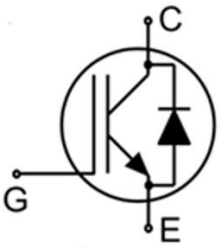
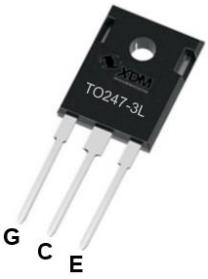
Trench Field-Stop Technology IGBT

Features

- 650V, 40A
- $V_{CE(sat)(typ.)}$ =1.9V@V_{GE}=15V, I_C=40A
- Maximum Junction Temperature 175℃
- 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_{CEsat}, T_{vj}=25℃	T_{vjmax}	Marking	Package
XD040Q065AY1S3	650V	40A	1.9V	175℃	D40Q65AY1	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℃)	80	A
	Continuous Collector Current (T_C=100℃)	40	A
I_{CM}	Pulsed Collector Current (Note 1)	160	A
P_D	Maximum Power Dissipation (T_C=25℃)	187.5	W
	Maximum Power Dissipation (T_C=100℃)	94	W
T_J	Operating Junction Temperature Range	-40 to 175	℃
T_{STG}	Storage Temperature Range	-55 to 150	℃

Thermal Data

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

Electrical Characteristics (T_C=25℃ 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℃	---	1.9	2.3	V
Q_G	Total Gate Charge	V_{CC}=520V V_{GE}=15V I_C=40A	---	63	---	nC
Q_{GE}	Gate-Emitter Charge		---	9.9	---	nC
Q_{GC}	Gate-Collector Charge		---	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℃	---	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 V_{GE}=0V f =1MHz	---	984	---	pF
C_{oes}	Output Capacitance		---	106	---	pF
C_{res}	Reverse Transfer Capacitance		---	31	---	pF

Diode Characteristics (T_C=25℃ unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=40A, T_j=25℃	---	1.58	2.2	V
t_{rr}	Diode Reverse Recovery Time	VR=400V I_F=40A dI_F/dt=350A/us T_C=25℃	---	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

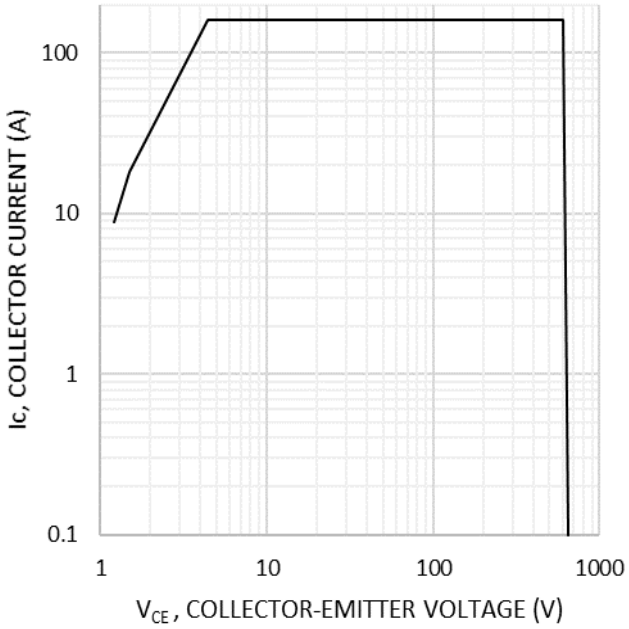


Fig. 1 Forward bias safe operating area (D=0, T_c=25℃, T_{vj}≤175℃; V_{GE}=15V. Recommended use at V_{GE}≥7.5V)

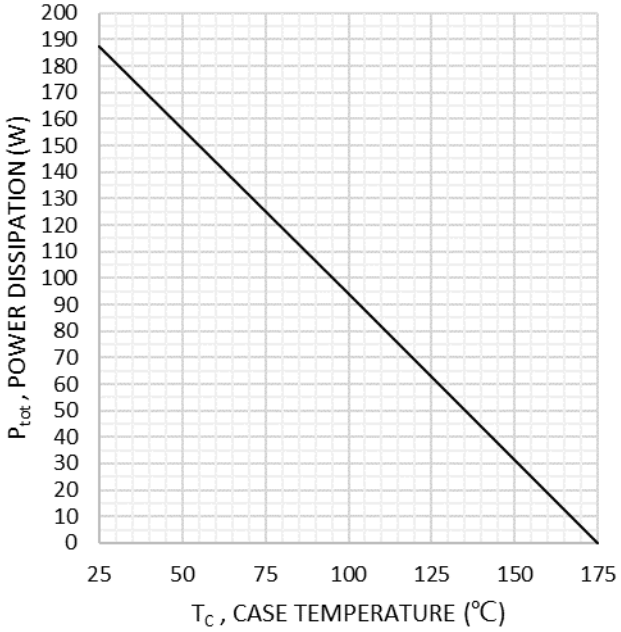


Fig. 2 Power dissipation as a function of case temperature (T_{vj}≤175℃)

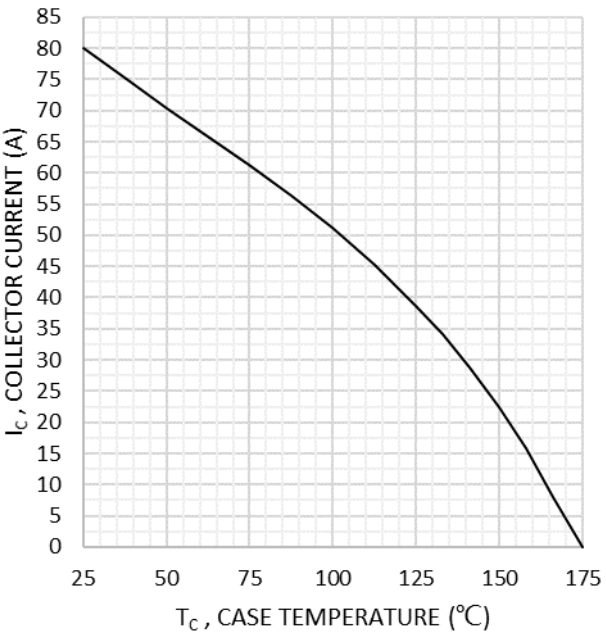


Fig. 3 Collector current as a function of case temperature (V_{GE}≥15V,T_{vj}≤175℃)

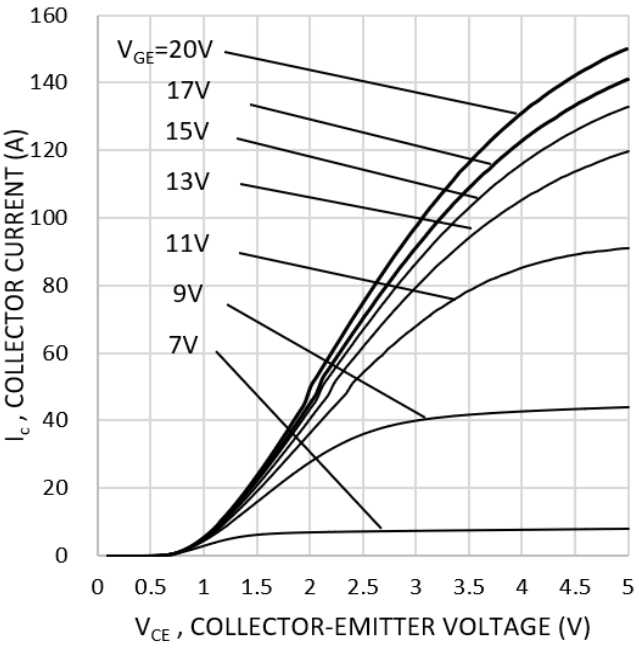


Fig. 4 Typical output characteristic (T_{vj}=25℃)

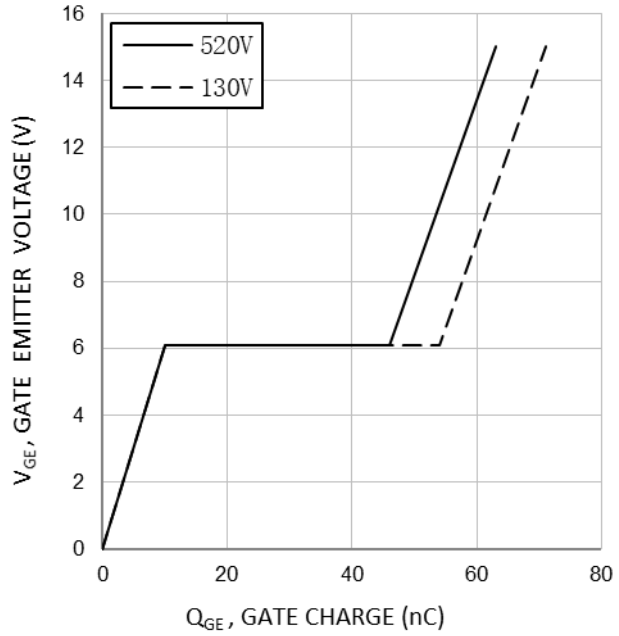


Fig. 5 Typical gate charge (I_C=40A)

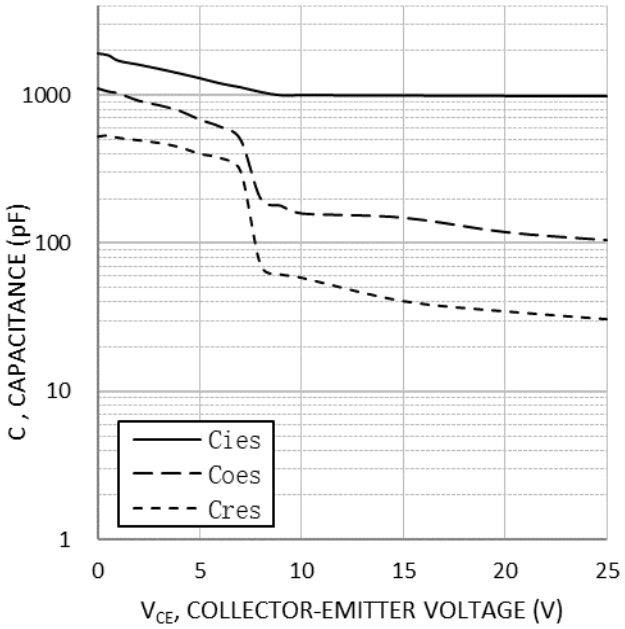


Fig. 6 Typical capacitance as a function of collector-emitter voltage (V_{GE}=0V, f=1MHz)

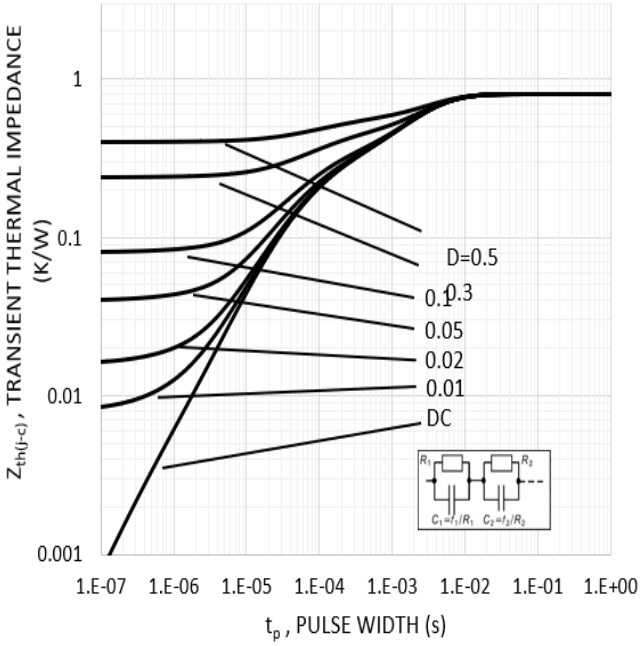
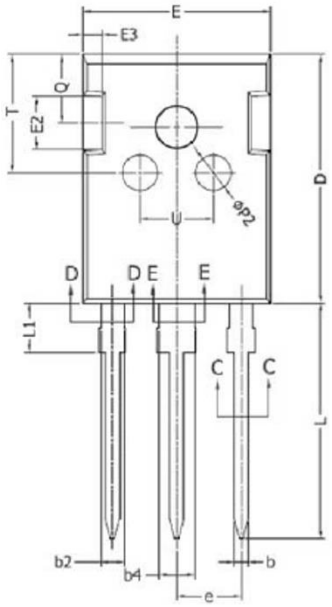
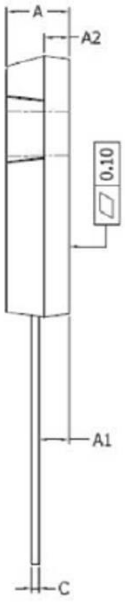


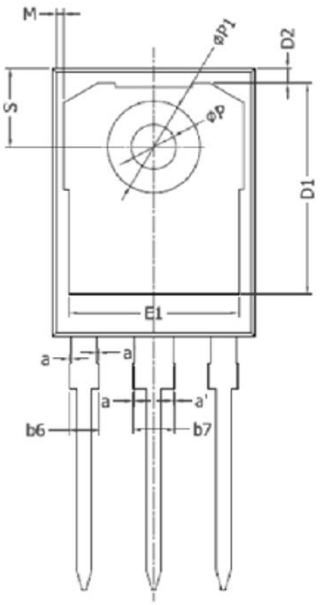
Fig. 7 IGBT transient thermal impedance (D=t_p/T)

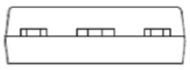
Package Information

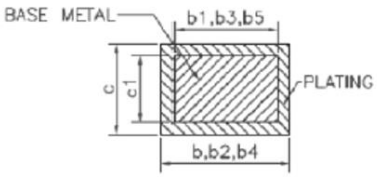
TO-247-3L











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