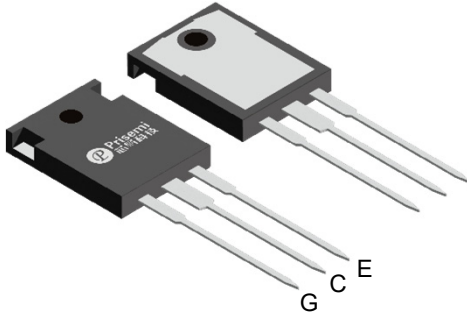
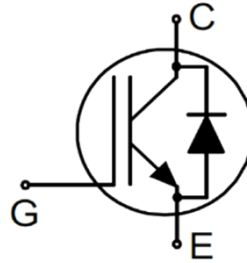
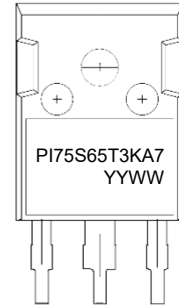


Insulate-Gate Bipolar Transistor
Description

TO-247-3L

Circuit Diagram

Marking (Top View)
Feature

- 650V Trench Gate & Field Stop Structure
- Low Gate Charge QG
- Low Switching Loss

Applications

- Solar String Inverters
- Uninterrupted Power Supplies
- Welding Converters
- Mid to High Range Switching Frequency Converters

Absolute maximum rating@25°C

Parameter	Symbol	Value	Units
Collector-Emitter Voltage @ $V_{GE}=0V$	V_{CES}	650	V
DC Collector Current @ $T_C=105^{\circ}C$, $T_{VJMax}=175^{\circ}C$	I_C	75	A
Peak Collector Current @ $t_p=1ms$	I_{CM}	150	A
Gate-Emitter Voltage	V_{GES}	± 20	V
Repetitive Peak Reverse Voltage	V_{RRM}	650	V
Continuous DC Forward Current	I_F	75	A
Repetitive Peak Forward Current @ $t_p=1ms$	I_{FRM}	150	A
Maximum Junction Temperature	T_{VJMax}	175	$^{\circ}C$
Operating Junction Temperature	T_{VJOP}	-40~+150	$^{\circ}C$
Storage Temperature Range	T_{STG}	-40~+125	$^{\circ}C$

Electrical characteristics per line@25°C (unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units		
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C=75A, V_{GE}=15V$	$T_{VJ}=25^{\circ}C$	-	1.6	1.9	V	
			$T_{VJ}=125^{\circ}C$	-	1.9	-		
			$T_{VJ}=150^{\circ}C$	-	2.0	-		
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$I_C=0.75mA, V_{CE}=V_{GE}$	3.3	3.8	4.3	V		
Collector-Emitter Cut-off Current	I_{CES}	$V_{CE}=650V, V_{GE}=0V$	-	-	75	μA		
Gate-Emitter Leakage Current	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$	-100	-	100	nA		
Internal Gate Resistance	R_{Gint}	-	-	0	-	Ω		
Gate Charge	Q_G	$I_C=75A, V_{CE}=650V, V_{GE}=-15V\sim+15V$	-	200	-	nC		
Input Capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=1MHz$	-	5700	-	pF		
Output Capacitance	C_{oes}		-	260	-			
Reverse Transfer Capacitance	C_{res}		-	25	-			
Turn-on Delay Time	$t_{d(on)}$	$I_C=75A, V_{CE}=400V, V_{GE}=0/15V, R_{Gon}=8\Omega, R_{Goff}=8\Omega, \text{Inductive Load}$	$T_{VJ}=25^{\circ}C$	-	24	-	ns	
			$T_{VJ}=125^{\circ}C$	-	31	-		
			$T_{VJ}=150^{\circ}C$	-	31	-		
Rise Time	t_r		$T_{VJ}=25^{\circ}C$	-	32	-		
			$T_{VJ}=125^{\circ}C$	-	33	-		
			$T_{VJ}=150^{\circ}C$	-	33	-		
Turn-off Delay Time	$t_{d(off)}$		$T_{VJ}=25^{\circ}C$	-	183	-		
			$T_{VJ}=125^{\circ}C$	-	192	-		
			$T_{VJ}=150^{\circ}C$	-	194	-		
Fall Time	t_f		$T_{VJ}=25^{\circ}C$	-	34	-		
			$T_{VJ}=125^{\circ}C$	-	35	-		
			$T_{VJ}=150^{\circ}C$	-	38	-		
Turn-on Energy Loss	E_{on}		$T_{VJ}=25^{\circ}C$	-	1.74	-		mJ
			$T_{VJ}=125^{\circ}C$	-	2.51	-		
			$T_{VJ}=150^{\circ}C$	-	2.61	-		
Turn-off Energy Loss	E_{off}	$T_{VJ}=25^{\circ}C$	-	0.91	-			
		$T_{VJ}=125^{\circ}C$	-	1.00	-			
		$T_{VJ}=150^{\circ}C$	-	1.02	-			

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	
Forward Voltage	V_F	$I_F=75A$	$T_{VJ}=25^{\circ}C$	-	1.3	1.6	V
			$T_{VJ}=125^{\circ}C$	-	1.2	-	
			$T_{VJ}=150^{\circ}C$	-	1.17	-	
Peak reverse recovery current	I_{RM}	$I_F=75A, V_R=400V,$ $di_F/dt=-750A/\mu s,$ $V_{GE}=0V,$ Inductive Load	$T_{VJ}=25^{\circ}C$	-	42.4	-	A
			$T_{VJ}=125^{\circ}C$	-	69.1	-	
			$T_{VJ}=150^{\circ}C$	-	76.7	-	
Reverse recovery charge	Q_{rr}	$I_F=75A, V_R=400V,$ $di_F/dt=-750A/\mu s,$ $V_{GE}=0V,$ Inductive Load	$T_{VJ}=25^{\circ}C$	-	3.0	-	μC
			$T_{VJ}=125^{\circ}C$	-	6.9	-	
			$T_{VJ}=150^{\circ}C$	-	8.6	-	
Reverse Recovery Time	t_{rr}	$I_F=75A, V_R=400V,$ $di_F/dt=-750A/\mu s,$ $V_{GE}=0V,$ Inductive Load	$T_{VJ}=25^{\circ}C$	-	116	-	ns
			$T_{VJ}=125^{\circ}C$	-	159	-	
			$T_{VJ}=150^{\circ}C$	-	179	-	
Reverse recovery energy loss	E_{rec}	$I_F=75A, V_R=400V,$ $di_F/dt=-750A/\mu s,$ $V_{GE}=0V,$ Inductive Load	$T_{VJ}=25^{\circ}C$	-	0.69	-	mJ
			$T_{VJ}=125^{\circ}C$	-	1.46	-	
			$T_{VJ}=150^{\circ}C$	-	1.82	-	

Thermal Resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance, Junction-to-Case	$R_{th(J-C)}$	-	0.46	-	K/W

Typical Characteristics

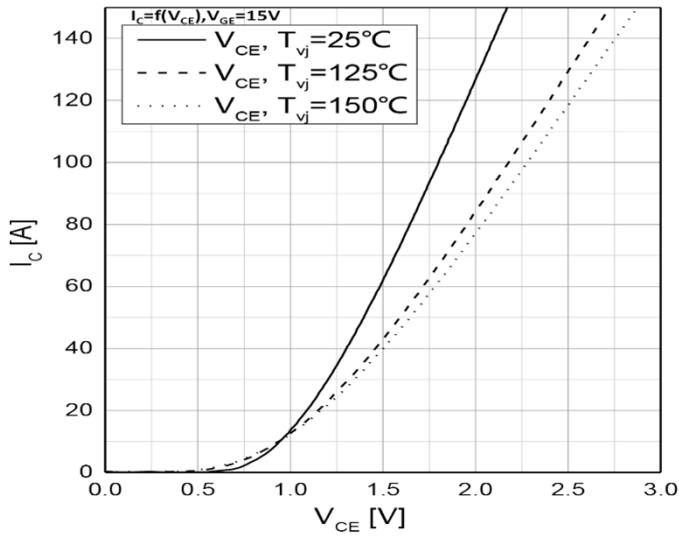


Fig 1. Output Characteristic IGBT(I)

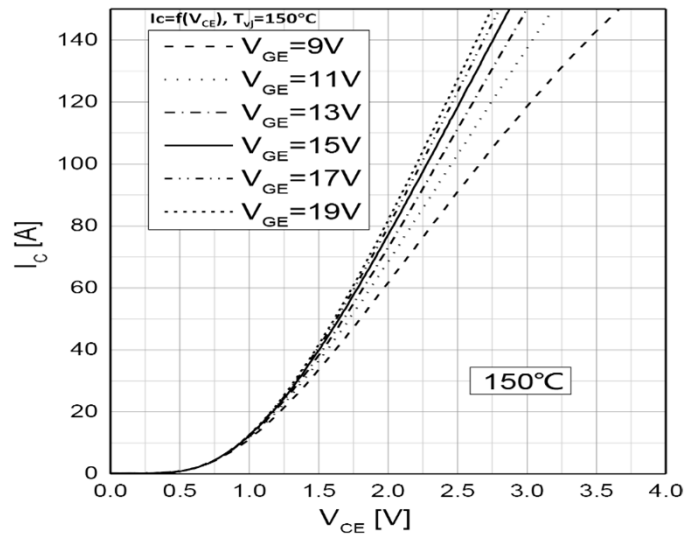


Fig 2. Output Characteristic IGBT(II)

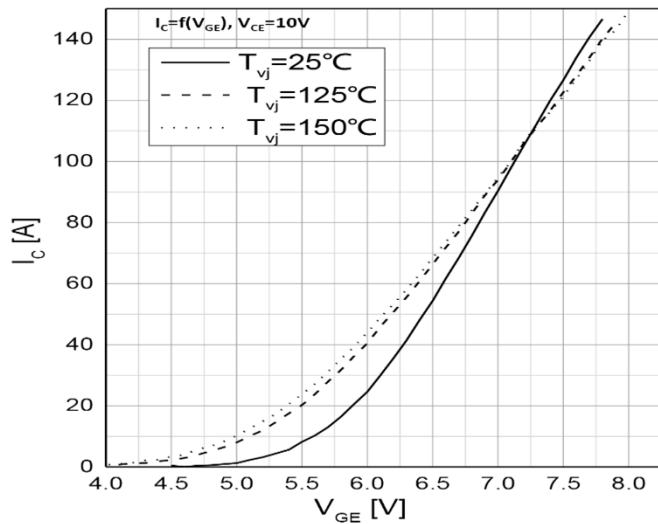


Fig 3. Transfer Characteristic IGBT

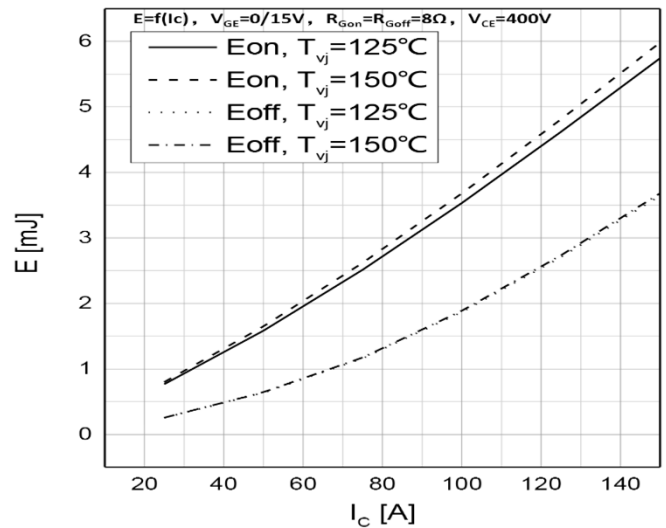


Fig 4. Switching Losses IGBT(I)

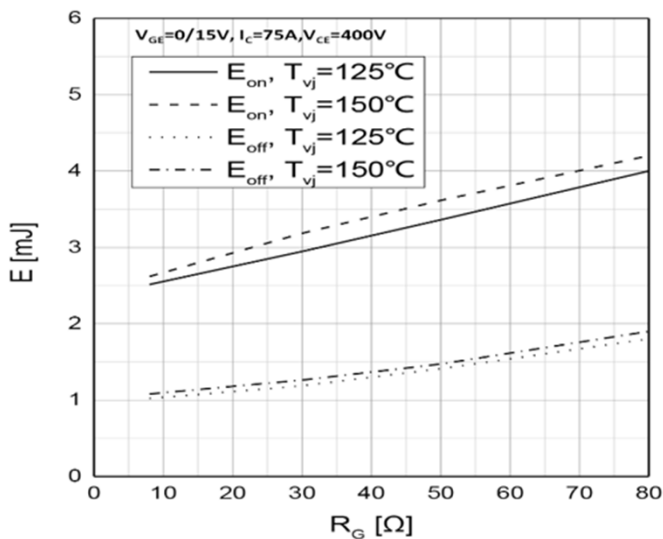


Fig 5. Switching Losses IGBT(II)

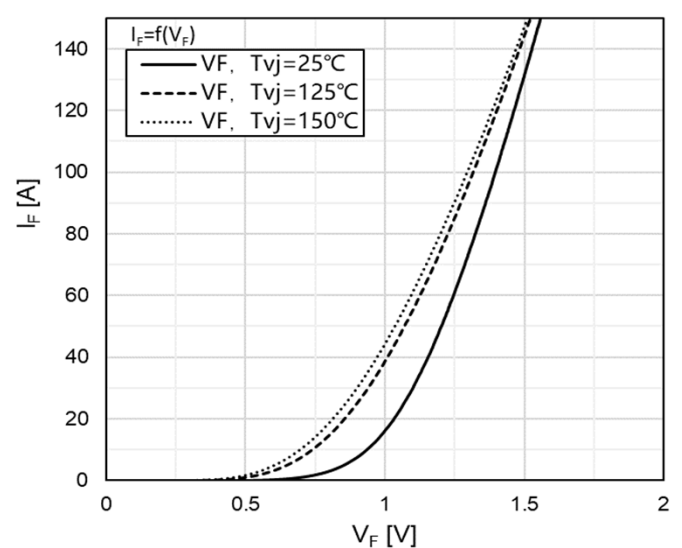


Fig 6. Forward Characteristic Diode

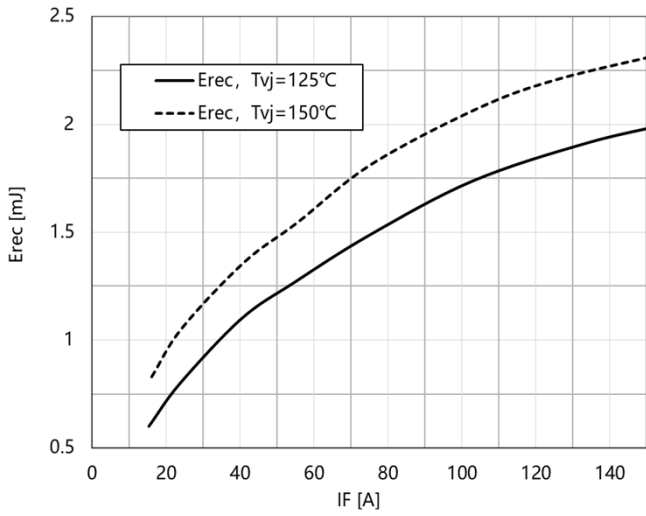


Fig 7. Switching Losses Diode(I)

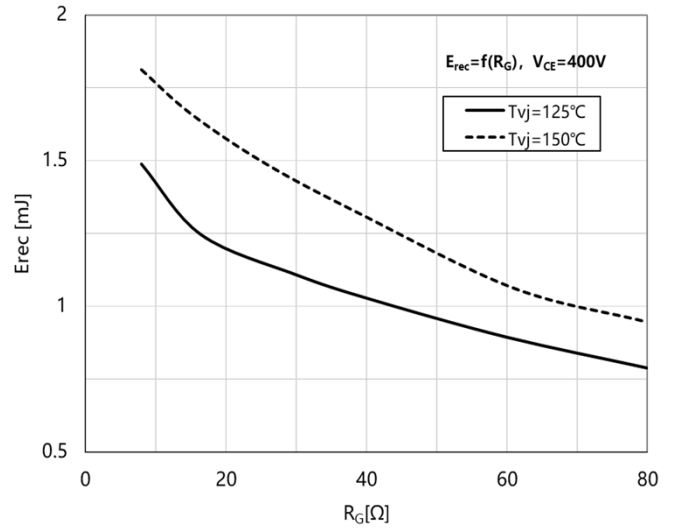


Fig 8. Switching Losses Diode(II)

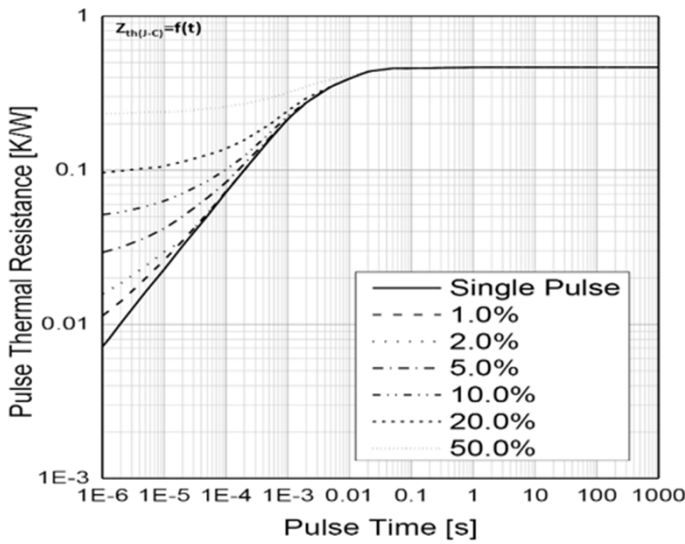


Fig 9. Transient Thermal Impedance IGBT

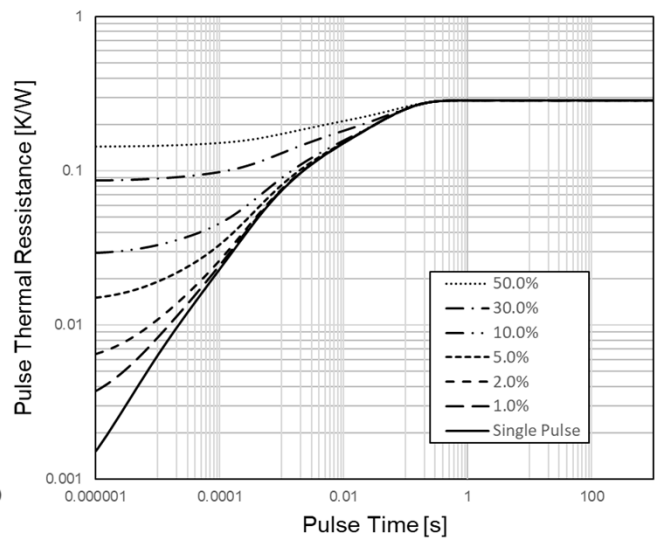
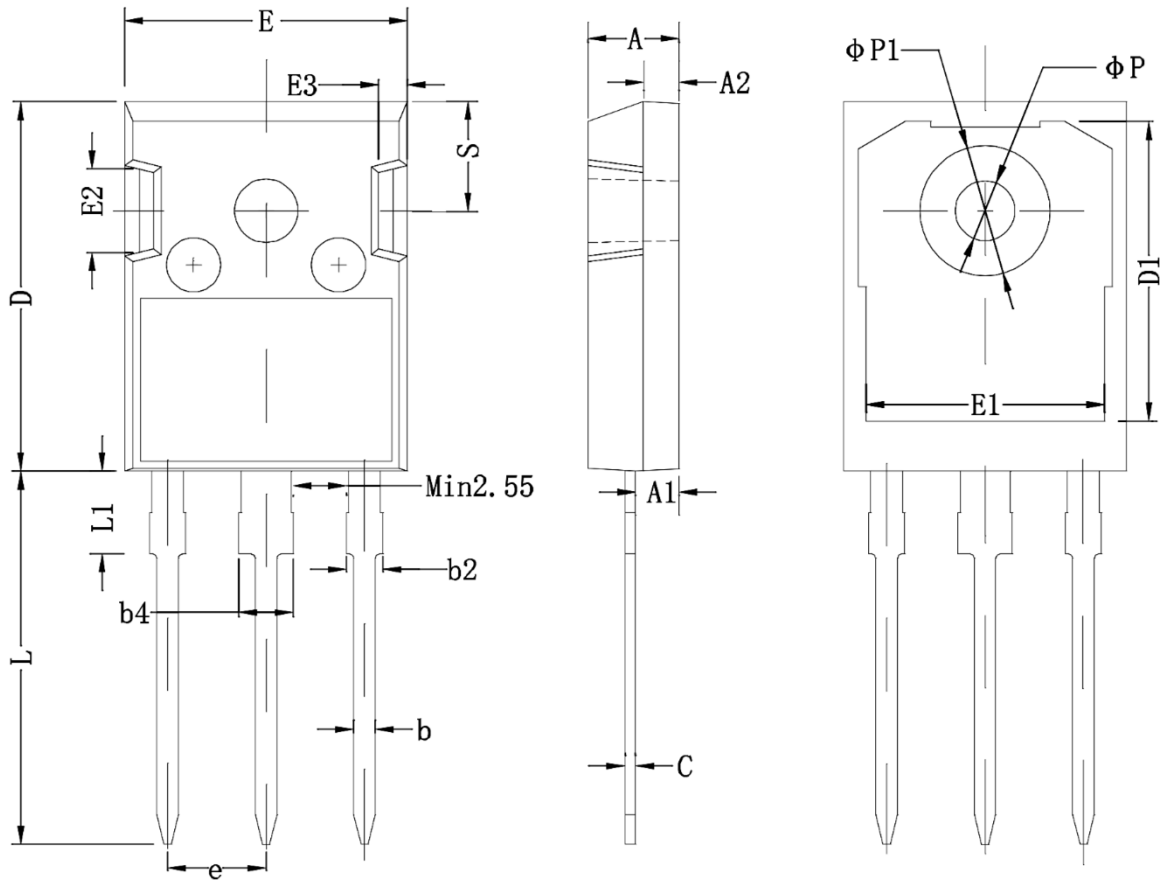



Fig 10. Transient Thermal Impedance Diode

Product Dimension (TO-247-3L)



Dim	Millimeters		Inches		Dim	Millimeters		Inches	
	Min	Max	Min	Max		Min	Max	Min	Max
A	4.80	5.20	0.189	0.205	E1	13.00	13.60	0.512	0.535
A1	2.21	2.59	0.087	0.102	E2	4.80	5.20	0.189	0.205
A2	1.85	2.15	0.073	0.085	E3	2.30	2.70	0.091	0.106
b	1.11	1.36	0.044	0.054	e	5.44 BSC.		0.214 BSC.	
b2	1.91	2.21	0.075	0.087	L	19.82	20.22	0.780	0.796
b4	2.91	3.21	0.115	0.126	L1	-	4.30	-	0.169
c	0.51	0.75	0.020	0.030	φP	3.40	3.80	0.134	0.150
D	20.80	21.30	0.819	0.839	φP1	-	7.30	-	0.287
D1	16.25	16.85	0.640	0.663	S	6.15 BSC.		0.242 BSC.	
E	15.50	16.10	0.610	0.634					


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