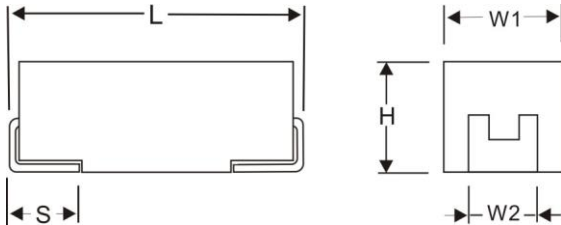


TS20L

FEATURES

- Low ESR, Volumetrically efficient, Stable in electrical & storage performances, Long lifespan, High reliability.
- Epoxy molded encapsulation, Chip, Easy for integration, Polarized.
- Typical applications include decoupling and filtering in industrial and automotive end applications, such as DC/DC converters, portable electronics, telecommunications and control units.



case	EIA Code	L	W ₁	H	S	W ₂
A	1206	3.2±0.2	1.6±0.2	1.6±0.2	0.8±0.2	1.2±0.2
B	1210	3.5±0.2	2.8±0.2	1.9±0.2	0.8±0.2	2.2±0.2
C	2312	6.0±0.2	3.2±0.2	2.5±0.2	1.3±0.2	2.2±0.2
D	2917	7.3±0.2	4.3±0.2	2.8±0.2	1.3±0.2	2.4±0.2
E	2917	7.3±0.4	4.3±0.4	4.1±0.4	1.3±0.2	2.4±0.2
V	2924	7.3±0.4	6.1±0.4	3.6±0.4	1.35±0.2	3.0±0.2



Technical Specifications

Technical Data		All technical data relate to an ambient temperature of +25°C									
Capacitance Range	0.47µF ~ 1000µF										
Capacitance Tolerance	±10% ; ±20%										
Rated Voltage (V _R)	≤+85°C:	4	6.3	10	16	20	25	35	50	63	
Category Voltage (V _C)	≤+125°C:	2.7	4	6.3	10	15	17	23	33	40	
Surge Voltage (V _S)	≤+85°C:	5.2	8	13	20	26	32	46	65	82	
Surge Voltage (V _S)	≤+125°C:	3.4	5	8	13	16	20	28	40	50	
Temperature Range	-55°C to +125°C										
Termination Finished	Sn Plating (standard), Gold and SnPb Plating upon request										

Capacitance And Rated Voltage Range (Letter Denotes Case Size)

Rated Voltage(V)	4	6.3	10	16
Capacitance(µF)	Case Size & ESR			
6.8				A(2000,2500),B(1200,2000)
10				A(1700),B(1200,2000)
15			A(1000,1800),B(600,900)	B(800,1000),C(600)
22			A(1200,1500),B(400,500)	B(700,1000),C(500,700),D(500)
33		A(1500,2000),B(600)	B(450,700),C(400,600),D(300,500)	C(500,700),D(300,500)
47	A(1500,2000),B(900,1500)	B(600,800),C(300,500)	B(500,700),C(400,600),D(300,500)	C(300,500),D(300,500),E(200,600)
68	B(1000,1500),C(600,C(1000)	B(500,700),C(500,700),D(250,500)	C(200,500),D(150,400)	C(1000),D(200,450),E(200,600)
100	B(450,800),C(500,1000)	B(400,700),C(300,500),D(300,500)	C(250,500),D(200,400),E(150)	C(800),D(200,500),E(200,600)
150	C(500,900),D(350,700),E(200,600)	C(300,500),D(300,500),E(150,300)	D(200,400),E(150,300)	D(500,600),E(200,250)
220	C(500,900),D(300,600),E(100,500)	C(200,500),D(150,300),E(150,300)	D(200,400),E(200,400),V(200,400)	E(200,400),V(200,400)
330	D(400,600),E(200,600),V(200,600)	D(150,300),E(150,300)	D(150,250),E(150,200),V(150,200)	E(180,500),V(180,500)
470	D(200,350),E(150,350),V(150,350)	E(150,300)	E(150,200)	E(450,600)
680	E(150,200)	E(150,300)	E(150,200)	
1000	E(150,200)			

Rated Voltage(V)	20	25	35	50	63
Capacitance(µF)	Case Size & ESR				
0.47			A(4000,A(8000)	A(3000,6000)	
0.68			A(6000,A(7000)	B(3000,6000)	
1			A(6000,7000),B(2500,3000)	B(2500,4000),C(1800,4000)	C(2000)
1.5		A(4500,7500),B(3000,5000)	B(3000,4000),C(2500,3000)	C(1800,3000),D(1000,2500)	D(2500)
2.2		A(3000,8000),B(2500,5000)	B(2500,3000),C(2000,2500)	C(1500,2000),D(700,1000)	D(1500)
3.3	A(4000,5000),B(3000,4000)	B(2000,3000),C(1200,2000)	B(2500,3000),C(1200,2000)	C(700,1500),D(700,1500)	D(1200)
4.7	A(2500,5000),B(1500,3000),C(1000,2500)	B(1000,1200),C(1000,2000)	B(2000,2500),C(800,1000),D(700,1000)	C(700,1000),D(600,1000)	E(800)
6.8	B(1000,1800),C(800,1200)	B(2000,2500),C(1000,1500),D(700,1000)	C(700,1200),D(600,1000)	D(600,800),E(500,1000)	E(600)
10	B(1200,1800),C(600,1000),D(500,1000)	B(1500,2000),C(900,1200),D(450,800)	C(700,1000),D(400,800)	D(400,600),E(400,800)	E(450)
15	B(1500,1800),C(800,1000),D(600,800)	C(500,1000),D(400,600)	D(350,600),E(300,600)	E(400,500)	E(300)V(300)
22	C(600,900),D(400,600)	C(800,1000),D(400,600)	D(400,500),E(300,400)	E(400,500)	V(300)
33	C(600,900),D(400,600)	D(300,500),E(250,500)	D(500,700),E(300,600)		
47	C(300,400),D(250,500),E(250,500)	D(350,500),E(300,600)	D(400,900),E(400,600)		
68	D(250,300),E(250,500)	E(250,500),V(250,600)	E(800)		
100	D(300,400),E(250,300)	E(200,250),V(200,250)			
150	D(450,600),E(180,250)	E(600),V(300)			
220	E(450,600),V(250,400)				
330	E(450,600),V(450,600)				

TS20L

Rated Voltage (V)	Rated CAP (µF)	Case Code	Rated Temp (°C)	Category Temp (°C)	Category Voltage (V)	Max DCL(µA) @25°C	Max DF(%) @25°C 100Hz	Max ESR (mΩ) @25°C 100KHz	Max Ripple @100kHz IRMS(A)		
									25°C	85°C	125°C
4	47	A	85	125	2.7	1.9	11	1500	0.208	0.125	0.083
		A	85	125	2.7	1.9	11	2000	0.180	0.108	0.072
		B	85	125	2.7	1.9	8	900	0.289	0.173	0.115
		B	85	125	2.7	1.9	8	1500	0.224	0.134	0.089
	68	B	85	125	2.7	2.7	8	1000	0.274	0.164	0.110
		B	85	125	2.7	2.7	8	1500	0.224	0.134	0.089
		C	85	125	2.7	2.7	6	600	0.387	0.232	0.155
		C	85	125	2.7	2.7	6	1000	0.300	0.180	0.120
	100	B	85	125	2.7	4.0	10	450	0.408	0.245	0.163
		B	85	125	2.7	4.0	10	800	0.306	0.184	0.122
		C	85	125	2.7	4.0	10	500	0.424	0.255	0.170
	150	C	85	125	2.7	4.0	10	1000	0.300	0.180	0.120
		C	85	125	2.7	6.0	10	500	0.424	0.255	0.170
		C	85	125	2.7	6.0	10	900	0.316	0.190	0.126
		D	85	125	2.7	6.0	8	350	0.548	0.329	0.219
		D	85	125	2.7	6.0	8	700	0.387	0.232	0.155
		E	85	125	2.7	6.0	8	200	0.791	0.474	0.316
	220	E	85	125	2.7	6.0	8	600	0.456	0.274	0.183
		C	85	125	2.7	8.8	12	500	0.424	0.255	0.170
		C	85	125	2.7	8.8	12	900	0.316	0.190	0.126
		D	85	125	2.7	8.8	10	300	0.592	0.355	0.237
		D	85	125	2.7	8.8	10	600	0.418	0.251	0.167
	330	E	85	125	2.7	8.8	10	100	1.118	0.671	0.447
		E	85	125	2.7	8.8	10	500	0.500	0.300	0.200
		D	85	125	2.7	13.2	14	400	0.512	0.307	0.205
		D	85	125	2.7	13.2	14	600	0.418	0.251	0.167
		E	85	125	2.7	13.2	12	200	0.791	0.474	0.316
		E	85	125	2.7	13.2	12	600	0.456	0.274	0.183
	470	V	85	125	2.7	13.2	12	200	0.866	0.520	0.346
		V	85	125	2.7	13.2	12	600	0.500	0.300	0.200
D		85	125	2.7	18.8	14	200	0.725	0.435	0.290	
D		85	125	2.7	18.8	14	350	0.548	0.329	0.219	
E		85	125	2.7	18.8	12	150	0.913	0.548	0.365	
680	E	85	125	2.7	18.8	12	350	0.598	0.359	0.239	
	V	85	125	2.7	18.8	12	150	1.000	0.600	0.400	
	V	85	125	2.7	18.8	12	350	0.655	0.393	0.262	
1000	E	85	125	2.7	27.2	14	150	0.913	0.548	0.365	
	E	85	125	2.7	27.2	14	200	0.791	0.474	0.316	
6.3	33	E	85	125	2.7	40.0	15	150	0.913	0.548	0.365
		E	85	125	2.7	40.0	15	200	0.791	0.474	0.316
		A	85	125	4	2.1	8	1500	0.208	0.125	0.083
	47	A	85	125	4	2.1	8	2000	0.180	0.108	0.072
		B	85	125	4	2.1	8	600	0.354	0.212	0.141
		B	85	125	4	3.0	8	600	0.354	0.212	0.141
		B	85	125	4	3.0	8	800	0.306	0.184	0.122
		C	85	125	4	3.0	6	300	0.548	0.329	0.219
		C	85	125	4	3.0	6	500	0.424	0.255	0.170
		C	85	125	4	3.0	6	500	0.424	0.255	0.170
	68	B	85	125	4	4.3	10	500	0.387	0.232	0.155
		B	85	125	4	4.3	10	700	0.327	0.196	0.131
		C	85	125	4	4.3	8	500	0.424	0.255	0.170
		C	85	125	4	4.3	8	700	0.359	0.215	0.143
D		85	125	4	4.3	6	250	0.648	0.389	0.259	
D		85	125	4	4.3	6	500	0.458	0.275	0.183	
100	B	85	125	4	6.3	14	400	0.433	0.260	0.173	

1. Please do not use multimeter through the measuring procedures.
2. Capacitance and DF measured at :100Hz U_~ =2.2 1.0V U_~ =1.0 0.5V, Frequency=100Hz. Test only applied in series equivalent circuit.
3. Voltage derating is applied at +125 The DCL parameter should be read after 5 minutes when it connected to the circuit
4. Special size and demand could consult with us.

TS20L

Rated Voltage (V)	Rated CAP (µF)	Case Code	Rated Temp (°C)	Category Temp (°C)	Category Voltage (V)	Max DCL(µA) @25°C	Max DF(%) @25°C 100Hz	Max ESR (mΩ) @25°C 100KHz	Max Ripple @100kHz IRMS(A)		
									25°C	85°C	125°C
6.3	100	B	85	125	4	6.3	14	700	0.327	0.196	0.131
		C	85	125	4	6.3	8	300	0.548	0.329	0.219
		C	85	125	4	6.3	8	500	0.424	0.255	0.170
		D	85	125	4	6.3	8	300	0.592	0.355	0.237
		D	85	125	4	6.3	8	500	0.458	0.275	0.183
	150	C	85	125	4	9.5	12	300	0.548	0.329	0.219
		C	85	125	4	9.5	12	500	0.424	0.255	0.170
		D	85	125	4	9.5	10	300	0.592	0.355	0.237
		D	85	125	4	9.5	10	500	0.458	0.275	0.183
		E	85	125	4	9.5	10	150	0.913	0.548	0.365
	220	E	85	125	4	9.5	10	300	0.645	0.387	0.258
		C	85	125	4	13.9	14	200	0.671	0.402	0.268
		C	85	125	4	13.9	14	500	0.424	0.255	0.170
		D	85	125	4	13.9	12	150	0.837	0.502	0.335
		D	85	125	4	13.9	12	300	0.592	0.355	0.237
	330	E	85	125	4	13.9	12	150	0.913	0.548	0.365
		E	85	125	4	13.9	12	300	0.645	0.387	0.258
		D	85	125	4	20.8	14	150	0.837	0.502	0.335
		D	85	125	4	20.8	14	300	0.592	0.355	0.237
	470	E	85	125	4	20.8	14	150	0.913	0.548	0.365
E		85	125	4	20.8	14	300	0.645	0.387	0.258	
680	E	85	125	4	29.6	14	150	0.913	0.548	0.365	
	E	85	125	4	29.6	14	300	0.645	0.387	0.258	
10	15	E	85	125	4	42.8	14	150	0.913	0.548	0.365
		E	85	125	4	42.8	14	300	0.645	0.387	0.258
		A	85	125	6.3	1.5	8	1000	0.255	0.153	0.102
		A	85	125	6.3	1.5	8	1800	0.190	0.114	0.076
	22	B	85	125	6.3	1.5	6	600	0.354	0.212	0.141
		B	85	125	6.3	1.5	6	900	0.289	0.173	0.115
		A	85	125	6.3	2.2	12	1200	0.233	0.140	0.093
		A	85	125	6.3	2.2	12	1500	0.208	0.125	0.083
	33	B	85	125	6.3	2.2	6	400	0.433	0.260	0.173
		B	85	125	6.3	2.2	6	500	0.387	0.232	0.155
		B	85	125	6.3	3.3	8	450	0.408	0.245	0.163
		B	85	125	6.3	3.3	8	700	0.327	0.196	0.131
		C	85	125	6.3	3.3	6	400	0.474	0.285	0.190
		C	85	125	6.3	3.3	6	600	0.387	0.232	0.155
	47	D	85	125	6.3	3.3	6	300	0.592	0.355	0.237
		D	85	125	6.3	3.3	6	500	0.458	0.275	0.183
		B	85	125	6.3	4.7	10	500	0.387	0.232	0.155
		B	85	125	6.3	4.7	10	700	0.327	0.196	0.131
		C	85	125	6.3	4.7	8	400	0.474	0.285	0.190
		C	85	125	6.3	4.7	8	600	0.387	0.232	0.155
	68	D	85	125	6.3	4.7	6	300	0.592	0.355	0.237
		D	85	125	6.3	4.7	6	500	0.458	0.275	0.183
		C	85	125	6.3	6.8	8	200	0.671	0.402	0.268
		C	85	125	6.3	6.8	8	500	0.424	0.255	0.170
	100	D	85	125	6.3	6.8	6	150	0.837	0.502	0.335
		D	85	125	6.3	6.8	6	400	0.512	0.307	0.205
		C	85	125	6.3	10.0	10	250	0.600	0.360	0.240
		C	85	125	6.3	10.0	10	500	0.424	0.255	0.170
D		85	125	6.3	10.0	8	200	0.725	0.435	0.290	
		E	85	125	6.3	10.0	8	400	0.512	0.307	0.205
		E	85	125	6.3	10.0	8	150	0.913	0.548	0.365

1. Please do not use multimeter through the measuring procedures.
2. Capacitance and DF measured at :100Hz U_~ =2.2 1.0V U_~=1.0 0.5V, Frequency=100Hz. Test only applied in series equivalent circuit.
3. Voltage derating is applied at +125 The DCL parameter should be read after 5 minutes when it connected to the circuit
4. Special size and demand could consult with us.

TS20L

Rated Voltage (V)	Rated CAP (µF)	Case Code	Rated Temp (°C)	Category Temp (°C)	Category Voltage (V)	Max DCL(µA) @25°C	Max DF(%) @25°C 100Hz	Max ESR (mΩ) @25°C 100KHz	Max Ripple @100kHz IRMS(A)			
									25°C	85°C	125°C	
10	150	D	85	125	6.3	15.0	10	200	0.725	0.435	0.290	
		D	85	125	6.3	15.0	10	400	0.512	0.307	0.205	
		E	85	125	6.3	15.0	10	150	0.913	0.548	0.365	
		E	85	125	6.3	15.0	10	300	0.645	0.387	0.258	
	220	D	85	125	6.3	22.0	12	200	0.725	0.435	0.290	
		D	85	125	6.3	22.0	12	400	0.512	0.307	0.205	
		E	85	125	6.3	22.0	12	200	0.791	0.474	0.316	
		E	85	125	6.3	22.0	12	400	0.559	0.335	0.224	
	330	V	85	125	6.3	22.0	12	200	0.866	0.520	0.346	
		V	85	125	6.3	22.0	12	400	0.612	0.367	0.245	
		D	85	125	6.3	33.0	14	150	0.837	0.502	0.335	
		D	85	125	6.3	33.0	14	250	0.648	0.389	0.259	
	470	E	85	125	6.3	33.0	14	150	0.913	0.548	0.365	
		E	85	125	6.3	33.0	14	200	0.791	0.474	0.316	
		V	85	125	6.3	33.0	14	150	1.000	0.600	0.400	
		V	85	125	6.3	33.0	14	200	0.866	0.520	0.346	
	680	E	85	125	6.3	47.0	14	150	0.913	0.548	0.365	
		E	85	125	6.3	47.0	14	200	0.791	0.474	0.316	
	16	6.8	E	85	125	6.3	68.0	14	150	0.913	0.548	0.365
			E	85	125	6.3	68.0	14	200	0.791	0.474	0.316
A			85	125	10	1.1	6	2000	0.180	0.108	0.072	
A			85	125	10	1.1	6	2500	0.161	0.097	0.064	
10		B	85	125	10	1.1	6	1200	0.250	0.150	0.100	
		B	85	125	10	1.1	6	2000	0.194	0.116	0.077	
		A	85	125	10	1.6	8	1700	0.196	0.117	0.078	
		B	85	125	10	1.6	6	1200	0.250	0.150	0.100	
15		B	85	125	10	1.6	6	2000	0.194	0.116	0.077	
		B	85	125	10	2.4	6	800	0.306	0.184	0.122	
		B	85	125	10	2.4	6	1000	0.274	0.164	0.110	
		C	85	125	10	2.4	6	600	0.387	0.232	0.155	
22		B	85	125	10	2.4	6	1000	0.274	0.164	0.110	
		B	85	125	10	3.5	8	700	0.327	0.196	0.131	
		B	85	125	10	3.5	8	1000	0.274	0.164	0.110	
		C	85	125	10	3.5	6	500	0.424	0.255	0.170	
33		C	85	125	10	3.5	6	700	0.359	0.215	0.143	
		D	85	125	10	3.5	6	500	0.458	0.275	0.183	
		C	85	125	10	5.3	6	500	0.424	0.255	0.170	
		C	85	125	10	5.3	6	700	0.359	0.215	0.143	
47	D	85	125	10	5.3	6	300	0.592	0.355	0.237		
	D	85	125	10	5.3	6	500	0.458	0.275	0.183		
	C	85	125	10	7.5	8	300	0.548	0.329	0.219		
	C	85	125	10	7.5	8	500	0.424	0.255	0.170		
68	D	85	125	10	7.5	6	300	0.592	0.355	0.237		
	D	85	125	10	7.5	6	500	0.458	0.275	0.183		
	E	85	125	10	7.5	6	200	0.791	0.474	0.316		
	E	85	125	10	7.5	6	600	0.456	0.274	0.183		
100	C	85	125	10	10.9	8	1000	0.300	0.180	0.120		
	D	85	125	10	10.9	8	200	0.725	0.435	0.290		
	D	85	125	10	10.9	8	450	0.483	0.290	0.193		
	E	85	125	10	10.9	6	200	0.791	0.474	0.316		
100	E	85	125	10	10.9	6	600	0.456	0.274	0.183		
	C	85	125	10	16.0	12	800	0.335	0.201	0.134		
	D	85	125	10	16.0	8	200	0.725	0.435	0.290		
	D	85	125	10	16.0	8	500	0.458	0.275	0.183		
		E	85	125	10	16.0	8	200	0.791	0.474	0.316	

1. Please do not use multimeter through the measuring procedures.
2. Capacitance and DF measured at :100Hz U_{DC} =2.2 1.0V U_{AC}~1.0 0.5V, Frequency=100Hz. Test only applied in series equivalent circuit.
3. Voltage derating is applied at +125 The DCL parameter should be read after 5 minutes when it connected to the circuit
4. Special size and demand could consult with us.

TS20L

Rated Voltage (V)	Rated CAP (µF)	Case Code	Rated Temp (°C)	Category Temp (°C)	Category Voltage (V)	Max DCL(µA) @25°C	Max DF(%) @25°C 100Hz	Max ESR (mΩ) @25°C 100KHz	Max Ripple @100kHz IRMS(A)		
									25°C	85°C	125°C
16	100	E	85	125	10	16.0	8	600	0.456	0.274	0.183
	150	D	85	125	10	24.0	12	500	0.458	0.275	0.183
		D	85	125	10	24.0	12	600	0.418	0.251	0.167
		E	85	125	10	24.0	10	200	0.791	0.474	0.316
		E	85	125	10	24.0	10	250	0.707	0.424	0.283
	220	E	85	125	10	35.2	12	200	0.791	0.474	0.316
		E	85	125	10	35.2	12	400	0.559	0.335	0.224
		V	85	125	10	35.2	12	200	0.866	0.520	0.346
		V	85	125	10	35.2	12	400	0.612	0.367	0.245
	330	E	85	125	10	52.8	12	180	0.833	0.500	0.333
		E	85	125	10	52.8	12	500	0.500	0.300	0.200
		V	85	125	10	52.8	12	180	0.913	0.548	0.365
		V	85	125	10	52.8	12	500	0.548	0.329	0.219
	470	E	85	125	10	75.2	16	450	0.527	0.316	0.211
E		85	125	10	75.2	16	600	0.456	0.274	0.183	
20	3.3	A	85	125	15	0.7	6	4000	0.127	0.076	0.051
		A	85	125	15	0.7	6	5000	0.114	0.068	0.046
		B	85	125	15	0.7	6	3000	0.158	0.095	0.063
		B	85	125	15	0.7	6	4000	0.137	0.082	0.055
	4.7	A	85	125	15	0.9	6	2500	0.161	0.097	0.064
		A	85	125	15	0.9	6	5000	0.114	0.068	0.046
		B	85	125	15	0.9	6	1500	0.224	0.134	0.089
		B	85	125	15	0.9	6	3000	0.158	0.095	0.063
		C	85	125	15	0.9	6	1000	0.300	0.180	0.120
	6.8	C	85	125	15	0.9	6	2500	0.190	0.114	0.076
		B	85	125	15	1.4	6	1000	0.274	0.164	0.110
		B	85	125	15	1.4	6	1800	0.204	0.122	0.082
		C	85	125	15	1.4	6	800	0.335	0.201	0.134
	10	C	85	125	15	1.4	6	1200	0.274	0.164	0.110
		B	85	125	15	2.0	6	1200	0.250	0.150	0.100
		B	85	125	15	2.0	6	1800	0.204	0.122	0.082
		C	85	125	15	2.0	6	600	0.387	0.232	0.155
		C	85	125	15	2.0	6	1000	0.300	0.180	0.120
	15	D	85	125	15	2.0	6	500	0.458	0.275	0.183
		D	85	125	15	2.0	6	1000	0.324	0.194	0.130
		B	85	125	15	3.0	6	1500	0.224	0.134	0.089
		B	85	125	15	3.0	6	1800	0.204	0.122	0.082
		C	85	125	15	3.0	6	800	0.335	0.201	0.134
		C	85	125	15	3.0	6	1000	0.300	0.180	0.120
	22	D	85	125	15	3.0	6	600	0.418	0.251	0.167
		D	85	125	15	3.0	6	800	0.362	0.217	0.145
		C	85	125	15	4.4	6	600	0.387	0.232	0.155
		C	85	125	15	4.4	6	900	0.316	0.190	0.126
	33	D	85	125	15	4.4	6	400	0.512	0.307	0.205
		D	85	125	15	4.4	6	600	0.418	0.251	0.167
		C	85	125	15	6.6	6	600	0.387	0.232	0.155
		C	85	125	15	6.6	6	900	0.316	0.190	0.126
47	D	85	125	15	6.6	6	400	0.512	0.307	0.205	
	D	85	125	15	6.6	6	600	0.418	0.251	0.167	
	C	85	125	15	9.4	8	300	0.548	0.329	0.219	
	C	85	125	15	9.4	8	400	0.474	0.285	0.190	
	D	85	125	15	9.4	8	250	0.648	0.389	0.259	
		E	85	125	15	9.4	8	500	0.458	0.275	0.183
		E	85	125	15	9.4	6	250	0.707	0.424	0.283

1. Please do not use multimeter through the measuring procedures.
2. Capacitance and DF measured at :100Hz U_~ =2.2 1.0V U_~ =1.0 0.5V, Frequency=100Hz. Test only applied in series equivalent circuit.
3. Voltage derating is applied at +125 The DCL parameter should be read after 5 minutes when it connected to the circuit
4. Special size and demand could consult with us.

TS20L

Rated Voltage (V)	Rated CAP (µF)	Case Code	Rated Temp (°C)	Category Temp (°C)	Category Voltage (V)	Max DCL(µA) @25°C	Max DF(%) @25°C 100Hz	Max ESR (mΩ) @25°C 100KHz	Max Ripple @100kHz IRMS(A)		
									25°C	85°C	125°C
20	47	E	85	125	15	9.4	6	500	0.500	0.300	0.200
	68	D	85	125	15	13.6	8	250	0.648	0.389	0.259
		D	85	125	15	13.6	8	300	0.592	0.355	0.237
		E	85	125	15	13.6	6	250	0.707	0.424	0.283
		E	85	125	15	13.6	6	500	0.500	0.300	0.200
	100	D	85	125	15	20.0	10	300	0.592	0.355	0.237
		D	85	125	15	20.0	10	400	0.512	0.307	0.205
		E	85	125	15	20.0	10	250	0.707	0.424	0.283
		E	85	125	15	20.0	10	300	0.645	0.387	0.258
	150	D	85	125	15	30.0	10	450	0.483	0.290	0.193
		D	85	125	15	30.0	10	600	0.418	0.251	0.167
		E	85	125	15	30.0	10	180	0.833	0.500	0.333
		E	85	125	15	30.0	10	250	0.707	0.424	0.283
	220	E	85	125	15	44.0	12	450	0.527	0.316	0.211
		E	85	125	15	44.0	12	600	0.456	0.274	0.183
		V	85	125	15	44.0	12	250	0.775	0.465	0.310
		V	85	125	15	44.0	12	400	0.612	0.367	0.245
	330	E	85	125	15	66.0	12	450	0.527	0.316	0.211
		E	85	125	15	66.0	12	600	0.456	0.274	0.183
		V	85	125	15	66.0	12	450	0.577	0.346	0.231
V		85	125	15	66.0	12	600	0.500	0.300	0.200	
25	1.5	A	85	125	17	0.5	6	4500	0.120	0.072	0.048
		A	85	125	17	0.5	6	7500	0.093	0.056	0.037
		B	85	125	17	0.5	6	3000	0.158	0.095	0.063
		B	85	125	17	0.5	6	5000	0.122	0.073	0.049
	2.2	A	85	125	17	0.6	6	3000	0.147	0.088	0.059
		A	85	125	17	0.6	6	8000	0.090	0.054	0.036
		B	85	125	17	0.6	6	2500	0.173	0.104	0.069
		B	85	125	17	0.6	6	5000	0.122	0.073	0.049
	3.3	B	85	125	17	0.8	6	2000	0.194	0.116	0.077
		B	85	125	17	0.8	6	3000	0.158	0.095	0.063
		C	85	125	17	0.8	6	1200	0.274	0.164	0.110
		C	85	125	17	0.8	6	2000	0.212	0.127	0.085
	4.7	B	85	125	17	1.2	6	1000	0.274	0.164	0.110
		B	85	125	17	1.2	6	1200	0.250	0.150	0.100
		C	85	125	17	1.2	6	1000	0.300	0.180	0.120
		C	85	125	17	1.2	6	2000	0.212	0.127	0.085
	6.8	B	85	125	17	1.7	6	2000	0.194	0.116	0.077
		B	85	125	17	1.7	6	2500	0.173	0.104	0.069
		C	85	125	17	1.7	6	1000	0.300	0.180	0.120
		C	85	125	17	1.7	6	1500	0.245	0.147	0.098
		D	85	125	17	1.7	6	700	0.387	0.232	0.155
		D	85	125	17	1.7	6	1000	0.324	0.194	0.130
	10	B	85	125	17	2.5	8	1500	0.224	0.134	0.089
		B	85	125	17	2.5	8	2000	0.194	0.116	0.077
		C	85	125	17	2.5	6	900	0.316	0.190	0.126
		C	85	125	17	2.5	6	1200	0.274	0.164	0.110
		D	85	125	17	2.5	6	450	0.483	0.290	0.193
		D	85	125	17	2.5	6	800	0.362	0.217	0.145
	15	C	85	125	17	3.8	6	500	0.424	0.255	0.170
		C	85	125	17	3.8	6	1000	0.300	0.180	0.120
D		85	125	17	3.8	6	400	0.512	0.307	0.205	
D		85	125	17	3.8	6	600	0.418	0.251	0.167	
22	C	85	125	17	5.5	6	800	0.335	0.201	0.134	

1. Please do not use multimeter through the measuring procedures.
2. Capacitance and DF measured at :100Hz U_~ =2.2 1.0V U_~ =1.0 0.5V, Frequency=100Hz. Test only applied in series equivalent circuit.
3. Voltage derating is applied at +125 The DCL parameter should be read after 5 minutes when it connected to the circuit
4. Special size and demand could consult with us.

TS20L

Rated Voltage (V)	Rated CAP (µF)	Case Code	Rated Temp (°C)	Category Temp (°C)	Category Voltage (V)	Max DCL(µA) @25°C	Max DF(%) @25°C 100Hz	Max ESR (mΩ) @25°C 100KHz	Max Ripple @100kHz IRMS(A)			
									25°C	85°C	125°C	
25	22	C	85	125	17	5.5	6	1000	0.300	0.180	0.120	
		D	85	125	17	5.5	6	400	0.512	0.307	0.205	
		D	85	125	17	5.5	6	600	0.418	0.251	0.167	
	33	D	85	125	17	8.3	8	300	0.592	0.355	0.237	
		D	85	125	17	8.3	8	500	0.458	0.275	0.183	
		E	85	125	17	8.3	6	250	0.707	0.424	0.283	
	47	E	85	125	17	8.3	6	500	0.500	0.300	0.200	
		D	85	125	17	11.8	8	350	0.548	0.329	0.219	
		D	85	125	17	11.8	8	500	0.458	0.275	0.183	
	68	E	85	125	17	11.8	6	300	0.645	0.387	0.258	
		E	85	125	17	11.8	6	600	0.456	0.274	0.183	
		V	85	125	17	17.0	8	250	0.707	0.424	0.283	
	100	E	85	125	17	17.0	8	500	0.500	0.300	0.200	
		V	85	125	17	17.0	8	250	0.775	0.465	0.310	
		V	85	125	17	17.0	8	600	0.500	0.300	0.200	
	150	E	85	125	17	25.0	10	200	0.791	0.474	0.316	
		E	85	125	17	25.0	10	250	0.707	0.424	0.283	
		V	85	125	17	25.0	10	250	0.866	0.520	0.346	
35	0.47	A	85	125	23	0.5	6	4000	0.127	0.076	0.051	
		A	85	125	23	0.5	6	8000	0.090	0.054	0.036	
	0.68	A	85	125	23	0.5	6	6000	0.104	0.062	0.042	
		A	85	125	23	0.5	6	7000	0.096	0.058	0.039	
	1	A	85	125	23	0.5	6	6000	0.104	0.062	0.042	
		A	85	125	23	0.5	6	7000	0.096	0.058	0.039	
		B	85	125	23	0.5	4	2500	0.173	0.104	0.069	
	1.5	B	85	125	23	0.5	4	3000	0.158	0.095	0.063	
		B	85	125	23	0.5	6	3000	0.158	0.095	0.063	
		C	85	125	23	0.5	6	4000	0.137	0.082	0.055	
	2.2	C	85	125	23	0.5	6	2500	0.190	0.114	0.076	
		C	85	125	23	0.5	6	3000	0.173	0.104	0.069	
		B	85	125	23	0.8	6	2500	0.173	0.104	0.069	
	3.3	B	85	125	23	0.8	6	3000	0.158	0.095	0.063	
		C	85	125	23	0.8	6	2000	0.212	0.127	0.085	
		C	85	125	23	0.8	6	2500	0.190	0.114	0.076	
	4.7	B	85	125	23	1.2	6	2500	0.173	0.104	0.069	
		B	85	125	23	1.2	6	3000	0.158	0.095	0.063	
		C	85	125	23	1.2	6	1200	0.274	0.164	0.110	
		C	85	125	23	1.2	6	2000	0.212	0.127	0.085	
		D	85	125	23	1.6	8	2000	0.194	0.116	0.077	
	6.8	B	85	125	23	1.6	8	2500	0.173	0.104	0.069	
		C	85	125	23	1.6	6	800	0.335	0.201	0.134	
		C	85	125	23	1.6	6	1000	0.300	0.180	0.120	
		D	85	125	23	1.6	6	700	0.387	0.232	0.155	
		D	85	125	23	1.6	6	1000	0.324	0.194	0.130	
	10	C	85	125	23	2.4	6	700	0.359	0.215	0.143	
		C	85	125	23	2.4	6	1200	0.274	0.164	0.110	
		D	85	125	23	2.4	6	600	0.418	0.251	0.167	
	10	D	85	125	23	2.4	6	1000	0.324	0.194	0.130	
		C	85	125	23	3.5	6	700	0.359	0.215	0.143	
		D	85	125	23	3.5	6	1000	0.300	0.180	0.120	
										0.512	0.307	0.205

1. Please do not use multimeter through the measuring procedures.
2. Capacitance and DF measured at :100Hz U_{max}=2.2 1.0V U_{min}=1.0 0.5V, Frequency=100Hz. Test only applied in series equivalent circuit.
3. Voltage derating is applied at +125 The DCL parameter should be read after 5 minutes when it connected to the circuit
4. Special size and demand could consult with us.

TS20L

Rated Voltage (V)	Rated CAP (µF)	Case Code	Rated Temp (°C)	Category Temp (°C)	Category Voltage (V)	Max DCL(µA) @25°C	Max DF(%) @25°C 100Hz	Max ESR (mΩ) @25°C 100KHz	Max Ripple @100kHz IRMS(A)		
									25°C	85°C	125°C
35	10	D	85	125	23	3.5	6	800	0.362	0.217	0.145
	15	D	85	125	23	5.3	6	350	0.548	0.329	0.219
		D	85	125	23	5.3	6	600	0.418	0.251	0.167
		E	85	125	23	5.3	6	300	0.645	0.387	0.258
		E	85	125	23	5.3	6	600	0.456	0.274	0.183
	22	D	85	125	23	7.7	6	400	0.512	0.307	0.205
		D	85	125	23	7.7	6	500	0.458	0.275	0.183
		E	85	125	23	7.7	6	300	0.645	0.387	0.258
	33	E	85	125	23	7.7	6	400	0.559	0.335	0.224
		D	85	125	23	11.6	8	500	0.458	0.275	0.183
		D	85	125	23	11.6	8	700	0.387	0.232	0.155
	47	E	85	125	23	11.6	6	300	0.645	0.387	0.258
		E	85	125	23	11.6	6	600	0.456	0.274	0.183
		D	85	125	23	16.5	8	400	0.512	0.307	0.205
	68	D	85	125	23	16.5	8	900	0.342	0.205	0.137
		E	85	125	23	16.5	6	400	0.559	0.335	0.224
E		85	125	23	16.5	6	600	0.456	0.274	0.183	
50	0.47	A	85	125	33	0.5	6	3000	0.147	0.088	0.059
		A	85	125	33	0.5	6	6000	0.104	0.062	0.042
	0.68	B	85	125	33	0.5	6	3000	0.158	0.095	0.063
		B	85	125	33	0.5	6	6000	0.112	0.067	0.045
	1	B	85	125	33	0.5	6	2500	0.173	0.104	0.069
		B	85	125	33	0.5	6	4000	0.137	0.082	0.055
		C	85	125	33	0.5	4	1800	0.224	0.134	0.089
	1.5	C	85	125	33	0.5	4	4000	0.150	0.090	0.060
		C	85	125	33	0.8	6	1800	0.224	0.134	0.089
		C	85	125	33	0.8	6	3000	0.173	0.104	0.069
	2.2	D	85	125	33	0.8	6	1000	0.324	0.194	0.130
		D	85	125	33	0.8	6	2500	0.205	0.123	0.082
		C	85	125	33	1.1	6	1500	0.245	0.147	0.098
	3.3	C	85	125	33	1.1	6	2000	0.212	0.127	0.085
		D	85	125	33	1.1	6	700	0.387	0.232	0.155
		D	85	125	33	1.1	6	1000	0.324	0.194	0.130
	4.7	C	85	125	33	1.7	6	700	0.359	0.215	0.143
		C	85	125	33	1.7	6	1500	0.245	0.147	0.098
		D	85	125	33	1.7	6	700	0.387	0.232	0.155
	6.8	D	85	125	33	1.7	6	1500	0.265	0.159	0.106
		C	85	125	33	2.4	6	700	0.359	0.215	0.143
		C	85	125	33	2.4	6	1000	0.300	0.180	0.120
	10	D	85	125	33	2.4	6	600	0.418	0.251	0.167
		D	85	125	33	2.4	6	1000	0.324	0.194	0.130
		D	85	125	33	3.4	6	600	0.418	0.251	0.167
	15	D	85	125	33	3.4	6	800	0.362	0.217	0.145
		E	85	125	33	3.4	6	500	0.500	0.300	0.200
		E	85	125	33	3.4	6	1000	0.354	0.212	0.141
	22	D	85	125	33	5.0	6	400	0.512	0.307	0.205
		D	85	125	33	5.0	6	600	0.418	0.251	0.167
		E	85	125	33	5.0	6	400	0.559	0.335	0.224
	33	E	85	125	33	5.0	6	800	0.395	0.237	0.158
E		85	125	33	7.5	6	400	0.559	0.335	0.224	
E		85	125	33	7.5	6	500	0.500	0.300	0.200	
47	E	85	125	33	11.0	8	400	0.559	0.335	0.224	
	E	85	125	33	11.0	8	500	0.500	0.300	0.200	

1. Please do not use multimeter through the measuring procedures.
2. Capacitance and DF measured at :100Hz U_{DC} =2.2 1.0V U_{AC}~1.0 0.5V, Frequency=100Hz. Test only applied in series equivalent circuit.
3. Voltage derating is applied at +125 The DCL parameter should be read after 5 minutes when it connected to the circuit
4. Special size and demand could consult with us.

TS20L

Rated Voltage (V)	Rated CAP (µF)	Case Code	Rated Temp (°C)	Category Temp (°C)	Category Voltage (V)	Max DCL(µA) @ 25°C	Max DF(%) @ 25°C 100Hz	Max ESR (mΩ) @ 25°C 100KHz	Max Ripple @ 100kHz IRMS(A)		
									25°C	85°C	125°C
63	1	C	85	125	40	0.6	6	2000	0.212	0.127	0.085
	1.5	D	85	125	40	0.9	6	2500	0.205	0.123	0.082
	2.2	D	85	125	40	1.4	6	1500	0.265	0.159	0.106
	3.3	D	85	125	40	2.1	6	1200	0.296	0.177	0.118
	4.7	E	85	125	40	3.0	6	800	0.395	0.237	0.158
	6.8	E	85	125	40	4.3	6	600	0.456	0.274	0.183
	10	E	85	125	40	6.3	8	450	0.527	0.316	0.211
	15	E	85	125	40	9.5	8	300	0.645	0.387	0.258
	V	85	125	40	9.5	8	300	0.707	0.424	0.283	
	V	85	125	40	13.9	8	300	0.707	0.424	0.283	

1. Please do not use multimeter through the measuring procedures.
2. Capacitance and DF measured at :100Hz U_{max} =2.2 1.0V U_{min}~1.0 0.5V, Frequency=100Hz. Test only applied in series equivalent circuit.
3. Voltage derating is applied at +125 The DCL parameter should be read after 5 minutes when it connected to the circuit
4. Special size and demand could consult with us.

Land Dimension / Courtyard

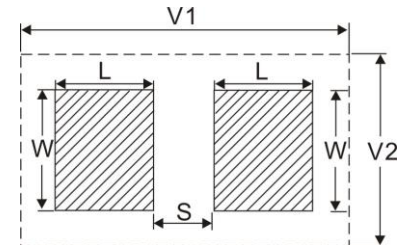
Case Code	Density Level A: Maximum (Most) Land Protrusion (mm)					Density Level B : Median (Nominal) Land Protrusion (mm)					Density Level C: Minimum (Least) Land Protrusion (mm)				
	W	L	S	V1	V2	W	L	S	V1	V2	W	L	S	V1	V2
A	1.35	2.20	0.62	6.02	2.8	1.23	1.8	0.82	4.92	2.3	1.13	1.42	0.98	4.06	2.04
B	2.35	2.21	0.92	6.32	4.0	2.23	1.8	1.12	5.22	3.5	2.13	1.42	1.28	4.36	3.24
C	2.35	2.77	2.37	8.92	4.5	2.23	2.37	2.57	7.82	4	2.13	1.99	2.73	6.96	3.74
D	2.55	2.77	3.67	10.22	5.6	2.43	2.37	3.87	9.12	5.1	2.33	1.99	4.03	8.26	4.84
E	2.55	2.77	3.67	10.22	5.6	2.43	2.37	3.87	9.12	5.1	2.33	1.99	4.03	8.26	4.84

Density Level A: For low-density product applications. Recommended for wave solder applications and provides a wider process window for reflow solder processes.

Density Level B: For products with a moderate level of component density. Provides a robust solder attachment condition for reflow solder processes.

Density Level C: For high component density product applications. Before adapting the minimum land pattern variations the user should perform qualification testing based on the conditions outlined in IPC standard 7351 (IPC-7351).

- 1 Height of these chips may create problems in wave soldering.
- 2 Land pattern geometry is too small for silkscreen outline.



Surface Mount Footprints

Soldering Process

Suntan tantalum capacitors are compatible with wave (single or dual), convection, IR, or vapor phase reflow techniques. Preheating of these components is recommended to avoid extreme thermal stress. Suntan's recommended profile conditions for convection and IR reflow reflect the profile conditions of the IPC/J STD 020D standard for moisture sensitivity testing. The devices can safely withstand a maximum of three reflow passes at these conditions.

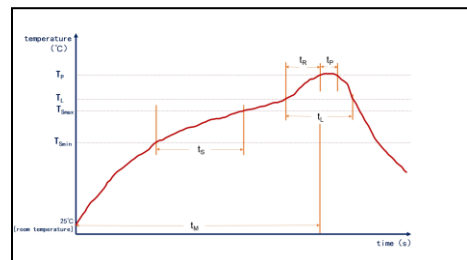
Hand soldering should be performed with care due to the difficulty in process control. If performed, care should be taken to avoid contact of the soldering iron to the molded case. The iron should be used to heat the solder pad, applying solder between the pad and the termination, until reflow occurs. Once reflow occurs, the iron should be removed immediately. "Wiping" the edges of a chip and heating the top surface is not recommended.

During typical reflow operations, a slight darkening of the gold-colored epoxy may be observed. This slight darkening is normal and not harmful to the product. Marking permanency is not affected by this change.

Curve Characteristics	Tin Lead Solder	Lead-free Solder
Preheating Minimum Temperature (T _{Smin})	100 °C	150 °C
Preheat Maximum Temperature (T _{Smax})	150 °C	200 °C
Warming-up Time (ts)	60 – 120 seconds	60 – 120 seconds
Heating Rate (T _L to T _P)	≤3 °C/seconds	≤3 °C/seconds
Melting Point of Solder Paste (T _L)	183 °C	217 °C
Melting Time of Solder Paste (t _L)	60 – 150 seconds	60 – 150 seconds
Peak Temperature (T _P)	220 °C* or 235 °C**	245 °C* or 250 °C**
Peak Temperature Holding Time, Deviation Less than 5 °C (t _P)	≤10 seconds	≤5 seconds
Cooling Rate (T _P to T _L)	≤6 °C/seconds	≤6 °C/seconds
Room Temperature 25 °C to Peak Temperature Time	≤6 minutes	≤8 minutes

Note: All temperatures refer to the center of the package, measured on the package body surface that is facing up during assembly reflow.

*Case Size D, E**Case Size A, B, C



Recommended Reflow Profile

Note: Specification are subject to change without notice. For more detail and update, please visit our website.