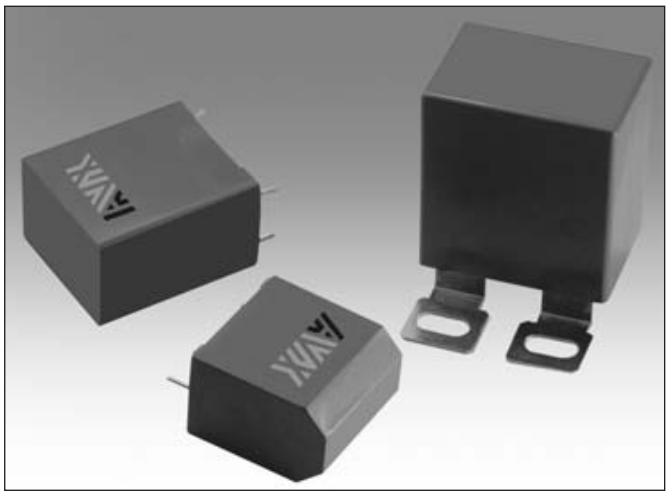
Medium Power Film Capacitors

FSB



GENERAL DESCRIPTION

Metallized polypropylene dielectric capacitor with controlled self-healing.

Reinforced metallization developed for high impulse currents.

APPLICATIONS

- IGBT protection
- IGBT clamping

PACKAGING

- Parallelipedic plastic case with thermosetting resin

PROTECTION

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 respect the thermal limits of the dielectric 85°C see "Hot spot temperature calculation"
Insulation Resistance	R_i x C ≥ 30,000 s
Impulse Current	$I^2.t$ max. = up to 1.69 A^2s 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 Ampere, and t is in seconds.

Note: 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	$\frac{\Delta C}{C}$ ≤ ±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.

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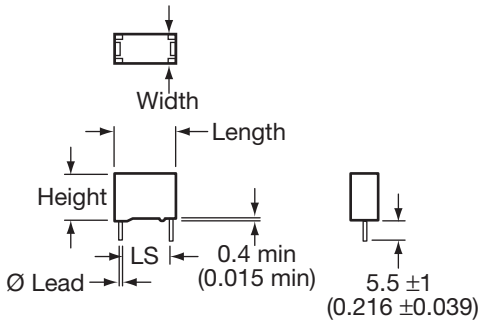
GENERAL DESCRIPTION

BOX KIND: P0; 18; 19; 26; R68 FSB1..5

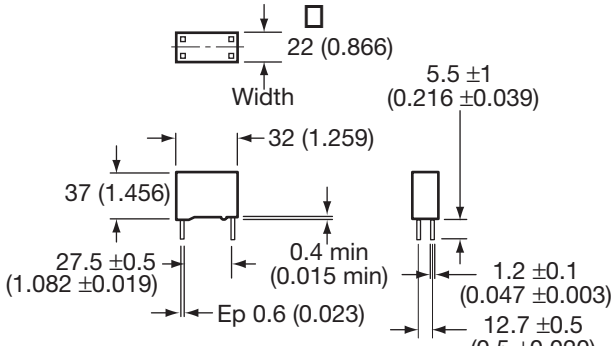
2 TERMINALS SOLUTION



General Tolerance: ±0.5mm (0.020)

BOX KIND: R68 FSB5

4 TERMINALS SOLUTION



General Tolerance: ±0.5mm (0.020)

DIMENSIONS: millimeters (inches)

Box Kind	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)
P0	31.1 (1.230)	13.0 (0.051)	22.4 (0.880)	Ø 0.80 (0.031)	27.5 (1.083)
18	31.1 (1.230)	14.6 (0.580)	25.7 (1.010)	Ø 0.80 (0.031)	27.5 (1.083)
19	31.1 (1.230)	17.3 (0.068)	29.8 (1.170)	Ø 0.80 (0.031)	27.5 (1.083)
26	31.1 (1.230)	20.8 (0.820)	31.3 (1.230)	Ø 1.00 (0.039)	27.5 (1.083)
R68 2 Terminals Solution	32.5 (1.280)	22.0 (0.870)	37.0 (1.460)	Ø 1.00 (0.039)	27.5 (1.083)
R68 4 Terminals Solution	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)

References	Capacitance (µF)	Box Kind	(I²t) (A²s)	Irms (A)	Rs (mΩ)	Rth (hotspot/amb.)
$U_N$dc = 1200V		**Vpeak = 1600V**		**Vrms = 560V**		**Vs = 2000V**
FSB16U0154J--	0.15	P0	0.05	3	14.3	45.9
FSB26U0274J--	0.27	18	0.15	7.6	8.4	36.8
FSB36U0394J--	0.39	19	0.31	11	6.2	32.2
FSB46U0474J--	0.47	26	0.41	12	5.6	29.4
FSB56U0684J--	0.68	R68 (2 terminals)	0.94	12	3.8	23.7
FSB56U0684JJC	0.68	R68 (4 terminals)	0.94	16.7	3.8	23.7
$U_N$dc = 1600V		**Vpeak = 2000V**		**Vrms = 630V**		**Vs = 2300V**
FSB16M0134J--	0.13	P0	0.05	4.6	13.3	44.9
FSB26M0184J--	0.18	18	0.1	6.4	9.9	35.9
FSB36M0244J--	0.24	19	0.18	8.5	7.8	32.4
FSB46M0334J--	0.33	26	0.35	11.7	5.6	28.6
FSB56M0434J--	0.43	R68 (2 terminals)	0.59	12	4.6	23.8
FSB56M0434JJC	0.43	R68 (4 terminals)	0.59	15.2	4.6	23.8
$U_N$dc = 2000V		**Vpeak = 2400V**		**Vrms = 700V**		**Vs = 2600V**
FSB16N0104J--	0.1	P0	0.05	4.2	14.3	44.6
FSB26N0134J--	0.13	18	0.08	5.5	11.3	35.7
FSB36N0184J--	0.18	19	0.15	7.6	8.5	32.1
FSB46N0224J--	0.22	26	0.22	9.3	6.8	29.1
FSB56N0304J--	0.3	R68 (2 terminals)	0.41	12	5.3	23.8
FSB56N0304JJC	0.3	R68 (4 terminals)	0.41	12.7	5.3	23.8

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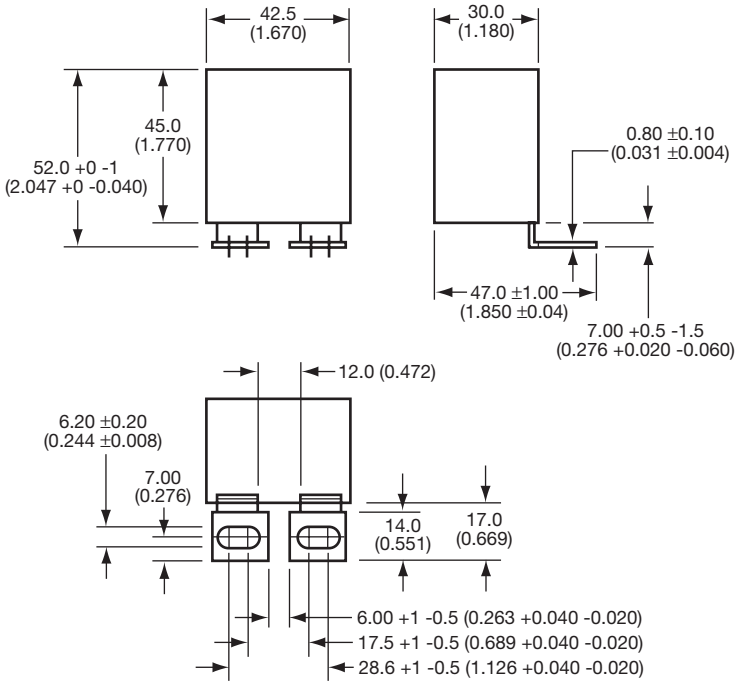
FSB6

Plastic case resin filled

Dimensions: millimeters (inches)



GENERAL TOLERANCES: ±0.50mm (±0.020 inches)

Part Number	Capacitance (µF)	(I^2t) (A^2s)	$I_{rms\ max.}$ (A)	R_s (mΩ)	R_{th} (°C/W)
FSB 850V	**$V_n$dc = 850V**	**V_{peak} = 1200V**	**V_{rms} = 450V**		**V_S = 1500V**
FSB66B0205K--	2	0.99	25	3.4	19.1
FSB66B0225K--	2.2	1.19	28	3.1	18.6
FSB66B0255K--	2.5	1.54	28	2.7	17.8
FSB 1200V	**$V_n$dc = 1200V**	**V_{peak} = 1600V**	**V_{rms} = 560V**		**V_S = 2000V**
FSB66U0105K--	1	1.47	25	3.6	17.2
FSB66U0125K--	1.2	1.69	26	3.4	17.5
FSB66U0155K--	1.5	1	26	3.4	17.5
FSB 2000V	**$V_n$dc = 2000V**	**V_{peak} = 2400V**	**V_{rms} = 700V**		**V_S = 2600V**
FSB66N0474K--	0.47	0.41	22	6.3	19.4
FSB66N0564K--	0.56	0.62	23	5.2	17.9
FSB66N0684K--	0.68	0.91	24	4.4	17.3

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Medium Power Film Capacitors

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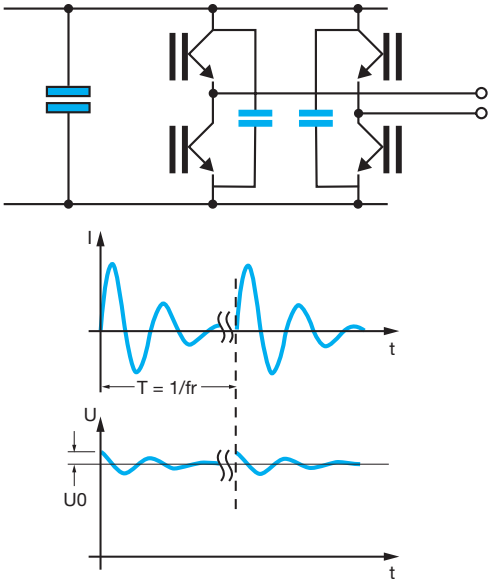
STANDARDS

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

TANGENT OF LOSS ANGLE (TANδ_0) FOR POLYPROPYLENE DIELECTRIC

Polypropylene has a constant dielectric loss factor of $2x10^{-4}$ 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

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

with P_d (Dielectric losses) = $Q \times tg\delta_0$

$\Rightarrow [\frac{1}{2} \times C_n \times (V_{ripple\ peak\ to\ peak})^2 \times f] \times (2 \times 10^{-4})$

P_t (Thermal losses) = $R_s \times (I_{rms})^2$

Rth : Rth ambient / hot spot in °C/W

where C_n in Farad, I_{rms} in Ampere, f in Hertz, V in Volt, R_s in Ohm, θ 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 problems.

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)

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

with $\beta 0 = \sqrt{\frac{1}{LC}}$; $\alpha = \frac{R}{2L}$; $\beta = \sqrt{\beta_0^{\,2} - \alpha^2}$

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