

ECOSPARK®2 300 mJ, 400 V, N-Channel Ignition IGBT

FGB3040G2-F085, FGD3040G2-F085, FGP3040G2-F085

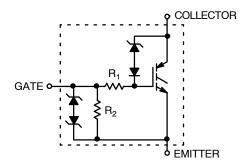
Features

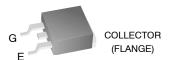
- SCIS Energy = 300 mJ at $T_J = 25$ °C
- Logic Level Gate Drive
- AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

Applications

- Automotive Ignition Coil Driver Circuits
- Coil On Plug Applications

SYMBOL

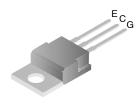


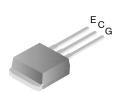


JEDEC TO-263AB D²PAK-3 (TO-263, 3-LEAD) CASE 418AJ



JEDEC TO-263AA DPAK3 (TO-252 3 LD) CASE 369AS

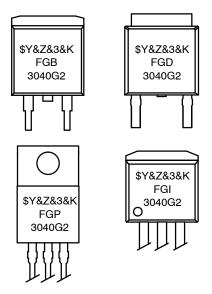




JEDEC TO-220AB TO-220-3LD CASE 340AT

JEDEC TO-262AA I2PAK (TO-262 3 LD) CASE 418AV

MARKING DIAGRAMS



FGx3040G2 = Specific Device Code (x = B/D/P/I)

\$Y = onsemi Logo &Z = Assembly Plant Code &3 = 3-Digit Date Code

&K = 2-Digits Lot Run Traceability Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

DEVICE MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Rating	Unit
BV _{CER}	Collector to Emitter Breakdown Voltage (I _C = 1 mA)	400	V
BV _{ECS}	Emitter to Collector Voltage – Reverse Battery Condition (I _C = 10 mA)	28	V
E _{SCIS25}	Self Clamping Inductive Switching Energy (Note 1)	300	mJ
E _{SCIS150}	Self Clamping Inductive Switching Energy (Note 2)	170	mJ
I _{C25}	Collector Current Continuous, at V _{GE} = 5.0 V, T _C = 25°C	41	Α
I _{C110}	Collector Current Continuous, at V _{GE} = 5.0 V, T _C = 110°C	25.6	Α
V _{GEM}	Gate to Emitter Voltage Continuous	±10	V
P _D	Power Dissipation Total, at T _C = 25°C	150	W
	Power Dissipation Derating, for T _C > 25°C	1	W/°C
TJ	Operating Junction Temperature Range	–55 to +175	°C
T _{STG}	Storage Junction Temperature Range	–55 to +175	°C
TL	Max. Lead Temp. for Soldering (Leads at 1.6 mm from case for 10 s)	300	°C
T _{PKG}	Reflow Soldering according to JESD020C	260	°C
ESD	HBM–Electrostatic Discharge Voltage at 100 pF, 1500 Ω	4	kV
	CDM-Electrostatic Discharge Voltage at 1 Ω	2	kV

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality

should not be assumed, damage may occur and reliability may be affected.

1. Self Clamping Inductive Switching Energy (E_{SCIS25}) of 300 mJ is based on the test conditions that starting Tj = 25°C; L = 3 mHy, I_{SCIS} = 14.2 A, V_{CC} = 100 V during inductor charging and V_{CC} = 0 V during the time in clamp.

2. Self Clamping Inductive Switching Energy (E_{SCIS150}) of 170 mJ is based on the test conditions that starting Tj = 150°C; L = 3 mHy, I_{SCIS} = 10.8 A, V_{CC} = 100 V during inductor charging and V_{CC} = 0 V during the time in clamp.

$\textbf{ELECTRICAL CHARACTERISTICS} \ (T_J = 25^{\circ}C \ unless \ otherwise \ noted)$

Symbol	Parameter	Test Conditions		Min	Тур	Max	Unit
OFF STATI	E CHARACTERISTICS	•			-	-	-
BV _{CER}	Collector to Emitter Breakdown Voltage	I_{CE} = 2 mA, V_{GE} = 0, R_{GE} = 1 k Ω , T_{J} = -40 to 150°C		370	400	430	V
BV _{CES}	Collector to Emitter Breakdown Voltage	I_{CE} = 10 mA, V_{GE} = 0 V, F T _J = -40 to 150°C	R _{GE} = 0,	390	420	450	V
BV _{ECS}	Emitter to Collector Breakdown Voltage	$I_{CE} = -20 \text{ mA}, V_{GE} = 0 \text{ V},$	T _J = 25°C	28	-	-	V
BV_{GES}	Gate to Emitter Breakdown Voltage	I _{GES} = ±2 mA		±12	±14	-	V
I _{CER}	Collector to Emitter Leakage Current	V_{CE} = 250 V, R_{GE} = 1 k Ω	T _J = 25°C	-	-	25	μΑ
		T _J = 15	T _J = 150°C	-	-	1	mA
I _{ECS}	Emitter to Collector Leakage Current	V _{EC} = 24 V	T _J = 25°C	-	-	1	mA
			T _J = 150°C	-	-	40	1
R ₁	Series Gate Resistance				120	-	Ω
R ₂	Gate to Emitter Resistance			10K	-	30K	Ω
ON STATE	CHARACTERISTICS						
V _{CE(SAT)}	Collector to Emitter Saturation Voltage	I _{CE} = 6 A, V _{GE} = 4 V	T _J = 25°C	-	1.15	1.25	V
V _{CE(SAT)}	Collector to Emitter Saturation Voltage	I _{CE} = 10 A, V _{GE} = 4.5 V	T _J = 150°C	-	1.35	1.50	V
V _{CE(SAT)}	Collector to Emitter Saturation Voltage	I _{CE} = 15 A, V _{GE} = 4.5 V	T _J = 150°C	-	1.68	1.85	V
E _{SCIS}	Self Clamped Inductive Switching	$\label{eq:local_local_local} \begin{array}{l} L = 3.0 \text{ mHy, RG} = 1 \text{ k}\Omega, \\ \text{VGE} = 5 \text{ V, (Note 3)} \end{array}$	TJ = 25°C	_	-	300	mJ
DYNAMIC	CHARACTERISTICS						
Q _{G(ON)}	Gate Charge	I _{CE} = 10 A, V _{CE} = 12 V, V	I _{CE} = 10 A, V _{CE} = 12 V, V _{GE} = 5 V		21	_	nC
V _{GE(TH)}	Gate to Emitter Threshold Voltage	I _{CE} = 1 mA, V _{CE} = V _{GE}	$T_J = 25^{\circ}C$	1.3	1.7	2.2	V
			T _J = 150°C	0.75	1.2	1.8	
V_{GEP}	Gate to Emitter Plateau Voltage	V _{CE} = 12 V, I _{CE} = 10 A		-	2.8	_	V
SWITCHIN	G CHARACTERISTICS						
t _{d(ON)R}	Current Turn-On Delay Time-Resistive	$V_{CE} = 14 \text{ V}, R_L = 1 \text{ k}\Omega$	$V_{CE} = 14 \text{ V}, R_L = 1 \text{ k}\Omega$		0.9	4	μs
t _{rR}	Current Rise Time-Resistive	$V_{GE} = 5 \text{ V, R}_{G} = 1 \text{ k}\Omega,$ $T_{J} = 25^{\circ}\text{C}$		-	1.9	7	μs
t _{d(OFF)L}	Current Turn-Off Delay Time-Inductive	V _{CE} = 300 V, L = 1 mH,		-	4.8	15	μs
t _{fL}	Current Fall Time-Inductive	$V_{GE} = 5 \text{ V}, R_G = 1 \text{ k}\Omega,$ $I_{CE} = 6.5 \text{ A}, T_J = 25 ^{\circ}\text{C}$		-	2.0	15	μs
THERMAL	CHARACTERISTICS	•					
$R_{\theta JC}$	Thermal Resistance Junction to Case			-	_	1	°C/W
	1						

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product

performance may not be indicated by the Electrical Characteristics if operated under different conditions.

3. Self Clamping Inductive Switching Energy (E_{SCIS25}) of 300 mJ is based on the test conditions that starting Tj = 25°C; L = 3 mHy, I_{SCIS} = 14.2 A, V_{CC} = 100 V during inductor charging and V_{CC} = 0 V during the time in clamp.

TYPICAL PERFORMANCE CURVES

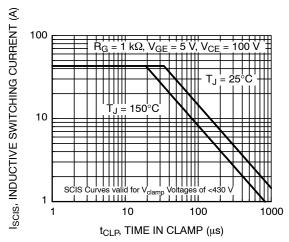


Figure 1. Self Clamped Inductive Switching Current vs. Time in Clamp

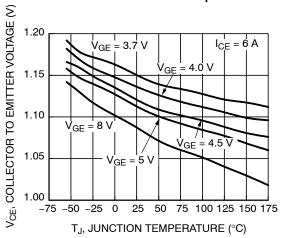


Figure 3. Collector to Emitter On–State Voltage vs. Junction Temperature

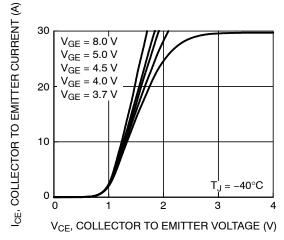


Figure 5. Collector to Emitter On–State Voltage vs. Collector Current

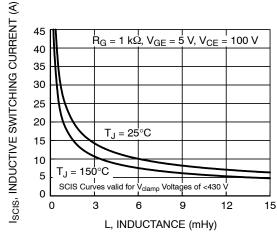


Figure 2. Self Clamped Inductive Switching Current vs. Inductance

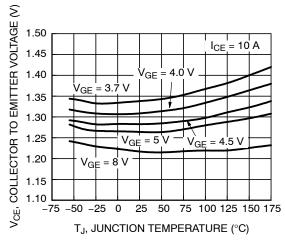


Figure 4. Collector to Emitter On–State Voltage vs. Junction Temperature

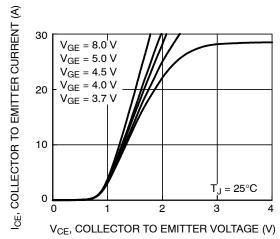


Figure 6. Collector to Emitter On-State Voltage vs. Collector Current

TYPICAL PERFORMANCE CURVES (Continued)

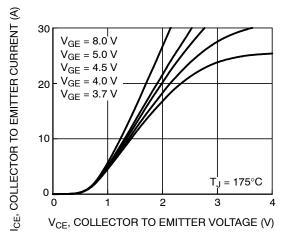


Figure 7. Collector to Emitter On-Stage Voltage vs. Collector Current

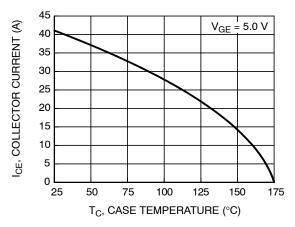


Figure 9. DC Collector Current vs. Case Temperature

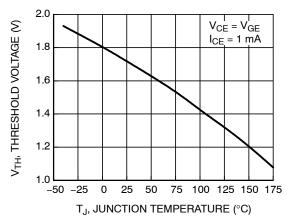


Figure 11. Threshold Voltage vs. Junction Temperature

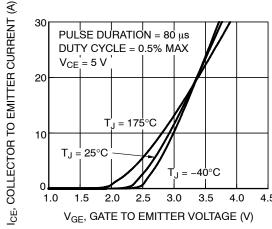


Figure 8. Transfer Characteristics

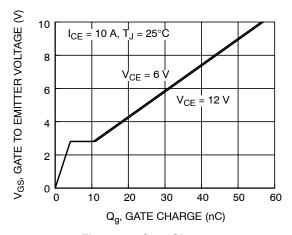


Figure 10. Gate Charge

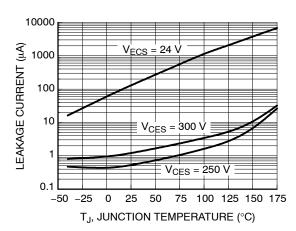


Figure 12. Leakage Current vs. Junction Temperature

TYPICAL PERFORMANCE CURVES (Continued)

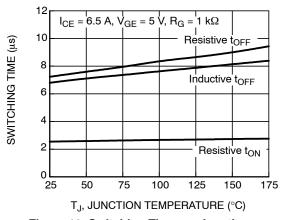


Figure 13. Switching Time vs. Junction Temperature

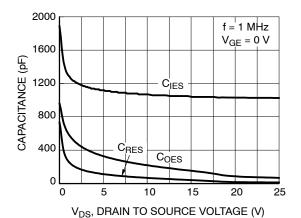


Figure 14. Capacitance vs. Collector to Emitter Voltage

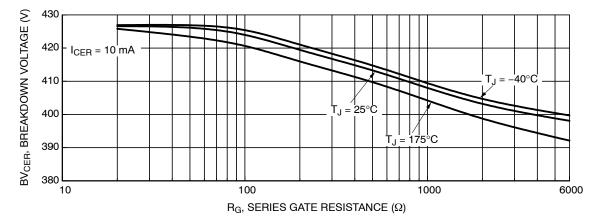


Figure 15. Breakdown Voltage vs. Series Gate Resistance

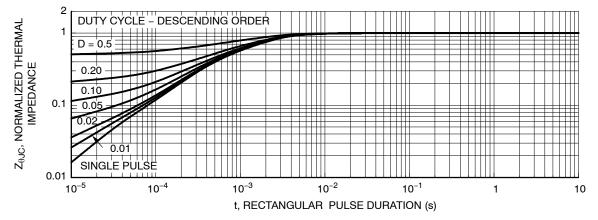


Figure 16. IGBT Normalized Transient Thermal Impedance, Junction to Case

TYPICAL PERFORMANCE CURVES (Continued)

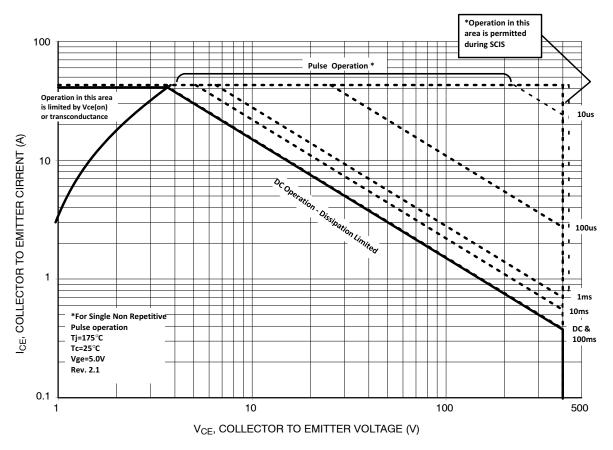
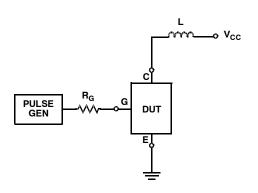


Figure 17. Forward Safe Operating Area

TEST CIRCUIT AND WAVEFORMS



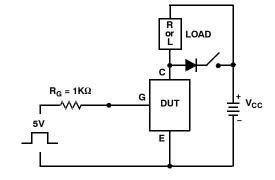
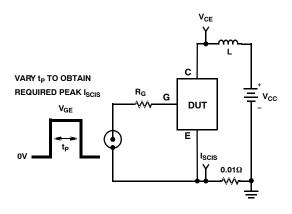


Figure 18. Inductive Switching Test Circuit

Figure 19. $t_{\mbox{\scriptsize ON}}$ and $t_{\mbox{\scriptsize OFF}}$ Switching Test Circuit





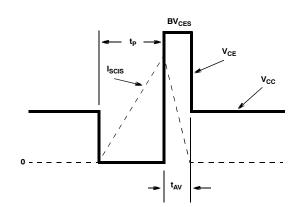


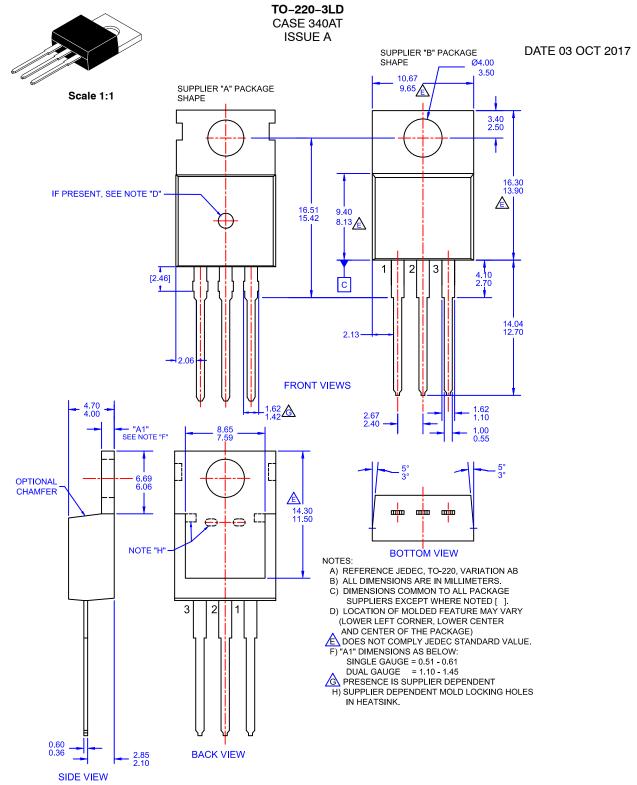
Figure 21. Energy Waveforms

PACKAGE MARKING AND ORDERING INFORMATION

Device	Device Marking	Package	Shipping [†]
FGB3040G2-F085	FGB3040G2	D ² PAK-3 (TO-263, 3-LEAD) (TO-263AB) (Pb-Free)	800 / Tape & Reel
FGD3040G2-F085	FGD3040G2	DPAK3 (TO-252 3 LD) (TO-252AA) (Pb-Free)	2500 / Tape & Reel
FGP3040G2-F085	FGP3040G2	TO-220-3LD (TO-220AB) (Pb-Free)	400 / Tube
FGl3040G2-F085	FGl3040G2	I2PAK (TO-262 3 LD) (TO-262AA) (Pb-Free)	400 / Tube

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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DESCRIPTION:	TO-220-3LD		PAGE 1 OF 1	

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3

 $-\Box$

L3

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L4

0.25 MAM C





C

(z)

DPAK3 (TO-252 3 LD)CASE 369AS **ISSUE A**

DATE 28 SEP 2022

NOTES: UNLESS OTHERWISE SPECIFIED

- A) THIS PACKAGE CONFORMS TO JEDEC, TO-252,
- ISSUE C, VARIATION AA.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
- D) SUPPLIER DEPENDENT MOLD LOCKING HOLES OR CHAMFERED CORNERS OR EDGE PROTRUSION.
- FOR DIODE PRODUCTS, L4 IS 0.25 MM MAX.
- F) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.
- G) LAND PATTERN RECOMMENDATION IS BASED ON IPC7351A STD TO228P991X239-3N.

DIM

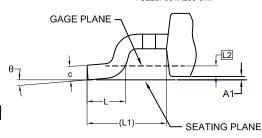
Α

L

11

L2

L3



Α1 0.127 0.00 0.89 b 0.64 0.77 b2 0.76 0.95 1.14 b3 5.21 5.34 5.46 0.61 С 0.45 0.53 c2 0.45 0.52 0.58 D 5.97 6.10 6.22 D1 5.21 Ε 6.35 6.54 6.73 E1 2.286 BSC е e1 4.572 BSC Н 9.40 9.91 10.41

1.40

0.89

1.59

2 90 RFF

0.51 BSC

1.08

1.78

MIN.

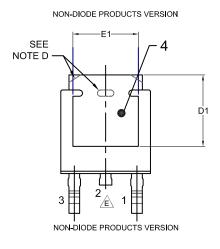
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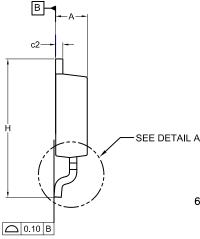
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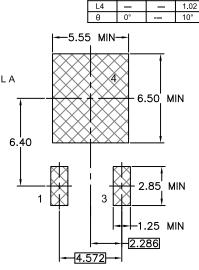
NOM. MAX.

2.39

DETAIL A (ROTATED -90°) SCALE: 12X







GENERIC MARKING DIAGRAM*

XXXXXX XXXXXX **AYWWZZ**

XXXX = Specific Device Code

= Assembly Location Α

WW = Work Week

= Assembly Lot Code

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "■", may or may not be present. Some products may not follow the Generic Marking.

LAND PATTERN RECOMMENDATION

*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL COLDEDOM/D

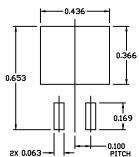
DOCUMENT NUMBER: 98AON13810G Electronic versions are uncontrolled except when accessed directly from the Document of Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in			
DESCRIPTION:	DPAK3 (TO-252 3 LD)		PAGE 1 OF 1

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D²PAK-3 (TO-263, 3-LEAD) CASE 418AJ ISSUE F

DATE 11 MAR 2021



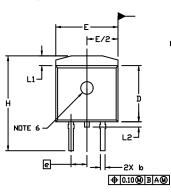
RECOMMENDED MOUNTING FOOTPRINT

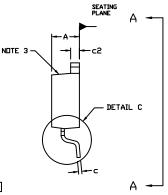
For additional information on our Pb-Free strategy and soldering details, please download the IN Seniconductor Soldering and Mounting Techniques Reference Manual, SILIERRM/D.

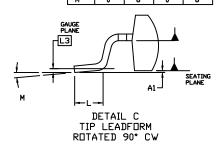
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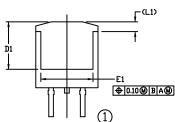
- 1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
- 2. CONTROLLING DIMENSION: INCHES
- 3. CHAMFER OPTIONAL.
- 4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH.
 MOLD FLASH SHALL NOT EXCEED 0.005 PER SIDE.
 THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST
 EXTREMES OF THE PLASTIC BODY AT DATUM H.
- 5. THERMAL PAD CONTOUR IS OPTIONAL WITHIN DIMENSIONS E, L1, D1, AND E1.
- 6. OPTIONAL MOLD FEATURE.
- 7. ①,② ... DPTIONAL CONSTRUCTION FEATURE CALL DUTS.

	INCHES		MILLIN	ETERS
DIM	MIN.	MAX.	MIN.	MAX.
Α	0.160	0.190	4.06	4.83
A1	0.000	0.010	0.00	0.25
b	0.020	0.039	0.51	0.99
С	0.012	0.029	0.30	0.74
c2	0.045	0.065	1.14	1.65
D	0.330	0.380	8.38	9.65
D1	0.260		6.60	
E	0.380	0.420	9.65	10.67
E1	0.245		6.22	
e	0.100	BSC	2.54 BSC	
Н	0.575	0.625	14.60	15.88
L	0.070	0.110	1.78	2.79
L1		0.066		1.68
L5		0.070		1.78
L3	0.010	BSC	0.25	BSC
м	0+	8*	n•	8.

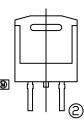


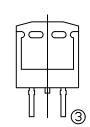


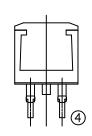




VIEW A-A







VIEW A-A

OPTIONAL CONSTRUCTIONS

GENERIC MARKING DIAGRAMS*

XXXXXX = Specific Device Code A = Assembly Location

 WL
 = Wafer Lot

 Y
 = Year

 WW
 = Work Week

 W
 = Week Code (SSG)

 M
 = Month Code (SSG)

 G
 = Pb-Free Package

 AKA
 = Polarity Indicator

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot " •", may or may not be present. Some products may not follow the Generic Marking.

DOCUMENT NUMBER:

98AON56370E

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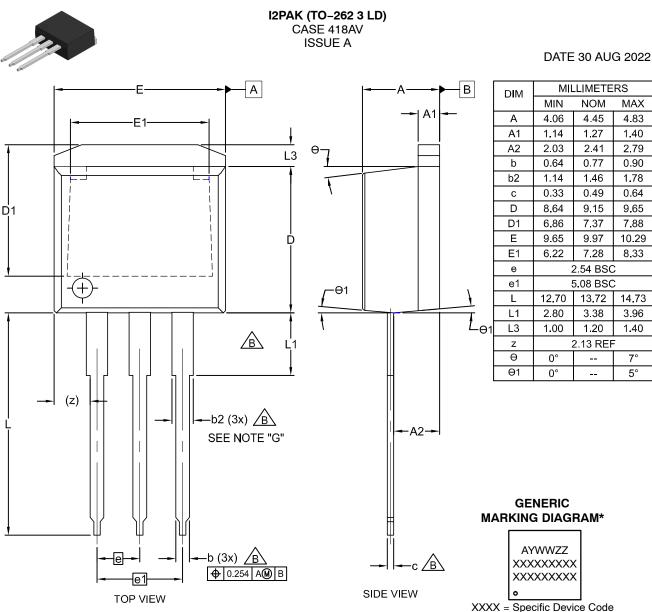
DESCRIPTION:

D²PAK-3 (TO-263, 3-LEAD)

PAGE 1 OF 1

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NOTES:

A. EXCEPT WHERE NOTED CONFORMS TO TO262 JEDEC VARIATION AA.

- 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.

WW = Work Week
 ZZ = Assembly Lot Code
 *This information is generic. Please refer to

= Year

= Assembly Location

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

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