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# FGD5T120SH

## 1200 V, 5 A FS Trench IGBT

### Features

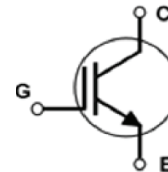
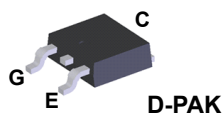
- FS Trench Technology, Positive Temperature Coefficient
- High Speed Switching
- Low Saturation Voltage:  $V_{CE(sat)} = 2.9\text{ V @ } I_C = 5\text{ A}$
- 100% of the Parts tested for  $I_{LM}(1)$
- High Input Impedance
- RoHS Compliant

### Applications

- Inrush current limitation
- Lighting
- Home appliances

### General Description

Using novel field stop IGBT technology, Fairchild's new series of field stop 3rd generation IGBTs offer the optimum performance for inrush current limitation, lighting and home appliance applications.



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

Symbol	Description	FGD5T120SH	Unit
$V_{CES}$	Collector to Emitter Voltage	1200	V
$V_{GES}$	Gate to Emitter Voltage	$\pm 25$	V
	Transient Gate to Emitter Voltage	$\pm 30$	V
$I_C$	Collector Current	@ $T_C = 25^\circ\text{C}$	10
	Collector Current	@ $T_C = 100^\circ\text{C}$	5
$I_{LM}(1)$	Clamped Inductive Load Current	@ $T_C = 25^\circ\text{C}$	12.5
$I_{CM}(2)$	Pulsed Collector Current		12.5
$P_D$	Maximum Power Dissipation	@ $T_C = 25^\circ\text{C}$	69
	Maximum Power Dissipation	@ $T_C = 100^\circ\text{C}$	28
$T_J$	Operating Junction Temperature	-55 to +150	$^\circ\text{C}$
$T_{stg}$	Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

- Notes:**  
 1.  $V_{CC} = 600\text{ V}, V_{GE} = 15\text{ V}, I_C = 12.5\text{ A}, R_G = 50\ \Omega$ , Inductive Load  
 2. Limited by  $T_{jmax}$

## Thermal Characteristics

Symbol	Parameter	FGD5T120SH	Unit
$R_{\theta JC}$ (IGBT)	Thermal Resistance, Junction to Case, Max.	1.8	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max. (3)	50	$^{\circ}\text{C}/\text{W}$

Notes : 3. Mounted on 1" square PCB (FR4 or G-10 material)

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Qty per Tube
FGD5T120SH	FGD5T120SH	TO-252 A03	380 mm	16 mm	2500

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
$BV_{CES}$	Collector to Emitter Breakdown Voltage	$V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$	1200	-	-	V
$\Delta BV_{CES} / \Delta T_J$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$	-	1.2	-	$\text{V}/^{\circ}\text{C}$
$I_{CES}$	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0\text{ V}$	-	-	250	$\mu\text{A}$
$I_{GES}$	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0\text{ V}$	-	-	$\pm 400$	nA
<b>On Characteristics</b>						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 5\text{ mA}, V_{CE} = V_{GE}$	2.5	3.5	4.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 5\text{ A}, V_{GE} = 15\text{ V}$	-	2.9	3.6	V
		$I_C = 5\text{ A}, V_{GE} = 15\text{ V}, T_C = 150^{\circ}\text{C}$	-	4.5	-	V
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	-	209	-	pF
$C_{oes}$	Output Capacitance		-	11	-	pF
$C_{res}$	Reverse Transfer Capacitance		-	2	-	pF
<b>Switching Characteristics</b>						
$T_{d(on)}$	Turn-On Delay Time	$V_{CC} = 600\text{ V}, I_C = 5\text{ A}, R_G = 30\text{ }\Omega, V_{GE} = 15\text{ V}, \text{Inductive Load}, T_C = 25^{\circ}\text{C}$	-	4.8	-	ns
$T_r$	Rise Time		-	20.8	-	ns
$T_{d(off)}$	Turn-Off Delay Time		-	24.8	-	ns
$T_f$	Fall Time		-	104	-	ns
$E_{on}$	Turn-On Switching Loss		-	247	-	$\mu\text{J}$
$E_{off}$	Turn-Off Switching Loss		-	94	-	$\mu\text{J}$
$E_{ts}$	Total Switching Loss		-	341	-	$\mu\text{J}$
$T_{d(on)}$	Turn-On Delay Time	$V_{CC} = 600\text{ V}, I_C = 5\text{ A}, R_G = 30\text{ }\Omega, V_{GE} = 15\text{ V}, \text{Inductive Load}, T_C = 150^{\circ}\text{C}$	-	4.8	-	ns
$T_r$	Rise Time		-	40	-	ns
$T_{d(off)}$	Turn-Off Delay Time		-	25.6	-	ns
$T_f$	Fall Time		-	134	-	ns
$E_{on}$	Turn-On Switching Loss		-	393	-	$\mu\text{J}$
$E_{off}$	Turn-Off Switching Loss		-	114	-	$\mu\text{J}$
$E_{ts}$	Total Switching Loss		-	507	-	$\mu\text{J}$
$Q_g$	Total Gate Charge	$V_{CC} = 600\text{ V}, I_C = 5\text{ A}, V_{GE} = 15\text{ V}$	-	6.7	-	nC
$Q_{ge}$	Gate to Emitter Charge		-	1.8	-	nC
$Q_{gc}$	Gate to Emitter Charge		-	2.6	-	nC

## Typical Performance Characteristics

Figure 1. Typical Output Characteristics

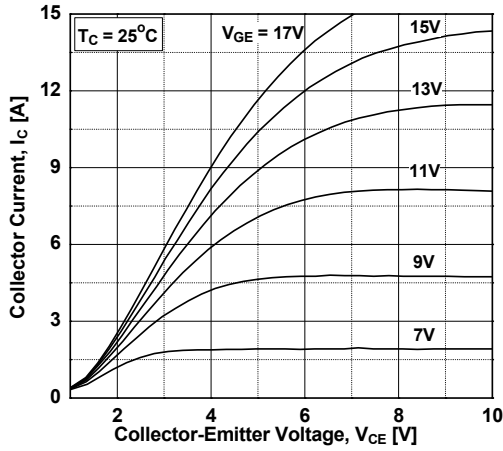


Figure 2. Typical Output Characteristics

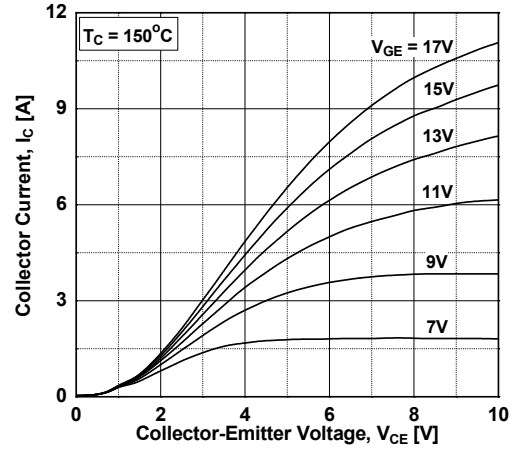


Figure 3. Typical Saturation Voltage Characteristics

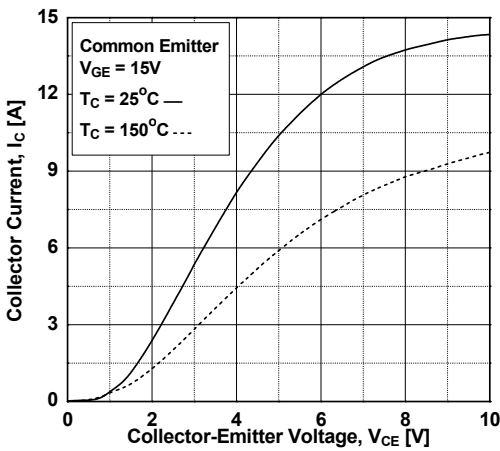


Figure 4. Transfer Characteristics

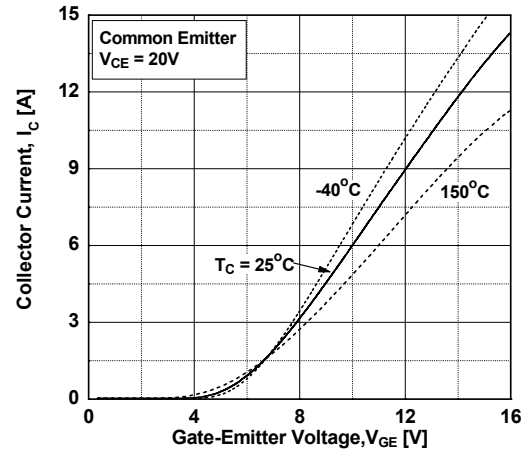


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

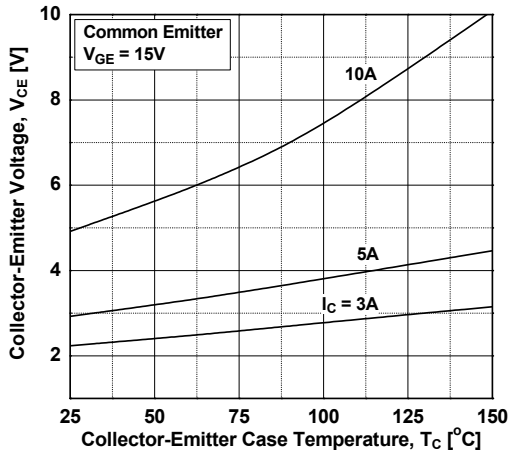
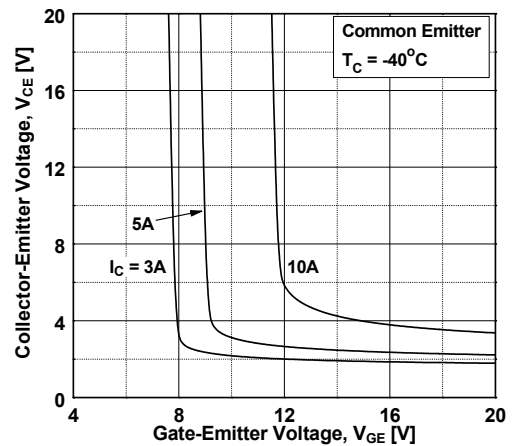


Figure 6. Saturation Voltage vs. Vge



## Typical Performance Characteristics

Figure 7. Saturation Voltage vs.  $V_{GE}$

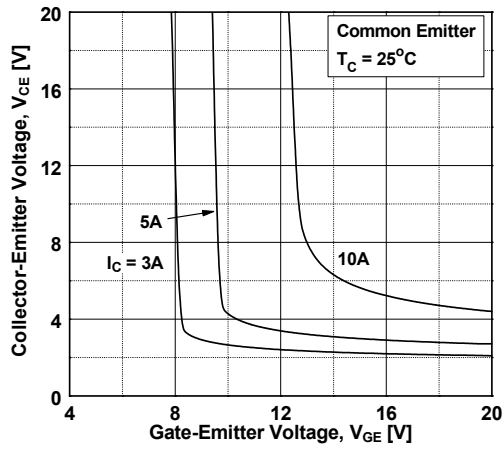


Figure 8. Saturation Voltage vs.  $V_{GE}$

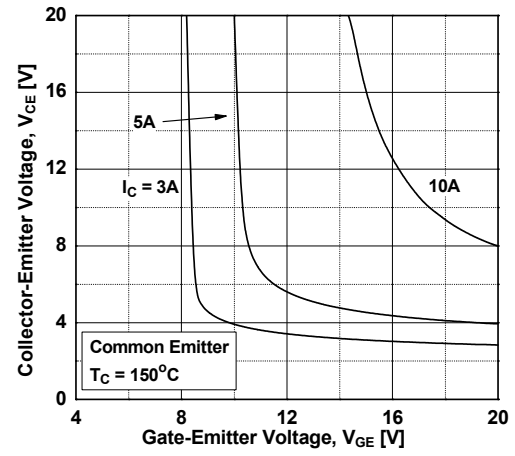


Figure 9. Capacitance Characteristics

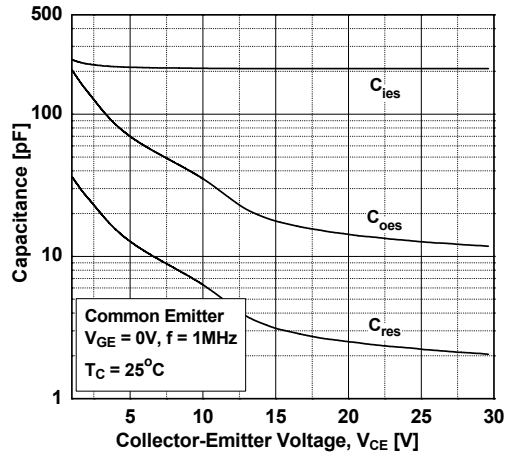


Figure 10. Gate Charge Characteristics

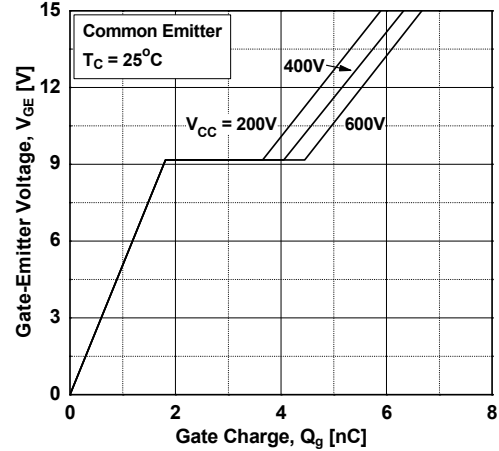


Figure 11. SOA Characteristics

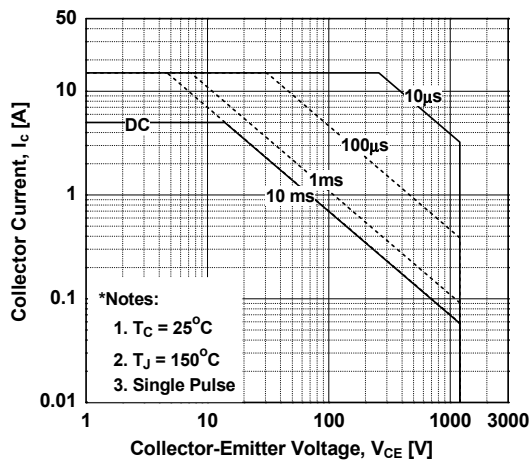
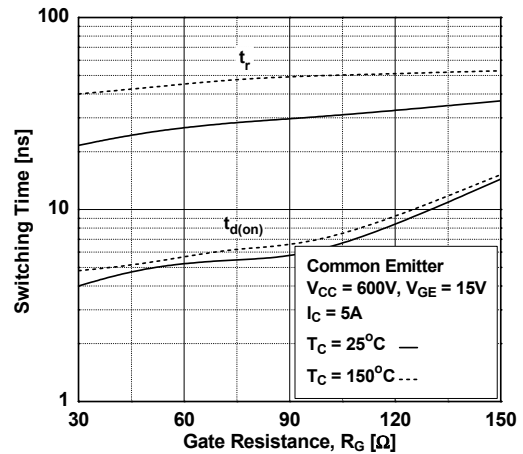
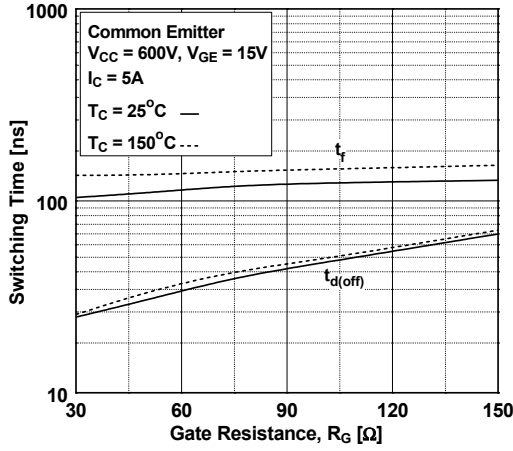


Figure 12. Turn-on Characteristics vs. Gate Resistance

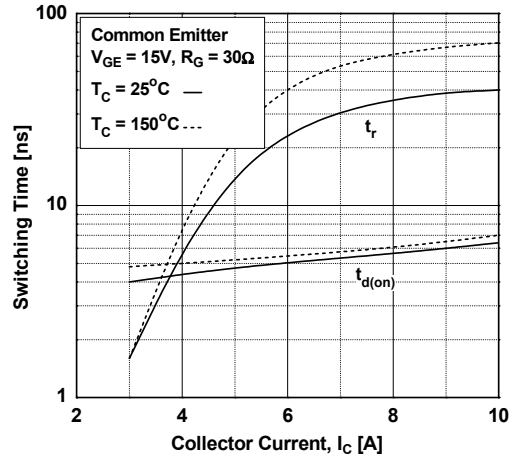


## Typical Performance Characteristics

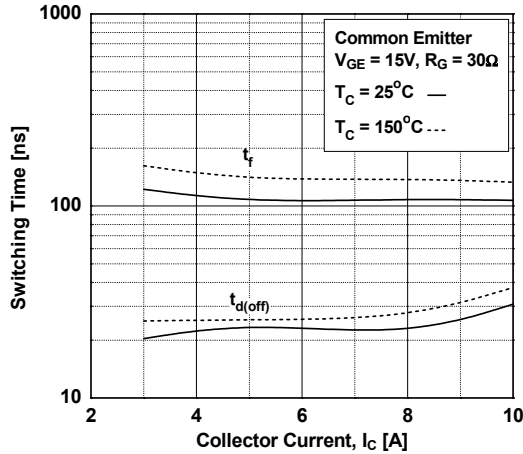
**Figure 13. Turn-off Characteristics VS. Gate Resistance**



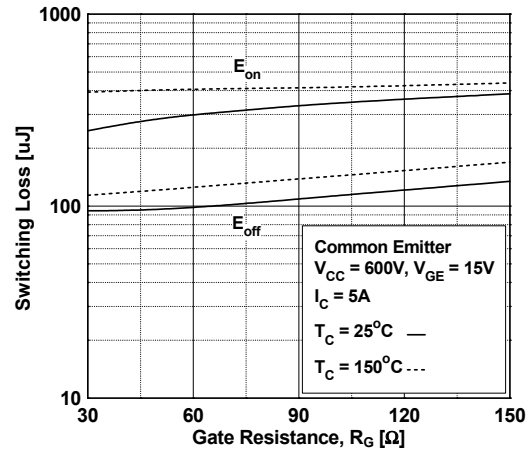
**Figure 14. Turn-on Characteristics VS. Collector Current**



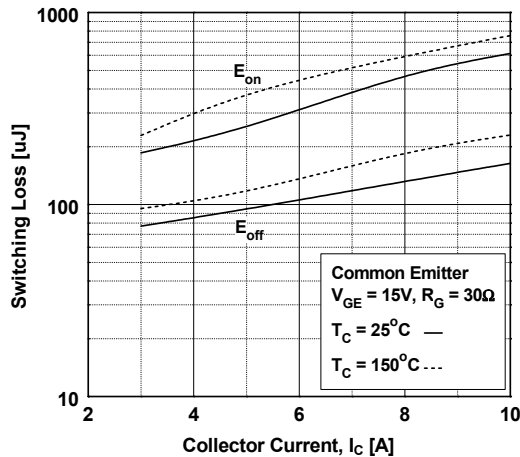
**Figure 15. Turn-off Characteristics VS. Collector Current**



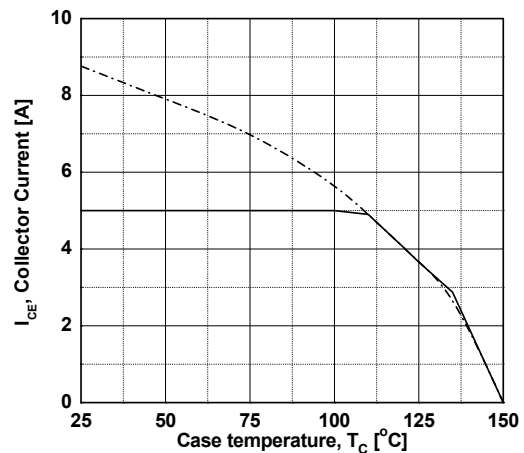
**Figure 16. Switching Loss VS. Gate Resistance**



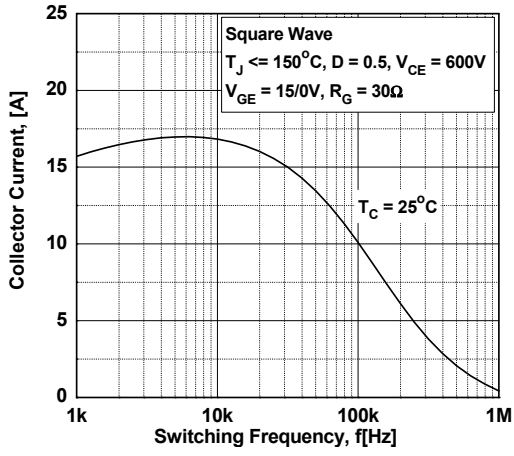
**Figure 17. Switching Loss VS. Collector Current**



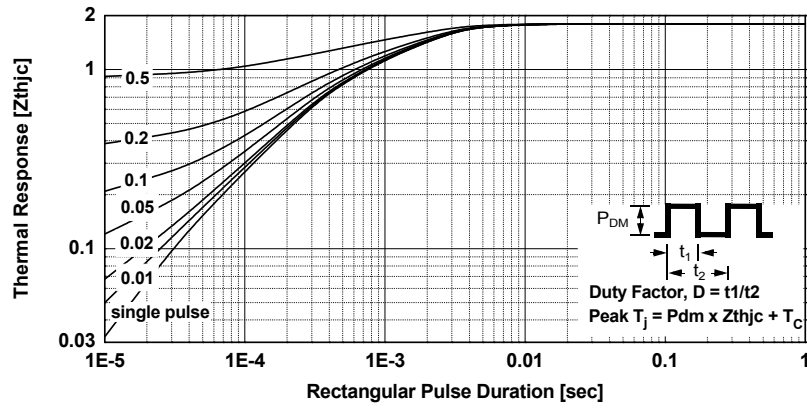
**Figure 18. Current Derating**



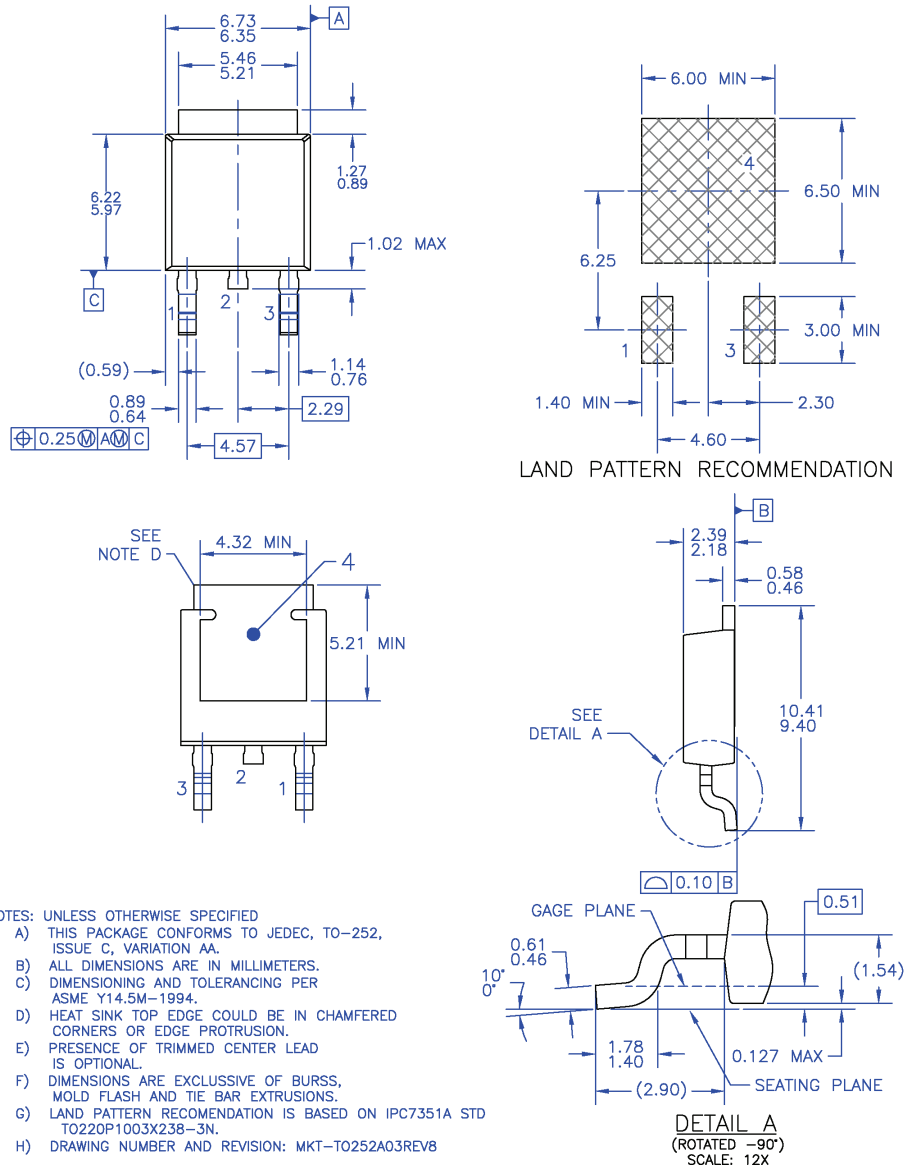
**Figure 19. Load Current Vs. Frequency**



**Figure 20. Transient Thermal Impedance of IGBT**



### Mechanical dimensions



**Figure 21. TO252 (D-PAK), Molded, 3-Lead, Option AA&AB**

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