

# **F81438**

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## **Single 5V RS232/RS422/RS485 Multiprotocol Transceiver**

**Release Date: Jan, 2012**  
**Version: V0.11P**

## F81438 Datasheet Revision History

Version	Date	Page	Revision History
V0.10P	2011/11	-	Preliminary
V0.11P	2012/01	-	Made Clarification and Correction Delete 28-SOP Package Update Pin 21 & 22 Description

Please note that all data and specifications are subject to change without notice. All the trade marks of products and companies mentioned in this data sheet belong to their respective owners.

### LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Fintek for any damages resulting from such improper use or sales.

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## 1 General Description

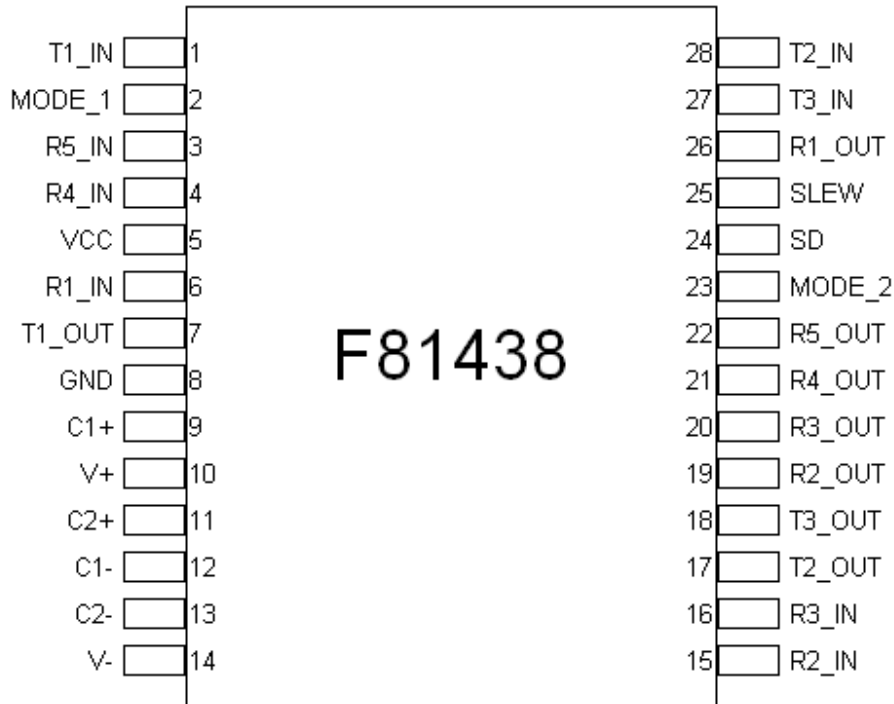
The F81438 is programmable, monolithic multi-protocol transceiver device that contains RS-232 and RS-485 / RS-422 drivers and receivers. The F81438 can be reconfigured into four operating modes including RS-232 only (3TX/5RX), one RS-485 (1TX/1RX) driver (TX) half duplex mode, one RS-485 (1TX/1RX) receiver (RX) half duplex mode, and RS-422 (1TX/1RX) full duplex mode which can be selected whenever you need by changing the logic state of the 2 mode selection pins. The device can implement a dual-mode serial port, mixed mode ports or as an interface signal translator. The extra charge pumps deliver true RS-232 driver output voltage from a single power supply at 5V. A slew rate control pin configures driver outputs for either high data rate or slew-controlled data rates. Slew-controlled outputs minimize the problems that caused by the reflections and ringing on long or un-terminated cables.

All RS-485 receivers or transceivers feature high impedance which allow up to 256 transceivers on a shared bus. When configured in RS-485/RS-422 mode, each driver may be individually enabled or put into tri-state, simplifying use on shared buses or bidirectional communication. All receivers have advanced failsafe protection to prevent oscillation when inputs are un - connected. In RS-232 mode each receiver input has a 5k $\Omega$  pull-down to ground. Differential Receivers will default to output logic 1 if inputs are floating, shorted or open but terminated. All driver outputs and receiver inputs are protected against ESD strikes up to  $\pm 15,000$  volts (IEC 61000-4-2 Air Gap).

## 2 Feature List

- 5V Single Supply Operation
- Robust  $\pm 15$ kV ESD Protection (IEC 61000-4-2 Air Gap)
- Mixed RS-232 / RS-485 Modes
- Adjustable Slew Rate for Minimize EMI Error
- RS-485 Advance Failsafe on Open, Short or Terminated Lines
- 28 Pin TSSOP Packaging
- Flexible 4 Operation Modes Selected by 2 Configuration Pins
- One set of 3T5R RS-232 V.28 Drivers & Receivers
- One Set of RS-485 Drivers (Half Duplex Configuration)
- One Set of RS-485 Receivers (Half Duplex Configuration)
- One set of RS-422 Driver & Receiver (Full Duplex Configuration)

### 3 Pin Configuration



### 4 Pin Description

IN <sub>t</sub>	- TTL level input pin.
IN <sub>t,pu 8uA</sub>	- TTL level input pin, pull up 8uA.
AIN	- Input pin (Receiver).
AOUT	- Output pin (Buffer driver).
O <sub>4</sub>	- Output pin with 4mA driver.
P	- Power.

#### 4.1. Power Pin

Pin	Pin Name	Type	Description
5	VCC	P	5V power supply voltage input
8	GND	P	GND.

**4.2. Transceiver**

Pin	Pin Name	Type	Description		
			Single Ended	Full-Duplex	Half-Duplex
1	T1_IN	IN <sub>t</sub>	T1 Driver input	T Driver Enable Active High	T Driver Enable Active High, R Enable Active Low
3	R5_IN	AIN/AOUT	R5 Receiver Input	T(B) Driver Output	R(B) Receiver Input, T (B) Output
4	R4_IN	AIN/AOUT	R4 Receiver Input	T(A) Driver Output	T(A) Driver Output, R(A) Receiver Input
6	R1_IN	AIN	R1 Receiver Input	High Impedance	High Impedance
7	T1_OUT	AOUT	T1 Driver Output	High Impedance	High Impedance
15	R2_IN	AIN	R2 Receiver Input	High Impedance	High Impedance
16	R3_IN	AIN	R3 Receiver Input	High Impedance	High Impedance
17	T2_OUT	AIN	T2 Driver Output	R(A) Receiver Input	High Impedance
18	T3_OUT	AIN	T3 Driver Output	R(B) Receiver Input	High Impedance
19	R2_OUT	O <sub>4</sub>	R2 Receiver Output High		
20	R3_OUT	O <sub>4</sub>	R3 Receiver Output High		
21	R4_OUT	O <sub>4</sub>	R4 Receiver Output	R Receiver Output	R Receiver Output High
22	R5_OUT	O <sub>4</sub>	R5 Receiver Output	High Impedance	R Receiver Output High
26	R1_OUT	O <sub>4</sub>	R1 Receiver Output High		
27	T3_IN	IN <sub>t</sub>	T3 Driver Input	High Impedance	High Impedance
28	T2_IN	IN <sub>t</sub>	T2 Driver Input	T Driver Input	T Driver Input

**4.3. Charge Pump, Mode Select & Other Functions**

Pin	Pin Name	Type	Description
9	C1+	Pump	Positive terminal of the flying capacitor
10	V+	Pump	VDD storage capacitor
11	C2+	Pump	Positive terminal of negative flying capacitor
12	C1-	Pump	Negative terminal of positive flying capacitor
13	C2-	Pump	Negative terminal of positive flying capacitor
14	V-	Pump	VSS Storage capacitor
2	MODE_1	IN <sub>t</sub>	Mode selection pin-1
23	MODE_2	IN <sub>t</sub>	Mode selection pin-2
24	SD	IN <sub>t</sub>	Shutdown pin.
25	SLEW	IN <sub>t,pu 8uA</sub>	Slew rate control pin, Logical Low input will limit driver slew from either RS-232 to 1Mbps or RS-485 to 10Mbps

## 5 Function Description

### 5.1 Mode Selection

The F81438 drivers and receivers can be configured to operate either as the standard RS-232 or RS-485 / RS-422 devices. It can be reconfigured into four operating modes, and be selected by 2 configuration pins. The table below shows how to use the configuration pins to select the function you want.

**TABLE 1: Mode Select Configuration**

Pin 2 Mode_1	Pin 23 Mode_2	Mode	Status
0	1	Pure RS-232	3T/ 5R RS-232.
1	0	RS-485 Receiver Half Duplex	1T/1R RS-485
1	1	RS-485 Driver Half Duplex	1T/1R RS-485
0	0	Pure RS-422 Full Duplex	1T/1R RS422 mode

The RS-485 / RS-422 drivers have the differential outputs and receivers have the differential inputs. RS-232 drivers and receivers are single-ended with the inverting outputs. The following table shows the characteristic of F81438 in RS-485 / RS-422 Full & Half Duplex mode.

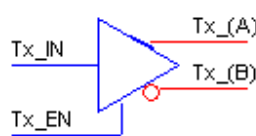
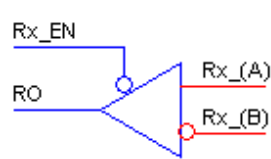
**TABLE 2: RS-232: MODE 01**

DRIVERS		RECEIVERS	
Input	Output	Input	Output
0	5V	3V	0
1	-5V	-3V	1
Open	-5V	Open	1

**TABLE 3: RS-485 Driver & Receiver Half DUPLEX: MODE 10, MODE 11**

TRANSMITTING				RECEIVING		
Inputs		Outputs		Inputs		Outputs
DE/RE	TXIN	TX(A)	TX(B)	DE/RE	RX(A) - RX(B)	RXOUT
1	1	0	1	1	x	High-Z
1	0	1	0	1	x	High-Z
0	x	High-Z	High-Z	0	> -50mV	1
				0	<-200mV	0
				0	Open / Shorted	1

**TABLE 4: RS-422 FULL DUPLEX: MODE 00**

DRIVERS				RECEIVERS	
Inputs		Outputs		Inputs	Outputs
TX_EN	TX_IN	TX(A)	TX(B)	RX(A) - RX(B)	RXOUT
1	1	0	1	> -50mV	1
1	0	1	0	< -200mV	0
0	x	High-Z		Open / Shorted	1
					

## 5.2 Mode Description

### 5.2.1 Pure RS-232 (Mode 01)

The F81438 supports all signals used in RS-232 over an 8 pin RJ-45 as defined in TIA/EIA-561. For DTE serial port only three drivers are required. F81438 may also be used to implement a standard serial port over a DB-9 connector (TIA/EIA-574 or the standard IBM serial port). In that case either DSR or RI signal can be supported. Both DSR and RI are used mainly for dial-up connections and are typically not needed on dedicated lines. If both signals are required, add a discrete transceiver such as F81438.

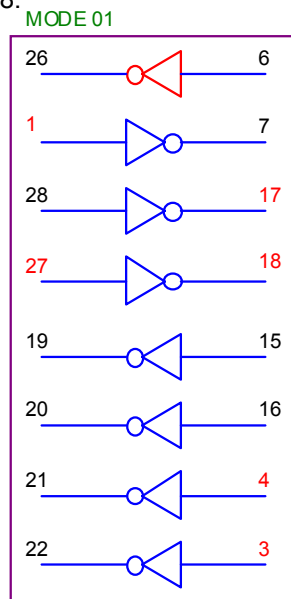


Figure 1: Pure RS-232 Mode



### 5.2.2 RS-485 Driver Half Duplex (Mode 10)

The F81438 provides 1 set of RS-485 driver half duplex 1T/1R.

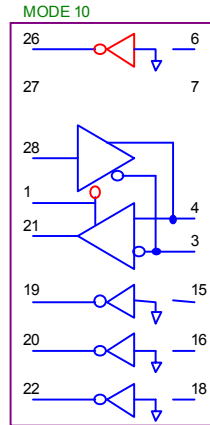


Figure 2: RS-485 Driver Half Duplex Mode

### 5.2.3 RS-485 Receiver Full Duplex (Mode 11)

The F81438 provides 1 set of RS-485 receiver half duplex 1T/1R.

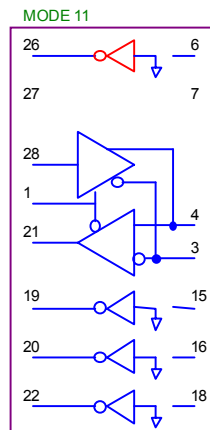


Figure 3: RS-485 Receiver Half Duplex Mode

**5.2.4 Pure RS-422 Full Duplex (Mode 00)**

The F81438 provides 1 set of RS-422 full duplex 1T/1R.

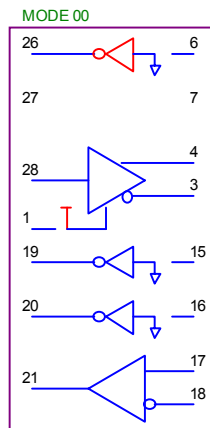


Figure 4: Pure RS-422 Full Duplex Mode

## 6 Electrical Characteristics Request

### 6.1 Absolute Maximum Ratings

PARAMETER	RATING	UNIT
Power Supply Voltage	+6.0	V
Receiver Input Voltage (DC input Voltage)	-13.2 to +13.2	V
Input Voltage at TTL input Pins	-0.3 to Vcc +0.5	V
Driver Output Voltage (from Ground)	-7.5 to +12.5	V
Short Cirecuit Duration, TXOUT to GND	Continous	-
Storage Tempreature	-65 to +150	° C
Lead Temperature (soldering, 10s)	+300	° C

Note: Exposure to conditions beyond those listed under Absolute Maximum Ratings may adversely affect the life and reliability of the device

### 6.2 DC Characteristics

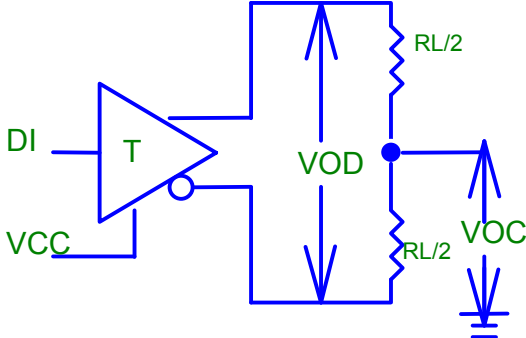
( $T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$ , VDD = +5.0V  $\pm$  5%)

Parameter	Conditions	MIN	TYP	MAX	Unit
Supply Current (RS-232)	No Load, MODE = 01.		2	30	mA
Supply Current (RS-485)	No Load, MODE = 10, 11.		2		mA
Supply Current (RS-422)	MODE = 00.		2		mA

( $T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$ , VDD = +5.0V  $\pm$  5%)

PARAMETER	SYM.	MIN.	TYP.	MAX.	UNIT	CONDITIONS
<b>Transmitter and Logic Input Pins (MODE, SLEW) 1, 2, 23, 24, 25, 27, 28</b>						
Logic Input Voltage HIGH	$V_{IL}$	2.4			V	VDD = 5.0 V
Logic Input Voltage LOW	-			0.8	V	
Logic Input Pull-up Current	-			$\pm 15$	$\mu\text{A}$	
TX_IN Pull High Current	$I_{IT}$			$\pm 15$	$\mu\text{A}$	
Logic Input Hysteresis	-		0.5		V	
<b>RS-232 and RS-485 / 422 Receiver Outputs RX_OUT: Pin 19, 20, 21, 22, 26</b>						
Receiver Output Voltage HIGH	$V_{OH}$	$V_{CC} - 0.6$			V	IOUT = -1.5mA.
Receiver Output Voltage LOW	$V_{OL}$			0.4	V	IOUT = 2.5mA.
Receiver Output Short-Circuit Current	$I_{OS}$		$\pm 20$	$\pm 60$	mA	$0 < V_o < V_{CC}$ .
Receiver Output Leakage Current	-		$\pm 0.05$	$\pm 1$	$\mu\text{A}$	Receivers Disabled.
<b>RS-232 Single-End Receiver Input (RX_IN, pin 3, 4, 6, 15, 16)</b>						
Input Voltage Range	-	-13.2		+13.2	V	
Input Threshold Low	$V_{IL}$	0.8	1.5		V	VCC = 5.0V.
Input Threshold HIGH	$V_{IH}$		1.8	2.4	V	VCC = 5.0V.
Input Hysteresis	-		0.5		V	
Input Resistance	-	3	5	7	K $\Omega$	
<b>RS-485 / RS-422 Differential Receiver Inputs (RX_IN, pin 3, 4)</b>						
Receiver Differential Threshold Voltage	-	-250	-200		mV	$V_B = 0V$ .
Receiver Input Hysteresis	-		30		mV	$V_{CM} = 0V$ .

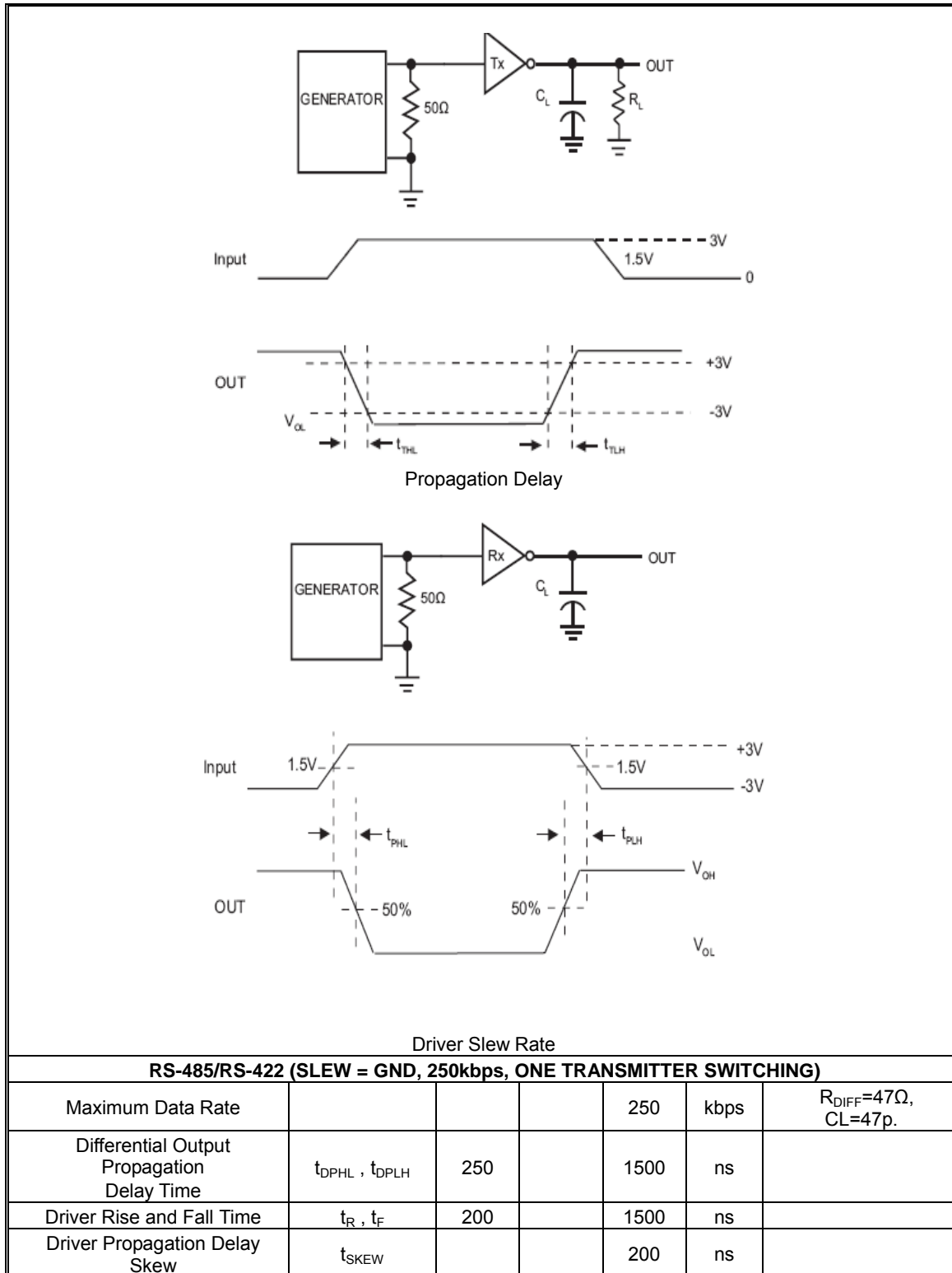
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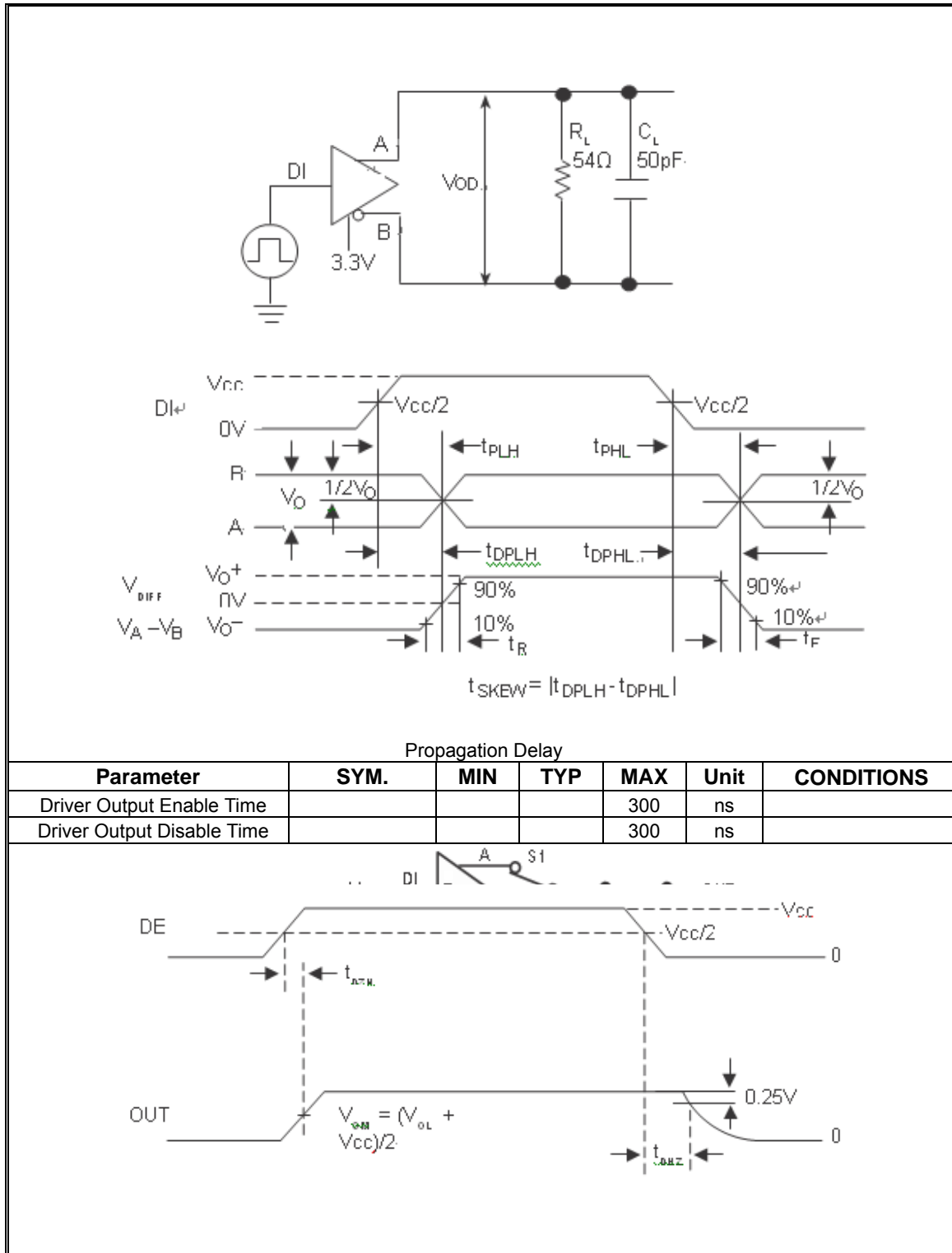
Input Current	-		200	300	$\mu\text{A}$	DE = 0V, VIN = 12V, Full-Duplex.
Input Current	-		-200	-300	$\mu\text{A}$	DE = 0V, VIN = -7V, Full-Duplex.
Input Resistance		30			K $\Omega$	$-7\text{V} \leq \text{VCM} \leq +12\text{V}$
<b>RS232 Single-Ended/RS422/485 Driver Outputs (TX_OUT, RS-232, Pin 7, 17, 18)</b>						
Output Voltage Swing	-	$\pm 5.0$	$\pm 5.4$		V	RLOAD = 3K $\Omega$ to GND.
	-			$\pm 6.0$	V	No Load Output.
Output Short Circuit Current	-			$\pm 60$	mA	VO = 0V.
Power Off Impedance	-	300	10M		$\Omega$	Vcc = 0V; VO = $\pm 2\text{V}$ .
						
<b>RS-485 / RS-422 Differential Driver Outputs (TX_OUT)</b>						
Differential Driver Output	-	2		Vcc	V	RLOAD = 100 $\Omega$ (RS422)
	-	1.5		Vcc	V	RLOAD = 54 $\Omega$ (RS485)
	-	1.5		Vcc	V	VCM = -7V
	-	1.5		Vcc	V	VCM = +12V
Change In Magnitude of Differential Output Voltage	-	-0.2		+0.2	V	RLOAD = 47 $\Omega$
Driver Common Mode Output Voltage	-			3	V	RLOAD = 47 $\Omega$
Change In Magnitude of Common Mode Output Voltage	-			0.2	V	RLOAD = 47 $\Omega$
Driver Output Short Circuit Current	-			$\pm 250$	mA	V = +12V to -7V
Output Leakage Current	-		$\pm 200$	$\pm 300$	$\mu\text{A}$	DE = 0V or Shutdown, VO = +12V to -7V.

**6.3 AC Characteristics**

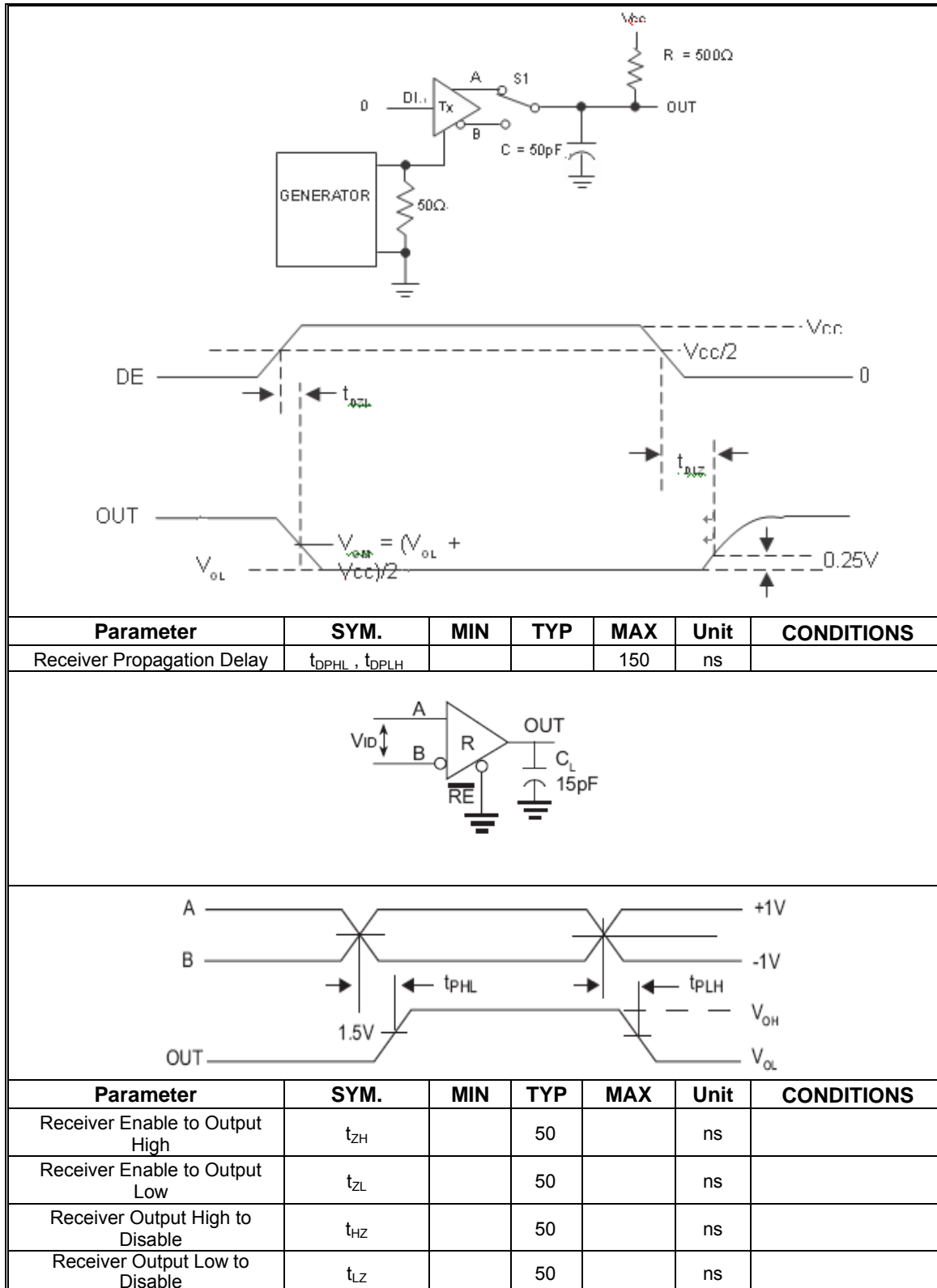
 ( $T_A = 0^\circ\text{C to } 70^\circ\text{C}$ ,  $V_{DD} = +5.0\text{V} \pm 5\%$ )

Parameter	SYM.	MIN	TYP	MAX	Unit	CONDITIONS
<b>RS-232 (SLEW = GND, 250Kbps, One Transmitter Switching)</b>						
Maximum Data Rate		250			Kbps	RL=3K, CL=1000p
Receiver Propagation Delay	$t_{PHL}, t_{PLH}$		100		ns	CL=150pF
Receiver Skew	$ t_{PHL} - t_{PLH} $		50		ns	CL=150pF
Driver Skew	$ t_{THL} - t_{TLH} $		100		ns	
Transition-Region Slew Rate $\pm 3.0\text{V}$		6		30	V/ $\mu\text{s}$	VCC=3V, RL=3~7K, CL=150~1000pF
<b>RS-232 (SLEW = Vcc, 1Mbps, One Transmitter Switching)</b>						
Maximum Data Rate	-	1			Mbps	RL = 3k, CL = 250pF.
Receiver Propagation Delay	$t_{PHL}, t_{PLH}$		100		ns	CL = 150pF.
Receiver Skew	$ t_{PHL} - t_{PLH} $		50		ns	CL = 150pF.
Driver Skew	$ t_{THL} - t_{TLH} $		25		ns	
Transition-Region Slew Rate $\pm 3.0\text{V}$			90		V/ $\mu\text{s}$	Vcc = 5V, RL = 3~7k , CL = 150~1000pF.

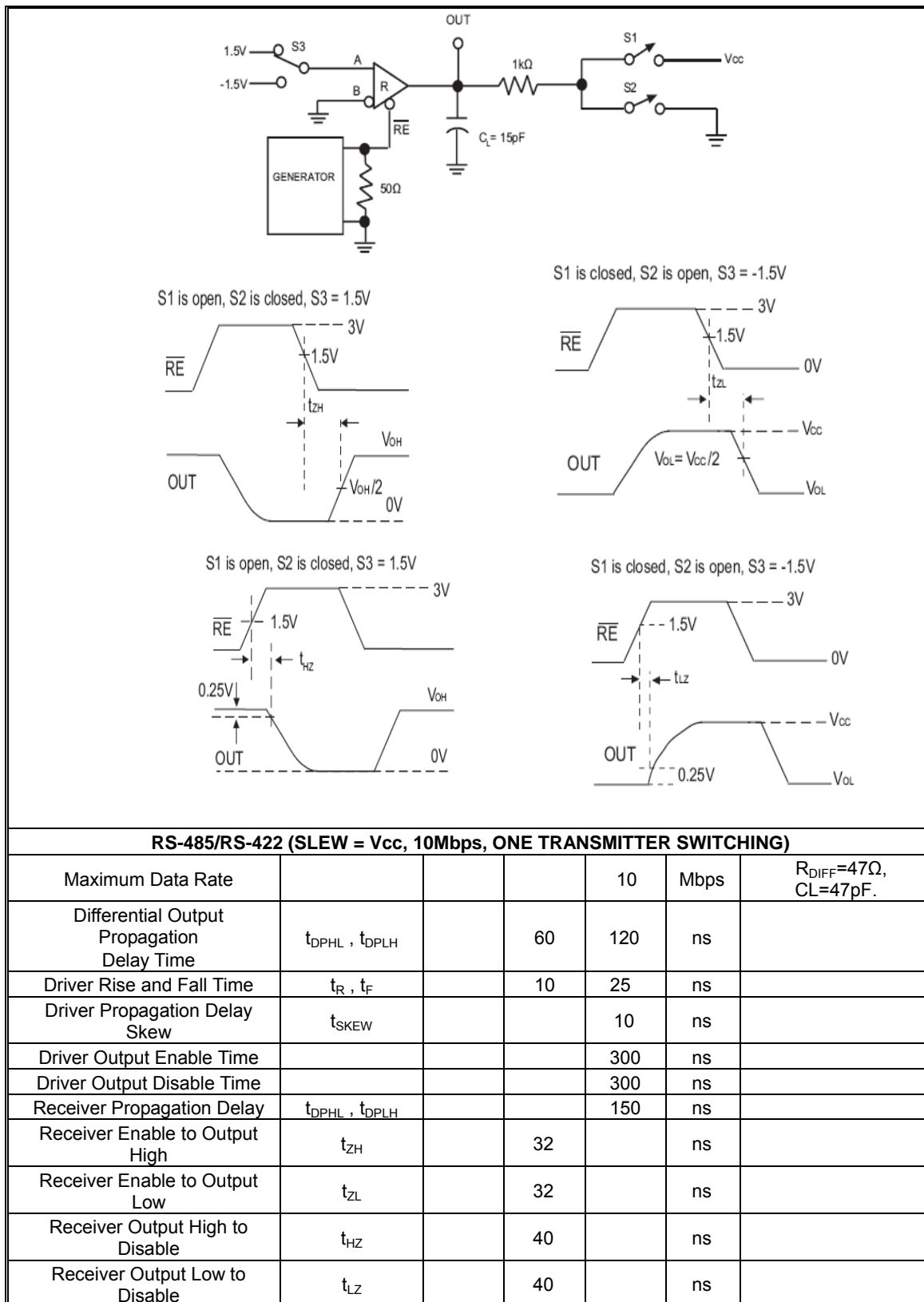
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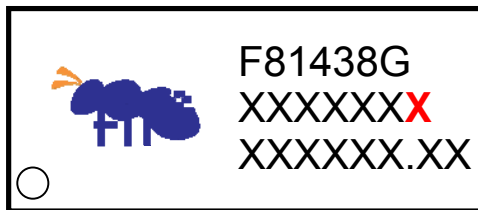


## 7 Ordering Information

Part Number	Package Type	Production Flow
F81438G	28-TSSOP Green Package	Commercial, 0°C to +70°C

## 8 Top Marking Specification

The version identification is shown as the bold red characters. Please refer to below for detail:



1<sup>st</sup> Line: Fintek Logo

2<sup>nd</sup> Line: Device Name → **F81438G**, where G means 28-TSSOP

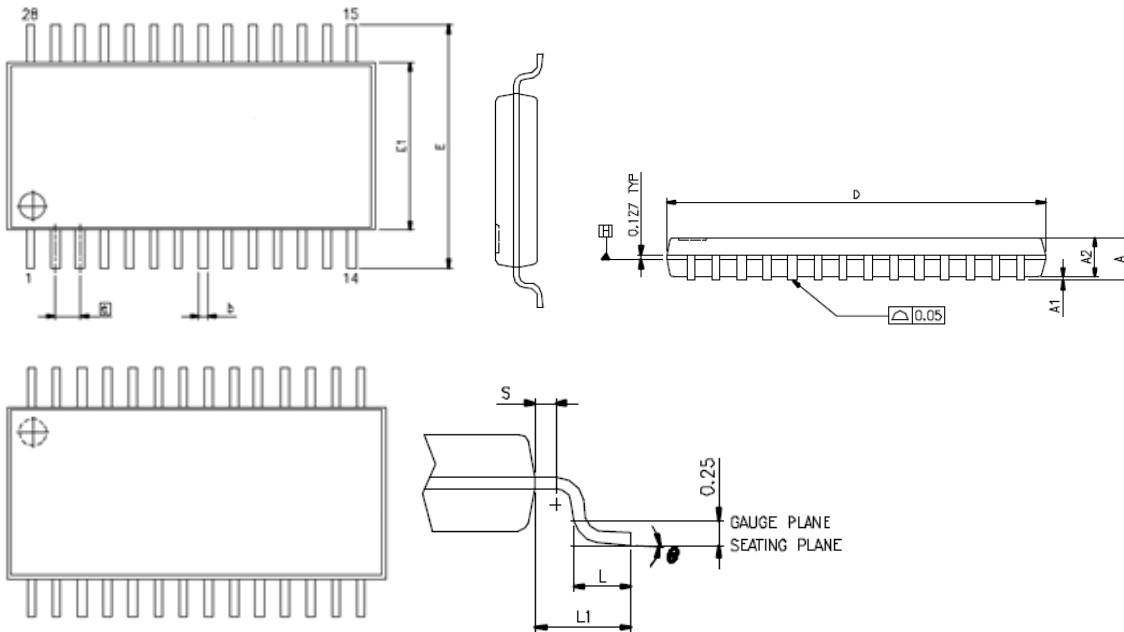
2<sup>nd</sup> Line: Assembly Plant Code (X) + Assembled Year Code (X) + Week Code (XX) + Fintek Internal Code (XX)  
+ **IC Version (X)** where A means version A, B means version B, ...

3<sup>rd</sup> Line: Wafer Fab Code (XXXX...XX)

○ : Pin 1 Identifier

## 9 Package Spec.

### 28-TSSOP Package



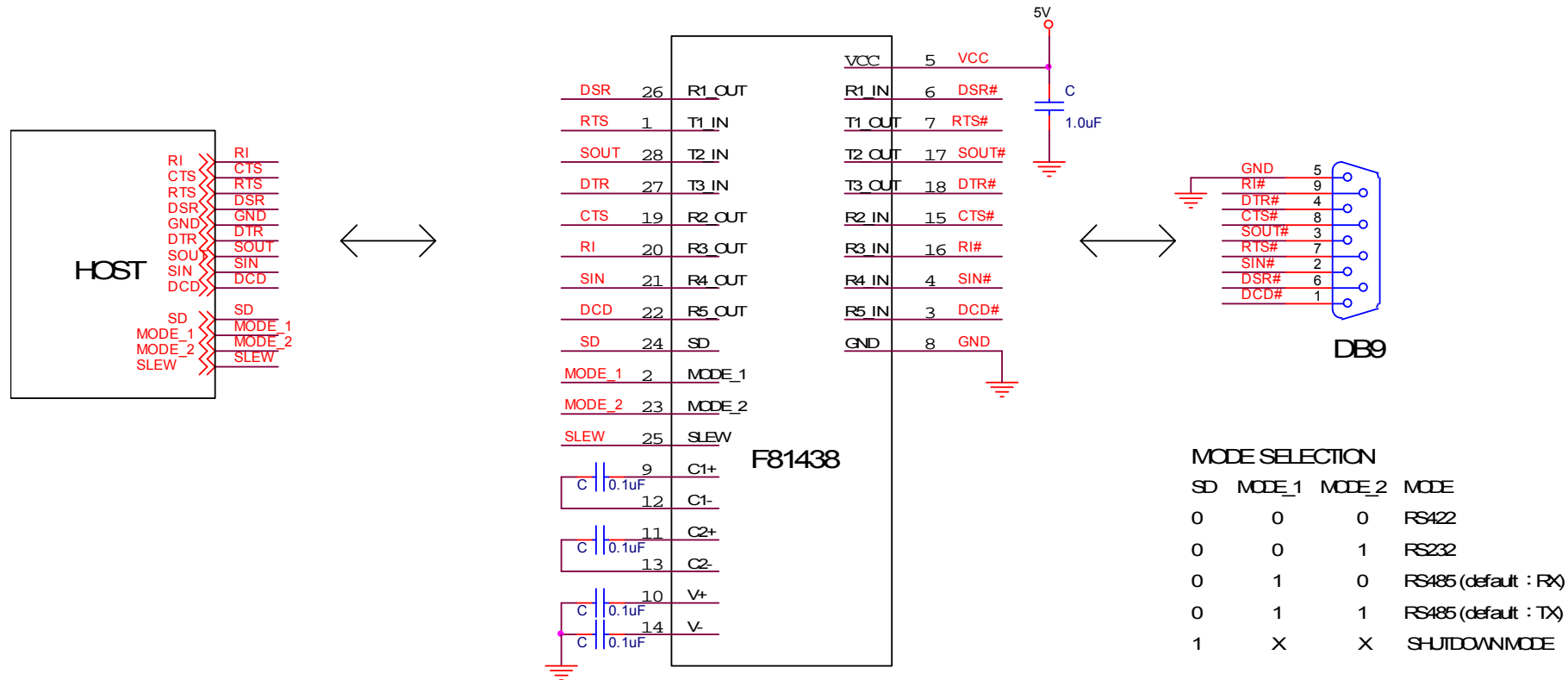
VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

SYMBOLS	MIN.	NOM	MAX
A	—	—	1.20
A1	0.00	—	0.15
A2	0.80	1.00	1.05
b	0.19	—	0.30
D	9.60	9.70	9.80
E1	4.30	4.40	4.50
E	6.40 BSC		
e	0.65 BSC		
L1	1.00 REF		
L	0.45	0.60	0.75
S	0.20	—	—
●	0°	—	8°

**NOTES:**

- JEDEC OUTLINE :  
MO-153 AE/MO-153 AET(THERMALLY ENHANCED VARIATIONS ONLY)
- DIMENSION 'D' DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE.
- DIMENSION 'E1' DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 PER SIDE.
- DIMENSION 'b' DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 MM TOTAL IN EXCESS OF THE 'b' DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT. MINIMUM SPACE BETWEEN PROTRUSION AND ADJACENT LEAD IS 0.07 MM.
- DIMENSIONS 'D' AND 'E1' TO BE DETERMINED AT DATUM PLANE [H]

# 10 Application Circuit



Title		
Size B	Document Number F81438	Rev A
Date: Monday, November 07, 2011	Sheet 1 of 1	