



650V 100A Field Stop IGBT

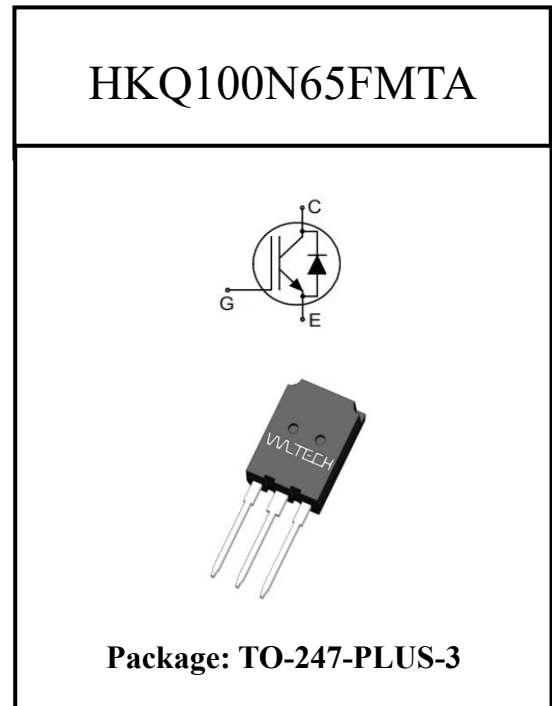
(Integrated FRD)

1. Product Features:

- Ultra-low static losses
- Internal integrated fast&soft recovery anti-parallel FRD
- Maximum junction temperature 175°C
- Qualified according to JEDEC
- RoHS compliant: Pb-Free Lead plating

2. Product Applications

- Solar
- Uninterruptible Power Inverter Supplies (UPS)
- Motor control
- General purpose inverters



3. Typical Performance Parameters

Tab.1. Typical Performance Parameters

Type	V_{CE}	I_C	V_{CEsat} $T_{vj} = 25^\circ\text{C}$	T_{vjmax}	Marking	Package
HKQ100N65FMTA	650V	100A	1.46V	175°C	HKQ100N65FMTA	TO-247-PLUS-3

4. Maximum Ratings

Tab.2. Maximum Ratings

Parameters	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	650	V
DC collector current	I_C	200.0 ($T_c = 25^\circ\text{C}$) 100.0 ($T_c = 100^\circ\text{C}$)	A
Pulsed collector current (t_p limited by T_{vjmax} .)	I_{Cpuls}	424.0	A
Turn off safe operating area ($V_{CE} \leq 650\text{V}$, $T_{vj} \leq 175^\circ\text{C}$)	-	400.0	A
Diode forward current (limited by T_{vjmax})	I_F	100.0 ($T_c = 100^\circ\text{C}$)	A
Diode pulse current (t_p limited by T_{vjmax} .)	I_{Fpuls}	300.0 ($T_c = 25^\circ\text{C}$)	A
Gate-emitter voltage	V_{GE}	± 20	V
Transient Gate to Emitter Voltage		± 30	V
Power dissipation	P_{tot}	1086.0 ($T_c = 25^\circ\text{C}$) 543.0 ($T_c = 100^\circ\text{C}$)	W
Operating junction temperature	T_{vj}	-40 to +175	$^\circ\text{C}$
Storage temperature	T_{stg}	-55 to +150	$^\circ\text{C}$
Soldering temperature, (wave soldering 1.6mm from case for 10s)		260	$^\circ\text{C}$
Mounting torque (M3 screw) (Maximum of mounting processes: 3)	M	0.6	Nm

5. Thermal Properties

Tab.3. Thermal Properties

Parameters	Symbol	Max. value	Unit
IGBT thermal resistance (junction - case)	$R_{th(j-c)}$	0.138	$^\circ\text{C/W}$
Diode thermal resistance (junction - case)	$R_{th(j-c)}$	0.35	$^\circ\text{C/W}$
Thermal resistance (junction – ambient)	$R_{th(j-a)}$	40	$^\circ\text{C/W}$

6. Electrical Characteristics

Tab.4. Static Characteristic ($T_{vj} = 25^{\circ}\text{C}$, unless otherwise specified)

Parameters	Symbol	Conditions	Min. value	Typ. value	Max. value	Unit
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0\text{V}$	650	-	-	V
Collector-emitter saturation voltage	V_{CEsat}	$V_{GE} = 15\text{V}, I_C = 100\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	- - -	1.46 1.78 1.87	1.9 - -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C = 1.00\text{mA}, V_{CE} = V_{GE}$	5.0	5.7	6.6	V
Zero gate voltage collector current	I_{CES}	$V_{CE} = 650\text{V}, V_{GE} = 0\text{V}$ $T_{vj} = 25^{\circ}\text{C}$	-	2	250	μA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\text{V}, V_{GE} = 20\text{V}$	-	-	200	nA

Tab.5. Dynamic Characteristic ($T_{vj} = 25^{\circ}\text{C}$, unless otherwise specified)

Parameters	Symbol	Conditions	Min. value	Typ. value	Max. value	Unit
Input capacitance	C_{ies}	$V_{CE} = 30\text{V}, V_{GE} = 0\text{V}$ $f = 1\text{MHz}$	-	8693	-	pF
Output capacitance	C_{oes}		-	325	-	
Reverse transfer capacitance	C_{res}		-	47	-	
Gate-charge	Q_g	$V_{CE} = 400\text{V}, I_C = 100.0\text{A},$ $V_{GE} = 15\text{V}$	-	284	-	nC

Tab.6. Switching Characteristic (Inductive load)

Parameters	Symbol	Conditions	Min. value	Typ. value	Max. value	Unit
IGBT Characteristic, at $T_{vj} = 25^{\circ}\text{C}$						
Turn-on delay time	$t_{d(on)}$	$T_{vj} = 25^{\circ}\text{C}$, $V_{CC} = 400\text{V}$, $I_C = 100.0\text{A}$, $V_{GE} = 0.0/15.0\text{V}$, $R_G = 16.0\Omega$ Inductive load	-	84	-	ns
Rise time	t_r		-	77	-	
Turn-off delay time	$t_{d(off)}$		-	366	-	
Fall time	t_f		-	53	-	
Turn-on energy	E_{on}	Energy losses include “tail” and diode reverse recovery.	-	4.51	-	mJ
Turn-off energy	E_{off}		-	2.44	-	
Total switching energy	E_{ts}		-	6.95	-	
IGBT Characteristic, at $T_{vj} = 175^{\circ}\text{C}$						
Turn-on delay time	$t_{d(on)}$	$T_{vj} = 175^{\circ}\text{C}$, $V_{CC} = 400\text{V}$, $I_C = 100.0\text{A}$, $V_{GE} = 0.0/15.0\text{V}$, $R_G = 16.0\Omega$ Inductive load	-	75	-	ns
Rise time	t_r		-	81	-	
Turn-off delay time	$t_{d(off)}$		-	389	-	
Fall time	t_f		-	116	-	
Turn-on energy	E_{on}	Energy losses include “tail” and diode reverse recovery.	-	5.52	-	mJ
Turn-off energy	E_{off}		-	3.38	-	
Total switching energy	E_{ts}		-	8.90	-	

Electrical Characteristics Of Diode($T_C=25^{\circ}\text{C}$ unless otherwise noted)

Parameters	Symbol	Conditions	Min. value	Typ. value	Max. value	Unit
Diode forward Voltage	V_{FM}	$I_F=100\text{A}$ $T_C=25^{\circ}\text{C}$ $T_C= 150^{\circ}\text{C}$ $T_C= 175^{\circ}\text{C}$	-	1.54	2	V
Reverse recovery energy	E_{rec}	$I_F=100\text{A}$, $dI_F/dt= 200\text{A/us}$, $T_C= 175^{\circ}\text{C}$	-	317	-	V
Diode reverse recovery time	t_{rr}	$I_F=100\text{A}$, $dI_F/dt= 200\text{A/us}$, $T_C= 25^{\circ}\text{C}$ $T_C= 175^{\circ}\text{C}$	-	77	-	V
Diode reverse recovery charge	Q_{rr}	$I_F=100\text{A}$, $dI_F/dt= 200\text{A/us}$, $T_C= 25^{\circ}\text{C}$ $T_C= 175^{\circ}\text{C}$	-	472	-	nC
			-	5530	-	

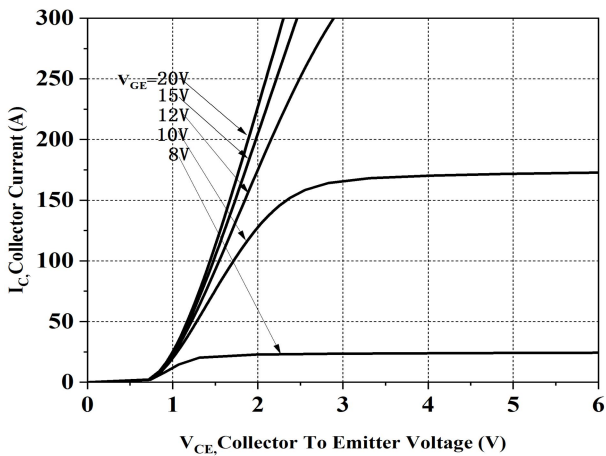


Fig.1. Typical output characteristics
($T_j = 25^\circ\text{C}$)

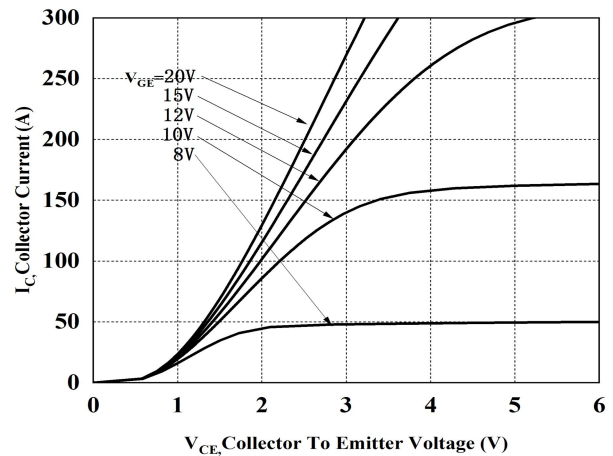


Fig.2. Typical output characteristics
($T_j = 175^\circ\text{C}$)

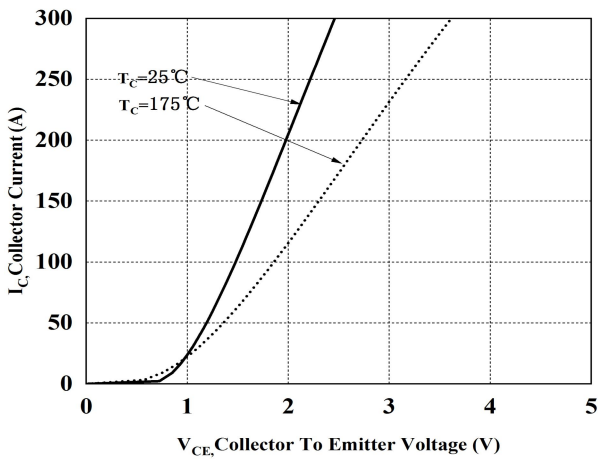


Fig.3. Typical saturation voltage characteristics

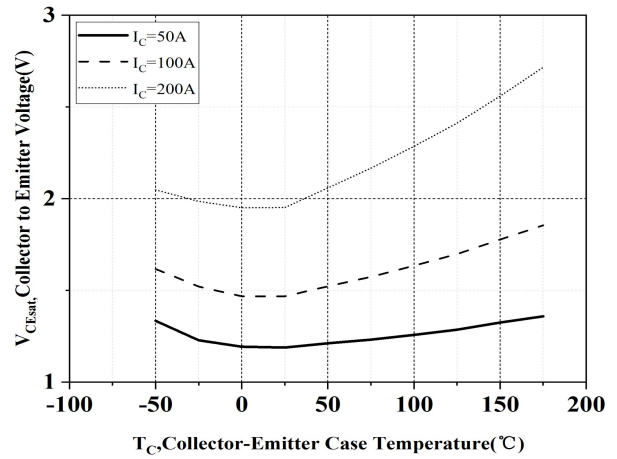


Fig.4. Saturation Voltage vs. Case temperature at Variant Current Level

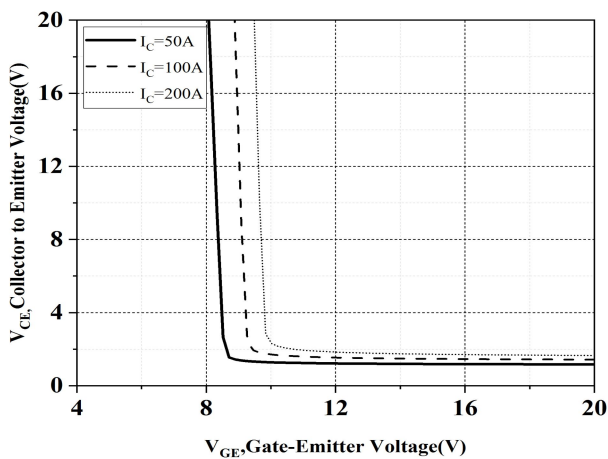


Fig.5. Saturation Voltage vs. V_{GE}
($T_j = 25^\circ\text{C}$)

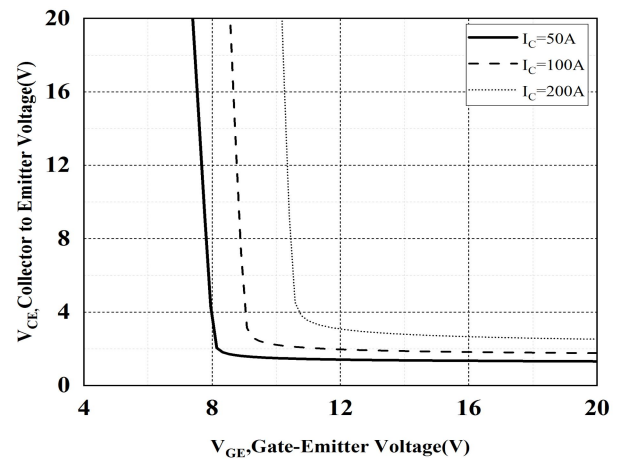


Fig.6. Saturation Voltage vs. V_{GE}
($T_j = 175^\circ\text{C}$)

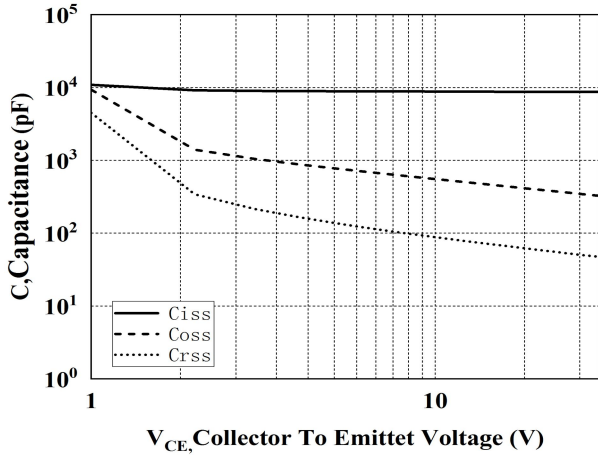


Fig.7. Capacitance Characteristic

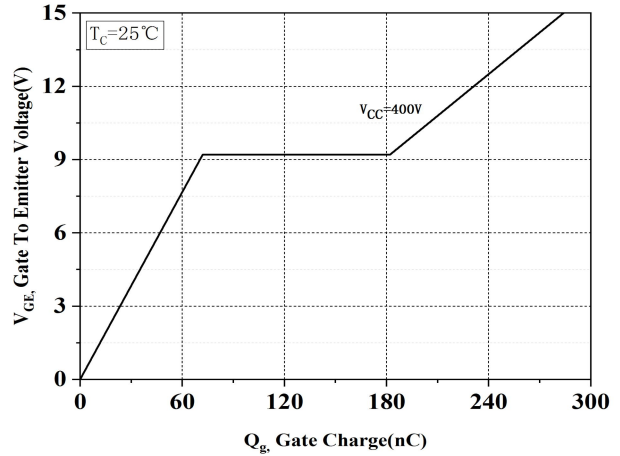


Fig.8. Gate charge Characteristic

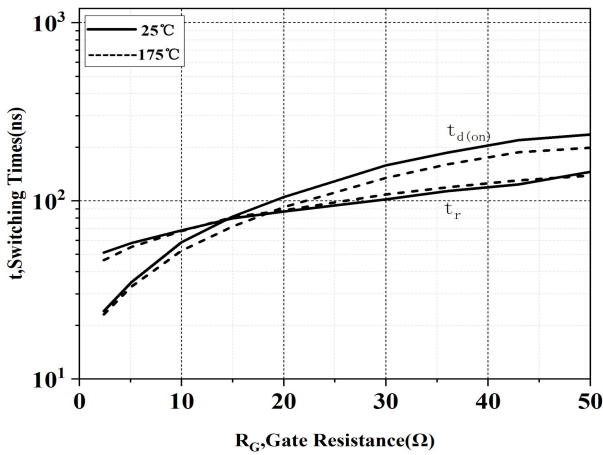


Fig.9. Turn-on Characteristics vs. gate Resistor ($V_{CE}=400V, V_{GE}=15V, I_C=100A$)

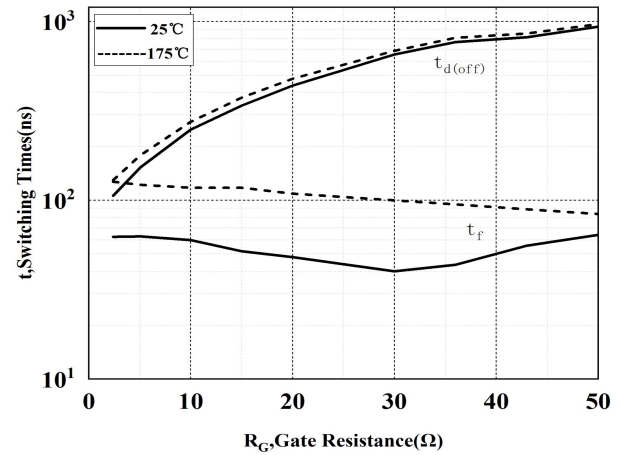


Fig.10. Turn-off Characteristics vs. gate Resistor ($V_{CE}=400V, V_{GE}=15V, I_C=100A$)

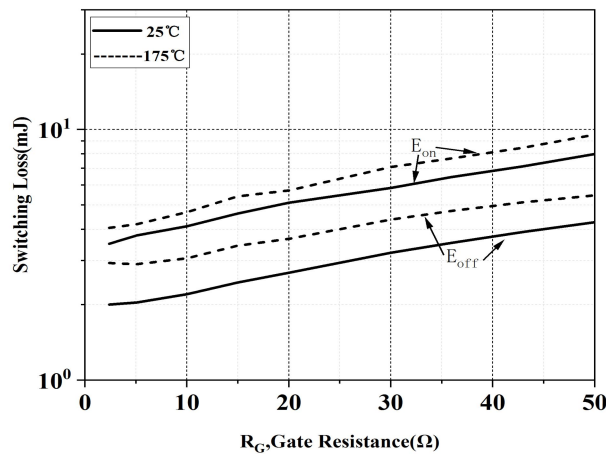


Fig.11. Switching Loss vs. Gate Resistance ($V_{CE}=400V, V_{GE}=15V, I_C=100A$)

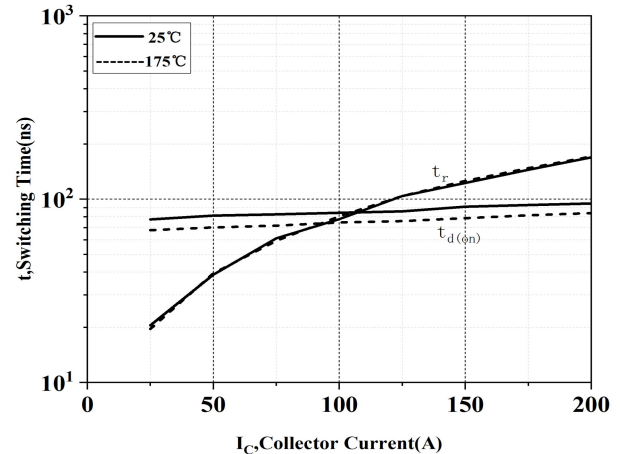


Fig.12. Turn-on Characteristics vs. Collector Current ($V_{CE}=400V, V_{GE}=15V, R_g=16\Omega$)

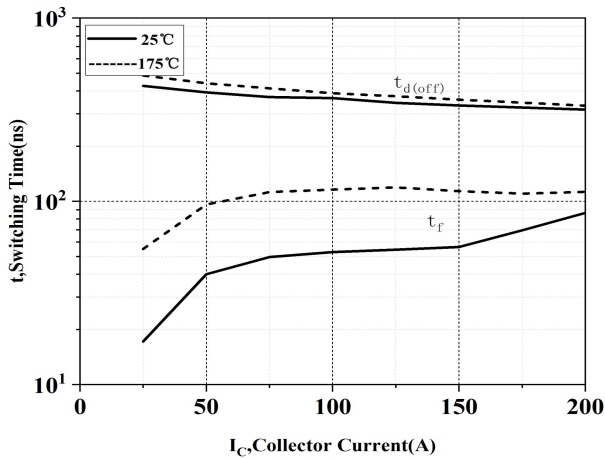


Fig.13. Turn-on Characteristics vs. Collector Current
($V_{CE}=400V, V_{GE}=15V, R_g=16\Omega$)

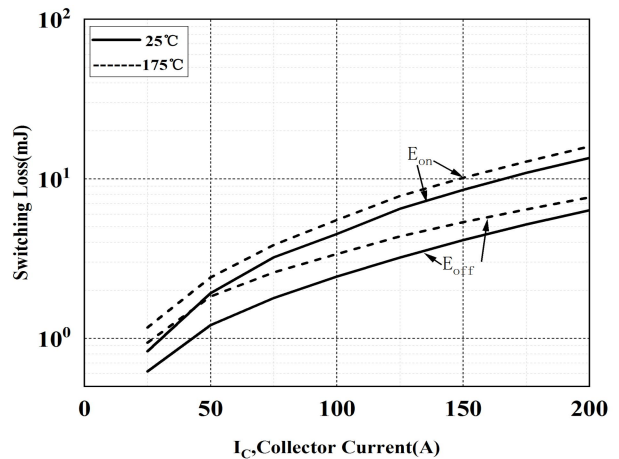


Fig.14. Switching Loss vs. Collector Current
($V_{CE}=400V, V_{GE}=15V, R_{g\text{tot}}=16\Omega$)

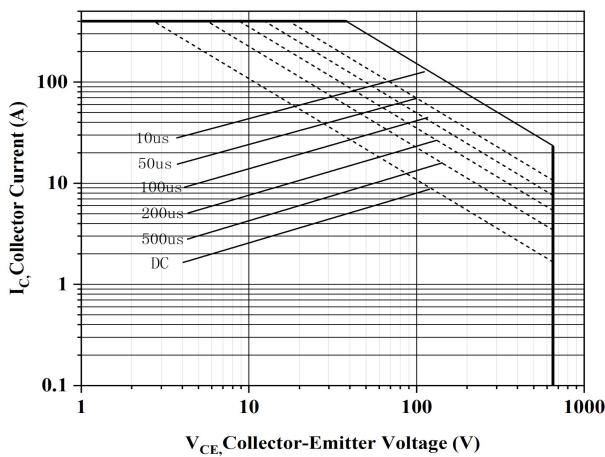


Fig.15. Forward bias safe operating area
($D=0, T_C=25^\circ C, T_J \le 175^\circ C, V_{GE}=15V$)

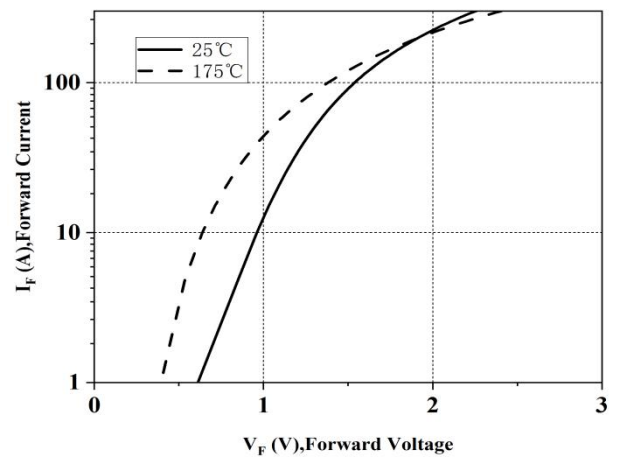


Fig.16. Forward Characteristics

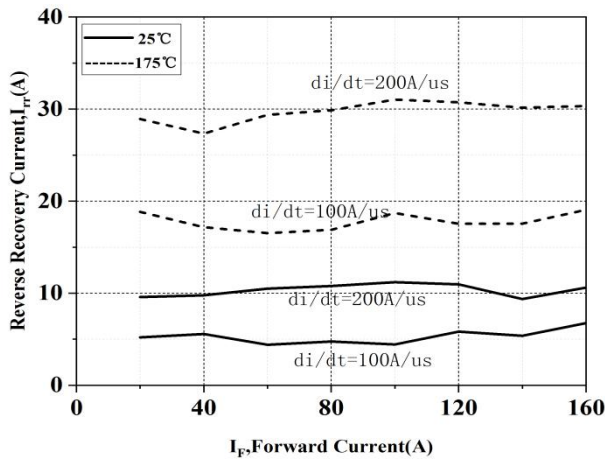


Fig.17. Reverse Recovery Current

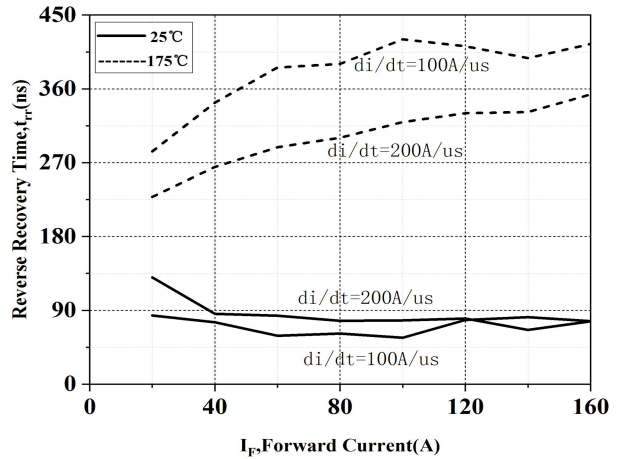


Fig.18. Reverse Recovery Time

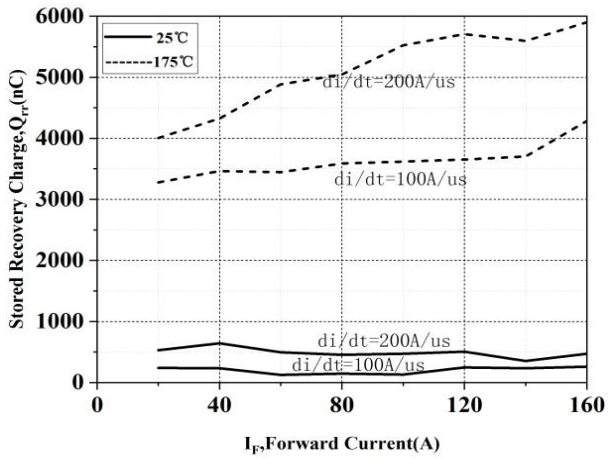


Fig.19. Stored Charge

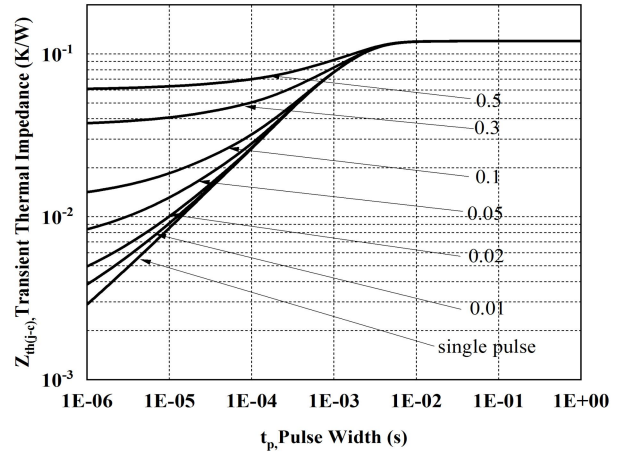


Fig.20. IGBT transient thermal impedance
($D = t_p/T$)

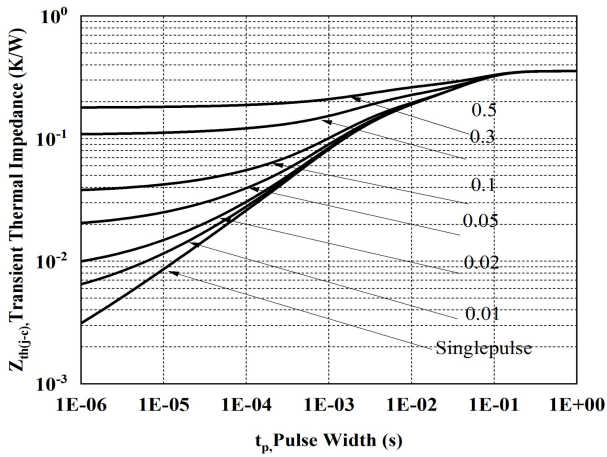
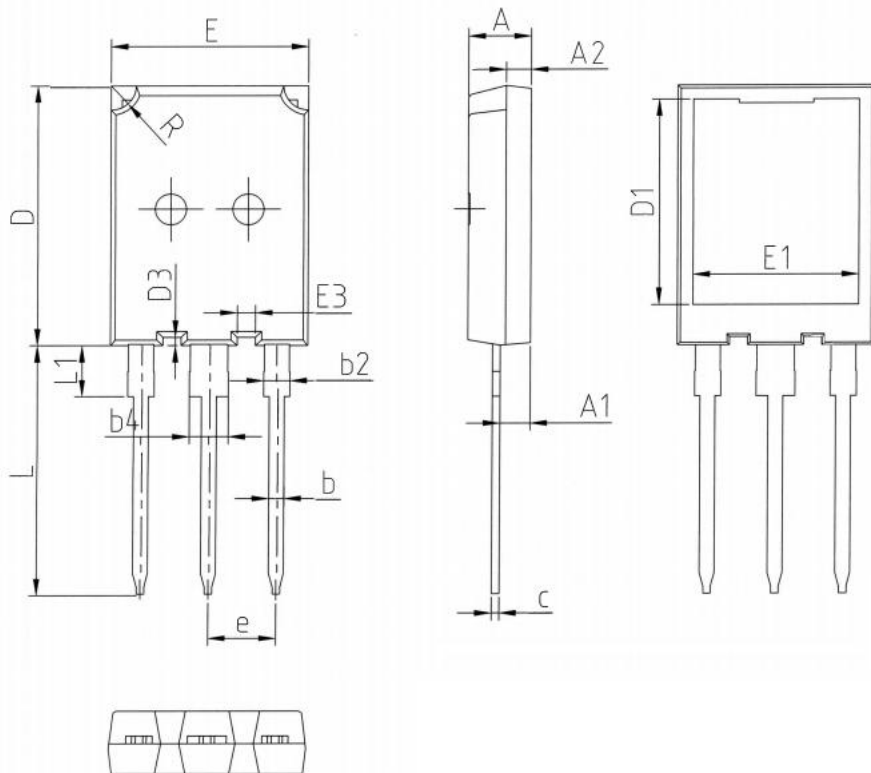


Fig.21. Transient thermal impedance of diode
($D = t_p/T$)

7. Package Dimensions



COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.50	0.61	0.75
D	20.70	21.00	21.30
D1	16.25	16.55	16.85
D3	0.53	0.68	0.83
E	15.50	15.80	16.10
E1	13.10	13.30	13.50
E3	1.30	1.45	1.60
e	5.44 (BSC)		
L	19.62	19.92	20.22
L1	-	-	4.30
R	1.85	2.00	2.15

8. Version Information

Version No.	Date changed	Version revision record
V1.0	2023/01	Initial Release