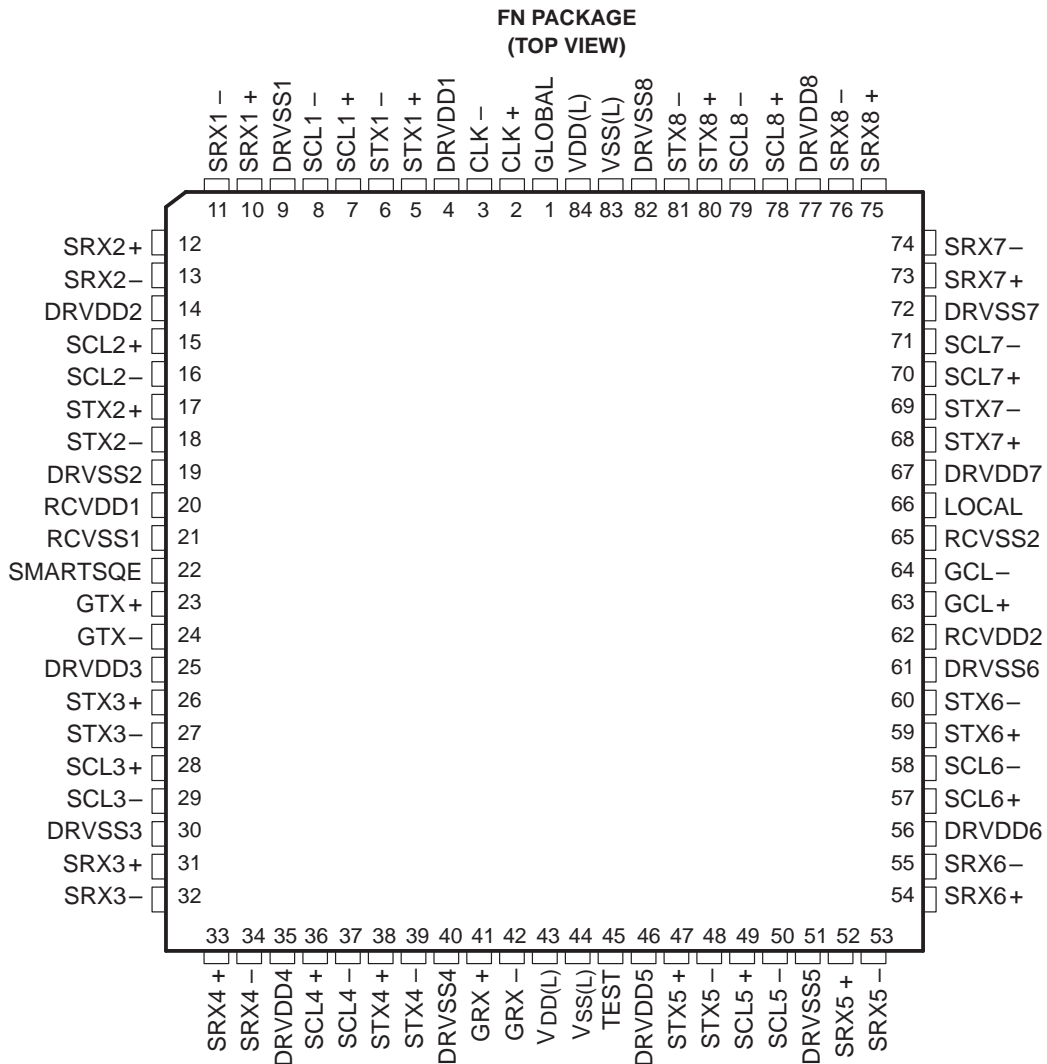


- Meets or Exceeds the Standards Set by ISO 8802.3:1990 and ANSI/IEEE 802.3-1990
- Receiver Squelch Circuit Integrity Improved With Noise Filter
- Differential (Twisted-Pair) I/O Driver and Receiver
- 84-Pin, Plastic Leaded Chip Carrier (PLCC) Package
- Control Logic Function for Local and Global Modes
- Low Port-to-Port Data Propagation Delay
- Drives Twisted-Pair Transmission Lines Up to 50 Meters
- Collision Detection for Multiple-User Networks



description

The SN75LBC088 attachment unit interface (AUI) concentrator chip (ACC) incorporates eight data terminal equipment (DTE) or station ports and one medium attachment unit (MAU) or global port on the same chip for connection to a local area network (LAN). Each station port emulates the driver/receiver functionality, timing, and signal response of a transceiver or MAU designed to meet the IEEE 802.3-1990 standard. The functional components of the ACC are a differential driver, collision detection driver, and a differential line receiver/squelch.

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description (continued)

This device also has two operational modes, local and global, and a self-exerciser test mode. The SN75LBC088 uses the LinBiCMOS™ process technology to ensure high-speed operation, analog precision, and low power consumption.

Each of the eight station ports includes two differential drivers (STX1 thru STX8 [STXx] and SCL1 thru SCL8 [SCLx]) and one differential receiver [SRX1 thru SRX8 (SRXx)]. The SRXx (station receive) input pair is for receiving data sent from the station to the network. The STXx (station transmit) output pair is for transmitting network data to the station. The SCLx (station collision) output pair transmits the collision condition to the station.

The global port supports one differential driver (GTX) and two differential receivers (GRX and GCL). The GTX output pair drives data from a station port to the network. The GRX input pair receives network data from the external transceiver and channels it to all eight station ports. The GCL input pair receives network collision status to be forwarded to the individual station ports.

Each station port differential output pair of the SN75LBC088 drives a 78-Ω, balanced, terminated, twisted-pair transmission line up to 50 meters. In the off or idle state, the drivers maintain minimal differential output voltage on the twisted-pair lines and remain within the required output common-mode range. When the driver is internally enabled, the driver goes through what is called a soft start or half-step driver start up due to the first transition out of idle swings only half the normal differential amplitude. The differential outputs then rise to full amplitude output levels within 35 ns. The output amplitude is maintained for the remainder of the packet. After the last transmitted packet positive edge, the driver's enable circuit maintains the differential potential above the output common-mode voltage for at least 210 ns, decay down to a minimum differential voltage, and then return to an idle state. Each driver powers up in the idle state to ensure no activity is placed on the twisted-pair cable that could be interpreted as network traffic.

The line receiver squelch function interfaces to a differential twisted-pair line terminated external to the device. The receiver squelch circuit allows differential receive signals to pass through while the input amplitude and pulse duration are greater than the minimum squelch threshold. This ensures a good signal-to-noise ratio while the data path is active and prevents system noise from causing false data transitions during line shut-down and line-idle conditions.

The SN75LBC088 functional control logic operates in two externally switched modes, local and global. Depending on the selected mode, the internal control logic selects the proper internal data path routing and collision handling. The internal data path is altered prior to enabling external line drivers to prevent data transmissions occurring during data path multiplexing.

Local mode is the simplest of the two modes of operation. While all SRXx input receivers from the stations are inactive, the device is in an idle state. The idle state disables all the STXx and SCLx output drivers to the stations. While in local mode, all control signals to and from the global port are logically disabled by the control logic. When transmit activity is detected on any of the eight SRXx input receivers, the channel's internal squelch goes high. While this condition exists, the single SRXx receiver is routed to all STXx drivers. When the transmission is complete, the channel's internal squelch returns low. This starts an end-of-packet hold on all the STXx output drivers. The driver switches to the idle state after the hold time has elapsed. During the specified squelch (SQE) test interval, the SN75LBC088 internally generates a SQE test burst. When Smart SQE is enabled (SMARTSQE pulled low), the SQE test burst is sent to the SCLx output of the station that transmitted last. If Smart SQE is not enabled, it sends the burst to all the SCLx outputs. The device recognizes a collision when one station is active and any other station(s) becomes active. The device then places a 10-MHz collision signal on all the SCLx output drivers. All STXx data is considered undefined during a collision. The STXx drivers are shut down while the SCLx drivers are active and are not reactivated until all SRXx receiver activity is finished. The device returns to the idle state after all transmit traffic has ceased.

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description (continued)

In global mode, the local station users are logically connected to the LAN backbone media. Global mode has two types of signal flow patterns: station to other stations and the LAN, and the LAN to all stations. When a station starts to transmit, its squelch deactivates and is considered active. The control logic then selects the active channel's data for transmission to the LAN. Unlike the local mode, the other stations do not get the data directly from the active port. Data first reaches the transceiver, gets looped back, and then is sent to the eight STXx drivers. This action emulates the operation between a station and a transceiver in a normal point-to-point link.

In global mode, local and global collisions are handled differently. For a local collision, the device cannot force a collision on the LAN backbone directly. To create a collision on the LAN, the device transmits a 5-MHz signal onto the GTX drivers to force activity on the LAN segment. Any LAN activity collides with this forced 5-MHz signal and is seen as a collision by the collision receiver. This action keeps the network synchronized. After the global port's data loops back from the LAN, the collision signal is sent to all the local nodes via the SCLx output drivers.

A global collision (collision on the network) is handled normally since station transmit data is routed to the GTX driver. In this instance, data sources are directly in collision. Once a collision is detected on the network, the transceiver asserts a collision signal that is detected on the GCL input receiver. The GCL receiver collision signal is then routed to all the SCLx output drivers tied to the stations.

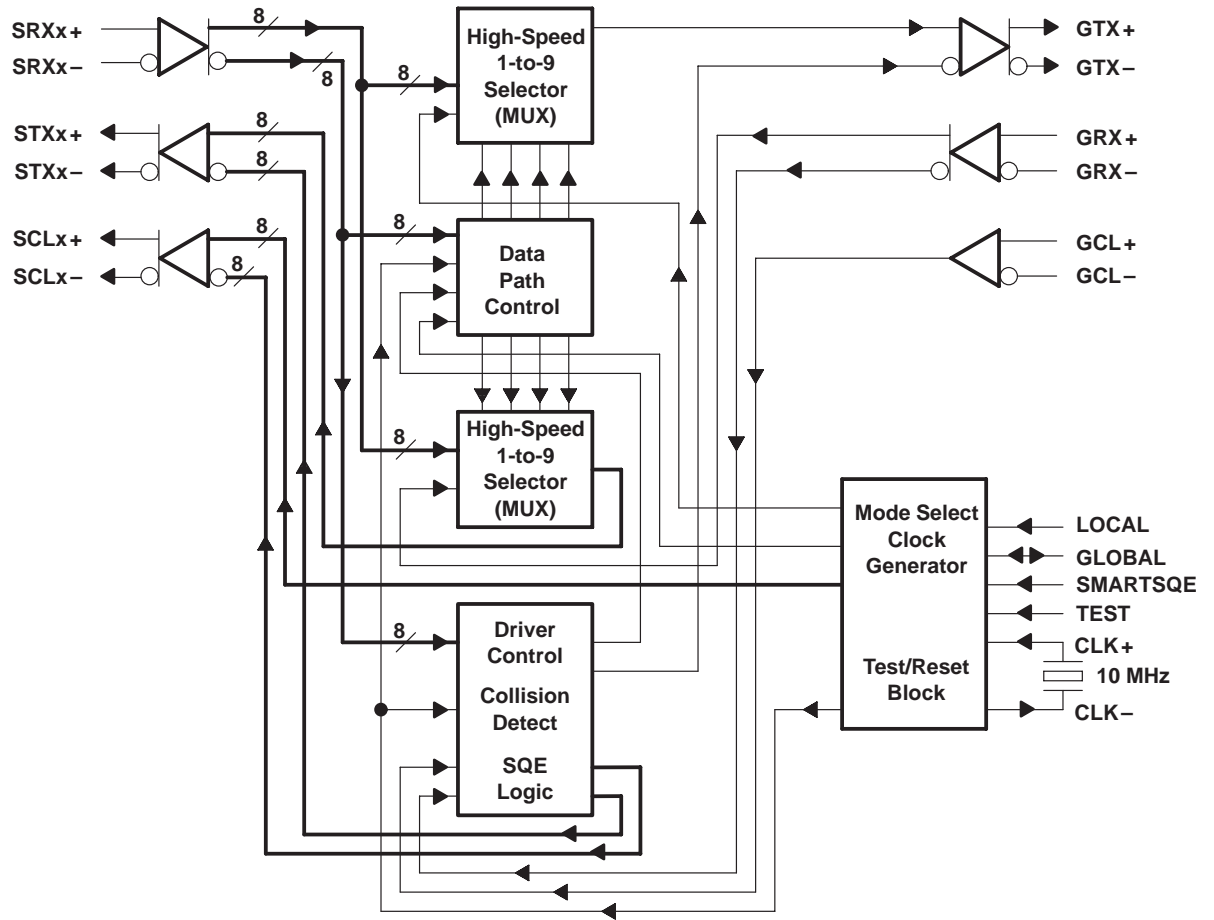
In global mode, the transceiver generates SQE. When a station finishes a transmission, the transceiver generates the SQE. This is detected on the GCL input. When Smart SQE is enabled (SMARTSQE pulled low), the SQE is sent to the station that originated the transmission. Because of this activity, the ACC has to remember which station transmitted the last signal and only allow collision back to that station during the SQE window. Once the SQE passes, the ACC then allows a collision signal back to all stations to indicate a network collision. When Smart SQE is disabled, the SQE signal is routed to all station collision lines (SCLx).

The SN75LBC088 supports a self-exerciser test mode. The self-exerciser mode tests all the drivers and receivers on the chip. This mode is invoked by pulling both GLOBAL and TEST low. While in the self-exerciser mode, a 6.4- μ s packet is generated of consistent preamble on the GTX driver port with a 6.4- μ s idle time. The GTX driver, with the help of loop back connectors, routes the preamble to both the GRX and the GCL receivers. The GRX data is then sent internally to all the STXx drivers. External connectors on the STXx drivers individually loop this data back to the local SRXx receiver. When the squelch for a receiver is turned off and the global GCL receiver is unsquelched, the collision driver for that receiver starts sending a collision signal. Each port drives a collision signal based on its own SRXx receiver squelch being held high and the presence of a global collision signal, therefore exercising all the drivers and receivers on the chip.

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functional block diagram



Terminal Functions

TERMINAL NAME	NO.	I/O	DESCRIPTION
CLK-	3	O	Clock output. Output for an external series-resonant 10-MHz crystal required for internal timing.
CLK+	2	I	Clock input. Input for an external series-resonant 10-MHz crystal required for internal timing. The CLK+ accepts an external TTL level clock also.
DRVDDx	4, 14, 25, 35, 46, 56, 67, 77		V _{DD} power supply. These terminals provide power to the drivers.
DRVSSx	9, 19, 30, 40, 51, 61, 72, 82		V _{SS} power ground. These terminals provide a ground return for the driver circuits.
GCL-	64	I	Global collision. Differential inputs that receive the network collision status for forwarding to the individual station ports.
GCL+	63	I	
GLOBAL	1	I/O	Global. This is a bidirectional terminal. When functioning as an output, the chip is in a test mode and monitors internal nodes that are multiplexed to it. When functioning as an input, the terminal is pulled low (LOCAL held high) and the station ports are connected to the LAN. This terminal is held inactive (high) with an internal pullup resistor.
GRX-	42	I	Global receive. Differential inputs that receive network data from an external transceiver and route it to all eight station ports.
GRX+	41	I	
GTX-	24	O	Global transmit. Differential outputs that transmit data from one of eight station ports to the network.
GTX+	23	O	
LOCAL	66	I	Local. When in local mode, this terminal is pulled low (GLOBAL held high) and the station ports are disconnected from the LAN. This terminal is held inactive (high) with an internal pullup resistor.
RCVDD1	20		V _{DD} power supply. These terminals provide power to the receivers.
RCVDD2	62		
RCVSS1	21		V _{SS} power ground. These terminals provide a ground return for receivers.
RCVSS2	65		
SCLx-	8, 16, 29, 37, 50, 58, 71, 79	O	Station port collision. Differential outputs that transmit the collision condition to the station. When during any station transmit activity one or more additional stations become active, the device recognizes this as a collision. The device then places a 10-MHz collision signal on all of the SCLx output drivers.
SCLx+	7, 15, 28, 36, 49, 57, 70, 78	O	
SRX-	11, 13, 32, 34, 53, 55, 74, 76	I	Station port receive. Differential input for receiving data from the station to the network.
SRX+	10, 12, 31, 33, 52, 54, 73, 75	I	
STX-	6, 18, 27, 39, 48, 60, 69, 81	O	Station port transmit. Differential output for transmitting network data to the the station.
STX+	5, 17, 26, 38, 47, 59, 68, 80	O	
SMARTSQE	22	I	This input enables the smart SQE circuitry. In normal operating mode, this enables the SMARTSQE test function performed at the end of a data packet transmission. In the test mode, SMARTSQE works with TEST to place the chip into a special mode. This terminal is held inactive (high) with an internal pullup resistor.
TEST	45	I	Test. To invoke the self-exerciser test mode, this terminal and GLOBAL are enabled.
V _{DD} (L)	43, 84		V _{DD} logic power supply. These terminals provide power to the CMOS logic.
V _{SS} (L)	44, 83		V _{SS} logic ground. These terminals provide power to a ground return for the CMOS logic.

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MODE CONFIGURATION

GLOBAL	LOCAL	SMARTSQE	TEST	CHIP CONFIGURATION
H	L	H	H	Local mode, no SQE
H	L	L	H	Local mode with SQE
L	H	H	H	Global mode, no SQE
L	H	L	H	Global mode with SQE
L	H	H	L	Self exerciser

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, V_{DD}	7 V
Input voltage, V_I	16 V
Output voltage at any output, V_O	16 V
Supply current, I_{CC}	500 mA
Operating free-air temperature range, T_A	0°C to 70°C
Storage temperature range, T_{stg}	0°C to 125°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	OPERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING
FN	3.0 W	0.024 W/°C	1.92 W

recommended operating conditions

		MIN	NOM	MAX	UNIT
Supply voltage, V_{DD}	DRVDDx, RCVDD1, RCVDD2, $V_{DD(L)}$	4.75	5	5.25	V
Common-mode input voltage, V_{IC}		1		4.2	V
High-level input voltage, V_{IH}	GLOBAL, LOCAL, SMARTSQE, TEST	2.4			V
Low-level input voltage, V_{IL}	GLOBAL, LOCAL, SMARTSQE, TEST			0.8	V
Differential input voltage, V_{ID}	GRX±, GCL±, SRXx±	±318		±1315	mV
Operating free-air temperature, T_A		0		70	°C

electrical characteristics over recommended operating free-air temperature and supply voltage range (unless otherwise noted)

drivers

PARAMETER		TEST CONDITIONS	MIN	MAX	UNIT
V _{CM}	Common-mode voltage	See Figure 1	1.0	4.2	V
V _{OD}	Differential-output voltage	See Figure 2	±600	±1315	mV
	Idle differential voltage	See Figure 2		±40	mV
	Idle differential load current			4	mA

receivers

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
	Differential-input threshold to disable squelch	t > 30 ns [†]			V _{ID} > -275	mV
	Differential-input threshold to not disable squelch	t < 20 ns [†]			V _{ID} < -255	mV
V _{ID}	Differential-input voltage		±380		±1315	mV
V _{IC}	Common-mode voltage		1		4.2	V
I _{IC}	Common-mode current				±1	mA
	Hysteresis (threshold)			±40		mV

[†] t is the duration time that the input signal swings from its common-mode state.

drivers and receivers

PARAMETER		TEST CONDITIONS	MIN	MAX	UNIT
I _{CC}	Supply current	DRVDDx, RCVDD1, RCVDD2, V _{DD} (L)	Steady state		mA
			Active		

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switching characteristics

PARAMETER		FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t _{pd1}	Propagation delay time, internal first stage squelch (see Note 1)	SRXX	Internal 1st stage squelch	See Figure 6	30		65	ns
		GRX						
t _{pd2}	Propagation delay time, internal squelch valid (see Note 2)	SRXX or GRXx	Internal channel squelch	See Figure 6	130		150	ns
t _{pd3}	Propagation delay time, driver startup	SRXX	GTX, STXx	See Figure 6	150		270	ns
		GRX	STXx					
t _{pd4}	Propagation delay time, steady state	SRXX	GTX, STXx	See Figure 6			35	ns
		GRX	STXx					
t _{pd5}	Propagation delay time, steady state	SRXX	GTX, STXx	See Figure 6			35	ns
		GRX	STXx					
t _{sk}	Skew time, signal edge (see Note 3)	SRXX	GTX, STXx	See Figure 6		2		ns
		GRX	STXx					
t _{pd6}	Propagation delay time, last received edge to internal squelch	SRXX or GRX	Internal channel squelch	See Figure 7	144		200	ns
t _{pd7}	Propagation delay time, steady state	SRXX	GTX, STXx	See Figure 7			35	ns
		GRX	STXx					
t _{pd8}	Propagation delay time, last positive edge out to 70% point	GTX, STXx	GTX, STXx	See Figure 7	210		320	ns
t _{pd9}	Propagation delay time, driver idle from last positive edge out (see Note 4)	GTX, STXx	GTX, STXx	See Figure 7	0.21		8	μs
t _{pd10}	Propagation delay time, collision detected to SCLx drivers active	SRXX	Collision signal active	See Figure 8			320	ns
t _{pd11}	Propagation delay time, collision detected to STXx drivers inactive	SRXX	STXx drivers inactive	See Figure 8	350		700	ns
t _{pd12}	Propagation delay time, last SRXX going inactive to collision signal going inactive	Last receiver inactive	Collision drivers inactive	See Figure 8			290	ns
t _{pd13}	Propagation delay time, SCLx drivers active overlap to STXx drivers active	Collision drivers active	STXx drivers active	See Figure 8	200			ns

- NOTES:
1. The measurement is referenced to the differential input crossing the -275-mV threshold.
 2. The first transmitted bit cell after the squelch deactivates is allowed to have bit cell timing errors. Bit cells beyond this must not be distorted.
 3. Skew = t_{pd4} - t_{pd5} × t_{pd4} must be within ±2 ns of t_{pd5} when measured at the 0% amplitude point.
 4. Driver-idle condition exists when the output differential amplitude is less than 40 mV maximum.

PARAMETER MEASUREMENT INFORMATION

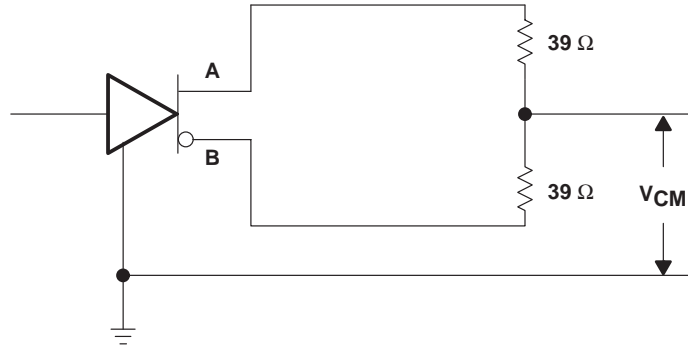


Figure 1. Driver Common-Mode Voltage Test Circuit

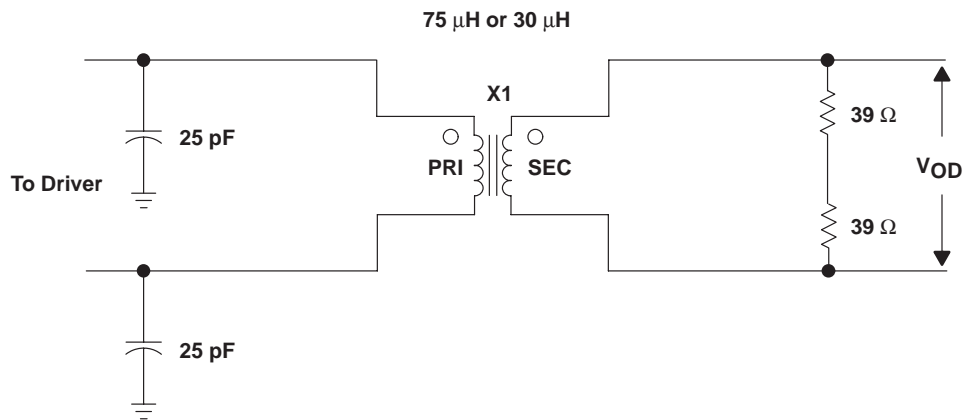


Figure 2. Differential Driver Load Circuit

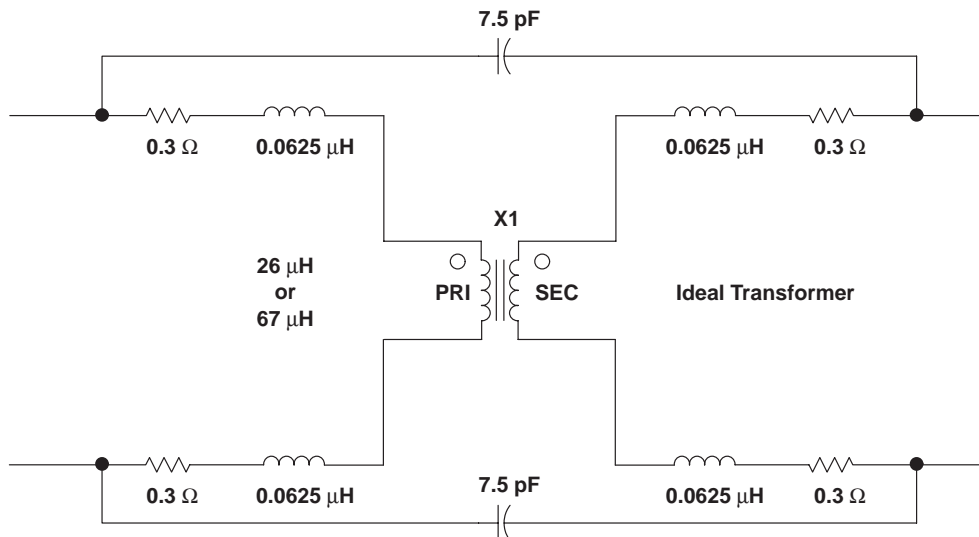


Figure 3. AUI Transformer Model

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PARAMETER MEASUREMENT INFORMATION

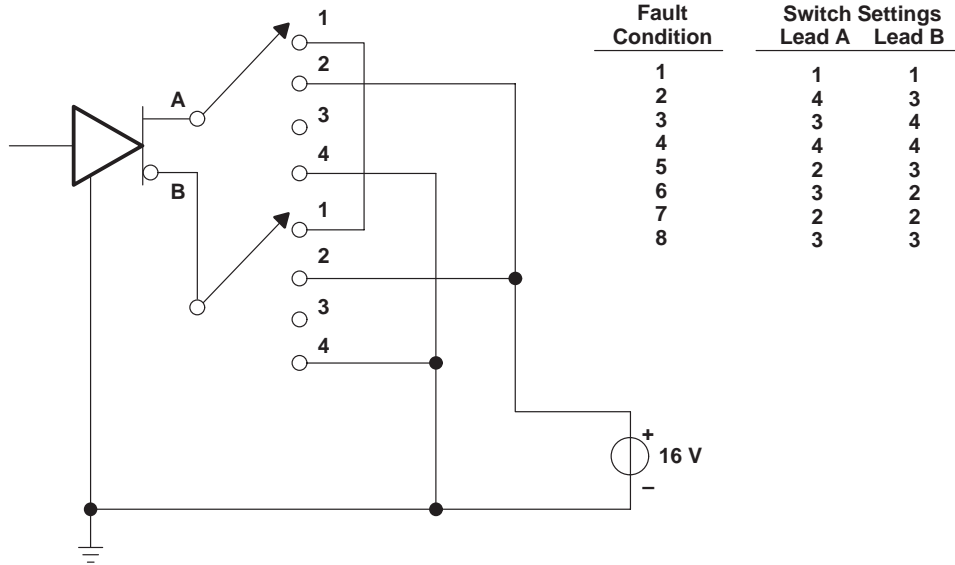


Figure 4. Driver Fault Test Circuit

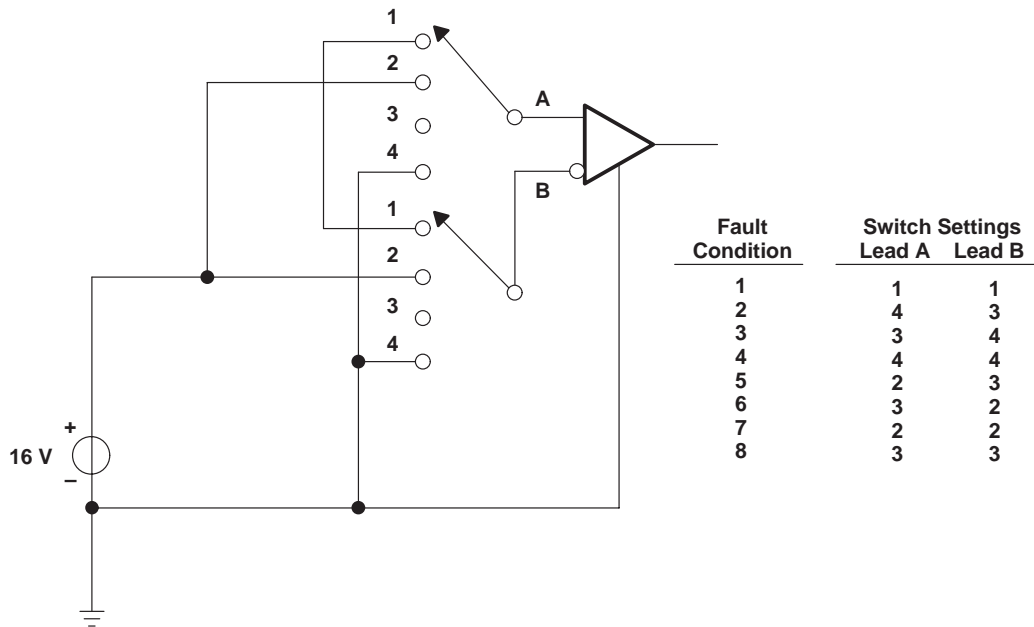


Figure 5. Receiver Fault Test Circuit

PARAMETER MEASUREMENT INFORMATION

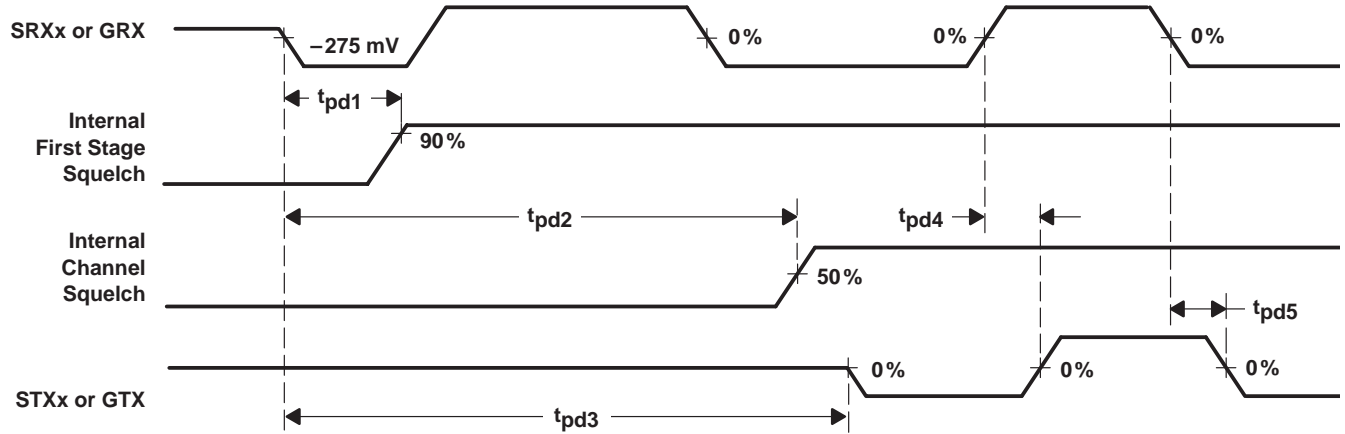


Figure 6. Differential Start-Up Sequence

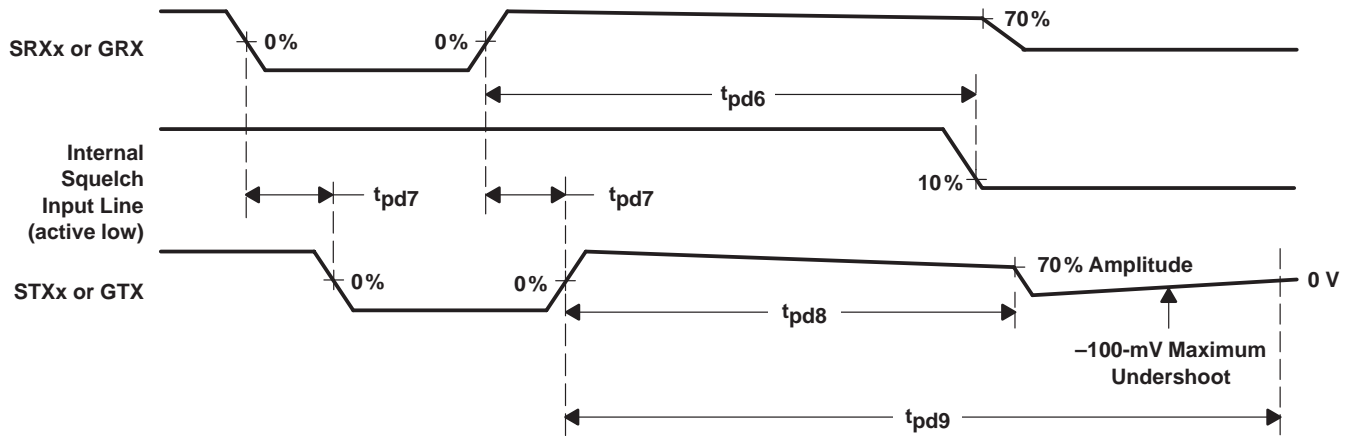


Figure 7. Differential Shut-Down Sequence

PARAMETER MEASUREMENT INFORMATION

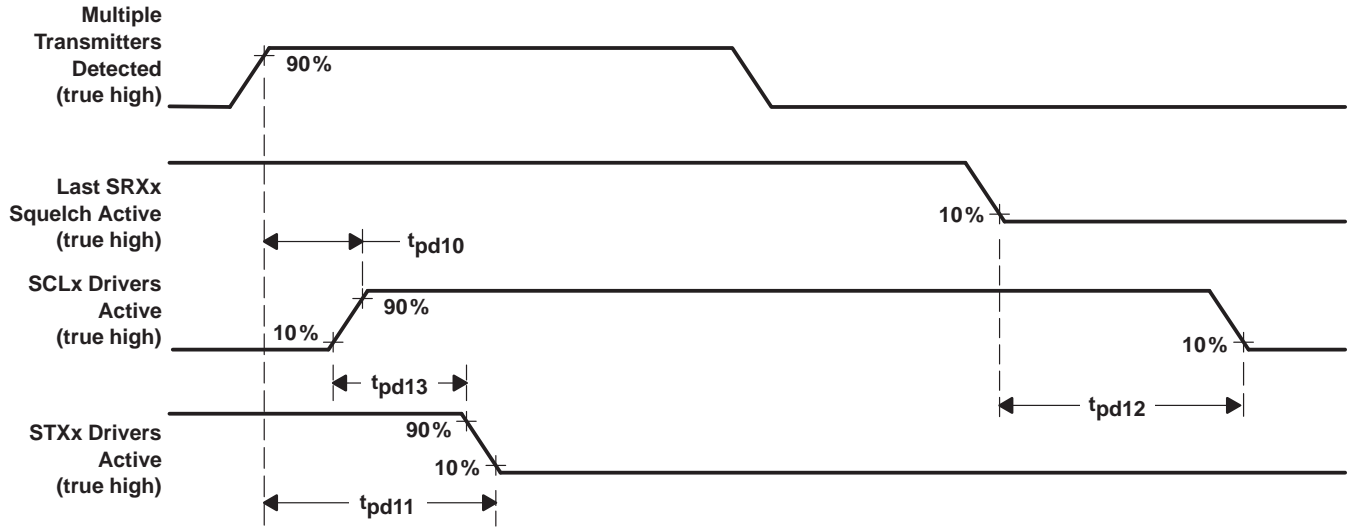
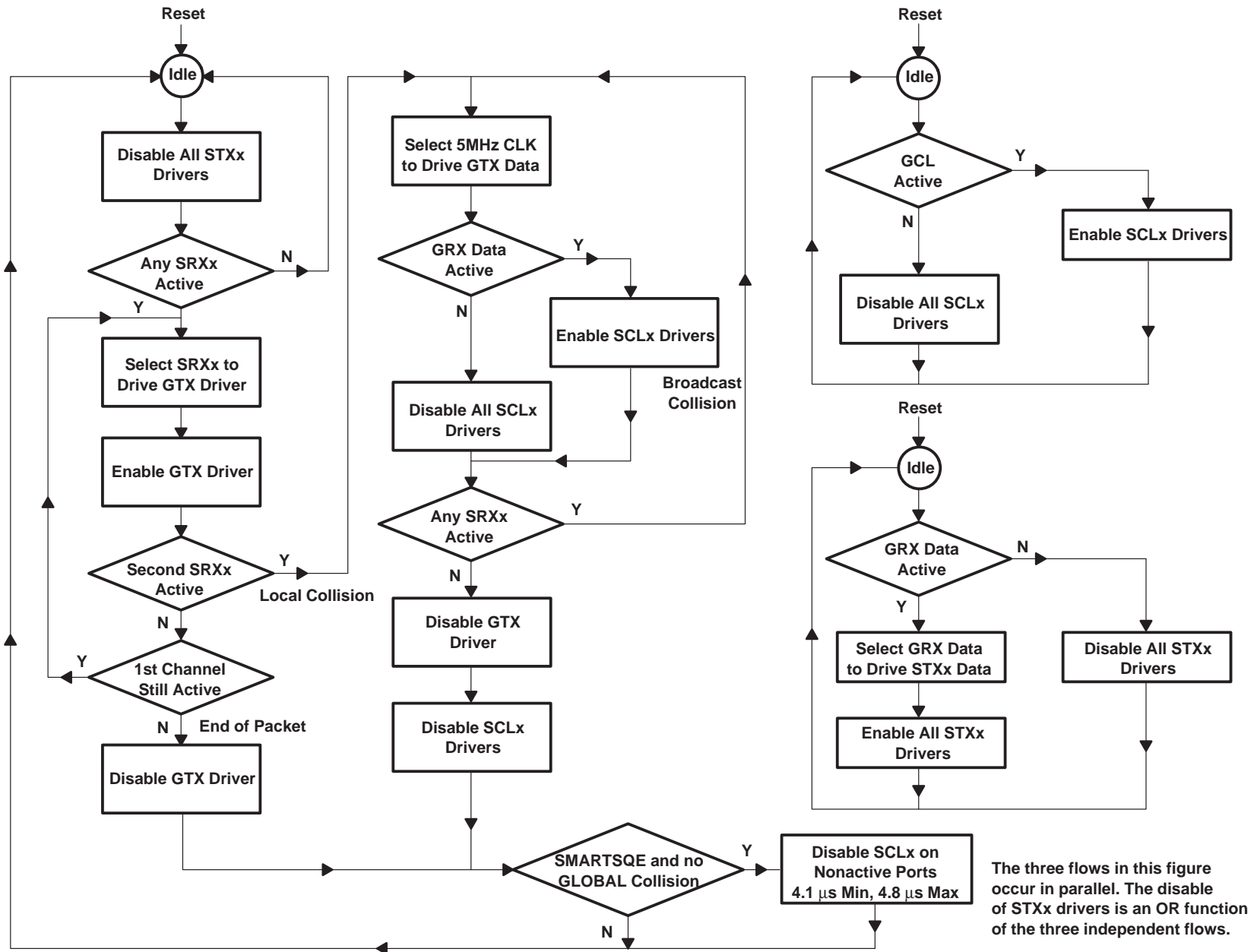


Figure 8. Local Mode Differential STXx Driver Shut-Down Sequence During Collision



The three flows in this figure occur in parallel. The disable of STXx drivers is an OR function of the three independent flows.

Figure 9. Global Mode Control Flow

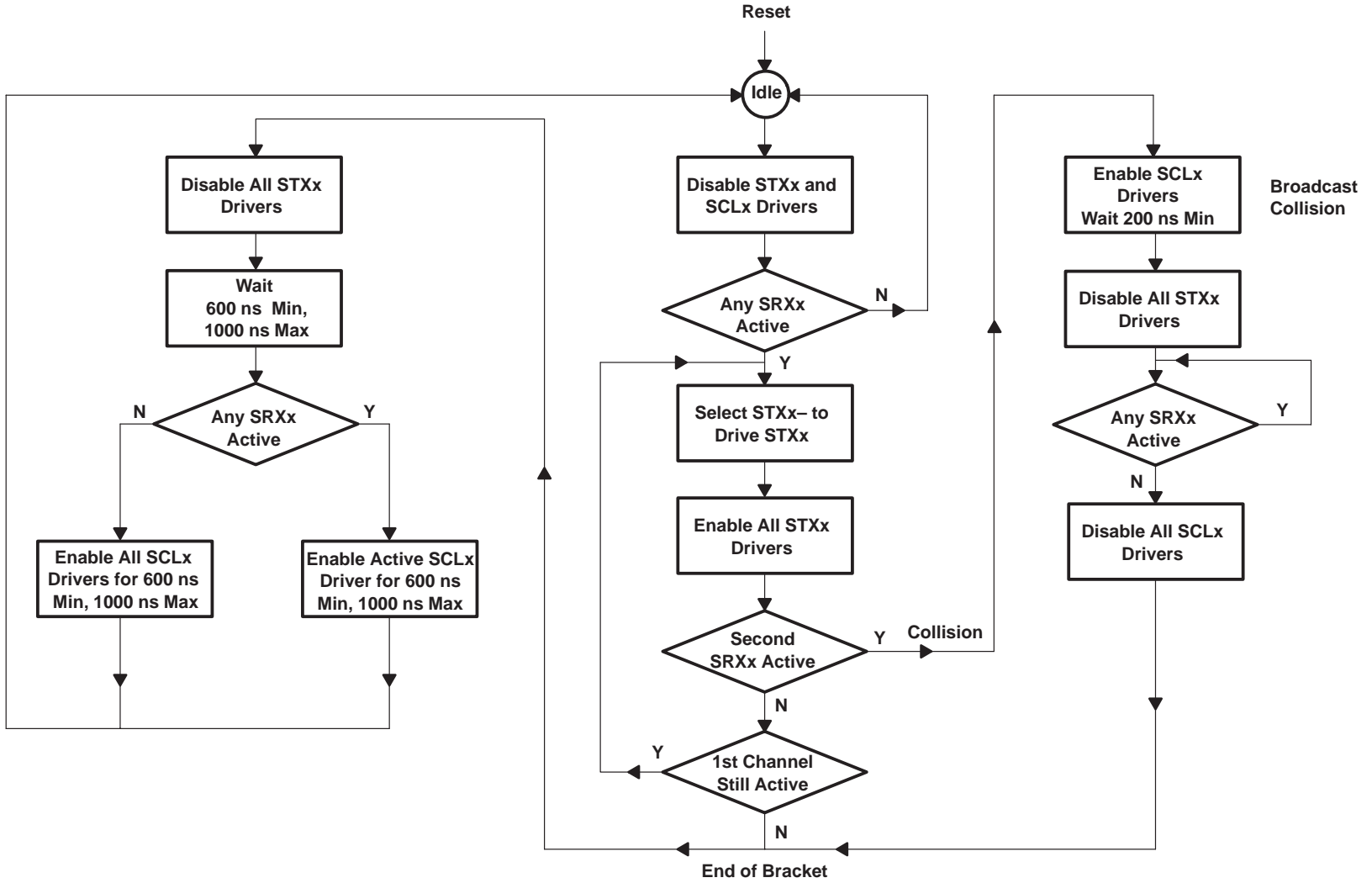


Figure 10. ACC Local Mode Control Flow

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN75LBC088FN	OBSOLETE	PLCC	FN	84		TBD	Call TI	Call TI

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

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⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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