

650V 50A CoolFAST™ 7 Technology IGBT

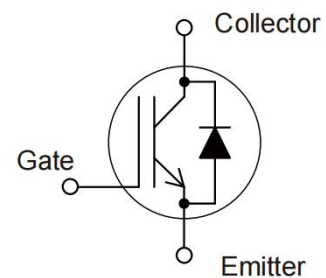
Features:

- 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	Packing
DKP50N65IF7	650V	50A	1.6V	175°C	DKP50N65IF7	TO-220-3	Tube

Maximum Ratings and Characteristics

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

Items	Symbols	Value	Units
Collector-emitter voltage	V _{CEs}	650	V
Gate-emitter voltage	V _{GES}	±20	V
Transient gate-emitter voltage (t _p ≤ 10μs, D < 0.010)	V _{GES}	±30	V
DC collector current, limited by T _{vjmax} T _C = 25°C T _C = 100°C	I _C	90 50	A
Pulsed collector current, t _p limited by T _{vjmax}	I _{CP}	300	A
Diode forward current, limited by T _{vjmax} T _C = 25°C T _C = 100°C	I _F	110 50	A
Diode Pulsed collector current, t _p limited by T _{vjmax}	I _{FP}	200	A
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

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

Description	Symbols	Conditions	Characteristics			Unit
			Min	Typ	Max	
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE}= 0\text{V}, I_C= 0.25\text{mA}$	650	-	-	V
Zero gate voltage collector current	I_{CES}	$V_{CE}= 650\text{V}, V_{GE}= 0\text{V}$	-	-	250	μA
Gate-emitter leakage current	I_{GES}	$V_{CE}= 0\text{V}, V_{GE}= \pm 20\text{V}$	-	-	± 200	nA
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE}= V_{GE}, I_C= 250\mu\text{A}$	5.0	5.8	6.6	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE}= 15\text{V}, I_C= 50\text{A}$	-	1.6	2.0	V
		$T_{vj}= 25^{\circ}\text{C}$ $T_{vj}= 175^{\circ}\text{C}$	-	2.2	-	
Input capacitance	C_{ies}	$V_{CE}= 25\text{V}, V_{GE}= 0\text{V}$ $f= 1\text{MHz}$	-	6800	-	pF
Output capacitance	C_{oes}		-	200	-	pF
Reverse transfer capacitance	C_{res}		-	72	-	pF
Gate charge	Q_G	$V_{CC}= 520\text{V}, I_C= 50\text{A}, V_{GE}= 15\text{V}$	-	215	-	nC
Forward voltage drop	V_F	$I_F= 20\text{A}$	-	2.2	3.0	V
		$T_{vj}= 25^{\circ}\text{C}$ $T_{vj}= 175^{\circ}\text{C}$	-	1.6	-	

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

Description	Symbols	Conditions	Characteristics			Unit
			Min	Typ	Max	
IGBT Characteristics						
Turn-on delay time	$t_{d(on)}$	$V_{CC}= 400\text{V}$ $I_C= 50\text{A}$ $V_{GE}= 15\text{V}$ $R_G= 10\Omega$ 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
Diode Characteristics						
Diode reverse recovery time	t_{rr}	$V_{CC}= 400\text{V}$	-	60	-	ns
Diode reverse recovery charge	Q_{rr}	$I_F= 50\text{A}$	-	0.24	-	μC
Diode peak reverse recovery current	I_{rrm}	$di_F/dt= 500\text{A}/\mu\text{s}$	-	0.6	-	A

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

Description	Symbols	Conditions	Characteristics			Unit
			Min	Typ	Max	
IGBT Characteristics						
Turn-on delay time	$t_{d(on)}$	$V_{CC}= 400\text{V}$ $I_C= 50\text{A}$ $V_{GE}= 15\text{V}$ $R_G= 10\Omega$ 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
Diode Characteristics						
Diode reverse recovery time	t_{rr}	$V_{CC}= 400\text{V}$	-	93	-	ns
Diode reverse recovery charge	Q_{rr}	$I_F= 50\text{A}$	-	1.44	-	μC
Diode peak reverse recovery current	I_{rrm}	$di_F/dt= 500\text{A}/\mu\text{s}$	-	20.48	-	A

Thermal Resistance

Items	Symbols	Characteristics			Unit
		Min	Typ	Max	
Thermal resistance, junction-ambient	$R_{th(j-a)}$	-	-	62	°C /W
Thermal resistance, IGBT junction to case	$R_{th(j-c)}$	-	-	0.7	
Thermal resistance, diodes junction to case	$R_{th(j-c)}$	-	-	1.5	

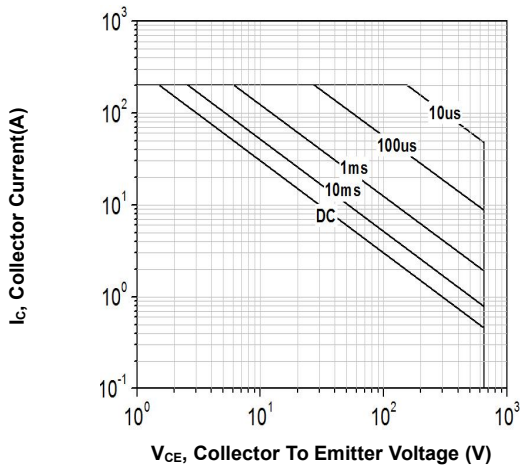


Figure 1. Forward bias safe operating area
($D = 0$, $T_c = 25^\circ\text{C}$, $T_{vj} \leq 175^\circ\text{C}$; $V_{GE} = 15\text{V}$)

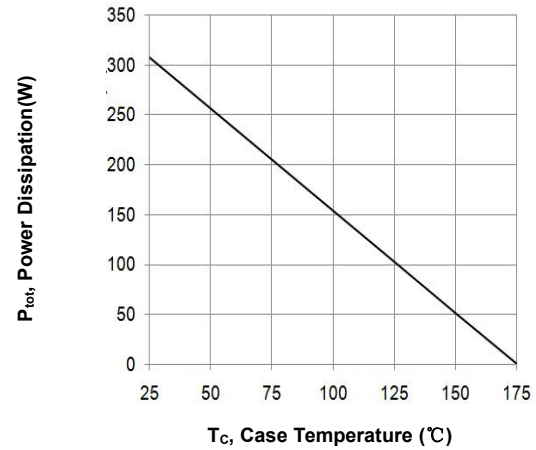


Figure 2. Power dissipation vs. case temperature
($T_{vj} \leq 175^\circ\text{C}$)

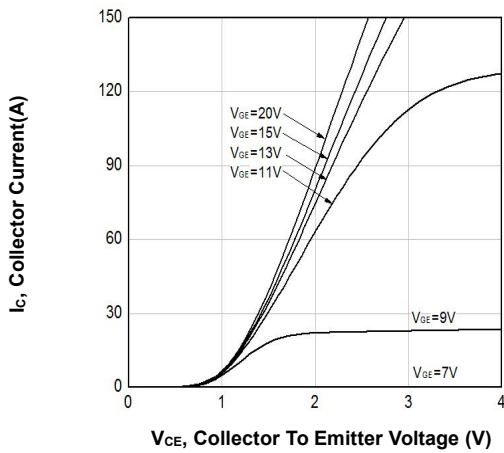


Figure 3. Typical output characteristic
($T_{vj} = 25^\circ\text{C}$)

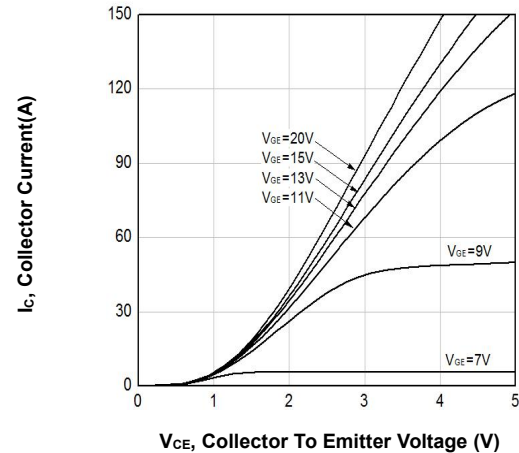


Figure 4. Typical output characteristic
($T_{vj} = 175^\circ\text{C}$)

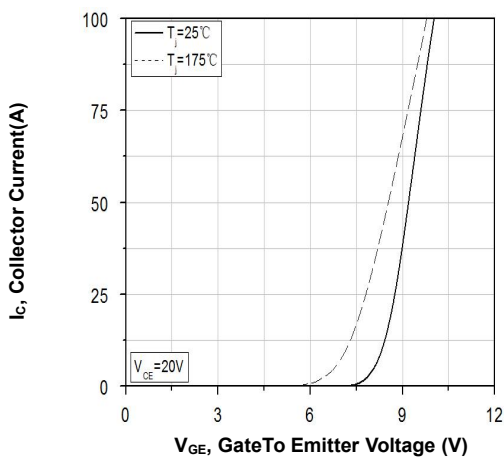


Figure 5. Typical transfer characteristic
($V_{CE} = 20\text{V}$)

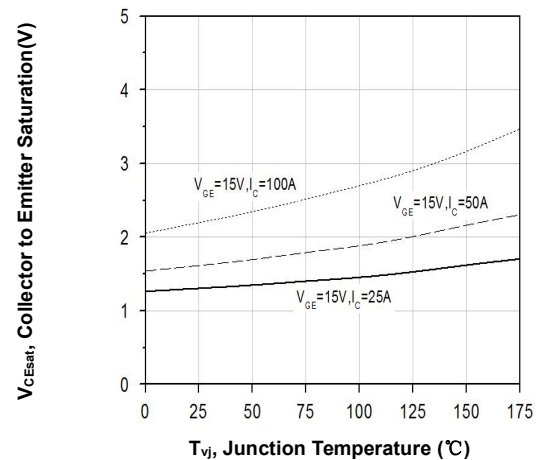


Figure 6. Typical collector-emitter saturation voltage vs. T_{vj} ($V_{GE} = 20\text{V}$)

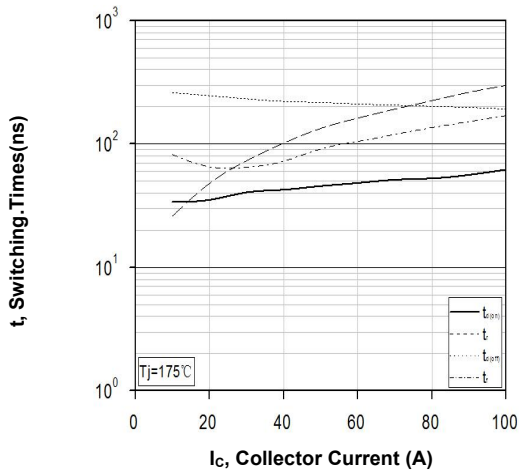


Figure 7. Typical switching times vs. collector current (Ind. load, $T_{vj} = 175^{\circ}\text{C}$, $V_{CE} = 400\text{V}$, $V_{GE} = 15/0\text{V}$, $R_G = 10\Omega$)

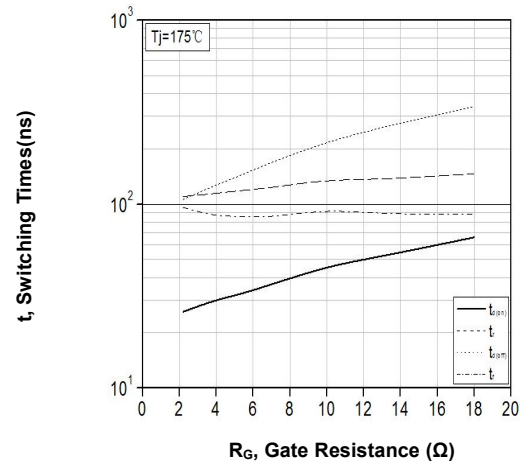


Figure 8. Typical switching times vs. gate resistor (Ind. Load, $T_{vj} = 175^{\circ}\text{C}$, $V_{CE} = 400\text{V}$, $V_{GE} = 15/0\text{V}$, $I_C = 50\text{A}$)

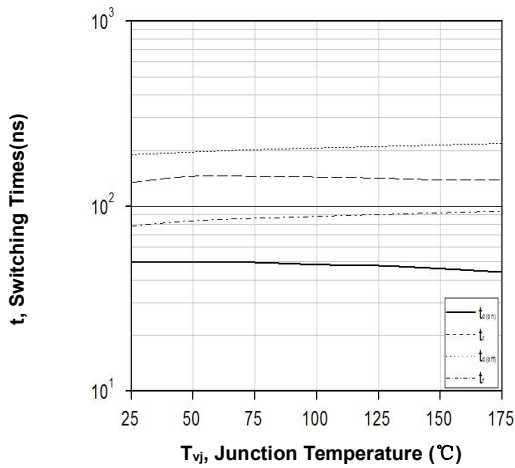


Figure 9. Typical switching times vs. T_{vj} (Ind. Load, $V_{CE} = 400\text{V}$, $V_{GE} = 15/0\text{V}$, $I_C = 50\text{A}$, $R_G = 10\Omega$)

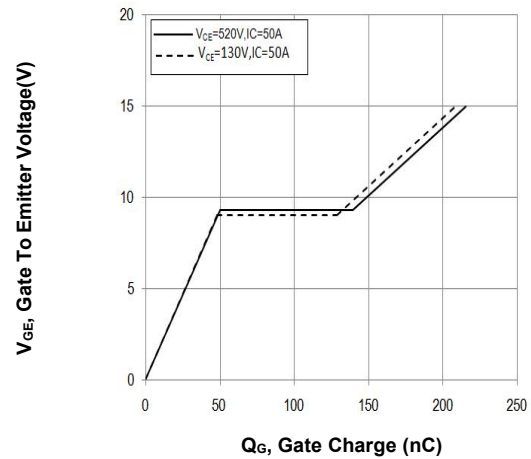


Figure 10. Typical gate charge ($I_C = 50\text{A}$)

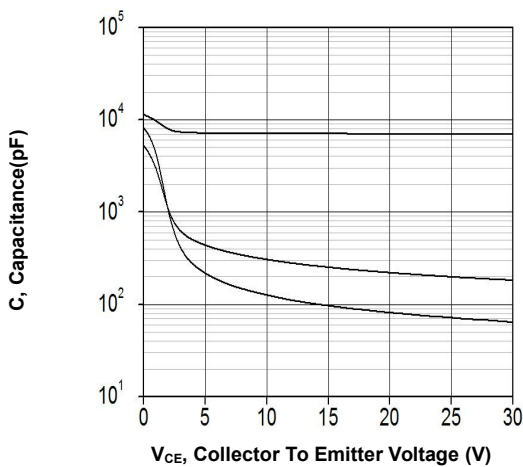


Figure 11. Typical capacitance vs. collector-emitter voltage ($V_{GE} = 0\text{V}$, $f = 1\text{MHz}$)

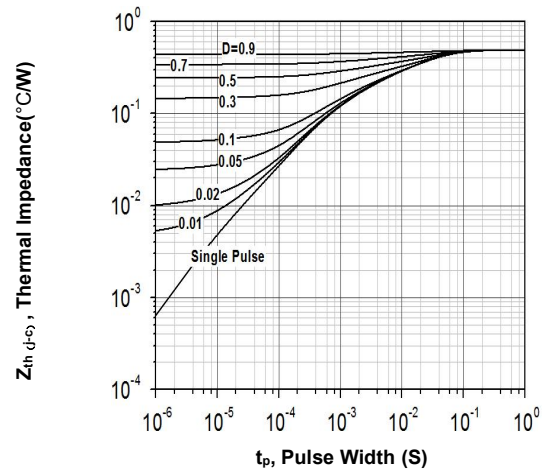
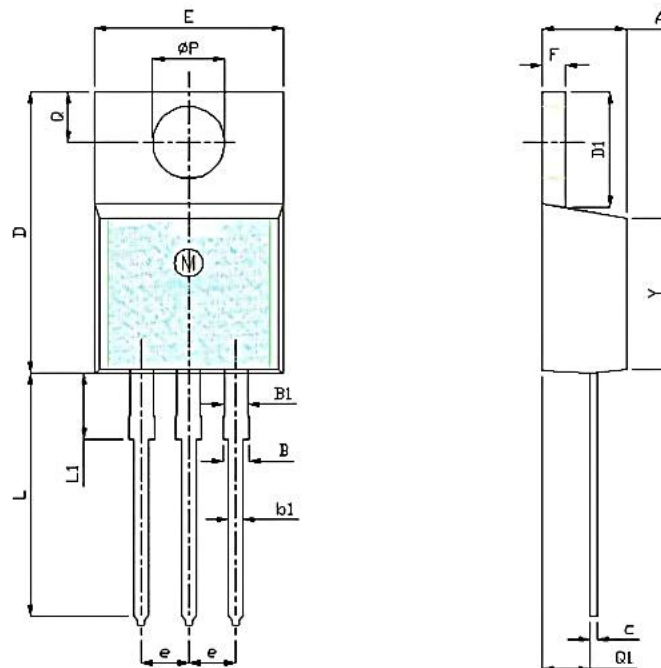


Figure 12. IGBT transient thermal impedance ($D = t_p/T$)

TO220 Package Outline

Unit: mm

Symbol	Min	Nom	Max	Symbol	Min	Nom	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	12.50		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



Revision History

Revision	Date	Subjects (major changes since last revision)
1,0	2023-3-5	Target version
1.1	2024-3-25	MP version

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