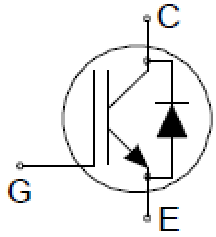
上海捷瑞德半导体
Jerrett Semiconductor

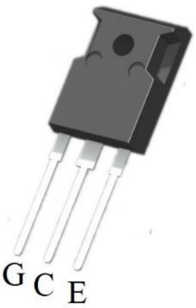
JRG40T120FDH

IGBT

1. Description

JRG40T120FDH is obtained by advanced Trench Field Stop (T-FS) technology which reduces the conduction loss, improves switching performance, and enhances the avalanche energy. The IGBT is suitable device for UPS, Welding, and high-speed switching.





TO-247

KEY CHARACTERISTICS

Parameter	Value	Unit
V_{CES}	1200	V
I_C	40	A
$V_{CE(sat).typ}$	2.0	V

FEATURES

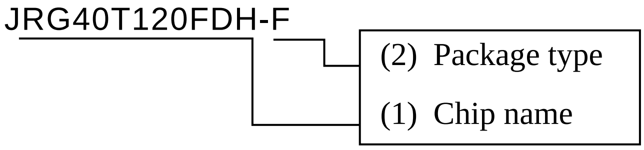
- Fast Switching
- Low $V_{CE(sat)}$
- Positive temperature coefficient
- Very soft, fast recovery anti-parallel diode
- RoHS product

APPLICATIONS

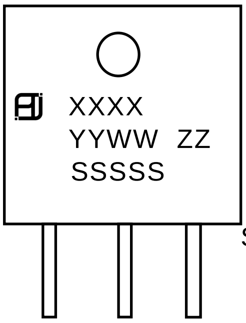
- UPS
- Welding Converters
- Converters with high switching frequency

ORDERING INFORMATION

Ordering Codes	Package	Product Code	Packing
JRG40T120FDH-F	TO-247	G40T120FDH	Tube



(1) JRG40T120FDH: 1200V 40A
(2) F:TO-247



XXXX：Product Code

YYWW：Year & Week

ZZ：Assembly Code

SSSSS：Lot Code

2. ABSOLUTE RATINGS

Symbol	Parameter	Values	Units
V_{CES}	Collector-Emitter Voltage	1200	V
I_C	Collector Current @T_C=25°C	80	A
	Collector Current @T_C=100°C	40	A
I_{CM}	Pulsed Collector Current, tp limited by T_{Jmax}	160	A
I_F	Diode Continuous Forward Current @T_C=25°C	80	A
	Diode Continuous Forward Current @T_C=100°C	40	A
I_{FM}	Diode Maximum Forward Current, limited by T_{Jmax}	160	A
V_{GES}	Gate-Emitter Voltage	±20	V
t_{SC}	Short circuit withstand time V_{GE}=15V, V_{CC}≤600V, Allowed number of short circuits<1000,Times between short circuits: ≥ 1.0s,T_J ≤ 150°C	10.0	µs
P_D	Power Dissipation @T_C=25°C	367	W
T_{Jmax}, T_{stg}	Operating Junction and Storage Temperature Range	150, –55 to 150	℃
T_L	Maximum Temperature for Soldering	260	℃

3. Thermal characteristics

Symbol	Parameter	Values	Units
$R_{\theta JC}$	Junction-to-Case (IGBT)	0.34	℃/W
$R_{\theta JC}$	Junction-to-Case (Diode)	0.8	℃/W
$R_{\theta JA}$	Junction-to-Ambient	40	℃/W

4. Electrical Characteristics

at T_C = 25°C, unless otherwise specified

Static Characteristics

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
V_{CES}	Collector-Emitter Breakdown Voltage	V_{GE} = 0V, I_C = 250µA	1200	--	--	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE} = 15V,I_C = 40A T_J=25℃ T_J=100℃ T_J=150℃	-- -- --	2.0 2.25 2.35	2.4	V

$V_{GE(TH)}$	Gate Threshold Voltage	V_{CE} = V_{GE},I_C = 1mA	5.0	5.8	6.5	V
V_F	Diode Forward Voltage	I_F=20A T_J=25℃ T_J=100℃ T_J=150℃	-- -- --	1.60 1.40 1.30	2.20 -- --	V
V_F	Diode Forward Voltage	I_F=40A T_J=25℃ T_J=100℃ T_J=150℃	-- -- --	1.85 1.75 1.65	2.45 -- --	V
I_{CES}	Collector-Emitter Leakage Current	V_{CE} = 1200V, V_{GE} = 0V	--	--	10	μA
$I_{GES(F)}$	Gate-Emitter Forward Leakage Current	V_{GE} = +20V	--	--	600	nA
$I_{GES(R)}$	Gate-Emitter Reverse Leakage Current	V_{GE} = -20V	--	--	-600	nA
Pulse width tp≤300μs, δ≤2%						

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
C_{iss}	Input Capacitance	V_{GE}=0V V_{CE}=25V f =1.0MHz	--	3640	--	pF
C_{oss}	Output Capacitance		--	168	--	
C_{rss}	Reverse Transfer Capacitance		--	89	--	
Q_G	Gate charge	V_{CC}=960V I_{CE}=40A V_{GE}=15V	--	259	--	nC
Q_{GE}	Gate-emitter charge		--	19	--	
Q_{GC}	Gate-collector charge		--	181	--	
$I_{C(SC)}$	Short circuit collector current Max.1000 short circuits, Times between short circuits: ≥ 1.0s	V_{GE}=15.0V,V_{CC}≤600V， t_{SC}≤10us，T_J≤150℃		160		A

IGBT Switching Characteristics, at T_J=25℃

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-on Delay Time	I_C =40A V_{CC} = 600V V_{GE} = 15V R_G =10Ω T_J=25°C Inductive Load	--	43	--	ns
tr	Rise Time		--	74	--	
$t_{d(off)}$	Turn-Off Delay Time		--	285	--	
t_f	Fall Time		--	30	--	
E_{on}	Turn-On Switching Loss		--	5.0	--	mJ

E_{off}	Turn-Off Switching Loss		--	1.5	--	
E_{ts}	Total Switching Loss		--	6.5	--	

IGBT Switching Characteristics, at T_J=150℃

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-on Delay Time	I_C =40A V_{CC} = 600V V_{GE} = 15V R_G =10Ω T_J=150°C Inductive Load	--	40	--	ns
tr	Rise Time		--	73	--	
$t_{d(off)}$	Turn-Off Delay Time		--	345	--	
t_f	Fall Time		--	86	--	
E_{on}	Turn-On Switching Loss		--	5.2	--	mJ
E_{off}	Turn-Off Switching Loss		--	2.7	--	
E_{ts}	Total Switching Loss		--	7.9	--	

Diode Characteristics, at T_J=25℃

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
T_{rr}	Reverse Recovery Time	I_F=20A, di/dt=200A/μs, T_J=25°C	--	40	--	ns
Q_{rr}	Reverse Recovery Charge		--	468	--	nC
I_{rrm}	Reverse Recovery Current		--	8	--	A
T_{rr}	Reverse Recovery Time	I_F=40A, di/dt=200A/μs, T_J=25°C	--	44	--	ns
Q_{rr}	Reverse Recovery Charge		--	598	--	nC
I_{rrm}	Reverse Recovery Current		--	10	--	A

Diode Characteristics, at T_J=150℃

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
T_{rr}	Reverse Recovery Time	I_F=20A, di/dt=200A/μs, T_J=150°C	--	53	--	ns
Q_{rr}	Reverse Recovery Charge		--	492	--	nC
I_{rrm}	Reverse Recovery Current		--	17	--	A
T_{rr}	Reverse Recovery Time	I_F=40A, di/dt=200A/μs, T_J=150°C	--	63	--	ns
Q_{rr}	Reverse Recovery Charge		--	660	--	nC
I_{rrm}	Reverse Recovery Current		--	18	--	A

5. Characteristics Curves

Figure 1. Forward Bias Safe Operating Area

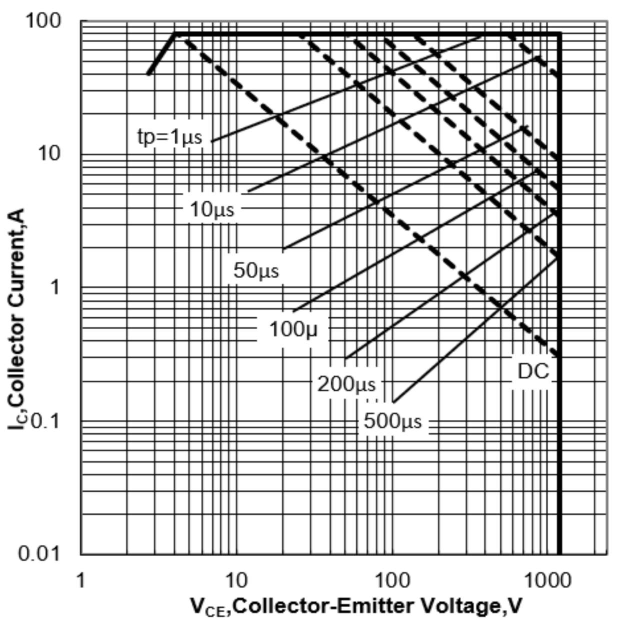


Figure 2. Power Dissipation vs Case Temperature

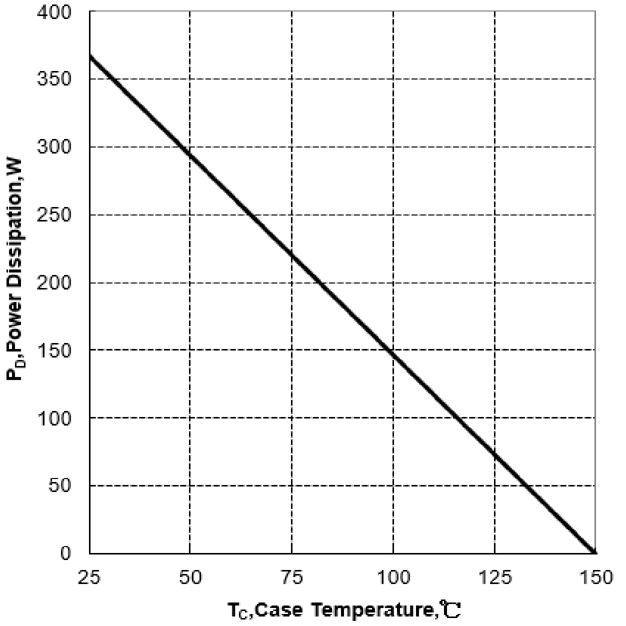


Figure 3. Collector Current vs Case Temperature

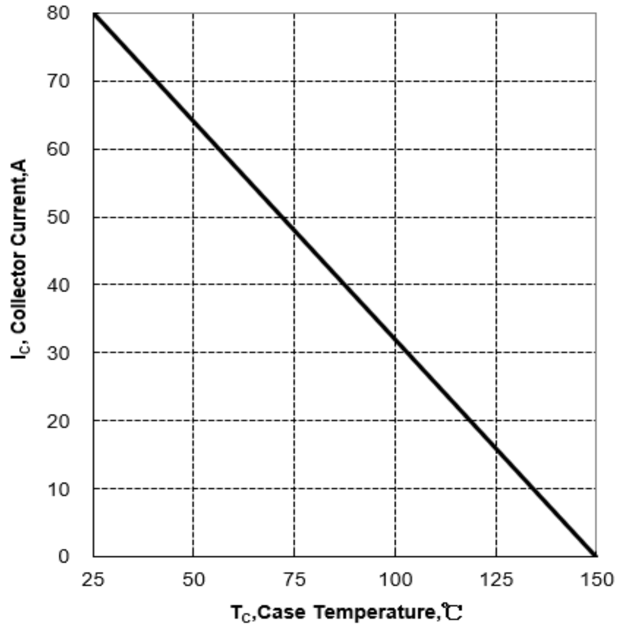


Figure 4. Typical Transfer Characteristics

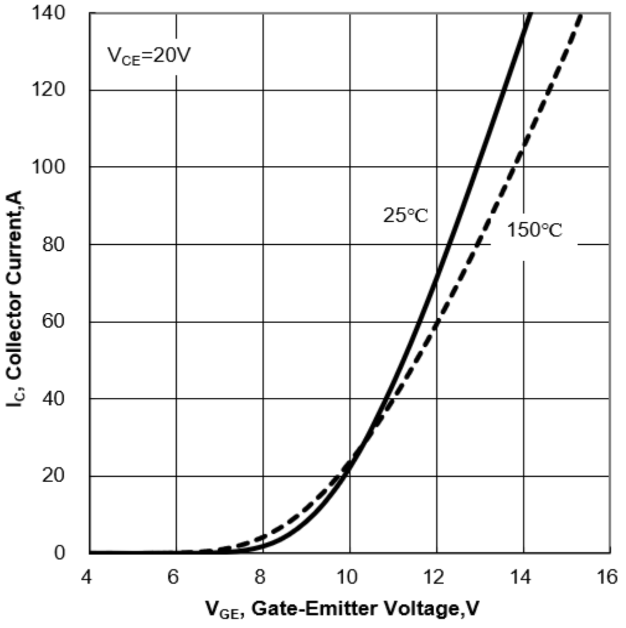


Figure 5. Typical Output Characteristics (T_J=25℃)

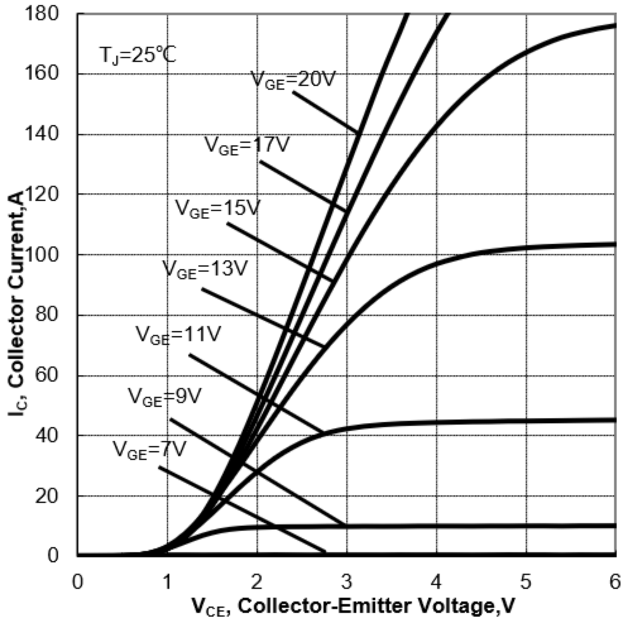


Figure 6. Typical Output Characteristics (T_J=150℃)

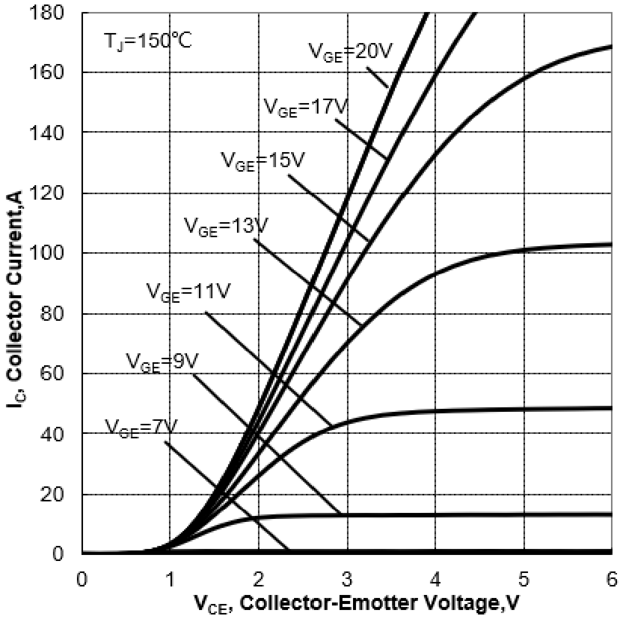


Figure 7. Typical Collector-Emitter Saturation Voltage vs Junction Temperature

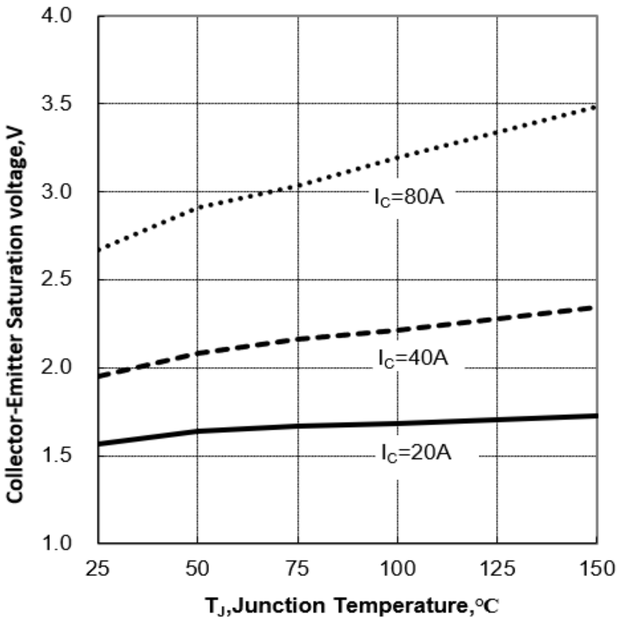


Figure 8. Typical Gate-Emitter Threshold Voltage vs Junction Temperature

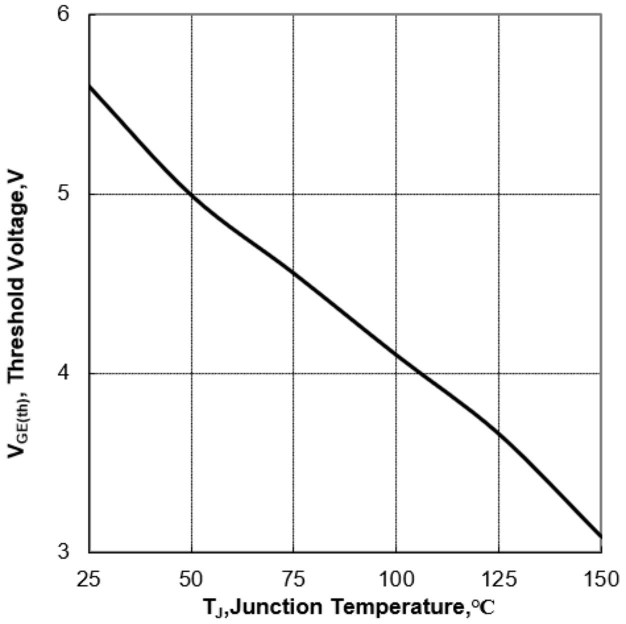


Figure 9. Typical Switching Times vs Gate Resistor (T_J=25℃, V_{CE}=600V, V_{GE}=15/0V, I_C=40A)

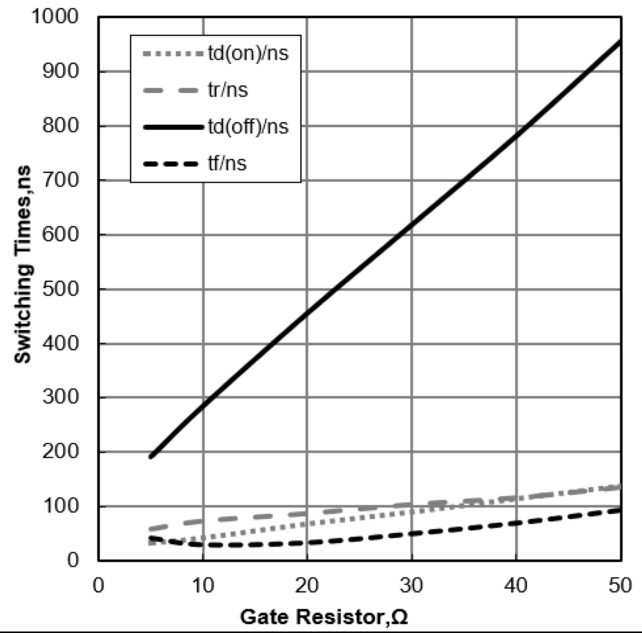


Figure 10. Typical Switching Energy vs Gate Resistor (T_J=25℃, V_{CE}=600V, V_{GE}=15/0V, I_C=40A)

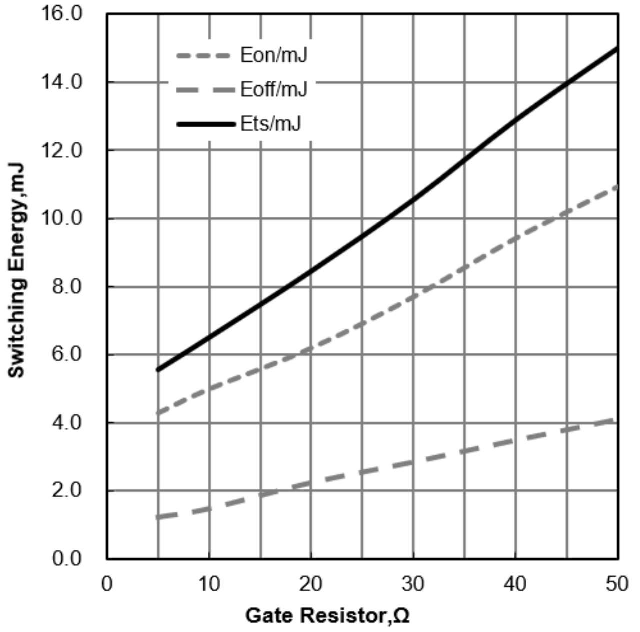


Figure 11. Typical Switching Times vs Junction Temperature (V_{CE}=600V, V_{GE}=15/0V, I_C=40A)

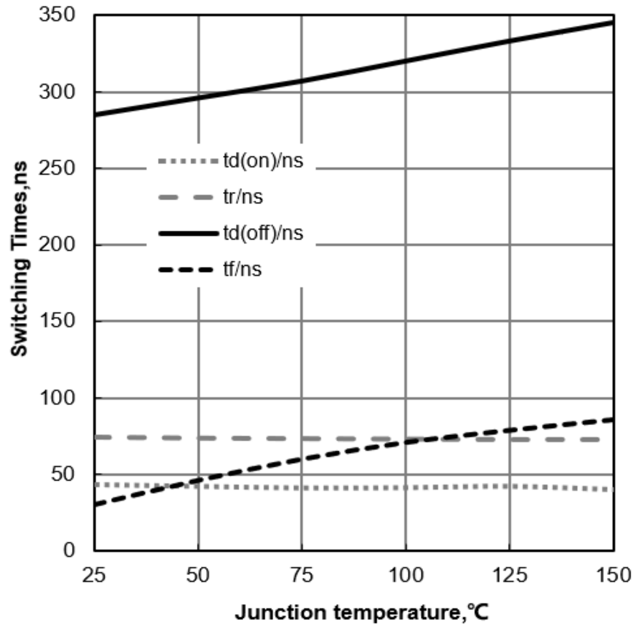


Figure 12. Typical Switching Energy vs Junction Temperature (V_{CE}=600V, V_{GE}=15/0V, I_C=40A)

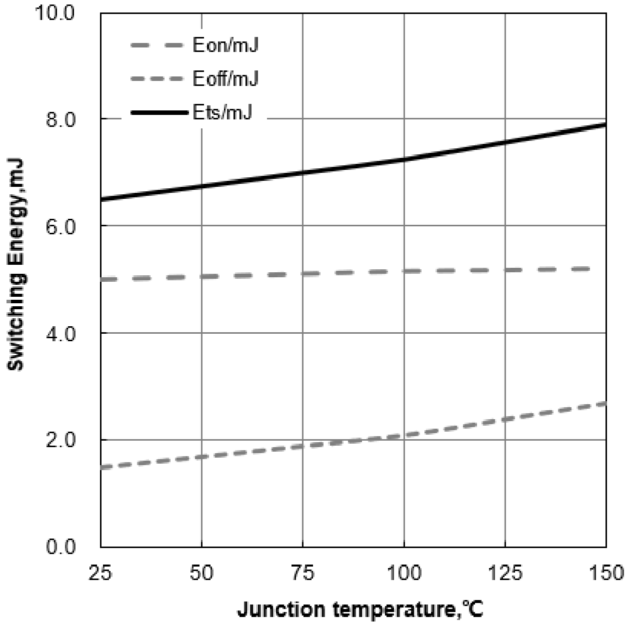


Figure 13. Typical Switching Times vs Collector Current (T_J=25℃, V_{CE}=600V, V_{GE}=15/0V)

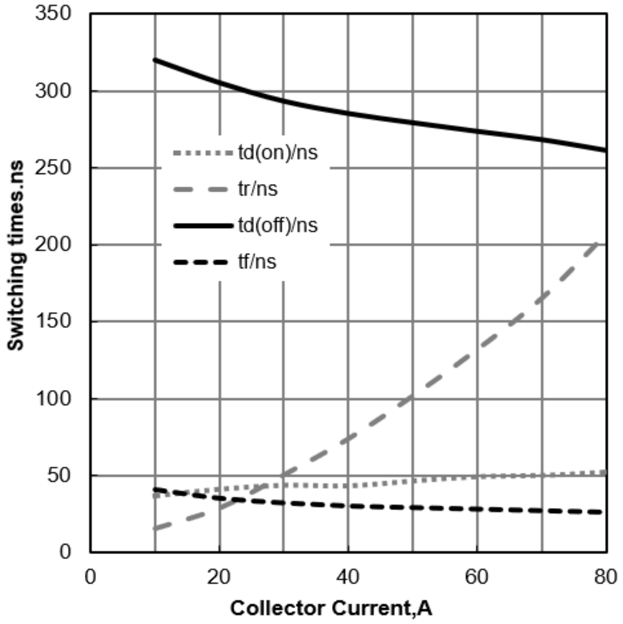


Figure 14. Typical Switching Energy vs Collector Current (T_J=25℃, V_{CE}=600V, V_{GE}=15/0V)

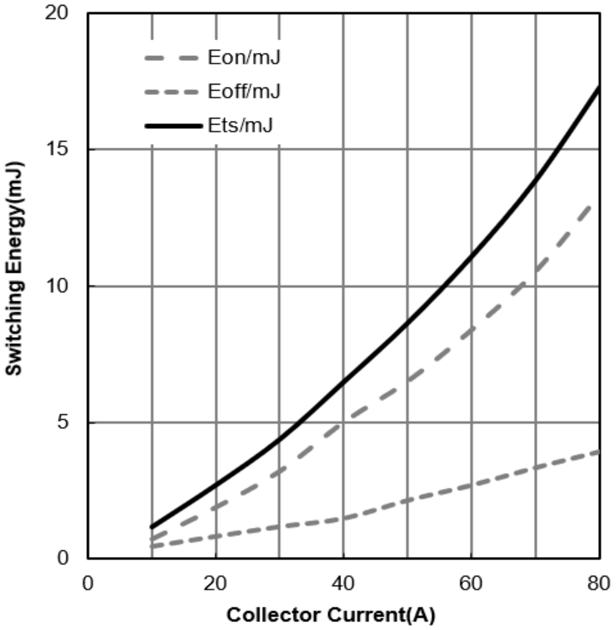


Figure 15. Typical Switching Times vs V_{CE} (T_J=25℃, V_{GE}=15/0V, I_C=40A)

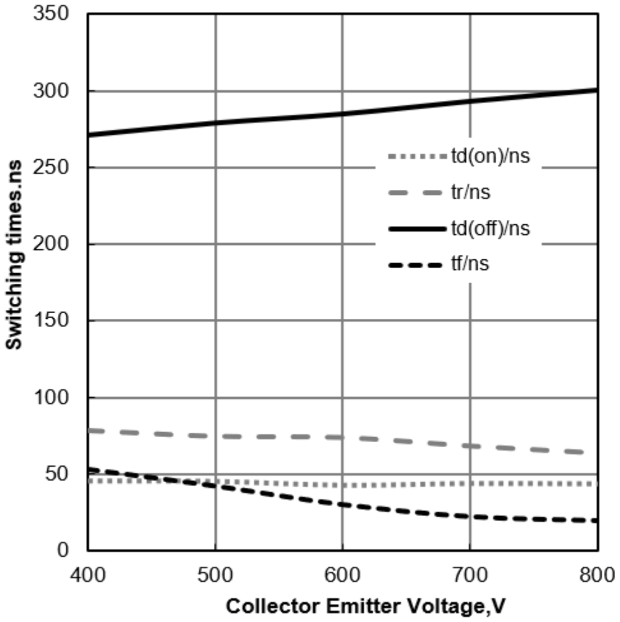


Figure 16. Typical Switching Energy vs V_{CE} (T_J=25℃, V_{GE}=15/0V, I_C=40A)

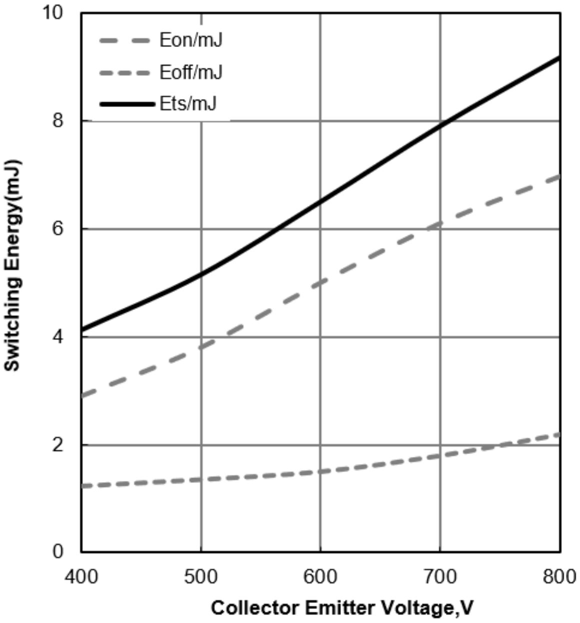


Figure 17. Typical Gate Charge

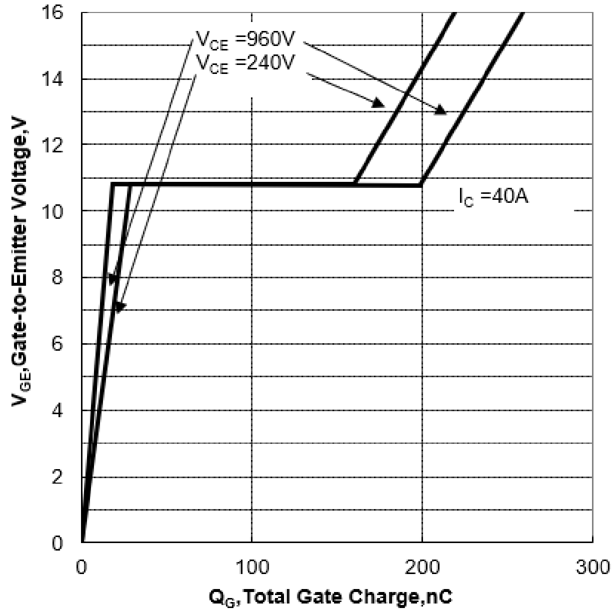


Figure 18. Typical Capacitance vs Collector-Emitter Voltage

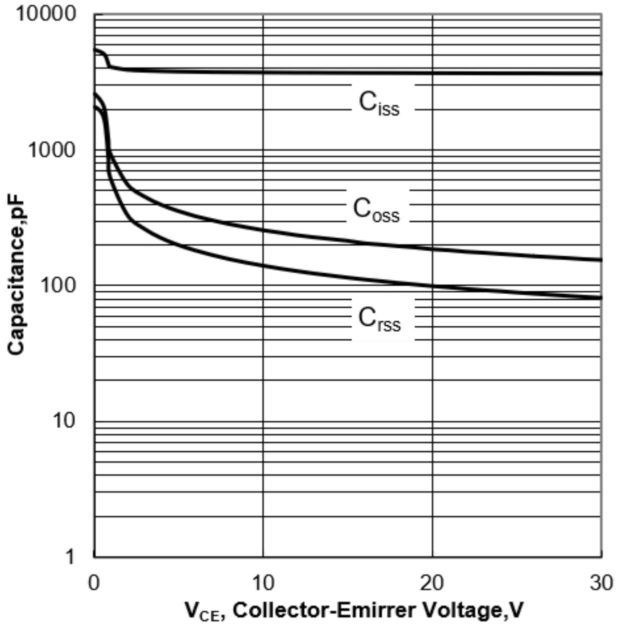


Figure 19. IGBT Transient Thermal Impedance vs Pulse Width

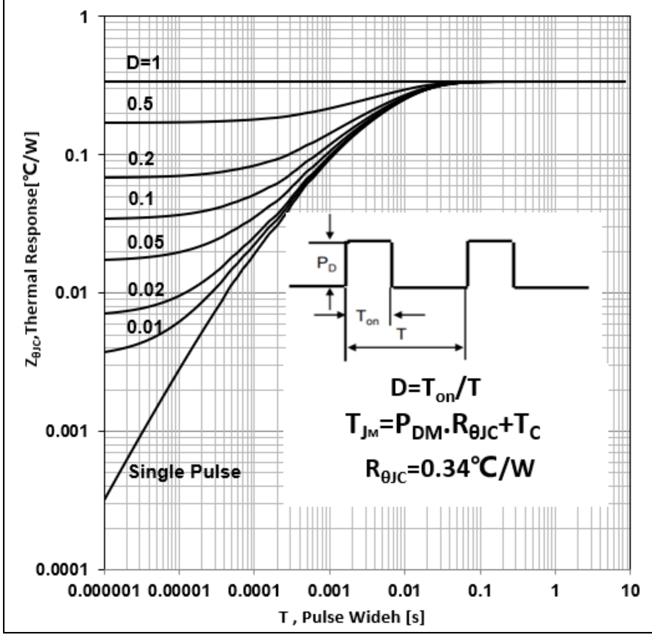


Figure 20. Diode Transient Thermal Impedance vs Pulse Width

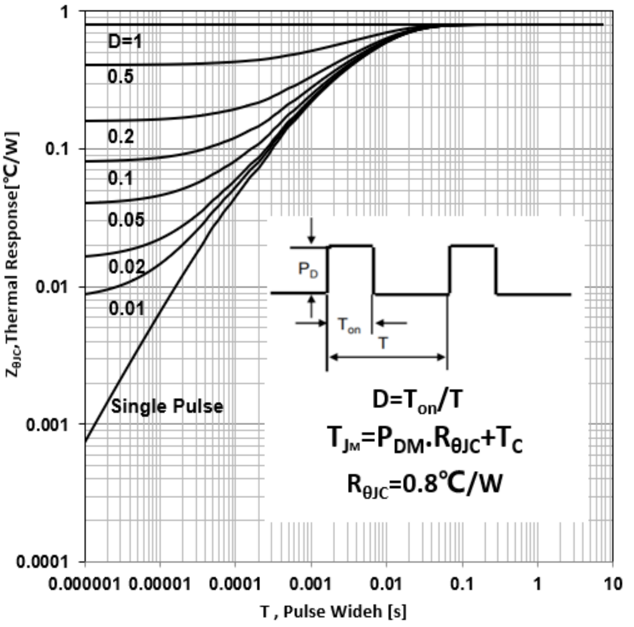
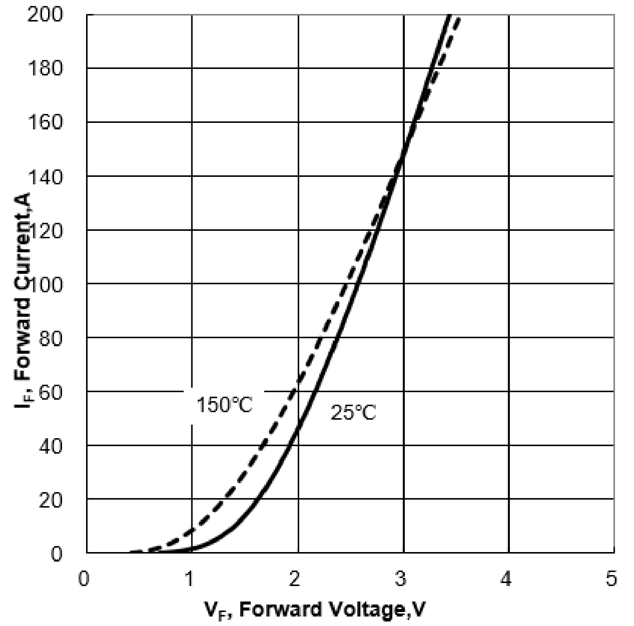


Figure 21. Typical Diode Forward Current vs Forward Voltage



6. Test Circuit and Waveform

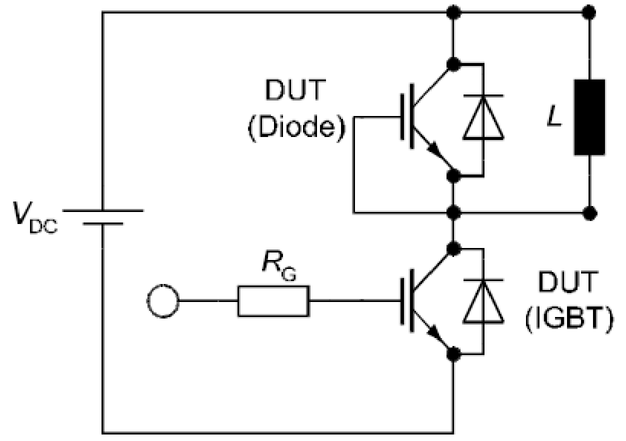


Figure 22. Inductive Switching Test Circuit

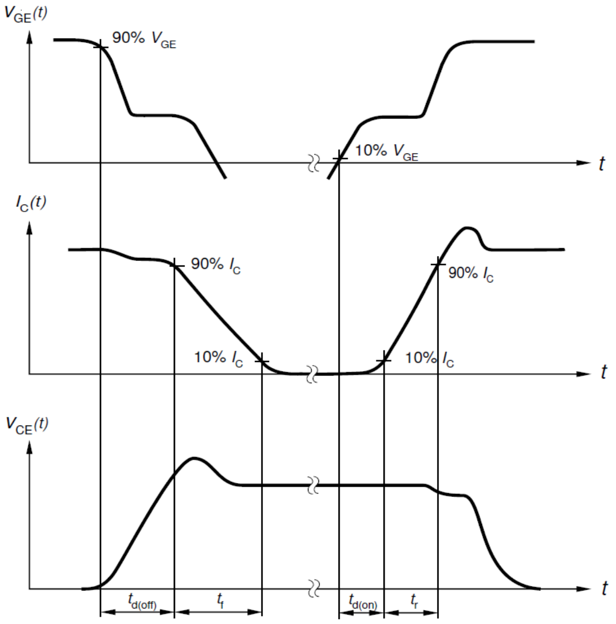


Figure 23. Definition of switching times

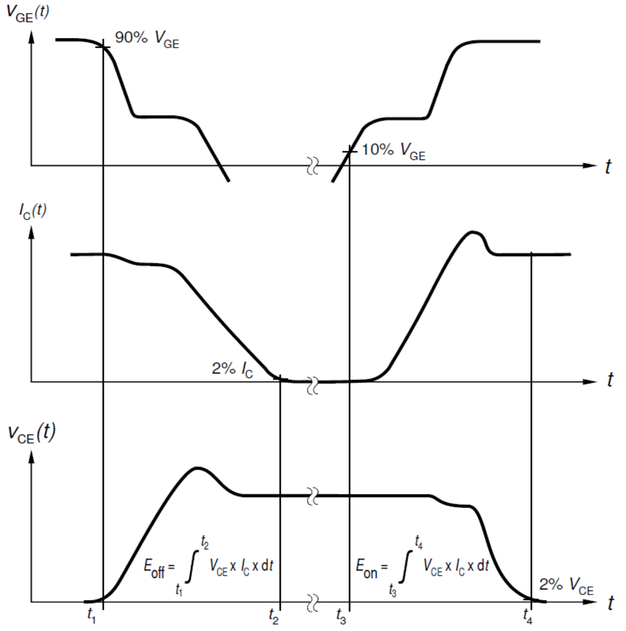


Figure 24. Definition of switching losses

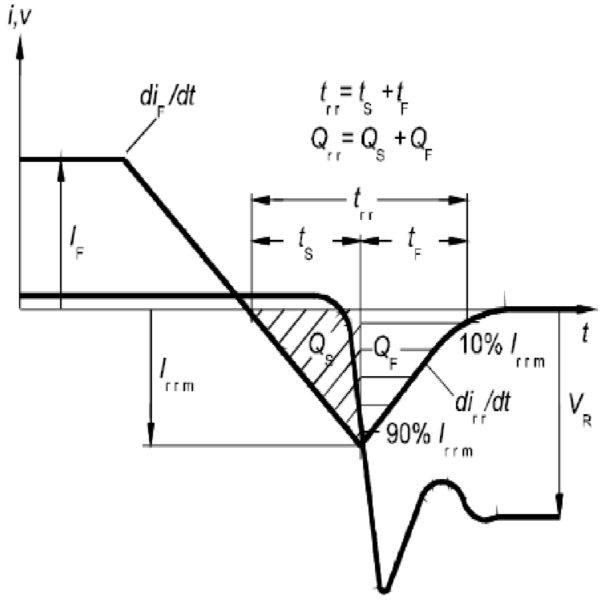
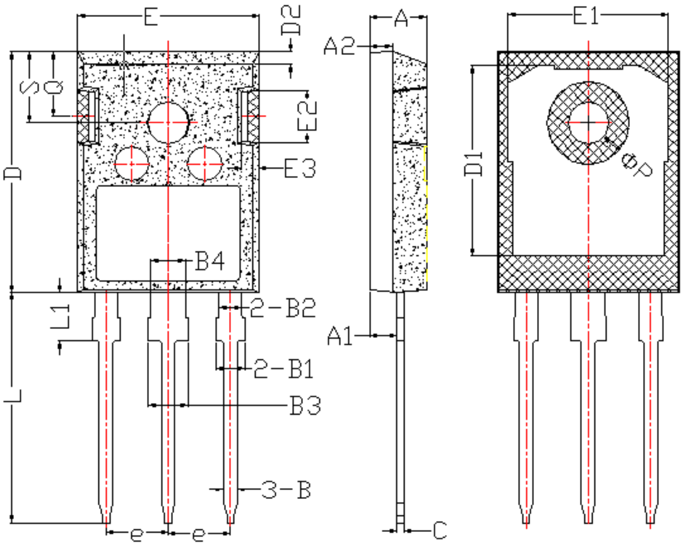


Figure 25. Definition of diode switching characteristics

7. Package Description



TO-247 Package

Items	Values(mm)	
	MIN	MAX
A	4.90	5.16
A1	2,27	2.53
A2	1.85	2.11
B	1.07	1.33
B1	1.90	2.41
B2	1.75	2.15
B3	2.87	3.38
B4	2.87	3.13
C	0.55	0.68
D	20.82	21.10
D1	16.25	17.65
D2	1.05	1.35
E	15.70	16.03
E1	13.10	14.15
E2	3.68	5.10
E3	1.68	2.60
e	5.44	
L	19.80	20.31
L1	4.17	4.47
ΦP	3.50	3.70
Q	5.49	6.00
S	6.04	6.30

NOTE:

1. Exceeding the maximum ratings of the device in performance may cause damage to the device, even the permanent failure, which may affect the dependability of the machine. Please do not exceed the absolute maximum ratings of the device when circuit designing.
2. When installing the heat sink, please pay attention to the torsional moment and the smoothness of the heat sink.
3. IGBTs is the device which is sensitive to the static electricity, it is necessary to protect the device from being damaged by the static electricity when using it.