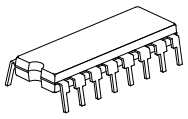
8-bit Constant Current LED Driver

Features

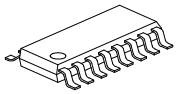
- 8 constant-current output channels
- Output current adjustable through an external resistor
- Serial data in/parallel data out
- Output current: 5-90 mA
- 20 MHz clock frequency

MBI5001CN



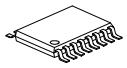
DIP16-P-300-2.54
Weight: 1.02g(typ)

MBI5001CD



SOP16-P-150-1.27
Weight: 0.13g(typ)

MBI5001CP



SSOP16-P-150-0.64
Weight: 0.07g(typ)

Product Description

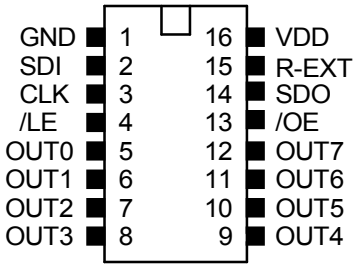
MBI5001, utilizing the most advanced Si technology, is targeted for LED panel display. MBI5001 contains CMOS shift registers and latch functions converting serial input data into parallel output format. At the output stage, eight regulated current sources were designed to provide 5-90 mA constant current for driving LEDs.

MBI5001 provides users with great flexibility and device performance while using the MBI5001 in their LED panel system design. Users may adjust the output current of the MBI5001 through an external resistor, Rext, which gives users flexibility in controlling the light intensity of LEDs. MBI5001 guarantees to endure maximum 17V at the output port, allowing users to connect more LEDs in series. The high clock frequency, 20 MHz, also satisfies the system requirement of high volume data transmission.

Terminal Description

PIN NO.	PIN NAME	FUNCTION
1	GND	GND terminal
2	SDI	Serial data input terminal
3	CLK	Clock input terminal
4	/LE	Latch input terminal
5-12	OUT0-7	Output terminal
13	/OE	Output enable input terminal
14	SDO	Serial data out terminal
15	R-EXT	Constant current programming
16	VDD	5V supply voltage terminal

Pin Description



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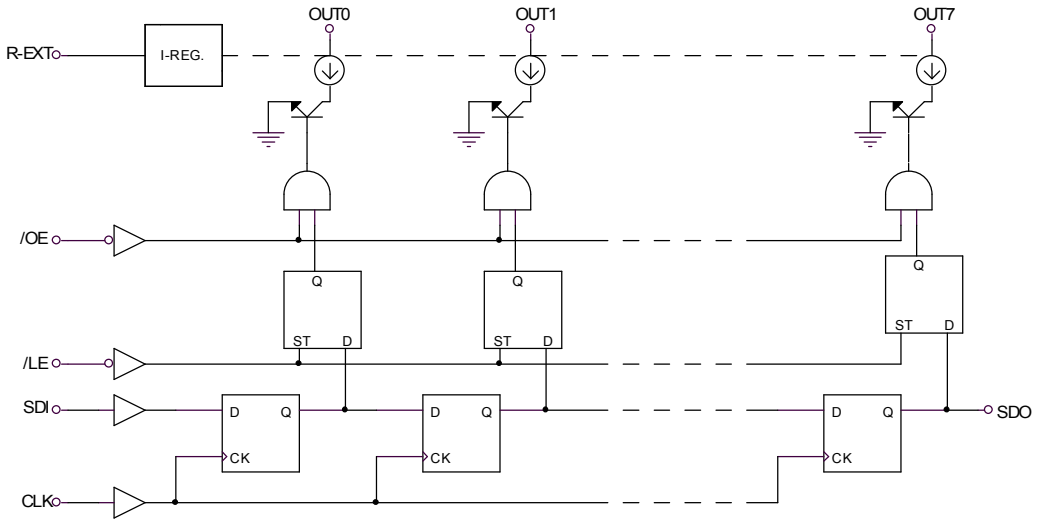
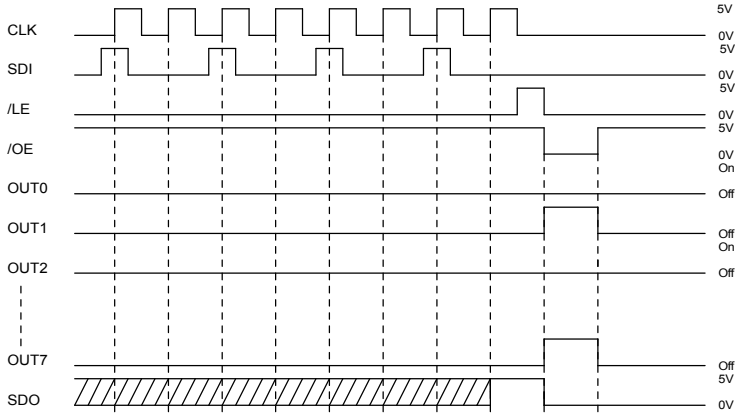
Block Diagram



Timing Diagram

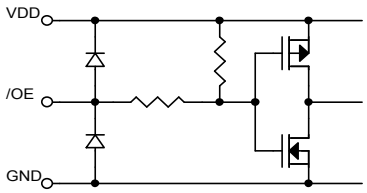


Truth table

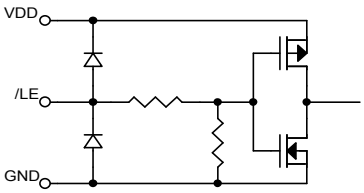
CLK	/LE	/OE	SDI	OUT0 OUT5 OUT7	SDO
UP	H	L	D_n	D_n D_{n-5} D_{n-7}	D_{n-7}
UP	L	L	D_{n+1}	NO CHANGE	D_{n-6}
UP	H	L	D_{n+2}	D_{n+2} D_{n+3} D_{n+5}	D_{n-5}
DOWN	X	L	D_{n+3}	D_{n+2} D_{n+3} D_{n+5}	D_{n-5}
DOWN	X	H	D_{n+3}	Off	D_{n-5}

Equivalent Circuit of Inputs and Outputs:

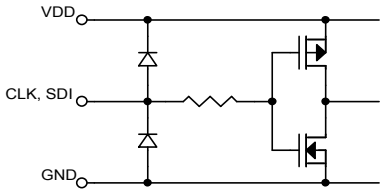
1. /OE terminal



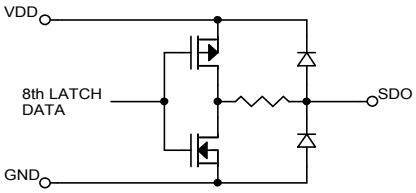
2. /LE terminal



3. CLK, SDI terminal



4. SDO terminal



Maximum Ratings

CHARACTER		SYMBOL	RATING	UNIT
Supply Voltage		V_{DD}	0~+7.0	V
Output Voltage		V_{CE}	-0.5~+17.0	V
Output Current		I_{OUT}	+90	mA
Input Voltage		V_{IN}	-0.4~V_{DD}+0.4	V
GND Terminal Current		I_{GND}	720	mA
Clock Frequency		F_{CLK}	20	MHZ
Power Dissipation (ON PCB, Ta=25℃)	CN – type	P_D	1.64	W
	CD – type		1.06	
	CP – type		0.88	
Thermal Resistance (ON PCB, Ta=25℃)	CN – type	$R_{th(j-a)}$	76	°C/W
	CD – type		117	
	CP – type		141	
Operating Temperature		T_{opr}	-40~+85	°C
Storage Temperature		T_{stg}	-55~+150	°C

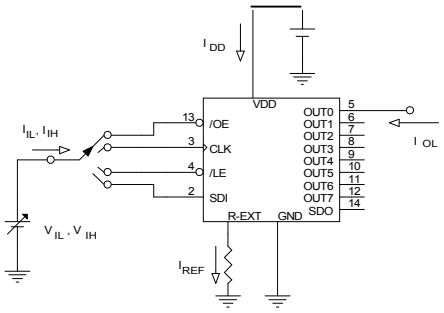
Recommended Operating Condition

CHARACTERISTIC		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage		V_{DD}	-	4.5	5.0	5.5	V
Output Voltage		V_{CE}	-	-	-	17.0	V
Output Current		I_{OUT}	DC Test Circuit	5	-	90	mA
		I_{OH}	SERIAL-OUT	-	-	-1.0	mA
		I_{OL}	SERIAL-OUT	-	-	1.0	mA
Input Voltage		V_{IH}	-	$0.7V_{DD}$	-	V_{DD}+0.3	V
		V_{IL}	-	-0.3	-	$0.3V_{DD}$	V
/LE Pulse Width		tw LAT	V_{DD}=4.5~5.5V	25	-	-	ns
CLK Pulse Width		tw CLK		25	-	-	ns
/OE Pulse Width		tw EN		400	-	-	ns
Setup Time for DATA		tsetup(D)		20	-	-	ns
Hold Time for DATA		thold(D)		15	-	-	ns
Setup Time for LATCH		tsetup(L)		20	-	-	ns
Hold Time for ENABLE		thold(E)		60	-	-	ns
Clock Frequency		F_{CLK}	Cascade Operation	-	-	20.0	MHz
Power Dissipation	CN – type	P_D	Ta=85°C	-	-	0.85	W
	CD – type					0.55	
	CP – type					0.46	

Electrical Characteristics

CHARACTERISTIC		SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Input Voltage	"H" level	V_{IH}	-		$0.7V_{DD}$	-	V_{DD}	V
	"L" level	V_{IL}	-		GND	-	$0.3V_{DD}$	
Output Leakage Current		I_{OH}	V_{OH}=17.0V		-	-	10	μA
Output Voltage	SERIAL-OUT	V_{OL}	I_{OL}=+1.0mA		-	-	0.4	V
		V_{OH}	I_{OH}=-1.0mA		-	-	-	V
Output Current 1		I_{OL1}	V_{CE} =0.8V	R_{ext} =865 Ω (include Skew)	-	40.0	-	mA
Current Skew		dI_{OL1}	IO = 40mA V_{CE} = 0.8V	R_{ext} =865 Ω	-	±1.5	±6.0	%
Output Current 2		I_{OL2}	V_{CE} =1.2V	R_{ext} =330 Ω (include Skew)	-	80.0	-	mA
Current Skew		dI_{OL2}	IO = 80mA V_{CE} = 1.2V	R_{ext} =330 Ω	-	±1.5	±6.0	%
Pull-up Resistor		RIN(up)	-		150	300	600	KΩ
Pull-down Resistor		RIN(down)	-		85	200	400	KΩ
Supply Current	"OFF"	I_{DD}(off) 1	R_{ext} =OPEN $\overline{OUT0\sim7}$=Off		-	0.1	1.0	mA
		I_{DD}(off) 2	R_{ext} =865 Ω $\overline{OUT0\sim7}$=Off		0.1	0.2	1.0	
		I_{DD}(off) 3	R_{ext} =330 Ω $\overline{OUT0\sim7}$=Off		0.1	0.2	1.0	
	"ON"	I_{DD}(on) 1	R_{ext} =865 Ω $\overline{OUT0\sim7}$=On		7.0	12.0	18.0	
		I_{DD}(on) 2	R_{ext} =330 Ω $\overline{OUT0\sim7}$=On		10.0	22.0	32.0	

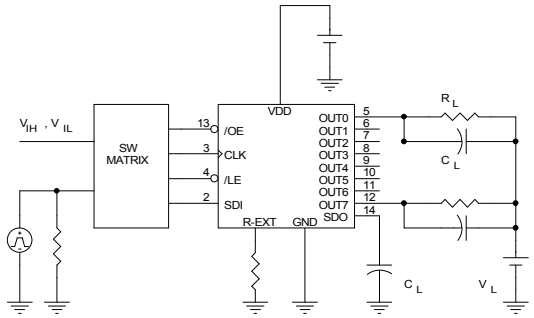
Test Circuit for Electrical Characteristics



Switching Characteristics

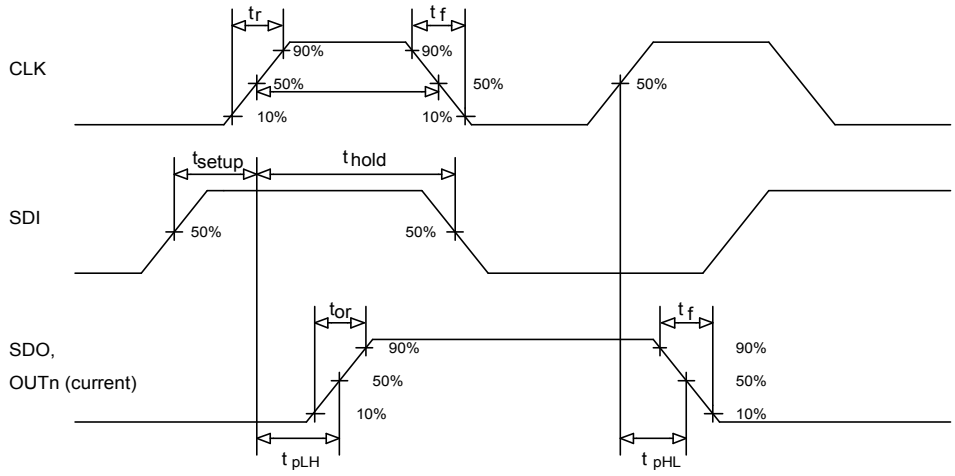
CHARACTERISTIC		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Propagation Delay Time (“L” to “H”)	INn-OUTn	tpLH	V_{DD}=5.0V V_{CE}=0.8V V_{IH}=V_{DD} V_{IL}=GND R_{ext} =865 Ω I_{OUT}=40mA V_L=3.4V R_L=65Ω C_L=10.5pF	-	200	300	ns
	/LE-OUTn			-	200	300	ns
	/OE-OUTn			-	200	300	ns
	CLK-SOUT			20	50	70	ns
Propagation Delay Time (“H” to “L”)	INn-OUTn	tpHL		-	200	300	ns
	/LE-OUTn			-	200	300	ns
	/OE-OUTn			-	200	300	ns
	CLK-SOUT			20	50	70	ns
Pulse Width	CLK	tw CLK-CLK		15	-	20	ns
	/LE	tw LAT-LAT		20	-	30	ns
Set-up Time for LATCH	tswtup LAT	Set-up Time for LATCH		10	-	20	ns
Hold Time for ENABLE	thold LAT	Hold Time for ENABLE		10	-	25	ns
Maximum CLK Rise Time	tr	Maximum CLK Rise Time		-	-	5	ns
Maximum CLK Fall Time	tf	Maximum CLK Fall Time		-	-	5	ns
Output Rise Time	tor	Output Rise Time		-	150	200	ns
Output Fall Time	tof	Output Fall Time		-	150	200	ns

Test Circuit for Switching Characteristics

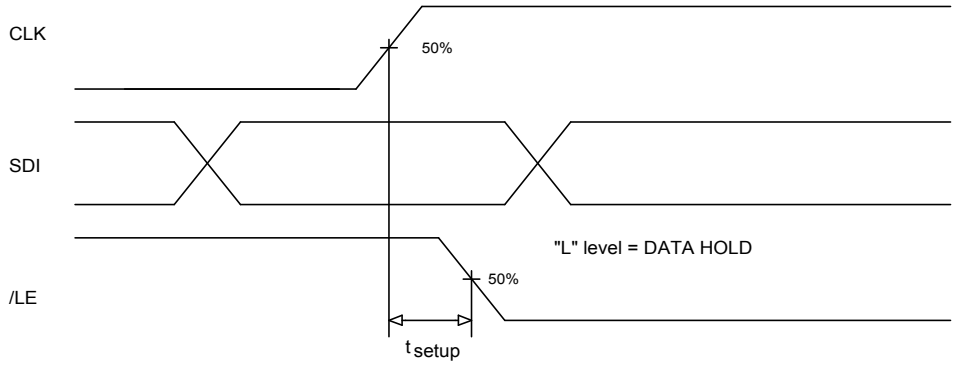


Timing Wave Form

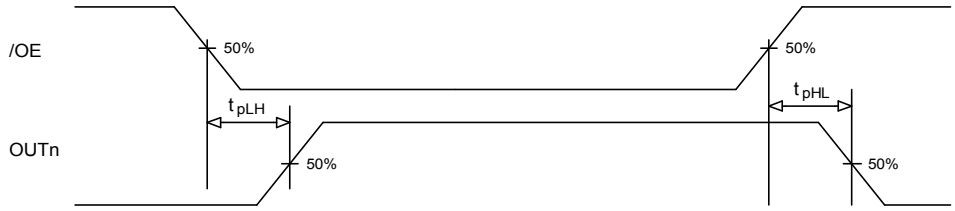
1. CLK, SDI, SDO, OUTn



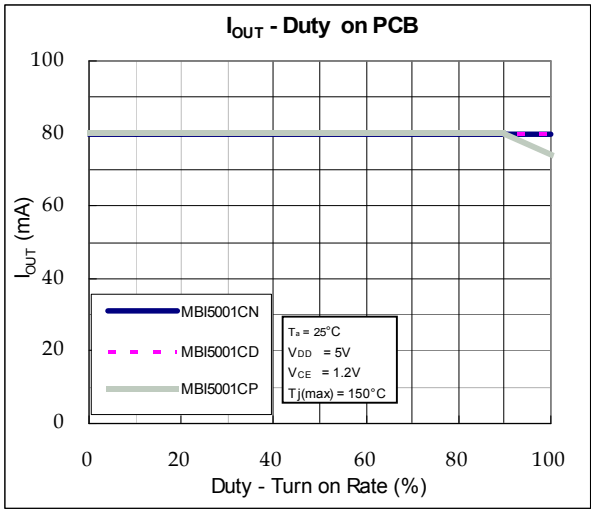
2. CLK - /LE

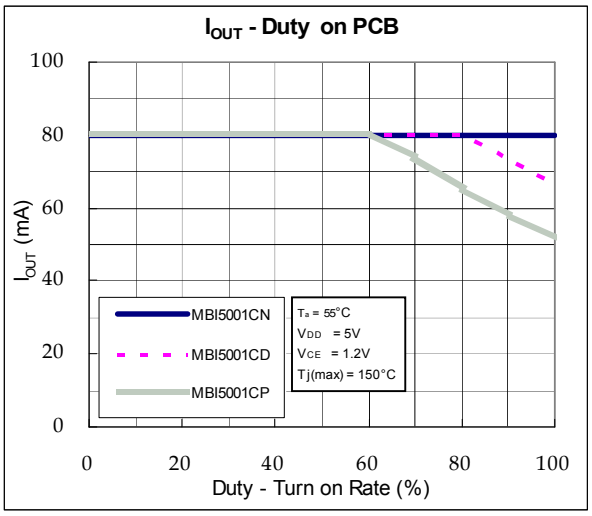


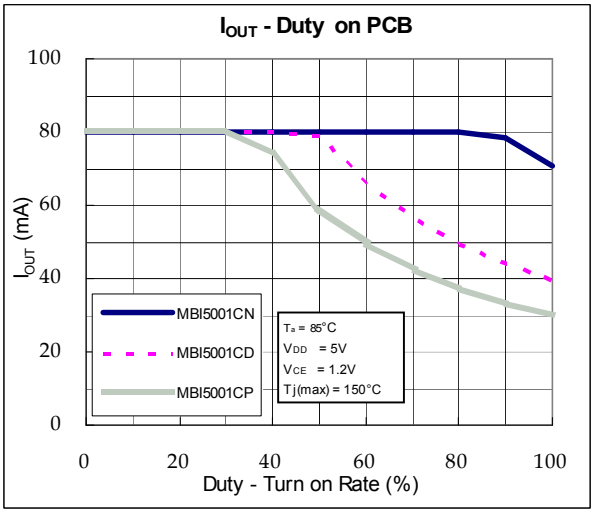
3. /OE - OUTn

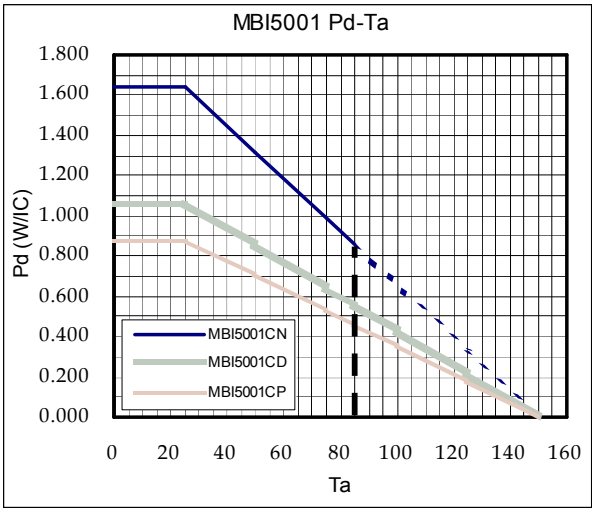


Graphs


IOUT - Duty on PCB
IOUT (mA)
Duty - Turn on Rate (%)
MBI5001CN
MBI5001CD
MBI5001CP
Ta = 25°C
VDD = 5V
VCE = 1.2V
Tj(max) = 150°C

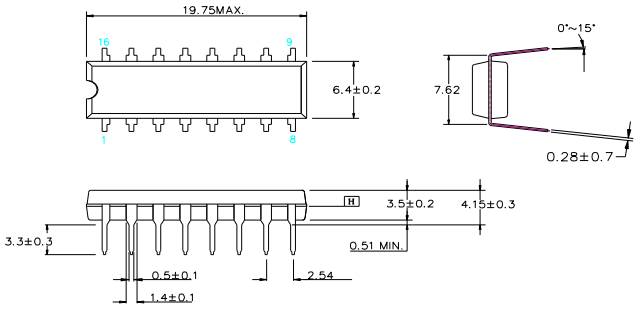

IOUT - Duty on PCB
IOUT (mA)
Duty - Turn on Rate (%)
MBI5001CN
MBI5001CD
MBI5001CP
Ta = 55°C
VDD = 5V
VCE = 1.2V
Tj(max) = 150°C


IOUT - Duty on PCB
IOUT (mA)
Duty - Turn on Rate (%)
MBI5001CN
MBI5001CD
MBI5001CP
Ta = 85°C
VDD = 5V
VCE = 1.2V
Tj(max) = 150°C


MBI5001 Pd-Ta
Pd (W/IC)
Ta
MBI5001CN
MBI5001CD
MBI5001CP

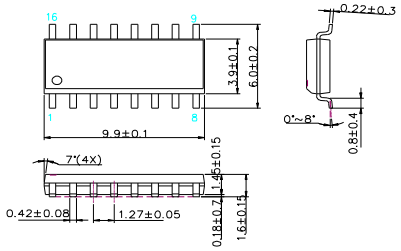
Outline Drawings

MBI5001 CN



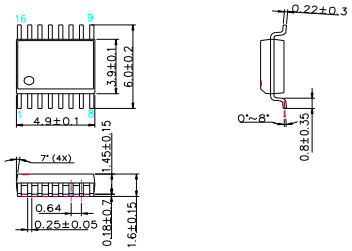
DIP-16-P-300-2.54
Units: mm
Weight: 1.02g (typ)

MBI5001 CD



SOP-16-P-150-1.27
Units: mm
Weight: 0.13g (typ)

MBI5001 CP



SSOP-16-P-150-0.64
Units: mm
Weight: 0.07g (typ)