



TT060U060EQ

主要参数 MAIN CHARACTERISTICS

Ic	60 A
VCES	600V
Vcesat-typ (Vge=15V)	1.9V

用途

- 焊接
- PFC
- 空调

APPLICATIONS

- Welding converters
- Power Factor Correction
- Air Condition

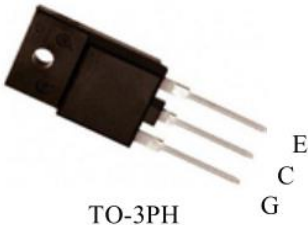
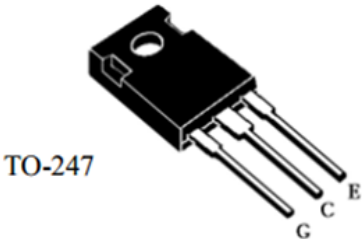
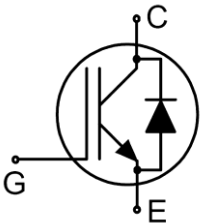
产品特性

- 低栅极电荷
- Trench FS 技术,
- RoHS 产品

FEATURES

- Low gate charge
- Trench FS Technology,
- RoHS product

封装 Package



订货信息 ORDER MESSAGE

订 货 型 号 Order codes				印 记 Marking	封 装 Package
有卤-条管 Halogen-Tube	无卤-条管 Halogen-Free-Tube	有卤-编带 Halogen-Reel	无卤-编带 Halogen-Free-Reel		
TT060U060EQ-GA-B	TT060U060EQ-GA-BR	N/A	N/A	TT060U060EQ	TO-3PH
TT060U060EQ-GE-B	TT060U060EQ-GE-BR	N/A	N/A	TT060U060EQ	TO-247

绝对最大额定值 ABSOLUTE RATINGS ($T_c=25^{\circ}\text{C}$)

项 目 Parameter	符 号 Symbol	数 值 Value		单 位 Unit
		TO-247	TO-3PH	
最高集电极-发射极直流电压 Collector-Emmitter Voltage	V_{ces}	600	600	V
*连续集电极电流 Collector Current-continuous	I_C $T=25^{\circ}\text{C}$	120	120	A
	I_C $T=100^{\circ}\text{C}$	60	60	A
最大脉冲集电极极电流 (注 1) Collector Current – pulse (note 1)	I_{CM}	200	200	A
二极管正向测试电流 Diode RMS forward current	I_F $T=25^{\circ}\text{C}$	80	80	A
	I_F $T=100^{\circ}\text{C}$	40	40	A
二极管正向脉冲电流 Diode pulse current	I_{FSM}	160	160	A
最高栅极发射极电压 Gate-Emmitter Voltage	V_{GES}	± 20	± 20	V
最高瞬态栅极发射极电压 Transient Gate-Emmitter Voltage($t_p \leq 10\mu\text{s}$)	V_{GES}	± 30	± 30	V
安全工作区 Turn-off safe area	-	200	200	A
耗散功率 Power Dissipation	P_D $T_c=25^{\circ}\text{C}$	454	136	W
最高结温及存储温度 Operating and Storage Temperature Range	T_J, T_{STG}	$-55 \sim +175$		$^{\circ}\text{C}$
引线最高焊接温度 Maximum Lead Temperature for Soldering Purposes	T_L	300		$^{\circ}\text{C}$

*连续集电极电流由最高结温限制

*Collector current limited by maximum junction temperature

注释:

1: 脉冲宽度由最高结温限制

Notes:

1: Pulse width limited by maximum junction temperature





电特性 ELECTRICAL CHARACTERISTICS

项 目 Parameter	符 号 Symbol	测试条件 Tests conditions	最小 Min	典型 Typ	最大 Max	单位 Units
关态特性 Off –Characteristics						
集电极—发射极击穿电压 Collector-Emmitter Voltage	BV _{CES}	I _C =250μA, V _{GE} =0V	600	-	-	V
零栅压下集电极漏电流 Zero Gate Voltage Collector Current	I _{CES}	V _{CE} =600V, V _{GE} =0V	-	-	25	uA
正向栅极体漏电流 Gate-body leakage current, forward	I _{GESF}	V _{CE} =0V, V _{GE} =20V	-	-	200	nA
反向栅极体漏电流 Gate-body leakage current, reverse	I _{GESR}	V _{CE} =0V, V _{GE} =-20V	-	-	-200	nA
通态特性 On-Characteristics						
阈值电压 Gate Threshold Voltage	V _{GE(th)}	V _{CE} = V _{GE} , I _C =250μA	4.0	-	6.0	V
饱和压降 Collector-Emmitter saturation Voltage	V _{CESAT}	V _{GE} =15V , I _C =60A, T _C =25℃	-	1.9	2.5	V
		V _{GE} =15V , I _C =60A,T _C =175℃	-	2.2	-	V
动态特性 Dynamic Characteristics						
输入电容 Input capacitance	C _{ies}	V _{CE} =25V, V _{GE} =0V, f=1.0MHz	-	3510	-	pF
输出电容 Output capacitance	C _{oes}		-	244	-	pF
反向传输电容 Reverse transfer capacitance	C _{res}		-	81	-	pF
栅极电荷总量 Total Gate Charge	Qg	V _{CC} =480V, I _C =60A, V _{GE} =15 V T _C =25℃	-	132	-	nC
栅极-反射极 Gate to emitter charge	Qge		-	33	-	
栅极-集电极 Gate to collector charge	Qgc		-	55	-	

项 目 Parameter	符 号 Symbol	MAX		单 位 Unit
		TO-247	TO-3PH	
结到管壳的热阻 Thermal Resistance, Junction to Case IGBT	$R_{th(j-c)}$	0.33	1.1	$^\circ C/W$
结到环境的热阻 Thermal Resistance, Junction to Ambient	$R_{th(j-A)}$	40	40	$^\circ C/W$



**电特性 ELECTRICAL CHARACTERISTICS****开关特性 Switching Characteristics**

项 目 Parameter	符 号 Symbol	测试条件 Tests conditions	最小 Min	典型 Typ	最大 Max	单位 Units
开启延迟时间 Turn-On delay time	$t_{d(on)}$	$V_{CC}=400V, I_c=60A, R_G=10\Omega$ $V_{GE}=15V, T_C=25^\circ C$	-	36	-	ns
上升时间 Turn-On rise time	t_r		-	96	-	ns
关断延迟时间 Turn-Off delay time	$t_{d(off)}$		-	101	-	ns
下降时间 Turn-Off Fall time	t_f		-	55	-	ns
开通损耗 Turn-On energy	E_{on}		-	1.65	-	mJ
关断损耗 Turn-off energy	E_{off}		-	1.14	-	mJ
总开关损耗 Total switching energy	E_{tot}		-	2.79	-	mJ
开启延迟时间 Turn-On delay time	$t_{d(on)}$	$V_{CC}=400V, I_c=60A, R_G=10\Omega$ $V_{GE}=15V, T_C=175^\circ C$	-	33	-	ns
上升时间 Turn-On rise time	t_r		-	108	-	ns
关断延迟时间 Turn-Off delay time	$t_{d(off)}$		-	130	-	ns
下降时间 Turn-Off Fall time	t_f		-	105	-	ns
开通损耗 Turn-On energy	E_{on}		-	1.9	-	mJ
关断损耗 Turn-off energy	E_{off}		-	1.55	-	mJ
总开关损耗 Total switching energy	E_{tot}		-	3.45	-	mJ

反并联二极管特性及最大额定值 Anti-Parallel Diode Characteristics and Maximum Ratings

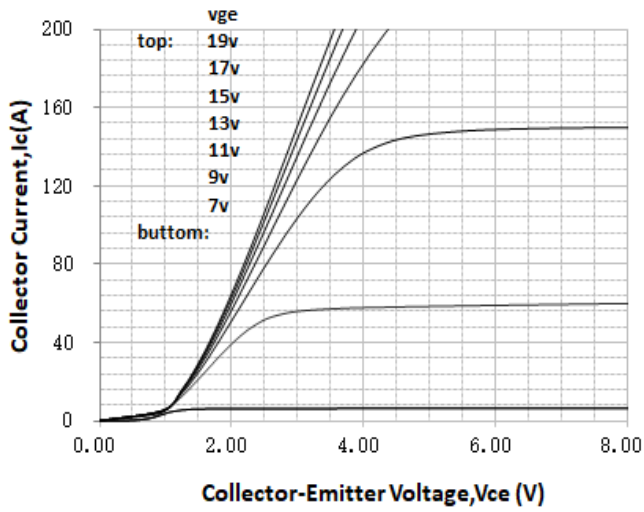
正向压降 Drain-Source Diode Forward Voltage	V_F	$V_{GE}=0V, I_F=30A, T_C=25^\circ C$	-	1.7	2.1	V
		$V_{GE}=0V, I_F=30A, T_C=175^\circ C$	-	1.5	-	V
反向恢复时间 Diode Reverse recovery time	t_{rr}	$V_{GE}=0V, V_R=400V, I_F=30A$ $di_F/dt=200A/\mu s$ $T_C=25^\circ C$	-	40	-	ns
反向恢复电荷 Diode Reverse recovery charge	Q_{rr}		-	26.4	-	nC
反向恢复电流 Diode Reverse recovery Current	I_{RRM}		-	1.16	-	A
反向恢复时间 Diode Reverse recovery time	t_{rr}	$V_{GE}=0V, V_R=400V, I_F=30A$ $di_F/dt=200A/\mu s$ $T_C=175^\circ C$	-	184	-	ns
反向恢复电荷 Diode Reverse recovery charge	Q_{rr}		-	386	-	nC
反向恢复电流 Diode Reverse recovery Current	I_{RRM}		-	3.8	-	A



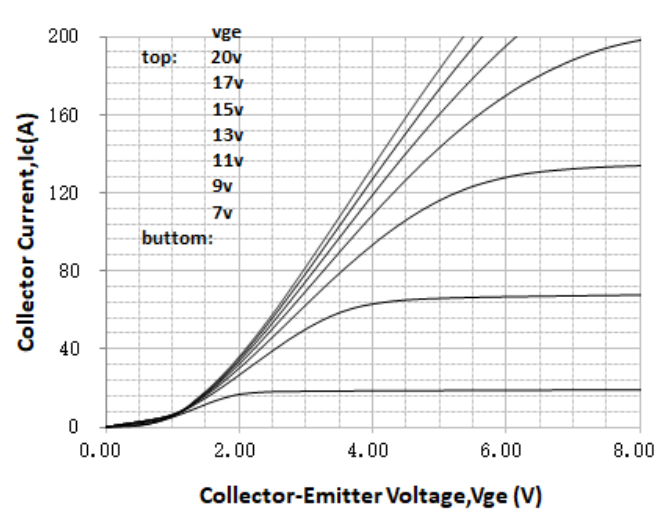


特征曲线 ELECTRICAL CHARACTERISTICS (curves)

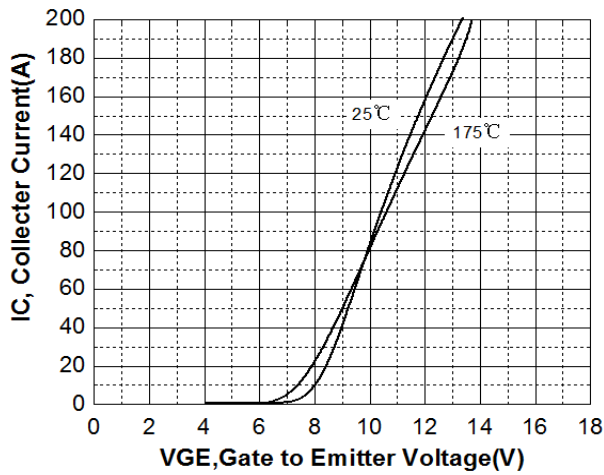
Output Characteristics (25°C)



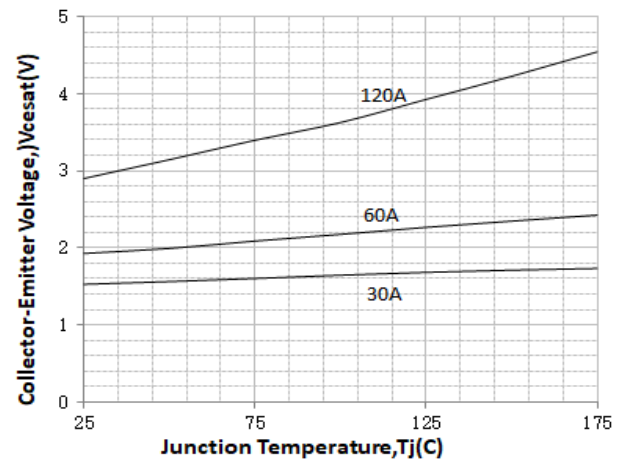
Output Characteristics (175°C)



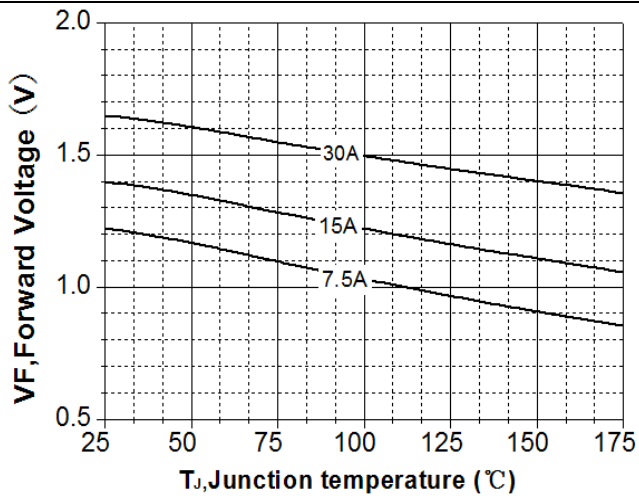
Transfer Characteristics



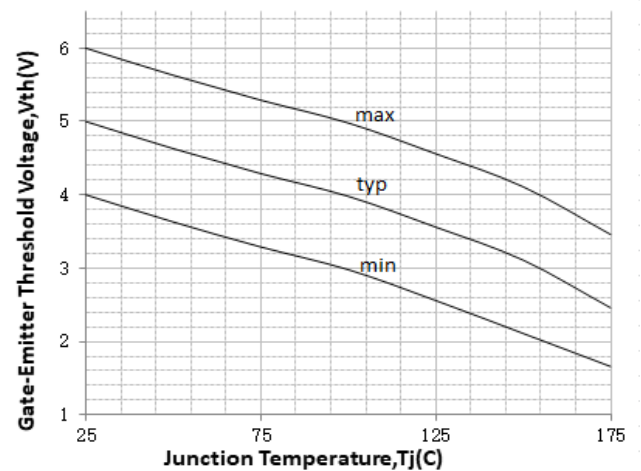
Vcesat vs. Tj

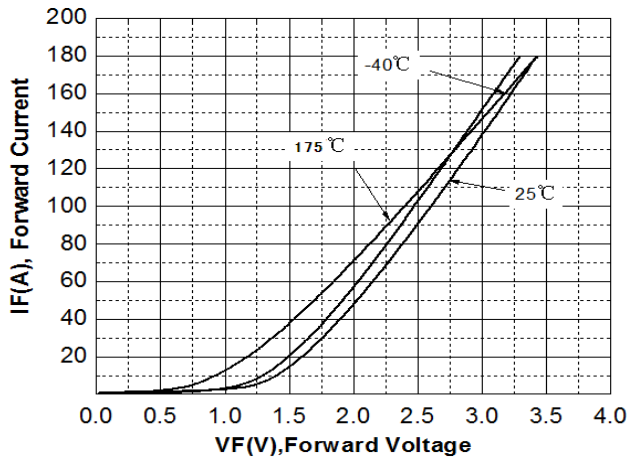
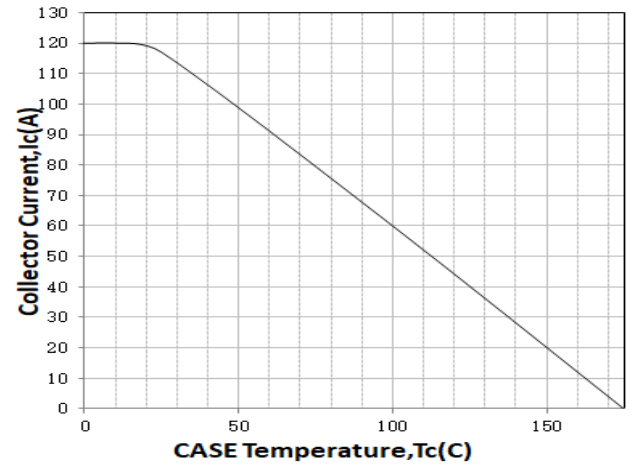
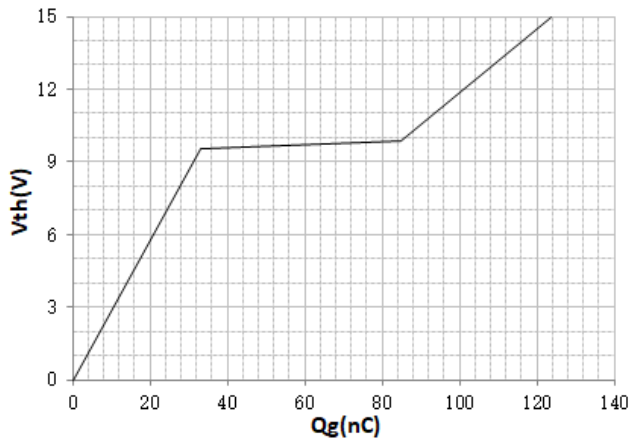
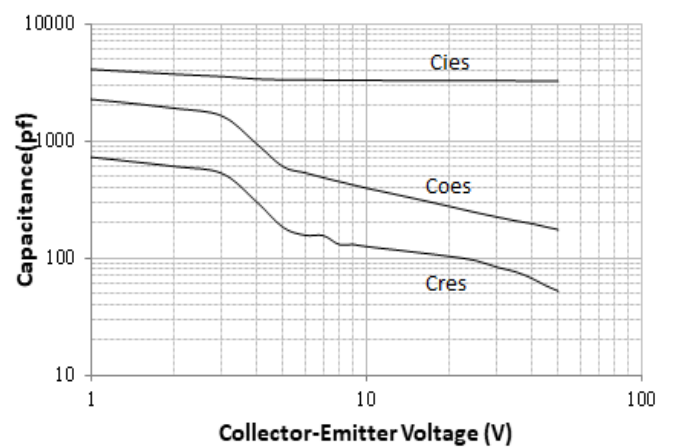
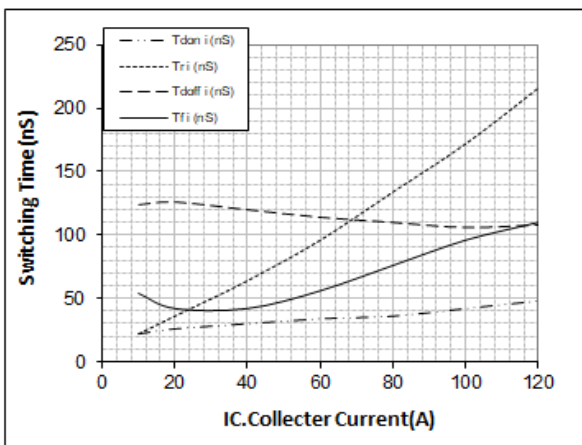
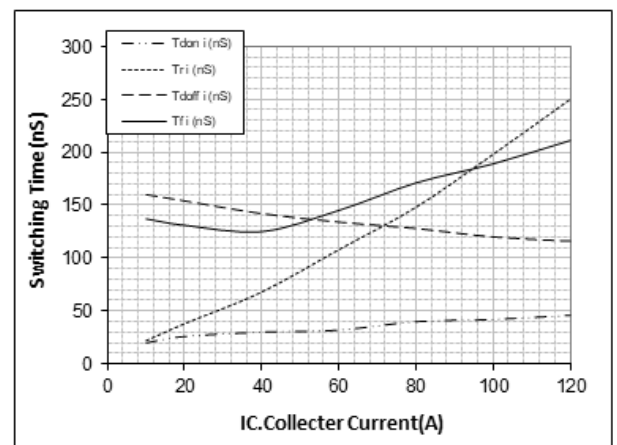


VF vs. Tj



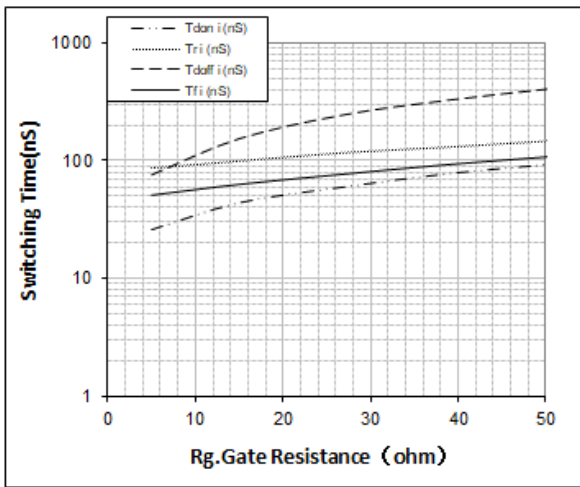
VTH vs. Tj



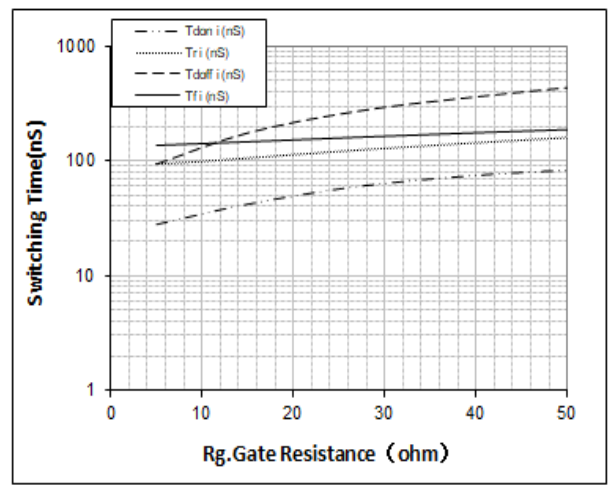
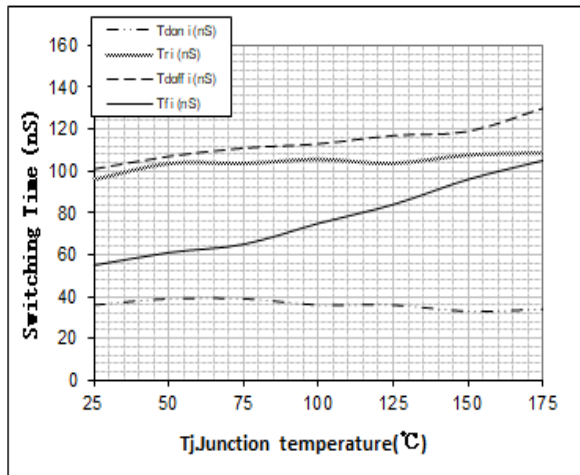
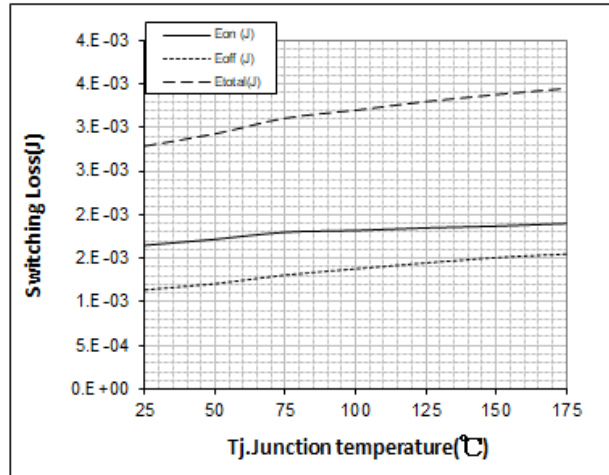
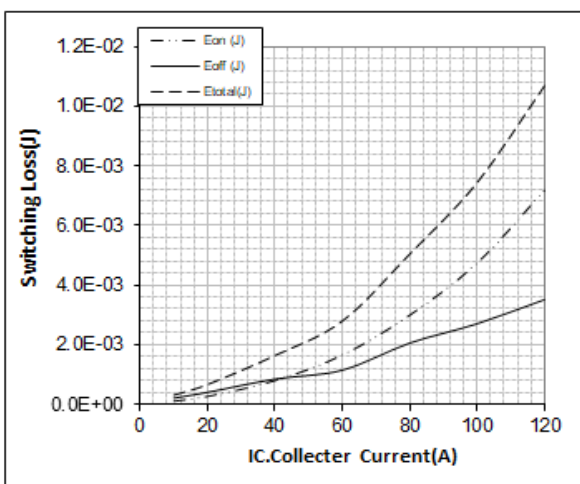
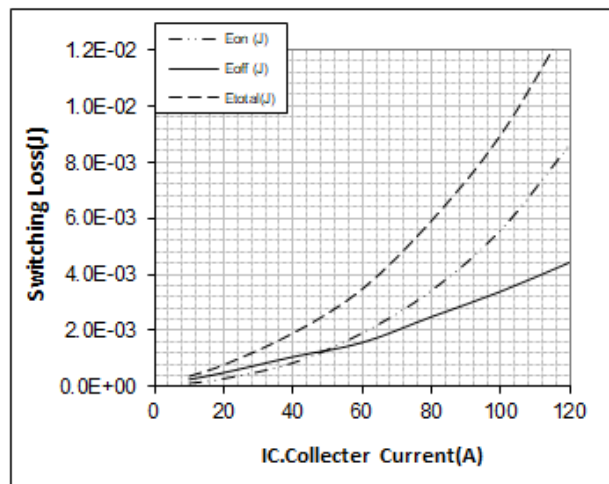
**Diode Characteristic****Collector current vs.case temperature****Gate Charge Characteristics** $V_{GE}=15\text{V}$, $V_{CC}=480\text{V}$, $I_C=60\text{A}$ **Capacitance Characteristic** $V_{GE}=0\text{V}$, $f=1.0\text{MHz}$ **Switching Time vs. IC(25°C)** $V_{CE}=400\text{V}$, $V_{GE}=15\text{V}$, $R_G=10\Omega$ **Switching Time vs. IC(175°C)** $V_{CE}=400\text{V}$, $V_{GE}=15\text{V}$, $R_G=10\Omega$ 

**Switching Time vs. $R_g(25^{\circ}\text{C})$**

VGE=15V, VCE=400V, IC=60A

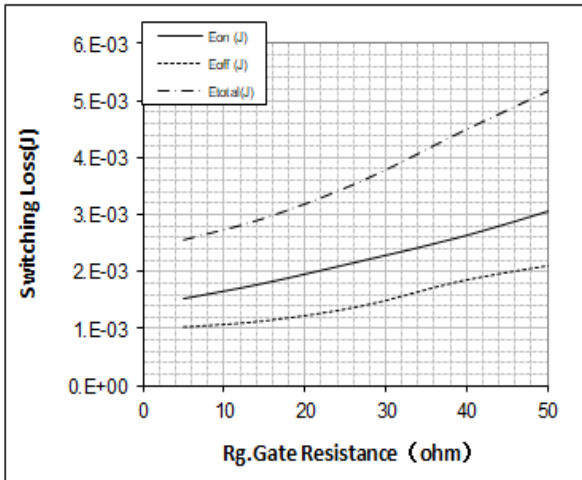
**Switching Time vs. $R_g(175^{\circ}\text{C})$**

VGE=15V, VCE=400V, IC=60A

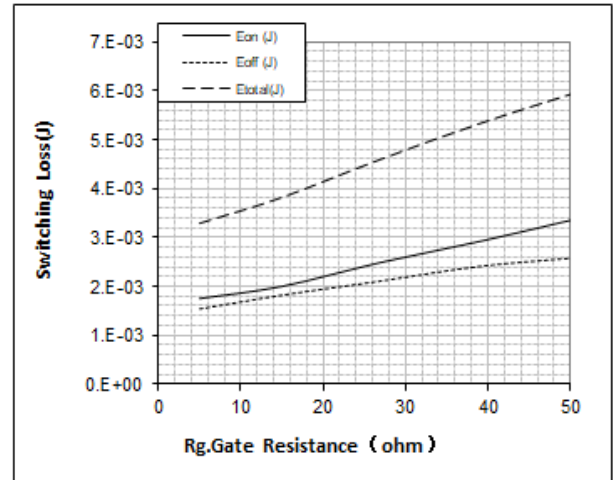
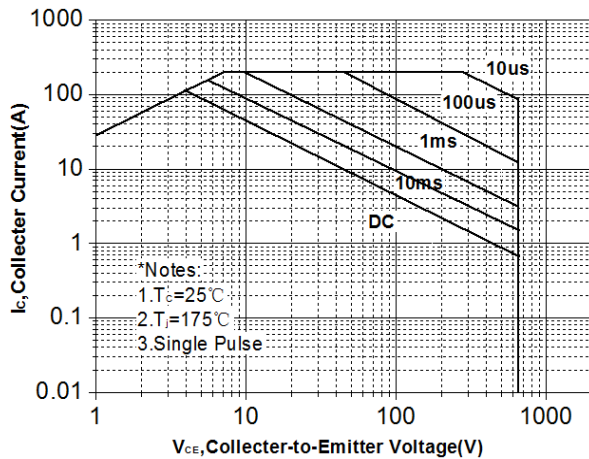
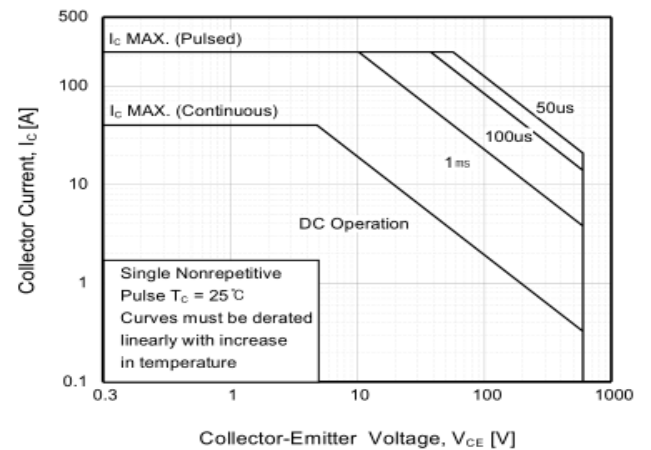
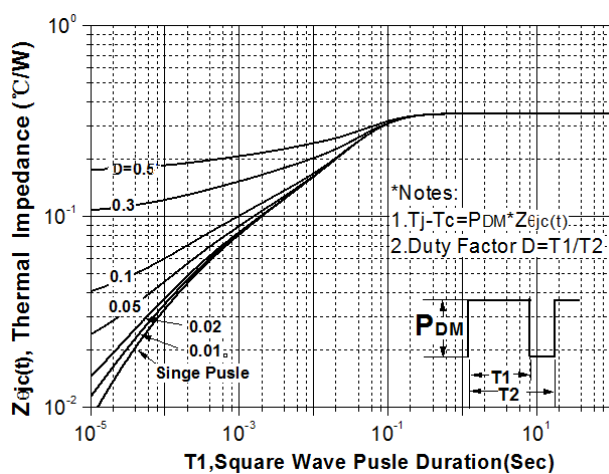
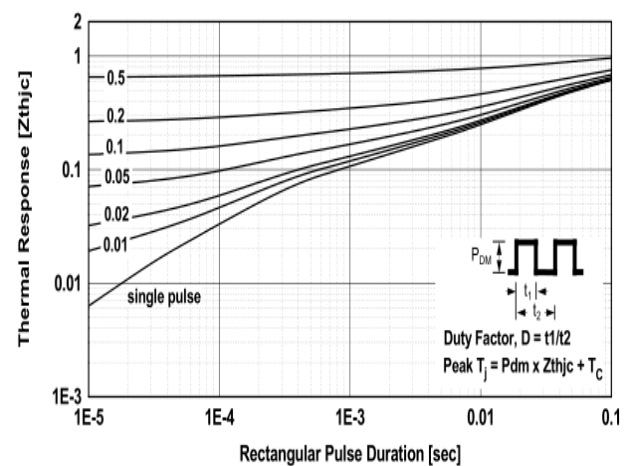
**Switching Time vs. T_j** VGE=15V, VCE=400V, IC=60A, $R_g=10\Omega$ **Switching Loss vs. T_j** VGE=15V, VCE=400V, IC=60A, $R_g=10\Omega$ **Switching Loss vs. $I_C(25^{\circ}\text{C})$** VGE=15V, VCE=400V, $R_g=10\Omega$ **Switching Loss vs. $I_C(175^{\circ}\text{C})$** VGE=15V, VCE=400V, $R_g=10\Omega$ 

**Switching Loss vs. Rg(25°C)**

VGE=15V, VCE=400V, IC=60A

**Switching Loss vs. Rg(175°C)**

VGE=15V, VCE=400V, IC=60A

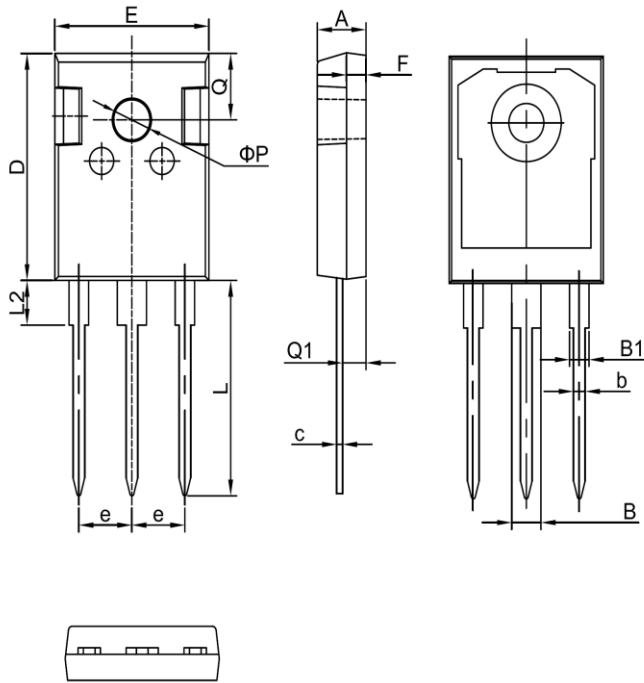
**Forward Bias SOA(TO-247)****Forward Bias SOA(TO-3PH)****Normalized Maximum Transient Thermal Impedance for IGBT(RJC) TO-247****Normalized Maximum Transient Thermal Impedance for IGBT(RJC) TO-3PH**



外形尺寸 PACKAGE MECHANICAL DATA

TO-247

单位 Unit : mm



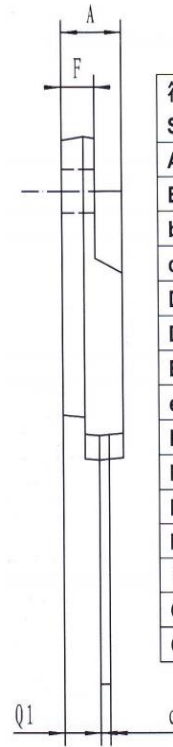
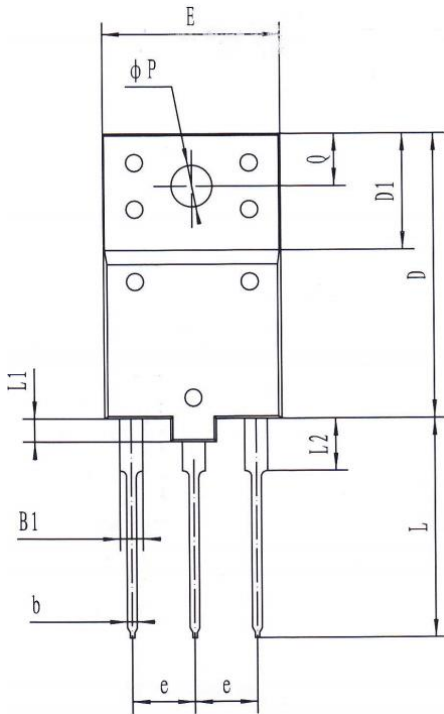
符号 symbol	MIN	MAX
A	4.90	5.10
B	2.95	3.35
B1	1.95	2.35
b	1.15	1.35
c	0.50	0.70
D	20.90	21.10
E	15.70	15.90
e	5.34	5.54
F	1.90	2.10
L	19.40	20.40
L2	4.03	4.23
Q	6.00	6.40
Q1	2.30	2.50
P	3.50	3.70





外形尺寸 PACKAGE MECHANICAL DATA

TO-3PH



符 号 Symbol	Min	Max
A	5.2	5.8
B1	1.8	2.2
b	0.75	1.05
c	0.8	1.1
D	24.0	25.0
D1	9.8	10.2
E	15.0	16.0
e	5.45 (typ)	
F	2.7	3.3
L	18.5	19.5
L1	1.8	2.2
L2	4.3	4.7
ΦP	3.4	3.8
Q	4.3	4.7
Q1	3.1	3.5





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3. Please do not exceed the absolute maximum ratings of the device when circuit designing.
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