FAIRCHILD SEMICONDUCTOR®

April 2012

UniFET™

FDP24N40

N-Channel MOSFET

400V, 24A, 0.175Ω

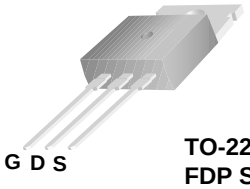
Features

- $R_{DS(on)}$ = 0.140Ω (Typ.)@ V_{GS} = 10V, I_D = 12A
- Low gate charge (Typ. 46nC)
- Low C_{rss} (Typ. 25pF)
- Fast switching
- 100% avalanche tested
- Improve dv/dt capability
- RoHS compliant

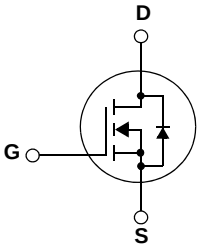
Description

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

This advanced 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.



TO-220
FDP Series



MOSFET Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter			FDP24N40	Units
V_{DSS}	Drain to Source Voltage			400	V
V_{GSS}	Gate to Source Voltage			±30	V
I_D	Drain Current	-Continuous (T_C = 25°C)		24	A
		-Continuous (T_C = 100°C)		14.4	
I_{DM}	Drain Current	- Pulsed	(Note 1)	96	A
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	1296	mJ
I_{AR}	Avalanche Current		(Note 1)	24	A
E_{AR}	Repetitive Avalanche Energy		(Note 1)	22.7	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	4.5	V/ns
P_D	Power Dissipation	(T_C = 25°C)		227	W
		- Derate above 25°C		1.8	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	FDP24N40	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.55	°C/W
$R_{\theta CS}$	Thermal Resistance, Case to Sink Typ.	0.5	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62.5	

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Package Marking and Ordering Information $T_C = 25^oC$ unless otherwise noted

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP24N40	FDP24N40	TO-220	-	-	50

Electrical Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 250\mu A$, $V_{GS} = 0V$, $T_J = 25^oC$	400	-	-	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu A$, Referenced to 25^oC	-	0.4	-	$V/^oC$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 400V$, $V_{GS} = 0V$	-	-	1	μA
		$V_{DS} = 320V$, $T_C = 125^oC$	-	-	10	
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 30V$, $V_{DS} = 0V$	-	-	±100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250\mu A$	3.0	-	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10V$, $I_D = 12A$	-	0.140	0.175	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 20V$, $I_D = 12A$ (Note 4)	-	34	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 25V$, $V_{GS} = 0V$, f = 1MHz	-	2270	3020	pF
C_{oss}	Output Capacitance		-	365	490	pF
C_{rss}	Reverse Transfer Capacitance		-	25	38	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 320V$, $I_D = 24A$, $V_{GS} = 10V$ (Note 4, 5)	-	46	60	nC
Q_{gs}	Gate to Source Gate Charge		-	12	-	nC
Q_{gd}	Gate to Drain “Miller” Charge		-	20	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 200V$, $I_D = 24A$, $R_G = 25\Omega$ (Note 4, 5)	-	40	90	ns
t_r	Turn-On Rise Time		-	90	190	ns
$t_{d(off)}$	Turn-Off Delay Time		-	110	230	ns
t_f	Turn-Off Fall Time		-	65	140	ns
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	24	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	96	A
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS} = 0V$, $I_{SD} = 24A$	-	-	1.4	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0V$, $I_{SD} = 24A$, $dI_F/dt = 100A/\mu s$ (Note 4)	-	360	-	ns
Q_{rr}	Reverse Recovery Charge		-	4.7	-	μC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 4.5mH, $I_{AS} = 24A$, $V_{DD} = 50V$, $R_G = 25\Omega$, Starting $T_J = 25°C$
3. $I_{SD} \le 24A$, $di/dt \le 200A/\mu s$, $V_{DD} \le BV_{DSS}$, Starting $T_J = 25°C$
4. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

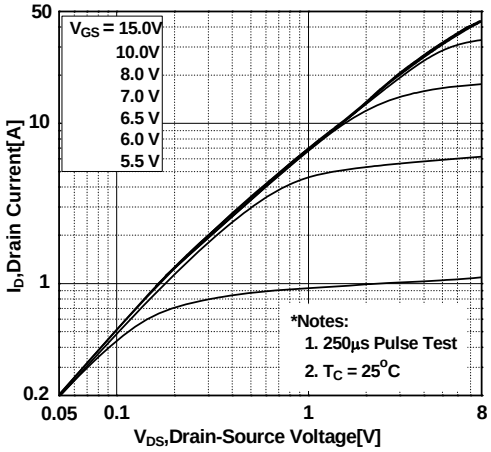


Figure 2. Transfer Characteristics

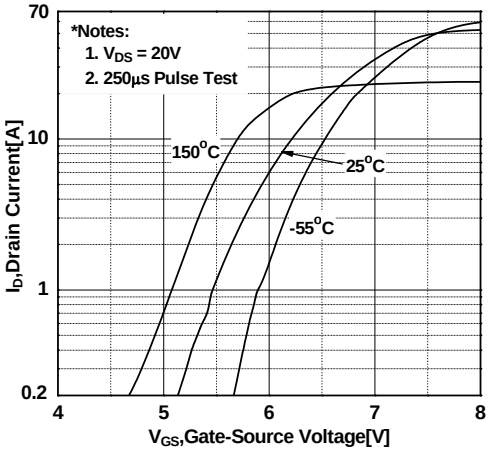


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

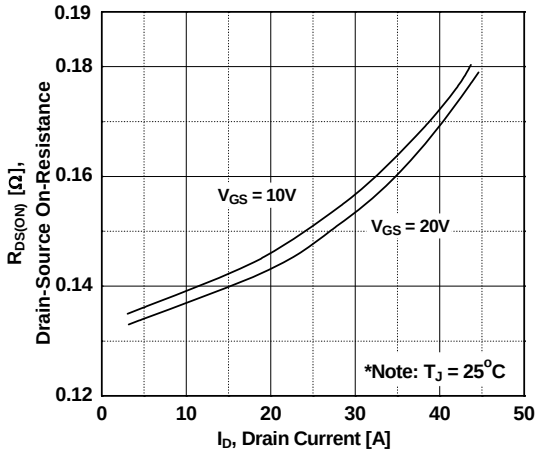


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

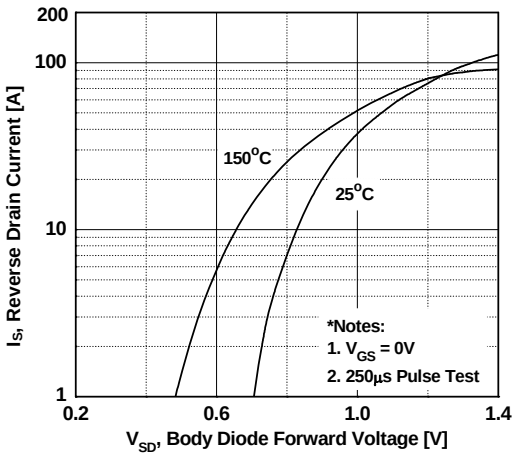


Figure 5. Capacitance Characteristics

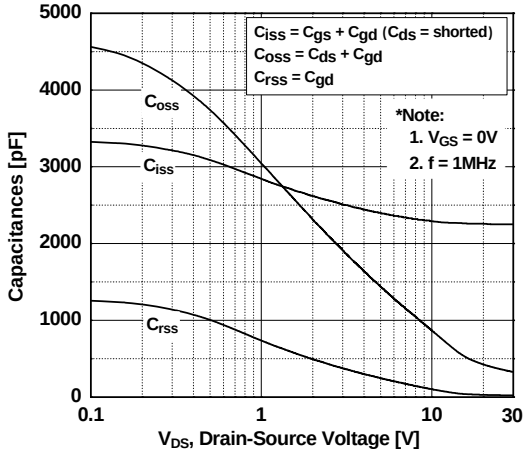
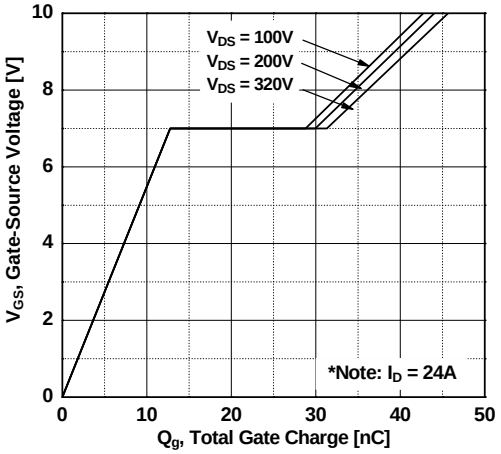


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

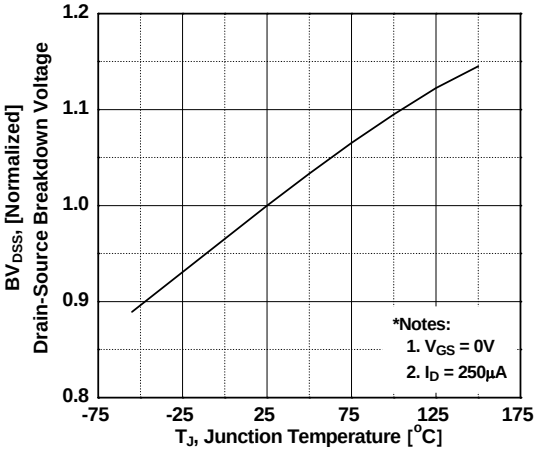


Figure 8. On-Resistance Variation vs. Temperature

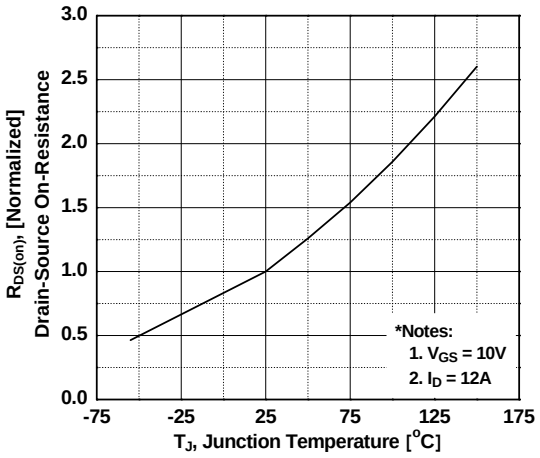


Figure 9. Maximum Safe Operating Area

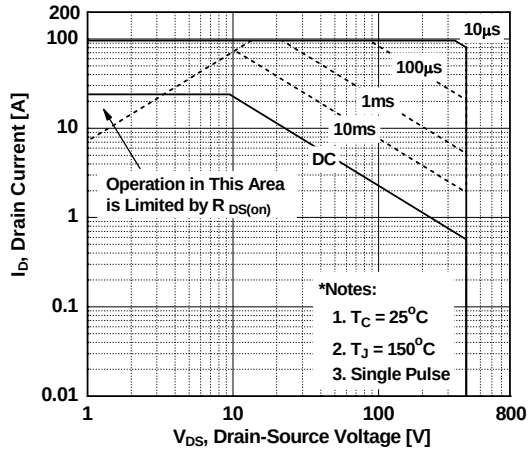


Figure 10. Maximum Drain Current vs. Case Temperature

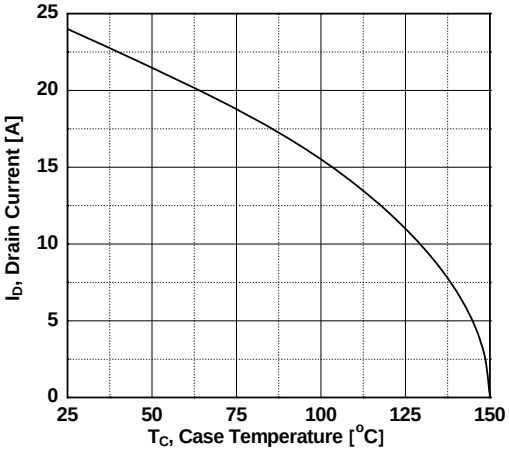
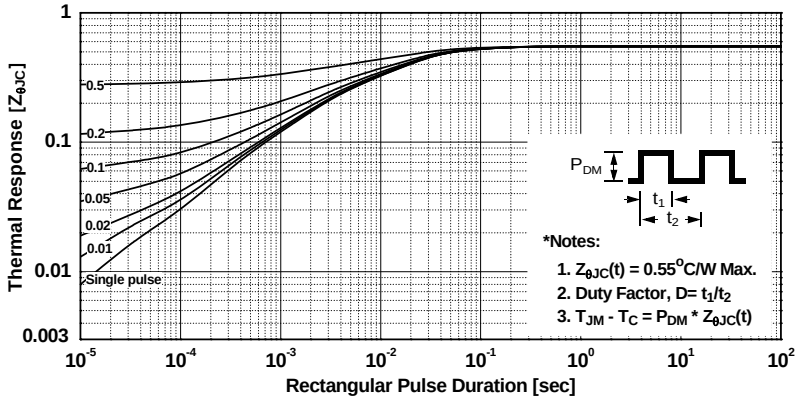
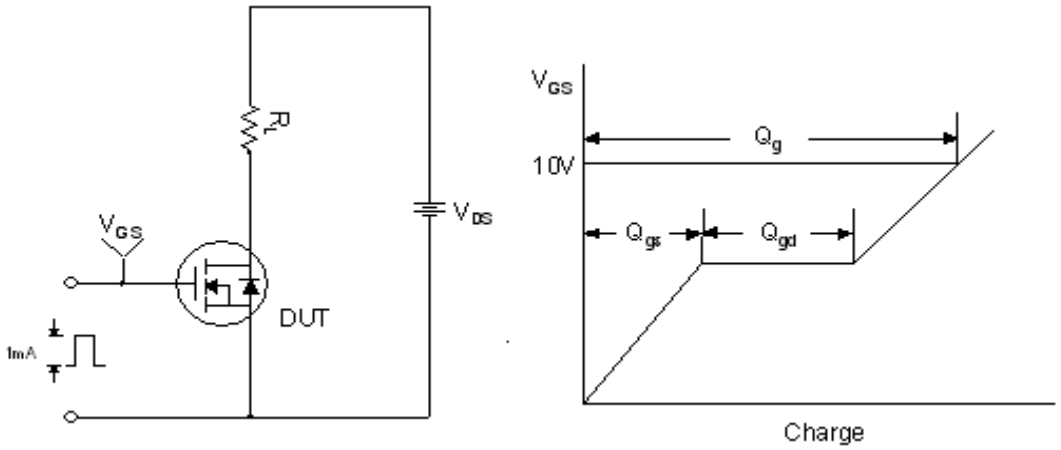


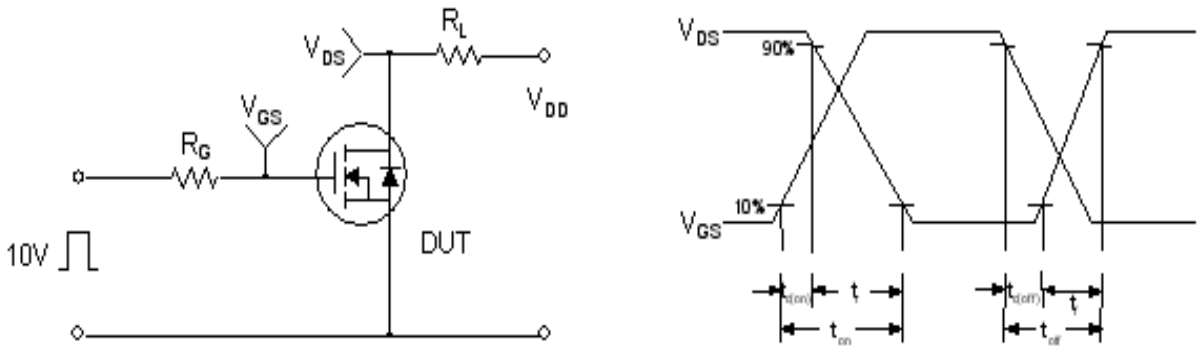
Figure 10. Transient Thermal Response Curve



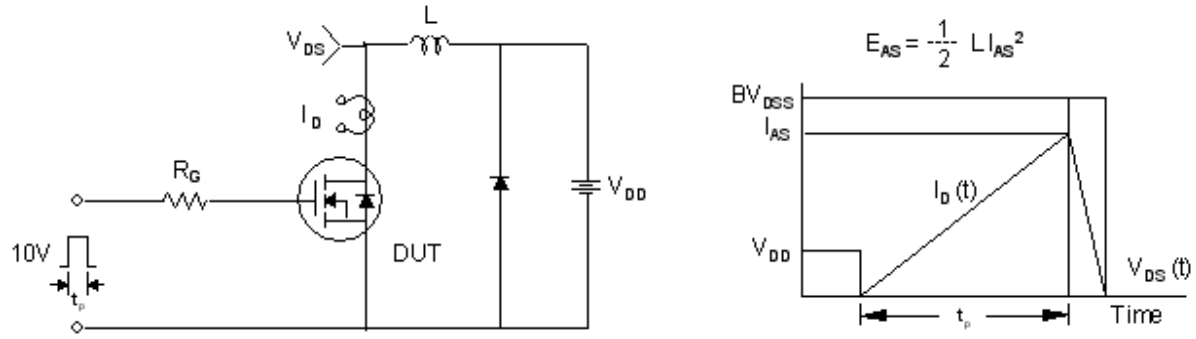
Gate Charge Test Circuit & Waveform



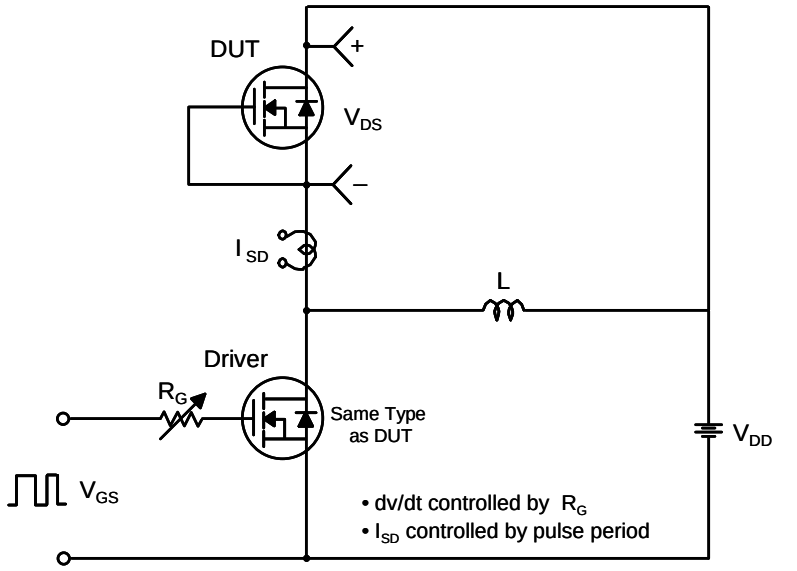
Resistive Switching Test Circuit & Waveforms

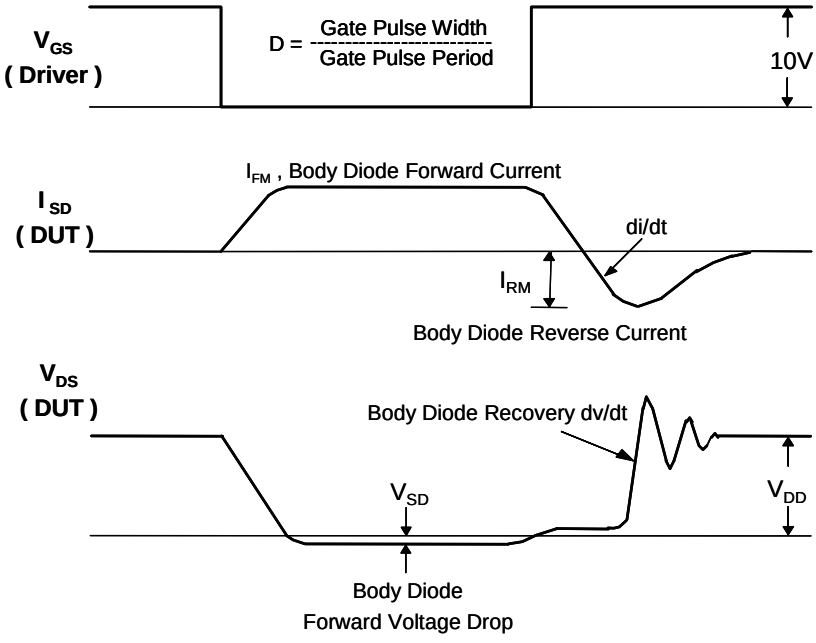


Unclamped Inductive Switching Test Circuit & Waveforms



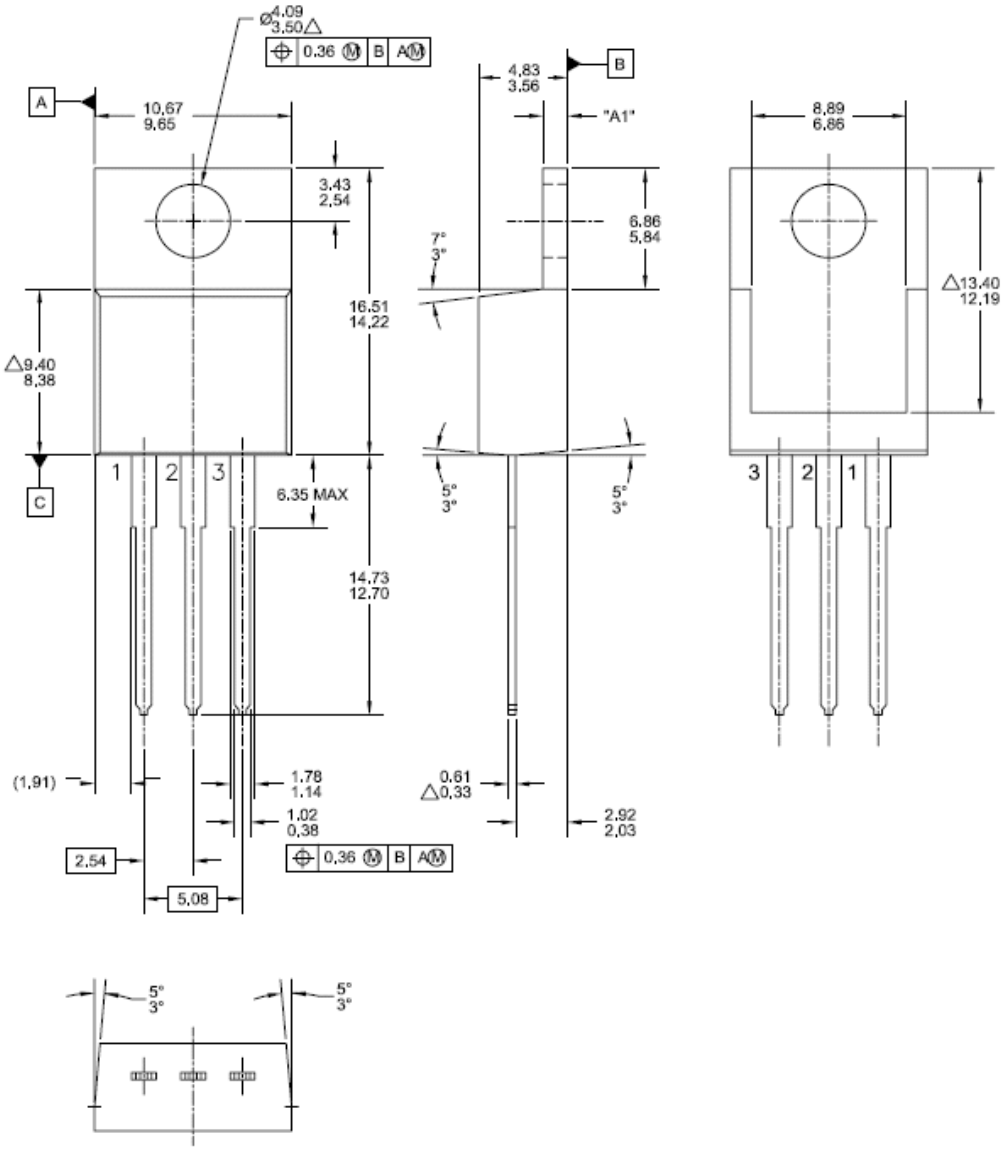
Peak Diode Recovery dv/dt Test Circuit & Waveforms





Mechanical Dimensions

TO-220



Dimensions in Millimeters

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