

MOSFET – Power, N-Channel, SUPERFET® III, Easy Drive

650 V, 14 A, 199 mΩ

FCB199N65S3

Description

SUPERFET III MOSFET is onsemi's brand-new high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This advance technology is tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate. Consequently, SUPERFET III MOSFET is very suitable for various power system miniaturization and higher efficiency.

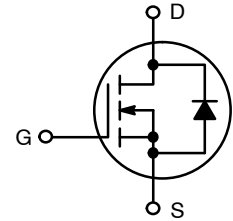
Features

- 700 V @ $T_J = 150^\circ\text{C}$
- Typ. $R_{DS(on)} = 170\text{ m}\Omega$
- Ultra Low Gate Charge (Typ. $Q_g = 30\text{ nC}$)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)} = 277\text{ pF}$)
- 100% Avalanche Tested
- These Devices are Pb-Free and are RoHS Compliant

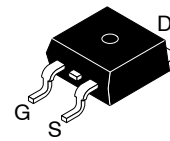
Applications

- Telecom / Server Power Supplies
- Industrial Power Supplies
- UPS / Solar

V_{DS}	$R_{DS(on)}\text{ MAX}$	$I_D\text{ MAX}$
650 V	199 mΩ @ 10 V	14 A

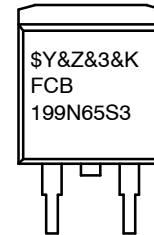


POWER MOSFET



D²-PAK
CASE 418AJ

MARKING DIAGRAM



\$Y	= onsemi Logo
&Z	= Assembly Plant Code
&3	= Data Code (Year & Week)
&K	= Lot
FCB199N65S3	= Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

FCB199N65S3

ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$, Unless otherwise specified)

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to Source Voltage		650	V
V_{GSS}	Gate to Source Voltage	DC	± 30	V
		AC ($f > 1\text{ Hz}$)	± 30	V
I_D	Drain Current	Continuous ($T_C = 25^\circ\text{C}$)	14	A
		Continuous ($T_C = 100^\circ\text{C}$)	9	
I_{DM}	Drain Current	Pulsed (Note 1)	35	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		76	mJ
I_{AS}	Avalanche Current (Note 1)		2.5	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		0.98	mJ
dv/dt	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt (Note 3)		20	
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	98	W
		Derate Above 25°C	0.79	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 s		300	$^\circ\text{C}$

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. Repetitive rating: pulse-width limited by maximum junction temperature.

2. $I_{AS} = 2.5\text{ A}$, $R_G = 25\ \Omega$, starting $T_J = 25^\circ\text{C}$.

3. $I_{SD} \leq 7\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq 400\text{ V}$, starting $T_J = 25^\circ\text{C}$.

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	1.27	$^\circ\text{C}/\text{W}$
	Thermal Resistance, Junction to Ambient, Max. (Note 4)	40	

4. Device on 1 in² pad 2 oz copper pad on 1.5 x 1.5 in. board of FR-4 material.

PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Marking	Package	Reel Size	Tape Width	Shipping [†]
FCB199N65S3	FCB199N65S3	D ² -PAK	330 mm	24 mm	800 / Tape & Reel

[†]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.

FCB199N65S3

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

BV _{DSS}	Drain to Source Breakdown Voltage	V _{GS} = 0 V, I _D = 1 mA, T _J = 25°C	650			V
		V _{GS} = 0 V, I _D = 1 mA, T _J = 150°C	700			V
ΔBV _{DSS} /ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 1 mA, Referenced to 25°C		0.6		V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 650 V, V _{GS} = 0 V			1	μA
		V _{DS} = 520 V, T _C = 125°C		0.89		
I _{GSS}	Gate to Body Leakage Current	V _{GS} = ±30 V, V _{DS} = 0 V			±100	nA

ON CHARACTERISTICS

V _{GS(th)}	Gate Threshold Voltage	V _{GS} = V _{DS} , I _D = 0.36 mA	2.5		4.5	V
R _{DS(on)}	Static Drain to Source On Resistance	V _{GS} = 10 V, I _D = 7 A		170	199	mΩ
g _{FS}	Forward Transconductance	V _{DS} = 20 V, I _D = 7 A		10		S

DYNAMIC CHARACTERISTICS

C _{iss}	Input Capacitance	V _{DS} = 400 V, V _{GS} = 0 V, f = 1 MHz		1225		pF
C _{oss}	Output Capacitance			30		pF
C _{oss(eff.)}	Effective Output Capacitance	V _{DS} = 0 V to 400 V, V _{GS} = 0 V		277		pF
C _{oss(er.)}	Energy Related Output Capacitance	V _{DS} = 0 V to 400 V, V _{GS} = 0 V		43		pF
Q _{g(tot)}	Total Gate Charge at 10 V	V _{DS} = 400 V, I _D = 7 A, V _{GS} = 10 V (Note 5)		30		nC
Q _{gs}	Gate to Source Gate Charge			7.4		nC
Q _{gd}	Gate to Drain "Miller" Charge			13		nC
ESR	Equivalent Series Resistance	f = 1 MHz		7		Ω

SWITCHING CHARACTERISTICS

t _{d(on)}	Turn-On Delay Time	V _{DD} = 400 V, I _D = 7 A, V _{GS} = 10 V, R _g = 4.7 Ω (Note 5)		19		ns
t _r	Turn-On Rise Time			23		ns
t _{d(off)}	Turn-Off Delay Time			52		ns
t _f	Turn-Off Fall Time			15		ns

SOURCE-DRAIN DIODE CHARACTERISTICS

I _S	Maximum Continuous Source to Drain Diode Forward Current			14		A
I _{SM}	Maximum Pulsed Source to Drain Diode Forward Current			35		A
V _{SD}	Source to Drain Diode Forward Voltage	V _{GS} = 0 V, I _{SD} = 7 A			1.2	V
t _{rr}	Reverse Recovery Time	V _{DD} = 400 V, I _{SD} = 7 A, dI _F /dt = 100 A/μs		256		ns
Q _{rr}	Reverse Recovery Charge			3.5		μC

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.

5. Essentially independent of operating temperature typical characteristics.

TYPICAL PERFORMANCE CHARACTERISTICS

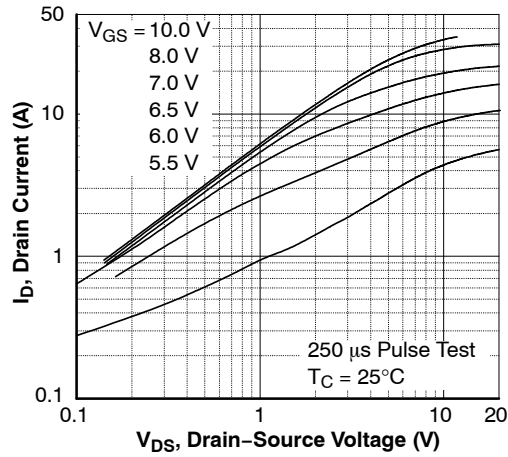


Figure 1. On-Region Characteristics

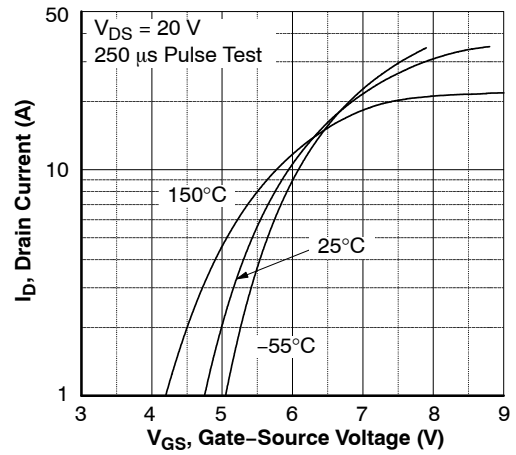


Figure 2. Transfer Characteristics

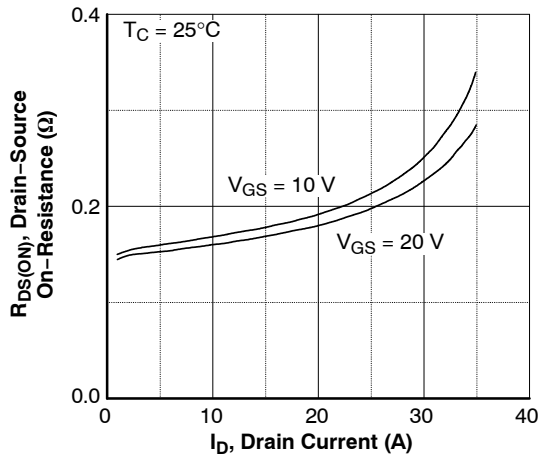


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

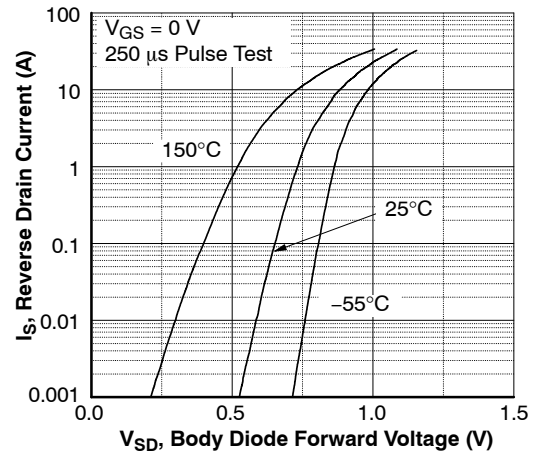


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

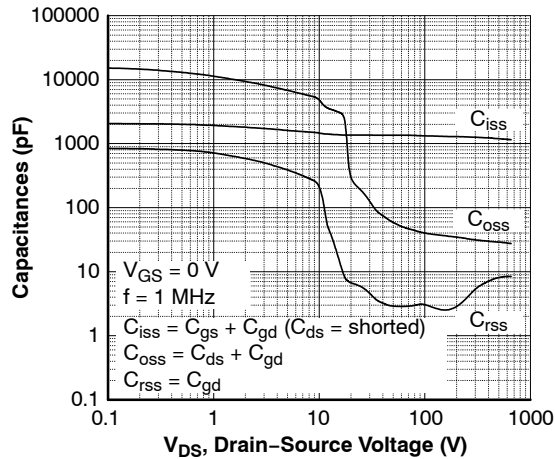


Figure 5. Capacitance Characteristics

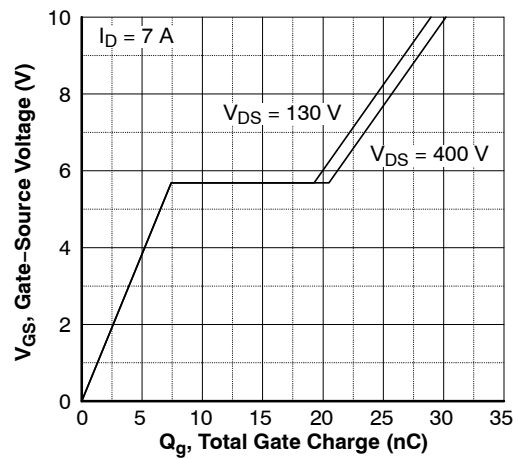


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

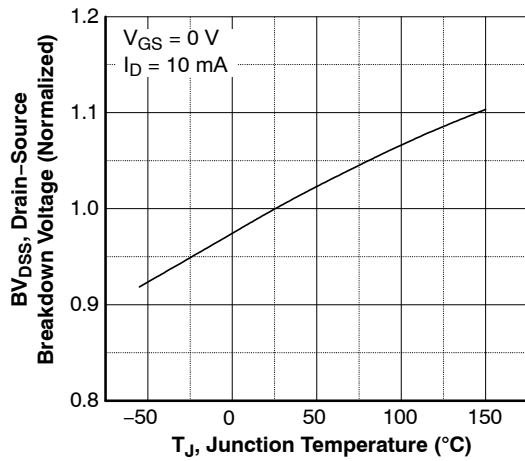


Figure 7. Breakdown Voltage Variation vs. Temperature

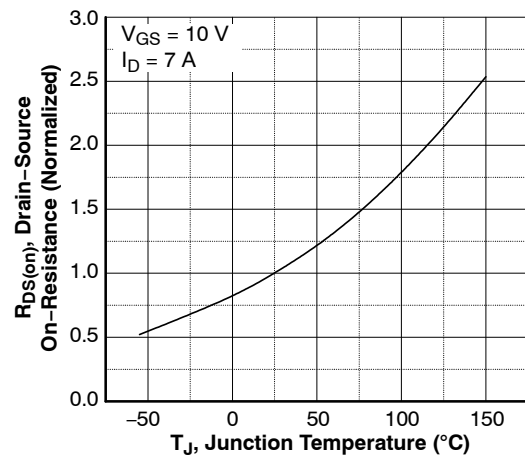


Figure 8. On-Resistance Variation vs. Temperature

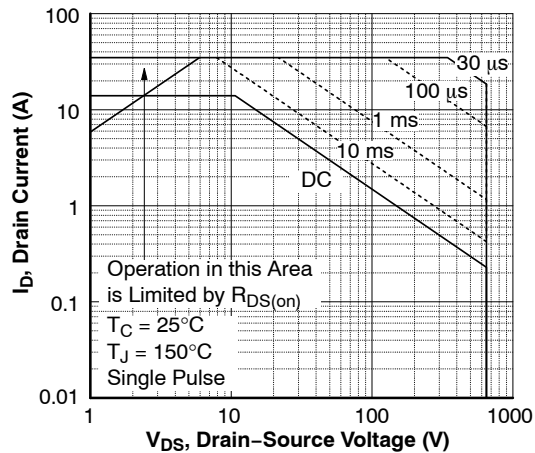


Figure 9. Maximum Safe Operating Area

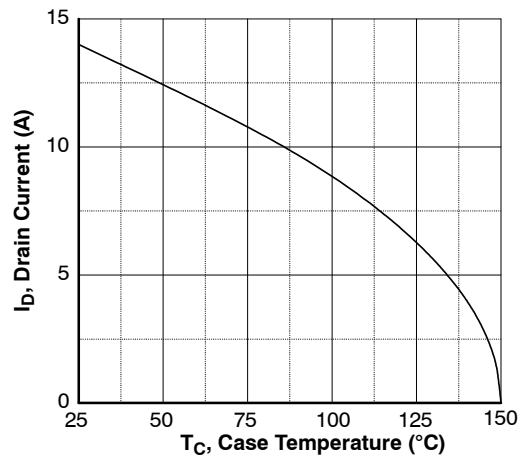
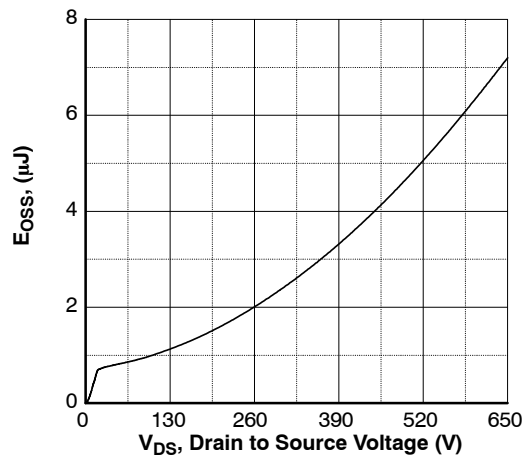


Figure 10. Maximum Drain Current vs. Case Temperature

Figure 11. E_{OSS} vs. Drain to Source Voltage

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

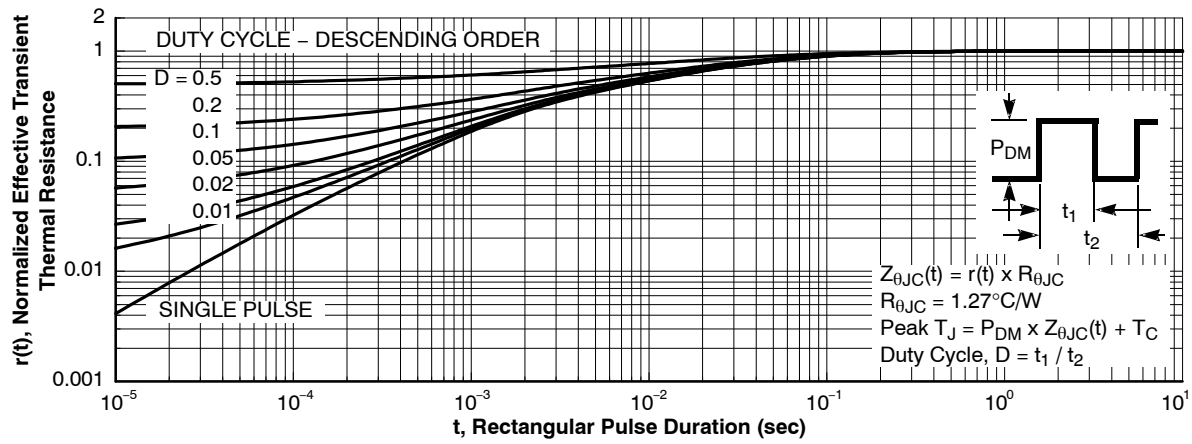


Figure 12. Transient Thermal Response Curve



Figure 13. Gate Charge Test Circuit & Waveform



Figure 14. Resistive Switching Test Circuit & Waveforms



Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

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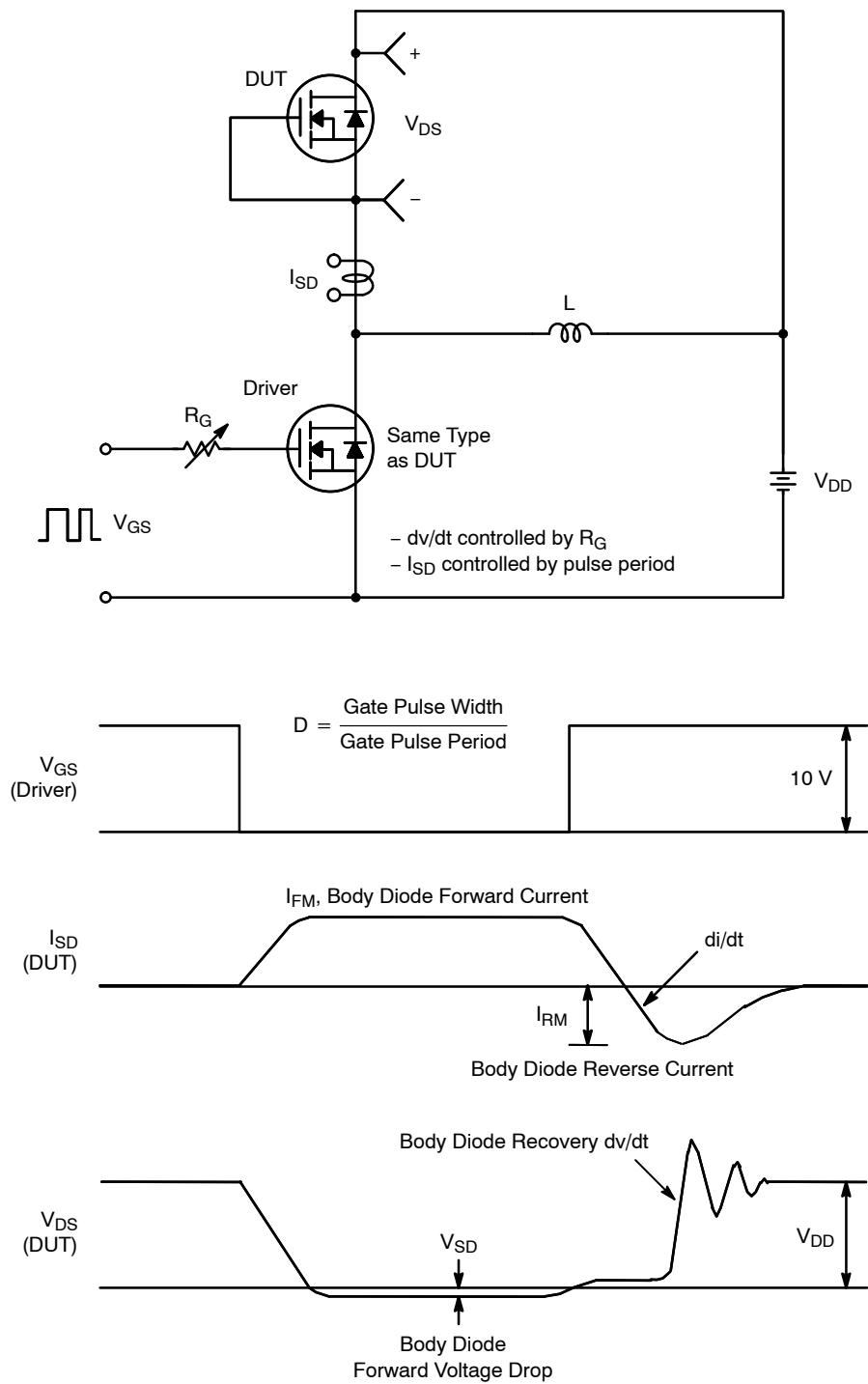


Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms



SCALE 1:1

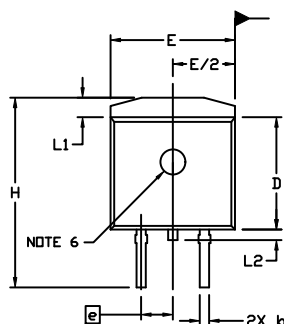
D²PAK-3 (TO-263, 3-LEAD)
CASE 418AJ
ISSUE F

DATE 11 MAR 2021



**RECOMMENDED
MOUNTING FOOTPRINT**

For additional information on our Pb-free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM1.

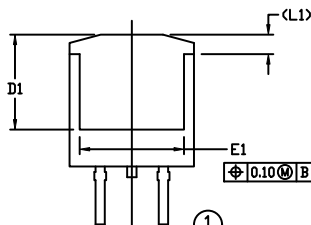
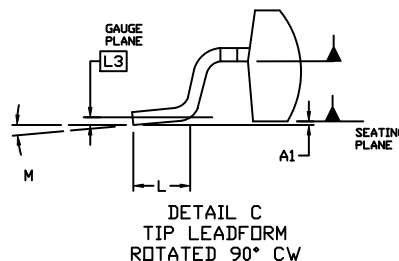
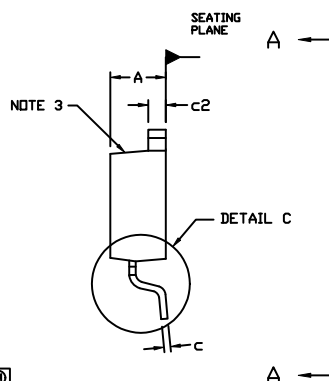


0.100 BSC 0.100 BSC

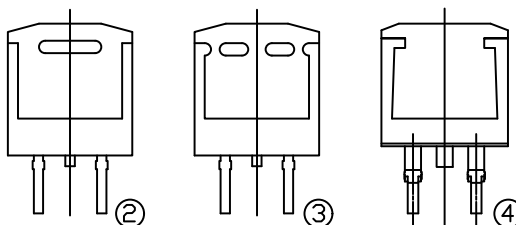
NOTES:

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 ... OPTIONAL CONSTRUCTION FEATURE CALL OUTS.

DIM	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	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
c	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	---
H	0.575	0.625	14.60	15.88
L	0.070	0.110	1.78	2.79
L1	---	0.066	---	1.68
L2	---	0.070	---	1.78
L3	0.010 BSC	---	0.25 BSC	---
M	0°	8°	0°	8°

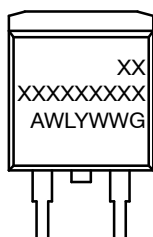


VIEW A-A

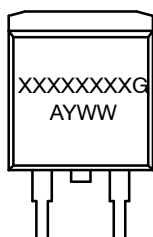


VIEW A-A
OPTIONAL CONSTRUCTIONS

GENERIC MARKING DIAGRAMS*



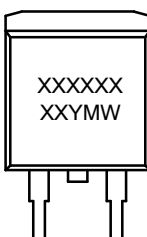
IC



Standard



Rectifier



SSG

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.

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