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September 2016

FDN028N20

N-Channel PowerTrench[®] MOSFET 20 V, 6.1 A, 28 mΩ

Features

- Max $r_{DS(on)}$ = 28 mΩ at $V_{GS} = 4.5$ V, $I_D = 5.2$ A
- Max $r_{DS(on)}$ = 45 mΩ at $V_{GS} = 2.5$ V, $I_D = 4.4$ A
- High Performance Trench Technology for Extremely Low $r_{DS(on)}$
- High Power and Current Handling Capability in a Widely Used Surface Mount Package
- Fast Switching Speed
- 100% UIL Tested
- RoHS Compliant

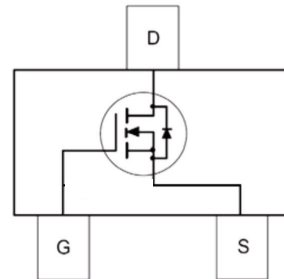
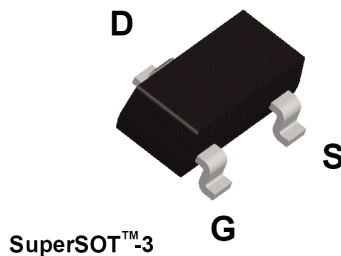


General Description

This N-Channel PowerTrench MOSFET is produced using Fairchild's advanced PowerTrench[®] process that has been especially tailored to minimize on-state resistance and yet maintain low gate charge for superior switching performance.

Applications

- Primary DC-DC Switch
- Load Switch



MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Rated	Units
V_{DS}	Drain to Source Voltage	20	V
V_{GS}	Gate to Source Voltage (Note 3)	± 12	V
I_D	-Continuous $T_A = 25^\circ\text{C}$ (Note 1a)	6.1	A
	-Pulsed (Note 5)	52	
E_{AS}	Single Pulse Avalanche Energy (Note 4)	6	mJ
P_D	Power Dissipation (Note 1a)	1.5	W
	Power Dissipation (Note 1b)	0.6	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to + 150	$^\circ\text{C}$

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	75	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	80	$^\circ\text{C/W}$

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
28N	FDN028N20	SSOT-3	7"	8 mm	3000 units

Electrical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 250 \mu\text{A}, V_{GS} = 0 \text{ V}$	20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$, referenced to 25°C		15		$\text{mV}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 16 \text{ V}, V_{GS} = 0 \text{ V}$			1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = 12 \text{ V}, V_{DS} = 0 \text{ V}$			100	nA

On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$	0.5	0.9	1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$, referenced to 25°C		-3		$\text{mV}/^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 4.5 \text{ V}, I_D = 5.2 \text{ A}$		23	28	m Ω
		$V_{GS} = 2.5 \text{ V}, I_D = 4.4 \text{ A}$		32	45	
		$V_{GS} = 4.5 \text{ V}, I_D = 5.2 \text{ A}, T_J = 125^\circ\text{C}$		30	41	
g_{FS}	Forward Transconductance	$V_{DS} = 5 \text{ V}, I_D = 5.2 \text{ A}$		28		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$		399	600	pF
C_{oss}	Output Capacitance			91	140	pF
C_{rss}	Reverse Transfer Capacitance			87	130	pF

Switching Characteristics

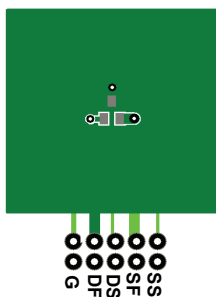
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 10 \text{ V}, I_D = 5.2 \text{ A}, V_{GS} = 10 \text{ V}, R_{GEN} = 6 \Omega$		5	10	ns	
t_r	Rise Time			2	10	ns	
$t_{d(off)}$	Turn-Off Delay Time			15	29	ns	
t_f	Fall Time			2	10	ns	
$Q_{g(TOT)}$	Total Gate Charge		$V_{GS} = 0 \text{ V to } 4.5 \text{ V}$		4.3	6.0	nC
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0 \text{ V to } 2.5 \text{ V}$	$V_{DD} = 10 \text{ V}, I_D = 5.2 \text{ A}$		2.8	3.9	nC
Q_{gs}	Gate to Source Charge				0.7		nC
Q_{gd}	Gate to Drain "Miller" Charge				1.6		nC

Drain-Source Diode Characteristics

V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0 \text{ V}, I_S = 5.2 \text{ A}$ (Note 2)		0.85	1.2	V
t_{rr}	Reverse Recovery Time	$I_F = 5.2 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$		13	27	ns
Q_{rr}	Reverse Recovery Charge			3	10	nC

Notes:

- $R_{\theta JA}$ 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 $R_{\theta CA}$ is determined by the user's board design.



a) $80^\circ\text{C}/\text{W}$ when mounted on a 1 in^2 pad of 2 oz copper



b) $180^\circ\text{C}/\text{W}$ when mounted on a minimum pad.

2. Pulse Test: Pulse Width < $300 \mu\text{s}$, Duty cycle < 2.0%.

3. As an N-ch device, the negative V_{GS} rating is for low duty cycle pulse occurrence only. No continuous rating is implied.

4. E_{AS} of 6 mJ is based on starting $T_J = 25^\circ\text{C}$, $L = 3 \text{ mH}$, $I_{AS} = 2 \text{ A}$, $V_{DD} = 20 \text{ V}$, $V_{GS} = 10 \text{ V}$. 100% test at $L = 0.1 \text{ mH}$, $I_{AS} = 7 \text{ A}$.

5. Pulsed I_D please refer to Fig 10 SOA graph for more details.

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted.

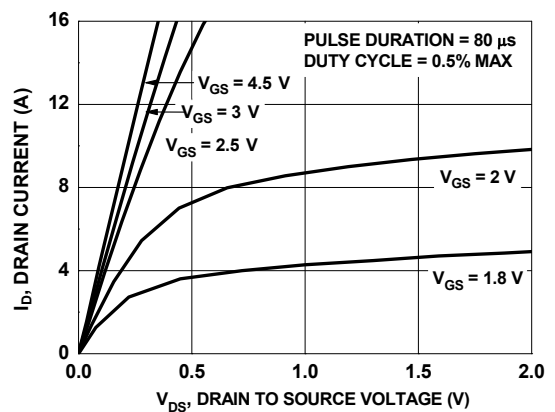


Figure 1. On Region Characteristics

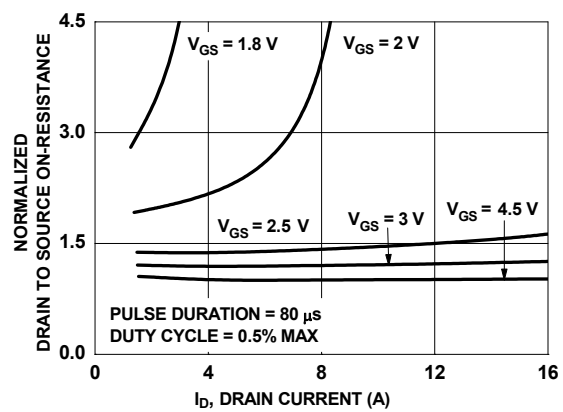


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

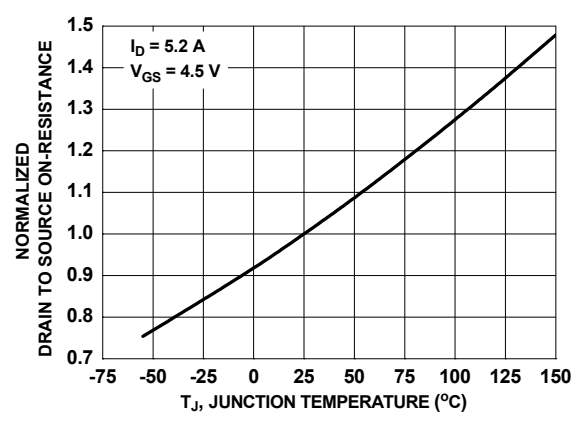


Figure 3. Normalized On Resistance vs. Junction Temperature

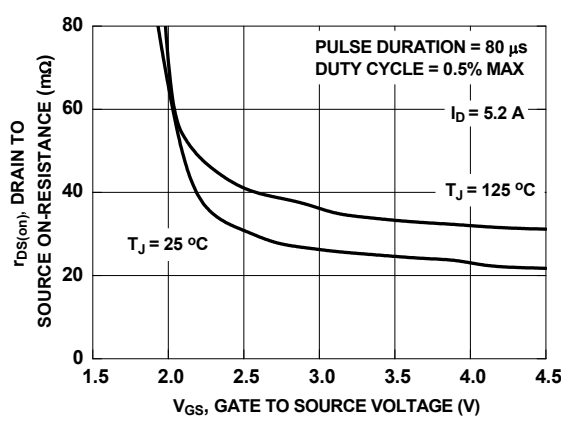


Figure 4. On-Resistance vs. Gate to Source Voltage

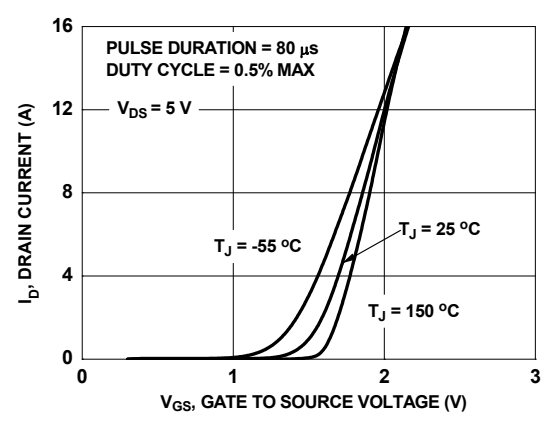


Figure 5. Transfer Characteristics

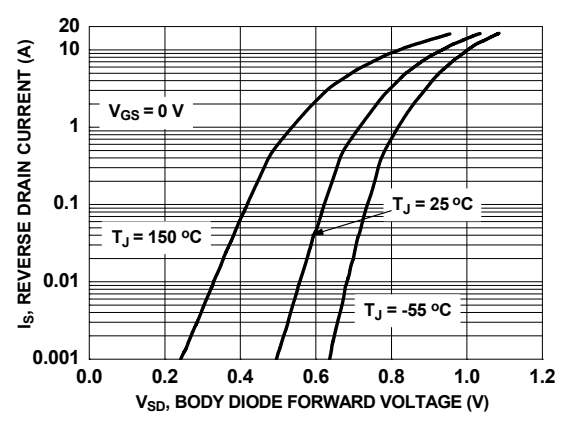


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted.

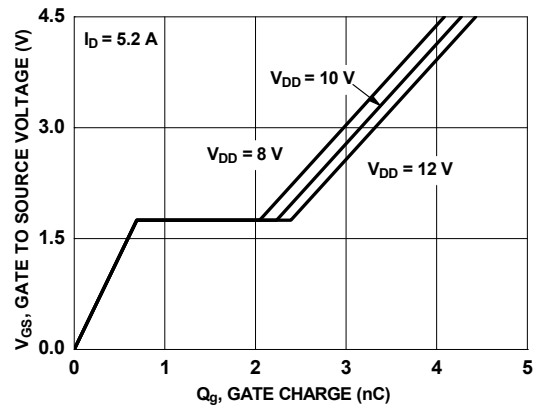


Figure 7. Gate Charge Characteristics

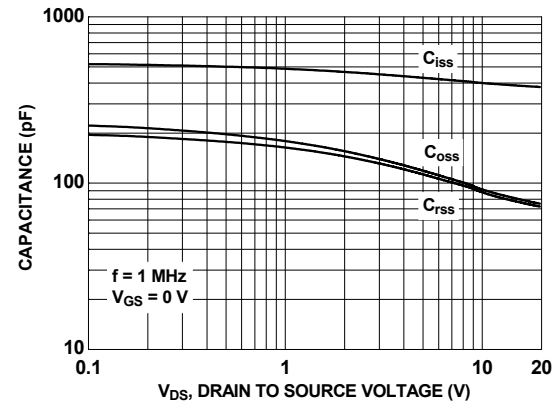


Figure 8. Capacitance vs. Drain to Source Voltage

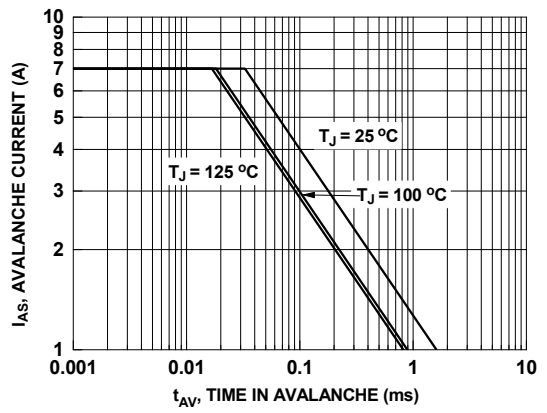


Figure 9. Unclamped Inductive Switching Capability

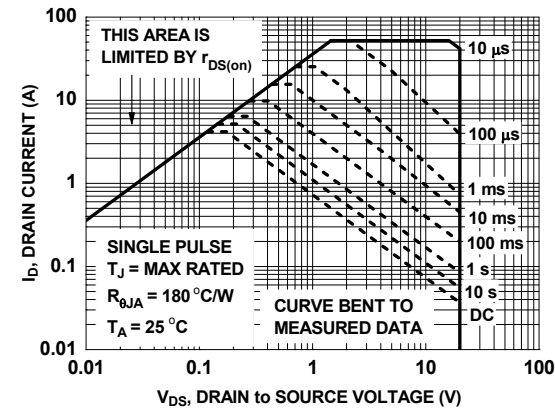


Figure 10. Forward Bias Safe Operating Area

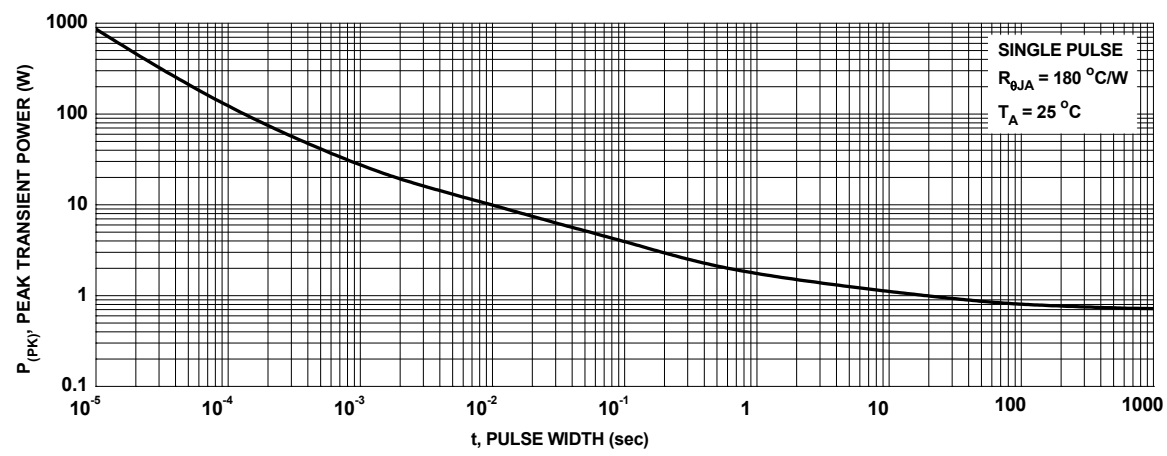


Figure 11. Single Pulse Maximum Power Dissipation

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted.

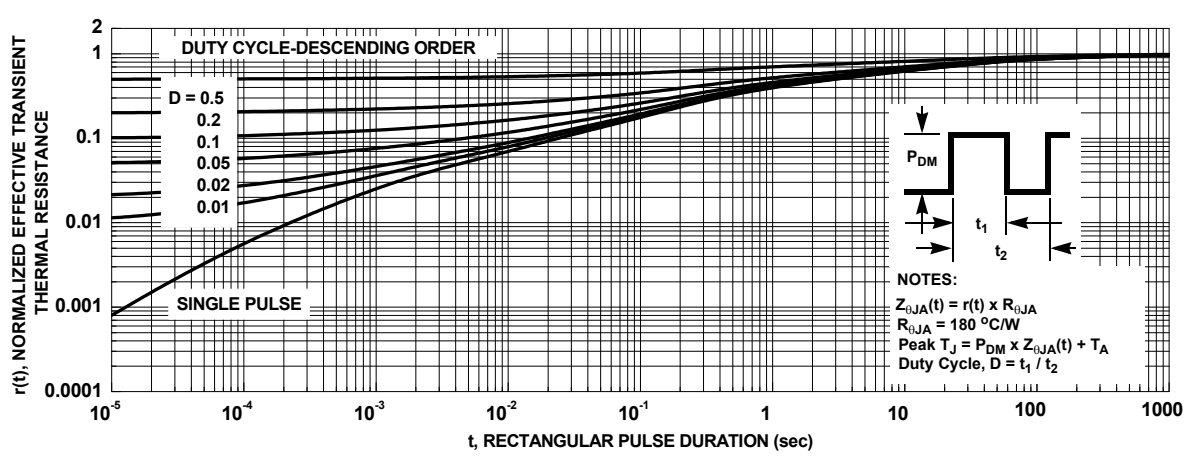
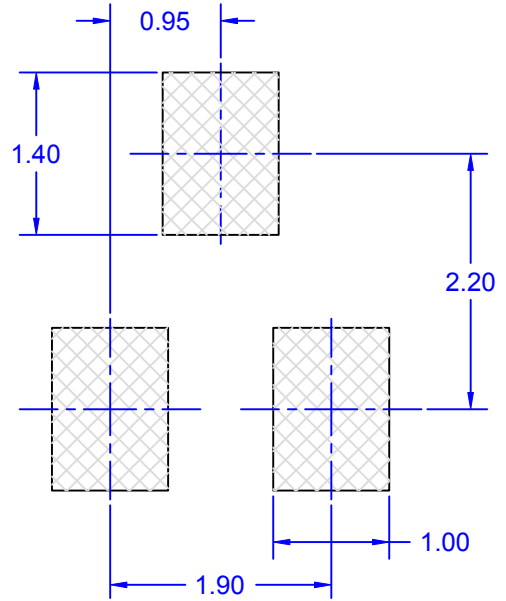
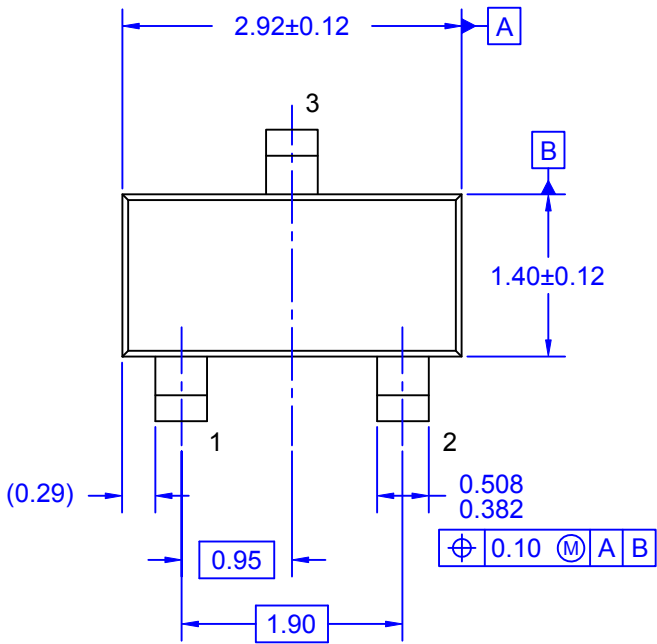
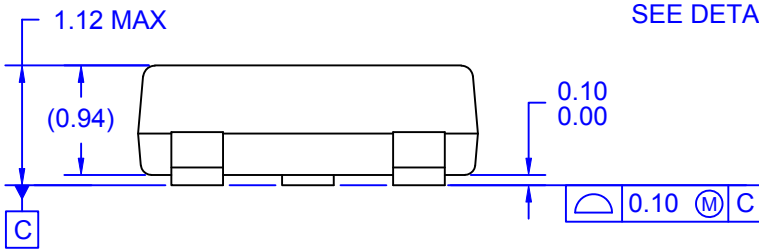


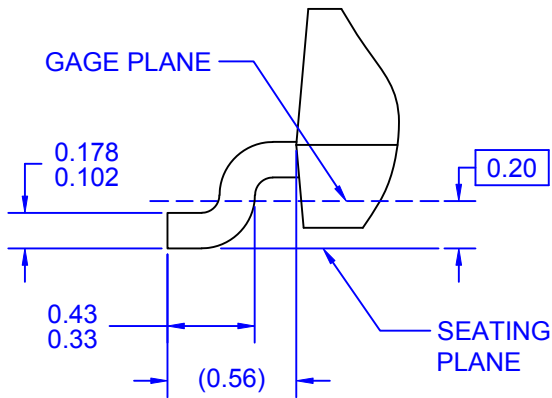
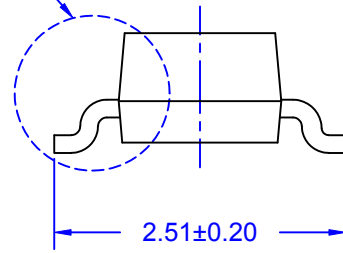
Figure 12. Junction-to-Ambient Transient Thermal Response Curve



LAND PATTERN RECOMMENDATION



SEE DETAIL A



DETAIL A

SCALE: 50:1

NOTES: UNLESS OTHERWISE SPECIFIED

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- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.
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