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FAIRCHILD SEMICONDUCTOR®

March 2009

FDG410NZ

Single N-Channel PowerTrench® MOSFET
20 V, 2.2 A, 70 mΩ

Features

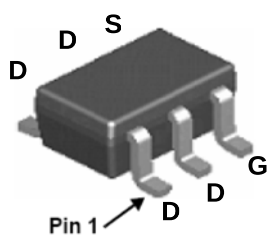
- Max $r_{DS(on)}$ = 70 mΩ at V_{GS} = 4.5 V, I_D = 2.2 A
- Max $r_{DS(on)}$ = 77 mΩ at V_{GS} = 2.5 V, I_D = 2.0 A
- Max $r_{DS(on)}$ = 87 mΩ at V_{GS} = 1.8 V, I_D = 1.8 A
- Max $r_{DS(on)}$ = 115 mΩ at V_{GS} = 1.5 V, I_D = 1.5 A
- HBM ESD protection level > 2 kV (Note 3)
- High performance trench technology for extremely low $r_{DS(on)}$
- High power and current handling capability
- Fast switching speed
- Low gate charge
- RoHS Compliant

General Description

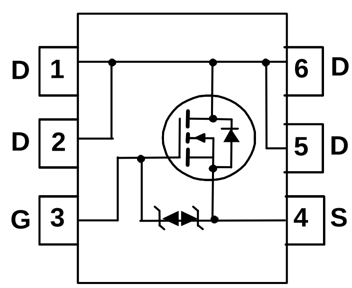
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized use in small switching regulaters, providing an extremely low $r_{DS(on)}$ and gate charge (Q_g) in a small package.

Applications

- DC/DC converter
- Power management
- Load switch



SC70-6



MOSFET Maximum Ratings T_A = 25 °C unless otherwise noted

Symbol	Parameter			Ratings	Units
V_{DS}	Drain to Source Voltage			20	V
V_{GS}	Gate to Source Voltage			±8	V
I_D	-Continuous	T_A = 25 °C	(Note 1a)	2.2	A
	-Pulsed			6.0	
P_D	Power Dissipation	T_A = 25 °C	(Note 1a)	0.42	W
	Power Dissipation	T_A = 25 °C	(Note 1b)	0.38	
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)	300	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1b)	333	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
.41	FDG410NZ	SC70-6	7 ”	8 mm	3000 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	20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25 °C		17		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 16 V, V_{GS} = 0 V			1	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±8 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	0.4	0.7	1.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25 °C		-3		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 4.5 V, I_D = 2.2 A		50	70	mΩ
		V_{GS} = 2.5 V, I_D = 2.0 A		56	77	
		V_{GS} = 1.8 V, I_D = 1.8 A		67	87	
		V_{GS} = 1.5 V, I_D = 1.5 A		83	115	
		V_{GS} = 4.5 V, I_D = 2.2 A, T_J = 125 °C		71	100	
g_{FS}	Forward Transconductance	V_{DD} = 5 V, I_D = 2.2 A		11		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz		400	535	pF
C_{oss}	Output Capacitance			70	95	pF
C_{rss}	Reverse Transfer Capacitance			45	70	pF
R_g	Gate Resistance			2.8		Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 10 V, I_D = 2.2 A, V_{GS} = 4.5 V, R_{GEN} = 6 Ω		5.3	11	ns
t_r	Rise Time			2.3	10	ns
$t_{d(off)}$	Turn-Off Delay Time			18	33	ns
t_f	Fall Time			2.3	10	ns
Q_g	Total Gate Charge	V_{GS} = 4.5 V, V_{DD} = 10 V, I_D = 2.2 A		5.1	7.2	nC
Q_{gs}	Gate to Source Charge			0.6		nC
Q_{gd}	Gate to Drain "Miller" Charge			1.0		nC
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain-Source Diode Forward Current				0.35	A
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_S = 0.35 A (Note 2)		0.6	1.2	V
t_{rr}	Reverse Recovery Time	I_F = 2.2 A, di/dt = 100 A/μs		11	20	ns
Q_{rr}	Reverse Recovery Charge			2.5	10	nC

Notes:
1. $R_{\theta JA}$ is determined with the device mounted on a 1 in^2 pad 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. 300 °C/W when mounted on a 1 in^2 pad of 2 oz copper.

b. 333 °C/W when mounted on a minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0%.
3: The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.

Typical Characteristics T_J = 25 °C unless otherwise noted

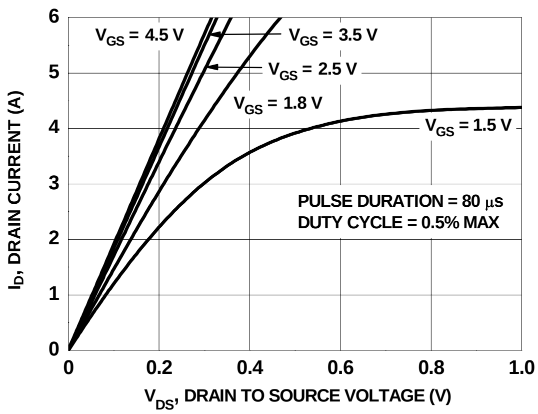


Figure 1. On Region Characteristics

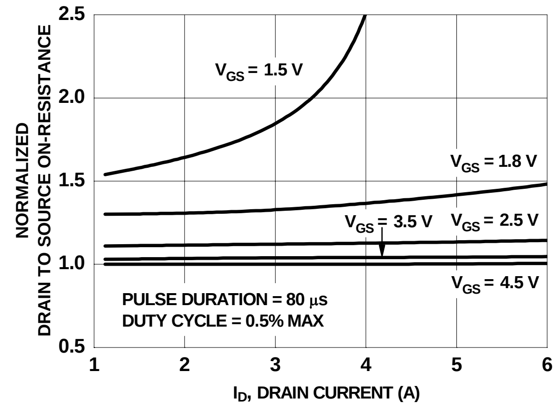


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

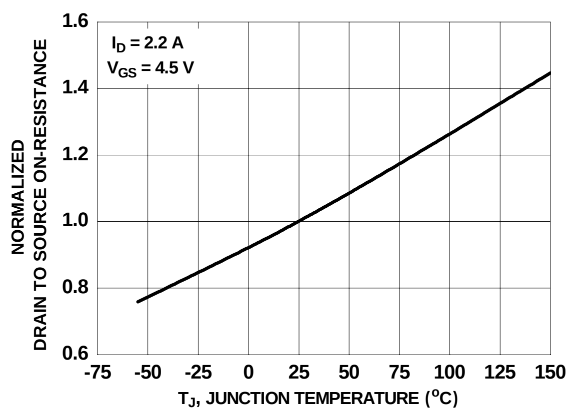


Figure 3. Normalized On Resistance vs Junction Temperature

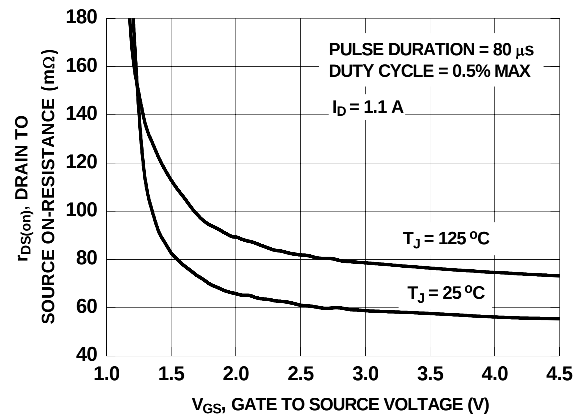


Figure 4. On-Resistance vs Gate to Source Voltage

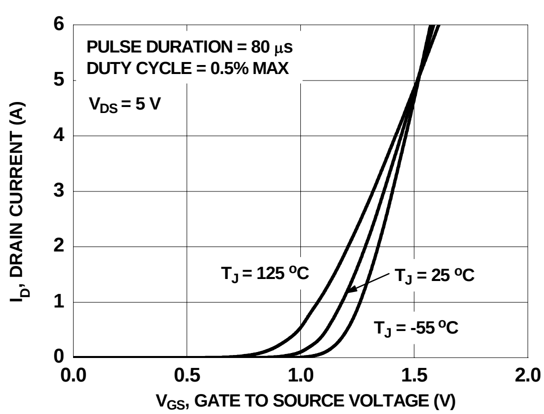


Figure 5. Transfer Characteristics

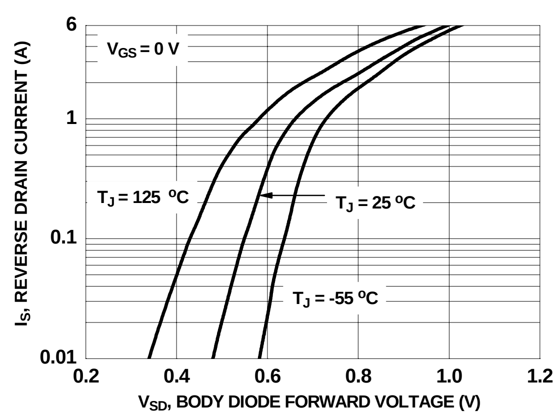


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25 °C unless otherwise noted

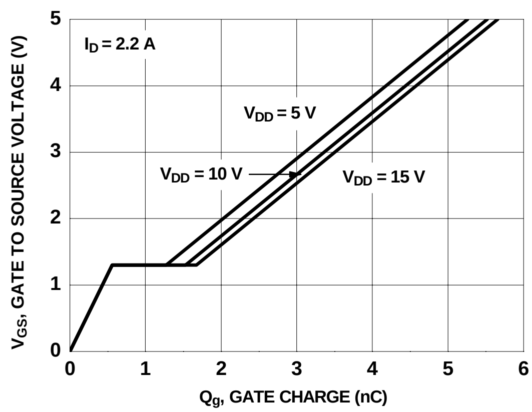


Figure 7. Gate Charge Characteristics

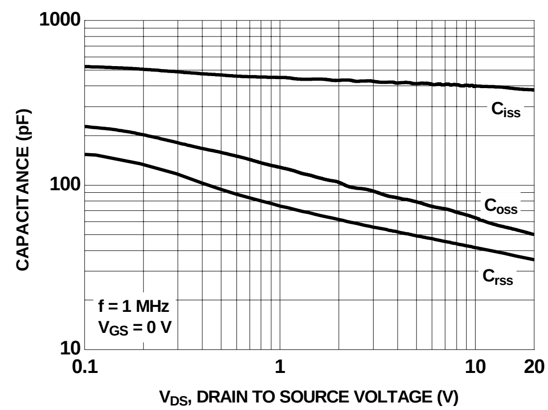


Figure 8. Capacitance vs Drain to Source Voltage

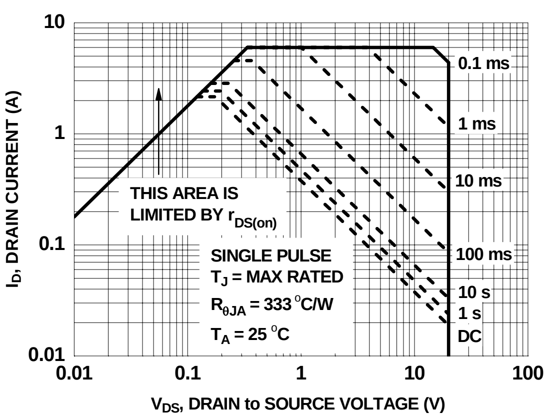


Figure 9. Forward Bias Safe Operating Area

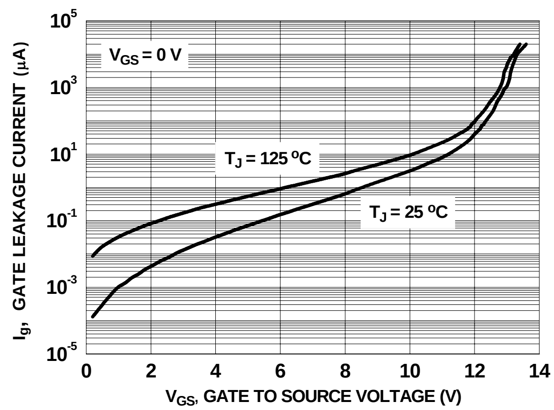


Figure 10. Gate Leakage Current vs Gate to Source Voltage

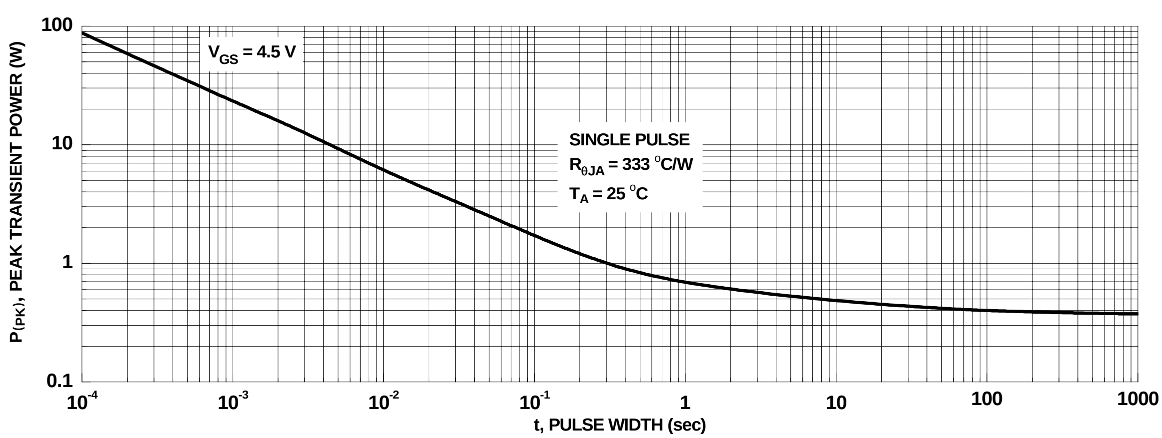


Figure 11. Single Pulse Maximum Power Dissipation

Typical Characteristics T_J = 25 °C unless otherwise noted

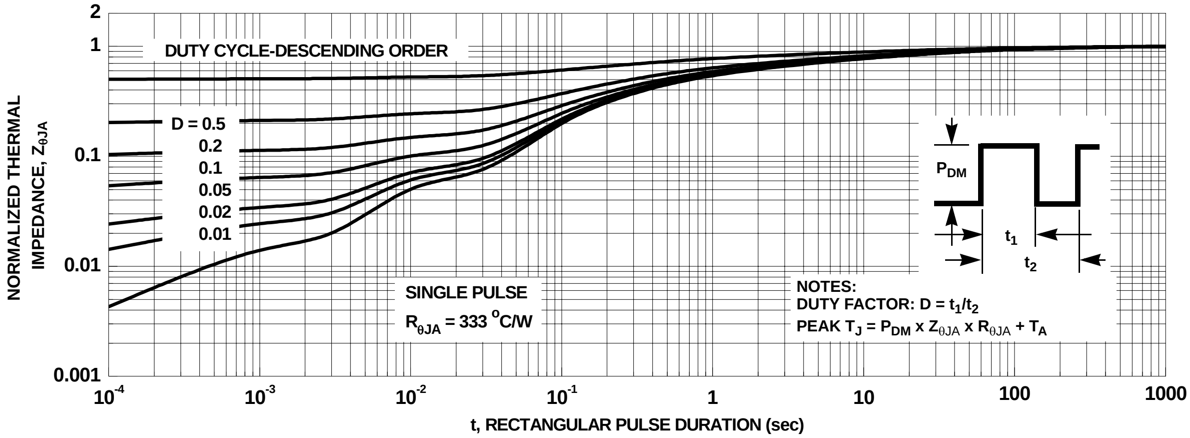
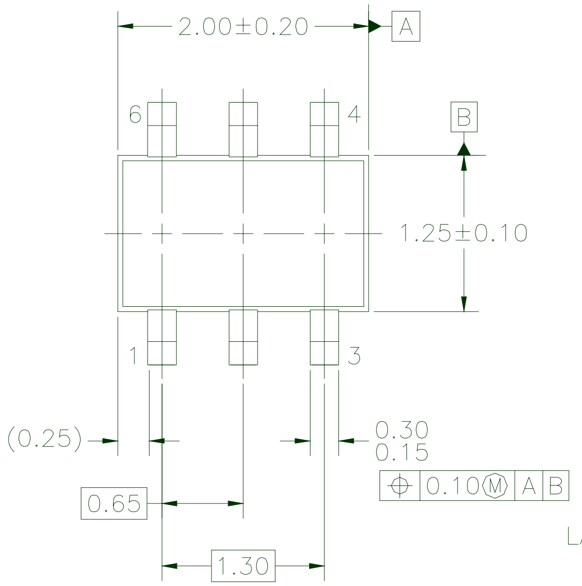
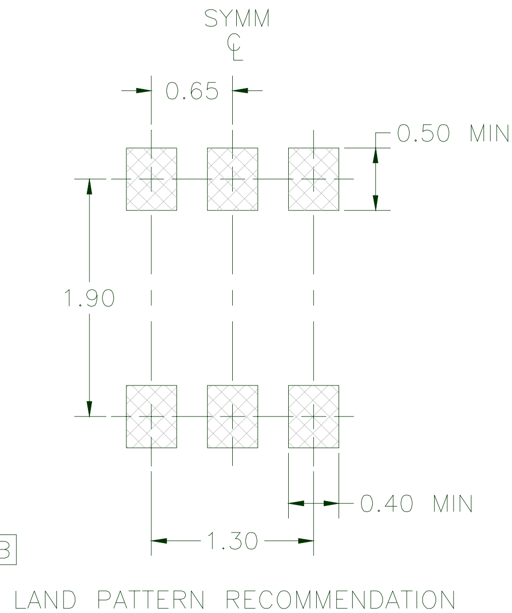
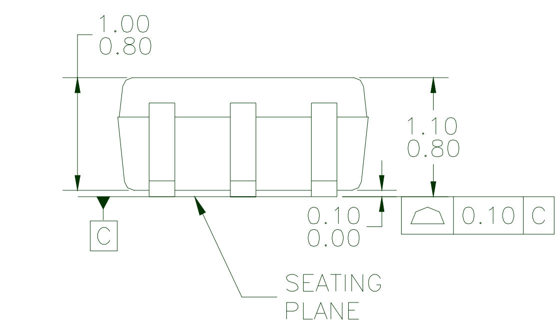


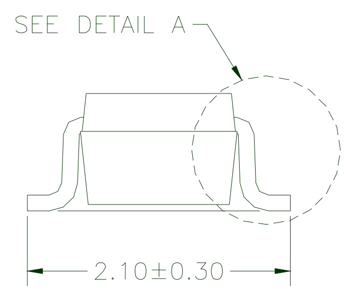
Figure 12. Junction-to-Ambient Transient Thermal Response Curve

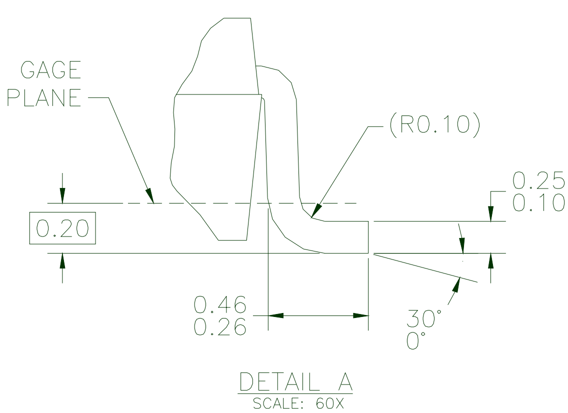
Dimensional Outline and Pad Layout











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Rev. I40

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