RGW60TS65CHR

650V 30A Hybrid IGBT with Built-In SiC-SBD Datasheet

V_{CES}	650V
$I_{C\ (100°C)}$	30A
$V_{CE(sat)\ (Typ.)}$	1.5V
P_D	178W

●Outline

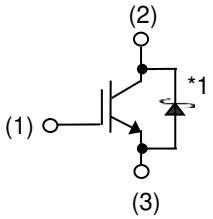
TO-247N

(1) (2)(3)

●Features

1) AEC-Q101 Qualified
2) Low Collector - Emitter Saturation Voltage
3) Low Switching Loss & Soft Switching
4) Built in No Recovery Silicon Carbide SBD
5) Pb - free Lead Plating ; RoHS Compliant

●Inner Circuit



(1) Gate
(2) Collector
(3) Emitter

*1 Built in SiC-SBD

●Application

Automotive
On & Off Board Chargers
DC-DC Converters
PFC
Industrial Inverter

●Packaging Specifications

Type	Packaging	Tube
	Reel Size (mm)	-
	Tape Width (mm)	-
	Basic Ordering Unit (pcs)	450
	Packing Code	C11
	Marking	RGW60TS65C

●Absolute Maximum Ratings (at T_C = 25°C unless otherwise specified)

Parameter		Symbol	Value	Unit
Collector - Emitter Voltage		V_{CES}	650	V
Gate - Emitter Voltage		V_{GES}	±30	V
Collector Current	T_C = 25°C	I_C	64	A
	T_C = 100°C	I_C	39	A
Pulsed Collector Current		I_{CP} *1	120	A
Diode Forward Current	T_C = 25°C	I_F	39	A
	T_C = 100°C	I_F	25	A
Diode Pulsed Forward Current		I_{FP} *1	100	A
Power Dissipation	T_C = 25°C	P_D	178	W
	T_C = 100°C	P_D	89	W
Operating Junction Temperature		T_j	-40 to +175	°C
Storage Temperature		T_{stg}	-55 to +175	°C

*1 Pulse width limited by $T_{jmax.}$

●Thermal Resistance

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Thermal Resistance IGBT Junction - Case	$R_{\theta(j-c)}$	-	-	0.84	°C/W
Thermal Resistance Diode Junction - Case	$R_{\theta(j-c)}$	-	-	1.34	°C/W

●IGBT Electrical Characteristics (at T_j = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Collector - Emitter Breakdown Voltage	BV_{CES}	I_C = 5mA, V_{GE} = 0V	650	-	-	V
Collector Cut - off Current	I_{CES}	V_{CE} = 650V, V_{GE} = 0V	-	-	5	mA
Gate - Emitter Leakage Current	I_{GES}	V_{GE} = ±30V, V_{CE} = 0V	-	-	±200	nA
Gate - Emitter Threshold Voltage	$V_{GE(th)}$	V_{CE} = 5V, I_C = 20.0mA	5.0	6.0	7.0	V
Collector - Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 30A, V_{GE} = 15V,				V
		T_j = 25°C	-	1.5	1.9	
		T_j = 175°C	-	1.85	-	

●**IGBT Electrical Characteristics** (at T_j = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input Capacitance	C_{ies}	V_{CE} = 30V,	-	2530	-	pF
Output Capacitance	C_{oes}	V_{GE} = 0V,	-	65	-	
Reverse transfer Capacitance	C_{res}	f = 1MHz	-	46	-	
Total Gate Charge	Q_g	V_{CE} = 400V,	-	84	-	nC
Gate - Emitter Charge	Q_{ge}	I_C = 30A,	-	17	-	
Gate - Collector Charge	Q_{gc}	V_{GE} = 15V	-	31	-	
Turn - on Delay Time	$t_{d(on)}$	I_C = 15A, V_{CC} = 400V, V_{GE} = 15V, R_G = 10Ω, T_j = 25°C Inductive Load *E_{on} include diode reverse recovery	-	37	-	ns
Rise Time	t_r		-	8	-	
Turn - off Delay Time	$t_{d(off)}$		-	91	-	
Fall Time	t_f		-	70	-	
Turn - on Switching Loss	E_{on}		-	0.07	-	mJ
Turn - off Switching Loss	E_{off}		-	0.22	-	
Turn - on Delay Time	$t_{d(on)}$	I_C = 15A, V_{CC} = 400V, V_{GE} = 15V, R_G = 10Ω, T_j = 175°C Inductive Load *E_{on} include diode reverse recovery	-	34	-	ns
Rise Time	t_r		-	9	-	
Turn - off Delay Time	$t_{d(off)}$		-	134	-	
Fall Time	t_f		-	86	-	
Turn - on Switching Loss	E_{on}		-	0.07	-	mJ
Turn - off Switching Loss	E_{off}		-	0.33	-	
Reverse Bias Safe Operating Area	RBSOA	I_C = 120A, V_{CC} = 520V, V_P = 650V, V_{GE} = 15V, R_G = 100Ω, T_j = 175°C	FULL SQUARE			-

●**SiC-SBD Electrical Characteristics** (at T_j = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Diode Forward Voltage	V_F	I_F = 20A, T_j = 25°C T_j = 175°C	- -	1.35 1.63	1.55 -	V
Diode Reverse Recovery Time	t_{rr}	I_F = 15A, V_{CC} = 400V, di_F/dt = 200A/µs, T_j = 25°C	-	34	-	ns
Diode Peak Reverse Recovery Current	I_{rr}		-	2.5	-	A
Diode Reverse Recovery Charge	Q_{rr}		-	49	-	nC
Diode Reverse Recovery Energy	E_{rr}		-	1.2	-	µJ
Diode Reverse Recovery Time	t_{rr}	I_F = 15A, V_{CC} = 400V, di_F/dt = 200A/µs, T_j = 175°C	-	37	-	ns
Diode Peak Reverse Recovery Current	I_{rr}		-	2.5	-	A
Diode Reverse Recovery Charge	Q_{rr}		-	55	-	nC
Diode Reverse Recovery Energy	E_{rr}		-	1.6	-	µJ
Total Capacitance	C	V_R = 1V,f=1MHz V_R = 600V,f=1MHz	- -	730 74	- -	pF

●Electrical Characteristic Curves

Fig.1 Power Dissipation vs. Case Temperature

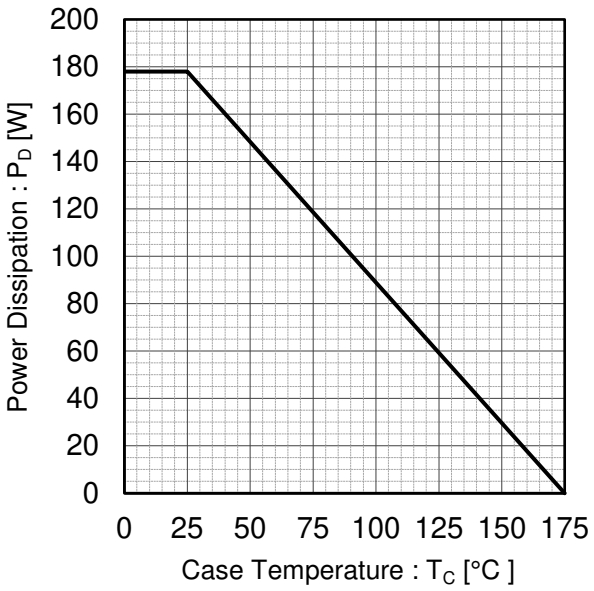


Fig.2 Collector Current vs. Case Temperature

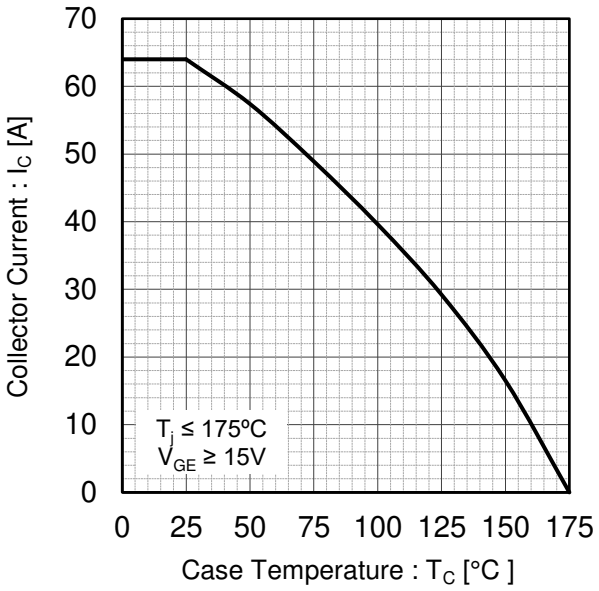


Fig.3 Forward Bias Safe Operating Area

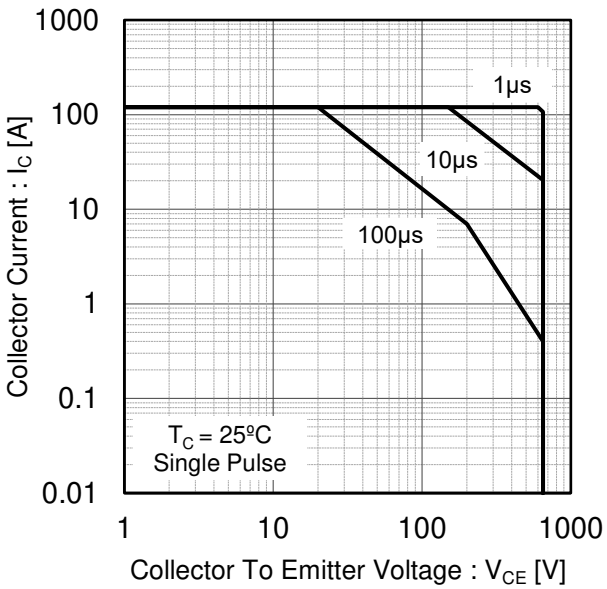
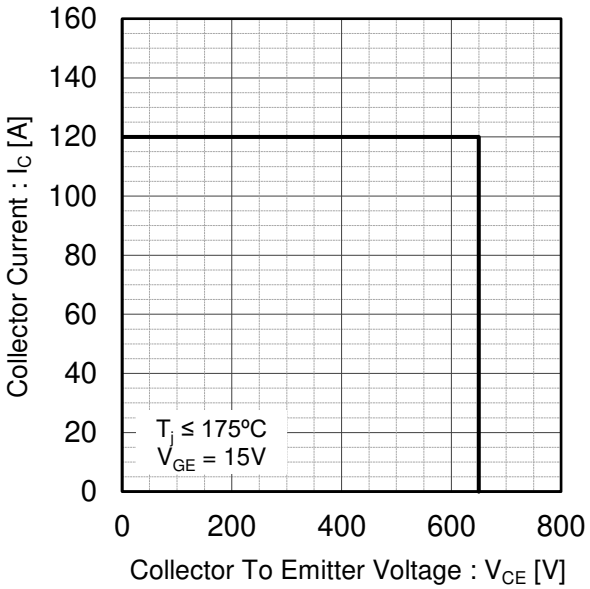


Fig.4 Reverse Bias Safe Operating Area



●Electrical Characteristic Curves

Fig.5 Typical Output Characteristics

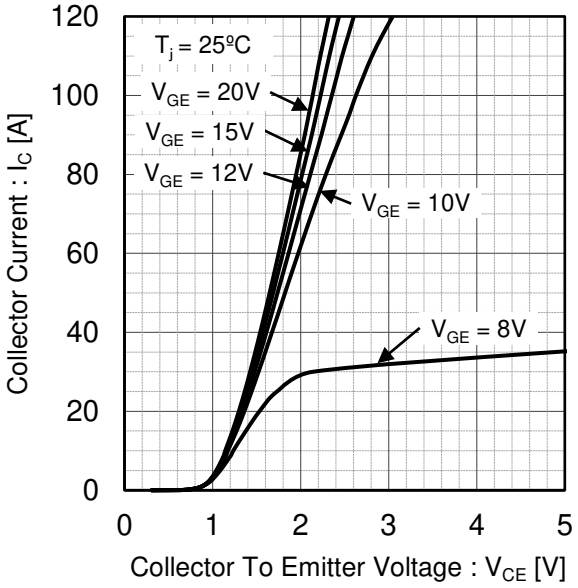


Fig.6 Typical Output Characteristics

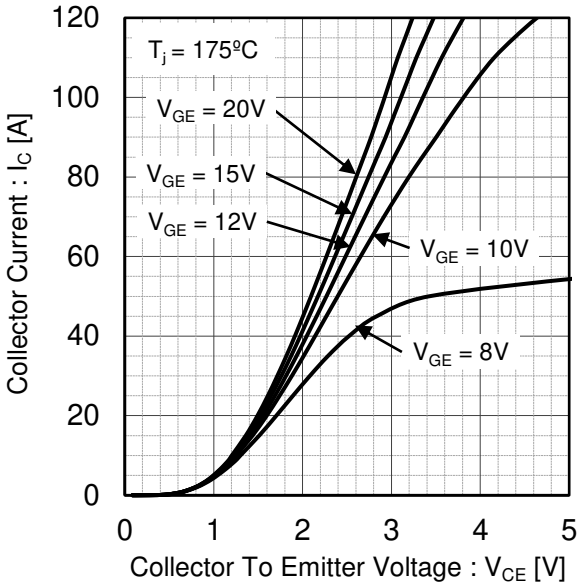


Fig.7 Typical Transfer Characteristics

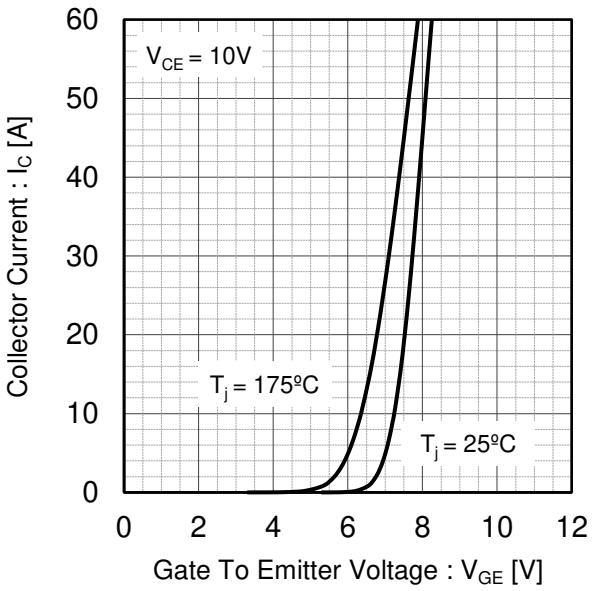
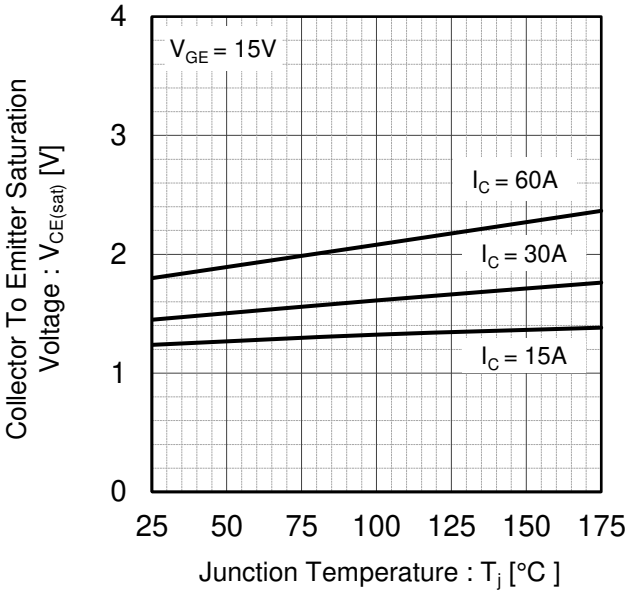


Fig.8 Typical Collector to Emitter Saturation Voltage vs. Junction Temperature



●Electrical Characteristic Curves

Fig.9 Typical Collector to Emitter Saturation Voltage vs. Gate to Emitter Voltage

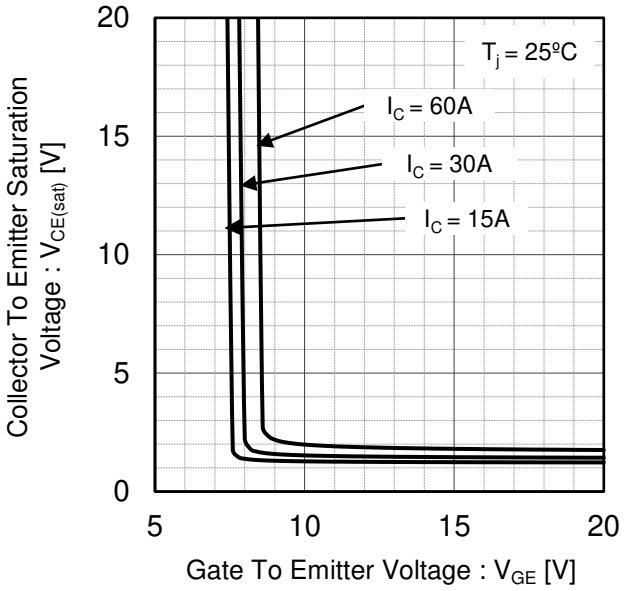


Fig.10 Typical Collector to Emitter Saturation Voltage vs. Gate to Emitter Voltage

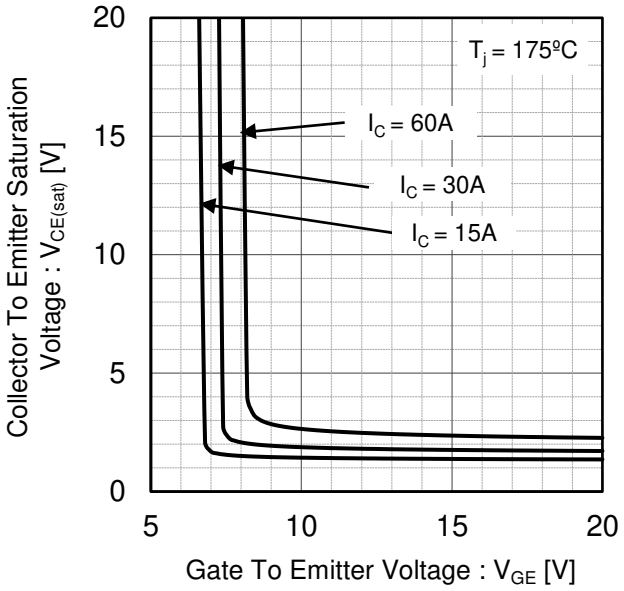


Fig.11 Typical Capacitance vs. Collector to Emitter Voltage

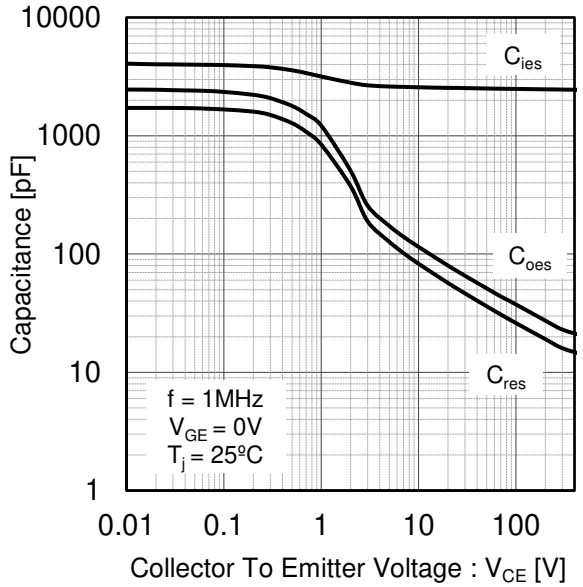
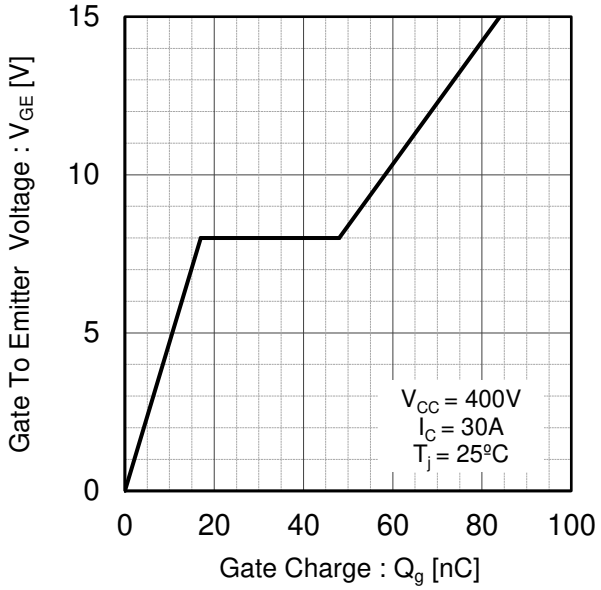


Fig.12 Typical Gate Charge



●Electrical Characteristic Curves

Fig.13 Typical Switching Time vs. Collector Current

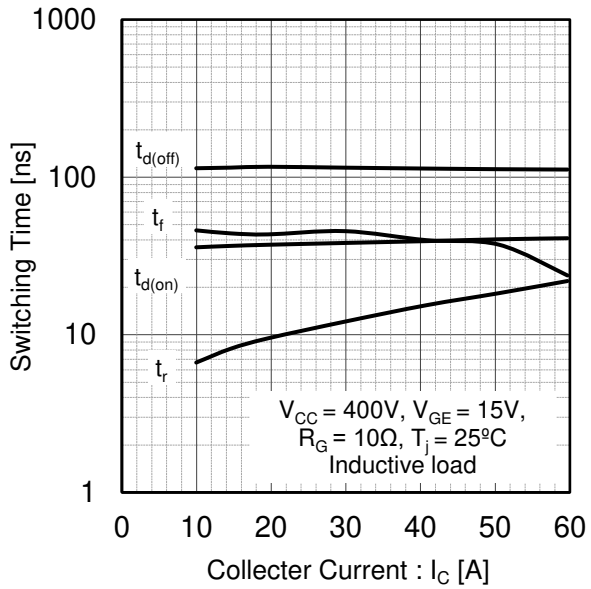


Fig.14 Typical Switching Time vs. Gate Resistance

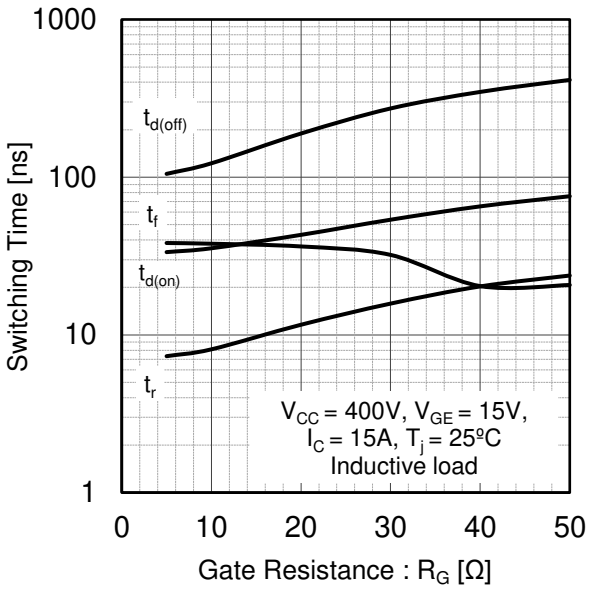


Fig.15 Typical Switching Energy Losses vs. Collector Current

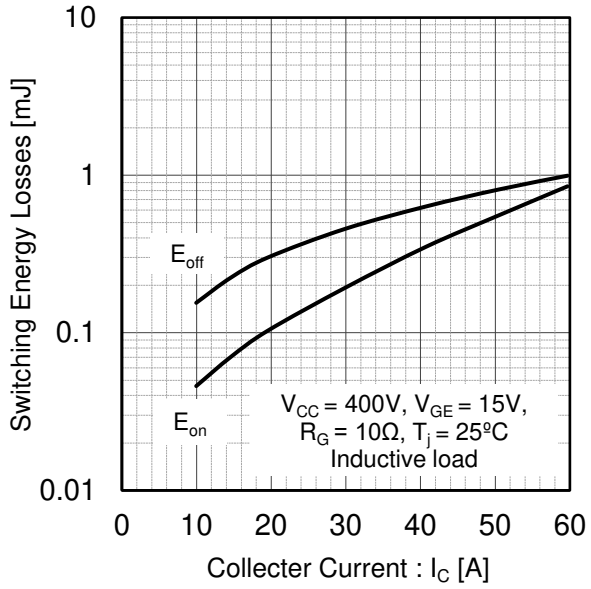
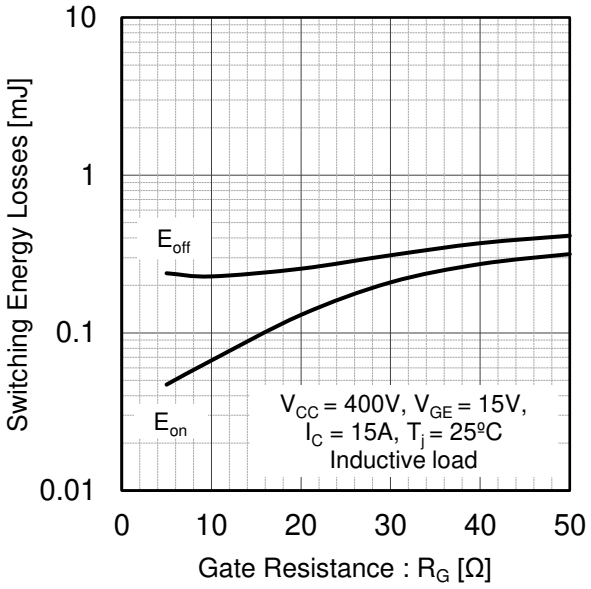


Fig.16 Typical Switching Energy Losses vs. Gate Resistance



●Electrical Characteristic Curves

Fig.17 Typical Switching Time vs. Collector Current

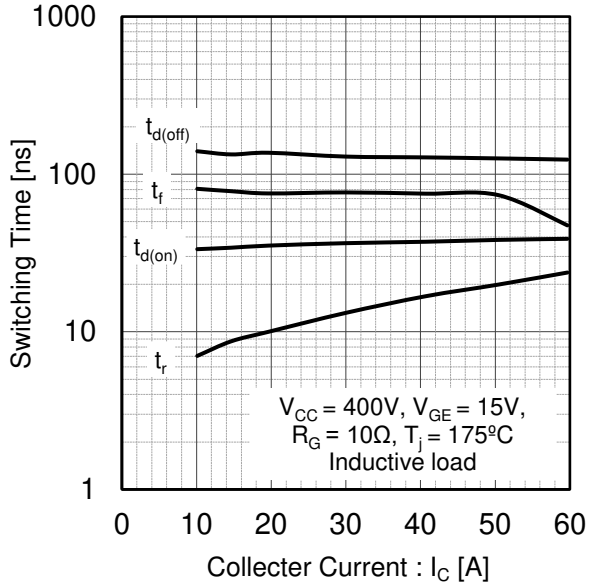


Fig.18 Typical Switching Time vs. Gate Resistance

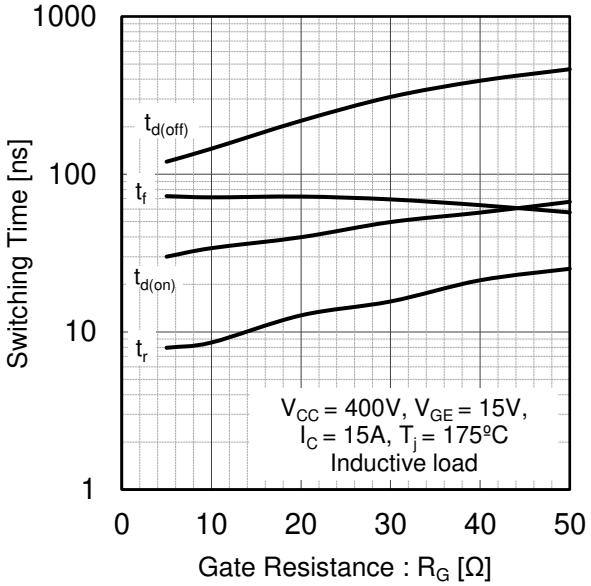


Fig.19 Typical Switching Energy Losses vs. Collector Current

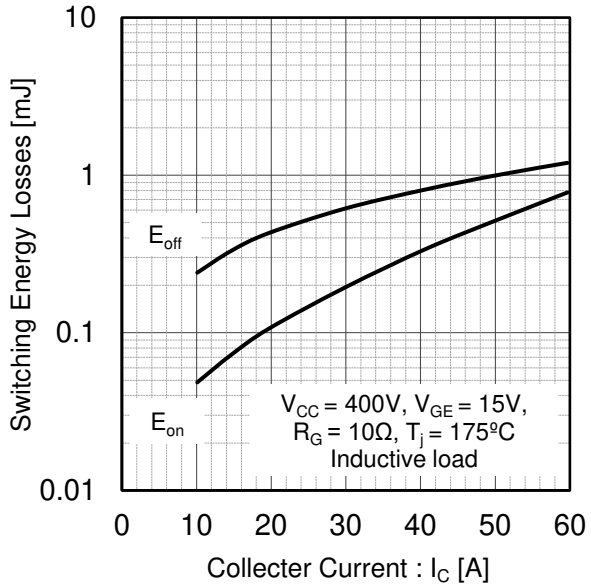
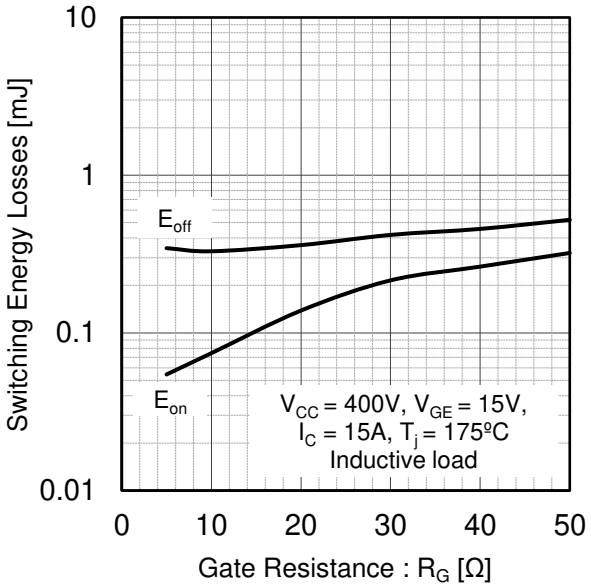


Fig.20 Typical Switching Energy Losses vs. Gate Resistance



●Electrical Characteristic Curves

Fig.21 Typical Diode Forward Current vs. Forward Voltage

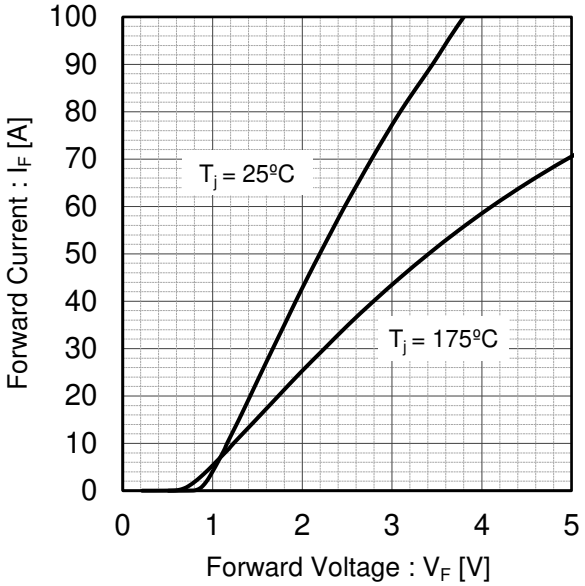


Fig.22 Typical Diode Revese Recovery Time vs. Forward Current

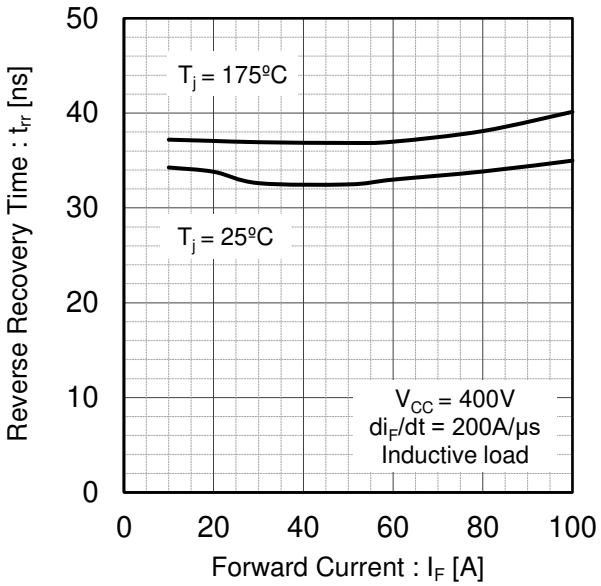


Fig.23 Typical Diode Reverse Recovery Current vs. Forward Current

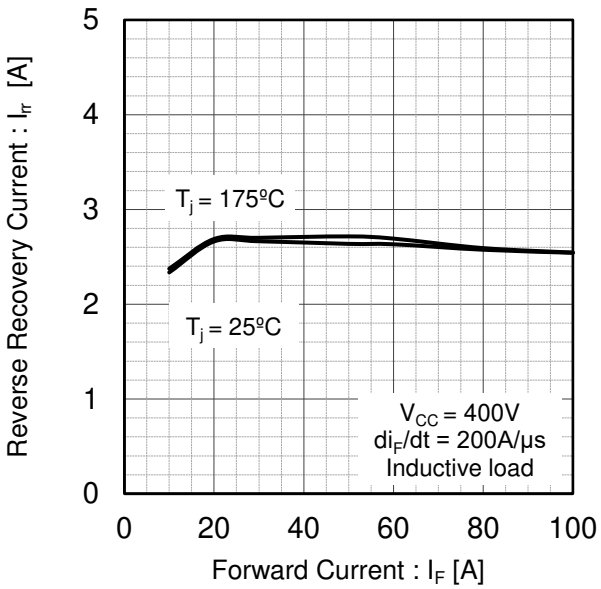
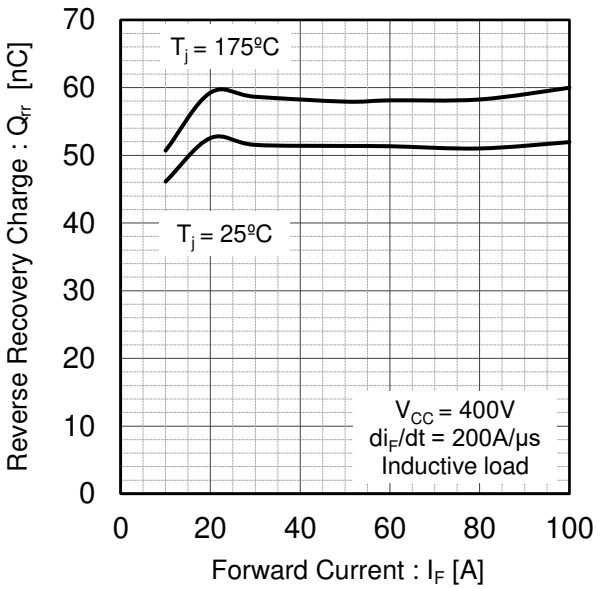


Fig.24 Typical Diode Rrverse Recovery Charge vs. Forward Current



●Electrical Characteristic Curves

Fig.25 Typical Diode Capacitance vs. Reverse Voltage

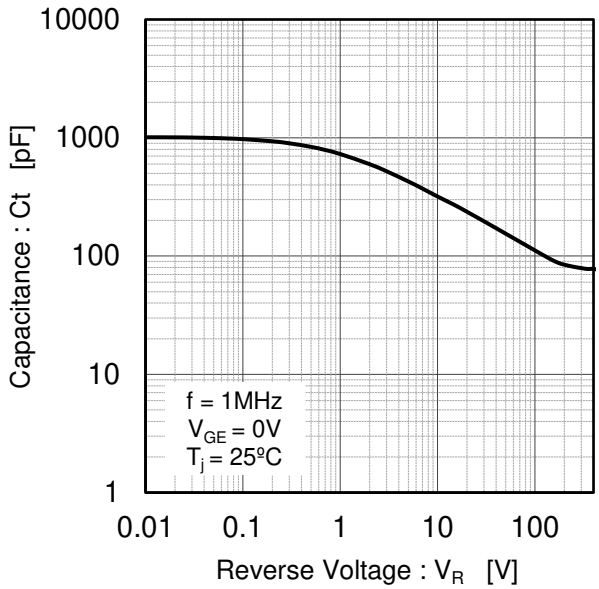
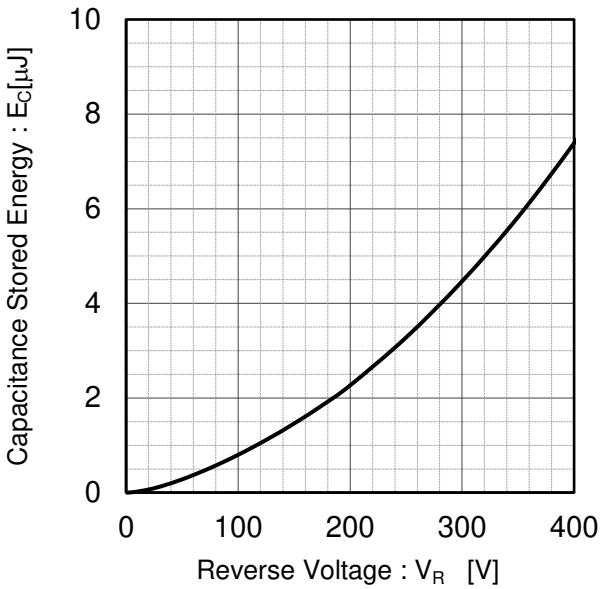
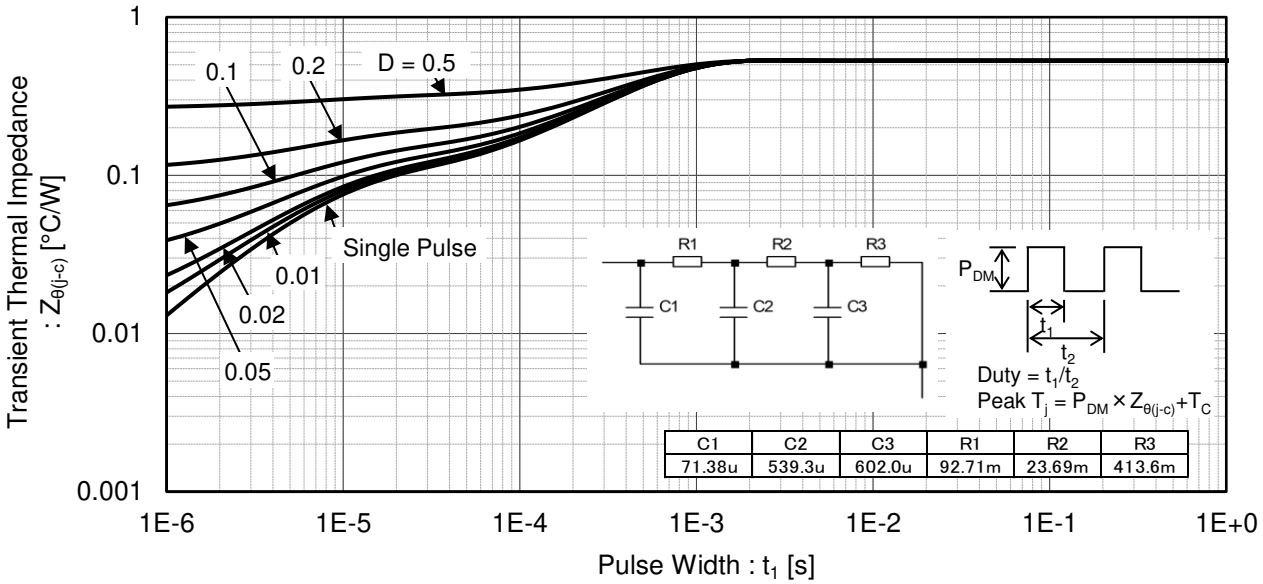


Fig.26 Typical Diode Capacitance Store Energy



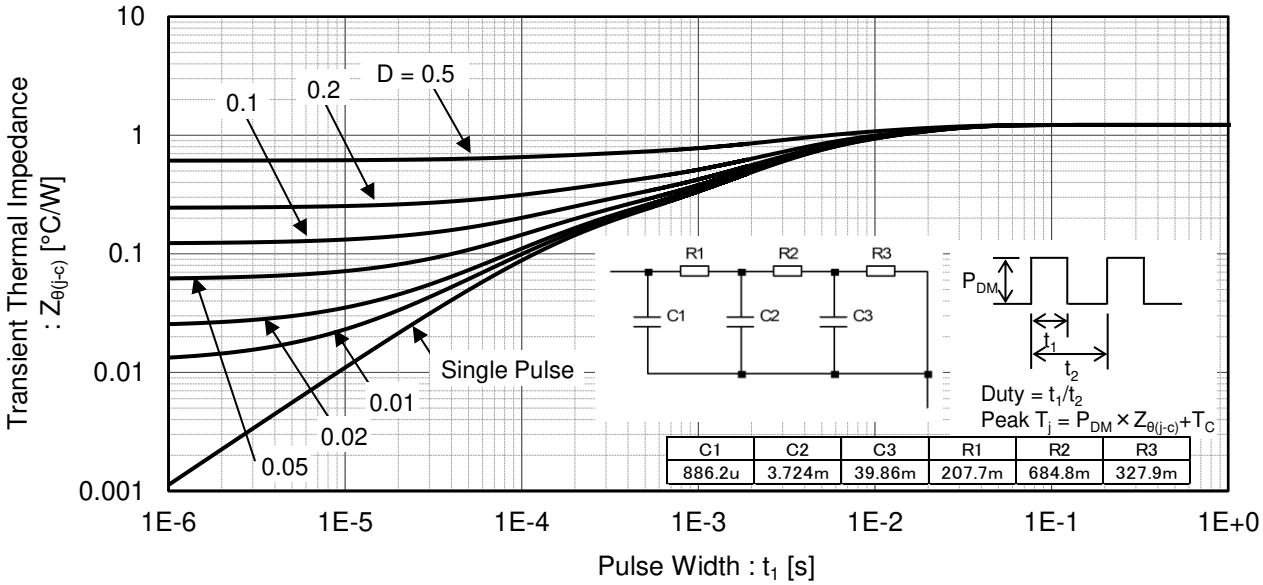
●Electrical Characteristic Curves

Fig.27 Typical IGBT Transient Thermal Impedance



C1	C2	C3	R1	R2	R3
71.38u	539.3u	602.0u	92.71m	23.69m	413.6m

Fig.28 Typical Diode Transient Thermal Impedance



C1	C2	C3	R1	R2	R3
886.2u	3.724m	39.86m	207.7m	684.8m	327.9m

●Inductive Load Switching Circuit and Waveform

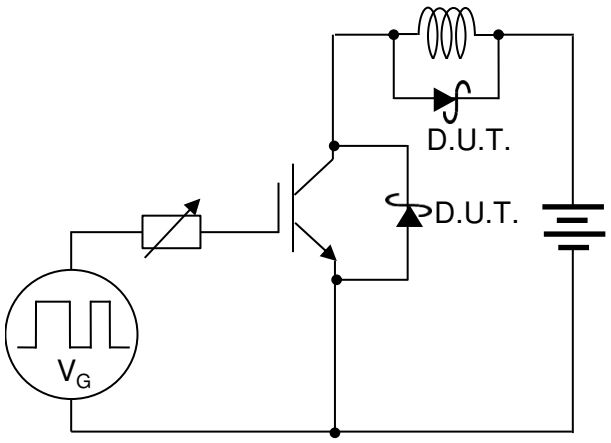


Fig.29 Inductive Load Circuit

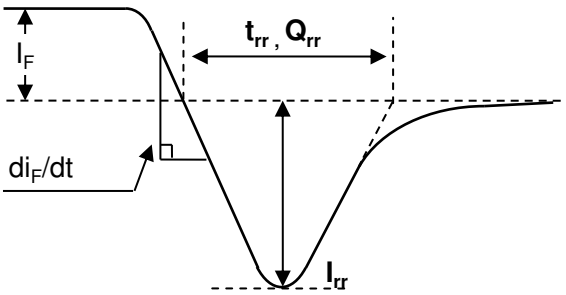


Fig.31 Diode Reverse Recovery Waveform

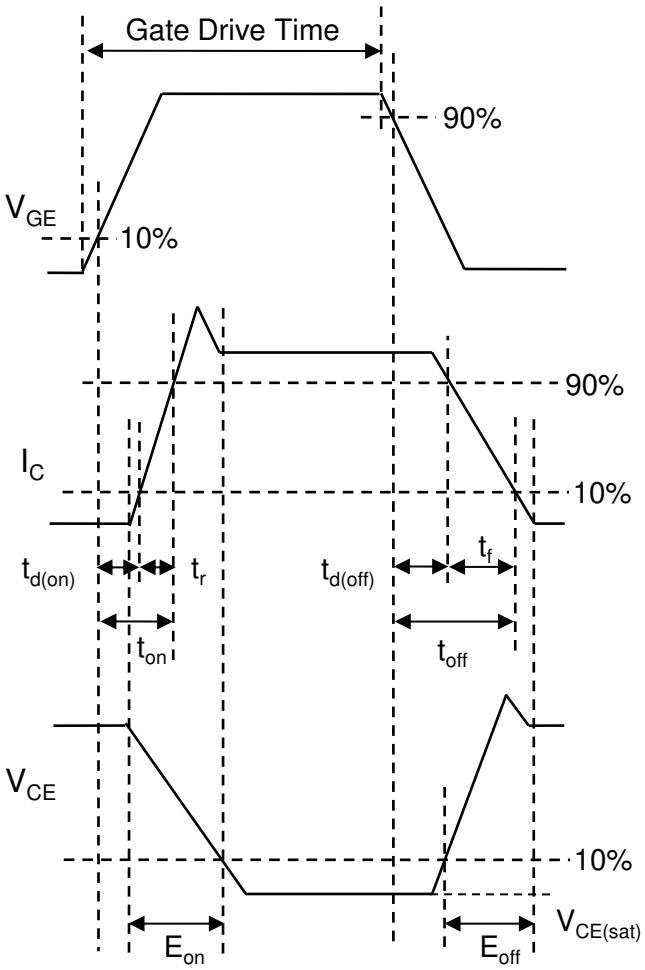


Fig.30 Inductive Load Waveform

Notes

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