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# FDMC610P

## P-Channel PowerTrench® MOSFET

-12 V, -80 A, 3.9 mΩ

### Features

- Max  $r_{DS(on)}$  = 3.9 mΩ at  $V_{GS} = -4.5$  V,  $I_D = -22$  A
- Max  $r_{DS(on)}$  = 6.4 mΩ at  $V_{GS} = -2.5$  V,  $I_D = -16$  A
- State-of-the-art switching performance
- Lower output capacitance, gate resistance, and gate charge boost efficiency
- Shielded gate technology reduces switch node ringing and increases immunity to EMI and cross conduction
- RoHS Compliant



### General Description

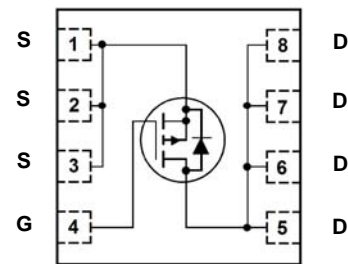
This P-Channel MOSFET has been designed specifically to improve the overall efficiency and to minimize switch node ringing of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low  $r_{DS(on)}$ , fast switching speed and body diode reverse recovery performance.

### Applications

- High side switching for high end computing
- High power density DC-DC synchronous buck converter



Power 33



### MOSFET Maximum Ratings $T_A = 25$ °C unless otherwise noted

Symbol	Parameter	Rated	Units
$V_{DS}$	Drain to Source Voltage	-12	V
$V_{GS}$	Gate to Source Voltage	±8	V
$I_D$	Drain Current - Continuous $T_C = 25$ °C	-80	A
	- Continuous (Note 1a)	-22	
	- Pulsed	-200	
$P_D$	Power Dissipation $T_C = 25$ °C	48	W
	Power Dissipation $T_A = 25$ °C (Note 1a)	2.4	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	$T_C = 25$ °C	2.6	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	$T_A = 25$ °C (Note 1a)	53	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
23AB	FDMC610P	Power 33	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	$I_D = -250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$	-12			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		-13		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -9.6\text{ V}$ , $V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 8\text{ V}$ , $V_{DS} = 0\text{ V}$			$\pm 100$	nA

#### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = -250\text{ }\mu\text{A}$	-0.4	-0.7	-1	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		3.1		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -4.5\text{ V}$ , $I_D = -22\text{ A}$		2.8	3.9	m $\Omega$
		$V_{GS} = -2.5\text{ V}$ , $I_D = -16\text{ A}$		3.7	6.4	
		$V_{GS} = -4.5\text{ V}$ , $I_D = -22\text{ A}$ , $T_J = 125\text{ }^\circ\text{C}$		3.6	5.4	
$g_{FS}$	Forward Transconductance	$V_{DD} = -5\text{ V}$ , $I_D = -22\text{ A}$		16		S

#### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -6\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		0.89	1.25	nF
$C_{oss}$	Output Capacitance			1620	2270	pF
$C_{rss}$	Reverse Transfer Capacitance			1440	2015	pF
$R_g$	Gate Resistance		0.1	3.6	7.2	$\Omega$

#### Switching Characteristics

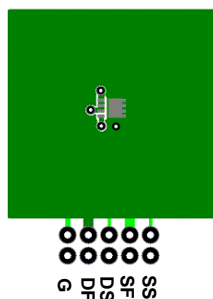
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -6\text{ V}$ , $I_D = -22\text{ A}$ , $V_{GS} = -4.5\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$		24	39	ns
$t_r$	Rise Time			37	60	ns
$t_{d(off)}$	Turn-Off Delay Time			193	309	ns
$t_f$	Fall Time			87	139	ns
$Q_g$	Total Gate Charge			71	99	nC
$Q_{gs}$	Gate to Source Charge	$V_{DD} = -6\text{ V}$ , $I_D = -22\text{ A}$ , $V_{GS} = -4.5\text{ V}$		13		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			14		nC

#### Drain-Source Diode Characteristics

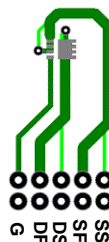
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = -2\text{ A}$ (Note 2)		-0.6	-1.2	V
		$V_{GS} = 0\text{ V}$ , $I_S = -22\text{ A}$ (Note 2)		-0.8	-1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = -22\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$		36	58	ns
$Q_{rr}$	Reverse Recovery Charge			19	33	nC

Note:

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



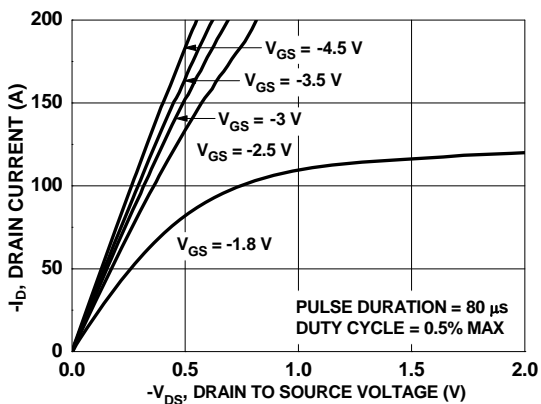
a.  $53\text{ }^\circ\text{C/W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper



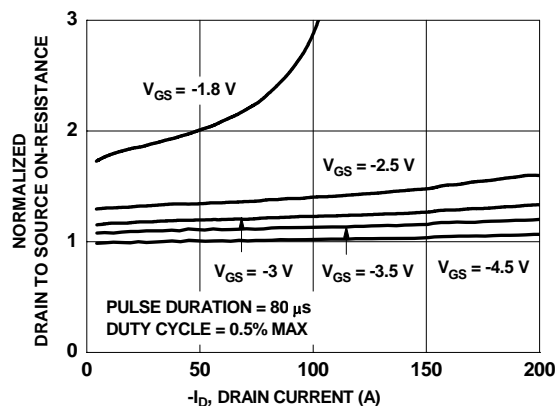
b.  $125\text{ }^\circ\text{C/W}$  when mounted on a minimum pad of 2 oz copper

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

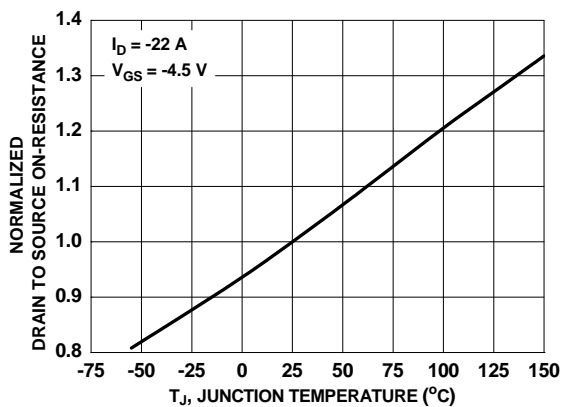
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



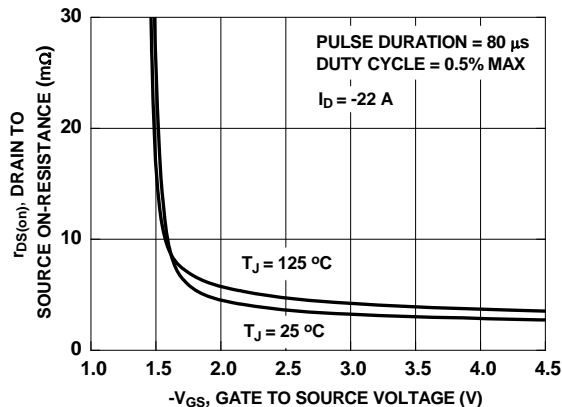
**Figure 1. On Region Characteristics**



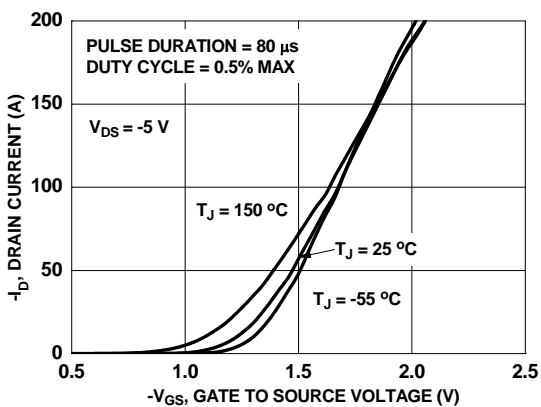
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



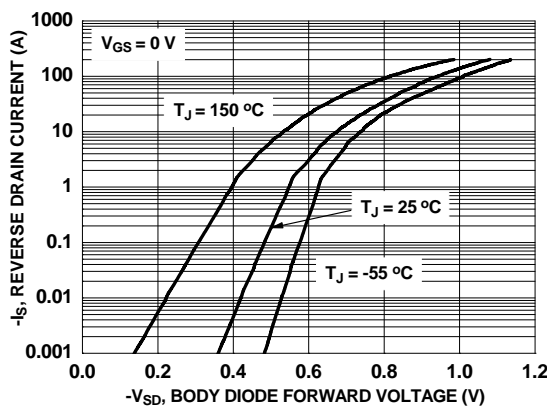
**Figure 3. Normalized On Resistance vs Junction Temperature**



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

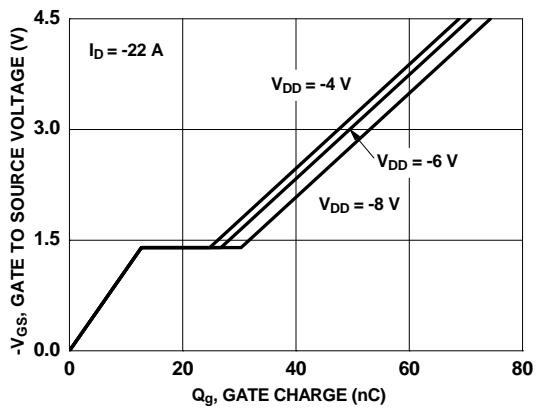


**Figure 5. Transfer Characteristics**

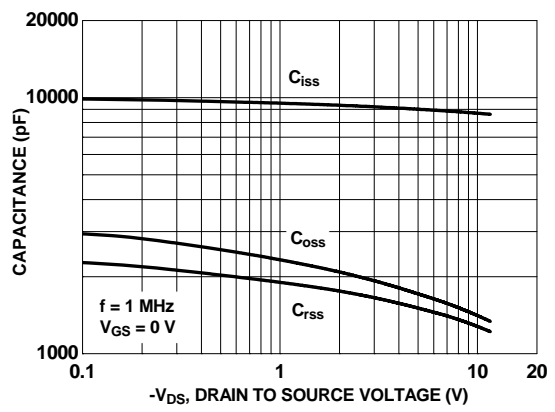


**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

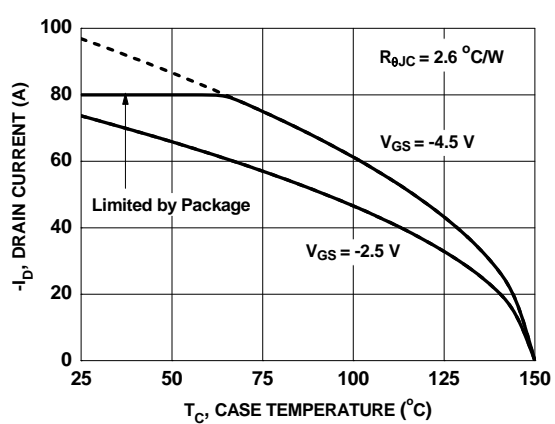
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



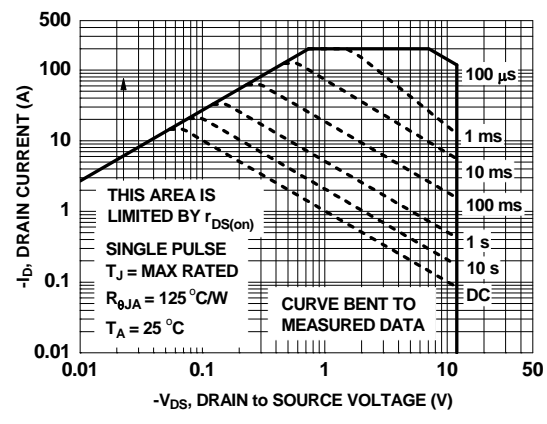
**Figure 7. Gate Charge Characteristics**



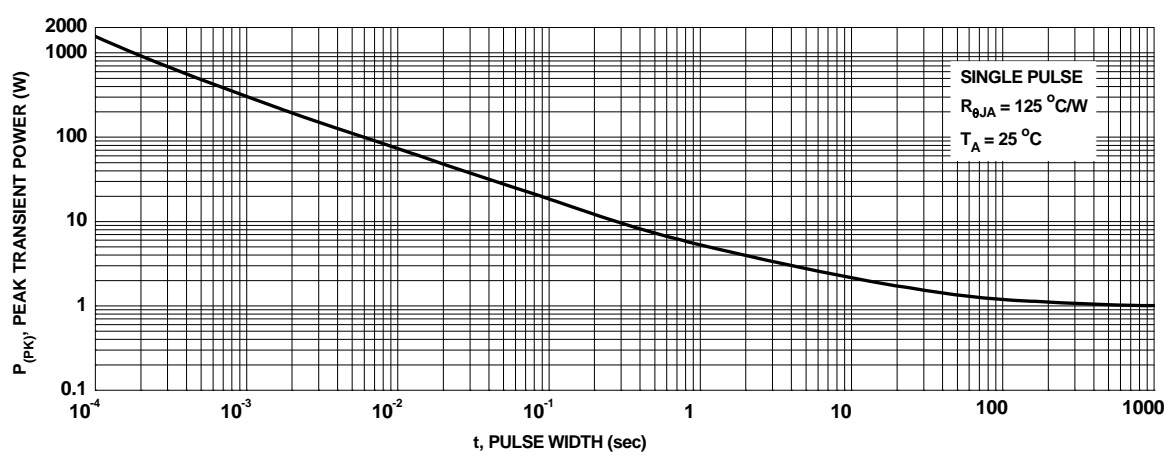
**Figure 8. Capacitance vs Drain to Source Voltage**



**Figure 9. Maximum Continuous Drain Current vs Case Temperature**

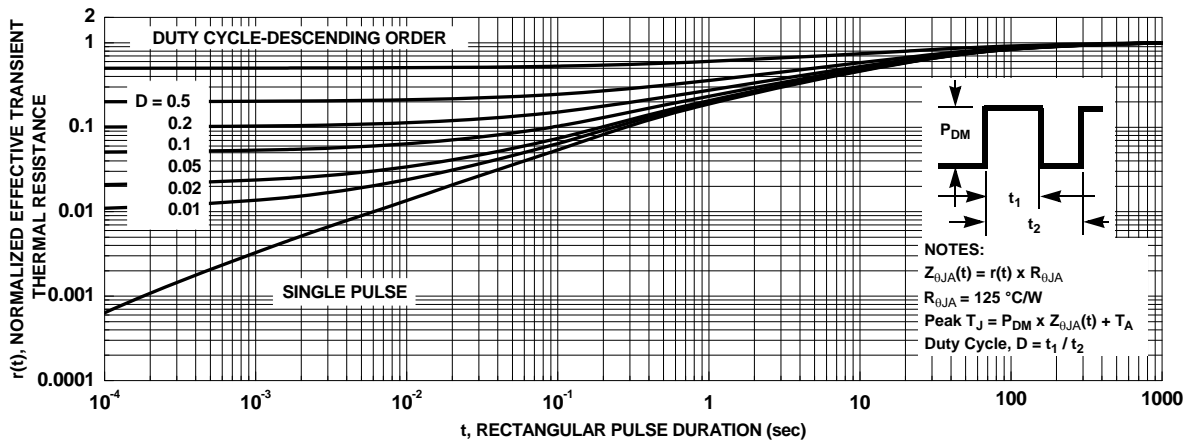


**Figure 10. Forward Bias Safe Operating Area**



**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**





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