

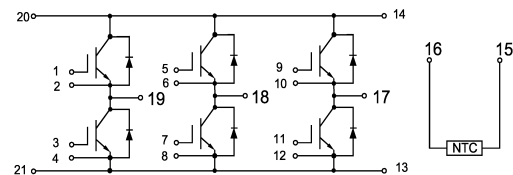
$V_{CES} = 600V$
$I_C = 50A$ at $T_C = 80^\circ C$
$t_{SC} \geq 10\mu sec$
$V_{CE(ON)} = 1.80V$ at $I_C = 50A$

**IGBT Six-Pack  
POWER ECO 2™ Package**



**Applications:**

- Industrial Motor Drive
- Servo drive
- Uninterruptible Power Supply
- AC 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
10 $\mu$ sec 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
IRG5K50FF06E	<b>POWER ECO 2™</b>	Box	80	IRG5K50FF06E

**Absolute Maximum Ratings of IGBT**

$V_{CES}$	Collector to Emitter Voltage	600	V
$V_{GES}$	Continuous Gate to Emitter Voltage	$\pm 20$	V
$I_C$	Continuous Collector Current	$T_C = 80^\circ C$	50 A
		$T_C = 25^\circ C$	100 A
$I_{CM}$	Pulse Collector Current	$T_J = 150^\circ C$	100 A
$P_D$	Maximum Power Dissipation (IGBT)	$T_C = 25^\circ C, T_J = 150^\circ C$	245 W
$T_J$	Maximum IGBT Junction Temperature	150	$^\circ C$
$T_{JOP}$	Maximum Operating Junction Temperature Range	-40 to +150	$^\circ C$
$T_{stg}$	Storage Temperature	-40 to +125	$^\circ C$

**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	600			V	$V_{GE} = 0V, I_C = 1mA$	
$V_{GE(th)}$	Gate Threshold Voltage	3.5	4.5	5.5	V	$I_C = 0.25mA, V_{CE} = V_{GE}$	
$V_{CE(ON)}$	Collector to Emitter Saturation Voltage		1.80	2.10	V	$T_J = 25^\circ\text{C}$	$I_C = 50A, V_{GE} = 15V$
			2.00		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		110		ns	$T_J = 25^\circ\text{C}$	$V_{CC}=300V, I_C = 50A, R_G = 30\Omega, V_{GE}=\pm 15V, \text{Inductive Load}$
			100			$T_J = 125^\circ\text{C}$	
$t_r$	Rise Time		75		ns	$T_J = 25^\circ\text{C}$	
			80			$T_J = 125^\circ\text{C}$	
$t_{d(off)}$	Turn-off Delay Time		220		ns	$T_J = 25^\circ\text{C}$	
			240			$T_J = 125^\circ\text{C}$	
$t_f$	Fall Time		90		ns	$T_J = 25^\circ\text{C}$	
			110			$T_J = 125^\circ\text{C}$	
$E_{on}$	Turn-on Switching Loss		0.68		mJ	$T_J = 25^\circ\text{C}$	
			0.78			$T_J = 125^\circ\text{C}$	
$E_{off}$	Turn-off Switching Loss		0.75		mJ	$T_J = 25^\circ\text{C}$	
			0.92			$T_J = 125^\circ\text{C}$	
$Q_g$	Total Gate Charge		260		nC	$T_J = 25^\circ\text{C}$	
$C_{ies}$	Input Capacitance		3.0		nF	$V_{CE} = 25V, V_{GE} = 0V, f = 1MHz, T_J = 25^\circ\text{C}$	
$C_{oes}$	Output Capacitance		0.35				
$C_{res}$	Reverse Transfer Capacitance		0.14				
RBSOA	Reverse Bias Safe Operating Area	Trapezoid				$I_C = 100A, V_{CC} = 480V, V_P = 600V, R_G = 15\Omega, V_{GE} = +15V \text{ to } 0V, T_J = 150^\circ\text{C}$	
SCSOA	Short Circuit Safe Operating Area	10			$\mu s$	$V_{CC} = 300V, V_{GE} = 15V, T_J = 150^\circ\text{C}$	

**Absolute Maximum Ratings of Freewheeling Diode**

$V_{RRM}$	Repetitive Peak Reverse Voltage	600	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**

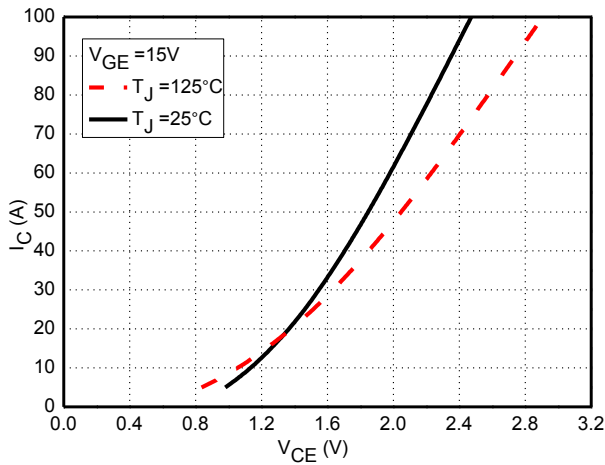
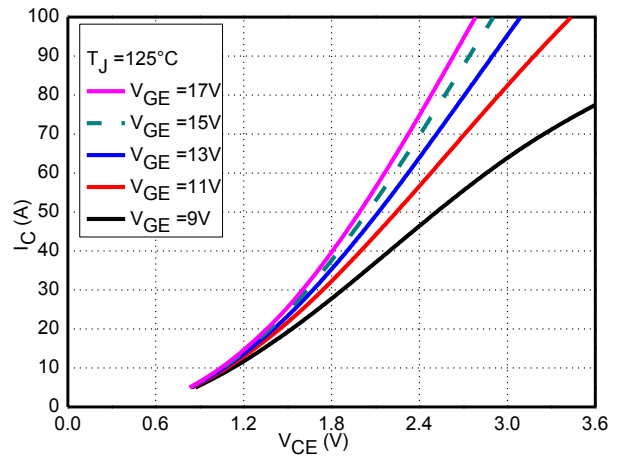
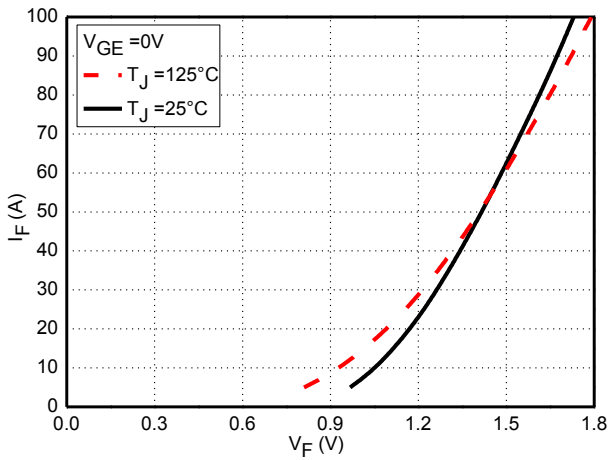
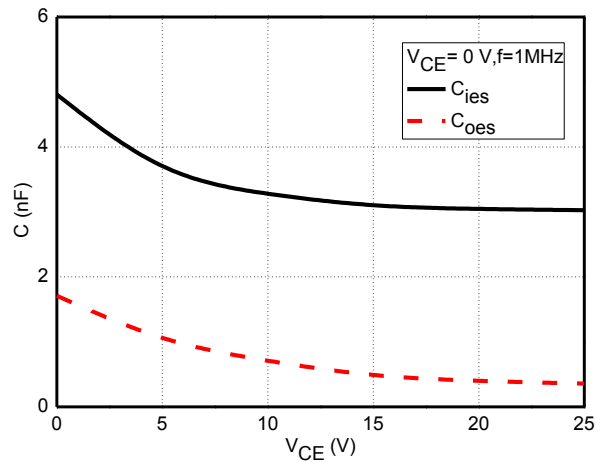
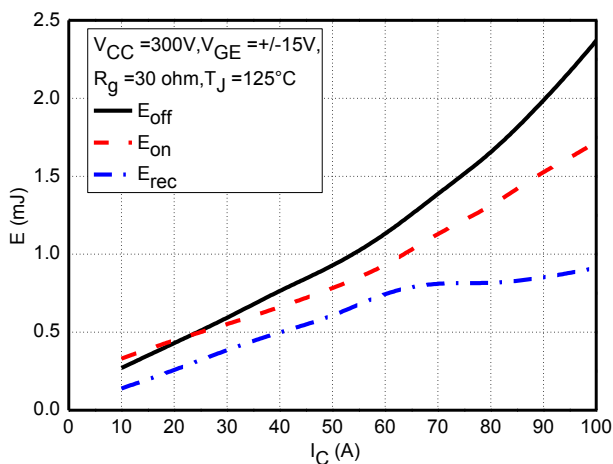
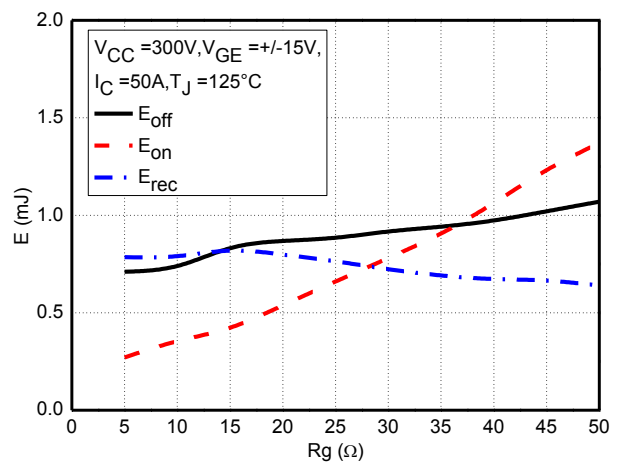
Parameter		Typ.	Max.	Unit	Test Conditions	
$V_F$	Forward Voltage	1.40	1.70	V	$T_J = 25^\circ\text{C}$	$I_F = 50\text{A}$ , $V_{GE} = 0\text{V}$
		1.40			$T_J = 125^\circ\text{C}$	
$I_{rr}$	Peak Reverse Recovery Current	30		A	$T_J = 25^\circ\text{C}$	$I_F = 50\text{A}$ , $di/dt = 840\text{A}/\mu\text{s}$ , $V_{rr} = 300\text{V}$ , $V_{GE} = -15\text{V}$
		40			$T_J = 125^\circ\text{C}$	
$Q_{rr}$	Reverse Recovery Charge	2.4		$\mu\text{C}$	$T_J = 25^\circ\text{C}$	
		3.6			$T_J = 125^\circ\text{C}$	
$E_{rec}$	Reverse Recovery Energy	0.25		mJ	$T_J = 25^\circ\text{C}$	
		0.70			$T_J = 125^\circ\text{C}$	

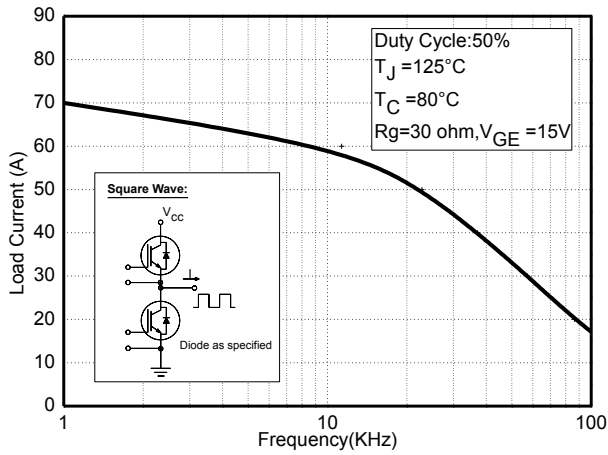
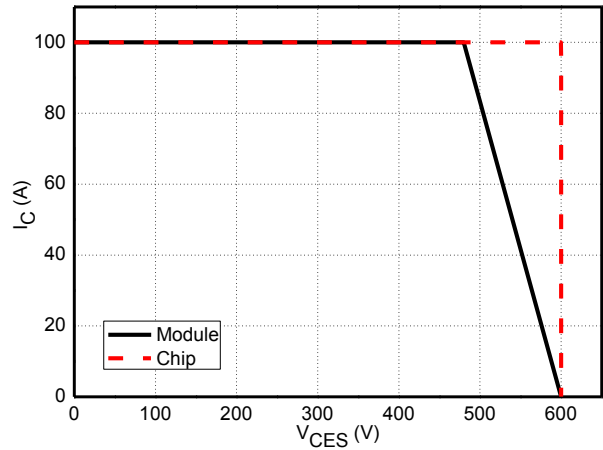
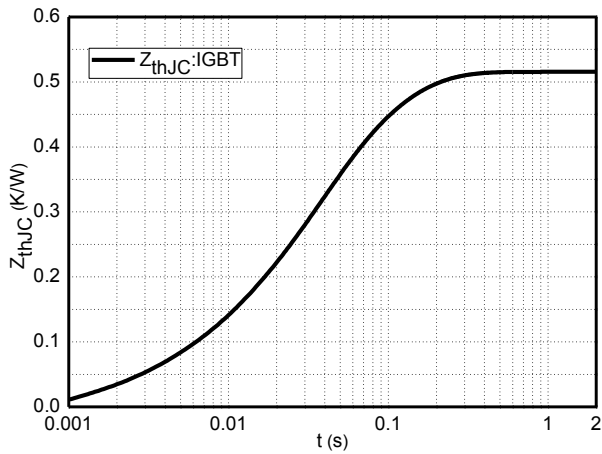
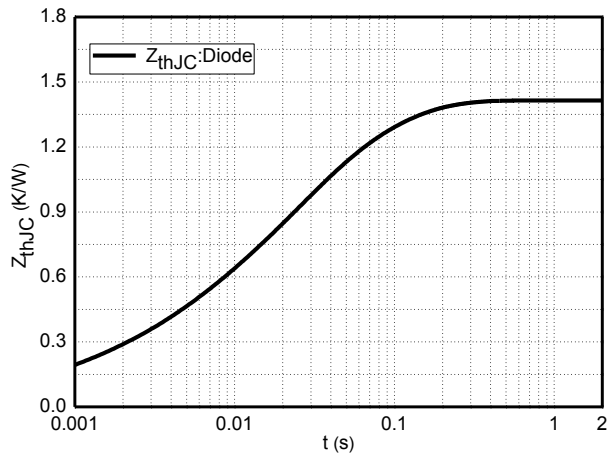
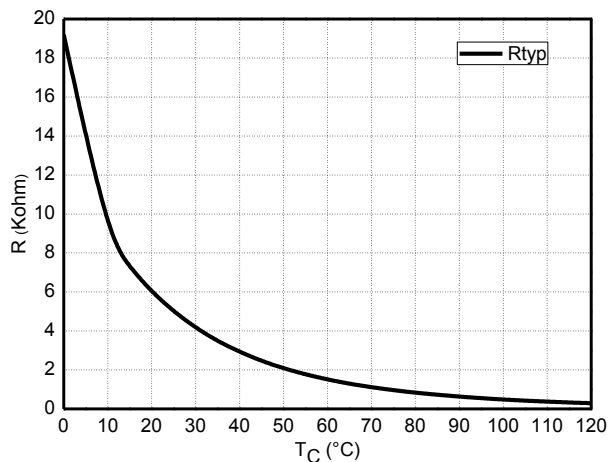
**NTC-Thermistor Characteristic Values**

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

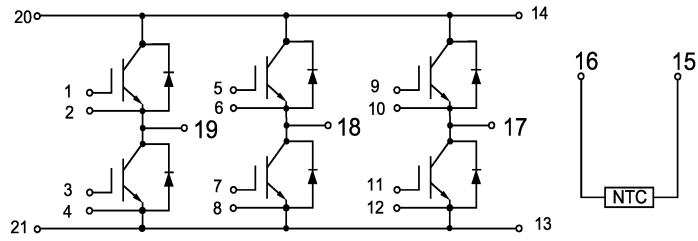
**Module Characteristics**

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)		0.515		$^\circ\text{C}/\text{W}$
$R_{\theta JC}$	Junction-to-Case (Diode)		1.41		$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Case-To-Sink (Conductive Grease Applied)		0.10		$^\circ\text{C}/\text{W}$
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**

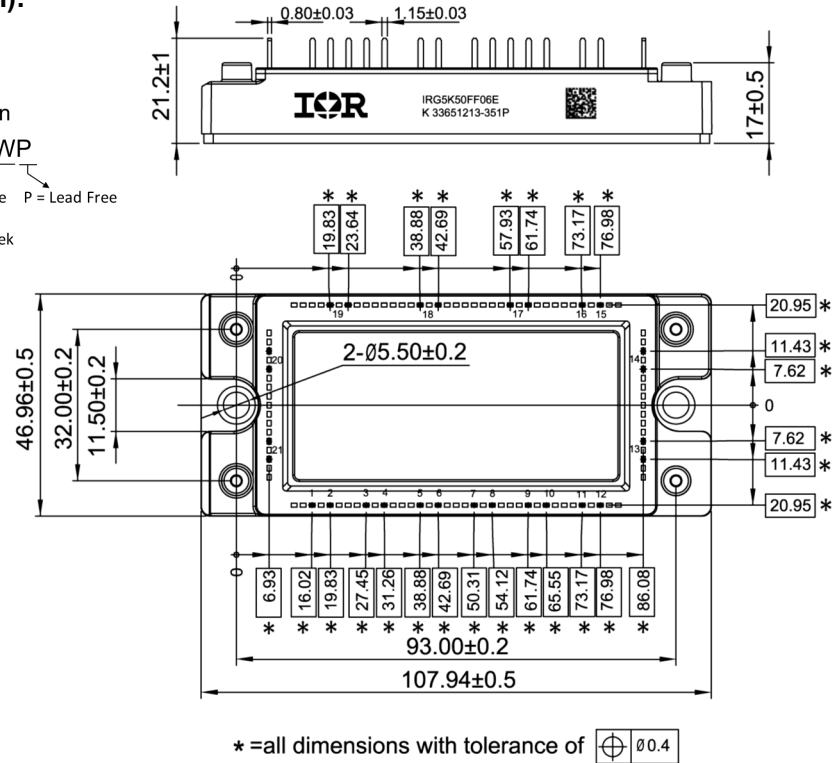

**Fig.7 Typical Load Current vs. Frequency**

**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**

### Internal Circuit:



### Package Outline (Unit: mm):

**Marking Information**  
**K XXXXXXXX-YWWP**  
 Assembly Site Code   Lot No.   Date Code   P = Lead Free  
 Y = Year  
 WW = Week



### Qualification Information†

Qualification Level	Industrial
Moisture Sensitivity Level	Not Applicable
RoHS Compliant	Yes

† Qualification standards can be found at International Rectifier's web site: <http://www.irf.com/product-info/reliability/>