FCD260N65S3

[MOSFET](#) – Power, N-Channel, SUPERFET III, Easy Drive

650 V, 12 A, 260 mΩ

Description

SUPERFET III MOSFET is ON Semiconductor'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 advanced technology is tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate. Consequently, SUPERFET III MOSFET Easy drive series helps manage EMI issues and allows for easier design implementation.

Features

- 700 V @ T_J = 150°C
- Typ. $R_{DS(on)}$ = 222 mΩ
- Ultra Low Gate Charge (Typ. Q_g = 24 nC)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)}$ = 248 pF)
- 100% Avalanche Tested
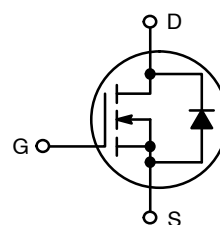- These Devices are Pb−Free and are RoHS Compliant

Applications

- Computing / Display Power Supplies
- Telecom / Server Power Supplies
- Industrial Power Supplies
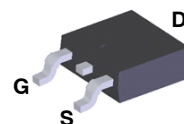- Lighting / Charger / Adapter

ON Semiconductor®

V_{DSS}	$R_{DS(ON)}$ MAX	I_D MAX
650 V	260 mΩ @ 10 V	12 A

POWER MOSFET

D−PAK
CASE 369AS

MARKING DIAGRAM

$Y&Z&3&K
FCD
260N65S3
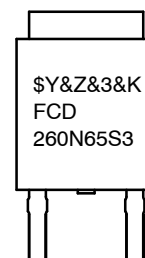
$Y	= ON Semiconductor Logo
&Z	= Assembly Plant Code
&3	= Data Code (Year & Week)
&K	= Lot
FCD260N65S3	= Specific Device Code

ORDERING INFORMATION

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

August, 2019 – Rev. 3

Publication Order Number:
FCD260N65S3/D

FCD260N65S3

ABSOLUTE MAXIMUM RATINGS (T_C = 25°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 Hz)	±30	V
I_D	Drain Current	Continuous (T_C = 25°C)	12	A
		Continuous (T_C = 100°C)	7.6	
I_{DM}	Drain Current	Pulsed (Note 1)	30	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		57	mJ
I_{AS}	Avalanche Current (Note 1)		2.3	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		0.9	mJ
dv/dt	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt (Note 3)		20	
P_D	Power Dissipation	(T_C = 25°C)	90	W
		Derate Above 25°C	0.72	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		−55 to +150	°C
T_L	Maximum Lead Temperature for Soldering, 1/8″ from Case for 5 s		300	°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} = 2.3 A, R_G = 25 Ω, starting T_J = 25°C.
3. $I_{SD} \leq$ 6 A, di/dt $\leq$ 200 A/μs, $V_{DD} \leq$ 400 V, starting T_J = 25°C.

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	1.39	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max. (Note 4)	40	

4. Device on 1 in^2 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[†]
FCD260N65S3	FCD260N65S3	D−PAK	330 mm	16 mm	2500 / 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.

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 1 mA, Referenced to 25°C		0.66		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		0.77		
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 = 0.29 mA	2.5		4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 6 A		222	260	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 6 A		7.4		S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 400 V, V_{GS} = 0 V, f = 1 MHz		1010		pF
C_{oss}	Output Capacitance			25		pF
$C_{oss(eff.)}$	Effective Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V		248		pF
$C_{oss(er.)}$	Energy Related Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V		33		pF
$Q_{g(tot)}$	Total Gate Charge at 10 V	V_{DS} = 400 V, I_D = 6 A, V_{GS} = 10 V (Note 5)		24		nC
Q_{gs}	Gate to Source Gate Charge			6.1		nC
Q_{gd}	Gate to Drain "Miller" Charge			9.7		nC
ESR	Equivalent Series Resistance	f = 1 MHz		8.7		Ω
SWITCHING CHARACTERISTICS						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 400 V, I_D = 6 A, V_{GS} = 10 V, R_g = 4.7 Ω (Note 5)		18		ns
t_r	Turn-On Rise Time			18		ns
$t_{d(off)}$	Turn-Off Delay Time			49		ns
t_f	Turn-Off Fall Time			12		ns
SOURCE-DRAIN DIODE CHARACTERISTICS						
I_S	Maximum Continuous Source to Drain Diode Forward Current				12	A
I_{SM}	Maximum Pulsed Source to Drain Diode Forward Current				30	A
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 6 A			1.2	V
t_{rr}	Reverse Recovery Time	V_{DD} = 400 V, I_{SD} = 6 A, dI_F/dt = 100 A/μs		251		ns
Q_{rr}	Reverse Recovery Charge			3.4		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.
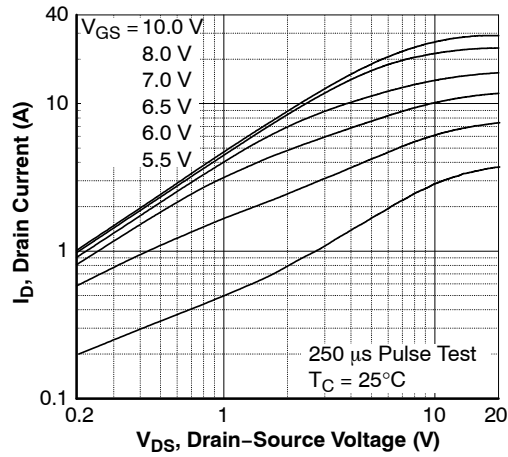
FCD260N65S3

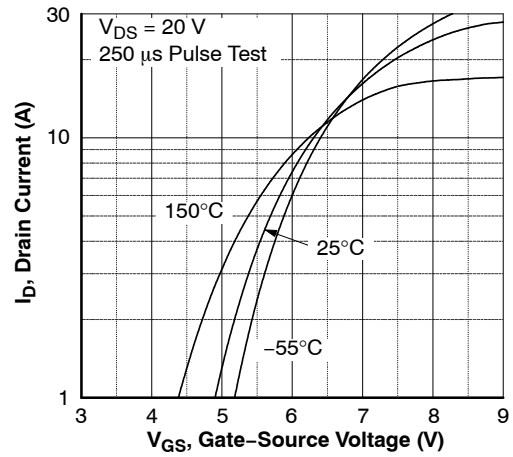## TYPICAL PERFORMANCE CHARACTERISTICS

Figure 1. On−Region Characteristics

V_{GS} = 10.0 V, 8.0 V, 7.0 V, 6.5 V, 6.0 V, 5.5 V

250 μs Pulse Test
T_C = 25°C

I_D, Drain Current (A) vs. V_{DS}, Drain−Source Voltage (V)

Figure 2. Transfer Characteristics

V_{DS} = 20 V
250 μs Pulse Test

150°C, 25°C, −55°C

I_D, Drain Current (A) vs. V_{GS}, Gate−Source Voltage (V)
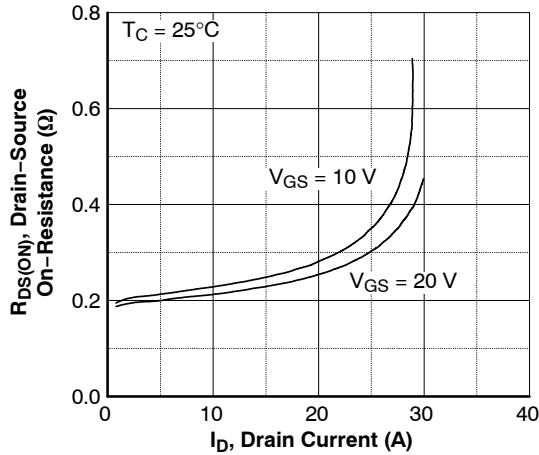
Figure 3. On−Resistance Variation vs. Drain Current and Gate Voltage

T_C = 25°C

V_{GS} = 10 V
V_{GS} = 20 V

$R_{DS(ON)}$, Drain−Source On−Resistance (Ω) vs. I_D, Drain Current (A)
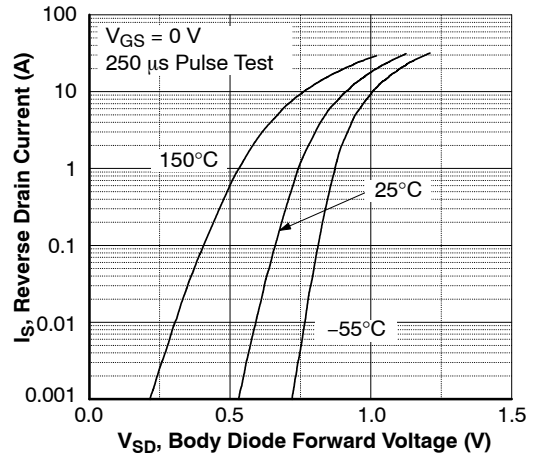
Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

V_{GS} = 0 V
250 μs Pulse Test

150°C, 25°C, −55°C

I_S, Reverse Drain Current (A) vs. V_{SD}, Body Diode Forward Voltage (V)
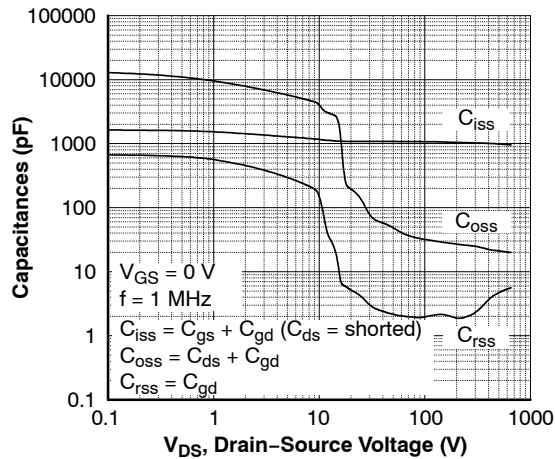
Figure 5. Capacitance Characteristics

V_{GS} = 0 V
f = 1 MHz
$C_{iss} = C_{gs} + C_{gd}$ (C_{ds} = shorted)
$C_{oss} = C_{ds} + C_{gd}$
$C_{rss} = C_{gd}$

C_{iss}, C_{oss}, C_{rss}

Capacitances (pF) vs. V_{DS}, Drain−Source Voltage (V)
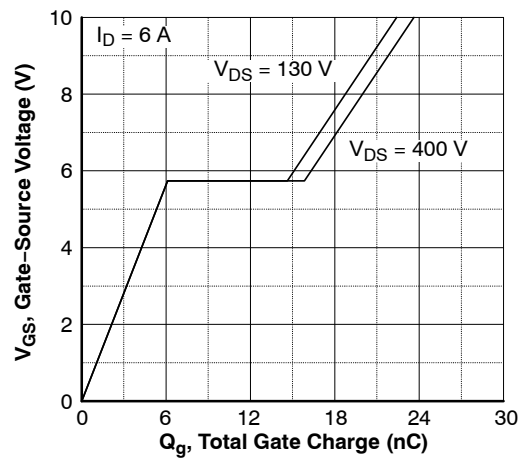
Figure 6. Gate Charge Characteristics

I_D = 6 A
V_{DS} = 130 V
V_{DS} = 400 V

V_{GS}, Gate−Source Voltage (V) vs. Q_g, Total Gate Charge (nC)

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)
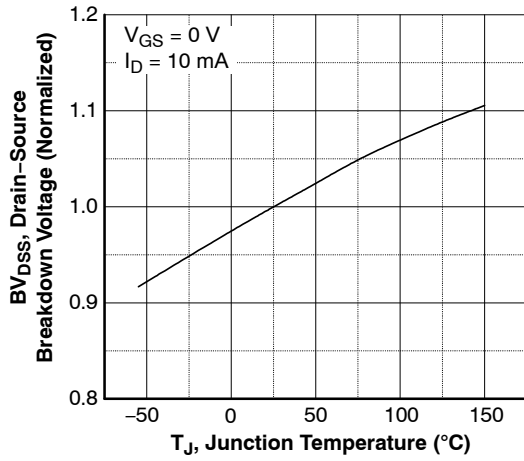
Figure 7. Breakdown Voltage Variation
vs. Temperature
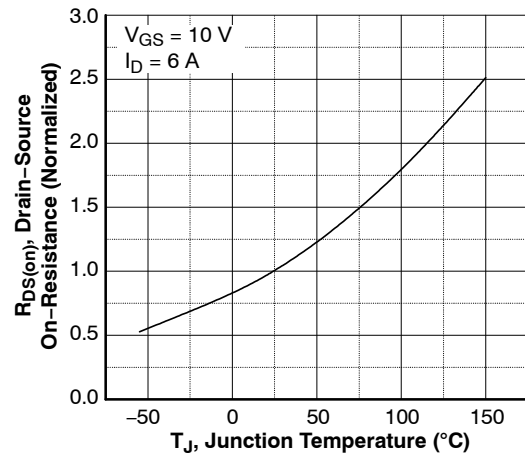
Figure 8. On–Resistance Variation
vs. Temperature
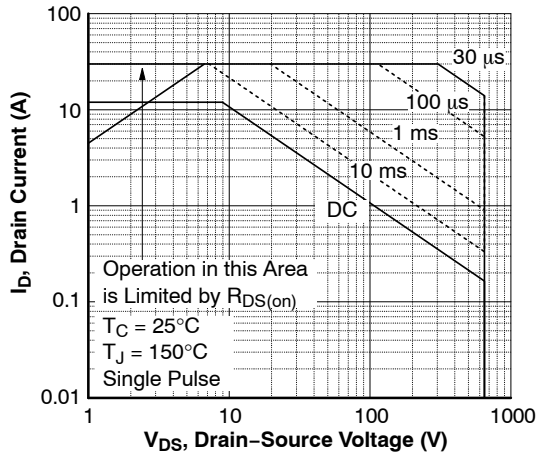
Figure 9. Maximum Safe Operating Area
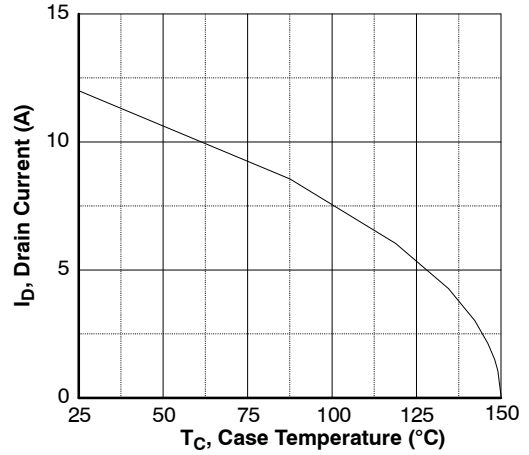
Figure 10. Maximum Drain Current
vs. Case Temperature
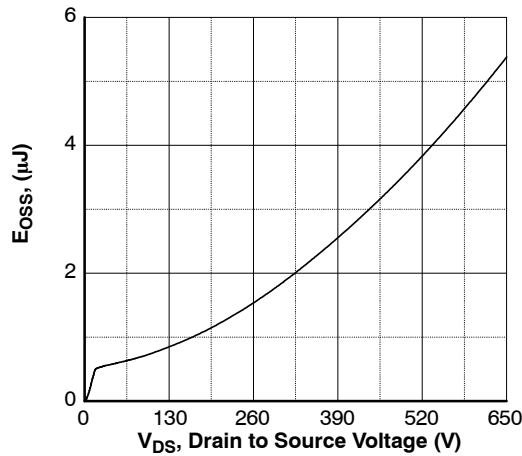
Figure 11. E_{OSS} vs. Drain to Source Voltage

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)
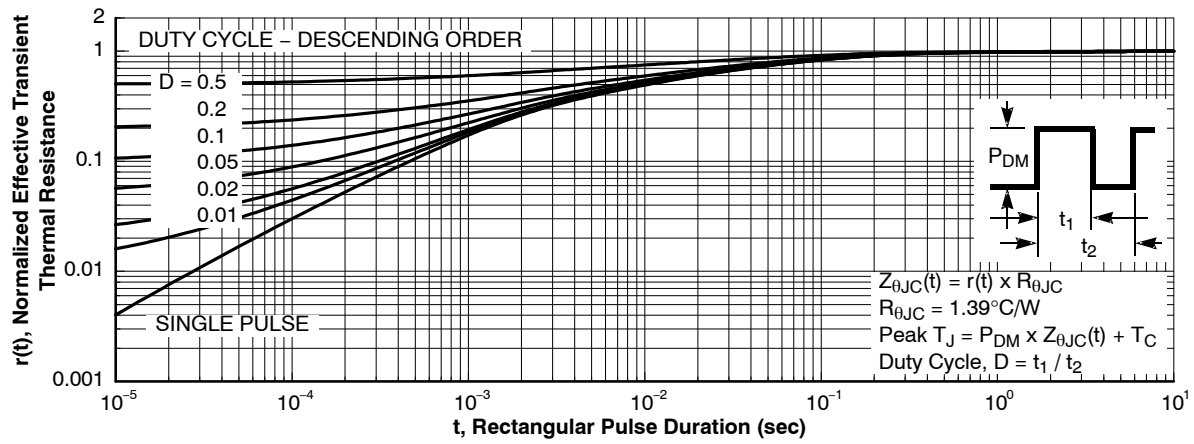
Figure 12. Transient Thermal Response Curve
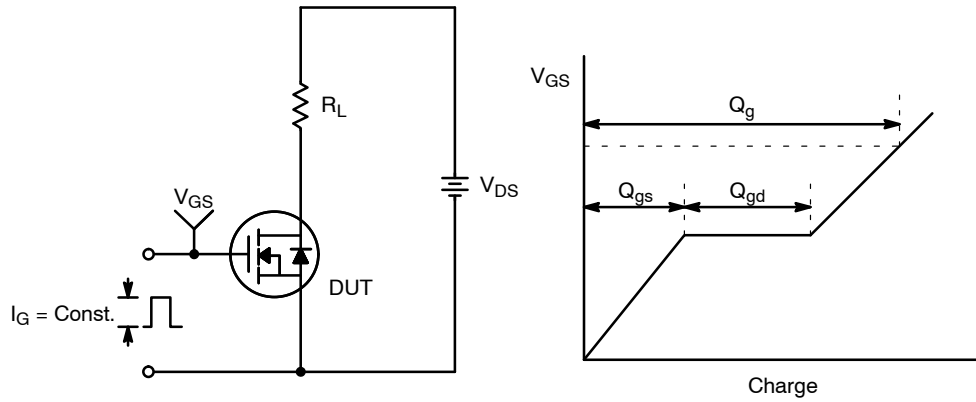
Figure 13. Gate Charge Test Circuit & Waveform

Figure 14. Resistive Switching Test Circuit & Waveforms

$$E_{AS} = \frac{1}{2} \cdot LI_{AS}^2$$
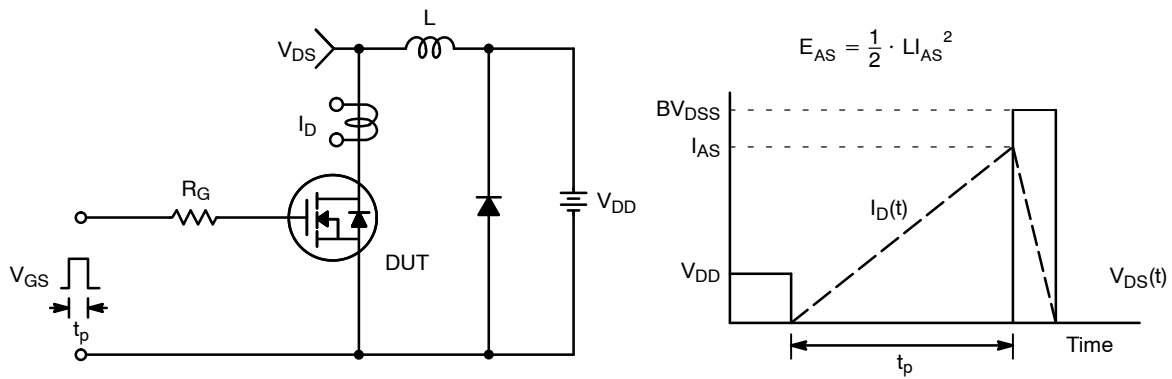
Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

$$D = \frac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$$

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

DPAK3 (TO−252 3 LD)
CASE 369AS
ISSUE O

DATE 30 SEP 2016

NON-DIODE PRODUCTS VERSION

DIODE PRODUCTS VERSION

LAND PATTERN RECOMMENDATION

NON-DIODE PRODUCTS VERSION

DIODE PRODUCTS VERSION

SEE DETAIL A

SEE NOTE D
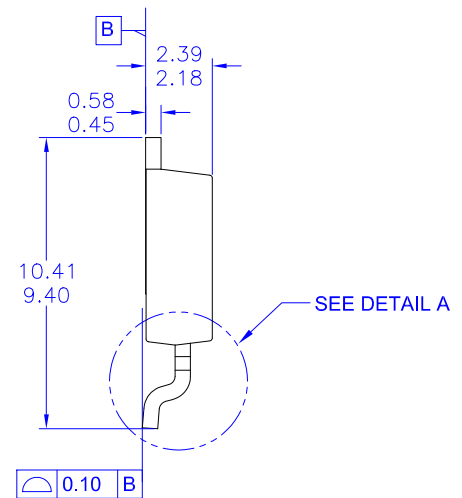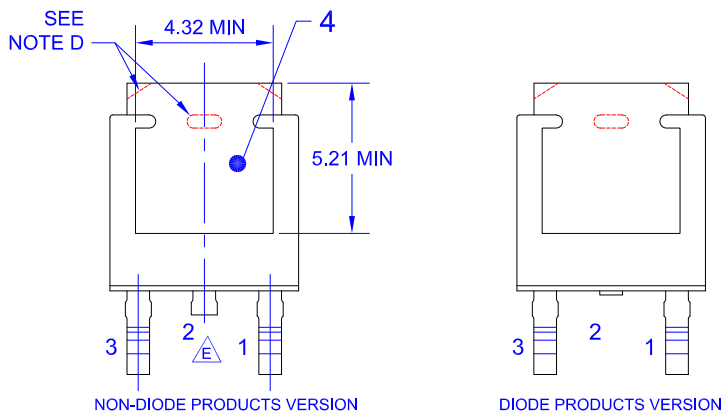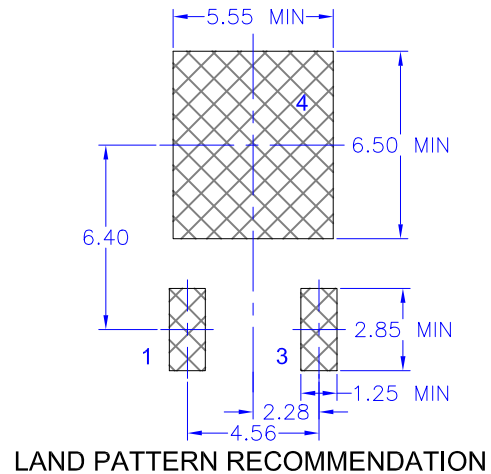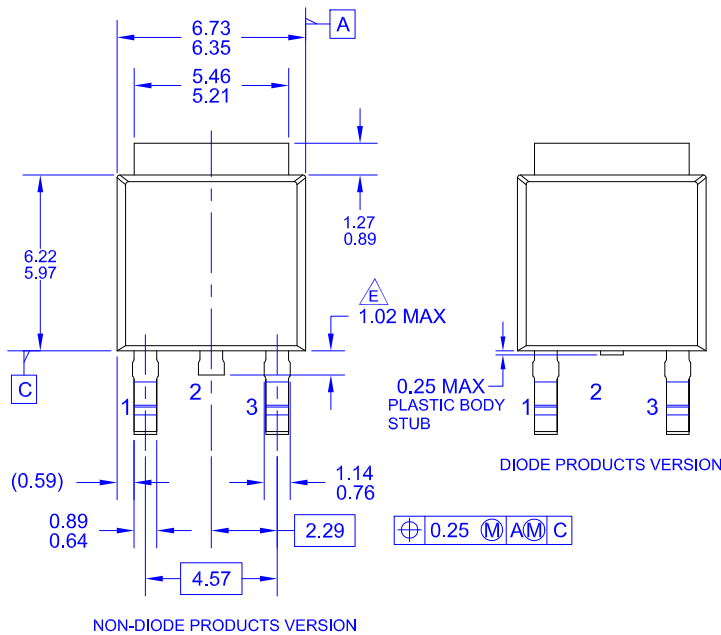
NOTES: UNLESS OTHERWISE SPECIFIED
  A) THIS PACKAGE CONFORMS TO JEDEC, TO-252,
     ISSUE C, VARIATION AA.
  B) ALL DIMENSIONS ARE IN MILLIMETERS.
  C) DIMENSIONING AND TOLERANCING PER
     ASME Y14.5M-2009.
  D) SUPPLIER DEPENDENT MOLD LOCKING HOLES OR CHAMFERED
     CORNERS OR EDGE PROTRUSION.
  E) TRIMMED CENTER LEAD IS PRESENT ONLY FOR DIODE PRODUCTS
  F) DIMENSIONS ARE EXCLUSIVE OF BURSS,
     MOLD FLASH AND TIE BAR EXTRUSIONS.
  G) LAND PATTERN RECOMENDATION IS BASED ON IPC7351A STD
     TO228P991X239-3N.

GAGE PLANE

SEATING PLANE

DETAIL A
(ROTATED -90°)
SCALE: 12X
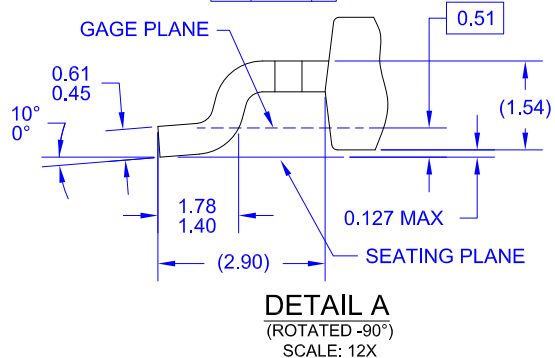
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PUBLICATION ORDERING INFORMATION

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