

# FDP52N20

## N-Channel UniFET MOSFET

200 V, 52 A, 49 mΩ

### Description

UniFET MOSFET is ON 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.

### Features

- $R_{DS(on)} = 41 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 26 \text{ A}$
- Low Gate Charge (Typ. 49 nC)
- Low  $C_{RSS}$  (Typ. 66 pF)
- 100% Avalanche Tested
- These Devices are Pb-Free and are RoHS Compliant

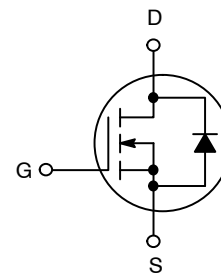
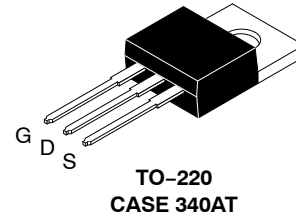
### Applications

- PDP TV
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply



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### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# FDP52N20

## ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub> = 25°C, Unless otherwise specified)

Symbol	Parameter	Value	Unit
V <sub>DSS</sub>	Drain to Source Voltage	200	V
V <sub>GSS</sub>	Gate to Source Voltage	±30	V
I <sub>D</sub>	Drain Current	Continuous (T <sub>C</sub> = 25°C)	52
		Continuous (T <sub>C</sub> = 100°C)	33
I <sub>DM</sub>	Drain Current	Pulsed (Note 1)	208
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)	2520	mJ
I <sub>AR</sub>	Avalanche Current (Note 1)	52	A
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)	35.7	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
P <sub>D</sub>	Power Dissipation	(T <sub>C</sub> = 25°C)	357
		Derate Above 25°C	2.86
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to +150	°C
T <sub>L</sub>	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 s	300	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 1.4 mH, I<sub>AS</sub> = 52 A, V<sub>DD</sub> = 50 V, R<sub>G</sub> = 25 Ω, starting T<sub>J</sub> = 25°C.
3. I<sub>SD</sub> ≤ 52 A, di/dt ≤ 200 A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, starting T<sub>J</sub> = 25°C.
4. Essentially independent of operating temperature typical characteristics.

## THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction to Case, Max.	0.35	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction to Ambient, Max.	62.5	

## PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Marking	Package	Packing Method	Reel Size	Tape Width	Quantity
FDP52N20	FDP52N20	TO-220	Tube	N/A	N/A	50 Units

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## 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	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}, T_J = 25^\circ\text{C}$	200	–	–	V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	–	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	$\mu\text{A}$
		$V_{DS} = 160\text{ V}, T_C = 125^\circ\text{C}$	–	–	10	
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$	–	–	$\pm 100$	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	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 26\text{ A}$	–	35	–	S

### DYNAMIC CHARACTERISTICS

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

### SWITCHING CHARACTERISTICS

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

### 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	$V_{GS} = 0\text{ V}, I_{SD} = 52\text{ A},$ $di_F/dt = 100\text{ A}/\mu\text{s}$	–	162	–	ns
$Q_{rr}$	Reverse Recovery Charge		–	1.3	–	

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

5. Essentially independent of operating temperature typical characteristics.

TYPICAL PERFORMANCE CHARACTERISTICS

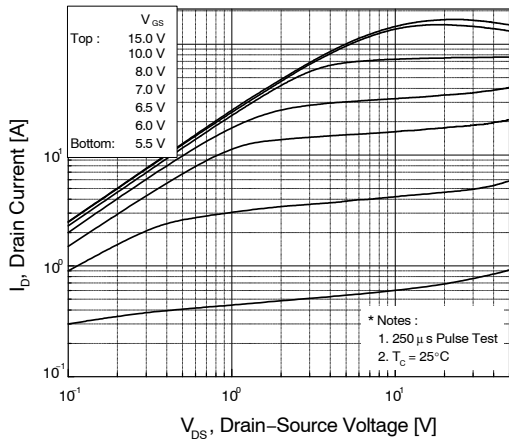


Figure 1. On-Region Characteristics

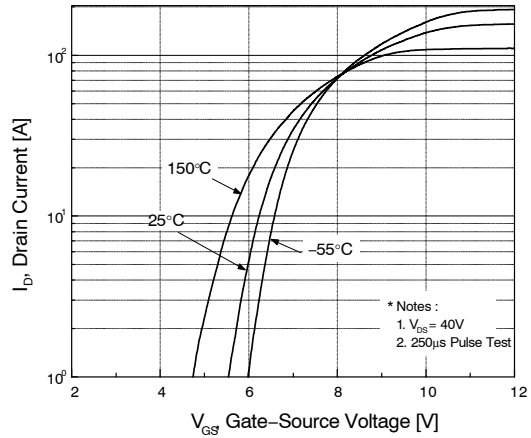


Figure 2. Transfer Characteristics

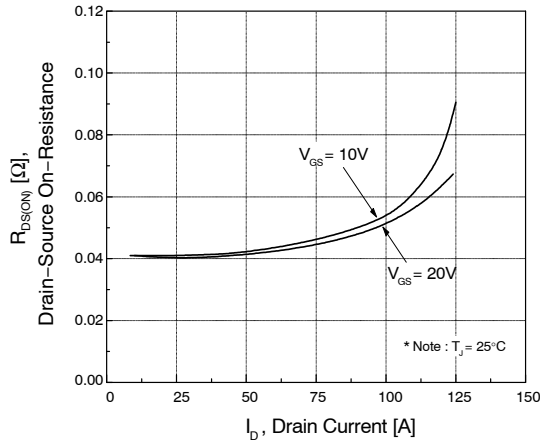


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

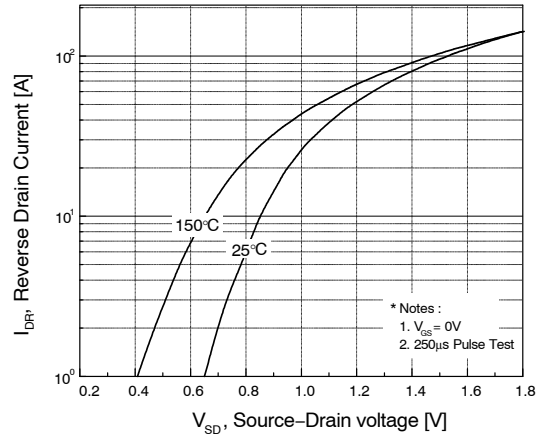


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

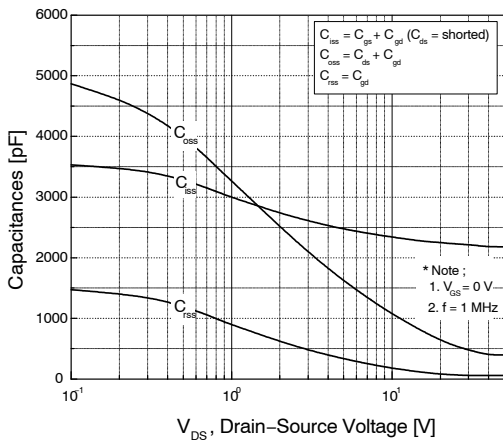


Figure 5. Capacitance Characteristics

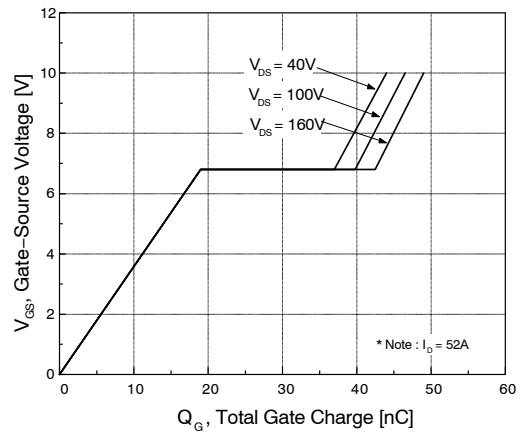


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS

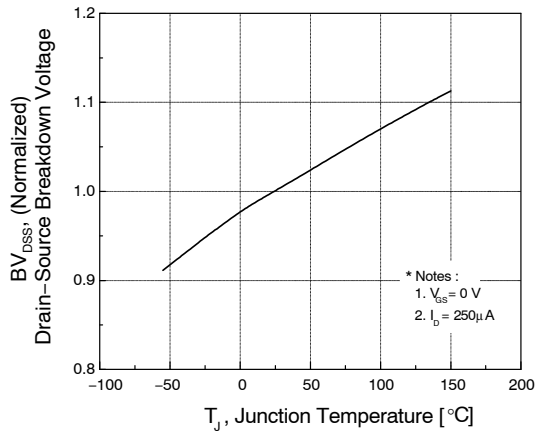


Figure 7. Breakdown Voltage Variation vs. Temperature

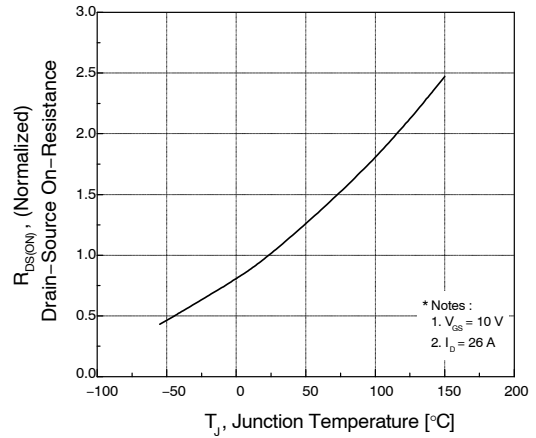


Figure 8. On-Resistance Variation vs. Temperature

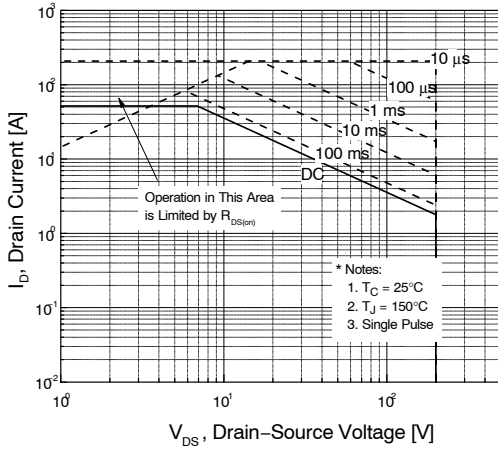


Figure 9. Maximum Safe Operation Area

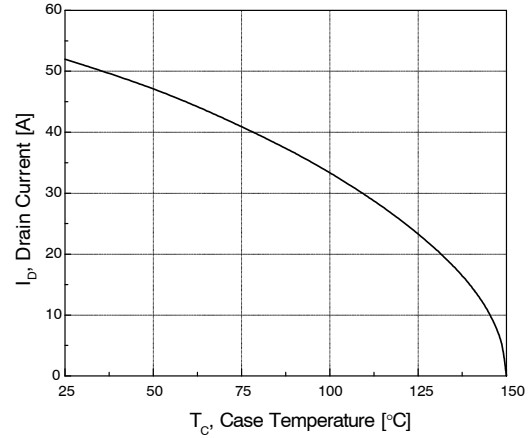


Figure 10. Maximum Drain Current

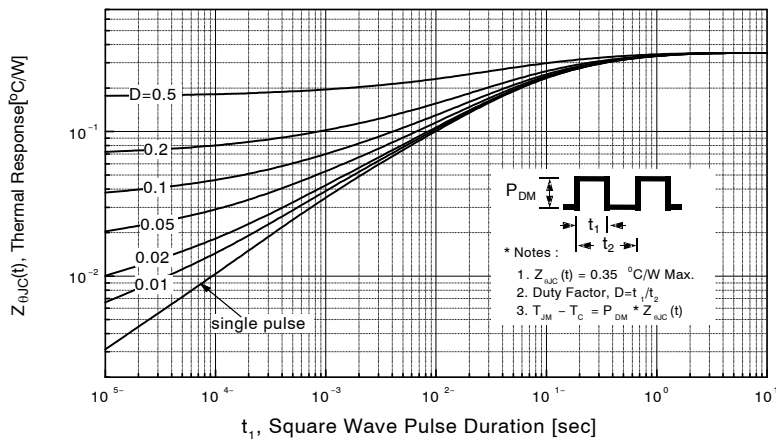


Figure 11. Transient Thermal Response Curve

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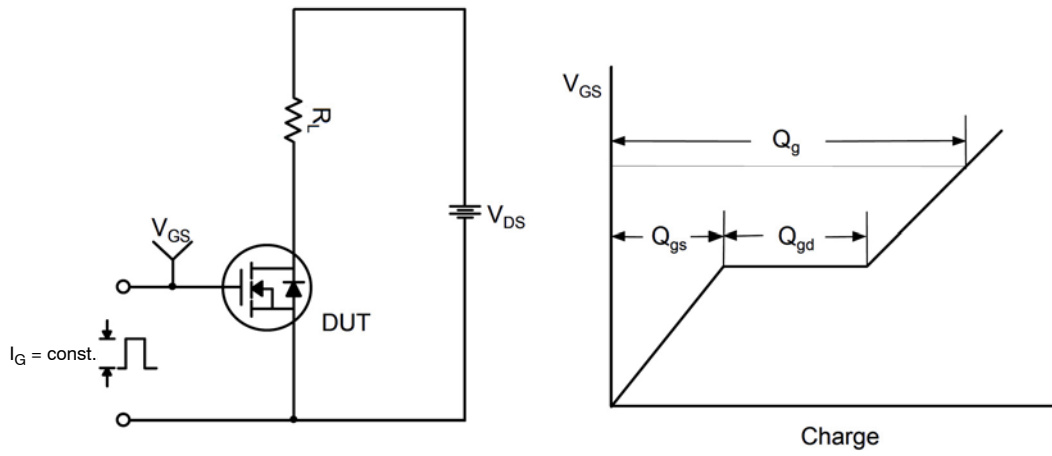


Figure 12. Gate Charge Test Circuit & Waveform

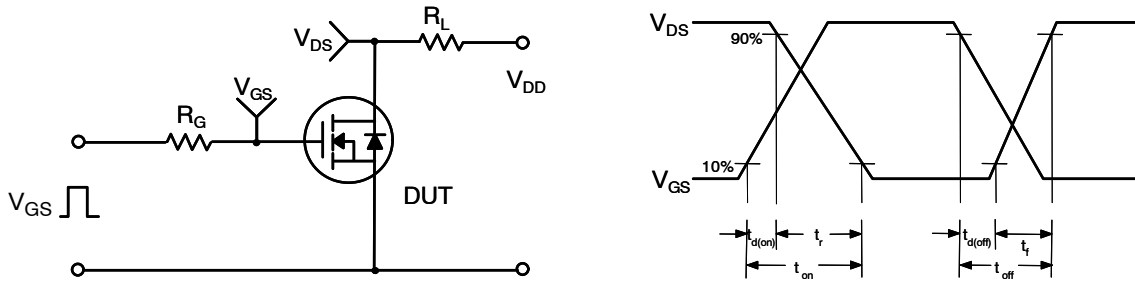


Figure 13. Resistive Switching Test Circuit & Waveforms

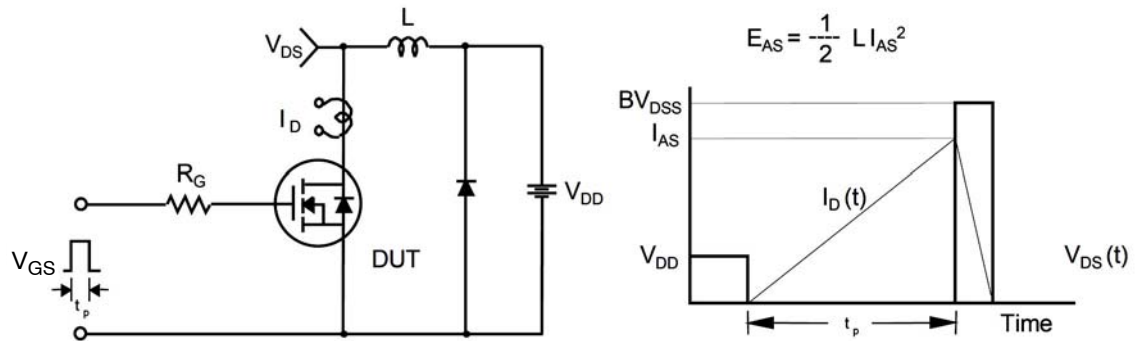


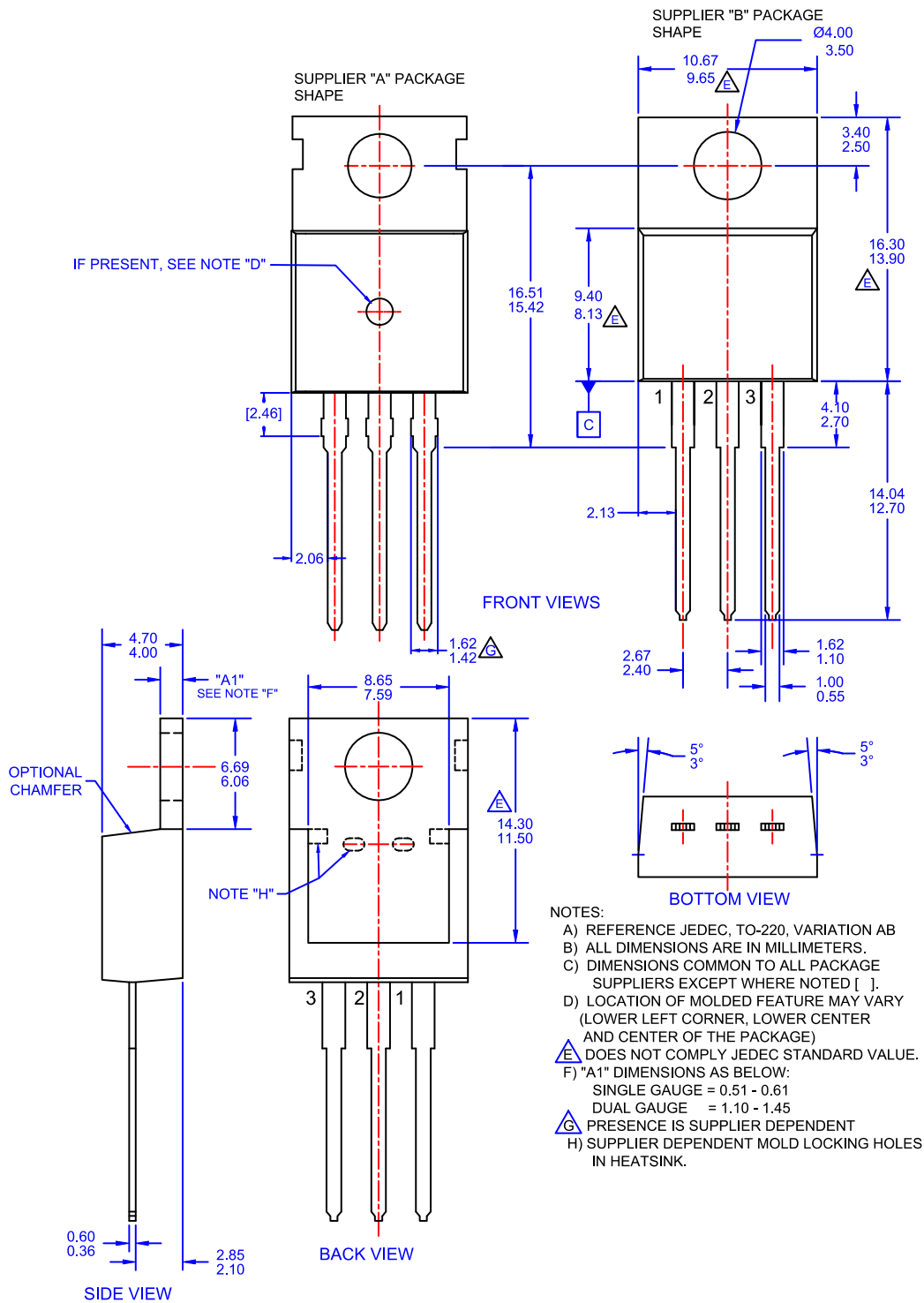
Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



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## PACKAGE DIMENSIONS

TO-220-3LD  
CASE 340AT  
ISSUE A




**NOTES:**

- A) REFERENCE JEDEC, TO-220, VARIATION AB
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS COMMON TO ALL PACKAGE SUPPLIERS EXCEPT WHERE NOTED [ ].
- D) LOCATION OF MOLDED FEATURE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)
- E) DOES NOT COMPLY JEDEC STANDARD VALUE.
- F) "A1" DIMENSIONS AS BELOW:  
SINGLE GAUGE = 0.51 - 0.61  
DUAL GAUGE = 1.10 - 1.45
- G) PRESENCE IS SUPPLIER DEPENDENT
- H) SUPPLIER DEPENDENT MOLD LOCKING HOLES IN HEATSINK.



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