

# C3M0065090D

## Silicon Carbide Power MOSFET

### C3M™ MOSFET Technology

#### N-Channel Enhancement Mode

#### Features

- New C3M SiC MOSFET technology
- High blocking voltage with low On-resistance
- High speed switching with low capacitances
- Fast intrinsic diode with low reverse recovery (Qrr)
- Halogen free, RoHS compliant

#### Benefits

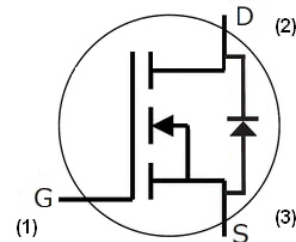
- Higher system efficiency
- Reduced cooling requirements
- Increased power density
- Increased system switching frequency

#### Applications

- Renewable energy
- EV battery chargers
- High voltage DC/DC converters
- Switch Mode Power Supplies

$V_{DS}$	900 V
$I_D @ 25^\circ\text{C}$	36 A
$R_{DS(on)}$	65 mΩ

#### Package



Part Number	Package
C3M0065090D	TO-247-3

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

Symbol	Parameter	Value	Unit	Test Conditions	Note
$V_{DSmax}$	Drain - Source Voltage	900	V	$V_{GS} = 0\text{ V}, I_D = 100\ \mu\text{A}$	
$V_{GSmax}$	Gate - Source Voltage	-8/+18	V	Absolute maximum values	
$V_{GSop}$	Gate - Source Voltage	-4/+15	V	Recommended operational values	
$I_D$	Continuous Drain Current	36	A	$V_{GS} = 15\text{ V}, T_C = 25^\circ\text{C}$	Fig. 19
		23		$V_{GS} = 15\text{ V}, T_C = 100^\circ\text{C}$	
$I_{D(pulse)}$	Pulsed Drain Current	90	A	Pulse width $t_p$ limited by $T_{jmax}$	Fig. 22
$E_{AS}$	Avalanche energy, Single pulse	110	mJ	$I_D = 22\text{ A}, V_{DD} = 50\text{ V}$	
$P_D$	Power Dissipation	125	W	$T_c = 25^\circ\text{C}, T_j = 150^\circ\text{C}$	Fig. 20
$T_J, T_{stg}$	Operating Junction and Storage Temperature	-55 to +150	$^\circ\text{C}$		
$T_L$	Solder Temperature	260	$^\circ\text{C}$	1.6mm (0.063") from case for 10s	

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	900			V	$V_{GS} = 0\text{ V}, I_D = 100\ \mu\text{A}$	
$V_{GS(th)}$	Gate Threshold Voltage	1.8	2.1		V	$V_{DS} = 10\text{ V}, I_D = 5\ \text{mA}$	Fig. 11
			1.6		V	$V_{DS} = 10\text{ V}, I_D = 5\ \text{mA}, T_J = 150^\circ\text{C}$	
$I_{DSS}$	Zero Gate Voltage Drain Current		1	100	$\mu\text{A}$	$V_{DS} = 900\ \text{V}, V_{GS} = 0\ \text{V}$	
$I_{GSS}$	Gate-Source Leakage Current		10	250	nA	$V_{GS} = 15\ \text{V}, V_{DS} = 0\ \text{V}$	
$R_{DS(on)}$	Drain-Source On-State Resistance		65	78	m $\Omega$	$V_{GS} = 15\ \text{V}, I_D = 20\ \text{A}$	Fig. 4, 5, 6
			90			$V_{GS} = 15\ \text{V}, I_D = 20\ \text{A}, T_J = 150^\circ\text{C}$	
$g_{fs}$	Transconductance		13.6		S	$V_{DS} = 15\ \text{V}, I_{DS} = 20\ \text{A}$	Fig. 7
			11.6			$V_{DS} = 15\ \text{V}, I_{DS} = 20\ \text{A}, T_J = 150^\circ\text{C}$	
$C_{iss}$	Input Capacitance		660		pF	$V_{GS} = 0\ \text{V}, V_{DS} = 600\ \text{V}$ $f = 1\ \text{MHz}$ $V_{AC} = 25\ \text{mV}$	Fig. 17, 18
$C_{oss}$	Output Capacitance		60				
$C_{rss}$	Reverse Transfer Capacitance		4.0				
$E_{oss}$	$C_{oss}$ Stored Energy		16		$\mu\text{J}$		Fig. 16
$E_{ON}$	Turn-On Switching Energy		225		$\mu\text{J}$	$V_{DS} = 400\ \text{V}, V_{GS} = -4\ \text{V}/15\ \text{V}, I_D = 20\ \text{A},$ $R_{G(ext)} = 2.5\ \Omega, L = 77\ \mu\text{H}, T_J = 150^\circ\text{C}$	Fig. 26
$E_{OFF}$	Turn Off Switching Energy		91				
$t_{d(on)}$	Turn-On Delay Time		21		ns	$V_{DD} = 400\ \text{V}, V_{GS} = -4\ \text{V}/15\ \text{V}$ $I_D = 20\ \text{A}, R_{G(ext)} = 2.5\ \Omega,$ Timing relative to $V_{DS}$ Per IEC60747-8-4 pg 83 Resistive load	Fig. 27
$t_r$	Rise Time		36				
$t_{d(off)}$	Turn-Off Delay Time		28				
$t_f$	Fall Time		25				
$R_{G(int)}$	Internal Gate Resistance		4.7		$\Omega$	$f = 1\ \text{MHz}, V_{AC} = 25\ \text{mV}$	
$Q_{gs}$	Gate to Source Charge		7.5		nC	$V_{DS} = 400\ \text{V}, V_{GS} = -4\ \text{V}/15\ \text{V}$ $I_D = 20\ \text{A}$ Per IEC60747-8-4 pg 21	Fig. 12
$Q_{gd}$	Gate to Drain Charge		12				
$Q_g$	Total Gate Charge		30.4				

**Reverse Diode Characteristics** ( $T_c = 25^\circ\text{C}$  unless otherwise specified)

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
$V_{SD}$	Diode Forward Voltage	4.8		V	$V_{GS} = -4\ \text{V}, I_{SD} = 10\ \text{A}$	Fig. 8, 9, 10
		4.4		V	$V_{GS} = -4\ \text{V}, I_{SD} = 10\ \text{A}, T_J = 150^\circ\text{C}$	
$I_S$	Continuous Diode Forward Current		21	A	$V_{GS} = -4\ \text{V}$	Note 1
$I_{S,pulse}$	Diode pulse Current		90	A	$V_{GS} = -4\ \text{V}$ , pulse width $t_p$ limited by $T_{jmax}$	Note 1
$t_{rr}$	Reverse Recover time	30		ns	$V_{GS} = -4\ \text{V}, I_{SD} = 20\ \text{A}, V_R = 400\ \text{V}$ $\text{dif}/\text{dt} = 600\ \text{A}/\mu\text{s}$	Note 1
$Q_{rr}$	Reverse Recovery Charge	134		nC		
$I_{rrm}$	Peak Reverse Recovery Current	7.5		A		

 Note (1): When using SiC Body Diode the maximum recommended  $V_{GS} = -4\text{V}$ 
**Thermal Characteristics**

Symbol	Parameter	Max.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	1.0	$^\circ\text{C}/\text{W}$		Fig. 21
$R_{\theta JA}$	Thermal Resistance From Junction to Ambient	40			

## Typical Performance

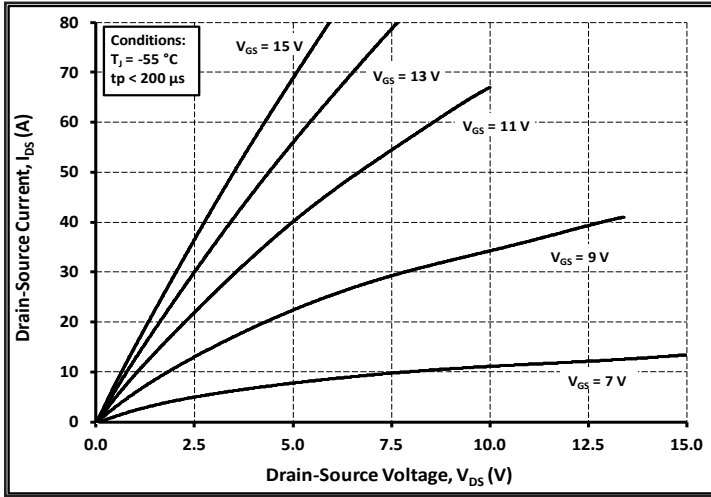


Figure 1. Output Characteristics  $T_J = -55\text{ }^\circ\text{C}$

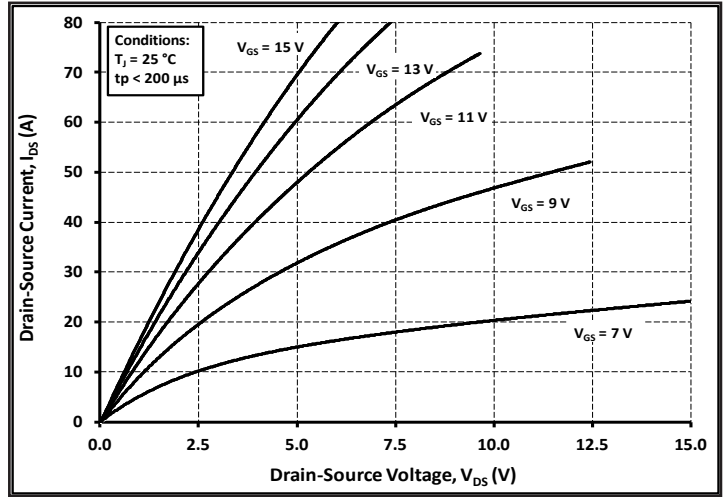


Figure 2. Output Characteristics  $T_J = 25\text{ }^\circ\text{C}$

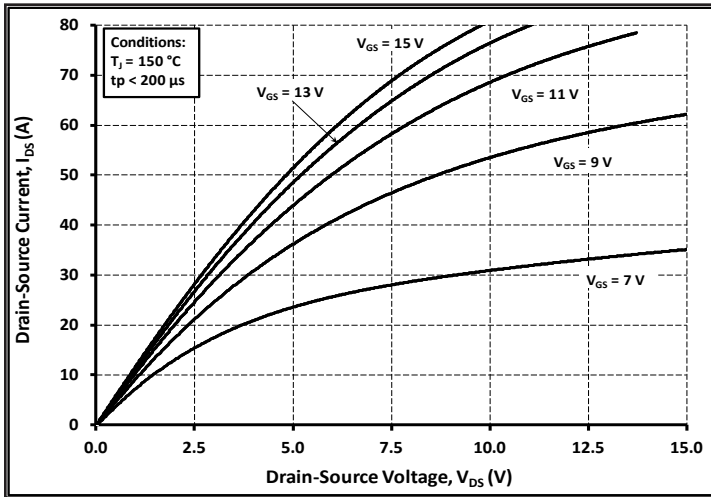


Figure 3. Output Characteristics  $T_J = 150\text{ }^\circ\text{C}$

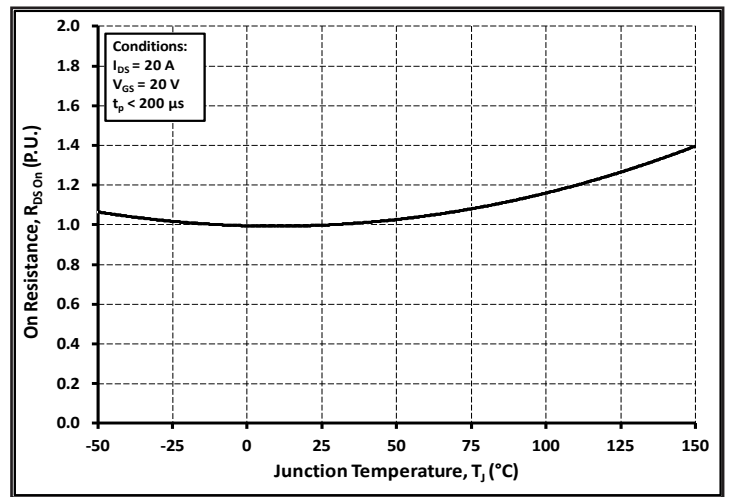


Figure 4. Normalized On-Resistance vs. Temperature

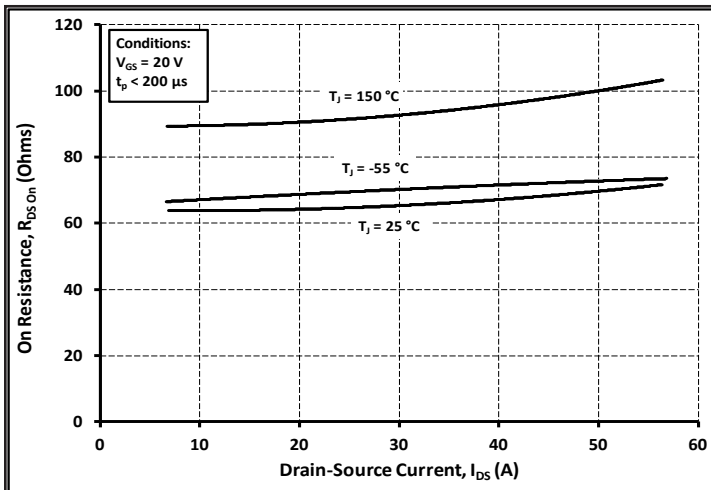


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

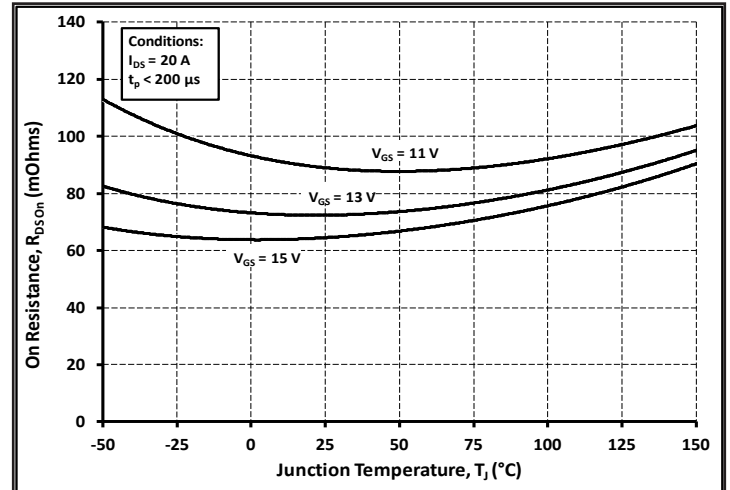


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage

## Typical Performance

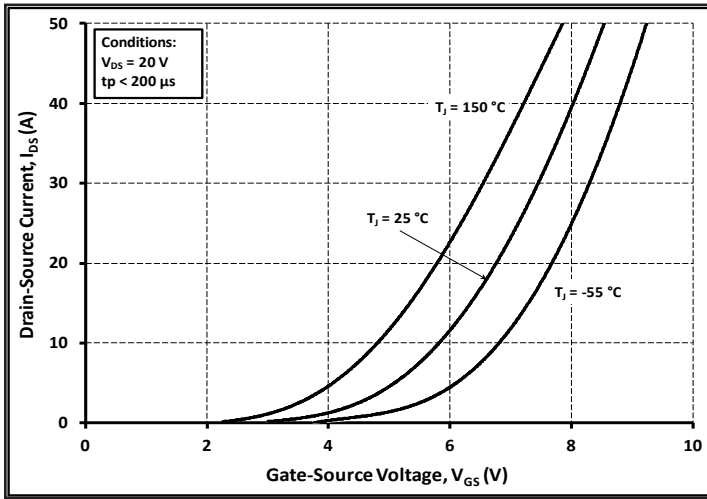


Figure 7. Transfer Characteristic for Various Junction Temperatures

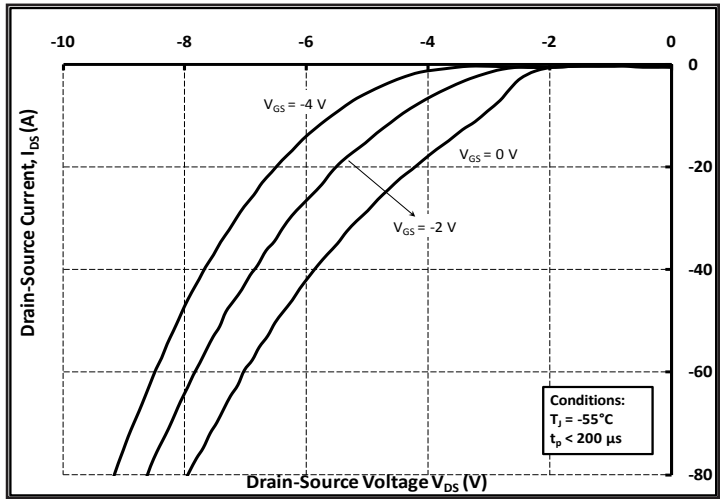


Figure 8. Body Diode Characteristic at  $-55\text{ }^\circ\text{C}$

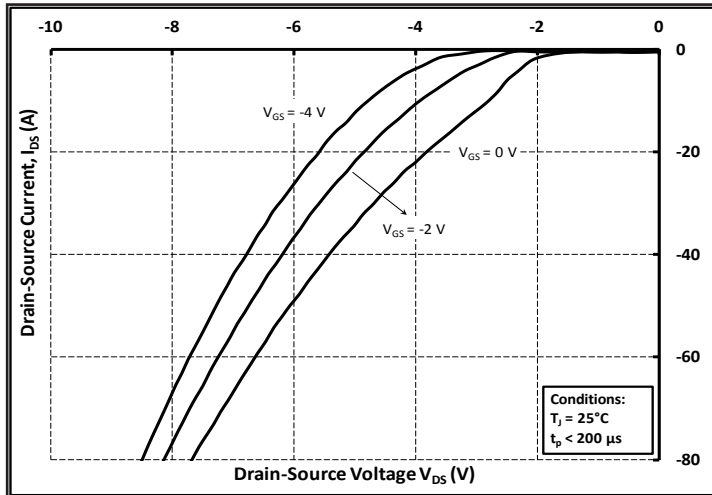


Figure 9. Body Diode Characteristic at  $25\text{ }^\circ\text{C}$

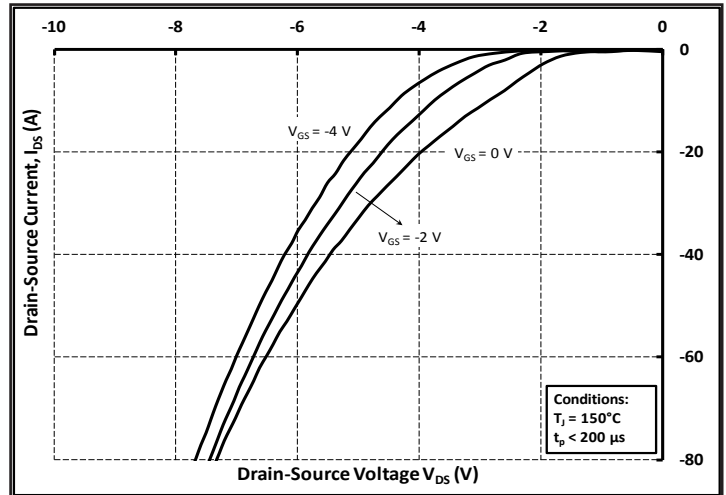


Figure 10. Body Diode Characteristic at  $150\text{ }^\circ\text{C}$

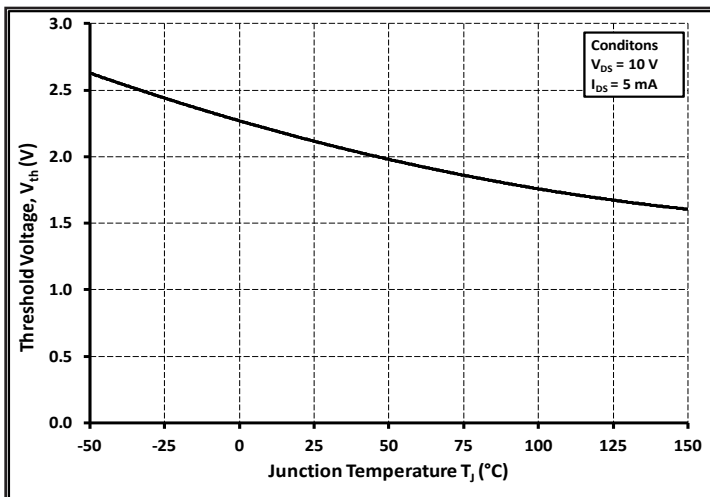


Figure 11. Threshold Voltage vs. Temperature

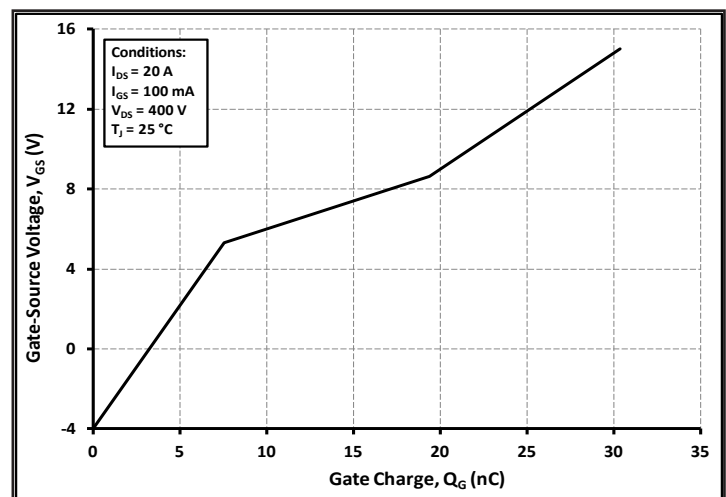


Figure 12. Gate Charge Characteristics

## Typical Performance

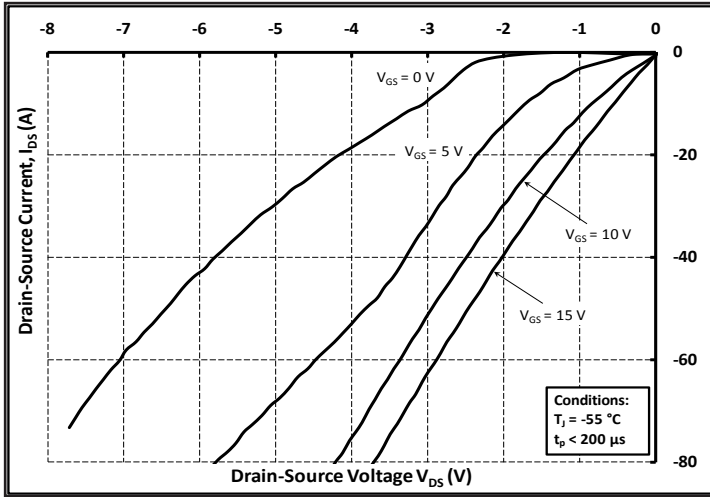


Figure 13. 3rd Quadrant Characteristic at -55 °C

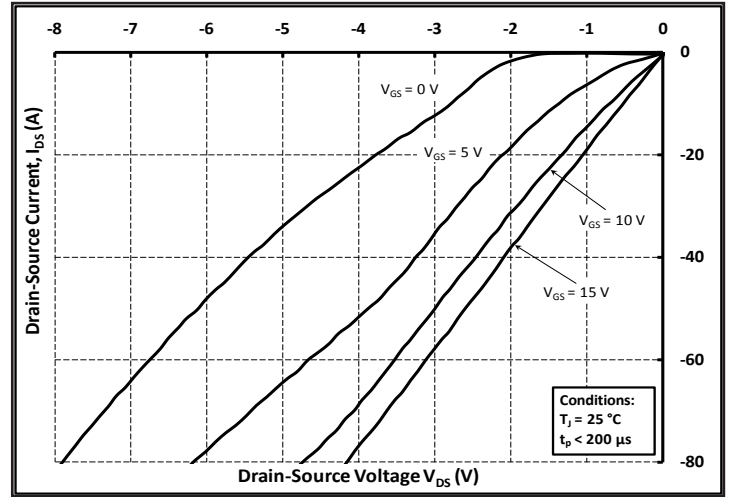


Figure 14. 3rd Quadrant Characteristic at 25 °C

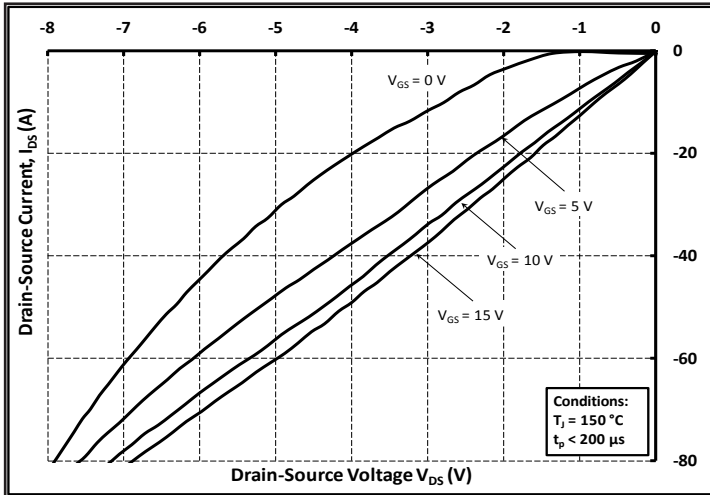


Figure 15. 3rd Quadrant Characteristic at 150 °C

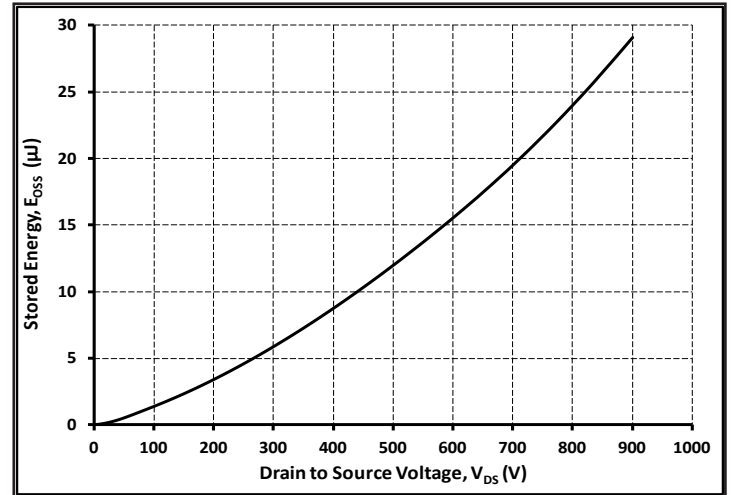


Figure 16. Output Capacitor Stored Energy

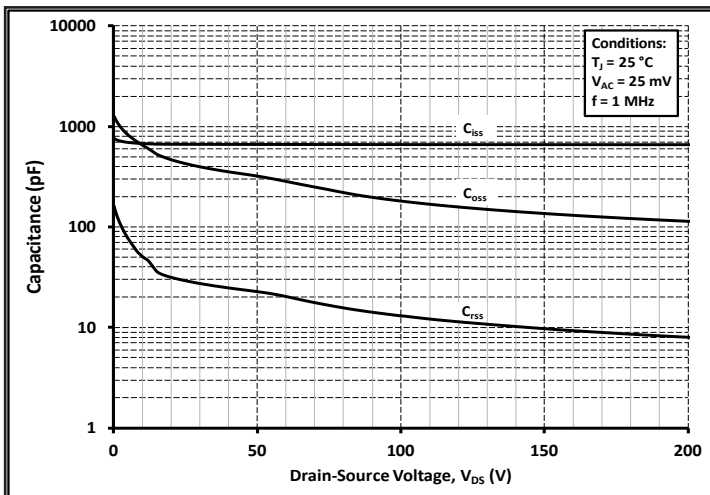


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

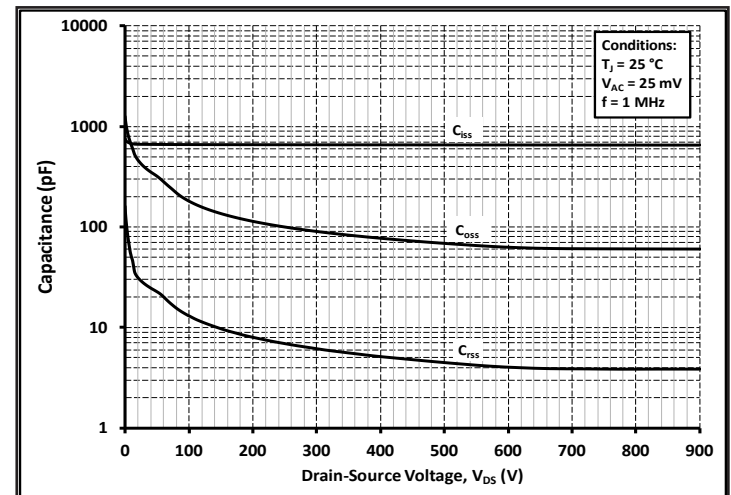


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 900V)

## Typical Performance

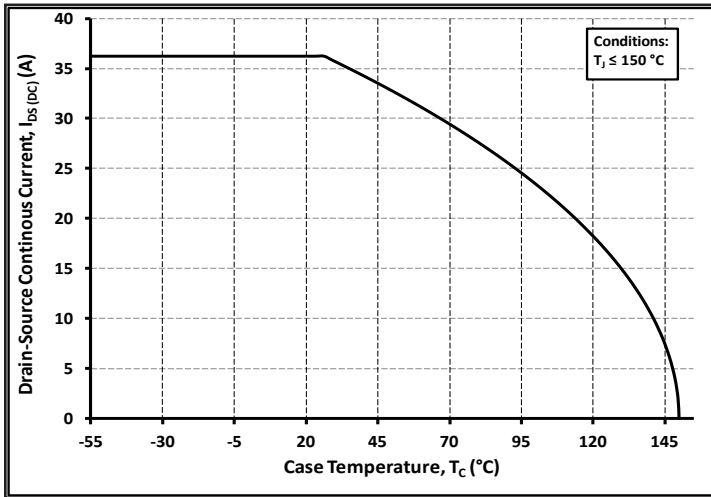


Figure 19. Continuous Drain Current Derating vs. Case Temperature

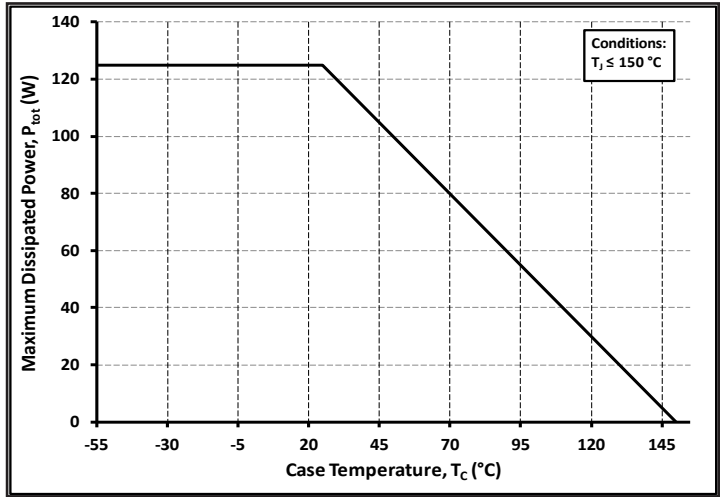


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

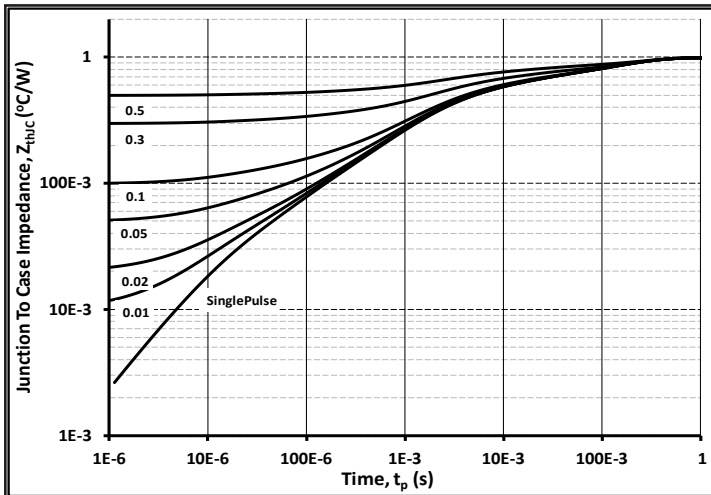


Figure 21. Transient Thermal Impedance (Junction - Case)

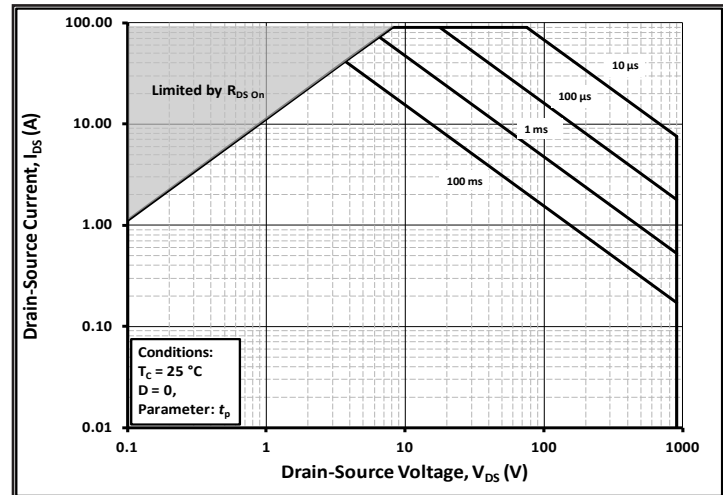


Figure 22. Safe Operating Area

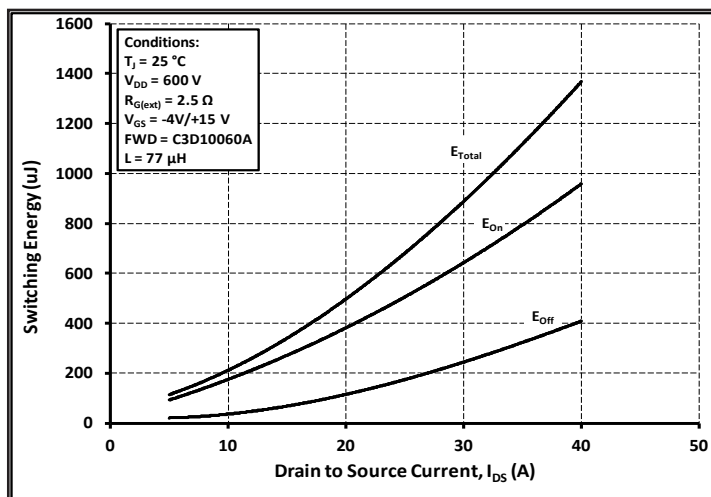


Figure 23. Clamped Inductive Switching Energy vs. Drain Current ( $V_{DD} = 600V$ )

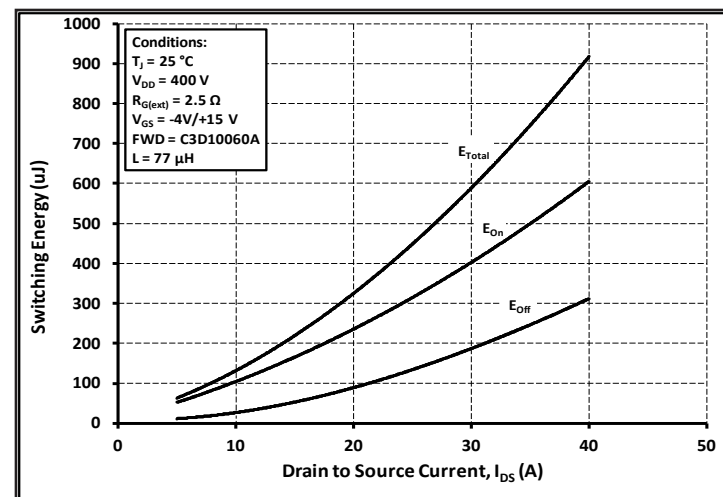


Figure 24. Clamped Inductive Switching Energy vs. Drain Current ( $V_{DD} = 400V$ )

## Typical Performance

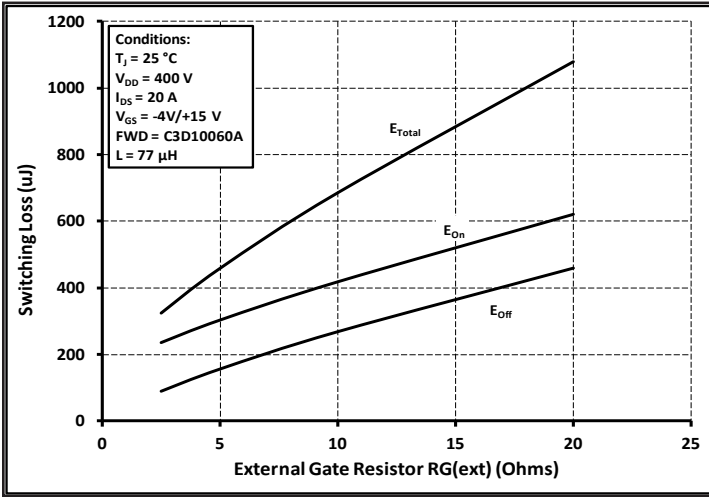


Figure 25. Clamped Inductive Switching Energy vs.  $R_{G(ext)}$

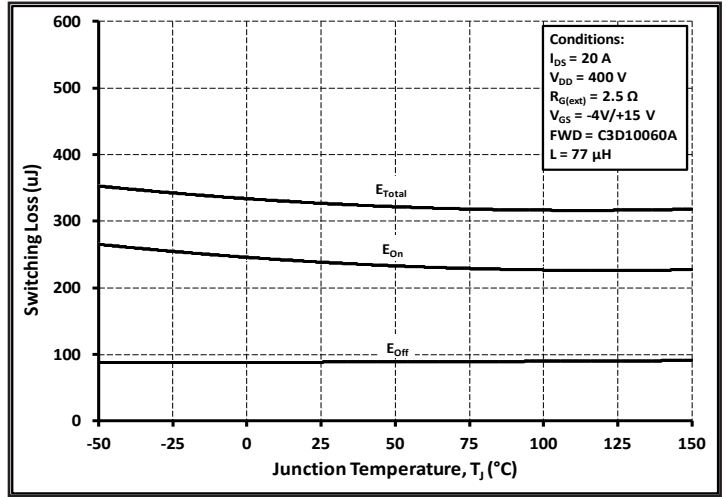


Figure 26. Clamped Inductive Switching Energy vs. Temperature

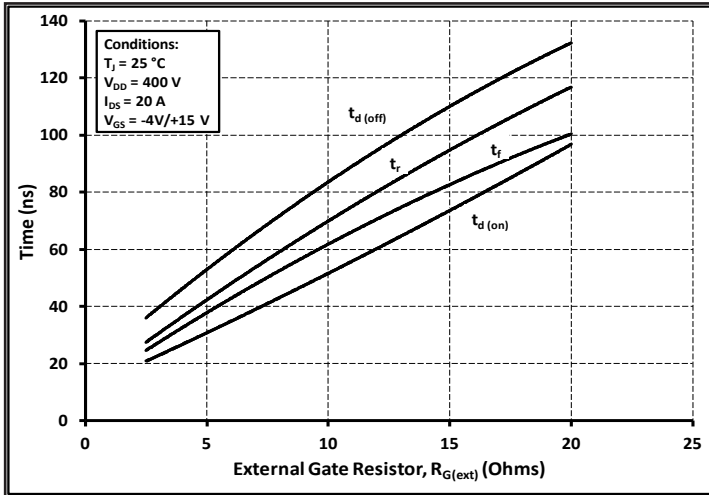


Figure 27. Switching Times vs.  $R_{G(ext)}$

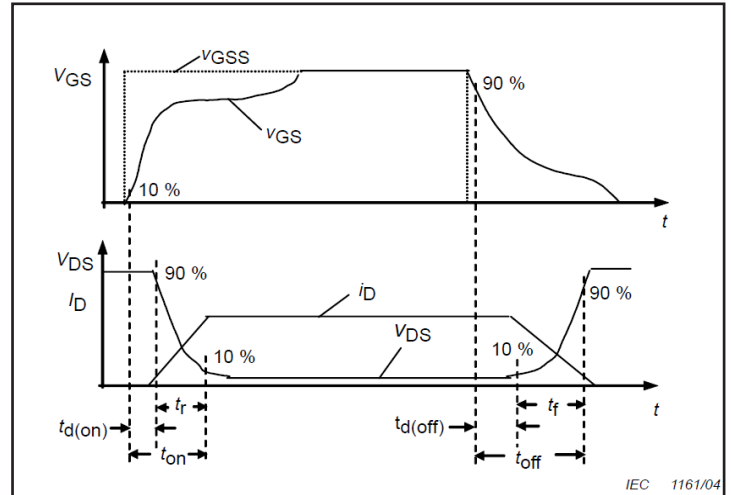


Figure 28. Switching Times Definition

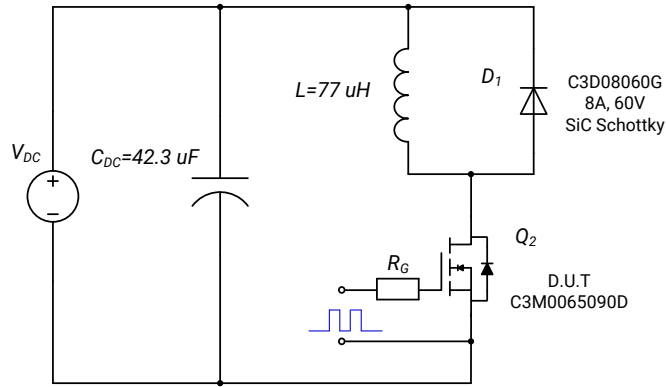


Figure 30. Clamped Inductive Switching Waveform Test Circuit

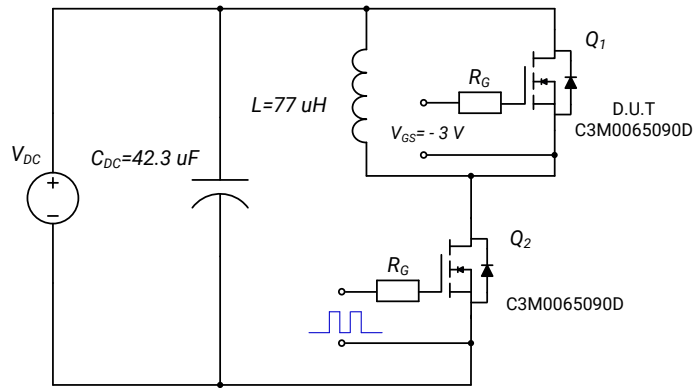
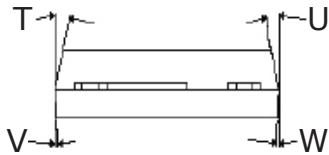
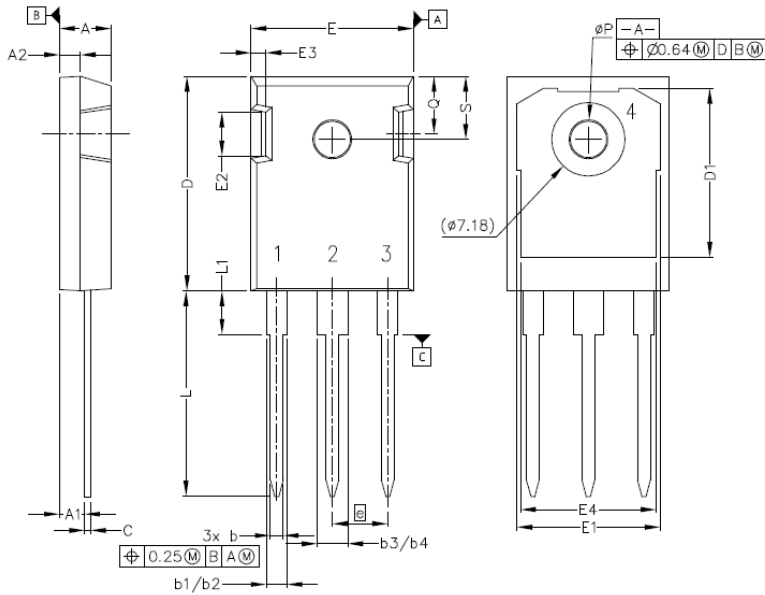


Figure 31. Body Diode Recovery Test Circuit



# Package Dimensions

Package TO-247-3

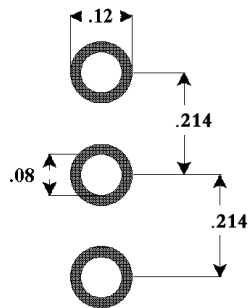


Pinout Information:

- Pin 1 = Gate
- Pin 2, 4 = Drain
- Pin 3 = Source

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
T	9°	11°	9°	11°
U	9°	11°	9°	11°
V	2°	8°	2°	8°
W	2°	8°	2°	8°

## Recommended Solder Pad Layout



TO-247-3

## Notes

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- **RoHS Compliance**  
The levels of RoHS 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 2011/65/EC (RoHS2), as implemented January 2, 2013. RoHS Declarations for this product can be obtained from your Cree representative or from the Product Documentation sections of [www.cree.com](http://www.cree.com).
- **REACH Compliance**  
REACH substances of high concern (SVHCs) information is available for this product. Since the European Chemical Agency (ECHA) has published notice of their intent to frequently revise the SVHC listing for the foreseeable future, please contact a Cree representative to insure you get the most up-to-date REACH SVHC Declaration. REACH banned substance information (REACH Article 67) is also available upon request.
- 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.

## Related Links

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- **SiC MOSFET Isolated Gate Driver reference design:** [www.cree.com/power/Tools-and-Support](http://www.cree.com/power/Tools-and-Support)
- **Application Considerations for Silicon-Carbide MOSFETs:** [www.cree.com/power/Tools-and-Support](http://www.cree.com/power/Tools-and-Support)



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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