Calculation of SμMMIT™ DXE (5V) Current Utilization

The following describes the typical supply current consumed by the SμMMIT DXE protocol device (UT69151DXE5) during 1553 message processing. Within the DXE multi-chip module containing the JA01 protocol die are also two 5 Volt transceivers drawing current (figure 1). 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 not that the devices cannot operate at this maximum.

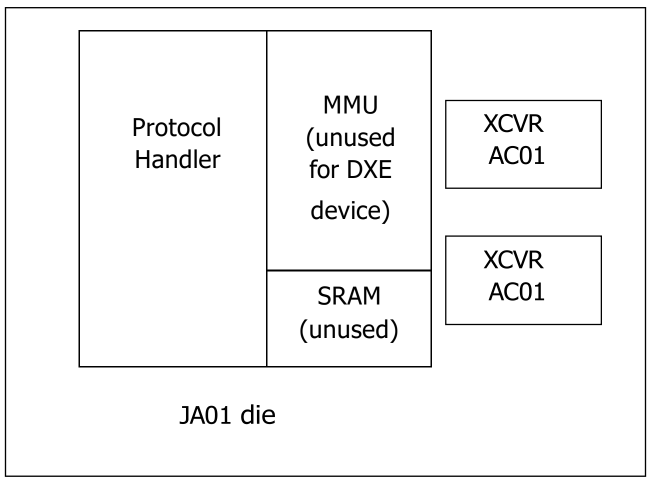

Figure 1. SμMMIT DXE Multi-Chip Module

With regard to the current consumption during 1553 message processing, the JA01 circuitry facilitates 1553 operations. 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 5-volt 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. Again, the data collected is comprehends one transceiver channel drawing idle current while the other operates at the various duty cycles.

The current utilization and power dissipation calculation methodology consists of adding the separate characterization values for the separate devices to arrive at the total for the DXE multi-chip module. Using this methodology simplifies power and supply current calculations required by the designer.

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Using information provided by the tables, it is possible to generate total current and subsequent power consumption by the SµMMIT DXE during 1553 processing.

Table 1. SµMMIT Current vs. Duty Cycle

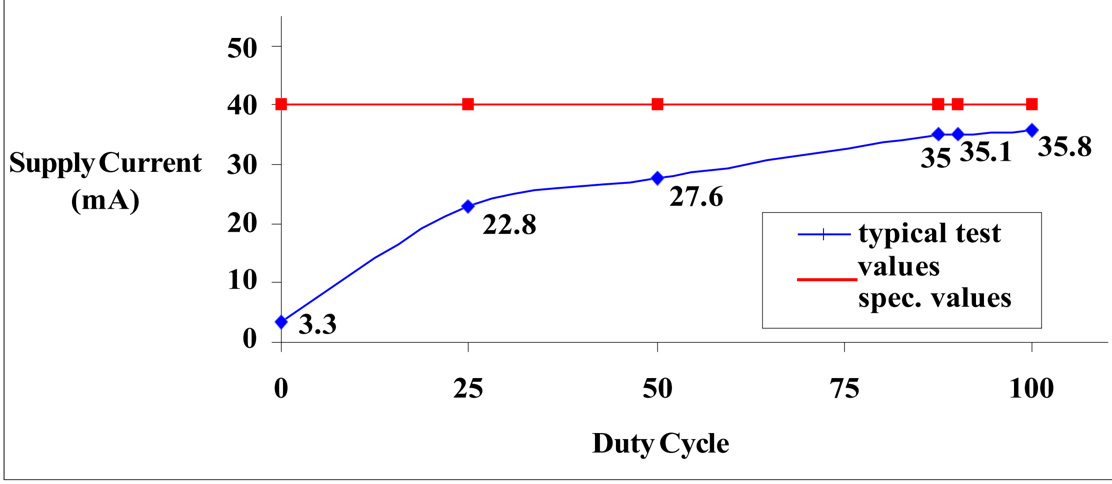
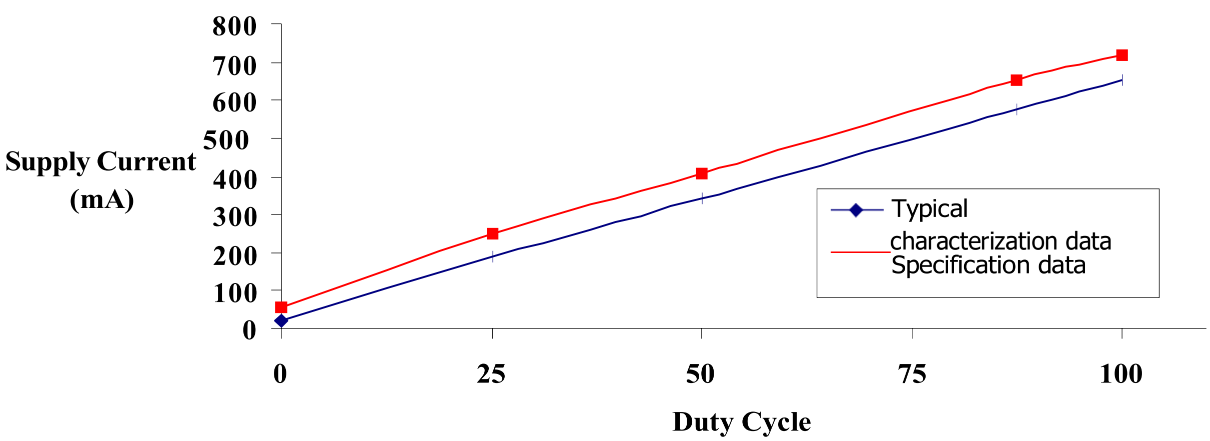


Table 2: Transceiver Supply Current vs. Duty Cycle



At 0% duty cycle the observed current consumption for the stand-alone S☐MMIT and two transceivers is 3.3mA and 39.4mA, respectively. Adding the currents drawn by the separate devices provides the total generic current equation below:

$$I_{DXE} = I_{JA01} + I_{AC01}$$

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Using values for each duty cycle provide the following results:

$$0\%\ I_{DXE} = 3.3mA + 39.4mA = 42.7mA$$

$$25\%\ I_{DXE} = 22.8mA + 188.3mA = 211.1mA$$

$$50\%\ I_{DXE} = 27.6mA + 339.7mA = 367.3mA$$

$$87.5\%\ I_{DXE} = 35.0mA + 576.2mA = 611.2mA$$

$$100\%\ I_{DXE} = 35.8mA + 653.4mA = 689.2mA$$

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

$$0\%\ P_{DXE} = 5V(42.7mA) = 0.213\ Watts$$

$$25\%\ P_{DXE} = 5V(211.1mA) = 1.05\ Watts$$

$$50\%\ P_{DXE} = 5V(367.3mA) = 1.84\ Watts$$

$$87.5\%\ P_{DXE} = 5V(611.2mA) = 3.06\ Watts$$

$$100\%\ P_{DXE} = 5V(689.2mA) = 3.45\ Watts$$

From the above it can be seen that under the most intensive 1553 message processing the SμMMIT DXE5 (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:

$$100\%_{rated}\ I_{DXE} = 40.0mA + 720mA = 760mA$$

Then calculate power using maximum voltage rating:

$$100\%_{rated}\ P_{DXE} = 5.5V(760mA) = 4.18\ Watts$$

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