

# ITS23C06

## POWERLINE N-CHANNEL IGBT WITH ULTRAFAST DIODE

The ITS23C06 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.

### 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

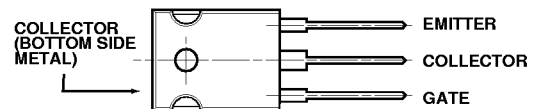
- High Frequency Inverters
- Motor Control
- Switched Mode Power Supplies
- High Frequency Welding
- Heating/Cooking Apparatus

### ORDERING INFORMATION

ITS23C06P TO247 (with fast recovery diode)

### KEY PARAMETERS

$V_{CES}$	(max)	600V
$V_{CE(sat)}$	(typ)	2.0V
$I_{C25}$	(max)	40A
$I_{C85}$	(max)	23A
$I_{CM}$	(max)	46A
$t_{sc}$	(max)	10 $\mu$ s



Outline type code: TO247

(See Package Outlines for further information)

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

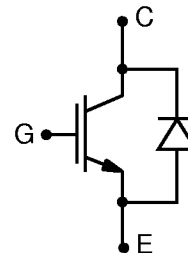


Fig.2 ITS23C06 circuit

## ITS23C06

### 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.

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

Symbol	Parameter	Test Conditions	Max.	Units
$V_{CES}$	Collector-emitter voltage	$V_{GE} = 0\text{V}$	600	V
$V_{GES}$	Gate-emitter voltage	-	$\pm 20$	V
$I_{C25}$	Continuous collector current	$T_{case} = 25^{\circ}\text{C}$	40	A
$I_{C85}$	Continuous collector current	$T_{case} = 85^{\circ}\text{C}$	23	A
$I_{CM}$	Pulsed collector current	1 ms, $T_{case} = 85^{\circ}\text{C}$	46	A
$P_{tot}$	Power dissipation	$T_{case} = 85^{\circ}\text{C}$	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	$^{\circ}\text{C}/\text{W}$
$R_{th(j-c)}$	Thermal resistance - Diode	DC junction to case	-	1.8	$^{\circ}\text{C}/\text{W}$
$T_{OP}$	Operating junction temperature range	-	-40	150	$^{\circ}\text{C}$
$T_{slg}$	Storage temperature range	-	-40	150	$^{\circ}\text{C}$
-	Mounting torque	M3 screw	-	1.1	Nm

### DC ELECTRICAL CHARACTERISTICS

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
$I_{CES}$	Collector cut-off current	$V_{GE} = 0\text{V}$ , $V_{CE} = 600\text{V}$	-	-	1	mA
$I_{GES}$	Gate leakage current	$V_{GE} = 20\text{V}$ , $V_{CE} = 0\text{V}$	-	-	$\pm 500$	nA
$V_{GE(TH)}$	Gate threshold voltage	$I_C = 1\text{mA}$ , $V_{CE} = V_{GE}$	4	6	7.5	V
$V_{CE(SAT)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{V}$ , $I_C = 23\text{A}$	-	2.0	2.6	V
		$V_{GE} = 15\text{V}$ , $I_C = 23\text{A}$ , $T_j = 125^{\circ}\text{C}$	-	2.2	-	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	$V_{\text{CE}} = 25\text{V}$ , $V_{\text{GE}} = 15\text{V}$ , $f = 1\text{MHz}$	-	2000	-	pF
$C_{\text{oes}}$	Output capacitance	$V_{\text{CE}} = 25\text{V}$ , $V_{\text{GE}} = 15\text{V}$ , $f = 1\text{MHz}$	-	520	-	pF
$C_{\text{res}}$	Reverse transfer capacitance	$V_{\text{CE}} = 25\text{V}$ , $V_{\text{GE}} = 15\text{V}$ , $f = 1\text{MHz}$	-	450	-	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
$t_{\text{d(ON)}}$	Turn-on delay time	$I_{\text{C}} = 23\text{A}$ , $V_{\text{GE}} = \pm 15\text{V}$ , $V_{\text{CE}} = 50\%V_{\text{ces}}$ $R_{\text{G(ON)}} = R_{\text{G(OFF)}} = 25\Omega$	-	200	-	ns
$t_{\text{r}}$	Rise time		-	32	-	ns
$E_{\text{ON}}$	Turn-on energy loss - per cycle		-	0.4	-	mJ
$t_{\text{d(OFF)}}$	Turn-off delay time		-	300	-	ns
$t_{\text{f}}$	Fall time		-	270	500	ns
$E_{\text{OFF}}$	Turn-off energy loss - per cycle		-	1.6	-	mJ

 $T_{\text{case}} = 125^{\circ}\text{C}$  unless stated otherwise.

$t_{\text{d(ON)}}$	Turn-on delay time	$I_{\text{C}} = 23\text{A}$ , $V_{\text{GE}} = \pm 15\text{V}$ , $V_{\text{CE}} = 50\%V_{\text{ces}}$ $R_{\text{G(ON)}} = R_{\text{G(OFF)}} = 25\Omega$	-	210	-	ns
$t_{\text{r}}$	Rise time		-	40	-	ns
$E_{\text{ON}}$	Turn-on energy loss - per cycle		-	0.48	-	mJ
$t_{\text{d(OFF)}}$	Turn-off delay time		-	320	-	ns
$t_{\text{f}}$	Fall time		-	520	-	ns
$E_{\text{OFF}}$	Turn-off energy loss - per cycle		-	2.3	-	mJ

## 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	$\mu\text{s}$

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## DIODE CHARACTERISTICS

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
$V_{FM}$	Forward voltage	At $I_F = 23\text{A}$ peak	-	1.4	-	V
		At $I_F = 23\text{A}$ peak, $T_{case} = 125^\circ\text{C}$	-	1.34	-	V
$t_{rr}$	Reverse recovery time	$I_F = 23\text{A}$ , $di_{RR}/dt = 200\text{A}/\mu\text{s}$	-	70	-	ns
$I_{RRM}$	Reverse recovery current	$V_R = 50\%V_{RRM}$	-	12	-	A

## BASIC TEST CIRCUIT AND SWITCHING DEFINITIONS

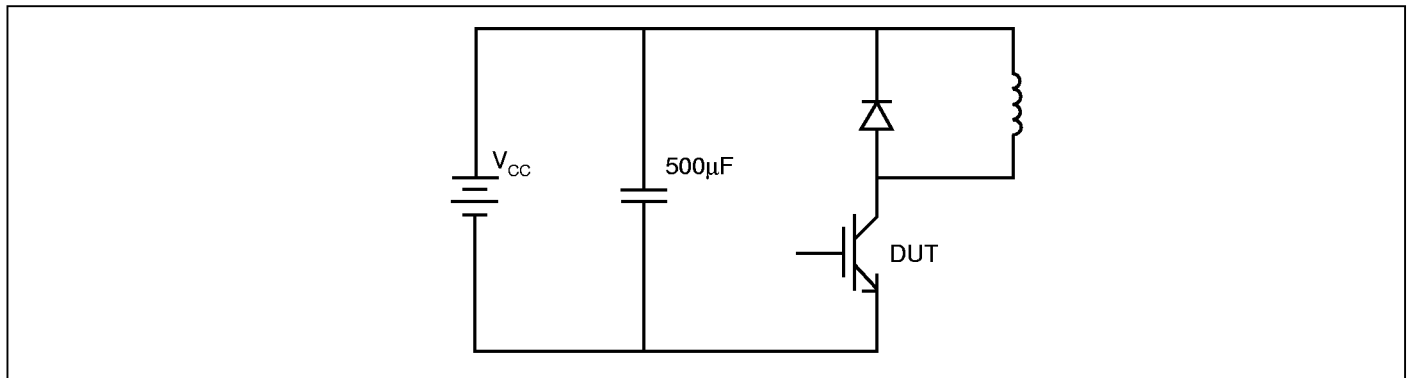


Fig.3 Basic d.c. chopper circuit

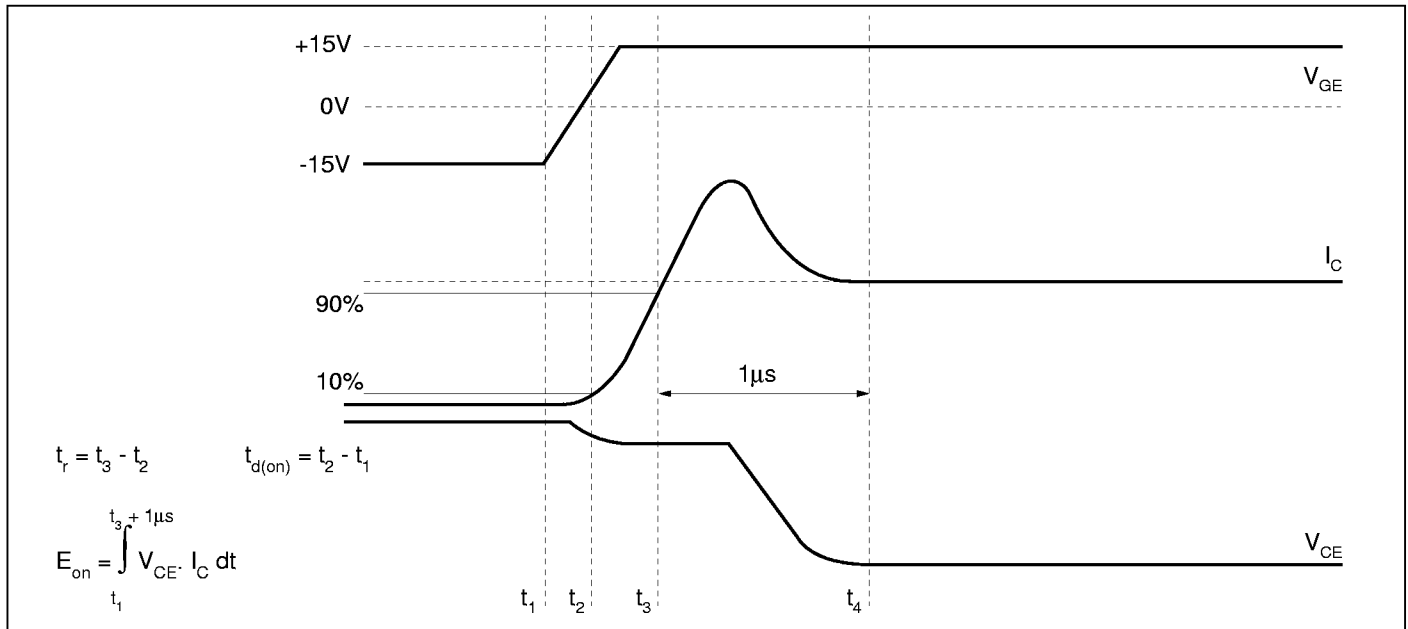


Fig.4 Turn-on characteristics

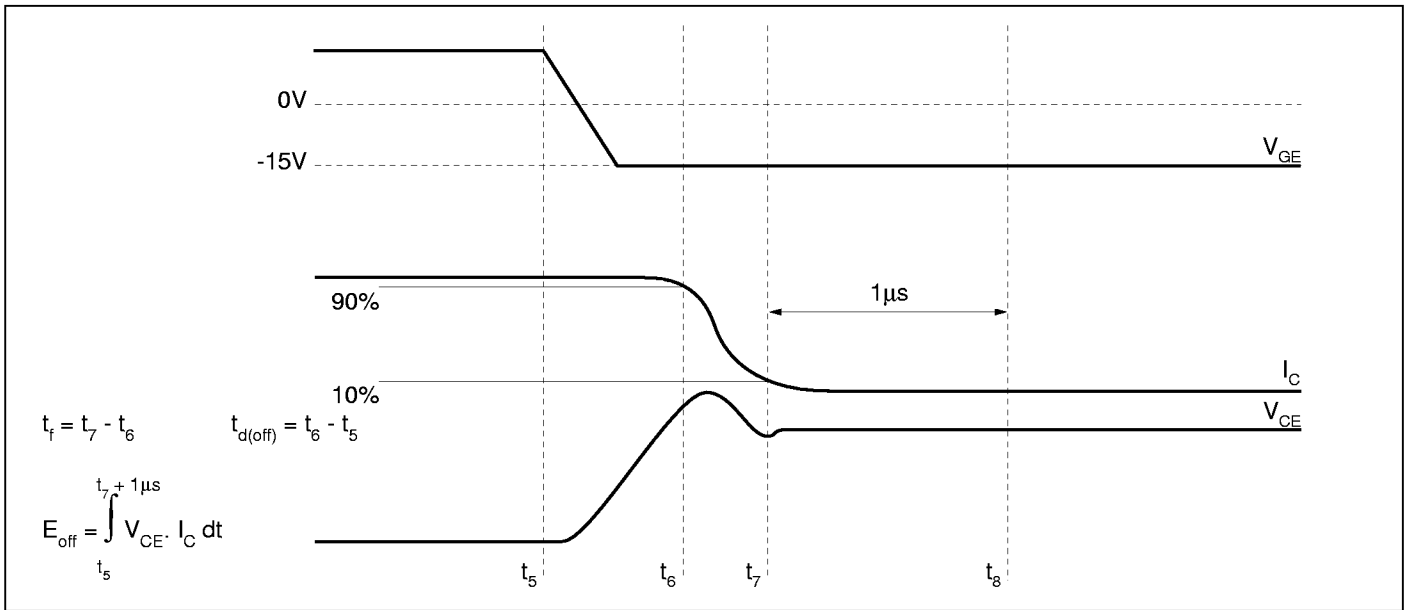


Fig.5 Turn-off characteristics

**CURVES**

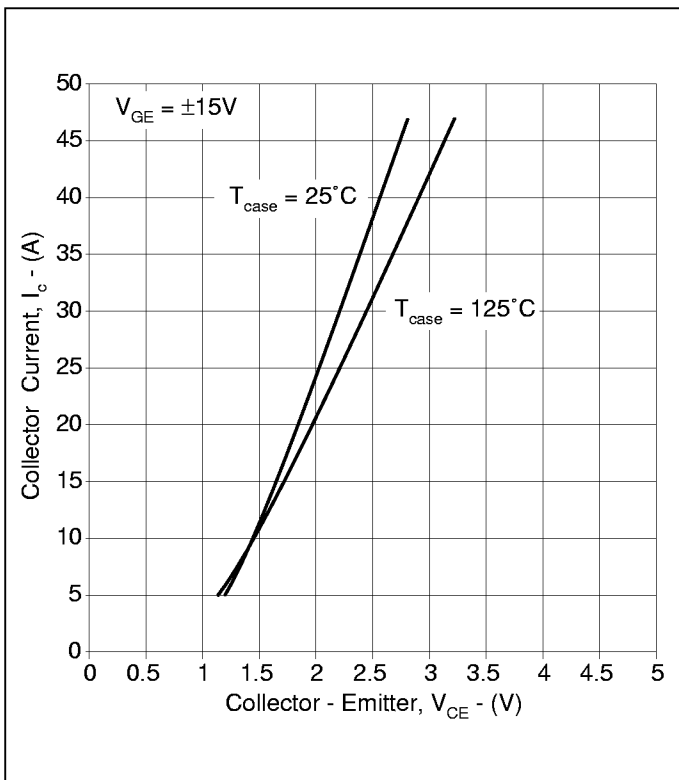


Fig.6 Typical output characteristics

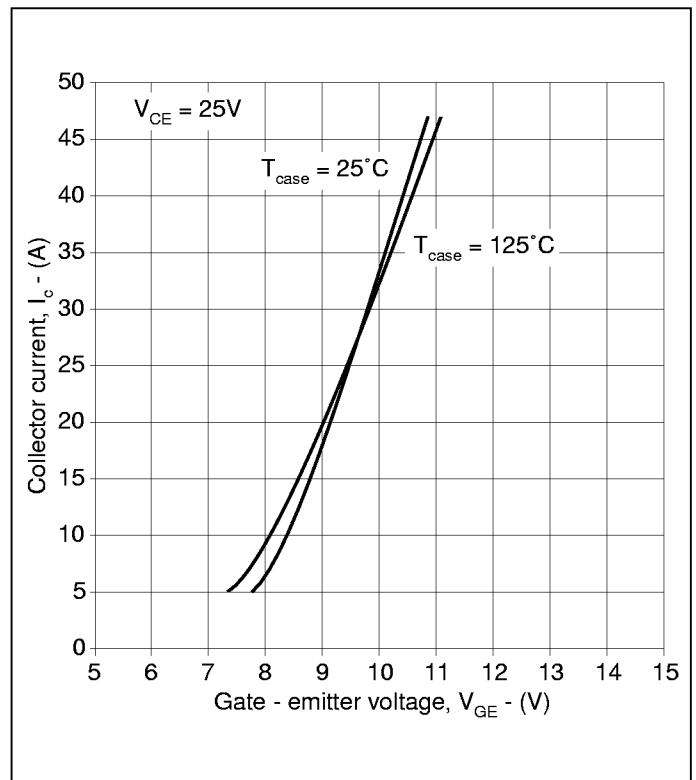


Fig.7 Typical transfer characteristics

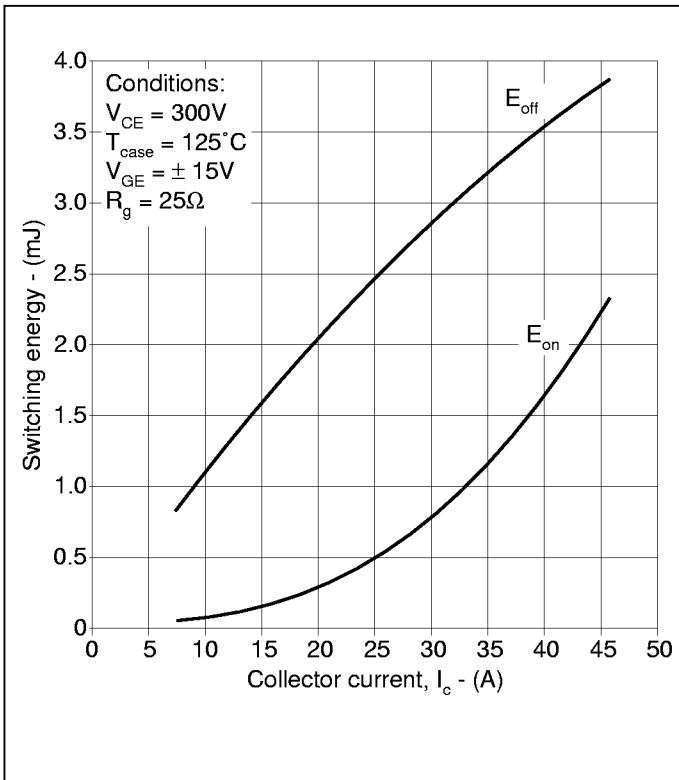


Fig.8 Typical switching losses vs collector current

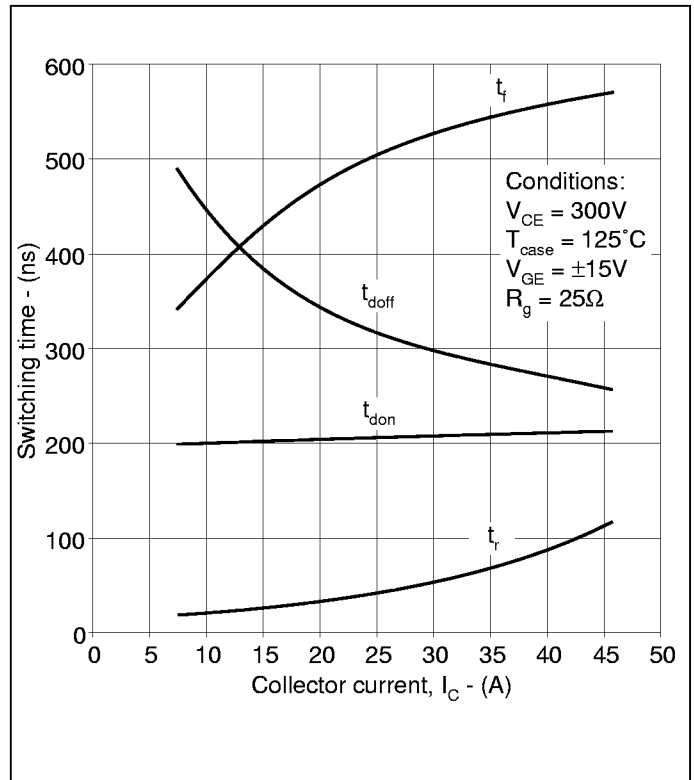


Fig.9 Typical switching times vs collector current

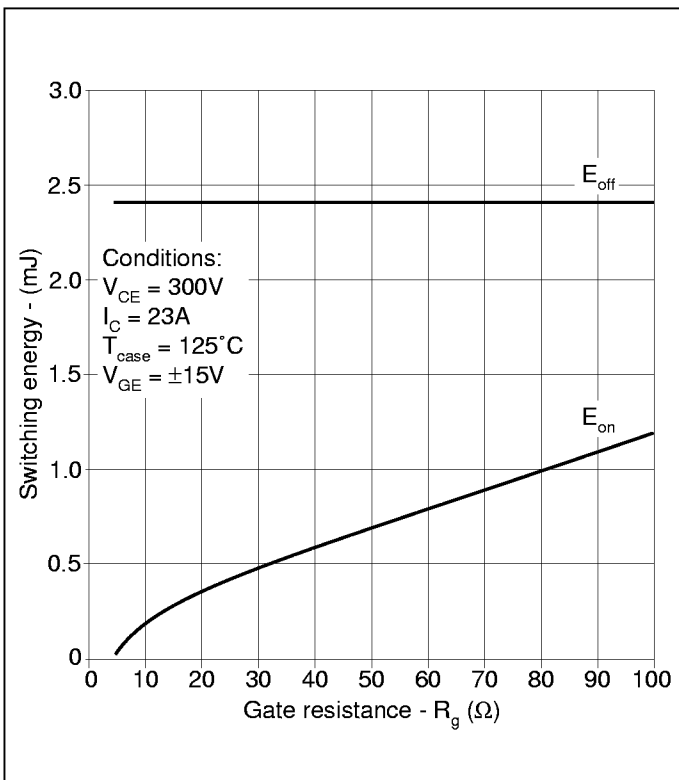


Fig.10 Typical switching losses vs gate resistance

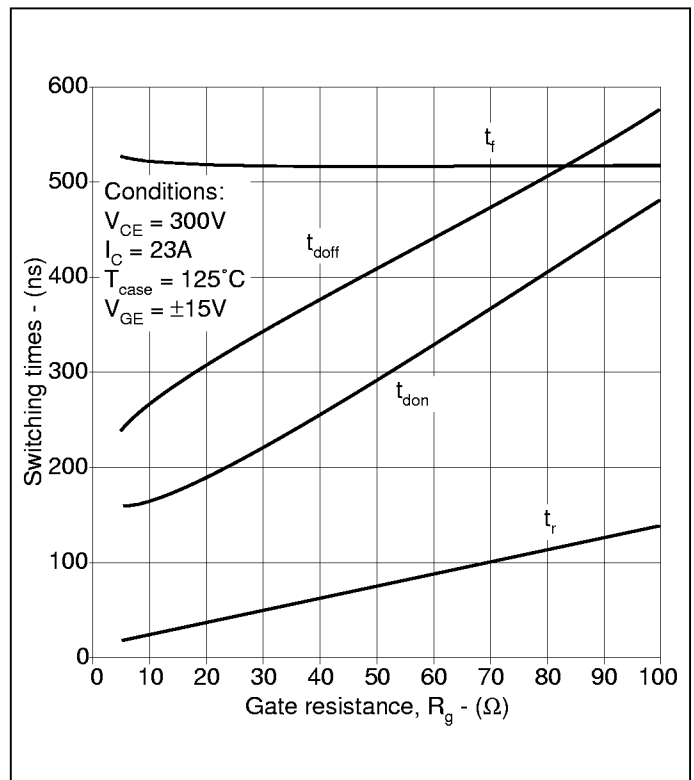


Fig.11 Typical switching time vs gate resistance

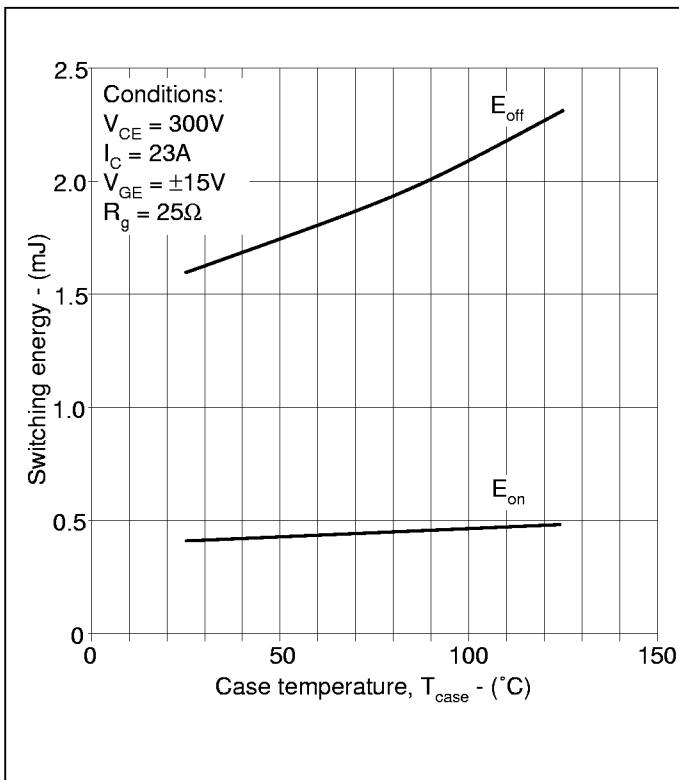


Fig.12 Typical switching losses vs case temperature

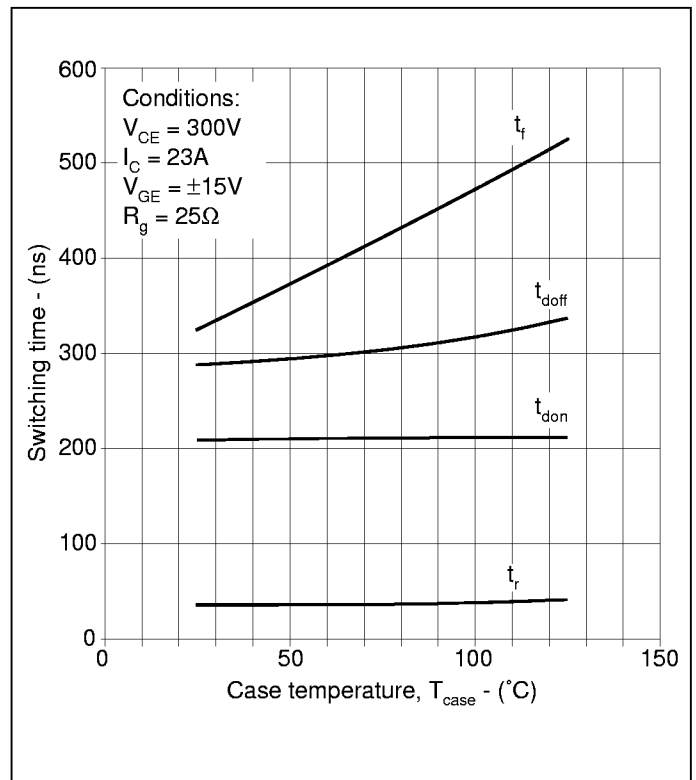


Fig.13 Typical switching time vs case temperature

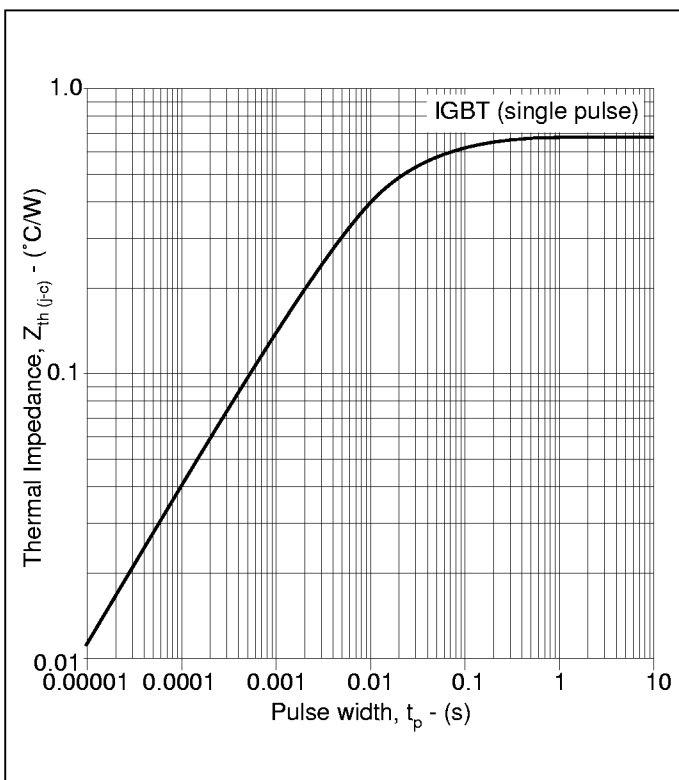


Fig.14 Transient thermal impedance - junction to case

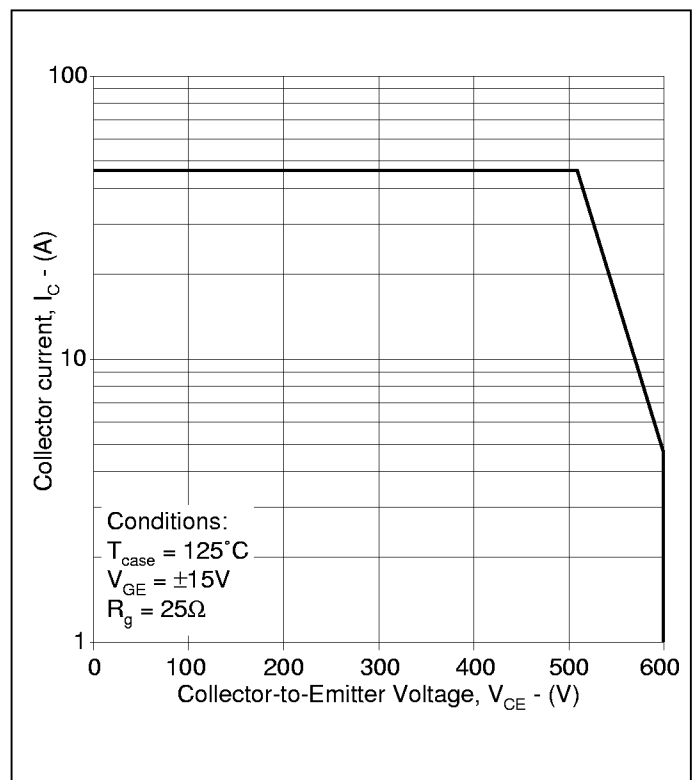


Fig.15 Reverse bias safe operating area

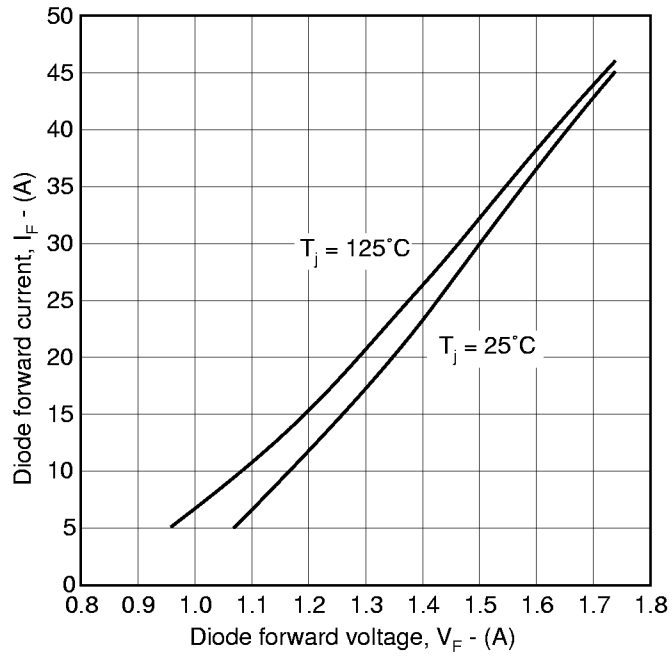


Fig.16 Diode typical forward characteristics

