

GENERAL DESCRIPTION

OB2301 is a high performance and tightly integrated secondary side synchronous rectification controller and driver used for secondary side rectification in switch mode power supply system. It drives a much lower voltage drop N-channel MOSFET to emulate the traditional diode rectifier at the secondary side of Flyback converter, which can reduce heat dissipation, increases output current capability and efficiency, and simplify thermal design. OB2301 can support low system output voltage down to 2V at constant current mode.

It is suitable for multiple mode applications including discontinuous conduction mode and quasi-resonant mode. With its versatility and optimization, OB2301 can be used in various switch mode power supply topologies including secondary-side control topology and primary-side control topology.

From the information on the secondary side of the isolation transformer, OB2301 generates a driving signal with dead time with respect to the primary side PWM signal to turn the integrated N-channel SR switch on and off in proximity of the zero current transition with the help of smart driver voltage control. It is optimized for 5V output voltage. In primary-side control topology, OB2301 can detect the output voltage and feed back a series of warning pulses to primary side controller when the output voltage is lower than an inner-

determined threshold to awaken the primary-side power switch to improve dynamic response.

The externally adjustable minimum on time and property off time control scheme effectively avoid the ring impact induced by parasitic elements so that a reliable and noise free operation of the SR system is insured.

OB2301 is offered in SOT23-6 package.

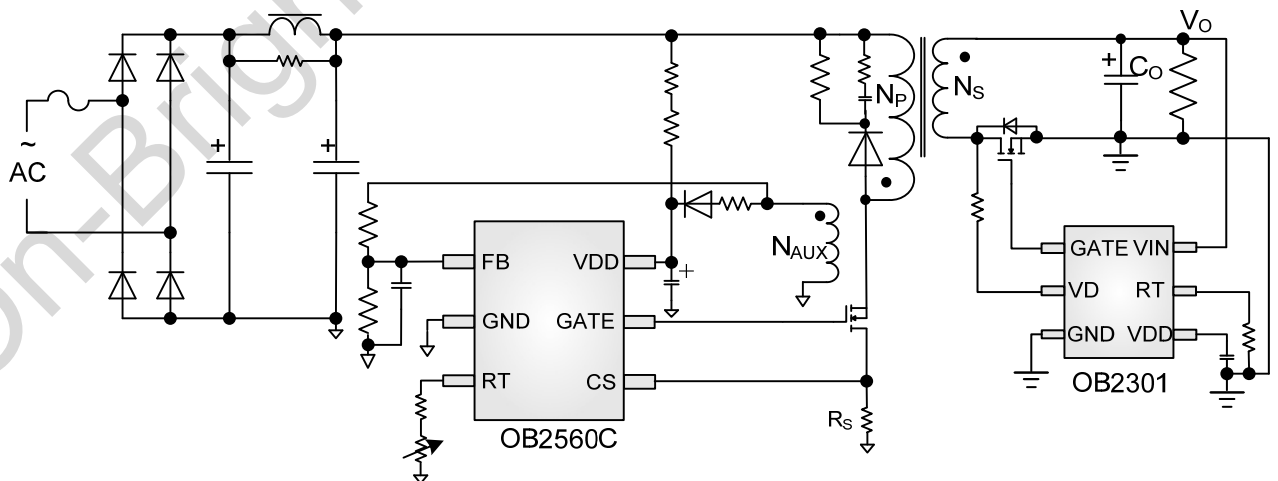
FEATURES

- Secondary-side synchronous rectification controller optimized for 5V output system
- Suitable for DCM, QR operation
- Accurate secondary side MOSFET Vds sensing
- Low cost small size CC/CV mode support
- Up to 200kHz operation frequency
- 3A/2A peak current sink/source driver capability
- Output voltage over-shoot and under-shoot control
- Enhanced dynamic response with firing warning pulses scheme
- VDD UVLO protection

APPLICATIONS

- AC/DC 5V adaptors
- Cell phone charger
- 5V Bias supply
- Low voltage rectification circuits

TYPICAL APPLICATION

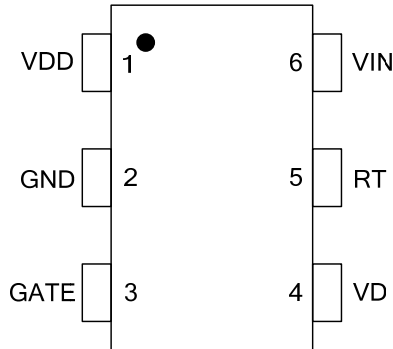


GENERAL INFORMATION

Pin Configuration

The OB2301 is offered in SOT23-6 package, shown as below.

SOT23-6



Absolute Maximum Ratings

Parameter	Value
Vin pin	-0.6V to 7V
VDD pin	-0.6V to 7V
VD pin	-2.5V to 50V ^{Note2}
Gate pin	-0.6V to 7V
RT pin	-0.6V to 7V
Min/Max Operating Junction Temperature T _J	-40 to 150 °C
Operating Temperature T _A Ambient	-20 to 85 °C
Min/Max Storage Temperature T _{stg}	-55 to 150 °C
Lead Temperature (Soldering, 10secs)	260 °C

Note1: Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute maximum-rated conditions for extended periods may affect device reliability.

Note2: -2.5V applies to minimum duty cycle during normal operation only.

Ordering Information

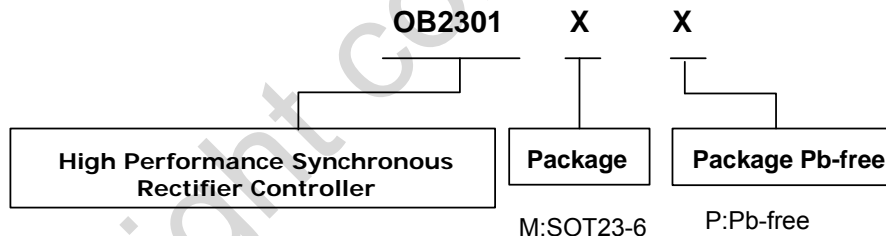
Part Number	Description
OB2301MP	SOT23-6, Pb-free in T&R

Package Dissipation Rating

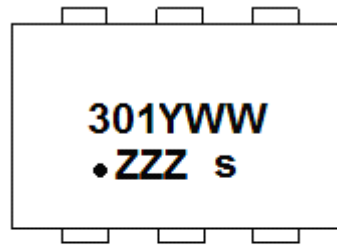
Package	R _{θJA} (°C/W)
SOT23-6	200

Recommended Operating Range

Symbol	Parameter	Min/Max
VDD	VDD Supply Voltage	4V to 5.5V



Marking Information

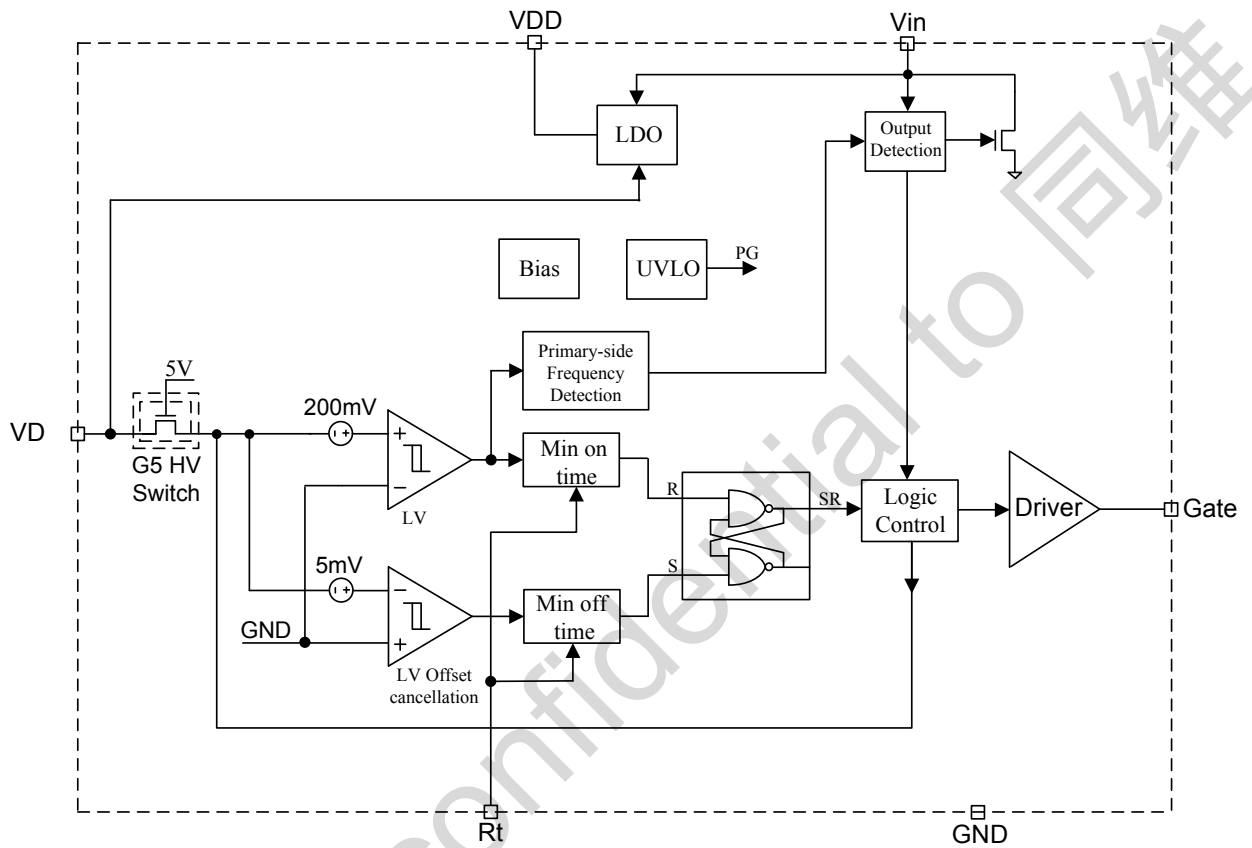


Y: Year Code
 WW: Week Code(01-52)
 ZZZ: Lot Code
 S: Internal Code(Optional)

TERMINAL ASSIGNMENTS

Pin Name	I/O	Description
VD	I	This pin is connected to external n-channel MOSFET drain
Gate	O	Driver output for external N-channel MOSFET
GND	P	Ground.
VDD	P	Power Supply
Vin	I	System output voltage detection
RT	O	Minimum on time control pin. A resistor is connected from this pin to GND

BLOCK DIAGRAM



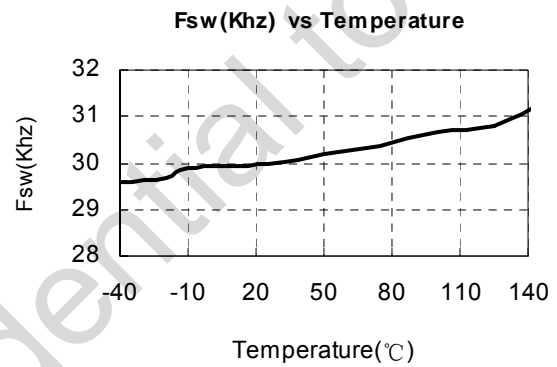
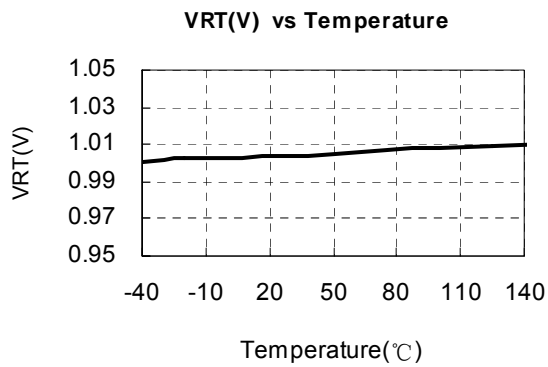
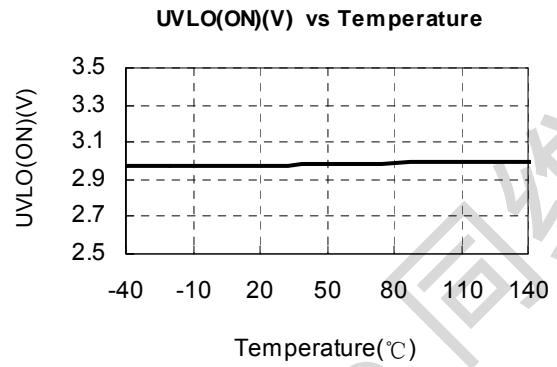
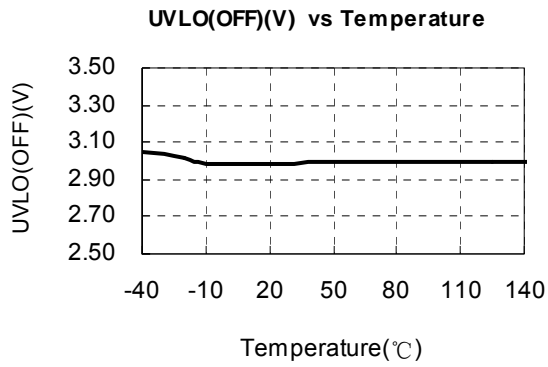
ELECTRICAL CHARACTERISTICS

(T_A = 25°C, VDD=5V, unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Supply Voltage (VDD)						
I_Vdd_operation	Operation current	Frequency@Vd=65KHz,VD D=5V,1nF Cap load at GATE.		1.5	2.0	mA
		Frequency@Vd=2KHz,VDD =5V,No load at GATE.		0.5	0.7	mA
Vdd_regulation_mini	Minimum Vdd regulation voltage			4.2		V
UVLO(ON)	VDD Under Voltage Lockout Entry		2.8	3.0	3.2	V
UVLO(OFF)	VDD Under Voltage Lockout Exit (Recovery)		2.9	3.1	3.3	V
VD Detection Section						
Vth_SR_act	SR MOSFET turn on threshold voltage detection at VD			-200		mV
Vth_SR_deact	SR MOSFET turn off threshold voltage detection at Vd			-5		mV
Tdelay_on	SR MOSFET turn-on propagation delay				100	ns
Tdelay_off	SR MOSFET turn-off propagation delay				75	ns
T_minimum_on	SR MOSFET minimum on time	RT=25KΩ		1.9		Us
RT Section						
Vrt	Voltage reference at RT pin		0.95	1	1.05	V
Over/Under Shoot Control Section						
Vo_delta	Output delta variation in system output undershoot control			160		mV
Vo_delta_enb	Output delta variation detection enable voltage			5.25		V
Fsample	Output delta variation detection Sample frequency			15		KHz
Vo_low_clamp	System output undershoot clamp control trigger voltage		4.5	4.6	4.7	V
Vo_High_clamp_1 st	System output 1st overshoot clamp control trigger voltage at Vin with SR frequency lower than 7.5KHz			5.65		V
Vo_High_clamp_2 nd	System output 2 nd overshoot clamp control trigger voltage at Vin			6.15		V
Ivo_High_clamp	System output overshoot clamp current			100		mA
Ivd_pulse	Warning current pulse peak			150		mA

	value at VD when system output undershoot is detected at Vin				
Dsr_pulse	Warning current pulse width at VD when system output undershoot is detected at Vin		2.5		uS
Fsw	Warning current frequency at VD when system output undershoot is detected at Vin	27	30	33	KHz
Tdelay	Warning signal blanking time after secondary-side demagnetization		90		us
GATE driver Section					
VOH	Output high level @ VDD=5V			5	V
VOL	Output low level @ VDD=5V	1			V
Rds_on	Pull-up driver		2.5		Ω
	Pull-down driver		1.5		Ω
Isource	Source current		2		A
Isink	Sink current		3		A
Tf	Falling time	Gate voltage falling from 4V to 1V @ $C_L=1nF$		30	ns
Tr	Rising time	Gate voltage rising from 1V to 4V @ $C_L=1nF$		30	ns

CHARACTERIZATION PLOTS



Operation Description

OB2301 is a high performance and tightly integrated secondary side synchronous rectification controller and driver in switch mode power supply system. It drives a much lower voltage drop N-channel MOSFET to emulate the traditional diode rectifier, which can reduce heat dissipation, increases output current capability and efficiency, and simplify thermal design.

Startup and under voltage lockout(UVLO)

OB2301 implements UVLO function during startup. When VDD rises above UVLO(off), the IC wakes up from under voltage lock out state and enter normal operation. When VDD drops below UVLO(on), the IC enter under voltage lock out state again and the SR gate is pulled low by 10K resistor on chip. In addition, there is a hysteresis window between UVLO(off) and UVLO(on) to make system work reliably.

Synchronization rectifier

OB2301 controls the turn-on and turn-off of synchronization rectifier MOSFET (SR MOSFET) by detection of drain-source voltage. When demagnetization of transformer starts, the secondary-side current will flow through the body diode of SR MOSFET and the voltage at the drain will drop to about -700mV. As soon as OB2301 detects this negative voltage, the driver voltage is pulled high to turn on the SR MOSFET after very short delay time about 100nS, refer to Fig.1. After the SR MOSFET is turned on, the drain voltage of SR MOSFET begins to rise based on its R_{dson} and secondary-side current. The drain voltage becomes higher with demagnetization going on. When the drain voltage rises above -5mV, the driver voltage will be pulled down to ground very quickly, refer to Fig.1

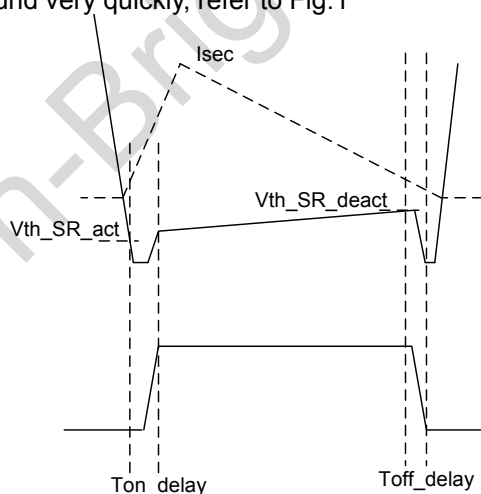


Fig.1 SR MOSFET turn-on and turn-off timing

Adjustable minimum on time

OB2301 offers adjustable minimum on time control. This timer can avoid effectively false turn-off due to high frequency interference caused by parasitic element at the start of secondary-side demagnetization.

$$T_{onmin}=8*RT*10E(-11)$$

Adaptive minimum off time

At the end of demagnetization, SR MOSFET will be turn off. The remaining current will flow through body diode again, which may result in negative voltage (about -700mV) appears at drain and SR MOSFET will turn on again. In addition, the resonance oscillation between the magnetization inductance and parasitic capacitance after demagnetization may cause negative drain voltage. These may turn on SR MOSFET by mistake. To avoid above mis-turn-on of SR MOSFET, constant minimum off time can be used to screen it. But it may disturb SR MOSFET operation. For reliable SR operation, proprietary adaptive minimum off time control is implemented in OB2301, which can guarantee reliable synchronous rectification operation in DCM, QR.

Output voltage under-shoot Control

When a load transient event happens, the system output voltage may drops. OB2301 can prevent output voltage drop too low through direct detection of system output voltage. When the output voltage variation between the successive sample cycle exceeds 160mV, OB2301 can output 8 current pulses (typical peak value 150mA) at VD pin with pulse width 2.5uS and 30Khz frequency to wake up primary side controller to switch the primary-side power MOSFET on to deliver more power to the loading in order to make output voltage back to regulation. In addition, if the system output voltage drops to threshold voltage determined by OB2301 (4.6V), the above primary side wake up process is still in effect. Fig.2 Output voltage under-shoot control timing diagram

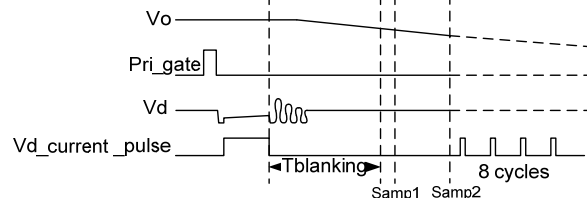


Fig.2 Output voltage under-shoot control timing diagram

Output overshoot clamp

For poor system design, there is usually output overshoot during startup and load transient. To facilitate system design, OB2301 can detect

output overshoot condition and prevent overshoot happen. When output voltage rises to meet the inner threshold, OB2301 will open a discharge path from V_{in} to ground to clamp the system output voltage, so the system output overshoot can be prevented.

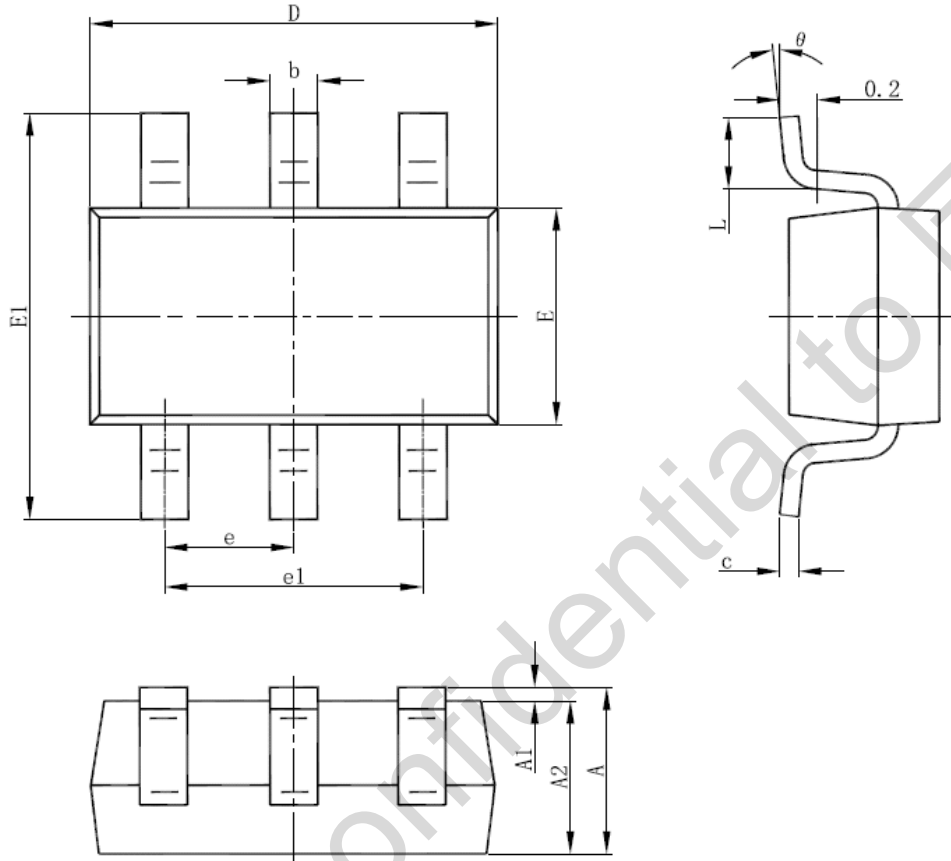
For good and efficient synchronous rectification operation, the SR MOSFET should be turned on/off in very short time. Therefore strong driver capability is needed. OB2301 can offer typical source capability 2A and typical sink capability 3A. This guarantees fast turn-on and turn-off of SR MOSFET.

Gate driver

On-Bright confidential to 同维

PACKAGE MECHANICAL DATA

SOT-23-6L PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.000	1.450	0.039	0.057
A1	0.000	0.150	0.000	0.006
A2	0.900	1.300	0.035	0.051
b	0.300	0.500	0.012	0.020
c	0.080	0.220	0.003	0.009
D	2.800	3.020	0.110	0.119
E	1.500	1.726	0.059	0.068
E1	2.600	3.000	0.102	0.118
e	0.950 (BSC)		0.037 (BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

IMPORTANT NOTICE

RIGHT TO MAKE CHANGES

On-Bright Electronics Corp. reserves the right to make corrections, modifications, enhancements, improvements and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete.

WARRANTY INFORMATION

On-Bright Electronics Corp. warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with its standard warranty. Testing and other quality control techniques are used to the extent it deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

On-Bright Electronics Corp. assumes no liability for application assistance or customer product design. Customers are responsible for their products and applications using On-Bright's components, data sheet and application notes. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

LIFE SUPPORT

On-Bright Electronics Corp.'s products are not designed to be used as components in devices intended to support or sustain human life. On-bright Electronics Corp. will not be held liable for any damages or claims resulting from the use of its products in medical applications.

MILITARY

On-Bright Electronics Corp.'s products are not designed for use in military applications. On-Bright Electronics Corp. will not be held liable for any damages or claims resulting from the use of its products in military applications.