

■ PRODUCT CHARACTERISTICS

BVCBO	700V
BVCEO	400V
HFE@5V2A	8-40
IC	4A

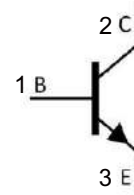
■ FEATURES

- \*  $V_{CEO(SUS)} = 400\text{ V}$
- \* Reverse bias SOA with inductive loads @  $T_C = 100^\circ\text{C}$
- \* Inductive switching matrix 2 to 4 Amp, 25 and  $100^\circ\text{C}$   
 $t_c$  @ 3A,  $100^\circ\text{C}$  is 180 ns (Typ)
- \* 700V blocking capability
- \* SOA and switching applications information

■ APPLICATIONS

- \* Switching regulator's, inverters
- \* Motor controls
- \* Solenoid/Relay drivers
- \* Deflection circuits

Symbol



■ ORDER INFORMATION

Order codes		Package	Packing
Halogen-Free	Halogen		
N/A	MOT13005DF	TO-220F	50 pieces/Tube
N/A	MOT13005DA	TO-220	50 pieces/Tube

■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT	
Collector-Emitter Voltage	$V_{CEO(SUS)}$	400	V	
Collector-Emitter Voltage ( $V_{BE}=0$ )	$V_{CES}$	700	V	
Collector-Base Voltage	$V_{CBO}$	700	V	
Emitter Base Voltage	$V_{EBO}$	9	V	
Collector Current	Continuous	$I_C$	4	
	Peak (1)	$I_{CM}$	8	
Base Current	Continuous	$I_B$	2	
	Peak (1)	$I_{BM}$	4	
Emitter Current	Continuous	$I_E$	6	
	Peak (1)	$I_{EM}$	12	
Power Dissipation at $T_C=25^\circ\text{C}$	TO-220F	$P_D$	40	
	TO-220		75	
Derate above $25^\circ\text{C}$	TO-220F		320	mW/ $^\circ\text{C}$
	TO-220		600	
Operating and Storage Junction Temperature	$T_J, T_{STG}$	-65 ~ +150	$^\circ\text{C}$	

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ THERMAL DATA

PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	$\theta_{JA}$	62.5	$^\circ\text{C/W}$
Junction to Case	$\theta_{JC}$	1.67	$^\circ\text{C/W}$

**■ ELECTRICAL CHARACTERISTICS** ( $T_C=25^\circ\text{C}$ , unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b> (Note 1)						
Collector-Emitter Sustaining Voltage	$V_{CEO(SUS)}$	$I_C=10\text{mA}$ , $I_B=0$	400			V
Collector Cutoff Current	$I_{CBO}$	$V_{CBO}=\text{Rated Value}$ , $V_{BE(OFF)}=1.5\text{V}$			1	mA
		$V_{CBO}=\text{Rated Value}$ , $V_{BE(OFF)}=1.5\text{V}$ , $T_C=100^\circ\text{C}$			5	
Emitter Cutoff Current	$I_{EBO}$	$V_{EB}=9\text{V}$ , $I_C=0$			1	mA
<b>SECOND BREAKDOWN</b>						
Second Breakdown Collector Current with base forward biased	$I_{S/B}$				See Fig. 11	
Clamped Inductive SOA with Base Reverse Biased	RBSOA				See Fig. 12	
<b>ON CHARACTERISTICS</b> (Note 1)						
DC Current Gain	$h_{FE1}$	$I_C=0.5\text{A}$ , $V_{CE}=5\text{V}$	20		40	
	$h_{FE2}$	$I_C=1\text{A}$ , $V_{CE}=5\text{V}$	10		60	
	$h_{FE3}$	$I_C=2\text{A}$ , $V_{CE}=5\text{V}$	8		40	
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	$I_C=1\text{A}$ , $I_B=0.2\text{A}$			0.5	V
		$I_C=2\text{A}$ , $I_B=0.5\text{A}$			0.6	V
		$I_C=4\text{A}$ , $I_B=1\text{A}$			1	V
		$I_C=2\text{A}$ , $I_B=0.5\text{A}$ , $T_a=100^\circ\text{C}$			1	V
Base-Emitter Saturation Voltage	$V_{BE(SAT)}$	$I_C=1\text{A}$ , $I_B=0.2\text{A}$			1.2	V
		$I_C=2\text{A}$ , $I_B=0.5\text{A}$			1.6	V
		$I_C=2\text{A}$ , $I_B=0.5\text{A}$ , $T_C=100^\circ\text{C}$			1.5	V
<b>DYNAMIC CHARACTERISTICS</b>						
Current-Gain-Bandwidth Product	$f_T$	$I_C=500\text{mA}$ , $V_{CE}=10\text{V}$ , $f=1\text{MHz}$	4			MHz
Output Capacitance	$C_{OB}$	$V_{CB}=10\text{V}$ , $I_E=0$ , $f=0.1\text{MHz}$		65		pF
<b>SWITCHING CHARACTERISTICS</b>						
Resistive Load (Table 1)						
Delay Time	$t_D$	$V_{CC}=125\text{V}$ , $I_C=2\text{A}$ , $I_{B1}=I_{B2}=0.4\text{A}$ , $t_p=25\mu\text{s}$ , Duty Cycles $\leq 1\%$		0.025	0.1	$\mu\text{s}$
Rise Time	$t_R$			0.3	0.7	$\mu\text{s}$
Storage Time	$t_S$			1.7	4	$\mu\text{s}$
Fall Time	$t_F$			0.4	0.9	$\mu\text{s}$

Note: 1. Pulse Test: Pulse Width=5ms, Duty Cycle $\leq 10\%$ 

2. Pulse Test:  $P_W=300\mu\text{s}$ , Duty Cycle $\leq 2\%$

RESISTIVE SWITCHING PERFORMANCE

Fig. 1 Turn-On Time

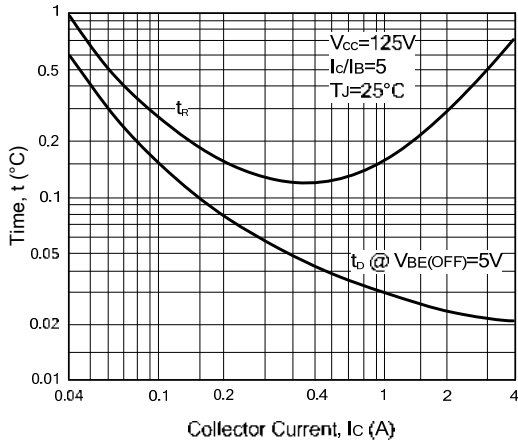


Fig. 2 Turn-Off Time

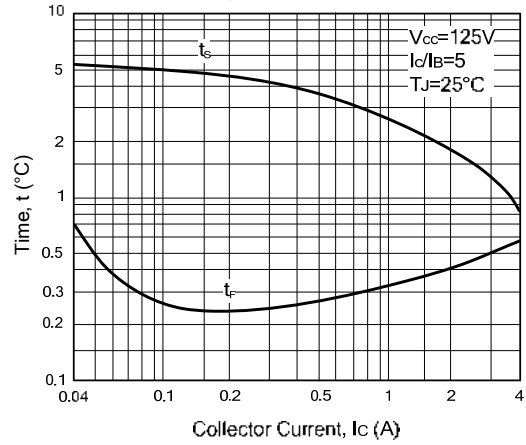


Fig. 3 Typical Thermal Response [ $Z_{\theta JC}(t)$ ]

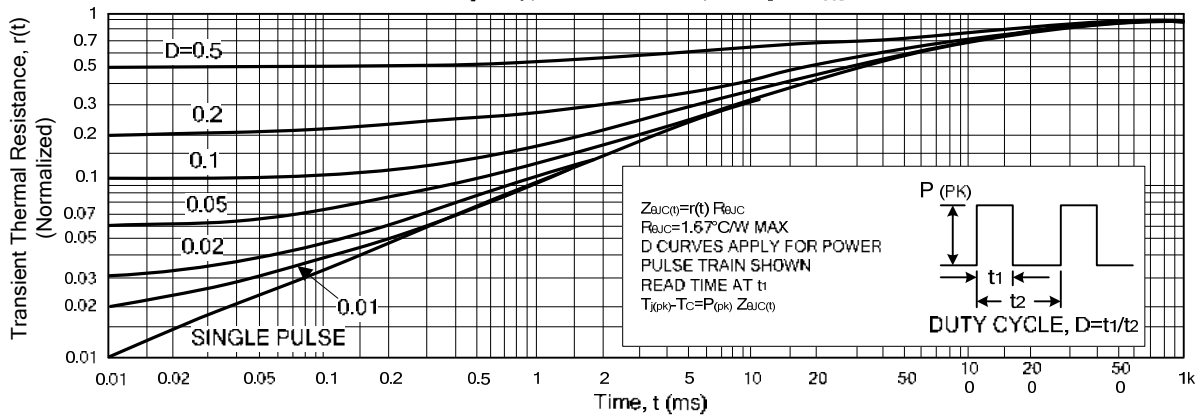


Fig. 4 Forward Bias Safe Operating Area

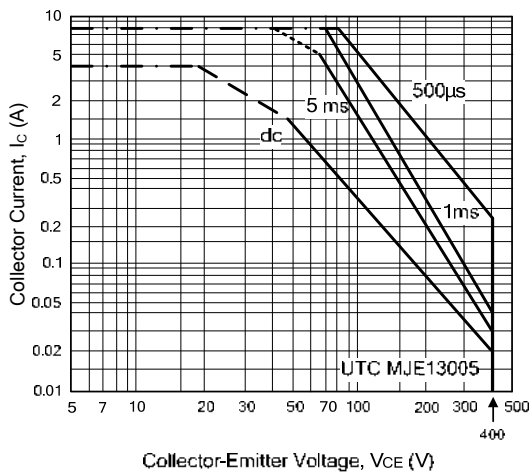
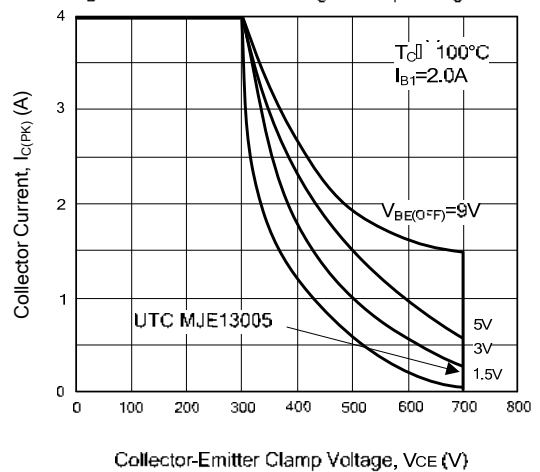
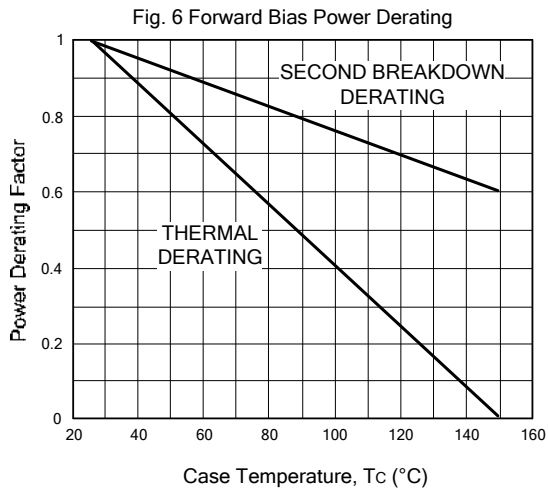


Fig. 5 Reverse Bias Switching Safe Operating Area



■ RESISTIVE SWITCHING PERFORMANCE(Cont.)





■ TO-220-3L PACKAGE OUTLINE DIMENSIONS

