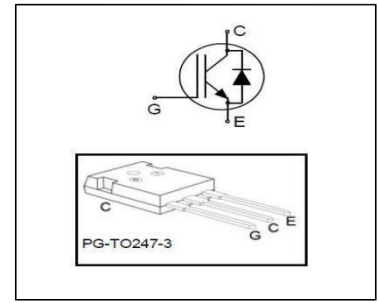




**TO247-3 Plastic-Encapsulate IGBT**

**CCG40Q120SDA** IGBT in advanced FS Technology with soft,fast recovery anti-parallel diode

$V_{(BR)CES}$	$V_{CEsat}$		$I_C$	
	$T_{vj}=25^{\circ}C$	1.90V @40A	$T_{vj}=25^{\circ}C$	80A
1200 V	$T_{vj}=150^{\circ}C$	2.50V @40A	$T_{vj}=100^{\circ}C$	40A



**Features:**

- 1200V planar field-stop technology
- Low conduction and switching losses
- Positive temperature coefficient
- Positive temperature coefficient of forward voltage
- Short Circuit withstand time-10  $\mu$  s

**Applications:**

- Frequency converter
- Inverter

**Key Performance and Package Parameters**

Type	VCE	$I_C$	$V_{CEsat}$ , $T_{vj}=25^{\circ}C$	$T_{vjmax}$	Marking	Package
CCG40Q120SDA	1200V	40A	1.90V	150° C	CCG40Q120SDA	PG-TO247-3

**TO247-3 Plastic-Encapsulate IGBT****Maximum Ratings**

For optimum lifetime and reliability, cloudchild recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.

Parameter	Symbol	Value	Unit
Collector-emitter voltage	VCE	1200	V
DC collector current, limited by $T_{vjmax}$ $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	$I_C$	80.0 40.0	A
Pulsed collector current, $t_p$ limited by $T_{vjmax}$	$I_{Cpuls}$	160.0	A
Diode forward current, limited by $T_{vjmax}$ $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	$I_F$	80.0 40.0	A
Diode pulsed current, $t_p$ limited by $T_{vjmax}$	$I_{Fpuls}$	160.0	A
Gate-emitter voltage	VGE	$\pm 20$	V
Short circuit withstand time $V_{GE} = 15.0\text{V}$ , $V_{CC} \leq 600\text{V}$ Allowed number of short circuits < 1000 Time between short circuits: $\geq 1.0\text{s}$ $T_{vj} = 150^\circ\text{C}$	$t_{SC}$	10	$\mu\text{s}$
Power dissipation $T_C = 25^\circ\text{C}$	$P_{tot}$	278	W
Operating junction temperature	$T_{vj}$	-40...+150	$^\circ\text{C}$
Storage temperature	$T_{stg}$	-55...+155	$^\circ\text{C}$
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s		260	$^\circ\text{C}$
Mounting torque, M3 screw Maximum of mounting processes: 3	$M$	0.6	Nm

**Thermal Resistance**

Parameter Characteristic	Symbol	Conditions	Max. Value	Unit
IGBT thermal resistance, junction - case	$R_{th(j-c)}$	/	0.35	K/W
Diode thermal resistance, junction - case	$R_{th(j-c)}$	/	0.58	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$	/	40	K/W



**TO247-3 Plastic-Encapsulate IGBT**

**Electrical Characteristic, at  $T_{vj} = 25^{\circ}\text{C}$ , unless otherwise specified**

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>Static Characteristic</b>						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0V, I_C = 250\mu A$	1200	-	-	V
Collector-emitter saturation voltage	$V_{CEsat}$	$V_{GE} = 15.0V, I_C = 40.0A$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	-	1.90 2.50	2.60	V
Diode forward voltage	$V_F$	$V_{GE} = 0V, I_F = 40.0A$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	-	2.1 2.4	2.65	V
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C = 250\mu A, V_{CE} = V_{GE}$	4.5	5.8	6.5	V
Zero gate voltage collector current	$I_{CES}$	$V_{CE} = 1200V, V_{GE} = 0V$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	-	-	100.0 1000.0	$\mu A$
Gate-emitter leakage current	$I_{GES}$	$V_{CE} = 0V, V_{GE} = \pm 20V$	-	-	$\pm 200$	nA
Transconductance	$g_{fs}$	$V_{CE} = 20V, I_C = 15.0A$	-	20.0	-	S

**Electrical Characteristic, at  $T_{vj} = 25^{\circ}\text{C}$ , unless otherwise specified**

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>Dynamic Characteristic</b>						
Input capacitance	$C_{ies}$	$V_{CE} = 25V, V_{GE} = 0V, f = 1\text{MHz}$	-	2830	-	pF
Output capacitance	$C_{oes}$		-	205	-	
Reverse transfer capacitance	$C_{res}$		-	110	-	
Gate charge	$Q_G$	$V_{CC} = 960V, I_C = 40.0A, V_{GE} = 15V$	-	185.0	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	$L_E$		-	13.0	-	nH
Short circuit collector current Max. 1000 short circuits Time between short circuits: $\geq 1.0s$	$I_{C(SC)}$	$V_{GE} = 15.0V, V_{CC} = 800V,$ $t_{SC} \leq 10\mu s$ $T_{vj} = 150^{\circ}\text{C}$	-	200	-	A
Reverse bias safe operating area	RBSOA	$V_{CC} = 800V, V_{GE} = 20V, T_j \leq 150^{\circ}\text{C}$	80			A



**TO247-3 Plastic-Encapsulate IGBT**

**Switching Characteristic, Inductive Load**

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>IGBT Characteristic, at <math>T_a = 25^\circ\text{C}</math></b>						
Turn-on delay time	$t_{d(on)}$	$T_a = 25^\circ\text{C}$ , $V_{CC} = 600\text{V}$ , $I_C = 40.0\text{A}$ , $V_{GE} = -7.5/15.0\text{V}$ , $R_{G(on)} = 10.0\Omega$ , $R_{G(off)} = 10.0\Omega$ , $L_\sigma = 70\text{nH}$ , $C_\sigma = 67\text{pF}$ $L_\sigma$ , $C_\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	50	-	ns
Rise time	$t_r$		-	58	-	ns
Turn-off delay time	$t_{d(off)}$		-	130	-	ns
Fall time	$t_f$		-	35	-	ns
Turn-on energy	$E_{on}$		-	2.9	-	mJ
Turn-off energy	$E_{off}$		-	1.65	-	mJ
Total switching energy	$E_{ts}$		-	4.55	-	mJ

**Diode Characteristic, at  $T_{vj} = 25^\circ\text{C}$**

Diode reverse recovery time	$t_{rr}$	$T_{vj} = 25^\circ\text{C}$ , $V_R = 600\text{V}$ , $I_F = 40.0\text{A}$ , $di_F/dt = 200\text{A}/\mu\text{s}$	-	86	-	ns
Diode reverse recovery charge	$Q_{rr}$		-	330	-	nC
Diode peak reverse recovery current	$I_{rrm}$		-	7.5	-	A
Diode peak rate of fall of reverse recovery current during $t_b$	$di_{rr}/dt$		-	150	-	A/ $\mu\text{s}$

**Switching Characteristic, Inductive Load  $T_{vj} = 150^\circ\text{C}$**

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>IGBT Characteristic, at <math>T_{vj} = 150^\circ\text{C}</math></b>						
Turn-on delay time	$t_{d(on)}$	$T_{vj} = 150^\circ\text{C}$ , $V_{CC} = 600\text{V}$ , $I_C = 40.0\text{A}$ , $V_{GE} = -7.5/15.0\text{V}$ , $R_{G(on)} = 10.0\Omega$ , $R_{G(off)} = 10.0\Omega$ , $L_\sigma = 70\text{nH}$ , $C_\sigma = 67\text{pF}$ $L_\sigma$ , $C_\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	48	-	ns
Rise time	$t_r$		-	94	-	ns
Turn-off delay time	$t_{d(off)}$		-	177	-	ns
Fall time	$t_f$		-	155	-	ns
Turn-on energy	$E_{on}$		-	5.7	-	mJ
Turn-off energy	$E_{off}$		-	2.60	-	mJ
Total switching energy	$E_{ts}$		-	8.3	-	mJ

**Diode Characteristic, at  $T_{vj} = 150^\circ\text{C}$**

Diode reverse recovery time	$t_{rr}$	$T_{vj} = 150^\circ\text{C}$ , $V_R = 600\text{V}$ , $I_F = 40.0\text{A}$ , $di_F/dt = 200\text{A}/\mu\text{s}$	-	335	-	ns
Diode reverse recovery charge	$Q_{rr}$		-	460	-	nC
Diode peak reverse recovery current	$I_{rrm}$		-	15	-	A
Diode peak rate of fall of reverse recovery current during $t_b$	$di_{rr}/dt$		-	106	-	A/ $\mu\text{s}$



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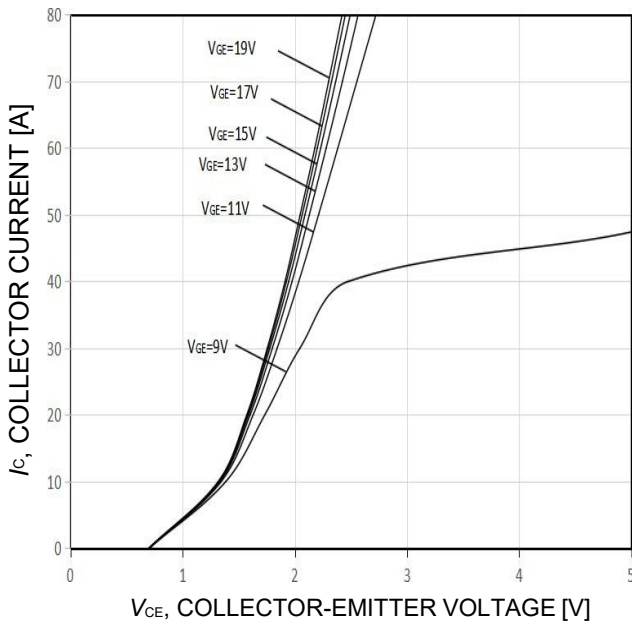


Figure 1. Typical output characteristic ( $T_j=25^{\circ}\text{C}$ )

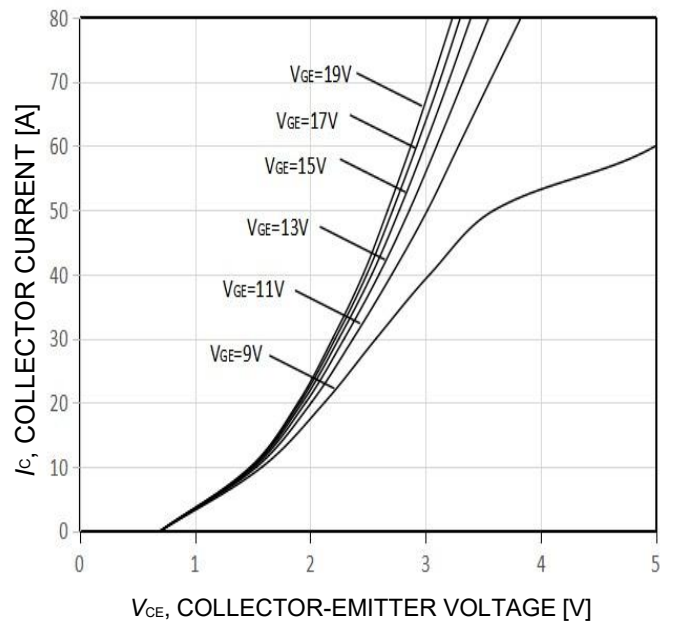


Figure 2. Typical output characteristic ( $T_j=150^{\circ}\text{C}$ )

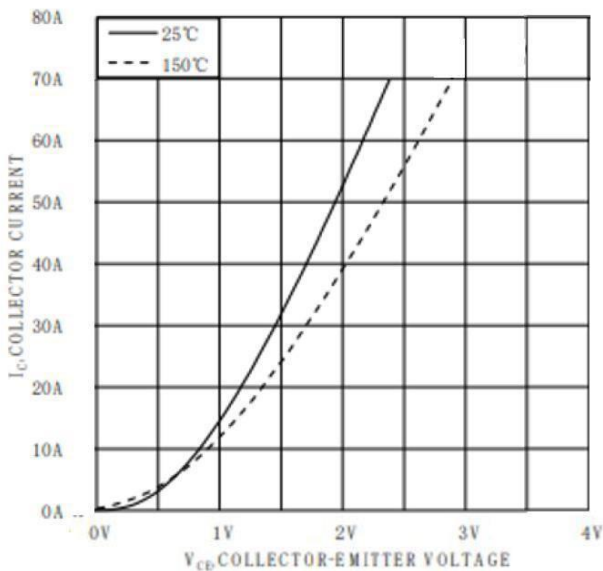


Figure 3. Typical on-state Characteristic ( $V_{GE}=15\text{V}$ )

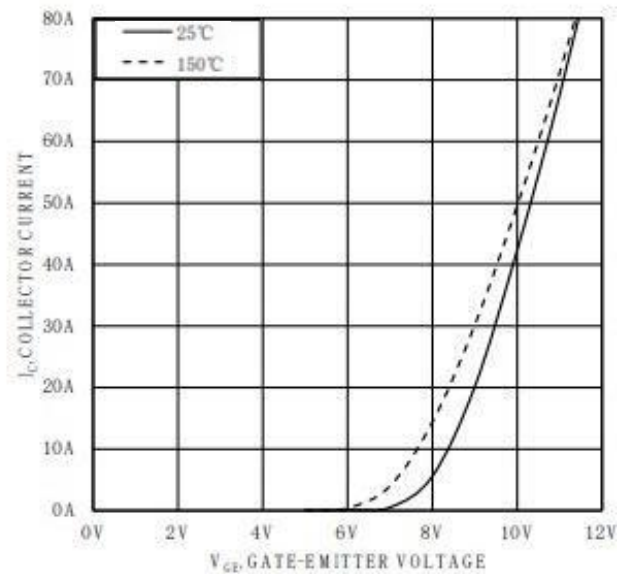


Figure 4. Typical transfer voltage ( $V_{CE}=20\text{V}$ )



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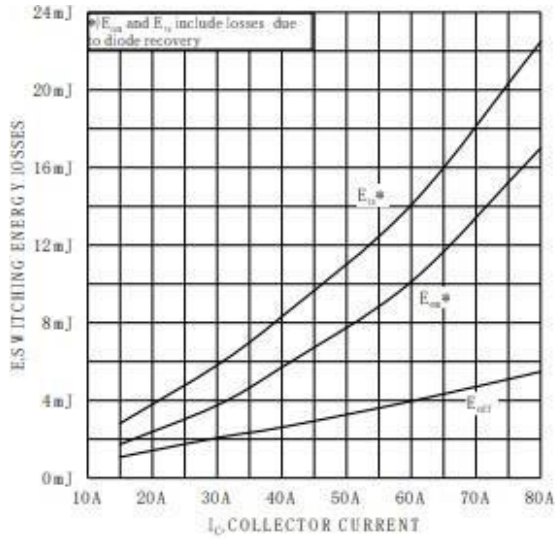


Figure 5. Typical switching energy losses as a function of collector current(inductive load,  $T_J=150^{\circ}\text{C}$ ,  $V_{CC}=600\text{V}$ ,  $V_{GE}=-7.5/15\text{V}$ ,  $R_G=10\Omega$ )

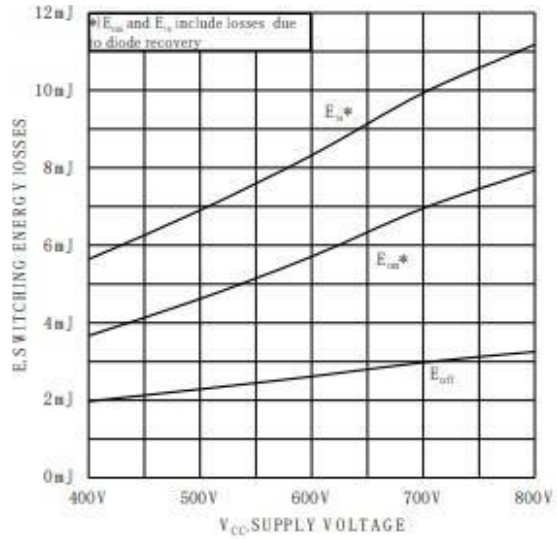


Figure 6. Typical switching energy losses as a function of collector emitter voltage(inductive load,  $T_J=150^{\circ}\text{C}$ ,  $V_{GE}=-7.5/15\text{V}$ ,  $I_C=40\text{A}$ ,  $R_G=10\Omega$ )

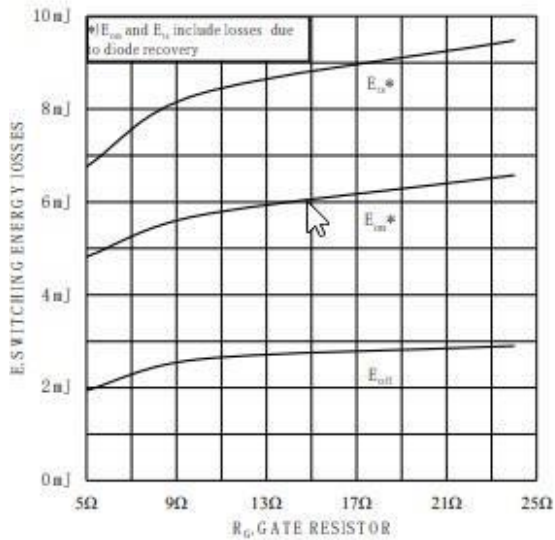


Figure 7. Typical switching energy losses as a function of gate resistor(inductive load,  $T_J=150^{\circ}\text{C}$ ,  $V_{CC}=600\text{V}$ ,  $V_{GE}=-7.5/15\text{V}$ ,  $I_C=40\text{A}$ )

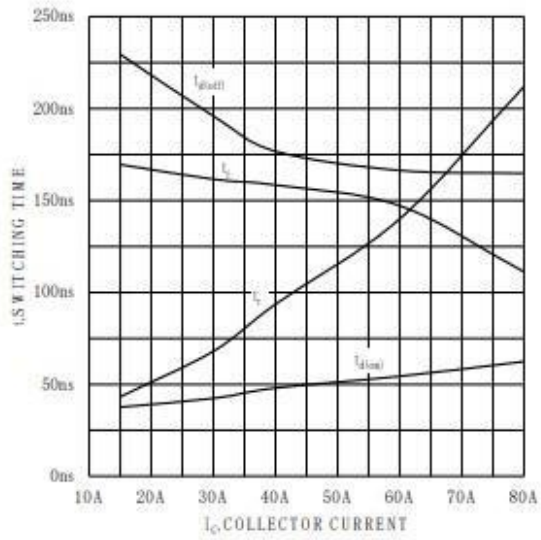


Figure 8. Typical switching times as a function of collector current(inductive load,  $T_J=150^{\circ}\text{C}$ ,  $V_{CC}=600\text{V}$ ,  $V_{GE}=-7.5/15\text{V}$ ,  $R_G=10\Omega$ )



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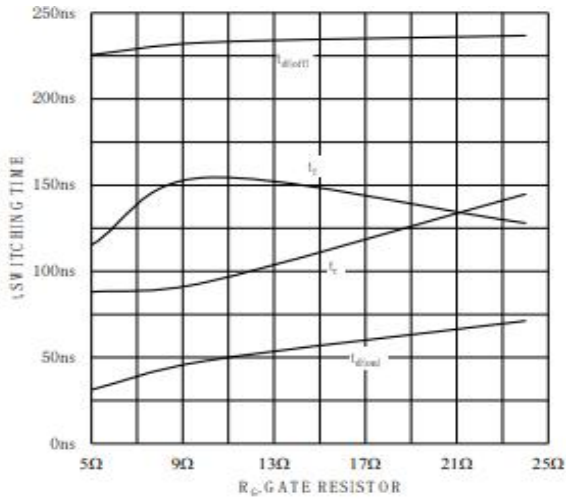


Figure 9. Typical switching times as a function of gate resistor (inductive load,  $T_J=150^\circ\text{C}$ ,  $V_{CC}=600\text{V}$ ,  $V_{GE}=-7.5/15\text{V}$ ,  $I_C=40\text{A}$ )

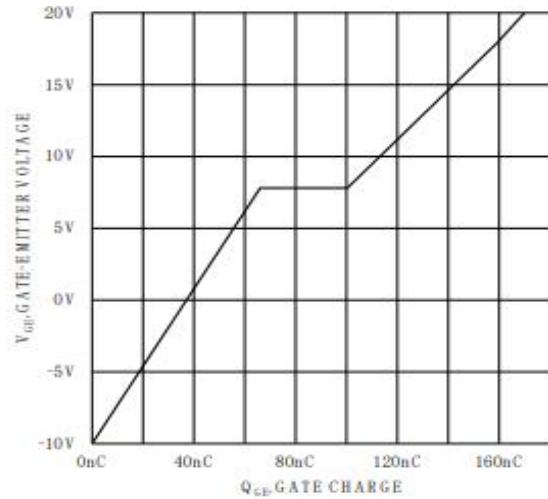


Figure 10. Typical gate charge ( $V_{CC}=600\text{V}$ ,  $I_C=40\text{A}$ )

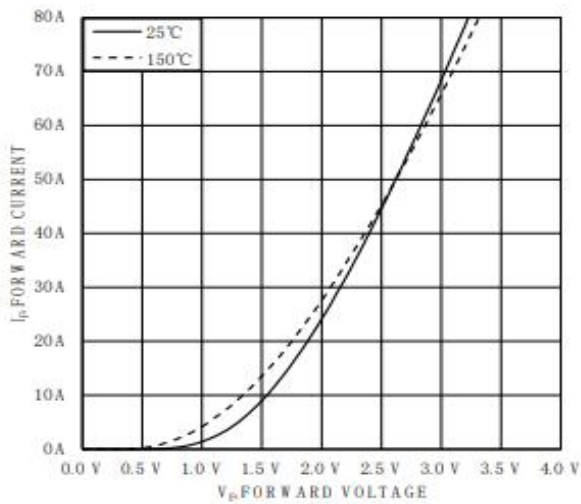


Figure 11. Typical diode forward current as a function of forward voltage

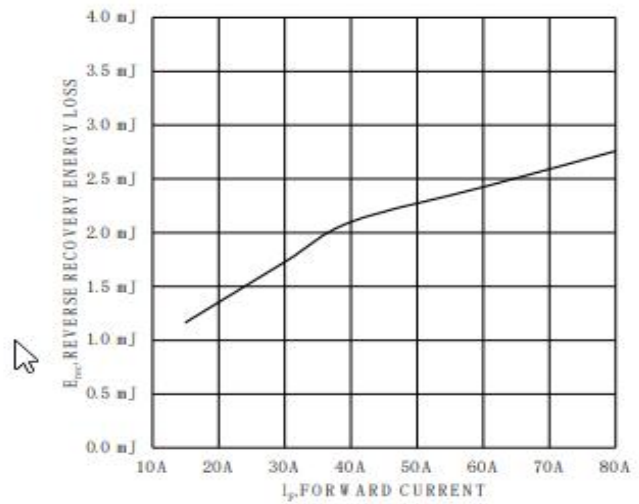


Figure 12. Typical diode reverse recovery loss as a function of forward current ( $T_J=150^\circ\text{C}$ ,  $V_R=600\text{V}$ ,  $R_G=10\Omega$ )



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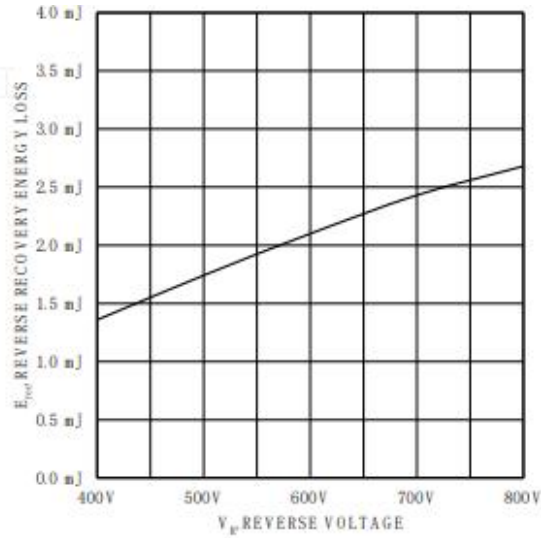


Figure 13. Typical diode reverse recovery loss as a function of reverse voltage  
(T<sub>J</sub>=150°C, I<sub>F</sub>=40A, R<sub>G</sub>=10Ω)

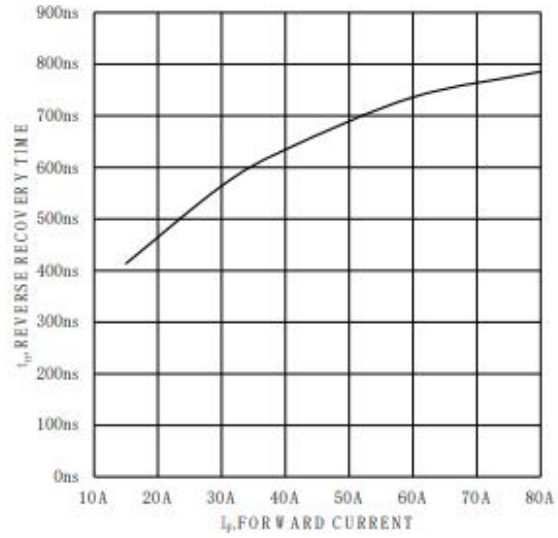


Figure 14. Typical reverse recovery time as a function of forward current  
(T<sub>J</sub>=150°C, V<sub>R</sub>=600V, R<sub>G</sub>=10Ω)

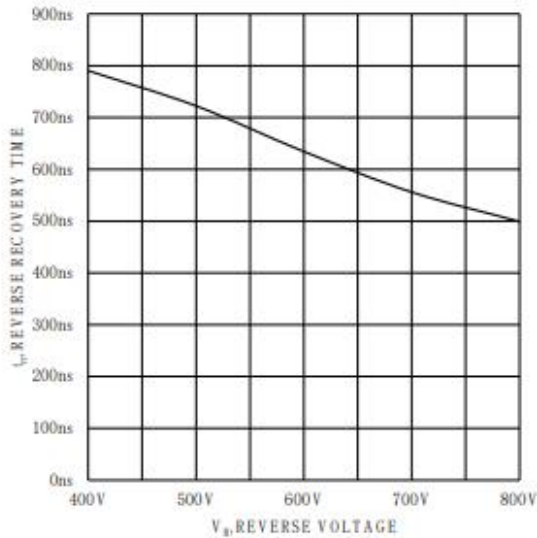


Figure 15. Typical reverse recovery time as a function of reverse voltage  
(T<sub>J</sub>=150°C, I<sub>F</sub>=40A, R<sub>G</sub>=10Ω)

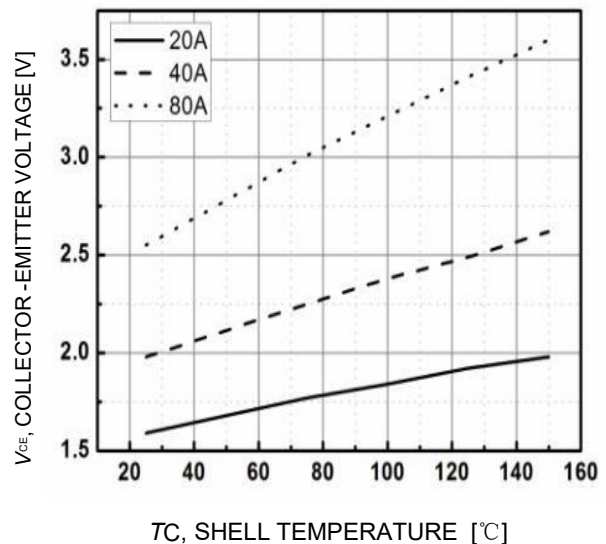


Figure 16. Typical Saturation pressure drop temperature characteristic (V<sub>GE</sub>=15V)





**TO247-3 Plastic-Encapsulate IGBT**

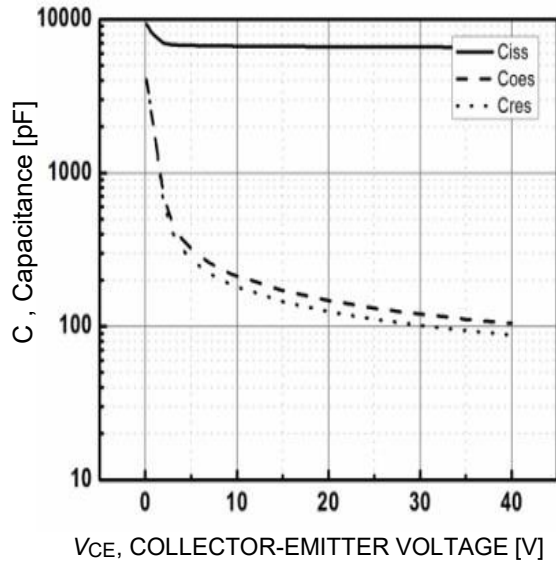


Figure17. Typical Capacitance characteristic

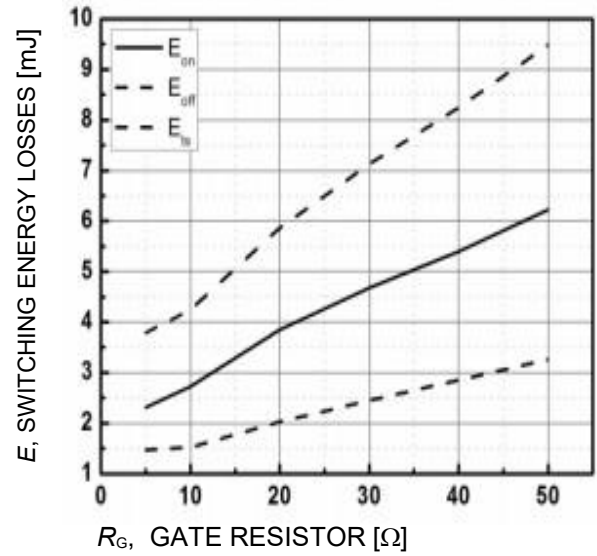


Figure18. Typical switching energy loss-gate resistance characteristic  
( $V_{CE}=600V, I_c=40A, R_g=10\Omega, V_{GE}=15V$ , 感性负载,  $T_a=25^\circ C$ )

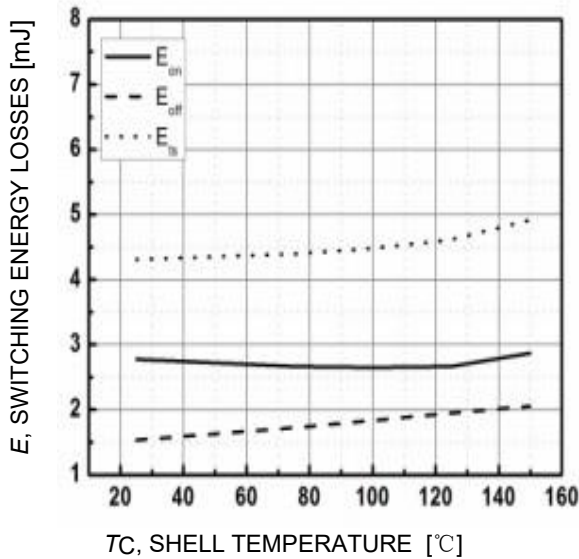


Figure 19. Typical switching energy loss temperature Characteristic  
( $V_{CE}=600V, I_c=40A, R_g=10\Omega, V_{GE}=15V$ , 感性负载)

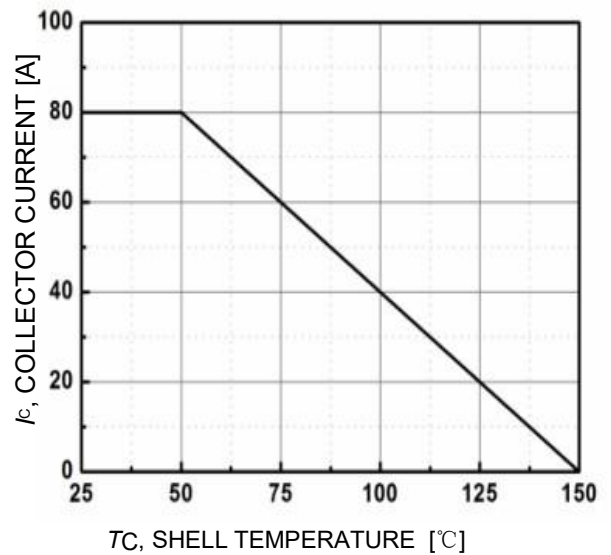


Figure 20. Typical collector current temperature characteristic



**TO247-3 Plastic-Encapsulate IGBT**

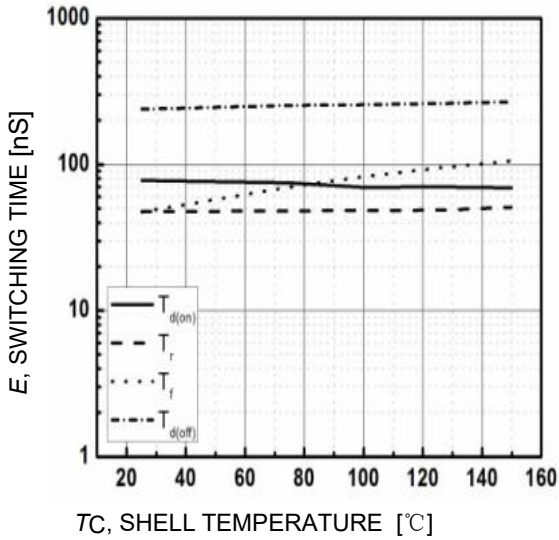


Figure 21. Typical switching time-temperature Characteristic (VCE=600V, Ic=40A, Rg=10Ω, VGE=15V, 感性负载)

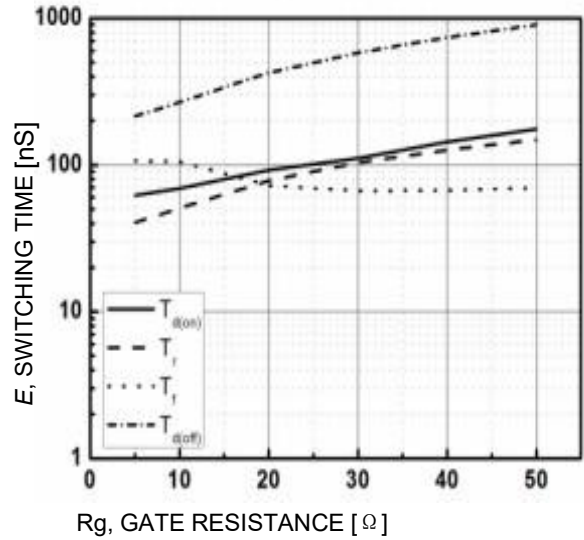


Figure 22. Typical switching time-gate resistance Characteristic (VCE=600V, Ic=40A, Rg=10Ω, VGE=15V, 感性负载, Ta=25°C)

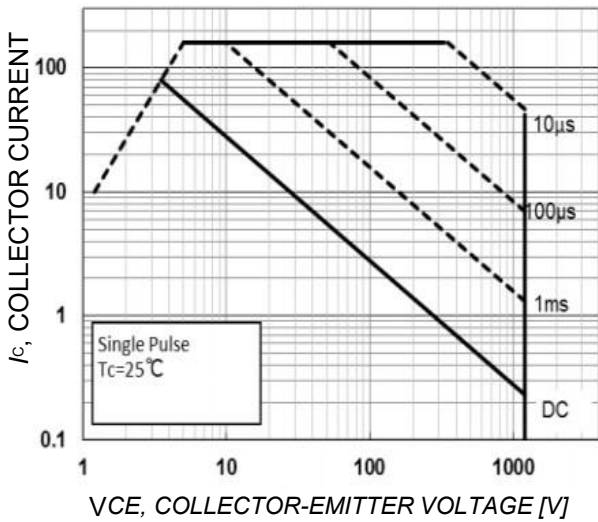


Figure 23. Typical positive safe working area characteristics

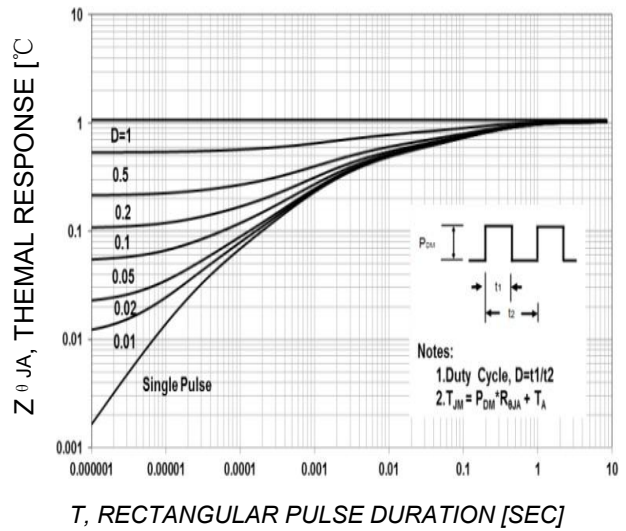
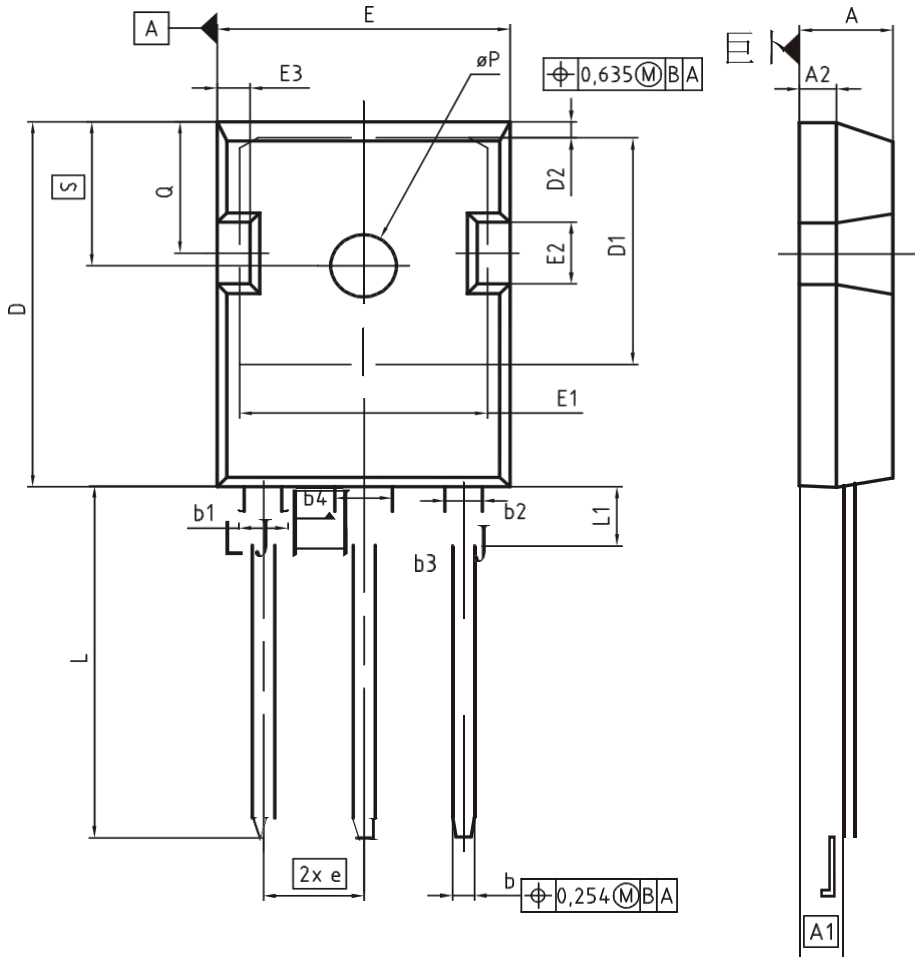


Figure 24. Typical transient thermal resistance characteristics



**TO247-3 Plastic-EncapsulateIGBT**

PG-TO247-3



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.27	2.54	0.089	0.100
A2	1.85	2.16	0.073	0.085
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20.80	21.10	0.819	0.831
D1	16.25	17.65	0.640	0.695
D2	0.95	1.35	0.037	0.053
E	15.70	16.13	0.618	0.635
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.00	2.60	0.039	0.102
e	5.44 (BSC)		0.214 (BSC)	
N	3		3	
L	19.80	20.32	0.780	0.800
L1	4.10	4.47	0.161	0.176
.-p	3.50	3.70	0.138	0.146
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248

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EUROPEAN PROJECTION

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CHONGQING CLOUDCHILD TECHNOLOGY CO., LTD

**TO247-3 Plastic-Encapsulate IGBT**

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