FAIRCHILD SEMICONDUCTOR®

February 2011

FDZ1040L

Integrated Load Switch

Features

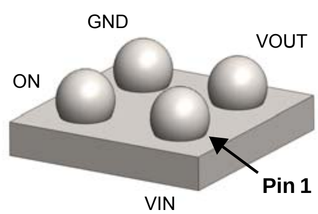
- Optimized for low-voltage core ICs in portable systems
- Very small package dimension: WL-CSP 0.8X0.8X0.5 mm^3
- Current = 1.2 A, V_{IN} max = 4 V
- Current = 2 A, V_{IN} max = 4 V(Pulsed)
- $R_{DS(on)}$ = 80 mΩ at V_{on} = V_{IN} = 4 V
- $R_{DS(on)}$ = 85 mΩ at V_{on} = V_{IN} = 3.6 V
- $R_{DS(on)}$ = 90 mΩ at V_{on} = V_{IN} = 3 V
- $R_{DS(on)}$ = 110 mΩ at V_{on} = 0.7 V, V_{IN} = 1.6 V
- $R_{DS(on)}$ = 309 mΩ at V_{on} = 0.7 V, V_{IN} = 1 V
- RoHS Compliant

General Description

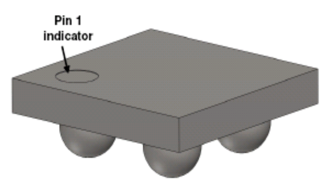
This device is particularly suited for compact power management in portable application where 1 V to 4 V input and 1.2 A output current capability are needed. This load switch integrated a level shifting function that drives a P-Channel Power MOSFET in the very small 0.8X0.8X0.5 mm^3 WL-CSP package.

Applications

- Load switch
- Power management in portable applications



BOTTOM



TOP

Ordering Information

Part Number	Device Marking	Ball Pitch	Operating Temperature Range	Switch	Eco status	Package	Packing Method
FDZ1040L	ZL	0.4 mm	-40 to 85 °C	80 mΩ, P-ch FET	RoHS	0.8x0.8x0.5 mm^3 WL-CSP	Tape and Reel

For Fairchild's definition of Eco Status, please visit: http://www.fairchildsemi.com/company/green/rohs_green.html

Application Diagram or Block Diagram

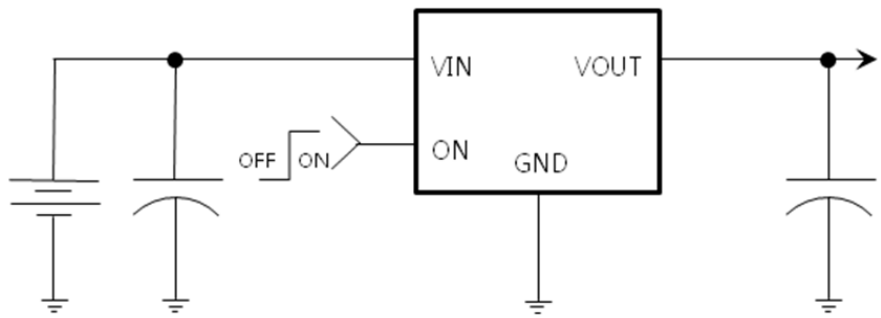
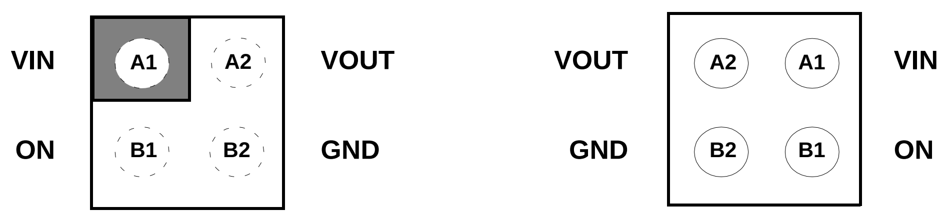


Figure 1. Typical Application Pin Configuration



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	ON/OFF Control Input
B2	GND	Ground

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Absolute Maximum Ratings

Parameter		Min.	Max.	Units
V_{IN}, V_{OUT}, ON to GND		-0.3	4.2	V
I_{OUT}-Load Current (Continuous)	(Note 1a)		1.2	A
I_{OUT}-Load Current (Pulsed)			2	A
Power Dissipation @ T_A = 25^oC	(Note 1a)		0.9	W
Operating Temperature Range		-40	85	^oC
Storage Temperature		-65	150	^oC
Electrostatic Discharge Capability	Human Body Model, JESD22-A114		8	kV
	Charged Device Model, JESD22-C101		2	

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)		117	°C/W

Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Unit
V_{IN}	1		4	V
ON	0.7		4	V
Ambient Operating Temperature, T_A	-40		85	^oC

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Electrical Characteristics T_J = 25 °C unless otherwise noted

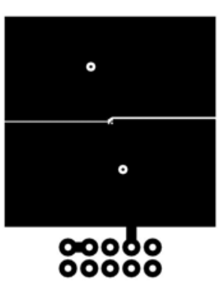
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V_{IN}	Operation Voltage		1		4	V
V_{IL}	ON Input Logic Low Voltage	1.6 V <= V_{IN} <= 4 V 1 V <= V_{IN} <= 1.6 V			0.35 0.25	V
V_{IH}	ON Input Logic High Voltage	1.6 V <= V_{IN} <= 4 V 1 V <= V_{IN} <= 1.6 V	1 0.7			V
I_Q	Quiescent Current	I_{OUT} = 0 mA, V_{IN} = V_{ON} = 1.8 V			1	μA
$I_{Q(off)}$	Off Supply Current	I_{OUT} = 0 mA, V_{IN} = 1.8 V, V_{ON} = GND			1	μA
$I_{SD(off)}$	Off Switch Current	V_{ON} = GND, V_{OUT} = 0 V, V_{IN} = 1.8 V,			100	nA
I_{ON}	ON Input Leakage	V_{ON} = V_{IN} or GND			1	μA
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{ON} = V_{IN} = 4 V, I_{OUT} = 300 mA V_{ON} = V_{IN} = 3.6 V, I_{OUT} = 300 mA V_{ON} = V_{IN} = 3 V, I_{OUT} = 300 mA V_{ON} = 0.7 V, V_{IN} = 1.6 V, I_{OUT} = 300 mA V_{ON} = 0.7 V, V_{IN} = 1 V, I_{OUT} = 300 mA V_{IN} = 3.6 V, I_{OUT} = 300 mA, T_J = 85 °C,		48 49 51 70 142 59	80 85 90 110 309 120	mΩ

Switching Characteristics

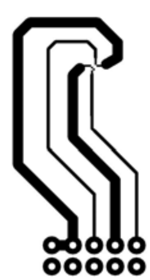
$t_{d(on)}$	Turn-On Delay Time	V_{IN} = 1.6 V, V_{ON} = 0.7 V C_L = 1 μF, R_L = 500 Ω		22		μs
t_r	Turn-On Rise Time			23		μs
$t_{d(off)}$	Turn-Off Delay Time			127		μs
t_f	Turn-Off Fall Time			298		μs
$t_{d(on)}$	Turn-On Delay Time	V_{IN} = 1 V, V_{ON} = 1.8 V C_L = 1 μF, R_L = 500 Ω		37		μs
t_r	Turn-On Rise Time			35		μs
$t_{d(off)}$	Turn-Off Delay Time			161		μs
t_f	Turn-Off Fall Time			544		μs
$t_{d(on)}$	Turn-On Delay Time	V_{IN} = 1.8 V, V_{ON} = 1.8 V C_L = 1 μF, R_L = 500 Ω		20		μs
t_r	Turn-On Rise Time			22		μs
$t_{d(off)}$	Turn-Off Delay Time			136		μs
t_f	Turn-Off Fall Time			272		μs
$t_{d(on)}$	Turn-On Delay Time	V_{IN} = 2.5 V, V_{ON} = 1.8 V C_L = 1 μF, R_L = 500 Ω		15		μs
t_r	Turn-On Rise Time			20		μs
$t_{d(off)}$	Turn-Off Delay Time			168		μs
t_f	Turn-Off Fall Time			229		μs
$t_{d(on)}$	Turn-On Delay Time	V_{IN} = 3.3 V, V_{ON} = 1.8 V C_L = 1 μF, R_L = 500 Ω		13		μs
t_r	Turn-On Rise Time			19		μs
$t_{d(off)}$	Turn-Off Delay Time			202		μs
t_f	Turn-Off Fall Time			214		μs

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 suface 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 in^2 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 μs, Duty cycle < 2.0%.

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Typical Characteristics (Continued)

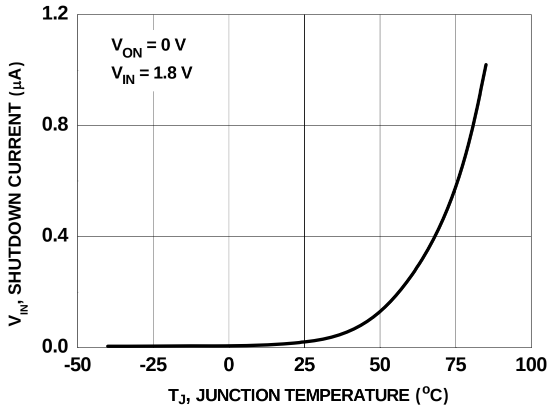

Figure 3. Shutdown Current vs. Temperature

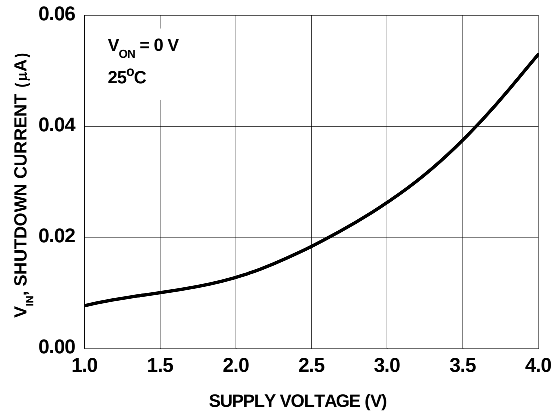

Figure 4. Shutdown Current vs. Supply Voltage

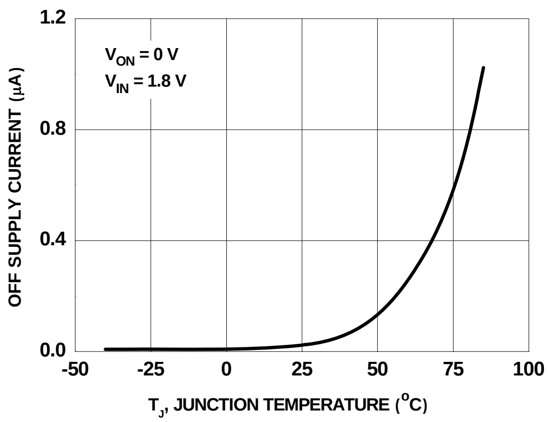

Figure 5. Off Supply Current vs. Temperature

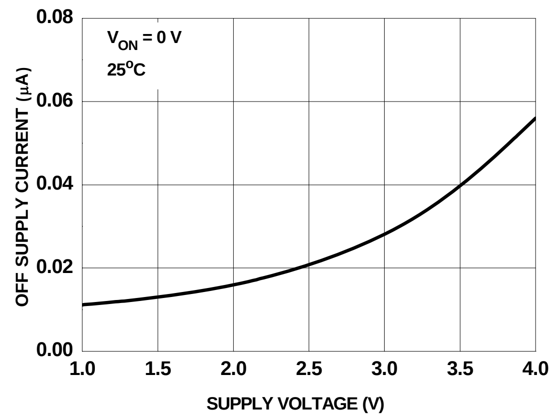

Figure 6. Off Supply Current vs. Supply Voltage

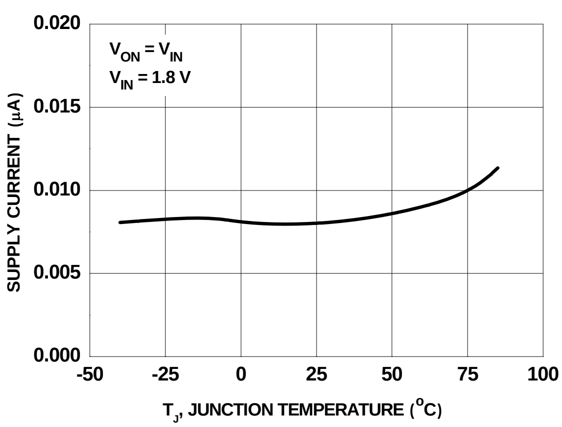

Figure 7. Quiescent Current vs. Temperature

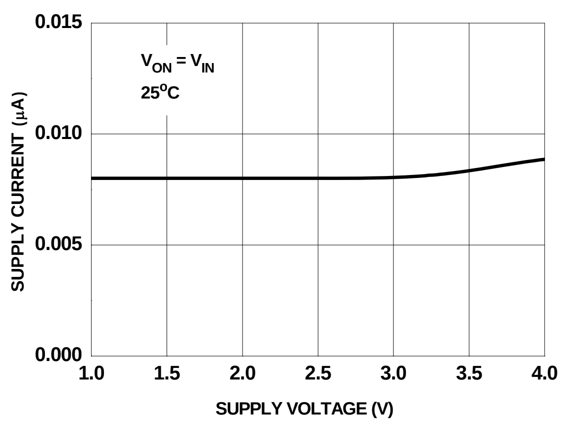

Figure 8. Quiescent Current vs.Supply Voltage

Typical Characteristics (Continued)

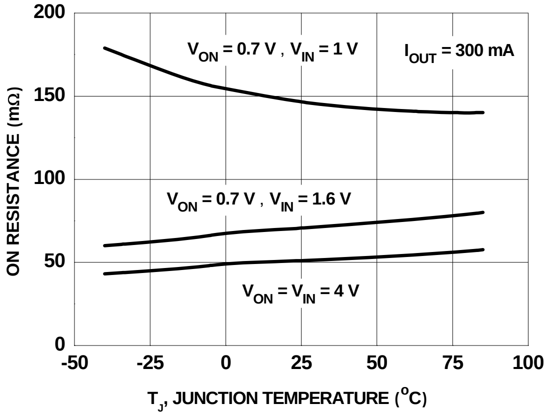

Figure 9. R_{ON} vs. Temperature

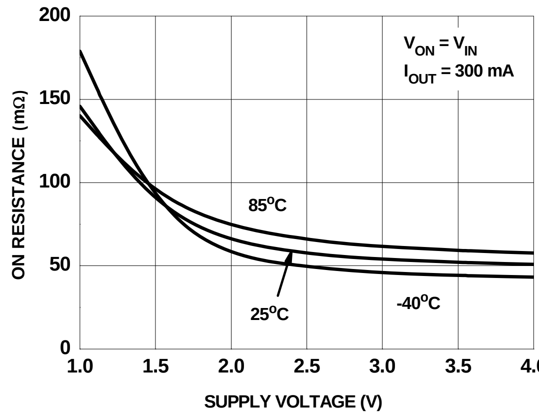

Figure 10. R_{ON} vs. Supply Voltage

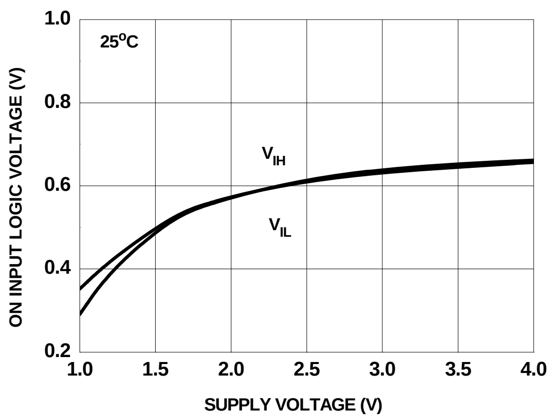

Figure 11. ON-Pin Threshold vs. V_{IN}

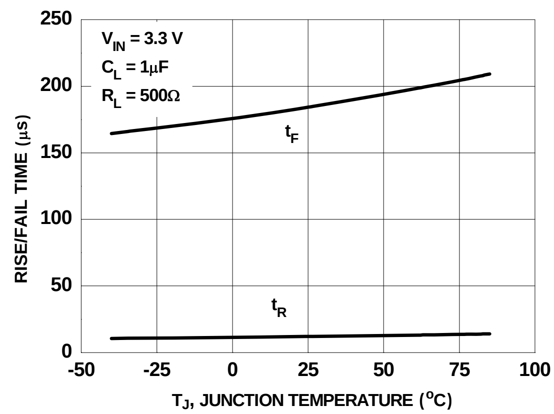

Figure 12. V_{OUT} Rise and Fall Time vs.Temperature at R_L=500Ω

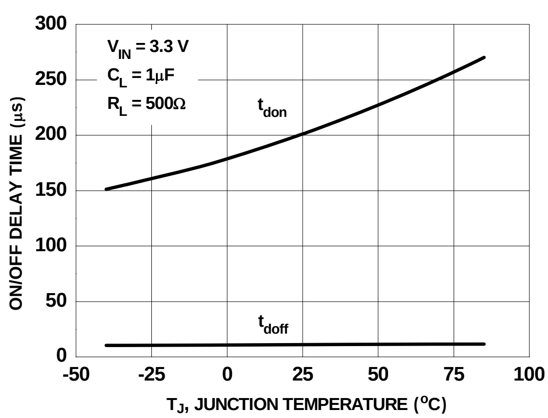

Figure 13. V_{OUT} Turn-On and Turn-Off Delay vs. Temperature at R_L=500Ω

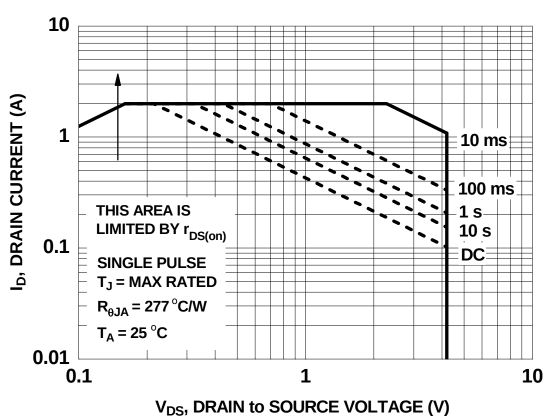

Figure 14. Forward Bias Safe Operation Area

Typical Characteristics (Continued)

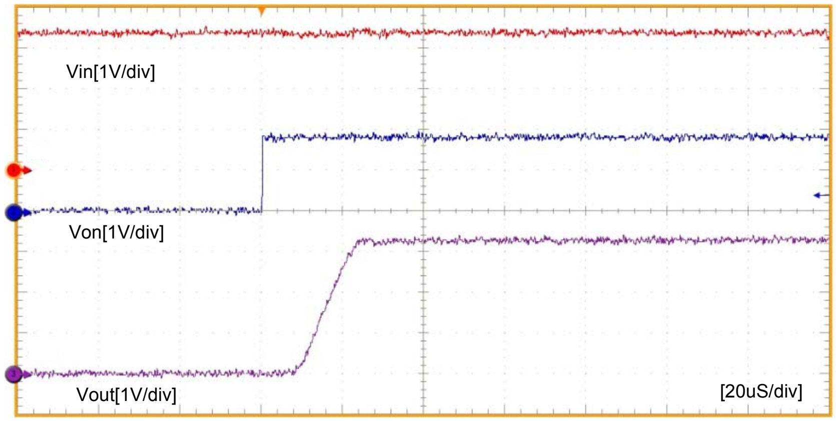

Figure 15. Turn-On Response (V_{IN} = 3.3V, C_{OUT}=1μF, R_L=500Ω)

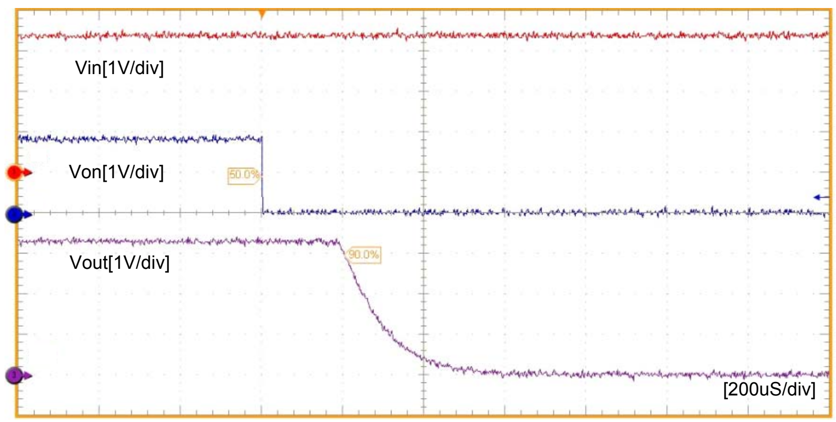

Figure 16. Turn-Off Response (V_{IN} = 3.3V, C_{OUT}=1μF, R_L=500Ω)

Operation Description

The FDZ1040L is a low $R_{DS(ON)}$ P-Channel load switch packaged in space saving 0.8x0.8 WL-CSP.
The core of the device is a 80 mΩ P-Channel MOSFET and capable of functioning over a wide input operating range of 1-4 V.
The ON pin, an active HI TTL compatible input that supports as low as 0.7 V of input, controls the state of the switch.

Applications Information

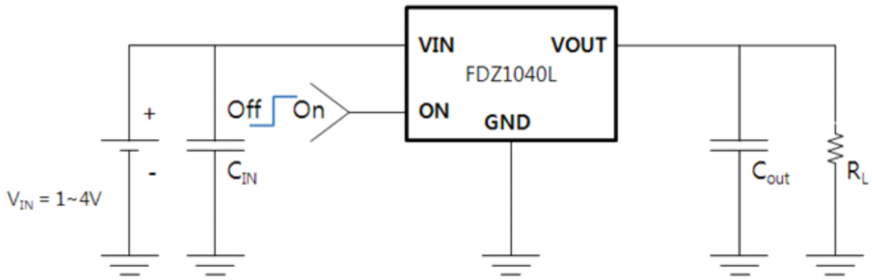

Figure 17. Typical Application

Input Capacitor

To reduce device inrush current effect, a 0.1 uF ceramic capacitor, C_{IN} is recommended close to 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

FDZ1040L switch works without an output capacitor. However, if parasitic board inductance forces Vout below GND when switching off, a 0.1 uF capacitor, C_{OUT}, should be placed between Vout and GND.

Fall Time

Device output fall time can be calculated based on RC constant of external components as follows:

$t_F = R_L \times C_{OUT} \times 2.2$

Where t_F is 90% to 10% fall time, R_L is output load and C_{OUT} is output capacitor.

Dimensional Outline and Pad Layout

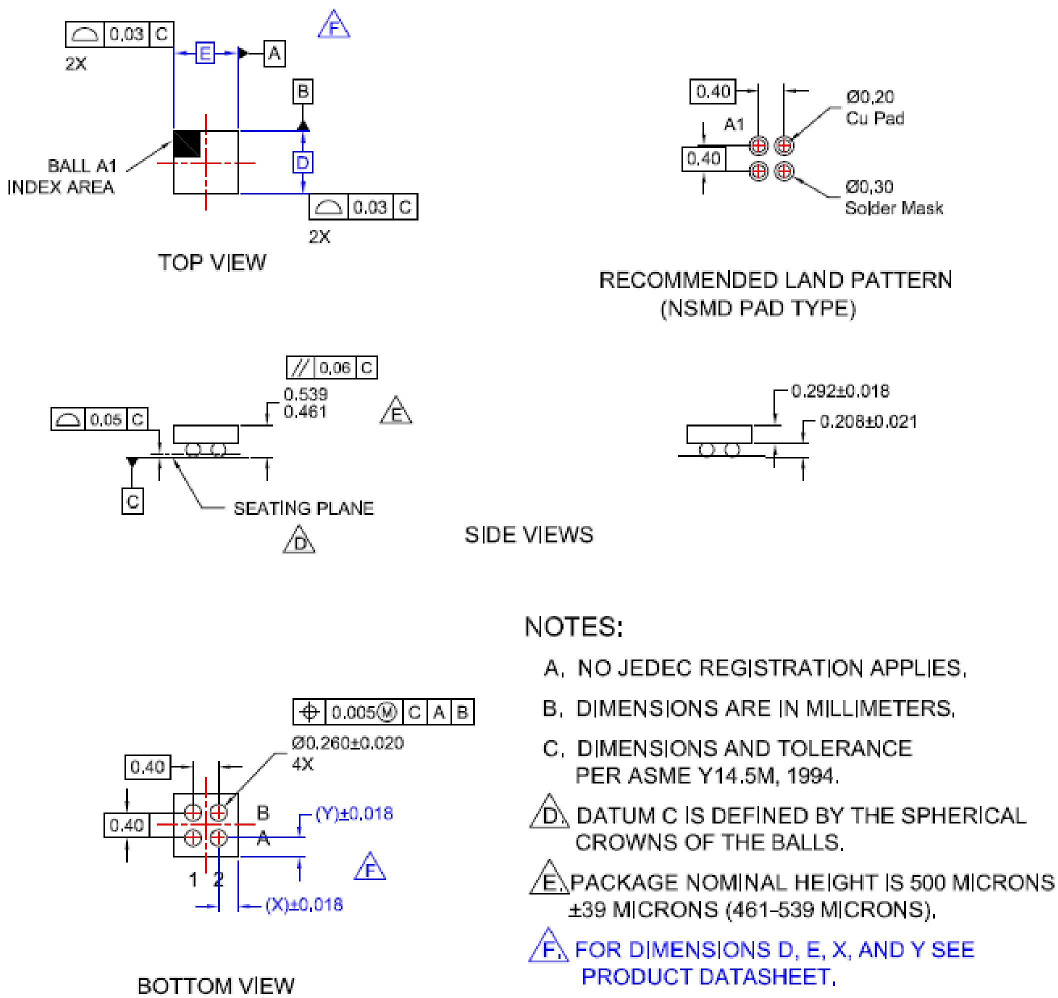

Figure 18. Official FSC Drawings

Product-Specific Dimensions

Product	D	E	X	Y
FDZ1040L	0.8±0.03mm	0.8±0.03mm	0.18 mm	0.18 mm

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