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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®

October 2013

# FGB3236_F085 / FGI3236_F085

## EcoSPARKÈ 320mJ, 360V, N-Channel Ignition IGBT

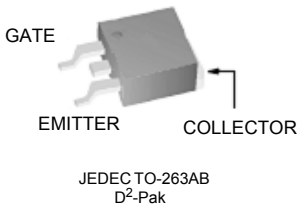
### Features

- Industry Standard $D^2$-Pak package
- SCIS Energy = 320mJ at $T_J$ = 25°C
- Logic Level Gate Drive
- Qualified to AEC Q101
- RoHS Compliant

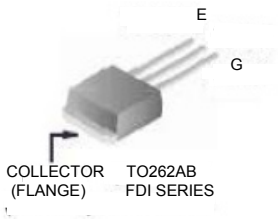
### Applications

- Automotive Ignition Coil Driver Circuits
- Coil On Plug Applications

### Package

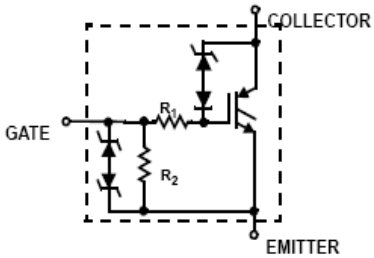



JEDEC TO-263AB
$D^2$-Pak




TO262AB
FDI SERIES

### Symbol



## Device Maximum Ratings $T_A$ = 25°C unless otherwise noted

| Symbol | Parameter | Ratings | Units |
|---|---|---|---|
| $BV_{CER}$ | Collector to Emitter Breakdown Voltage ($I_C$ = 1mA) | 360 | V |
| $BV_{ECS}$ | Emitter to Collector Voltage - Reverse Battery Condition ($I_C$ = 10mA) | 24 | V |
| $E_{SCIS25}$ | Self Clamping Inductive Switching Energy ($I_{SCIS}$ = 14.7A, L = 3.0mHy, $T_J$ = 25°C) | 320 | mJ |
| $E_{SCIS150}$ | Self Clamping Inductive Switching Energy ($I_{SCIS}$ = 10.4A, L = 3.0mHy, $T_J$ = 150°C) | 160 | mJ |
| $I_{C25}$ | Collector Current Continuous, at $V_{GE}$ = 4.0V, $T_C$ = 25°C | 44 | A |
| $I_{C110}$ | Collector Current Continuous, at $V_{GE}$ = 4.0V, $T_C$ = 110°C | 27 | A |
| $V_{GEM}$ | Gate to Emitter Voltage Continuous | ±10 | V |
| $P_D$ | Power Dissipation Total, at $T_C$ = 25°C | 187 | W |
| | Power Dissipation Derating, for $T_C$ > 25°C | 1.25 | W/°C |
| $T_J$ | Operating Junction Temperature Range | -40 to +175 | °C |
| $T_{STG}$ | Storage Junction Temperature Range | -40 to +175 | °C |
| $T_L$ | Max. Lead Temp. for Soldering (Leads at 1.6mm from case for 10s) | 300 | °C |
| $T_{PKG}$ | Max. Lead Temp. for Soldering (Package Body for 10s) | 260 | °C |
| ESD | Electrostatic Discharge Voltage at100pF, 1500Ω | 4 | kV |

## Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| FGB3236 | FGB3236_F085 | TO263 | 330mm | 24mm | 800 units |
| FGI3236 | FGI3236_F085 | TO262 | Tube | NA | 50 units |

## Electrical Characteristics $T_A$ = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| **Off State Characteristics** | | | | | | | |
| $BV_{CER}$ | Collector to Emitter Breakdown Voltage | $I_{CE}$ = 2mA, $V_{GE}$ = 0, $R_{GE}$ = 1KΩ, See Fig. 15 $T_J$ = -40 to 150°C | | 330 | 363 | 390 | V |
| $BV_{CES}$ | Collector to Emitter Breakdown Voltage | $I_{CE}$ = 10mA, $V_{GE}$ = 0V, $R_{GE}$ = 0, $T_J$ = -40 to 150°C | | 350 | 378 | 410 | V |
| $BV_{ECS}$ | Emitter to Collector Breakdown Voltage | $I_{CE}$ = -75mA, $V_{GE}$ = 0V, $T_C$ = 25°C | | 30 | - | - | V |
| $BV_{GES}$ | Gate to Emitter Breakdown Voltage | $I_{GES}$ = ±2mA | | ±12 | ±14 | - | V |
| $I_{CES}$ | Collector to Emitter Leakage Current | $V_{CES}$ = 250V, See Fig. 11 | $T_C$ = 25°C | - | - | 25 | μA |
| | | | $T_C$ = 150°C | - | - | 1 | mA |
| $I_{ECS}$ | Emitter to Collector Leakage Current | $V_{EC}$ = 24V, See Fig.11 | $T_C$ = 25°C | - | - | 1 | mA |
| | | | $T_C$ = 150°C | - | - | 40 | |
| $R_1$ | Series Gate Resistance | | | - | 100 | - | Ω |
| $R_2$ | Gate to Emitter Resistance | | | 10K | - | 30K | Ω |
| **On State Characteristics** | | | | | | | |
| $V_{CE(SAT)}$ | Collector to Emitter Saturation Voltage | $I_{CE}$ = 6A, $V_{GE}$ = 4V, | $T_C$=25°C, See Fig. 3 | - | 1.14 | 1.4 | V |
| $V_{CE(SAT)}$ | Collector to Emitter Saturation Voltage | $I_{CE}$ = 10A, $V_{GE}$ = 4.5V, | $T_C$ = 150°C, See Fig. 4 | - | 1.32 | 1.7 | V |
| $V_{CE(SAT)}$ | Collector to Emitter Saturation Voltage | $I_{CE}$ = 15A, $V_{GE}$ = 4.5V, | $T_C$ = 150°C | - | 1.61 | 2.05 | V |
| $I_{CE(ON)}$ | Collector to Emitter On State Current | $V_{GE}$ = 5V, $V_{CE}$ = 5V | | 50 | - | - | A |

## Electrical Characteristics $T_A$ = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| **Dynamic Characteristics** | | | | | | | |
| $Q_{G(ON)}$ | Gate Charge | $I_{CE}$ = 10A, $V_{CE}$ = 12V, $V_{GE}$ = 5V, See Fig.14 | | - | 20 | - | nC |
| $V_{GE(TH)}$ | Gate to Emitter Threshold Voltage | $I_{CE}$ = 1mA, $V_{CE}$ = $V_{GE}$, See Fig. 10 | $T_C$ = 25°C | 1.3 | 1.6 | 2.2 | V |
| | | | $T_C$ = 150°C | 0.75 | 1.1 | 1.8 | |
| $V_{GEP}$ | Gate to Emitter Plateau Voltage | $V_{CE}$ = 12V, $I_{CE}$ = 10A | | - | 2.6 | - | V |
| **Switching Characteristics** | | | | | | | |
| $t_{d(ON)R}$ | Current Turn-On Delay Time-Resistive | $V_{CE}$ = 14V, $R_L$ = 1Ω | | - | 0.65 | 4 | μs |
| $t_{rR}$ | Current Rise Time-Resistive | $V_{GE}$ = 5V, $R_G$ = 1KΩ, $T_J$ = 25°C, See Fig.12 | | - | 1.7 | 7 | μs |
| $t_{d(OFF)L}$ | Current Turn-Off Delay Time-Inductive | $V_{CE}$ = 300V, L = 500μHy, | | - | 5.4 | 15 | μs |
| $t_{fL}$ | Current Fall Time-Inductive | $V_{GE}$ = 5V, $R_G$ = 1KΩ, $T_J$ = 25°C, See Fig.12 | | - | 1.64 | 15 | μs |
| SCIS | Self Clamped inductive Switching | $T_J$ = 25°C, L = 3.0mHy, $I_{CE}$ = 14.7A, $R_G$ = 1KΩ, $V_{GE}$ = 5V, See Fig.1&2 | | - | - | 320 | mJ |
| **Thermal Characteristics** | | | | | | | |
| $R_{\theta JC}$ | Thermal Resistance Junction to Case | All Packages | | - | - | 0.8 | °C/W |

## Typical Performance Curves

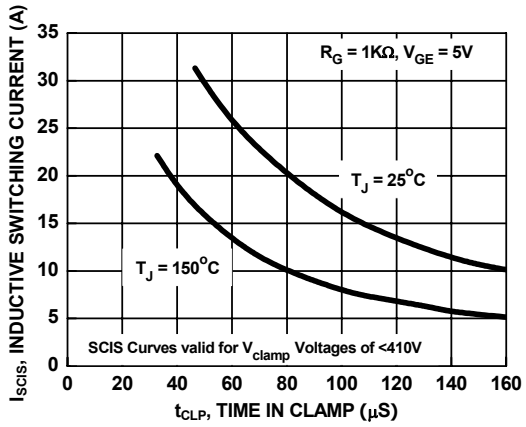



**Figure 1. Self Clamped Inductive Switching Current vs. Time in Clamp**

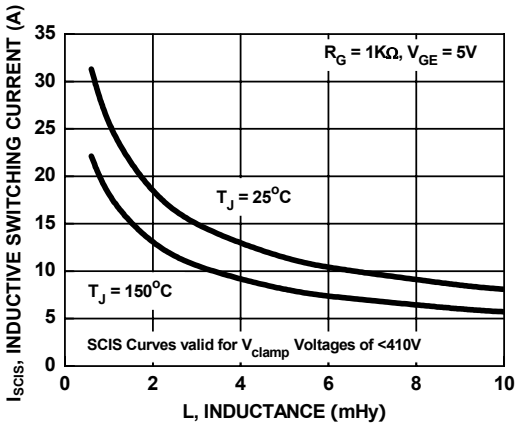



**Figure 2. Self Clamped Inductive Switching Current vs. Inductance**

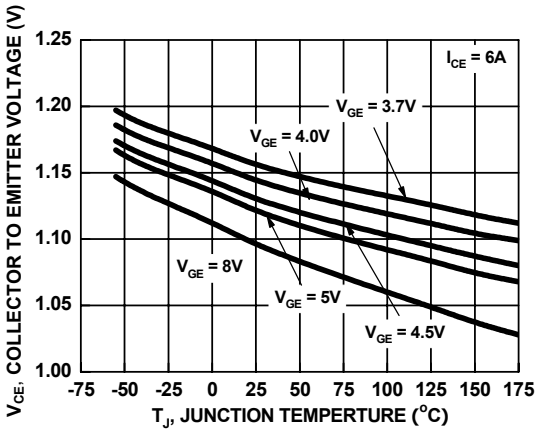



**Figure 3. Collector to Emitter On-State Voltage vs. Junction Temperature**

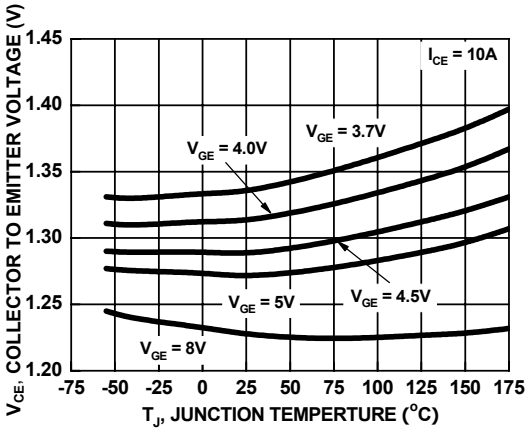



**Figure 4. Collector to Emitter On-State Voltage vs. Junction Temperature**

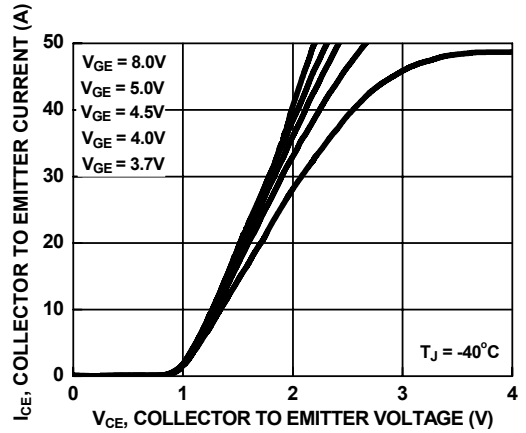



**Figure 5. Collector to Emitter On-State Voltage vs. Collector Current**

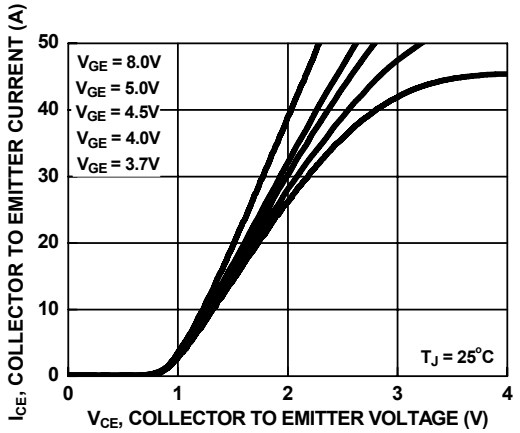



**Figure 6. Collector to Emitter On-State Voltage vs. Collector Current**

## Typical Performance Curves (Continued)

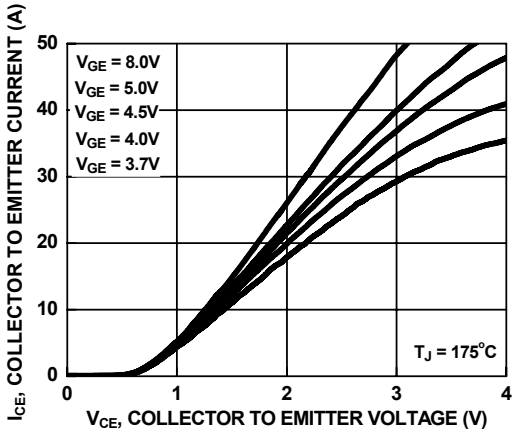



**Figure 7. Collector to Emitter On-State Voltage vs. Collector Current**

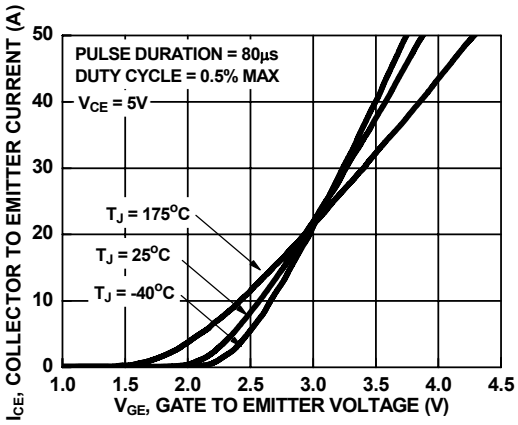



**Figure 8. Transfer Characteristics**

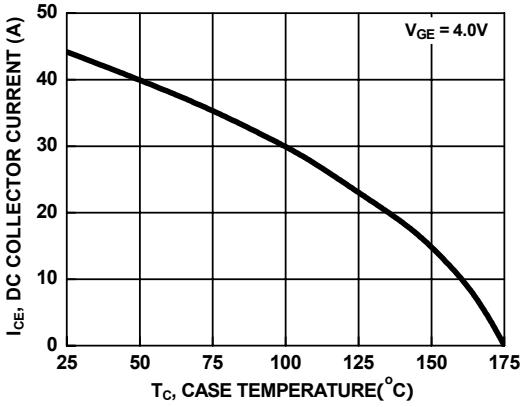



**Figure 9. DC Collector Current vs. Case Temperature**

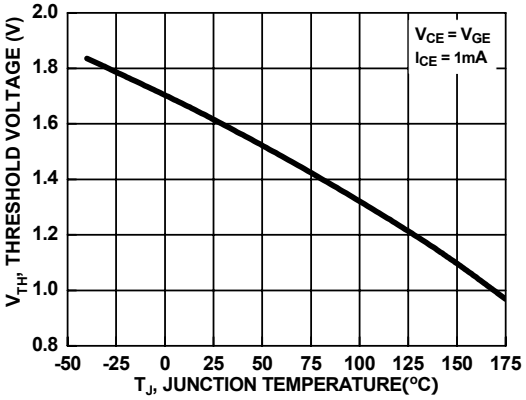



**Figure 10. Threshold Voltage vs. Junction Temperature**

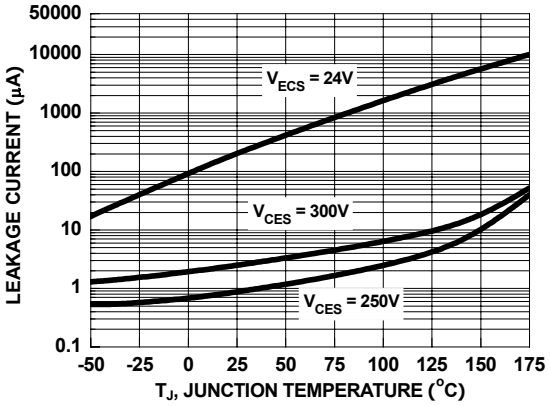



**Figure 11. Leakage Current vs. Junction Temperature**

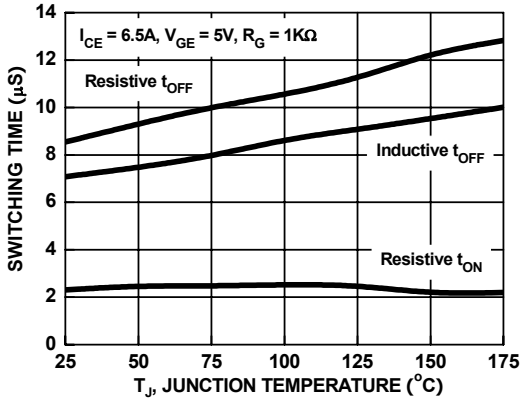



**Figure 12. Switching Time vs. Junction Temperature**

## Typical Performance Curves (Continued)

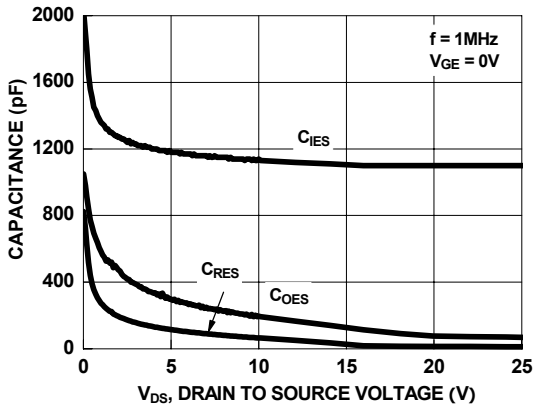



**Figure 13. Capacitance vs. Collector to Emitter Voltage**

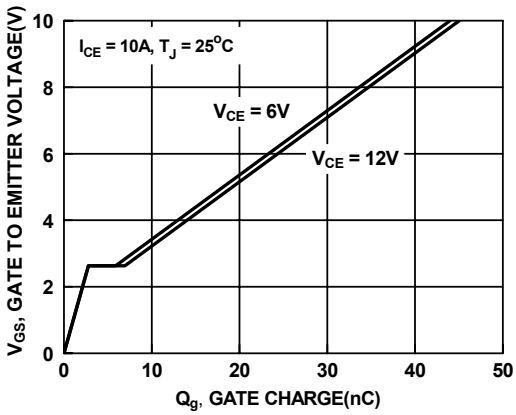



**Figure 14. Gate Charge**

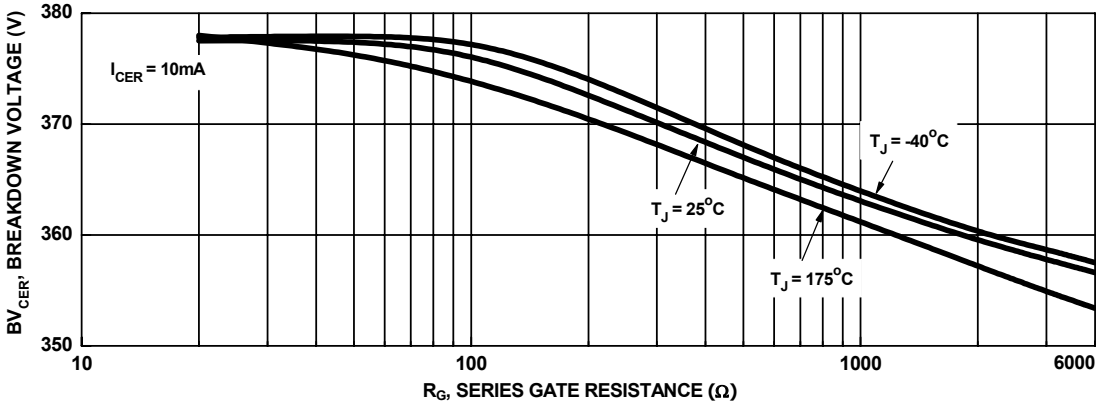



**Figure 15. Break Down Voltage vs. Series Gate Resistance**

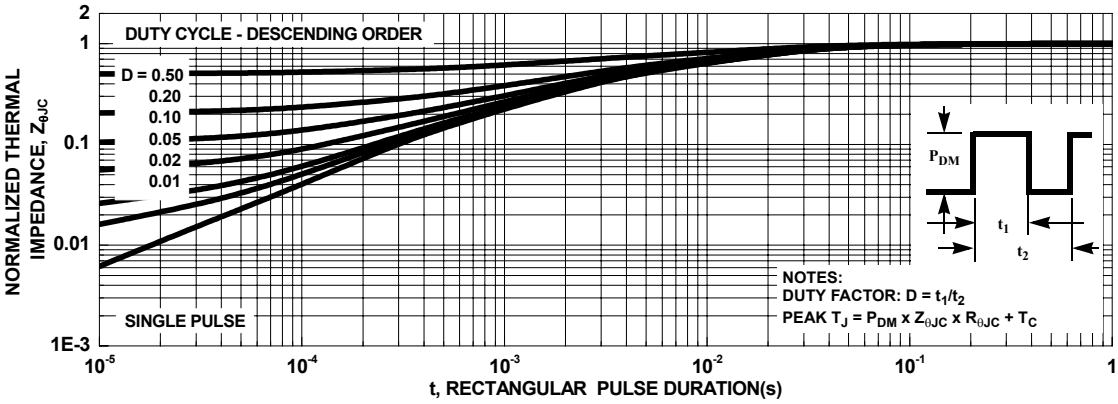



**Figure 16. IGBT Normalized Transient Thermal Impedance, Junction to Case**

## Test Circuit and Waveforms

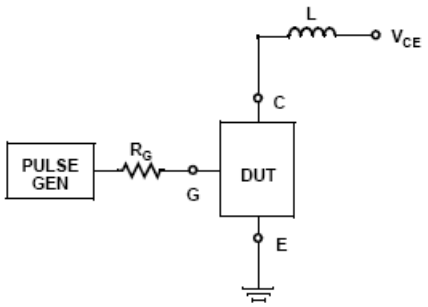



Figure 17. Inductive Switching Test Circuit

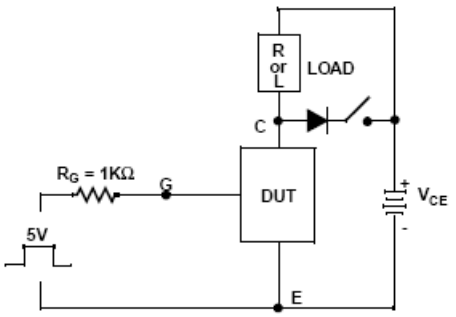



Figure 18. $t_{ON}$ and $t_{OFF}$ Switching Test Circuit

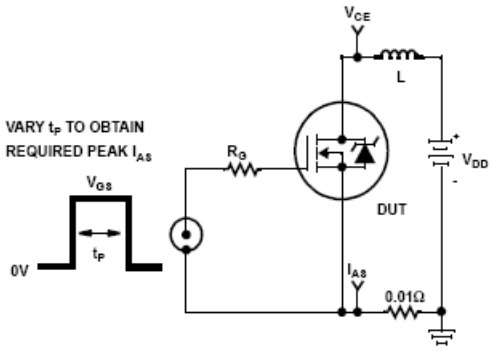



Figure 19. Energy Test Circuit

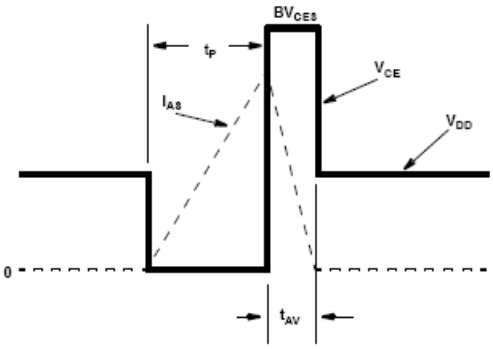
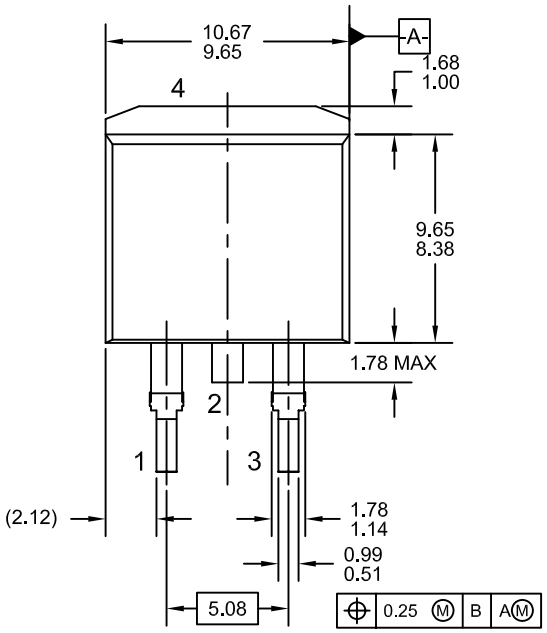
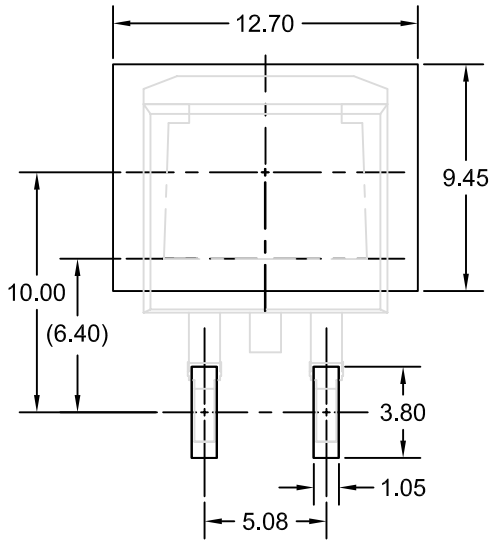


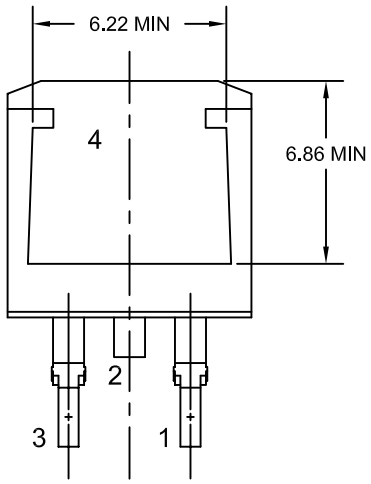

Figure 20. Energy Waveforms

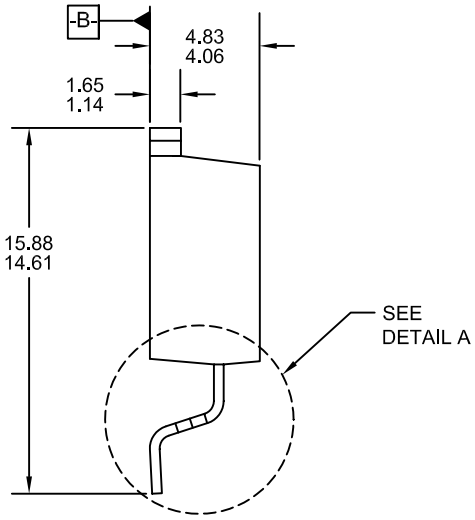
| REVISIONS | | | | |
|---|---|---|---|---|
| LTR | DESCRIPTION | E.C.N. | DATE | BY/APPD |
| A | RELEASE TO DOCUMENT CONTROL | CB/085/99 | 08NOV1999 | MRG |
| B | CHG HEATSINK DIM FR .370 TO .380, PKG DIM FR .320 TO .330, LD CUT FR .135 TO 1.47, ADD DIM (2.12); CHG TER 4 FR .51 TO (8.00), FR .315 TO (7.20); TOT LGH FR .520 TO .525; ADD DETAIL A; CHG LD THICK FR .36 TO .39; CHG FOOT LGTH FR .130 TO .135; ADD DIM (5.38); CHG LAND PATTERN DIM FR 9,50 TO 9,90 MIN, FR 9,00 TO 9,90 MIN, FR 4,00 TO 4,00 MIN, FR 1,50 TO 1,20 MIN; DEL NOTE C&D AND ARRANGE, ADD NOTE D. | CB/044/00 | 28FEB2000 | MRG |
| C | CHG CEN LD CUT FR .135 TO 1.78 MAX; LD WID FR .026 TO .031; PKG THICK FR .320 TO .330; HEAT SINK THICK FR .145 TO .175; LD THICK FR .022 TO .035; FOOT LANDING FR .320 TO .330; FOOT ANGLE FR 2 TO 3 DEG; PROFILE DIM FR 0,13 MAX TO 0,25 MAX; BACK HEAT SINK WID FR (8,00) TO 6,22 MIN, LEN FR (7,20) TO 6,60 MIN; REMOVE EJECTOR PIN MARK; ADD NOTE E | CB/254/04 | 7OCT2004 | RCM |
| D | REMOVE NOTE B; ADD NOTE E | CB/043/05 | 30MAR2005 | MRG |
| 5 | REMOVED SITE INFO AND ECN COLUMN, ADDED NOTE F, TITLE CHANGED | | 06AUG2007 | H.ALLEN |
| 6 | UPDATED HEATSINK PER IPC STANDARD, NOTE E IPC REFERENCE, FONT TO ARIAL, UPDATED DRAWING TITLE TO REFLECT JEDEC STANDARD. | | 02 MAY 09 | H.ALLEN |



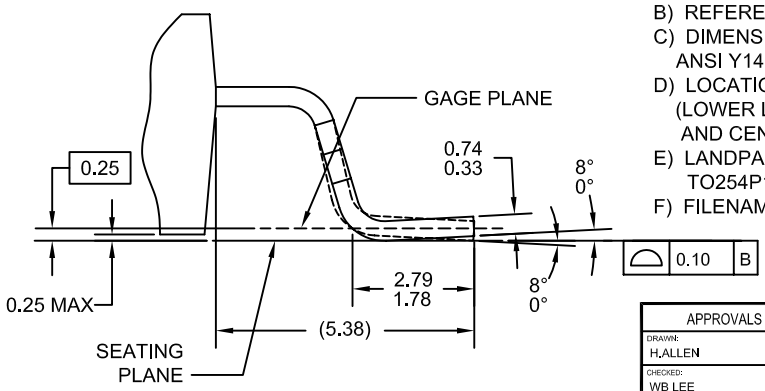




LAND PATTERN RECOMMENDATION
UNLESS NOTED, ALL DIMS TYPICAL




NOTES: UNLESS OTHERWISE SPECIFIED
A) ALL DIMENSIONS ARE IN MILLIMETERS.
B) REFERENCE JEDEC, TO-263, VARIATION AB.
C) DIMENSIONING AND TOLERANCING PER ANSI Y14.5M - 1994.
D) LOCATION OF THE PIN HOLE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE).
E) LANDPATTERN RECOMMENDATION PER IPC TO254P1524X482-3N
F) FILENAME: TO263A02REV6




DETAIL A, ROTATED 90°
SCALE: 2X

| APPROVALS | DATE |
|---|---|
| DRAWN: H.ALLEN | 2 MAY 09 |
| CHECKED: WB LEE | 2 MAY 09 |
| APPROVED: | |

FAIRCHILD SEMICONDUCTOR™

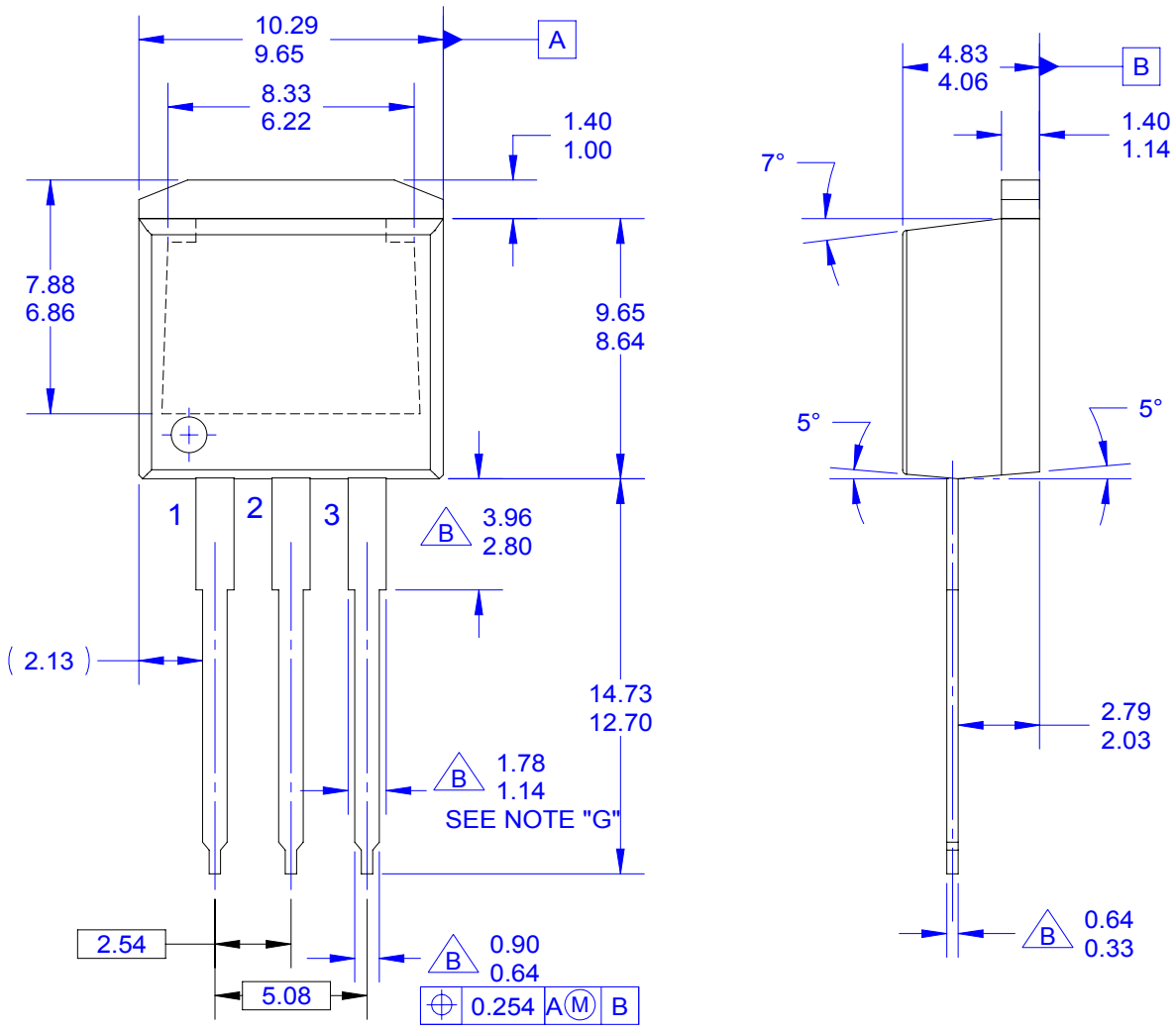
2LD, JEDEC TO-263,VARIATION AB,SURFACE MOUNT

PROJECTION
INCH
[MM]

| SCALE | SIZE | DRAWING NUMBER | REV |
|---|---|---|---|
| 1:1 | NA | MKT-TO263A02 | 6 |

FORMERLY: N/A

SHEET: 1 OF 1




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: TO262A03REV5

| APPROVALS | DATE |
|---|---|
| DRAWN: BOBOY MALDO | 11FEB2010 |
| CHECKED: KH LEE | |
| APPROVED: BY HUANG | |
| APPROVED: HOWARD ALLEN | |

FAIRCHILD SEMICONDUCTOR™

TO262 3LD JEDEC VARIATION AA

| PROJECTION | SCALE | SIZE | DRAWING NUMBER | REV |
|---|---|---|---|---|
| [MM] INCH | 1:1 | N/A | MKT-TO262A03 | 5 |

FORMERLY: N/A SHEET : 1 OF 1

## TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

AccuPower™
AX-CAP®*
BitSiC™
Build it Now™
CorePLUS™
CorePOWER™
*CROSSVOLT*™
CTL™
Current Transfer Logic™
DEUXPEED®
Dual Cool™
EcoSPARK®
EfficientMax™
ESBC™
Fairchild®
Fairchild Semiconductor®
FACT Quiet Series™
FACT®
FAST®
FastvCore™
FETBench™
FPS™
F-PFS™
FRFET®
Global Power Resource℠
GreenBridge™
Green FPS™
Green FPS™ e-Series™
G*max*™
GTO™
IntelliMAX™
ISOPLANAR™
Making Small Speakers Sound Louder and Better™
MegaBuck™
MICROCOUPLER™
MicroFET™
MicroPak™
MicroPak2™
MillerDrive™
MotionMax™
mWSaver®
OptoHiT™
OPTOLOGIC®
OPTOPLANAR®
PowerTrench®
PowerXS™
Programmable Active Droop™
QFET®
QS™
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