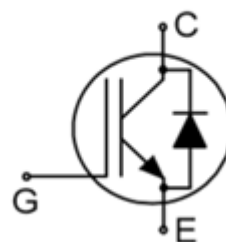


Trench Field-Stop Technology IGBT

Features

- 1200V, 40A
- $V_{CE(sat)(typ.)} = 2.47V @ V_{GE} = 15V, I_C = 40A$
- Low Switching Losses
- $V_{CE(sat)}$ with Positive Temperature Coefficient
- Pb-free Lead Plating; RoHS Compliant



Applications

- Frequency Converters
- Uninterrupted Power Supply
- Air Conditioning
- Motor Drives

Order codes	V_{CE}	I_C	$V_{CEsat}, T_{vj}=25^{\circ}C$	T_{vjmax}	Marking	Package
XD040Q120AT1S3	1200V	40A	2.47V	175 $^{\circ}C$	D40Q120AT1	TO247-3

Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Continuous Collector Current ($T_C=100^{\circ}C$)	40	A
I_{CM}	Pulsed Collector Current (Note 1)	80	A
I_F	Diode Continuous Forward Current ($T_C=100^{\circ}C$)	40	A
I_{FM}	Diode Maximum Forward Current (Note 1)	80	A
t_{sc}	Short Circuit Withstand Time	10	us
P_D	Maximum Power Dissipation ($T_C=25^{\circ}C$)	277	W
T_J	Operating Junction Temperature Range	-40 to 150	$^{\circ}C$
T_{STG}	Storage Temperature Range	-40 to 125	$^{\circ}C$

Thermal Data

Symbol	Parameter	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case for IGBT	0.45	$^{\circ}C/W$

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{CES}	Collector-Emitter Breakdown Voltage	$V_{GE}=0V, I_C=500\mu A$	1200	---	---	V
I_{CES}	Collector-Emitter Leakage Current	$V_{CE}=1200V, V_{GE}=0V$	---	---	1	mA
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	$V_{GE}=V_{CE}, I_C=1mA$	4.5	5.6	6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15V, I_C=40A$	---	2.47	2.75	V
$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=600V$	---	22	---	ns
t_r	Turn-on Rise Time	$V_{GE}=\pm 15V$	---	32	---	ns
$t_{d(off)}$	Turn-off Delay Time	$I_C=40A$	---	163	---	ns
t_f	Turn-off Fall Time	$R_G=10\Omega$	---	144	---	ns
E_{on}	Turn-on Switching Loss	Inductive Load $T_c=25^{\circ}\text{C}$	---	3.7	---	mJ
E_{off}	Turn-off Switching Loss		---	1.1	---	mJ
C_{ies}	Input Capacitance	$V_{CE}=25V$	---	3000	---	pF
C_{oes}	Output Capacitance	$V_{GE}=0V$	---	250	---	pF
C_{res}	Reverse Transfer Capacitance	$f=1MHz$	---	100	---	pF

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=40A, V_{GE}=0V$	---	2.5	2.75	V
I_{rr}	Diode Peak Reverse Recovery Current	$V_{CE}=600V$ $I_F=40A$	---	14	---	A
Q_{rr}	Diode Reverse Recovery Charge	$di_F/dt=400A/\mu s$ $T_{vj}=25^{\circ}\text{C}$	---	1.4	---	μC
E_{rr}	Reverse Recovery energy		---	0.4	---	mJ

Note 1: Repetitive Rating: Pulse width limited by maximum junction temperature

Typical Characteristics

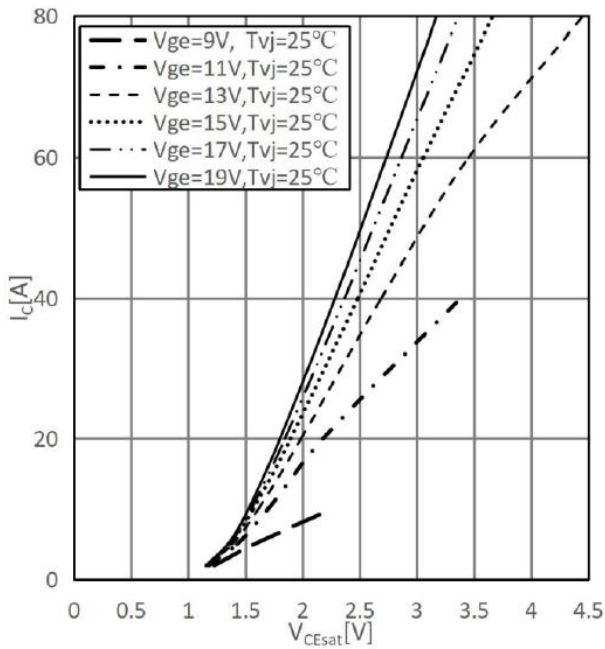


Fig. 1 Typical IGBT Output Characteristics at $T_j=25^\circ\text{C}$

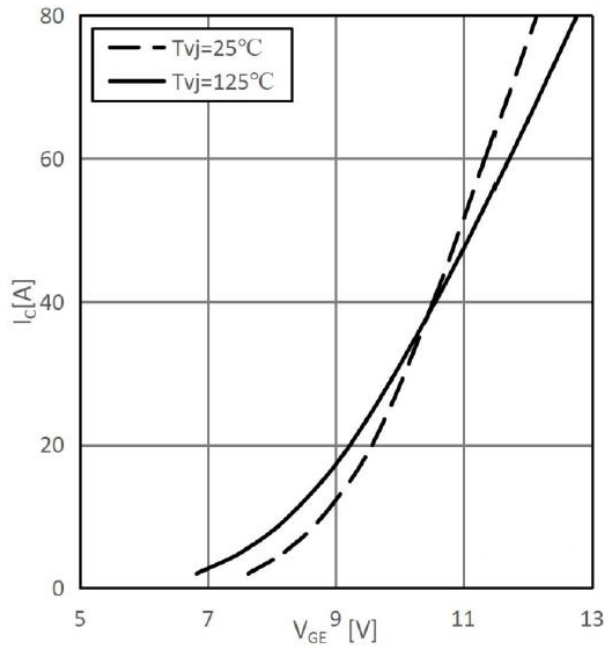


Fig. 2 Typical Transfer Characteristics at $V_{CE}=20\text{V}$

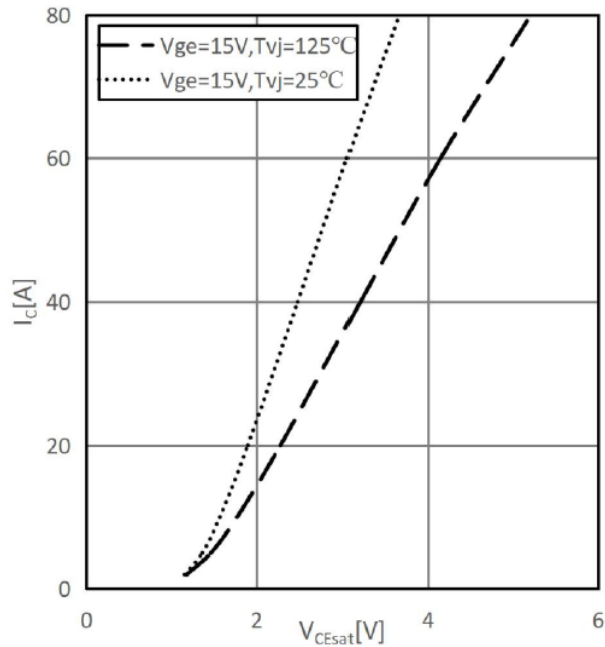


Fig. 3 Typical Transfer Characteristics at $V_{CE}=15\text{V}$

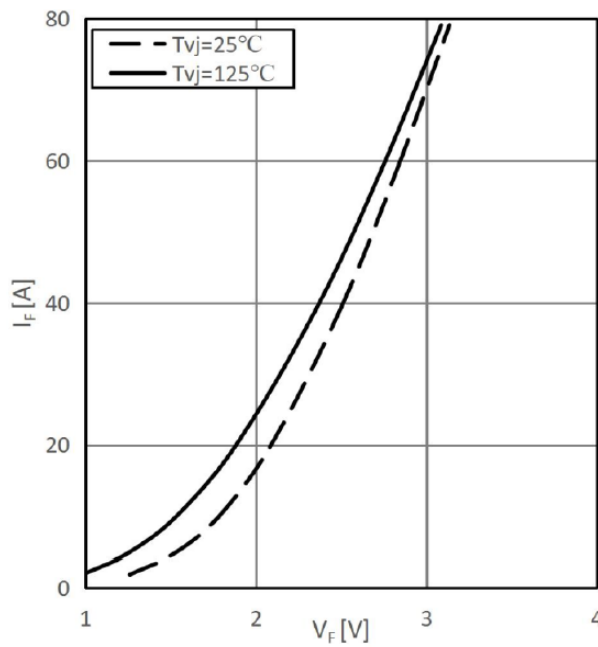
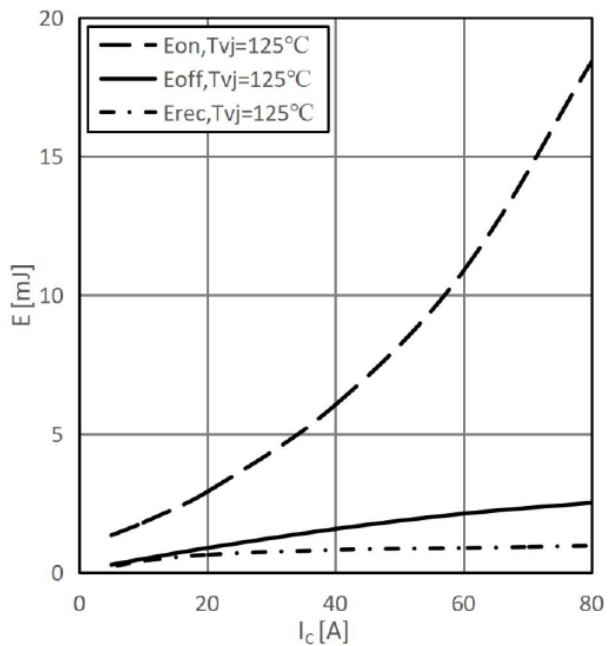
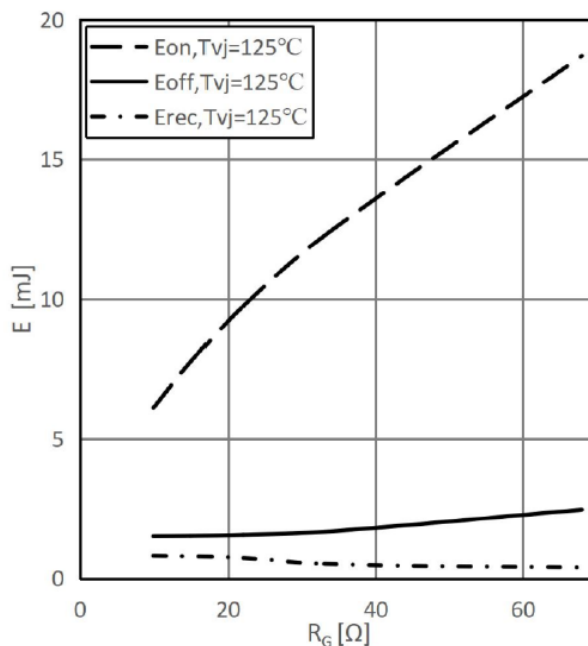


Fig. 4 Forward characteristic of Diode-Inverter



**Fig. 5 Typical Energy Loss vs. I_c at $T_c=125^\circ\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=15\text{V}$, $I_F=40\text{A}$**



**Fig. 6 Typical Switching Time vs. R_g at $T_c=125^\circ\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=15\text{V}$, $I_F=40\text{A}$**

Package Information

TO-247



SYMBOL	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
A2	1.85	2.00	2.15
b	1.11	----	1.36
b2	1.91	----	2.25
b4	2.91	----	3.25
c	0.51	----	0.75
D	20.80	21.00	21.30
E	15.50	15.80	16.10
E2	4.40	5.00	5.20
e	5.44 BSC		
L	19.72	19.92	20.22
L1	----	----	4.30
Q	5.60	5.80	6.00