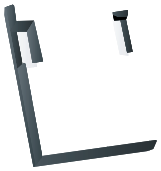
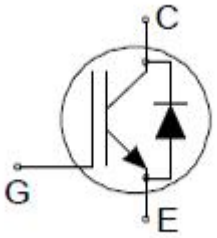
IGBT

- 650V/40A
  $V_{CE(sat)}$= 1.65V(typ.) @I_C = 40A
- Positive temperature coefficient
- Fast Switching
- Low $V_{CE(sat)}$
- Reliable and Rugged
- Halogen Free and Green Devices Available
  (RoHS Compliant)





- Motor drives
- Solar Inverter
- Resonant converters

W HYG40T65 XYMXXX	Package Code W:TO-247-3L Date Code XYMXXX

Note: HUAYI halogen free products contain molding compounds/die attach materials and 100% matte tin plate Termi-Nation finish;which are fully compliant with RoHS. HUAYI halogen free products meet or exceed the halogen free require-ments of IPC/JEDEC J-STD-020 for MSL classification at halogen free peak reflow temperature. HUAYI defines “Green” to mean halogen free (RoHS compliant) and halogen free (Br or Cl does not exceed 900ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500ppm by weight).

HUAYI reserves the right to make changes, corrections, enhancements, modifications, and improvements to this pr -oduct and/or to this document at any time without notice.

(Tc=25°C Unless Otherwise Noted)				
V_{CES}	Collector-Emitter Voltage		650	V
V_{GES}	Gate-Emitter Voltage		30	V
T_J	Junction Temperature Range		-55 to 175	°C
T_{STG}	Storage Temperature Range			°C
I_{CM}	Pulsed Collector Current *	Tc=25°C	160	A
I_C	Continuous Drain Current	Tc=25°C	80	A
		Tc=100°C	40	A
I_{FM}	Diode Maximum Forward Current *	Tc=25°C	160	A
I_F	Diode Continuous Forward Current	Tc=25°C	80	A
		Tc=100°C	40	A
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (IGBT)		0.66	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Diode)		0.58	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient		40	°C/W

Note: * Repetitive rating: pulse width limited by max. junction temperature.

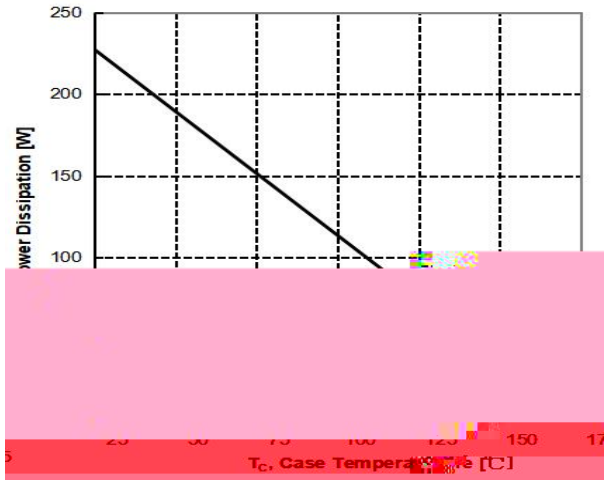
(Tc =25°C Unless Otherwise Noted)

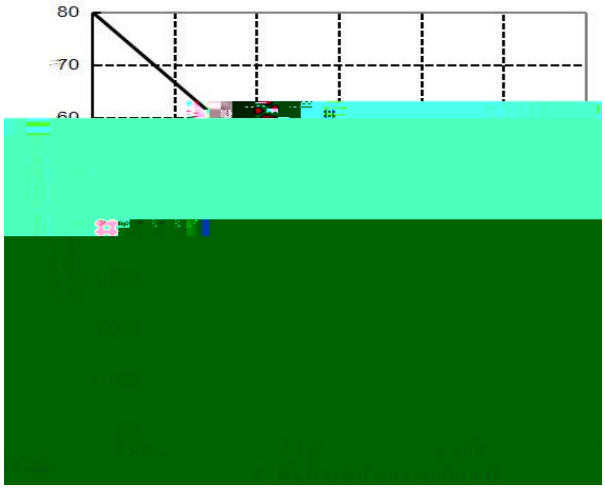
*

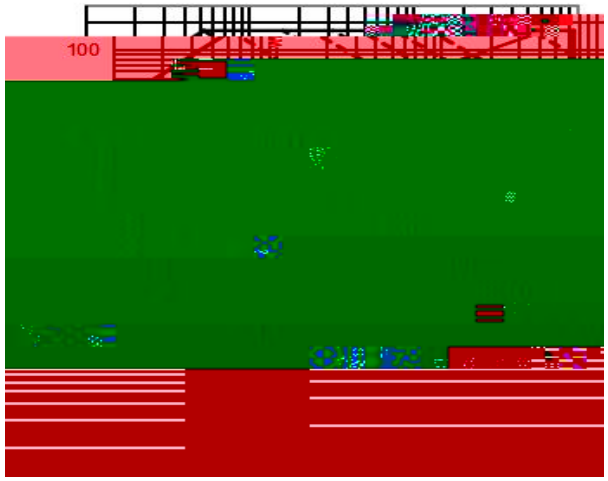
BV_{CES} Collector-Emitter

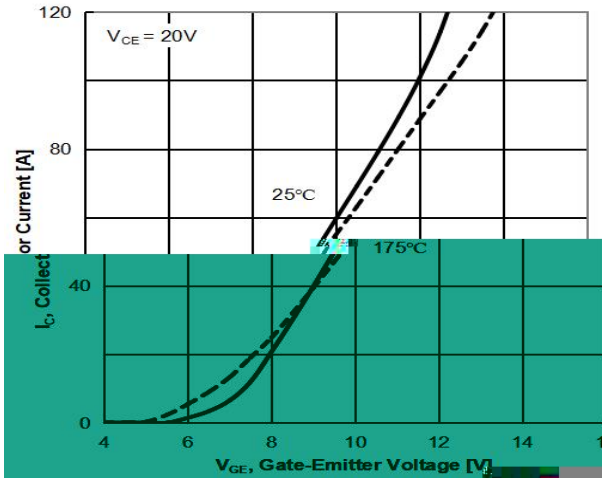
C_{ies}	Input Capacitance	V_{GE}=0V	-	2540	-	pF
C_{oes}	Output Capacitance	V_{CE}=25V	-	126	-	
C_{res}	Reverse Transfer Capacitance	Frequency=1MHz	-	67	-	
Q_g	Total Gate Charge	V_{CC}=520V	-	146	-	nC
Q_{ge}	Gate- Emitter Charge	I_C=40A	-	24	-	
Q_{gc}	Gate- Collector Charge	V_{GE}=15V	-	71	-	
$t_{(SC)}$	Short circuit collector current Max.1000 short circuits, times between short circuits: ≥ 1.0s	V_{GE}=15V, V_{CC}≤400V T_J≤175°C	-	8	-	μs
$t_{d(ON)}$	Turn-on Delay Time	I_C=40A V_{CC}=400V V_{GE}=15V R_g=5Ω T_J=25°C Inductive Load	-	20	-	ns
t_r	Turn-on Rise Time		-	67	-	
$t_{d(OFF)}$	Turn-off Delay Time		-	104	-	
t_f	Turn-off Fall Time		-	74	-	
E_{on}	Turn-On Switching Loss		-	0.95	-	mJ
E_{off}	Turn-Off Switching Loss		-	0.93	-	
E_{ts}	Total Switching Loss		-	1.88	-	
$t_{d(ON)}$	Turn-on Delay Time	I_C=40A V_{CC}=400V V_{GE}=15V R_g=5Ω T_J=175°C Inductive Load	-	22	-	ns
t_r	Turn-on Rise Time		-	73	-	
$t_{d(OFF)}$	Turn-off Delay Time		-	178	-	
t_f	Turn-off Fall Time		-	70	-	
E_{on}	Turn-On Switching Loss		-	1.82	-	mJ
E_{off}	Turn-Off Switching Loss		-	1.16	-	
E_{ts}	Total Switching Loss		-	2.98	-	
t_{rr}	Reverse Recovery Time	I_F=40A di/dt=200A/μs	-	188	-	ns
Q_{rr}	Reverse Recovery Charge		-	243	-	nC
I_{rrm}	Reverse Recovery Current		-	6.8	-	A
t_{rr}	Reverse Recovery Time	I_F=40A di/dt=200A/μs	-	215	-	ns
Q_{rr}	Reverse Recovery Charge		-	278	-	nC
I_{rrm}	Reverse Recovery Current		-	9.7	-	A

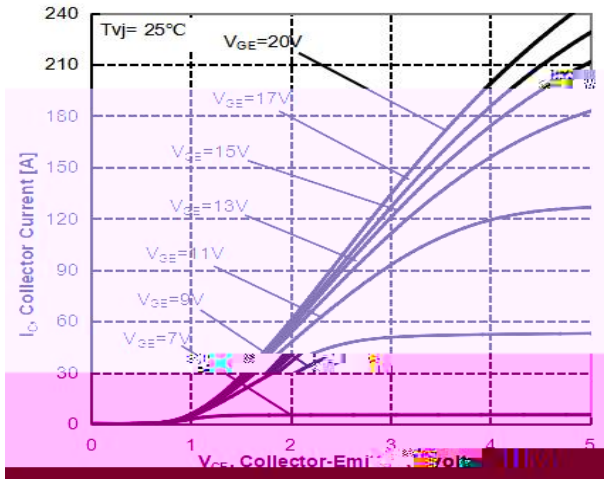
Note: *Pulse test pulse width ≤ 300us duty cycle ≤ 2%

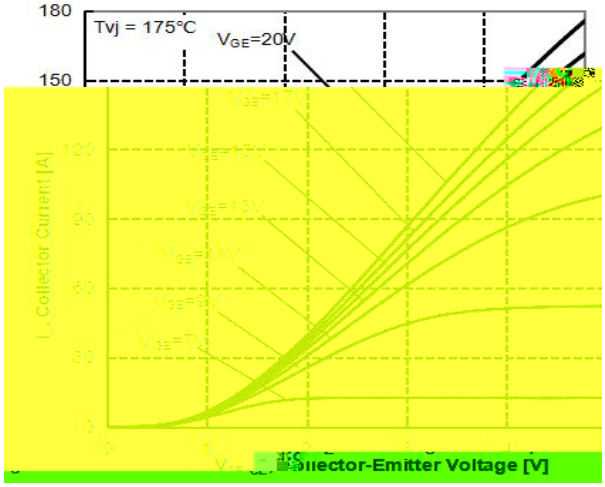

250
200
150
100
150
Tc, Case Temperature [C]

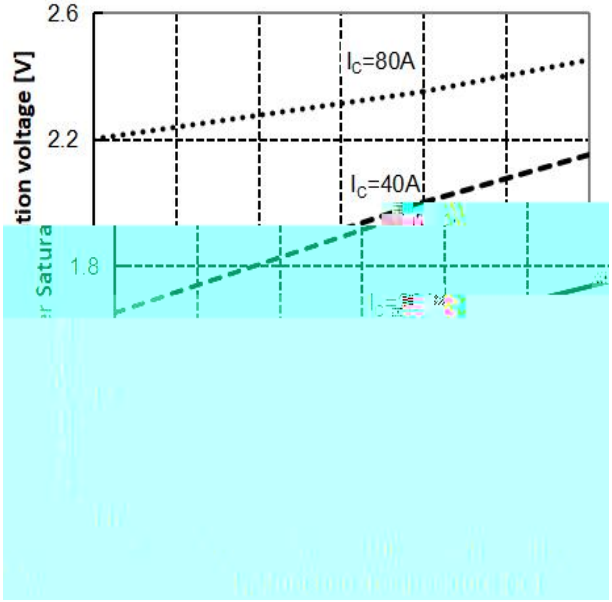

80
70
60

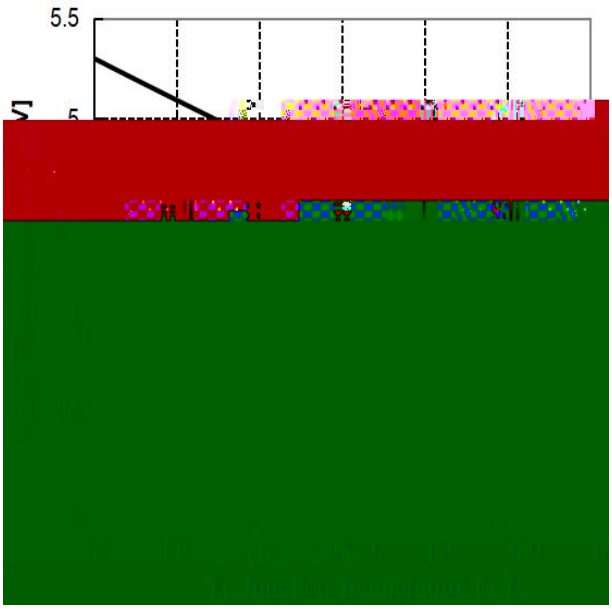

100

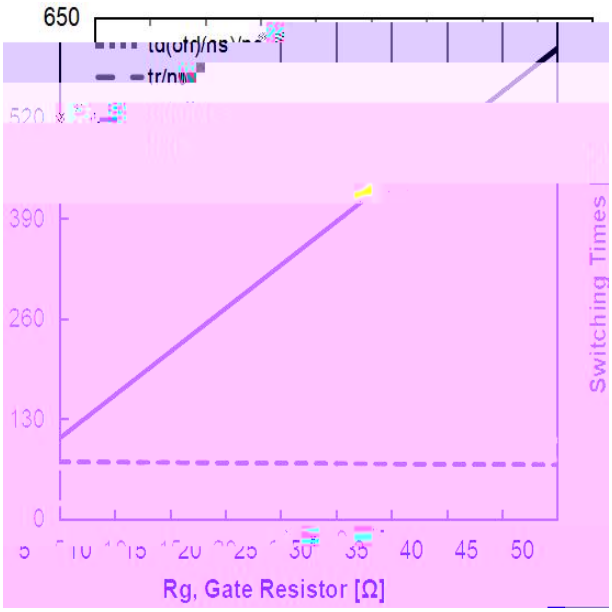

120
80
40
0
VCE = 20V
25°C
175°C
4
6
8
10
12
14
VGE, Gate-Emitter Voltage [V]

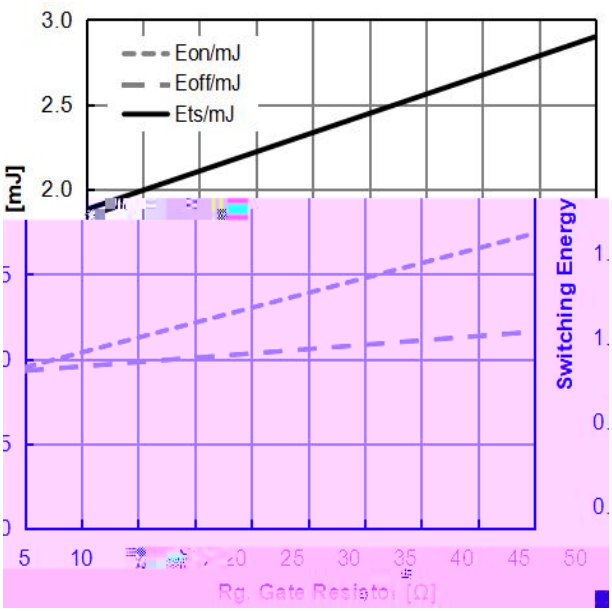

240
210
180
150
120
90
60
30
0
Tvj= 25°C
VGE=20V
VGE=17V
VGE=15V
VGE=13V
VGE=11V
VGE=9V
VGE=7V
IC, Collector Current [A]
0
1
2
3
4
5

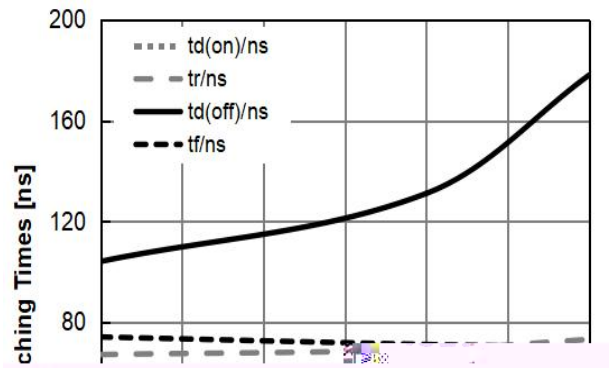

180
150
Tvj = 175°C
VGE=20V
IC, Collector Current [A]
Collector-Emitter Voltage [V]

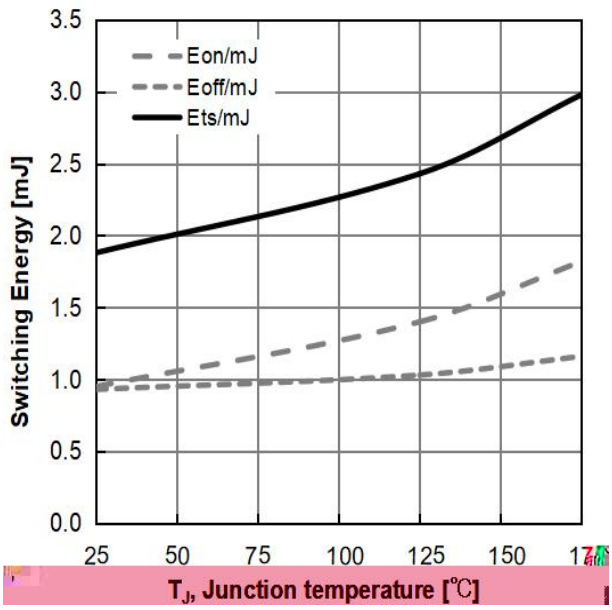

2.6
2.2
1.8
I_C=80A
I_C=40A

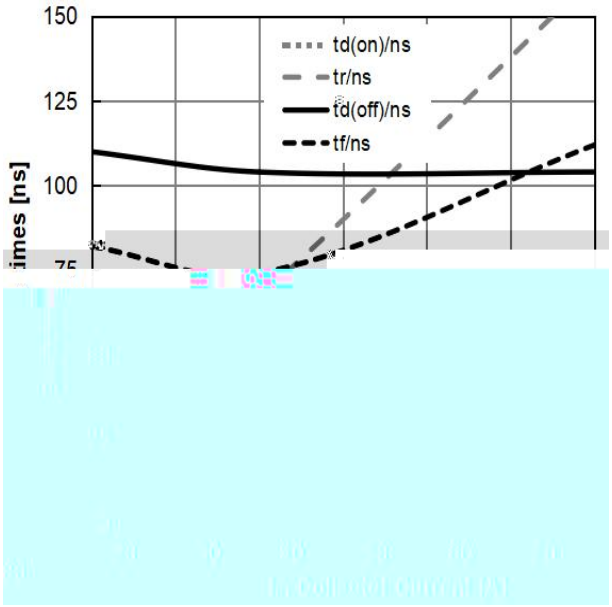

5.5

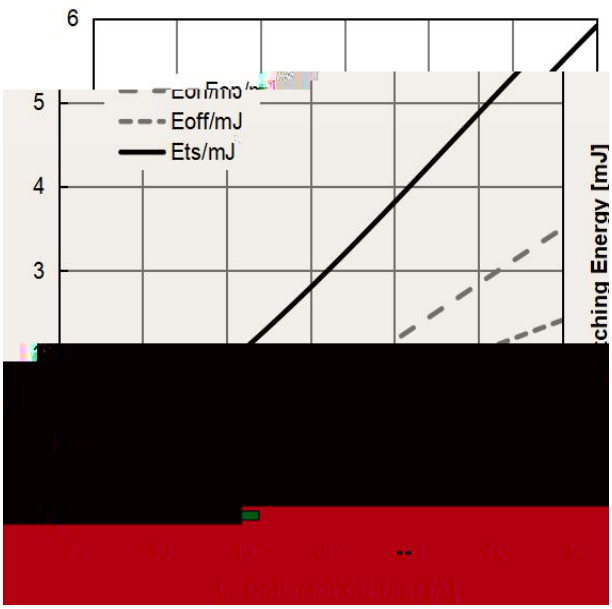

650
390
260
130
0
40
45
50
Rg, Gate Resistor [Ω]
Switching Times

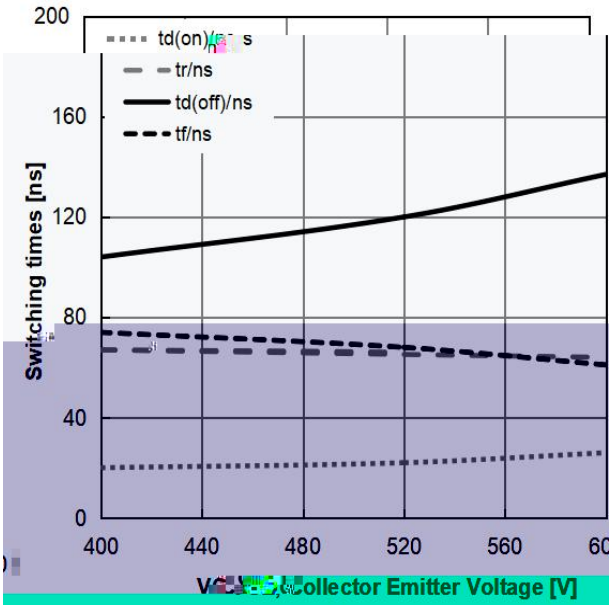

3.0
2.5
2.0
[mJ]
Eon/mJ
Eoff/mJ
Ets/mJ
5
10
40
45
50
Switching Energy

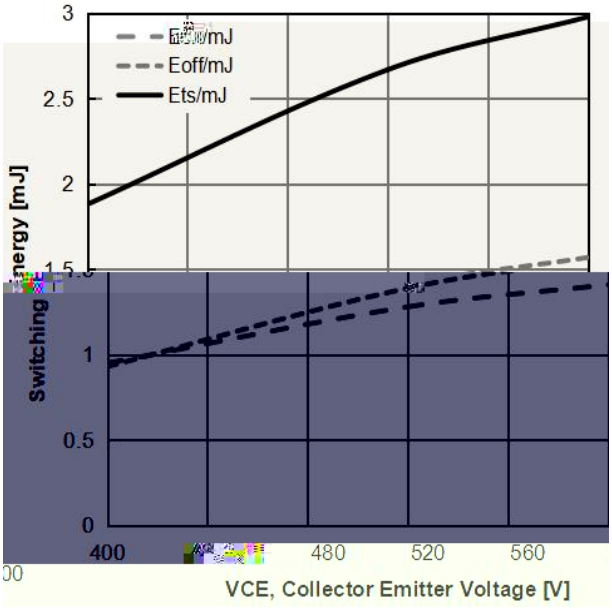

200
160
120
80
td(on)/ns
tr/ns
td(off)/ns
tf/ns
ching Times [ns]

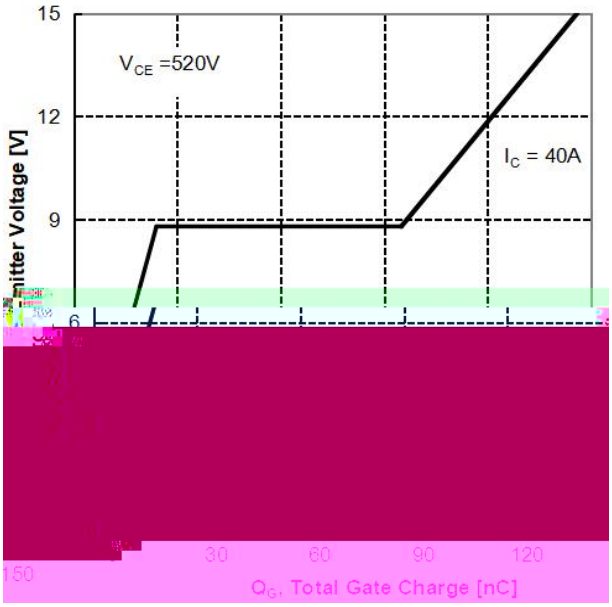

3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Eon/mJ
Eoff/mJ
Ets/mJ
Switching Energy [mJ]
25
50
75
100
125
150
T_J, Junction temperature [℃]

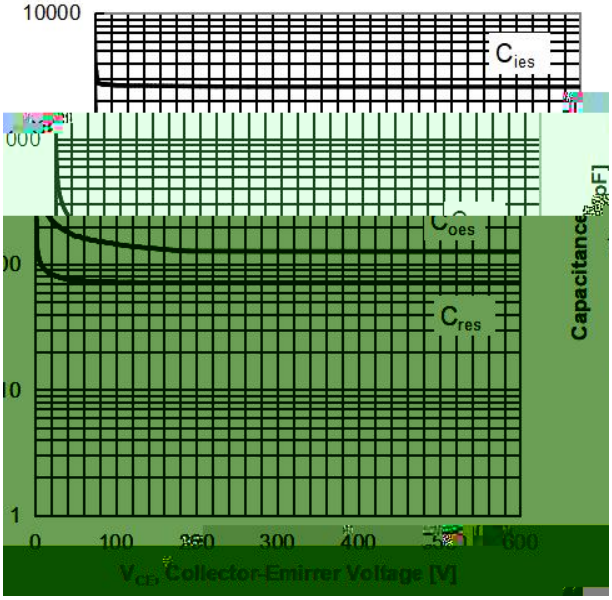

150
125
100
td(on)/ns
tr/ns
td(off)/ns
tf/ns
imes [ns]

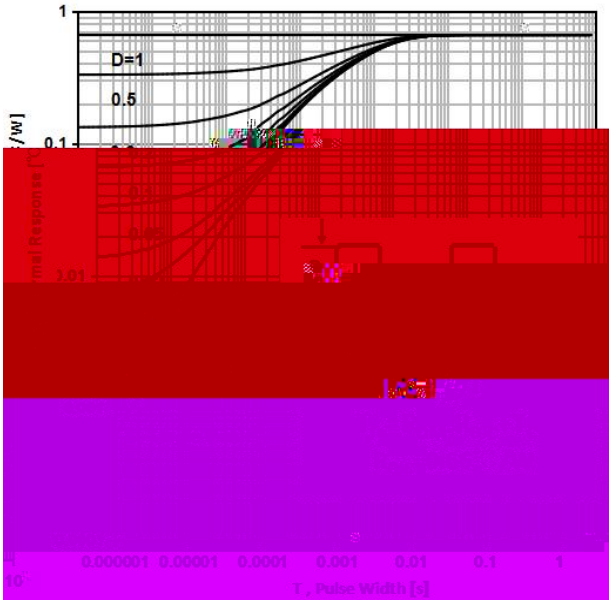

6
5
4
3
Eoff/mJ
Ets/mJ
ching Energy [mJ]

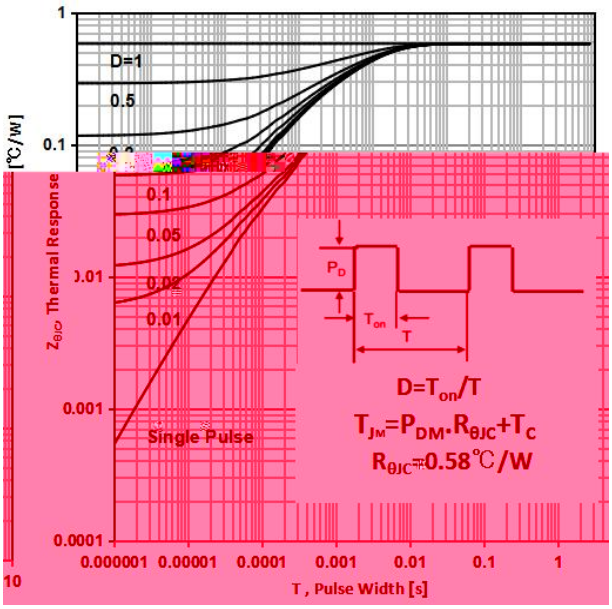

td(on)/ns
tr/ns
td(off)/ns
tf/ns
Switching times [ns]
200
160
120
80
40
0
400
440
480
520
560
Collector Emitter Voltage [V]

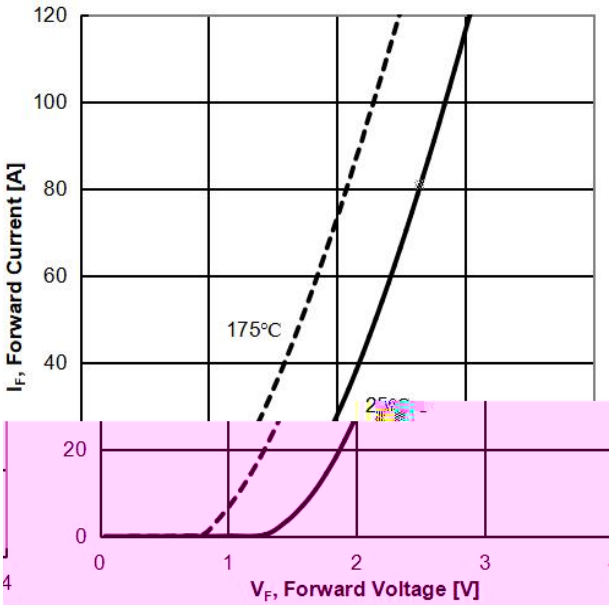

Eon/mJ
Eoff/mJ
Ets/mJ
Switching
3
2.5
2
1
0.5
0
400
480
520
560
VCE, Collector Emitter Voltage [V]

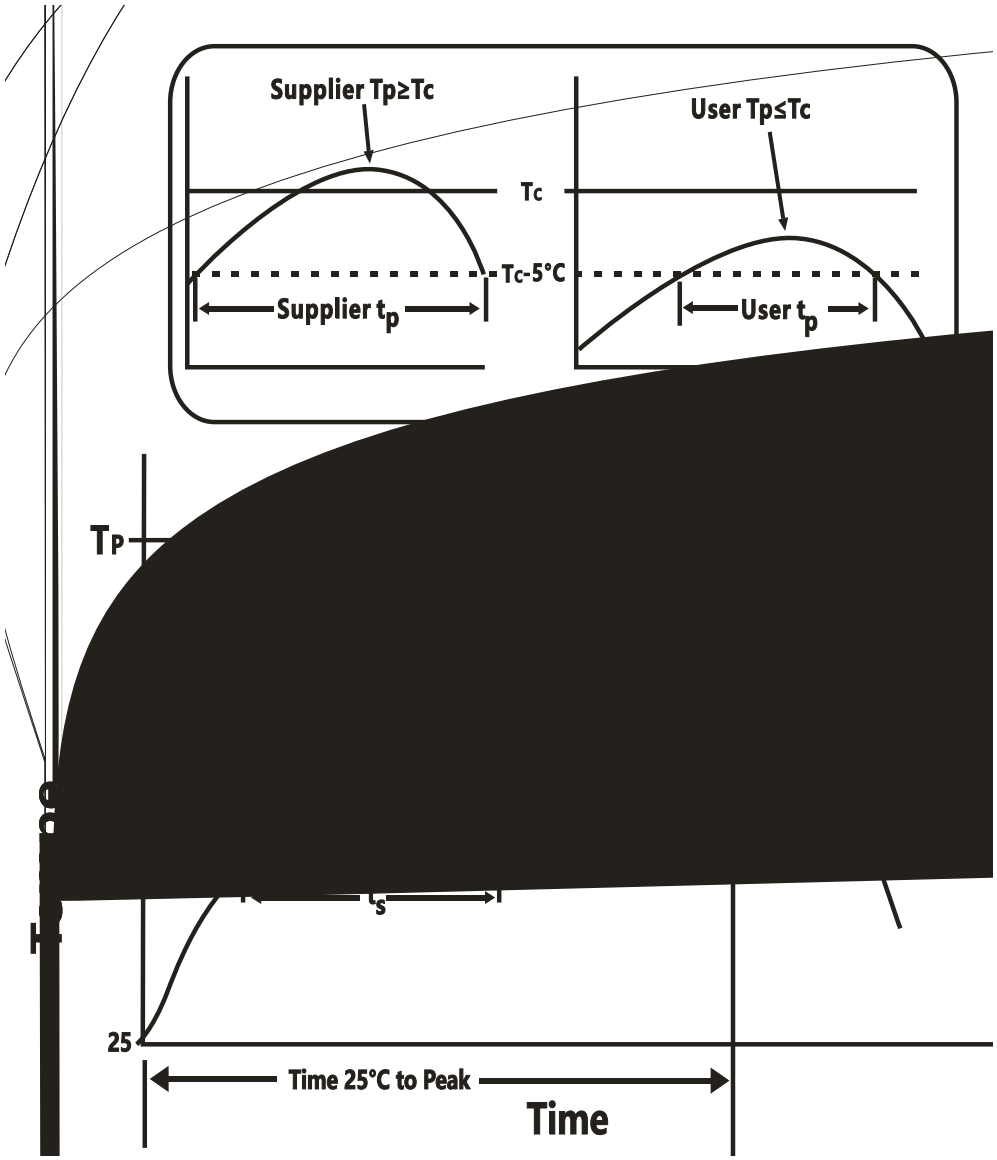

V_{CE} =520V
I_C = 40A
15
12
9
6
30
60
90
120
Q_G, Total Gate Charge [nC]


C_{ies}
C_{oes}
C_{res}
Capacitance
10000
1
100
300
400
V_{CE}, Collector-Emitter Voltage [V]


1
D=1
0.5
0.1
0.01
0.000001 0.00001 0.0001 0.001 0.01 0.1 1
T , Pulse Width [s]


1
D=1
0.5
0.1
0.1
0.05
0.02
0.01
0.01
0.001
0.0001
Single Pulse
$Z_{\theta JC}$ Thermal Response [℃/W]
P_D
T_{on}
T
$D=T_{on}/T$
$T_{JM}=P_{DM}.R_{\theta JC}+T_C$
$R_{\theta JC}$=0.58℃/W
0.000001 0.00001 0.0001 0.001 0.01 0.1 1
T , Pulse Width [s]


120
100
80
60
40
20
0
175°C
25°C
I_F, Forward Current [A]
0 1 2 3
V_F, Forward Voltage [V]



Temperature min (T_{smin}) Temperature max (T_{smax}) Time (Tsmin to Tsmax) (T_s)	100 °C 150 °C 60-120 seconds	150 °C 200 °C 60-120 seconds
Average ramp-up rate (T_{smax} to T_P)	3 °C/second max.	3°C/second max.
Liquidous temperature (T_L) Time at liquidous (t_L)	183 °C 60-150 seconds	217 °C 60-150 seconds

Peak package body temperature (T_p)*	See Classification Temp in table 1	See Classification Temp in table 2
Time (T_P)** within 5°C of the specified classification temperature (T_c)	20** seconds	30** seconds
Average ramp-down rate (T_p to T_{smax})	6 °C/second max.	6 °C/second max.
Time 25°C to peak temperature	6 minutes max.	8 minutes max.
*Tolerance for peak profile Temperature (T_p) is defined as a supplier minimum and a user maximum. ** Tolerance for time at peak profile temperature (t_p) is defined as a supplier minimum and a user maximum.		

Table 1.Sn-Pb Eutectic Process – Classification Temperatures (Tc)

2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 2.Pb-free Process – Classification Temperatures (Tc)

<1.6 mm	260 °C	260 °C	260 °C
1.6 mm – 2.5 mm	260 °C	250 °C	245 °C
2.5 mm	250 °C	245 °C	245 °C

HTRB	JESD-22, A108	168/500 Hrs, Bias @ 150°C
HTGB	JESD-22, A108	168 /500 Hrs, 100%V_{GE} @ 150°C
PCT	JESD-22, A102	96 Hrs, 100%RH, 2atm, 121°C
TCT	JESD-22, A104	250/500 Cycles, -55°C~150°C

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