DD311

HIGH CONSTANT CURRENT LED DRIVER

點晶科技股份有限公司
SILICON TOUCH TECHNOLOGY INC.
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DD311

HIGH CONSTANT CURRENT LED DRIVER

General Description

DD311 is a single-channel constant current LED driver, which incorporates current mirror and current switch, designed to drive power LEDs. It can provide a maximum sink current of 1A, adjustable by reference current input. The output current is 100 times the input current value set by an external resistor or bias voltage. Tuning or enabling the bias voltage can provide dot correction or global brightness control in LEDs system. The Maximum output voltage of 36V can provide more series power LEDs in a string. The output enable allows dimming control applications.

Features

- Maximum output current: 1A (determined by input reference current)
- Minimum output voltage: 1V (Iout = 1A)
- Maximum output voltage: 36V (output leakage current < 0.1uA)
- Maximum output enable frequency: 1MHz
- Excellent output current accuracy

Applications

- LED architectural or entertainment lighting
- LED general or specialty illumination
- LED backlighting applications

Package Types

- TO-252

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Block Diagram
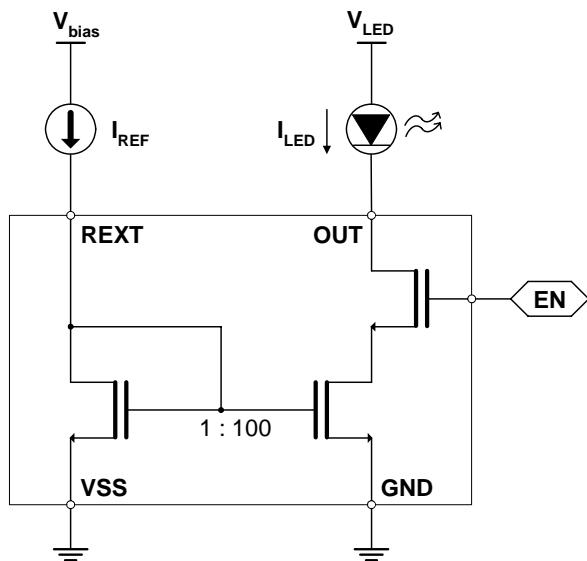
Pin Connection
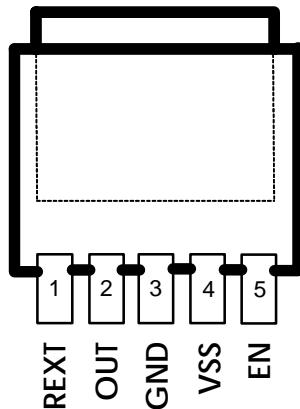
Pin Description

PIN No.	PIN NAME	FUNCTION
1	REXT	Reference current input terminal.
2	OUT	Sink constant current outputs (open-drain).
3	GND	Ground terminal.
4	VSS	Ground terminal.
5	EN	Output current enable terminal: V_{EN} = **0V**, output current is turned **OFF**. V_{EN} > **3.3V**, output current is turned **ON**.

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Maximum Ratings (Ta=25°C, Tj(max) = 125°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Input Reference Current	I_{REF}	10	mA
Output Current	Iout	1.0	A
Output Voltage	Vout	-0.3 ~ 36	V
Enable Voltage	V_{EN}	-0.3 ~ 18	
Output Enable Frequency	F_{EN}	1	MHz
GND Terminal Current	I_{GND}	1.01	A
Power Dissipation	Pd	4.2 (Ta=25°C)	W
Thermal Resistance (Junction to Air)	Rth(j-a)	23.38	°C/W
Thermal Resistance (Junction to Case)	Rth(j-c)	1.77	
Operating Temperature	Top	-40 ~ 85	°C
Storage Temperature	Tstg	-55 ~ 150	

Recommended Operating Condition

CHARACTERISTIC	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Bias Voltage	Vbias	force REXT terminal directly	—	—	2.7	V
		with an external resistor	5	—	36	
Output Voltage	Vout	Driver On [*1]	1	—	—	V
Output Voltage	Vout	Driver Off [*2]	—	—	36	
Output Current	Iout	Ven > 3.3V	—	—	1	A
Input Enable Voltage	$V_{EN(IH)}$	I_{REF} = 1mA ~ 10mA	3.3	—	18	V
	$V_{EN(IL)}$		-0.3	—	0.0	
Input Enable Frequency	F_{EN}	Ven > 3.3V	DC	—	1	MHz

[*1] Notice that the power dissipation is limited to its package and ambient temperature.
[*2] The driver output voltage including any overshoot stress has to be compliant with the maximum voltage (33V).

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Electrical Characteristics (Ta = 25°C unless otherwise noted)

| CHARACTERISTIC	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Input Enable Voltage "H" Level	$V_{EN(IH)}$	I_{REF} = 1mA ~ 10mA	3.3	—	18	V
Input Enable Voltage "L" Level	$V_{EN(IL)}$		-0.3	—	0.0	
Output Leakage Current	I_{OL1}	Vout = 36 V Ven = 0V	—	—	0.1	uA
Output Current Skew (Chip-to-Chip) [1]	I_{OL2}		—	± 0.5	± 10	%
Ambient Temperature Regulation	η_1	I_{REF} = 1mA ~ 10mA Vout = 1.0 V	—	0.01	—	% / °C
Ambient Temperature Regulation	η_2		—	0.05	—	mA / °C
Output Voltage Regulation	% / Vout	I_{REF} = 1mA ~ 10mA Vout = 1V ~ 3V	—	1.5	10	% / V

Switching Characteristics (Ta = 25°C unless otherwise noted)

CHARACTERISTIC		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Propagation Delay ('L to 'H')	EN-to-OUT (Driver On)	tpLH	I_{REF} = 10mA (Iout = 1A)	—	10	—	ns
Propagation Delay ('H' to 'L')	EN-to-OUT (Driver Off)	tpHL	$V_{EN(IH)}$ = 5V $V_{EN(IL)}$ = 0V	—	50	—	
Output Current Rise Time		tor	VL = 12V	—	25	—	
Output Current Fall Time		tof	RL = 10 Ω CL = 13 pF	—	50	—	

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[1] Chip-to-Chip skew is defined as the range into which any ratio between output current and reference current of any IC falls.

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Switching Characteristics Test Circuit
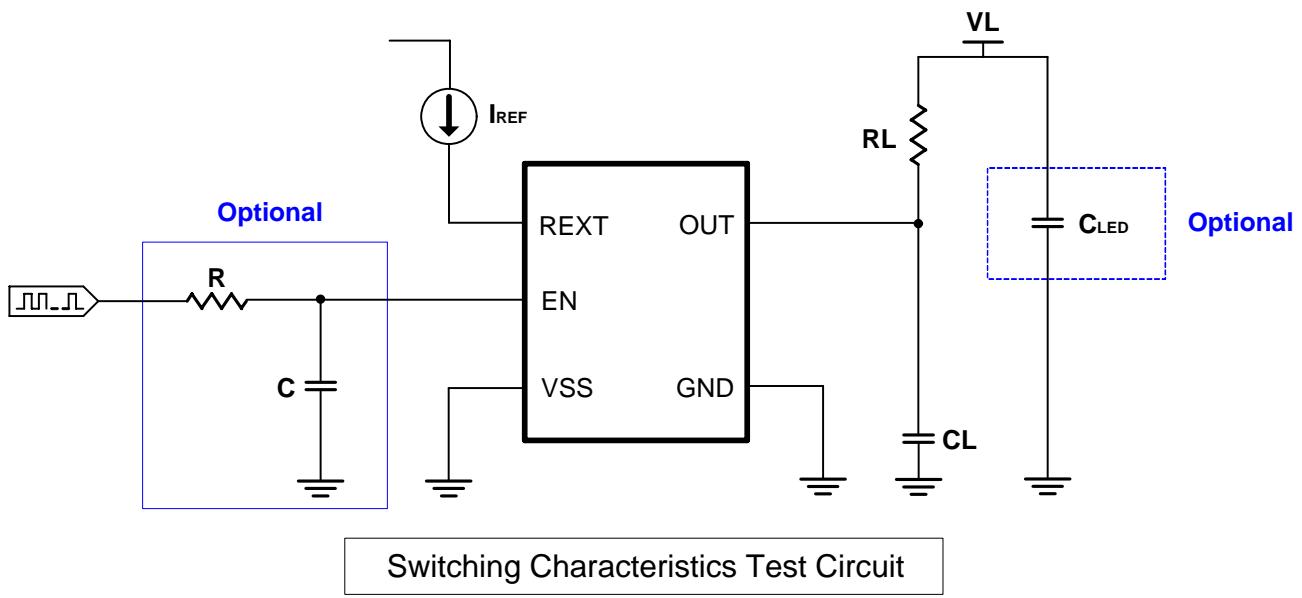
Transient Characteristics

In order to reduce the overshoot or undershoot(Vout) during switching large current, it is recommended adding a large enough capacitor between V$_{LED}$ and GND to keep LED supply voltage(V$_{LED}$) stable. The longer rise time and fall time of the EN dimming signal, adjustable by RC filter, produce the smooth transient response of output current. The two output waveforms illustrating the EN dimming signal with and without RC filter are given below:
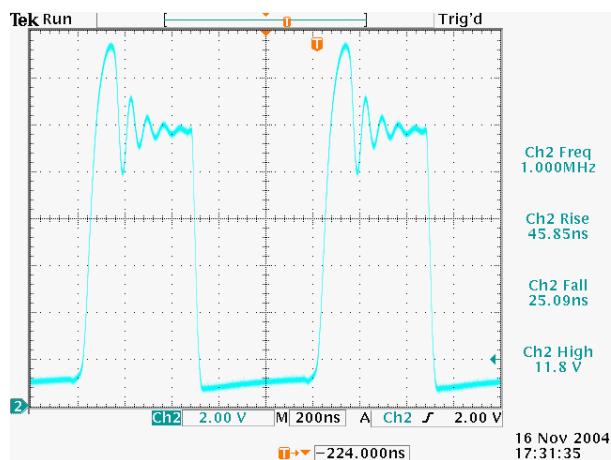
without RC filter

with RC filter

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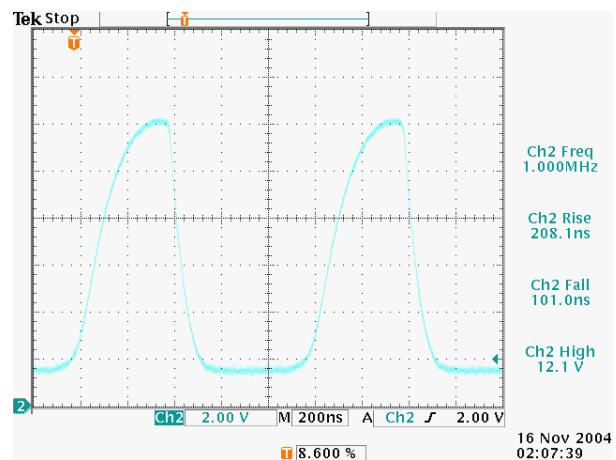
Constant-Current Output

Constant-current value is set by the reference current input. The output current will be 100 times the input current value produced by an external resistor between the REXT pin and the bias voltage[2] or, alternatively, force the low bias voltage to REXT pin. Varying the resistor or the bias voltage value can adjust the current scale ranging up to 1A. Notice that the output current is a little increasing or decreasing until the device temperature and ambient temperature are balance. The output current value is calculated roughly by the following equation:

$$I_{LED}(A) \simeq 100 \times (V_{bias} - V_{REXT}) / R_{EXT}(ohm) = 100 \times I_{REF}(A)$$

[2] The variation of bias voltage influences the output stability directly.

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Output Current as a Function of REXT value

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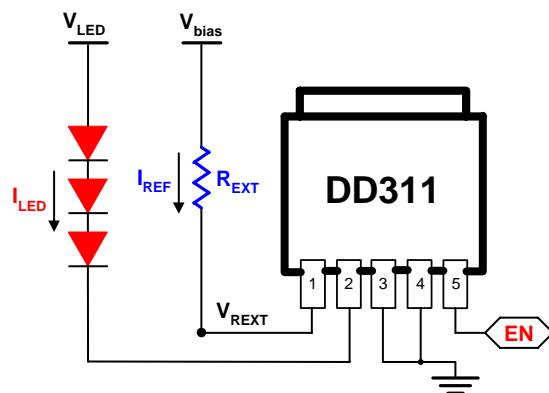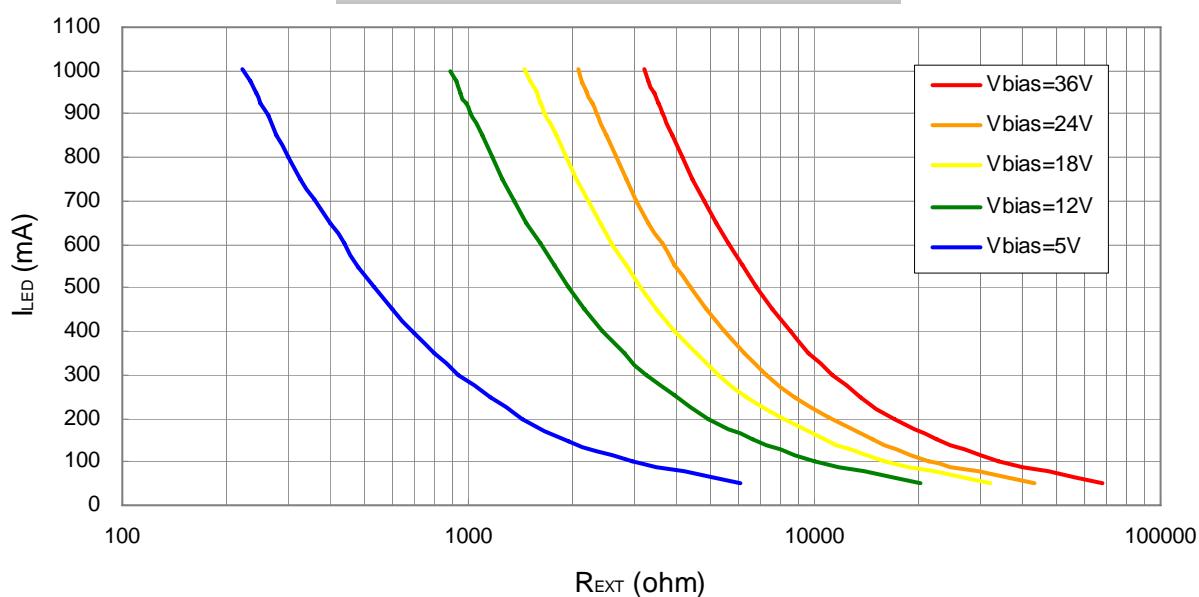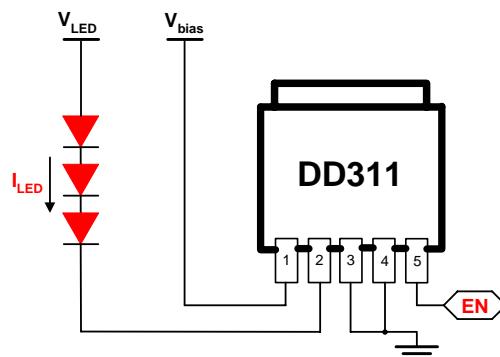
Output Current as a Function of Vbias
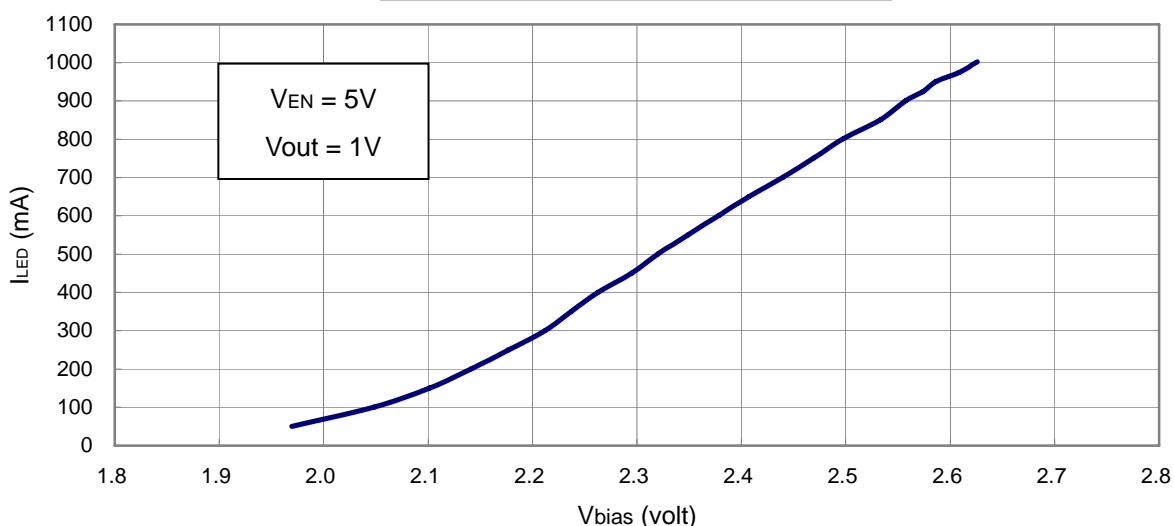
Output Current as a Function of Output Voltage

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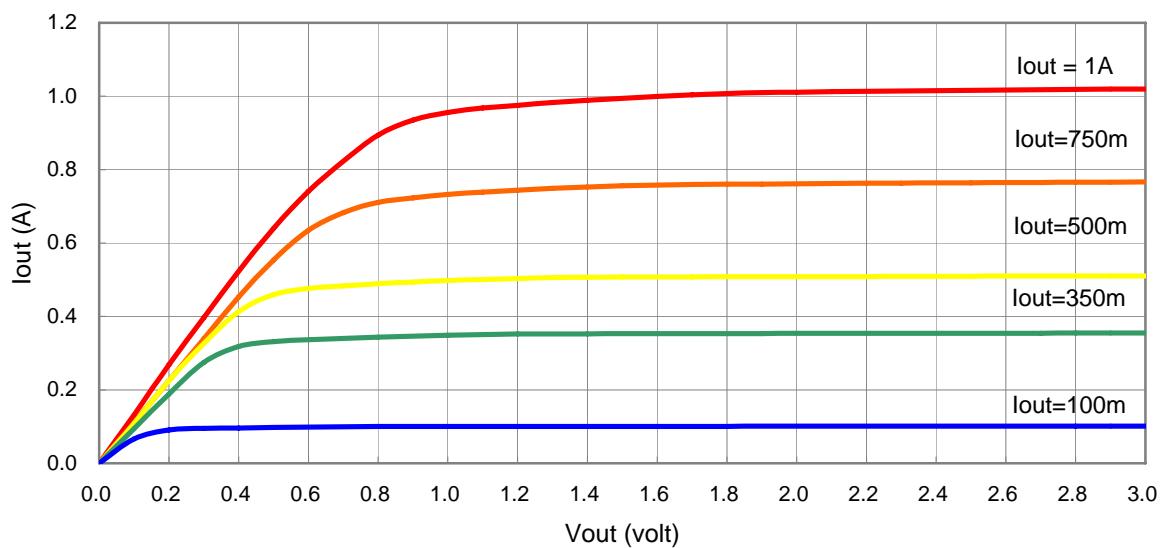
Ambient Temperature vs. Output Current

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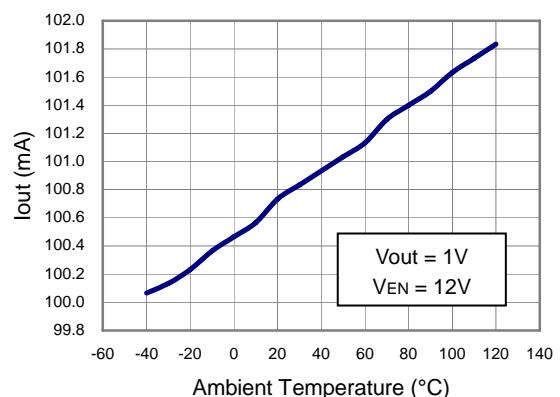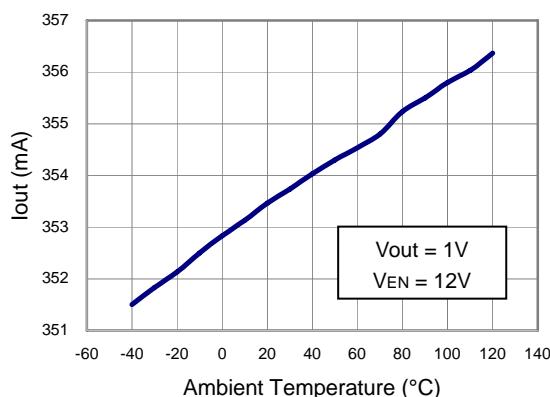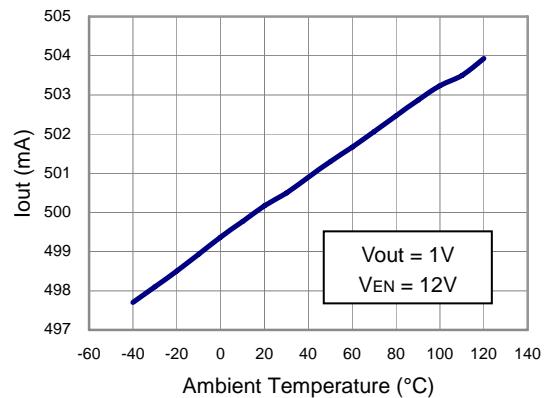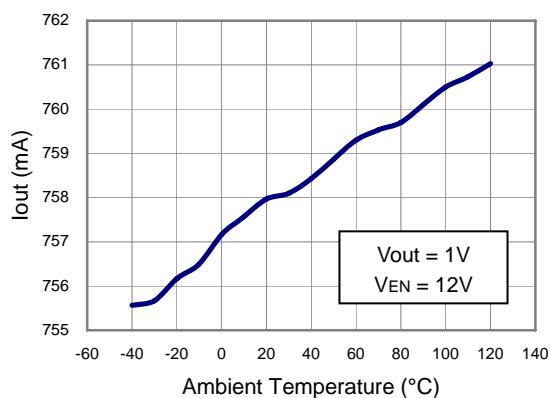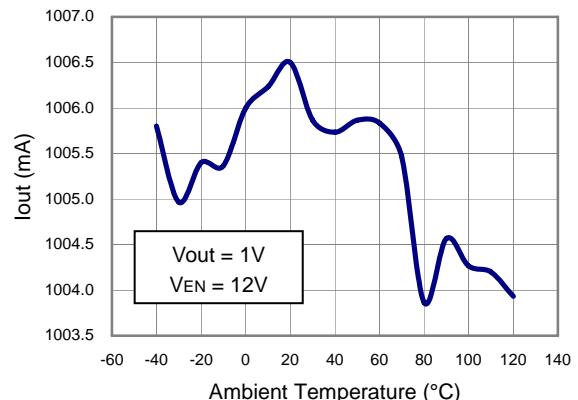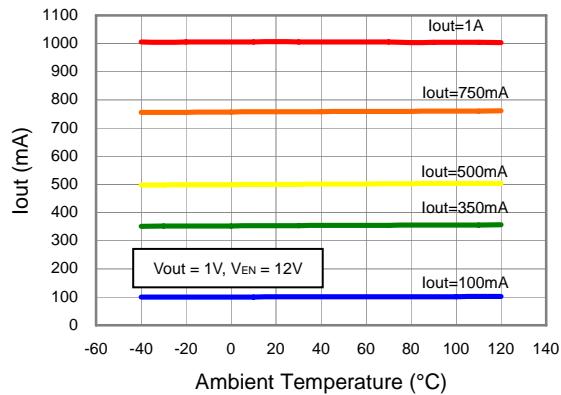
Enable Voltage vs. Output Current

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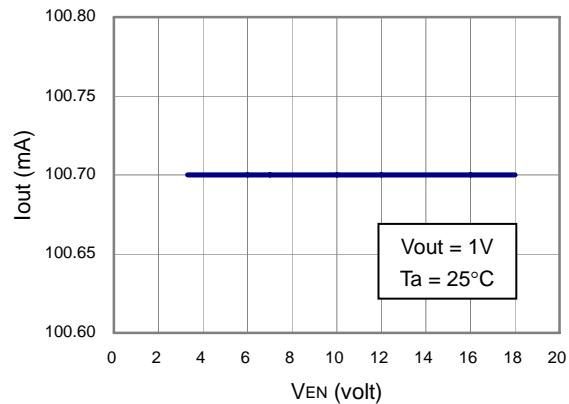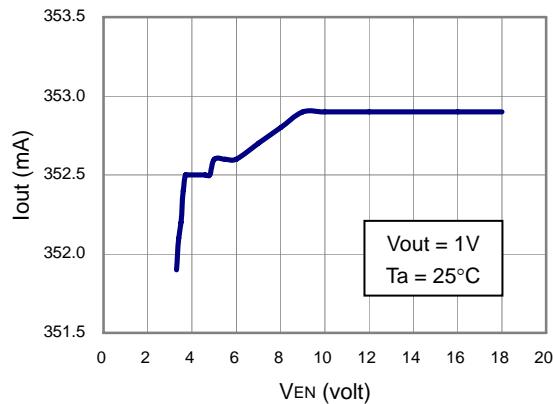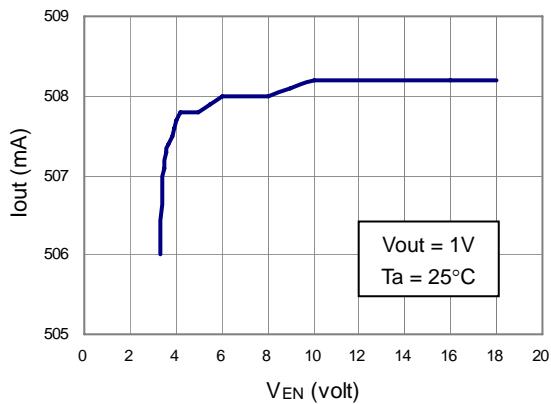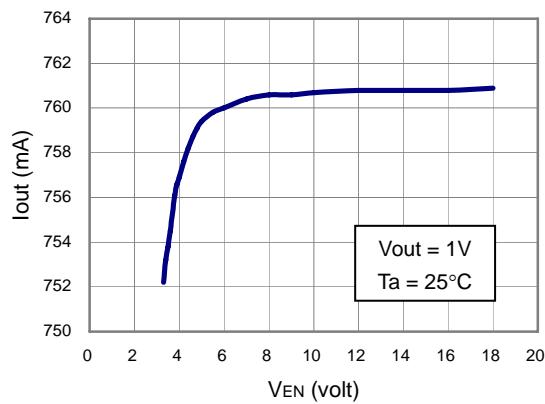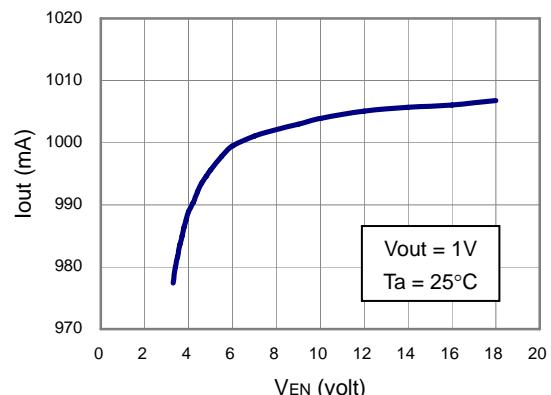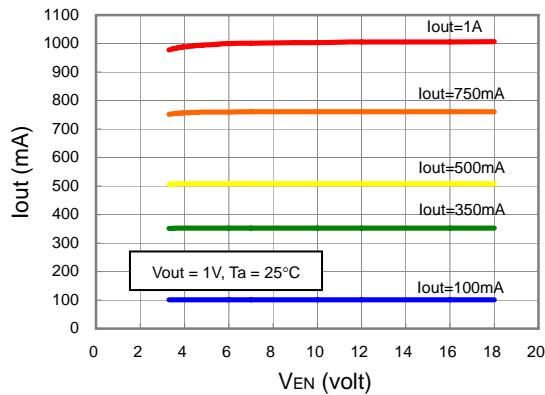
Power Dissipation

Notice that the power dissipation of a semiconductor chip is limited to its package and ambient temperature, in which the device requires the maximum output current calculated for given operating conditions. The maximum allowable power consumption can be calculated by the following equation:

$$Pd(max)(Watt) = \frac{Tj(junction\ temperature)(max)(\,^{\circ}\!C) - Ta(ambient\ temperature)(\,^{\circ}\!C)}{Rth(junction\text{-}to\text{-}air\ thermal\ resistance)(\,^{\circ}\!C/Watt)}$$

The relationship between power dissipation and operating temperature can be refer to the figure below:
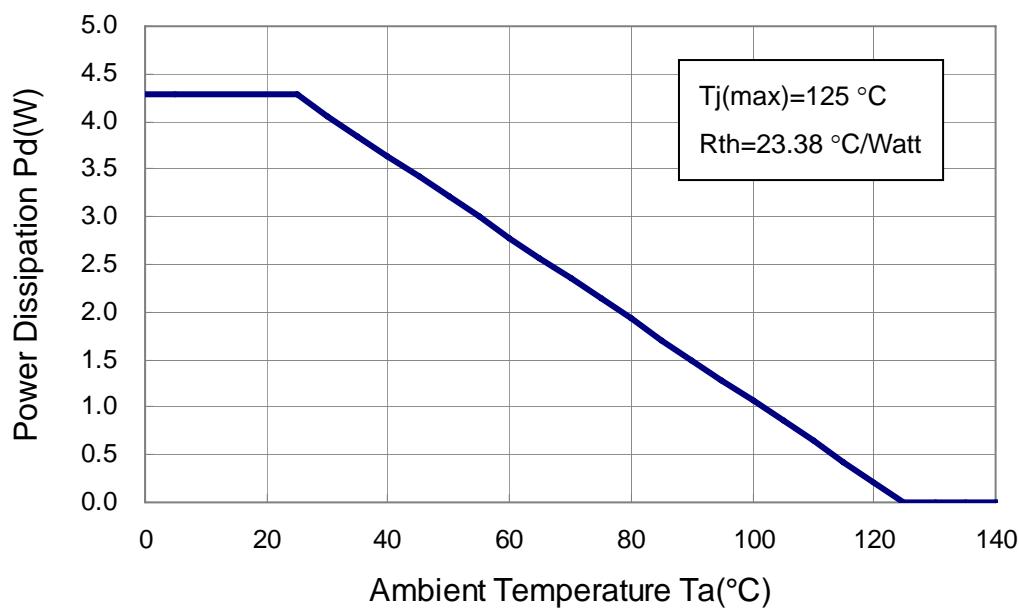

Based on the Pd(max), the maximum allowable voltage of output terminal can be calculated as follows:

$$Vout(max)(Volt) = \frac{Pd(max)(Watt) - V_{REXT}(Volt) \times I_{REF}(A)}{Iout(A) \times Dimming\ Duty}$$

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Typical Application
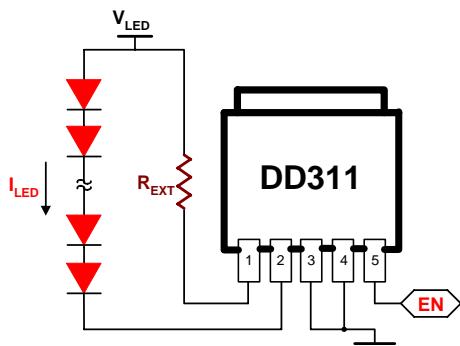
Series String (Suggested)
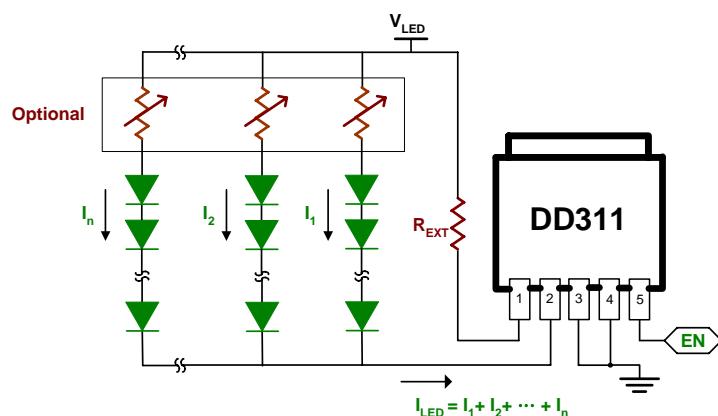
Paralleled Strings
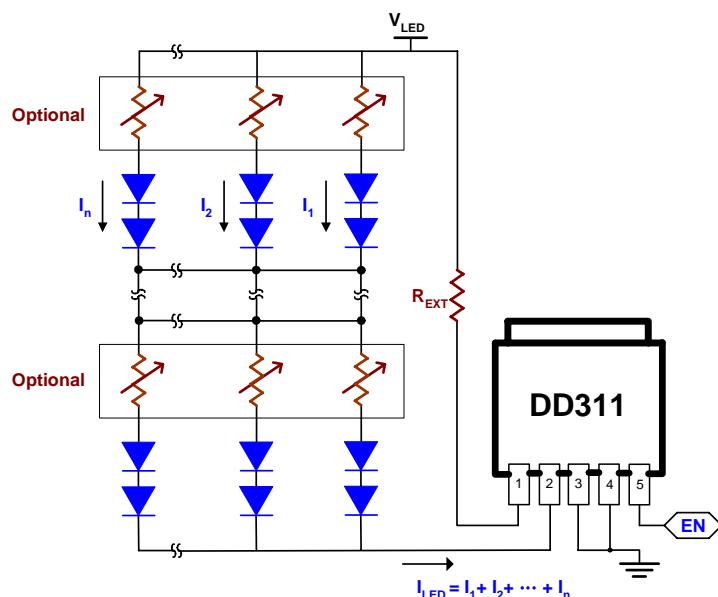
Cross Connected Paralleled Strings

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Typical Application
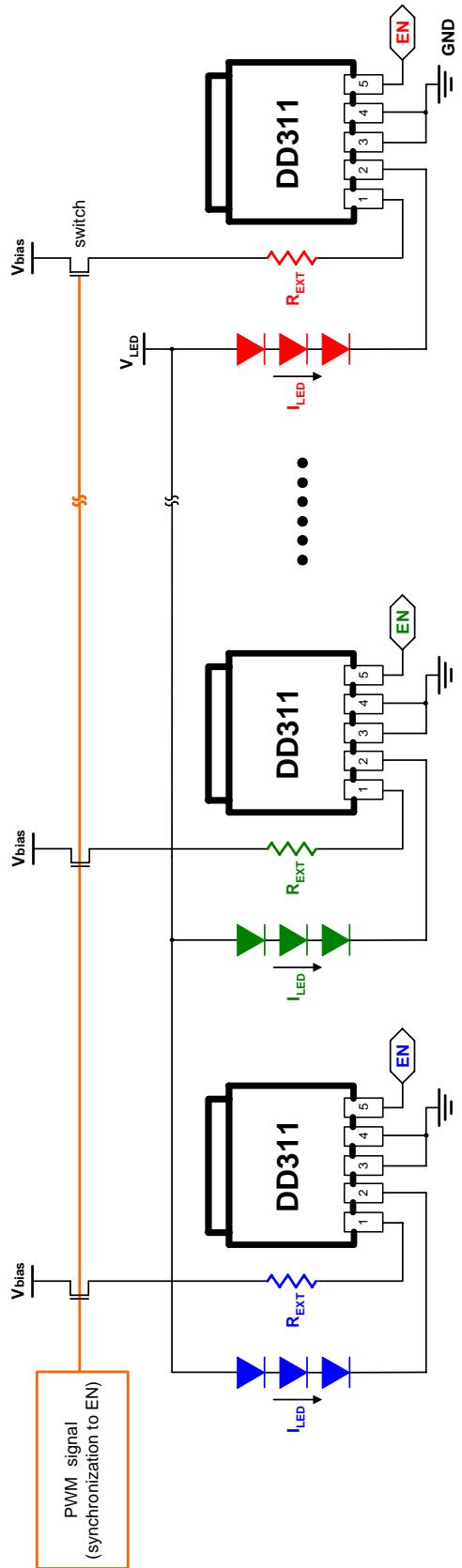
Global Brightness Control
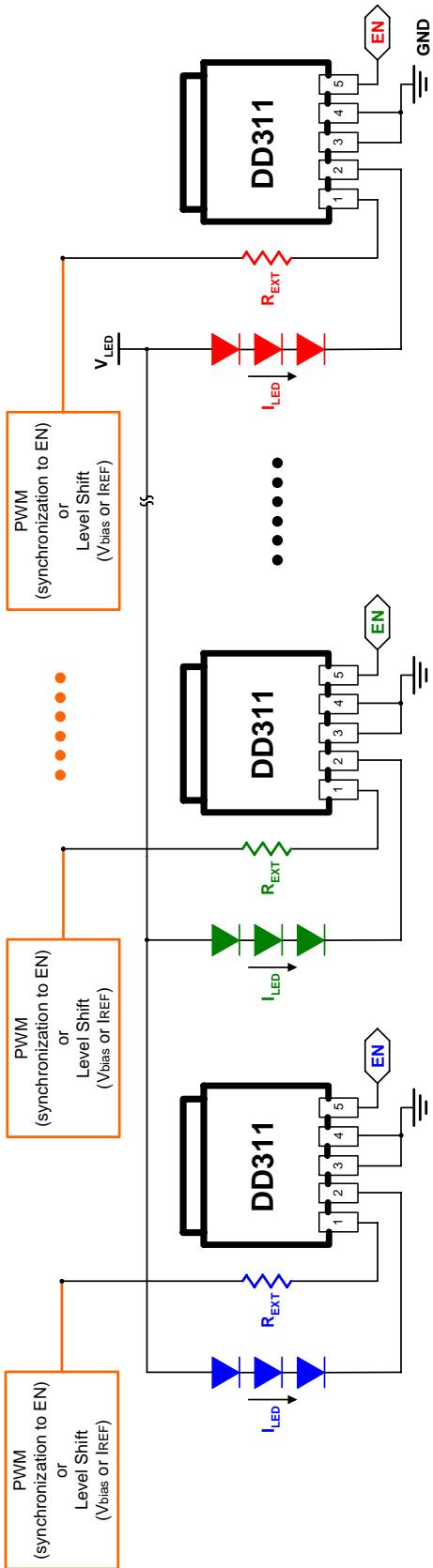
Dot Correction (compensation data from sensing LEDs)

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Typical Application
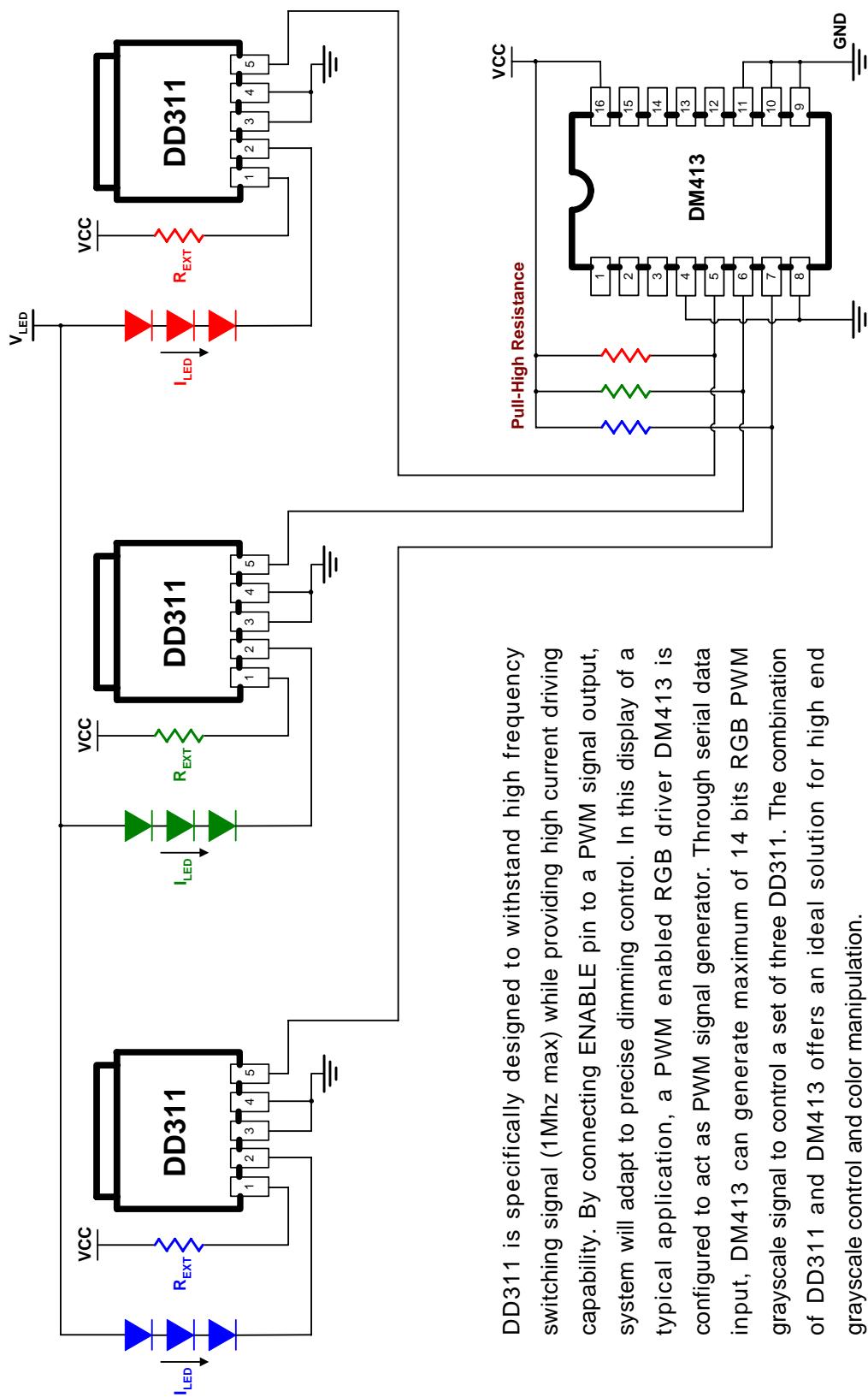
DD311 is specifically designed to withstand high frequency switching signal (1Mhz max) while providing high current driving capability. By connecting ENABLE pin to a PWM signal output, system will adapt to precise dimming control. In this display of a typical application, a PWM enabled RGB driver DM413 is configured to act as PWM signal generator. Through serial data input, DM413 can generate maximum of 14 bits RGB PWM grayscale signal to control a set of three DD311. The combination of DD311 and DM413 offers an ideal solution for high end grayscale control and color manipulation.

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Package Outline Dimension

TO-252   Unit: inch/mm
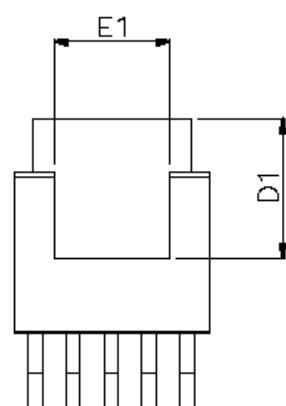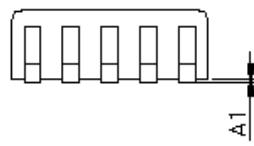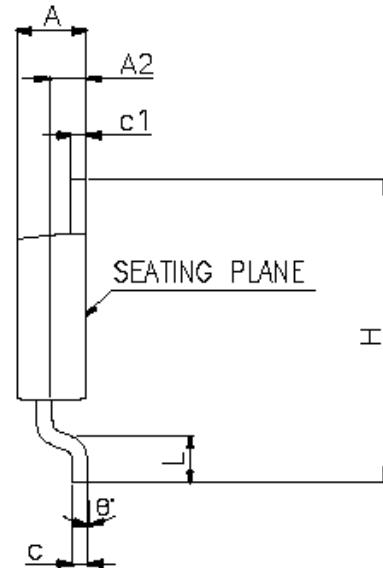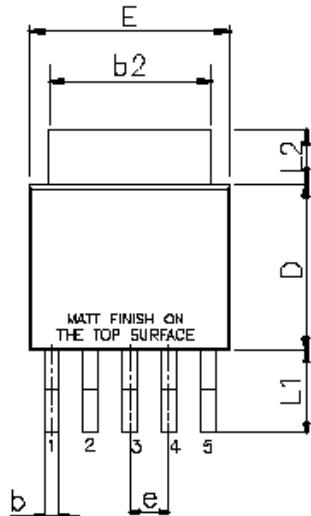
	DIMENSIONS IN INCH		DIMENSIONS IN MM	
SYMBOLS	MIN.	MAX.	MIN.	MAX.
A	0.086	0.094	2.184	2.388
A1	0.000	0.005	0.000	0.127
A2	0.040	0.050	1.016	1.270
b	0.020 TYP		0.508 TYP	
b2	0.205	0.215	5.207	5.461
c	0.018	0.023	0.457	0.584
c1	0.018	0.023	0.457	0.584
D	0.210	0.220	5.334	5.588
D1	0.180	-	4.572	-
E	0.250	0.265	6.350	6.731
E1	0.150	-	3.810	
e	0.050 BSC		1.270 BSC	
H	0.370	0.410	9.398	10.414
L	0.055	0.070	1.397	1.778
L1	0.105 REF		2.667 REF	
L2	0.06	0.08	1.524	2.032
Θ	0°	4°	0°	4°

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Product Ordering Information

Part Number	Package Type	Number / Weight (typ.)	
		Tube / Tray	Reel (Box included)
DD311-TO252EX	TO252-1.27 (Exposed Pad)	80pcs / Tube 0.046kg ± 5%	─

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DD311-TO252EX Package and Weight（4 Boxes Set）

TO252 - 1.27（Exposed Pad）

IC

TO252

Tube

53cm

80 pcs ICs per Tube

Box

17cm

10cm

61cm

40 Tubes per Box

Carton

35cm

24cm

64cm
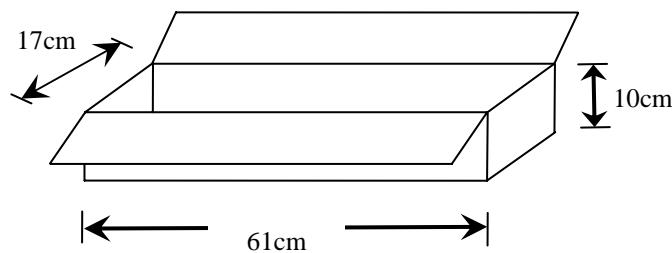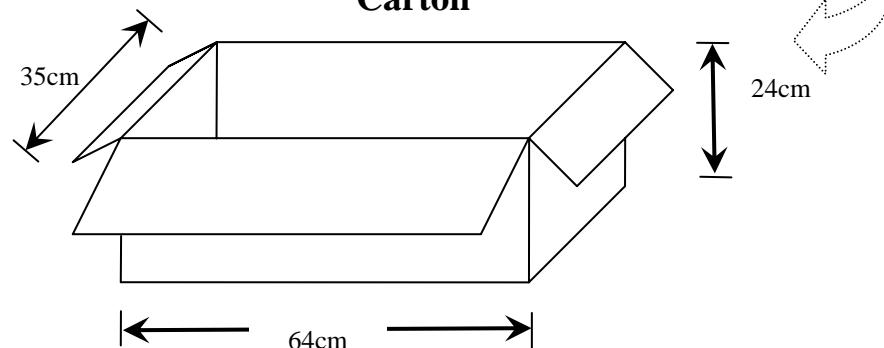
4 Boxes per Carton

Weight

Item	Description	Weight（Kg）
1	80 pcs DD311-TO252EX per Tube	0.046±5%
2	Net Weight of one Box	0.40±5%
3	Net Weight of one Carton	1.24±5%
4	Per Carton Set（4 Boxes, 12,800 pcs）	10.20±5%

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DD311-TO252EX Package and Weight（6 Boxes Set）

TO252 - 1.27（Exposed Pad）

IC

TO252

Tube

53cm

80 pcs ICs per Tube

Box

17cm

10cm

61cm

40 Tubes per Box

Carton

35cm

34cm

64cm
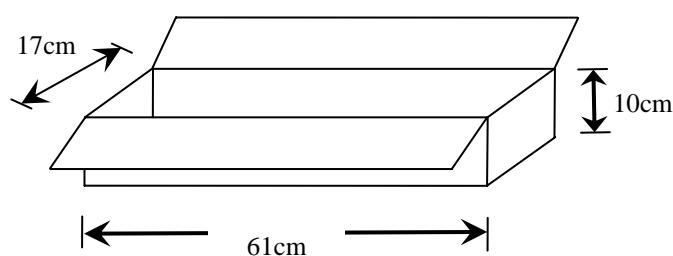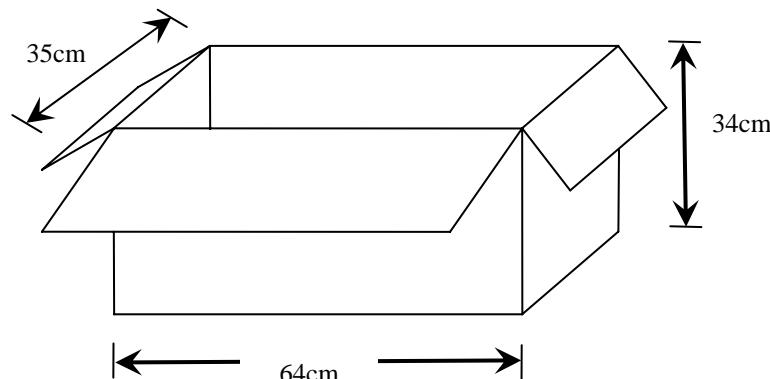
6 Boxes per Carton

Weight

Item	Description	Weight（Kg）
1	80 pcs DD311-TO252EX per Tube	0.046±5%
2	Net Weight of one Box	0.40±5%
3	Net Weight of one Carton	1.44±5%
4	Per Carton Set（6 Boxes, 19,200 pcs）	14.88±5%

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