TOSHIBA

INTEGRATED GTR MODULE

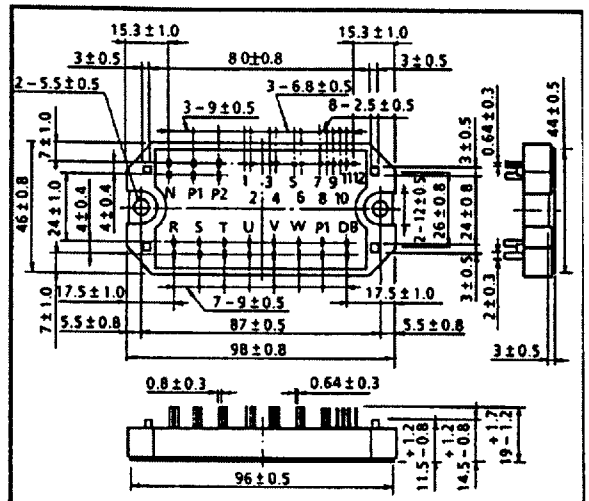
MIG20J951H

Unit in mm

High Power Switching Applications

Motor Control Applications

- Integrates Inverter, Converter and Brake Power Circuits in One Package.
- Output (Inverter Stage)
  : 3ø20A/600V High Speed Type IGBT
  $V_{CE(sat)}$ = 4.00V (Max.)
  t_f = 0.30μs (Max.)
  t_{rr} = 0.15μs (Max.)
- Input (Converter Stage)
  : 1ø30A/800V Silicon Rectifier
  V_F = 1.20V (Max.)
- Brake Stage
  : 15A/600V IGBT & 15A/600V FRD
- The Electrodes are Isolated from Case.

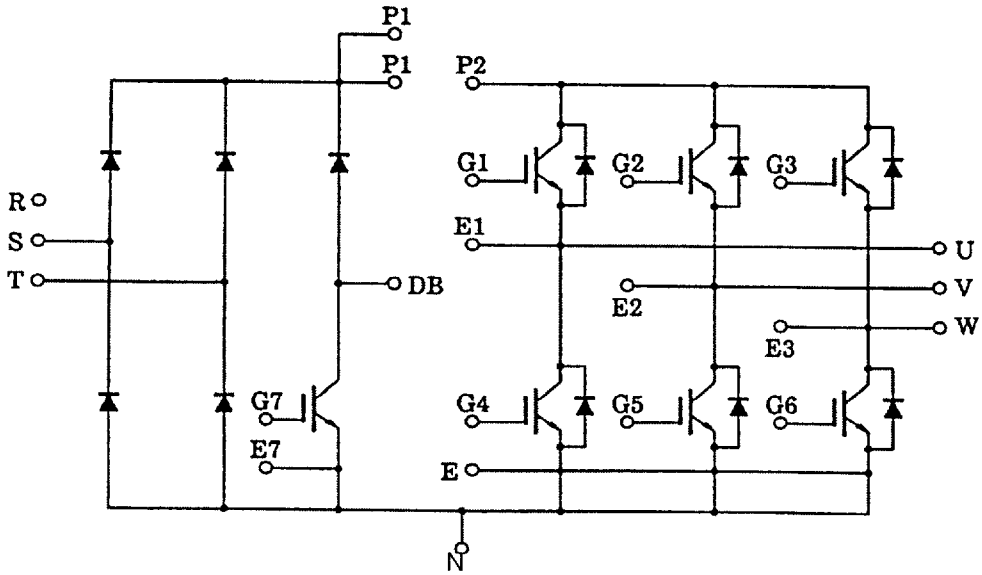


SIGNAL TERMINAL 1 : G1 2 : E1 3 : G2 4 : E2
5 : G3 6 : E3 7 : G4 8 : G5
9 : G6 10 : E 11 : G7 12 : E7

JEDEC	—
EIAJ	—
TOSHIBA	2-99A1A

Weight : 175g

Equivalent Circuit



Maximum Ratings (Ta = 25°C)

STAGE		CHARACTERISTIC		SYMBOL	RATINGS	UNIT
Inverter		Collector-Emitter Voltage		V_{CES}	600	V
		Gate-Emitter Voltage		V_{GES}	±20	V
		Collector Current	DC	I_C	20	A
			1ms	I_{CP}	40	
		Forward Current	DC	I_F	20	A
			1ms	I_{FM}	40	
		Collector Power Dissipation (Tc = 25°C)		P_C	80	W
Converter		Repetitive Peak Reverse Voltage		V_{RRM}	800	V
		Average Output Rectified Current		I_O	30	A
		Peak One Cycle Surge Forward Current (50Hz, Non-Repetitive)		I_{FSM}	400	A
Brake	IGBT	Collector-Emitter Voltage		V_{CES}	600	V
		Gate-Emitter Voltage		V_{GES}	±20	V
		Collector Current	DC	I_C	15	A
			1ms	I_{CP}	30	
		Collector Power Dissipation (Tc = 25°C)		P_C	65	W
	FRD	Repetitive Peak Reverse Voltage		V_{RRM}	600	V
		Forward Current	DC	I_F	15	A
			1ms	I_{FM}	30	
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		—	3	N•m

Electrical Characteristics (Ta = 25°C)

a. Inverter Stage

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MX.	UNIT
Gate Leakage Current		I_{GES}	V_{GE} = ±20V, V_{CE} = 0	–	–	±20	μA
Collector Cut-off Current		I_{CES}	V_{CE} = 600V, V_{GE} = 0	–	–	1.0	mA
Gate-Emitter Cut-off Voltage		$V_{GE\ (off)}$	V_{CE} = 5V, I_C = 20mA	3.0	–	6.0	V
Collector-Emitter Saturation Voltage		$V_{CE\ (sat)}$	I_C = 20A, V_{GE} = 15V	–	3.0	4.0	V
Input Capacitance		C_{ies}	V_{CE} = 10V, V_{GE} = 0 f = 1MHz	–	1300	–	pF
Switching Time	Turn-on Delay Time	$t_{d(on)}$	Inductive Load V_{CC} = 300V I_C = 20A V_{GE} = ±15V R_G = 120Ω (Note 1)	–	0.08	0.16	μs
	Rise Time	t_r		–	0.12	0.24	
	Turn-on Time	t_{on}		–	0.40	0.80	
	Turn-off Delay Time	$t_{d\ (off)}$		–	0.30	0.60	
	Fall Time	t_f		–	0.15	0.30	
	Turn-off Time	t_{off}		–	0.60	1.00	
Forward Voltage		V_F	I_F = 20A, V_{GE} = 0	–	1.7	2.5	V
Reverse Recovery Time		t_{rr}	I_F = 20A, V_{GE} = -10V di/dt = 50A/μs	–	0.08	0.15	μs
Thermal Resistance		$R_{th\ (j-c)}$	Transistor	–	–	1.56	°C/W
			Diode	–	–	2.80	

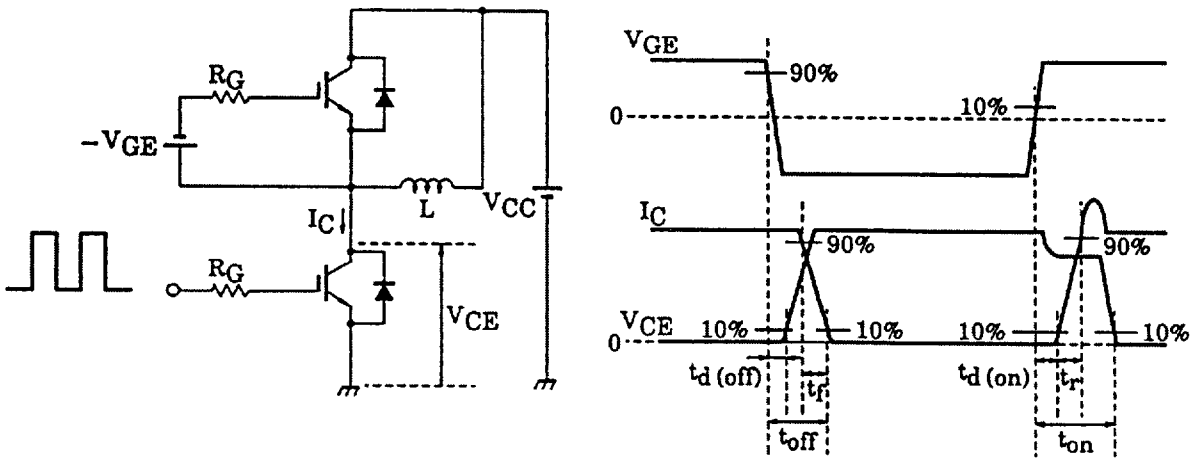
b. Converter Stage

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MX.	UNIT
Repetitive Peak Reverse Current	I_{RRM}	V_{RRM} = 800V	–	–	50	μA
Peak Forward Voltage	V_{FM}	I_{FM} = 30A	–	1.05	1.20	V
Peak One Cycle Surge Forward Current	I_{FSM}	50Hz Sine-half-wave	400	–	–	A
Thermal Resistance	$R_{th(j-c)}$	–	–	–	1.56	°C/W

c. Brake Stage

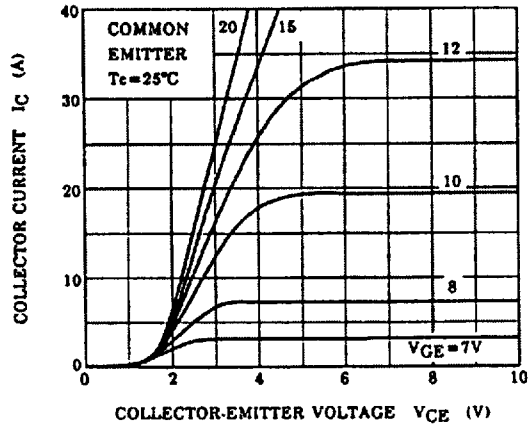
CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MX.	UNIT
Gate Leakage Current		I_{GES}	V_{GE} = ±20V, V_{CE} = 0	–	–	±20	μA
Collector Cut-off Current		I_{CES}	V_{CE} = 600V, V_{GE} = 0	–	–	1.0	mA
Repetitive Peak Reverse Current		I_{RRM}	V_{RRM} = 600V	–	–	1.0	mA
Gate-Emitter Cut-off Voltage		$V_{GE(off)}$	V_{CE} = 5V, I_C = 15mA	3.0	–	6.0	V
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$	I_C = 15A, V_{GE} = 15V	–	3.0	4.0	V
Input Capacitance		C_{ies}	V_{CE} = 10V, V_{GE} = 0 f = 1MHz	–	1000	–	pF
Switching Time	Turn-on Delay Time	$t_{d(on)}$	Inductive Load V_{CC} = 300V I_C = 15A V_{GE} = ±15V R_G = 150Ω (Note 1)	–	0.08	0.16	μs
	Rise Time	t_r		–	0.12	0.24	
	Turn-on Time	t_{on}		–	0.40	0.80	
	Turn-off Delay Time	$t_{d(off)}$		–	0.30	0.60	
	Fall Time	t_f		–	0.30	0.55	
	Turn-off Time	t_{off}		–	0.65	1.00	
Forward Voltage		V_F	I_F = 15A, V_{GE} = 0	–	1.7	2.5	V
Thermal Resistance		$R_{th\ (j-c)}$	Transistor	–	–	1.92	°C/W
			Diode	–	–	2.80	

Note. 1 Switching Time Test Circuit & Timing Chart

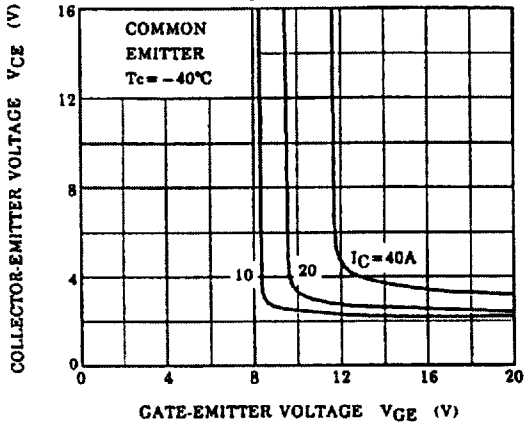


a. Inverter Stage

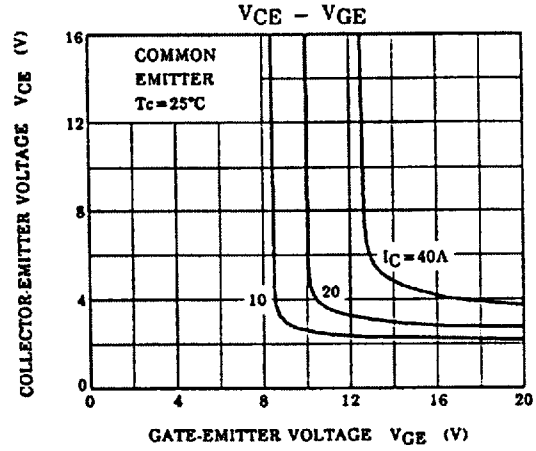
I_C – V_{CE}



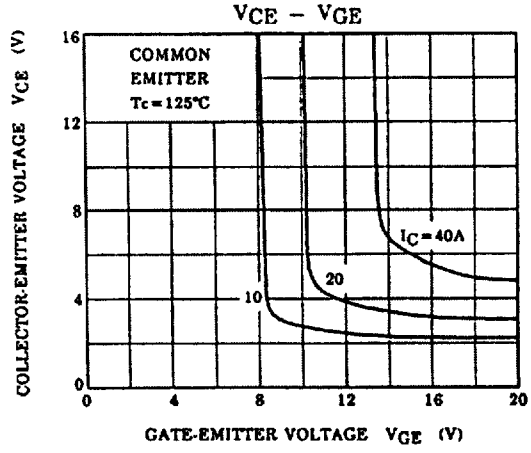
V_{CE} – V_{GE}



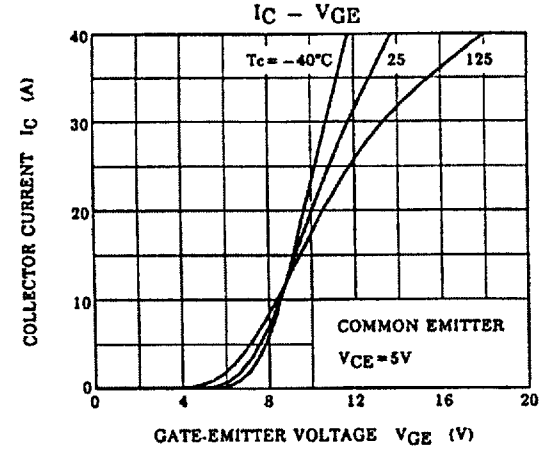
V_{CE} – V_{GE}



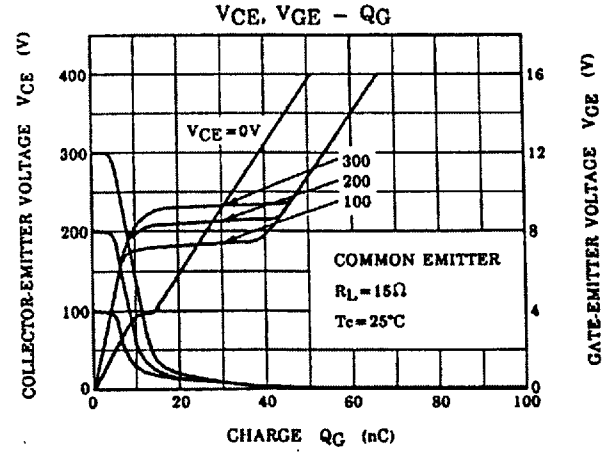
V_{CE} – V_{GE}



I_C – V_{GE}

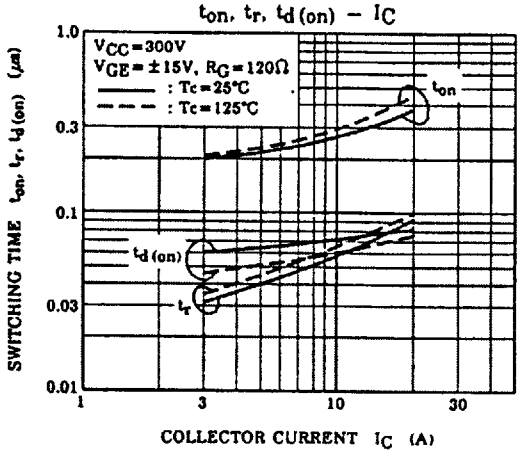


V_{CE}, V_{GE} – Q_G

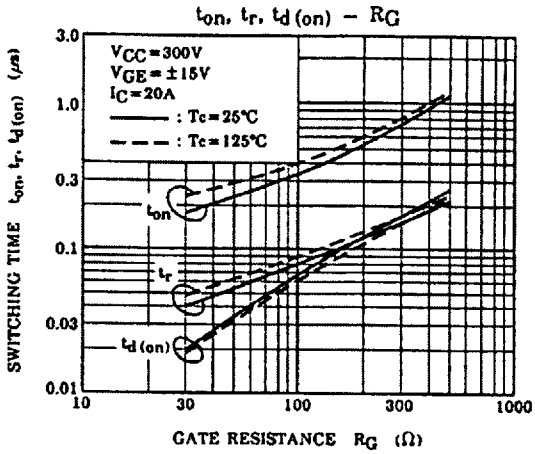


a. Inverter Stage

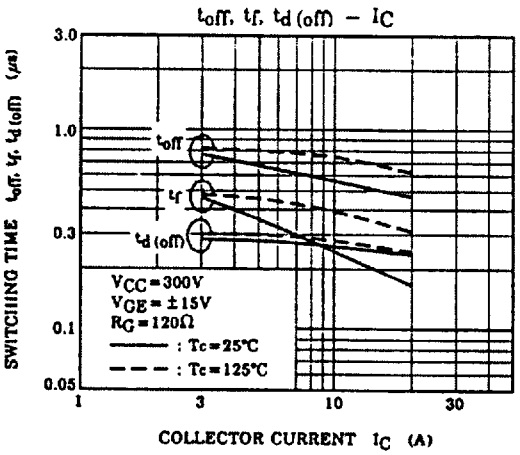
t_{on}, t_r, $t_{d(on)}$ – I_C



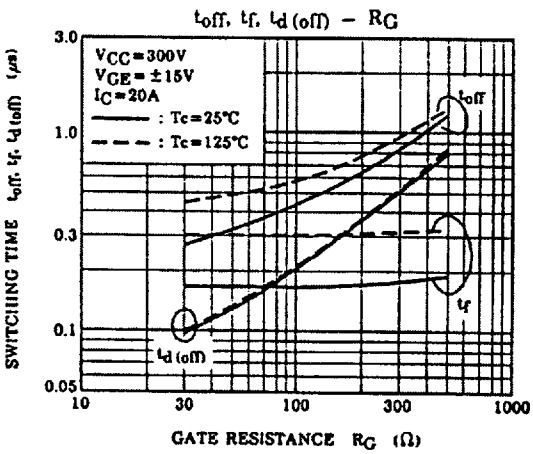
t_{on}, t_r, $t_{d(on)}$ – R_G



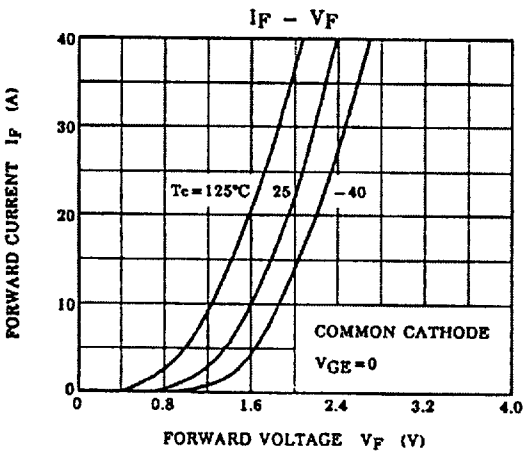
t_{off}, t_f, $t_{d(off)}$ – I_C



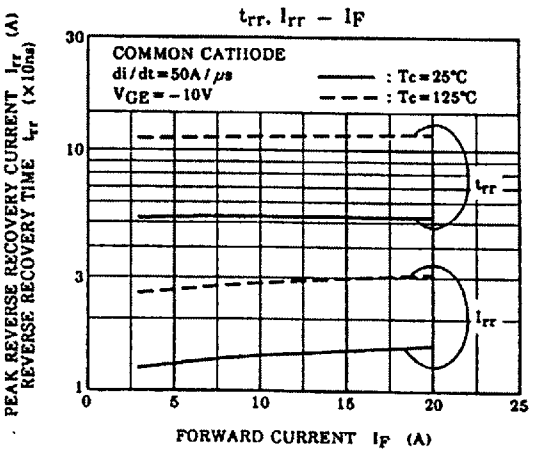
t_{off}, t_f, $t_{d(off)}$ – R_G



I_F – V_F

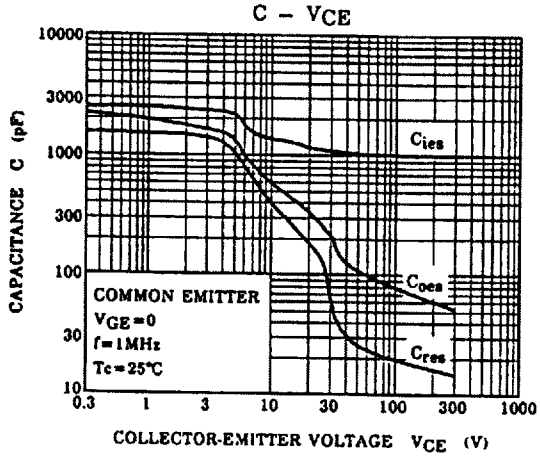


t_{rr}, I_{rr} – I_F

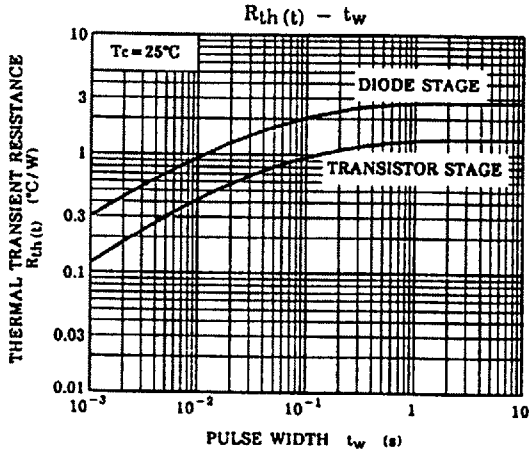


a. Inverter Stage

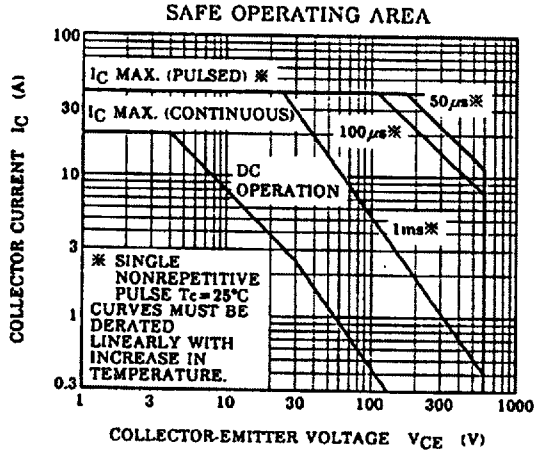
C – V_{CE}



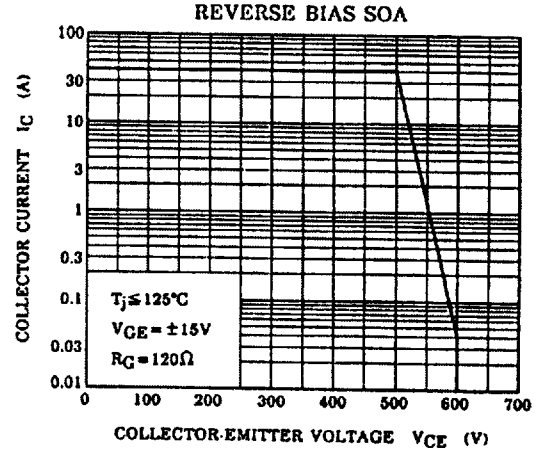
$R_{th}(t)$ – t_w



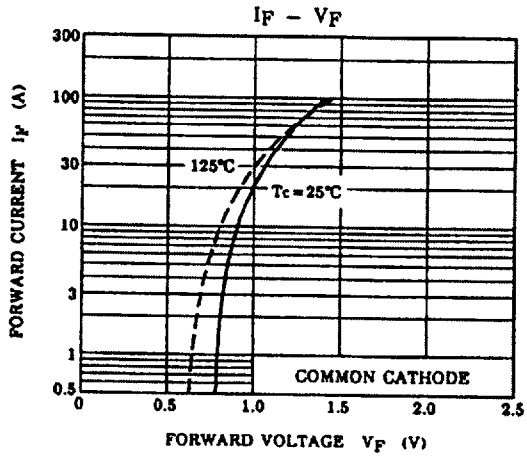
SAFE OPERATING AREA

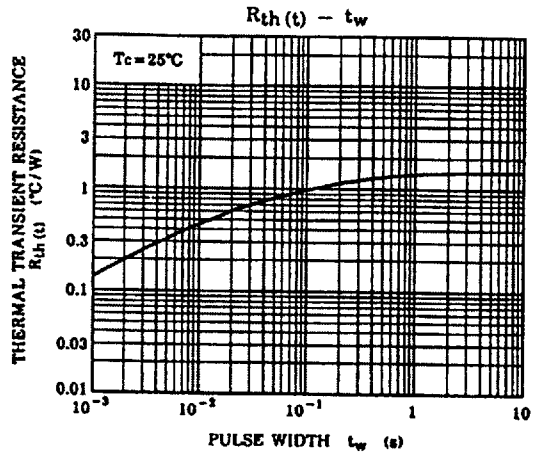


REVERSE BIAS SOA



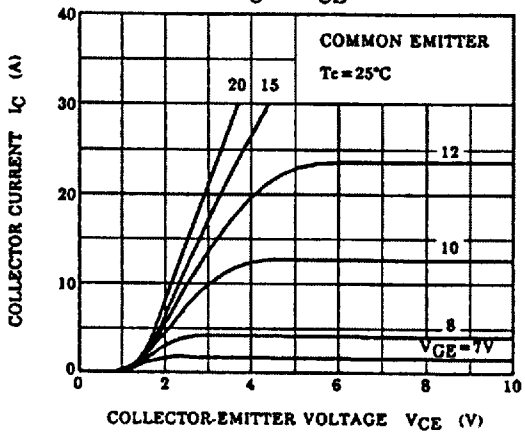
b. Converter Stage



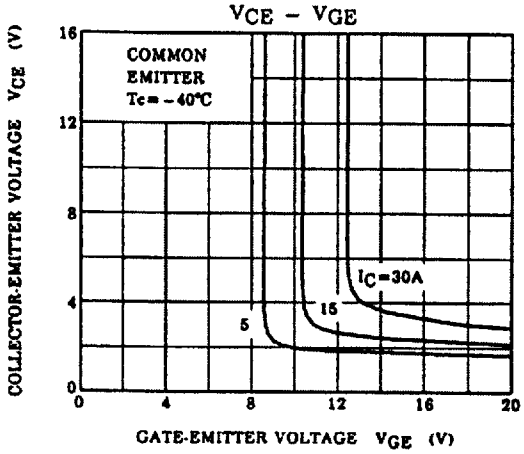


c. Brake Stage

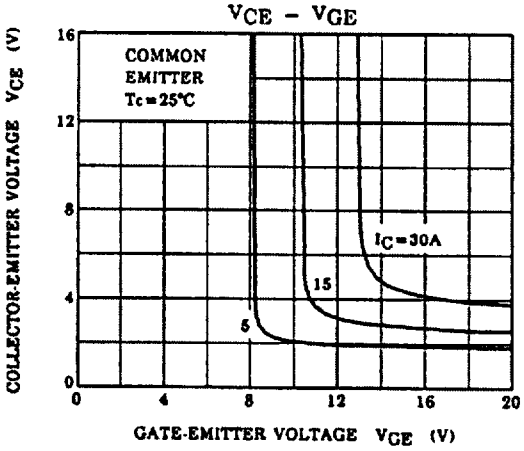
I_C – V_{CE}



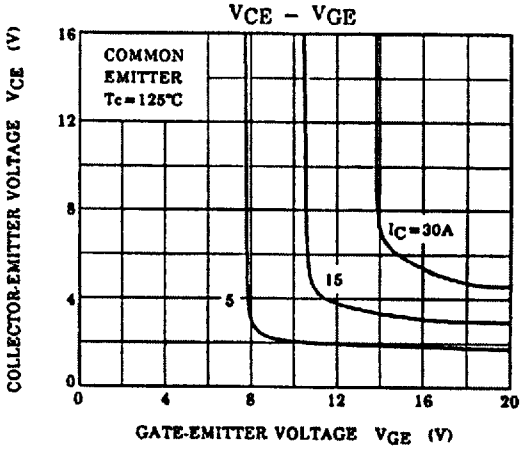
V_{CE} – V_{GE}



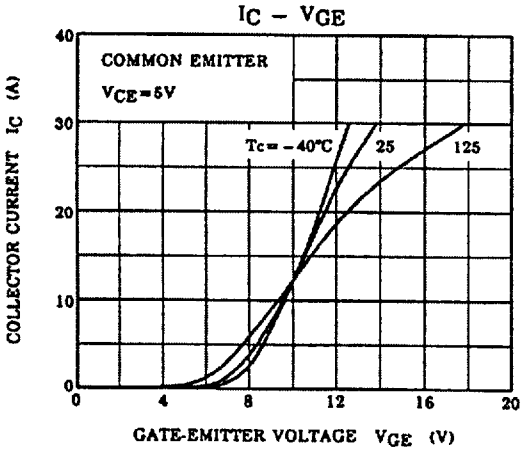
V_{CE} – V_{GE}



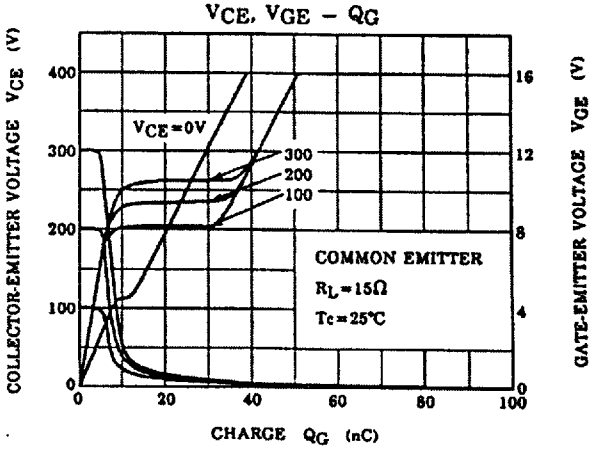
V_{CE} – V_{GE}



I_C – V_{GE}



V_{CE}, V_{GE} – Q_G

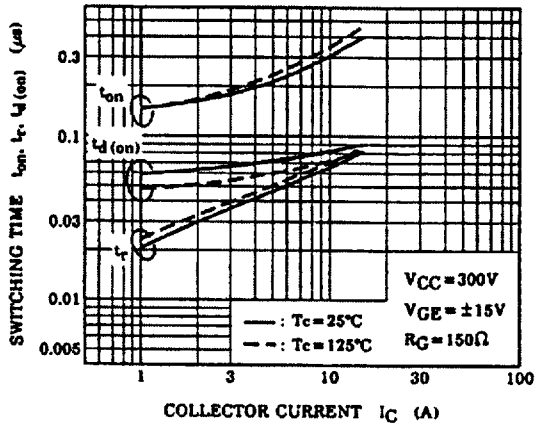


c. Brake Stage

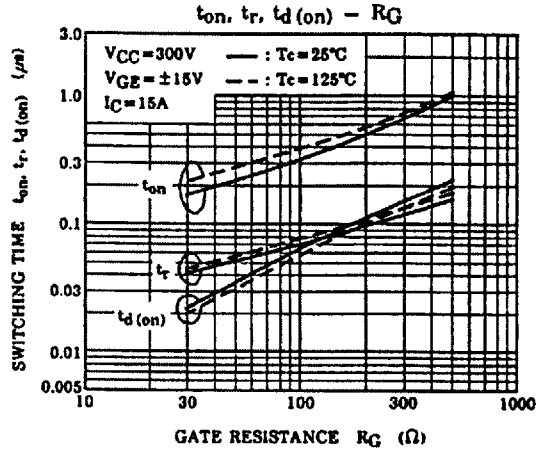
(MIG20J951H)

c. Brake Stage

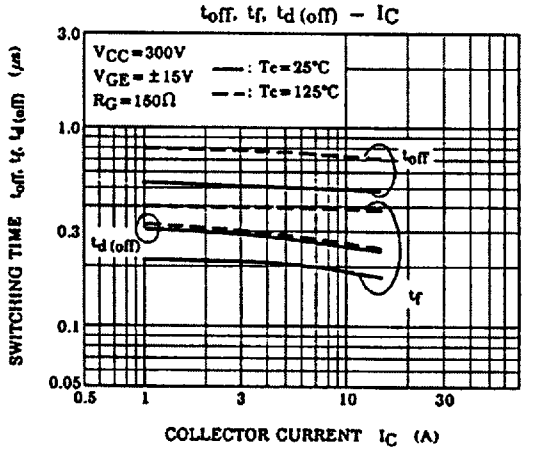
t_{on}, t_r, $t_{d(on)}$ – I_C



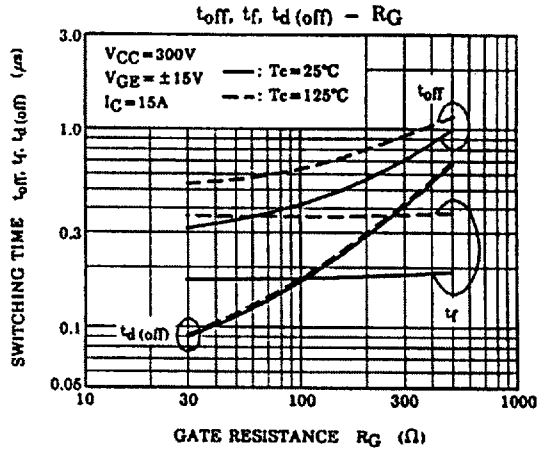
t_{on}, t_r, $t_{d(on)}$ – R_G



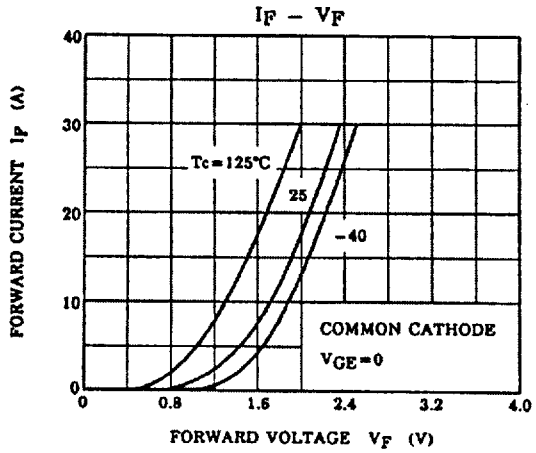
t_{off}, t_f, $t_{d(off)}$ – I_C



t_{off}, t_f, $t_{d(off)}$ – R_G

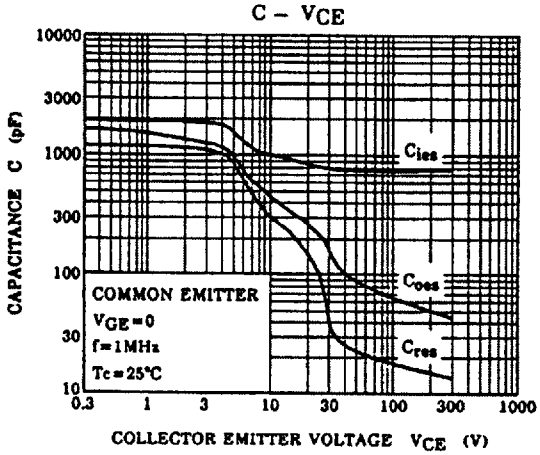


I_F – V_F

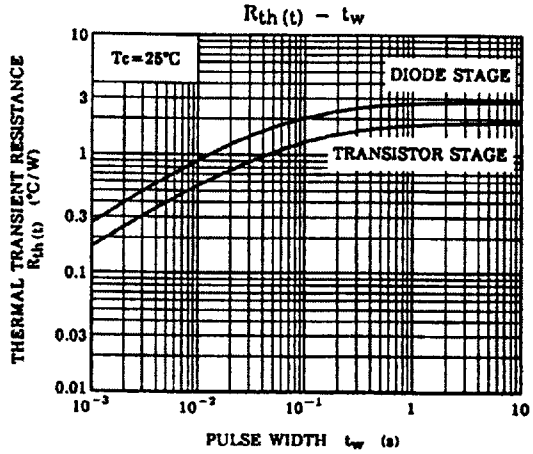


c. Brake Stage

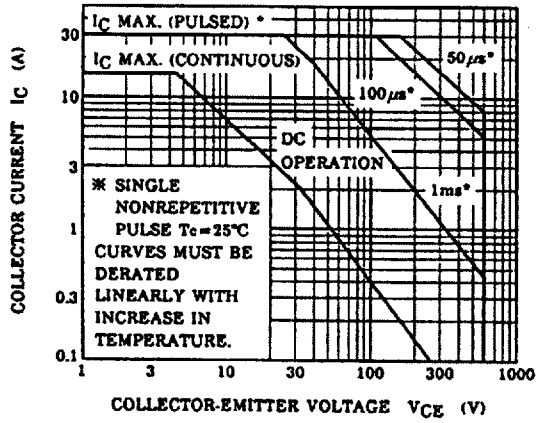
C – V_{CE}



$R_{th}(t)$ – t_w



SAFE OPERATING AREA



REVERSE BIAS SOA