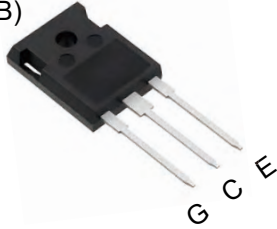


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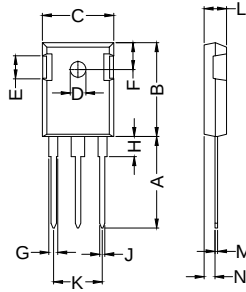
Discrete Reverse Conducting IGBTs

C(TAB)



G=Gate,
C=Collector,
E=Emitter,
TAB=Collector

Dimensions TO-247AD



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.620	0.640
ØD	3.15	3.65	0.124	0.144
E	4.32	5.49	0.170	0.216
F	5.40	6.30	0.213	0.248
G	1.65	2.18	0.065	0.086
H	3.80	4.50	0.150	0.177
J	1.00	1.40	0.039	0.055
K	10.80	11.10	0.425	0.437
L	4.70	5.30	0.185	0.209
M	0.40	0.80	0.016	0.031
N	1.50	2.49	0.059	0....

SG20N135RCB2

Maximum Ratings

Symbol	Parameter	Value	Unit
V_{CE}	Collector-emitter voltage	1350	V
I_C	DC collector current $T_C = 25^\circ\text{C}$	40	A
	$T_C = 100^\circ\text{C}$	20	
I_{Cpuls}	Pulsed collector current, t_p limited by T_{jmax}	55	
-	Turn off safe operating area $V_{CE} \leq 1200\text{V}$, $T_j \leq 150^\circ\text{C}$	55	
V_{GE}	Gate-emitter voltage	± 30	V
E_{AS}	Avalanche energy, single pulse $I_C = 20\text{A}$, $V_{CC} = 50\text{V}$, $R_{GE} = 25\Omega$, start at $T_j = 25^\circ\text{C}$	95	mJ
t_{SC}	Short circuit withstand time ¹⁾ $V_{GE} = 15\text{V}$, $100\text{V} \leq V_{CC} \leq 1200\text{V}$, $T_j \leq 150^\circ\text{C}$	10	μs
P_{tot}	Power dissipation $T_C = 25^\circ\text{C}$	205	W
T_j, T_{stg}	Operating junction and storage temperature	-55...+150	$^\circ\text{C}$
-	Soldering temperature, 1.6mm (0.063 in.) from case for 10s	260	

Thermal Resistance

Symbol	Parameter	Conditions	Max. Value	Unit
Characteristic				
R_{thJC}	IGBT thermal resistance, junction – case		0.45	K/W
R_{thJA}	Thermal resistance, junction – ambient	TO-247AD	36	

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Discrete Reverse Conducting IGBTs

Electrical Characteristic, at $T_j = 25^\circ\text{C}$, unless otherwise specified

Symbol	Parameter	Conditions	Value			Unit
			min.	typ.	max.	
Static Characteristic						
V _{(BR)CES}	Collector-emitter breakdown voltage	V _{GE} =0V, I _C =1000μA	1350	1400	-	V
V _{CE(sat)}	Collector-emitter saturation voltage	V _{GE} = 15V, I _C =20A T _j =25°C T _j =150°C	-	2.70 3.10	3.30 3.70	
V _{GE(th)}	Gate-emitter threshold voltage	I _C =600μA,V _{CE} =V _{GE}	3.00	5.00	6.00	
I _{CES}	Zero gate voltage collector current	V _{CE} =1200V,V _{GE} =0V T _j =25°C T _j =150°C	- -	- -	300 1000	μA
I _{GES}	Gate-emitter leakage current	V _{CE} =0V,V _{GE} =20V	-	-	100	nA
g _{fs}	Transconductance	V _{CE} =20V, I _C =20A		10	-	S
Dynamic Characteristic						
C _{iss}	Input capacitance	V _{CE} =25V,	-	1790	2200	pF
C _{oss}	Output capacitance	V _{GE} =0V,	-	77	100	
C _{rss}	Reverse transfer capacitance	f=1MHz	-	13	30	
Q _{Gate}	Gate charge	V _{CC} =960V, I _C =20A V _{GE} =15V	-	120	170	nC
L _E	Internal emitter inductance measured 5mm (0.197 in.) from case	TO-247AD	-	13	-	nH
I _{C(SC)}	Short circuit collector current ²⁾	V _{GE} =15V,t _{SC} ≤5μs 100V≤V _{CC} ≤1200V , T _j ≤150°C	-	165	-	A

1) Device on 50mm*50mm*1.5mm epoxy PCB FR4 with 6cm² (one layer, 70 μ m thick) copper area for collector connection. PCB is vertical without blown air.

2) Allowed number of short circuits: <1000; time between short circuits: >1s.



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Discrete Reverse Conducting IGBTs

Switching Characteristic, Inductive Load, at $T_J=25^\circ\text{C}$

Symbol	Parameter	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic						
t _{d(on)}	Turn-on delay time	T _j =25°C, V _{CC} =600V,I _C =20A, V _{GE} =15V/0V, R _G =33Ω, L _σ ¹⁾ =180nH, C _σ ¹⁾ =40pF	-	18	35	ns
t _r	Rise time		-	28	36	
t _{d(off)}	Turn-off delay time		-	147	300	
t _f	Fall time		-	150	262	
E _{on}	Turn-on energy	Energy losses include “tail” and diode reverse recovery.	-	0.83	1.40	mJ
E _{off}	Turn-off energy		-	0.90	1.20	
E _{ts}	Total switching energy		-	1.73	2.60	

Reverse Diode (Reverse conducting Diode)

($T_J=25^\circ\text{C}$, unless otherwise specified)

Symbol	Test Conditions	Characteristic Values			Unit
		min.	typ.	max.	
V_F	$I_F=20\text{A}$; $V_{GE}=0\text{V}$		2.50	3.30	V
I_F	$T_C=25^\circ\text{C}$ $T_C=90^\circ\text{C}$			40 20	A
I_{RM}	$I_F=20\text{V}$; $-di_F/dt=400\text{A}/\mu\text{s}$; $V_R=600\text{V}$		20		A
t_{rr}	$V_{GE}=0\text{V}$; $T_J=125^\circ\text{C}$ $I_F=1\text{A}$; $-di_F/dt=100\text{A}/\mu\text{s}$; $V_R=30\text{V}$; $V_{GE}=0\text{V}$		210 40		ns

Features

- NPT IGBT technology
- Low switching losses
Switching frequency up to 20KHz
- Square RBSOA, no latch up
- High short circuit capability
- Positive temperature coefficient for easy paralleling
- MOS input, voltage controlled
- Reverse conducting IGBT with monolithic body diode

Application

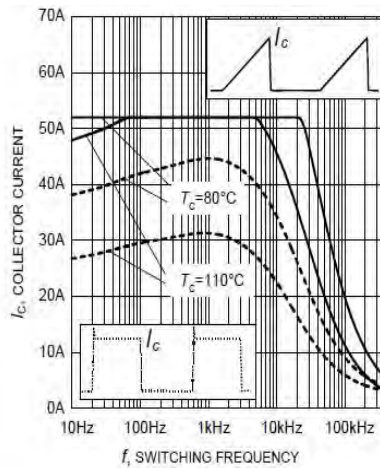
- Inductive cooking
- Inverterized microwave oven
- Resonant converter
- Soft switching application

Advantages

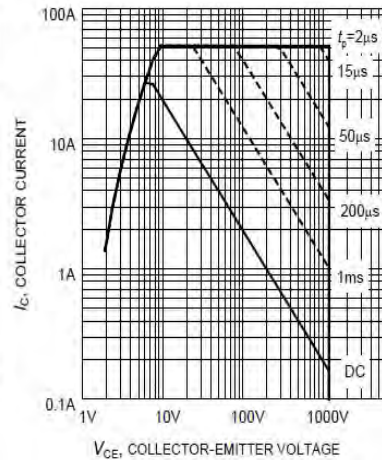
- space and weight savings
- reduced protection circuits

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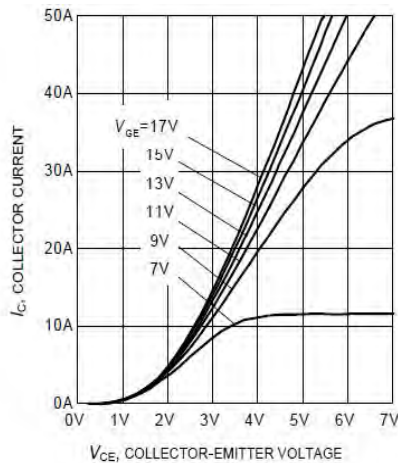
Discrete Reverse Conducting IGBTs



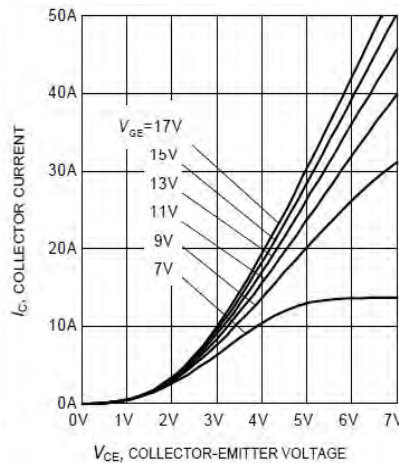
Collector current versus switching frequency



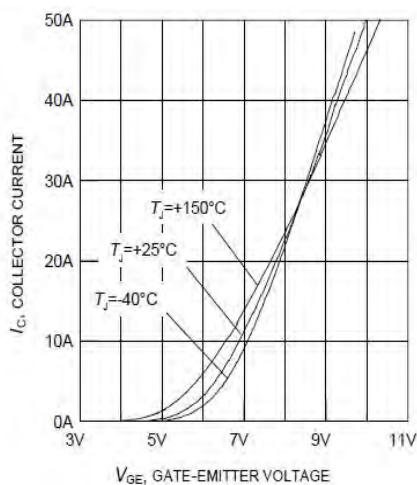
Safe working area



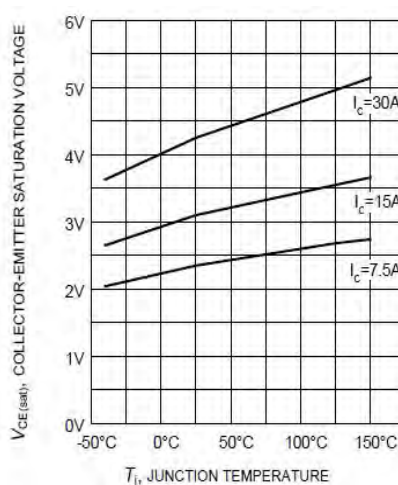
Output characteristic ($T_C = 25^\circ\text{C}$)



Output characteristic ($T_C = 150^\circ\text{C}$)



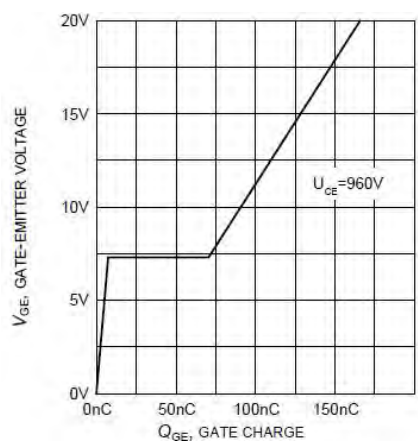
Transmission characteristic



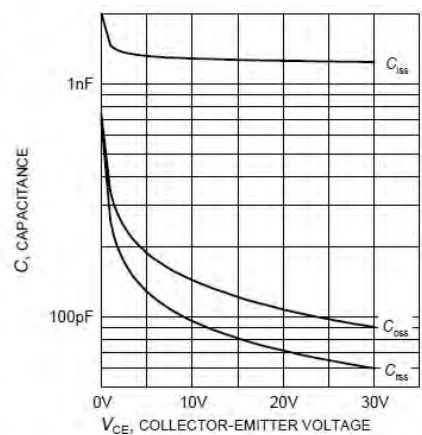
Relationship between $V_{CE(sat)}$ and T_J

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Discrete Reverse Conducting IGBTs

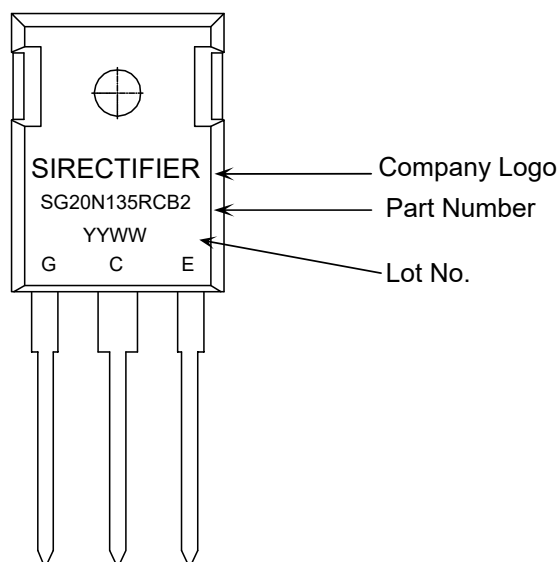


Gate charge characteristic
($I_C=20A$)



Capacitance versus collector/emitter voltage
($V_{GE}=0V$ $f=1MHz$)

MARKING



ORDERING INFORMATION

Part Number	Package	Shipping	Marking Code
SG20N135RCB2	TO-247AD	30pcs / Tube	SG20N135RCB2



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Discrete Reverse Conducting IGBTs

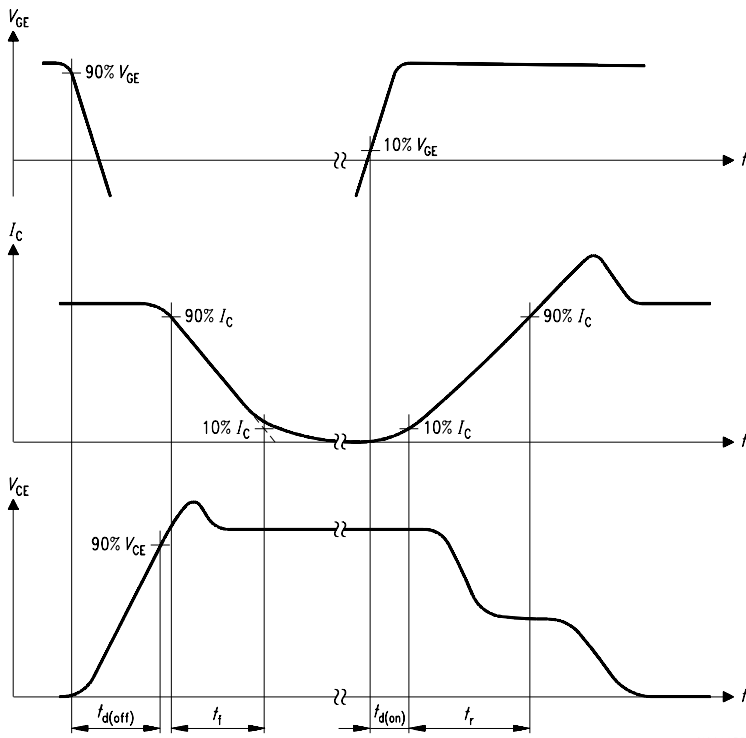


Figure A. Definition of switching times

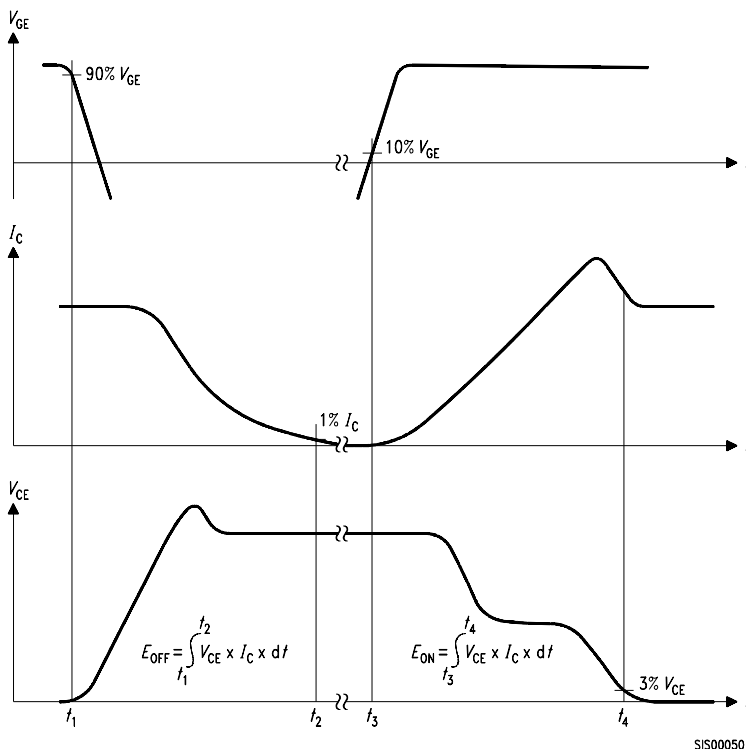


Figure B. Definition of switching losses

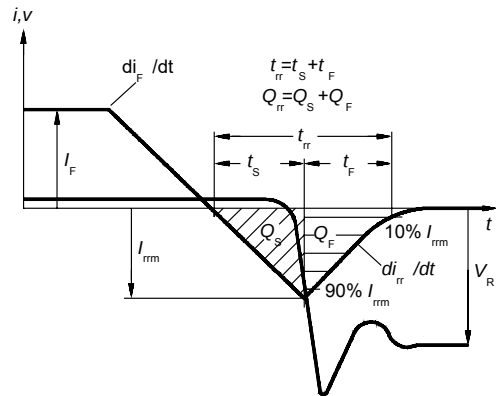


Figure C. Definition of diodes switching characteristics

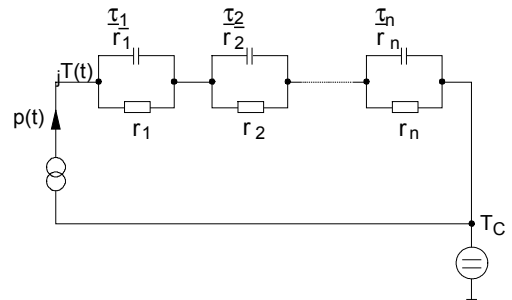


Figure D. Thermal equivalent circuit

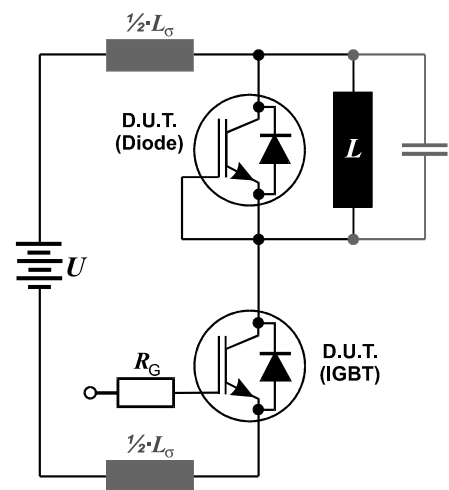


Figure E. Dynamic test circuit
Leakage inductance $L_\sigma = 180\text{nH}$,
and stray capacity $C_\sigma = 40\text{pF}$.