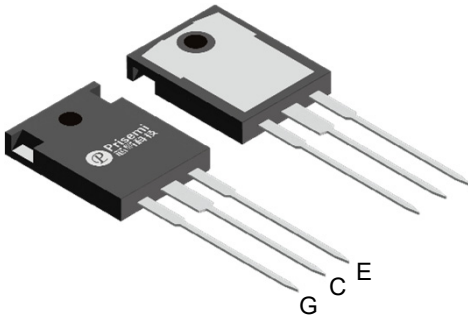
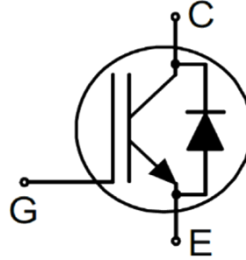
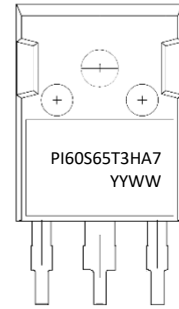


Insulate-Gate Bipolar Transistor
Description

TO-247-3L

Circuit Diagram

Marking (Top View)
Feature

- Low switching power loss
- Low switching surge and noise
- Advanced Field Stop technology
- Low EMI
- Qualified according to JEDEC for target applications
- Pb-free lead plating, halogen-free mold compound, RoHS compliant
- Internal insulation

Applications

- Industrial UPS
- Welding machine
- Solar converters
- Energy Storage
- EV Charger

Absolute maximum rating@25°C

Parameter	Symbol	Value	Units
Collector-Emitter Voltage	V_{CE}	650	V
Gate-Emitter Voltage	V_{GE}	± 20	V
Transient Gate-emitter Voltage ($t_p \leq 10\mu s$, $D < 0.010$)		± 30	
Collector Current	I_C	$T_c = 25^\circ C$	A
		$T_c = 100^\circ C$	
Pulsed Collector Current	I_{CM}	180	A
Diode Forward Current	I_F	$T_c = 25^\circ C$	A
		$T_c = 100^\circ C$	
Diode Maximum Forward Current	I_{FM}	180	A
Power Dissipation	P_D	$T_c = 25^\circ C$	W
		$T_c = 100^\circ C$	
Operating Junction Temperature	T_J	-40~+150	$^\circ C$
Storage Temperature	T_{STG}	-55~+150	$^\circ C$
Wave Soldering Temperature for 10 sec	T_L	270	$^\circ C$

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	
Collector-Emitter Breakdown Voltage	BV_{CE}	$V_{GE}=0V, I_{CE}=1mA$	650	-	-	V	
C-E Leakage Current	I_{CES}	$V_{CE}=650V, V_{GE}=0V$	-	-	2.0	mA	
G-E Leakage Current	I_{GES}	$V_{GE}=\pm 20V, V_{CE}=0V$	-	-	± 250	nA	
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$I_C=1mA, V_{CE}=V_{GE}$	4.0	5.4	7.0	V	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C=60A, V_{GE}=15V$	-	1.72	2.3	V	
Input Capacitance	C_{ies}	$V_{CE}=30V, V_{GE}=0V, f=1MHz$	-	3398	-	pF	
Output Capacitance	C_{oes}		-	224	-		
Reverse Transfer Capacitance	C_{res}		-	44	-		
Turn-on Delay Time	$t_{d(on)}$	$V_{CE}=400V, V_{GE}=15V, R_G=10\Omega, I_C=60A$	$T_c=25^\circ C$	-	56	-	ns
Rise Time	t_r		$T_c=125^\circ C$	-	55	-	
			$T_c=25^\circ C$	-	68	-	
Turn-off Delay Time	$t_{d(off)}$		$T_c=125^\circ C$	-	74	-	
			$T_c=25^\circ C$	-	153	-	
Fall Time	t_f		$T_c=125^\circ C$	-	170	-	
			$T_c=25^\circ C$	-	42	-	
Turn-on Energy Loss	E_{on}		$T_c=125^\circ C$	-	43	-	
		$T_c=25^\circ C$	-	4.79	-		
Turn-off Energy Loss	E_{off}	$T_c=125^\circ C$	-	4.73	-	mJ	
		$T_c=25^\circ C$	-	1.42	-		
Total Switching Loss	E_{st}	$T_c=125^\circ C$	-	1.57	-		
		$T_c=25^\circ C$	-	6.21	-		
Total Gate Charge	Q_g	$T_c=125^\circ C$	-	6.30	-		
		$T_c=25^\circ C$	-	117	-		
Gate to Emitter Charge	Q_{ge}	$V_{CE}=400V, V_{GE}=15V, I_C=60A$	-	35	-	nC	
Gate to Collector Charge	Q_{gc}		-	47	-		
Diode Forward Voltage	V_F	$I_F=60A$	-	1.6	2.0	V	
Reverse Recovery Time	t_{rr}	$I_F=60A, di/dt=200A/\mu s$	-	57	-	ns	
Reverse Recovery Charge	Q_{rr}		-	135	-	nC	
Reverse Recovery Current	I_{rrm}		-	4.75	-	A	

Thermal Resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance, Junction to case for IGBT	$R_{\theta JC}$	-	-	0.31	$^{\circ}C/W$
Thermal Resistance, Junction to case for Diode	$R_{\theta JC}$	-	-	0.54	$^{\circ}C/W$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	-	-	40.1	$^{\circ}C/W$

Typical Characteristics

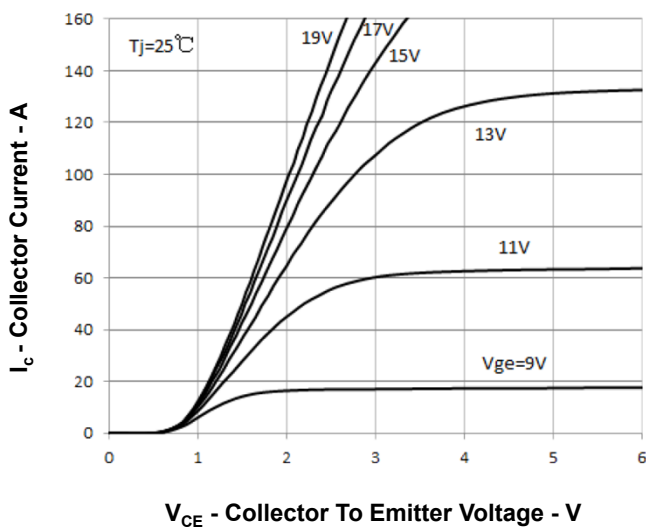


Figure 1. Output Characteristics

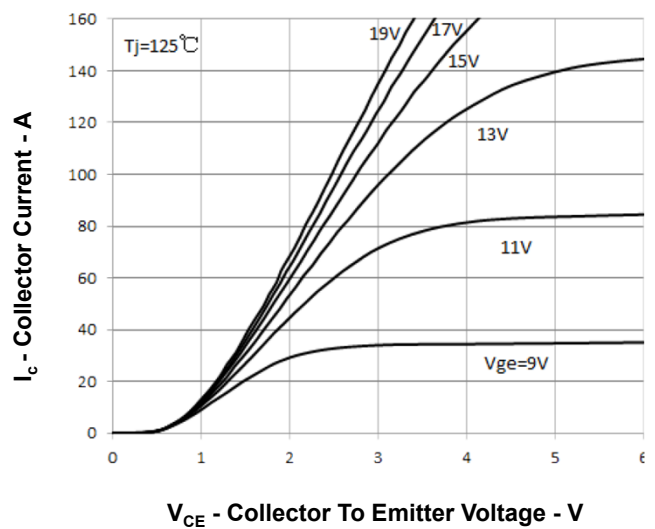


Figure 2. Output Characteristics

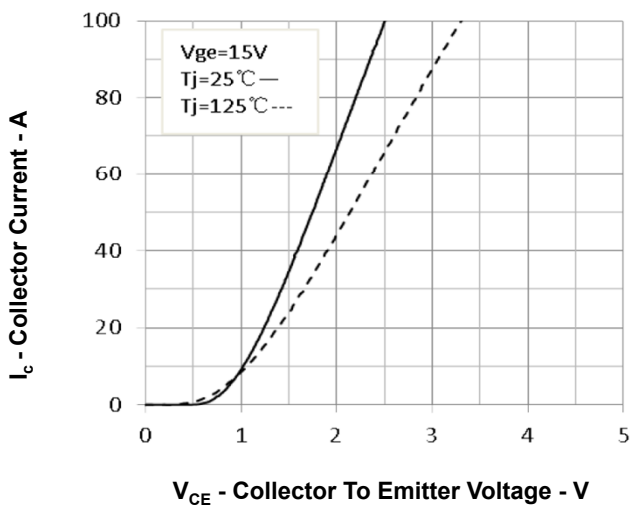


Figure 3. Saturation Voltage Characteristics

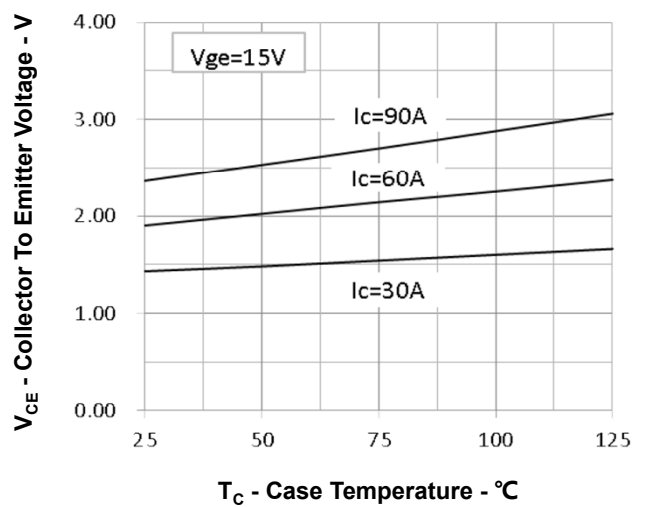


Figure 4. Saturation Voltage - T_c Characteristics

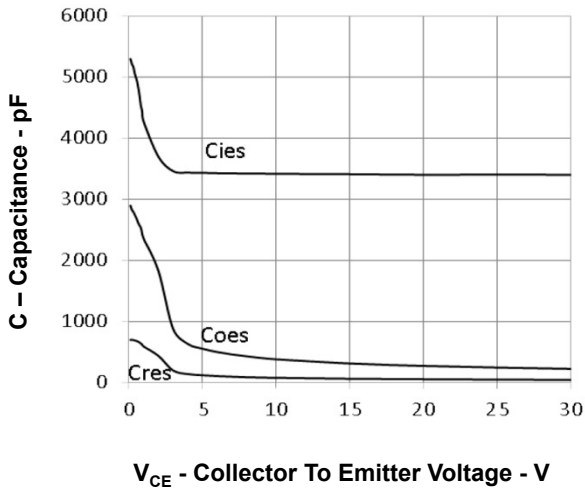


Figure 5. Capacitance Characteristics

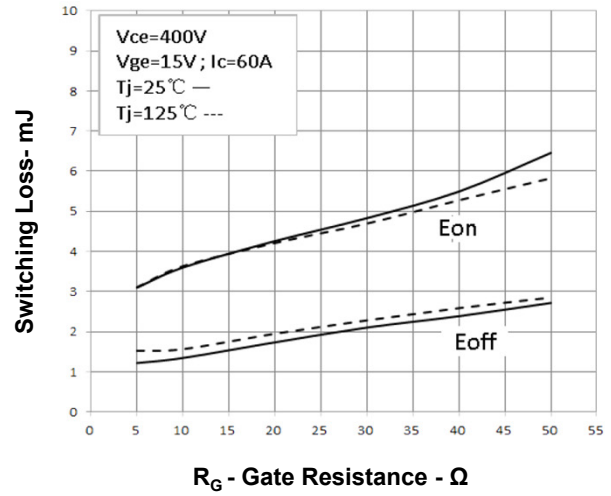


Figure 6. Switching Loss-R_G Characteristics

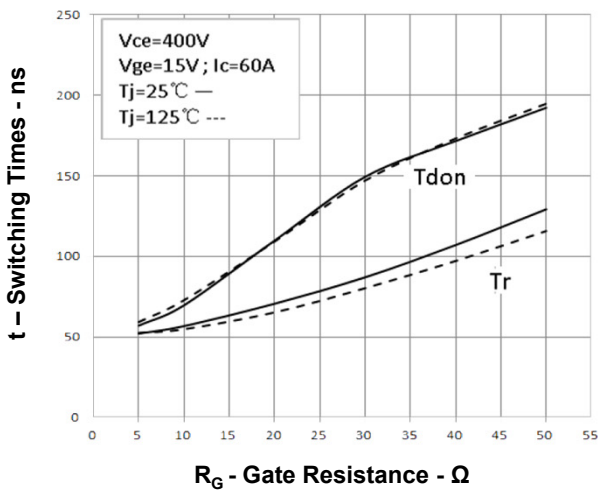


Figure 7. Switching Time-R_G Characteristics

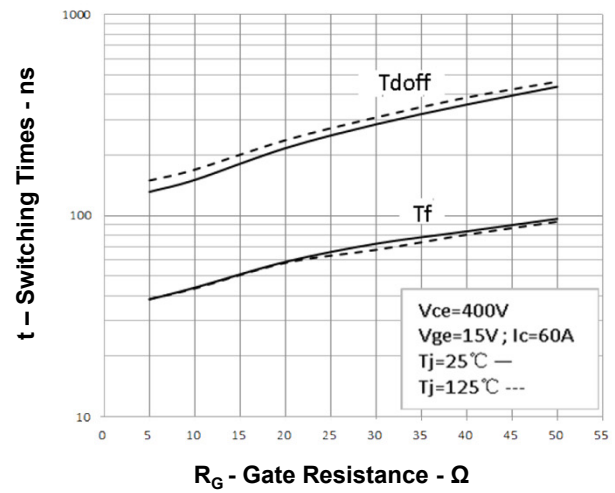


Figure 8. Switching Time-R_G Characteristics

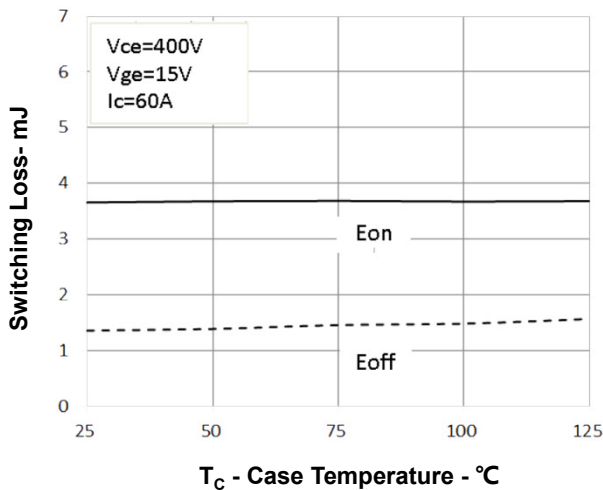


Figure 9. Switching Loss-T_c Characteristics

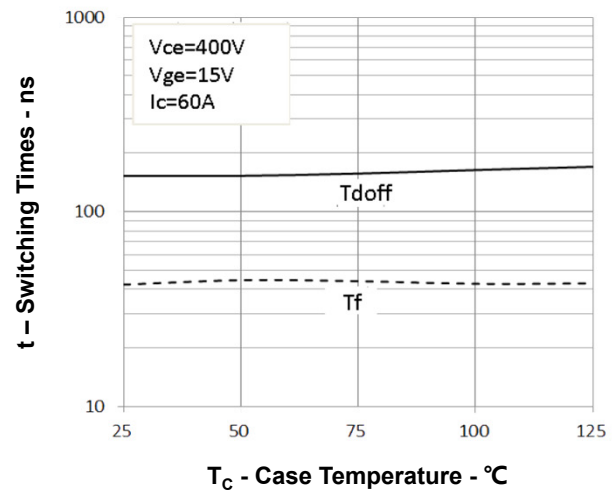


Figure 10. Turn-Off Time-T_c Characteristics

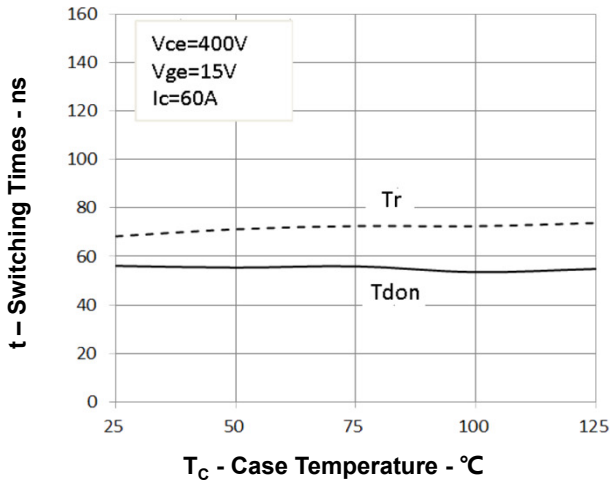


Figure 11. Turn-On Time-Tc Characteristics

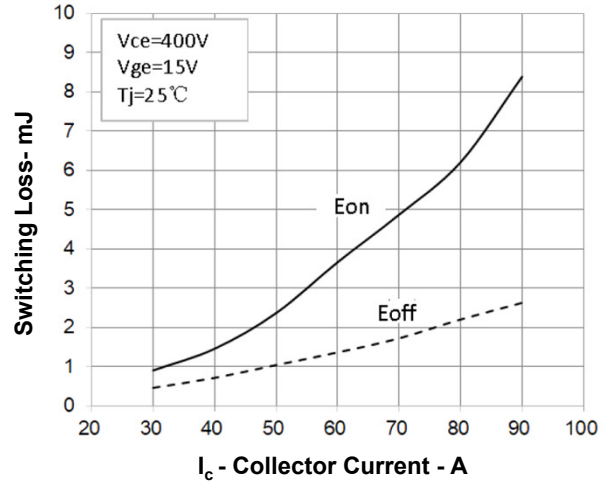


Figure 12. Switching Loss-Ic Characteristics

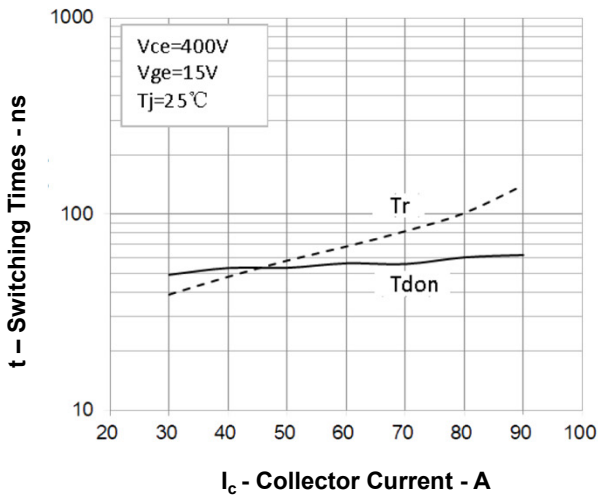


Figure 13. Turn-On Time-Ic Characteristics

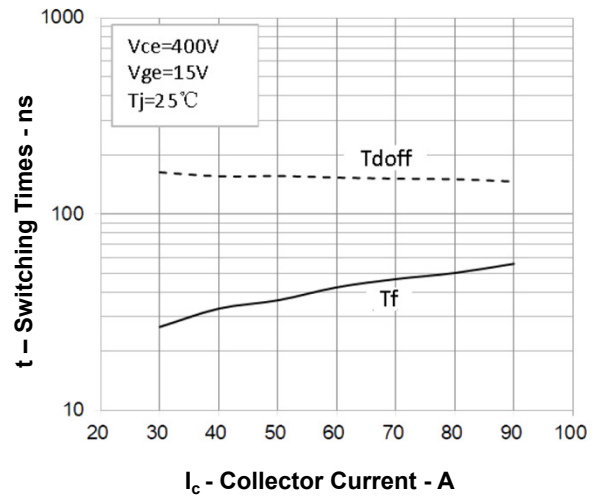


Figure 14. Turn-Off Time-Ic Characteristics

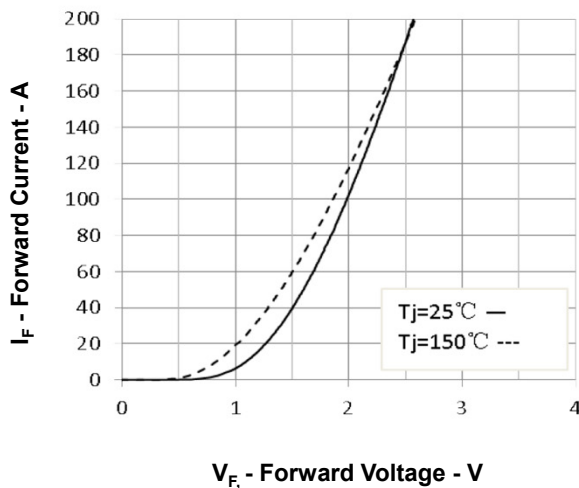


Figure 15. Diode Forward Characteristics

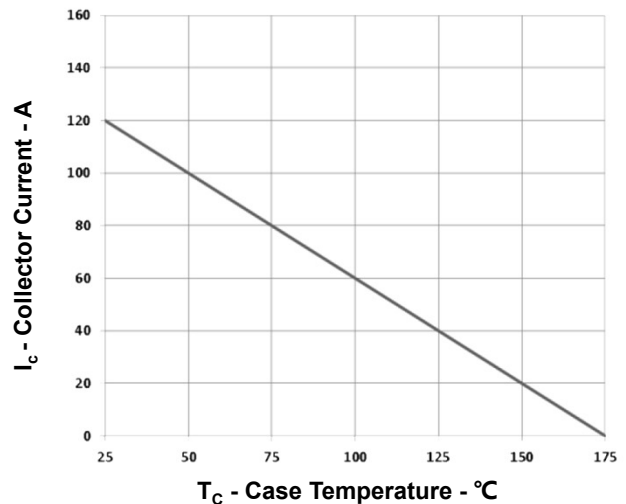


Figure 16. Collector Current-Tc Characteristics

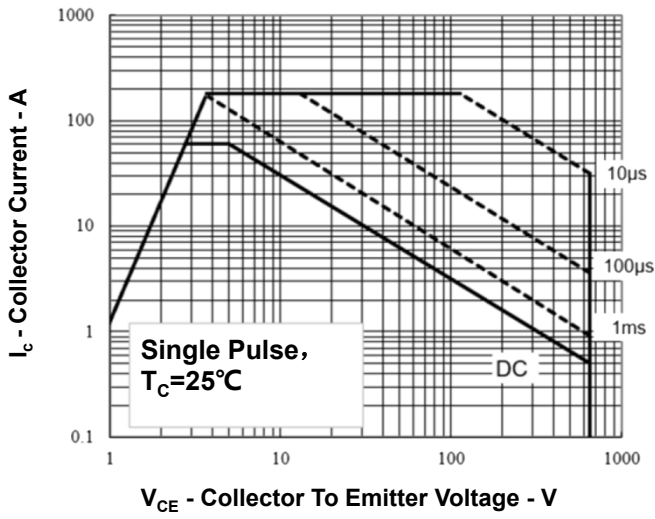


Figure 17. Forward Bias Safe Operating Area

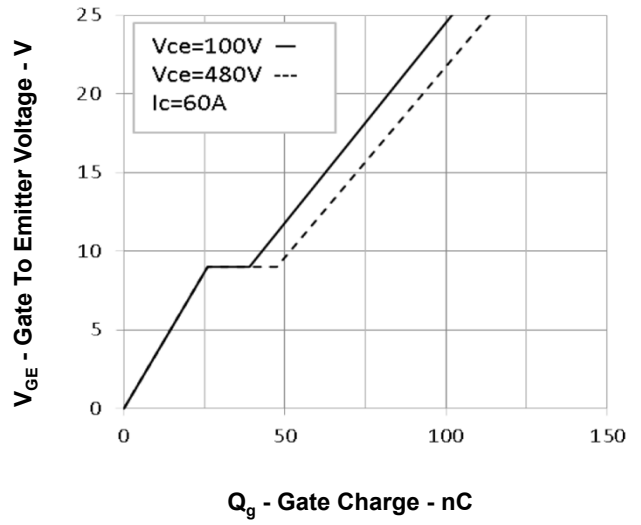


Figure 18. Gate Charge Characteristics

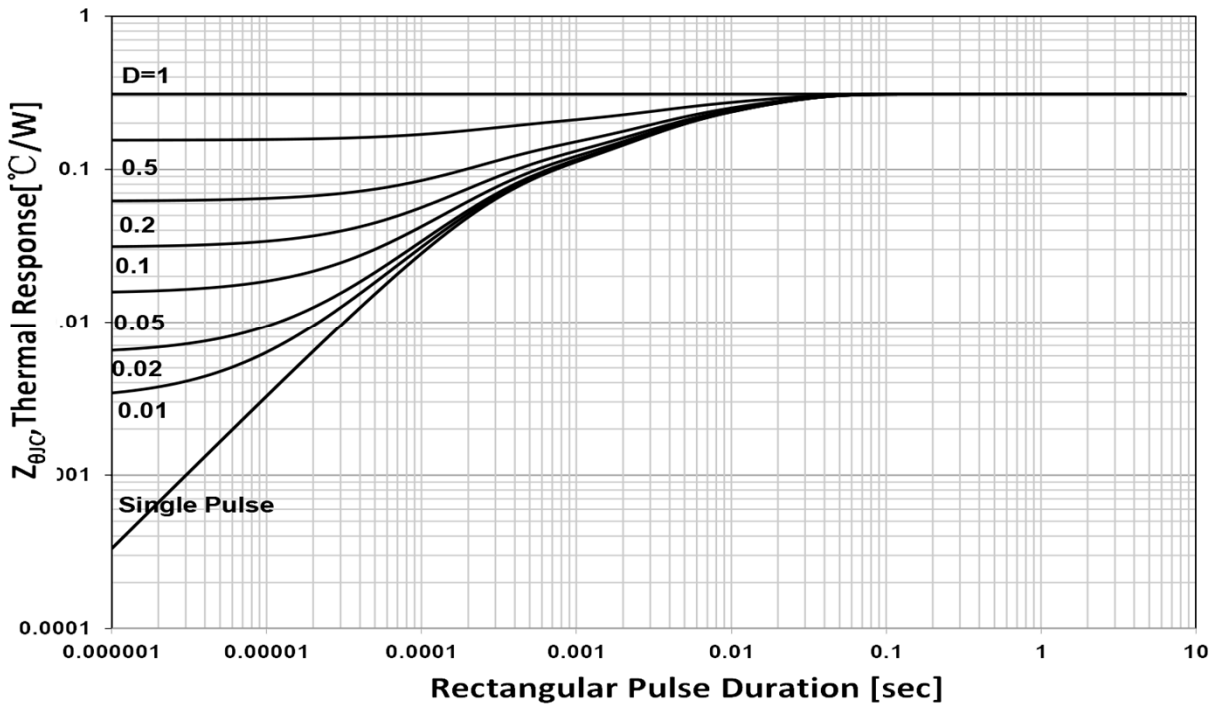
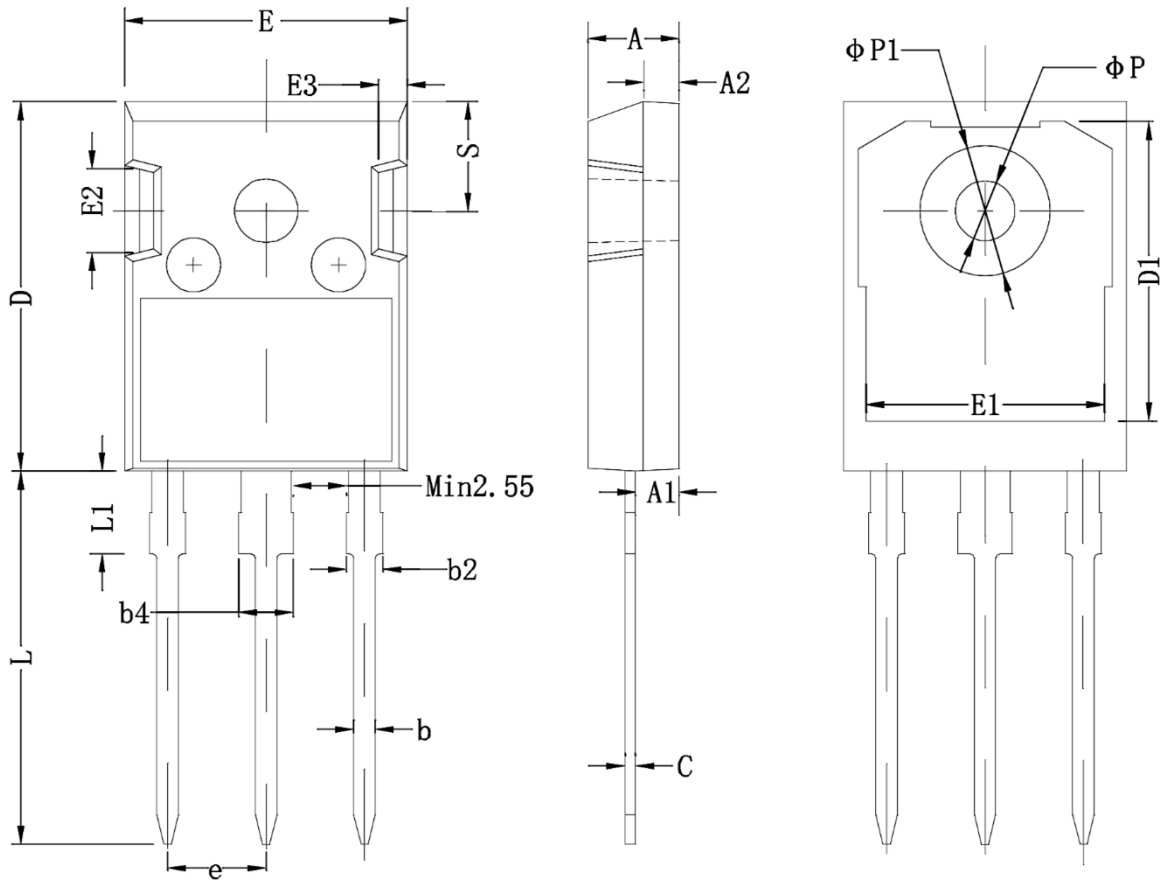



Figure 19. IGBT Transient Thermal Impedance

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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