

Description

The DFI450HF12DFH1 offer lower losses and higher energy for application such as motor drive, inverter and soft switching applications.

Features

- 1200V450A, $V_{CE(sat)}(typ.) = 1.60V$
- Lower losses and higher energy
- High speed switching



Applications

- Motor drive
- Inverter
- Welding machines
- Power supply
- UPS

Circuit diagram

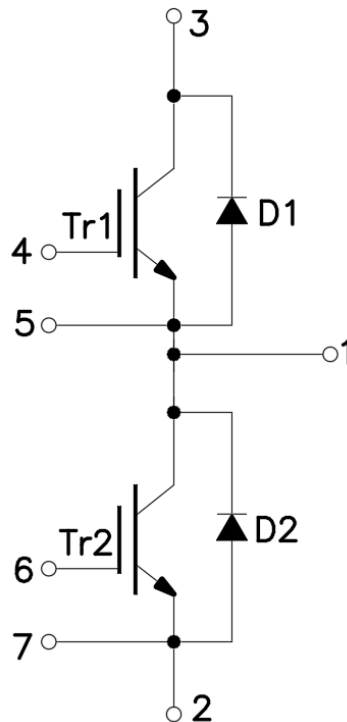


Figure 1. Out drawing & circuit diagram for DFI450HF12DFH1

Pin Configuration and Marking Information

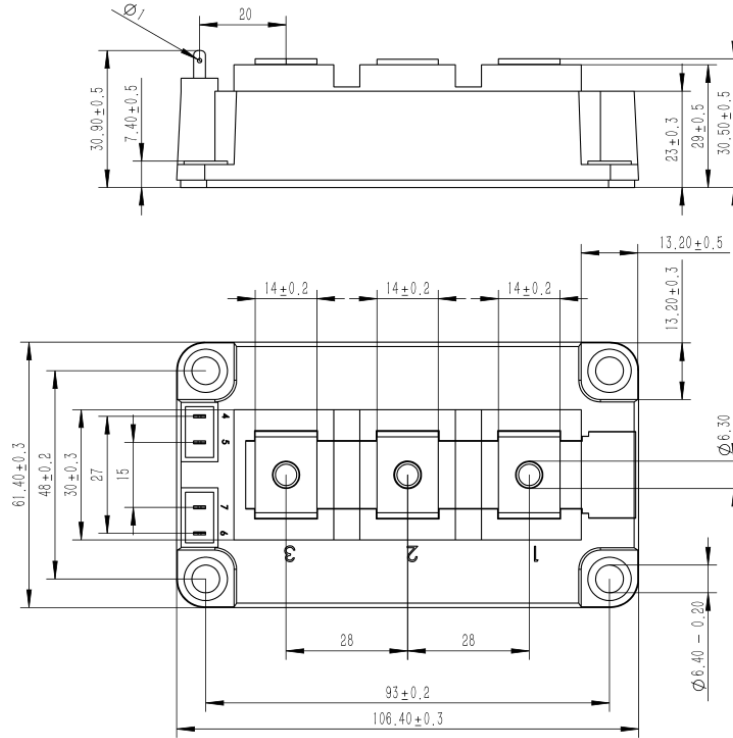


Figure 2. Pin configuration

Module

Parameter	Condition	Value	Unit
Isolation Voltage	RMS, f = 50Hz, t =1 min	3.4	kV
Material of module baseplate	-	Cu	-
Creepage distance	terminal to heatsink	47	mm
	terminal to terminal	26	
Clearance	terminal to heatsink	29	mm
	terminal to terminal	14	
CTI	-	>200	-
Module lead resistance, terminals – chip	T _C =25°C	0.8	mΩ
Mounting torque for module mounting	M6	3 to 6	Nm
Weight	-	315	g

Maximum Ratings (T_j=25°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	±20V	V
I _C	DC Continuous Collector Current	T _C =95°C	450	A
I _{CM}	Pulse Collector Current	t _p =1ms, Note1	900	A
P _C	Maximum Power Dissipation	T _C =25°C, T _{jmax} =175°C(IGBT)	2500	W
I _F	Diode Forward Current	-	450	A
I _{FRM}	Repetitive peak forward Current	t _p =1ms, Note1	900	A
T _{jmax}	junction temperature	-	-40 to 175	°C
T _{vjop}	Operating junction temperature	-	-40 to 150	°C
T _{stg}	Storage temperature	-	-40 to 125	°C

Note1: Pulse width limited by maximum junction temperature

IGBT Electrical characteristics (T_j=25°C unless otherwise specified, chip)

Symbol	Item	Condition	Value			Unit	
			Min.	Typ.	Max		
V _{CE(sat)}	Collector-Emitter Saturation Voltage	I _C =450A V _{GE} =15V	T _j =25°C	-	1.60	1.92	V
			T _j =125°C	-	1.92	-	V
			T _j =150°C	-	2.00	-	V
			T _j =175°C	-	2.35	-	V
V _{GE(th)}	Gate-Emitter threshold Voltage	I _C =8mA, V _{CE} =V _{GE}	5.0	5.8	6.5	V	
Q _G	Gate charge	V _{GE} = -15V to +15V	-	5.2	-	uC	
R _{Gint}	Internal gate resistor	-	T _j =25°C	-	0.7	-	Ω
C _{ies}	Input Capacitance	V _{CE} =25V, V _{GE} =0V f=1MHz	T _j =25°C	-	64.8	-	nF
C _{oes}	Output Capacitance			-	1.76	-	nF
C _{res}	Reverse transfer Capacitance			-	0.49	-	nF
I _{CES}	Collector- Emitter Cut off Current	V _{CE} =1200V, V _{GE} =0V	T _j =25°C	-	-	1	mA
I _{GES}	Gate-Emitter Leakage Current	V _{GE} =20V, V _{CE} =0V	T _j =25°C	-	-	1	uA
t _{d(on)}	Turn-on delay time	V _{CC} =600V I _C =450A V _{GE} =+15V/-8V R _{Gon} = R _{Goff} =1.3Ω Inductive load	T _j =25°C	-	335	-	ns
			T _j =125°C	-	387	-	
			T _j =175°C	-	406	-	
t _r	Rise time		T _j =25°C	-	98	-	ns
			T _j =125°C	-	134	-	
			T _j =175°C	-	141	-	
t _{d(off)}	Turn-off delay time		T _j =25°C	-	402	-	ns
			T _j =125°C	-	448	-	
			T _j =175°C	-	487	-	
t _f	Fall time	T _j =25°C	-	220	-	ns	
		T _j =125°C	-	272	-		
		T _j =175°C	-	288	-		
E _{on}	Turn-on power dissipation	T _j =25°C	-	16.02	-	mJ	
		T _j =125°C	-	25.05	-		
		T _j =175°C	-	33.96	-		
E _{off}	Turn-off power dissipation	T _j =25°C	-	45.48	-	mJ	
		T _j =125°C	-	51.39	-		
		T _j =175°C	-	54.97	-		
R _{th(j-c)}	Thermal Resistance, Junction to Case (IGBT)		-	0.06	-	°C/W	
R _{th(c-s)}	Thermal Resistance, Case to sink (Conductive Grease applied) , Note1		-	0.015	-	°C/W	

Note1: Assumes Thermal Conductivity of grease is 2.8 W/m · K and thickness is 50um.

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

Symbol	Item	Condition	Value			Unit	
			Min.	Typ.	Max		
V_F	Diode Forward Voltage	$I_F=450\text{A}, V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$	-	1.59	1.91	V
			$T_j=125^\circ\text{C}$	-	1.51	-	
			$T_j=150^\circ\text{C}$	-	1.59	-	
			$T_j=175^\circ\text{C}$	-	1.66	-	
t_{rr}	Reverse recovery time	(Switch side) $V_{CC}=600\text{V}$ $I_C=450\text{A}$	$T_j=25^\circ\text{C}$	-	0.469	-	us
			$T_j=125^\circ\text{C}$	-	0.715	-	
			$T_j=175^\circ\text{C}$	-	0.890	-	
I_{RM}	Peak reverse recovery Current	(FRD side) $V_{GE}=+15\text{V}/-8\text{V}$ $R_G=1.3\Omega$	$T_j=25^\circ\text{C}$	-	383	-	A
			$T_j=125^\circ\text{C}$	-	467	-	
			$T_j=175^\circ\text{C}$	-	516	-	
Q_{rr}	Recovered charge	$V_{rr}=600\text{V}$ $I_F=450\text{A}$ $V_{GE}=-8\text{V}$	$T_j=25^\circ\text{C}$	-	74.11	-	uC
			$T_j=125^\circ\text{C}$	-	117.5	-	
			$T_j=175^\circ\text{C}$	-	152.1	-	
E_{rr}	Reverse recovered energy	Inductive load switching operation	$T_j=25^\circ\text{C}$	-	40.58	-	mJ
			$T_j=125^\circ\text{C}$	-	63.44	-	
			$T_j=175^\circ\text{C}$	-	79.16	-	
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (Diode)		-	0.08	-	$^\circ\text{C}/\text{W}$	
$R_{th(c-s)}$	Thermal Resistance, Case to sink (Conductive Grease applied), Note1		-	0.015	-	$^\circ\text{C}/\text{W}$	

Note1: Assumes Thermal Conductivity of grease is $2.8 \text{ W/m} \cdot \text{K}$ and thickness is $50\mu\text{m}$.

Test Conditions

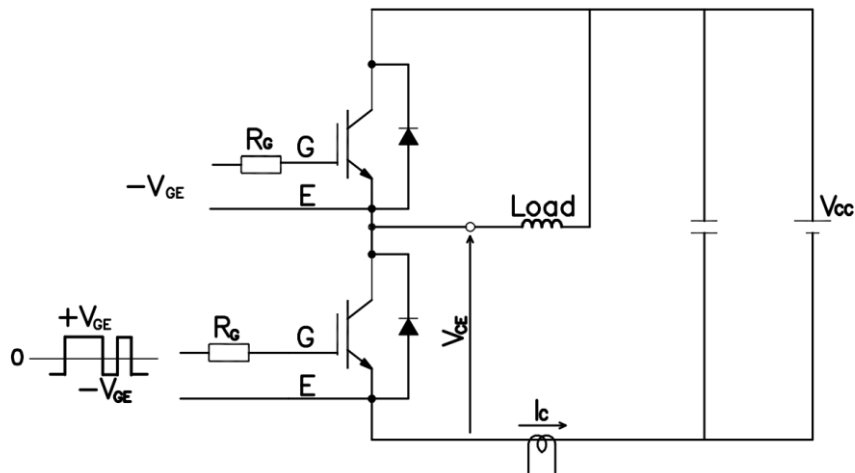


Figure 3. Switching time measure circuit

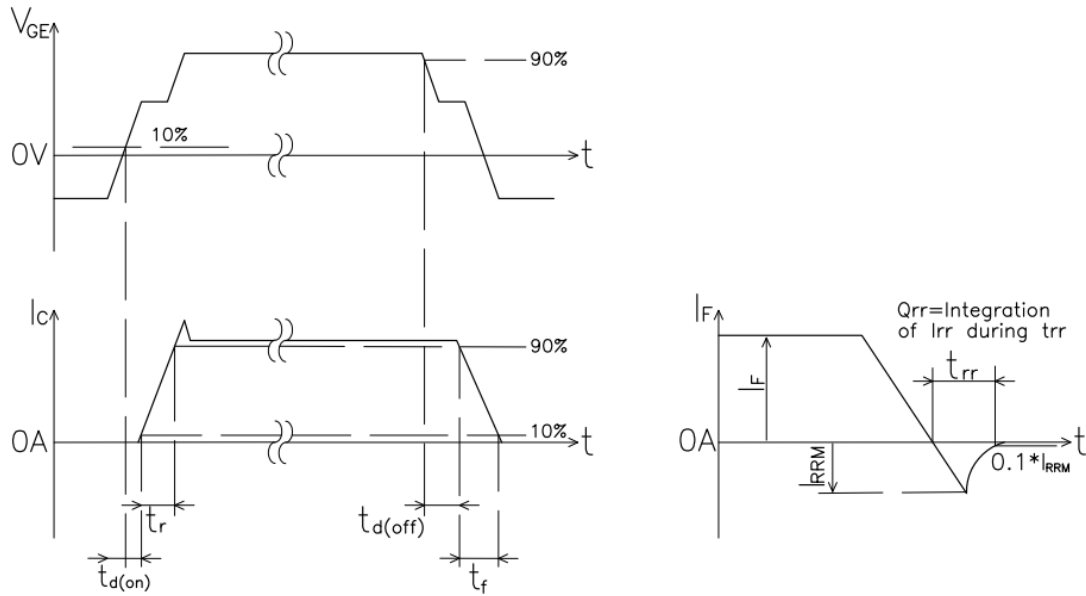
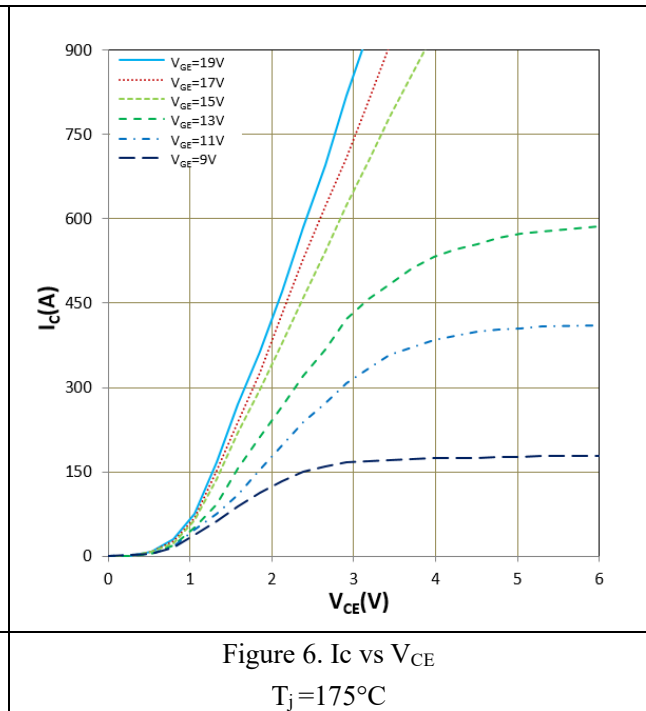
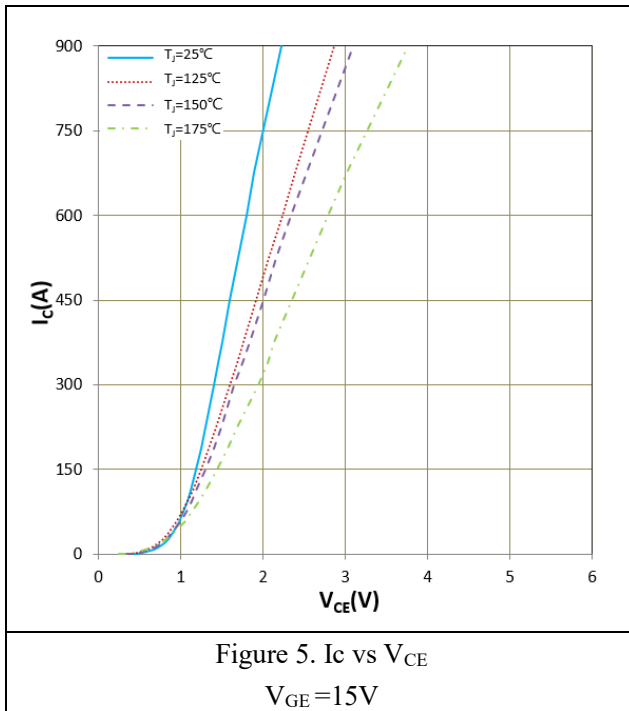


Figure 4. Switching time definition



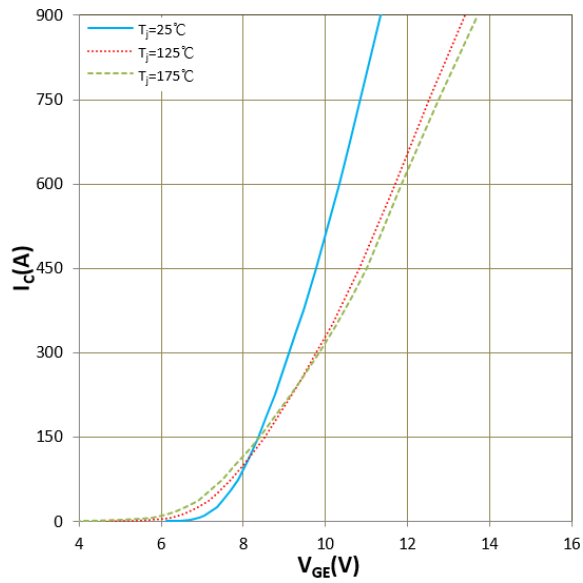


Figure 7. I_c vs V_{GE}
 $V_{CE}=20V$

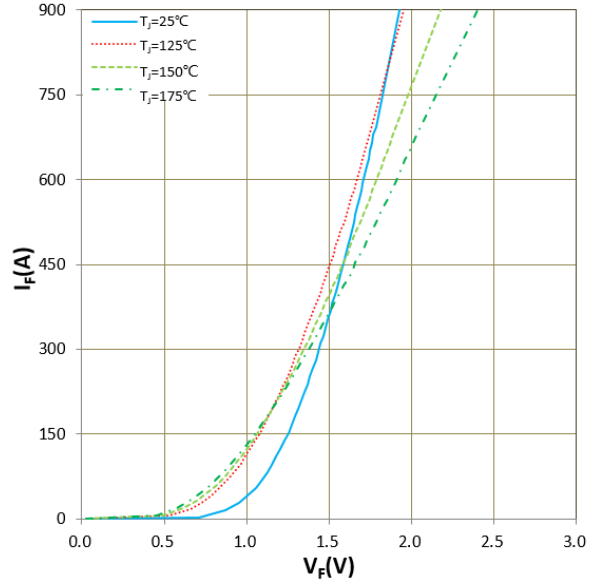


Figure 8. I_F vs V_F

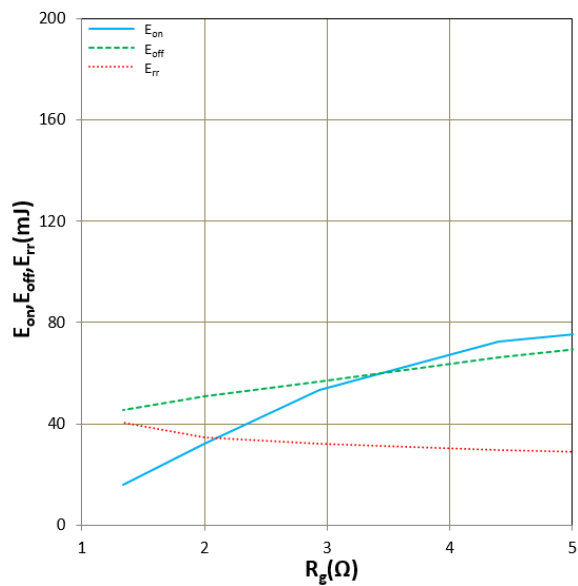


Figure 9. E_{on} , E_{off} , E_{rr} vs R_g (Typ)
 $V_{CC}=600V$, $V_{GE}=+15V/-8V$, $I_c=450A$, $T_j=25^\circ C$
Inductive Load

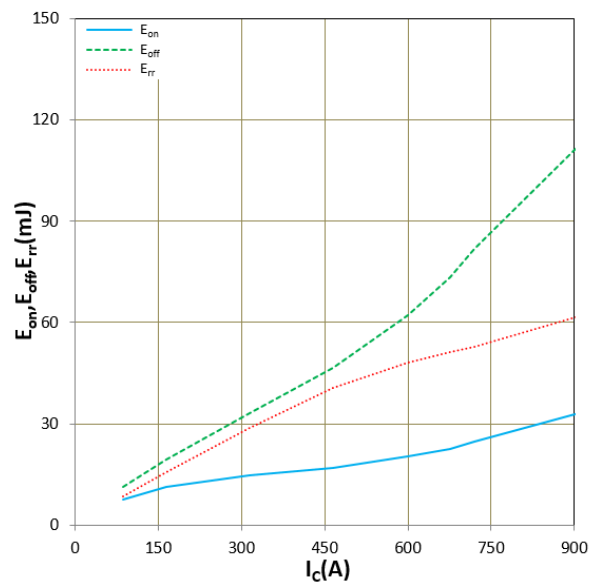


Figure 10. E_{on} , E_{off} , E_{rr} vs I_c (Typ)
 $V_{CC}=600V$, $V_{GE}=+15V/-8V$, $R_g=1.3\Omega$, $T_j=25^\circ C$
Inductive Load

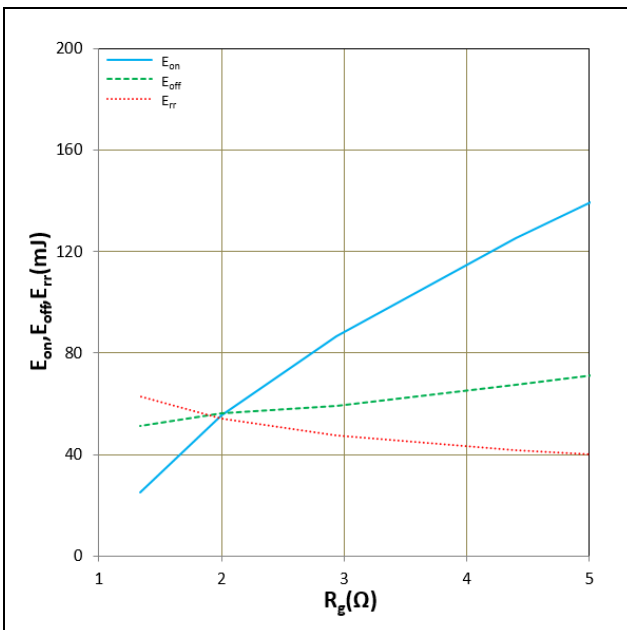


Figure 11. E_{on} , E_{off} , E_{rr} vs R_g (Typ)
 $V_{CC}=600V$, $V_{GE}=+15V/-8V$, $I_C=450A$, $T_j=125^\circ C$
 Inductive Load

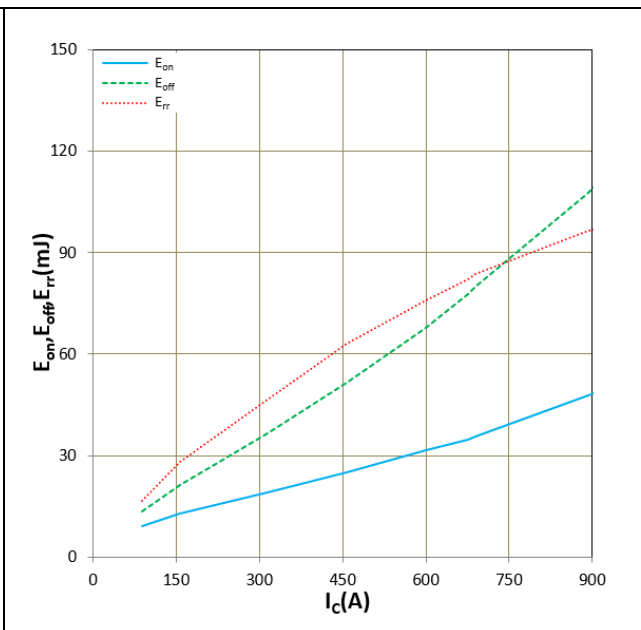


Figure 12. E_{on} , E_{off} , E_{rr} vs I_c (Typ)
 $V_{CC}=600V$, $V_{GE}=+15V/-8V$, $R_g=1.3\Omega$, $T_j=125^\circ C$
 Inductive Load

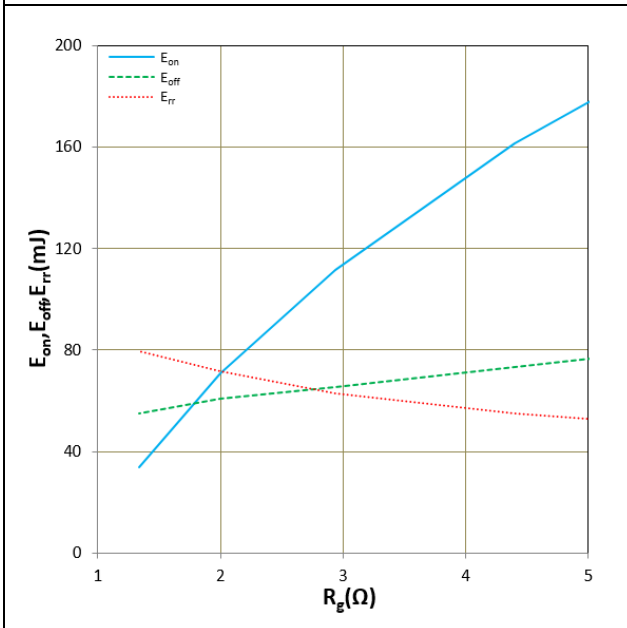


Figure 13. E_{on} , E_{off} , E_{rr} vs R_g (Typ)
 $V_{CC}=600V$, $V_{GE}=+15V/-8V$, $I_C=450A$, $T_j=175^\circ C$
 Inductive Load

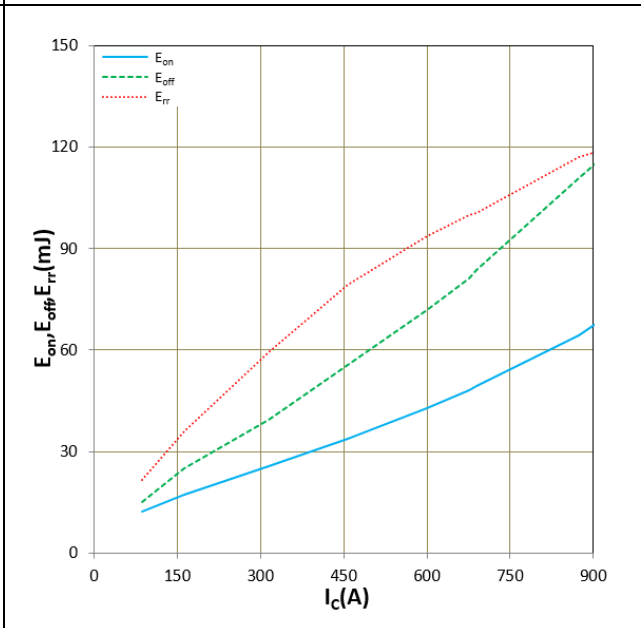


Figure 14. E_{on} , E_{off} , E_{rr} vs I_c (Typ)
 $V_{CC}=600V$, $V_{GE}=+15V/-8V$, $R_g=1.3\Omega$, $T_j=175^\circ C$
 Inductive Load

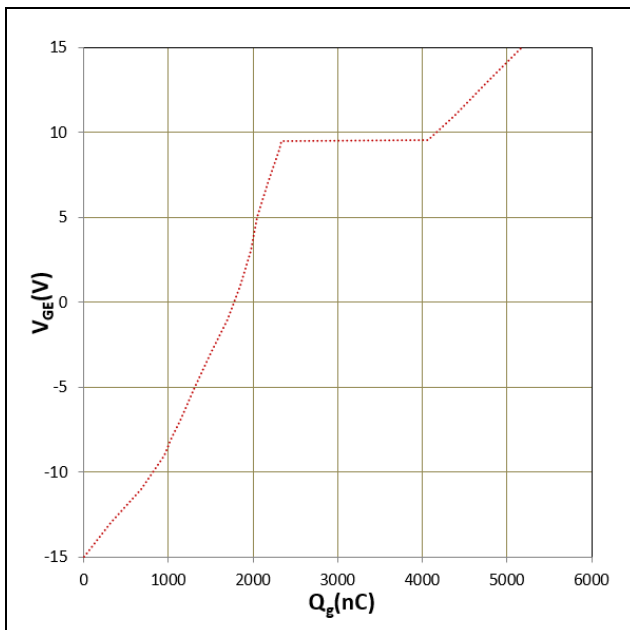


Figure 15. Gate charge

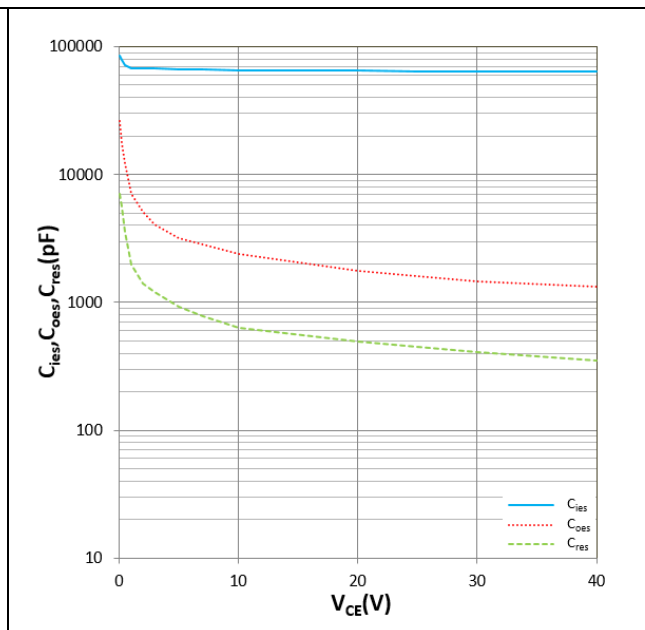


Figure 16. C_{ies} , C_{oes} , C_{res} vs V_{ce}
 $T_j = 25^\circ\text{C}$, $f = 1\text{MHz}$

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