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FCP4N60

N-Channel SuperFET® MOSFET

600 V, 3.9 A, 1.2 Ω

Features

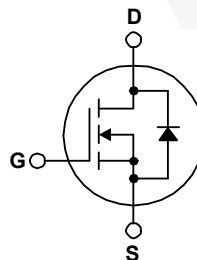
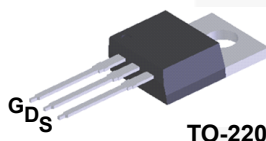
- 650 V @ $T_J = 150^\circ\text{C}$
- Typ. $R_{DS(on)} = 1.0\ \Omega$
- Ultra Low Gate Charge (Typ. $Q_g = 12.8\ \text{nC}$)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)} = 32\ \text{pF}$)
- 100% Avalanche Tested
- RoHS Compliant

Application

- LCD / LED / PDP TV and Monitor Lighting
- 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.



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

Symbol	Parameter	FCP4N60	Unit
V_{DSS}	Drain-Source Voltage	600	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$) - Continuous ($T_C = 100^\circ\text{C}$)	3.9 2.5	A A
I_{DM}	Drain Current - Pulsed (Note 1)	11.7	A
V_{GSS}	Gate-Source voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	128	mJ
I_{AR}	Avalanche Current (Note 1)	3.9	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	5.0	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$) - Derate Above 25°C	50 0.4	W 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	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	FCP4N60	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	2.5	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	83	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCP4N60	FCP4N60	TO-220	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
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0 V, I _D = 250 μA, T _J = 25°C	600	--	--	V
		V _{GS} = 0 V, I _D = 250 μA, T _J = 150°C	--	650	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C	--	0.6	--	V/°C
BV _{DS}	Drain-Source Avalanche Breakdown Voltage	V _{GS} = 0 V, I _D = 3.9 A	--	700	--	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 600 V, V _{GS} = 0 V	--	--	1	μA
		V _{DS} = 480 V, T _C = 125°C	--	--	10	μA
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 30 V, V _{DS} = 0 V	--	--	100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -30 V, V _{DS} = 0 V	--	--	-100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250 μA	3.0	--	5.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 2.0 A	--	1.0	1.2	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40 V, I _D = 2.0 A	--	3.2	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1.0 MHz	--	415	540	pF
C _{oss}	Output Capacitance		--	210	275	pF
C _{rss}	Reverse Transfer Capacitance		--	19.5	--	pF
C _{oss}	Output Capacitance	V _{DS} = 480 V, V _{GS} = 0 V, f = 1.0 MHz	--	12	16	pF
C _{oss} eff.	Effective Output Capacitance	V _{DS} = 0 V to 400 V, V _{GS} = 0 V	--	32	--	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 300 V, I _D = 3.9 A R _G = 25 Ω (Note 4)	--	16	45	ns
t _r	Turn-On Rise Time		--	45	100	ns
t _{d(off)}	Turn-Off Delay Time		--	36	85	ns
t _f	Turn-Off Fall Time		--	30	70	ns
Q _g	Total Gate Charge	V _{DS} = 480 V, I _D = 3.9 A V _{GS} = 10 V (Note 4)	--	12.8	16.6	nC
Q _{gs}	Gate-Source Charge		--	2.4	--	nC
Q _{gd}	Gate-Drain Charge		--	7.1	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	3.9	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	11.7	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 3.9 A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 3.9 A dI _F /dt =100 A/μs	--	277	--	ns
Q _{rr}	Reverse Recovery Charge		--	2.07	--	μC

Notes:

1. Repetitive rating; pulse-width limited by maximum junction temperature.
2. $I_{AS} = 1.9\text{ A}$, $V_{DD} = 50\text{ V}$, $R_G = 25\text{ }\Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 3.9\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

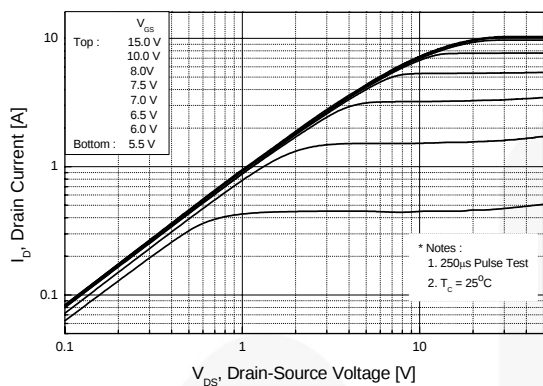


Figure 2. Transfer Characteristics

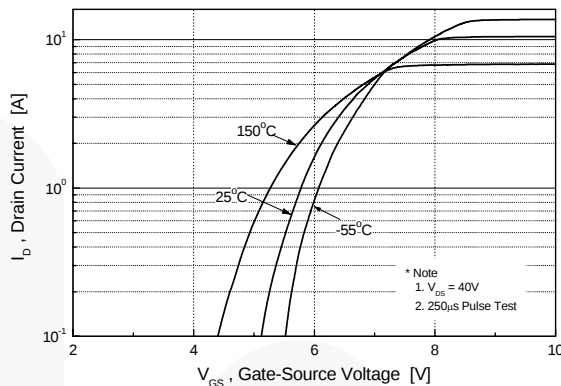


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

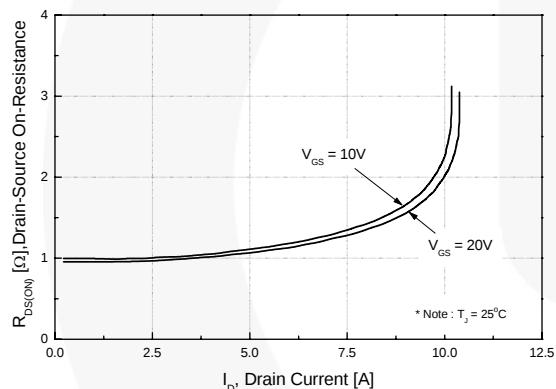


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

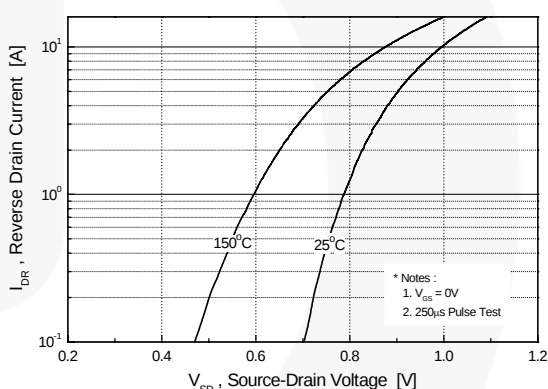


Figure 5. Capacitance Characteristics

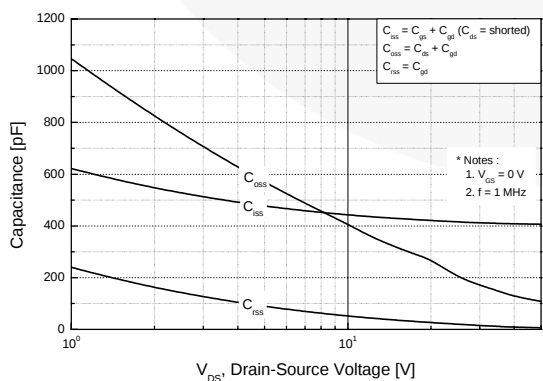
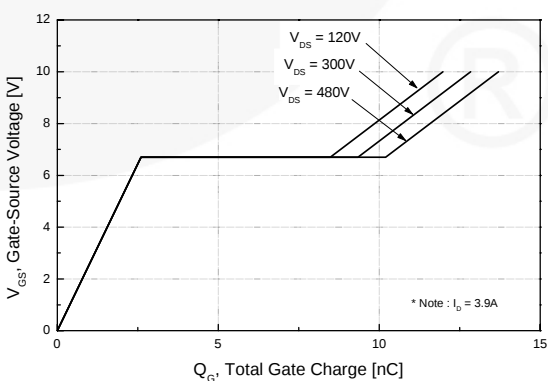


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

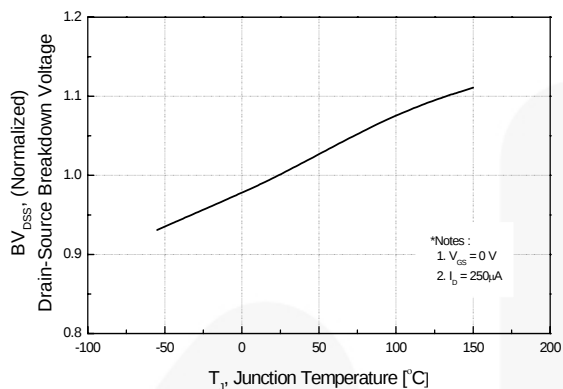


Figure 8. On-Resistance Variation vs. Temperature

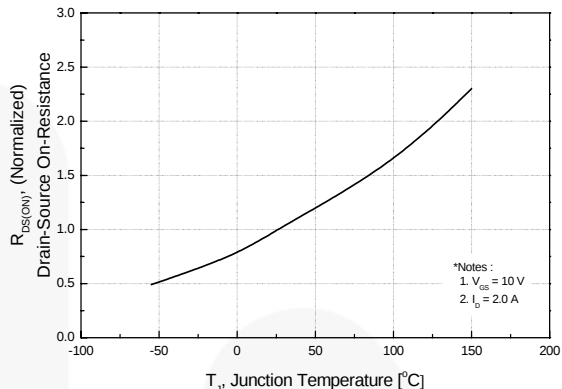


Figure 9. Maximum Safe Operating Area

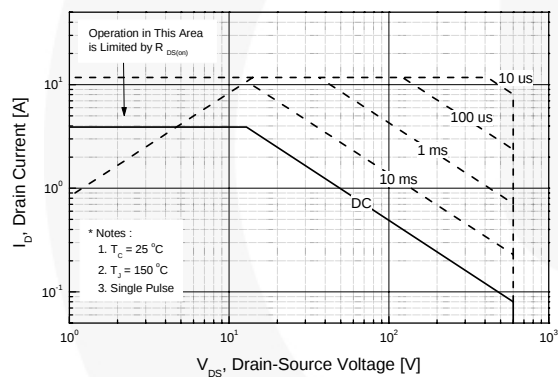


Figure 10. Maximum Drain Current vs. Case Temperature

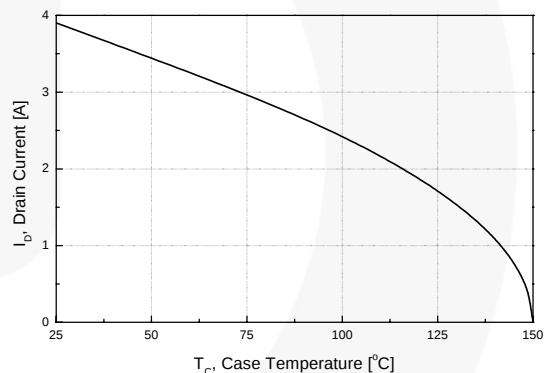
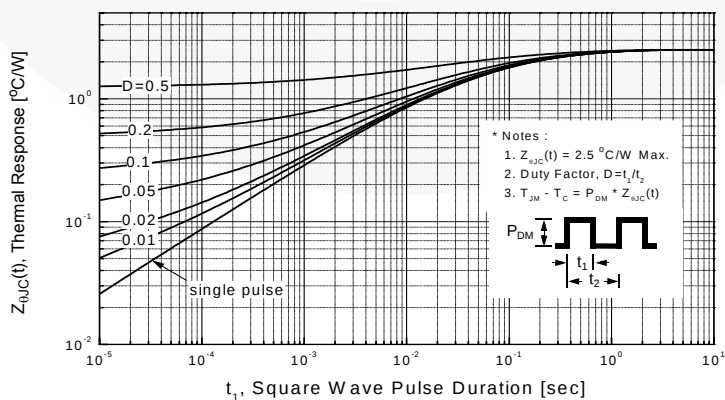


Figure 11. Transient Thermal Response Curve



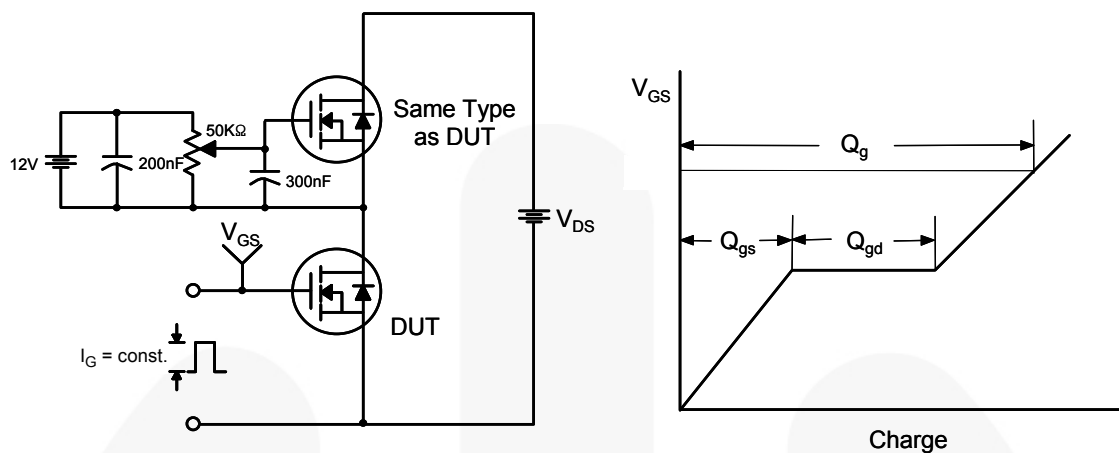


Figure 12. Gate Charge Test Circuit & Waveform

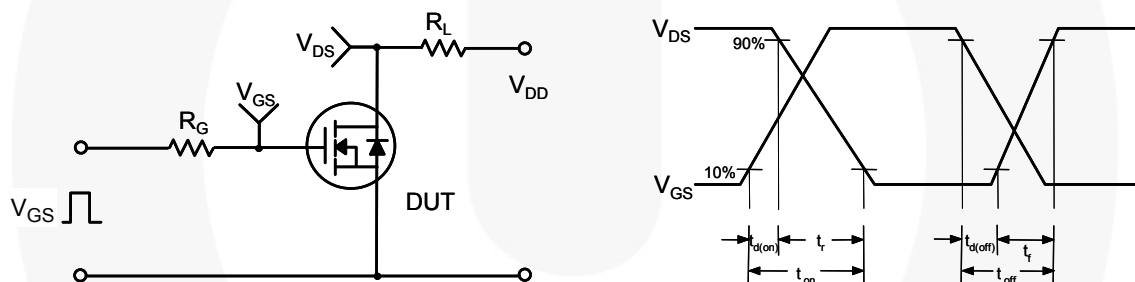


Figure 13. Resistive Switching Test Circuit & Waveforms

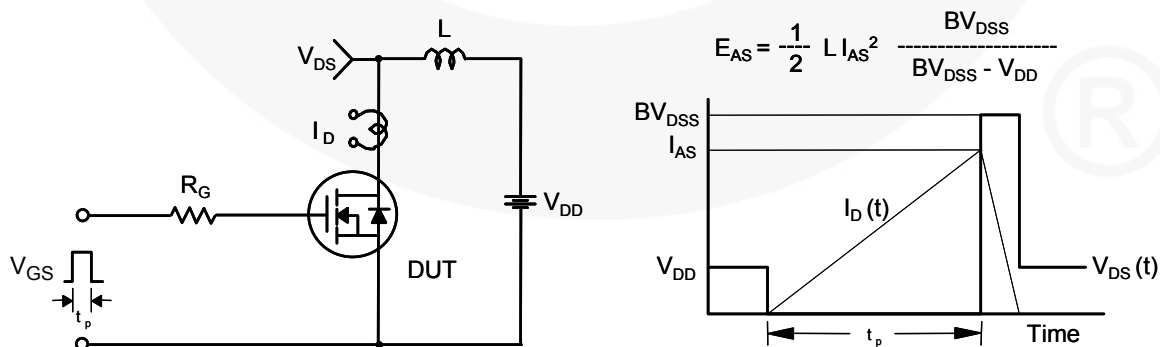


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

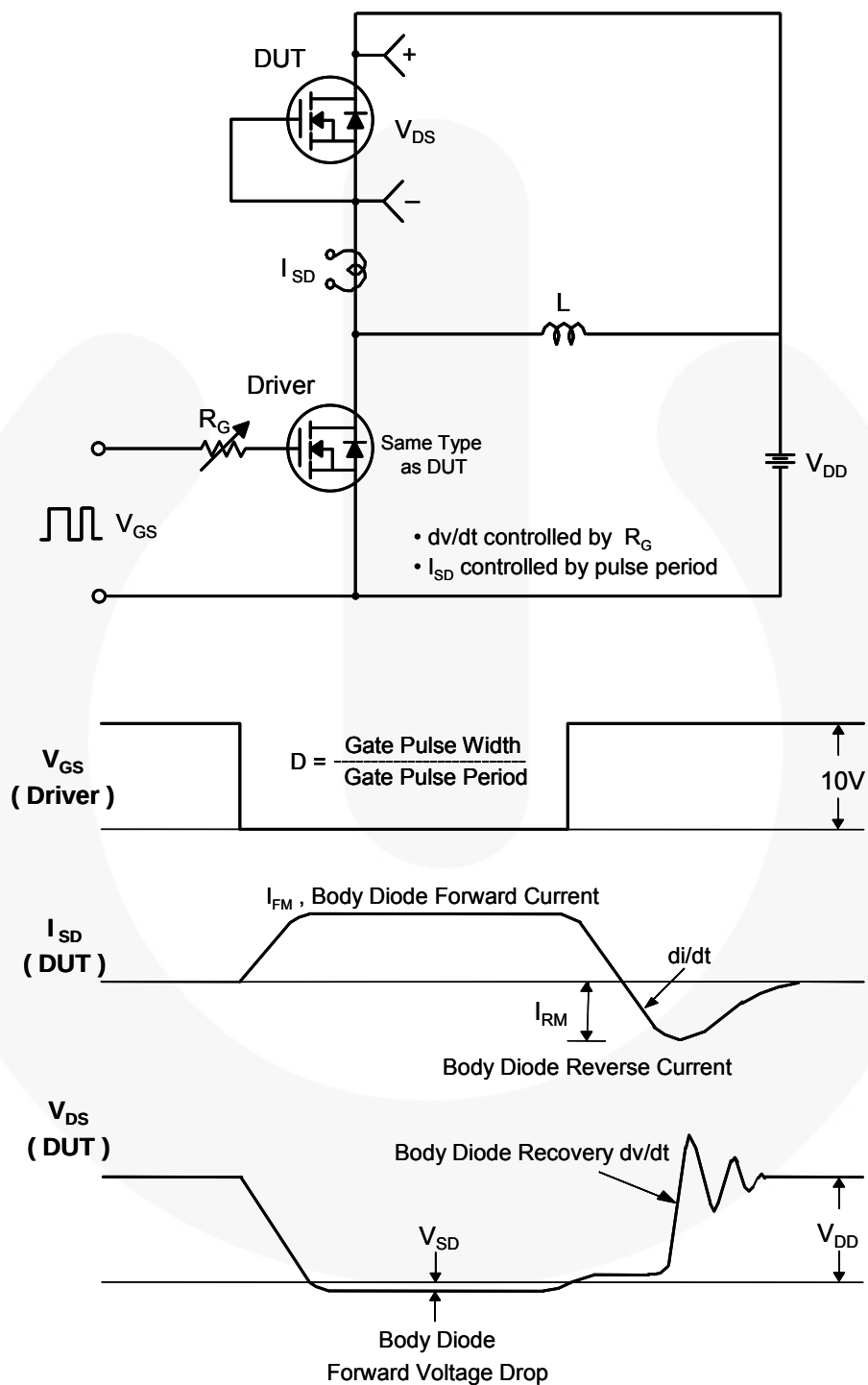
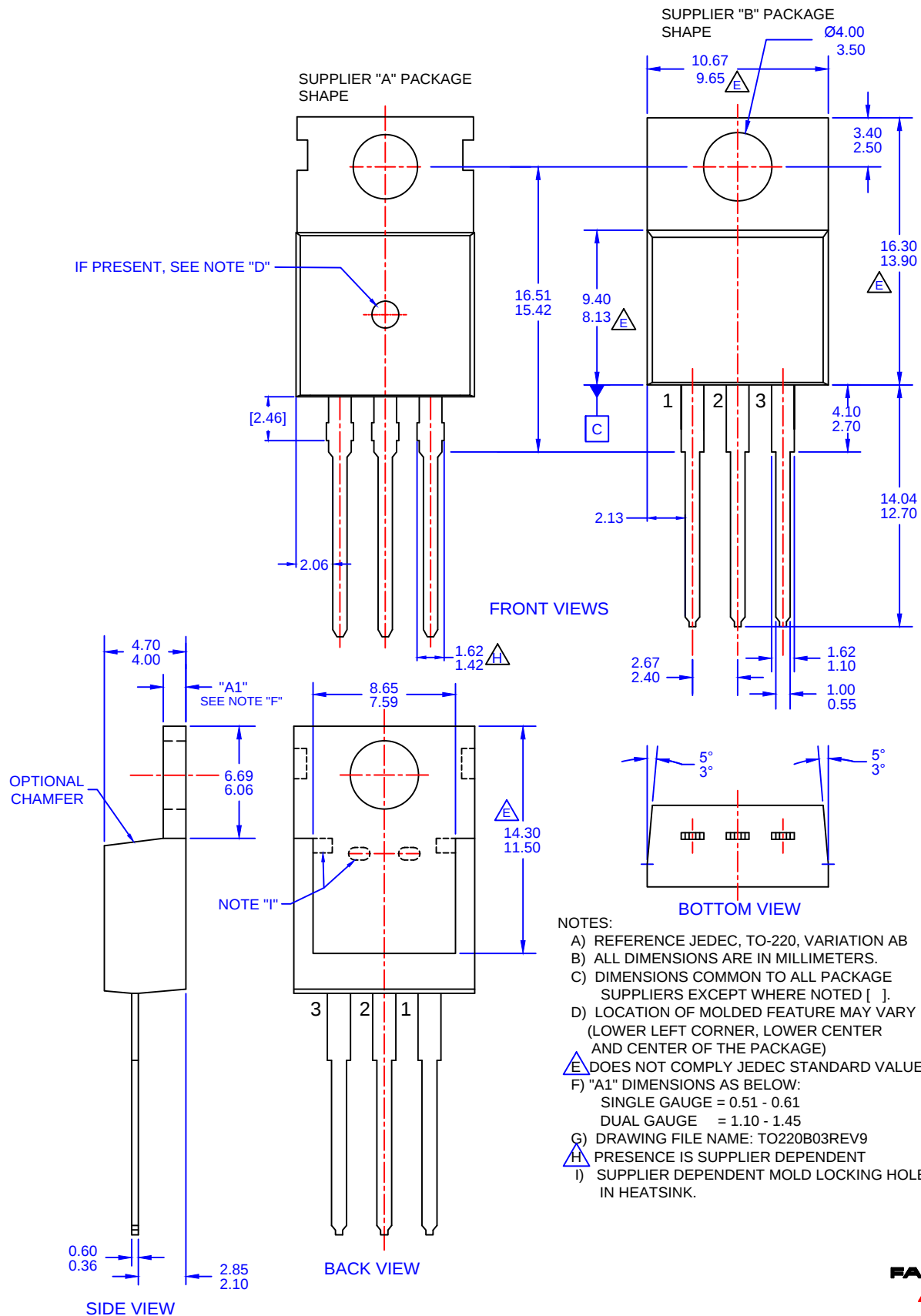


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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