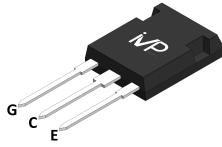
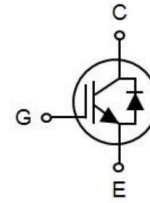


TO-247

Symbol


Key Features

- High Speed Switching & Low $V_{CE(sat)}$ Loss
- $V_{CE(sat)} = 2.0V$ @ $I_C = 25A$
- High Input Impedance
- $t_{rr} = 100ns$ (typ.) @ $di_F/dt = 500A/\mu s$
- Maximum junction temperature $175^\circ C$
- Pb-free ; RoHS compliant
- Ultra Soft, fast recovery anti-parallel diode
- Ultra narrowed V_F distribution control
- Positive Temperature coefficient for easy paralleling

Applications

- PFC
- UPS
- Welder
- PV Inverter

Ordering Information

Ordering part Number	Marking code	Package	Form
VPMIPP4001	4001	TO-247	Tube

Maximum Rating ($T_J = 25^\circ C$, unless otherwise specified)

Parameter	Symbol	Rating	Unit
Collector-emitter voltage	V_{CE}	1200	V
DC collector current, limited by T_{vjmax}	I_C	$T_C=25^\circ C$ 50	A
		$T_C=100^\circ C$ 25	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpuls}	100	A
Turn off safe operating area $V_{CE} \leq 1200V$, $T_{vj} \leq 175^\circ C$	-	100	A
Diode forward current limited by T_{vjmax}	I_F	$T_C=25^\circ C$ 25	A
		$T_C=100^\circ C$ 12.5	
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpuls}	100	A
Gate-emitter voltage	V_{GE}	± 20	V
Power dissipation	P_D	$T_C=25^\circ C$ 348	W
		$T_C=100^\circ C$ 174	
Short circuit withstand time $V_{CC} \leq 600V$, $V_{GE} = 15V$, $T_{vj} = 175^\circ C$	t_{sc}	10	μs
Operating Junction temperature range	T_{vj}	-40~175	$^\circ C$
Storage temperature range	T_{stg}	-55~150	$^\circ C$
Soldering temperature		260	$^\circ C$
Wave soldering 1.6 mm (0.063 in.) from case for 10s			
Mounting torque, M3 screw	M	0.6	Nm
Maximum of mounting processes: 3			

Thermal Characteristic

Parameter	Symbol	Rating	Unit
Thermal resistance junction-to-ambient	$R_{\theta JA}$	40	$^\circ C/W$
Thermal resistance junction-to-case for IGBT	$R_{\theta JC}$	0.43	
Thermal resistance junction-to-case for Diode	$R_{\theta JC}$	1.55	

Electrical Characteristic ($T_{vj} = 25^{\circ}\text{C}$ unless otherwise specified)

Static Characteristic

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Collector-emitter breakdown voltage	BV_{CES}	1200	-	-	V	$I_C = 500\mu\text{A}$, $V_{GE} = 0\text{V}$
Collector-emitter saturation voltage	$V_{CE(sat)}$	-	2.0	2.4	V	$I_C = 25\text{A}$, $V_{GE} = 15\text{V}$, $T_{vj} = 25^{\circ}\text{C}$
		-	2.4	-		$I_C = 25\text{A}$, $V_{GE} = 15\text{V}$, $T_{vj} = 150^{\circ}\text{C}$
		-	2.5	-		$I_C = 25\text{A}$, $V_{GE} = 15\text{V}$, $T_{vj} = 175^{\circ}\text{C}$
Diode forward voltage	V_F	-	2.1	2.6	V	$V_{GE} = 0\text{V}$, $I_F = 12.5\text{A}$, $T_{vj} = 25^{\circ}\text{C}$
		-	1.9	-		$V_{GE} = 0\text{V}$, $I_F = 12.5\text{A}$, $T_{vj} = 175^{\circ}\text{C}$
Diode forward voltage	V_F	-	2.5	3.0	V	$V_{GE} = 0\text{V}$, $I_F = 25\text{A}$, $T_{vj} = 25^{\circ}\text{C}$
		-	2.55	-		$V_{GE} = 0\text{V}$, $I_F = 25\text{A}$, $T_{vj} = 150^{\circ}\text{C}$
		-	2.45	-		$V_{GE} = 0\text{V}$, $I_F = 25\text{A}$, $T_{vj} = 175^{\circ}\text{C}$
Gate-emitter threshold voltage	$V_{GE(th)}$	5.0	6.0	7.0	V	$V_{CE} = V_{GE}$, $I_C = 0.85\text{mA}$
Zero gate voltage collector current	I_{CES}	-	-	250	μA	$V_{CE} = 1200\text{V}$, $V_{GE} = 0\text{V}$, $T_{vj} = 25^{\circ}\text{C}$
		-	-	2500		$V_{CE} = 1200\text{V}$, $V_{GE} = 0\text{V}$, $T_{vj} = 175^{\circ}\text{C}$
Gate-emitter leakage current	I_{GES}	-	-	± 250	nA	$V_{GE} = 20\text{V}$, $V_{CE} = 0\text{V}$
Transconductance	g_{fs}	-	16	-	S	$V_{CE} = 20\text{V}$, $I_C = 25\text{A}$

Dynamic Characteristic

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Total gate charge	Q_g	-	204	-	nC	$V_{CE} = 960\text{V}$, $I_C = 25\text{A}$, $V_{GE} = 15\text{V}$
Gate-emitter charge	Q_{ge}	-	34	-		
Gate-collector charge	Q_{gc}	-	94	-		
Input capacitance	C_{ies}	-	3942	-	pF	$V_{CE} = 25\text{V}$, $V_{GE} = 0\text{V}$, $f = 1\text{MHz}$
Reverse transfer capacitance	C_{res}	-	72	-		
Output capacitance	C_{oes}	-	142	-		
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E	-	13.0	-	nH	
Short circuit collector current Max. 1000 short circuits Time between short circuits: $\geq 1.0\text{s}$	$I_{C(SC)}$	-	121	-	A	$V_{GE} = 15\text{V}$, $V_{CC} = 600\text{V}$, $t_{SC} \leq 10\mu\text{s}$, $T_{vj} = 175^{\circ}\text{C}$

Switching Characteristic

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Turn-on delay time	$t_{d(on)}$	-	73	-	ns	$V_{GE} = 15V$, $V_{CC} = 600V$, $I_C = 25A$, $R_G = 23\Omega$, Inductive Load, $T_{vj} = 25^{\circ}C$
Rise time	t_r	-	41	-		
Turn-off delay time	$t_{d(off)}$	-	269	-		
Fall time	t_f	-	39	-		
Turn-on switching energy	E_{on}	-	1.44	-	mJ	
Turn-off switching energy	E_{off}	-	0.55	-		
Total switching energy	E_{ts}	-	1.99	-		
Reverse recovery time	t_{rr}	-	100	-	ns	$I_F = 25A$, $di_F/dt = 500A/\mu s$, $V_R = 600V$, $T_{vj} = 25^{\circ}C$
Reverse recovery current	I_{rr}	-	17	-	A	
Reverse recovery charge	Q_{rr}	-	0.85	-	μC	
Rate of fall of reverse recovery current during t_b	di_r/dt	-	-376	-	A/ μs	

Performance Characteristics Diagrams

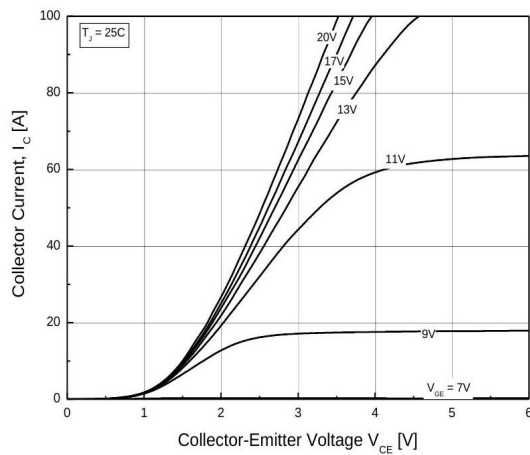


Figure 1. Typical Output Characteristic ($T_J=25^\circ\text{C}$)

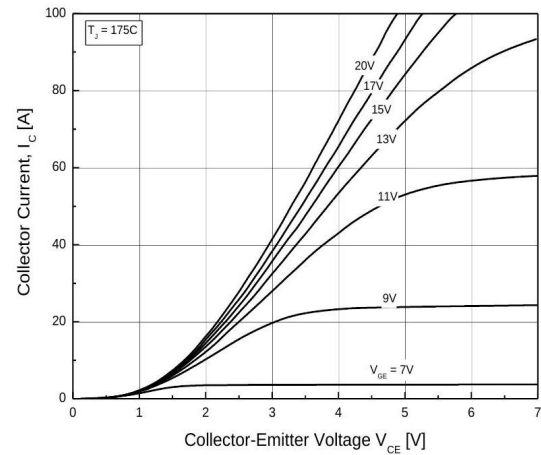


Figure 2. Typical Output Characteristic ($T_J=175^\circ\text{C}$)

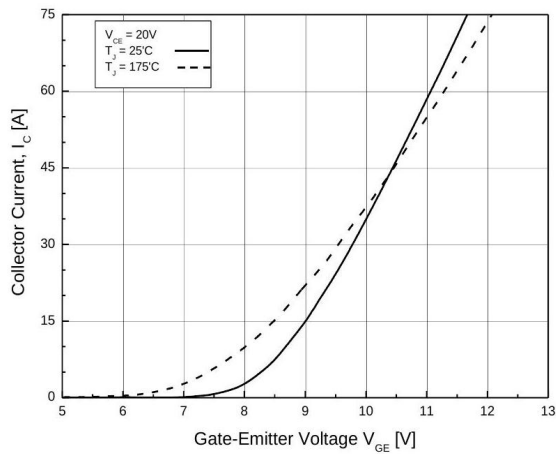


Figure 3. Typical Transfer Characteristic

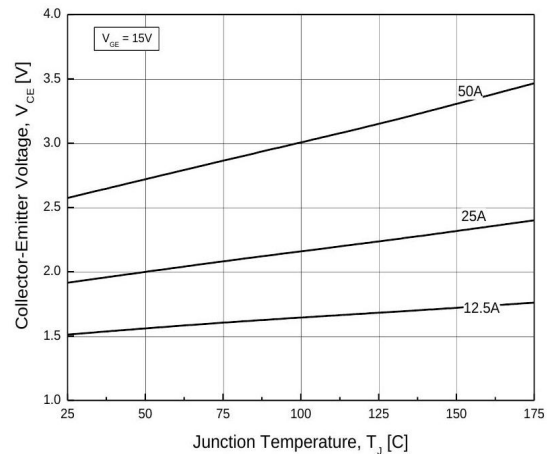


Figure 4. Typical Collector-Emmitter Saturation Voltage-Junction Temperature

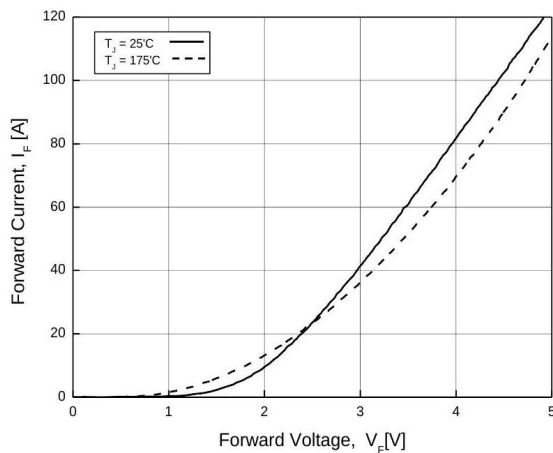


Figure 5. Diode Forward Characteristic

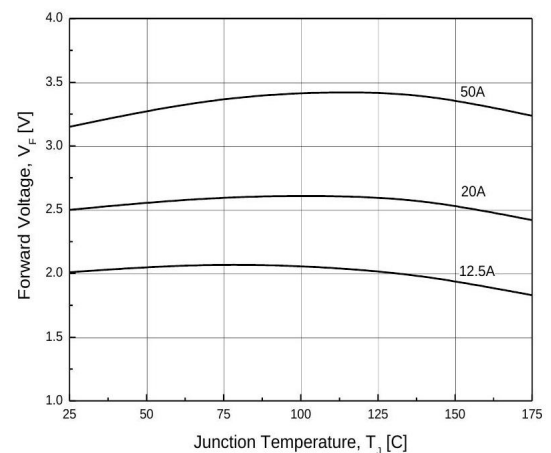


Figure 6. Diode Forward-Junction Temperature

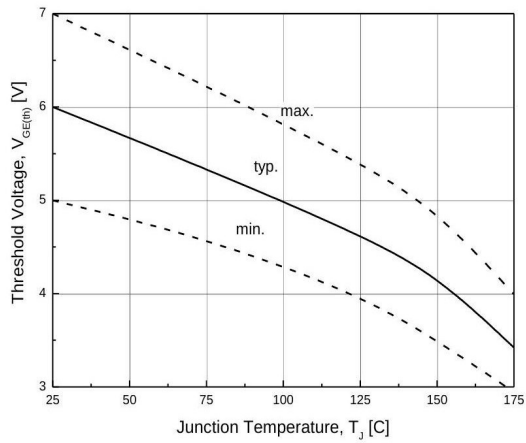


Figure 7. Threshold Voltage-Junction Temperature

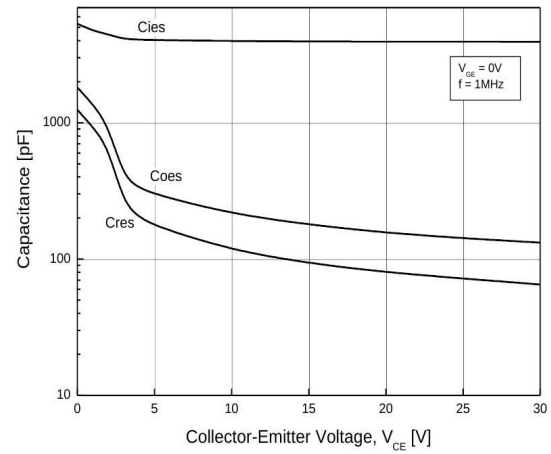


Figure 8. Typical Capacitance

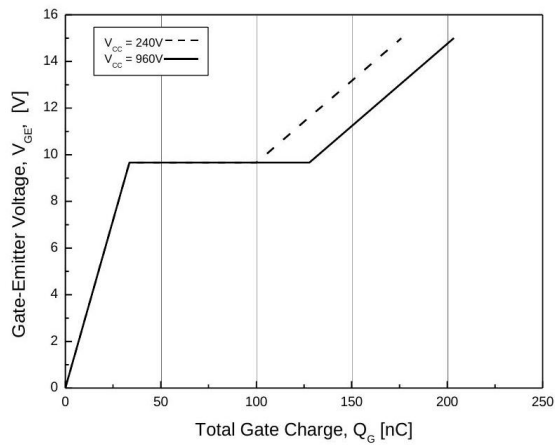


Figure 9. Typical Gate Charge

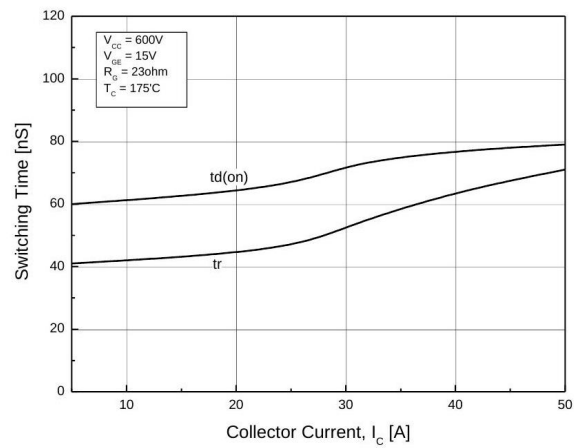


Figure 10. Typical Turn on-Collector Current

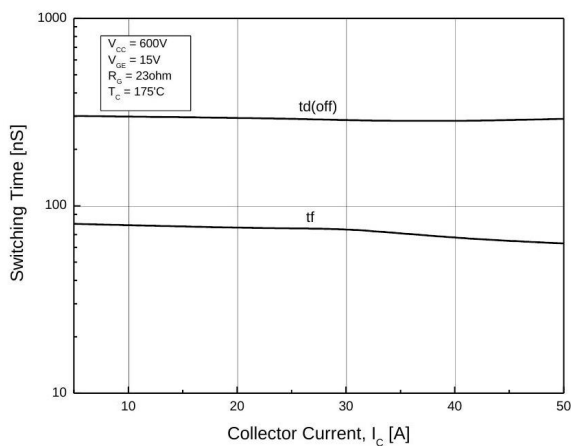


Figure 11. Typical Turn off-Collector Current

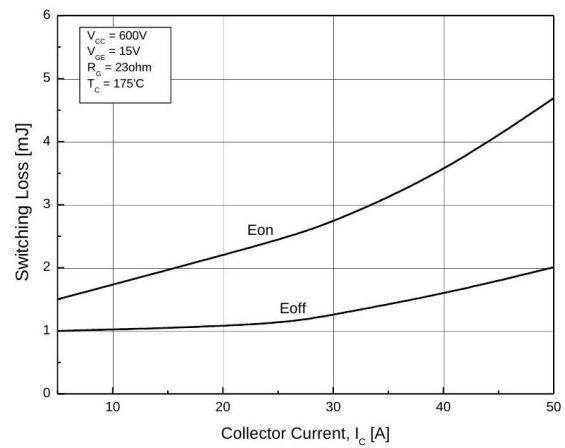


Figure 12. Switching Loss-Collector Current

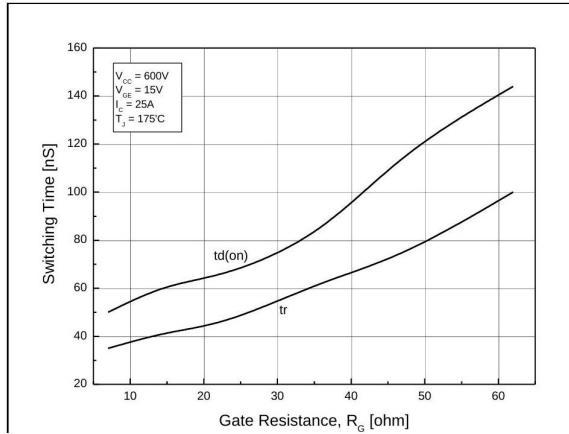


Figure 13. Turn on Characteristic-Gate Resistance

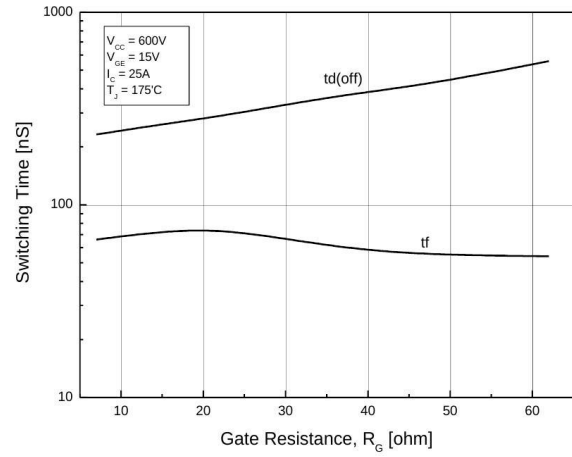


Figure 14. Turn off Characteristic-Gate Resistance

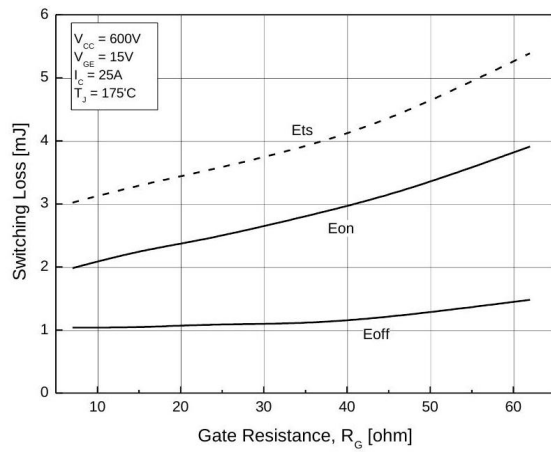


Figure 15. Switching Loss-Gate Resistance

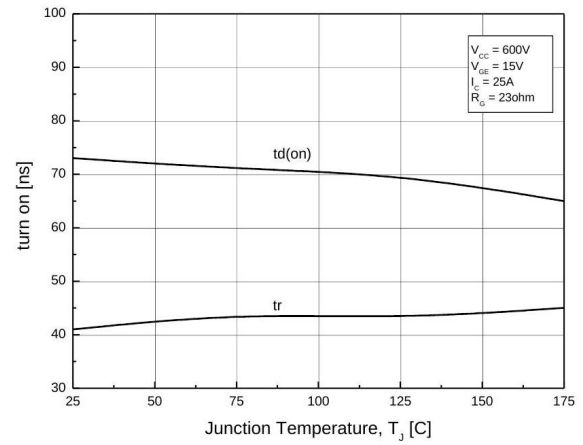


Figure 16. Turn on Characteristic-Junction Temperature

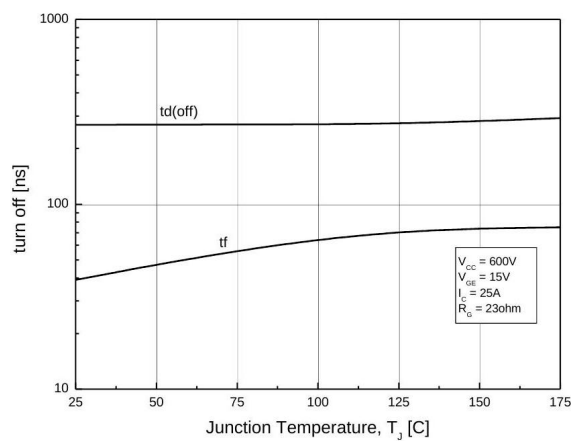


Figure 17. Turn off Characteristic-Junction Temperature

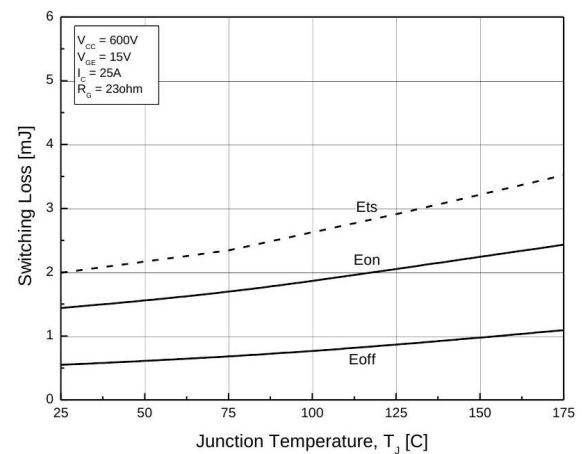


Figure 18. Switching Loss-Junction Temperature

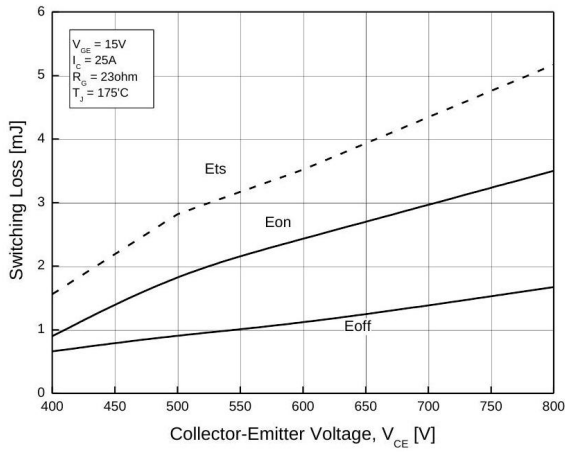


Figure 19. Switching Loss-Collector Emitter Voltage

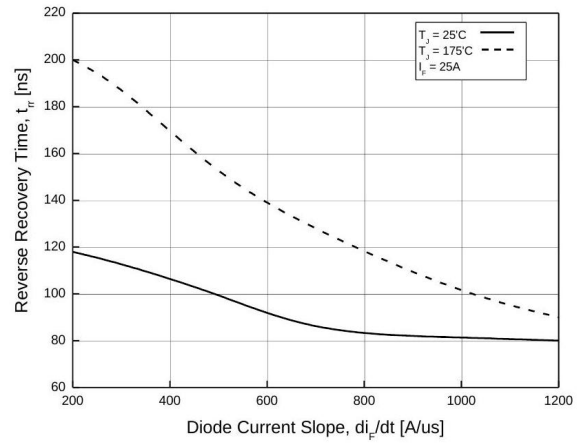


Figure 20. Reverse Recovery Time-Diode Current Slope

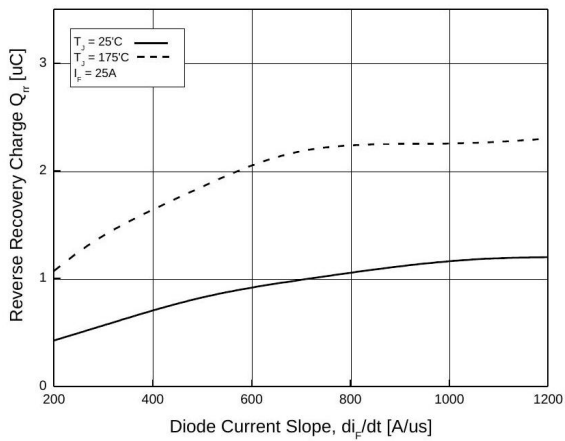


Figure 21. Reverse Recovery Charge-Diode Current Slope

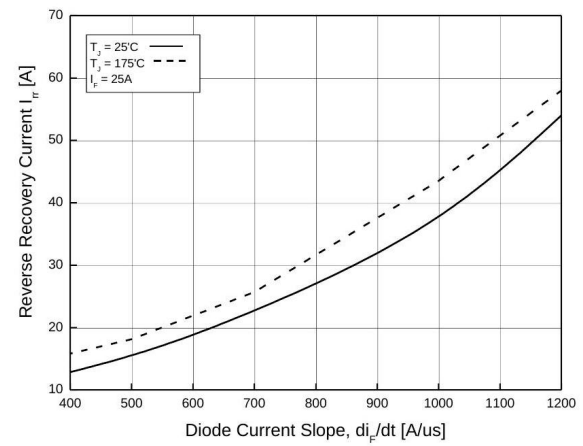


Figure 22. Reverse Recovery Current-Diode Current Slope

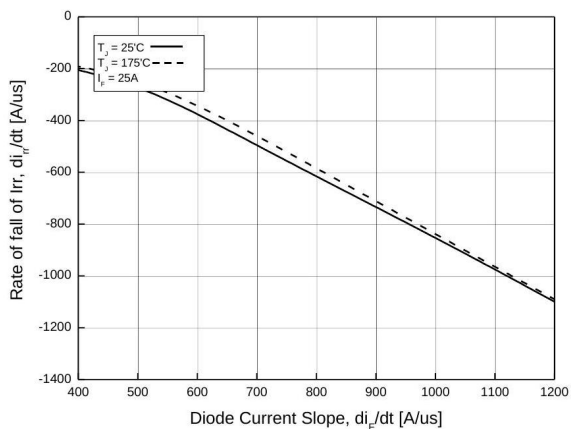


Figure 23. Rate of fall of reverse recovery current-Diode Current Slope

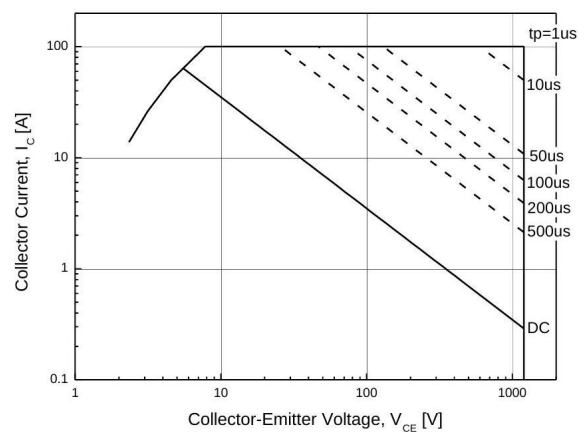


Figure 24. Forward Bias Safe Operating Area

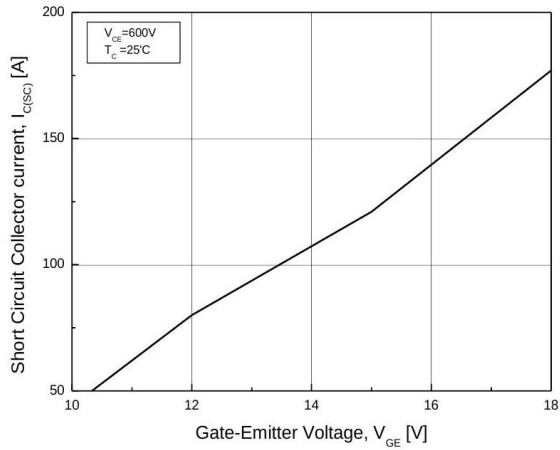


Figure 25. Typical Short Circuit Collector Current

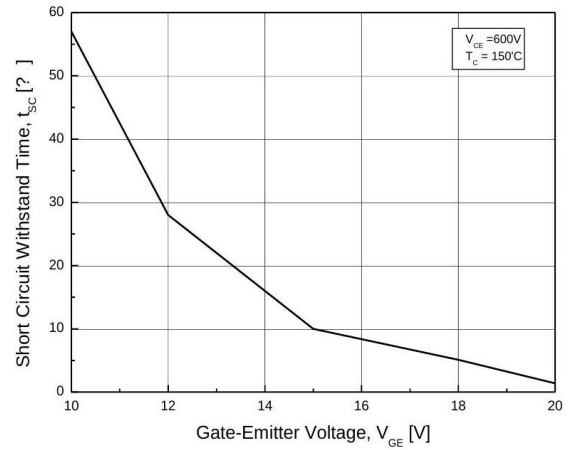


Figure 26. Typical Short Circuit Withstand Time

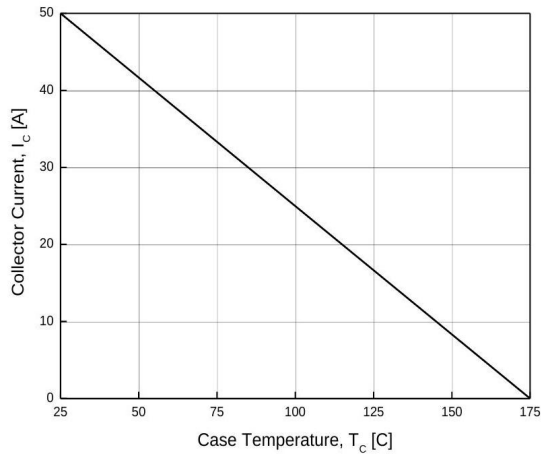


Figure 27. Case Temperature-Collector Current

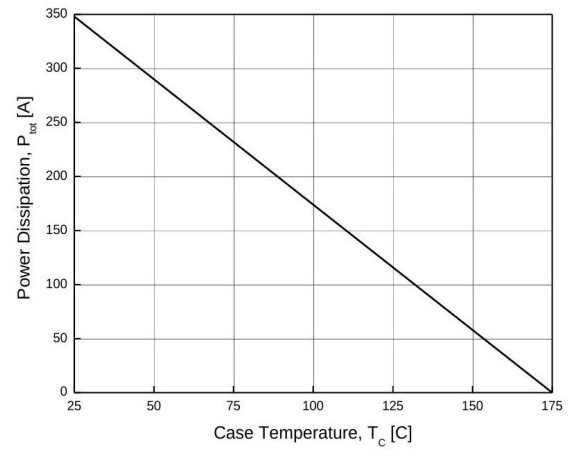


Figure 28. Power Dissipation-Case Temperature

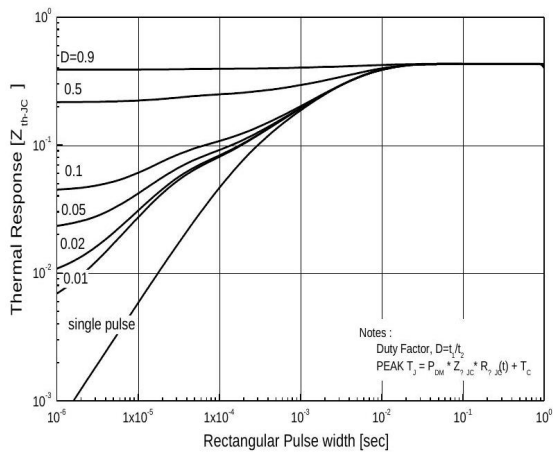


Figure 29. IGBT Transient Thermal Impedance

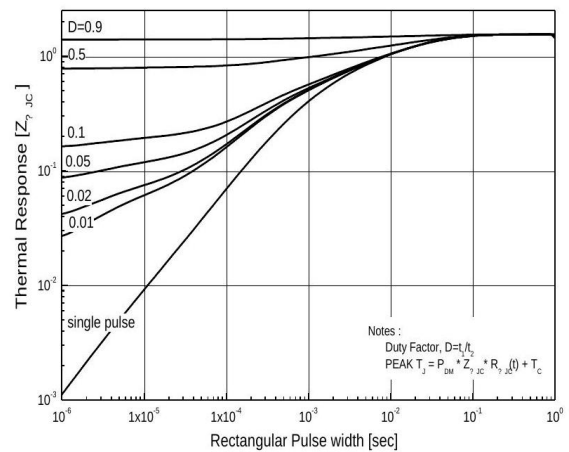
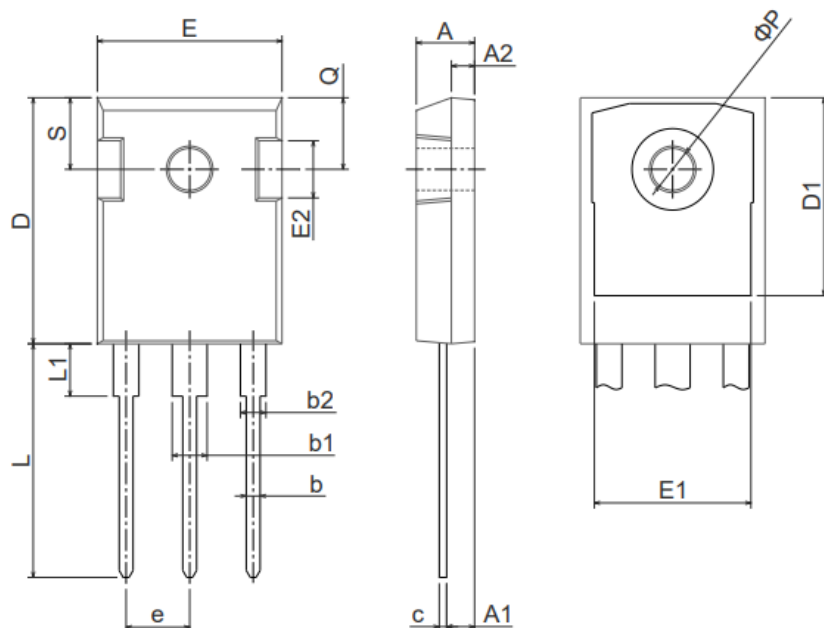


Figure 30. FRD Transient Thermal Impedance

Package Information (TO-247)



Outline dimensions in mm

Symbol	Min	Nom	Max
A	4.70	-	5.31
A1	2.20	-	2.60
A2	1.50	-	2.49
b	0.99	-	1.40
b1	2.59	-	3.43
b2	1.65	-	2.39
c	0.38	-	0.89
D	20.30	-	21.46
D1	13.08	-	-
E	15.45	-	16.26
E1	13.06	-	14.02
E2	4.32	-	5.49
e	5.45 BSC		
L	19.81	-	20.57
L1	-	-	4.50
ØP	3.50	-	3.70
Q	5.38	-	6.20
S	6.15 BSC		

Disclaimer

The information provided in this datasheet is believed to be accurate and reliable. Errors or omissions are expected. iVP Semiconductor Pvt. Ltd. reserves the right to make changes to the product specifications without prior notice. Users should verify the suitability of the product for their specific applications. Please visit our website for the latest datasheet.

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