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February 2003

FDZ2553N

Monolithic Common Drain N-Channel 2.5V Specified PowerTrench® BGA MOSFET

General Description

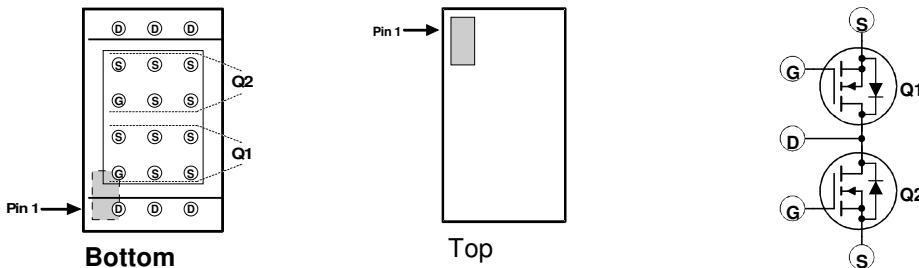
Combining Fairchild's advanced 2.5V specified PowerTrench process with state-of-the-art BGA packaging, the FDZ2553N minimizes both PCB space and $R_{DS(ON)}$. This Monolithic Common Drain BGA MOSFET embodies a breakthrough in packaging technology which enables the device to combine excellent thermal transfer characteristics, high current handling capability, ultra-low profile packaging, low gate charge, and low $R_{DS(ON)}$.

Applications

- Battery management
- Load switch
- Battery protection

Features

- 9.6 A, 20 V. $R_{DS(ON)} = 14 \text{ m}\Omega$ @ $V_{GS} = 4.5 \text{ V}$
 $R_{DS(ON)} = 20 \text{ m}\Omega$ @ $V_{GS} = 2.5 \text{ V}$
- Occupies only 0.10 cm^2 of PCB area:
1/3 the area of SO-8.
- Ultra-thin package: less than 0.80 mm height when mounted to PCB.
- Outstanding thermal transfer characteristics: significantly better than SO-8.
- Ultra-low $Q_g \times R_{DS(ON)}$ figure-of-merit
- High power and current handling capability



Absolute Maximum Ratings

$T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{DSS}	Drain-Source Voltage	20	V
V_{GSS}	Gate-Source Voltage	± 12	V
I_D	Drain Current – Continuous (Note 1a)	9.6	A
	– Pulsed	20	
P_D	Power Dissipation (Steady State) (Note 1a)	2.1	W
T_J, T_{STG}	Operating and Storage Junction Temperature Range	–55 to +150	°C

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	60	°C/W
$R_{\theta JB}$	Thermal Resistance, Junction-to-Ball (Note 1)	6.3	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	0.6	

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
2553N	FDZ2553N	7"	12mm	3000 units

Electrical Characteristics

$T_A = 25^\circ\text{C}$ unless otherwise noted

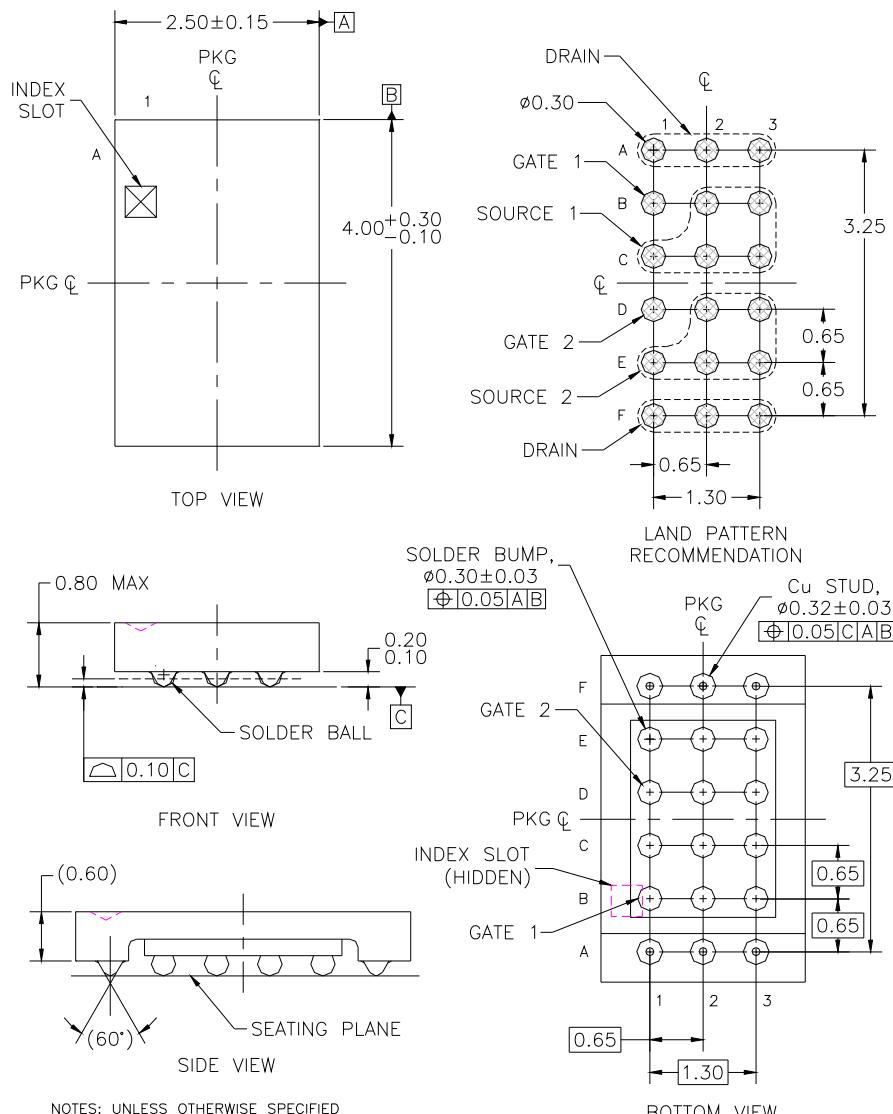
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}$, $I_D = 250 \mu\text{A}$	20			V
ΔBV_{DSS}	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$, Referenced to 25°C		14		$\text{mV/}^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 16 \text{ V}$, $V_{GS} = 0 \text{ V}$			1	μA
I_{GSSF}	Gate-Body Leakage, Forward	$V_{GS} = 12 \text{ V}$, $V_{DS} = 0 \text{ V}$			100	nA
I_{GSSR}	Gate-Body Leakage, Reverse	$V_{GS} = -12 \text{ V}$, $V_{DS} = 0 \text{ V}$			-100	nA
On Characteristics (Note 2)						
$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250 \mu\text{A}$	0.6	0.9	1.5	V
$\Delta V_{GS(\text{th})}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$, Referenced to 25°C		-3		$\text{mV/}^\circ\text{C}$
$R_{DS(\text{on})}$	Static Drain-Source On-Resistance	$V_{GS} = 4.5 \text{ V}$, $I_D = 9.6 \text{ A}$ $V_{GS} = 2.5 \text{ V}$, $I_D = 7.9 \text{ A}$ $V_{GS} = 4.5 \text{ V}$, $I_D = 9.6 \text{ A}$, $T_J=125^\circ\text{C}$	11 15 15	14 20 20		$\text{m}\Omega$
$I_{D(\text{on})}$	On-State Drain Current	$V_{GS} = 4.5 \text{ V}$, $V_{DS} = 5 \text{ V}$	10			A
g_{FS}	Forward Transconductance	$V_{DS} = 5 \text{ V}$, $I_D = 9.6 \text{ A}$		45		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 10 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1.0 \text{ MHz}$		1299		pF
C_{oss}	Output Capacitance			317		pF
C_{rss}	Reverse Transfer Capacitance			166		pF
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 10 \text{ V}$, $I_D = 1 \text{ A}$, $V_{GS} = 4.5 \text{ V}$, $R_{\text{GEN}} = 6 \Omega$		9.0	18	ns
t_r	Turn-On Rise Time			11	20	ns
$t_{d(off)}$	Turn-Off Delay Time			29	46	ns
t_f	Turn-Off Fall Time			11	20	ns
Q_g	Total Gate Charge	$V_{DS} = 10 \text{ V}$, $I_D = 9.6 \text{ A}$, $V_{GS} = 4.5 \text{ V}$		12	17	nC
Q_{gs}	Gate-Source Charge			2.3		nC
Q_{gd}	Gate-Drain Charge			3.2		nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current				1.7	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}$, $I_S = 1.7 \text{ A}$ (Note 2)		0.7	1.2	V
t_{rr}	Diode Reverse Recovery Time	$I_F = 9.6 \text{ A}$, $d_I/d_t = 100 \text{ A}/\mu\text{s}$		21		nS
Q_{rr}	Diode Reverse Recovery Charge			13		nC

Notes:

- R_{thJA} is determined with the device mounted on a 1 in² 2 oz. copper pad on a 1.5 x 1.5 in. board of FR-4 material. The thermal resistance from the junction to the circuit board side of the solder ball, R_{thJB} , is defined for reference. For R_{thJC} , the thermal reference point for the case is defined as the top surface of the copper chip carrier. R_{thJC} and R_{thJB} are guaranteed by design while R_{thJA} is determined by the user's board design.
 - $R_{\text{thJA}} = 60^\circ\text{C/W}$ when mounted on a 1 in² pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB
 - $R_{\text{thJA}} = 108^\circ\text{C/W}$ when mounted on a minimum pad of 2 oz copper
- Pulse Test: Pulse Width < 300μs, Duty Cycle < 2.0%

FDZ2553N

Dimensional Outline and Pad Layout



BGA12AREVC

FDZ2553N Rev D2 (W)

Typical Characteristics

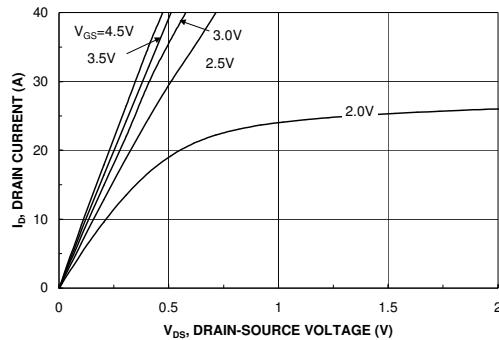


Figure 1. On-Region Characteristics.

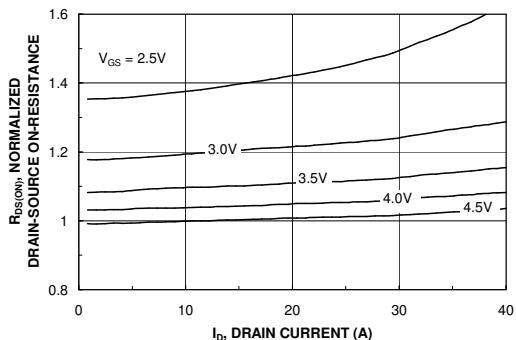


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

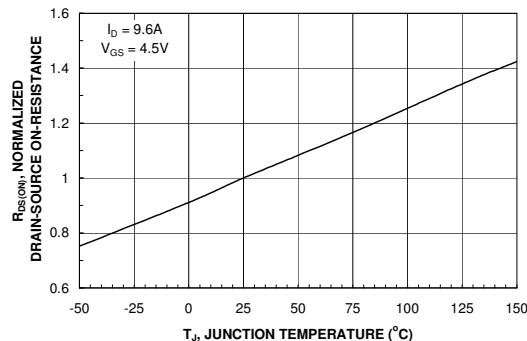


Figure 3. On-Resistance Variation with Temperature.

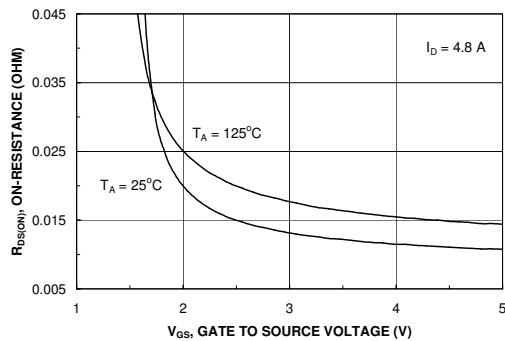


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

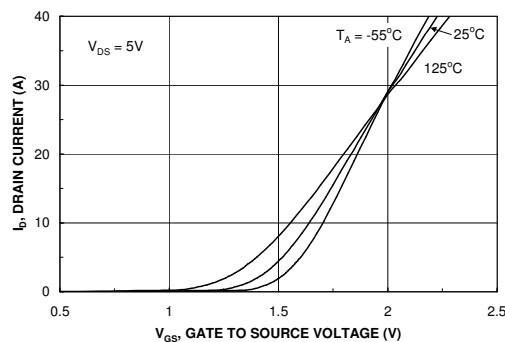


Figure 5. Transfer Characteristics.

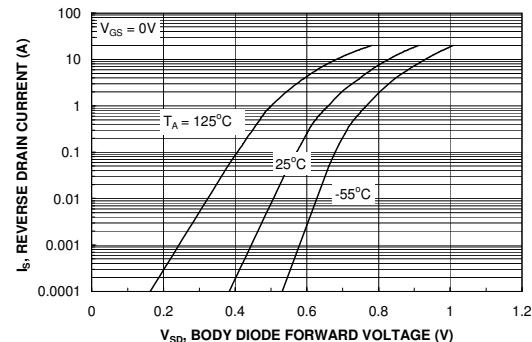


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

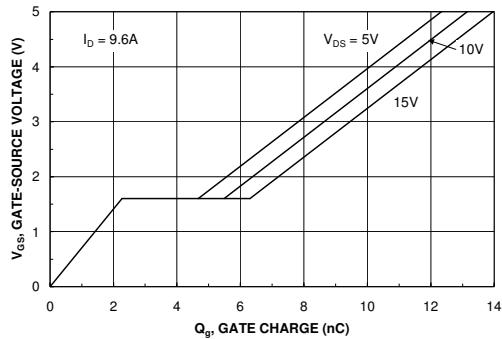


Figure 7. Gate Charge Characteristics.

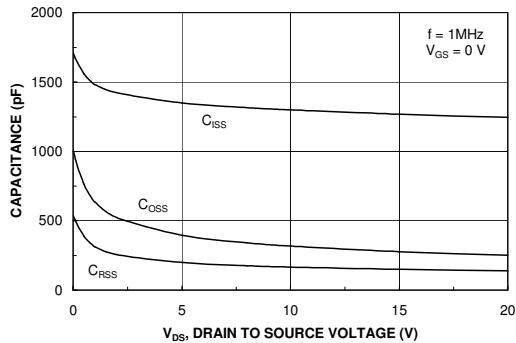


Figure 8. Capacitance Characteristics.

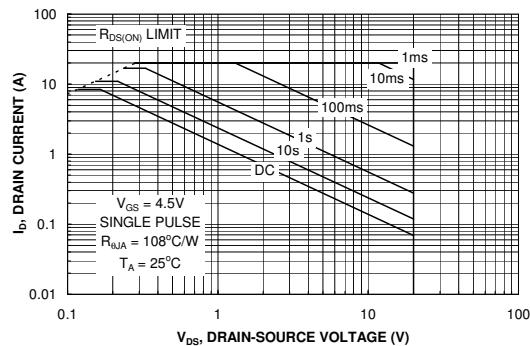


Figure 9. Maximum Safe Operating Area.

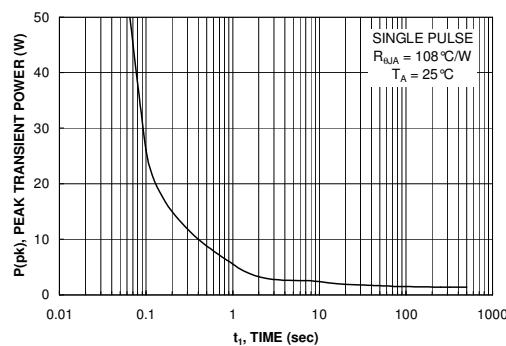


Figure 10. Single Pulse Maximum Power Dissipation.

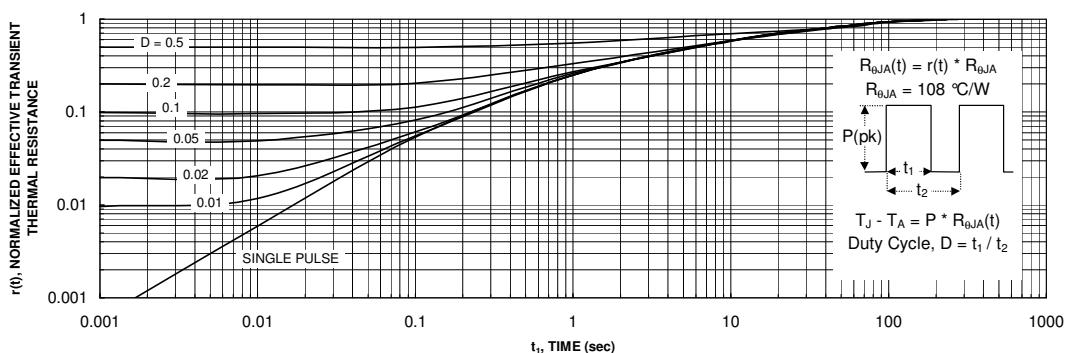


Figure 11. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in Note 1b.
Transient thermal response will change depending on the circuit board design.

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