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# FDP7N50

## N-Channel UniFET™ MOSFET

500 V, 7 A, 900 mΩ

### Features

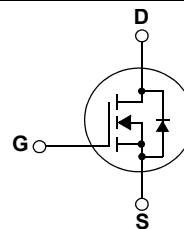
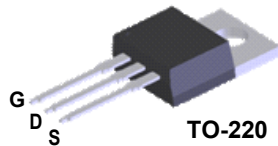
- $R_{DS(on)} = 900 \text{ m}\Omega$  (Max.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 3.5 \text{ A}$
- Low Gate Charge (Typ. 12.8 nC)
- Low  $C_{rss}$  (Typ. 9 pF)
- 100% Avalanche Tested

### Applications

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

### 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.



### Absolute Maximum Ratings

Symbol	Parameter	FDP7N50	Unit
$V_{DSS}$	Drain-Source Voltage	500	V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	7
		- Continuous ( $T_C = 100^\circ\text{C}$ )	4.2
$I_{DM}$	Drain Current	- Pulsed (Note 1)	28
$V_{GSS}$	Gate-Source voltage	$\pm 30$	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	( $T_C = 25^\circ\text{C}$ )	89
		- Derate above $25^\circ\text{C}$	0.71
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300	$^\circ\text{C}$

### Thermal Characteristics

Symbol	Parameter	FDP7N50	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	1.4	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink, Typ.	0.5	
$R_{\theta JA}$	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<sub>C</sub> = 25°C unless otherwise noted

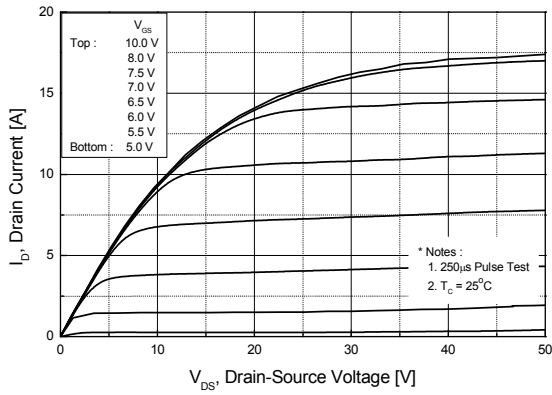
Symbol	Parameter	Conditions	Min.	Typ.	Max	Unit
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA	500	--	--	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250μA, Referenced to 25°C	--	0.5	--	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 500V, V <sub>GS</sub> = 0V V <sub>DS</sub> = 400V, T <sub>C</sub> = 125°C	--	--	1 10	μA μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 30V, V <sub>DS</sub> = 0V	--	--	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V	--	--	-100	nA
<b>On Characteristics</b>						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	3.0	--	5.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 3.5A	--	0.76	0.9	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40V, I <sub>D</sub> = 3.5A	--	2.5	--	S
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1.0MHz	--	720	940	pF
C <sub>oss</sub>	Output Capacitance		--	95	190	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	9	13.5	pF
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 250V, I <sub>D</sub> = 7A R <sub>G</sub> = 25Ω  (Note 4)	--	6	20	ns
t <sub>r</sub>	Turn-On Rise Time		--	55	120	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	25	60	ns
t <sub>f</sub>	Turn-Off Fall Time		--	35	80	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 400V, I <sub>D</sub> = 7A V <sub>GS</sub> = 10V  (Note 4)	--	12.8	16.6	nC
Q <sub>gs</sub>	Gate-Source Charge		--	3.7	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	5.8	--	nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		--	--	7	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		--	--	28	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>S</sub> = 7A	--	--	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0V, I <sub>S</sub> = 7A di <sub>F</sub> /dt = 100A/μs	--	275	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge		--	1.7	--	μC

### NOTES:

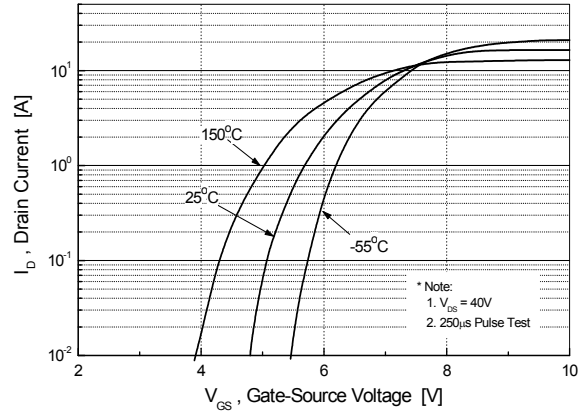
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I<sub>AS</sub> = 7A, V<sub>DD</sub> = 50V, L = 10mH, R<sub>G</sub> = 25Ω, Starting T<sub>J</sub> = 25°C
3. I<sub>SD</sub> ≤ 7A, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C
4. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

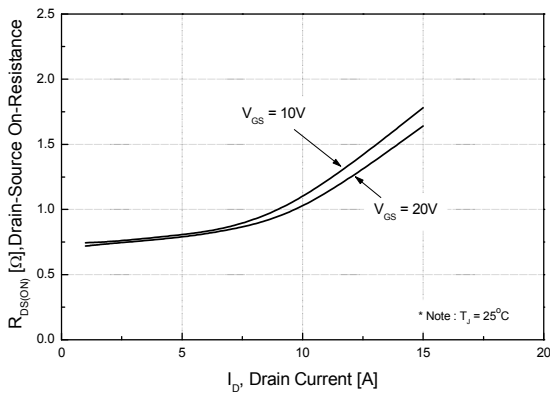
**Figure 1. On-Region Characteristics**



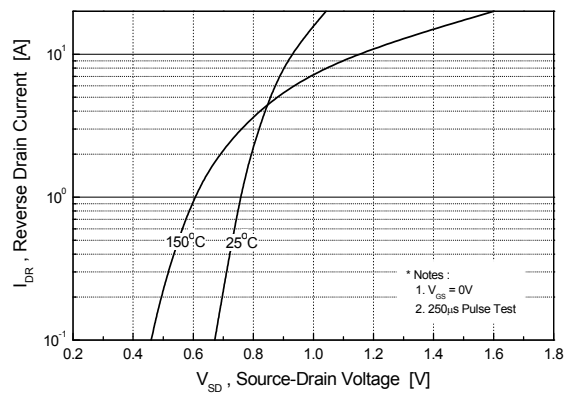
**Figure 2. Transfer Characteristics**



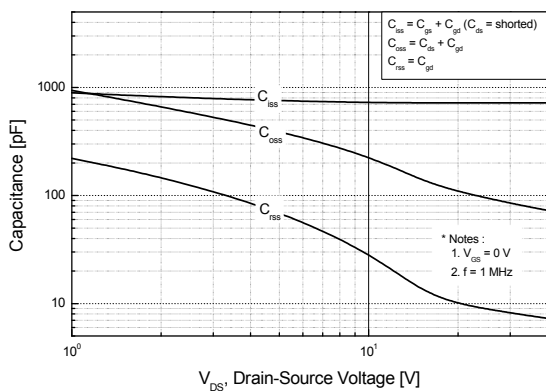
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



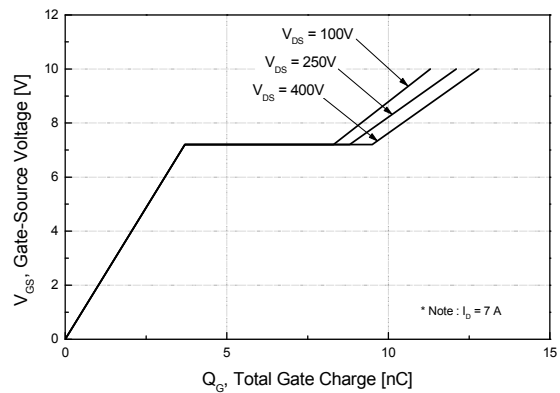
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

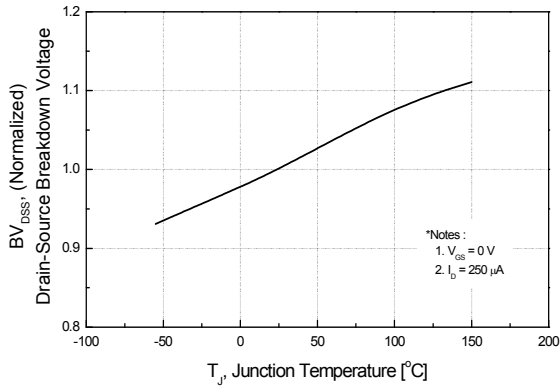


**Figure 6. Gate Charge Characteristics**

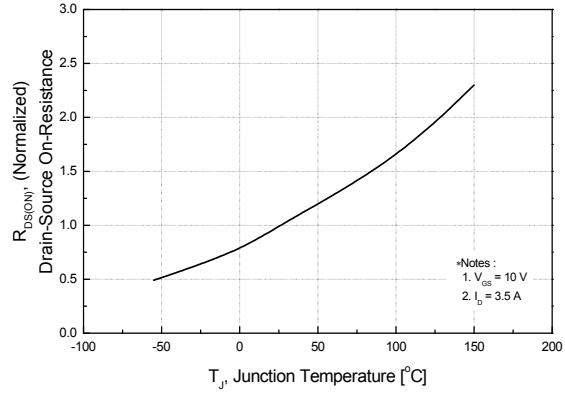


**Typical Performance Characteristics (Continued)**

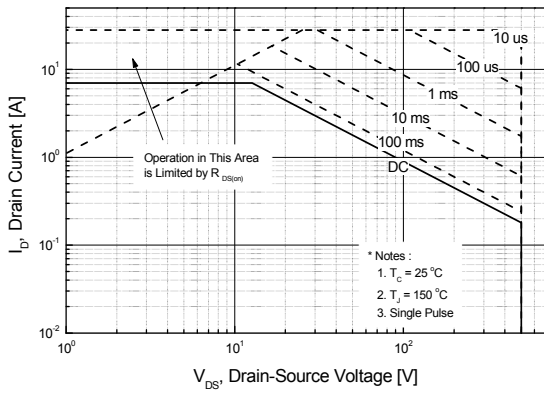
**Figure 7. Breakdown Voltage Variation vs. Temperature**



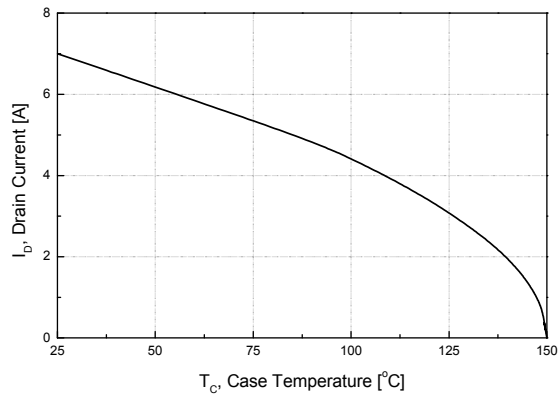
**Figure 8. On-Resistance Variation vs. Temperature**



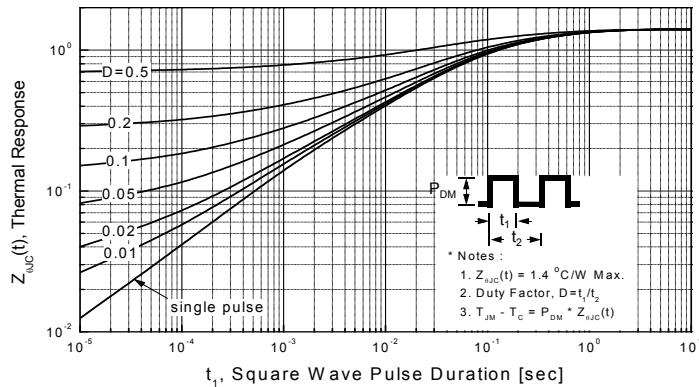
**Figure 9. Maximum Safe Operating Area - FDP7N50**



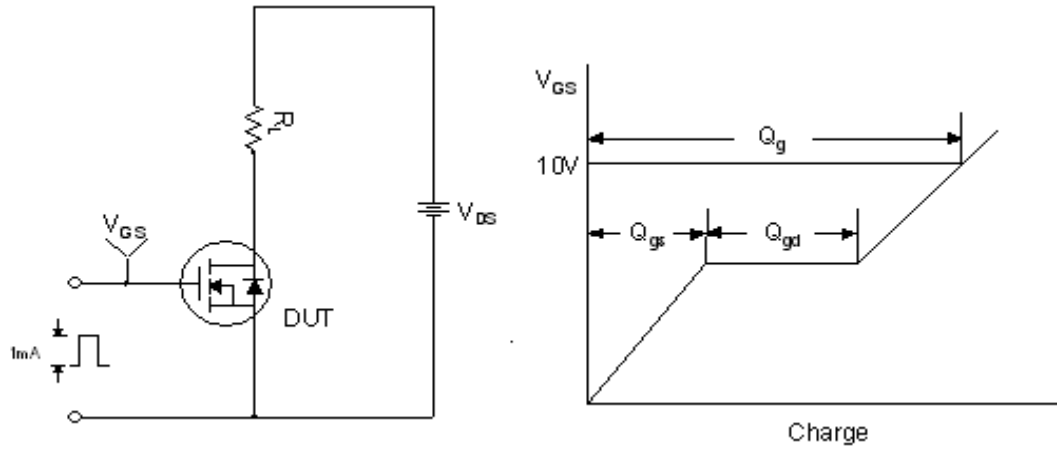
**Figure 10. Maximum Drain Current vs. Case Temperature**



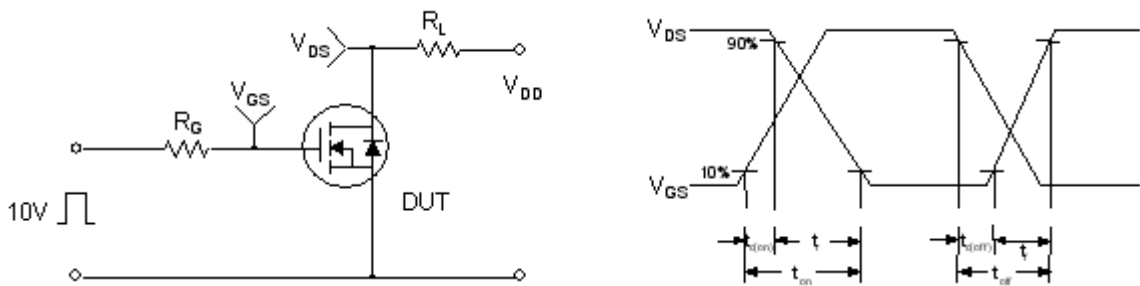
**Figure 11. Transient Thermal Response Curve**



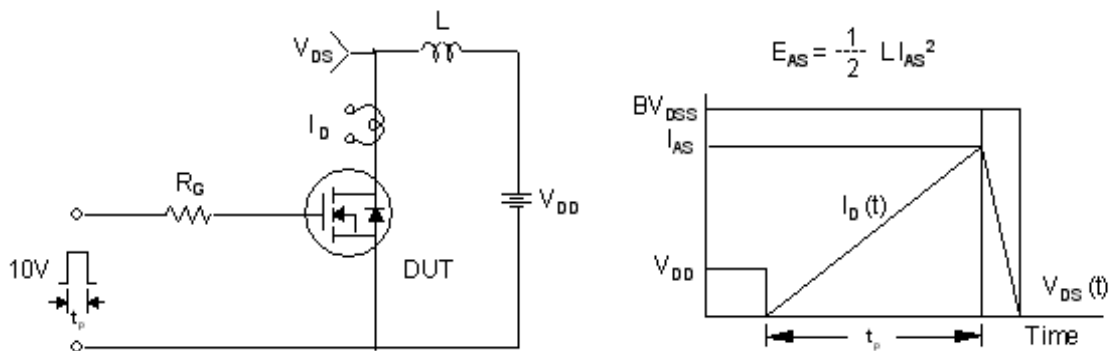
**Gate Charge Test Circuit & Waveform**



**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

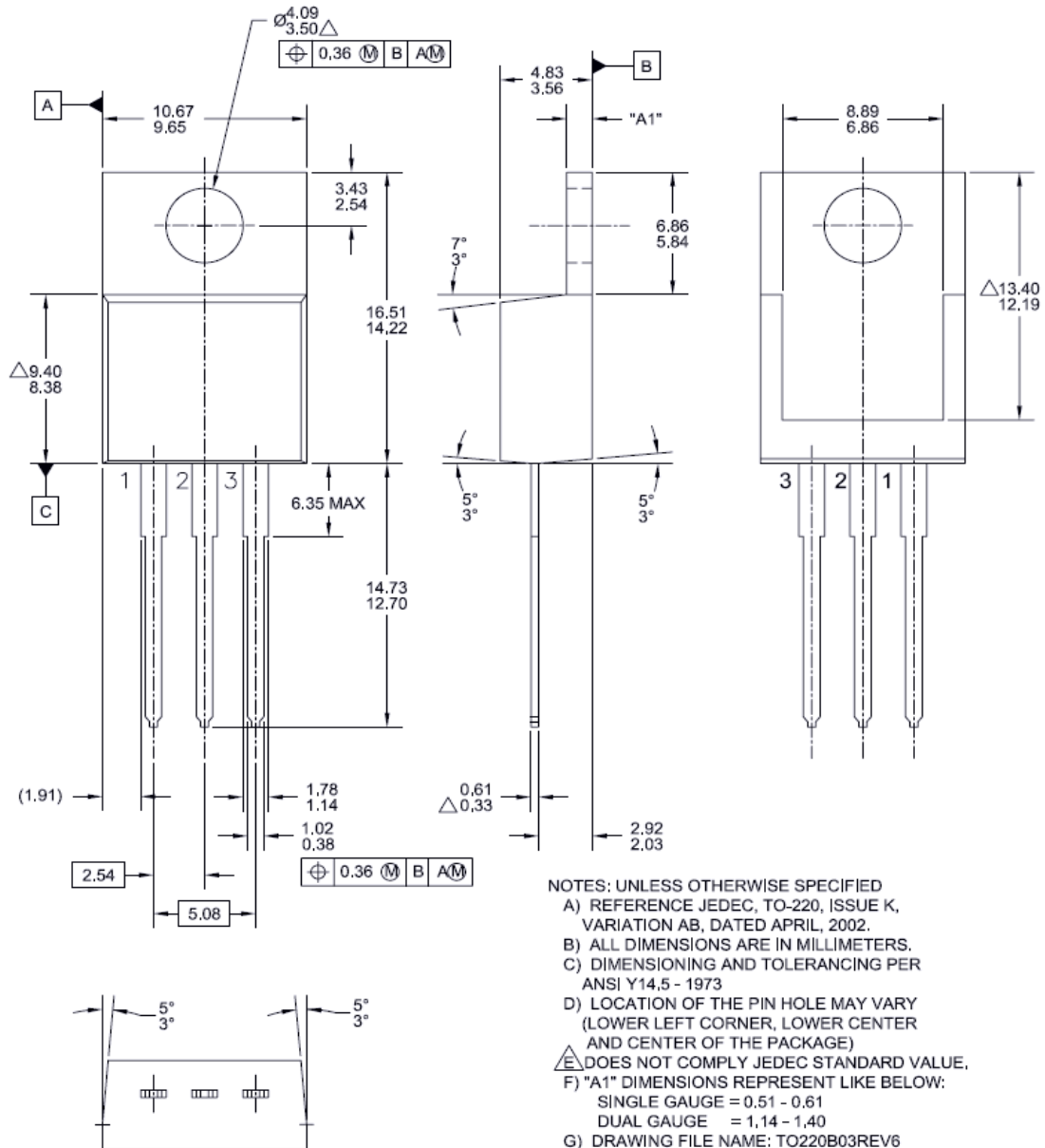


Peak Diode Recovery dv/dt Test Circuit & Waveforms



**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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| AccuPower™               | F-PFS™  | PowerXS™  | <b>E SYSTEM</b> ®* |
| AX-CAP®*                 | FRFET®  | Programmable Active Droop™                      | <b>GENERAL</b>     |
| BitSiC™                  | Global Power Resource <sup>SM</sup>             | QFET®   | TinyBoost™         |
| Build it Now™            | Green Bridge™                                   | QS™   | TinyBuck™          |
| CorePLUS™                | Green FPS™                                      | Quiet Series™                                   | TinyCalc™          |
| CorePOWER™               | Green FPS™ e-Series™                            | RapidConfigure™                                 | TinyLogic®         |
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| Fairchild Semiconductor® | MillerDrive™                                    | mWSaver™  | Ultra FRFET™       |
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|                          |   | Programmable Active Droop™                      |                    |
|                          |   | QFET®   |                    |
|                          |   | QS™   |                    |
|                          |   | Quiet Series™                                   |                    |
|                          |   | RapidConfigure™                                 |                    |
|                          |   | IntelliMAX™                                     |                    |
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|                          |   | MegaBuck™                                       |                    |
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|                          |   | MicroFET™                                       |                    |
|                          |   | MicroPak™                                       |                    |
|                          |   | MicroPak2™                                      |                    |
|                          |   | MillerDrive™                                    |                    |
|                          |   | MotionMax™                                      |                    |
|                          |   | mWSaver™  |                    |
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|                          |   | PowerXS™  |                    |
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|                          |   | QS™   |                    |
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|                          |   | RapidConfigure™                                 |                    |
|                          |   | IntelliMAX™                                     |                    |
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|                          |   | MicroPak™                                       |                    |
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|                          |   | MillerDrive™                                    |                    |
|                          |   | MotionMax™                                      |                    |
|                          |   | mWSaver™  |                    |
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|                          |   | MicroPak™                                       |                    |
|                          |   | MicroPak2™                                      |                    |
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|                          |   | MicroFET™                                       |                    |
|                          |   | MicroPak™                                       |                    |
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|                          |   | OptoHiT™  |                    |
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|                          |   | PowerTrench®                                    |                    |
|                          |   | PowerXS™  |                    |
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