Chipsmall

Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of "Quality Parts,Customers Priority,Honest Operation,and Considerate Service",our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

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FAIRCHILD

SEMICONDUCTOR®

IGBT

SGP13N60UFD

Ultra-Fast IGBT

General Description

Fairchild's UFD series of Insulated Gate Bipolar Transistors (IGBTs) provides low conduction and switching losses. The UFD series is designed for applications such as motor control and general inverters where high speed switching is a required feature.

Features

- High speed switching
- Low saturation voltage : $V_{CE(sat)}$ = 2.1 V @ I_C = 6.5A
- High input impedance
- CO-PAK, IGBT with FRD : t_{rr} = 37ns (typ.)

Applications

AC & DC motor controls, general purpose inverters, robotics, and servo controls.

G C E   **TO-220**

C

G

E
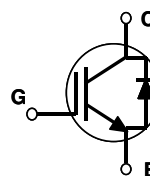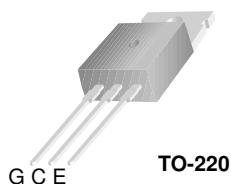
Absolute Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Description		SGP13N60UFD	Units
V_{CES}	Collector-Emitter Voltage		600	V
V_{GES}	Gate-Emitter Voltage		$\pm$ 20	V
I_C	Collector Current	@ T_C = 25°C	13	A
	Collector Current	@ T_C = 100°C	6.5	A
$I_{CM\,(1)}$	Pulsed Collector Current		52	A
I_F	Diode Continuous Forward Current	@ T_C = 100°C	8	A
I_{FM}	Diode Maximum Forward Current		56	A
P_D	Maximum Power Dissipation	@ T_C = 25°C	60	W
	Maximum Power Dissipation	@ T_C = 100°C	25	W
T_J	Operating Junction Temperature		-55 to +150	°C
T_{stg}	Storage Temperature Range		-55 to +150	°C
T_L	Maximum Lead Temp. for Soldering Purposes, 1/8" from Case for 5 Seconds		300	°C

Notes :
(1) Repetitive rating : Pulse width limited by max. junction temperature

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$(IGBT)	Thermal Resistance, Junction-to-Case	--	2.0	°C/W
$R_{\theta JC}$(DIODE)	Thermal Resistance, Junction-to-Case	--	3.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	62.5	°C/W

Electrical Characteristics of the IGBT $T_C = 25°C$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{CES}	Collector-Emitter Breakdown Voltage	$V_{GE} = 0V$, $I_C = 250uA$	600	--	--	V
$\Delta B_{VCES}/\Delta T_J$	Temperature Coeff.icient of Break-down Voltage	$V_{GE} = 0V$, $I_C = 1mA$	--	0.6	--	V/°C
I_{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}$, $V_{GE} = 0V$	--	--	250	uA
I_{GES}	G-E Leakage Current	$V_{GE} = V_{GES}$, $V_{CE} = 0V$	--	--	± 100	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 6.5mA$, $V_{CE} = V_{GE}$	3.5	4.5	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 6.5A$, $V_{GE} = 15V$	--	2.1	2.6	V
		$I_C = 13A$, $V_{GE} = 15V$	--	2.6	--	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	$V_{CE} = 30V$, $V_{GE} = 0V$, f = 1MHz	--	375	--	pF
C_{oes}	Output Capacitance		--	63	--	pF
C_{res}	Reverse Transfer Capacitance		--	13	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300 V$, $I_C = 6.5A$, $R_G = 50\Omega$, $V_{GE} = 15V$, Inductive Load, $T_C = 25°C$	--	20	--	ns
t_r	Rise Time		--	27	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	70	130	ns
t_f	Fall Time		--	97	150	ns
E_{on}	Turn-On Switching Loss		--	85	--	uJ
E_{off}	Turn-Off Switching Loss		--	95	--	uJ
E_{ts}	Total Switching Loss		--	180	270	uJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300 V$, $I_C = 6.5A$, $R_G = 50\Omega$, $V_{GE} = 15V$, Inductive Load, $T_C = 125°C$	--	30	--	ns
t_r	Rise Time		--	32	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	85	200	ns
t_f	Fall Time		--	168	250	ns
E_{on}	Turn-On Switching Loss		--	180	--	uJ
E_{off}	Turn-Off Switching Loss		--	165	--	uJ
E_{ts}	Total Switching Loss		--	345	500	uJ
Q_g	Total Gate Charge	$V_{CE} = 300 V$, $I_C = 6.5A$, $V_{GE} = 15V$	--	25	35	nC
Q_{ge}	Gate-Emitter Charge		--	7	12	nC
Q_{gc}	Gate-Collector Charge		--	8	14	nC
L_e	Internal Emitter Inductance	Measured 5mm from PKG	--	7.5	--	nH

Electrical Characteristics of DIODE $T_C = 25°C$ unless otherwise noted

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V_{FM}	Diode Forward Voltage	$I_F = 8A$	$T_C = 25°C$	--	1.4	1.7	V
			$T_C = 100°C$	--	1.3	--	
t_{rr}	Diode Reverse Recovery Time	$I_F = 8A$, di/dt = 200A/us	$T_C = 25°C$	--	37	55	ns
			$T_C = 100°C$	--	55	--	
I_{rr}	Diode Peak Reverse Recovery Current		$T_C = 25°C$	--	3.5	5.0	A
			$T_C = 100°C$	--	4.5	--	
Q_{rr}	Diode Reverse Recovery Charge		$T_C = 25°C$	--	65	138	nC
			$T_C = 100°C$	--	124	--	
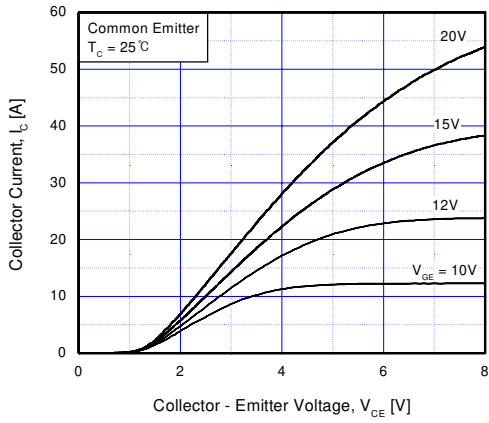
Fig 1. Typical Output Characteristics

Collector Current, I_C [A] vs. Collector - Emitter Voltage, V_{CE} [V]

Common Emitter
$T_C = 25°C$

20V
15V
12V
$V_{GE} = 10V$
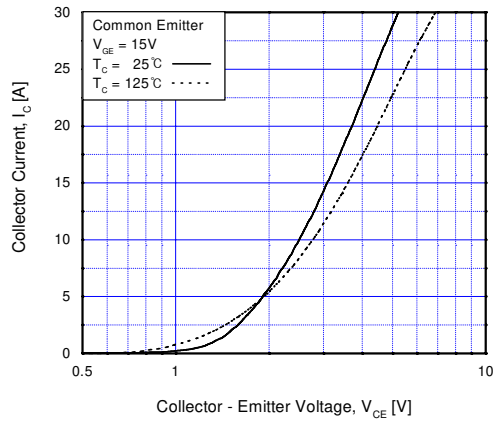
Fig 2. Typical Saturation Voltage Characteristics

Collector Current, I_C [A] vs. Collector - Emitter Voltage, V_{CE} [V]

Common Emitter
$V_{GE} = 15V$
$T_C = 25°C$
$T_C = 125°C$
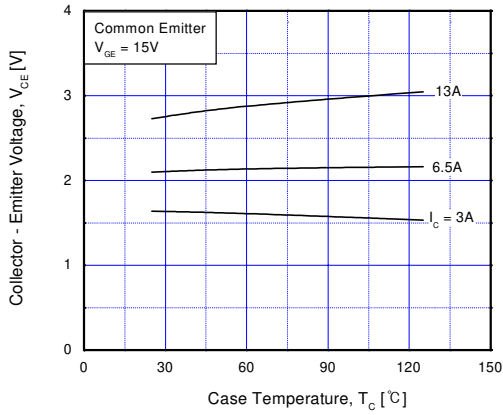
Fig 3. Saturation Voltage vs. Case Temperature at Variant Current Level

Collector - Emitter Voltage, V_{CE} [V] vs. Case Temperature, T_C [°C]

Common Emitter
$V_{GE} = 15V$

13A
6.5A
$I_C = 3A$
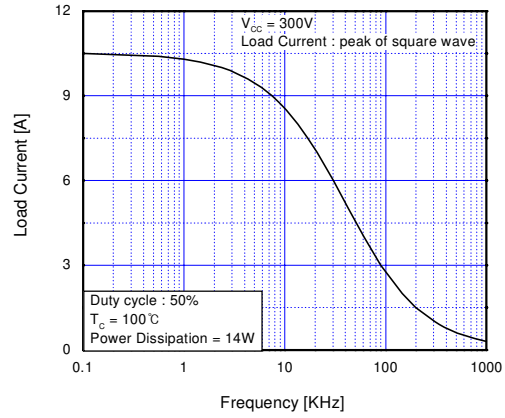
Fig 4. Load Current vs. Frequency

Load Current [A] vs. Frequency [KHz]

$V_{CC} = 300V$
Load Current : peak of square wave

Duty cycle : 50%
$T_C = 100°C$
Power Dissipation = 14W

Fig 5. Saturation Voltage vs. V_{GE}

Collector - Emitter Voltage, V_{CE} [V] vs. Gate - Emitter Voltage, V_{GE} [V]

Common Emitter
$T_C = 25°C$

13A
6.5A
$I_C = 3A$

Fig 6. Saturation Voltage vs. V_{GE}

Collector - Emitter Voltage, V_{CE} [V] vs. Gate - Emitter Voltage, V_{GE} [V]

Common Emitter
$T_C = 125°C$

13A
6.5A
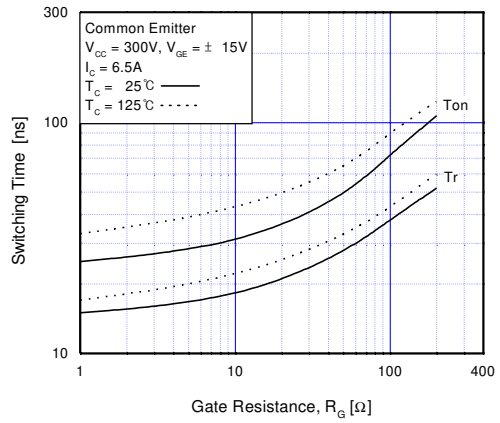$I_C = 3A$
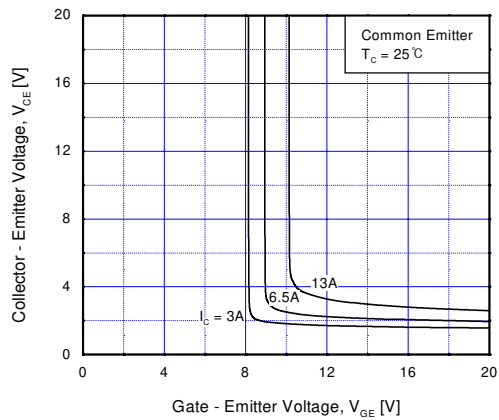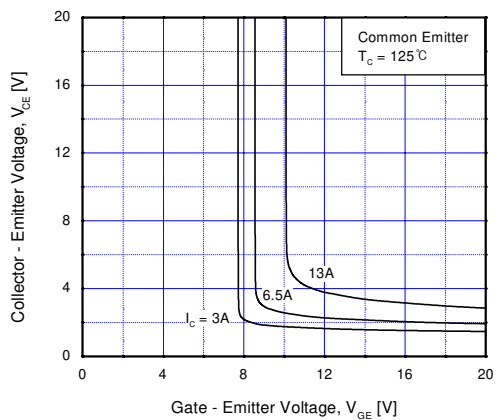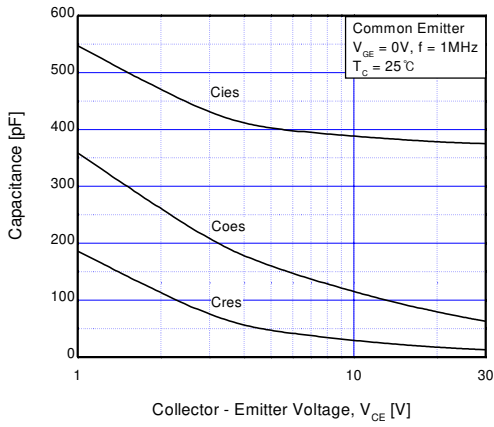
Fig 7. Capacitance Characteristics

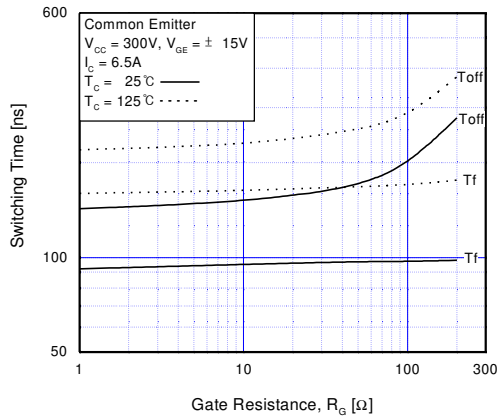**Fig 8. Turn-On Characteristics vs. Gate Resistance**

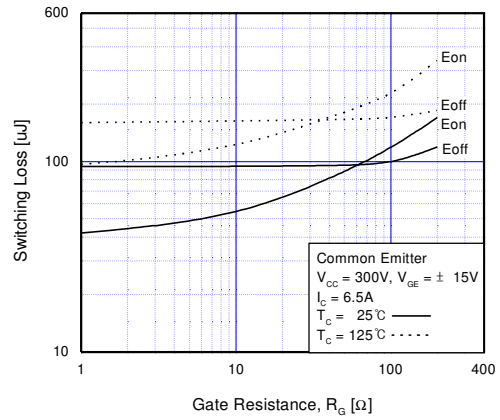**Fig 9. Turn-Off Characteristics vs. Gate Resistance**

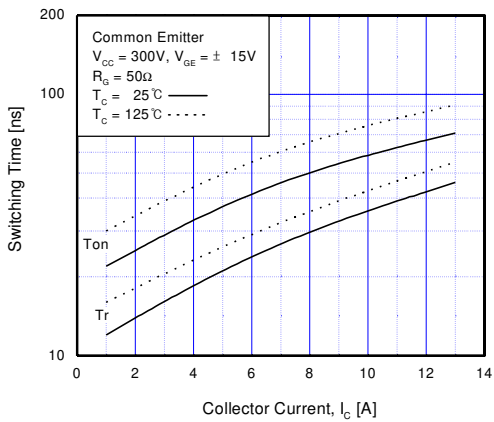**Fig 10. Switching Loss vs. Gate Resistance**

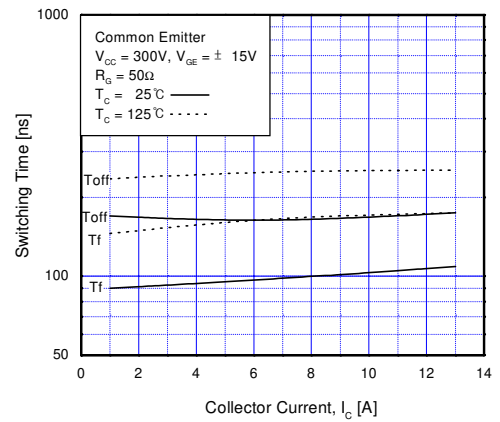**Fig 11. Turn-On Characteristics vs. Collector Current**

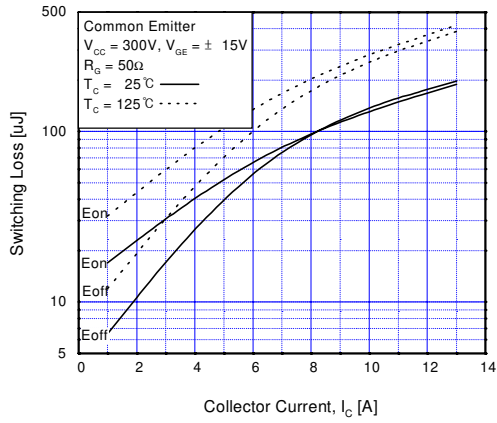**Fig 12. Turn-Off Characteristics vs. Collector Current**

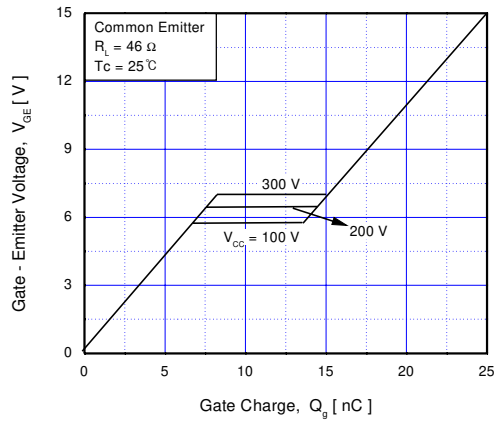Fig 13. Switching Loss vs. Collector Current

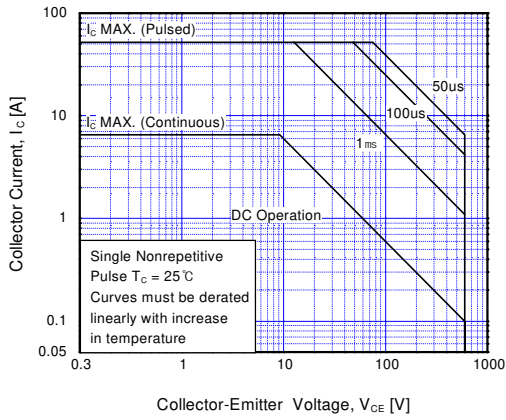Fig 14. Gate Charge Characteristics
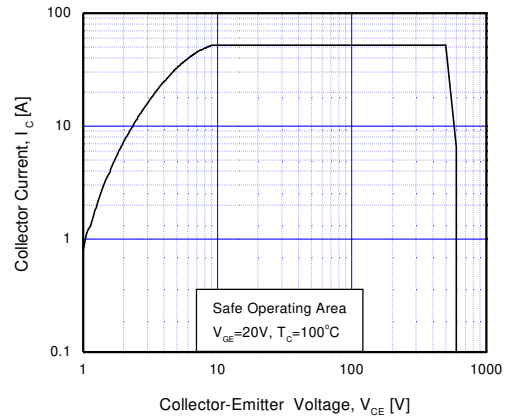

Fig 15. SOA Characteristics
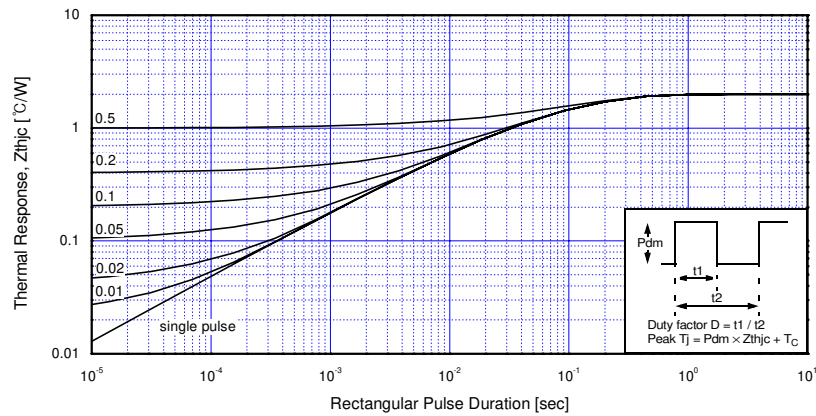

Fig 16. Turn-Off SOA Characteristics
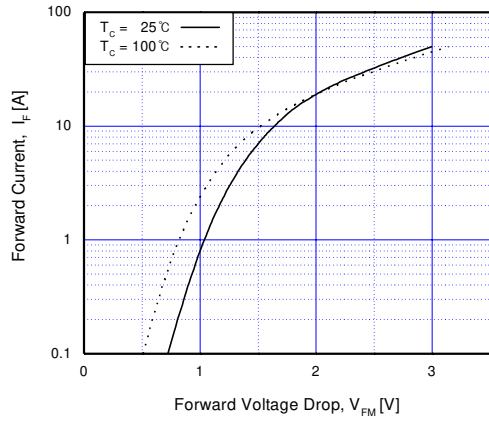

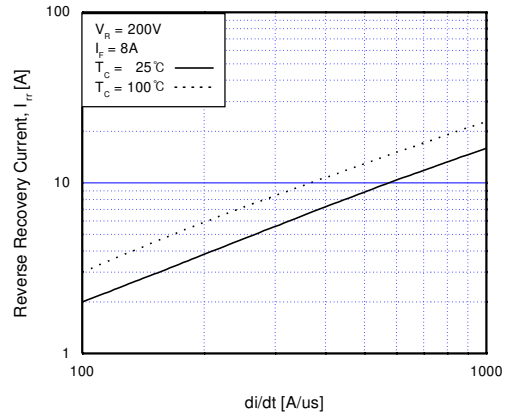Fig 17. Transient Thermal Impedance of IGBT

Fig 18. Forward Characteristics

Fig 19. Reverse Recovery Current
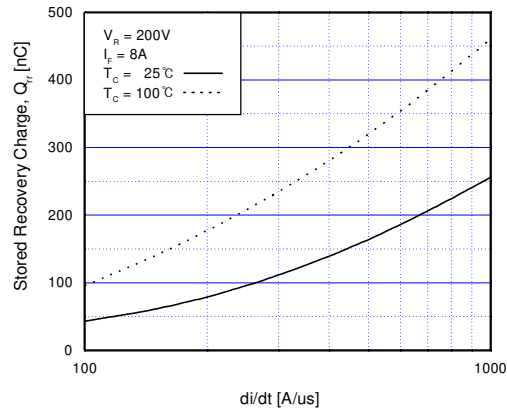
Fig 20. Stored Charge
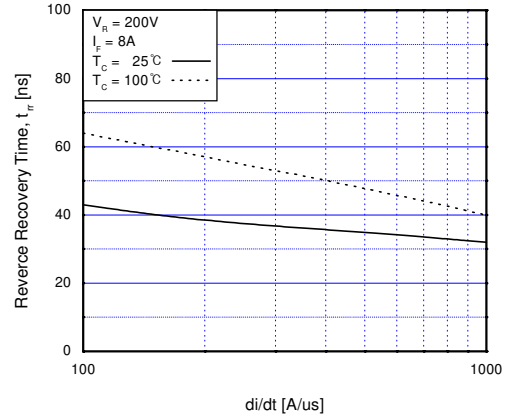
Fig 21. Reverse Recovery Time

Mechanical Dimensions

TO - 220

Ø 4.09
3.50 △

⊕ | 0.36 Ⓜ | B | AⓂ

A ▸

10,67
9,65

3,43
2,54

16,51
14,22

△ 9,40
8,38

C

1   2   3

6.35 MAX

14,73
12,70

(1.91)

1.78
1.14

1.02
0.38

2.54

5,08

⊕ | 0.36 Ⓜ | B | AⓂ

4,83
3,56

B

"A1"

7°
3°

6,86
5,84

5°
3°

5°
3°

0.61
△ 0.33

2.92
2.03

8,89
6,86

△ 13,40
12,19

3   2   1

5°
3°

5°
3°
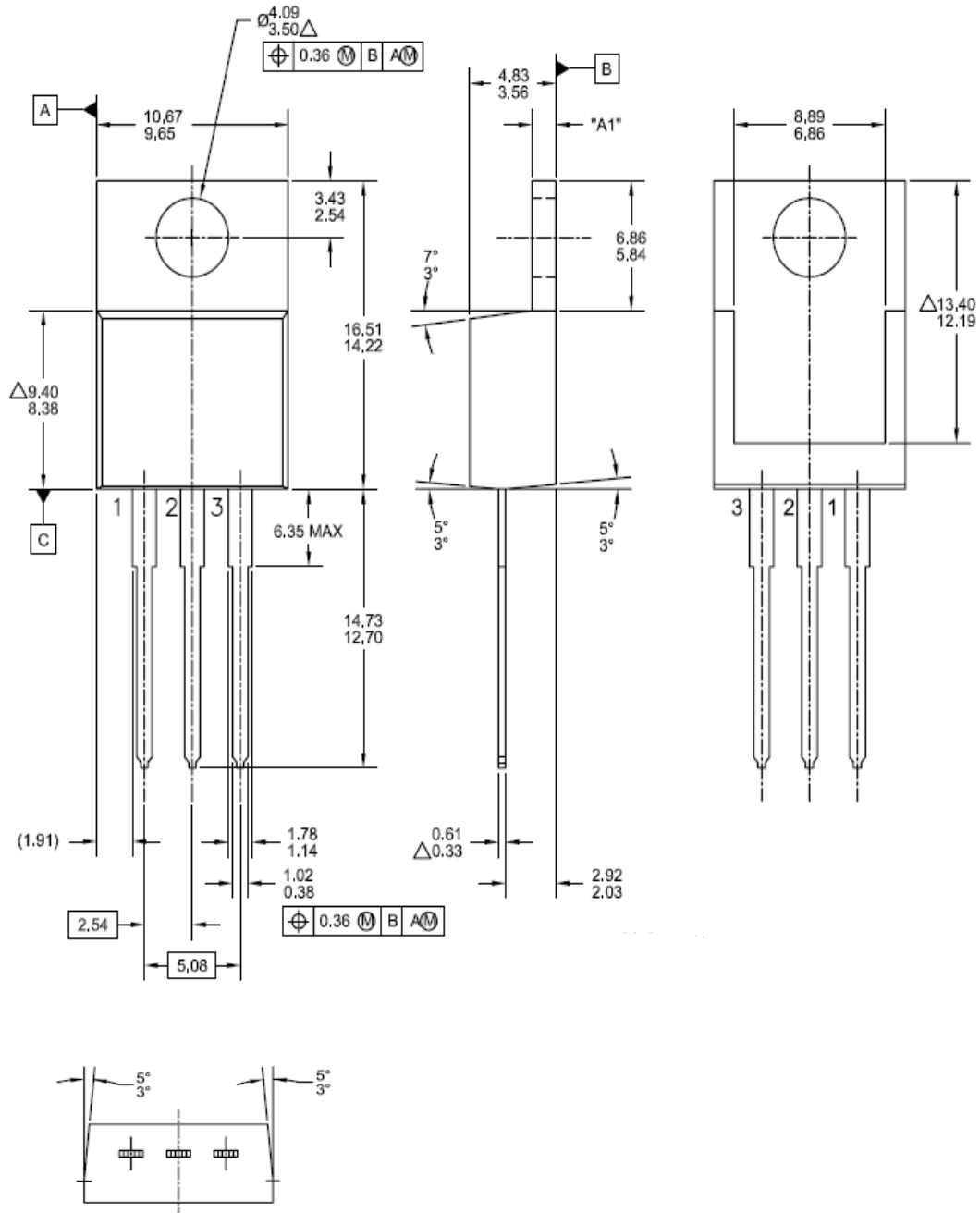
Dimensions in Millimeters

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CoolFET™	FRFET™	OPTOPLANAR™	SPM™	VCX™
CROSSVOLT™	GlobalOptoisolator™	PACMAN™	STAR*POWER™	
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DOME™	HiSeC™	Power247™	SuperSOT™-3	
EcoSPARK™	I²C™	PowerTrench®	SuperSOT™-6	
E²CMOS™	ISOPLANAR™	QFET™	SuperSOT™-8	
EnSigna™	LittleFET™	QS™	SyncFET™	
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2. A critical component is 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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