TOSHIBA Insulated Gate Bipolar Transistor Silicon N Channel IGBT

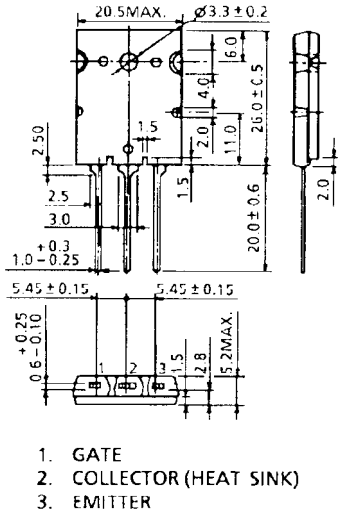
GT50J325

High Power Switching Applications

Fast Switching Applications

- The 4th generation
- Enhancement-mode
- Fast switching (FS): Operating frequency up to 50 kHz (reference)
  - High speed: t_f = 0.05 μs (typ.)
  - Low switching loss: E_{on} = 1.30 mJ (typ.)
    : E_{off} = 1.34 mJ (typ.)
- Low saturation Voltage: $V_{CE\ (sat)}$ = 2.0 V (typ.)
- FRD included between emitter and collector

Unit: mm



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

JEDEC	—
JEITA	—
TOSHIBA	2-21F2C

Weight: 9.75 g

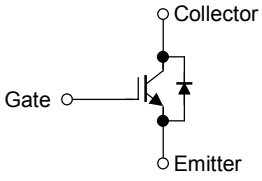
Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Collector-emitter voltage		V_{CES}	600	V
Gate-emitter voltage		V_{GES}	±20	V
Collector current	DC	I_C	50	A
	1 ms	I_{CP}	100	
Emitter-collector forward current	DC	I_F	50	A
	1 ms	I_{FM}	100	
Collector power dissipation (Tc = 25°C)		P_C	240	W
Junction temperature		T_j	150	°C
Storage temperature range		T_{stg}	−55 to 150	°C

Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance (IGBT)	$R_{th\ (j\text{-}c)}$	0.521	°C/W
Thermal resistance (diode)	$R_{th\ (j\text{-}c)}$	2.30	°C/W

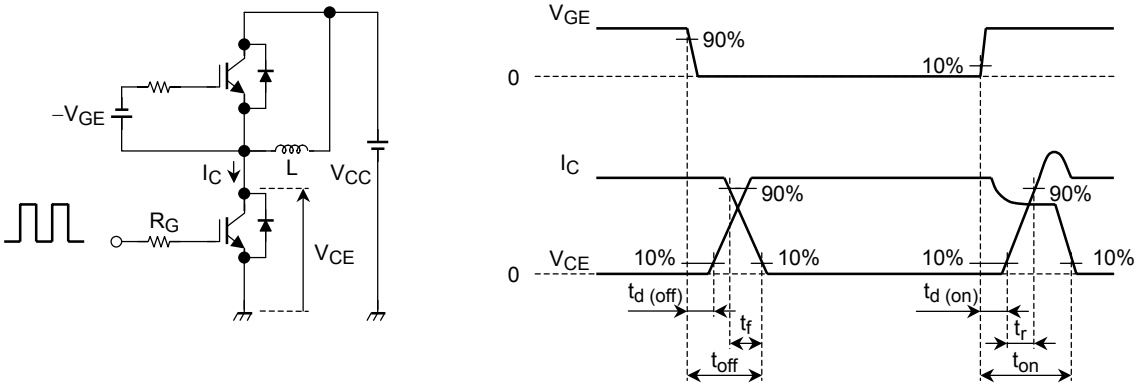
Equivalent Circuit



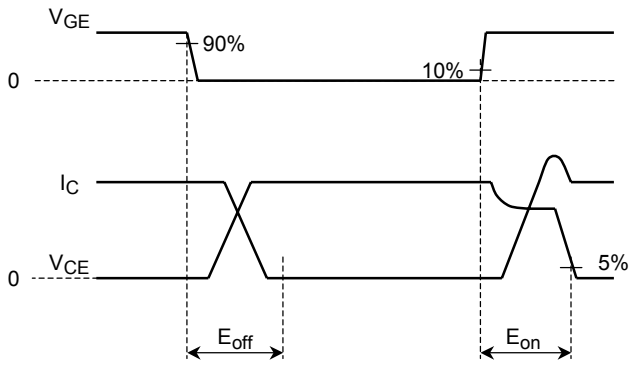
Electrical Characteristics (Ta = 25°C)

Characteristics		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} = 600 V, V_{GE} = 0	—	—	1.0	mA
Gate-emitter cut-off voltage		$V_{GE\ (OFF)}$	I_C = 5 mA, V_{CE} = 5 V	3.5	—	6.5	V
Collector-emitter saturation voltage		$V_{CE\ (sat)}$	I_C = 50 A, V_{GE} = 15 V	—	2.0	2.45	V
Input capacitance		C_{ies}	V_{CE} = 10 V, V_{GE} = 0, f = 1 MHz	—	7900	—	pF
Switching time	Turn-on delay time	$t_{d\ (on)}$	Inductive load V_{CC} = 300 V, I_C = 50 A V_{GG} = +15 V, R_G = 13 Ω (Note 1) (Note 2)	—	0.09	—	μs
	Rise time	t_r		—	0.07	—	
	Turn-on time	t_{on}		—	0.24	—	
	Turn-off delay time	$t_{d\ (off)}$		—	0.30	—	
	Fall time	t_f		—	0.05	—	
	Turn-off time	t_{off}		—	0.43	—	
Switching loss	Turn-on switching loss	E_{on}		—	1.30	—	mJ
	Turn-off switching loss	E_{off}		—	1.34	—	
Peak forward voltage		V_F	I_F = 50 A, V_{GE} = 0	—	—	4.2	V
Reverse recovery time		t_{rr}	I_F = 50 A, di/dt = −100 A/μs	—	65	—	ns

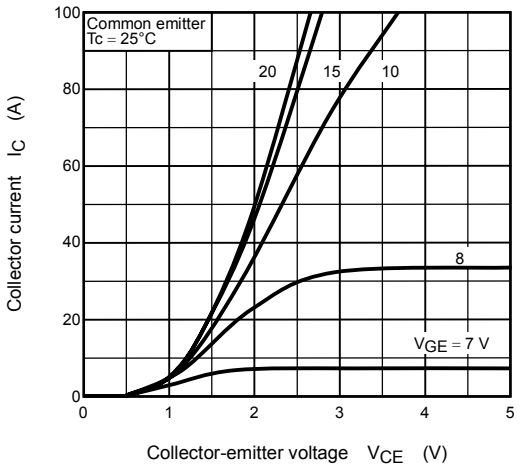
Note 1: Switching time measurement circuit and input/output waveforms



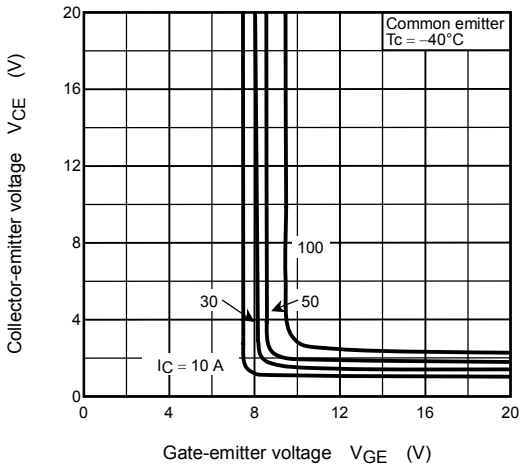
Note 2: Switching loss measurement waveforms



$I_C - V_{CE}$



$V_{CE} - V_{GE}$



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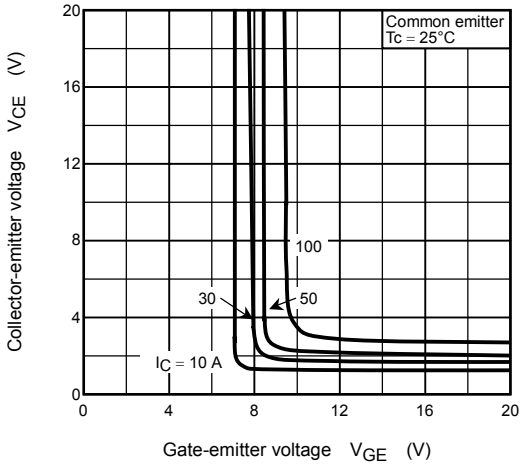

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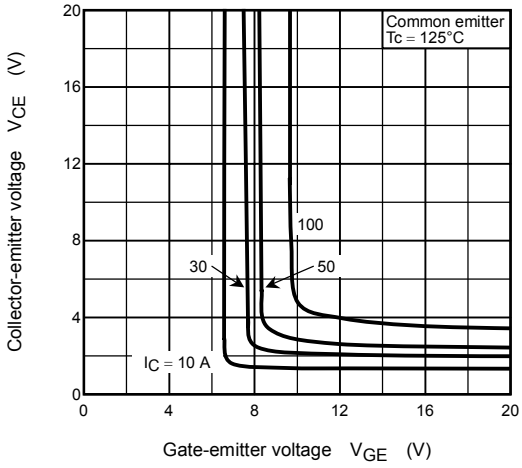
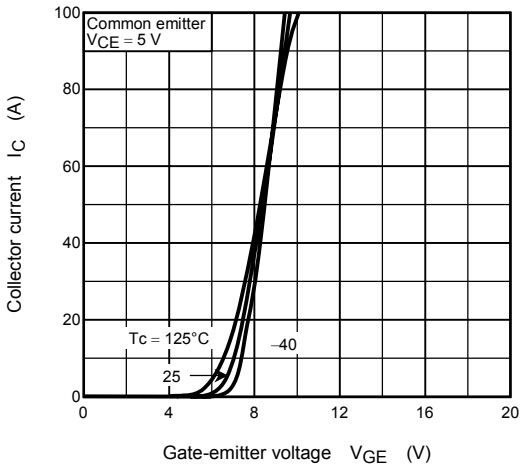
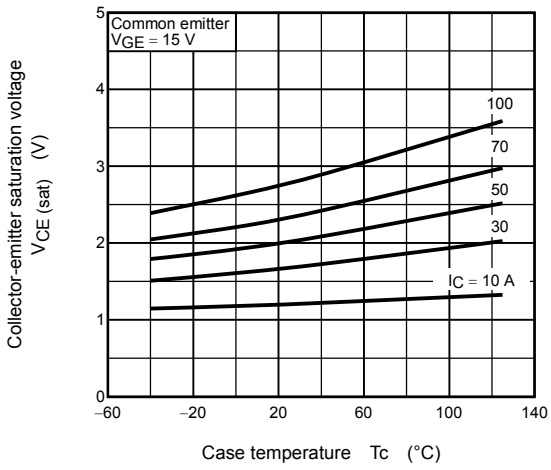


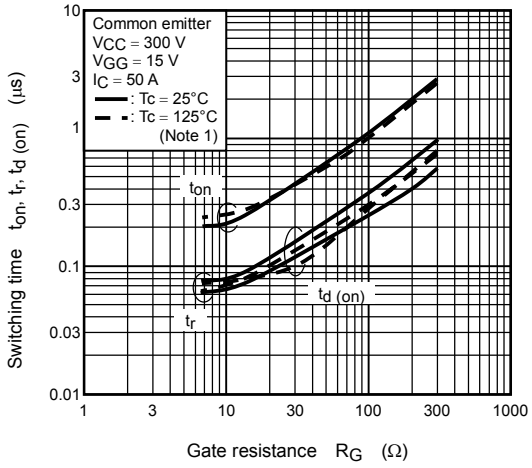
$I_C - V_{GE}$



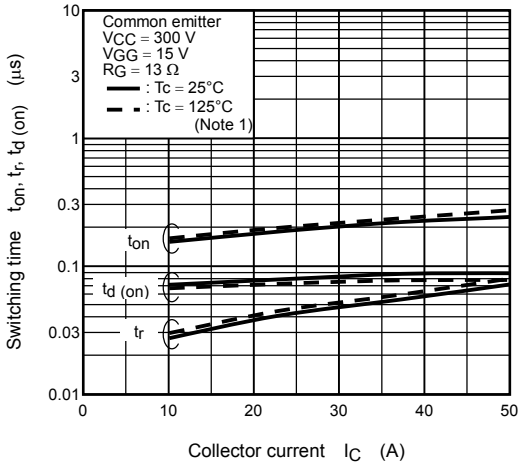
$V_{CE\ (sat)} - Tc$



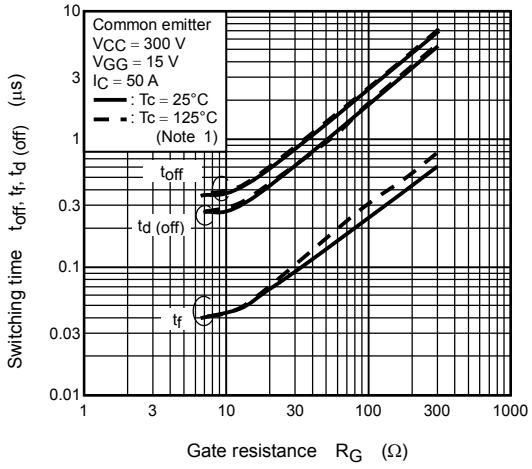
Switching time t_{on}, t_r, $t_{d\ (on)}$ – R_G



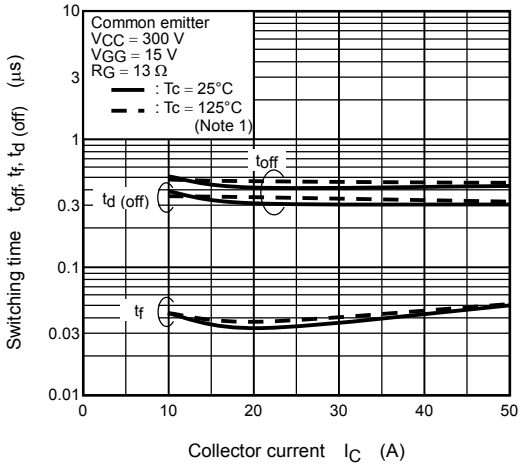
Switching time t_{on}, t_r, $t_{d\ (on)}$ – I_C



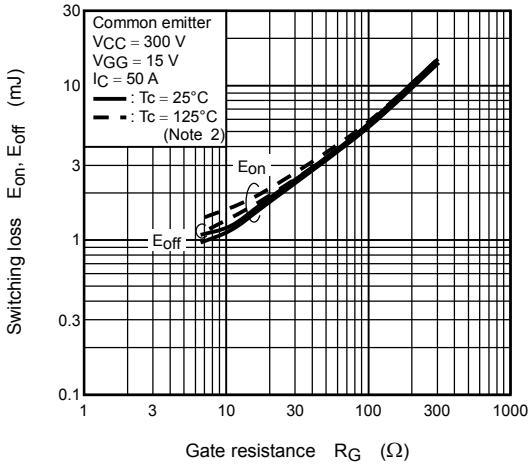
Switching time t_{off}, t_f, $t_{d\ (off)}$ – R_G



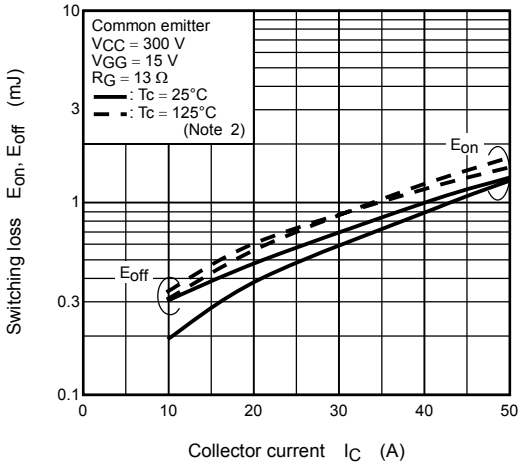
Switching time t_{off}, t_f, $t_{d\ (off)}$ – I_C



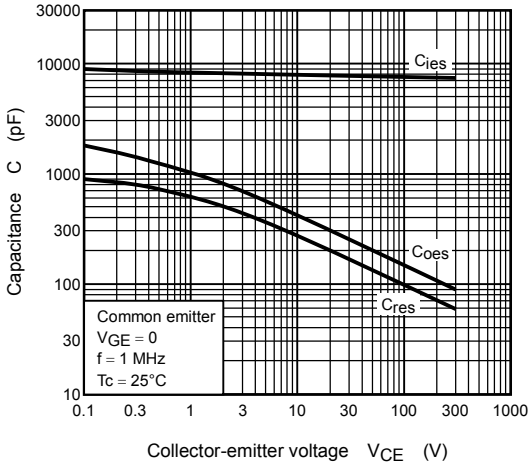
Switching loss E_{on}, E_{off} – R_G



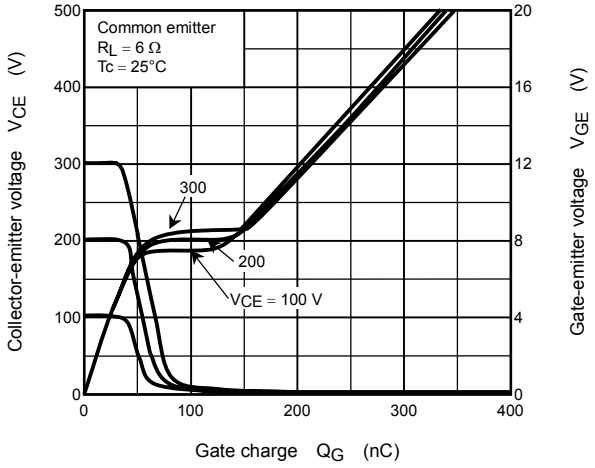
Switching loss E_{on}, E_{off} – I_C



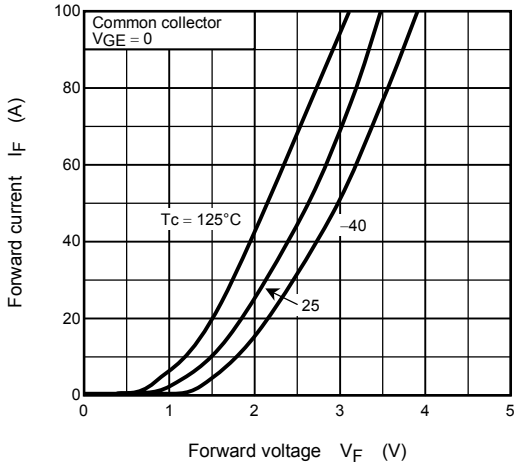
$C - V_{CE}$



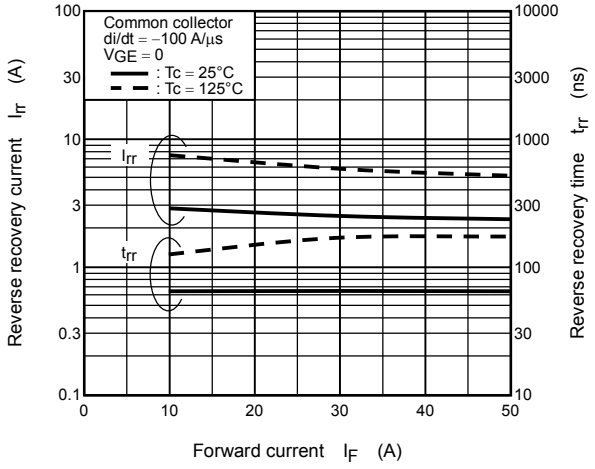
V_{CE}, $V_{GE} - Q_G$



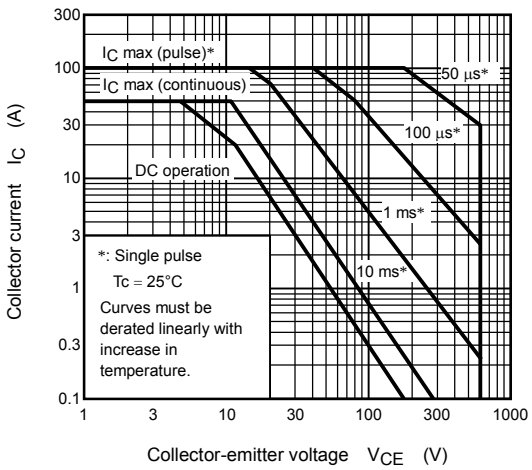
$I_F - V_F$



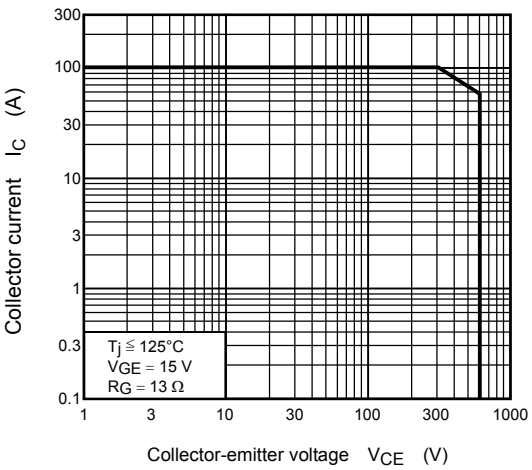
t_{rr}, $I_{rr} - I_F$

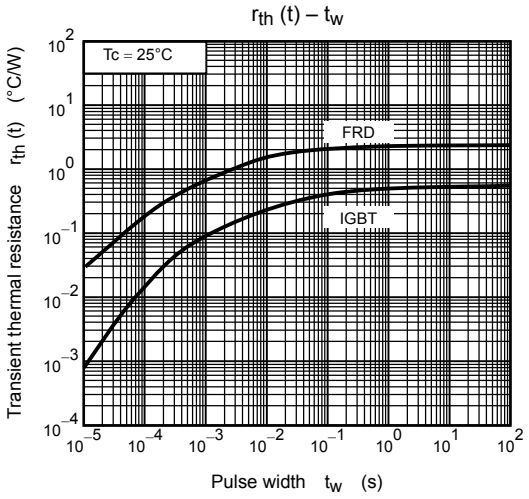


Safe operating area



Reverse bias SOA




r_{th} (t) – t_w
Tc = 25°C
FRD
IGBT
Transient thermal resistance r_{th} (t) (°C/W)
Pulse width t_w (s)

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