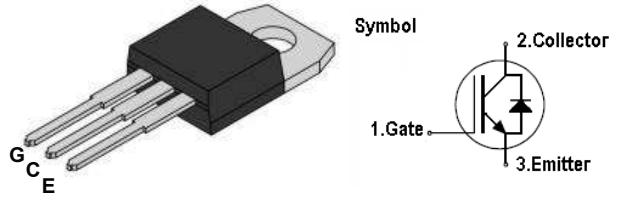


## IGBT in TO-220

### Features

- 650V 20A,  $V_{CE(sat)}(typ.) = 1.70 V@20A$
- Field Stop IGBT Technology
- 10 $\mu$ s Short Circuit Capability
- Square RBSOA
- Positive VCE (on) Temperature Coefficient



### Mechanical Data

- **Case:** TO-220 (plastic package).  
Lead free; RoHS compliant
- **Molding Compound Flammability Rating:**  
UL 94 V-0
- **Terminals:** High temperature soldering guaranteed:  
260 °C/10 sec. at terminals

### Benefits

- High Efficiency for Motor Control
- Rugged Performance
- Excellent Current Sharing in Parallel Operation

### Applications

CREATEK's IGBTs offer lower losses and higher energy for application such as motor drive ,UPS, inverter and other soft switching applications.

### Absolute Maximum Ratings

Symbol	Parameter	Value	Units
$V_{CES}$	Collector-Emitter Voltage	650	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 30$	V
$I_C$	Continuous Collector Current ( $T_C=25^\circ C$ )	40	A
	Continuous Collector Current ( $T_C=100^\circ C$ )	20	A
$I_{CM}$	Pulsed Collector Current (Note 1)	80	A
$I_F$	Diode Continuous Forward Current ( $T_C=100^\circ C$ )	20	A
$I_{FM}$	Diode Maximum Forward Current (Note 1)	80	A
$t_{sc}$	Short Circuit Withstand Time	10	us
$I_{SC}$	Short Circuit Current	150	A
$P_D$	Maximum Power Dissipation ( $T_C=25^\circ C$ )	178	W
$P_D$	Maximum Power Dissipation ( $T_C=100^\circ C$ )	71	W
$T_J$	Operating Junction Temperature Range	-55 to +150	$^\circ C$
$T_{STG}$	Storage Temperature Range	-55 to +150	$^\circ C$

### Thermal Characteristics

Symbol	Parameter	Max.	Units
$R_{thj-c}$	Thermal Resistance, Junction to case for IGBT	0.7	$^\circ C/W$
$R_{thj-c}$	Thermal Resistance, Junction to case for Diode	1.5	$^\circ C/W$
$R_{thj-a}$	Thermal Resistance, Junction to Ambient	80	$^\circ C/W$

**Electrical Characteristics** (TC=25°C unless otherwise noted )

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$BV_{CES}$	Collector-Emitter Breakdown Voltage	$V_{GE} = 0V, I_C = 250\mu A$	650	-	-	V
$I_{CES}$	Collector-Emitter Leakage Current	$V_{CE} = 650V, V_{GE} = 0V$	-	-	250	$\mu A$
$I_{GES}$	Gate Leakage Current, Forward	$V_{GE} = 30V, V_{CE} = 0V$	-	-	100	nA
	Gate Leakage Current, Reverse	$V_{GE} = -30V, V_{CE} = 0V$	-	-	-100	nA
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE} = V_{CE}, I_C = 250\mu A$	4.0	-	5.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE} = 15V, I_C = 20A$	-	1.70		V
$Q_g$	Total Gate Charge	$V_{CC} = 480V$ $V_{GE} = 15V$ $I_C = 20A$	-	79		nC
$Q_{ge}$	Gate-Emitter Charge		-	11		nC
$Q_{gc}$	Gate-Collector Charge		-	43		nC
$t_{d(on)}$	Turn-on Delay Time	$V_{CC} = 400V$ $V_{GE} = 15V$ $I_C = 20A$ $R_G = 10\Omega$ Inductive Load $T_C = 25^\circ C$	-	16	-	ns
$t_r$	Turn-on Rise Time		-	27	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	113	-	ns
$t_f$	Turn-off Fall Time		-	26	-	ns
$E_{on}$	Turn-on Switching Loss		-	0.49	-	mJ
$E_{off}$	Turn-off Switching Loss		-	0.31	-	mJ
$C_{ies}$	Input Capacitance	$V_{CE} = 25V$	-	980	-	pF
$C_{oes}$	Output Capacitance	$V_{GE} = 0V$	-	130	-	pF
$C_{res}$	Reverse Transfer Capacitance	$f = 1MHz$	-	60	-	pF
$R_{Gint}$	Integrated gate resistor	$f = 1MHz; V_{pp} = 1V$		2.30		$\Omega$

**Electrical Characteristics of Diode** (TC=25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_F$	Diode Forward Voltage	$I_F = 20A$	-	2.3		V
$t_{rr}$	Diode Reverse Recovery Time	$V_{CE} = 400V, I_F = 20A$ $dI/dt = 500A/\mu s$	-	42		ns
$I_{rrm}$	Diode peak Reverse Recovery Current		-	7.6		A
$Q_{rr}$	Diode Reverse Recovery Charge		-	186		nC

**Notes:**

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

**Typical Characteristics**

Fig 1. DC Collector current as a function of case temperature ( $V_{GE} \geq 15V$ ,  $T_j \leq 150^\circ C$ )

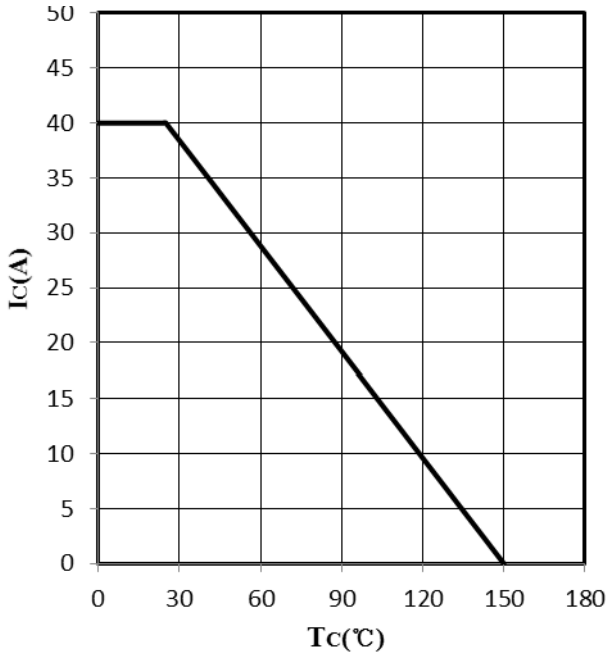


Fig 2. Power dissipation as a function of case temperature ( $T_j \leq 150^\circ C$ )

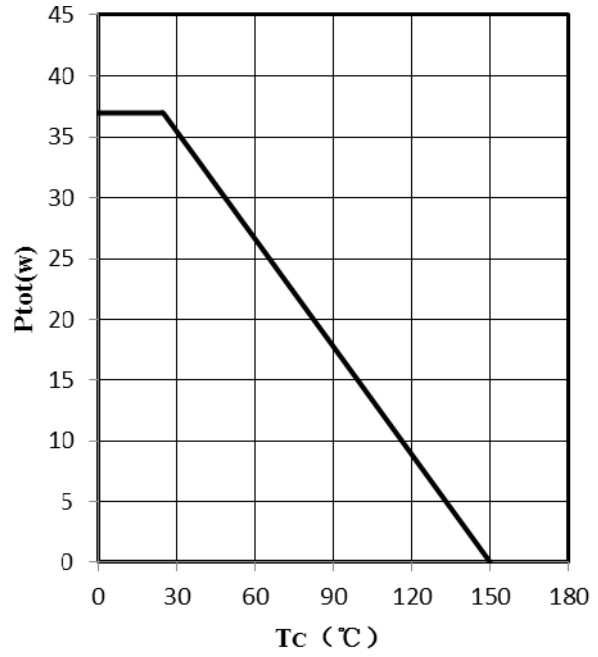


Fig 3. IGBT Forward safe operation area

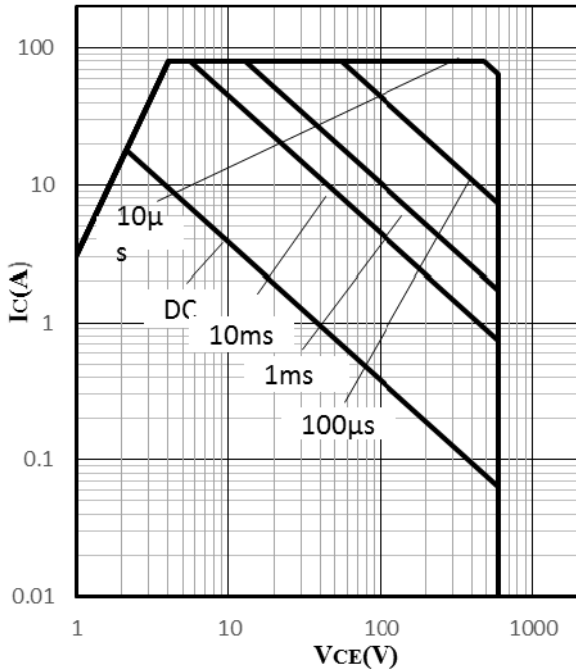
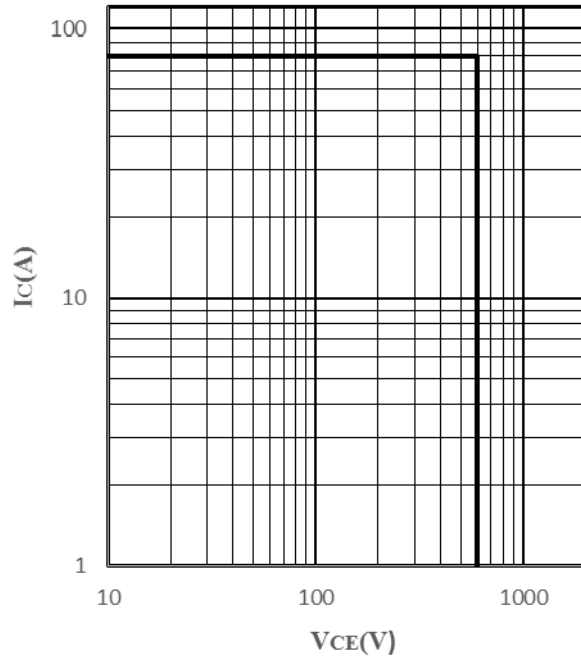


Fig 4. IGBT Reverse safe operation area



**Typical Characteristics**

Fig 5. Typical output characteristic ( $T_j=25^\circ\text{C}$ )

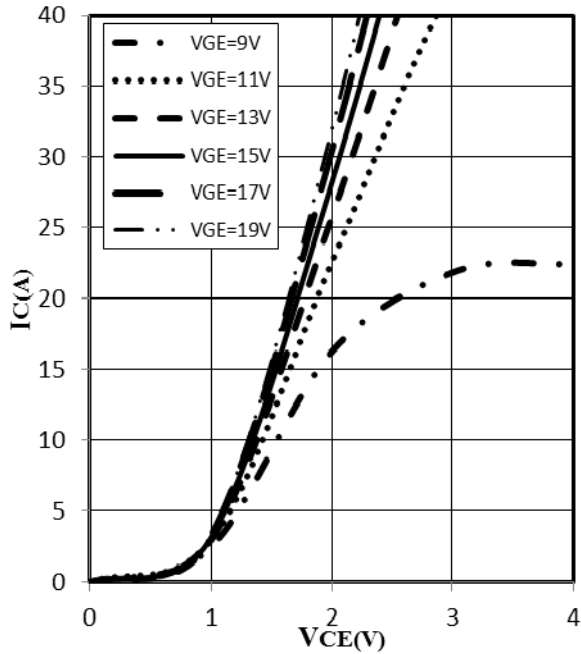


Fig 6. Typical output characteristic ( $T_j=125^\circ\text{C}$ )

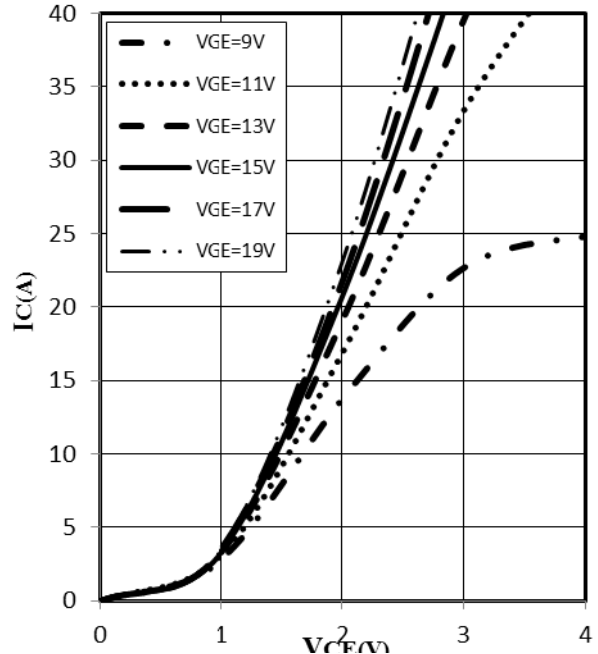


Fig 7. Typical transfer characteristic ( $V_{ce}=20\text{V}$ )

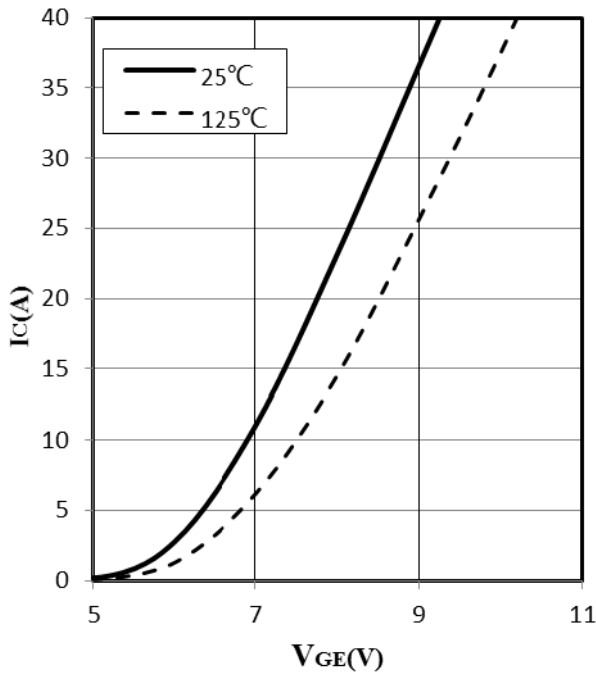
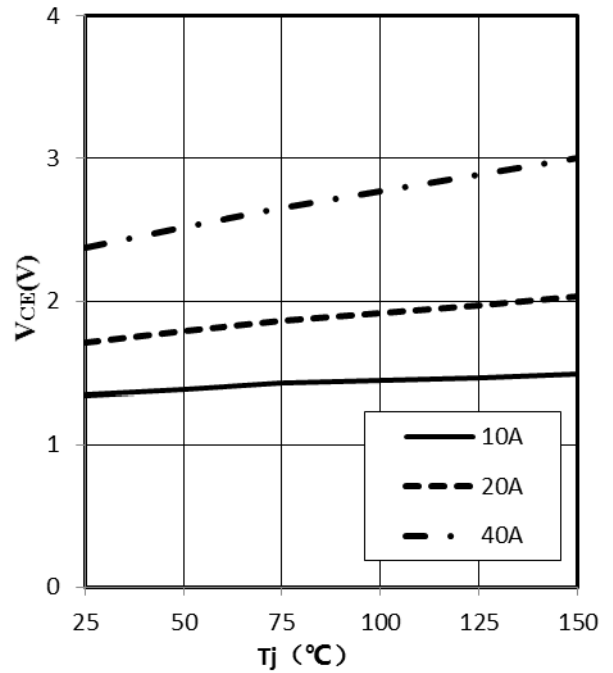


Fig 8. Typical collector-emitter saturation voltage as a function of junction temperature ( $V_{ge}=15\text{V}$ )



**Typical Characteristics**

Fig 9. Typical collector-emitter saturation voltage as a function of  $V_{GE}$  ( $T_j=25^\circ\text{C}$ )

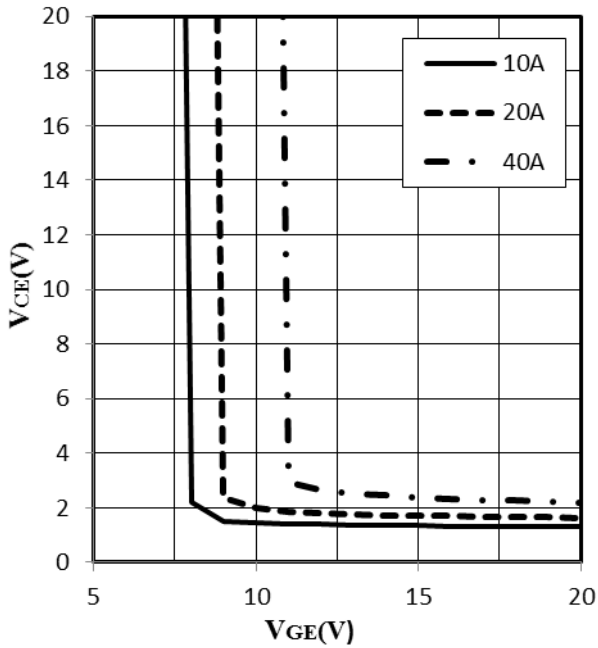


Fig 10. Typical collector-emitter saturation voltage as a function of  $V_{GE}$  ( $T_j=125^\circ\text{C}$ )

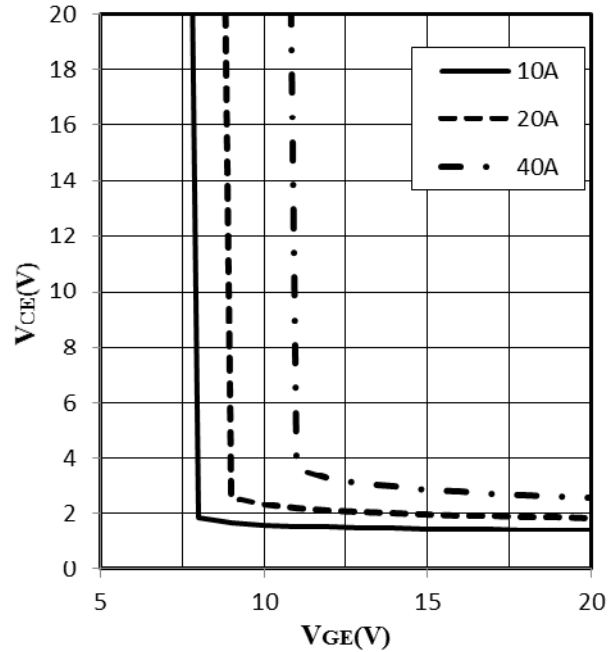


Fig 11. Typical switch energy as a function of  $I_c$  (inductive load,  $T_j=25^\circ\text{C}$ ,  $V_{CE}=400\text{V}$ ,  $V_{GE}=15\text{V}$ ,  $R_G=10\Omega$ )

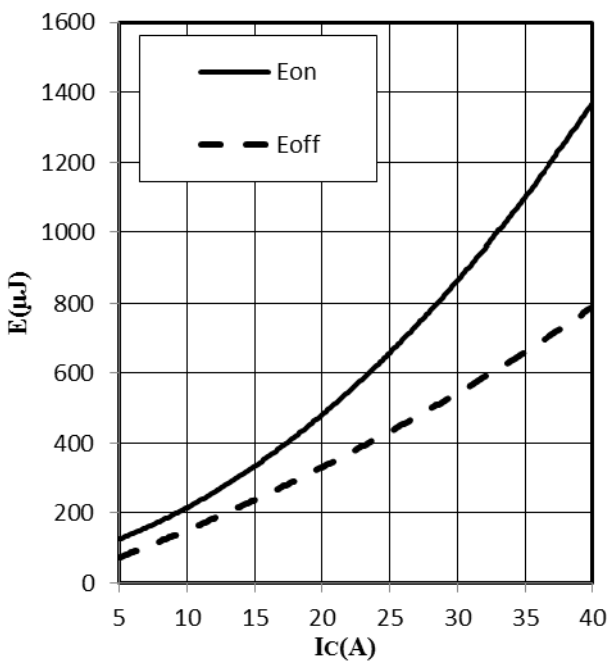
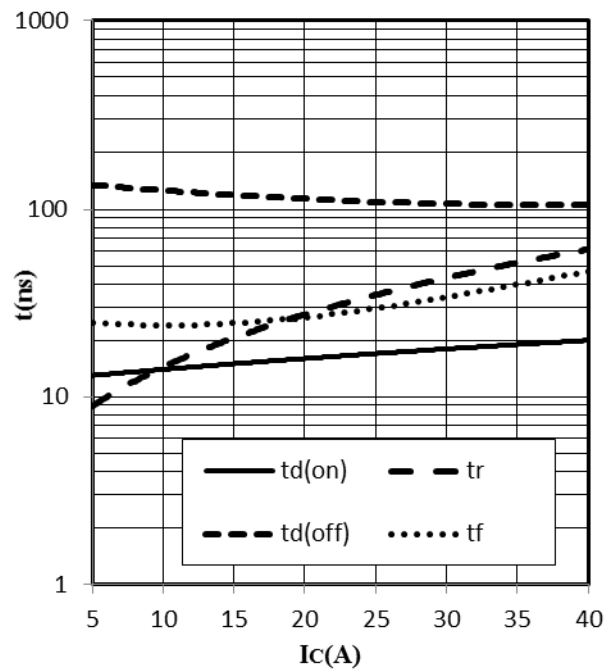


Fig 12. Typical switch time as a function of  $I_c$  (inductive load,  $T_j=25^\circ\text{C}$ ,  $V_{CE}=400\text{V}$ ,  $V_{GE}=15\text{V}$ ,  $R_G=10\Omega$ )



**Typical Characteristics**

Fig 13. Typical switch energy as a function of  $R_G$   
(inductive load,  $T_j=25^\circ\text{C}$ ,  $V_{CE}=400\text{V}$ ,  $V_{GE}=15\text{V}$ ,  $I_c=20\text{A}$ )

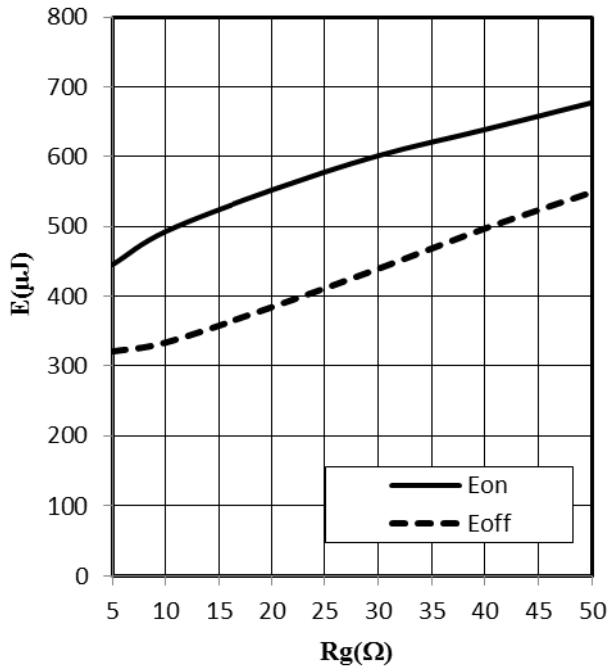


Fig 14. Typical switch time as a function of  $R_G$   
(inductive load,  $T_j=25^\circ\text{C}$ ,  $V_{CE}=400\text{V}$ ,  $V_{GE}=15\text{V}$ ,  $I_c=20\text{A}$ )

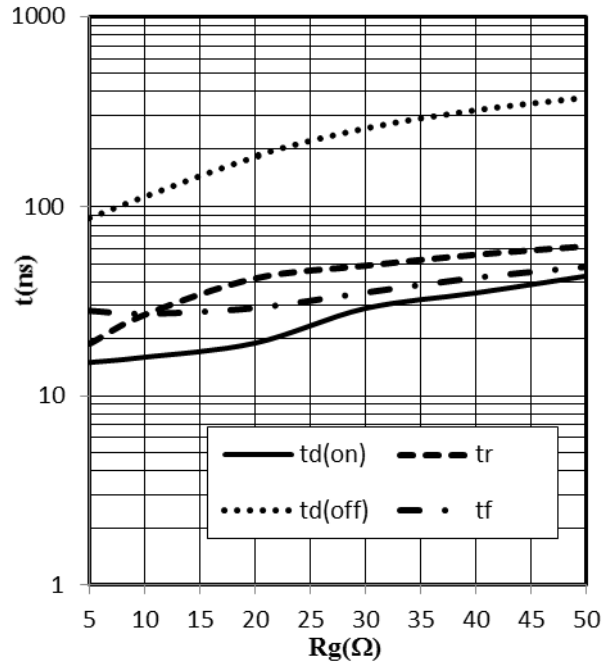


Fig 15. Typical capacitance as a function of collector-emitter voltage ( $V_{GE}=0\text{V}$ ,  $f=1\text{MHz}$ )

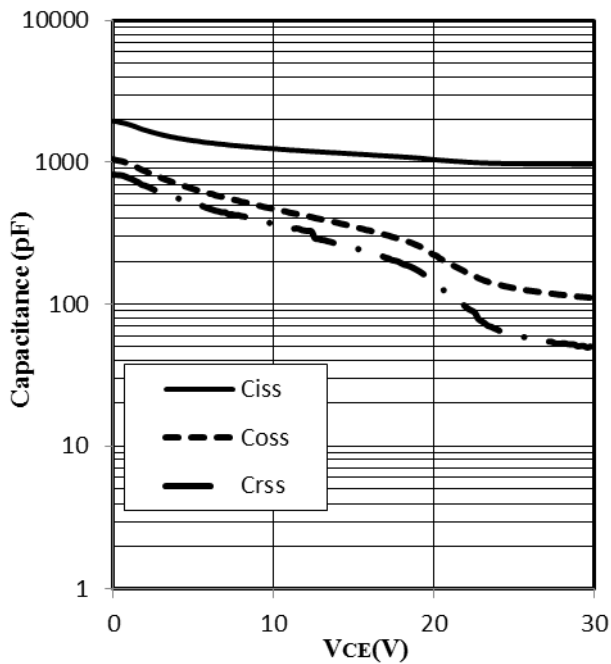
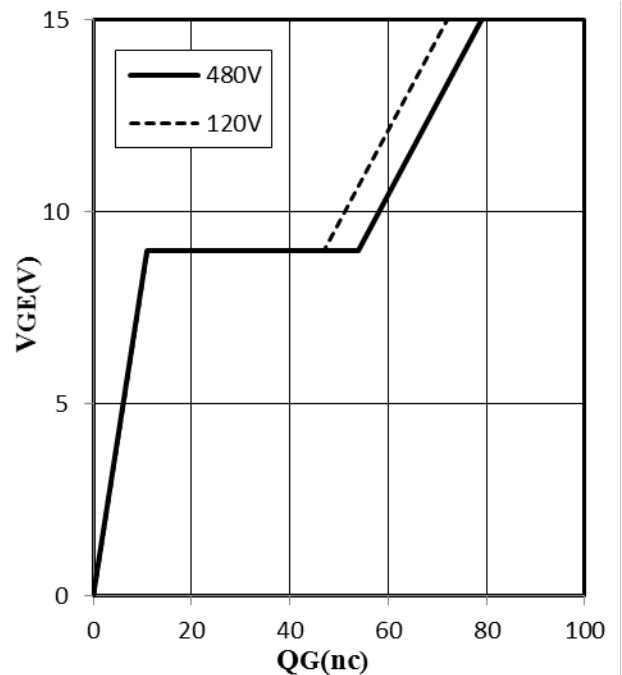


Fig 16. Typical gate charge ( $I_c=20\text{A}$ )



**Typical Characteristics**

Fig 17. Typical diode forward current as a function of forward voltage

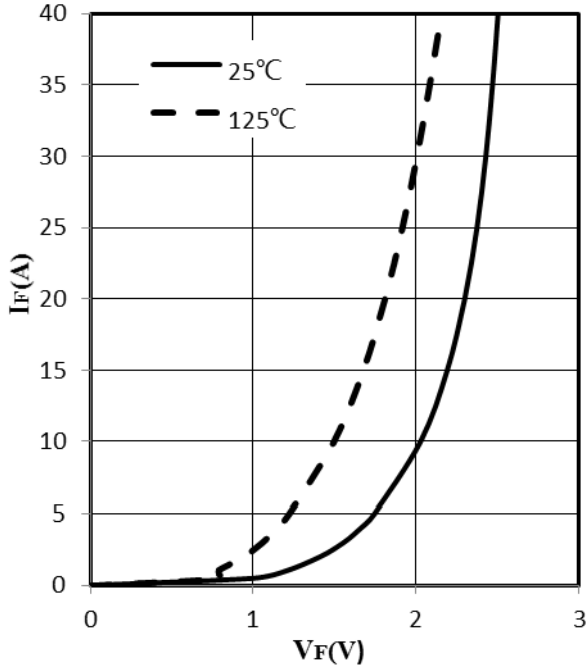


Fig 18. Typical  $t_{rr}$  as a function of  $dI_F/dt$

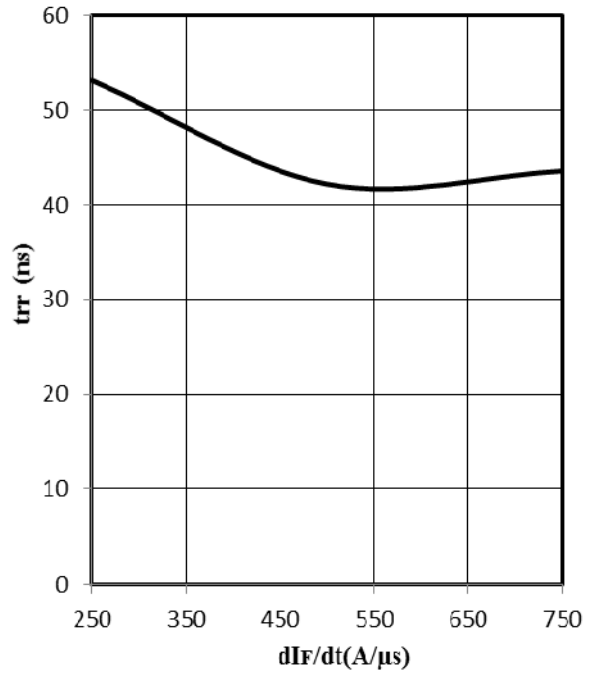


Fig 19. Typical  $I_{rrm}$  as a function of  $dI_F/dt$

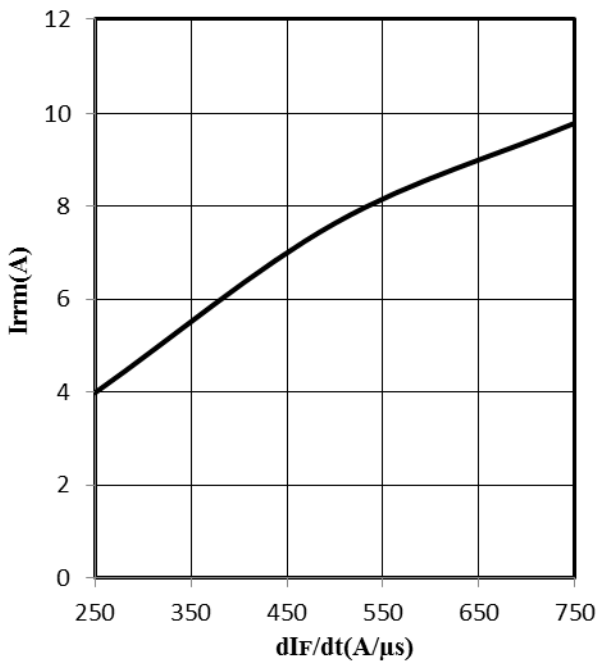
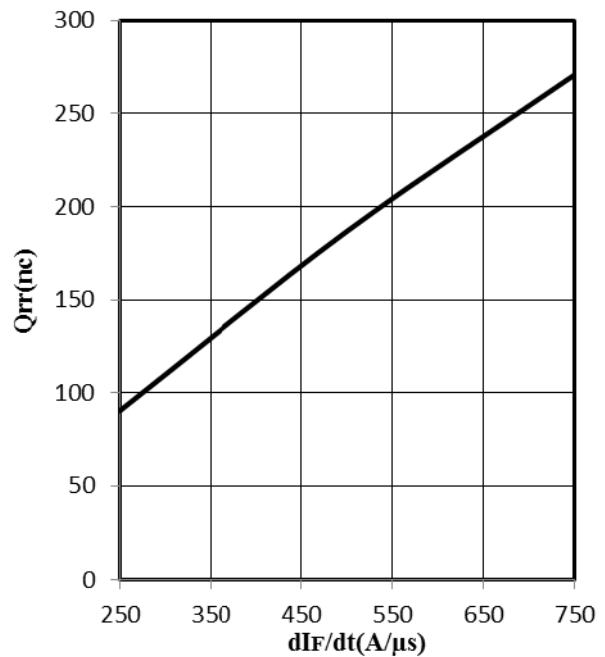
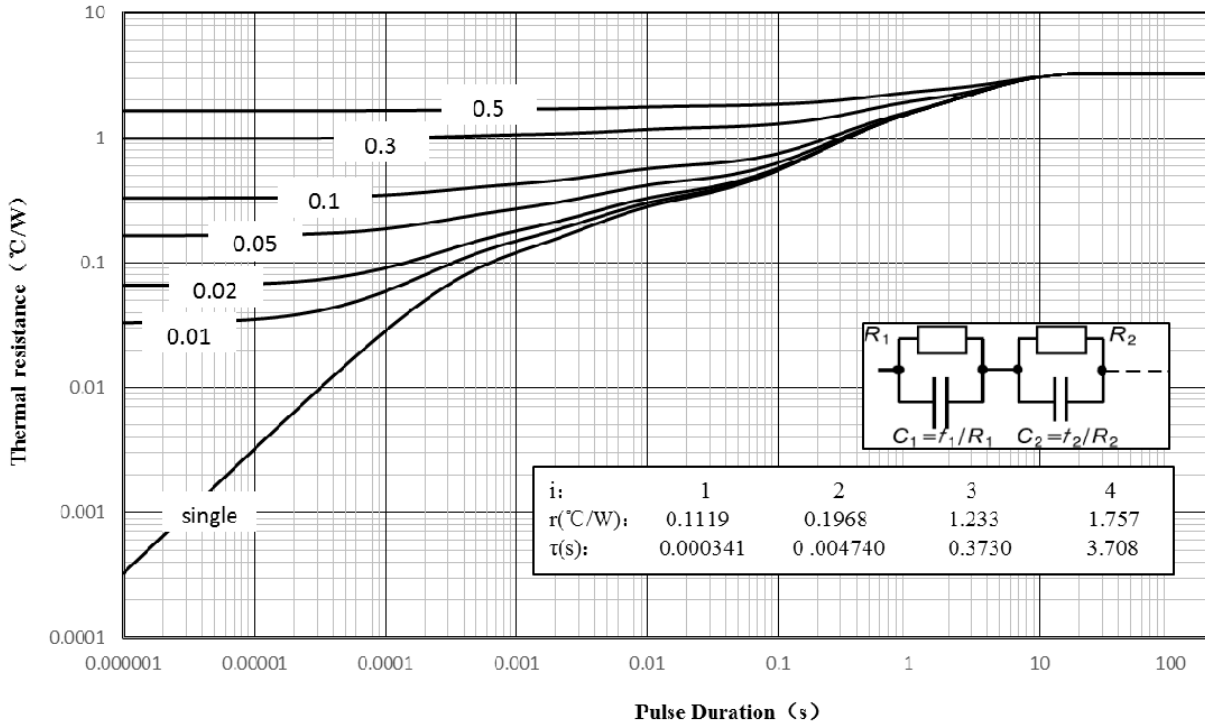


Fig 20. Typical  $Q_{rr}$  as a function of  $dI_F/dt$



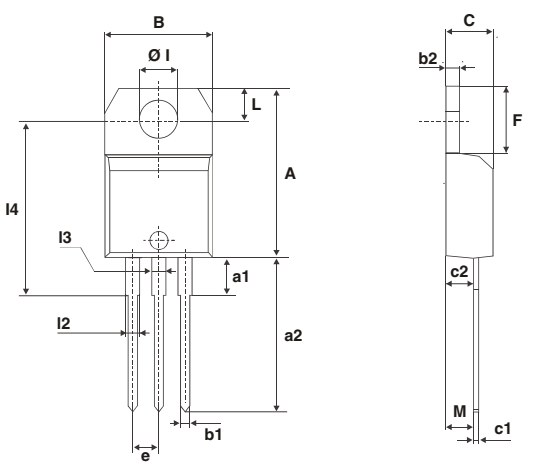
**Typical Characteristics**

Fig 21. IGBT transient thermal resistance( $D=tp/T$ )





## Package Dimensions



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	15.20		15.90	0.598		0.625
a1		3.75			0.147	
a2	13.00		14.00	0.511		0.551
B	10.00		10.40	0.393		0.409
b1	0.61		0.88	0.024		0.034
b2	1.23		1.32	0.048		0.051
C	4.40		4.60	0.173		0.181
c1	0.49		0.70	0.019		0.027
c2	2.40		2.72	0.094		0.107
e	2.40		2.70	0.094		0.106
F	6.20		6.60	0.244		0.259
ØI	3.75		3.85	0.147		0.151
I4	15.80	16.40	16.80	0.622	0.646	0.661
L	2.65		2.95	0.104		0.116
I2	1.14		1.70	0.044		0.066
I3	1.14		1.70	0.044		0.066
M		2.60			0.102	

## Ordering information

Order code	Package	Packaging option	Base quantity	Packaging specification
CXG20N65PS	TO-220	Tube/BOX	2000pcs / BOX	EIA STD RS-481

## Revision history

Date	Revision	Changes
23-May-2012	1.0	Initial release

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