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# AFGHL50T65SQD

## 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 ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Collector-emitter breakdown voltage, gate-emitter short-circuited	$V_{GE} = 0\text{ V}$ , $I_C = 1\text{ mA}$	$BV_{CES}$	650	-	-	V
Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0\text{ V}$ , $I_C = 1\text{ mA}$	$\frac{\Delta BV_{CES}}{\Delta T_J}$	-	0.6	-	V/°C
Collector-emitter cut-off current, gate-emitter short-circuited	$V_{GE} = 0\text{ V}$ , $V_{CE} = 650\text{ V}$	$I_{CES}$	-	-	250	μA
Gate leakage current, collector-emitter short-circuited	$V_{GE} = 20\text{ V}$ , $V_{CE} = 0\text{ V}$	$I_{GES}$	-	-	±400	nA

### ON CHARACTERISTICS

Gate-emitter threshold voltage	$V_{GE} = V_{CE}$ , $I_C = 50\text{ mA}$	$V_{GE(th)}$	3.4	4.9	6.4	V
Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$ , $I_C = 50\text{ A}$ $V_{GE} = 15\text{ V}$ , $I_C = 50\text{ A}$ , $T_J = 175^\circ\text{C}$	$V_{CE(sat)}$	-	1.6	2.1	V
			-	1.95	-	

### DYNAMIC CHARACTERISTICS

Input capacitance	$V_{CE} = 30\text{ V}$ , $V_{GE} = 0\text{ V}$ , $f = 1\text{ MHz}$	$C_{ies}$	-	3258	-	pF
Output capacitance		$C_{oes}$	-	85	-	
Reverse transfer capacitance		$C_{res}$	-	11	-	
Gate charge total	$V_{CE} = 400\text{ V}$ , $I_C = 50\text{ A}$ , $V_{GE} = 15\text{ V}$	$Q_g$	-	102	-	nC
Gate-to-emitter charge		$Q_{ge}$	-	18	-	
Gate-to-collector charge		$Q_{gc}$	-	24	-	

### SWITCHING CHARACTERISTICS, INDUCTIVE LOAD

Turn-on delay time	$T_C = 25^\circ\text{C}$ , $V_{CC} = 400\text{ V}$ , $I_C = 25\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GE} = 15\text{ V}$ , 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	$T_C = 25^\circ\text{C}$ , $V_{CC} = 400\text{ V}$ , $I_C = 50\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GE} = 15\text{ V}$ , 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	-	

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## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted) (Continued)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
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### SWITCHING CHARACTERISTICS, INDUCTIVE LOAD

Turn-on delay time	T <sub>C</sub> = 175°C, V <sub>CC</sub> = 400 V, I <sub>C</sub> = 25 A, R <sub>G</sub> = 4.7 Ω, V <sub>GE</sub> = 15 V, Inductive Load	t <sub>d(on)</sub>	-	18	-	ns
Rise time		t <sub>r</sub>	-	14	-	
Turn-off delay time		t <sub>d(off)</sub>	-	99	-	
Fall time		t <sub>f</sub>	-	7	-	
Turn-on switching loss		E <sub>on</sub>	-	0.66	-	mJ
Turn-off switching loss		E <sub>off</sub>	-	0.3	-	
Total switching loss		E <sub>ts</sub>	-	0.96	-	
Turn-on delay time	T <sub>C</sub> = 175°C, V <sub>CC</sub> = 400 V, I <sub>C</sub> = 50 A, R <sub>G</sub> = 4.7 Ω, V <sub>GE</sub> = 15 V, Inductive Load	t <sub>d(on)</sub>	-	20	-	ns
Rise time		t <sub>r</sub>	-	29	-	
Turn-off delay time		t <sub>d(off)</sub>	-	88	-	
Fall time		t <sub>f</sub>	-	46	-	
Turn-on switching loss		E <sub>on</sub>	-	1.42	-	mJ
Turn-off switching loss		E <sub>off</sub>	-	0.65	-	
Total switching loss		E <sub>ts</sub>	-	2.07	-	

### DIODE CHARACTERISTIC

Diode Forward Voltage	I <sub>F</sub> = 30 A, T <sub>C</sub> = 25°C	V <sub>FM</sub>	-	2.0	2.6	V
	I <sub>F</sub> = 30 A, T <sub>C</sub> = 175°C		-	1.7	-	
Reverse Recovery Energy	I <sub>F</sub> = 30 A, dI <sub>F</sub> /dt = 200 A/μs, T <sub>C</sub> = 175°C	E <sub>rec</sub>	-	50	-	μJ
Diode Reverse Recovery Time	I <sub>F</sub> = 30 A, dI <sub>F</sub> /dt = 200 A/μs, T <sub>C</sub> = 25°C	T <sub>rr</sub>	-	30	-	ns
	I <sub>F</sub> = 30 A, dI <sub>F</sub> /dt = 200 A/μs, T <sub>C</sub> = 175°C		-	194	-	

Diode Reverse Recovery Charge 96.226c2754 349 .90707 ref8 0 0 8 220.252Tf8 0 0 8 4arge=

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## TYPICAL CHARACTERISTICS

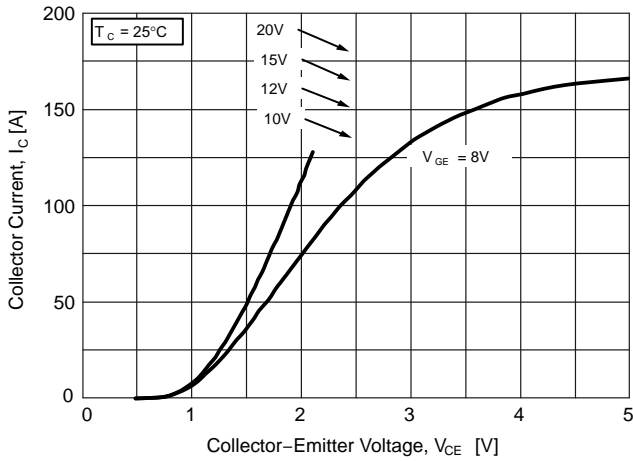


Figure 1. Typical Output Characteristics

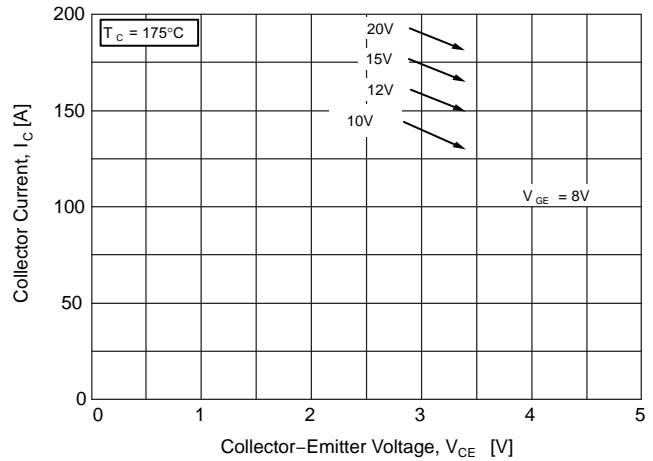


Figure 2. Typical Output Characteristics

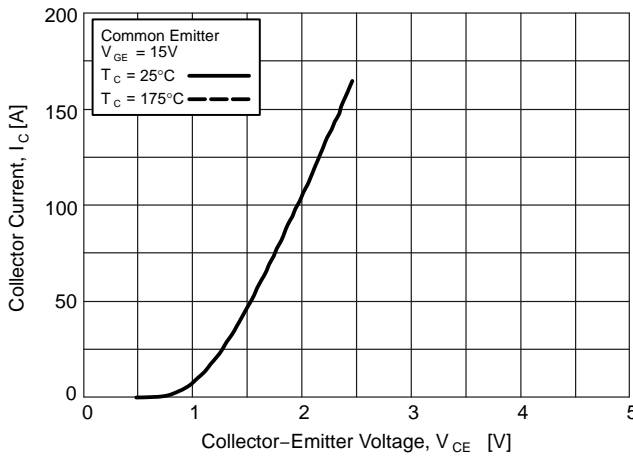


Figure 3. Typical Saturation Voltage

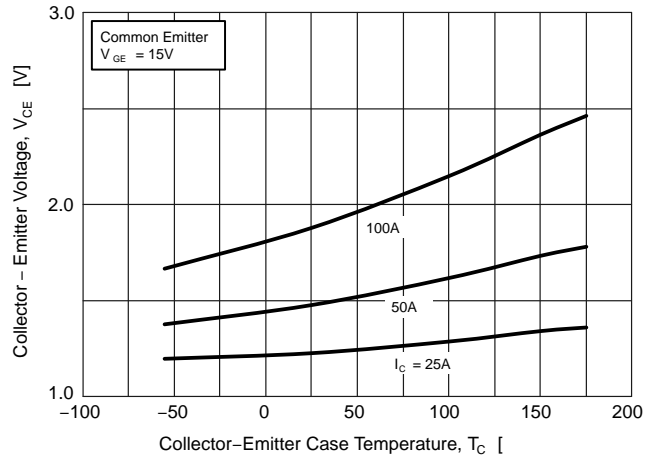


Figure 4. Saturation Voltage vs. Case Temperature

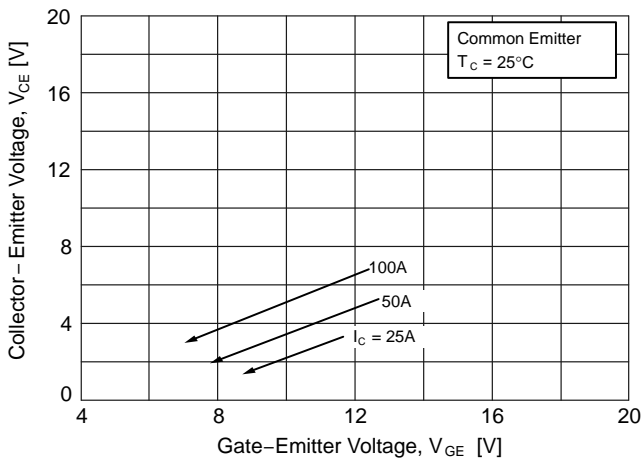


Figure 5. Saturation Voltage vs.  $V_{GE}$

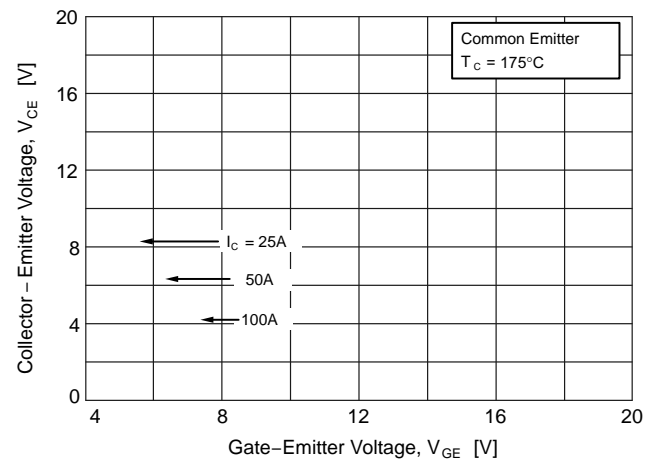


Figure 6. Saturation Voltage vs.  $V_{GE}$

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## 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

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