



# FDMC012N03

## N-Channel Power Trench<sup>®</sup> MOSFET

### 30 V, 1.23 mΩ

#### Features

- Max  $r_{DS(on)}$  = 1.23 mΩ at  $V_{GS} = 10\text{ V}$ ,  $I_D = 35\text{ A}$
- Max  $r_{DS(on)}$  = 1.46 mΩ at  $V_{GS} = 4.5\text{ V}$ ,  $I_D = 32\text{ A}$
- High performance technology for extremely low  $r_{DS(on)}$
- Termination is Lead-free
- RoHS Compliant

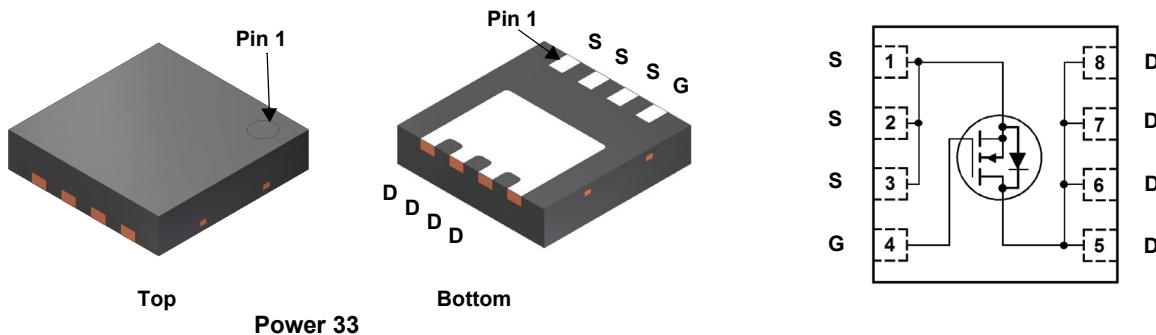


#### General Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced Power Trench<sup>®</sup> process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

#### Application

- DC-DC Conversion



#### MOSFET Maximum Ratings $T_A = 25\text{ °C}$ unless otherwise noted

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	30	V
$V_{GS}$	Gate to Source Voltage	±12	V
$I_D$	Drain Current -Continuous	$T_C = 25\text{ °C}$ (Note 5)	185
	-Continuous	$T_C = 100\text{ °C}$ (Note 5)	117
	-Continuous	$T_A = 25\text{ °C}$ (Note 1a)	35
	-Pulsed	(Note 4)	688
$E_{AS}$	Single Pulse Avalanche Energy	(Note 3)	337.5
$P_D$	Power Dissipation	$T_C = 25\text{ °C}$	64
	Power Dissipation	$T_A = 25\text{ °C}$ (Note 1a)	2.3
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C

#### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	(Note 1)	1.95	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1a)	53	

#### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMC012N03	FDMC012N03	Power33	13 "	12 mm	3000 units

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

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

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\ \mu\text{A}, V_{GS} = 0\ \text{V}$	30			V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		21		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24\ \text{V}, V_{GS} = 0\ \text{V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 12\ \text{V}, V_{DS} = 0\ \text{V}$			$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	0.8	1.3	2.0	V
$\Delta V_{GS(th)} / \Delta T_J$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		-4.5		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\ \text{V}, I_D = 35\ \text{A}$		0.96	1.23	m $\Omega$
		$V_{GS} = 4.5\ \text{V}, I_D = 32\ \text{A}$		1.14	1.46	
		$V_{GS} = 10\ \text{V}, I_D = 35\ \text{A}, T_J = 125\text{ }^\circ\text{C}$		1.36	1.77	
$g_{FS}$	Forward Transconductance	$V_{DD} = 5\ \text{V}, I_D = 35\ \text{A}$		220		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 15\ \text{V}, V_{GS} = 0\ \text{V}, f = 1\ \text{MHz}$		5845	8183	pF
$C_{oss}$	Output Capacitance			1440	2016	pF
$C_{rss}$	Reverse Transfer Capacitance			94	132	pF
$R_g$	Gate Resistance		0.1	0.5	1	$\Omega$

### Switching Characteristics

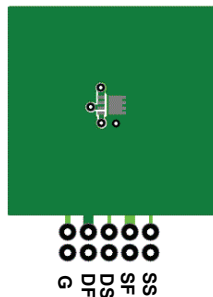
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\ \text{V}, I_D = 35\ \text{A}, V_{GS} = 10\ \text{V}, R_{GEN} = 6\ \Omega$		16	29	ns	
$t_r$	Rise Time			5.5	11	ns	
$t_{d(off)}$	Turn-Off Delay Time			43	69	ns	
$t_f$	Fall Time			4.5	10	ns	
$Q_{g(TOT)}$	Total Gate Charge		$V_{GS} = 0\ \text{V to } 10\ \text{V}$		78	110	nC
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\ \text{V to } 4.5\ \text{V}$	$V_{DD} = 15\ \text{V}, I_D = 35\ \text{A}$		35	50	nC
$Q_{gs}$	Gate to Source Charge				11.5		nC
$Q_{gd}$	Gate to Drain "Miller" Charge				6		nC

### Drain-Source Diode Characteristics

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\ \text{V}, I_S = 35\ \text{A}$ (Note 2)		0.8	1.3	V
		$V_{GS} = 0\ \text{V}, I_S = 2\ \text{A}$ (Note 2)		0.7	1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = 35\ \text{A}, di/dt = 100\ \text{A}/\mu\text{s}$		45	80	ns
$Q_{rr}$	Reverse Recovery Charge			27.5	45	nC

Notes:

1.  $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material.  $R_{\theta CA}$  is determined by the user's board design.



53 °C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



130 °C/W when mounted on a minimum pad of 2 oz copper

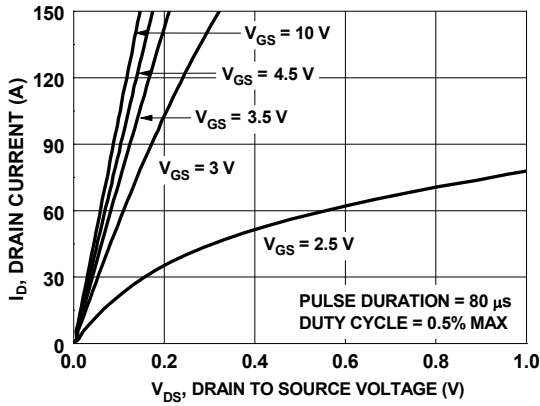
2. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0%.

3.  $E_{AS}$  of 337.5 mJ is based on starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 3\ \text{mH}$ ,  $I_{AS} = 15\ \text{A}$ ,  $V_{DD} = 30\ \text{V}$ ,  $V_{GS} = 10\ \text{V}$ . 100% test at  $L = 0.1\ \text{mH}$ ,  $I_{AS} = 47\ \text{A}$ .

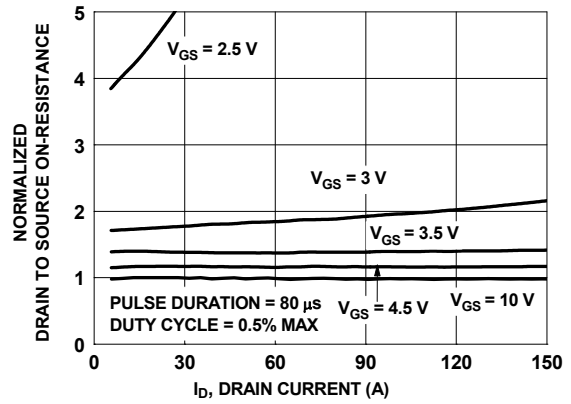
4. Pulsed  $I_d$  please refer to Fig.11 SOA curve for more details.

5. Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro-mechanical application board design.

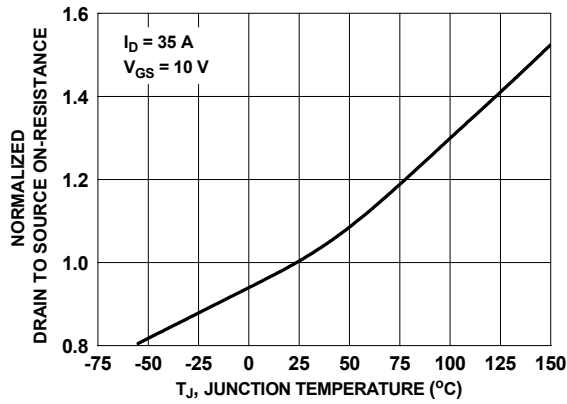
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



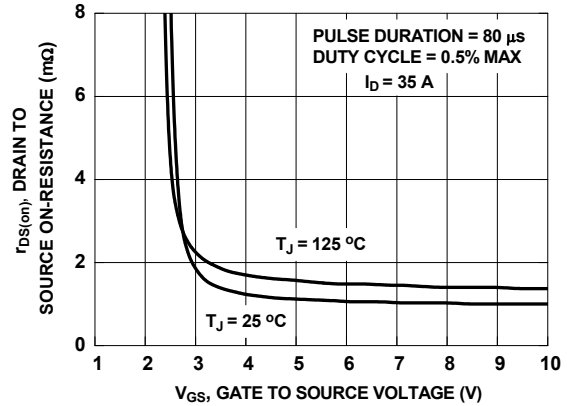
**Figure 1. On Region Characteristics**



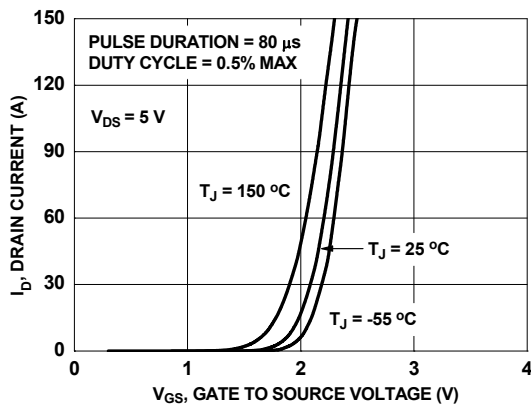
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



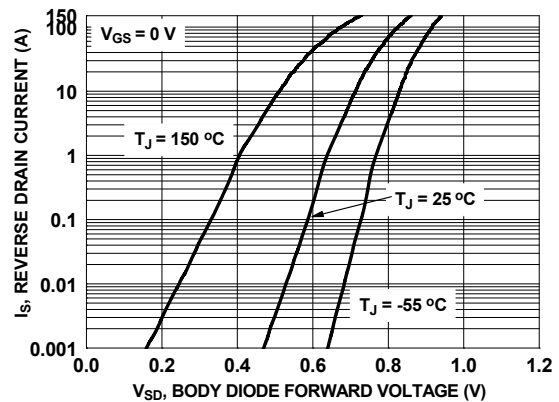
**Figure 3. Normalized On Resistance vs Junction Temperature**



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

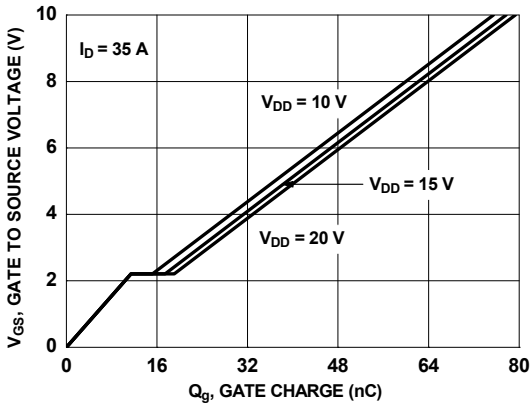


**Figure 5. Transfer Characteristics**

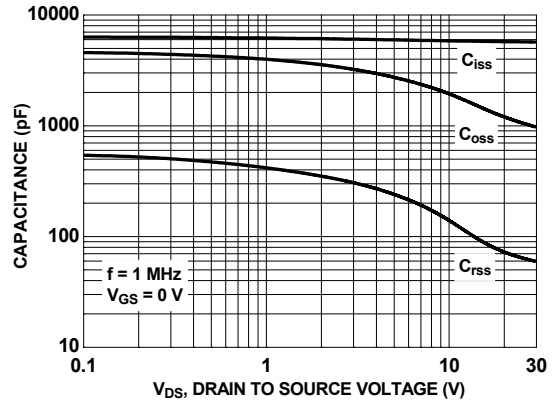


**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

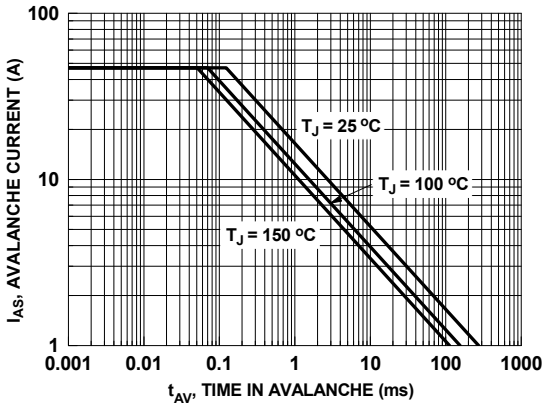
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



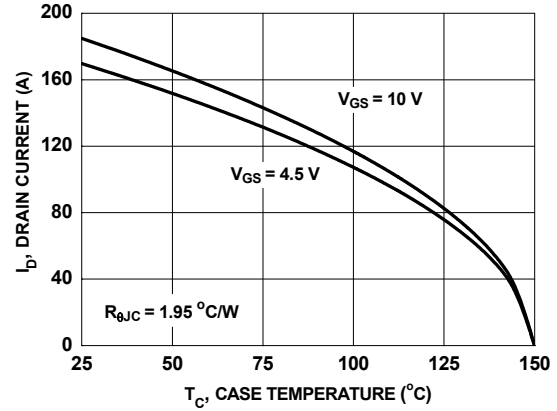
**Figure 7. Gate Charge Characteristics**



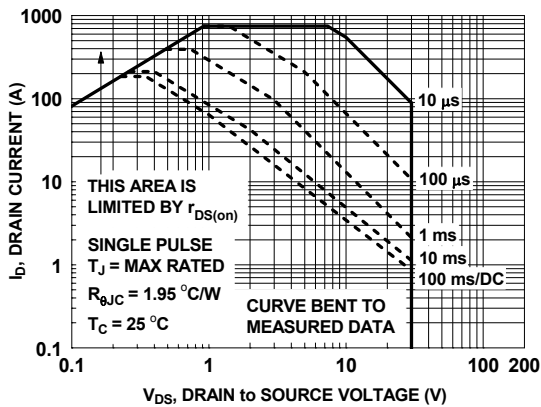
**Figure 8. Capacitance vs Drain to Source Voltage**



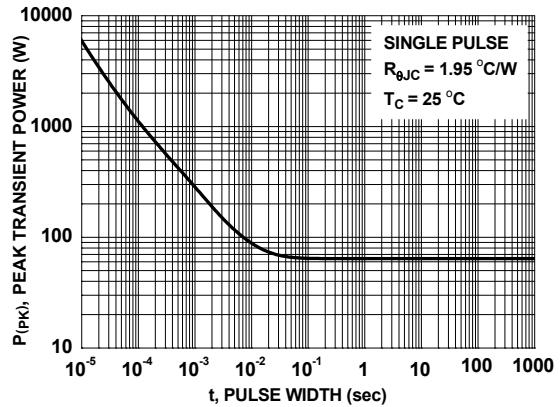
**Figure 9. Unclamped Inductive Switching Capability**



**Figure 10. Maximum Continuous Drain Current vs Case Temperature**

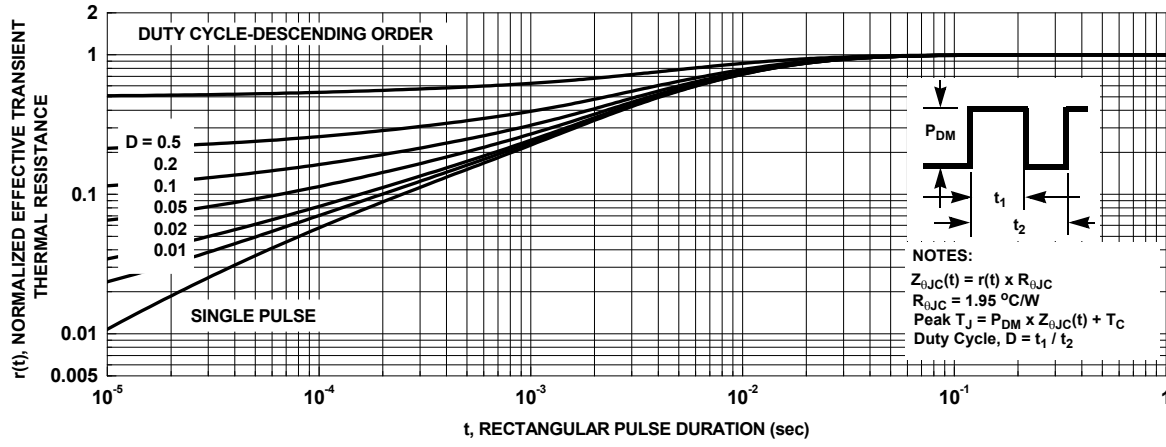


**Figure 11. Forward Bias Safe Operating Area**



**Figure 12. Single Pulse Maximum Power Dissipation**

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



**Figure 13. Junction-to-Case Transient Thermal Response Curve**





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