Preliminary

SM2G50US60

IGBT MODULE

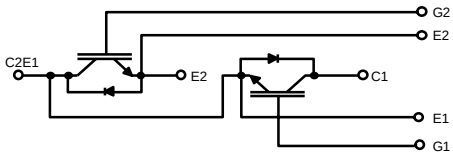
FEATURES

- High Speed Switching
- Low Conduction Loss
  : V_{CE}(sat) = 2.1 V (typ)
- Fast & Soft Anti-Parallel FWD
- Short circuit rated
  : Min 10uS at Tc=100℃

Package code : 7-PM-AA

APPLICATIONS

- General Purpose Inverters
- Welding Machine
- Induction Heating
- UPS , CVCF
- Robotics , Servo Controls



Internal Circuit Diagram

ABSOLUTE MAXIMUM RATINGS (Tc = 25℃)

Symbol	Characteristics	Rating	Units
V_{CES}	Collector-Emitter Voltage	600	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ Tc = 25℃	50	A
$I_{CM\ (1)}$	Pulsed Collector Current	100	A
I_F	Diode Continuous Forward Current @ Tc = 25℃	50	A
I_{FM}	Diode Maximum Forward Current	100	A
P_C	Maximum Power Dissipation @Tc = 25℃	250	W
Tj	Operating Junction Temperature	-40 ~ 150	℃
Tstg	Storage Temperature Range	-40 ~ 125	℃
Viso	Isolation Voltage @ AC 1 min	2500	V
	Mounting Torque @ Power terminals screw :M5	2.0	N.m
	Mounting screw :M5	2.0	N.m

Notes: (1) Repetitive Rating : Pulse width Limited by Max.Junction Temperature

ELECTRICAL CHARACTERISTICS (IGBT PART)

(T_C=25℃,Unless Otherwise Specified)

Symbol	Characteristics	Test Conditions	Min	Typ	Max	Units
BV_{CES}	C - E Breakdown Voltage	V_{GE} = 0V , I_C = 250㎂	600	-	-	V
$\Delta V_{CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	V_{GE} = 0V , I_C = 1mA	-	0.6	-	V/℃
$V_{GE(th)}$	G - E threshold voltage	I_C =50mA , V_{CE} = VGE	5	6	8.5	V
I_{CES}	Collector cutoff Current	V_{CE} = V_{CES} , V_{GE} = 0V	-	-	250	uA
I_{GES}	G - E leakage Current	V_{GE} = V_{GES} , V_{CE} = 0V	-	-	100	nA
V_{CE}(sat)	Collector to Emitter saturation voltage	Ic=50A, V_{GE} = 15V @Tc= 25℃	-	2.1	2.7	V
		Ic=50A, V_{GE} = 15V @Tc=100℃	-	2.7	-	V
Cies	Input capacitance	V_{GE} = 0V , f = 1㎒	-	4200	-	pF
Coes	Output capacitance	V_{CE} = 30V	-	400	-	pF
Cres	Reverse transfer capacitance		-	120	-	pF
td(on)	Turn on delay time	V_{CC} = 300V , I_C = 50A	-	90	-	ns
tr	Turn on rise time	V_{GE} = 15V	-	65	-	ns
td(off)	Turn off delay time	R_G = 13 Ω	-	184	-	ns
tf	Turn off fall time	Inductive Load	-	80	250	ns
Eon	Turn on Switching Loss		-	1.5	-	mJ
Eoff	Turn off Switching Loss		-	0.9	-	mJ
Ets	Total Switching Loss		-	2.4	4.8	mJ
Tsc	Short Circuit withstand Time	Vcc = 300V, V_{GE} = 15V @Tc = 100℃	10	-	-	uS
Qg	Total Gate Charge	Vcc = 300V	-	220	330	nC
Qge	Gate-Emitter Charge	V_{GE} = 15V	-	50	-	nC
Qgc	Gate-Collector Charge	Ic = 50A	-	90	-	nC

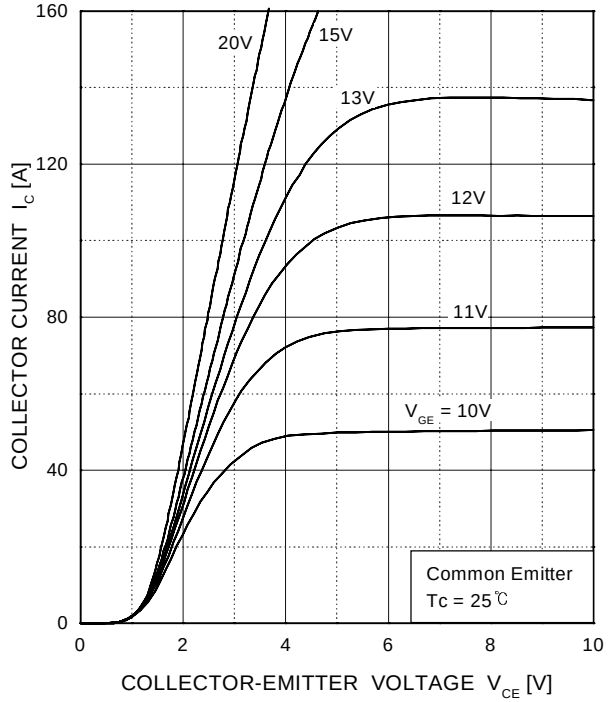
ELECTRICAL CHARACTERISTICS (DIODE PART)

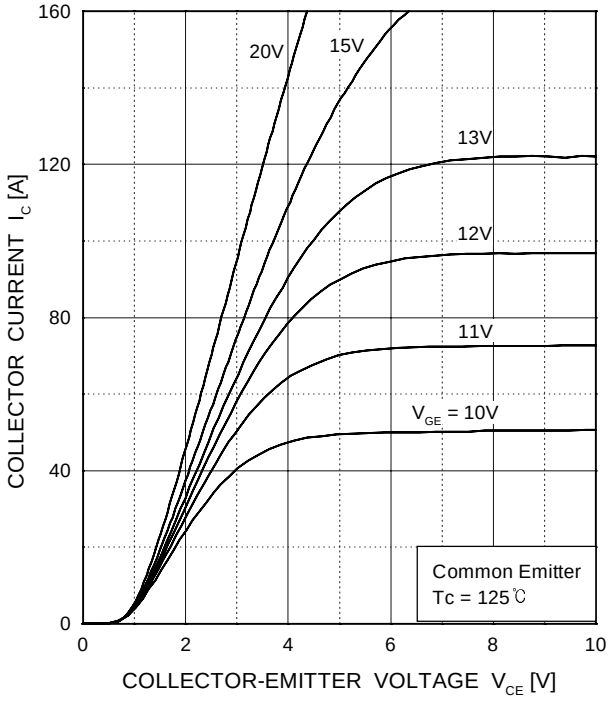
(T_C=25℃,Unless Otherwise Specified)

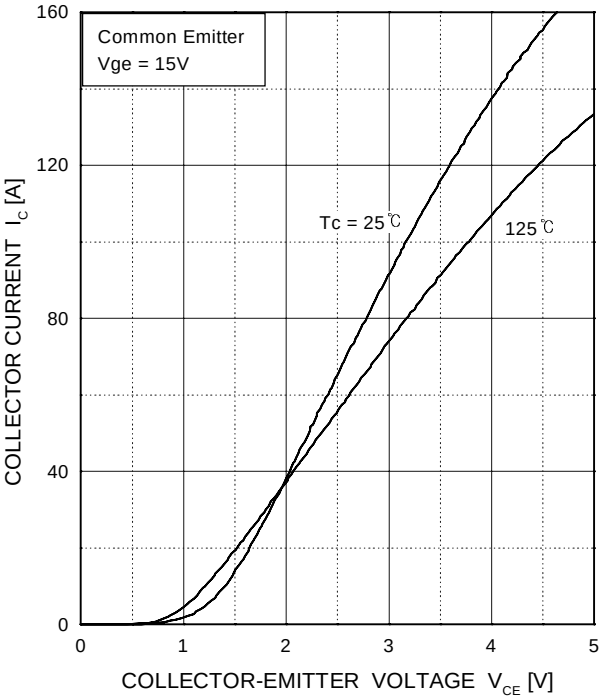
Symbol	Characteristics	Test Conditions		Min	Typ	Max	Units
V_{FM}	Diode Forward Voltage	I_F=50A	Tc =25℃	-	1.9	2.8	V
			Tc =100℃	-	1.8	-	
Trr	Diode Reverse Recovery Time	I_F=50A, V_R=200V di/dt= -100A/uS	Tc =25℃	-	90	130	nS
			Tc =100℃	-	130	-	
Irr	Diode Peak Reverse Recovery Current		Tc =25℃	-	5	6.5	A
			Tc =100℃	-	7	-	
Qrr	Diode Reverse Recovery Charge		Tc =25℃	-	225	422	nC
			Tc =100℃	-	455	-	

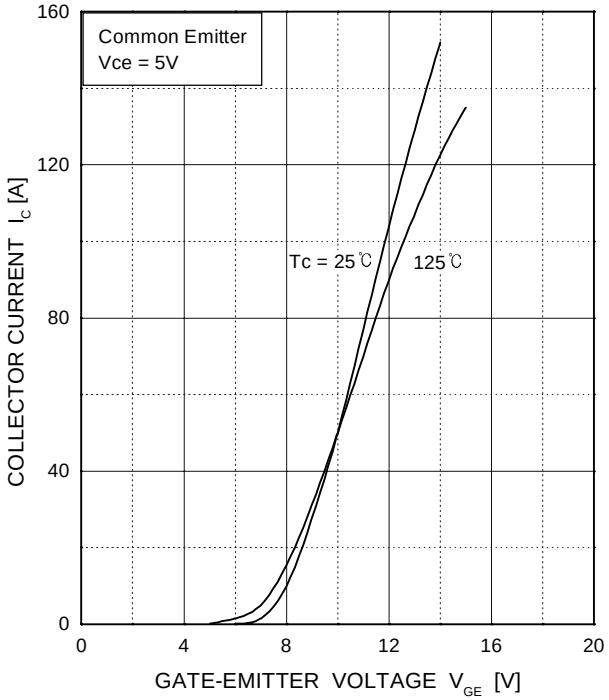
THERMAL RESISTANCE

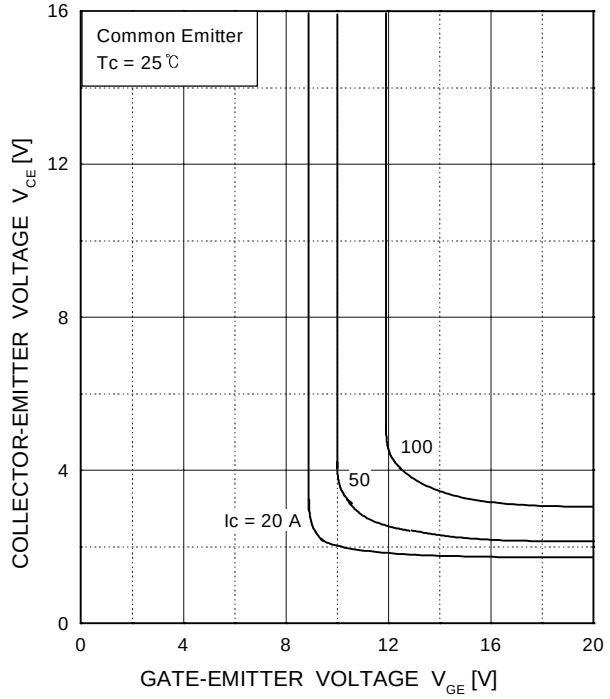
Symbol	Characteristics	Typ	Max	Units
R_{θ}JC	Junction-to-Case(IGBT Part, Per 1/2 Module)	-	0.5	℃/W
R_{θ}JC	Junction-to-Case(DIODE Part, Per 1/2 Module)	-	1.0	℃/W
R_{θ}CS	Case-to-Sink (Conductive grease applied)	-	0.15	℃/W
Weight	Weight of Module	-	190	℃/W

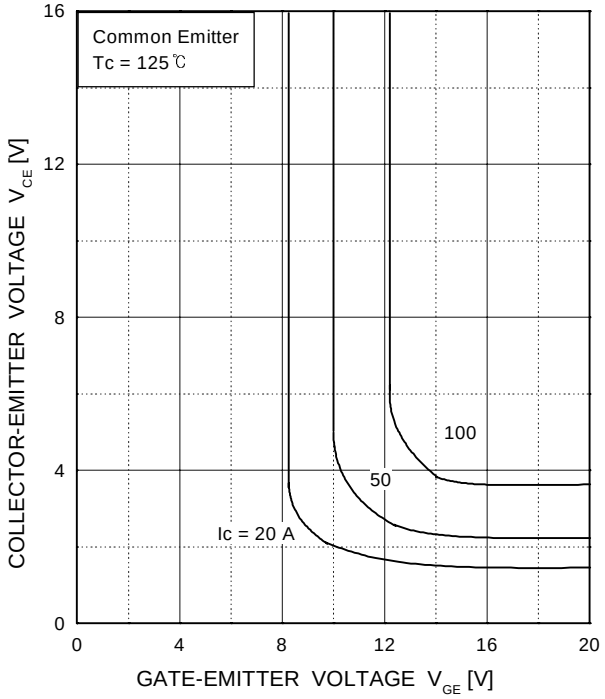

160
120
80
40
0
0
2
4
6
8
10
20V
15V
13V
12V
11V
V_{GE} = 10V
Common Emitter
Tc = 25℃
COLLECTOR CURRENT I_C [A]
COLLECTOR-EMITTER VOLTAGE V_{CE} [V]

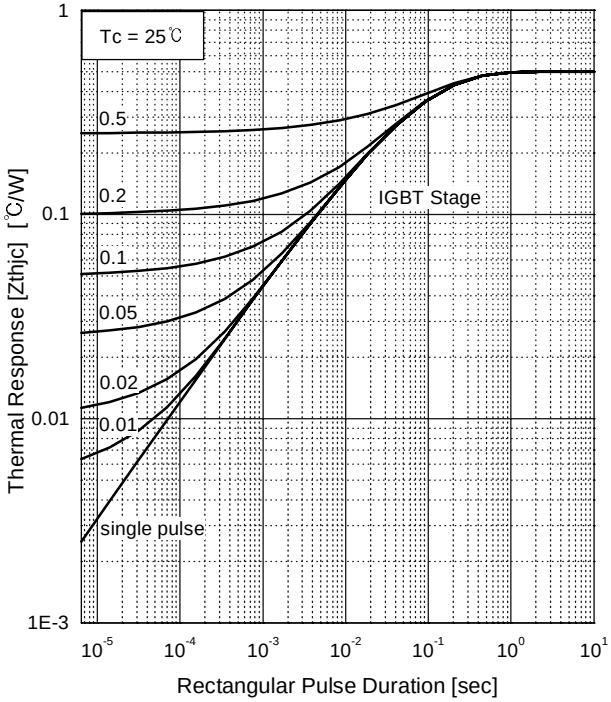

160
120
80
40
0
0
2
4
6
8
10
20V
15V
13V
12V
11V
V_{GE} = 10V
Common Emitter
Tc = 125℃
COLLECTOR CURRENT I_C [A]
COLLECTOR-EMITTER VOLTAGE V_{CE} [V]

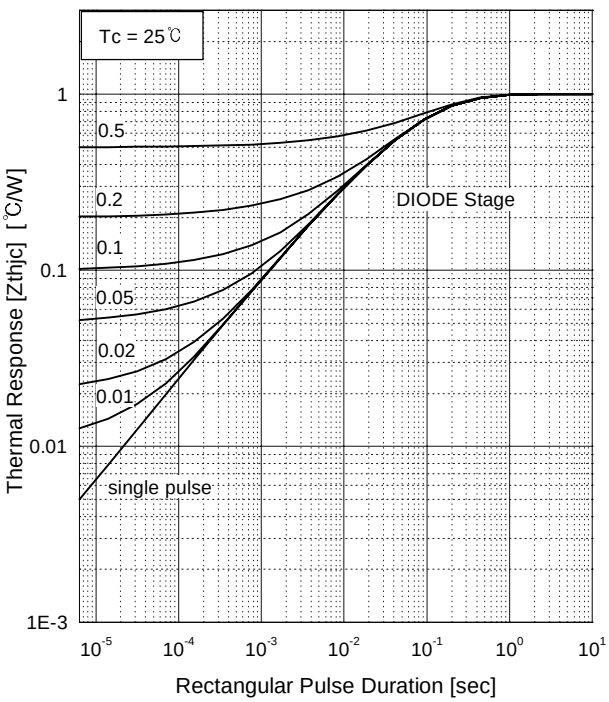

160
120
80
40
0
0
1
2
3
4
5
Common Emitter
Vge = 15V
Tc = 25℃
125℃
COLLECTOR CURRENT I_C [A]
COLLECTOR-EMITTER VOLTAGE V_{CE} [V]

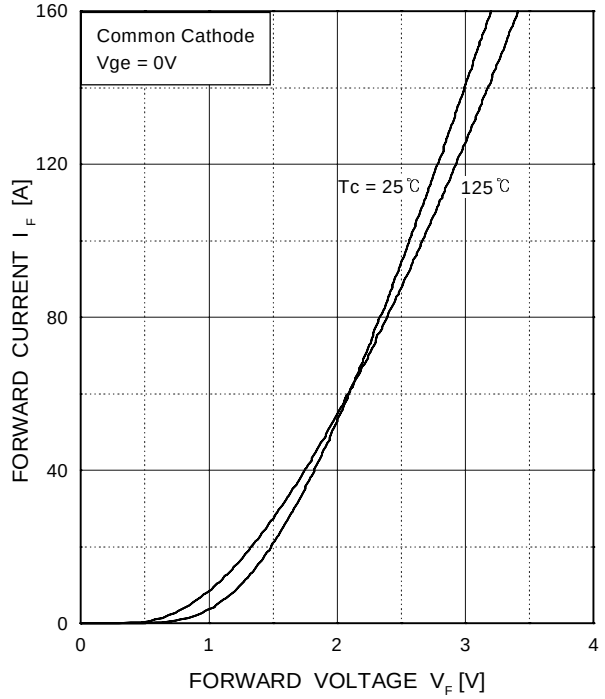

160
120
80
40
0
0
4
8
12
16
20
Common Emitter
Vce = 5V
Tc = 25℃
125℃
COLLECTOR CURRENT I_C [A]
GATE-EMITTER VOLTAGE V_{GE} [V]

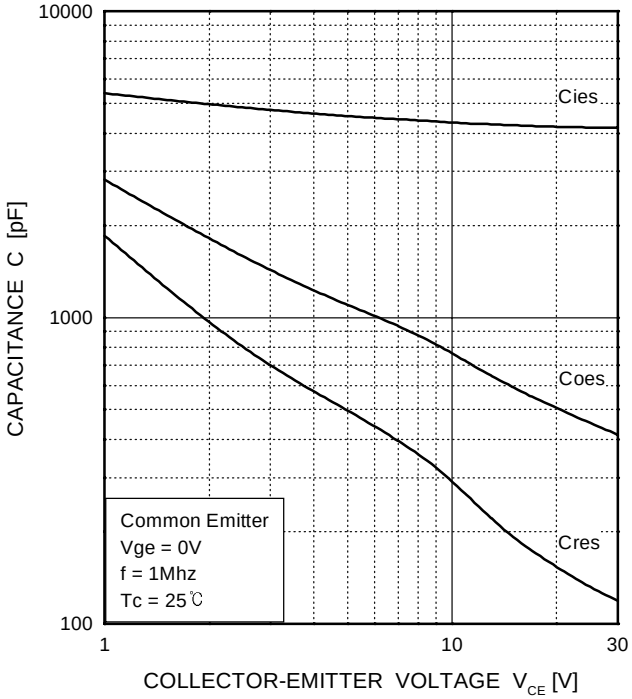

Common Emitter
Tc = 25℃
COLLECTOR-EMITTER VOLTAGE V_{CE} [V]
GATE-EMITTER VOLTAGE V_{GE} [V]
Ic = 20 A
50
100
0
4
8
12
16
20

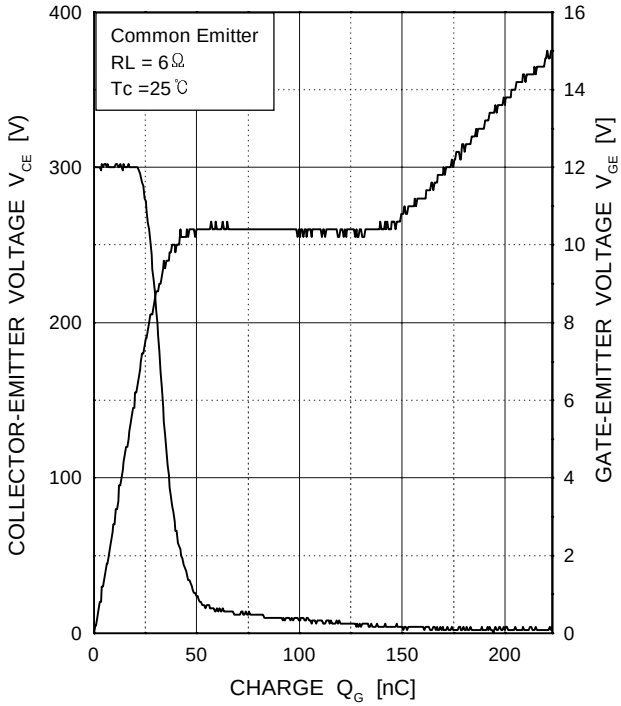

Common Emitter
Tc = 125℃
COLLECTOR-EMITTER VOLTAGE V_{CE} [V]
GATE-EMITTER VOLTAGE V_{GE} [V]
Ic = 20 A
50
100
0
4
8
12
16
20

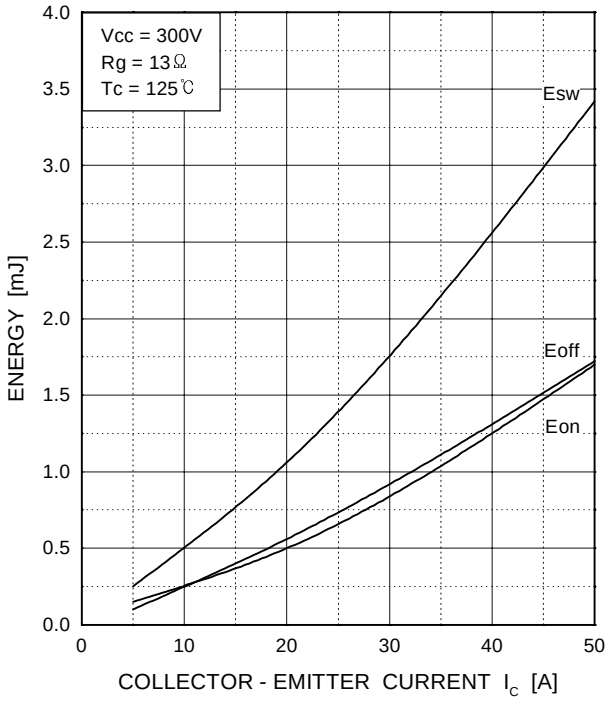

Tc = 25℃
Thermal Response [Zthjc] [℃/W]
Rectangular Pulse Duration [sec]
IGBT Stage
0.5
0.2
0.1
0.05
0.02
0.01
single pulse
1
0.1
0.01
1E-3
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}

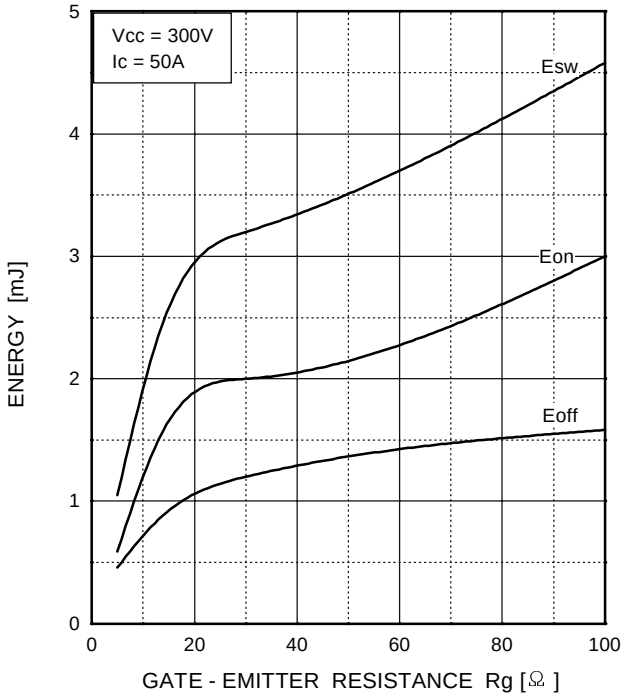

Tc = 25℃
Thermal Response [Zthjc] [℃/W]
Rectangular Pulse Duration [sec]
DIODE Stage
0.5
0.2
0.1
0.05
0.02
0.01
single pulse
1
0.1
0.01
1E-3
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}

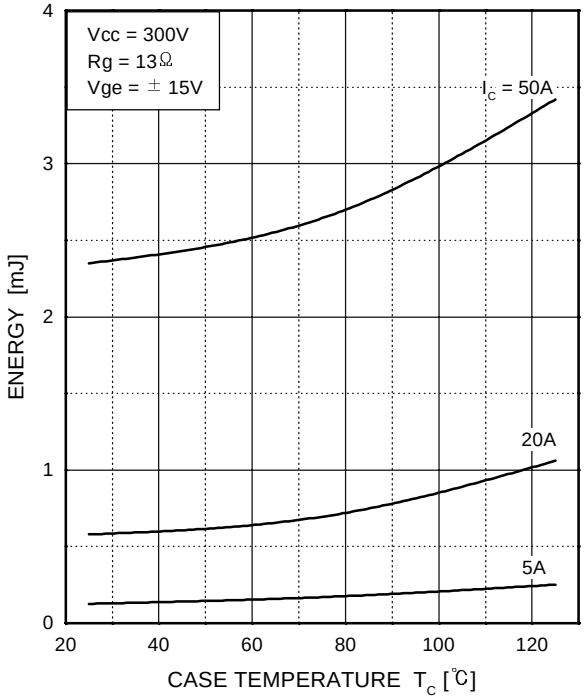

Common Cathode
Vge = 0V
Tc = 25℃
125℃
FORWARD CURRENT I_F [A]
FORWARD VOLTAGE V_F [V]
0
40
80
120
160
0
1
2
3
4

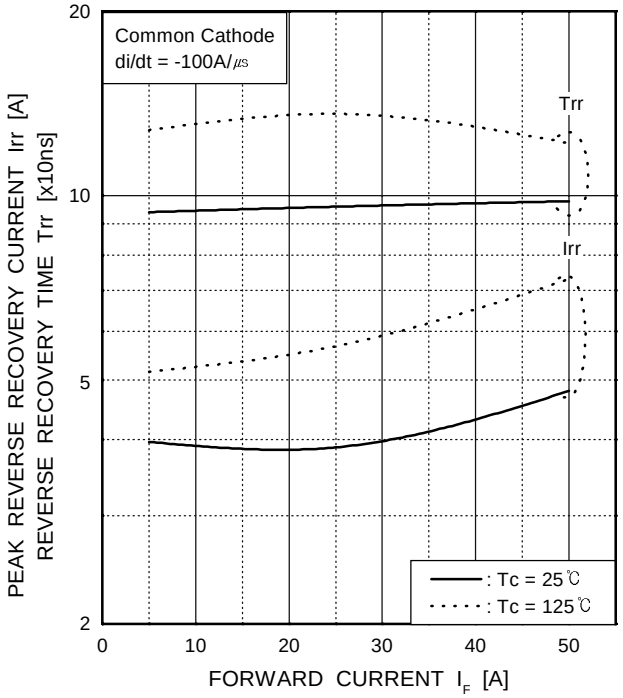

Cies
Coes
Cres
Common Emitter
Vge = 0V
f = 1Mhz
Tc = 25℃
CAPACITANCE C [pF]
COLLECTOR-EMITTER VOLTAGE V_{CE} [V]
100
1000
10000
1
10
30

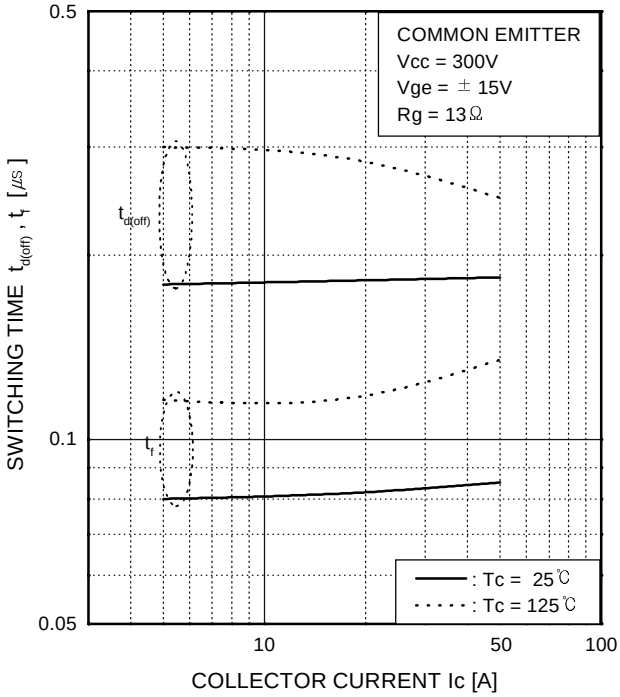

Common Emitter
RL = 6Ω
Tc =25℃
COLLECTOR-EMITTER VOLTAGE V_{CE} [V]
GATE-EMITTER VOLTAGE V_{GE} [V]
CHARGE Q_G [nC]
0
100
200
300
400
0
2
4
6
8
10
12
14
16
0
50
100
150
200

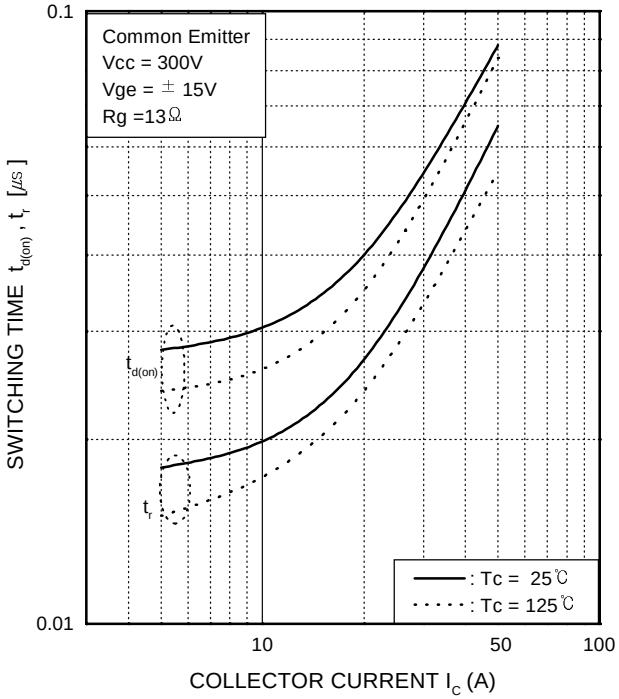

Vcc = 300V
Rg = 13Ω
Tc = 125℃
Esw
Eoff
Eon
ENERGY [mJ]
COLLECTOR - EMITTER CURRENT I_C [A]
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
0
10
20
30
40
50

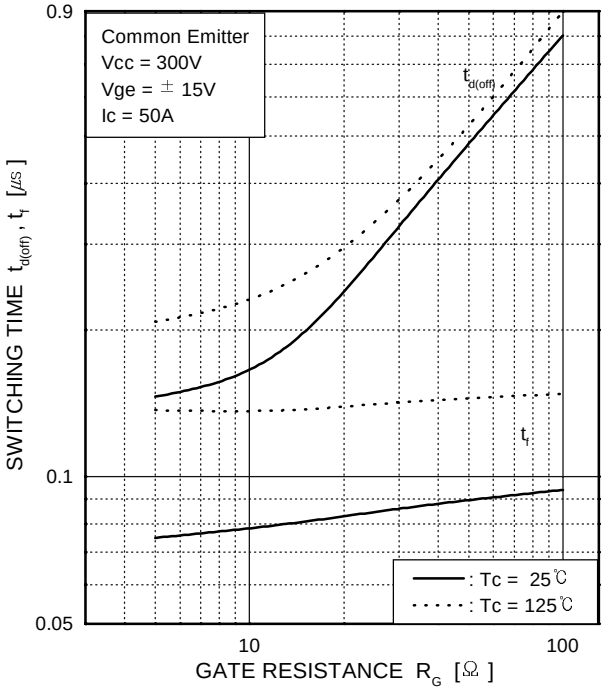

Vcc = 300V
Ic = 50A
Esw
Eon
Eoff
ENERGY [mJ]
GATE - EMITTER RESISTANCE Rg [Ω]

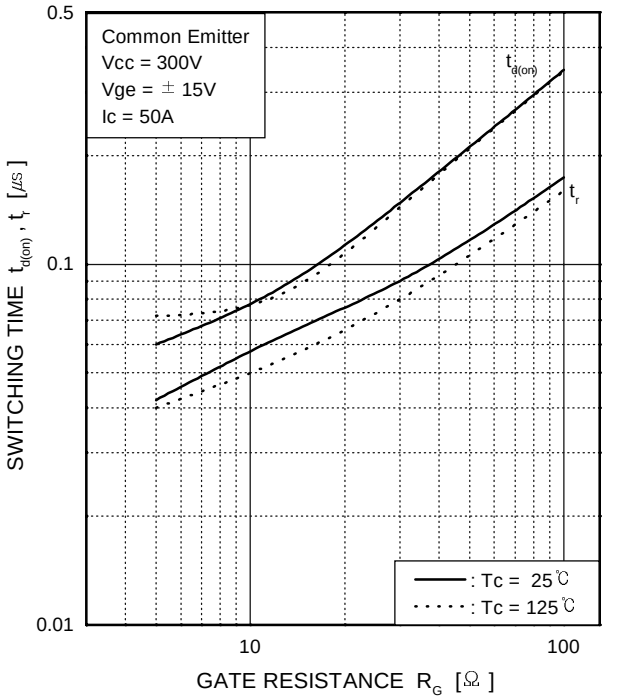

Vcc = 300V
Rg = 13Ω
Vge = ± 15V
Ic = 50A
20A
5A
ENERGY [mJ]
CASE TEMPERATURE Tc [℃]

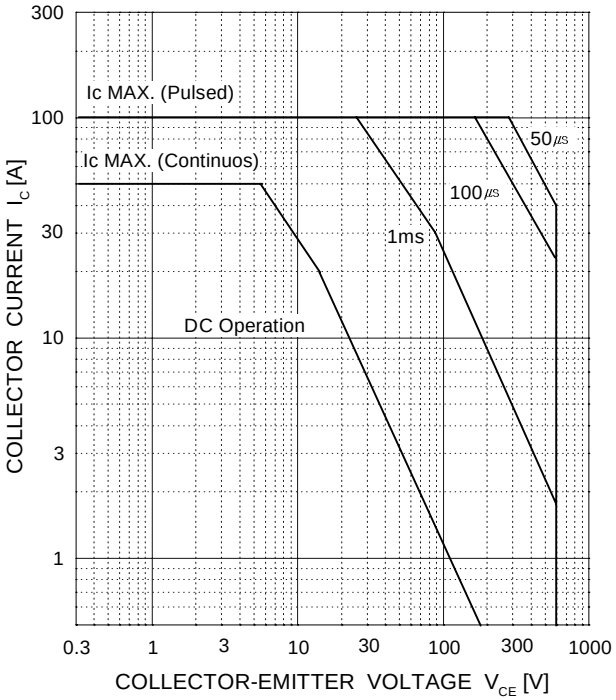

Common Cathode
di/dt = -100A/μs
Trr
Irr
: Tc = 25℃
: Tc = 125℃
PEAK REVERSE RECOVERY CURRENT Irr [A]
REVERSE RECOVERY TIME Trr [x10ns]
FORWARD CURRENT IF [A]

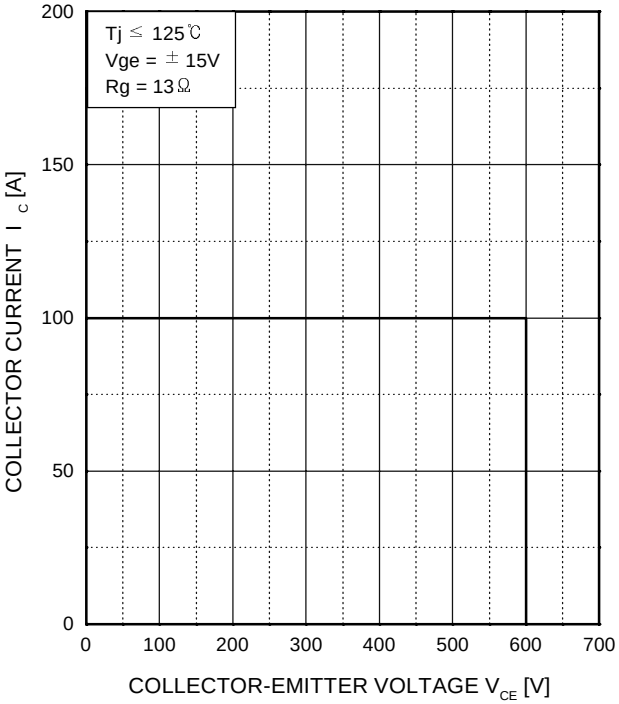

COMMON EMITTER
Vcc = 300V
Vge = ± 15V
Rg = 13Ω
td(off)
tf
: Tc = 25℃
: Tc = 125℃
SWITCHING TIME td(off) , tf [μs]
COLLECTOR CURRENT Ic [A]

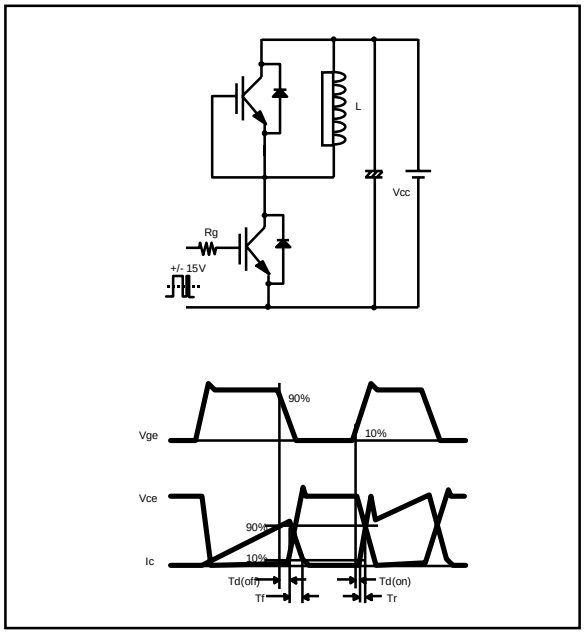

Common Emitter
Vcc = 300V
Vge = ± 15V
Rg =13Ω
: Tc = 25℃
: Tc = 125℃
SWITCHING TIME $t_{d(on)}$, t_r [μS]
COLLECTOR CURRENT I_C (A)
0.1
0.01
10
50
100


Common Emitter
Vcc = 300V
Vge = ± 15V
Ic = 50A
: Tc = 25℃
: Tc = 125℃
SWITCHING TIME $t_{d(off)}$, t_f [μS]
GATE RESISTANCE R_G [Ω]
0.9
0.1
0.05
10
100


Common Emitter
Vcc = 300V
Vge = ± 15V
Ic = 50A
: Tc = 25℃
: Tc = 125℃
SWITCHING TIME $t_{d(on)}$, t_r [μS]
GATE RESISTANCE R_G [Ω]
0.5
0.1
0.01
10
100

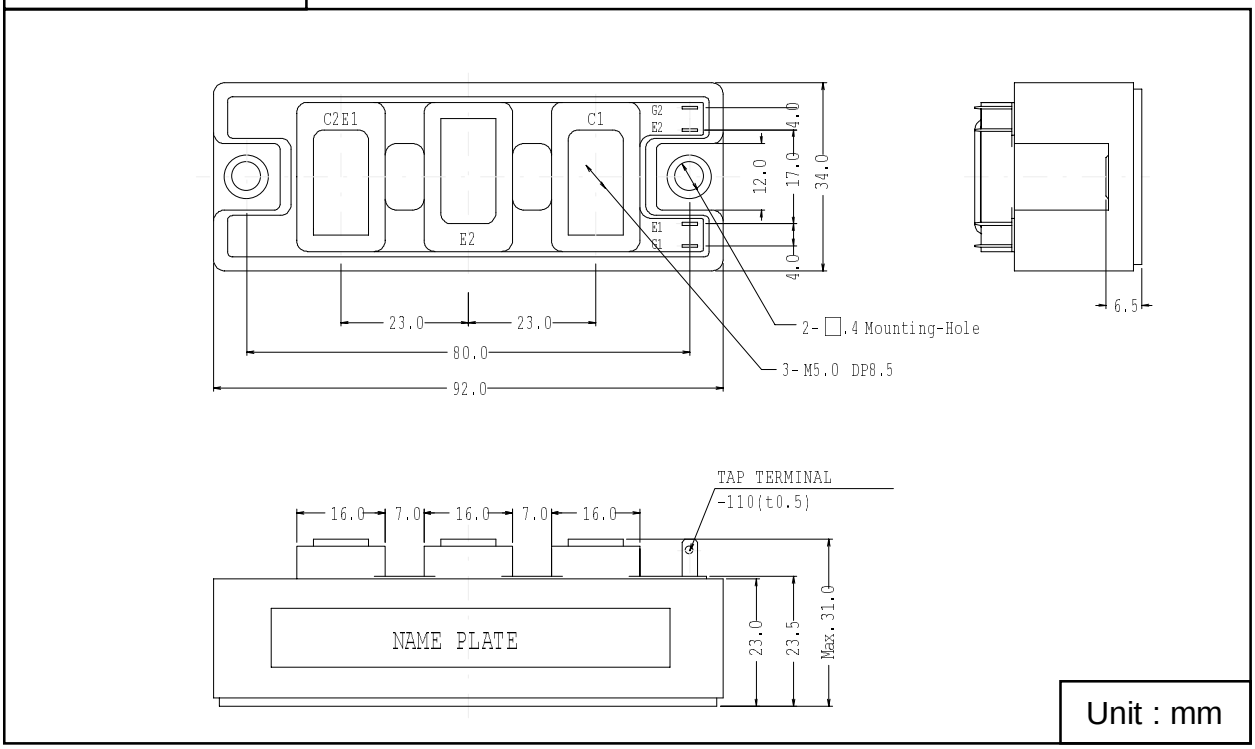

Ic MAX. (Pulsed)
Ic MAX. (Continuos)
50μS
100μS
1ms
DC Operation
COLLECTOR CURRENT I_C [A]
COLLECTOR-EMITTER VOLTAGE V_{CE} [V]
300
100
30
10
3
1
0.3
1
3
10
30
100
300
1000





Inductive Load Test Circuit and Waveforms

7-PM-AA



Unit : mm

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LIFE SUPPORT POLICY

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