

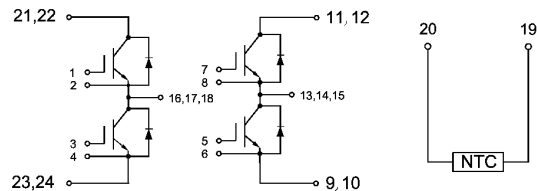
$V_{CES} = 1200V$ $I_C = 50A$ at $T_C = 80^\circ C$ $t_{SC} \geq 10\mu sec$ $V_{CE(ON)} = 3.20V$ at $I_C = 50A$
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**IGBT H-Bridge  
POWER ECO 2™ Package**



**Applications:**

- Industrial Motor Drive
- Uninterruptible Power Supply
- Welding and Cutting Machine
- Switched Mode Power Supply
- Induction Heating
- DC Inverter Drive



Features	Benefits
Low $V_{CE(ON)}$ and Switching Losses	High Efficiency in a Wide Range of Applications
100% RBSOA Tested	Rugged Transient Performance
10μsec Short Circuit Safe Operating Area	
<b>POWER ECO 2™</b> Package	Industry Standard
Lead Free	RoHS Compliant, Environmental Friendly

Base Part Number	Package Type	Standard Pack	Quantity	Orderable Part Number
IRG5U50HH12E	<b>POWER ECO 2™</b>	Box	80	IRG5U50HH12E

**Absolute Maximum Ratings of IGBT**

$V_{CES}$	Collector to Emitter Voltage	1200	V
$V_{GES}$	Continuous Gate to Emitter Voltage	±20	V
$I_C$	Continuous Collector Current	$T_C = 80^\circ C$	50 A
		$T_C = 25^\circ C$	85 A
$I_{CM}$	Pulse Collector Current	$T_J = 150^\circ C$	100 A
$P_D$	Maximum Power Dissipation (IGBT)	$T_C = 25^\circ C, T_J = 150^\circ C$	390 W
$T_J$	Maximum IGBT Junction Temperature	150	°C
$T_{JOP}$	Maximum Operating Junction Temperature Range	-40 to +150	°C
$T_{stg}$	Storage Temperature	-40 to +125	°C

**Electrical Characteristics of IGBT at  $T_J = 25^\circ\text{C}$  (Unless Otherwise Specified)**

Parameter		Min.	Typ.	Max.	Unit	Test Conditions	
$V_{(BR)CES}$	Collector to Emitter Breakdown Voltage	1200			V	$V_{GE} = 0V, I_C = 1mA$	
$V_{GE(th)}$	Gate Threshold Voltage	4.5	5.3	6.0	V	$I_C = 0.50mA, V_{CE} = V_{GE}$	
$V_{CE(ON)}$	Collector to Emitter Saturation Voltage (Module Level)		3.20	3.50	V	$T_J = 25^\circ\text{C}$	$I_C = 50A, V_{GE} = 15V$
			3.80		V	$T_J = 125^\circ\text{C}$	
$I_{CES}$	Collector to Emitter Leakage Current			1	mA	$V_{GE} = 0V, V_{CE} = V_{CES}$	
$I_{GES}$	Gate to Emitter Leakage Current			400	nA	$V_{GE} = \pm 20V, V_{CE} = 0$	

**Switching Characteristics of IGBT**

Parameter		Min.	Typ.	Max.	Unit	Test Conditions	
$t_{d(on)}$	Turn-on Delay Time		115		ns	$T_J = 25^\circ\text{C}$	$V_{CC} = 600V, I_C = 50A, R_G = 15\Omega, V_{GE} = \pm 15V, \text{Inductive Load}$
			110			$T_J = 125^\circ\text{C}$	
$t_r$	Rise Time		70		ns	$T_J = 25^\circ\text{C}$	
			70			$T_J = 125^\circ\text{C}$	
$t_{d(off)}$	Turn-off Delay Time		305		ns	$T_J = 25^\circ\text{C}$	
			325			$T_J = 125^\circ\text{C}$	
$t_f$	Fall Time		125		ns	$T_J = 25^\circ\text{C}$	
			160			$T_J = 125^\circ\text{C}$	
$E_{on}$	Turn-on Switching Loss		3.6		mJ	$T_J = 25^\circ\text{C}$	
			4.6			$T_J = 125^\circ\text{C}$	
$E_{off}$	Turn-off Switching Loss		1.0		mJ	$T_J = 25^\circ\text{C}$	
			1.9			$T_J = 125^\circ\text{C}$	
$Q_g$	Total Gate Charge		630		nC	$T_J = 25^\circ\text{C}$	
$C_{ies}$	Input Capacitance		6.0		nF	$V_{CE} = 25V, V_{GE} = 0V, f = 1MHz, T_J = 25^\circ\text{C}$	
$C_{oes}$	Output Capacitance		0.50				
$C_{res}$	Reverse Transfer Capacitance		0.20				
RBSOA	Reverse Bias Safe Operating Area	Trapezoid				$I_C = 100A, V_{CC} = 960V, V_P = 1200V, R_G = 15\Omega, V_{GE} = +15V \text{ to } 0V, T_J = 150^\circ\text{C}$	
SCSOA	Short Circuit Safe Operating Area	10			$\mu s$	$V_{CC} = 600V, V_{GE} = 15V, T_J = 150^\circ\text{C}$	

**Absolute Maximum Ratings of Freewheeling Diode**

$V_{RRM}$	Repetitive Peak Reverse Voltage	1200	V
$I_F$	Diode Continuous Forward Current, $T_C = 25^\circ\text{C}$	100	A
	Diode Continuous Forward Current, $T_C = 80^\circ\text{C}$	50	
$I_{FM}$	Pulse Diode Current	100	A

**Electrical and Switching Characteristics of Freewheeling Diode**

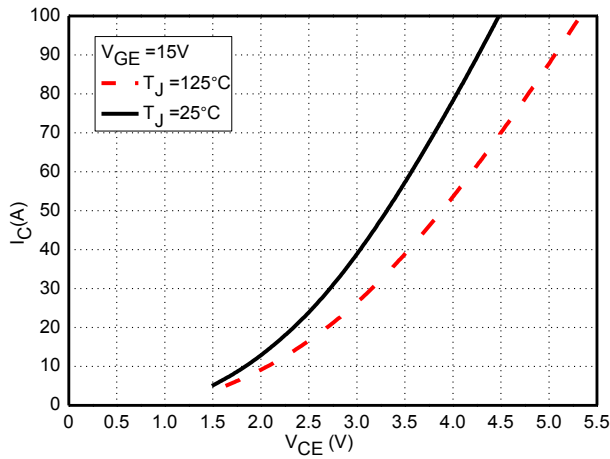
Parameter		Typ.	Max.	Unit	Test Conditions	
$V_F$	Forward Voltage	2.20	2.70	V	$T_J = 25^\circ\text{C}$	$I_F = 50\text{A}$ , $V_{GE} = 0\text{V}$
		2.40			$T_J = 125^\circ\text{C}$	
$I_{rr}$	Peak Reverse Recovery Current	40		A	$T_J = 25^\circ\text{C}$	$I_F = 50\text{A}$ , $di/dt = 850\text{A}/\mu\text{s}$ , $V_{rr} = 600\text{V}$ , $V_{GE} = -15\text{V}$
		50			$T_J = 125^\circ\text{C}$	
$Q_{rr}$	Reverse Recovery Charge	3.0		$\mu\text{C}$	$T_J = 25^\circ\text{C}$	
		5.6			$T_J = 125^\circ\text{C}$	
$E_{rec}$	Reverse Recovery Energy	1.02		mJ	$T_J = 25^\circ\text{C}$	
		2.01			$T_J = 125^\circ\text{C}$	

**NTC-Thermistor Characteristic Values**

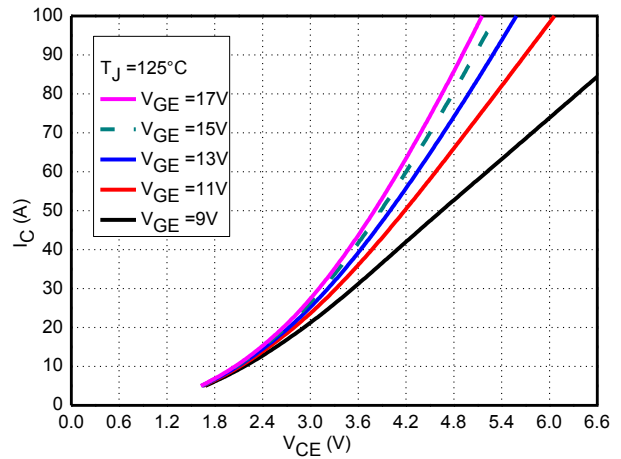
Parameter		Typ.	Max.	Unit
$R_{25}$	$T_C = 25^\circ\text{C}$	5		k $\Omega$
$\Delta R/R$	$T_C = 100^\circ\text{C}$ , $R_{100} = 481\Omega$		$\pm 5$	%
$P_{25}$	$T_C = 25^\circ\text{C}$	50		mW
$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298.15\text{K}))]$	3380		K
$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298.15\text{K}))]$	3440		K

**Module Characteristics**

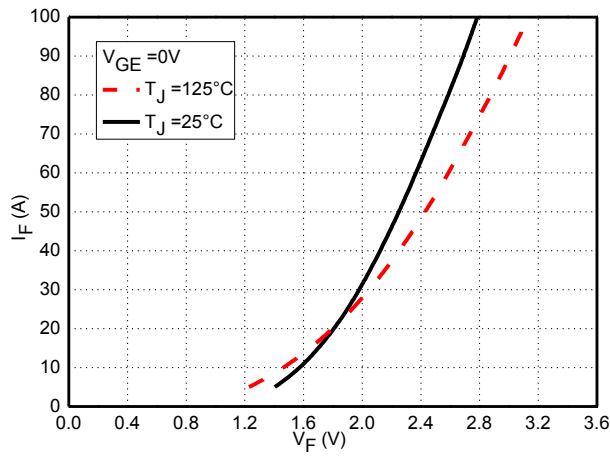
Parameter		Min.	Typ.	Max.	Unit
$V_{iso}$	Isolation Voltage (All Terminals Shorted), $f = 50\text{Hz}$ , 1minute			2500	V
$R_{\theta JC}$	Junction-to-Case (IGBT)		0.32		$^\circ\text{C}/\text{W}$
$R_{\theta JC}$	Junction-to-Case (Diode)		0.87		$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Case-To-Sink (Conductive Grease Applied)		0.1		$^\circ\text{C}/\text{W}$
M	Mounting Screw: M6	4.0		6.0	N·m
G	Weight		200		g



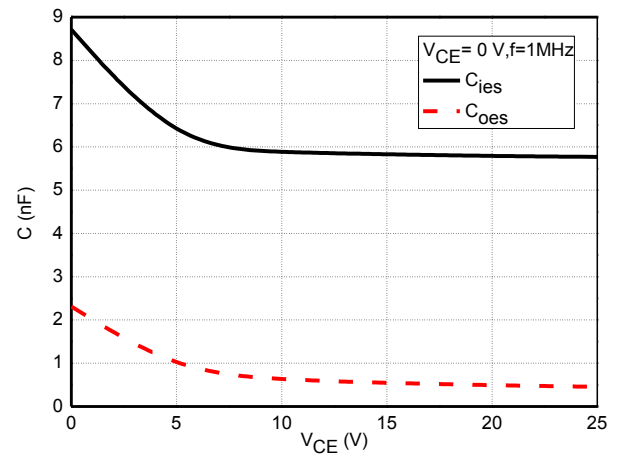
**Fig.1 Typical IGBT Saturation Characteristics**



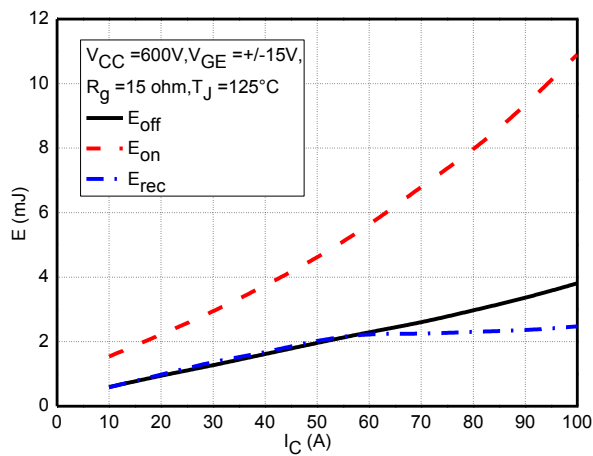
**Fig.2 Typical IGBT Output Characteristics**



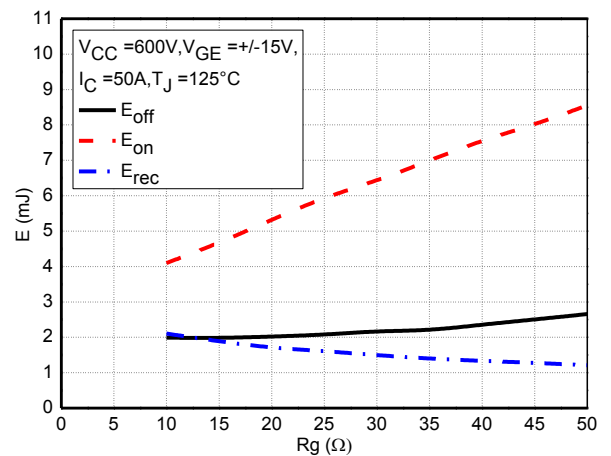
**Fig.3 Typical Freewheeling Diode Characteristics**



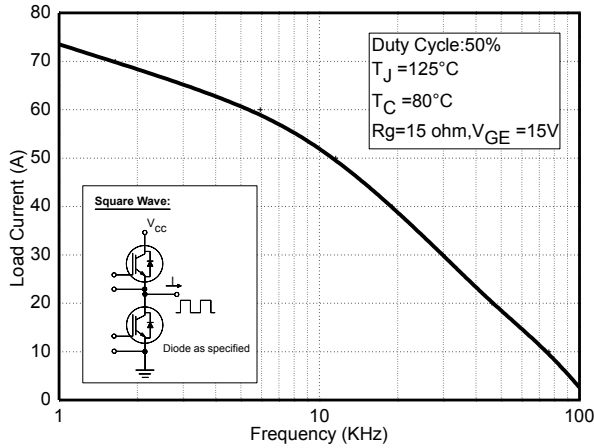
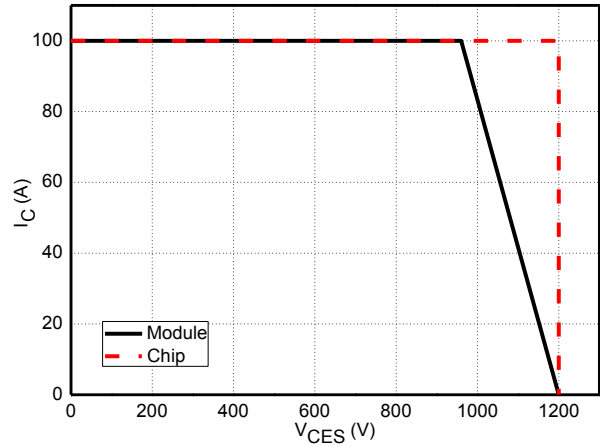
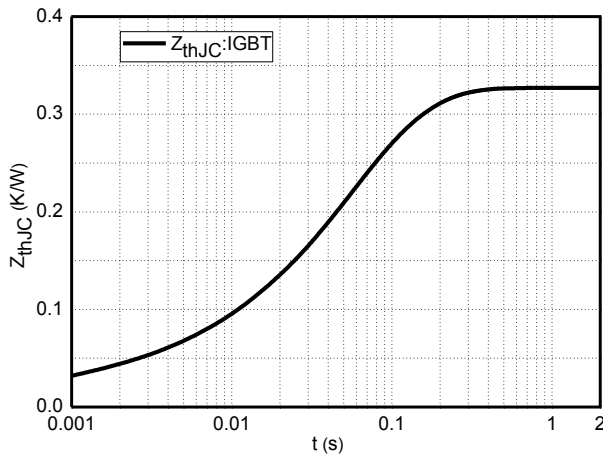
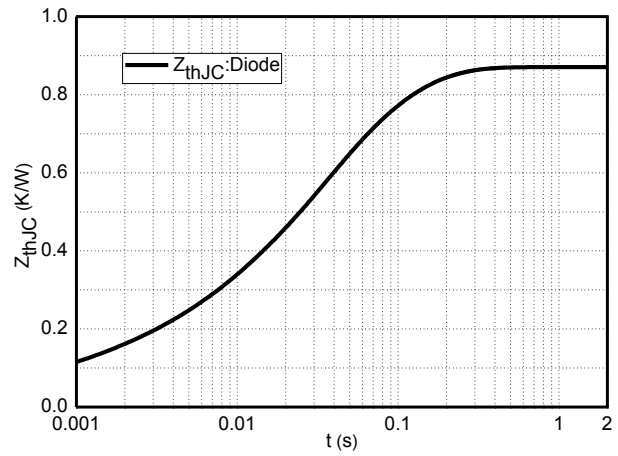
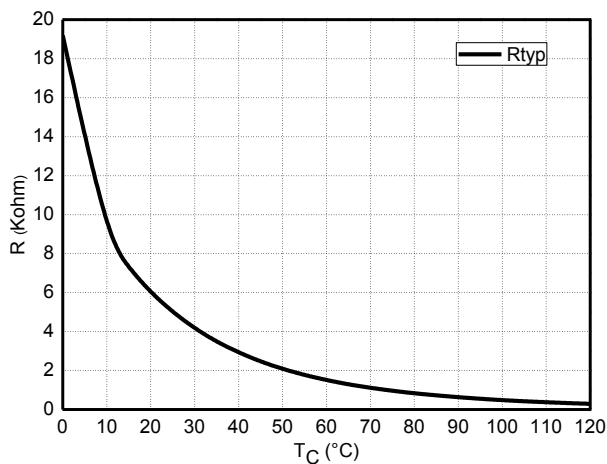
**Fig. 4 Typical Capacitance Characteristics**



**Fig.5 Typical Switching Loss vs. Collector Current**



**Fig.6 Typical Switching Loss vs. Gate Resistance**


**Fig.7 Typical Load Current vs. Frequency**

**Fig.8 Reverse Bias Safe Operation Area (RBSOA)**

**Fig.9 Typical Transient Thermal Impedance (IGBT)**

**Fig.10 Typical Transient Thermal Impedance (Diode)**

**Fig.11 NTC Temperature Characteristics**

