

# IGBT – Power, Co-PAK

## N-Channel, Field Stop VII (FS7), Non SCR, Power TO247-3L, 1200 V, 1.7 V, 75 A

### FGY75T120SWD

#### Description

Using the novel field stop 7<sup>th</sup> generation IGBT technology and the Gen7 Diode in TP247 3-lead package, FGY75T120SWD offers the optimum performance with low switching and conduction losses for high-efficiency operations in various applications like Solar, UPS and ESS.

#### Features

- Maximum Junction Temperature –  $T_J = 175^\circ\text{C}$
- Positive Temperature Coefficient for Easy Parallel Operation
- High Current Capability
- Smooth and Optimized Switching
- Low Switching Loss
- RoHS Compliant

#### Applications

- Boost and Inverter in Solar System
- UPS
- Energy Storage System

#### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

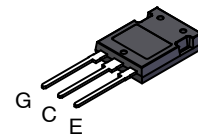
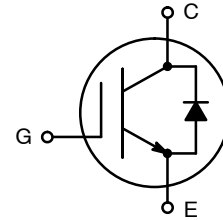
Parameter	Symbol	Value	Unit
Collector to Emitter Voltage	$V_{CES}$	1200	V
Gate to Emitter Voltage	$V_{GES}$	$\pm 20$	V
Transient Gate to Emitter Voltage		$\pm 30$	
Collector Current	$I_C$	$T_C = 25^\circ\text{C}$	A
		$T_C = 100^\circ\text{C}$	
Power Dissipation	$P_D$	$T_C = 25^\circ\text{C}$	W
		$T_C = 100^\circ\text{C}$	
Pulsed Collector Current	$I_{CM}$	300	A
Diode Forward Current	$I_F$	$T_C = 25^\circ\text{C}$	A
		$T_C = 100^\circ\text{C}$	
Pulsed Diode Maximum Forward Current	$I_{FM}$	300	A
Operating Junction and Storage Temperature	$T_J, T_{STG}$	-55 to 175	$^\circ\text{C}$
Lead Temperature for Soldering Purposes	$T_L$	260	$^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Repetitive rating: pulse width limited by max. Junction temperature.

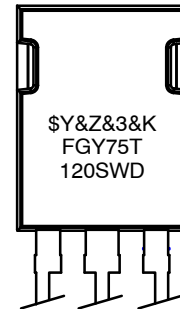
$BV_{CES}$	$V_{CE(SAT)}$	$I_C$
1200 V	1.7 V	75.0 A

#### PIN CONNECTIONS



TO247-3LD  
CASE 340CD

#### MARKING DIAGRAM



\$Y = onsemi Logo  
 &Z = Assembly Plant Code  
 &3 = 3-Digit Date Code  
 &K = 2-Digit Lot Traceability Code  
 FGY75T120SWD = Specific Device code

#### ORDERING INFORMATION

Device	Package	Shipping
FGY75T120SWD	TO247-3LD (Pb-Free)	30 Units / Tube

# FGY75T120SWD

## THERMAL CHARACTERISTICS

Parameter	Symbol	Max Value	Unit
Thermal Resistance, Junction to Case for IGBT	$R_{\theta JC}$	0.3	°C/W
Thermal Resistance, Junction to Case for Diode		0.4	
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	40	

## ELECTRICAL CHARACTERISTICS OF THE IGBT ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Collector to Emitter Breakdown Voltage	$BV_{CES}$	$V_{GE} = 0\text{ V}, I_C = 5\text{ mA}$	1200	-	-	V
Breakdown Voltage Temperature Coefficient	$\Delta BV_{CES} / \Delta T_J$	$V_{GE} = 0\text{ V}, I_C = 5\text{ mA}$	-	666	-	mV/°C
Collector to Emitter Cut-Off Current	$I_{CES}$	$V_{GE} = 0\text{ V}, V_{CE} = V_{CES}$	-	-	40	μA
Gate to Emitter Leakage Current	$I_{GES}$	$V_{GE} = 20\text{ V}, V_{CE} = 0\text{ V}$	-	-	±400	nA

### ON CHARACTERISTICS

Gate to Emitter Threshold Voltage	$V_{GE(TH)}$	$V_{GE} = V_{CE}, I_C = 75\text{ mA}$	5.6	6.55	7.4	V
Collector to Emitter Saturation Voltage	$V_{CE(SAT)}$	$V_{GE} = 15\text{ V}, I_C = 75\text{ A}, T_J = 25^\circ\text{C}$	-	1.68	-	V
		$V_{GE} = 15\text{ V}, I_C = 75\text{ A}, T_J = 175^\circ\text{C}$	-	2.24	-	

### DYNAMIC CHARACTERISTICS

Input Capacitance	$C_{IES}$	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	-	6331	-	pF
Output Capacitance	$C_{OES}$		-	234	-	
Reverse Transfer Capacitance	$C_{RES}$		-	29.6	-	
Total Gate Charge	$Q_G$	$V_{CE} = 600\text{ V}, V_{GE} = 15\text{ V}, I_C = 75\text{ A}$	-	214	-	nC
Gate to Emitter Charge	$Q_{GE}$		-	53.9	-	
Gate to Collector Charge	$Q_{GC}$		-	77.7	-	

### SWITCHING CHARACTERISTIC, INDUCTIVE LOAD

Turn-On Delay Time	$t_{d(on)}$	$V_{CE} = 600\text{ V}, V_{GE} = 15\text{ V}, I_C = 37.5\text{ A}, R_G = 4.7\ \Omega, T_J = 25^\circ\text{C}$	-	42	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	221	-	ns
Rise Time	$t_r$		-	27	-	ns
Fall Time	$t_f$		-	77	-	
Turn-On Switching Loss	$E_{on}$		-	2.12	-	mJ
Turn-Off Switching Loss	$E_{off}$		-	1.43	-	
Total Switching Loss	$E_{ts}$		-	3.55	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{CE} = 600\text{ V}, V_{GE} = 15\text{ V}, I_C = 75\text{ A}, R_G = 4.7\ \Omega, T_J = 25^\circ\text{C}$	-	42	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	171	-	ns
Rise Time	$t_r$		-	56	-	ns
Fall Time	$t_f$		-	66	-	
Turn-On Switching Loss	$E_{on}$		-	5.00	-	mJ
Turn-Off Switching Loss	$E_{off}$		-	2.32	-	
Total Switching Loss	$E_{ts}$		-	7.32	-	

# FGY75T120SWD

## ELECTRICAL CHARACTERISTICS OF THE IGBT ( $T_J = 25^\circ\text{C}$ unless otherwise noted) (continued)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
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### SWITCHING CHARACTERISTIC, INDUCTIVE LOAD

Turn-On Delay Time	$t_{d(on)}$	$V_{CE} = 600\text{ V}, V_{GE} = 15\text{ V},$ $I_C = 37.5\text{ A}, R_G = 4.7\ \Omega,$ $T_J = 175^\circ\text{C}$	-	38	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	276	-	ns
Rise Time	$t_r$		-	26	-	ns
Fall Time	$t_f$		-	132	-	
Turn-On Switching Loss	$E_{on}$		-	3.50	-	mJ
Turn-Off Switching Loss	$E_{off}$		-	2.31	-	
Total Switching Loss	$E_{ts}$	-	5.81	-		
Turn-On Delay Time	$t_{d(on)}$	$V_{CE} = 600\text{ V}, V_{GE} = 15\text{ V},$ $I_C = 75\text{ A}, R_G = 4.7\ \Omega,$ $T_J = 175^\circ\text{C}$	-	38	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	210	-	ns
Rise Time	$t_r$		-	53	-	ns
Fall Time	$t_f$		-	115	-	
Turn-On Switching Loss	$E_{on}$		-	7.29	-	mJ
Turn-Off Switching Loss	$E_{off}$		-	3.50	-	
Total Switching Loss	$E_{ts}$	-	10.79	-		

### DIODE CHARACTERISTIC

Diode Forward Voltage	$V_F$	$I_F = 75\text{ A}, T_J = 25^\circ\text{C}$	-	1.84	-	V
		$I_F = 75\text{ A}, T_J = 175^\circ\text{C}$	-	1.91	-	

### DIODE SWITCHING CHARACTERISTIC, INDUCTIVE LOAD

Reverse Recovery Time	$t_{rr}$	$V_R = 600\text{ V}, I_F = 37.5\text{ A},$ $di_F/dt = 500\text{ A}/\mu\text{s},$ $T_J = 25^\circ\text{C}$	-	233	-	ns
Reverse Recovery Charge	$Q_{rr}$		-	2343	-	nC
Reverse Recovery Energy	$E_{rec}$		-	0.8	-	mJ
Peak Reverse Recovery Current	$I_{RRM}$		-	20.2	-	A
Reverse Recovery Time	$t_{rr}$	$V_R = 600\text{ V}, I_F = 75\text{ A},$ $di_F/dt = 500\text{ A}/\mu\text{s},$ $T_J = 25^\circ\text{C}$	-	307	-	nS
Reverse Recovery Charge	$Q_{rr}$		-	3285	-	nC
Reverse Recovery Energy	$E_{rec}$		-	1	-	mJ
Peak Reverse Recovery Current	$I_{RRM}$		-	21.4	-	A
Reverse Recovery Time	$t_{rr}$	$V_R = 600\text{ V}, I_F = 37.5\text{ A},$ $di_F/dt = 500\text{ A}/\mu\text{s},$ $T_J = 175^\circ\text{C}$	-	407	-	ns
Reverse Recovery Charge	$Q_{rr}$		-	5965	-	nC
Reverse Recovery Energy	$E_{rec}$		-	2	-	mJ
Peak Reverse Recovery Current	$I_{RRM}$		-	29.4	-	A
Reverse Recovery Time	$t_{rr}$	$V_R = 600\text{ V}, I_F = 75\text{ A},$ $di_F/dt = 500\text{ A}/\mu\text{s},$ $T_J = 175^\circ\text{C}$	-	541	-	ns
Reverse Recovery Charge	$Q_{rr}$		-	8974	-	nC
Reverse Recovery Energy	$E_{rec}$		-	4	-	mJ
Peak Reverse Recovery Current	$I_{RRM}$		-	33.2	-	A

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

# FGY75T120SWD

## TYPICAL CHARACTERISTICS

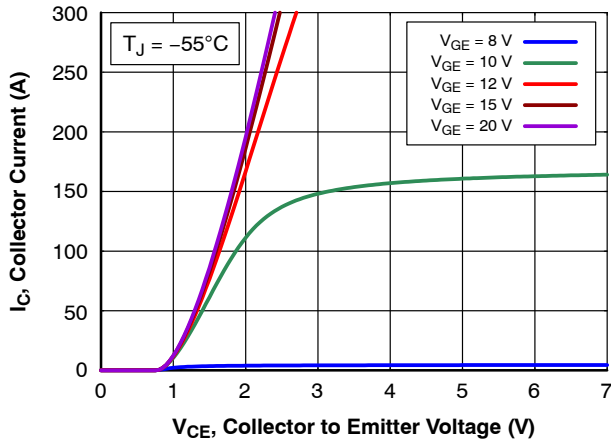


Figure 1. Output Characteristics

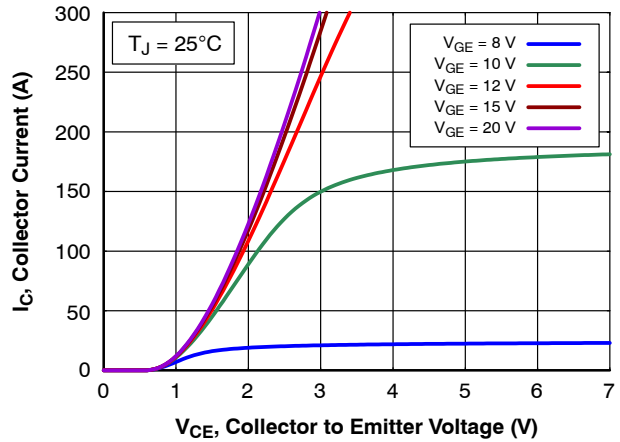


Figure 2. Output Characteristics

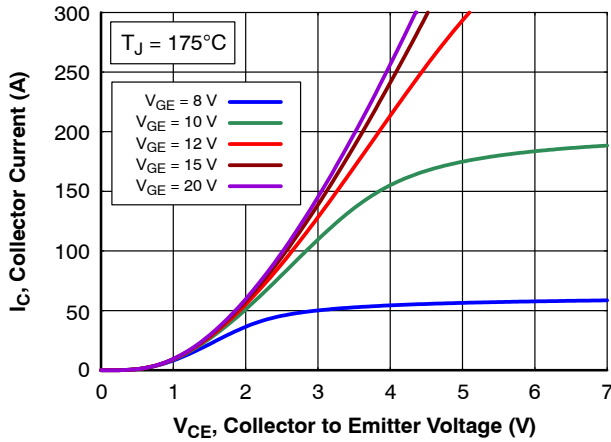


Figure 3. Output Characteristics

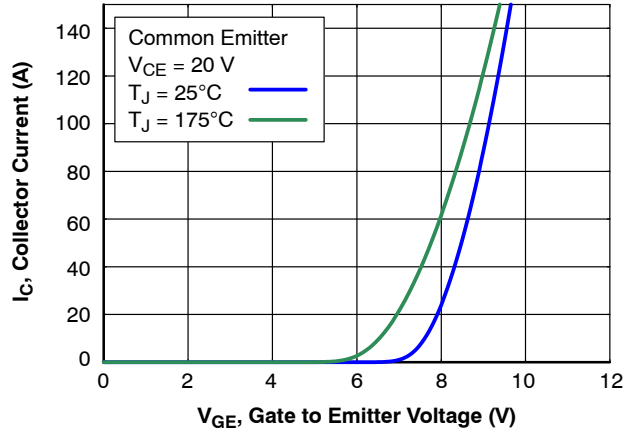


Figure 4. Transfer Characteristics

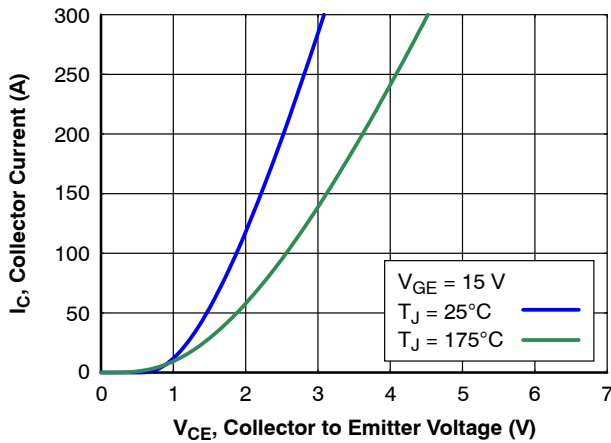


Figure 5. Saturation Voltage Characteristics

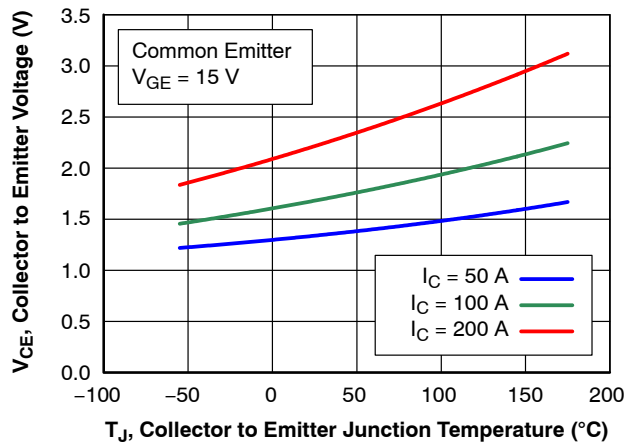


Figure 6. Saturation Voltage vs Junction Temperature

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## TYPICAL CHARACTERISTICS (CONTINUED)

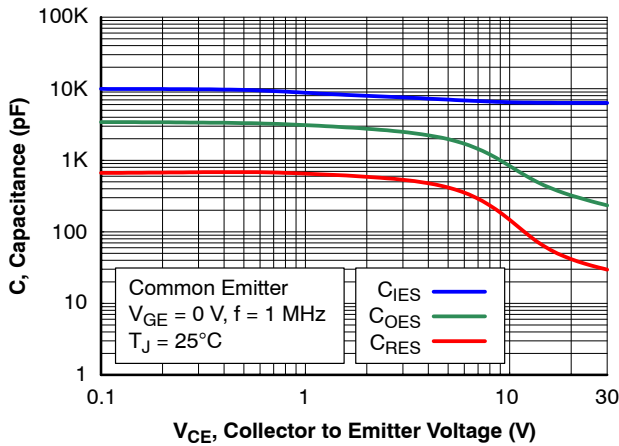


Figure 7. Capacitance Characteristics

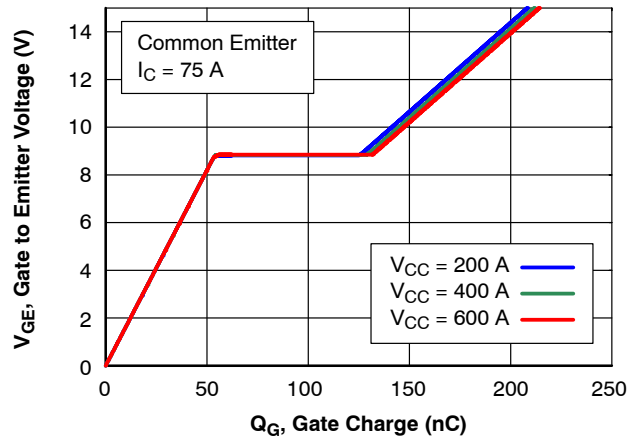


Figure 8. Gate Charge Characteristics

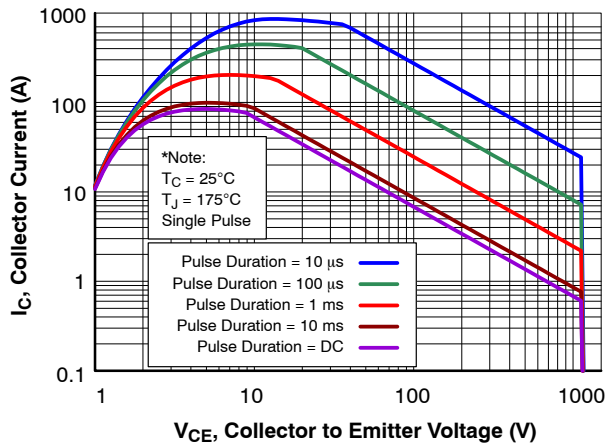


Figure 9. SOA Characteristics

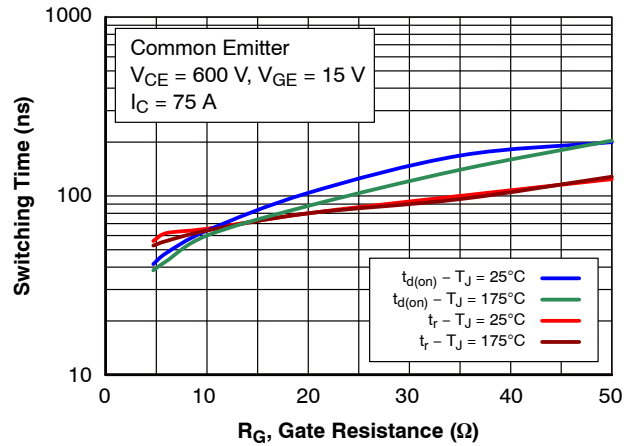


Figure 10. Turn-On Time vs Gate Resistance

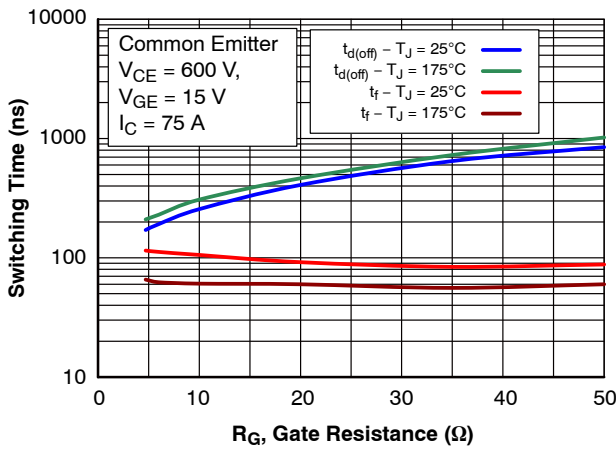


Figure 11. Turn-Off Time vs Gate Resistance

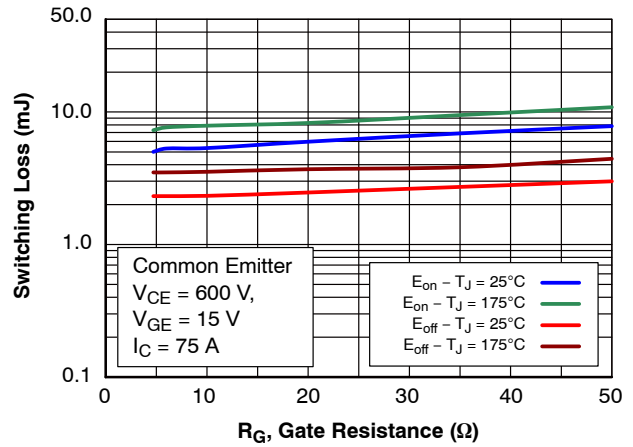


Figure 12. Switching Loss vs Gate Resistance

# FGY75T120SWD

## TYPICAL CHARACTERISTICS (CONTINUED)

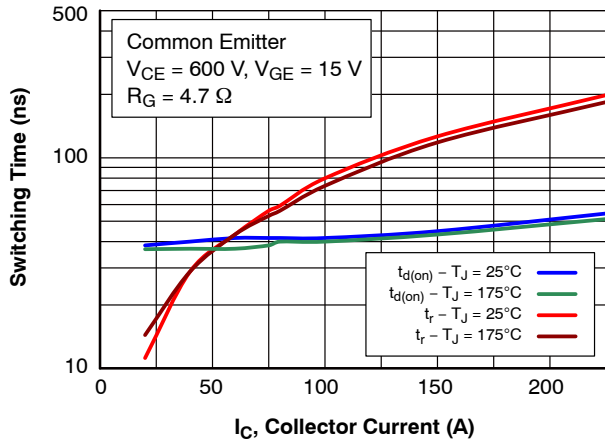


Figure 13. Turn-On Time vs Collector Current

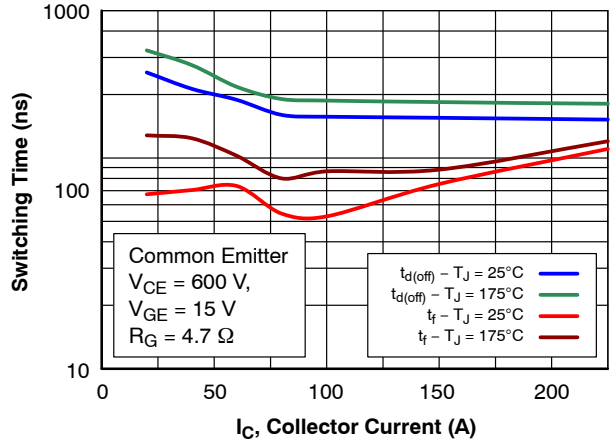


Figure 14. Turn-Off Time vs Collector Current

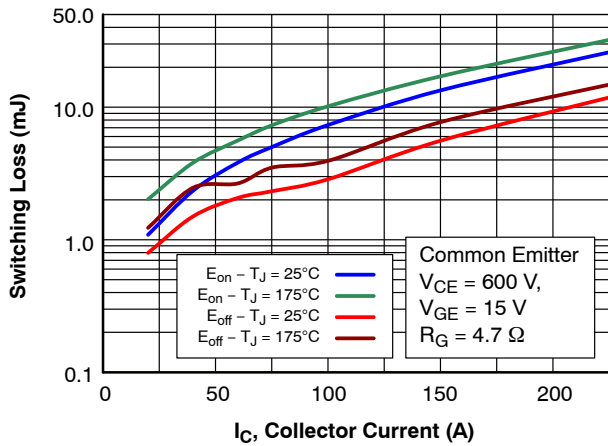


Figure 15. Switching Loss vs Collector Current

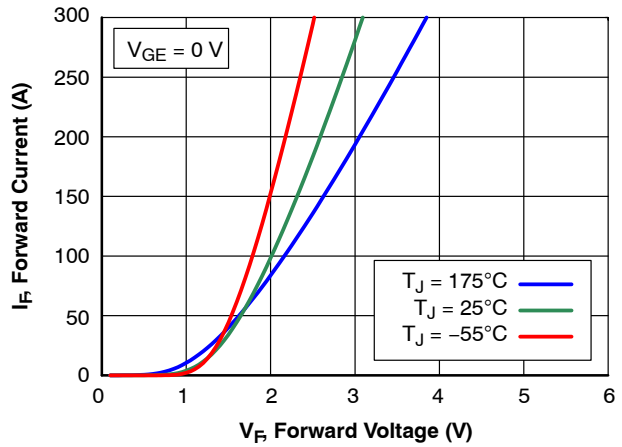


Figure 16. Diode Forward Characteristics

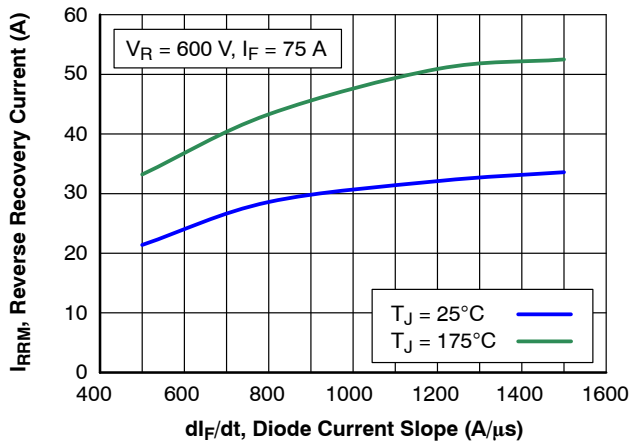


Figure 17. Diode Reverse Recovery Current

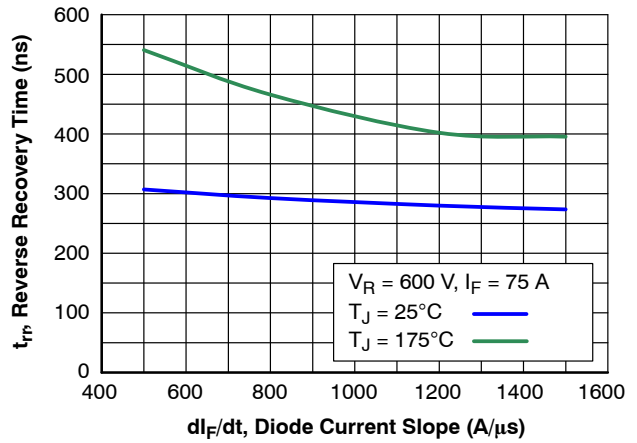


Figure 18. Diode Reverse Recovery Time

# FGY75T120SWD

## TYPICAL CHARACTERISTICS (CONTINUED)

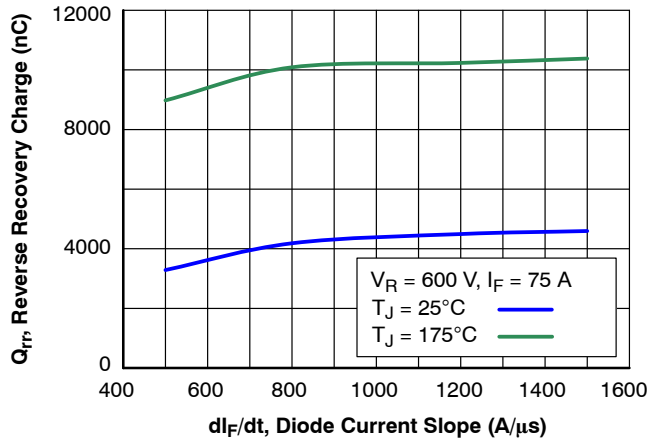


Figure 19. Diode Stored Charge Characteristics

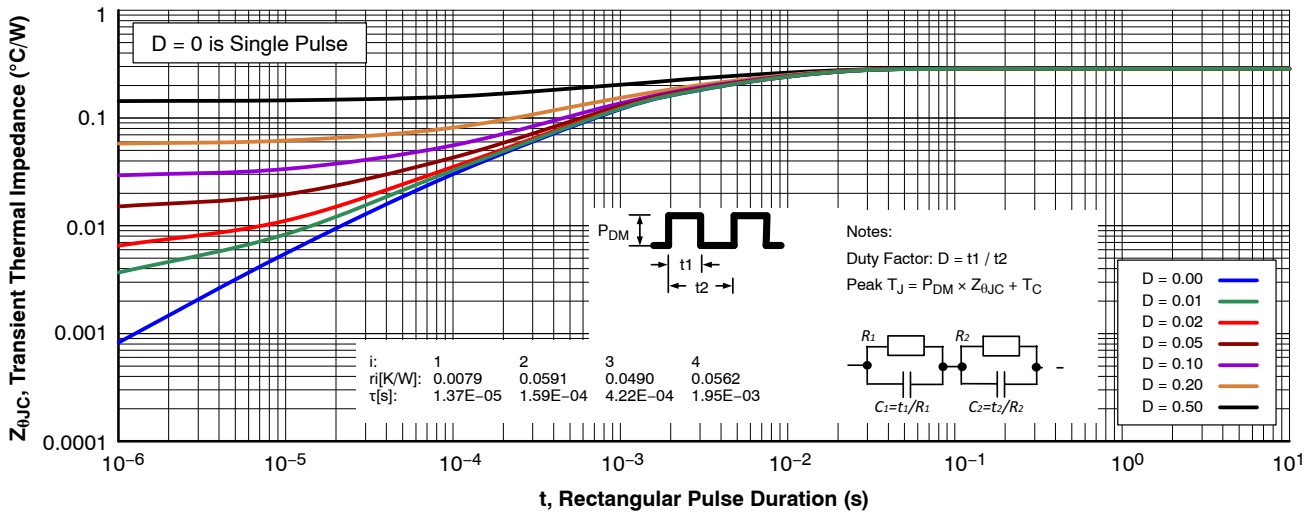


Figure 20. Transient Thermal Impedance of IGBT

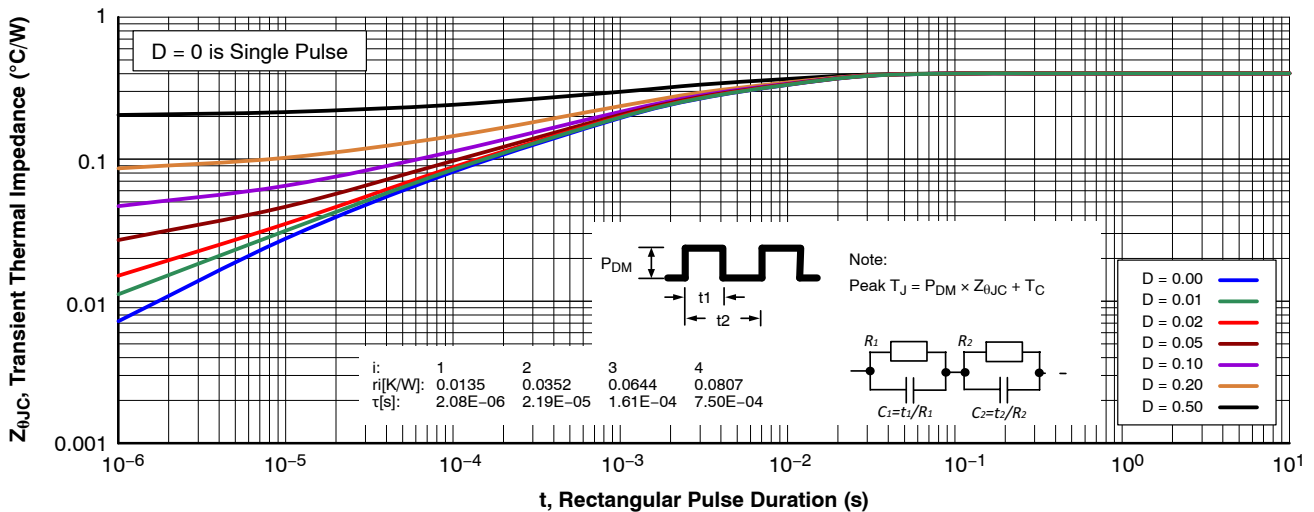


Figure 21. Transient Thermal Impedance of Diode

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



TO-247-3LD  
CASE 340CD  
ISSUE A

DATE 18 SEP 2018

**NOTES:**

- A. THIS PACKAGE DOES NOT CONFORM TO ANY STANDARDS.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- D. DIMENSION AND TOLERANCE AS PER ASME Y14.5-2009.



DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.80	2.00	2.20
D	20.32	20.57	20.82
E	15.37	15.62	15.87
E2	4.12	4.32	4.52
e	~	5.45	~
L	19.90	20.00	20.10
L1	3.69	3.81	3.93
Q	5.34	5.46	5.58
b	1.10	1.20	1.30
b2	2.10	2.24	2.39
b4	2.87	3.04	3.20
c	0.51	0.61	0.71
D1	16.63	16.83	17.03
D2	0.51	0.93	1.35
E1	13.40	13.60	13.80

**GENERIC MARKING DIAGRAM\***



- XXXX = Specific Device Code
- A = Assembly Location
- Y = Year
- WW = Work Week
- G = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

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