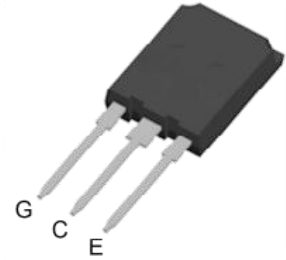


650V 75A CoolFAST™ 7 Technology IGBT With Internal Isolation

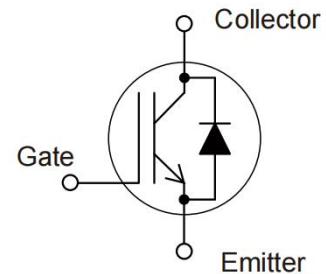
Features:

- 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



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
DKI75N65EF7	650V	75A	1.75V	175°C	DKI75N65EF7	TO247IPS-3L

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)		±30	V
DC collector current, limited by T _{vjmax}			
T _C = 25°C	I _C	125	A
T _C = 100°C		75	
Pulsed collector current, t _p limited by T _{vjmax}	I _{CP}	300	A
Diode forward current, limited by T _{vjmax}			
T _C = 25°C	I _F	115	A
T _C = 100°C		75	
Diode Pulsed collector current, t _p limited by T _{vjmax}	I _{FP}	300	A
IGBT max. power dissipation	P _{D_IGBT}	517	W
FWD max. power dissipation	P _{D_FWD}	417	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	$V_{(BR)CES}$	$V_{GE}= 0\text{V}, I_C= 0.50\text{mA}$	650	-	-	V
Zero gate voltage collector current	I_{CES}	$V_{CE}= 650\text{V}, V_{GE}= 0\text{V}$	-	-	200	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	$V_{CE(sat)}$	$V_{GE}= 15\text{V}, I_C= 75\text{A}$ $T_{vj}= 25^{\circ}\text{C}$ $T_{vj}= 175^{\circ}\text{C}$	-	1.75	2.25	V
			-	2.50		
Input capacitance	C_{ies}	$V_{CE}= 25\text{V}, V_{GE}= 0\text{V}$ $f= 1\text{MHz}$	-	9600	-	pF
Output capacitance	C_{oes}		-	310	-	pF
Reverse transfer capacitance	C_{res}		-	100	-	pF
Gate charge	Q_G	$V_{CC}= 520\text{V}, I_C= 75\text{A}, V_{GE}= 15\text{V}$	-	330	-	nC
Forward voltage drop	V_F	$I_F= 75\text{A}$ $T_{vj}= 25^{\circ}\text{C}$ $T_{vj}= 175^{\circ}\text{C}$	-	1.5	3.0	V
			-	1.3		

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

Description	Symbols	Conditions	Characteristics			Unit
			Min	Typ	Max	
IGBT Characteristics						
Turn-on delay time	$t_{d(on)}$	$V_{CC}= 400\text{V}$ $I_C= 75\text{A}$ $V_{GE}= 15\text{V}$ $R_G= 10\Omega$ Inductive load	-	78	-	ns
Rise time	t_r		-	217	-	ns
Turn-off delay time	$t_{d(off)}$		-	274	-	ns
Fall time	t_f		-	119	-	ns
Turn-on energy	E_{on}		-	5.4	-	mJ
Turn-off energy	E_{off}		-	2.4	-	mJ
Total switching energy	E_{ts}		-	7.8	-	mJ
Diode Characteristics						
Diode reverse recovery time	t_{rr}	$V_{CC}= 400\text{V}$	-	83	-	ns
Diode reverse recovery charge	Q_{rr}	$I_F= 75\text{A}$	-	0.7	-	μC
Diode peak reverse recovery current	I_{rrm}	$di_F/dt= 500\text{A}/\mu\text{s}$	-	14.5	-	A

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

Description	Symbols	Conditions	Characteristics			Unit
			Min	Typ	Max	
IGBT Characteristics						
Turn-on delay time	$t_{d(on)}$	$V_{CC}= 400\text{V}$ $I_C= 75\text{A}$ $V_{GE}= 15\text{V}$ $R_G= 10\Omega$ Inductive load	-	68	-	ns
Rise time	t_r		-	200	-	ns
Turn-off delay time	$t_{d(off)}$		-	302	-	ns
Fall time	t_f		-	134	-	ns
Turn-on energy	E_{on}		-	5.2	-	mJ
Turn-off energy	E_{off}		-	2.7	-	mJ
Total switching energy	E_{ts}		-	7.9	-	mJ
Diode Characteristics						
Diode reverse recovery time	t_{rr}	$V_{CC}= 400\text{V}$	-	172	-	ns
Diode reverse recovery charge	Q_{rr}	$I_F= 75\text{A}$	-	4.6	-	μC
Diode peak reverse recovery current	I_{rrm}	$di_F/dt= 500\text{A}/\mu\text{s}$	-	47.8	-	A

Thermal Resistance

Items	Symbols	Characteristics			Unit
		Min	Typ	Max	
Thermal resistance, junction-ambient	$R_{th(j-a)}$	-	-	50	°C /W
Thermal resistance, IGBT junction to case	$R_{th(j-c)}$	-	-	0.29	
Thermal resistance, diodes junction to case	$R_{th(j-c)}$	-	-	0.36	

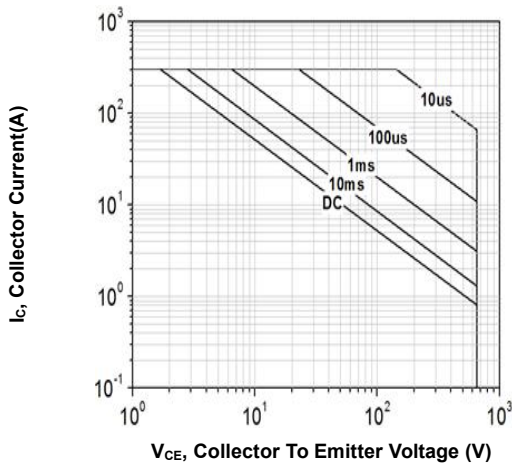


Figure 1. Forward bias safe operating area
($D=0$, $T_C=25^\circ\text{C}$, $T_{vj}\leq 175^\circ\text{C}$; $V_{GE}=15\text{V}$)

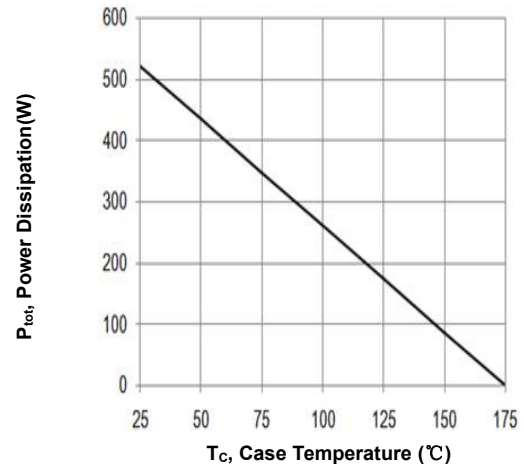


Figure 2. Power dissipation vs. case temperature
($T_{vj}\leq 175^\circ\text{C}$)

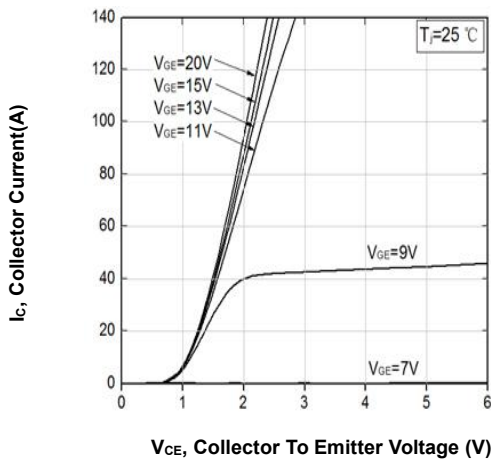


Figure 3. Typical output characteristic
($T_{vj}=25^\circ\text{C}$)

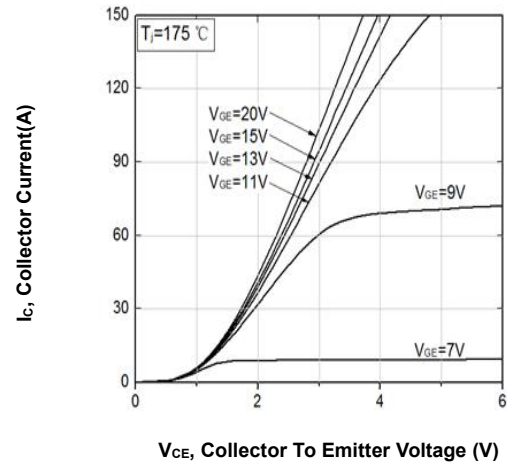


Figure 4. Typical output characteristic
($T_{vj}=175^\circ\text{C}$)

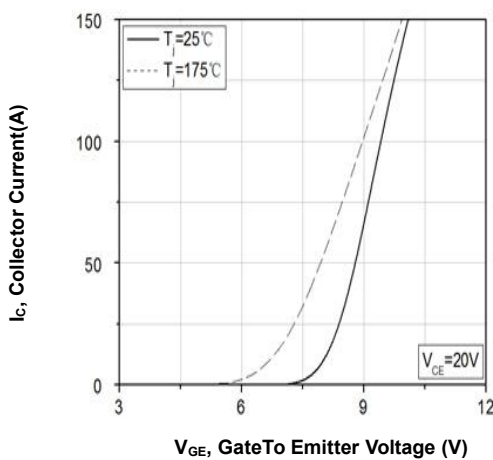


Figure 5. Typical transfer characteristic
($V_{CE}=20\text{V}$)

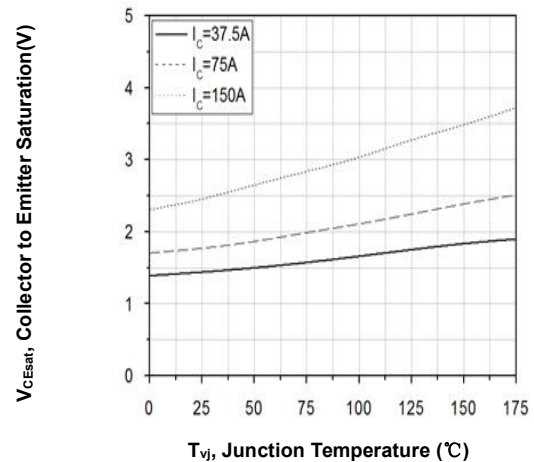


Figure 6. Typical collector-emitter saturation voltage vs. T_{vj} ($V_{GE}=20\text{V}$)

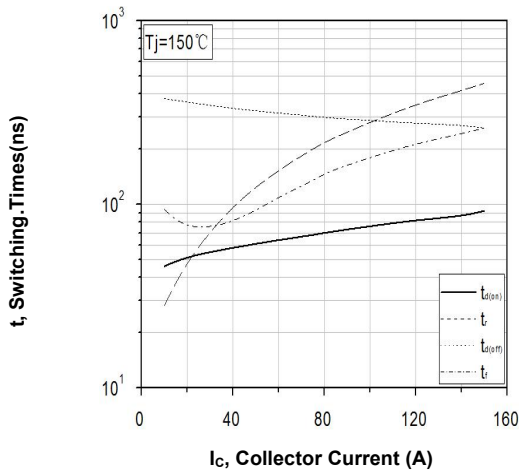


Figure 7. Typical switching times vs. collector current (Ind. load, $T_j=150^\circ\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$, $R_G=12\Omega$)

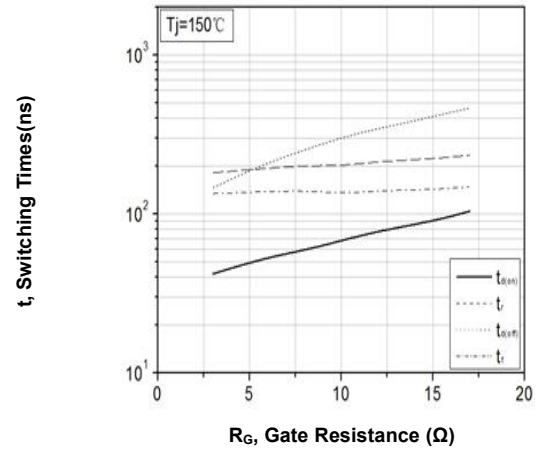


Figure 8. Typical switching times vs. gate resistor (Ind. Load, $T_j=150^\circ\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=75\text{A}$)

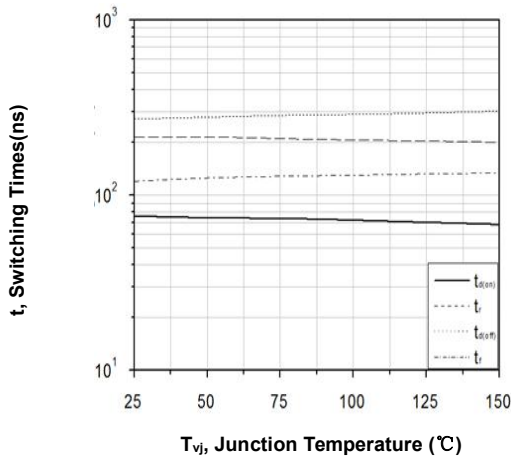


Figure 9. Typical switching times vs. T_j (Ind. Load, $V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=75\text{A}$, $R_G=12\Omega$)

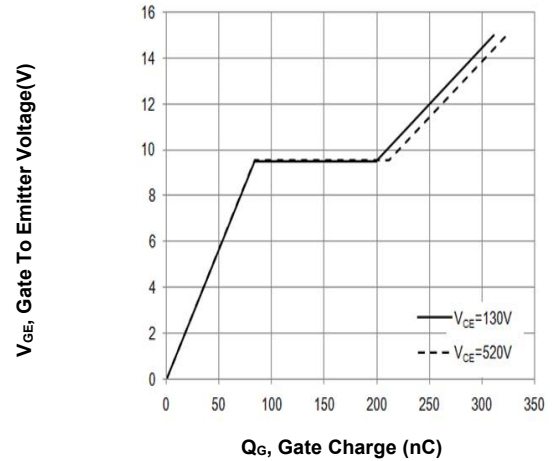


Figure 10. Typical gate charge ($I_C=75\text{A}$)

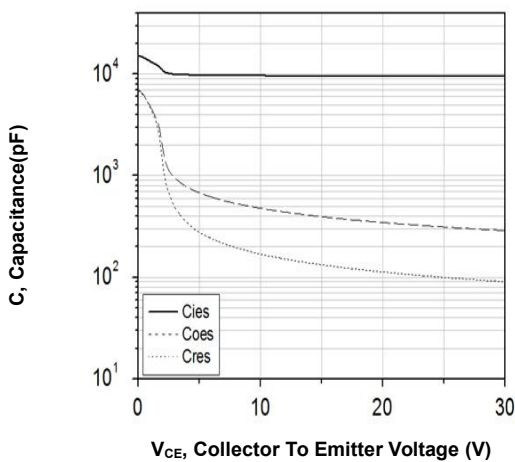


Figure 11. Typical capacitance vs. collector-emitter voltage ($V_{GE}=0\text{V}$, $f=1\text{MHz}$)

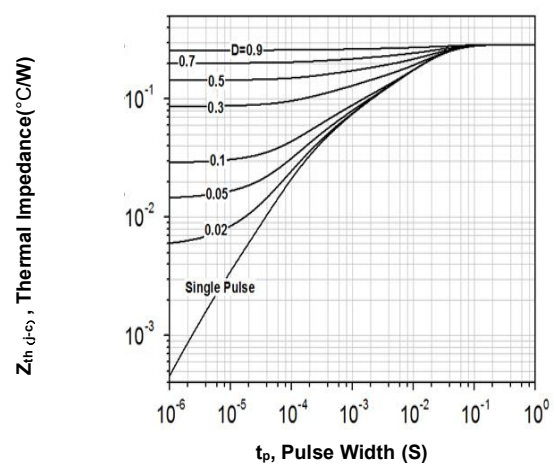


Figure 12. IGBT transient thermal impedance ($D=t_p/T$)

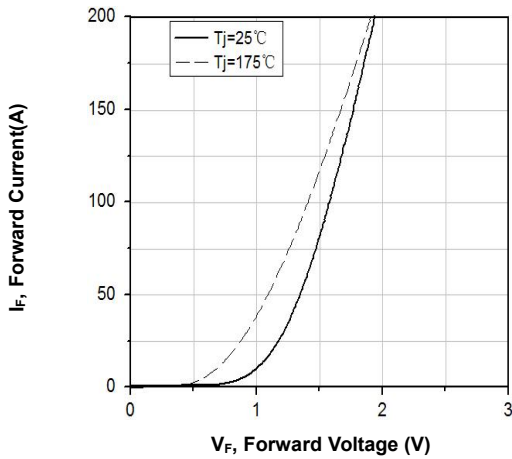


Figure 13. Typical diode forward current vs. forward voltage

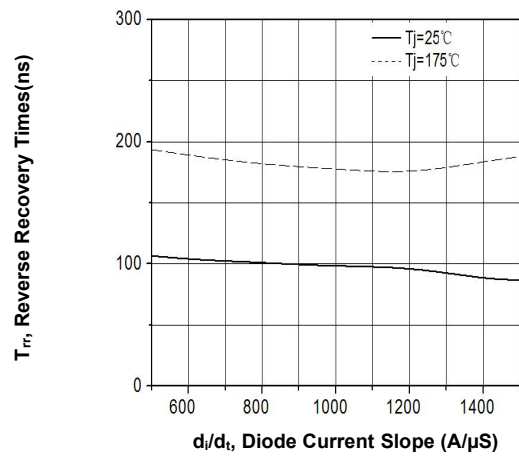


Figure 14. Typical reverse recovery time vs. diode current slope ($V_R = 400V$)

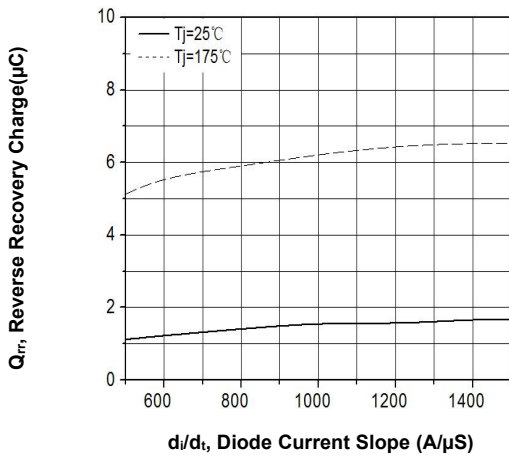


Figure 15. Typical reverse recovery charge vs. diode current slope ($V_R = 400V$)

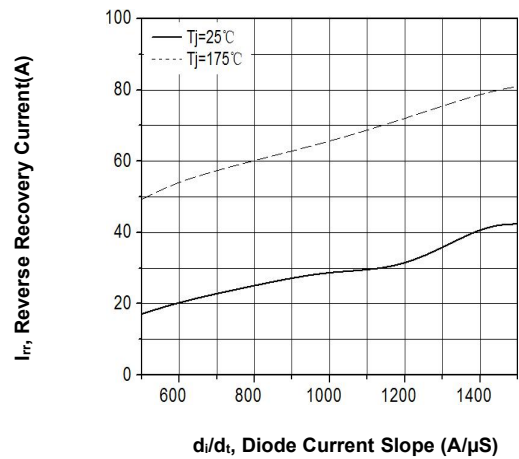
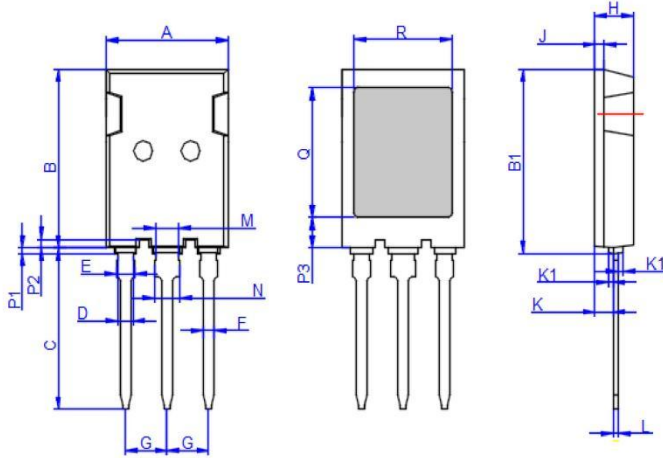


Figure 16. Typical reverse recovery current vs. diode current slope ($V_R = 400V$)

TO247iPS-3L Package Outline



TO-247iPS-3L

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	15.70	16.00	16.30	0.618	0.630	0.642
B	21.80	22.00	22.20	0.858	0.866	0.874
B1	22.30	22.50	22.70	0.878	0.886	0.894
C	19.40	19.70	20.00	0.764	0.776	0.787
D	1.80	2.00	2.20	0.071	0.079	0.087
E	2.15	2.35	2.55	0.085	0.093	0.100
F	1.16	1.36	1.56	0.046	0.054	0.061
G	5.25	5.45	5.65	0.207	0.215	0.222
H	4.80	5.00	5.20	0.189	0.197	0.205
J	1.10	1.20	1.30	0.043	0.047	0.051
K	2.20	2.35	2.50	0.087	0.093	0.098
K1	0.45	0.60	0.75	0.018	0.024	0.030
L	0.51	0.70	0.89	0.020	0.028	0.035
M	2.80	3.00	3.20	0.110	0.118	0.126
N	3.15	3.35	3.55	0.124	0.132	0.140
P1	0.44	0.64	0.84	0.017	0.025	0.033
P2	0.80	1.00	1.20	0.031	0.039	0.047
P3	3.55	3.75	3.95	0.140	0.148	0.156
Q	12.60	12.90	13.20	0.496	0.508	0.520
R	15.55	15.85	16.15	0.612	0.624	0.636

Revision History

Revision	Date	Subjects (major changes since last revision)
0.1	2021-03-20	Target version
1.1	2022-11-11	Preliminary version
1.2	2023-06-18	MP version

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