

FDP10N60NZ / FDPF10N60NZ

N-Channel UniFET™ II MOSFET

600 V, 10 A, 750 mΩ

Features

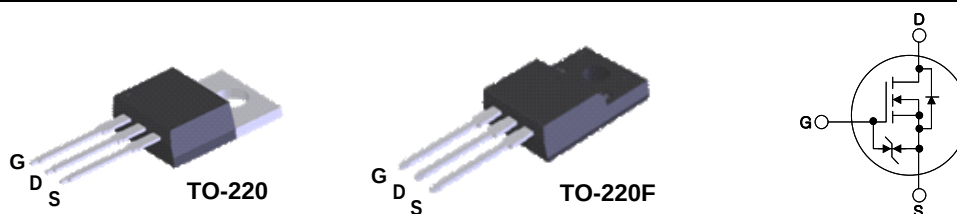
- $R_{DS(on)} = 640 \text{ m}\Omega$ (Typ.) @ $V_{GS} = 10 \text{ V}$, $I_D = 5 \text{ A}$
- Low Gate Charge (Typ. 23 nC)
- Low C_{RSS} (Typ. 10 pF)
- 100% Avalanche Tested
- Improved dv/dt Capability
- ESD Improved Capability
- RoHS compliant

Description

UniFET™ II MOSFET is Fairchild Semiconductor®'s high voltage MOSFET family based on advanced planar stripe and DMOS technology. This advanced MOSFET family has the smallest on-state resistance among the planar MOSFET, and also provides superior switching performance and higher avalanche energy strength. In addition, internal gate-source ESD diode allows UniFET™ II MOSFET to withstand over 2kV HBM surge stress. 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.

Applications

- LCD/ LED/ PDP TV
- Lighting
- Uninterruptible Power Supply



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

Symbol	Parameter	FDP10N60NZ	FDPF10N60NZ	Unit
V_{DSS}	Drain to Source Voltage	600		V
V_{GSS}	Gate to Source Voltage	± 25		V
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	10	A
		- Continuous ($T_C = 100^\circ\text{C}$)	6	
I_{DM}	Drain Current	- Pulsed (Note 1)	40	A
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	550	mJ
I_{AR}	Avalanche Current	(Note 1)	10	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	18.5	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	10	V/ns
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	185	W
		- Derate above 25°C	1.5	
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		$^\circ\text{C}$

*Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FDP10N60NZ	FDPF10N60NZ	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.68	3.3	$^\circ\text{C/W}$
$R_{\theta CS}$	Thermal Resistance, Case to Sink, Typ.	0.5	-	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	62.5	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP10N60NZ	FDP10N60NZ	TO-220	-	-	50
FDPF10N60NZ	FDPF10N60NZ	TO-220F	-	-	50

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	$I_D = 250\mu\text{A}$, $V_{GS} = 0\text{V}$, $T_J = 25^\circ\text{C}$	600	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$, Referenced to 25°C	-	0.6	-	$\text{V}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 600\text{V}$, $V_{GS} = 0\text{V}$ $V_{DS} = 480\text{V}$, $T_C = 125^\circ\text{C}$	-	-	1 10	μA
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 25\text{V}$, $V_{DS} = 0\text{V}$	-	-	± 10	μA

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	$V_{GS} = 10\text{V}$, $I_D = 5\text{A}$	-	0.64	0.75	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 20\text{V}$, $I_D = 5\text{A}$	-	14	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{V}$, $V_{GS} = 0\text{V}$ $f = 1\text{MHz}$	-	1110	1475	pF
C_{oss}	Output Capacitance		-	130	175	pF
C_{rss}	Reverse Transfer Capacitance		-	10	15	pF
Q_g	Total Gate Charge at 10V	$V_{DS} = 480\text{V}$, $I_D = 10\text{A}$ $V_{GS} = 10\text{V}$ (Note 4)	-	23	30	nC
Q_{gs}	Gate to Source Gate Charge		-	6	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	8	-	nC

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 300\text{V}$, $I_D = 10\text{A}$ $R_G = 25\Omega$ (Note 4)	-	25	60	ns
t_r	Turn-On Rise Time		-	50	110	ns
$t_{d(off)}$	Turn-Off Delay Time		-	70	150	ns
t_f	Turn-Off Fall Time		-	50	110	ns

Drain-Source Diode Characteristics

I _S	Maximum Continuous Drain to Source Diode Forward Current	-	-	10	A	
I _{SM}	Maximum Pulsed Drain to Source Diode Forward Current	-	-	40	A	
V _{SD}	Drain to Source Diode Forward Voltage	V _{GS} = 0V, I _{SD} = 10A	-	-	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0V, I _{SD} = 10A	-	300	-	ns
Q _{rr}	Reverse Recovery Charge	dI _F /dt = 100A/μs	-	2	-	μC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $L = 11\text{mH}$, $I_{AS} = 10\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 10\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

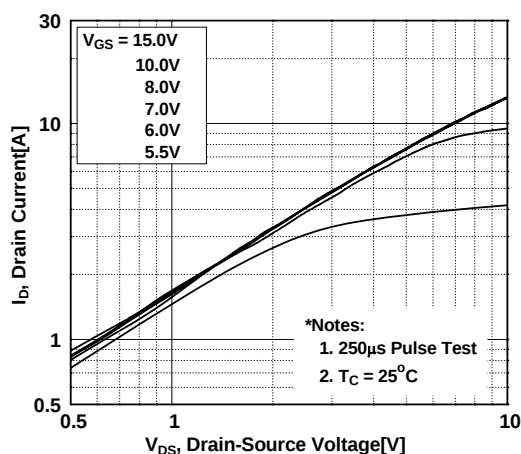


Figure 2. Transfer Characteristics

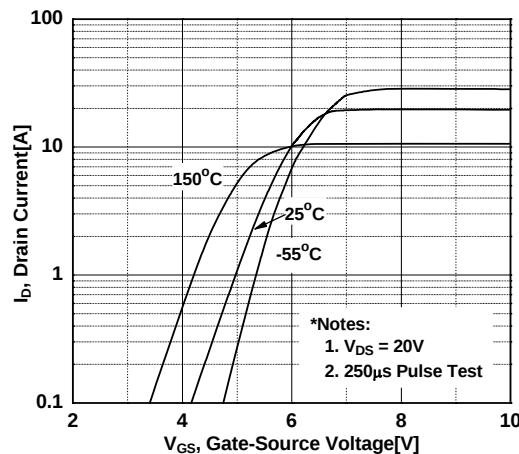


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

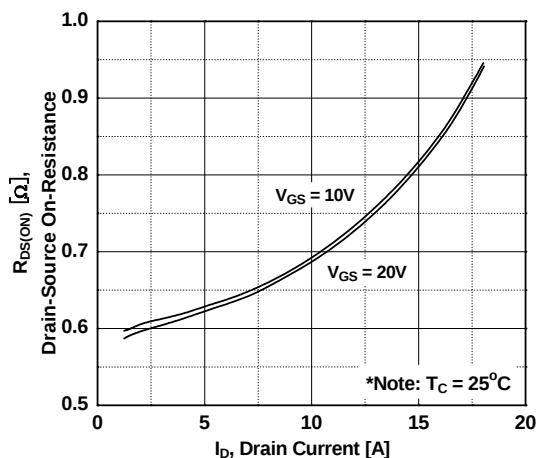


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

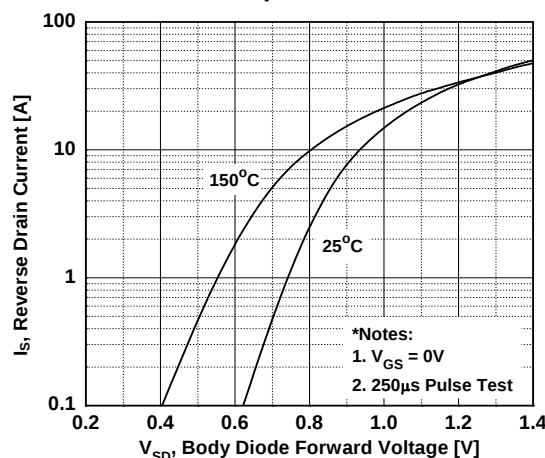


Figure 5. Capacitance Characteristics

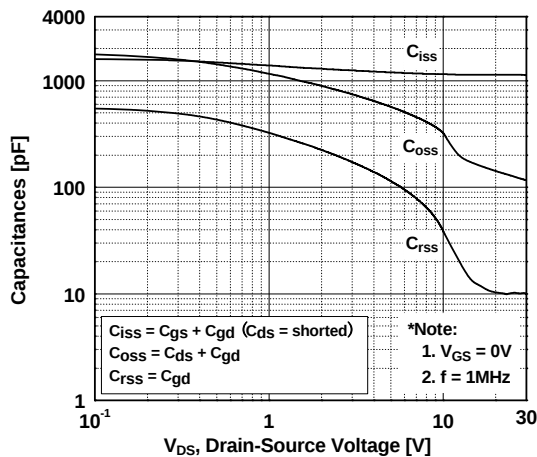
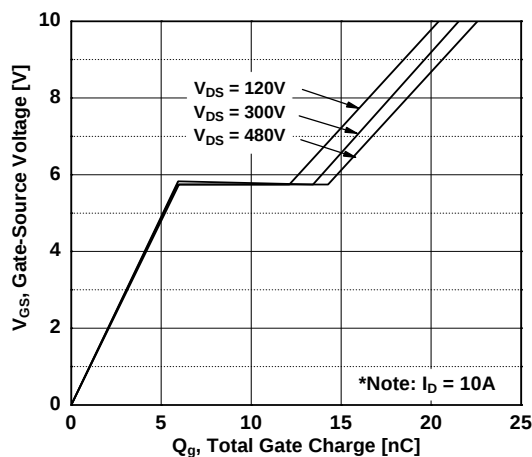


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

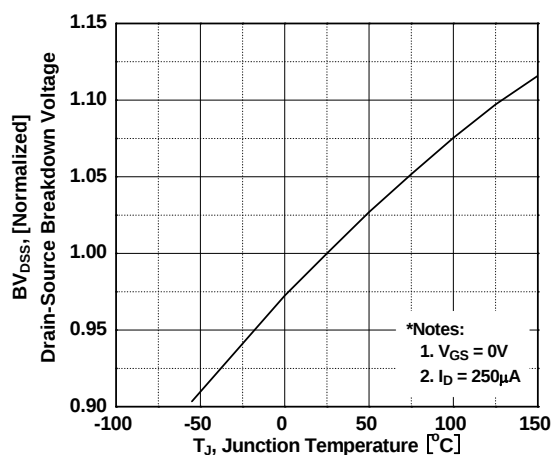


Figure 8. On-Resistance Variation vs. Temperature

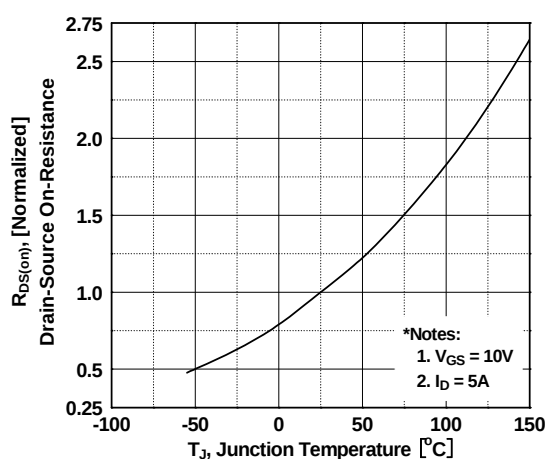


Figure 9. Maximum Safe Operating Area -FDP10N60NZ

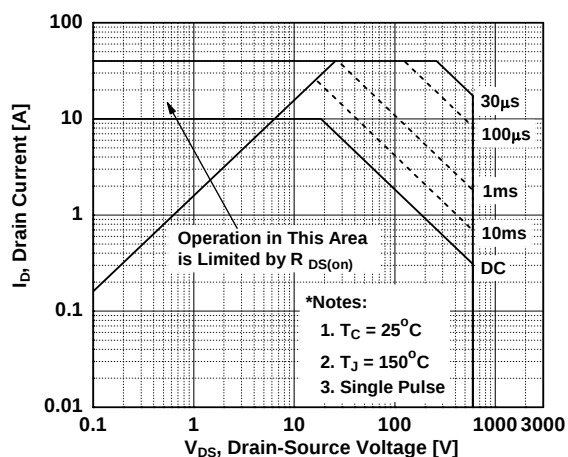


Figure 10. Maximum Safe Operating Area -FDPF10N60NZ

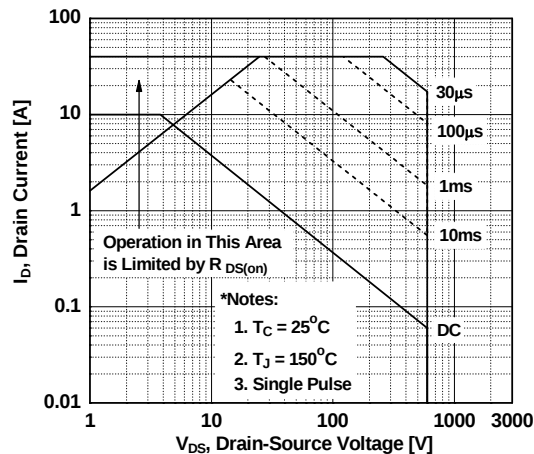
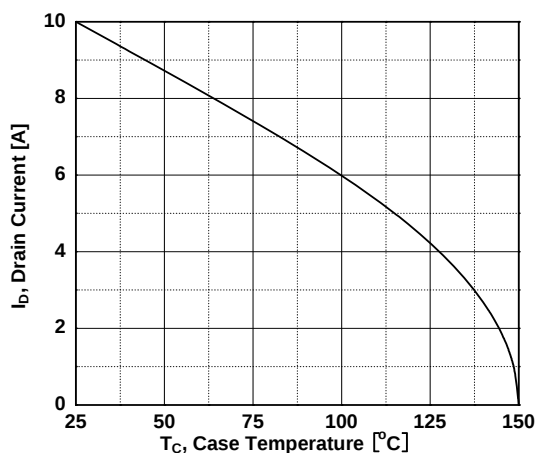


Figure 11. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve
-FDP10N60NZ

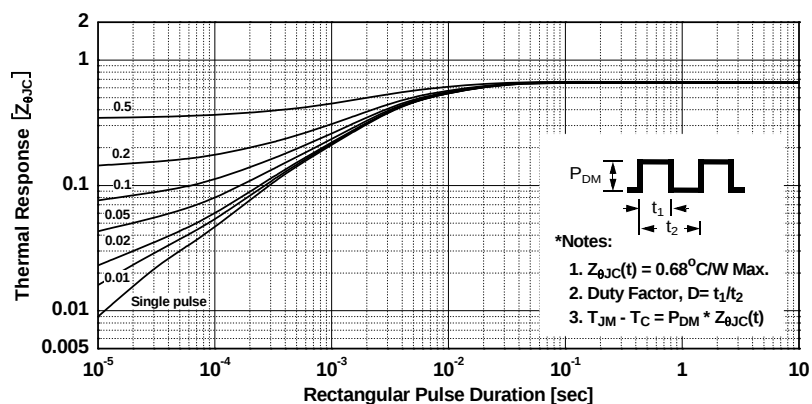
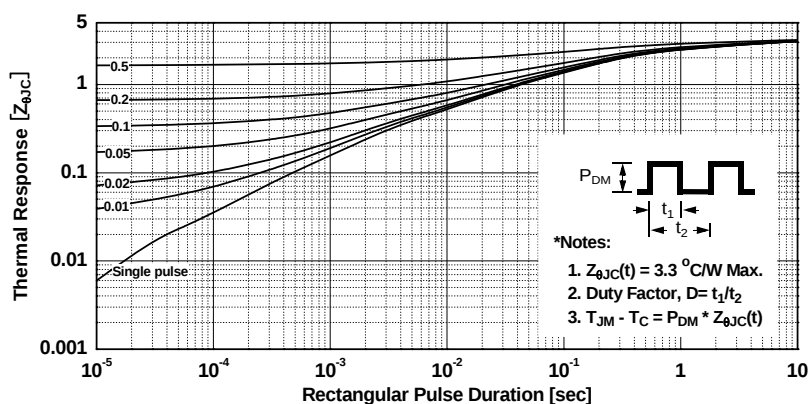
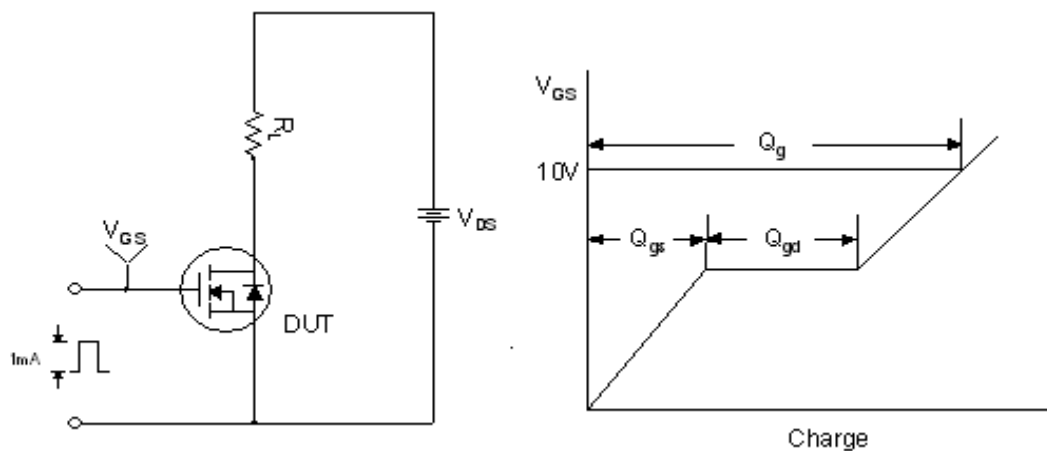


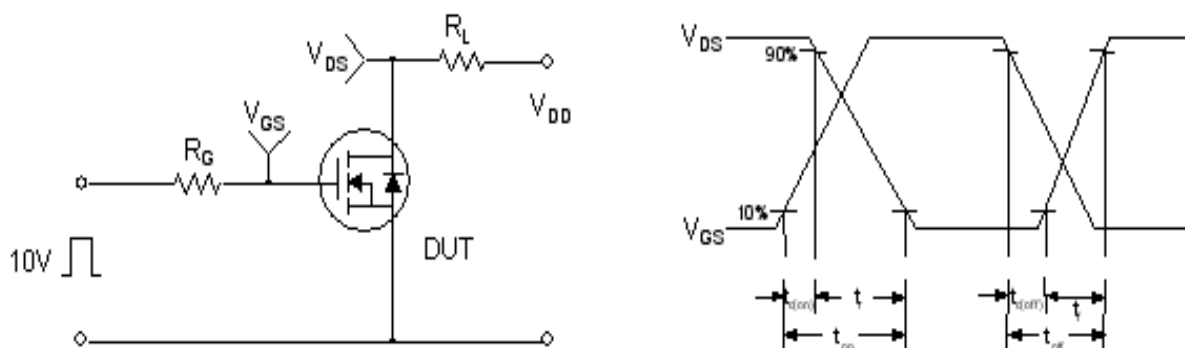
Figure 13. Transient Thermal Response Curve
-FDPF10N60NZ



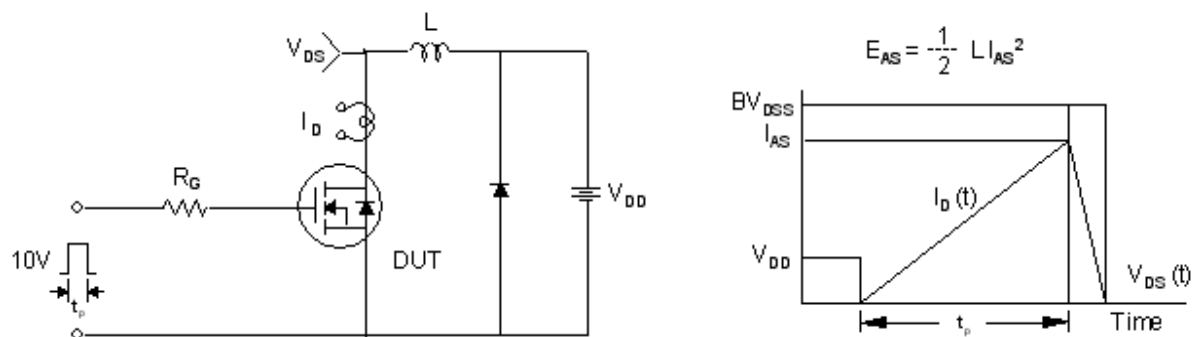
Gate Charge Test Circuit & Waveform



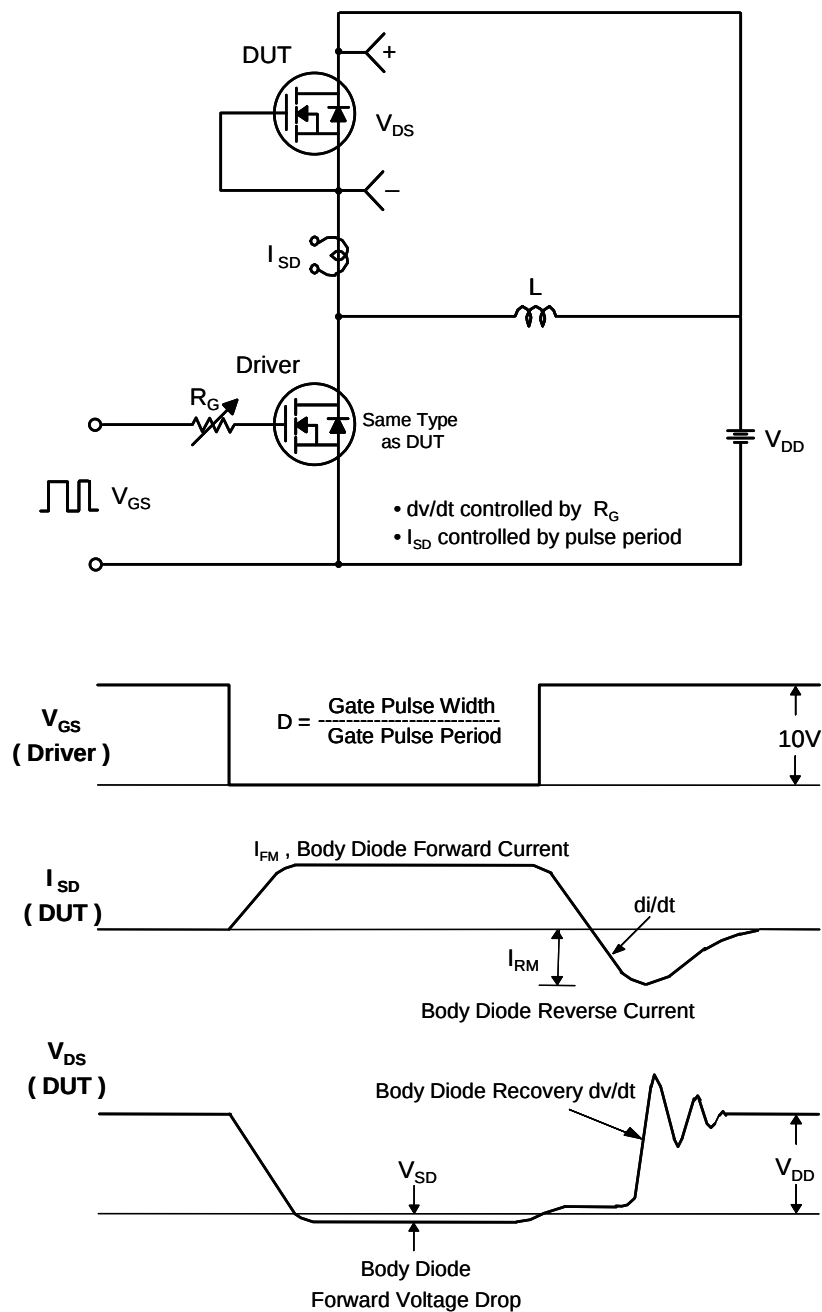
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

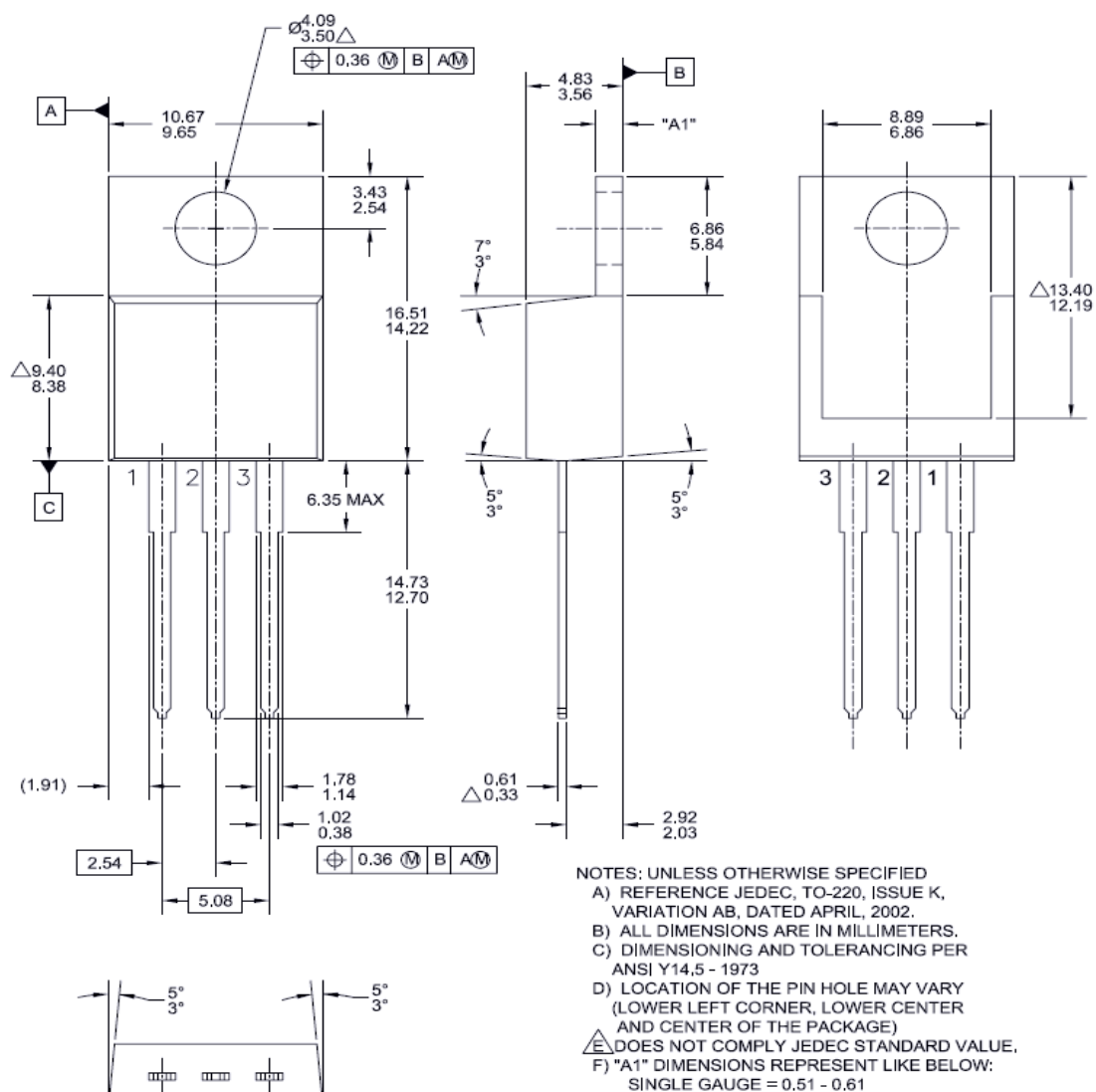


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

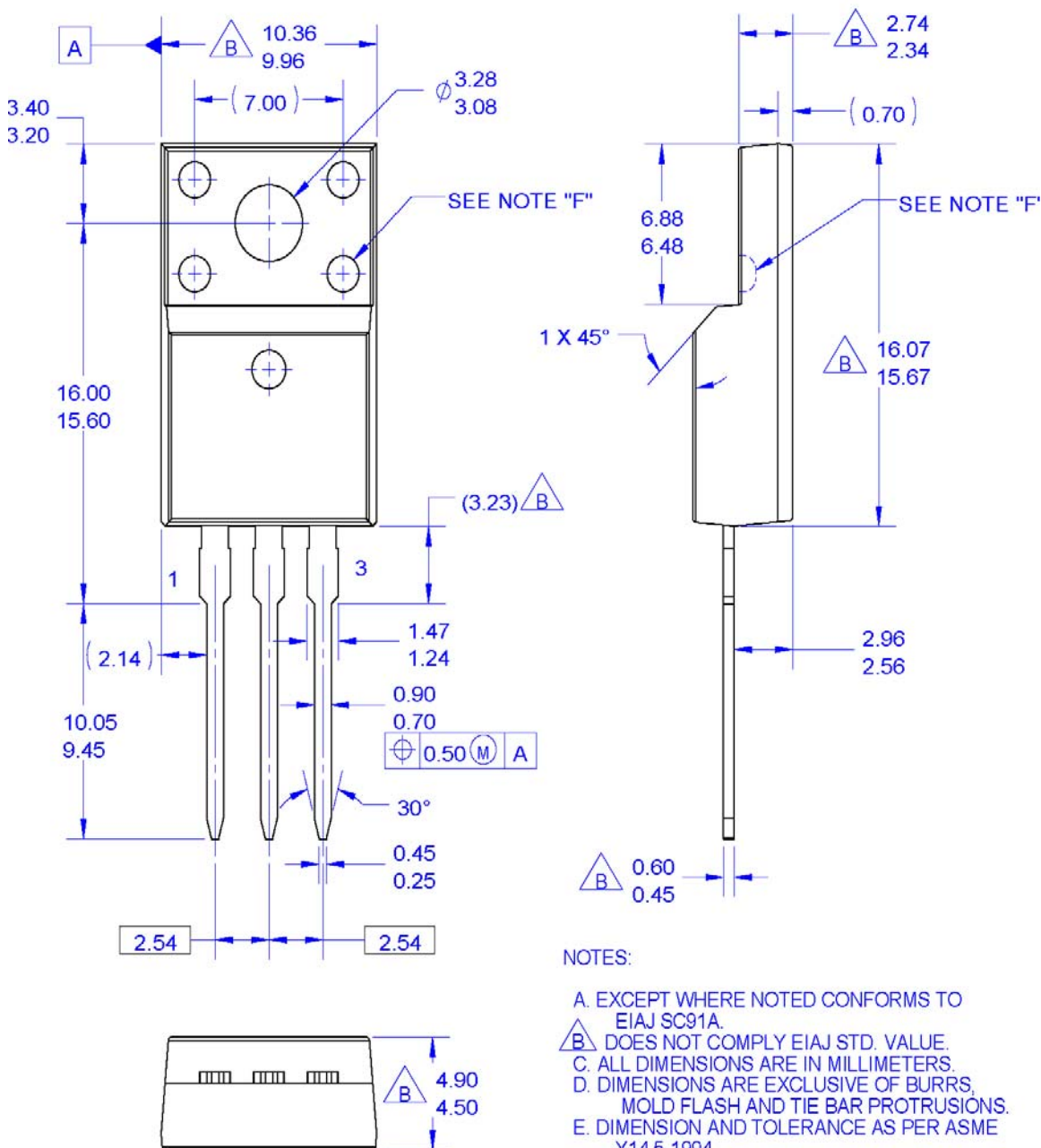
TO-220B03



Dimensions in Millimeters

Package Dimensions

TO-220M03



Dimensions in Millimeters



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Rev. 164