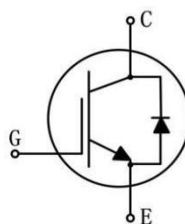


Trench Field-stop IGBT Discrete

Parameter	Value	Unit
V_{CE}	1200	V
I_C	40	A
$V_{CE(sat)}$	1.9	V



---Marking
---Tracking code
TO-247-3L

Features

- 1200V trench gate/field termination process
- Low switching losses
- V_{cesat} has a positive temperature coefficient

Applications

- Charging station
- Uninterruptible power supplies
- Inverters

IGBT

Maximum Ratings

Parameter	Symbol	Test condition	Value	Unit
Collector-Emitter Voltage	V_{CES}	$T_{vj}=25^{\circ}\text{C}$	1200	V
Continuous DC collector current	I_C	$T_C=100^{\circ}\text{C}, T_{vj\ max}=175^{\circ}\text{C}$	40	A
Repetitive peak collector current	I_{CRM}	$t_p=1\text{ms}$	120	A
Short-circuit withstand time	t_{SC}	$V_{CC}\leq 600\text{V}, V_{GE}=15\text{V}$, Allowed number of short circuits<1000, Time between short circuits $\geq 1.0\text{s}$, $T_{vj}=150^{\circ}\text{C}$	10	μs
Total power dissipation	P_{tot}	$T_C=25^{\circ}\text{C}, T_{vj\ max}=175^{\circ}\text{C}$ $T_C=100^{\circ}\text{C}, T_{vj\ max}=175^{\circ}\text{C}$	900 500	W
Gate emitter voltage	V_{GE}		± 20	V
Transient Gate-emitter voltage	V_{GE}	$t_p\leq 10\mu\text{s}, D<0.010$	± 25	V
Temperature under switching conditions	$T_{vj\ op}$		$-40\dots+175$	$^{\circ}\text{C}$
Storage temperature	T_{stg}		$-40\dots+150$	$^{\circ}\text{C}$

Thermal Characteristics

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
IGBT thermal resistance, junction - case	$R_{th(j-C)}$			0.138		$^{\circ}\text{C/W}$
Diode thermal resistance, junction - case	$R_{th(j-C)}$			0.393		$^{\circ}\text{C/W}$

Characteristic Values

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE}=0V, I_C=0.25mA$	1200			V
Collector-Emitter saturation Voltage	V_{CEsat}	$V_{GE}=15V, I_C=40A$ $T_{vj}=25^{\circ}C$		1.90	2.40	
		$V_{GE}=15V, I_C=40A$ $T_{vj}=125^{\circ}C$		2.47		
		$V_{GE}=15V, I_C=40A$ $T_{vj}=150^{\circ}C$		2.57		
Gate-Emitter threshold Voltage	$V_{GE(th)}$	$I_C=0.4mA, V_{GE}=V_{CE}, T_{vj}=25^{\circ}C$	4.9	5.5	6.1	
Transconductance	G_{fs}	$V_{CE}=20V, I_C=40A$		28		S
Internal gate resistor	R_{Gint}	$T_{vj}=25^{\circ}C$		2.3		Ω
Input capacitance	C_{ies}	$f=100kHz, V_{CE}=25V, V_{GE}=0V, T_{vj}=25^{\circ}C$		3.12		nF
Output capacitance	C_{oes}			0.24		
Reverse transfer capacitance	C_{res}			0.12		
Gate charge	Q_G	$I_C=40A, V_{GE}=15V$ $T_{vj}=25^{\circ}C$ $V_{CE}=960V$		255		μC
Collector-emitter cut-off current	I_{CES}	$V_{CE}=1200V, V_{GE}=0V$ $T_{vj}=25^{\circ}C$		3000	10	μA
		$T_{vj}=175^{\circ}C$				
Gate-emitter leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=20V$ $T_{vj}=25^{\circ}C$			100	nA
Turn-on delay time	$t_{d on}$	$I_C=40A, V_{CE}=600V$ $T_{vj}=25^{\circ}C$ $V_{GE}=\pm 15V, R_G=10\Omega$ $T_{vj}=175^{\circ}C$ (inductive load)		49 50		ns
Rise time	t_r	$I_C=40A, V_{CE}=600V$ $T_{vj}=25^{\circ}C$ $V_{GE}=\pm 15V, R_G=10\Omega$ $T_{vj}=175^{\circ}C$ (inductive load)		74 69		
Turn-off delay time	$t_{d off}$	$I_C=40A, V_{CE}=600V$ $T_{vj}=25^{\circ}C$ $V_{GE}=\pm 15V, R_G=10\Omega$ $T_{vj}=175^{\circ}C$ (inductive load)		162 237		
Fall time	t_f	$I_C=40A, V_{CE}=600V$ $T_{vj}=25^{\circ}C$ $V_{GE}=\pm 15V, R_G=10\Omega$ $T_{vj}=175^{\circ}C$ (inductive load)		136 160		
Turn-on energy loss per pulse	E_{on}	$I_C=40A, V_{CE}=600V$ $T_{vj}=25^{\circ}C$ $V_{GE}=\pm 15V, R_G=10\Omega$ $T_{vj}=175^{\circ}C$ (inductive load)		3.51 6.78		mJ
Turn-off energy loss per pulse	E_{off}	$I_C=40A, V_{CE}=600V$ $T_{vj}=25^{\circ}C$ $V_{GE}=\pm 15V, R_G=10\Omega$ $T_{vj}=175^{\circ}C$ $di/dt=450A/\mu s$ $(T_{vj}=175^{\circ}C)$		1.61 2.66		mJ
Total switching energy	E_{ts}	$I_C=40A, V_{CE}=600V$ $T_{vj}=25^{\circ}C$ $V_{GE}=\pm 15V, R_G=10\Omega$ $T_{vj}=175^{\circ}C$ $dv/dt=5500V/\mu s$ $(T_{vj}=175^{\circ}C)$		5.12 9.44		

Diode
Maximum Ratings

Parameter	Symbol	Test condition	Value	Unit
Repetitive peak reverse Voltage	V_{RRM}	$T_{vj}=25^{\circ}C$	1200	V
Continuous DC forward current	I_F	$T_C=100^{\circ}C, T_{vj max}=175^{\circ}C$	40	A
Repetitive peak forward current	I_{FRM}	$t_p=1ms$	120	A
I^2t -value	I^2t	$t_p=10ms, \sin 180^{\circ}, T_j=125^{\circ}C$	310	A

Characteristics Values

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	V_F	$I_F=40A, V_{GE}=0V$ $T_{vj}=25^{\circ}C$ $I_F=40A, V_{GE}=0V$ $T_{vj}=125^{\circ}C$ $I_F=40A, V_{GE}=0V$ $T_{vj}=150^{\circ}C$		1.82 1.60 1.54	2.40	V
Peak reverse recovery current	I_{RM}	$I_F=40A,$ $-di_F/dt=350A/\mu s(T_{vj}=175^{\circ}C)$ $T_{vj}=25^{\circ}C$ $V_R=600V, V_{GE}=-15V$ $T_{vj}=175^{\circ}C$		12 29		A
Reverse Recovered charge	Q_{rr}	$I_F=40A,$ $-di_F/dt=350A/\mu s(T_{vj}=175^{\circ}C)$ $T_{vj}=25^{\circ}C$ $V_R=600V, V_{GE}=-15V$ $T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$		3.29 10.5		μC
Reverse Recovery Time	t_{rr}	$I_F=40A,$ $-di_F/dt=350A/\mu s(T_{vj}=175^{\circ}C)$ $T_{vj}=25^{\circ}C$ $V_R=600V, V_{GE}=-15V$ $T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$		558 870		ns
Reverse recovered energy	E_{rec}	$I_F=40A,$ $-di_F/dt=350A/\mu s(T_{vj}=175^{\circ}C)$ $T_{vj}=25^{\circ}C$ $V_R=600V, V_{GE}=-15V$ $T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$		1.40 4.21		mJ

Typical Characteristics

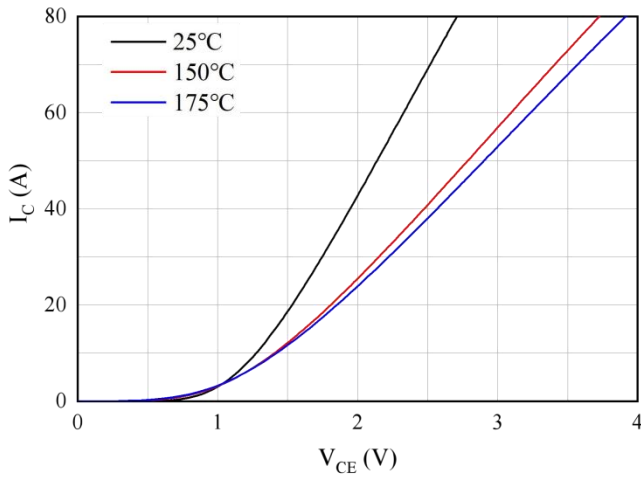


Fig 1. Typical output characteristics ($V_{GE}=15V$)

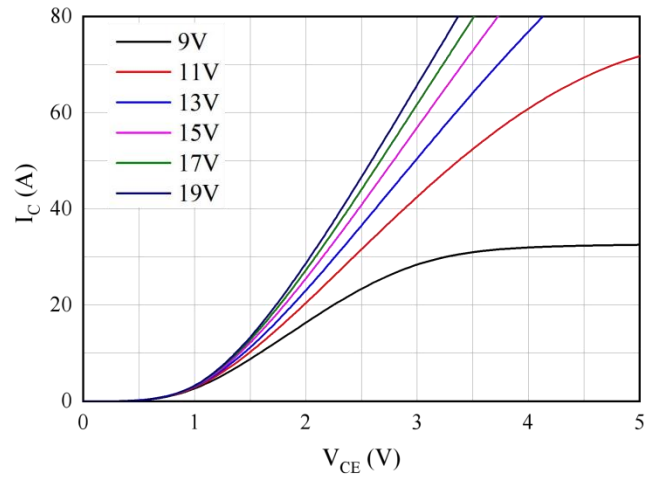


Fig 2. Typical output characteristics ($T_{vj}=150^{\circ}C$)

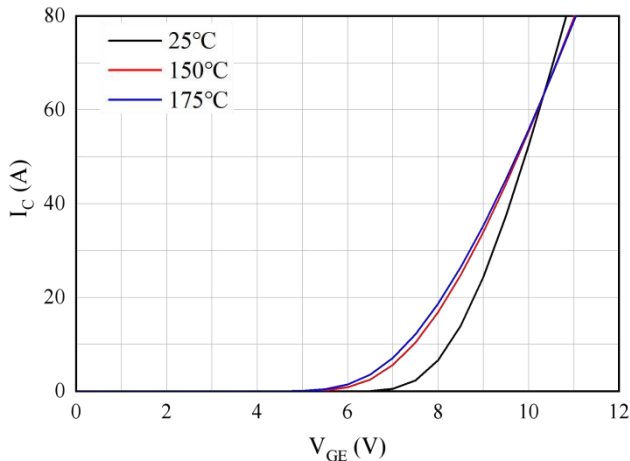


Fig 3. Typical transfer characteristic ($V_{CE}=20V$)

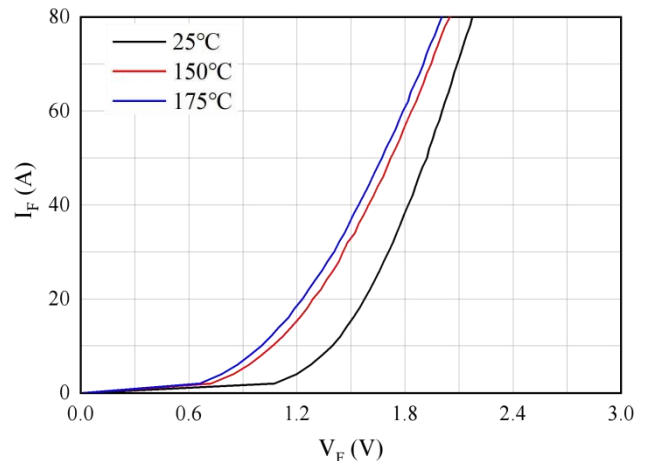


Fig 4. Forward characteristic of Diode

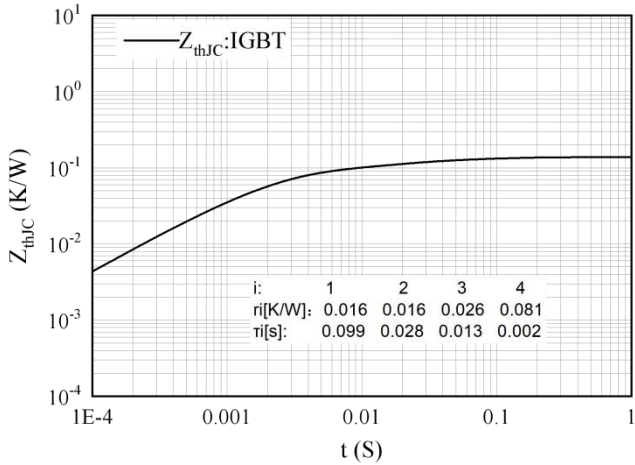


Fig 5. Transient thermal impedance IGBT,
 $Z_{thJC}=f(t)$

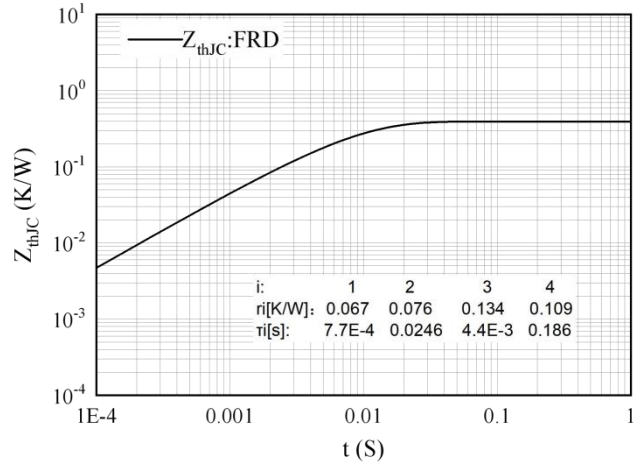


Fig 6. Transient thermal impedance FRD,
 $Z_{thJC}=f(t)$

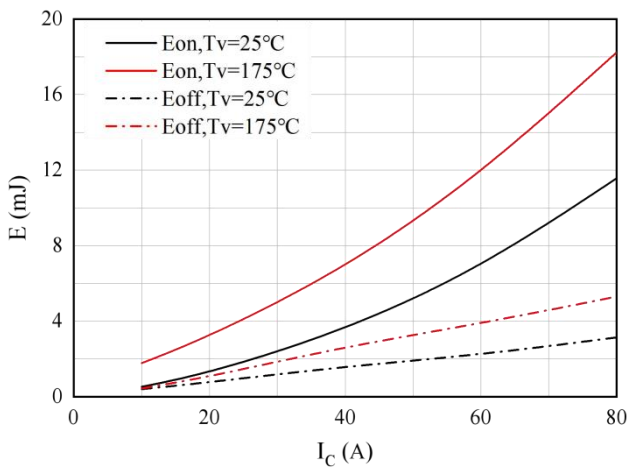


Fig 7. Switching losses of IGBT
 $V_{GE}=\pm 15V$, $R_{Gon}=10\Omega$, $R_{Goff}=10\Omega$, $V_{CE}=600V$

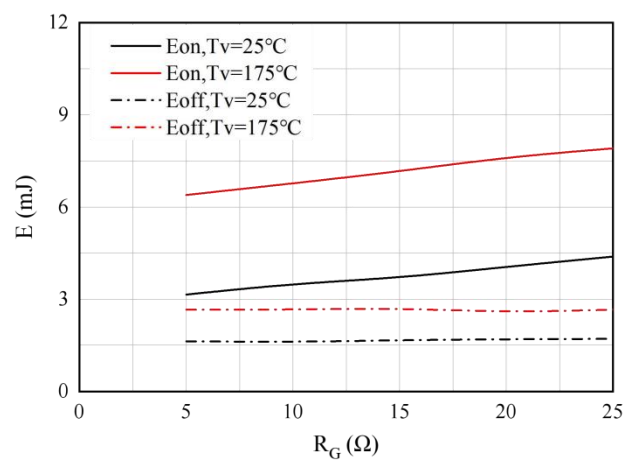


Fig 8. Switching losses of IGBT
 $V_{GE}=\pm 15V$, $I_C=40A$, $V_{CE}=600V$

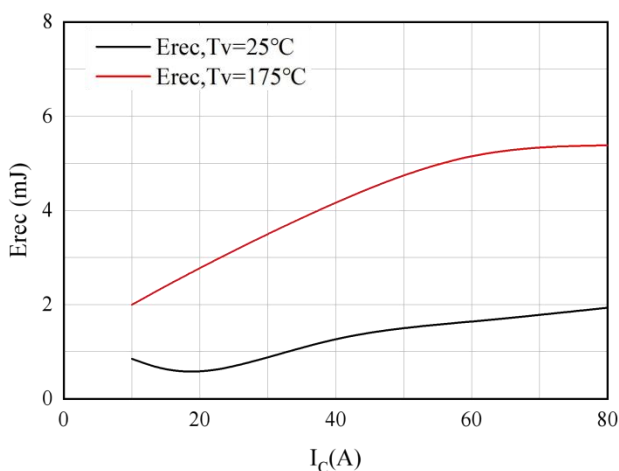


Fig 9. Switching losses of Diode
 $R_{gon}=10\Omega$, $V_{CE}=600V$

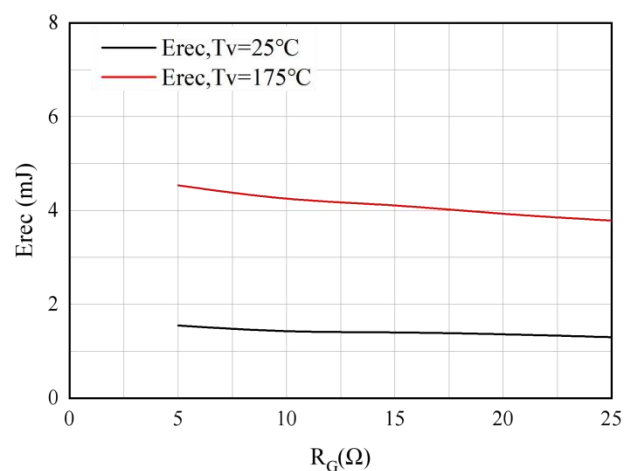


Fig 10. Switching losses of Diode
 $I_F=40A$, $V_{CE}=600V$

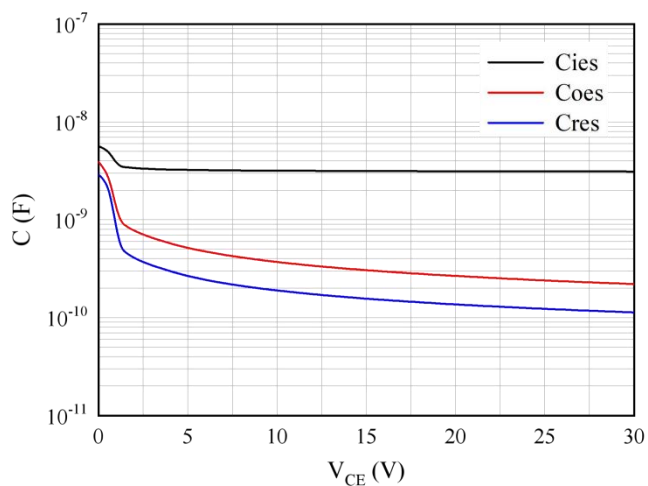
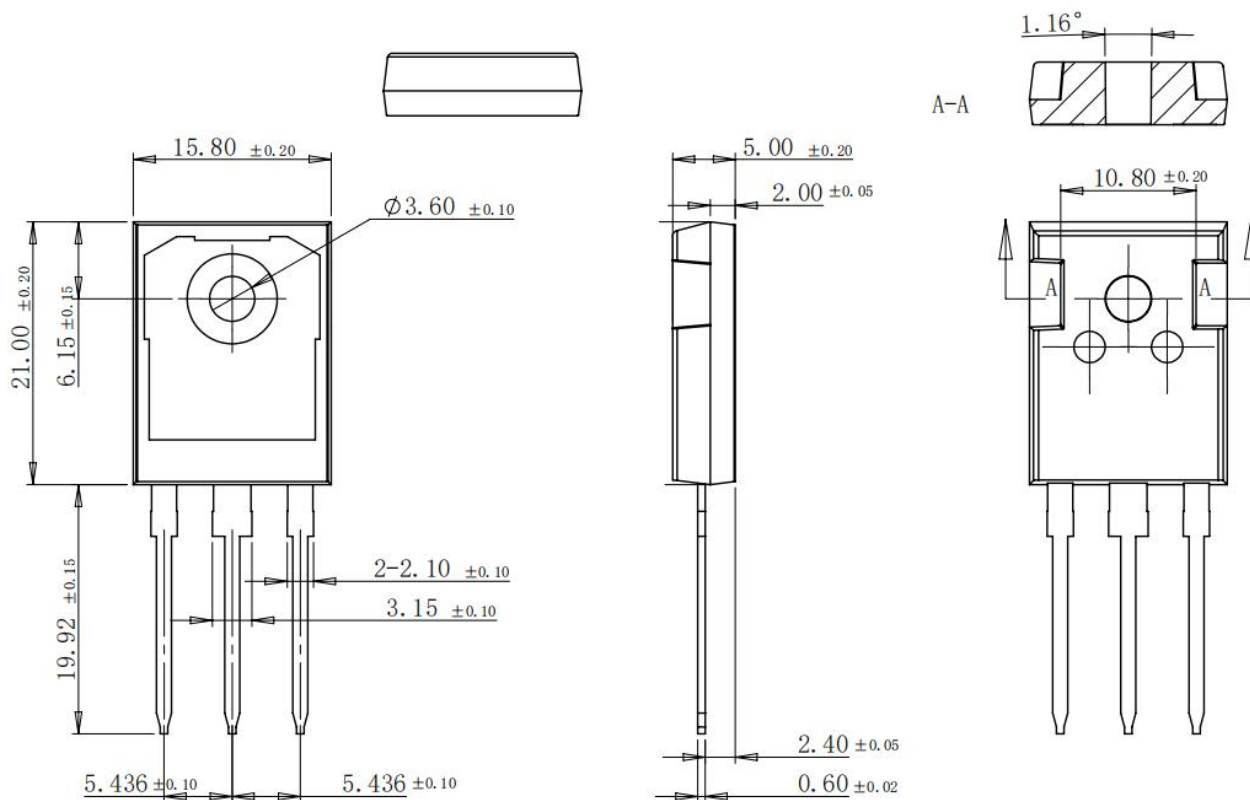


Fig 11. Capacitance characteristic

Package Outlines (Unit: mm)

TO-247-3L



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