CMF10120D – Silicon Carbide MOSFET

Z-FET™ MOSFET

V_{DS}	= 1200 V
$R_{DS(On)}$	= 160 mΩ
Qg	= 47.1 nC

Features

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

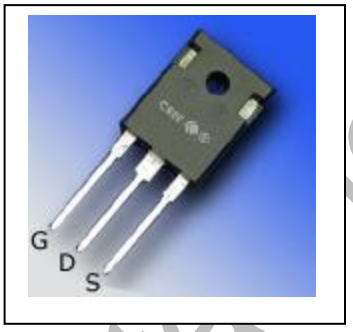
Benefits

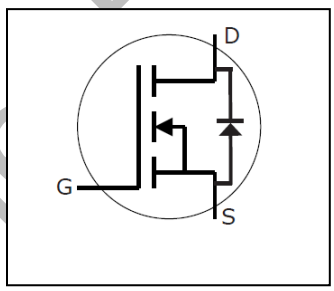
- High Temperature Operation
- High Frequency Operation
- Higher Efficiency
- Reduction of Heat Sink Requirements
- Parallel Devices Without Thermal Runaway

Applications

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

Package





Part Number	Package	Marking
CMF10120	TO-247	CMF10120D

Maximum Ratings (T_C = 25°C unless otherwise specified)

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

Electrical Characteristics (T_C = 25°C unless otherwise specified)

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

Reverse Diode Characteristics

Symbol	Parameter	Value		Unit	Test Conditions	Notes
		Typ	Max			
V_{sd}	Diode Forward Voltage	3.5		V	V_{GS} = -5V, I_F = 5A, T_J = 25°C	
		3.1		V	V_{GS} = -5V, I_F = 5A, T_J = 125°C	
t_{rr}	Reverse Recovery Time	138		ns	V_{GS} = -5V, I_F = 10A T_J = 25°C V_R = 800V di_f/dt = 100A/µs	
Q_{rr}	Reverse Recovery Charge	94		nC		
I_{rrm}	Peak Reverse Recovery Current	1.57		A		

Thermal Characteristics

Symbol	Parameter	Value			Unit	Test Conditions	Notes
		Min	Typ	Max			
$R_{\theta JC}$	Thermal Resistance Junction to Case		0.66		K/W		
$R_{\theta CS}$	Thermal Resistance Case to Sink						
$R_{\theta JA}$	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				

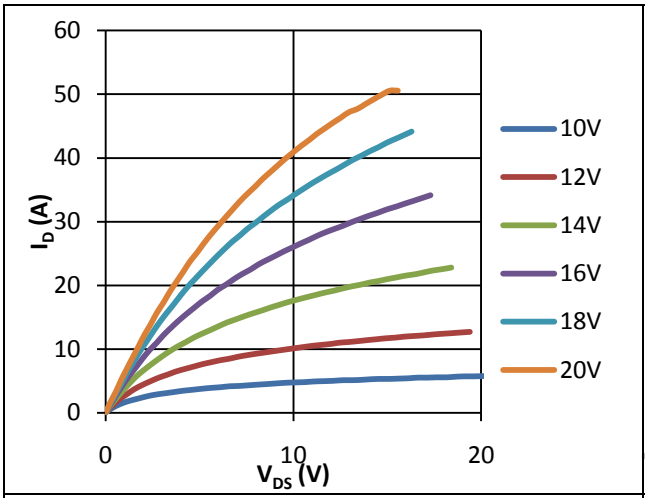


Fig 1. Typical Output Characteristics T_J = 25°C

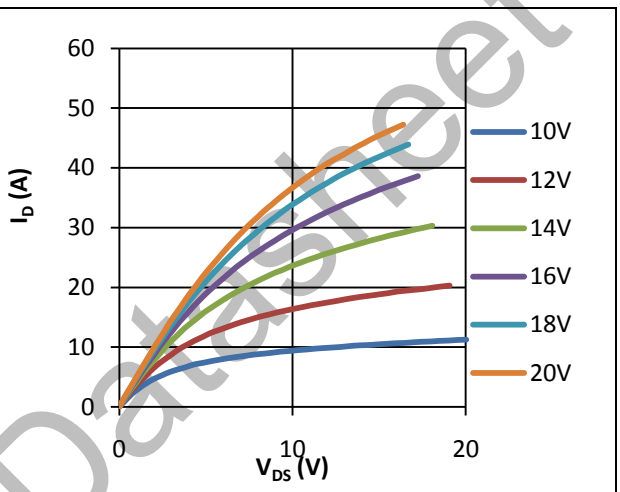


Fig 2. Typical Output Characteristics T_J = 125°C

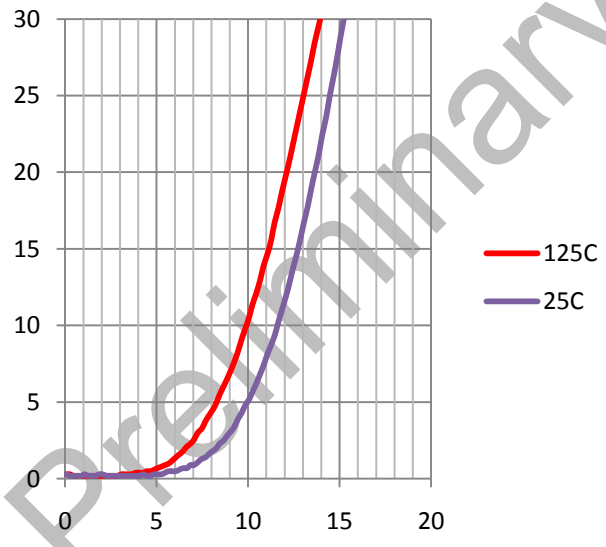


Fig 3. Typical Transfer Characteristics

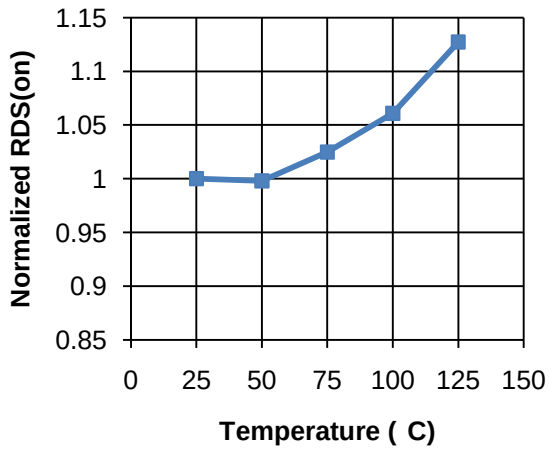


Fig 4. Normalized On-Resistance vs. Temperature

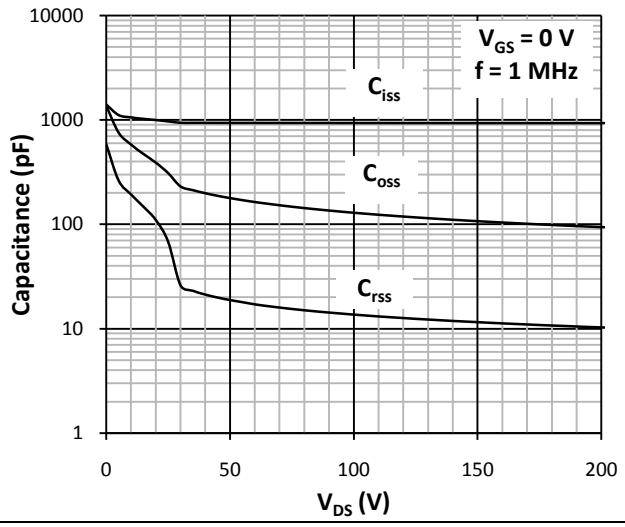


Fig 5a. Typical Capacitance vs. VDS (0 - 200V)

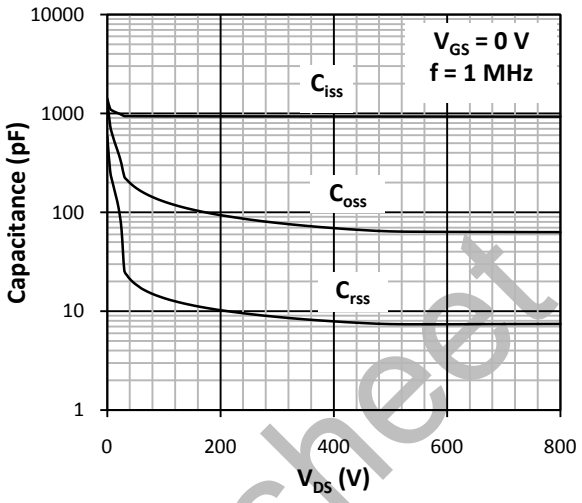


Fig 5b. Typical Capacitance vs. VDS (0 - 800V)

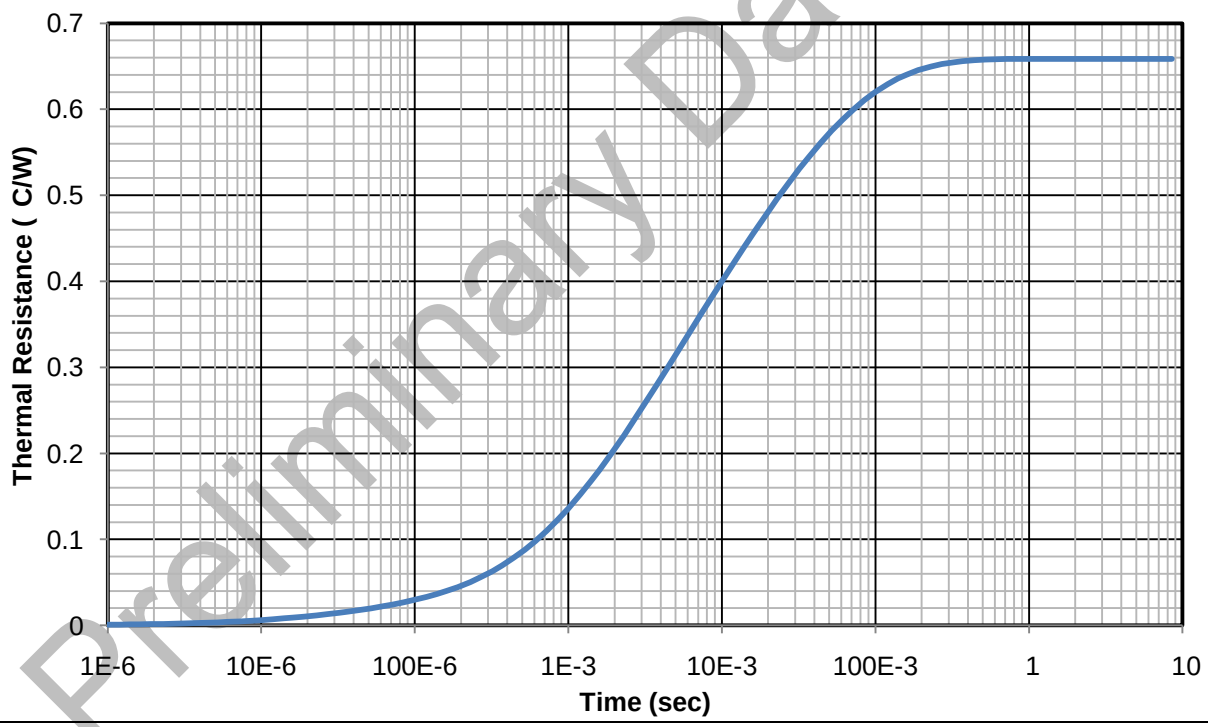


Fig 6. Transient Thermal Impedance Junction to Case

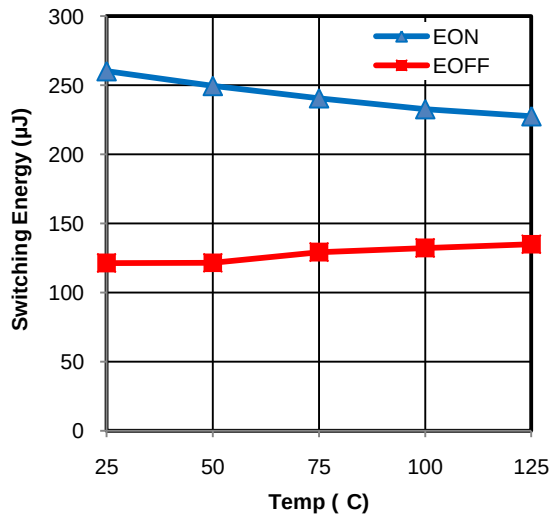


Fig 7. Inductive Switching Energy vs. Temp

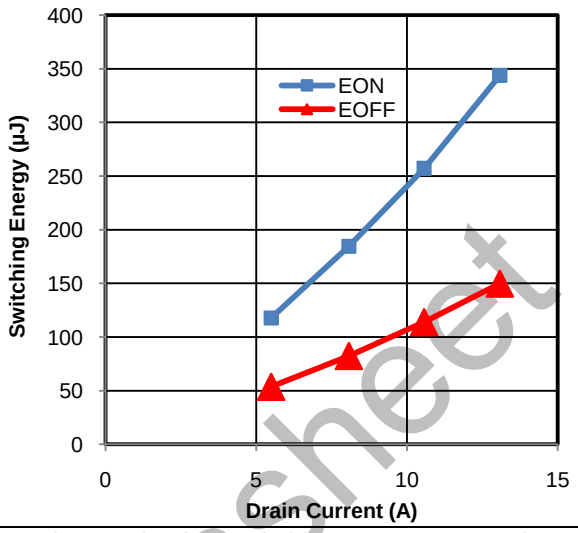


Fig 8. Inductive Switching Energy vs. Drain Current

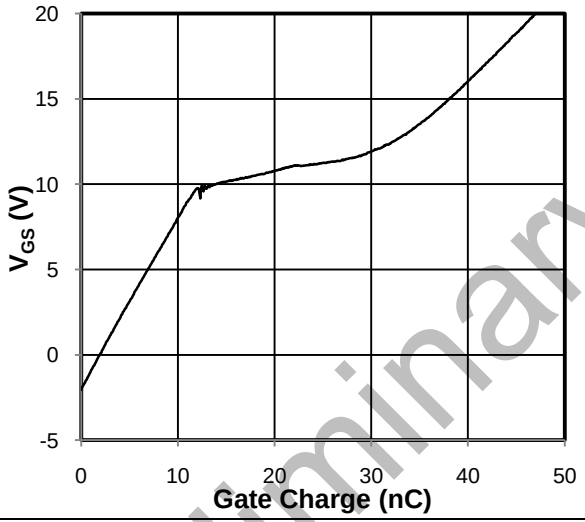


Fig 9. Typical Gate Charge Characteristics @ 25°C

TBD

Fig 10. Typical Avalanche Voltage

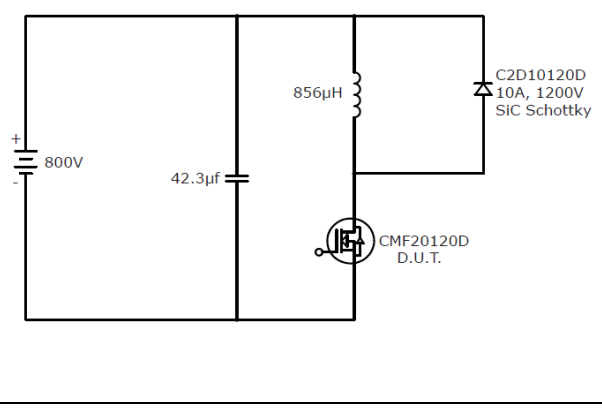


Fig 11. Switching Waveform Test Circuit

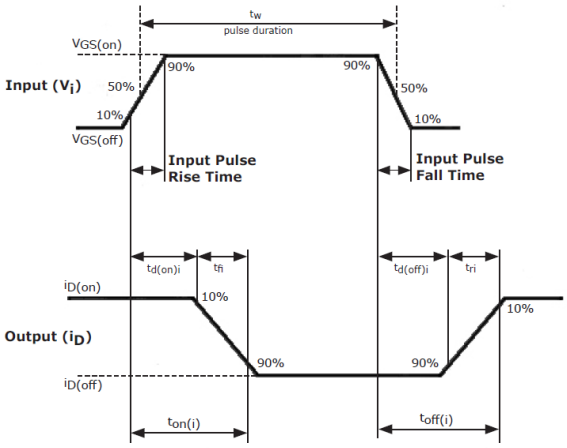


Fig 12. Switching Test Waveform Times

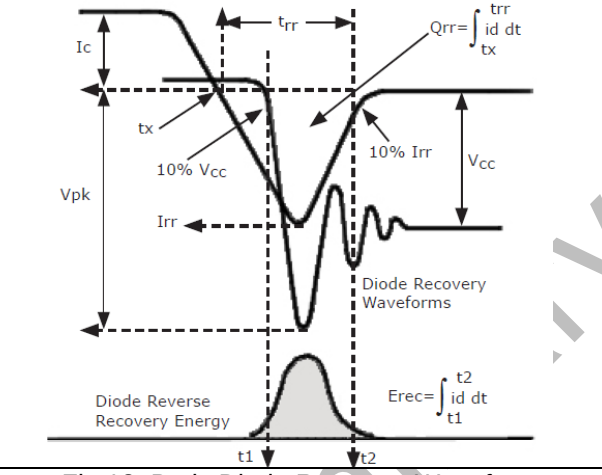


Fig 13. Body Diode Recovery Waveform

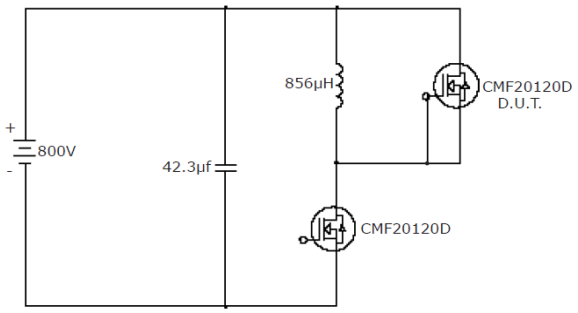
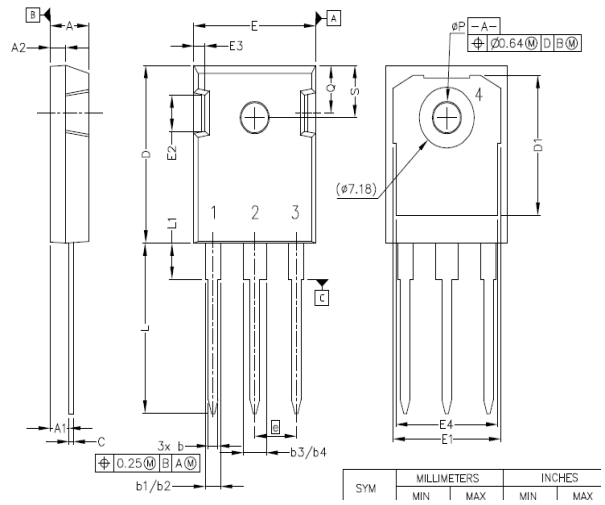


Fig 14. Body Diode Recovery Test

Package Dimensions



Part Number	Package
CMF20120D	TO-247-3

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