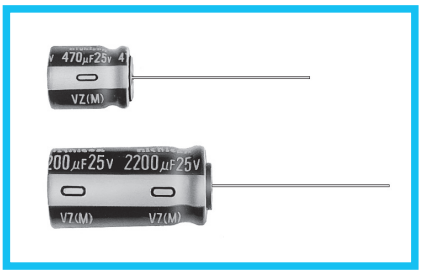
ALUMINUM ELECTROLYTIC CAPACITORS

nichicon

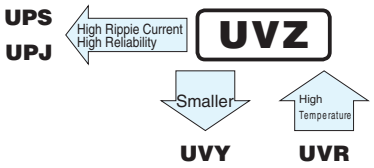
UVZ

Wide Temperature Range

Anti-Solvent Feature
(Through 100V only)



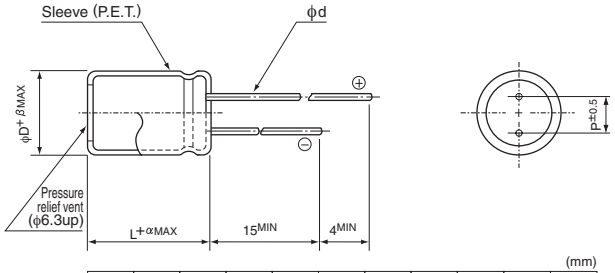
- Wide temperature range and same size as UVR.
- Compliant to the RoHS directive (2011/65/EU,(EU)2015/863).



■Specifications

Item	Performance Characteristics
Category Temperature Range	−55 to +105˚C (6.3 to 100V) , −40 to +105˚C (160 to 400V), −25 to +105˚C (450V)
Rated Voltage Range	6.3 to 450V
Rated Capacitance Range	0.47 to 33000μF
Capacitance Tolerance	±20% at 120Hz, 20˚C
Leakage Current	Rated voltage (V) | 6.3 to 100: After 1 minute's application of rated voltage at 20°C, leakage current is not more than 0.03CV or 4 (μA), whichever is greater. After 2 minutes' application of rated voltage at 20°C, leakage current is not more than 0.01CV or 3 (μA), whichever is greater. | 160 to 450: After 1 minute's application of rated voltage at 20°C, CV ≦ 1000 : I = 0.1CV+40 (μA) or less; After 1 minute's application of rated voltage at 20°C, CV > 1000 : I = 0.04CV+100 (μA) or less
Tangent of loss angle (tan δ)	For capacitance of more than 1000μF, add 0.02 for every increase of 1000μF. Measurement frequency : 120Hz at 20˚C Rated voltage (V): 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 100 | 160 to 315 | 350 to 450 tan δ (MAX.): 0.28 | 0.24 | 0.20 | 0.16 | 0.14 | 0.12 | 0.10 | 0.08 | 0.20 | 0.25
Stability at Low Temperature	Measurement frequency : 120Hz Rated voltage (V): 6.3 | 10 | 16 | 25 | 35 | 50 | 63 | 100 | 160 to 200 | 250 to 350 | 400 | 450 Impedance ratio (MAX.) Z−25˚C / Z+20˚C: 5 | 4 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 4 | 6 | 15 Impedance ratio (MAX.) Z−40˚C / Z+20˚C: 10 | 8 | 6 | 4 | 3 | 3 | 3 | 3 | 4 | 8 | 10 | —
Endurance	The specifications listed at right shall be met when the capacitors are restored to 20°C after the rated voltage is applied for 2000 hours (1000 hours for φD = 5,6.3 and 8) at 105°C. Capacitance change: Within ±20% of the initial capacitance value tan δ: 200% or less than the initial specified value Leakage current: Less than or equal to the initial specified value
Shelf Life	After storing the capacitors under no load at 105˚C for 1000 hours and then performing voltage treatment based on JIS C 5101-4 clause 4.1 at 20°C, they shall meet the specified values for the endurance characteristics listed above.
Marking	Printed with white color letter on black sleeve.

■Radial Lead Type



(mm)

φD	5	6.3	8	10	12.5	16	18	20	22	25
P	2.0	2.5	3.5	5.0	5.0	7.5	7.5	10.0	10.0	12.5
φd	0.5	0.5	0.6	0.6	0.6	0.8	0.8	1.0	1.0	1.0
β	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0

α	
	(L<20) 1.5
	(L≧20) 2.0

• Please refer to page 18 about the end seal configuration.

Type numbering system (Example : 10V 330μF)

1	2	3	4	5	6	7	8	9	10	11
U	V	Z	1	A	3	3	1	M	E	D

Configuration※
Capacitance tolerance (±20%)
Rated capacitance (330μF)
Rated voltage (10V)
Series name
Type

※Configuration

φ D	Pb-free leadwire Pb-free PET sleeve
5	DD
6.3	ED
8 · 10	PD
12.5 to 18	HD
20 to 25	RD

● Frequency coefficient of rated ripple current

V	Cap. (μF) \ Frequency	50Hz	120Hz	300Hz	1 kHz	10 kHz or more
6.3 to 100	2.2 to 47	0.75	1.00	1.35	1.57	2.00
	100 to 470	0.80	1.00	1.23	1.34	1.50
	1000 to 33000	0.85	1.00	1.10	1.13	1.15
160 to 450	0.47 to 220	0.80	1.00	1.25	1.40	1.60
	330 to 1000	0.90	1.00	1.10	1.13	1.15

● Dimension table in next page.

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■ Dimensions

Rated Voltage (V) (code)	Rated Capacitance (μF)	Case Size φD×L (mm)	tan δ	Leakage Current (μA)		Rated Ripple (mArms) (105℃/120Hz)	Part Number
				at 20℃ after 1 minute	at 20℃ after 2 minutes		
6.3 (0J)	22	5×11	0.28	4.158	3	45	UVZ0J220MDD
	33	5×11	0.28	6.237	3	55	UVZ0J330MDD
	47	5×11	0.28	8.883	3	65	UVZ0J470MDD
	100	5×11	0.28	18.9	6.3	95	UVZ0J101MDD
	220	5×11	0.28	41.58	13.86	145	UVZ0J221MDD
	330	6.3×11	0.28	62.37	20.79	195	UVZ0J331MED
	470	6.3×11	0.28	88.83	29.61	230	UVZ0J471MED
	1000	8×11.5	0.28	189	63	390	UVZ0J102MPD
	2200	10×20	0.30	415.8	138.6	710	UVZ0J222MPD
	3300	10×20	0.32	623.7	207.9	840	UVZ0J332MPD
	4700	12.5×20	0.34	888.3	296.1	1090	UVZ0J472MHD
	6800	12.5×25	0.38	1285.2	428.4	1350	UVZ0J682MHD
	10000	16×25	0.46	1890	630	1650	UVZ0J103MHD
	15000	16×35.5	0.56	2835	945	2010	UVZ0J153MHD
	22000	18×40	0.70	4158	1386	2350	UVZ0J223MHD
	33000	22×50	0.92	6237	2079	2800	UVZ0J333MRD
10 (1A)	22	5×11	0.24	6.6	3	45	UVZ1A220MDD
	33	5×11	0.24	9.9	3.3	58	UVZ1A330MDD
	47	5×11	0.24	14.1	4.7	68	UVZ1A470MDD
	100	5×11	0.24	30	10	105	UVZ1A101MDD
	220	6.3×11	0.24	66	22	175	UVZ1A221MED
	330	6.3×11	0.24	99	33	210	UVZ1A331MED
	470	6.3×11	0.24	141	47	250	UVZ1A471MED
	1000	10×12.5	0.24	300	100	460	UVZ1A102MPD
	2200	10×20	0.26	660	220	760	UVZ1A222MPD
	3300	12.5×20	0.28	990	330	1000	UVZ1A332MHD
	4700	12.5×25	0.30	1410	470	1260	UVZ1A472MHD
	6800	16×25	0.34	2040	680	1570	UVZ1A682MHD
	10000	16×35.5	0.42	3000	1000	1890	UVZ1A103MHD
	15000	18×35.5	0.52	4500	1500	2180	UVZ1A153MHD
	22000	20×40	0.66	6600	2200	2650	UVZ1A223MRD
	33000	22×50	0.88	9900	3300	3250	UVZ1A333MRD
16 (1C)	10	5×11	0.20	4.8	3	35	UVZ1C100MDD
	22	5×11	0.20	10.56	3.52	54	UVZ1C220MDD
	33	5×11	0.20	15.84	5.28	65	UVZ1C330MDD
	47	5×11	0.20	22.56	7.52	79	UVZ1C470MDD
	100	5×11	0.20	48	16	115	UVZ1C101MDD
	220	6.3×11	0.20	105.6	35.2	190	UVZ1C221MED
	330	8×11.5	0.20	158.4	52.8	265	UVZ1C331MPD
	470	8×11.5	0.20	225.6	75.2	315	UVZ1C471MPD
	1000	10×16	0.20	480	160	560	UVZ1C102MPD
	2200	12.5×20	0.22	1056	352	920	UVZ1C222MHD
	3300	12.5×25	0.24	1584	528	1170	UVZ1C332MHD
	4700	16×25	0.26	2256	752	1480	UVZ1C472MHD
	6800	16×35.5	0.30	3264	1088	1780	UVZ1C682MHD
	10000	18×35.5	0.38	4800	1600	2060	UVZ1C103MHD
	15000	20×40	0.48	7200	2400	2430	UVZ1C153MRD
	22000	22×50	0.62	10560	3520	3000	UVZ1C223MRD
	33000	25×50	0.84	15840	5280	3450	UVZ1C333MRD
25 (1E)	4.7	5×11	0.16	4	3	25	UVZ1E4R7MDD
	10	5×11	0.16	7.5	3	36	UVZ1E100MDD
	22	5×11	0.16	16.5	5.5	58	UVZ1E220MDD

For cut leads, formed leads or taped parts, please add the appropriate code after the size code (12th digit).
If there is no size code in the part number, please add size code "1" and then add the appropriate code.

UVZ

■ Dimensions

Rated Voltage (V) (code)	Rated Capacitance (μF)	Case Size φD×L (mm)	tan δ	Leakage Current (μA)		Rated Ripple (mArms) (105℃/120Hz)	Part Number
				at 20℃ after 1 minute	at 20℃ after 2 minutes		
25 (1E)	33	5×11	0.16	24.75	8.25	68	UVZ1E330MDD
	47	5×11	0.16	35.25	11.75	83	UVZ1E470MDD
	100	6.3×11	0.16	75	25	140	UVZ1E101MED
	220	8×11.5	0.16	165	55	240	UVZ1E221MPD
	330	10×12.5	0.16	247.5	82.5	315	UVZ1E331MPD
	470	10×12.5	0.16	352.5	117.5	380	UVZ1E471MPD
	1000	10×20	0.16	750	250	680	UVZ1E102MPD
	2200	12.5×25	0.18	1650	550	1090	UVZ1E222MHD
	3300	16×25	0.20	2475	825	1400	UVZ1E332MHD
	4700	16×31.5	0.22	3525	1175	1710	UVZ1E472MHD
	6800	18×35.5	0.26	5100	1700	2040	UVZ1E682MHD
	10000	20×40	0.34	7500	2500	2150	UVZ1E103MRD
	15000	22×50	0.44	11250	3750	2750	UVZ1E153MRD
	22000	25×50	0.58	16500	5500	3250	UVZ1E223MRD
35 (1V)	4.7	5×11	0.14	4.935	3	28	UVZ1V4R7MDD
	10	5×11	0.14	10.5	3.5	41	UVZ1V100MDD
	22	5×11	0.14	23.1	7.7	61	UVZ1V220MDD
	33	5×11	0.14	34.65	11.55	75	UVZ1V330MDD
	47	5×11	0.14	49.35	16.45	93	UVZ1V470MDD
	100	6.3×11	0.14	105	35	150	UVZ1V101MED
	220	10×12.5	0.14	231	77	275	UVZ1V221MPD
	330	10×12.5	0.14	346.5	115.5	350	UVZ1V331MPD
	470	10×16	0.14	493.5	164.5	460	UVZ1V471MPD
	1000	12.5×20	0.14	1050	350	810	UVZ1V102MHD
	2200	16×25	0.16	2310	770	1260	UVZ1V222MHD
	3300	16×35.5	0.18	3465	1155	1610	UVZ1V332MHD
	4700	18×35.5	0.20	4935	1645	1910	UVZ1V472MHD
	6800	20×40	0.24	7140	2380	2150	UVZ1V682MRD
	10000	22×50	0.32	10500	3500	2650	UVZ1V103MRD
	15000	25×50	0.42	15750	5250	3100	UVZ1V153MRD
50 (1H)	2.2	5×11	0.12	4	3	20	UVZ1H2R2MDD
	3.3	5×11	0.12	4.95	3	25	UVZ1H3R3MDD
	4.7	5×11	0.12	7.05	3	30	UVZ1H4R7MDD
	10	5×11	0.12	15	5	46	UVZ1H100MDD
	22	5×11	0.12	33	11	68	UVZ1H220MDD
	33	5×11	0.12	49.5	16.5	90	UVZ1H330MDD
	47	6.3×11	0.12	70.5	23.5	115	UVZ1H470MED
	100	8×11.5	0.12	150	50	190	UVZ1H101MPD
	220	10×12.5	0.12	330	110	300	UVZ1H221MPD
	330	10×16	0.12	495	165	410	UVZ1H331MPD
	470	12.5×20	0.12	705	235	530	UVZ1H471MHD
	1000	12.5×25	0.12	1500	500	950	UVZ1H102MHD
	2200	16×35.5	0.14	3300	1100	1470	UVZ1H222MHD
	3300	18×35.5	0.16	4950	1650	1770	UVZ1H332MHD
	4700	20×40	0.18	7050	2350	2100	UVZ1H472MRD
	6800	22×50	0.22	10200	3400	2500	UVZ1H682MRD
	10000	25×50	0.30	15000	5000	2850	UVZ1H103MRD
63 (1J)	10	5×11	0.10	18.9	6.3	46	UVZ1J100MDD
	22	5×11	0.10	41.58	13.86	71	UVZ1J220MDD
	33	6.3×11	0.10	62.37	20.79	100	UVZ1J330MED
	47	6.3×11	0.10	88.83	29.61	120	UVZ1J470MED
	100	10×12.5	0.10	189	63	215	UVZ1J101MPD

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■ Dimensions

Rated Voltage (V) (code)	Rated Capacitance (μF)	Case Size φD×L (mm)	tan δ	Leakage Current (μA)		Rated Ripple (mArms) (105℃/120Hz)	Part Number
				at 20℃ after 1 minute	at 20℃ after 2 minutes		
63 (1J)	220	10×16	0.10	415.8	138.6	335	UVZ1J221MPD
	330	10×20	0.10	623.7	207.9	510	UVZ1J331MPD
	470	12.5×20	0.10	888.3	296.1	640	UVZ1J471MHD
	1000	16×25	0.10	1890	630	930	UVZ1J102MHD
	2200	18×35.5	0.12	4158	1386	1650	UVZ1J222MHD
	3300	20×40	0.14	6237	2079	1950	UVZ1J332MRD
	4700	22×50	0.16	8883	2961	2450	UVZ1J472MRD
	6800	25×50	0.20	12852	4284	2800	UVZ1J682MRD
100 (2A)	2.2	5×11	0.08	6.6	3	21	UVZ2A2R2MDD
	3.3	5×11	0.08	9.9	3.3	29	UVZ2A3R3MDD
	4.7	5×11	0.08	14.1	4.7	32	UVZ2A4R7MDD
	10	6.3×11	0.08	30	10	54	UVZ2A100MED
	22	6.3×11	0.08	66	22	93	UVZ2A220MED
	33	8×11.5	0.08	99	33	130	UVZ2A330MPD
	47	10×12.5	0.08	141	47	165	UVZ2A470MPD
	100	10×20	0.08	300	100	265	UVZ2A101MPD
	220	12.5×25	0.08	660	220	440	UVZ2A221MHD
	330	12.5×25	0.08	990	330	540	UVZ2A331MHD
	470	16×25	0.08	1410	470	715	UVZ2A471MHD
	1000	18×40	0.08	3000	1000	985	UVZ2A102MHD
	2200	22×50	0.10	6600	2200	1750	UVZ2A222MRD
	3300	25×50	0.12	9900	3300	2070	UVZ2A332MRD
160 (2C)	0.47	6.3×11	0.20	47.52	—	11	UVZ2CR47MED
	1	6.3×11	0.20	56	—	16	UVZ2C010MED
	2.2	6.3×11	0.20	75.2	—	25	UVZ2C2R2MED
	3.3	6.3×11	0.20	92.8	—	30	UVZ2C3R3MED
	4.7	6.3×11	0.20	115.2	—	34	UVZ2C4R7MED
	10	8×11.5	0.20	164	—	41	UVZ2C100MPD
	22	10×16	0.20	240.8	—	100	UVZ2C220MPD
	33	10×20	0.20	311.2	—	145	UVZ2C330MPD
	47	12.5×20	0.20	400.8	—	195	UVZ2C470MHD
	100	12.5×25	0.20	740	—	215	UVZ2C101MHD
	220	16×35.5	0.20	1508	—	570	UVZ2C221MHD
	330	18×40	0.20	2212	—	750	UVZ2C331MHD
	470	22×40	0.20	3108	—	900	UVZ2C471MRD
	1000	25×50	0.20	6500	—	1310	UVZ2C102MRD
200 (2D)	0.47	6.3×11	0.20	49.4	—	11	UVZ2DR47MED
	1	6.3×11	0.20	60	—	16	UVZ2D010MED
	2.2	6.3×11	0.20	84	—	25	UVZ2D2R2MED
	3.3	6.3×11	0.20	106	—	30	UVZ2D3R3MED
	4.7	8×11.5	0.20	134	—	39	UVZ2D4R7MPD
	10	10×12.5	0.20	180	—	65	UVZ2D100MPD
	22	10×20	0.20	276	—	120	UVZ2D220MPD
	33	12.5×20	0.20	364	—	160	UVZ2D330MHD
	47	12.5×20	0.20	476	—	195	UVZ2D470MHD
	100	16×31.5	0.20	900	—	375	UVZ2D101MHD
	220	18×35.5	0.20	1860	—	575	UVZ2D221MHD
	330	20×40	0.20	2740	—	705	UVZ2D331MRD
	470	22×50	0.20	3860	—	840	UVZ2D471MRD
250 (2E)	0.47	6.3×11	0.20	51.75	—	10	UVZ2ER47MED
	1	6.3×11	0.20	65	—	15	UVZ2E010MED
	2.2	6.3×11	0.20	95	—	23	UVZ2E2R2MED

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UVZ

■ Dimensions

Rated Voltage (V) (code)	Rated Capacitance (μF)	Case Size φD×L(mm)	tan δ	Leakage Current (μA)		Rated Ripple (mArms) (105℃/120Hz)	Part Number
				at 20℃ after 1 minute	at 20℃ after 2 minutes		
250 (2E)	3.3	8×11.5	0.20	122.5	—	32	UVZ2E3R3MPD
	4.7	8×11.5	0.20	147	—	39	UVZ2E4R7MPD
	10	10×16	0.20	200	—	74	UVZ2E100MPD
	22	12.5×20	0.20	320	—	130	UVZ2E220MHD
	33	12.5×20	0.20	430	—	160	UVZ2E330MHD
	47	12.5×25	0.20	570	—	210	UVZ2E470MHD
	100	16×31.5	0.20	1100	—	365	UVZ2E101MHD
	220	20×40	0.20	2300	—	600	UVZ2E221MRD
	330	22×50	0.20	3400	—	730	UVZ2E331MRD
	470	25×50	0.20	4800	—	870	UVZ2E471MRD
315 (2F)	1	6.3×11	0.20	71.5	—	15	UVZ2F010MED
	2.2	8×11.5	0.20	109.3	—	26	UVZ2F2R2MPD
	3.3	10×12.5	0.20	141.58	—	38	UVZ2F3R3MPD
	4.7	10×12.5	0.20	159.22	—	45	UVZ2F4R7MPD
	10	10×20	0.20	226	—	80	UVZ2F100MPD
	22	12.5×20	0.20	377.2	—	115	UVZ2F220MHD
	33	16×25	0.20	515.8	—	195	UVZ2F330MHD
	47	16×25	0.20	692.2	—	230	UVZ2F470MHD
	100	18×35.5	0.20	1360	—	395	UVZ2F101MHD
	220	22×50	0.20	2872	—	620	UVZ2F221MRD
	330	25×50	0.20	4258	—	760	UVZ2F331MRD
350 (2V)	1	6.3×11	0.25	75	—	15	UVZ2V010MED
	2.2	8×11.5	0.25	117	—	26	UVZ2V2R2MPD
	3.3	10×12.5	0.25	146.2	—	38	UVZ2V3R3MPD
	4.7	10×12.5	0.25	165.8	—	45	UVZ2V4R7MPD
	10	10×20	0.25	240	—	80	UVZ2V100MPD
	22	12.5×25	0.25	408	—	115	UVZ2V220MHD
	33	16×25	0.25	562	—	195	UVZ2V330MHD
	47	16×35.5	0.25	758	—	270	UVZ2V470MHD
	100	18×40	0.25	1500	—	420	UVZ2V101MHD
	220	22×50	0.25	3180	—	620	UVZ2V221MRD
400 (2G)	1	8×11.5	0.25	80	—	17	UVZ2G010MPD
	2.2	10×12.5	0.25	128	—	30	UVZ2G2R2MPD
	3.3	10×12.5	0.25	152.8	—	38	UVZ2G3R3MPD
	4.7	10×16	0.25	175.2	—	50	UVZ2G4R7MPD
	10	12.5×20	0.25	260	—	90	UVZ2G100MHD
	22	16×25	0.25	452	—	165	UVZ2G220MHD
	33	16×31.5	0.25	628	—	215	UVZ2G330MHD
	47	16×35.5	0.25	852	—	270	UVZ2G470MHD
	100	20×40	0.25	1700	—	450	UVZ2G101MRD
	220	25×50	0.25	3620	—	660	UVZ2G221MRD
450 (2W)	1	8×11.5	0.25	85	—	13	UVZ2W010MPD
	2.2	10×12.5	0.25	139	—	23	UVZ2W2R2MPD
	3.3	10×16	0.25	159.4	—	31	UVZ2W3R3MPD
	4.7	10×20	0.25	184.6	—	40	UVZ2W4R7MPD
	10	12.5×20	0.25	280	—	65	UVZ2W100MHD
	22	16×25	0.25	496	—	115	UVZ2W220MHD
	33	16×35.5	0.25	694	—	165	UVZ2W330MHD
	47	18×40	0.25	946	—	185	UVZ2W470MHD
	100	22×40	0.25	1900	—	270	UVZ2W101MRD

For cut leads, formed leads or taped parts, please add the appropriate code after the size code (12th digit).
If there is no size code in the part number, please add size code “1” and then add the appropriate code.

Please refer to page 18, 19 about the formed or taped product spec.
Please refer to page 4 for the minimum order quantity.

Mouser Electronics

Authorized Distributor

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Nichicon:

UVZ0J101MDD UVZ0J101MDH UVZ0J102MPD UVZ0J102MPD1TD UVZ0J102MPH UVZ0J102MPH1TD UVZ0J103MHD UVZ0J472MHD UVZ0J472MHH UVZ0J682MHD UVZ0J682MHH UVZ1A101MDD UVZ1A101MDD1TA UVZ1A101MDD1TD UVZ1A101MDH UVZ1A101MDH1TA UVZ1A101MDH1TD UVZ1A102MPD UVZ1A102MPD1TD UVZ1A102MPH UVZ1A102MPH1TD UVZ0J222MPH UVZ0J223MHD UVZ0J223MHH UVZ0J330MDD UVZ0J331MED UVZ0J331MEH UVZ0J103MHH UVZ0J153MHD UVZ0J153MHH UVZ0J220MDD UVZ0J221MDD UVZ0J221MDH UVZ0J222MPD UVZ1A103MHD UVZ1A103MHH UVZ1A153MHD UVZ1A153MHH UVZ1A220MDD UVZ1A221MED UVZ1A221MEH UVZ1A472MHD UVZ1A472MHH UVZ1A682MHD UVZ1A682MHH UVZ1C100MDD UVZ1C100MDD1TA UVZ1C100MDD1TD UVZ1C100MDH UVZ1C100MDH1TA UVZ1C100MDH1TD UVZ1C101MDD UVZ1C101MDD1TA UVZ1C101MDH UVZ1C470MDH1TD UVZ1C471MPD UVZ1C471MPD1TA UVZ1C471MPH UVZ1C471MPH1TA UVZ1C472MHD UVZ1C472MHH UVZ1C682MHD UVZ1C682MHH UVZ1E100MDD UVZ1E100MDD1TA UVZ1E100MDD1TD UVZ1E100MDH UVZ1E470MDH1TA UVZ1E470MDH1TD UVZ1E471MPD UVZ1E471MPD1AA UVZ1E471MPD1CM UVZ1E471MPD1TD UVZ1E471MPH UVZ1E471MPH1AA UVZ1E471MPH1CM UVZ1E471MPH1TD UVZ1E472MHD UVZ1E472MHH UVZ1E4R7MDD UVZ1E682MHD UVZ1E682MHH UVZ1H331MPD1TD UVZ1H331MPH UVZ1H331MPH1AA UVZ1H331MPH1TD UVZ1H332MHD UVZ1H332MHH UVZ1H3R3MDD UVZ1H3R3MDD1TD UVZ1H3R3MDH UVZ1H3R3MDH1TD UVZ1H470MED UVZ1H470MED1TA UVZ1H470MED1TD UVZ1H470MEH UVZ1H470MEH1TA UVZ1H470MEH1TD UVZ0J332MPD UVZ0J332MPH