THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal resistance junction−to−case, for IGBT	$R_{\theta JC}$	0.56	°C/W
Thermal resistance junction−to−case, for Diode	$R_{\theta JC}$	1.25	°C/W
Thermal resistance junction−to−ambient	$R_{\theta JA}$	40	°C/W

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector−emitter breakdown voltage, gate−emitter short−circuited	V_{GE} = 0 V, I_C = 1 mA	BV_{CES}	650	−	−	V
Temperature Coefficient of Breakdown Voltage	V_{GE} = 0 V, I_C = 1 mA	$\frac{\Delta BV_{CES}}{\Delta T_J}$	−	0.6	−	V/°C
Collector−emitter cut−off current, gate−emitter short−circuited	V_{GE} = 0 V, V_{CE} = 650 V	I_{CES}	−	−	250	μA
Gate leakage current, collector−emitter short−circuited	V_{GE} = 20 V, V_{CE} = 0 V	I_{GES}	−	−	±400	nA
ON CHARACTERISTICS						
Gate−emitter threshold voltage	V_{GE} = V_{CE}, I_C = 50 mA	$V_{GE(th)}$	3.4	4.9	6.4	V
Collector−emitter saturation voltage	V_{GE} = 15 V, I_C = 50 A V_{GE} = 15 V, I_C = 50 A, T_J = 175°C	$V_{CE(sat)}$	− −	1.6 1.95	2.1 −	V
DYNAMIC CHARACTERISTICS						
Input capacitance	V_{CE} = 30 V, V_{GE} = 0 V, f = 1 MHz	C_{ies}	−	3258	−	pF
Output capacitance		C_{oes}	−	85	−	
Reverse transfer capacitance		C_{res}	−	11	−	
Gate charge total	V_{CE} = 400 V, I_C = 50 A, V_{GE} = 15 V	Q_g	−	102	−	nC
Gate−to−emitter charge		Q_{ge}	−	18	−	
Gate−to−collector charge		Q_{gc}	−	24	−	
SWITCHING CHARACTERISTICS, INDUCTIVE LOAD						
Turn−on delay time	T_C = 25°C, V_{CC} = 400 V, I_C = 25 A, R_G = 4.7 Ω, V_{GE} = 15 V, Inductive Load	$t_{d(on)}$	−	19	−	ns
Rise time		t_r	−	11	−	
Turn−off delay time		$t_{d(off)}$	−	87	−	
Fall time		t_f	−	5	−	
Turn−on switching loss		E_{on}	−	0.35	−	mJ
Turn−off switching loss		E_{off}	−	0.12	−	
Total switching loss		E_{ts}	−	0.47	−	
Turn−on delay time	T_C = 25°C, V_{CC} = 400 V, I_C = 50 A, R_G = 4.7 Ω, V_{GE} = 15 V, Inductive Load	$t_{d(on)}$	−	20	−	ns
Rise time		t_r	−	28	−	
Turn−off delay time		$t_{d(off)}$	−	81	−	
Fall time		t_f	−	36	−	
Turn−on switching loss		E_{on}	−	0.95	−	mJ
Turn−off switching loss		E_{off}	−	0.46	−	
Total switching loss		E_{ts}	−	1.41	−	

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted) (Continued)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS, INDUCTIVE LOAD						
Turn−on delay time	T_C = 175°C, V_{CC} = 400 V, I_C = 25 A, R_G = 4.7 Ω, V_{GE} = 15 V, Inductive Load	$t_{d(on)}$	−	18	−	ns
Rise time		t_r	−	14	−	
Turn−off delay time		$t_{d(off)}$	−	99	−	
Fall time		t_f	−	7	−	
Turn−on switching loss		E_{on}	−	0.66	−	mJ
Turn−off switching loss		E_{off}	−	0.3	−	
Total switching loss		E_{ts}	−	0.96	−	
Turn−on delay time	T_C = 175°C, V_{CC} = 400 V, I_C = 50 A, R_G = 4.7 Ω, V_{GE} = 15 V, Inductive Load	$t_{d(on)}$	−	20	−	ns
Rise time		t_r	−	29	−	
Turn−off delay time		$t_{d(off)}$	−	88	−	
Fall time		t_f	−	46	−	
Turn−on switching loss		E_{on}	−	1.42	−	mJ
Turn−off switching loss		E_{off}	−	0.65	−	
Total switching loss		E_{ts}	−	2.07	−	
DIODE CHARACTERISTIC						
Diode Forward Voltage	I_F = 30 A, T_C = 25°C	V_{FM}	−	2.0	2.6	V
	I_F = 30 A, T_C = 175°C		−	1.7	−	
Reverse Recovery Energy	I_F = 30 A, dI_F/dt = 200 A/μs, T_C = 175°C	E_{rec}	−	50	−	μJ
Diode Reverse Recovery Time	I_F = 30 A, dI_F/dt = 200 A/μs, T_C = 25°C	T_{rr}	−	30	−	ns
	I_F = 30 A, dI_F/dt = 200 A/μs, T_C = 175°C		−	194	−	
Diode Reverse Recovery Charge96.226c2754 349 .90707 ref8 0 0 8 220.252Tf8 0 0 8 4arge=						

TYPICAL CHARACTERISTICS

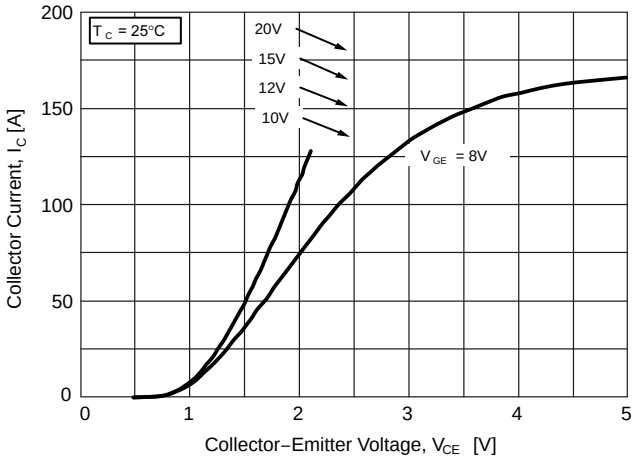


Figure 1. Typical Output Characteristics

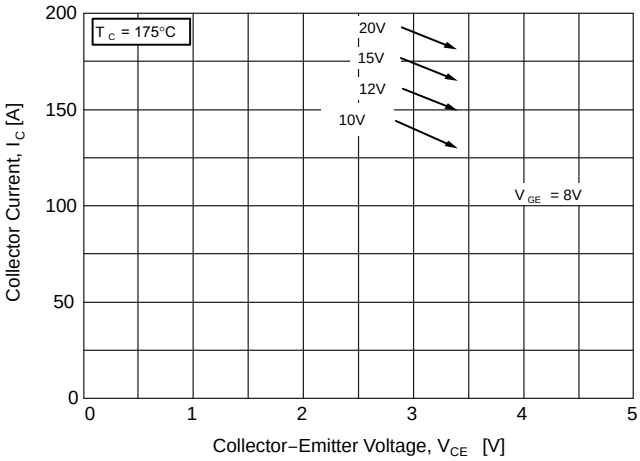


Figure 2. Typical Output Characteristics

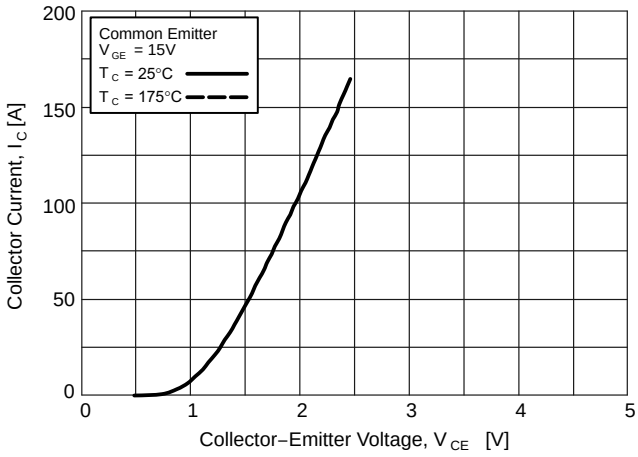


Figure 3. Typical Saturation Voltage

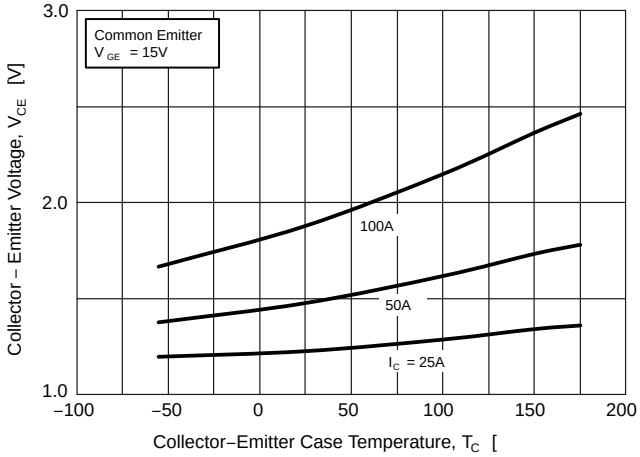


Figure 4. Saturation Voltage vs. Case Temperature

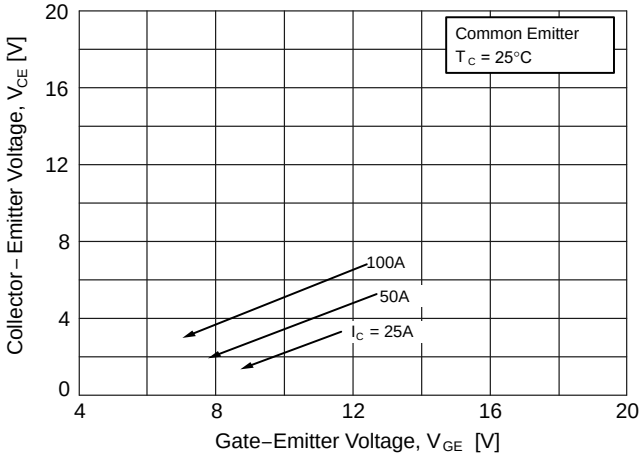


Figure 5. Saturation Voltage vs. V_{GE}

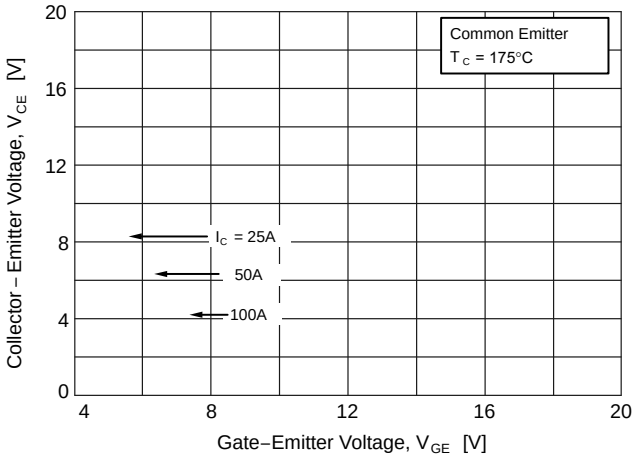


Figure 6. Saturation Voltage vs. V_{GE}

TYPICAL CHARACTERISTICS

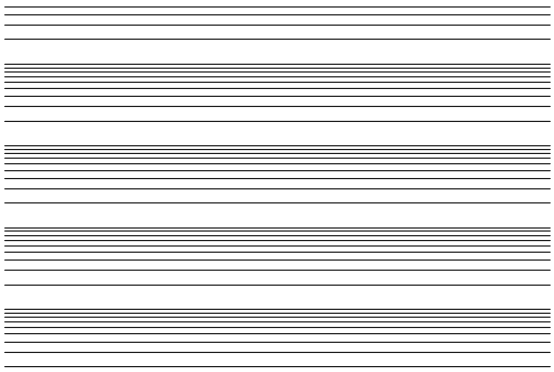


Figure 7. Capacitance Characteristics

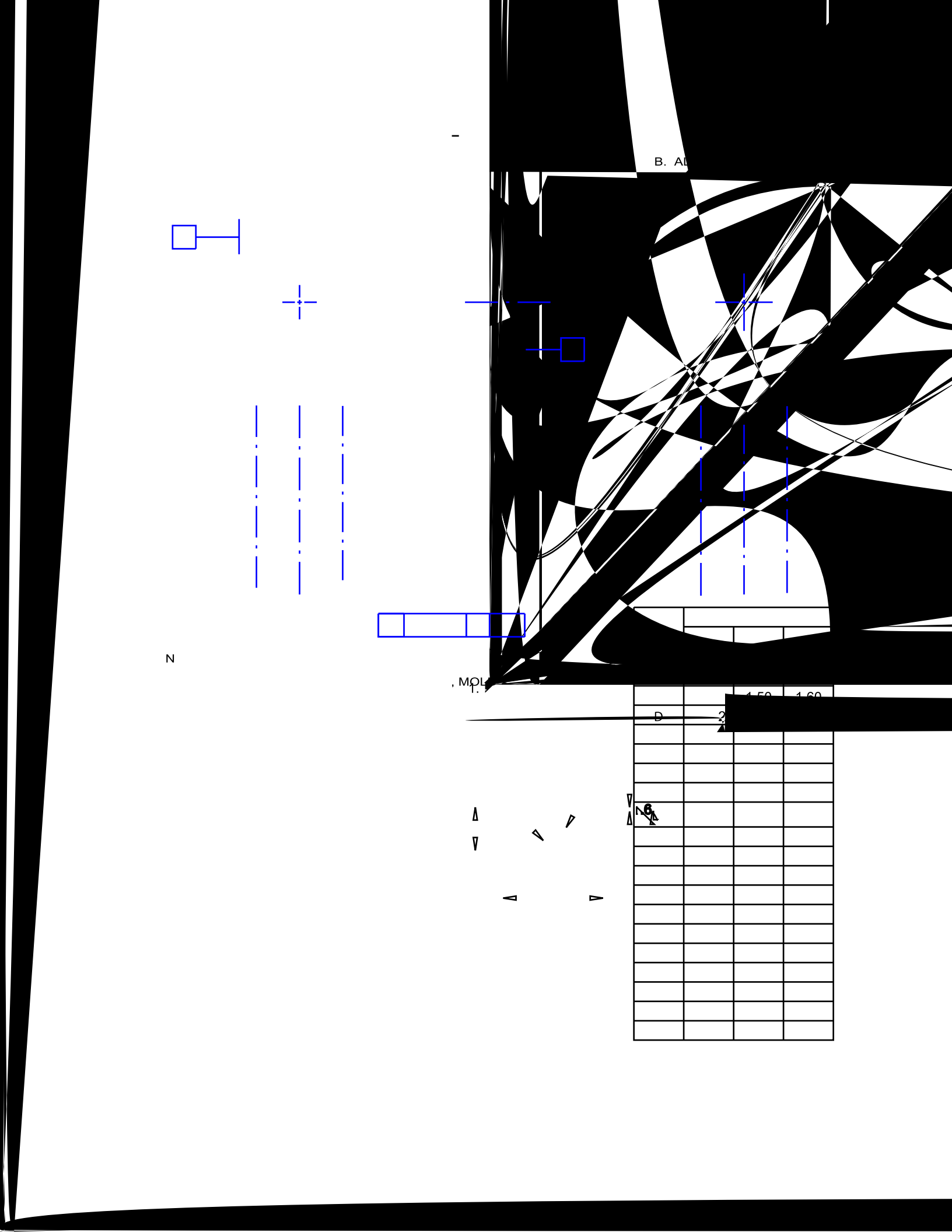
Figure 8. Gate Charge

Figure 9. Turn−On Characteristics vs. Gate Resistance

Figure 10. Turn−Off Characteristics vs. Gate Resistance

Figure 11. Turn−On Characteristics vs. Collector Current

Figure 12. Turn−Off Characteristics vs. Collector Current


B. Al
N
1.50
1.60
D
3
6