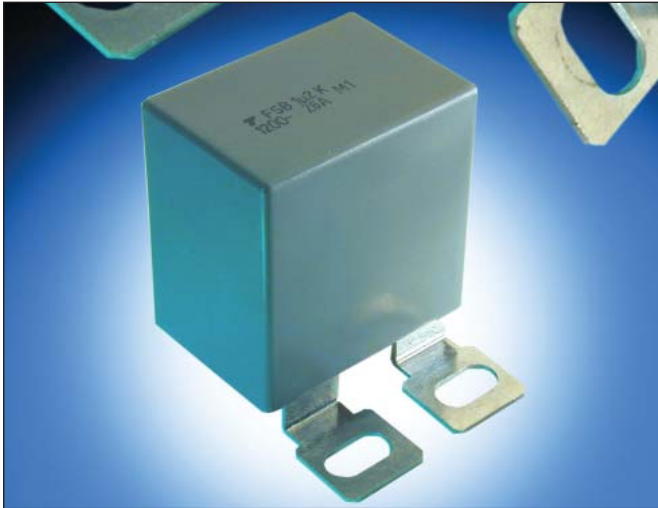


# Medium Power Film Capacitors



## FSB (RoHS Compliant)



### GENERAL DESCRIPTION

Metallized polypropylene dielectric capacitor with controlled self-healing.

Reinforced metallization developed for high impulse currents.

### APPLICATIONS

- IGBT protection
- IGBT clamping

### PACKAGING MATERIAL

- Plastic case backfilled with thermosetting resin

PROTECTION

### HOW TO ORDER

<b>FSB</b> ┆	<b>1</b> ┆	<b>6</b> ┆	<b>U</b> ┆	<b>0154</b> ┆	<b>J</b> ┆	<b>--</b> ┆
<b>Series</b>	<b>Case Size</b>	<b>Dielectric</b>	<b>Voltage Code</b>	<b>Capacitance Code</b>	<b>Capacitance Tolerances</b>	<b>Terminal Code</b>
	1 = PO Style 2 = 18 Style 3 = 19 Style 4 = 26 style 5 = R28 Style (2 terminal or 4 terminal)	6 = Polypropylene	B = 850Vdc U = 1200Vdc M = 1600Vdc N = 2000Vdc	0 + pF code 0154 = 0.15μF 0334 = 0.33μF 0255 = 2.5μF etc.	J = ± 5% K = ±10% (Case size 6 only)	-- = 2 Terminal JC = 4 Terminal (Case Size 5 option only)

### ELECTRICAL CHARACTERISTICS

Capacitance Range $C_n$	0.10μF to 2.5μF
Tolerance on $C_n$	±5%: FSB1...5    ±10%: FSB6
Rated DC Voltage $V_{n,dc}$	850 to 2000 V
Stray Inductance	≤ 25 nH
RMS Current	$I_{rms}$ max. = up to 28A The currents shown in the tables are maximum. It is necessary to maintain operation within the maximum temperature of the dielectric 85°C. See "Hot spot temperature calculation"
Insulation Resistance	$R_i \times C \geq 30,000$ s
Impulse Current	$I^2.t$ max. = up to 1.69 A <sup>2</sup> s Spikes or peak currents in the capacitors may cause a deterioration of the bonding between the metallization and the connections. These bonds are capable of withstanding only a limited amount of energy for each spike. The table shows the maximum energy permitted in the form ( $I^2.t$ ), where I is in Amperes, and t is in seconds.
<b>Note:</b> The formula ( $I^2.t$ ) replaces $dv/dt$ which is less easy to use as it is not an expression of energy ( $I = C.dv/dt$ ). This type of capacitor has been designed to withstand high ( $I^2.t$ ) values.	
Variation of Capacitance with Temperature	$\frac{\Delta C}{C} \leq \pm 2\%$ between -40 and +85°C
Climatic Category	40/085/56 (IEC 68)
Test Voltage Between Terminals @ 25°C	1.6 $V_{n,dc}$ during 10s
Withstanding Voltage Between Terminals and Case @ 25°C	@ 3 kVrms @ 50Hz during 1 min.

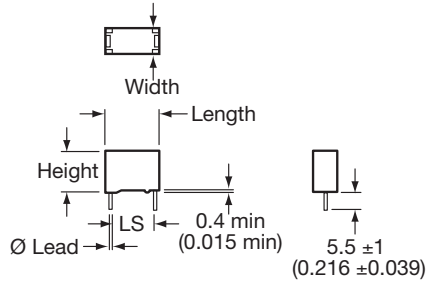
# Medium Power Film Capacitors



FSB (RoHS Compliant)

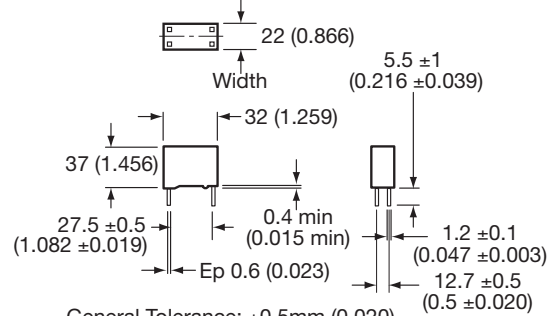
## GENERAL DESCRIPTION

**STYLE: P0; 18; 19; 26; R68**  
**ALL CASE SIZES**  
**2 TERMINALS VERSION**



General Tolerance: ±0.5mm (0.020)

**STYLE: R68**  
**CASE SIZE 5 ONLY**  
**4 TERMINALS VERSION**



General Tolerance: ±0.5mm (0.020)

PROTECTION

## DIMENSIONS: millimeters (inches)

Case Size	Case Style	Length mm ±0.40 (inches)	Width mm ±0.40 (inches)	Height mm ±0.30 (inches)	Dimensions lead mm +10% -0.05 (inches)	LS mm ±0.40 (inches)
1	<b>P0</b>	31.1 (1.230)	13.0 (0.051)	22.4 (0.880)	Ø 0.80 (0.031)	27.5 (1.083)
2	<b>18</b>	31.1 (1.230)	14.6 (0.580)	25.7 (1.010)	Ø 0.80 (0.031)	27.5 (1.083)
3	<b>19</b>	31.1 (1.230)	17.3 (0.068)	29.8 (1.170)	Ø 0.80 (0.031)	27.5 (1.083)
4	<b>26</b>	31.1 (1.230)	20.8 (0.820)	31.3 (1.230)	Ø 1.00 (0.039)	27.5 (1.083)
5	<b>R68</b> <b>2 Terminals</b> <b>Version</b>	32.5 (1.280)	22.0 (0.870)	37.0 (1.460)	Ø 1.00 (0.039)	27.5 (1.083)
	<b>R68</b> <b>4 Terminals</b> <b>Version</b>	32.5 (1.280)	22.0 (0.870)	37.0 (1.460)	1.20 x 0.60 (0.047 x 0.023)	27.5 (1.083)

## RATINGS AND PART NUMBER REFERENCE

Part Number	Capacitance (µF)	Case Style	(I <sup>2</sup> t) (A <sup>2</sup> s)	I <sub>rms</sub> (A)	R <sub>s</sub> (mΩ)	R <sub>th</sub> (hotspot/amb.)	Typical Weight (g)
<b>U<sub>dc</sub> = 1200V V<sub>peak</sub> = 1600V V<sub>rms</sub> = 560V V<sub>s</sub> = 2000V (Voltage Code U)</b>							
FSB16U0154J--	0.15	P0	0.05	3	14.3	45.9	15
FSB26U0274J--	0.27	18	0.15	7.6	8.4	36.8	20
FSB36U0394J--	0.39	19	0.31	11	6.2	32.2	25
FSB46U0474J--	0.47	26	0.41	12	5.6	29.4	32
FSB56U0684J--	0.68	R68 (2 terminals)	0.94	12	3.8	23.7	40
FSB56U0684JJC	0.68	R68 (4 terminals)	0.94	16.7	3.8	23.7	40
<b>U<sub>dc</sub> = 1600V V<sub>peak</sub> = 2000V V<sub>rms</sub> = 630V V<sub>s</sub> = 2300V (Voltage Code M)</b>							
FSB16M0134J--	0.13	P0	0.05	4.6	13.3	44.9	15
FSB26M0184J--	0.18	18	0.1	6.4	9.9	35.9	20
FSB36M0244J--	0.24	19	0.18	8.5	7.8	32.4	25
FSB46M0334J--	0.33	26	0.35	11.7	5.6	28.6	32
FSB56M0434J--	0.43	R68 (2 terminals)	0.59	12	4.6	23.8	40
FSB56M0434JJC	0.43	R68 (4 terminals)	0.59	15.2	4.6	23.8	40
<b>U<sub>dc</sub> = 2000V V<sub>peak</sub> = 2400V V<sub>rms</sub> = 700V V<sub>s</sub> = 2600V (Voltage Code N)</b>							
FSB16N0104J--	0.1	P0	0.05	4.2	14.3	44.6	15
FSB26N0134J--	0.13	18	0.08	5.5	11.3	35.7	20
FSB36N0184J--	0.18	19	0.15	7.6	8.5	32.1	25
FSB46N0224J--	0.22	26	0.22	9.3	6.8	29.1	32
FSB56N0304J--	0.3	R68 (2 terminals)	0.41	12	5.3	23.8	40
FSB56N0304JJC	0.3	R68 (4 terminals)	0.41	12.7	5.3	23.8	40



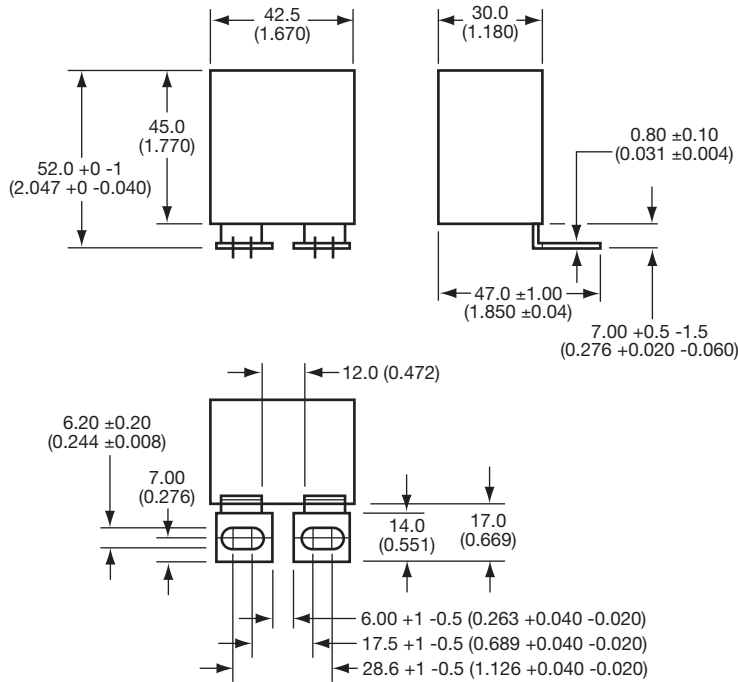
# Medium Power Film Capacitors



FSB (RoHS Compliant)

## CASE SIZE 6

Plastic case resin filled  
Dimensions: millimeters (inches)



GENERAL TOLERANCES: ±0.50mm (±0.020 inches)

## RATINGS AND PART NUMBER REFERENCE

Part Number	Capacitance (μF)	(I <sub>z</sub> t) (A <sup>2</sup> s)	I <sub>rms max.</sub> (A)	R <sub>s</sub> (mΩ)	R <sub>th</sub> (°C/W)	Typical Weight (g)
<b>FSB 850V V<sub>ndc</sub> = 850V V<sub>peak</sub> = 1200V V<sub>rms</sub> = 450V V<sub>S</sub> = 1500V (Voltage Code B)</b>						
FSB66B0205K--	2	0.99	25	3.4	19.1	87
FSB66B0225K--	2.2	1.19	28	3.1	18.6	87
FSB66B0255K--	2.5	1.54	28	2.7	17.8	87
<b>FSB 1200V V<sub>ndc</sub> = 1200V V<sub>peak</sub> = 1600V V<sub>rms</sub> = 560V V<sub>S</sub> = 2000V (Voltage Code U)</b>						
FSB66U0105K--	1	1.47	25	3.6	17.2	87
FSB66U0125K--	1.2	1.69	26	3.4	17.5	87
FSB66U0155K--	1.5	1	26	3.4	17.5	87
<b>FSB 2000V V<sub>ndc</sub> = 2000V V<sub>peak</sub> = 2400V V<sub>rms</sub> = 700V V<sub>S</sub> = 2600V (Voltage Code N)</b>						
FSB66N0474K--	0.47	0.41	22	6.3	19.4	87
FSB66N0564K--	0.56	0.62	23	5.2	17.9	87
FSB66N0684K--	0.68	0.91	24	4.4	17.3	87

PROTECTION

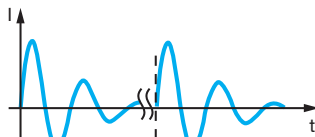
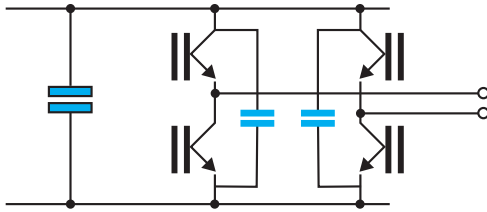
### STANDARDS

IEC 61071-1, IEC 61071-2: Power electronic capacitors

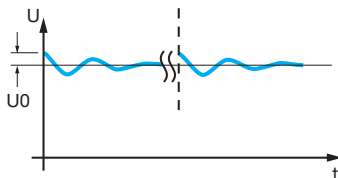
### TANGENT OF LOSS ANGLE (TANδ<sub>0</sub>) FOR POLYPROPYLENE DIELECTRIC

Polypropylene has a constant dielectric loss factor of 2x10<sup>-4</sup> irrespective of temperature and frequency (up to 1 MHz).

### IGBT SNUBBER



With



L = stray inductance IGBT + capacitor

R = serial resistance IGBT + capacitor

### HOT SPOT TEMPERATURE CALCULATION

See *Hot Spot Temperature*, page 3.

$$\theta_{\text{hot spot}} = \theta_{\text{ambient}} + (P_d + P_t) \times R_{\text{th}}$$

with  $P_d$  (Dielectric losses) =  $Q \times \text{tg}\delta_0$   
 $\Rightarrow [ \frac{1}{2} \times C_n \times (V_{\text{ripple peak to peak}})^2 \times f ] \times (2 \times 10^{-4})$   
 $P_t$  (Thermal losses) =  $R_s \times (I_{\text{rms}})^2$   
 $R_{\text{th}}$  :  $R_{\text{th ambient}} / \text{hot spot}$  in °C/W

where  $C_n$  in Farad     $I_{\text{rms}}$  in Ampere     $f$  in Hertz  
 $V$  in Volt     $R_s$  in Ohm     $\theta$  in °C

Due to the design of the capacitor and its technology, the thermal impedance between the terminations and the core of the capacitor is low, it is necessary to take care that the capacitor is never overheated by use of wrongly sized connections.

Do not use the capacitor as a heat sink.

Due to the complexity of the IGBT / capacitor thermal exchanges, we recommend that thermal measurements shall be made on the different components. We would be pleased to advise you on specific applications.

### WORKING TEMPERATURE

(according to the power to be dissipated) -40°C to +85°C

### MARKING

TPC logo

Capacitance and tolerance in clear

Nominal DC voltage in clear

RMS current in clear

Date of manufacture (IEC coding)

$$I_{\text{eff}} = \sqrt{\left[ \frac{C\beta_0^2 \times U_0}{2j\beta} \right]^2 \times \frac{1}{T} \times \left[ \frac{e^{-2\alpha \times T}}{\beta^2 + \alpha^2} \times [\beta \sin(2\beta \times T) - \alpha \times \cos(2\beta \times T)] + \frac{1}{\alpha} \times e^{-2\alpha \times T} + \frac{\alpha}{\beta^2 + \alpha^2} - \frac{1}{\alpha} \right]}$$

with  $\beta_0 = \sqrt{\frac{1}{LC}}$ ;  $\alpha = \frac{R}{2L}$ ;  $\beta = \sqrt{\beta_0^2 - \alpha^2}$