Table 3. ELECTRICAL CHARACTERISTICS T_J = 25°C unless otherwise noted

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
HALF BRIDGE IGBT CHARACTERISTICS						
Collector−Emitter Cutoff Current	V_{GE} = 0 V, V_{CE} = 1200 V	I_{CES}	–	–	300	µA
Collector−Emitter Saturation Voltage	V_{GE} = 15 V, I_C = 25 A, T_J = 25°C	$V_{CE(sat)}$	–	1.90	2.50	V
	V_{GE} = 15 V, I_C = 25 A, T_J = 125°C		–	1.96	–	
Gate−Emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 1.5 mA	$V_{GE(TH)}$	4.90	5.49	6.50	V
Gate Leakage Current	V_{GE} = 20 V, V_{CE} = 0 V	I_{GES}	–	–	300	nA
Turn−on Delay Time	T_J = 25°C V_{CE} = 350 V, I_C = 15 A V_{GE} = ±15 V, R_G = 15 Ω	$t_{d(on)}$	–	59	–	ns
Rise Time		t_r	–	26	–	
Turn−off Delay Time		$t_{d(off)}$	–	242	–	
Fall Time		t_f	–	52	–	
Turn−on Switching Loss per Pulse		E_{on}	–	220	–	µJ
Turn off Switching Loss per Pulse		E_{off}	–	240	–	
Turn−on Delay Time	T_J = 125°C V_{CE} = 350 V, I_C = 15 A V_{GE} = ±15 V, R_G = 15 Ω	$t_{d(on)}$	–	48	–	ns
Rise Time		t_r	–	29	–	
Turn−off Delay Time		$t_{d(off)}$	–	293	–	
Fall Time		t_f	–	258	–	
Turn−on Switching Loss per Pulse		E_{on}	–	400	–	µJ
Turn off Switching Loss per Pulse		E_{off}	–	710	–	
Input Capacitance	V_{CE} = 20 V, V_{GE} = 0 V. f = 10 kHz	C_{ies}	–	8502	–	pF
Output Capacitance		C_{oes}	–	187	–	
Reverse Transfer Capacitance		C_{res}	–	154	–	
Total Gate Charge	V_{CE} = 600 V, I_C = 25 A, V_{GE} = ±15 V	Q_g	–	352	–	nC
Thermal Resistance − chip−to−heatsink	Thermal grease, Thickness ≤ 2.25 Mil, λ = 2.9 W/mK	R_{thJH}	–	1.17	–	°C/W
NEUTRAL POINT DIODE CHARACTERISTICS						
Diode Forward Voltage	I_F = 15 A, T_J = 25°C	V_F	–	2.43	–	V
	I_F = 15 A, T_J = 125°C		–	1.60	–	
Combined IGBT + Diode Voltage Drop	I_F = 15 A, T_J = 25°C	V_{DT}	–	3.76	4.60	V
Reverse Recovery Time	T_J = 25°C V_{CE} = 350 V, I_C = 15 A V_{GE} = ±15 V, R_G = 15 Ω	t_{rr}	–	59	–	ns
Reverse Recovery Charge		Q_{rr}	–	0.21	–	µC
Peak Reverse Recovery Current		I_{RRM}	–	7	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	106	–	A/µs
Reverse Recovery Energy		E_{rr}	–	40	–	µJ
Reverse Recovery Time	T_J = 125°C V_{CE} = 350 V, I_C = 15 A V_{GE} = ±15 V, R_G = 15 Ω	t_{rr}	–	67	–	ns
Reverse Recovery Charge		Q_{rr}	–	0.69	–	µC
Peak Reverse Recovery Current		I_{RRM}	–	19	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	451	–	A/µs
Reverse Recovery Energy		E_{rr}	–	100	–	µJ
Thermal Resistance − chip−to−heatsink	Thermal grease, Thickness ≤ 2.25 Mil, λ = 2.9 W/mK	R_{thJH}	–	2.45	–	°C/W

Table 3. ELECTRICAL CHARACTERISTICS T_J = 25°C unless otherwise noted

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
NEUTRAL POINT IGBT CHARACTERISTICS						
Collector−Emitter Cutoff Current	V_{GE} = 0 V, V_{CE} = 650 V	I_{CES}	–	–	200	µA
Collector−Emitter Saturation Voltage	V_{GE} = 15 V, I_C = 20 A, T_J = 25°C	$V_{CE(sat)}$	–	1.49	–	V
	V_{GE} = 15 V, I_C = 20 A, T_J = 125°C		–	1.61	–	
Gate−Emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 1.65 mA	$V_{GE(TH)}$	4.70	5.68	6.50	V
Gate Leakage Current	V_{GE} = 20 V, V_{CE} = 0 V	I_{GES}	–	–	200	nA
Turn−on Delay Time	T_J = 25°C V_{CE} = 350 V, I_C = 15 A V_{GE} = ±15V, R_G = 15 Ω	$t_{d(on)}$	–	33	–	ns
Rise Time		t_r	–	18	–	
Turn−off Delay Time		$t_{d(off)}$	–	126	–	
Fall Time		t_f	–	43	–	
Turn−on Switching Loss per Pulse		E_{on}	–	250	–	µJ
Turn off Switching Loss per Pulse		E_{off}	–	180	–	
Turn−on Delay Time	T_J = 125°C V_{CE} = 350 V, I_C = 15 A V_{GE} = ±15 V, R_G = 15 Ω	$t_{d(on)}$	–	31	–	ns
Rise Time		t_r	–	19	–	
Turn−off Delay Time		$t_{d(off)}$	–	138	–	
Fall Time		t_f	–	72	–	
Turn−on Switching Loss per Pulse		E_{on}	–	390	–	uJ
Turn off Switching Loss per Pulse		E_{off}	–	300	–	
Input Capacitance	V_{CE} = 20 V, V_{GE} = 0 V, f = 10 kHz	C_{ies}	–	3837	–	pF
Output Capacitance		C_{oes}	–	127	–	
Reverse Transfer Capacitance		C_{res}	–	104	–	
Total Gate Charge	V_{CE} = 480 V, I_C = 20 A, V_{GE} = ±15 V	Q_g	–	166	–	nC
Thermal Resistance − chip−to−heatsink	Thermal grease, Thickness ≤ 2.25 Mil, λ = 2.9 W/mK	R_{thJH}	–	1.90	–	°C/W
HALF BRIDGE DIODE CHARACTERISTICS						
Diode Forward Voltage	I_F = 15 A, T_J = 25°C	V_F	–	2.47	3	V
	I_F = 15 A, T_J = 125°C		–	1.97	–	
Reverse Recovery Time	T_J = 25°C V_{CE} = 350 V, I_C = 15 A V_{GE} = ±15 V, R_G = 15 Ω	t_{rr}	–	63	–	ns
Reverse Recovery Charge		Q_{rr}	–	0.45	–	µC
Peak Reverse Recovery Current		I_{RRM}	–	17	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	313	–	A/µs
Reverse Recovery Energy		E_{rr}	–	70	–	µJ
Reverse Recovery Time	T_J = 125°C V_{CE} = 350 V, I_C = 15 A V_{GE} = ±15 V, R_G = 15 Ω	t_{rr}	–	233	–	ns
Reverse Recovery Charge		Q_{rr}	–	1.55	–	µC
Peak Reverse Recovery Current		I_{RRM}	–	22	–	A
Peak Rate of Fall of Recovery Current		di/dt	–	76	–	A/µs
Reverse Recovery Energy		E_{rr}	–	360	–	µJ
Thermal Resistance − chip−to−heatsink	Thermal grease, Thickness ≤ 2.25 Mil, λ = 2.9 W/mK	R_{thJH}	–	2.21	–	°C/W