TENTATIVE TOSHIBA INSULATED GATE BIPOLAR TRANSISTOR SILICON N CHANNEL IGBT

GT5J311, GT5J311(SM)

HIGH POWER SWITCHING APPLICATIONS

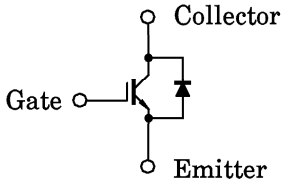
MOTOR CONTROL APPLICATIONS

- The 3rd Generation
- Enhancement-Mode
- High Speed : $t_f = 0.30\mu s$ (Max.) ($I_C = 5A$)
- Low Saturation Voltage : $V_{CE\,(sat)} = 2.7V$ (Max.) ($I_C = 5A$)
- FRD included between Emitter and Collector.

MAXIMUM RATINGS (Ta = 25°C)

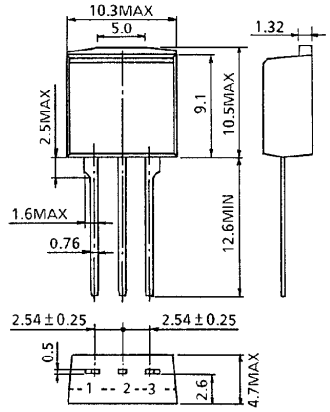
CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Emitter Voltage		V_{CES}	600	V
Gate-Emitter Voltage		V_{GES}	±20	V
Collector Current	DC	I_C	5	A
	1ms	I_{CP}	10	A
Emitter-Collector Forward Current	DC	I_F	5	A
	1ms	I_{FM}	10	A
Collector Power Dissipation (Tc = 25°C)		P_C	45	W
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	−55~150	°C

EQUIVALENT CIRCUIT



Unit in mm

GT5J311

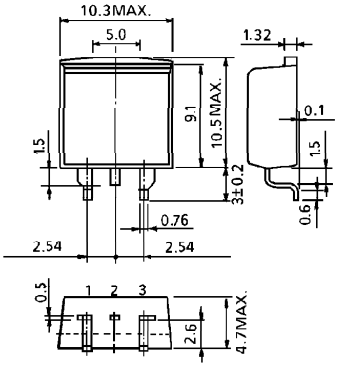


1. GATE
2. COLLECTOR (HEAT SINK)
3. EMITTER

JEDEC	—
EIAJ	—
TOSHIBA	2-10S1C

Weight : 1.5g

GT5J311(SM)



1. GATE
2. COLLECTOR (HEAT SINK)
3. EMITTER

JEDEC	—
EIAJ	—
TOSHIBA	2-10S2C

Weight : 1.4g

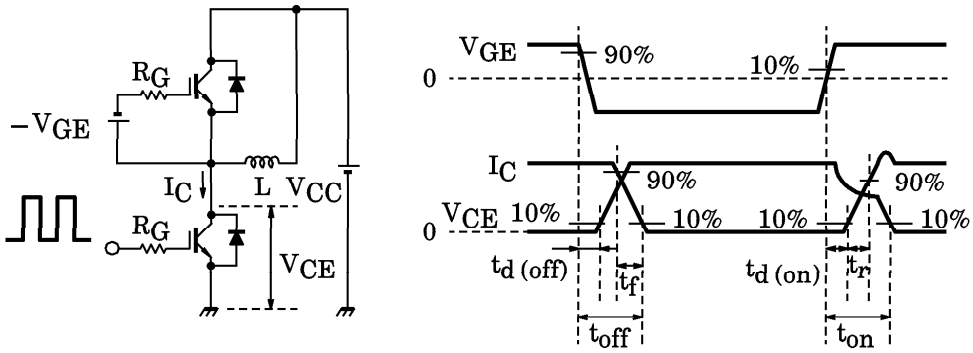
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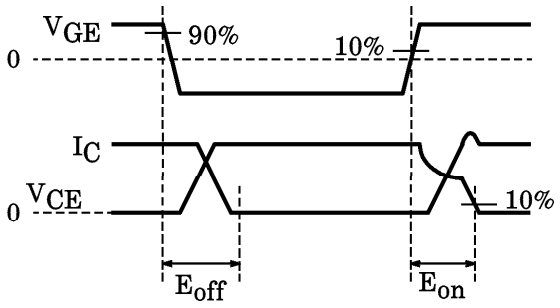
ELECTRICAL CHARACTERISTICS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GES}	$V_{GE}=\pm20V$, $V_{CE}=0$	—	—	±500	nA
Collector Cut-Off Current		I_{CES}	$V_{CE}=600V$, $V_{GE}=0$	—	—	1.0	mA
Gate-Emitter Cut-Off Voltage		$V_{GE\ (OFF)}$	$I_C=0.5mA$, $V_{CE}=5V$	5.0	—	8.0	V
Collector-Emitter Saturation Voltage		$V_{CE\ (sat)}$	$I_C=5A$, $V_{GE}=15V$	—	2.1	2.7	V
Input Capacitance		C_{ies}	$V_{CE}=20V$, $V_{GE}=0$, f=1MHz	—	650	—	pF
Switching Time	Rise Time	t_r	Inductive Load $V_{CC}=300V$, $I_C=5A$ $V_{GG}=\pm15V$, $R_G=180\Omega$ (Note 1)	—	0.12	—	μs
	Turn-On Time	t_{on}		—	0.40	—	
	Fall Time	t_f		—	0.15	0.30	
	Turn-Off Time	t_{off}		—	0.50	—	
Peak Forward Voltage		V_F	$I_F=5A$, $V_{GE}=0$	—	—	1.8	V
Reverse Recovery Time		t_{rr}	$I_F=5A$, $di/dt=-100A/\mu s$	—	—	200	ns
Thermal Resistance (IGBT)		$R_{th\ (j-c)}$	—	—	—	2.8	°C/W
Thermal Resistance (Diode)		$R_{th\ (j-c)}$	—	—	—	3.76	°C/W

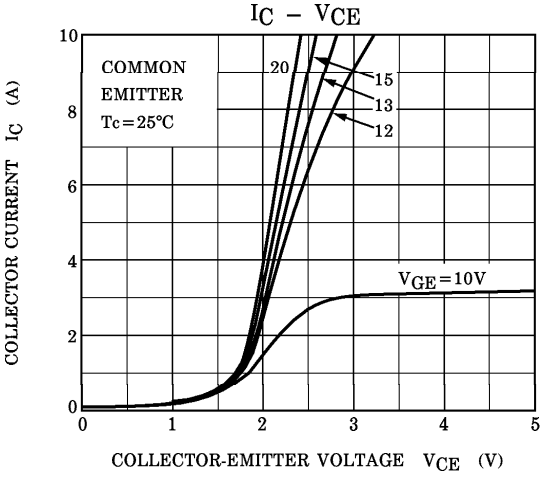
(Note 1) Switching time measurement circuit and input/output waveforms



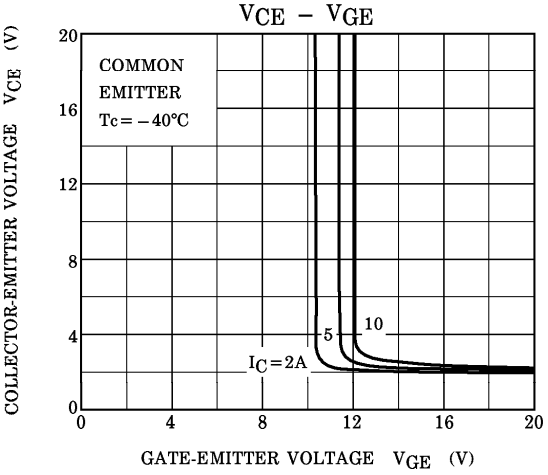
Switching loss measurement waveforms



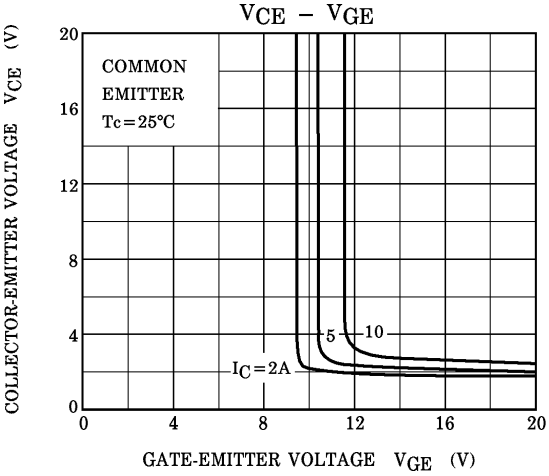
I_C – V_{CE}



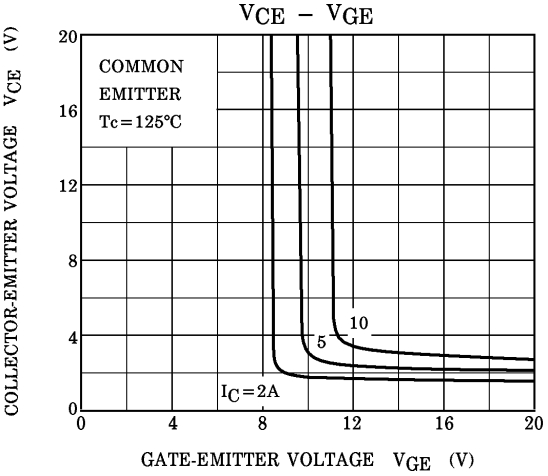
V_{CE} – V_{GE}



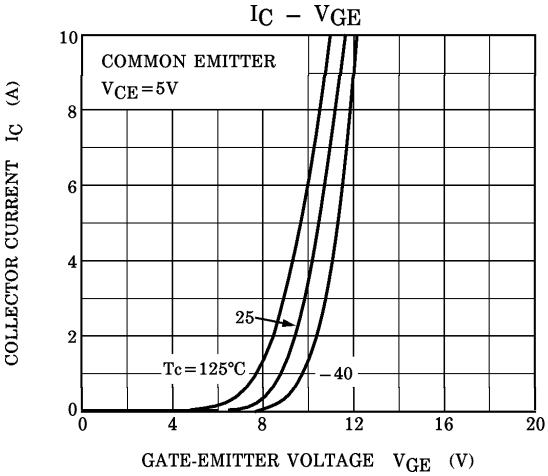
V_{CE} – V_{GE}



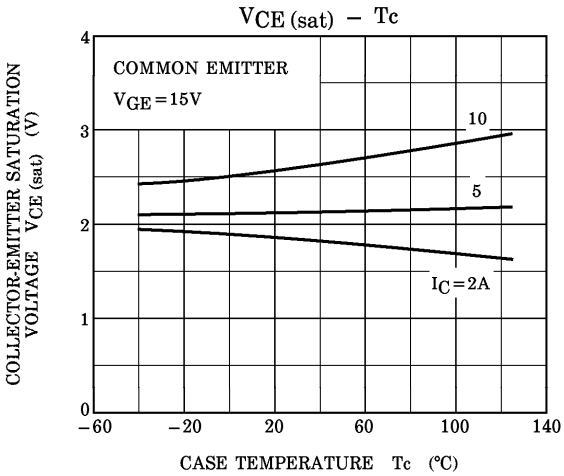
V_{CE} – V_{GE}



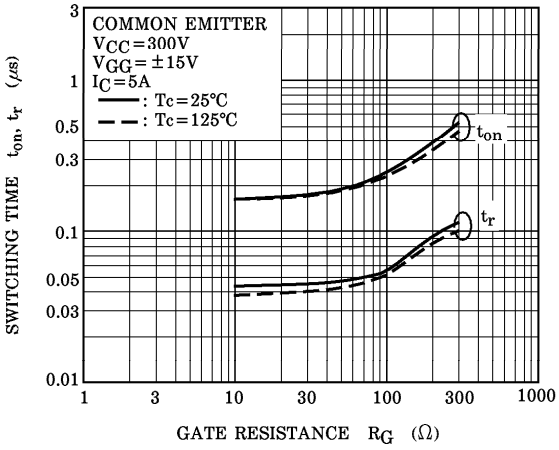
I_C – V_{GE}



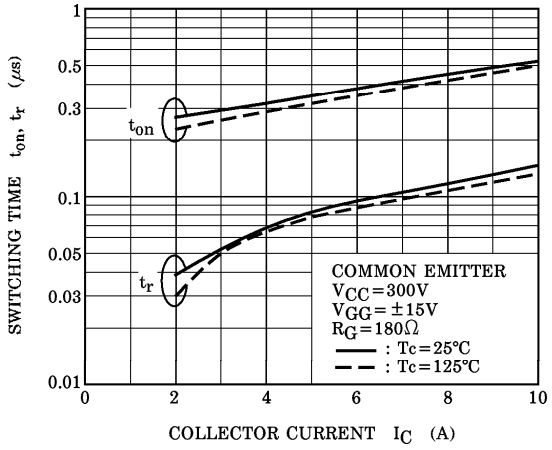
$V_{CE\,(sat)}$ – Tc



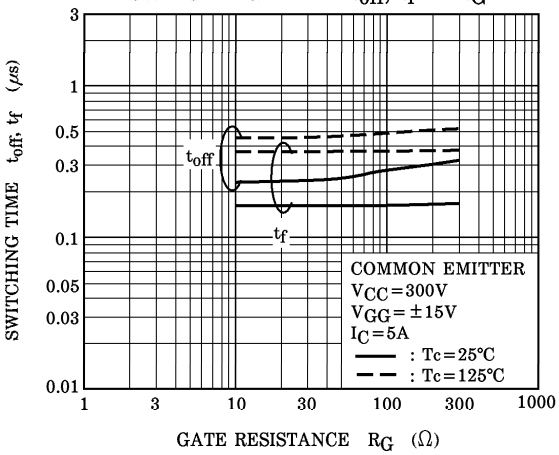
SWITCHING TIME t_{on}, t_r – R_G



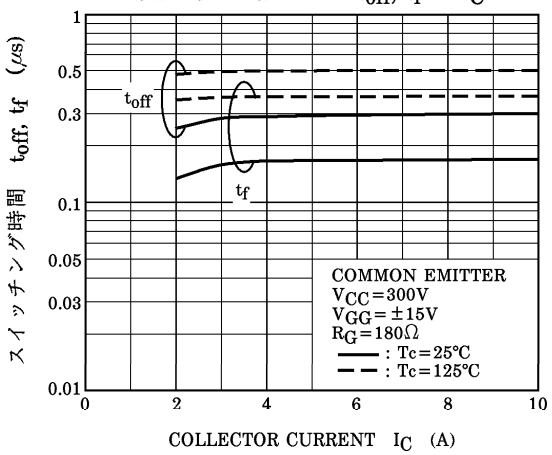
SWITCHING TIME t_{on}, t_r – I_C



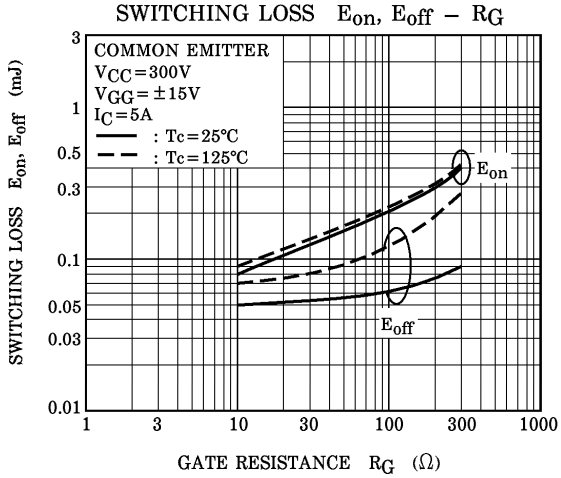
SWITCHING TIME t_{off}, t_f – R_G



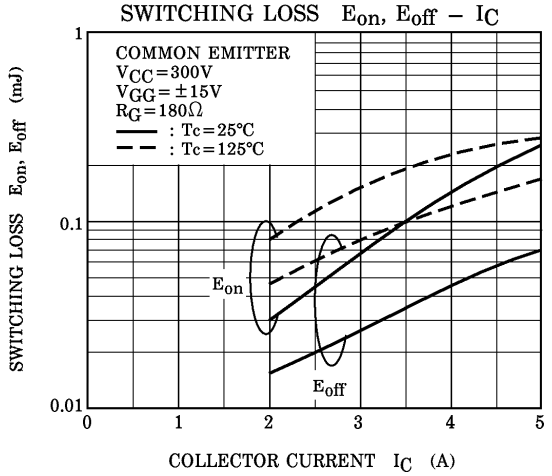
SWITCHING TIME t_{off}, t_f – I_C



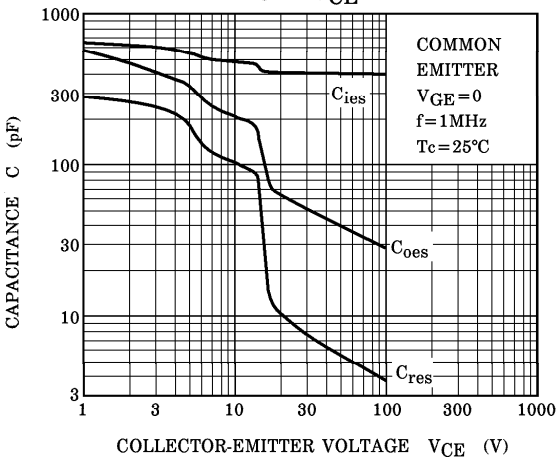
SWITCHING LOSS E_{on}, E_{off} – R_G



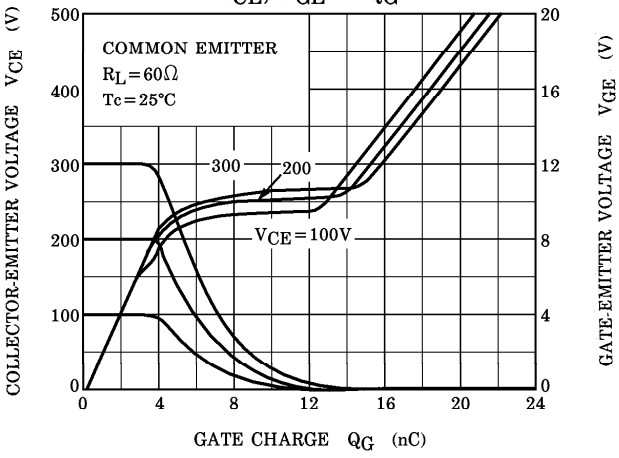
SWITCHING LOSS E_{on}, E_{off} – I_C



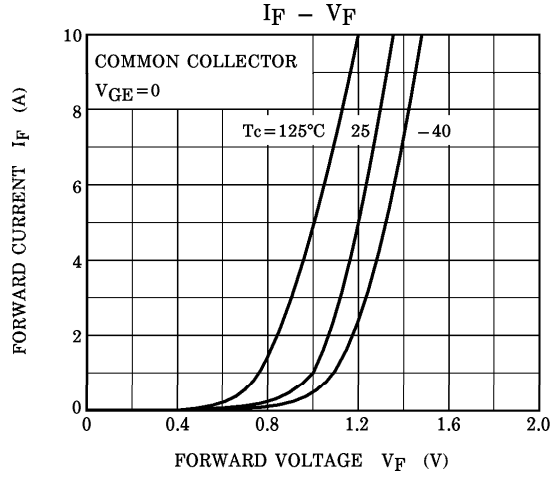
C – V_{CE}



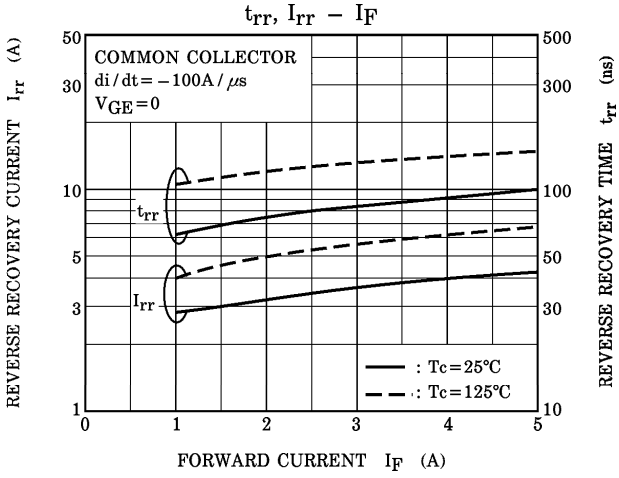
V_{CE}, V_{GE} – Q_G



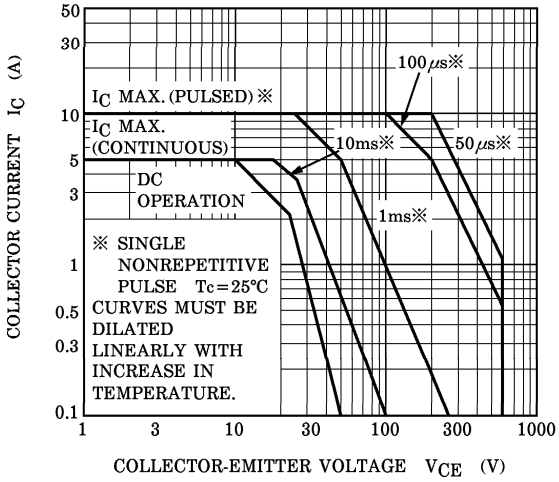
I_F – V_F



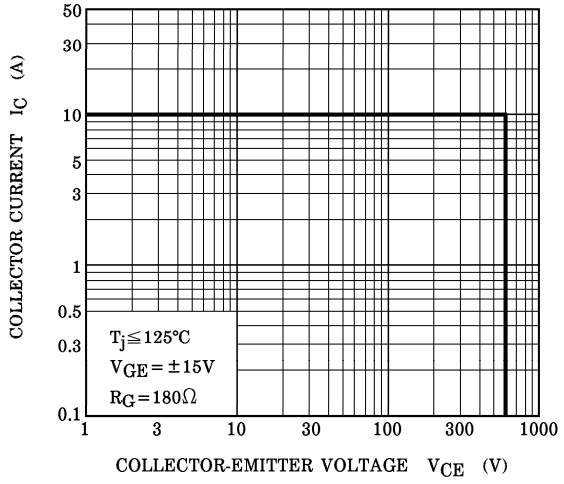
t_{rr}, I_{rr} – I_F

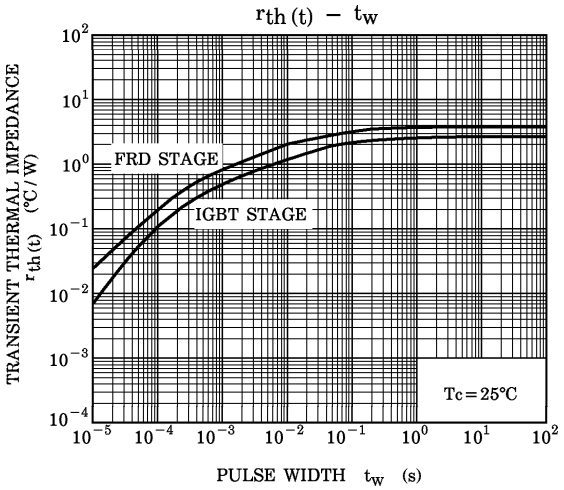


SAFE OPERATING AREA



REVERSE BIAS SOA




$r_{th}(t) - t_w$
TRANSIENT THERMAL IMPEDANCE $r_{th}(t)$ (°C/W)
10^2
10^1
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-4}
FRD STAGE
IGBT STAGE
Tc = 25°C
10^{-5} 10^{-4} 10^{-3} 10^{-2} 10^{-1} 10^0 10^1 10^2
PULSE WIDTH t_w (s)