

**Electrical Characteristics of IGBT @ Inverter**  $T_C = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
<b>Off Characteristics</b>						
$BV_{CES}$	Collector-Emitter Breakdown Voltage	$V_{GE} = 0V, I_C = 250\mu A$	600	--	--	V
$\frac{\Delta BV_{CES}}{\Delta T_J}$	Temperature Coeff. of Breakdown Voltage	$V_{GE} = 0V, I_C = 1mA$	--	0.6	--	$V/^\circ C$
$I_{CES}$	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0V$	--	--	250	$\mu A$
$I_{GES}$	Gate - Emitter Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0V$	--	--	$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GE(th)}$	Gate - Emitter Threshold Voltage	$I_C = 20mA, V_{CE} = V_{GE}$	5.0	6.5	8.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 20A, V_{GE} = 15V$	--	2.1	2.7	V
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance	$V_{CE} = 30V, V_{GE} = 0V,$ $f = 1MHz$	--	1277	--	pF
$C_{oes}$	Output Capacitance		--	98	--	pF
$C_{res}$	Reverse Transfer Capacitance		--	21	--	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300V, I_C = 20A,$ $R_G = 10\Omega, V_{GE} = 15V,$ Inductive Load, $T_C = 25^\circ C$	--	65	130	ns
$t_r$	Rise Time		--	100	200	ns
$t_{d(off)}$	Turn-Off Delay Time		--	80	160	ns
$t_f$	Fall Time		--	100	200	ns
$E_{on}$	Turn-On Switching Loss		--	0.45	--	mJ
$E_{off}$	Turn-Off Switching Loss		--	0.42	--	mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300V, I_C = 20A,$ $R_G = 10\Omega, V_{GE} = 15V,$ Inductive Load, $T_C = 125^\circ C$	--	70	140	ns
$t_r$	Rise Time		--	100	200	ns
$t_{d(off)}$	Turn-Off Delay Time		--	110	220	ns
$t_f$	Fall Time		--	210	350	ns
$E_{on}$	Turn-On Switching Loss		--	0.5	--	mJ
$E_{off}$	Turn-Off Switching Loss		--	0.72	--	mJ
$T_{sc}$	Short Circuit Withstand Time	$V_{CC} = 300V, V_{GE} = 15V$ @ $T_C = 100^\circ C$	10	--	--	$\mu s$
$Q_g$	Total Gate Charge	$V_{CE} = 300V, I_C = 20A,$ $V_{GE} = 15V$	--	55	65	nC
$Q_{ge}$	Gate-Emitter Charge		--	10	15	nC
$Q_{gc}$	Gate-Collector Charge		--	20	30	nC

### Electrical Characteristics of DIODE @ Inverter T<sub>C</sub> = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units	
V <sub>FM</sub>	Diode Forward Voltage	I <sub>F</sub> = 20A	T <sub>C</sub> = 25°C	--	1.9	2.8	V
			T <sub>C</sub> = 100°C	--	2.0	--	
t <sub>rr</sub>	Diode Reverse Recovery Time	I <sub>F</sub> = 20A di / dt = 40 A/us	T <sub>C</sub> = 25°C	--	75	150	ns
			T <sub>C</sub> = 100°C	--	110	--	
I <sub>rr</sub>	Diode Peak Reverse Recovery Current		T <sub>C</sub> = 25°C	--	1.3	2.6	A
			T <sub>C</sub> = 100°C	--	1.8	--	
Q <sub>rr</sub>	Diode Reverse Recovery Charge		T <sub>C</sub> = 25°C	--	50	195	nC
			T <sub>C</sub> = 100°C	--	100	--	

### Electrical Characteristics of DIODE @ Converter T<sub>C</sub> = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units	
V <sub>FM</sub>	Diode Forward Voltage	I <sub>F</sub> = 20A	T <sub>C</sub> = 25°C	--	1.1	1.5	V
			T <sub>C</sub> = 100°C	--	1.0	--	
I <sub>R</sub> RM	Repetitive Reverse Current	V <sub>R</sub> = V <sub>RRM</sub>	T <sub>C</sub> = 25°C	--	--	8	mA
			T <sub>C</sub> = 100°C	--	5	--	

### Thermal Characteristics

	Symbol	Parameter	Typ.	Max.	Units
Inverter	R <sub>θJC</sub>	Junction-to-Case (IGBT Part, per 1/6 Module)	--	1.4	°C/W
	R <sub>θJC</sub>	Junction-to-Case (DIODE Part, per 1/6 Module)	--	2.3	°C/W
Converter	R <sub>θJC</sub>	Junction-to-Case (DIODE Part, per 1/6 Module)	--	1.5	°C/W
Weight		Weight of Module	60	--	g

### NTC Thermistor Characteristics

	Symbol	Parameter	Tol.	Typ.	Units
Thermistor	R25	Rated Resistance @ T <sub>c</sub> = 25°C	+/- 5 %	4.7	KΩ
	B(25/100)	B - Value	+/- 3 %	3530	