

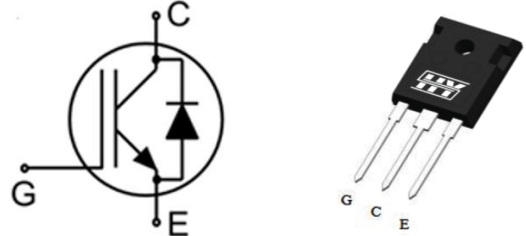
Trench Field-Stop Technology IGBT

Features

- 650V, 40A
- $V_{CE(sat)}(typ.) = 1.9V @ V_{GE}=15V, I_C=40A$
- Maximum Junction Temperature 175°C
- Pb-free Lead Plating; RoHS Compliant

Applications

- Solar Converters
- Uninterrupted Power Supply
- Welding Converters
- Mid to High Range Switching Frequency Converters



Key Performance and Package Parameters

Order codes	V_{CE}	I_C	$V_{CE(sat)}, T_{vj}=25^{\circ}C$	T_{vjmax}	Marking	Package
SYD040Q065AY1S3	650V	40A	1.9V	175°C	SYD40Q65AY1	TO247-3L

Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-Emitter Voltage	650	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Continuous Collector Current ($T_C=25^{\circ}C$)	80	A
	Continuous Collector Current ($T_C=100^{\circ}C$)	40	A
I_{CM}	Pulsed Collector Current (Note 1)	160	A
P_D	Maximum Power Dissipation ($T_C=25^{\circ}C$)	187.5	W
	Maximum Power Dissipation ($T_C=100^{\circ}C$)	94	W
T_J	Operating Junction Temperature Range	-40 to 175	°C
T_{STG}	Storage Temperature Range	-55 to 150	°C

Thermal Data

Symbol	Parameter	Conditions	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case for IGBT	TO247-3L	0.8	°C/W

Electrical Characteristics (T_c=25°C unless otherwise noted.)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV _{CES}	Collector-Emitter Breakdown Voltage	V _{GE} =0V, I _C =200uA	650	---	---	V
I _{CES}	Collector-Emitter Leakage Current	V _{CE} =650V, V _{GE} =0V	---	---	40	uA
I _{GES}	Gate Leakage Current, Forward	V _{GE} =20V, V _{CE} =0V	---	---	100	nA
	Gate Leakage Current, Reverse	V _{GE} =-20V, V _{CE} =0V	---	---	100	nA
V _{GE(th)}	Gate Threshold Voltage	V _{GE} =V _{CE} , I _C =400uA	3.7	4.5	5.3	V
V _{CE(sat)}	Collector-Emitter Saturation Voltage	V _{GE} =15V, I _C =40A, T _j =25°C	---	1.9	2.3	V
Q _G	Total Gate Charge	V _{CC} =520V	---	63	---	nC
Q _{GE}	Gate-Emitter Charge	V _{GE} =15V	---	9.9	---	nC
Q _{GC}	Gate-Collector Charge	I _C =40A	---	36	---	nC
t _{d(on)}	Turn-on Delay Time	V _{CC} =400V V _{GE} =±15V I _C =40A R _G =12Ω Inductive Load T _C =25°C	---	12	---	ns
t _r	Turn-on Rise Time		---	40.6	---	ns
t _{d(off)}	Turn-off Delay Time		---	122	---	ns
t _f	Turn-off Fall Time		---	58.9	---	ns
E _{on}	Turn-on Switching Loss		---	0.37	---	mJ
E _{off}	Turn-off Switching Loss		---	0.57	---	mJ
E _{ts}	Total Switching Loss		---	0.94	---	mJ
C _{ies}	Input Capacitance	V _{CE} =25V	---	984	---	pF
C _{oes}	Output Capacitance	V _{GE} =0V	---	106	---	pF
C _{res}	Reverse Transfer Capacitance	f =1MHz	---	31	---	pF

Diode Characteristics ($T_C=25^{\circ}\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=40\text{A}$, $T_J=25^{\circ}\text{C}$	---	1.58	2.2	V
t_{rr}	Diode Reverse Recovery Time	$V_R=400\text{V}$ $I_F=40\text{A}$ $dI_F/dt=350\text{A}/\mu\text{s}$ $T_C=25^{\circ}\text{C}$	---	116.9	---	ns
I_{rr}	Diode peak Reverse Recovery Current		---	6.35	---	A
Q_{rr}	Diode Reverse Recovery Charge		---	313.8	---	nC

Note1: Repetitive rating, pulse width limited by maximum junction temperature

Typical Characteristics

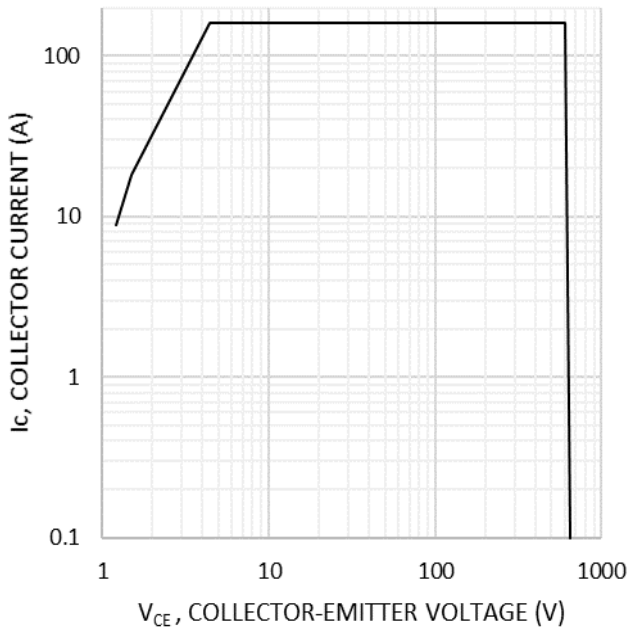


Fig. 1 Forward bias safe operating area (D=0, $T_c=25^\circ\text{C}$, $T_{vj}\leq 175^\circ\text{C}$; $V_{GE}=15\text{V}$. Recommended use at $V_{GE}\geq 7.5\text{V}$)

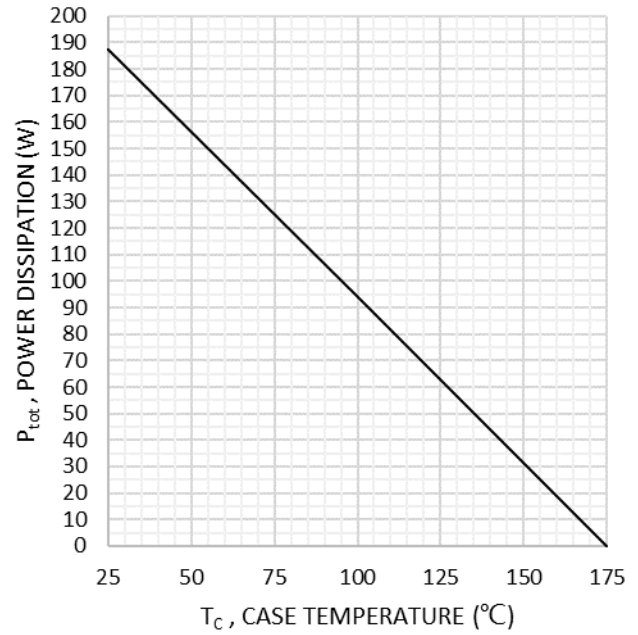


Fig. 2 Power dissipation as a function of case temperature ($T_{vj}\leq 175^\circ\text{C}$)

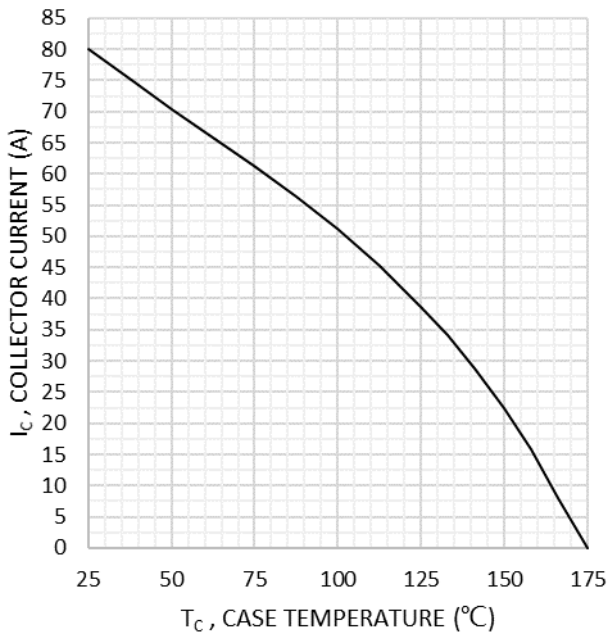


Fig. 3 Collector current as a function of case temperature ($V_{GE}\geq 15\text{V}$, $T_{vj}\leq 175^\circ\text{C}$)

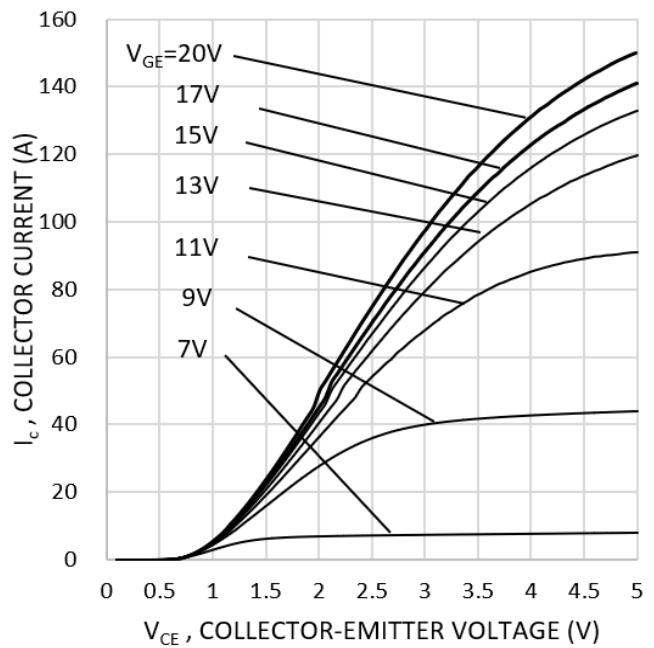


Fig. 4 Typical output characteristic ($T_{vj}=25^\circ\text{C}$)

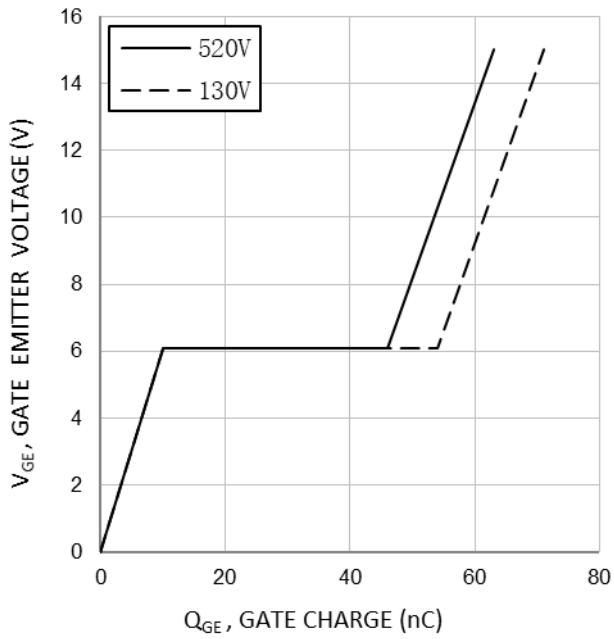


Fig. 5 Typical gate charge ($I_c=40A$)

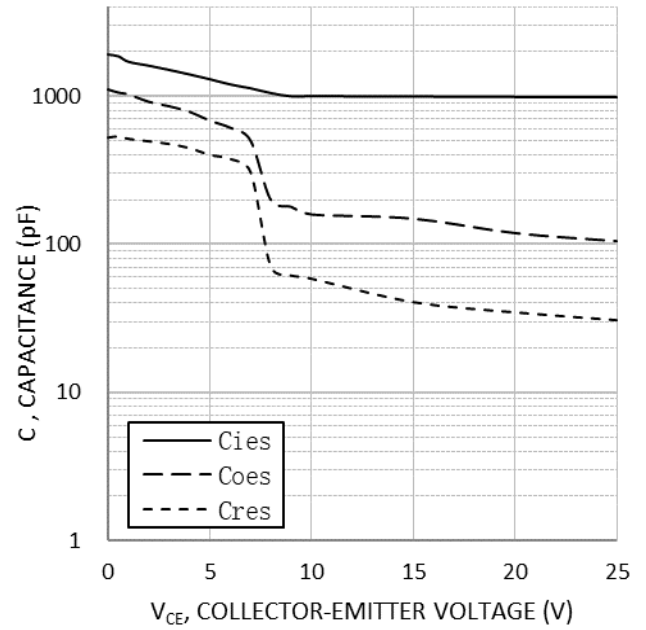


Fig. 6 Typical capacitance as a function of collector-emitter voltage ($V_{GE}=0V$, $f=1MHz$)

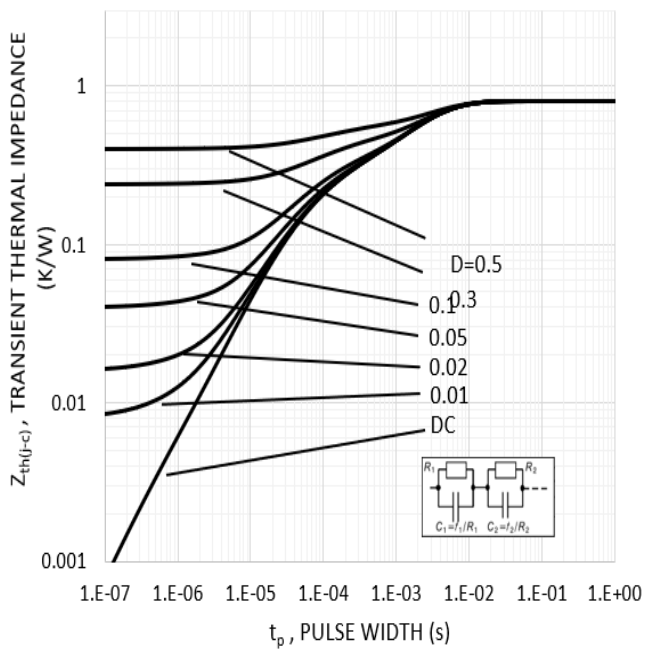
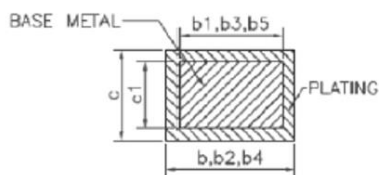
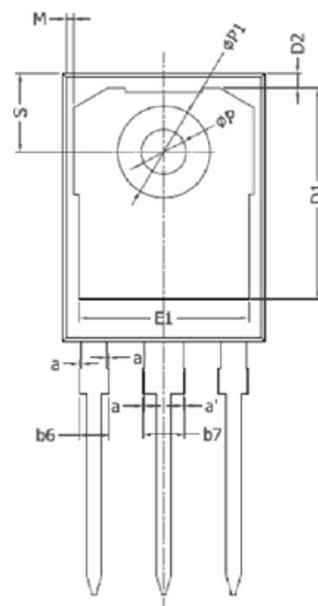
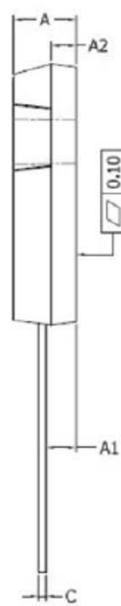
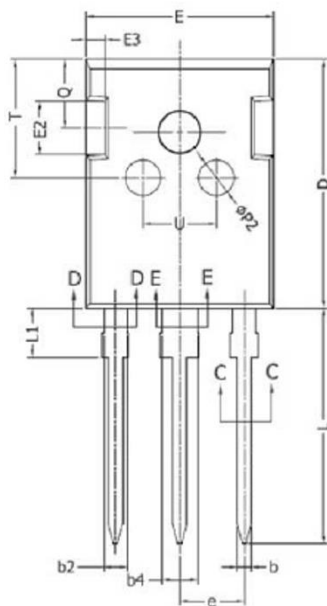


Fig. 7 IGBT transient thermal impedance ($D=t_p/T$)

Package Information

TO-247-3L



SECTION C-C, D-D & E-E

SYMBOL	MIN	NOM	MAX
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
a	0	---	0.15
a'	0	---	0.15
b	1.16	---	1.26
b1	1.15	1.2	1.22
b2	1.96	---	2.06
b3	1.95	2.00	2.02
b4	2.96	---	3.06
b5	2.96	3.00	3.02
b6	---	---	2.25
b7	---	---	3.25
c	0.59	---	0.66
c1	0.58	0.60	0.62
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.17	1.35
E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	4.40	4.50	4.60
E3	1.50	1.60	1.70
e	5,436 BSC		
L	19.80	19.92	20.10
L1	---	---	4.30
M	0.35	---	0.95
P	3.40	3.50	3.60
P1	7.00	---	7.40
P2	2.40	2.50	2.60
Q	5.60	---	6.00
S	6.05	6.15	6.25
T	9.80	---	10.20
U	6.00	---	6.40