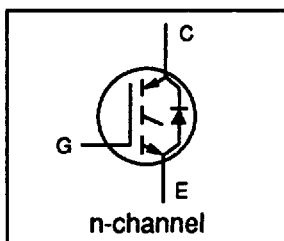


IRGMVC50U

INSULATED GATE BIPOLAR TRANSISTOR
WITH ON-BOARD REVERSE DIODE

Ultra Fast-Speed IGBT

- Electrically Isolated
- Hermetically Sealed
- Simple Drive Requirements
- Latch-proof
- UltraFast operation > 10 kHz
- Switching-loss rating includes all "tail" losses
- Ceramic Eyelets

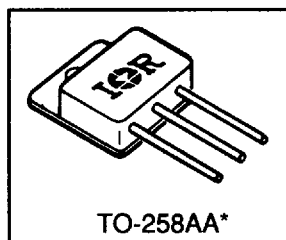


$V_{CES} = 600V$
 $f_{ic2} \approx 20kHz$
 $I_C @ f_{ic2} = 18A$
 $V_{CE(sat)} \leq 3.0V$
 @ $V_{GE} = 15V, I_C = 27A$

Description

Insulated Gate Bipolar Transistors (IGBTs) from International Rectifier have higher usable current densities than comparable bipolar transistors, while at the same time having simpler gate-drive requirements of the familiar power MOSFET. They provide substantial benefits to a host of higher-voltage, higher-current applications.

The performance of various IGBTs varies greatly with frequency. Note that IR now provides the designer with a speed benchmark (f_{ic2} , or the "half-current frequency"), as well as an indication of the current handling capability of the device.



*For mechanical specifications
see page G-122

Absolute Maximum Ratings

	Parameter	Max.	Units
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	45*	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	27	
I_{CM}	Pulsed Collector Current ①	220	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
I_{LM}	Clamped Inductive Load Current ②	180	A
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	200	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	80	W
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to 150	$^\circ C$
	Soldering Temperature, for 10 sec.	300 (0.063 in. (1.6mm) from case)	
	Weight	10.5	g

* I_C current limited by pin diameter

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case-IGBT	—	—	0.625	$^\circ C/W$
$R_{\theta JC}$	Junction-to-Case-Diode	—	—	1.0	
$R_{\theta CS}$	Case-to-Sink, flat, greased surface	—	0.21	—	
$R_{\theta JA}$	Junction-to-Ambient	—	—	30	

Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600	—	—	V	$V_{GE} = 0V, I_C = 1.0\text{ mA}$
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coefficient of Breakdown Voltage	—	0.60	—	$V/^\circ\text{C}$	$V_{GE} = 0V, I_C = 1.0\text{ mA}$
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	—	3.0	V	$V_{GE} = 15V, I_C = 27A$
		—	—	3.25		$V_{GE} = 15V, I_C = 45A$
		—	—	2.85		$V_{GE} = 15V, I_C = 27A, T_J = 125^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	5.5	V	$V_{CE} = V_{GE}, I_C = 250\mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Temp. Coeff. of Threshold Voltage	—	-13	—	$mV/^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 250\mu A$
g_{fe}	Forward Transconductance ③	16	—	—	S	$V_{CE} = 100V, I_C = 27A, V_{DS} \geq 15V$
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	μA	$V_{GE} = 0V, V_{CE} = 480V, T_J = 25^\circ\text{C}$
		—	—	5000		$V_{GE} = 0V, V_{CE} = 480V, T_J = 125^\circ\text{C}$
V_{FM}	Diode Forward Voltage Drop	—	—	1.7	V	$I_C = 27A, T_J = 25^\circ\text{C}$
		—	—	1.5		$I_C = 27A, T_J = 125^\circ\text{C}$

Switching Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Test Conditions
Q_G	Total Gate Charge (turn-on)	—	—	140	nC	$I_C = 27A, V_{CC} = 300V$
Q_{GE}	Gate-Emitter Charge (turn-on)	—	—	35		See Fig. 8
Q_{GC}	Gate-Collector Charge (turn-on)	—	—	70		$V_{GE} = 15V$
$t_{d(on)}$	Turn-On Delay Time	—	—	50	ns	$I_C = 27A, V_{CC} = 480V$
t_r	Rise Time	—	—	75		$T_J = 25^\circ\text{C}$
$t_{d(off)}$	Turn-Off Delay Time	—	—	300		$V_{GE} = 15V, R_G = 2.35\Omega$
t_f	Fall Time	—	—	210		Energy losses include "tail"
E_{on}	Turn-On Switching Loss	—	0.12	—	mJ	See Fig. 10 and 15a
E_{off}	Turn-Off Switching Loss	—	1.6	—		
E_{ts}	Total Switching Loss	—	1.7	2.8		
$t_{d(on)}$	Turn-On Delay Time	—	24	—	ns	$I_C = 27A, V_{CC} = 480V$
t_r	Rise Time	—	27	—		$T_J = 125^\circ\text{C}$
$t_{d(off)}$	Turn-Off Delay Time	—	180	—		$V_{GE} = 15V, R_G = 2.35\Omega$
t_f	Fall Time	—	130	—		See Fig. 10 and 15a
E_{ts}	Total Switching Loss	—	2.7	—	mJ	
L_E	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	2900	—	pF	$V_{GE} = 0V$
C_{oes}	Output Capacitance	—	330	—		$V_{CC} = 30V$
C_{res}	Reverse Transfer Capacitance	—	41	—		$f = 1.0\text{MHz}$
t_{rr}	Diode Peak Reverse Recovery Time	—	—	100	ns	$di/dt = 200A/\mu s, I_F = 27A$ $T_J = 25^\circ\text{C}, V_R \leq 200V$
Q_{rr}	Diode Peak Reverse Recovery Charge	—	—	375	nC	$di/dt = 200A/\mu s, I_F = 27A$ $T_J = 125^\circ\text{C}, V_R \leq 200V$

Notes: ① Repetitive rating; $V_{GE} = 20V$, pulse width limited by max. junction temperature.
(See Fig. 13b).

② $V_{CC} = 80\%$ (V_{CES}), $V_{GE} = 20V$, $L = 10\mu H$,
 $R_G = 10\Omega$. (See Fig. 13a).

③ Pulse width $\leq 5\mu s$, single shot.

Power dissipation = 47W

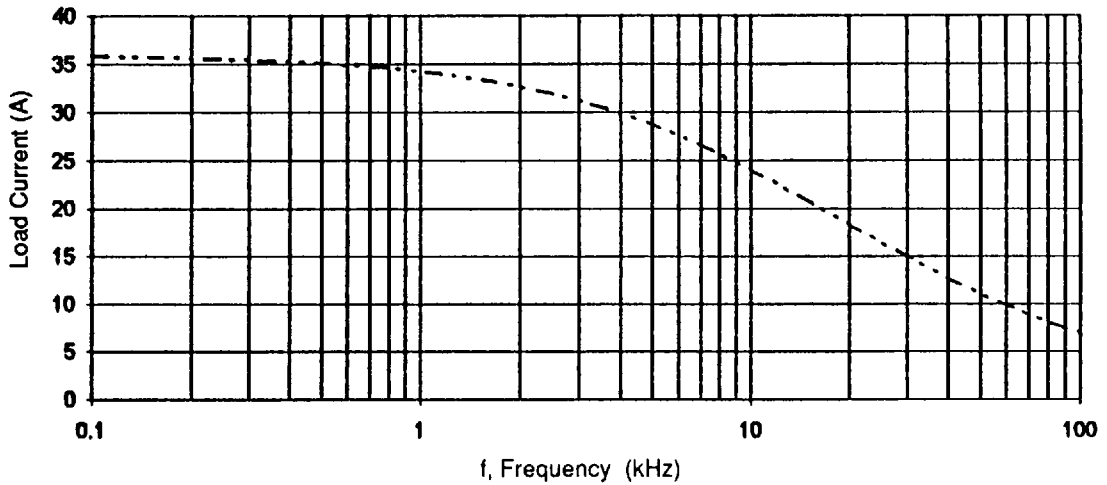


Fig. 1. Typical Load Current vs. Frequency
(For square wave, $I = I_{RMS}$ of fundamental; for triangular wave, $I = I_{PK}$)

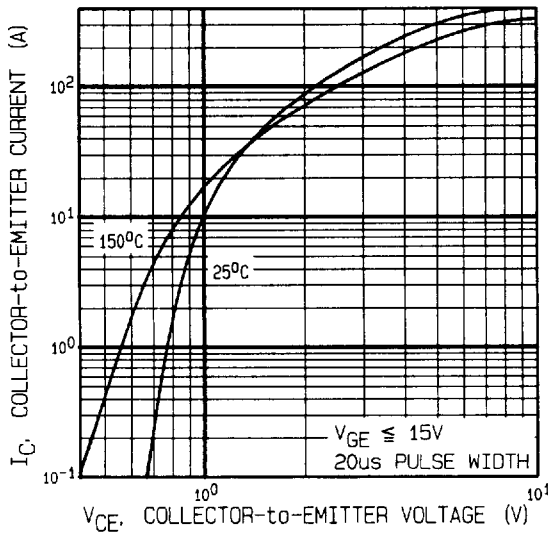


Fig. 2. Typical Output Characteristics
 $T_J = 25^\circ C$
 $T_J = 150^\circ C$

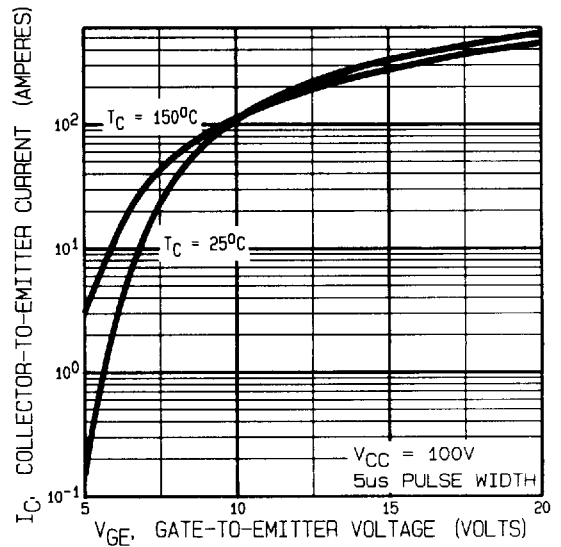


Fig. 3. Typical Transfer Characteristics
 $T_J = 25^\circ C$
 $T_J = 150^\circ C$

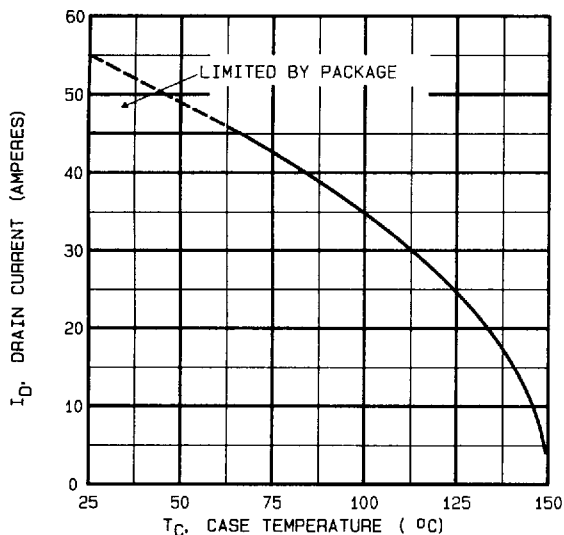


Fig. 4 Maximum Collector Current vs. Case Temperature

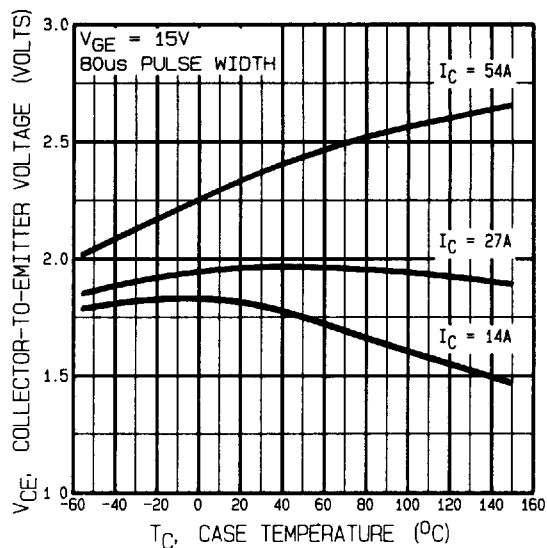


Fig. 5. Collector-to-Emitter Saturation Voltage vs. Case Temperature

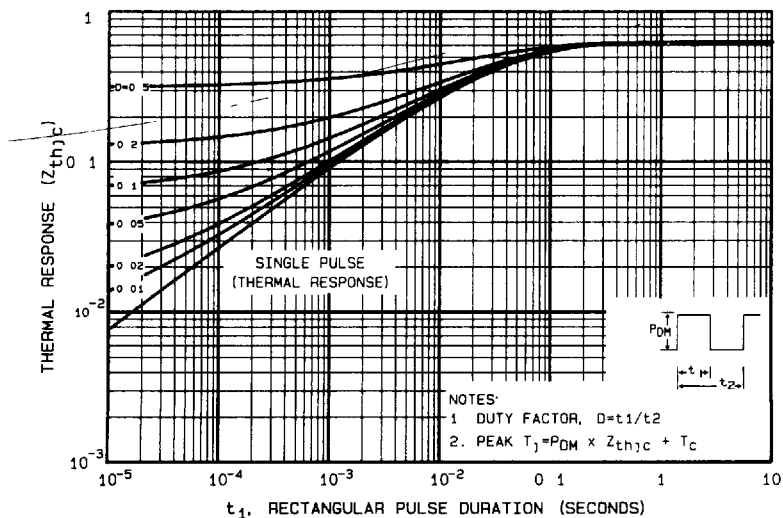
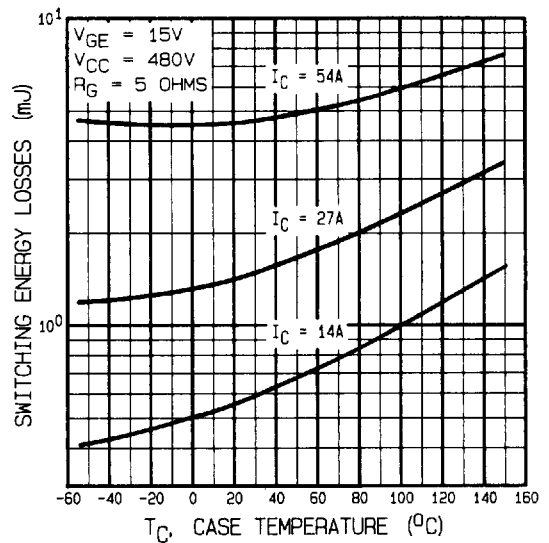
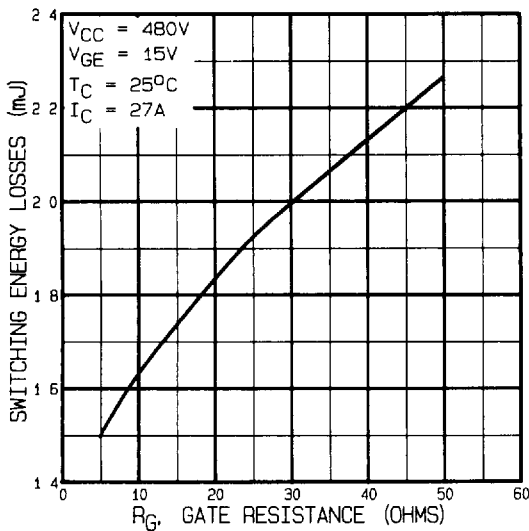
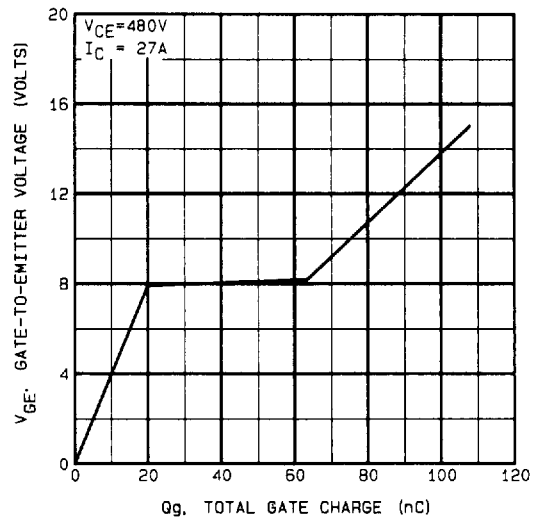
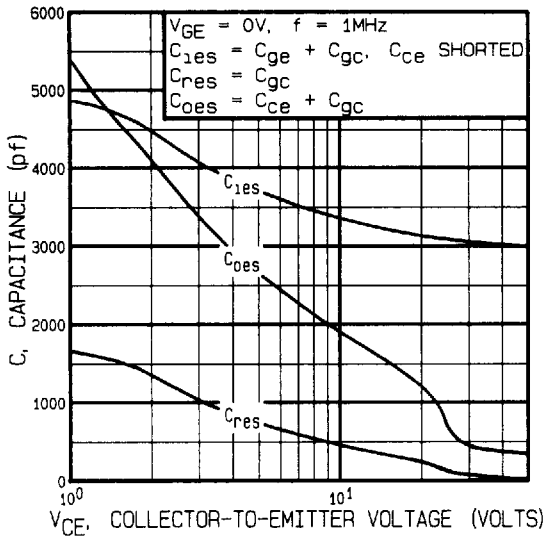


Fig. 6. Maximum Effective Transient Thermal Impedance, Junction-to-Case



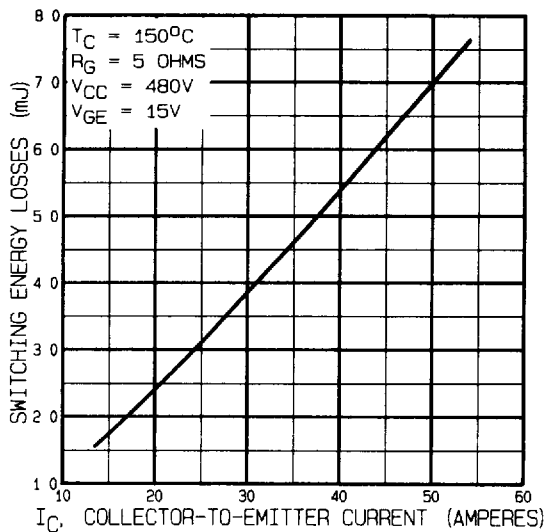
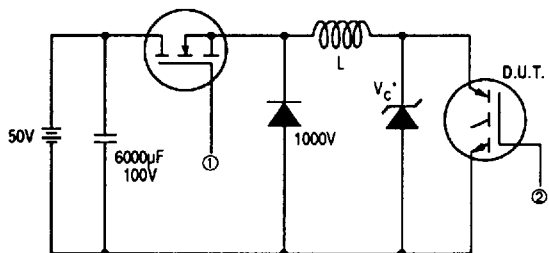


Fig. 11. Typical Switching Losses vs. Collector-to-Emitter Current



* Driver same type as D.U.T.; $V_c = 80\%$ of $V_{ce(max)}$
 * Note: Due to the 50V power supply, pulse width and inductor will increase to obtain rated I_d

Fig. 12a. Clamped Inductive Load Test Circuit

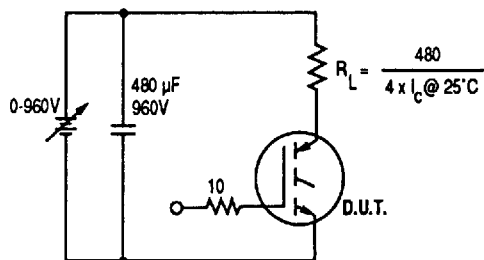


Fig. 12b. Pulsed Collector Current Test Circuit

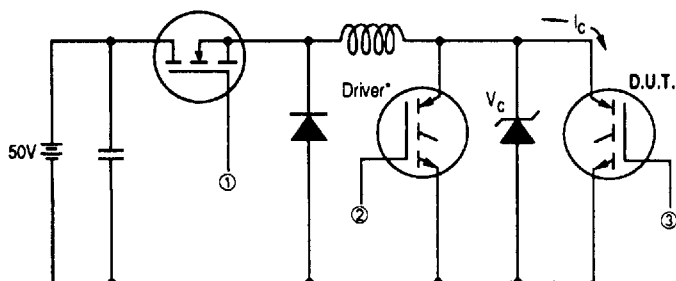


Fig 13a. Switching Loss Test Circuit

* Driver same type as D.U.T., $V_c = 480V$

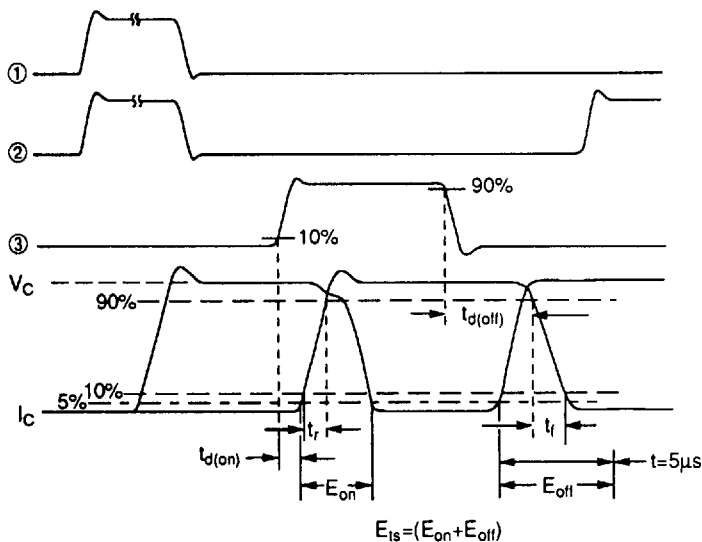
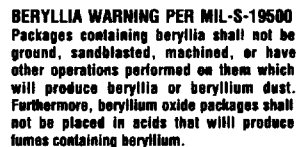


Fig 13b. Switching Loss Waveforms



4855452 0018717 965