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# FDPF3860T

## N-Channel PowerTrench® MOSFET

100 V, 20 A, 38.2 mΩ



### Features

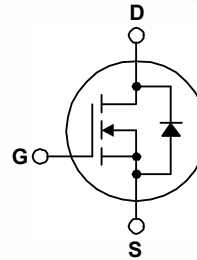
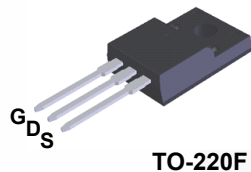
- $R_{DS(on)} = 29.1 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 5.9 \text{ A}$
- Fast Switching Speed
- Low Gate Charge
- High Performance Trench Technology for Extremely Low  $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

### Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process that has been tailored to minimize the on-state resistance while maintaining superior switching performance.

### Applications

- Consumer Appliances
- LCD/LED/PDP TV
- Synchronous Rectification
- Uninterruptible Power Supply
- Micro Solar Inverter



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

Symbol	Parameter	FDPF3860T	Unit
$V_{DSS}$	Drain to Source Voltage	100	V
$V_{GSS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	20
		- Continuous ( $T_C = 100^\circ\text{C}$ )	12.7
$I_{DM}$	Drain Current	- Pulsed (Note 1)	80
$E_{AS}$	Single Pulsed Avalanche Energy	(Note 2)	278
$I_{AR}$	Avalanche Current	(Note 1)	20
$E_{AR}$	Repetitive Avalanche Energy	(Note 1)	3.4
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	15
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	33.8
		- Derate Above $25^\circ\text{C}$	0.27
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds	300	$^\circ\text{C}$

### Thermal Characteristics

Symbol	Parameter	FDPF3860T	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	3.7	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDPF3860T	FDPF3860T	TO-220F	Tube	N/A	N/A	50 units

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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### Off Characteristics

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250 \mu\text{A}$ , $V_{GS} = 0 \text{ V}$ , $T_J = 25^\circ\text{C}$	100	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	0.1	-	$V/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 80 \text{ V}$ , $V_{GS} = 0 \text{ V}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 48 \text{ V}$ , $T_C = 150^\circ\text{C}$	-	-	500	
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 20 \text{ V}$ , $V_{DS} = 0 \text{ V}$	-	-	$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250 \mu\text{A}$	2.5	-	4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}$ , $I_D = 5.9 \text{ A}$	-	29.1	38.2	$\text{m}\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 10 \text{ V}$ , $I_D = 5.9 \text{ A}$	-	21	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$	-	1350	1800	pF
$C_{oss}$	Output Capacitance		-	145	190	pF
$C_{rss}$	Reverse Transfer Capacitance		-	60	90	pF

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 50 \text{ V}$ , $I_D = 5.9 \text{ A}$ , $V_{GS} = 10 \text{ V}$ , $R_G = 6 \Omega$	-	15	40	ns
$t_r$	Turn-On Rise Time		-	17	45	ns
$t_{d(off)}$	Turn-Off Delay Time		-	24	60	ns
$t_f$	Turn-Off Fall Time		(Note 4)	-	7	25
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 80 \text{ V}$ , $I_D = 5.9 \text{ A}$ , $V_{GS} = 10 \text{ V}$	-	23	35	nC
$Q_{gs}$	Gate to Source Gate Charge		-	7	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		(Note 4)	-	8	-

### Drain-Source Diode Characteristics

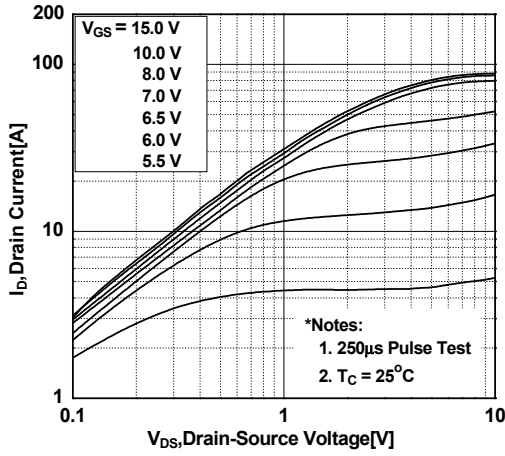
$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	20	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	80	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}$ , $I_{SD} = 5.9 \text{ A}$	-	-	1.3	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0 \text{ V}$ , $I_{SD} = 5.9 \text{ A}$ , $di_F/dt = 100 \text{ A}/\mu\text{s}$	-	40	-	ns
$Q_{rr}$	Reverse Recovery Charge		-	56	-	nC

#### Notes:

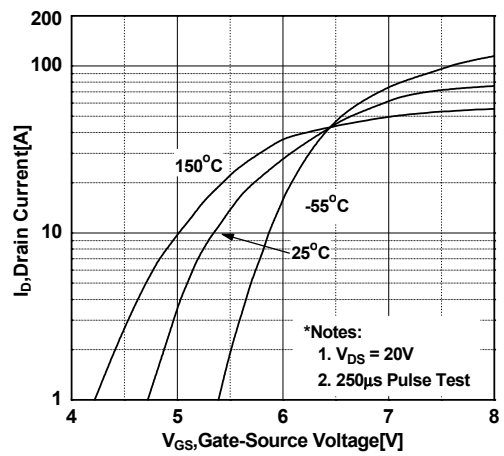
1. Repetitive rating; pulse-width limited by maximum junction temperature.
2.  $L = 16 \text{ mH}$ ,  $I_{AS} = 5.9 \text{ A}$ ,  $V_{DD} = 50 \text{ V}$ ,  $R_G = 25 \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 5.9 \text{ A}$ ,  $di/dt \leq 200 \text{ A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

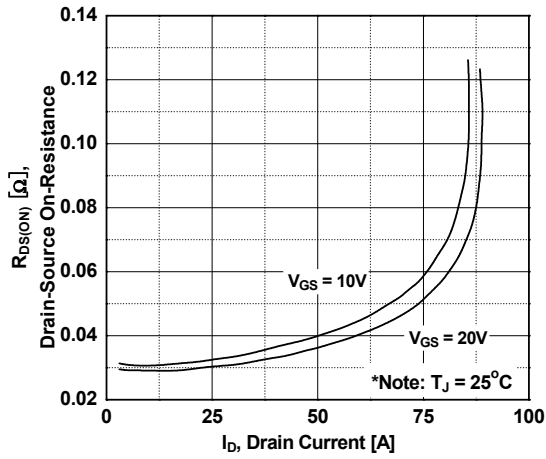
**Figure 1. On-Region Characteristics**



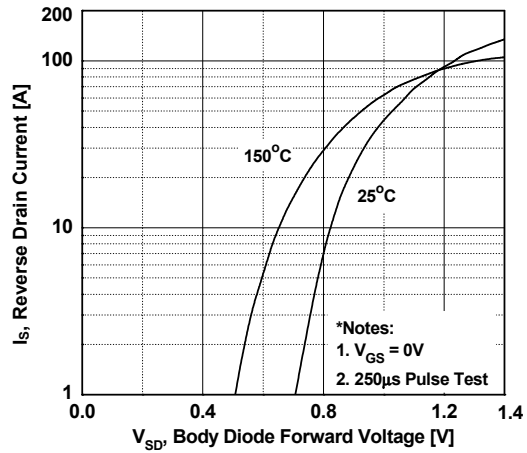
**Figure 2. Transfer Characteristics**



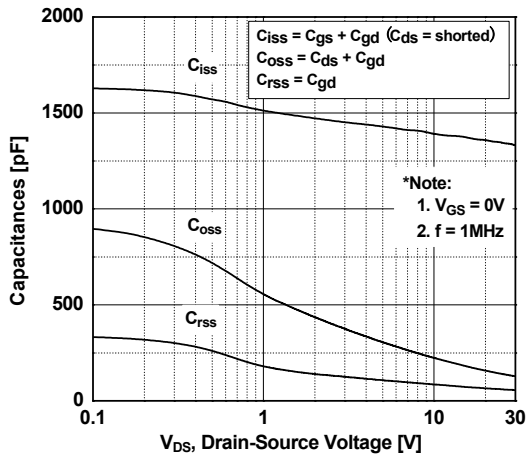
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



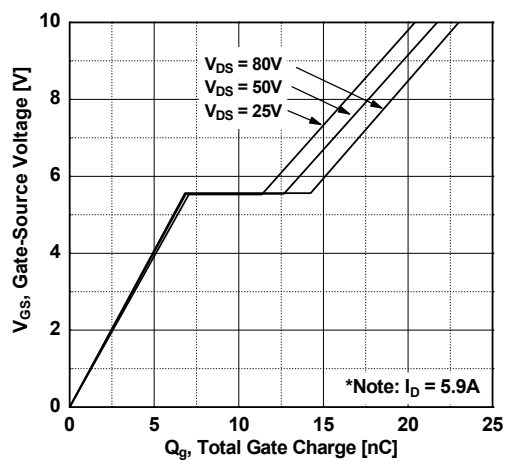
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**



**Figure 6. Gate Charge Characteristics**



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

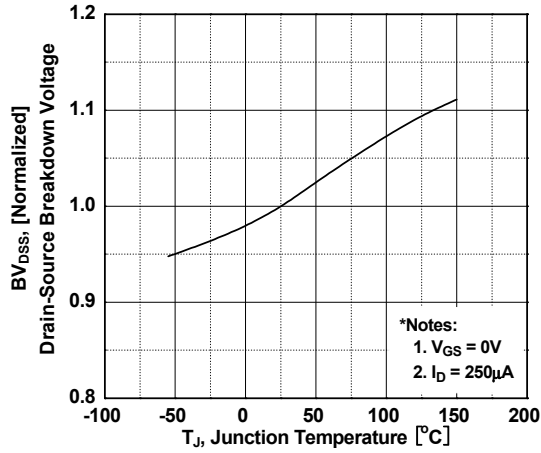


Figure 8. On-Resistance Variation vs. Temperature

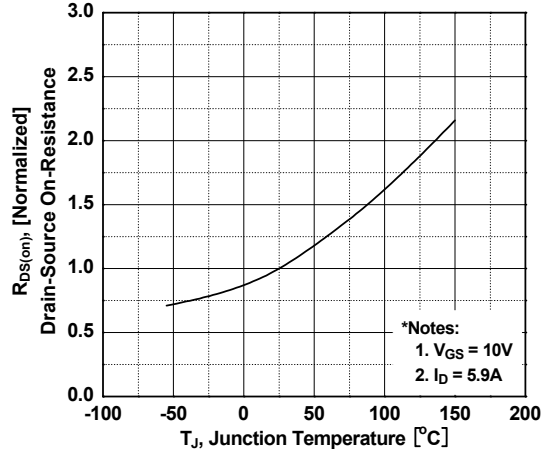


Figure 9. Maximum Safe Operating Area

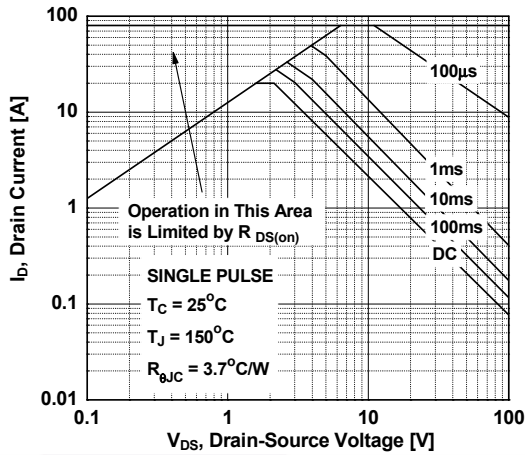


Figure 10. Maximum Drain Current vs. Case Temperature

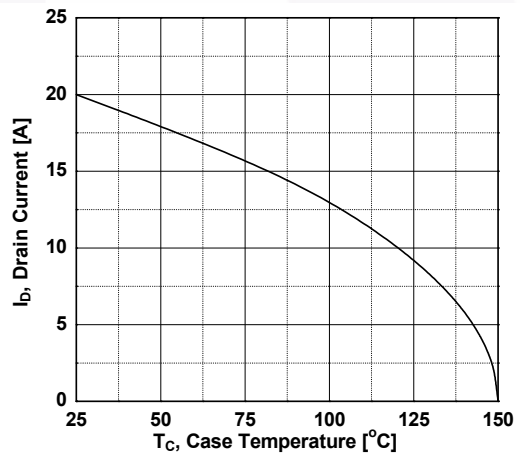
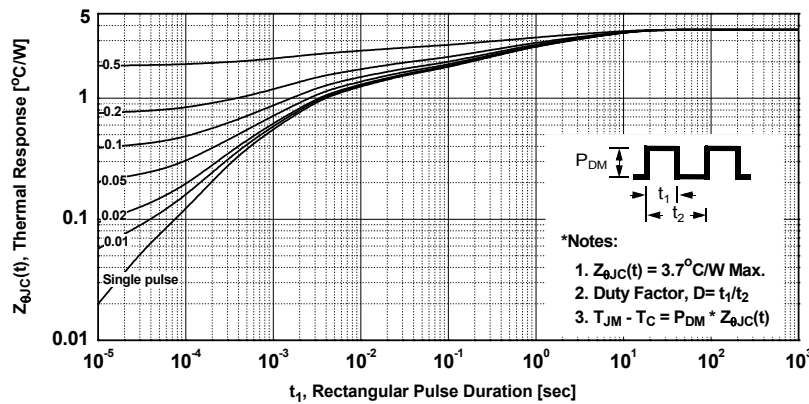
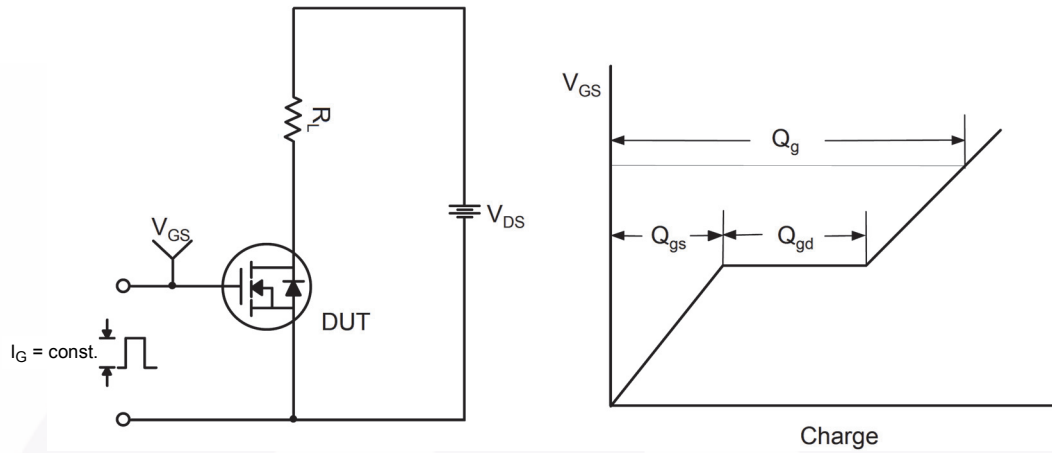


Figure 11. Transient Thermal Response Curve

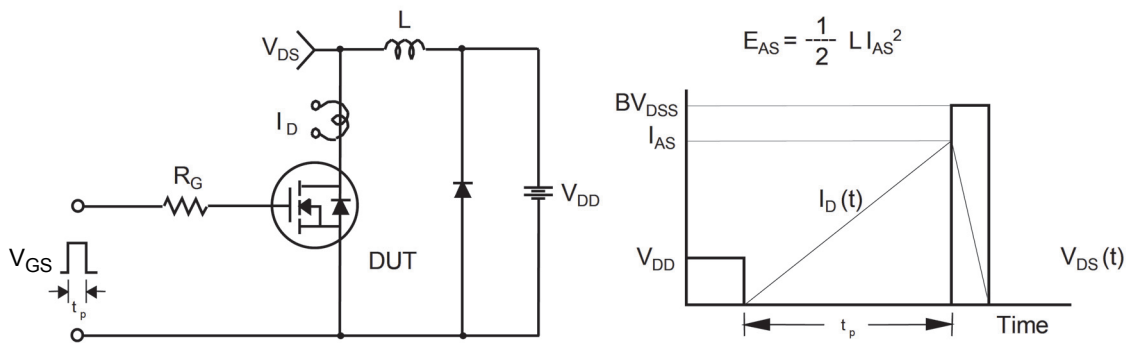




**Figure 12. Gate Charge Test Circuit & Waveform**



**Figure 13. Resistive Switching Test Circuit & Waveforms**



**Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms**



Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

## Mechanical Dimensions



### NOTES:

- A. EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
- B. DOES NOT COMPLY EIAJ STD. VALUE.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- E. DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
- F. OPTION 1 - WITH SUPPORT PIN HOLE.  
OPTION 2 - NO SUPPORT PIN HOLE.
- G. DRAWING FILE NAME: TO220M03REV3

**Figure 16. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead**

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