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02166766957 - 02166766927



تهران پاسار امجد طبقه 1 واحد 16



[info@atrinelec.com](mailto:info@atrinelec.com)



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## Silicon FS Trench IGBT



## BT40T60 ANFU

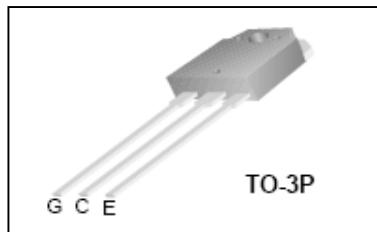
### General Description:

Using HUAJING's proprietary trench design and advanced Field Stop (FS) technology, offering superior conduction and switching performances.

<b>V<sub>CES</sub></b>	<b>600</b>	<b>V</b>
<b>I<sub>C</sub></b>	<b>40</b>	<b>A</b>
<b>P<sub>tot</sub> (T<sub>C</sub>=25°C)</b>	<b>280</b>	<b>W</b>
<b>V<sub>CE(sat)</sub></b>	<b>1.9</b>	<b>V</b>

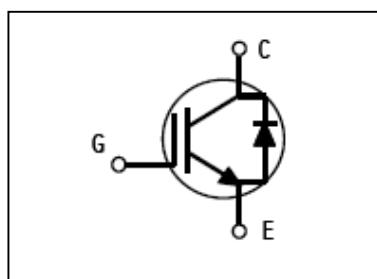
### Features:

- | FS Trench Technology, Positive temperature coefficient
- | Low saturation voltage: V<sub>CE(sat)</sub>, typ= 1.9V  
@ I<sub>C</sub> = 40A and T<sub>C</sub> = 25°C
- | RoHS Compliant



### Applications:

- | Welding
- | Solar Inverter
- | UPS



### Absolute Maximum Ratings (T<sub>j</sub>= 25°C unless otherwise specified):

Symbol	Parameter	Rating	Units
V <sub>CES</sub>	Collector-Emitter Voltage	600	V
V <sub>GES</sub>	Gate- Emitter Voltage	±20	V
I <sub>C</sub>	Collector Current@TC=25°C	80	A
	Collector Current @TC = 100 °C	40	A
I <sub>CM</sub> <sup>a1</sup>	Pulsed Collector Current@TC=25°C	120	A
I <sub>F</sub>	Diode Continuous Forward Current @T <sub>C</sub> = 100 °C	20	A
I <sub>FM</sub>	Diode Maximum Forward Current	100	A
P <sub>D</sub>	Power Dissipation @ T <sub>C</sub> = 25°C	280	W
	Power Dissipation @T <sub>C</sub> = 100 °C	110	W
	Power Dissipation @T <sub>A</sub> = 25 °C	3.125	W
T <sub>J</sub> , T <sub>stg</sub>	Operating Junction and Storage Temperature Range	-55 to +150	°C
T <sub>L</sub>	Maximum Temperature for Soldering	270	°C

<sup>a1</sup>: Repetitive rating; pulse width limited by maximum junction temperature

**Thermal Characteristics**

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Thermal Resistance, Junction to case for IGBT	--	0.446	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction to case for Diode	--	1.25	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	--	40	°C/W

**Electrical Characteristics of the IGBT** ( $T_j = 25^\circ C$  unless otherwise specified):

<b>OFF Characteristics</b>						
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$V_{GE}=0V, I_{CE}=250\mu A$	600	--	--	V
$I_{CES}$	Collector-Emitter Leakage Current	$V_{GE}=0V$ $V_{CE}=600V$	--	--	1.0	mA
$I_{GES(F)}$	Gate to Emitter Forward Leakage	$V_{GE}=+20V$	--	--	+250	nA
$I_{GES(R)}$	Gate to Source Reverse Leakage	$V_{GE}=-20V$	--	--	-250	nA
<b>ON Characteristics</b>						
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=40A, V_{GE}=15V$	--	1.9	2.4	V
$V_{GE(th)}$	Gate Threshold Voltage	$I_C=1mA, V_{CE}=V_{GE}$	4.0	5.7	7.0	V
Pulse width $t_p \leq 300\mu s, \delta \leq 2\%$						
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance	$V_{CE}=30V, V_{GE}=0V$ $f=1MHz$	--	3070	--	pF
$C_{oes}$	Output Capacitance		--	123	--	
$C_{res}$	Reverse Transfer Capacitance		--	80	--	
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-on Delay Time	$V_{CE}=400V, I_C=40A$ $V_{GE}=15V, R_g=10\Omega$ Inductive Load, $T_j=25^\circ C$	--	42	--	ns
$t_r$	Rise Time		--	50	--	
$t_{d(off)}$	Turn-Off Delay Time		--	207	--	
$t_f$	Fall Time		--	53	--	
$E_{on}$	Turn-On Switching Loss		--	1.6	--	mJ
$E_{off}$	Turn-Off Switching Loss		--	0.82	--	
$E_s$	Total Switching Loss		--	2.42	--	
$Q_g$	Total Gate Charge	$V_{CE}=400V, I_C=40A$ $V_{GE}=15V$	--	165	--	nC
$Q_{ge}$	Gate to Emitter Charge		--	15	--	
$Q_{gc}$	Gate to Collector Charge		--	96	--	

**Electrical Characteristics of the DIODE** ( $T_j = 25^\circ C$  unless otherwise specified):

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_F$	Diode Forward Voltage	$I_F=20A$	--	1.8	2.6	V
$t_{rr}$	Reverse Recovery Time	$I_F=20A$ $di/dt=200A/uS$	--	80	--	ns
$I_{rm}$	Reverse Recovery Current		--	6	--	A
$Q_{rr}$	Reverse Recovery Charge		--	240	--	nC
Pulse width $t_{tp} \leq 300\mu s, \delta \leq 2\%$						



## Typical Performance Characteristics

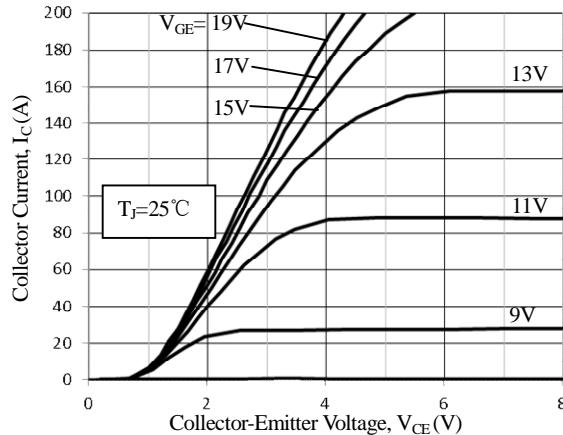


Figure 1.Output Characteristics

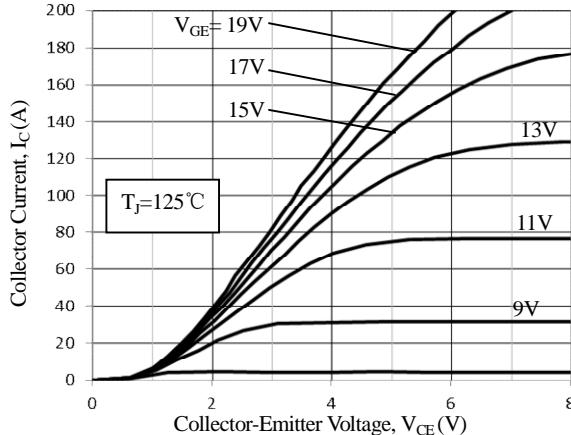


Figure 2.Output Characteristics

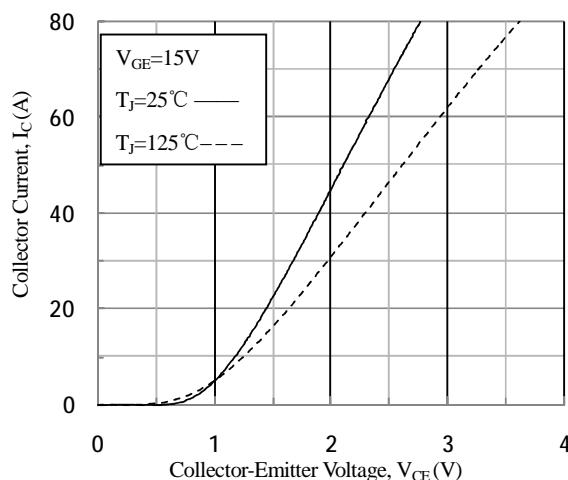


Figure 3.Saturation Voltage Characteristics

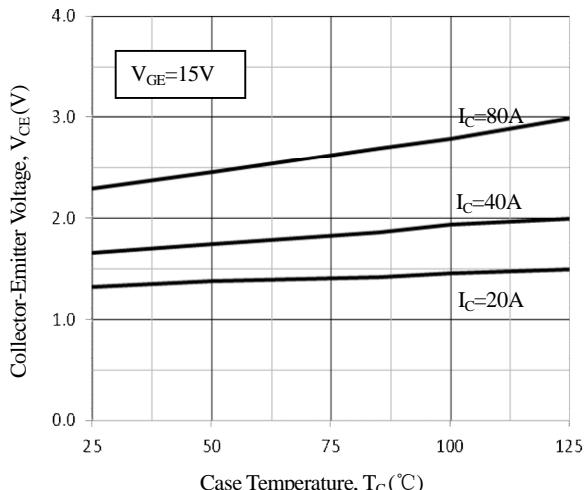


Figure 4.Saturation Voltage -  $T_C$  Characteristics

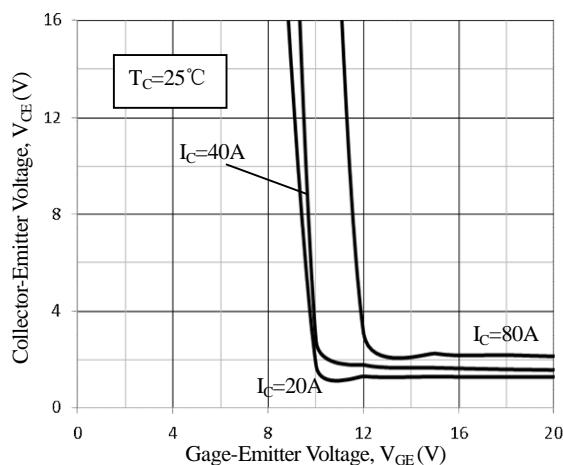


Figure 5. $V_{CE(\text{sat})}$ — $V_{GE}$  Characteristics

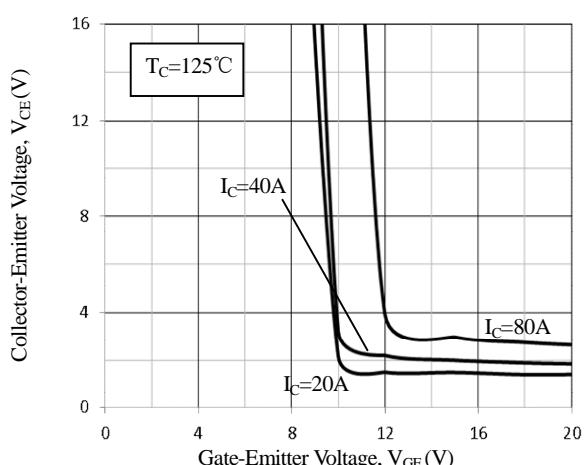
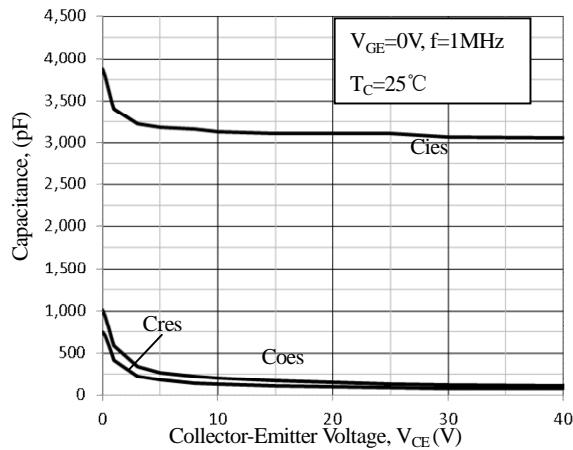
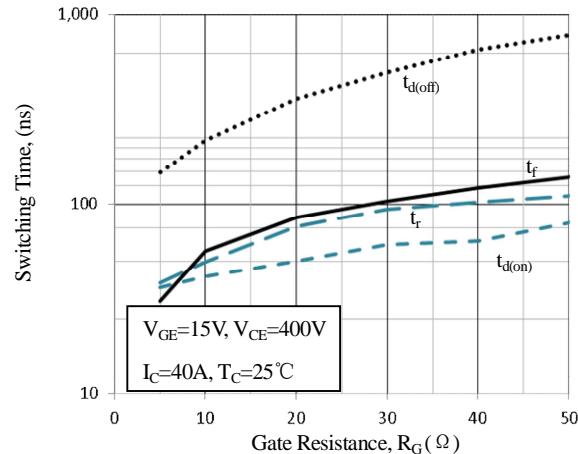
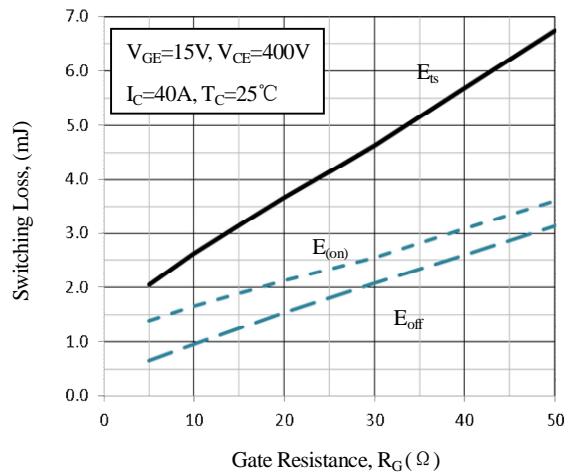
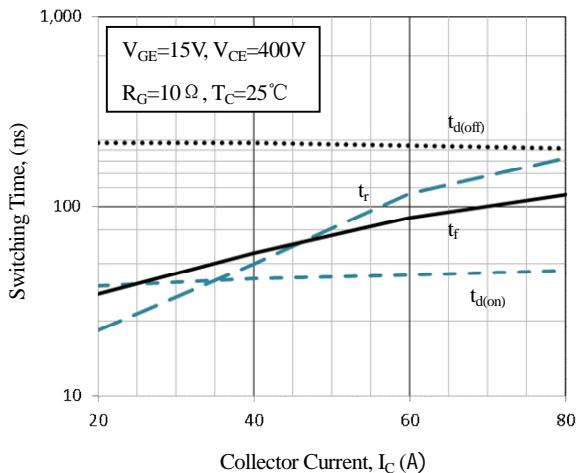
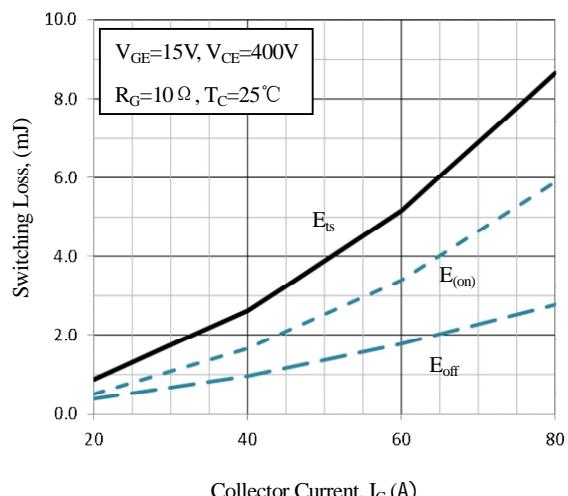
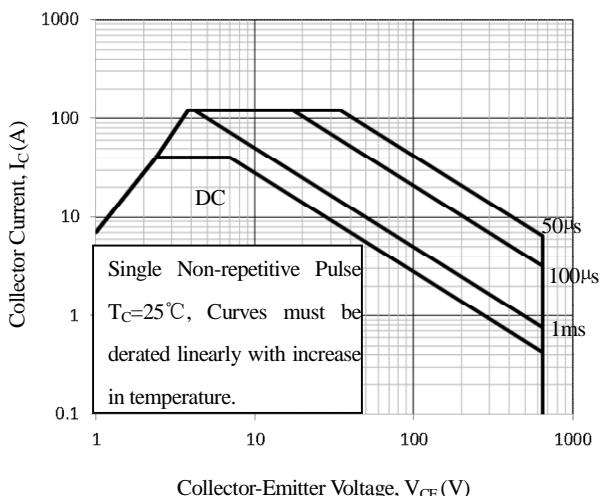


Figure 6. $V_{CE(\text{sat})}$ — $V_{GE}$  Characteristics


**Figure 7.Capacitance Characteristics**

**Figure 8.Switching Time- $R_G$  Characteristics**

**Figure 9.Switching Loss- $R_G$  Characteristics**

**Figure 10.Switching Time- $I_C$  Characteristics**

**Figure 11.Switching Loss- $I_C$  Characteristics**

**Figure 12.Forward Bias Safe Operating Area**



## BT40T60 ANFU

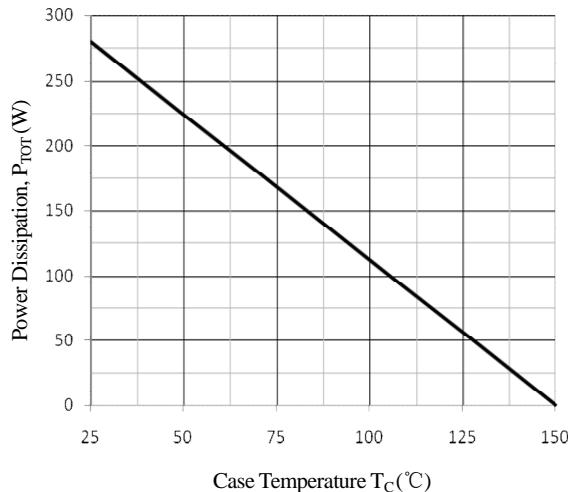


Figure 13.Power Dissipation- $T_c$  Characteristics

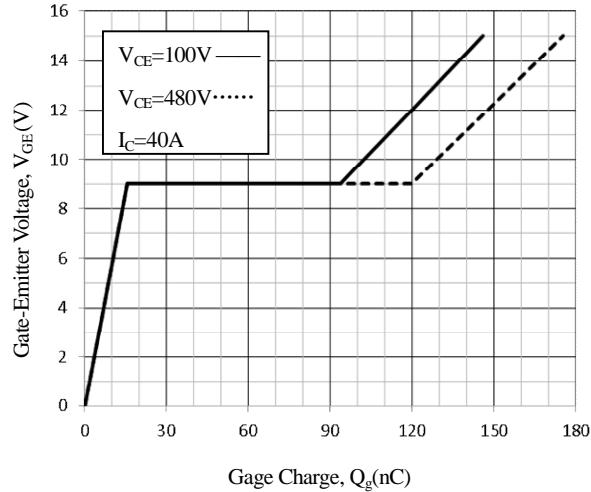


Figure 14.Gage Charge Characteristics

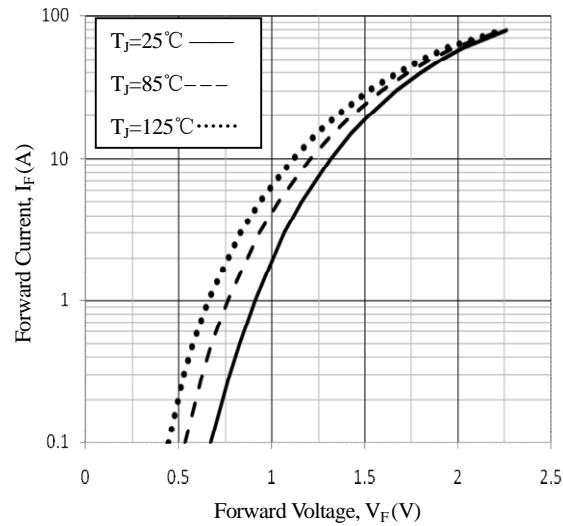


Figure 15.Diode Forward Characteristics

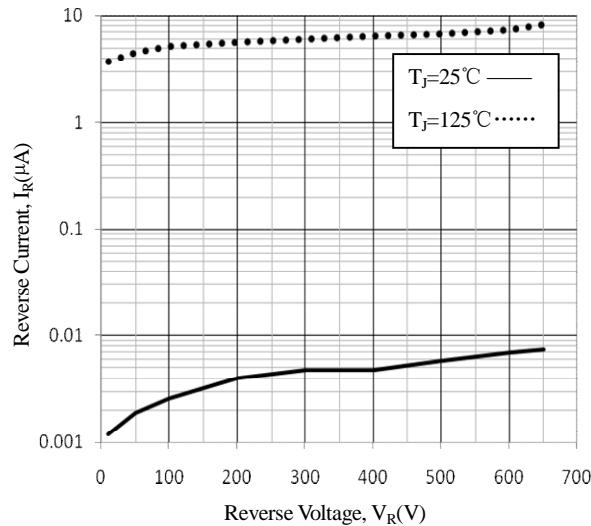


Figure 16. Diode Reverse Characteristics

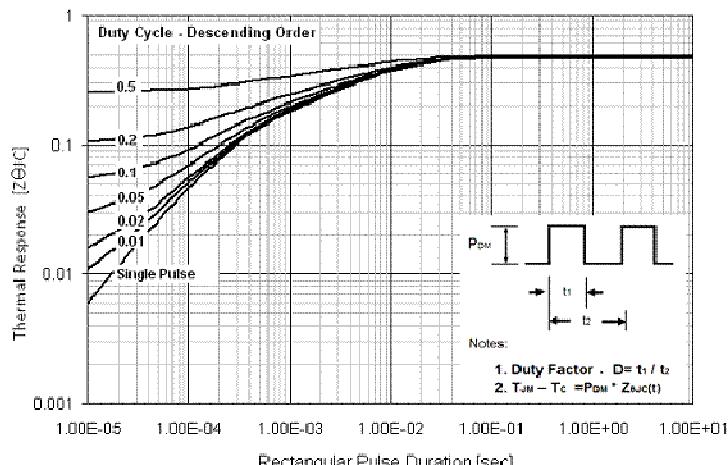
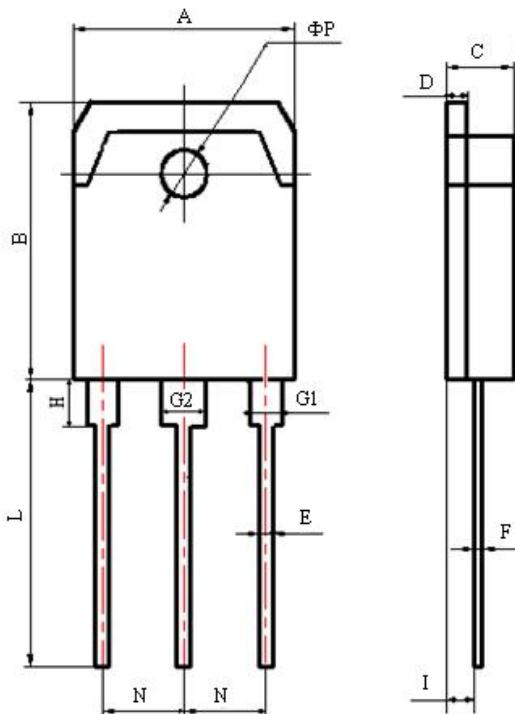


Figure 17.IGBT Transient Thermal Impedance

**Package Information:**

Items	Values(mm)	
	MIN	MAX
A	15.00	16.00
B	19.20	20.60
C	4.60	5.00
D	1.40	1.60
E	0.90	1.10
F	0.50	0.70
G1	2.00	2.20
G2	3.00	3.20
H	3.00	3.70
I	1.20	1.70
	2.70	2.90
L*	19.00	21.00
N	5.25	5.65
Φ P	3.10	3.30

\*: adjustable

TO-3P(N) Package



## **The name and content of poisonous and harmful material in products**

## Warnings

1. Exceeding the maximum ratings of the device in performance may cause damage to the device, even the permanent failure, which may affect the dependability of the machine. It is suggested to be used under 80 percent of the maximum ratings of the device.
  2. When installing the heat sink, please pay attention to the torsional moment and the smoothness of the heat sink.
  3. IGBTs is the device which is sensitive to the static electricity, it is necessary to protect the device from being damaged by the static electricity when using it.
  4. This publication is made by Huajing Microelectronics and subject to regular change without notice.

WUXI CHINA RESOURCES HUAJING MICROELECTRONICS CO., LTD.

Add: No.14 Liangxi RD. Wuxi, Jiangsu, China Mail: 214061 <http://www.crhi.com.cn>  
Tel: 0510-85807228 Fax: 0510-85800864

**Marketing Part:** Post: 214061 Tel / Fax: 0510-85807228-3663/5508  
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