NXP Semiconductors Application Notes

# Using CAN2CAN, CAN2ETH and ETH2CAN Features of LLCE on S32G

by: NXP Semiconductors

## 1. Introduction

This application note is a complementary to the LLCE Getting Started Guide and the LLCE firmware user guide for using CAN2CAN, CAN2ETH and ETH2CAN in S32G.

These three are LLCE's key features to realize offloading CAN gateway tasks. LLCE has the capability to perform CAN frame routing between CAN channels (i.e. CAN2CAN) and between CAN and Ethernet (i.e. CAN2ETH / ETH2CAN) without host core's intervention. These feature reduces the routing latency and host core load. After going through this document, you will be able to understand what are those features and how to play them.

LLCE can perform the CAN frame routing according to the configured routing table without host CPU's load.

CAN2CAN: When the configured frame ID is coming into the configured CAN channels, LLCE routes it to the configured destination CAN channel(s).

CAN2ETH: When the configured frame ID is coming into the configured CAN channels, LLCE encapsulates the CAN frame into the Ethernet frame in IEEE1722 format and UDP packet. PFE sends it to the Ethernet.

ETH2CAN: When the PFE receives the Ethernet frame, LLCE parses it and unpacks the IEEE1722 packet /

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#### CAN2CAN, CAN2ETH and ETH2CAN features

UDP packet and route it to CAN channels. The following figure shows an overview diagram of CAN2CAN, CAN2ETH and ETH2CAN with respect to LLCE in S32G.



Figure 1. Overview diagram

# 2. CAN2CAN, CAN2ETH and ETH2CAN features

The CAN2CAN feature performs the off-loaded CAN frame routing according to the configured routing table. The following options are available:

- Multicast/Unicast: Not only single destination channel (i.e. Unicast) but also multiple destination channels (i.e. Multicast) can be configured.
- ID remapping: Remapping CAN frame ID can be configured. Switching Standard & Extended ID is also possible.
- Frame transformation between Classic CAN and CANFD can be configured.





The CAN2ETH feature performs the off-loaded encapsulation which packs configured CAN frames into Ethernet frames in IEEE1722 format. The following steps are taken by CAN2ETH for encapsulations of the CAN frames:

- CAN frames are packed into IEEE1722 packet (Compliant to AVTP Time-Synchronous / Non time synchronous control format. Packed as ACF CAN Brief /Full messages) or packed into UDP packet.
- LLCE packs the message and put it on the buffers in the SRAM.
- The packet length is controlled by the configuration of the buffer size.
- Stream ID is constant, Not configurable.



The ETH2CAN feature performs the off-loaded unpacking IEEE1722 AVTP frames. The following steps are taken for unpacking the frames:

- Any IEEE1722 frames /UDP packets will be parsed and unpacked and routed.
- The maximum number of ACF CAN frames inside one AVTP frame is limited by the number of HTH you configured. 16 frames per one channel is the maximum case.

### NOTE

In order to avoid conflict between host application's Ethernet frame handling, be aware the LLCE FW is using PEF\_HIF3 for CAN2ETH/ETH2CAN.



Figure 4. ETH2CAN feature

This section and sub sections describes how to use the sample application. The steps that needs to be followed are shown in the section.

### NOTE

This section is based on the latest release as of February 2023. (i.e. S32G\_LLCE\_GATEWAY\_1\_0\_5\_QLP1\_D230228.exe). If you are using newer version, the contents described in this chapter may be different.

### 3.1. Downloading and installing the LLCE package

Go to FLEXERA and download the latest LLCE software package. After download install the package. Refer to the following screenshot.

NXP > Design > Automotive SV	/ - S32G - LLCE Driver + Firmware > S32G_LLCE_1.0.5_QLP1 : Files		
You are a member of m	ultiple licensing accounts and are currently viewing	: (Switch Account)	
Software & Support	Product Download		
Product List	Product Download		
Product Search	S32G_LLCE_1.0.5_QLP1		
Order History	Files License Keye Notes	O Download Help	
Recent Product Releases	License Reys Wiles		
Recent Updates	Show All Files	3 Files	
Licensing	+ File Description 💠 File Size 🗢	File Name	
License Lists	+ S32G_LLCE_GATEWAY_1.0.5_QLP1_D2302_ReleaseNotes.txt 1.8 KB	S32G_LLCE_GATEWAY_1.0.5_QLP1_D2302_ReleaseNotes.txt	
Offline Activation	+ S32G_LLCE_GATEWAY_1.0.5_QLP1_D2302_SCR.txt 355 bytes	S32G_LLCE_GATEWAY_1.0.5_QLP1_D2302_SCR.txt	
oninie Activation	+ S32G_LLCE_GATEWAY_1_0_5_QLP1_230228.exe 20.1 MB	S32G_LLCE_GATEWAY_1_0_5_QLP1_230228.exe	
FAQ			
1		0000 H OF CATEWAY 4 0 5 OLD4 00000 ave	

Figure 5. Downloading and installing LLCE

After installation of LLCE SW package, put the bundled plugins folders and files into the tresos/plugins as shown below.





If you do not have PFE MCAL 4.4 driver 1.0.0 and RTD package, download both of them.

You are a member of m	W - S32G - PFE Driver + Standard Firmware > S32G PFE MCAL 4.4 ( aultiple licensing accounts and are currently viewing Masa	driver - SW32G_MCL01_1.0.0_D22 ataka Yakashiro Software Acc	11 : Files ount. (Switch Account)
Software & Support Product List	Product Download		
Product Search	S32G PFE MCAL 4.4 driver - SW32G_MCL0	1_1.0.0_D2211	
Order History			O Download Help
Recent Product Releases	Files License Keys Notes		Cowindad Trep
Recent Undates	Show All Files		4 Files
recom opaulos	+ File Description	File Size 🗘 File Name	\$
Licensing	+ PFE-DRV_S32G_M7_MCAL_RTM_1.0.0.zip	5 MB J PFE-DRV_S32G_M	M7_MCAL_RTM_1.0.0.zip
License Lists	+ PFE-DRV_S32G_M7_MCAL_RTM_1.0.0_QP.zip	19.1 MB 🛓 PFE-DRV_S32G_N	M7_MCAL_RTM_1.0.0_QP.zip
Offline Activation	+ PFE-DRV_S32G_M7_MCAL_RTM_1.0.0_ReleaseNotes.txt	51 KB 🛓 PFE-DRV_S32G_N	17_MCAL_RTM_1.0.0_ReleaseNotes.txt
FAO	+ PFE-DRV_S32G_M7_MCAL_RTM_1.0.0_SCR.bd	2.2 KB & PFE-DRV_S32G_M	M7_MCAL_RTM_1.0.0_SCR.bd
Download Help			
-DRV S32G M7 MC	CAL RTM 1.0.0 QP.zip	19.1 MB	S32G M7 MCAL RTM 1.0.0
	RV_S32G_M7_MCAL_RTM_1.0.0) Figure 7. PFE N DUCTS APPLICATIONS DESIGN SUPPORT	MCAL 4.4 driver	Q. Search nxp.com
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Figure 8. RTD package

After the installation of PFE MCAL and RTD, put the folders and files into the tresos/plugins as shown below.





Figure 9. PFE MCAL and RTD in tresos

For llce\_sample\_app\_pfe, modify the sample\_app\_initialization.c. as shown in the following screenshot.

### 3.2. Modifying the files and make

Modify the config.mk for your environment. For CAN2CAN, modify the file: C:\NXP\S32G\_LLCE\_1\_0\_5\_QLP1\sample\_app\_llce\llce\_sample\_app\_af\config.mk.

Please refer to the following screenshot.



Figure 10. Modifying config.mk

#### Using CAN2CAN, CAN2ETH and ETH2CAN Features of LLCE on S32G, Rev. 1, 03/2023

In the S32G\_LLCE\_1\_0\_5\_QLP1 release, there is one known-issue in S32G3's EB-Tresos config of the CAN2CAN sample app, which is needed to fix. In default, the interrupt is disabled in the S32G3's CAN2CAN sample app config. So, change it to Enabled as following flow.

Run EB-Tresos Studio and import sample config.

	👪 Import 🛛 🚽 🗖	×
	Import Projects 4. Click Browse Select a directory to search for existing Eclipse projects.	
I. File - Import ×	Select root directory:     Brow	vse
Select	◯ Select archive file:	vse
Create new projects from an archive file or directory.	Projects:	
Select an import wizard:	Selec	ct All
type filter text	Desele	ect All
	Refr	resh
Security Projects into Workspace		
V 🗁 CVS		
B Projects from		
> > Team		
	Options	
2. Click "Existing	Search for nested projects	
Projects into	Copy projects into workspace	
	Hide projects that already exist in the workspace	
Workspace"	Working sets	
	Add project to working sets New	
	Working sets:	
3. Click Next	Holking Sol	
Cancel	(?) < Back Next > Finish Car	icel

Figure 11. Import Sample config of CAN2CAN-G3

			Import		
Browse For Folder		×	Import Projects Select a directory to sea	rch for existing Eclipse projects.	
Browse For Folder Select root directory	of the projects to import 2G_LLCE_1_0_5_QLP1 eclipse firmware sample_app_lice Can_mon 2G3/Tresos_CAN CAN Can_mcal_can2can can_mcal_can2can can_mcal_can2can can_mcal_multihost tresos_s32g3 Tresos_CAN2CAN_Project 	× ^ N2CAN_Project.	Select a directory to sea Select root directory: Select archive file: Projects: Sample_App_LL Sample_App_LL Copy projects into v Copy projects into v Hide projects that a Working sets	rch for existing Eclipse projects.	Browse Browse Select All Deselect All Refresh
< Folder: Tressos_C Make New Folder	AN2CAN_Project OK Cancel		Add project to wor Working sets:	king sets 7. Click	New Select Finish
	6. 0	Click OK	?	< Back Next > Finish	Cancel

Figure 12. Import Sample config of CAN2CAN-G3



Figure 13. Load Config

Run EB-Tresos Studio and import sample config.

	🔢 Import 🛛 🚽 🗆 🗧
	Import Projects 4. Click Browse 👝
	Select a directory to search for existing Eclipse projects.
1. File - Import	
Import X	Select root directory:     Browse
Select	O Select archive file: V Browse
Create new projects from an archive file or directory.	Projects:
Select an import wizard:	Select All
type filter text	Deselect All
V 🗁 General	Refresh
Existing Projects into Workspace	
😨 Projects from	
> > > SVN	
	Options
2. Click "Existing	Search for nested projects
Projects into	Copy projects into workspace     Hide projects that already exist in the workspace
	Working sets
vvorkspace	
	Add project to working sets
3. Click Next	Working sets: Select
Cancel	
	Cancel
Figure 14.	Import sample config
Browse For Folder	× Browse For Folder ×
Select root directory of the projects to import	Select root directory of the projects to import
> S20_LLCE_I_0_3_QLP1	SZG_LLCE_1_0_S_QLP1
> plugins	> plugins
> Ilce_sample_app_af	5 For S32C2 choose "trasse S22C2
E For S22C2 above "traces S22C2"	
5. FOI 552G3, Choose Tresos_532G3.	

Figure 15. Import Sample Config

Cancel

pfe\_firmware

tresos\_S32G2 tresos\_S32G3

OK

src

<

Folder: Make New Folder

tresos\_S32G3

Folder: tresos\_S32G2

Make New Folder

6. Click OK

build\_files include

pfe\_firmwa

tresos\_S32G2 > 📙 tresos\_S32G3

OK

Cancel

src

👪 Import		_		×	
Import Projects Select a directory to sear	ch for existing Eclipse projects.			7	
Select root directory:     Select archive file:     Projects:	C:\NXP\S32G_LLCE_1_0_5_QLP1\sam	ple_apr ~	Browse. Browse.		
☑ llce-pfe-g3 (C:\N	XP\S32G_LLCE_1_0_5_QLP1\sample_a	pp_lice\lice	Select A Deselect A Refresh	All	
<ul> <li>Options</li> <li>Search for nested pro</li> <li>Copy projects into w</li> <li>Hide projects that all</li> </ul>	jects orkspace eady exist in the workspace	>			
Working sets	ing sets	~	New Select	7	. Click Finish
?	< Back Next > F	inish	Cancel		

Figure 16. Import Sample Config



Figure 17. Load config of CAN2CAN-G3







Figure 19. Enable the interrupt on Tresos

					stange t	ab		
62 P	latform							
						)		
al Platf	ormEcucPartitionR	ef System Settings Interrupt (	Controller Generic Int	errupt Settings F	Published Informatio	n		
Gene	aric Interrupt Settin	qs						<b>☆ ♀   + × ⊡   &amp;</b>
ndex	▷ Name	Interrupt Name	X A53-Clus	🕅 M7.0	X M7_1	x M7_2	X M7.3	Handler
148	Platformlsr	MCSCM_INT11_IRQn		<u></u>				undefined_handler
149	Platformlsr	LLCE0_INT0_IRQn	<b>X</b> 🗹	X 🗸	X 🗸	X 🗸	<b>X V</b>	undefined_handler
150	🗁 Platformlsr	LLCE0_INT1_IRQn	<b>X</b>	🔀 🗹	<b>X</b>	<b>X</b>	<b>X</b>	undefined_handler
151	🗁 Platformlsr	LLCE0_INT2_IRQn	🔀 🗹	🔀 🗹	🔏 🗹	🔀 🗹	<b>X</b>	undefined_handler
152	🗁 Platformlsr	LLCE0_INT3_IRQn	🔀 🗹	🔀 🗹	<b>X</b>	🔀 🗹	<b>X</b>	undefined_handler
153	🗁 Platformlsr	LLCE0_ICSR14_IRQn	🔀 🗹	<b>X</b>	<b>X</b>	🔀 🗹		Can_FifoRxInNotEmptyIsr_0_7
154	🗁 Platformlsr	LLCE0_ICSR15_IRQn	<b>X</b>	<b>X</b>	<b>X</b>	🔀 🗹		Can_FifoRxInNotEmptyIsr_8_15
155	🗁 Platformlsr	LLCE0_ICSR16_IRQn	🔀 🗹	🔀 🗹	<b>X</b>	🔀 🗹	😼 🗹  🔨	Can_FifoRxOutNotEmptyIsr_0_7
156	🗁 Platformlsr	LLCE0_ICSR17_IRQn	🔀 🗹	<b>X</b>	<b>X</b>	🔀 🗹		Can_FifoRxOutNotEmptylsr_8_15
157	🗁 Platformlsr	LLCE0_ICSR18_IRQn	<b>X</b>	<b>X</b>	<b>X</b>	🔀 🗹		undefined_handler
158	🗁 Platformlsr	LLCE0_ICSR19_IRQn	<b>X</b>	<b>X</b>	<b>X</b>	X 🗸	<b>X</b>	undefined_handler
159	Platformlsr	LLCE0_ICSR20_IRQn	<b>X</b>					undefined_handler
160	Platformlsr	LLCE0 ICSR21 IRQn	<b>X</b>					undefined handler
161	Platformlsr	LLCE0_ICSR22_IRQn	<b>X</b>	X 🗸	<b>⋈</b> ✓	X 🗸		Can_FifoTxAckNotEmptylsr_0_7
4.00	Platformlsr	LLCE0_ICSR23_IRQn	<b>X</b>	X 🗸	X 🗸			Can_FifoTxAckNotEmptylsr_8_15
162					8 -			
162	Platformlsr	LLCE0_ICSR24_IRQn	X6 🗹	X 🗸	X6 🖌	X6 🗹 🖊		b undefined handler



Figure 20. Enable the interrupt on Tresos

Figure 21. Generate Code

Now CAN2CAN sample app is ready to build.

Under llce\_sample\_app\_af folder, you can build as following.

- \$make clean
- \$make can\_routing

Then, you can see the elf file "can\_routing.elf" under llce\_sample\_app\_af/build.

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As for the CAN2ETH/ETH2CAN sample app, modify the config.mak for your environment. For CAN2ETH/ETH2CAN, modify

C:\NXP\S32G\_LLCE\_1\_0\_5\_QLP1\sample\_app\_llce\llce\_sample\_app\_pfe\config.mak

Please refer to the following screenshot.





Figure 22. Modifying config.mak

In the S32G\_LLCE\_1\_0\_5\_QLP1 release, there is one known-issue in the EB-Tresos config of the llce\_sample\_app\_pfe, which is needed to fix. As for S32G3, you should modify

 $\label{eq:lice_sample_app_fe} C:\NXP\S32G_LLCE_1_0_5_QLP1\sample_app_llce\lice_sample_app_pfe\tresos_S32G3\config\Eth.x\dm. As for S32G2, you should modify$ 

 $\label{eq:c:NXPS32G_LLCE_1_0_5_QLP1 app_llce llce_sample_app_pfe tresos_S32G2 configEth.x dm.$ 

As for S32G3, change value from 2048 to 1522 on line 223, 429 and 618 as below. For S32G3, on line 269,521, and 756.

1002201	201 Original distrigues The Transition of the Contract of the	{d:ctr.pame="http://contiglogressh Modified
00221	type="IDENTIFIABLE">	type="IDENTIFIABLE">
00222	22 <d:var 00222<="" name="EthCtrlConfigIngressFifoBufLenByte" p=""></d:var>	<d:var <="" name="EthCtrlConfigIngressFifoBufLenByte" td=""></d:var>
00223	23 type="INTEGER" value="2048"> 00223	type="INTEGER" value="1522">
00224	224 <a:a name="IMPORTER_INFO" value="@DEF"></a:a> 00224	<a:a name="IMPORTER_INF0" value="@DEF"></a:a>
00225	25  100225	(/d:var)
00226	26 <d:var ethctrlconfigingressfifobuftotal"<="" name="[Compare Lines&lt;/p&gt;&lt;/td&gt;&lt;td&gt;× e=" td=""></d:var>	
00227	127 type= 1:1 223 type="IN typ	TEGER" value="2048">UP e="INTEGER" value="4"/>
00228	28 <divar 1522"="" 2.8="" 223="" name="1" type="IN&lt;/p&gt;&lt;/td&gt;&lt;td&gt;TEGER value= ">18 e= EthUtrlConfigIngresshifoldx</divar>	
00228		e= INIEGER Value= 0 //
00230		- "EthOt r l Config Ingroop Eife Priority designment" /
00232	OK	
00233	333 (/d: lst> 1002331	
00425	25 (d: 1st_name="EthCtrlCopfigIngressFifo" type="MAP"> 00425	<pre><d:lst_name="ethctrlconfigingresseifo" type="MAP"></d:lst_name="ethctrlconfigingresseifo"></pre>
00426	d:ctr_name="EthCtrlConfigIngressFifo_1" 00426	<d:ctr <="" name="EthCtrlConfigIngressFifo_1" td=""></d:ctr>
00427	127 type="IDENTIFIABLE"> 00427	type="IDENTIFIABLE">
00428	428 <a ethctrlconfigingressfifobuflenbyte"<="" href="display:displa&lt;/td&gt;&lt;td&gt;&lt;d:var name=" td=""></a>	
00429	129 type="INTEGER" value="2048"> 00429	type="INTEGER" value="1522">
00430	ISO <a:a name="IMPORTER_INFO" value="@DEF"></a:a> 00430	<a:a name="IMPORTER_INFO" value="@DEF"></a:a>
00431	31  00431	
00432	32 <d:var lines<="" name="Compare" td=""><td>× ne="EthCtrlConfigIngressFitoButlotal"</td></d:var>	× ne="EthCtrlConfigIngressFitoButlotal"
00433		EGER" value= "2048" Will a service of the Charles o
00434	104 (G:Var hame- 114 1420 G)Ver 114	FOR $ralue = \frac{1500}{150}$
00435	100 type- 2.1 423	Pe- INIEGER Value- 0 //
00437	127 name="	ne="EthCtrlConfigIngressEifoPriority@ssignment"/
00438	V/d:ctr> 0K	
00420		
00616	516 type= IDENTIFTABLE > 00616	type= IUENTIFIABLE >
00617	1/ < d:var name EthotriconfigingresshitobutLenbyte 0001/ 00000000	<pre><d:var <="" name="EthUtriUonfigIngressFif0butLenbyte" pre="" tume="INTECEP" uplue="1600"></d:var></pre>
00010	Operative         Value         2040         00010           10         Coperative         MORTER         NEC         00010           110         Coperative         MORTER         NEC         00010	(ata pame="INFEGER Value= 1522 /
00620		(d:var)
00621	21 (d:var_name="ficompare lines	× e="EthCtrlConfigIngressFifoBufTotal"
00622	322 type="]	e="INTEGER" value="4"/>
00623	323 <d:var []nt<="" name="[]1:L 618 type=" td=""><td>EGER″ value=″2048″&gt;48 e=″EthCtrlConfigIngressFifoIdx″</td></d:var>	EGER″ value=″2048″>48 e=″EthCtrlConfigIngressFifoIdx″
00624	524 type="  2:R 618 type="INT	EGER value= 1522 >JC e= "INTEGER" value= "0"/>
00625	225 <d: <<="" lst="" td=""><td>&gt;</td></d:>	>
00626	name="	e="EthCtrlConfigIngressFifoPriorityAssignment"∕>
00627	2// C/dtctr>	
00628	228 (/d:1st2	(/d:Ist/

Figure 23. Modifying Eth.xdm

In PFE MCAL 4.4 driver 1.0.0, there is a known-issue in the Eth\_43\_PFE\_TS\_T40D11M10I0R0\include\hal.h. So fix the copied file under tresos/plugins as follows. Change symbol from "GHS" to "\_\_ghs\_\_".

Original		Modified
00048 #endif /* PFE_CFG_MULTI_IN 00049 00050 #if_defined(GHS)	NSTANCE_SUPPORT */ 00048  #endif /* PFE_CFG_MULTI_1 00049   00050 #if defined(ehs)	INSTANCE_SUPPORT */
00051 #define hal_nop() 00052 #else /* GCC and DIAB */ 00053 #define hal_nop() 00054 #endif 00055 00056	asm(" nop") 00051 #define hal_nop()asm_ Compare Lines 1:L 50 #if defined(GHS)=ur 2:R 50 #if defined(ghsur	asm("nop") nvolatile("nop" ::: "memory")
	Figure 24. Fixing hal.h	

In case of S32G2, follow below steps 1) - 11) before generating the config code.







Figure 26. For S32G2, fix Eth config





Then, generate the config code.

	EB tresos 27.1.0 - v File Edit Search	vorks Proje	pace: C:\EB\tresos_27\workspace - install: C:\E ect Window Help ▲ ▼ : ◇ ◇ : ◇ ▼ : ◇ ▼ : ◇ ▼ : ②	B∖tr			
	Project Explorer Ilce-pfe-g3 ECU (COF ECU (COF Ecu onfig output	×	Load Configuration Reload Configuration	an			
10. Right click an "Generate Project	d select :t"	l select "	Module Configurations Verify Project Generate Project		Progress Information —	×	
		ž	4	Build Project Expand All	>	(13026) Code generation finished successfully. Errors "0" Warnings "0" rep details please refer to the Error Log	ported, for
					11. Generation complete Confirm Errors "0"	ОК	

Figure 28. Generate config code

Under llce\_sample\_app\_pfe folder, you can build as following.

- \$make clean
- \$make

You can see the elf file "int\_app.elf" under llce\_sample\_app\_pfe/out.

### 3.3. Connect the wires and run

For CAN2CAN, connect the CAN wires between CAN0 and 1, CAN14 and 15. After connecting the wires run the bundled CMM.

The CAN routing sample app performs CAN2CAN routing from CAN0 to CAN15. CAN1 sends the frames to be routed. Connect the external CAN wires between CAN0 and CAN1.



Figure 29. Connecting the CAN wires

You can see the Lauterbach's cmm scripts to run the sample app under folder

S32G\_LLCE\_1\_0\_5\_QLP1\sample\_app\_llce\llce\_sample\_app\_af\tools\cmm\_scripts.

"S32G2\_app\_load.cmm" and "S32G3\_app\_load.cmm" are there. The former is for S32G2. The latter is for S32G3.

In the CMM, select CAN\_ROUTING\_DEBUG\_MODE instead of CAN\_LOOPBACK as below. Then, you can debug the sample app for CAN2CAN on TRACE32.

45 🔵	GOSUB CAN_LOOPBACK
46	GOSUB CAN_LOOPBACK_DEBUG_MODE
47	
48	GOSUB LIN_LOOPBACK
49	GOSUB LIN_LOOPBACK_DEBUG_MODE
50	
51	GOSUB CAN_ROUTING
52 🔵	GOSUB CAN_ROUTING_DEBUG_MODE
5.0	

If you capture the two CAN buses with Logic Analyzer, you can see the routings as shown in the following figure.

Using CAN2CAN, CAN2ETH and ETH2CAN Features of LLCE on S32G, Rev. 1, 03/2023



Figure 30. CAN routings

For CAN2ETH, Connect CAN wires between CAN0 and 1. Also Connect Ethernet cable to PFE\_MAC1, run the bundled CMM.

CAN0 sends 64 CANFD frames. If you connect CAN wires between CAN0 and CAN1, CAN1 receives those frames and encapsulates them into IEEE1722 packets and into UDP packets. Then, LLCE sends the packets to PFE without host CPU's intervention. Then PFE sends them from PFE\_MAC1.

If you connect an Ethernet cable between your PC and PFE\_MAC1 (For RDB2/RDB3, it corresponds to P3A connector as shown below), you can capture those routed packets by your PC (e.g. Wireshark).





#### Figure 31. CAN2ETH routing

Run the Lauterbach's cmm script "*s32g.cmm*" under folder S32G\_LLCE\_1\_0\_5\_QLP1\sample\_app\_llce\llce\_sample\_app\_pfe.

You can debug sample app on TRACE32.

If you capture the routed packets, you can see encapsulated CAN frames. CAN0 sends frames which has seven kinds of IDs (ID=0x5,0xa,0xf,0x14,0x19,0x1e and 0x23). With this app's Tresos config, each CAN frames except ID=0x5 are processed as shown below.





On EB-Tresos, above configurations are done in LIce\_Af as below.

ne 🙆	≥ [	Llce_Af									
eneral	Can	AdvancedFeature Can2Ca	nRoutingTable Can2EthRouti	ingTable Eth2Can Pub	lished Information						
	Can	2EthRoutingTable								}	1 8 / 1
Inde	ex	🗁 Name	Encapsulation Type	EthDestAddress	EthSrcAddress	IpDestAd	. DSrcAdd		UdpDest	UdpSrcPort	Buffer Size
0	)	Can2EthRoutingTable	0 AVTP_NTSCF_BRIEF	A6:B5:C4:D3:E2:F1	4C:4C:43:45:41:46	127.0.0.1	127.0.0.1		1500 🔒	1500 📄	501
1	1	Can2EthRoutingTable	1 AVTP_NTSCF_BRIEF	66:55:44:33:22:11	4C:4C:43:45:41:46	127.0.0.1	127.0.0.1		1500 🔒	1500 📄	120
2	2	Can2EthRoutingTable	2 DDP	11:22:33:44:55:66	AC:4C:43:45:41:46	127.0.0.1	127.0.0.1		1500 🔒	1500 📄	200
3	3	Can2EthRoutingTable	3 AVTP_NTSCF_FULL	66:55:44:33:22:11	AC:4C:43:45:41:46	127.0.0.1	127.0.0.1		1500 🔒	1500 📄	130
4	1	Can2EthRoutingTable	4 AVTP_TSCF_BRIEF	66:55:44:33:22:11	4C:4C:43:45:41:46	127.0.0.1	127.0.0.1		1500 🔒	1500 📄	140
5	5	Can2EthRoutingTable	5 AVTP_TSCF_FULL	66:55:44:33:22:11	AC:4C:43:45:41:46	127.0.0.1	127.0.0.1	B	1500 🔒	1500 📄	150



	2 💿 🚞		000		¥ ± 🗉	<b>Q Q</b>	Q II				
Apply a	display filter	<ctrl-></ctrl->									
No.	Time	Source		Destination	Protocol	Length Info					-
10	0.001441598	40:40:4	13:45:41:40	66:55:44:33	: ACF-CAN	102 ACF-CAN	(1): 0x0000	0023 80	81 82 83	84 85 86	
12	0.001980768	127.0.0	0.1	127.0.0.1	UDP	98 1500 → 1	1500 Len=56	0001 CC	0 01 02 03	C4 C5 C0	Can2EthRoutingTable_1
13	0.002094492	4c:4c:4	43:45:41:40	6 66:55:44:33	: ACF-CAN	90 ACF-CAN	(1): 0x0000	0019 c6	) c1 c2 c3	c4 c5 c6	g7 c8 c9 ca cb cc cd c
14	0.002224094	4c:4c:4	13:45:41:40	66:55:44:33	: ACF-CAN	94 ACF-CAN	(1): 0x0000	001e c0	c1 c2 c3	C4 C5 C6	c7 c8 c9 ca cb cc cd c
66:5	5:44:3	3:	ACF-	CAN	82	ACF-CAN	1(1):	0x0	00000	90f	Can2EthRoutingTable_2
127.0	9.0.1		UDP		98	1500 →	1500	Len	=56	-	08 09 0a 0b 0c 0d 6 08 09 0a 0b 0c 0d 6
66:55	5:44:3	3:	ACF-	CAN	90	ACF-CAN	(1):	0x0	00000	919←	48 49 4 Can2EthRoutingTable_3
66:5	5:44:3	3:	ACF-	CAN	94	ACF-CAN	1(1):	0x0	00000	91e 🔨	48 49 4a 4b 4c 4d 4
66:5	5:44:3	3:	ACF-	CAN	102	ACF-CAN	1(1):	0x0	00000	923	48 49 th Can2EthRoutingTable_4
a6:b	5:c4:d	3:	ACF -	CAN	474	ACF-CAN	1(1):	0x0	00000	90a	9 00 00 00 00 00 00 88
29	0.005193072	40.40.4	13.4J.41.4	00.33.44.33	ACT CAN	34 ACF-CAN	(1). 0X0000	0010 00	01 02 03	04 05 00	27 88 Can2EthRoutingTable 5
31	0.005732822	40:40:4	43:45:41:40	66:55:44:33	ACF-CAN	82 ACF-CAN	(1): 0x0000	0023 80	) c1 c2 c3	c4 c5 c6	c7 c8 c9 ca cb cc cd c
32	0.005918077	127.0.0	9.1	127.0.0.1	UDP	98 1500 → 3	1500 Len=56			/	0 054 D 11 T 11 0
33	0.006038798	40:40:4	13:45:41:40	66:55:44:33	: ACF-CAN	90 ACF-CAN	(1): 0x0000	0019 c6	c1 c2 c3	c4 c5 c6	CanzetnRouting Table_0
34	0.006174178	40:40:4	43:45:41:40	66:55:44:33	ACF-CAN	102 ACF-CAN	(1): 0X0000 (1): 0X0000	0010 00	c1 c2 c3	C4 C5 C6	c7 c8 c9 ca cb cc cd c
36	0.006603221	4c:4c:4	43:45:41:4	a6:b5:c4:d3	: ACF-CAN	474 ACF-CAN	(1): 0x0000	000a 00	0 01 02 03	04 05 06	07 08 09 0a 0b 0c 0d 6
1 27	0 006773838	40.40.7	12-15-11-11	R	· ACE.CAN	83 ACE-CAN	(1) · Avaaaa	000+ 00	0 01 02 03	01 05 06	AT AR AG As Ah Ar Ad r

Figure 33. Capturing CAN2ETH frames on Wireshark

#### Using CAN2CAN, CAN2ETH and ETH2CAN Features of LLCE on S32G, Rev. 1, 03/2023

For ETH2CAN, you can play it with CAN2ETH setup as is. Running the same elf file as CAN2ETH (use same cmm also), LLCE performs ETH2CAN. If you will simply send back the CAN2ETH UDP packet to S32G, you can play the UDP ETH2CAN example easily.

At first, export PCAP based on the captured CAN2ETH UDP packet (sent via Can2EthRoutingTable\_2). As below, on Wireshark, select the CAN2ETH UDP packet and File-Export Specified Packets. This creates PCAP to send back to S32G.

	Wireshar	k · Export Spe	ecified Pac	kets					8
Look in: 📄 /hon	ne/nxp/ETH2CAN			- (	3 0	0	<b></b>	::	
Computer	Name IEEE1722-example. UDP_capture.pcap	• S	iize 194 bytes 138 bytes	Type pcap F pcap F	ile	Date 2023 2023	Moo 8/02/ 8/02/	difie '06 : '06 :	
File name: UDP_ca	pture.pcap ark/tcpdump/ pcaj	0		Compro	c with			Sa Can	ve Icel
r deket Hunge	0 C	aptured 💿 Di	splayed	compre.	55 WILL	i <u>gz</u> ip			
<ul> <li><u>All packets</u></li> <li><u>Selected packet</u></li> <li><u>Marked packet</u></li> <li>First to last me</li> <li><u>Range:</u></li> <li>Remove ignored</li> </ul>	ets only ts only arked ed packets	77 1 0 0 0 0	77 1 0 0 0						

Figure 34. Export PCAP of captured CAN2ETH UDP

Then, send back the UDP packet to S32G using the exported PCAP. For example, you can send the packet using tcpreplay as below.



Figure 35. Send back UDP CAN2ETH packet to S32G

Then, you will see the CAN frame on LLCE\_CAN1 unpacked from the ETH2CAN UDP packet.



Figure 36. ETH2CAN unpacked CAN frame

As for IEEE1722 ETH2CAN example, if you connect multiple CAN channels, you can see more routed CAN frames.

If you send the packet generated from bundled PCAP "IEEE1722-example.pcap" to PFE\_MAC1, LLCE parses it and unpacks the encapsulated CAN frames to each destination according to the ACF CAN msg information embedded in the packet (i.e. all odd CAN channels). If you connect all odd CAN channels to the companion CAN channels (e.g. even channels), you can observe all unpacked CAN frames from the IEEE1722 Ethernet frame.



Figure 37. IEEE1722 ETH2CAN routing example

If you capture the odd CAN buses with Logic Analyzer, you can see the routed CAN frames.



Figure 38. Routed CAN frames

This section explains how to configure essential items for customization of CAN2CAN/CAN2ETH/ETH2CAN. Import the EB-Tresos configuration delivered in the sample app as a template, then customize it.

#### NOTE

This section is based on the sample app config latest release as of February 2023. (i.e. S32G\_LLCE\_GATEWAY\_1.0.5\_QLP1\_D2302.exe).

### 4.1. Importing the sample config

Run EB-Tresos Studio and import sample config.



Import Select Create new projects from an archive file or directory.	×	Import Import Projects Select a directory to search Select root directory: Contexture to fine	5. Click Browse for existing Eclipse projects.	Browse
Select an import wizard:		<u>Projects:</u>		B <u>r</u> owse
v ➢ General ➢ Existing Projects into Workspace ✓ ➢ CVS ➢ Projects from 2				<u>S</u> elect All Deselect All R <u>e</u> fresh
<ul> <li>A. Ch</li> <li>2. Click "Existing</li> <li>Projects into</li> <li>Workspace"</li> </ul>	eck "Copy	Options Search for nested proje Copy projects into work Hide projects that alrea	nto workspace" cts kspace dy exist in the workspace	
3. Click Next		Working sets	g sets 🗸 🗸	Ne <u>w</u> S <u>e</u> lect
Cancel		? <	<u>Back N</u> ext > <u>F</u> inish	Cancel

Figure 39. Importing file

In case of CAN2CAN, import the following file. Choose "tresos\_s32g3" or "tresos\_s32g2" according to your target, and then, select "Tresos\_CAN2CAN\_Project".



Figure 40. Importing CAN2CAN config file

In case of CAN2ETH and ETH2CAN, choose "tresos\_S32G2" or "tresos\_S32G3" depending on your target.



Figure 41. Importing CAN2ETH and ETH2CAN config file

To import sample configuration, browse and select the root directory, click on finish. Refer to the following screenshot.

B Import				×	
mport Projects Select a directory to sea	rch for existing Eclipse projects.		T		
Select root directory: Select archive file: Projects:	C:\NXP\S32G_LLCE_1_0_5_QLP1\sample_app	~	Browse	<b>e</b>	
Sample_App_LL	TE_CAN2CAN_S32G3 (C:\NXP\S32G_LLCE_1_0_3	5_C	Select Deselect Refres	All t All	
Coptions Search for nested pr Copy projects into w Hide projects that al	ojects orkspace ready exist in the workspace	>			
Working sets Add project to work Working sets:	cing sets	8	New	lick	: Finis
?	< Back Next > Finish		Cance	el	

Figure 42. Importing sample configuration

To rename the imported project config right click and select Rename. Enter the new name in the dialog box and click OK.



Figure 43. Renaming the imported project

Every time you start configuration on the Tresos studio, you need to load config.



Figure 44. Restarting and selecting the config

### 4.2. Configure LIce\_Af for CAN2CAN

In Configure Can2CanRoutingTable follow the steps to configure Llce\_Af.

- 1. Double click Llce\_Af.
- 2. Select Can2CanRoutingTable Tab.
- 3. You can add/delete these for your CAN2CAN use case. In order to configure routing details, double click the entry index.

EB tresos 27.1.0 - workspace: C:\EB\tresos_27\workspace	- install: C:\EB\tresos_27
File Edit Search Project Window Help	
🖆 •   🔚   🎯 • ! 🕊 隆 • ! 🞺 🗠 ! 🥔 • ! 🗇 • !	⇒ ▼
🎦 Project Explorer 🕱 🛛 🕞 🤹 🗸 🖓 🗖	Lice_Af (Lice_Af)
✓ If Your_customized_config ^ ✓ Itest_lice (CORTEXM, S32G3XXM7)	Lice_Af
>	Name ≽ Lice_Af
>      @ Dem (V4.0.0, 454, 40)     Secure (V4.0.1, 114, 114, 114, 114, 114, 114, 114, 1	General CanAdvancedFeature Can2CanRoutingTable Can2EthRoutingTable Eth2Can Published Information
>	Can2CanRoutingTable
> 🕸 Mcu (V4.0.0, AS4.4.0)	Index 🍃 Name 🕱 Convert destination to CAN 🕅 Convert destination to CAN FD if possible
> W Os (V4.0.0, AS4.4.0)	0 🗁 Can2CanRoutingTable_0 🧏 🗌
> Platform (V4.0.0, AS4.4.0)	1 🗁 Can2CanRoutingTable_1 🧏 🗌 🛛 🕅
> W Port (V4.0.0, AS4.4.0)	2 😂 Can2CanRoutingTable_2 🛛 🗹
> Config	3 🗁 Can2CanRoutingTable_3 🚯 🗌 🙀 🔂

Figure 45. Configuring Llce\_Af

In CanDestinationList, configure routing destinations.

- 1. Select CanDestinationList
- 2. Select the destination channel from the pull-down list. If the desired channel is missing in the list, you should add it on the Can\_43\_Llce/CanController (as explained in the section "Configure CanController")
- 3. You can add/delete entries for the destination. Now there is only 1 destination in this list hence this routing is unicast. If you add destination, the corresponding routing will be multicast routing.

*Lice_Af (Lice_Af)      ⊗		
Can2CanRoutingTable		
Name 🗁 Can2CanRoutingTable_0		
General CanDestinationList		
CanDestinationList		
Index 🗁 Name	Can Controller Reference	
0 🗁 CanDestinationList_0	/Can_43_LLCE/Can/CanConfigSet_0/CanController_15	
3.	2.	



Configure routing details in General Tab.



Figure 47. Configuring the General tab

You should ensure that the configured Can2CanRouting is referred from CanAdvancedFeature table. Follow the steps given below.

- 1. Click home icon.
- 2. Select CanAdvancedFeature.
- 3. You can add/delete these entries. Note these entries are referred from Hardware Receive Handle, which will be configured in Can\_43\_LLCE/CanHardwareObject.
- 4. Select the routing table from the pull-down list.

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vancedFeature Can2CanRo	outingTable Can2Eth	RoutingTable Etha	Can Published Inf	ormation					
							A 8 1 4 10 10	9 / 11/	1.4
vancedFeature							T ♦   ₱ A III		10
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CanAdvancedFeature 2	3	3	36	8	6	0 @ /	/Lice_Af/Lice_Af/LiceAfGeneral/Can2CanRoutingTable_2	@	
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CanAdvancedFeature_3	<b>B</b>		36	<b>16</b>	1D	0 @ /	Lice_Af/Lice_Af/LiceAfGeneral/Can2CanRouting lable_3	(a)	
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### 4.3. Configuring Lice\_Af for CAN2ETH

In Configure Can2EthRoutingTable follow the steps to configure Llce\_Af.

#### Using CAN2CAN, CAN2ETH and ETH2CAN Features of LLCE on S32G, Rev. 1, 03/2023

- 1. Double click Llce\_Af.
- 2. Select Can2EthRouting Table Tab.
- 3. You can add/delete these for your CAN2ETH use case. In order to configure routing details, double click the entry index.

	✓		
	ECU (CORTEXM, S32G3XXM7)		
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	B Cap 42 LLCE (V10.5, AS4.4.0)		
	Ser Call_45_LECC (V1.0.5, A54.4.0)		
	> 🦉 Dem (V4.0.0, AS4.4.0)		
Use Af/Use A0 ↔	> 🖞 EcuC (V4.0.0, AS4.4.0)		
Dice_Ar(Lice_Ar) &	>   EcuM (V4.0.0, AS4.4.0)		
Lice_Af	>   Eth_43_PFE (V1.0.0, AS4.4.0)		e
	🖌 🖳 🕸 Llce_Af (V1.0.5, AS4.4.0)		
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Figure 49. Configuring Llce\_Af

As for the EncapsulationType, you can choice as following.

AVTP\_NTSCF\_BRIEF : IEEE1722 ACF\_CAN\_BRIEF on the Non- Time-Synchronous Control Format

AVTP\_NTSCF\_FULL: IEEE1722 ACF\_CAN on the Non-Time-Synchronous Control Format

AVTP\_TSCF\_BRIEF : IEEE1722 ACF\_CAN\_BRIEF on the Time-Synchronous Control Format

AVTP\_TSCF\_FULL: IEEE1722 ACF\_CAN on the Time-Synchronous Control Format

As for Buffer Size, if you want to pack *N* ACF msg in one IEEE1722 CAN2ETH packet, use the following formula to calculate the buffer size.

In case of the ACF\_CAN\_BRIEF on the Non- Time-Synchronous Control Format, the Buffer size should be equal or larger than

26+(N-1)\*(8+can\_msg\_payload) -1 + 72

and less than

26+N\*(8+can\_msg\_payload) -1+72

In case of the ACF\_CAN on the Non-Time-Synchronous Control Format, the Buffer size should be equal or larger than

 $26+(N-1)*(16+can_msg_payload) -1 + 80$ 

and less than

26+N\*(16+can\_msg\_payload) -1+80

In case of the ACF\_CAN\_BRIEF on the Time-Synchronous Control Format, the Buffer size should be equal or larger than

 $40+(N-1)*(8+can_msg_payload) -1 + 72$ 

and less than

 $40+N*(8+can_msg_payload) -1+72$ 

In case of the ACF\_CAN on the Time-Synchronous Control Format, the Buffer size should be equal or larger than

40+(N-1)\*(16+can\_msg\_payload) -1 + 80

and less than

 $40+N*(16+can_msg_payload) -1+80$ 

#### NOTE

"can\_msg\_payload" is the term of Abbreviated CAN/CAN FD message for IEEE-1722 ACF message. It should be 0 - 16 quadlets.

For example, if you want to pack 10 ACF msg / packet (DLC=1) in ACF\_CAN\_BRIEF on the Non-Time-Synchronous Control Format, the Buffer size should be equal or larger than 205 (i.e. 26+9\*(8+4) - 1 + 72) and less than 217 (i.e. 26+10\*(8+4) - 1+72).

The buffer count depends on a multitude of factors. It is not that easy to calculate exact values without some experimentation.

- There might be a risk data will be over-written when more Can frames arrive before the Eth frame is sent
- Multiple input buses

### 4.4. Configuring Can controller

In the following example config, BCAN0,1,14 and 15 are configured in default. Follow the steps to add BCAN.

- 1. Double click Can43\_LLCE.
- 2. Select CanController tab.
- 3. Select CanController\_15 for example.
- 4. Click Duplicate icon.

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Figure 50. Configuring BCAN (one)

- 5. Select BCAN at column "Can Hardware Channel".
- 6. Set sequential number at column "Can Controller ID" (4 in this case.).
- 7. Double click the index column of the added element.



Figure 51. Configuring BCAN (two)

- 8. Select CanControllerBaudrateConfig Tab.
- 9. Double click the index column of any of these. (In this explanation, choice index 0).

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✓ If Your_customized_config ✓ If test_lice (CORTEXM, S32G3XXM7)	CanController
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>      Ganif (V4.0.0, AS4.4.0)     Sent (V4.0.0, AS4.4.0)	General CanControllerBaudrateConfig
> @ EcuC (V4.0.0, AS4.4.0) > @ EcuM (V4.0.0, AS4.4.0)	CanController@audrateConfig*
<ul> <li>We Lice_Af (V1.0.5, AS4.4.0)</li> <li>Mcu (V4.0.0, AS4.4.0)</li> <li>Os (V4.0.0, AS4.4.0)</li> </ul>	Index 🇀 Name 🗟 Can Bus 📴 Can Prop 🕅 Can Time 🗟 Can Cont 🗟 Can Cont
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> (V4.0.0, AS4.4.0)	2 🖕 CanContro 🗊 40 🗊 150.0 🕅 📝 🗊 1 🗊 2 🗊 1000.0 🕞
> 🗁 config	
> 🗁 output 🗸 🗸	

Figure 52. Configuring BCAN (three)

10. Configure baud rate parameters.

1	*Can_43_LLCE (Can_43_LLCE)	
	CanControllerBaudrateConfig	
-	Name* 😕 CanControllerBaudrateConfig_0	
	General	
	Can Automatic Time Segments Calculation*	₿ □
Set prescaler value.	Can Bus Length (meters) (1 -> 5000)*	<b>a</b> 40
	Can Propagation Delay Tranceiver (ns) (0 -> 5000)*	150.0
Set baudrate	Can Time Segments Checking*	🖟 🗹 🥒 🕶
	Can Controller Prescaller*	5
	Can Controller BaudRate Config ID (0 -> 65535)*	0 · · · · · · · · · · · · · · · · · · ·
Set prop segment	Can Controller BaudRate (Kbps) (0 -> 1000)*	250.0
	Can Synchronization Segment (1 -> 1)*	₿ 1
Set Phase seg 1	Can Propagation Segment (0 -> 255)*	11
Set Phase seg 2	Can Phase Segment 1*	👔 12 🗸 🗸 🗸
5017 habb 00g 2	Can Phase Segment 2*	
Set Resynch Jump Width	Can Resynch Jump Width*	<u>₽</u> 1

Figure 53. Baud rate setting



Figure 54. Data phase baud rate setting

### 4.5. Configure Can hardware object

Follow the steps to configure message buffer related settings.

- 1. Double click Can43\_LLCE.
- 2. Select CanHardwareObject tab.

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> 05 (V4.0.0, AS4.4.0)			0	CAN_RX0	BASIC	MIXED		0 🕞	RECEIVE	B 🗆	B 🗆	@	/Can_43_L	16 📑	0
> B Post 0/4 0.0 AS4 4.0	)		1	CAN_RX1_1	FULL	<b>STANDARD</b>		1 🝺	RECEIVE	B 🗆	B 🗆	0	/Can_43_L	100 🔛	10
Recourse (VADD ASAAD	n		2	CAN_RX1_2	FULL	STANDARD		2 🝺	RECEIVE	B 🗆	B 🗆	0	/Can_43_L	100 🔛	15
> config	9		3	CAN_RX1_3	FULL	STANDARD		3 🝺	RECEIVE			0	/Can_43_L	100 🔛	20
> Contract		~	4	CAN_RX1_4	FULL	STANDARD		4 6	RECEIVE	3		@	/Can_43_L	100 🕞	25
PE Outline 12	10 10	VOR	5	CAN_RX1_5	FULL	STANDARD		5 🐻	RECEIVE	B 🗆		1	/Can_43_L	100 📄	30
	6 6	-	6	CAN_RX1_6	FULL	STANDARD		6 🕞	RECEIVE	3	B 🗆	0	/Can_43_L	100 📄	35
Post Build Variant Used:false			7	CAN_RX1	BASIC	MIXED		7 🐻	RECEIVE	B 🗆	B 🗆	@	/Can_43_L	100 🗊	0
Config variant:variantPostBuild			8	CAN_RX2	BASIC	MIXED		8 🝺	RECEIVE	36	B 🗆	0	/Can_43_L	16 📄	0
CanGeneral			9	CAN_RX3	BASIC	MIXED		9 🝺	RECEIVE	😼 🗆	3	@	/Can_43_L	100 📑	0
CanConfigset			10	CAN_RX4	BASIC	MIXED		10 🕞	RECEIVE	B 🗆		0	/Can_43_L	16 🔛	0
CanCentreller			11	CAN_RX5	BASIC	MIXED		11 🕞	RECEIVE			1	/Can_43_L	100 🗟	0
CanHardwareObject			12	CAN_RX6	BASIC	MIXED		12 🕞	RECEIVE		8	0	/Can_43_L	16	0
CanAuxFilter			13	CAN_RX7	BASIC	MIXED		13 🕞	RECEIVE	<b>B</b>	B 🗆	@	/Can_43_L	100 🗟	0
> CommonPublishedInformation			14	CAN_RX8	BASIC	MIXED		14 🔒	RECEIVE	26 -		@	/Can_43_L	16 📾	0
			15	CAN RX9	BASIC	MIXED		15 6	RECEIVE	8	8	@	/Can_43_L	100	0
			16	CAN RX10	BASIC	MIXED		16	RECEIVE	8		6	/Can 43 L	16 😭	0

- 3. Select ID mask BASIC : ID mask enabled. FULL: Exact ID match.
- 4. Select CAN frame ID type STANDARD / EXTENDED.

#### Using CAN2CAN, CAN2ETH and ETH2CAN Features of LLCE on S32G, Rev. 1, 03/2023

- 5. Object Handle ID. Should start with 0 and continue without any gaps.
- 6. Select MB Type. RX or TX.

Na	me of		cPartitionRef	Can	MainFunctionRWPeriods Can	Cont	roller CanHardwareObje	t F	ublished Information			
the	object	-										
	Car	Har	dwareObject	_							) 🕂 🗙 🗎	2 0 1
	Index	6	> Name		Can Implementation Type		Can ID Message Type	121	Can Object ID (MB Handle)		Can MB Type	
	15	0	CAN_RX12	B	BASIC	B	STANDARD		15		RECEIVE	
	16	B	CAN_RX13		FULL		STANDARD		16		RECEIVE	
	17	B	CAN_RX14	6	BASIC		STANDARD		17		RECEIVE	
	18	e	CAN_RX15		FULL	B	STANDARD		18	B	RECEIVE	
	19	e	CAN_TX0	6	BASIC		STANDARD		19		TRANSMIT	
	20	e	CAN_TX1	6	BASIC	B	STANDARD		20		TRANSMIT	
	21	0	CAN_TX2	6	BASIC	B	STANDARD		21		TRANSMIT	
	22	B	CAN TX3	R	BASIC		STANDARD		22		TRANSMIT	

- 7. MAC feature: Not available for standard enablement FW.
- 8. Enables polling of the object.
- 9. Specify which CanController has the object

Gene	al CanEcucPartitionRef	CanMainFunctionRWPeriod	CanController	CanHardwareObje	ct CanAuxFilter	Published Information	
	CanHardwareObject					<b>↑ ↓   + × </b> ⊡	8/11 📩
	X Add MAC code to	o transmitted frames.	Hardware Ob	ject Uses Polling	Can Control	ler Reference	^
	<b>X</b>	🔒 🗌	]		/Can_43_LLCE	/Can/CanConfigSet/Car	nController_0
	🔏 🗆	🔏 🗆	]		/Can_43_LLCE	/Can/CanConfigSet/Car	nController_1
	🔏 🗆	🔏 🗆	]		/Can_43_LLCE	/Can/CanConfigSet/Car	nController_1
	🔏 🗆	🔏 🗆	]		/Can_43_LLCE	/Can/CanConfigSet/Car	nController_1
	🔏 🗆	🔀 🗆	]		/Can_43_LLCE	/Can/CanConfigSet/Car	nController_1
		🔀 🗆	]		/Can_43_LLCE	/Can/CanConfigSet/Car	nController_1
		🔀 🗆	]		/Can_43_LLCE	/Can/CanConfigSet/Car	Controller_1
	🔏 🗆	🔏 🗆	]		/Can_43_LLCE	/Can/CanConfigSet/Car	nController_1
			1		@ (Cap 42 LLCE	ICan/CanConfigSet/Car	Controller 2

- 10. Number of hardware objects used to implement the object handle. It means that the number of message buffers which are assigned to the object handle.
- 11. Specify (together with the filter mask) the frame ID that passes the hardware filter for the RX object.

銜

12. Specify (together with the Filter Code) the range that passes the hardware filter for the RX object.

eneral	CanEcucPartitionRef	CanMainFunctionRWPeriods 0	CanCont	troller CanHardwareO	bject	Published Informatio	n 🕻
	CanHardwareObject			÷.	+	× 🗈   & 🖉 🗹	i 📩
12	Number of Hw obj	ects used to implement one HO	H	Can Hw Filter Code	12	Can Hw Filter Mask	^
12		1	6 🔒	0		0	6
121		10	0	10	122	4294967295	6
121		1	6 🔒	0		0	6
123		10	0	10	12	4294967295	6
123			8 🔒	0		0	6
123			8 🔒	0		0	6
			8 🗟	0		0	F

- 13. Specify that this filter is of range type. This over-rides the information in the standard CanHwFilter. If enabled, the filter will accept IDs from RangeStart to RangeEnd.
- 14. Specify which CanAdvancedFeature is used for the RX object. The host should take care of the RX objects which do not have any reference here.

ieneral	CanEcucPartitionRef	CanMai	nFu	nctio	nRWPeriods	CanControlle	r Ca	anl	HardwareObject Published Information	
	CanHardwareObject								↑ ↓   <b>+ × ⊡   &amp; / ⊠</b>   d	5
12	Filter range start (in	cluded)		12	Filter range	end (included	)	D)	Can LLCE Advanced Feature Reference	
123		0	12			429496729	5 @	)		
12		0	12			429496729	5 @	1	/LIce_Af/LIce_Af/LIceAfGeneral/CanAdvancedFeature_0	
121		0				429496729	5 @	1		
12		0	12			429496729	5 @	1	/LIce_Af/LIce_Af/LIceAfGeneral/CanAdvancedFeature_0	
12		0	12			429496729	5 @	1		
12		0	121			429496729	5 @	1		

# 5. Configuring on S32CT

This section explains how to configure essential items on S32CT for customization of CAN2CAN. After installing RTD and the LLCE complex driver, you can open CAN2CAN sample app project on S32DS which has same behavior as this document already described in previous sections. This section guides how to build and play it. It then describes how to config it with S32CT instead of EB Tresos.

#### NOTE

This section is based on the sample app config of the latest release as of February 2023. (i.e. S32G\_LLCE\_GATEWAY\_1.0.5\_QLP1\_D2302.exe ).

### 5.1. Installing S32DS 3.5, RTD and LLCE drivers

The following four software packages needs to be downloaded and installed.

- S32 Design Studio v3.5 installer
- S32 Design Studio 3.5.1 development packages for offline use, support for S32G
- S32G Real Time Drivers Version 4.0.0 Update Site
- S32G\_LLCE\_GATEWAY\_1.0.5\_QLP1\_D2302

Go Flexera, download the S32DS3.5 installer and install it.

You are a member of n	studio IDE > S32 Design Studio for S32 Platform v nultiple licensing accounts and are currently	3.5 : Files viewing Masataka Yakashiro S	Software Account. (Switch Account)	
Software & Support	Desident Descriptional			
Product List	Product Download			
Product Search	S32 Design Studio for S32 Platfo	rm v.3.5		
Order History	Files License Keys Notes		@ Downlo	ad Help
Recent Product Releases	License Keys Woles			
Recent Updates	Note: For Windows OS, the user account desi be a member of the local Administrators secur	gnated for installing S32 Design Stu ty group.	dio for the S32 Platform must	
Licensing	Show All Files			8 Files
License Lists				01100
Offline Activation	+ File Description	File Size	File Name	\$
	+ S32 Design Studio 3.5 development packages	for offline use 4.6	GB & SW32_S32DS_OfflineDevPack_3.5.0_D220	07.zip.zip
				and the second
FAQ	+ S32 Design Studio 3.5 Release Notes	73	KB # S32DS_Release_Notes.pdf	
FAQ Download Help	+ S32 Design Studio 3.5 Release Notes + S32 Design Studio 3.5.1 development package for S32G	73 s for offline use, support 2	KB         S32DS_Release_Notes.pdf           GB         SW32G_S32DS_3.5.1_D2210.zip	
FAQ Download Help Table of Contents	S32 Design Studio 3.5 Release Notes     S32 Design Studio 3.5.1 development package     for S32G     S32 Design Studio 3.5.1 development package     for S32R45	73 s for offline use, support 2 s for offline use, support 3.5	KB         \$\$ \$32D\$_Release_Notes.pdf           GB         \$\$ \$W326_\$32D\$_3.5.1_D2210.zip           GB         \$\$ \$W32R45_\$32D\$_3.5.1_D22010.zip	
FAQ Download Help Table of Contents FAQs	+ S32 Design Studio 3.5 Release Notes     + S32 Design Studio 3.5.1 development package     for S32G     + S32 Design Studio 3.5.1 development package     for S32R45     + S32 Design Studio Installation Guide	73 s for offline use, support 2 s for offline use, support 3.5	KB         \$\$ \$32D\$_Release_Notes.pdf           GB         \$\$ \$W32G_\$32D\$_3.5.1_D2210.zip           GB         \$\$ \$W32R45_\$32D\$_3.5.1_D22010.zip           MB         \$\$ \$32D\$\$_Installation_Guide.pdf	
FAQ Download Help Table of Contents FAQs	+ S32 Design Studio 3.5 Release Notes     + S32 Design Studio 3.5.1 development package     for S32G     + S32 Design Studio 3.5.1 development package     for S32R45     + S32 Design Studio Installation Guide     + S32 Design Studio v3.5 Linux installer	73     s for offline use, support     2     s for offline use, support     3.5     1.4     1.3	KB ▲ S32DS_Release_Notes.pdf           GB ▲ SW32G_S32DS_3.5.1_D2210.zip           GB ▲ SW32R45_S32DS_3.5.1_D22010.zip           MB ▲ S32DS_Installation_Guide.pdf           GB ▲ S32DS_3.5.5_b220726_linux.x86_64.bin	
FAQ Download Help Table of Contents FAQs	+ S32 Design Studio 3.5 Release Notes     + S32 Design Studio 3.5.1 development package     for S32G     + S32 Design Studio 3.5.1 development package     for S32R45     + S32 Design Studio Installation Guide     + S32 Design Studio v3.5 Linux installer     + S32 Design Studio v3.5 Windows installer	73 s for offline use, support 2 s for offline use, support 3.5 1.4 1.3 1.6	KB ▲ S32DS_Release_Notes.pdf         GB ▲ SW32G_S32DS_3.5.1_D2210.zip         GB ▲ SW32R45_S32DS_3.5.1_D22010.zip         MB ▲ S32DS_Installation_Guide.pdf         GB ▲ S32DS_3.5_b220726_linux.x86_64.bin         GB ▲ S32DS.3.5_b220726_win32.x86_64.exe	

Figure 55. Downloading S32DS3.4

Download the S32 Design Studio 3.5.1 development package for S32G family.

#### **Configuring on S32CT**

	UCTS	APPLICATIONS	DESIGN	SUPPORT	CON	IPANY	Q :	Search nxp.com	0
NXP > Design > S32 Design Stu You are a member of mu	idio IDE > ! Iltiple lice	S32 Design Studio for nsing accounts an	or S32 Platform	v.3.5 : Files viewing				Switch Account)	
Software & Support Product List	Pro	oduct Dov	vnload						
Product Search	<b>S</b> 32	Design Studio f	for S32 Platf	orm v.3.5					
Order History Recent Product Releases	Files	License Keys	Notes user account des	ignated for instal	lina S32	Desian Studi	o for the S32 Platform	<u> O Download He</u> must	1 <u>p</u>
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	+ \$32	2 Design Studio 3.5 dev	elopment package	s for offline use		4.6 G	B # SW32_S32DS_Of	flineDevPack_3.5.0_D2207.zip.	lip
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Download Help	+ S32	2 Design Studio 3.5.1 de S32G	evelopment packag	jes for offline use,	support	2 G	B 🛓 SW32G_S32DS_3	3.5.1_D2210.zip	
Table of Contents	+ \$32 for \$	2 Design Studio 3.5.1 de S32R45	evelopment packag	ges for offline use,	support	3.5 G	B 🛓 SW32R45_S32DS	3.5.1_D22010.zip	
FAQs	+ S32	2 Design Studio Installat	tion Guide			1.4 M	B 🕂 S32DS_Installatio	n_Guide.pdf	
	+ \$32	2 Design Studio v3.5 Lir	nux installer			1.3 G	B 🕹 \$32D\$.3.5_b2207	26_linux.x86_64.bin	_ \
	+ \$32	2 Design Studio v3.5 Wi	ndows installer			1.6 G	B 4 S32DS.3.5_b2207	26_win32.x86_64.exe	_ \
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+ S32 Design Studio 3 for S32G	3.5.1 de	evelopment pac	kages for of	fline use, suj	pport		2 GB <u>4</u> SW3	32G_S32DS_3.5.1_E	)2210.zip

Figure 56. Update for support of S32G2 family

Download the S32G Real Time Drivers Version 4.0.0 Update Site .

You are a member of m	ultiple licensing accounts and are currently viewing	(Switch Account)
Software & Support Product List	Product Download	
Product Search	S32 Real-Time Drivers Version 4.0.0	
Order History	Files License Keys Notes	O Download Help
Recent Product Releases		
Recent Updates	Show All Files	12 Files
Licensing	+ File Description	File Size C File Name
License Lists	+ apache_license.bt	11.3 KB 🛓 apache_license bt
0.00	+ SW32G_S32CT_1.6.3_D2210_ReleaseNotes.bd	5.1 KB & SW32G_S32CT_1.6.3_D2210_ReleaseNotes.bt
Omine Activation	+ SW32G_S32CT_1.6.3_D2210_ReleaseNotes_updated_230224	5.4 KB & SW32G_S32CT_1.6.3_D2210_ReleaseNotes_updated_230224.bd
FAQ	+ SW32_RTD_4.4_4.0.0_D2210.exe	64.2 <u>\$SW32_RTD_4.4_4.0.0_D2210.exe</u> MB
Table of Contents	+ SW32_RTD_4.4_4.0.0_D2210_QualityPackage.zip	49.3 <u>\$SW32_RTD_4.4_4.0.0_D2210_QualityPackage.zip</u> MB
FAQs	+ SW32_RTD_4.4_4.0.0_D2210_QualityPackage_updated.zip	49.3 <u>SW32_RTD_4.4_4.0.0_D2210_QualityPackage_updated.zip</u> MB
	+ SW32_RTD_4.4_4.0.0_D2210_QualityPackage_updated_D2302224.zip	p 250.1 <u>\$</u> SW32_RTD_4.4_4.0.0_D2210_QualityPackage_updated_D2302224 KB
	+ SW32_RTD_4.4_4.0.0_D2210_ReleaseNotes.pdf	2.1 MB & SW32_RTD_4.4_4.0.0_D2210_ReleaseNotes.pdf
	+ SW32_RTD_4.4_4.0.0_D2210_ReleaseNotes_updated_D230224.pdf	1.1 MB & SW32_RTD_4.4_4.0.0_D2210_ReleaseNotes_updated_D230224.pd
	+ SW32_RTD_4.4_4.0.0_D2210_SafetyPackage.zip	1.2 MB & SW32_RTD_4.4_4.0.0_D2210_SafetyPackage.zip
	+ SW32_RTD_4.4_4.0.0_D2210_SCR.bd	2.1 KB & SW32_RTD_4.4_4.0.0_D2210_SCR.td
	+ SW32_RTD_4.4_4.0.0_DS_updatesite_D2210.zip	143.7 § SW32_RTD_4.4_4.0.0_DS_updatesite_D2210.zip MB

Figure 57. Downloading S32G Real Time Drivers Version 4.0.0 Update Site

As for S32G\_LLCE\_GATEWAY\_1.0.5\_QLP1\_D2302, assuming you already installed in your PC. The update site file is located under the installed folder.

#### Configuring on S32CT



Figure 58. LLCE update site

After installing S32DS3.5, add the downloaded three zip files (S32DS3.5.1 Devlopment package for S32G, RTD4.0.0 updatesite and LLCE1.0.5\_updatesite.) in the S32DS.



#### Configuring on S32CT

🔡 Preferences			— 🗆 X			
type filter text	S32DS Extensi	ons and Updates	⇔ ▼ ⇔ 🖇			
> General > C/C++ > Help	<ul> <li>Show "S32DS</li> <li>Automatically</li> <li>Show Unsuital</li> </ul>	Extensions and Updates" window on star find new updates and notify me ole Packages Dialog	tup	Proferences		- • × ]
> Install/Update > Java				Freierences		
Repeat it	until all	3 files are adde	iloaded zij id. <sub>  </sub>	O TIIE. <sub>eral</sub> > C/C++ > Help	Show "S32DS Extensions and Updates" window or Automatically find new updates and notify me Show Unsuitable Packages Dialog	startup
<ul> <li>&gt; Run/Debu</li> <li>S32 Confiç Name</li> <li>S32 Desig Location: jar:file:/C:/User</li> <li>Collater</li> <li>NXP Lic</li> <li>OK</li> <li>S32 Do</li> </ul>	s/ezq03/Downloads	/SW32G_S32DS_3.5.1_D221C Archiv	e	<ul> <li>Install/Update</li> <li>Java</li> <li>JavaFX</li> <li>Memory Analyzer</li> <li>Remote Development</li> <li>Remote Systems</li> </ul>	Update schedule Update schedule Update schedule Updates on the following schedule: Once a day	S32 Platform is started
532 De 532D5 532D5	Available 532D5	OK Cancel		<ul> <li>Run/Debug</li> <li>S32 Configuration Tools</li> <li>S32 Design Studio for S32 Platform</li> </ul>	Overlap http	
SDK Management	Name ^	Location	Add	Collateral Server	Try to use https protocol if http is not available	
> Terminal	AMMCLIB	http://www.nxp.com/lgfiles/update	7100011	NXP Licenses		
Validation	PnE Micro	http://www.pemicro.com/eclipse/u	Add All	S32 Debugger	Timeout for network connection	
> Version Control (Team)	RTD	http://www.nxp.com/lgfiles/update	Edit	S32DS Extensions and Updates	Use timeout for network connection Timeout,s: 0	
> XML	S32DesignSt	http://www.nxp.com/lgfiles/update	Demons	SDK Management	Available S32DS Software Sites	
> Apand			Remove	Software Analysis	Name Location	Add
				> Terminal	AMMCLIB http://www.nxp.com/lgfiles/update	Add All
		Restore Defaul	ts Apply	Validation	PnE Micro http://www.pemicro.com/eclipse/u.	
		5	After 3 zip	files are added.	Click "Apply and Clos	Se" Edit
? è d		Apply and Close	Cancel	> Xpand	jar:file:/C:/NXP/S32G LLCE 1 0 5 Q	Remove
					iarfile/C/Users/ezn03/Downloads.	
					Restore D	efaults Apply
				? è 4	Apply and C	lose Cancel

Figure 59. Adding the downloaded zip files

Installing the S32 Design Studio 3.5.1 with support for S32G family. Please follow the below steps.

- 1. Click on Help and select S32DS Extensions and Updates.
- 2. Select following extensions:
  - GCC 9.2 build 1649
  - GCC 10.2 build1728
  - Platform pkg.
  - Platform Tools pkg.
  - S32G Dev. Pkg.
- 3. Click "Install/Update 5 item(s)".



	ιþ		2. Select follow	ving extensions.
Window	Hel	p		
	• 7 22	Getting Started Help Contents Search Show Contextual Help	GCC 10.2 build 1728	NXP GCC for Arm Ems v10.2 build 1728 version: 1728
	8.	Show Active Keybindings Ctrl+Shift+L Tips and Ticks Chest Sheets Check for Updates	GCC 9.2 build 1649	NXP GCC for Arm Emrs v9.2 build 1649 version: 1649
2 D	64 10 10	Install New Software Install stion Details S32DS Entransion and Undates	Platform pkg.	S32 Design Studio Platform package version: 3.5.0
	Gen	About 532 Design Studio for 532 Pletform NOP Licenses ming oranical minima program orange or 32 Platform is your first time usion S12 Design Studio for S12 Platform	Platform Tools pkg.	S32 Object available S32 Design Studioform Tools package version: 3.5.0
3. (	Cli	ick "Install/Update 5 item(s)".	<mark>S32G Dev. Pkg.</mark>	S32G development package version: 3.5.1
			P Install/Update 5 i	item(s)

Figure 60. Steps to update support for S32G family

4. Click on Next and in the next window and select "I accept...". Click finish to complete the installation. A pop up window appears to restart S32DS, click Yes.



Figure 61. Steps to finish S32DS for S32G2 family

Using CAN2CAN, CAN2ETH and ETH2CAN Features of LLCE on S32G, Rev. 1, 03/2023

### 5.2. Installing LLCE driver and RTD on S32DS

To install LLCE driver follow these steps:

- 1. Select LLCE1.0.5, S32 RTD 4.0.0, S32G2 RTD4.0.0 and S32G3 RTD 4.0.0 on "S32DS Extensions and Updates" window.
- 2. Click "Install/Update 4 item(s)" and click Next.
- 3. Select "I accept..." and click on Finish. A pop up window appears to restart S32DS, click Yes.

	332DS Extensions and Updates		3.0	Click Next
	S32DS Extensions and Updates			
1.Select these 4 or	n "S32DS Extensions ar	d Updates	" window.	Always show at startup < Back Next > Finish Cancel
	GNU ARM PEMin miars reveion 5.1.7	S32G3 RTD AUersio	Dn 4.0.0	
LLCE 1.0.5	S32 ULCE 1.0.5 for S32G version: 1.0.5	The S32 Real-Time Driver compliant. The S32 Real-Time Driver	S32DS Extensions and Updates Licenses: > ATTACHMENT A - NKP 532 PLATFORM SOFTWARE LICENSE AC	License Helt GREEMENT v17 August 2 ATACHMENT A - NOP 532 PLATFORM SOFTWARE LICENSE
	Radar extension package for \$32R45	non-AUTOSAR environme drivers designed to simplif development on NXP micr	> NKP Automotive Software License Agreement v1.8 1 1	AGREEMENT v1.7 August 2022 IMPORTANT. Read the following NOP 512 Platform Software License Agreement? Completely. By selecting the "I Accept" button at the end of this page, or by downloading, installing, or
S32 RTD4.0.0	S32 RTD AUTOSAR 4.4 Version 4.0.0	S32G378A     S32G379A		4. Select "I accept"
	S32 SDK for S32S247TV Versi 0.8.0 EAR with Patch 0.8.1 version: 0.8.1	S32G379A     S32G398A     S32G399A     S32G399A     S32G338M		terms and coholds that is the software embedded anywhere in the Software or of this Agreement shall control, if a summary of the Software has been signed by a software of the Software has been software the has been
	S32 SDK for S32V23x Version 1.0.0 RT/M with Patch 1.0.1	<ul> <li>S32G339M</li> <li>S32G358A</li> <li>S32G358A</li> </ul>		I accept the terms of the license agreements     I do not accept the terms of the license agreements
S32G2 RTD4.0.0	S32G2 RTD AUTOSAR 4.4 Version 4.0.0	This package includes:	٢	Always show at startup < Back Finish Cancel
S32G3 RTD4.0.0	S32G3 RTD AUTOSAR 4.4 Version 4.0.0	New Project Wizard     New Project from Ex     User and Integration	support camples 5	Click Finish
	S32Kbx development package	GHS Compiler supp     NXP GCC Compiler     Wind River Diab Co	ort support mpiler support	,
2. Click "Install	/Update 4 item(s)".	Ma	nage Sites Add Update Sites Installation Details	
	② Always show at startup Install/Up	date 4 item(s) Reinstall	Uninstall Cancel	
			Confirm user action	×
			You will need to restart S32 Desig effect. Would you like to restart r	in Studio for S32 Platform for the changes to take how?
	6. Clic	k OK to re	start S32DS	Yes No

Figure 62. Steps to install LLCE driver and RTD

You will see pop-up window to trust certificates. Then accept it as below.



Figure 63. Trust certificate

# 6. CAN2CAN sample app creation

The following steps show how to create a new project.

1. Click on File, select New  $\rightarrow$  select S32DS Project from Example.

2. Select Can\_Llce\_DS\_Can2Can and click on Finish.

workspaceS32DS.3	.5 - S32 Design Studio	for S32 Platform	Mataols Run Window Help	
New	Nerdetor Navigate	Alt+Shift+N >	S32DS Project from Example	Ctrl+Alt+E
Open File Open Projects f	rom File System		<ul> <li>S32DS Library Project</li> <li>S32DS Application Project</li> </ul>	Ctrl+Alt+L Ctrl+Alt+A
Recent Files		>	Makefile Project with Existing Code	
	C			
	Create S32DS Proj	ect from Example	1A_M7	
Calact Car	Create S32DS Proj	ect from Example	MA_M7	

Figure 64. Starting a new project

3. Switch to S32CT Peripheral view and you can see the project of LLCE CAN2CAN sample app which is identical to the one which is already explained in this document. Click on ConfigTools and select Peripherals.



Figure 65. Selecting Peripheral

4. To set up configuration tools Select Can\_Llce\_DS\_Can2Can\_S32Gxxx\_M7.

					5.	S	elec	<mark>:t</mark>								
					Ca	an	Llo	ce DS	S	Can2	2Can	S	32(	Gxx	хN	<b>M</b> 7
🔀 works	pace	eS32DS	.3.5 - S32	Design	Studio	tor :	S32 Plat	torm	_	-					_	
File Ed	lit	Naviga	te Searc	h Pro	ojec.		gTools	Periphe								
📑 👻 🗐	G	<u>)</u>	Select Proj	ect>				* 4								
		Ca	an_Llce_DS	_Can2C	an_S32	G39	9A_M7									
Compo	oner	nts ≅ <sup>Re</sup>	emoteSyst	emsTer	npFiles											
type filte	er tex	xt			01	1	Use Pe	eripherals								

Figure 66. Configuring tools

5. Update the code by clicking on Update Code. At first you see error indicators but once code is updated, they would be all disappeared.



Figure 67. Updating code

Click on the C code view icon in the window and copy the LLCE FW binary files from LLCE installed folder to the LLCE\_BIN\_DIR folder.

LLCE FW binary files location :

 $S32G3 C:\NXP\S32G\_LLCE\_1\_0\_5\_QLP1\firmware\lce\_bin\s32g3\bin\ghs\enablement\\S32G2 C:\NXP\S32G\_LLCE\_1\_0\_5\_QLP1\firmware\lce\_bin\s32g2\bin\ghs\enablement\\$ 

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Figure 68. Copy LLCE FW binary files

Now you are ready to build the CAN2CAN sample application once all the steps are successfully completed.

To build the sample application you have to. Right click the project and select Clean Project in the window click on select Build Project.



Figure 69. Build project

#### CAN2CAN sample app creation

The Elf file can be found in your workspace inside the folder "Can\_Llce\_DS\_Can2Can\_S32Gxxx\_M7/Debug\_RAM".



Figure 70. Elf file location

### 6.1. Configuring LLCE\_Af for CAN2CAN

Follow the steps to configure LLCE\_Af for CAN2CAN.

- 1. In Llce\_Af, Configure Can2CanRoutingTable click on LLCE\_Af\_1.
- 2. Scroll to Can2CanRoutingTable part.
  - 3. You can add/delete these for your CAN2CAN use case. In order to configure routing details, click the index

🔡 workspaceS32DS.3.5 - S32 Design Studio for S32 Platform	
File Edit Navigate Search Project ConfigTools Peripherals Run Window Help	
1 🕆 🖩 🕼 🗋 🗄 Can_Lice_DS_Can2Can_S32G399A_M 🛛 👫 🛕 🖻 Update Code 🔻 🖄 📲 Functional Group 🛛 🛂 0 👘 👘 😌 🗳 👘	; t¥ 🔍 🍐 '
2 Scroll to Can2CanRoutin	aTable par
Components # P Peripherals 2 Start @ Use Af 1 # Aut nem by Clicking on pus building	g lable par
type filter text 1. click Lice_Af_1 +	-
MCAL	
Can_43_LLCE_1 Canif_1 Dev Can2CanRoutingTable + × ·	
EcuC_1 EcuM_1 Lice_Af_1 0 Name Can2CanRoutingTable_0	
Mari 1 Or 1 Plotform 1 Convert destination to CAN	
Convert destination to CAN FD if possible	
Drivers 0 Can Id remap value	
osif_1 Siul2_Port_1 Add item by clicking on plus button	
	_
Force Extended ID	
3. You can add/delete these for your	
CAN2CAN use case.	
In order to configure routing details Name CanDestinationList_0	
Can Controller Reference //Can_43_LLCE_1/Can/CanConfigSet/CanC	Controller_
click the index.	

Figure 71. Configuring LLCE\_Af for CAN2CAN

4. To configure routing details in the Can2CanRoutingTable part you can either convert FD to Classic or convert Classic to FD in the CAN2CAN routing there are two checkboxes.

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5. If you want to remap CAN frame ID when the CAN2CAN routing click on the plus button under Add item by clicking the plus button and enter remap ID value.

∧ Can2CanRoutin	gTable If you want to convert FD t routing, check <u>her</u> e.	o Classic when the CAN2CAN
0	Name Convert destination to CAN Convert destination to CAN FD if possible Can Id remap value Add item by clicking on plus button H Fort Add item by clicking on plus button H Can Convert destination Add item by clicking on plus button H Can Convert destination Can Convert destination Name Can Controller Reference	If you want to convert Classic         to FD when the CAN2CAN         routing, check here.         SAN frame ID         buting, check         Duting, check         ID value.         Can_43_LICE_1/Can/CanConfigSet/CanController_15
You can add/de n this list hence corresponding i	lete entries for the destination. Now the this routing is unicast. If you add des outing will be multicast routing.	nere is only 1 destination stination, the

Figure 72. CAN2CAN routing table

- 6. You can select the destination channel from the pull down list, if it is missing you can add it as explained in Configuring Can controller.
- 7. You can enter and delete the entries for destination in the CanDestinationList.

#### NOTE

The entries will be referred from Hardware Receive Handle, which will be configured in Can\_43\_LLCE/CanHardwareObject.

### 6.2. Configuring CanController

In the following configuration example, BCAN0, 1, 14 and 15 are configured. To add BCAN follow the steps mentioned below.

- 1. Click Can43\_LLCE\_1.
- 2. Select CanConfigSet tab.
- 3. Select CanController tab.
- 4. Right click at 3 (i.e. CanController\_15) for example.
- 5. Click Copy and then click on "+" button to add BCAN.



Figure 73. Configuring CanController

6. Right click at newly added BCAN (i.e. 4 in this case) and then click Paste to copy the BCAN15's configuration.



Figure 74. Configuring CanControler 2

7. Change the Name and BCAN channel and set sequential number at column "Can Controller ID"

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(4 in this case).

- 8. Scroll to CanControllerBaudrateConfig part and click the index of any of these (in this explanation, click index 0).
- 9. Configure baud rate parameters for arb phase.

∧ CanControllerBa	audrateConfig $+ \times \wedge 11$ .	Scroll to CanControllerBaudrateConfig part					
0	Name	CanControllerBaudrateConfig_0					
1	12. Click the index	of any of these.					
	(In this explanation, click index 0)						
	▲ CanBusLength	Cet presseler velue					
	+	Set prescaler value.					
13	. Configure baud ra	te parameters					
for	arb phase	Set baudrate					
	Can Time Segments Checking						
	Can Controller Prescaller	5					
	Can Controller BaudRate Config ID (0 - > 65.535)	o Set prop segment					
	Can Controller BaudRate (Kbps) (0 -> 1000)	250					
	Can Synchronization Segment (1 -> 1)	1 Set Phase seg 1					
	Can Propagation Segment (0 -> 255)	11					
	Can Phase Segment 1 (2 -> 255)	12 Sot Phase sog 2					
	Can Phase Segment 2 (2 -> 128)	8 Set Pliase seg Z					
	Can Resynch Jump Width (0 -> 127)	1					
		Set Resynch Jump Width					

Figure 75. Configuring Baud rate setting

10. Configure baud rate parameters for data phase.

		Preset Custom v	
Name	CanControllerFdBaudrateConfig		
<ul> <li>Can Automatic Time Segments Calculati</li> </ul>	on	Set	prescaler value.
Add item by clicking on plus button			
3. Configure baud	rate parameters		
		Set	baudrate
or data phase			
Can Controller Prescaller FD (1 -> 63)	5	Set	nron segment
Can FD Controller BaudRate (0 -> 8000)	500	Set	prop segment
Can FD Synchronization Segment (1 -> 1)	1		
Can FD Propagation Segment	5	Cat	Dhaaa aag 1
Can FD Phase Segment 1	6	Sel	Phase seg T
Can FD Phase Segment 2	4		
Can FD Resynch Jump Width	1	Set	Phase seg 2
<ul> <li>Transmitter Delay Compensation Offset (</li> </ul>	0 -> 255)		
Add item by clicking on plus button			
+		Set	Resynch Jump Width
CanControllerTxBitRateSwitch			

Figure 76. Configuring Baud rate parameters

### 6.3. Configuring CAN hardware object

To configure CAN hardware object follow the steps mentioned below.

1. Click on Can43\_LLCE\_1, select CanConfigSet tab and then select CanHardwareObject tab.

🔡 workspaceS32DS.3.5 - S32 Design Studio for S32 Platform							
File Edit Navigate Search Project Con	File Edit Navigate Search Project ConfigTools Peripherals Run Window Help						
🗂 👻 🗟 🖌 📓 🗄 Can_Llce_DS_Can2Can_S32G3	99A_N 🛛 🐐 🗛 📱 Update Code 🔻 🖻 🔳	Functional Group VS 0	5				
Components ≅ ¥ Peripherals □	Start						
type filter text • • •	AUTOSAR CAN_LLCE Driver	MCALI 2. Se	lect CanCon	figSet tab.			
MCAL O	Name Can_43_LLCE_1						
Can_43_LLCE_1 CanIf_1 Dem_1	Mode General Mode						
Ecuter EcuM_1 Llce_Af_1							
Mcu Os_1 Platform_1	Name ConfigTimeSupport CanGeneral Ca	nConfigSet CommonPublish	edInformation				
Drivers			The Colored				
1. click Siul2_Port_1		CanHardwareObject	Filter Canicom				
Can43_LLCE_1	0 Name 1 Y FD padding value	ue (0 -> 255)	<ol> <li>Select Can</li> </ol>	HardwareObject tab.			
	2 3 Add item by click	ing on plus button					
		-					
	6 Can Implementation	n lype	BASIC				
	7 Can ID Message Ty	pe	STANDARD				
	8 Can Object ID (MB	Handle)	10				
	9 Can MB Type		TRANSMIT				
	10 Add MAC code to	transmitted frames.					

Figure 77. Configuring Can hardware object

- 2. You have the option to choose or add or remove the Hardware Object Handle in the Left side of the window.
- 3. In the right side of the window you can name the object, select the ID mask. You can also select the CAN frame type, select the Object Handle type and also select the MB type (RX or TX). You can also specify which CanController has the object.

$\frown$	Name of	Select ID mask
	the object.	BASIC : ID mask enabled.
0	Name	CanHOH_Can2CanFD FULL: Exact ID match
2	<ul> <li>FD padding value (0 -&gt; 255)</li> </ul>	
3	Add item by clicking on plus button	Select CAN frame ID type
4 5	+	STANDARD / EXTENDED
6	Can Implementation Type	BASIC
7	Can ID Message Type	standard Cobject Handle ID.
9	Can Object ID (MB Handle)	2 A Should start with 0 and
10	Can MB Type	RECEIVE continue without any gaps.
	Add MAC code to transmitted frames.	
You can choice or	Hardware Object Uses Polling <ul> <li>CanTriggerTransmitEnable</li> </ul>	Select MB Type. RX or TX.
add range the	Add item by clicking on plur button	On a sife within the Open Opentary line
add remove the		
Harware Object		has the object.
Llevelle, here	Can Controller Reference	/Can_43_LLCE_1/Can/CanConfigSet/CanController_0
nandle here.	<ul> <li>Can MainFunction RW Period Reference</li> </ul>	
	+	
	Number of Hw objects used to implement one	
	HOH (1->2016)	20

Figure 78. Configuring Can hardware object 2

4. In this window you can configure message buffer related settings.

			Number of hardware objects used to			
			implement the object handle. It means that			
Number of Hw objects ( HOH (1->2016)	used to implement on	e 20 🔸	the number of message buffers which are			
CanHwFilter			assigned to the object handle.			
Name	CanHwEilter		Specify (together with the filter			
Can Hw Filter Code	123		mask) the frame ID that passes the			
Can Hw Filter Mask	2047		hardware filter for the RX object.			
∧ RangeFilter			Specify (together with the Filter			
Add item by clicking o	on plus button		Code) the range that			
+			passes the hardware filter for			
<ul> <li>CanAdvancedFeatur</li> </ul>	e		the RX object.			
∧ 0			Preset Custom V			
Name		Can Advanced Feature				
Can LLCE Advanced	Can LLCE Advanced Feature Reference //Llce_Af_1/Llce_Af/LlceAf		General/CanAdvancedFeature_1			
▲ CanTTHardwareObie	ectTrigger		used for the DV shipst. The best should			
Add item by clicking o	on plus button		take care of the RX objects which do not			
			have any reference here.			



# 7. Revision history

Revision No.	Release Date	Changes
0	11/2021	Initial release
1	03/2022	• Updated the bullets in CAN2CAN, CAN2ETH and ETH2CAN features.
		• Updated the note in Using sample application.
		• Updated Modifying the files and make.
		• Updated Configuring LLCE_Af for CAN2CAN.

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