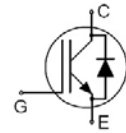
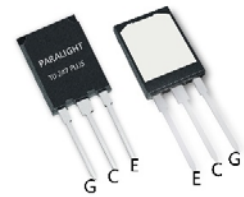


**1200V 40A CoolFAST™ 7 Technology IGBT
With Internal Isolation****Features:**

- 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
- Internal insulation

**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}	Marking	Package
PC40N120HD7	1200V	40A	1.75V	175°C	PC40N120HD7	TO247IPS-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	65 40	A
Pulsed collector current, tp limited by T _{Vjmax}	I _{Cpuls}	160	A
Turn-off safe operating area V _{CE} ≤ 1200V, T _{Vj} ≤ 175°C, tp=1μs	-	160	A
Diode forward current, limited by T _{Vjmax} T _c = 25°C T _c = 100°C	I _F	65 40	A
Gate-emitter voltage Transient gate-emitter voltage (tp ≤ 10μs, D < 0.010)	V _{GES}	±20 ±30	V
IGBT max. power dissipation	P _{D_IGBT}	420	W
FWD max. power dissipation	P _{D_FWD}	300	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)	-	-	50	°C /W
Thermal resistance, IGBT junction-case	Rth(j-c)	-	-	0.35	
Thermal resistance, diodes junction-case	Rth(j-c)	-	-	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 =0.50mA	1200	-	-	V
Collector-emitter saturation voltage	V _{CEsat}	V _{GE} = 15V, I _C = 40A	-	1.75	2.20	V
		T _{vj} = 25°C	-	2.40	-	
Diode forward voltage	V _F	I _F = 40A	-	1.7	3.0	V
		T _{vj} = 175°C	-	1.5	-	
Gate-emitter threshold voltage	V _{GE(th)}	V _{CE} = V _{GE} , I _C = 250uA	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} = ±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	-	9500	-	pF
Output capacitance	C _{oes}		-	150	-	pF
Reverse transfer capacitance	C _{res}		-	86	-	pF
Gate charge	Q _G	V _{CC} = 600V, I _c = 40A, V _{GE} = 15V	-	320	-	nC

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

Parameter	Symbols	Conditions	Value			Unit
			Min	Typ	Max	
IGBT Characteristics						
Turn-on delay time	$t_{d(on)}$	$V_{CC}= 600V$ $I_C= 40A$ $V_{GE}= 15V$ $R_G= 10\Omega$	-	65	-	ns
Rise time	t_r		-	110	-	ns
Turn-off delay time	$t_{d(off)}$		-	250	-	ns
Fall time	t_f		-	75	-	ns
Turn-on energy	E_{on}		-	2.1	-	mJ
Turn-off energy	E_{off}		-	1.2	-	mJ
Total switching energy	E_{ts}		-	3.3	-	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	-	270	-	ns
Diode reverse recovery charge	Q _{rr}	I _F = 40A	-	2.8	-	μC
Diode peak reverse recovery current	I _{rrm}	di _F /dt= 300A/μs	-	19	-	A

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

Parameter	Symbols	Conditions	Value			Unit
			Min	Typ	Max	
IGBT Characteristics						
Turn-on delay time	$t_{d(on)}$	$V_{CC}= 600V$ $I_C= 40A$ $V_{GE}= 15V$ $R_G= 10\Omega$	-	60	-	ns
Rise time	t_r		-	100	-	ns
Turn-off delay time	$t_{d(off)}$		-	360	-	ns
Fall time	t_f		-	150	-	ns
Turn-on energy	E_{on}		-	3.3	-	mJ
Turn-off energy	E_{off}		-	2.3	-	mJ
Total switching energy	E_{ts}		-	5.6	-	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 = 300A/μs	-	440	-	ns
Diode reverse recovery charge	Q _{rr}		-	8.5	-	μC
Diode peak reverse recovery current	I _{rrm}		-	39	-	A

Typical Characteristics

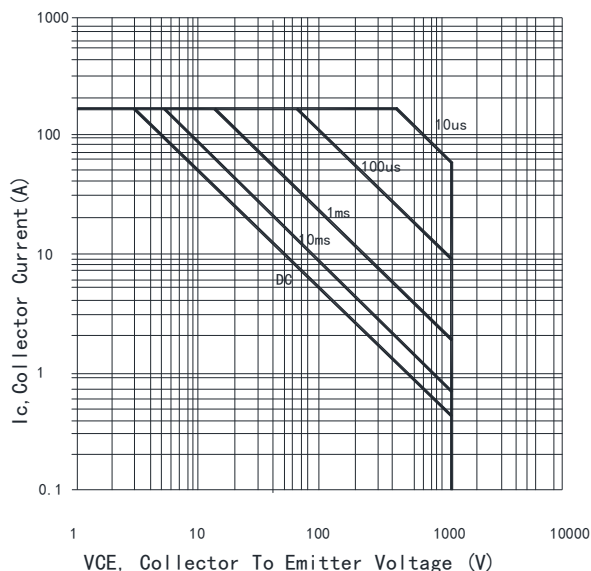


Fig. 1 Forward bias safe operating area ($D=0$, $T_c=25^\circ\text{C}$, $T_{vj}\leq 175^\circ\text{C}$; $V_{GE}=15\text{V}$)

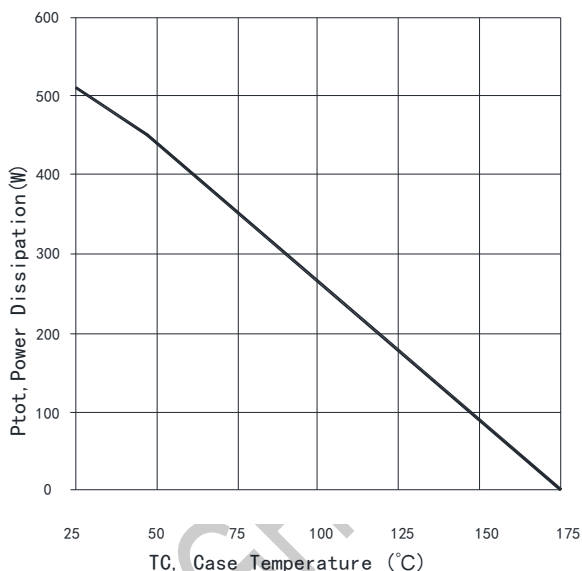


Fig. 2 Power dissipation vs. case temperature ($T_{vj}\leq 175^\circ\text{C}$)

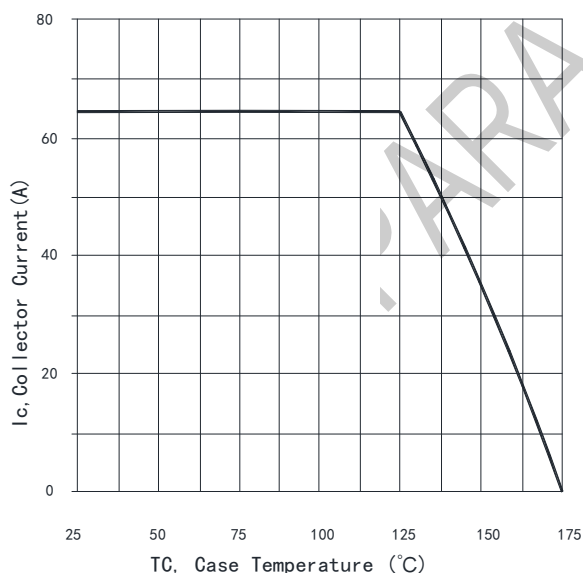


Fig. 3 Collector current vs. case temperature ($V_{GE}\leq 15\text{V}$, $T_{vj}\leq 175^\circ\text{C}$)

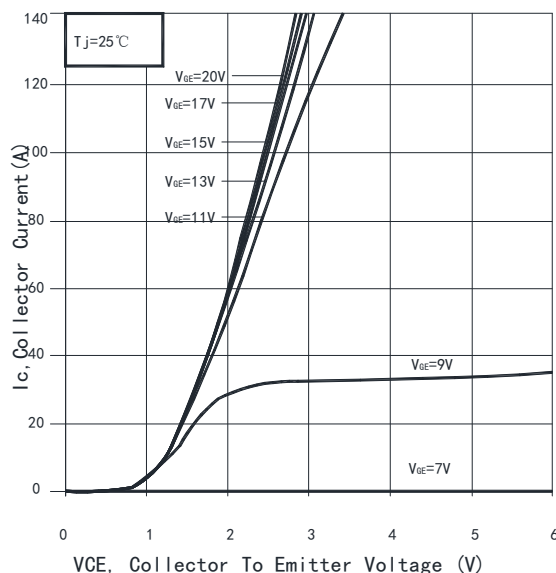


Fig. 4 Typical output characteristic ($T_{vj}=25^\circ\text{C}$)

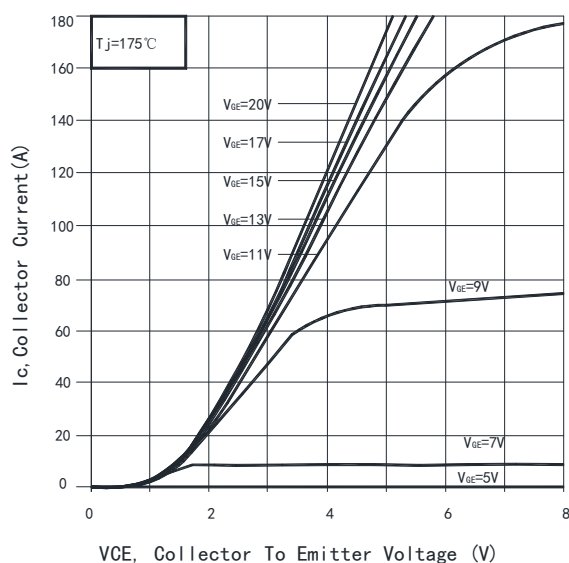


Fig. 5 Typical output characteristic
($T_j = 175^\circ\text{C}$)

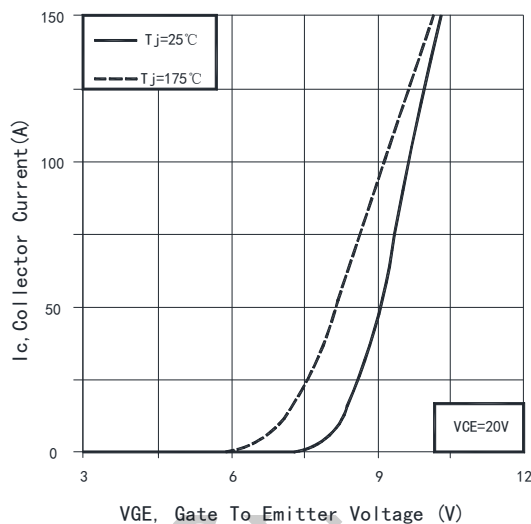


Fig. 6 Typical transfer characteristic
($V_{CE} = 20\text{V}$)

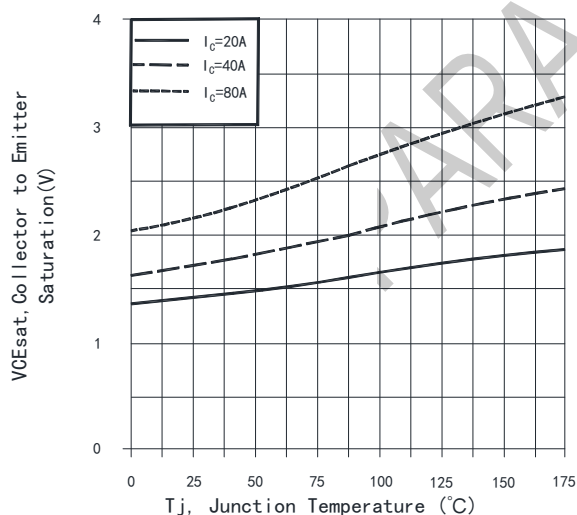


Fig. 7 Typical collector-emitter saturation voltage vs. T_j ($V_{GE} = 20\text{V}$)

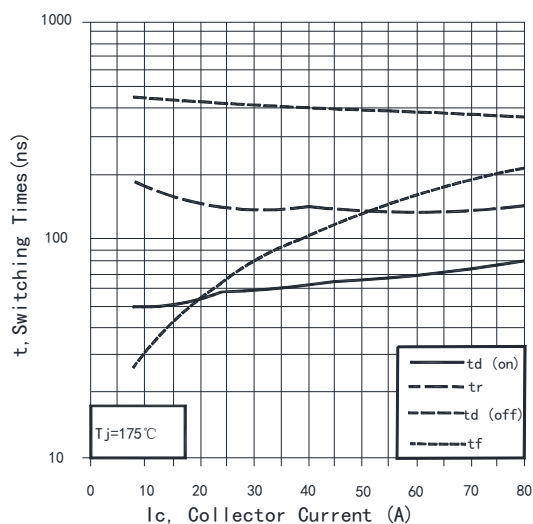


Fig. 8 Typical switching times vs. collector current (Ind. load, $T_j = 175^\circ\text{C}$, $V_{CE} = 600\text{V}$, $V_{GE} = 15/0\text{V}$, $R_g = 12\Omega$)

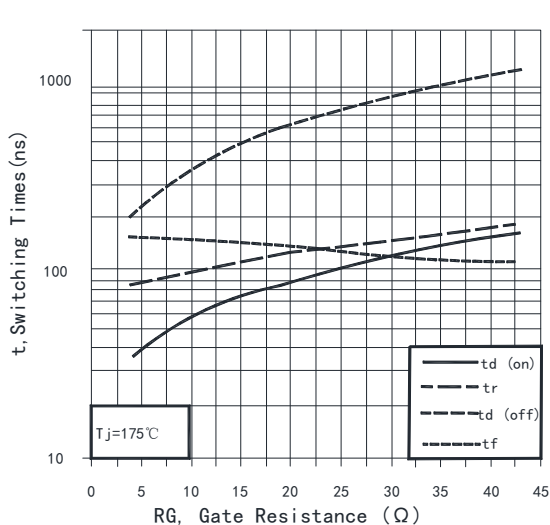


Fig. 9 Typical switching times vs. gate resistor
(Ind. Load, $T_j=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=40\text{A}$)

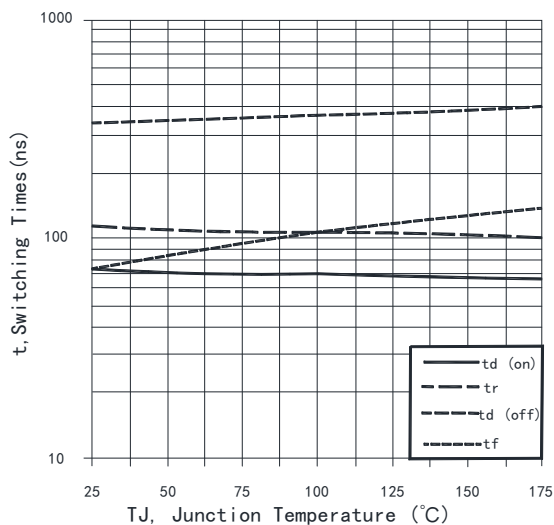


Fig. 10 Typical switching times vs. T_j
(Ind. Load, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=40\text{A}$, $R_g=12\Omega$)

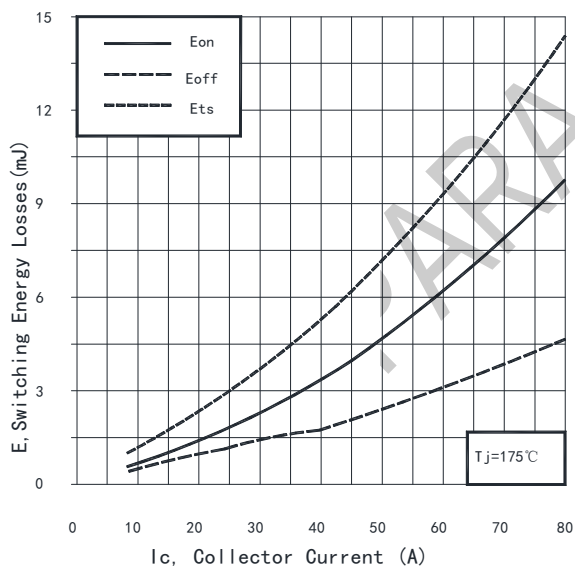


Fig. 11 Typical switching energy losses vs. collector current (Ind. load, $T_j=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $R_g=12\Omega$)

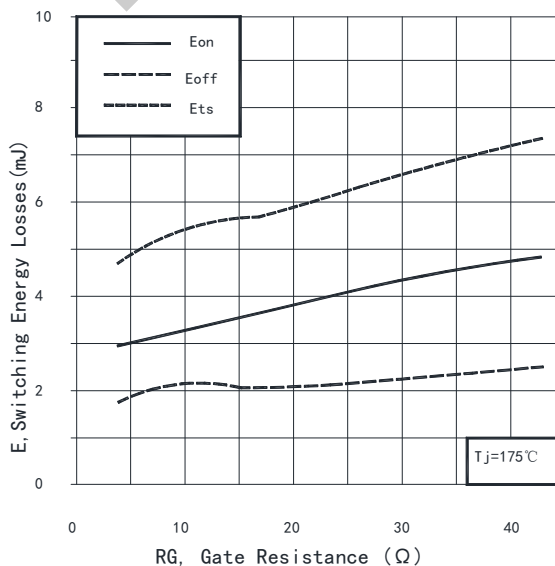


Fig. 12 Typical switching energy losses vs. gate resistor (Ind. load, $T_j=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=40\text{A}$)

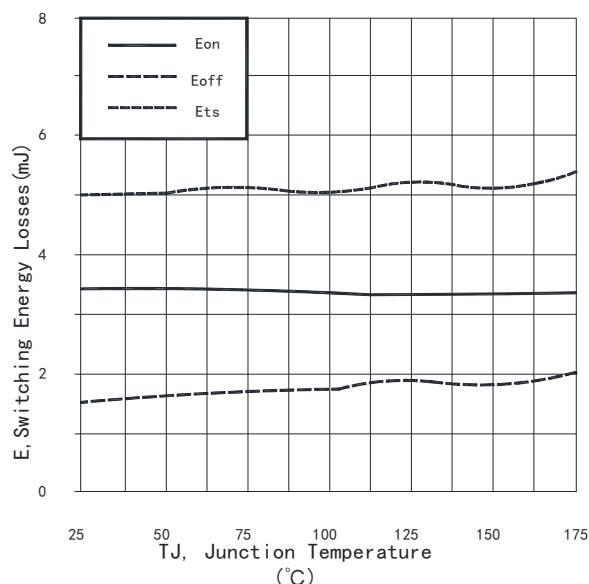


Fig. 13 Typical switching energy losses vs. T_j
(Ind load, $V_{CE}=600V$, $V_{GE}=15/0V$, $I_C=40A$,
 $R_g=12\Omega$)

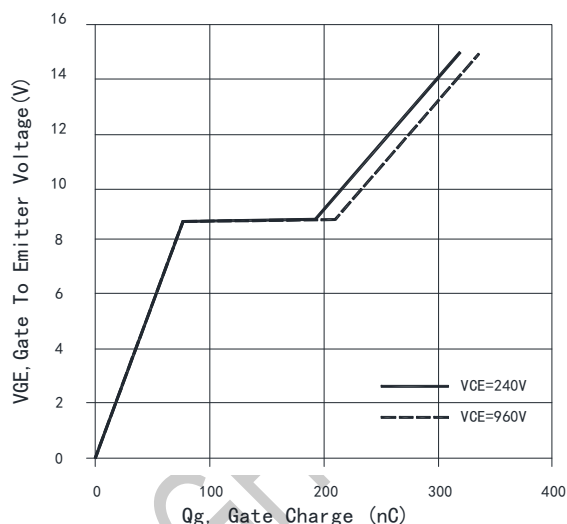


Fig. 14 Typical gate charge
($I_C=40A$)

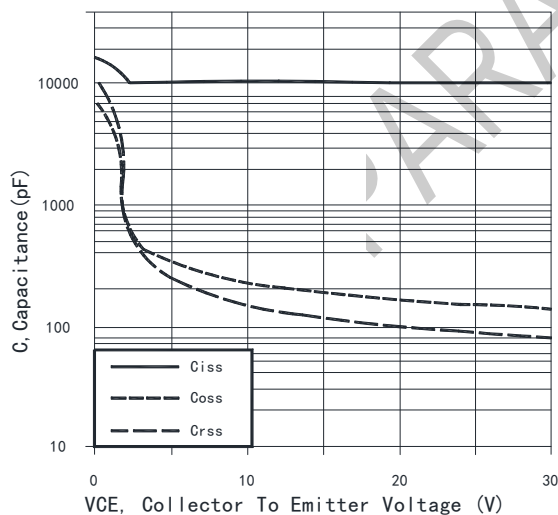


Fig. 15 Typical capacitance vs. collector-emitter voltage ($V_{GE}=0V$, $f=1MHz$)

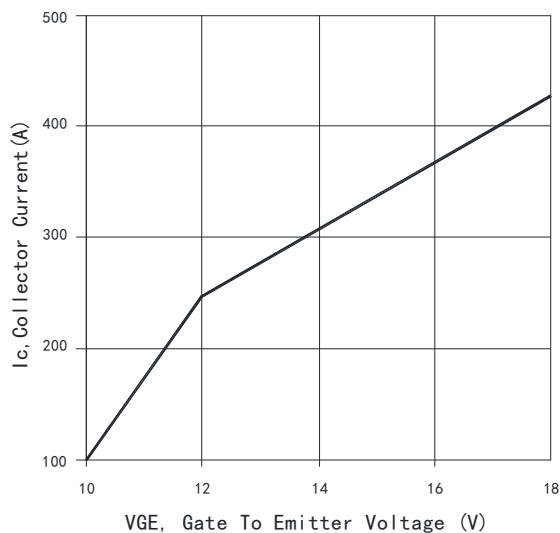


Fig. 16 Typical short circuit collector current vs. gate-emitter voltage ($V_{CE}\leq 600V$ start at $T_j=25^\circ C$)

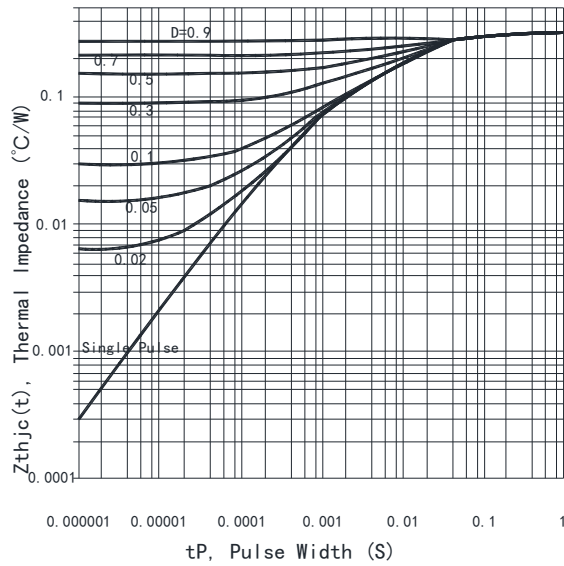


Fig. 17 IGBT transient thermal impedance ($D=tp/T$)

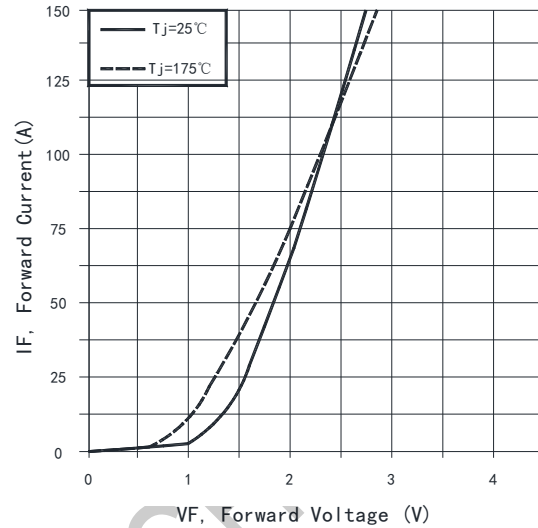


Fig. 18 Typical diode forward current vs. forward voltage

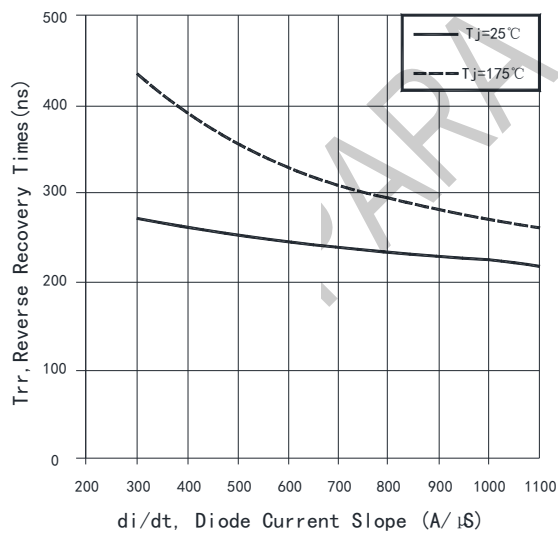


Fig. 19 Typical reverse recovery time vs. diode current slope ($V_R=600V$)

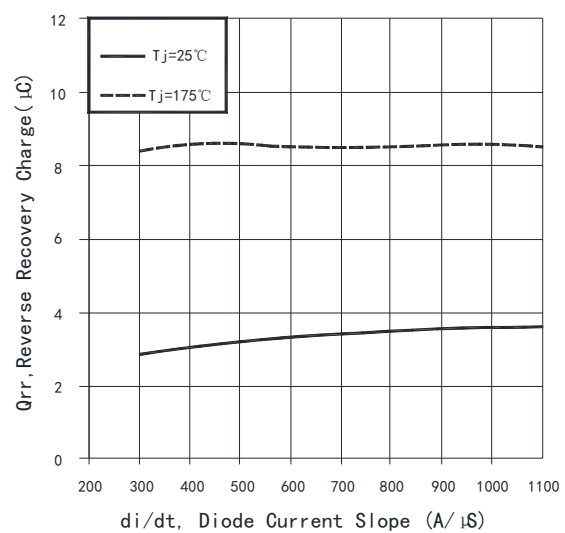


Fig. 20 Typical reverse recovery charge vs. diode current slope ($V_R=600V$)

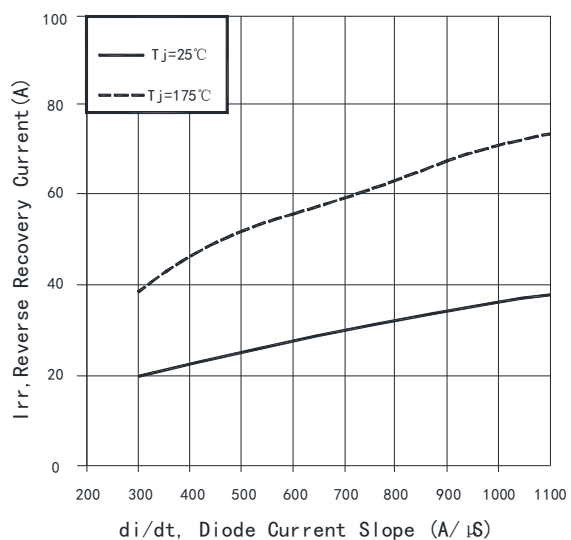
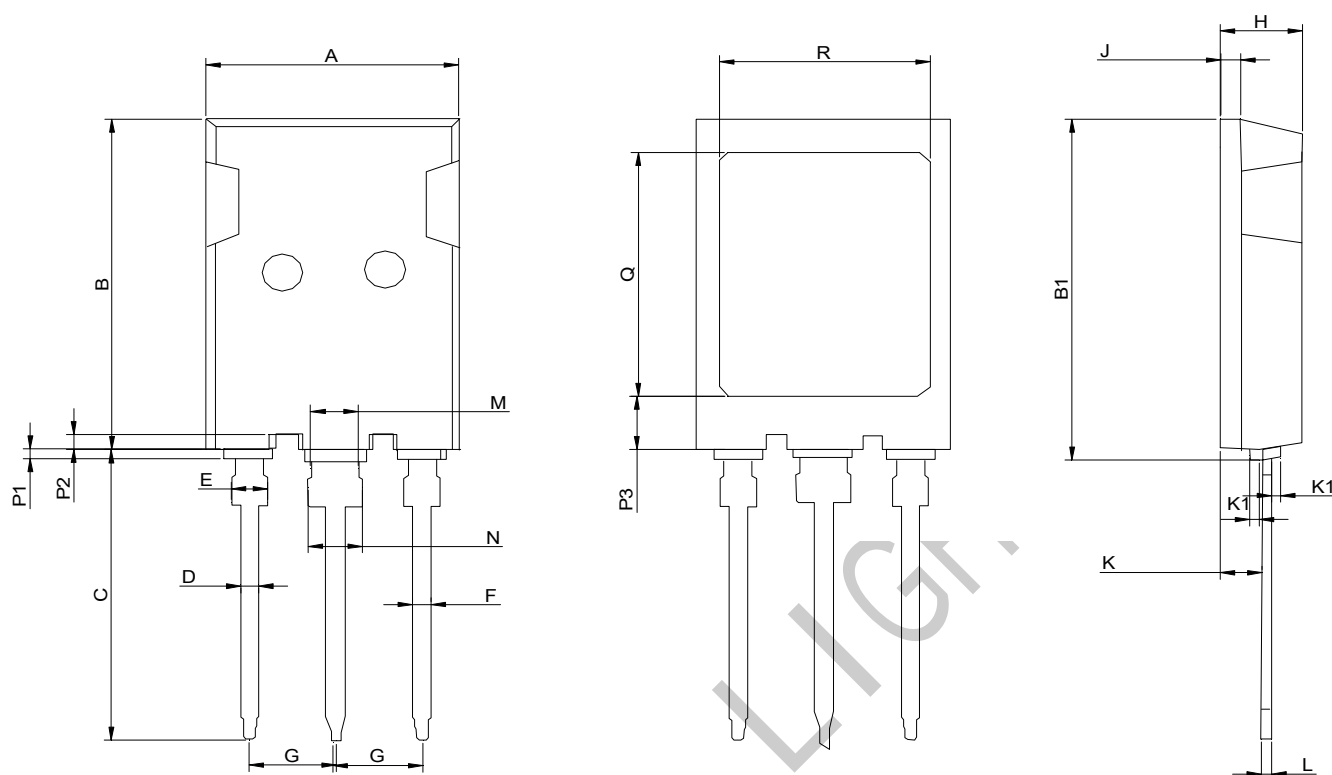


Fig. 21 Typical reverse recovery current vs. diode current slope ($V_R=600\text{V}$)

Package Dimensions



Common dimensions(mm)							
Symbol	Min	Typ	Max	Symbol	Min	Typ	Max
A	15.70	16.00	16.30	K	2.20	2.35	2.50
B	21.80	22.00	22.20	K1	0.45	0.60	0.75
B1	22.30	22.50	22.70	L	0.51	0.70	0.89
C	19.40	19.70	20.00	M	2.80	3.00	3.20
D	1.80	2.00	2.20	N	3.15	3.35	3.55
E	2.15	2.35	2.55	P1	0.44	0.64	0.84
F	1.16	1.36	1.56	P2	0.80	1.00	1.20
G	5.25	5.45	5.65	P3	3.55	3.75	3.95
H	4.80	5.00	5.20	Q	12.60	12.90	13.20
J	1.10	1.20	1.30	R	15.55	15.85	16.15

PART NO. SYSTEM :

P C 40 N 120 H D 7

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
2024.01.31	A / 0	First release.