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# FCP7N60 / FCPF7N60

## N-Channel SuperFET® MOSFET

600 V, 7 A, 600 mΩ

### Features

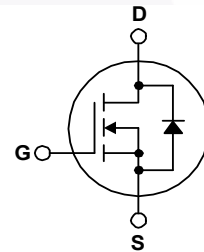
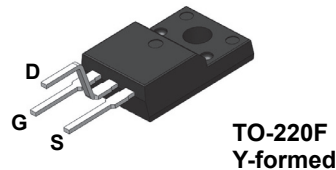
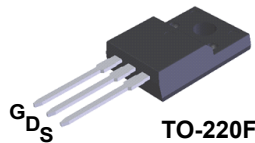
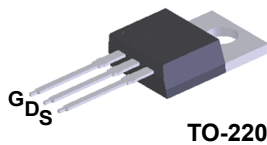
- 650 V @  $T_J = 150^\circ\text{C}$
- Typ.  $R_{DS(on)} = 530\text{ m}\Omega$
- Ultra Low Gate Charge (Typ.  $Q_g = 23\text{ nC}$ )
- Low Effective Output Capacitance (Typ.  $C_{oss(eff.)} = 60\text{ pF}$ )
- 100% Avalanche Tested
- RoHS Compliant

### Application

- LCD/LED/PDP TV
- Solar Inverter
- AC-DC Power Supply

### Description

SuperFET® MOSFET is Fairchild Semiconductor's first generation of high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching performance,  $dv/dt$  rate and higher avalanche energy. Consequently, SuperFET MOSFET is very suitable for the switching power applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications.



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

Symbol	Parameter		FCP7N60	FCPF7N60 / FCPF7N60YDTU	Unit
$V_{DSS}$	Drain-Source Voltage		600		V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	7	7*	A
		- Continuous ( $T_C = 100^\circ\text{C}$ )	4.4	4.4*	A
$I_{DM}$	Drain Current	- Pulsed (Note 1)	21	21*	A
$V_{GSS}$	Gate-Source voltage		$\pm 30$		V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)		230		mJ
$I_{AR}$	Avalanche Current (Note 1)		7		A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)		8.3		mJ
$dv/dt$	Peak Diode Recovery $dv/dt$ (Note 3)		4.5		V/ns
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	83	31	W
		- Derate Above $25^\circ\text{C}$	0.67	0.25	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature Range		-55 to +150		$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds		300		$^\circ\text{C}$

\*Drain current limited by maximum junction temperature.

### Thermal Characteristics

Symbol	Parameter	FCP7N60	FCPF7N60 / FCPF7N60YDTU	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	1.5	4.0	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	62.5	

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCP7N60	FCP7N60	TO220	Tube	N/A	N/A	50 units
FCPF7N60	FCPF7N60	TO220F	Tube	N/A	N/A	50 units
FCPF7N60YDTU	FCPF7N60	TO-220F (Y-formed)	Tube	N/A	N/A	50 units

## Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted.

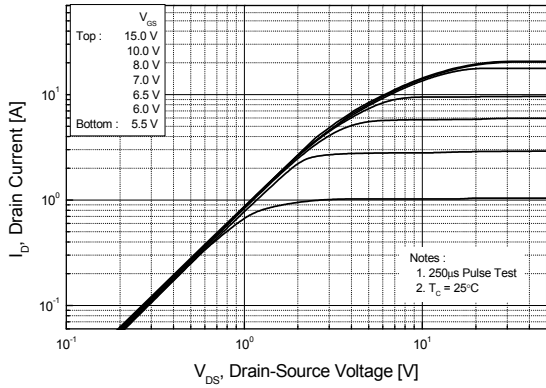
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}, T_J = 25^\circ\text{C}$	600	--	--	V
		$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}, T_J = 150^\circ\text{C}$	--	650	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.6	--	$\text{V}/^\circ\text{C}$
$BV_{DS}$	Drain-Source Avalanche Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 7\text{ A}$	--	700	--	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	$\mu\text{A}$
		$V_{DS} = 480\text{ V}, T_C = 125^\circ\text{C}$	--	--	10	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 3.5\text{ A}$	--	0.53	0.6	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 3.5\text{ A}$	--	6	--	S
<b>Dynamic Characteristics</b>						
$C_{ISS}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	--	710	920	pF
$C_{OSS}$	Output Capacitance		--	380	500	pF
$C_{RSS}$	Reverse Transfer Capacitance		--	34	--	pF
$C_{OSS}$	Output Capacitance	$V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	--	22	29	pF
$C_{OSS(eff.)}$	Effective Output Capacitance	$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$	--	60	--	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 300\text{ V}, I_D = 7\text{ A}, V_{GS} = 10\text{ V}, R_G = 25\ \Omega$	--	35	80	ns
$t_r$	Turn-On Rise Time		--	55	120	ns
$t_{d(off)}$	Turn-Off Delay Time		--	75	160	ns
$t_f$	Turn-Off Fall Time		(Note 4)	--	32	75
$Q_g$	Total Gate Charge	$V_{DS} = 480\text{ V}, I_D = 7\text{ A}, V_{GS} = 10\text{ V}$	--	23	30	nC
$Q_{gs}$	Gate-Source Charge		--	4.2	5.5	nC
$Q_{gd}$	Gate-Drain Charge		(Note 4)	--	11.5	--
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	Maximum Continuous Drain-Source Diode Forward Current		--	--	7	A
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current		--	--	21	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 7\text{ A}$	--	--	1.4	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 7\text{ A}, di_f/dt = 100\text{ A}/\mu\text{s}$	--	360	--	ns
$Q_{rr}$	Reverse Recovery Charge		--	4.5	--	$\mu\text{C}$

**Notes:**

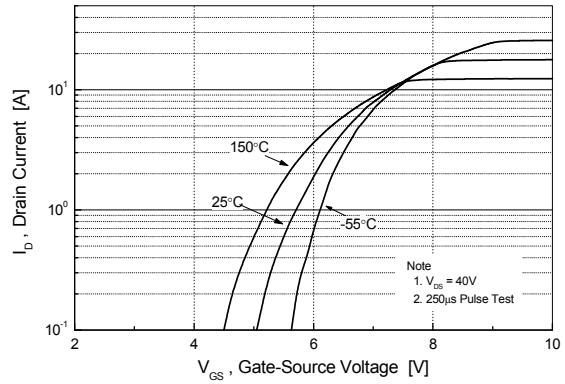
1. Repetitive rating: pulse-width limited by maximum junction temperature.
2.  $I_{AS} = 3.5\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 7\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

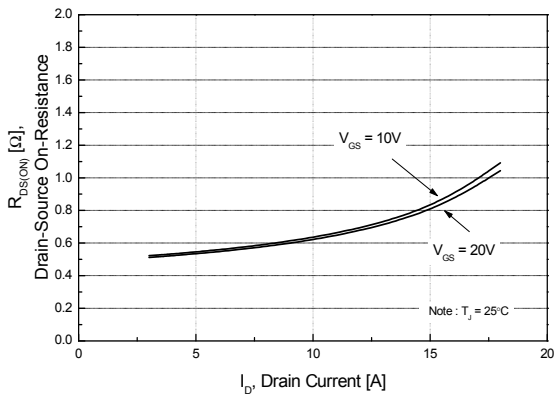
**Figure 1. On-Region Characteristics**



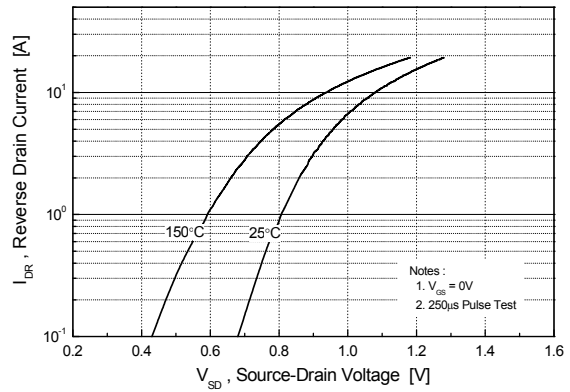
**Figure 2. Transfer Characteristics**



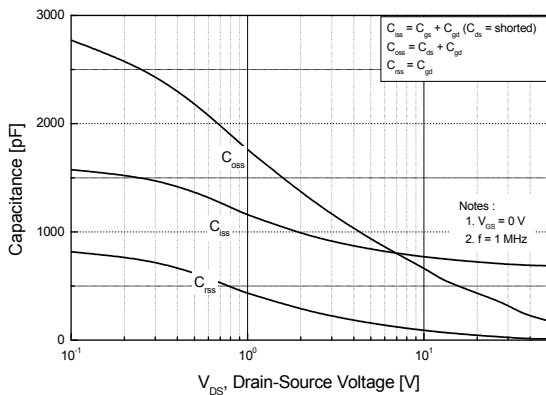
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



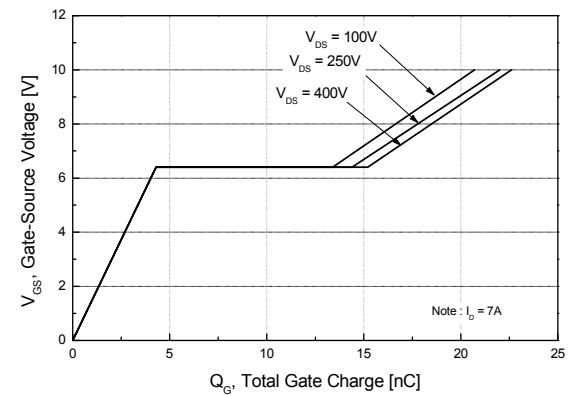
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

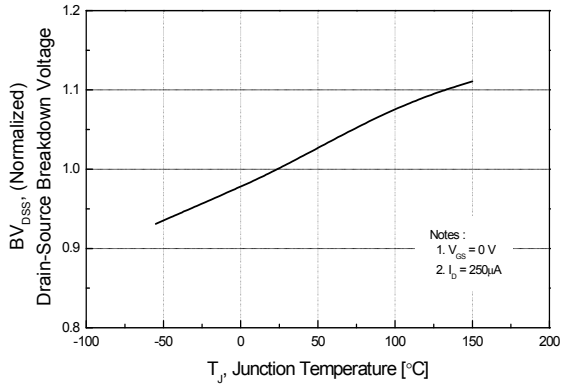


**Figure 6. Gate Charge Characteristics**

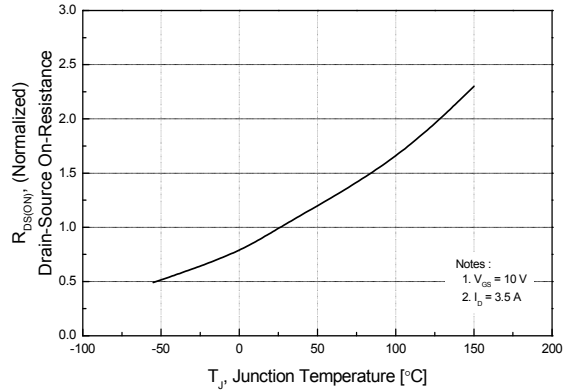


## Typical Performance Characteristics (Continued)

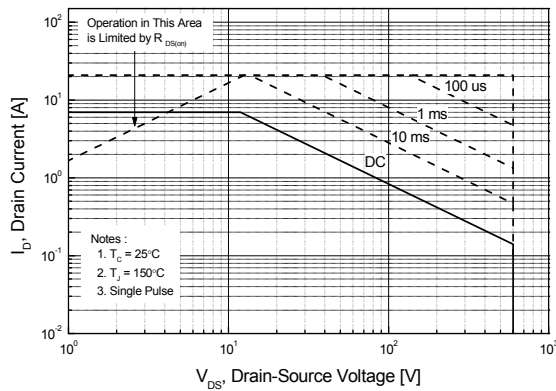
**Figure 7. Breakdown Voltage Variation vs. Temperature**



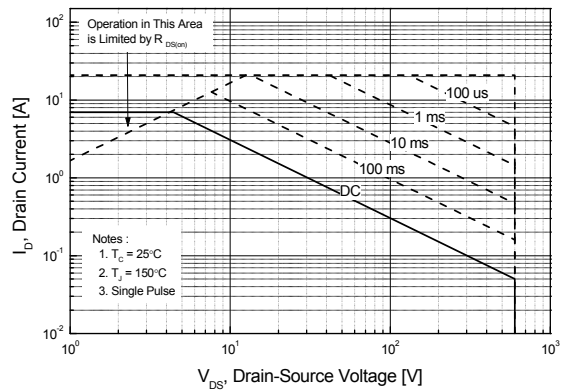
**Figure 8. On-Resistance Variation vs. Temperature**



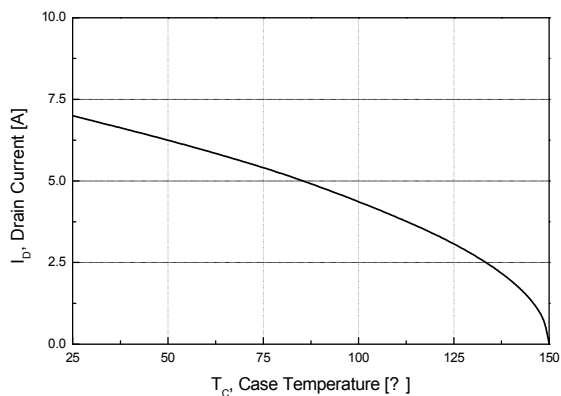
**Figure 9-1. Maximum Safe Operating Area for FCP7N60**



**Figure 9-2. Maximum Safe Operating Area for FCPF7N60**



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



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve for FCP7N60

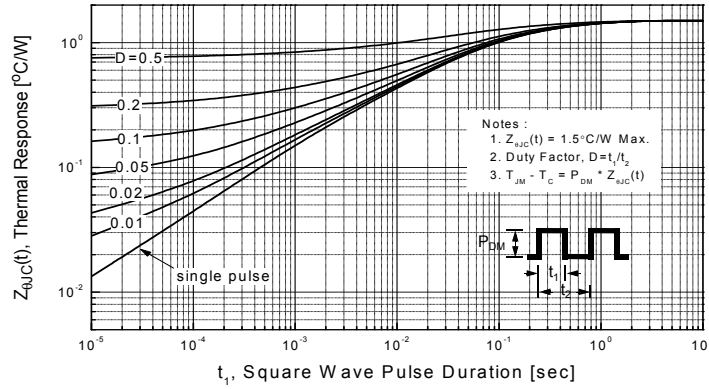
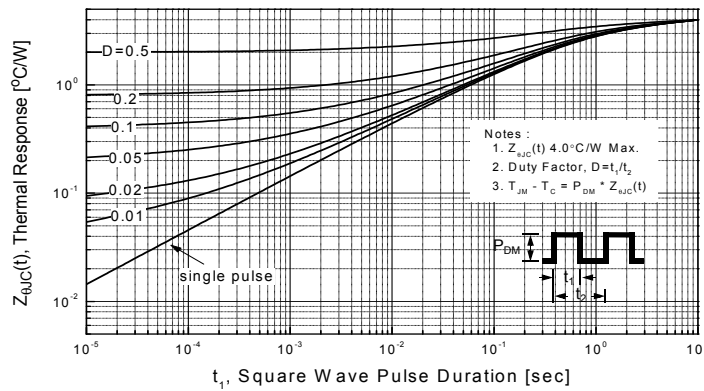


Figure 11-2. Transient Thermal Response Curve for FCPF7N60



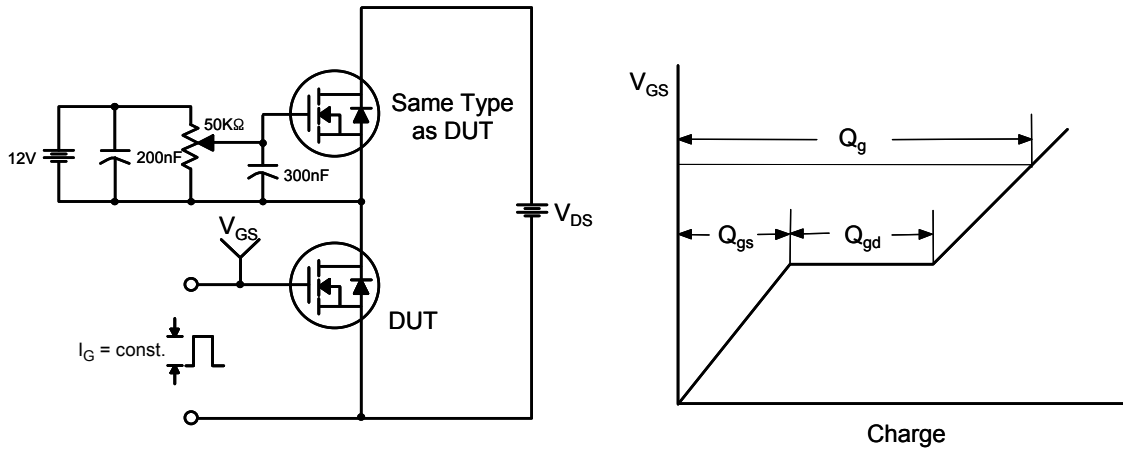


Figure 12. Gate Charge Test Circuit & Waveform



Figure 13. Resistive Switching Test Circuit & Waveforms

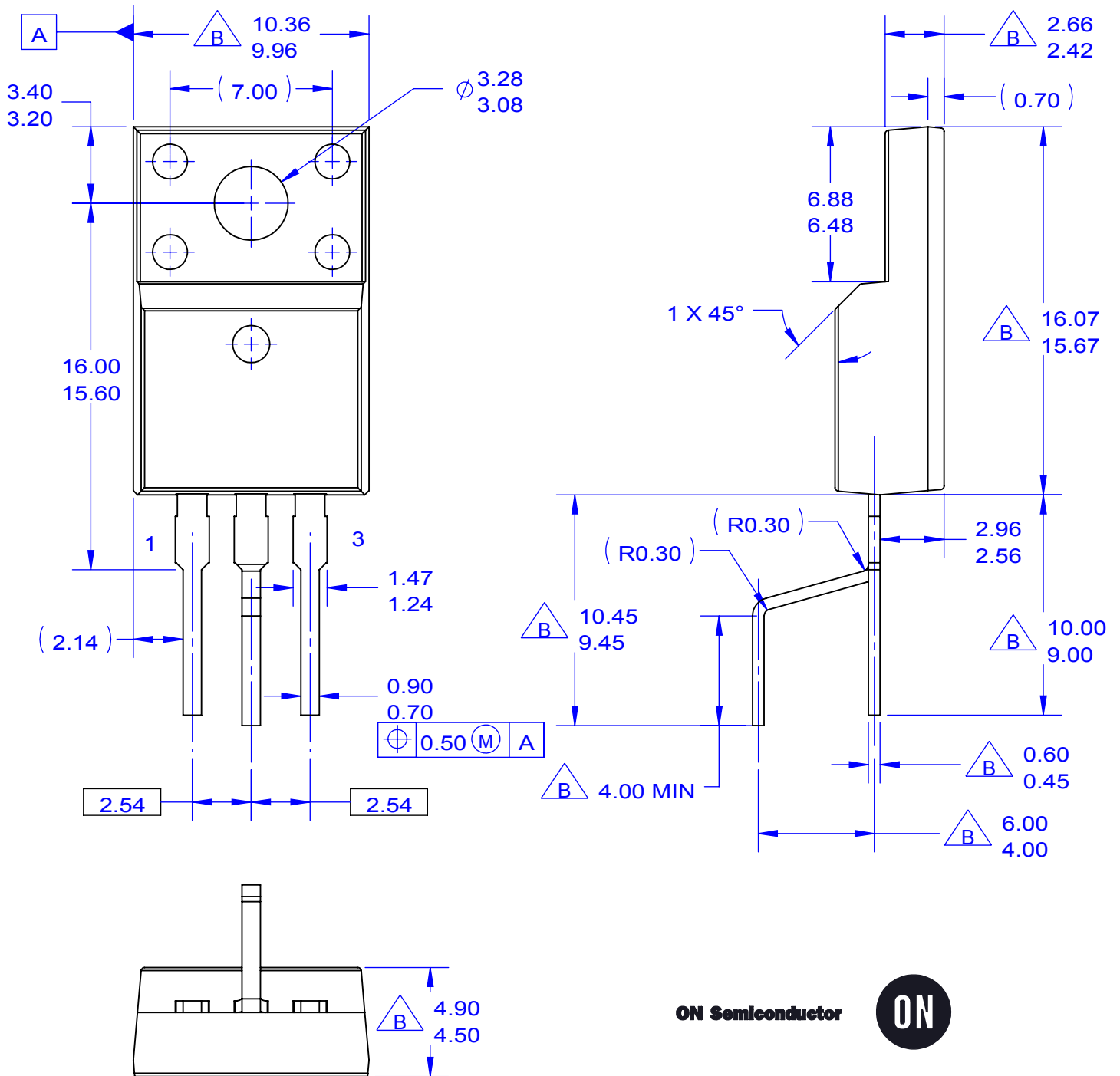


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms



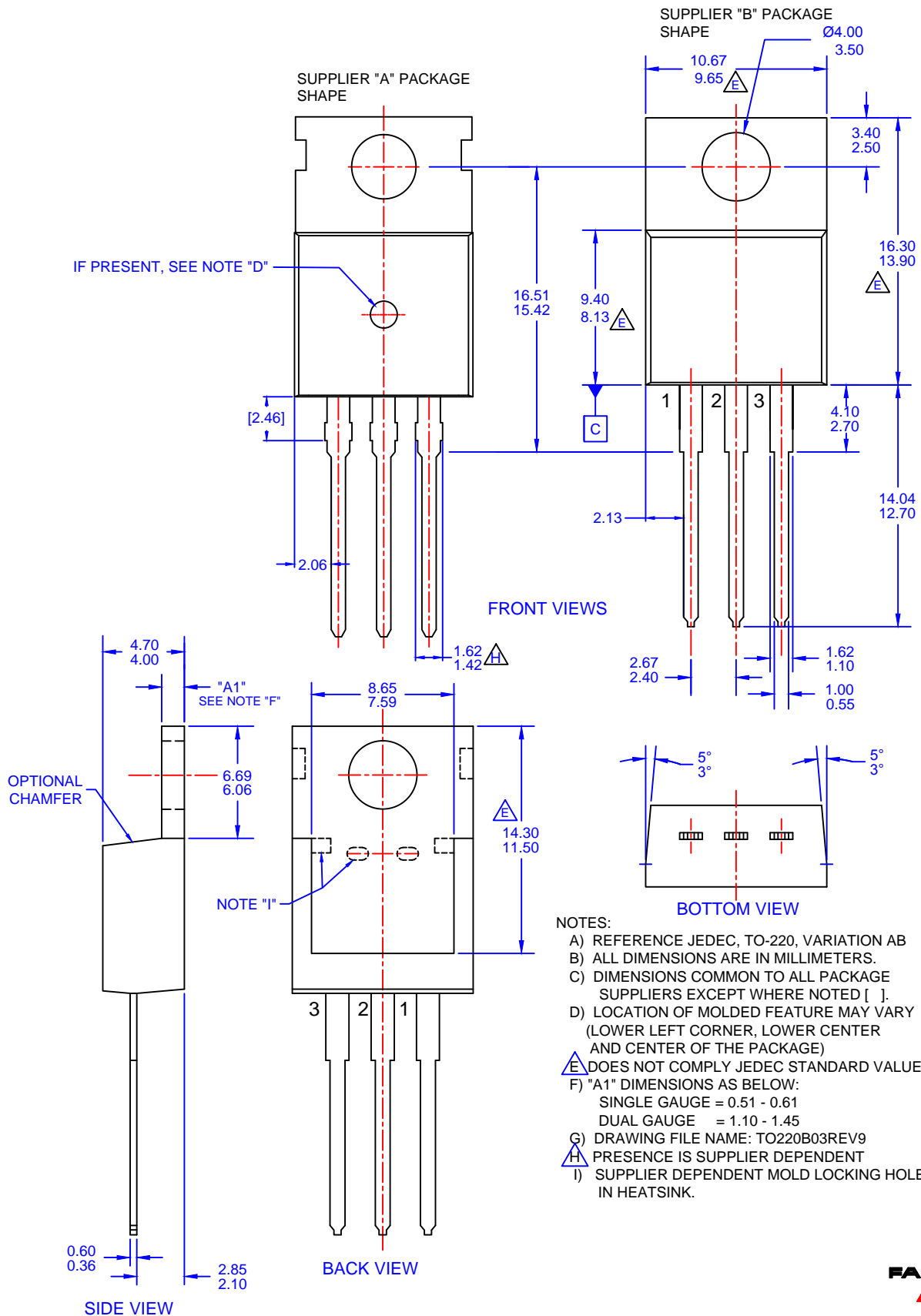


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NOTES:

- A. EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
- $\triangle B$  DOES NOT COMPLY EIAJ STD. VALUE.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- E. DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
- F. DRAWING FILE NAME: TO220Q03REV2



- 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) DRAWING FILE NAME: TO220B03REV9
  - H) PRESENCE IS SUPPLIER DEPENDENT
  - I) SUPPLIER DEPENDENT MOLD LOCKING HOLES IN HEATSINK.



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