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TOSHIBA GTR MODULE SILICON N CHANNEL IGBT

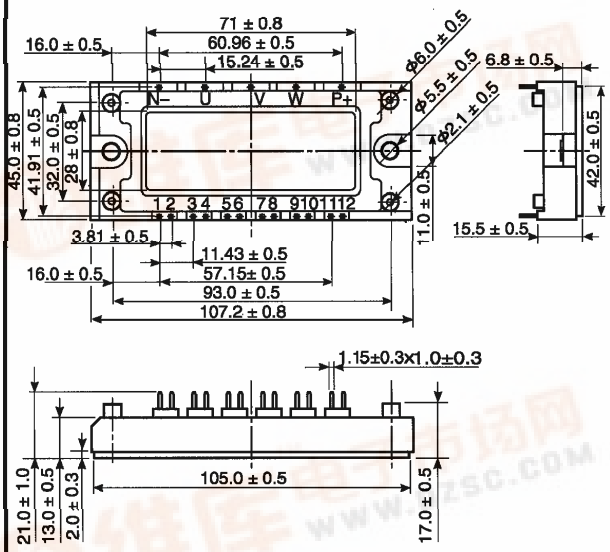
MG50Q6ES50

HIGH POWER SWITCHING APPLICATIONS

MOTOR CONTROL APPLICATIONS

- The Electrodes are Isolated from Case.
- High Input Impedance.
- 6 IGBTs Built Into 1 Package.

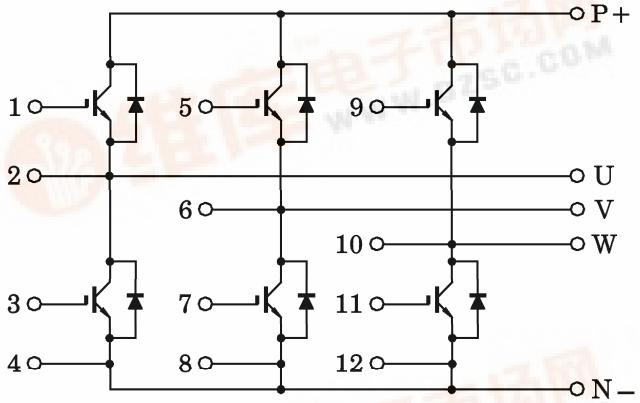
Unit in mm



JEDEC	—
EIAJ	—
TOSHIBA	2-108E1A

Weight : 185g

EQUIVALENT CIRCUIT



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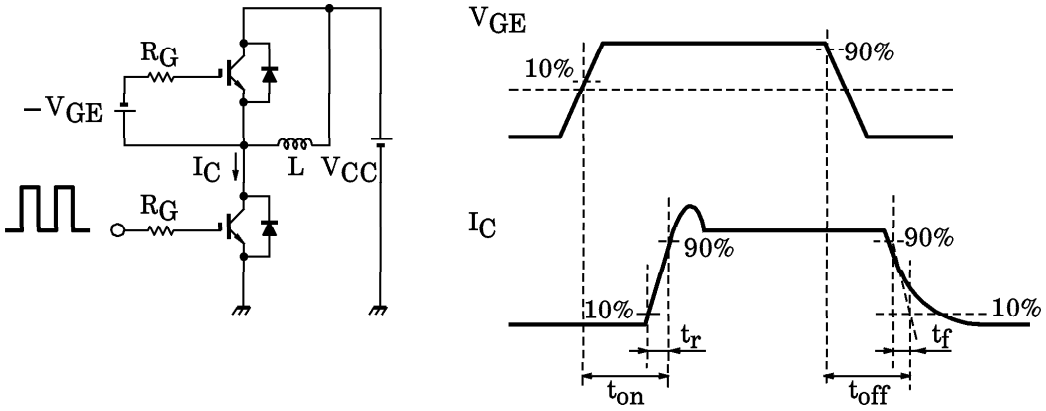
MAXIMUM RATINGS (Ta = 25°C)

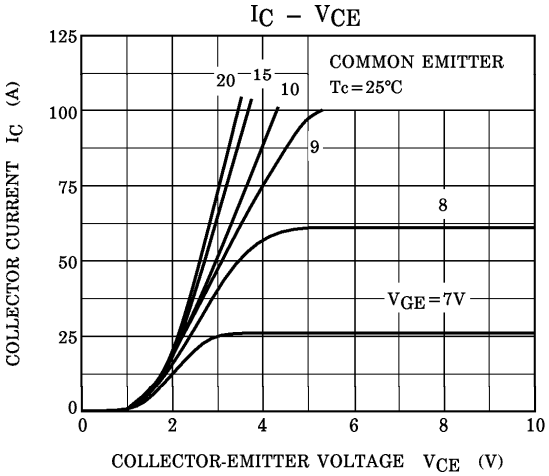
CHARACTERISTIC		SYMBOL	RATING	UNIT
Collector-Emitter Voltage		V_{CES}	1200	V
Gate-Emitter Voltage		V_{GES}	±20	V
Collector Current	DC	I_C (25°C / 80°C)	72 / 50	A
	1ms	I_{CP} (25°C / 80°C)	144 / 100	A
Forward Current	DC	I_F	50	A
	1ms	I_{FM}	100	A
Collector Power Dissipation (Tc = 25°C)		P_C	350	W
Junction Temperature		T_j	150	°C
Storage Temperature Range		T_{stg}	−40~125	°C
Isolation Voltage		V_{Isol}	2500 (AC 1 minute)	V
Screw Torque		—	6	N·m

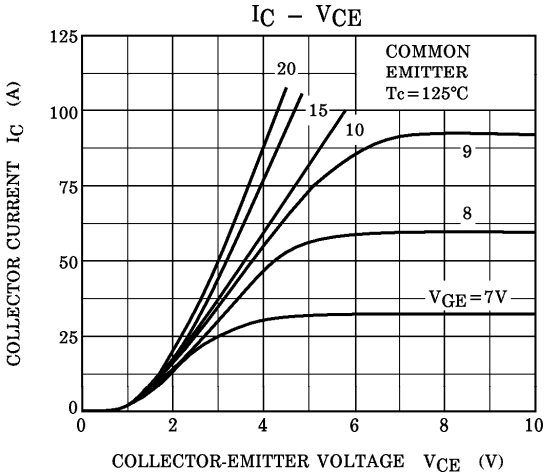
ELECTRICAL CHARACTERISTICS (Ta = 25°C)

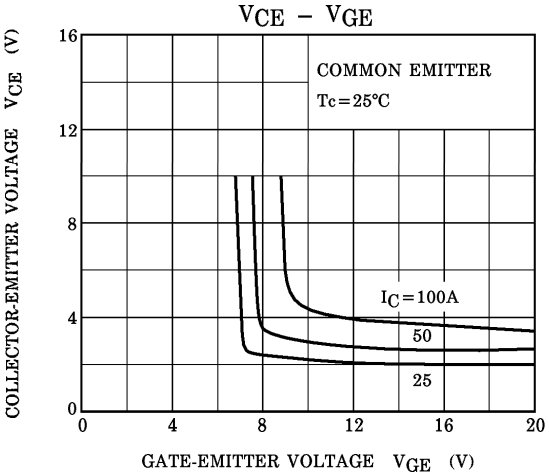
CHARACTERISTIC		SYMBOL	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Gate Leakage Current		I_{GES}	V_{GE} = ±20V, V_{CE} = 0		—	—	±500	nA
Collector Cut-Off Current		I_{CES}	V_{CE} = 1200V, V_{GE} = 0		—	—	0.5	mA
Gate-Emitter Cut-Off Voltage		$V_{GE\ (off)}$	I_C = 50mA, V_{CE} = 5V		3.0	—	6.0	V
Collector-Emitter Saturation Voltage		$V_{CE\ (sat)}$	I_C = 50A, V_{GE} = 15V	T_j = 25°C	—	2.8	3.2	V
				T_j = 125°C	—	3.1	3.7	
Input Capacitance		C_{ies}	V_{CE} = 10V, V_{GE} = 0, f = 1MHz		—	6.0	—	nF
Switching Time	Rise Time	t_r	V_{CC} = 600V, I_C = 50A, V_{GE} = ±15V, R_G = 24Ω, T_j = 125°C (Note 1)		—	0.07	0.15	μs
	Turn-On Time	t_{on}			—	0.15	0.30	
	Fall Time	t_f			—	0.07	0.10	
	Turn-Off Time	t_{off}			—	0.60	0.90	
Forward Voltage		V_F	I_F = 50A, V_{GE} = 0		—	2.0	2.8	V
Reverse Recovery Time		t_{rr}	I_F = 50A, V_{GE} = −10V, di / dt = 700A / μs		—	0.10	0.25	μs
Thermal Resistance		$R_{th\ (j-c)}$	Transistor Stage		—	—	0.35	°C / W
			Diode Stage		—	—	0.7	

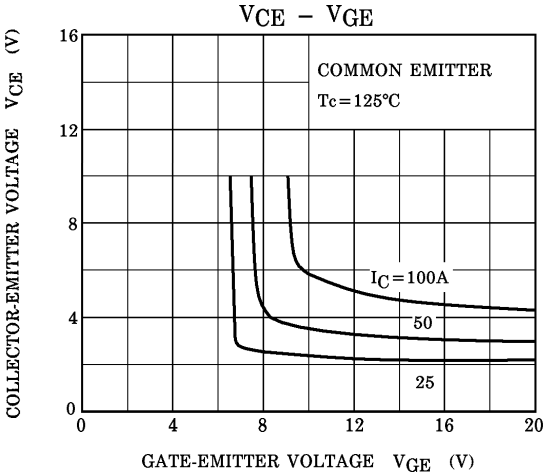
(Note 1) Switching Time Test Circuit & Timing Chart

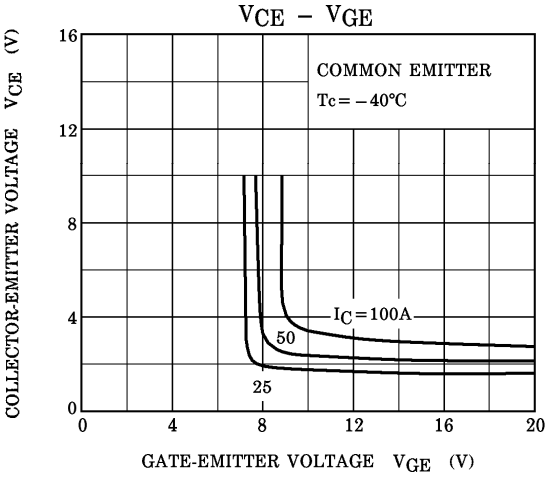


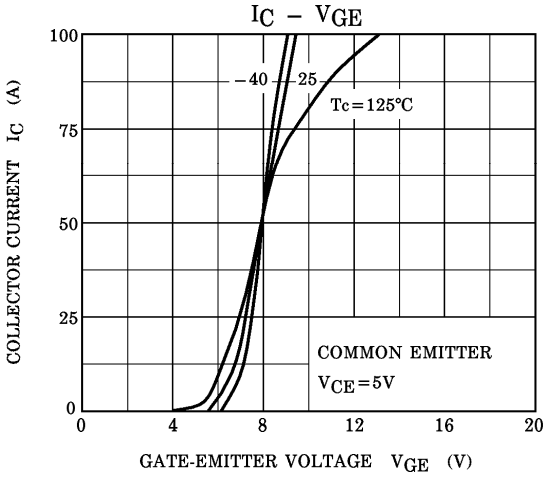

IC – VCE
COMMON EMITTER
Tc=25°C
20
15
10
9
8
VGE=7V
COLLECTOR CURRENT IC (A)
COLLECTOR-EMITTER VOLTAGE VCE (V)
0
25
50
75
100
125
0
2
4
6
8
10

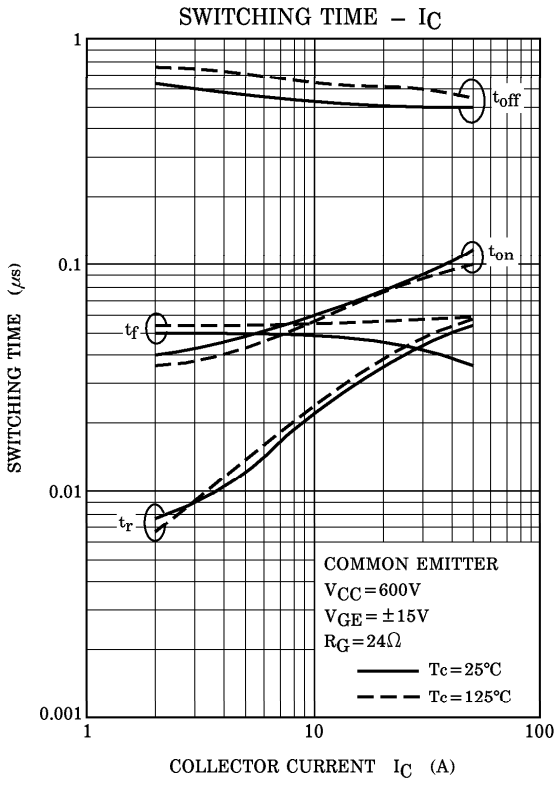

IC – VCE
COMMON
EMITTER
Tc=125°C
20
15
10
9
8
VGE=7V
COLLECTOR CURRENT IC (A)
COLLECTOR-EMITTER VOLTAGE VCE (V)
0
25
50
75
100
125
0
2
4
6
8
10

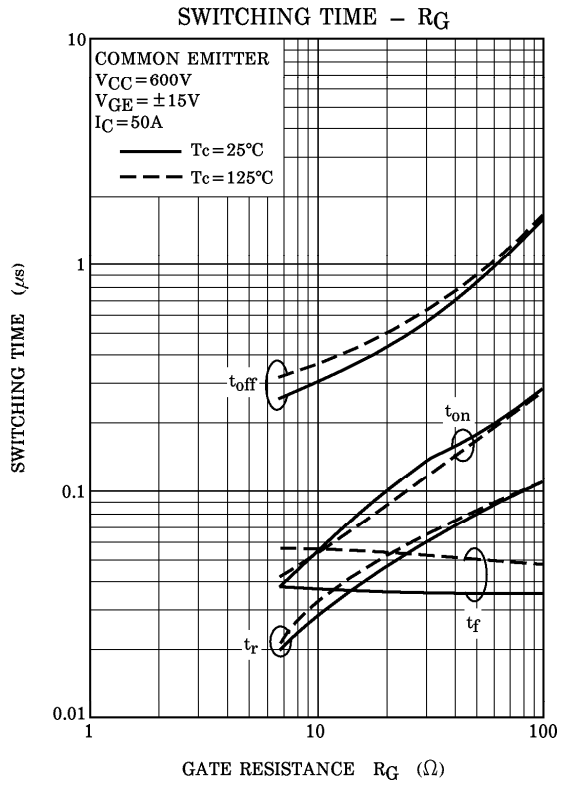

VCE – VGE
COMMON EMITTER
Tc=25°C
IC=100A
50
25
COLLECTOR-EMITTER VOLTAGE VCE (V)
GATE-EMITTER VOLTAGE VGE (V)
0
4
8
12
16
0
4
8
12
16
20

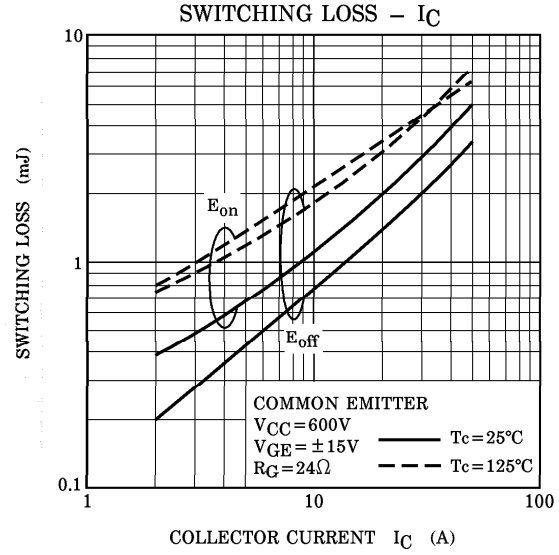

VCE – VGE
COMMON EMITTER
Tc=125°C
IC=100A
50
25
COLLECTOR-EMITTER VOLTAGE VCE (V)
GATE-EMITTER VOLTAGE VGE (V)
0
4
8
12
16
0
4
8
12
16
20

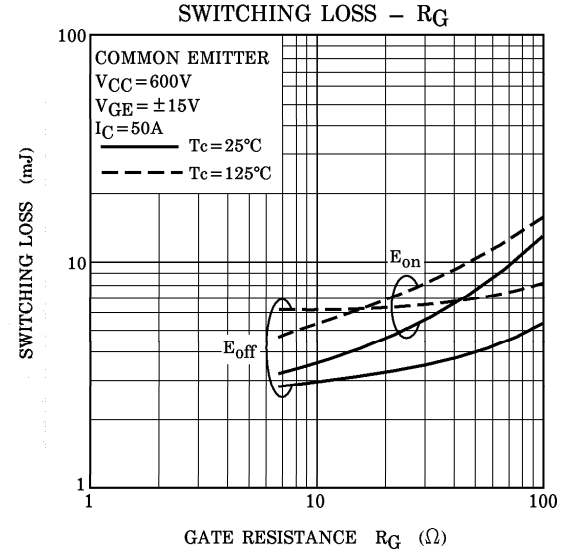

VCE – VGE
COMMON EMITTER
Tc=−40°C
IC=100A
50
25
COLLECTOR-EMITTER VOLTAGE VCE (V)
GATE-EMITTER VOLTAGE VGE (V)
0
4
8
12
16
0
4
8
12
16
20

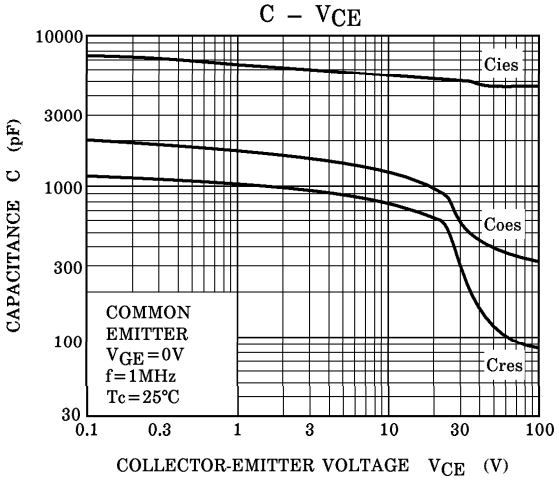

IC – VGE
−40
25
Tc=125°C
COMMON EMITTER
VCE=5V
COLLECTOR CURRENT IC (A)
GATE-EMITTER VOLTAGE VGE (V)
0
25
50
75
100
0
4
8
12
16
20

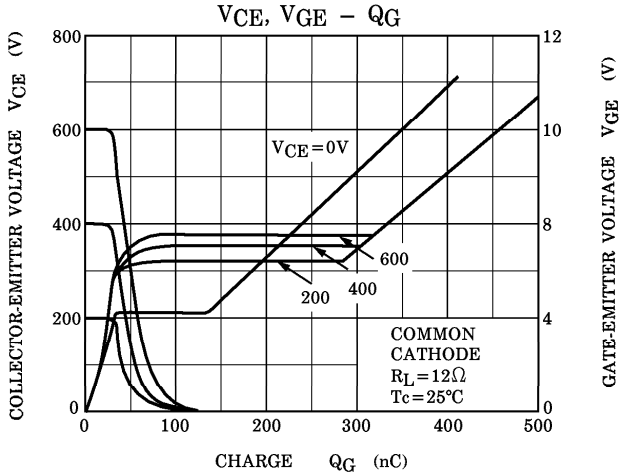

SWITCHING TIME – IC
SWITCHING TIME (μs)
COLLECTOR CURRENT IC (A)
toff
ton
tf
tr
COMMON EMITTER
VCC=600V
VGE=±15V
RG=24Ω
Tc=25°C
Tc=125°C
1
0.1
0.01
0.001
1
10
100

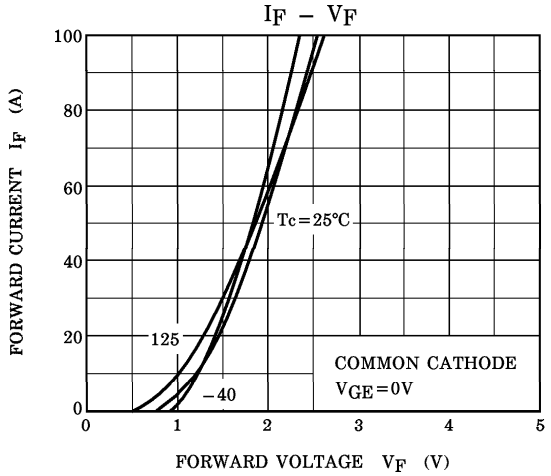

SWITCHING TIME – RG
SWITCHING TIME (μs)
GATE RESISTANCE RG (Ω)
COMMON EMITTER
VCC=600V
VGE=±15V
IC=50A
Tc=25°C
Tc=125°C
toff
ton
tr
tf
10
1
0.1
0.01
1
10
100

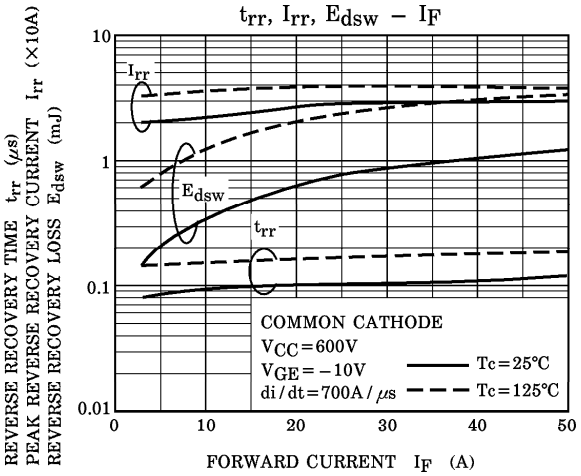

SWITCHING LOSS – IC
SWITCHING LOSS (mJ)
COLLECTOR CURRENT IC (A)
Eon
Eoff
COMMON EMITTER
VCC=600V
VGE=±15V
RG=24Ω
Tc=25°C
Tc=125°C
10
1
0.1
1
10
100

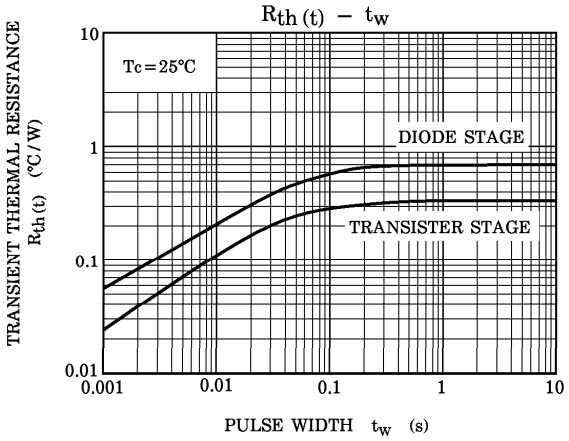

SWITCHING LOSS – RG
SWITCHING LOSS (mJ)
GATE RESISTANCE RG (Ω)
COMMON EMITTER
VCC=600V
VGE=±15V
IC=50A
Tc=25°C
Tc=125°C
Eon
Eoff
100
10
1
1
10
100

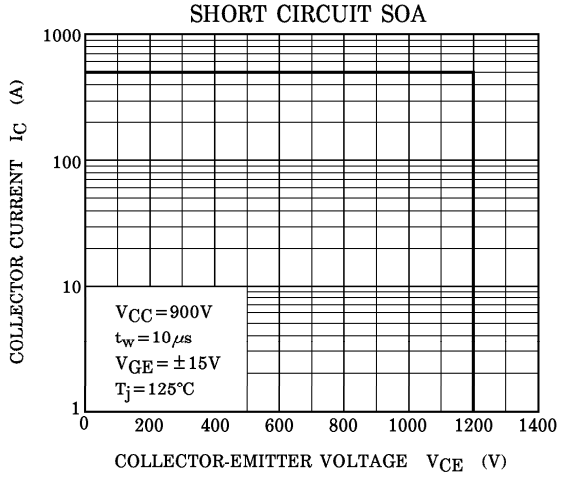

C – VCE
CAPACITANCE C (pF)
10000
3000
1000
300
100
30
Cies
Coes
Cres
COMMON
EMITTER
VGE=0V
f=1MHz
Tc=25°C
0.1
0.3
1
3
10
30
100
COLLECTOR-EMITTER VOLTAGE VCE (V)

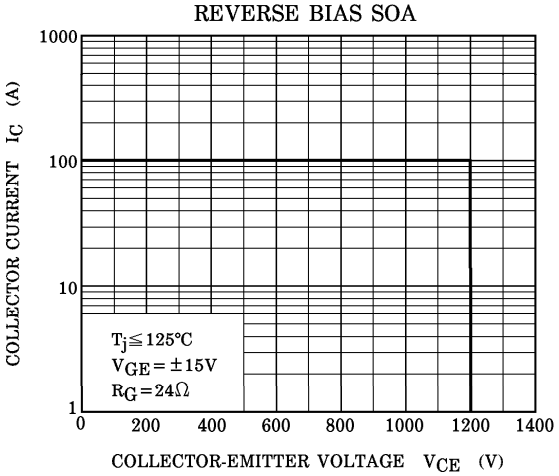

VCE, VGE – QG
COLLECTOR-EMITTER VOLTAGE VCE (V)
GATE-EMITTER VOLTAGE VGE (V)
800
600
400
200
0
12
10
8
4
0
VCE=0V
600
400
200
COMMON
CATHODE
RL=12Ω
Tc=25°C
0
100
200
300
400
500
CHARGE QG (nC)


IF – VF
FORWARD CURRENT IF (A)
100
80
60
40
20
0
Tc=25°C
125
–40
COMMON CATHODE
VGE=0V
0
1
2
3
4
5
FORWARD VOLTAGE VF (V)


trr, Irr, Edsw – IF
REVERSE RECOVERY TIME trr (μs)
PEAK REVERSE RECOVERY CURRENT Irr (×10A)
REVERSE RECOVERY LOSS Edsw (mJ)
10
1
0.1
0.01
Irr
Edsw
trr
COMMON CATHODE
VCC=600V
VGE=–10V
di/dt=700A/μs
Tc=25°C
Tc=125°C
0
10
20
30
40
50
FORWARD CURRENT IF (A)


Rth (t) – tw
TRANSIENT THERMAL RESISTANCE
Rth (t) (°C/W)
10
1
0.1
0.01
Tc=25°C
DIODE STAGE
TRANSISTER STAGE
0.001
0.01
0.1
1
10
PULSE WIDTH tw (s)


SHORT CIRCUIT SOA
COLLECTOR CURRENT IC (A)
1000
100
10
1
VCC=900V
tw=10μs
VGE=±15V
Tj=125°C
0
200
400
600
800
1000
1200
1400
COLLECTOR-EMITTER VOLTAGE VCE (V)


REVERSE BIAS SOA
COLLECTOR CURRENT I_C (A)
1000
100
10
1
0
200
400
600
800
1000
1200
1400
$T_j \leq 125°C$
$V_{GE} = \pm 15V$
$R_G = 24\Omega$
COLLECTOR-EMITTER VOLTAGE V_{CE} (V)