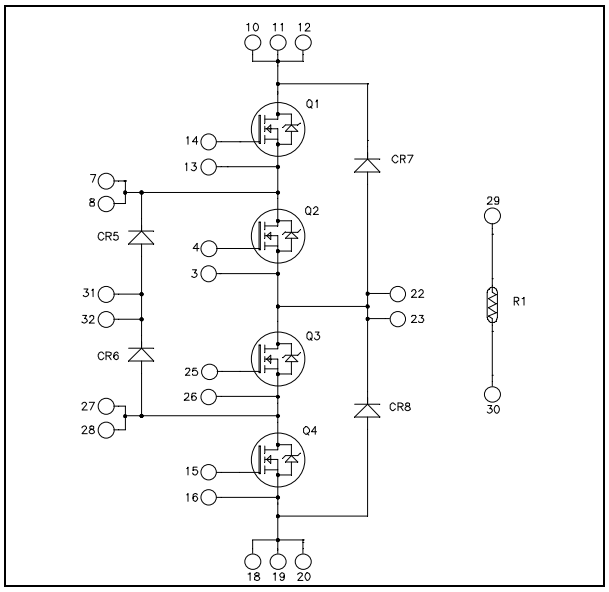
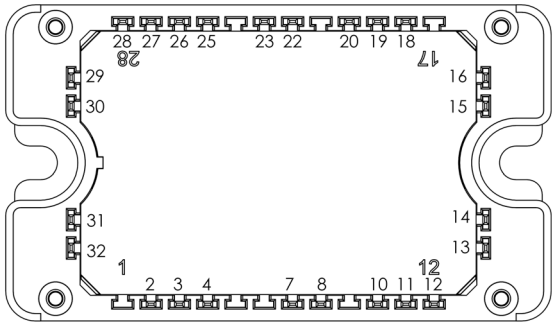
APTMC60TLM55CT3AG

Three level inverter SiC MOSFET Power Module

***SiC Power MOSFET* :**
V_{DSS} = 1200V ; R_{DSon} = 49mΩ @ Tj = 25°C





All multiple inputs and outputs must be shorted together
10/11/12 ; 7/8 ; 27/28 ; …

Application

- Uninterruptible Power Supplies

Features

- ***SiC Power MOSFET***
  - Low $R_{DS(on)}$
  - High temperature performance
- ***SiC Schottky Diode***
  - Zero reverse recovery
  - Zero forward recovery
  - Temperature Independent switching behavior
  - Positive temperature coefficient on VF
- Kelvin emitter for easy drive
- Very low stray inductance
- High level of integration
- Internal thermistor for temperature monitoring
- AlN substrate for improved thermal performance

Benefits

- Stable temperature behavior
- Very rugged
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Easy paralleling due to positive TC of VCEsat
- Low profile
- RoHS Compliant

All ratings @ T_j = 25°C unless otherwise specified

Q1 to Q4 Absolute maximum ratings (per SiC MOSFET)

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{DSS}	Drain - Source Breakdown Voltage		1200	V
I_D	Continuous Drain Current	T_c = 25°C	55	A
		T_c = 80°C	42	
I_{DM}	Pulsed Drain current		110	
V_{GS}	Gate - Source Voltage		-10/+25	V
R_{DSon}	Drain - Source ON Resistance		49	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	250	W

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.
See application note APT0502 on www.microsemi.com

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Q1 to Q4 Electrical Characteristics (per SiC MOSFET)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_{DSS}	Zero Gate Voltage Drain Current	V_{GS} = 0V ; V_{DS} = 1200V			25	200	µA
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 20V, I_D = 40A	T_j = 25°C		40	49	mΩ
			T_j = 150°C		75	104	
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 2mA		1.7	2.2		V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = 20 V, V_{DS} = 0V				500	nA

Q1 to Q4 Dynamic Characteristics (per SiC MOSFET)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 1000V f = 1MHz			1900		pF
C_{oss}	Output Capacitance				160		
C_{rss}	Reverse Transfer Capacitance				13		
Q_g	Total gate Charge	V_{GS} = 20V V_{Bus} = 800V I_D = 40A			98		nC
Q_{gs}	Gate – Source Charge				22		
Q_{gd}	Gate – Drain Charge				36		
$T_{d(on)}$	Turn-on Delay Time	V_{GS} = -5/+20V V_{Bus} = 800V I_D = 40A R_L = 20Ω ; R_G = 25Ω			12		ns
T_r	Rise Time				14		
$T_{d(off)}$	Turn-off Delay Time				23		
T_f	Fall Time				18		
E_{on}	Turn on Energy	Inductive Switching V_{GS} = -5/+20V V_{Bus} = 600V I_D = 40A R_G = 25Ω	T_j = 150°C		0.9		mJ
E_{off}	Turn off Energy		T_j = 150°C		0.5		mJ
R_{thJC}	Junction to Case Thermal Resistance					0.5	°C/W

CR5 & CR6 SiC diode ratings and characteristics (Per SiC diode)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V_{RRM}	Maximum Peak Repetitive Reverse Voltage			600			V
I_{RM}	Maximum Reverse Leakage Current	V_R=600V	T_j = 25°C		30	180	µA
			T_j = 175°C		60	900	
I_F	DC Forward Current		Tc = 125°C		30		A
V_F	Diode Forward Voltage	I_F = 30A	T_j = 25°C		1.6	1.8	V
			T_j = 175°C		2	2.4	
Q_C	Total Capacitive Charge	I_F = 30A, V_R = 600V di/dt =1000A/µs			84		nC
C	Total Capacitance	f = 1MHz, V_R = 200V			195		pF
		f = 1MHz, V_R = 400V			150		
R_{thJC}	Junction to Case Thermal Resistance					0.8	°C/W

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CR7 & CR8 diode ratings and characteristics (Per SiC diode)

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V_{RRM}	Maximum Peak Repetitive Reverse Voltage			1200			V
I_{RM}	Maximum Reverse Leakage Current	V_R=1200V	T_j = 25°C		96	600	µA
			T_j = 175°C		168	3000	
I_F	DC Forward Current		Tc = 125°C		30		A
V_F	Diode Forward Voltage	I_F = 30A	T_j = 25°C		1.6	1.8	V
			T_j = 175°C		2.3	3	
Q_C	Total Capacitive Charge	I_F = 30A, V_R = 1200V di/dt =1500A/µs			240		nC
C	Total Capacitance	f = 1MHz, V_R = 200V			288		pF
		f = 1MHz, V_R = 400V			207		
R_{thJC}	Junction to Case Thermal Resistance					0.50	°C/W

Temperature sensor NTC (see application note APT0406 on www.microsemi.com).

Symbol	Characteristic		Min	Typ	Max	Unit
R_{25}	Resistance @ 25°C			50		kΩ
$\Delta R_{25}/R_{25}$				5		%
$B_{25/85}$	T_{25} = 298.15 K			3952		K
ΔB/B		T_C=100°C		4		%

$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

T: Thermistor temperature
R_T: Thermistor value at T

Thermal and package characteristics

Symbol	Characteristic		Min	Typ	Max	Unit
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz		4000			V
T_J	Operating junction temperature range	SiC MOSFET	-40		150	°C
		SiC diode	-40		175	
T_{JOP}	Recommended junction temperature under switching conditions		-40		$T_J$max -25	
T_{STG}	Storage Temperature Range		-40		125	
T_C	Operating Case Temperature		-40		125	
Torque	Mounting torque	To heatsink M4	2		3	N.m
Wt	Package Weight				110	g

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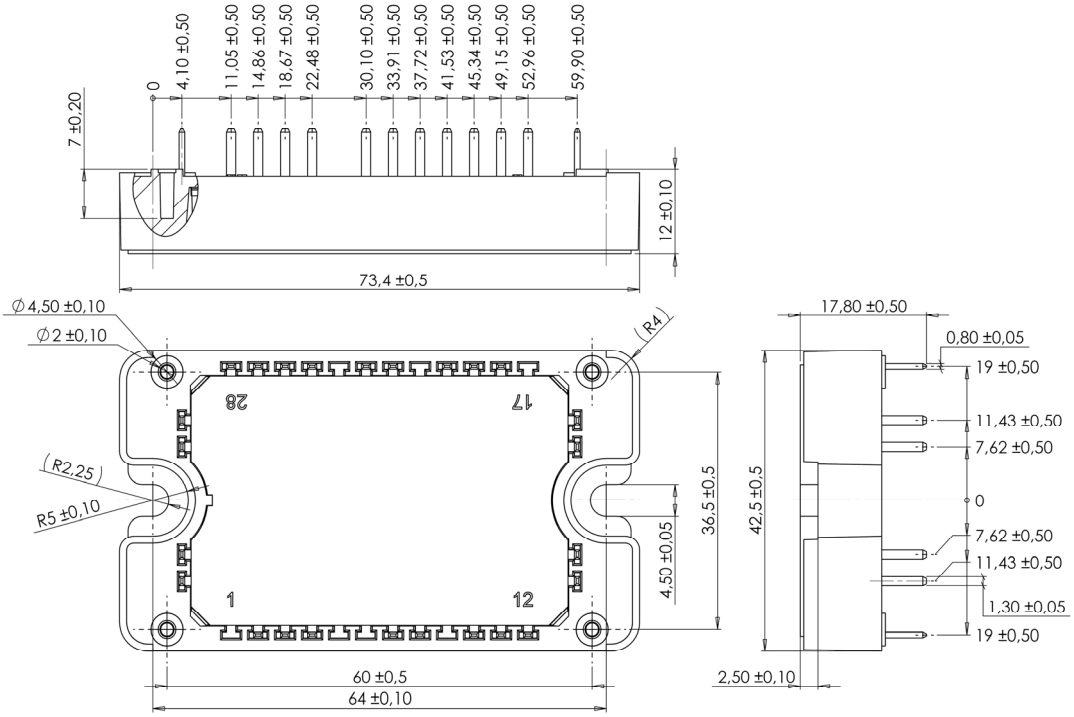
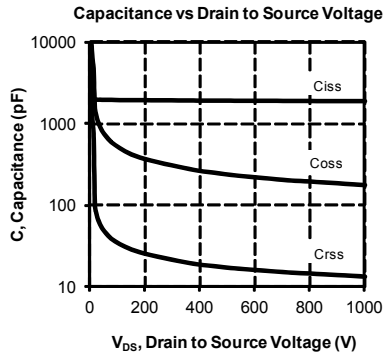
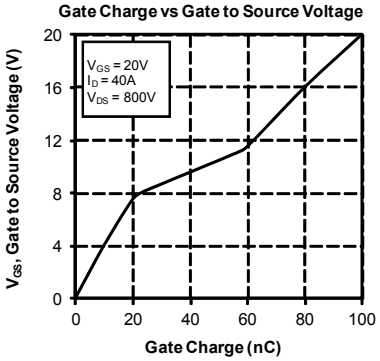
SP3 Package outline (dimensions in mm)

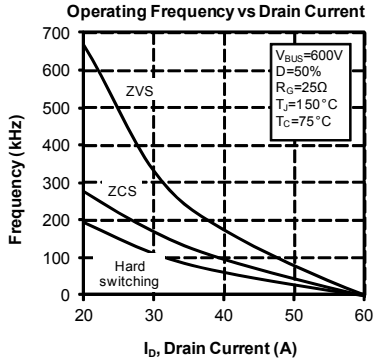


See application note 1906 - Mounting Instructions for SP3F Power Modules on www.microsemi.com

Q1 to Q4 Typical performance curve







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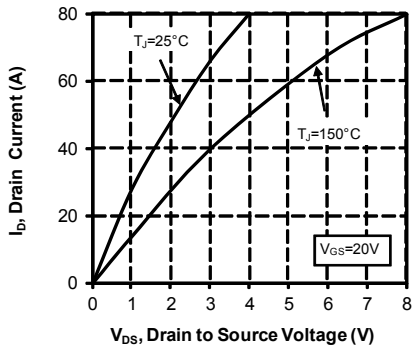
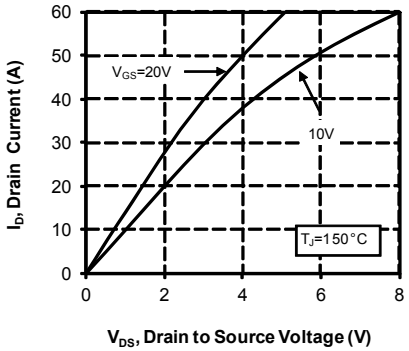
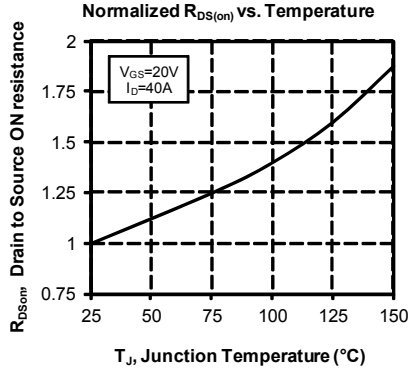
Output Characteristics



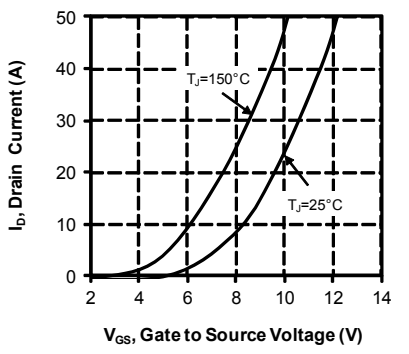
Output Characteristics



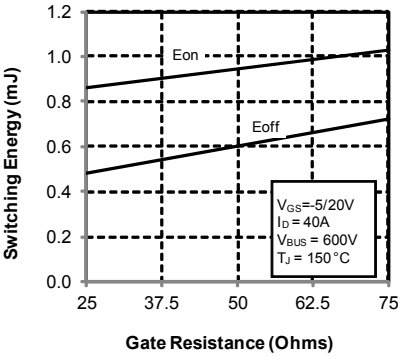
Normalized $R_{DS(on)}$ vs. Temperature



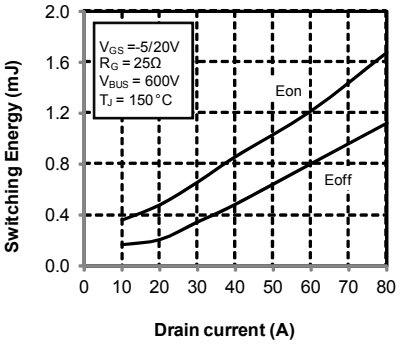
Transfert Characteristics



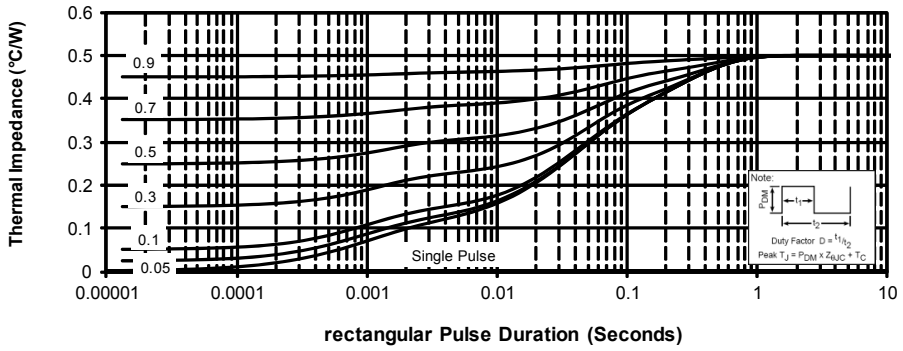
inductive switching energy vs RG



Inductive switching energy vs current



Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration



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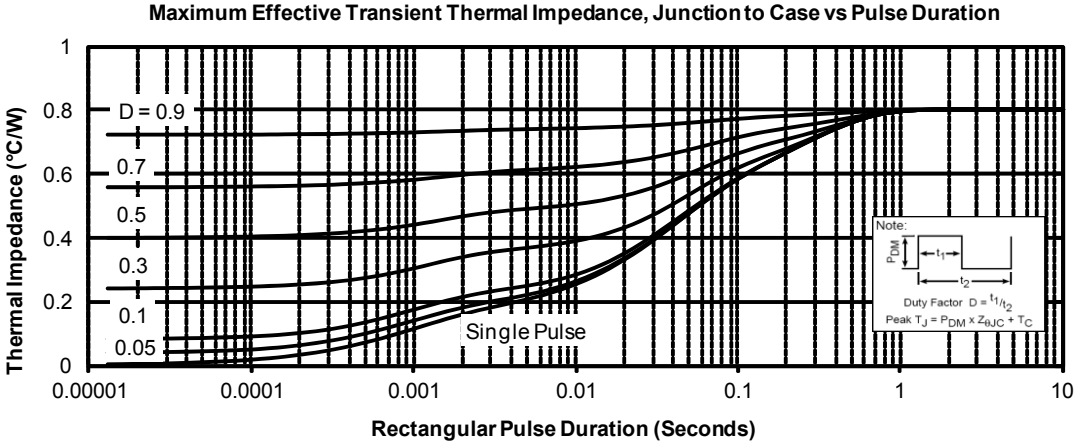
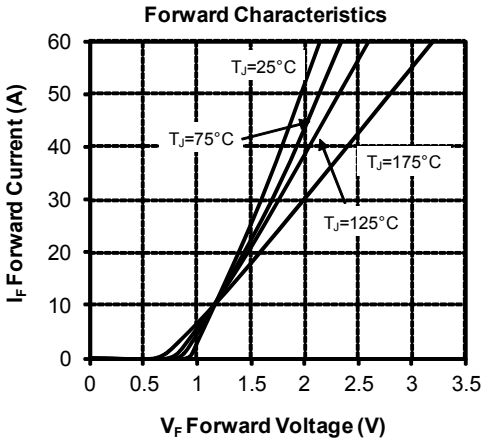
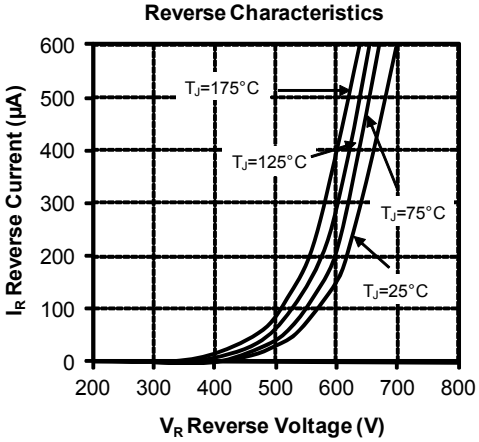
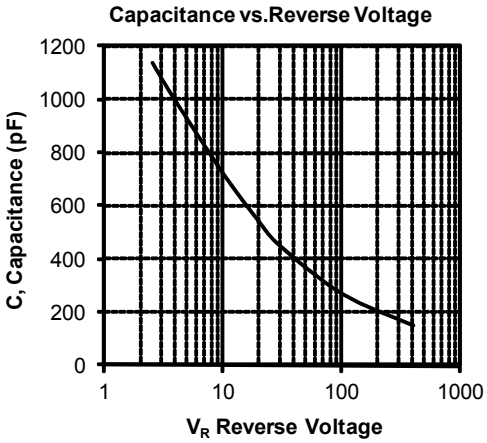
CR5 & CR6 Typical performance curve









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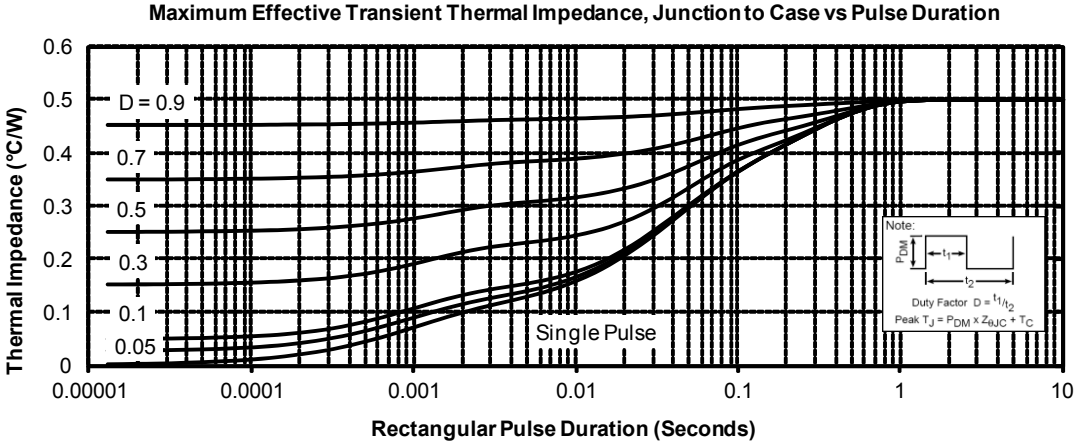
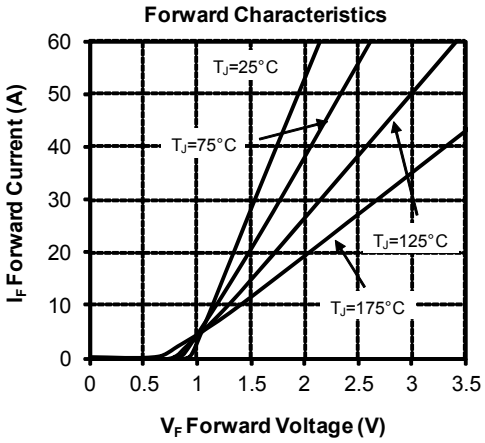
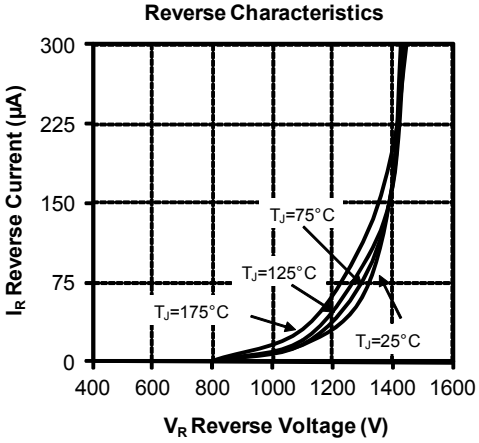
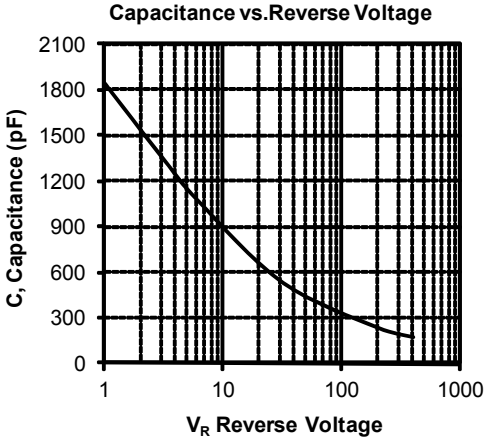
CR7 & CR8 Typical performance curve









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