



## APPLICATION NOTE 362

# Replacing the TDK 78P7200/2241 with the DS3150 Line Interface Unit

*Abstract: This application note provides the information required to use the DS3150 line interface unit (LIU) in place of the TDK 78P7200, TDK 78P200L, and TDK 78P2241. The DS3150 LIU performs all the functions necessary for interfacing at the physical layer to T3, E3, and STS-1 lines.*

## Introduction

The DS3150 is a full-featured line interface unit (LIU) that performs all of the functions necessary for interfacing at the physical layer to T3, E3, and STS-1 lines. The DS3150 is pin compatible with the TDK 78P2241, 78P2241B, and 78P7200L devices and an easy replacement for the 78P7200. The purpose of this application note is to describe how to replace the TDK devices with the DS3150 in existing designs. This application note should be read in conjunction with the DS3150 data sheet and the relevant TDK data sheet(s).

## Replacing the 78P2241, 78P2241B, and 78P7200L with the DS3150

Although for new designs the DS3150 data sheet recommends somewhat different external components than those used with these TDK devices, *the DS3150 can be dropped into existing 3.3V designs with no changes to the board artwork and no component changes*, if the wiring recommendations in the TDK data sheets were followed. Since the DS3150 is a 3.3V-only device, it cannot replace the 78P2241 devices in 5V applications unless it is provided with a 3.3V supply. TDK's recommended wire-up for the 78P2241 devices configures the DS3150, as shown in Table 1. TDK's recommended wire-up for the 78P7200L configures the DS3150, as shown in Table 2.

## Replacing the 78P7200 with the DS3150 in Existing Designs

To replace the 78P7200 in an existing design, the following changes are required. See Figure 1 for component locations.

1. Provide a 3.3V power supply to the DS3150 rather than the 78P7200's 5V supply.
2. Replace the CPD capacitor with a 0 $\Omega$  resistor.
3. For E3 applications RTT should be 301 $\Omega$ .
4. For best impedance matching, change RTR to 330 $\Omega$ .

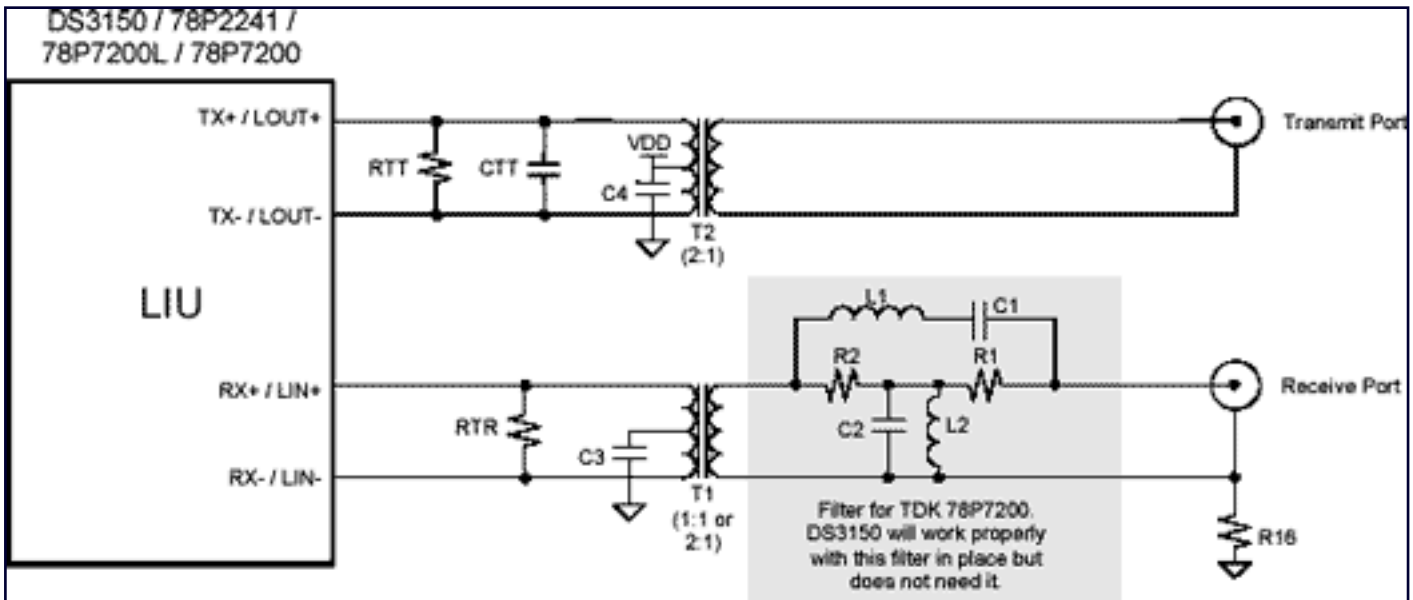


Figure 1. Line interface external components.

The CPD pin on the TDK 78P7200 is used to place a decoupling capacitor between the peak detector node and  $V_{CC}$ . On the DS3150, the CPD pin function is not required and the pin is reassigned to be the loopback control input active-low LBKS. Replacing the CPD capacitor with a  $0\Omega$  resistor results in active-low LBKS being pulled up to  $V_{CC}$ , disabling loopbacks in the DS3150. If the DS3150 is used in an existing 78P7200 design, TDK's recommended wire-up of the 78P7200 plus the required changes above configure the DS3150, as shown in Table 3.

Table 1. Pin-by-Pin Look at the DS3150 in a 78P2241 Application

PLCC Pin #	TQFP Pin #	78P2241 Pin	DS3150 Pin	78P2241 Recommended Wiring: Effect on DS3150 Operation
1, 3	42, 44	LIN+, LIN-	RX+, RX-	$75\Omega$ termination resistor and 1:1 transformer gives actual line termination of approximately $73\Omega$ . Receiver works fine.
2	43	GND	EFE	EFE=0 disables DS3150 enhanced features.
4	46	GND	TDS0	TDS0=0 has no effect. EFE pin tied low causes DS3150 to ignore this pin.
5	2	RFO	TDS1 / OFSEL	Resistor RFO to ground has no effect. MCLK pin internally pulled up causes DS3150 to ignore this pin and use TCLK as master clock.
n/a	8	GND	DM*	Open-drain DM* output tied to ground is no problem.
9, 11	9, 11	LOUT+, LOUT-	TX+, TX-	$301\Omega$ termination resistor and 2:1 transformer gives actual line termination of approximately $69\Omega$ . Transmitter works fine.
10	10	ICKP	ICE	DS3150 pin function matches 78P2241 pin function.
12	13	LBO		DS3150 pin function matches 78P2241 pin function.
13	15	E3*	TESS	DS3150 pin function matches 78P2241 pin function.
14	16	TPOS / TNRZ		DS3150 pin function matches 78P2241 pin function.
15	17	TNEG		DS3150 pin function matches 78P2241 pin function.
16	18	TCLK		DS3150 pin function matches 78P2241 pin function.
18	22	TXEN	TTS*	DS3150 pin function matches 78P2241 pin function.
19	26	LF1	MCLK	Capacitor to ground is no problem. Internal pull-up to $V_{DD}$ pulls MCLK high, causing DS3150 to use TCLK as its master clock.

20	27	ENDEC*	ZCSE*	DS3150 pin function matches 78P2241 pin function.
21	28	MON	RMON	DS3150 pin function matches 78P2241 pin function.
n/a	29	GND	PRBS	PRBS output tied to ground is no problem. EFE pin tied low causes DS3150 to tri-state this pin.
23	33	RCLK		DS3150 pin function matches 78P2241 pin function.
24	34	RNEG / RLCV		DS3150 pin function matches 78P2241 pin function. (Only 78P2241B has LCV function when ENDEC*=0)
25	35	RPOS / RNRZ		DS3150 pin function matches 78P2241 pin function.
27	39	LOS*		DS3150 pin function matches 78P2241 pin function.
28	40	LPBK*	LBKS*	DS3150 pin function matches 78P2241 pin function.
6-8, 17, 22, 26	1, 3-7, 12, 14, 19-21, 23-25, 30-32, 36-38, 41, 45, 47, 48	VSS, VDD		<b>VDD must be 3.3V.</b>

**Table 2. Pin-by-Pin Look at the DS3150 in a 78P7200L Application**

PLCC Pin #	TQFP Pin #	7200L Pin	DS3150 Pin	78P7200L Recommended Wiring Plus Required Change: Effect on DS3150 Operation
1, 3	42, 44	LIN+, LIN-	RX+, RX-	75Ω termination resistor and 1:1 transformer gives actual line termination of approximately 73Ω. Receiver works fine.
2	43	GND	EFE	EFE=0 disables DS3150 enhanced features.
4	46	GND	TDS0	TDS0=0 has no effect. EFE pin tied low causes DS3150 to ignore this pin.
5	2	RFO	TDS1 / OFSEL	Resistor RFO to ground has no effect. MCLK pin internally pulled up causes DS3150 to ignore this pin and use TCLK as master clock.
n/a	8	GND	DM*	Open-drain DM* output tied to ground is no problem.
9, 11	9, 11	LOUT+, LOUT-	TX+, TX-	301Ω termination resistor and 2:1 transformer gives actual line termination of approximately 69Ω. Transmitter works fine.
10	10	ICKP	ICE	DS3150 pin function matches 78P7200L pin function.
12	13	LBO		DS3150 pin function matches 78P7200L pin function.
13	15	E3*	TESS	DS3150 pin function matches 78P7200L pin function.
14	16	TPOS	TPOS/TNRZ	DS3150 pin function matches 78P7200L pin function when ZCSE*=1.
15	17	TNEG		DS3150 pin function matches 78P7200L pin function when ZCSE*=1.
16	18	TCLK		DS3150 pin function matches 78P7200L pin function.
18	22	TXEN	TTS*	DS3150 pin function matches 78P7200L pin function.
19	26	LF1	MCLK	Capacitor to ground is no problem. Internal pull-up to VDD pulls MCLK high, causing DS3150 to use TCLK as its master clock.

20	27	N/C	ZCSE*	Internal pull-up disables DS3150 B3ZS/HDB3 encoder/decoder and puts DS3150 into bipolar interface mode, which matches 78P7200L behavior.
21	28	N/C	RMON	RMON floating is a valid state: 20dB pre-amp disabled, jitter attenuator enabled in the receiver path.
n/a	29	GND	PRBS	PRBS output tied to ground is no problem. EFE pin tied low causes DS3150 to tri-state this pin.
23	33	RCLK		DS3150 pin function matches 78P7200L pin function.
24	34	RNEG	RNEG/RLCV	DS3150 pin function matches 78P7200L pin function when ZCSE*=1.
25	35	RPOS	RPOS/RNRZ	DS3150 pin function matches 78P7200L pin function when ZCSE*=1.
27	39	LOS*		DS3150 pin function matches 78P7200L pin function.
28	40	LPBK*	LBKS*	DS3150 pin function matches 78P7200L pin function.
6-8, 17, 22, 26	1, 3-7, 12, 14, 19-21, 23-25, 30-32, 36-38, 41, 45, 47, 48	VSS, VDD		<b>VDD must be 3.3V.</b>

**Table 3. Pin-by-Pin Look at the DS3150 in a 78P7200 Application**

PLCC Pin #	78P7200 Pin	DS3150 Pin	78P7200 Recommended Wiring Plus Required Changes: Effect on DS3150 Operation
1, 3	LIN+, LIN-	RX+, RX-	<b>422Ω termination resistor changed to 330Ω</b> and 1:2 transformer gives actual line termination of approximately 75Ω. Receiver works fine.
2	NCR	EFE	EFE=0 disables DS3150 enhanced features.
4	NCR	TDS0	TDS0=0 has no effect. EFE pin tied low causes DS3150 to ignore this pin.
5	RFO	TDS1 / OFSEL	Resistor RFO to ground has no effect. MCLK pin internally pulled up causes DS3150 to ignore this pin and use TCLK as master clock.
9, 11	LOUT+, LOUT-	TX+, TX-	301Ω termination resistor and 2:1 transformer: actual line termination is approximately 69Ω. <b>Termination resistor must be the same for E3 mode.</b> Transmitter works fine. (Changing resistor to 330Ω results in actual line termination of approximately 75Ω.)
10	NCT	ICE	Tied to ground: DS3150 matches 78P7200 behavior.
12	LBO		DS3150 pin function matches 78P7200 pin function.
13	OPT1*	TESS	DS3150 pin function matches 78P7200 pin function. Although the preferred wiring of TESS for STS-1 is to leave it floating, the DS3150 will handle STS-1 correctly with TESS pulled high.
14	TPOS	TPOS/TNRZ	DS3150 pin function matches 78P7200 pin function when ZCSE*=1.
15	TNEG		DS3150 pin function matches 78P7200 pin function when ZCSE*=1.
16	TCLK		DS3150 pin function matches 78P7200 pin function.
18	OPT2*	TTS*	DS3150 pin function matches 78P7200 pin function.
19	LF1	MCLK	Resistor to LF2/ZCSE*, capacitor to ground is no problem. With resistor to LF2/ZCSE* and resistor from LF2/ZCSE* to V <sub>CC</sub> , MCLK is pulled up, causing DS3150 to use TCLK as its master clock.

20	LF2	ZCSE*	Resistor to V <sub>CC</sub> disables DS3150 B3ZS/ HDB3 encoder/decoder and puts DS3150 into bipolar interface mode, which matches 78P7200 behavior.
21	NCD	RMON	RMON=0 disables DS3150 20dB pre-amp and Rx Jitter Attenuator.
23	RCLK		DS3150 pin function matches 78P7200 pin function.
24	RNEG	RNEG / RLCV	DS3150 pin function matches 78P7200 pin function when ZCSE* = 1.
25	RPOS	RPOS / RNRZ	DS3150 pin function matches 78P7200 pin function when ZCSE* = 1.
27	LOWSIG*	LOS*	DS3150 pin function matches 78P7200 pin function.
28	CPD	LBKS*	Capacitor to V <sub>CC</sub> <b>must be changed to 0Ω resistor</b> to disable DS3150 loopbacks.
6-8, 17, 22, 26	VSS, VDD		<b>VDD supply must be changed from 5V to 3.3V.</b>

Application Note 362: <http://www.maxim-ic.com/an362>

### More Information

For technical questions and support: <http://www.maxim-ic.com/support>

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### Related Parts

DS3150: [QuickView](#) -- [Full \(PDF\) Data Sheet](#)

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