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June 2013

FDZ2040L Integrated Load Switch

Features

- Optimized for Low-Voltage Core ICs in Portable Systems
- Very Small Package Dimension: WL-CSP 0.8 X 0.8 X 0.5 mm³
- Current = 1.2 A, V_{IN} max. = 4 V
- Current = 2 A, V_{IN} max. = 4 V (Pulsed)
- $R_{DS(ON)} = 80 \text{ m}\Omega$ at $V_{ON} = 0 \text{ V}$, $V_{IN} = 4 \text{ V}$
- $R_{DS(ON)} = 85 \text{ m}\Omega \text{ at } V_{ON} = 0 \text{ V}, V_{IN} = 3.6 \text{ V}$
- $R_{DS(ON)} = 90 \text{ m}\Omega$ at $V_{ON} = 0 \text{ V}$, $V_{IN} = 3 \text{ V}$
- RoHS Compliant

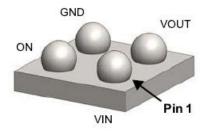


General Description

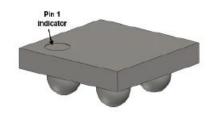
This device is particularly suited for compact power management in portable applications where 1.6 V to 4 V input and 1.2 A output current capability are needed. This load switch integrates a level-shifting function that drives a P-channel power MOSFET in the very small 0.8 X 0.8 X 0.5 mm³ WL-CSP package.

Applications

- Load Switch
- Power Management in Portable Applications





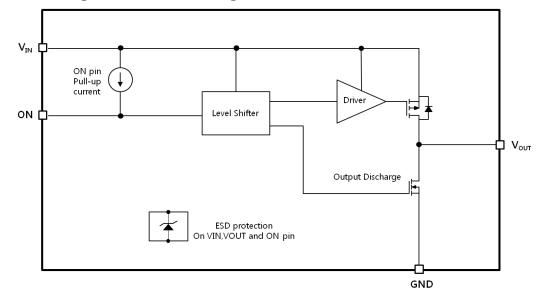


TOP

Ordering Information

Part Number	Device Marking	Ball Pitch	Operating Temperature Range	Switch	Package	Packing Method
FDZ2040L	ZL	0.4 mm	-25 to 75°C	80 mΩ, P-Channel MOSFET	0.8x0.8x0.5 mm ³ WL-CSP	Tape and Reel

Application Diagram and Block Diagram



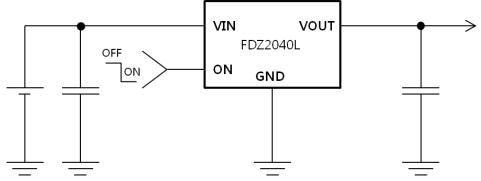
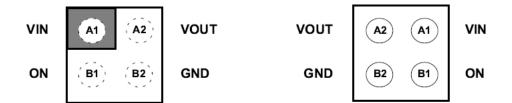


Figure 1. Block Diagram and Typical Application Pin Configuration



Top View: Bumps Facing Down Bottom View: Bumps Facing Up

Figure 2. Pin Assignment

Pin Definitions

Pin#	Name	Description	
A1	V_{IN}	Supply Input: Input to the load switch	
A2	V_{OUT}	Switch Output: Output of the load switch	
B1	ON	N/OFF Control Input, Active LOW	
B2	GND	Ground	

Absolute Maximum Ratings

Pa	rameter	Min.	Max.	Unit
V _{IN} , V _{OUT} , ON to GND			4.2	V
I _{OUT} – Load Current (Continuous) ^(1a)			1.2	А
I _{OUT} – Load Current (Pulsed) ⁽²⁾	_{OUT} – Load Current (Pulsed) ⁽²⁾			А
Power Dissipation @ Ta = 25°C ^(1a)		0.9	W	
Operating Temperature Range			105	°C
Storage Temperature			150	°C
Floatroatatic Discharge Canability	Human Body Model, JESD22-A114	8		kV
Electrostatic Discharge Capability	Charged Device Model, JESD22-C101	2		KV

Thermal Characteristics

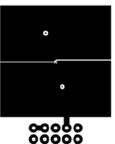
Parameter	Min.	Max.	Unit
Thermal Resistance, Junction to Ambient ^(1a)		117	°C/W

Recommended Operating Conditions

Parameter	Min.	Max.	Unit
V _{IN}	1.6	4.0	V
Ambient Operating Temperature, T _A	-25	75	°C

Notes:

1. $R_{\Theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\Theta JC}$ is guaranteed by design while $R_{\Theta JA}$ is determined by the user's board design.



 a. 117 °C/W when mounted on a 1 in² pad of 2 oz copper.



 b. 277 °C/W when mounted on a minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width < 300 μ s, Duty Cycle < 2.0%.

Electrical Characteristics

 $T_J = 25$ °C unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
V _{IN}	Operation Voltage		1.6		4.0	٧
V.		V_{IN} = 1.6 V, Ramp-Down V_{ON} from 1 V to 0 V, V_{OUT} LOW to HIGH, T_J = -25 to 75°C			0.35	٧
V_{IL}	ON Input Logic LOW Voltage	V_{IN} = 4 V, Ramp-Down V_{ON} from 1 V to 0 V, V_{OUT} LOW to HIGH, T_J = -25 to 75°C			0.35	V
V _{IH}	ON Input Logic HIGH Voltage	V_{IN} = 1.6 V, Ramp-Up V_{ON} from 0 V to 1 V, V_{OUT} HIGH to LOW, T_J = -25 to 75°C	1.35			V
VIH	ON Input Logic HIGH Voltage	V_{IN} = 4 V, Ramp-Up V_{ON} from 0 V to 1 V, V_{OUT} HIGH to LOW, T_J = -25 to 75°C	1.35			V
ΙQ	Quiescent Current $V_{IN} = 3 \text{ V}, V_{ON} = 0.35 \text{ V}, I_{OUT} = 0 \text{ A}, T_{J} = -25 \text{ to } 75^{\circ}\text{C}$			1.55	2.50	μΑ
$I_{Q_{off}}$	Off Supply Current	$V_{IN} = 3 \text{ V}, V_{ON} = 1.3 \text{ V}, I_{OUT} = 0 \text{ A},$ $T_J = -25 \text{ to } 75^{\circ}\text{C}$		2.4	6.5	μA
I _{SD_off}	Off Switch Current	$V_{IN} = 3 \text{ V}, V_{ON} = 1.3 \text{ V}, V_{OUT} = 0 \text{ V},$ $T_{J} = -25 \text{ to } 75^{\circ}\text{C}$		0.1	3.5	μΑ
la #	Off Cumply Current with ON	V _{IN} = 3 V, V _{ON} = Floating, I _{OUT} = 0 A		1.6	2.3	μΑ
I _{Q_off} (VON float)	Off Supply Current with ON Pin Floating	$V_{IN} = 3 \text{ V}, V_{ON} = \text{Floating}, I_{OUT} = 0 \text{ A},$ $T_J = -25 \text{ to } 75^{\circ}\text{C}$		1.6	4.0	μΑ
R _{PULL-DOWN}	Output Pull-Down Resistance	V _{IN} =3 V, I _{OUT} =10 mA		22		Ω
		V _{IN} = 1.6 V, V _{ON} = 0 V, I _{OUT} = 300m A		68	120	
R _{DS(ON)}	On Resistance	V _{IN} = 3 V, V _{ON} = 0 V, I _{OUT} = 300m A		50	90	mΩ
		V _{IN} = 3.6 V, V _{ON} = 0 V, I _{OUT} = 300 mA		48	85	
		$V_{IN} = 4 \text{ V}, V_{ON} = 0 \text{ V}, I_{OUT} = 300 \text{ mA},$ $T_J = -25 \text{ to } 75^{\circ}\text{C}$		47	80	
C _{V-ON(INP)}	ON Input Capacitance	T _J = -25 to 75°C			5	pF
I _{ON(PULL-UP)}	ON Pull-Up Current	$V_{IN} = 3 \text{ V}, V_{ON} = 0 \text{ V}, T_{J} = -25 \text{ to } 75^{\circ}\text{C}$	0.30	0.76	1.20	μΑ

Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
t _{on}	Turn-On Time (V _{ON} 50% to V _{OUT} 90%)			45	150	ns
t _{don}	Turn-On Delay (V _{ON} 50% to V _{OUT} 10%)			35	100	ns
t_{rise}	Turn-On Rise Time (V _{OUT} 10% to 90%)	V _{IN} =3 V, V _{ON} = 0 V as Logic LOW and		10	50	ns
t_{off}	Turn-Off Time (V _{ON} 50% to V _{OUT} 10%)	1.3 V as Logic HIGH, $C_{OUT} = 1$ nF, $R_L = 30 \Omega$, $T_J = -25$ to 75°C		60	150	ns
t_{doff}	Turn-Off Delay (V _{ON} 50% to V _{OUT} 90%)			25	100	ns
t _{fall}	Turn-Off Fall Time (V _{OUT} 90% to 10%)			35	65	ns
$t_{don} - t_{doff}$	Turn-On Turn-Off Delay Delta				50	ns

Typical Performance Characteristics

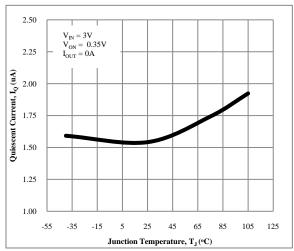
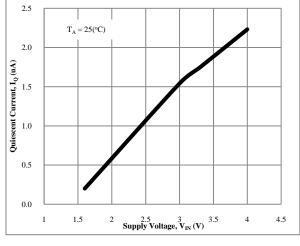


Figure 3. Quiescent Current vs. Temperature Figure 4. Quiescer



 $V_{IN}=3V\\$ $V_{IN} = 3V$ $V_{ON} = 1.3V$ $I_{OUT} = 0A$ 13 Off Supply Current, IQOFF (uA) 11 9 7 5 3 25 45 85 105 -35 65 Junction Temperature, $T_J(^{o}C)$

Figure 5.Off Supply Current vs. Temperature

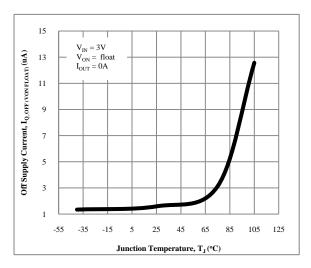


Figure 7. Off Supply Current (V_{ON} Float) vs. Temperature

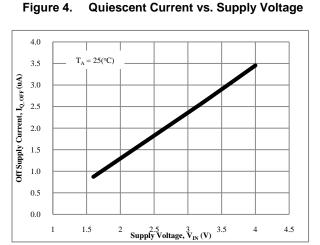


Figure 6. Off Supply Current vs. Supply Voltage

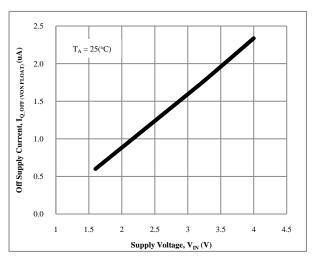


Figure 8. Off Supply Current (V_{ON} Float) vs. Supply Voltage

Typical Performance Characteristics (Continued)

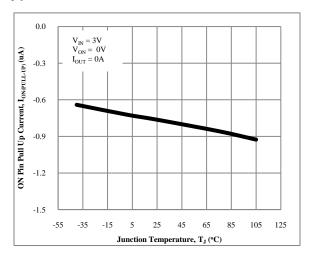
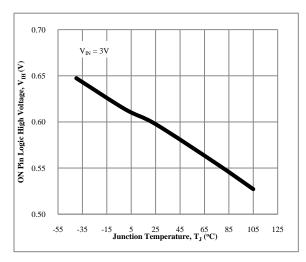


Figure 9. ON Pin Pull-Up Current vs. Temperature

Figure 10. ON Pin Pull-Up Current vs. Supply Voltage



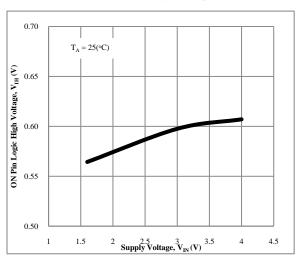
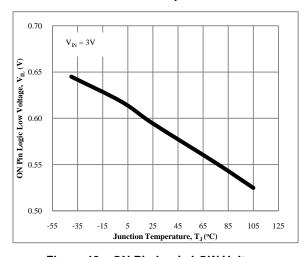


Figure 11. ON Pin Logic HIGH Voltage vs. Temperature

Figure 12. ON Pin Logic HIGH Voltage vs. Supply Voltage



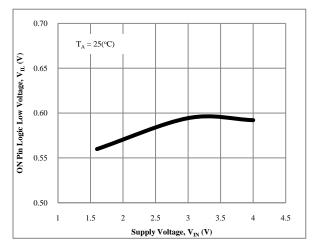


Figure 13. ON Pin Logic LOW Voltage vs. Temperature

Figure 14. ON Pin Logic LOW Voltage vs. Supply Voltage

Typical Performance Characteristics (Continued)

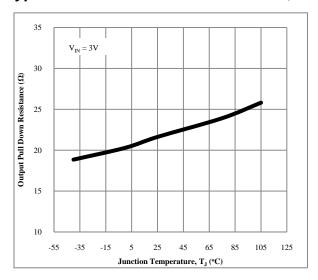


Figure 15. Output Pull-Down Resistance vs. Temperature

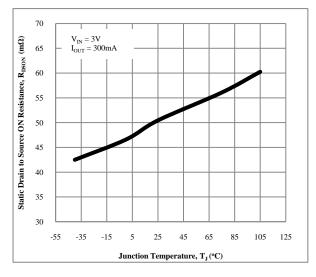


Figure 17. Static Drain-to-Source ON Resistance vs. Temperature

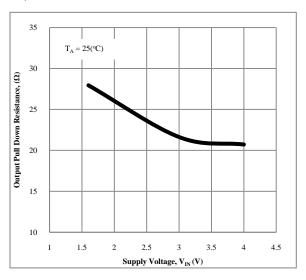


Figure 16. Output Pull-Down Resistance vs. Supply Voltage

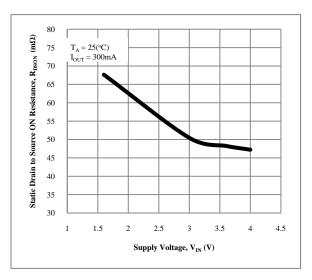
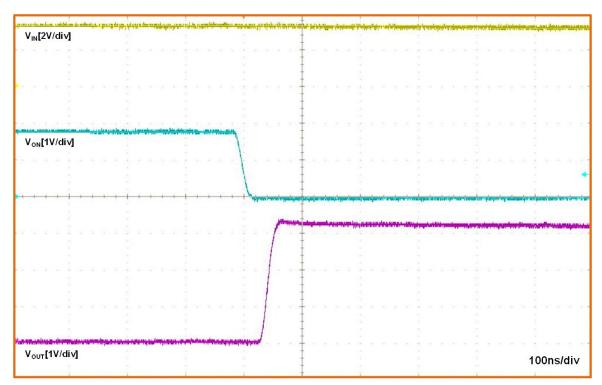


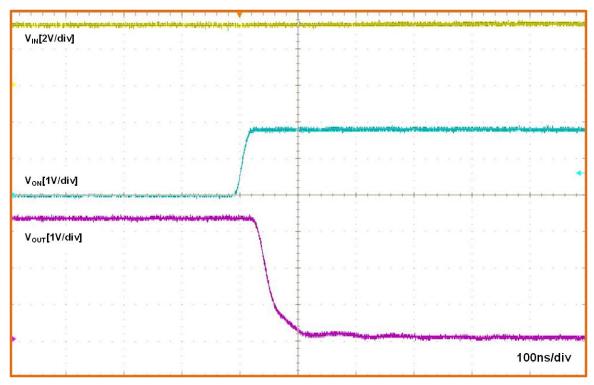
Figure 18. Static Drain-to-Source ON Resistance vs. Supply Voltage

Typical Performance Characteristics (Continued)



 V_{IN} = 3.3 V, V_{ON} = 0 V, C_{IN} = 1 $\mu\text{F},\,C_{\text{OUT}}$ = 1 nF, R_{L} = 30 Ω

Figure 19. ton Response



 $V_{\text{IN}} = 3.3 \text{ V}, \, V_{\text{ON}} = 0 \text{ V}, \, C_{\text{IN}} = 1 \text{ } \mu\text{F}, \, C_{\text{OUT}} = 1 \text{ } n\text{F}, \, R_{\text{L}} = 30 \text{ } \Omega$

Figure 20. t_{OFF} Response

Operation Description

The FDZ2040L is a low-R_{DS(ON)} P-channel load switch packaged in space-saving 0.8 x 0.8 WL-CSP.

The core of the device is an $80m\Omega$ P-channel MOSFET and capable of functioning over a wide input operating range of 1.6 V-4 V.

Applications Information

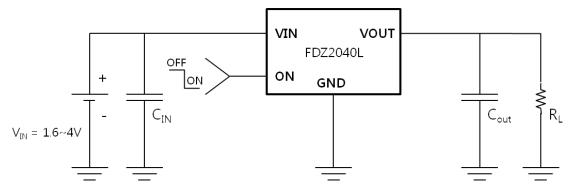


Figure 21. Typical Application

Input Capacitor

To reduce device inrush current effect, a 0.1 μ F ceramic capacitor, C_{IN} is recommended close to the V_{IN} pin. A higher value of C_{IN} can be used to further reduce the voltage drop experienced as the switch is turned on into a large capacitive load.

Output Capacitor

FDZ2040L switch works without an output capacitor. If parasitic board inductance forces V_{OUT} below GND when switching off, a 1 nF capacitor, C_{OUT}, should be placed between VOUT and GND.

Note:

3. The intrinsic diode for P-channel load switch would conduct if V_{OUT} is greater than V_{IN} , by a diode drop.

Evaluation Board Layout

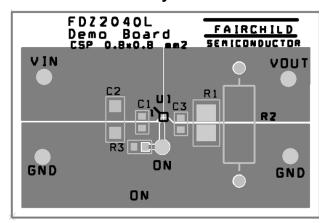


Figure 22. Top View

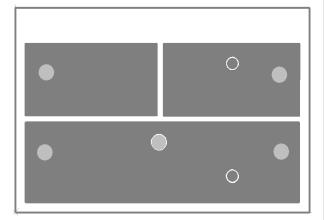
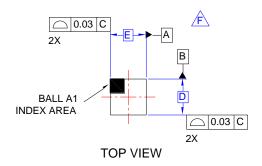
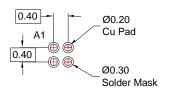


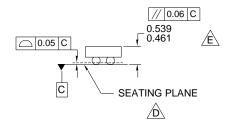
Figure 23. Bottom View

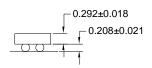
Physical Dimensions





RECOMMENDED LAND PATTERN (NSMD PAD TYPE)

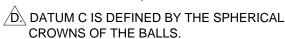




SIDE VIEWS

NOTES:

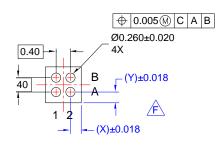
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- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCE PER ASME Y14.5M, 1994.



EXPACKAGE NOMINAL HEIGHT IS 500 MICRONS ±39 MICRONS (461-539 MICRONS).

FOR DIMENSIONS D, E, X, AND Y SEE PRODUCT DATASHEET.

G. DRAWING FILNAME: MKT-UC004AFrev1.



BOTTOM VIEW

Figure 24. 4 Ball, WLCSP, 2 X 2 Array, 0.4 mm Pitch, 250 µm Ball

Product-Specific Dimensions

Product	D	E	х	Υ	
FDZ2040L	FDZ2040L 0.8 ± 0.03 mm		0.21 mm	0.21 mm	

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Definition of Terms						
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