

FDP52N20 / FDPF52N20T

N-Channel MOSFET

200V, 52A, 0.049Ω

Features

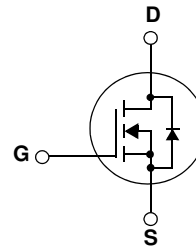
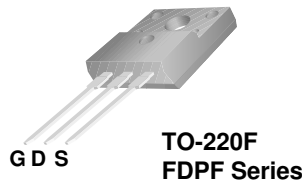
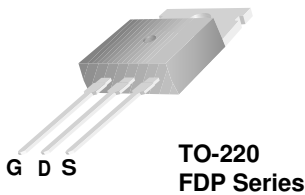
- $R_{DS(on)} = 0.041\Omega$ (Typ.)@ $V_{GS} = 10V, I_D = 26A$
- Low gate charge (Typ. 49nC)
- Low C_{rss} (Typ. 66pF)
- Fast switching
- 100% avalanche tested
- Improve dv/dt capability
- RoHS compliant



Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

This advance technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficient switching mode power supplies and active power factor correction.



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

Symbol	Parameter	FDP52N20	FDPF52N20T	Units	
V_{DSS}	Drain to Source Voltage	200		V	
V_{GSS}	Gate to Source Voltage	±30		V	
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	52	52*	A
		- Continuous ($T_C = 100^\circ\text{C}$)	33	33*	
I_{DM}	Drain Current	- Pulsed (Note 1)	208	208*	A
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	2520		mJ
I_{AR}	Avalanche Current	(Note 1)	52		A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	35.7		mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5		V/ns
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	357	38.5	W
		- Derate above 25°C	2.86	0.3	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	

*Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FDP52N20	FDPF52N20T	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.35	3.3	°C/W
$R_{\theta CS}$	Thermal Resistance, Case to Sink Typ.	0.5	-	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62.5	62.5	

Package Marking and Ordering Information $T_C = 25^\circ\text{C}$ unless otherwise noted

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP52N20	FDP52N20	TO-220	-	-	50
FDPF52N20T	FDPF52N20T	TO-220F	-	-	50

Electrical Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}, T_J = 25^\circ\text{C}$	200	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$, Referenced to 25°C	-	0.2	-	$\text{V}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 200\text{V}, V_{GS} = 0\text{V}$	-	-	1	μA
		$V_{DS} = 160\text{V}, T_C = 125^\circ\text{C}$	-	-	10	
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 30\text{V}, V_{DS} = 0\text{V}$	-	-	± 100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	3.0	-	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 26\text{A}$	-	0.041	0.049	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40\text{V}, I_D = 26\text{A}$ (Note 4)	-	35	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$	-	2230	2900	pF
C_{oss}	Output Capacitance		-	540	700	pF
C_{rss}	Reverse Transfer Capacitance		-	66	100	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 160\text{V}, I_D = 52\text{A}$ $V_{GS} = 10\text{V}$ (Note 4, 5)	-	49	63	nC
Q_{gs}	Gate to Source Gate Charge		-	19	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	24	-	nC

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 100\text{V}, I_D = 20\text{A}$ $R_G = 25\Omega$ (Note 4, 5)	-	53	115	ns
t_r	Turn-On Rise Time		-	175	359	ns
$t_{d(off)}$	Turn-Off Delay Time		-	48	107	ns
t_f	Turn-Off Fall Time		-	29	68	ns

Drain-Source Diode Characteristics

I_S	Maximum Continuous Drain to Source Diode Forward Current	-	-	52	A	
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current	-	-	204	A	
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_{SD} = 52\text{A}$	-	-	1.5	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{V}, I_{SD} = 52\text{A}$	-	162	-	ns
Q_{rr}	Reverse Recovery Charge	$di/dt = 100\text{A}/\mu\text{s}$ (Note 4)	-	1.3	-	μC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $L = 1.4\text{mH}, I_{AS} = 52\text{A}, V_{DD} = 50\text{V}, R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 52\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$
4. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

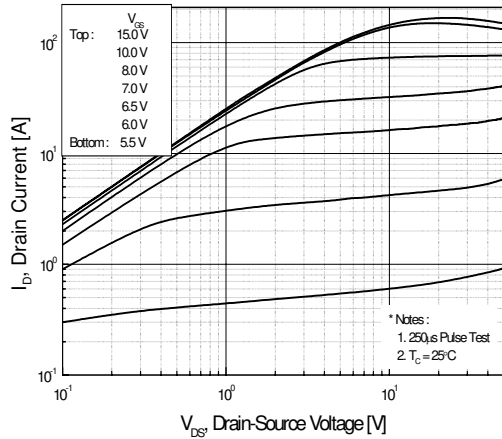


Figure 2. Transfer Characteristics

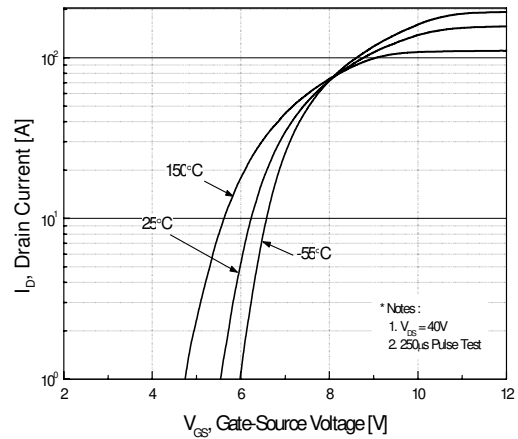


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

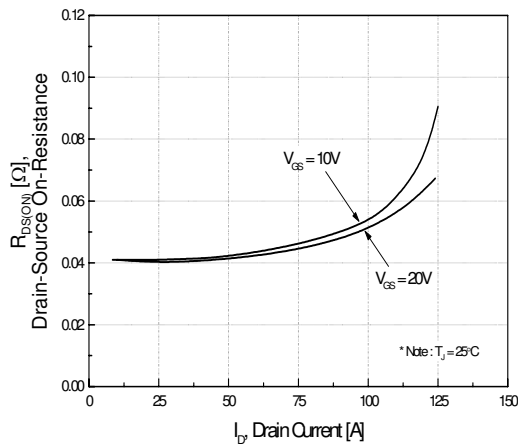


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

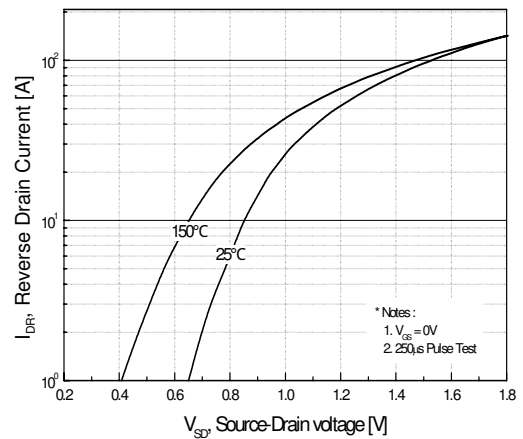


Figure 5. Capacitance Characteristics

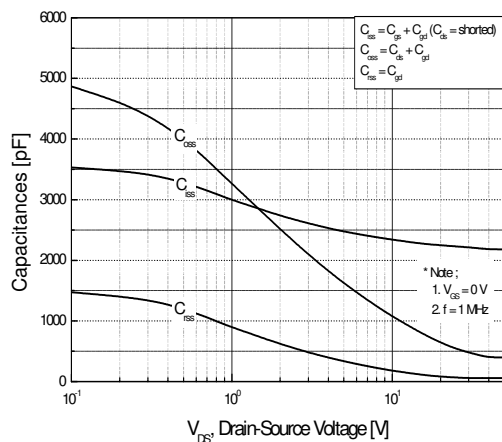
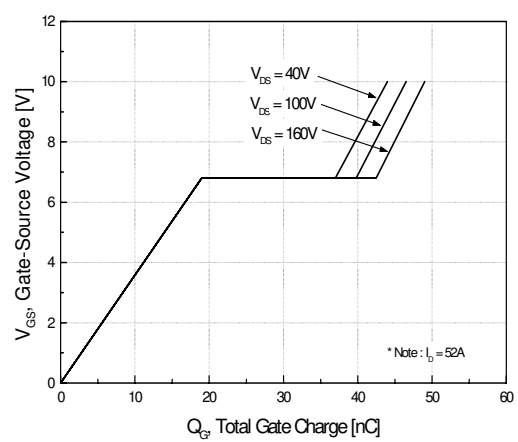


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

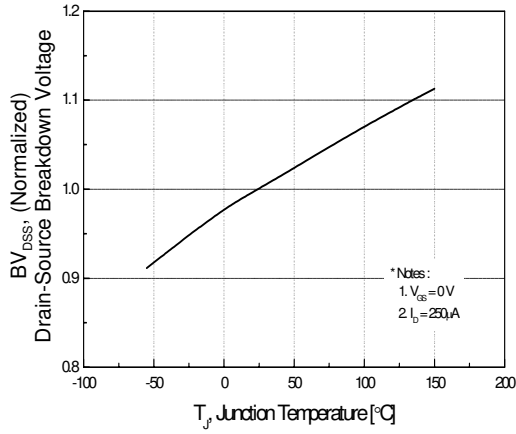


Figure 8. On-Resistance Variation vs. Temperature

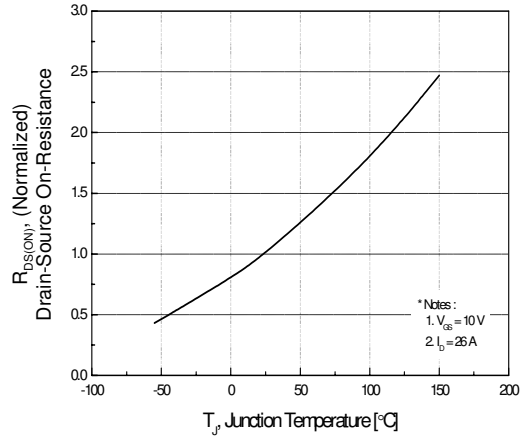


Figure 9-1. Maximum Safe Operating Area - FDP52N20

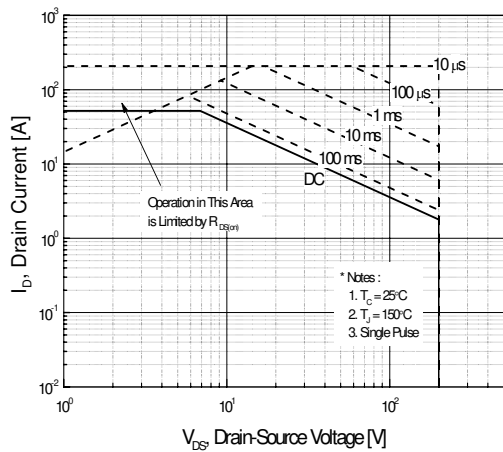


Figure 9-2. Maximum Safe Operating Area - FDPF52N20T

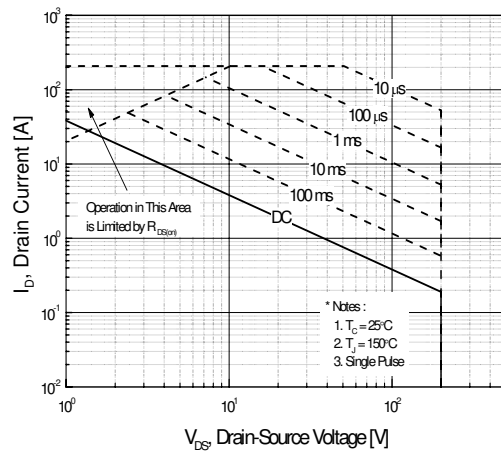
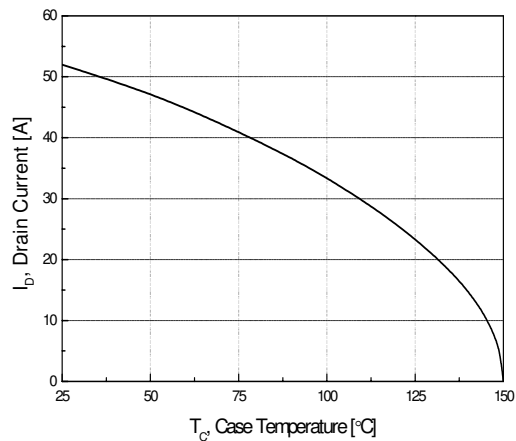


Figure 10. Maximum Drain Current



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve - FDP52N20

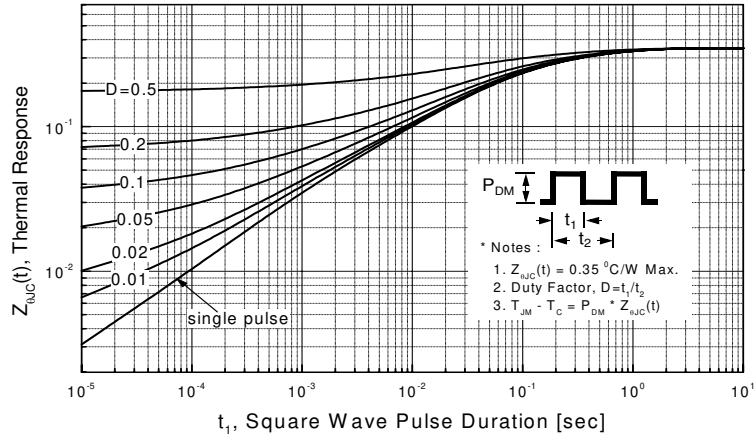
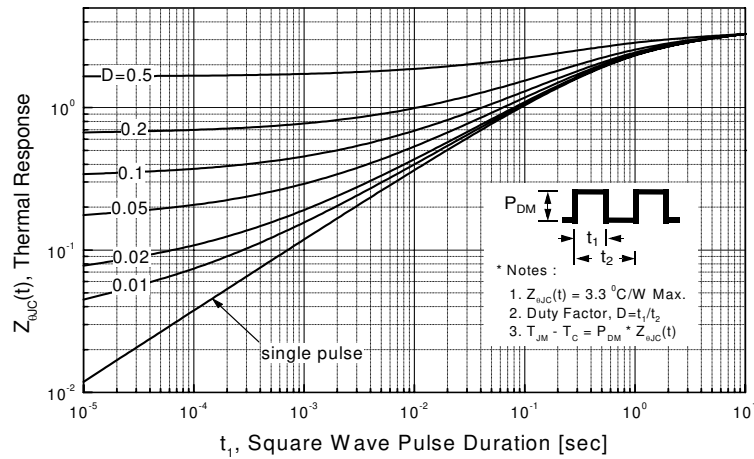
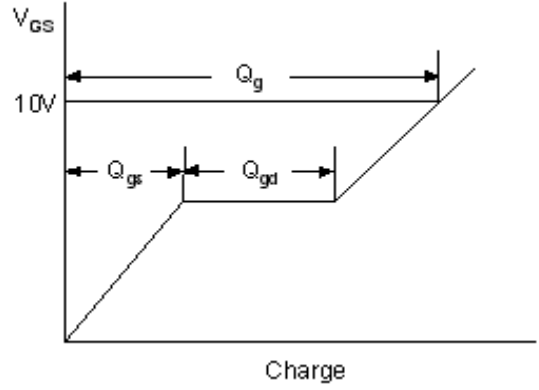
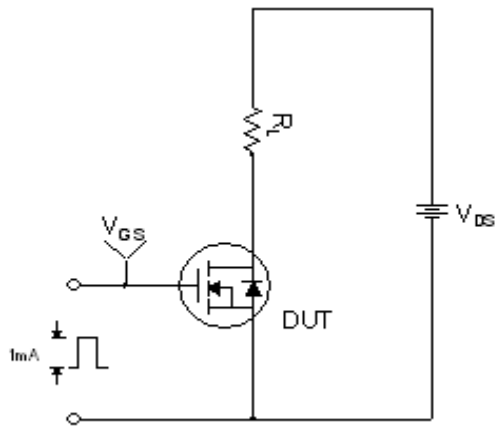


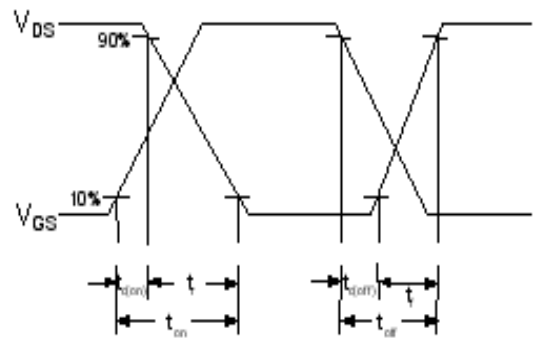
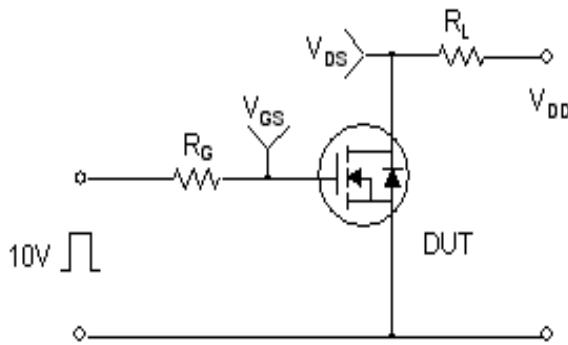
Figure 11-2. Transient Thermal Response Curve - FDPF52N20T



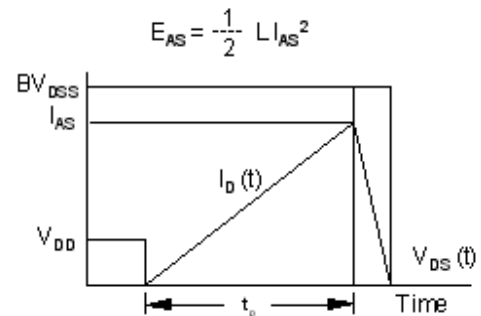
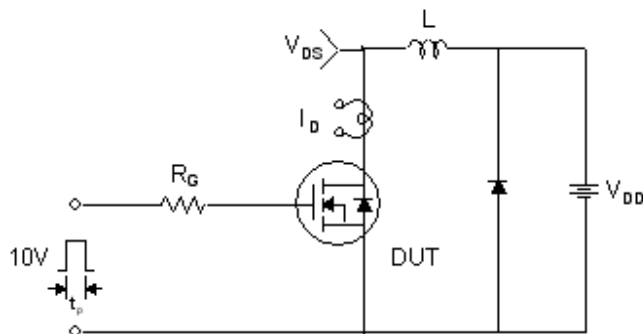
Gate Charge Test Circuit & Waveform



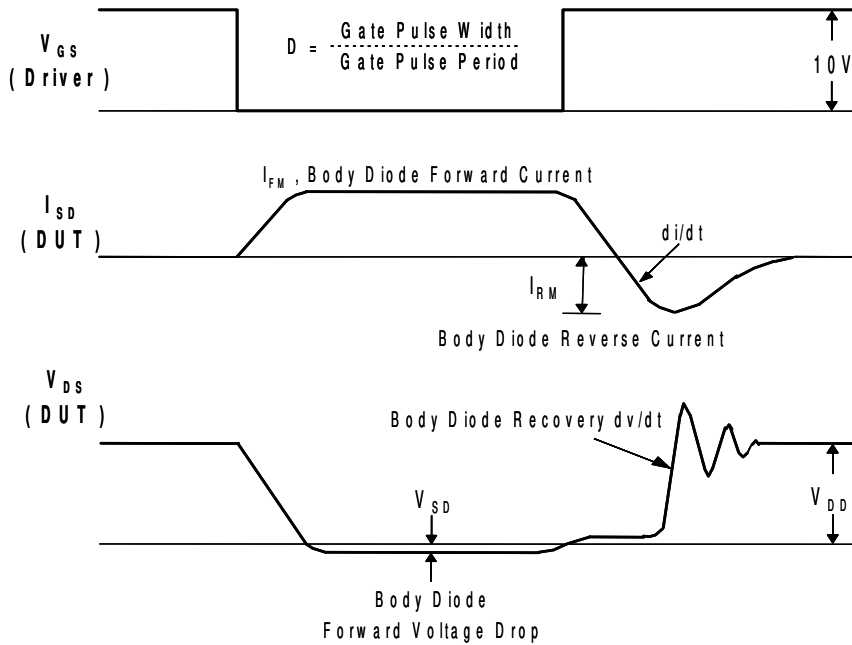
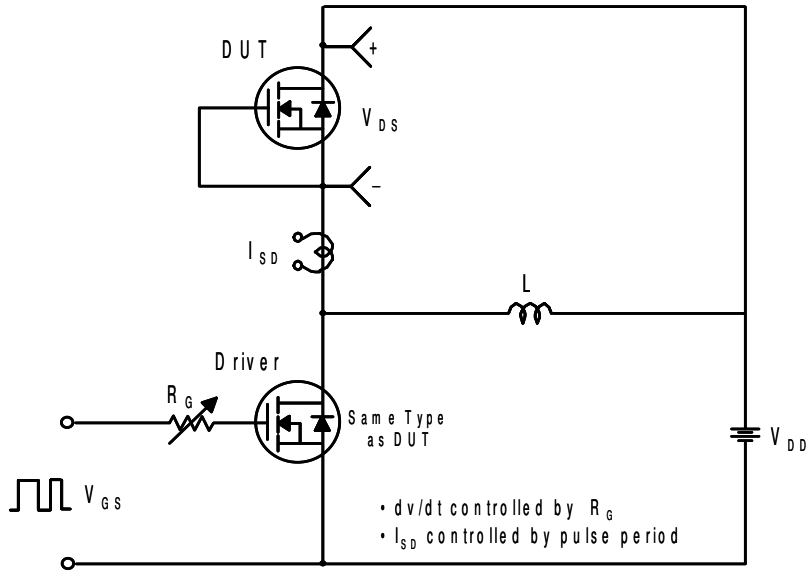
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

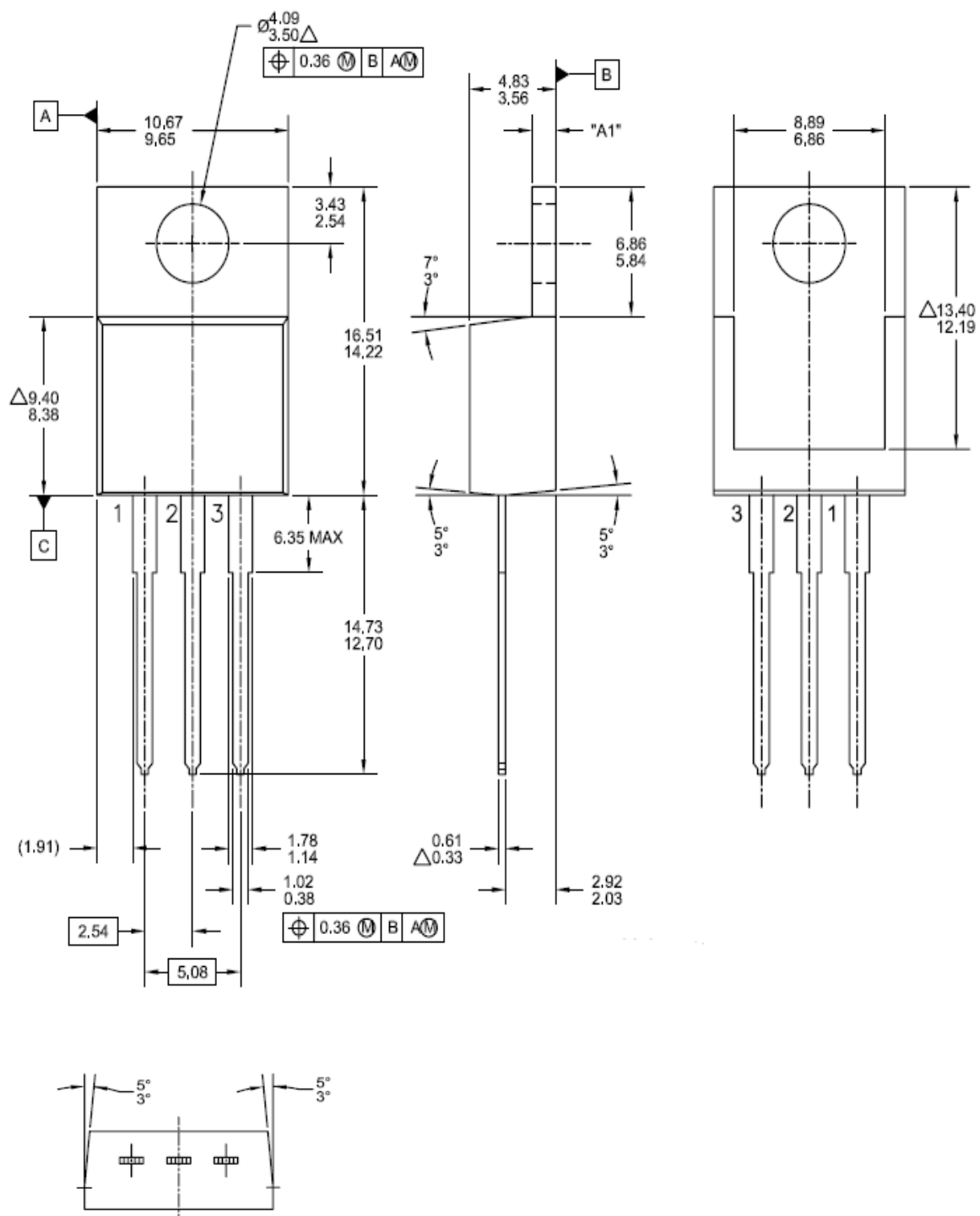


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

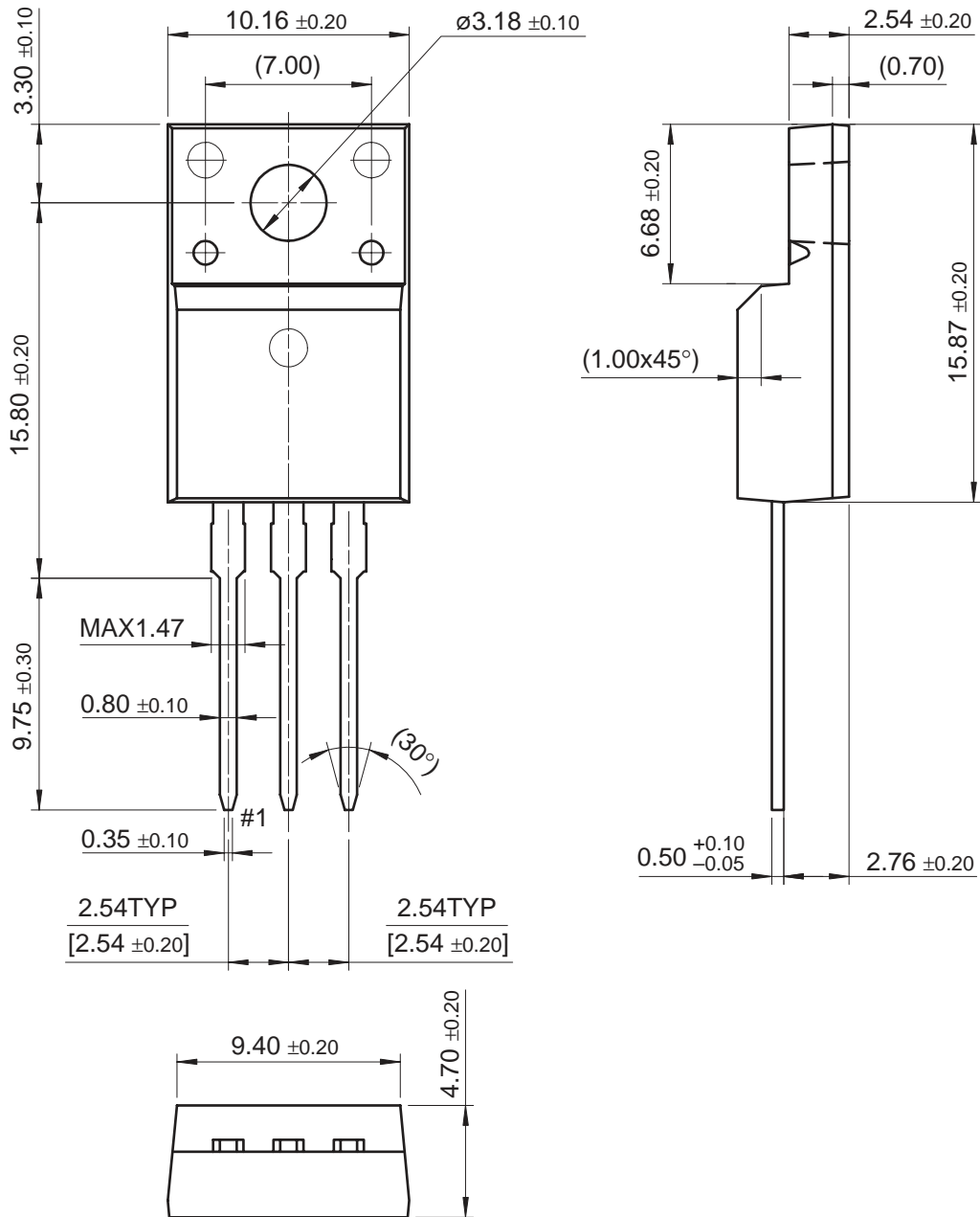
TO - 220



Dimensions in Millimeters

Mechanical Dimensions

TO-220F



Dimensions in Millimeters



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Rev. I31