Preliminary TOSHIBA Insulated Gate Bipolar Transistor Silicon N Chanenel IGBT

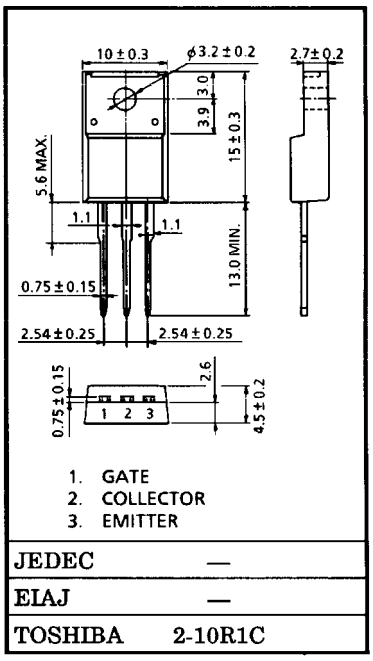
GT10J321

High Power Switching Applications

Fast Switching Applications

- The 4th generation
- Enhancement-mode
- Fast Switching(FS) :Operating frequency up to 150kHz(Reference)
  - High speed :t_f=0.03μs(typ.)
  - Low switching loss :E_{on}=0.26mJ(typ.)
    :E_{off}=0.18mJ(typ.)
- Low saturation voltage :$V_{CE(sat)}$=2.0V(typ.)
- FRD included between emitter and collector

Unit in mm

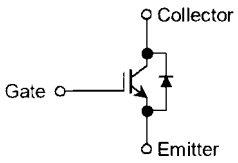


Weight : 1.7g

Maximum Ratings (Ta=25°C)

Characteristic		Symbol	Ratings	Unit
Collector−emitter voltage		V_{CES}	600	V
Gate−emitter voltage		V_{GES}	±20	V
Collector current	DC	I_C	10	A
	1ms	I_{CP}	20	
Emitter−collector forward current	DC	I_F	10	A
	1ms	I_{FM}	20	
Collector power dissipation (Tc=25°C)		P_C	29	W
Junction temperature		T_j	150	°C
Storage temperature range		T_{stg}	−55～150	°C

Equivalent Circuit



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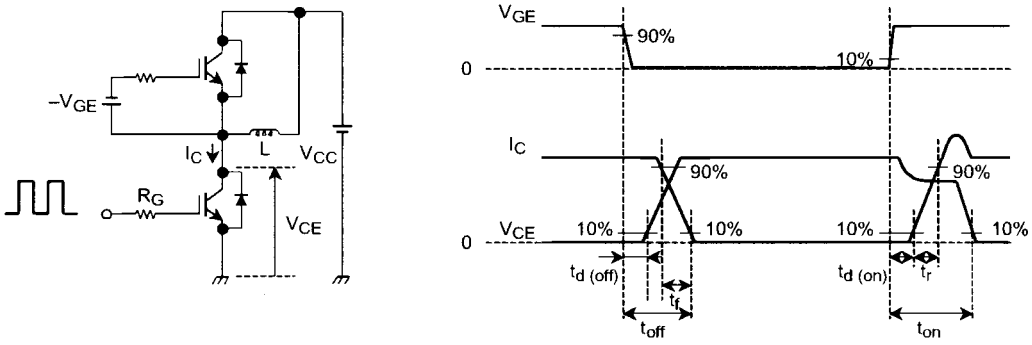
Preliminary

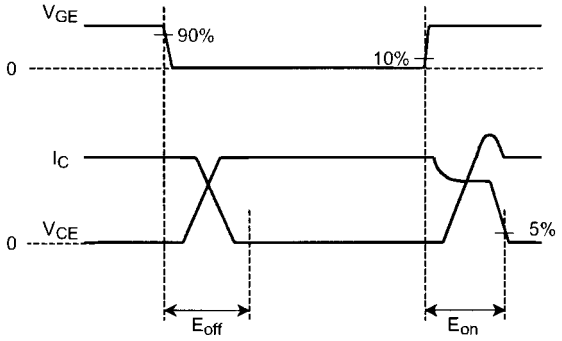
Electrical Characteristics(Ta=25℃)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GES}	V_{GE}=±20V,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=1mA,V_{CE}=5V	3.5	−	6.5	V
Collector-emitter saturation volatage		$V_{CE(sat)}$	I_C=10A,V_{GE}=15V	−	2.0	2.45	V
Input capacitance		C_{ies}	V_{CE}=10V,V_{GE}=0,f=1MHz	−	1500	−	pF
Switching time	Turn-on delay time	$t_{d(on)}$	Inductive Load V_{CC}=300V,I_C=10A V_{GG}=+15V,R_G=68Ω (Note 1) (Note 2)	−	0.06	−	μs
	Rise Time	t_r		−	0.03	−	
	Turn-on Time	t_{on}		−	0.17	−	
	Turn-off delay time	$t_{d(off)}$		−	0.24	−	
	Fall Time	t_f		−	0.03	0.15	
	Turn-off Time	t_{off}		−	0.30	−	
Switching loss	Turn-on switching loss	E_{on}		−	0.26	−	mJ
	Turn-off switching loss	E_{off}		−	0.18	−	
Peak forward voltage		V_F	I_F=10A,V_{GE}=0	−	−	2.0	V
Reverse recovery time		t_{rr}	I_F=10A,di/dt=−100A/μs	−	−	200	ns
Thermal resistance(IGBT)		$R_{th(j-c)}$	—	−	−	4.31	℃/W
Thermal resistance(Diode)		$R_{th(j-c)}$	—	−	−	4.90	℃/W

Note1: Switching time measurement circuit and input/output waveforms

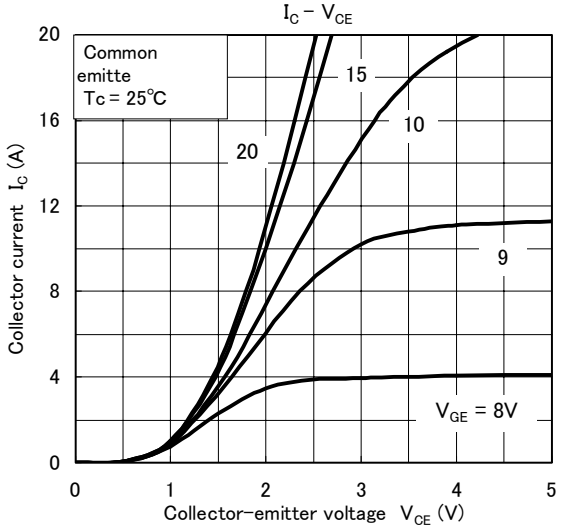


Note 2: Switching loss measurement waveforms

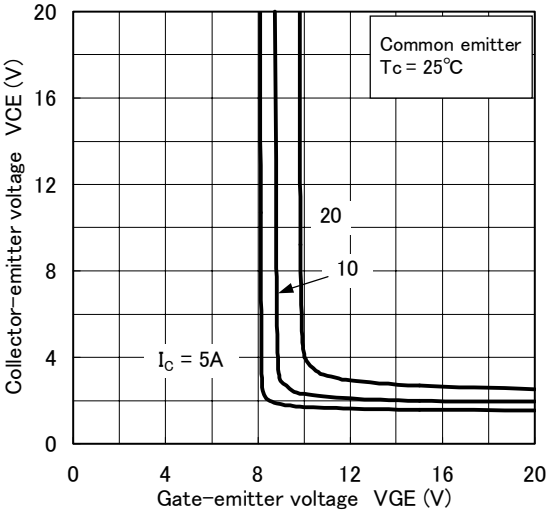


Reference

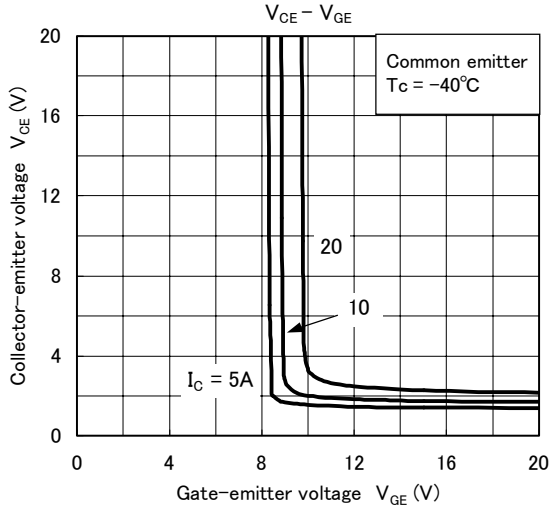
$I_C - V_{CE}$



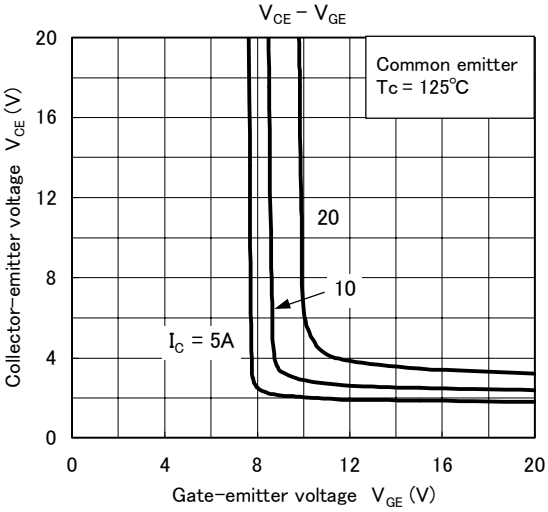
VCE − VGE



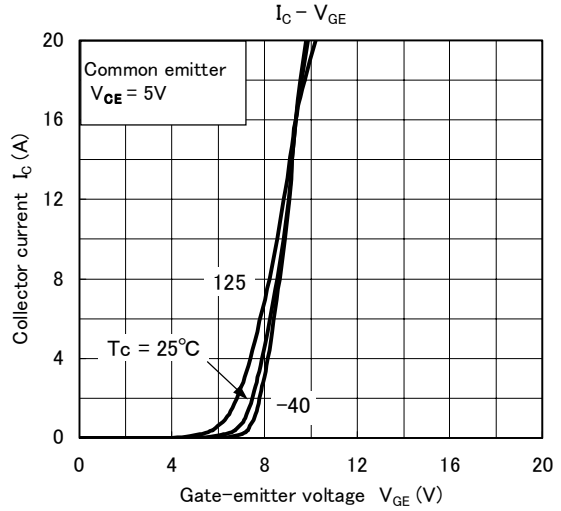
$V_{CE} - V_{GE}$



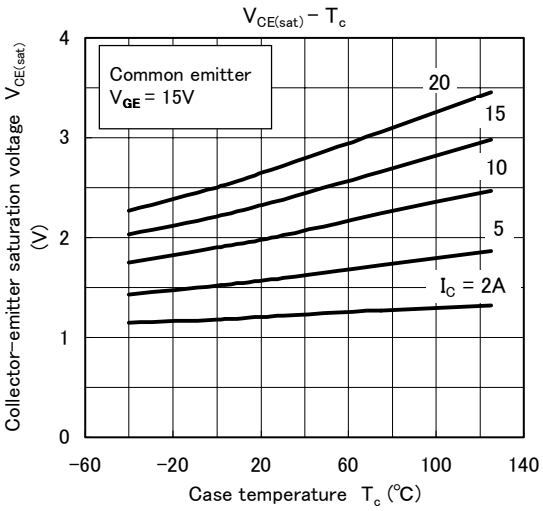
$V_{CE} - V_{GE}$



$I_C - V_{GE}$

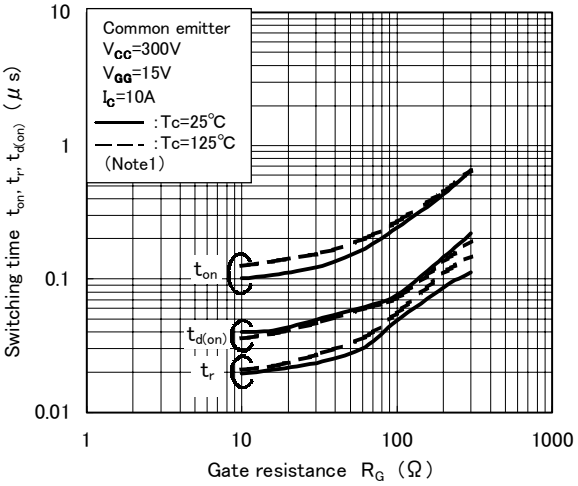


$V_{CE(sat)} - T_c$

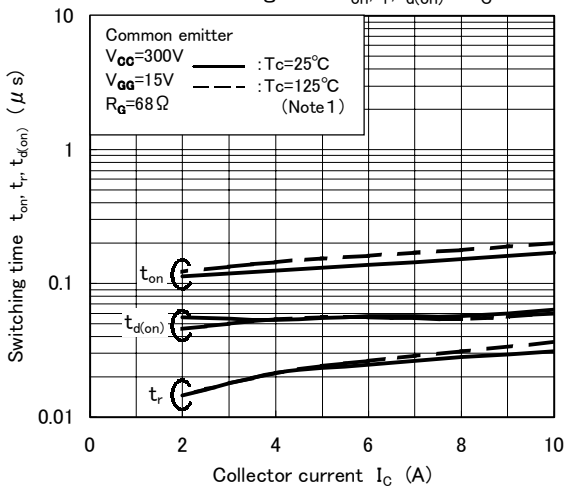


Reference

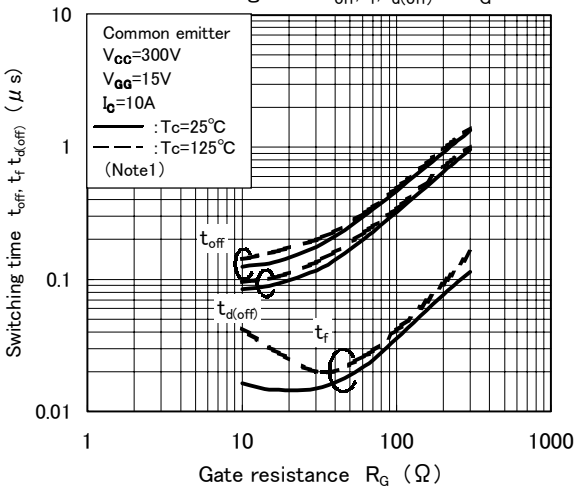
Switching time t_{on},t_r,$t_{d(on)}$ – R_G



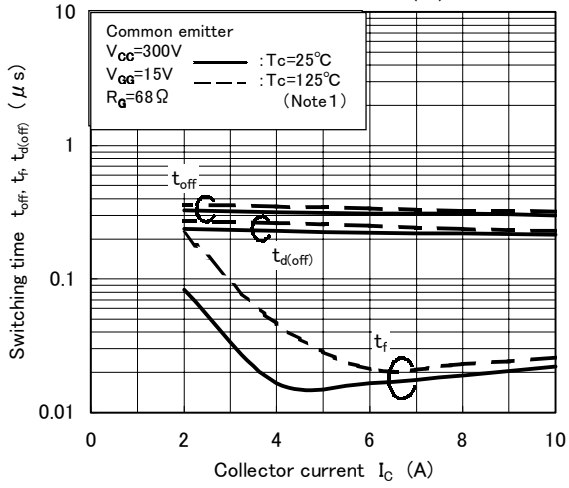
Switching time t_{on},t_r,$t_{d(on)}$ – I_C



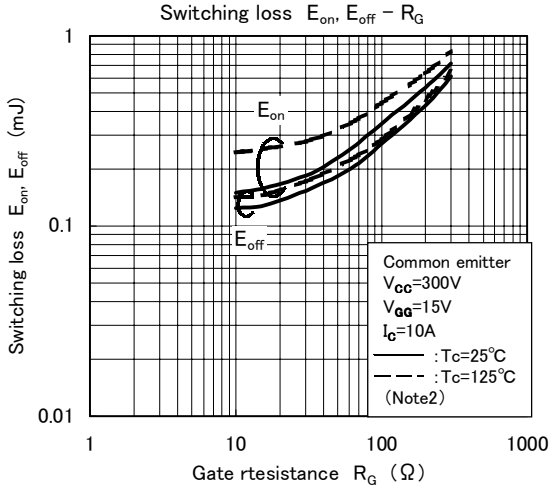
Switching time t_{off},t_f,$t_{d(off)}$ – R_G



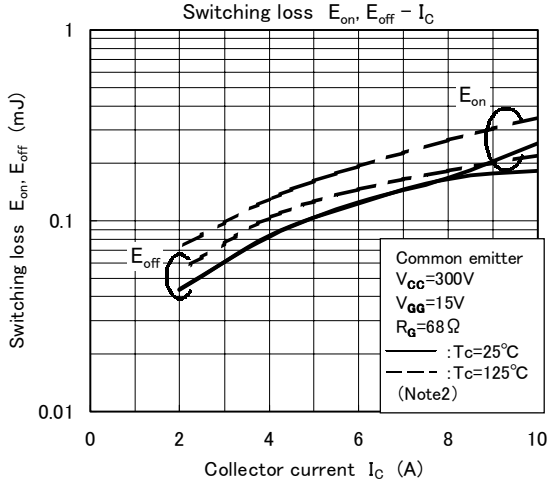
Switching time t_{off},t_f,$t_{d(off)}$ – I_C



Switching loss E_{on}, E_{off} – R_G

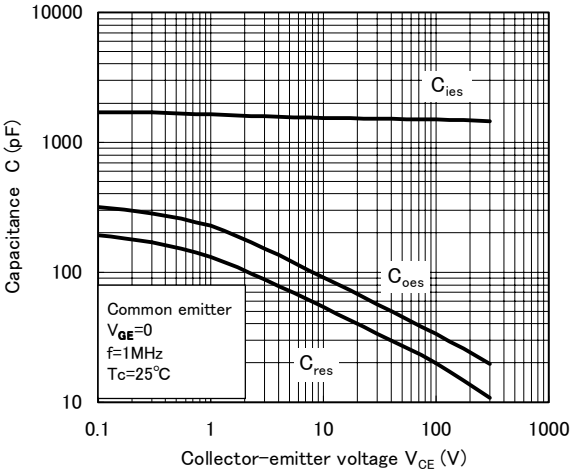


Switching loss E_{on}, E_{off} – I_C

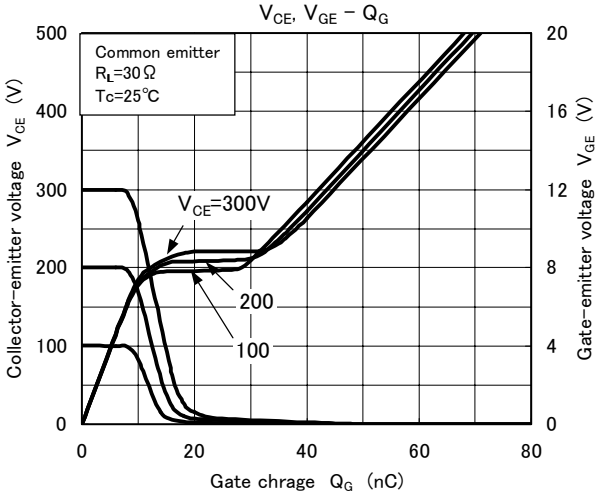


Reference

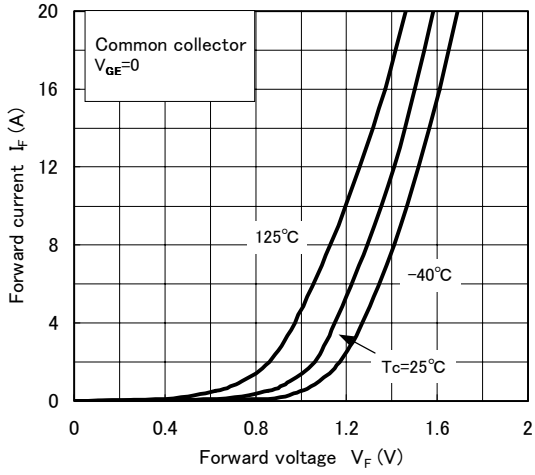
C–V_{CE}



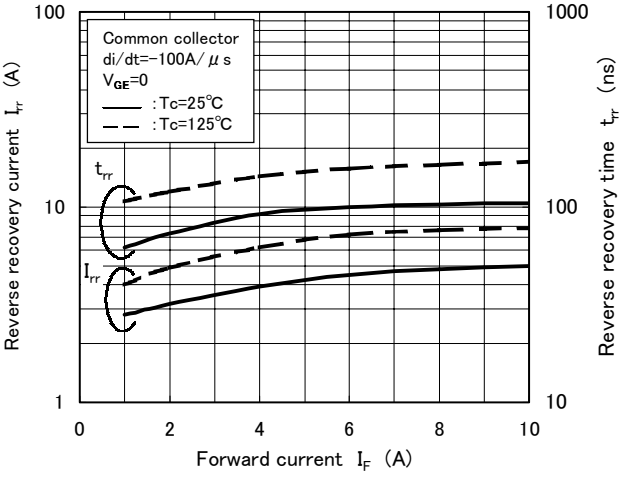
V_{CE}, V_{GE} – Q_G



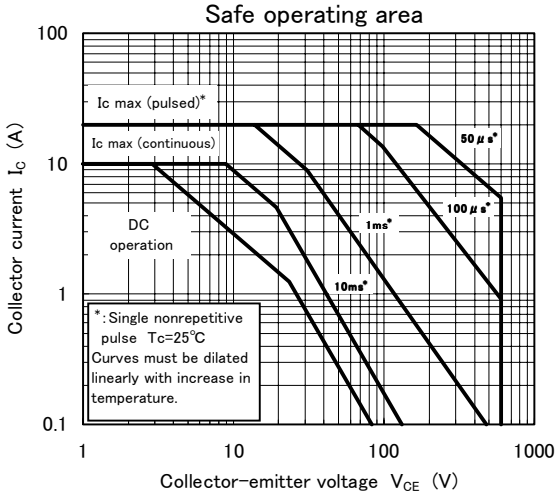
I_F–V_F



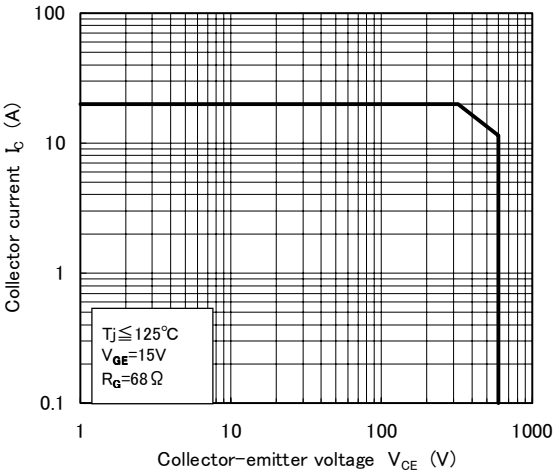
t_{rr}, I_{rr} – I_F



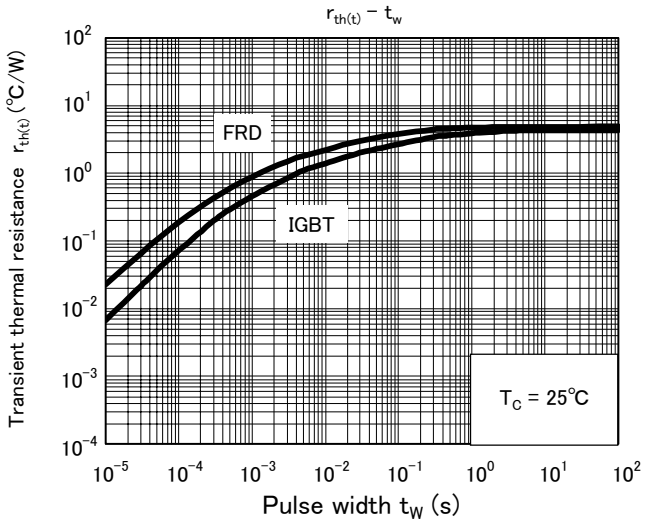
Safe operating area



Reverse bias SOA



Reference


$r_{th(t)} - t_w$
Transient thermal resistance $r_{th(t)}$ (°C/W)
10^2
10^1
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-4}
FRD
IGBT
T_C = 25°C
10^{-5} 10^{-4} 10^{-3} 10^{-2} 10^{-1} 10^0 10^1 10^2
Pulse width t_W (s)