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April 2013
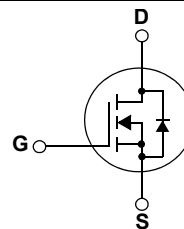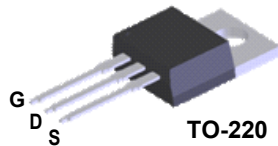
FDP7N50

N-Channel UniFET™ MOSFET

500 V, 7 A, 900 mΩ

Features

- $R_{DS(on)}$ = 900 mΩ (Max.) @ V_{GS} = 10 V, I_D = 3.5 A
- Low Gate Charge (Typ. 12.8 nC)
- Low C_{rss} (Typ. 9 pF)
- 100% Avalanche Tested

Applications

- ALCD/LED TV
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supplypplications

Description

UniFET™ MOSFET is Fairchild Semiconductor®'s high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.

TO-220

Absolute Maximum Ratings

Symbol	Parameter		FDP7N50	Unit
V_{DSS}	Drain-Source Voltage		500	V
I_D	Drain Current	- Continuous (T_C = 25°C)	7	A
		- Continuous (T_C = 100°C)	4.2	A
I_{DM}	Drain Current	- Pulsed (Note 1)	28	A
V_{GSS}	Gate-Source voltage		±30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		270	mJ
I_{AR}	Avalanche Current (Note 1)		7	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		8.9	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5	V/ns
P_D	Power Dissipation (T_C = 25°C)		89	W
	- Derate above 25°C		0.71	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	°C
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds		300	°C

Thermal Characteristics

Symbol	Parameter	FDP7N50	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	1.4	
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink, Typ.	0.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP7N50	FDP7N50	TO-220	--	--	50

Electrical Characteristics $T_C = 25°C$ unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0V$, $I_D = 250\mu A$	500	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu A$, Referenced to 25°C	--	0.5	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 500V$, $V_{GS} = 0V$ $V_{DS} = 400V$, $T_C = 125°C$	-- --	-- --	1 10	μA μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30V$, $V_{DS} = 0V$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -30V$, $V_{DS} = 0V$	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250\mu A$	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10V$, $I_D = 3.5A$	--	0.76	0.9	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40V$, $I_D = 3.5A$	--	2.5	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 25V$, $V_{GS} = 0V$, f = 1.0MHz	--	720	940	pF
C_{oss}	Output Capacitance		--	95	190	pF
C_{rss}	Reverse Transfer Capacitance		--	9	13.5	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 250V$, $I_D = 7A$ $R_G = 25\Omega$	--	6	20	ns
t_r	Turn-On Rise Time		--	55	120	ns
$t_{d(off)}$	Turn-Off Delay Time		--	25	60	ns
t_f	Turn-Off Fall Time	(Note 4)	--	35	80	ns
Q_g	Total Gate Charge	$V_{DS} = 400V$, $I_D = 7A$ $V_{GS} = 10V$	--	12.8	16.6	nC
Q_{gs}	Gate-Source Charge		--	3.7	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4)	--	5.8	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	7	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	28	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0V$, $I_S = 7A$	--	--	1.4	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0V$, $I_S = 7A$ $dI_F/dt = 100A/\mu s$	--	275	--	ns
Q_{rr}	Reverse Recovery Charge		--	1.7	--	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS} = 7A$, $V_{DD} = 50V$, L=10mH, $R_G = 25\Omega$, Starting $T_J = 25°C$
3. $I_{SD} \leq 7A$, di/dt $\leq 200A/\mu s$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25°C$
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics
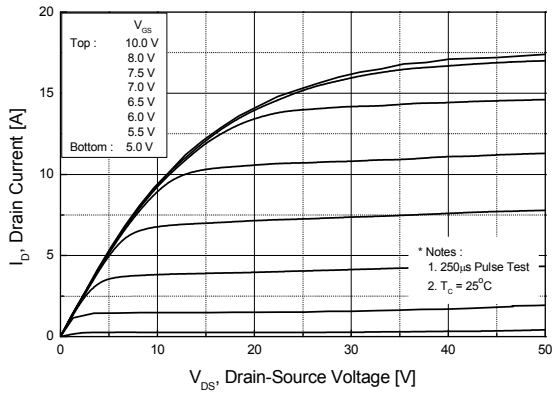
Figure 1. On-Region Characteristics

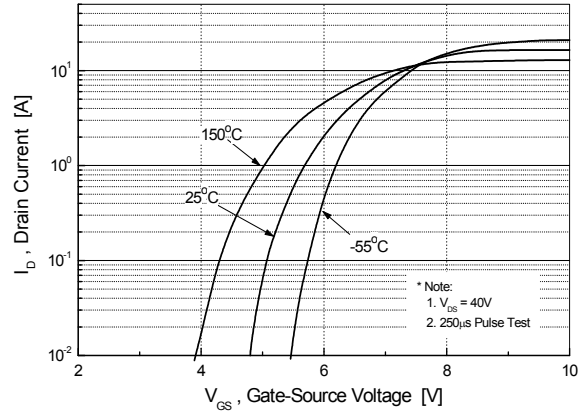### Figure 2. Transfer Characteristics

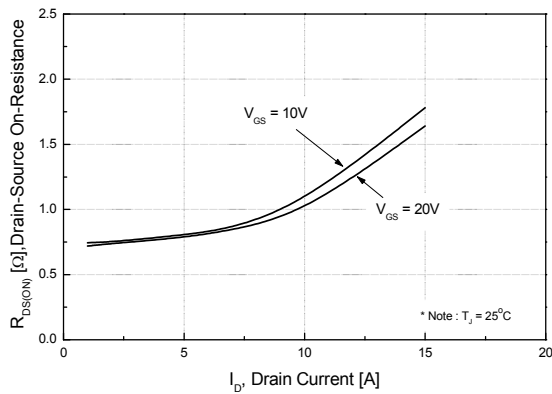### Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

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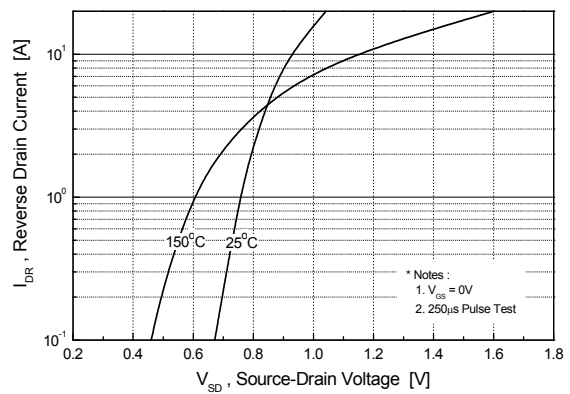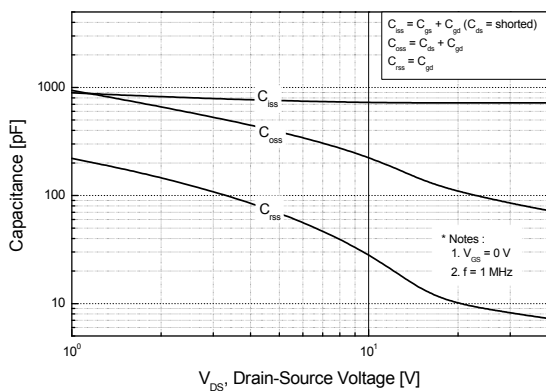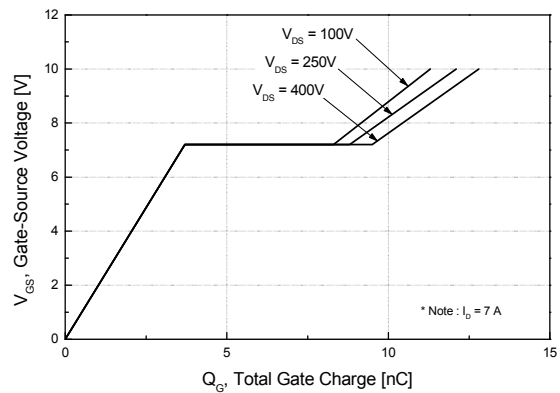

Figure 5. Capacitance Characteristics

Figure 6. Gate Charge Characteristics

Typical Performance Characteristics (Continued)
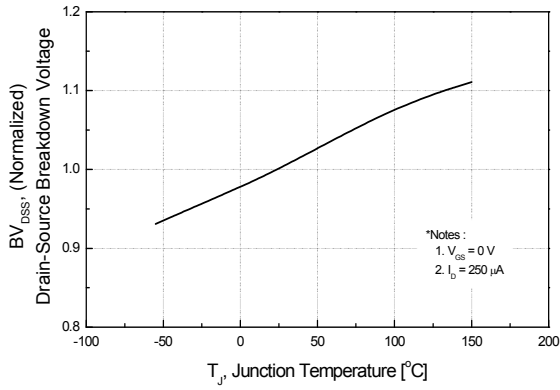
Figure 7. Breakdown Voltage Variation vs. Temperature

*Notes :
1. $V_{GS} = 0$ V
2. $I_D = 250 \mu A$

Figure 8. On-Resistance Variation vs. Temperature

*Notes :
1. $V_{GS} = 10$ V
2. $I_D = 3.5$ A
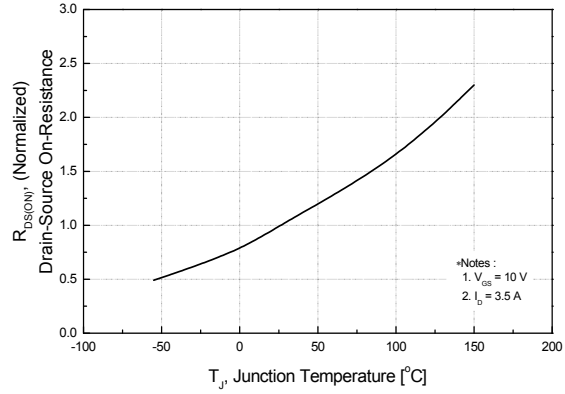
Figure 9. Maximum Safe Operating Area - FDP7N50

Operation in This Area is Limited by $R_{DS(on)}$
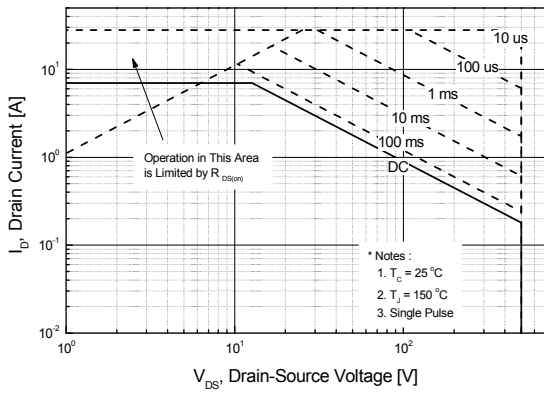
* Notes :
1. $T_C = 25$ °C
2. $T_J = 150$ °C
3. Single Pulse

Figure 10. Maximum Drain Current vs. Case Temperature
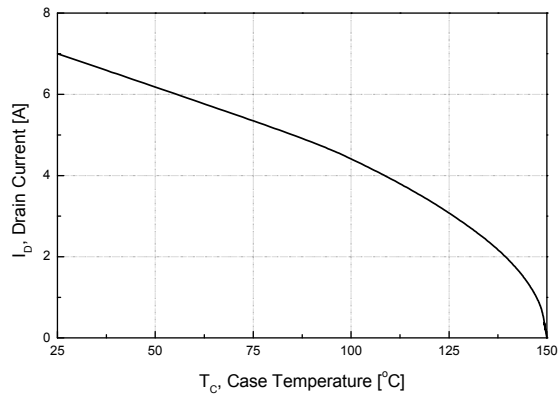
Figure 11. Transient Thermal Response Curve

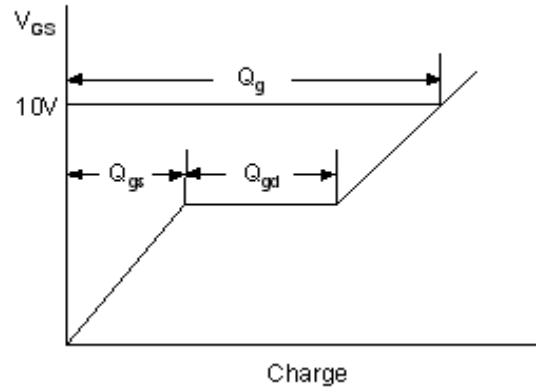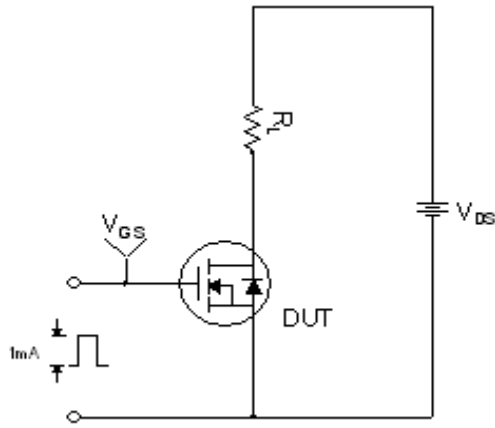
* Notes :
1. $Z_{\theta JC}(t) = 1.4$ °C/W Max.
2. Duty Factor, $D = t_1/t_2$
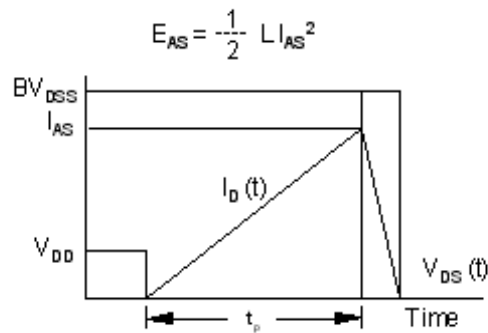3. $T_{JM} - T_C = P_{DM} * Z_{\theta JC}(t)$
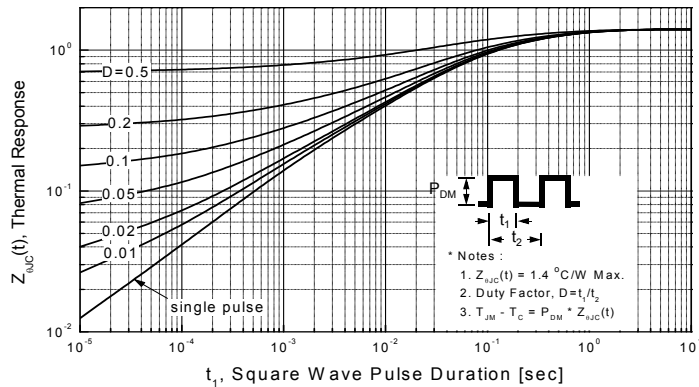
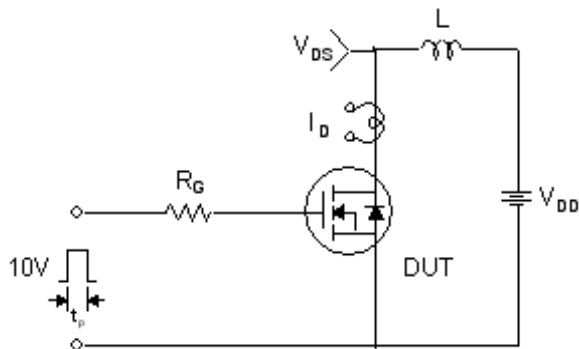**Gate Charge Test Circuit & Waveform**

Resistive Switching Test Circuit & Waveforms
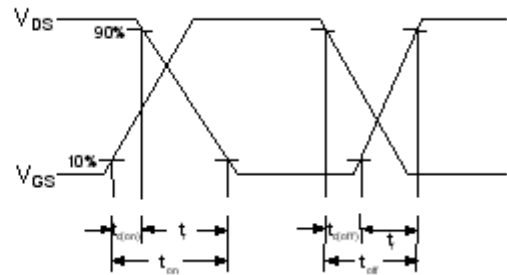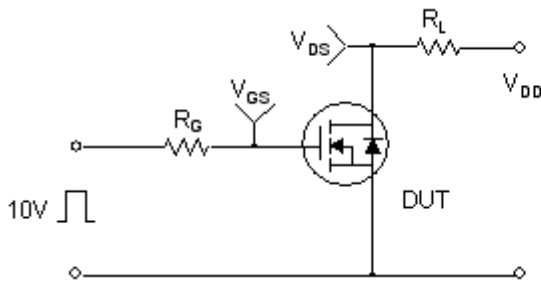
Unclamped Inductive Switching Test Circuit & Waveforms

$$E_{AS} = \frac{1}{2} L I_{AS}^2$$

Peak Diode Recovery dv/dt Test Circuit & Waveforms

DUT

V_DS

I_SD

L

Driver

R_G

Same Type
as DUT

V_GS

V_DD

- dv/dt controlled by R_G
- I_SD controlled by pulse period

$$D = \frac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$$

V_GS
(Driver)

10V

I_SD
(DUT)

I_FM , Body Diode Forward Current

di/dt

I_RM

Body Diode Reverse Current

V_DS
(DUT)

Body Diode Recovery dv/dt

V_SD

V_DD

Body Diode
Forward Voltage Drop
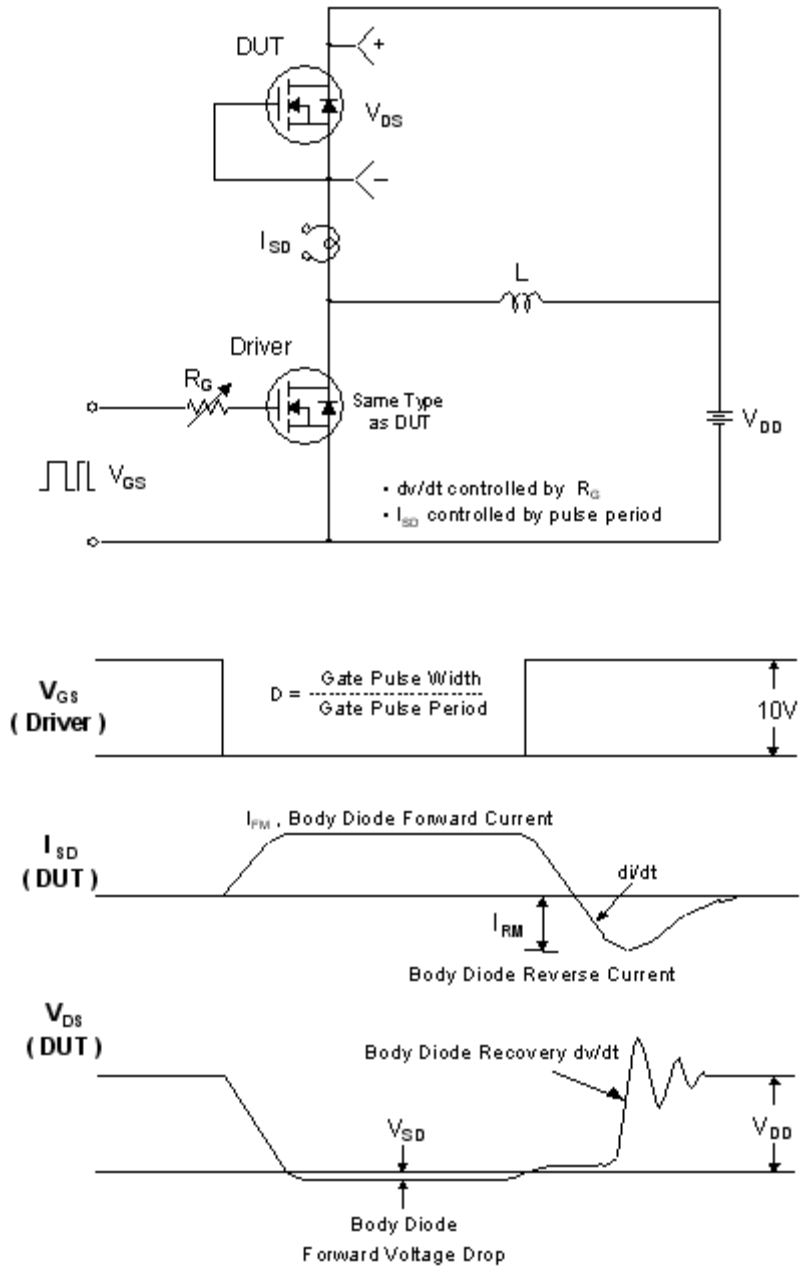
Mechanical Dimensions

TO-220B03

NOTES: UNLESS OTHERWISE SPECIFIED
A) REFERENCE JEDEC, TO-220, ISSUE K,
   VARIATION AB, DATED APRIL, 2002.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONING AND TOLERANCING PER
   ANSI Y14,5 - 1973
D) LOCATION OF THE PIN HOLE MAY VARY
   (LOWER LEFT CORNER, LOWER CENTER
   AND CENTER OF THE PACKAGE)
△E) DOES NOT COMPLY JEDEC STANDARD VALUE,
F) "A1" DIMENSIONS REPRESENT LIKE BELOW:
   SINGLE GAUGE = 0,51 - 0,61
   DUAL GAUGE   = 1,14 - 1,40
G) DRAWING FILE NAME: TO220B03REV6

Dimensions in Millimeters

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No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
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