

Calculation of SμMMIT XTE (5V) Current Utilization

The following describes the typical supply current consumed by the SμMMIT XTE protocol device (UT69151XTE5) during 1553 message processing. Within the XTE multi-chip module containing the JA01 protocol die is a 32K x 16 SRAM and two 5 Volt transceivers which draw current. Considering the SμMMIT's power saving architecture, it is appropriate to calculate supply current with respect to some reference of message rate or duty cycle. Therefore, characterization data and device specifications exist for 0%, 25%, 50%, 87.5%, and 100% duty cycles. These percentages comprehend actual intermessage gap and RT response times defined by the 1553 bus protocol (i.e. 12μs and 4μs, respectively). In rare cases where a maximum number of data words are transferred, the transceivers and protocol circuitry operate at just above 90% duty cycle, well below their maximum ratings. **Note:** Characterization and specification data do not usually include 100% duty cycle by definition of 1553.

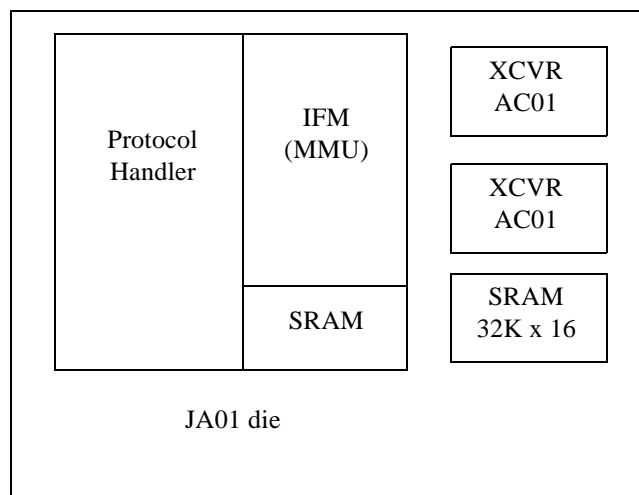


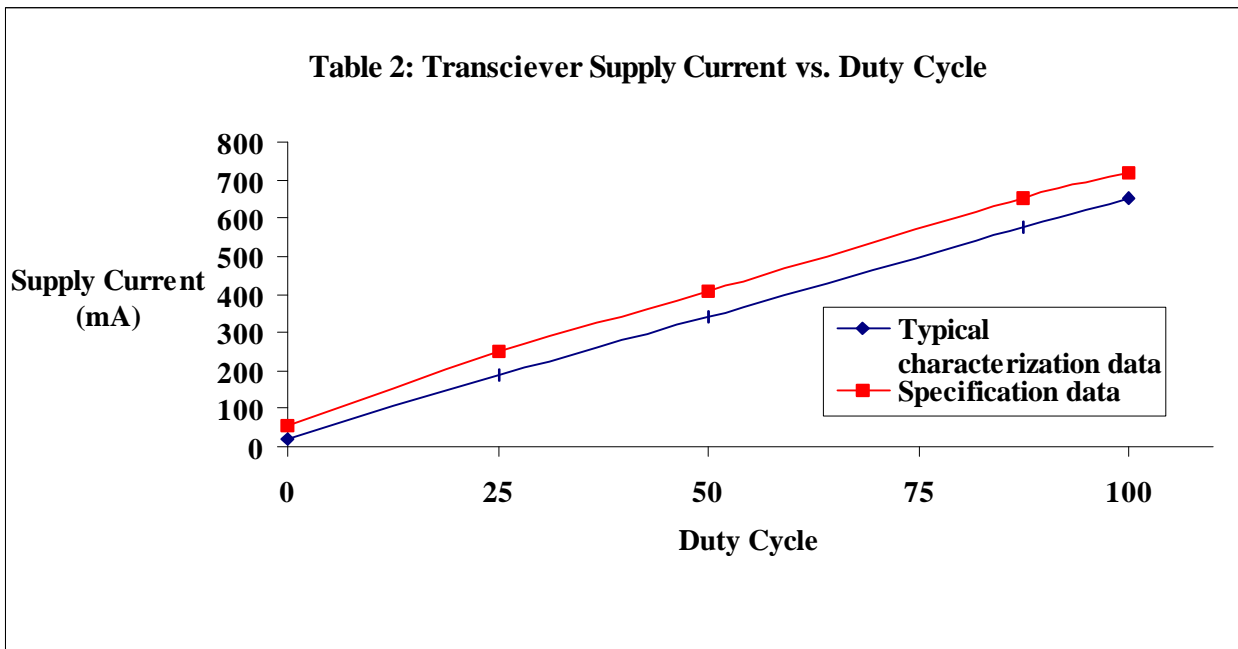
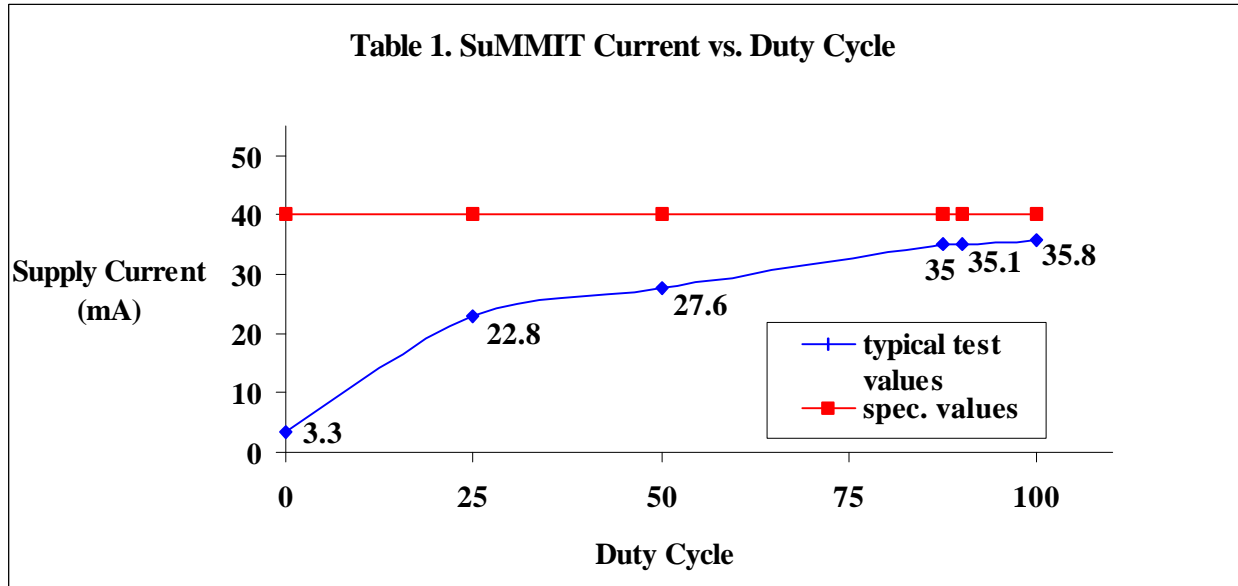
Figure 1. SμMMIT XTE Multi-Chip Module

With regard to the current consumption during 1553 message processing, the JA01 circuitry facilitates 1553 operations, as well as interfacing to internal and external memory through the memory management unit (MMU). In addition, one transceiver operates at various capacities while the redundant transceiver draws idle current. This situation is comprehended by data specified in the SμMMIT handbook for the stand-alone device and transceivers. Table 1 relates typical test data collected, at worst case temperature and voltage, for the stand-alone SμMMIT part in comparison to 40mA standby current specified within the SμMMIT handbook (Chapter 16).

Characterization data (see Table 2) is shown relative to specifications for two 5V AC01 (UT63M147) transceivers. Further, specific to the XTE offering is the current drawn by the additional 32K x 16 onboard SRAM. Test data for the JA01 shows that additional memory draws anywhere from 3mA to 6mA of current during 1553 message processing. To simplify power calculations it was determined to add 6mA to the current consumption of JA01 and transceivers for final power analysis. Using this methodology simplifies power and supply current calculations required by the designer.

UTMC Application Note

Using information provided by the tables and test data observed for the 32K x 16 SRAM, it is possible to generate total current and subsequent power consumption by the SμMMIT XTE during 1553 processing.



At 0% duty cycle the observed current consumption for the stand-alone SμMMIT and two transceivers is 3.3mA and 39.4mA, respectively. Adding the current drawn by the memory die provides the total generic current equation below:

$$I_{XTE} = I_{JA01} + I_{AC01} + I_{MEM}$$

UTMC Application Note

Using values for each duty cycle plus the 6mA for the additional memory die provide the following results:

$$0\% \quad I_{XTE} = 3.3\text{mA} + 39.4\text{mA} + 6\text{mA} = 48.7\text{mA}$$

$$25\% \quad I_{XTE} = 22.8\text{mA} + 188.3\text{mA} + 6\text{mA} = 217.1\text{mA}$$

$$50\% \quad I_{XTE} = 27.6\text{mA} + 339.7\text{mA} + 6\text{mA} = 373.3\text{mA}$$

$$87.5\% \quad I_{XTE} = 35.0\text{mA} + 576.2\text{mA} + 6\text{mA} = 617.2\text{mA}$$

$$100\% \quad I_{XTE} = 35.8\text{mA} + 653.4\text{mA} + 6\text{mA} = 695.2\text{mA}$$

Multiplying these total currents by the nominal voltage supply value of 5 Volts provides the following power consumption equations per respective duty cycle:

$$0\% \quad P_{XTE} = 5\text{V}(48.7\text{mA}) = 0.244 \text{ Watts}$$

$$25\% \quad P_{XTE} = 5\text{V}(217.1\text{mA}) = 1.09 \text{ Watts}$$

$$50\% \quad P_{XTE} = 5\text{V}(373.3\text{mA}) = 1.87 \text{ Watts}$$

$$87.5\% \quad P_{XTE} = 5\text{V}(617.2\text{mA}) = 3.09 \text{ Watts}$$

$$100\% \quad P_{XTE} = 5\text{V}(695.2\text{mA}) = 3.47 \text{ Watts}$$

From the above it can be seen that under the most intensive 1553 message processing the SμMMIT XTE5 (5 Volt transceiver) consumes just over 3 Watts of power (87.5%). For the sake of comparison it might be worth noting and calculating absolute worst case power consumption by considering the very guard-banded specification values at 100%. Using data from the tables above provides the following:

$$100\%_{\text{rated}} \quad I_{XTE} = 40.0\text{mA} + 720\text{mA} + 6\text{mA} = 766\text{mA}$$

Then calculate power using maximum voltage rating:

$$100\%_{\text{rated}} \quad P_{XTE} = 5.5\text{V}(766\text{mA}) = 4.2 \text{ Watts}$$