

Metal Composite Power Inductors

AEC-Q200 Compliant
for Automotive & Industrial
Use in Harsh Environments

- Vibration Resistance up to 50G (5Hz - 2kHz)
- Miniaturization up to 50% compared to ferrite products with the same performances
- Fully magnetic shielded structure



IN Your Future



IN Your Innovation



Power Inductor Automotive Application

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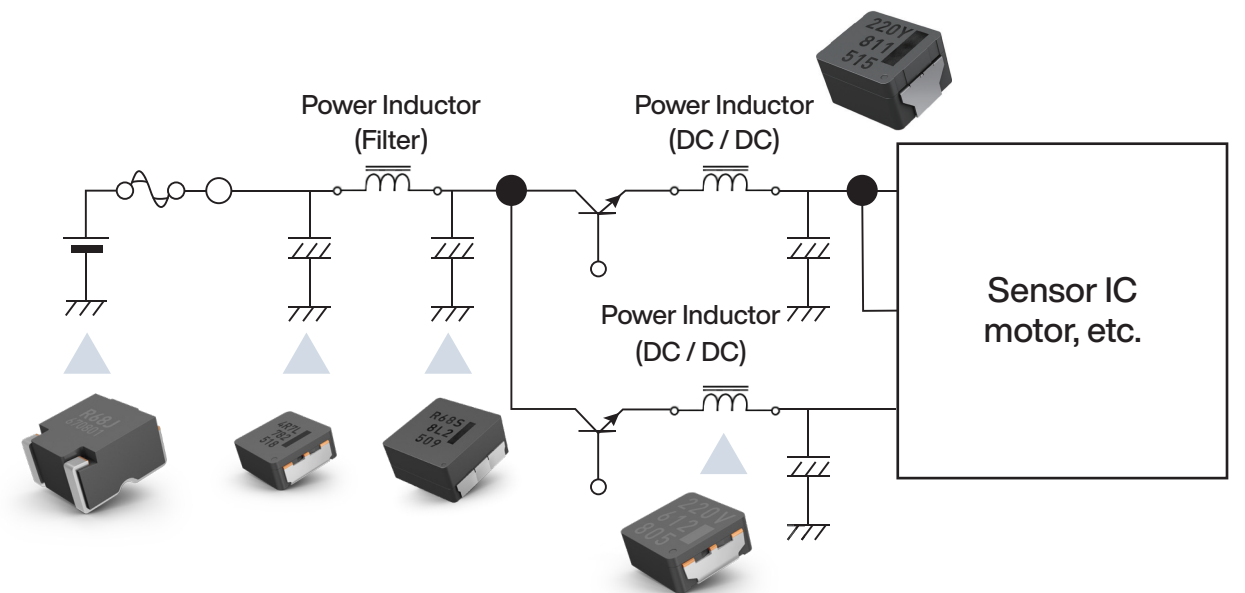
Selection Guide

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DC / DC Converter Application Example



Applications



Circuit Function

- Noise Filter For Drive Circuits
- DC/DC Converter
- Voltage Regulator
- Buck/Boost Converters



Automotive

- HEV/EV
- Engine ECU
- ADAS
- Powertrain
- Lighting
- Autonomous Driving



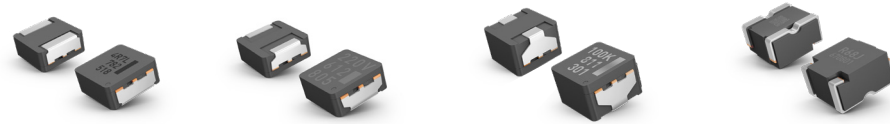
Industrial

- Automation
- Server
- LED Driver
- Power Supply Module

Power Inductor Automotive Application

Main Series

Below Panasonic inductors are AEC-Q200 compliant



Series	PCC-MC High Performance	PCC-LP Low Profile	PCC-LE LE type	PCC-1280/-1510 Large Current	High Vibration Series
Temperature range	-40°C - +150°C	-55°C - +155°C	-40°C - +150°C	-40°C - +160°C	-40°C - +150°C
Inductance range	0.33 - 100μH	0.33 - 47μH	3.3 - 47μH	0.33 - 4.7μH	0.68 - 44μH
Rated current	1.9 - 39.7A	2.1 - 23.9A	2.9 - 9.2A	20.2 - 83A	4.1 - 32.3A
Package size (mm)	□5.5x5.0x3.0 - □0.9x10.0x6.0	□5.5x5.0x3.0 - □10.7x10.0x4.0	□6.4x6.0x4.8 □7.4x7.0x4.8	□13.2x12.6x8.0 □15.6x17.2x10.5	□9.5x8.0x5.4 □10.9x10.0x5.0-6.0
Benefit	<ul style="list-style-type: none"> High performance Robust & high stability High saturation Low AC-power loss 	<ul style="list-style-type: none"> Low profile design Max 3.0 & 4.0mm height. Low DCR Pin layout compatible with IHL series. 	<ul style="list-style-type: none"> Lower DCR Pin to pin compatible with Ferrite type 	<ul style="list-style-type: none"> High current Lower DCR 30G Vibration ½ package size 	<ul style="list-style-type: none"> 50G Vibration High Performance Low AC-power loss

Main Applications

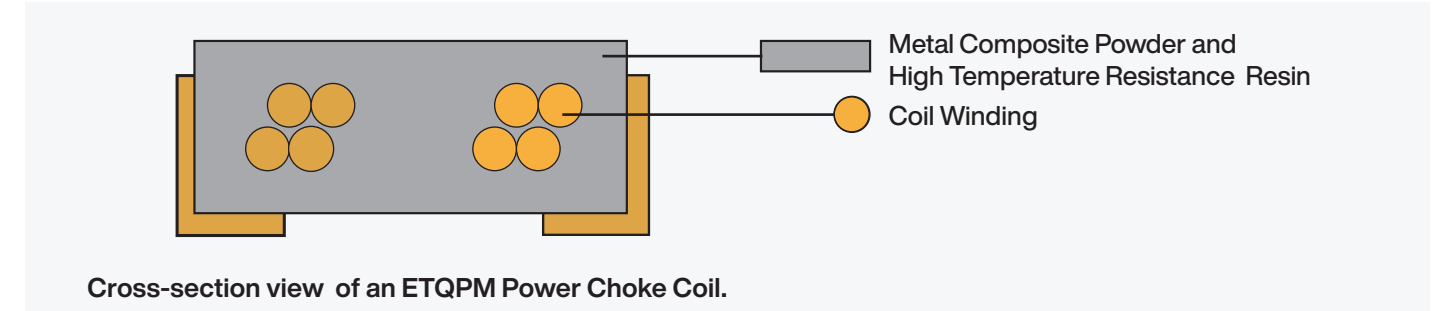
Automotive Application Examples

Engine ECU	Autonomous Driving	E-Power Steering	Transmission ECU	Battery Management System	
E-Compressors	Navigation System			Battery ECU	
Panel/HUD	On-board Charger			Camera	
Radar	ADAS			Lidar	
Fan Motor Driver	Domain Controller		Gateway	Monitor	
LED Headlamp	Electrical Pump		48V/EV Inverter	Zone Controller	Door Motor Controller

Features and Benefits

Main Characteristics

High Current, High Heat Resistance and Excellent Thermal Stability

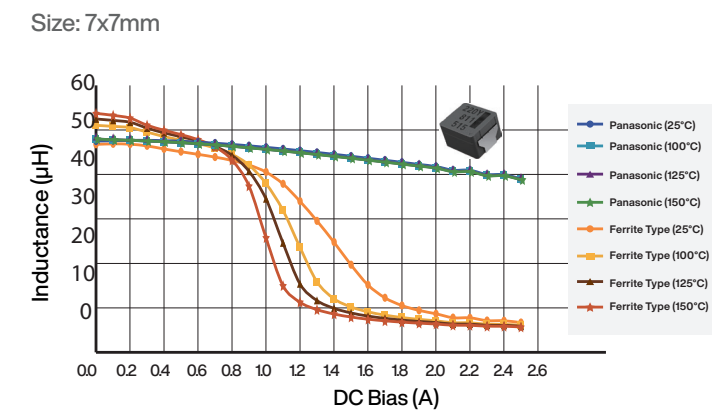


- The ETQP Power Inductor consists of metal powder, Binding & Coating resin and coil winding. The magnetic material, which is created from Fe-based powder, enables high current, high heat resistance and excellent thermal stability.
- Excellent magnetic saturation characteristics (i.e. Ferrite core = 0.4T vs. Metal Composite Type=above 1.5T) make it difficult to magnetically saturate, resulting in good inductance vs. current performance without substantial drop off.
- By using a high temperature capable resin material, an operating temperature up to 180°C is achievable for several hours.

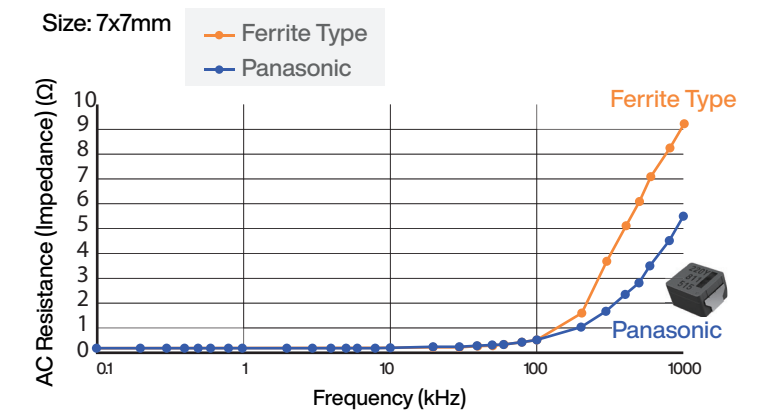
Metal Composite vs Ferrite Type Inductors

With metal composite power inductors you can save up to 50% space with respect a ferrite type inductor with the same performances.

Effect of DC Bias Current on Inductance

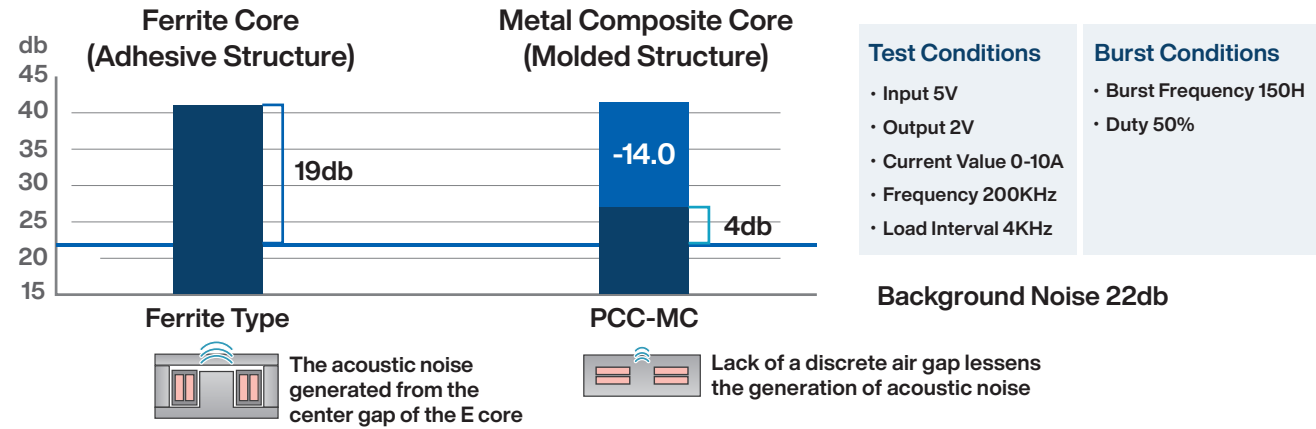


Frequency Characteristics of AC Resistance



Acoustic Noise Reduction

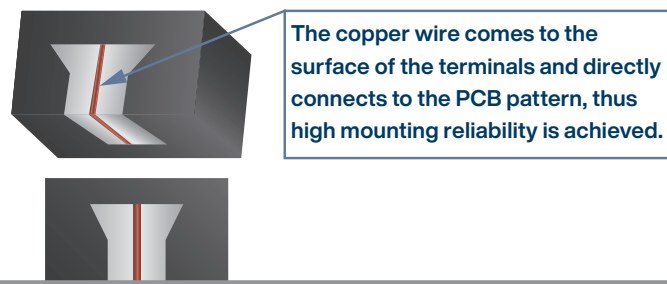
Troublesome acoustic noise at audible frequencies is reduced by having a distributed gap structure where the resin replaces the air gap. This enables a large reduction of acoustic noise compared to Ferrite Types.



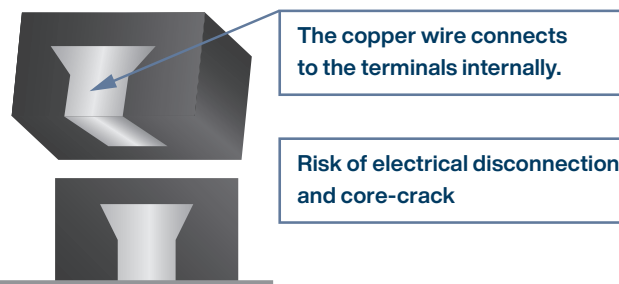
Terminal Coating Process

The surface of terminal is processed by dip-soldering, which is copper wire and terminals are dipped into solder bath. It enables to good solderability and mountability, also good effect for anti-wisker compared with electric plating.

Panasonic Metal Composite Type*



Other Company



*For the actual product, dip solder is applied on the copper wire part and terminal to keep good mountability. The corresponding part numbers are included in the Selection Guide on page 13 of this document.



Withstanding Voltage Characteristics

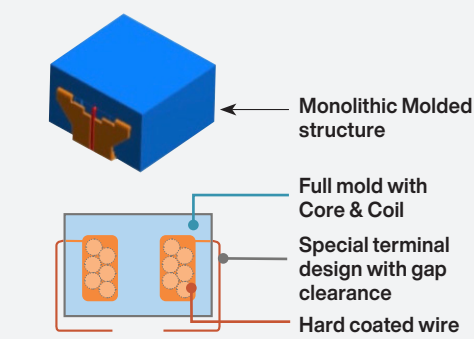

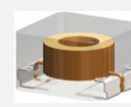
ETQP Series Metal Composite Type achieves excellent withstanding voltage characteristics that can be used in various applications.

Maximum Operation Voltage Target

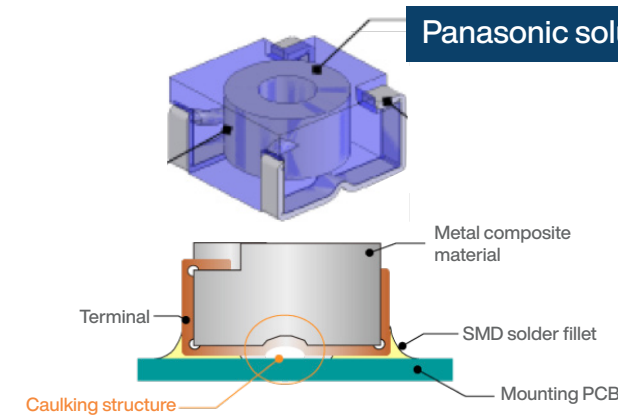
PCC Series	Size (mm)	Withstanding Voltage														
		0.68μH	1.0μH	1.5μH	2.2μH	3.3μH	4.7μH	6.8μH	10μH	15μH	22μH	33μH	47μH	68μH	100μH	
Large Current	13.2x12.6x8.0	50V														
High Performance	10.9x10.0x6.0		70V													
High Performance	10.9x10.0x5.0	70V														
High Performance	10.7x10.0x5.4		70V										65V			
Low Profile	10.7x10.0x4.0	65V											60V			
High Performance	8.5x8.0x5.4		70V					65V								
Low Profile	8.5x8.0x4.0	65V														
High Performance	7.5x7.0x5.4		65V					60V								
High Performance	6.5x6.0x4.5		60V					55V								
High Performance	6.5x6.0x3.0	60V														
Low Profile	6.4x6.0x3.0	60V					55V									
High Performance	5.5x5.0x4.0		55V													
High Performance	5.5x5.0x3.0		55V													
Low Profile	5.5x5.0x3.0	55V					50V									

Robust Design for High Vibration Proof and Large Current

High Vibration Design Features

Standard Design	High Vibration Design
 <ul style="list-style-type: none"> Monolithic Molded structure Full mold with Core & Coil Special terminal design with gap clearance Hard coated wire 	<p>Lower position Terminal design Lower center of gravity, less movement</p>  <p>PCC 10x10mm <50G 5-2,000Hz 108/axis</p> 
10G to 30G	30G to 50G

Large Current Series Features



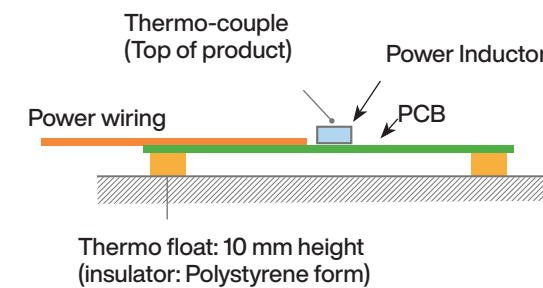
ETQP8M__JFA & ETQPAM__JFW series

- Large current in compact size as 12x12mm & 15x15mm SMD
- Designed for harsh environments up to 30G vibration proof
- High saturation current up to 100A

Technical Information

Design Information

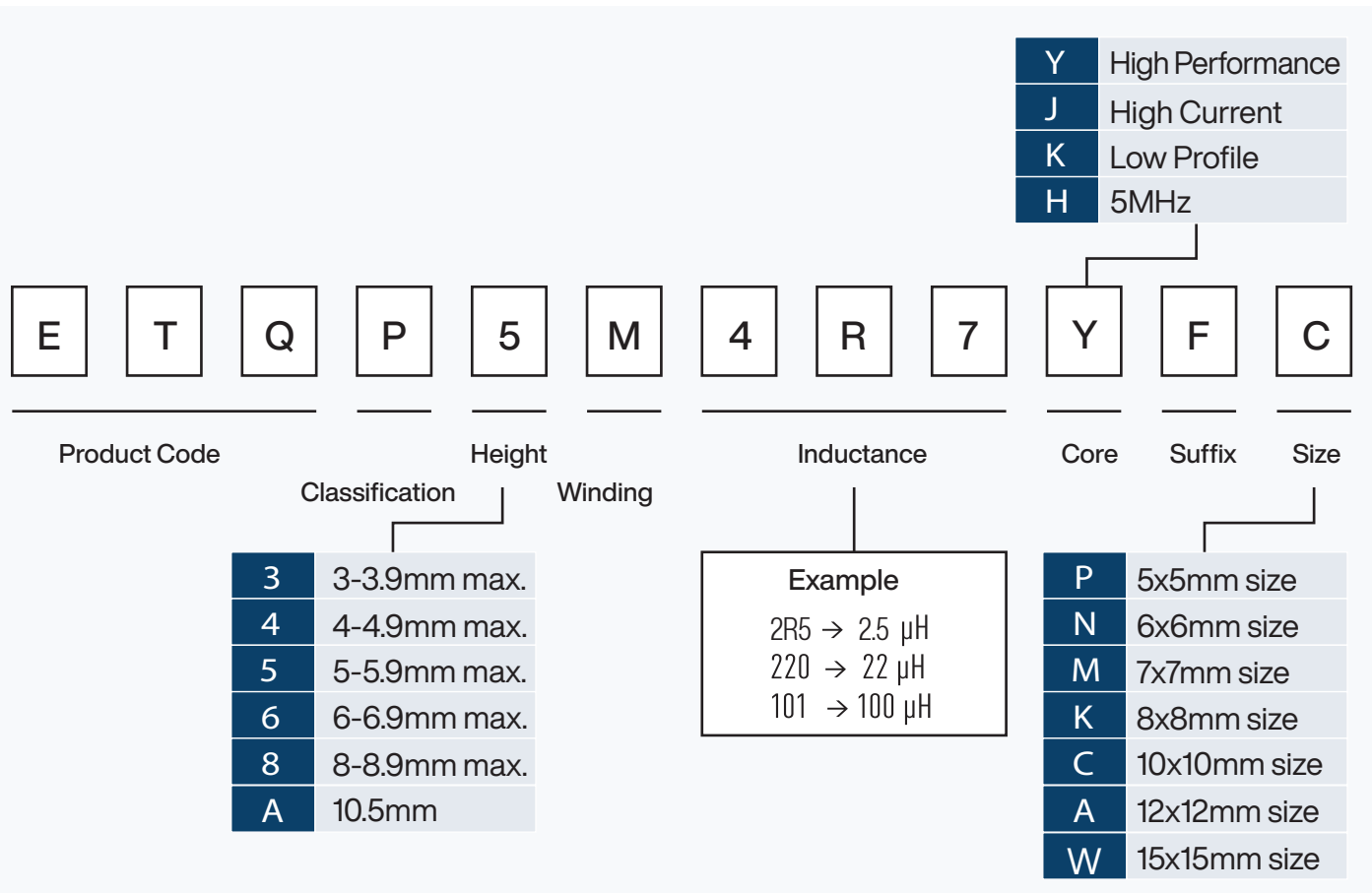
Temperature Measurement Conditions by Panasonic



PCB specification:

- 1.6mm, FR4 / 4layers or Multi-layer PCB
- PCB with high heat dissipation performance
 - PCB size: 110 × 80 × T1.6 mm
 - Land pattern; Using Panasonic recommendation pattern by series (shown in WEB catalog)

Explanation of Part Numbers



Selection Guide

Panasonic ETQP Series Selection Guide

High Performance Series

Type	5x5 ETQP*M__YFP		6x6 ETQP*M__YFN		7x7 ETQP5M__YFM		8x8 ETQP5M__Y*K		10x10 ETQP5M__Y*C		10x10 (Low DCR) ETQP*M__YLC	
	WxLxT	Height=t	WxLxT	Height=t	WxLxT	Height=t	WxLxT	Height=t	WxLxT	Height=t	WxLxT	Height=t
LO (µH)	Rated Current (A)	DCR (mΩ)	Rated Current (A)	DCR (mΩ)	Rated Current (A)	DCR (mΩ)	Rated Current (A)	DCR (mΩ)	Rated Current (A)	DCR (mΩ)	Rated Current (A)	DCR (mΩ)
100					1.9 (*1)	348	2.1	302	2.7(*5)	208		
68					2.3	251			3.6(*7)	136		
47			2.2	210	2.9 (*3)	156	3.4 (*3)	125	4.2	99		
33			2.5	172	3.3	120			5.0	68.5		
22	2.3	163	2.9	126	3.7	92.0	4.8	63.0	6.2	45.0		
15							5.5	48.2	7.0	35.6	7.9 (*8)	28.0
10			4.5	54.2	5.7	37.6	6.7	33.4	8.5	23.8		
6.8			5.2	39.3	6.9	26.7						
4.7	4.8	36.0			8.0	20.4			13.1	10.2	14.1	8.7
3.3	5.0	31.3	8.2	16.1	10.4	11.9	12.5	9.5	15.7	7.1	17.0	6.0
2.2	5.8	22.6	10.2	10.4			14.0 (*4)	7.6	18.1(*4)	5.3	19.6(*9)	4.55
1.5									21.4	3.8	23.3	3.2
1.0			10.7	7.9							27.5	2.3
0.68			12.0	6.3							31.5	1.75
0.33											39.7	1.1

*Other part numbers available upon request

Note: Current value (Rated Current) is the typical value when overall temperature rise is 40K up with multi-layer PWB (high-heat dissipation)

(*1) 95µH (*2) 97µH (*3) 48µH (*4) 2.5µH (*5) 97.0µH (*6) 3.2µH (*7) 66µH (*8) 14.0µH (*9) 2.5µH

Selection Guide

Panasonic ETQP Series Selection Guide

Low Profile Series // LE Series

Part Number	M0530M-LP		M0630M-LP		M0648M-LE		M0748M-LE		M0840M-LP		M1040M-LP	
Type	5x5 ETQP3M__KVP		6x6 ETQP3M__KVN		8x8 ETQP4M__KVK		10x10 ETQP4M__KVC		6x6 ETQP4M__KFN		7x7 ETQP4M__KFM	
(Size) WxLxT Height=t	5.5x5.0mm t=3.0mm		6.4x6.0mm t=3.0mm		8.5x8.0mm t=4.0mm		10.7x10.0mm t=4.0mm		6.4x6.0mm t=4.8mm		7.4x7.0mm t=4.8mm	
LO (μH)	Rated Current (A)	DCR (mΩ)	Rated Current (A)	DCR (mΩ)	Rated Current (A)	DCR (mΩ)	Rated Current (A)	DCR (mΩ)	Rated Current (A)	DCR (mΩ)	Rated Current (A)	DCR (mΩ)
47							3.4	132.0			2.9	148.6
33			2.1	206	3.1	118	4.2	84.6				
22			2.7	128	3.8	78.4	5.0	60.0			3.9	84.1
15			3.0	99.2	4.5	55	6.3	37.0	4.2	63.8		
10	2.9	96	3.6	71.0	5.2	41.6	7.6	25.4	5.2	40.4	6.0	36.0
6.8	3.5	65.7	4.5	45.6	6.9	23.5	8.9	18.5	5.9	32.1		
4.7	4.1	45.6	5.6	29.0	8.3	16.1	11.2	12.3	7.3	20.7	8.8	16.8
3.3	5.4	27.3	6.1	24.1	8.9	14.1	12.6	9.4	9.2	13.1		
2.2	6.3	20.0	7.9	14.5	11.4	8.5	14.8	6.8				
1.5	8.1	12.0	9.1	11.0	15.1	4.9	17.4	4.9				
1.0	9.0	9.6	12.1	6.2	17.3	3.7	23.9	2.6				
0.68	10.2	7.6	13.2	5.2	19.5	2.92						
0.47	11.6	5.8										
0.33	12.7	4.85										

*please contact Panasonic for availability

Note: Current value (Rated Current) is the typical value when overall temperature rise is 40K up with multi-layer PWB (high-heat dissipation)

Panasonic ETQP Series Selection Guide

High Frequency Series // High Vibration Resistance Series // Large Current Series

Type	5x5 ETQP3M__HFP		6x6 ETQP3M__HFN		8x8 ETQP5M__YSK		10x10 ETQP5M__YSC		12x12 ETQP*M__JFA		15x15 ETQPAM__JFW		
(Size) WxLxT Height=t	5.5x5.0mm t=3.0mm		6.5x6.0mm t=3.0mm		8.5x8.0mm t=5.4mm		10.9x10.0mm t=5.0mm		13.2x12.8mm t=8.0mm		15.6x17.2mm t=10.0mm		
LO (μH)	Rated Current (A)	DCR (mΩ)	Rated Current (A)	DCR (mΩ)	Rated Current (A)	DCR (mΩ)	Rated Current (A)	DCR (mΩ)	Rated Current (A)	DCR (mΩ)	Rated Current (A)	DCR (mΩ)	
47							4.1 (*5)	102					
33													
22			2.5	144			6.2 (*4)	45.5					
15													
10			3.7	68									
6.8													
4.7									20.2	4.9			
3.3									23.6	3.6			
2.2	6.3	19.5			14.1 (*1)	7.4	19.7 (*2)	4.48	27.7 (*1)	2.6			
1.5							29.8 (*3)	19.8	33.3	1.8			
1.0									38.3	1.36			
0.68								32.3	1.66	42.6	1.1	65	0.70
0.47													
0.33									53.5	0.7	83	0.42	

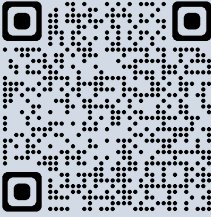



*please contact Panasonic for availability



Note: Current value (Rated Current) is the typical value when overall temperature rise is 40K up with multi-layer PWB (high-heat dissipation)

(*1) 2.45μH (*2) 2.5μH (*3) 1.9μH (*4) 20.0μH (*5) 44.0μH

Panasonic ETQP Design & Sales Support

Panasonic offers many tools to help with your circuit designs. Follow the links below for a device library for circuit simulators, CAD data and further information.

Scan and find all the information about Panasonic Power Inductors	Simulation Data Libraries	Industrial & Automotive use LC filter simulator	Power Inductor Loss Simulator
	<p>Equivalent circuit models and S-parameter data can be downloaded for each individual item number.</p> <p style="text-align: center;"> Start Selection</p>	<p>The Industrial & Automotive use LC filter simulator enables the simulation of attenuation amounts when configuring a filter using Panasonic power inductor and aluminum electrolytic capacitor suitable for industrial & automotive use.</p> <p style="text-align: center;"> Start Simulation</p>	<p>The Power Inductor loss simulator for automotive application enables the simulation of losses and temperature rises according to the current for Panasonic power inductors designed for automotive use.</p> <p style="text-align: center;"> Start Simulation</p>

CAD Data	Characteristic Viewer	Local Technical Support
<p>Find inductor CAD data for download (3D STEP, 3D PDF)</p> <p style="text-align: center;"> Start Selection</p>	<p>Characteristic Viewer is the tool which represent various characteristics of a selected part by means of a graph of the frequency axis and temperature axis, etc.</p> <p style="text-align: center;"> Start Simulation</p>	<p>Our Business Development Team as well as our respective Product Managers are available for technical on-site support.</p> <p>Or if you have any further inquiries, you can contact them at Inductor@eu.panasonic.com</p>

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