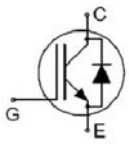
650V 50A CoolFAST™ 7 Technology IGBT

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
PC50N065BH7	650V	50A	1.6V	175°C	PC50N065BH7	TO220-3

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} Tc= 25°C Tc= 100°C	I_C	 90 50	A
Pulsed collector current, tp limited by T_{vjmax}	I_{Cpuls}	300	A
Diode forward current, limited by T_{vjmax} Tc= 25°C Tc= 100°C	I_F	 110 50	A
Diode Pulsed collector current, t_p limited by T_{vjmax}	I_{FP}	200	A
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}	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	$R_{th(j-a)}$	-	-	62	°C /W
Thermal resistance, IGBT junction-case	$R_{th(j-c)}$	-	-	0.7	
Thermal resistance, diodes junction-case	$R_{th(j-c)}$	-	-	1.5	

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Electrical Characteristics at T_{vj}= 25°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	650	-	-	V
Collector-emitter saturation voltage	V_{CEsat}	V_{GE}= 15V, I_C=50A T_{vj}= 25°C T_{vj}= 175°C	 - -	 1.6 2.2	 2.0	V
Diode forward voltage	V_F	I_F= 20A T_{vj}= 25°C T_{vj}= 175°C	 - -	 2.2 1.6	 3.0 -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	V_{CE}= V_{GE}, I_C= 250μA	5.0	5.8	6.6	V
Zero gate voltage collector current	I_{CES}	V_{CE}= 650V, V_{GE}= 0V	-	-	250	μA
Gate-emitter leakage current	I_{GES}	V_{CE}= 0V, V_{GE}= ±20V	-	-	±200	nA

Electrical Characteristics at T_{vj}= 25°C (unless otherwise specified)

Parameter	Symbols	Conditions	Value			Unit
			Min	Typ	Max	
Dynamic Characteristic						
Input capacitance	C_{ies}	V_{CE}= 25V, V_{GE}= 0f= 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°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_{ts}		-	3.7	-	mJ

Switching Characteristics at T_{vj}= 25°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	-	60	-	ns
Diode reverse recovery charge	Q_{rr}		-	0.24	-	μC
Diode peak reverse recovery current	I_{rrm}		-	0.6	-	A

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Switching Characteristics at T_{vj}= 175°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	-	45	-	ns
Rise Time	t_r		-	137	-	ns
Turn-off delay time	$t_{d(off)}$		-	218	-	ns
Fall time	t_f		-	95	-	ns
Turn-on energy	E_{on}		-	2.7	-	mJ
Turn-off energy	E_{off}		-	1.2	-	mJ
Total switching energy	E_{ts}		-	3.9	-	mJ

Switching Characteristics at T_{vj}= 175°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

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Typical Characteristics

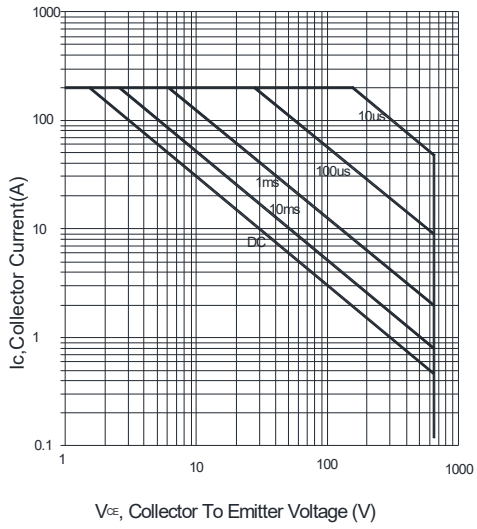

Fig. 1 Forward bias safe operating area (D= 0, T_C= 25°C, T_{vj}≤ 175°C; V_{GE}= 15V)

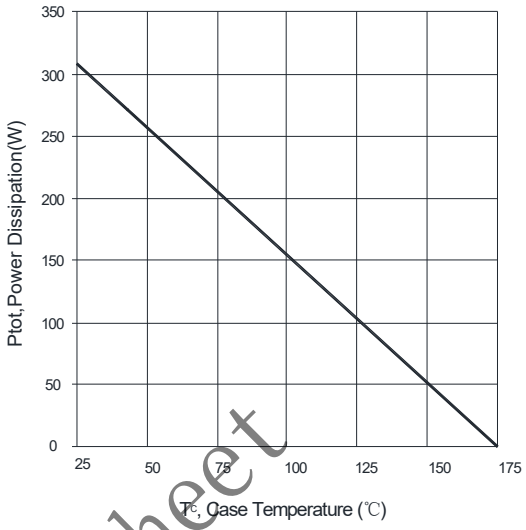

Fig. 2 Power dissipation vs. case temperature (T_{vj}≤ 175°C)

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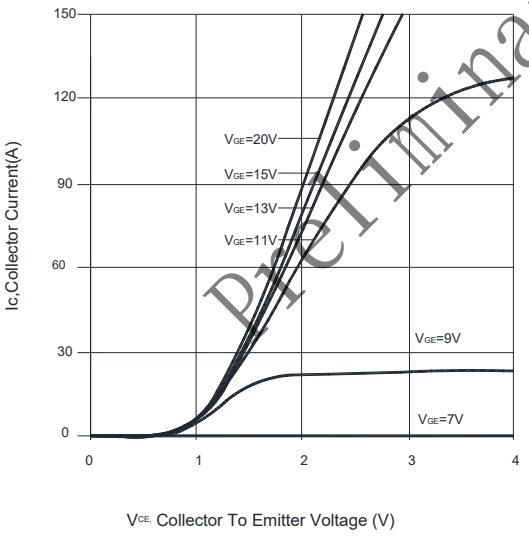

Fig. 3 Typical output characteristic(T_{vj}= 25°C)

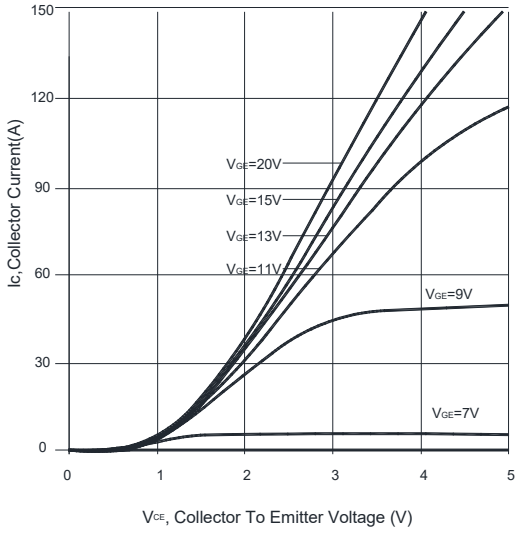

Fig. 4 Typical output characteristic(T_{vj}= 175°C)

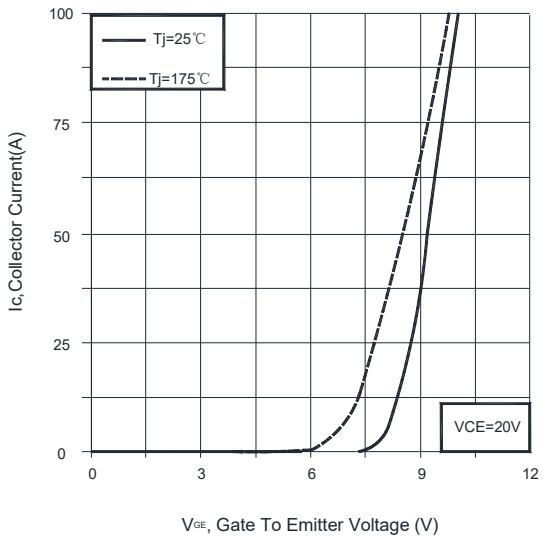

Fig. 5 Typical transfer characteristic (V_{CE}= 20V)

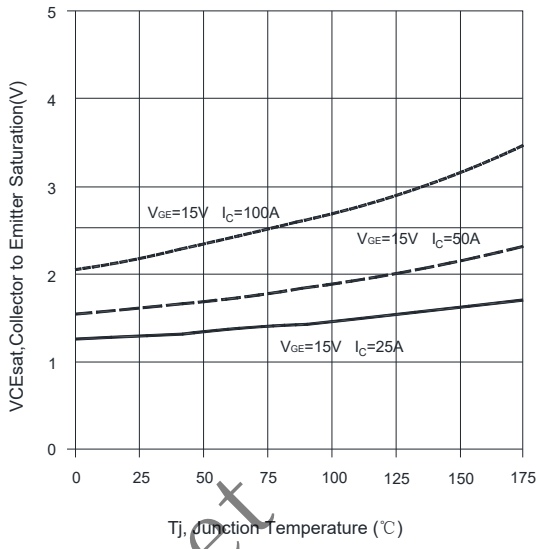

Fig. 6 Typical collector-emitter saturation voltage vs. T_{vj} (V_{GE}= 20V)

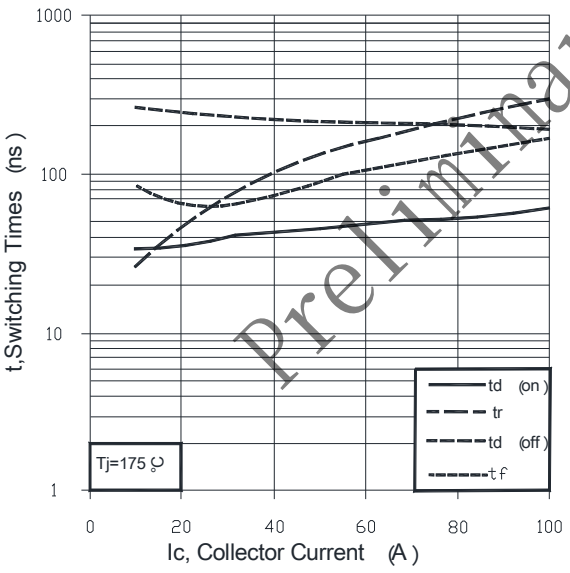

Fig. 7 Typical switching times vs. collector current(Ind. load, T_{vj}= 175°C, V_{CE}= 400V, V_{GE}= 15/0V, R_G=10Ω)

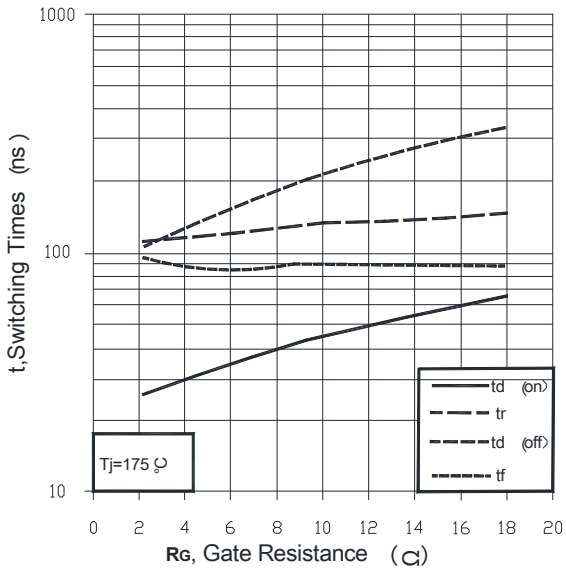

Fig. 8 Typical switching times vs. gate resistor (Ind. Load, T_{vj}= 175°C, V_{CE}= 400V,V_{GE}= 15/0V, I_C= 50A)

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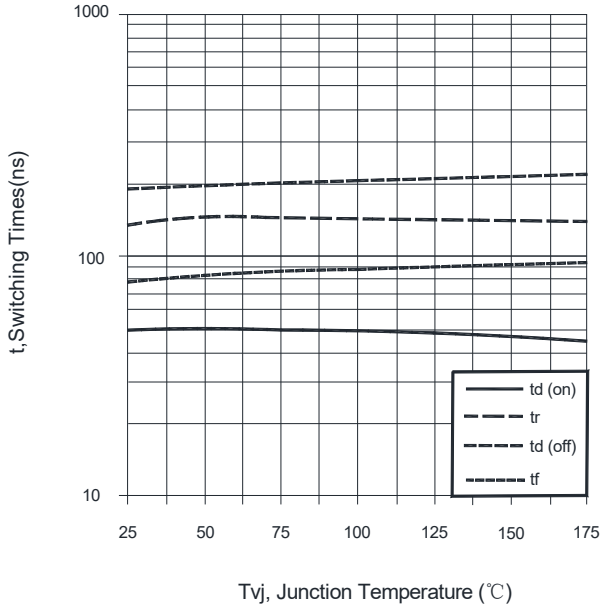

Fig. 9 Typical switching times vs. Tvj (Ind. Load, V_{CE}= 400V, V_{GE}= 15/0V, I_C= 50A, R_G= 10Ω)

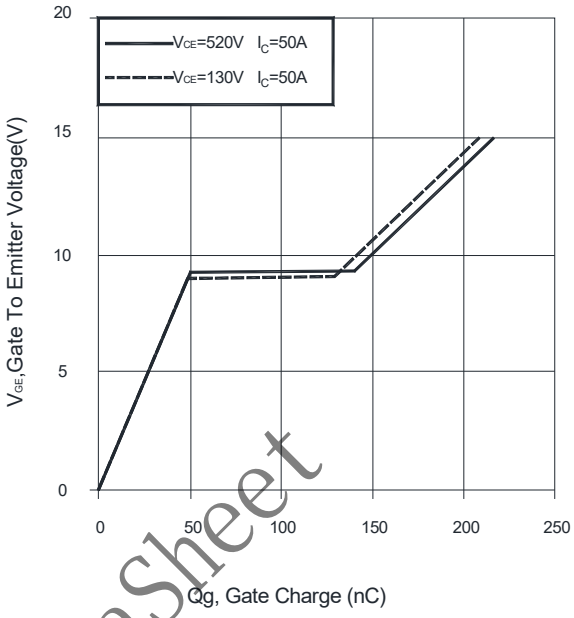

Fig. 10 Typical gate charge (I_C= 50A)

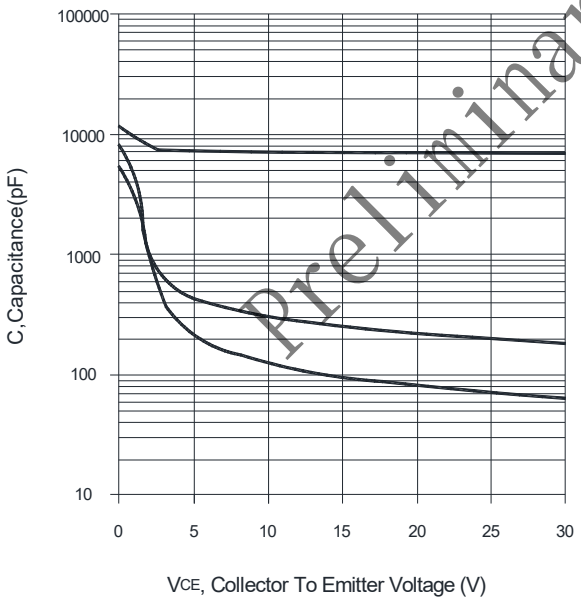

Fig. 11 Typical capacitance vs. collector-emitter voltage (V_{GE}= 0V, f= 1MHz)

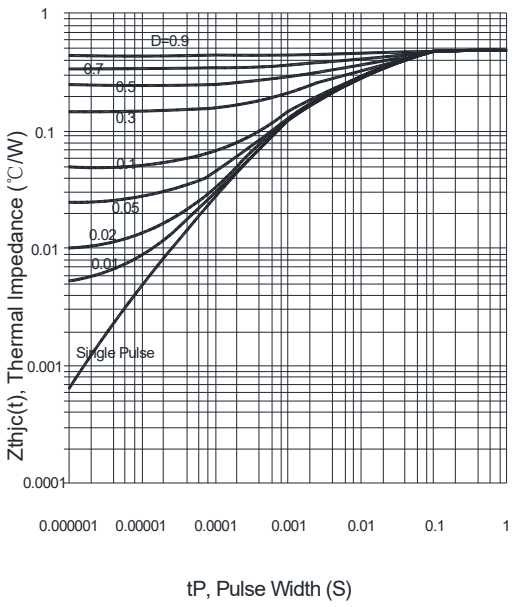

Fig. 12 IGBT transient thermal impedance (D= tp/T)

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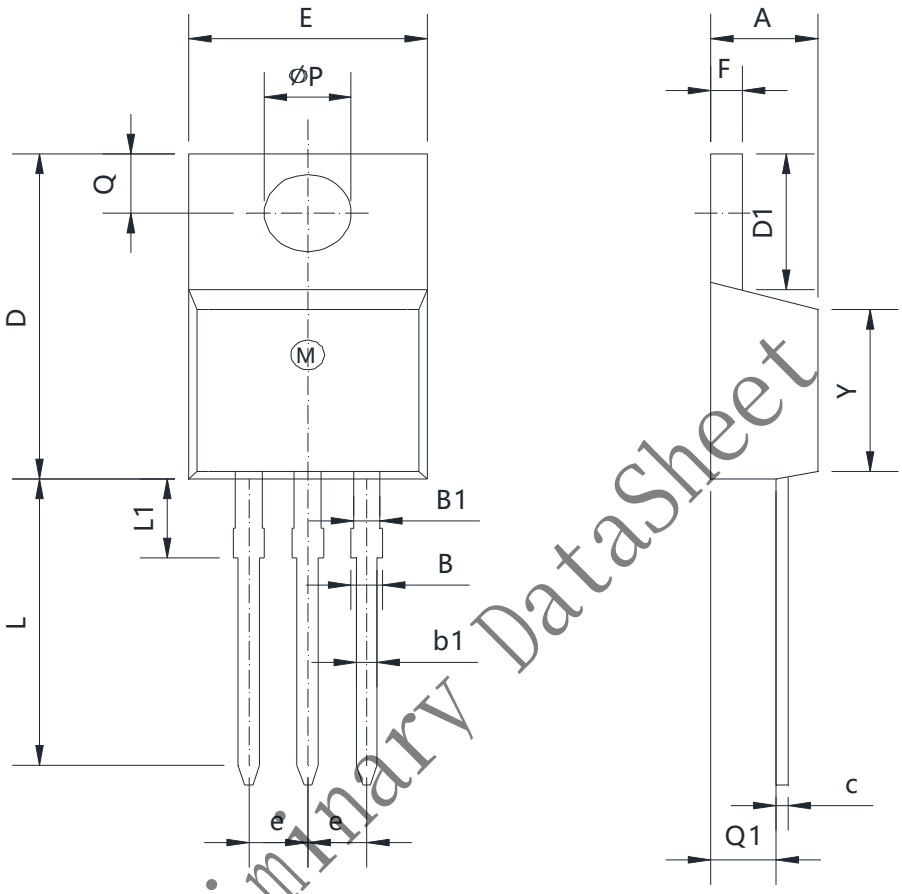
Package Dimensions



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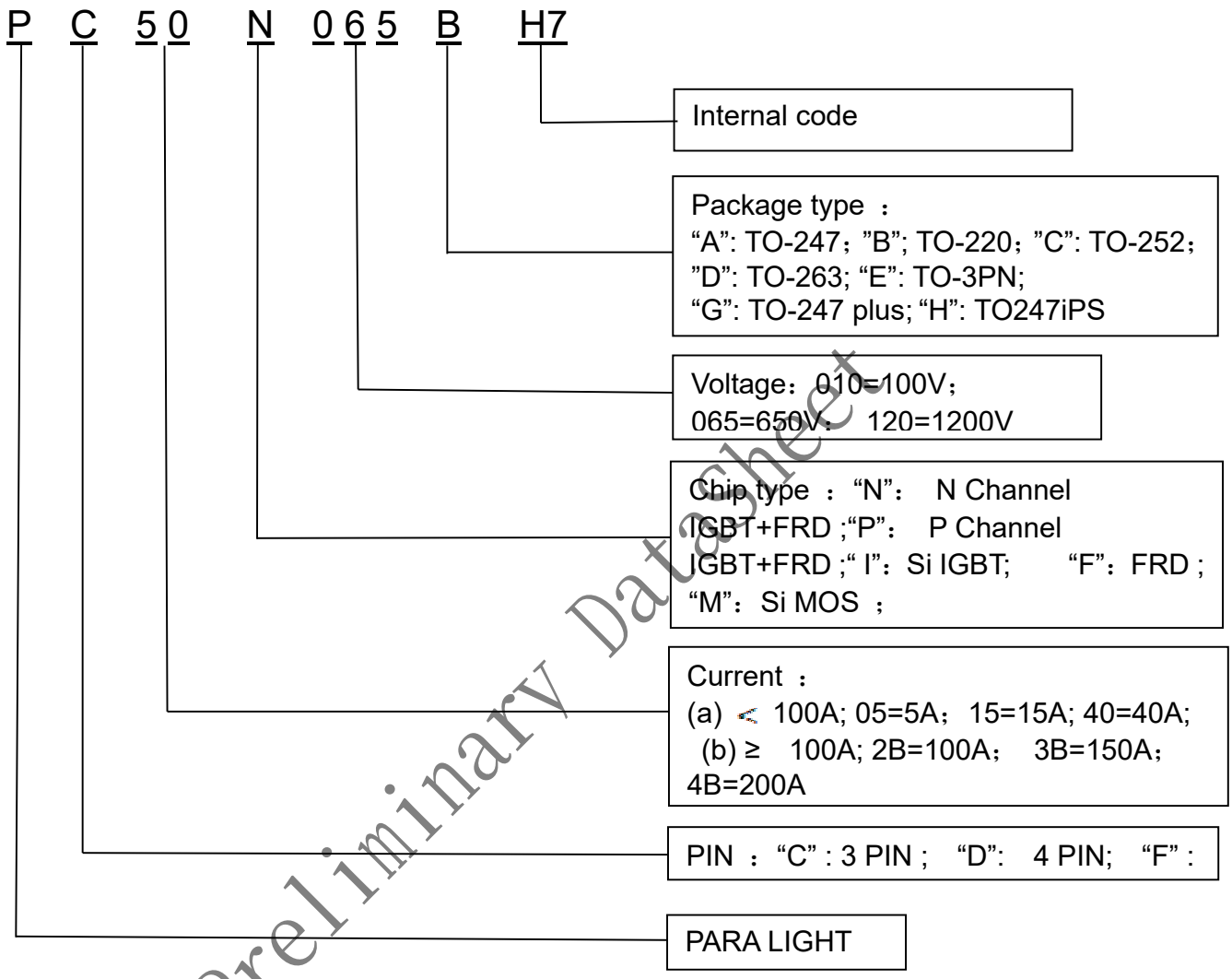
Common dimensions(mm)							
Symbol	Min	Typ	Max	Symbol	Min	Typ	Max
A	4.00	-	4.80	e	2.44	2.54	2.64
B	1.20	-	1.40	F	1.10	-	1.40
B1	1.00	-	1.40	L	12.5	-	14.50
b1	0.75	-	0.95	L1	3.00	3.50	4.00
c	0.40	-	0.55	ΦP	3.70	3.80	3.90
D	15.00	-	16.50	Q	2.50	-	3.00
D1	5.90	-	6.90	Q1	2.00	-	2.90
E	9.90	-	10.70	Y	8.02	8.12	8.22

PART NO. SYSTEM :



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Revision history

Document revision history

Date	Version	Changes
2025.01.11	A / 0	First release.

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