

## IGBT Discrete with Anti-Parallel Diode

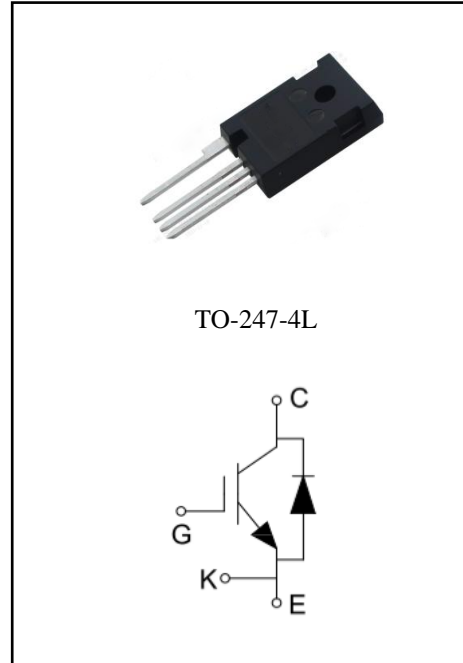
$V_{CES} = 650V$ ,  $I_{C\ nom} = 75A$  /  $I_{CRM} = 300A$

### Features :

- 650V Trench /Field Stop type
- Low switching losses
- $V_{cesat}$  has a positive temperature coefficient

### Applications:

- Energy storage inverter
- Uninterruptible power supplies
- Solar converters



## IGBT

### Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Collector-Emitter voltage	$T_{vj} = 25^{\circ}C$	$V_{CES}$	650	V
Continuous DC collector current	$T_C = 100^{\circ}C$ , $T_{vj\ max} = 175^{\circ}C$	$I_{C\ nom}$	75	A
Repetitive peak collector current	$t_p = 1\ ms$	$I_{CRM}$	300	A
Gate emitter voltage	$t_p \leq 10\ \mu s$ , $D < 0.010$	$V_{GE}$	$\pm 20$ $+ 30$	V
Power dissipation	$T_C = 25^{\circ}C$ $T_C = 100^{\circ}C$	$P_{tot}$	520 260	W
Temperature under switching		$T_{vj\ op}$	-40...+175	$^{\circ}C$

conditions				
Storage temperature		T <sub>stg</sub>	-40...+150	°C
Soldering temperature			260	°C
Mounting torque		M	0.6	Nm

## Thermal Characteristics

Parameter	Conditions	Symbol	Value	Unit
IGBT thermal resistance, junction - case		R <sub>th(j-C)</sub>	0.29	K/W
Diode thermal resistance, junction - case		R <sub>th(j-C)</sub>	0.35	K/W

## Characteristic Values

Parameter	Conditions	Symbol	Value			Unit	
			Min.	Typ.	Max.		
Collector-Emitter saturation voltage	V <sub>GE</sub> =15V, I <sub>C</sub> =75A V <sub>GE</sub> =15V, I <sub>C</sub> =75A V <sub>GE</sub> =15V, I <sub>C</sub> =75A	T <sub>vj</sub> =25°C T <sub>vj</sub> =150°C T <sub>vj</sub> =175°C	V <sub>CEsat</sub>	1.40 1.68 1.73	1.90	V	
Gate-Emitter threshold voltage	I <sub>C</sub> =0.75mA, V <sub>GE</sub> = V <sub>CE</sub>	T <sub>vj</sub> =25°C	V <sub>GE(th)</sub>	3.6	4.2	4.8	V
Transconductance	V <sub>CE</sub> =20V, I <sub>C</sub> =75A		G <sub>fs</sub>	68		S	
Input capacitance			C <sub>ies</sub>	4250		pF	
Output capacitance	f=100kHz, V <sub>CE</sub> =25 V, V <sub>GE</sub> =0 V	T <sub>vj</sub> =25°C	C <sub>oes</sub>	180		pF	
Reverse transfer capacitance			C <sub>res</sub>	23		pF	
Gate charge	I <sub>C</sub> = 75 A, V <sub>GE</sub> = ±15 V, V <sub>CE</sub> =600 V	T <sub>vj</sub> =25°C	Q <sub>G</sub>	260		nC	
Collector-emitter cut-off current	V <sub>CE</sub> =650V, V <sub>GE</sub> = 0 V	T <sub>vj</sub> =25°C	I <sub>CES</sub>		1	mA	
Gate-emitter leakage current	V <sub>CE</sub> =0 V, V <sub>GE</sub> = 20 V	T <sub>vj</sub> =25°C	I <sub>GES</sub>		200	nA	
Turn-on delay time	I <sub>C</sub> =75A, V <sub>CE</sub> =300V V <sub>GE</sub> =±15 V, R <sub>G</sub> =8Ω (inductive load)	T <sub>vj</sub> =25°C T <sub>vj</sub> =175°C	t <sub>don</sub>	22 23		ns	
Rise time	I <sub>C</sub> =75A, V <sub>CE</sub> =300V V <sub>GE</sub> =±15 V, R <sub>G</sub> =8Ω (inductive load)	T <sub>vj</sub> =25°C T <sub>vj</sub> =175°C	t <sub>r</sub>	30 34		ns	

Turn-off delay time	I <sub>C</sub> =75A, V <sub>CE</sub> =300V V <sub>GE</sub> =±15 V, R <sub>G</sub> =8Ω (inductive load)	T <sub>vj</sub> =25°C	t <sub>doff</sub>	108		ns
		T <sub>vj</sub> =175°C		132		
Fall time	I <sub>C</sub> =75A, V <sub>CE</sub> =300V V <sub>GE</sub> =±15 V, R <sub>G</sub> =8Ω (inductive load)	T <sub>vj</sub> =25°C	t <sub>f</sub>	65		ns
		T <sub>vj</sub> =175°C		114		
Turn-on energy loss per pulse	I <sub>C</sub> =75A, V <sub>CE</sub> =300V V <sub>GE</sub> =±15 V, R <sub>G</sub> =8Ω di/dt=1800A/us(T <sub>vj</sub> =175°C) (inductive load)	T <sub>vj</sub> =25°C	E <sub>on</sub>	0.67		mJ
		T <sub>vj</sub> =175°C		1.00		
Turn-off energy loss per pulse	I <sub>C</sub> =75A, V <sub>CE</sub> =300V V <sub>GE</sub> =±15 V, R <sub>G</sub> =8Ω dv/dt=6700V/us(T <sub>vj</sub> =175°C) (inductive load)	T <sub>vj</sub> =25°C	E <sub>off</sub>	0.95		mJ
		T <sub>vj</sub> =175°C		1.56		

## Diode

### Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	T <sub>vj</sub> =25°C	V <sub>RRM</sub>	650	V
Continuous DC forward current	T <sub>C</sub> =100°C, T <sub>vj max</sub> =175°C	I <sub>F</sub>	75	A
Repetitive peak forward current	t <sub>p</sub> =1ms	I <sub>FRM</sub>	300	A

### Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	I <sub>F</sub> =75A, V <sub>GE</sub> =0V I <sub>F</sub> =75A, V <sub>GE</sub> =0V I <sub>F</sub> =75A, V <sub>GE</sub> =0V	V <sub>F</sub>		1.55	2.0	V
				1.70		
				1.68		
Peak reverse recovery current	I <sub>F</sub> =75A, -di <sub>F</sub> /dt=1800A/μs(T <sub>vj</sub> =175°C) V <sub>R</sub> =300V, V <sub>GE</sub> =-15V	T <sub>vj</sub> =25°C T <sub>vj</sub> =175°C	I <sub>IRM</sub>		37 51	A
Reverse Recovered charge	I <sub>F</sub> =75A, -di <sub>F</sub> /dt=1800A/μs(T <sub>vj</sub> =175°C) V <sub>R</sub> =300V, V <sub>GE</sub> =-15V	T <sub>vj</sub> =25°C T <sub>vj</sub> =175°C	Q <sub>rr</sub>		1.20 3.34	μC
Reverse Recovery Time	I <sub>F</sub> =75A, -di <sub>F</sub> /dt=1800A/μs(T <sub>vj</sub> =175°C) V <sub>R</sub> =300V, V <sub>GE</sub> =-15V	T <sub>vj</sub> =25°C T <sub>vj</sub> =175°C	t <sub>rr</sub>		70 153	ns
Reverse recovered energy	I <sub>F</sub> =75A, -di <sub>F</sub> /dt=1800A/μs(T <sub>vj</sub> =175°C) V <sub>R</sub> =300V, V <sub>GE</sub> =-15V	T <sub>vj</sub> =25°C T <sub>vj</sub> =175°C	E <sub>rec</sub>		0.23 0.74	mJ

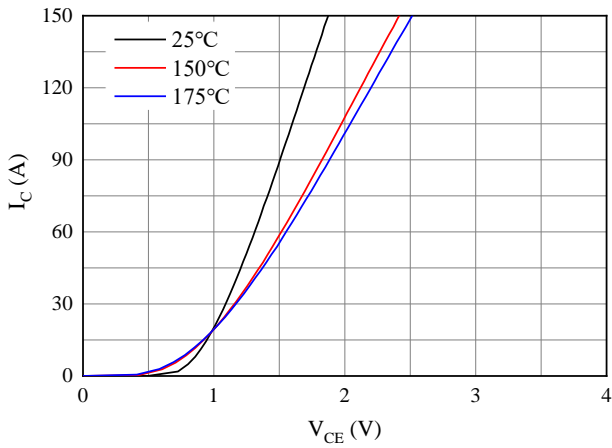


Fig 1. Typical output characteristics ( $V_{GE}=15V$ )

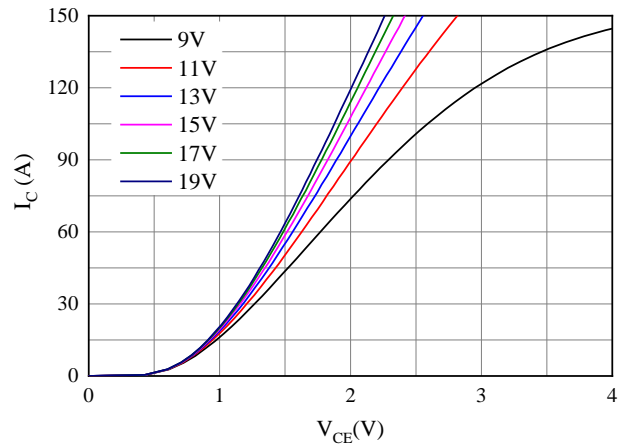


Fig 2. Typical output characteristics ( $T_{vj}=150^{\circ}C$ )

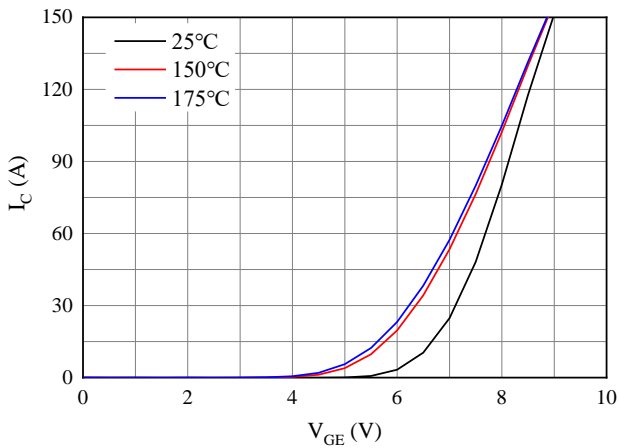


Fig 3. Typical transfer characteristic ( $V_{CE}=20V$ )

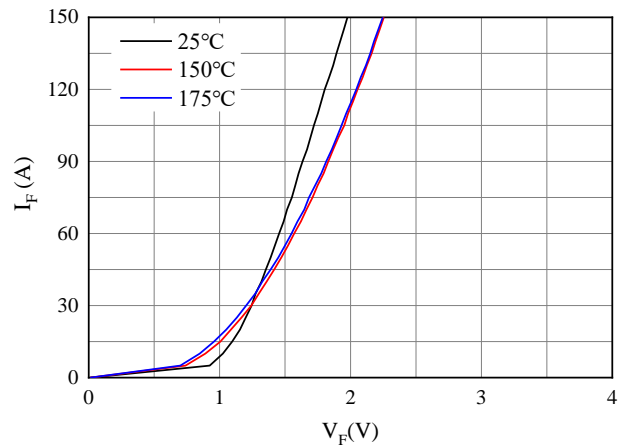


Fig 4. Forward characteristic of Diode

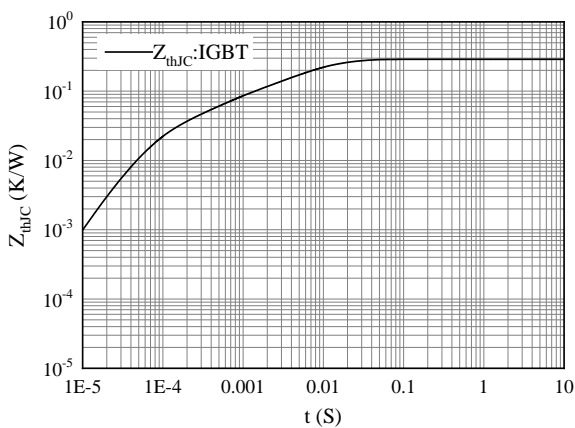


Fig 5. Transient thermal impedance IGBT,  
 $Z_{thJC}=f(t)$

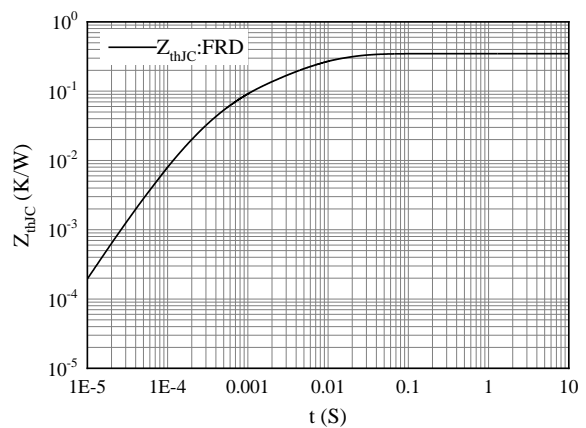
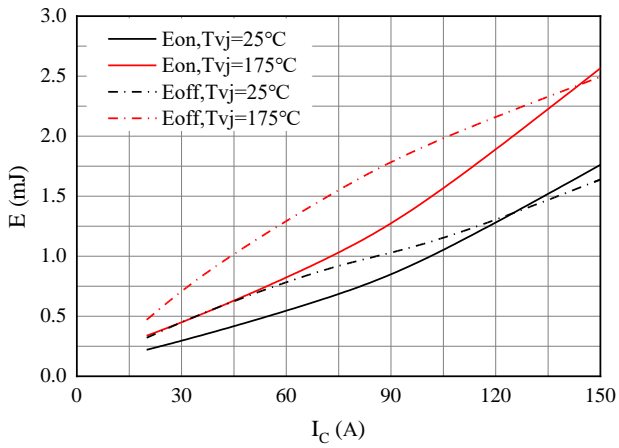
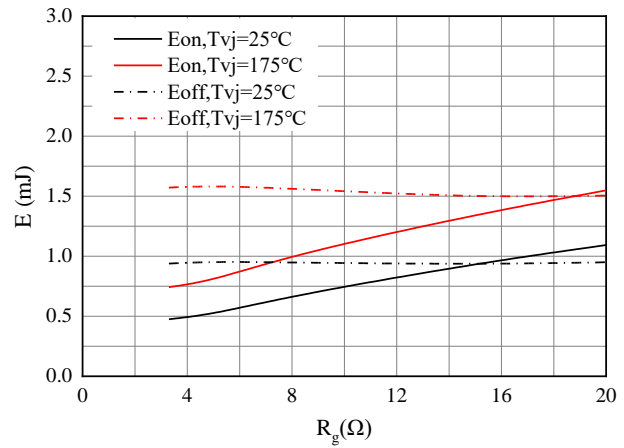


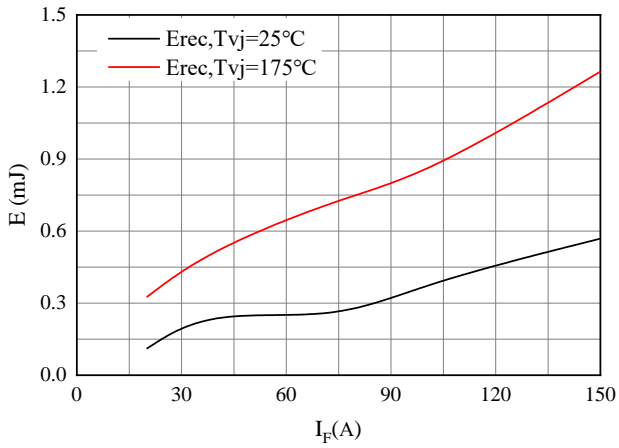
Fig 6. Transient thermal impedance FRD,  
 $Z_{thJC}=f(t)$



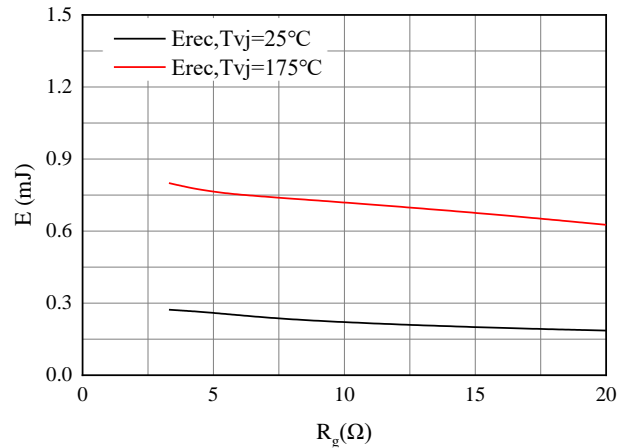
**Fig 7. Switching losses of IGBT**  
 $V_{GE} = \pm 15V, R_{gon} = 8\Omega, R_{goff} = 8\Omega, V_{CE} = 300V$



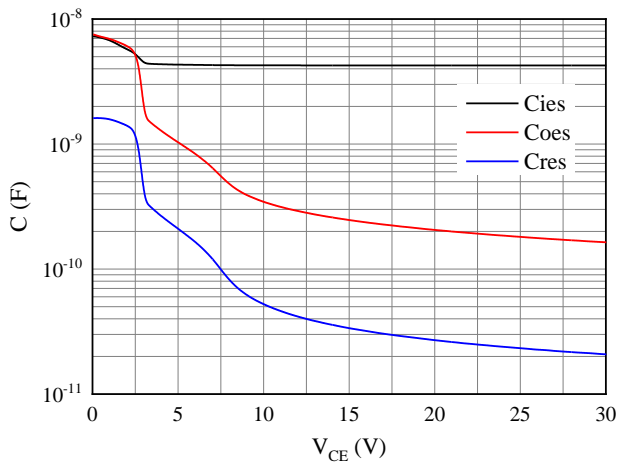
**Fig 8. Switching losses of IGBT**  
 $V_{GE} = \pm 15V, I_C = 75A, V_{CE} = 300V$



**Fig 9. Switching losses of Diode**  
 $R_{gon} = 8\Omega, V_{CE} = 300V$

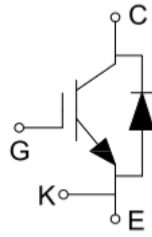


**Fig 10. Switching losses of Diode**  
 $I_F = 75A, V_{CE} = 300V$

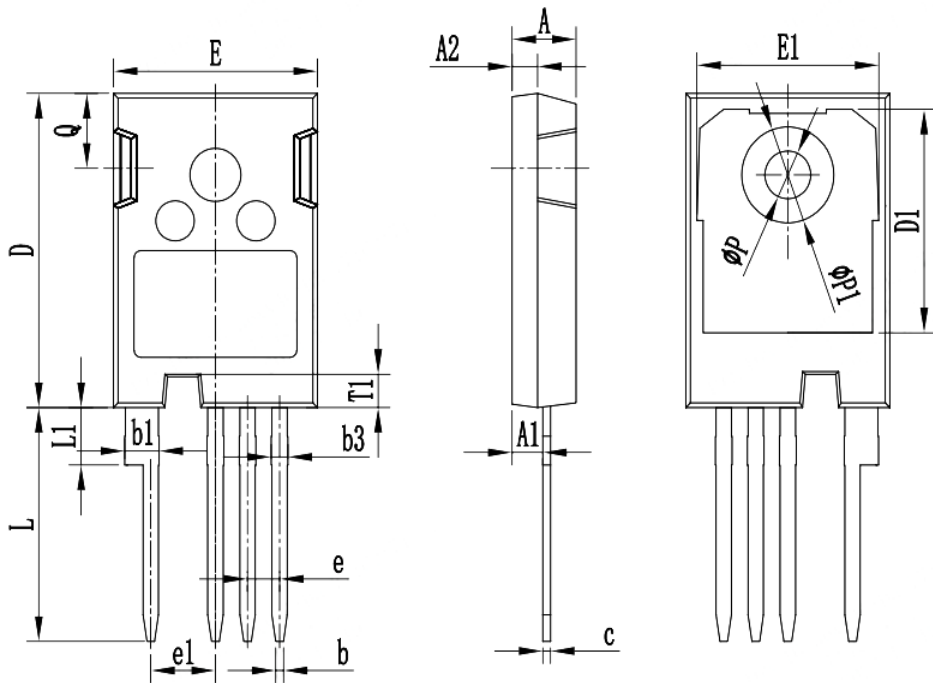


**Fig 11. Capacitance characteristic**

**Circuit diagram**



**Package outlines**



symbol	unit:mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.8	2.00	2.20
b	1.06	1.21	1.36
b1	2.33	2.63	2.93
b3	1.07	1.30	1.60
c	0.51	0.61	0.75
D	23.30	23.45	23.60
D1	16.25	16.55	16.85
E	15.74	15.94	16.14
E1	13.72	14.02	14.32
T1	2.35	2.50	2.65
e	2.54 BSC		
e1	5.08 BSC		
Q	5.49	5.79	6.09
L	17.27	17.57	17.87
L1	3.99	4.19	4.39
phi P	3.40	3.60	3.80
phi P1	7.19 REF		