ITS13C06

Powerline N-Channel IGBT With Ultrafast Diode

Advance Information

Supersedes February 1998 version 2.2

DS4738 - 3.1 March 1998

The ITS13C06 is a 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.

Fast rise and fall times allow very high frequency switching making the device suitable for modern systems employing high frequency switching.

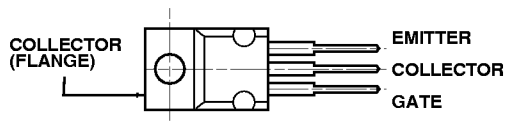
Low saturation voltages minimise power dissipation, thereby reducing the cost of the overall system in which they are used.

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

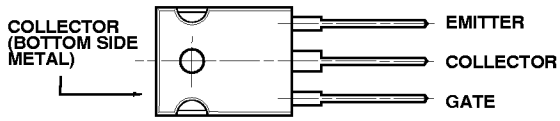
Typical applications include high frequency inverters for motor control, welding and heating apparatus. The Powerline range of IGBTs is also applicable to switched mode and uninterruptible power supplies.

KEY PARAMETERS

V_{CES}	(max)	600V
$V_{CE(sat)}$	(typ)	2.1V
I_{C25}	(max)	26A
I_{C85}	(max)	13A
I_{CM}	(max)	26A
t_{sc}	(max)	10µs



Outline type code: TO220



Outline type code: TO247

(See Package Outlines for further information)

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

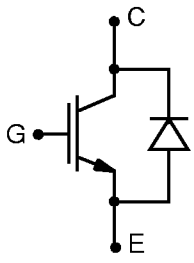


Fig.2 ITS13C06 circuit

FEATURES

- Enhancement Mode n-Channel Device
- High Switching Speed
- Low On-state Saturation Voltage
- High Input Impedance Simplifies Gate Drive
- Latch-Free Operation
- Short Circuit Rated
- Integral Fast Recovery Diode

APPLICATIONS

- High Frequency Inverters
- Motor Control
- Switched Mode Power Supplies
- High Frequency Welding
- Heating/Cooking Apparatus

ORDERING INFORMATION

ITS13C06B*	TO220 (with fast recovery diode)
ITS13C06P	TO247 (with fast recovery diode)

*TO220 is the preferred outline for this device.

ABSOLUTE MAXIMUM RATINGS

Stresses above those listed under 'Absolute Maximum Ratings' may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to Absolute Maximum Ratings for extended periods may affect device reliability.

T_{case} = 25°C unless stated otherwise.

Symbol	Parameter	Test Conditions	Max.	Units
V_{CES}	Collector-emitter voltage	V_{GE} = 0V	600	V
V_{GES}	Gate-emitter voltage	-	±20	V
I_{C25}	Continuous collector current	T_{case} = 25°C	26	A
I_{C85}	Continuous collector current	T_{case} = 85°C	13	A
I_{CM}	Pulsed collector current	1ms, T_{case} = 85°C	26	A
P_{tot}	Power dissipation	T_{case} = 85°C	54	W

THERMAL AND MECHANICAL RATINGS

Symbol	Parameter	Conditions	Min.	Max.	Units
$R_{th(j-c)}$	Thermal resistance - IGBT	DC junction to case	-	1.2	°C/W
$R_{th(j-c)}$	Thermal resistance - Diode	DC junction to case	-	3.0	°C/W
T_{OP}	Operating junction temperature range	-	–40	150	°C
T_{stg}	Storage temperature range	-	–40	150	°C
-	Mounting torque	M3 screw	-	1.1	Nm

DC ELECTRICAL CHARACTERISTICS

T_{case} = 25°C unless stated otherwise.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
I_{CES}	Collector cut-off current	V_{GE} = 0V, V_{CE} = 600V	-	-	0.5	mA
I_{GES}	Gate leakage current	V_{GE} = 20V, V_{CE} = 0V	-	-	±500	nA
$V_{GE(TH)}$	Gate threshold voltage	I_C = 0.5mA, V_{CE} = V_{GE}	4	6	7.5	V
$V_{CE(SAT)}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 13A	-	2.1	2.7	V
		V_{GE} = 15V, I_C = 13A, T_j = 125°C	-	2.3	-	V

AC ELECTRICAL CHARACTERISTICS

T_{case} = 25°C unless stated otherwise.

Symbol		Conditions	Min.	Typ.	Max.	Units
C_{ies}	Input capacitance	V_{CE} = 25V, V_{GE} = 15V, f = 1MHz	-	1000	-	pF
C_{oes}	Output capacitance	V_{CE} = 25V, V_{GE} = 15V, f = 1MHz	-	260	-	pF
C_{res}	Reverse transfer capacitance	V_{CE} = 25V, V_{GE} = 15V, f = 1MHz	-	230	-	pF

INDUCTIVE SWITCHING CHARACTERISTICS - see figures 3 to 5

T_{case} = 25°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}, $R_{G(ON)}$ = $R_{G(OFF)}$ = 25Ω	-	140	-	ns
t_r	Rise time		-	22	-	ns
E_{ON}	Turn-on energy loss - per cycle		-	0.25	-	mJ
$t_{d(OFF)}$	Turn-off delay time		-	180	-	ns
t_f	Fall time		-	300	500	ns
E_{OFF}	Turn-off energy loss - per cycle		-	0.6	-	mJ
T_{case} = 125°C unless stated otherwise.						
$t_{d(ON)}$	Turn-on delay time	I_C = 13A, V_{GE} = ±15V, V_{CE} = 50%V_{ces}, $R_{G(ON)}$ = $R_{G(OFF)}$ = 25Ω	-	144	-	ns
t_r	Rise time		-	28	-	ns
E_{ON}	Turn-on energy loss - per cycle		-	0.4	-	mJ
$t_{d(OFF)}$	Turn-off delay time		-	160	-	ns
t_f	Fall time		-	620	-	ns
E_{OFF}	Turn-off energy loss - per cycle		-	1.1	-	mJ

SHORT CIRCUIT RATING

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
t_{sc}	Short circuit withstand time	T_c = 125°C, V_{GE} = 15V, V_{CE} = 50% V_{CES}	-	-	10	µs

DIODE CHARACTERISTICS

T_c = 25°C unless stated otherwise.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
V_{FM}	Forward voltage	At I_F = 13A peak	-	1.4	-	V
		At I_F = 13A peak, T_{case} = 125°C	-	1.3	-	V
t_{rr}	Reverse recovery time	I_F = 13A, di_{RR}/dt = 200A/µs	-	60	-	ns
I_{RRM}	Reverse recovery current	V_R = 50%V_{RRM}	-	10	-	A

BASIC TEST CIRCUIT AND SWITCHING DEFINITIONS

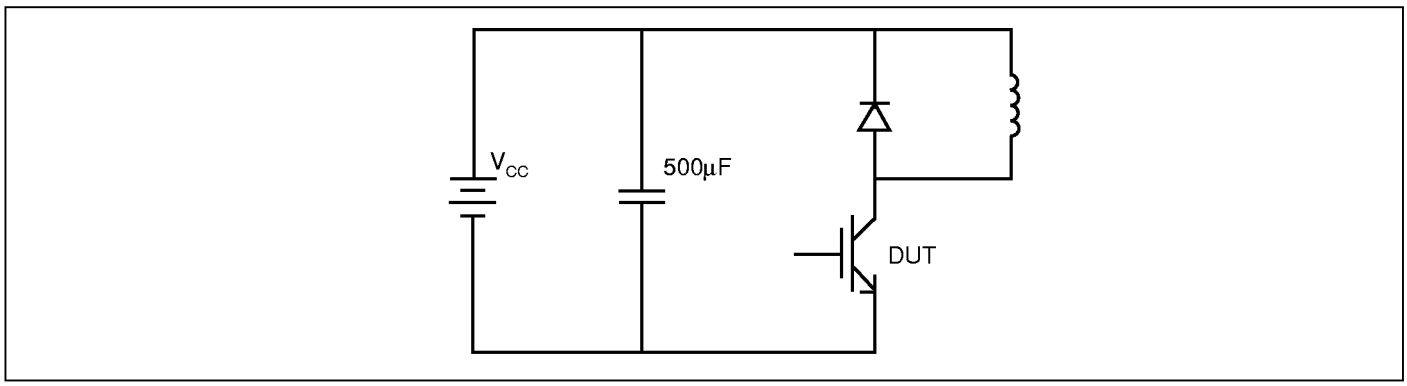


Fig.3 Basic d.c. chopper ciruit

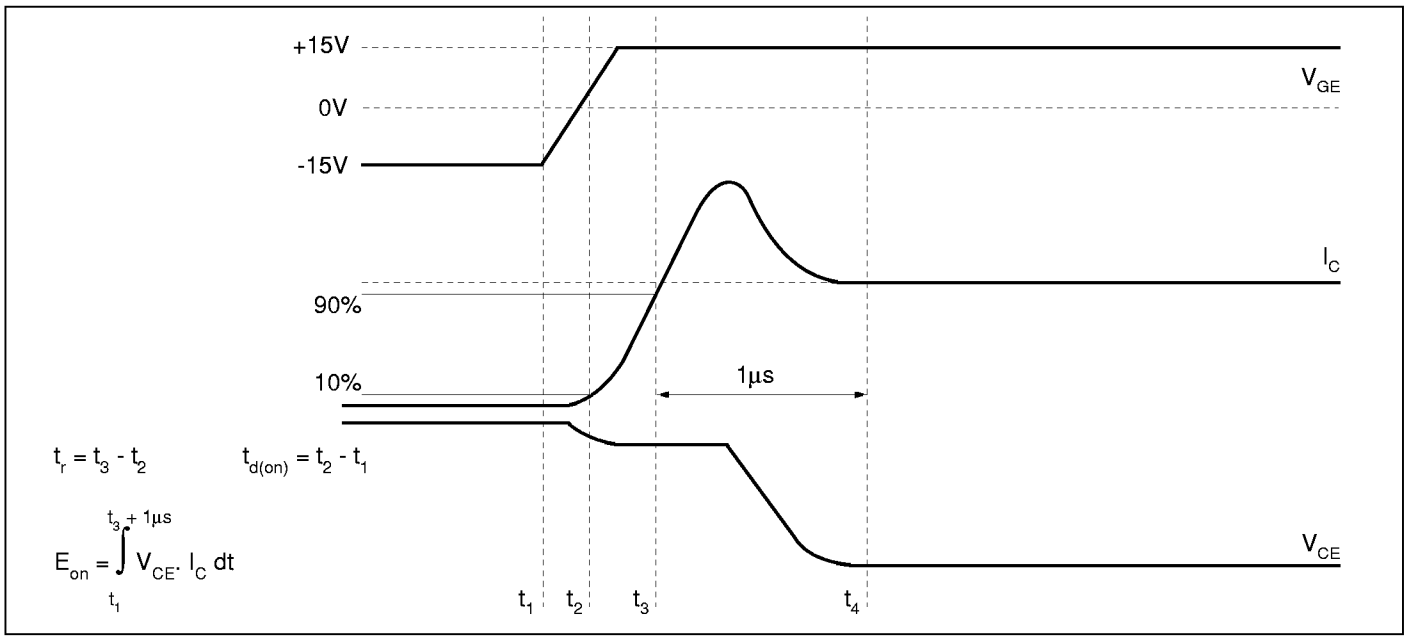


Fig.4 Turn-on characteristics

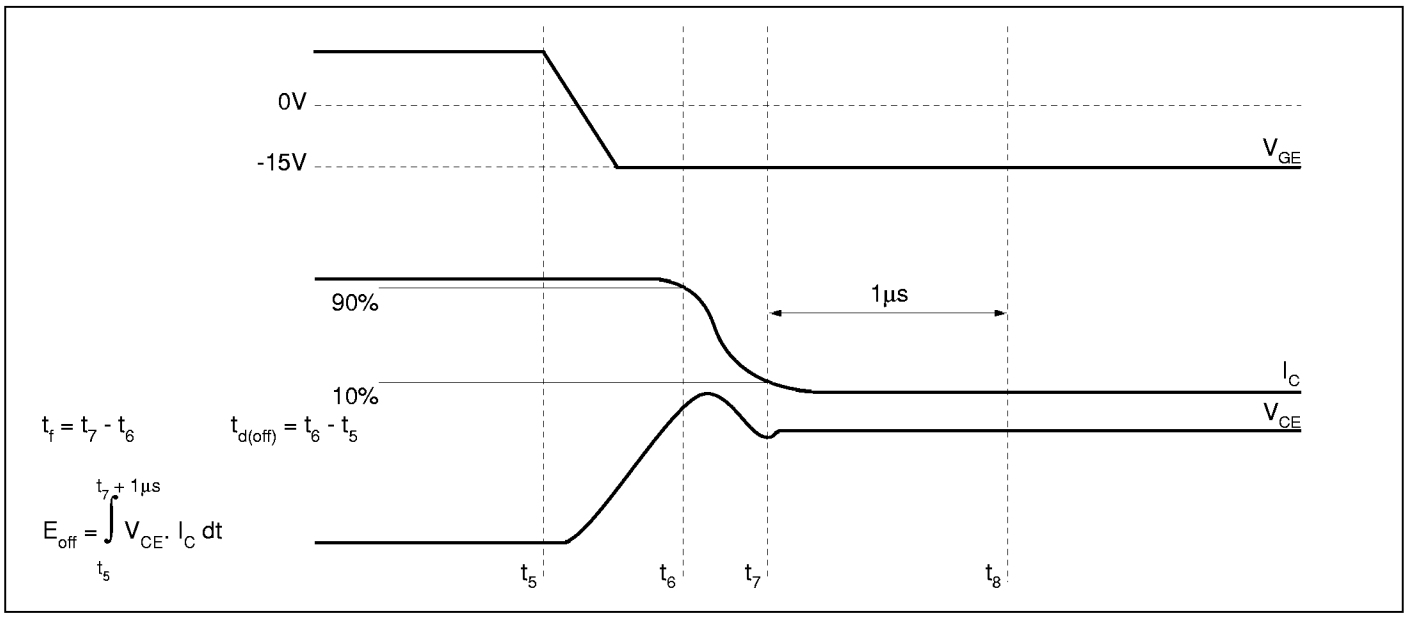


Fig.5 Turn-off characteristics

CURVES

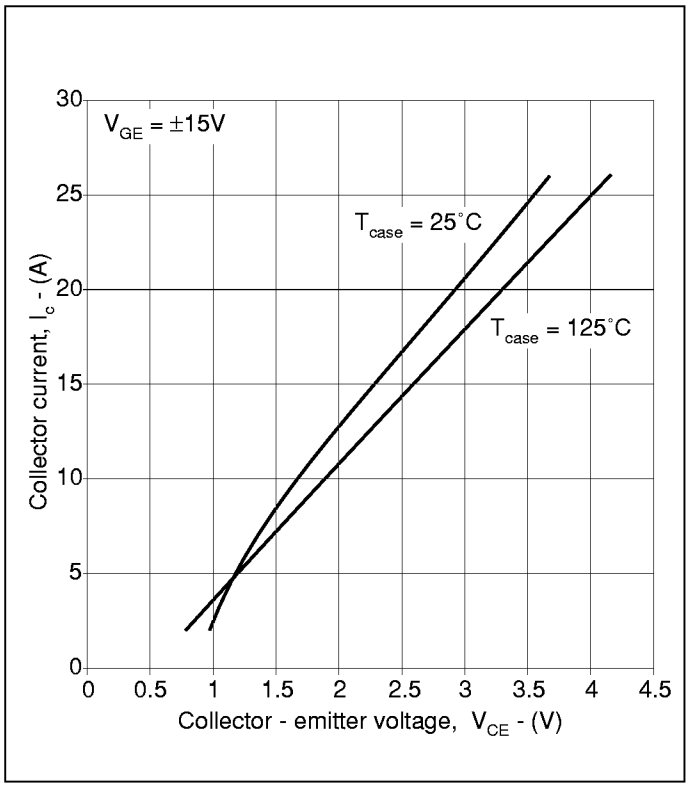


Fig.6 Typical output characteristics

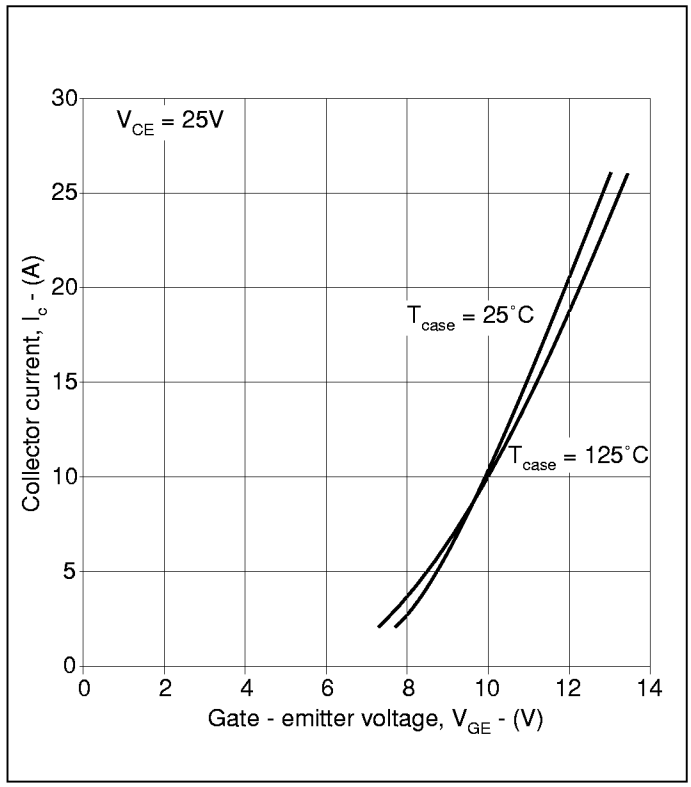


Fig.7 Typical transfer characteristics

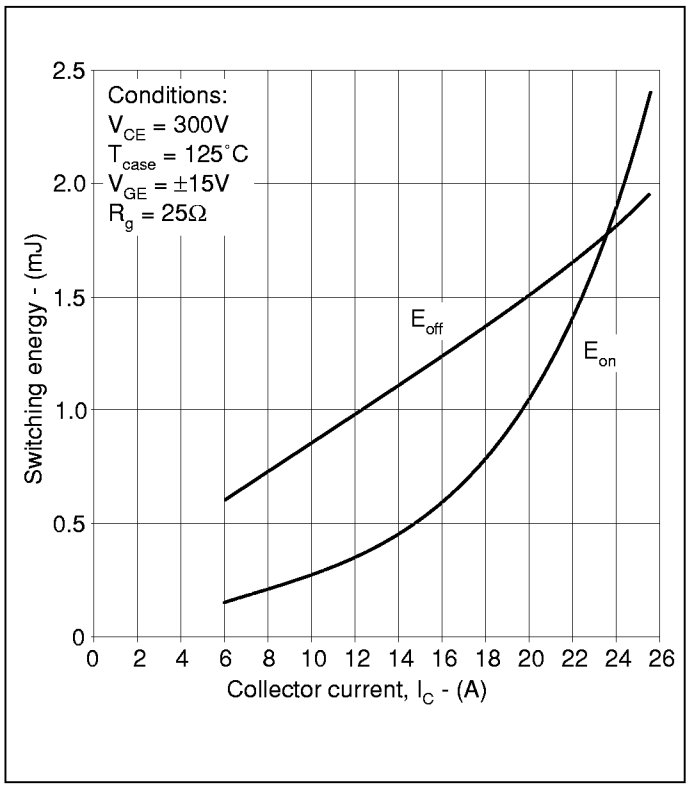


Fig.8 Typical switching losses vs collector current

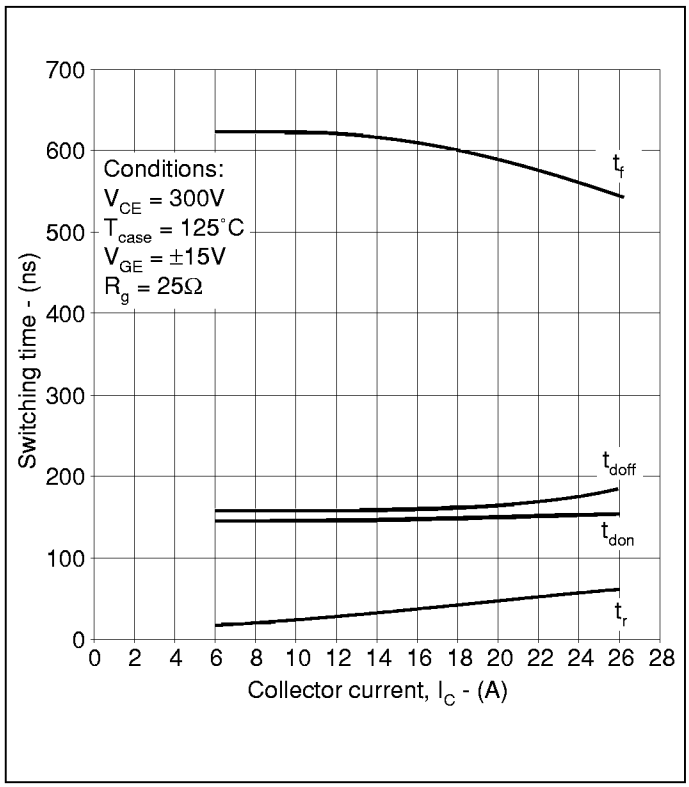


Fig.9 Typical switching times vs collector current

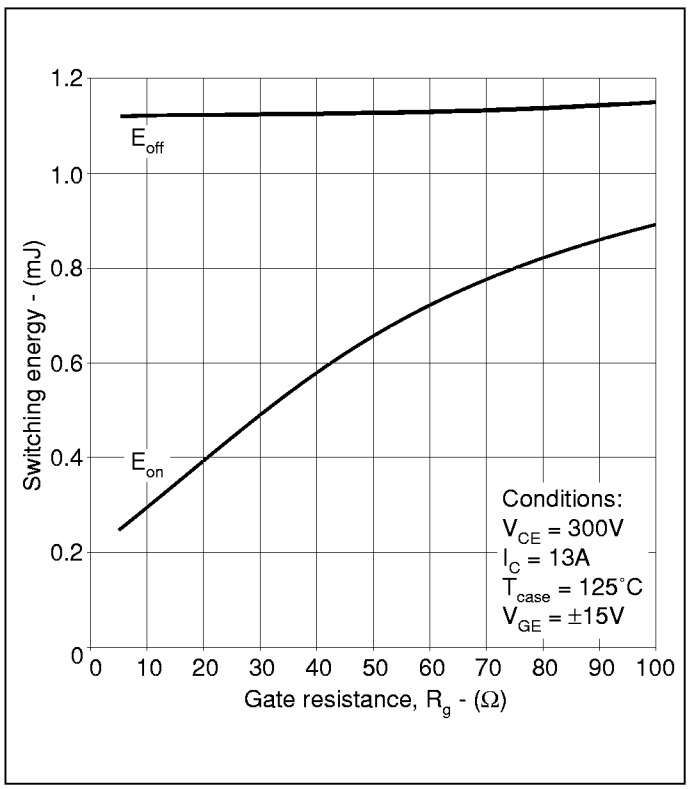


Fig.10 Typical switching losses vs gate resistance

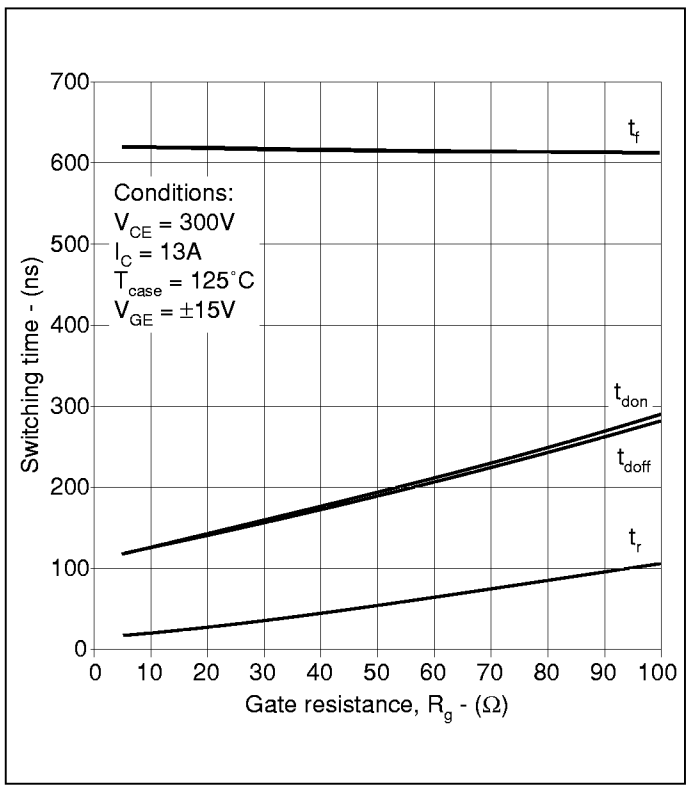


Fig.11 Typical switching times vs gate resistance

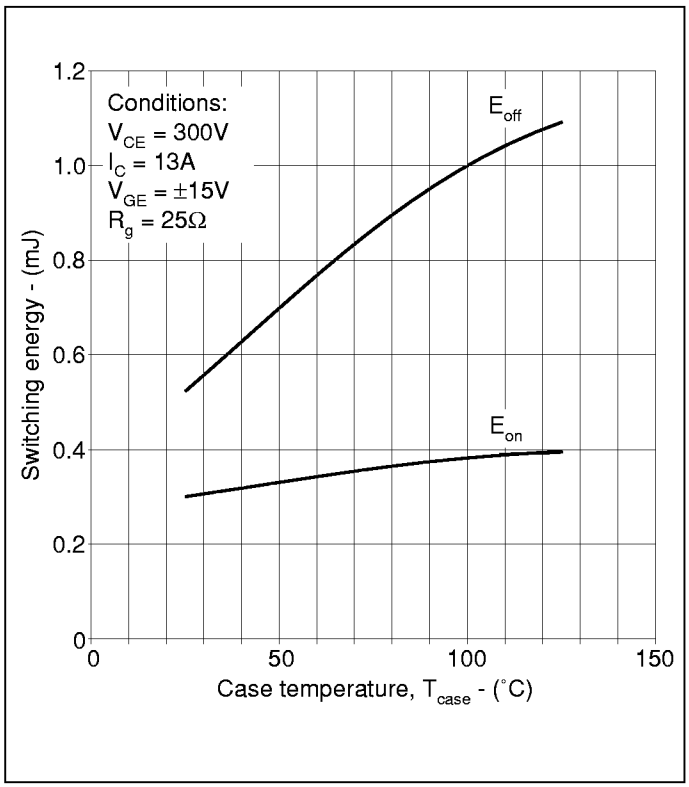


Fig.12 Typical switching losses vs case temperature

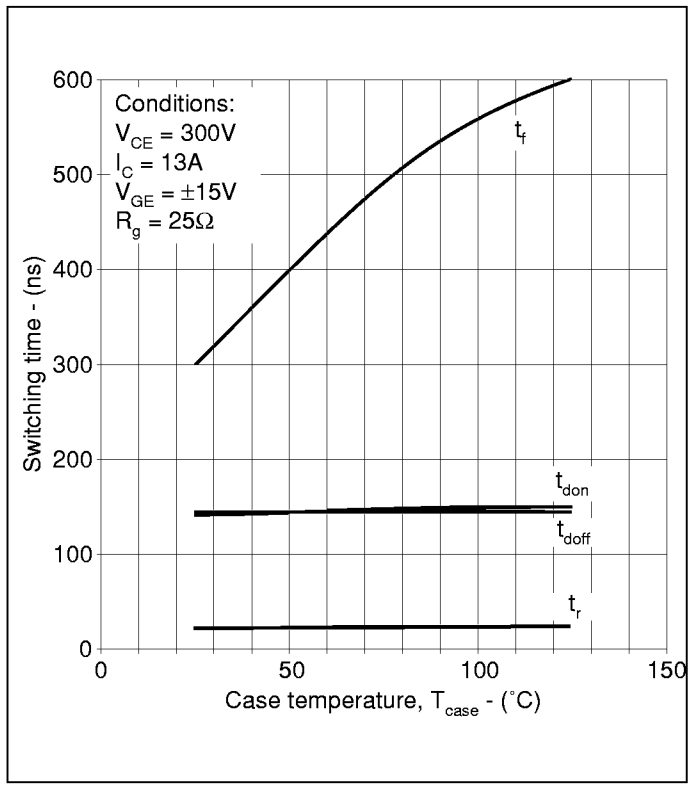


Fig.13 Typical switching times vs case temperature

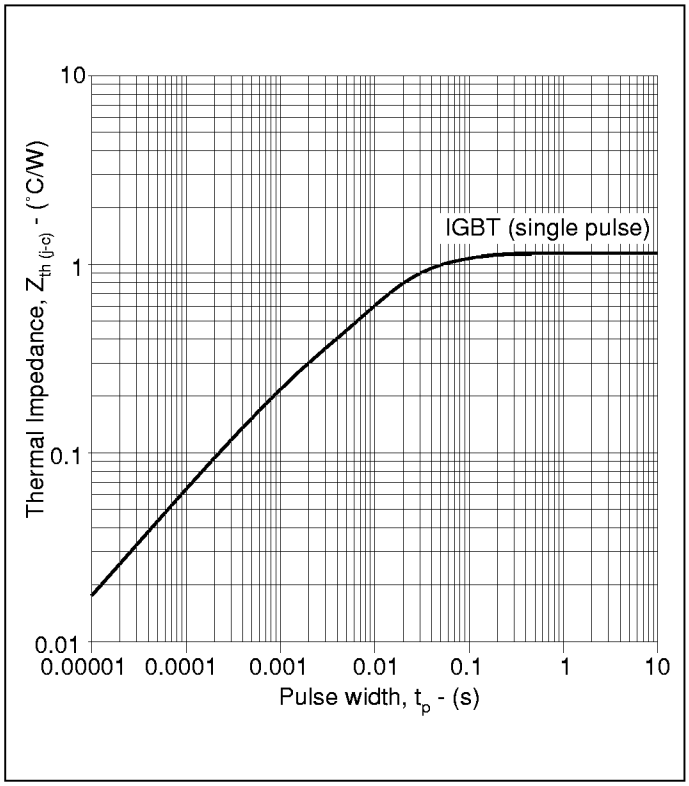


Fig.14 Transient thermal impedance - junction to case

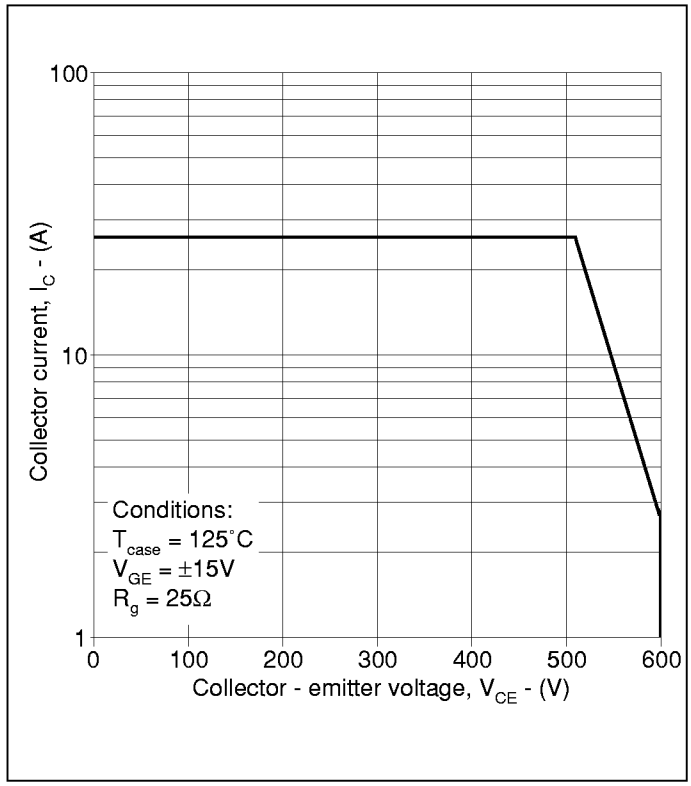


Fig.15 Reverse bias safe operating area

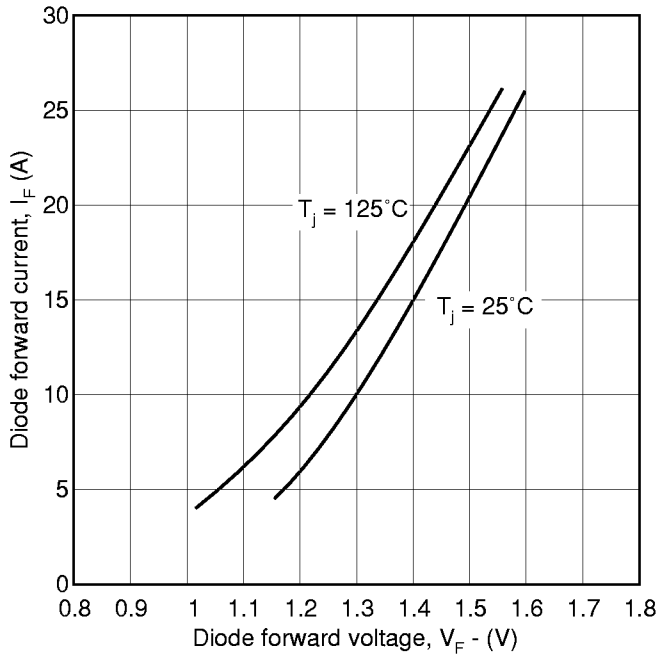
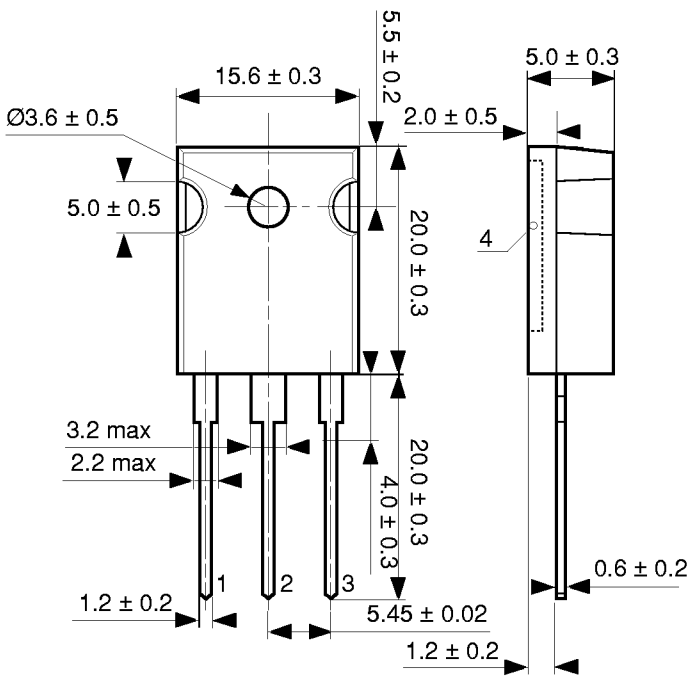


Fig.16 Diode typical forward characteristics

PACKAGE OUTLINE - TO247

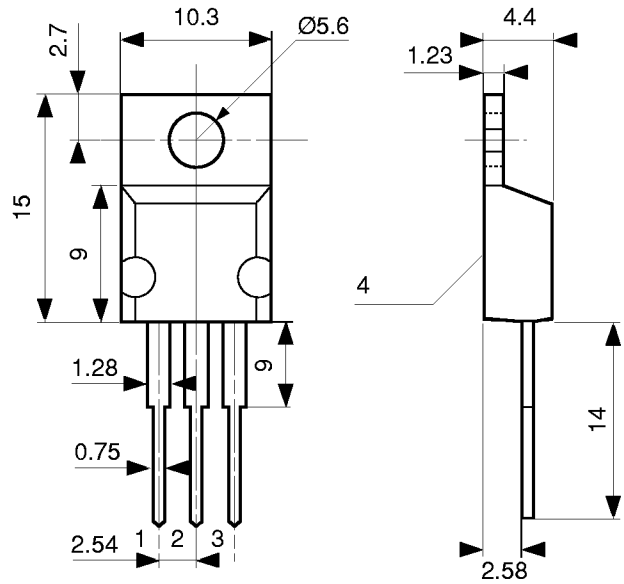
For further package information, please contact your local Customer Service Centre. All dimensions in mm, unless stated otherwise. DO NOT SCALE.



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

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

MITEL
SEMICONDUCTOR

HEADQUARTERS OPERATIONS
MITEL SEMICONDUCTOR
Cheney Manor, Swindon,
Wiltshire SN2 2QW, United Kingdom.
Tel: (01793) 518000
Fax: (01793) 518411

MITEL SEMICONDUCTOR
1500 Green Hills Road,
Scotts Valley, California 95066-4922
United States of America.
Tel (408) 438 2900
Fax: (408) 438 5576/6231

Internet: http://www.mitelsemi.com
POWER PRODUCT CUSTOMER SERVICE CENTRES
- **FRANCE, BENELUX & SPAIN.** Les Ulis Cedex. Tel: (1) 69 18 90 00. Fax: (1) 64 46 54 50.
- **GERMANY**. München. Tel: 089 41 95 080. Fax: 089 41 95 08 55.
- **NORTH AMERICA.** Dedham. Tel: (781) 251 0126. Fax: (781) 251 0106.
- **UNITED KINGDOM.** Lincoln. Tel: 01522 500500. Fax: 01522 510550.

These are supported by Agents and Distributors in major countries world-wide.