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FAIRCHILD SEMICONDUCTOR®

July 2010

FDZ3N513ZT

Integrated NMOS and Schottky Diode

Features

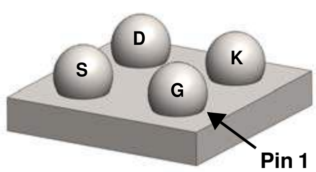
- Monolithic NMOS and Schottky Diode
- Ultra-small form factor 1mm x 1mm WLCSP
- Max $r_{DS(on)}$ = 462 mΩ at V_{GS} = 4.5 V, I_D = 0.3 A
- Max $r_{DS(on)}$ = 520 mΩ at V_{GS} = 3.2 V, I_D = 0.3 A
- HBM ESD protection level > 2000V (Note3)
- RoHS Compliant

General Description

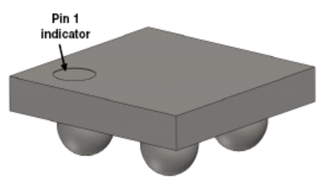
The FDZ3N513ZT is a monolithic NMOS/ Schottky combination (FETky) and is designed and wired to function as a discontinuous conduction mode (DCM) boost LED power train for mobile LED backlighting applications.

Application

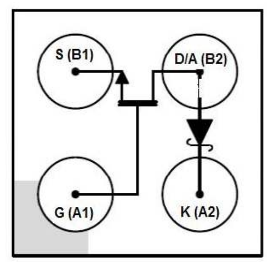
- Boost Converter Power Train for single cell Li-ion LED backlighting



WL-CSP 3D Bumps Facing Up View



WL-CSP 3D Bumps Facing Down View



WL-CSP 1.0X1.0 Bumps Facing Up View

Absolute Maximum Ratings

Symbol	Parameter		Ratings	Units
V_{DS}	NMOS Drain to Source Voltage		30	V
V_{GS}	NMOS Gate to Source Voltage		-0.3/5.5	V
P_D	Power Dissipation @ T_A = 25°C	(Note 1a)	1	W
I_D	Maximum Continuous NMOS Drain Current	(Note 1a)	1.1	A
V_{RRM}	Schottky Repetitive Peak Reverse Voltage		25	V
I_O	Schottky Average Forward Current		0.3	A
T_J, T_{STG}	Operating Junction and Storage Temperature		-55/125	°C
ESD	Electrostatic Discharge Protection	CDM	2000	V

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction to Ambient - 1in^2, 2oz. Copper	(Note 1a)	100	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient - Minimum Pad	(Note 1b)	260	°C/W

Package Marking and Ordering Information

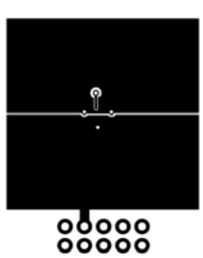
Part Number	Device Marking	Package	Reel Size	Tape Width	Quantity
FDZ3N513ZT	Z3	WL-CSP 1.0X1.0	7”	8mm	5000 units

Electrical Characteristics T_J = 25 °C unless otherwise noted

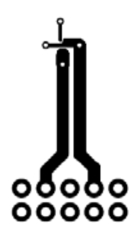
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250 μA, V_{GS} = 0 V	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25 °C		47		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V			1	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = +5 V/-0.3 V, V_{DS} = 0 V			±10	μA
On Characteristics						
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	0.5	0.7	1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25 °C		-1.6		mV/°C
$r_{DS(on)}$	Drain to Source On Resistance	V_{GS} = 4.5 V, I_D = 0.3 A		384	462	mΩ
		V_{GS} = 3.2 V, I_D = 0.3 A		410	520	
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 0.3 A		0.5		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V, f = 1 MHz		45	85	pF
C_{oss}	Output Capacitance			45	85	pF
C_{rss}	Reverse Transfer Capacitance			10	25	pF
R_g	Gate Resistance			2.0		Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 15 V, I_D = 0.3 A V_{GS} = 5 V, R_{GEN} = 6 Ω		3.1	10	ns
t_r	Rise Time			1.9	10	ns
$t_{d(off)}$	Turn-Off Delay Time			9.6	20	ns
t_f	Fall Time			2.7	10	ns
Q_g	Total Gate Charge (V_{GS} = 4.5 V)	V_{DD} = 15 V I_D = 0.3 A		1.0		nC
Q_{gs}	Gate to Source Gate Charge			0.1		nC
Q_{gd}	Gate to Drain "Miller" Charge			0.3		nC
Drain-Source Diode Characteristics						
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_S = 0.3 A (Note 2)		0.75	1.2	V
t_{rr}	Reverse Recovery Time	I_F = 0.3 A, di/dt = 100 A/μs		16	29	ns
Q_{rr}	Reverse Recovery Charge			6.0	10	nC
Schottky Diode Characteristics						
I_R	Reverse Leakage	V_R = 20 V, T_J = 25 °C		15	30	μA
		V_R = 20 V, T_J = 85 °C		300		μA
V_F	Forward Voltage	I_F = 300 mA, T_J = 25 °C		0.72	1.2	V
		I_F = 300 mA, T_J = 85 °C		0.74		

Notes:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 in^2 oz. copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta JA}$ is determined by the user's board design.



a. 100 °C/W when mounted on a 1 in^2 pad of 2 oz copper.



b. 260 °C/W when mounted on a minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width < 300μs, Duty cycle < 2.0%.

3. The diode connected between the gate and source serves only as protection ESD. No gate overvoltage rating is implied.

Typical Characteristics T_J = 25°C unless otherwise noted

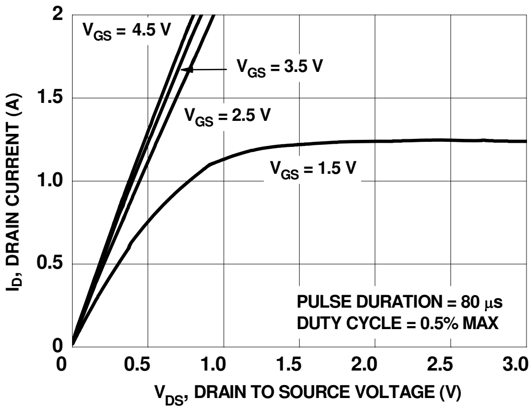


Figure 1. On Region Characteristics

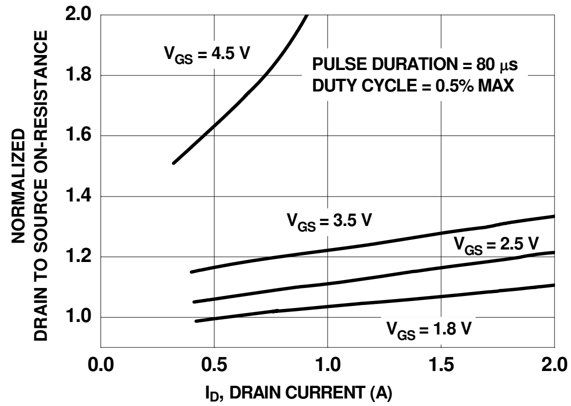


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

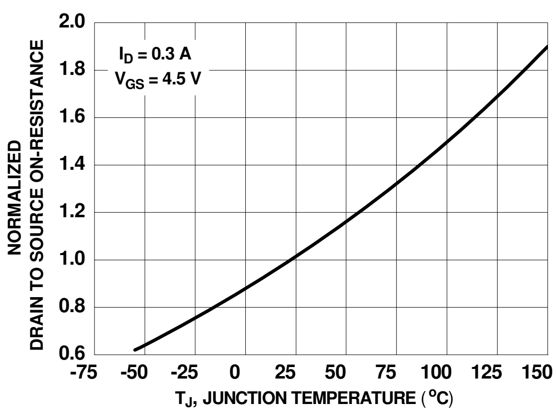


Figure 3. Normalized On Resistance vs Junction Temperature

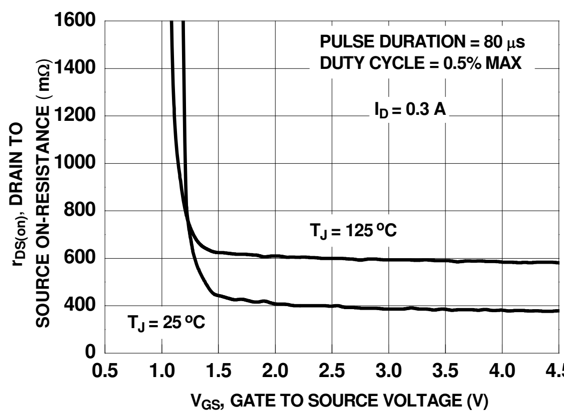


Figure 4. On-Resistance vs Gate to Source Voltage

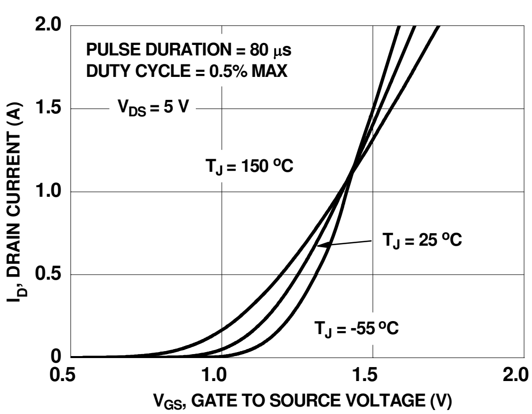


Figure 5. Transfer Characteristics

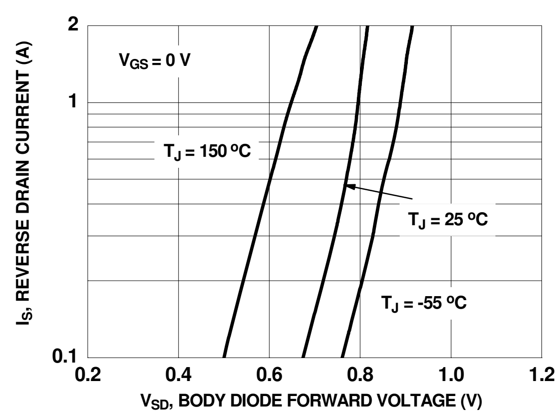


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics $T_J = 25°C$ unless otherwise noted

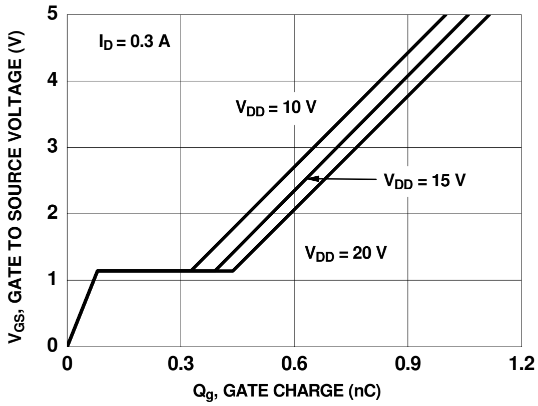


Figure 7. Gate Charge Characteristics

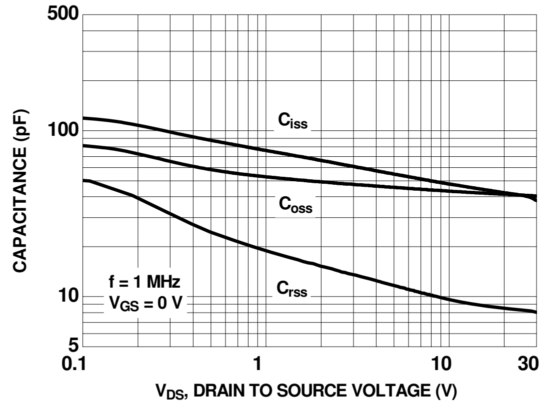


Figure 8. Capacitance vs Drain to Source Voltage

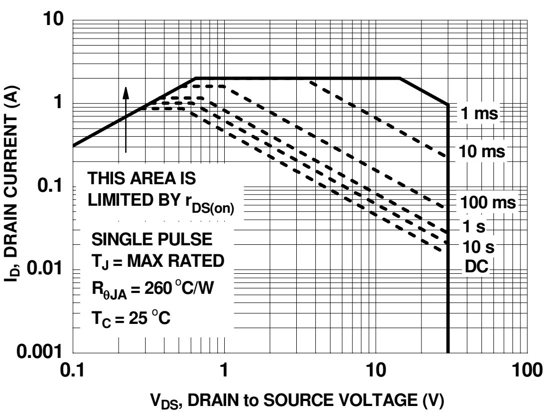


Figure 9. Forward Bias Safe Operating Area

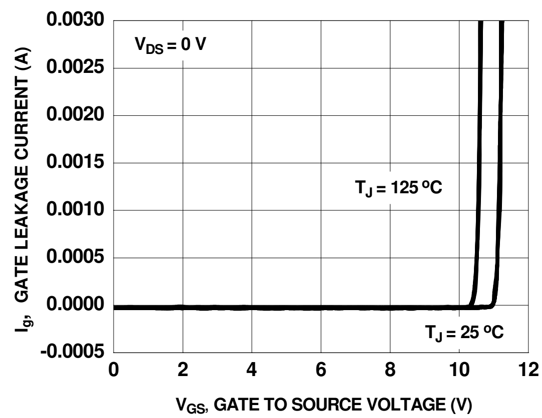


Figure 10. Gate Leakage Current vs Gate to Source Voltage

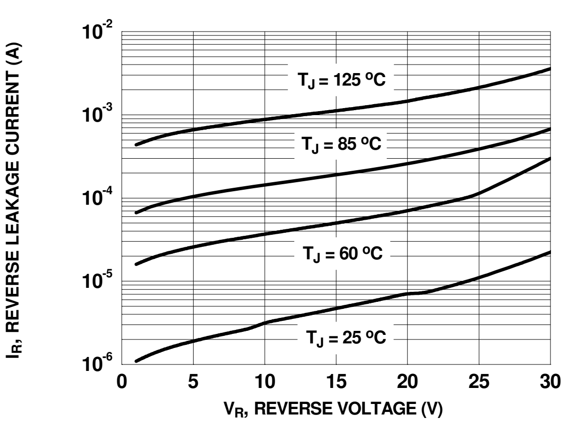


Figure 11. Schottky Diode Reverse Current

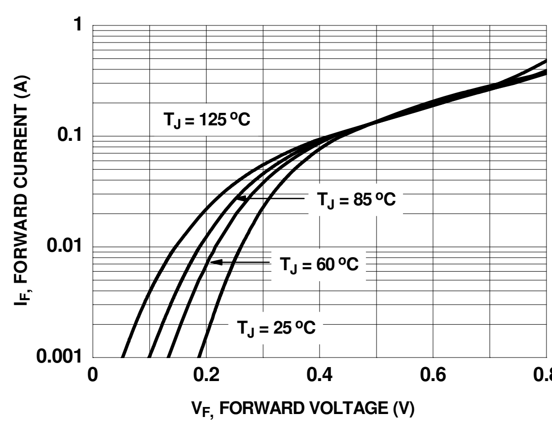


Figure 12. Schottky Diode Forward Voltage

Typical Characteristics T_J = 25°C unless otherwise noted

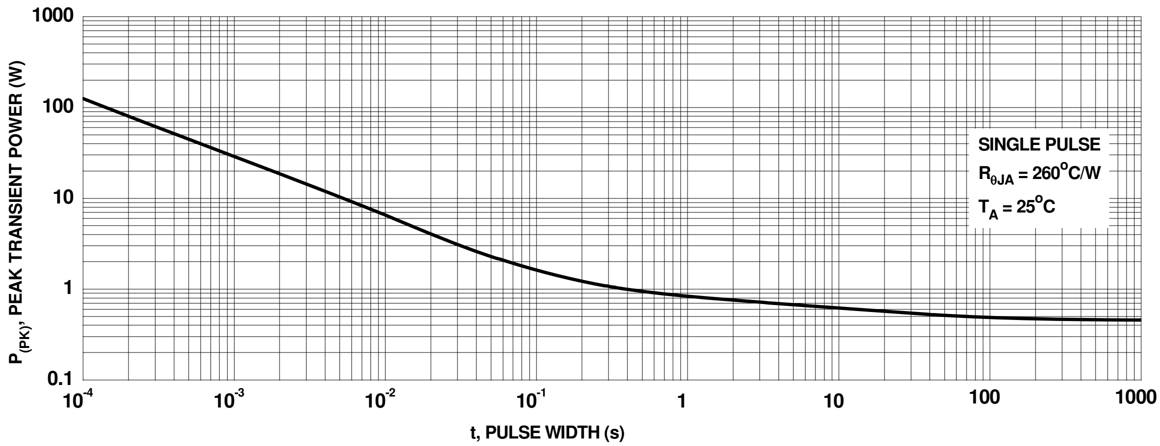


Figure 13. Single Pulse Maximum Power Dissipation

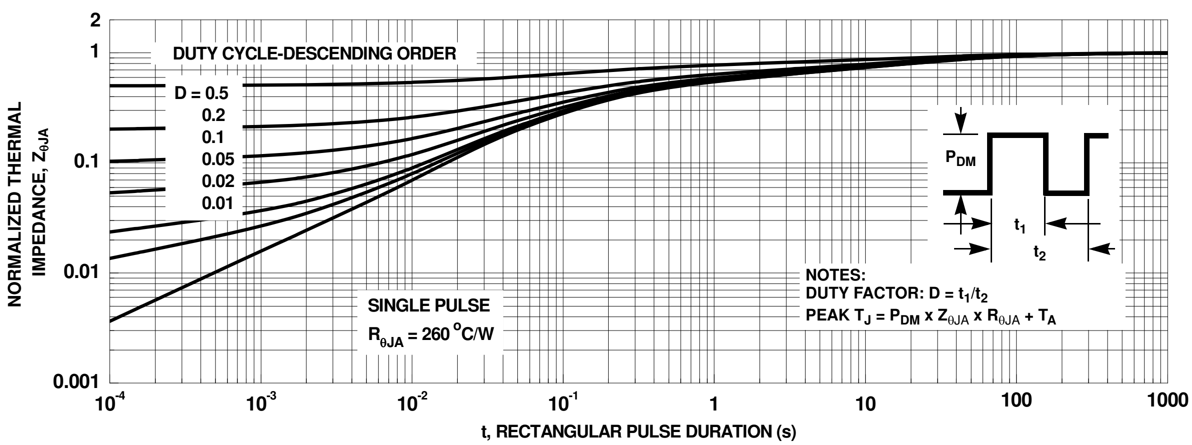
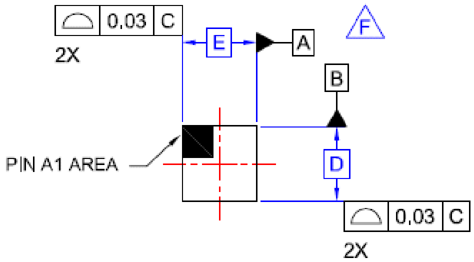
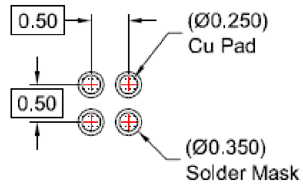


Figure 14. Junction-to-Ambient Transient Thermal Response Curve

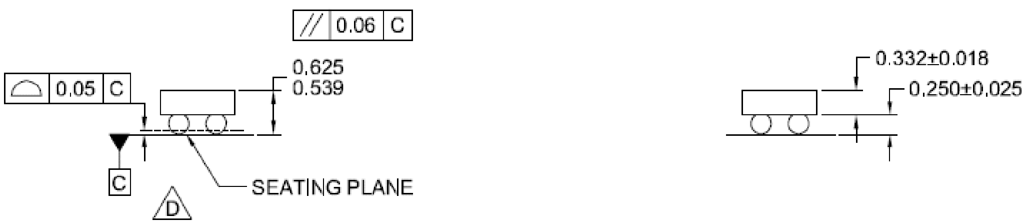
Dimensional Outline and Pad Layout



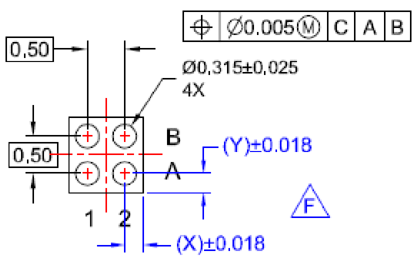
TOP VIEW



RECOMMENDED LAND PATTERN
(NSMD PAD TYPE)



SIDE VIEWS



BOTTOM VIEW

NOTES:

A. NO JEDEC REGISTRATION APPLIES.

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.

D. DATUM C IS DEFINED BY THE SPHERICAL CROWNS OF THE BALLS.

E. PACKAGE NOMINAL HEIGHT IS 582 MICRONS ±43 MICRONS (539-625 MICRONS).

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

Product Specific Dimensions

Product	D	E	X	Y
FDZ3N513ZTUCX	1.000 +/-0.030	1.000 +/-0.030	0.018	0.018

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Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. I48

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