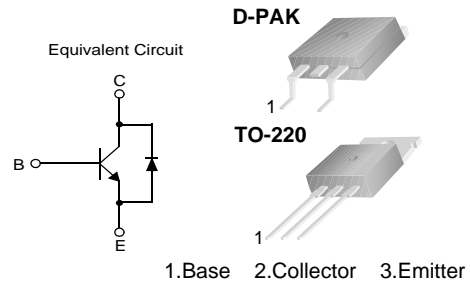


KSC5402D/KSC5402DT

NPN Silicon Transistor, Planar Silicon Transistor

Features

- High Voltage High Speed Power Switch Application
- Wide Safe Operating Area
- Built-in Free Wheeling Diode
- Suitable for Electronic Ballast Application
- Small Variance in Storage Time
- Two Package Choices; D-PAK or TO-220



Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Value	Units
V_{CBO}	Collector-Base Voltage	1000	V
V_{CEO}	Collector-Emitter Voltage	450	V
V_{EBO}	Emitter-Base Voltage	12	V
I_C	Collector Current (DC)	2	A
I_{CP}	*Collector Current (Pulse)	5	A
I_B	Base Current (DC)	1	A
I_{BP}	*Base Current (Pulse)	2	A
P_C	Power Dissipation($T_C=25^\circ\text{C}$) : D-PAK* : TO-220	30 50	W W
T_J	Junction Temperature	150	$^\circ\text{C}$
T_{STG}	Storage Temperature	- 65 to 150	$^\circ\text{C}$

* Pulse Test: Pulse Width=5ms, Duty Cycle \leq 10%

Thermal Characteristics $T_A=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Rating		Units	
		TO-220	D-PAK		
$R_{\theta JC}$	Thermal Resistance	Junction to Case	2.5	4.17*	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$		Junction to Ambient	62.5	50	$^\circ\text{C}/\text{W}$
T_L	Maximum Lead Temperature for Soldering Purpose ; 1/8" from Case for 5 Seconds		270	270	$^\circ\text{C}$

* Mounted on 1" square PCB (FR4 ro G-10 Material)

Electrical Characteristics $T_A=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
BV_{CBO}	Collector-Base Breakdown Voltage	$I_C=1\text{mA}, I_E=0$	1000	1090		V
BV_{CEO}	Collector-Emitter Breakdown Voltage	$I_C=5\text{mA}, I_B=0$	450	525		V
BV_{EBO}	Emitter-Base Breakdown Voltage	$I_E=1\text{mA}, I_C=0$	12	14		V
I_{CES}	Collector Cut-off Current	$V_{CES}=1000\text{V}, I_{EB}=0$	$T_A=25^\circ\text{C}$	0.03	100	μA
			$T_A=125^\circ\text{C}$	1.2	500	μA
I_{CEO}	Collector Cut-off Current	$V_{CE}=450\text{V}, V_B=0$	$T_A=25^\circ\text{C}$	0.3	100	μA
			$T_A=125^\circ\text{C}$	15	500	μA
I_{EBO}	Emitter Cut-off Current	$V_{EB}=10\text{V}, I_C=0$		0.01	100	μA
h_{FE}	DC Current Gain	$V_{CE}=1\text{V}, I_C=0.4\text{A}$	$T_A=25^\circ\text{C}$	14	29	
			$T_A=125^\circ\text{C}$	8	17	
		$V_{CE}=1\text{V}, I_C=1\text{A}$	$T_A=25^\circ\text{C}$	6	9	
			$T_A=125^\circ\text{C}$	4	6	
$V_{CE}(\text{sat})$	Collector-Emitter Saturation Voltage	$I_C=0.4, I_B=0.04\text{A}$	$T_A=25^\circ\text{C}$	0.25	0.6	V
			$T_A=125^\circ\text{C}$	0.4	1.0	V
		$I_C=1\text{A}, I_B=0.2\text{A}$	$T_A=25^\circ\text{C}$	0.3	0.75	V
			$T_A=125^\circ\text{C}$	0.65	1.2	V
$V_{BE}(\text{sat})$	Base-Emitter Saturation Voltage	$I_C=0.4\text{A}, I_B=0.04\text{A}$	$T_A=25^\circ\text{C}$	0.78	1.0	V
			$T_A=125^\circ\text{C}$	0.65	0.9	V
		$I_C=1\text{A}, I_B=0.2\text{A}$	$T_A=25^\circ\text{C}$	0.85	1.1	V
			$T_A=125^\circ\text{C}$	0.75	1.0	V
C_{ib}	Input Capacitance	$V_{EB}=8\text{V}, I_C=0, f=1\text{MHz}$		330	500	pF
C_{ob}	Output Capacitance	$V_{CB}=10\text{V}, I_E=0, f=1\text{MHz}$		35	100	pF
f_T	Current Gain Bandwidth Product	$I_C=0.5\text{A}, V_{CE}=10\text{V}$		11		MHz
V_F	Diode Forward Voltage	$I_F=1\text{A}$	$T_A=25^\circ\text{C}$	0.86	1.5	V
			$T_A=125^\circ\text{C}$	0.75	1.2	V
		$I_F=0.2\text{A}$	$T_A=25^\circ\text{C}$	0.6		V
			$T_A=125^\circ\text{C}$	0.8	1.3	V
		$I_F=0.4\text{A}$	$T_A=125^\circ\text{C}$	0.65		V

Electrical Characteristics (Continued) $T_A=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units	
t_{fr}	Diode Forward Recovery Time ($di/dt=10\text{A}/\mu\text{s}$)	$I_F=0.2\text{A}$		540		ns	
		$I_F=0.4\text{A}$		520		ns	
		$I_F=1\text{A}$		480		ns	
$V_{CE(DSAT)}$	Dynamic Saturation Voltage	$I_C=0.4\text{A}, I_{B1}=40\text{mA}$ $V_{CC}=300\text{V}$	@ $1\mu\text{s}$	7.5		V	
			@ $3\mu\text{s}$	2.5		V	
		$I_C=1\text{A}, I_{B1}=200\text{mA}$ $V_{CC}=300$	@ $1\mu\text{s}$	11.5		V	
			@ $3\mu\text{s}$	1.5		V	
RESISTIVE LOAD SWITCHING (D.C $\leq 10\%$, Pulse Width= $20\mu\text{s}$)							
t_{ON}	Turn On Time	$I_C=1\text{A},$ $I_{B1}=200\text{mA},$ $I_{B2}=150\text{mA},$ $V_{CC}=300\text{V},$ $R_L = 300\Omega$	$T_A=25^\circ\text{C}$		110	150	ns
			$T_A=125^\circ\text{C}$		135		ns
t_{OFF}	Turn Off Time		$T_A=25^\circ\text{C}$	0.95		1.25	μs
			$T_A=125^\circ\text{C}$		1.4		μs
INDUCTIVE LOAD SWITCHING ($V_{CC}=15\text{V}$)							
t_{STG}	Storage Time	$I_C=0.4\text{A},$ $I_{B1}=40\text{mA},$ $I_{B2}=200\text{mA},$ $V_Z=300\text{V},$ $L_C=200\text{H}$	$T_A=25^\circ\text{C}$		0.56	0.65	μs
			$T_A=125^\circ\text{C}$		0.7		μs
t_F	Fall Time		$T_A=25^\circ\text{C}$		60	175	ns
			$T_A=125^\circ\text{C}$		75		ns
t_C	Cross-over Time		$T_A=25^\circ\text{C}$		90	175	ns
			$T_A=125^\circ\text{C}$		90		ns
t_{STG}	Storage Time	$I_C=0.8\text{A},$ $I_{B1}=160\text{mA},$ $I_{B2}=160\text{mA},$ $V_Z=300\text{V},$ $L_C=200\text{H}$	$T_A=25^\circ\text{C}$			2.75	μs
			$T_A=125^\circ\text{C}$		3		μs
t_F	Fall Time		$T_A=25^\circ\text{C}$		110	175	ns
			$T_A=125^\circ\text{C}$		180		ns
t_C	Cross-over Time		$T_A=25^\circ\text{C}$		125	350	ns
			$T_A=125^\circ\text{C}$		185		ns
t_{STG}	Storage Time	$I_C=1\text{A},$ $I_{B1}=200\text{mA},$ $I_{B2}=500\text{mA},$ $V_Z=300\text{V},$ $L_C=200\mu\text{H}$	$T_A=25^\circ\text{C}$		1.1	1.2	μs
			$T_A=125^\circ\text{C}$		1.35		μs
t_F	Fall Time		$T_A=25^\circ\text{C}$		105	150	ns
			$T_A=125^\circ\text{C}$		75		ns
t_C	Cross-over Time		$T_A=25^\circ\text{C}$		125	150	ns
			$T_A=125^\circ\text{C}$		100		ns

Typical Performance Characteristics

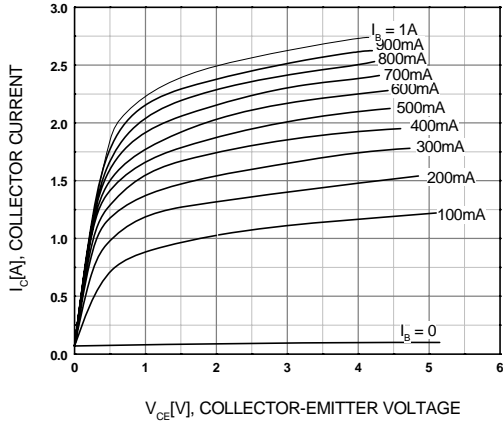


Figure 1. Static Characteristic

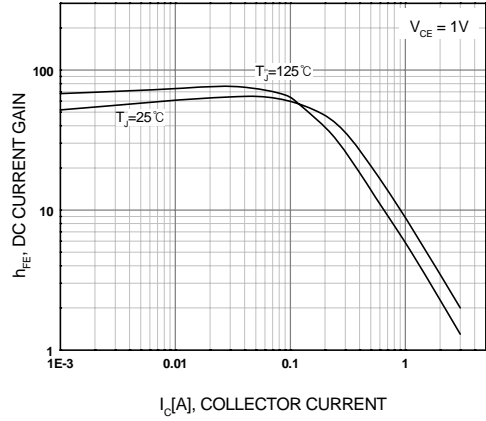


Figure 2. DC current Gain

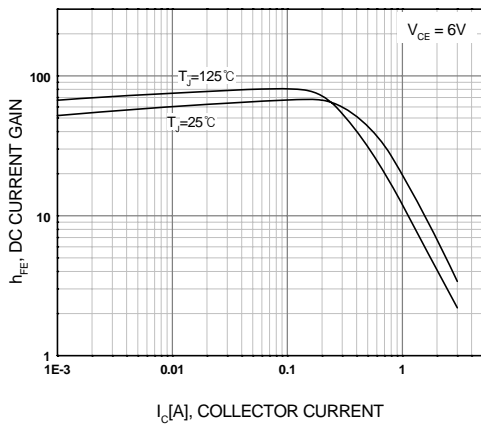


Figure 3. DC current Gain

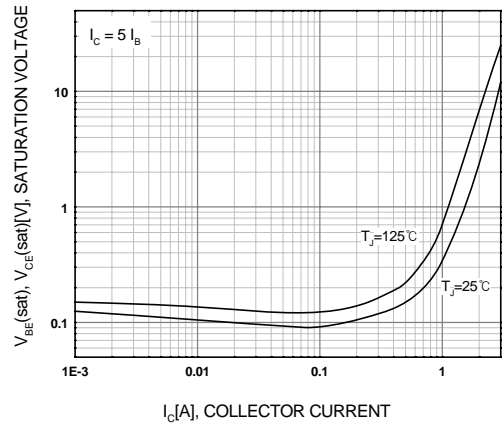


Figure 4. Collector-Emitter Saturation Voltage

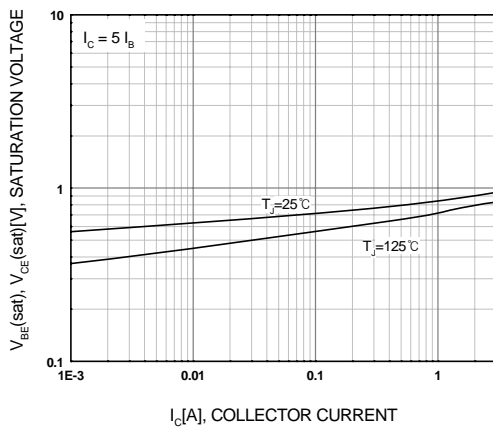


Figure 5. Base-Emitter Saturation Voltage

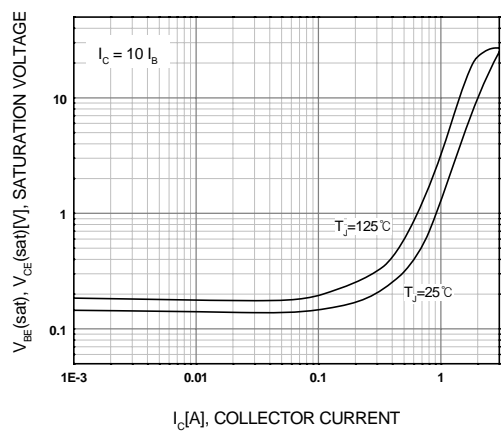


Figure 6. Collector-Emitter Saturation Voltage

Typical Performance Characteristics (Continued)

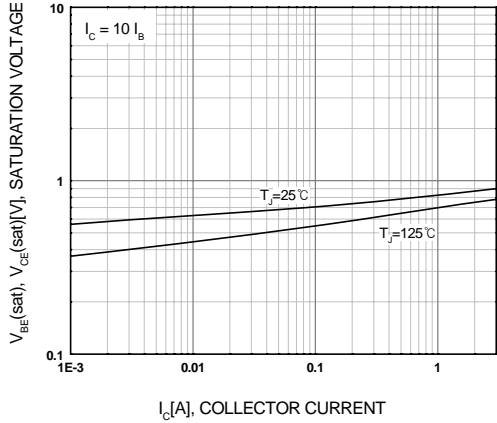


Figure 7. Base-Emitter Saturation Voltage

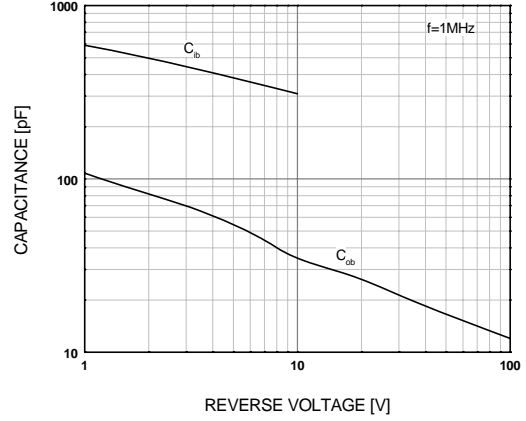


Figure 8. Collector Output Capacitance

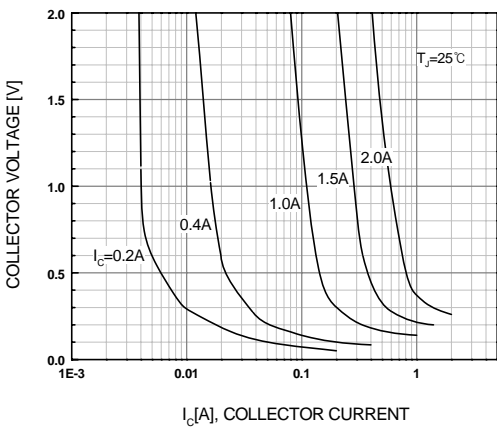


Figure 9. Typical Collector Saturation Region

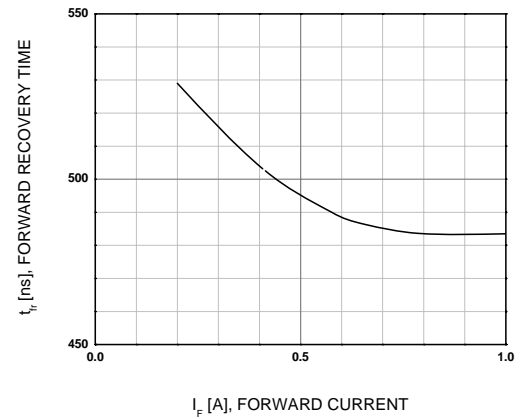


Figure 10. Forward Recovery Time

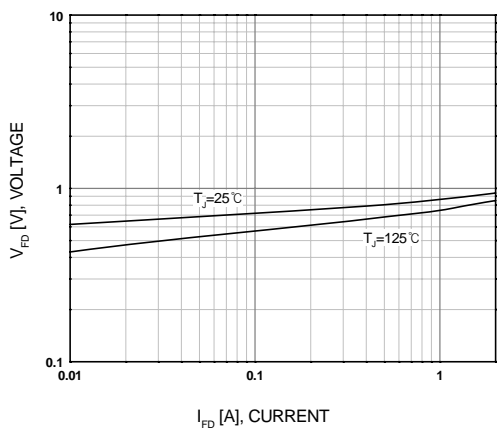


Figure 11. Diode Forward Voltage

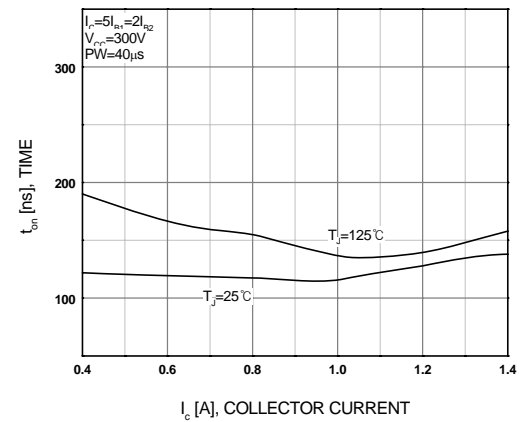


Figure 12. Resistive Switching Time, t_{on}

Typical Performance Characteristics (Continued)

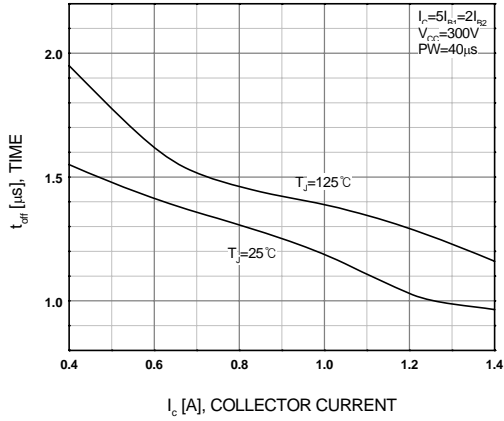


Figure 13. Resistive Switching Time, t_{off}

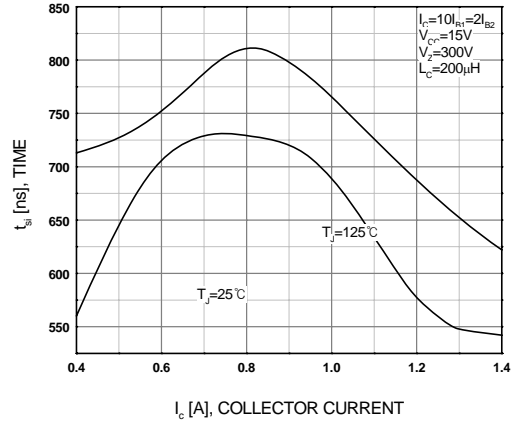


Figure 14. Inductive Switching Time, t_{si}

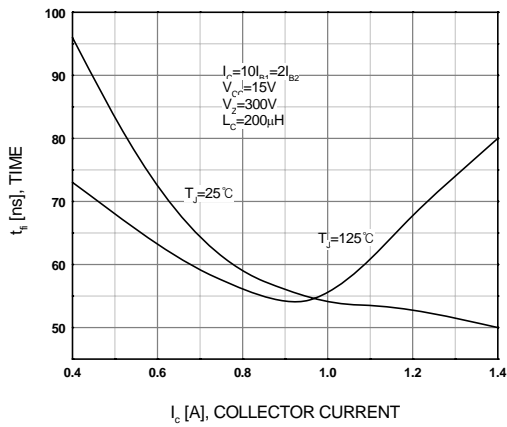


Figure 15. Inductive Switching Time, t_{fi}

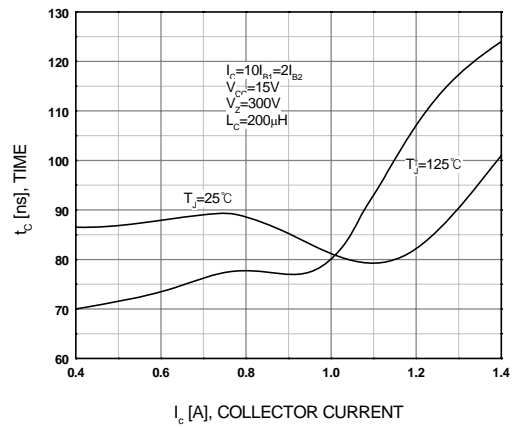


Figure 16. Inductive Switching Time, t_c

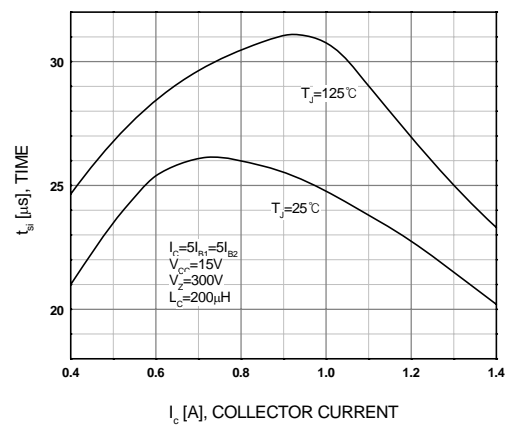


Figure 17. Inductive Switching Time, t_{si}

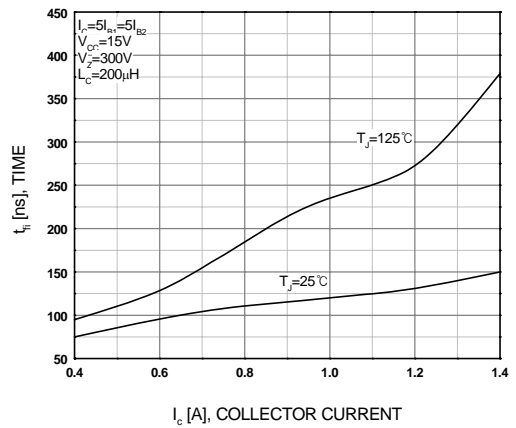


Figure 18. Inductive Switching Time, t_{fi}

Typical Performance Characteristics (Continued)

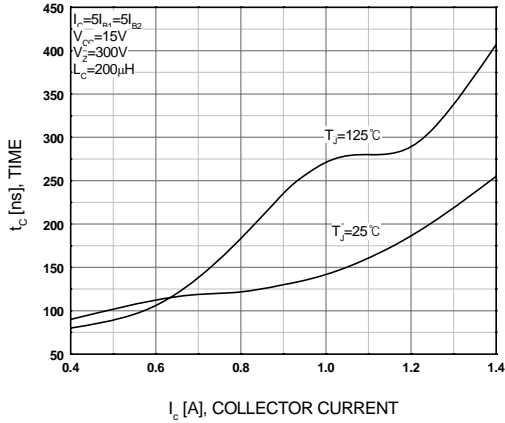


Figure 19. Inductive Switching Time, t_c

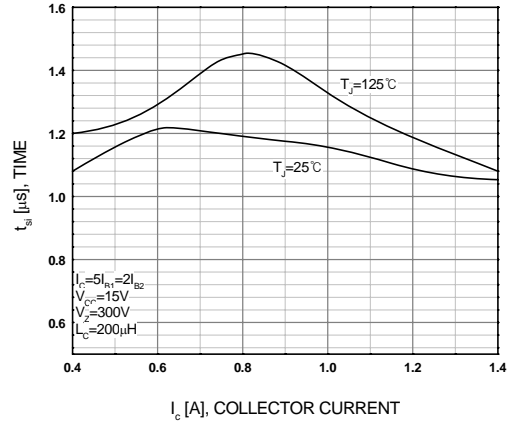


Figure 20. Inductive Switching Time, t_{si}

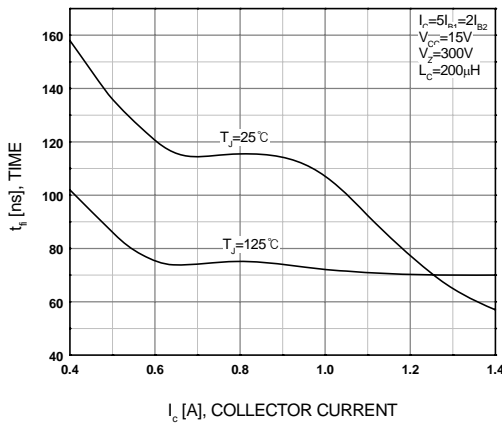


Figure 21. Inductive Switching Time, t_{fi}

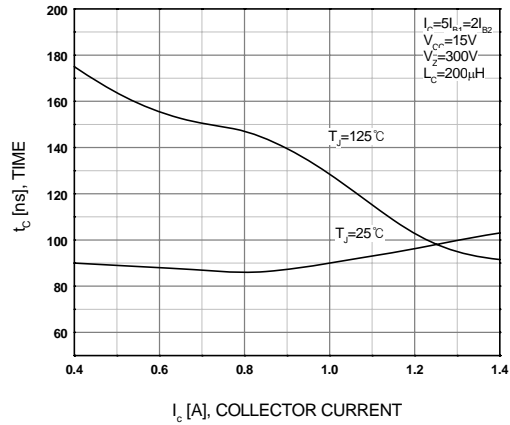


Figure 22. Inductive Switching Time, t_c

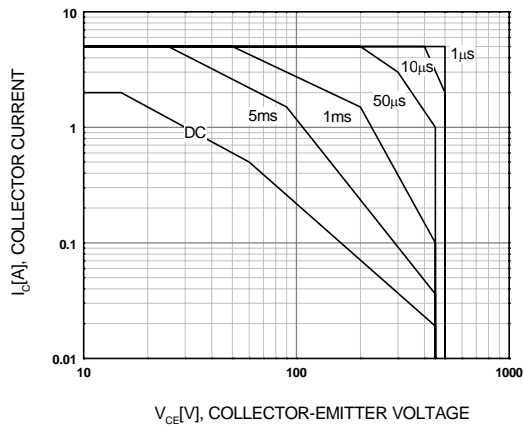


Figure 23. Forward Bias Safe Operating Area

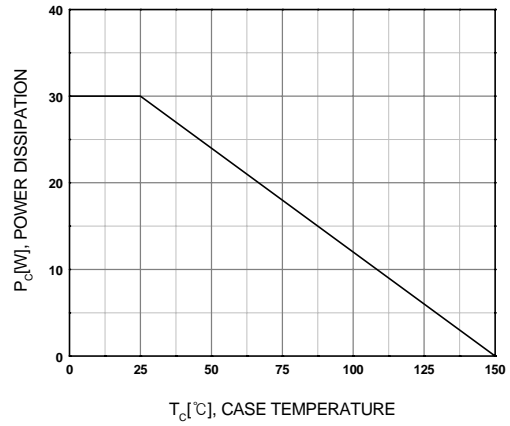
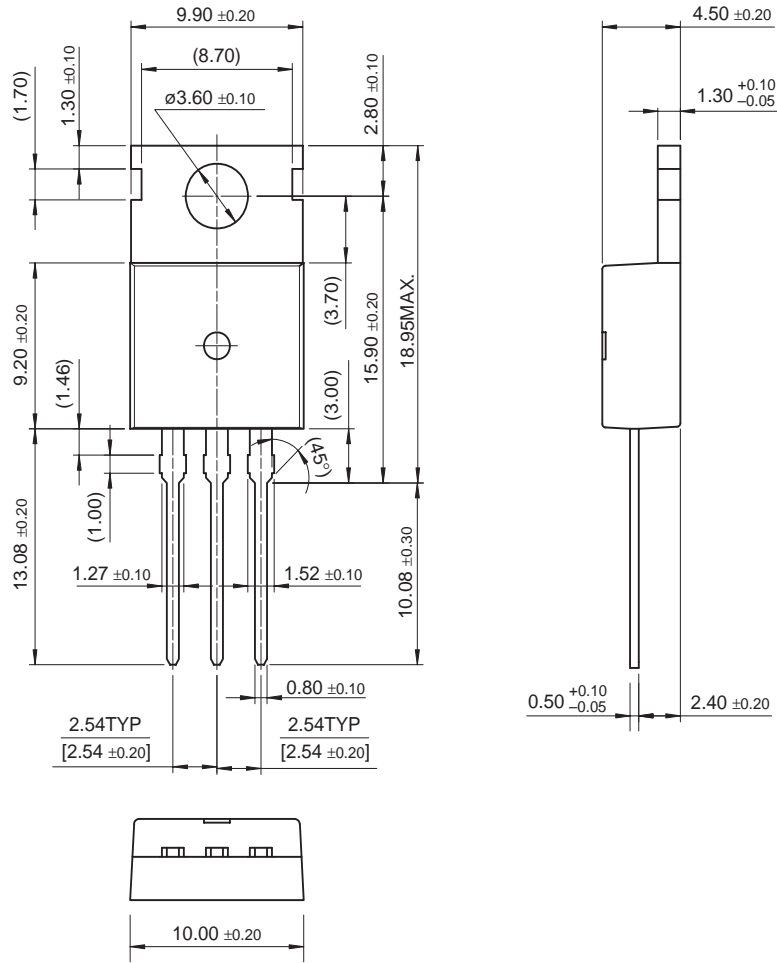


Figure 24. Power Derating

Physical Dimension

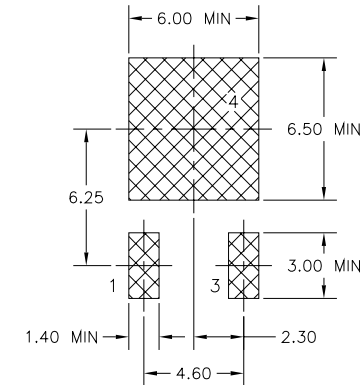
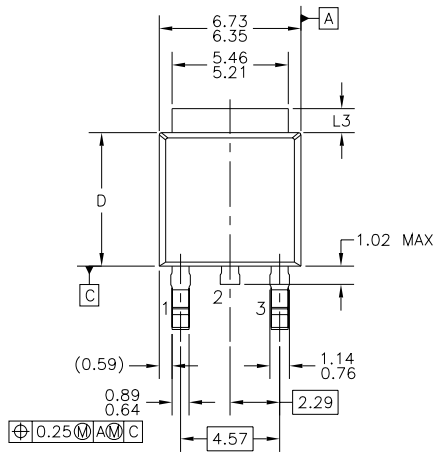
TO-220



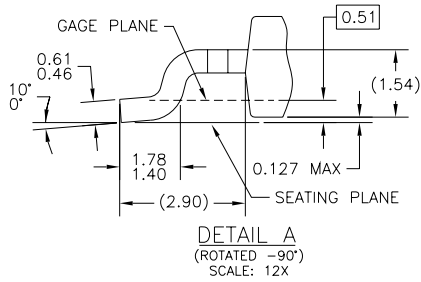
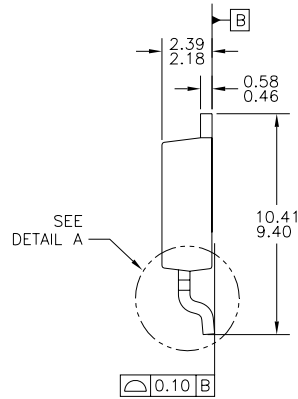
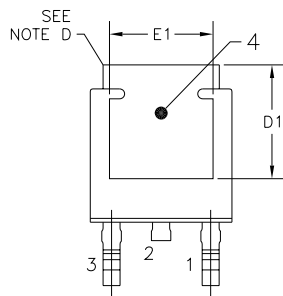
Dimensions in Millimeters

Physical Dimension (Continued)

D-PAK



LAND PATTERN RECOMMENDATION









- NOTES: UNLESS OTHERWISE SPECIFIED
 A) ALL DIMENSIONS ARE IN MILLIMETERS.
 B) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE C, VARIATION AA & AB, DATED NOV. 1999.
 C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
 D) HEAT SINK TOP EDGE COULD BE IN CHAMFERED CORNERS OR EDGE PROTRUSION.
 E) DIMENSIONS L3,D,E1&D1 TABLE:
- | | OPTION AA | OPTION AB |
|----|-----------|-----------|
| L3 | 0.89-1.27 | 1.52-2.03 |
| D | 5.97-6.22 | 5.33-5.59 |
| E1 | 4.32 MIN | 3.81 MIN |
| D1 | 5.21 MIN | 4.57 MIN |
- F) PRESENCE OF TRIMMED CENTER LEAD IS OPTIONAL.

Dimensions in Millimeters



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Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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