

650V 50A 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}	Marking	Package
PC50N065IH7	650V	50A	1.6V	175°C	PC50N065IH7	TO220F-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}	650	V
DC collector current, limited by T _{Vjmax}	I _C	90	A
T _C = 25°C			
T _C = 100°C			
Pulsed collector current, tp limited by T _{Vjmax}	I _{Cpuls}	300	A
Diode forward current, limited by T _{Vjmax}	I _F	110	A
T _C = 25°C			
T _C = 100°C			
Gate-emitter voltage	V _{GES}	±20	V
Transient gate-emitter voltage (t _p ≤10μs, D <0.010)		±30	
IGBT max. power dissipation	P _{D_IGBT}	307	W
FWD max. power dissipation	P _{D_FWD}	274	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)	-	-	62	°C /W
Thermal resistance, IGBT junction-case	Rth(j-c)	-	-	0.7	
Thermal resistance, diodes junction-case	Rth(j-c)	-	-	1.5	

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	VGE=0V, IC=0.25mA	650	-	-	V
Collector-emitter saturation voltage	VCEsat	VGE= 15V, IC=50A	-	1.6	2.0	V
		Tvj= 25°C	-	2.2		
Diode forward voltage	VF	IF= 20A	-	2.2	3.0	V
		Tvj= 25°C	-	1.6		
Gate-emitter threshold voltage	VGE(th)	VCE= VGE, IC= 250μA	5.0	5.8	6.6	V
Zero gate voltage collector current	ICES	VCE= 650V, VGE= 0V	-	-	250	μA
Gate-emitter leakage current	IGES	VCE= 0V, VGE= ±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	-	6800	-	pF
Output capacitance	C _{oes}		-	200	-	pF
Reverse transfer capacitance	C _{res}		-	72	-	pF
Gate charge	Q _G	V _{CC} = 520V, I _C = 50A, V _{GE} = 15V	-	215	-	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} = 400V I _C = 50A V _{GE} = 15V R _G = 10Ω Inductive load	-	50	-	ns
Rise time	t _r		-	133	-	ns
Turn-off delay time	t _{d(off)}		-	195	-	ns
Fall time	t _f		-	78	-	ns
Turn-on energy	E _{on}		-	2.6	-	mJ
Turn-off energy	E _{off}		-	1.1	-	mJ
Total switching energy	E _{is}		-	3.7	-	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 = 400V	-	60	-	ns
Diode reverse recovery charge	Q _{rr}	I _F = 50A	-	0.24	-	μC
Diode peak reverse recovery current	I _{rrm}	di _F /dt = 500A/μs	-	0.6	-	A

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

Parameter	Symbols	Conditions	Value			Unit
			Min	Typ	Max	
IGBT Characteristics						
Turn-on delay time	td(on)	VCC= 400V IC= 50A VGE= 15V RG= 10Ω Inductive load	-	45	-	ns
Rise Time	tr		-	137	-	ns
Turn-off delay time	td(off)		-	218	-	ns
Fall time	tf		-	95	-	ns
Turn-on energy	Eon		-	2.7	-	mJ
Turn-off energy	Eoff		-	1.2	-	mJ
Total switching energy	Ets		-	3.9	-	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 = 400V I _F = 50A di _F /dt = 500A/μs	-	93	-	ns
Diode reverse recovery charge	Q _{rr}		-	1.44	-	μC
Diode peak reverse recovery current	I _{rrm}		-	20.48	-	A

Typical Characteristics

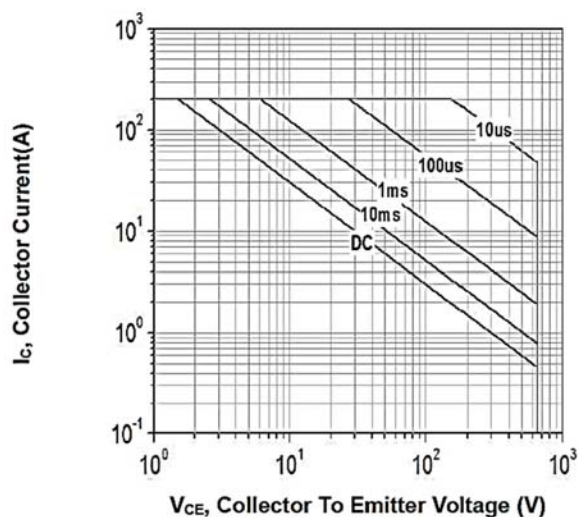


Fig. 1 Forward bias safe operating area
($D = 0$, $T_c = 25^\circ\text{C}$, $T_{vj} \leq 175^\circ\text{C}$; $V_{GE} = 15\text{V}$)

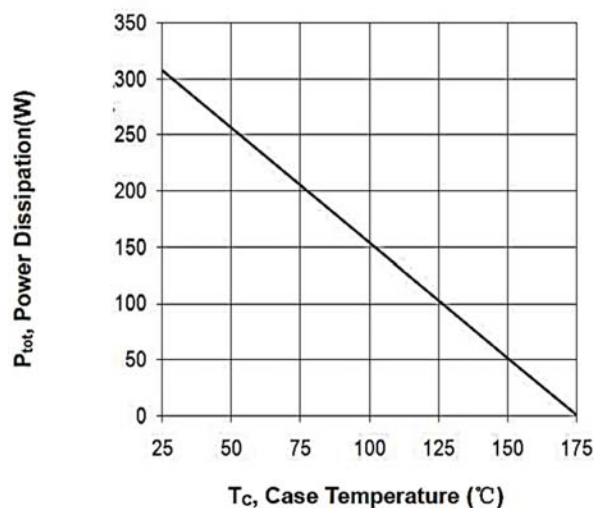


Fig. 2 Power dissipation vs. case temperature
($T_{vj} \leq 175^\circ\text{C}$)

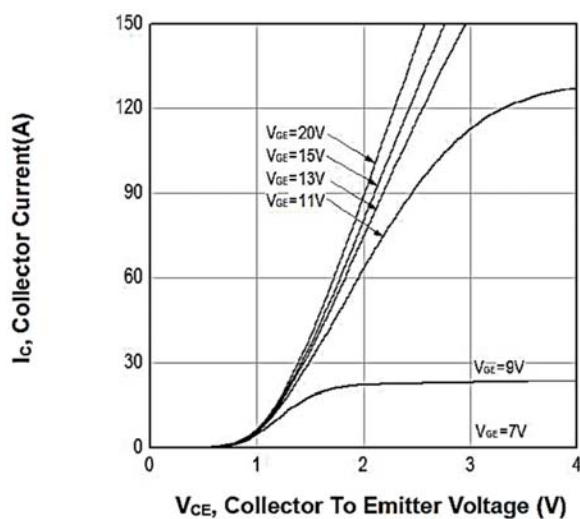


Fig. 3 Typical output characteristic
($T_{vj} = 25^\circ\text{C}$)

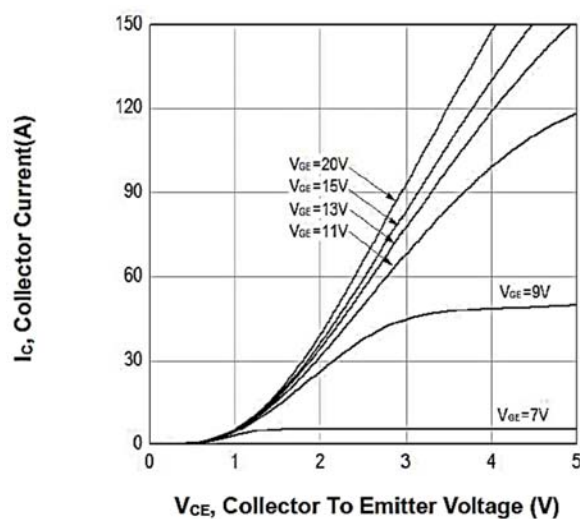


Fig. 4 Typical output characteristic
($T_{vj} = 175^\circ\text{C}$)

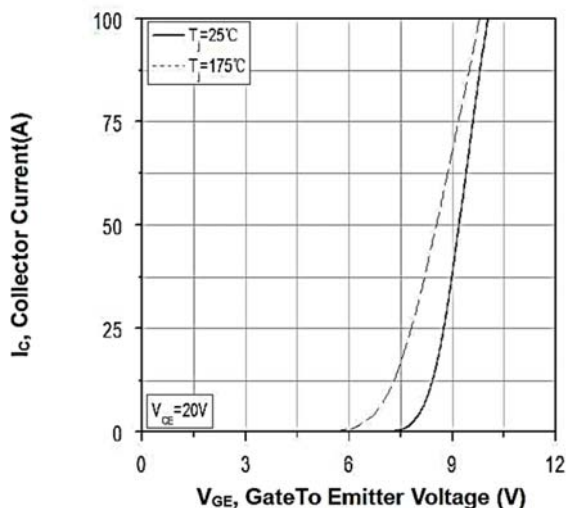


Fig. 5 Typical transfer characteristic ($V_{CE} = 20V$)

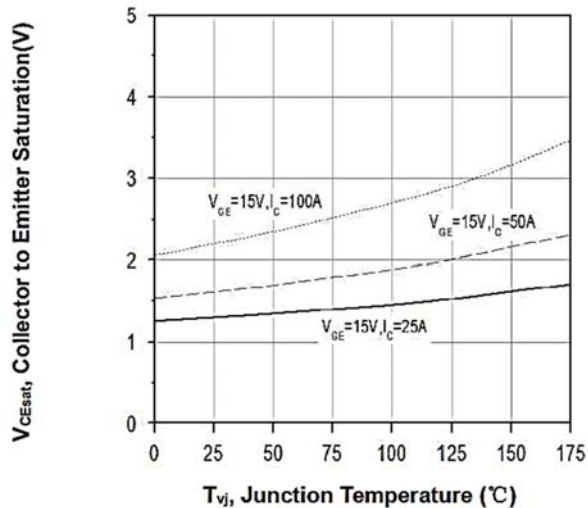


Fig. 6 Typical collector-emitter saturation voltage vs. T_{vj} ($V_{GE} = 20V$)

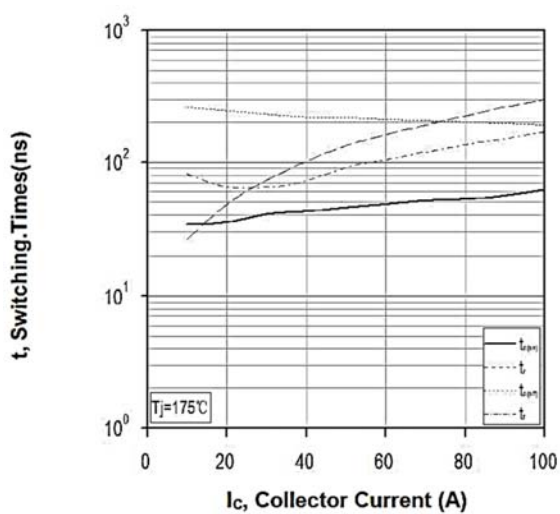


Fig. 7 Typical switching times vs. collector current (Ind. load, $T_{vj} = 175^\circ\text{C}$, $V_{CE} = 400V$, $V_{GE} = 15/0V$, $R_g = 10\Omega$)

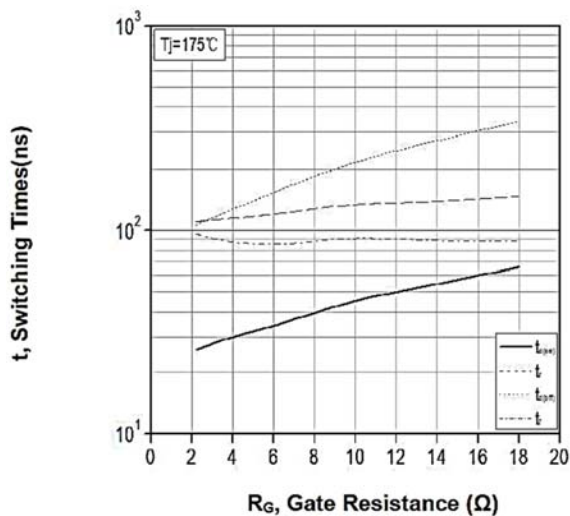


Fig. 8 Typical switching times vs. gate resistor (Ind. Load, $T_{vj} = 175^\circ\text{C}$, $V_{CE} = 400V$, $V_{GE} = 15/0V$, $I_c = 50A$)

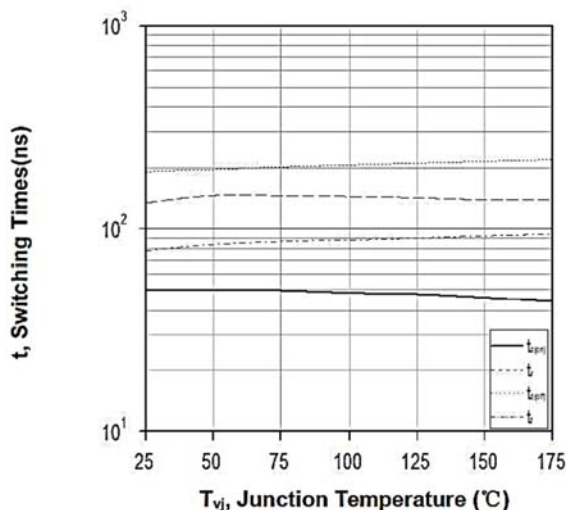


Fig. 9 Typical switching times vs. T_j
(Ind. Load, $V_{CE} = 400V$, $V_{GE} = 15/0V$,
 $I_c = 50A$, $R_G = 10\Omega$)

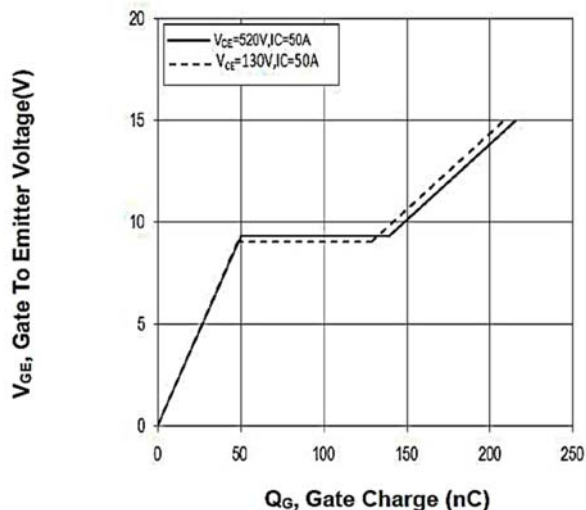


Fig. 10 Typical gate charge ($I_c = 50A$)

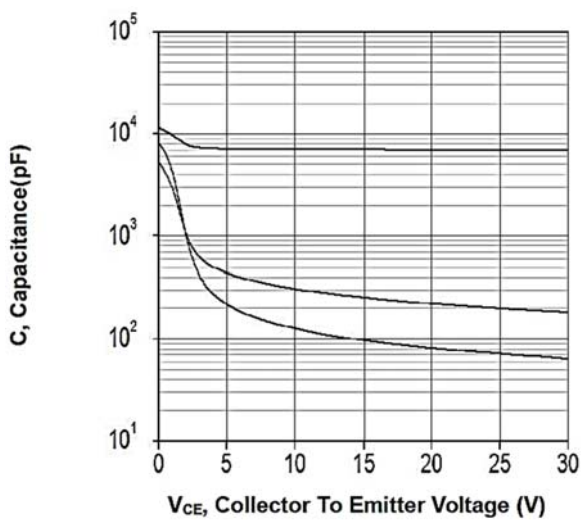


Fig. 11 Typical capacitance vs. collector-emitter voltage
($V_{GE} = 0V$, $f = 1MHz$)

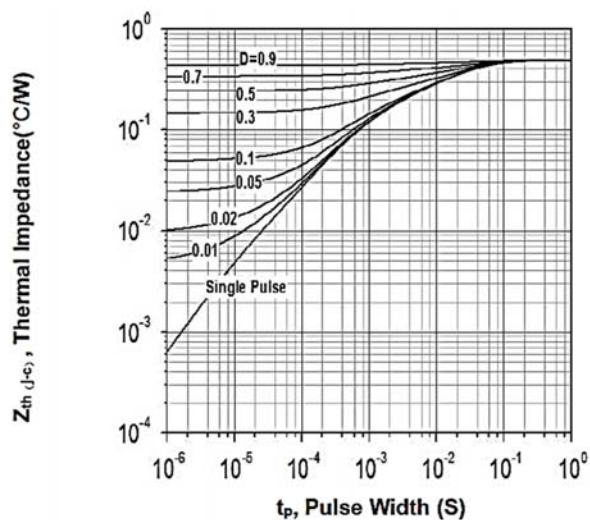
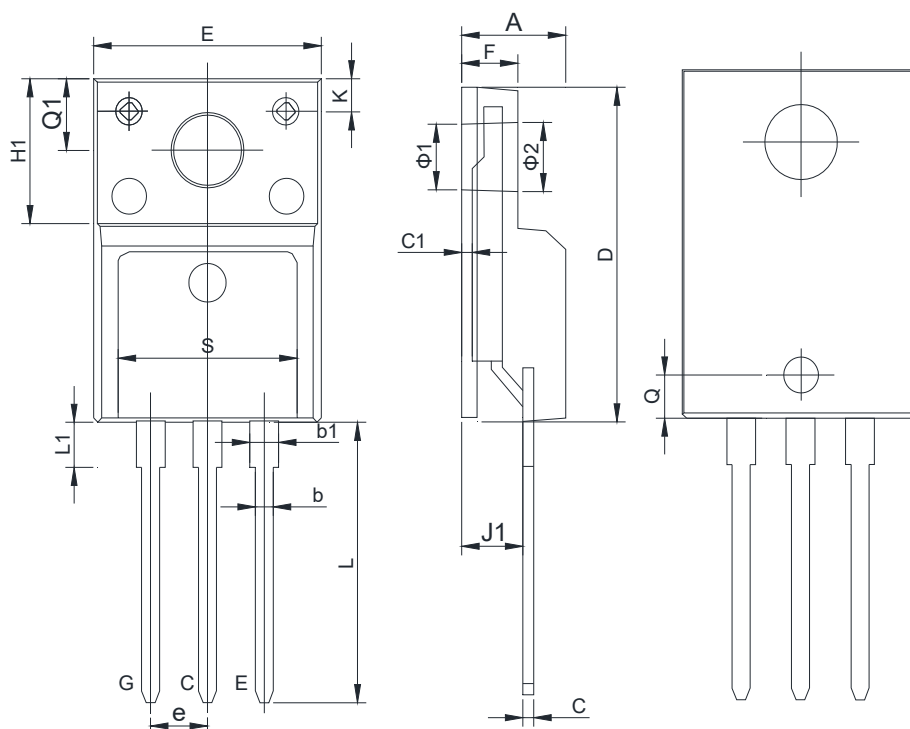


Fig. 12 IGBT transient thermal impedance ($D = t_p/T$)

Package Dimensions



DIM	MIM(mm)	MAX(mm)
A	4.53	4.93
b	0.71	0.91
b1	1.15	1.39
C / C1	0.45	0.6
D	15.67	16.07
E	9.96	10.36
F	2.34	2.74
H1	6.5	6.9
J	0.32	0.43
J1	2.56	2.96
K	1.9	2.1
e	2.54 BSC	
Q	1.9	2.1
Q1	3.1	3.5
S	7.9	8.1
L	12.78	13.18
L1	1.9	2.3
Ø1	3.08	3.28
Ø2	3.35	3.55

PART NO. SYSTEM :

P C 50 N 065 I H 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;
"I": TO-220F

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
2024.05.11	A / 0	First release.