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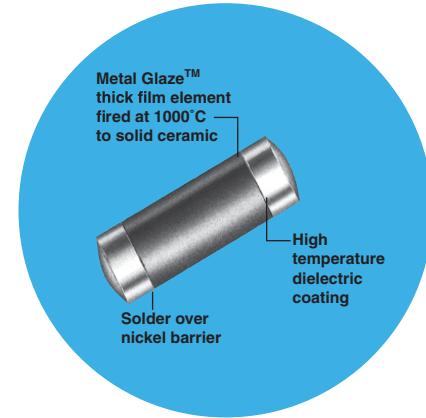
## Resistors



# High Surge Film Surface Mount Metal Glaze™

### HSF Series

- 150°C maximum operating temperature
- RoHS - compatible components available
- Up to triple the surge rating of the rugged CHP1
- Replaces costly surface-mount wirewound resistors



All Pb-free parts comply with EU Directive 2011/65/EU (RoHS2)

### Electrical Data

Industry Footprint	Type	Maximum Power Rating	Working Voltage	Resistance Range (Ω)	Tolerance (±%)	TCR (ppm/°C)	Product Category
2512	HSF-1	1W @ 70°C	350	5R9, 6R8, 11R, 27R, 12R, 68R, 270R	10	±200 <sup>1</sup>	High Surge
3612	HSF-2	2W @ 25°C	500	8R2, 22R, 300R	10	±200 <sup>1</sup>	High Surge

Note 1 – Standard TCR is ±200ppm/°C. TCR of ±100ppm/°C is available at selected values on request.

### Environmental Data

Characteristics	Maximum Change	Test Method
Temperature Coefficient	As specified	MIL-R-55342H Par 4.7.9 (-55°C +125°C)
Thermal Shock	±0.5% +0.01 ohm	MIL-R-55342H Par 4.7.3 (-65°C +150°C, 5 cycles)
Low Temperature Operation	±0.25% +0.01 ohm	MIL-R-55342H Par 4.7.4 (-65°C @ working voltage)
Short Time Overload	±0.5% +0.01 ohm	MIL-R-55342H Par 4.7.5 2.5 x $\sqrt{P \times R}$ for 5 seconds
High Temperature Exposure	±0.5% +0.01 ohm	MIL-R-55342H Par 4.7.6 (+150°C for 100 hours)
Resistance to Bonding Exposure	±0.25% +0.01 ohm	MIL-R-55342H Par 4.7.7 (reflow soldered to board at 260°C for 10 seconds)
Solderability	95% min. coverage	MIL-STD-202, Method 208 (245°C for 5 seconds)
Moisture Resistance	±0.5% +0.01 ohm	MIL-R-55342H Par 4.7.8 (10 cycles, total 240 hours)
Life Test	±0.5% +0.01 ohm	MIL-R-55342H Par 4.7.10 (2000 hours at 70°C intermittent)
Terminal Adhesion Strength	±1% +0.01 ohm no mechanical damage	1200 gram push from underside of mounted chip for 60 seconds
Resistance to Board bending	±1% +0.01 ohm no mechanical damage	Chip mounted in center of 90mm long board, deflected 5mm so as to exert pull on chip contacts for 10 seconds

#### General Note

TT Electronics reserves the right to make changes in product specification without notice or liability.

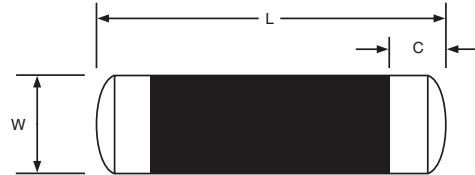
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## High Surge Film Surface Mount Metal Glaze™



### HSF Series

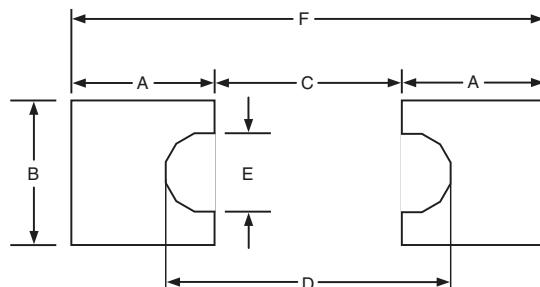
## Physical Data



**Dimensions (Inches and (mm))**

Industry Footprint	Type	L (Length)	W (Width/Diameter)	C (Termination Width)
2512	HSF-1	0.251 ± 0.010 (6.38 ± 0.25)	0.079 ± 0.006 (2.01 ± 0.15)	0.040 ± 0.010 (1.02 ± 0.25)
3612	HSF-2	0.367 ± 0.010 (9.32 ± 0.25)	0.105 ± 0.006 (2.67 ± 0.15)	0.050 ± 0.010 (1.27 ± 0.25)

## Recommended Solder Pad Dimensions (Reflow):



Industry Footprint	Dimensions (Inches and mm))					
	A	B	C	D	E	F
HSF 1 2512	0.121 (3.07)	0.126 (3.20)	0.127 (3.23)	0.183 (4.65)	0.040 (1.02)	0.369 (9.37)
HSF 2 3610	0.17 (4.32)	0.16 (4.06)	0.213 (5.41)	0.273 (6.93)	0.044 (1.12)	0.553 (14.05)

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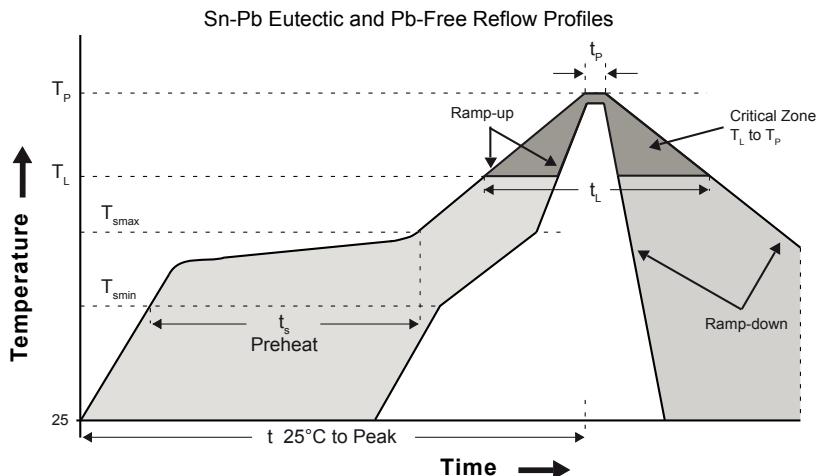
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**High Surge Film**  
**Surface Mount Metal Glaze™**



**HSF Series**

## IRC Solder Reflow Recommendations



\* Based on Industry Standards and IPC recommendations

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average Ramp-up rate ( $T_{smax}$ to $T_p$ )	3°C / second max.	3°C / second max.
Preheat		
- Temperature Min ( $T_{smin}$ )	100°C	150°C
- Temperature Max ( $T_{smax}$ )	150°C	200°C
- Time ( $T_{smin}$ to $T_{smax}$ ) ( $t_s$ )	60 - 120 seconds	60 - 180 seconds
Time maintained above		
- Temperature ( $T_L$ )	183°C	217°C
- Time ( $t_L$ )	60 - 150 seconds	60 - 150 seconds
Peak Temperature ( $T_p$ )	See Table 1	See Table 2
Time within 5°C of actual Peak Temperature ( $t_p$ ) <sup>2</sup>	10 - 30 seconds	20 - 40 seconds
Ramp-down Rate	6°C / second max.	6°C / second max.
Time 25°C to Peak Temperature	6 minutes max.	8 minutes max.

**Tabel 1: SnPb Eutectic Process - Package Peak Reflow Temperatures**

Package Thickness	Volume mm <sup>3</sup> < 350	Volume mm <sup>3</sup> ≥ 350
< 2.5 mm	240 +0/-5°C	225 +0/-5°C
≥ 2.5 mm	225 +0/-5°C	225 +0/-5°C

**Note 1:** All temperatures refer to topside of the package, measured on the package body surface.

**Note 2:** Time within 5 °C of actual peak temperature ( $t_p$ ) specified for the reflow profiles is a "supplier" minimum and a "user" maximum.

**Tabel 2: Pb-free Process - Package Peak Reflow Temperatures**

Package Thickness	Volume mm <sup>3</sup> < 350	Volume mm <sup>3</sup> 350 - 2000	Volume mm <sup>3</sup> > 2000
< 1.6 mm	260°C *	260°C *	260°C *
1.6 mm - 2.5 mm	260°C *	250°C *	245°C *
≥ 2.5 mm	250°C *	245°C *	245°C *

**Note 1:** Package volume excludes external terminals (balls, bumps, lands, leads) and/or non-integral heat sinks.

**Note 2:** The maximum component temperature reached during reflow depends on package thickness and volume. The use of convection reflow processes reduces the thermal gradients between packages. However, thermal gradients due to differences in thermal mass of SMD packages may still exist.

**Note 3:** Components intended for use in "lead-free" assembly process shall be evaluated using the "lead-free" peak temperature and profiles defined in Table 1, 2 and reflow profile whether or not lead-free.

\* Tolerance: The device manufacturer/supplier shall assure process compatibility up to and including the stated classification temperature at the rated MSL level.

**General Note**

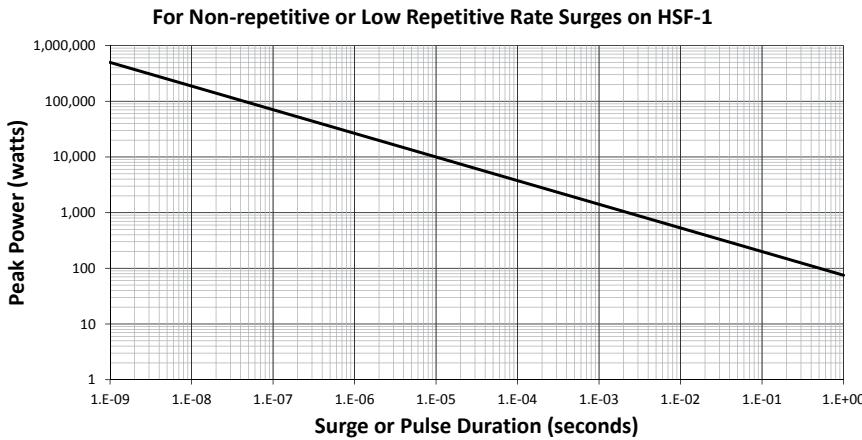
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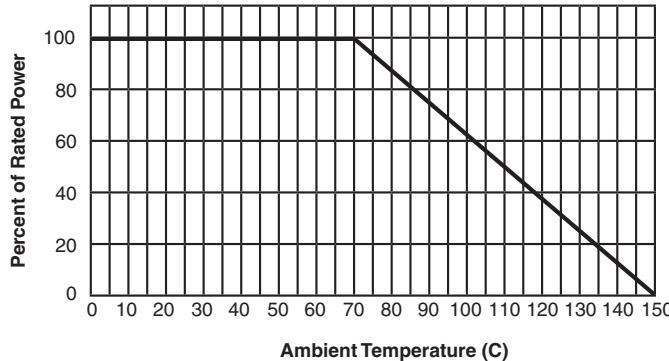
**HSF Series**



## Surge Capability Data



## Power Derating Curve



## Ordering Data

Sample Part No.....	HSF-1	200	11R0	K	LF	13
Type .....	HSF-1 or HSF-2					
Temperature Coefficient .....	200 = $\pm 200\text{ppm}/^\circ\text{C}$ (standard)					
	Note - Standard TCR is $\pm 200\text{ppm}/^\circ\text{C}$ . TCR of $\pm 100\text{ppm}/^\circ\text{C}$ is available at selected values on request.					
Resistance Value .....	Standard 4-digit resistance code.					
Tolerance .....	K = 10%					
Lead-Free Construction .....						
Packaging Code .....	BLK = Bulk, 7 = 7" Reel, 13 = 13" Reel					

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