

Replacement of National LM86 with Philips SA56004

The SA56004 can replace the LM86 without modifying the software or hardware and will behave exactly the same.

1. Comparison

Parameters	SA56004	LM86
✓ Package and Pin-to-pin Drop in Replacement	YES	YES
✓ Functionally Identical (ALERT/T_CRIT/Configuration/etc)	YES	YES
✓ Non-ideality factor = 1.008	YES	YES
✓ No Software Change	YES	YES
✓ Accuracy $\pm 1^{\circ}\text{C}$ for remote sensor from 60°C to 100°C @ V_{DD} 3.0 V to 3.6 V	YES	YES
✓ Accuracy $\pm 3^{\circ}\text{C}$ for local sensor from 0°C to 125°C @ V_{DD} 3.0 V to 3.6 V	YES	YES
✓ 11-bit or 0.125°C resolution for remote sensor	YES	YES
✓ Compatible AC/DC Parameters	YES	YES
✓ Same default T_CRIT, high and low temp trip point	YES	YES

2. Noticeable Differences

The important difference between these two devices is that LM86's BFh register is 3-bit. One of these three bits are the same as the SA56004 but two of these three bits are used as "filter level" in the LM86 but are defined as reserved bits in the SA56004 and the device ignores them. The LM86 also specified $\pm 0.75^{\circ}\text{C}$ remote temperature sensor accuracy at 30°C ambient temperature that the SA56004 only specify $\pm 1^{\circ}\text{C}$ accuracy. The SA56004 is 40% lower power than the LM86, and three times lower power than LM86 in shutdown mode. All of the differences do not require rewriting software for the SA56004.

Parameters	SA56004	LM86	Comments
✓ Register, BFh	1-bit bit<0> = 0 → interrupt; bit<0> = 1 → comparator	3-bit bit<0> = same as SA56004) bit<2:1>= filter level	SA56004 ignores bit<2:1> (no software change)
✓ Manufacturer ID, FEh	A1h	17h	Manufacturer specific
✓ Revision register, FFh	0h	1h	Manufacturer specific
✓ Local temperature Resolution	11-bit ¹	8-bit	SA56004 is Better



✓ I _{DD} Active (conversion at 16 Hz)	500 µA (typical)	800 µA (typical)	SA56004 is Better
✓ I _{DD} Shutdown (no conversion)	10 µA (typical)	350 µA (typical)	SA56004 is Better
✓ Remote temp accuracy ± 0.75 °C	NO	T _{amb} =30 °C; T _d =85 °C	LM86 is Better
✓ Local temp accuracy ± 2 °C	60 °C to 100 °C	NO	SA56004 is Better
✓ I ² C/SMBus speed	0 to 400 kHz	10 kHz to 100 kHz	SA56004 is Better

3. Orderable Part Number Cross Reference

Package	Slave Address	LM86	SA56004
SO8/SOIC8	4Ch	LM86CIM	SA56004ED ²
TSSOP8/MSOP8	4Ch	LM86CIMM	SA56004EDP ²

Note:

1. Still compatible with the existing 8-bit software used by the LM86 because the extra temperature resolution for the SA56004 bits stored in its separate register (22h). If the user wants higher resolution when switching to the SA56004, then they simply modify the software to read the lower byte limit (22h). The 11-bit mode gives the temperature resolution of 0.125 °C as compared with the 8-bit mode of 1 °C.
2. SA56004 also comes with seven more slave addresses from the one listed.

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