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June 2014

FDMC7692S

N-Channel PowerTrench[®] SyncFET[™]

30 V, 18 A, 9.3 mΩ

Features

- Max $r_{DS(on)}$ = 9.3 mΩ at $V_{GS} = 10\text{ V}$, $I_D = 12.5\text{ A}$
- Max $r_{DS(on)}$ = 13.6 mΩ at $V_{GS} = 4.5\text{ V}$, $I_D = 10.4\text{ A}$
- High performance technology for extremely low $r_{DS(on)}$
- Termination is Lead-free and RoHS Compliant

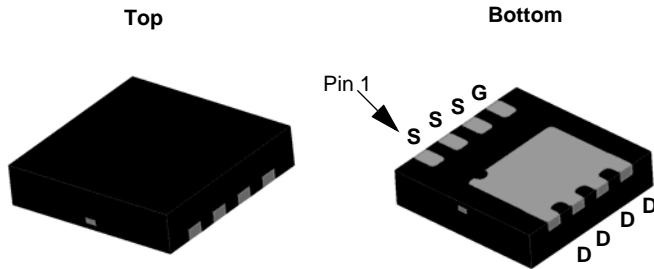


General Description

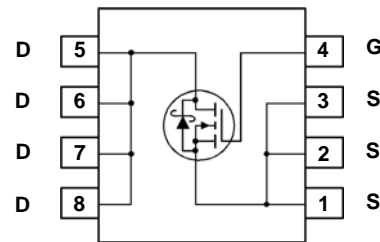
This FDMC7692S is produced using Fairchild Semiconductor's advanced PowerTrench[®] process that has been especially tailored to minimize the on-state resistance. This device is well suited for Power Management and load switching applications common in Notebook Computers and Portable Battery packs.

Applications

- DC - DC Buck Converters
- Notebook DC - DC application



MLP 3.3x3.3



MOSFET Maximum Ratings $T_A = 25\text{ °C}$ unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{DS}	Drain to Source Voltage	30	V
V_{GS}	Gate to Source Voltage	±20	V
I_D	Drain Current -Continuous $T_C = 25\text{ °C}$	18	A
	-Continuous $T_A = 25\text{ °C}$ (Note 1a)	12.5	
	-Pulsed	45	
E_{AS}	Single Pulse Avalanche Energy (Note 3)	21	mJ
P_D	Power Dissipation $T_C = 25\text{ °C}$	27	W
	Power Dissipation $T_A = 25\text{ °C}$ (Note 1a)	2.3	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	4.7	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	53	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMC7692S	FDMC7692S	MLP 3.3X3.3	13"	12 mm	3000 units

Electrical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 1\text{ mA}, V_{GS} = 0\text{ V}$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 10\text{ mA}$, referenced to $25\text{ }^\circ\text{C}$		16		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}$			500	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$			100	nA

On Characteristics (Note 2)

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 1\text{ mA}$	1.2	2.0	3.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 10\text{ mA}$, referenced to $25\text{ }^\circ\text{C}$		-5		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 12.5\text{ A}$		7.8	9.3	m Ω
		$V_{GS} = 4.5\text{ V}, I_D = 10.4\text{ A}$		10.8	13.6	
		$V_{GS} = 10\text{ V}, I_D = 12.5\text{ A}$ $T_J = 125\text{ }^\circ\text{C}$		9.6	13.0	
g_{FS}	Forward Transconductance	$V_{DS} = 5\text{ V}, I_D = 12.5\text{ A}$		62		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$		1040	1385	pF
C_{oss}	Output Capacitance			445	590	pF
C_{rss}	Reverse Transfer Capacitance			40	60	pF
R_g	Gate Resistance			1.1	2.9	Ω

Switching Characteristics

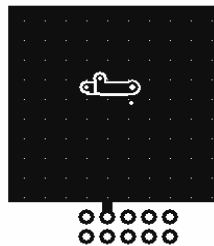
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{ V}, I_D = 12.5\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$		9	17	ns	
t_r	Rise Time			3	10	ns	
$t_{d(off)}$	Turn-Off Delay Time			19	34	ns	
t_f	Fall Time			3	10	ns	
Q_g	Total Gate Charge		$V_{GS} = 0\text{ V to } 10\text{ V}$		16	23	nC
Q_g	Total Gate Charge	$V_{GS} = 0\text{ V to } 4.5\text{ V}$	$V_{DD} = 15\text{ V}$ $I_D = 12.5\text{ A}$		8	10	nC
Q_{gs}	Gate to Source Gate Charge				4		nC
Q_{gd}	Gate to Drain "Miller" Charge				2		nC

Drain-Source Diode Characteristics

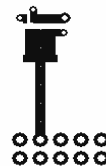
V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 12.5\text{ A}$ (Note 2)		0.9	1.3	V
		$V_{GS} = 0\text{ V}, I_S = 0.9\text{ A}$ (Note 2)		0.5	0.7	
t_{rr}	Reverse Recovery Time	$I_F = 12.5\text{ A}, di/dt = 300\text{ A}/\mu\text{s}$		21	33	ns
Q_{rr}	Reverse Recovery Charge			16	29	nC

Notes:

1. $R_{\theta JA}$ is determined with the device mounted on a 1in² pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a. 53 °C/W when mounted on a 1 in² pad of 2 oz copper.



b. 125 °C/W when mounted on a minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width < 300 μs , Duty cycle < 2.0%.

3. E_{AS} of 21 mJ is based on starting $T_J = 25\text{ }^\circ\text{C}$, $L = 0.3\text{ mH}$, $I_{AS} = 12.0\text{ A}$, $V_{DD} = 27\text{ V}$, $V_{GS} = 10\text{ V}$. 100% test at $L = 3\text{ mH}$, $I_{AS} = 3.2\text{ A}$.

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

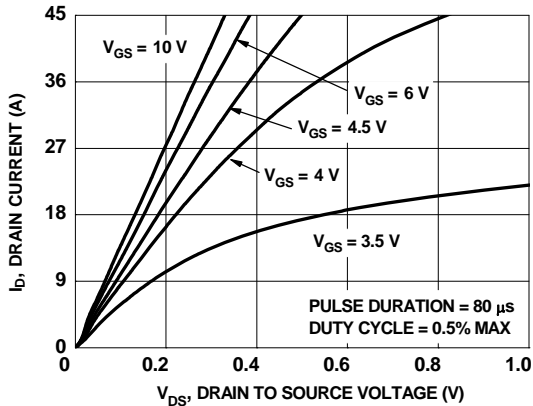


Figure 1. On-Region Characteristics

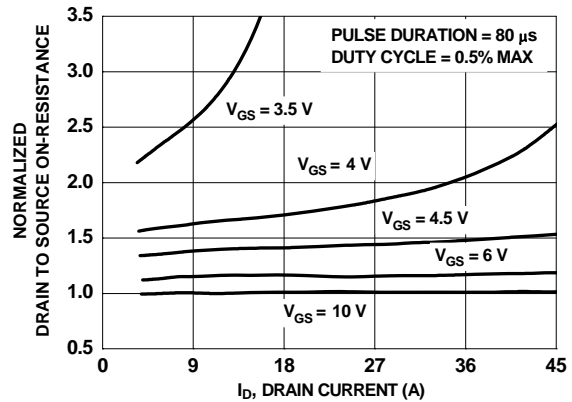


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

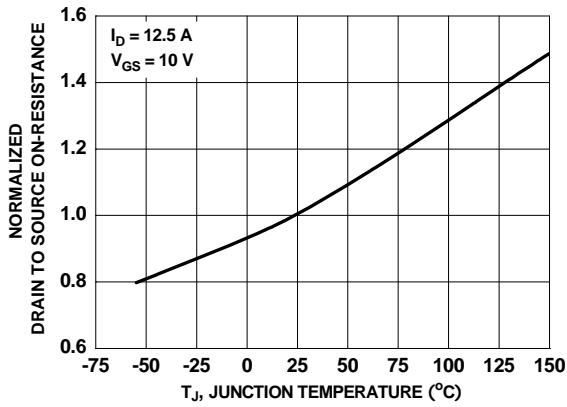


Figure 3. Normalized On-Resistance vs Junction Temperature

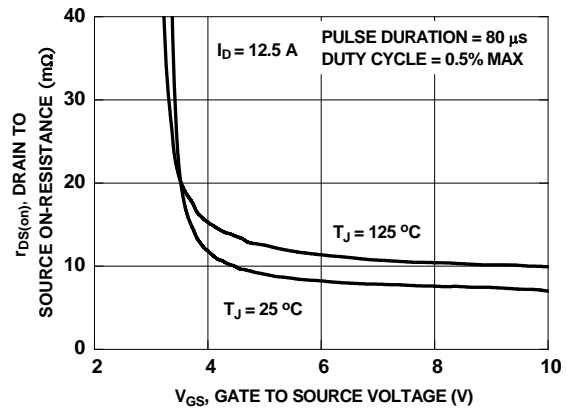


Figure 4. On-Resistance vs Gate to Source Voltage

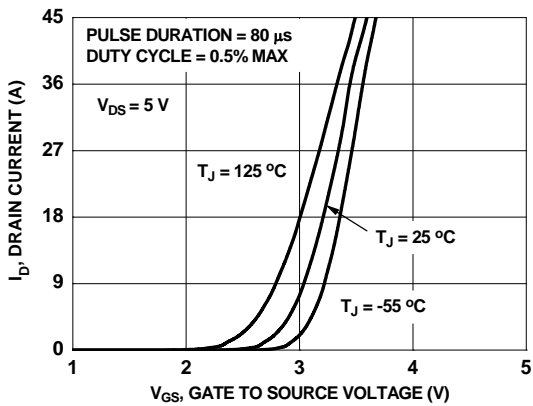


Figure 5. Transfer Characteristics

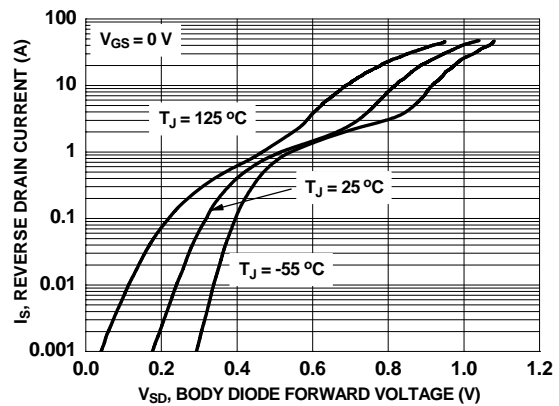


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

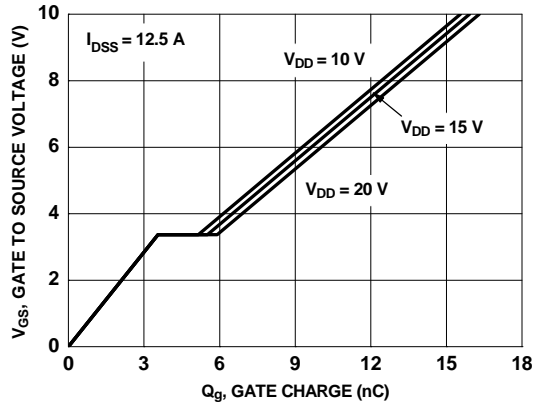


Figure 7. Gate Charge Characteristics

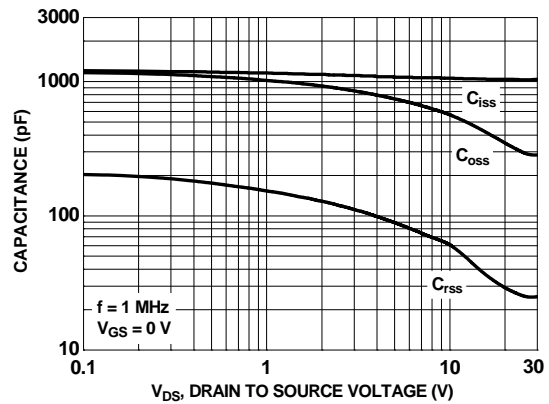


Figure 8. Capacitance vs Drain to Source Voltage

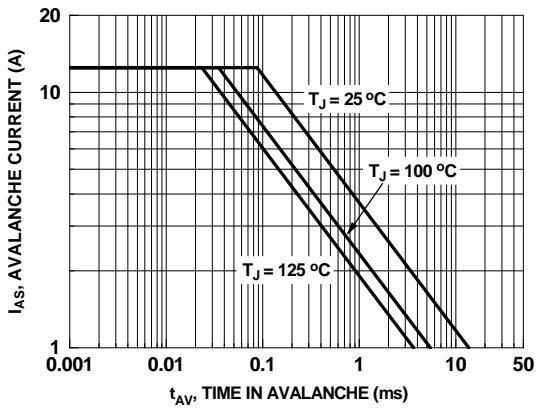


Figure 9. Unclamped Inductive Switching Capability

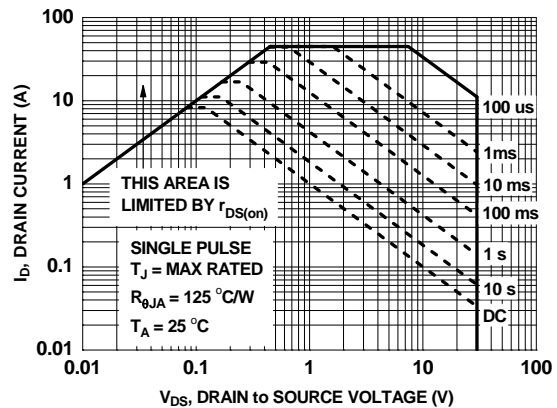


Figure 10. Forward Bias Safe Operating Area

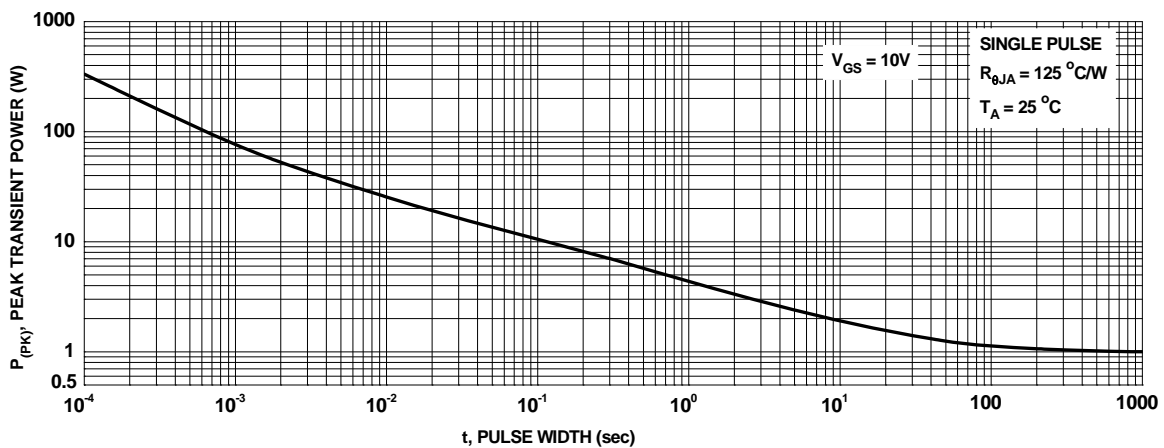


Figure 11. Single Pulse Maximum Power Dissipation

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

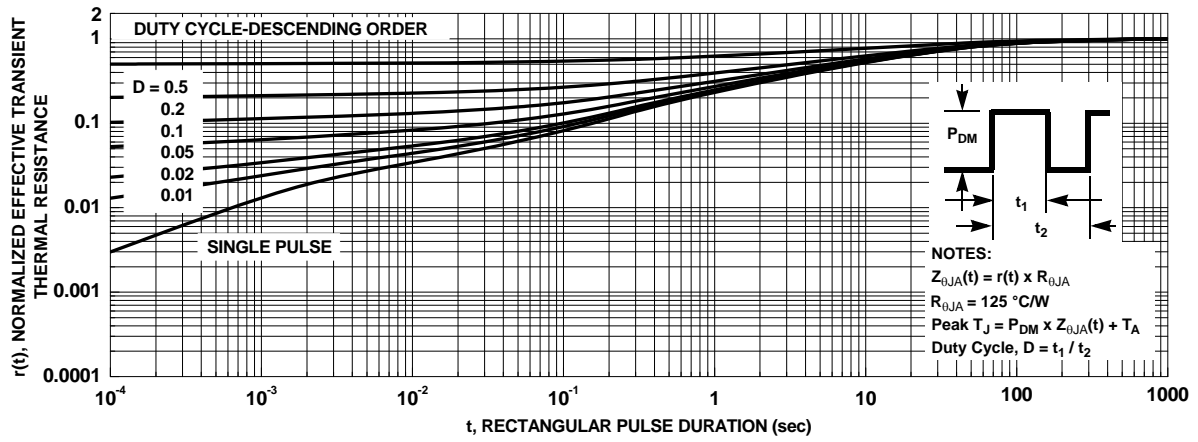


Figure 12. Junction-to-Ambient Transient Thermal Response Curve

Typical Characteristics (continued)

SyncFET Schottky body diode Characteristics

Fairchild's SyncFET process embeds a Schottky diode in parallel with PowerTrench MOSFET. This diode exhibits similar characteristics to a discrete external Schottky diode in parallel with a MOSFET. Figure 13 shows the reverse recovery characteristic of the FDMC7692S.

Schottky barrier diodes exhibit significant leakage at high temperature and high reverse voltage. This will increase the power in the device.

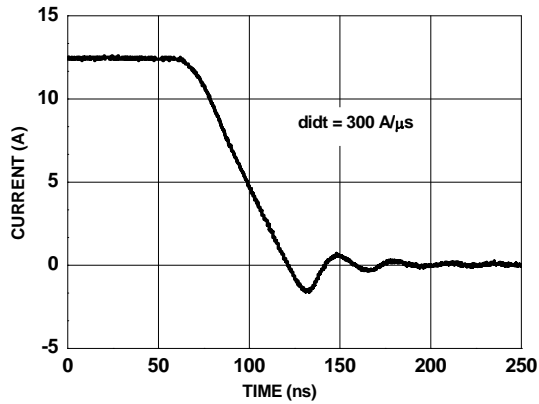


Figure 13. SyncFET body diode reverse recovery characteristic

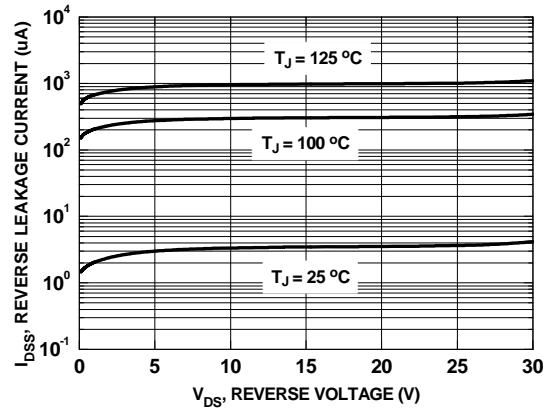
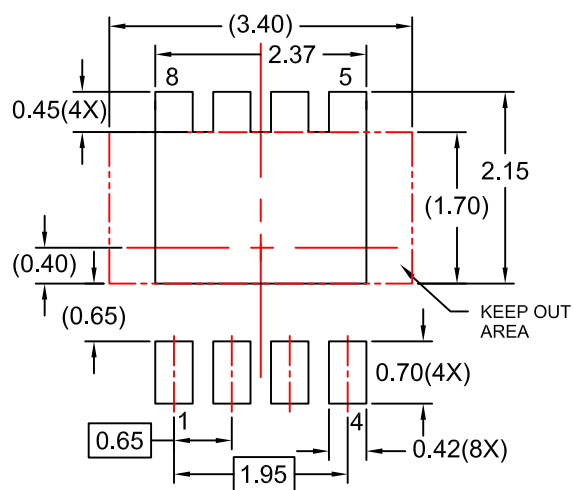
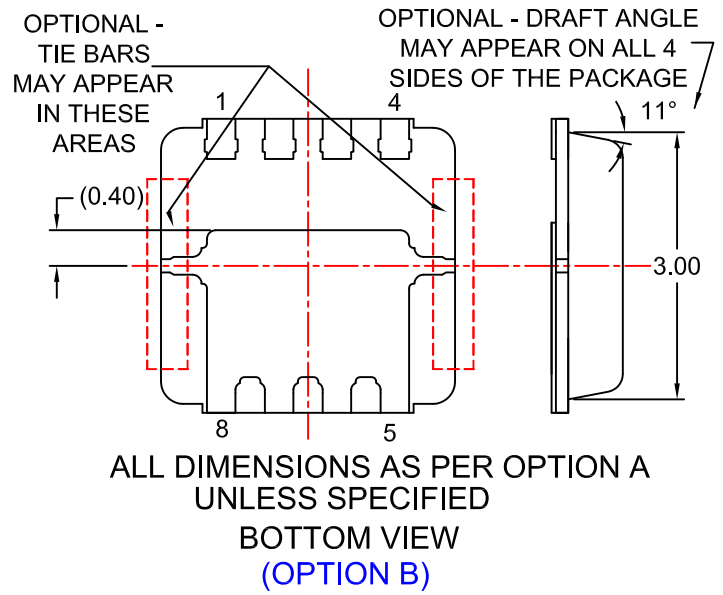
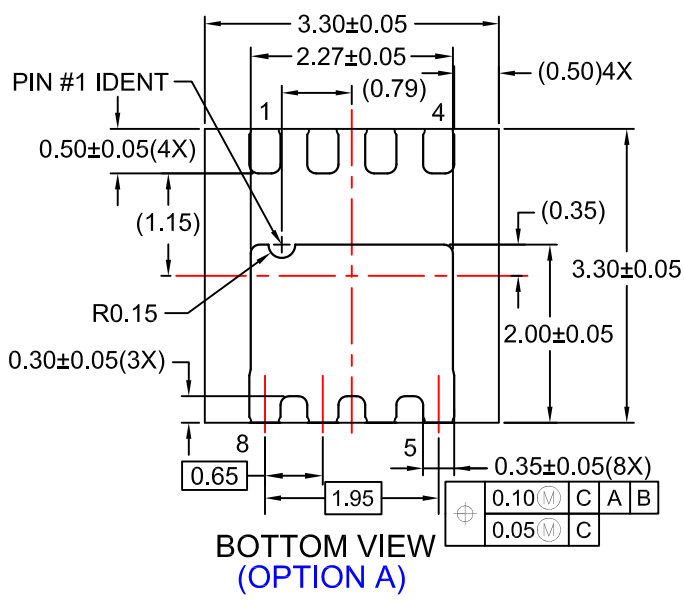
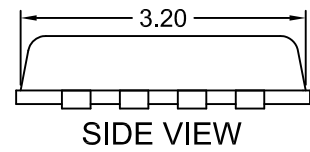
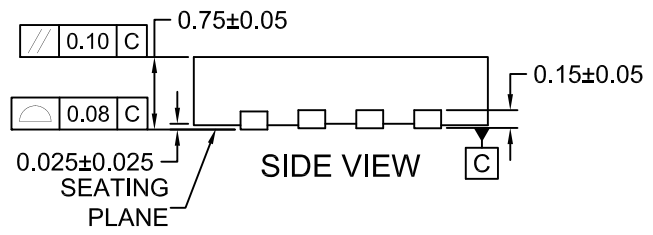
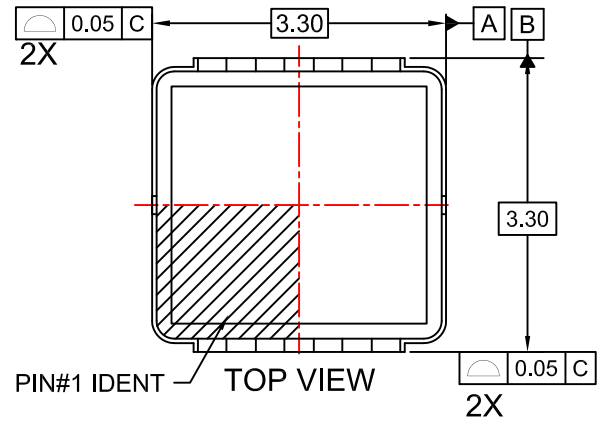
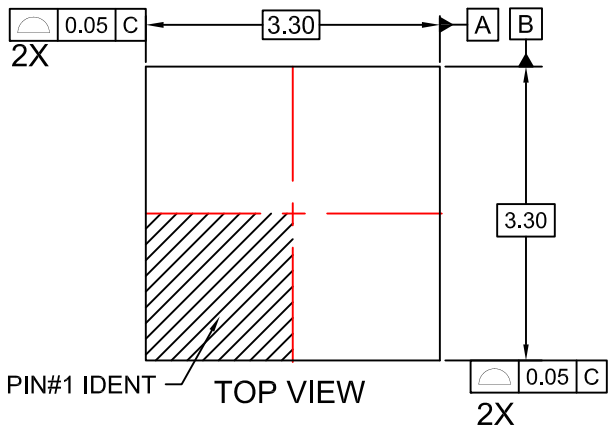
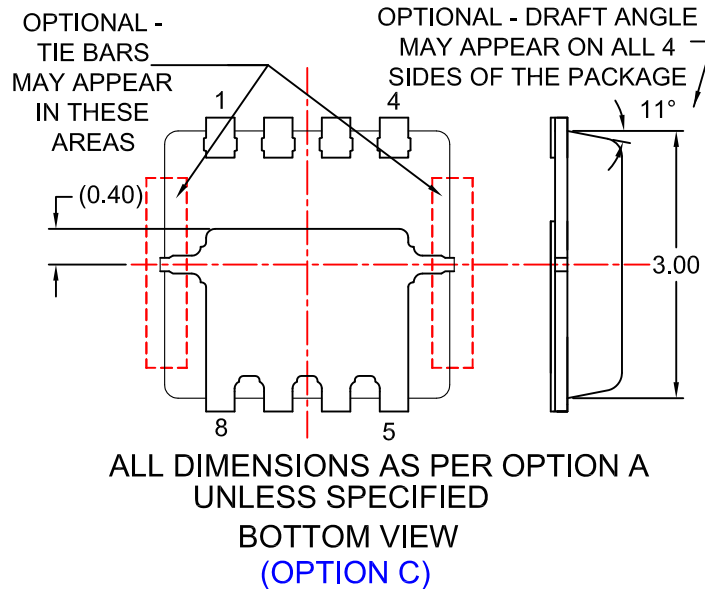
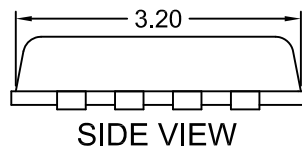
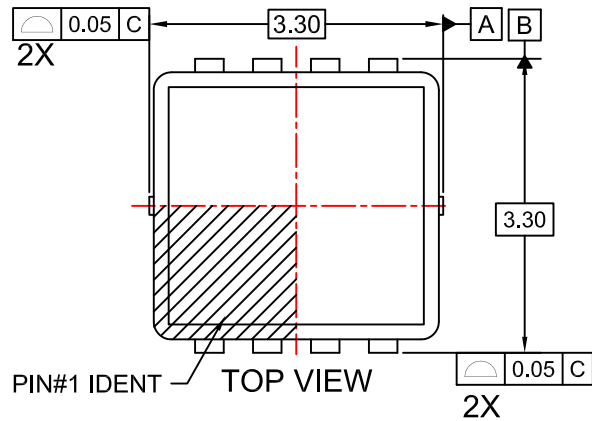


Figure 14. SyncFET body diode reverse leakage versus drain-source voltage



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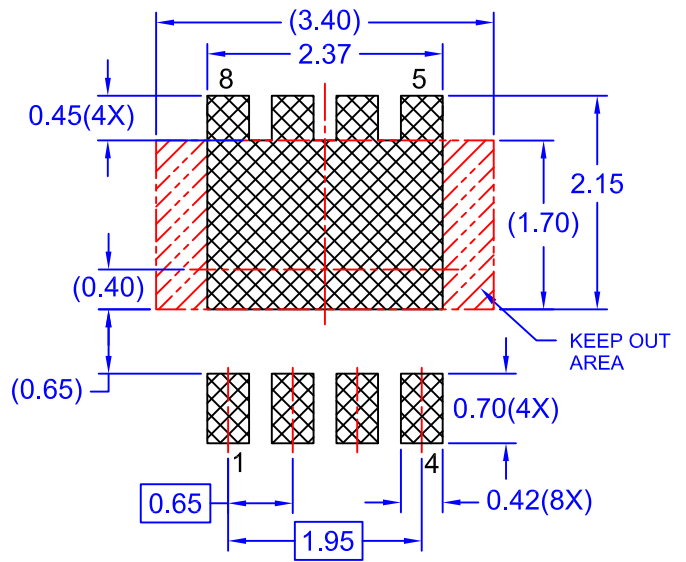
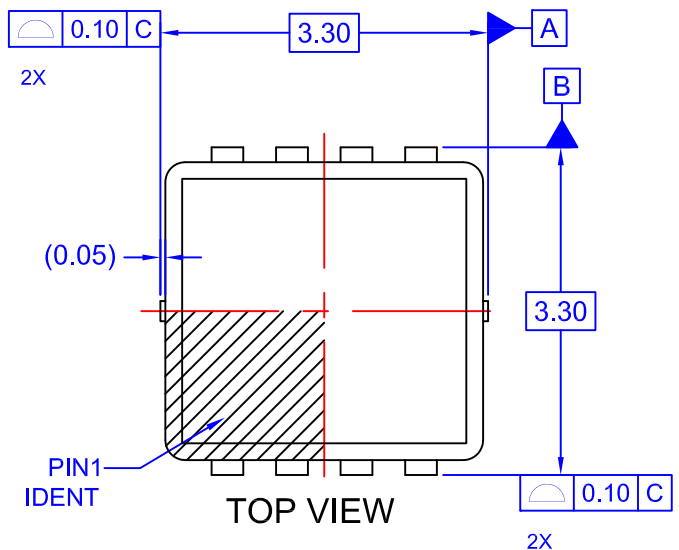




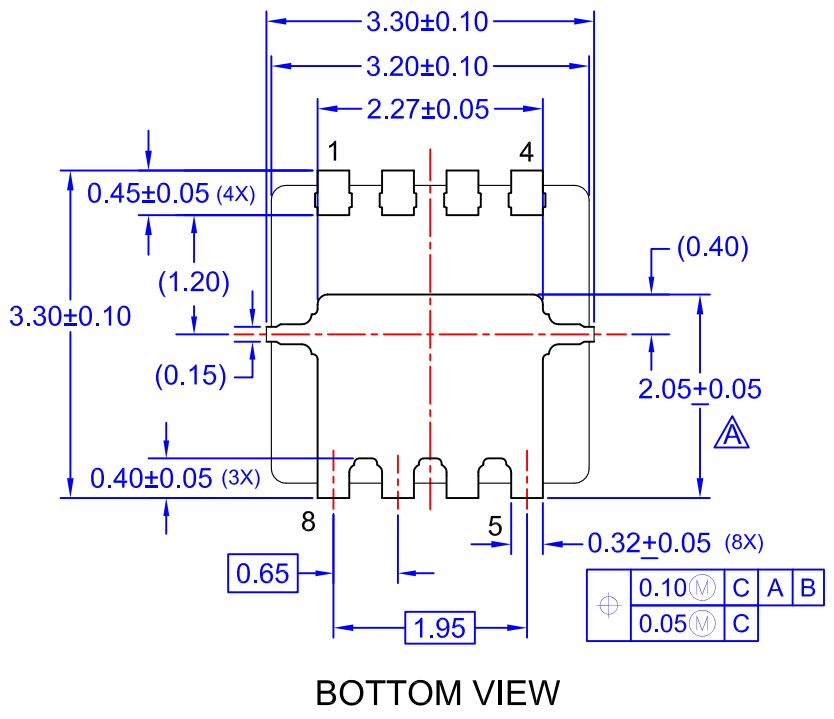
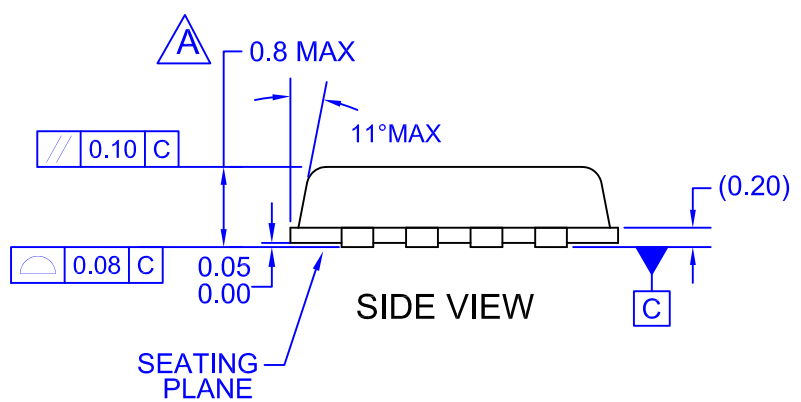
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- G. OPTION A - SAWN MLP, OPTIONS B & C - PUNCH MLP.



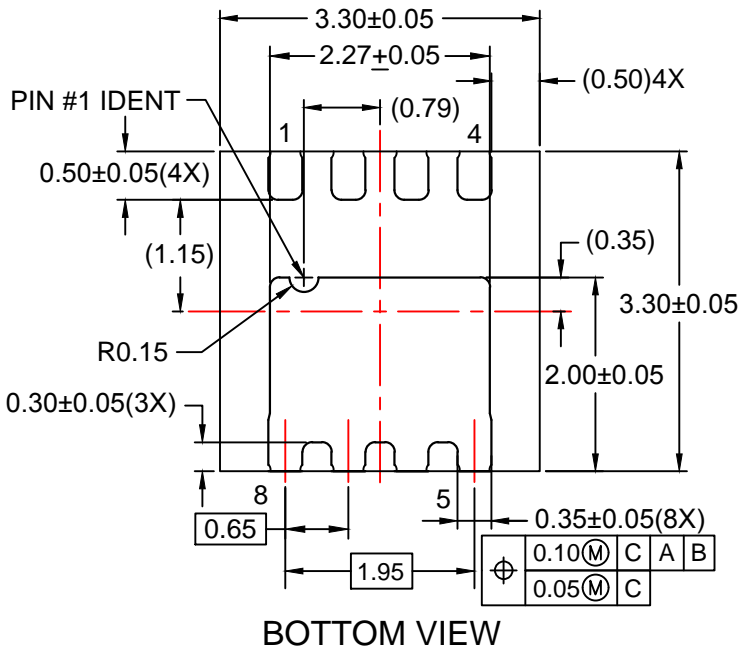
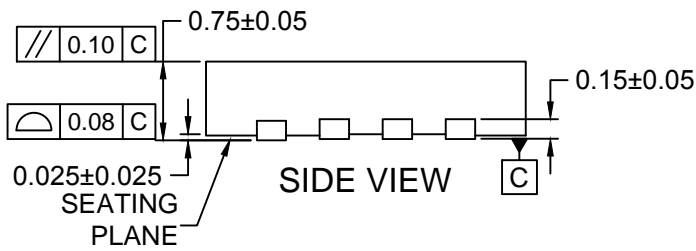
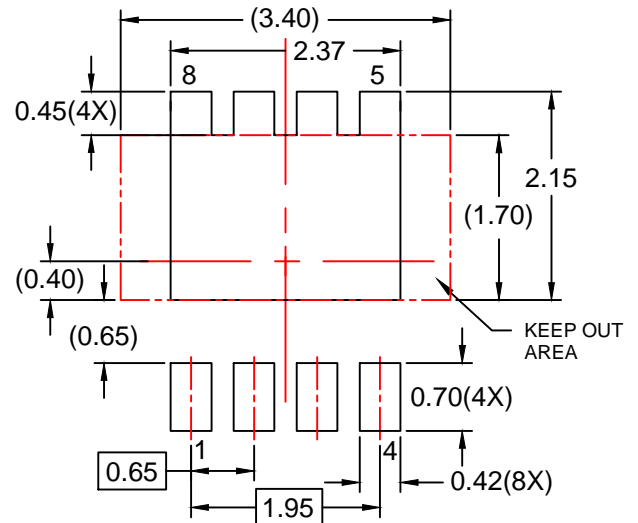
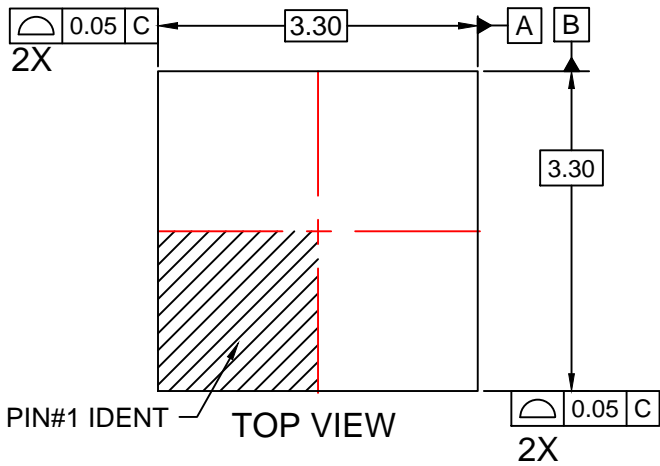


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