

# FCD620N60ZF

## N-Channel SuperFET® II FRFET® MOSFET 600 V, 7.3 A, 620 mΩ

### Features

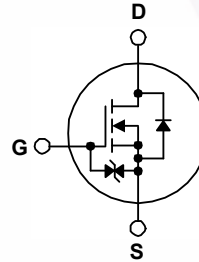
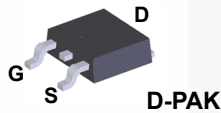
- 650 V @  $T_J = 150^\circ\text{C}$
- Typ.  $R_{DS(on)} = 528\text{ m}\Omega$
- Ultra Low Gate Charge (Typ.  $Q_g = 20\text{ nC}$ )
- Low Effective output Capacitance (Typ.  $C_{oss(eff.)} = 71\text{ pF}$ )
- 100% Avalanche Tested
- ESD Improved Capacity
- RoHS Compliant

### Applications

- LCD / LED / PDP TV and Monitor 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.



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

Symbol	Parameter		FCD620N60ZF	Unit
$V_{DSS}$	Drain to Source Voltage		600	V
$V_{GSS}$	Gate to Source Voltage	- DC	$\pm 20$	V
		- AC ( $f > 1\text{ Hz}$ )	$\pm 30$	
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	7.3	A
		- Continuous ( $T_C = 100^\circ\text{C}$ )	4.6	
$I_{DM}$	Drain Current	- Pulsed (Note 1)	21.9	A
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)		135	mJ
$I_{AR}$	Avalanche Current (Note 1)		1.5	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)		0.89	mJ
$dv/dt$	MOSFET $dv/dt$		100	V/ns
	Peak Diode Recovery $dv/dt$ (Note 3)		20	
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	89	W
		- Derate Above $25^\circ\text{C}$	0.71	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	FCD620N60ZF	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	1.4	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	100	

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FCD620N60ZF	FCD620N60ZF	DPAK	Tape and Reel	330 mm	16 mm	2500 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 $25^\circ\text{C}$	-	0.6	-	$^\circ\text{V}/^\circ\text{C}$
$BV_{DS}$	Drain-Source Avalanche Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 7.3\text{ A}$	-	700	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}$	-	-	5	$\mu\text{A}$
		$V_{DS} = 480\text{ V}, T_C = 125^\circ\text{C}$	-	-	20	
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	-	-	$\pm 10$	$\mu\text{A}$

### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	3	-	5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 3.6\text{ A}$	-	0.528	0.62	$\Omega$

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	-	855	1135	pF
$C_{oss}$	Output Capacitance		-	625	830	pF
$C_{rss}$	Reverse Transfer Capacitance		-	30	45	pF
$C_{oss}$	Output Capacitance	$V_{DS} = 380\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	-	16	-	pF
$C_{oss(eff.)}$	Effective Output Capacitance	$V_{DS} = 0\text{ V to } 480\text{ V}, V_{GS} = 0\text{ V}$	-	71	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380\text{ V}, I_D = 3.6\text{ A}, V_{GS} = 10\text{ V}$ (Note 4)	-	20	36	nC
$Q_{gs}$	Gate to Source Gate Charge		-	4.5	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		-	7.7	-	nC
ESR	Equivalent Series Resistance	$f = 1\text{ MHz}$	-	2.7	-	$\Omega$

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380\text{ V}, I_D = 3.6\text{ A}, V_{GS} = 10\text{ V}, R_g = 4.7\text{ }\Omega$ (Note 4)	-	15	40	ns
$t_r$	Turn-On Rise Time		-	7	24	ns
$t_{d(off)}$	Turn-Off Delay Time		-	35	80	ns
$t_f$	Turn-Off Fall Time		-	10	30	ns

### Drain-Source Diode Characteristics

I <sub>S</sub>	Maximum Continuous Drain to Source Diode Forward Current		-	-	7.3	A
I <sub>SM</sub>	Maximum Pulsed Drain to Source Diode Forward Current		-	-	21.9	A
V <sub>SD</sub>	Drain to Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 3.6 A	-	-	1.2	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 3.6 A, dI <sub>F</sub> /dt = 100 A/μs	-	84	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge		-	0.325	-	μC

#### Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2.  $I_{AS} = 1.5\text{ A}, V_{DD} = 50\text{ V}, R_g = 25\text{ }\Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 3.6\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

Figure 1. On-Region Characteristics

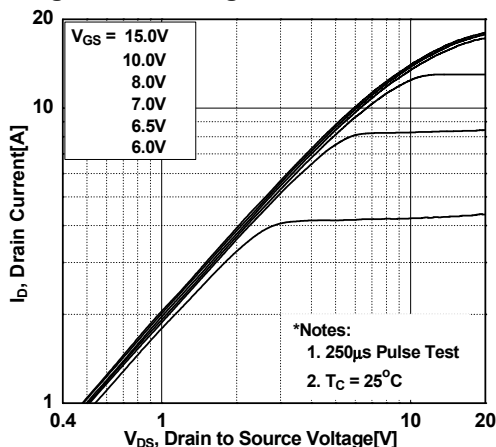


Figure 2. Transfer Characteristics

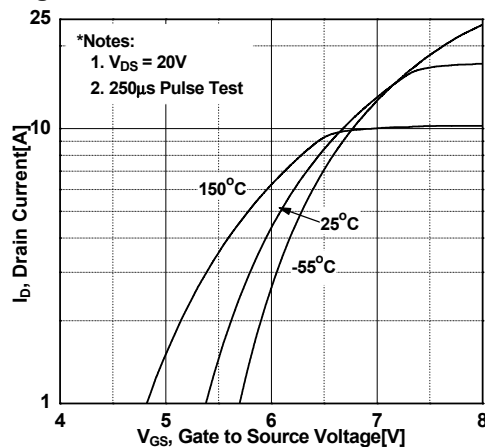


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

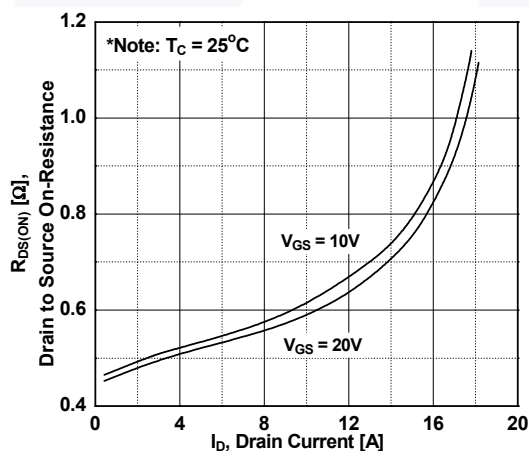


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

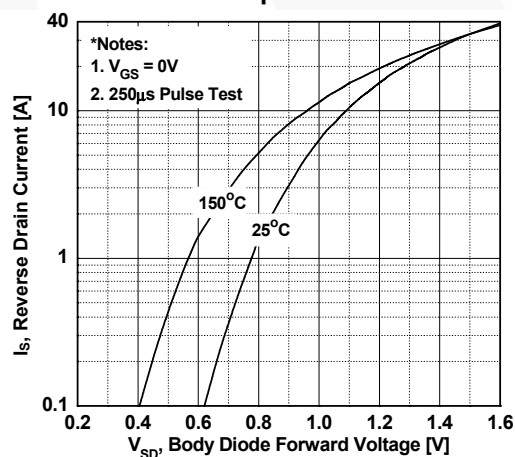


Figure 5. Capacitance Characteristics

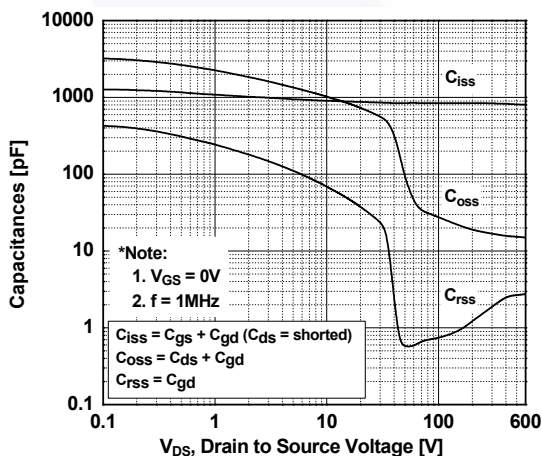
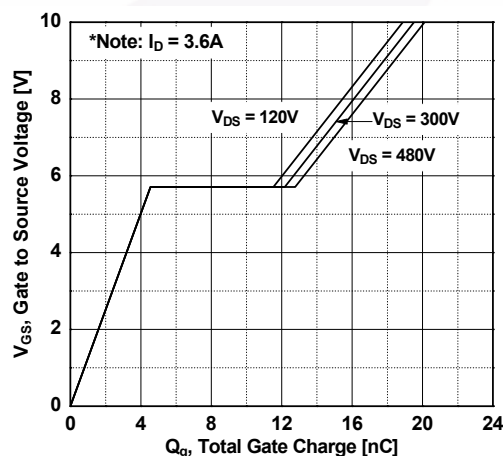
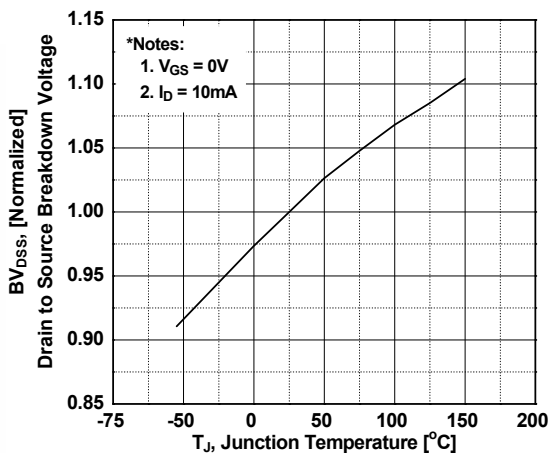


Figure 6. Gate Charge Characteristics

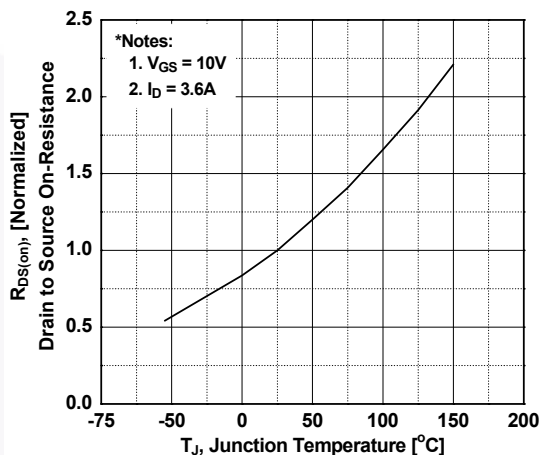


# Typical Performance Characteristics (Continued)

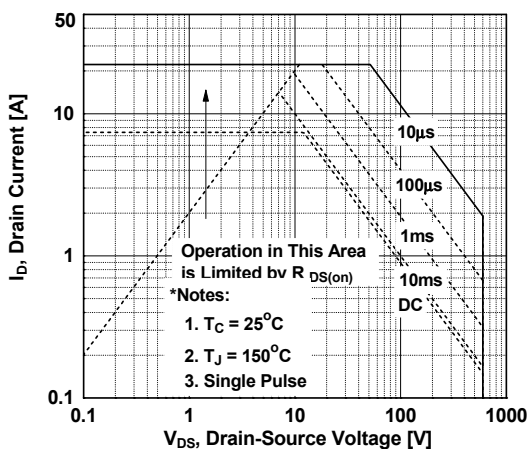
**Figure 7. Breakdown Voltage Variation vs. Temperature**



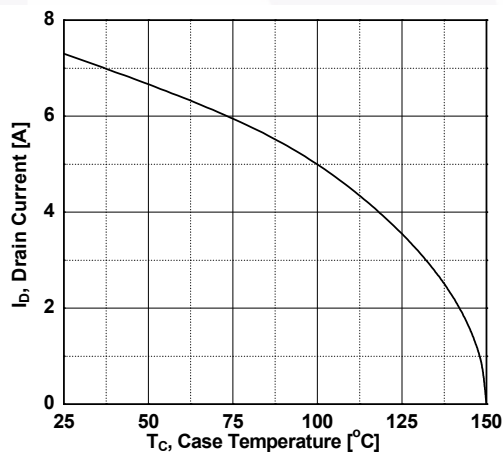
**Figure 8. On-Resistance Variation vs. Temperature**



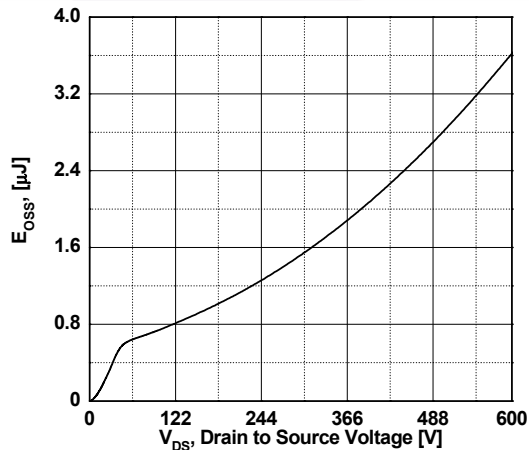
**Figure 9. Maximum Safe Operating Area**



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



**Figure 11. Eoss vs. Drain to Source Voltage**



# Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve

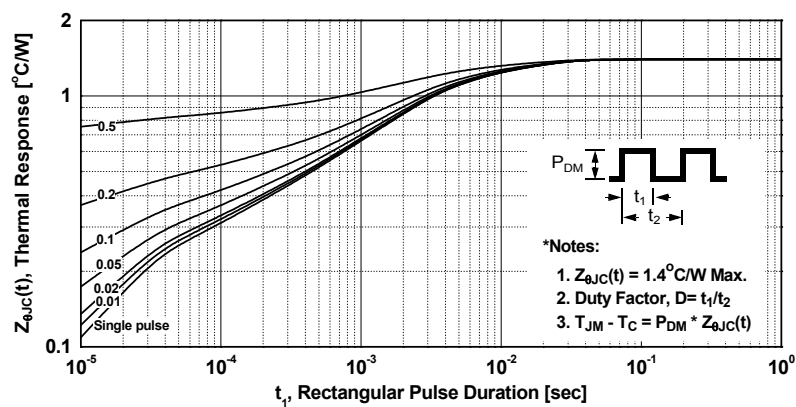




Figure 13. Gate Charge Test Circuit & Waveform



Figure 14. Resistive Switching Test Circuit & Waveforms



Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

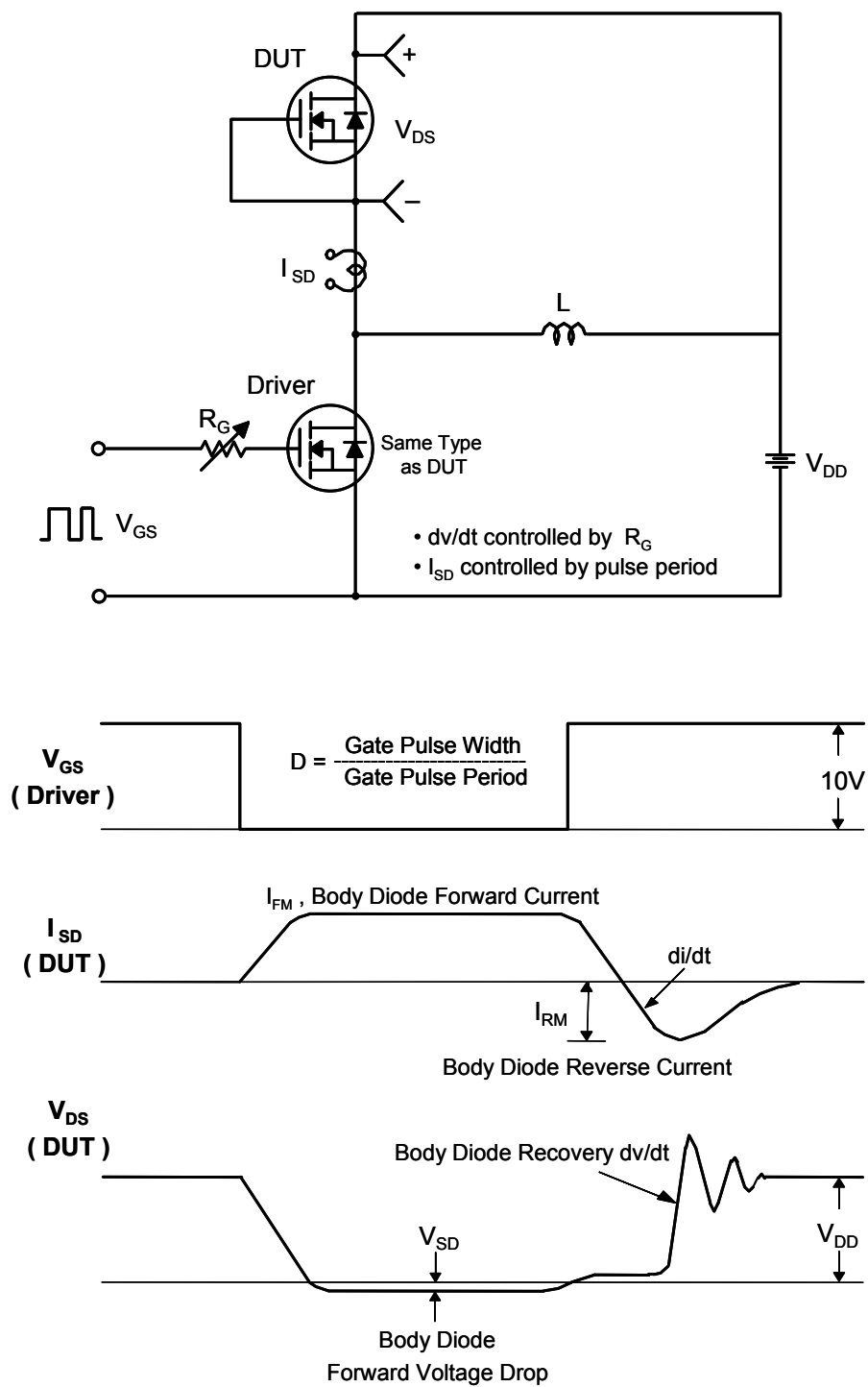
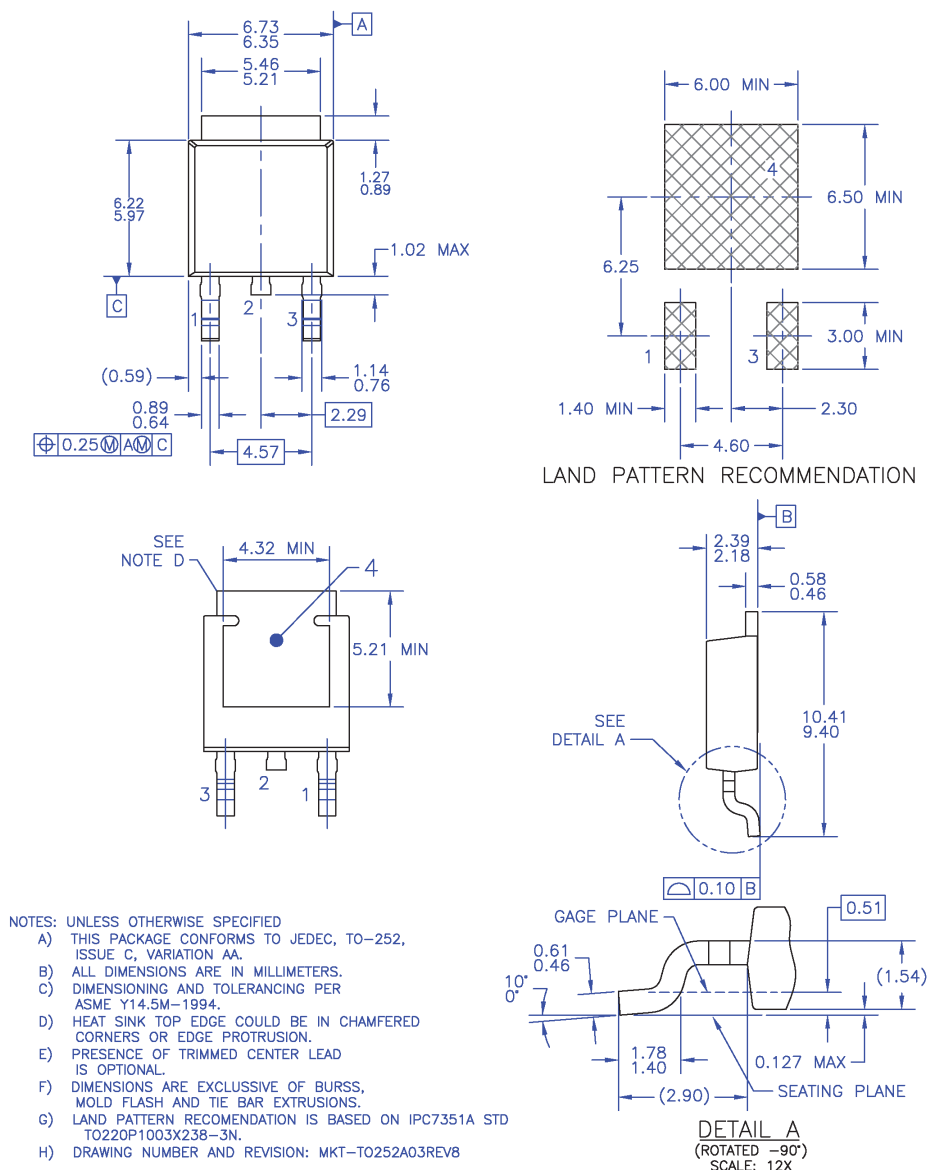


Figure 16. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

# Mechanical Dimensions



**Figure 17. TO252 (D-PAK), Molded, 3-Lead, Option AA&AB**

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