XRP7618

8-Channel Constant Current Linear LED Driver With Smart Talk™

July 2011 Rev. 1.0.0

GENERAL DESCRIPTION

The XRP7618 is an 8-channel, high voltage, constant-current sink LED driver capable of driving up to 100mA current per channel. With outputs rated at 30V, the XRP7618 can control strings of multiple LEDs with better than ±1.5% channel to channel current matching.

LED channel current is programmed via an external resistor within a 10mA to 100mA range. Dimming control is supported through a standard PWM scheme up to 25kHz or through an analog signal.

Featuring Exar's Smart Talk™ technology, when combined with a boost converter, the XRP7618 maximizes the overall system efficiency by dynamically reporting the minimum LED voltage necessary to maintain current regulation mode. Multiple channels can be combined to increase current driving capability per channel and multiple XRP7618s can be placed in parallel to drive over 8 strings of LEDs.

An under voltage lock out, open LED and over temperature protections insure safe operations under abnormal operating conditions.

The XRP7618 is available in RoHS compliant, "green"/halogen free space saving 20-pin TSSOP (EP) package.

APPLICATIONS

- **LCD Backlighting**
- **Desktop, Notebook and TV Displays**
- **Industrial and Medical Displays**
- **Signage Backlighting**

FEATURES

- **8 Constant-Current Channels**
  - Adjustable up to 100mA per Channel
  - Channel Paralleling for higher Current
  - ±1.5% Current Matching Accuracy
- **Up to 30V LED Channel Voltage Range**
  - 5V Biasing Voltage and Control
- **Smart Talk™ Power Optimization**
- **Parallel Operations Support**
- **PWM and Analog Dimming**
- **UVLO, Open LED & Over Temperature protection**
- **RoHS Compliant Halogen Free, 20-pin TSSOP (EP) Package**

TYPICAL APPLICATION DIAGRAM

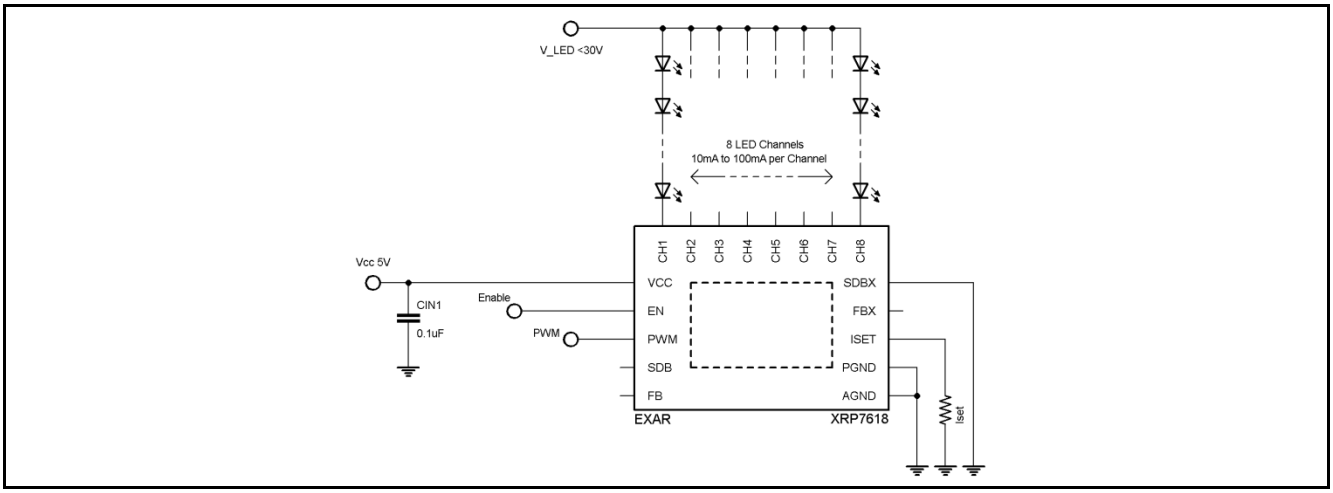


Fig. 1: XRP7618 Typical Application Diagram

ABSOLUTE MAXIMUM RATINGS

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

V_{CC}, ISET, EN, FB, SDB, PWM ..... -0.3V to 6.0V
CHx ..... -0.3V to 30V
Junction Temperature ..... 150°C
Storage Temperature ..... -65°C to 150°C
Power Dissipation ..... Internally Limited
Lead Temperature (Soldering, 10 sec) ..... 260°C
ESD Rating (HBM - Human Body Model) 6kV
ESD Rating (MM - Machine Model) 200V

OPERATING RATINGS

Input Voltage Range V_{CC} ..... 4.2V to 5.5V
PWM Dimming Frequency ..... 0.1KHz to 25KHz
Current per Channel .....
V_{CHx}≥0.5V ..... 10mA to 25mA
V_{CHx}≥1V ..... 10mA to 65mA
V_{CHx}≥1.5V ..... 10mA to 110mA
Operating Temperature Range ..... -40°C to 85°C
Thermal Resistance θ_{JA} (TSSOP-20) ..... 35°C/W

ELECTRICAL SPECIFICATIONS

Specifications with standard type are for an Operating Junction Temperature of T_J = 25°C only. Minimum and Maximum limits are guaranteed through test, design, or statistical correlation. Typical values represent the most likely parametric norm at T_J = 25°C, and are provided for reference purposes only. Unless otherwise indicated, V_{CC} = 5V, R_{ISET} = 8.2kΩ, T_A= 25°C.

Parameter	Min.	Typ.	Max.	Units	Conditions
Operating Input Voltage Range V_{CC}	4.2	5.0	5.5	V	
Shutdown Supply Current		0.1	1	µA	V_{EN}=0V
Quiescent Supply Current		0.5	1	mA	No load
Under Voltage Lockout threshold	3.6	3.8	4.0	V	Falling edge
Under Voltage Lockout Hysteresis		200		mV	
ISET Reference Voltage	1.170	1.194	1.218	V	
Current Multiplication Ratio	370	400	430		I_{CHX}/I_{SET}
Maximum Output Current per Channel	23	45		mA	V_{CHX}=0.5V
	65	70			V_{CHX}=1.0V
	110	120			V_{CHX}=1.5V
LED Current Matching	-1.5		1.5	%	Any 2 channels V_{CHX}=1.0V, I_{CHX}=60mA
Current Sink Saturation Voltage			0.45	V	I_{CHX}=20mA
			0.8		I_{CHX}=60mA
			1.2		I_{CHX}=100mA
Output Current Line Regulation			2	%/V	V_{CC}=4.2V to 5.5V
Output Current Load Regulation			4	%	V_{CHX}=0.5V to 2.8V
Enable Logic LOW			0.8	V	XRP7618 is disabled
Enable Logic HIGH	1.8			V	XRP7618 is active
PWM Pin Logic LOW			0.8	V	XRP7618 is disabled
PWM Pin Logic HIGH	1.8			V	XRP7618 is active
SDB Pin Logic LOW			0.4	V	
SDB Pin Logic HIGH	2.4			V	
Feedback Output Current	5	15		µA	
Thermal Shutdown Die Temperature		160		°C	
Thermal Shutdown Hysteresis		20		°C	

BLOCK DIAGRAM

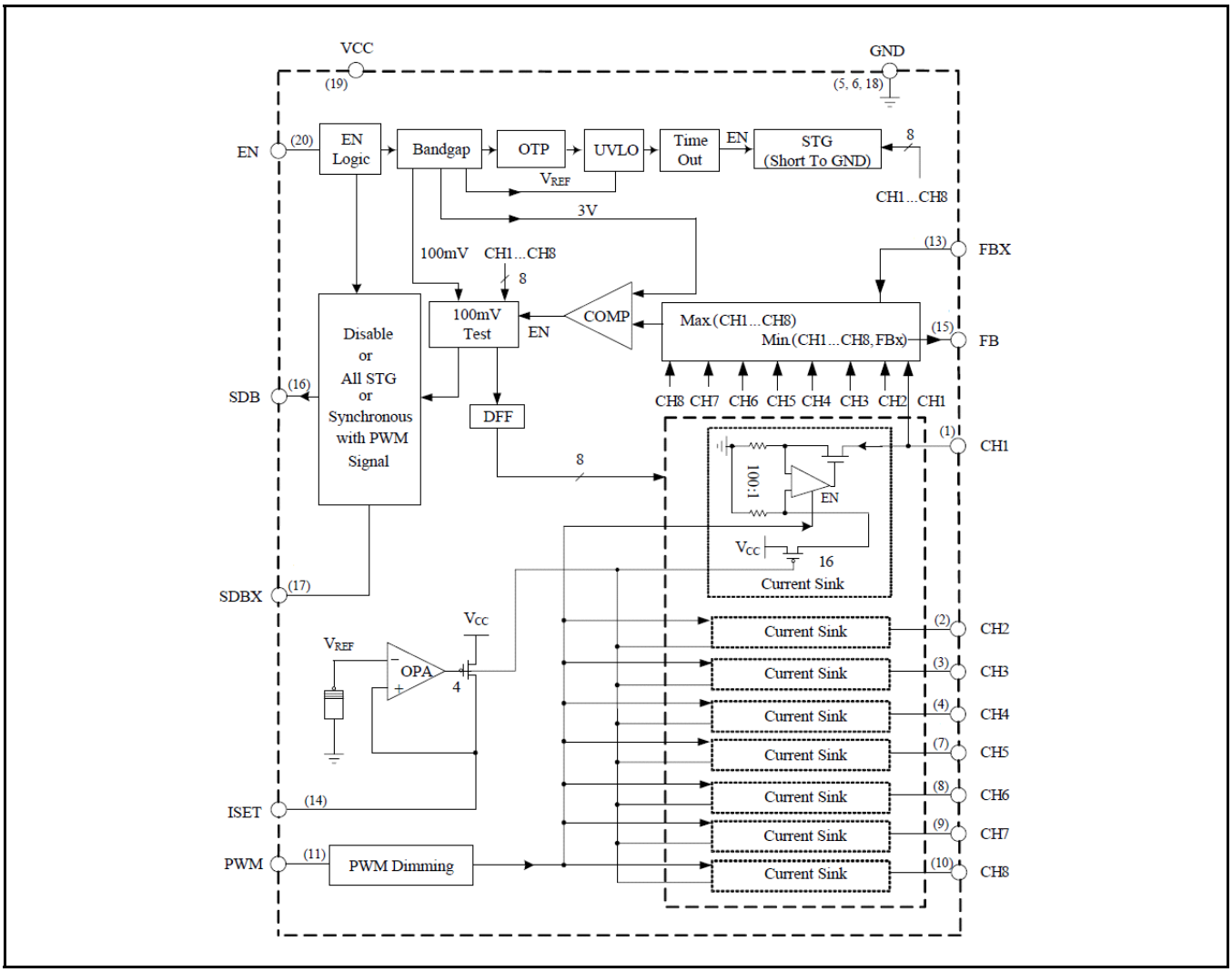


Fig. 2: XRP7618 Block Diagram

PIN ASSIGNMENT

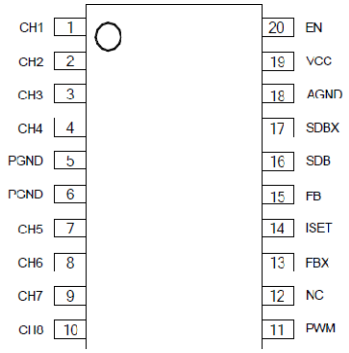


Fig. 3: XRP7618 Pin Assignment

PIN DESCRIPTION

Name	Pin Number	Description
CHx	1, 2, 3, 4, 7, 8, 9, 10	CH1 to CH8 pins Connect an LED between each pin and LED supply rail voltage (V_{LED}). Current value is controlled by R_{SET}. Connect unused channel(s) to GND.
NC	12	Not Connected
PWM	11	PWM pin This must be held HIGH to enable the output drivers. It can be used for PWM dimming up to 25kHz. If not used, connect to V_{CC}.
FBX	13	FBX input pin Used in parallel configuration as an interface terminal by connecting it to FB pin of the next XRP7618. If not used, leave it unconnected.
ISET	14	ISET pin Connect resistor R_{SET} from this pin to ground to set LED channel current as per $I_{CHANNEL}=1.194x400/R_{SET}$
FB	15	FB pin Samples the LED cathode voltage on each channel and outputs the lowest voltage to the step-up converter.
SDB	16	SDB output pin SDB signal is synchronous with the PWM signal during PWM Dimming. It outputs low logic to the step-up converter under conditions such as shutdown or when all channels are inactive.
SDBX	17	SDBX input pin Used in parallel configuration as an interface terminal by connecting it to SDB pin of the next XRP7618. If not used, connect it to GND.
AGND	18	Ground pin
VCC	19	Input Voltage pin Must be closely decoupled to GND pin with a 0.1µF ceramic capacitor.
EN	20	Enable pin This pin must be held HIGH to enable the XRP7618.
PGND	5, 6	Ground pin
EP	Exposed Pad	Exposed Pad Connect to ground

ORDERING INFORMATION

Part Number	Temperature Range	Marking	Package	Packing Quantity	Note 1	Note 2
XRP7618IGB-F	-40°C≤T_A≤+85°C	EXAR XRP7618IGB YYWWF XXXX	TSSOP-20	Bulk	Halogen Free RoHS Compliant	Exposed Pad
XRP7618IGBTR-F				1.5K/Tape & Reel		
XRP7618EVB	XRP7618 Evaluation Board					

"YY" = Year – "WW" = Work Week – "X" = Lot Number, when applicable.

TYPICAL PERFORMANCE CHARACTERISTICS

All data taken at V_{CC} = 5V, R_{ISET} = 8kΩ, T_A = 25°C, unless otherwise specified - Schematic and BOM from Application Information section of this datasheet.

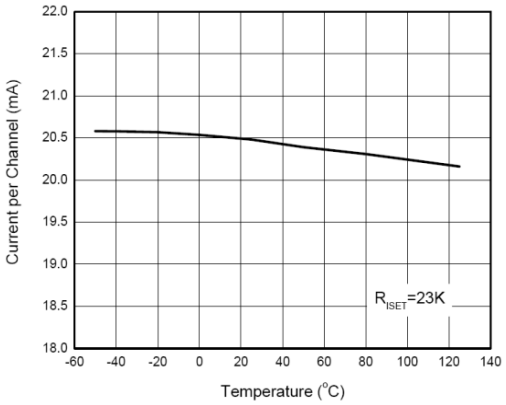


Fig. 4: Current per Channel vs Temperature

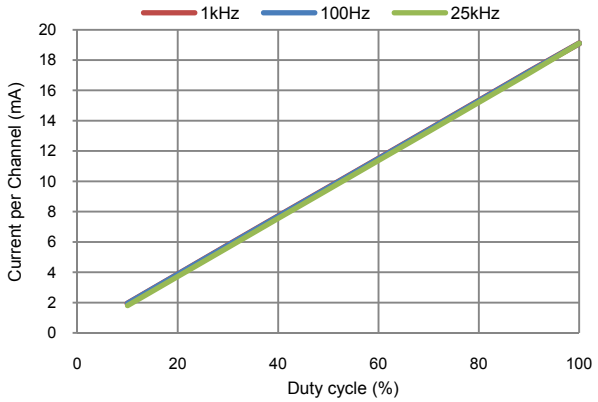


Fig. 5: PWM Dimming: Current per Channel vs Duty Cycle

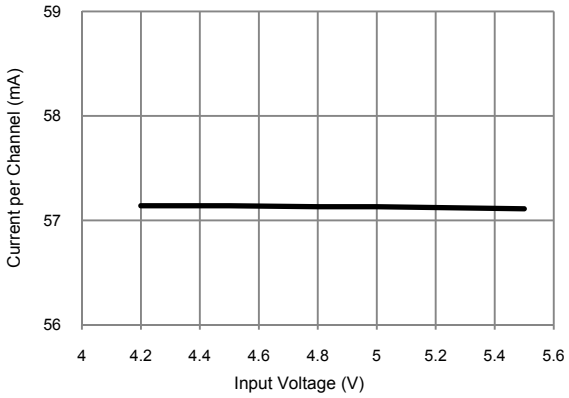


Fig. 6: Current per Channel vs Input Voltage

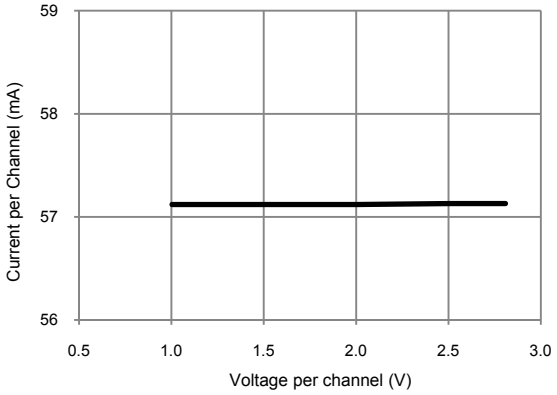


Fig. 7: Current per Channel vs Voltage per Channel

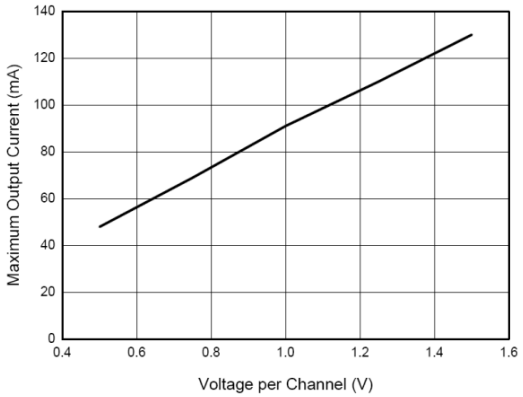


Fig. 8: Maximum Output Current vs Voltage per Channel

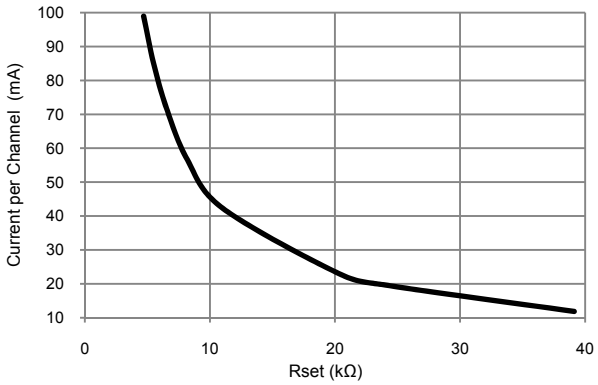


Fig. 9: Current per Channel vs RSET resistor

THEORY OF OPERATION

The XRP7618 is an eight channel programmable constant current LED driver capable of up to 100mA per channel. A single external resistor adjusts the current for each channel over a 10mA to 100mA range with tight matching between channels.

Dimming is supported through a standard PWM scheme or through an analog signal. Furthermore, the XRP7618 maximizes the overall system efficiency by dynamically reporting the minimum LED voltage necessary to remain in current regulation mode when used with a boost converter.

Multiple XRP7618s can be placed in parallel to drive over 8 strings of LEDs; however, unused channels should be tied to ground.

Built-in under voltage lock out, open LED and over temperature protections insure safe operations under abnormal operating conditions.

LED CHANNELS CURRENT SETTING

The maximum LED current can be set up to 100mA per channel through the ISET pin. To set the reference current I_{SET}, connect a resistor R_{SET} between this pin and ground. The value of R_{SET} can be calculated by the following formula:

$$I_{SET} = \frac{1.194V}{R_{SET}}$$

This reference current is multiplied internally with a gain (K) of 400 then mirrored on all enabled channels. This sets the maximum LED current, referred to as 100% current (I_{LEDMAX}). The value can be calculated by the following formula:

$$I_{LEDMAX} = K \times I_{SET}$$

or,

$$R_{SET} = \frac{K \times 1.194V}{I_{LEDMAX}} = \frac{400 \times 1.194V}{I_{LEDMAX}}$$

The LED current can be reduced from 100% by PWM dimming control.

PWM DIMMING CONTROL

The LED current can be adjusted by applying a PWM signal to the PWM pin. In this mode, all enabled channels are adjusted at the same time and brightness is adjusted from 1% to 100% of I_{LEDMAX}.

The supported external PWM signal frequency is 100Hz to 25kHz.

ANALOG DIMMING CONTROL

Besides PWM dimming control, the LED current can be controlled continuously (from highest to lowest LED current) by raising the voltage at the bottom of RSET from 0V normally to 1V max, respectively. RSET value may be determined as

$$R_{SET} = \frac{(1.194 - V_{MOD}) \times 400}{I_{LEDMAX}}$$

where, 1.194V is a typical ISET pin voltage, VMOD is an adjustment voltage applied to the bottom side of RSET, 400 is the typical current multiplication ratio, and I_{LEDMAX} is the required LED current per channel.

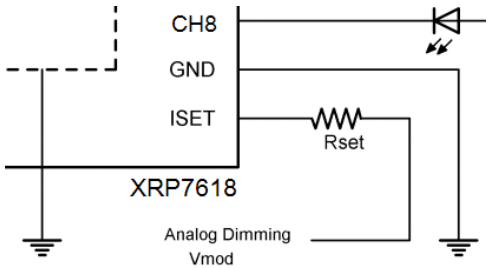


Fig. 10: XRP7618 Analog Dimming Control

If adjustment voltage VMOD isn't used, RSET resistor should be connected to ground.

SYSTEM POWER OPTIMIZATION

The Smart Talk feature enables XRP7618 to maximize the overall system power efficiency, when used with a step-up converter, by dynamically reporting the minimum LED channel voltage needed to maintain current regulation mode. The XRP7618 samples the voltage on each channel input and reports the lowest voltage of all strings via the FB signal to the associated step up converter.

If placed in shutdown through the EN pin or if all channels are inactive, the XRP7618 outputs

a logic low to the converter via the SDB signal. Furthermore, the SDB signal is synchronous to the PWM signal when PWM dimming is used.

OPEN LED PROTECTION

The XRP7618 provides a built-in protection for open LED channel. Upon detection of an open LED channel event, the FB signal is driven low to allow the step-up converter to operate open loop which in turn raises the voltage on the remaining CHx pins. Upon reaching an internally pre-set threshold of 3V, the XRP7618 identifies the faulty channel and removes it from the control and reporting loop. At this point the FB signal resumes its normal function of reporting the lowest LED channel voltage and hence restores the proper operations of the converter. Note that the open LED channel is not disabled; however, its CHx voltage is no longer reported. Upon reconnection of the open LED channel, current will be driven at the programmed level.

PARALLEL MODE OF OPERATION

Multiple XRP7618s can be placed in parallel to drive over 8 strings of LEDs; however, unused channels should be tied to ground.

While the initial XRP7618 is connected to the step-up converter via its FB and SDB pins, the daisy chained XRP7618s are connected to each other through the respective FBX and SDBX pins. In this configuration, the initial XRP7618 reports the lowest LED voltage and SDB signal of all the XRP7618s in parallel. Refer to figure 12.

TYPICAL APPLICATION SCHEMATICS

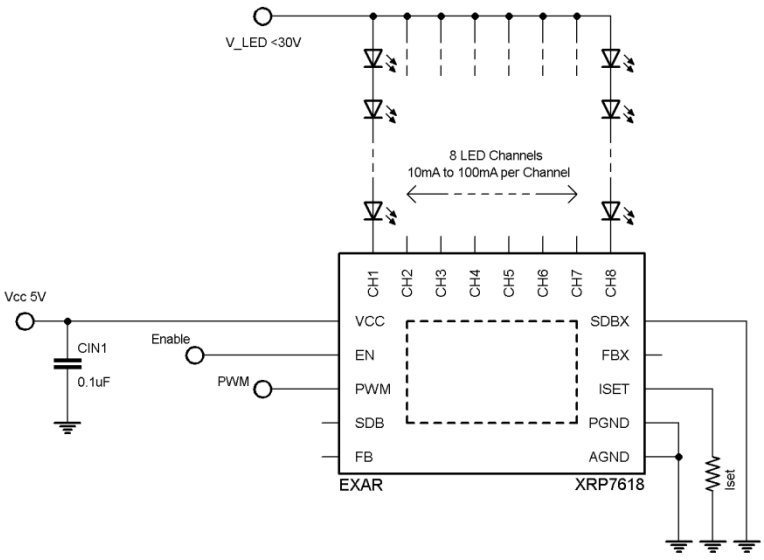


Fig. 11: Single XRP7618 Application

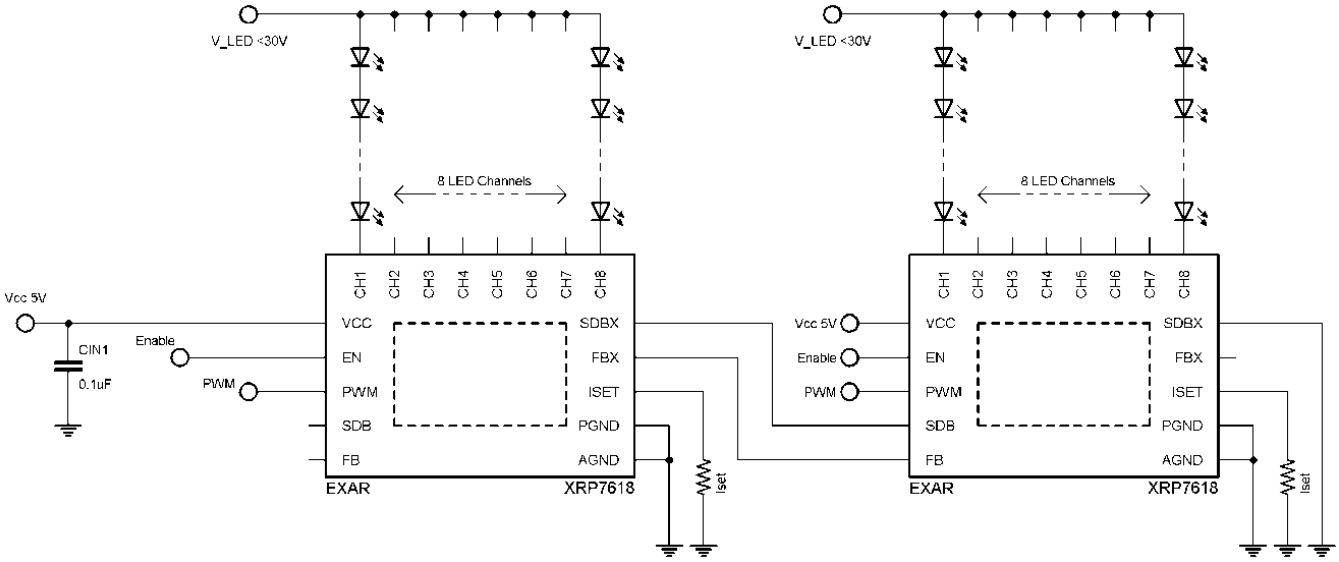


Fig. 12: Parallel Operations with the XRP7618

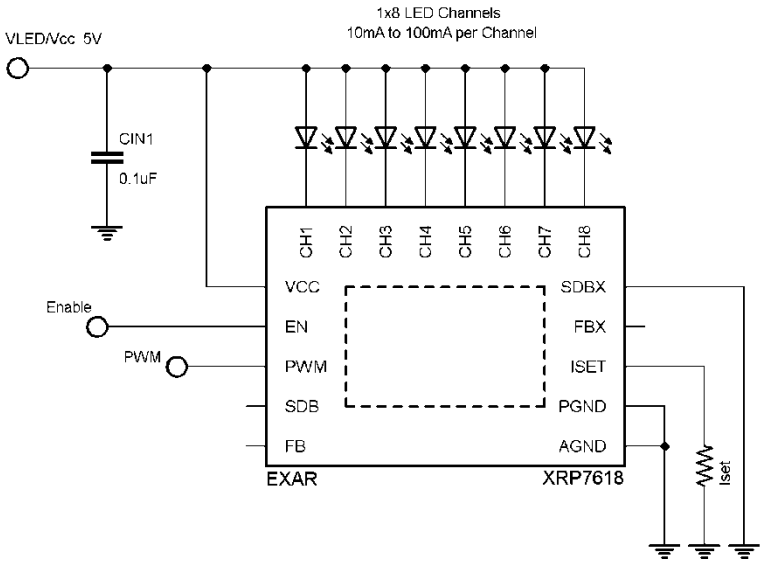
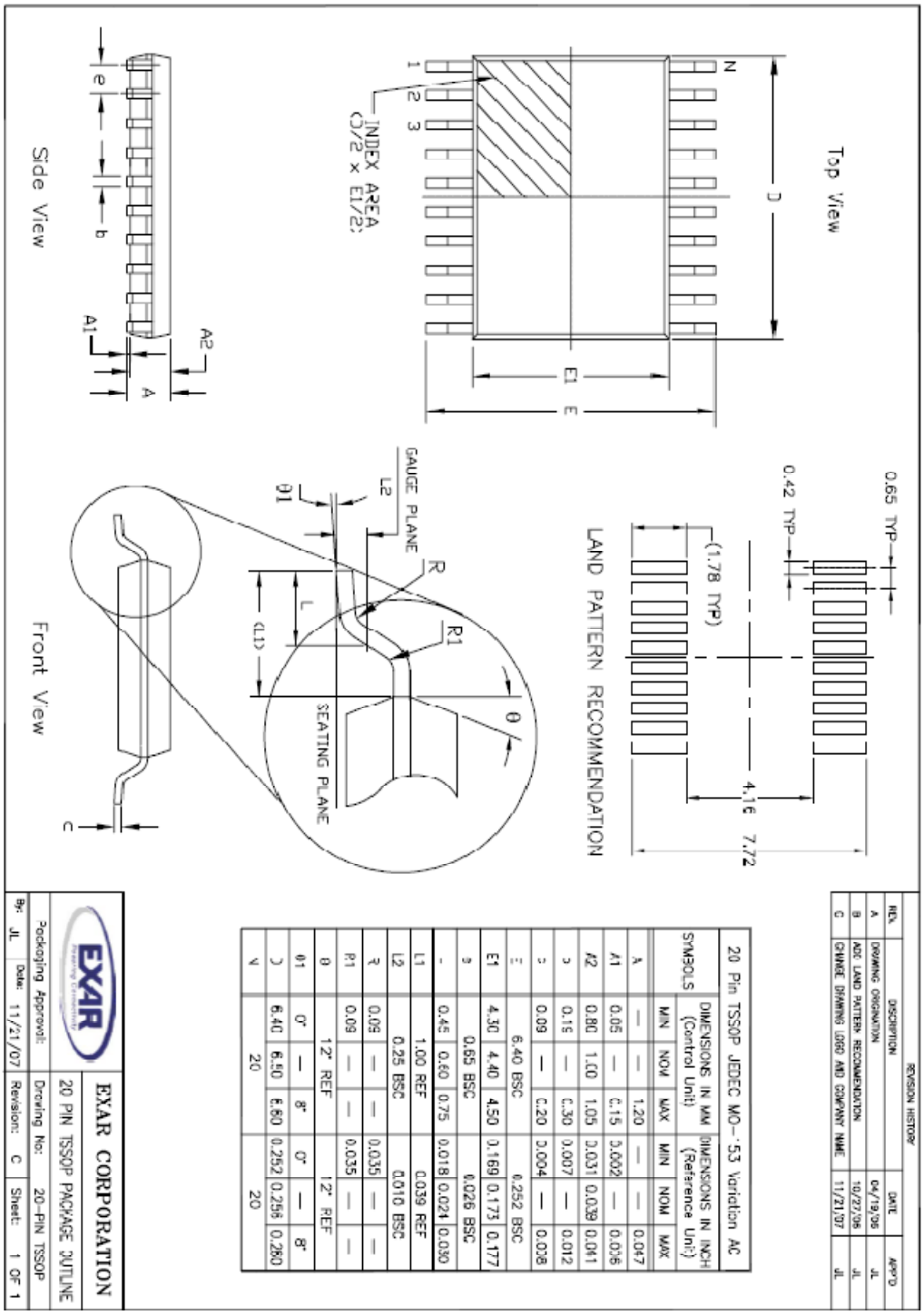


Fig. 13: Single Supply Operations with the XRP7618

PACKAGE SPECIFICATION

20-PIN TSSOP (EXPOSED PAD)

Unit: mm (inch)



REVISION HISTORY			
REV.	DESCRIPTION	DATE	APP'D
A	DRAWING ORGANIZATION	04/19/06	JL
B	ADD LAND PATTERN RECOMMENDATION	10/27/06	JL
C	CHANGE DRAWING LOGO AND COMPANY NAME	11/21/07	JL

20 Pin TSSOP JEDEC MO-153 Variation AC

SYMBOLS	DIMENSIONS IN MM (Control Unit)			DIMENSIONS IN INCH (Reference Unit)		
	MIN	NOM	MAX	MIN	NOM	MAX
A	—	—	1.20	—	—	0.047
A1	0.05	—	0.15	0.002	—	0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19	—	0.30	0.007	—	0.012
c	0.09	—	0.20	0.004	—	0.008
E	6.40 BSC			0.252 BSC		
E1	4.30	4.40	4.50	0.169	0.173	0.177
e	0.65 BSC			0.026 BSC		
L	0.45	0.60	0.75	0.018	0.024	0.030
L1	1.00 REF			0.039 REF		
L2	0.25 BSC			0.010 BSC		
R	0.09	—	—	0.035	—	—
R1	0.09	—	—	0.035	—	—
θ	12° REF			12° REF		
θ1	0°	—	8°	0°	—	8°
D	6.40	6.50	6.60	0.252	0.256	0.260
N	20			20		

EXAR CORPORATION

20 PIN TSSOP PACKAGE OUTLINE

Packaging Approval:	Drawing No:	20-PIN TSSOP
By: JL Date: 11/21/07	Revision: C	Sheet: 1 OF 1

REVISION HISTORY

Revision	Date	Description
1.0.0	07/26/2011	Initial Release of datasheet

FOR FURTHER ASSISTANCE

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