OKI Semiconductor

ML60820TA

Preliminary

USB Transceiver
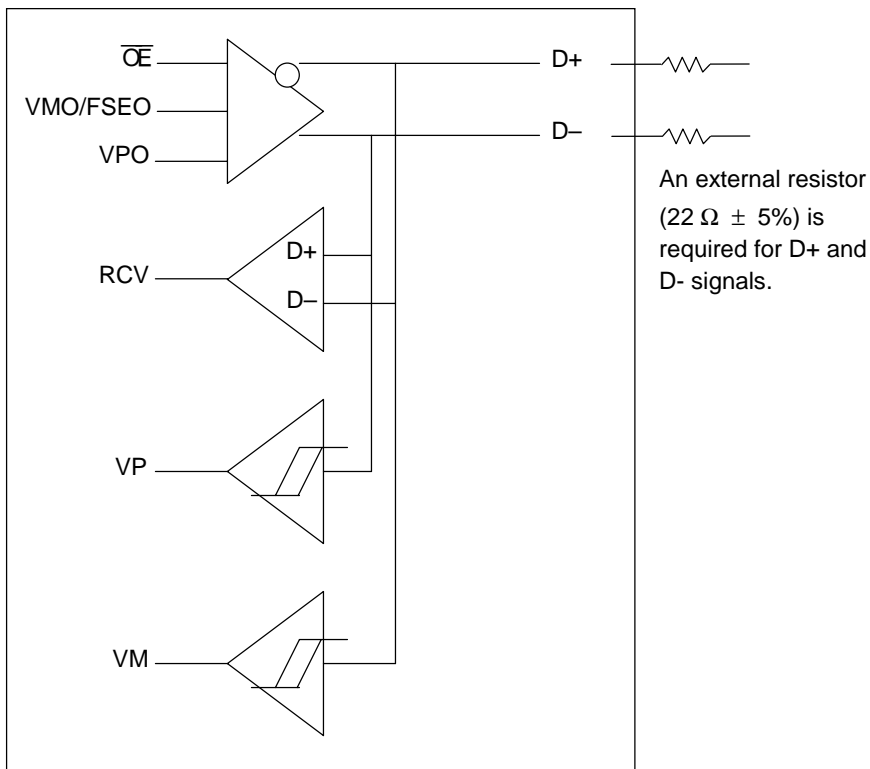
GENERAL DESCRIPTION

The ML60820 is a Universal Serial Bus (USB) transceiver which can be interfaced with a physical layer and transfer transmit/receive data at Full-Speed (12 Mbit/s).
The ML60820 has the same transceiver as one used in the ML60851C (USB Controller).

FEATURES

- Conforms to USB1.1
- Supports 12 Mbit/s (Full-Speed).
- Supports single-ended data interface.
- 3.3 V single V_{CC}
- 14-pin Plastic TSOP(2)14-P-4.4×5.0-0.65-TK

BLOCK DIAGRAM

An external resistor (22 Ω ± 5%) is required for D+ and D- signals.

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PIN DESCRIPTION

Pin	Pin name	Pin count	Type	Description
11, 10	D+, D–	2	I/O	USB data
3	RCV	1	O	Receive data. CMOS Level output for USB differential
2	$\overline{OE}$	1	I	Low-transmission mode, High-reception mode
1	MODE	1	I	VPO, VMO/FSEO signal mode select signal. A pull-up resistor is internally connected to this pin.
6	SUSPEND	1	I	This pin enters the device into a low power state when the USB bus is not used. When this pin is valid, the RCV pin is Low and the D+/D- pin is tri-state.
12, 13	VPO, VMO/FSEO	2	I	Input to differential driver MODE VPO VMO/FSEO Result 0 0 0 Logic "0" 　　　1 $\overline{SEO}$ 　　1 0 Logic "1" 　　　1 $\overline{SEO}$ 1 0 0 $\overline{SEO}$ 　　　1 Logic "0" 　　1 0 Logic "1" 　　　1 Illegal Code
4, 5	VP, VM	2	O	D+/D- version setting VP VM Result 0 0 $\overline{SEO}$ 0 1 Error 1 0 Full Speed 1 1 Error
8, 9	NC	9		Non Connect
14	V_{CC}	1	I	V_{CC} 3.0 V to 3.6 V
7	Gnd	1	I	Ground

(Note 1) SEO: single ended zero

(Note 2) In MODE selection, to change the result from $\overline{SEO}$ to Logic "1", change the VMO/FSEO signal from "1" to "0" after changing the VPO signal from "0" to "1".

If the VPO signal and VMO/FSEO signal are changed reversely, voltage spikes can be generated on the D+ and/or D- signal.

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ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Condition	Rating	Unit
Power Supply Voltage	V_{CC}	—	−0.3 to +4.6	V
Input Voltage	V_I	—	−0.3 to +V_{CC} + 0.3	V
Storage Temperature	T_{STG}	—	−55 to +150	°C

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Condition	Range	Unit
Power Supply Voltage	V_{CC}	—	3.0 to 3.6	V
Operating Temperature	T_{OP}	—	0 to 70	°C

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ELECTRICAL CHARACTERISTICS

DC Characteristics

(1)   Digital Signal

(V_{CC} = 3.0 to 3.6 V, Ta = 0 to 70°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input High Voltage	V_{IH}		2.0	—	V_{CC}+0.3	V
Input Low Voltage	V_{IL}		−0.3	—	0.8	V
Output High voltage	V_{OH}	I_{OH} = −100 µA	V_{CC}−0.2		—	V
		I_{OH} = −4 mA	2.4		—	V
Output Low Voltage	V_{OL}	I_{OL} = 100 µA	—		0.2	V
		I_{OL} = 4 mA	—		0.4	V
Input High Current	I_{IH}	V_{IH} = V_{cc}	—	0.01	1	µA
		Pull-UP pin	—	—	5	
Input Low Current	I_{IL}	V_{IL} = 0 V	−1	−0.01	—	µA
		Pull-UP pin	−160	−45	−10	
Operating Current	I_{CC}		—		TBD	mA
Standby Current	I_{CCS}		—		TBD	µA

(2)   USB Port Section

(V_{CC3} = 3.0 V to 3.6 V, Ta = 0 to 70°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Differential Input Sensitivity	V_{DI}	|(D+) − (D−)|	0.2		—	V
Differential Common Mode Range	V_{CM}	Including V_{DI}	0.8		2.5	V
Single-ended Receiver Threshold	V_{SE}		0.8		2.0	V
Output High Voltage	V_{OH}	15 KΩ to GND	2.8		3.6	V
Output Low Voltage	V_{OL}	1.5 KΩ to 3.6 V	—		0.3	V
Output Leakage Current	I_{LO}	0 V<V_{IN}<3.3 V	−10		+10	µA

AC CHARACTERISTICS USB PORT SECTION

(V_{CC3} = 3.0 V to 3.6 V, Ta = 0 to 70°C)

Parameter	Symbol	Condition (Notes 1, 2 & 3)	Min.	Typ.	Max.	Unit
Rise Time	T_R	CL = 50 pF	4		20	ns
Fall Time	T_F	CL = 50 pF	4		20	ns
Output Signal Crossover Voltage	V_{CRS}		1.3		2	V
Driver Output Resistance	Z_{DRV}	When operating at a normal state	28		44	Ω
Data Rate	T_{DRATE}	Average bit rate (12 Mbps ± 0.25%)	11.97		12.03	Mbps

(Note 1) The D+ line is pulled up to 3.3 V using a 1.5 kΩ resistor.
(Note 2) TR and TF are transition times measured at 10 % and 90 % of amplitude.
(Note 3) The external resistance of 22 Ω ± 5 % is included for the D+ and D- lines.

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TIIMING DIAGRAM

(V_{CC} = 3.0 to 3.6 V, Ta = 0 to 70°C)

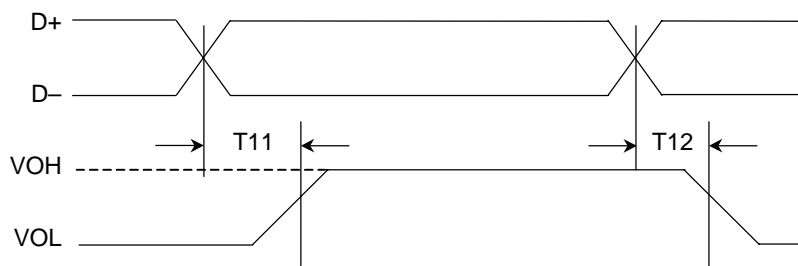| Parameter	Symbol	Condition	Min.	Max.	Unit	Note
Receiver Delay Time	T11			16	ns	
D+, D– to RCV	T12			19	ns	
Single-ended Delay Time	T11			14	ns	
D+, D– to VP, VM	T12			12	ns	
Driver Delay Time	T21			22	ns	
VPO, VMO/FSEO to D+/D–	T22			19	ns	
Driver Enable Time	T31			20	ns	
$\overline{OE}$ to D+/D–	T31			20	ns	
Driver Disable Time	T32			18	ns	
$\overline{OE}$ to D+/D–	T32			18	ns	

Figure 1: D+/D– to RCV, VP/VM
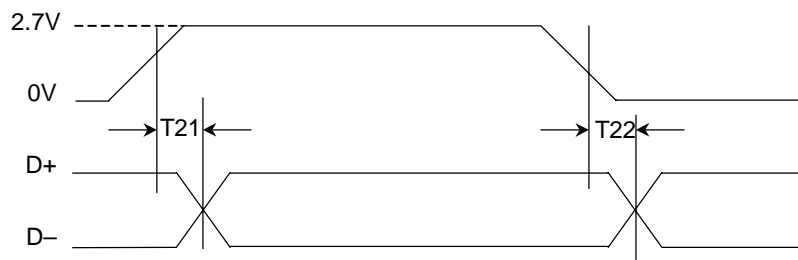
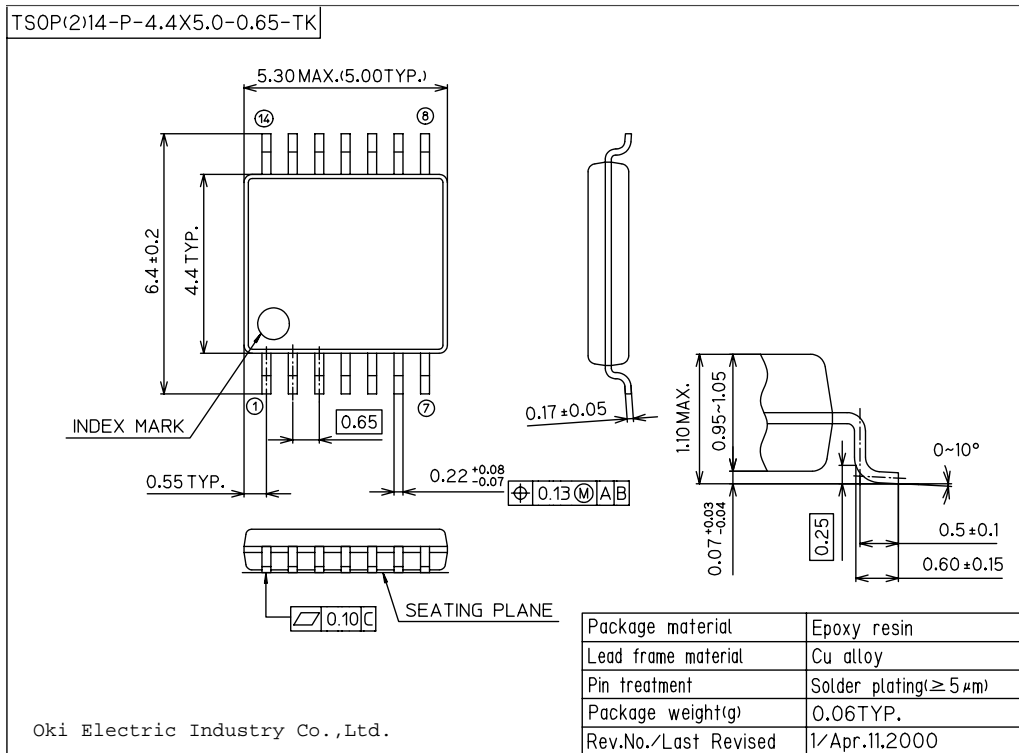**Figure 2: VPO, VMO/FSEO to D+/D–**

Figure 3: $\overline{OE}$ to D+/D–

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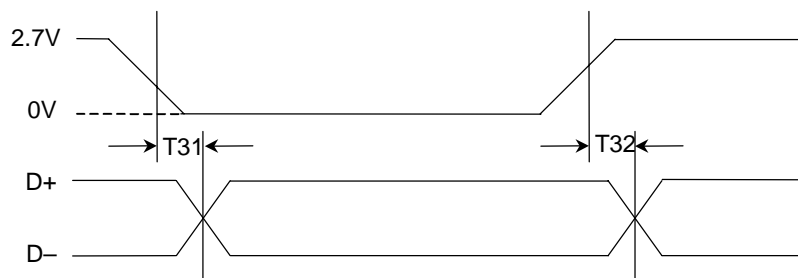
PACKAGE DIMENSIONS

(Unit: mm)

TSOP(2)14-P-4.4X5.0-0.65-TK

5.30MAX.(5.00TYP.)

6.4±0.2

4.4 TYP.

INDEX MARK

0.65

0.55 TYP.

$0.22^{+0.08}_{-0.07}$

⊕ 0.13 Ⓜ A B

0.17±0.05

1.10MAX.

0.95~1.05

$0.07^{+0.03}_{-0.04}$

0.25

0~10°

0.5±0.1

0.60±0.15

0.10 C

SEATING PLANE

Package material	Epoxy resin
Lead frame material	Cu alloy
Pin treatment	Solder plating(≥5μm)
Package weight(g)	0.06TYP.
Rev.No./Last Revised	1/Apr.11.2000

Oki Electric Industry Co.,Ltd.

Notes for Mounting the Surface Mount Type Package

The surface mount type packages are very susceptible to heat in reflow mounting and humidity absorbed in storage.
Therefore, before you perform reflow mounting, contact Oki's responsible sales person for the product name, package name, pin number, package code and desired mounting conditions (reflow method, temperature and times).

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