LC717A30UJGEVK Electrostatic Capacitive Sensor Evaluation Kit User's Manual

Contents

Electrostatic capacitive sensor kit (LC717A30UJGEVK) has both several evaluation boards to evaluate the operation of various switch patterns and the communication facility for PC because of changing some registers. This manual explains configuration, usage and specification.

Features

- Evaluation of 8ch Touch Switch
- Evaluation of 2ch Proximity Sensor
- Evaluation of Liquid Level Sensing
- Evaluation of Electrode Sheet of Film Type
- Evaluation of Customer's Sensor Board
- Communication Module between this Kit and PC through USB



ON Semiconductor®

www.onsemi.com

EVAL BOARD USER'S MANUAL

Equipment Used

- Electrostatic Capacitive Sensor Evaluation Kit "LC717A30UJGEVK"
- PC (Installed GUI and USB Power Supply)



Figure 1. Photo of LC717A30UJGEVK Evaluation Kit

1

LC717A30UJGEVK Content

1 Main Control Board "LC717A30UJ00GEVB" 0 @ 2 Touch Switch Board 3 Proximity Sensor Board "ELECTRODE00GEVB" "ELECTRODE01GEVB" 5 DIP Conversion Board 6 FPC Conversion Board 7 2ch Sensor Board "LC717A30UJDIPGEVB" "LC717A30UJFPCGEVB" "LC717A30UJ2CH00GEVB" 8 Sensor Key Sheet 9 Plastic Bottle 10 Funnel Liquid Level Sensing Board 4 11 Pin Header (7pin) "ELECTRODE02GEVB" 12 Jump Wire 14 USB Conversion Module 13 USB Cable Type mini-B "SPP-150" "MM-FT232H"

SET UP

(1) Install the Device Driver for USB Conversion Module (MM-FT232H)

The system uses the MM–FT232H interface module to communicate to PC USB port and needs the device drivers of FTDI to be installed into PC. Refer to <u>InstallationGuides</u> of FTDI (<u>http://www.ftdichip.com/</u>). Install the device driver before using GUI software.

(2) Install the Evaluating Software (GUI)

Unzip GUI software (e.g. LC717A30A_SOFT.ZIP) to an arbitrary folder from website LC717A30UJ product.

The file contains:

Name	
鷆 wave	Wave file folder
船 LC717A30App.exe	GUI execution file
IIbMPSSE.dll	DLL file
SetParamDefault.prm	Generic evaluation setting file

Unzip the setting file (e.g. LC717A30_PARAMETER. ZIP) corresponding to the purpose of each evaluation from website LC717A30UJGEVB.

The setting files need to be stored into the same folder as the GUI software LC717A30App.exe.

The file contains:



- A30UJGEVK_2ch00PCB.prm: Setting-file for 2ch sensor board
- A30UJGEVK_FPCSW.prm: Setting-file for sensor key sheet
- A30UJGEVK_Liquid.prm: Setting-file for liquid level sensing on Cin4
- A30UJGEVK_PCBSW.prm: Setting-file for touch switch PCB
- A30UJGEVK_Proximity.prm: Setting-file for proximity sensor board

(3) Connect USB Conversion Module to PC (with GUI-installed) by USB Cable

USB conversion module MM–FT232H's LEDPWR lights up green. USB conversion module can select power-supply voltage for I/O 3.3 V or 5.0 V by jumper setup. Refer "Operation guide of USB conversion module" in detail. 3.3 V draws less power than 5.0 V.

(4) Connect USB Conversion Module to Touch Switch Board

(5) Execute Evaluation Software LC717A30App.exe

Refer application software user's manual about how to operate.

(6) Load the Proper Setting (File Extension ".prm") for Corresponding to the Target Touch Sensor Board (Evaluation Purpose)

(7) Use "Reset-Button" when the Behavior of Sensor Evaluation Operation Fails

Do not push and hold the "Reset-Button".

SETTING PROCESS CORRESPONDING TO EVALUATION PURPOSE

Touch Evaluation

(1) Configuration

Connect the main control board

^{••} 1 LC717A30UJ00GEVB" to the touch switch board
^{••} 2 ELECTRODE00GEVB", connect USB conversion module "^{••} 14 MM-FT232H". LED9 on the main control board will light up red by connecting PC.



Cross Section:



(2) GUI Software Setup

Execute GUI software "LC717A30App.exe". Push button "Load Parameters" and open the setting file of PCB touch evaluation "A30UJGEVK_PCBSW.prm". Output window pattern will match the pattern on the touch switch electrode board and the register values will be loaded.



Register settings can be reviewed by pushing "Setting Dialog" to display Initial Setting Window.

Slave Address (7bit) Slave Address (7bit) Sampling Tim 16 hex Monitor START Monitor START	AL ADVANCED Write Retry Count None • Parameter Update	0000 0000 Touch Status Soft Reset	ble :					
Output View RawDati Graph	Setting Dialog Register Dia	log						
Load Parameters Save Param	eters							
Log Data								
Log Data Count 100 times		Data Log Start						
Auto File Name								
Loguata.txt								
initial Setting Window								
-			Setting Mode (540	1	Pin Configuration	Cin0-Cin3 Cref	
			Normal Normal	,		Cdrv_Bar(opp:Hiz)	Crefonly	Cref+CrefAdd
		-				CMAdd4(opp:Hiz)	Cin4-Cin7 Cref	
						CMAdd0(opp:Hiz)	Crefonly	Cref+CrefAdd
			Cdac / Digi O	fset	~~~~	Gain(1st)	Dynamic Offset Calls	ration
Setting Register [hex]	Use Ch Gain(2nd) Tous	h Thr. Off Thr.	CdadP	CdadM	Digi Offset	Cin0-Cin3	Curle (Short Internal	
01 04 13 07 28 80	✓ Cin0 1(Min) - 5	7	0	0	0	1600(Min) -	Plus Data Time	0 step
02 00 14 07 30 40	VOn1 1(Min) - 1	7	0	0	0	Cin4-Cin7		2000 ms
03 00 15 07 31 02	V Cin2 1(Min) • 1	7	0	0	0	1600(Min) ·	Minus Data Time	300 ms
04 00 16 07 32 01	V Cin3 10Min) • 1	7	0	0	0		DynamicCalTh Plus	4(Init) •
05 00 17 07 33 01						Accuracy Average count	DynamicCalTh Minus	-4(Init) •
06 00 18 07 34 05	Cin4-Cin7 V =Cir	4		0	On4-On7	64 times 💌	1000 Million and College	Col condition)
07 00 19 07 35 01	Use un Gain(2nd) Tou	on inr. Off Thr.	CdadP	CdadM	Digi Offset	Cin(Non measure)	Al Touch Off	(D Not al Off
08 00 22 00 36 00						Low 👻	a a robron	O HALL OIL
	10/un5 1(Min) • 1		0	0		Debounce Counts		
09 00 23 00 37 03	✓On5 1(Min) • 11	7	0	0	_	for (OFF->ON)	2 times	
09 00 23 00 37 03 0A 0A 24 00 38 03) 7	0	0	0	for (ON->OFF)	2 tres	
09 00 23 00 37 03 0A 0A 24 00 38 03 06 0A 25 00 39 80	V Cin7 1(Min) • 1						unco	
09 00 23 00 37 03 0A 0A 24 00 38 03 06 0A 25 00 39 80 0C 0A 26 00 3A 00	Cin7 1(Min)		Interval Time					
09 00 23 00 37 03 0A 0A 24 00 38 03 06 0A 25 00 39 80 0C 0A 26 00 3A 00 0D 0A 27 00 38 00	Sleep / Interval mode	rval mode	Interval Time Short Inter	al Time	5 ms			
09 00 23 00 37 03 0A 0A 24 00 38 03 06 0A 25 00 39 80 0C 0A 26 00 3A 00 0D 0A 27 00 38 00 0C 0A 26 00 3A 00 0D 0A 27 00 38 00 0E 0A 28 00 3C 05	CON7 Sleep / Interval mode Sleep Time Sleep Time 16	rval mode ms	Interval Time Short Inter Long Inter	al Time	5 ms 101 ms			
09 00 23 00 37 03 0A 0A 24 00 38 03 06 0A 25 00 39 00 0D 0A 25 00 34 00 0D 0A 27 00 36 03 0E 0A 28 00 3C 05 0F 0A 29 00 3D 00	VOn7 1(Min) Sleep / Interval mode Sleep mode Inte Sleep Time 16	rval mode ms	Interval Time Short Inter Long Inter	val Time val Time	5 ms 101 ms			

(3) Start Operation

Push "Monitor Start" on Main Window. Static offset calibration will be performed.

LC717A30 EVA Application	
58 Dongle I/F 12C Setting Mode (Mail NORMAL	n) Cin7 Cin0 ADVANCED 0000 0000
Slave Address (7bit) Sampling Time 1 16 hex 17 ms	Nrite Retry Count Touch Status
Monitor START Monitor STOP	Parameter Update SW Error Enable Offset Calibration SW Label Set
Output View RawData Graph Setting	Dialog Register Dialog
Load Parameters Save Parameters	
Log Data Log Data Count 100 times	Data Log Start
Ele Name File Name LogData.txt	

Correct operation; Cin0 to Cin7 become blue button. Noise alarm display might be yellow by around noise.

Output	-			6 8 X
Ho SYS Err H	• CAL (NOISE ALARM		<u>LC717A30</u>
Cire	Gm1	Cin2	On3	
Cint	Cin5	Ciné	Qn7	

Incorrect operation; CAL Error displays yellow, Error channels become yellow.



(4) Touch Switch Operation Check

The target channel on "Output Window" becomes red when a finger touches above Cin0 to Cin7 on the top of Touch Switch Board. LED1 (Cin0) to LED8 (Cin7) on the main control board will light up green.



Proximity Sensor Evaluation

(1) Configuration

Connect the main control board " 1 LC717A30UJ00GEVB" to the proximity sensor board " 3 ELECTRODE01GEVB", connect USB conversion module " ¹⁴ MM–FT232H". LED9 on the main control board will light up red by connecting PC.



Cross Section:



PCB Board

(2) GUI Software Setup

Execute GUI software "LC717A30App.exe". Push button "Load Parameters" and open the setting file of proximity sensor evaluation "A30UJGEVK_ Proximity.prm" Output window pattern will match the pattern on the proximity sensor board and the register values will be loaded.

the state of the s	NORMAL	ADVANCED	0000 0000	no svs tri
ive Address (7bit) 16 hex	Sampling Time 17 ms	Write Retry Count	Soft Reset	Cin0
Monitor START	Monitor STOP	Parameter Update	SW Error Enable	
		request to an		
load Parameters	100 times		Data Log Start	Output
load Parameters og Data Log Data Count Auto File Name File Name	100 times 100 LogData.txt		Data Log Start	Output No SYS Err



Register settings can be reviewed by pushing "Setting Dialog" to display Initial Setting Window.

LC217ADD EVA Application
 administration (Mark)
 administration (Mark)
 administration (Mark)
 administration (Mark)
 administration (Mark)
 administration
 administratin
 administration
 administration
 administratin
 adm



(3) Start Operation

Push "Monitor Start" on Main Window. Static offset calibration will be performed.

💑 LC717A30 EVA A	pplication	- 6 %
USB Dongle I/F I2C	Setting Mode (Main) NORMAL O ADVANCED	Cin7 Cin0
Slave Address (7bit) 16 hex	Samping Time Write Retry Count	Soft Reset
Monitor START	Nonitor STOP	ite VSW Error Enable on VSW Label Set
Output View Ra	wData Graph Setting Dialog Register	Dialog
Load Parameters	Save Parameters	
Log Data	100 times	Data Log Start
File Name	LogData.txt	

Correct operation;

Cin0 or Cin1 become blue button. Noise alarm display might be yellow by around noise.



Incorrect operation; CAL Error displays yellow, Error channel becomes yellow.



(4) Proximity Sensor Operation Check

The target channel on "Output Window" becomes red when a hand approaches within 10 cm above the proximity sensor electrode Cin0 or Cin1. LED1 (Cin0) or LED2 (Cin1) on the main control board will light up green.



	- E 23
NOSE ALARM No SYS Ern No CAL Ern Lovel Level Level Lovel Donce L	<u>C717A30</u>
Cat	

Liquid Level Sensing Evaluation

(1) Configuration

Confirm whether the liquid level sensing board " 4 ELECTRODE02GEVB" was pasted to 9 the plastic bottle firmly. Make sure to stick both the plastic bottle and the electrode board by pushing when adhesion clearance is not small.



Connect the main control board " 1 LC717A30UJ00GEVB" to each terminal on the liquid level sensing board " 4 ELECTRODE02GEVB" by 12 Jump wires; GND–GND, Cin4–Cin, Cdrv–Cdrv.

Open the cap, lead a wire (not included in this kit) from GND pin on the main control board into the tank bottom and settle ¹⁰ the funnel. Connect USB conversion module " ¹⁴ MM–FT232H". LED9 on the main control board will light up red by connecting PC.



(2) GUI Software Setup

Execute GUI software "LC717A30App.exe". Push button "Load Parameters" and open the setting file of liquid level sensing evaluation "A30UJGEVK_Liquid.prm". Output window pattern will match the pattern on the liquid level sensing board and the register values will be loaded.



Register settings can be reviewed by pushing "Setting Dialog" to display Initial Setting Window.

LC717A30 EVA Application	- 6 %
USB Dangle I/F [ZC Settr Slave Address (/brl) IS hex I/F Monitor START Monitor Output View RanOata (20 Load Parameters Save Pa	ng Mode (Warn) STOP With Refty Count m With Refty Count Stops
Log Data Log Data Count 100 tin Auto File Name File Name LogData.to	mes Data Log Start

Starting Stepher (hel) Ord-Ord Ord Ord </th <th></th> <th>Setting Mode (i) Normal</th> <th>(Sub)</th> <th></th> <th></th> <th>Pin Configuration</th> <th>Cin0-Cin3 Cref</th> <th>Cref+CrefAc</th>											Setting Mode (i) Normal	(Sub)			Pin Configuration	Cin0-Cin3 Cref	Cref+CrefAc
Starting Surgiting Party COLCAD Colda Co															CMAdd4(opp:Hiz)	Cin4-Cin7 Cref	
Stemp Repletive Ref. Oci Col 3 Oci 3 Oci Col 3 Oci 3															CMAdd0(opp:Hiz)	Creforly	Cref+CrefAc
0 0	Ce H	ine De	nieter	[hey]			000-003		-Cn0		Cdac / Digi C	ffset 🧷	000-0	n3	Gain(1st)	Dynamic Offset Ci	albration
10 <	 m	10	12	07	28	90	Use Ch	Gain(2nd)	Touch Thr.	Off Thr.	CdacP	CdacM	Digi O	ffset	Cin0-Cin3	Cycle (Short Inter	a Osv
No. No. <td>01</td> <td>64</td> <td>11</td> <td>07</td> <td>78</td> <td>00</td> <td>Cin0</td> <td>5 👻</td> <td>10</td> <td>7</td> <td>0</td> <td>0</td> <td>0</td> <td></td> <td>1600(Min) 👻</td> <td>Plus Data Time</td> <td></td>	01	64	11	07	78	00	Cin0	5 👻	10	7	0	0	0		1600(Min) 👻	Plus Data Time	
No. 4 No. 7 No. 7 <th< td=""><td>02</td><td>44</td><td>14</td><td>07</td><td>30</td><td>40</td><td>Cin1</td><td>5 -</td><td>10</td><td>7</td><td>0</td><td>0</td><td></td><td></td><td>Cin4-Cin7</td><td></td><td>2000</td></th<>	02	44	14	07	30	40	Cin1	5 -	10	7	0	0			Cin4-Cin7		2000
9 0	03	44	15	07	31	02	Cin2	5 -	10	7	0	0			1600(Min) -	Minus Data Time	300
dis dis <td>04</td> <td>40</td> <td>16</td> <td>07</td> <td>32</td> <td>01</td> <td>Con 3</td> <td>5 -</td> <td>10</td> <td>7</td> <td>0</td> <td>0</td> <td>i</td> <td></td> <td></td> <td>DynamicCalTh Pk</td> <td>:\$ (4(Init) •</td>	04	40	16	07	32	01	Con 3	5 -	10	7	0	0	i			DynamicCalTh Pk	:\$ (4(Init) •
00 00<	05	44	17	07	33	01	10.000	<u> </u>							Accuracy Average count	Dynamic Call h Mi	110 -4(1wt) -
by: box by: box box <td>06</td> <td>00</td> <td>18</td> <td>07</td> <td>34</td> <td>05</td> <td>Cin4-Cin7</td> <td></td> <td>=Cin4</td> <td></td> <td></td> <td></td> <td>0n+0</td> <td>n7</td> <td>64 times ·</td> <td></td> <td>daid .</td>	06	00	18	07	34	05	Cin4-Cin7		=Cin4				0n+0	n7	64 times ·		daid .
N O Z O	07	00	19	07	35	01	Use Ch	Gain(2nd)	Touch Thr	Off Thr.	CdadP	CdadM	Digi O	ffset	Cinflion mean rel	PDCLP(Dynamic I	OffCal condition)
9 0 2 0	18	00	22	00	36	00	Cin4	1(Min) -	10	7	0	0			Low *	All Touch Off	Not all Off
As As<	09	00	23	00	37	03	CinS	5 •	10	7	0	0	0				
80 A2 25 0 36 0 7 0 0 0 for (DFF-OU) 2 tends C A3 A5 0 Seep / Intervit mode Intervit Time 5 for (DFF-OU) 2 tends D A3 26 A3 0 Seep / Intervit mode Intervit Time 5 ns E A3 26 X Y Beep mode Intervit Time 5 ns F A2 A3 0 0 0 0 0 1	A	0A	24	00	38	03	Cin6	5 -	10	7	0	0			Debounce Counts		
C Ai Ai O Seep Time Deray If Time Find Find Find Ai Find <	6	0A	25	00	39	80	Con7	5 -	10	7	0	0			for (OFF->ON)	2 times	
0 5 27 00 38 00 Seep mode Einterval mode Sev 11 bitman Time 5 ns 26 30 00 00 00 Seep Time Se 11 bitman Time 5 ns 26 30 30 00 00 Seep Time 5 ns Larg Startung Time 50 ns 0 An Seep Time 55 ns Larg Startung Time 50 ns 0 An Seep Time 55 ns Larg Startung Time 50 ns	с	0A	26	00	3A	00	1000	· · · ·							for (ON->OFF)	2 times	
B As 26 Core 27 Elementorie Butterval mode Statuterval mode	D	0A	27	00	38	00	Sleep / Int	erval mode			Interval Time						
0F 0A 29 00 30 00 Sleep Time 15 ms Long Interval Time 101 ms 10 0A Long Interval Start Count 359 etcm	œ	0A	28	00	эс	57	Sleep	o mode (Interval m	ode	Short Inter	val Time	5	ms			
10 0A Long Interval Start Count 350 etem	0F	0A	29	00	30	00	Sleep	Time	16 ms		Long Inter	val Time	101	ms			
LAN A CHEVE STORE COURT STORE STORE	10	0A									Long Totopual St	et Count	250				
11 OA	11	0A	Ē								cong interval 50	in count	350	step			

(3) Start Operation

Push "Monitor Start" on Main Window. Static offset calibration will be performed.

USB Dongle I/F 12C Setting Mode (Main) NORMAL O ADVANCED	Cin7 Cin0
Slave Address (7bit) Sampling Time Write Retry Count	Touch Status
Monitor START Monitor STOP Ø Offset Calbratic Output View RawData Graph Setting Dialog Register	on 📝 SW Label Set
Load Parameters Save Parameters	
Log Data Count 100 times	Data Log Start
Auto File Name	

Correct operation;

Cin4 becomes blue button.

Noise alarm display might be yellow by around noise.



Incorrect operation; CAL Error displays yellow, Error channel becomes yellow.



(4) Liquid Level Sensing Operation Check

Pour water from the funnel. The level display of Cin4 on "Output Window" becomes red corresponding to the amount of poured water. LED5 (Cin4) on the main control board will light up green by exceeding the threshold.



Sensor Key Sheet Evaluation

(1) Configuration

Connect the FPC conversion board " 6 LC717A30UJFPCGEVB" to 8 the sensor key sheet, connect USB conversion module " ¹⁴ MM–FT232H". LED1 on the FPC conversion board will light up red by connecting PC.



(2) GUI Software Setup

Execute GUI software "LC717A30App.exe". Push button "Load Parameters" and open the setting file of sensor key sheet evaluation "A30UJGEVK_FPCSW.prm". Output window pattern will match the pattern on the sensor key sheet and the register values will be loaded.



Register settings can be reviewed by pushing "Setting Dialog" to display Initial Setting Window.

COTIVAD EVA Application Setting Seting Setting Setting Setting Setting Setting	Idde (Main) AL © ADVANCED e Wike Retry Cou Wike Retry Cou Porenter ? Office Call Setting Dalog Reg reters	it Tr Apdate V ration V ter Dialog	CO CO	Ino a since a					
initial Setting Window									
				Setting Mode (a) Normal	(Sub)		Pin Configuration	Cin0-Cin3 Cref © Crefonly	Cref+CrefAdd
							CMAdd4(opp:Hiz)	Cin4-Cin7 Cref	Cref+CrefAdd
Settion Denister Day1	001-003	-Cin0		Cdac / Digi C	Offset	Gn0-Gn3	Gain(1st)	Dynamic Offset Calif	bration
00 55 12 07 28 60	Use Ch Gain(2nd)	Touch Thr.	Off Thr.	CdadP	CdadM	Digi Offset	Cin0-Cin3	Cycle (Short Interva	0 0
01 C4 13 07 28 05	Cin0 1(Min) -	50	7	0	0	0	1600(Min) -	Plus Data Time	step
02 00 14 07 30 40	☑ Cin1 1(Min) -	10	7	0	0	0	Cin4-Cin7		2000 ms
03 00 15 07 31 02	✓ Cin2 1(Min) ▼	10	7	0	0	0	1600(Min) 💌	minus vata Time	300 ms
04 00 16 07 32 01	Vicn3 1060) -	10	7	0	0	0		DynamicCalTh Plus	4(Init) -
05 00 17 07 33 01	and and						Accuracy Average count	DynamicCalTh Min-	s _4/1mit) =
05 00 18 07 34 05	Cin4-Cin7	Cin4			e	On+On7	64 tmes ·		- [. [.]
07 00 19 07 35 01	Use Ch Gain(2nd	Touch Thr.	Off Thr.	CdacP	CdadM	Digi Offset	Cin(Non measure)	PDCLP(Dynamic Of	#Cal condition)
08 00 22 00 36 00	V Cin4 1(Min) *	10	7	0	0	0	Low -	All Touch Off	Not all Off
09 00 23 00 37 03	🗸 Cin5 🛛 1(Min) 💌	10	7	0	0	0			
0A 0A 24 00 38 03	✓ Cin5 1(Min) ▼	10	7	0	0	0	Debounce Counts		
08 0A 25 00 39 80	V Cin7 1(Min) -	10	7	0	0	0	for (OPP->ON)	2 times	
0C 0A 26 00 3A 00							for (ON->OPP)	2 times	
00 0A 27 00 38 00	Sleep / Interval mode			Interval Time					
CE 0A 28 00 3C 05	Sleep mode	Interval mo	de	snort Inter	rval time	0 ms			
0F 0A 29 00 30 00	Sleep Time	16 ms		Long Inter	rval Time	101 ms			
10 0A				Loop Interval St.	art Count	20 eteo			
11 OA						sup			
rext out set reg.									

(3) Start Operation

Push "Monitor Start" on Main Window. Static offset calibration will be performed.

LC717A30 EVA Application	- 6 %
B Groupie LP [202 → Setting Node (Nam) Since Address (7bit) Same Address (7bit) Same Address (7bit) Montor STAPT Montor STAPT Colput New Rescharks Graph Setting Dulag Register Data	Cin 2 Cin 0 Coopo Doco Touch Status SoftReset V SW Error Enable V SW Label Set 29
Load Parameters Save Parameters	
Log Data Count 100 times	Data Log Start
File Netter LocData, byt	

Correct operation;

Cin1 to Cin7 become blue button. Noise alarm display might be yellow by around noise.



Incorrect operation; CAL Error displays yellow, Error channel becomes yellow.

Output	
NOSE ALAM	<u>LC717A30</u>
Cin7 Cin1	
Cas5 Cn3	

(4) Sensor Key Operation Check

The target channel on "Output Window" becomes red when a finger touches above Cin1 to Cin7 on the top of the sensor key sheet.





Evaluation of Using DIP Conversion Board

(1) Configuration

DIP Conversion Board " **5** LC717A30UJDIPGEVB" is an evaluation board for customer to confirm whether its original sensor board works correctly. Make sure to complete the evaluation preparation by soldering **11** the 7 pin header (included) or generic pin header/connecter. Connect USB conversion module " **14** MM–FT232H". LED1 on the DIP conversion board will light up red by connecting PC.

Take care of the direction of connector between USB conversion module and this evaluation board because of opposite direction of other boards.



(2) GUI Software Setup

Execute GUI software "LC717A30App.exe". When GUI starts, "SetParamDefault.prm" is loaded as configuration file.

LC717A30 EVA Application	- 6 %	Output	
USB Dongle I/F 12C Setting Mode (Main) NORMAL ADVANCED	Cin7 Cin0	NOISE ALARM	<u>LC717A30</u>
Slave Address (7bit) Sampling Time Write Retry Count 15 hex 17 ms None •	Soft Reset	Cin0 Cin1 Cin2 Cin3 Cin4 Cin5	Cin6 Cin7
Monitor START Monitor STOP Office Calibration Output View RawData Graph Setting Dialog Register Dialo	SW Label Set		
Load Parameters Save Parameters			
Log Data Log Data Count 100 times	Data Log Start		
File Name LogData.txt			

Register settings can be reviewed by pushing "Setting Dialog" to display Initial Setting Window.

USB Dongle I/F	Setting Mode (NORMAL	Main) () ADVANCED	Cin7 Cin0 0000 0000
Slave Address (7bit) 16 hex Monitor START	Sampling Time 17 ms Monitor STOP	Write Retry Count None Parameter Update Offset Calibration	Soft Reset
Output View Ra	wData Gleph Set	ang Dialog Register Dialo	g
Log Data	100 times		Data Log Start

(3) Start Operation

Push "Monitor Start" on Main Window. Static offset calibration will be performed.

LC717A30 EVA Application	
S8 Dongle I/F 12C Setting Mode (Main) NORMAL ADVANCED	Cin7 Cin0
Slave Address (7bit) Sampling Time Write Retry Count	SoftReset
Monitor START Monitor STOP	date SW Error Enable
Output New RawData Graph Setting Dialog Registe	r Dialog
Load Parameters Save Parameters	
Log Data Uog Data Count 100 times	Data Log Start
Ele Name LogDeta.txt	

Correct operation;

Cin0 to Cin7 become blue button. Noise alarm display might be yellow by around noise.

Output		-		_			E
	No CAL	(<u>1C717</u>	<u>'A30</u>
Cin0	Cin1	Cin2	Cin3	Cin4	Cin5	Cin6	Cin7

Incorrect operation; CAL Error displays yellow, Error channel becomes yellow.



2ch Sensor Board Evaluation

(1) Configuration

2ch sensor board " 7 LC717A30UJ2CH00GEVB" is an evaluation board for customer to confirm whether its original sensor board works correctly in small space. Connect USB conversion module " ¹⁴ MM–FT232H".

Take care of the direction of connector between USB conversion module and this 2ch evaluation board because of opposite direction of other boards.



(2) GUI Software Setup

Execute GUI software "LC717A30App.exe". Push button "Load Parameters" and open the setting file of the 2ch00PCB board "A30UJGEVK_2ch00PCB.prm". Output window pattern will match the pattern on the 2ch sensor board and the register values will be loaded.

NOTE: Make sure to select SPI but I²C on "USB Dongle I/F".





Register settings can be reviewed by pushing "Setting Dialog" to display Initial Setting Window.



										Setting Mode (ii) Normal	(Sub)			Pin Configuration	Cin0-Cin3 Cref	Cref+CrefAd
											_			CMAdd4(opp:Hiz)	Cin4-Cin7 Cref Crefonly	Cref+CrefAd
Sett	na Rei	nister	[hex]			Cn0-Cn3		-Cin0		Cdac / Digi C	ffset (6	Ono-C	in3	Gain(1st)	Dynamic Offset Calib	ration
~	02		07	10	90	Use Ch	Gain(2nd)	Touch Th	r. Off Thr.	CdacP	CdadM	Digi C	ffset	Cin0-Cin3	Cycle (Short Interval	
	64	17	07	20	00	V Cin0	1(Min) -	10	7	0	0		0	1600(Min) 👻	Plus Data Time	st
			07	10		V On1	10Min) -	10	7	0	0		0	Cin4-Cin7		2000
02		15	07	31		Cin2	10Min) -	10	7	0	0		0	1600(Min) -	Minus Data Time	300 ,
14		16	07	32	01	El conte	104-1	10	-	-					DynamicCalTh Plus	4(Init) •
ns		17	07	33	01	Lions	10400 4							Accuracy	Description The Marco	
		10	07	74		Cin4-Cin7		V =0n4			e) On+C	in7	Average count	DynamicCarin Minut	-Hund) •
		10	07	35		Use Ch	Gain(2nd) Touch Th	r. Off Thr.	CdacP	CdadM	Digi 0	offset	(or and o	PDCLP(Dynamic Off	Cal condition)
-		22	00	36		Cin4	1(Min) -	10	7	0	0		D	Cin(von measure)	All Touch Off	Not all Off
09		23	00	37	03	CinS	1(Min) *	10	7	0	0		0			
14	0A	24	00	38	03	Cin6	1(Min) -	10	7	0	0		0	Debounce Counts		
8	0A	25	00	39	40	Elon7	104m) -	10	7	-	0			for (OFF->ON)	2 times	
c	0.4	26	00	34	00	E.on	10.00							for (ON->OFF)	2 times	
	0A	27	00	38	00	Sleep / Int	erval mode			Interval Time						
Œ	AD	28	00	30	05) Sleep	mode	Interval	node	Short Inter	val Time	5	ms			
0F	0A	29	00	30	00	Sleep	Time	16 .	15	Long Inter	val Time	101	ms			
10	0A									Long Tabanal Ch		~	-			
11	0A	ſ								cong interval 50	In Count	200	step			
			Texto	ut set	reg.											

(3) Start Operation

Push "Monitor Start" on Main Window. Static offset calibration will be performed.

LC717A30 EVA Application	
US8 Dongle I/F SPL Setting Mode (Main) NORMAL ADVANCED	Cin7 Cin0
Sampling Time Write Retry Count	Soft Reset
Monitor START Monitor STOP	SW Error Enable
Output Wew RawData Graph Setting Dialog Register Dialo	×
Load Parameters Save Parameters	
Log Data	Data Log Start
Auto File Name	
File Name LogData.txt	

Correct operation;

Cin0 or Cin1 become blue button. Noise alarm display might be yellow by around noise.



Incorrect operation; CAL Error displays yellow, Error channels become yellow.



FUNCTION EXPLANATION

Main Control Board (LC717A30UJ00GEVB)

(1) Schematic





(2) BOM

Table 1. BILL OF MATERIALS OF LC717A30UJ00GEVB EVALUATION BOARD

Designator	Qty.	Description	Part Number	Value	Manufacturer
IC1	1	Capacitive Touch Sensors LSI	LC717A30UJ	8ch, SSOP30	ON Semiconductor
IC2	1	I/O Expander LSI	PCA9654EDTR2G	8ch, TSSOP16	ON Semiconductor
LED1-LED8	8	LED	KP-2012ZGC	Green LED	Kingbright
LED9	1	LED	KP-2012SURCK	Red LED	Kingbright
R5	1	Resistor	MCR03EZPJ000	0 Ω	ROHM
R12, R13	2	Resistor	MCR03EZPJ102	1.0 kΩ ±5%, 0.1 W	ROHM
R1, R3, R4, R20–R27	11	Resistor	MCR03EZPJ332	3.3 kΩ ±5%, 0.1 W	ROHM
R2, R7, R9, R10	4	Resistor	RK73B1JTTD103J	10.0 kΩ ±5%, 0.1 W	KOA
C5	1	Multilayer Ceramic Capacitor	GRM1885C1H4R0CA01D	4 pF ±0.25 pF, 50 V	Murata
C7, C10–C12	4	Multilayer Ceramic Capacitor	GRM1885C1H8R0DA01D	8 pF ±0.5 pF, 50 V	Murata
C2, C20	2	Multilayer Ceramic Capacitor	GRM188B11E104KA01D	0.1 μF ±10%, 25 V	Murata
C3	1	Multilayer Ceramic Capacitor	GRM188B31E105KA75D	1.0 μF ±0%, 25 V	Murata
C1	1	Multilayer Ceramic Capacitor	GRM21BB31C106KE15L	10.0 μF ±10%, 16 V	Murata
SW1	1	Push Button Switch	DTSM-31N-V-T/R		Diptronics Manufacturing
CN1	1	Connector	2545B-1x7G	7 pin, Right Angle	HO CHIEN
CN2	1	Connector	FSR-41085-13	13 pin, Right Angle	Hirosugi–Keiki
CN3	1	Socket Pin	PM-1-5P	5 pin-cut, Gold-Su	MAC8
Cdrv, CdrvBar	2	Check Terminal	LC-3-G-Skyblue	1 pin, Skyblue	MAC8
GND1, GND2	2	Check Terminal	LC-3-G-Black	1 pin, Black	MAC8
	1	Printed Circuit Board	LC717A30UJ00GEVB	160.0 mm x 50.0 mm, 2-levels, t = 1.6 mm	ON Semiconductor
	4	Screw		M3 x 18.0 mm	
	4	Nut		M3	
	4	Washer		M3, 6.0 mm, in Rubber Foot	
	4	Washer		M3, 7.0 mm, Top Side	
	4	Plastic Spacer	EB-10	Black, M3 x 10.0 mm	MAC8
	4	Natural Rubber Foot	BU-692-A	Black, M15 x 7.5 mm	SATO PARTS

(3) Printed Circuit Board Layout



Figure 3. Pattern 1 Layer (Solder Side)



Figure 4. Pattern 2 Layer (Parts Side)



Figure 5. Resist 1 Layer (Solder Side)



Figure 6. Resist 2 Layer (Parts Side)



Figure 7. Silk 1 Layer (Solder Side)



Figure 8. Silk 2 Layer (Parts Side)



Figure 9. Hole



Figure 10. Outline

DIP Conversion Board (LC717A30UJDIPGEVB)

(1) Schematic





(2) BOM

Table 2. BILL OF MATERIALS OF LC717A30UJDIPGEVB EVALUATION BOARD

Designator	Qty.	Description	Part Number	Value	Manufacturer
IC1	1	Capacitive Touch Sensors LSI	LC717A30UJ	8 ch, SSOP30	ON Semiconductor
LED1	1	LED	KP-2012SURCK	Red LED	Kingbright
R5	1	Resistor	MCR03EZPJ000	0 Ω	ROHM
R12, R13	2	Resistor	MCR03EZPJ102	1.0 kΩ ±5%, 0.1 W	ROHM
R1, R3, R4	3	Resistor	MCR03EZPJ332	3.3 kΩ ±5%, 0.1 W	ROHM
R2, R7, R9, R10	4	Resistor	RK73B1JTTD103J	10.0 kΩ ±5%, 0.1 W	KOA
C5	1	Multilayer Ceramic Capacitor	GRM1885C1H4R0CA01D	4 pF ±0.25 pF, 50 V	Murata
C2	1	Multilayer Ceramic Capacitor	GRM188B11E104KA03D	0.1 μF ±10%, 25 V	Murata
C3	1	Multilayer Ceramic capacitor	GRM188B31E105KA75D	1.0 μF ±10%, 25 V	Murata
C1	1	Multilayer Ceramic Capacitor	GRM21BB31C106KE15L	10.0 μF ±10%, 16 V	Murata
SW1	1	Push Button Switch	DTSM-31N-V-T/R		Diptronics Manufacturing
	1	Printed Circuit Board	LC717A30UJDIPGEVB	50.0 mm x 30.0 mm, 2-levels, t = 1.6 mm	ON Semiconductor

(3) Printed Circuit Board Layout



Figure 12. Pattern 1 Layer (Solder Side)



Figure 14. Resist 1 Layer (Solder Side)



Figure 16. Silk 1 Layer (Solder Side)



Figure 18. Hole



Figure 13. Pattern 2 Layer (Parts Side)



Figure 15. Resist 2 Layer (Parts Side)



Figure 17. Silk 2 Layer (Parts Side)



Figure 19. Outline

FPC Conversion Board (LC717A30UJFPCGEVB)

(1) Schematic



Figure 20. FPC Conversion Board – Schematic

(2) BOM

Table 3. BILL OF MATERIALS OF LC717A30UJFPCGEVB EVALUATION BOARD

Designator	Qty.	Description	Part Number	Value	Manufacturer
IC1	1	Capacitive Touch Sensors LSI	LC717A30UJ	8 ch, SSOP30	ON Semiconductor
LED1	1	LED	KP-2012SURCK	Red LED	Kingbright
R5	1	Resistor	MCR03EZPJ000	0 Ω	ROHM
R12, R13	2	Resistor	MCR03EZPJ102	1.0 kΩ ±5%, 0.1 W	ROHM
R1, R3, R4	3	Resistor	MCR03EZPJ332	3.3 kΩ ±5%, 0.1 W	ROHM
R2, R7, R9, R10	4	Resistor	RK73B1JTTD103J	10.0 kΩ ±5%, 0.1 W	KOA
C5	1	Multilayer Ceramic Capacitor	GRM1885C1H2R0CA01D	2 pF ±0.25 pF, 50 V	Murata
C2	1	Multilayer Ceramic Capacitor	GRM188B11E104KA01D	0.1 μF ±10%, 25 V	Murata
C3	1	Multilayer Ceramic Capacitor	GRM188B31E105KA75D	1.0 μF ±10%, 25 V	Murata
C1	1	Multilayer Ceramic Capacitor	GRM21BB31C106KE15L	10.0 μF ±10%, 16 V	Murata
SW1	1	Push Button Switch	SKRPACE010		ALPUS
CN1	1	Connector	2545B-1x7G	7 pin, Right Angle	HO CHIEN
CN2	1	FFC/FPC Connector	00 6224 015 001 800+	15 pin, Right Angle	Kyocera Connector Products
	1	Printed Circuit Board	LC717A30UJFPCGEVB	80.0 mm x 50.0 mm, 2-levels, t = 1.6 mm	ON Semiconductor

(3) Printed Circuit Board Layout



Figure 21. Pattern 1 Layer (Solder Side)



Figure 23. Resist 1 Layer (Solder Side)



Figure 25. Silk 1 Layer (Solder Side)



Figure 27. Hole



Figure 22. Pattern 2 Layer (Parts Side)



Figure 24. Resist 2 Layer (Parts Side)



Figure 26. Silk 2 Layer (Parts Side)



Figure 28. Outline

2ch Sensor Board (LC717A30UJ2CH00GEVB)

(1) Schematic



Figure 29. 2ch Sensor Board – Schematic

(2) BOM

Table 4. BILL OF MATERIALS OF LC717A30UJ2CH00GEVB EVALUATION BOARD

Designator	Qty.	Description	Part Number	Value	Manufacturer
IC1	1	Capacitive Touch Sensors LSI	LC717A30UJ	8 ch, SSOP30	ON Semiconductor
R7	1	Resistor	MCR03EZPJ102	1.0 kΩ ±5%, 0.1 W	ROHM
R2-R6	5	Resistor	RK73B1JTTD103J	10.0 kΩ ±5%, 0.1 W	KOA
Cref	1	Multilayer Ceramic Capacitor	GRM1885C1H2R0CA01D	2 pF ±0.25 pF, 50 V	Murata
C2	1	Multilayer Ceramic Capacitor	GRM188B11E104KA01D	0.1 μF ±10%, 25 V	Murata
C3	1	Multilayer Ceramic Capacitor	GRM188B31E105KA75D	1.0 μF ±10%, 25 V	Murata
C1	1	Multilayer Ceramic Capacitor	GRM21BB31C106KE15L	10.0 μF ±10%, 16 V	Murata
SW1	1	Push Button Switch	SKRPACE010		ALPUS
CN1	1	Connector	2545B-1x7G	7 pin, Right Angle	HO CHIEN
	1	Printed Circuit Board	LC717A30UJ2CH00GEVB	30.0 mm x 20.0 mm, 2-levels, t = 1.6 mm	ON Semiconductor

(3) Printed Circuit Board Layout



Figure 30. Pattern 1 Layer (Solder Side)



Figure 31. Pattern 2 Layer (Parts Side)



Figure 32. Resist 1 Layer (Solder Side)



Figure 33. Resist 2 Layer (Parts Side)



Figure 34. Silk 1 Layer (Solder Side)



Figure 36. Hole



Figure 35. Silk 2 Layer (Parts Side)



Figure 37. Outline

Touch Switch Board (ELECTRODE00GEVB)

(1) Schematic



Figure 38. Touch Switch Board – Schematic

(2) BOM

Table 5. BILL OF MATERIALS OF ELECTRODE00GEVB EVALUATION BOARD

Designator	Qty.	Description	Part Number	Value	Manufacturer
CN1	1	Connector	2545B-1x13G	13 pin, Right Angle	HO CHIEN
	1	Printed Circuit Board	ELECTRODE00GEVB	160.0 mm x 100.0 mm, 2-levels, t = 1.6 mm	ON Semiconductor
	1	Plastic Prate		160.0 mm x 80.0 mm, t = 3.0 mm	
	4	Screw		M3 x 25.0 mm	
	4	Nut		М3	
	4	Washer		M3, 6.0 mm, in Rubber Foot	
	4	Washer		M3, 7.0 mm, Top Side	
	4	Plastic Spacer	EB-10	Black, M3 x 10.0 mm	MAC8
	4	Plastic Spacer	EP-3	White, M3 x 3.0 mm	MAC8
	4	Natural Rubber Foot	BU-692-A	Black, M15 x 7.5 mm	SATO PARTS

(3) Printed Circuit Board Layout



Figure 39. Pattern 1 Layer (Solder Side)



Figure 40. Pattern 2 Layer (Parts Side)



Figure 41. Resist 1 Layer (Solder Side)



Figure 42. Resist 2 Layer (Parts Side)



Figure 43. Silk 1 Layer (Solder Side)



Figure 44. Silk 2 Layer (Parts Side)







Figure 46. Outline



Figure 47. Electrode Pattern

Proximity Sensor Board (ELECTRODE01GEVB)

(1) Schematic



Figure 48. Proximity Sensor Board – Schematic

(2) BOM

Table 6. BILL OF MATERIALS OF ELECTRODE01GEVB EVALUATION BOARD

Designator	Qty.	Description	Part Number	Value	Manufacturer
CN1	1	Connector	2545B-1x13G	13 pin, Right Angle	HO CHIEN
	1	Printed Circuit Board	ELECTRODE01GEVB	340.0 mm x 35.0 mm, 2-levels, t = 1.6 mm	ON Semiconductor
	2	Plastic Prate		210.0 mm x 35.0 mm, t = 3.0 mm	
	2	Screw		M3 x 18.0 mm	
	2	Nut		M3	
	2	Washer		M3, 6.0 mm, in Rubber Foot	
	2	Washer		M3, 7.0 mm, Top Side	
	2	Plastic Spacer	EB-10	Black, M3 x 10.0 mm	MAC8
	2	Natural Rubber Foot	BU-692-A	Black, M15 x 7.5 mm	SATO PARTS
	2	Double-face Tape		Clear, 210.0 mm x 35.0 mm	

(3) Printed Circuit Board Layout

	Ŧ	হা	Τ				Τ	Τ	Τ				Τ	Τ	Т		Γ	Τ	Т	Т	Ч			Γ		Τ	Τ	Τ			Γ	Τ	Т	Τ	Т				Γ	Τ	Τ	Τ	Т	Τ				Γ	Γ	Γ	Τ	Γ	Τ	Τ	Τ	Т	Τ			Г	Τ	Τ	Τ	T	T
•							Т	Т	Т				Т	Т	Τ		Γ	Т	Т							Γ	Т	Т				Т	Т	Т	Т				Γ	Т	Т	Т	Т	Т				Γ	Г	Γ	Г	Г	Τ	Т		Τ				Γ	Τ		Т	Т	Т
•	Т					ſ		Ι.	Π	Т			Т	Т	Т		Г	Т	Т	Т						Г	Т	Т			Г	Т	Т	Т	Т			Г	Г	Т	Т	Т	Т	Т				Г	Г	Г	Г	Г	Т	Т	Т	Т				Г	1		5	Т	Т
•						П			Π				Τ	Τ				T								Γ	T			N		Τ	T						Γ	Τ	Τ	T						Γ	Γ	Γ		Γ	Τ	ſ	1					Γ	П			T	T
÷.	\Box		Т			Γ	-	-	Т				Г	Т	Т		Γ	Т	Т					Γ		Г	Т	Т		W	Г	Т	Т	Т	Т				Γ	Т	Т	Т	Т	Т				Γ	Г	Γ		Г	Τ	14		Т	Τ			Г	Π	-	┯	T	Т
																																																																	Т
	Ц	_	- 1	_	_	1	1	1	-	_	_	_	-	-	- 1		-		-		- 1	 _	-	1	1	1	-	- 1	,	JL		-	-	_	_	_		-	-	-	-	-	-	_	_	-	1	-	-	1	-	-	-	IJ										T	T

Figure 49. Pattern 1 Layer (Solder Side)



Figure 50. Pattern 2 Layer (Parts Side)



Figure 51. Resist 1 Layer (Solder Side)



Figure 52. Resist 2 Layer (Parts Side)

Nothing

Figure 53. Silk 1 Layer (Solder Side)

Derv			1	1
and .	JPOdrv		Cdrv	Cdrv
	X	0	CINI	CINO
99HD	<u></u>	ON Semiconductor		
SIND C1n0	G	ELECTRODE01GEVB		

Figure 54. Silk 2 Layer (Parts Side)



Figure 55. Hole



Figure 56. Outline and Electrode Pattern

Liquid Level Sensing Board (ELECTRODE02GEVB)

(1) Schematic



Figure 57. Liquid Level Sensing Board – Schematic

(2) BOM

Table 7. BILL OF MATERIALS OF ELECTRODE02GEVB EVALUATION BOARD

Designator	Qty.	Description	Part Number	Value	Manufacturer
Cin, Cdrv, GND	3	Socket Pin	PE-1	1pin	MAC8
	1	Printed Circuit Board	ELECTRODE02GEVB	100.0 mm x 30.0 mm, 2-levels, t = 1.6 mm	ON Semiconductor

(3) Printed Circuit Board Layout



Figure 58. Pattern 1 Layer (Solder Side)



Figure 60. Resist 1 Layer (Solder Side)



Figure 59. Pattern 2 Layer (Parts Side)



Figure 61. Resist 2 Layer (Parts Side)



Figure 62. Silk 1 Layer (Solder Side)



Figure 63. Silk 2 Layer (Parts Side)





Figure 65. Outline



Figure 66. Electrode Pattern

Sensor Key Sheet

(1) Product Drawing





(2) BOM

Table 8. BILL OF MATERIALS OF SENSOR KEY SHEET

Designator	Qty.	Description	Part Number	Value	Manufacturer
(1)	1	Top Panel		Plastic, t = 2000 µm	K&D
(2)	1	Glue Sheet		Polyester, t = 50 μ m	K&D
(3)	1	Sensor Key Sheet		Polyester, t = 100 µm	K&D
(4)	1	Bottom Sheet		Polyester, t = 50 μ m	K&D
(5)	1	Reinforcing Plate		Polyester, t = 213 μm	K&D

NOTE: K&D Co., Ltd. Refer to URL; http://www.kandd.co.jp or http://www.kandd.co.jp/en/.

USB CONVERSION MODULE OPERATION GUIDE

USB Conversion Module (MM-FT232H: Sunhayato) in this kit is made of FTDI's IC (FT232H) and can change USB interface into various interfaces. It can output the power-supply voltage from USB port to the connecter terminal and it is possible to change a voltage level to 3.3 V or 5.0 V by jumper setup.



LED

Connector

USB Connector (Type Mini-B)

Table 9.

No.	I ² C I/F Terminal	SPI I/F Terminal
1	VDD	VDD
2	GND	GND
3	SCL	SCK
4	SDA	SI
5	SDA (Note 1)	SO
6	N.C. (open)	N.C. (open)
7	N.C. (open)	nCS

1. Make sure to connect both 4 pin and 5 pin as the common terminal on customer's board side at I²C interface.



Voltage Selectable Jumper

Table 10.

Jumper Location	Voltage Level
³⁰³ و CN2	5.0 V
CN2 51	3.3 V

NOTE

Refer to the application note on ON Semiconductor touch sensor page for sensor patterns of the design rule and usage of LSI.

Refer to the user's manual of the application-software for usage of the software and installing the device driver.

All brand names and product names appearing in this document are registered trademarks or trademarks of their respective holders.

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns me rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at <u>www.onsemi.com/site/pdf/Patent_Marking.pdf</u>. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor as sume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regarding less of any support or applications information provided by ON Semiconductor, "Typical" parameters which may be provided in ON Semiconductor products can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights on the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor 19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA Phone: 303–675–2175 or 800–344–3860 Toll Free USA/Canada Fax: 303–675–2176 or 800–344–3867 Toll Free USA/Canada Email: orderlit@onsemi.com N. American Technical Support: 800–282–9855 Toll Free USA/Canada Europe, Middle East and Africa Technical Support:

Phone: 421 33 790 2910 Japan Customer Focus Center Phone: 81–3–5817–1050 ON Semiconductor Website: www.onsemi.com

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative