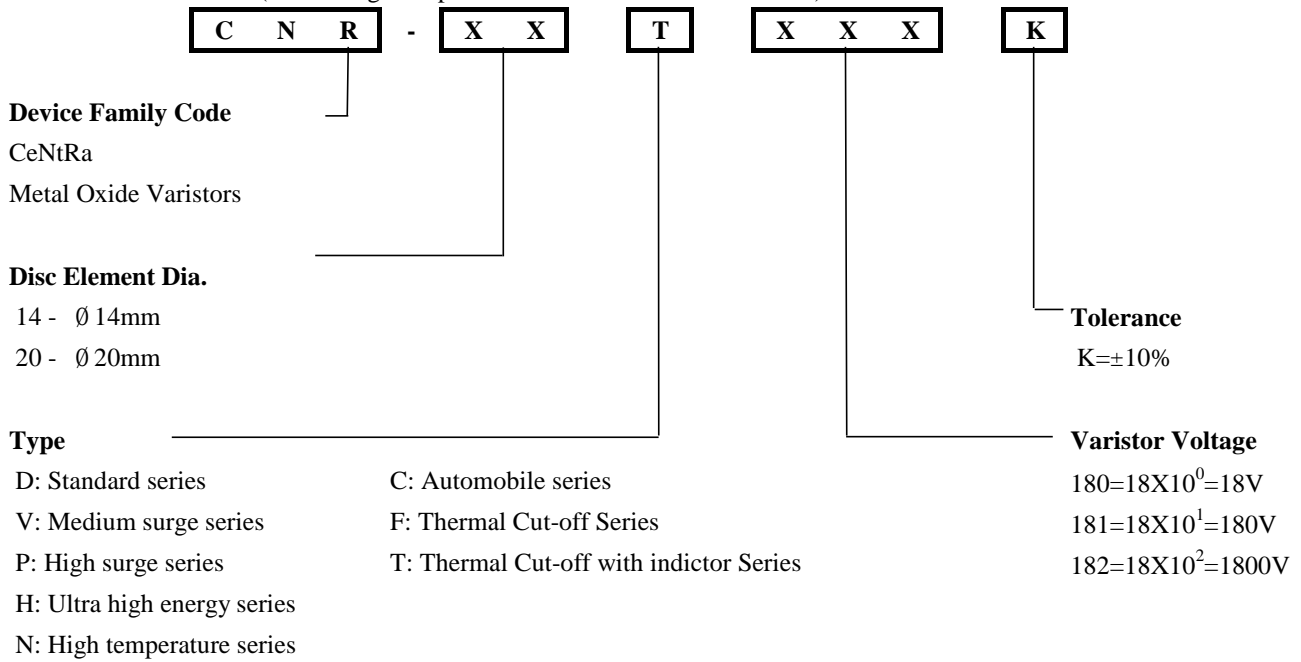
Series	Pack Quantity (pcs/bag)	InCarton Quantity (box)	Outer Carton Quantity(box)
14T	100	1000	2000
20T	50	500	1000
14F	100	1000	2000
20F	50	500	1000

T max. Table							Unit:mm		
Model	14T			20T			Model	14F	20F
	TMax	aMax	bMax	TMax	aMax	bMax		TMax	TMax
201K	7.8	2.0	3.6	7.9	2.0	3.6	201K	7.8	7.9
221K	8	2.1	3.7	8.1	2.1	3.7	221K	8.0	8.1
241K	8.1	2.2	3.8	8.2	2.2	3.8	241K	8.1	8.2
271K	8.2	2.3	3.9	8.5	2.3	3.9	271K	8.2	8.5
301K	8.3	2.5	4.1	8.6	2.5	4.1	301K	8.3	8.6
331K	8.4	2.7	4.3	8.7	2.7	4.3	331K	8.4	8.7
361K	8.5	2.8	4.4	8.8	2.8	4.4	361K	8.5	8.8
391K	8.6	3.0	4.6	8.9	3.0	4.6	391K	8.6	8.9
431K	8.7	3.2	4.8	9.1	3.2	4.8	431K	8.7	9.1
471K	9	3.4	5.1	9.3	3.4	5.1	471K	9.0	9.3
511K	9.2	3.6	5.4	9.5	3.6	5.4	511K	9.2	9.5
561K	9.5	3.8	5.6	9.7	3.8	5.6	561K	9.5	9.7
621K	10	4.1	5.9	10.1	4.1	5.9	621K	10.0	10.1
681K	10.2	4.4	6.2	10.4	4.4	6.2	681K	10.2	10.4
751K	10.5	4.7	6.6	10.7	4.7	6.6	751K	10.5	10.7
781K	10.7	4.9	6.8	10.9	4.9	6.8	781K	10.7	10.9
821K	11.0	5.1	7.0	11.0	5.1	7.0	821K	11.0	11
911K	11.2	5.5	7.5	11.5	5.5	7.5	911K	11.2	11.5
102K	12.0	6.0	8.0	12.0	6.0	8.0	102K	12.0	12
112K	12.2	6.5	8.6	12.2	6.5	8.6	112K	12.2	12.2

Explanation of Part Numbers

MAIN PART CODES

(See Ratings & Specifications tables and notes below)



Ordering Notes: