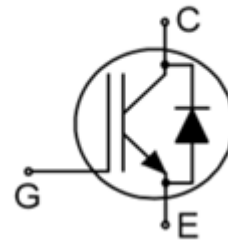


## Trench Field-Stop Technology IGBT

### Features

- 1200V, 10A
- $V_{CE(sat)(typ.)} = 1.7V @ V_{GE} = 15V, I_C = 10A$
- 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
XD010H120AY1H3	1200V	10A	1.7V	175 $^{\circ}C$	D10H120AY1	TO220F-3L

### Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-Emitter Voltage	1200	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	V
$I_C$	Continuous Collector Current ( $T_C=25^{\circ}C$ )	20	A
	Continuous Collector Current ( $T_C=100^{\circ}C$ )	10	A
$I_{CM}$	Pulsed Collector Current (Note 1)	40	A
$I_F$	Diode Continuous Forward Current ( $T_C=100^{\circ}C$ )	10	A
$I_{FM}$	Diode Maximum Forward Current (Note 1)	40	A
$t_{sc}$	Short Circuit Withstand Time	10	us
$P_D$	Maximum Power Dissipation ( $T_C=25^{\circ}C$ )	88	W
	Maximum Power Dissipation ( $T_C=100^{\circ}C$ )	44	W
$T_J$	Operating Junction Temperature Range	-40 to 175	$^{\circ}C$
$T_{STG}$	Storage Temperature Range	-55 to 150	$^{\circ}C$

### Thermal Data

Symbol	Parameter	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case for IGBT	1.7	$^{\circ}C/W$
$R_{\theta JCD}$	Thermal Resistance, Junction to Case for Diode	2.3	$^{\circ}C/W$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	40	$^{\circ}C/W$

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

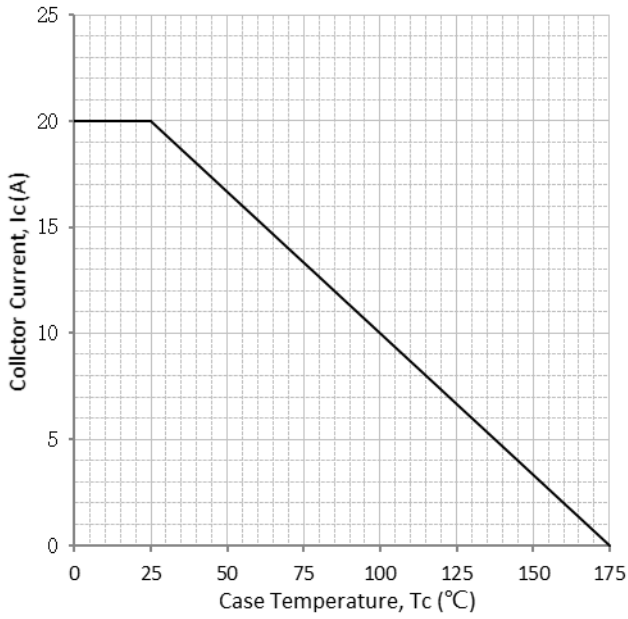
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$BV_{CES}$	Collector-Emitter Breakdown Voltage	$V_{GE}=0V, I_C=250\mu A$	1200	---	---	V
$I_{CES}$	Collector-Emitter Leakage Current	$V_{CE}=1200V, V_{GE}=0V$	---	---	1	mA
$I_{GES}$	Gate Leakage Current, Forward	$V_{GE}=20V, V_{CE}=0V$	---	---	200	nA
	Gate Leakage Current, Reverse	$V_{GE}=-20V, V_{CE}=0V$	---	---	-200	nA
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE}=V_{CE}, I_C=250\mu A$	5.2	---	6.8	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15V, I_C=10A$	---	1.7	2.1	V
$Q_G$	Total Gate Charge	$V_{CC}=960V$	---	29.4	---	nC
$Q_{GE}$	Gate-Emitter Charge	$V_{GE}=15V$	---	8.34	---	nC
$Q_{GC}$	Gate-Collector Charge	$I_C=10A$	---	14.6	---	nC
$t_{d(on)}$	Turn-on Delay Time	$V_{CC}=600V$ $V_{GE}=\pm 15V$ $I_C=10A$ $R_G=12\Omega$ Inductive Load $T_c=25^\circ\text{C}$	---	6	---	ns
$t_r$	Turn-on Rise Time		---	24	---	ns
$t_{d(off)}$	Turn-off Delay Time		---	71	---	ns
$t_f$	Turn-off Fall Time		---	419	---	ns
$E_{on}$	Turn-on Switching Loss		---	0.23	---	mJ
$E_{off}$	Turn-off Switching Loss		---	0.98	---	mJ
$E_{ts}$	Total Switching Loss		---	1.21	---	mJ
$C_{ies}$	Input Capacitance	$V_{CE}=25V$	---	740	---	pF
$C_{oes}$	Output Capacitance	$V_{GE}=0V$	---	45	---	pF
$C_{res}$	Reverse Transfer Capacitance	$f=1\text{MHz}$	---	14	---	pF

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

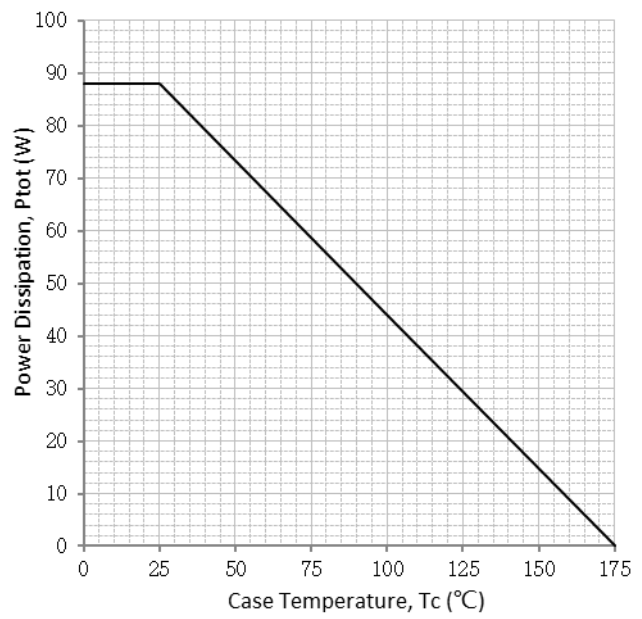
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_F$	Diode Forward Voltage	$I_F=10A$	---	1.8	2.2	V
$t_{rr}$	Diode Reverse Recovery Time	$V_{CE}=600V$ $I_F=10A$ $di_F/dt=300A/\mu s$	---	278	---	ns
$I_{rr}$	Diode Peak Reverse Recovery Current		---	7.7	---	A
$Q_{rr}$	Diode Reverse Recovery Charge		---	1	---	$\mu\text{C}$

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

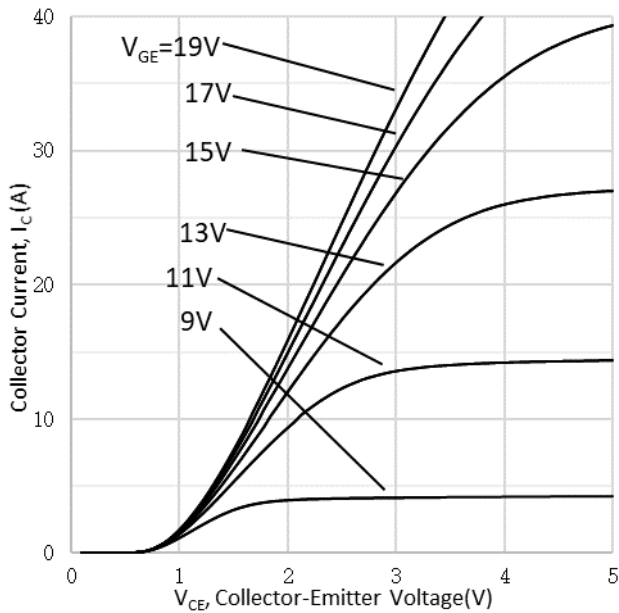
## Typical Characteristics



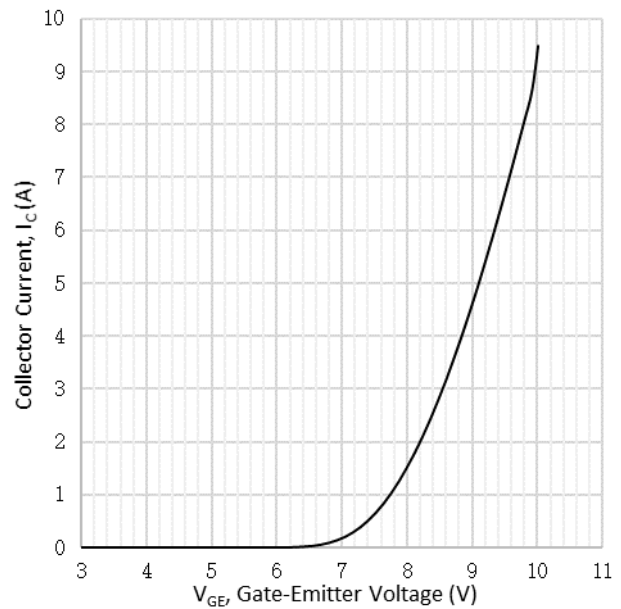
**Fig. 1 Maximum DC Collector Current vs. Case Temperature**



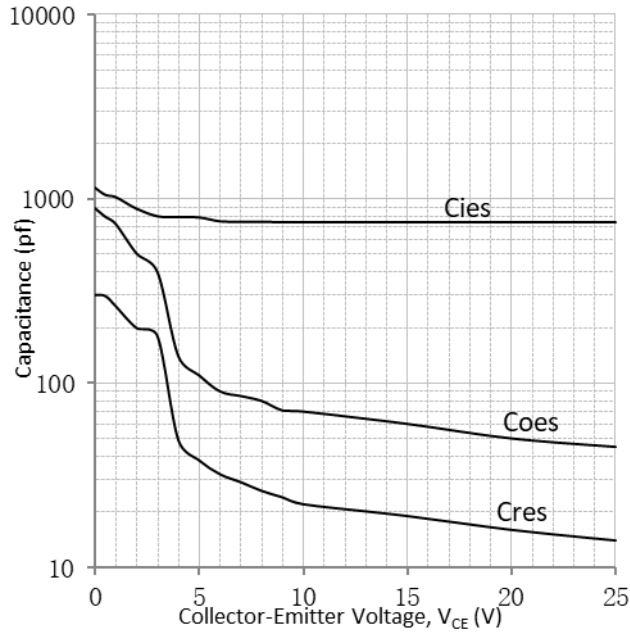
**Fig. 2 Power Dissipation vs. Case Temperature**



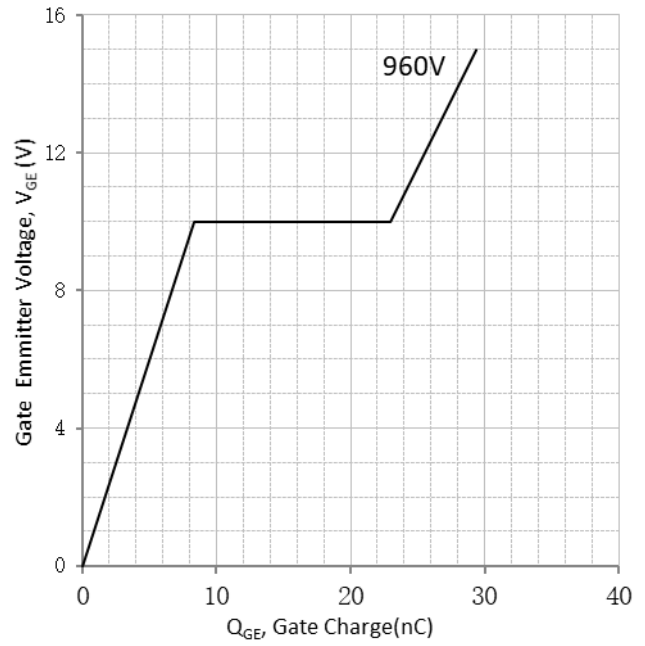
**Fig. 3 Typical IGBT Output Characteristics at  $T_J=25^\circ\text{C}$**



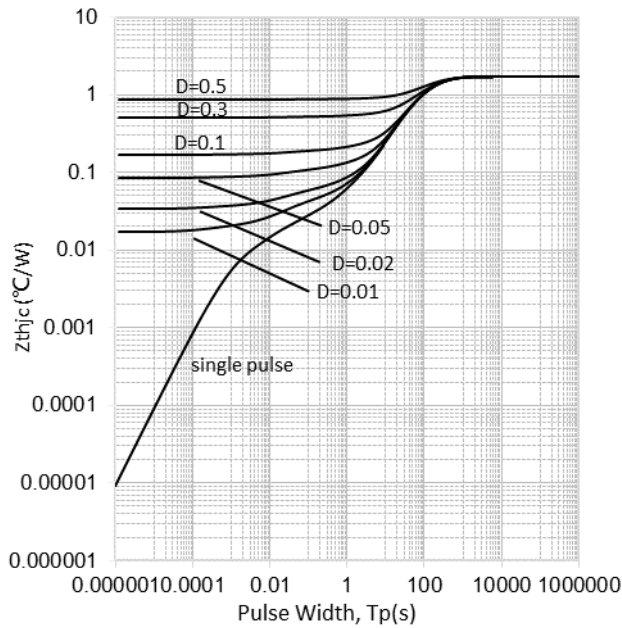
**Fig. 4 Typical Transfer Characteristics at  $V_{CE}=20\text{V}$**



**Fig. 5 Typical Capacitance vs.  $V_{CE}$  at  $V_{GE}=0V$  and  $f=1MHz$**



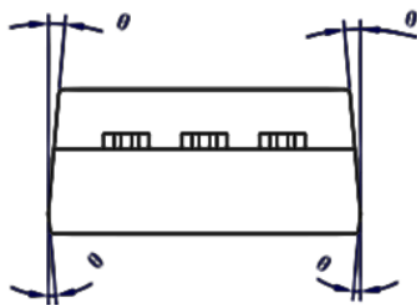
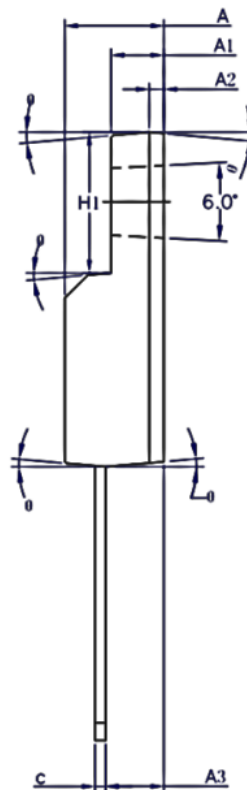
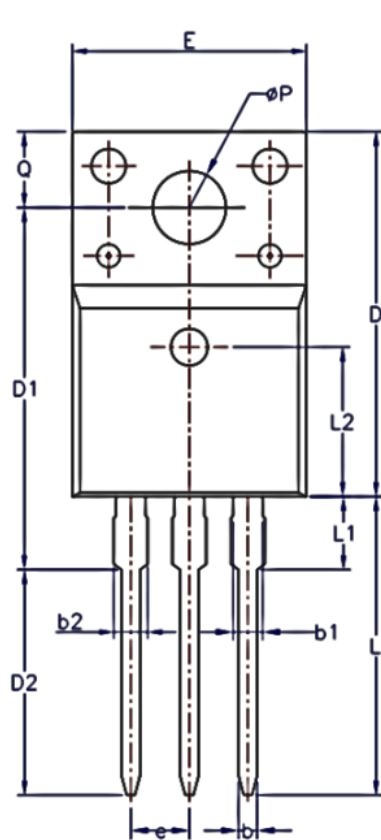
**Fig. 6 Typical Gate Charge vs.  $V_{GE}$  at  $I_C=10A$**



**Fig. 7 IGBT Transient Thermal Resistance**  
( $D=t_p / T$ )

### Package Information

TO-220F-3L



SYMBOL	MIN	NOM	MAX
A	4.50	4.70	4.83
A1	2.34	2.54	2.74
A2	0.70 REF		
A3	2.56	2.76	2.93
b	0.70	-	0.90
b1	1.18	-	1.38
b2	-	-	1.47
c	0.45	0.50	0.60
D	15.67	15.87	16.07
D1	15.55	15.75	15.95
D2	9.60	9.80	10.0
E	9.96	10.16	10.36
e	2.54BSC		
H1	6.48	6.68	6.88
L	12.68	12.98	13.28
L1	-	-	3.50
L2	6.50REF		
øP	3.08	3.18	3.28
Q	3.20	-	3.40
θ1	1°	3°	5°