

# FP7G50US60

## Transfer Molded Type IGBT Module

### General Description

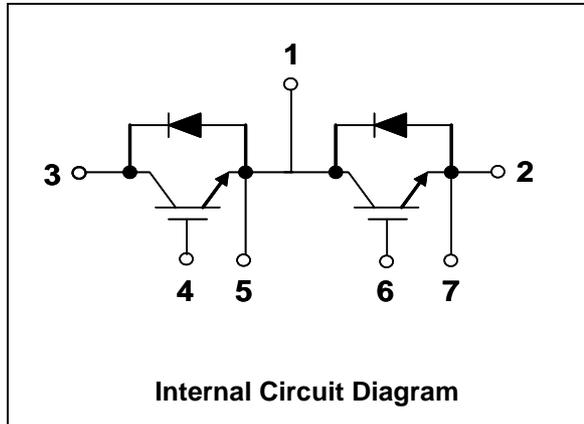
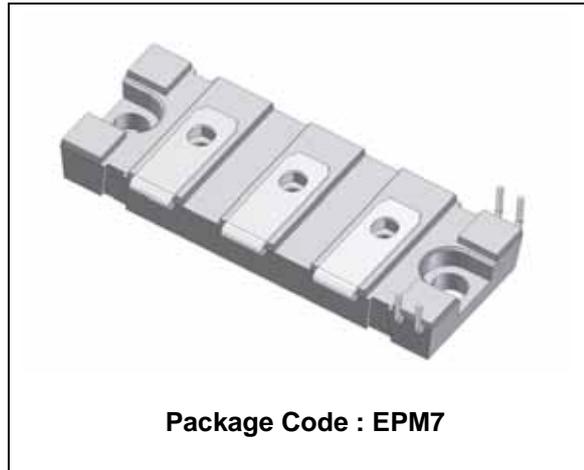
Fairchild's New IGBT Modules ( Transfer Molded Type ) provide low conduction and switching losses as well as short circuit ruggedness. They are designed for applications such as Motor control, Uninterrupted Power Supplies (UPS) and general Inverters where short circuit ruggedness is a required feature.

### Features

- Short Circuit rated 10us @Tc=100°C, Vge=15V
- High Speed Switching
- Low Saturation Voltage : Vce(sat) =2.2V @Ic=50A
- High Input Impedance
- Fast & Soft Anti-Parallel FWD

### Application

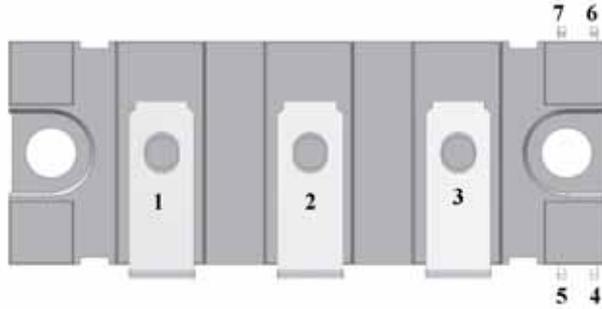
- Welders
- AC & DC Motor Controls
- General Purpose Inverters
- Robotics
- Servo Controls
- UPS



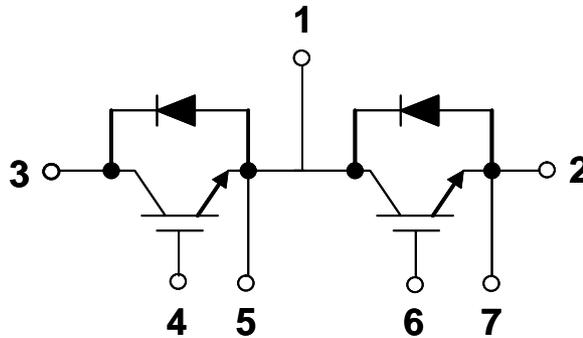
### Absolute Maximum Ratings

Symbol	Description	Rating	Units
V <sub>CES</sub>	Collector-Emitter Voltage	600	V
V <sub>GES</sub>	Gate-Emitter Voltage	± 20	V
I <sub>C</sub>	Collector Current @ T <sub>C</sub> = 25°C	50	A
I <sub>CM(1)</sub>	Pulsed Collector Current	100	A
I <sub>F</sub>	Diode Continuous Forward Current @ T <sub>C</sub> = 100°C	50	A
I <sub>FM</sub>	Diode Maximum Forward Current	100	A
T <sub>SC</sub>	Short Circuit Withstand Time @ T <sub>C</sub> = 100°C	10	us
P <sub>D</sub>	Maximum Power Dissipation @ T <sub>C</sub> = 25°C	250	W
T <sub>J</sub>	Operating Junction Temperature	-40 to +125	°C
T <sub>stg</sub>	Storage Temperature Range	-40 to +125	°C
V <sub>iso</sub>	Isolation Voltage @ AC 1minute	2500	V
Mounting Torque	Power Terminals Screw : M5	2.0	N.m
	Mounting Screw : M5	2.0	N.m

## Pin Configuration and Pin Description



Top View



Internal Circuit Diagram

### Pin Description

Pin Number	Pin Description
1	Emitter of Q1, IGBT, Collector of Q2, IGBT
2	Emitter of Q2, IGBT
3	Collector of Q1, IGBT
4	Gate of Q1, IGBT
5	Emitter of Q1, IGBT
6	Gate of Q2, IGBT
7	Emitter of Q2, IGBT

**Electrical Characteristics** ( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
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**Off Characteristics**

$BV_{CES}$	Collector-Emitter Breakdown Voltage	$V_{GE} = 0V, I_C = 250\mu A$	600	-	-	V
$\frac{\Delta BV_{CES}}{\Delta T_J}$	Temperature Coeff. of Breakdown Voltage	$V_{GE} = 0V, I_C = 1mA$	-	0.6	-	V
$I_{CES}$	Collector Cut-off Current	$V_{CE} = V_{CES}, V_{GE} = 0V$	-	-	250	$\mu A$
$I_{GES}$	Gate-Emitter Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0V$	-	-	$\pm 100$	nA

**On Characteristics**

$V_{GE(th)}$	G-E Threshold Voltage	$V_{GE} = 0V, I_C = 50mA$	5.0	6.0	8.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 50A, V_{GE} = 15V$	-	2.2	2.8	V

**Dynamic Characteristics**

$C_{ies}$	Input Capacitance	$V_{CE} = 30V, V_{GE} = 0V,$ $f = 1MHz$		2920		pF
$C_{oes}$	Output Capacitance			400		pF
$C_{res}$	Reverse Capacitance			75		pF

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300V, I_C = 50A,$ $R_G = 5.9\Omega, V_{GE} = 15V$ Inductive Load, $T_C = 25^\circ\text{C}$	-	58	-	ns
$t_r$	Rise Time		-	40	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	107	-	ns
$t_f$	Fall Time		-	140	-	ns
$E_{on}$	Turn-On Switching Loss		-	0.75	-	mJ
$E_{off}$	Turn-Off Switching Loss		-	0.54	-	mJ
$E_{ts}$	Total Switching Loss		-	1.29	-	mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300V, I_C = 50A,$ $R_G = 5.9\Omega, V_{GE} = 15V$ Inductive Load, $T_C = 125^\circ\text{C}$	-	53	-	ns
$t_r$	Rise Time		-	40	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	106	-	ns
$t_f$	Fall Time		-	274	-	ns
$E_{on}$	Turn-On Switching Loss		-	1.09	-	mJ
$E_{off}$	Turn-Off Switching Loss		-	1.68	-	mJ
$E_{ts}$	Total Switching Loss		-	2.77	-	mJ
$T_{sc}$	Short Circuit Withstand Time	$V_{CC} = 300V, V_{GE} = 15V @ T_C = 100^\circ\text{C}$	10	-	-	$\mu s$
$Q_g$	Total Gate Charge	$V_{CE} = 300V, I_C = 50A, V_{GE} = 15V$	-	136	-	nC
$Q_{ge}$	Gate-Emitter Charge		-	26	-	nC
$Q_{gc}$	Gate-Collector Charge		-	76	-	nC

**Electrical Characteristics of DIODE** ( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Units	
$V_{FM}$	Diode Forward Voltage	$I_F = 50\text{A}$	$T_C = 25^\circ\text{C}$	-	1.9	2.8	V
			$T_C = 100^\circ\text{C}$	-	1.8	-	
$t_{rr}$	Diode Reverse Recovery Time		$T_C = 25^\circ\text{C}$	-	76	100	ns
			$T_C = 100^\circ\text{C}$	-	138		
$I_{rr}$	Diode Peak Reverse Recovery Current	$I_F = 50\text{A}$ $di/dt = 100\text{ A/us}$	$T_C = 25^\circ\text{C}$	-	4	5.2	A
			$T_C = 100^\circ\text{C}$	-	6		
$Q_{rr}$	Diode Reverse Recovery Charge		$T_C = 25^\circ\text{C}$	-	152	260	nC
			$T_C = 100^\circ\text{C}$	-	404		

**Thermal Characteristics**

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case (IGBT Part, per 1/2 Module)	-	0.4	$^\circ\text{C/W}$
$R_{\theta JC}$	Junction-to-Case (DIODE Part, per 1/2 Module)	-	1.0	$^\circ\text{C/W}$
$R_{\theta CS}$	Case-to-Sink (Conductive grease applied)	0.05	-	$^\circ\text{C/W}$
Weight	Weight of Module	-	90	g

## Typical Performance Characteristics

Fig 1. Typical Output Characteristics

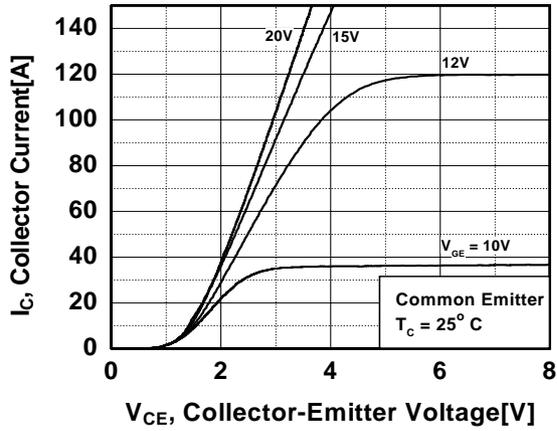


Fig 2. Typical Saturation Voltage Characteristics

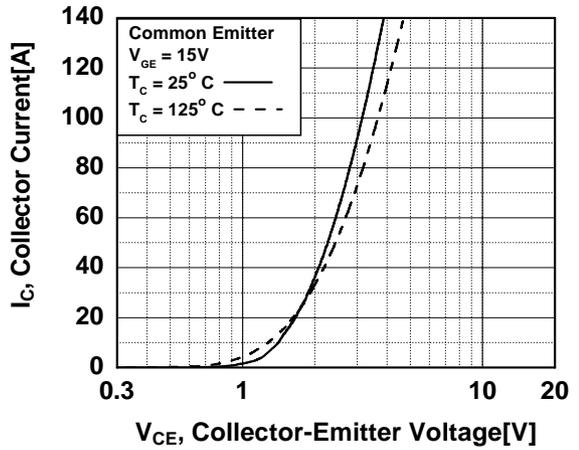


Fig 3. Saturation Voltage vs. Case Temperature at Variant Current Level

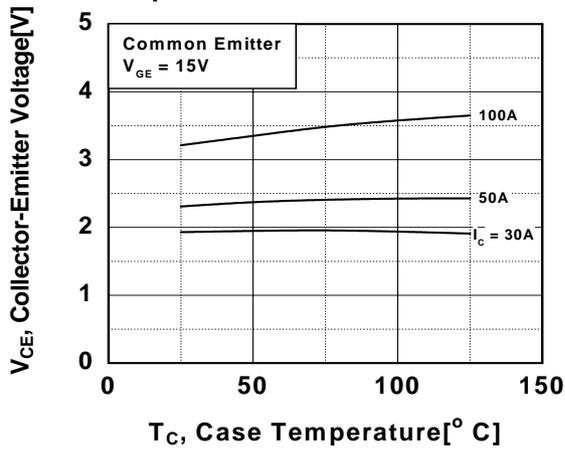


Fig 4. Load Current vs. Frequency

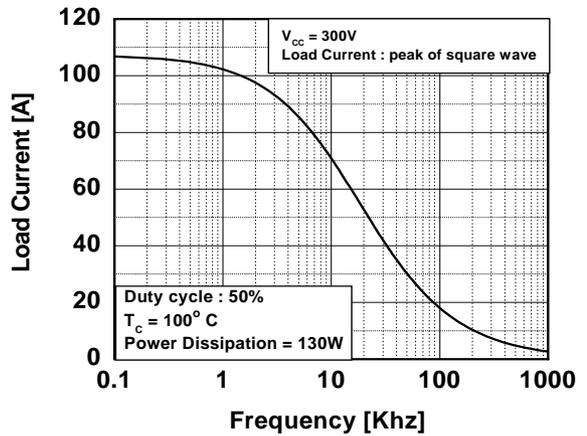


Fig 5. Saturation Voltage vs.  $V_{GE}$

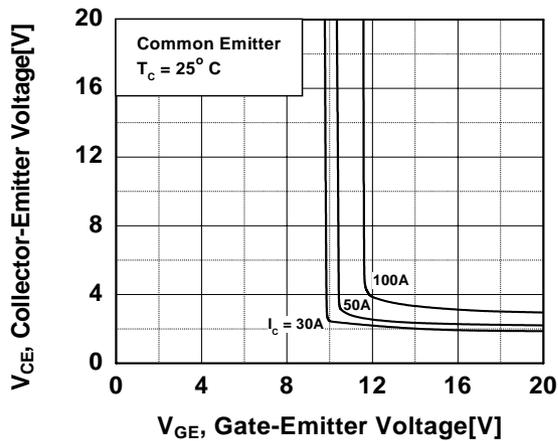
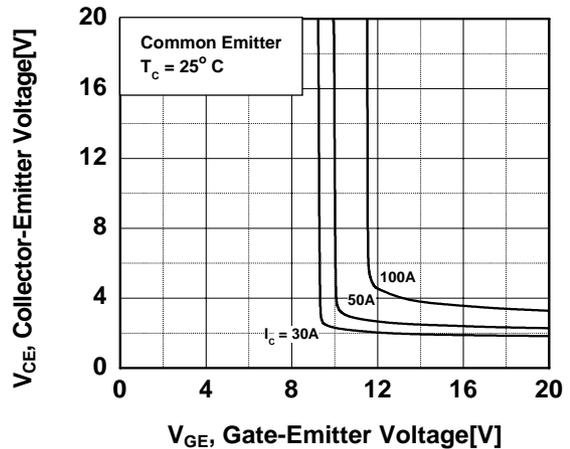
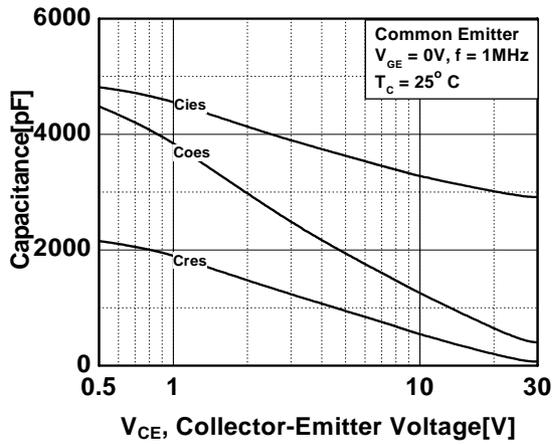


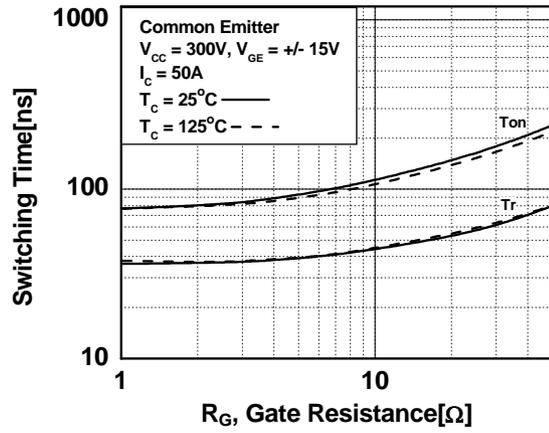
Fig 6. Saturation Voltage vs.  $V_{GE}$



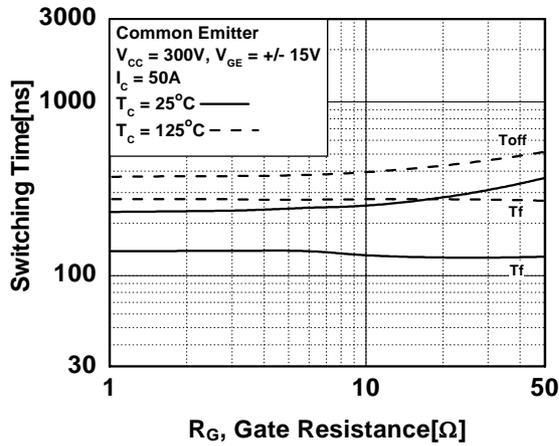
**Fig 7. Capacitance Characteristics**



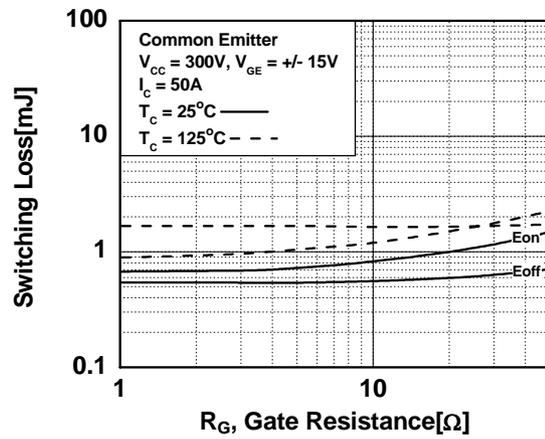
**Fig 8. Turn-On Characteristics vs. Gate Resistance**



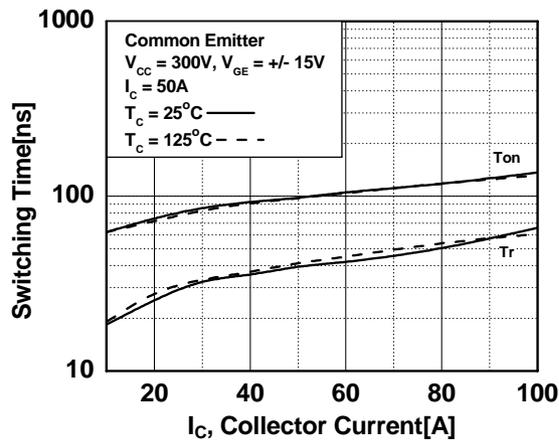
**Fig 9. Turn-Off Characteristics vs. Gate Resistance**



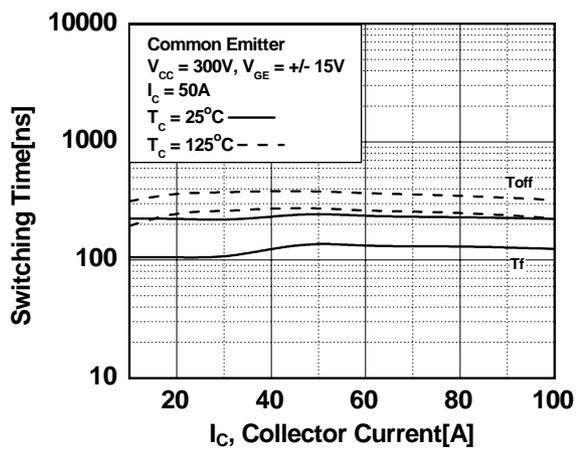
**Fig 10. Switching Loss vs. Gate Resistance**



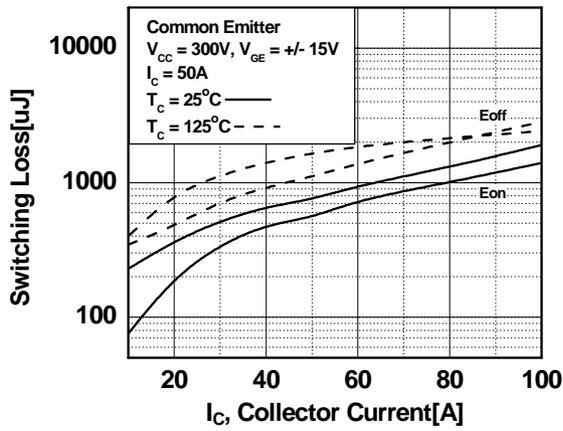
**Fig 11. Turn-On Characteristics vs. Collector Current**



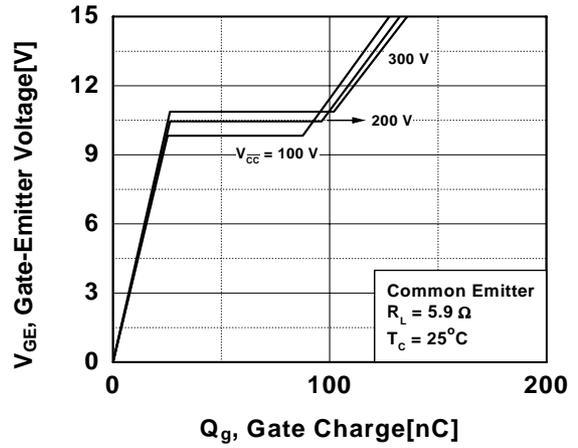
**Fig 12. Turn-Off Characteristics vs. Collector Current**



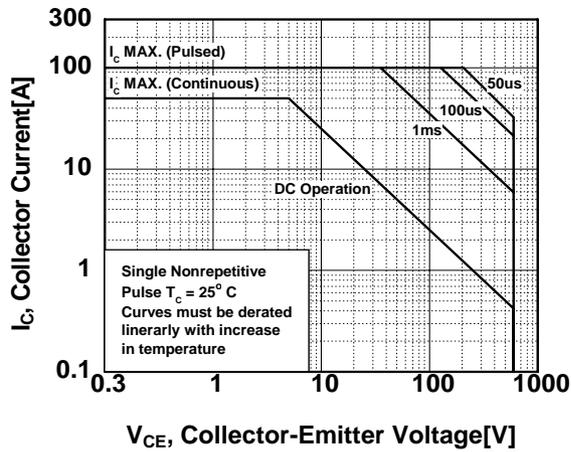
**Fig 13. Switching Loss vs. Collector**



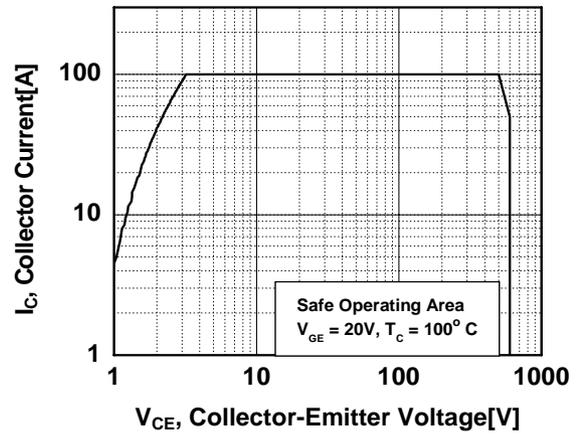
**Fig 14. Gate Charge Characteristics**



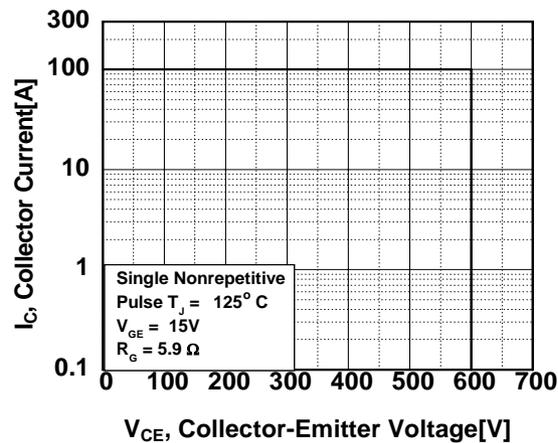
**Fig 15. SOA Characteristics**



**Fig 16. Turn-Off SOA Characteristics**



**Fig 17. RBSOA Characteristics**



**Fig 18. Transient Thermal Impedance**

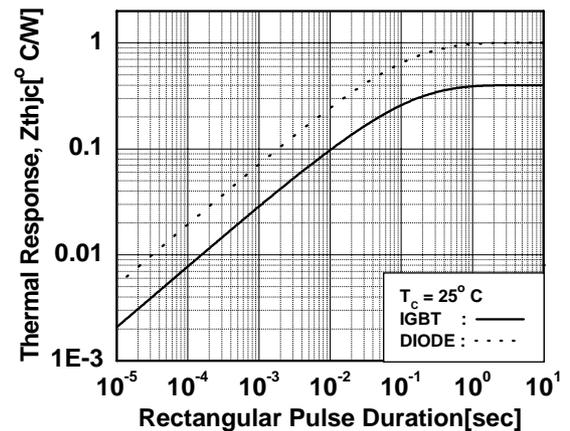


Fig 19. Forward Characteristics

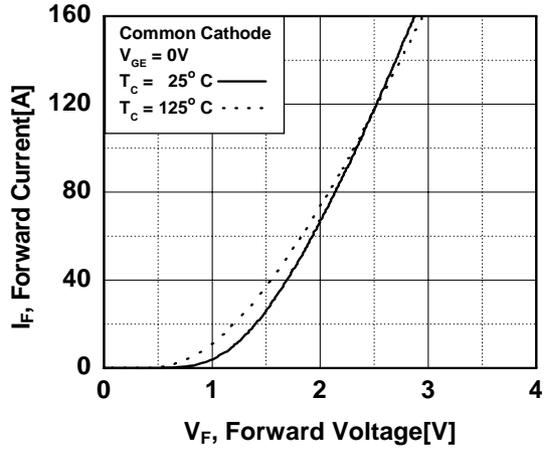
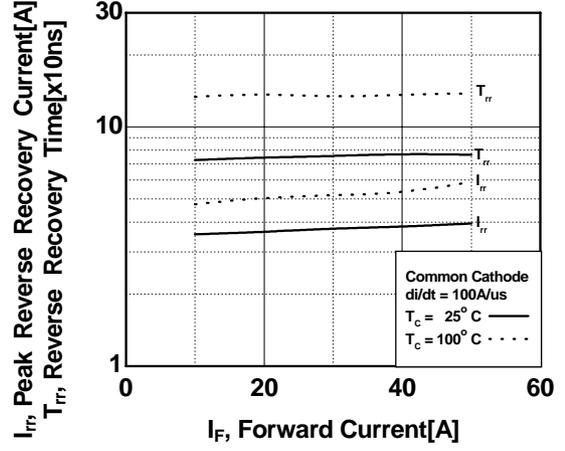
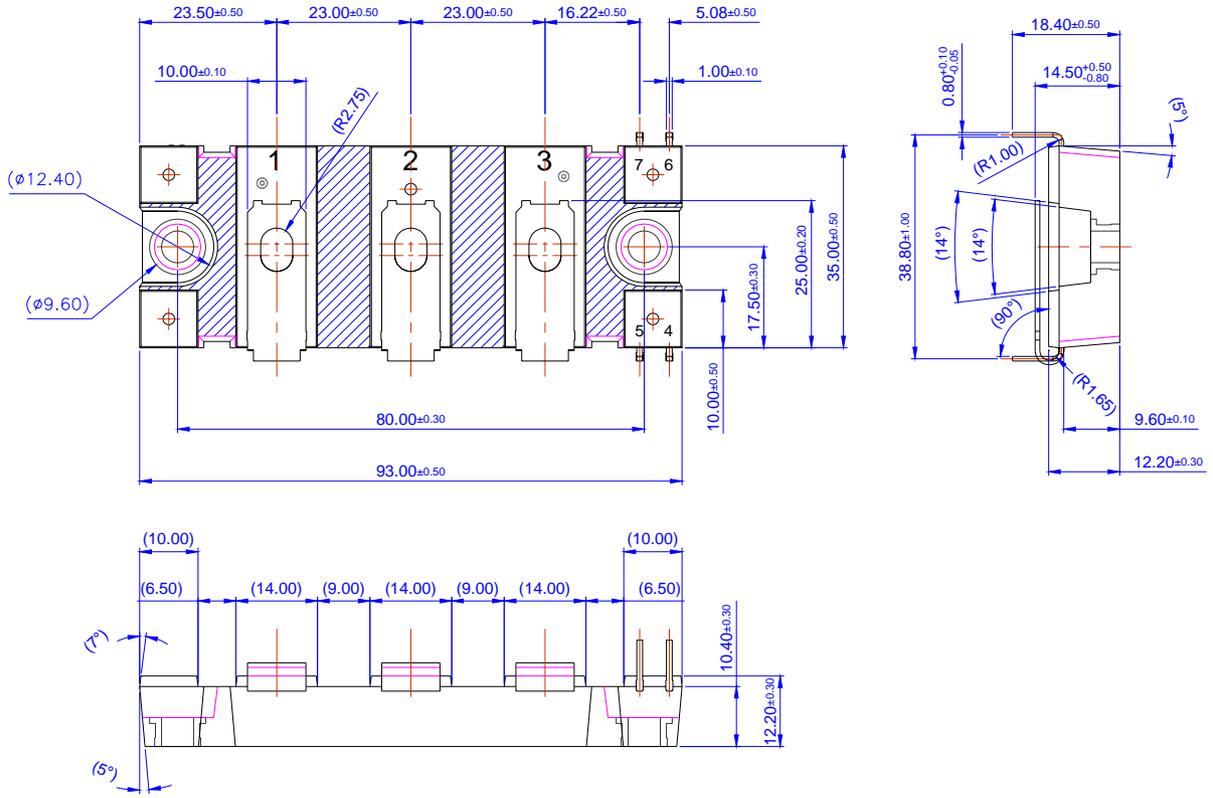


Fig 20. Reverse Recovery Characteristics







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