Single inductor multi-output (SIMO) high power step down LED driver IC

Features

- Input voltage range: 9V ~ 55V.
- Individual PWM shunt MOSFET dimming channels for RGBW.
- Support wide high PWM dimming frequency: 1 kHz to 25 kHz
- Adjustable Current Calibrator (ACC) for channel skew.
- Hysteretic PFM operation mechanism eliminates external compensation design.
- Built-in Bootstrap Schottky Diode from VSW to VBT.
- Programmable constant output current by internal 100mV reference voltage.
- PWM dimming technique supported only.
- PWM dimming resolution up to 16 bit at proper applications.
- Complete protection function: UVLO, Start-up, OTP.
- Package: SOP-24, TSSOP-24, QFN-24.

Surface Mount Device

GF-SOP24L

GTS-TSSOP24L

GFN-QFN4×4-24L

Product Description

MBI6673 is constant current step-down LED driver IC which drives N-MOS, and besides, it could control individually red, green, blue and white LED dimming with SIMO configuration. Because MBI6673 is controller, by choosing the type of N-MOSFET, the fixtures could easily drive 3A or even more than 3A current loading with MBI6673. Through Macroblock's outstanding technique, the bootstrap schottky diode from VCCH to VBT to help users to save BOM cost. In addition, with low current sensing reference voltage, 100mV, it could help customers to set up wide output current range based on application scope.

Through hysteretic pulse frequency modulation, users can design MBI6673 application circuit without external components and MBI6673 has fast transient response. When it comes to current sensing accuracy, MBI6673 could achieve high current accuracy with peak current detection and moreover, with ACC function MBI6673 could avoid current inconsistency due to tolerance of external components, especially inductors. With respect to dimming resolution, MBI6673 could provide great dimming linearity and 16 bit resolution by shunt dimming technique, realized by external N-MOSFET connected to LED in parallel. In the end, according to input voltage range from 9V to 55V, MBI6673 is not only suitable for stage lighting application but also ideal for automotive alarm lighting.

6F-4, No.18, Pu-Ting Rd., Hsinchu, Taiwan 30072, R.O.C.
TEL: +886-3-579-0068, FAX: +886-3-579-7534 E-mail: info@mblock.com.tw

Applications

- Stage lighting
- Wall wash lighting
- High power LED lighting
- Constant current source
- Automotive alarm lighting (suitable for After Market)

Typical Application Circuit

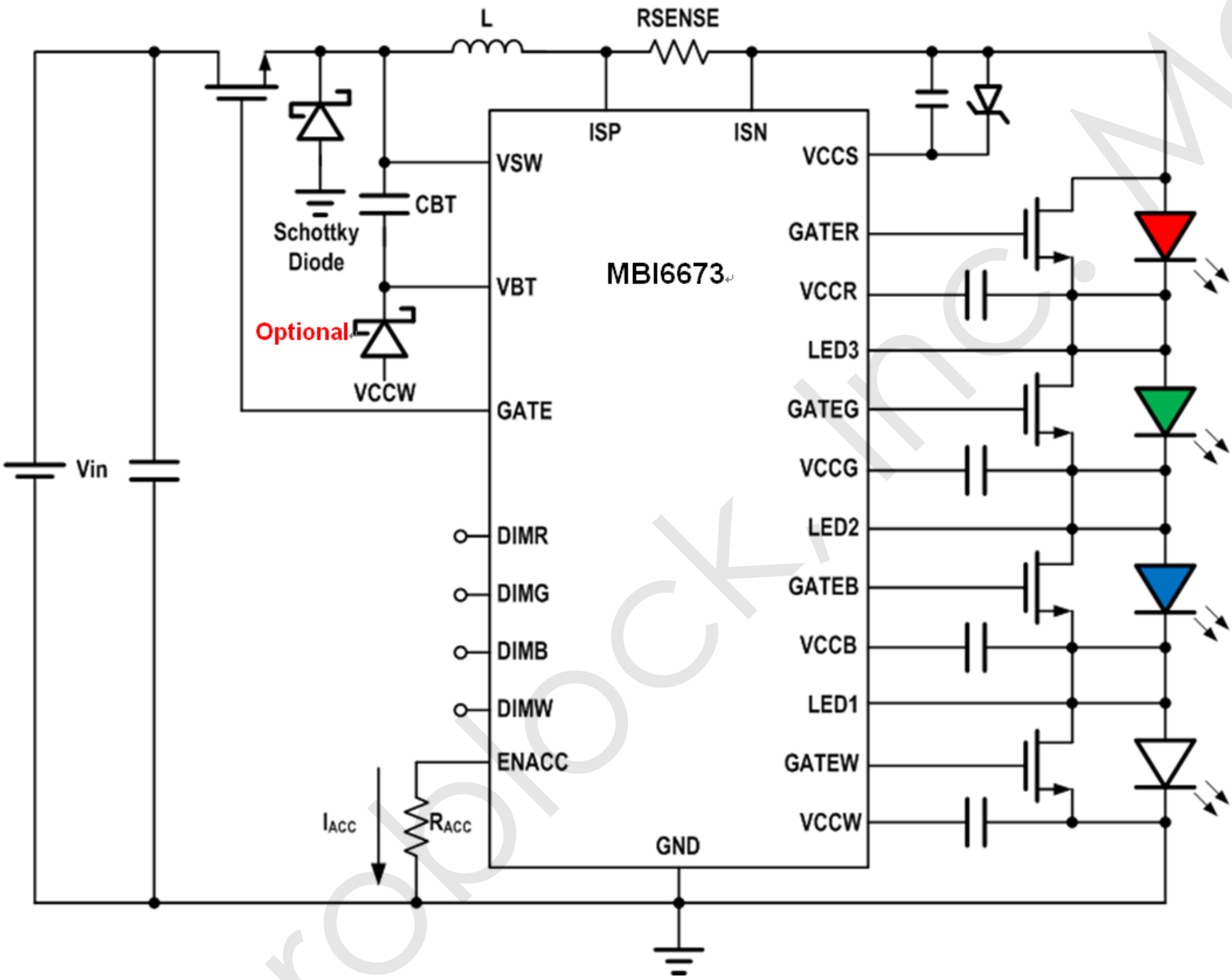


Fig.1 Application circuit of MBI6673

Functional Block Diagram

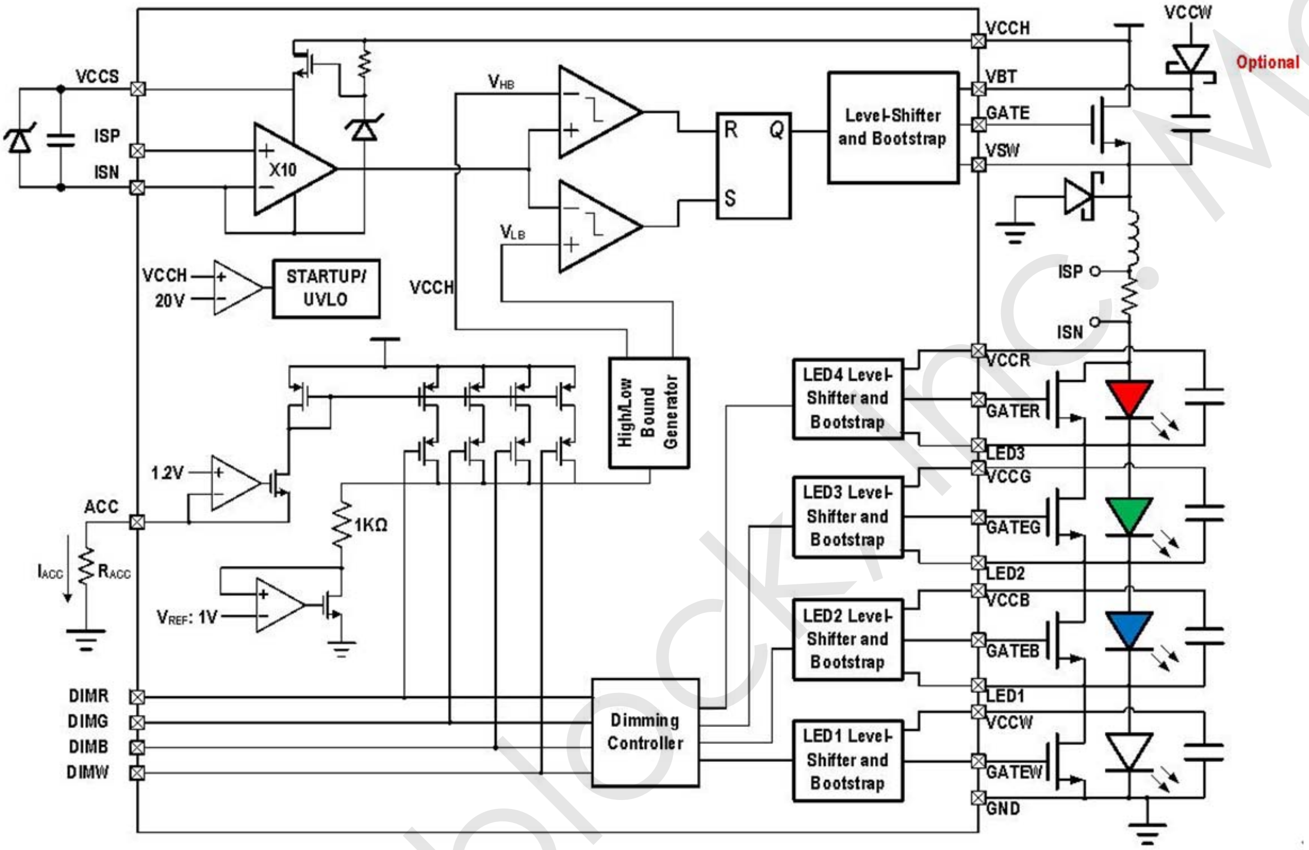


Fig.2 Functional block diagram of MBI6673

Pin Configuration

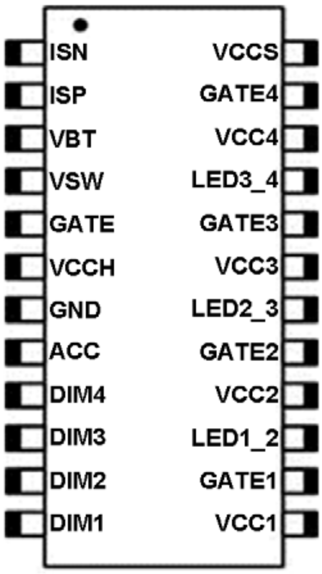


Fig.3 MBI6673 GF & GTS package (top View)

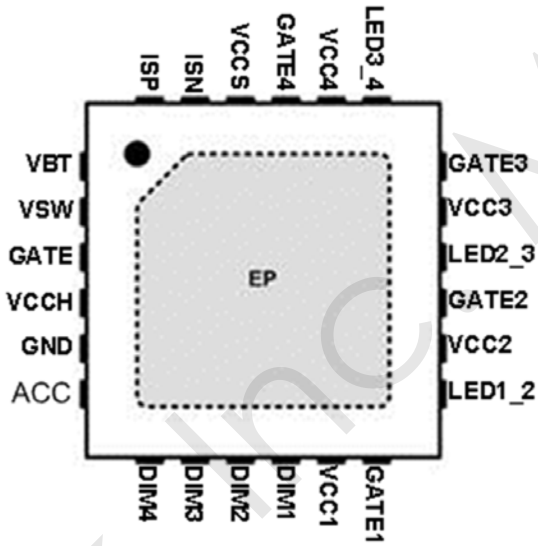


Fig.4 MBI6673 GFN package (top view)

Pin Description

GF(SOP-24), GTS(TSSOP-24) Package

Pin No.	Pin Name	Function
1	ISN	The negative input to the output current sense amplifier
2	ISP	The positive input to the output current sense amplifier
3	VBT	High-side Bootstrap gate drive supply. External bootstrap capacitor 0.1μF (ceramic) is required. Please connect positive side of bootstrap capacitor to this pin.
4	VSW	Switching node. Connect the source of high side N-type MOSFET switch and the negative side of bootstrap capacitor to this pin.
5	GATE	The input control pin of external high side power MODFET switch for the maximum 1A constant output current.
6	VCCH	Supply input
7	GND	The signal ground pin.
8	ACC	ACC setting pin, attach resistor between ACC pin and GND to set calibration level, or float this pin to disable ACC function.
9	DIM4	PWM control input for the shunt FET dimming of LED4. Signal “L” bypasses the LED4 and then turns off LED4. Signal “H” disables the dimming switch and turns on LED4. Let the pin floating and be pulling “H” internally.
10	DIM3	PWM control input for the shunt FET dimming of LED3. Signal “L” bypasses the LED3 and then turns off LED4. Signal “H” disables the dimming switch and turns on LED3. Let the pin floating and be pulling “H” internally.
11	DIM2	PWM control input for the shunt FET dimming of LED2. Signal “L” bypasses the LED2 and then turns off LED2. Signal “H” disables the dimming switch and turns on LED2. Let the pin floating and be pulling “H” internally.
12	DIM1	PWM control input for the shunt FET dimming of LED1. Signal “L” bypasses the LED1 and then turns off LED1. Signal “H” disables the dimming switch and turns on LED1. Let the pin floating and be pulling “H” internally.
13	VCC1	Local power for LED 1 dimming.
14	GATE1	The gate control pin of external dimming MOSFET switch for the maximum 1A constant output current.
15	LED1_2	Connect LED1 anode to LED2 cathode.
16	VCC2	Local power for LED 2 dimming.
17	GATE2	The gate control pin of external dimming MOSFET switch for the maximum 1A constant output current.
18	LED2_3	Connect LED2 anode to LED3 cathode.
19	VCC3	Local power for LED 3 dimming.
20	GATE3	The gate control pin of external dimming MOSFET switch for the maximum 1A constant output current
21	LED3_4	Connect LED3 anode to LED4 cathode.
22	VCC4	Local power for LED 4 dimming.
23	GATE4	The gate control pin of external dimming MOSFET switch for the maximum 1A constant output current
24	VCCS	Local power for current sense amplifier

GFN (QFN4×4-24) Package

Pin No.	Pin Name	Function
1	VBT	High-side Bootstrap gate drive supply. External bootstrap capacitor 0.1μF (ceramic) is required. Please connect positive side of bootstrap capacitor to this pin.
2	VSW	Switching node. Connect the source of high side N-type MOSFET switch and the negative side of bootstrap capacitor to this pin.
3	GATE	The input control pin of external high side power MODFET switch for the maximum 1A constant output current.
4	VCCH	Supply input
5	GND	The signal ground pin.
6	ACC	ACC setting pin, attach resistor between ACC pin and GND to set calibration level, or float this pin to disable ACC function.
7	DIM4	PWM control input for the shunt FET dimming of LED4. Signal “L” bypasses the LED4 and then turns off LED4. Signal “H” disables the dimming switch and turns on LED4. Let the pin floating and be pulling “H” internally.
8	DIM3	PWM control input for the shunt FET dimming of LED3. Signal “L” bypasses the LED3 and then turns off LED4. Signal “H” disables the dimming switch and turns on LED3. Let the pin floating and be pulling “H” internally.
9	DIM2	PWM control input for the shunt FET dimming of LED2. Signal “L” bypasses the LED2 and then turns off LED2. Signal “H” disables the dimming switch and turns on LED2. Let the pin floating and be pulling “H” internally.
10	DIM1	PWM control input for the shunt FET dimming of LED1. Signal “L” bypasses the LED1 and then turns off LED1. Signal “H” disables the dimming switch and turns on LED1. Let the pin floating and be pulling “H” internally.
11	VCC1	Local power for LED 1 dimming.
12	GATE1	The gate control pin of external dimming MOSFET switch for the maximum 1A constant output current.
13	LED1_2	Connect LED1 anode to LED2 cathode.
14	VCC2	Local power for LED 2 dimming.
15	GATE2	The gate control pin of external dimming MOSFET switch for the maximum 1A constant output current.
16	LED2_3	Connect LED2 anode to LED3 cathode.
17	VCC3	Local power for LED 3 dimming.
18	GATE3	The gate control pin of external dimming MOSFET switch for the maximum 1A constant output current.
19	LED3_4	Connect LED3 anode to LED4 cathode.
20	VCC4	Local power for LED 4 dimming.
21	GATE4	The gate control pin of external dimming MOSFET switch for the maximum 1A constant output current.
22	VCCS	Local power for current sense amplifier.
23	ISN	The negative input to the output current sense amplifier.
24	ISP	The positive input to the output current sense amplifier.
	THERMAL PAD	Thermal PAD

Maximum Ratings

Operation above the maximum ratings may cause device failure. Operation at the extended periods of the maximum ratings may reduce the device reliability.

Characteristic		Symbol	Rating	Unit
Supply Voltage		VCCH, VCCS, VCC1~4	-0.3~65	V
Sustaining voltage at GATE, VSW, ISP, ISN, LED1_2, LED2_3, LED3_4		GATE, VSW, ISP, ISN, LED1_2, LED2_3, LED3_4	-0.3~65	V
Sustaining Voltage at VBT pin		VBT	-0.3~70	V
Sustaining Voltage at DIM1~4, ACC, GATE1~4 pin		DIM1~4, ACC, GATE1~4	-0.3~7	V
Thermal Resistance (By simulation, on 4-Layer PCB)*	GF(SOP-24)	$\Theta_{(j\text{-}a)}$	90	℃/W
	GP (TSSOP-24)		73	
	GFN (QFN-24)		37	
Junction Temperature		$T_{j,max}$	150**	℃
Operating Ambient Temperature		T_{opr}	-40~+85	℃
Storage Temperature		T_{stg}	-55~+150	℃
ESD Rating	Human Body Mode (MIL-STD-883G Method 3015.8)	HBM	Class 2 (2.5kV)	-
	Machine Mode (ANSI/ ESD S5.2-2009)	MM	Class M3 (250V)	-

*The PCB size is 76.2mm*114.3mm in simulation. Please refer to JEDEC JESD51-7 thermal measurement standard.

**Operation at the maximum rating for extended periods may reduce the device reliability; therefore, the suggested junction temperature of the device is under 125°C.

Note: The performance of thermal dissipation is strongly related to the size of thermal pad, thickness and layer numbers of the PCB. The empirical thermal resistance may be different from simulative value. Users should plan for expected thermal dissipation performance by selecting package and arranging layout of the PCB to maximize the capability.

Electrical Characteristics

V_{IN}=19V, V_{OUT}=12V, L=22μH, C_{IN}=10μF, T_A=25℃; unless otherwise specified.

Characteristics	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input and Output voltage						
Supply Voltage	V_{IN}	V_{OUT}=2 LEDs	9		55	V
Quiescent Current	I_Q	No switching		2	5	mA
Continuous LX switching current	$I_{LX(mean)}$	External NMOS	0.5		5	A
Start-up voltage threshold	V_{CC_STR-UP}			8.2	9.0	V
Under Voltage Lock Out voltage	V_{CC_UVLO}		6.3	7.0	-	V
Current Sensing						
Mean sense voltage	V_{SENSE}	V_{ISP}-V_{ISN}	-	100	-	mV
Sense voltage hysteresis	V_{SENSE_HYS}		-	15	-	%
Output current setting accuracy		I_{OUT}=350mA, V_{IN}=20V, LED=1~4, no dimming			±3	%
Channel Skew		With ACC function (V_{IN}=20V, LED=1~4)			±2	%
High side Gate Driver						
Gate driver source resistance	R_{SRC}	ISP-ISN<0.1V, sink 50mA		10	20	Ω
Gate driver sink resistance	R_{SNK}	ISP-ISN>0.1V, source 50mA		5	10	Ω
Output high voltage	$V_{GATE(H)}$	ISP-ISN<0.1V, sink 50mA, V_{BT}-V_{SW}=5V	4		5.5	V
Output low voltage	$V_{GATE(L)}$	ISP-ISN>0.1V, source 50mA			0.5	V
VSW Rise Time	t_{Rise_SW}			20		ns
VSW Fall Time	t_{Fall_SW}			20		ns
Maximum On Time	t_{MAX_ON}		400	450	500	μs
Internal Propagation Delay Time	t_{PD}		100	280	350	ns
Minimum SW On Time	$t_{ON(MIN)}$		-	250	-	ns
Minimum SW Off Time	$t_{OFF(MIN)}$		-	250	-	ns
Recommended duty cycle range of SW	D_{SW}		20	-	80	%
Recommended operation frequency range	F_{SW}		40	-	500	kHz
PWM Dimming (Control by DIM1/ DIM2/ DIM3/ DIM4)						
Input Voltage of PWM “H” Level	$V_{PWM(IH)}$		3.2	-	-	V
Input Voltage of PWM “L” Level	$V_{PWM(IL)}$				0.5	V
PWM Dimming Frequency	F_{DIM}	Dimming Resolution: 14 bit@1KHz	1	-	25	kHz
Shunt Dimming Switches						
Dimming gate driver source resistance	R_{SRC_Drive}			12	20	Ω
Dimming gate driver sink resistance	R_{SNK_Drive}			6	20	Ω

PWM to Dimming Gate Falling (High to Low)	t_{DIM_H2L}	C_{Load}=50pF, 50% level		75		ns
PWM to Dimming Gate Rising (Low to High)	t_{DIM_L2H}	C_{Load}=50pF, 50% level		50		ns
Adjustable Output Current Calibration (ACC)						
ACC pin voltage	V_{ACC}			1.2		V
I_{ACC} and V_{sense} calibration voltage ratio	V_{SNS_CAL}/I_{ACC}		8	10	12	mV/mA
Protection						
Thermal Shut down threshold	T_{OVP}			150		℃
Thermal Shut down hysteresis	T_{OVP_HYS}			30		℃

Typical Performance Characteristic

1. Efficiency vs. Input Voltage at various output voltage

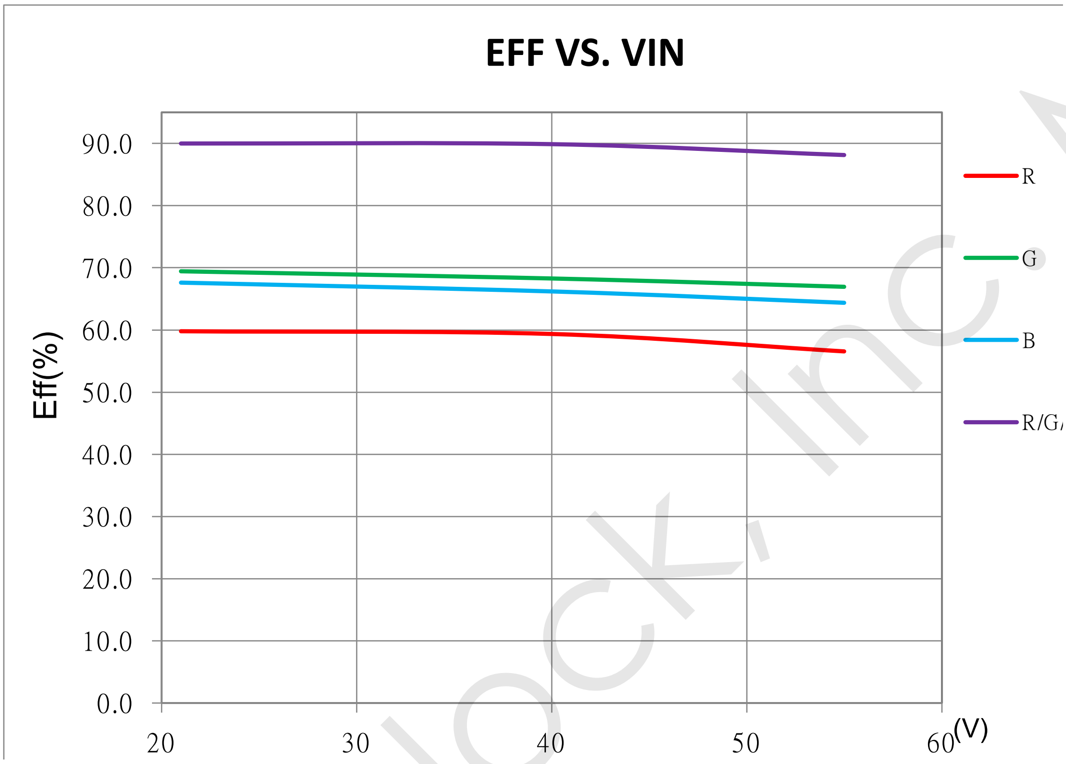


Fig.5 Efficiency vs. Input voltage at I_{OUT} = 1A

2. Output Current Change at Various Ambient Temperatures

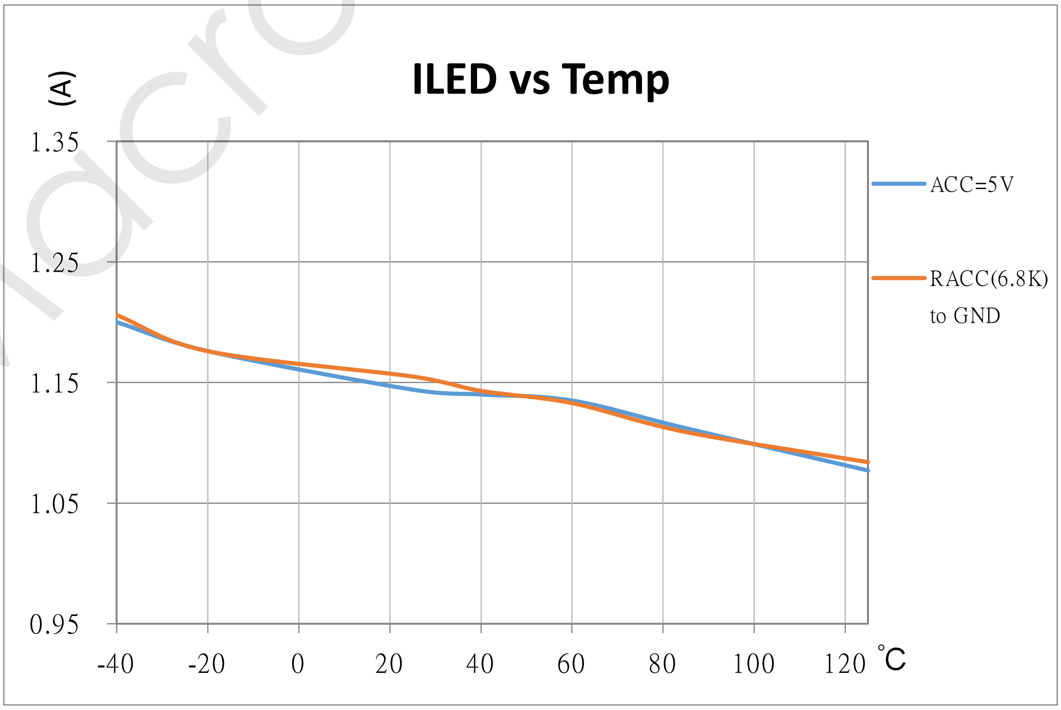


Fig.6 Output current vs. various ambient temperatures

3. Start-up and UVLO Waveform at Various Ambient Temperatures

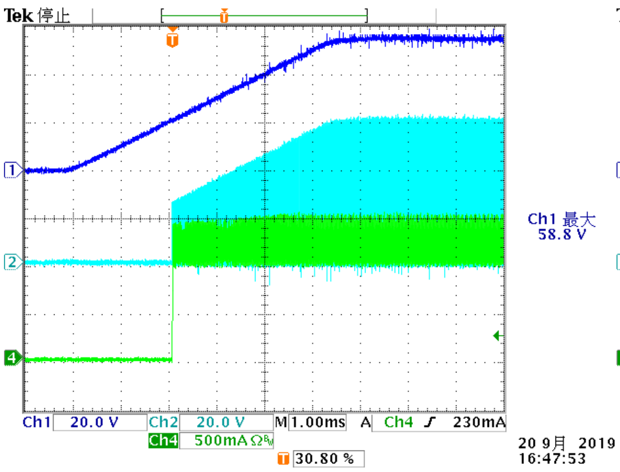


Fig.7 Start-up waveform at T_A=-40℃

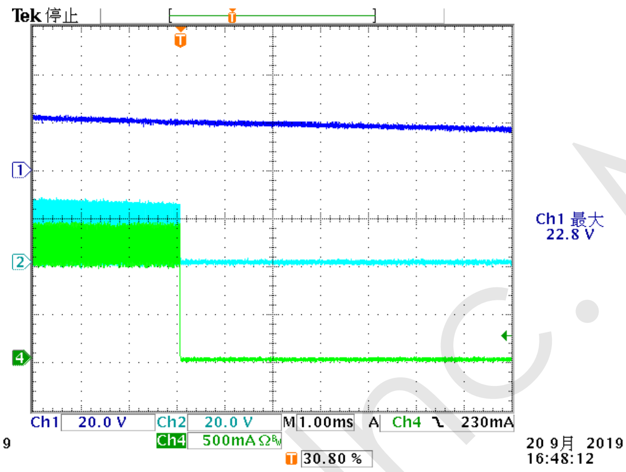


Fig.8 UVLO waveform at T_A=-40℃

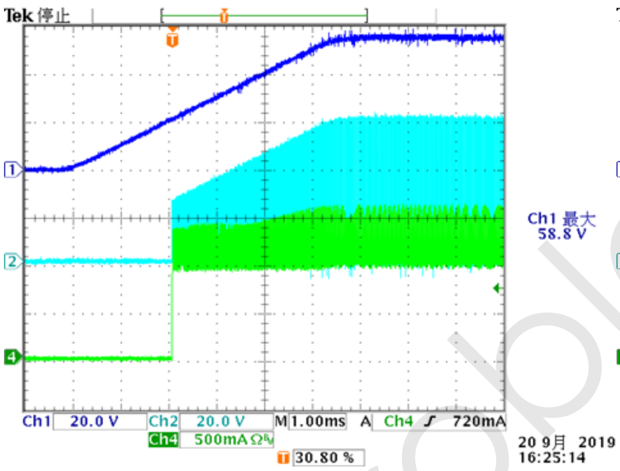


Fig.9 Start-up waveform at T_A=0℃

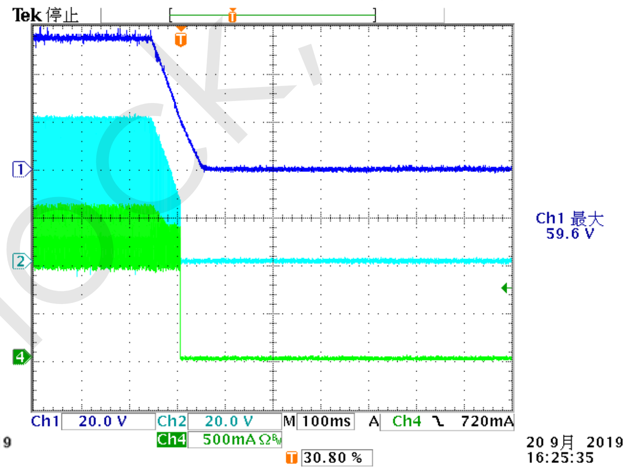


Fig.10 UVLO waveform at T_A=0℃

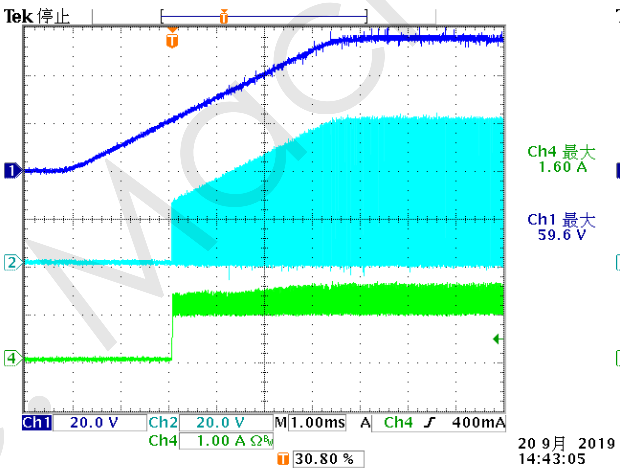


Fig.11 Start-up waveform at T_A=25℃

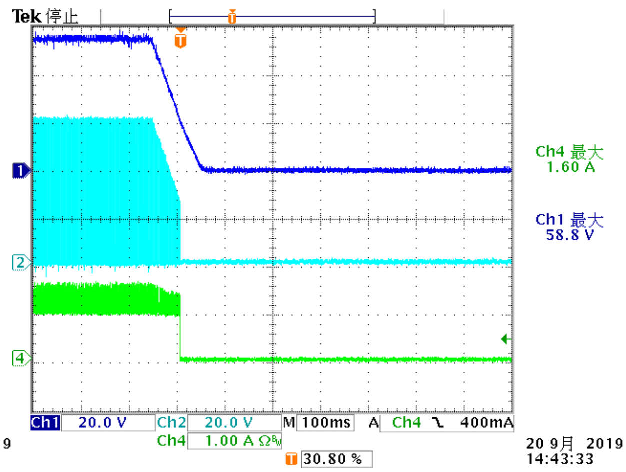


Fig.12 UVLO waveform at T_A=25℃

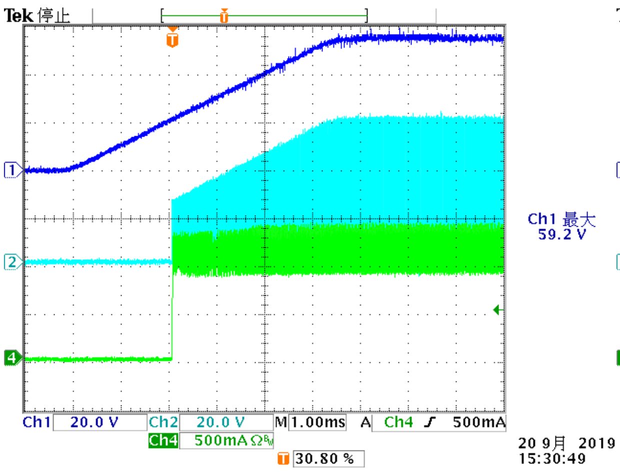


Fig.13 Start-up waveform at T_A=85℃

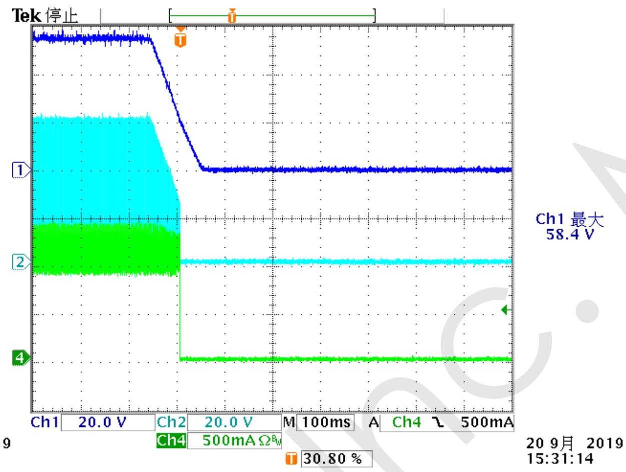


Fig.14 UVLO waveform at T_A=85℃

4. Dimming Linearity at Various Ambient Temperatures

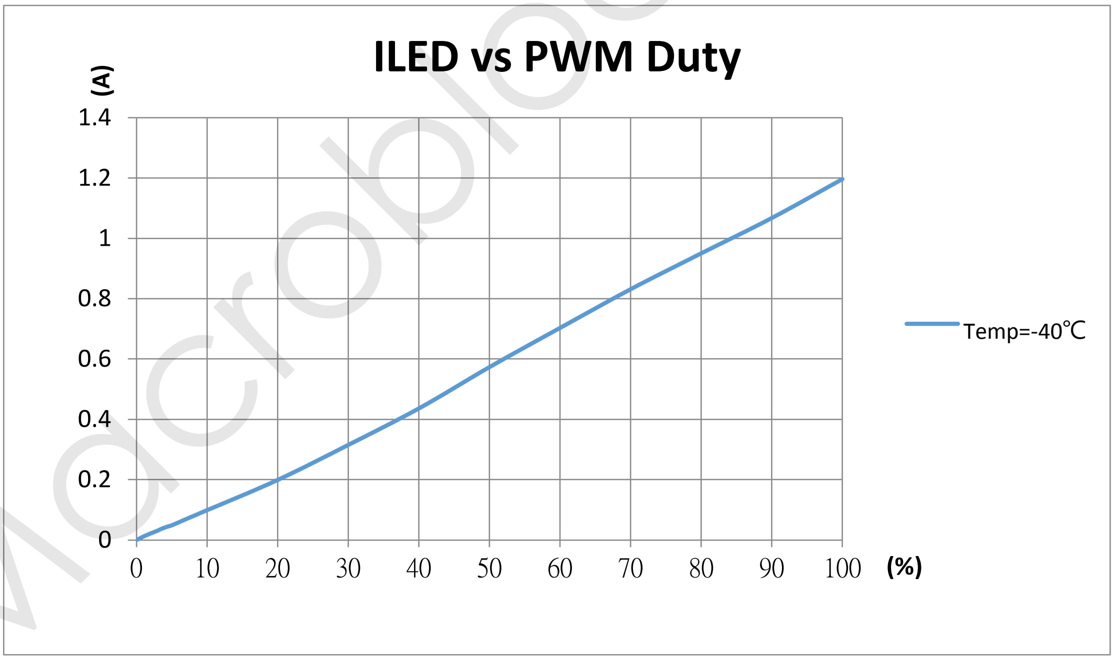


Fig.15 Dimming Linearity at T_A=-40℃

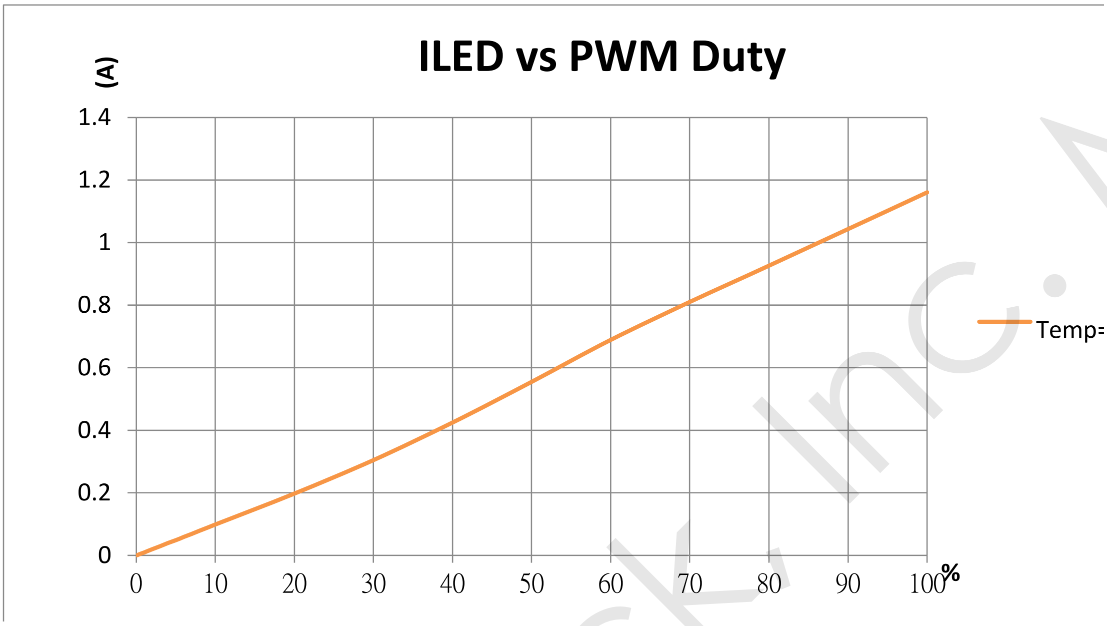


Fig.16 Dimming Linearity at T_A=25℃

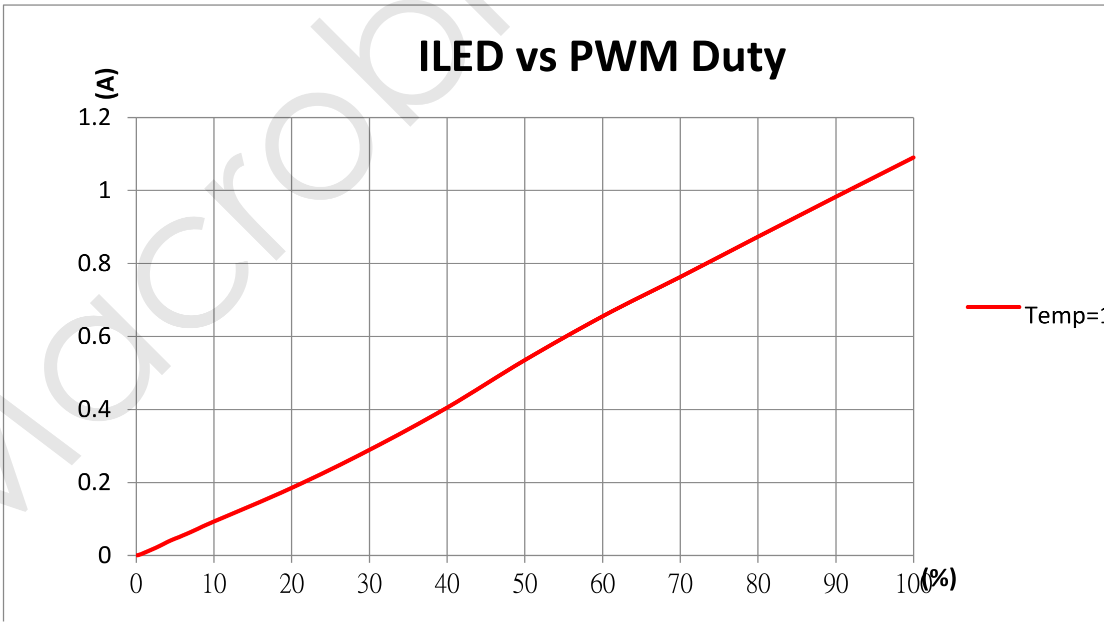


Fig.17 Dimming Linearity at T_A=125℃

5. ACC Function Test

V_{IN}=21V, V_{OUT}= "lighting up Red LED" or "lighting up RGB LEDs", I_{LED}=1A, L=10μH, F_{DIM}=1 kHz, T_A=25℃

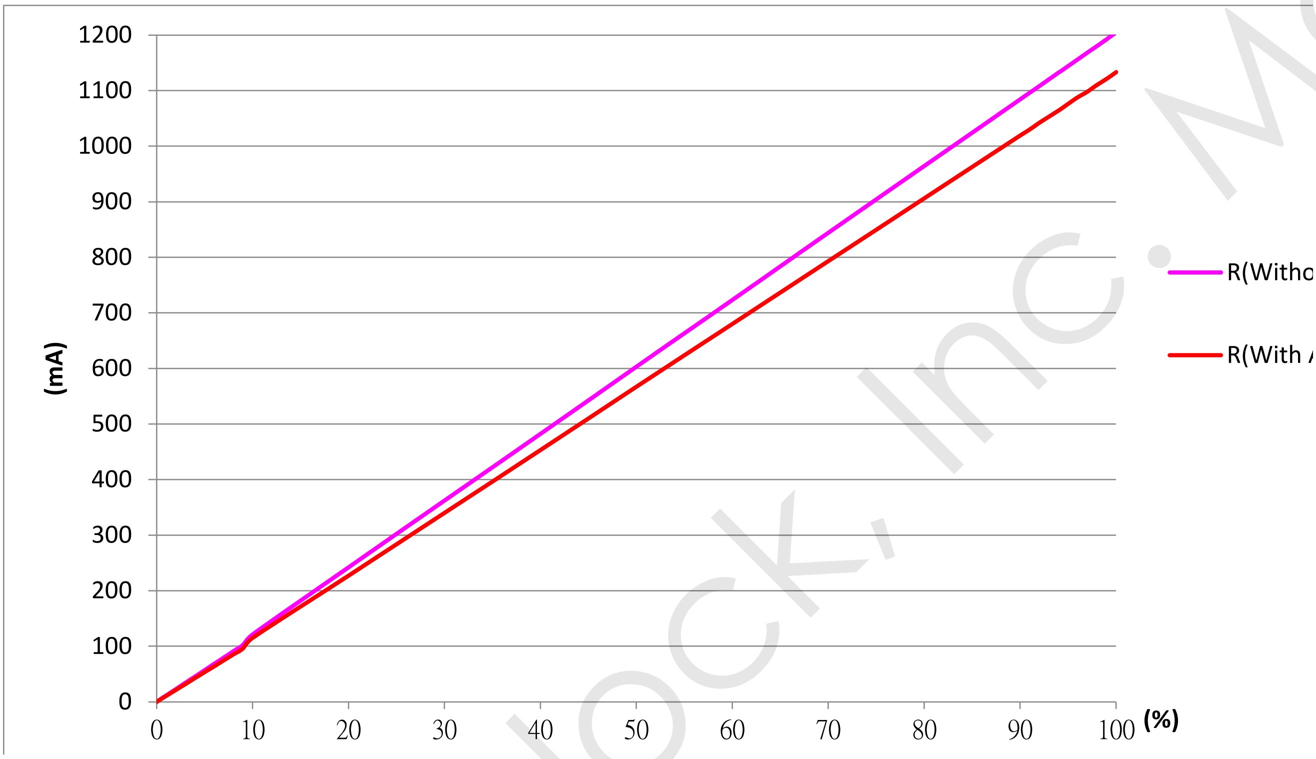


Fig. 18 The comparison of lighting up Red LED Without ACC and with ACC

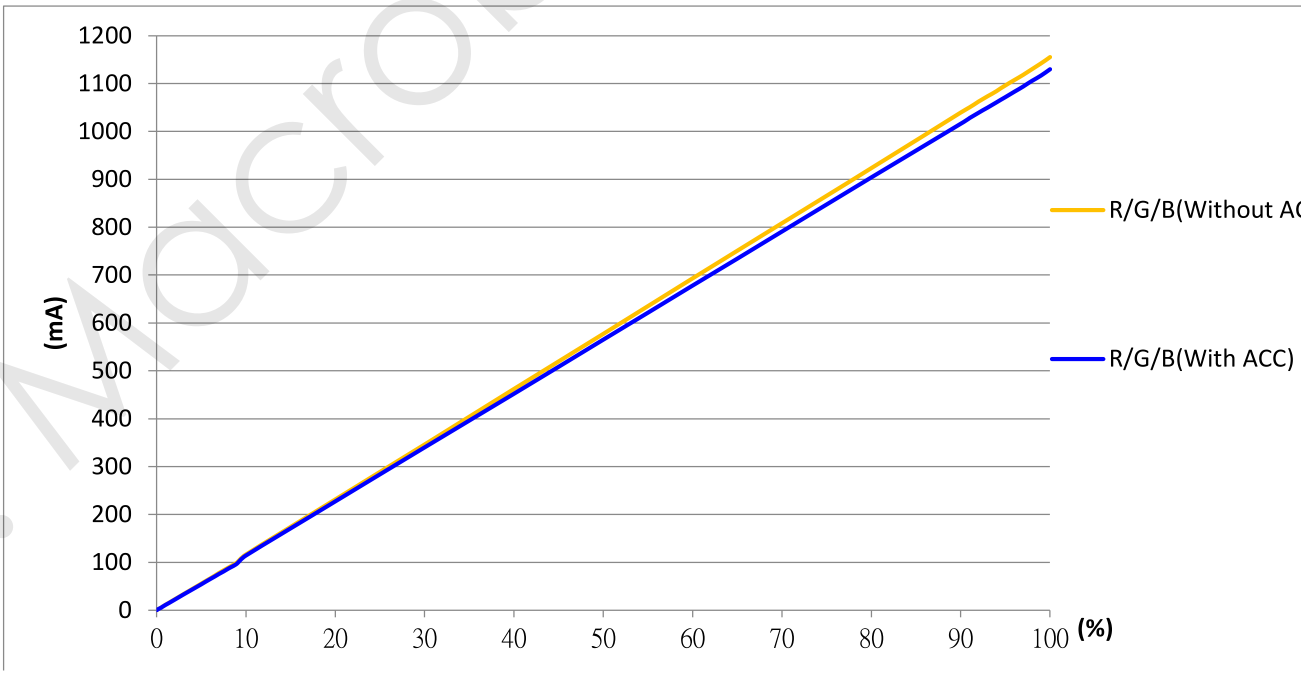


Fig. 19 The comparison of lighting up Red LED and RGB (with ACC)

Application Information

Single Inductor Multi Output Configuration (SIMO)

Due to the high request in stage lighting, such as high dimming resolution, high dimming linearity, high color rendering, stage lighting often use Red, Green, Blue and White to do color mixing, which increase LED modules and volumes. As Fig. 20 shown, MBI6673 is a configuration of single inductor multi output (SIMO). The electrical circuit is an asynchronous Buck and collocates RGBW series application circuit and dimming switching components (M1~M4). Users could realize various color mixing results through driving individually RGBW pins. Compared to traditional Buck circuit, SIMO can make PCB design easier, shrink volumes and decrease cost. In short, in comparison to traditional Buck driving RGBW LEDs, MBI6673 could help users to save 3 inductors, 3 driver ICs and 3 MOSFETs.

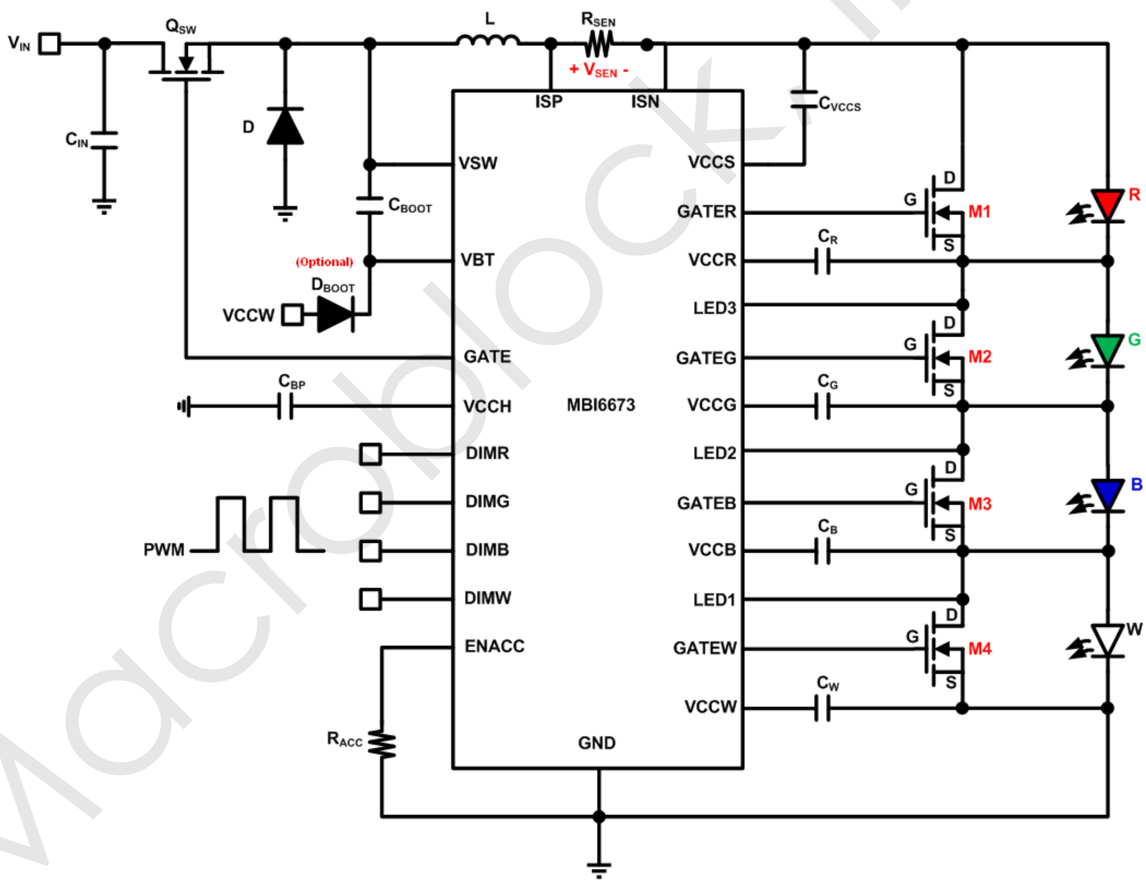


Fig. 20 The application circuit of MBI6673

Support multiple LEDs connected in series

From those description above, MBI6673 specific single inductor multi-output (SIMO) configuration could control individually 4 LEDs of different colors and even 4 LED strings. It is because MBI6673 built-in high voltage components could allow users to connetct more than 1 LED in series for each channel.

For example, in reference to Fig. 20, now the lighting fixture design is : red LED string, green LED string, blue LED string and white LED string, and each LED string comprise 2 LEDs; if designed with traditional LED driver IC, the PCB space would be very complicated and crowded. Fortuantely, MBI6673 could substaintially decline this design difficutly : MBI6673 could drive 4 LED strings of different colors. However, with the numbers of LED connected in series increasing, when more than two LED strings proceed dimming, the voltage spikes produced from shunt dimming would be more and more. As the voltage spikes are more than absolute maximum rating of high voltage components, MBI6673 would damage and even be burnt-out. Besides, this voltage spike resulted from shunt dimming is more than V_F of adjacent LED

Hysteretic Pulse Frequency Modulation Control Scheme

The key feature of MBI6673 is an Hysteretic PFM scheme. When power is on, V_{SEN} is lower than V_H, the internal MOSFET of MBI6673 would be turned on and V_{SEN} increases with inductor current, I_L. As VSEN is higher than V_H, the MOSFET turns off and V_{SEN} decreases with I_L until V_{SEN} is lower than V_L. The inductor current will always work in Continuous Conduction Mode (CCM) due to the characteristcs of Hysteretic PFM control scheme. This is helpful in terms of reducing the LED ripple current. Fig. 21 shows the relative waveform of hysteretic PFM control.

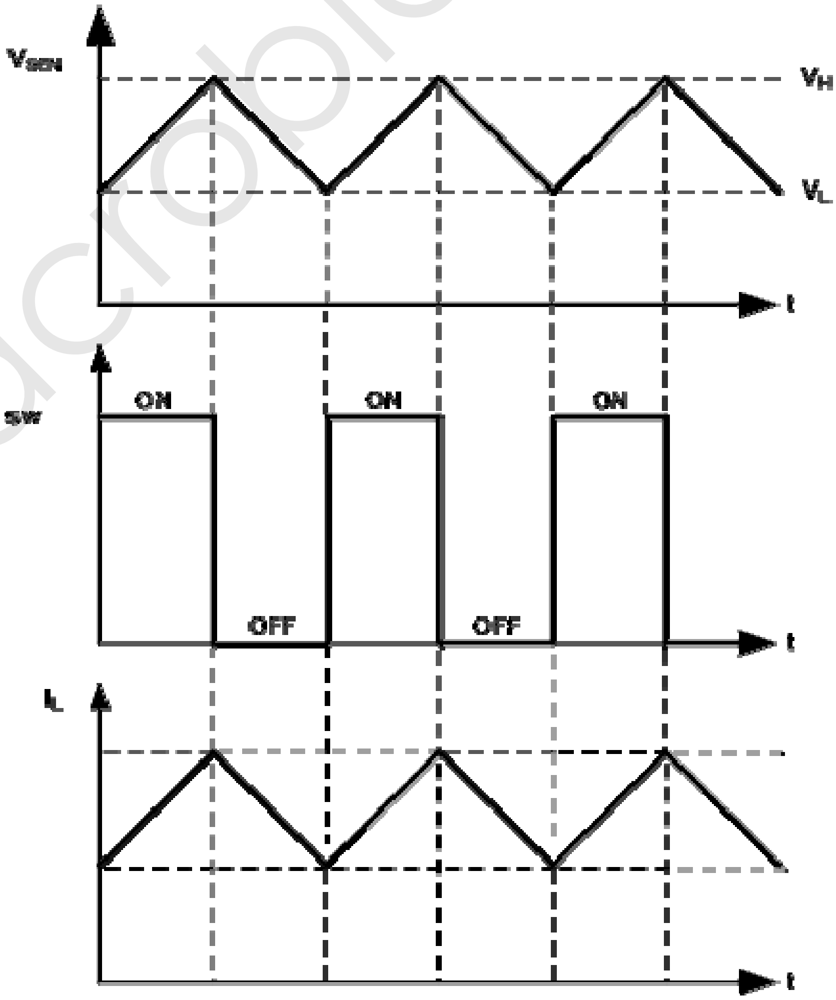


Fig. 21 Waveforms of hysteretic PFM control scheme

Under Voltage Lock Out (UVLO)

When V_{IN} reaches the threshold voltage of $V_{Start\text{-}up}$, the MBI6673 starts working and provides gate signal to the main switch, Q_{SW}. Once the V_{IN} is lower than UVLO threshold (V_{UVLO}), MBI6673 will stop working to prevent the excessive inrush current from input source. Also MBI6673 provides 1.5V hysteretic range of UVLO (V_{UVLO}=$V_{Start\text{-}up}$ – 1.5V). Fig. 22 is the waveform chart of UVLO protection.

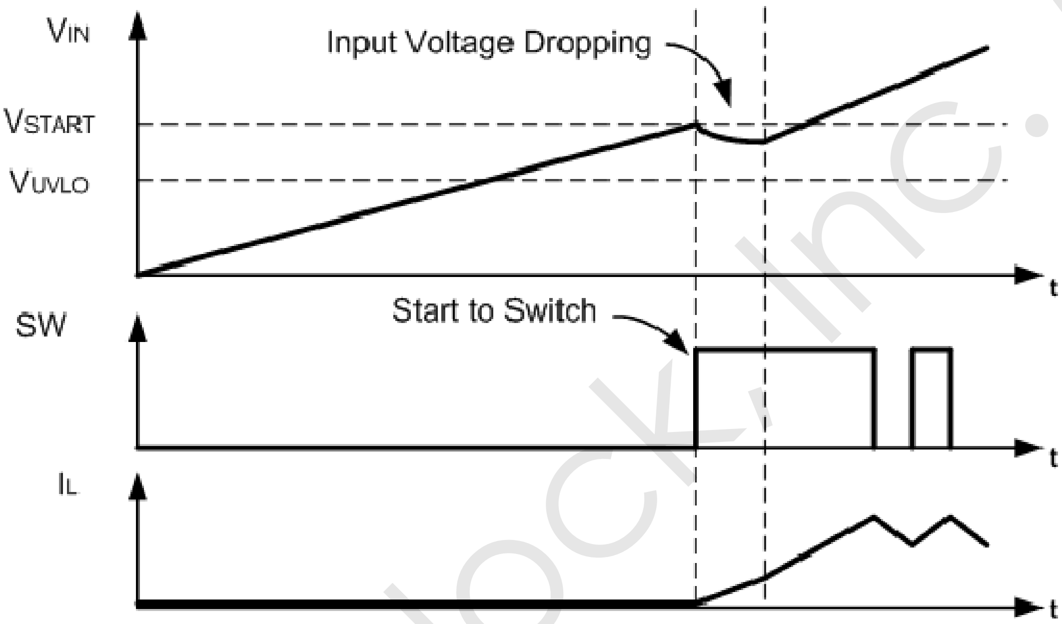


Fig. 22 Waveforms of UVLO protection

Over Temperature Protection (OTP)

The MBI6673 provides the thermal shutdown function to prevent components being damaged by overheating. The HG signal of MBI6673 will be pulled to low and turns off Q_{SW} when the junction temperature reaches thermal shut-down threshold (T_{SD}). MBI6673 will recover to normal operation when the junction temperature drops lower than hysteretic temperature point ($T_{SD\text{-}HYS}$). Fig. 23 is the waveform sketch of OTP.

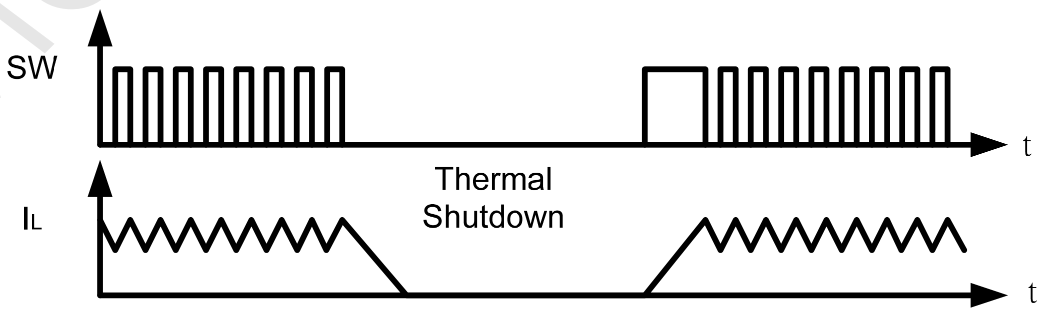
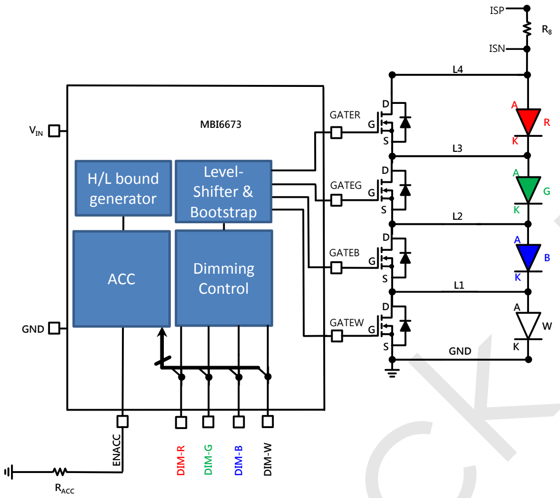


Fig. 23 Waveforms of OTP

Adjustable Output Current Calibrator (ACC)

Users could make output current compensation through external R_{ACC} between ENACC pin and ground, recommended 20kΩ. If there is no need to use ACC function, please leave the ENACC pin open to close ACC circuit. Fig. 24 is ACC circuit.



2

Fig. 24 ACC application circuit

PWM Dimming Function

Users could do PWM dimming through sending dimming signals into RGBW DIM pin of MBI6673. Output current could rise along with duty cycle increasing. The high level of PWM signal is 5V. The change of current with PWM dimming could be derived from (1) :

$$I_{LED,PWM} = D_{PWM} \times I_{LED} \quad \text{...}(1)$$

where D_{PWM} is duty cycle of PWM signal.

During power on process, we recommend to follow the rule, “Sending VIN power and then DIM signal”, to light up LED. When all four DIM pins would not accept any PWM dimming signal, LED would be not lighted up because the voltage of DIM pin is in the status, “pull low”.

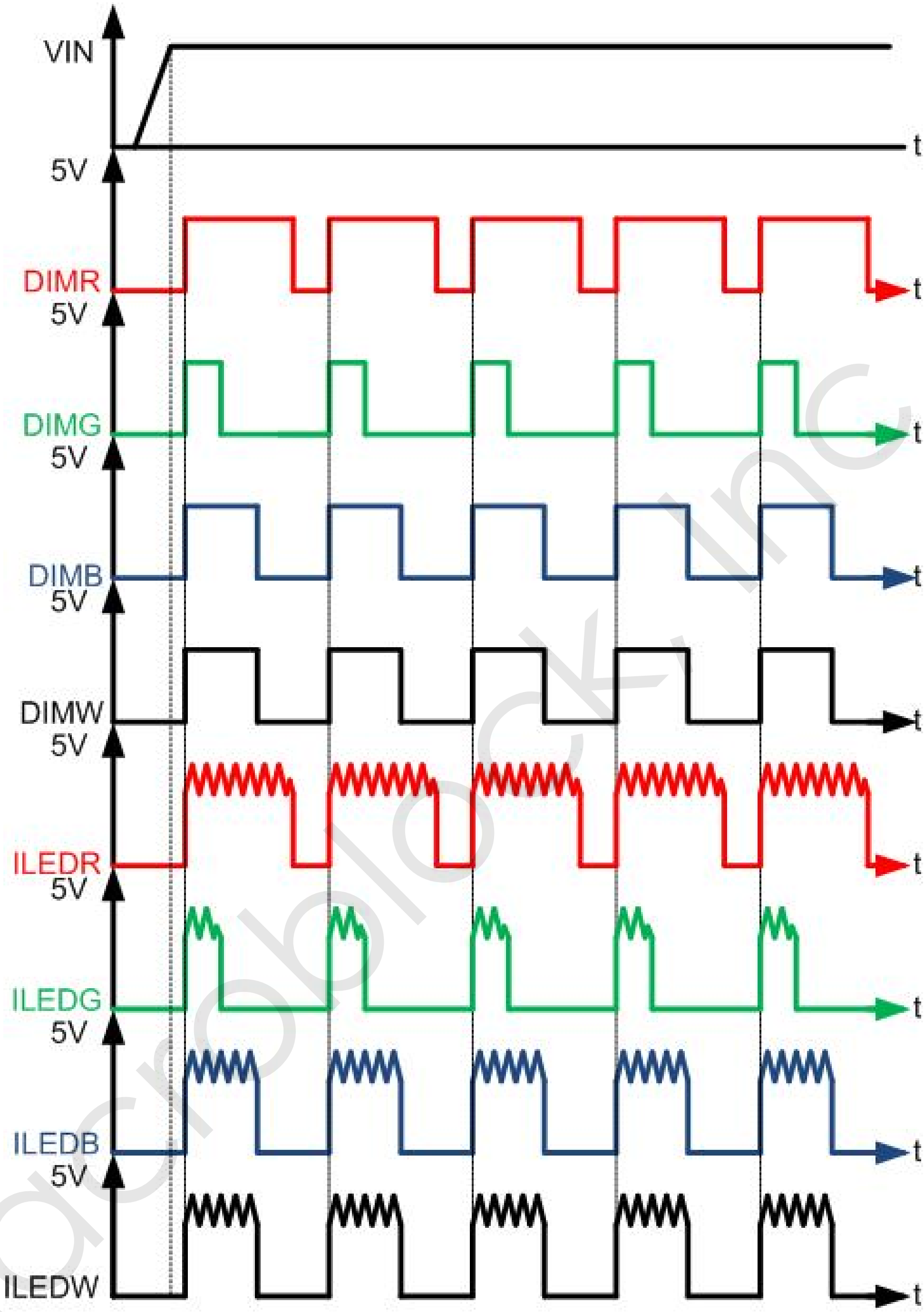
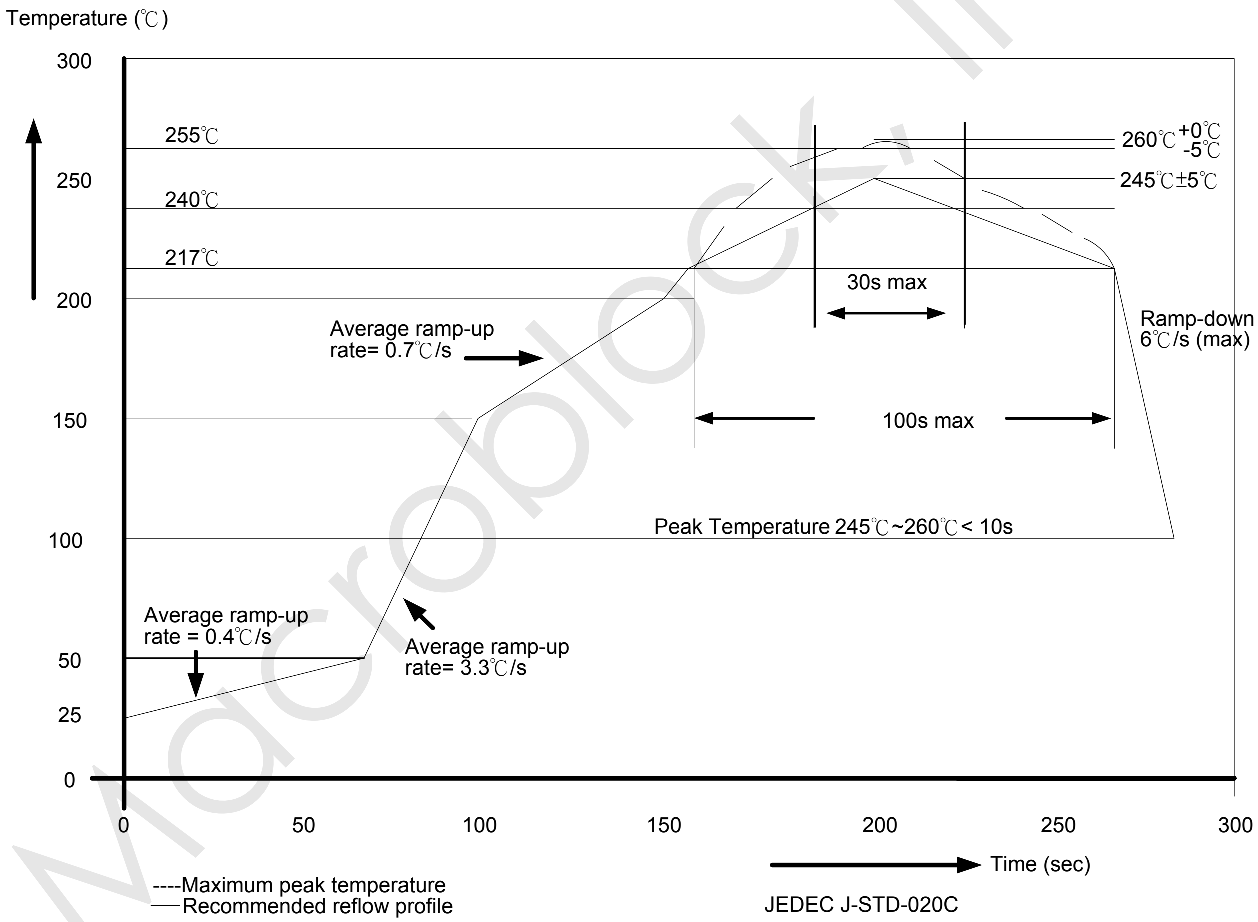


Fig. 25 Waveforms of PWM dimming

Besides, in PWM dimming applications, dimming resolutio is related with switching frequency; that is, the higher switching frequency, the higher dimming resolution. In normal situation, the minimum “on” pulse width of PWM signal is 3~5 times bigger than IC switching cycle. However, the higher switching frequency would produce higher switching loss in order to make external MOSFET temperature rise. Therefore, it is the very trade-off between dimming resolution and IC switching frequency.We recommend that dimming frequency should be operated at 1 kHz to 4 kHz for flicker-free and noise-free.

Soldering Process of “Pb-free” Package Plating*

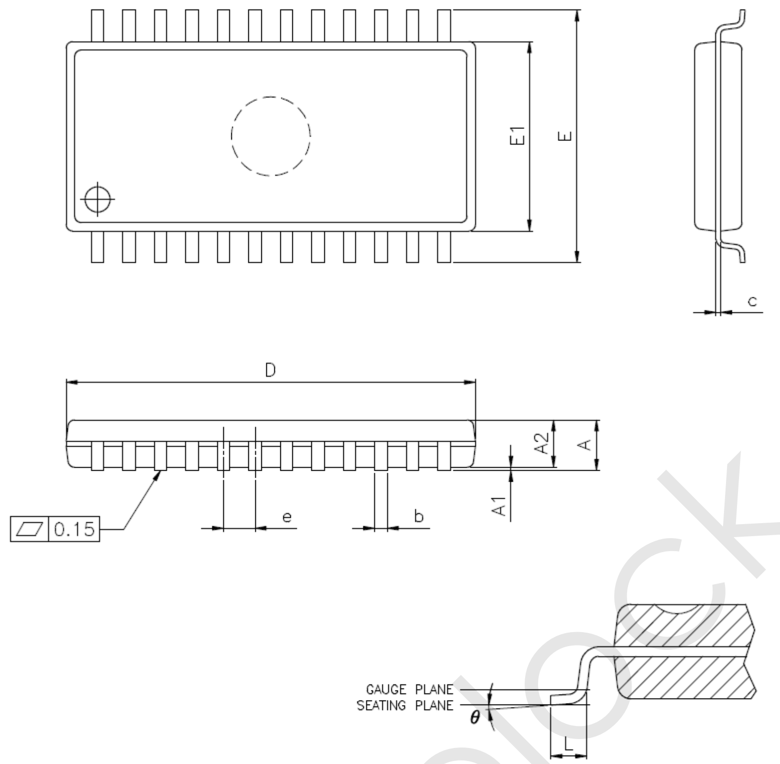
Macroblock has defined "Pb-Free & Green" to mean semiconductor products that are compatible with the current RoHS requirements and selected 100% pure tin (Sn) to provide forward and backward compatibility with both the current industry-standard SnPb-based soldering processes and higher-temperature Pb-free processes. Pure tin is widely accepted by customers and suppliers of electronic devices in Europe, Asia and the US as the lead-free surface finish of choice to replace tin-lead. Also, it adopts tin/lead (SnPb) solder paste, and please refer to the JEDEC J-STD-020C for the temperature of solder bath. However, in the whole Pbfree soldering processes and materials, 100% pure tin (Sn) will all require from 245°C to 260°C for proper soldering on boards, referring to JEDEC J-STD-020C as shown below.



Package Thickness	Volume mm³ <350	Volume mm³ 350-2000	Volume mm³ ≧2000
<1.6mm	260 + 0 °C	260 + 0 °C	260 + 0 °C
1.6mm – 2.5mm	260 + 0°C	250 + 0 °C	245 + 0 °C
≧2.5mm	250 + 0 °C	245 + 0°C	245 + 0 °C

* For details, please refer to Macroblock’s “Policy on Pb-free & Green Package”.

Package Outline Drawing

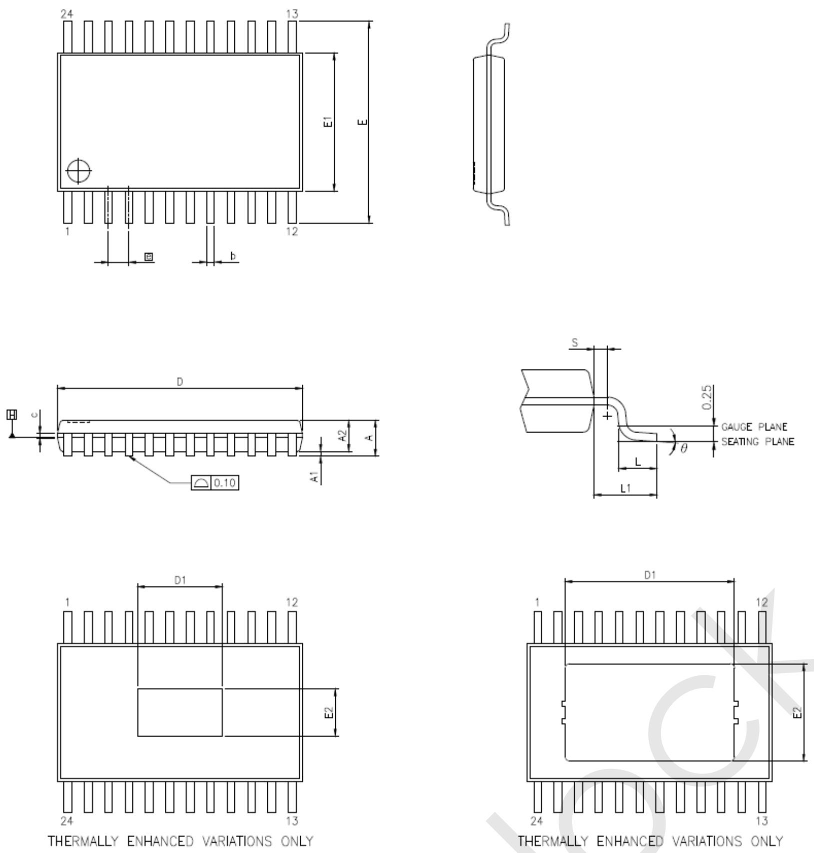


VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

SYMBOLS	MIN.	NOM.	MAX.
A	–	–	1.90
A1	0.05	0.10	0.20
A2	1.30	1.50	1.70
b	0.30	0.40	0.50
c	0.10	0.15	0.25
D	12.80	13.00	13.20
E	7.70	8.00	8.30
E1	5.80	6.00	6.20
e	1.00 BSC		
L	0.25	0.45	0.65
θ	0°	–	10°

NOTES:
1.JEDEC OUTLINE : N/A.

MBI6673 GF(SOP-24L) Package Outline Drawing



VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

SYMBOLS		MIN.	NOM.	MAX.
A		–	–	1.20
A1	STANDARD	0.05	–	0.15
	THERMALLY ENHANCED	0.00	–	0.15
A2		0.80	1.00	1.05
b		0.19	–	0.30
c		0.09	–	0.20
D		7.70	7.80	7.90
E1		4.30	4.40	4.50
E		6.40 BSC		
e		0.65 BSC		
L1			1.00 REF	
L		0.45	0.60	0.75
S		0.20	–	–
θ		0°	–	8°

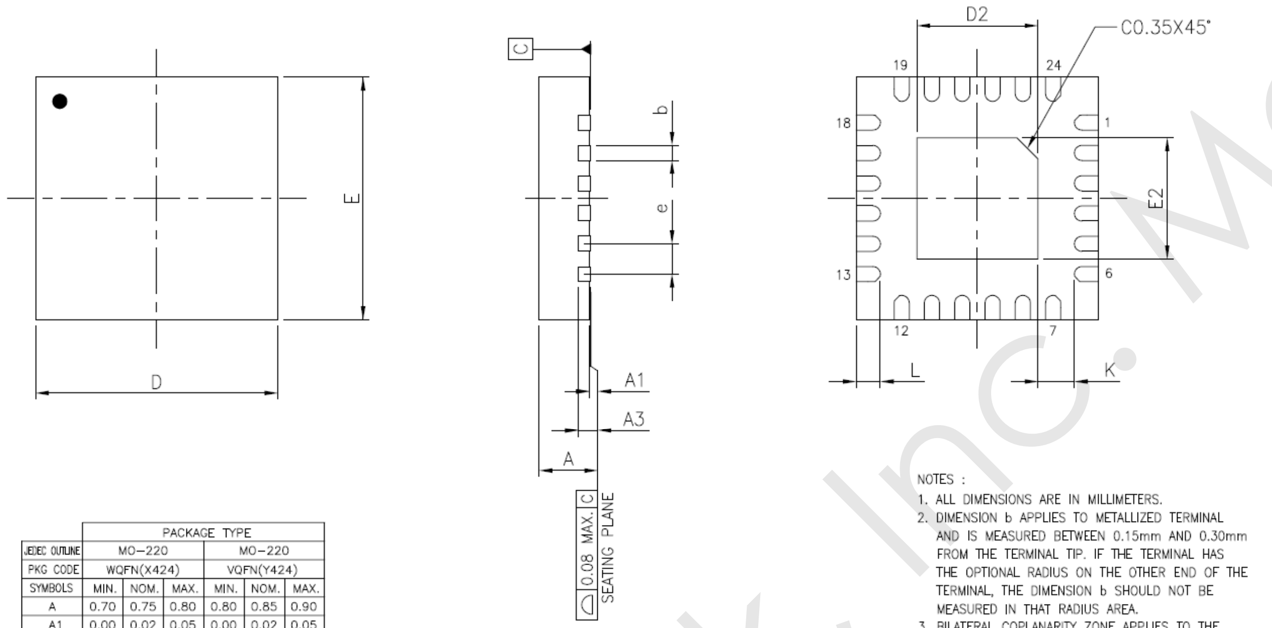
THERMALLY ENHANCED DIMENSIONS(SHOWN IN MM)

PAD SIZE	E2		D1	
	MIN.	MAX.	MIN.	MAX.
74X18*	1.50	2.03	3.70	4.77
112X18*	2.28	3.00	3.70	4.75
126X21*	2.80	3.20	5.00	5.50

"*"表示汎用字元,此汎用字元可能被其它不同字元所取代,實際的字元請參照bonding diagram所示.
"*" is an universal character, which means maybe replaced by specific character, the actual character please refers to the bonding diagram.

NOTES:
1.JEDEC OUTLINE :
STANDARD : MO-153 AD
THERMALLY ENHANCED : MO-153 ADT
2.DIMENSION 'D' DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE.
3.DIMENSION 'E1' DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 PER SIDE.
4.DIMENSION 'b' DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 MM TOTAL IN EXCESS OF THE 'b' DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT. MINIMUM SPACE BETWEEN PROTRUSION AND ADJACENT LEAD IS 0.07 MM.
5.DIMENSIONS 'D' AND 'E1' TO BE DETERMINED AT DATUM PLANE H.

MBI6673 GTS(TSSOP-24) Package Outline Drawing



	PACKAGE TYPE					
JEDEC OUTLINE	MO-220			MO-220		
PKG CODE	WQFN(X424)			VQFN(Y424)		
SYMBOLS	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.80	0.85	0.90
A1	0.00	0.02	0.05	0.00	0.02	0.05
A3	0.203 REF.			0.203 REF.		
b	0.18	0.25	0.30	0.18	0.25	0.30
D	4.00 BSC			4.00 BSC		
E	4.00 BSC			4.00 BSC		
e	0.50 BSC			0.50 BSC		
L	0.30	0.40	0.50	0.30	0.40	0.50
K	0.20	—	—	0.20	—	—

PAD SIZE	D2			E2			LEAD FINISH		JEDEC CODE
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	Pure Tin	PPF	
110X11* MIL	1.95	2.00	2.05	1.95	2.00	2.05	V	V	W(V)GGD-2

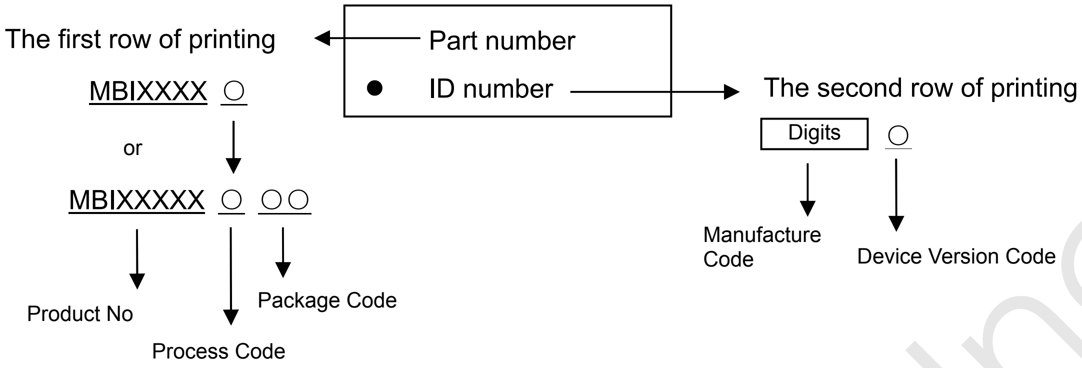
"*"表示汎用字元,此汎用字元可能被其它不同字元所取代,實際的字元請參照bonding diagram所示.
"*" is an universal character, which means maybe replaced by specific character, the actual character please refers to the bonding diagram.

NOTES :
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.15mm AND 0.30mm FROM THE TERMINAL TIP. IF THE TERMINAL HAS THE OPTIONAL RADIUS ON THE OTHER END OF THE TERMINAL, THE DIMENSION b SHOULD NOT BE MEASURED IN THAT RADIUS AREA.
3. BILATERAL COPLANARITY ZONE APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.

MBI6673 GFN(QFN4×4) Package Outline Drawing

Product Top Mark Information

GF(SOP-24L)、GTS(TSSOP-24L) & GFN(QFN4×4-24L)



Product Revision History

Datasheet version	Device Version Code
V1.00	A

Product Ordering Information

Product Ordering Number*	RoHS Compliant Package Type	Weight (g)
MBI6673GF-A	SOP-24L	0.657
MBI6673GTS-A	TSSOP-24L	0.096
MBI6673GFN-A	QFN4×4-24L	0.03

*Please place your order with the "product ordering number" information on your purchase order (PO).

Disclaimer

Macroblock reserves the right to make changes, corrections, modifications, and improvements to their products and documents or discontinue any product or service. Customers are advised to consult their sales representative for the latest product information before ordering. All products are sold subject to the terms and conditions supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

Macroblock's products are not designed to be used as components in device intended to support or sustain life or in military applications. Use of Macroblock's products in components intended for surgical implant into the body, or other applications in which failure of Macroblock's products could create a situation where personal death or injury may occur, is not authorized without the express written approval of the Managing Director of Macroblock. Macroblock will not be held liable for any damages or claims resulting from the use of its products in medical and military applications.