

The ITH13F06 is a very robust n-channel, enhancement mode insulated gate bipolar transistor (IGBT) designed for low power dissipation in a wide range of high voltage applications such as power supplies and motor drives. The high impedance gate simplifies gate drive considerations, allowing operation directly from low power control circuitry.

The device is optimised for high frequency operation with fast rise and fall times. The product is suitable for modern systems employing switching frequencies up to and beyond the audible spectrum.

Low saturation voltages minimise power dissipation, thereby reducing the cost of the overall system in which they are used.

The ITH is fully short circuit rated making it especially suited for motor control and other applications requiring short circuit withstand capability. Each device in the Powerline range is available with or without an integral anti-parallel ultrafast soft recovery diode, see separate datasheet for co-pack device.

Typical applications include high frequency inverters for motor control, pwm, welding and heating apparatus. The Powerline range of IGBTs is also applicable to switched mode (SMPS) and uninterruptible power supplies (UPS).

## FEATURES

- Enhancement Mode n-Channel Device
- High Switching Speed
- Low On-state Saturation Voltage
- High Input Impedance Simplifies Gate Drive
- Latch-Free Operation
- Fully Short Circuit Rated To 10μs
- Square RBSOA

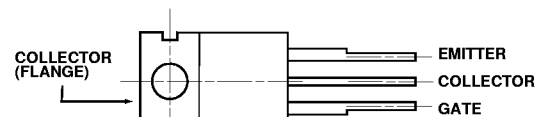
## APPLICATIONS

- High Frequency Inverters
- Motor Control
- Switched Mode Power Supplies
- High Frequency Welding
- UPS Systems
- PWM Drives

Caution: These devices are sensitive to electrostatic discharge. Users should observe proper ESD handling precautions.

## KEY PARAMETERS

$V_{CES}$		600V
$V_{CE(sat)}$	(typ)	2.3V
$I_{C25}$	(max)	23A
$I_{C85}$	(max)	13A
$I_{CM}$	(max)	39A
$t_{sc}$	(max)	10μs



Outline type code: TO220

(See Package Outlines for further information)

Fig.1 Pin connections - top view (not to scale)

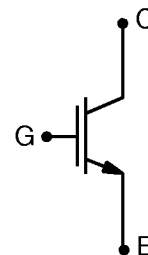


Fig.2 ITH13F06 circuit

## ORDERING INFORMATION

ITH13F06B TO220

Note: When ordering, use the complete part number.

ITH13F06

ABSOLUTE MAXIMUM RATINGS

Stresses above those listed under 'Absolute Maximum Ratings' may cause permanent damage to the device.

T<sub>case</sub> = 25°C unless stated otherwise.

Symbol	Parameter	Test Conditions	Max.	Units
V <sub>CES</sub>	Collector-emitter voltage	V <sub>GE</sub> = 0V	600	V
V <sub>GES</sub>	Gate-emitter voltage	-	±20	V
I <sub>C25</sub>	Continuous collector current	T <sub>case</sub> = 25°C	23	A
I <sub>C85</sub>	Continuous collector current	T <sub>case</sub> = 85°C	13	A
I <sub>CM</sub>	Pulsed collector current	1ms, T <sub>case</sub> = 85°C	39	A
P <sub>tot</sub>	Power dissipation	T <sub>case</sub> = 85°C	54	W

THERMAL AND MECHANICAL RATINGS

Symbol	Parameter	Conditions	Min.	Max.	Units
R <sub>th(j-c)</sub>	Thermal resistance	DC junction to case	-	1.2	°C/W
T <sub>OP</sub>	Operating junction temperature range	-	−40	150	°C
T <sub>slg</sub>	Storage temperature range	-	−40	150	°C
-	Mounting torque	M3 screw	-	1.1	Nm

DC ELECTRICAL CHARACTERISTICS

T<sub>case</sub> = 25°C unless stated otherwise.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
I <sub>CES</sub>	Collector cut-off current	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V	-	-	0.25	mA
I <sub>GES</sub>	Gate leakage current	V <sub>GE</sub> = 20V, V <sub>CE</sub> = 0V	-	-	±500	nA
V <sub>GE(TH)</sub>	Gate threshold voltage	I <sub>C</sub> = 0.5mA, V <sub>CE</sub> = V <sub>GE</sub>	4.5	6	7.5	V
V <sub>CE(SAT)</sub>	Collector-emitter saturation voltage	V <sub>GE</sub> = 15V, I <sub>C</sub> = 13A	-	2.3	2.8	V
		V <sub>GE</sub> = 15V, I <sub>C</sub> = 13A, T <sub>j</sub> = 125°C	-	2.5	-	V

## AC ELECTRICAL CHARACTERISTICS

 $T_{\text{case}} = 25^{\circ}\text{C}$  unless stated otherwise.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
$C_{\text{ies}}$	Input capacitance	$V_{\text{CE}} = 25\text{V}$ , $V_{\text{GE}} = 15\text{V}$ , $f = 1\text{MHz}$	-	1470	-	pF
$C_{\text{oes}}$	Output capacitance	$V_{\text{CE}} = 25\text{V}$ , $V_{\text{GE}} = 15\text{V}$ , $f = 1\text{MHz}$	-	118	-	pF
$C_{\text{res}}$	Reverse transfer capacitance	$V_{\text{CE}} = 25\text{V}$ , $V_{\text{GE}} = 15\text{V}$ , $f = 1\text{MHz}$	-	15.6	-	pF

## INDUCTIVE SWITCHING CHARACTERISTICS - see figures 3 to 5

 $T_{\text{case}} = 25^{\circ}\text{C}$  unless stated otherwise.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
$t_{d(ON)}$	Turn-on delay time	$I_C = 13A,$ $V_{GE} = 15V,$ $V_{CE} = 50\%V_{ces}$ $R_{G(ON)} = R_{G(OFF)} = 5\Omega$	-	85	-	ns
$t_r$	Rise time		-	32	-	ns
$E_{ON}$	Turn-on energy loss - per cycle		-	180	-	$\mu J$
$t_{d(OFF)}$	Turn-off delay time		-	145	-	ns
$t_f$	Fall time		-	150	300	ns
$E_{OFF}$	Turn-off energy loss - per cycle		-	380	-	$\mu J$
<b><math>T_{case} = 125^{\circ}C</math> unless stated otherwise.</b>						
$t_{d(ON)}$	Turn-on delay time	$I_C = 13A,$ $V_{GE} = 15V,$ $V_{CE} = 50\%V_{ces}$ $R_{G(ON)} = R_{G(OFF)} = 5\Omega$	-	85	-	ns
$t_r$	Rise time		-	35	-	ns
$E_{ON}$	Turn-on energy loss - per cycle		-	300	-	$\mu J$
$t_{d(OFF)}$	Turn-off delay time		-	160	-	ns
$t_f$	Fall time		-	290	-	ns
$E_{OFF}$	Turn-off energy loss - per cycle		-	600	-	$\mu J$

For additional switching information please refer to figures 8 to 13.

## SHORT CIRCUIT RATING

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
$t_{\text{sc}}$	Short circuit withstand time	$T_{\text{c}} = 125^{\circ}\text{C}$ , $V_{\text{GE}} = 15\text{V}$ , $V_{\text{CE}} = 50\% V_{\text{CES}}$	-	-	10	$\mu\text{s}$

Caution: These devices are sensitive to electrostatic discharge. Users should observe proper ESD handling precautions.

BASIC TEST CIRCUIT AND SWITCHING DEFINITIONS

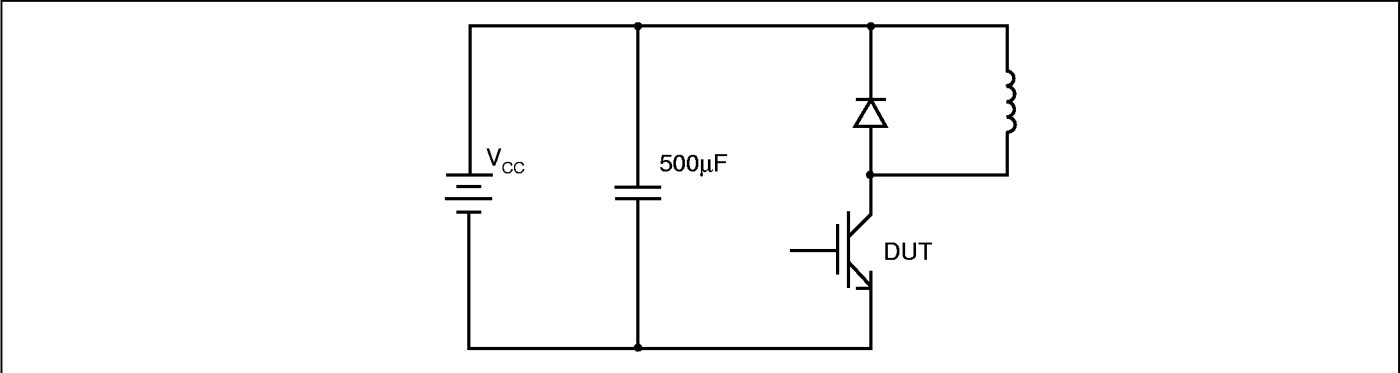


Fig.3 Basic d.c. chopper circuit

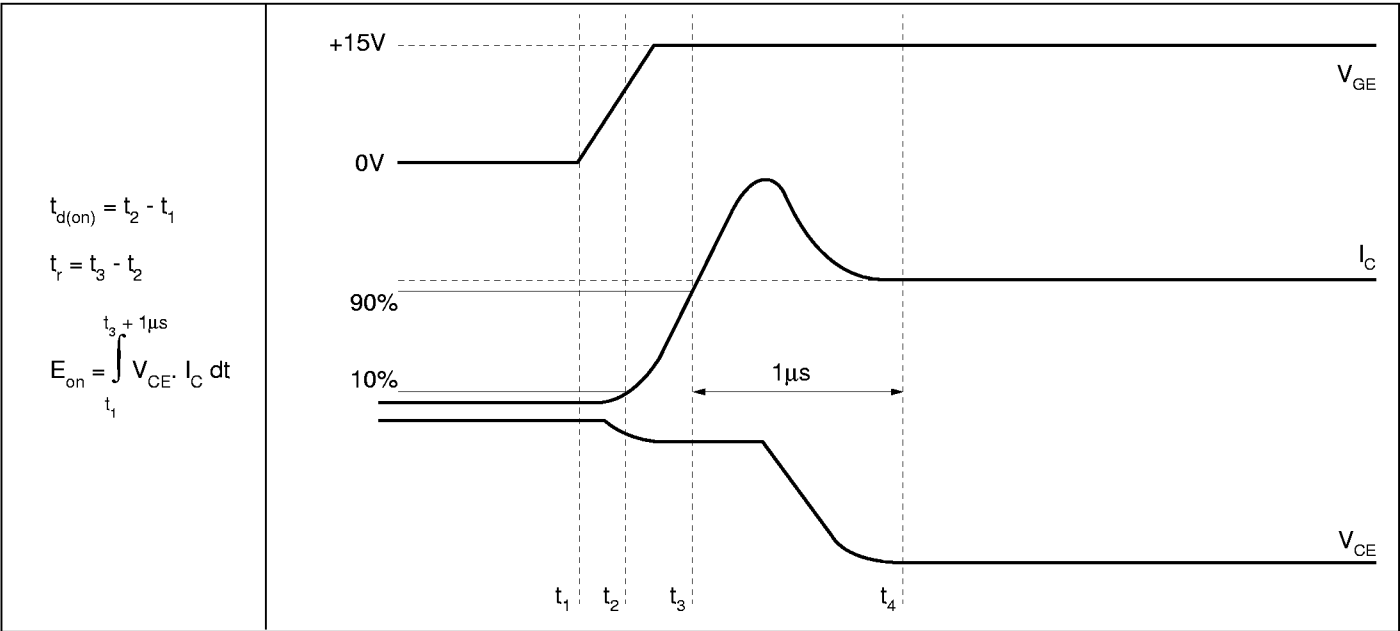


Fig.4 Turn-on characteristics

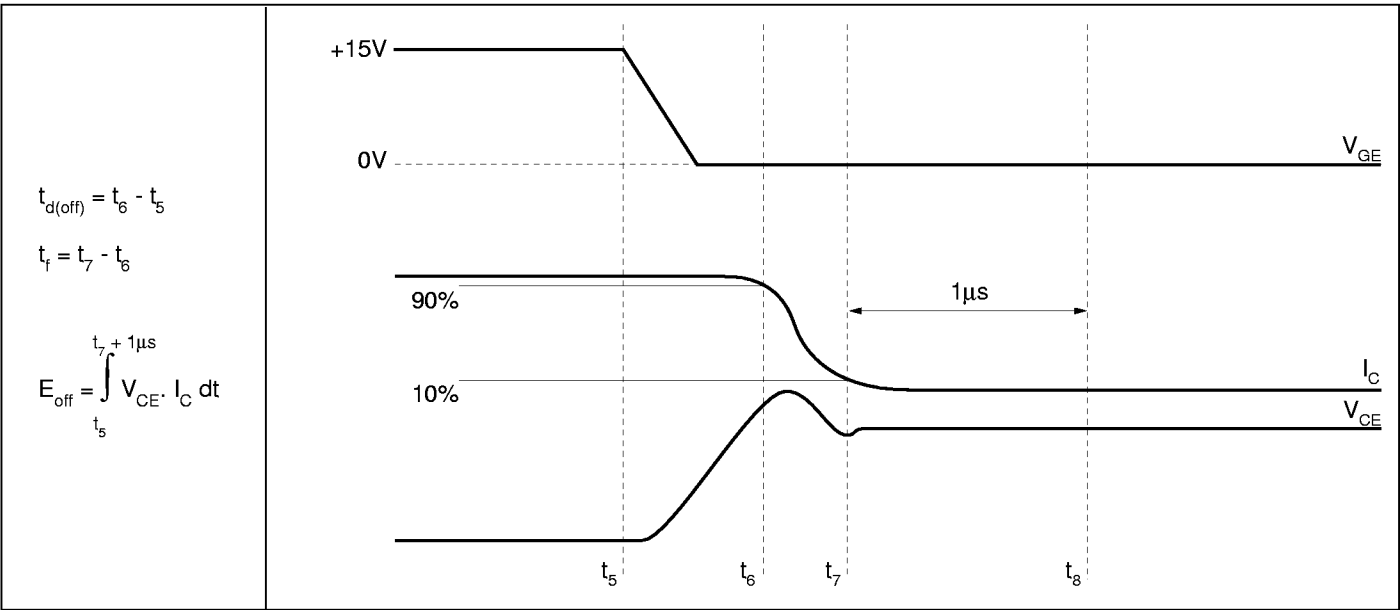
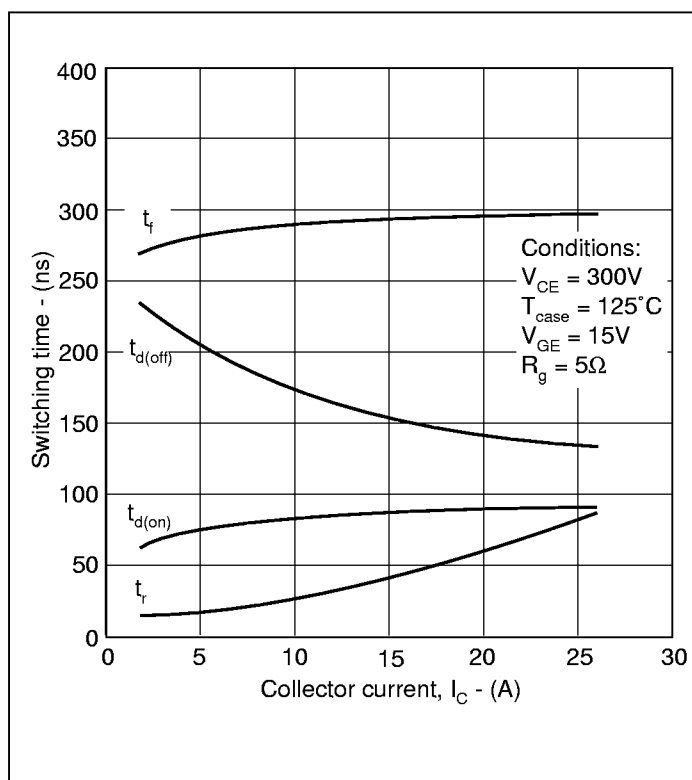
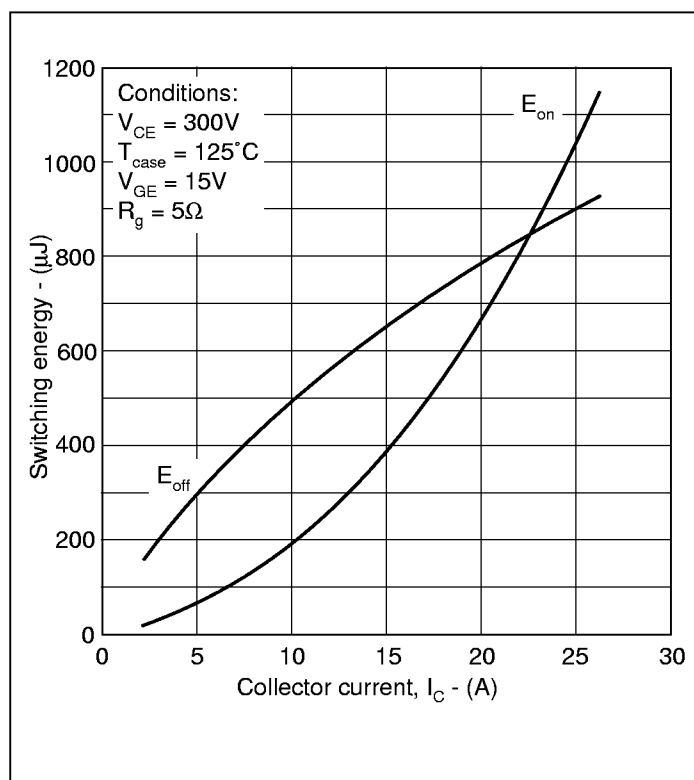
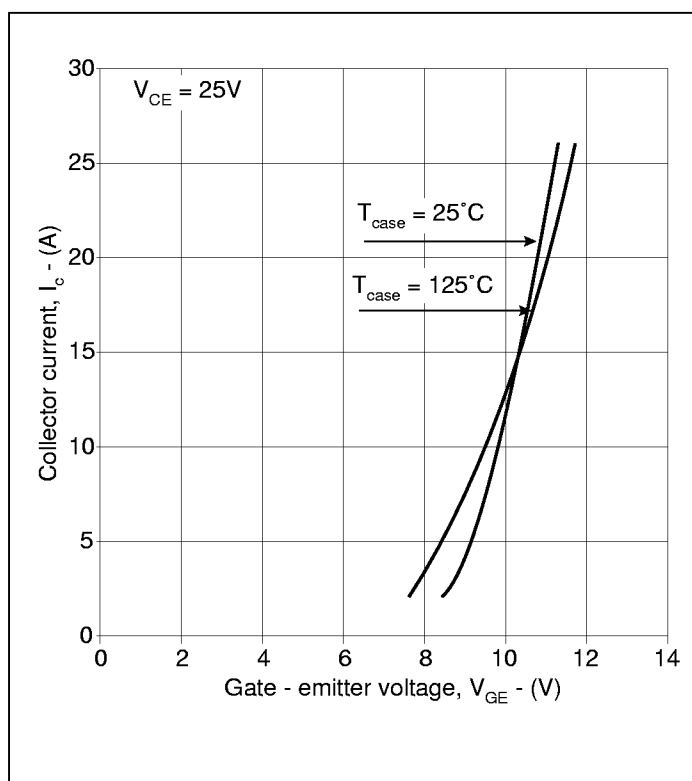
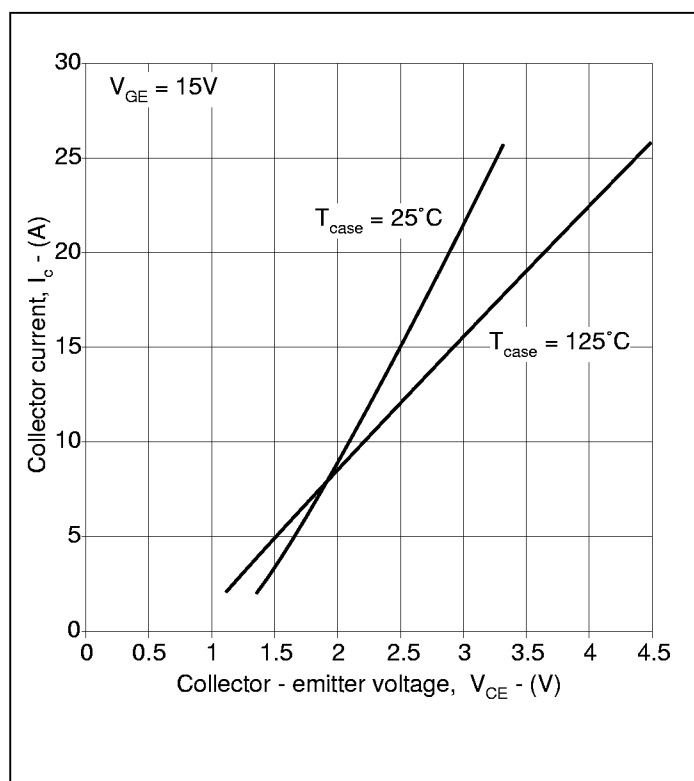


Fig.5 Turn-off characteristics

## CURVES



Caution: These devices are sensitive to electrostatic discharge. Users should observe proper ESD handling precautions.

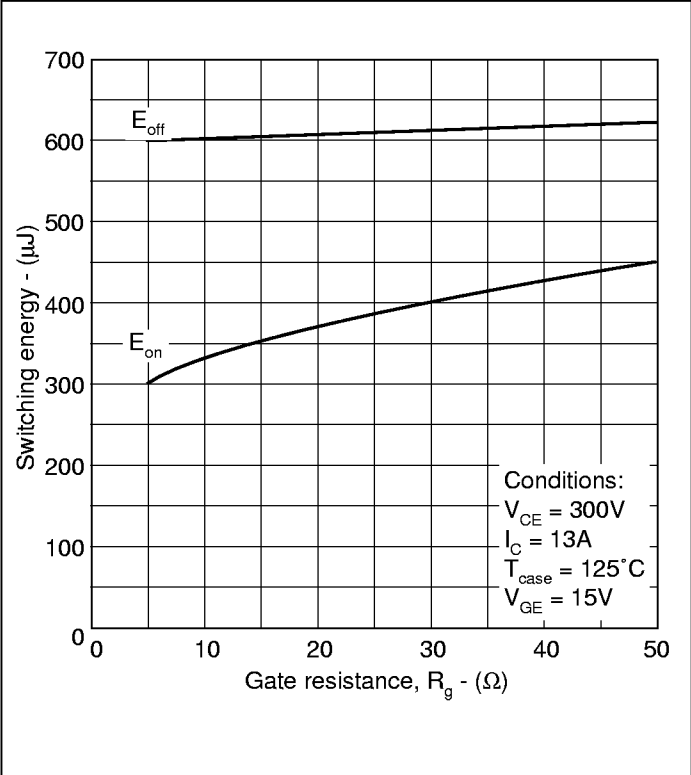


Fig.10 Typical switching losses vs gate resistance

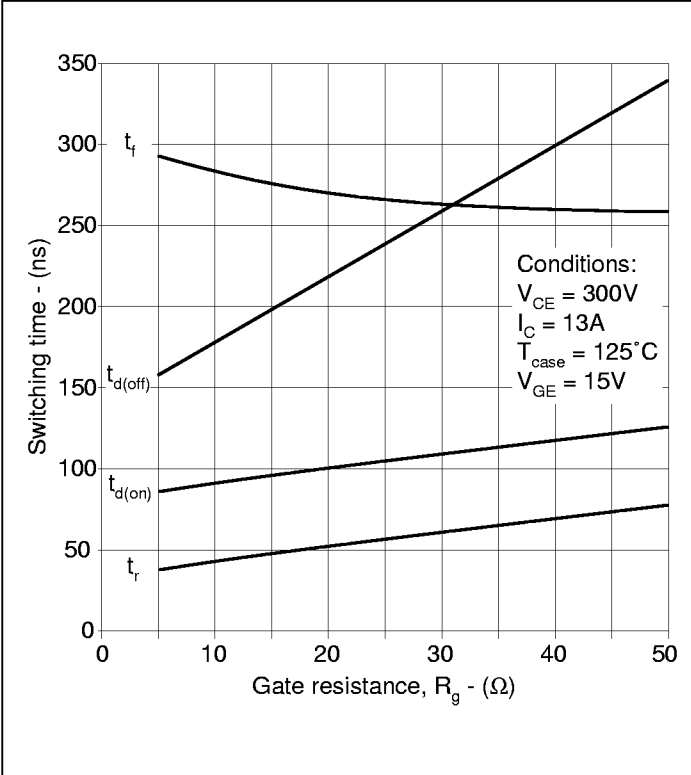


Fig.11 Typical switching time vs gate resistance

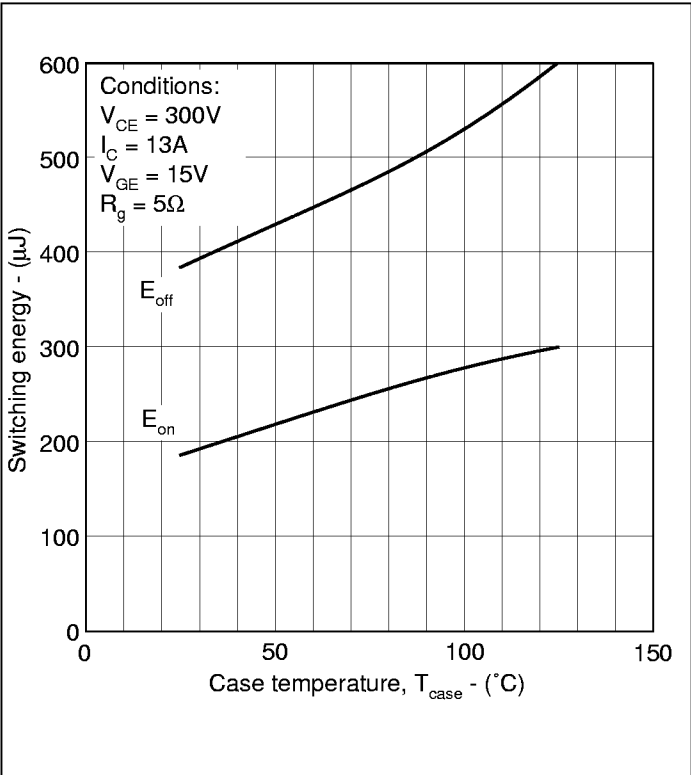


Fig.12 Typical switching losses vs case temperature

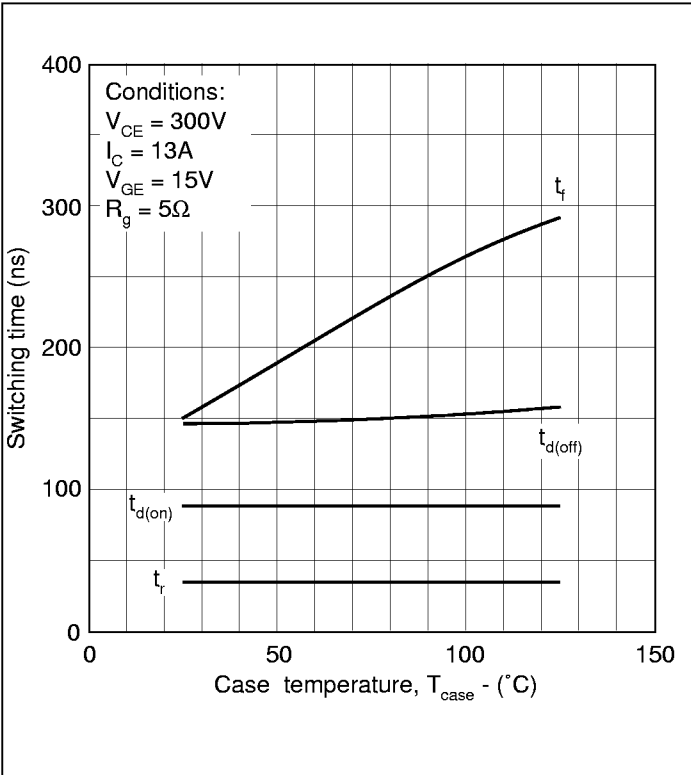


Fig.13 Typical switching time vs case temperature

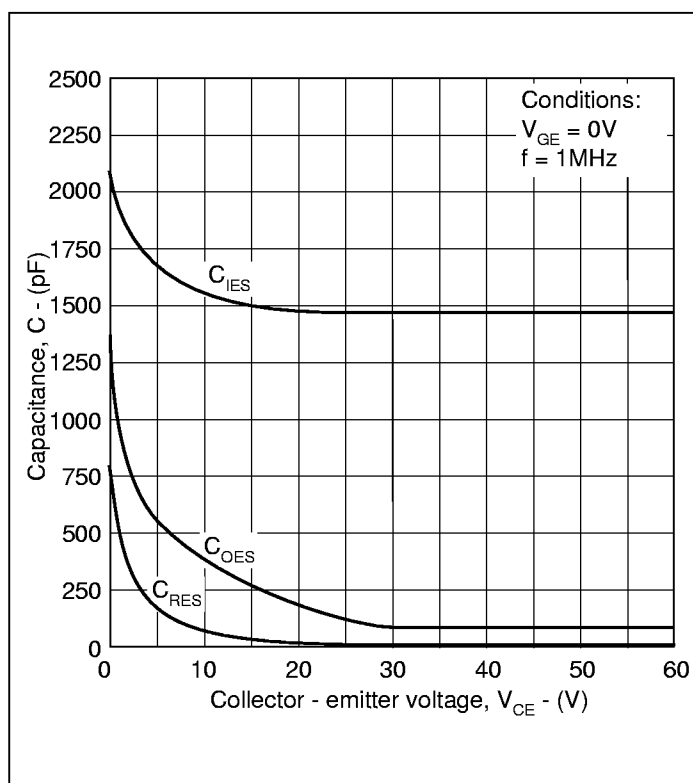


Fig.14 Typical capacitance

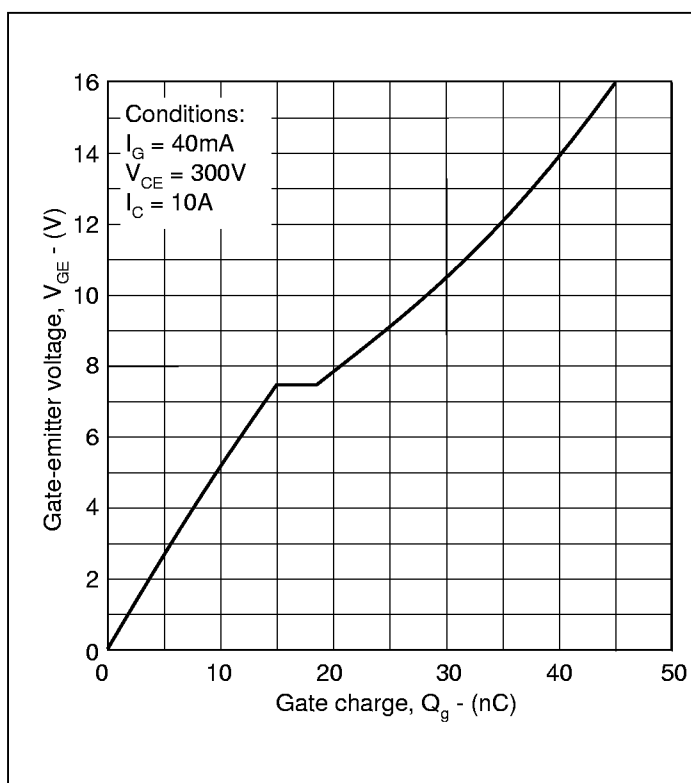


Fig.15 Typical gate charge

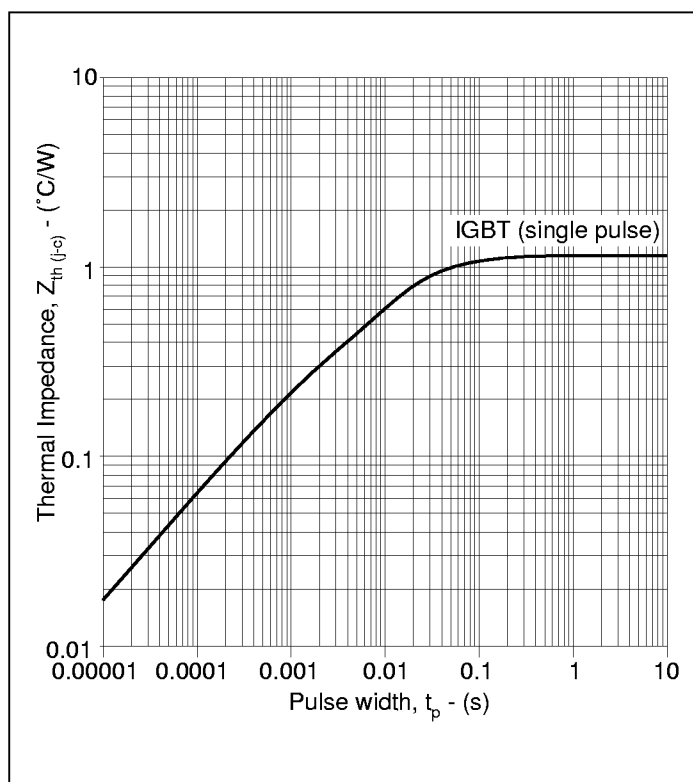


Fig.16 Transient thermal impedance - junction to case

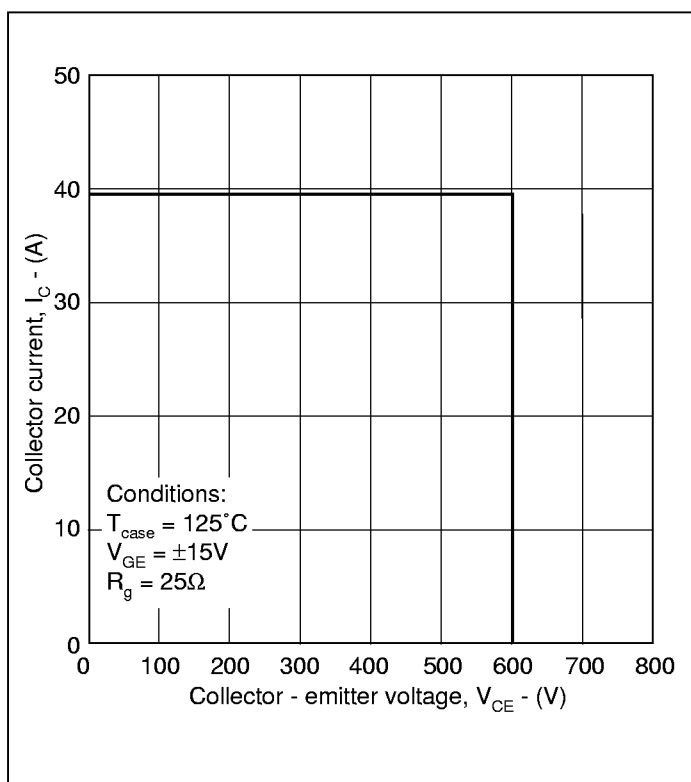


Fig.17 Reverse bias safe operating area

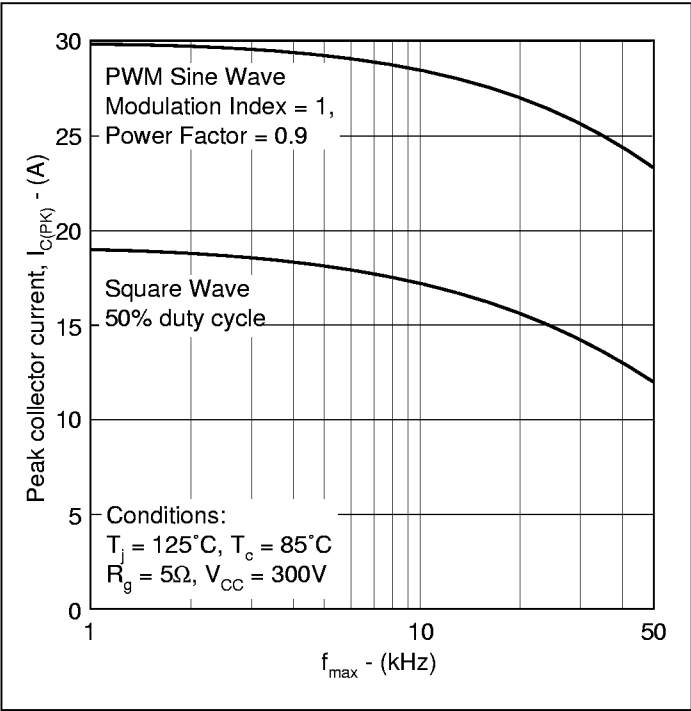


Fig.18 Three Phase PWM inverter operating frequency

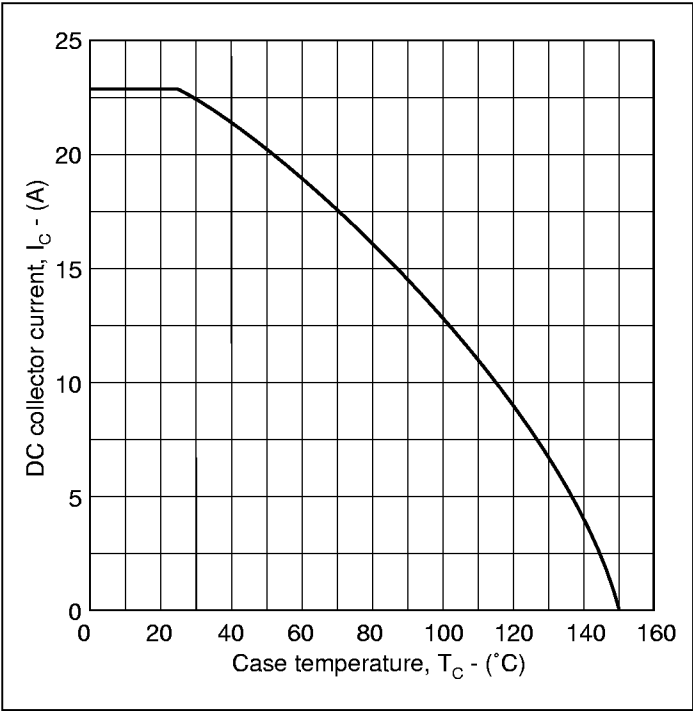


Fig.19 DC current rating vs case temperature

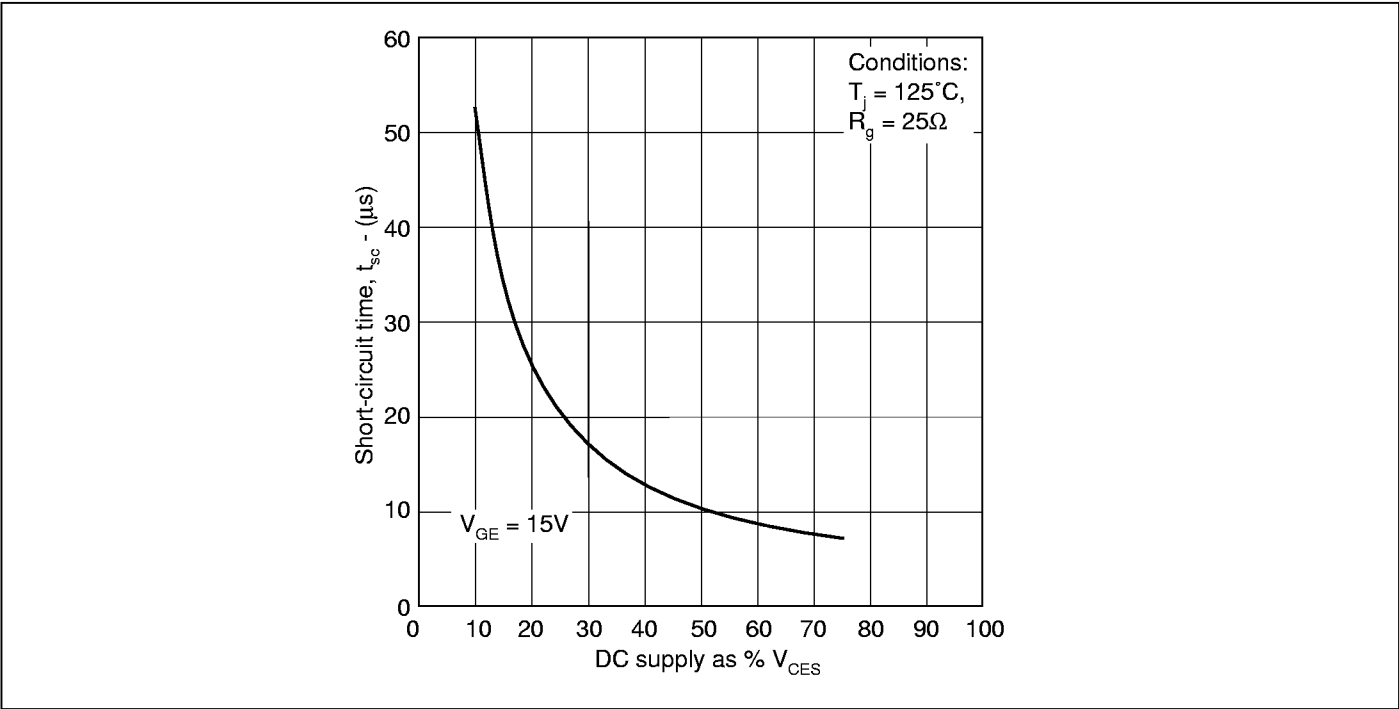
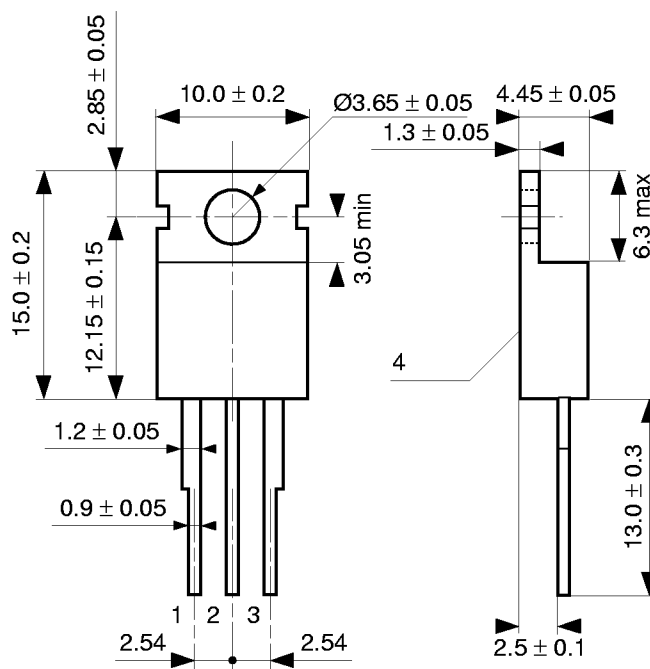


Fig.20 Short circuit withstand



## PACKAGE OUTLINE - TO220

For further package information, please contact your local Customer Service Centre. All dimensions in mm, unless stated otherwise.  
DO NOT SCALE.



Terminal 1 - Gate  
Terminal 2 - Collector  
Terminal 3 - Emitter  
Terminal 4 - Collector



## HEADQUARTERS POWER OPERATIONS

**MITEL SEMICONDUCTOR**

Doddington Road, Lincoln,  
LN6 3LF, United Kingdom.  
Tel: + 44 (0)1522 500500  
Fax: + 44 (0)1522 500550

**Internet:** <http://www.mitelsemi.com>

**e-mail: [power\\_solutions@mitel.com](mailto:power_solutions@mitel.com)**

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