

# CMF10120D – Silicon Carbide MOSFET

## Z-FET™ MOSFET

$V_{DS}$	= 1200 V
$R_{DS(on)}$	= 160 mΩ
$Q_g$	= 47.1 nC

### Features

- High-Frequency Operation
- Temperature-Independent Switching
- Extremely Fast Switching

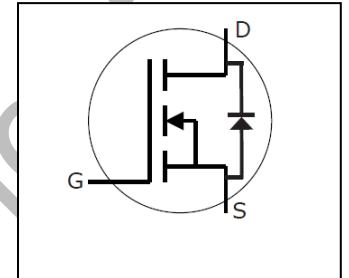
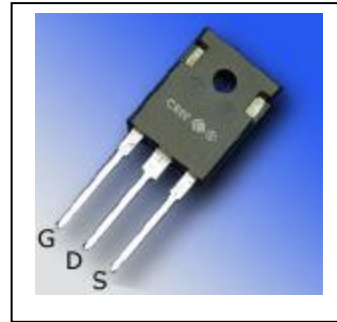
### Benefits

- High Temperature Operation
- High Frequency Operation
- Higher Efficiency
- Reduction of Heat Sink Requirements
- Parallel Devices Without Thermal Runaway

### Applications

- Switch Mode Power Supplies
- Power Factor Correction
- Motor Drives

### Package



Part Number	Package	Marking
CMF10120	TO-247	CMF10120D

### Maximum Ratings ( $T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Notes
$I_D$	Continuous Drain Current	24	A	$V_{GS} = 20\text{V}, T_C = 25^\circ\text{C}$	
		12	A	$V_{GS} = 20\text{V}, T_C = 100^\circ\text{C}$	
$I_{Dpulse}$	Pulsed Drain Current		A	Pulse width limited by $T_{J(max)}$ , $T_C = 25^\circ\text{C}$	
$E_{AS}$	Single Pulse Avalanche Energy	TBD	J	$I_D = 20\text{A}, V_{DD} = 50\text{V}, L = 9.5\text{mH}$ $t_{AR}$ limited by $T_{J(max)}$	
$E_{AR}$	Repetitive Avalanche Energy	TBD	J		
$I_{AR}$	Repetitive Avalanche Current	TBD	A	$I_D = 20\text{A}, V_{DD} = 50\text{V}, L = 3\text{mH}$ $t_{AR}$ limited by $T_{J(max)}$	
$V_{GS}$	Gate – Source Voltage	-5/+25	V		
$P_{tot}$	Maximum Power Dissipation	152	W	$T_C = 25^\circ\text{C}$	
$T_J, T_{stg}$	Operating Junction and Storage Temperature Range	-55 to +125	$^\circ\text{C}$		
$T_L$	Solder Temperature	260	$^\circ\text{C}$	1.6mm (0.063") from case for 10 sec	
$M_d$	Mounting Torque	1	Nm	M3 or 6-32 screw	
		8.8	lbf-in		



## Electrical Characteristics (T<sub>C</sub> = 25°C unless otherwise specified)

Symbol	Parameter	Value			Unit	Test Conditions	Notes
		Min	Typ	Max			
V <sub>(BR)DSS</sub>	Drain – Source Breakdown Voltage	1200			V	V <sub>GS</sub> = -5V, I <sub>D</sub> = 100μA	
V <sub>GS(th)</sub>	Gate Threshold Voltage		2.85	4	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 500μA	20A was 2.5V
			2.20		V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 500μA, T <sub>J</sub> = 125°C	20A was 1.8V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current		1	50	μA	V <sub>DS</sub> = 1200V, V <sub>GS</sub> = 0V	
			10	125		V <sub>DS</sub> = 1200V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 125°C	
I <sub>GSS</sub>	Gate-Source Leakage Current			250	nA	V <sub>GS</sub> = 20V, V <sub>DS</sub> = 0V	
R <sub>DS(on)</sub>	Drain-Source On-State Resistance		0.16	0.22	Ω	V <sub>GS</sub> = 20V, I <sub>D</sub> = 10A	
			0.19	0.26		V <sub>GS</sub> = 20V, I <sub>D</sub> = 10A, T <sub>J</sub> = 125°C	
g <sub>fs</sub>	Transconductance		3.7		S	V <sub>GS</sub> = 20V, I <sub>D</sub> = 10A	
			3.4			V <sub>GS</sub> = 20V, I <sub>D</sub> = 10A, T <sub>J</sub> = 125°C	
C <sub>iss</sub>	Input Capacitance		928		pF	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 800V f = 1MHz, V <sub>AC</sub> = 25mV	
C <sub>oss</sub>	Output Capacitance		63.2				
C <sub>rss</sub>	Reverse Transfer Capacitance		7.45				
t <sub>d(on)i</sub>	Turn-On Delay Time		7		ns	V <sub>DD</sub> = 800V, V <sub>GS</sub> = -2/20V I <sub>D</sub> = 10A, R <sub>G(ext)</sub> = 6.8Ω, L = 856μH Per JEDEC24 pg 27	
t <sub>ri</sub>	Rise Time		14				
t <sub>d(off)i</sub>	Turn-Off Delay Time		46				
t <sub>fi</sub>	Fall Time		37				
E <sub>ON</sub>	Turn-On Switching Loss		261				
E <sub>OFF</sub>	Turn-Off Switching Loss		120		μJ		
R <sub>G</sub>	Internal Gate Resistance		13.6		Ω	f = 1MHz, V <sub>AC</sub> = 25mV	

## Reverse Diode Characteristics

Symbol	Parameter	Value		Unit	Test Conditions	Notes
		Typ	Max			
V <sub>sd</sub>	Diode Forward Voltage	3.5		V	V <sub>GS</sub> = -5V, I <sub>F</sub> = 5A, T <sub>J</sub> = 25°C	
		3.1		V	V <sub>GS</sub> = -5V, I <sub>F</sub> = 5A, T <sub>J</sub> = 125°C	
t <sub>rr</sub>	Reverse Recovery Time	138		ns	V <sub>GS</sub> = -5V, I <sub>F</sub> = 10A T <sub>J</sub> = 25°C V <sub>R</sub> = 800V di/dt = 100A/μs	
Q <sub>rr</sub>	Reverse Recovery Charge	94		nC		
I <sub>rrm</sub>	Peak Reverse Recovery Current	1.57		A		

## Thermal Characteristics

Symbol	Parameter	Value			Unit	Test Conditions	Notes
		Min	Typ	Max			
R <sub>θJC</sub>	Thermal Resistance Junction to Case		0.66		K/W		
R <sub>θCS</sub>	Thermal Resistance Case to Sink						
R <sub>θJA</sub>	Thermal Resistance Junction to Ambient						



### Gate Charge Characteristics

Symbol	Parameter	Value			Unit	Test Conditions	Notes
		Min	Typ	Max			
$Q_{gs}$	Gate to Source Charge		11.8		nC	$V_{DD} = 800V, V_{GS} = -2/20V$ $I_D = 10A,$ Per JEDEC24 pg 27	
$Q_{gd}$	Gate to Drain Charge		21.5				
$Q_g$	Total Gate Charge		47.1				

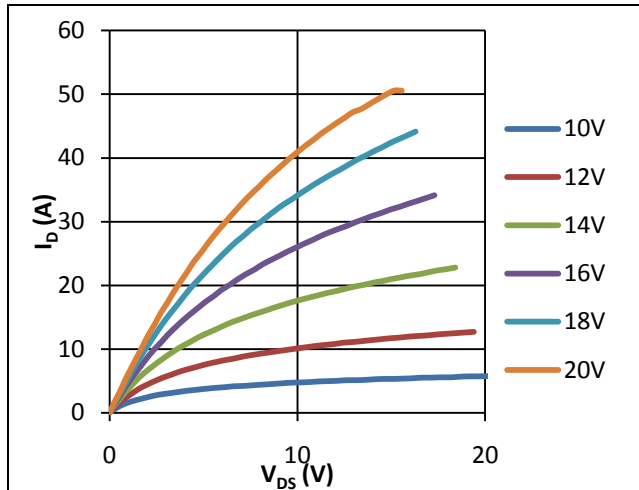


Fig 1. Typical Output Characteristics  $T_J = 25^\circ C$

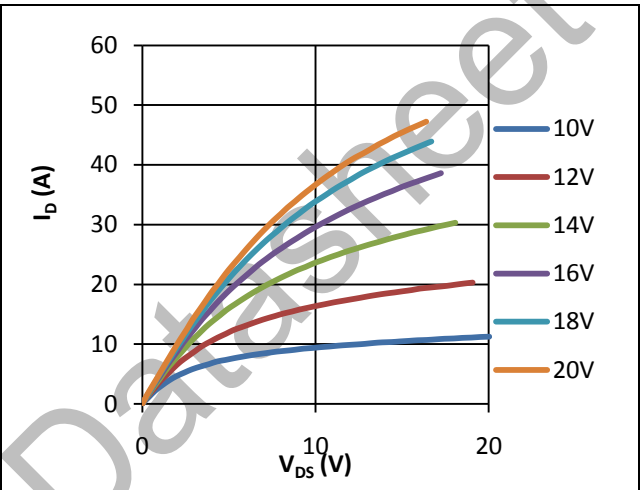


Fig 2. Typical Output Characteristics  $T_J = 125^\circ C$

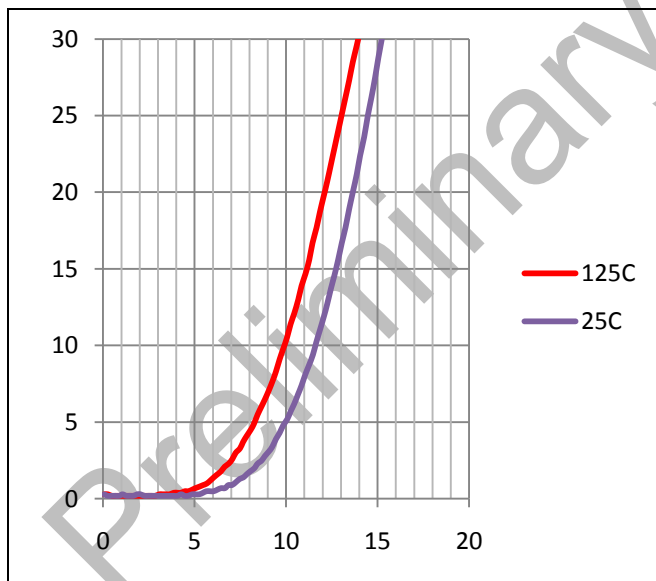


Fig 3. Typical Transfer Characteristics

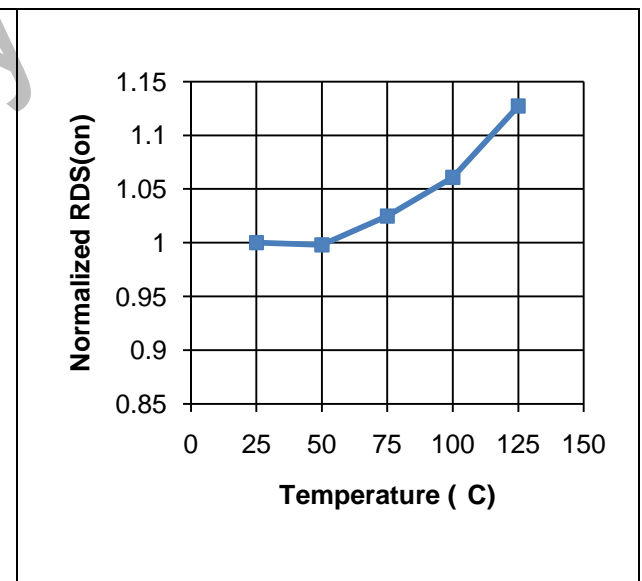


Fig 4. Normalized On-Resistance vs. Temperature

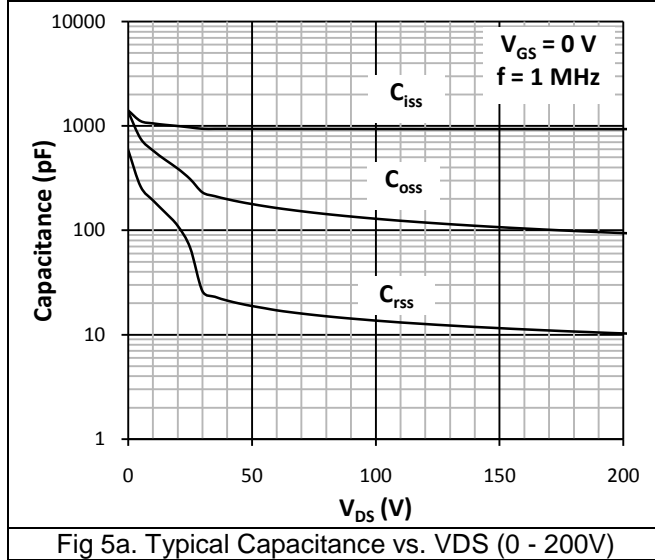


Fig 5a. Typical Capacitance vs. VDS (0 - 200V)

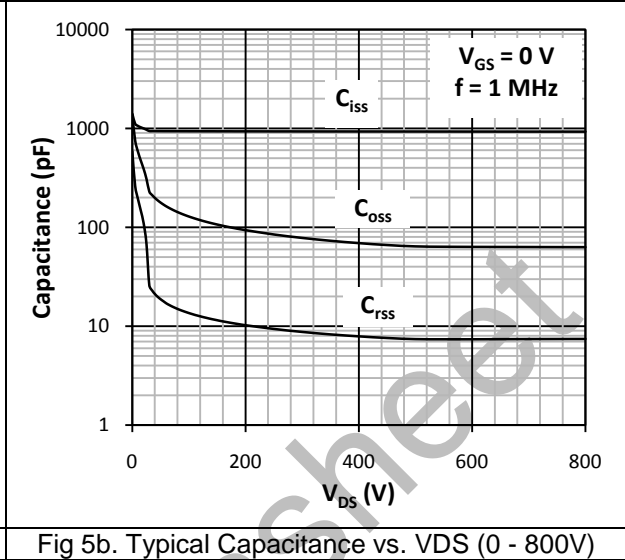


Fig 5b. Typical Capacitance vs. VDS (0 - 800V)

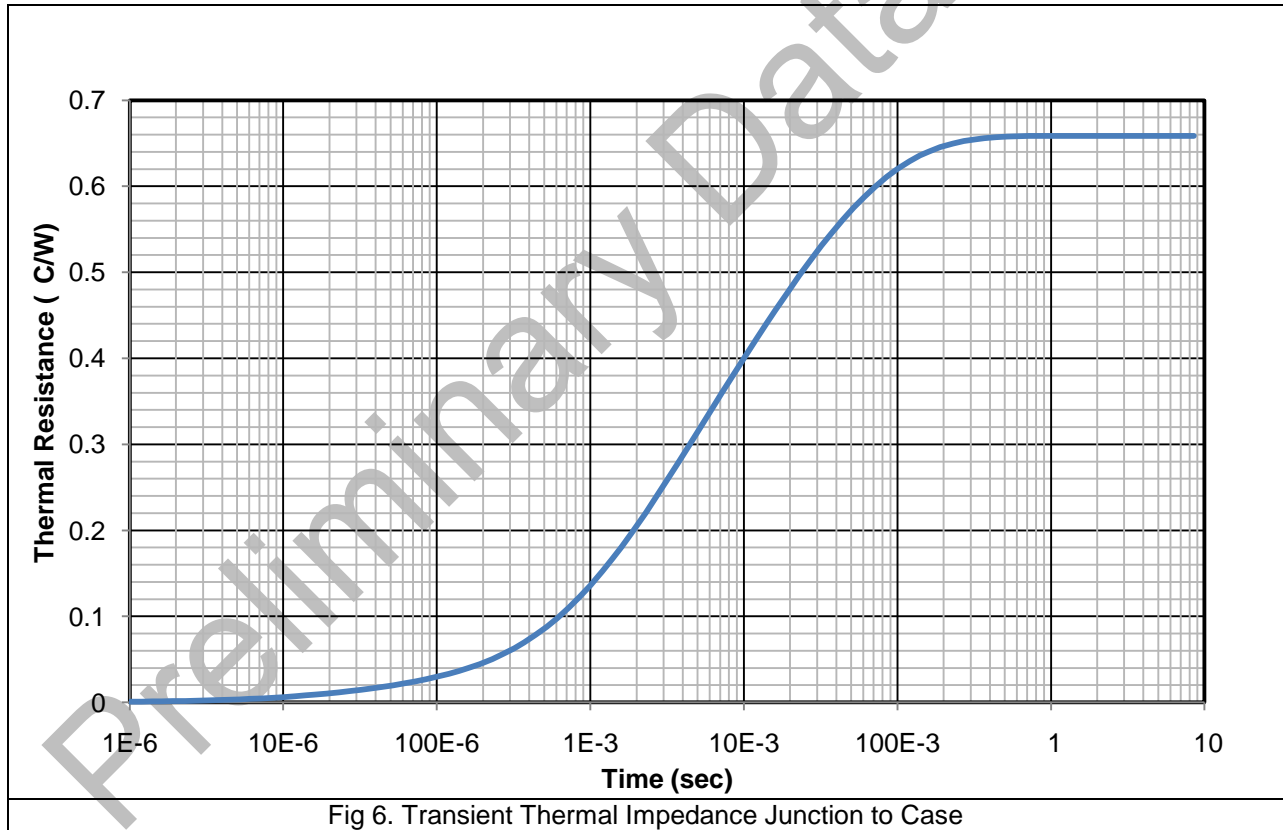


Fig 6. Transient Thermal Impedance Junction to Case

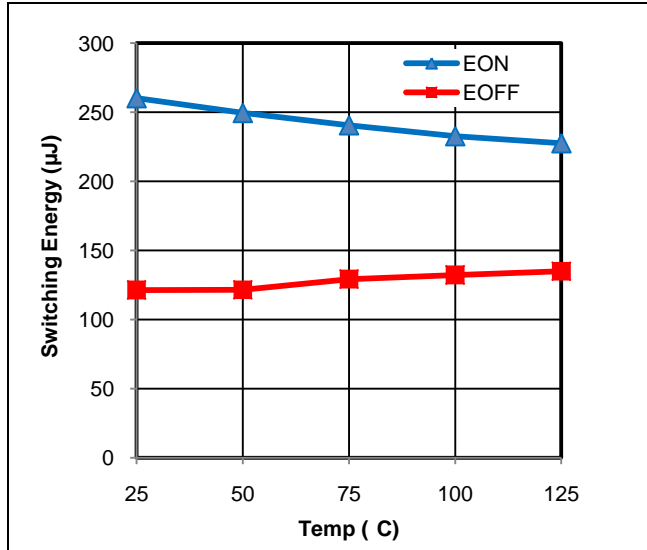


Fig 7. Inductive Switching Energy vs. Temp

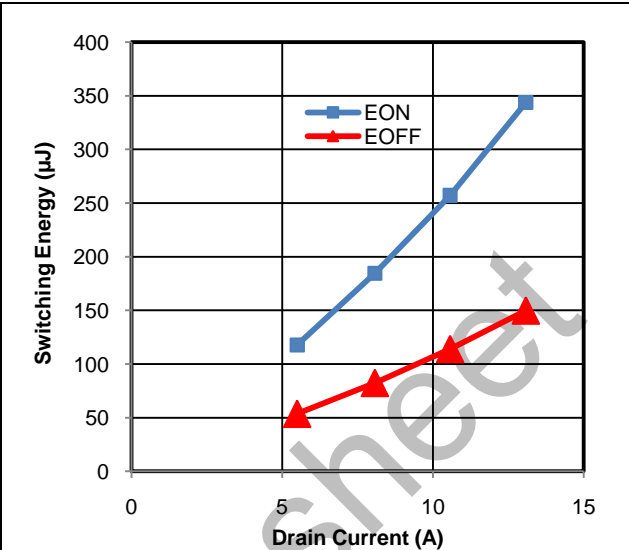


Fig 8. Inductive Switching Energy vs. Drain Current

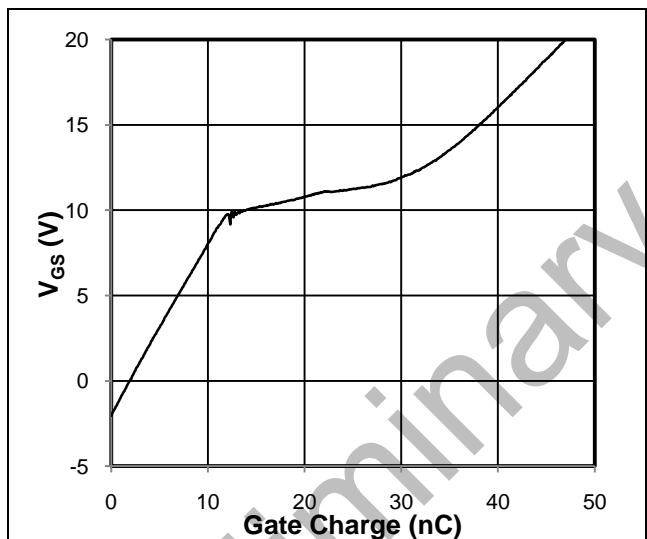


Fig 9. Typical Gate Charge Characteristics @ 25°C

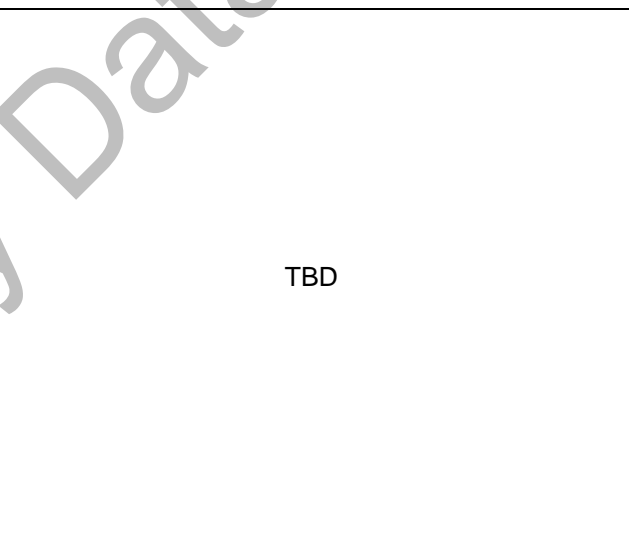


Fig 10. Typical Avalanche Voltage

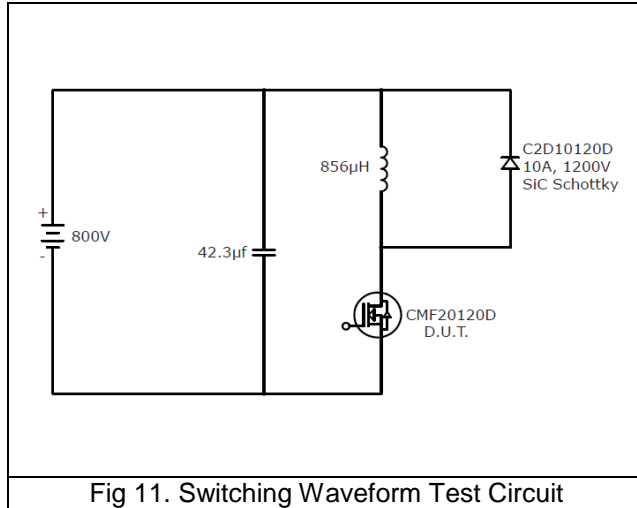


Fig 11. Switching Waveform Test Circuit

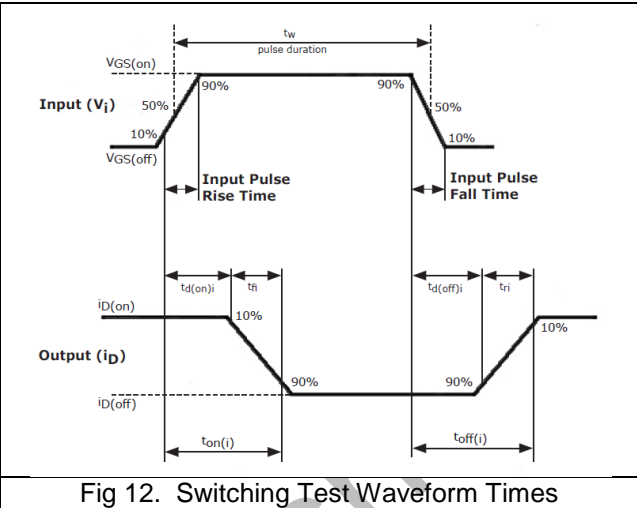


Fig 12. Switching Test Waveform Times

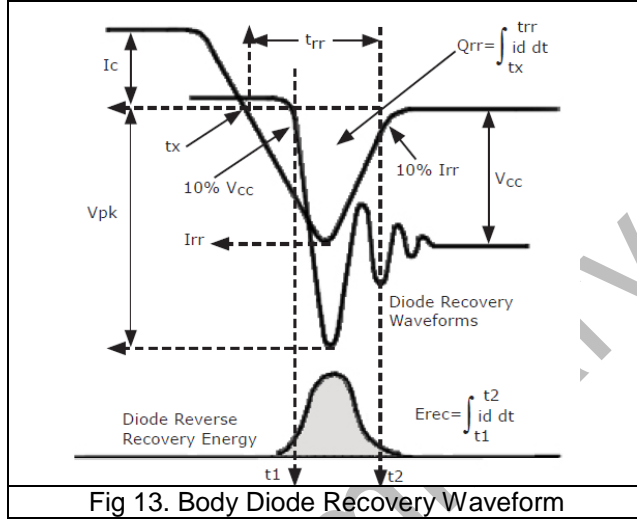


Fig 13. Body Diode Recovery Waveform

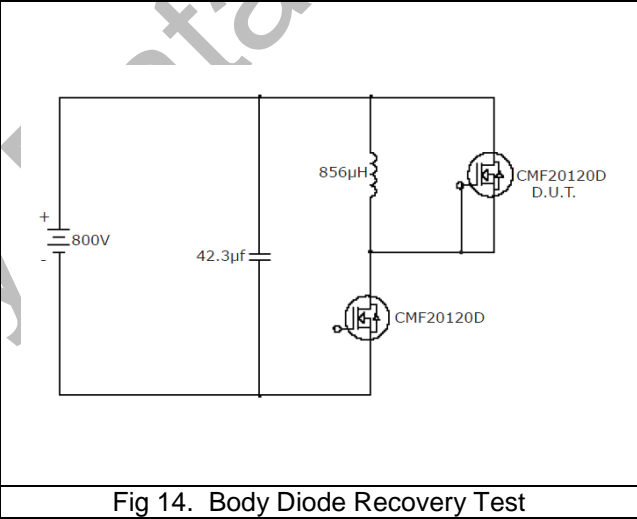
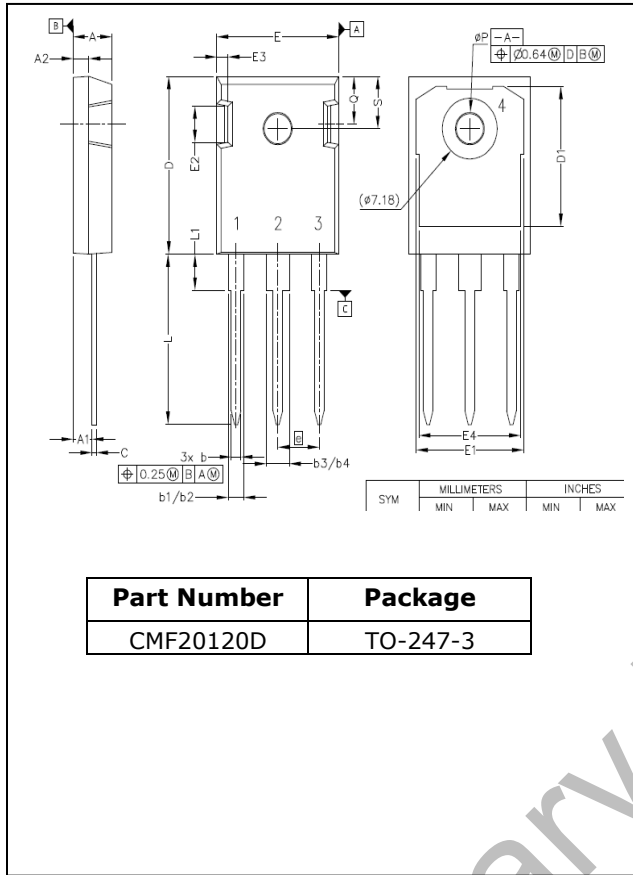


Fig 14. Body Diode Recovery Test



## Package Dimensions



POS	Inches		Millimeters	
	Min	Max	Min	Max
A	.190	.205	4.83	5.21
A1	.090	.100	2.29	2.54
A2	.075	.085	1.91	2.16
b	.042	.052	1.07	1.33
b1	.075	.095	1.91	2.41
b2	.075	.085	1.91	2.16
b3	.113	.133	2.87	3.38
b4	.113	.123	2.87	3.13
c	.022	.027	0.55	0.68
D	.819	.831	20.80	21.10
D1	.640	.695	16.25	17.65
D2	.037	.049	0.95	1.25
E	.620	.635	15.75	16.13
E1	.516	.557	13.10	14.15
E2	.145	.201	3.68	5.10
E3	.039	.075	1.00	1.90
E4	.487	.529	12.38	13.43
e	.214 BSC		5.44 BSC	
N	3		3	
L	.780	.800	19.81	20.32
L1	.161	.173	4.10	4.40
ØP	.138	.144	3.51	3.65
Q	.216	.236	5.49	6.00
S	.238	.248	6.04	6.30

“The levels of environmentally sensitive, persistent biologically toxic (PBT), persistent organic pollutants (POP), or otherwise restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS), as amended through April 21, 2006.”

This product has not been designed or tested for use in, and is not intended for use in, applications implanted into the human body nor in applications in which failure of the product could lead to death, personal injury or property damage, including but not limited to equipment used in the operation of nuclear facilities, life-support machines, cardiac defibrillators or similar emergency medical equipment, aircraft navigation or communication or control systems, air traffic control systems, or weapons systems.

Copyright © 2006-2009 Cree, Inc. All rights reserved. The information in this document is subject to change without notice. Cree, the Cree logo, and Zero Recovery are registered trademarks of Cree, Inc.