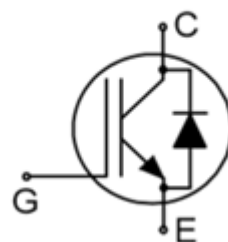


Trench Field-Stop Technology IGBT

Features

- 1200V, 40A
- $V_{CE(sat)}(typ.) = 2.0V @ V_{GE}=15V, I_C=40A$
- 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	$V_{CE(sat)}, T_{vj}=25^{\circ}C$	T_{vjmax}	Marking	Package
XD040Q120AT1S3	1200V	40A	2.0V	150 $^{\circ}C$	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 ($T_C=25^{\circ}C$)	80	A
	Continuous Collector Current ($T_C=100^{\circ}C$)	40	A
I_{CM}	Pulsed Collector Current (Note 1)	160	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	μs
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 150	$^{\circ}C$

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°C unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV _{CES}	Collector-Emitter Breakdown Voltage	V _{GE} =0V, I _C =500uA	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	---	---	600	nA
	Gate Leakage Current, Reverse	V _{GE} =-20V, V _{CE} =0V	---	---	-600	nA
V _{GE(th)}	Gate Threshold Voltage	V _{GE} =V _{CE} , I _C =1mA	4.9	5.9	6.9	V
V _{CE(sat)}	Collector-Emitter Saturation Voltage	V _{GE} =15V, I _C =40A	---	2.0	---	V
t _{d(on)}	Turn-on Delay Time	V _{CC} =600V V _{GE} =±15V I _C =40A R _G =12Ω Inductive Load T _C =25°C	---	24	---	ns
t _r	Turn-on Rise Time		---	58	---	ns
t _{d(off)}	Turn-off Delay Time		---	168	---	ns
t _f	Turn-off Fall Time		---	177	---	ns
E _{on}	Turn-on Switching Loss		---	2.8	---	mJ
E _{off}	Turn-off Switching Loss		---	0.8	---	mJ
C _{ies}	Input Capacitance		---	3000	---	pF
C _{oes}	Output Capacitance	V _{CE} =25V V _{GE} =0V	---	200	---	pF
C _{res}	Reverse Transfer Capacitance	f =1MHz	---	100	---	pF

Diode Characteristics (T_C=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _F	Diode Forward Voltage	I _F =40A	---	2.2	3.2	V
I _{rr}	Diode Peak Reverse Recovery Current	V _{CE} =600V I _F =40A	---	26	---	A
Q _{rr}	Diode Reverse Recovery Charge	di _F /dt=400A/us	---	2.1	---	uC

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

Typical Characteristics

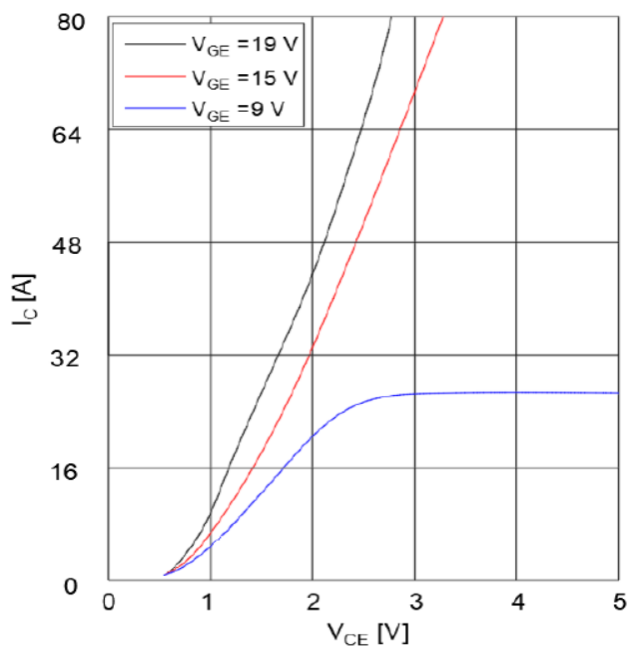


Fig. 1 Typical IGBT Output Characteristics at $T_j = 25^\circ\text{C}$

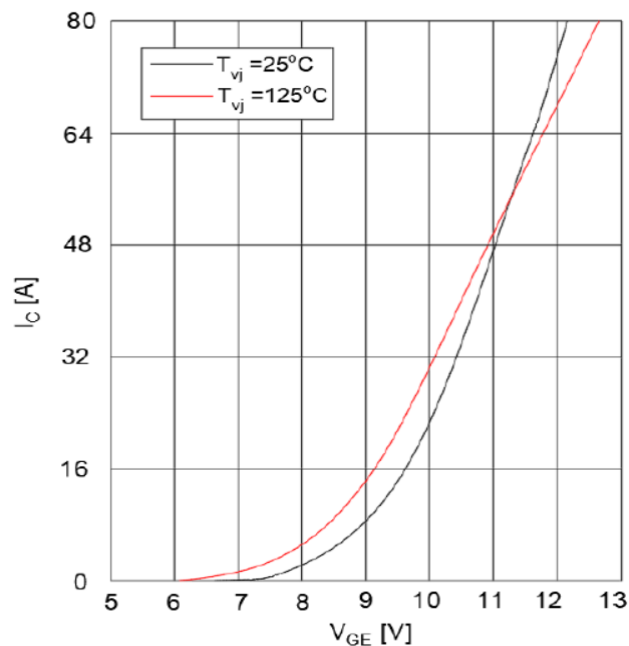


Fig. 2 Typical Transfer Characteristics at $V_{CE} = 20\text{V}$

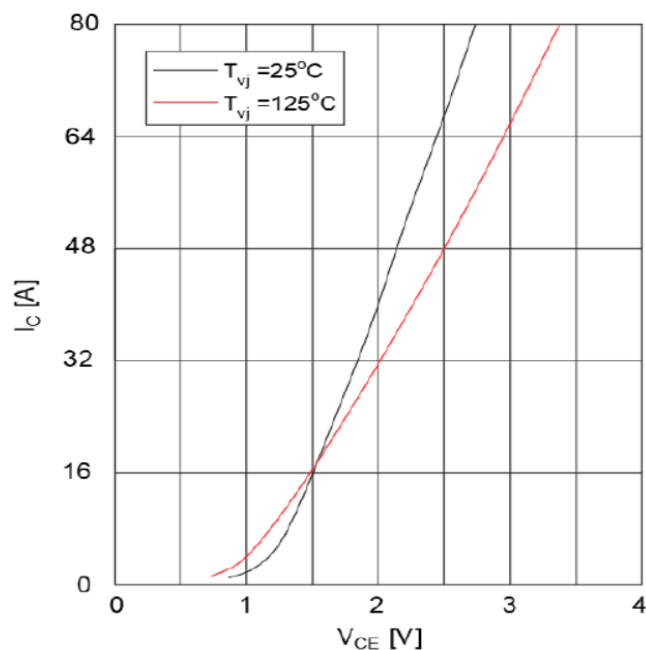


Fig. 3 Typical Transfer Characteristics at $V_{CE} = 15\text{V}$

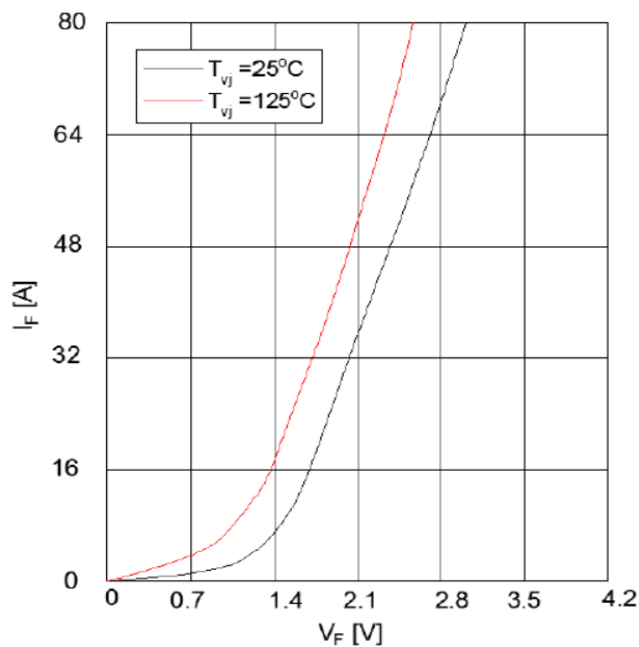


Fig. 4 Forward characteristic of Diode-Inverter

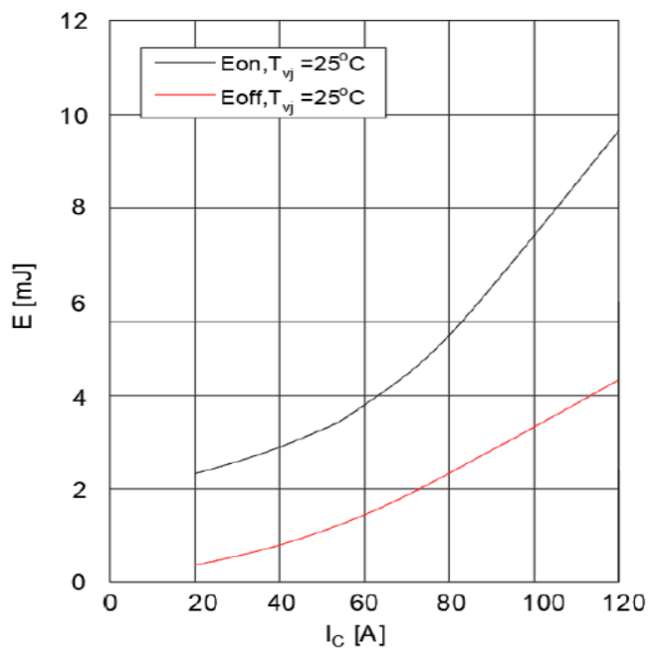


Fig. 5 Typical Energy Loss vs. I_c at $T_c=25^\circ\text{C}$,
 $V_{ce}=600\text{V}$, $V_{ge}=15\text{V}$, $R_g=12\Omega$

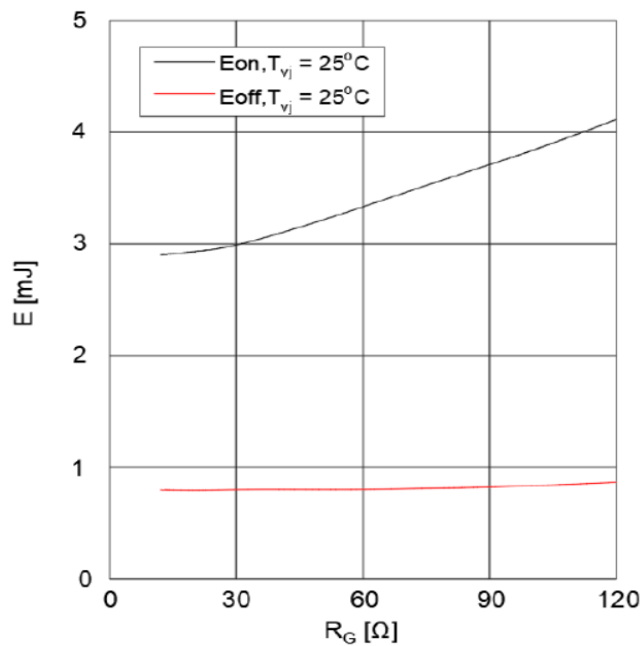


Fig. 6 Typical Switching Time vs. R_g at $T_c=25^\circ\text{C}$,
 $V_{ce}=600\text{V}$, $V_{ge}=15\text{V}$, $I_c=40\text{A}$

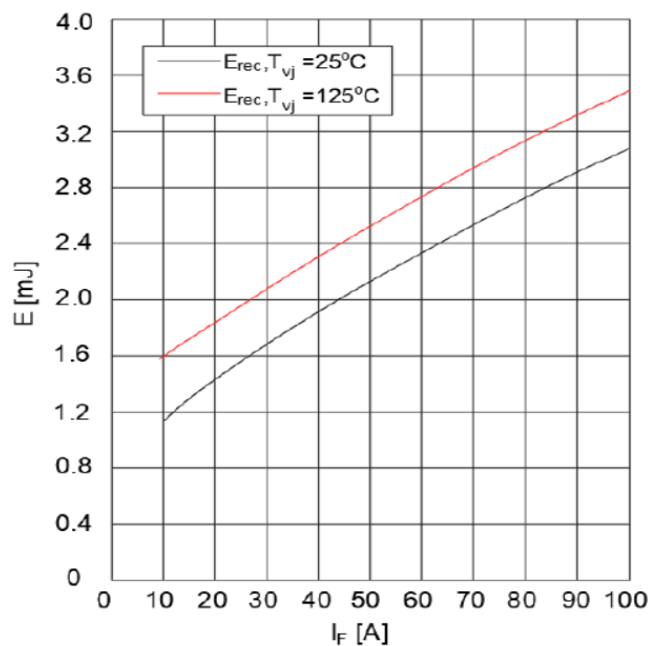


Fig. 7 Typical Diode Energy Loss vs. I_c at $V_{cc}=600\text{V}$
and $R_g=12\Omega$

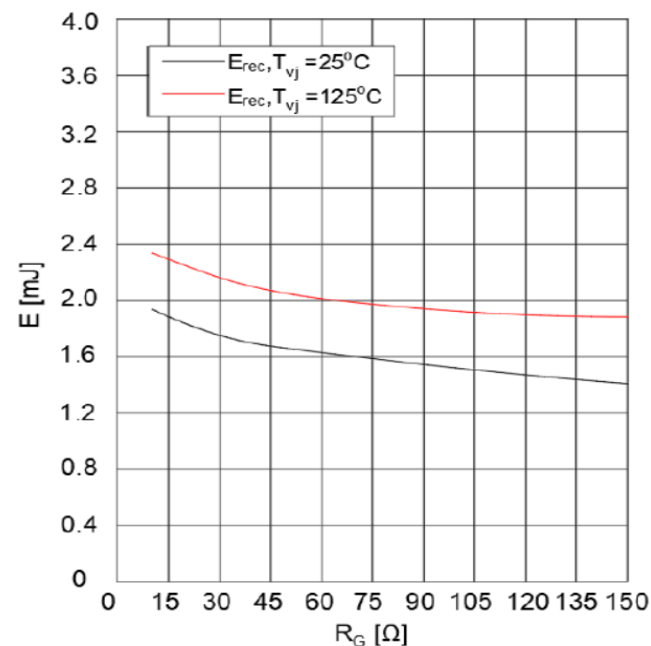
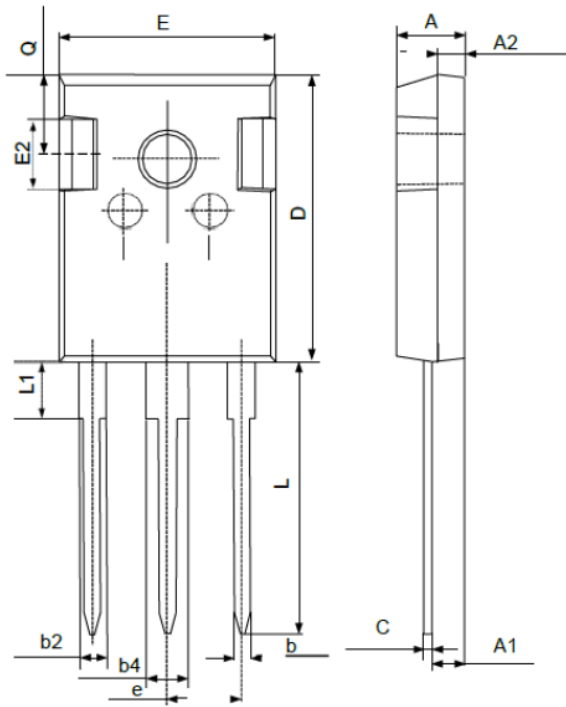


Fig. 8 Typical Diode Energy Loss vs. R_g at
 $V_{cc}=600\text{V}$ and $I_F=40\text{A}$

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