Application Note AN12
Electrical Drive Considerations for Bridgelux LED Arrays

Introduction

The Bridgelux family of LED Array products delivers high performance, compact and cost-effective solid-state lighting solutions to serve the general lighting market. These products combine the higher efficiency, lifetime, and reliability benefits of LEDs with the light output levels of many conventional lighting sources. To achieve optimal performance of the LED Arrays, proper electronic drivers must be selected or designed.

The purpose of this application note is to assist designers in selecting or developing electronic drivers for use with Bridgelux LED Arrays. The first step is to become familiar with relevant electrical characteristics of the LED Arrays. This includes the relationship between forward voltage and current and the relationship between flux and current. A review of these characteristics results in design rules and recommendations for driving Bridgelux LED Arrays.

The second step is to define LED driver requirements, usually specific to the given application. Design considerations include defining the driver's input voltage (i.e., AC line voltage input, a combination of AC-DC and DC-DC drivers, or DC input from batteries), defining an optimal driver output current, establishing dimming requirements, and determining both temperature and lifetime requirements to satisfy the needs of the application. This application note provides general guidelines to the designer to assist in enabling a successful design.

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LED Array Electrical Characteristics

Bridgelux LED Arrays are manufactured using high power InGaN light emitting diodes, a technology that is proven to be a robust solid state light source and one that exhibits specific electrical characteristics relevant to driver selection and design. The first of these characteristics is the relationship between forward voltage and forward current. These relationships are provided in the Product Data Sheets with further detail included in the appendix of this application note. Key points illustrated by this data are described below.

1. The relationship between forward voltage and forward current forms a distribution of product performance. The range of the distribution is defined by minimum and maximum values and can be considered as nearly normal (Figure 1) with a minimum, typical and maximum value. The entire range of performance possibilities, not just the typical characteristics, must be considered when designing or selecting an LED driver. Output power and output voltage requirements for drivers must be designed for maximum forward voltage parts to ensure a successful design.

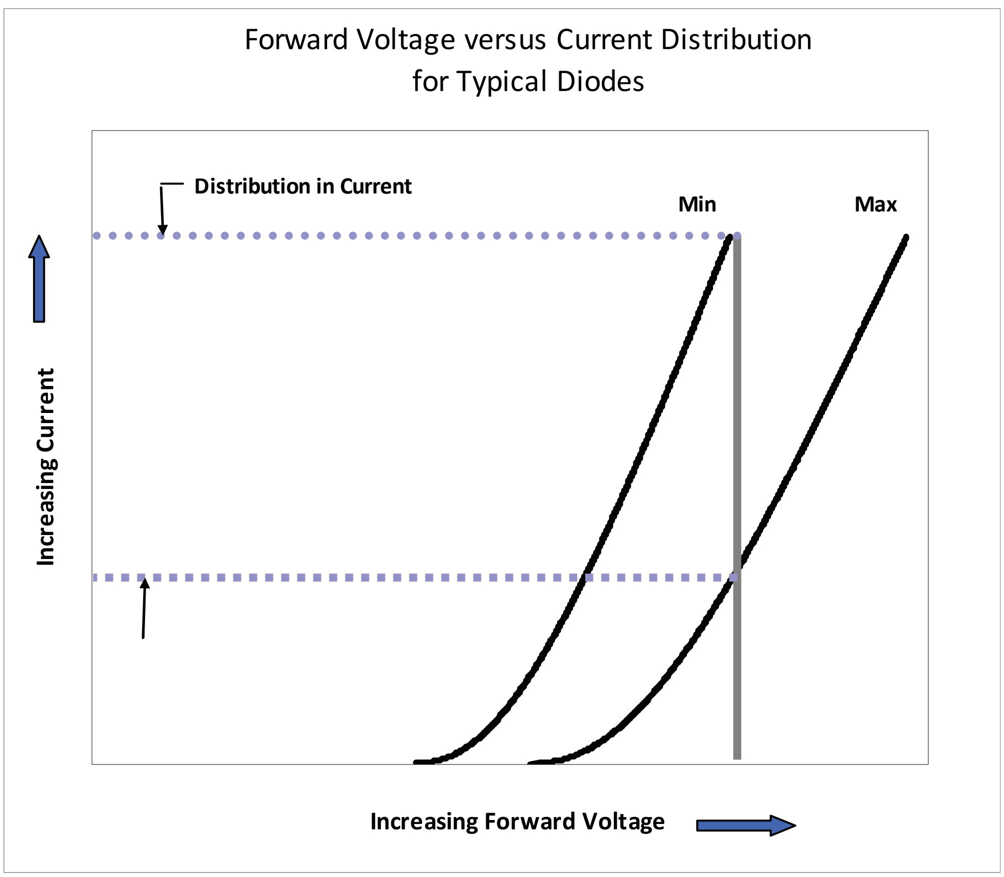

Figure 1: Distribution of forward current at constant forward voltage for a typical diode

If a constant voltage source, as opposed to a constant current source, is used to apply power to the LED Array, a small change or difference in the forward voltage of the LED Array can result in a large change in the forward current flowing through the junction, and ultimately in a large change in flux performance (Figure 2).

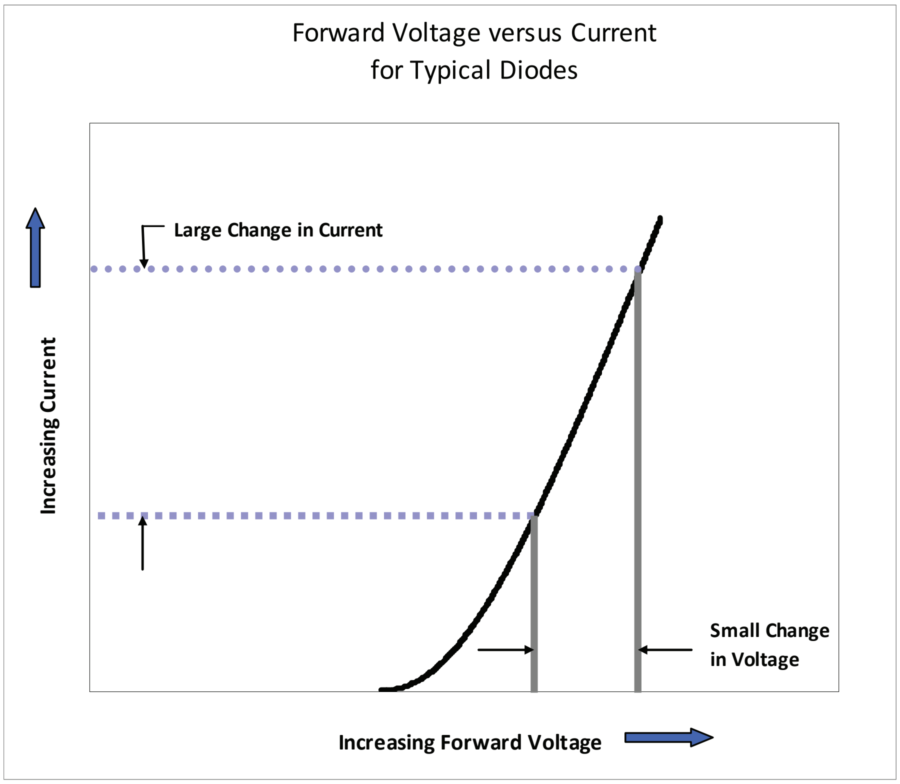

Figure 2: Impact of a small voltage change on forward current for a typical diode

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2. LEDs require a minimum voltage to be applied across the junction before current flows, generating light. This minimum voltage is commonly referred to as the threshold voltage or Turn On Voltage (V_{TO}) as shown in Figure 3.

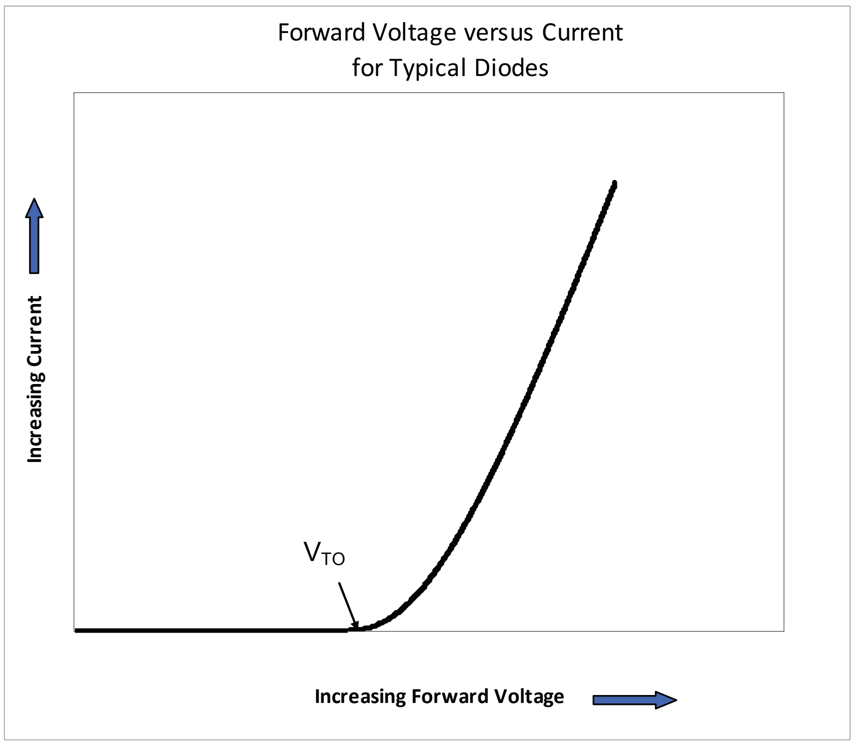

Figure 3: Threshold Voltage or Turn On Voltage for a typical diode

The light, or flux, emitted by the LED Array is dependant upon the forward current applied across the junction. At a fixed voltage the current flowing through the devices can vary dramatically depending on the forward voltage of the individual LED Array. Consider the range of currents that occur at a fixed voltage. If we look at Figure A11 in the Appendix we see that the minimum, typical, and maximum currents for a 400 lumen cool white LED Array (BXRA-C0400) with an applied voltage of 8.4V would be 0mA, 70mA and 300mA, respectively, depending on the forward voltage of the array. If this voltage was applied to adjacent LED Arrays, one would appear out (0 mA), one dim (70mA) and one bright (300mA). It is for this reason that Bridgelux recommends against driving LED Arrays with constant voltage sources or connecting multiple LED Arrays in parallel.

Due to the nature of semiconductor technology, reverse voltage data is not shown. LEDs are not designed to be driven with reverse voltage as they may be damaged. LED drivers should be selected or designed to avoid applying a reverse bias to the LED Array.

As noted before, another important electrical characteristic of the Bridgelux LED Arrays is the relationship between forward current and flux. Figure 4 shows a representative typical flux versus current plot for the BXRA-C0400 product. All Bridgelux LED Array products exhibit similar characteristics, listed below.

1. Increasing the forward current increases the flux output of the LED Array. However, the relationship between flux performance and forward current is not linear, a common characteristic for all LEDs. For example, doubling the forward current does not lead to doubling of the flux output. This non-linear relationship of flux vs. forward current (or LED efficacy vs. forward current) is typically referred to as “droop.”

2. LEDs are less efficient at higher driver currents than at lower currents (see above). Driving the LED Array with a fixed current will maintain a given efficiency level.

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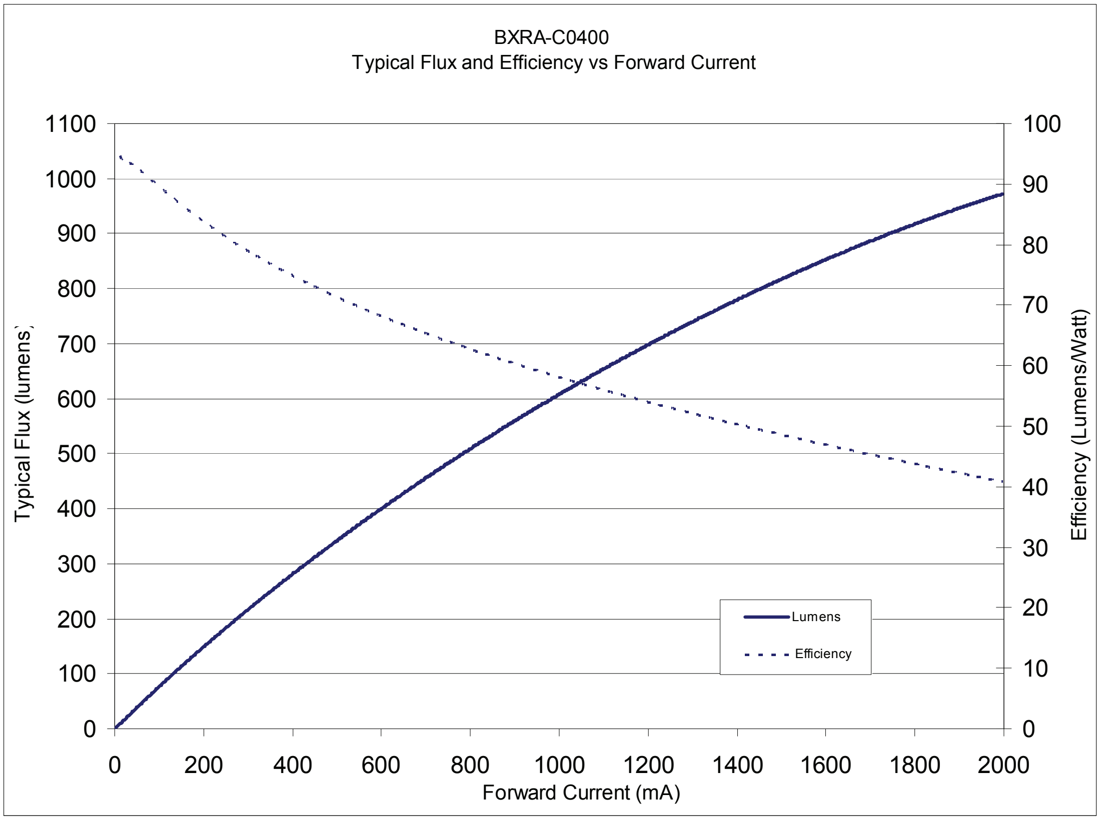

Figure 4: Typical flux and efficiency versus current for a BXRA-C0400 LED Array

Low Current Performance

The LED Array Product Data Sheets list minimum recommended drive currents in the absolute minimum and maximum ratings section. As a result of variation in flux performance under low current operation, Bridgelux does not recommend driving the LED Arrays at currents lower than those specified in the Product Data Sheets. Recommendations for dimming are included later in this application note.

High Current Performance

LED Arrays may be driven at currents exceeding the maximum DC drive currents listed in the absolute minimum and maximum rating section of the Product Data Sheets if the arrays are run in pulsed mode. Maximum pulse currents are listed in the Product Data Sheets. Pulsing requires a maximum 10% duty cycle at 1 to 10 KHz. Pulse driving LED Arrays at a lower frequency may result in excessive heating of the LED junction, a noticeable flicker to the human eye, or both.

Temperature Effects on Electrical Characteristics and Driver Design

The forward voltage of Bridgelux LED Arrays varies with temperature. The degree of change in forward voltage is listed in the electrical characteristics section of the Product Data Sheets. To minimize the effect of shifts in forward voltage, Bridgelux recommends driving LED Arrays using constant current sources rather than constant voltage sources.

Dimming

Bridgelux recommends dimming LED Arrays using pulse width modulation (PWM). Pulse width modulation is illustrated in Figure 5. Using PWM methods for dimming will result in consistent performance between multiple LED Arrays in a lighting system or installation at reduced light output levels, ensuring luminaire to luminaire consistency over a wide range of output levels.

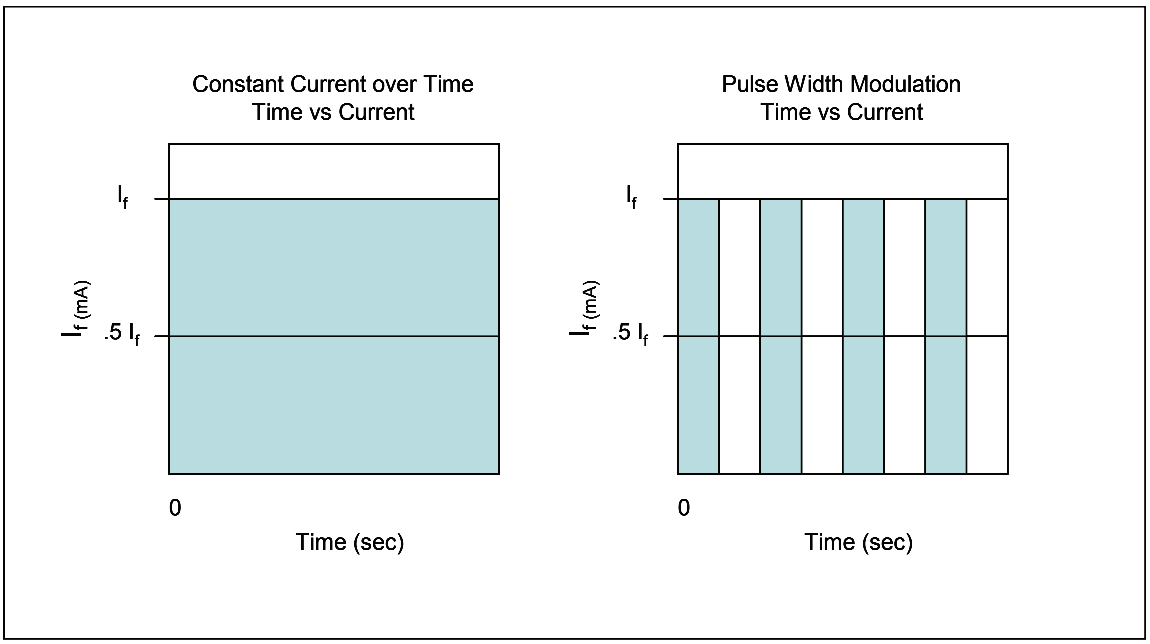

Figure 5: Current over time is shown for two different scenarios. The graph on the left depicts current over time for an LED Array under constant current drive, where the average current is depicted by I_f. The graph on the right depicts current over time for an LED Array that is pulse width modulated (current is turned on and off over time), where the average current is depicted as 0.5 I_f due to a 50% duty cycle. This will result in a perceived light output level of 50% (50% dimming) compared to the graph on the left.

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General Electrical Drive Recommendations

Based on the electrical characteristics of Bridgelux LED Arrays, Bridgelux recommends the following basic guidelines for electronic driver design.

1. Drive the LED Arrays using constant current sources, not constant voltage sources.
2. Do not apply a reverse voltage to the LED Array.
3. Use pulse width modulation (PWM) for dimming the LED Array.

Figure 6 illustrates constant current sources driven by different input sources.

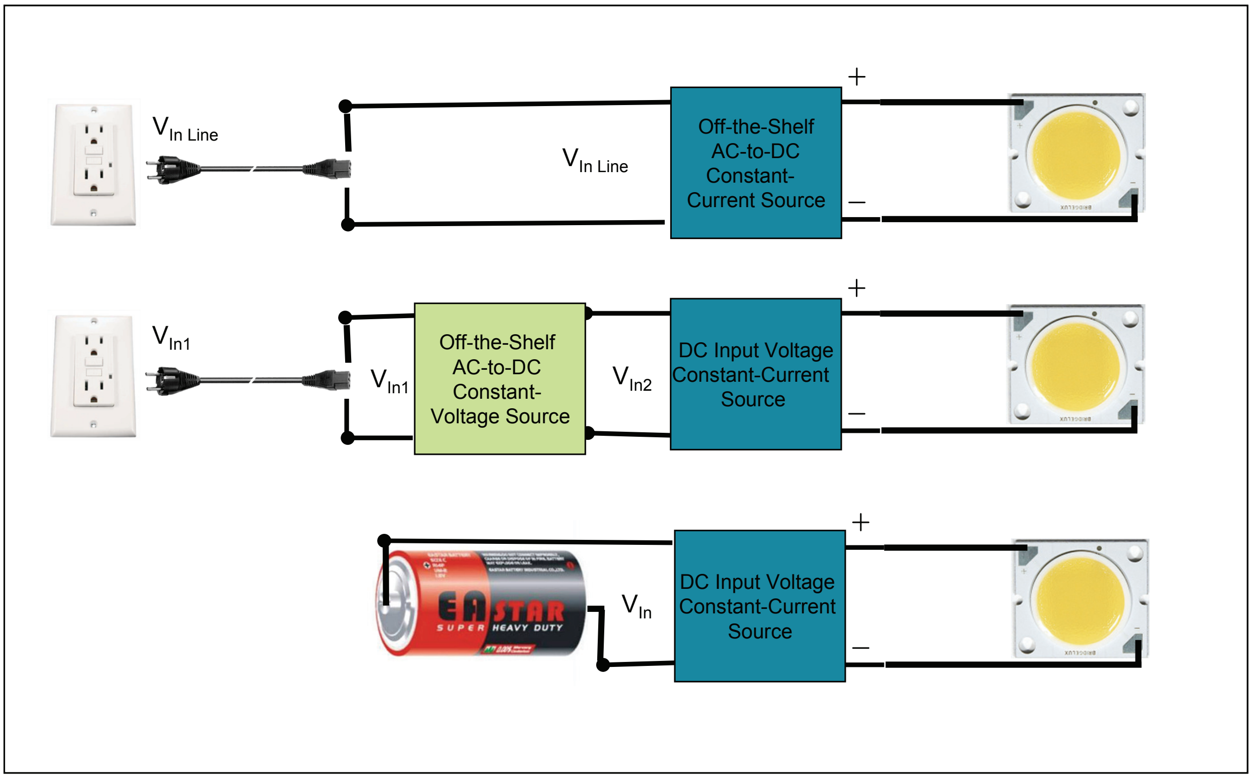

Figure 6: Illustration of drivers that accommodate different input voltage requirements

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Multiple Array Circuit Design Recommendations

For some luminaire designs it may be desired to incorporate multiple LED Arrays driven at the same forward current. For these designs Bridgelux provides the following recommendations.

1. When using a single LED driver with a single constant current output channel, connect the LED Arrays in series to complete the electrical circuit (Figure 7). This arrangement ensures that all LED Arrays will be operated at the same current.

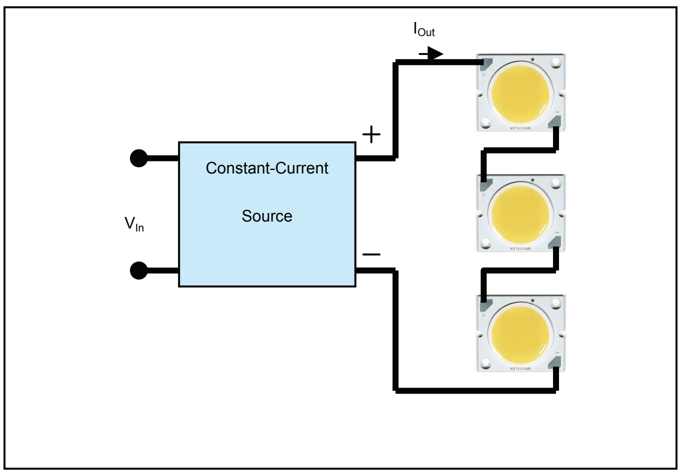

Figure 7: Multiple LED Arrays driven in series with a single constant current source

2. LED drivers are also available which have multiple output channels. If a driver with multiple constant current output channels is selected, the number of channels needs to be sufficient to drive all of the LED Arrays (Figure 8).

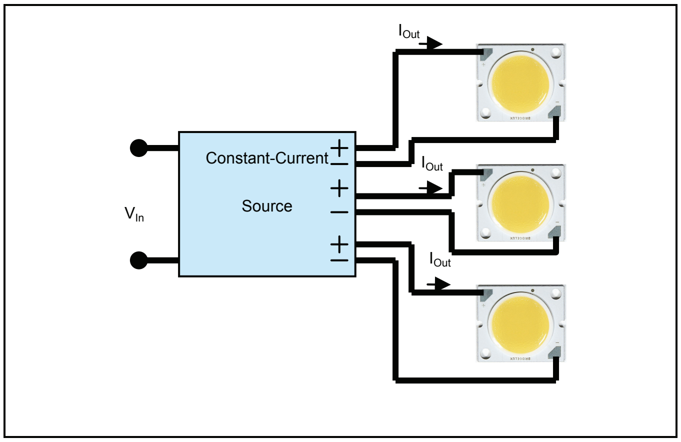

Figure 8: Multiple LED Arrays driven by a driver with multiple constant current channels

3. A combination of the two configurations above can also be applied. LED Arrays can be connected in multiple series strings from a multi-channel LED driver, allowing for an increased quantity of LED Arrays to be powered from a single driver.

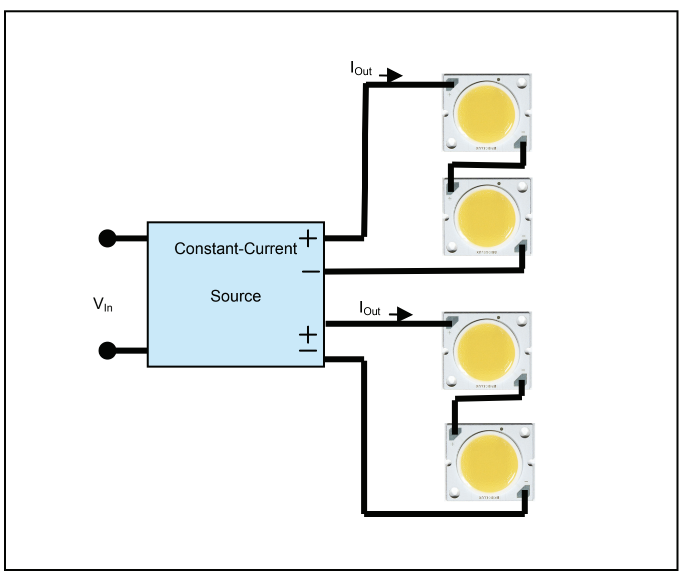

Figure 9: Series strings of multiple LED Arrays driven by a multi-channel driver

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4. Bridgelux does not recommend connecting multiple LED Arrays in a parallel circuit. Variation in the forward voltage of the individual LED Arrays can result in current hogging, where a lower Vf LED Array may see a higher forward current compared to a higher Vf LED Array connected in parallel. This may produce non-uniform flux and color, and may affect the reliability of the lighting system.

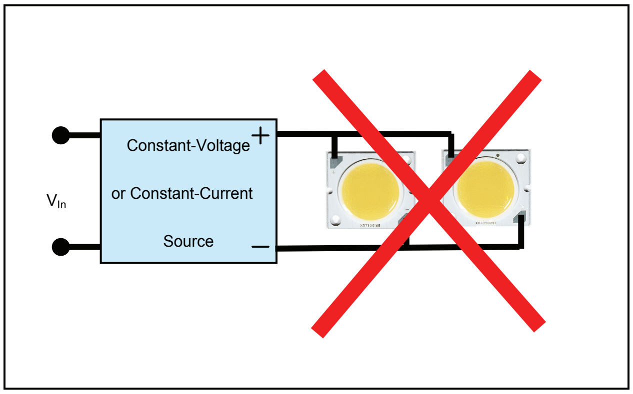

Figure 10: Parallel connection of multiple LED Arrays to a driver – *NOT RECOMENDED*

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LED Driver Power Requirements

LED drivers convert available input power into the required output current and voltage, analogous to ballasts used with fluorescent and other conventional light sources. Bridgelux recommends the use of constant current sources to drive the LED Arrays. In addition to meeting input requirements specified by the user (such as 110V AC input, 220V AC input, 12V DC input etc.), the driver selected must meet the output requirements as specified for the application. These include, but are not limited to, V_{out}, I_{out}, and Power. Table 1 lists the requirements for driving a single LED Array at recommended test currents.

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Table1: Bridgelux LED Array V_{out}, I_{out}, and Power requirements for proper driver selection

Bridgelux LED Array Part Number	**Minimum Compliance Voltage V_{out} at T_j 25°C (V)**	**Constant Current I_{out} (mA)**	**Maximum Power at Rated I_{out} (W)**
BXRA-W0240	14.3	350	5.0
BXRA-W0241	7.3	700	5.1
BXRA-W0260	13.6	350	4.8
BXRA-W0261	6.8	700	4.8
BXRA-W0400	10.6	900	9.5
BXRA-W0401	10.3	700	7.2
BXRA-W0402	9.7	700	6.8
BXRA-W0403	31.7	250	7.9
BXRA-W0800	14.3	1300	18.6
BXRA-W0802	13.2	1050	13.9
BXRA-W1200	17.8	1600	28.5
BXRA-W1202	16.3	1200	19.6
BXRA-W1203	19.8	1050	20.8
BXRA-W3000	28.3	2100	59.4
BXRA-N0400	10.5	800	8.4
BXRA-N0402	9.7	600	5.8
BXRA-N0800	14.1	1200	16.9
BXRA-N0802	13.2	1050	13.9
BXRA-N1200	17.5	1400	24.5
BXRA-N1203	19.8	1050	20.8
BXRA-N3500	28.3	2100	59.4
BXRA-C0360	14.3	350	5.0
BXRA-C0361	7.3	700	5.1
BXRA-C0400	10.6	600	6.4
BXRA-C0402	10.3	500	5.2
BXRA-C0603	31.7	250	7.9
BXRA-C0800	14.1	900	12.7
BXRA-C0802	13.7	700	9.6
BXRA-C1200	14.3	1300	18.6
BXRA-C1202	13.8	1050	14.5
BXRA-C2000	18.0	1750	31.5
BXRA-C2002	17.5	1500	26.3
BXRA-C4500	28.3	2100	59.4

LED Driver Design and Selection Considerations

It is the responsibility of the designer to ensure that the selected LED driver meets all local regulatory requirements. Bridgelux also recommends considering the following specifications when selecting or designing an LED driver.

Power Factor

The power factor of an AC electric power system is defined as the ratio of the real power to the apparent power, specified as a number between 0 and 1. A power factor of 1.0 is the goal of any electric utility. For LED drivers, power factors greater than 0.9 are recommended.

Efficiency

Many lighting applications are governed by local energy use requirements, such as Energy Star, Title 24, Part L and other global standards. As these requirements are based on not only the LED Array but on the entire lighting system, it is important to select an LED driver with an appropriate efficiency to meet these regulatory requirements. Driver efficiencies can range from 75% to 93% for switch-mode power supplies depending on the design and manufacturer. Losses are typically due to switching, internal resistances, and transformer selection. Efficiencies may also vary considerably as a function of the load. Bridgelux recommends designing or selecting LED drivers that are highly efficient over the range of loads expected in the lighting system.

Reliability

The expected life of the LED driver should match that of the LED Array over the required operating temperature range of the lighting system. Vibration, heat, moisture, and other environmental conditions can have negative effects on components that comprise the LED driver. For example; FETs typically have maximum junction temperatures of 125°C, electrolytic capacitors can dry out when exposed to heat, and mechanical vibrations can cause sensitive ceramic capacitors to fail. It is important to consider these potential limitations during the component selection and design of the LED driver.

Safety

Please ensure compliance to all regulatory and approbation requirements. Certain approvals such as UL, CE and others may be required for the lighting system, which may pose requirements on output voltage, electrical isolation, maximum operating temperature, and other parameters critical to the design of the LED driver. It is the responsibility of the designer to ensure a safe and compliant design of not only the LED driver but of the entire lighting system.

Feedback Features

Some applications may benefit from, or require, LED drivers that include active feedback. For example a temperature sensor may be included to safeguard against thermal run away, adjusting the current in the event that a maximum case temperature for the LED Array is reached or exceeded. Light or motion sensors may also be desired to provide feedback to the driver circuit, enabling additional system functionality and power saving capabilities in the lighting installation for some applications.

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Ripple

Ripple is the small and unwanted residual periodic variation of the direct current output of an AC to DC LED driver. Bridgelux recommends using LED drivers with low ripple, defined as a ripple value of less than ± 10%.

Noise

Electromagnetic and radio frequency noise is not desirable and often regulated by standards. Care should be taken to specify an LED driver with low noise to avoid interference and/or violation of regulated standards.

Dimming

Dimming is a desired feature for many applications, allowing the user to reduce the apparent brightness of a luminaire. Bridgelux recommends using Pulse Width Modulation (PWM) for dimming to deliver consistent performance between lighting systems over a broad range of light output levels.

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Commercially Available AC-to-DC Constant Current Source LED Drivers

Designers have options when it comes to selecting commercially available LED drivers. Many manufacturers produce drivers which work well with Bridgelux LED Arrays to enable rapid system design. Tables 2-13 list a subset of commercially available drivers that meet the technical requirements necessary to drive the Bridgelux LED Arrays, such as output voltage, output constant current, and power requirements. A list of web sites for the LED driver manufacturers listed in these tables is included in the design resources section of this application note. This list is not exhaustive and is for reference only. Bridgelux does not warrant the use of these drivers with our LED Array products. Check with the supplier of the LED driver for the latest information in specifications and availability. This list will be updated on a regular basis as additional solutions become available. Any LED driver that is selected must be thoroughly evaluated by the customer to ensure that all application specific requirements are met.

Tables 2-13 include several key specifications which can be used to assist in the selection of an appropriate LED driver. Bridgelux LED Arrays are tested and binned at their rated nominal current, a current optimized to deliver the desired performance in terms of lumen output and efficacy. In designing with the Bridgelux LED Arrays, however, the designer has options to set the drive current to meet application specific requirements. For example, a customer may decide to power the LED Array at a drive current lower than nominal conditions to achieve a higher LED efficacy or to fall within thermal constraints in the system design. Alternatively, a customer may decide to drive the LED Array at a higher drive current to deliver increased light output in order to meet application requirements. As such there is flexibility surrounding the nominal rated current listed in the Product Data Sheets.

To use tables 2-13, first identify the appropriate table for the LED Array under consideration. Next determine the target drive current for the application. Depending on the drive current selected, one can determine the effect on the nominal light output by reviewing the relative flux column. For example, if an 800 lumen LED Array (which typically delivers 880 lumens at its nominal test current) is powered by a driver which states that it will deliver a relative flux of 1.2X, using this driver will result in approximately 1060 lumens (1.2x 880). Once the drive current is selected the other parameters contained in the tables can be used to select the most appropriate LED driver for the application.

It should be noted that there are many additional commercially available drivers which will also work well with Bridgelux LED Arrays. The LED industry has developed many drivers with output currents in multiples of 250, 350 and 500 mA based on commercially available LED components. As such, many constant current drivers exist with typical drive currents of 500, 700, 1000, 1050, and 1400 mA (to name a few). Depending on system design requirements the use of one of these drivers, even if it does not power the Bridgelux LED Array at the rated test current, may enable the best solution to meet application requirements.

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Table 2: Partial list of LED drivers suitable for use with Bridgelux BXRA-W0240, BXRA-W0260 and BXRA-C0360 LED Arrays

Supplier	Driver Part Number	V AC in (V)	I out (mA)	Relative Flux	Dimming	Efficiency (%)	V DC Out (V)	Maxmium T_{case} (°C)
GlacialPower	LC3554-04	90 to 264	350	1.00	NO	80	10 to 54	TBD
Harvard Engineering	CL700S-240	198 to 265	350	1.00	NO	88	9 to 48	80
Hatch	LCA006Q-UNI	90 to 264	350	1.00	NO	TBD	2 to 19.8	90
LIGHTTECH	LED-18-350-120-D	120	350	1.00	TRIAC	80	5.6 to 42	TBD
LUMOtech	LO5016i	110 or 240	350 (250 to 1050)	1.00	0 to 10V	85	1 to 33	85
LUMOtech	LO5021	230 to 240	350	1.00	TRIAC	TBD	1 to 32	85
MeanWell	LPC-18-350	90 to 132	350	1.00	NO	82	6 to 48	TBD
MeanWell	LPC-20-350	90 to 264	350	1.00	NO	83	6 to 48	TBD
ROAL	RLDD015L-350H	114 or 230	350	1.00	TRIAC	80	12 to 21	90
Advance	XI-LED120A035-0C335	120	350	1.00	NO	TBD	2.6 to 32.8	TBD
Harvard Engineering	CL1000S-240	198 to 265	500	1.33	NO	88	9 to 48	80
High Perfecion	LA1012-36-C0500	90 to 264	500	1.33	NO	TBD	5 to 24	90
LIGHTTECH	LED-26-500-120-D	120	500	1.33	TRIAC	80	5.6 to 42	TBD
Thomas Research	LED12W-24-C500	100 to 277	500	1.33	NO	TBD	12 to 24	TBD

Table 3: Partial list of LED drivers suitable for use with Bridgelux BXRA-W0241, BXRA-W0261 and BXRA-C0361 LED Arrays

Supplier	Driver Part Number	V AC in (V)	I out (mA)	Relative Flux	Dimming	Efficiency (%)	V DC Out (V)	Maxmium Tcase (°C)
LUMOtech	LO5016i	110 or 240	500 (up to 1050)	0.75	0 to 10V	85	1 to 33	85
Harvard Engineering	CL1000S-240	198 to 265	500	0.75	NO	88	9 to 48	80
GlacialPower	LV5012-02	90 to 264	500	0.75	NO	75	12	TBD
ROAL	RLDD015L-600-1	115 or 230	600	0.88	TRIAC	80	8 to 12	90
MagTech	LA1012-16-C600	115 or 230	600	0.88	NO	75	3 to 12	90
pnPower	PAA-12700M001	110 to 250	700	1.00	NO	TBD	2 to 12	TBD
LUMOtech	LO5021	230 to 240	700	1.00	TRIAC, TE	TBD	1 to 18	85
LIGHTECH	901018700NPU-LED	240	700	1.00	NO	75	3 to 30	90
LIGHTECH	LED-36-700-120-D	120	700	1.00	TRIAC	80	5.6 to 42	TBD
Hatch	LCBP018-WJ-UNV	90 to 300	700	1.00	NO	TBD	3 to 27	90
Thomas Research	LA1012-12-C900	100 to 277	800	1.12	NO	83 max	6 to 12	90
MagTech	LA1012-16-C800	115 or 230	800	1.12	NO	75	3 to 12	90
MagTech	LA1012-16-C900	115 or 230	900	1.23	NO	75	3 to 12	90
Thomas Research	LED12W-12-C1000	100 to 277	1000	1.33	NO	83 max	6 to 12	90
Harvard Engineering	CL1000S-240	198 to 265	1000	1.33	NO	88	9 to 48	80
LIGHTECH	LED-36-1050-120-D	120	1050	1.39	TRIAC	80	5.6 to 42	TBD

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Table 4: Partial list of LED drivers suitable for use with Bridgelux BXRA-C0400 and BXRA-C0402 LED Arrays

Supplier	Driver Part Number	V AC in (V)	I out (mA)	BXRA-C0400 Relative Flux	BXRA-C0402 Relative Flux	Dimming	Efficiency (%)	V DC Out (V)	Maxmium T_{case} (°C)
LUMOtech	LO5016i	110 or 240	500 (up to 1050)	0.85	1.00	0 to 10V	85	1 to 33	85
Harvard Engineering	CL1000S-240	198 to 265	500	0.85	1.00	NO	88	9 to 48	80
GlacialPower	LV5012-02	90 to 264	500	0.85	1.00	NO	75	12	TBD
ROAL	RLDD015L-600-1	115 or 230	600	1.00	1.17	TRIAC	80	8 to 12	90
MagTech	LA1012-16-C600	115 or 230	600	1.00	1.17	NO	75	3 to 12	90
GlacialPower	LS10P-18A	90 to 264	680	1.11	1.30	0 to10V (Optional)	81	7 to 18	TBD
pnPower	PAA-12700M001	110 to 250	700	1.14	1.33	NO	TBD	2 to 12	TBD
Meanwell	LPLC-18-700	90 to 132	700	1.14	1.33	NO	82	25	TBD
LUMOtech	LO5021	230 to 240	700	1.14	1.33	TRIAC, TE	TBD	1 to 18	85
LIGHTECH	901018700N PU-LED	240	700	1.14	1.33	NO	75	3 to 30	90
LIGHTECH	LED-36-700-120-D	120	700	1.14	1.33	TRIAC	80	5.6 to 42	TBD
Hatch	LCBP018-WJ-UNV	90 to 300	700	1.14	1.33	NO	TBD	3 to 27	90
Advance	LED-120A-0700-24F	120	700	1.14	1.33	NO	80	7.8 to 24.6	90
Thomas Research	LA1012-12-C900	100 to 277	800	1.27	1.49	NO	83 max	6 to 12	90
MagTech	LA1012-16-C800	115 or 230	800	1.27	1.49	NO	75	3 to 12	90
MagTech	LA1012-16-C900	115 or 230	900	1.40	1.64	NO	75	3 to 12	90
Thomas Research	LED12W-12-C1000	100 to 277	1000	1.52	1.78	NO	83 max	6 to 12	90
Harvard Engineering	CL1000S-240	198 to 265	1000	1.52	1.78	NO	88	9 to 48	80
LIGHTECH	LED-36-1050-120-D	120	1050	1.58	1.85	TRIAC	80	5.6 to 42	TBD

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Table 5: Partial list of LED drivers suitable for use with Bridgelux BXRA-W0403 and BXRA-C0603 LED Arrays

Supplier	Driver Part Number	V AC In (V)	I out (mA)	Relative Flux	Dimming	Efficiency (%)	V DC Out (V)	Maxmium T_{case} (°C)
Thomas Research	LED12W-48-C0250	100 to 277	250	1.00	NO	83 max	24 to 48	TBD
MagTech	LA1012-48-C0250	90 to 264	250	1.00	NO	75	12 to 48	TBD
LUMOtech	LO5016i	110 or 240	250 (250 to 1050)	1.00	0 to 10V	85	1 to 33	85
Thomas Research	LED12W-48-C0350	100 to 277	350	1.33	NO	83 max	18 to 36	TBD
Philips Advance	LED-120A-0350C-33-F	120	350	1.33	NO	TBD	2.8 to 33	85
MeanWell	LPC-18-350	90 to 132	350	1.33	NO	82	6 to 48	TBD
MeanWell	LPC-20-350	90 to 264	350	1.33	NO	83	6 to 48	TBD
LUMOtech	LO5021	230 to 240	350	1.33	TRIAC	TBD	1 to 32	85
LIGHTTECH	LED-18-350-240V	240	350	1.33	0 to 10 V	85	2.8 to 48	TBD
LIGHTTECH	LED-18W DC350 mA	100 to 265	350	1.33	NO	80	120 to 58	90
Harvard Engineering	CL1000S-240-B or C	198 to 265	350	1.33	NO	88	9 to 48	80
Harvard Engineering	CL350D-240-A,B,or C	198 to 265	350	1.33	DALI	85	9 to 48	80
Thomas Research	LED17W-36-C0470	100 to 277	470	1.69	NO	83 max	18 to 36	TBD
MagTech	LP1017-36-C0350	90 to 264	470	1.69	NO	85	18 to 36	TBD
LUMOtech	LO5016i	110 or 240	500	1.78	0 to 10V	85	1 to 33	85
LIGHTTECH	LED-26-500-120-D	120	500	1.78	TRIAC	80	5.6 to 42	TBD
High Perfecion	LA1012-36-C0500	90 to 264	500	1.78	NO	TBD	5 to 24	90
Harvard Engineering	CL700S-240-B or C	198 to 265	500	1.78	NO	88	9 to 48	80
Harvard Engineering	CL1000S-240	198 to 265	500	1.78	NO	88	9 to 48	80
LUMOtech	LO5016i	110 or 240	250 (250 to 1050)		0 to 10V	85	1 to 33	85

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Table 6: Partial list of LED drivers suitable for use with Bridgelux BXRA-N0400, BXRA-W0400, BXRA-W0401, BXRA-W0402, and BXRA-N0402 LED Arrays

Supplier	Part Number	V AC in (V)	I out (mA)	BXRA-W0400 Relative Flux	BXRA-N0400 Relative Flux	BXRA-W0401 and BXRA-W0402 Relative Flux	Dimming	Efficiency (%)	V DC Out (V)	Maxmium T_{case} (°C)
pnPower	PAA12700M 001	110 to 250	680	0.79	0.87	0.98	NO	81	7 to 18	TBD
LUMOtech	LO5016i	110 or 240	700	0.80	0.89	1.00	0 to 10V	TBD	1 to 18	85
LIGHTTECH	LED-36-700-120-D	120	700	0.80	0.89	1.00	TRIAC	75	3 to 30	90
Hatch	LCBP018-WJ-UNV	90 to 300	700	0.80	0.89	1.00	NO	TBD	3 to 27	90
Harvard Engineering	CL700S-240	198 to 265	700	0.80	0.89	1.00	NO	80	5.6 to 42	80
GlacialPower	LS10P-18A	90 to 264	700	0.80	0.89	1.00	0 to10V optional	80	3 to 34	TBD
Advance	LED-120A-0700-24F	120	700	0.80	0.89	1.00	NO	80	7.8 to 24.6	90
Thomas Research	LED12W-16-C0800	100 to 277	800	0.90	1.00	1.13	NO	83 max	8 to 12	90
ROAL	RLDD015L-800-1	115 or 230	800	0.90	1.00	1.13	TRIAC	80	8 to 12	90
MagTech	LA1012-12-C800	<115 or <230	800	0.90	1.00	1.13	NO	75	3 to 16	90
ROAL	RLDD015L-900L	115 or 230	900	1.00	1.11	1.24	TRIAC	80	8 to 12	90
Meanwell	LPC-20-900	120 to 264	900	1.00	1.11	1.24	NO	83	3 to 30	TBD
MagTech	LA1012-12-C900	<115 or <230	900	1.00	1.11	1.24	NO	75	3 to 12	90
LIGHTTECH	LED-36-1050-120-D	120	1050	1.09	1.21	1.36	TRIAC	75	3 to 30	90
LUMOtech	LO5011i	110 or 240	1050	1.09	1.21	1.36	0 to 10V	88	9 to 48	85
Thomas Research	TRC-025S0105PS	88 to 305	1050	1.14	1.26	1.42	NO	83 max	8 to 24	90
Inventronics	EUC-025S105DS	90 to 305	1050	1.14	1.26	1.42	0 to 10V	83	8 to 24	TBD
Harvard Engineering	CL700S-240	198 to 265	1050	1.14	1.26	1.42	NO	80	5.6 to 42	80
Advance	LED-120A-0024V-10F	120	1050	1.14	1.26	1.42	NO	80	7.8-24.6	90

Table 7: Partial list of LED drivers suitable for use with Bridgelux BXRA-C0800 and BXRA-C0802 LED Arrays

Supplier	Driver Part Number	V AC In (V)	I out (mA)	BXRA-C800 Relative Flux	BXRA-C0802 Relative Flux	Dimming	Efficiency (%)	V DC Out (V)	Maxmium T_{case} (°C)
Meanwell	LPC-20-700	90 to 264	700	0.80	1.00	NO	83	3 to 30	TBD
LUMOtech	LO5021	230 to 240	700	0.80	1.00	TRIAC, Trail Edge	TBD	1 to 18	85
LIGHTTECH	LED-36-700-120-D	120	700	0.80	1.00	TRIAC	80	5.6 to 42	TBD
ROAL	RLDD015L-700	115 or 230	700	0.80	1.00	TRIAC	81	11 to 24	90
Harvard Engineering	CL700S-240-B or C	198 to 265	700	0.80	1.00	NO	88	9 to 48	80
ROAL	RCDD015L-900-1	115 or 230	900	1.00	1.24	TRIAC	80	10 to 16	90
Mag Tech	LP1020-22-CXXX	90 to 264	900	1.00	1.24	0 to 10 V Option	85	12 to 22	TBD
Thomas Research	LED20W-22-C0910	100 to 277	910	1.01	1.25	NO	TBD	12 to 22	TBD
ROAL	RLDD015L-1000	115 to 230	1000	1.09	1.36	TRIAC	80	10 to 16	90
Harvard Engineering	CL1000S-240-B or C	198 to 265	1000	1.09	1.36	NO	88	9 to 48	80
LUMOtech	LO5016i	110 or 240	250 to 1050	1.14	1.42	0 to 10V	85	1 to 33 max	85
GlacialPower	LS35P-30A	90 to 264	1050	1.14	1.42	0 to 10V or PWM	86	5 to 30	TBD
Advance	LED-120A-0024 -10D	120	1050	1.14	1.42	0 to 10V	80	10.4 -24.6	80
Hatch	LCBDE015-L-UNI	90 to 264	1200	1.27	1.58	NO	TBD	2.5 to 16	90
ISTL	I40-X0-0818D	100 to 277	1200 (up to 1800)	1.27	1.58	TRIAC	75 to 85	8 to 18	TBD
Thomas Research	TWC-030S125SS	90 to 264	1250	1.31	1.64	NO	85	12 to 24	TBD
Meanwell	ELN-30-15	90 to 264	1300	1.36	1.69	0 to 10V or PWM	82	3 to 15	TBD
MagTech	LP1040	90 to 264, or 277	1,300	1.36	1.69	NO	85	9 to 15	TBD
Thomas Research	LED20W-13-C1330	90 to 264	1330	1.38	1.72	NO	85	9 to 15	90
MagTech	LP1020-15-Cxxx	90 to 264	1,330	1.38	1.72	0 to 10V	85	9 to 15	TBD
Thomas Research	LED40W-24-C1400	100 to 277	1400	1.44	1.79	NO	87	12 to 24	90
Meanwell	LPC-60-1400	90 to 264	1400	1.44	1.79	NO	87	9 to 42	TBD
Lutron	L3D25140AUNV1S	120/277	1400	1.44	1.79	Contact Lutron	80	11 to 18	TBD
Inventronics	EUC-040S140DS	90 to 305	1400	1.44	1.79	0 to 10V	87	10 to 29	TBD

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Table 8: Partial list of LED drivers suitable for use with Bridgelux BXRA-N0800, BXRA-W0800, BXRA-N802, and BXRA-W0802 LED Arrays

Supplier	Driver Part Number	V AC In (V)	I out (mA)	BXRA-N800 Relative Flux	BXRA-W800 Relative Flux	BXRA-W802 and BXRA-N802 Relative Flux	Dimming	Efficiency (%)	V DC Out (V)	Maxmium T_{case} (°C)
LUMOtech	LO5021	230 to 240	700	0.62	0.58	0.73	TRIAC, Trail Edge	TBD	1 to 18	85
LIGHTTECH	LED-36-700-120-D	120	700	0.62	0.58	0.73	TRIAC	80	5.6 to 42	TBD
ROAL	RLDD015L-1000	115 or 230	1000	0.86	0.80	1.00	TRIAC	80	10 to 16	90
Harvard Engineering	CL1000S-240	198 to 265	1000	0.86	0.80	1.00	NO	88	9 to 48	80
LUMOtech	LO5016i	110 or 240	1050 (250 min)	0.89	0.83	1.04	0 to 10V	85	1 to 33 max	85
GlacialPower	LS35P-30A	90 to 264	1050	0.89	0.83	1.04	0 to10V	86	5 to 30	TBD
Advance	LED-120A-0024 -10D	120	1050	0.89	0.83	1.04	0 to 10V	80	10.4 -24.6	80
Hatch	LCBDE015-L-UNI	90 to 264	1200	1.00	0.93	1.17	NO	TBD	2.5 to 16	90
ROAL	RLDD015L-1000 [1]	115 or 230	1200	1.00	0.93	NA	TRIAC	80	10 to 13.2	90
ISTL	I40-X0-0818D	Varies by PN	1200 (up to 1800)	1.00	0.93	1.17	TRIAC	75 to 85	8 to 18	TBD
Thomas Research	TWC-030S125SS	90 to 264	1250	1.04	0.97	1.21	NO	85	12 to 24	TBD
MagTech	LP1020-17-Cxxx	90 to 264	1250	1.04	0.97	1.21	0 to 10V	85	9 to 17	TBD
Meanwell	ELN-30-15	90 to 264	1300	1.07	1.00	1.25	0 to 10V	82	3 to 15	TBD
MagTech	LP1040	90 to 264, 277	1,300	1.07	1.00	1.25	NO	85	9 to 15	TBD
MagTech	LP1020-15-Cxxx	90 to 264	1,330	1.09	1.02	1.27	0 to 10V	85	9 to 15	TBD
Thomas Research	LED40W-24-C1400	100 to 277	1400	1.14	1.06	1.33	NO	87	12 to 24	90
Meanwell	LPC-60-1400	90 to 264	1400	1.14	1.06	1.33	NO	87	9 to 42	TBD
Lutron	L3D25140AUNV1S	120/277	1400	1.14	1.06	1.33	0 to 10V	80	11 to 18	TBD
Inventronics	EUC-040S166DS	90 to 305	1660	1.31	1.22	1.53	0 to 10V	87	8 to 24	TBD
Thomas Research	TRC-040-S140PS	90 to 305	1660	1.31	1.22	1.53	NO	87	12 to 24	90

Notes for Table 8:

1. This driver is not suitable for driving BXRA-W0802 LED Arrays.

Table 9: Partial list of LED drivers suitable for use with Bridgelux BXRA-C1200 and BXRA-C1202 LED Arrays

Supplier	Driver Part Number	V AC In (V)	I out (mA)	BXRA-C1200 Relative Flux	BXRA-C1202 Relative Flux	Dimming	Efficiency (%)	V DC Out (V)	Maxmium T_{case} (°C)
LUMOtech	LO5021	230 to 240	700	0.58	0.62	TRIAC, Trail Edge	TBD	1 to 18	85
LIGHTTECH	LED-36-700-120-D	120	700	0.58	0.62	TRIAC	80	5.6 to 42	TBD
ROAL	RLDD015L-1000	115 or 230	1000	0.80	0.86	TRIAC	80	10 to 16	90
Harvard Engineering	CL1000S-240	198 to 265	1000	0.80	0.86	NO	88	9 to 48	80
LUMOtech	LO5016i	110 or 240	1050 (250 min)	0.83	0.89	0 to 10V	85	1 to 33 max	85
GlacialPower	LS35P-30A	90 to 264	1050	0.83	0.89	0 to10V	86	5 to 30	TBD
Advance	LED-120A-0024 -10D	120	1050	0.83	0.89	0 to 10V	80	10.4 -24.6	80
Hatch	LCBDE015-L-UNI	90 to 264	1200	0.93	1.00	NO	TBD	2.5 to 16	90
ISTL	I40-X0-0818D	Varies by PN	1200 (up to 1800)	0.93	1.00	TRIAC	75 to 85	8 to 18	TBD
Thomas Research	TWC-030S125SS	90 to 264	1250	0.97	1.04	NO	85	12 to 24	TBD
MagTech	LP1020-17-Cxxx	90 to 264	1250	0.97	1.04	0 to 10V	85	9 to 17	TBD
Meanwell	ELN-30-15	90 to 264	1300	1.00	1.07	0 to 10V	82	3 to 15	TBD
MagTech	LP1040	90 to 264, 277	1,300	1.00	1.07	NO	85	9 to 15	TBD
MagTech	LP1020-15-Cxxx	90 to 264	1,330	1.02	1.09	0 to 10V	85	9 to 15	TBD
Thomas Research	LED40W-24-C1400	100 to 277	1400	1.06	1.14	NO	87	12 to 24	90
Meanwell	LPC-60-1400	90 to 264	1400	1.06	1.14	NO	87	9 to 42	TBD
Lutron	L3D25140AU NV1S	120/277	1400	1.06	1.14	Contact Lutron	80	11 to 18	TBD
Inventronics	EUC-040S166DS	90 to 305	1660	1.22	1.31	0 to 10V	87	8 to 24	TBD
Thomas Research	TRC-040-S140PS	90 to 305	1660	1.22	1.31	NO	87	12 to 24	90

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Table 10: Partial list of LED drivers suitable for use with Bridgelux BXRA-N1200, BXRA-W1200 and BXRA-W1202 LED Arrays

Supplier	Driver Part Number	V AC In (V)	I out (mA)	BXRA-N1200 Relative Flux	BXRA-W1200 Relative Flux	BXRA-W1202 Relative Flux	Dimming	Efficiency (%)	V DC Out (V)	Maxmium T_{case} (°C)
Harvard Engineering	CL1000S-240	198 to 265	1000	0.75	0.67	0.85	NO	88	9 to 48	80
LUMOtech	LO5011i	110 or 240	1050 (Varies)	0.78	0.69	0.89	0 to 10V	85	1 to 33 max	85
LIGHTTECH	LED-36-1050-120-D	120	1050	0.78	0.69	0.89	TRIAC	80	5.6 to 42	TBD
GlacialPower	LS35P-30A	90 to 264	1050	0.78	0.69	0.89	0 to10V or PWM	86	5 to 30	TBD
ISTL	I40-X0-0818D	Varies by PN	1200 (Varies)	0.88	0.78	1.00	TRIAC	TBD	8 to 18	TBD
Thomas Research	LED40W-24-C1200	100 to 277	1200	0.88	0.78	1.00	NO	85	12 to 24	90
Meanwell	ELN-60-48	90 to 264	1300	0.94	0.84	1.07	0 to 10V or PWM	87	3 to 48	TBD
Lutron	L3D25140AU NV1S	120 or 277	1400	1.00	0.89	1.14	Contact Lutron	80	11 to 18	TBD
Inventronics	EUC-040S140DS	90 to 305	1400	1.00	0.89	1.14	0 to 10 V	87	10 to 29	TBD
ISTL	I40-X0-0818D	Varies by PN	1400 (Varies)	1.00	0.89	1.14	TRIAC	TBD	8 to 18	TBD
Moso Power	EWC-030S140SS	85 to 305	1400	1.00	0.89	1.14	NO	TBD	TBD	TBD
Meanwell	PLC-30-20	90 to 264	1500	1.06	0.95	1.21	NO	84	TBD	TBD
Meanwell	ELN-60-24	90 to 264	1600	1.12	1.00	1.28	0 to 10V or PWM	87	3 to 24	TBD
MagTech	LP1040	90 to 264	1600	1.12	1.00	1.28	TBD	85	12 to 24	TBD
Moso Power	EWC-030S166SS	85 to 305	1600	1.12	1.00	1.28	NO	92	TBD	TBD
Thomas Research	TRC-040-S140PS	90 to 305	1660	1.16	1.03	1.32	NO	87	12 to 24	90
Inventronics	EUC-040S166DS	90 to 305	1660	1.16	1.03	1.32	0 to 10 V	87	8 to 24	TBD
ROAL	RSLD035-05	90 to 305	1750	1.21	1.08	1.38	0 to 10 V	87	12.5 to 17.5	90
Moso Power	EWC-030S175SS	85 to 305	1750	1.21	1.08	1.38	NO	TBD	TBD	TBD
Meanwell	LPC-60-1750	90 to 264	1750	1.21	1.08	1.38	NO	87	9 to 34	TBD
MagTech	LP1040	90 to 264	1750	1.21	1.08	1.38	TBD	85	12 to 24	TBD
Advance	LED-120A-0024V-1F	Varies by PN	1750	1.21	1.08	1.38	0 to 10V or PWM	80	7.8 to 24.6	85
Thomas Research	LED40W-22-C1820	100 to 277	1820	1.25	1.11	1.43	NO	87	12 to 22	90
Inventronics	EWC-050S210SS	90 to 264	2100	1.40	1.25	1.60	NO	86	13 to 24	TBD
Inventronics	EUC-040S222DS	90 to 305	2220	1.46	1.30	1.66	0 to 10 V	85	6 to 18	TBD

Table 11: Partial list of LED drivers suitable for use with Bridgelux BXRA-W1203 and BXRA-N1203 LED Arrays

Supplier	Driver Part Number	V AC In (V)	I out (mA)	Relative Flux	Dimming	Efficiency (%)	V DC Out (V)	Maxmium T_{case} (°C)
ROAL	RLDD015L-700	115 or 230	700	0.70	TRIAC	81	11 to 24	90
Meanwell	LPC-20-700	90 to 264	700	0.70	NO	83	3 to 30	TBD
LIGHTTECH	LED-36-700-120-D	120	700	0.70	TRIAC	80	5.6 to 42	TBD
Harvard Engineering	CL1000S-240	198 to 265	1000	0.96	NO	88	9 to 48	80
Thomas Research	TRC-025S0105PS	88 to 305	1050	1.00	NO	83 max	8 to 24	90
LUMOtech	LO5011i	110 or 240	1050	1.00	0 to 10V	88	9 to 48	85
LIGHTTECH	LED-36-1050-120-D	120	1050	1.00	TRIAC	75	3 to 30	90
Inventronics	EUC-025S105DS	90 to 305	1050	1.00	0 to 10V	83	8 to 24	TBD
Harvard Engineering	CL700S-240	198 to 265	1050	1.00	NO	80	5.6 to 42	80
GlacialPower	LS35P-30A	90 to 264	1050	1.00	0 to10V or PWM	86	5 to 30	TBD
Advance	LED-120A-0024V-10F	120	1050	1.00	NO	80	7.8-24.6	90
Thomas Research	LED40W-24-C1200	100 to 277	1200	1.12	NO	85	12 to 24	90
Meanwell	ELN-60-48	90 to 264	1300	1.20	0 to 10V or PWM	87	3 to 48	TBD
Moso Power	EWC-030S140SS	85 to 305	1400	1.28	NO	TBD	TBD	TBD
Inventronics	EUC-040S140DS	90 to 305	1400	1.28	0 to 10 V	87	10 to 29	TBD
Meanwell	PLC-30-20	90 to 264	1500	1.35	NO	84	TBD	TBD
Moso Power	EWC-030S166SS	85 to 305	1600	1.43	NO	92	TBD	TBD
Meanwell	ELN-60-24	90 to 264	1600	1.43	0 to 10V or PWM	87	3 to 24	TBD
MagTech	LP1040	90 to 264	1600	1.43	TBD	85	12 to 24	TBD
Thomas Research	TRC-040-S140PS	90 to 305	1660	1.43	NO	87	12 to 24	90
Inventronics	EUC-040S166DS	90 to 305	1660	1.43	0 to 10 V	87	8 to 24	TBD
Meanwell	LPC-60-1750	90 to 264	1750	1.54	NO	87	9 to 34	TBD
MagTech	LP1040	90 to 264	1750	1.54	TBD	85	12 to 24	TBD
Advance	LED-120A-0024V-1F	Varies by PN	1750	1.54	0 to 10V or PWM	80	7.8 to 24.6	85
LUMOtech	LO5011i	110 or 240	1050 (Varies)	1.00	0 to 10V	85	1 to 33 max	85

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Table 12: Partial list of LED drivers suitable for use with Bridgelux BXRA-C2000 and BXRA-C2002 LED Arrays

Supplier	Driver Part Number	V AC In (V)	I out (mA)	BXRA-C2000 Relative Flux	BXRA-C2002 Relative Flux	Dimming	Efficiency (%)	V DC Out (V)	Maxmium T_{case} (°C)
Harvard Engineering	CL1000S-240	198 to 265	1000	0.62	0.70	NO	88	9 to 48	80
LUMOtech	LO5011i	110 or 240	1050 (Varies)	0.64	0.73	0 to 10V	85	1 to 33 max	85
LIGHTTECH	LED-36-1050-120-D	120	1050	0.64	0.73	TRIAC	80	5.6 to 42	TBD
GlacialPower	LS35P-30A	90 to 264	1050	0.64	0.73	0 to10V or PWM	86	5 to 30	TBD
Meanwell	ELN-60-48	90 to 264	1300	0.78	0.88	0 to 10V or PWM	87	3 to 48	TBD
ROAL	RSLD035-6A	110 or 240	1400	0.83	0.94	0 to 10V	TBD	15 to 21	90
Lutron	L3D25140AU NV1S	120 or 277	1400	0.83	0.94	0 to 10V	80	11 to 18	TBD
Inventronics	EUC-040S140DS	90 to 305	1400	0.83	0.94	0 to 10 V	87	10 to 29	TBD
Moso Power	EWC-030S140SS	85 to 305	1400	0.83	0.94	NO	TBD	TBD	TBD
ISTL	I40-X0-0818D	Varies by PN	1400 (Varies)	0.83	0.94	TRIAC	TBD	8 to 18	TBD
Meanwell	PLC-30-20	90 to 264	1500	0.88	1.00	NO	84	TBD	TBD
Meanwell	ELN-60-24	90 to 264	1600	0.93	1.06	0 to 10V or PWM	87	3 to 24	TBD
MagTech	LP1040	90 to 264	1600	0.93	1.06	TBD	85	12 to 24	TBD
Moso Power	EWC-030S166SS	85 to 305	1600	0.93	1.06	NO	92	TBD	TBD
Thomas Research	TRC-040-S140PS	90 to 305	1660	0.96	1.09	NO	87	12 to 24	90
Inventronics	EUC-040S166DS	90 to 305	1660	0.96	1.09	0 to 10 V	87	8 to 24	TBD
ROAL	RSLD035-05	90 to 305	1750	1.00	1.14	0 to 10 V	87	12.5 to 17.5	90
Moso Power	EWC-030S175SS	85 to 305	1750	1.00	1.14	NO	TBD	TBD	TBD
Meanwell	LPC-60-1750	90 to 264	1750	1.00	1.14	NO	87	9 to 34	TBD
MagTech	LP1040	90 to 264	1750	1.00	1.14	TBD	85	12 to 24	TBD
Advance	LED-120A-0024V-1F	Varies by PN	1750	1.00	1.14	0 to 10V or PWM	80	7.8 to 24.6	85
Thomas Research	LED40W-22-C1820	100 to 277	1820	1.03	1.18	NO	87	12 to 22	90
Inventronics	EWC-050S210SS	90 to 264	2100	1.16	1.32	NO	86	13 to 24	TBD
Inventronics	EUC-040S222DS	90 to 305	2220	1.21	1.38	0 to 10 V	85	6 to 18	TBD

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Table 13: Partial list of LED drivers suitable for use with Bridgelux BXRA-C4500, BXRA-N3500, and BXRA-W3000 LED Arrays

Supplier	Driver Part Number	V AC in (V)	I out (mA)	Relative Flux	Dimming	Efficiency (%)	V DC out (V)	Maxmium T_{case} (°C)
Meanwell	ELN-60-48	90 to 264	1300	0.71	0 to 10V or PWM	88	3 to 48	TBD
Inventronics	EUC-040S140DS	90 to 305	1400	0.71	0 to 10 V	87	10 to 29	TBD
Inventronics	EUC-040S140PS	90 to 305	1400	0.71	NO	87	10 to 29	TBD
Meanwell	LPC-60-1400	90 to 264	1400	0.71	NO	87	9 to 42	TBD
Inventronics	EUC-060S170ST	90 to 305	1700	0.83	NO	90	18 to 36	TBD
Inventronics	EUC-150S490ST[1]	90 to 305	1750	0.86	NO	91	41 to 68	TBD
Inventronics	EUC-150S490ST	90 to 305	1750	0.86	NO	91	TBD	TBD
Thomas Research	TRC-120S175ST[1]	90 to 305	1750	0.86	NO	91	41 to 68	TBD
MagTech	LP1090-XX-YZ-E	90 to 264	2000	0.96	NO	85	18 to 36	TBD
Meanwell	CEN-75-30	90 to 295	2000	0.96	NO	90	18 to 30	TBD
Meanwell	CEN-60-30	90 to 295	2000	0.96	NO	90	18 to 30	TBD
Inventronics	EUC-200S210ST[1]	90 to 305	2100	1.00	NO	89	57 to 95	TBD
Inventronics	EUC-075S210ST	90 to 305	2100	1.00	NO	89	18 to 36	TBD
Thomas Research	TRC-200S210ST[1]	90 to 305	2100	1.00	NO	91	57 to 95	TBD
Thomas Research	TRC-200S21ST[1]	90 to 305	2100	1.00	NO	91	57 to 95	TBD
Meanwell	CEN-75-30	90 to 295	2500	1.17	NO	90	18 to 30	TBD
Thomas Research	TRC-100S315ST	90 to 305	3150	1.41	NO	90	19 to 32	90

Notes for Table 13:

1. This driver is suitable for driving two LED Arrays in series. This driver is not suitable for driving a single LED Array.

Custom LED Drivers

Depending on the application requirements, designing a custom LED driver may have advantages for a given lighting system. Custom LED drivers are typically IC based solutions, requiring a DC input voltage. These drivers may be advantageous in the fact that they can deliver miniaturized designs. Several IC suppliers have reference designs available to enable the development of suitable drivers for Bridgelux LED Arrays. These designs can be customized to meet application specific needs and are capable of working with a wide spectrum of input and output requirements.

A selection of companies offering reference designs for IC based drivers to power Bridgelux LED Arrays is included in Table 14 below.

Table 14: IC based custom driver solution companies

Company	Website
Cirrus Logic	www.cirruslogic.com
Cypress Semiconductor	www.cypress.com
iWatt	www.iwatt.com
Maxim	www.maxim-ic.com/solutions/hb_led_drivers
mSilica	www.msilicaweb.com
National Semiconductor	www.national.com/analog/led
NEC	www.nec.com
Power Integrations	www.powerint.com
RECOM Power Solutions	www.recom-international.com
Supertex, Inc.	www.supertex.com
Texas Instruments	www.ti.com/led
Zywyn Corporation	www.zywyn.com

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Appendix: I-V Characteristics of Bridgelux LED Arrays

Each figure shown in this Appendix contains three curves – a minimum, a typical, and a maximum forward voltage versus forward current curve for the respective Bridgelux LED Array products. These curves can be used to ensure that the driver design is compatible with the full production range of Bridgelux LED Arrays.

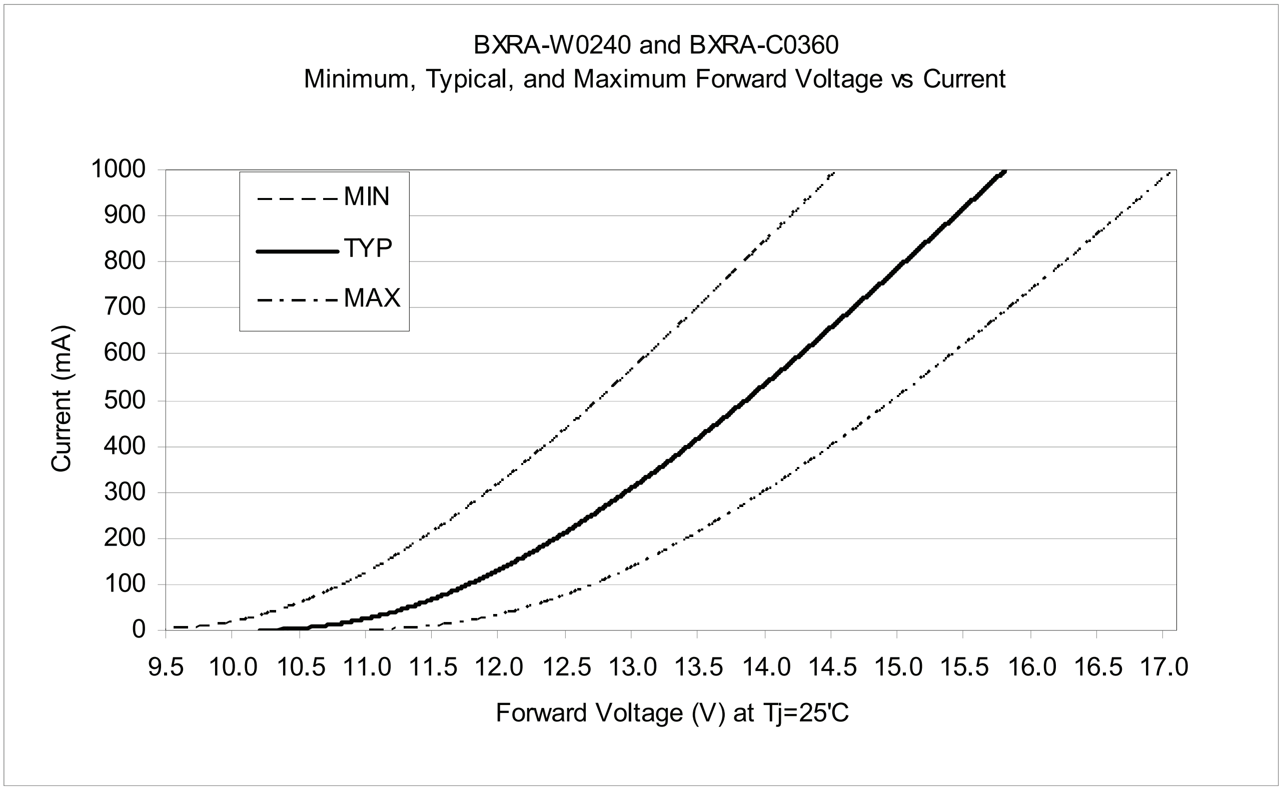

Figure A1: Forward voltage versus current for BXRA-W0240 and BXRA-C0360 LED Arrays

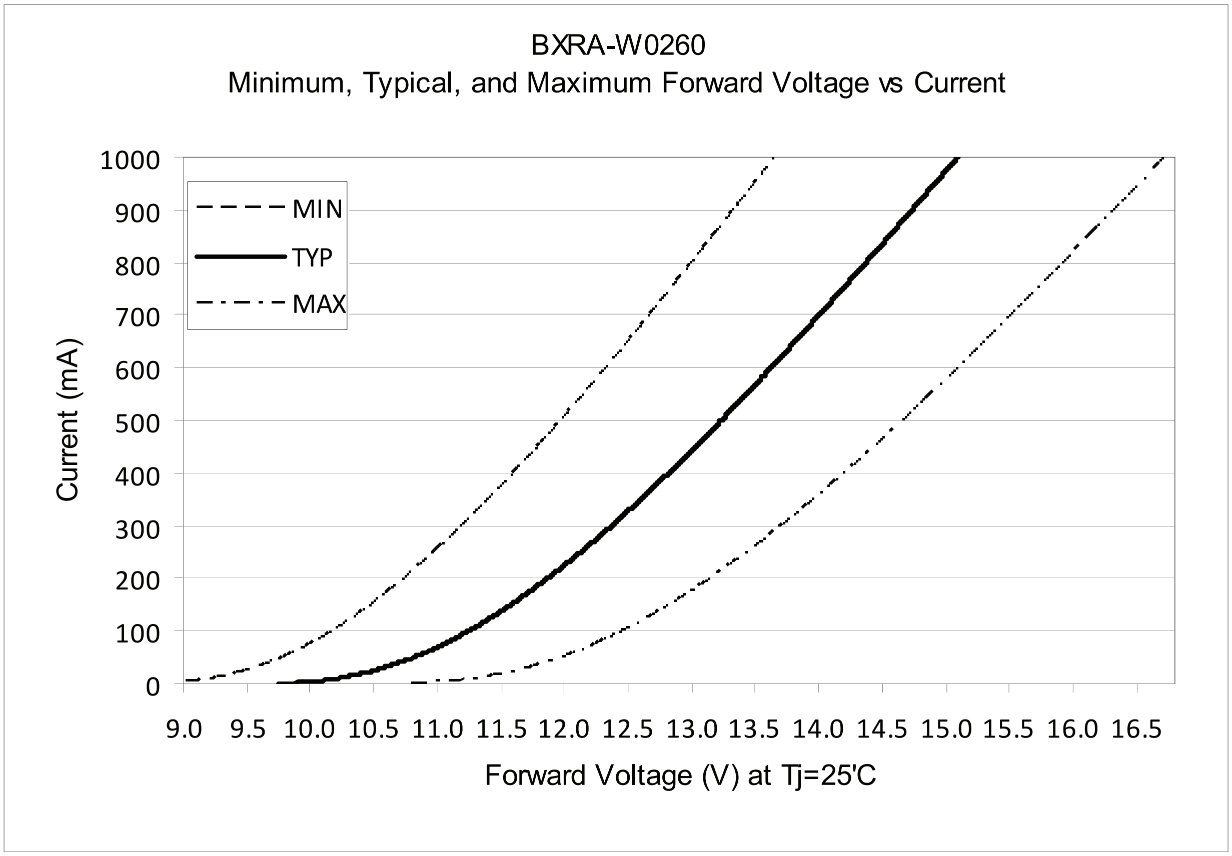

Figure A2: Forward voltage versus current for BXRA-W0260 LED Arrays

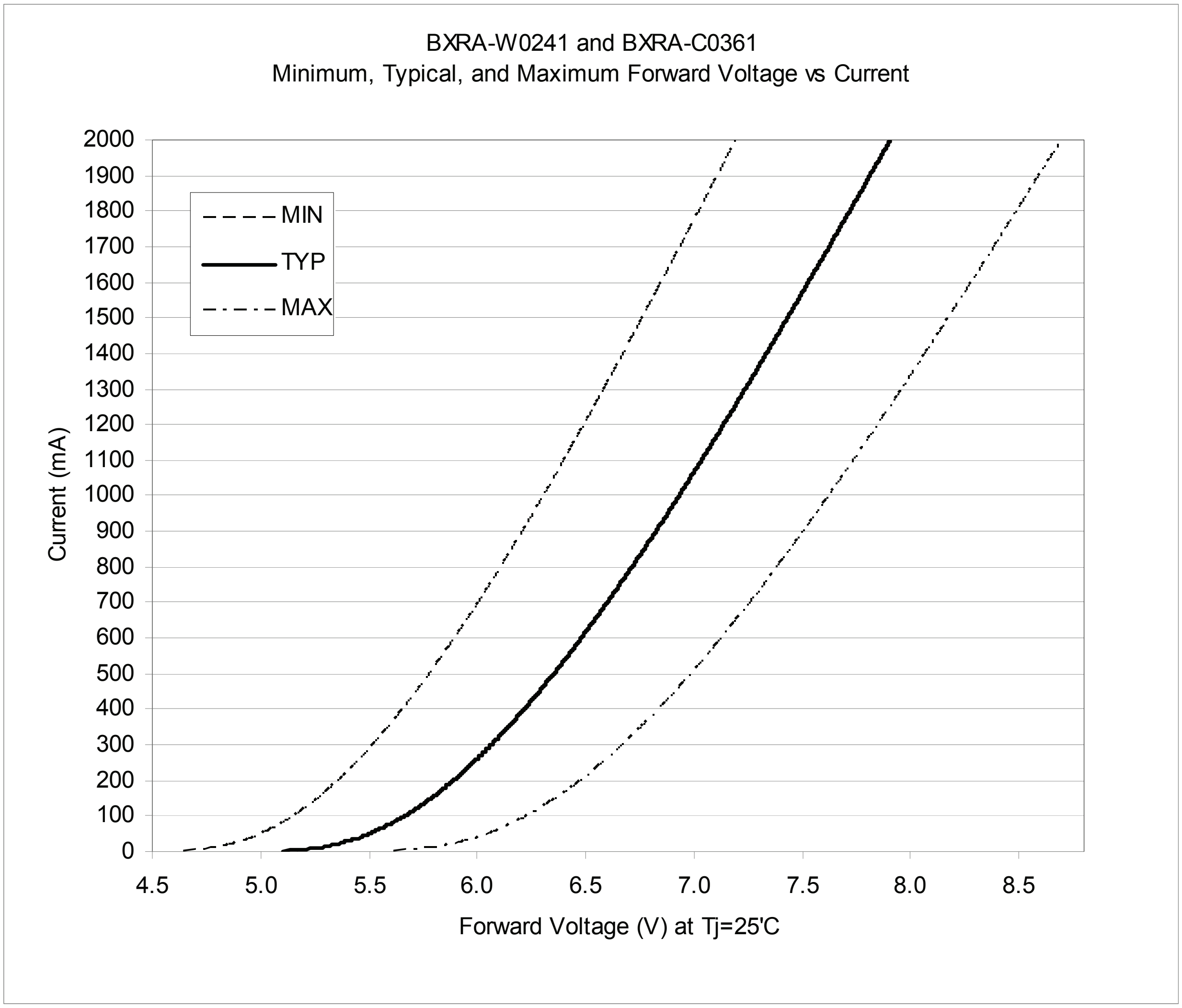

Figure A3: Forward voltage versus current for BXRA-W0241 and BXRA-C0361 LED Arrays

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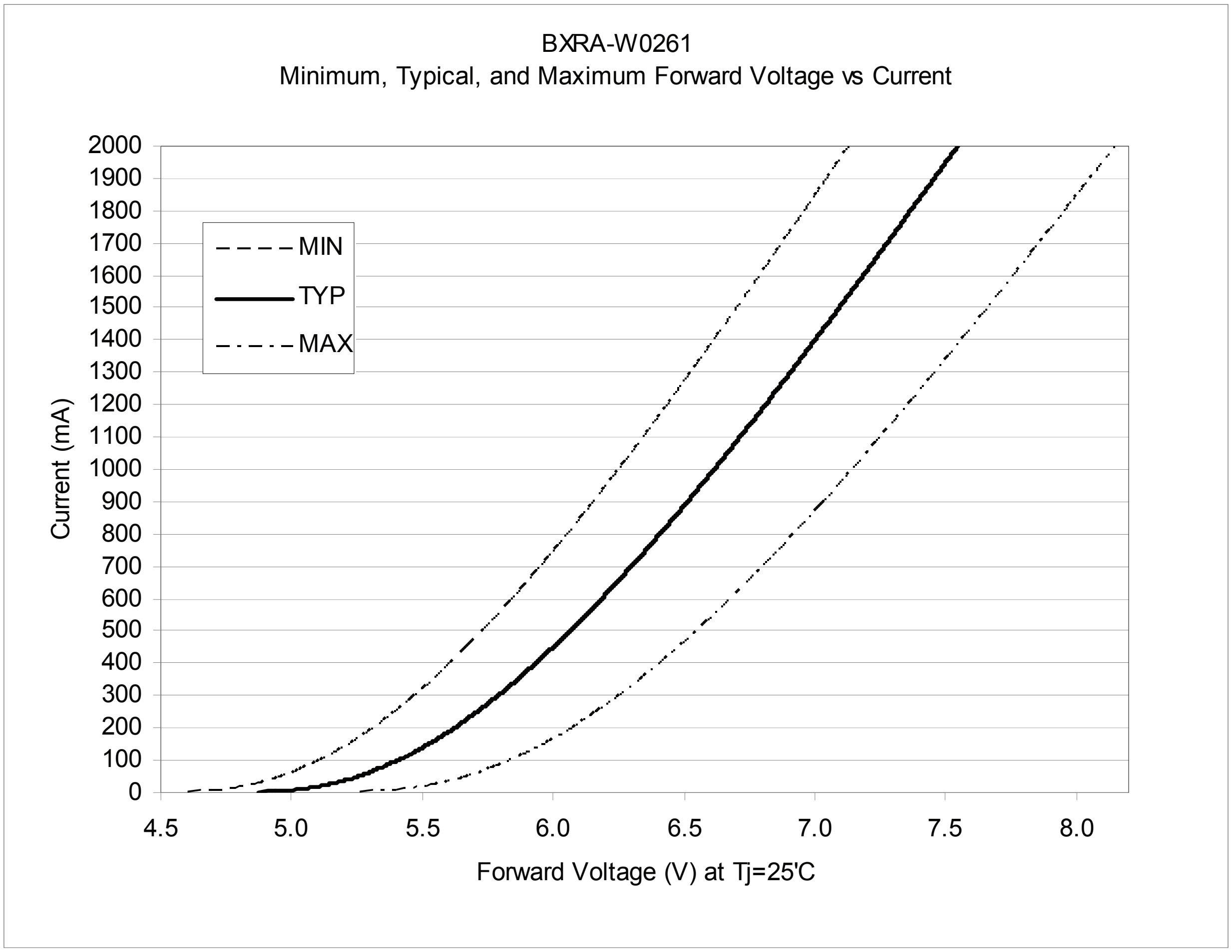

Figure A4: Forward voltage versus current for BXRA-W0261 LED Arrays

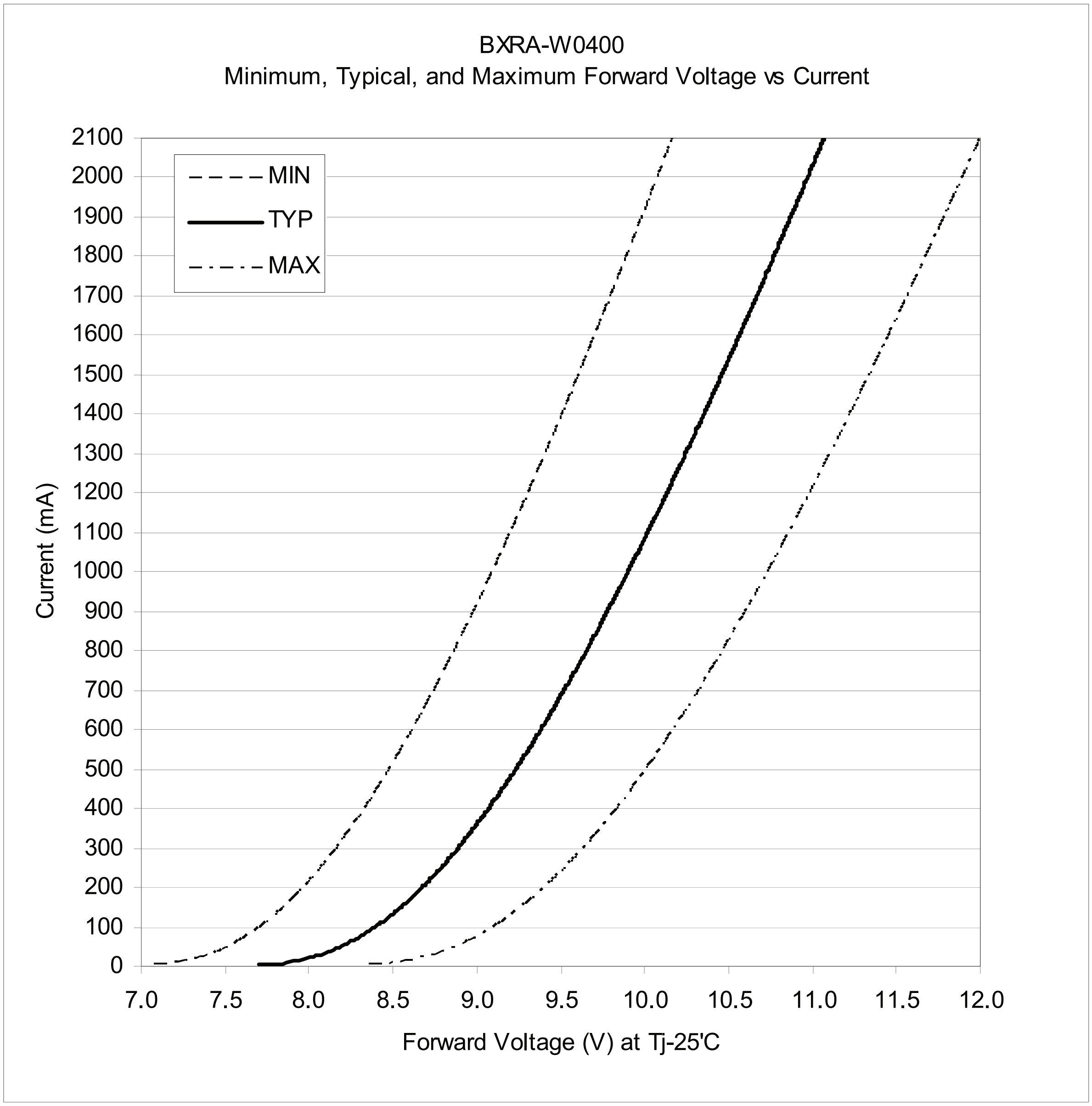

Figure A5: Forward voltage versus current for BXRA-W0400 LED Arrays

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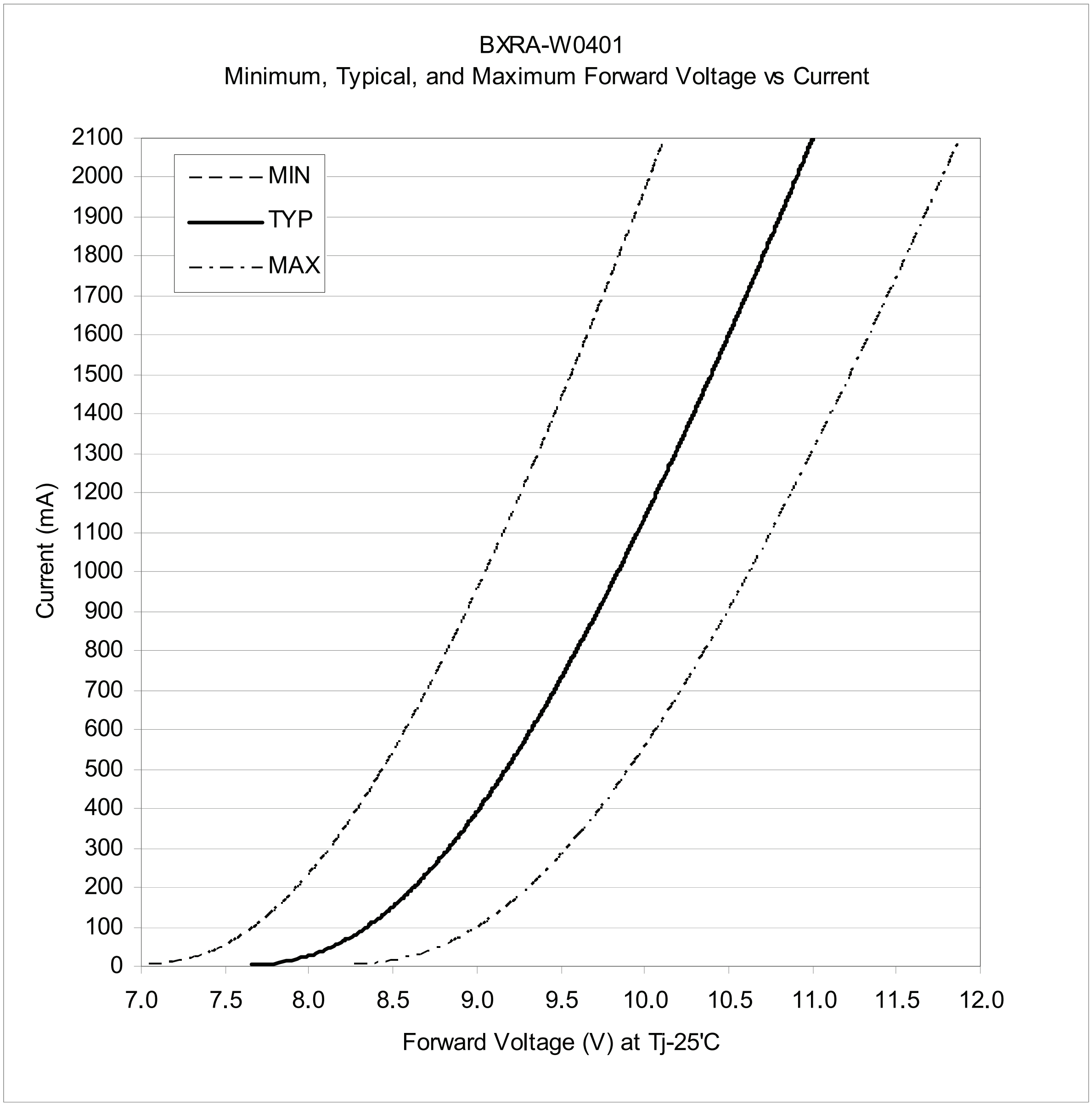

Figure A6: Forward voltage versus current for BXRA-W0401 LED Arrays

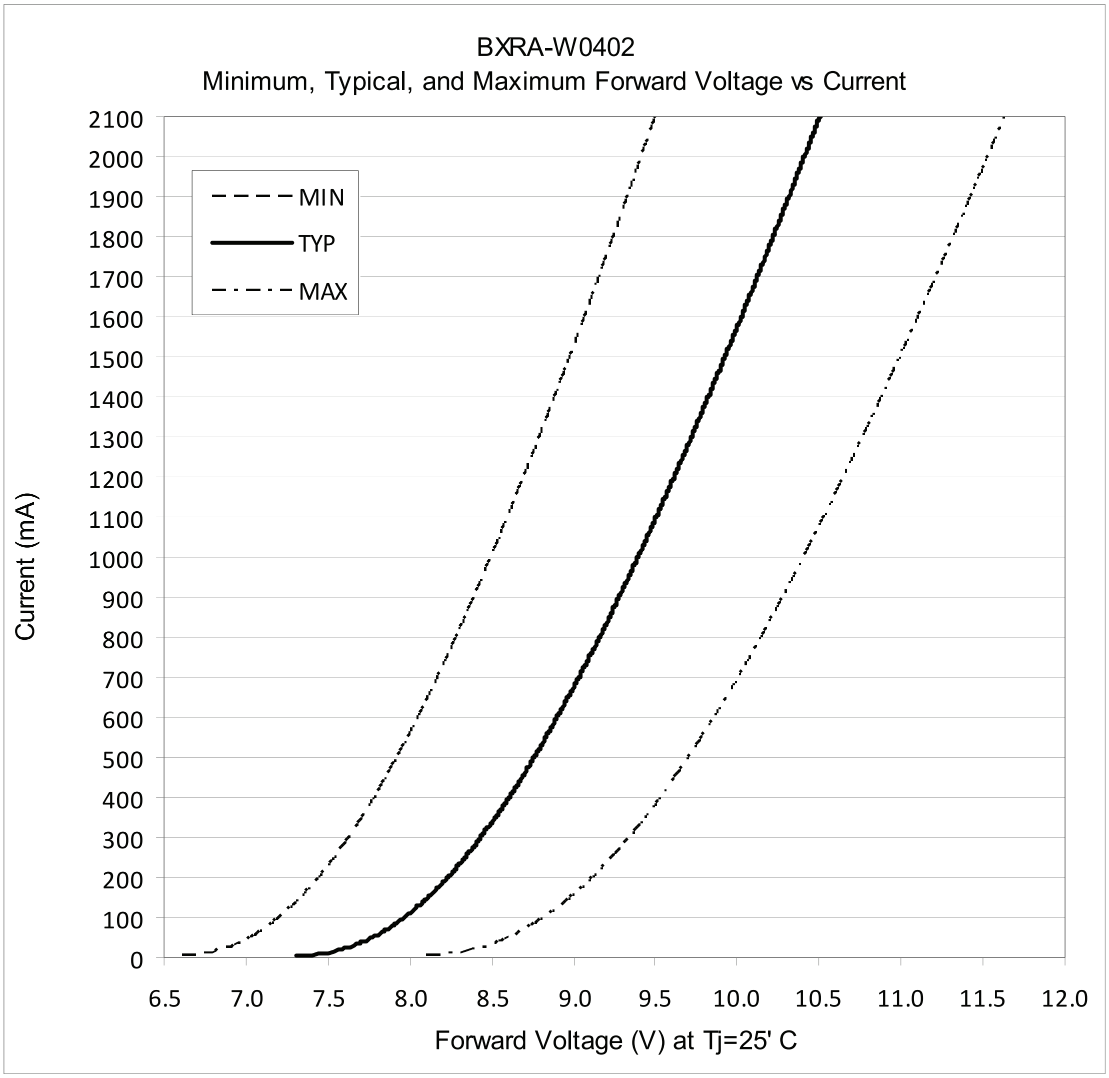

Figure A7: Forward voltage versus current for BXRA-W0402 LED Arrays

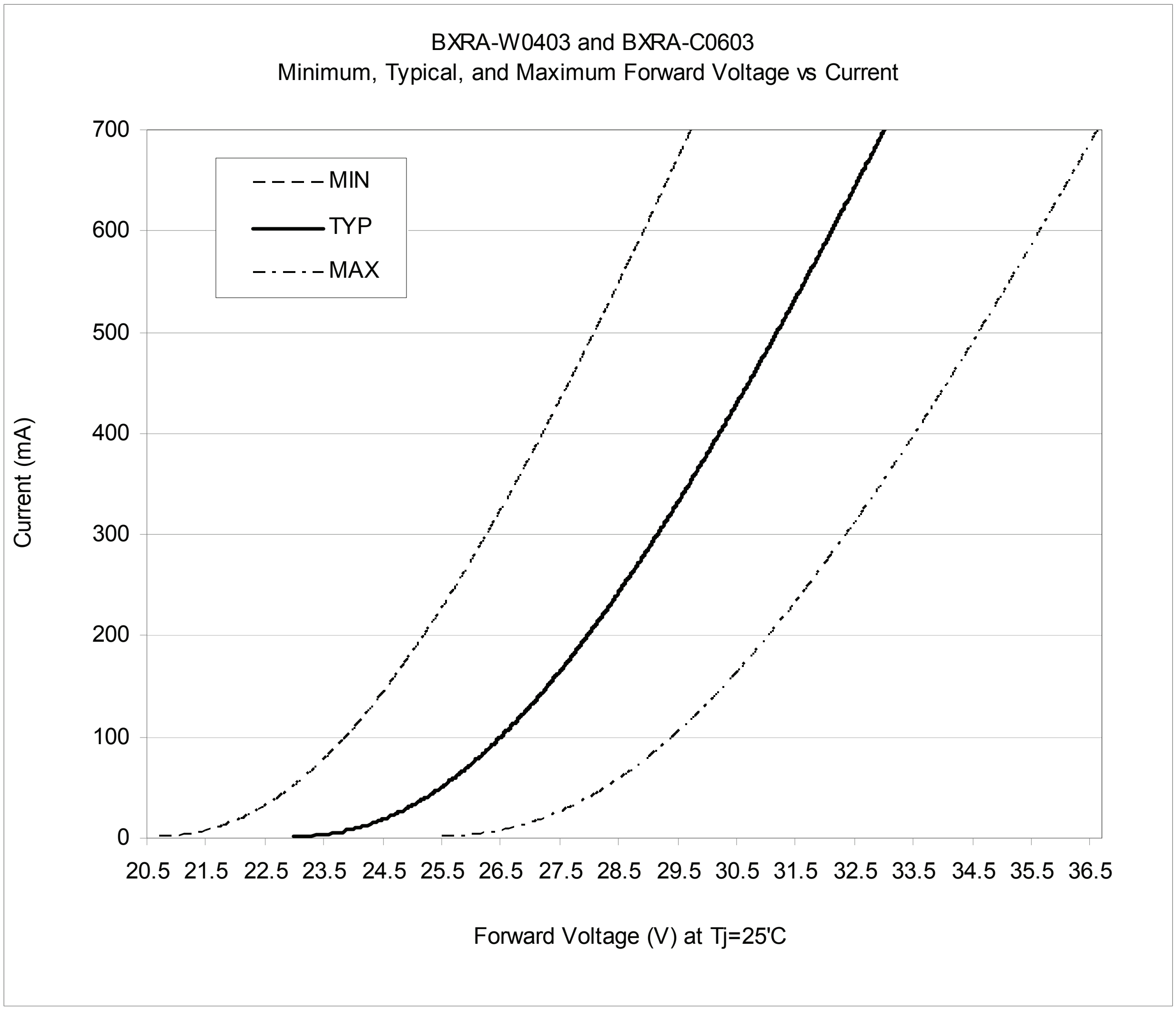

Figure A8: Forward voltage versus current for BXRA-W0403 and BXRA-C0603 LED Arrays

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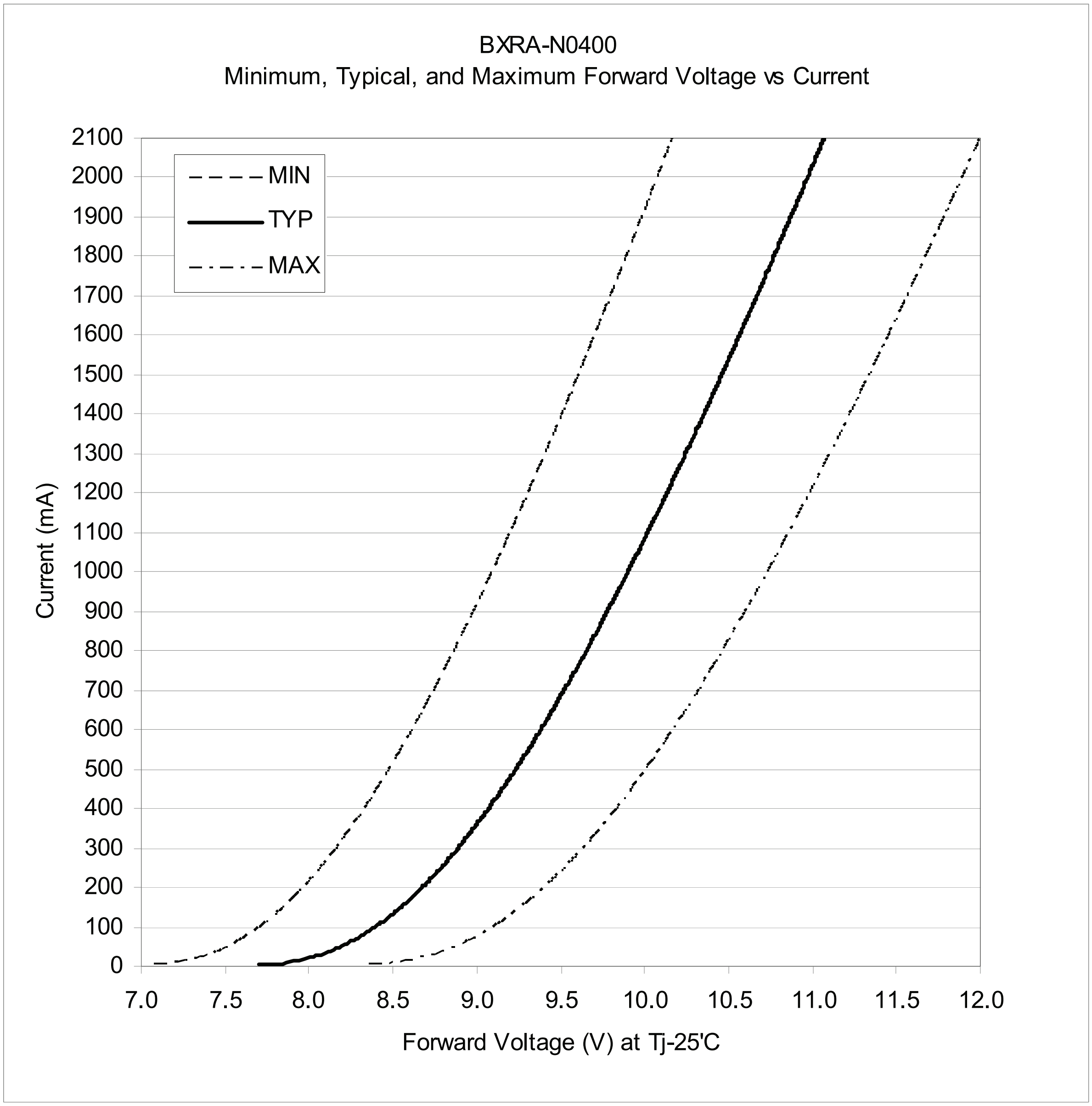

Figure A9: Forward voltage versus current for BXRA-N0400 LED Arrays

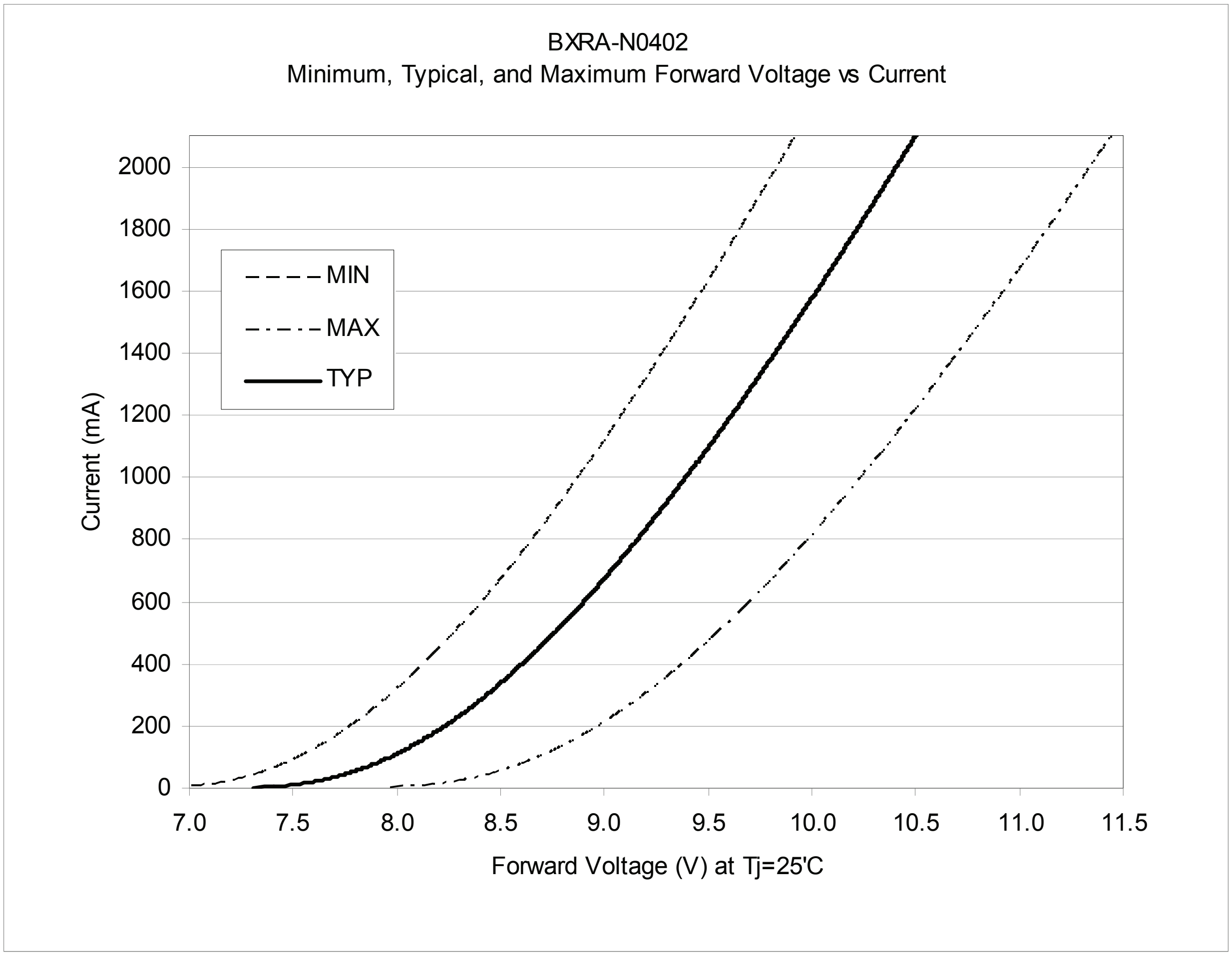

Figure A10: Forward voltage versus current for BXRA-N0402 LED Arrays

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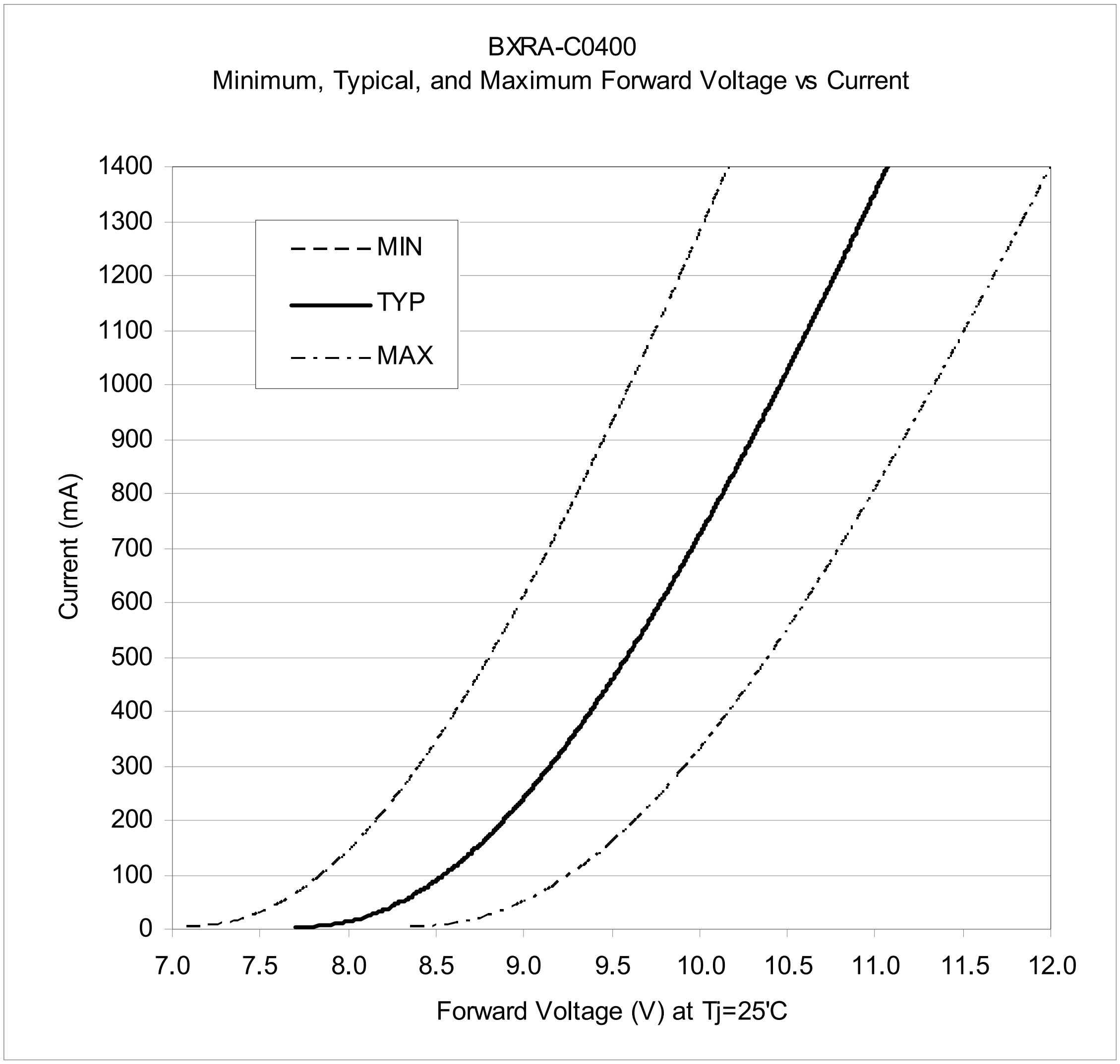

Figure A11: Forward voltage versus current for BXRA-C0400 LED Arrays

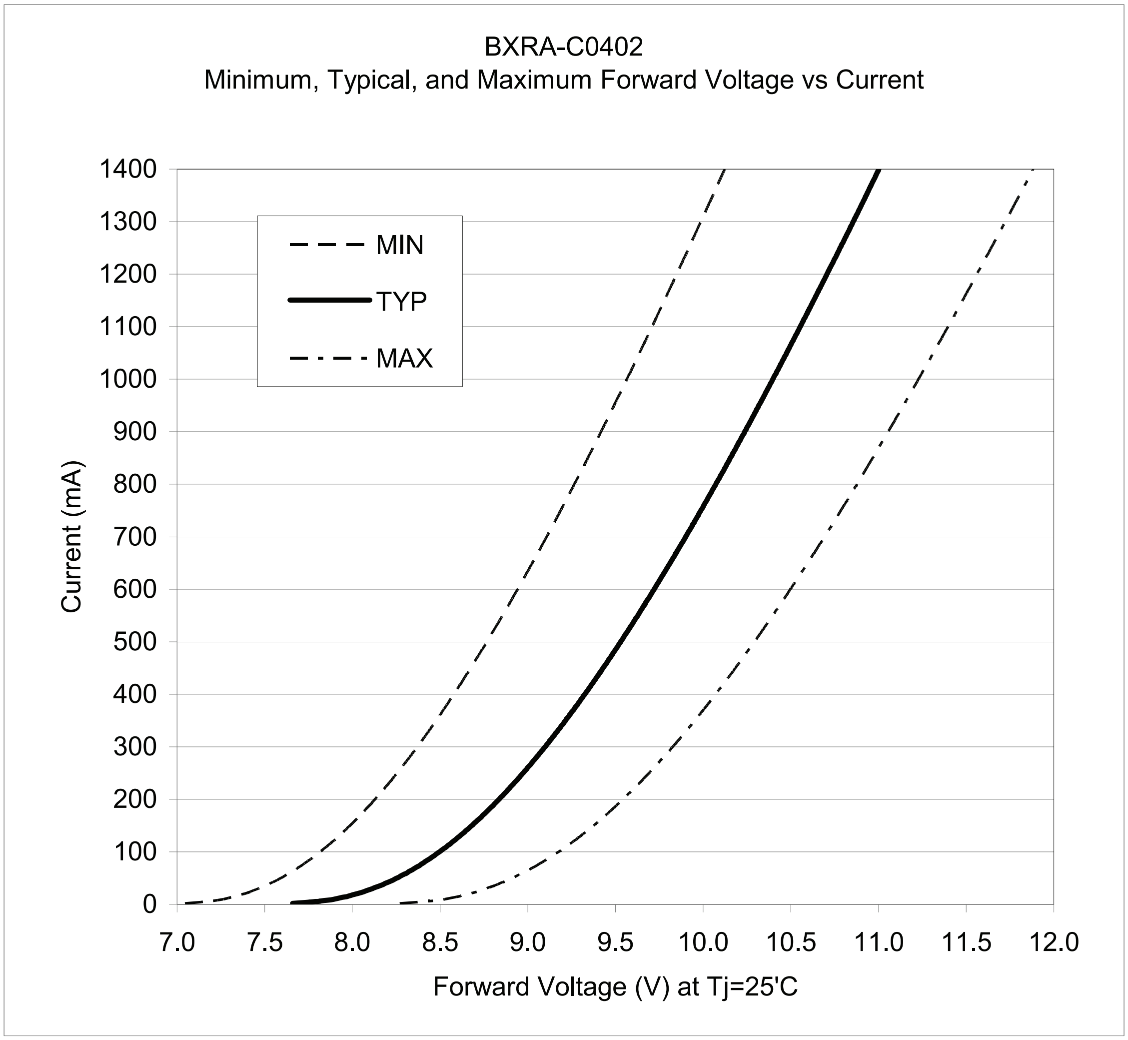

Figure A12: Forward voltage versus current for BXRA-C0402 LED Arrays

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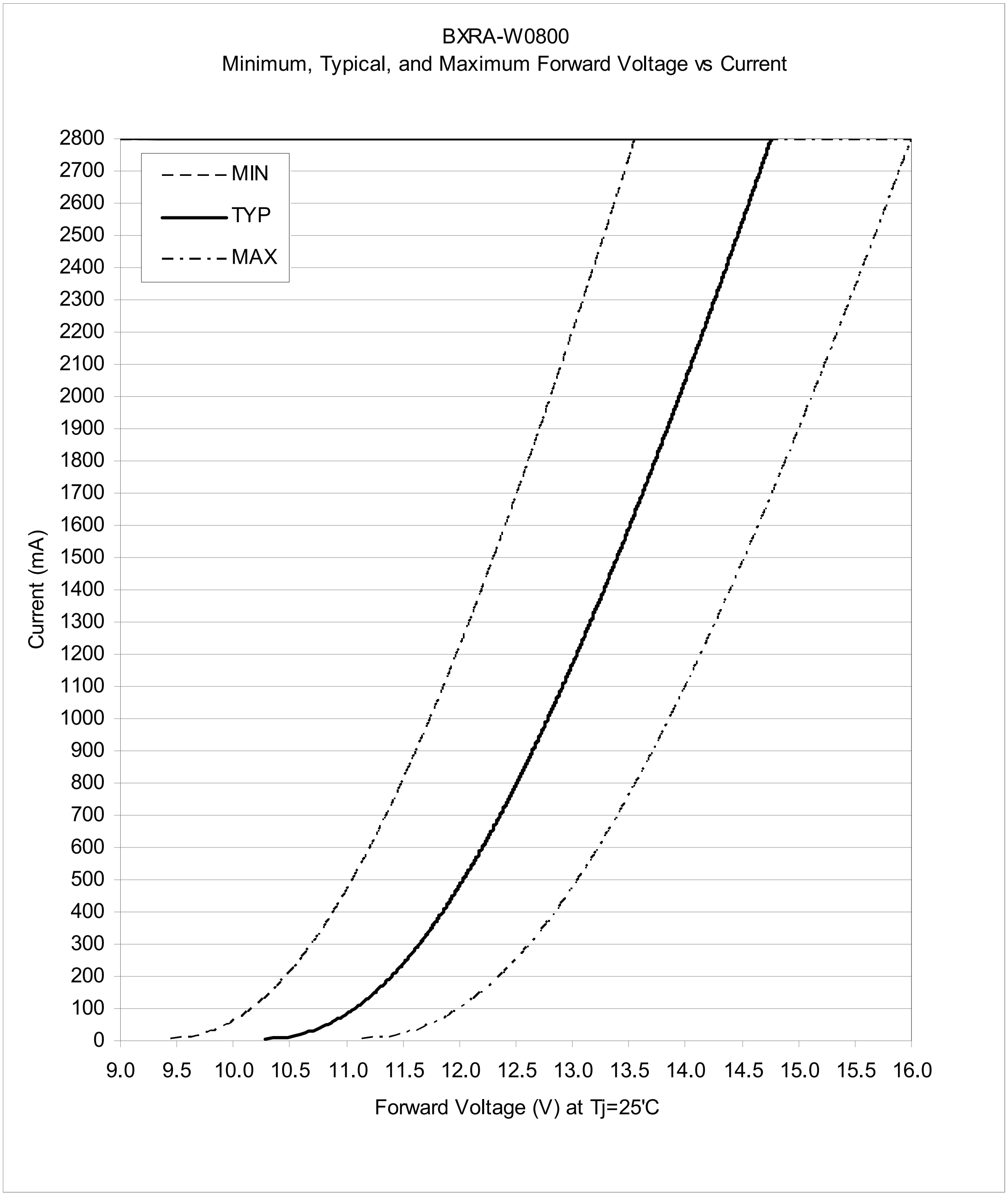

Figure A13: Forward voltage versus current for BXRA-W0800 LED Arrays

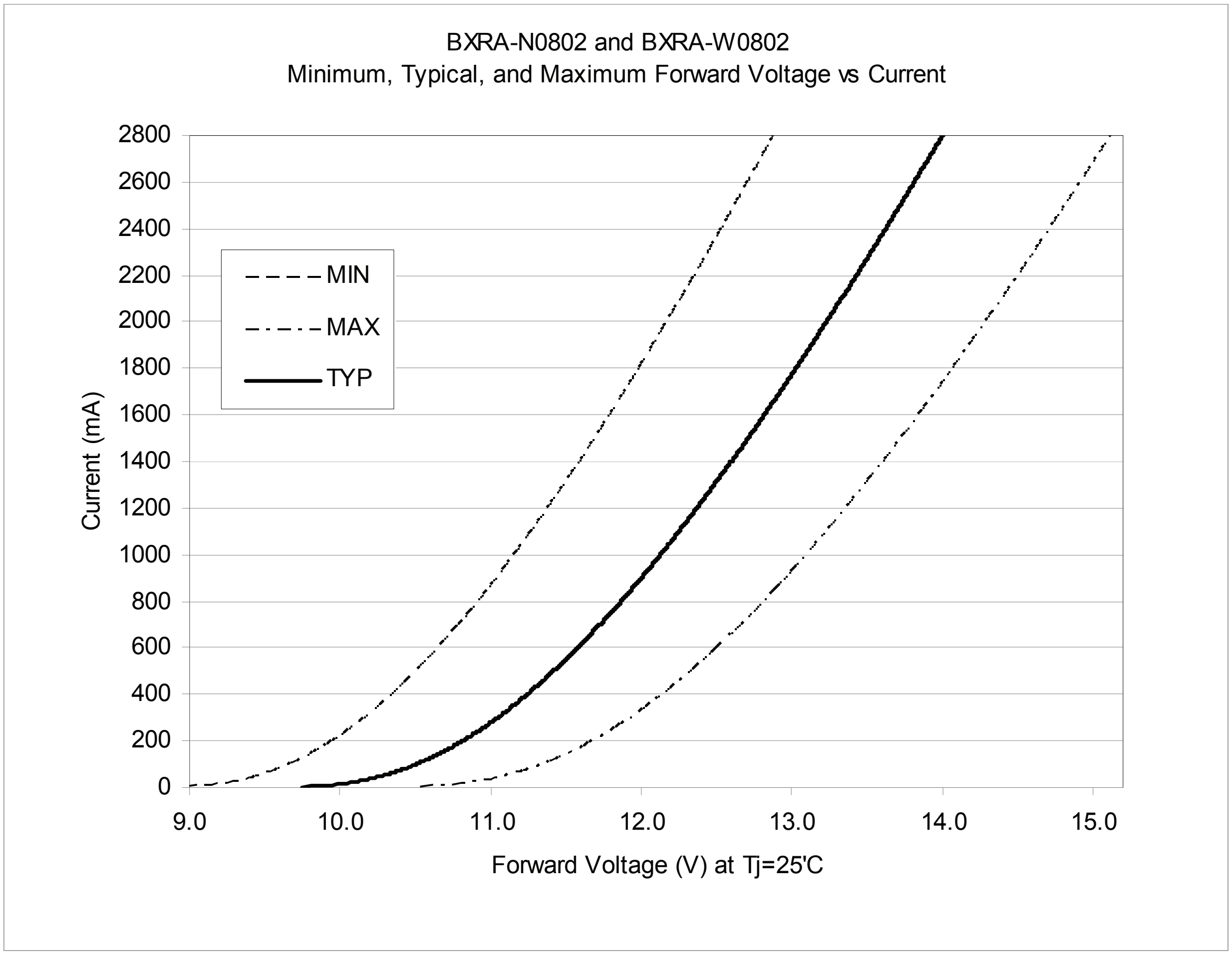

Figure A14: Forward voltage versus current for BXRA-W0802 and BXRA-N0802 LED Arrays

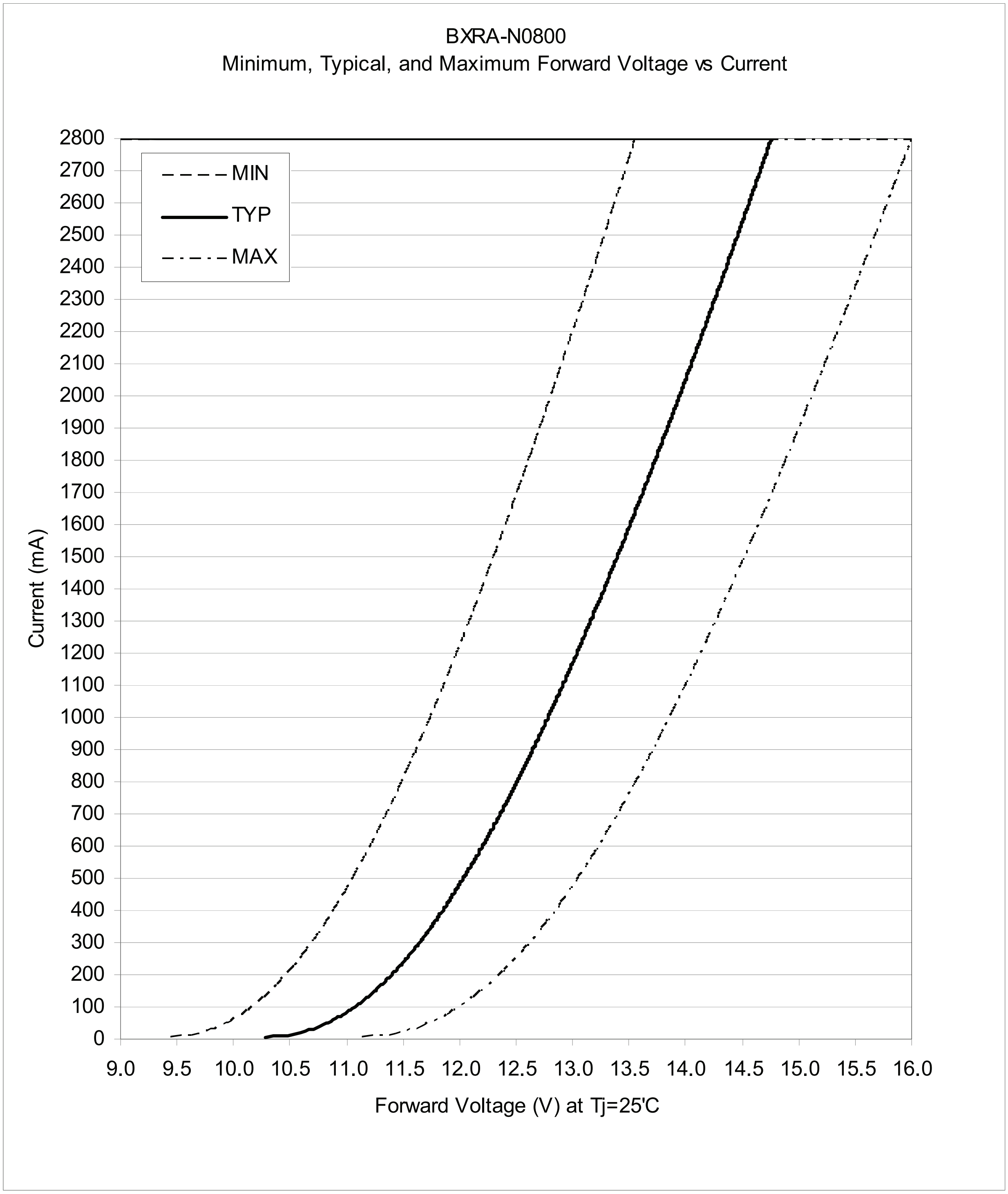

Figure A15: Forward voltage versus current for BXRA-N0800 LED Arrays

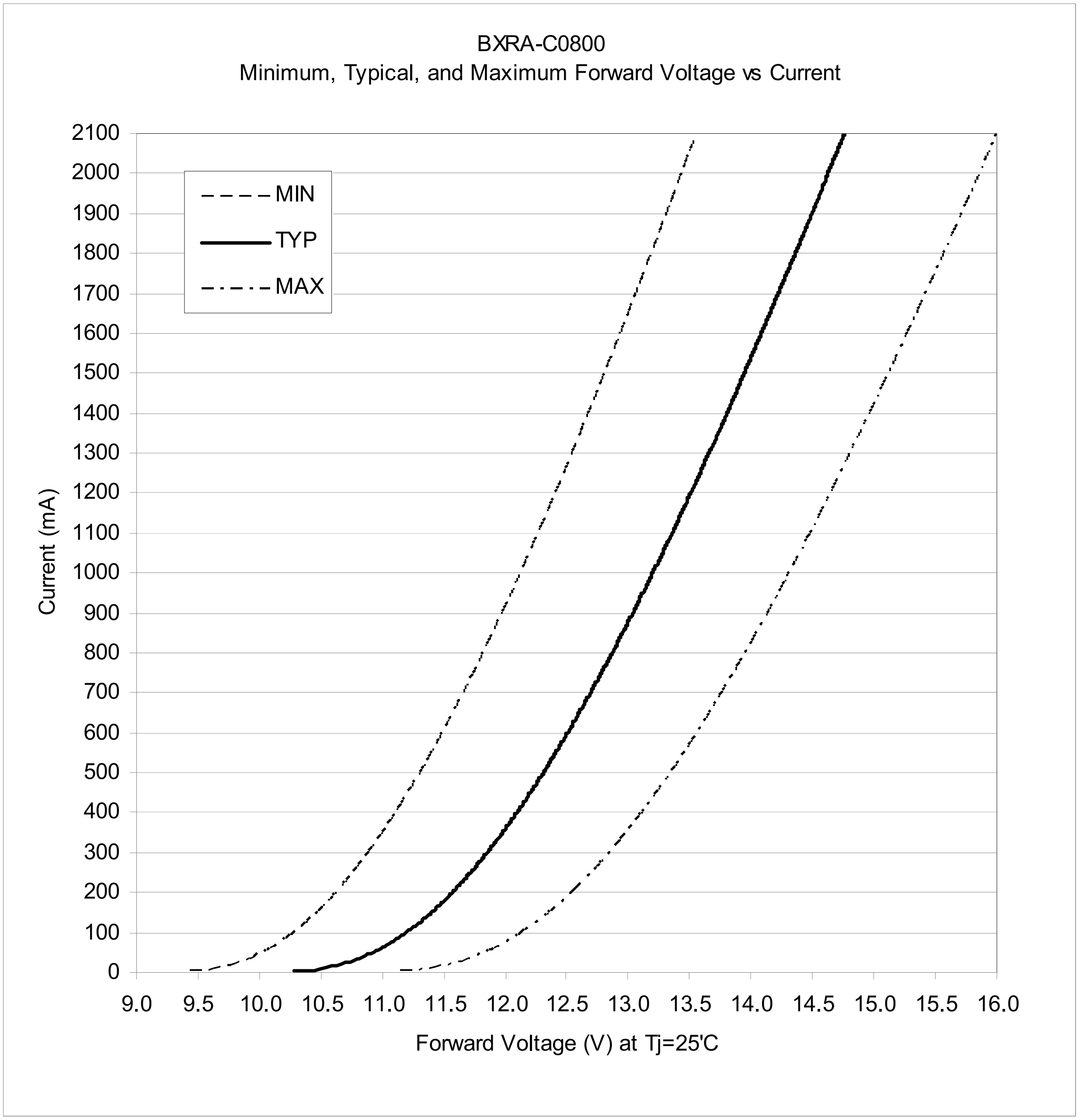

Figure A16: Forward voltage versus current for BXRA-C0800 LED Arrays

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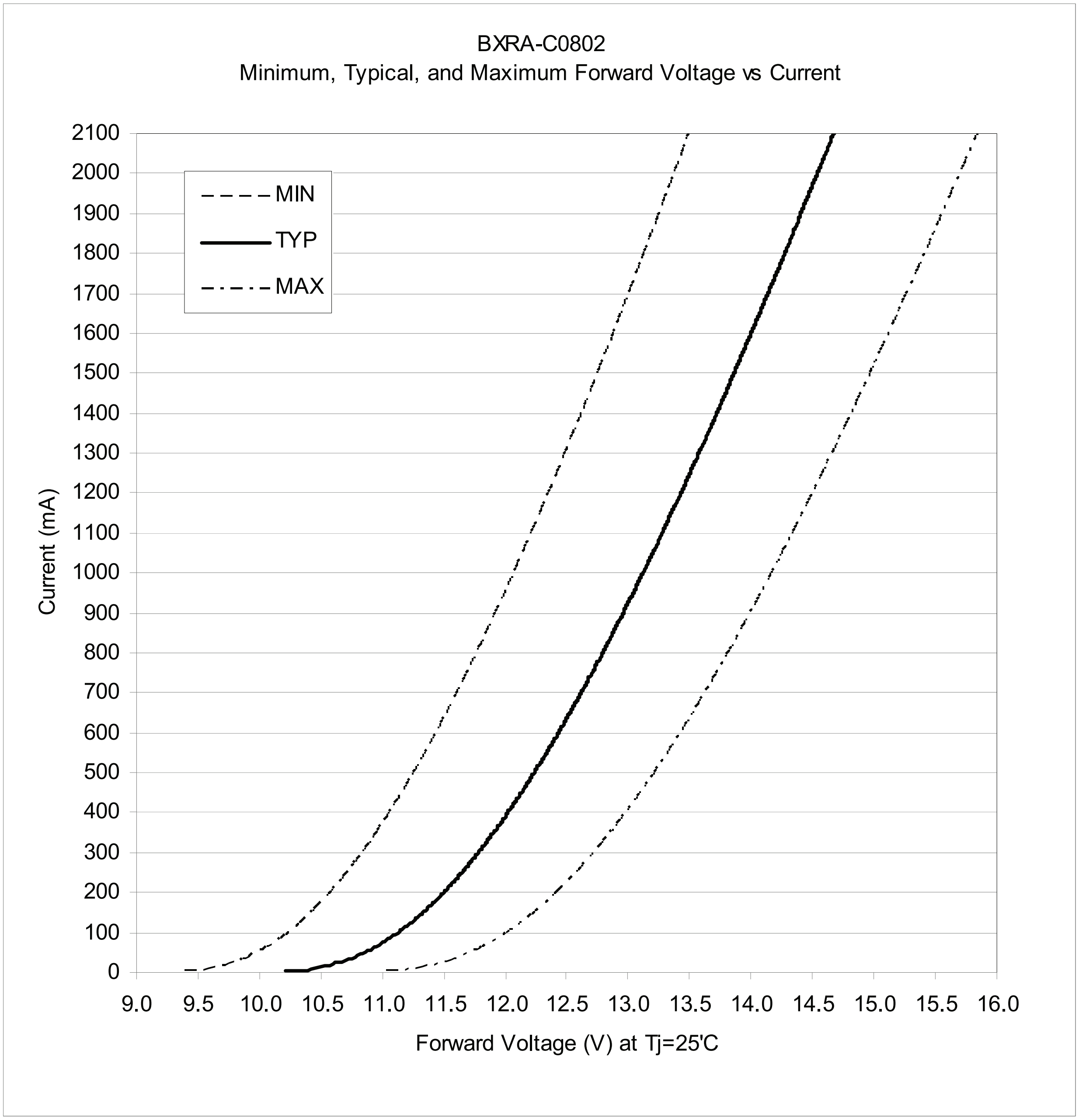

Figure A17: Forward voltage versus current for BXRA-C0802 LED Arrays

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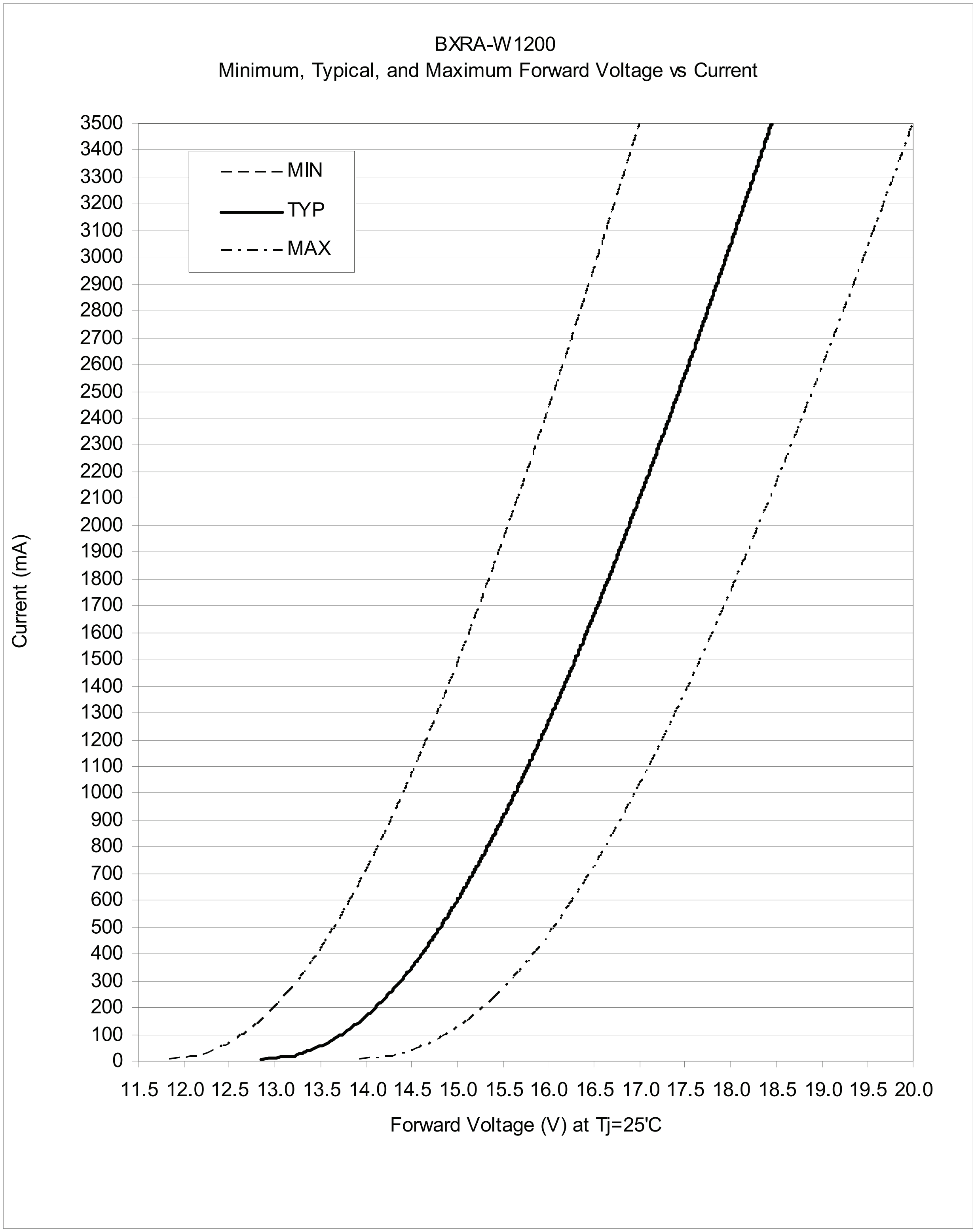

Figure A18: Forward voltage versus current for BXRA-W1200 LED Arrays

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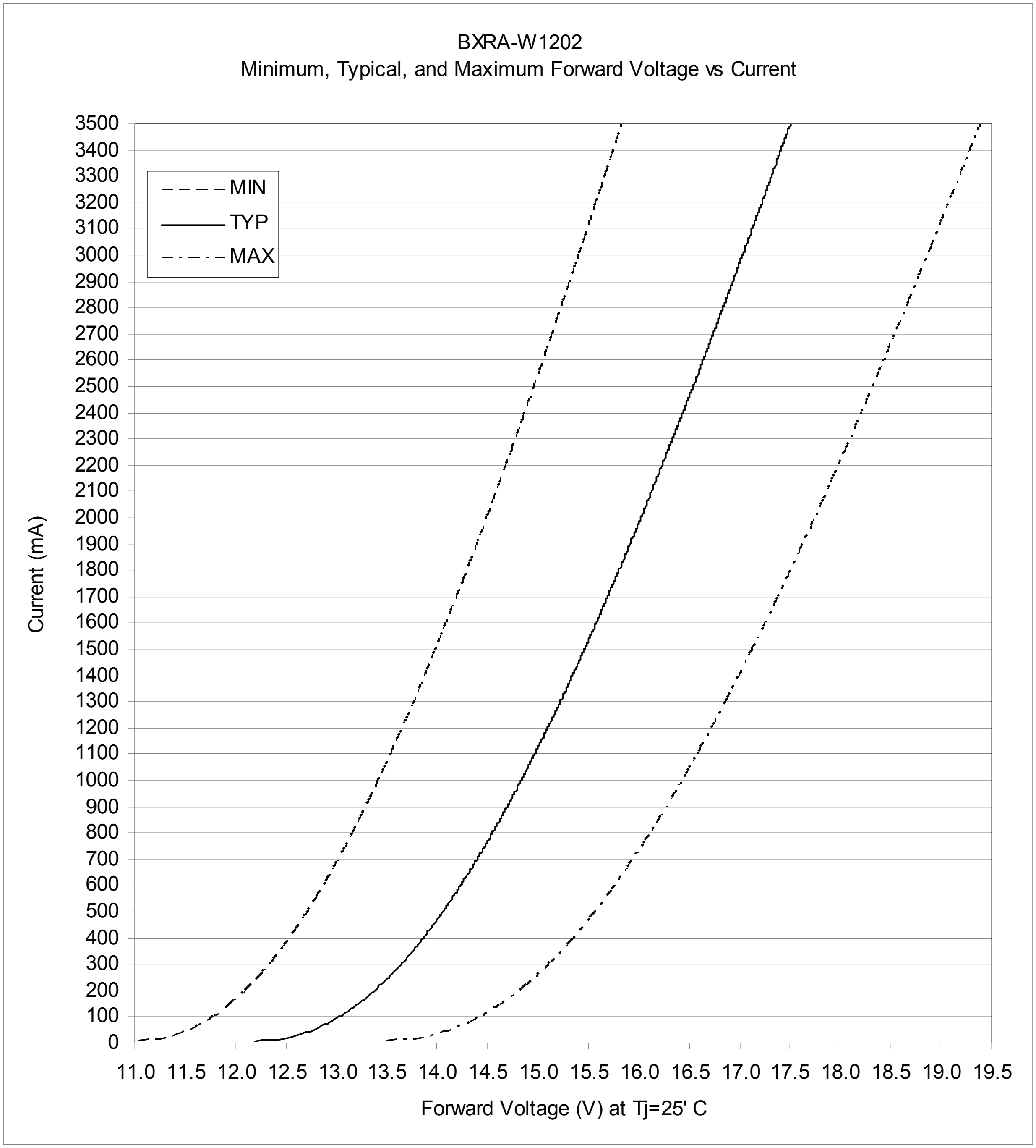

Figure A19: Forward voltage versus current for BXRA-W1202 LED Arrays

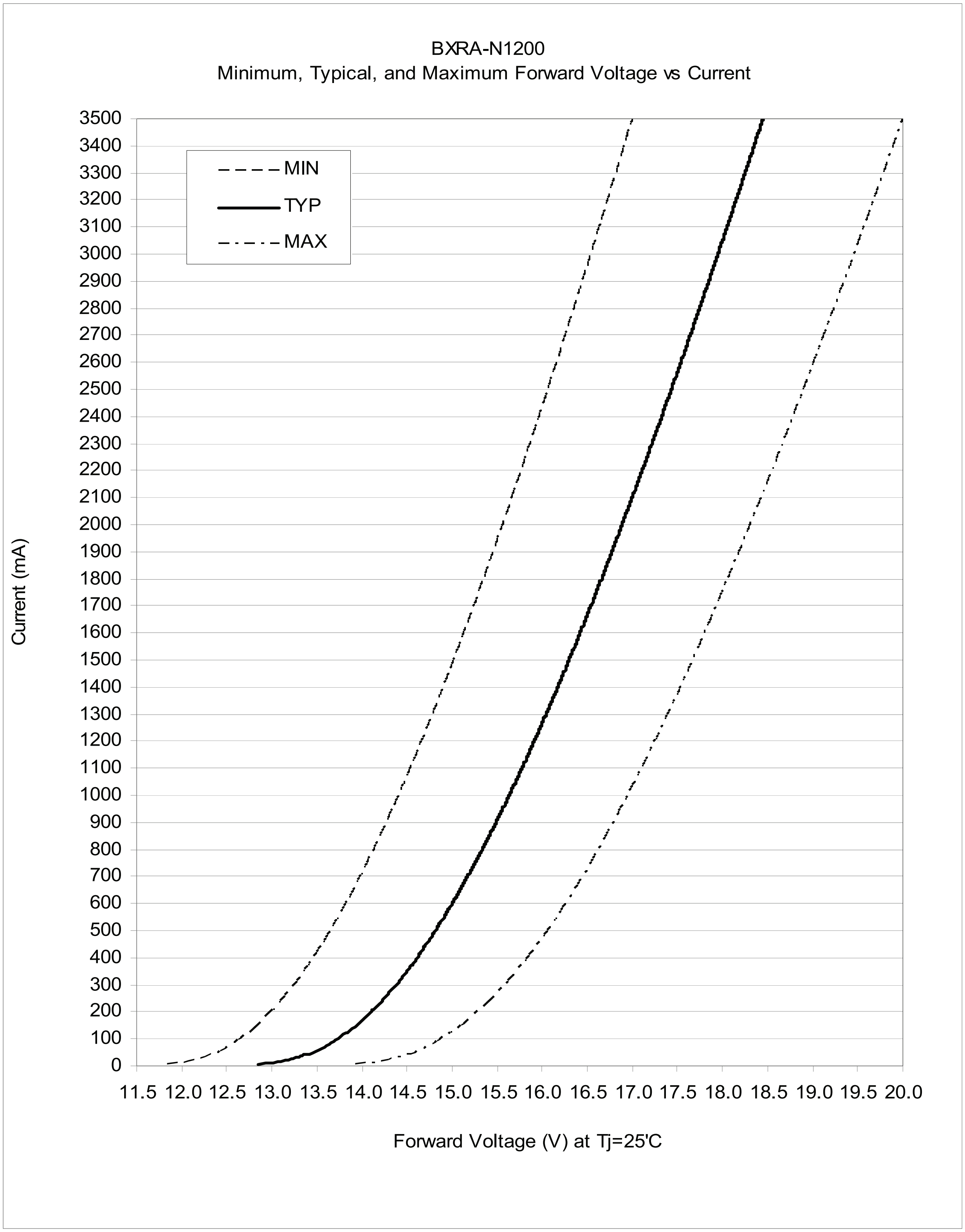

Figure A20: Forward voltage versus current for BXRA-N1200 LED Arrays

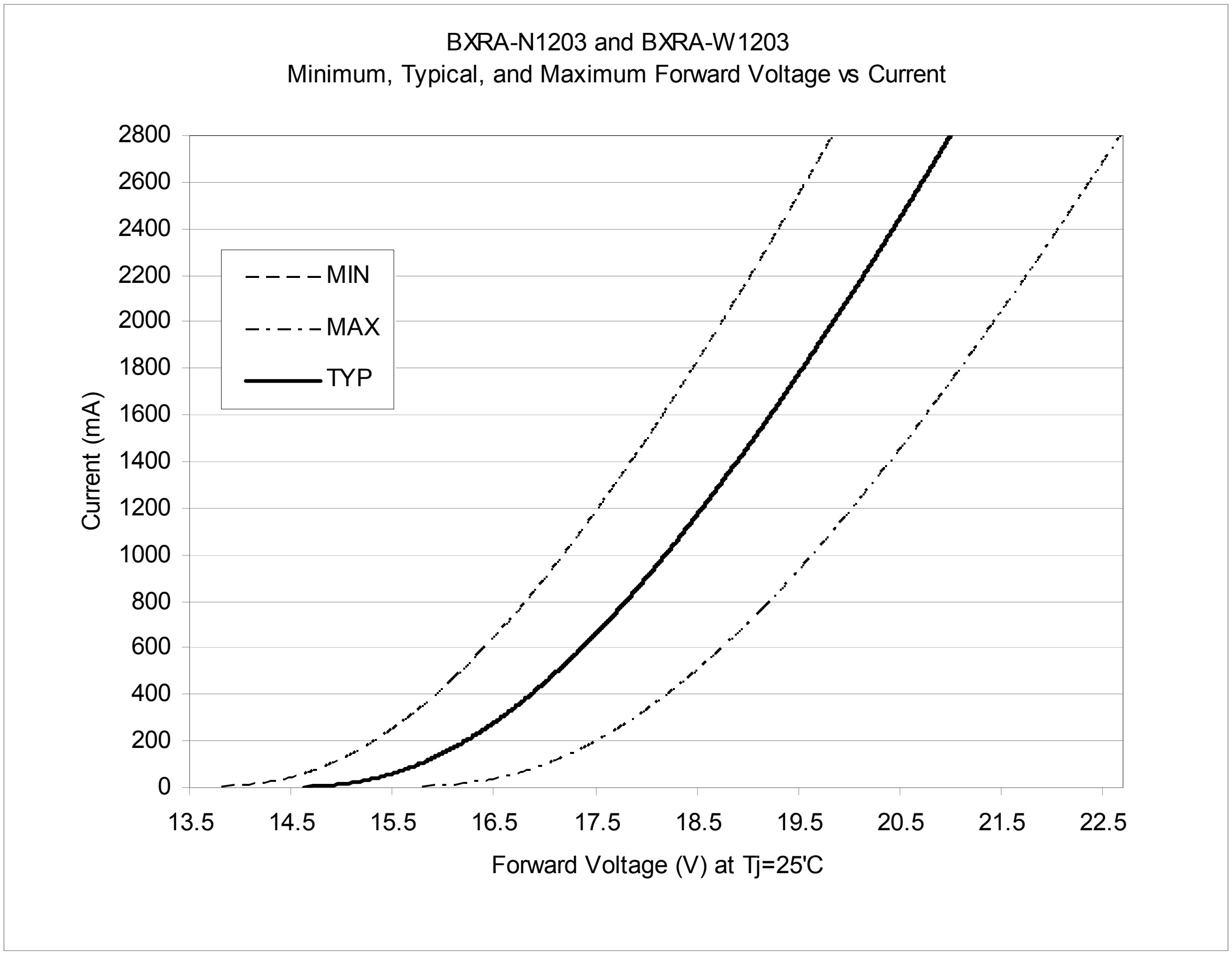

Figure A21: Forward voltage versus current for BXRA-N1203 and BXRA-W1203 LED Arrays

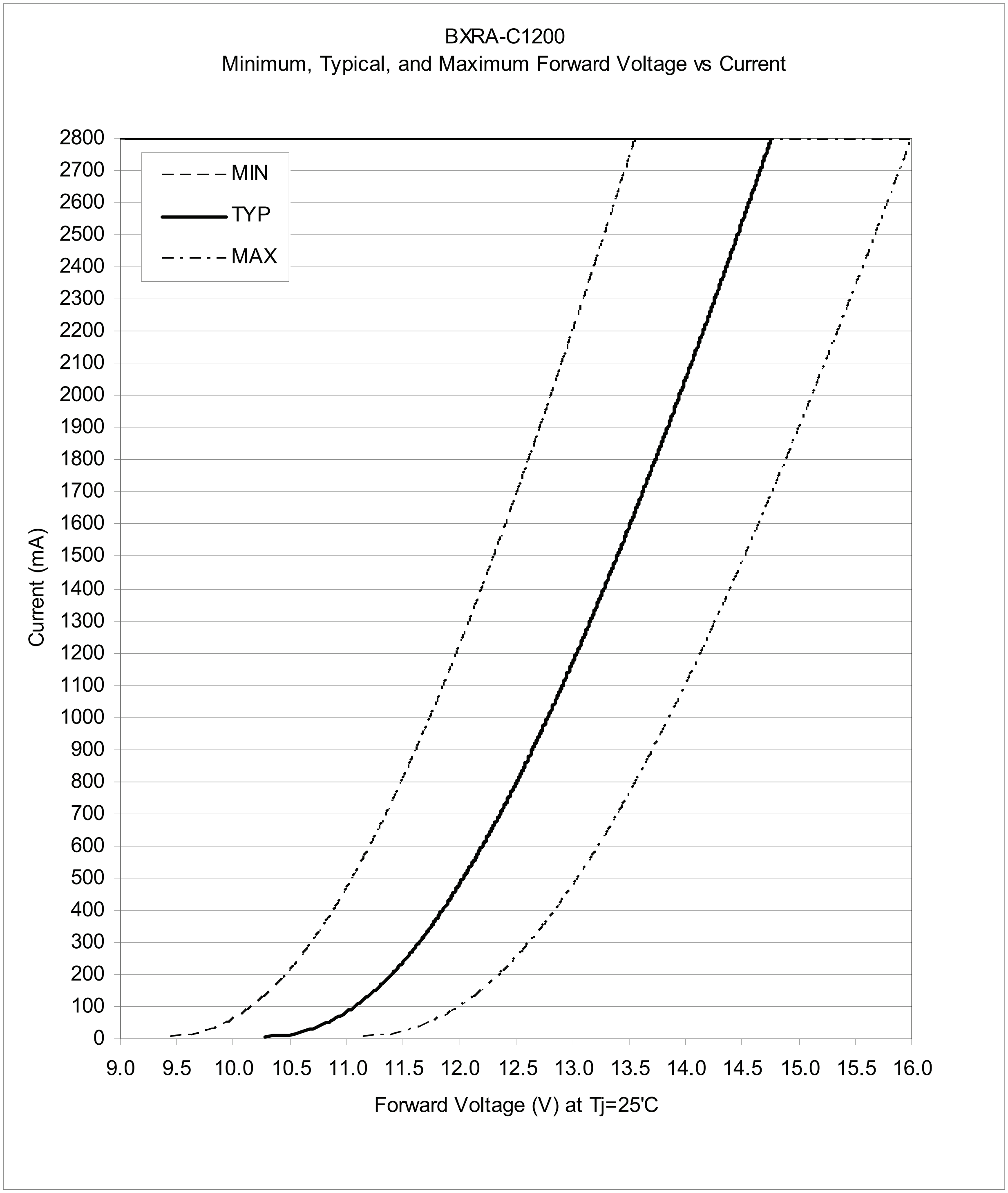

Figure A22: Forward voltage versus current for BXRA-C1200 LED Arrays

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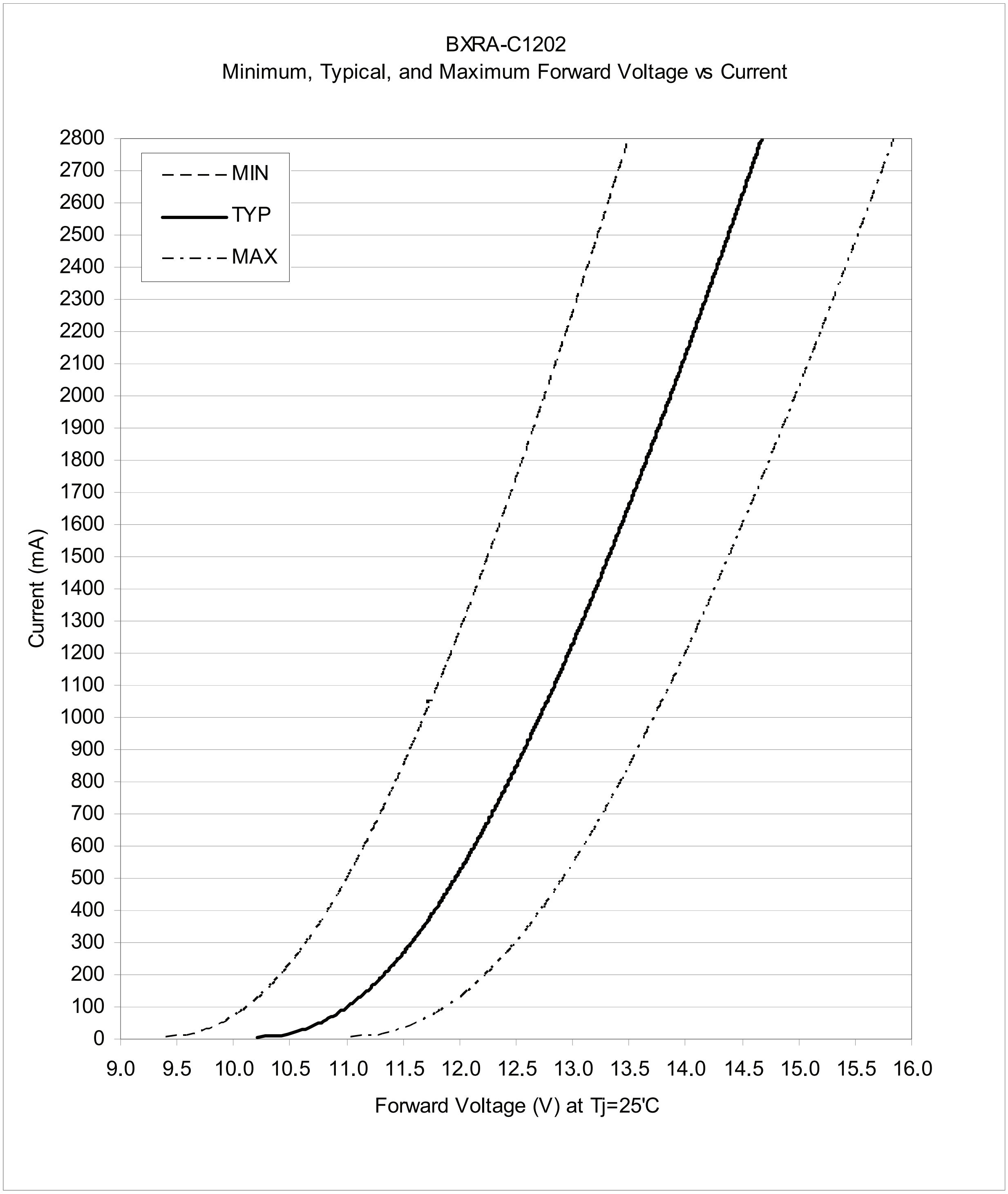

Figure A23: Forward voltage versus current for BXRA-C1202 LED Arrays

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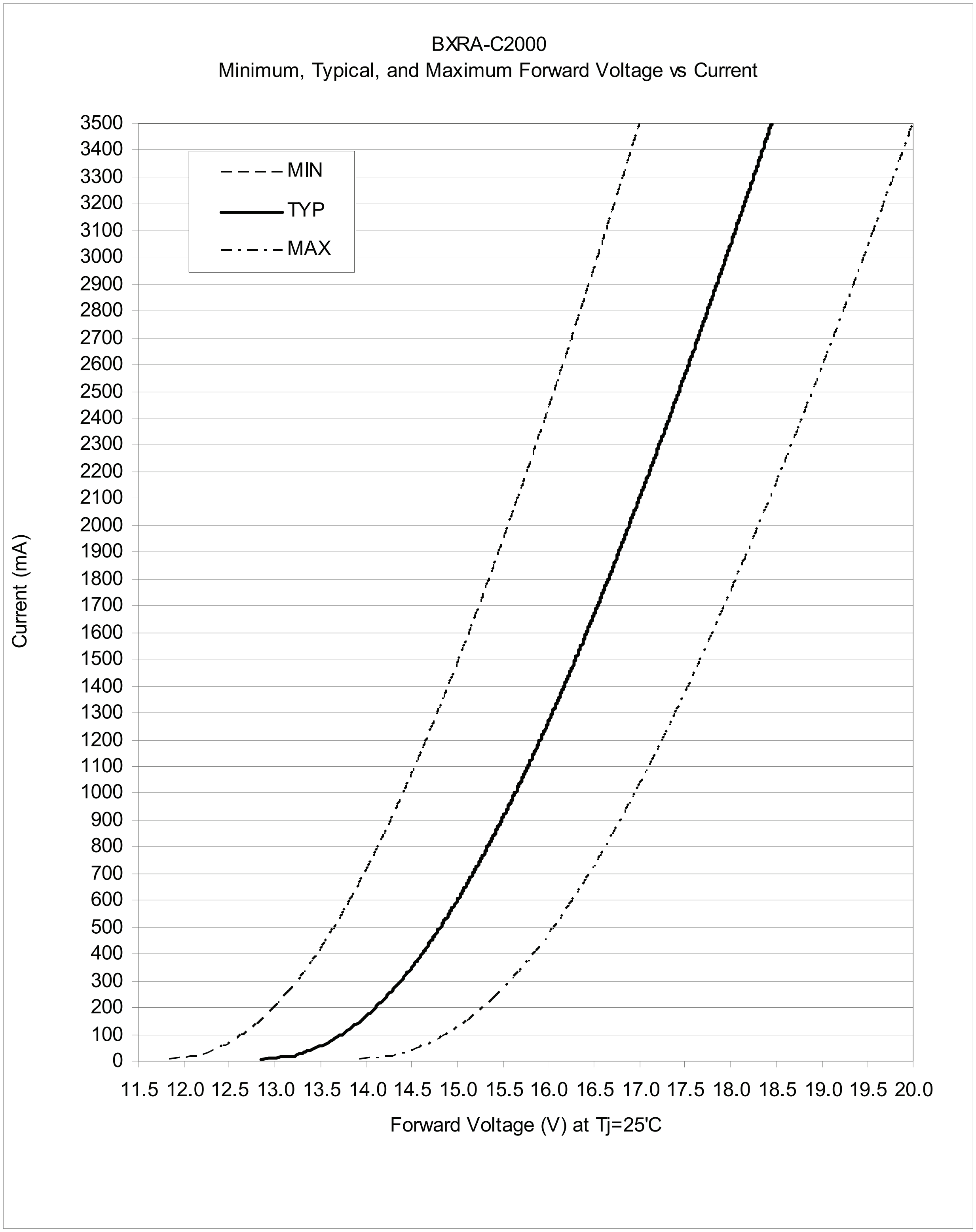

Figure A24: Forward voltage versus current for BXRA-C2000 LED Arrays

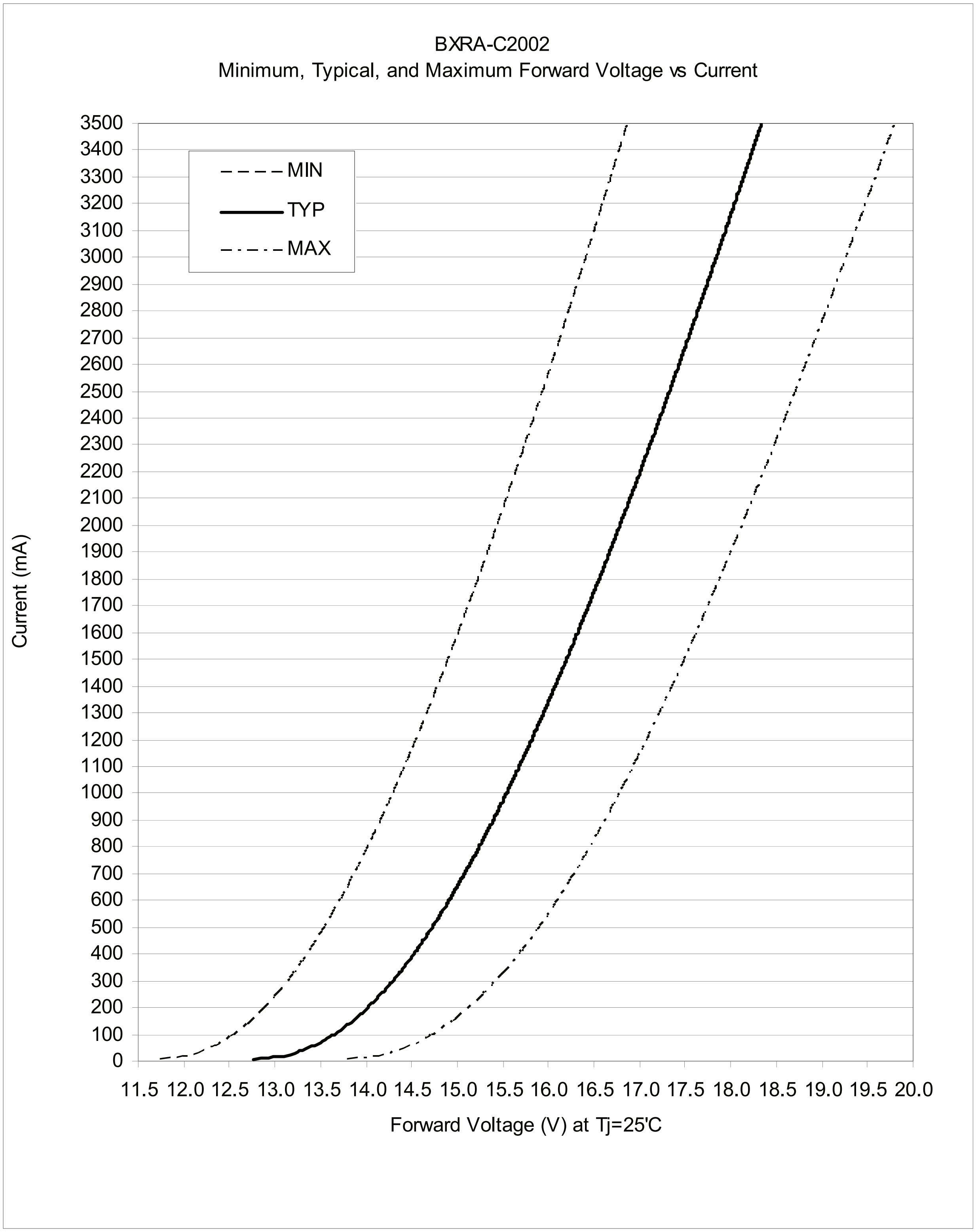

Figure A25: Forward voltage versus current for BXRA-C2002 LED Arrays

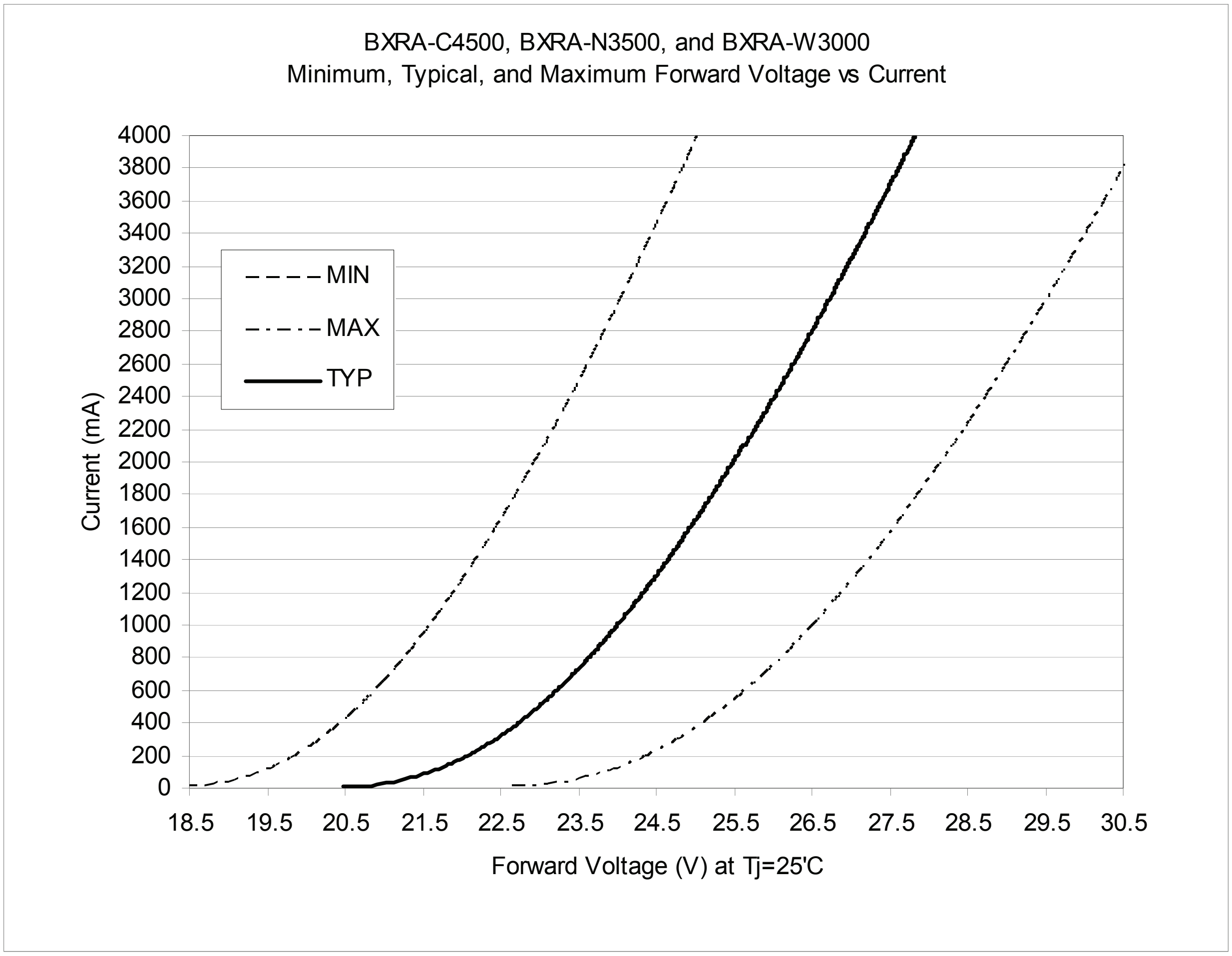

Figure A26: Forward voltage versus current for BXRA-C4500, BXRA-N3500, and BXRA-W3000 LED Arrays

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Design Resources

General Electronics

www.hyperphysics.phy-astr.gsu.edu/hbase/emcon

References

Steve Winder. Power Supplies for LED Driving. Oxford: Elsevier, 2005.

Web Sites directory for off the shelf LED driver manufacturers

Manufacturer	Web Site
Advance Transformer	www.advance.philips.com
Glacial Power	www.glacialpower.com
Harvard Engineering	www.harvardeng.com
Hatch Transformer	www.hatchtransformers.com
High Perfection	www.highperfection.com.tw
Inventronics	www.inventronics-co.com
IST Ltd	www.istl.com
Lightech	www.lightechinc.com
LUMOtech	www.lumotech.com
Lutron	www.lutron.com
Magtech Industries	www.magtechind.com
Meanwell	www.meanwell.com
Moso Power	www.mosopower.com
pnPower	www.pnpower.com
Roal	www.roallivingenergy.com
Thomas Research	www.thomasresearchproducts.com

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About Bridgelux

Bridgelux LED Arrays are developed, manufactured and marketed by Bridgelux, Inc. Bridgelux is a U.S. lighting company and leading developer of technologies and solutions that will transform the $40 billion global lighting industry into a $100 billion market opportunity. Based in Silicon Valley, Bridgelux is a pioneer in solid-state lighting (SSL), expanding the market for solid state lighting by driving down the cost of light through innovation. Bridgelux's patented light source technology replaces traditional lighting technologies (such as incandescent, halogen and fluorescent lamps) with integrated, solid-state solutions, enabling lamp and luminaire manufacturers to develop high performance and energy-efficient white light products. The plug and play simplicity of the Bridgelux LED Arrays enable our customers to address the rapidly growing interior and exterior solid state lighting markets, including street lights, retail lighting, commercial lighting and consumer applications. With more than 250 patent applications filed or granted worldwide, Bridgelux is the only vertically integrated LED manufacturer that designs its solutions specifically for the lighting industry.

For more information about the company, please visit www.bridgelux.com

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