

DIO1553

Dual SPST Depletion Audio Switch with Negative Swing

Features

- Dual SPST depletion switch
- Switches configurable via select pins
- Normally closed when $V_{CC} < 0.2\text{ V}$
- V_{SW} range is from -1.5 V to 1.5 V
- $R_{ON} = 0.35\ \Omega$ (Typ.)
- $R_{FLAT} < 0.01\ \Omega$ (Typ.)
- THD+N = -103 dB (Typ.)
- OIRR = -88 dB (Typ.)

Applications

- Smart phones
- Tablets, ultra books

Descriptions

The DIO1553 is a high-performance dual single-pole single-throw (SPST \times 2) audio switch. When V_{CC} is not available, the Depletion technology allows the device to conduct signals; when V_{CC} is present, the Depletion technology allows the device to isolate signals. During signal conduction, the Depletion gate control enables the DIO1553 to achieve great THD+N performance with consuming ultra-low power.

Typical Applications

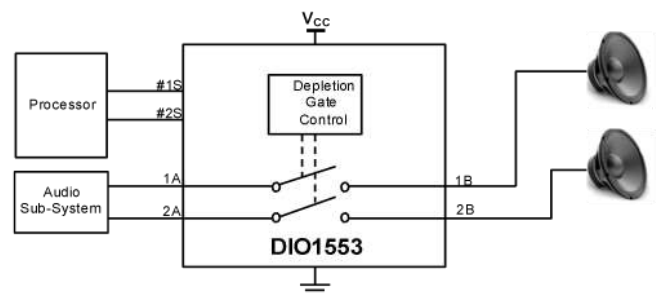
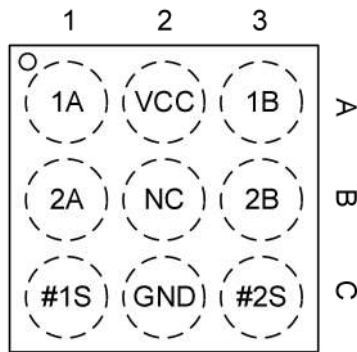


Figure 1. Application block diagram

Ordering Information

Ordering Part No.	Top Marking	MSL	RoHS	T _A	Package	
DIO1553WL9	1553	1	Green	-40 to 85°C	WLCSP-9	Tape & Reel, 3000

Pin Configuration



WLCSP-9

Figure 2. Pin assignment (Top view)

Pin Definitions

Pin No.	Pin Name	Type	Description
A1	1A	Depletion I/O	A-port of Switch 1 (normally closed)
A3	1B	Depletion I/O	B-port of Switch 1 (normally closed)
C1	#1S	Control	Select to enable / disable SW1 (enable low)
A2	VCC	Power Supply / Control	Power supply input
B2	NC	No connect	Do not connect.
C2	GND	Ground	Ground
B1	2A	Depletion I/O	A-port of Switch 2 (normally closed)
B3	2B	Depletion I/O	B-port of Switch 2 (normally closed)
C3	#2S	Control	Select to enable / disable SW2 (enable low)

Truth Table (Table 1)

VCC	#1S	#2S	Switch 1	Switch 2
LOW	X	X	ON	ON
HIGH	HIGH	HIGH	OFF	OFF
HIGH	LOW	HIGH	ON	OFF
HIGH	HIGH	LOW	OFF	ON

Absolute maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter		Min	Max	Unit
V _{CC}	Supply / control voltage		-0.5	4.3	V
V _{CNTRL}	Select input voltage	#1S, #2S	-0.5	4.3	V
V _{SW(ON)}	DC switch I/O voltage (switch conducting)	1A, 1B, 2A, 2B	-2	2	V
V _{SW(OFF)}	DC switch I/O voltage (switch isolated)	1A, 1B, 2A, 2B	-1.8	V _{CC}	V
I _{SW}	Switch I/O current	V _{CC} = 0 V (switch conducting)		350	mA
I _{SWPEAK}	Peak switch current	Pulsed at 1 ms duration, < 10% duty cycle		500	mA
ESD	HBM, ANSI/ESDA/JEDEC JS-001			±4	kV
θ _{JA}	Thermal resistance, junction-to-ambient			97	°C/W
T _{STG}	Storage temperature		-65	150	°C
T _A	Absolute maximum operating temperature		-40	85	°C

Recommended 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 these ratings or designing to Absolute Maximum Ratings.

Symbol	Parameter		Min	Max	Unit
V _{CC(ON)}	Supply voltage with depletion switch conducting (1A = 1B; 2A = 2B)		0	0.2	V
V _{CC(OFF)}	Supply voltage with depletion switch isolated (1A ≠ 1B; 2A ≠ 2B)		1.6	3	V
V _{SW(ON)}	DC switch I/O voltage; switch conducting		-1.5	1.5	V
V _{SW(OFF)}	DC switch I/O voltage; switch isolated		-1.5	1.5	V
V _{CNTRL}	Select input voltage; #1S, #2S		0	3	V

DC Electrical Characteristics

Typical values are for $T_A = 25^\circ\text{C}$, unless otherwise specified.

Symbol	Parameter	Condition	$T_A = -40^\circ\text{C to } 85^\circ\text{C}$				
			V_{CC} (V)	Min	Typ	Max	Unit
$V_{CC(HYS)}$	Supply voltage hysteresis				180		mV
I_{ON}	Switch on leakage current	nA = -0.5 V, 0.5 V, 1.5 V, -1.5 V, nB = Float, #1S = #2S = Float	0		0.1		μA
I_{OFF}	Switch off leakage current	nA = -0.5 V, 0.5 V, 1.5 V, -1.5 V, nB = GND, #1S = #2S = V_{CC}	1.8		0.5		μA
I_{CCT}	Increase in I_{CC} for each select pin	#1S = V_{CC} , #2S = 1.2 V	3		7		μA
		#1S = 1.2 V, #2S = V_{CC}					
R_{ON}	Switch on resistance	$I_{SW} = 100 \text{ mA}$, $V_{SW} = -1.5 \text{ V to } 1.5 \text{ V}$	0		0.35		Ω
ΔR_{ON}	Switch on resistance difference, channel to channel	$I_{SW} = 100 \text{ mA}$, $V_{SW} = -1.5 \text{ V to } 1.5 \text{ V}$	0		0.01		Ω
$R_{FLAT(ON)}$	On resistance flatness	$I_{SW} = 100 \text{ mA}$, $V_{SW} = -1.5 \text{ V to } 1.5 \text{ V}$	0		0.01		Ω
R_{PD}	V_{CC} pull-down resistance		<0.2		1.5		$\text{M}\Omega$
R_{PU}	Select pull-up resistance		<0.2		3		$\text{M}\Omega$
I_{CC}	Quiescent supply current	#1S = # 2S = 0 V or Float	Switch isolated	1.5 - 3.0	50		μA
			Switch conducting	0.2	0.2		
V_{IH}	Select pin input high voltage		1.5 - 3.0	1.2			V
V_{IL}	Select pin input low voltage		1.5 - 3.0			0.5	V

Note:

(1) Specifications subject to change without notice.



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AC Electrical Characteristics

Typical values are for $T_A = 25^\circ\text{C}$, unless otherwise specified.

Symbol	Parameter	Condition	$T_A = -40^\circ\text{C to } 85^\circ\text{C}$				
			V_{CC} (V)	Min	Typ	Max	Unit
t_{ON}	Turn-on time V_{CC} to output	$R_L = 32 \Omega$, $C_L = 10 \text{ pF}$, #nS = Float ⁽¹⁾	$V_{SW} = 1.5 \text{ V}$	1.8 → 0	1		μs
			$V_{SW} = -1.5 \text{ V}$	1.8 → 0	1		
t_{OFF}	Turn-off time V_{CC} to output	$R_L = 32 \Omega$, $C_L = 10 \text{ pF}$, #nS = Float ⁽¹⁾	$V_{SW} = 1.5 \text{ V}$	0 → 1.8	130		μs
			$V_{SW} = -1.5 \text{ V}$	0 → 1.8	170		
t_{ONS}	Turn-on time select pin	$R_L = 32 \Omega$, $C_L = 10 \text{ pF}$, #nS = $V_{CC} \rightarrow 0$ ⁽²⁾	$V_{SW} = 1.5 \text{ V}$	1.8	180		μs
			$V_{SW} = -1.5 \text{ V}$	1.8	180		
t_{OFFS}	Turn-off time select pin	$R_L = 32 \Omega$, $C_L = 10 \text{ pF}$, #nS = $0 \rightarrow V_{CC}$ ⁽²⁾	$V_{SW} = 1.5 \text{ V}$	1.8	55		μs
			$V_{SW} = -1.5 \text{ V}$	1.8	100		
BW	-3 dB bandwidth	$V_{SW} = 600 \text{ mVpp}$, $R_L = 50 \Omega$; $C_L = 5 \text{ pF}$		0		340	MHz
THD+N	Total harmonic distortion + noise	$V_{SW} = 1 V_{RMS}$, $R_L = 32 \Omega$, $f = 1 \text{ kHz}$	Non A-weighted	0		-103	dB
			A-weighted			-107	
OIRR	Port off isolation	$V_{SW} = 0.707 V_{RMS}$, $R_L = 32 \Omega$, $f = 20 \text{ Hz to } 100 \text{ kHz}$ ⁽³⁾		1.8	-70	-88	dB
X_{TALK}	Cross talk	$V_{SW} = 1 V_{RMS}$, $f = 20 \text{ kHz}$, $R_L = 32 \Omega$		1.8		-100	dB
		$V_{SW} = 1 V_{RMS}$, $f = 100 \text{ kHz}$, $R_L = 32 \Omega$				-75	
PSRR	Power supply rejection ratio	Switch isolating, $V_{Ripple} =$ $V_{CC} + 300 \text{ mVpp}$, $R_L = 32 \Omega$	217 Hz	1.8		-80	dB
			1 kHz			-77	
			20 kHz			-73	

Note:

- (1) See Figure 3.
- (2) See Figure 4.
- (3) See Figure 5
- (4) Specifications subject to change without notice.

Capacitance

Unless otherwise specified, typical values are for $T_A = 25^\circ\text{C}$.

Symbol	Parameter	Condition	$T_A = -40^\circ\text{C to } 85^\circ\text{C}$				
			V_{CC} (V)	Min	Typ	Max	Unit
C_{ON}	On capacitance	$V_{SW} = 400 \text{ mVPP}$, $f = 1 \text{ MHz}$,	0		21		pF
C_{OFF}	Off capacitance	$V_{SW} = 400 \text{ mVPP}$, $f = 1 \text{ MHz}$, #1S = #2S = V_{CC}	1.8		25		pF
C_{CTRL}	Select pin capacitance	#nS = 400 mVPP , $f = 1 \text{ MHz}$,	1.8		5		pF

Timing Diagrams

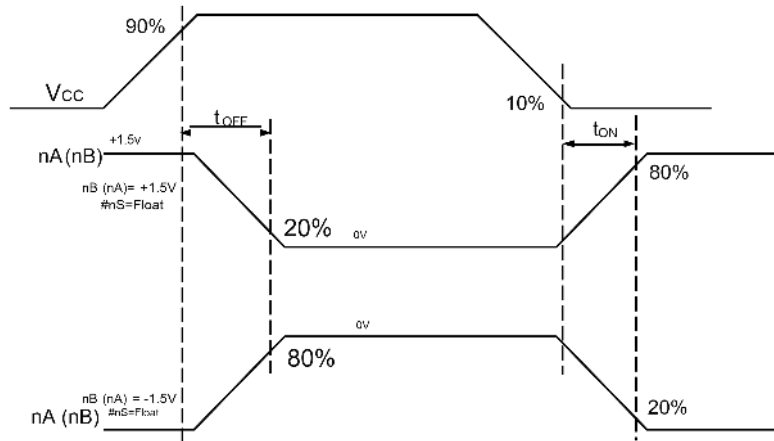


Figure 3. t_{ON}/t_{OFF} V_{CC} to output timing

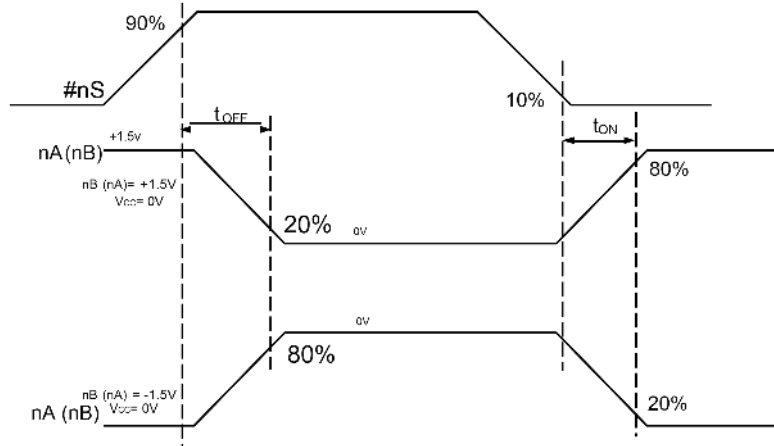


Figure 4. t_{ON}/t_{OFF} select ($\#nS$) to output timing

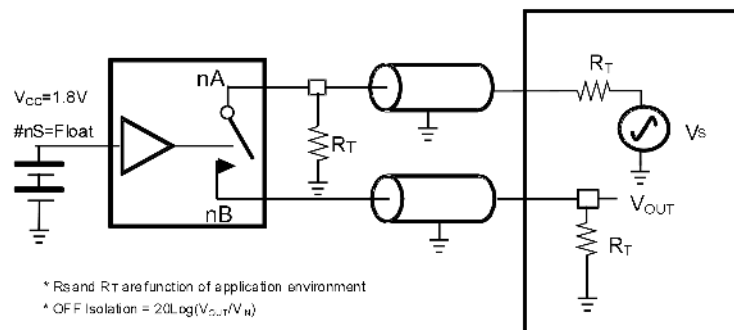


Figure 5. OFF isolation

Typical Performance Characteristics

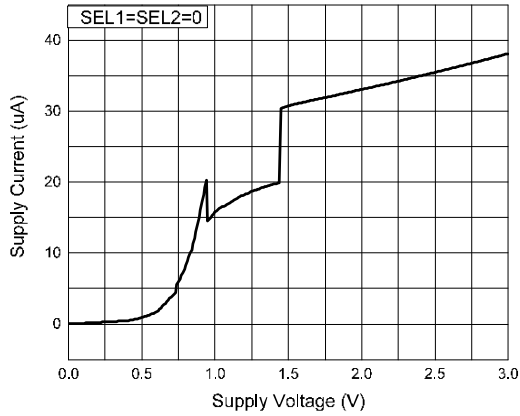


Figure 6. Icc vs. Vcc

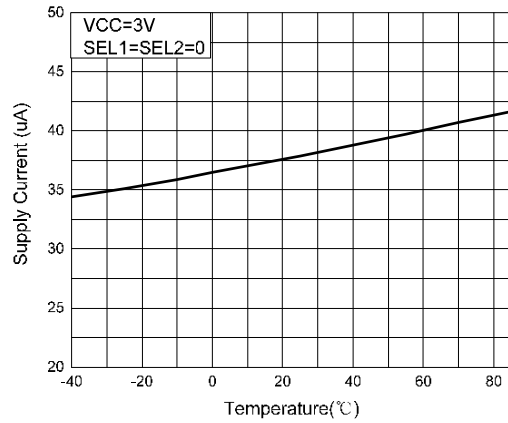


Figure 7. Icc vs. Temperature

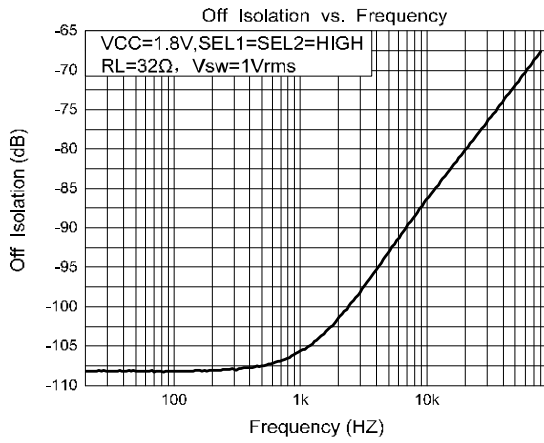
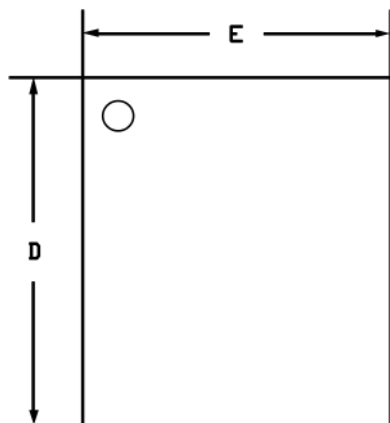
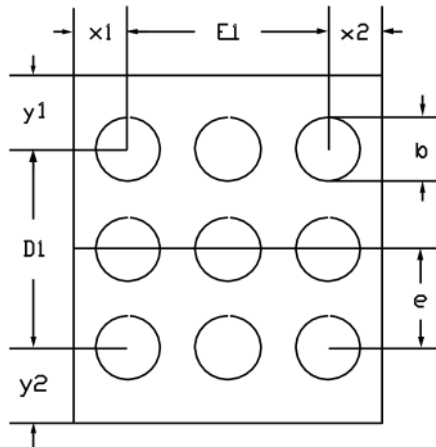


Figure 8. OIRR

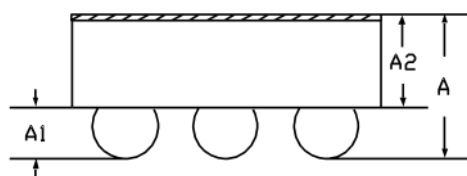
Physical Dimensions: WLCSP-9



TOP VIEW
(MARK SIDE)

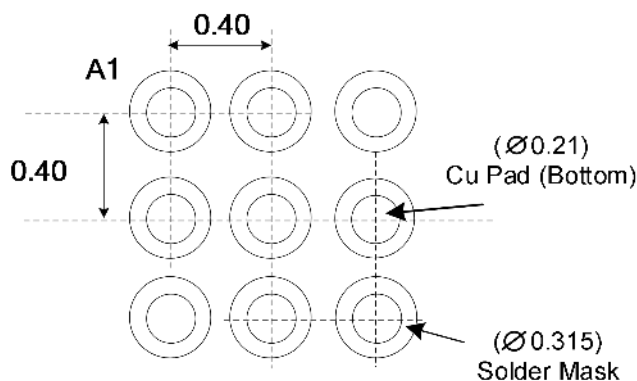


BOTTOM VIEW
(BALL SIDE)



SIDE VIEW

NOTES:
ALL WAFER ORIENTATION NOTCH DOWN



Land Pattern Recommendation

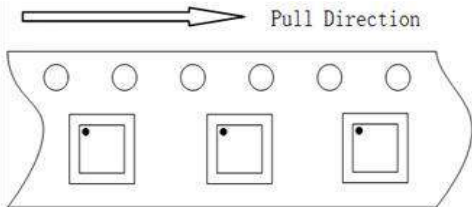
Common Dimensions			
Units of measure = Millimeter			
Symbol	Min	Nom	Max
A	0.541	0.581	0.624
A1	0.183	0.203	0.223
A2	0.358	0.378	0.398
D	1.365	1.385	1.405
D1	0.800 BSC		
E	1.195	1.215	1.235
E1	0.800 BSC		
b	0.23	0.26	0.29
e	0.400 BSC		
x1	0.2075 REF		
x2	0.2075 REF		
y1	0.2925 REF		
y2	0.2925 REF		

DIO1553WL9 Packing Instructions

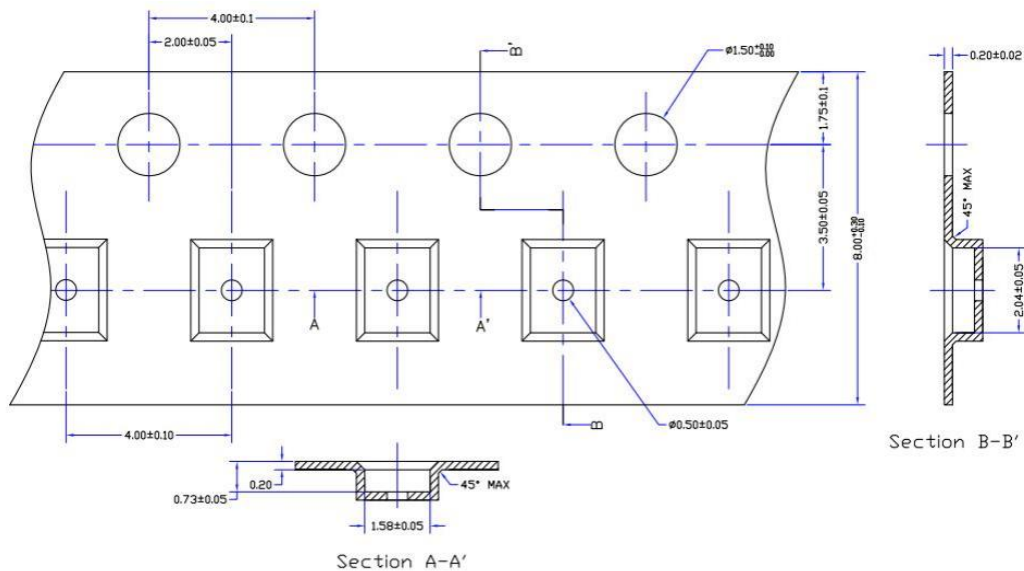
DIO1553WL9 WLCSP-9 MSL1

Package: Tape & Reel + Moisture Barrier Bag + Vacuum

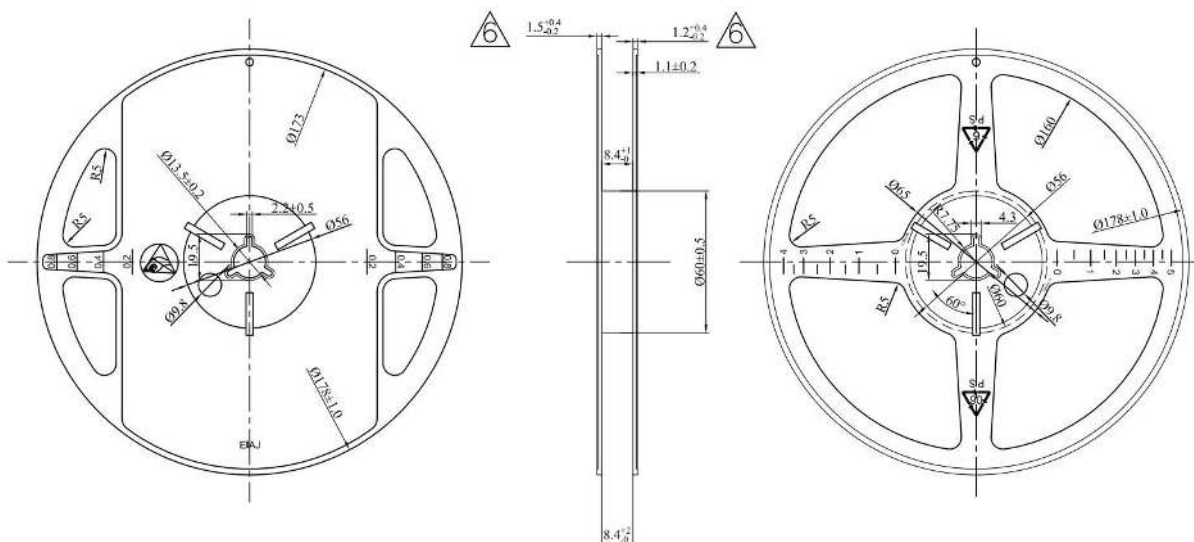
1. Tape & Reel orientation



2. Tape dimensions



3. Reel dimensions (7 inches)





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4. Packing Specification

PKG	Pcs / Reel	Gram / Reel	Reel / Box	Pcs / Box	Box / Carton	Pcs / Carton
WLCSP-9	3000	100	4	12000	12	144000



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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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