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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

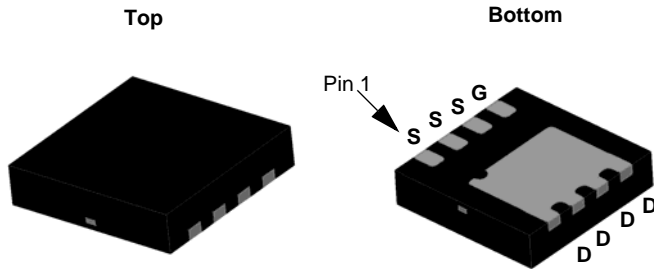


### General Description

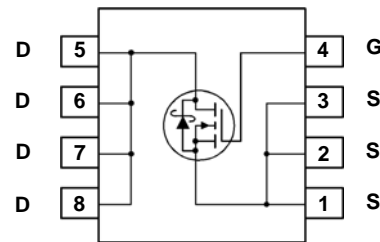
This FDMC7692S is produced using Fairchild Semiconductor's advanced PowerTrench® process that has been especially tailored to minimize the on-state resistance. This device is well suited for Power Management and load switching applications common in Notebook Computers and Portable Battery packs.

### 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

FDMC7692S N-Channel PowerTrench® SyncFET™

**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	$\mu\text{A}$
$I_{GSS}$	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 $\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 10.4\text{ A}$		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	$\Omega$

**Switching Characteristics**

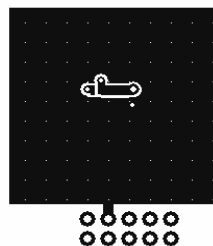
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{ V}, I_D = 12.5\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$		9	17	ns	
$t_r$	Rise Time			3	10	ns	
$t_{d(off)}$	Turn-Off Delay Time			19	34	ns	
$t_f$	Fall Time			3	10	ns	
$Q_g$	Total Gate Charge		$V_{GS} = 0\text{ V to }10\text{ V}$		16	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**

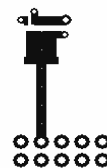
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 12.5\text{ A}$ (Note 2)		0.9	1.3	V
		$V_{GS} = 0\text{ V}, I_S = 0.9\text{ A}$ (Note 2)		0.5	0.7	
$t_{rr}$	Reverse Recovery Time	$I_F = 12.5\text{ A}, di/dt = 300\text{ A}/\mu\text{s}$		21	33	ns
$Q_{rr}$	Reverse Recovery Charge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

**Notes:**

1.  $R_{\theta JA}$  is determined with the device mounted on a  $1\text{ in}^2$  pad 2 oz copper pad on a  $1.5 \times 1.5\text{ in.}$  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.  $53\text{ }^\circ\text{C/W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper.

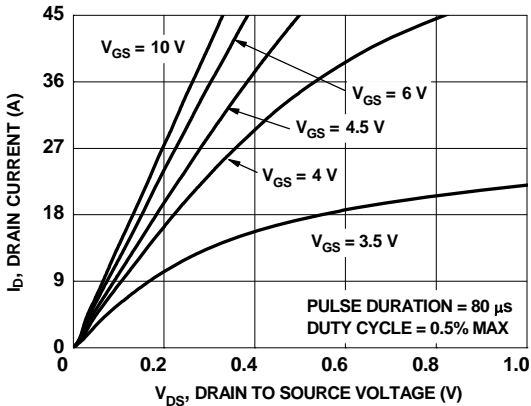


b.  $125\text{ }^\circ\text{C/W}$  when mounted on a minimum pad of 2 oz copper.

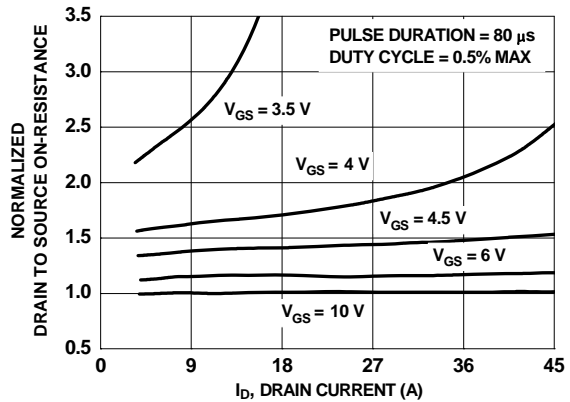
2. Pulse Test: Pulse Width <  $300\text{ }\mu\text{s}$ , Duty cycle < 2.0%.

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  $L = 3\text{ mH}$ ,  $I_{AS} = 3.2\text{ A}$ .

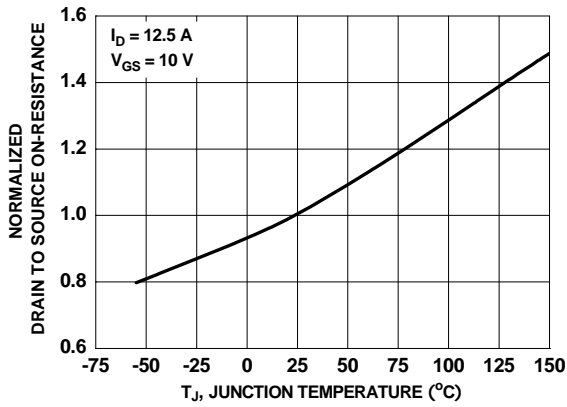
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



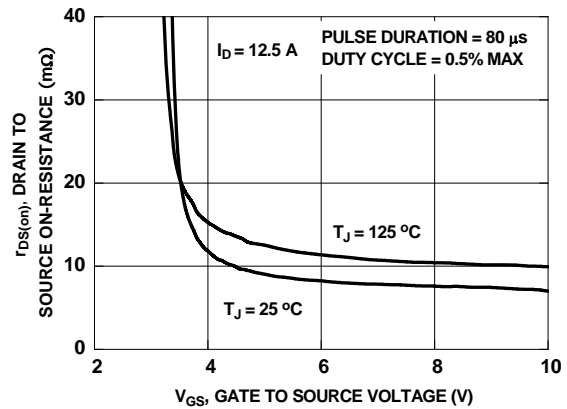
**Figure 1. On-Region Characteristics**



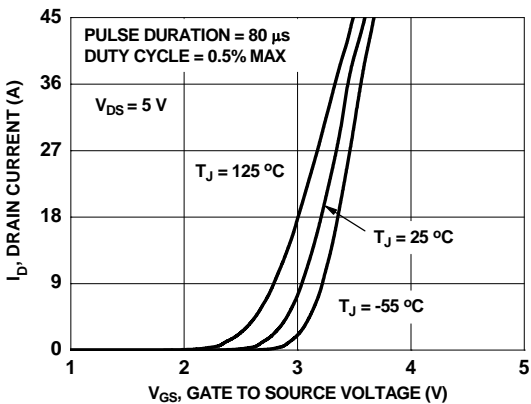
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



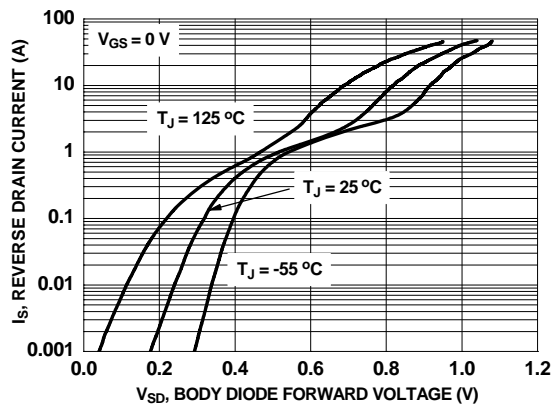
**Figure 3. Normalized On-Resistance vs Junction Temperature**



**Figure 4. On-Resistance vs Gate to Source Voltage**

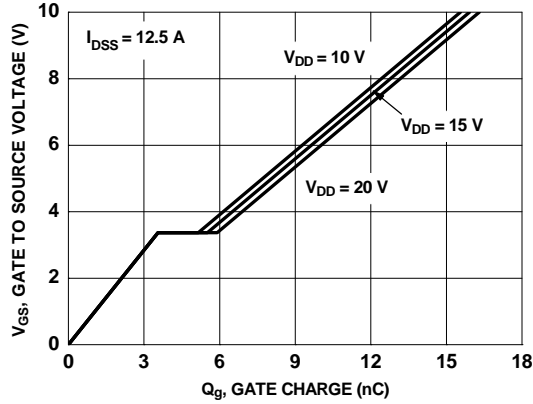


**Figure 5. Transfer Characteristics**

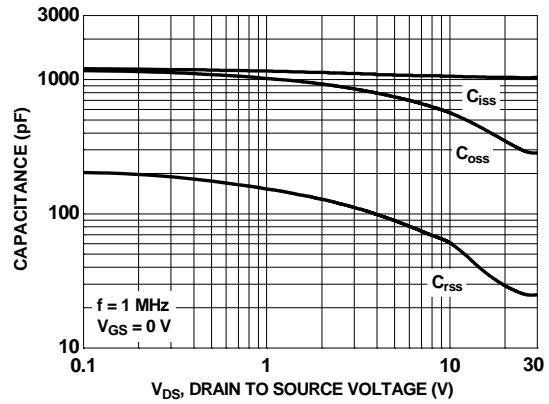


**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

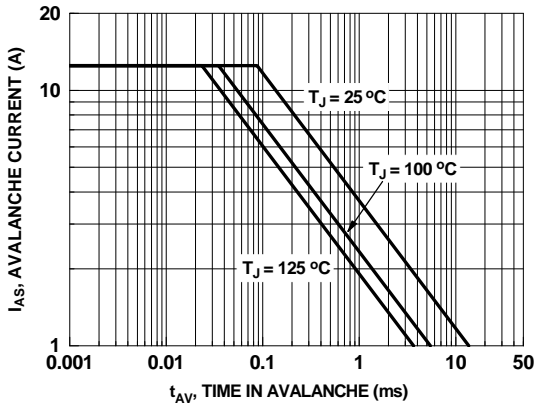
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



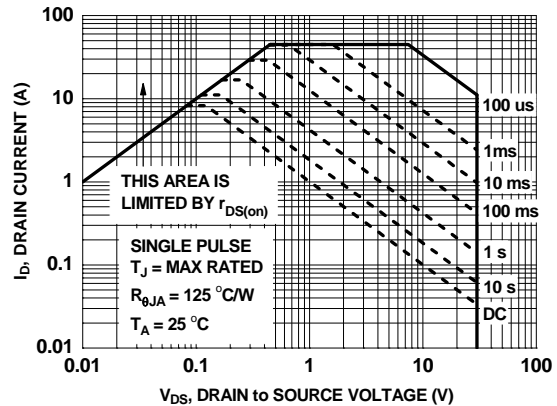
**Figure 7. Gate Charge Characteristics**



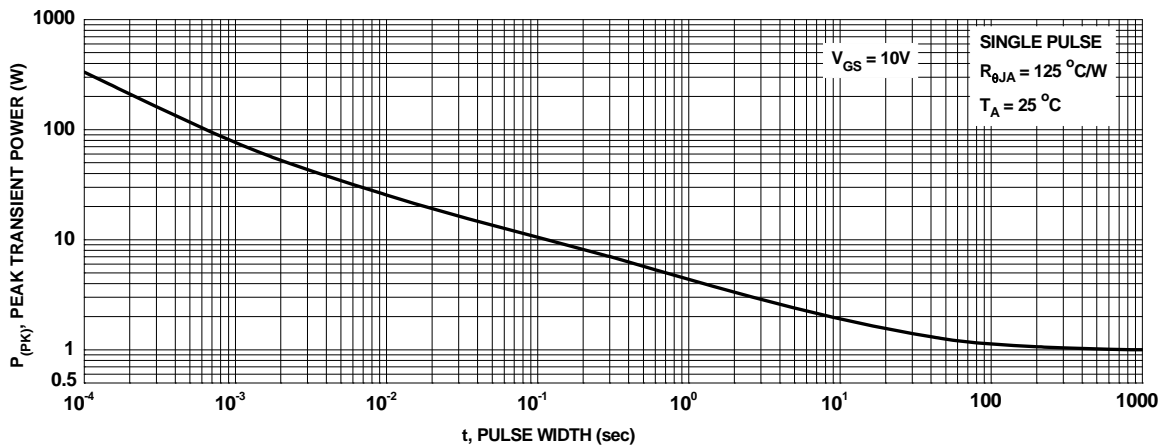
**Figure 8. Capacitance vs Drain to Source Voltage**



**Figure 9. Unclamped Inductive Switching Capability**

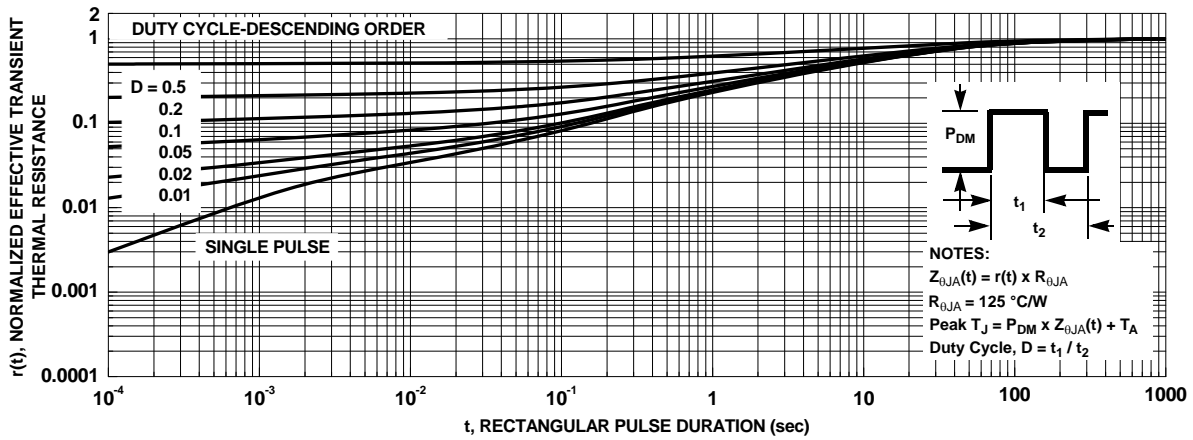


**Figure 10. Forward Bias Safe Operating Area**



**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.

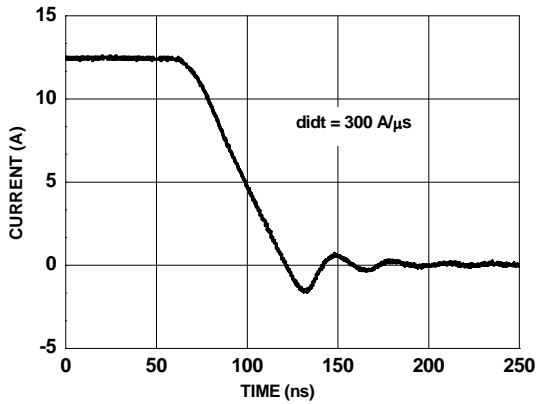


Figure 13. SyncFET body diode reverse recovery characteristic

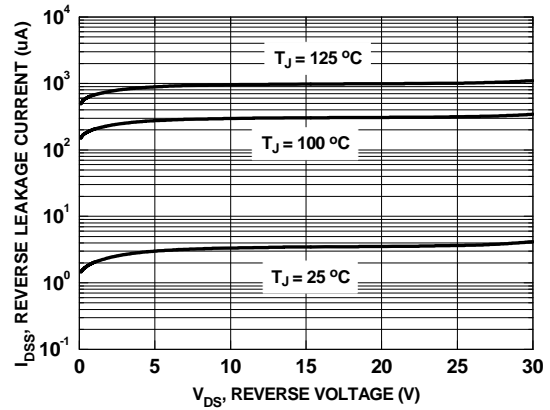
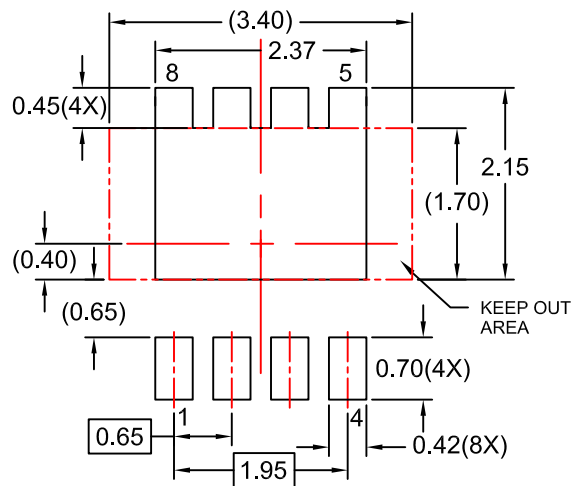
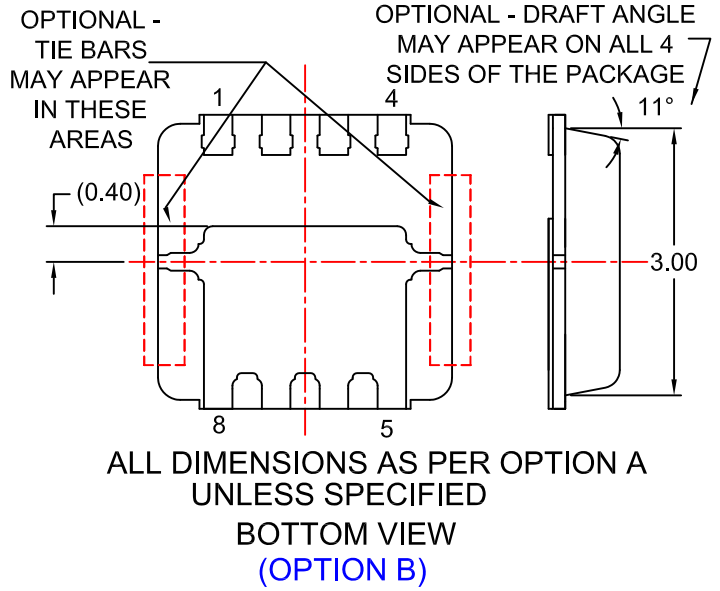
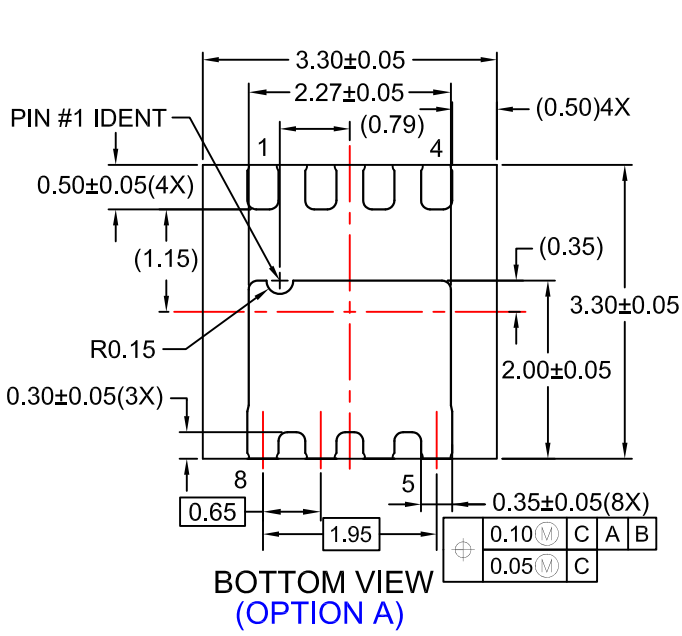
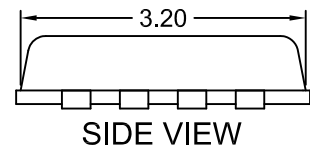
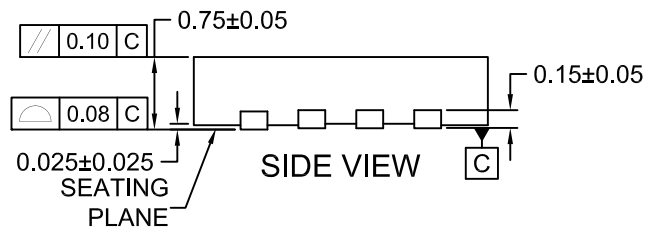
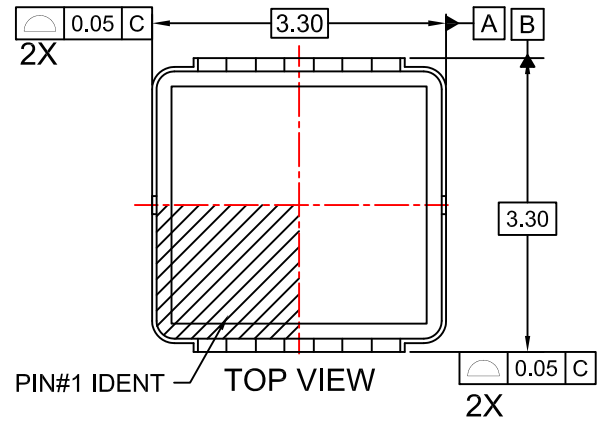
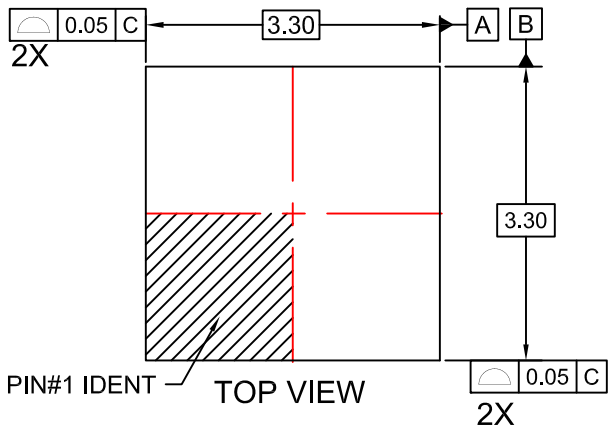
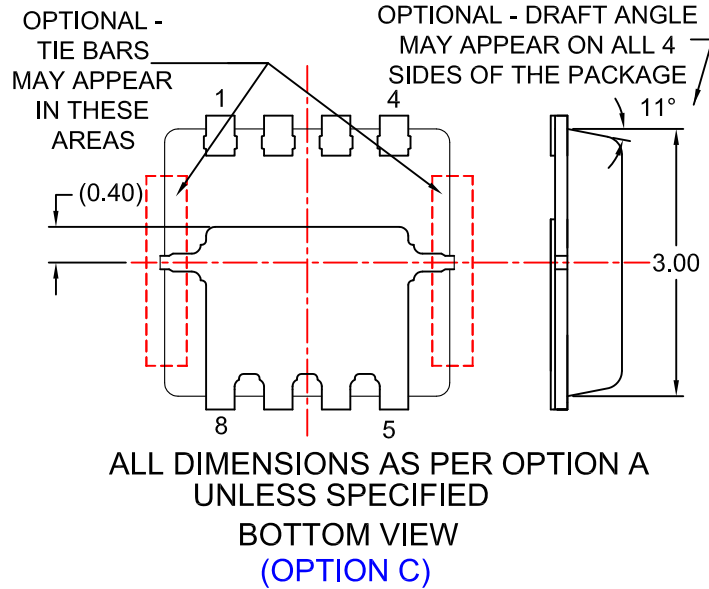
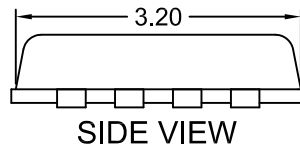
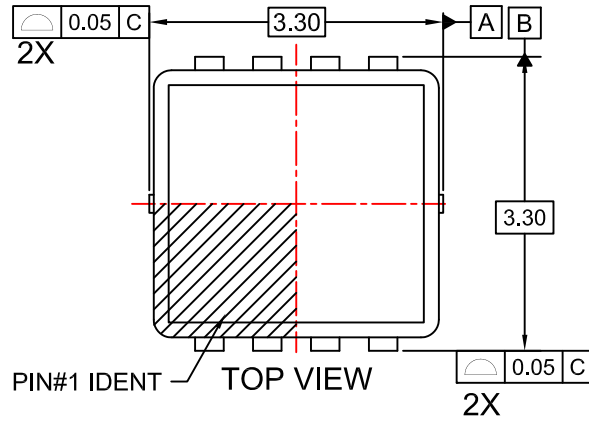


Figure 14. SyncFET body diode reverse leakage versus drain-source voltage



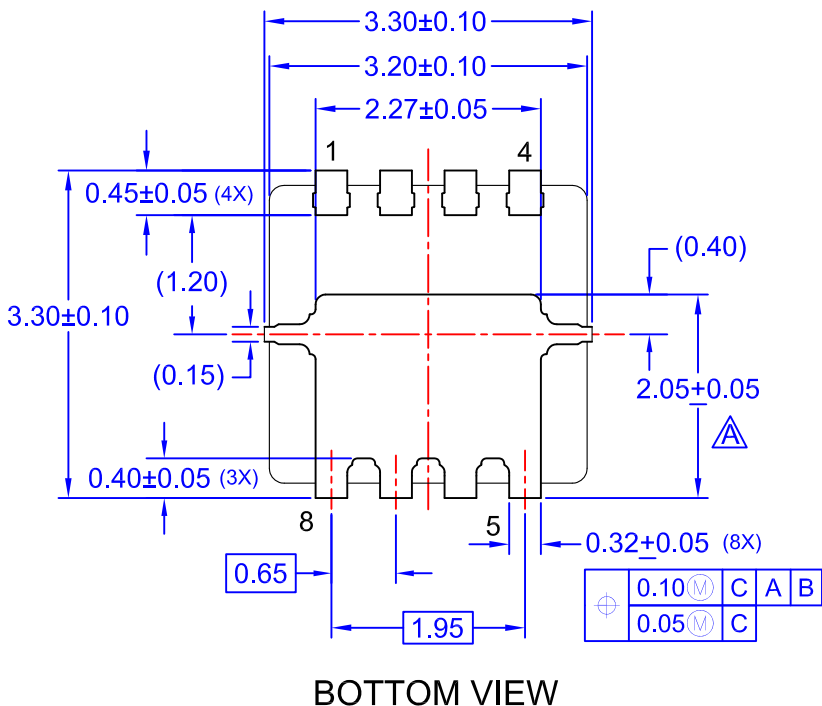
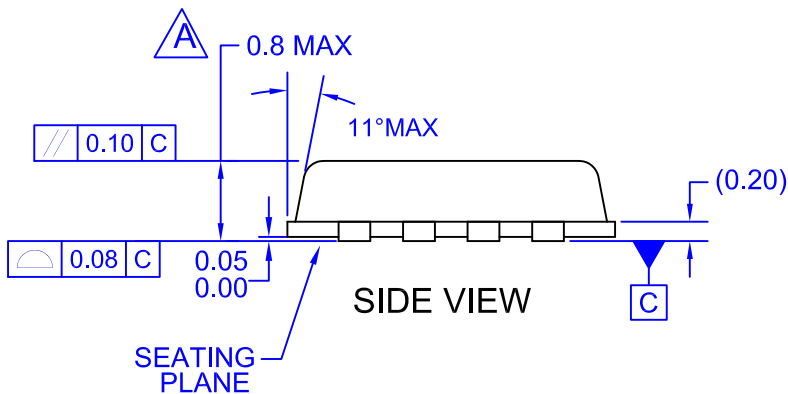
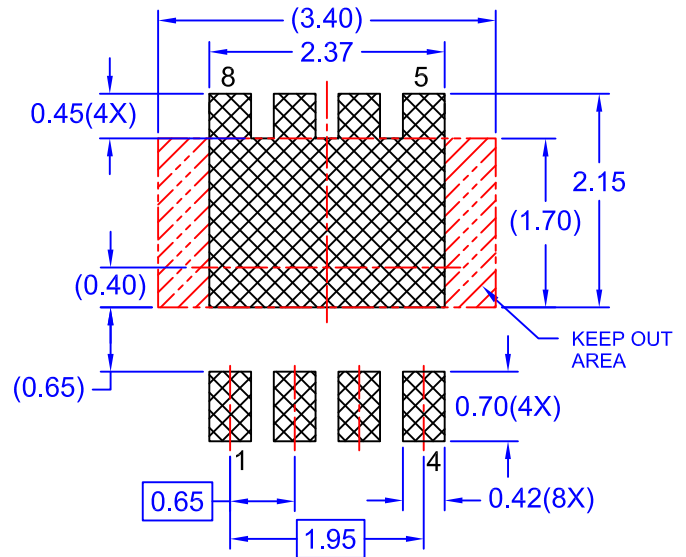
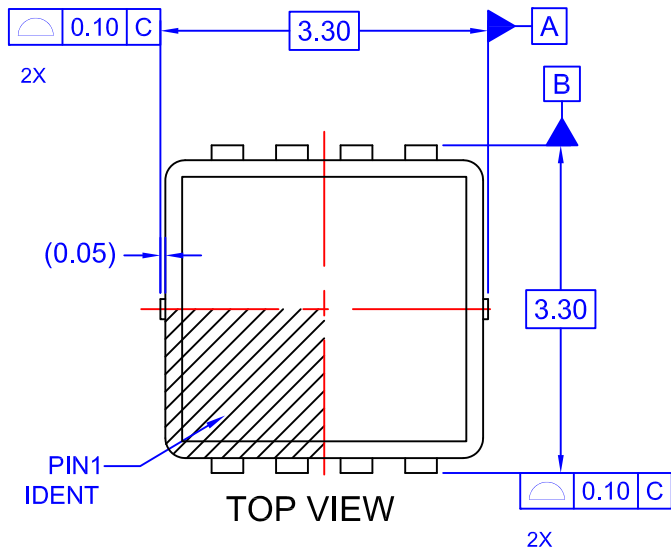




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- G. OPTION A - SAWN MLP, OPTIONS B & C - PUNCH MLP.



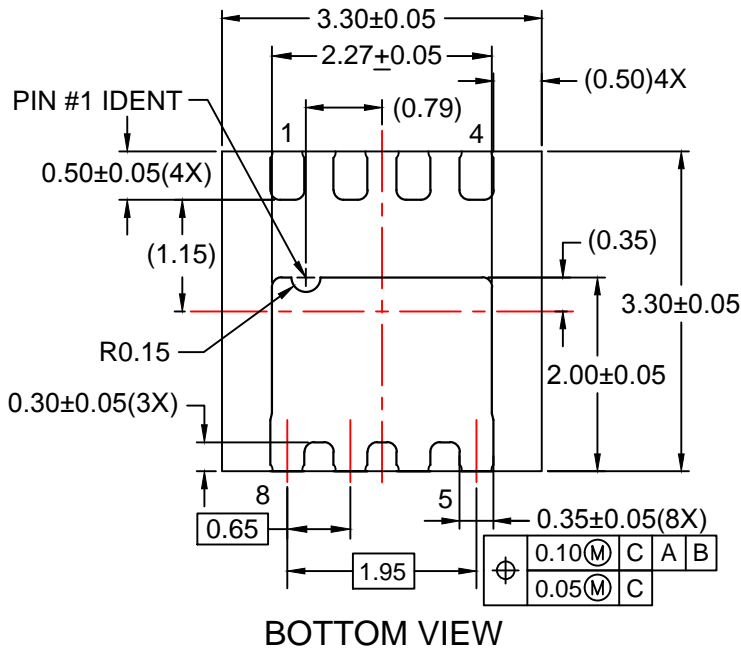
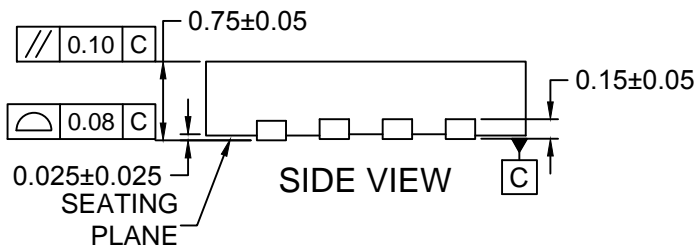
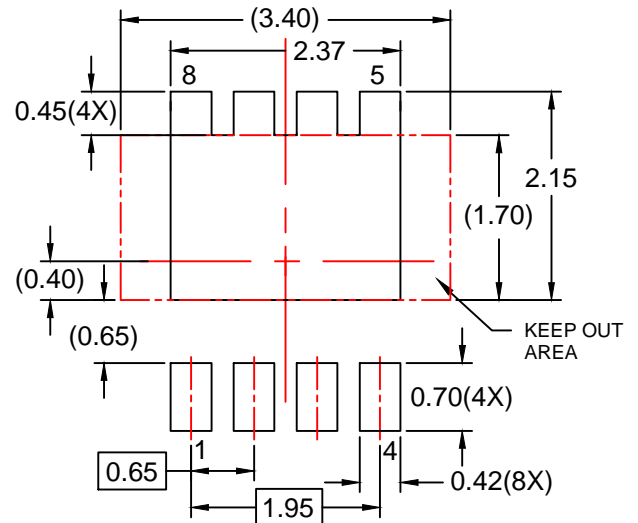
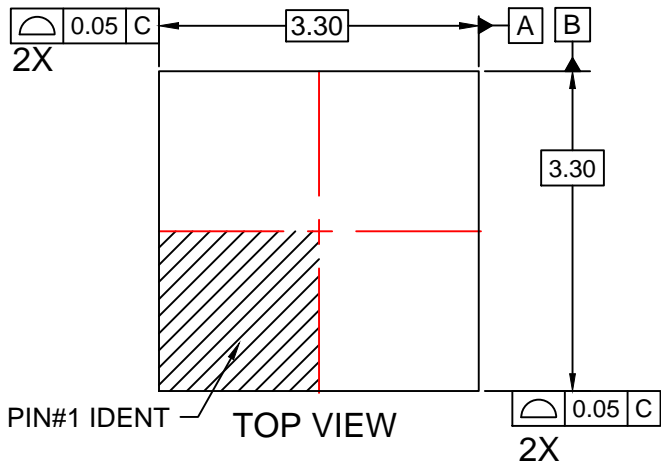


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