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# FDMC7696

## N-Channel PowerTrench<sup>®</sup> MOSFET 30 V, 12 A, 11.5 mΩ

### Features

- Max  $r_{DS(on)}$  = 11.5 mΩ at  $V_{GS} = 10\text{ V}$ ,  $I_D = 12\text{ A}$
- Max  $r_{DS(on)}$  = 14.5 mΩ at  $V_{GS} = 4.5\text{ V}$ ,  $I_D = 10\text{ A}$
- High performance technology for extremely low  $r_{DS(on)}$
- Termination is Lead-free and RoHS Compliant

### General Description

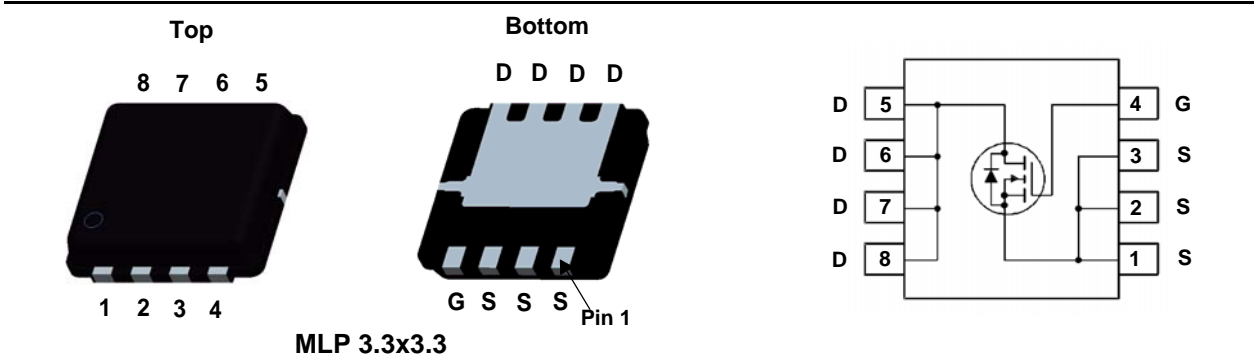
This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced Power Trench<sup>®</sup> process that has been especially tailored to minimize the on-state resistance. This device is well suited for Power Management and load switching applications common in Notebook Computers and Portable Battery Packs.

### Applications

- DC/DC Buck Converters
- Notebook battery power management
- Load Switch in Notebook



FDMC7696 N-Channel PowerTrench<sup>®</sup> MOSFET



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

Symbol	Parameter	Conditions	Rated Value	Units
$V_{DS}$	Drain to Source Voltage		30	V
$V_{DS(t)}$	Drain to Source Transient Voltage ( $t_{\text{transient}} < 100\text{ ns}$ )		33	V
$V_{GS}$	Gate to Source Voltage	(Note 4)	$\pm 20$	V
$I_D$	Drain Current -Continuous (Package limited)	$T_C = 25^\circ\text{C}$	20	A
	-Continuous (Silicon limited)	$T_C = 25^\circ\text{C}$	38	
	-Continuous	$T_A = 25^\circ\text{C}$ (Note 1a)	12	
	-Pulsed		50	
$E_{AS}$	Single Pulse Avalanche Energy	(Note 3)	21	mJ
$P_D$	Power Dissipation	$T_C = 25^\circ\text{C}$	25	W
	Power Dissipation	$T_A = 25^\circ\text{C}$ (Note 1a)	2.4	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range		-55 to +150	$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case		5.0	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1a)	53	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMC7696	FDMC7696	MLP 3.3x3.3	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	$I_D = 250\text{ }\mu\text{A}, V_{GS} = 0\text{ V}$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		14		mV/°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, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$			100	nA

### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	1.2	2.0	3.0	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 $25\text{ }^\circ\text{C}$		-6		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 12\text{ A}$		8.5	11.5	m $\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 10\text{ A}$		11.5	14.5	
		$V_{GS} = 10\text{ V}, I_D = 12\text{ A}, T_J = 125\text{ }^\circ\text{C}$		11.6	15.7	
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{ V}, I_D = 12\text{ A}$		45		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		1075	1430	pF
$C_{oss}$	Output Capacitance			380	505	pF
$C_{rss}$	Reverse Transfer Capacitance			40	55	pF
$R_g$	Gate Resistance		0.2	1.0	2.0	$\Omega$

### Switching Characteristics

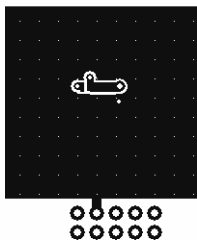
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{ V}, I_D = 12\text{ A}, V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$		9	18	ns	
$t_r$	Rise Time			2	10	ns	
$t_{d(off)}$	Turn-Off Delay Time			19	33	ns	
$t_f$	Fall Time			2	10	ns	
$Q_g$	Total Gate Charge		$V_{GS} = 0\text{ V to }10\text{ V}$		16	22	nC
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{ V to }5\text{ V}$	$V_{DD} = 15\text{ V}, I_D = 12\text{ A}$		8	11	nC
$Q_{gs}$	Gate to Source Charge				3.2		nC
$Q_{gd}$	Gate to Drain "Miller" Charge				1.8		nC

### Drain-Source Diode Characteristics

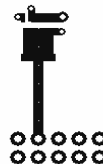
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 1.9\text{ A}$ (Note 2)		0.75	1.2	V
		$V_{GS} = 0\text{ V}, I_S = 12\text{ A}$ (Note 2)		0.84	1.2	
$t_{rr}$	Reverse Recovery Time	$I_F = 12\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		25	40	ns
$Q_{rr}$	Reverse Recovery Charge			9	18	nC

#### Notes:

- $R_{\theta JA}$  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.  $R_{\theta JC}$  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 in<sup>2</sup> 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  $\mu\text{s}$ , Duty cycle < 2.0%.

3.  $E_{AS}$  of 21 mJ is based on starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 0.3\text{ mH}$ ,  $I_{AS} = 12\text{ A}$ ,  $V_{DD} = 27\text{ V}$ ,  $V_{GS} = 10\text{ V}$ .

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

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

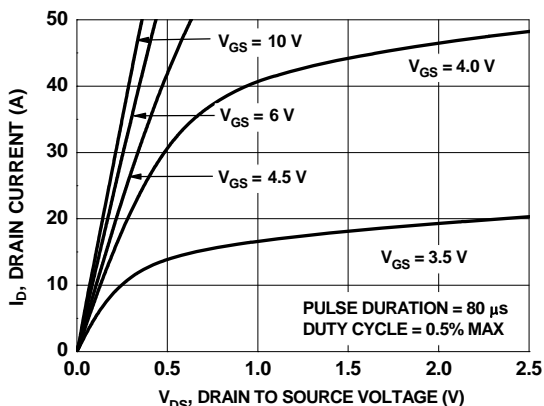


Figure 1. On Region Characteristics

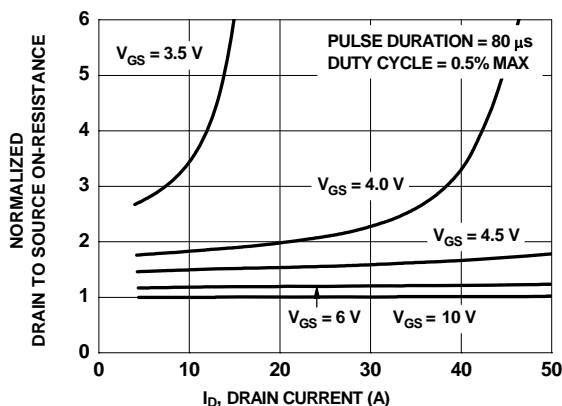


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

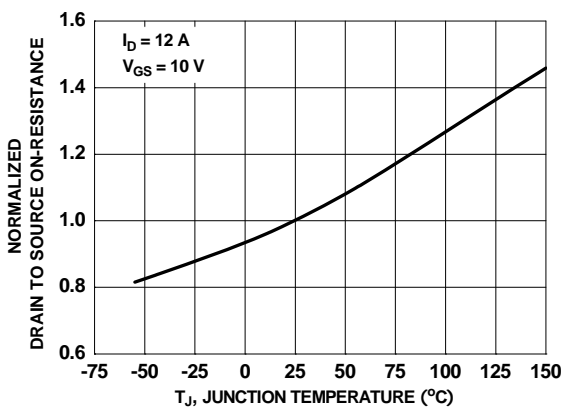


Figure 3. Normalized On Resistance vs Junction Temperature

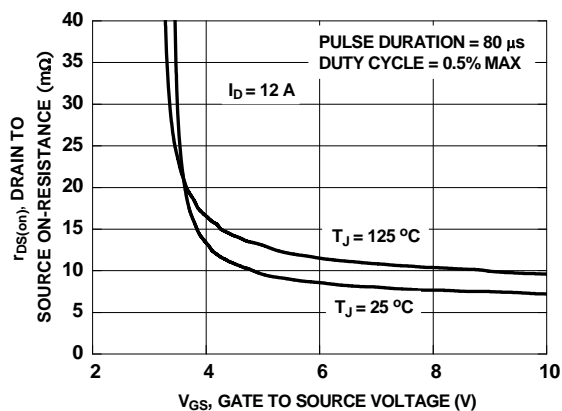


Figure 4. On-Resistance vs Gate to Source Voltage

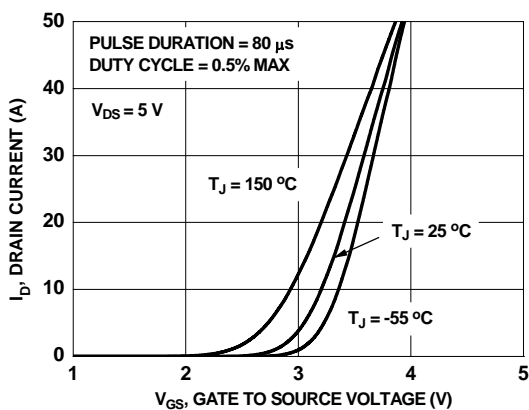


Figure 5. Transfer Characteristics

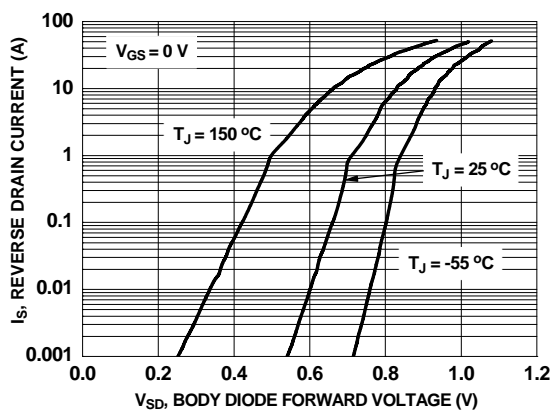
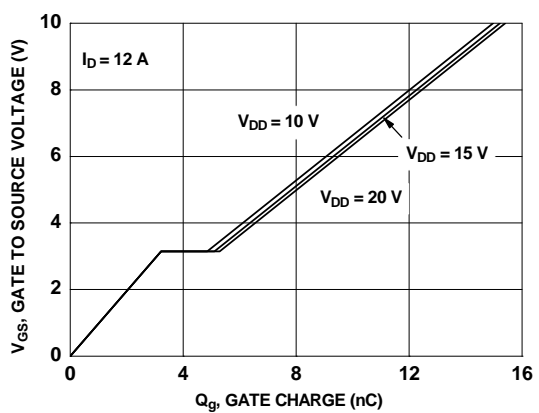
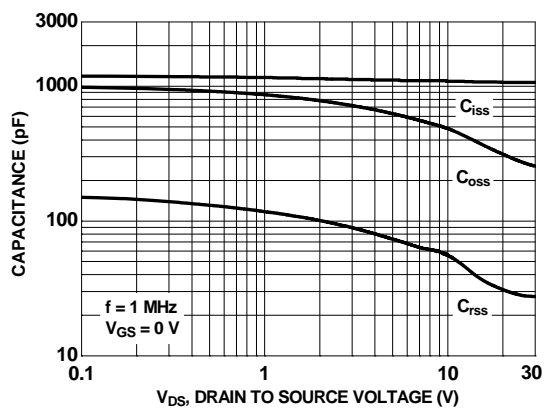


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

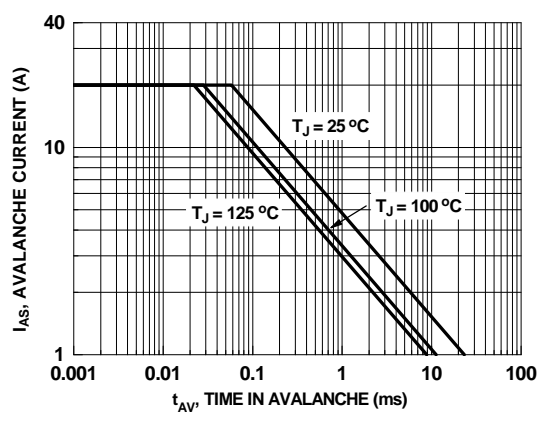
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



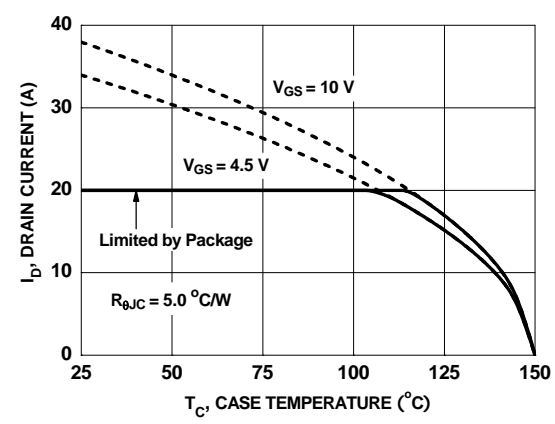
**Figure 7. Gate Charge Characteristics**



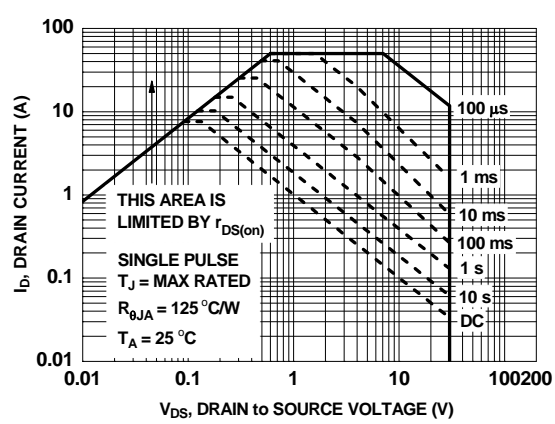
**Figure 8. Capacitance vs Drain to Source Voltage**



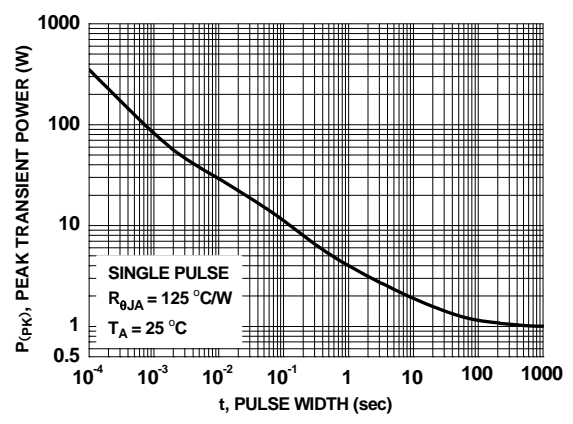
**Figure 9. Unclamped Inductive Switching Capability**



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

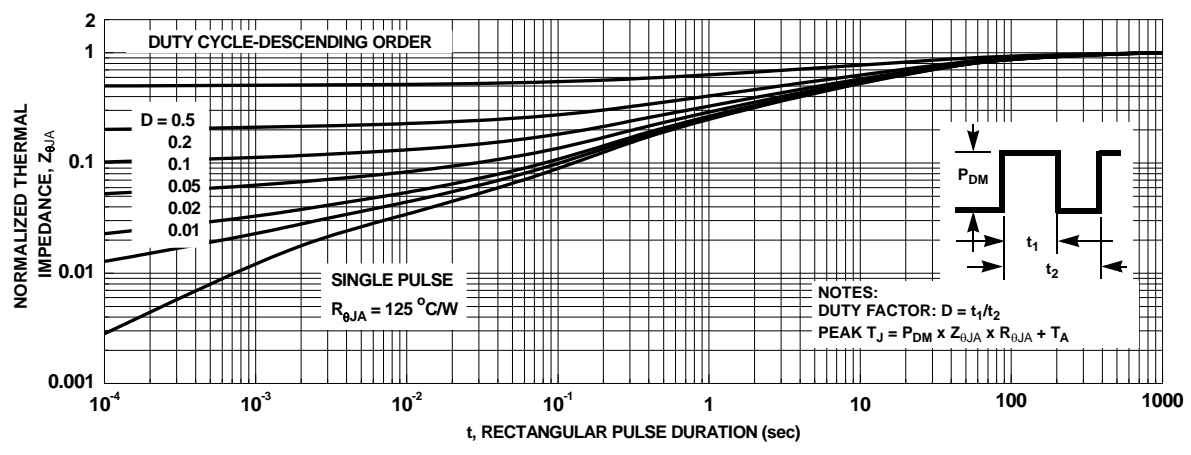


**Figure 11. Forward Bias Safe Operating Area**



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

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



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



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