SGS-THOMSON MICROELECTRONICS

MK5025
SINGLE CHANNEL LAPD

INTRODUCTION

The SGS-Thomson X.25 Link Level Controller (MK5025) is a VLSI device which provides a complete link level data communication control conforming to the 1984 CCITT version of X.25. The MK5025 also supports X.32 (XID frames) and X.75 as well as single channel LAPD (Link Access Procedure on the D-channel) for ISDN with its extended addressing capabilities and UI (Unnumbered Information) frames for TEI assignment.

One of the outstanding features of the MK5025 is its buffer managment which includes on-chip DMA. This feature allows users to handle multiple frames of receive and transmit data at a time. In order to utilize these buffer managment and DMA features with protocols not directly supported by the MK5025, a transparent mode is also available for customized protocols using HDLC framing.

PURPOSE

LAPD is a protocol operating at the data link layer, whose purpose is to convey information between layer 3 entities across the ISDN user-network interface using the D-channel. For further information on LAPD please consult CCITT Recommendations Q.920 and Q.921. The purpose of this application brief is to provide a detailed description for using the MK5025 in single channel LAPD applications. Please refer to the MK5025 Technical Manual for more detailed information concerning the overall operation of the MK5025.

USE OF MK5025 FOR LAPD VS LAPB

Since X.25 LAPB and LAPD are very similar, the operation of the MK5025 is very similar for both protocols. Differences include implementation of the T203 timer and support of UI frames for TEI assignment. However, the main difference between the two standards is in level 2 addressing of the frames.

The frame structure supported by the MK5025 conforms to HDLC rules and is as follows:

F	A	C	I	FCS	F

where:
	F	= Flag
	A	= Address field (A-field)
	C	= Control field (C-field)
	I	= Information field
	FCS	= Frame Check Sequence

For LAPD the Address field contains the SAPI and TEI in the following format.

0	C/R	SAPI	1	TEI

where:
	C/R	= Command/Response bit
	SAPI	= Service Access Point Identifier
	TEI	= Terminal Endpoint Identifier

The values for SAPI and TEI should be the same for both the Local and Remote Address fields, located in the MK5025 Initialization Block. The only difference between these fields will be in the setting of the C/R bit. According to CCITT Q.921, the setting of the C/R bit should be as follows:

	C/R Value	
	Network Side	User Side
Commands from	1	0
Responses to	1	0
Commands to	0	1
Responses from	0	1

The MK5025 sends commands with the Remote address in the A-field of the frame, and it sends responses with the Local address in the A-field of the frame. The setting of the Local and Remote address fields is dependent upon whether the MK5025 is used in the NT (Network side) or the TE (Terminal Equipment - user side), as shown in Figure 1.

CONTROL AND STATUS REGISTER OPERATION

For LAPD all the control and status register mechanisms still function the same, but there are some bits that pertain typically to LAPD. These are bits 09, 12, and 13 of CSR2.

CSR2<09> - UIE - This bit should be set to enable the recognition of UI frames, which are used for TEI assignment in LAPD.

CSR2<12> - T203E- This bit should be set to enable the MK5025 T3 timer to behave as specified for LAPD T203 timer. The difference between T3 and T203 is that T3 determines the amount of link idle (all "1's") time necessary to consider the link disconnected, while T203 determines the maximum amount of time allowed without frames being exhanged.

CSR2<13> - FRMRD - Setting this bit to a one

will disable the sending of FRMR frames in response to the conditions described in section 3.6.1 or 3.6.11 (items b, c, and d) of CCITT Q.921 (Blue Book). The MK5025 will issue an Error Indication primitive and allow for the re-establishment of the link rather than establishing a frame rejection condition. Setting of this bit allows compliance with CCITT Q.921 (Blue Book) section 5.8.5 which basically states that upon occurence of a frame rejection condition the data link layer entity shall initiate re-establishment of the link.

DESCRIPTOR RING OPERATION

The buffer management and descriptor ring operation is the same for LAPD as for X.25 LAPB applications. It should be noted however that for the Transmit Message Descriptor, TUI (bit 11 of
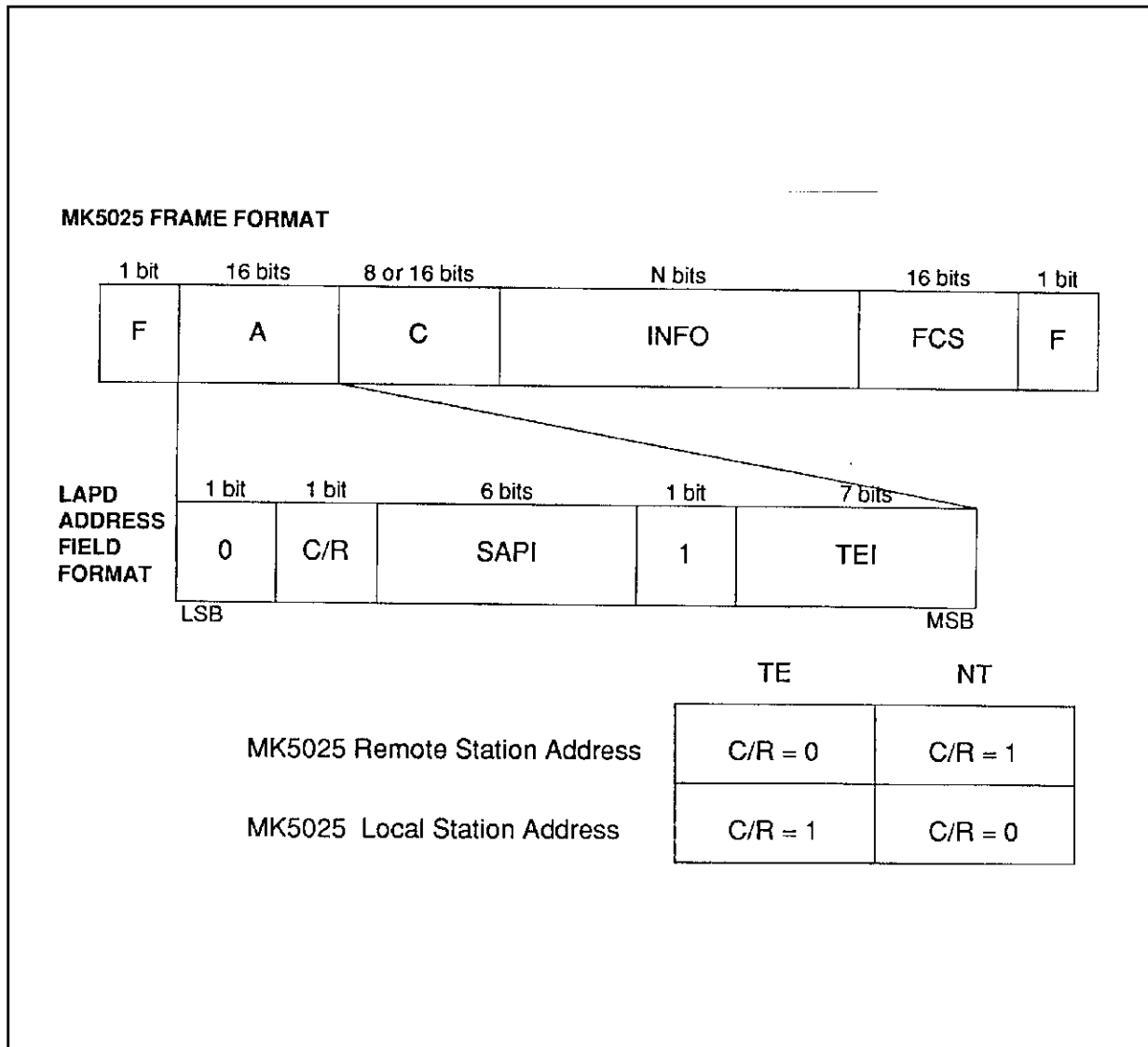
TMD0) should be set to 1 in order to transmit UI frames for TEI assignment.

In LAPD as in LAPB, the Transmit Window size (TWD) in the Transmit Descriptor Ring Pointer must be set to a value greater than 0 for any transmission to occur, if EXTC(bit 07 of Mode Register) = 0 .. In fact, if TWD=0 the MK5025 will not poll the Transmit Descriptor Ring.

CONCLUSION

The MK5025 offers great flexibility to the data communications system designer. The on-chip protocol processing may be used to save the designer much time in implementing standard protocols such as X.25, LAPB, X.32, X.75, and LAPD for ISDN, while still allowing the flexibility of implementing alternate or customized HDLC based protocols using the MK5025's transparent mode.

Figure 1: MK5025 Addressing for LAPD

MK5025 FRAME FORMAT

1 bit	16 bits	8 or 16 bits	N bits	16 bits	1 bit
F	A	C	INFO	FCS	F

LAPD ADDRESS FIELD FORMAT

1 bit	1 bit	6 bits	1 bit	7 bits
0	C/R	SAPI	1	TEI

LSB   MSB

	TE	NT
MK5025 Remote Station Address	C/R = 0	C/R = 1
MK5025 Local Station Address	C/R = 1	C/R = 0

SGS-THOMSON
MICROELECTRONICS