

IGBT - Power, Co-PAK **N-Channel, Field Stop VII** **(FS7), Non-SCR, TO247-3L** **1200 V, 1.7 V, 60 A** **FGY60T120SWD**

Description

Using the novel field stop 7th generation IGBT technology and the Gen7 Diode in TO247 3-lead package, FGY60T120SWD 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)

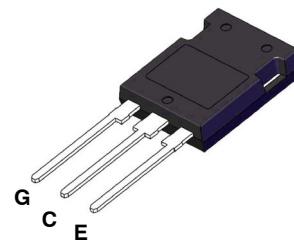
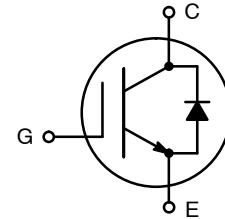
Parameter	Symbol	Value	Unit
Collector-to-Emitter Voltage	V_{CES}	1200	V
Gate-to-Emitter Voltage	V_{GES}	± 20	V
Transient Gate-to-Emitter Voltage		± 30	V
Collector Current	$T_C = 25^\circ\text{C}$ (Note 1)	I_C	A
		105	
	$T_C = 100^\circ\text{C}$	60	
Power Dissipation	$T_C = 25^\circ\text{C}$	P_D	W
	$T_C = 100^\circ\text{C}$	635	
		317	
Pulsed Collector Current	$T_C = 25^\circ\text{C}$, $t_p = 10 \mu\text{s}$ (Note 2)	I_{CM}	A
Diode Forward Current	$T_C = 25^\circ\text{C}$	I_F	A
	$T_C = 100^\circ\text{C}$	120	
		60	
Pulsed Diode Maximum Forward Current	$T_C = 25^\circ\text{C}$, $t_p = 10 \mu\text{s}$ (Note 2)	I_{FM}	A
Operating Junction and Storage Temperature Range	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. Value limit by bond wire
2. Repetitive rating: Pulse width limited by max. Junction temperature

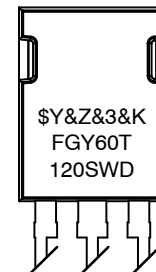
BV_{CES}	$V_{CE(SAT)}$	I_C
1200 V	1.7 V	60 A

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
 FGY60T120SWD = Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping
FGY60T120SWD	TO-247-3LD (Pb-Free)	30 Units / Tube

FGY60T120SWD

THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case for IGBT	$R_{\theta JC}$	0.24	°C/W
Thermal Resistance, Junction-to-Case for Diode		0.41	
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	40	

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

Parameter	Symbol	Test Condition	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
Collector-to-Emitter Breakdown Voltage Temperature Coefficient	$\Delta BV_{CES} / \Delta T_J$			1225		mV/°C
Zero Gate Voltage Collector 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 Threshold Voltage	$V_{GE(TH)}$	$V_{GE} = V_{CE}, I_C = 60\text{ mA}$	5.6	6.55	7.4	V
Collector-to-Emitter Saturation Voltage	$V_{CE(SAT)}$	$V_{GE} = 15\text{ V}, I_C = 60\text{ A}, T_J = 25^\circ\text{C}$	1.35	1.68	2.0	
		$V_{GE} = 15\text{ V}, I_C = 60\text{ A}, T_J = 175^\circ\text{C}$		2.25		

DYNAMIC CHARACTERISTICS

Input Capacitance	C_{IES}	$V_{GE} = 0\text{ V}, V_{CE} = 30\text{ V}, f = 1\text{ MHz}$		5093		pF
Output Capacitance	C_{OES}			193		
Reverse Transfer Capacitance	C_{RES}			25.2		
Total Gate Charge	Q_G	$V_{CE} = 600\text{ V}, V_{GE} = 15\text{ V}, I_C = 60\text{ A}$		174		nC
Gate-to-Emitter Charge	Q_{GE}			43.4		
Gate-to-Collector Charge	Q_{GC}			65.1		

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(on)}$	$V_{CE} = 600\text{ V}, V_{GE} = 0/15\text{ V}, I_C = 30\text{ A}, R_G = 4.7\ \Omega, T_J = 25^\circ\text{C}$		30.4		ns
Turn-Off Delay Time	$t_{d(off)}$			146.4		
Rise Time	t_r			15.2		
Fall Time	t_f			68		
Turn-On Switching Loss	E_{on}			1.6		
Turn-Off Switching Loss	E_{off}	$V_{CE} = 600\text{ V}, V_{GE} = 0/15\text{ V}, I_C = 60\text{ A}, R_G = 4.7\ \Omega, T_J = 25^\circ\text{C}$		0.9		mJ
Total Switching Loss	E_{ts}			2.6		
Turn-On Delay Time	$t_{d(on)}$			31.2		ns
Turn-Off Delay Time	$t_{d(off)}$			130		
Rise Time	t_r			40.8		
Fall Time	t_f			68.8		
Turn-On Switching Loss	E_{on}			4		mJ
Turn-Off Switching Loss	E_{off}			1.9		
Total Switching Loss	E_{ts}			5.8		

FGY60T120SWD

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Turn-On Delay Time	$t_{d(on)}$	$V_{GE} = 0/15\text{ V}, I_C = 30\text{ A}, V_{CE} = 600\text{ V}, R_G = 4.7\ \Omega, T_J = 175^\circ\text{C}$		27.2		ns
Turn-Off Delay Time	$t_{d(off)}$			168		
Rise Time	t_r			16		
Fall Time	t_f			102.4		
Turn-On Switching Loss	E_{on}			2.6		mJ
Turn-Off Switching Loss	E_{off}			1.2		
Total Switching Loss	E_{ts}			3.8		
Turn-On Delay Time	$t_{d(on)}$	$V_{GE} = 0/15\text{ V}, I_C = 60\text{ A}, V_{CE} = 600\text{ V}, R_G = 4.7\ \Omega, T_J = 175^\circ\text{C}$		28.8		ns
Turn-Off Delay Time	$t_{d(off)}$			153.6		
Rise Time	t_r			38.4		
Fall Time	t_f			120		
Turn-On Switching Loss	E_{on}			5.7		mJ
Turn-Off Switching Loss	E_{off}			2.8		
Total Switching Loss	E_{ts}			8.5		

DIODE CHARACTERISTICS

Forward Voltage	V_F	$I_F = 60\text{ A}, T_J = 25^\circ\text{C}$	1.62	1.91	2.22	V
		$I_F = 60\text{ A}, T_J = 175^\circ\text{C}$		2		

DIODE SWITCHING CHARACTERISTIC, INDUCTIVE LOAD

Reverse Recovery Time	t_{rr}	$V_R = 600\text{ V}, I_F = 30\text{ A}, dI_F/dt = 1000\text{ A}/\mu\text{s}, T_J = 25^\circ\text{C}$		143		ns
Reverse Recovery Charge	Q_{rr}			2262		nC
Reverse Recovery Energy	E_{rec}			0.7		mJ
Peak Reverse Recovery Current	I_{RRM}			32		A
Reverse Recovery Time	t_{rr}	$V_R = 600\text{ V}, I_F = 60\text{ A}, dI_F/dt = 1000\text{ A}/\mu\text{s}, T_J = 25^\circ\text{C}$		200		ns
Reverse Recovery Charge	Q_{rr}			3486		nC
Reverse Recovery Energy	E_{rec}			1.1		mJ
Peak Reverse Recovery Current	I_{RRM}			35		A
Reverse Recovery Time	t_{rr}	$V_R = 600\text{ V}, I_F = 30\text{ A}, dI_F/dt = 1000\text{ A}/\mu\text{s}, T_J = 175^\circ\text{C}$		221		ns
Reverse Recovery Charge	Q_{rr}			4908		nC
Reverse Recovery Energy	E_{rec}			1.7		mJ
Peak Reverse Recovery Current	I_{RRM}			44		A
Reverse Recovery Time	t_{rr}	$V_R = 600\text{ V}, I_F = 60\text{ A}, dI_F/dt = 1000\text{ A}/\mu\text{s}, T_J = 175^\circ\text{C}$		334		ns
Reverse Recovery Charge	Q_{rr}			8665		nC
Reverse Recovery Energy	E_{rec}			3.1		mJ
Peak Reverse Recovery Current	I_{RRM}			52		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.

FGY60T120SWD

TYPICAL CHARACTERISTICS

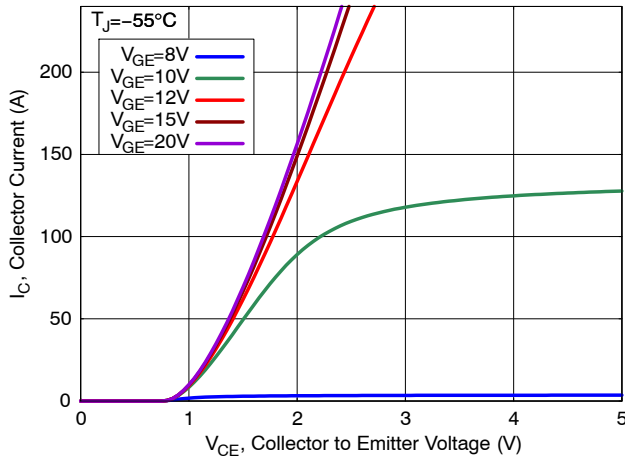


Figure 1. Output Characteristics

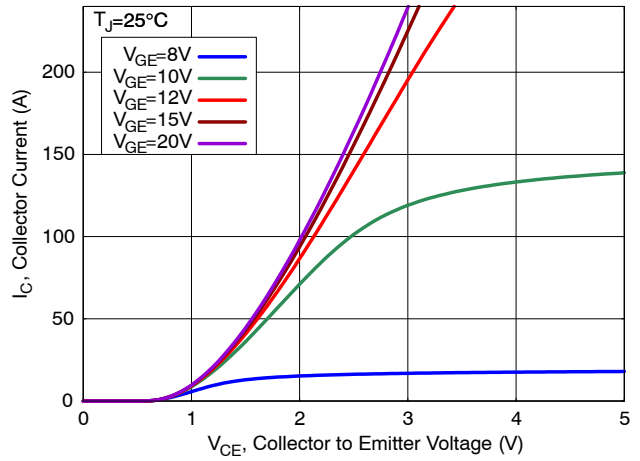


Figure 2. Output Characteristics

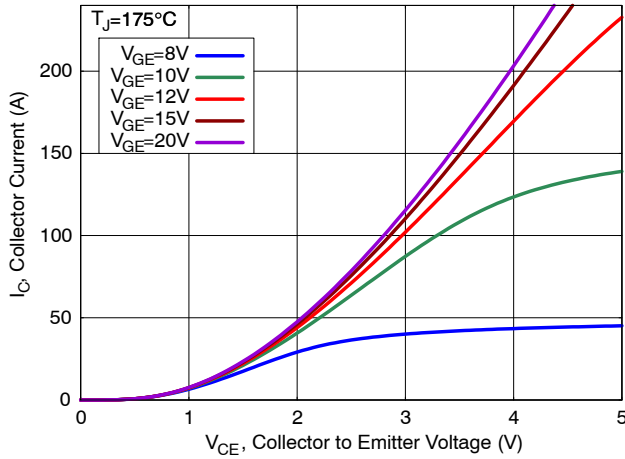


Figure 3. Output Characteristics

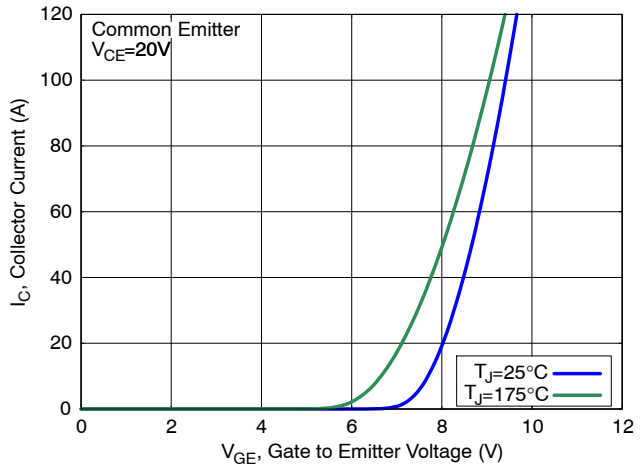


Figure 4. Transfer Characteristics

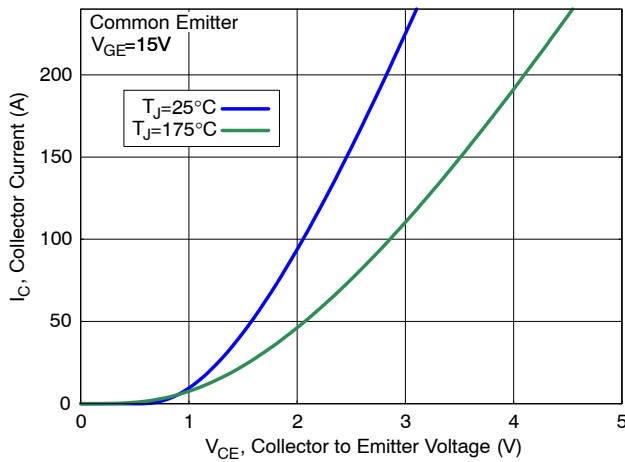


Figure 5. Saturation Characteristics

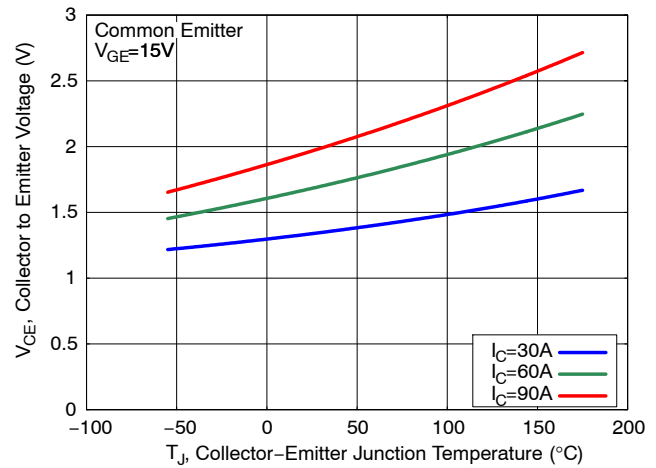


Figure 6. Saturation Voltage vs. Junction Temperature

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TYPICAL CHARACTERISTICS

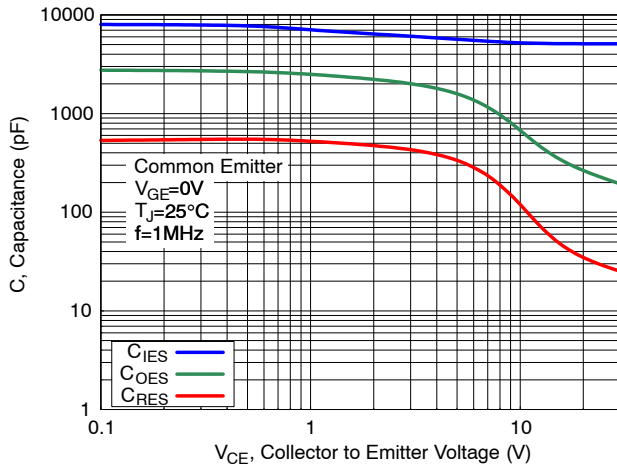


Figure 7. Capacitance Characteristics

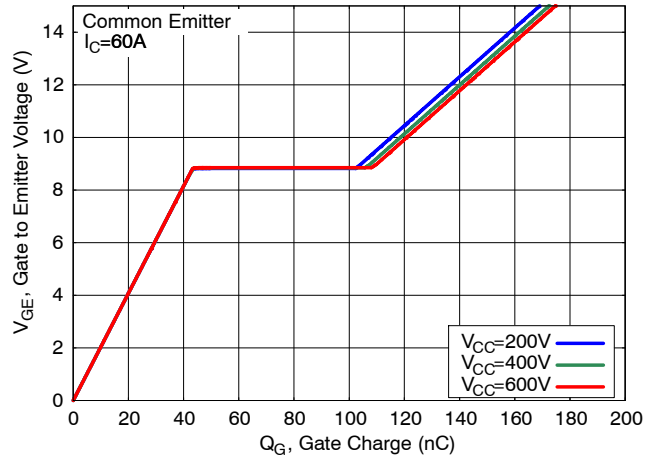


Figure 8. Gate Charge Characteristics

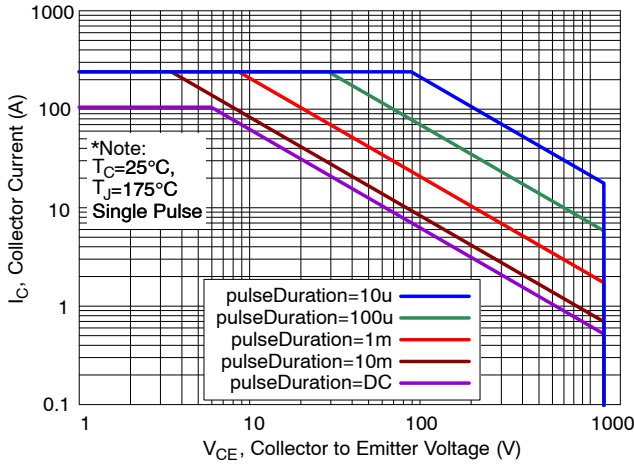


Figure 9. SOA Characteristics

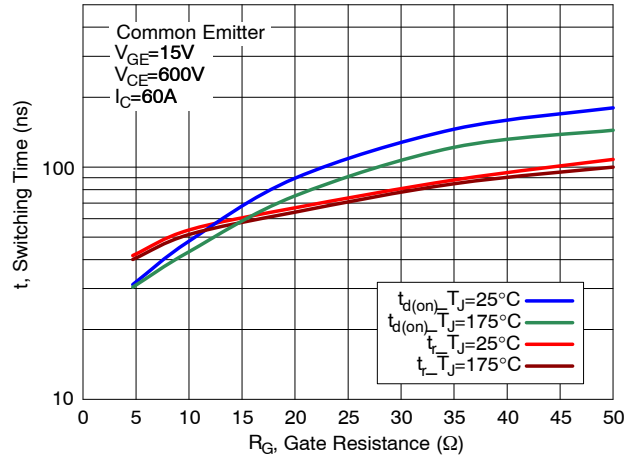


Figure 10. Turn-On Switching Time vs. Gate Resistance

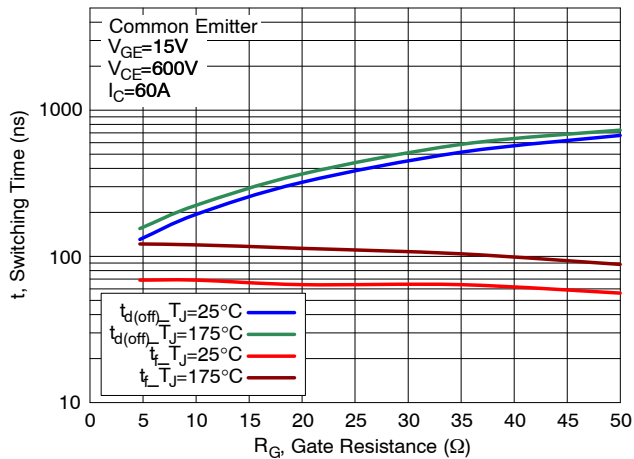


Figure 11. Turn-Off Switching Time vs. Gate Resistance

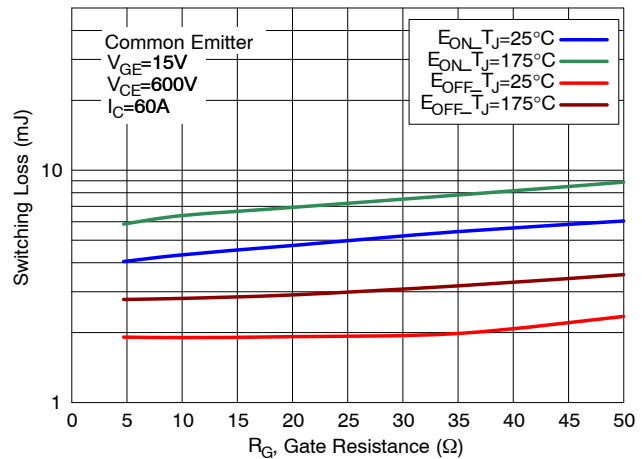


Figure 12. Switching Loss vs. Gate Resistance

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TYPICAL CHARACTERISTICS

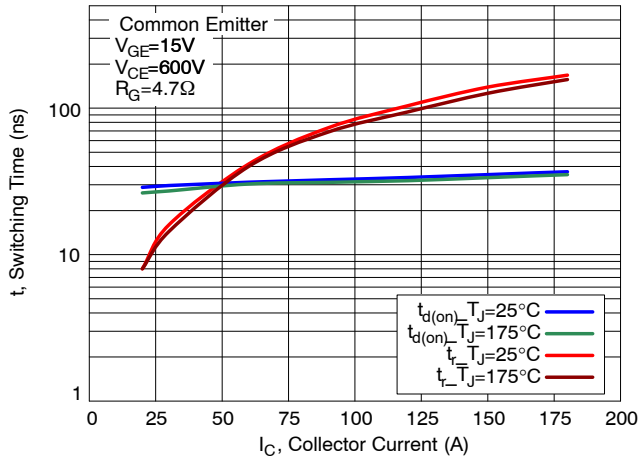


Figure 13. Turn-On Switching Time vs. Collector Current

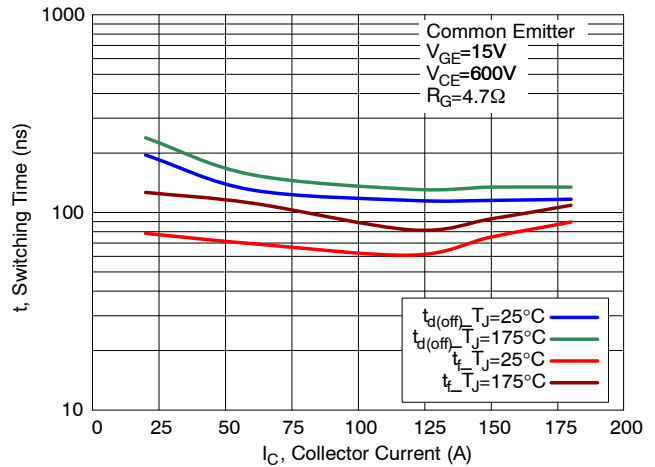


Figure 14. Turn-Off Switching Time vs. Collector Current

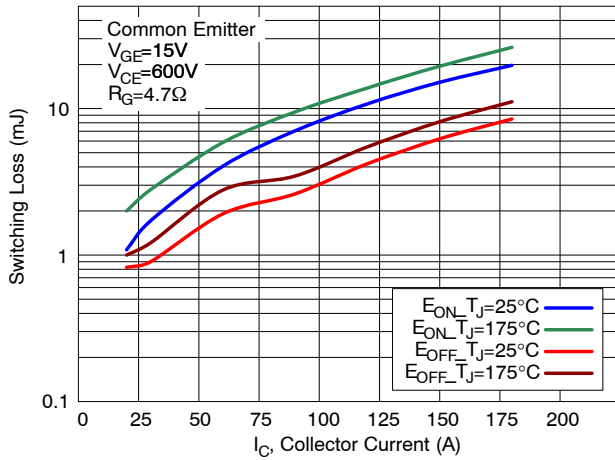


Figure 15. Switching Loss vs. Collector Current

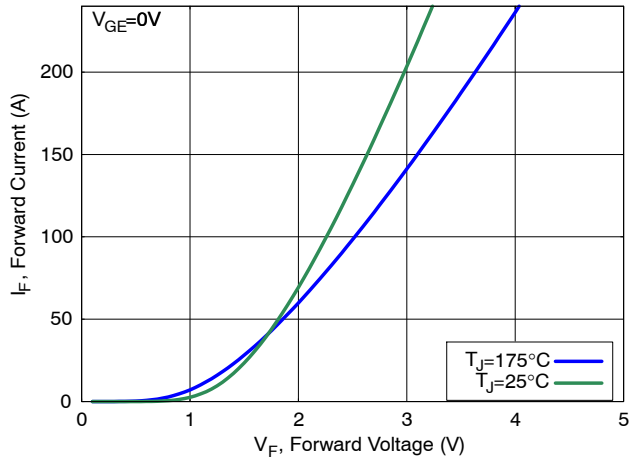


Figure 16. Diode Forward Characteristics

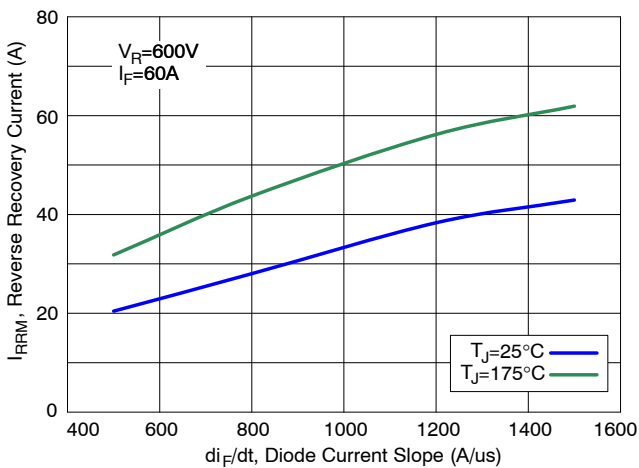


Figure 17. Diode Reverse Recovery Current

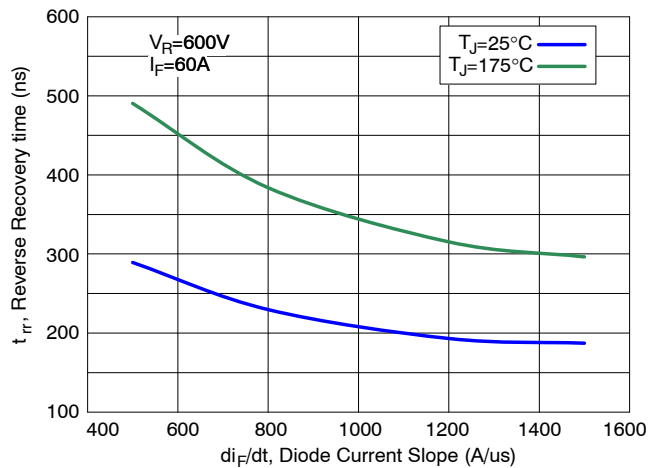


Figure 18. Diode Reverse Recovery Time

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TYPICAL CHARACTERISTICS

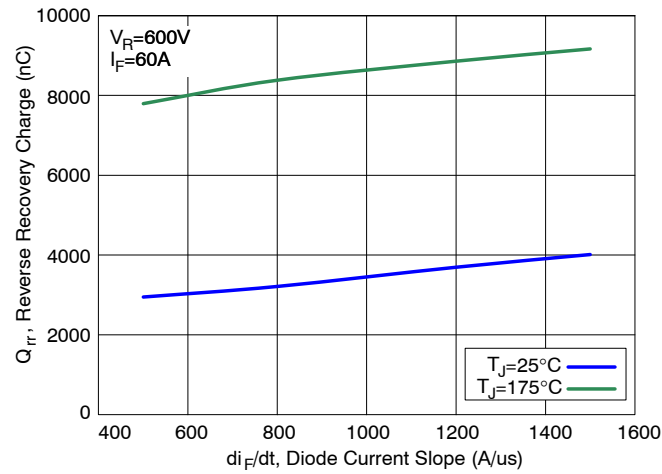


Figure 19. Diode Stored Charge Characteristics

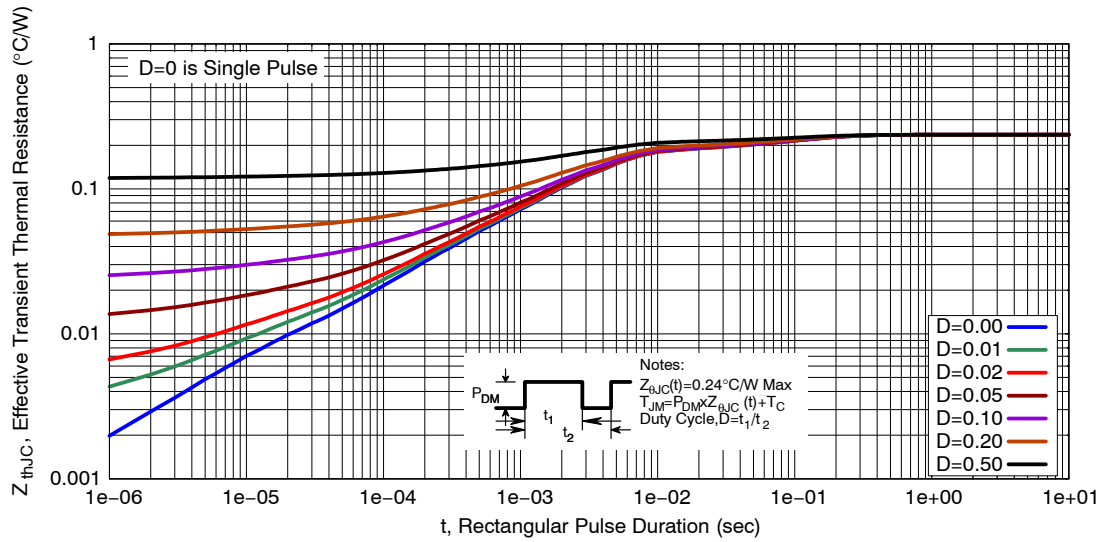


Figure 20. Transient Thermal Impedance of IGBT

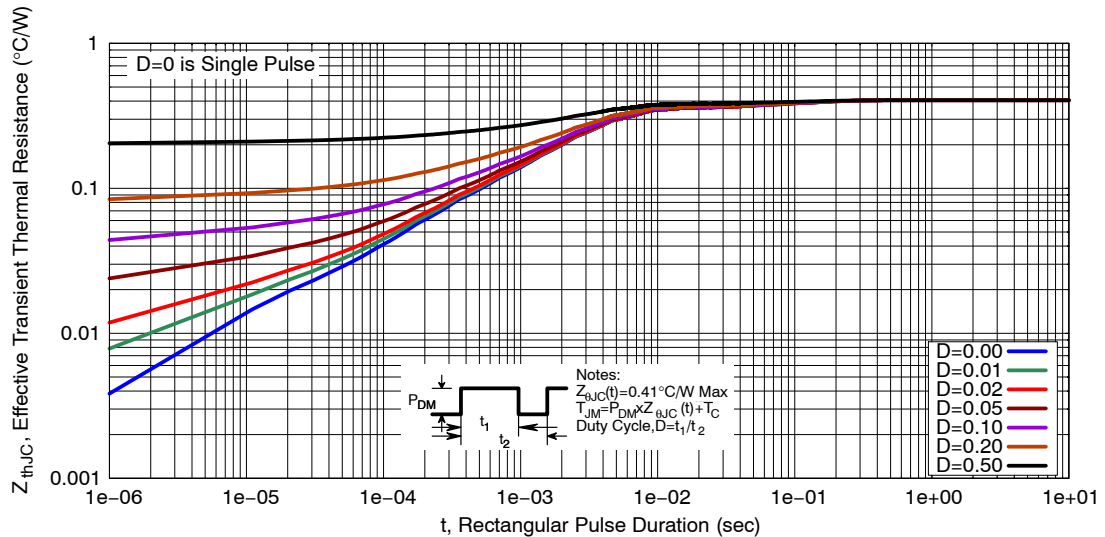
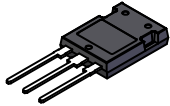


Figure 21. Transient Thermal Impedance of Diode

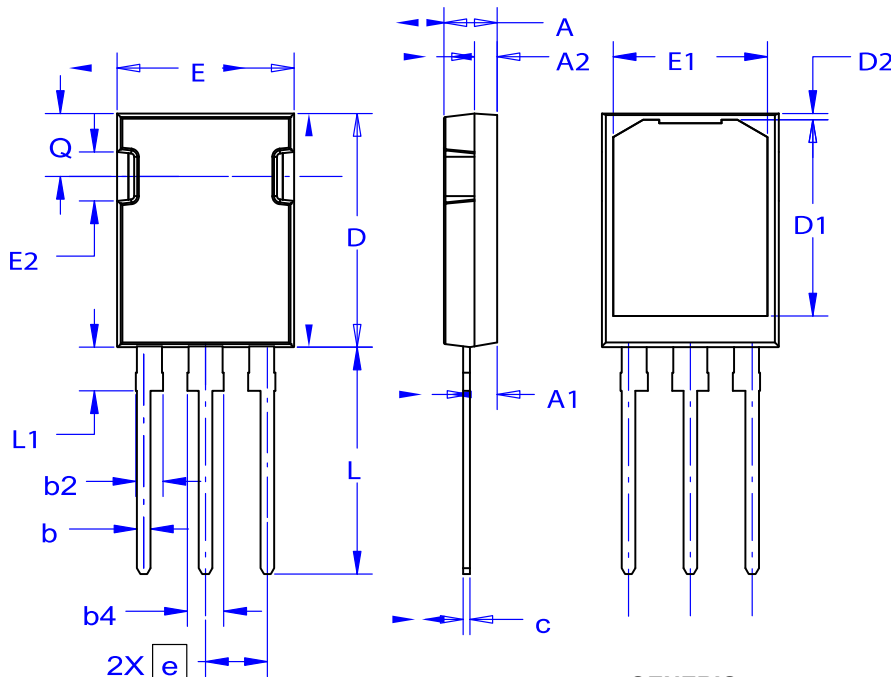


TO-247-3LD
CASE 340CD
ISSUE A

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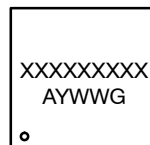
NOTES:

- 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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