



GENTOS

Application Note #002 (AN002-V1.2)

[MiDAS1.0 / 1.1] Driving LEDs in MiDAS Family

V1.2

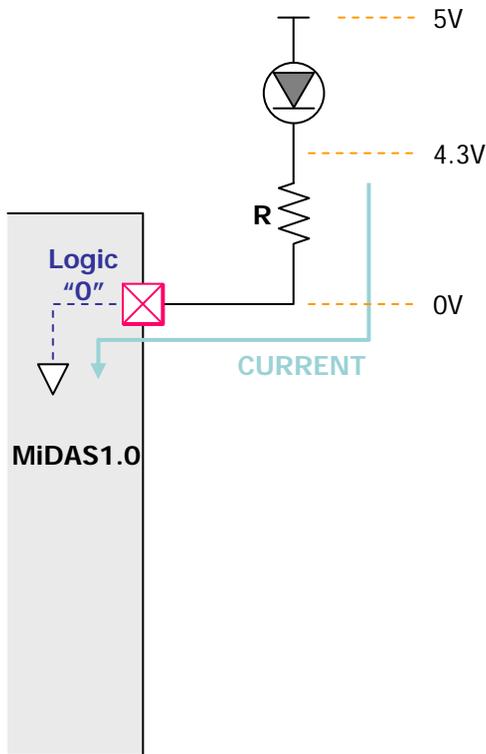
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1. Driving LED in MiDAS1.0 Family: Sink

- ◆ All ports P0~P3 can driving LEDs at sink.
- ◆ When a pin is configured as an output, it can sink 20mA (P0) or 10mA (P1~P3) at 5V.
- ◆ Example

- ✓ To drive LED from port P1 at 5V power supply, the voltage V_R becomes 4.3V by the diode drop. In table of DC characteristics, the driving current for output low voltage is 10mA at ports P1~P4 at 5V. Therefore, the minimum resistance is $4.3V/10mA = 430\Omega$.
- ✓ When $R = 820 \Omega$ is used, the current through resistor becomes $4.3V/820 \Omega = 5.2mA$.

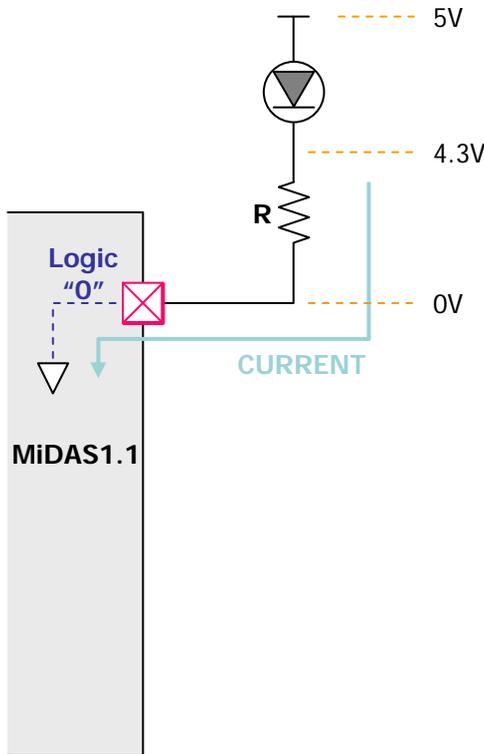


2. Driving LED in MiDAS1.0 Family: Source

- ◆ All ports can support as sources for LEDs. But, the lightness of LEDs is darker than that in sink.
- ◆ Therefore, we recommend that you had better use ports as sink to drive LEDs in full performance.

3. Driving LED in MiDAS1.1 Family: Sink

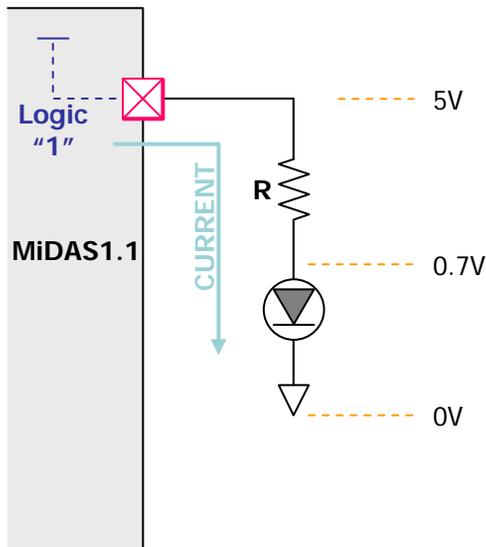
- ◆ All ports can support as sink for LEDs.
- ◆ In sink, the port can be configurable to push-pull output or open-drain output.
- ◆ The allowable driving current at P1.0(XTAL1), P1.1(XTAL2), P0, or P2 is 20mA at 5V as shown in the below table.
- ◆ Note: The current at port P1.2(RESETB) is different from that of other ports.



Parameter	Symbol	Pin	Conditions	Value			Unit
				Min.	Typ.	Max.	
Input Low Voltage	V_{IL1}	P0, P2	$VDD = 2.4V \sim 5.5V$	-0.5	-	$0.2VDD - 0.1$	V
	V_{IL2}	XTAL1, XTAL2, RESETB		-0.5	-	$0.3VDD$	
Input high Voltage	V_{IH1}	P0, P2	$VDD = 2.4V \sim 5.5V$	$0.2VDD + 1.0$	-	$VDD + 0.5$	V
	V_{IH2}	XTAL1, XTAL2, RESETB		$0.7VDD$	-	$VDD + 0.5$	
Output Low Voltage	V_{OL1}	XTAL1, XTAL2, P0, P2	$I_{OL} = 20mA @VDD=5V$ $(I_{OL} = 5mA @VDD=2.6V)$	-	-	$0.3VDD$	V
	V_{OL2}	RESETB	$I_{OL} = 10mA @VDD=5V$ $(I_{OL} = 2.5mA @VDD=2.6V)$	-	-	$0.3VDD$	
Output High Voltage	V_{OH}	XTAL1, XTAL1, P0, P2	$I_{OH} = -15mA @VDD=5V$ $(I_{OH} = -2.5mA @VDD=2.6V)$	$0.7VDD$	-	-	V
	V_{OH1}	P0, P2 (pull-up only)	$I_{OH} = -140\mu A @VDD=5V$ $(I_{OH} = -20\mu A @VDD=2.6V)$	$0.7VDD$	-	-	V
	V_{OH2}	XTAL1, XTAL2 (pull-up only)	$I_{OH} = -10\mu A @VDD=5V$ $(I_{OH} = -1.5\mu A @VDD=2.6V)$	$0.7VDD$	-	-	V
Input Leakage Current	I_L	All pin except XTAL1, XTAL2	$V_{IN} = V_{IH}$ or V_{IL}	-	-	± 1	μA
Pin Capacitance	C_{20}	All	$VDD = 5V$	-	10	-	pF

4. Driving LED in MiDAS1.1 Family: Source

- ◆ In source, all ports except P1.2(RESETB) can be configurable only to push-pull output.
- ◆ Because P1.2(RESETB) can be configurable only open-drain output, it can't support as high output.
- ◆ Note:
 - ✓ V_{OHP1} and V_{OHP2} mean the voltage at open-drain output using pull-up resistor.
 - ✓ Remember that the current value is very small at open-drain output using pull-up resistor.
 - ✓ Therefore, we recommend the push-pull output when driving some load such as LED.



Parameter	Symbol	Pin	Conditions	Value			Unit
				Min.	Typ.	Max.	
Input Low Voltage	V_{IL1}	P0, P2	VDD = 2.4V~5.5V	-0.5	-	0.2VDD-0.1	V
	V_{IL2}	XTAL1, XTAL2, RESETB		-0.5	-	0.3VDD	
Input high Voltage	V_{IH1}	P0, P2	VDD = 2.4V~5.5V	0.2VDD+1.0	-	VDD+0.5	V
	V_{IH2}	XTAL1, XTAL2, RESETB		0.7VDD	-	VDD+0.5	
Output Low Voltage	V_{OL1}	XTAL1, XTAL2, P0, P2	$I_{\text{OL}} = 20\text{mA} @V\text{DD}=5\text{V}$ ($I_{\text{OL}} = 5\text{mA} @V\text{DD}=2.6\text{V}$)	-	-	0.3VDD	V
	V_{OL2}	RESETB	$I_{\text{OL}} = 10\text{mA} @V\text{DD}=5\text{V}$ ($I_{\text{OL}} = 2.5\text{mA} @V\text{DD}=2.6\text{V}$)	-	-	0.3VDD	
Output High Voltage	V_{OH}	XTAL1, XTAL2, P0, P2	$I_{\text{OH}} = -15\text{mA} @V\text{DD}=5\text{V}$ ($I_{\text{OH}} = -2.5\text{mA} @V\text{DD}=2.6\text{V}$)	0.7VDD	-	-	V
	V_{OHP1}	P0, P2 (pull-up only)	$I_{\text{OH}} = -140\mu\text{A} @V\text{DD}=5\text{V}$ ($I_{\text{OH}} = -20\mu\text{A} @V\text{DD}=2.6\text{V}$)	0.7VDD	-	-	V
	V_{OHP2}	XTAL1, XTAL2 (pull-up only)	$I_{\text{OH}} = -10\mu\text{A} @V\text{DD}=5\text{V}$ ($I_{\text{OH}} = -1.5\mu\text{A} @V\text{DD}=2.6\text{V}$)	0.7VDD	-	-	V
Input Leakage Current	I_{L}	All pin except XTAL1,XTAL2	$V_{\text{IN}} = V_{\text{IH}}$ or V_{IL}	-	-	± 1	μA
Pin Capacitance	C_{IO}	All	VDD = 5V	-	10	-	pF