

### Description

The DFI300HF12DF1 offer ultrafast switching speed for high frequency application.



### Features

- 1200V300 A,  $V_{CE(sat)}(typ.) = 2.30V$
- Lower losses, higher system efficiency
- Excellent short circuit ruggedness
- 62mm half bridge module

### Applications

- Welder
- Inverter
- Power supply
- Inductive heating
- UPS EPS

### Circuit diagram

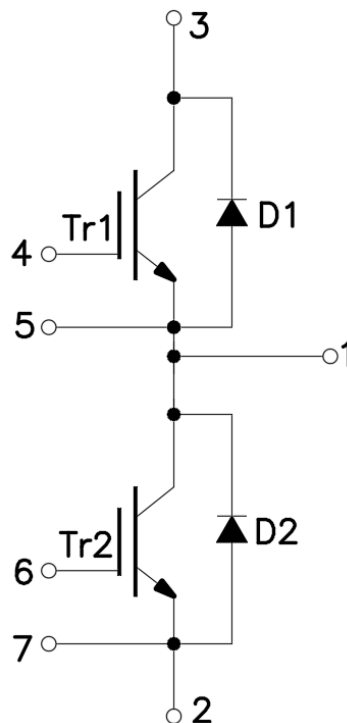


Figure 1. Out drawing & circuit diagram for DFI300HF12DF1

### Pin Configuration and Marking Information

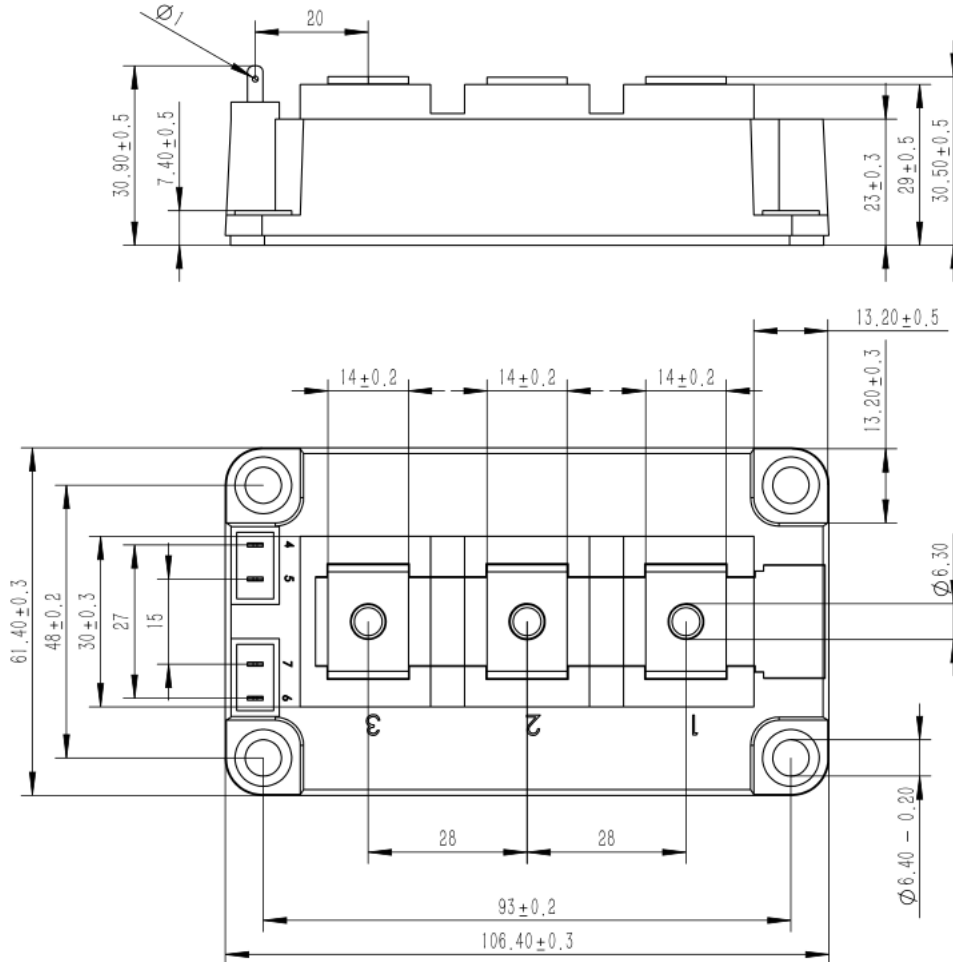


Figure 2. Pin configuration

### Module

Parameter	Conditions	Value	Unit
Isolation Voltage	RMS, f = 50Hz, t = 1min	2.5	KV
Material of module baseplate	-	Cu	-
Creepage distance	terminal to heatsink terminal to terminal	47 26	mm
Clearance	terminal to heatsink terminal to terminal	29 14	mm
CTI	-	>200	-
Module lead resistance, terminals – chip	T <sub>C</sub> = 25°C	0.8	mΩ
Mounting torque for module mounting	M6	3 to 6	Nm
Weight	-	315	g

### Maximum Ratings (IGBT, $T_j=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
$V_{CES}$	Collector-Emitter Voltage	G-E Short	1200	V
$V_{GES}$	Gate-Emitter Voltage	C-E Short	$\pm 30\text{V}$	V
$I_C$	DC Continuous Collector Current	$T_C=100^{\circ}\text{C}$	300	A
$I_{CM}$	Pulse Collector Current	$t_p=1\text{ms}$ , Note1	600	A
$P_C$	Maximum Power Dissipation	$T_C=25^{\circ}\text{C}$ , $T_j=150^{\circ}\text{C}$ (IGBT)	1140	W
$T_j$	junction temperature	-	-40 to 150	$^{\circ}\text{C}$
$T_{stg}$	Storage temperature	-	-40 to 125	$^{\circ}\text{C}$

Note1: Pulse width limited by maximum junction temperature

### Maximum Ratings (Freewheeling diode, $T_j=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
$V_{RRM}$	Peak Repetitive Revers Voltage	-	1200	V
$I_F$	Diode forward Current	$T_C=100^{\circ}\text{C}$	300	A
$I_{FRM}$	Repetitive peak forward Current	$t_p=1\text{ms}$ , Note1	600	A
$T_j$	junction temperature	-	-40 to 150	$^{\circ}\text{C}$
$T_{stg}$	Storage temperature	-	-40 to 125	$^{\circ}\text{C}$

Note1: Pulse width limited by maximum junction temperature

### IGBT Electrical characteristics ( $T_j=25^{\circ}\text{C}$ unless otherwise specified, chip)

Symbol	Item	Condition	Value			Unit	
			Min.	Typ.	Max		
$V_{CE(sat)}$ (Chip)	Collector-Emitter Saturation Voltage	$I_C=300\text{A}$ $V_{GE}=15\text{V}$	$T_j=25^{\circ}\text{C}$	-	2.3	2.5	V
			$T_j=125^{\circ}\text{C}$	-	2.7	-	V
$V_{GE(th)}$	Gate-Emitter threshold Voltage	$I_C=1\text{mA}$ , $V_{CE}=V_{GE}$	4.5	-	5.7	V	
$Q_G$	Gate charge	$V_{GE}=-15\text{V}$ to $+15\text{V}$	-	2.2	-	$\mu\text{C}$	
$R_{Gint}$	Internal gate resistor	$f=1\text{M}$ , $V_{pp}=1\text{V}$	$T_j=25^{\circ}\text{C}$	-	2.5	-	$\Omega$
$C_{ies}$	Input Capacitance	$V_{CE}=25\text{V}$ , $V_{GE}=0\text{V}$ $f=1\text{MHz}$	$T_j=25^{\circ}\text{C}$	-	22.0	-	nF
$C_{oes}$	Output Capacitance			-	3.1	-	nF
$C_{res}$	Reverse transfer Capacitance			-	1.8	-	nF
$I_{CES}$	Collector- Emitter Cut off Current	$V_{CE}=1200\text{V}$ , $V_{GE}=0\text{V}$	$T_j=25^{\circ}\text{C}$	-	-	5	mA
$I_{GES}$	Gate-Emitter Leakage Current	$V_{GE}=30\text{V}$ , $V_{CE}=0\text{V}$	$T_j=25^{\circ}\text{C}$	-	-	400	nA
$t_{d(on)}$	Turn-on delay time	$V_{CC}=600\text{V}$ $I_C=300\text{A}$	$T_j=25^{\circ}\text{C}$	-	120	-	ns
			$T_j=125^{\circ}\text{C}$	-	130	-	
$t_r$	Rise time	$V_{GE}=+15\text{V}/-15\text{V}$ $R_G=3.3\Omega$	$T_j=25^{\circ}\text{C}$	-	90	-	ns
			$T_j=125^{\circ}\text{C}$	-	100	-	
$t_{d(off)}$	Turn-off delay time	Inductive load	$T_j=25^{\circ}\text{C}$	-	720	-	ns
			$T_j=125^{\circ}\text{C}$	-	780	-	

t <sub>f</sub>	Fall time	V <sub>CC</sub> = 600V	T <sub>j</sub> = 25°C	-	90	-	ns
			T <sub>j</sub> = 125°C	-	120	-	
E <sub>on</sub>	Turn-on power dissipation	I <sub>C</sub> = 300A V <sub>GE</sub> = +15V/-15V	T <sub>j</sub> = 25°C	-	10.5	-	mJ
			T <sub>j</sub> = 125°C	-	13.5	-	
E <sub>off</sub>	Turn-off power dissipation	R <sub>G</sub> = 3.3Ω Inductive load	T <sub>j</sub> = 25°C	-	19.5	-	mJ
			T <sub>j</sub> = 125°C	-	23.0	-	
R <sub>th(j-c)</sub>	Thermal Resistance, Junction to Case (IGBT)		-	-	-	0.110	°C/W

### Freewheeling Diode Electrical characteristics (T<sub>j</sub> = 25°C unless otherwise specified, chip)

Symbol	Item	Condition	Value			Unit	
			Min.	Typ.	Max		
V <sub>F</sub>	Diode Forward Voltage	I <sub>F</sub> = 300A, V <sub>GE</sub> = 0V	T <sub>j</sub> = 25°C	-	1.9	2.2	V
			T <sub>j</sub> = 125°C	-	1.9	-	
t <sub>rr</sub>	Reverse recovery time	V <sub>rr</sub> = 600V, I <sub>F</sub> = 300A di/dt = 3000A/μs	T <sub>j</sub> = 25°C	-	230	-	ns
			T <sub>j</sub> = 125°C	-	300	-	
I <sub>rr</sub>	Peak reverse recovery Current	V <sub>rr</sub> = 600V, I <sub>F</sub> = 300A di/dt = 3000A/μs	T <sub>j</sub> = 25°C	-	220	-	A
			T <sub>j</sub> = 125°C	-	280	-	
Q <sub>rr</sub>	Recovered charge	V <sub>rr</sub> = 600V, I <sub>F</sub> = 300A di/dt = 3000A/μs	T <sub>j</sub> = 25°C	-	24.5	-	nC
			T <sub>j</sub> = 125°C	-	42.5	-	
E <sub>rr</sub>	Reverse recovered energy	V <sub>rr</sub> = 600V, I <sub>F</sub> = 300A di/dt = 3000A/μs	T <sub>j</sub> = 25°C	-	7.8	-	mJ
			T <sub>j</sub> = 125°C	-	15.5	-	
R <sub>th(j-c)</sub>	Thermal Resistance, Junction to Case (Diode)		-	-	-	0.115	°C/W

## Test Conditions

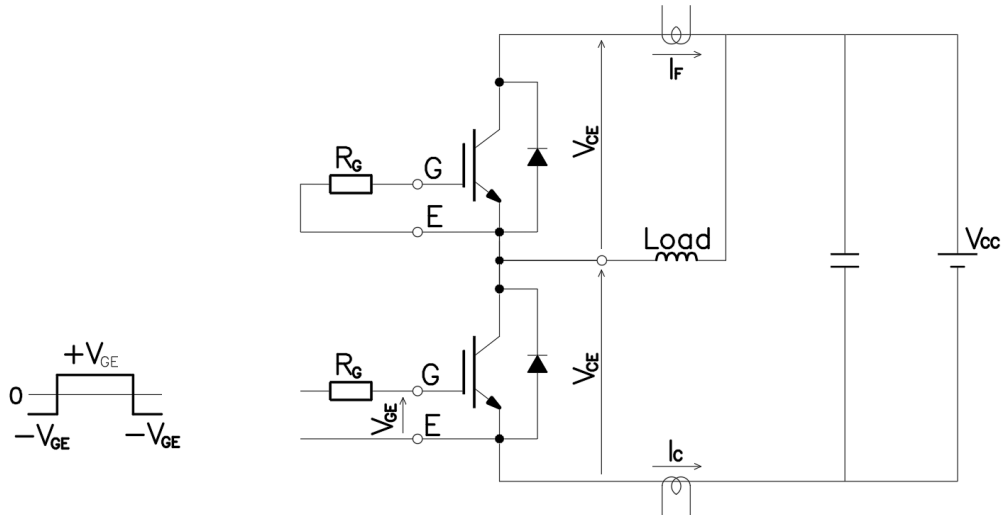


Figure 3. Switching time measure circuit

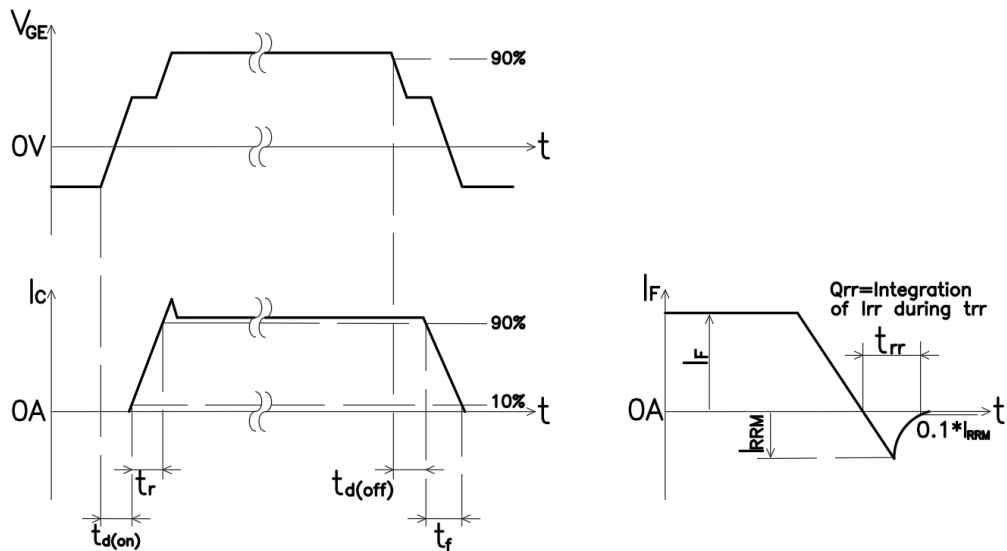


Figure 4. Switching time definition

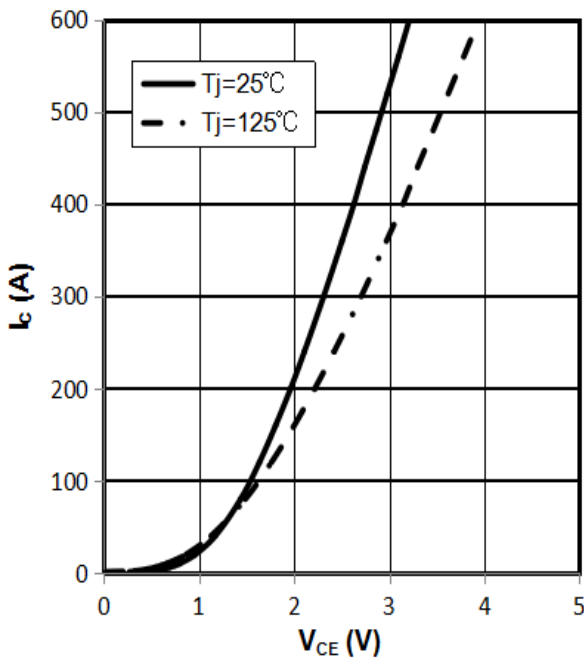


Figure 5.  $I_c$  vs  $V_{CE}$   
 $V_{GE} = 15\text{V}$

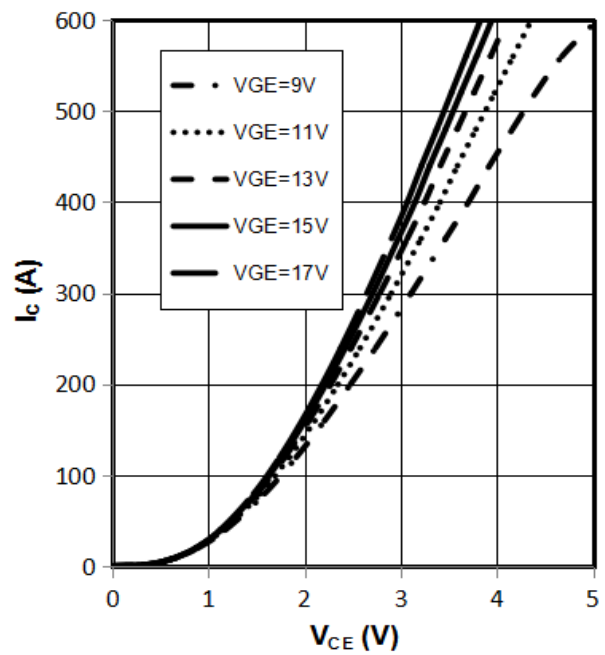


Figure 6.  $I_c$  vs  $V_{CE}$   
 $T_j = 125^\circ\text{C}$

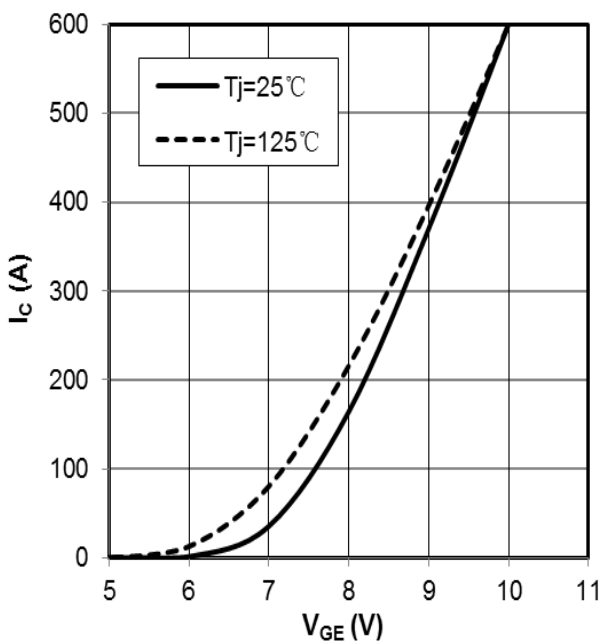


Figure 7.  $I_c$  vs  $V_{GE}$   
 $V_{CE} = 20\text{V}$

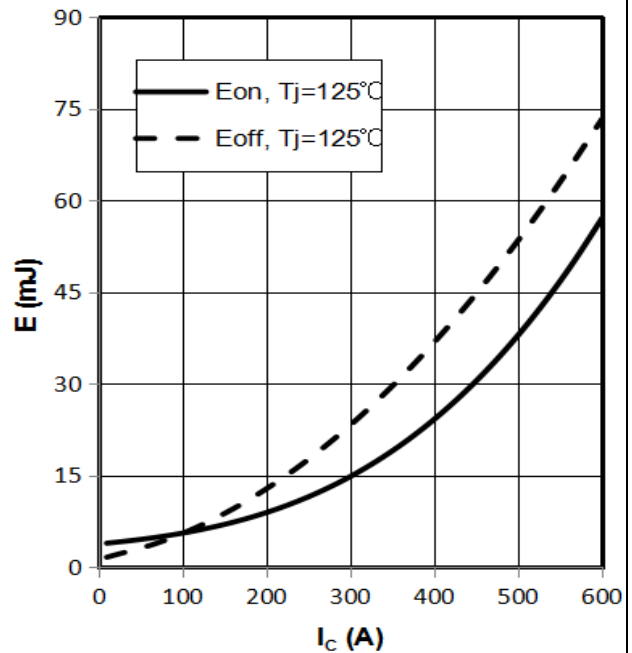


Figure 8.  $E_{on}$ ,  $E_{off}$  vs  $I_c$  (Typ)  
 $V_{CC} = 600\text{V}$ ,  $V_{GE} = +15\text{V}/-15\text{V}$ ,  $R_G = 3.3\Omega$

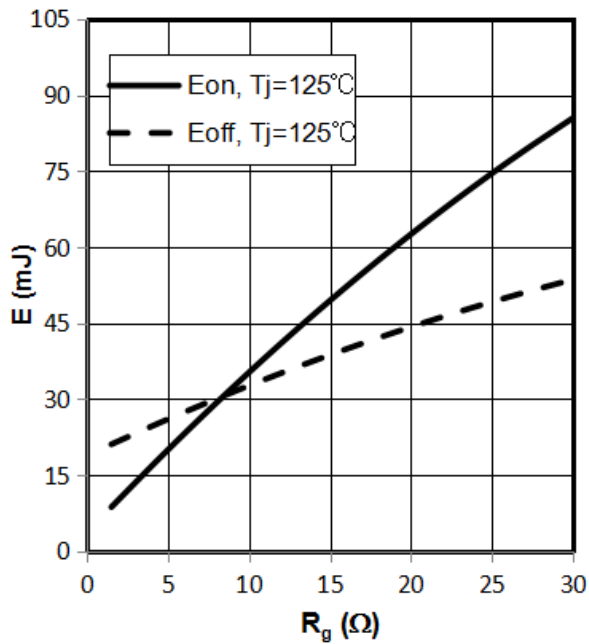


Figure 9.  $E_{on}$ ,  $E_{off}$  vs  $R_g$ (Typ)  
 $V_{CC}=600V$ ,  $V_{GE}=+15V/-15V$ ,  $I_C=300A$

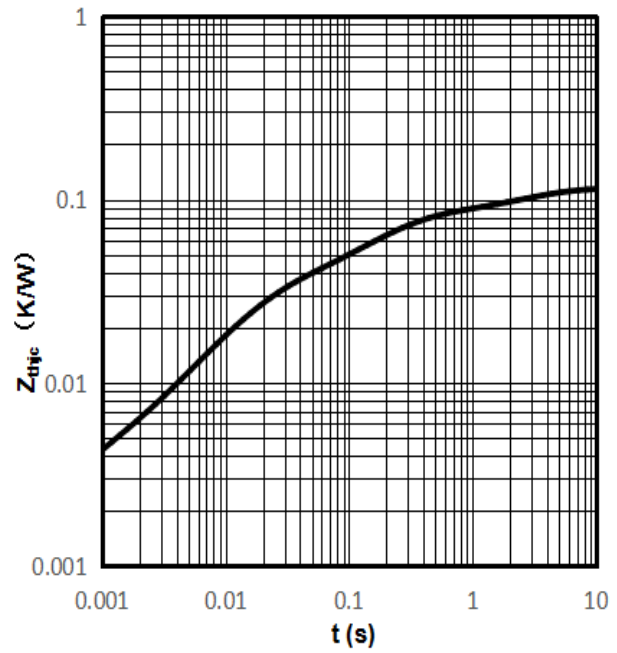


Figure 10. Transient thermal impedance IGBT,  
 $Z_{thjc}=f(t)$

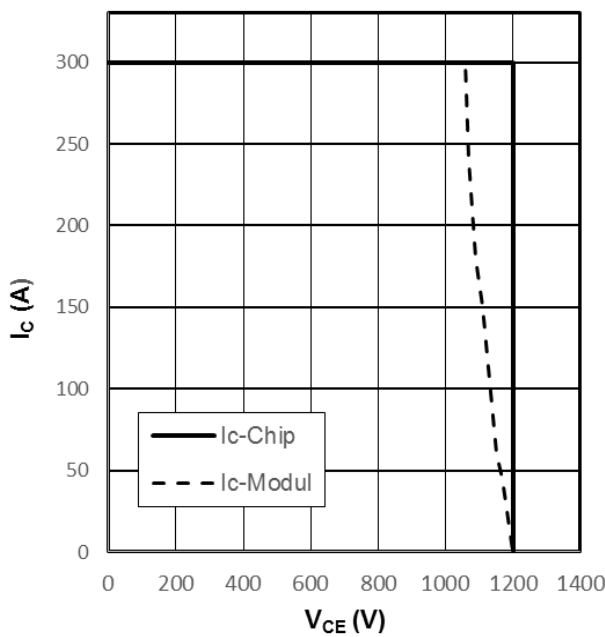


Figure 11. Reverse bias safe operating area IGBT,  
 $I_C=f(V_{CE})$ ,  $V_{GE}=\pm 15V$ ,  $R_{Goff}=3.3\Omega$ ,  $T_{vj}=125^\circ C$

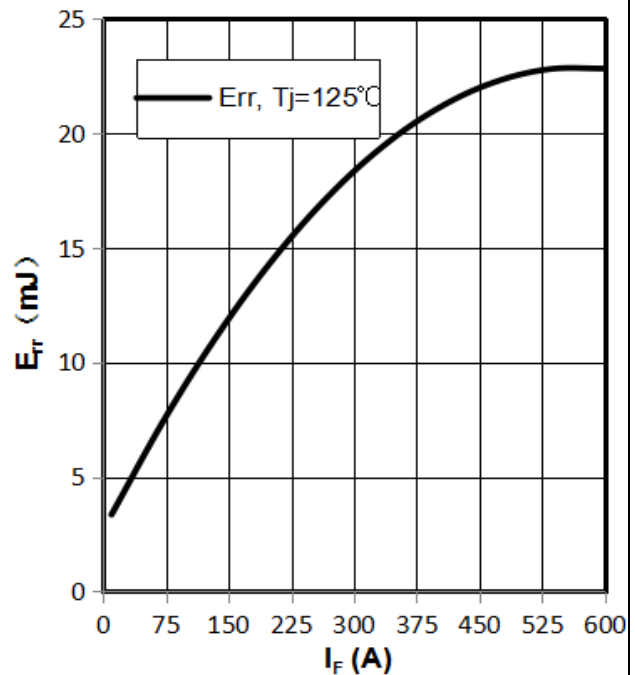


Figure 12.  $E_{rr}$  vs  $I_F$ (Typ)  
 $V_{CC}=600V$ ,  $V_{GE}=+15V/-15V$ ,  $R_G=3.3\Omega$

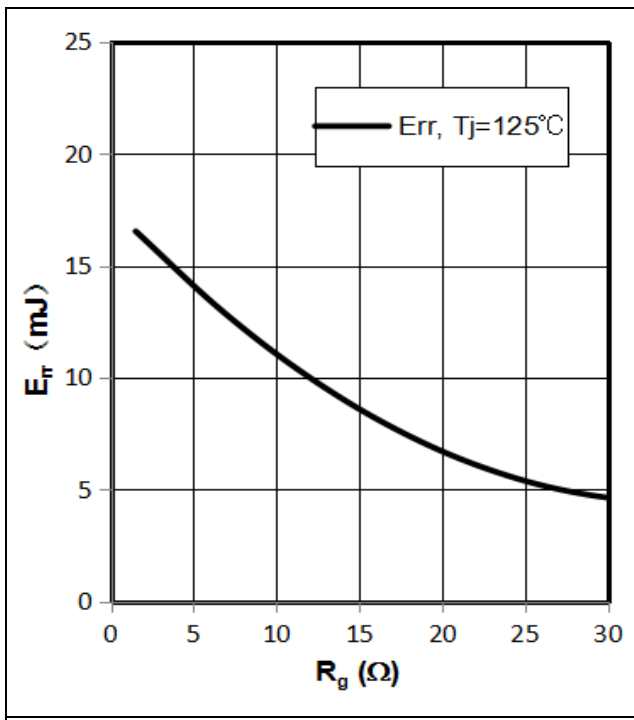


Figure 13. Err vs R<sub>G</sub>(Typ)  
 $V_{CC}=600V, V_{GE}=+15V/-15V, I_F=300A$

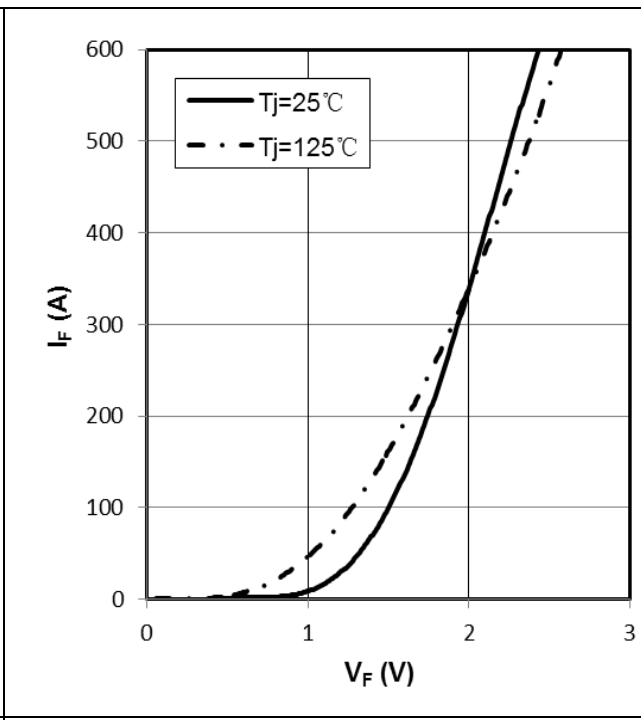


Figure 14. Forward characteristic of Diode ,  
 $I_F=f(V_F)$

### IMPORTANT NOTICE:

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