DIO88164/A

Highly Integrated, Single Stage Buck & PFC Regulator for LED Lighting

Features

- Internal 600 V power MOSFET
- Valley turn-on of the MOSFET to achieve low switching losses
- No auxiliary winding and VCC capacitor
- A 0.2 V current sense reference voltage leads to a lower sense resistance thus a lower conduction loss
- Reliable short LED and open LED protection
- Power factor > 0.9
- Compact package: SOIC-7 and DIP-7

Applications

- Tube lamp & PAR lamp
- Down light & bulb lamp

Descriptions

The DIO88164/A consists of an integrated single stage buck & PFC regulator and a 600 V power MOSFET, specifically designed for a high performance non-isolated converter with minimal external components targeting at LED lighting applications.

The DIO88164/A drives the buck converter in the quasi-resonant mode to achieve higher efficiency and keeps the buck converter in constant on time operation to achieve high power factor.

This chip adopts special design to achieve reliable protection for safety requirement.

Block Diagram

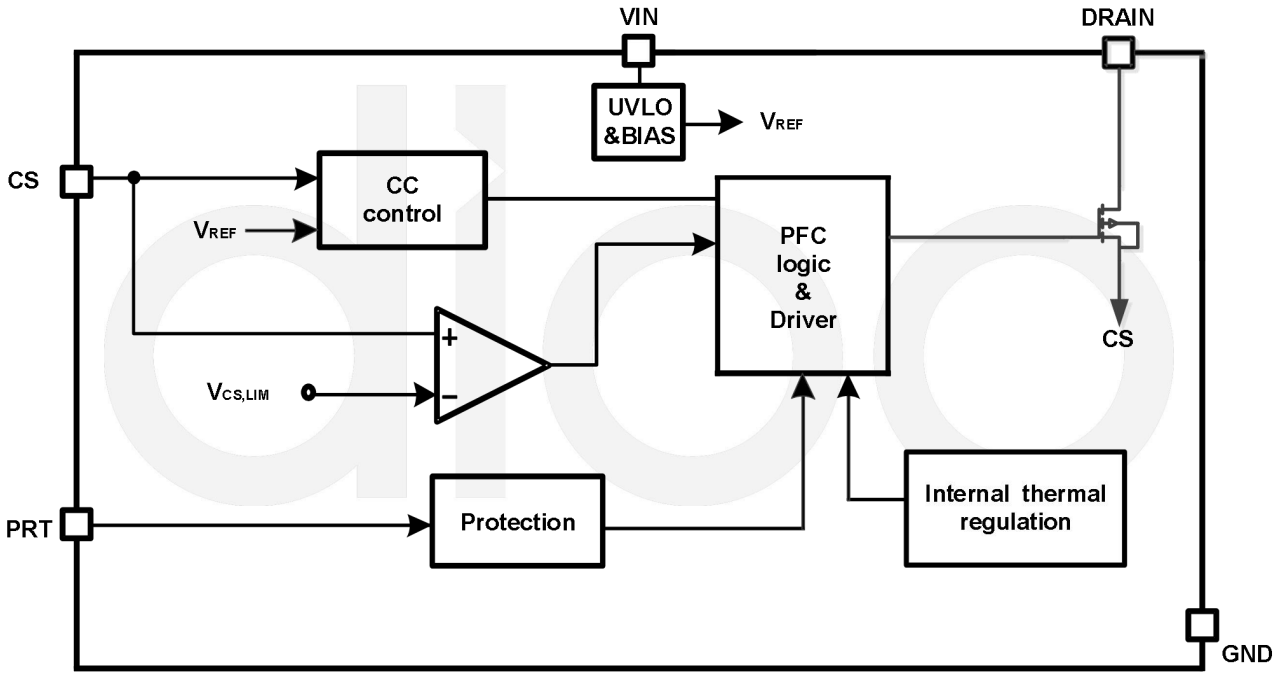
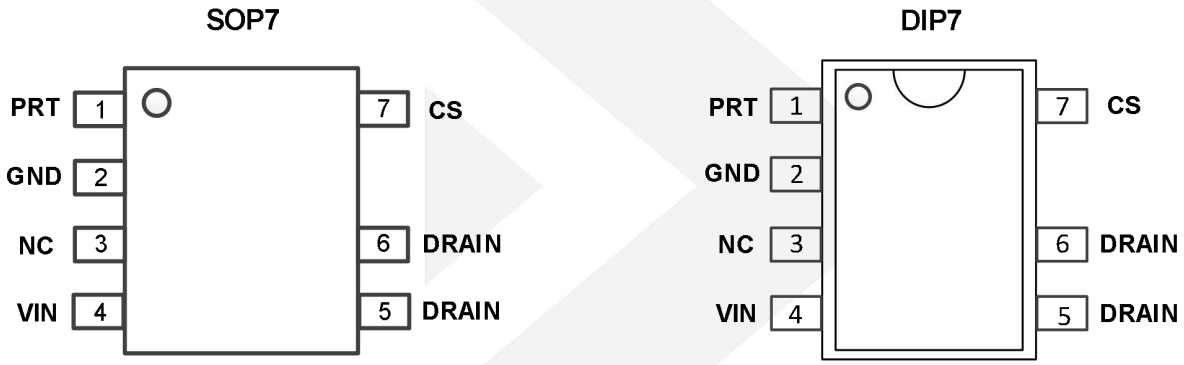


Figure 1. Block diagram

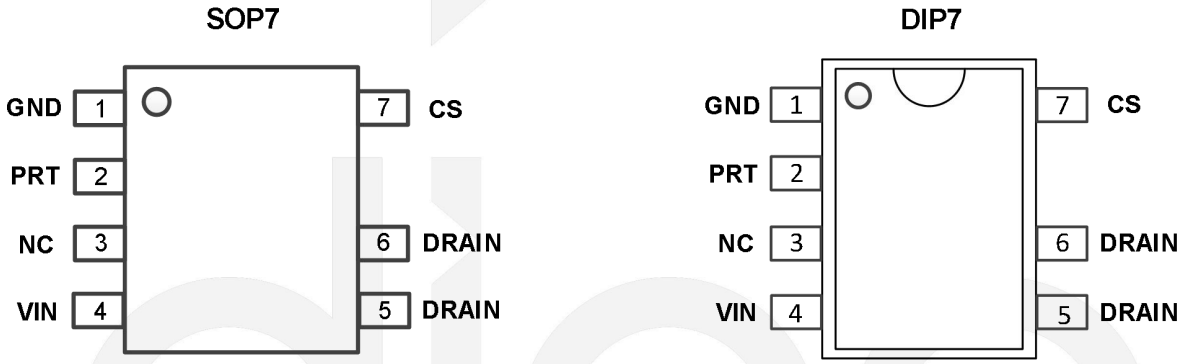
Ordering Information

Order Part Number	Top Marking	RoHS	T_A	Package	
DIO88164CS7	DIOHHA6D	Green	-40 to 85°C	SOIC-7	Tape & Reel, 2500
DIO88164DP7	DIOHHA6D	Green	-40 to 85°C	DIP-7	Tube type, 50
DIO88164ACS7	DIOHA6DA	Green	-40 to 85°C	SOIC-7	Tape & Reel, 2500
DIO88164ADP7	DIOHA6DA	Green	-40 to 85°C	DIP-7	Tube type, 50

Pin Assignment



Top View (DIO88164A)



Top View (DIO88164)

Figure 2. Pin assignment

Pin Descriptions

Name	Description
GND	Ground pin.
PRT	Protection pin. Set OVP threshold with three gears.
NC	Not connect.
VIN	Power supply pin.
DRAIN	Power MOSFET drain pin. The DRAIN pin is connected to the transformer.
CS	Current sense pin. Connect this pin to the source of the primary switch. Connect the sense resistor across the source of the primary switch and the GND pin.

Absolute Maximum Ratings

Stresses beyond those listed under the Absolute Maximum Rating table may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other condition beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Symbol	Parameter	Rating	Unit
V_{IN}	VIN	700	V
V_{DRAIN}	DRAIN	600	V
I_{VIN}	Supply current I_{VIN}	15	mA
V_{CS} , V_{PRT}	CS, PRT	-0.3 to 5	V
P_D	Power dissipation, P_D at T_A = 25°C, SOIC-7/DIP-7	1.1	W
$R_{\Theta JA}$	Package thermal resistance, SOIC-7	100	°C/W
$R_{\Theta JC}$		50	
$R_{\Theta JA}$	Package thermal resistance, DIP-7	80	°C/W
$R_{\Theta JC}$		35	
T_{STG}	Storage temperature range	-65 to 150	°C
T_J	Junction temperature range	150	°C
T_L	Lead temperature range	260	°C
ESD	HBM, JEDEC: JESD22-A114	2000	V

Recommend Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. DIOO does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Min	Typ	Max	Unit
V_{IN}	VIN voltage	30		500	V
T_J	Operating junction temperature	–40		125	°C

Electrical Characteristics

T_A = 25°C, unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN_ON}	VIN start-up voltage		7	8.5	10	V
I_Q	Quiescent current	No switching	150		300	μA
I_{VINO}	Operation current	C_L = 100 pF, f =15 kHz	200		450	μA
Constant current section						
V_{REF}	Internal reference voltage		0.194	0.2	0.206	V
Protection section						
V_{OUT_OVP}	Output OVP voltage threshold	R_{PRT} = 470 kΩ		72		V
I_{PRT}	PRT pin source current			4		μA
Current sense section (source PIN of integrated MOSFET)						
$V_{CS.LMT}$	Current limit reference voltage			1.2		V
PWM section						
$T_{ON.MAX}$	Maximum on time			25		μs
$T_{ON.MIN}$	Minimum on time			1.2		μs
$T_{OFF,MAX}$	Maximum off time			68		μs
T_{OFF_MIN}	Minimum off time			2		μs
f_{MAX}	Maximum switching frequency			85		kHz
Power MOSFET section						
V_{BVDSS}	Break-down voltage	I_{DS} = 250 μA, T_J = 25°C	600	630		V
R_{DSON}	MOSFET on resistance			1.8	2.2	Ω
I_{DSS}	Off-state drain current	V_{DS} = 600 V, V_{GS} = 0 V, T_J = 25°C			1	μA
Thermal section						
T_{SD}	Thermal shutdown temperature			150		°C

Typical Application

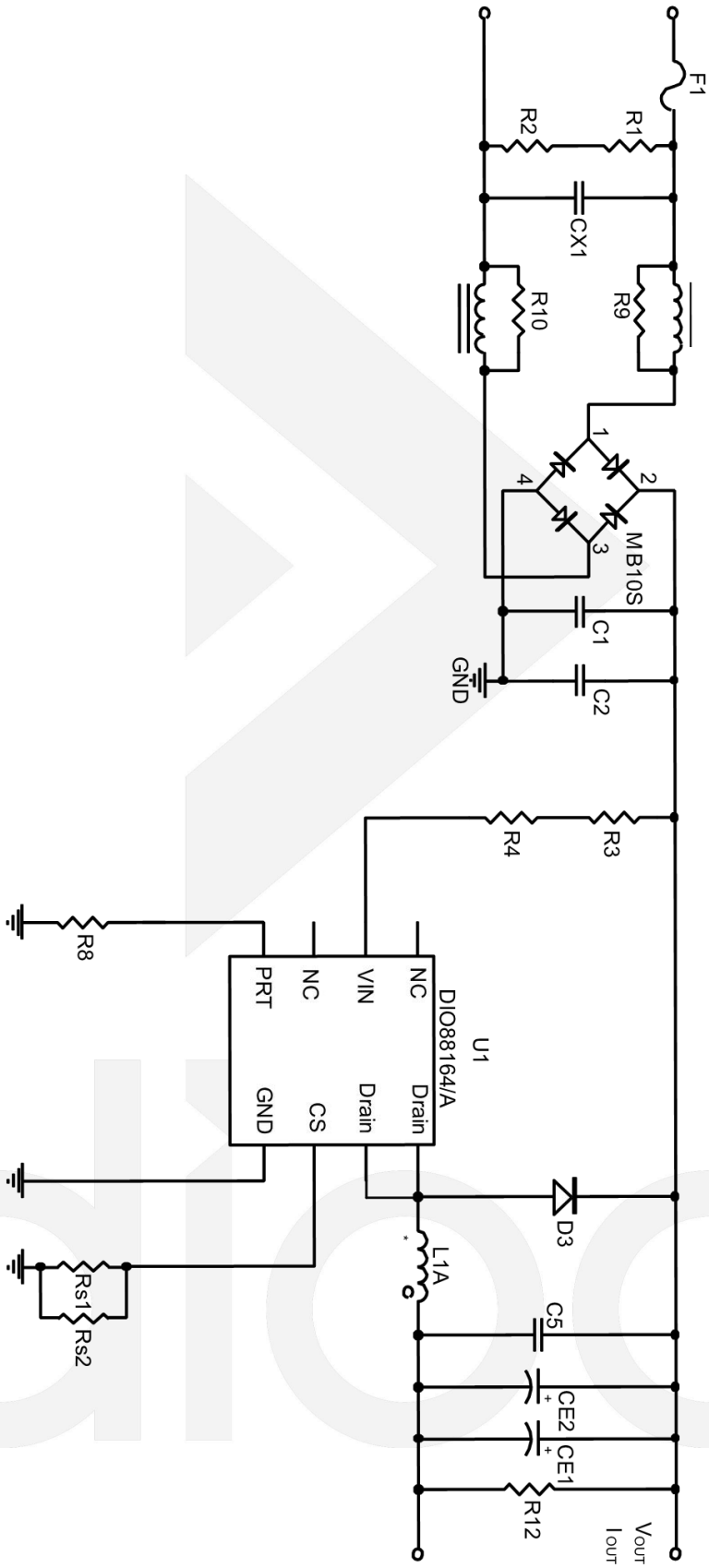


Figure 3. Typical Application

Application Information

The DIO88164/A consists of an integrated single stage buck & PFC regulator and a 600 V power MOSFET, specifically designed for a high performance non-isolated converter with minimal external components targeting at LED lighting applications.

Start up

After AC or DC supply is powered on, the internal power supply is increasing through HV JFET. As soon as V_{VIN} rises up to V_{IN_ON}, the internal blocks start to work and PWM output is enabled. As soon as VIN is lower than VIN under voltage lockout, the DIO88164/A series stops switching.

Shut down

After AC supply or DC bus is powered off, the energy stored in the bus capacitor will be discharged. Then internal power supply will drop down. As soon as V_{VIN} is below the threshold voltage, the IC will stop working.

Quasi-resonant operation

QR mode operation provides low turn-on switching losses for the buck converter.

LED over-temperature protection

When the internal temperature of the chip exceeds 150°C, the DIO88164/A series decreases LED current to help the chip cooling.

LED open protection

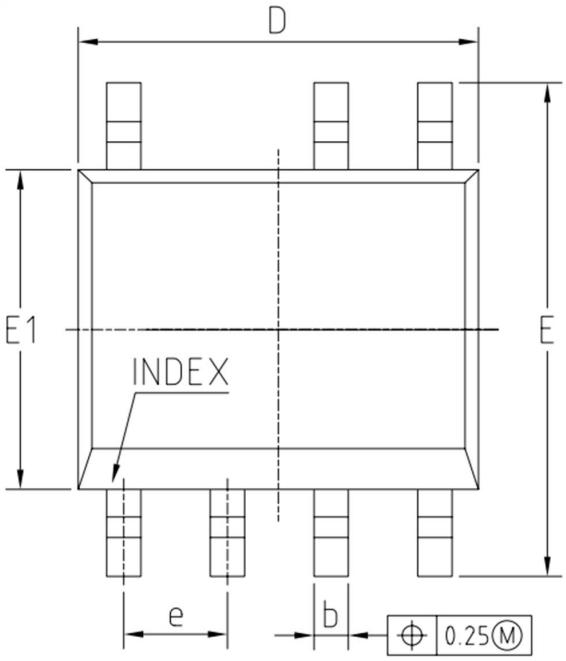
When the load is null or large transient happens, the output voltage will exceed the rated value. The output OVP threshold (V_{OUT_OVP}) is regulated by the PRT pin. When the output voltage is higher than V_{OUT_OVP}, the overvoltage protection is triggered and the chip stops switching for 850ms. The system will operate in hiccup mode.

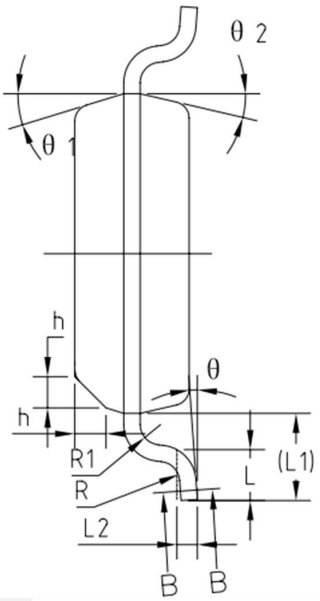
The selection of R_{VIN} will have some impact on the open-circuit protection voltage. The recommended design guidelines for R_{VIN} and OVP are shown in the following table:

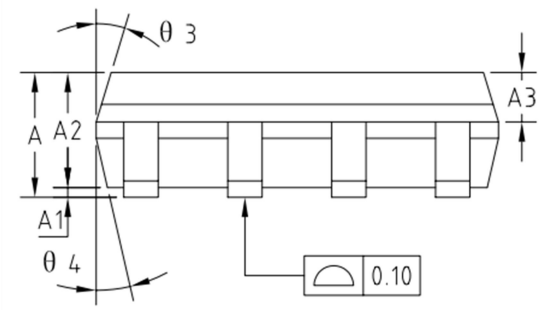
Vo_peak (V)	Recommended R_{VIN} (kΩ)	OVP
42-60	5.1	72 V (typ)
60-100	10	112 V (typ)
100-145	15	172 V (typ)

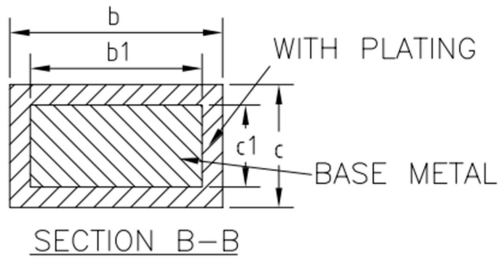
Vo_peak (V) is the peak of the output voltage, considering the ripple of the output voltage.

Physical Dimensions: SOIC-7



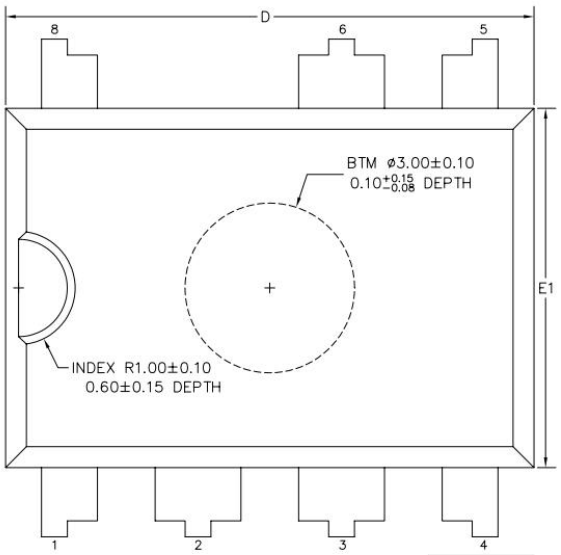


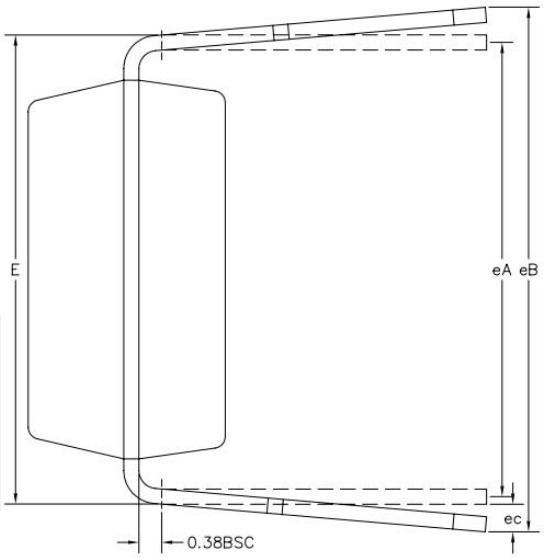


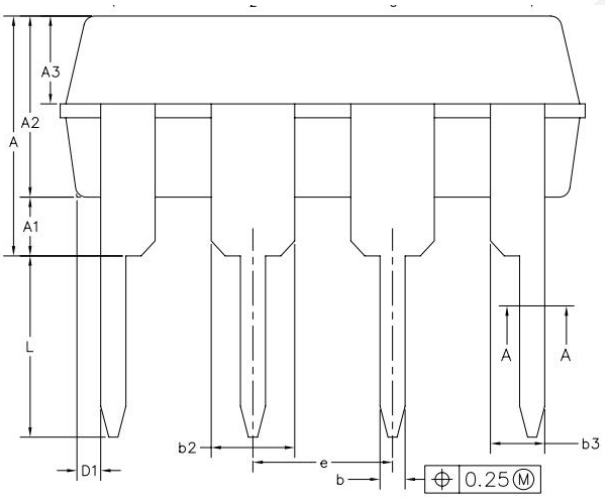


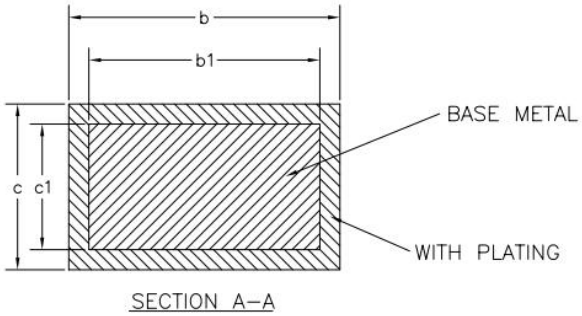
Common Dimensions (Units of of measure = Millimeter)			
Symbol	**Min**	**Non**	**Max**
A	1.35	1.55	1.75
A1	0.05	0.15	0.25
A2	1.25	1.40	1.65
A3	0.50	0.60	0.70
b	0.38	-	0.51
b1	0.37	0.42	0.47
c	0.17	-	0.25
c1	0.17	0.20	0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.17	1.27	1.37
L	0.45	0.60	0.80
L1	1.04 REF		
L2	0.25 BSC		
R	0.07	-	-
R1	0.07	-	-
h	0.30	0.40	0.50
θ	0°	-	8°
θ1	15°	17°	19°
θ2	11°	13°	15°
θ3	15°	17°	19°
θ4	11°	13°	15°

Physical Dimensions: DIP-7









Common Dimensions (Units of of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	-	-	4.80
A1	0.50	-	-
A2	3.20	3.30	3.40
A3	1.50	1.60	1.70
b	0.38	-	0.55
b1	0.38	0.46	0.51
b2	1.42	1.52	1.62
B3	0.89	0.99	1.09
c	0.25	-	0.30
c1	0.24	0.25	0.26
D	9.25	9.35	9.45
D1	0.13	-	-
E	7.62	7.87	8.25
E1	6.25	6.35	6.45
e	2.44	2.54	2.64
eA	7.62 REF		
eB	8.30	8.80	9.30
eC	0	-	1.52
L	2.92	3.30	3.81

CONTACT US

Dioo is a professional design and sales corporation for high-quality and performance analog semiconductors. The company focuses on industry markets, such as cell phones, handheld products, laptops, medical equipment, and so on. Dioo's product families include analog signal processing and amplifying, LED drivers, and charger ICs. Go to http://www.dioo.com for a complete list of Dioo product families.

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