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FCP104N60F

N-Channel SuperFET® II FRFET® MOSFET

600 V, 37 A, 104 mΩ

Features

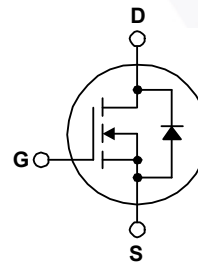
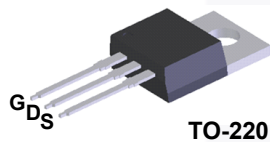
- 650 V @ $T_J = 150^\circ\text{C}$
- Typ. $R_{DS(on)} = 91\text{ m}\Omega$
- Ultra Low Gate Charge (Typ. $Q_g = 110\text{ nC}$)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)} = 313\text{ pF}$)
- 100% Avalanche Tested

Applications

- Lighting
- Solar Inverter
- AC-DC Power Supply

Description

SuperFET® II MOSFET is Fairchild Semiconductor's brand-new 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 II MOSFET is very suitable for the switching power applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications. SuperFET® II FRFET® MOSFET's optimized body diode reverse recovery performance can remove additional component and improve system reliability.



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

Symbol	Parameter	FCP104N60F	Unit
V_{DSS}	Drain to Source Voltage	600	V
V_{GSS}	Gate to Source Voltage	- DC	± 20
		- AC ($f > 1\text{Hz}$)	± 30
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	37
		- Continuous ($T_C = 100^\circ\text{C}$)	24
I_{DM}	Drain Current	- Pulsed (Note 1)	114
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	809
I_{AR}	Avalanche Current	(Note 1)	6.8
E_{AR}	Repetitive Avalanche Energy	(Note 1)	3.57
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	50
	MOSFET dv/dt		100
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	357
		- Derate Above 25°C	2.85
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	FCP104N60F	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.35	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCP104N60F	FCP104N60F	TO220	Tube	N/A	N/A	50 units

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	$V_{GS} = 0\text{ V}, I_D = 10\text{ mA}, T_J = 25^\circ\text{C}$	600	-	-	V
		$V_{GS} = 0\text{ V}, I_D = 10\text{ mA}, T_J = 150^\circ\text{C}$	650	-	-	
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 10\text{ mA}$, Referenced to 25°C	-	0.67	-	$\text{V}/^\circ\text{C}$
BV_{DS}	Drain-Source Avalanche Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 18.5\text{ A}$	-	700	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$	-	-	10	μA
		$V_{DS} = 480\text{ V}, T_C = 125^\circ\text{C}$	-	16	-	
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	-	-	± 100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	3	-	5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 18.5\text{ A}$	-	91	104	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS} = 20\text{ V}, I_D = 18.5\text{ A}$	-	33	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}$ $f = 1\text{ MHz}$	-	4610	6130	pF
C_{oss}	Output Capacitance		-	3255	4330	pF
C_{rss}	Reverse Transfer Capacitance		-	155	235	pF
C_{oss}	Output Capacitance	$V_{DS} = 380\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	-	74	-	pF
$C_{oss\text{ eff.}}$	Effective Output Capacitance	$V_{DS} = 0\text{ V to } 480\text{ V}, V_{GS} = 0\text{ V}$	-	313	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380\text{ V}, I_D = 18.5\text{ A}$ $V_{GS} = 10\text{ V}$ (Note 4)	-	110	145	nC
Q_{gs}	Gate to Source Gate Charge		-	24	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	44	-	nC
ESR	Equivalent Series Resistance	Drain open		0.9		Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380\text{ V}, I_D = 18.5\text{ A}$ $V_{GS} = 10\text{ V}, R_{GEN} = 4.7\ \Omega$ (Note 4)	-	34	78	ns
t_r	Turn-On Rise Time		-	20	50	ns
$t_{d(off)}$	Turn-Off Delay Time		-	102	214	ns
t_f	Turn-Off Fall Time		-	5.7	21.4	ns

Drain-Source Diode Characteristics

I_S	Maximum Continuous Drain to Source Diode Forward Current	-	-	37	A	
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current	-	-	114	A	
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_{SD} = 18.5\text{ A}$	-	-	1.2	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_{SD} = 18.5\text{ A}$	-	144	-	ns
Q_{rr}	Reverse Recovery Charge	$di/dt = 100\text{ A}/\mu\text{s}$	-	0.91	-	μC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS} = 6.8\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 18.5\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$
4. Essentially Independent of Operating Temperature Typical Characteristics

Typical Characteristics

Figure 1. On-Region Characteristics

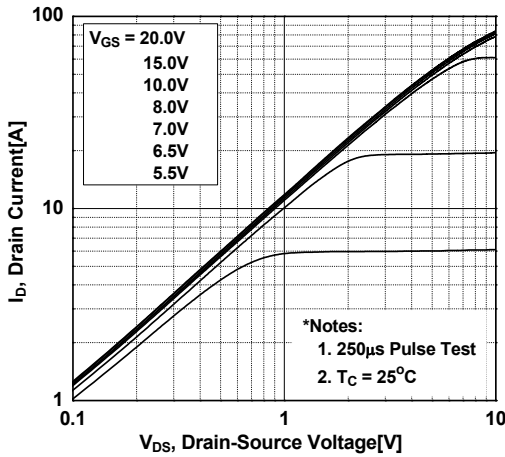


Figure 2. Transfer Characteristics

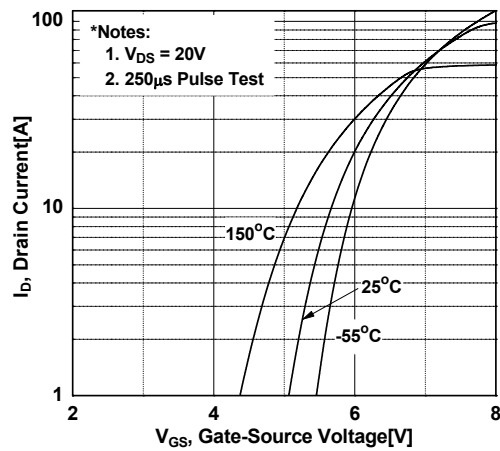


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

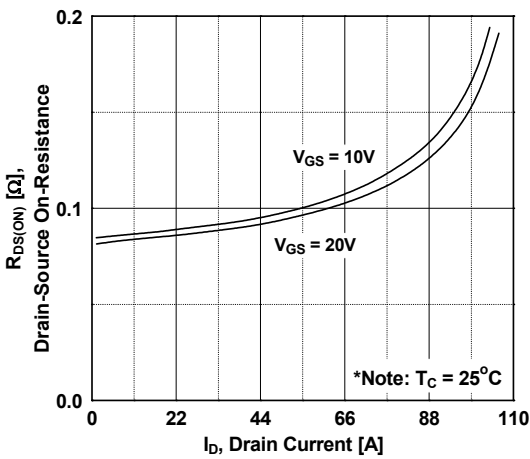


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

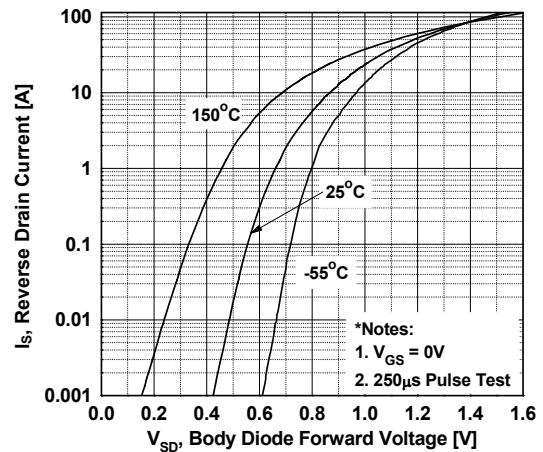


Figure 5. Capacitance Characteristics

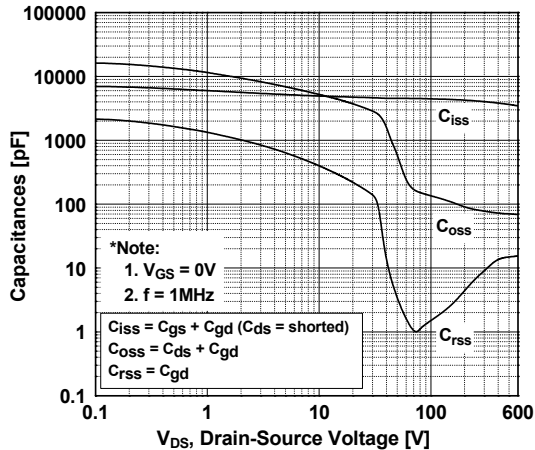
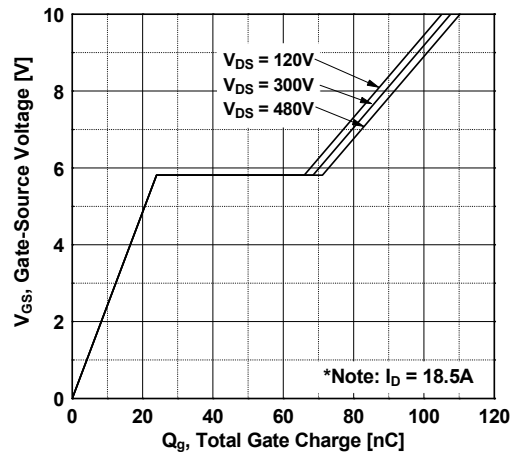


Figure 6. Gate Charge Characteristics



Typical Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

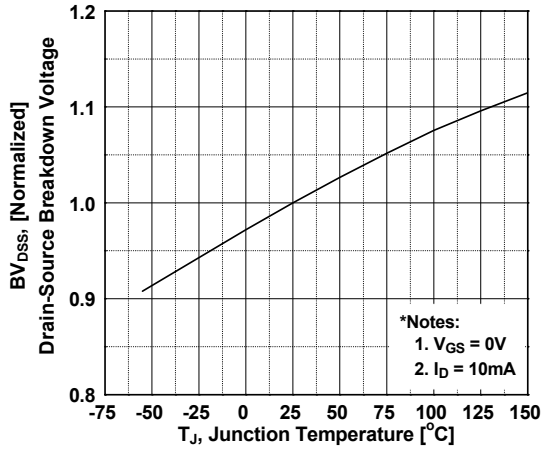


Figure 8. On-Resistance Variation vs. Temperature

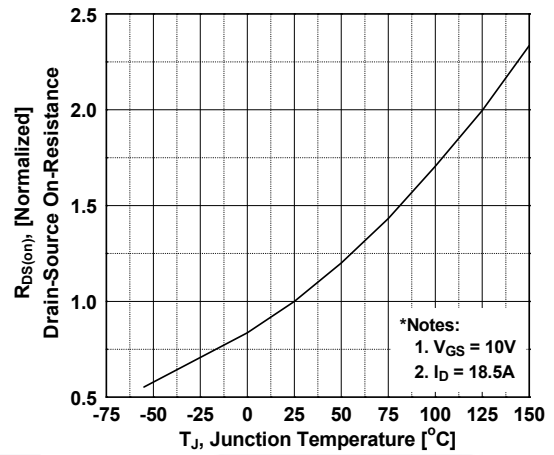


Figure 9. Maximum Safe Operating Area

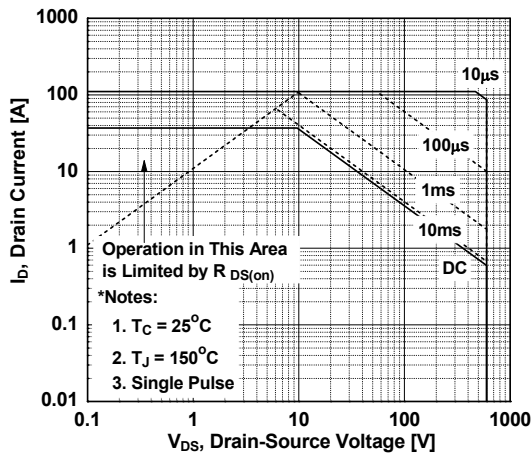


Figure 10. Maximum Drain Current vs. Case Temperature

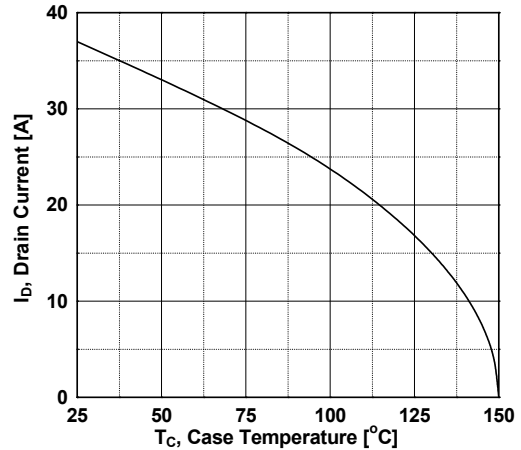


Figure 11. Transient Thermal Response Curve

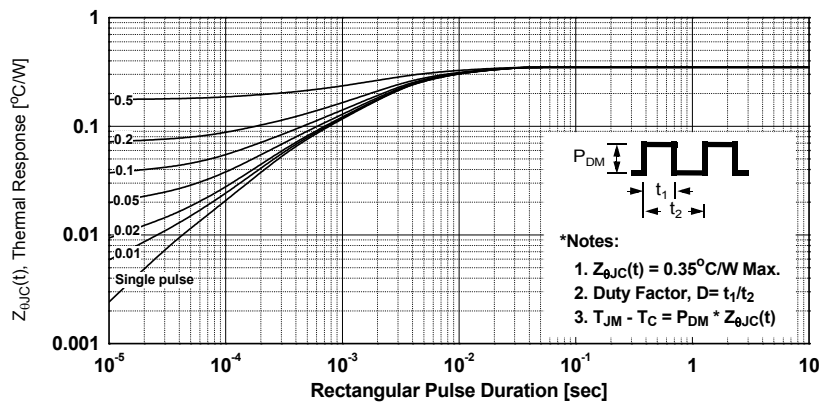


Figure 12. Gate Charge Test Circuit & Waveform

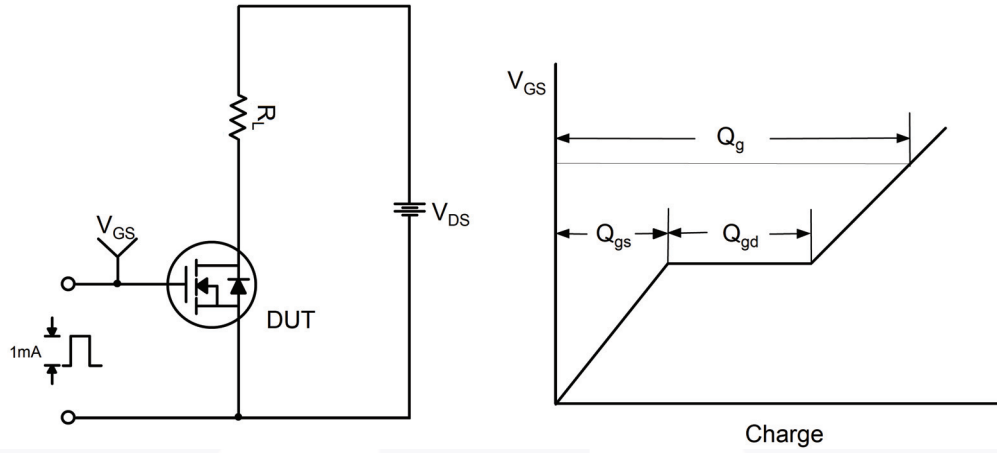


Figure 13. Resistive Switching Test Circuit & Waveforms

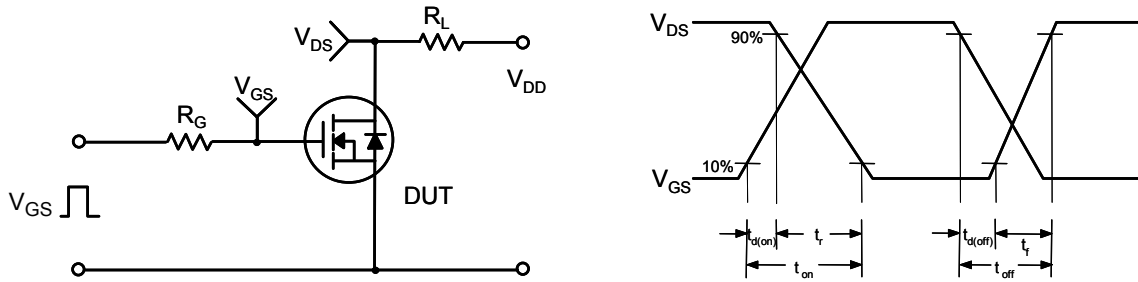


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

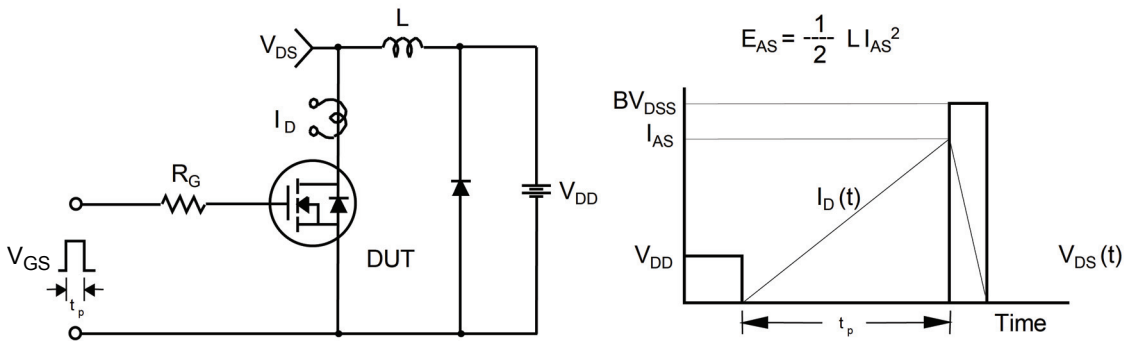
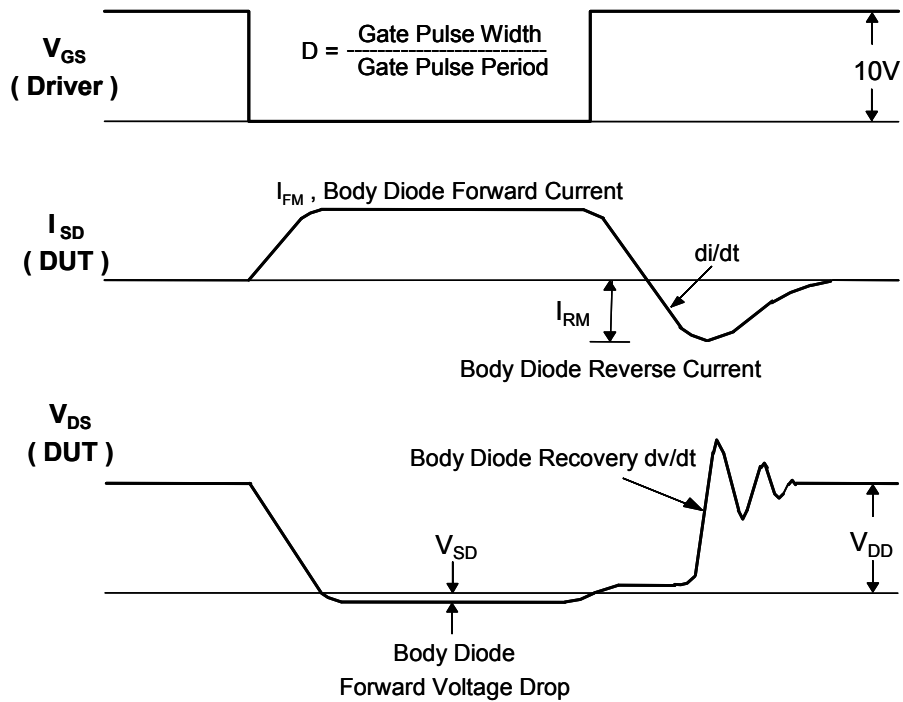
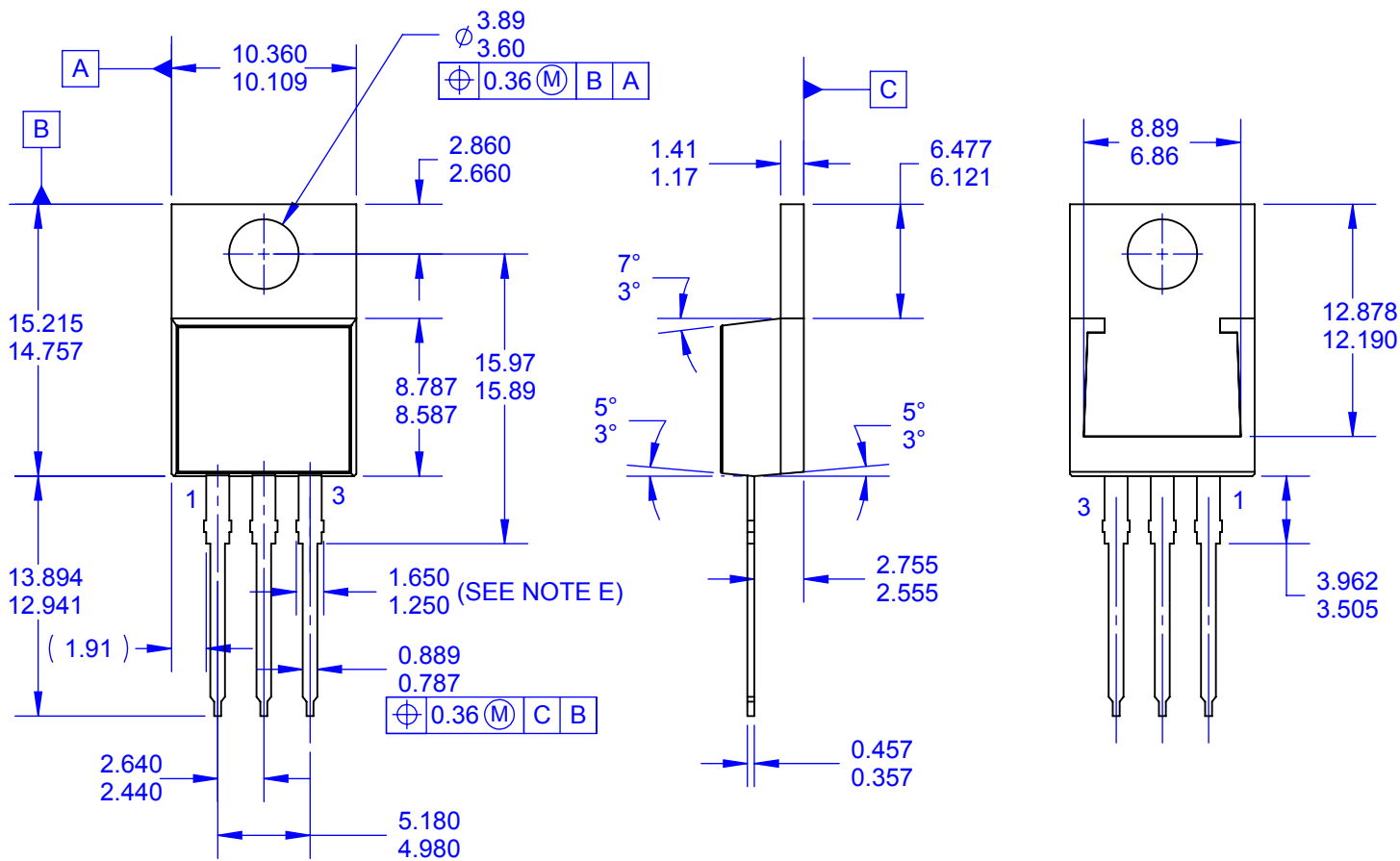


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms





NOTES:

- A. PACKAGE REFERENCE: JEDEC TO220 VARIATION AB
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSION AND TOLERANCE AS PER ASME Y14.5-2009.
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- E. MAX WIDTH FOR F102 DEVICE = 1.35mm.
- F. DRAWING FILE NAME: TO220T03REV4.
- G. FAIRCHILD SEMICONDUCTOR.

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