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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

FAIRCHILD SEMICONDUCTOR®

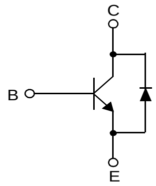
December 2009

KSC5402D/KSC5402DT NPN Silicon Transistor, Planar Silicon Transistor

Features

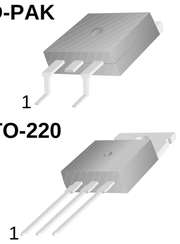
- High Voltage High Speed Power Switch Application
- Wide Safe Operating Area
- Built-in Free Wheeling Diode
- Suitable for Electronic Ballast Application
- Small Variance in Storage Time
- Two Package Choices; D-PAK or TO-220

Equivalent Circuit



D-PAK

TO-220



1.Base 2.Collector 3.Emitter

Absolute Maximum Ratings T_A=25°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°C) : D-PAK* : TO-220	30 50	W W
T_J	Junction Temperature	150	°C
T_{STG}	Storage Temperature	- 65 to 150	°C

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

Thermal Characteristics T_A=25°C unless otherwise noted

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

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

Electrical Characteristics T_A=25°C unless otherwise noted

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

Electrical Characteristics (Continued) T_A=25°C unless otherwise noted

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

Typical Performance Characteristics

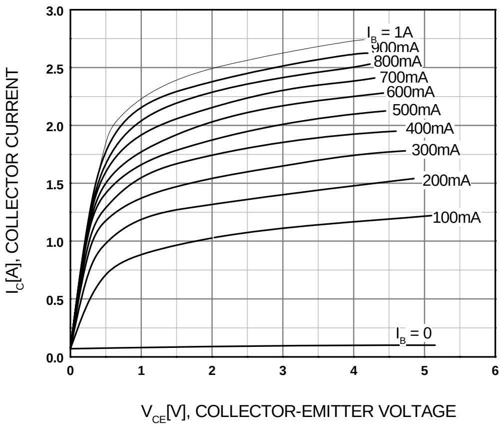


Figure 1. Static Characteristic

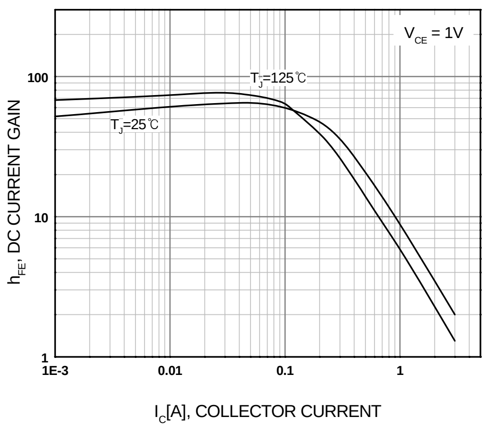


Figure 2. DC current Gain

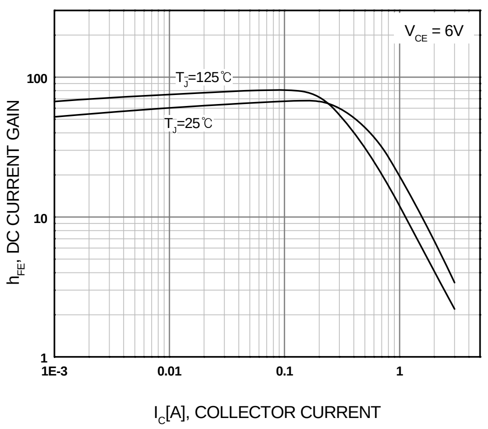


Figure 3. DC current Gain

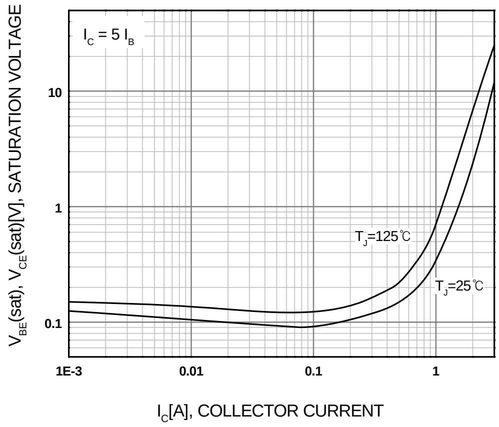


Figure 4. Collector-Emitter Saturation Voltage

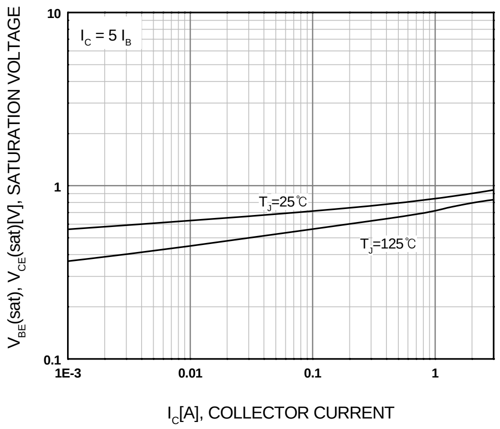


Figure 5. Base-Emitter Saturation Voltage

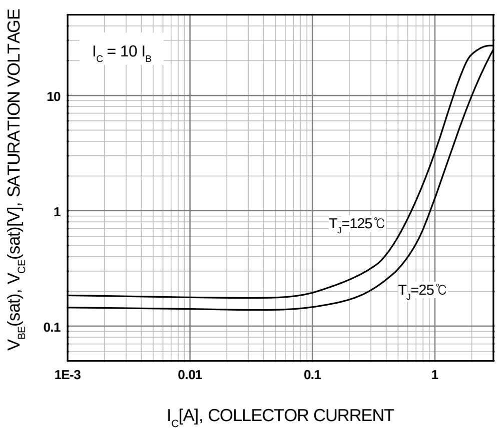


Figure 6. Collector-Emitter Saturation Voltage

Typical Performance Characteristics (Continued)

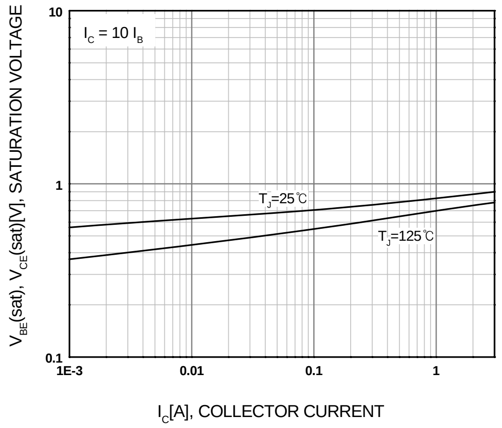


Figure 7. Base-Emitter Saturation Voltage

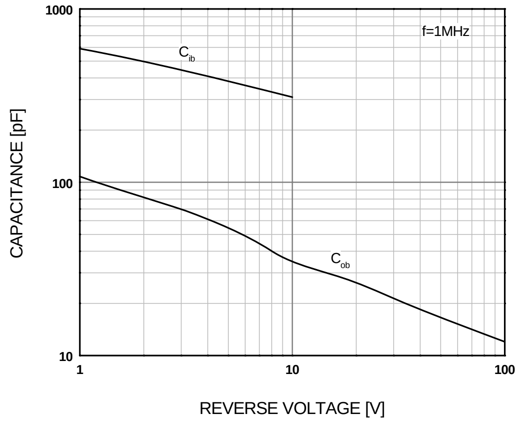


Figure 8. Collector Output Capacitance

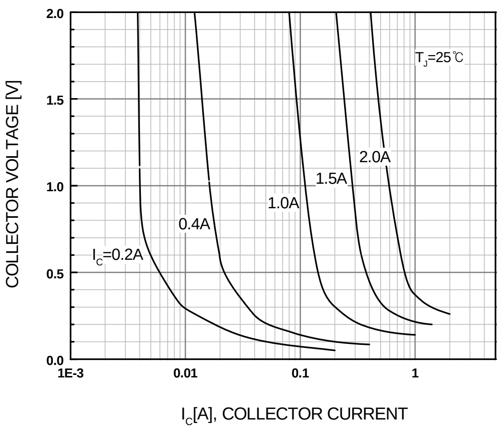


Figure 9. Typical Collector Saturation Region

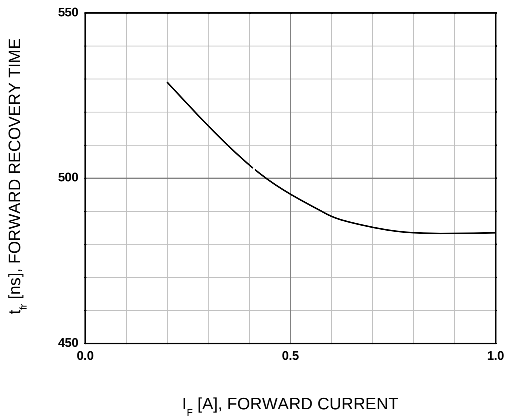


Figure 10. Forward Recovery Time

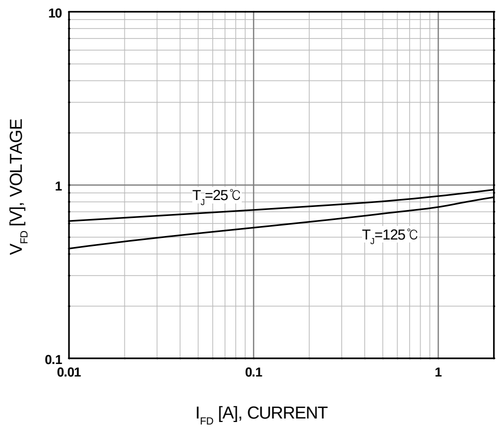


Figure 11. Diode Forward Voltage

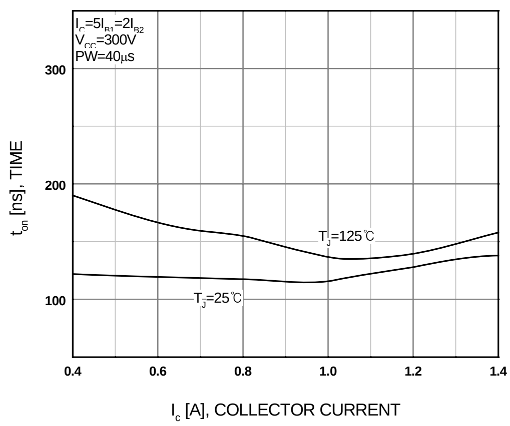


Figure 12. Resistive Switching Time, t_{on}

Typical Performance Characteristics (Continued)

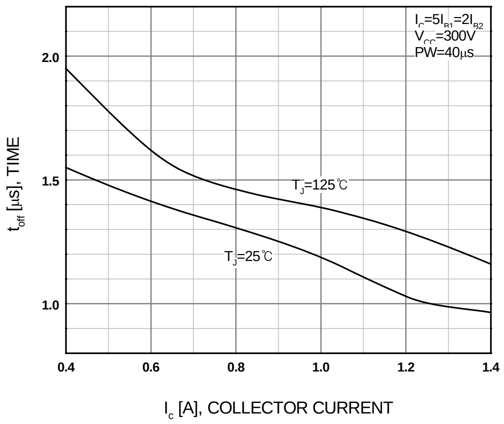


Figure 13. Resistive Switching Time, t_{off}

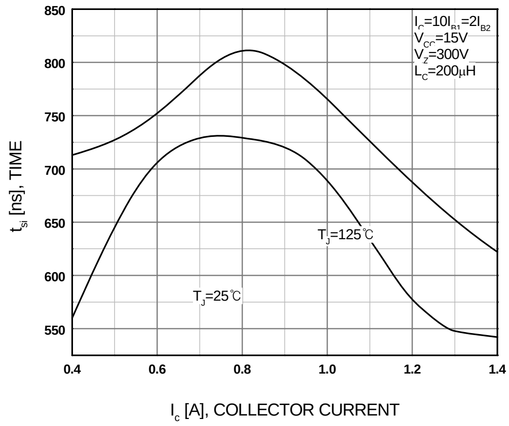


Figure 14. Inductive Switching Time, t_{si}

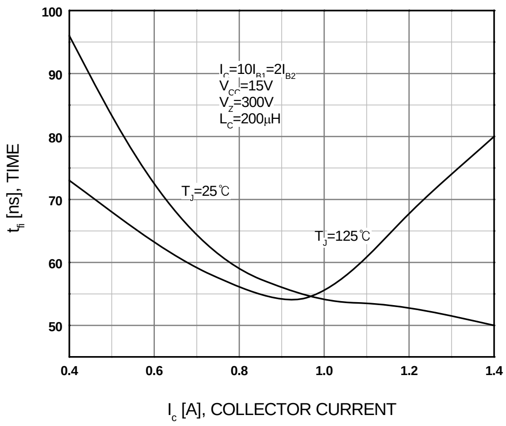


Figure 15. Inductive Switching Time, t_{fi}

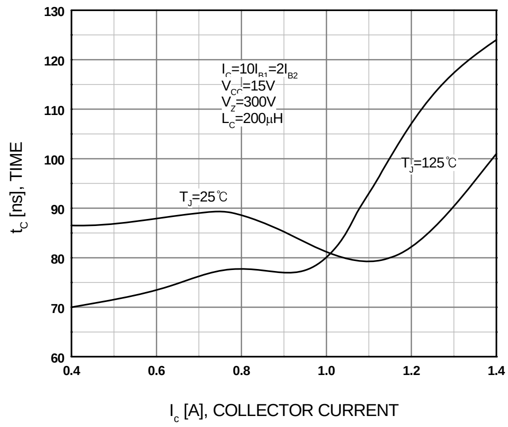


Figure 16. Inductive Switching Time, t_c

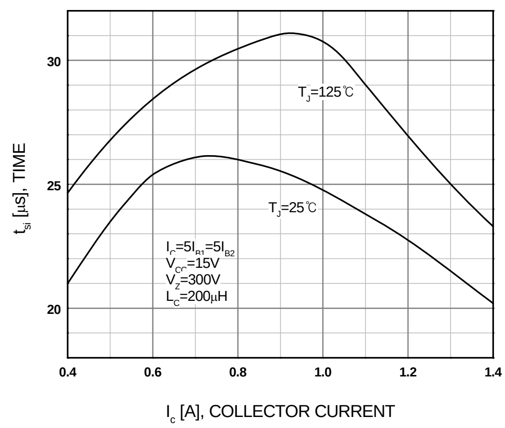


Figure 17. Inductive Switching Time, t_{si}

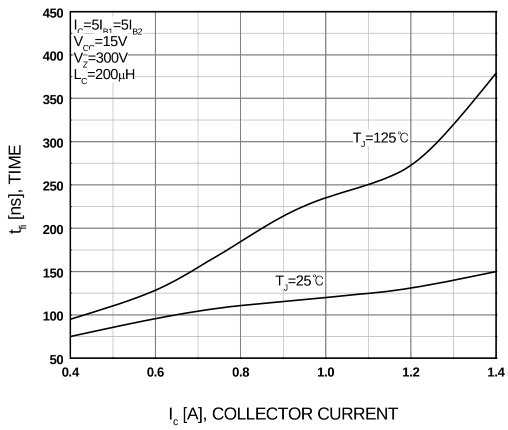


Figure 18. Inductive Switching Time, t_{fi}

Typical Performance Characteristics (Continued)

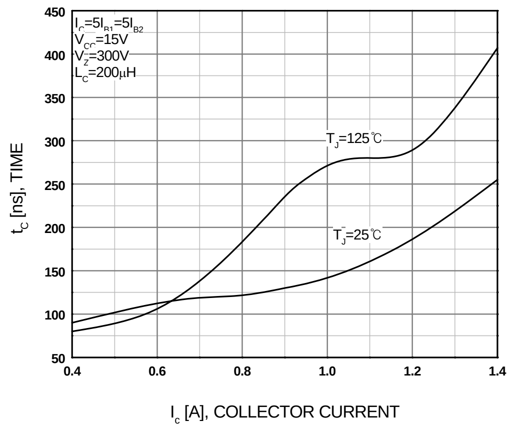


Figure 19. Inductive Switching Time, t_c

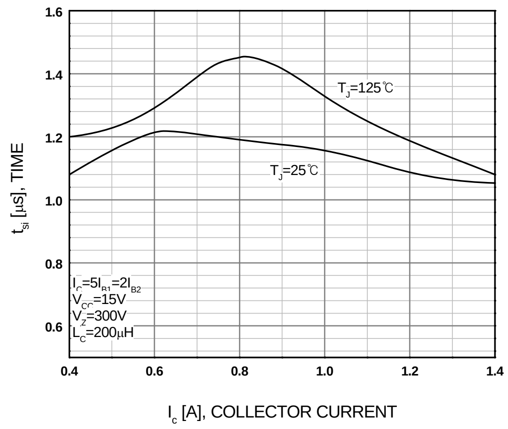


Figure 20. Inductive Switching Time, t_{si}

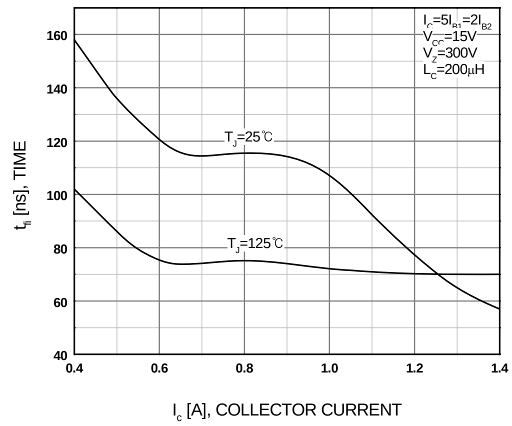


Figure 21. Inductive Switching Time, t_{fi}

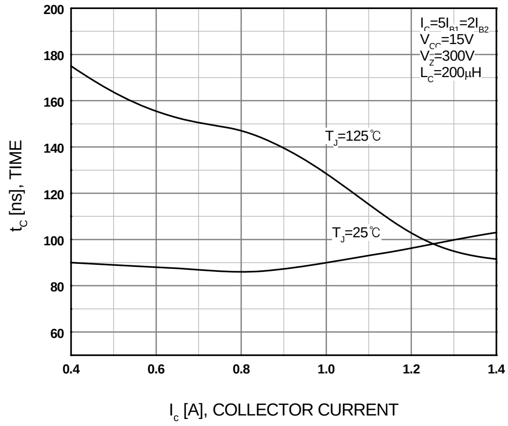


Figure 22. Inductive Switching Time, t_c

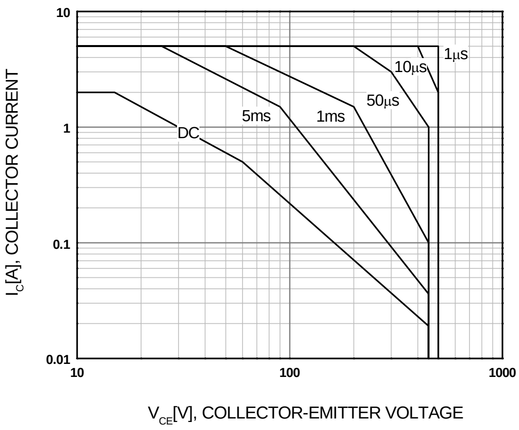


Figure 23. Forward Bias Safe Operating Area

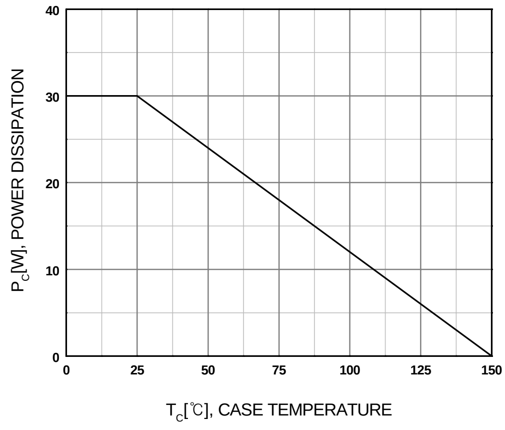
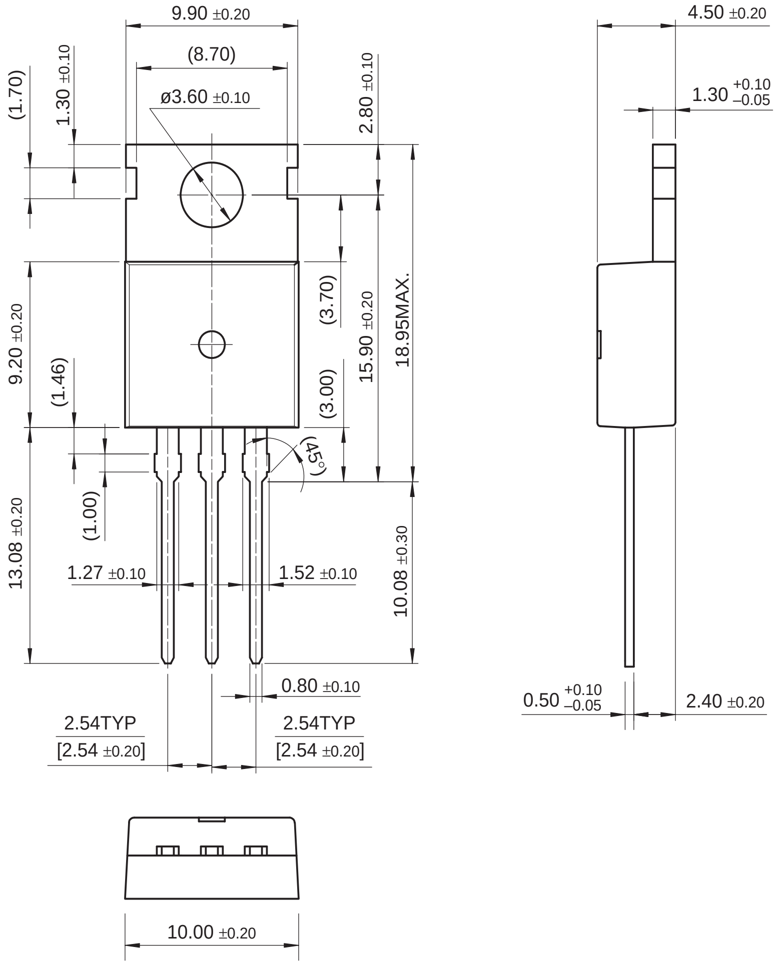


Figure 24. Power Derating

Physical Dimension

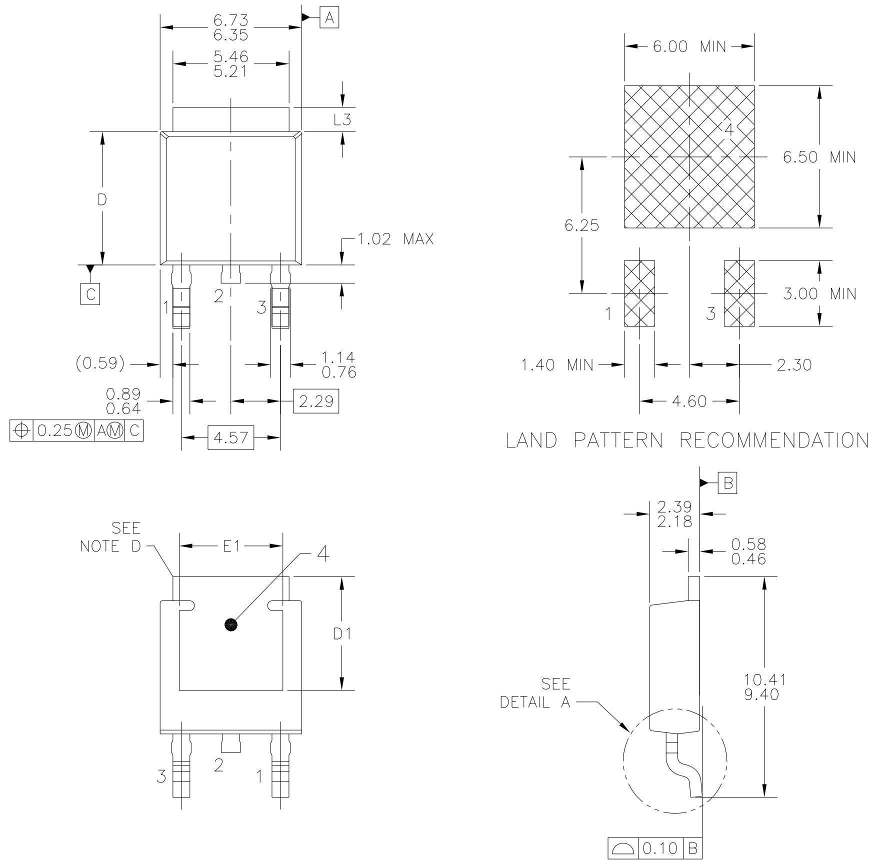
TO-220

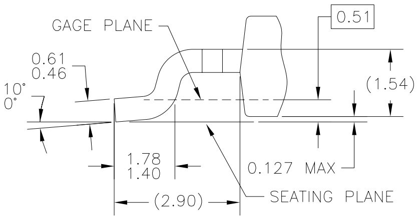


Dimensions in Millimeters

Physical Dimension (Continued)

D-PAK





DETAIL A
(ROTATED −90°)
SCALE: 12X

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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2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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.

Rev. I41

PUBLICATION ORDERING INFORMATION

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