

To: Our Customer

2004.03.05

THine Electronics, Inc.
Quality Management Dept.

THC63LVD Series Information of Lead-Free Package

Dear Customer

We would like to inform you of the Lead-Free products in THC63LVD Series.

Please refer to the following description.

If you have any question, please feel free to contact us.

Sincerely Yours

1. Lead-Free Specification

Products & Package Type	THC63LVDM83R, THC63LVDF84B / TSSOP56		
Assembly subcontractor.		IST *1)	Oki_Thail
Scope	Contents	Contents of Specification	
Plating Specification	Outer Plating Composition	Ni/Pd/Au(Flash) (Pd-PPF)	Sn-3.0Bi
	Pleating Thickness	Ni=1.0~3.0um Pd=0.076~0.254um Au(Flash)=0.003~0.001um	5.0~22.0 (um)
	Lead Frame material	Cu	Cu
Package material	Epoxy molding compound	KMC184-2 (SHINETSU CHEMICAL)	ST-7400 (NITTO DENKO)
	Die Attach	Ag-paste	Ag-Paste

*1) International Semiconductor Technology, Ltd. (Taiwan)

2. General Specification

Scope	Contents
Package outline	Nothing change.
Electrical performance	Nothing change. (There is no difference between the Pb Free sample and Pb sample)
Reflow specification	Nothing change. 1) Maximum reflow peak temperature at 255 (+5/-0) degree C. *Please refer to Page3 of "4.Solder-Reflow Conditions".
Moisture specification	Nothing change. 1) Shelf life in dry pack: 12months on 5~35 degree C / 45~75%RH 2) Bake profile: 125 degree C / 24 h. 3) Floor life out of dry pack (for JEDEC): 5~35 degree C / 60%RH / 168h *Please refer to Page3 of "4.Solder-Reflow Conditions".
Marking Specification	Add in "F" with Date Code. As a recognition character *Please refer to "FIG2 The explanation of "Date Code"

3. Reliability Test Result

Item	Condition	Test Q'ty	Result Fail / Test Q'ty
Temperature Humidity with Bias Test*2)	Ta=85 (degree) Vdd=3.6(V) Time=1000(hours) RH=85%	76	0/76
Temperature Cycle Test*2)	Ta= -65~150(degree) / 10 (min) 300(cyc)	45	0/45
Thermal Shock Test*2)	Ta= -65~150 (degree) / 5 (min) 100(cyc)	45	0/45
High Temperature Storage Life Test	Ta=150(degree) Time=1000(hours)	45	0/45
Low Temperature Storage Life Test	Ta=-65(degree) Time=1000(hours)	45	0/45
Resistance to Solder Heat Test	255 +5/-0(degree) Time=10(sec) IRS	22	0/22
Solderability Test	245(degree) Time=5(sec)	22	0/22

*2) "Resistance to solder heat" is done before the test as pre-treatment.

4.Solder-Reflow Conditions

Hand Soldering Condition: 350 (degree), within 3 (sec)
 Reflow Condition: 255 +5/-0 (degree) / 10 (sec) / 2 (times)

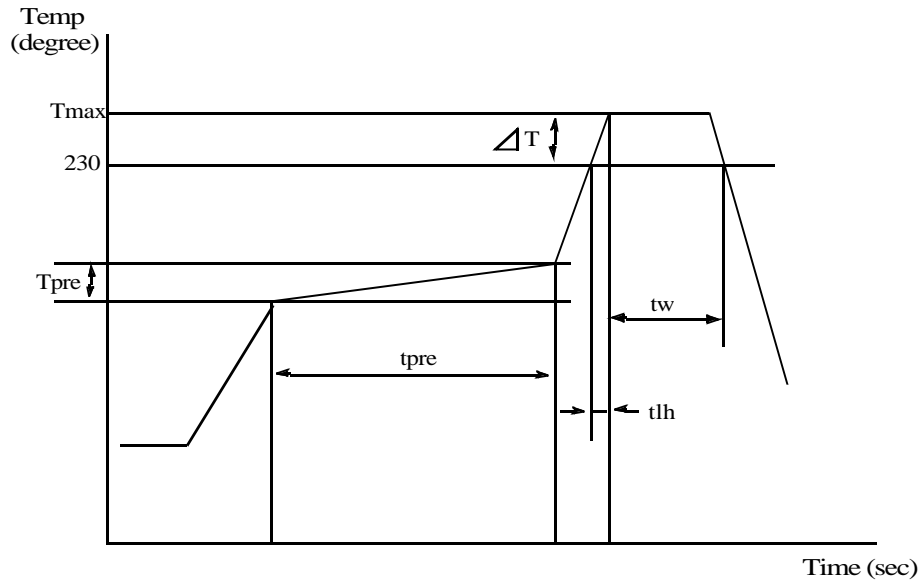


FIG1: Reflow Condition

Control Items	Standard Value
Pre Heat Temperature (Tpre)	150~180(degree)
Pre Heat Time(tpre)	90 +/-30 (sec)
Maximum Temperature (Tmax)	255 +5/-0 (degree)
230 degree Time (tw)	within 60 (sec)
Temperature Slope (T/th)	1.5 ~ 4.0 (degree / sec)

4.2 Storage Conditions

(1) Shelf life in sealed bag

Temperature: 0 ~ 40 degree Humidity: 10 ~ 75%RH Period: 12 months

(2) After the bag is opened

Products that will be subjected to infrared reflow, vapor-phase reflow, or equivalent processing must be:

- a) Mounted within 168 hours, 30 degree / 60%RH, or
- b) Stored within 20%RH.

(3) Products require baking in 24 hours at 125+/-5 degree, if:

- a) 30%RH mark of humidity indicator card turned into pink color, or
- b) (2)a or (2)b is not met.

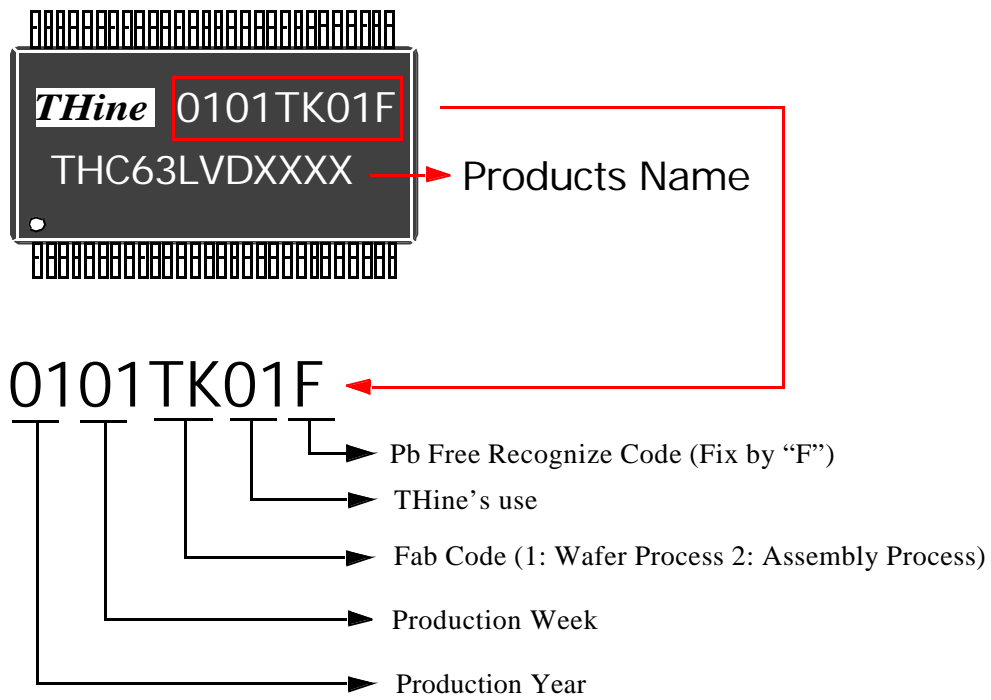


FIG2: The explanation of "Date Code"

THC63LVDM83R/THC63LVDM63R

REDUCED SWING LVDS 24Bit/18Bit COLOR HOST-LCD PANEL INTERFACE

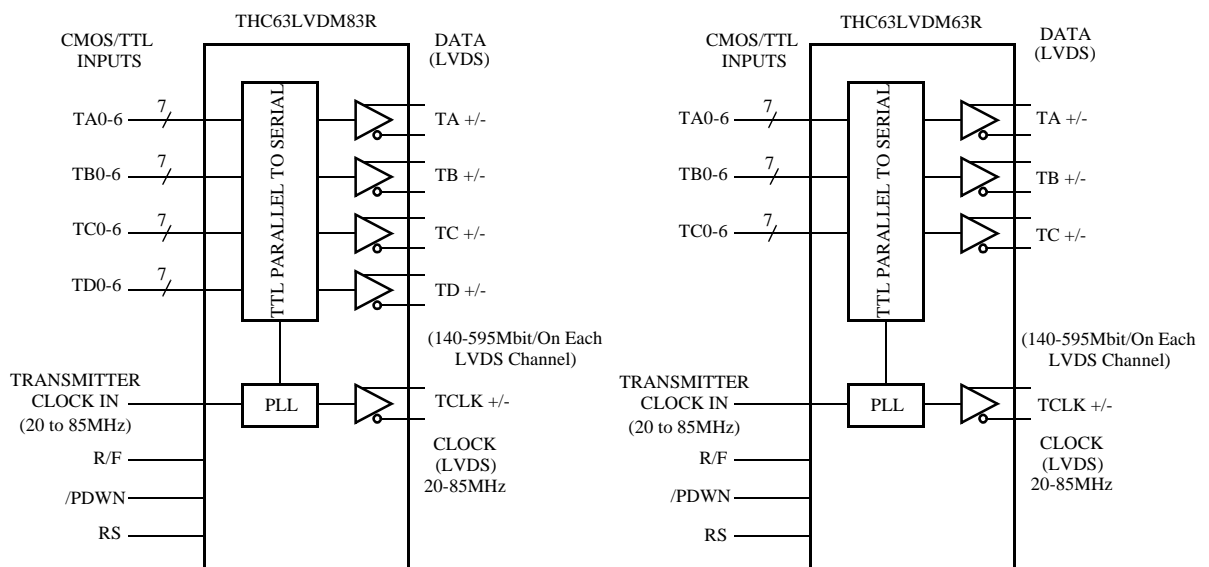
General Description

The THC63LVDM83R transmitter converts 28bits of CMOS/TTL data into LVDS (Low Voltage Differential Signaling) data stream. A phase-locked transmit clock is transmitted in parallel with the data streams over a fifth LVDS link. At a transmit clock frequency of 85MHz, 28bits of RGB data and 4bits of LCD timing and control data (HSYNC, VSYNC, CNTL1, CNTL2) are transmitted at a rate of 595Mbps per LVDS channel. Also available is THC63LVDM63R that converts 21bits of CMOS/TTL data into LVDS(Low Voltage Differential Signaling) data stream. Both transmitters can be programmed reduced swing LVDS through a dedicated pin for low power consumption and EMI.

Features

- 28:4 Data channel compression at up to 298 Megabytes per sec throughput
- Wide dot clock range: 20-85MHz suited for VGA, SVGA, XGA and SXGA
- Narrow bus (10 lines or 8 lines) reduces cable size
- Support Reduced swing LVDS for Low EMI
- 200mV swing LVDS/350mV swing LVDS selectable
- Support Spread Spectrum Clock Generator
- On chip Input Jitter Filtering
- PLL requires No external components
- Single 3.3V supply with 125mW(TYP)
- Power-Down Mode
- Low profile 56 or 48 Lead TSSOP Package
- Clock Edge Programmable
- Improved Replacement for the National DS90C383 or DS90C363

Block Diagram



Pin Out

THC63LVDM83R

RS	1	56	TA4
TD1	2	55	TA3
TA5	3	54	TA2
TA6	4	53	GND
GND	5	52	TA1
TB0	6	51	TA0
TB1	7	50	TD0
TD2	8	49	LVDS GND
VCC	9	48	TA-
TD3	10	47	TA+
TB2	11	46	TB-
TB3	12	45	TB+
GND	13	44	LVDS VCC
TB4	14	43	LVDS GND
TB5	15	42	TC-
TD4	16	41	TC+
R/F	17	40	TCLK-
TD5	18	39	TCLK+
TB6	19	38	TD-
TC0	20	37	TD+
GND	21	36	LVDS GND
TC1	22	35	PLL GND
TC2	23	34	PLL VCC
TC3	24	33	PLL GND
TD6	25	32	/PDWN
VCC	26	31	CLK IN
TC4	27	30	TC6
TC5	28	29	GND

THC63LVDM63R

TA4	1	48	TA3
RS	2	47	TA2
TA5	3	46	GND
TA6	4	45	TA1
GND	5	44	TA0
TB0	6	43	N/C
TB1	7	42	LVDS GND
VCC	8	41	TA-
TB2	9	40	TA+
TB3	10	39	TB-
GND	11	38	TB+
TB4	12	37	LVDS VCC
TB5	13	36	LVDS GND
R/F	14	35	TC-
TB6	15	34	TC+
TC0	16	33	TCLK-
GND	17	32	TCLK+
TC1	18	31	LVDS GND
TC2	19	30	PLL GND
TC3	20	29	PLL VCC
VCC	21	28	PLL GND
TC4	22	27	/PDWN
TC5	23	26	CLK IN
GND	24	25	TC6

THC63LVDM83R Pin Description

Pin Name	Pin #	Type	Description								
TA+, TA-	47, 48	LVDS OUT	LVDS Data Out.								
TB+, TB-	45, 46	LVDS OUT									
TC+, TC-	41, 42	LVDS OUT									
TD+, TD-	37, 38	LVDS OUT									
TCLK+, TCLK-	39, 40	LVDS OUT	LVDS Clock Out.								
TA0 ~ TA6	51, 52, 54, 55, 56, 3, 4	IN	Pixel Data Inputs.								
TB0 ~ TB6	6, 7, 11, 12, 14, 15, 19	IN									
TC0 ~ TC6	20, 22, 23, 24, 27, 28, 30	IN									
TD0 ~ TD6	50, 2, 8, 10, 16, 18, 25	IN									
/PDWN	32	IN	H: Normal operation, L: Power down (all outputs are Hi-Z)								
RS	1	IN	LVDS swing control. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>RS</th> <th>LVDS swing</th> </tr> </thead> <tbody> <tr> <td>VCC</td> <td>350mV</td> </tr> <tr> <td>:</td> <td>:</td> </tr> <tr> <td>GND</td> <td>200mV</td> </tr> </tbody> </table>	RS	LVDS swing	VCC	350mV	:	:	GND	200mV
RS	LVDS swing										
VCC	350mV										
:	:										
GND	200mV										
R/F	17	IN	Input Clock Triggering Edge Select. H: Rising edge, L: Falling edge								
VCC	9, 26	Power	Power Supply Pins for TTL inputs and digital circuitry.								
CLKIN	31	IN	Clock in.								
GND	5, 13, 21, 29, 53	Ground	Ground Pins for TTL inputs and digital circuitry.								
LVDS VCC	44	Power	Power Supply Pins for LVDS Outputs.								
LVDS GND	36, 43, 49	Ground	Ground Pins for LVDS Outputs.								
PLL VCC	34	Power	Power Supply Pin for PLL circuitry.								
PLL GND	33, 35	Ground	Ground Pins for PLL circuitry.								

THC63LVDM63R Pin Description

Pin Name	Pin #	Type	Description								
TA+, TA-	40, 41	LVDS OUT	LVDS Data Out.								
TB+, TB-	38, 39	LVDS OUT									
TC+, TC-	34, 35	LVDS OUT									
TCLK+, TCLK-	32, 33	LVDS OUT	LVDS Clock Out.								
TA0 ~ TA6	44, 45, 47, 48, 1, 3, 4	IN	Pixel Data Inputs.								
TB0 ~ TB6	6, 7, 9, 10, 12, 13, 15	IN									
TC0 ~ TC6	16, 18, 19, 20, 22, 23, 25	IN									
/PDWN	27	IN	H: Normal operation, L: Power down (all outputs are Hi-Z)								
RS	2	IN	LVDS swing control. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>RS</th> <th>LVDS swing</th> </tr> </thead> <tbody> <tr> <td>VCC</td> <td>350mV</td> </tr> <tr> <td>:</td> <td>:</td> </tr> <tr> <td>GND</td> <td>200mV</td> </tr> </tbody> </table>	RS	LVDS swing	VCC	350mV	:	:	GND	200mV
RS	LVDS swing										
VCC	350mV										
:	:										
GND	200mV										

Pin Name	Pin #	Type	Description
R/F	14	IN	Input Clock Triggering Edge Select. H: Rising edge, L: Falling edge
VCC	8, 21	Power	Power Supply Pins for TTL inputs and digital circuitry.
CLKIN	26	IN	Clock in.
GND	5, 11, 17, 24, 46	Ground	Ground Pins for TTL inputs and digital circuitry.
LVDS VCC	37	Power	Power Supply Pins for LVDS Outputs.
LVDS GND	36, 42	Ground	Ground Pins for LVDS Outputs.
PLL VCC	29	Power	Power Supply Pin for PLL circuitry.
PLL GND	28, 30	Ground	Ground Pins for PLL circuitry.

Absolute Maximum Ratings ¹

Supply Voltage (V_{CC})	-0.3V ~ +4.0V
CMOS/TTL Input Voltage	-0.3V ~ ($V_{CC} + 0.3V$)
CMOS/TTL Output Voltage	-0.3V ~ ($V_{CC} + 0.3V$)
LVDS Driver Output Voltage	-0.3V ~ ($V_{CC} + 0.3V$)
Output Current	continuous
Junction Temperature	+125°C
Storage Temperature Range	-55°C ~ +150°C
Resistance to soldering heat	+260°C /10sec
Maximum Power Dissipation @+25°C	0.5W

Electrical Characteristics

CMOS/TTL DC Specifications

$V_{CC} = 3.0V \sim 3.6V$, $T_a = -10^\circ C \sim +70^\circ C$

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
V_{IH}	High Level Input Voltage		2.0		V_{CC}	V
V_{IL}	Low Level Input Voltage		GND		0.8	V
I_{INC}	Input Current	$0V \leq V_{IN} \leq V_{CC}$			± 10	μA
I_{PD}	Pull Down Current	R/F pin, $V_{IH} = V_{CC}$			100	μA
I_{RS}	RS Pull Down Current	RS pin, $V_{IH} = V_{CC}$			100	μA

1. "Absolute Maximum Ratings" are those valued beyond which the safety of the device can not be guaranteed. They are not meant to imply that the device should be operated at these limits. The tables of "Electrical Characteristics" specify conditions for device operation.

LVDS Transmitter DC Specifications

 $V_{CC} = 3.0V \sim 3.6V$, $T_a = -10^{\circ}C \sim +70^{\circ}C$

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units	
VOD	Differential Output Voltage	RL=100Ω	Normal swing RS=V _{CC}	250	350	450	mV
			Reduced swing RS=GND	100	200	300	mV
ΔVOD	Change in VOD between complimentary output states	RL=100Ω			35	mV	
VOC	Common Mode Voltage		1.125	1.25	1.375	V	
ΔVOC	Change in VOC between complimentary output states				35	mV	
I _{OS}	Output Short Circuit Current	V _{OUT} =0V, RL=100Ω			-24	mA	
I _{OZ}	Output TRI-STATE Current	/PDWN=0V, V _{OUT} =0V to V _{CC}			±10	μA	

THC63LVDM83R Supply Current

 $V_{CC} = 3.0V \sim 3.6V$, $T_a = -10^{\circ}C \sim +70^{\circ}C$

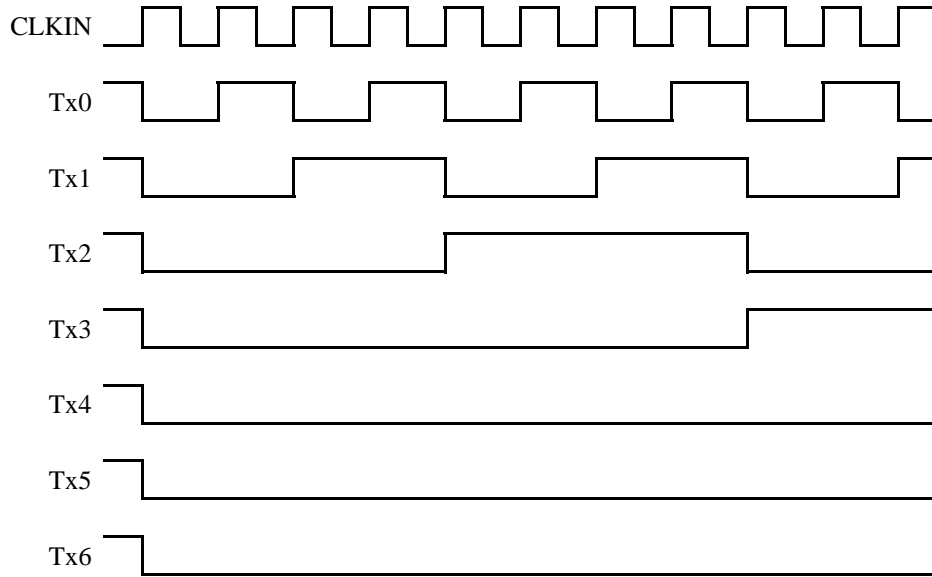
Symbol	Parameter	Condition(*)	Typ.	Max.	Units	
I _{TCCG}	Transmitter Supply Current	RL=100Ω, CL=5pF V _{CC} =3.3V, RS=V _{CC} 16 Gray Scale Pattern	f=65MHz	36	46	mA
			f=85MHz	39	49	mA
		RL=100Ω, CL=5pF V _{CC} =3.3V, RS=GND 16 Gray Scale Pattern	f=65MHz	31	41	mA
			f=85MHz	34	44	mA
I _{TCCW}	Transmitter Supply Current	RL=100Ω, CL=5pF V _{CC} =3.3V, RS=V _{CC} Worst Case Pattern	f=65MHz	38	48	mA
			f=85MHz	41	51	mA
		RL=100Ω, CL=5pF V _{CC} =3.3V, RS=GND Worst Case Pattern	f=65MHz	33	43	mA
			f=85MHz	36	46	mA
I _{TCCS}	Transmitter Power Down Supply Current	/PDWN = L		10	μA	

THC63LVDM63R Supply Current

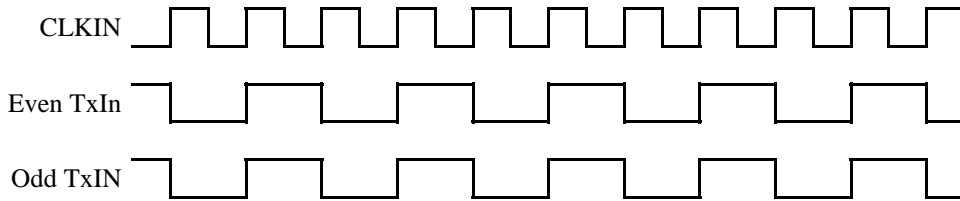
 $V_{CC} = 3.0V \sim 3.6V$, $T_a = -10^{\circ}C \sim +70^{\circ}C$

Symbol	Parameter	Condition(*)	Typ.	Max.	Units	
I_{TCCG}	Transmitter Supply Current	RL=100Ω,CL=5pF $V_{CC}=3.3V$, RS= V_{CC} 16 Gray Scale Pattern	f=65MHz	33	41	mA
			f=85MHz	37	45	mA
		RL=100Ω,CL=5pF $V_{CC}=3.3V$, RS=GND 16 Gray Scale Pattern	f=65MHz	29	36	mA
			f=85MHz	33	39	mA
I_{TCCW}	Transmitter Supply Current	RL=100Ω,CL=5pF $V_{CC}=3.3V$, RS= V_{CC} Worst Case Pattern	f=65MHz	35	43	mA
			f=85MHz	39	47	mA
		RL=100Ω,CL=5pF $V_{CC}=3.3V$, RS=GND Worst Case Pattern	f=65MHz	31	38	mA
			f=85MHz	35	42	mA
I_{TCCS}	Transmitter Power Down Supply Current	/PDWN = L		10	μA	

16 Gray Scale Pattern



Worst Case Pattern



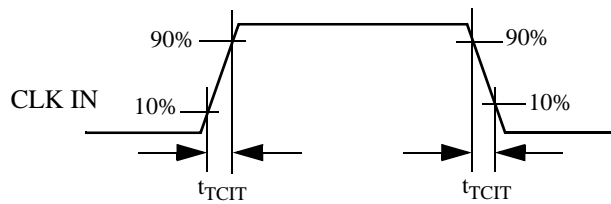
Switching Characteristics

V_{CC} = 3.0V ~ 3.6V, T_a = -10°C ~ +70°C

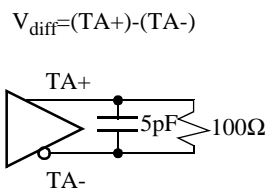
Symbol	Parameter	Min.	Typ.	Max.	Units
t _{TCIT}	CLK IN Transition time			5.0	ns
t _{TCP}	CLK IN Period	11.76	T	50.0	ns
t _{TCH}	CLK IN High Time	0.35T	0.5T	0.65T	ns
t _{TCL}	CLK IN Low Time	0.35T	0.5T	0.65T	ns
t _{TCD}	CLK IN to TCLK+/- Delay		2T/7		ns
t _{TS}	TTL Data Setup to CLK IN	2.5			ns
t _{TH}	TTL Data Hold from CKL IN	2.5			ns
t _{LVT}	LVDS Transition Time		0.6	1.5	ns
t _{TOP1}	Output Data Position0 (T=11.76ns)	-0.2	0.0	+0.2	ns
t _{TOP0}	Output Data Position1 (T=11.76ns)	$\frac{T}{7} - 0.2$	$\frac{T}{7}$	$\frac{T}{7} + 0.2$	ns
t _{TOP6}	Output Data Position2 (T=11.76ns)	$2\frac{T}{7} - 0.2$	$2\frac{T}{7}$	$2\frac{T}{7} + 0.2$	ns
t _{TOP5}	Output Data Position3(T=11.76ns)	$3\frac{T}{7} - 0.2$	$3\frac{T}{7}$	$3\frac{T}{7} + 0.2$	ns
t _{TOP4}	Output Data Position4 (T=11.76ns)	$4\frac{T}{7} - 0.2$	$4\frac{T}{7}$	$4\frac{T}{7} + 0.2$	ns
t _{TOP3}	Output Data Position5 (T=11.76ns)	$5\frac{T}{7} - 0.2$	$5\frac{T}{7}$	$5\frac{T}{7} + 0.2$	ns
t _{TOP2}	Output Data Position6 (T=11.76ns)	$6\frac{T}{7} - 0.2$	$6\frac{T}{7}$	$6\frac{T}{7} + 0.2$	ns
t _{TPLL}	Phase Lock Loop Set			10.0	ms

AC Timing Diagrams

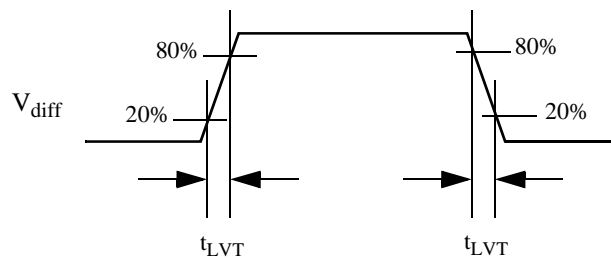
TTL Input



LVDS Output

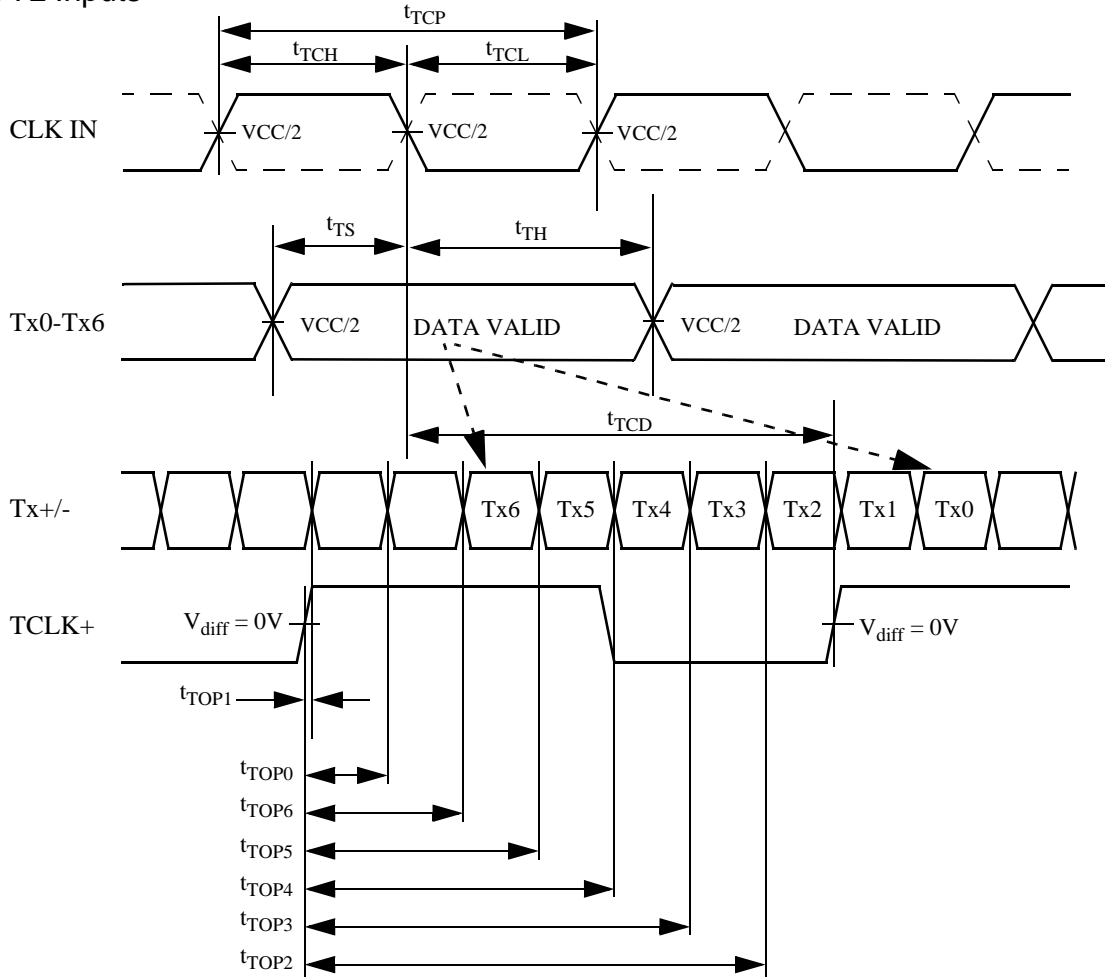


LVDS Output Load



AC Timing Diagrams

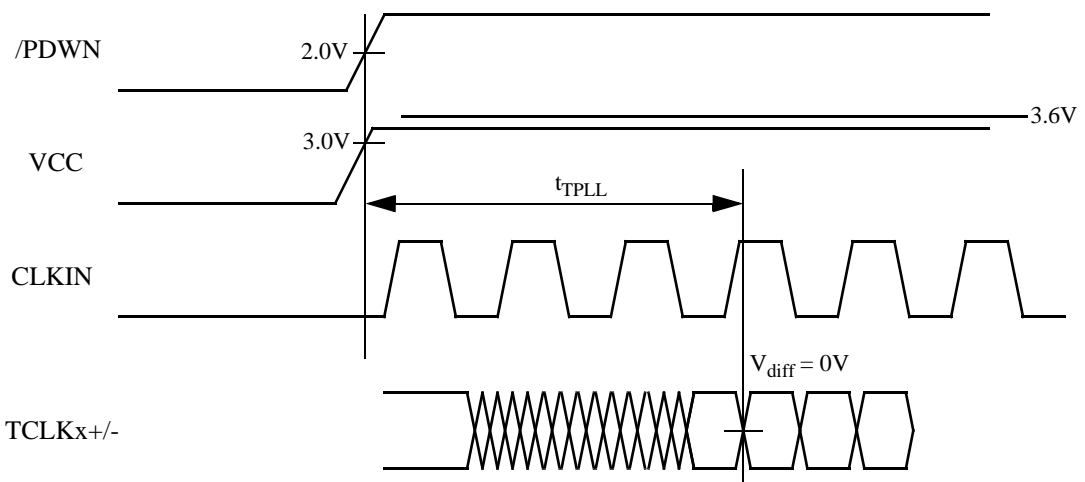
TTL Inputs



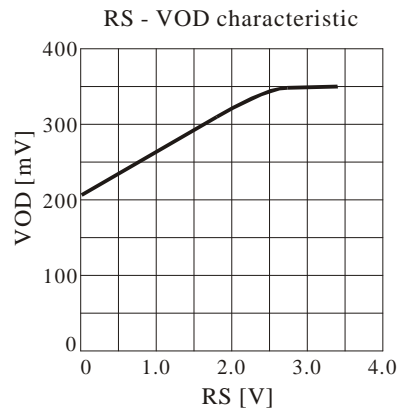
Note:

- 1) CLK IN: for THC63LVDM83R/THC63LVDM63R(R/F=GND), denote as solid line,
for THC63LVDM83R/THC63LVDM63R(R/F=VCC), denote as dashed line
- 2) V_{diff} = (Tx_{x+}) - (Tx_{x-}) , ---- (TCLK_{x+}) - (TCLK_{x-})

Phase Lock Loop Set Time

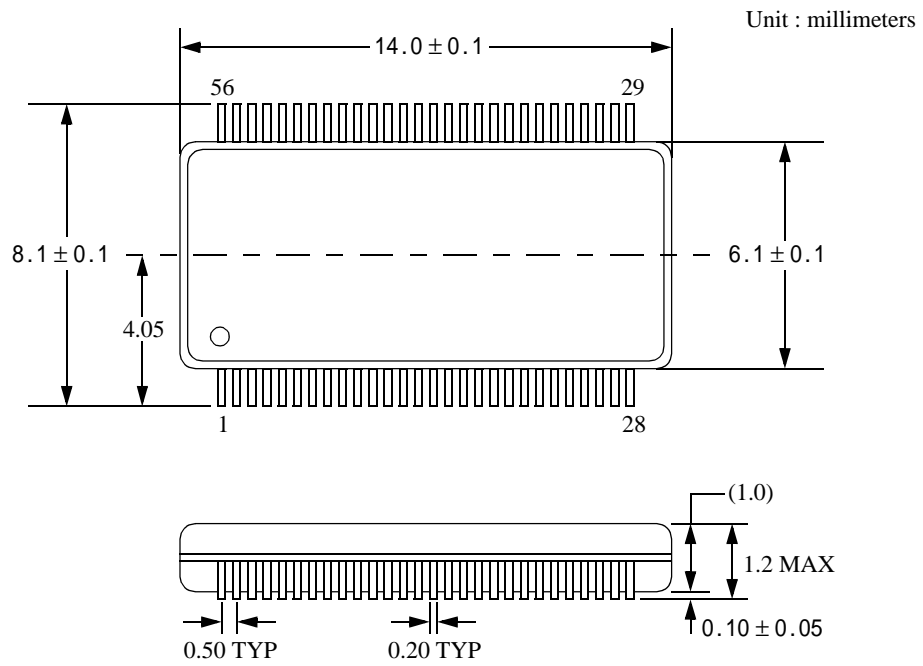


Reduced Swing Characteristic ($T_A=25^{\circ}\text{C}$, $V_{CC}=3.3\text{V}$, $R_L=100\Omega$)

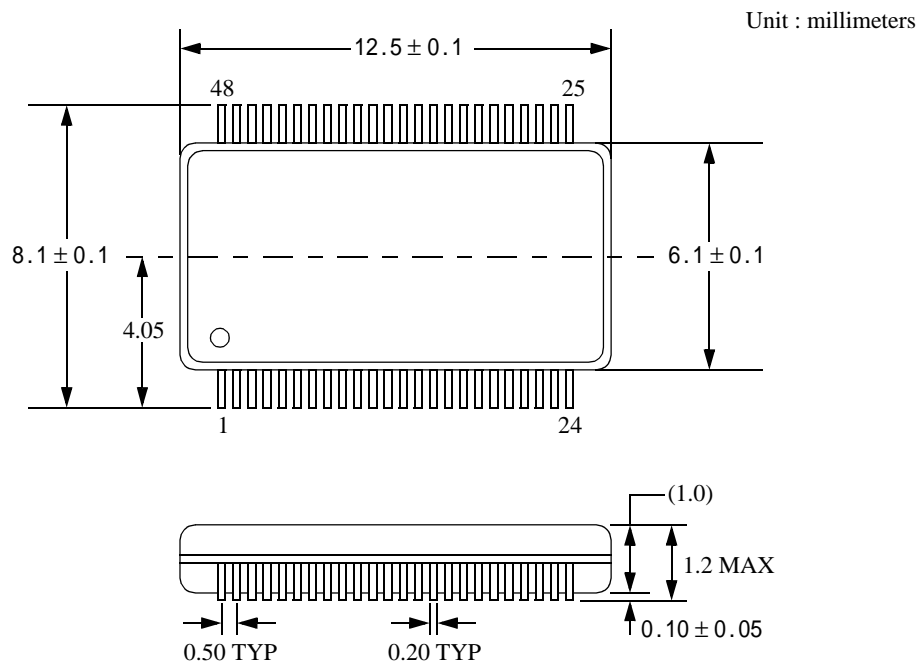


Package

56 Lead Molded Thin Shrink Small Outline Package, JEDEC



48 Lead Molded Thin Shrink Small Outline Package, JEDEC



Notes to Users:

1. The contents of this data sheet are subject to change without prior notice.
2. Circuit diagrams shown in this data sheet are examples of application. Therefore, please pay sufficient attention when designing circuits. Even if there are incorrect descriptions, we are not responsible for any problem due to them. Please note that incorrect descriptions sometimes cannot be corrected immediately if found.
3. Our copyright and know-how are included in this data sheet. Duplication of the data sheet and disclosure to other persons are strictly prohibited without our permission.
4. We are not responsible for any problems of industrial proprietorship occurring during THC63LVDM83R/THC63LVDM63R use, except for those directly related to THC63LVDM83R/THC63LVDM63R's structure, manufacture or functions. THC63LVDM83R/THC63LVDM63R is designed on the premise that it should be used for ordinary electronic devices. Therefore, it shall not be used for applications that require extremely high-reliability (space equipment, nuclear control equipment, medical equipment that affects people's lives, etc.). In addition, when using THC63LVDM83R/THC63LVDM63R for traffic signals, safety devices and control/safety units in transportation equipment, etc., appropriate measures should be taken.
5. We are making the utmost effort to improve the quality and reliability of our products. However, there is a very slight possibility of failure in semiconductor devices. To avoid damage to social or official organizations, much care should be taken to provide sufficient redundancy and fail-safe design.
6. No radiation-hardened design is incorporated in THC63LVDM83R/THC63LVDM63R.
7. Judgment on whether THC63LVDM83R/THC63LVDM63R comes under strategic products prescribed by the Foreign Exchange and Foreign Trade Control Law is the user's responsibility.
8. This technical document was provisionally created during development of THC63LVDM83R/THC63LVDM63R, so there is a possibility of differences between it and the product's final specifications. When designing circuits using THC63LVDM83R/THC63LVDM63R, be sure to refer to the final technical documents.

THine Electronics, Inc.

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