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SPECIFICATION FOR APPROVAL

DATE: _____

CUSTOMER: _____

PART NAME: Metal Strip Type Halogen Free Current Sensing Resistors

CUSTOMER'S DWG. NO. _____

CUSTOMER'S PART NO. _____

PDC PART NO. FMF SERIES APPROVED

DESCRIPTION. _____

| RESULT \ ACTION | " ~ " | CUSTOMER'S SIGNATURE | NOTE |
|----------------------|-------|----------------------|------|
| FULL APPROVED | | | |
| CONDITIONAL APPROVED | | | |
| REJECTED | | | |

| OUR ACTION | SIGNATURE |
|-------------|--------------------|
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| CHECKED BY | <i>Tony Chou</i> |
| APPROVED BY | <i>Byron Tsai</i> |

CUSTOMER SIGNATURE FOR ACCEPTANCE

| | |
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1. Features

- High power rating and low TCR.
- Low resistance and high precision (1%).
- Inductance less than 1.0nH.
- Excellent reliability and suitable cost.
- Suitable for lead free soldering.
- RoHS compliant & Halogen Free

2.Applications

- Switching model power supply.
- Battery pack.
- Notebook, Tablet PC
- Test Instrument.
- Power Amplifier.

3.Dimension and Construction



| Item | Protective Molding | Resistive Element | Internal Terminal | External Terminal |
|----------|--------------------|-------------------|-------------------|-------------------|
| Material | Resin | Alloy Metal | Copper | Solder |

| Unit : mm | | | | |
|---------------|-----------|-----------|-----------|------------|
| Type | L | W | T | a |
| FMF05 5~20m | 2.00±0.15 | 1.20±0.15 | 0.45±0.15 | 0.325±0.20 |
| FMF06 5m~30m | 3.10±0.20 | 1.65±0.20 | 0.60±0.20 | 0.60±0.20 |
| FMF25 3m~100m | 6.20±0.20 | 3.25±0.20 | 0.60±0.20 | 0.80±0.20 |
| FMF59 2~10m | 15.0±0.20 | 7.80±0.20 | 0.70±0.20 | 3.50±0.20 |

4. Power Derating Curve

Operating Temperature Range: -55 to +170 deg.C



5. Rating

| Type \ Rating | Power Rating at 70°C (W) | Max Working Voltage | Max Overload Voltage | Resistance Tolerance (%) | Temperature coefficient of Resistance (ppm/°C) | Resistance (mΩ) |
|-----------------------|--------------------------|---------------------|----------------------|---|--|--|
| FMF05 0805 | 0.25 | 71mV | 158mV | ±1%(F) | ±100 | 5,6,7,8,9,10,20 |
| | 0.5 | 100mV | 224mV | ±2%(G) ±5%(J) | | |
| FMF06 1206 | 0.5 | 123mV | 274mV | ±1%(F) ±2%(G) | ±70 | 5,10,15,20,25,30 |
| | 1 | 173mV | 387mV | ±5%(J) | ±70 | 5,10,15,20,25,30 |
| FMF25 2512 | 1 | 316mV | 707mV | ±1%(F) ±2%(G) ±5%(J) | ±100 | 3,4 |
| | | | | | ±70 | 5,6,7,8,9,10,12,15, 20,25,50,100 |
| | 2 | 447mV | 1000mV | | ±100 | 3,4 |
| | | | | | ±70 | 5,6,7,8,9,10,12,15, 20,25,30,33,35,40, 50,100 |
| FMF59 5931 | 5 | 224mV | 500mV | ±1%(F) ±2%(G) ±5%(J) | ±100 | 2,3 |
| | | | | | ±70 | 5,10 |

FMF series Metal Strip Type Lead Free Current Sensing Resistors

Note:

- (i) $E = \sqrt{P * R}$ or Max. Working Voltage whichever is lower.
- (ii) E : Working Voltage(V) , P : Rated Power (W) , R : Resistance Value(Ω)
- (iii) Solder-pad and trace size should be $>300 \text{ mm}^2$ and board surface temperature should not exceed 105°C when applying rated power

6.Part Number

| Type | Size | Tolerance | Packing | Watt | R Value | TCR | Special Code |
|------------|-----------------|----------------------|--|--|-------------|------------|---|
| FMF | 05 :0805 | F : $\pm 1\%$ | T :Paper Tape | D : | RXXX | ± : | 2512/1206 |
| | 06 :1206 | G : $\pm 2\%$ | 5Kpcs (For 0805) | 1/4W | | As | 5931 : |
| | 25 :2512 | J : $\pm 5\%$ | 4Kpcs (For 1206) | F : | 4 digit | Rating | L \leftrightarrow LH : |
| | 59 :5931 | | P :Plastic Tape 4Kpcs (For 2512) Q :Plastic Tape 3Kpcs (For 5931) | 1/2W H : 1W J : 2W M : 5W | | Info | Standard B \leftrightarrow BH : Low EMF |
| | | | | | | | 0805 : LH : Standard BH : Low EMF |
| | | | | | | | All size : AEC-Q200 LHM : Standard BHM : Low EMF |

Example :

FMF25FPJR005-BH \leftrightarrow FMF25FPJR005-B

→Metal strip, 2512 size, $\pm 1\%$, plastic tape, 2W, $5\text{m}\Omega$, low emf

FMF25FPJR010-BHM

→Metal strip, 2512 size, $\pm 1\%$, plastic tape, 2W, $10\text{m}\Omega$, low emf, AEC-Q200

FMF05FTFR010-LHM

→Metal strip, 0805 size, $\pm 1\%$, paper tape, 1/2W, $10\text{m}\Omega$, standard, AEC-Q200

7. Marking

FMF 1206/2512/5931

TOP : Marking. (4 Digits marking to identify the resistance value.)



R005=5mΩ , R020=20mΩ

FMF 0805

TOP : No marking product.

Bottom : Index sign.



8. Reliability Performance (AEC-Q200)

* Normal test items for standard product.

| Test Item | Specification | Test Method (AEC-Q200. IEC 60115) |
|--|---|--|
| *DC Resistance | F : ±1%、G : ±2%、J : ±5% | AEC-Q200 TABLE 7.1 IEC 60115-1 / JIS C 5201-1 , Clause 4.5 Measure the resistance Value. |
| High Temperature Exposure (Storage) | J、G : $\Delta R \leq \pm(3\%+0.5m\Omega)$ F : $\Delta R \leq \pm(1\%+0.5m\Omega)$ | AEC-Q200 TABLE 7.3 1000 hrs. @ T=125°C. Unpowered. Measurement at 24 ±2 hours after test conclusion. |
| *Temperature Cycling | J、G : $\Delta R \leq \pm(1\%+1m\Omega)$ F : $\Delta R \leq \pm(0.5\%+1m\Omega)$ No mechanical damage. | AEC-Q200 TABLE 7.4 1000 Cycles (-55°C to +125°C). Measurement at 24±2 hours after test conclusion. |
| Moisture Resistance | J、G : $\Delta R \leq \pm(1\%+0.5m\Omega)$ F : $\Delta R \leq \pm(0.5\%+0.5m\Omega)$ | AEC-Q200 TABLE 7.6 Test 65°C/80~100%RH/10Cycles. Measurement at 24±2 hours after test conclusion. (t=24hrs/cycle). |

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| | | |
|-----------------------------------|---|---|
| Biased Humidity | J、G : $\Delta R \leq \pm(3\%+0.5m\Omega)$ F : $\Delta R \leq \pm(1\%+0.5m\Omega)$ | AEC-Q200 TABLE 7.7 1000 hours 85°C/85%RH. 10% of operating power. Measurement at 24 ±2 hours after test conclusion. |
| Operational Life | J、G : $\Delta R \leq \pm(3\%+0.5m\Omega)$ F : $\Delta R \leq \pm(1\%+0.5m\Omega)$ | AEC-Q200 TABLE 7.8 Test 1000hr @ TA=125°C at specified rated power. Measurement at 24±2 hours after test conclusion. |
| External Visual | No visual damage and refer PDC marking code. | AEC-Q200 TABLE 7.9 Inspect device construction, marking and workmanship. |
| Physical Dimension | Within the spec. | AEC-Q200 TABLE 7.10 Verify physical dimensions to the applicable device detail specification. |
| Mechanical Shock | Within product specification tolerance and no visible damage. | AEC-Q200 TABLE 7.13 Test Peak value:100g's,Wave:Hail-sine, Duration:6ms,Velocity:12.3ft/sec. |
| Vibration | No mechanical damage. | AEC-Q200 TABLE 7.14 5 g's for 20 min., 12 cycles each of 3 orientations. Test from 10-2000 Hz. |
| *Resistance to Solder Heat | J、G : $\Delta R \leq \pm(1\%+0.5m\Omega)$ F : $\Delta R \leq \pm(0.5\%+0.5m\Omega)$ No mechanical damage. | AEC-Q200 TABLE 7.15 Solder dipping @ 270°C±5°C for 10sec.±1sec. |
| Thermal Shock | J、G : $\Delta R \leq \pm(1\%+0.5m\Omega)$ F : $\Delta R \leq \pm(0.5\%+0.5m\Omega)$ No mechanical damage. | AEC-Q200 TABLE 7.16 -55 to 155°C/ dwell time 15min/ Max transfer time 20sec/ 300cycles. |
| ESD | $\Delta R \leq \pm(1\%+0.5m\Omega)$ No mechanical damage. | AEC-Q200-002 Test contact min. 1KV. |
| *Solder Ability | Over 95% of termination must be covered with solder. | AEC-Q200 TABLE 7.18 a)Baking 155°C 4H, dipping 235°C 5s b)Steam 1H, dipping 215°C 5s c)Steam 1H, dipping 260°C 7s |

FMF series Metal Strip Type Lead Free Current Sensing Resistors

| | | |
|---|---|--|
| Flammability | Refer UL-94. | AEC-Q200 TABLE 7.20 UL-94 V-0 or V-1 are acceptable |
| *Board Flex | J、G : $\Delta R \leq \pm(1\% + 1m\Omega)$ F : $\Delta R \leq \pm(0.5\% + 1m\Omega)$ No mechanical damage. | AEC-Q200 TABLE 7.21 Bending 2mm 5931.2512.2010.1210.1206 3mm 0805 |
| Terminal Strength | No mechanical damage | AEC-Q200 TABLE 7.22 Force 1 Kg for 60 seconds. |
| *Short Time Overload | J、G : $\Delta R \leq \pm(2\% + 0.5m\Omega)$ F : $\Delta R \leq \pm(1\% + 0.5m\Omega)$ | IEC 60115-1, Clause 4.13 5 × Rated power for 5 seconds |
| *Load Life Humidity | J、G : $\Delta R \leq \pm(3\% + 0.5m\Omega)$ F : $\Delta R \leq \pm(1\% + 0.5m\Omega)$ | IEC 60115-1, Clause 4.24 40±2°C with relative humidity 90% ~ 95% D.C. rated voltage for 1.5 hours ON 30 minutes OFF. Cycle repeated 1000 hours. |
| *Temperature Coefficient of Resistance (TCR) | Within the spec. | IEC 60115-1, Clause 4.8 $TCR(ppm/^{\circ}C) = \frac{(R_2 - R_1) / R_1 \times 10^6}{(T_2 - T_1)}$ Test temperature : 25°C ~ -55°C 25°C ~ +155°C |
| *Load Life | J、G : $\Delta R \leq \pm(3\% + 0.5m\Omega)$ F : $\Delta R \leq \pm(1\% + 0.5m\Omega)$ | IEC 60115-1, Clause 4.25 Rated voltage for 1.5 hours for followed by a pause 0.5 hour at 70±2°C. Cycle repeated 1000 hours. |
| *Insulation Resistance | Between termination and coating must over 1000MΩ | IEC 60115-1, Clause 4.6 Test voltage : 100±15V |

9. PACKAGING

9.1 Peel Strength of Top Cover Tape

The peel speed shall be about 300 mm/min

The peel force of top cover tape shall be between 0.1 to 0.7N



9.2 Tape Packaging Dimensions



• Accumulated dimensional tolerance $40\pm 0.2\text{mm}$

| Size | A | B | W | F | E | P1 | P2 | P0 | D |
|------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 0805 | 1.65 ± 0.20 | 2.40 ± 0.20 | 8.00 ± 0.30 | 3.50 ± 0.05 | 1.75 ± 0.10 | 4.00 ± 0.10 | 2.00 ± 0.05 | 4.00 ± 0.10 | 1.50 ± 0.10 |
| 1206 | 2.00 ± 0.20 | 3.60 ± 0.20 | 8.00 ± 0.30 | 3.50 ± 0.05 | 1.75 ± 0.10 | 4.00 ± 0.10 | 2.00 ± 0.05 | 4.00 ± 0.10 | 1.50 ± 0.10 |
| 2512 | 3.50 ± 0.20 | 6.75 ± 0.20 | 12.0 ± 0.30 | 5.50 ± 0.05 | 1.75 ± 0.10 | 4.00 ± 0.10 | 2.00 ± 0.05 | 4.00 ± 0.10 | 1.50 ± 0.10 |
| 5931 | 8.20 ± 0.10 | 15.4 ± 0.10 | 24.0 ± 0.30 | 11.5 ± 0.10 | 1.75 ± 0.10 | 12 ± 0.10 | 2.00 ± 0.10 | 4.00 ± 0.10 | 1.50 ± 0.10 |

unit : mm

9.3 Reel Dimensions



| Size | Packaging Q'ty | A | N | C | D | B | G | T |
|------|----------------|-----------|-----------|----------|----------|---------|----------|----------|
| 0805 | 5kpcs/Reel | 178.0±2.0 | 60.0±0.5 | 13.0±0.5 | 20(Min.) | 2.0±0.5 | 10.0±1.5 | 14.9max. |
| | 10kpcs/Reel | 254.0±2.0 | 100.0±1.0 | 13.5±0.5 | 20(Min.) | 2.0±0.5 | 10.0±1.5 | 14.9max. |
| | 20kpcs/Reel | 330.0±2.0 | 100.0±1.0 | 13.5±0.5 | 20(Min.) | 2.0±0.5 | 10.0±1.5 | 14.9max. |
| 1206 | 4kpcs/Reel | 178.0±2.0 | 60.0±0.5 | 13.0±0.5 | 20(Min.) | 2.0±0.5 | 10.0±1.5 | 14.9max. |
| 2512 | 4kpcs/Reel | 178.0±2.0 | 60.0±0.5 | 13.0±0.5 | 20(Min.) | 2.0±0.5 | 13.8±1.5 | 16.7max. |
| | 8kpcs/Reel | 254.0±2.0 | 100.0±0.5 | 13.5±0.5 | 20(Min.) | 2.0±0.5 | 13.8±1.5 | 20.0max. |
| | 16kpcs/Reel | 330.0±2.0 | 100.0±1.0 | 13.5±0.5 | 20(Min.) | 2.0±0.5 | 13.8±1.5 | 20.0max. |
| 5931 | 3kpcs/Reel | 330.0±2.0 | 99.5±1.0 | 13.0±0.5 | 20(Min.) | 2.0±0.5 | 24.0±1.0 | 28.6max. |

10. Storage & Handling

... Products are recommended to be used up within one year as ensured shelf life.

Check solder ability in case shelf life extension is needed.

... To store products with following condition:

Temperature: 5 to 40°C ; Humidity: 20 to 70% relative humidity.

Precaution for use :

The AEC-Q200 series resistors is mainly used on general automotive equipment without safety considerations.

Please contact our company in advanced if you intend to use resistor for designing the equipment which may

damage itself and the safety of third party. If necessary, please consider to add the protect circuit in devising

process and obtaining fully safety evaluation. The contents of the acknowledgment is only used for our parent

company, marketing subsidiaries and official marketing agents who purchase our products. Not applicable for the

other nonofficial channels.

※ All product specification and data are subject to change without notice.

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