

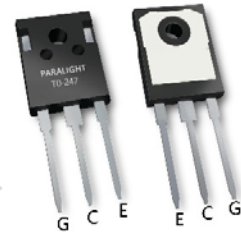
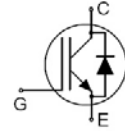
1200V 40A CoolFAST™ 7 Technology IGBT

Features:

- Low switching power loss
- Low switching surge and noise
- Advanced field stop technology
- Low EMI
- Maximum junction temperature 175°C
- Qualified according to JEDEC for target applications
- Pb-free lead plating, halogen-free mold compound, RoHS compliant

Applications:

- Industrial UPS
- Welding machine
- Solar converters
- Energy storage
- EV charger



Key Performance and Package Parameters

Type	V _{CE}	I _C	V _{CEsat} , T _{Vj} =25°C	T _{Vjmax}	T _{sc}	Marking	Package
PC40N120AH7S	1200V	40A	1.6V	175°C	5μs	PC40N120AH7S	TO247-3

Maximum Ratings and Characteristics

Absolute Maximum Ratings at T_{Vj}= 25°C (unless otherwise specified)

Parameter	Symbols	Value	Units
Collector-emitter voltage	V _{CEs}	1200	V
DC collector current, limited by T _{Vjmax} T _c = 25°C T _c = 100°C	I _C	85 40	A
Pulsed collector current, t _p limited by T _{Vjmax}	I _{Cpuls}	160	A
Diode pulsed collector current, t _p limited by T _{Vjmax}	I _{FP}	160	A
Diode forward current, limited by T _{Vjmax} T _c = 25°C T _c = 100°C	I _F	40 30	A
Short circuit withstand time, V _{GE} = 15V, V _{CE} ≤ 600V	T _{SC}	5	μs
Gate-emitter voltage Transient gate-emitter voltage (t _p ≤ 10μs, D < 0.010)	V _{GES}	±20 ±30	V
IGBT max. power dissipation	P _{D_IGBT}	517	W
FWD max. power dissipation	P _{D_FWD}	341	W
Operating junction temperature	T _{Vj}	-40 ~ +175	°C
Storage temperature	T _{stg}	-55 ~ +175	°C

Thermal Resistance

Parameter	Symbols	Value			Unit
		Min	Typ	Max	
Rth Characteristics					
Thermal resistance, junction-ambient	Rth(j-a)	-	-	40	°C / W
Thermal resistance, IGBT junction-case	Rth(j-c)	-	0.29	0.35	
Thermal resistance, diodes junction-case	Rth(j-c)	-	0.44	0.5	

Electrical Characteristics at $T_{vj}= 25^{\circ}\text{C}$ (unless otherwise specified)

Parameter	Symbols	Conditions	Value			Unit
			Min	Typ	Max	
Static Characteristic						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE}=0V, I_C=0.25mA$	1200	-	-	V
Collector-emitter saturation voltage	V_{CEsat}	$V_{GE}= 15V, I_C= 40A$	-	1.6	2.25	V
		$T_{vj}= 25^{\circ}C$ $T_{vj}= 175^{\circ}C$	-	2.0		
Diode forward voltage	V_F	$I_F= 40A$	-	1.78	3.0	V
		$T_{vj}= 25^{\circ}C$ $T_{vj}= 175^{\circ}C$	-	1.55		
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE}= V_{GE}, I_C= 250\mu A$	5.1	5.9	6.7	V
Zero gate voltage collector current	I_{CES}	$V_{CE}= 1200V, V_{GE}= 0V$	-	-	200	μA
Gate-emitter leakage current	I_{GES}	$V_{CE}= 0V, V_{GE}= \pm 20V$	-	-	± 200	nA

Electrical Characteristics at $T_{vj}= 25^{\circ}\text{C}$ (unless otherwise specified)

Parameter	Symbols	Conditions	Value			Unit
			Min	Typ	Max	
Dynamic Characteristic						
Input capacitance	C _{ies}	V _{CE} = 25V, V _{GE} = 0V f= 1MHz	-	9467	-	pF
Output capacitance	C _{oes}		-	132	-	pF
Reverse transfer capacitance	C _{res}		-	65	-	pF
Gate charge	Q _G	V _{CC} = 960V, I _c = 40A, V _{GE} = 15V	-	315	-	nC

Switching Characteristics at $T_{vj}= 25^{\circ}\text{C}$

Parameter	Symbols	Conditions	Value			Unit
			Min	Typ	Max	
IGBT Characteristics						
Turn-on delay time	$t_{d(on)}$	$V_{CC}= 600V$ $I_C= 40A$ $V_{GE}= 15V$ $R_G= 10\Omega$ Inductive load	-	57	-	ns
Rise time	t_r		-	60	-	ns
Turn-off delay time	$t_{d(off)}$		-	225	-	ns
Fall time	t_f		-	85	-	ns
Turn-on energy	E_{on}		-	3.2	-	mJ
Turn-off energy	E_{off}		-	1.5	-	mJ
Total switching energy	E_{ts}		-	4.7	-	mJ

Switching Characteristics at $T_{vj}= 25^{\circ}\text{C}$

Parameter	Symbols	Conditions	Value			Unit
			Min	Typ	Max	
Diode Characteristics						
Diode reverse recovery time	t _{rr}	V _R = 600V	-	279	-	ns
Diode reverse recovery charge	Q _{rr}	I _F = 40A	-	3.9	-	μC
Diode peak reverse recovery current	I _{rrm}	di _F /dt= 500A/μs	-	24.4	-	A

Switching Characteristics at $T_{vj}= 175^{\circ}\text{C}$

Parameter	Symbols	Conditions	Value			Unit
			Min	Typ	Max	
IGBT Characteristics						
Turn-on delay time	$t_{d(on)}$	$V_{CC}= 600V$ $I_C= 40A$ $V_{GE}= 15V$ $R_G= 10\Omega$ Inductive load	-	48	-	ns
Rise time	t_r		-	60	-	ns
Turn-off delay time	$t_{d(off)}$		-	257	-	ns
Fall time	t_f		-	163	-	ns
Turn-on energy	E_{on}		-	3.3	-	mJ
Turn-off energy	E_{off}		-	2.2	-	mJ
Total switching energy	E_{ts}		-	5.5	-	mJ

Switching Characteristics at $T_{vj}= 175^{\circ}\text{C}$

Parameter	Symbols	Conditions	Value			Unit
			Min	Typ	Max	
Diode Characteristics						
Diode reverse recovery time	t_{rr}	$V_R = 600V$ $I_F = 40A$ $dI_F/dt = 500A/\mu s$	-	447	-	ns
Diode reverse recovery charge	Q_{rr}		-	10.0	-	μC
Diode peak reverse recovery current	I_{rrm}		-	44.8	-	A

Typical Characteristics

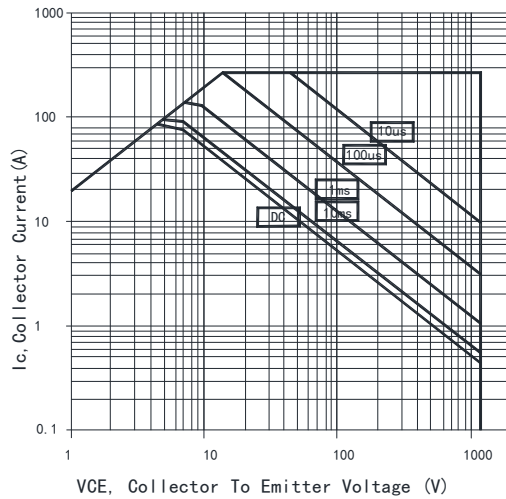


Fig. 1 Forward bias safe operating area ($D=0$, $T_c=25^\circ\text{C}$, $T_{vj}\leq 175^\circ\text{C}$, $V_{GE}=15\text{V}$)

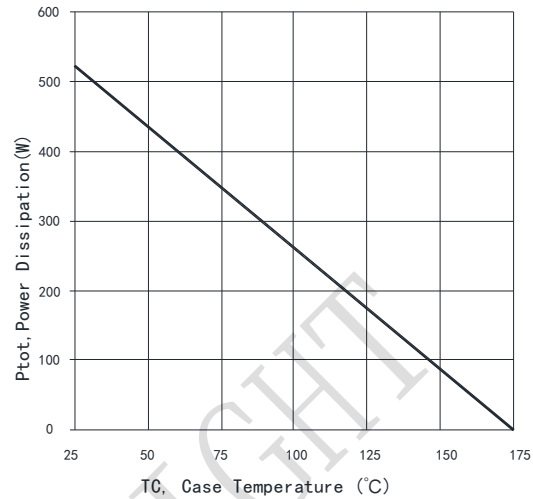


Fig. 2 Power dissipation vs. case temperature ($T_{vj}\leq 175^\circ\text{C}$)

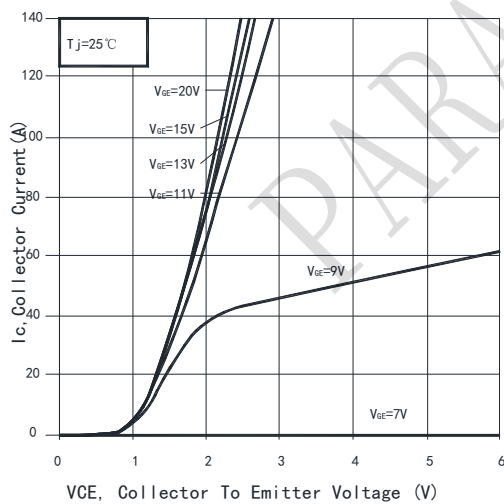


Fig. 3 Typical output characteristic ($T_{vj}= 25^\circ\text{C}$)

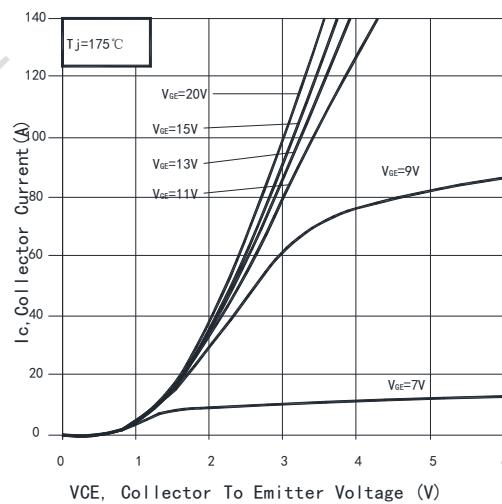


Fig. 4 Typical output characteristic ($T_{vj}=175^\circ\text{C}$)

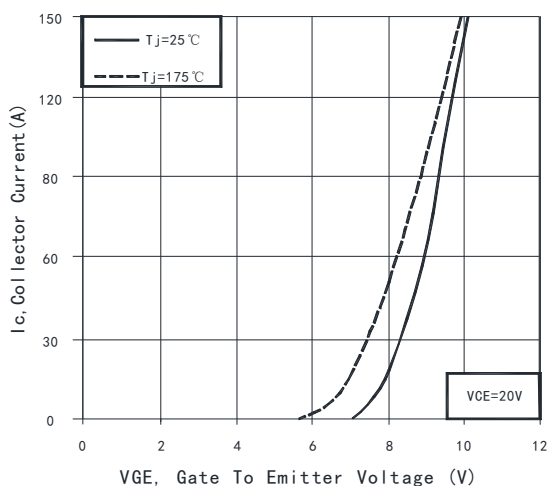


Fig. 5 Typical transfer characteristic
($V_{CE} = 20\text{V}$)

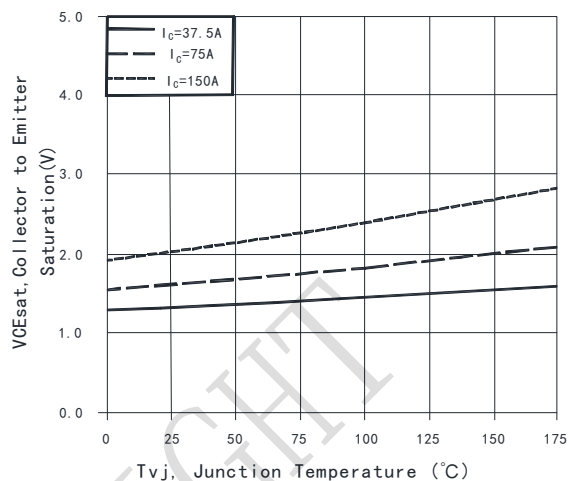


Fig. 6 Typical collector-emitter saturation
voltage vs. T_{vj} ($V_{GE} = 20\text{V}$)

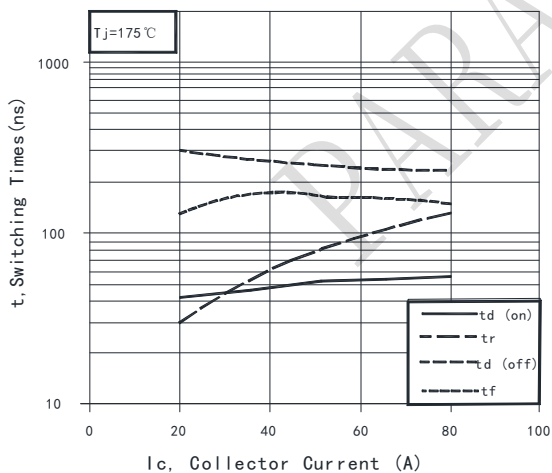


Fig. 7 Typical switching times vs. collector current
(Ind. load, $T_{vj} = 175^\circ\text{C}$, $V_{CE} = 600\text{V}$, $V_{GE} = 15/0\text{V}$, $R_G = 10\Omega$)

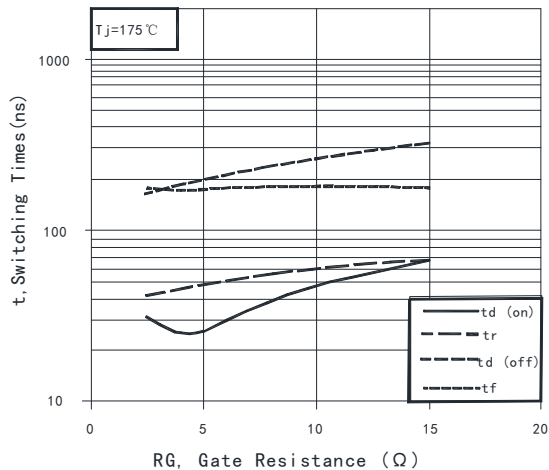


Fig. 8 Typical switching times vs. gate resistor
(Ind. Load, $T_{vj} = 175^\circ\text{C}$, $V_{CE} = 600\text{V}$, $V_{GE} = 15/0\text{V}$, $I_c = 40\text{A}$)

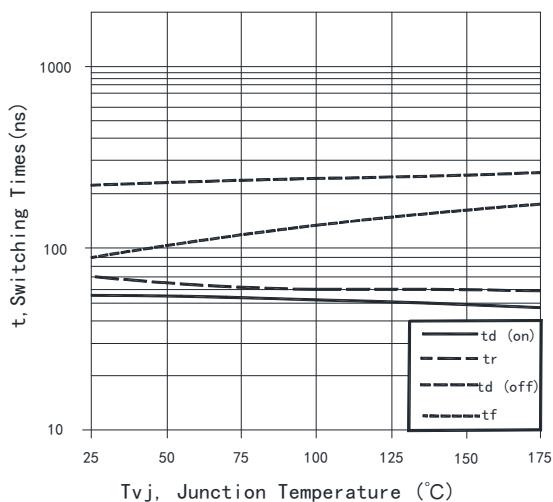


Fig. 9 Typical switching times vs. T_{vj}
(Ind. Load, $V_{CE} = 600V$, $V_{GE} = 15/0V$, $I_C = 40A$, $R_G = 10\Omega$)

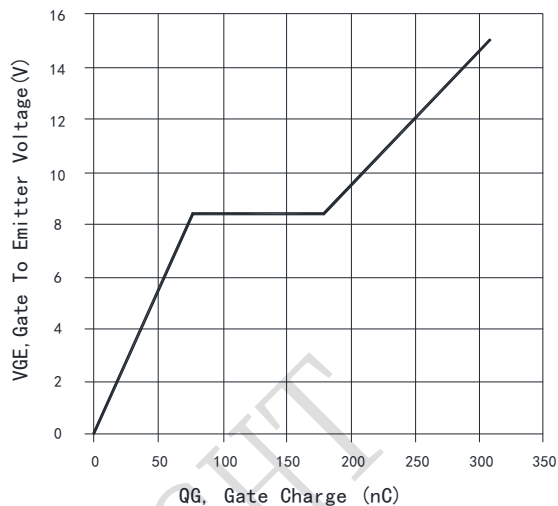


Fig. 10 Typical gate charge
($I_C = 40A$, $V_{CE} = 960V$)

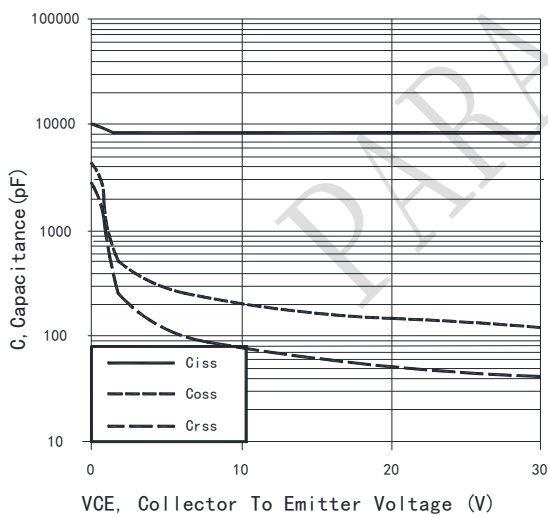


Fig. 11 Typical capacitance vs. collector-emitter voltage
($V_{GE} = 0V$, $f = 1MHz$)

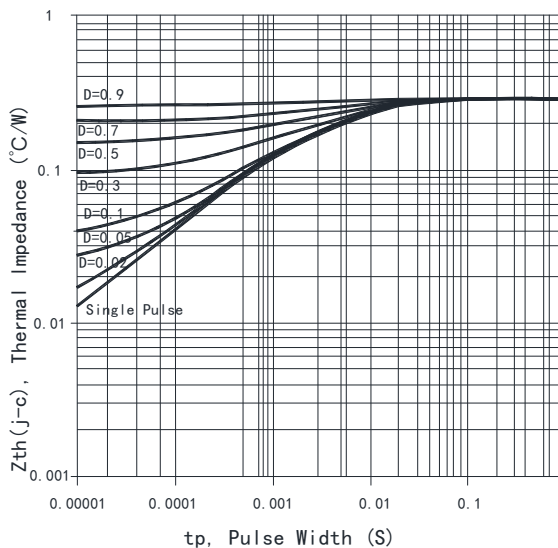


Fig. 12 IGBT transient thermal impedance
($D = t_p/T$)

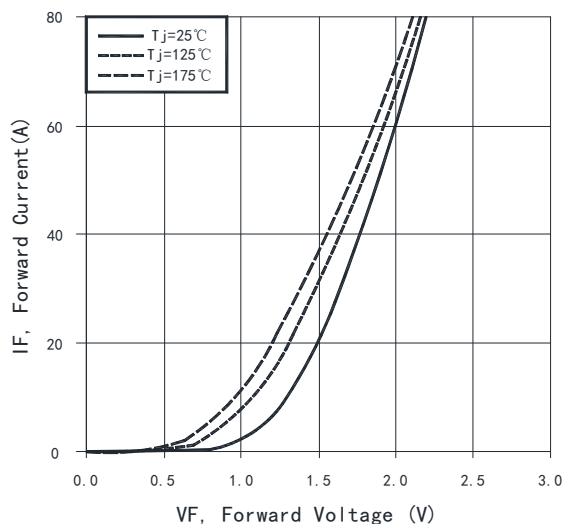


Fig. 13 Typical diode forward current vs. forward voltage

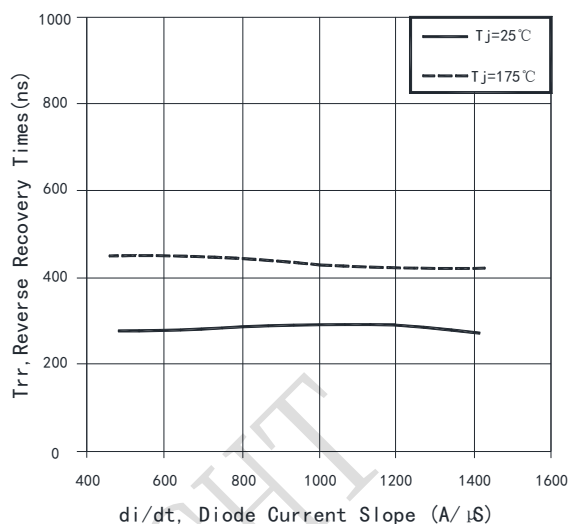


Fig. 14 Typical reverse recovery time vs. diode current slope (VR= 600V)

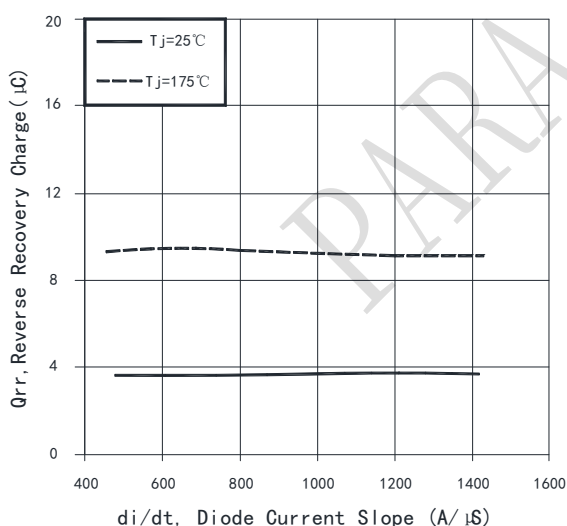


Fig. 15 Typical reverse recovery charge vs. diode current slope (VR= 600V)

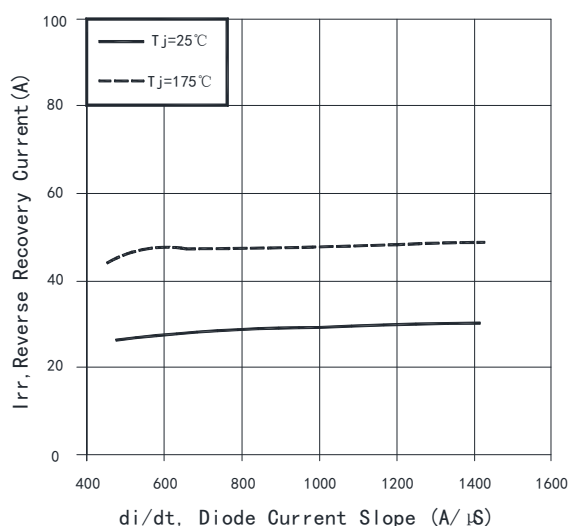
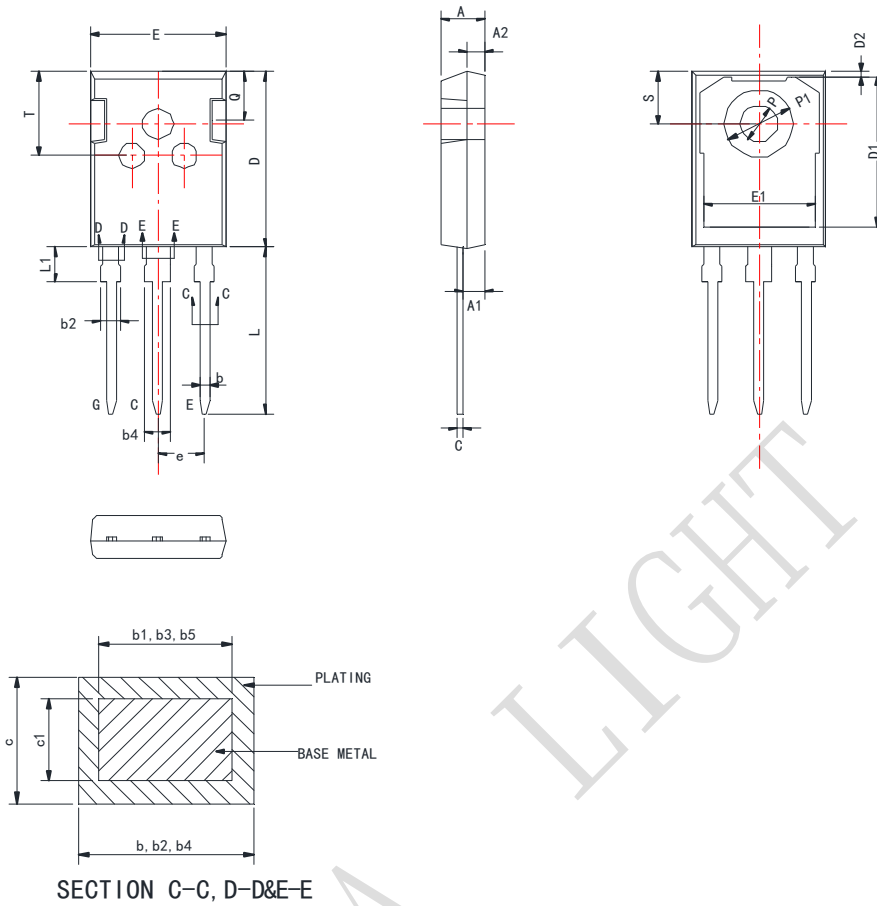


Fig. 16 Typical reverse recovery current vs. diode current slope (VR= 600V)

Package Dimensions



Common dimensions(mm)							
Symbol	Min	Typ	Max	Symbol	Min	Typ	Max
A	4.83	-	5.21	E	15.7	15.9	16.13
A1	2.27	2.41	2.54	E1	13.1	-	14.15
A2	1.85	-	2.16	e	5.4TYP		
b	1.07	-	1.33	Q	5.49	5.7	6.0
b2	1.9	-	2.41	S	6.15 BSC		
b4	2.87	-	3.38	L	19.8	19.92	20.3
c	0.55	-	0.68	L1	4.1	-	4.47
D	20.9	21.0	21.1	P	3.51	3.6	3.65
D1	16.25	-	17.65	P1	-	-	7.4
D2	0.95	1.17	1.35	-	-	-	-

PART NO. SYSTEM :

P C 40 N 120 A H 7 S

Short circuit withstand time:
S:5μs

Internal code

Package type :

"A": TO-247; "B": TO-220; "C": TO-252;
"D": TO-263; "E": TO-3PN;
"G": TO-247 plus; "H": TO247iPS

Voltage: 010=100V;
065=650V; 120=1200V

Chip type : "N": N Channel IGBT+FRD ;
"P": P Channel IGBT+FRD ;
"I": Si IGBT; "F": FRD ; "M": Si MOS ;
"S": SiC MOS; "C": SiC IGBT+SBD

Current :

(a) < 100A; 05=5A; 15=15A; 40=40A;
(b) ≥ 100A; 2B=100A; 3B=150A;
4B=200A

PIN : "C" : 3 PIN ; "D": 4 PIN; "F" : 5PIN

PARA LIGHT

Revision history

Document revision history

Date	Version	Changes
2023.11.10	A / 0	First release.
2024.03.01	A / 1	Present version