TX-IR - 8-Pin Programmable Infrared Transmitter IC

```
                    TX-IR
          ┌───────┬─┴─┬───────┐
VDD    1  │ +5V   │   │ GND   │ 8   VSS
          │       │   │       │
OSC1   2  │ OSC1  │   │ DIN   │ 7   DATA IN
          │       │   │       │
OSC2   3  │ OSC2  │   │ DOUT  │ 6   DATA OUT
          │       │   │       │
FREQUENCY SELECT  4  │ FSEL  │   │ MSEL  │ 5   MODE SELECT
          └───────┴───┴───────┘
```
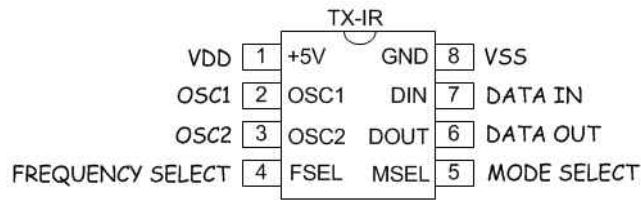
TX-IR Serial Infrared Interface IC

The TX-IR is an 8-pin infrared transmitter IC designed for infrared serial data links, and remote control applications. Data present on the DIN pin is recreated on the DOUT pin modulated at the selected carrier frequency of 38KHz or 40KHz providing a simple, single-chip solution, for infrared data communications and remote control applications.

Programmable Features:

The programmable features of the TX-IR allow specific configuration options to be set before power is applied to the circuit. Programmable options are:

1. **FSEL** – 38-40KHz Data Carrier "Frequency Select"
2. **MSEL** – True or Inverted Data Input Logic "Mode Select".

FSEL Options:

The FSEL pin selects the modulation frequency of the data carrier for outgoing infrared data. Selectable frequencies are 38KHz or 40KHz. This feature allows the TX-IR to be used with inexpensive 38KHz or 40KHz infrared photo detector modules for infrared wireless communications, and remote control applications.

Pin programmable options are set at design time by connecting the FSEL & MSEL pins to the appropriate logic levels as shown below. When power is applied, the user-selected operating modes will be in effect.
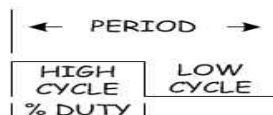
FSEL = 0
   ❑   Frequency $\cong$ 40KHz | Duty-Cycle $\cong$ 52%

FSEL = 1
   ❑   Frequency $\cong$ 38KHz | Duty-Cycle $\cong$ 50%

Note: Duty cycle % refers to the "High Cycle" time of the carrier frequency period.

```
    ┌─ ←    PERIOD    → ─┐
    │                    │
    │ ┌────────┬         │
    │ │ HIGH   │  LOW    │
    │ │ CYCLE  │  CYCLE  │
    │ % DUTY │
```

MSEL Options:

The MSEL pin selects an input logic state of "1" or "0" that will turn ON or OFF the data carrier/infrared LED drive output on the DOUT pin. This feature allows the TX-IR to be used for infrared serial communications using TRUE or INVERTED serial modes, and simple push-button switches for remote control applications.

MSEL = 0
- ❑ Data Input Mode = TRUE
- ❑ Logic 0 on DIN Activates Modulated Data Carrier on DOUT

MSEL = 1
- ❑ Data Input Mode = Inverted
- ❑ Logic 1 on DIN Activates Modulated Data Carrier on DOUT

DIN & DOUT Pins

The DIN pin samples the logic state and bit timing of the incoming serial or logic pulse, and passes this timing information to the DOUT pin. The DOUT pin then outputs a carrier frequency matching the width of the sampled data bit by turning the carrier ON / OFF as shown below in Figure 1.
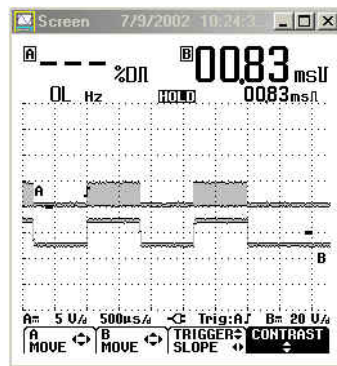

Figure 1

Trace B of the oscilloscope screen-capture shown in Figure 1 shows an incoming 1200-baud serial data stream present on DIN. Trace A shows the 40KHz modulated data signal being output on DOUT. The "input mode" selected by MSEL = 1 is inverted.

With the flexibility of programmable input logic modes, the TX-IR can be interfaced to the PC serial port, microcontrollers like the PIC, BASIC Stamp, 8051, and even simple push-button switches for wireless infrared serial communications, and remote control applications.

For your convenience, we have included several infrared communications and remote control applications schematics with this document. Schematic examples provided are:

- ❑ Direct RS-232 PC Serial Port Interface
- ❑ Buffered RS-232 PC Serial Port Interface Using the MAX233
- ❑ Microcontroller Interface
- ❑ Push-Button Switch Interface For Remote Control Applications
- ❑ Object Detection

The TX-IR IC has been tested up to 2400 baud. Normal operation with standard infrared photo detectors such as the 38KHz Panasonic PNA4602M limits "reliable" serial data communications data-rates to 1200 baud. The PNA4602M is inexpensive, and best suited for remote control ON / OFF type applications.

Higher speed IR detectors such as the Vishay Telefunken 38KHz TSOP-1138 & 40KHz TSOP-1140 allow using up to the MAX data-rate of 2400 baud with the TX-IR IC. These IR detectors are suited for remote control ON / OFF, and serial communications.

TX-IR Applications:

- ❑ Infrared Serial Communications
- ❑ Object Detection Systems
- ❑ Remote Control Applications
- ❑ Robotics

Specifications:
TX-IR IC: Microchip PIC12F508 PIC™ Microcontroller
Power Requirements: Well Regulated 5 VDC
DOUT Max Output Drive Current: Sink or Source 25mA
DIN MAX Input Data Rate: 2,400 bps [2400 Baud]
Oscillator Frequency: 4MHz
Idle Current: ≅ < 2mA @5 VDC

For more detailed device specifications or to download the datasheet for the PIC12F508 PIC microcontroller used for the TX-IR IC, please visit the Microchip corporate web site at: http://www.microchip.com
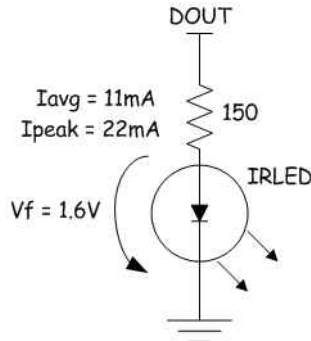

Example IR LED Drive Circuits

DOUT

$I_{avg} = 11mA$
$I_{peak} = 22mA$

150

$V_f = 1.6V$

IRLED

DOUT

$I_{avg} = 12mA$
$I_{peak} = 24mA$

75

$V_f = 1.6V$

IRLED

$V_f = 1.6V$

IRLED

Example #1: Single Infrared LED
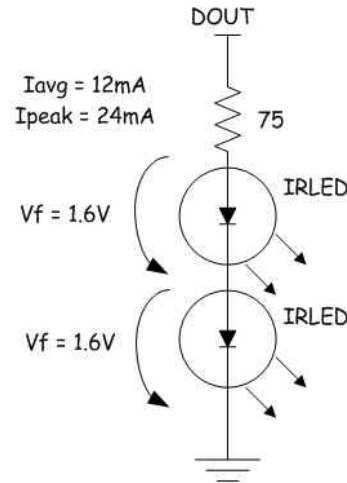
Example #2: Dual Infrared LEDs

+5V

30

$V_f = 1.6V$

IRLED

DOUT

2.2K

10k

NPN
2N3904

$I_{avg} = 54mA$
$I_{peak} = 108mA$
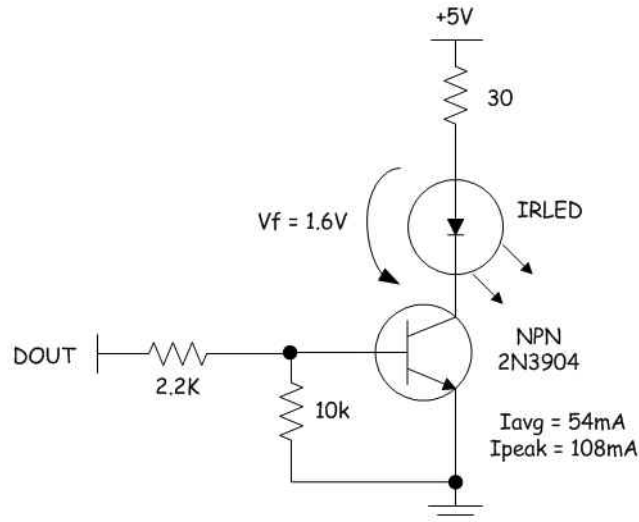
Example #3: Transistor LED Drive Circuit

Disclaimer

Reynolds Electronics reserves the right to make changes to product documentation and specifications without notice. The information contained in this document is believe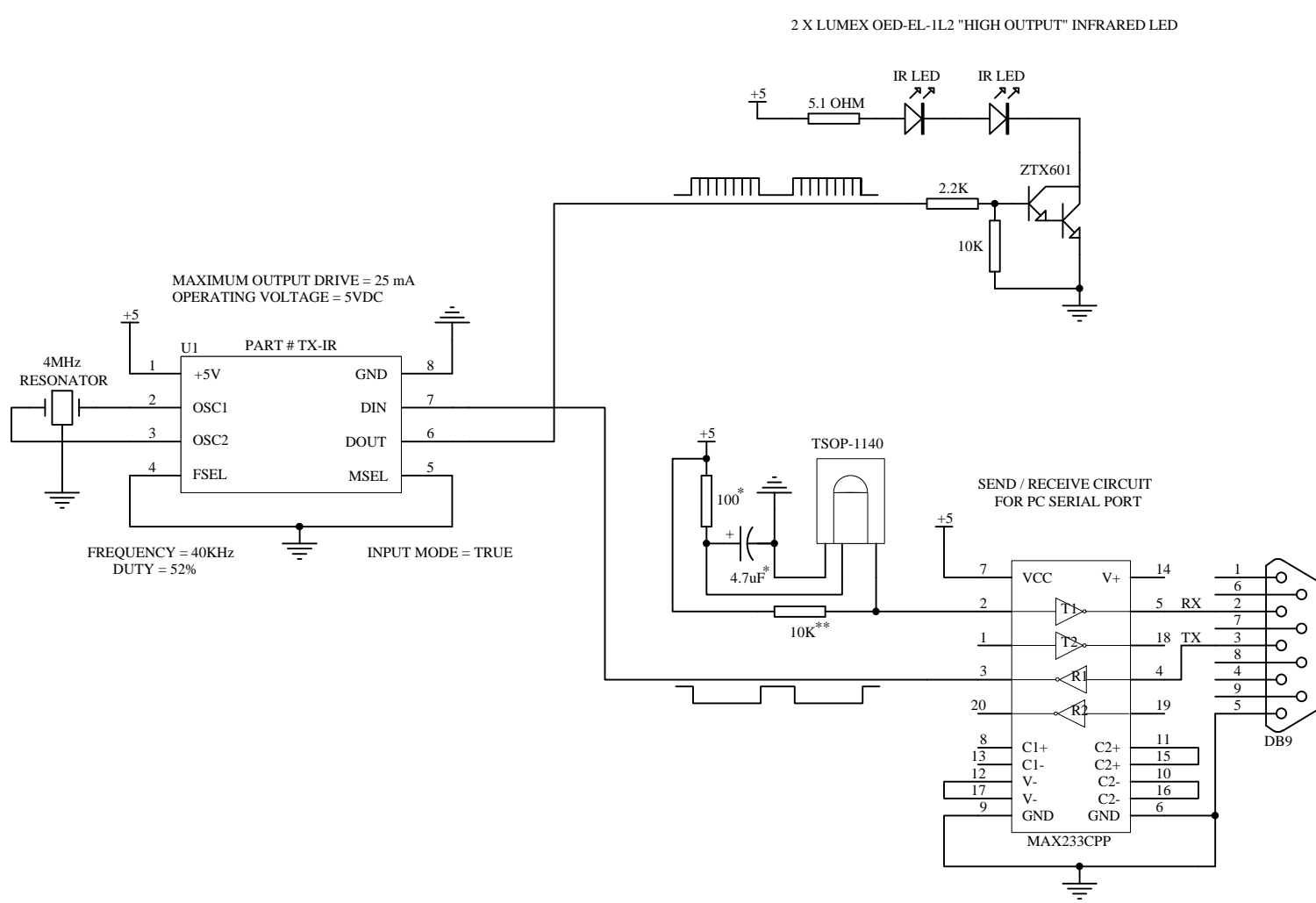d to be accurate at the time of publication. Specifications are based on lot samples. Values may vary from lot to lot, and are not guaranteed. Reynolds Electronics makes no guarantee, warranty, or representation regarding the suitability or legality of any product for use in a specific application. None of these devices are intended for use in applications of a critical nature where safety, life, or property is at risk. The user of this product assumes full liability for the use of this product in such applications. Under no conditions will Reynolds Electronics be responsible for losses arising from the use of, or failure of, the device in any application, other than the repair, replacement, or refund limited to the original product purchase price.

2 X LUMEX OED-EL-1L2 "HIGH OUTPUT" INFRARED LED

IR LED   IR LED

+5   5.1 OHM

ZTX601

2.2K

10K

MAXIMUM OUTPUT DRIVE = 25 mA
OPERATING VOLTAGE = 5VDC

+5

4MHz
RESONATOR

U1   PART # TX-IR

1   +5V   GND   8
2   OSC1   DIN   7
3   OSC2   DOUT 6
4   FSEL   MSEL 5

FREQUENCY = 40KHz   INPUT MODE = TRUE
DUTY = 52%

+5

TSOP-1140

SEND / RECEIVE CIRCUIT
FOR PC SERIAL PORT

100*

+5

4.7uF*

10K**

7   VCC   V+   14
                        1
                        6
2   T1   5   RX   2
                        7
1   T2   18 TX   3
                        8
3   R1   4   4
                        9
20 R2   19   5

                    DB9

8   C1+   C2+ 11
13 C1-   C2+ 15
12 V-   C2- 10
17 V-   C2- 16
9   GND   GND 6

MAX233CPP

Title	TX-IR BUFFERED RS-232 INFRARED SERIAL INTERFACE		
	TRANSMIT & RECEIVE APPLICATION [MAX DATA-RATE 2400 BAUD]		
Size	Number		Revision
Orcad A			A.1
Date:	10-Jul-2002	Sheet 1 of 1	
File:	C:\CAD\SCHEMATICS.Ddb	Drawn By: B. REYNOLDS	

2 X LUMEX OED-EL-1L2 "HIGH OUTPUT" INFRARED LED

IR LED   IR LED

+5   5.1 OHM

ZTX601

2.2K

10K

MAXIMUM OUTPUT DRIVE = 25 mA
OPERATING VOLTAGE = 5VDC

+5

4MHz
RESONATOR

U1   PART # TX-IR

1	+5V	GND	8
2	OSC1	DIN	7
3	OSC2	DOUT	6
4	FSEL	MSEL	5

+5

INPUT MODE = INVERTED

FREQUENCY = 40KHz

DUTY = 52%

SERIAL DATA FROM PC SERIAL PORT TO TX-IR

22K

| 1 |
| 6 |
| 2 |
| 7 |
| 3 |
| 8 |
| 4 |
| 9 |
| 5 |

DB9

DIRECT SERIAL FROM PC
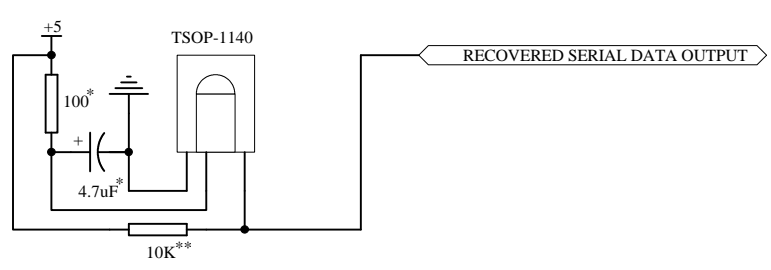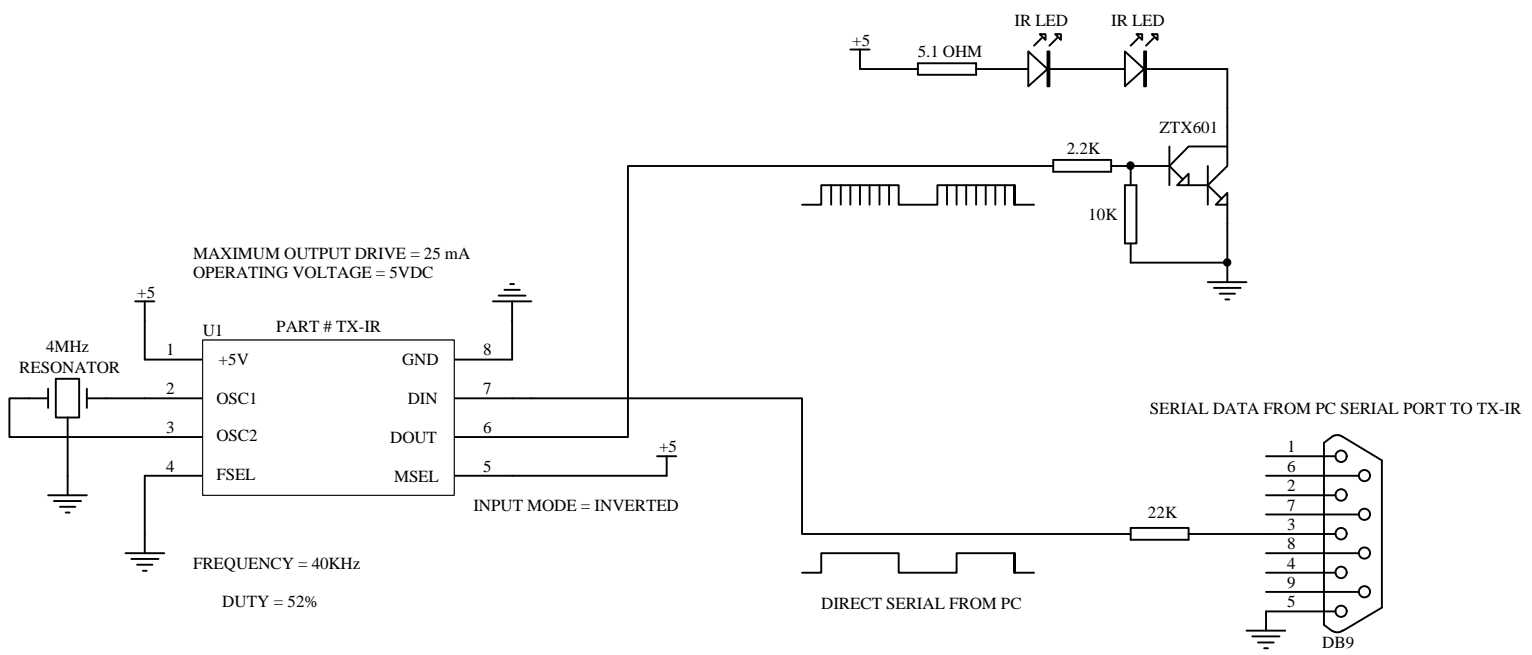
Recovered serial data output on the TSOP-1140 IR dtetector will be in TRUE mode;

Sample BASIC Stamp II receiver program:

VALUE VAR BYTE
DIRL = %11111111 ' Pins 0 to 7 = OUTPUTS
INPUT 8   ' Receive serial data on pin 8
T1200 CON 813   ' T1200 Baud [TRUE MODE]
T2400 CON 396   ' T2400 Baud [TRUE MODE]

BEGIN:
    SERIN 8, T2400, [VALUE] ' Receive serial data & place in byte variable VALUE
    OUTL = VALUE   ' Place serial data on pins 0 to 7
    GOTO BEGIN   ' Return for more serial data

+5

TSOP-1140

100*

RECOVERED SERIAL DATA OUTPUT

4.7uF*

10K**

Title	TX-IR DIRECT RS-232 INFRARED SERIAL INTERFACE FOR MICROCONTROLLER APPLICATIONS		
Size	Number		Revision
Orcad A			A.1
Date:	14-Dec-2002	Sheet 1 of 1	
File:	C:\CAD\SCHEMATICS.Ddb	Drawn By: B. REYNOLDS	