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January 2016

# FJ15603D NPN Silicon Transistor

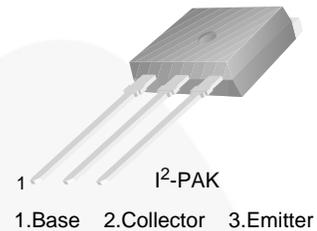
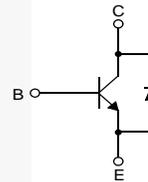
## Applications

- High Voltage and High Speed Power Switch Application
- Electronic Ballast Application

## Features

- Wide Safe Operating Area
- Small Variance in Storage Time
- Built-in Free Wheeling Diode

Equivalent Circuit



## Ordering Information

Part Number	Marking	Package	Packing Method
FJ15603DTU	J5603D	TO-262 3L (I2PAK)	Rail

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.

Symbol	Parameter	Value	Unit
$V_{CBO}$	Collector-Base Voltage	1600	V
$V_{CEO}$	Collector-Emitter Voltage	800	V
$V_{EBO}$	Emitter-Base Voltage	12	V
$I_C$	Collector Current (DC)	3	A
$I_{CP}$	Collector Current (Pulse) <sup>(1)</sup>	6	A
$I_B$	Base Current (DC)	2	A
$I_{BP}$	Base Current (Pulse) <sup>(1)</sup>	4	A
$P_C$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	100	W
$T_J$	Junction Temperature	150	$^\circ\text{C}$
$T_{STG}$	Storage Junction Temperature Range	-65 to +150	$^\circ\text{C}$
EAS	Avalanche Energy ( $T_J = 25^\circ\text{C}$ , 8 mH)	3.5	mJ

### Notes:

1. Pulse test: pulse width = 5 ms, duty cycle  $\leq 10\%$

**Thermal Characteristics<sup>(2)</sup>**Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.

Symbol	Parameter	Rating	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.25	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	80	$^\circ\text{C/W}$

**Note:**

2. Device mounted on minimum pad size.

**Electrical Characteristics<sup>(3)</sup>**Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
$BV_{CBO}$	Collector-Base Breakdown Voltage	$I_C = 0.5\text{ mA}, I_E = 0$	1600	1689		V	
$BV_{CEO}$	Collector-Emitter Breakdown Voltage	$I_C = 5\text{ mA}, I_B = 0$	800	870		V	
$BV_{EBO}$	Emitter-Base Breakdown Voltage	$I_E = 0.5\text{ mA}, I_C = 0$	12.0	14.8		V	
$I_{CES}$	Collector Cut-Off Current	$V_{CE} = 1600\text{ V}, V_{BE} = 0$	$T_C = 25^\circ\text{C}$	0.01	100	$\mu\text{A}$	
			$T_C = 125^\circ\text{C}$		1000		
$I_{CEO}$	Collector Cut-Off Current	$V_{CE} = 800\text{ V}, I_B = 0$	$T_C = 25^\circ\text{C}$	0.01	100	$\mu\text{A}$	
			$T_C = 125^\circ\text{C}$		1000		
$I_{EBO}$	Emitter Cut-Off Current	$V_{EB} = 12\text{ V}, I_C = 0$		0.05	500	$\mu\text{A}$	
$h_{FE}$	DC Current Gain	$V_{CE} = 3\text{ V}, I_C = 0.4\text{ A}$	$T_C = 25^\circ\text{C}$	20	29	35	
			$T_C = 125^\circ\text{C}$	6	15		
		$V_{CE} = 10\text{ V}, I_C = 5\text{ mA}$	$T_C = 25^\circ\text{C}$	20	43		
			$T_C = 125^\circ\text{C}$	20	46		
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 250\text{ mA}, I_B = 25\text{ mA}$		0.50	1.25	V	
		$I_C = 500\text{ mA}, I_B = 50\text{ mA}$		1.50	2.50		
		$I_C = 1\text{ A}, I_B = 0.2\text{ A}$		1.20	2.50		
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	$I_C = 500\text{ mA}, I_B = 50\text{ mA}$	$T_C = 25^\circ\text{C}$	0.74	1.20	V	
			$T_C = 125^\circ\text{C}$	0.61	1.10		
		$I_C = 2\text{ A}, I_B = 0.4\text{ A}$	$T_C = 25^\circ\text{C}$	0.85	1.20		
			$T_C = 125^\circ\text{C}$	0.74	1.10		
$C_{ib}$	Input Capacitance	$V_{EB} = 10\text{ V}, I_C = 0, f = 1\text{ MHz}$		745	1000	pF	
$C_{ob}$	Output Capacitance	$V_{CB} = 10\text{ V}, I_E = 0, f = 1\text{ MHz}$		56	500	pF	
$f_T$	Current Gain Bandwidth Product	$I_C = 0.1\text{ A}, V_{CE} = 10\text{ V}$		5		MHz	
$V_F$	Diode Forward Voltage	$I_F = 0.4\text{ A}$		0.76	1.20	V	
		$I_F = 1\text{ A}$		0.83	1.50		

**Note:**3. Pulse test: pulse width = 20  $\mu\text{s}$ , duty cycle  $\leq 10\%$ .

**Electrical Characteristics** (Continued)Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
RESISTIVE LOAD SWITCHING (D.C. $\leq$ 10%, Pulse Width = 20 $\mu\text{s}$ )						
$t_{\text{ON}}$	Turn-On Time	$I_C = 0.3\text{ A}$ , $I_{B1} = 50\text{ mA}$ , $I_{B2} = 150\text{ mA}$ , $V_{CC} = 125\text{ V}$ , $R_L = 416\ \Omega$		400	600	ns
$t_{\text{STG}}$	Storage Time		1.9	2.1	2.3	$\mu\text{s}$
$t_F$	Fall Time			310	1000	ns
$t_{\text{ON}}$	Turn-On Time	$I_C = 0.5\text{ A}$ , $I_{B1} = 50\text{ mA}$ , $I_{B2} = 250\text{ mA}$ , $V_{CC} = 125\text{ V}$ , $R_L = 250\ \Omega$		600	1100	ns
$t_{\text{STG}}$	Storage Time			1.3	1.5	$\mu\text{s}$
$t_F$	Fall Time			180	350	ns
INDUCTIVE LOAD SWITCHING ( $V_{CC} = 15\text{ V}$ )						
$t_{\text{STG}}$	Storage Time	$I_C = 0.3\text{ A}$ , $I_{B1} = 50\text{ mA}$ , $I_{B2} = 150\text{ mA}$ , $V_Z = 300\text{ V}$ , $L_C = 200\text{ H}$	0.8		1.2	$\mu\text{s}$
$t_F$	Fall Time			170	250	ns
$t_C$	Cross-Over Time			180	250	ns
$t_{\text{STG}}$	Storage Time	$I_C = 0.5\text{ A}$ , $I_{B1} = 50\text{ mA}$ , $I_{B2} = 250\text{ mA}$ , $V_Z = 300\text{ V}$ , $L_C = 200\text{ H}$	0.8		1.2	$\mu\text{s}$
$t_F$	Fall Time			140	175	ns
$t_C$	Cross-Over Time			170	200	ns

## Typical Performance Characteristics

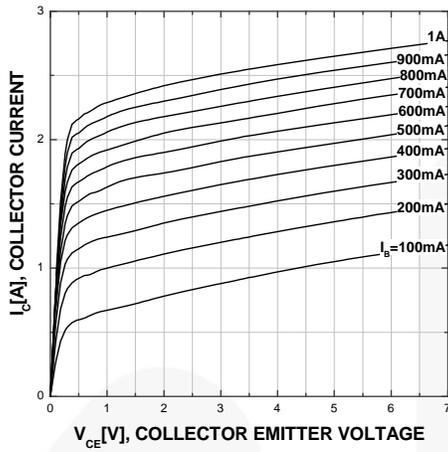


Figure 1. Static Characteristic

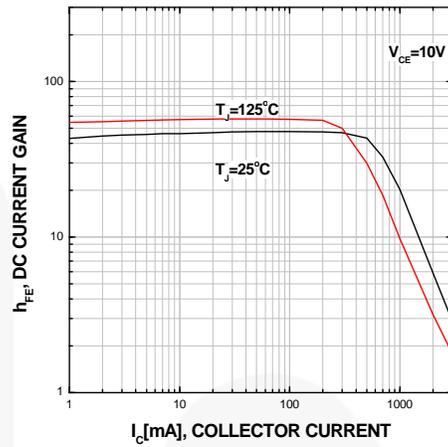


Figure 2. DC Current Gain

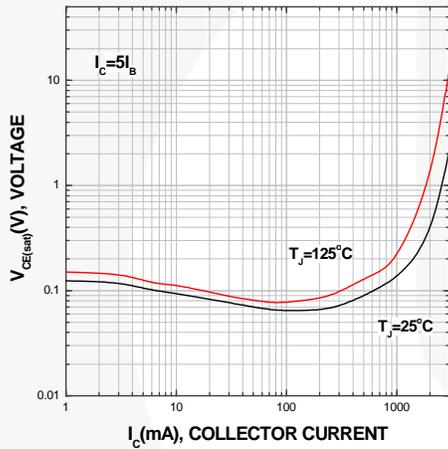


Figure 3. Collector-Emitter Saturation Voltage

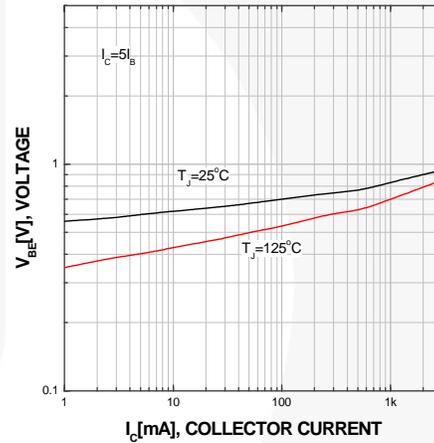


Figure 4. Base-Emitter Saturation Voltage

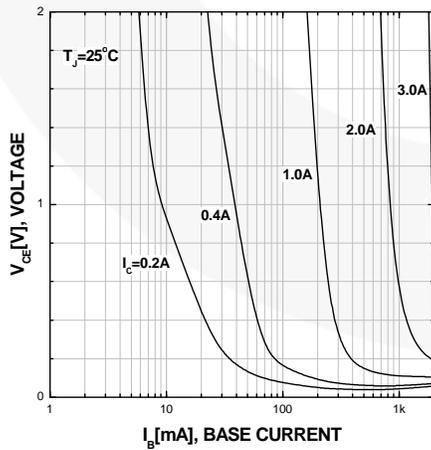


Figure 5. Typical Collector Saturation Voltage

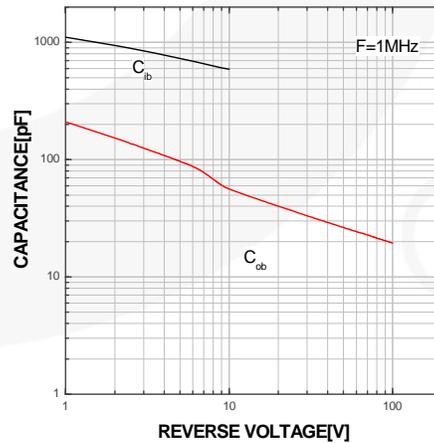


Figure 6. Capacitance

Typical Performance Characteristics (Continued)

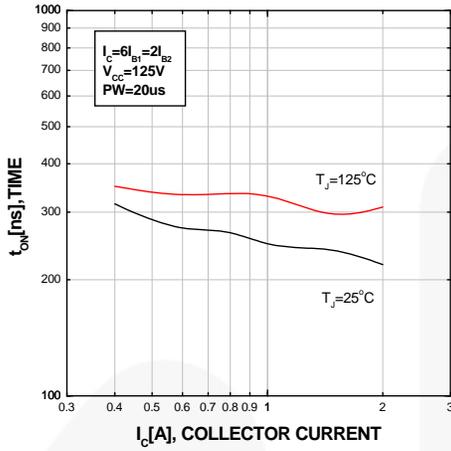


Figure 7. Resistive Switching Time,  $t_{on}$

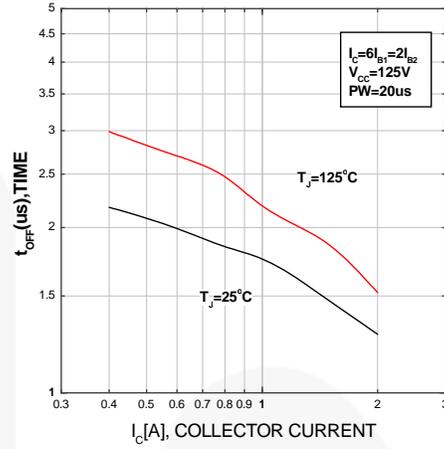


Figure 8. Resistive Switching Time,  $t_{off}$

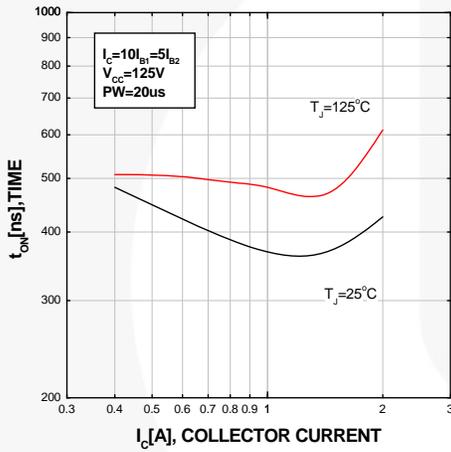


Figure 9. Resistive Switching Time,  $t_{on}$

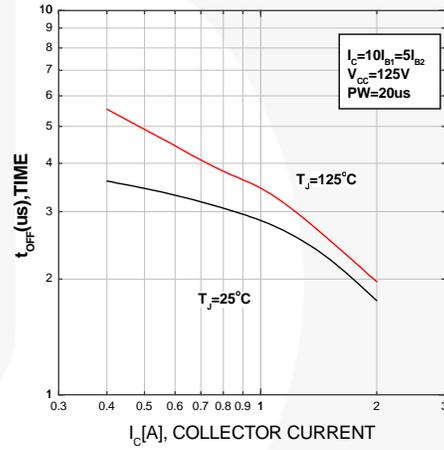


Figure 10. Resistive Switching Time,  $t_{off}$

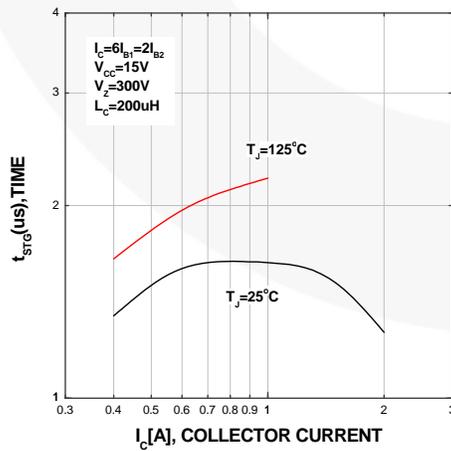


Figure 11. Inductive Switching Time,  $t_{STG}$

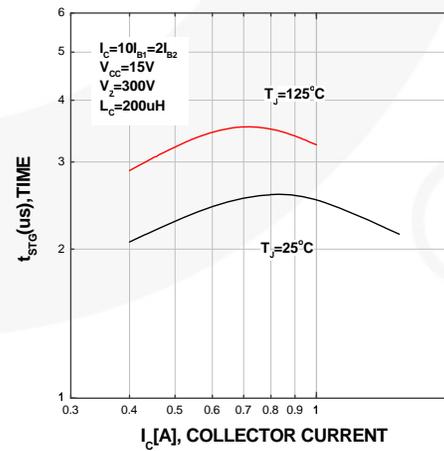


Figure 12. Inductive Switching Time,  $t_{STG}$

Typical Performance Characteristics (Continued)

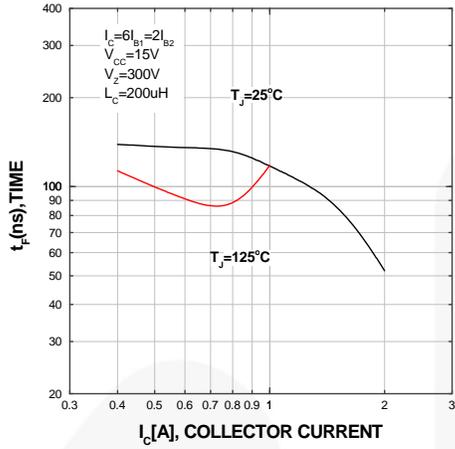


Figure 13. Inductive Switching Time,  $t_f$

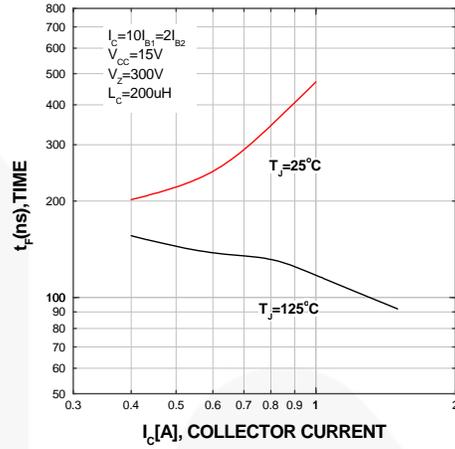


Figure 14. Inductive Switching Time,  $t_f$

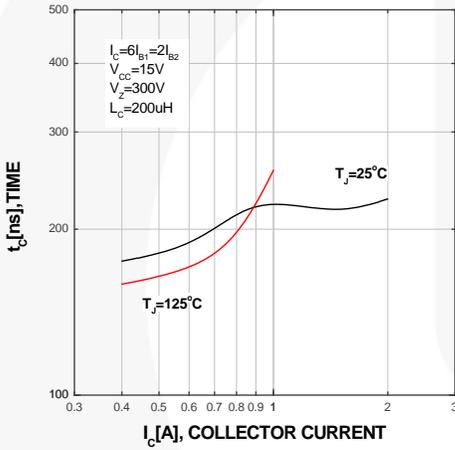


Figure 15. Inductive Switching Time,  $t_c$

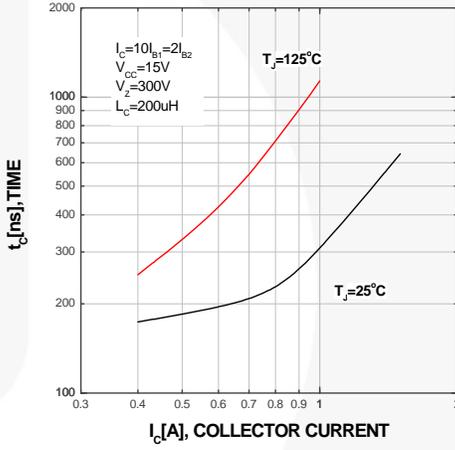


Figure 16. Inductive Switching Time,  $t_c$

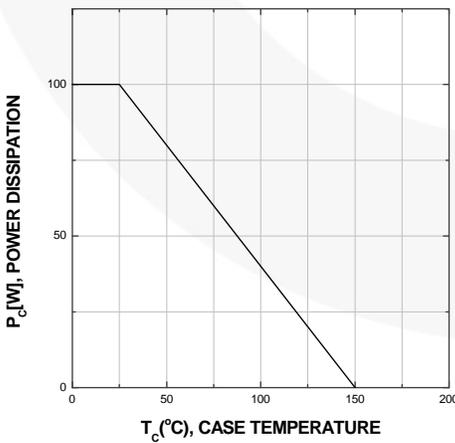
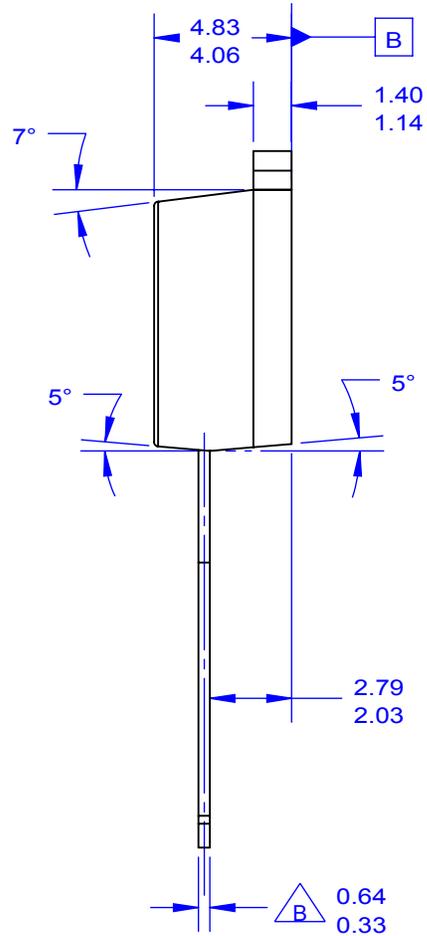
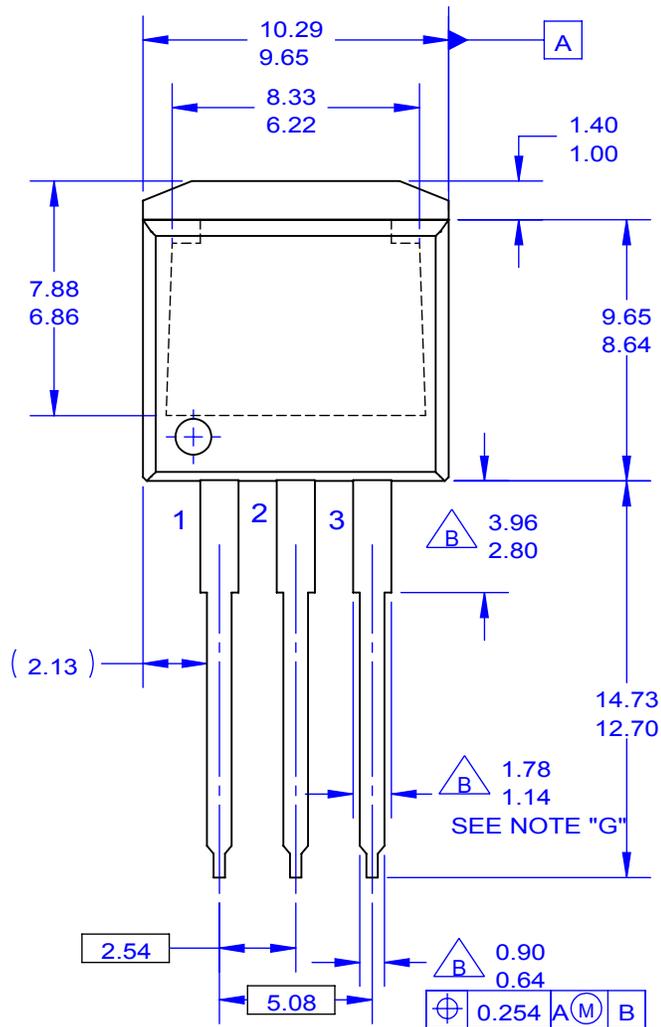


Figure 17. Power Derating





NOTES:

- A. EXCEPT WHERE NOTED CONFORMS TO TO262 JEDEC VARIATION AA.
- B. DOES NOT COMPLY JEDEC STD. VALUE.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- E. DIMENSION AND TOLERANCE AS PER ANSI Y14.5-1994.
- F. LOCATION OF PIN HOLE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF PACKAGE)
- G. MAXIMUM WIDTH FOR F102 DEVICE = 1.35 MAX.
- H. DRAWING FILE NAME: TO262A03REV6



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