Leaded Metal Film Resistors With Established Reliability

FEATURES

- IECQ-CECC approved to EN 140101-806, version E
- Established reliability, failure rate level E7
- Advanced thin film technology
- Intrinsic sulfur resistance
- Single lot date code
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS COMPLIANT
HALOGEN FREE

LINKS TO ADDITIONAL RESOURCES

3D Models

APPLICATIONS

- Military
- Avionics
- Space

MBA/SMA 0204 VG06, MBB/SMA 0207 VG06, and MBE/SMA 0414 VG06 leaded metal film resistors with established reliability are the perfect choice for all high-reliability applications typically found in military, aircraft and spacecraft electronics. These versions supplement the families of professional and precision leaded resistors MBA/SMA 0204, MBB/SMA 0207, and MBE/SMA 0414.

TECHNICAL SPECIFICATIONS

DESCRIPTION	MBA/SMA 0204 VG06	MBB/SMA 0207 VG06	MBE/SMA 0414 VG06
DIN size	0204	0207	0414
Size code (EN/CECC style)	A	B	D
Resistance range	1 Ω to 5.11 MΩ; 0 Ω	1 Ω to 10 MΩ; 0 Ω	1 Ω to 21.5 MΩ
Resistance tolerance	± 1 %; ± 0.1 %		
Temperature coefficient	± 50 ppm/K; ± 15 ppm/K		
Rated dissipation, P_{70} (1)	0.4 W	0.6 W	1 W (2)
Operating voltage, $U_{max.}$ AC_{RMS} or DC	200 V	350 V (2)	500 V
Permissible voltage against ambient (insulation): 1 min; U_{ins}	300 V	500 V	800 V (2)
Assessed failure rate level	E7 = 10^{-7}/h		
Quality factor, π_Q	0.1		
Failure rate, $FIT_{observed}$	< 0.1 x 10^{-9}/h		

Notes

- These resistors do not feature a limited lifetime when operated within the permissible limits. However, resistance value drift increasing over operating time may result in exceeding a limit acceptable to the specific application, thereby establishing a functional lifetime
- The failure rate level E7 (10^{-7}/h, π_Q = 0.1), corresponding to MIL Level R, is superior to level E6 (10^{-6}/h, π_Q = 0.3) or level E5 (10^{-5}/h, π_Q = 1) and thus may be used as a replacement

(1) These specification details apply to the products ± 50 ppm/K; ±1 %. Please find more details for all product versions below
(2) These data provide a user advantage over the ratings and requirements of EN140101-806

TECHNICAL SPECIFICATIONS FOR PRODUCTS ± 50 ppm/K; ± 1 %			
DESCRIPTION	**MBA/SMA 0204 VG06**	**MBB/SMA 0207 VG06**	**MBE/SMA 0414 VG06**
Rated dissipation, P_{70}	0.4 W	0.6 W	1 W (1)
Permissible film temperature, $\vartheta_{F\,max.}$	155 °C		
Operating temperature range	-55 °C to +155 °C		
Max. resistance change at P_{70} for resistance, $\lvert\Delta R/R\rvert$ max., after:	1 Ω to 332 kΩ	1 Ω to 1 MΩ	1 Ω to 2.43 MΩ
1000 h	≤ 0.5 %	≤ 0.5 %	≤ 0.4 % (1)
8000 h	≤ 1 %	≤ 1 %	≤ 0.8 % (1)

Note

(1) These data provide a user advantage over the ratings and requirements of EN140101-806

TECHNICAL SPECIFICATIONS FOR PRODUCTS ± 15 ppm/K; ± 0.1 %			
DESCRIPTION	**MBA/SMA 0204 VG06**	**MBB/SMA 0207 VG06**	**MBE/SMA 0414 VG06**
Rated dissipation, P_{70}	0.25 W	0.4 W	0.65 W (1)
Permissible film temperature, $\vartheta_{F\,max.}$	125 °C		
Operating temperature range	-55 °C to 125 °C		
Max. resistance change at P_{70} for resistance, $\lvert\Delta R/R\rvert$ max., after:	100 Ω to 221 kΩ	100 Ω to 499 kΩ	100 Ω to 470 kΩ
1000 h	≤ 0.25 %	≤ 0.15 % (1)	≤ 0.25 %
8000 h	≤ 0.5 %	≤ 0.5 %	≤ 0.5 %

Note

(1) These data provide a user advantage over the ratings and requirements of EN140101-806

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE				
TYPE / SIZE	**TCR**	**TOLERANCE**	**RESISTANCE**	**E-SERIES**
MBA/SMA 0204 VG06	± 50 ppm/K	± 1 %	1 Ω to 5.11 MΩ	E96
	± 15 ppm/K	± 0.1 %	100 Ω to 221 kΩ	E192
	Jumper (1); $I_{max.}$ = 3 A	≤ 10 mΩ	0 Ω	-
MBB/SMA 0207 VG06	± 50 ppm/K	± 1 %	1 Ω to 10 MΩ	E96
	± 15 ppm/K	± 0.1 %	100 Ω to 499 kΩ	E192
	Jumper (1); $I_{max.}$ = 5 A	≤ 10 mΩ	0 Ω	-
MBE/SMA 0414 VG06	± 50 ppm/K	± 1 %	1 Ω to 21.5 MΩ	E96
	± 15 ppm/K	± 0.1 %	100 Ω to 470 kΩ	E192

Notes

- Other TCR or tolerances, or combinations thereof, or resistance values from other E-series than given are not permitted in EN 140101-806 for version E products

(1) The temperature coefficient of resistance (TCR) is not specified for 0 Ω jumpers

PACKAGING

TYPE / SIZE	CODE	QUANTITY	PACKAGING STYLE	WIDTH	PITCH	PACKAGING DIMENSIONS
MBA/SMA 0204 VG06	C1	1000	Taped acc. IEC 60286-1, fan-folded in a box	53 mm	5 mm	184 mm x 75 mm x 42 mm
	CT	5000				330 mm x 75 mm x 55 mm
MBB/SMA 0207 VG06	C1	1000		53 mm		184 mm x 75 mm x 42 mm
	CT	5000				324 mm x 77 mm x 83 mm
MBE/SMA 0414 VG06	C1	1000		63 mm		377 mm x 85 mm x 47 mm

Notes

- Width is the nominal spacing between tapes, with the nominal tape width on both sides being 6 mm, and pitch is the nominal standard spacing between components; tolerances apply according to IEC 60286-1
- The tape on one side is marked with a black print every 100th component position

PART NUMBER AND PRODUCT DESCRIPTION

PART NUMBER: MBB0207CE3523BCT00

PART NUMBER: MBB0207CZ0000ZCT00

M	B	B	0	2	0	7	C	E	3	5	2	3	B	C	T	0	0
M	B	B	0	2	0	7	C	Z	0	0	0	0	Z	C	T	0	0

TYPE / SIZE	VERSION	TCR	RESISTANCE	TOLERANCE	PACKAGING
MBA/SMA **0204** **MBB**/SMA **0207** **MBE**/SMA **0414**	**C** = EN 140101-806, version E, failure rate level E7	**C** = ± 50 ppm/K **E** = ± 15 ppm/K **Z** = jumper	**3 digit value** **1 digit multiplier** MULTIPLIER **8** = $*10^{-2}$ **9** = $*10^{-1}$ **0** = $*10^{0}$ **1** = $*10^{1}$ **2** = $*10^{2}$ **3** = $*10^{3}$ **4** = $*10^{4}$ **5** = $*10^{5}$ **0000** = Jumper	**F** = ± 1 % **B** = ± 0.1 % **Z** = jumper	**C1** **CT**

PRODUCT DESCRIPTION: MBB/SMA 0207-15 0.1 % VG06 CT 352K

PRODUCT DESCRIPTION: MBB/SMA 0207 VG06 CT 0R0

MBB/SMA 0207	-15	0.1 %	VG06	CT	352K
MBB/SMA 0207	**-**	**-**	**VG06**	**CT**	**0R0**

TYPE / SIZE	TCR	TOLERANCE	VERSION	PACKAGING	RESISTANCE
MBA/SMA 0204 **MBB/SMA 0207** **MBE/SMA 0414**	**± 50 ppm/K** **± 15 ppm/K**	**± 1 %** **± 0.1 %**	**VG06** = EN 140101-806, version E, failure rate level E7	**C1** **CT**	**49R9** = 49.9 Ω **352K** = 352 kΩ **0R0** = jumper

Notes

- The products can be ordered using either the PART NUMBER or the PRODUCT DESCRIPTION
- Products within a packaging unit are single lot date code

EN 140101-806 ORDERING INFORMATION

Example of the ordering information for a resistor: MBB/SMA 0207-15 0.1 % VG06 352K

EN140101-806EZBP352KBE7

Example of the ordering information for a zero ohm jumper: MBB/SMA 0207 VG06 0R0

EN140101-806EZB-0R00-E7

The elements used in the component number have the following meaning:

EN140101-806	EN detail specification number
EZ	Assessment level for the zero-defect approach
B	Style (size)
P	Temperature coefficient, according to EN 60062
	R = ± 50 ppm/K; P = ± 15 ppm/K
352K	Resistance, according to EN 60062, 4 characters
B	Tolerance on rated resistance, according to EN 60062
	F = ± 1 %; B = ± 0.1 %
E7	Failure rate level according to EN 60115-1, annex ZR

Notes

- The ordering information according to EN 140401-806:2007 shown above succeeds and replaces the ordering information according to its predecessor CECC 40101-806, for example:

CECC 40101-806 S B E 352K B E7

with	S	Assessment level, where EZ is successor to and superior replacement for S
	E	Temperature coefficient, according to the detail specification C = ± 50 ppm/K; E = ± 15 ppm/K

- EN 140101-806 succeeds the prior specification CECC 40101-806 and a huge variety of historical specifications CECC 40101-0xx. Preceding specifications on resistors with established reliability (now “version E”) have been CECC 40101-046 and CECC 40101-047

DESCRIPTION

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A homogeneous film of metal alloy is deposited on a high grade ceramic body (Al_2O_3) and conditioned to achieve the desired temperature coefficient. Plated steel termination caps are firmly pressed on the metallised rods. A special laser is used to achieve the target value by smoothly cutting a helical groove in the resistive layer without damaging the ceramics. Connecting wires of electrolytic copper plated with fused pure tin are welded to the termination caps. The resistor elements are covered by a light blue protective coating designed for electrical, mechanical and climatic protection. Five color code rings designate the resistance value and tolerance in accordance with **IEC 60062** (1).

The result of the determined production is verified by an extensive testing procedure performed on 100 % of the individual resistors. For IECQ-CECC approved products, this includes pulse load screening for the elimination of products with a potential risk of early life failures according to EN 140101-806, 2.1.2.2 (feasible for $R \geq 10\ \Omega$). Only accepted products are stuck directly on the adhesive tapes in accordance with **IEC 60286-1** (1). Products within a package unit are from the same production lot and carry the same date code.

ASSEMBLY

The resistors are suitable for processing on lead forming and cropping equipment and automatic insertion machines. They are suitable for automatic wave or reflow soldering, including miniature wave selective soldering. Solderability is specified for 2 years after production or requalification, however, the permitted storage time is 20 years.

The resistors are completely lead (Pb)-free, the fused pure tin plating provides compatibility with lead (Pb)-free soldering processes. The immunity of the plating against tin whisker growth has been proven under extensive testing.

The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions. The suitability of conformal coatings, potting compounds, and their processes, if applied, shall be qualified by appropriate means to ensure the long-term stability of the whole system.

MATERIALS

Vishay acknowledges the following systems for the regulation of hazardous substances.

- IEC 62474, Material Declaration for Products of and for the Electrotechnical Industry, with the list of declarable substances given therein (2)
- The Global Automotive Declarable Substance List (GADSL) (3)
- The REACH regulation (1907/2006/EC) and the related list of substances with very high concern (SVHC) (4) for its supply chain

The products do not contain any of the banned substances as per IEC 62474, GADSL, or the SVHC list, see www.vishay.com/how/leadfree.
Hence the products fully comply with the following directives:

- 2000/53/EC End-of-Life Vehicle Directive (ELV) and Annex II (ELV II)
- 2011/65/EU Restriction of the Use of Hazardous Substances Directive (RoHS) with amendment 2015/863/EU
- 2012/19/EU Waste Electrical and Electronic Equipment Directive (WEEE)

Vishay pursues the elimination of conflict minerals from its supply chain, see the Conflict Minerals Policy at www.vishay.com/doc?49037.

APPROVALS

The resistors are approved within the IECQ-CECC Quality Assessment System for Electronic Components to the detail specification **EN 140101-806** which refers to **EN 60115-1**, **EN 140100** and the variety of environmental test procedures of the **IEC 60068** (1) series.

Conformity is attested by the use of the **CECC** logo () as the Mark of Conformity on the package label.

Vishay Beyschlag has achieved **"Approval of Manufacturer"** in accordance with **IECQ 03-1**. The release certificate for **"Technology Approval Schedule"** in accordance with **CECC 240001** based on **IECQ 03-3-1** is granted for the Vishay Beyschlag manufacturing process.

The Vishay Beyschlag production facility is registered with the CAGE code D9539.

RELATED PRODUCTS

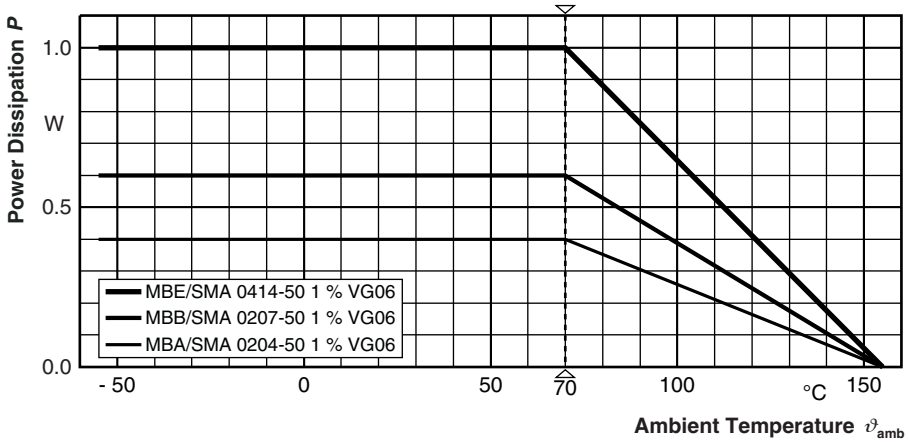
A wider range of TCR, tolerance and resistance values, plus the option of values from a different E series is available with products approved to **EN 140101-806**, version A, without established reliability, nominal failure rate level E0 (Quality factor $\pi_Q = 3$). See the datasheets:

- "Professional Leaded Metal Film Resistors" (www.vishay.com/doc?28766)
- "Precision Leaded Metal Film Resistors" (www.vishay.com/doc?28767)

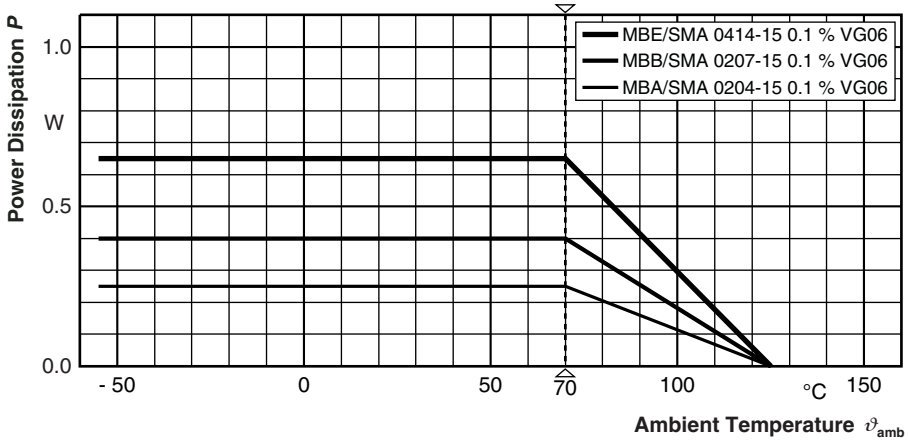
Notes

(1) The quoted IEC standards are also released as EN standards with the same number and identical contents
(2) The IEC 62474 list of declarable substances is maintained in a dedicated database, which is available at http://std.iec.ch/iec62474
(3) The Global Automotive Declarable Substance List (GADSL) is maintained by the American Chemistry Council, and available at www.gadsl.org
(4) The SVHC list is maintained by the European Chemical Agency (ECHA) and available at http://echa.europa.eu/candidate-list-table

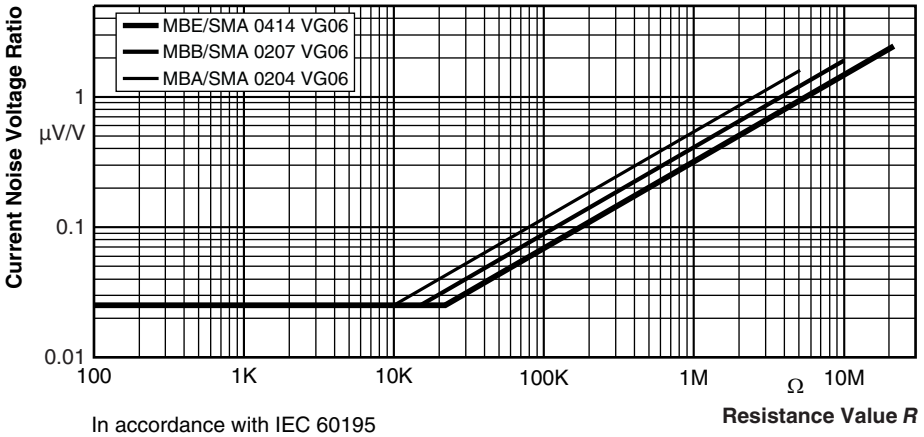
FUNCTIONAL PERFORMANCE



Derating for Products ± 50 ppm/K; ± 1 %

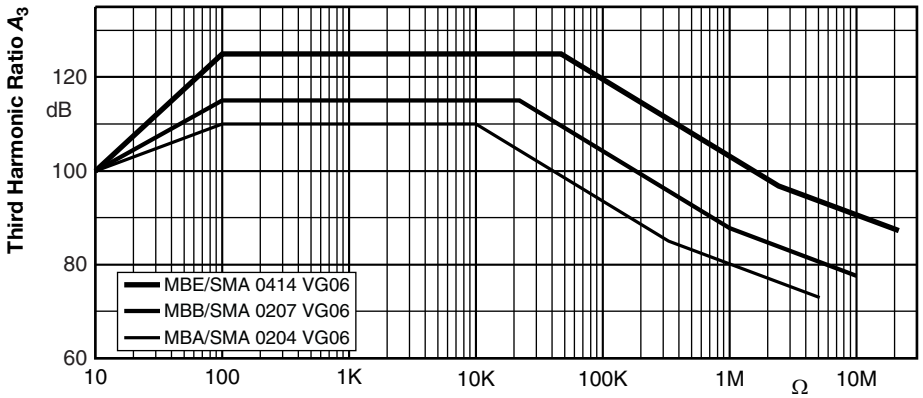


Derating for Products ± 15 ppm/K; ± 0.1 %



In accordance with IEC 60195

Current Noise Voltage Ratio



In accordance with IEC 60440

Non-Linearity - Third Harmonic Ratio A_3

Further information on the performance of these products is given in the following datasheets:

- "Professional Leaded Metal Film Resistors" (www.vishay.com/doc?28766) for products ± 50 ppm/K; ± 1 % and 0 Ω jumper
- "Precision Leaded Metal Film Resistors" (www.vishay.com/doc?28767) for products ± 15 ppm/K; ± 0.1 %

TESTS AND REQUIREMENTS

All tests are carried out in accordance with the following specifications:

EN 60115-1, generic specification

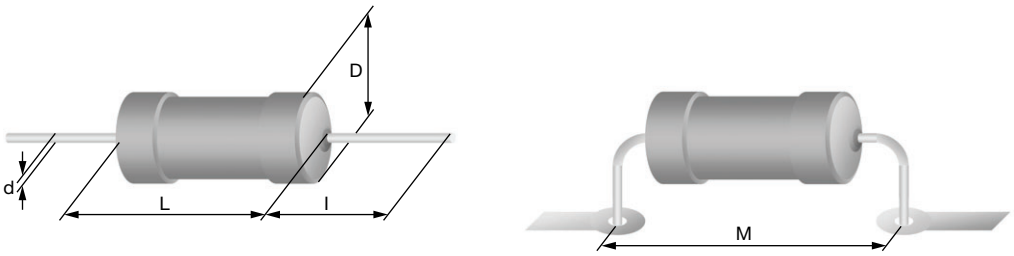
EN 140100 (successor of EN 140400), sectional specification

EN 140101-806, detail specification

For further information on the tests and requirements of these products please refer to the specifications mentioned above, and to the following datasheets:

- "Professional Leaded Metal Film Resistors" (www.vishay.com/doc?28766) for products ± 50 ppm/K; ± 1 % and 0 Ω jumper
- "Precision Leaded Metal Film Resistors" (www.vishay.com/doc?28767) for products ± 15 ppm/K; ± 0.1 %

DIMENSIONS



DIMENSIONS AND MASS						
TYPE	**$D_{max.}$ (mm)**	**$L_{max.}$ (mm)**	**$l_{min.}$ (mm)**	**$d_{nom.}$ (mm)**	**$M_{min.}$ (mm)**	**MASS (mg)**
MBA/SMA 0204 VG06	1.6	3.6	29	0.5	5.0	125
MBB/SMA 0207 VG06	2.5	6.3	28	0.6	10	220
MBE/SMA 0414 VG06	4.0	11.9	31	0.8	15	700

Notes

- Color code marking is applied according to IEC 60062 (1) in five bands. Each color band appears as a single solid line, voids are permissible if at least $^2/_3$ of the band is visible from each radial angle of view. The last color band for tolerance is approximately 50 % wider than the other bands. Zero ohm jumpers are marked with one centered black color band. An interrupted violet band between the 1st and 2nd full band indicates the failure rate level E7. An interrupted orange band between the 4th and 5th full band indicates the temperature coefficient of 15 ppm/K

(1) The quoted IEC standards are also released as EN standards with the same number and identical contents

HISTORICAL 12NC INFORMATION

- The resistors had a 12-digit numeric code starting with 2312
- The subsequent 4 digits indicated the resistor type, specification and packaging; see the 12NC table
- The remaining 4 digits indicated the resistance value:
  - The first 3 digits indicate the resistance value
  - The last digit indicated the resistance decade in accordance with the resistance decade table

RESISTANCE DECADE	LAST DIGIT
1 Ω to 9.99 Ω	8
10 Ω to 99.9 Ω	9
100 Ω to 999 Ω	1
1 kΩ to 9.99 kΩ	2
10 kΩ to 99.9 kΩ	3
100 kΩ to 999 kΩ	4
1 MΩ to 9.99 MΩ	5
10 MΩ to 99.9 MΩ	6

Historical 12NC

The 12NC of a MBB 0207 VG06 resistor, resistance 352K, TCR 15, ± 0.1 % tolerance, supplied taped and fan-folded in a box of 5000 units was: 2312 917 03524.

HISTORICAL 12NC - Resistor type and packaging

DESCRIPTION			2312	
			TAPED, FAN-FOLDED IN A BOX	
TYPE	TCR	TOL.	C1 1000 PIECES	CT 5000 PIECES
MBA 0204 VG06	± 50 ppm/K	± 1 %	900 0....	905 0....
	± 15 ppm/K	± 0.1 %	902 0....	907 0....
	Jumper		902 90001	907 90001
MBB 0207 VG06	± 50 ppm/K	± 1 %	910 0....	915 0....
	± 15 ppm/K	± 0.1 %	912 0....	917 0....
	Jumper		912 90001	917 90001
MBE 0414 VG06	± 50 ppm/K	± 1 %	920 0....	-
	± 15 ppm/K	± 0.1 %	922 0....	

Note

- The 12NC coding had been established for the series of MBA 0204 VG06, MBB 0207 VG06 and MBE 0414 VG06 products. These products are succeeded and replaced by the new series of MBA/SMA 0204 VG06, MBB/SMA 0207 VG06 and MBE/SMA 0414 VG06 products, for which the 12NC coding is no longer applicable

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MBB0207CC6190FC100	MBE0414CC2749FC100	MBB0207CZ0000ZC100	MBA0204CZ0000ZC100
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MBB0207CC1152FC100	MBB0207CC3162FC100	MBB0207CC3830FC100	MBB0207CC3321FC100
MBB0207CC2433FC100	MBB0207CC4641FC100	MBB0207CC1104FC100	MBE0414CC5110FC100
MBB0207CC4750FC100	MBB0207CC1783FC100	MBB0207CC4992FC100	MBB0207CC3482FC100
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MBB0207CC1473FC100	MBA0204CC1001FC100	MBB0207CC9091FC100	MBB0207CC2551FC100
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