MITEL
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ITZ15C12

Powerline N-Channel IGBT With Ultrafast Diode

Advance Information

DS5071 - 1.1 January 1999

The ITZ15C12 is a very robust non punch through 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 ITZ is fully short circuit rated making it especially suited for motor control and other applications requiring short circuit with stand capability. 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.

FEATURES

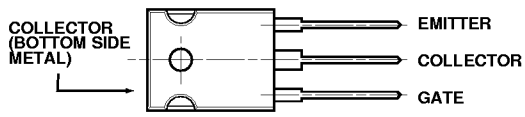
- Enhancement Mode n-Channel Device
- Non Punch Through Structure
- High Switching Speed
- Low On-state Saturation Voltage
- High Input Impedance Simplifies Gate Drive
- Latch-Free Operation
- Fully Short Circuit Rated To 10µs
- Square RBSOA
- Integral Fast Recovery Diode

APPLICATIONS

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

KEY PARAMETERS

V_{CES}	(max)	1200V
$V_{CE(sat)}$	(typ)	2.8V
I_{C25}	(max)	28A
I_{C85}	(max)	15A
I_{CM}	(max)	45A
t_{sc}	(max)	10µs



Outline type code: TO247

(See Package Outlines for further information)

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

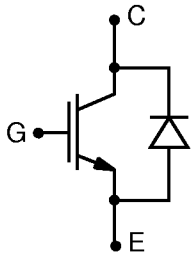


Fig.2 ITZ15C12 circuit

ORDERING INFORMATION

ITZ15C12P TO247 (with fast recovery diode)

Note: When ordering, use the complete part number.

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

ABSOLUTE MAXIMUM RATINGS

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

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

Symbol	Parameter	Test Conditions	Max.	Units
V_{CES}	Collector-emitter voltage	V_{GE} = 0V	1200	V
V_{GES}	Gate-emitter voltage	-	±20	V
I_{C25}	Continuous collector current	T_{case} = 25˚C	28	A
I_{C85}	Continuous collector current	T_{case} = 85˚C	15	A
I_{CM}	Pulsed collector current	1ms, T_{case} = 85˚C	45	A
P_{tot}	Power dissipation	T_{case} = 85˚C	80	W

THERMAL AND MECHANICAL RATINGS

Symbol	Parameter	Conditions	Min.	Max.	Units
$R_{th(j-c)}$	Thermal resistance - IGBT	DC junction to case	-	0.8	°C/W
$R_{th(j-c)}$	Thermal resistance - Diode	DC junction to case	-	1.8	°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} = 1200V	-	-	1	mA
I_{GES}	Gate leakage current	V_{GE} = 20V, V_{CE} = 0V	-	-	±500	nA
$V_{GE(TH)}$	Gate threshold voltage	I_C = 1mA, V_{CE} = V_{GE}	4.5	6	7.5	V
$V_{CE(SAT)}$	Collector-emitter saturation voltage	V_{GE} = 15V, I_C = 15A	-	2.8	3.3	V
		V_{GE} = 15V, I_C = 15A, T_j = 125˚C	-	3.6	-	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	-	2160	-	pF
C_{oes}	Output capacitance	V_{CE} = 25V, V_{GE} = 15V, f = 1MHz	-	215	-	pF
C_{res}	Reverse transfer capacitance	V_{CE} = 25V, V_{GE} = 15V, f = 1MHz	-	10	-	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 = 15A, V_{GE} = ±15V, V_{CE} = 50%V_{ces}, $R_{G(ON)}$ = $R_{G(OFF)}$ = 5Ω	-	30	-	ns
t_r	Rise time		-	15	-	ns
E_{ON}	Turn-on energy loss - per cycle		-	750	-	µJ
$t_{d(OFF)}$	Turn-off delay time		-	110	-	ns
t_f	Fall time		-	50	-	ns
E_{OFF}	Turn-off energy loss - per cycle		-	1500	-	µJ
T_{case} = 125˚C unless stated otherwise.						
$t_{d(ON)}$	Turn-on delay time	I_C = 15A, V_{GE} = ±15V, V_{CE} = 50%V_{ces}, $R_{G(ON)}$ = $R_{G(OFF)}$ = 5Ω	-	30	-	ns
t_r	Rise time		-	15	-	ns
E_{ON}	Turn-on energy loss - per cycle		-	1400	-	µJ
$t_{d(OFF)}$	Turn-off delay time		-	160	-	ns
t_f	Fall time		-	60	-	ns
E_{OFF}	Turn-off energy loss - per cycle		-	1900	-	µJ

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

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} = 80% 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 = 15A peak	-	1.86	-	V
		At I_F = 15A peak, T_{case} = 125˚C	-	1.8	-	V
t_{rr}	Reverse recovery time	I_F = 15A, di_{RR}/dt = 200A/µs	-	90	-	ns
I_{RRM}	Reverse recovery current	V_R = 50%V_{RRM}	-	10	-	A

BASIC TEST CIRCUIT AND SWITCHING DEFINITIONS

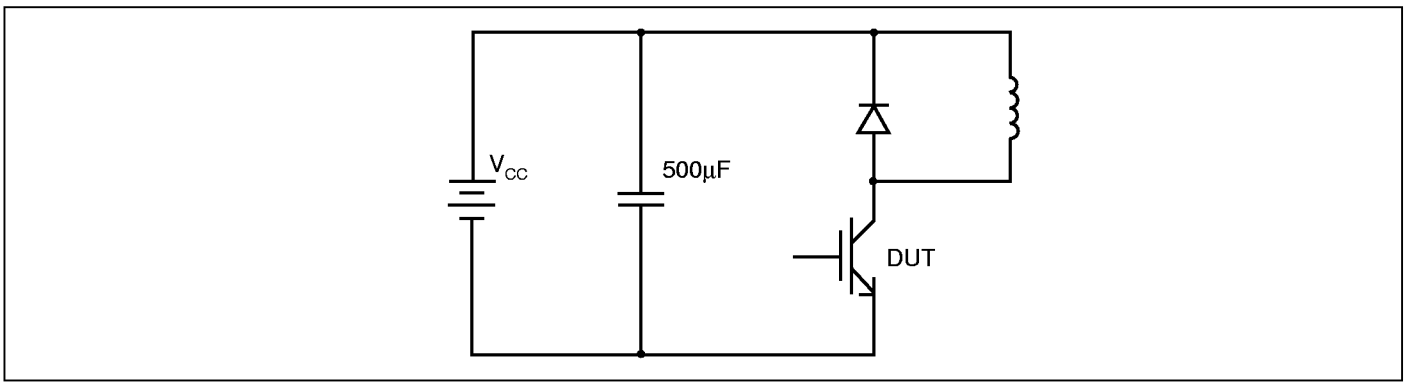


Fig.3 Basic d.c. chopper circuit

$t_{d(on)} = t_2 - t_1$

$t_r = t_3 - t_2$

$E_{on} = \int_{t_1}^{t_3 + 1\mu s} V_{CE} \cdot I_C \, dt$

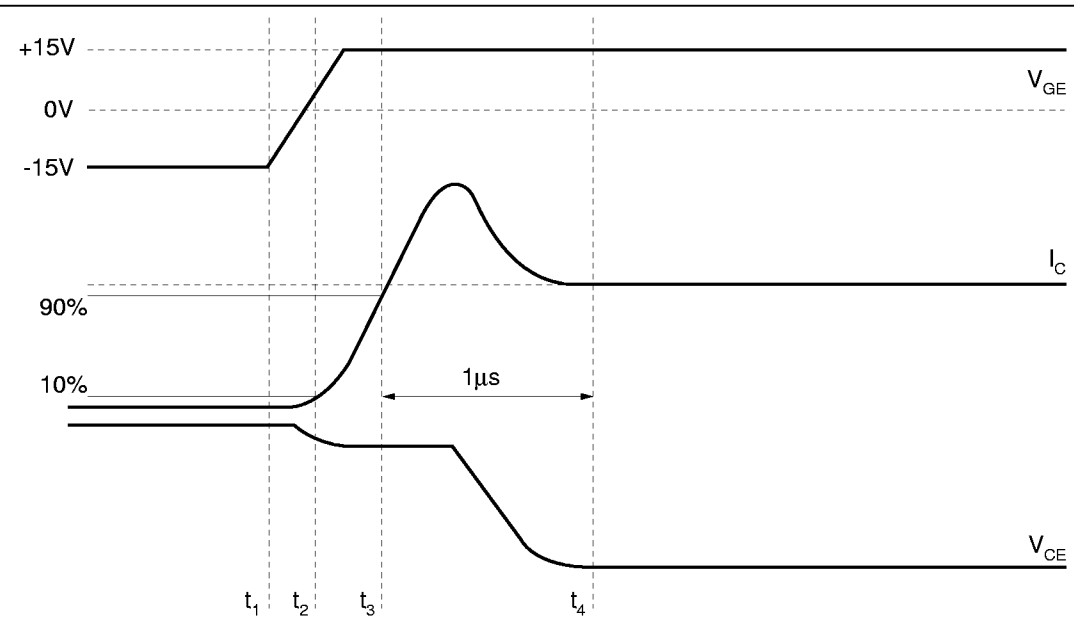


Fig.4 Turn-on characteristics

$t_f = t_7 - t_6$

$t_{d(off)} = t_6 - t_5$

$E_{off} = \int_{t_5}^{t_7 + 1\mu s} V_{CE} \cdot I_C \, dt$

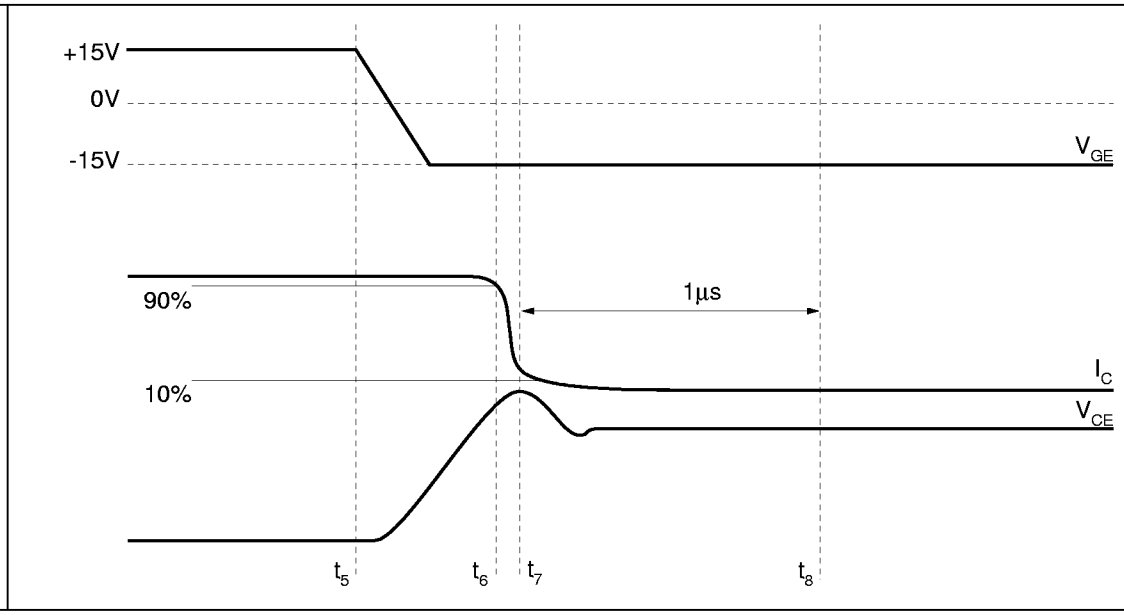


Fig.5 Turn-off characteristics

CURVES

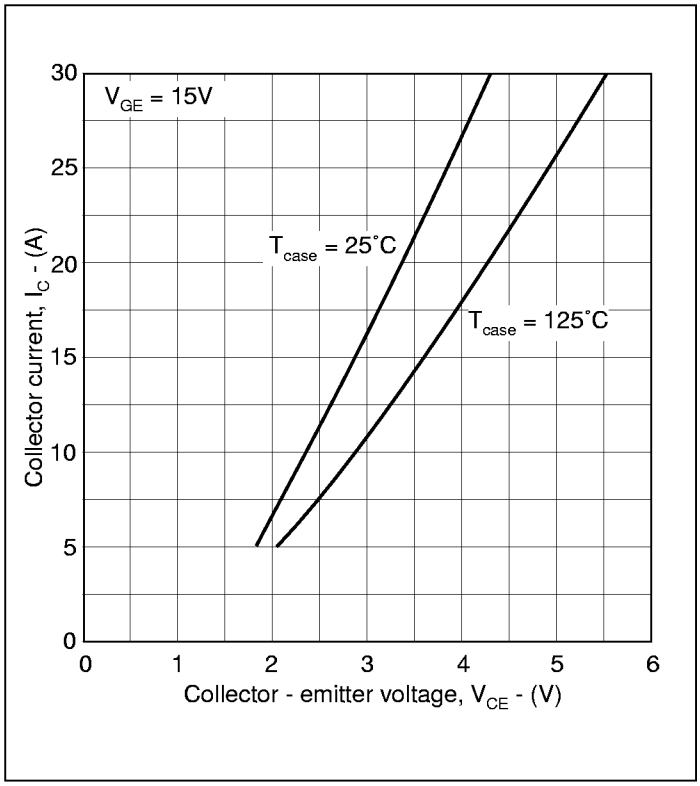


Fig.6 Typical output characteristics

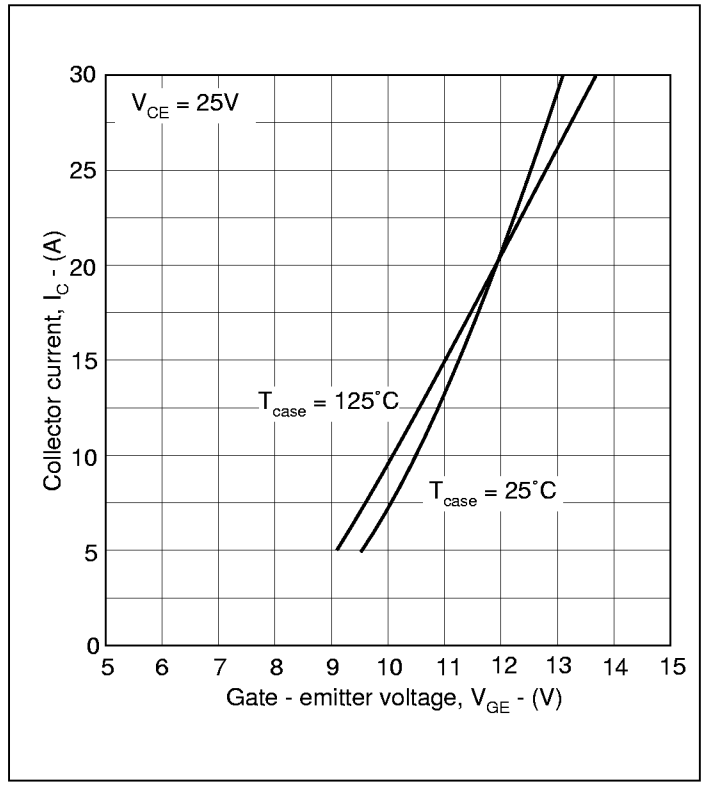


Fig.7 Typical transfer characteristics

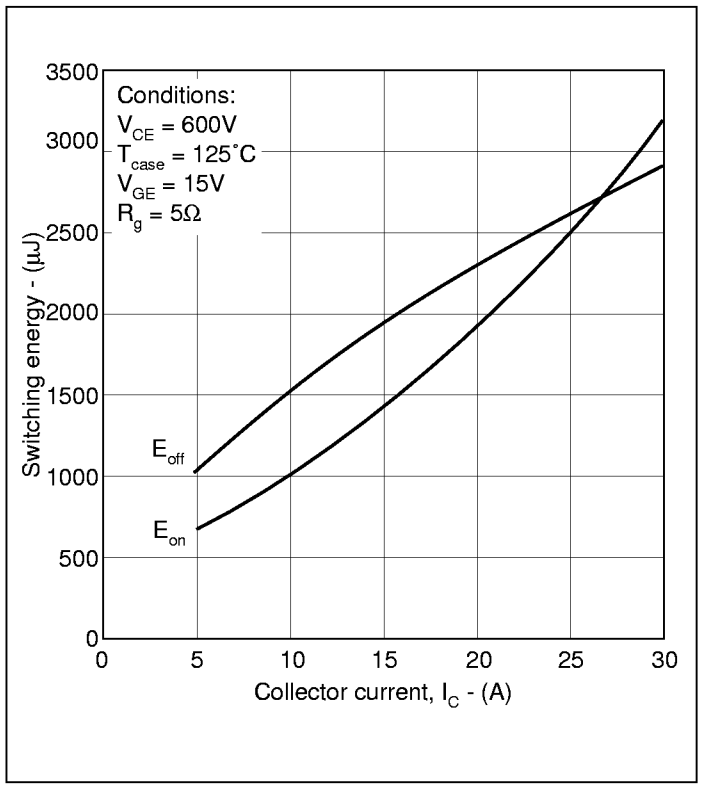


Fig.8 Typical switching losses vs collector current

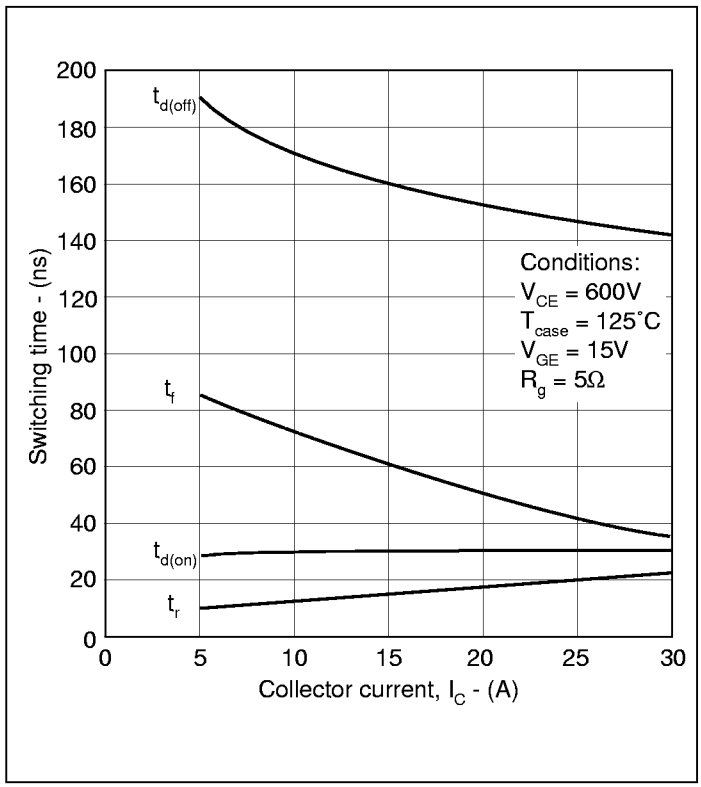


Fig.9 Typical switching times vs collector current

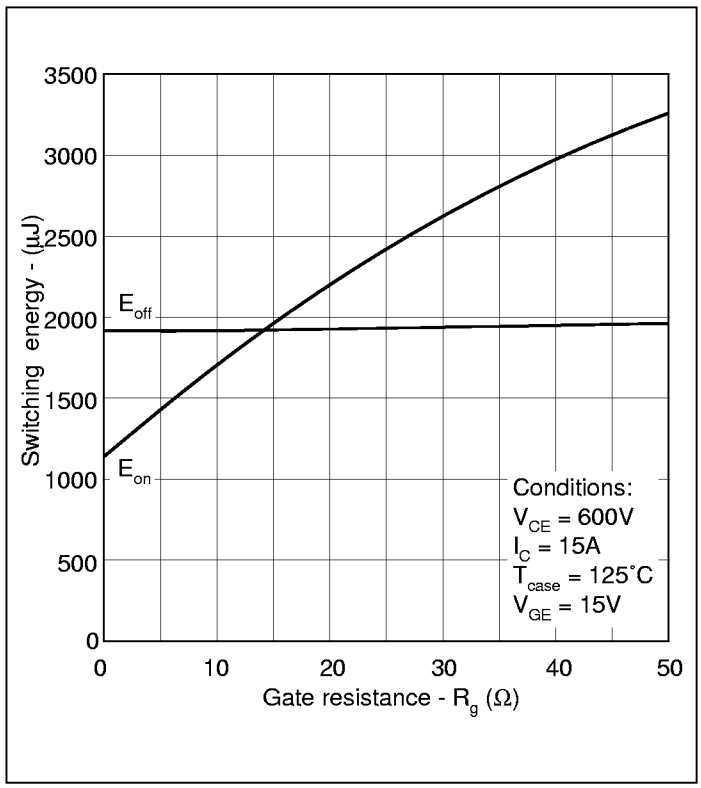


Fig.10 Typical switching losses vs gate resistance

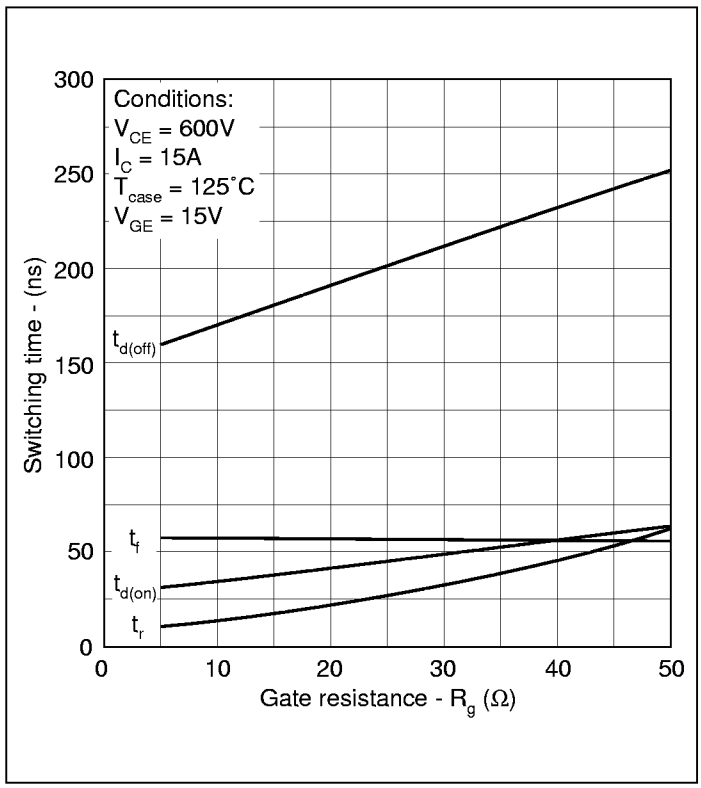


Fig.11 Typical switching times vs gate resistance

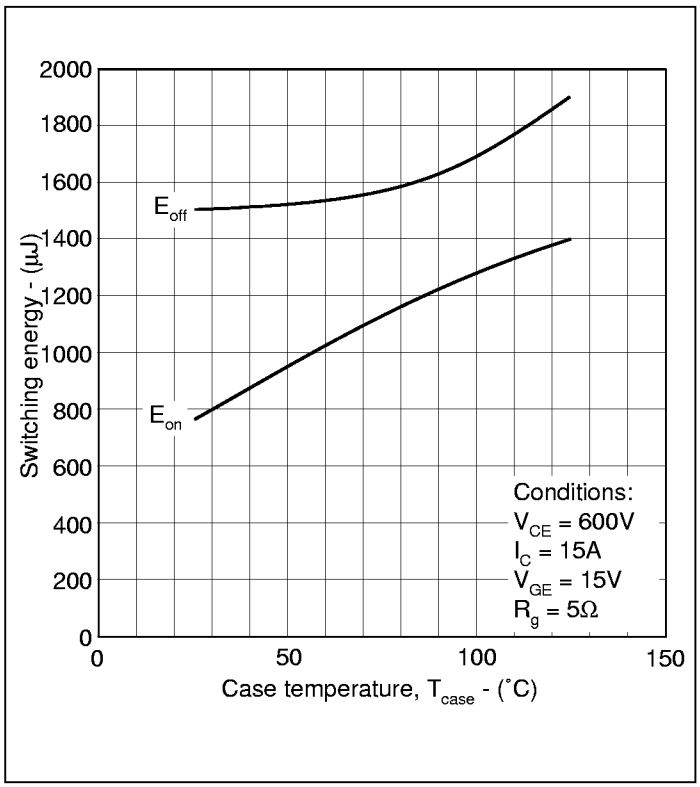


Fig.12 Typical switching losses vs case temperature

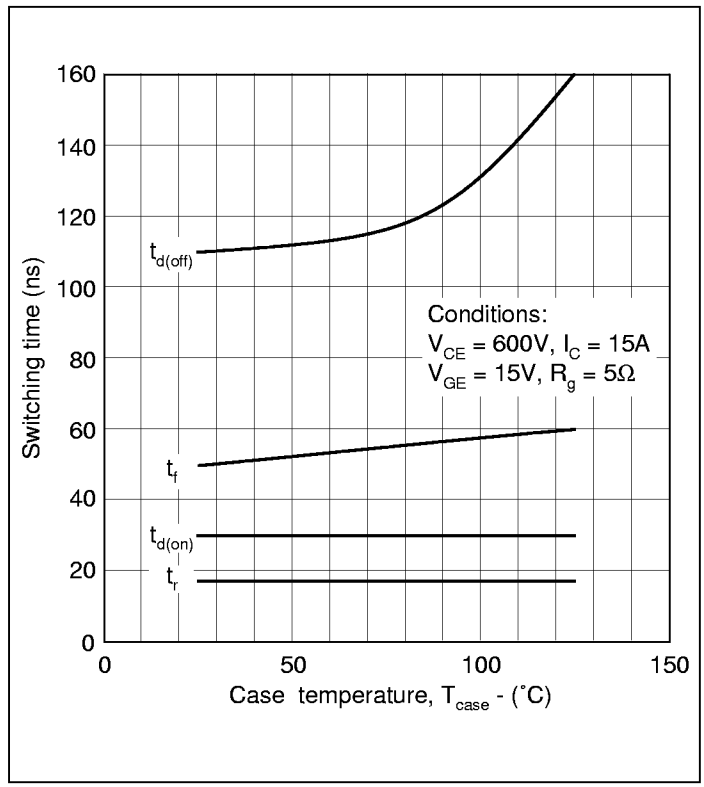


Fig.13 Typical switching times vs case temperature

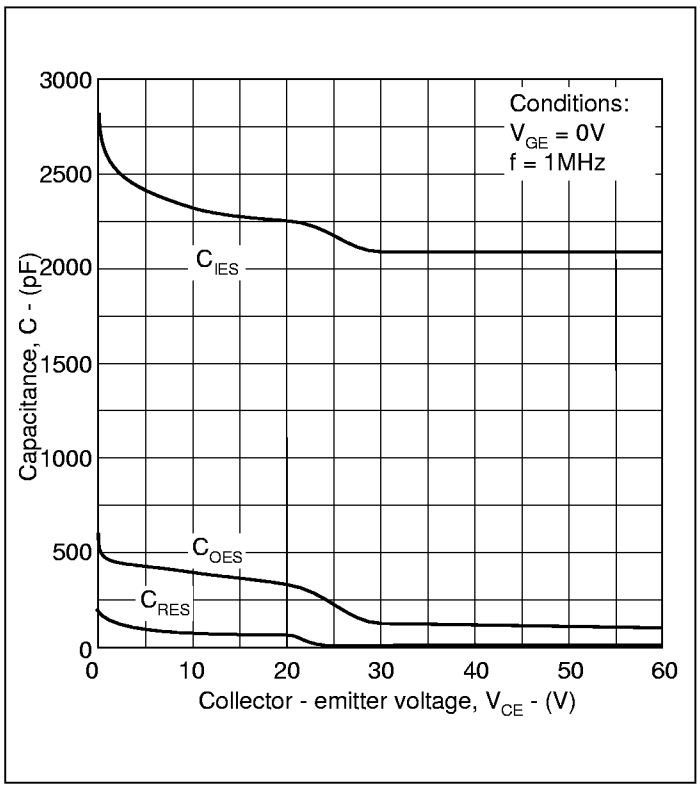


Fig.14 Typical capacitance

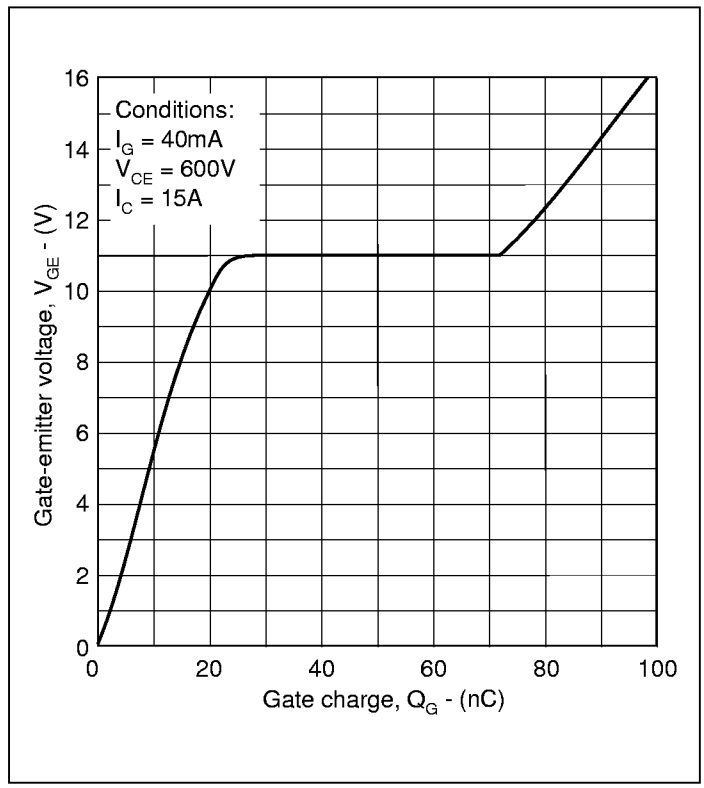


Fig.15 Typical gate charge

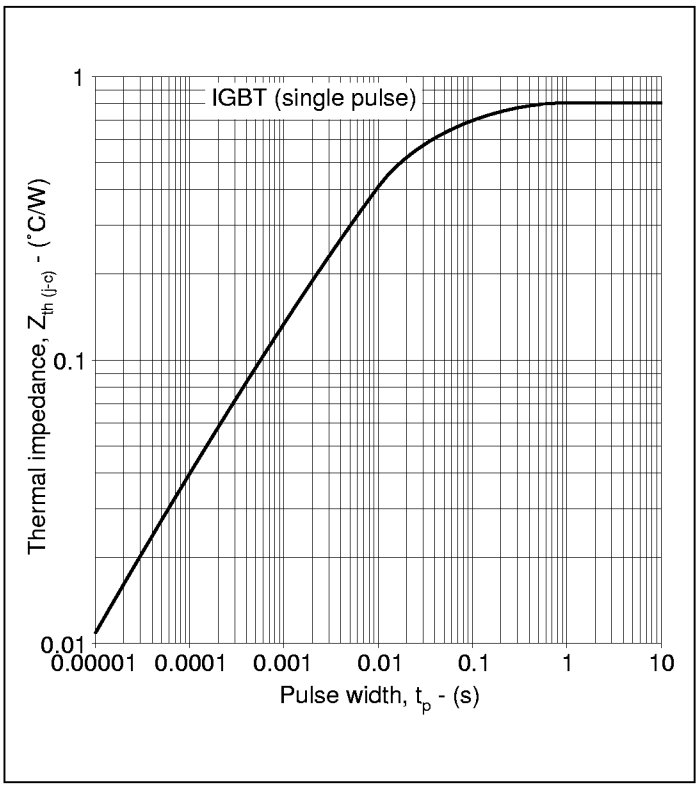


Fig.16 Transient thermal impedance - junction to case

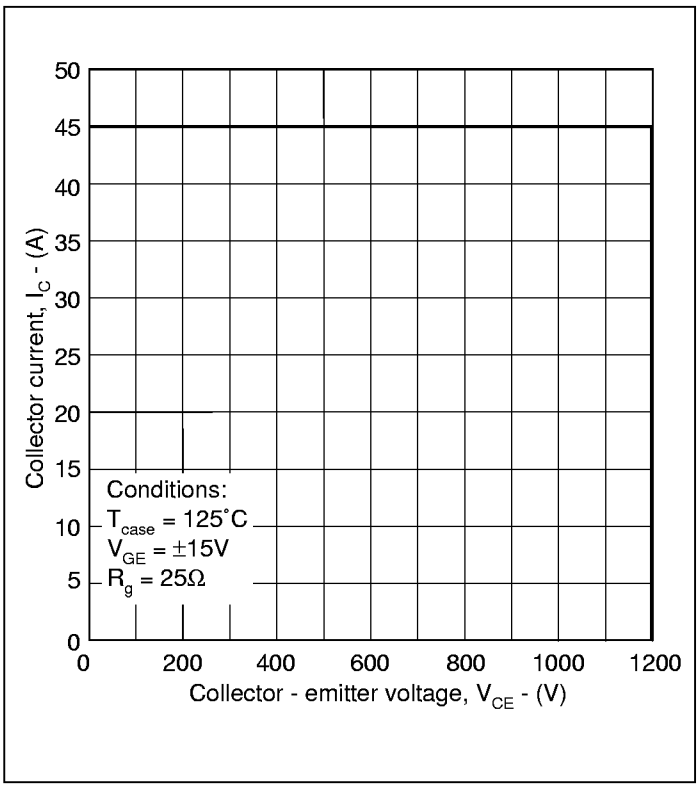


Fig.17 Reverse bias safe operating area

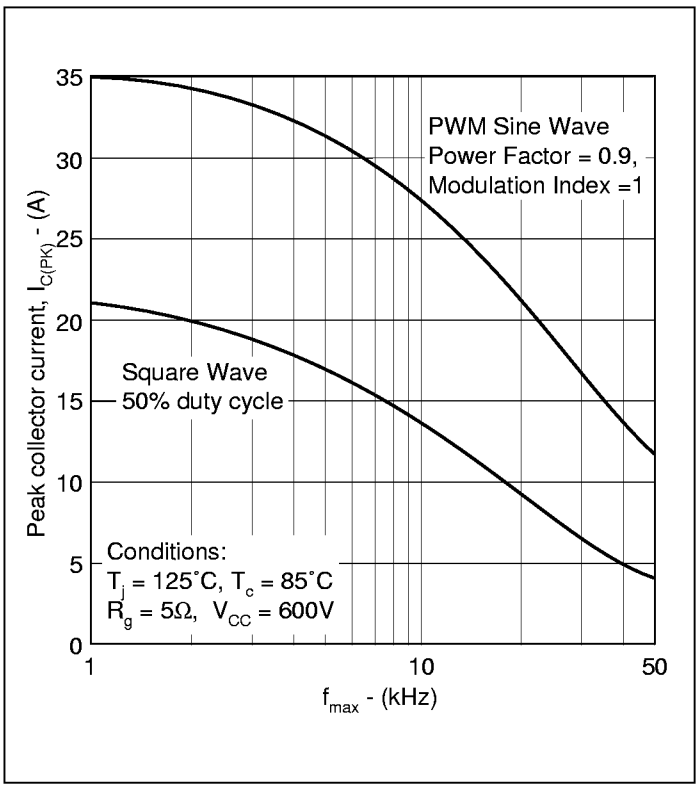


Fig.18 Three Phase PWM inverter operating frequency

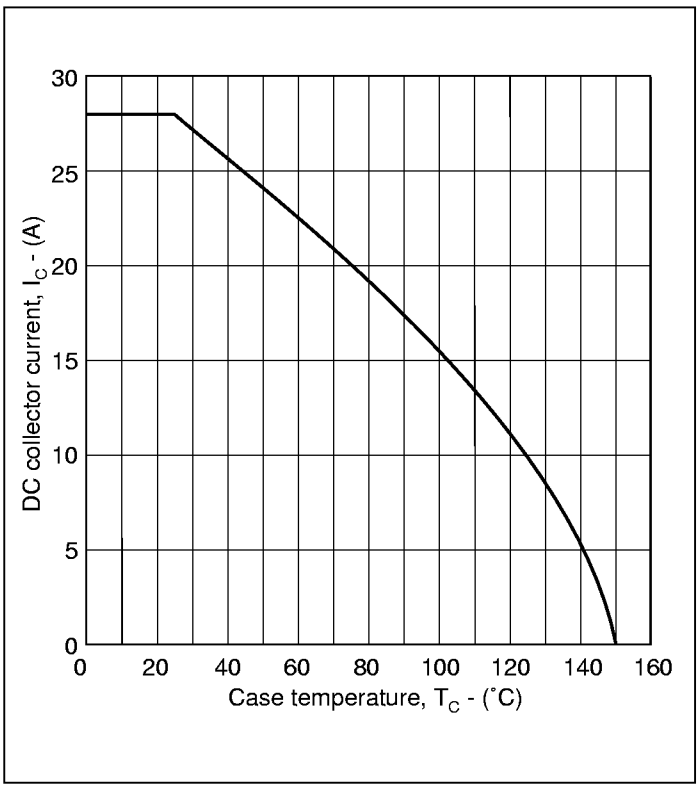


Fig.19 DC current rating vs case temperature

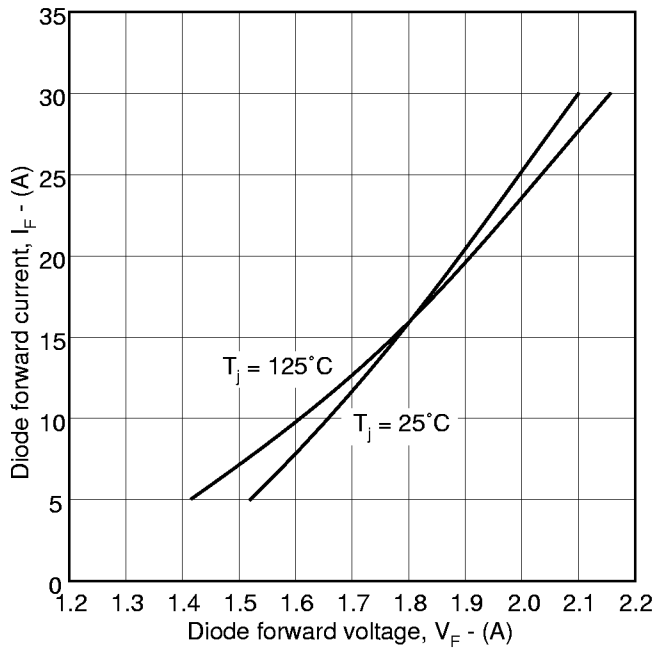
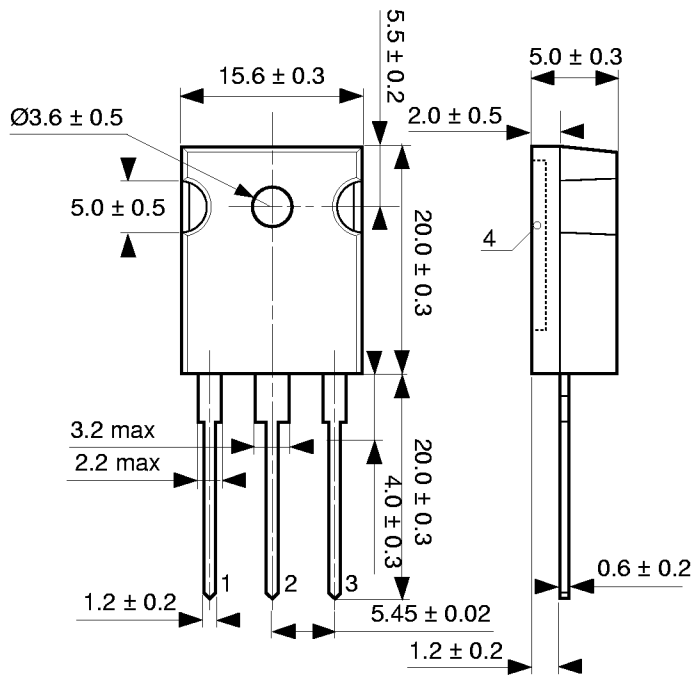


Fig.20 Diode typical forward characteristics

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

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These are supported by agents and distributors in major countries world-wide.

ADVANCE INFORMATION - The product design is complete and final characterisation for volume production is well in hand.

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