

THC63LVDM83R/THC63LVDM63R

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

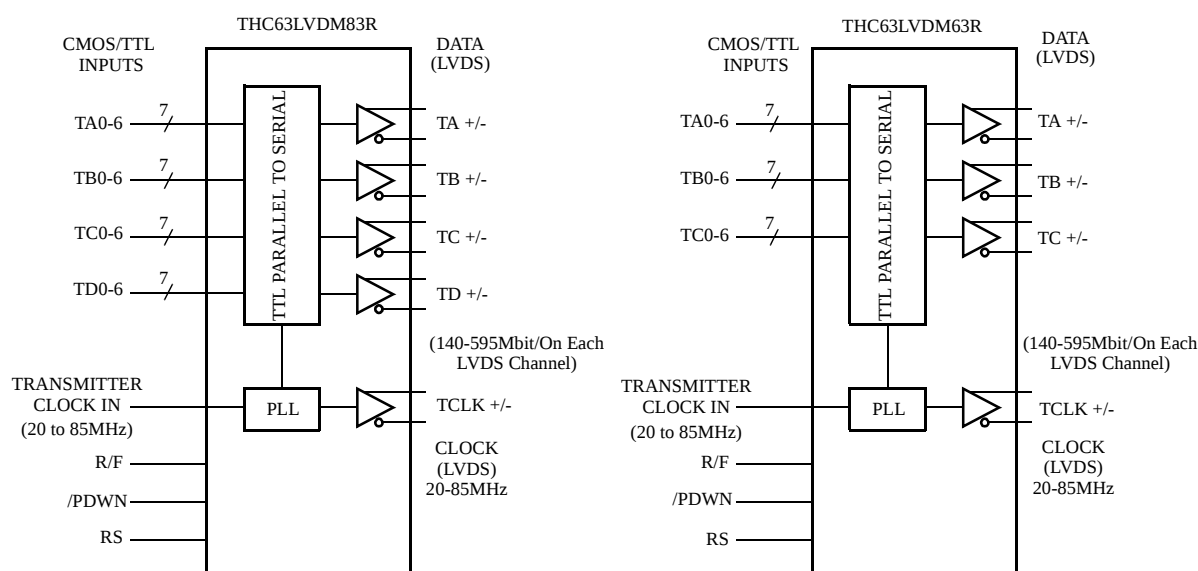
General Description

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><tr><td>RS</td><td>LVDS swing</td></tr><tr><td>VCC</td><td>350mV</td></tr><tr><td>:</td><td>:</td></tr><tr><td>GND</td><td>200mV</td></tr></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><tr><td>RS</td><td>LVDS swing</td></tr><tr><td>VCC</td><td>350mV</td></tr><tr><td>:</td><td>:</td></tr><tr><td>GND</td><td>200mV</td></tr></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	+150°C
Storage Temperature Range	-65°C ~ +150°C
Lead Temperature (Soldering, 4sec)	+260°C
Maximum Power Dissipation @+25°C	1.4W

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

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

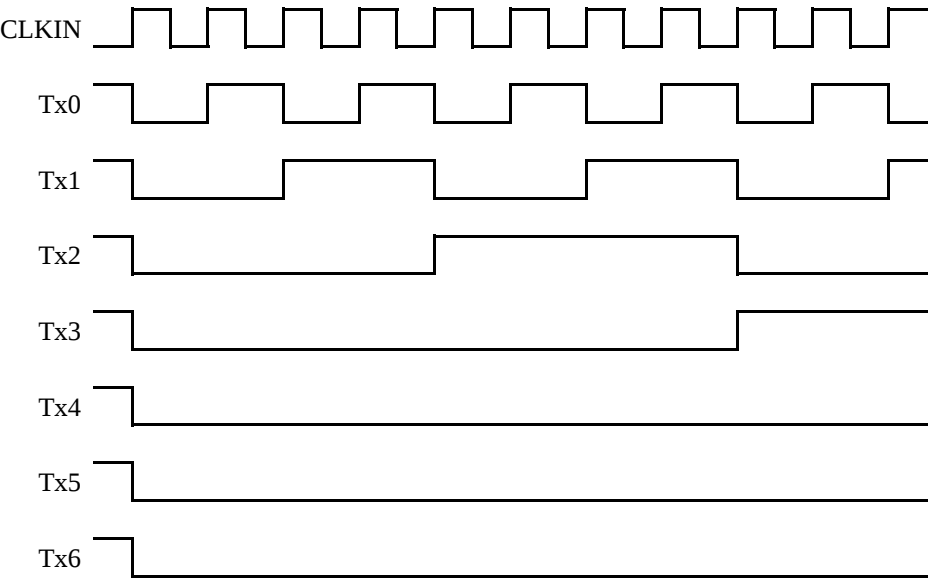
Symbol	Parameter	Condition(*)		Typ.	Max.	Units
I _{TCCG}	Transmitter Supply Current	RL=100Ω, CL=5pF V _{CC} =3.3V, RS=V _{CC} 16 Gray Scale Pattern	f=65MHz	36	46	mA
			f=85MHz	39	49	mA
		RL=100Ω, CL=5pF V _{CC} =3.3V, RS=GND 16 Gray Scale Pattern	f=65MHz	31	41	mA
			f=85MHz	34	44	mA
I _{TCCW}	Transmitter 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

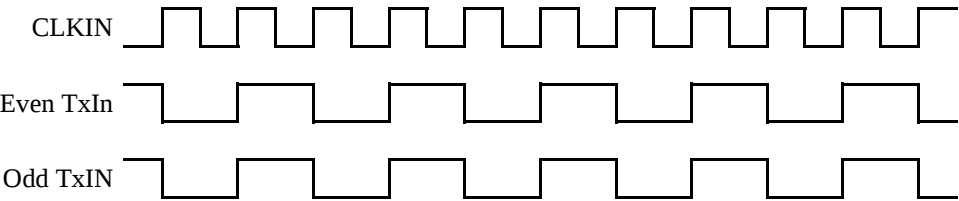
 $V_{CC} = 3.0V \sim 3.6V$, $T_a = -10^{\circ}C \sim +70^{\circ}C$

Symbol	Parameter	Condition(*)		Typ.	Max.	Units
I_{TCCG}	Transmitter Supply Current	RL=100 Ω , CL=5pF V_{CC} =3.3V, RS= V_{CC} 16 Gray Scale Pattern	f=65MHz	33	41	mA
			f=85MHz	37	45	mA
		RL=100 Ω , 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=100 Ω , CL=5pF V_{CC} =3.3V, RS= V_{CC} Worst Case Pattern	f=65MHz	35	43	mA
			f=85MHz	39	47	mA
		RL=100 Ω , 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



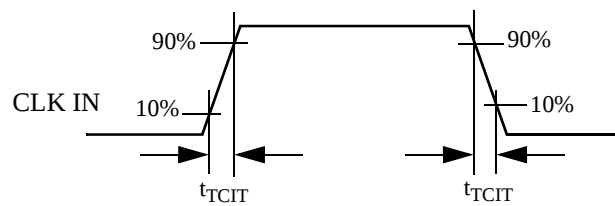
Switching Characteristics

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

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

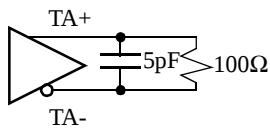
AC Timing Diagrams

TTL Input

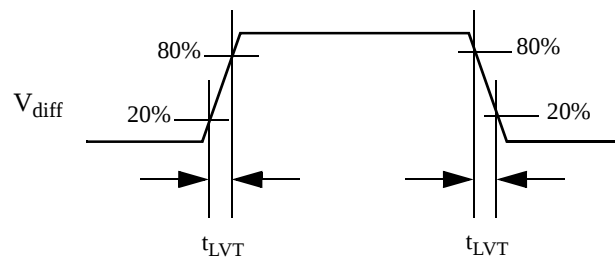


LVDS Output

$$V_{diff} = (TA+) - (TA-)$$

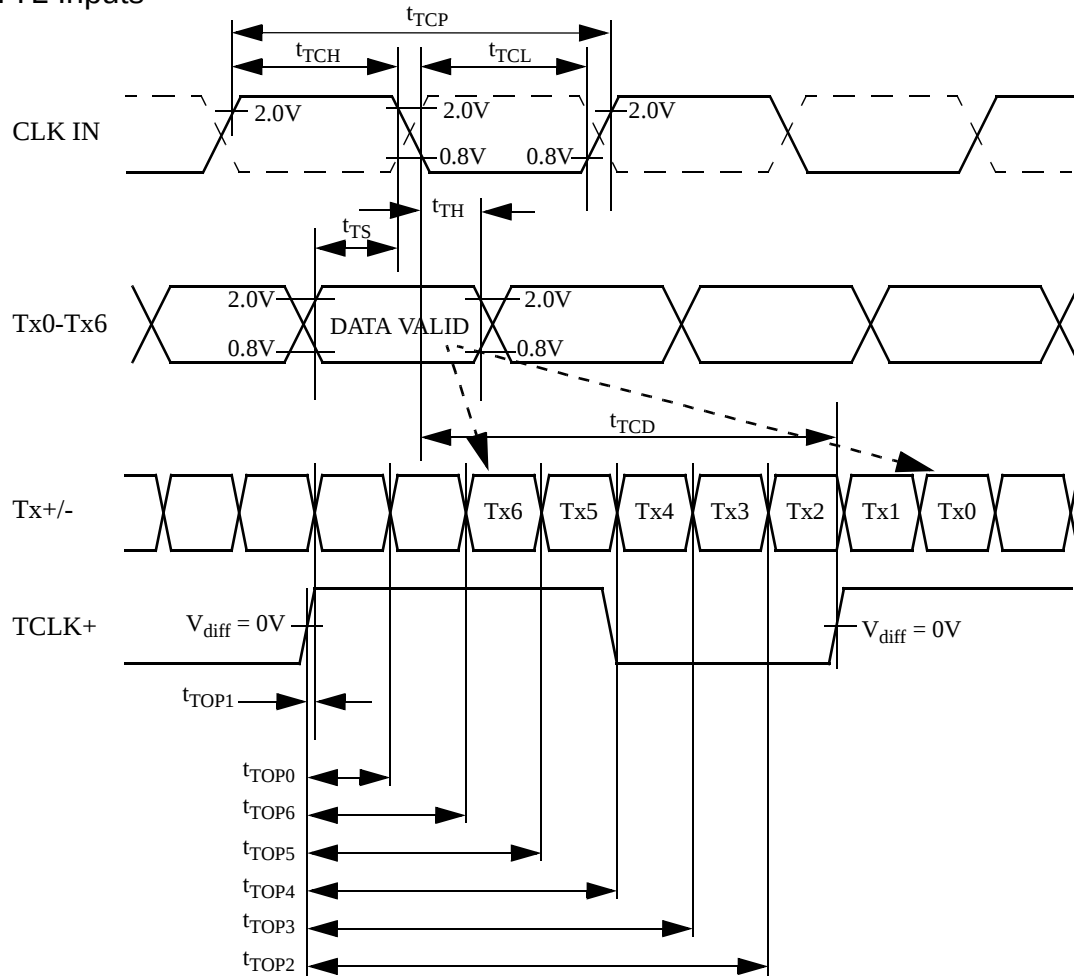


LVDS Output Load



AC Timing Diagrams

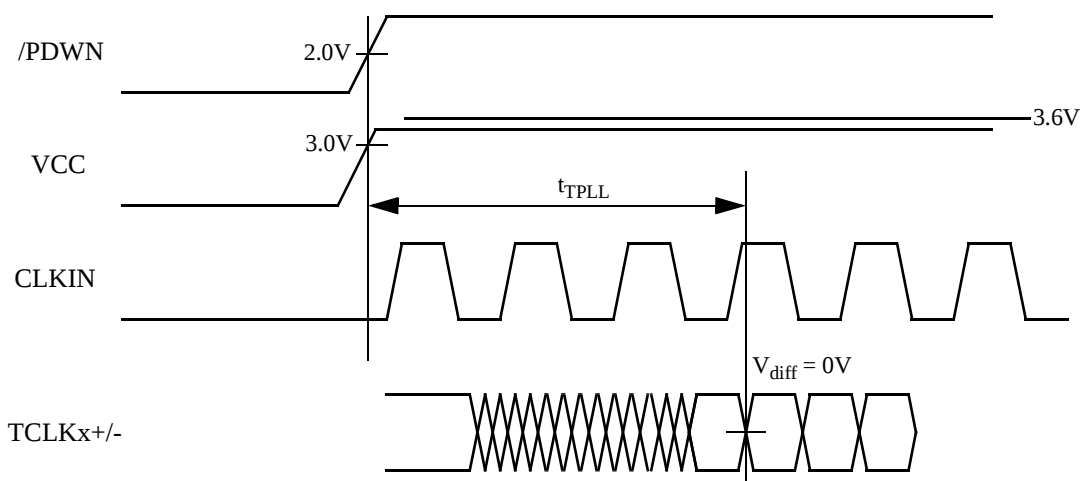
TTL Inputs



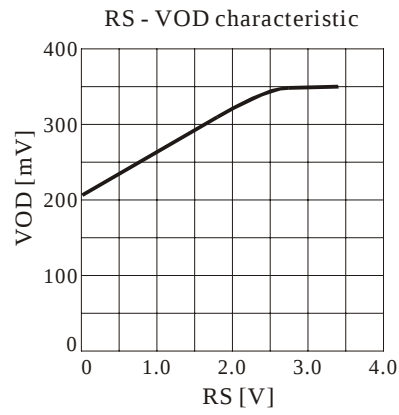
Note:

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

Phase Lock Loop Set Time

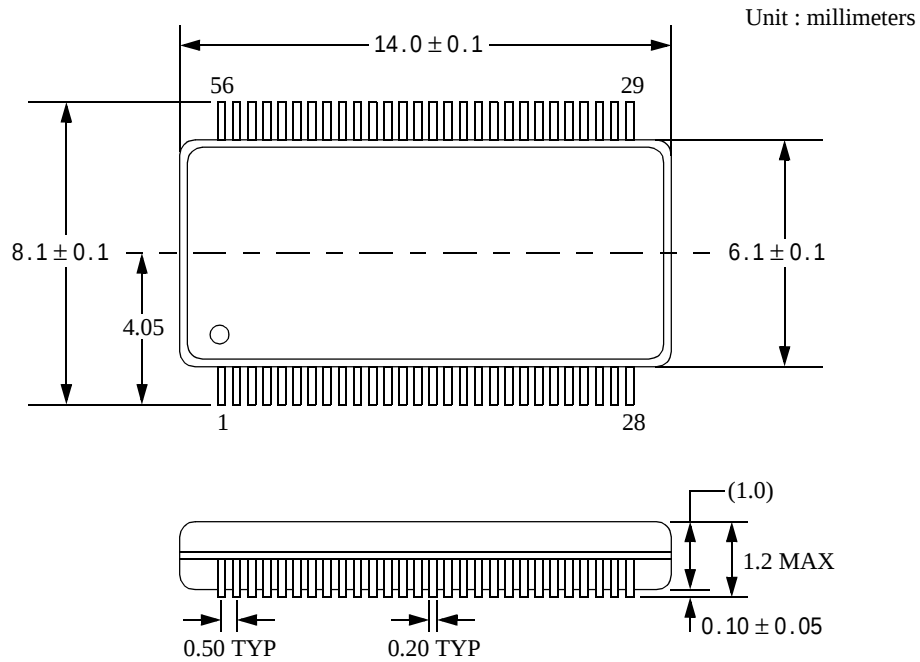


Reduced Swing Characteristic ($T_A=25^\circ\text{C}$, $V_{CC}=3.3\text{V}$, $R_L=100\Omega$)

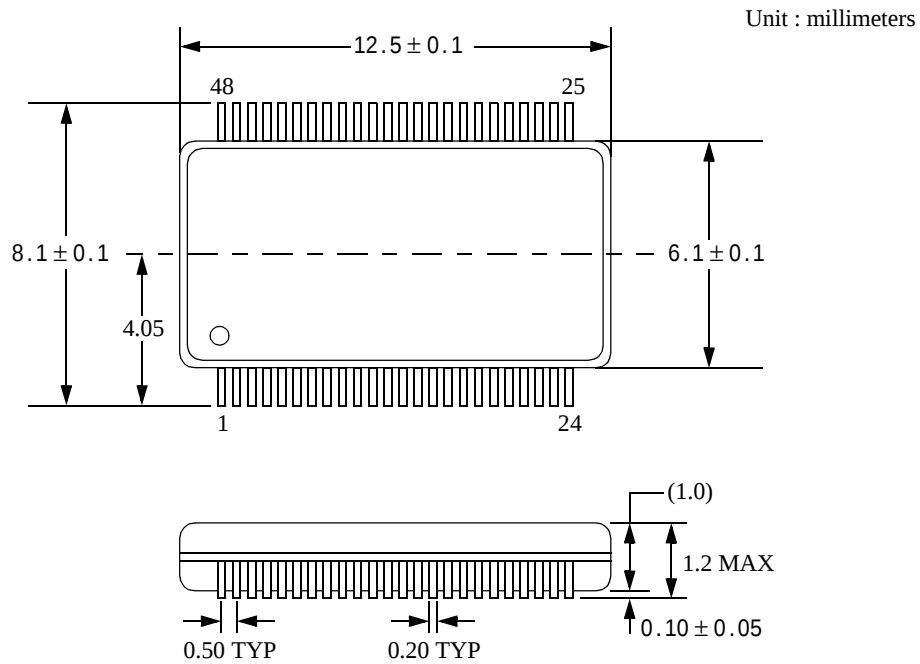


Package

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.

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