Application Note 362
Replacing the TDK 78P7200/2241 with the DS3150

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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 and nearly pin compatible with the 78P7200 and 78P7200L devices. 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 WITH THE DS3150

The following discussion covers both the original 78P2241 and the new 78P2241B. Although for new designs the DS3150 data sheet recommends somewhat different external components than those used with the TDK 78P2241 devices, the DS3150 can be dropped into existing 3.3V 78P2241 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 will configure the DS3150 as shown in Table 1.

REPLACING THE 78P7200L WITH THE DS3150

The 78P7200L is a feature-reduced version of the 78P2241. The DS3150 can be dropped into existing 3.3V 78P7200L designs with just one required change: The DS3150's ZCSE* pin (a no-connect pin on the 78P7200L) must be wired to VDD. Since the DS3150 is a 3.3V only device, it cannot replace the 78P7200L in 5V applications unless it is provided with a 3.3V supply. TDK's recommended wire-up for the 78P7200L *plus* the required change will configure 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 0Ω resistor
3. For E3 applications RTT should be 301Ω
4. For best impedance matching, change RTR to 330Ω

The CPD pin on the TDK 78P7200 is used to place a decoupling capacitor between the peak detector node and Vcc. On the DS3150, the CPD pin function is not required and the pin is reassigned to be the loopback control input LBKS*. Replacing the CPD capacitor with a zero ohm resistor results in LBKS* being pulled up to Vcc, 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 will configure the DS3150 as shown in Table 3.

PIN-BY-PIN LOOK AT THE DS3150 IN A 78P2241 APPLICATION—Table 1

PLCC Pin #	TQFP Pin #	78P2241 Pin	DS3150 Pin	78P2241 Recommended Wiring: 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 pulled up causes DS3150 to ignore this pin and use TCLK as master clock.
n/a	8	GND	DM*	DM* output tied to ground is no problem. EFE pin tied low causes DS3150 to tri-state this pin.
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 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 VDD 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		**VDD must be 3.3V.**

PIN-BY-PIN LOOK AT THE DS3150 IN A 78P7200L APPLICATION—Table 2

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 pulled up causes DS3150 to ignore this pin and use TCLK as master clock.
n/a	8	GND	DM*	DM* output tied to ground is no problem. EFE pin tied low causes DS3150 to tri-state this pin.
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	E#	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*	**ZCSE* must be pulled up to VDD.**
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	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		**VDD must be 3.3V.**

PIN-BY-PIN LOOK AT THE DS3150 IN A 78P7200 APPLICATION—Table 3

PLCC Pin #	78P7200 Pin	DS3150 Pin	78P7200 Recommended Wiring Plus Required Changes: Effect on DS3150 Operation
1,3	LIN+, LIN-	RX+, RX-	422Ω **termination resistor changed to 330Ω** 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 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. **Termination resistor must be the same for E3 mode.** 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 Vcc, MCLK is pulled up, causing DS3150 to use TCLK as its master clock.
20	LF2	ZCSE*	Resistor to Vcc disables DS3150 B3ZS/ HDB3 encoder/decoder and puts DS3150 into bipolar interface mode.
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 Vcc **must be changed to 0Ω resistor** to disable DS3150 loopbacks.
6-8, 17, 22, 26	VSS, VDD		**VDD supply must be changed from 5V to 3.3V.**

Line Interface External Components: Figure 1