

# SGF40N60UFD

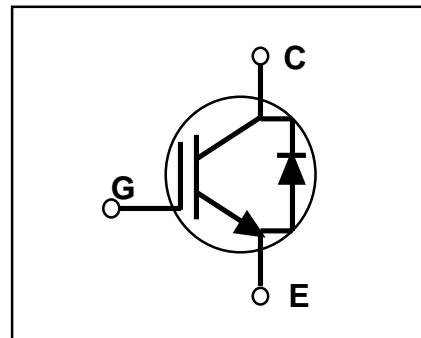
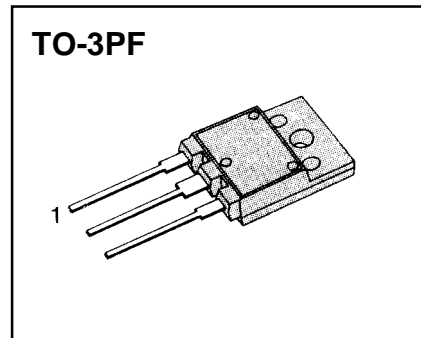
# CO-PAK IGBT

## FEATURES

- \* High Speed Switching
- \* Low Saturation Voltage  
:  $V_{CE(sat)} = 2.0\text{ V}$  (@  $I_C=20\text{A}$ )
- \* High Input Impedance
- \* CO-PAK, IGBT with FRD  
:  $T_{rr} = 42\text{nS}$  (typ.)

## APPLICATIONS

- \* AC & DC Motor controls
- \* General Purpose Inverters
- \* Robotics , Servo Controls
- \* Power Supply
- \* Lamp Ballast



## ABSOLUTE MAXIMUM RATINGS

Symbol	Characteristics	Rating	Units
$V_{CES}$	Collector-Emitter Voltage	600	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current @ $T_c = 25^\circ\text{C}$	40	A
	Collector Current @ $T_c = 100^\circ\text{C}$	20	A
$I_{CM(1)}$	Pulsed Collector Current	160	A
$I_F$	Diode Continuous Forward Current @ $T_c = 100^\circ\text{C}$	15	A
$I_{FM}$	Diode Maximum Forward Current	160	A
$P_D$	Maximum Power Dissipation @ $T_c = 25^\circ\text{C}$	96	W
	Maximum Power Dissipation @ $T_c = 100^\circ\text{C}$	38	W
$T_j$	Operating Junction Temperature	-55 ~ 150	$^\circ\text{C}$
$T_{stg}$	Storage Temperature Range	-55 ~ 150	$^\circ\text{C}$
$T_L$	Maximum Lead Temp. For Soldering Purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

**Notes:**(1) Repetitive rating : Pulse width limited by max. junction temperature

**ELECTRICAL CHARACTERISTICS (IGBT PART)**  
**(T<sub>c</sub>=25°C, Unless Otherwise Specified)**

Symbol	Characteristics	Test Conditions	Min	Typ	Max	Units
BV <sub>CES</sub>	C - E Breakdown Voltage	V <sub>GE</sub> = 0V , I <sub>C</sub> = 250uA	600	-	-	V
ΔV <sub>CES</sub> / ΔT <sub>J</sub>	Temperature Coeff. of Breakdown Voltage	V <sub>GE</sub> = 0V , I <sub>C</sub> = 1mA	-	0.6	-	V/°C
V <sub>GE(th)</sub>	G - E threshold voltage	I <sub>C</sub> = 20mA , V <sub>CE</sub> = V <sub>GE</sub>	4.5	5.5	7.5	V
I <sub>CES</sub>	Collector cutoff Current	V <sub>CE</sub> = V <sub>CES</sub> , V <sub>GE</sub> = 0V	-	-	250	uA
I <sub>GES</sub>	G - E leakage Current	V <sub>GE</sub> = V <sub>GES</sub> , V <sub>CE</sub> = 0V	-	-	100	nA
V <sub>CE(sat)</sub>	Collector to Emitter saturation voltage	I <sub>C</sub> =20A, V <sub>GE</sub> = 15V	-	2.0	2.6	V
		I <sub>C</sub> =40A, V <sub>GE</sub> = 15V	-	2.6	-	V
Cies	Input capacitance	V <sub>GE</sub> = 0V , f = 1MHz	-	1430	-	pF
Coes	Output capacitance	V <sub>CE</sub> = 30V	-	168	-	pF
Cres	Reverse transfer capacitance		-	50	-	pF
td(on)	Turn on delay time	V <sub>CC</sub> = 300V , I <sub>C</sub> = 20A	-	12	-	ns
tr	Turn on rise time	V <sub>GE</sub> = 15V	-	20	-	ns
td(off)	Turn off delay time	R <sub>G</sub> = 10Ω	-	68	100	ns
tf	Turn off fall time	Inductive Load	-	50	100	ns
Eon	Turn on Switching Loss		-	0.08	-	mJ
Eoff	Turn off Switching Loss		-	0.19	-	mJ
Ets	Total Switching Loss		-	0.27	0.47	mJ
Qg	Total Gate Charge	V <sub>CC</sub> = 300V	-	92	138	nC
Qge	Gate-Emitter Charge	V <sub>GE</sub> = 15V	-	21	31	nC
Qgc	Gate-Collector Charge	I <sub>C</sub> = 20A	-	28	42	nC
Le	Internal Emitter Inductance	Measured 5mm from PKG	-	14	-	nH

**ELECTRICAL CHARACTERISTICS (DIODE PART)**  
 (T<sub>c</sub>=25°C, Unless Otherwise Specified)

Symbol	Characteristics	Test Conditions		Min	Typ	Max	Units
V <sub>FM</sub>	Diode Forward Voltage	I <sub>F</sub> =15A	T <sub>c</sub> =25°C	-	1.4	1.7	V
			T <sub>c</sub> =100°C	-	1.3	-	
T <sub>rr</sub>	Diode Reverse Recovery Time	I <sub>F</sub> =15A, V <sub>R</sub> =200V -di/dt=200A/uS	T <sub>c</sub> =25°C	-	42	60	nS
			T <sub>c</sub> =10 °C	-	74	-	
I <sub>rr</sub>	Diode Peak Reverse Recovery Current		T <sub>c</sub> =25°C	-	4.0	6.0	A
			T <sub>c</sub> =10 °C	-	6.5	-	
Q <sub>rr</sub>	Diode Reverse Recovery Charge		T <sub>c</sub> =25°C	-	80	180	nC
			T <sub>c</sub> =100°C	-	220	-	

**THERMAL RESISTANCE**

Symbol	Characteristics	Min	Typ	Max	Units
R <sub>θJC</sub>	Junction-to-Case (IGBT)	-	-	1.3	°C/W
R <sub>θJC</sub>	Junction-to-Case (DIODE)	-	-	2.5	°C/W
R <sub>θJA</sub>	Junction-to-Ambient	-	-	45	°C/W

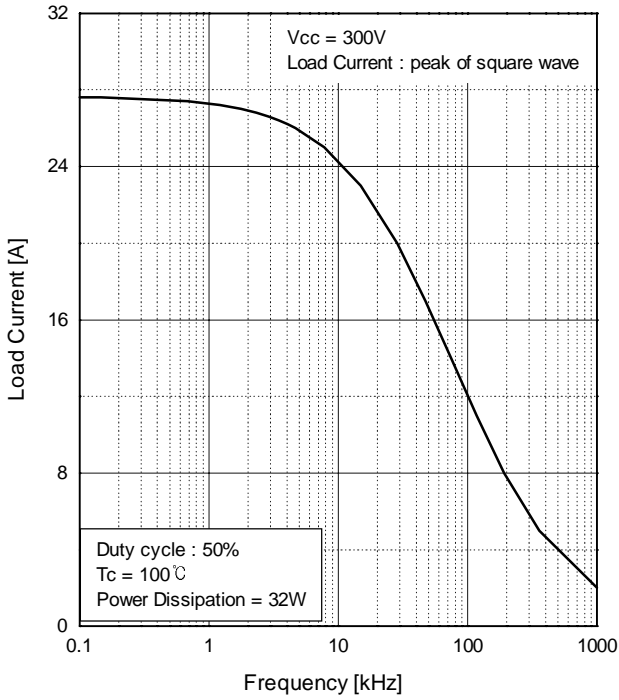


Fig.1 Typical Load Current vs. Frequency

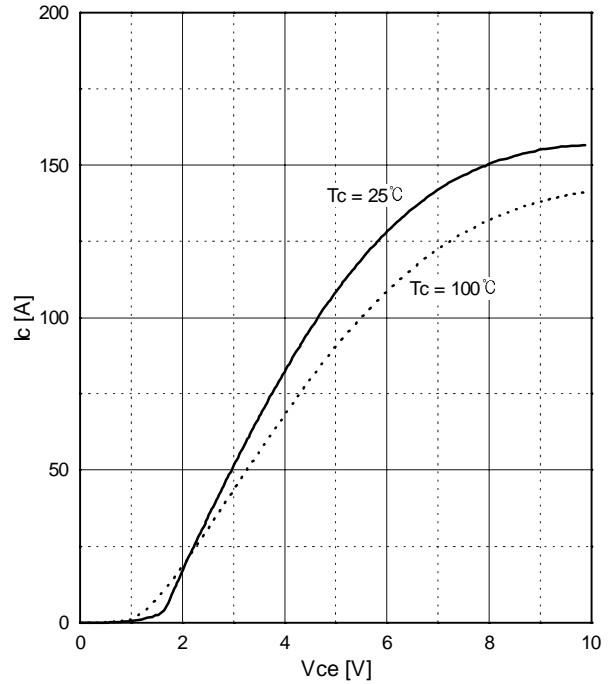


Fig.2 Typical Output Characteristics

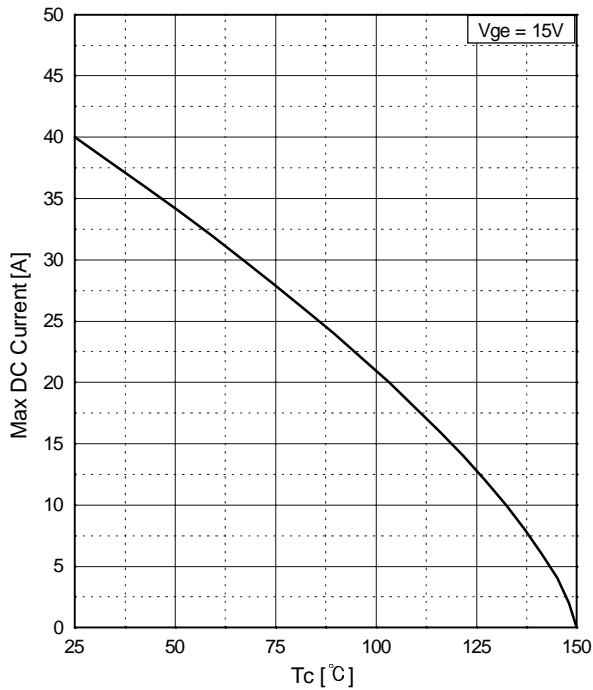


Fig.3 Maximum Collector Current vs. Case Temperature

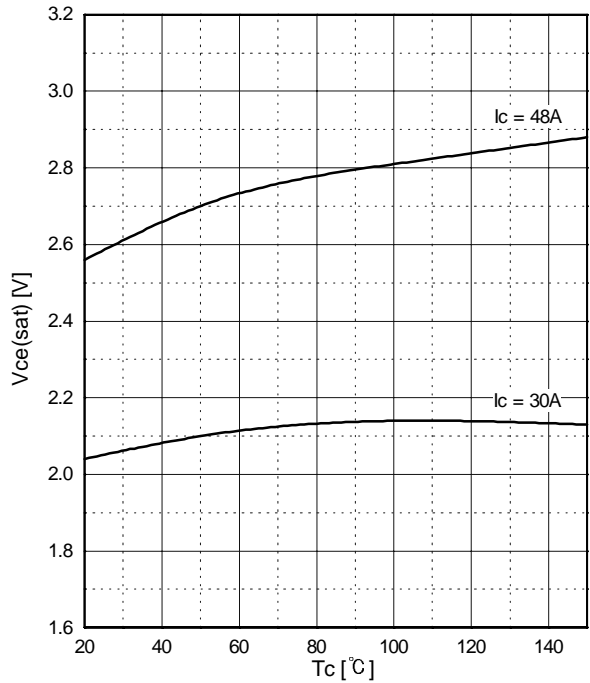


Fig.4 Collector to Emitter Voltage vs. Case Temperature

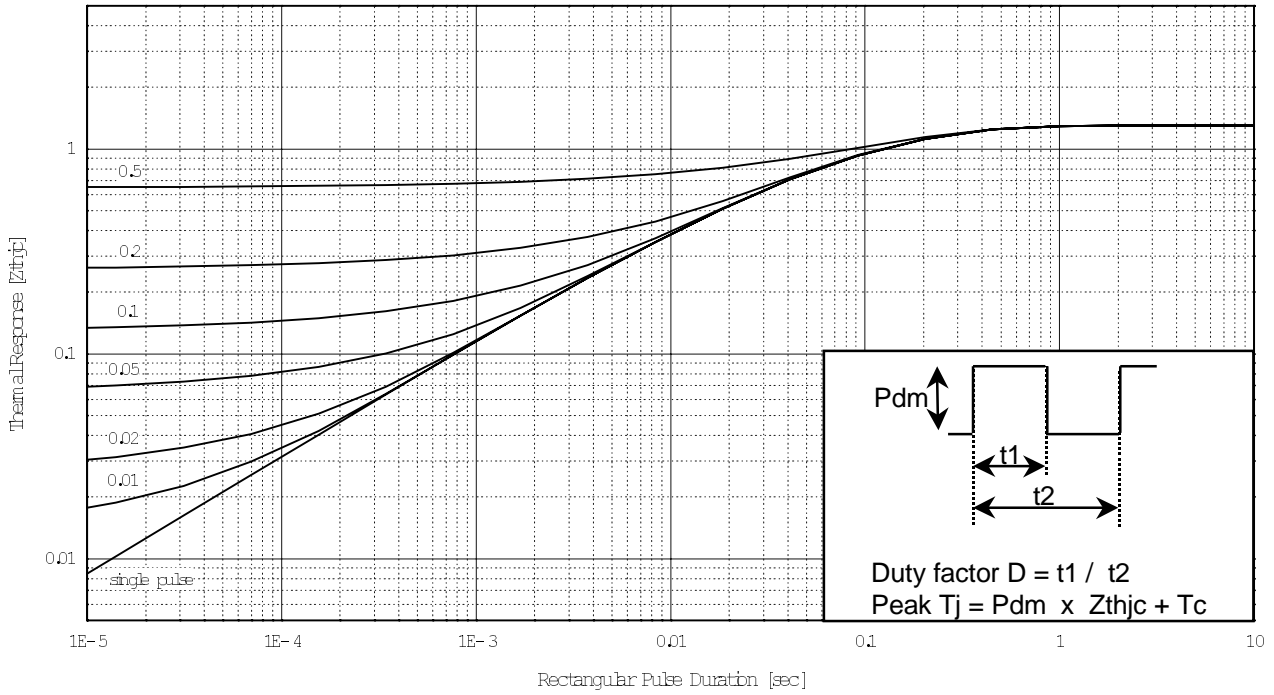


Fig.5 Maximum Effective Transient Thermal Impedance, Junction to Case

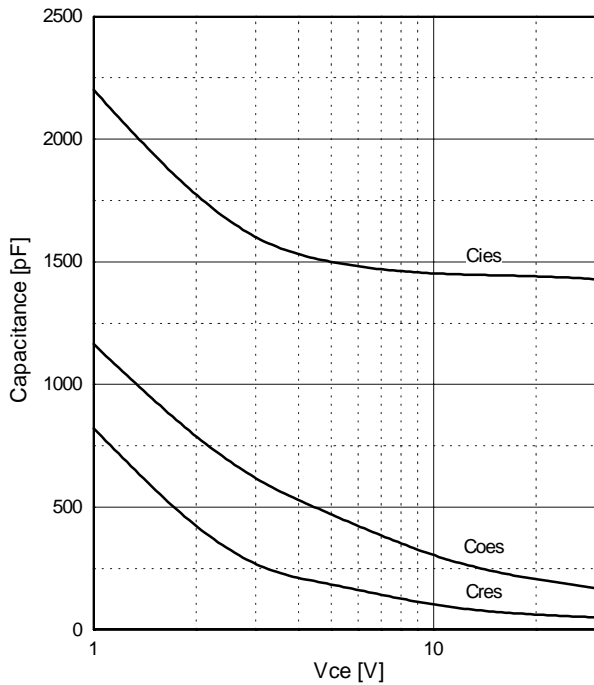


Fig.6 Typical Capacitance vs. Collector to Emitter Voltage

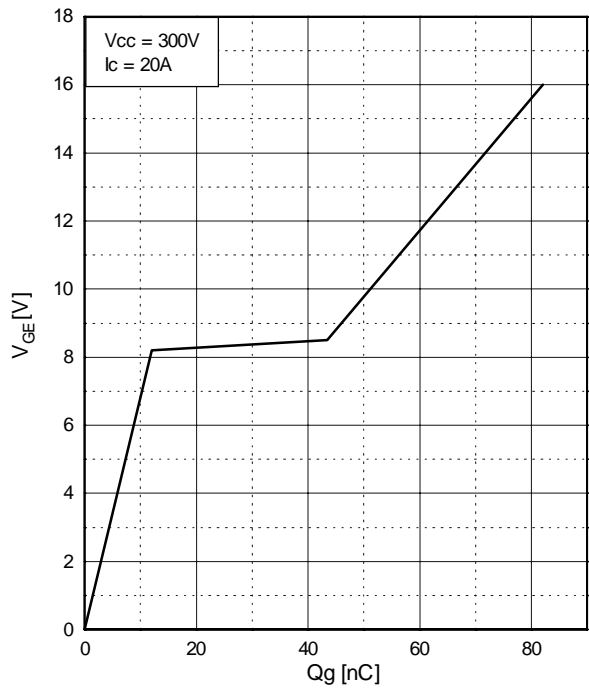


Fig.7 Typical Gate Charge vs. Gate to Emitter Voltage

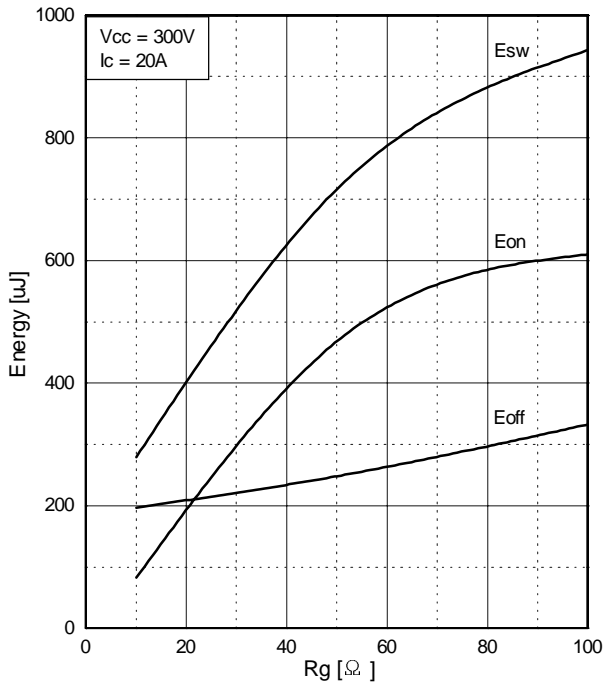


Fig.8 Typical Switching Loss vs. Gate Resistance

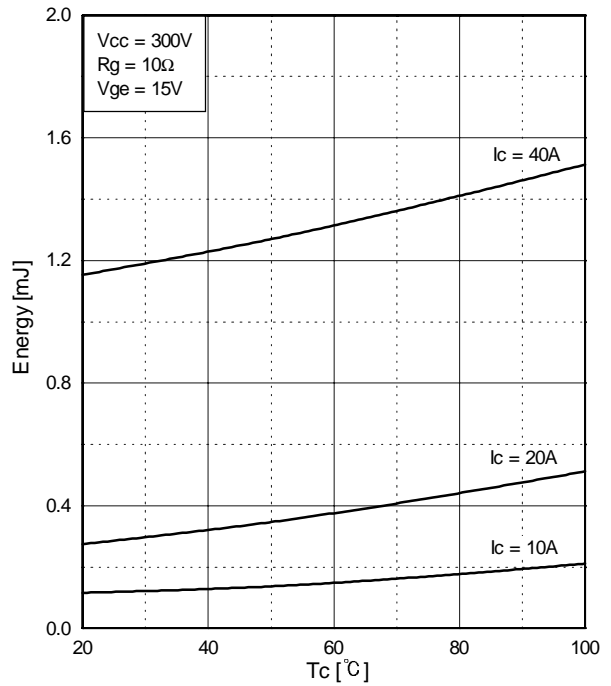


Fig.9 Typical Switching Loss vs. Case Temperature

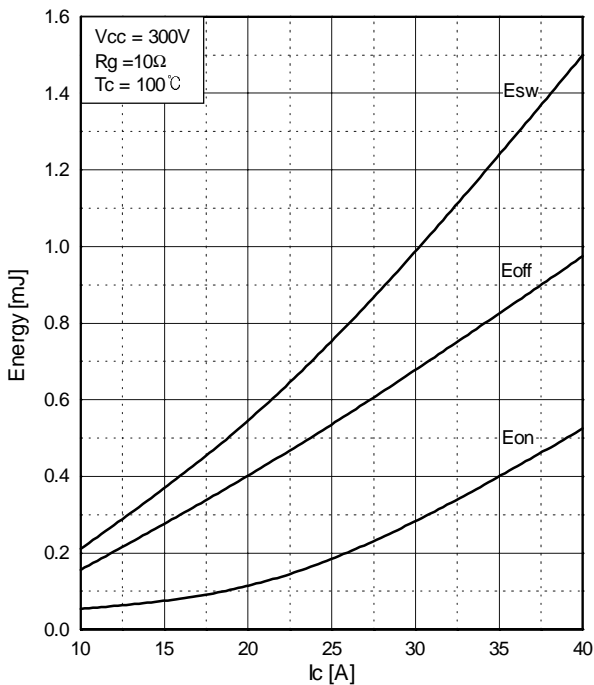


Fig.10 Typical Switching loss vs. Collector to Emitter Current

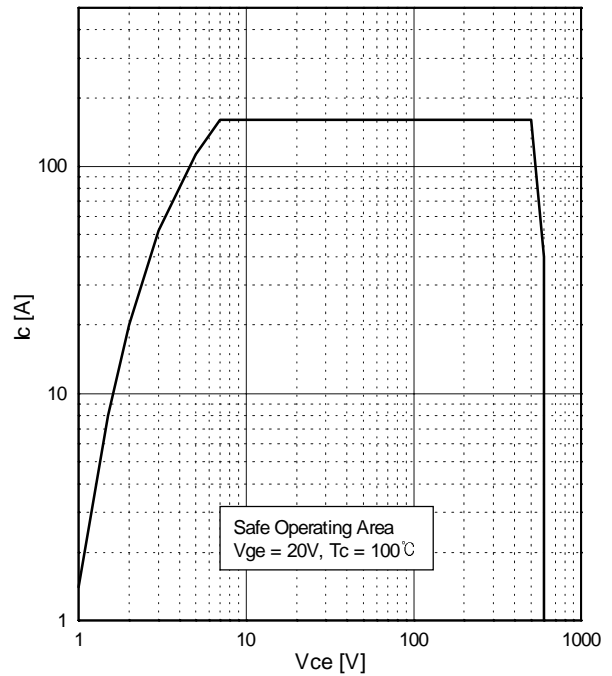


Fig.11 Turn-off SOA

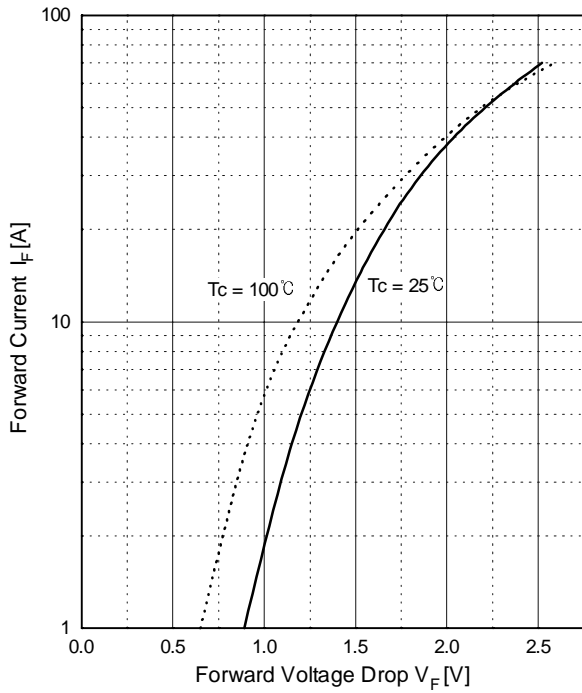


Fig.12 Typical Forward Voltage Drop vs. Forward Current

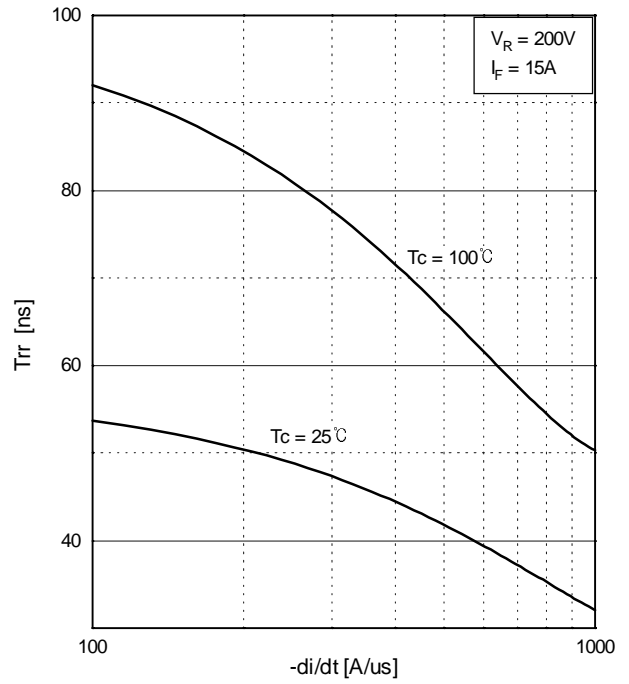


Fig.13 Typical Reverse Recovery Time vs.  $di/dt$

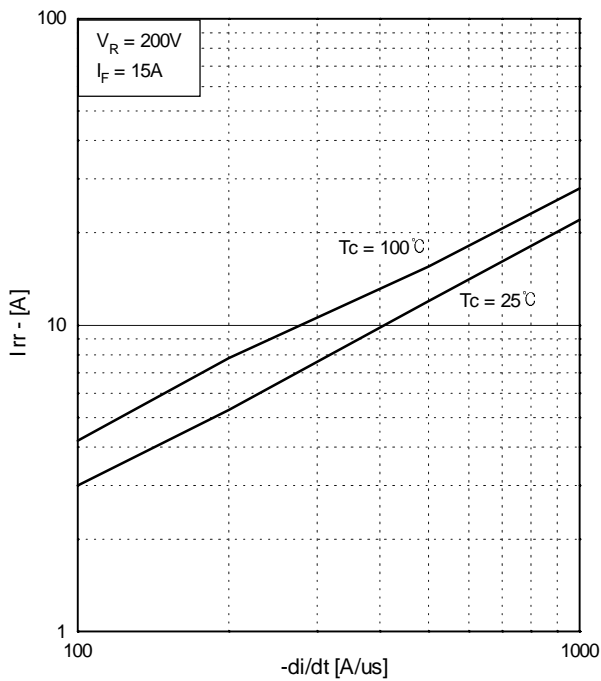


Fig.14 Typical Reverse Recovery Current vs.  $di/dt$

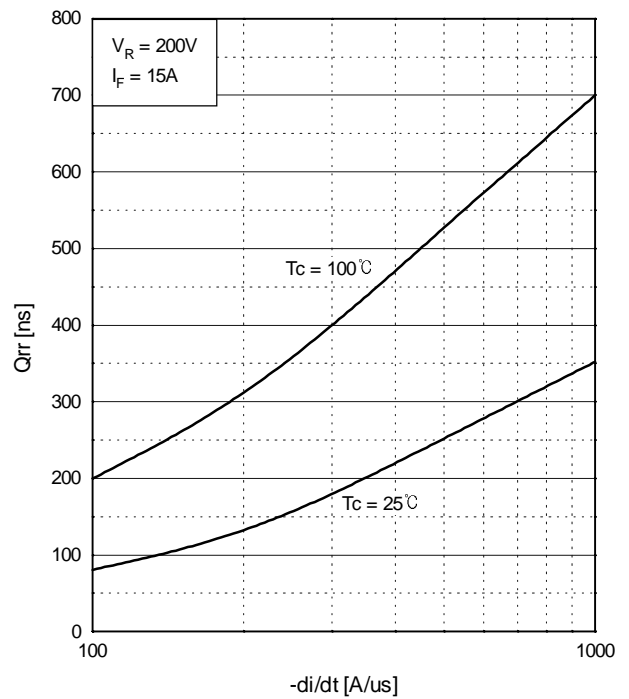


Fig.15 Typical Stored Charge vs.  $di/dt$

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