



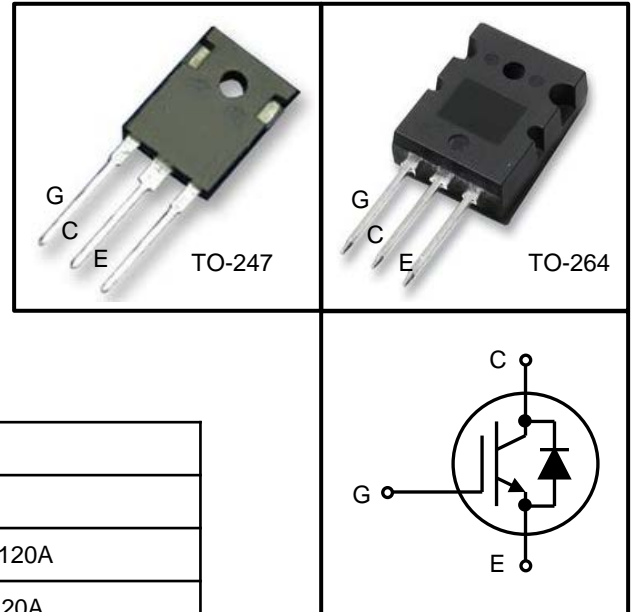
1200V 40A High Speed IGBT

FEATURES

- 1200V Trench & Field Stop technology
- Low saturation voltage
- High switching frequency
- Very soft , fast recovery anti-parallel diode

APPLICATIONS

- Welding converters
- Uninterruptible Power Supply
- General purpose inverters



Ordering Information		
Device	Package	Marking
TGW40N120A	TO-247	TGW40N120A
TGL40N120A	TO-264	TGL40N120A

Absolute Maximum Ratings $T_C = 25^\circ\text{C}$, unless otherwise noted				
Parameter	Symbol	Value		Unit
		TO-247	TO-264	
Collector-Emitter Voltage	V_{CES}	1200		V
Continuous Drain Current $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	I_C	-- 64 40		A
Pulsed Collector Current (note)	I_{Cpulse}	160		A
Gate-Emitter Voltage	V_{GES}	± 20		V
Short Circuit Withstand Time $V_{GE} = 15\text{V}, V_{CC} = 600\text{V}, T_C \leq 125^\circ\text{C}$	t_{SC}	10		μs
Power Dissipation ($T_C = 25^\circ\text{C}$)	P_D	400	500	W
Operating Junction and Storage Temperature Range	T_J	-55~+150		$^\circ\text{C}$
Maximum Soldering Temperature, 1/8" from Case for 5s	--	300		$^\circ\text{C}$

Note : Pulse width limited by maximum junction temperature



Thermal Resistance				
Parameter	Symbol	Value		Unit
		TO-247	TO-264	
IGBT Thermal Resistance, Junction-to-Case	R_{thJC}	0.31	0.25	K/W
Diode Thermal Resistance, Junction-to-Case	R_{thJC}	1.11	0.7	
Thermal Resistance, Junction-to-Ambient	R_{thJA}	40	25	

Specifications $T_J = 25^\circ\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
Static						
Collector-Emitter Breakdown Voltage	$V_{(BR)CES}$	$V_{GE} = 0V, I_C = 250\mu\text{A}$	1200	--	--	V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE} = 15V, I_C = 40A,$ $T_J = 25^\circ\text{C},$ $T_J = 125^\circ\text{C}$	-- --	-- 2.0 2.5	-- --	V
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$I_C = 1.5\text{mA}, V_{CE} = V_{GE}$	--	5.2	--	V
Zero Gate Voltage Collector Current	I_{CES}	$V_{CE} = 1200V, V_{GE} = 0V,$ $T_J = 25^\circ\text{C}$	--	--	1.0	mA
Gate-Emitter Leakage Current	I_{GES}	$V_{CE} = 0V, V_{GE} = \pm 20V$	--	--	± 250	nA
Dynamic						
Input Capacitance	C_{iss}	$V_{CE} = 30V,$ $V_{GE} = 0V,$ $f = 1\text{MHz}$	--	9150	--	pF
Output Capacitance	C_{oss}		--	295	--	
Reverse Transfer Capacitance	C_{rss}		--	76	--	
Gate Charge	Q_g	$V_{CC} = 600V,$ $I_C = 40A,$ $V_{GE} = 15V$	--	225	--	nC
Gate-Emitter Charge	Q_{ge}		--	55	--	
Gate-Collector Charge	Q_{gc}		--	90	--	
Short Circuit Collector Current	$I_{C(SC)}$	$V_{GE} = 15V, t_{SC} \leq 10s,$ $V_{CC} = 600V,$ $T_J = 25^\circ\text{C}$	--	310	--	A



Switching Characteristic $T_J = 25^\circ\text{C}$						
Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
IGBT Characteristic						
Turn-on Delay Time	$t_{d(on)}$	$T_J = 25^\circ\text{C}$, $V_{CC} = 600\text{V}$, $I_C = 40\text{A}$, $V_{GE} = 15\text{V}$, $R_G = 10\Omega$, Inductive load	--	50	--	ns
Rise Time	t_r		--	65	--	
Turn-off Delay Time	$t_{d(off)}$		--	295	--	
Fall Time	t_f		--	85	--	
Turn-on Energy	E_{on}		--	2.3	--	mJ
Turn-off Energy	E_{off}		--	2.2	--	
Total Switching Energy	E_{ts}		--	4.5	--	
Anti-Parallel Diode Characteristic						
Diode Reverse Recovery Time	t_{rr}	$T_J = 25^\circ\text{C}$, $V_R = 600\text{V}$, $I_F = 40\text{A}$, $di_F/dt = 200\text{A}/\mu\text{s}$	--	400	--	ns
Diode Reverse Recovery Charge	Q_{rr}		--	1000	--	nC
Diode Peak Reverse Recovery Current	I_{rrm}		--	7.7	--	A
Diode Forward Voltage	V_{FM}		--	2.6	--	V

Switching Characteristic $T_J = 125^\circ\text{C}$						
Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
IGBT Characteristic						
Turn-on Delay Time	$t_{d(on)}$	$T_J = 125^\circ\text{C}$, $V_{CC} = 600\text{V}$, $I_C = 40\text{A}$, $V_{GE} = 15\text{V}$, $R_G = 10\Omega$, Inductive load	--	90	--	ns
Rise Time	t_r		--	70	--	
Turn-off Delay Time	$t_{d(off)}$		--	415	--	
Fall Time	t_f		--	165	--	
Turn-on Energy	E_{on}		--	2.65	--	mJ
Turn-off Energy	E_{off}		--	3.2	--	
Total Switching Energy	E_{ts}		--	5.85	--	
Anti-Parallel Diode Characteristic						
Diode Reverse Recovery Time	t_{rr}	$T_J = 125^\circ\text{C}$, $V_R = 600\text{V}$, $I_F = 40\text{A}$, $di_F/dt = 200\text{A}/\mu\text{s}$	--	470	--	ns
Diode Reverse Recovery Charge	Q_{rr}		--	1600	--	nC
Diode Peak Reverse Recovery Current	I_{rrm}		--	8	--	A
Diode Forward Voltage	V_{FM}		--	2.4	--	V



Typical Characteristics $T_J = 25^\circ\text{C}$, unless otherwise noted

Figure 1. Typical Output Characteristics

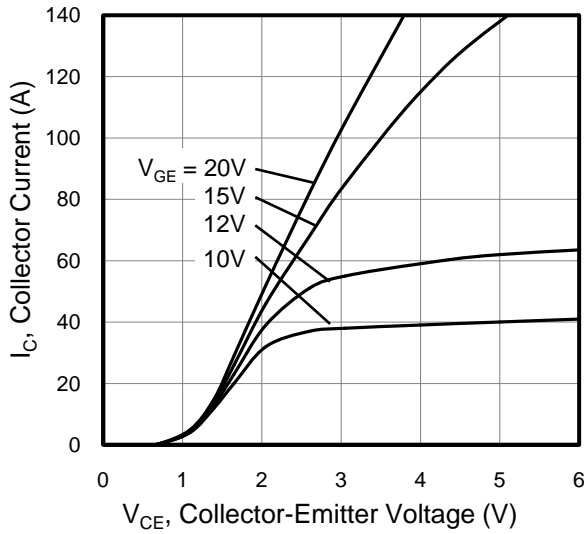


Figure 2. Typical Saturation Voltage

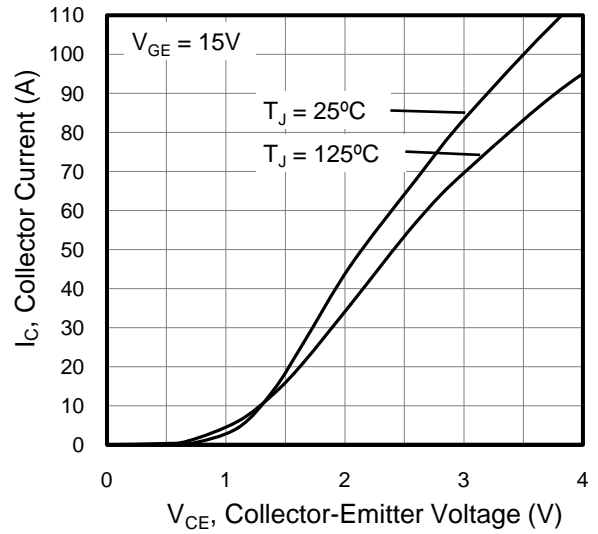


Figure 3. Saturation Voltage vs. Case Temperature at Variant Current Level

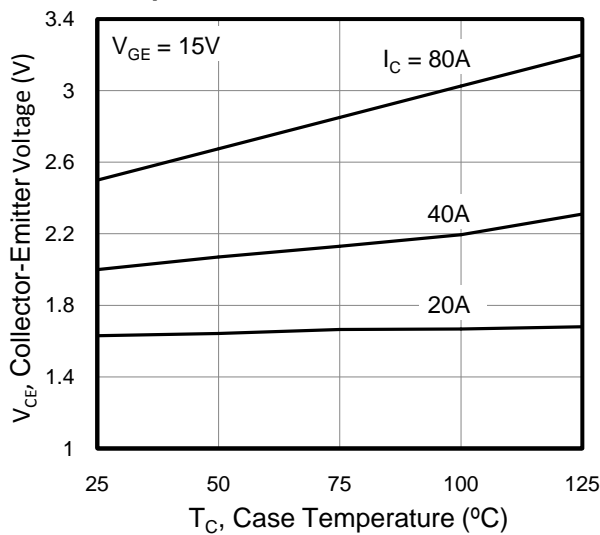


Figure 4. Load Current vs. Frequency

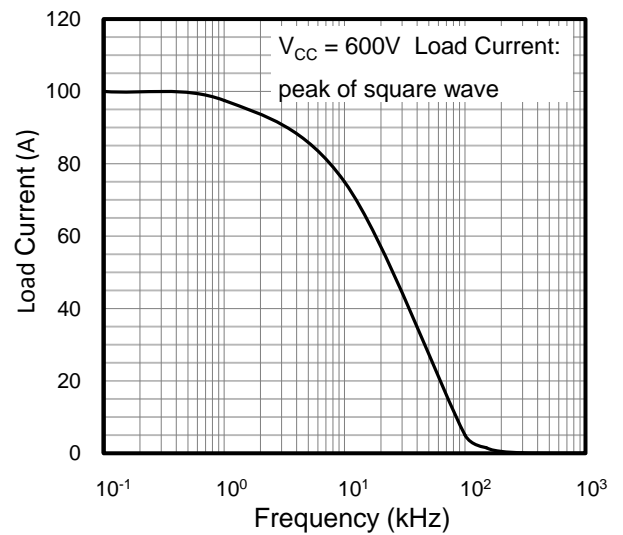


Figure 5. Saturation Voltage vs. V_{GE}

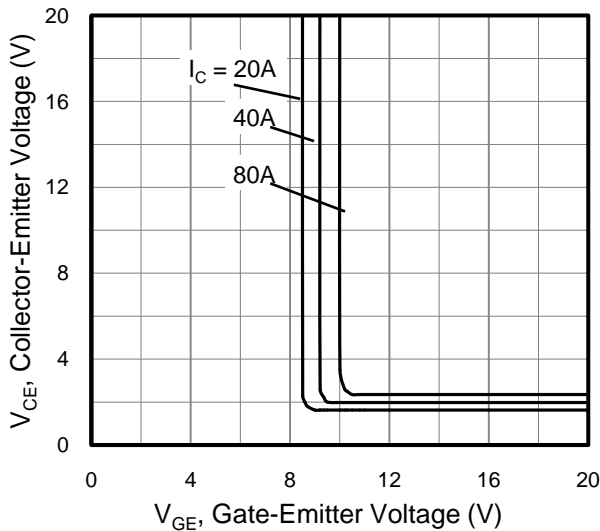
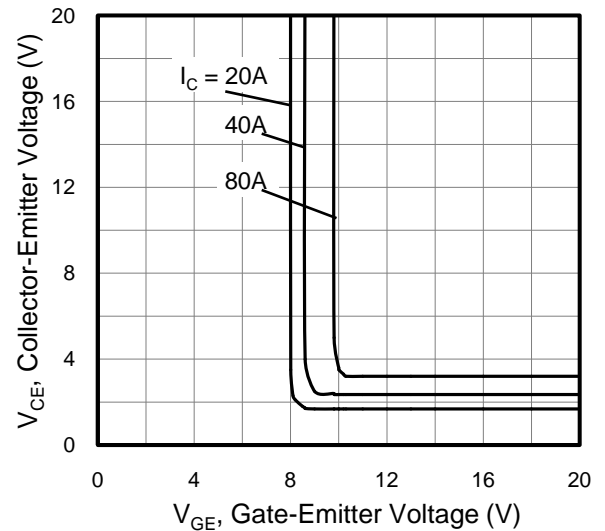


Figure 6. Saturation Voltage vs. V_{GE}





Typical Characteristics $T_J = 25^\circ\text{C}$, unless otherwise noted

Figure 7. Capacitance Characteristics

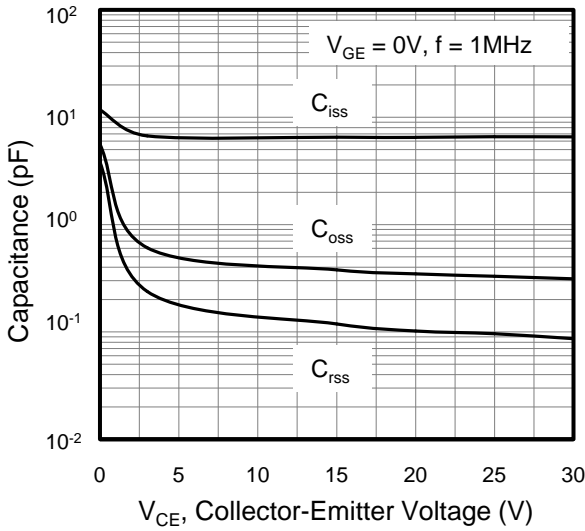


Figure 8. Turn-On Characteristics vs. R_G

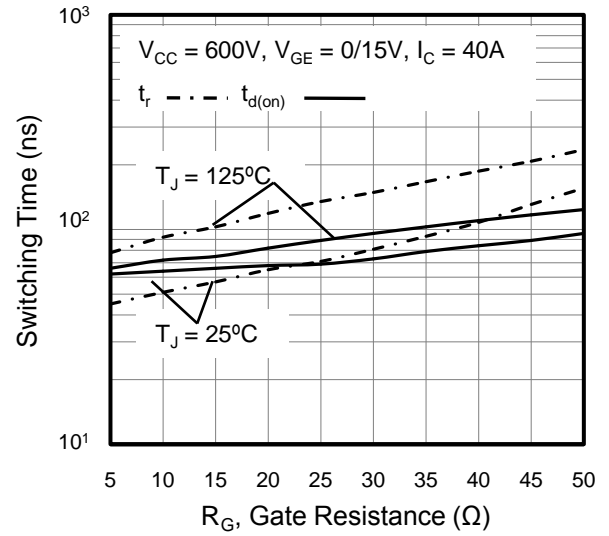


Figure 9. Turn-Off Characteristics vs. R_G

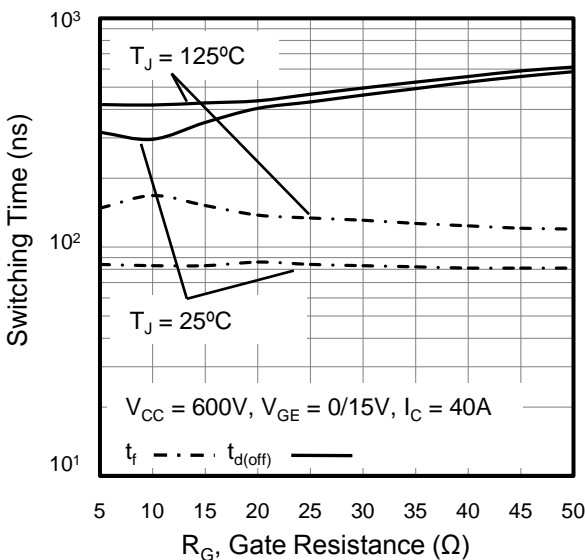


Figure 10. Switching Loss vs. R_G

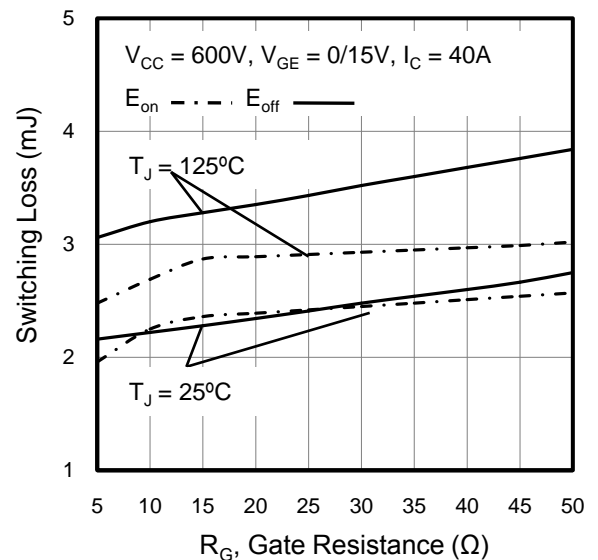


Figure 11. Turn-On Characteristics vs. I_C

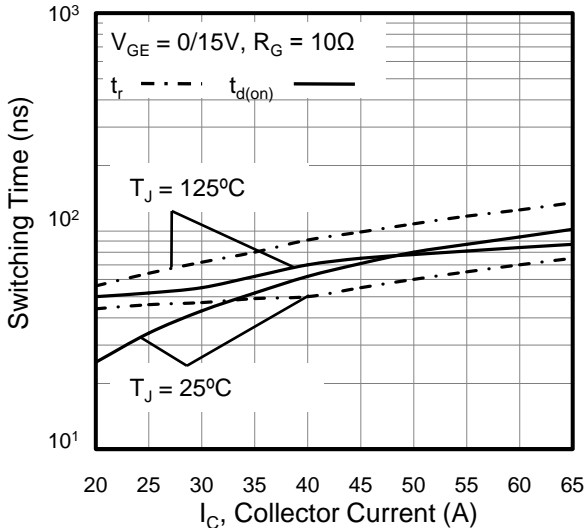
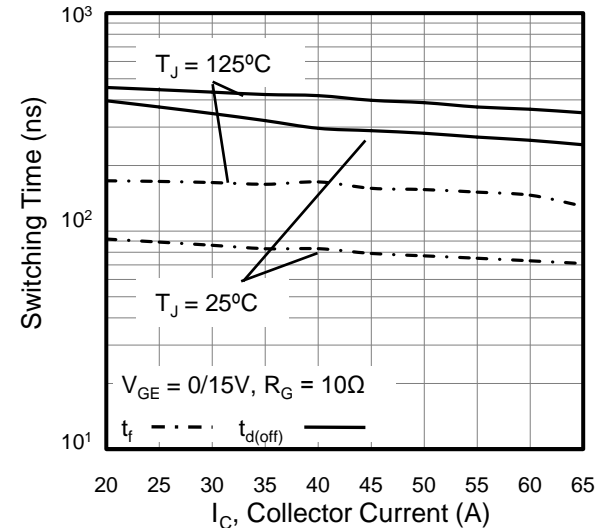


Figure 12. Turn-Off Characteristics vs. I_C





Typical Characteristics $T_J = 25^\circ\text{C}$, unless otherwise noted

Figure 13. Switching Loss vs. I_C

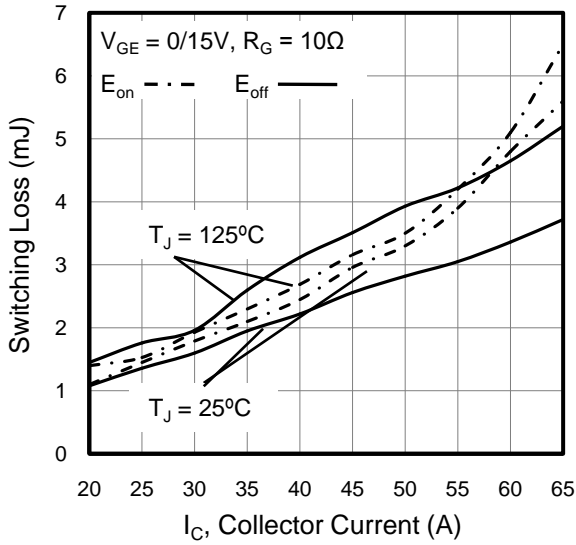


Figure 14. Gate Charge Characteristics

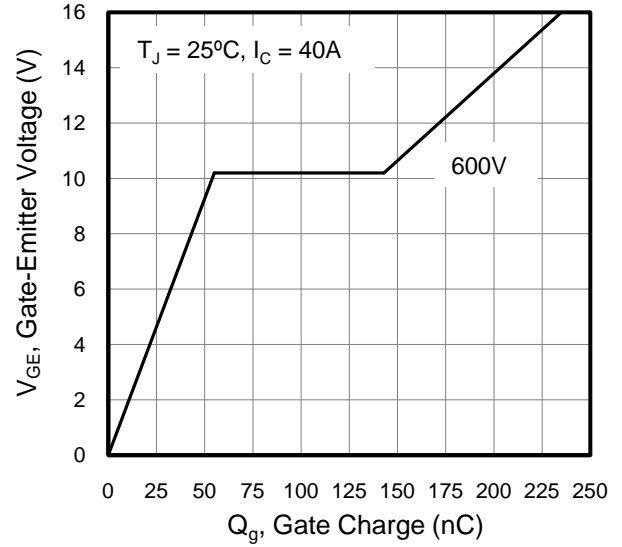


Figure 15. SOA Characteristics

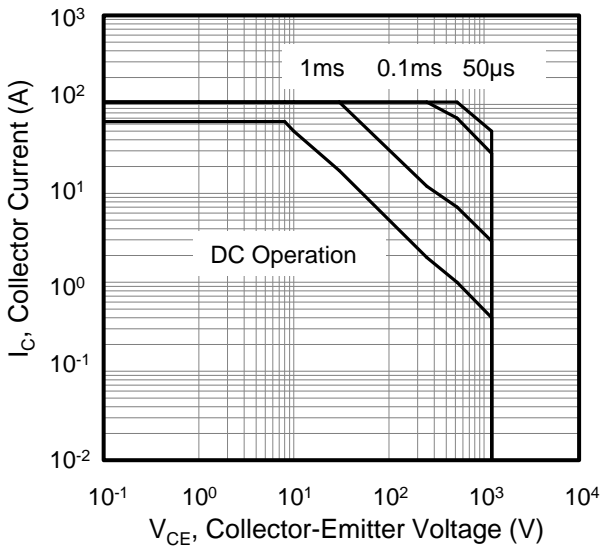


Figure 16. Turn-Off SOA

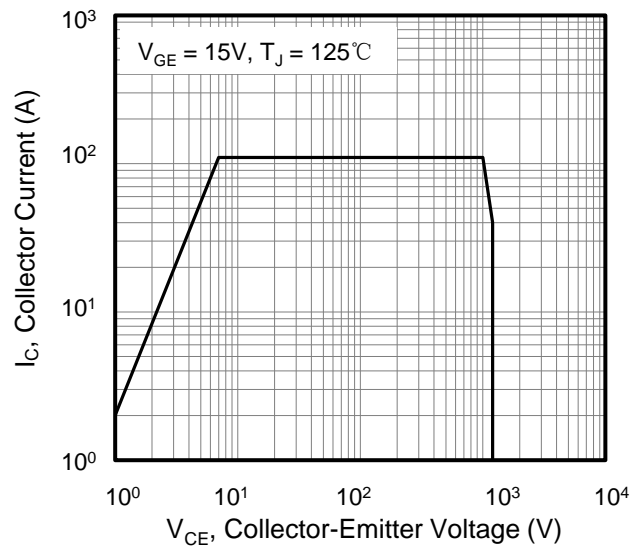


Figure 17. Forward Characteristics

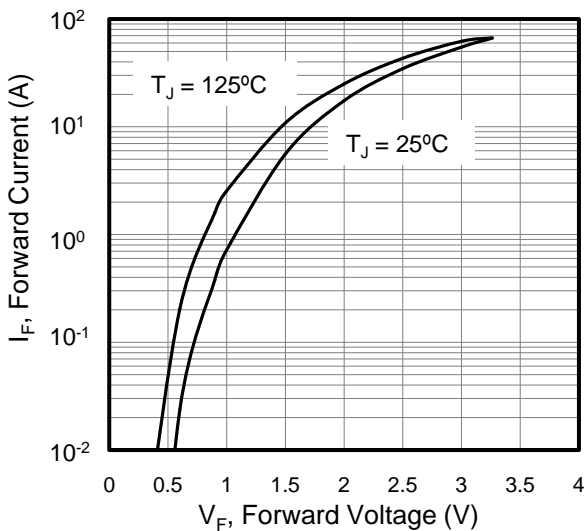
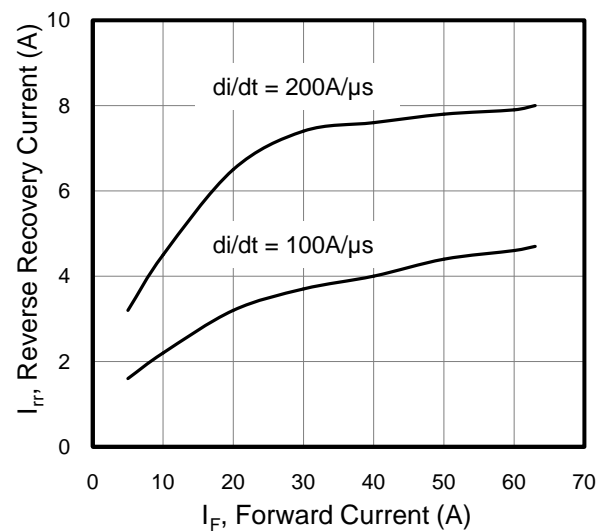


Figure 18. Reverse Recovery Current





Typical Characteristics $T_j = 25^\circ\text{C}$, unless otherwise noted

Figure 19. Stored Charge

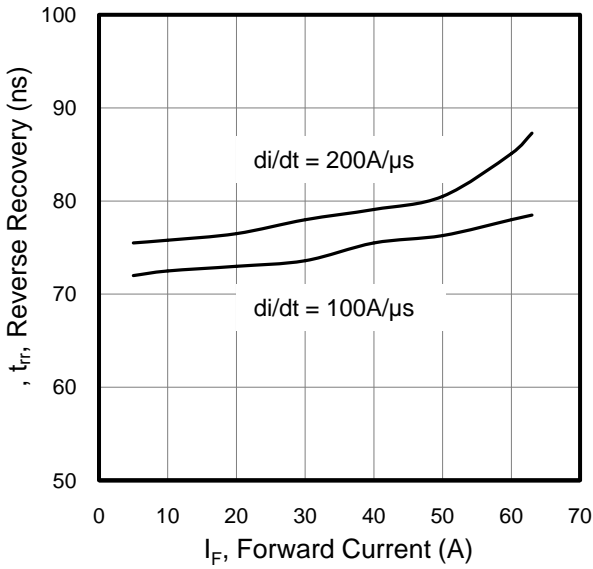


Figure 20. Reverse Recovery Time

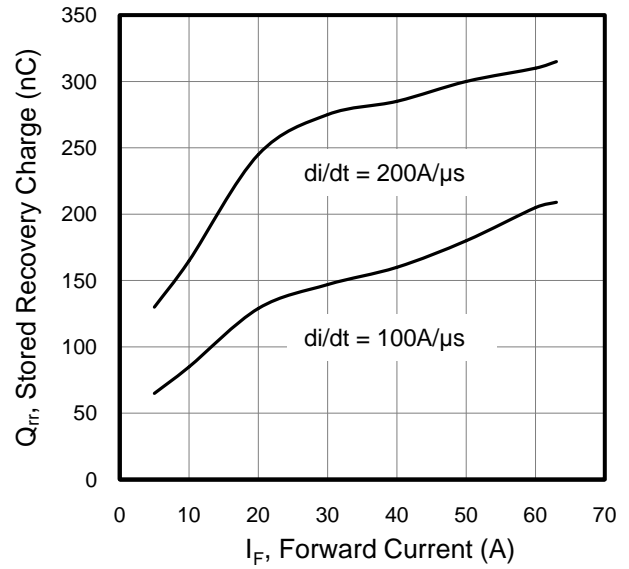


Figure 21. IGBT Transient Thermal Impedance TO-247

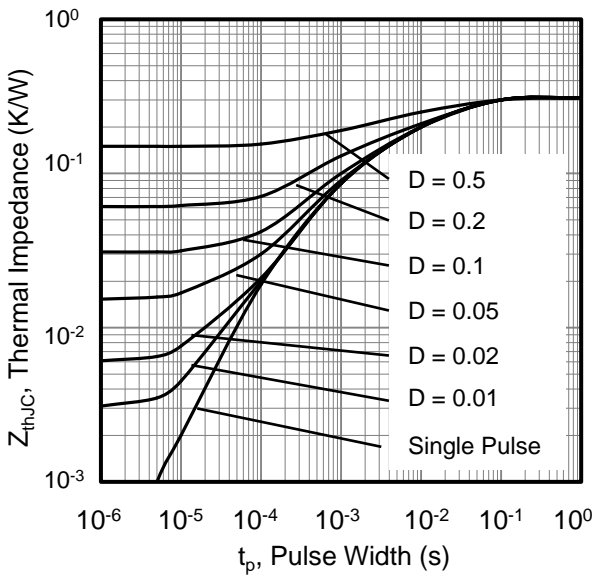


Figure 22. IGBT Transient Thermal Impedance TO-264

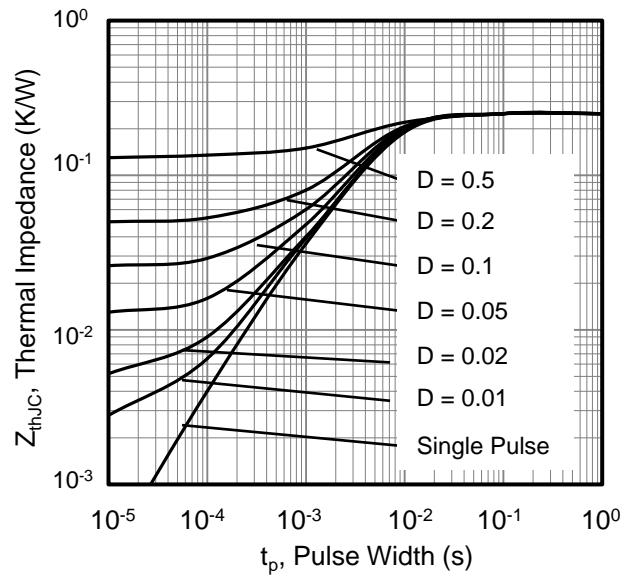




Figure A: Dynamic Test Circuit

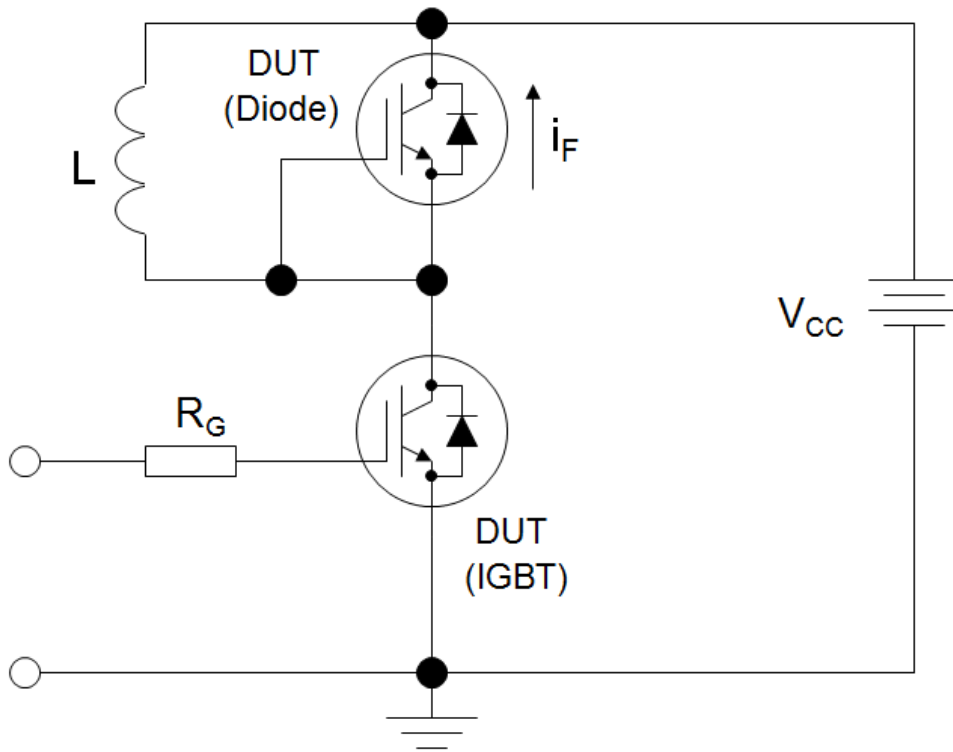


Figure B: Definition of Switching Times

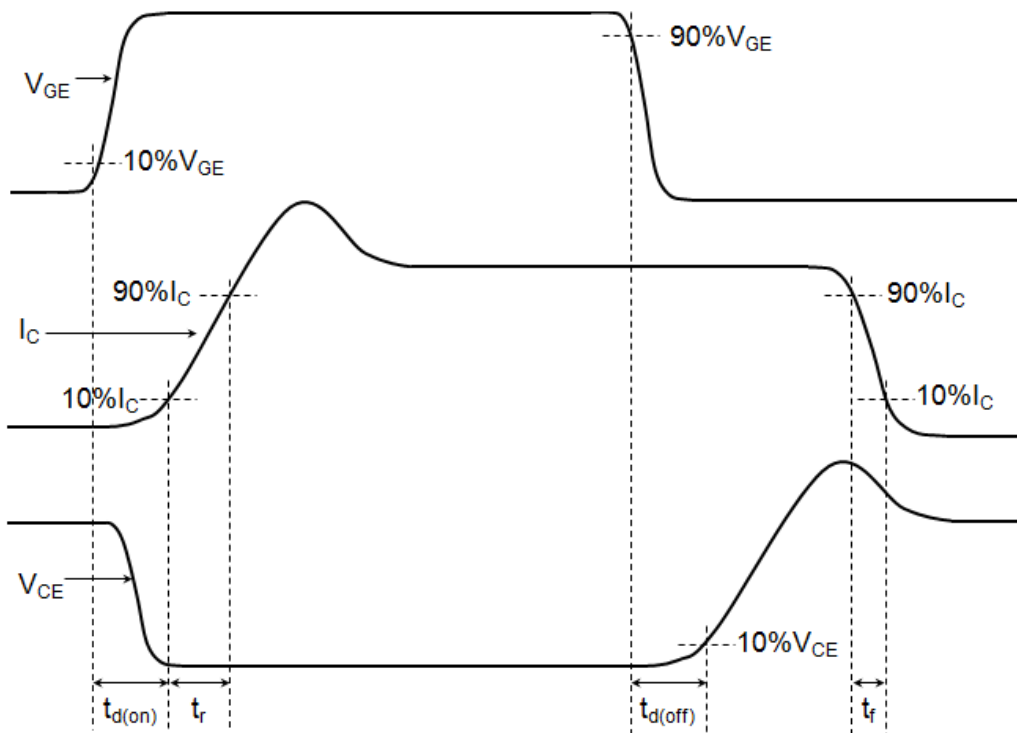




Figure C. Definition of Switching Losses

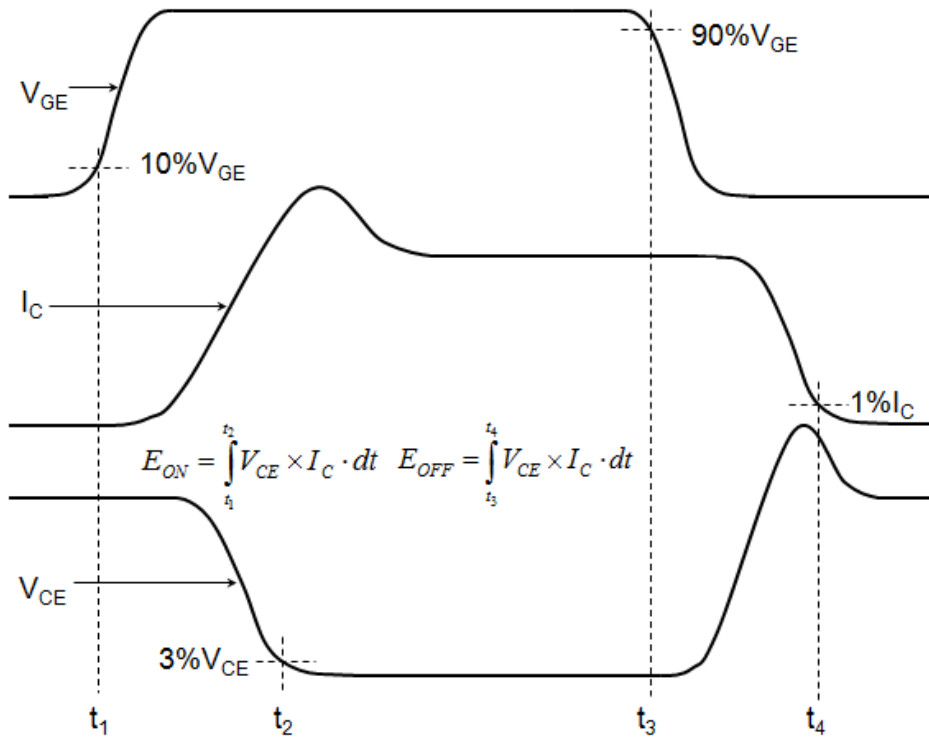
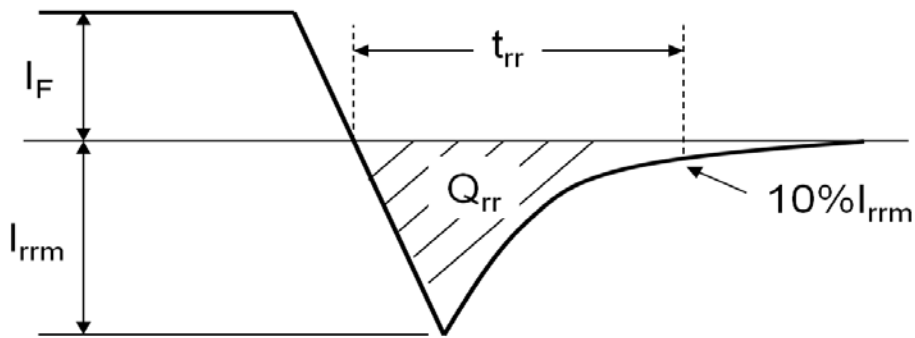
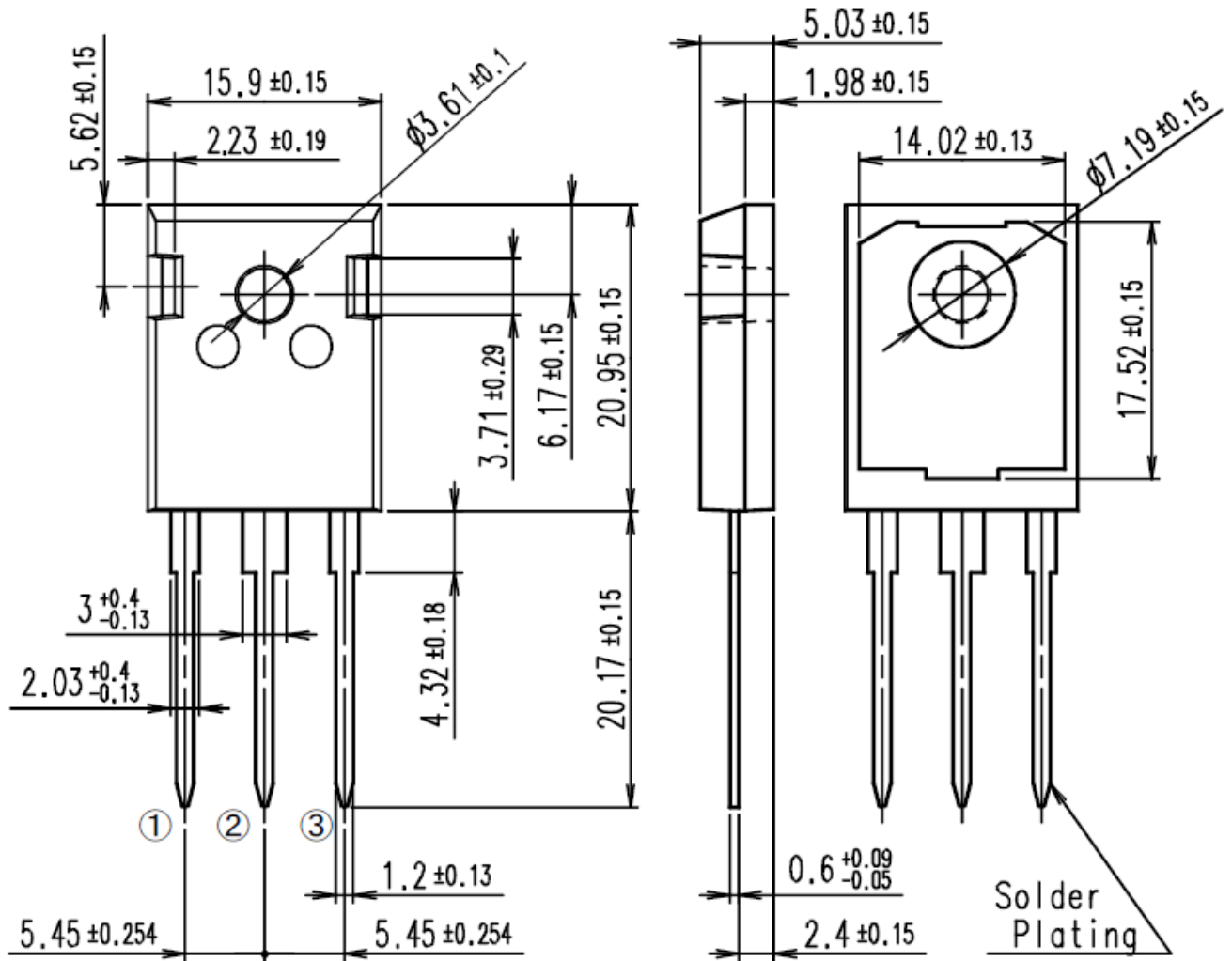


Figure D. Definition of Diodes Reverse Recovery Characteristics



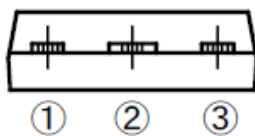


TO-247



CONNECTION

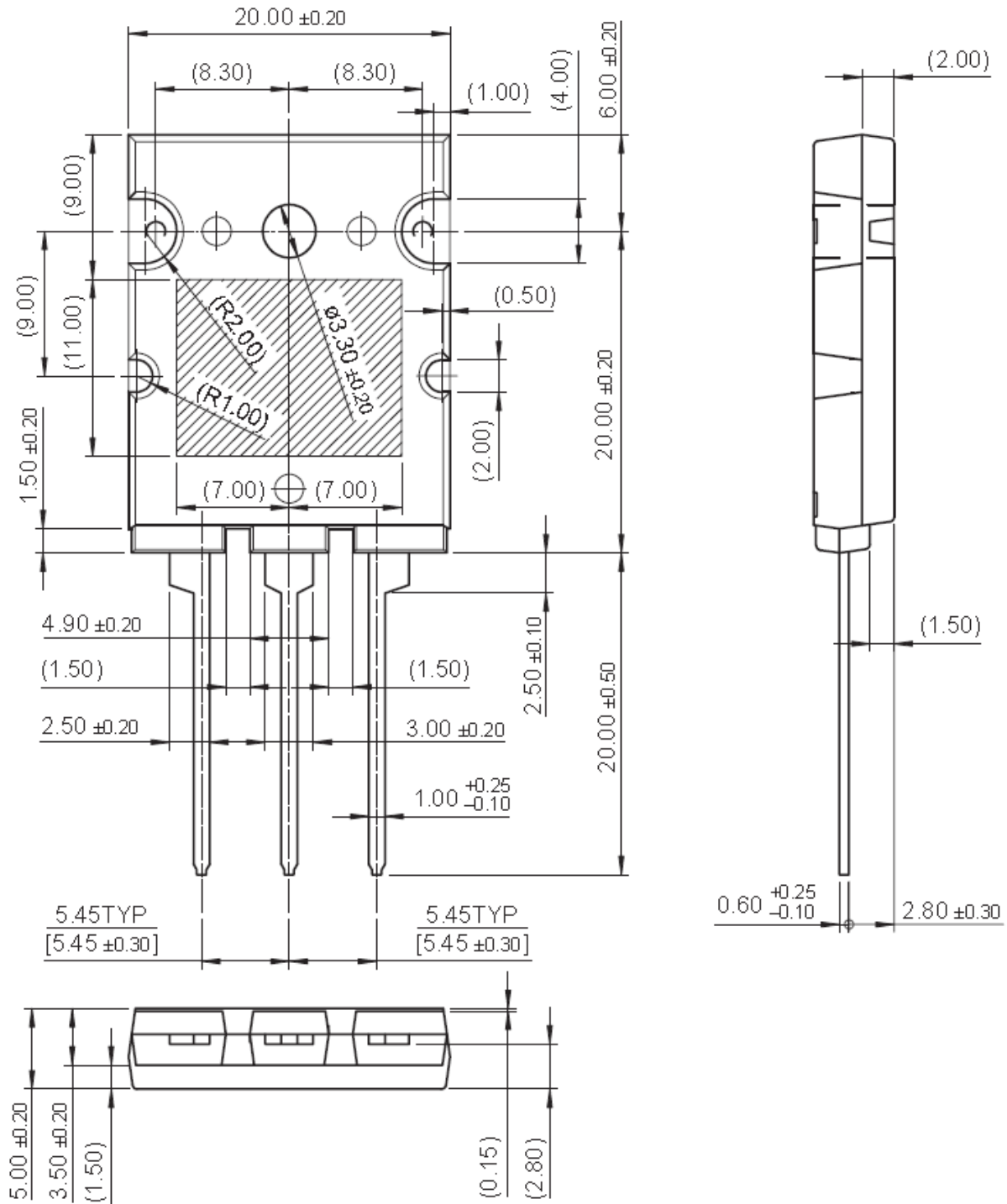
- ① GATE
- ② COLLECTOR
- ③ EMITTER



DIMENSIONS ARE IN MILLIMETERS.



TO-264





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