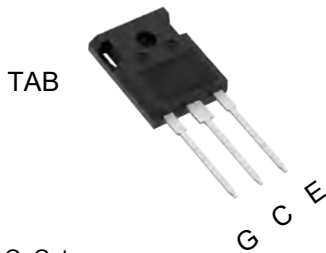
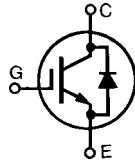


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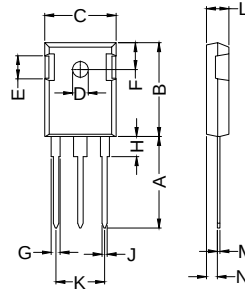
Discrete Reverse Conducting IGBTs



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	0.098

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	1350	V
DC collector current $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	I_C	80 40	A
Pulsed collector current, t_p limited by T_{jmax}	I_{Cpuls}	125	
Turn off safe operating area $V_{CE} \leq 1200\text{V}$, $T_j \leq 150^\circ\text{C}$	-	55	
Gate-emitter voltage	V_{GE}	± 30	V
Avalanche energy, single pulse $I_C = 20\text{A}$, $V_{CC} = 50\text{V}$, $R_{GE} = 25\Omega$, start at $T_j = 25^\circ\text{C}$	E_{AS}	95	mJ
Short circuit withstand time ¹⁾ $V_{GE} = 15\text{V}$, $100\text{V} \leq V_{CC} \leq 1200\text{V}$, $T_j \leq 150^\circ\text{C}$	t_{SC}	10	μs
Power dissipation $T_C = 25^\circ\text{C}$	P_{tot}	255	W
Operating junction and storage temperature	T_j, T_{stg}	-55...+150	$^\circ\text{C}$
Soldering temperature, 1.6mm (0.063 in.) from case for 10s	-	260	

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction – case	R_{thJC}		0.35	K/W
Thermal resistance, junction – ambient	R_{thJA}	TO-247AD	30	

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Discrete Reverse Conducting IGBTs

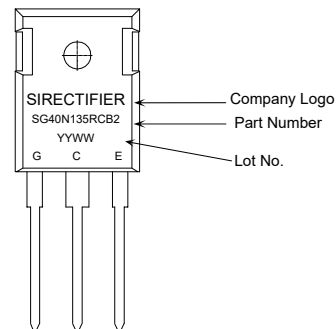
Electrical Characteristic, at $T_j = 25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Static Characteristic						
Collector-emitter breakdown voltage	V _{(BR)CES}	V _{GE} =0V, I _C =1000μA	1350	1400	-	V
Collector-emitter saturation voltage	V _{CE(sat)}	V _{GE} = 15V, I _C =40A T _j =25°C T _j =150°C	-	2.70 3.10	3.30 3.70	
Gate-emitter threshold voltage	V _{GE(th)}	I _C =600μA, V _{CE} =V _{GE}	4.00	5.50	6.50	
Zero gate voltage collector current	I _{CES}	V _{CE} =1200V, V _{GE} =0V T _j =25°C T _j =150°C	- -	- -	300 1000	μA
Gate-emitter leakage current	I _{GES}	V _{CE} =0V, V _{GE} =20V	-	-	100	nA
Transconductance	g _{fs}	V _{CE} =20V, I _C =40A		10	-	S
Dynamic Characteristic						
Input capacitance	C _{iss}	V _{CE} =25V, V _{GE} =0V, f=1MHz	-	2850	3100	pF
Output capacitance	C _{oss}		-	305	330	
Reverse transfer capacitance	C _{rss}		-	165	180	
Gate charge	Q _{Gate}	V _{CC} =960V, I _C =40A V _{GE} =15V	-	260	270	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L _E	TO-247AD	-	14	-	nH
Short circuit collector current ²⁾	I _{C(SC)}	V _{GE} =15V, t _{SC} ≤5μs 100V≤V _{CC} ≤1200V, T _j ≤ 150°C	-	195	-	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.

MARKING



ORDERING INFORMATION

Part Number	Package	Shipping	Marking Code
SG40N135RCB2	TO-247AD	30pcs / Tube	SG40N135RCB2

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Discrete Reverse Conducting IGBTs

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

Parameter	Symbol	Conditions	Value			Unit	
			min.	typ.	max.		
IGBT Characteristic							
Turn-on delay time	t _{d(on)}	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	-	68		ns	
Rise time	t _r		V _{CC} =600V,I _C =20A,	-	58		
Turn-off delay time	t _{d(off)}		V _{GE} =15V/0V,	-	187		
Fall time	t _f		R _G =33Ω,	-	170		
Turn-on energy	E _{on}	Energy losses include “tail” and diode reverse recovery.	-	0.53		mJ	
Turn-off energy	E _{off}		-	1.40			
Total switching energy	E _{ts}		-	1.93			

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	$I_F=40\text{A}; V_{GE}=0\text{V}$		2.50	3.30	V
I_F	$T_C=25^\circ\text{C}$ $T_C=90^\circ\text{C}$			80 40	A
I_{RM}	$I_F=20\text{V}; -di_F/dt=400\text{A/us}; V_R=600\text{V}$		40		A
t_{rr}	$V_{GE}=0\text{V}; T_J=125^\circ\text{C}$ $I_F=1\text{A}; -di_F/dt=100\text{A/us}; V_R=30\text{V}; V_{GE}=0\text{V}$		210 60		ns

Features

- Planar Gate Field Stop IGBT technology
- Low switching losses
- Switching frequency up to 20KHz
- Square RBSOA, no latch up
- High short circuit capability
- Positive temperature coefficient for easy parallelling
- 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

SG40N135RCB2

Discrete Reverse Conducting IGBTs

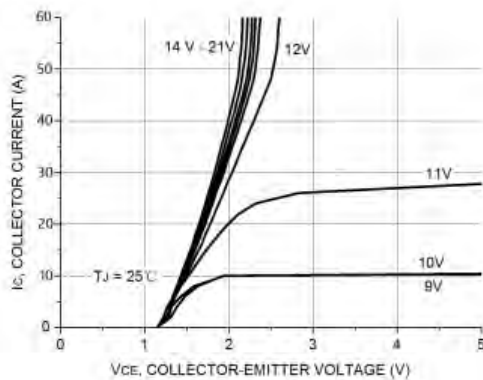


Figure 1. Typical Output Characteristics

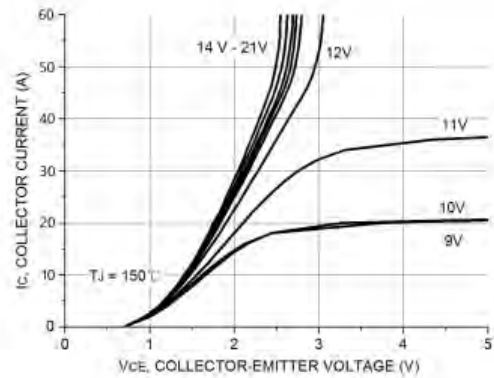


Figure 2. Typical Output Characteristics

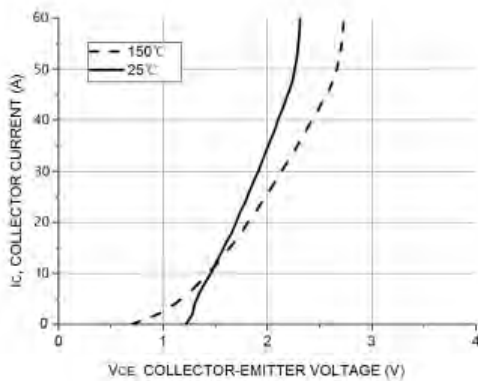


Figure 3. Typical Output Characteristics

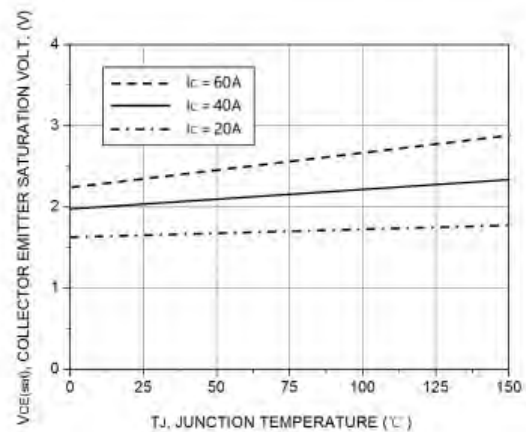


Figure 4. Typical Saturation Voltage vs. T_j

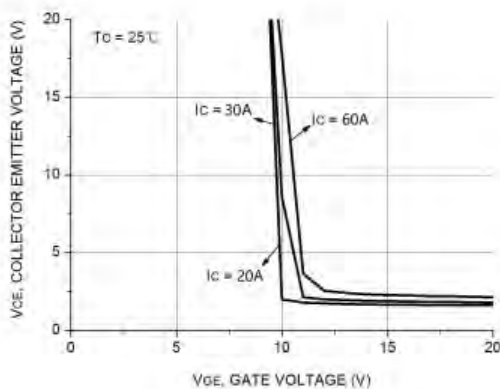


Figure 5. Saturation Voltage v. s. Gate Emitter Voltage

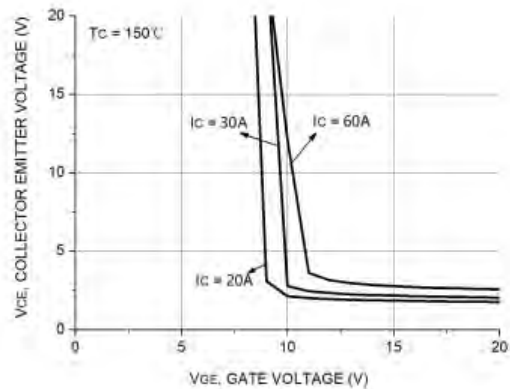


Figure 6. Saturation Voltage v. s. Gate Emitter Voltage

SG40N135RCB2

Discrete Reverse Conducting IGBTs

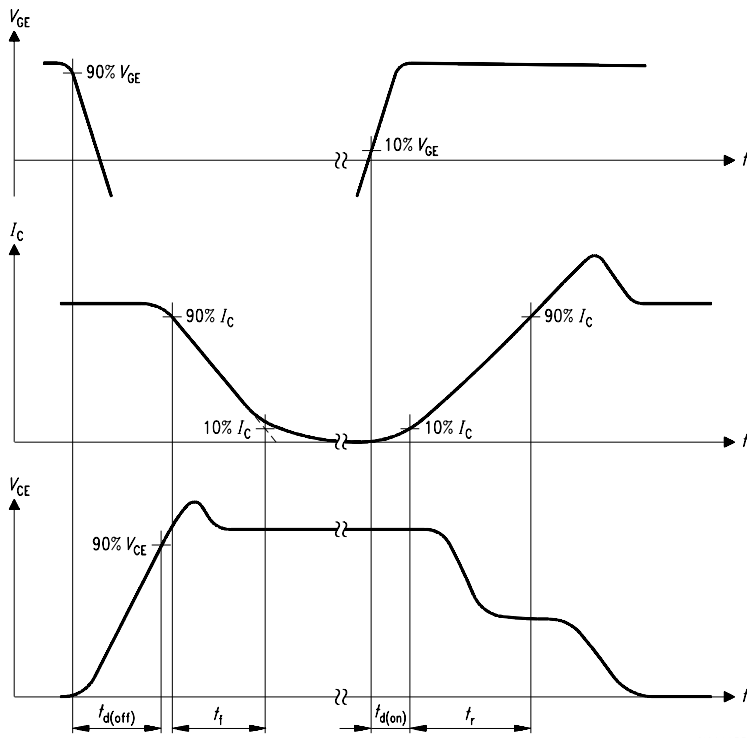


Figure A. Definition of switching times

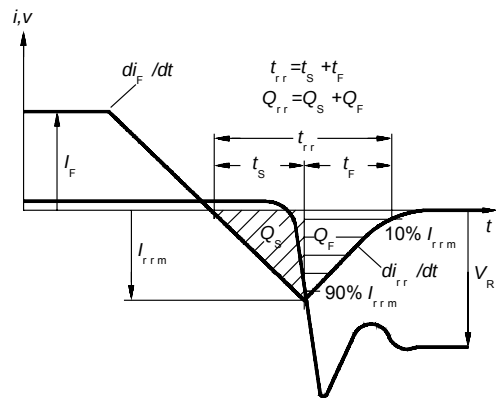


Figure C. Definition of diodes switching characteristics

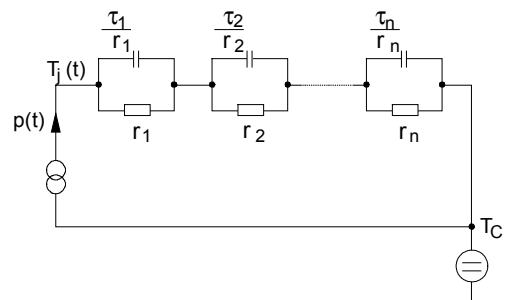


Figure D. Thermal equivalent circuit

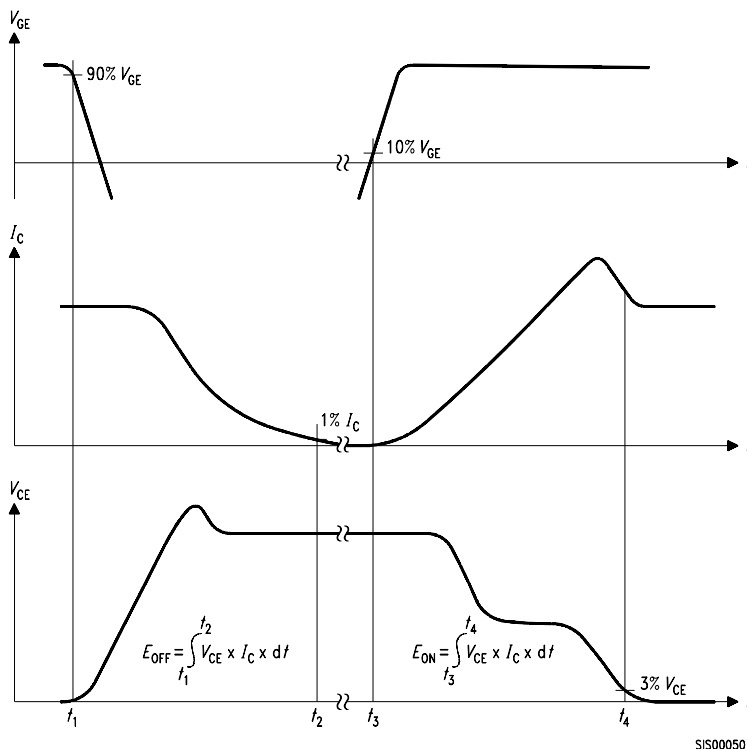


Figure B. Definition of switching losses

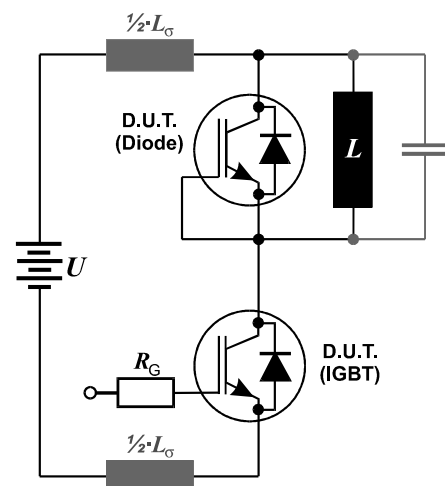


Figure E. Dynamic test circuit
Leakage inductance $L_\sigma = 180\text{nH}$,
and stray capacity $C_\sigma = 40\text{pF}$.