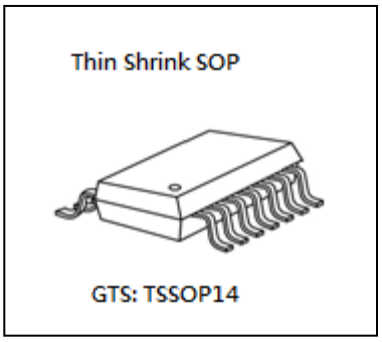
Multi-topology Constant Current Controller

Features



- 4.5~65V wide input voltage range
- Provide high constant current by external power NMOS switch Full protections: UVLO/ OVP/Thermal Shutdown / LED Open-Circuit/ Short Circuit Error Flag
- PWM/DC input for dimming control
- Full protections: Thermal shutdown/ LED Open/ Cycle-by-cycle Current-Limit
- LED short circuit detection flag

Product Description

MBI6671 is a multi-topology constant-current high-brightness LED controller to provide a reliable design solution for high power automotive illumination applications.

The output current of MBI6671 can be programmed by an external resistor and dimmed via pulse width modulation (PWM) to achieve higher efficiency linear current modulation.

MBI6671 features completed protection design to handle faulty situations. The cycle-by-cycle current limitation function limits the inrush current while the power is switched on. Thermal shutdown guards the system to be robust and keep the driver away from being damaged which results from LED open-circuited, and other abnormal events. With an error flag pin, short circuit condition can be reported to a possible external mechanism for further control decision making. MBI6671 is packaged in the thermal-enhanced TSSOP14 for efficient power dissipation.

Applications

- Automotive Lighting
- High Power LED Lighting
- Constant Current Source

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Typical Application Circuit

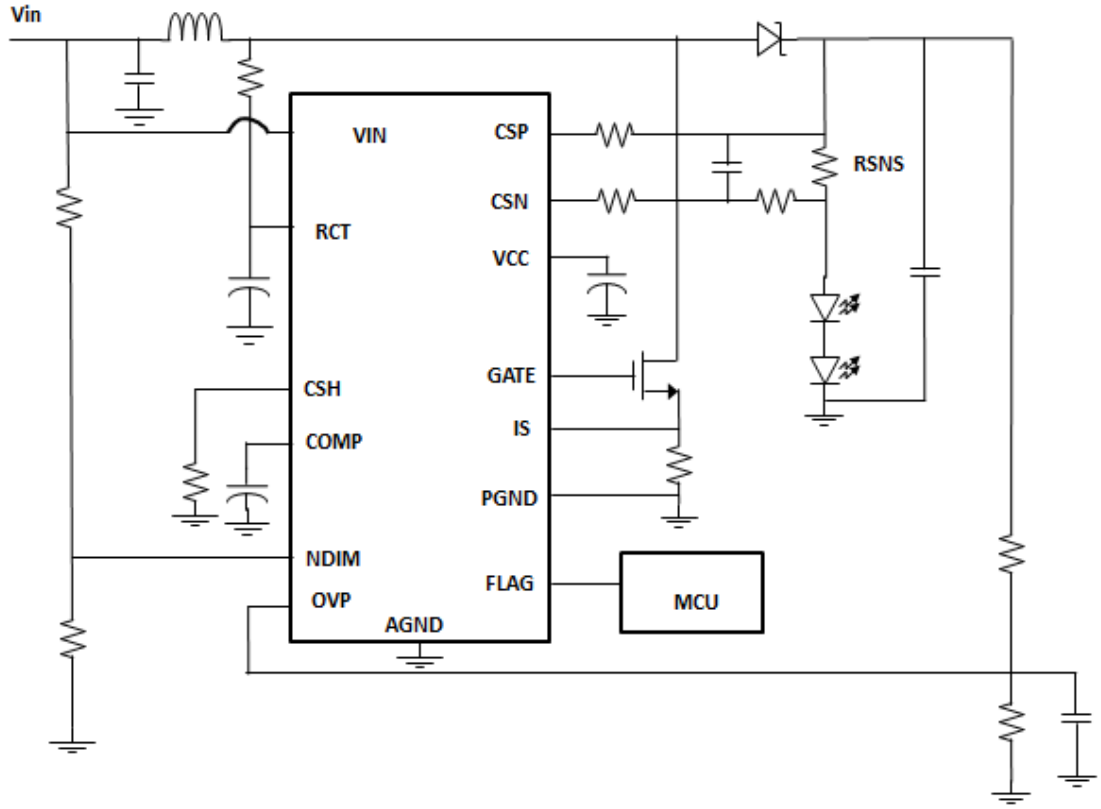


Fig. 1 Boost circuit of MBI6671

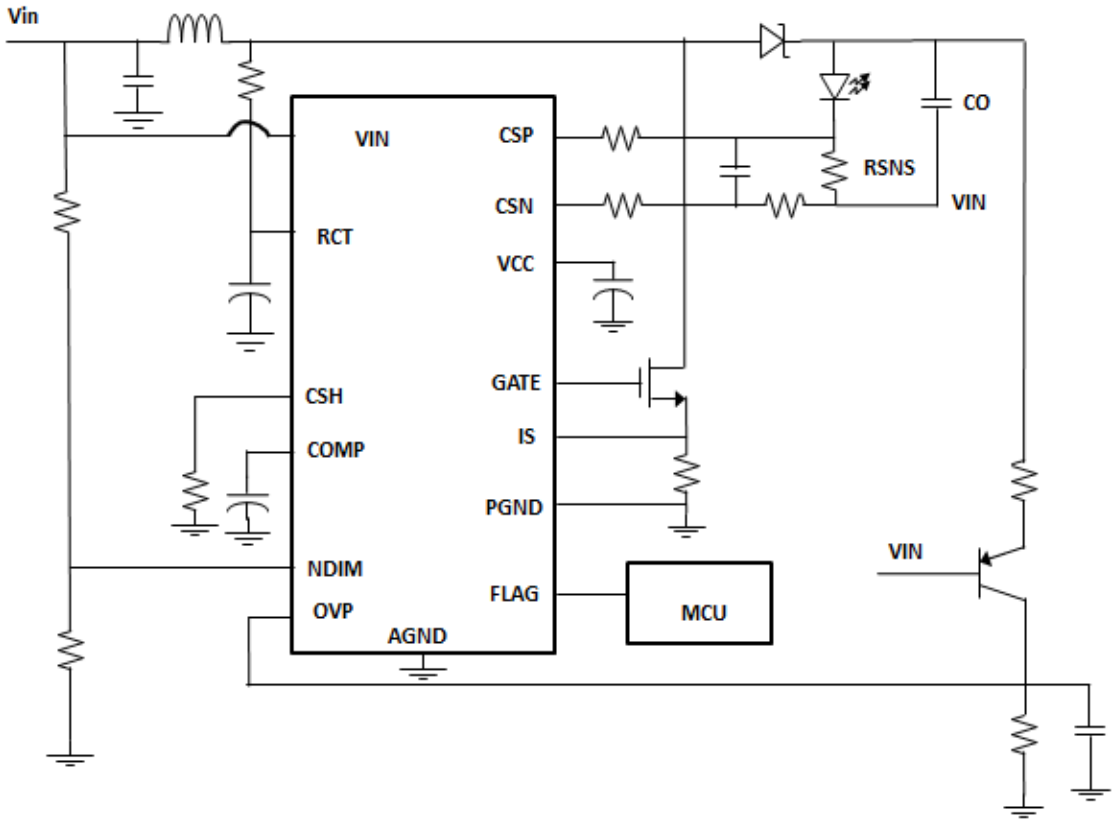


Fig. 2 Buck-Boost circuit of MBI6671

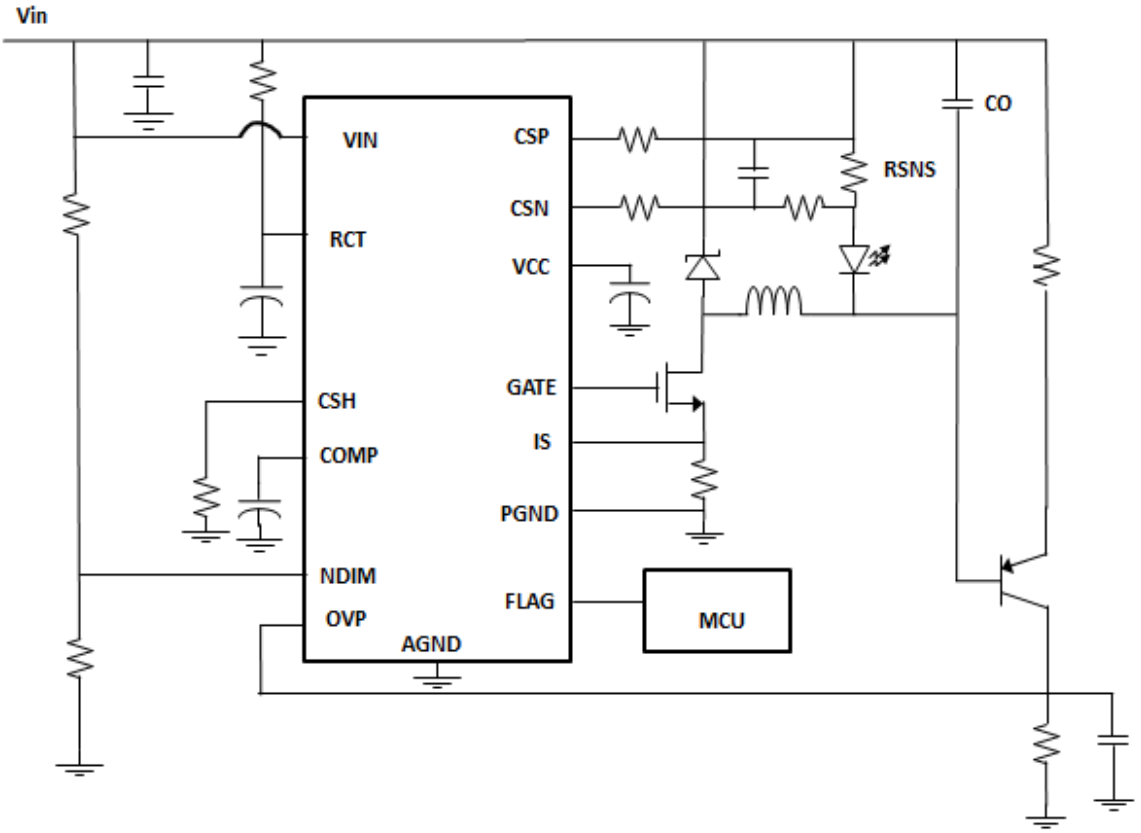


Fig. 3 Buck circuit of MBI6671

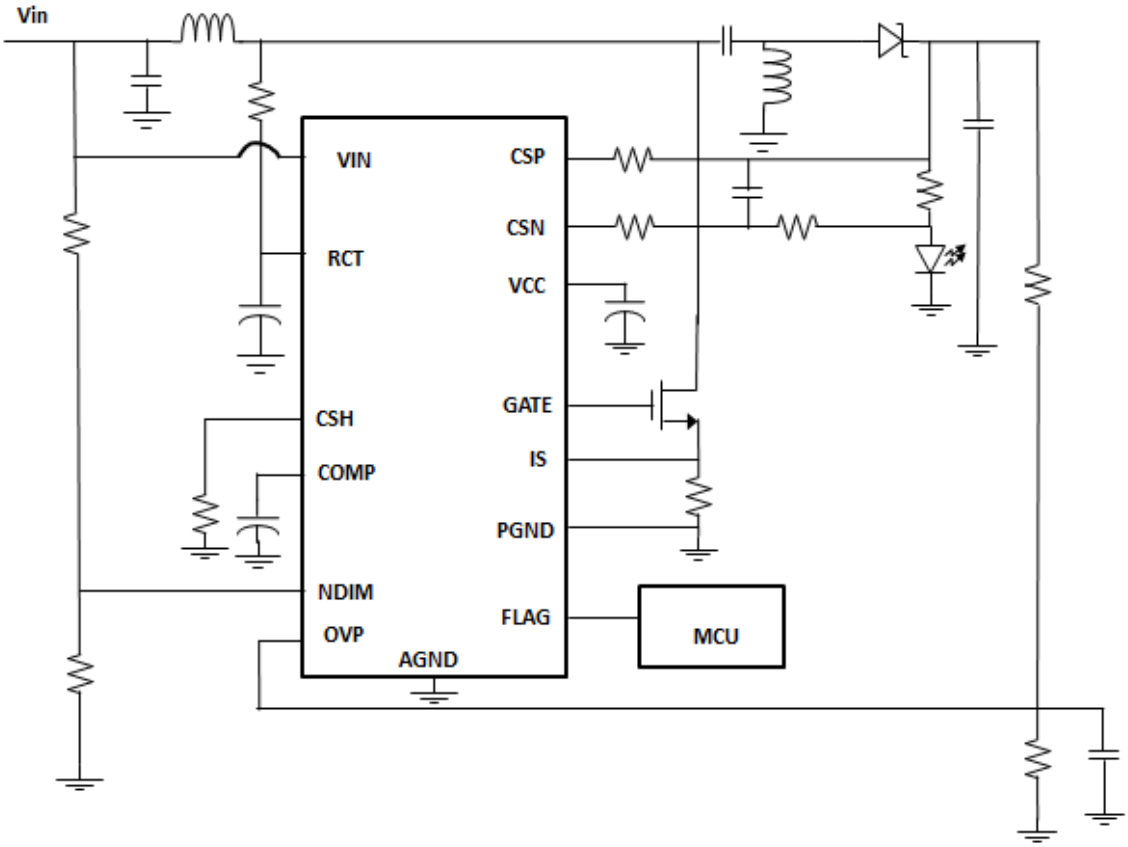


Fig. 4 SEPIC circuit of MBI6671

Functional Diagram

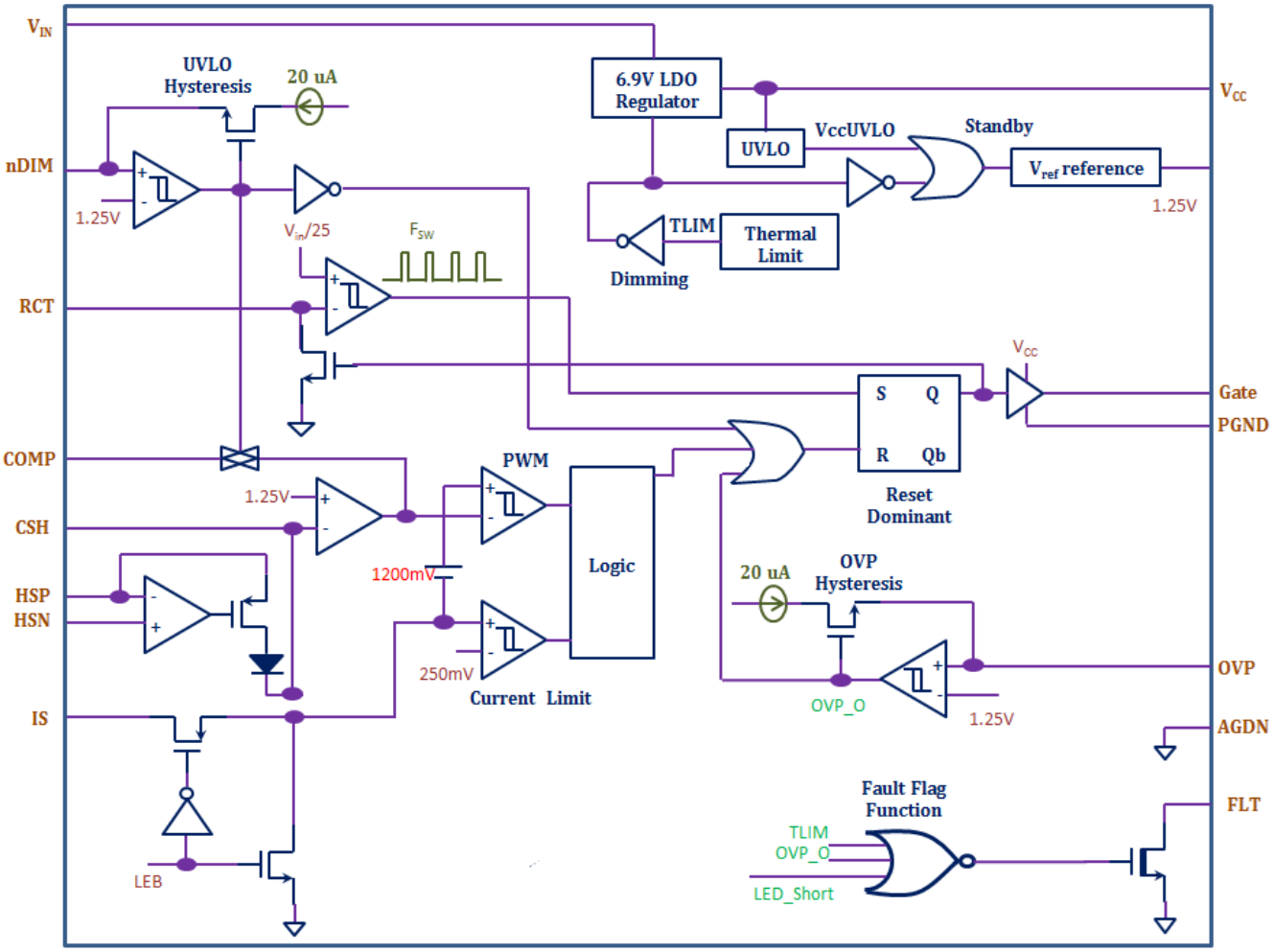
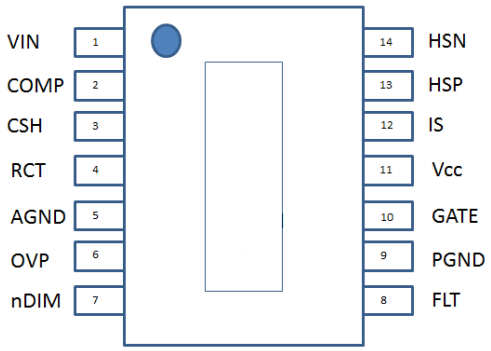


Fig. 5 Function block diagram of MBI6671

Pin Configuration



MBI6671GTS (Top View)

Pin Description

Pin No.	Pin Name	Pin Type	Pin Rating	Function
1	Vin	P	65V	Input Voltage
2	COMP	I/O	5V	Set Compensation
3	CSH	I/O	5V	Current Sense High
4	RCT	I/O	65V	Resistor Capacitor Timing
5	AGND	P	0V	Analog Ground
6	OVP	I	65V	Over-voltage Protection
7	nDIM	I/O	65V	UVLO/PWM Dimming
8	FLT	O	65V	Flag OVP
9	PGND	P	0	Power Ground
10	GATE	O	6.9V	Gate Drive Output
11	Vcc	P	6.9V	Internal Regulator Output
12	IS	I/O	65V	Main Switch Current Sense
13	HSP	I	65V	LED Sense Positive
14	HSN	I	65V	LED Sense Negative
	Thermal PAD		0V	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		V_{IN}	-0.3~71	V
Sustaining Voltage at DIM pin		V_{nPWM}	-0.3~71	V
Sustaining Voltage at Flag pin		V_{flag}	-0.3~71	V
Sustaining Voltage at OVP pin		V_{OVP}	-0.3~71	V
Sustaining Voltage at HSP/HSN pin		V_{SEN}	-0.3~71	V
Power Dissipation (On 4-Layer PCB, Ta=25°C)	GTS Type	P_D	-	W
Empirical Thermal Resistance (On PCB, Ta=25°C)**	GTS Type	$R_{th(j-a)}$	-	°C/W
Junction Temperature		$T_{j,max}$	-	°C
Operating Ambient Temperature		T_{opr}	-40~+125	°C
Storage Temperature		T_{stg}	-55~+150	°C
ESD Rating	Human Body Mode (MIL-STD-883G Method 3015.8)	HBM	Class 3A (5KV)	-
	Machine Mode (ANSI/ ESD S5.2-2009)	MM	Class M4 (400V)	-

*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.

Electrical Characteristics

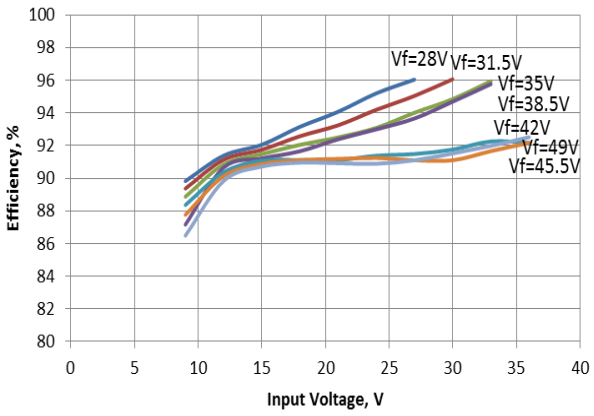
Vin=14V, Tj=25C unless otherwise noted.

Characteristics	Symbol	Conditions	Min	Typ	Max	Unit
INPUT						
Supply Voltage	V_{IN}		4.5		65	V
Quiescent Current	I_Q	Static		1.6	3	mA
Startup Regulator (Vcc)						
Vcc Regulation	Vcc_{REG}	Icc=0mA	6.3	6.9	7.35	V
Vcc Current Limitt	I_{CC-LIM}	Vcc=0V		27		V
Vcc UVLO Threshold	Vcc_{UVLO}	Vcc Decrease		4.2		V
Vcc Start-Up Threshold	Vcc_{STRUP}	Vcc Increase		4.3		V
Vcc Hysteresis	V_{CC-HYS}			100		mV
Over Voltage Protection(OVP)						
OVP OVLO Threshold	V_{TH-OVP}	OVP Increasing		1.25		V
OVP Hysteresis Source Current	$I_{HYS-OVP}$	OVP Active (high)	10	20	30	uA
Error Amplifier (EA)						
CSH Reference Voltage	V_{CSH}	With Respect to AGND	-2%	1.25	+2%	V
COMP Sink/Source Current				27		uA
Trans-conductance				100		uA/V
OFF Timer(RCT)						
Minimum Off-time	$T_{OFF-MIN}$	RCT=1V through 1 KΩ		50		nS
RCT Pull down resistance	R_{RCT}			50		Ω
RCT Ref Voltage (Vin/25)	$T_{R,SW}$	V_{IN}=14V		565		mV
PWM Comparator						
COMP to PWM Offset (Level Shift)		V_{IN}=14V		1.2		V
Current Limit (IS)						
Current limit Threshold	V_{LIM}			250		mV
I_{LIM} Delay to Output	$I_{LIM\ DELAY}$			35		nS
Minimum On Time	$V_{MIN\ ON}$			500		nS
High Side Sense Circuit						
CSH source current	I_{CSH}	R_{HSN}=1k, (V_{HSP} - V_{HSN})=100mV (V_{HSP} - V_{HSN})/ R_{HSN} =100uA		100		uA
Gate						
Gate Rise Time	T_{Rise}	Cload=1nF 20%~80% Trise Time		30		Ns
Gate Fall Time	T_{Fall}	Cload=1nF 80%~20% Fall Time		20		Ns
UVLO and DIM						
nDIM/UVLO Threshold	$V_{TH-nDIM}$			1.24		V
nDIM Hysteresis Current	$I_{HYS-nDIM}$		10	20	30	uA
Thermal Shutdown						
Thermal Shutdown Threshold	TSD			155		C

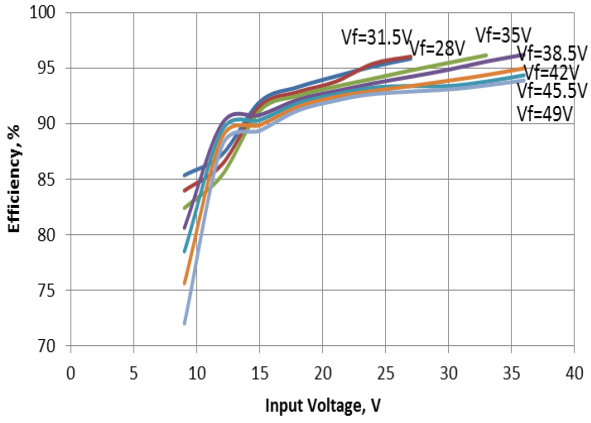
Thermal Shutdown Hysteresis	THYS			25		C
PULL-DOWN Resistance						
R_{FLT} Pull-down Resistance	R_{FLT}			145	300	ohm

Typical Performance Characteristic

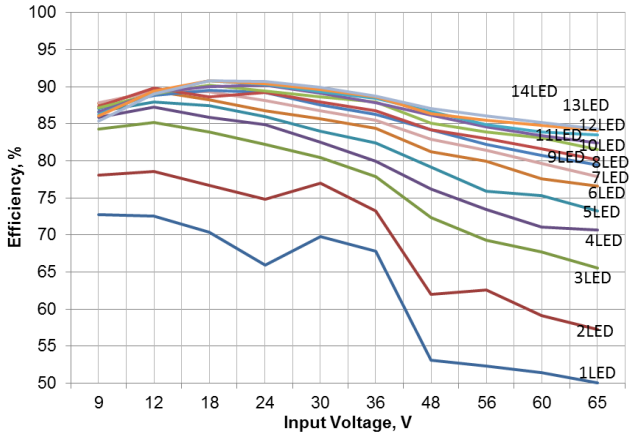
1. Efficiency vs. Input Voltage at Various LED Cascaded Numbers



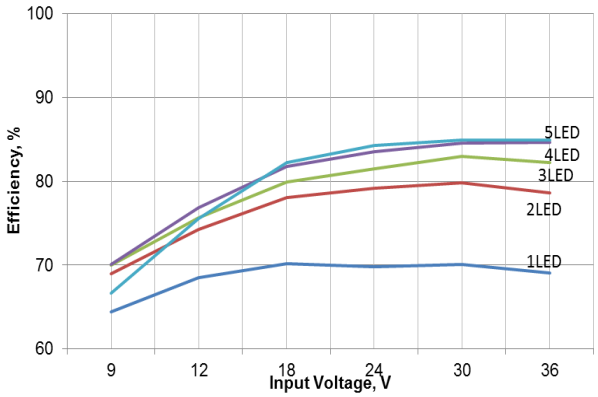
(a) I_{OUT} = 250mA for Boost



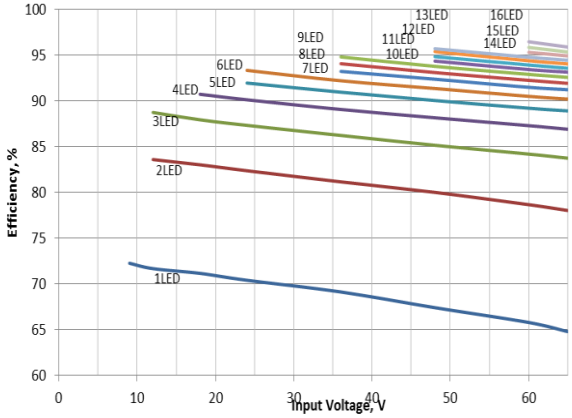
(b) I_{OUT} = 500mA for Boost



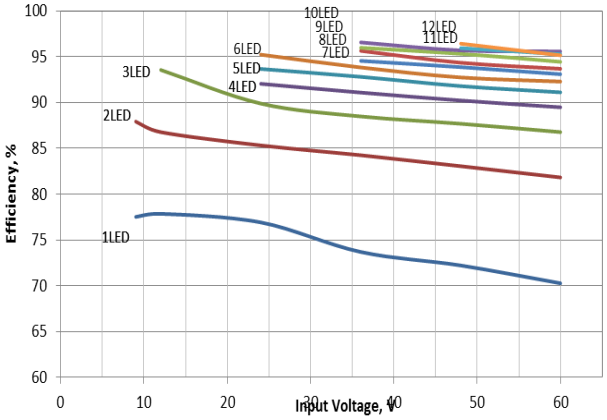
(c) I_{OUT} = 200mA for Buck-Boost



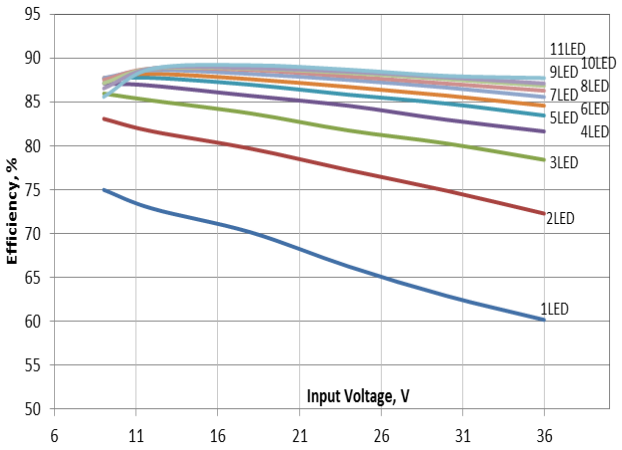
(d) I_{OUT} =2A for Buck-Boost



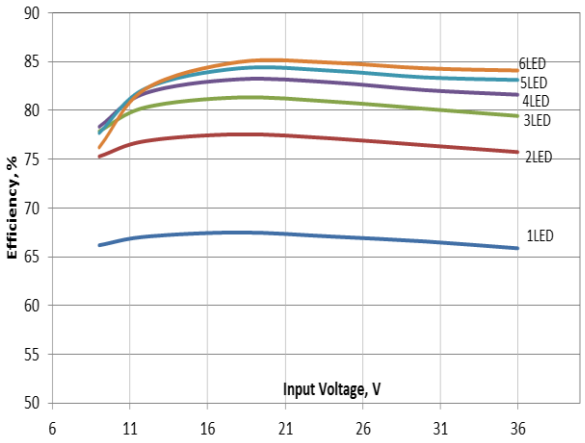
(e) I_{OUT} = 1A for Buck



(f) I_{OUT} =2A for Buck

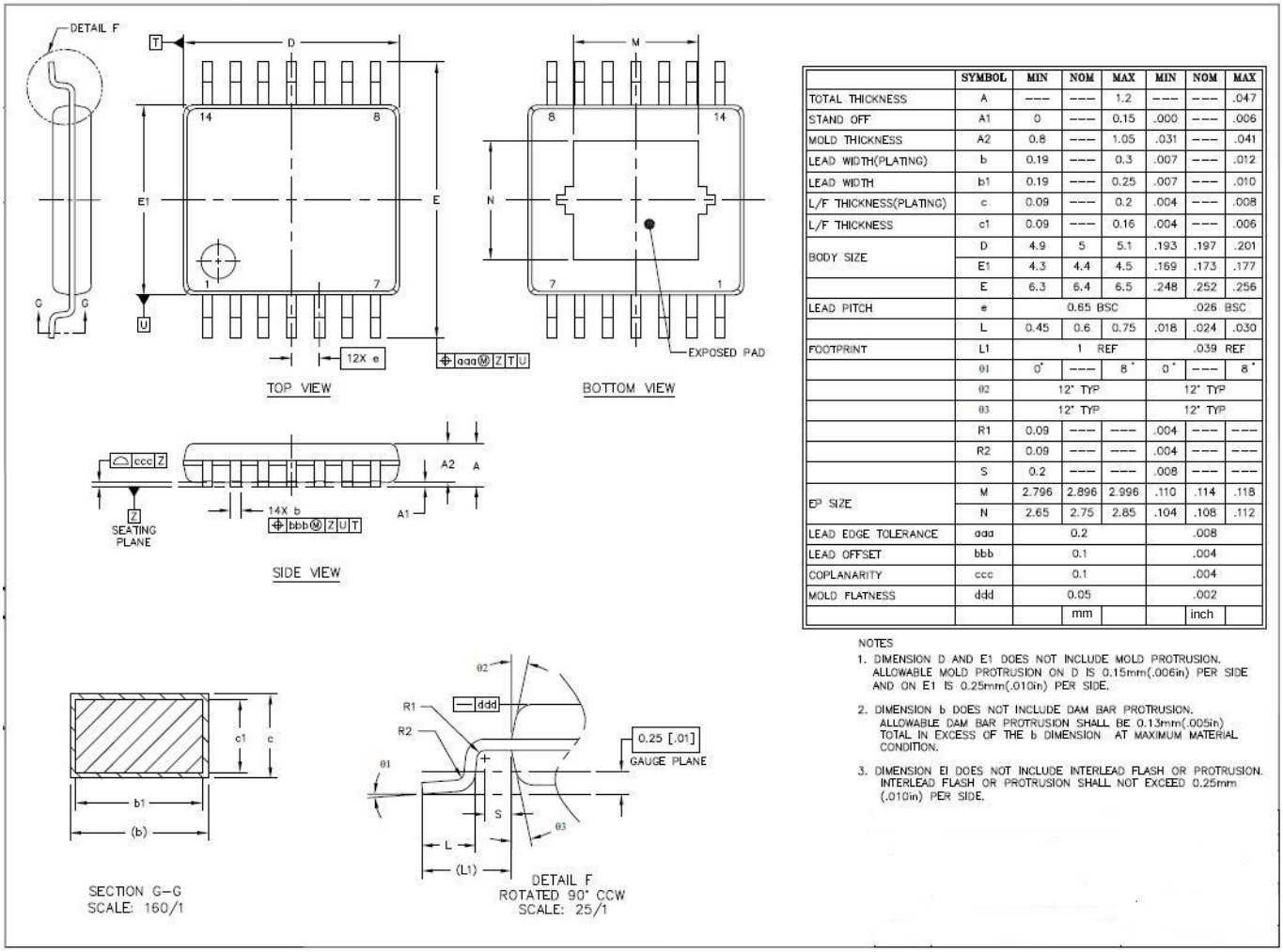


(e) I_{OUT} = 200mA for SEPIC



(f) I_{OUT} =1A for SEPIC

Outline Drawing



	SYMBOL	MIN	NOM	MAX	MIN	NOM	MAX
TOTAL THICKNESS	A	---	---	1.2	---	---	.047
STAND OFF	A1	0	---	0.15	.000	---	.006
MOLD THICKNESS	A2	0.8	---	1.05	.031	---	.041
LEAD WIDTH(PLATING)	b	0.19	---	0.3	.007	---	.012
LEAD WIDTH	b1	0.19	---	0.25	.007	---	.010
L/F THICKNESS(PLATING)	c	0.09	---	0.2	.004	---	.008
L/F THICKNESS	c1	0.09	---	0.16	.004	---	.006
BODY SIZE	D	4.9	5	5.1	.193	.197	.201
	E1	4.3	4.4	4.5	.169	.173	.177
	E	6.3	6.4	6.5	.248	.252	.256
LEAD PITCH	e	0.65 BSC			.026 BSC		
	L	0.45	0.6	0.75	.018	.024	.030
FOOTPRINT	L1	1 REF			.039 REF		
	θ1	0°	---	8°	0°	---	8°
	θ2	12° TYP			12° TYP		
	θ3	12° TYP			12° TYP		
	R1	0.09	---	---	.004	---	---
	R2	0.09	---	---	.004	---	---
	S	0.2	---	---	.008	---	---
EP SIZE	M	2.796	2.896	2.996	.110	.114	.118
	N	2.65	2.75	2.85	.104	.108	.112
LEAD EDGE TOLERANCE	aaa	0.2			.008		
LEAD OFFSET	bbb	0.1			.004		
COPLANARITY	ccc	0.1			.004		
MOLD FLATNESS	ddd	0.05			.002		
			mm			inch	

MBI6671GTS Outline Drawing

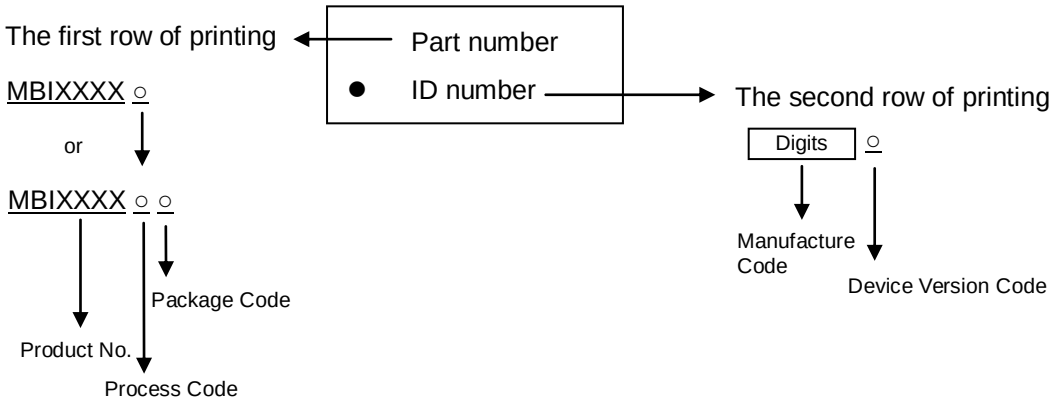
Application Information

MBI6671 is a simple and high efficient multi-topology converter with capability to drive external MOSFET. The device adopts hysteretic PFM control scheme to regulate loading and input voltage variations. The hysteretic PFM control requires no loop compensation bringing very fast load transient response and simplicity of the design.

The device is well suited for applications requiring a wide input voltage range. The high-side current sensing and an integrated current-setting circuitry minimize the number of external components while delivering an average output current with ±5% accuracy. Featured by PWM dimming and analog dimming capability, MBI6671 offers flexible ways to meet LED dimming related applications.

Product Top Mark Information

GTS (TSSOP-14L)



Product Revision History

Datasheet Version	Device Version Code
V1.00	A

Product Ordering Information

Product Ordering Number*	RoHS Compliant Package Type	Weight (g)
MBI6671GTS-A	TSSOP14L-150-1.27	0.079

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

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