TOSHIBA INTEGRATED IGBT MODULE SILICON N CHANNEL IGBT

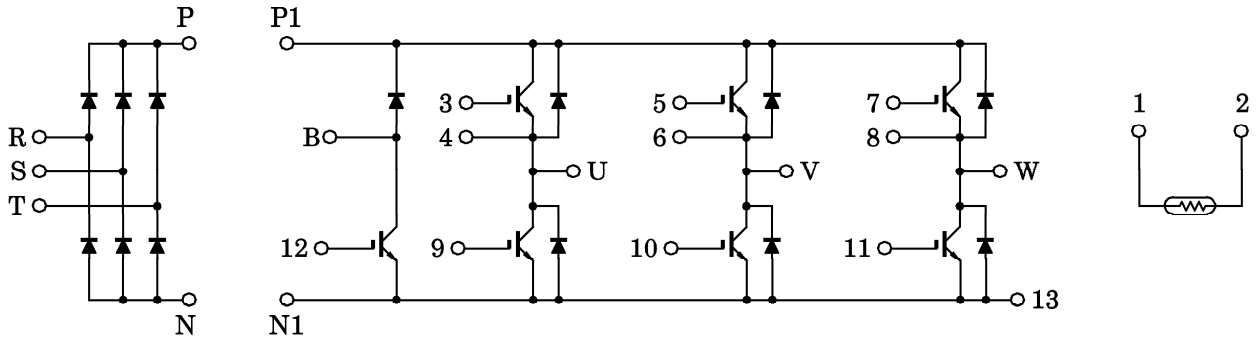
MIG10Q906H, MIG10Q906HA

HIGH POWER SWITCHING APPLICATIONS

MOTOR CONTROL APPLICATIONS

- Integrates Inverter, Converter and Brake Power Circuits and Thermistor in One Package.
- Output (Inverter Stage) : 3ϕ 10 A / 1200 V IGBT
- Input (Converter Stage) : 3ϕ 15 A / 1600 V Silicon Rectifier
- The Electrodes are Isolated from Case.
- Outline
  MIG10Q906H : 2-108E5A
  MIG10Q906HA : 2-108E6A
- Weight : 190 g

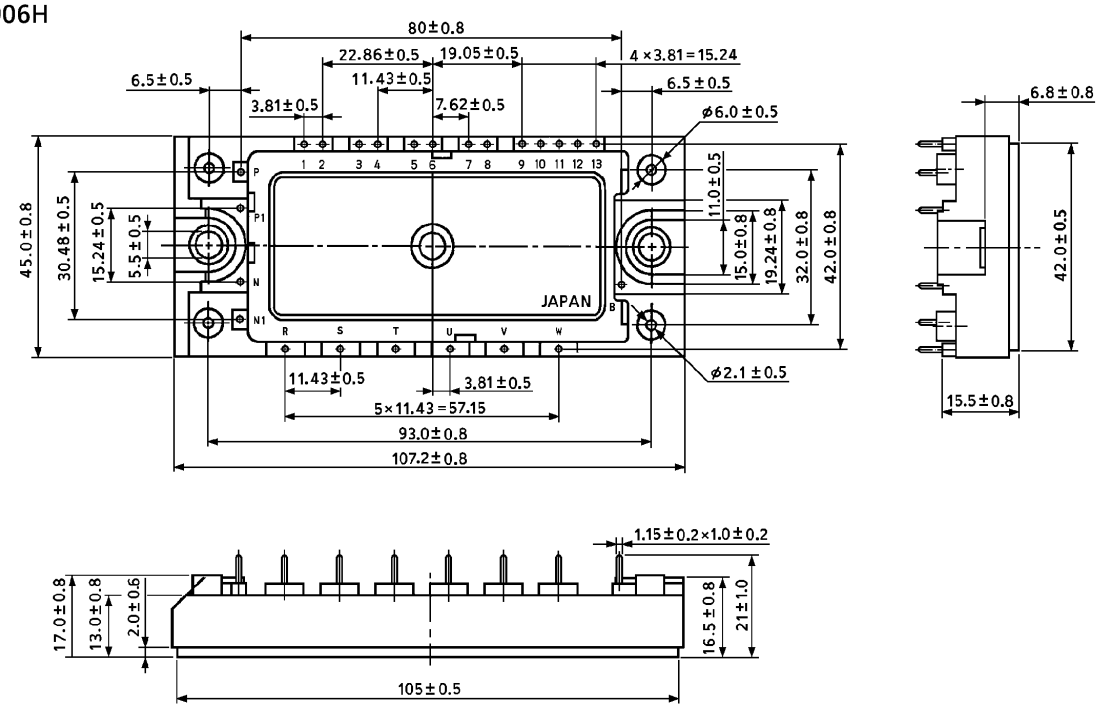
EQUIVALENT CIRCUIT



Package Dimension

Unit : mm

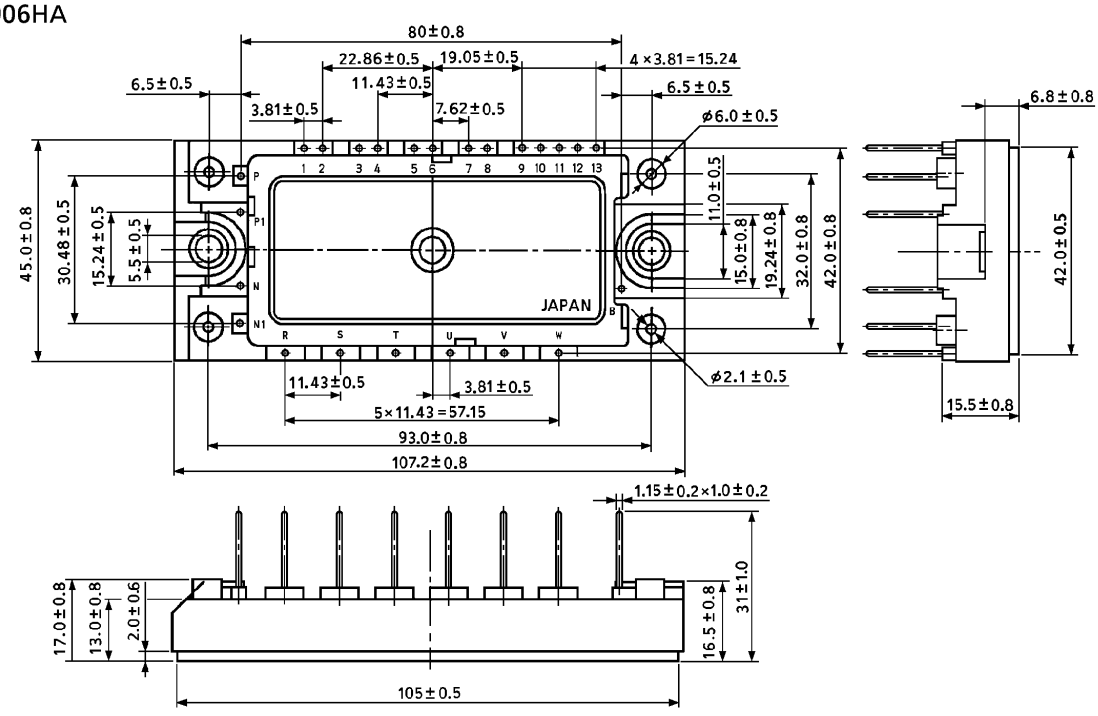
MIG10Q906H



2-108E5A

Unit : mm

MIG10Q906HA



2-108E6A

MAXIMUM RATINGS (Ta = 25°C)

STAGE		CHARACTERISTIC		SYMBOL	RATING	UNIT	
Inverter		Collector-Emitter Voltage		V_{CES}	1200	V	
		Gate-Emitter Voltage		V_{GES}	±20	V	
		Collector Current	DC	I_C	15 / 10	A	(25°C / 80°C)
			1 ms	I_{CP}	30 / 20	A	(25°C / 80°C)
		Forward Current	DC	I_F	10	A	
			1 ms	I_{FM}	20	A	
		Collector Power Dissipation (Tc = 25°C)		P_C	82	W	
Converter		Repetitive Peak Reverse Voltage		V_{RRM}	1600	V	
		Average Output Rectified Current		I_O	15	A	
		Peak One Cycle Surge Forward Current (50 Hz, Non-Repetitive)		I_{FSM}	250	A	
Brake	IGBT	Collector-Emitter Voltage		V_{CES}	1200	V	
		Gate-Emitter Voltage		V_{GES}	±20	V	
		Collector Current	DC	I_C	15 / 10	A	(25°C / 80°C)
			1 ms	I_{CP}	30 / 20	A	(25°C / 80°C)
		Collector Power Dissipation (Tc = 25°C)		P_C	82	W	
	FWD	Reverse Voltage		V_R	1200	V	
		Forward Current	DC	I_F	10	A	
			1 ms	I_{FM}	20	A	
Module		Junction Temperature		T_j	150	°C	
		Storage Temperature Range		T_{stg}	−40~125	°C	
		Isolation Voltage		V_{Isol}	2500 (AC 1 minute)	V	
		Screw Torque		—	6	N·m	

ELECTRICAL CHARACTERISTICS (Ta = 25°C)

a. Inverter stage

CHARACTERISTIC		SYMBOL	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GES}	V_{GE} = ±20 V, V_{CE} = 0		—	—	±500	nA
Collector Cut-Off Current		I_{CES}	V_{CE} = 1200 V, V_{GE} = 0		—	—	0.5	mA
Gate-Emitter Cut-Off Voltage		$V_{GE\ (off)}$	I_C = 10 mA, V_{CE} = 5 V		—	6.0	—	V
Collector-Emitter Saturation Voltage		$V_{CE\ (sat)}$	I_C = 10 A, V_{GE} = 15 V	T_j = 25°C	—	2.8	3.2	V
				T_j = 125°C	—	3.1	3.7	
Input Capacitance		C_{ies}	V_{CE} = 10 V, V_{GE} = 0, f = 1 MHz		—	1200	—	pF
Switching Time	Rise Time	t_r	V_{CC} = 600 V, I_C = 10 A, V_{GE} = ±15 V, R_G = 120 Ω, T_j = 125°C (Note 1)		—	0.07	0.15	μs
	Turn-On Time	t_{on}			—	0.15	0.30	
	Fall Time	t_f			—	0.07	0.10	
	Turn-Off Time	t_{off}			—	0.60	0.90	
Forward Voltage		V_F	I_F = 10 A, V_{GE} = 0		—	2.0	2.8	V
Reverse Recovery Time		t_{rr}	I_F = 10 A, V_{GE} = −10 V, di / dt = 200 A / μs		—	0.10	0.25	μs
Thermal Resistance		$R_{th\ (j-c)}$	Transistor		—	—	1.52	°C / W
			Diode		—	—	1.5	

b. Converter stage

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Repetitive Peak Reverse Current	I_{RRM}	V_{RRM} = 1600 V	—	—	50	μA
Peak Forward Voltage	V_{FM}	I_{FM} = 15 A	—	1.05	1.20	V
Peak One Cycle Surge Forward Current	I_{FSM}	50 Hz sine-half-wave	250	—	—	A
Thermal Resistance	$R_{th\ (j-c)}$	—	—	—	1.90	°C / W

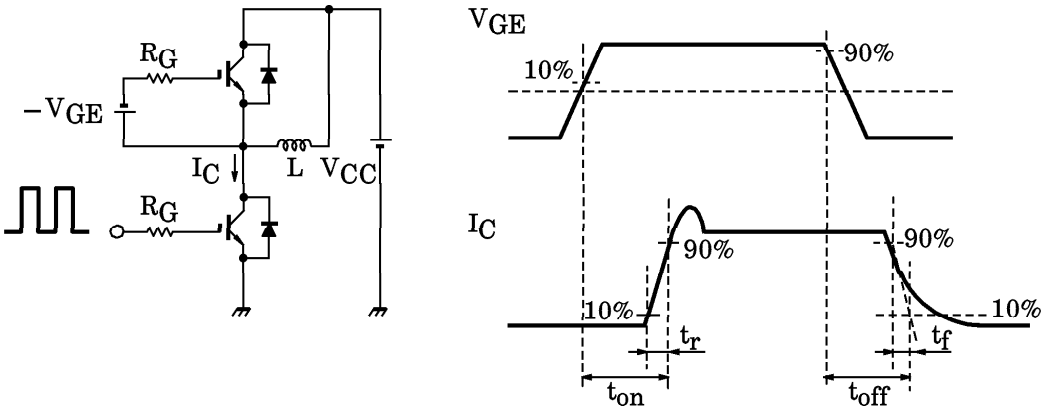
c. Brake stage

CHARACTERISTIC		SYMBOL	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GES}	V_{GE} = ±20 V, V_{CE} = 0		—	—	±500	nA
Collector Cut-Off Current		I_{CES}	V_{CE} = 1200 V, V_{GE} = 0		—	—	0.5	mA
Reverse Current		I_R	V_R = 1200 V, V_{GE} = 0		—	—	0.5	mA
Gate-Emitter Cut-Off Voltage		$V_{GE\ (off)}$	I_C = 10 mA, V_{CE} = 5 V		—	6.0	—	V
Collector-Emitter Saturation Voltage		$V_{CE\ (sat)}$	I_C = 10 A, V_{GE} = 15 V	T_j = 25°C	—	2.8	3.2	V
				T_j = 125°C	—	3.1	3.7	
Input Capacitance		C_{ies}	V_{CE} = 10 V, V_{GE} = 0, f = 1 MHz		—	1200	—	pF
Switching Time	Rise Time	t_r	V_{CC} = 600 V, I_C = 10 A, V_{GE} = ±15 V, R_G = 120 Ω, T_j = 125°C (Note 1)		—	0.07	0.15	μs
	Turn-On Time	t_{on}			—	0.15	0.30	
	Fall Time	t_f			—	0.07	0.10	
	Turn-Off Time	t_{off}			—	0.60	0.90	
Forward Voltage		V_F	I_F = 10 A, V_{GE} = 0		—	2.0	2.8	V
Thermal Resistance		$R_{th\ (j-c)}$	Transistor		—	—	1.52	°C / W
			Diode		—	—	1.5	

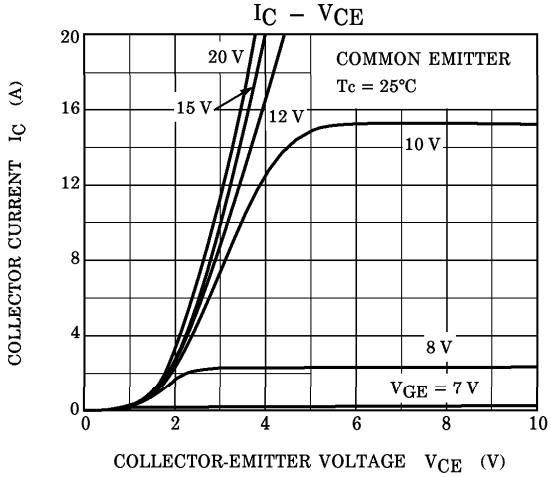
d. Thermistor

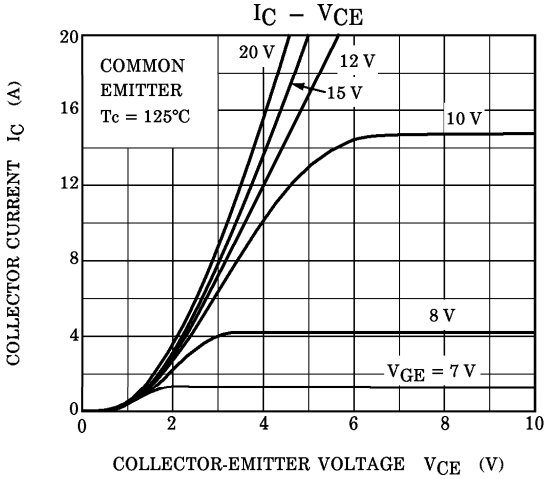
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Zero-power Resistance	R_{25}	I_{TM} = 0.2 mA, Tc = 25°C	17.31	20	23.14	kΩ
B Value	$B_{25\ /\ 85}$	Tc = 25°C / Tc = 85°C	—	3760	—	K

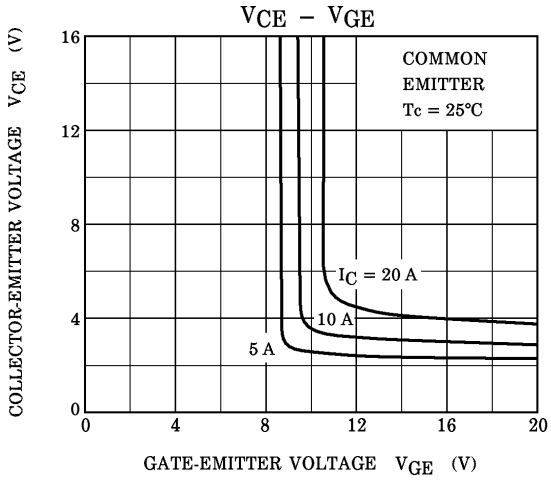
(Note 1) Switching Time Test Circuit & Timing Chart

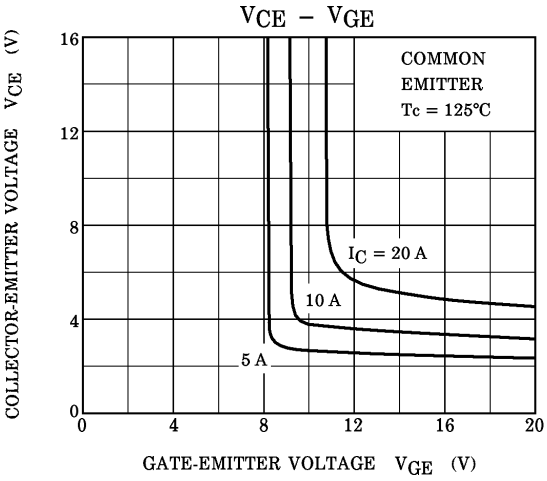


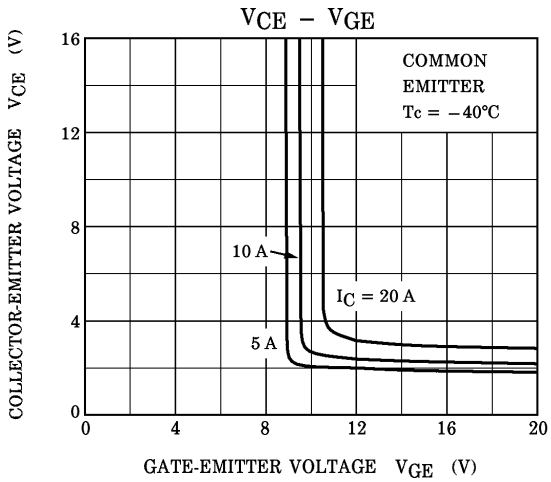
a. Inverter stage / c. Brake stage

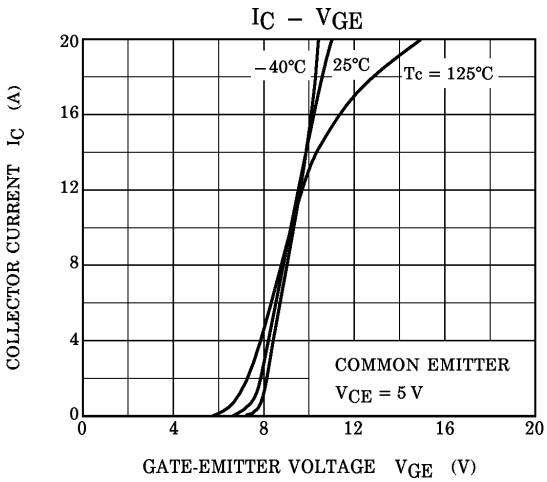




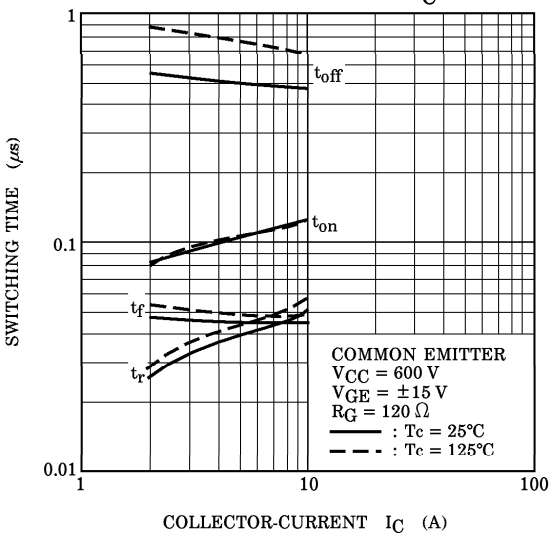




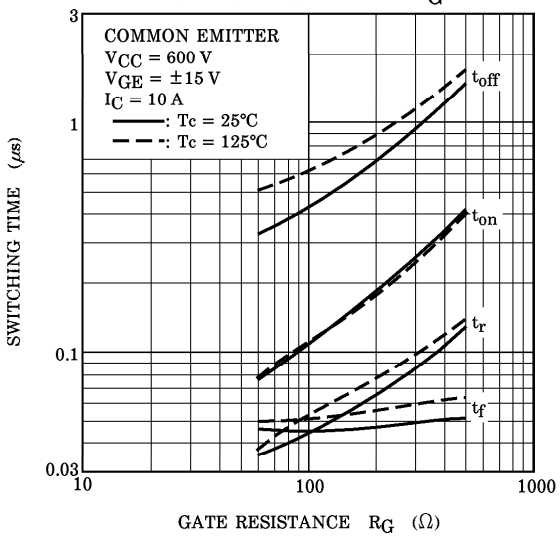




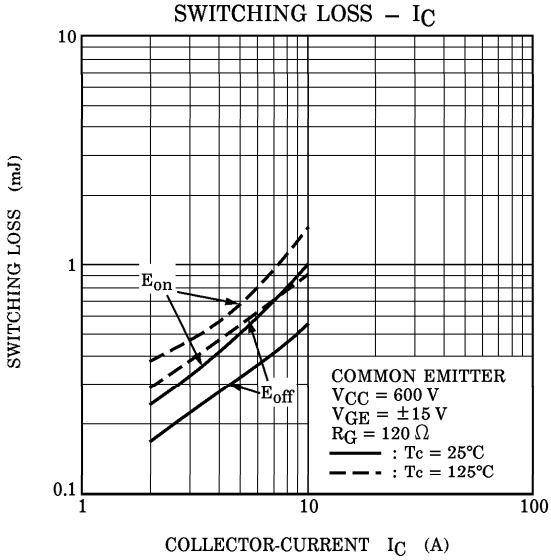
SWITCHING TIME – I_C



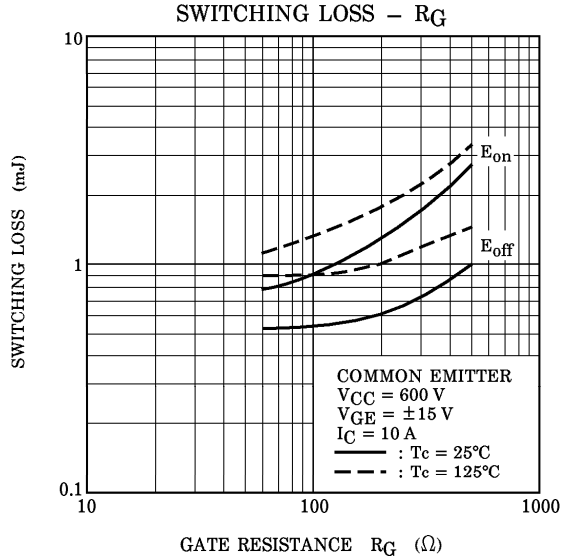
SWITCHING TIME – R_G



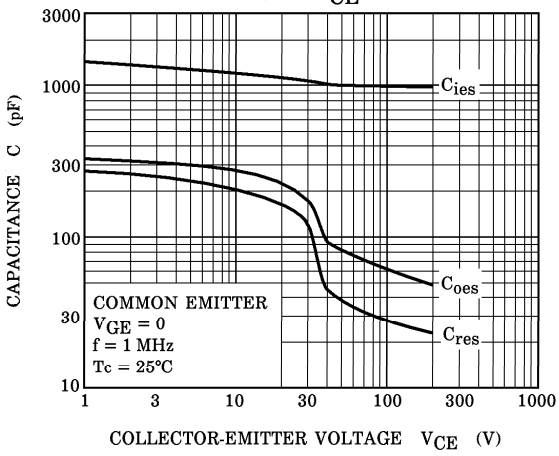
SWITCHING LOSS – I_C



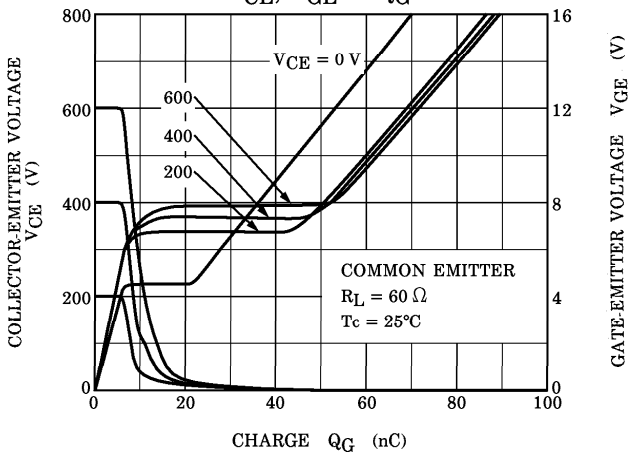
SWITCHING LOSS – R_G



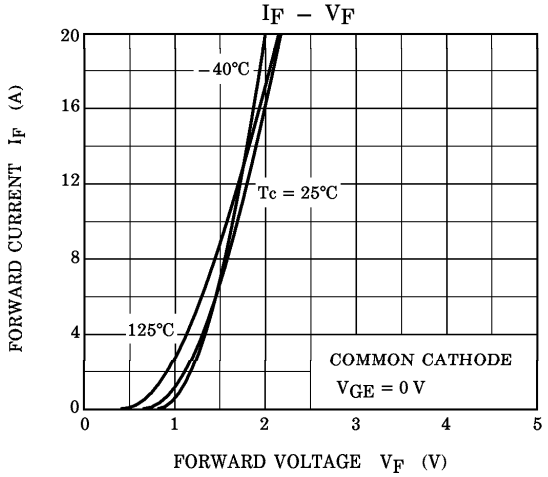
C – V_{CE}



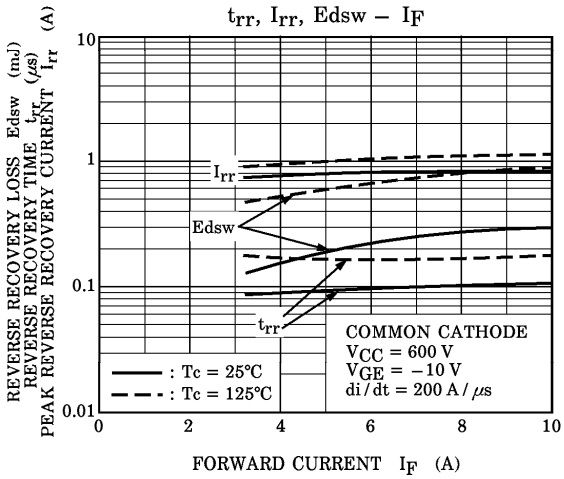
V_{CE}, V_{GE} – Q_G



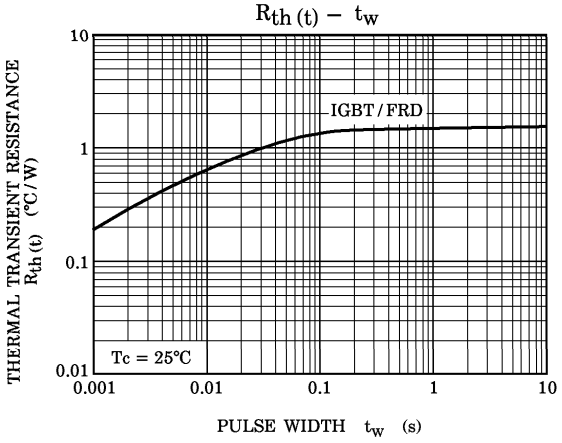
I_F – V_F



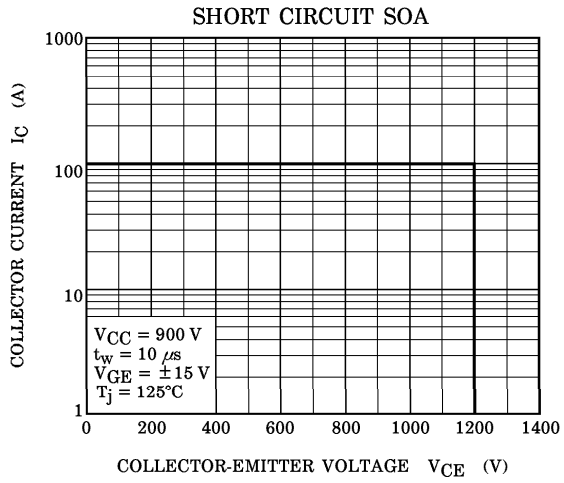
t_{rr}, I_{rr}, Edsw – I_F



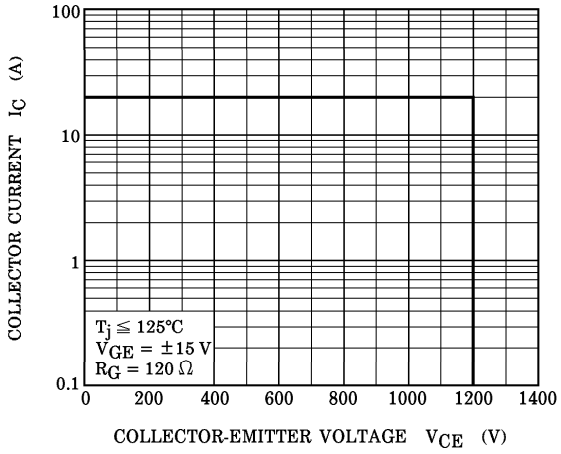
$R_{th\,(t)}$ – t_w



SHORT CIRCUIT SOA

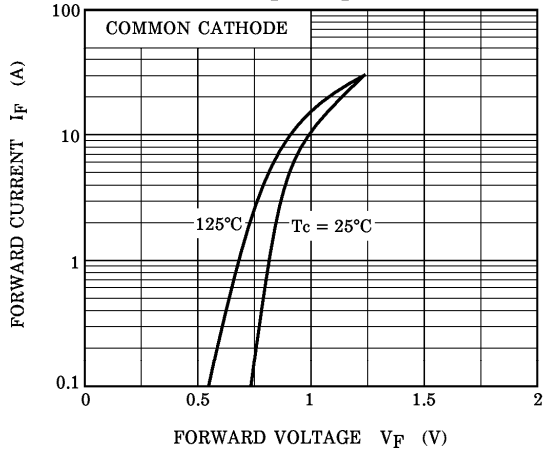


REVERSE BIAS SOA



b. Converter stage

$I_F - V_F$



$R_{th\,(t)} - t_w$