ALPHA & OMEGA SEMICONDUCTOR

AOTF600A60L/AOT600A60L/AOB600A60L
600V, αMOS5™ N-Channel Power Transistor

General Description

- Proprietary αMOS5™ technology
- Low $R_{DS(ON)}$
- Optimized switching parameters for better EMI performance
- Enhanced body diode for robustness and fast reverse recovery

Applications

- SMPS with PFC, Flyback and LLC topologies
- Silver ATX,adapter,TV,lighting,Server power

Product Summary

V_{DS} @ $T_{j,max}$	700V
I_{DM}	32A
$R_{DS(ON),max}$	< 0.6Ω
$Q_{g,typ}$	11.5nC
E_{oss} @ 400V	1.8μJ

100% UIS Tested
100% R_g Tested

TO-220F   TO-220   TO-263 D²PAK

AOTF600A60L   AOT600A60L   AOB600A60L
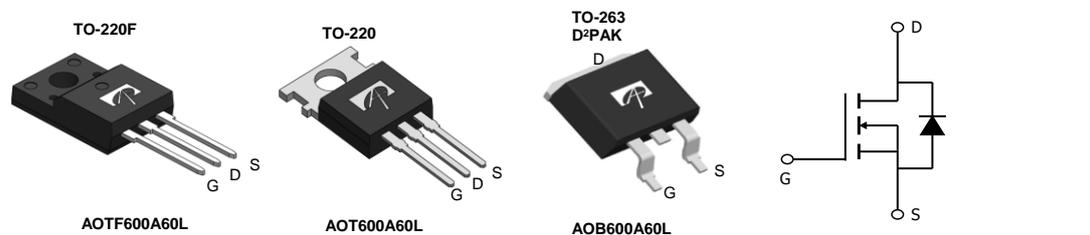
Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOTF600A60L	TO220F Green	Tube	1000
AOT600A60L	TO220 Green	Tube	1000
AOB600A60L	TO263 Green	Tape &Reel	800

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	AOT(B)600A60L	AOTF600A60L	Units
Drain-Source Voltage		V_{DS}	600		V
Gate-Source Voltage		V_{GS}	±20		V
Gate-Source Voltage (dynamic) AC(f>1Hz)		V_{GS}	±30		V
Continuous Drain Current	T_C=25°C	I_D	8	8*	A
	T_C=100°C		5	5*	
Pulsed Drain Current ^{C}		I_{DM}	32		
Avalanche Current ^{C} L=1mH		I_{AR}	1.6		A
Repetitive avalanche energy ^{C}		E_{AR}	1.3		mJ
Single pulsed avalanche energy ^{G}		E_{AS}	19		mJ
MOSFET dv/dt ruggedness		dv/dt	100		V/ns
Peak diode recovery dv/dt			20		
Power Dissipation ^{B}	T_C=25°C	P_D	96	27.5	W
	Derate above 25°C		0.8	0.2	W/°C
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150		°C
Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds		T_L	300		°C

Thermal Characteristics

Parameter	Symbol	AOT(B)600A60L	AOTF600A60L	Units
Maximum Junction-to-Ambient ^{A,D}	$R_{θJA}$	65	65	°C/W
Maximum Case-to-sink ^{A}	$R_{θCS}$	0.5	---	°C/W
Maximum Junction-to-Case	$R_{θJC}$	1.3	4.6	°C/W

* Drain current limited by maximum junction temperature.

Electrical Characteristics (T$_J$=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV$_{DSS}$	Drain-Source Breakdown Voltage	I$_D$=250µA, V$_{GS}$=0V, T$_J$=25°C	600			V
		I$_D$=250µA, V$_{GS}$=0V, T$_J$=150°C		700		
BV$_{DSS}$ /∆TJ	Breakdown Voltage Temperature Coefficient	I$_D$=250µA, V$_{GS}$=0V		0.59		V/^{o}C
I$_{DSS}$	Zero Gate Voltage Drain Current	V$_{DS}$=600V, V$_{GS}$=0V			1	µA
		V$_{DS}$=480V, T$_J$=125°C			10	
I$_{GSS}$	Gate-Body leakage current	V$_{DS}$=0V, V$_{GS}$=±20V			±100	nA
V$_{GS(th)}$	Gate Threshold Voltage	V$_{DS}$=5V, I$_D$=250µA	2.9	3.5	4.1	V
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$=10V, I$_D$=2.1A		0.53	0.6	Ω
g$_{FS}$	Forward Transconductance	V$_{DS}$=10V, I$_D$=2.1A		4.2		S
V$_{SD}$	Diode Forward Voltage	I$_S$=2.1A,V$_{GS}$=0V		0.8	1.2	V
I$_S$	Maximum Body-Diode Continuous Current				8	A
I$_{SM}$	Maximum Body-Diode Pulsed Current [C]				32	A
DYNAMIC PARAMETERS						
C$_{iss}$	Input Capacitance	V$_{GS}$=0V, V$_{DS}$=100V, f=1MHz		608		pF
C$_{oss}$	Output Capacitance			19		pF
C$_{o(er)}$	Effective output capacitance, energy related [H]	V$_{GS}$=0V, V$_{DS}$=0 to 480V, f=1MHz		21		pF
C$_{o(tr)}$	Effective output capacitance, time related [I]			76		pF
C$_{rss}$	Reverse Transfer Capacitance	V$_{GS}$=0V, V$_{DS}$=100V, f=1MHz		1.3		pF
R$_g$	Gate resistance	f=1MHz		4.6		Ω
SWITCHING PARAMETERS						
Q$_g$	Total Gate Charge	V$_{GS}$=10V, V$_{DS}$=480V, I$_D$=2.1A		11.5		nC
Q$_{gs}$	Gate Source Charge			4.2		nC
Q$_{gd}$	Gate Drain Charge			2.8		nC
T$_{d(on)}$	Turn-On DelayTime	V$_{GS}$=10V, V$_{DS}$=400V, I$_D$=2.1A, R$_G$=5Ω		18		ns
T$_r$	Turn-On Rise Time			5.5		ns
T$_{d(off)}$	Turn-Off DelayTime			36		ns
T$_f$	Turn-Off Fall Time			16		ns
T$_{rr}$	Body Diode Reverse Recovery Time	I$_F$=2.1A, dI/dt=100A/µs, V$_{DS}$=400V		159		ns
I$_{rm}$	Peak Reverse Recovery Current			13		A
Q$_{rr}$	Body Diode Reverse Recovery Charge			1.2		µC

A. The value of R$_{θJA}$ is measured with the device in a still air environment with T$_A$=25°C.

B. The power dissipation P$_D$ is based on T$_{J(MAX)}$=150°C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C. Repetitive rating, pulse width limited by junction temperature T$_{J(MAX)}$=150°C, Ratings are based on low frequency and duty cycles to keep initial T$_J$ =25°C.

D. The R$_{θJA}$ is the sum of the thermal impedance from junction to case R$_{θJC}$ and case to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300µs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T$_{J(MAX)}$=150°C. The SOA curve provides a single pulse rating.

G. L=60mH, I$_{AS}$=0.8A, R$_G$=25Ω, Starting T$_J$=25°C.

H. C$_{o(er)}$ is a fixed capacitance that gives the same stored energy as C$_{oss}$ while V$_{DS}$ is rising from 0 to 80% V$_{(BR)DSS}$.

I. C$_{o(tr)}$ is a fixed capacitance that gives the same charging time as C$_{oss}$ while V$_{DS}$ is rising from 0 to 80% V$_{(BR)DSS}$.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Figure 1: On-Region Characteristics
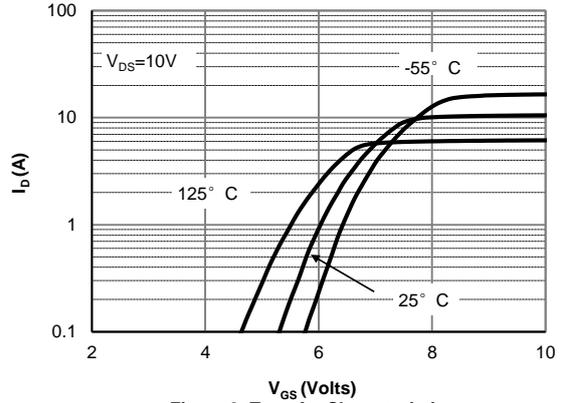
Figure 2: Transfer Characteristics
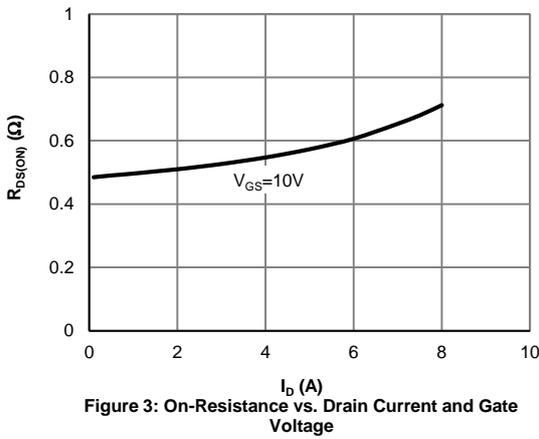
Figure 3: On-Resistance vs. Drain Current and Gate Voltage
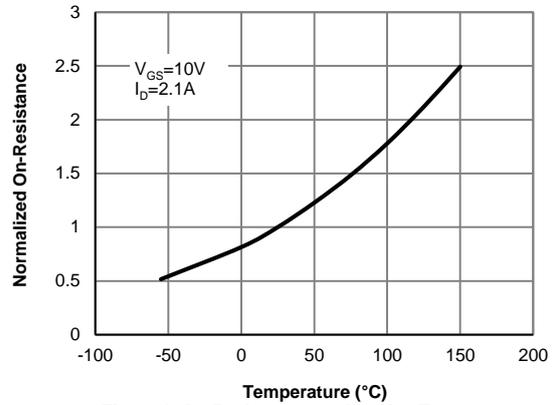
Figure 4: On-Resistance vs. Junction Temperature
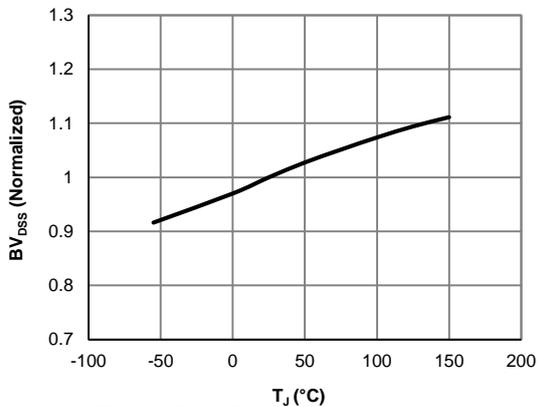
Figure 5: Break Down vs. Junction Temparature
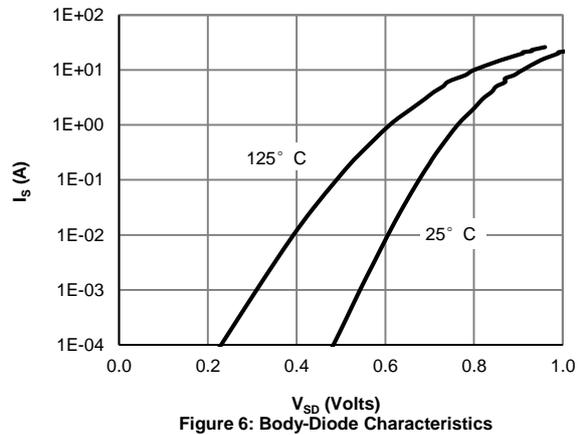
Figure 6: Body-Diode Characteristics

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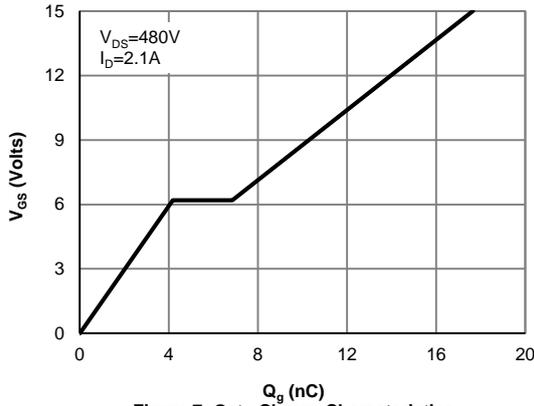
V_{DS}=480V
I_D=2.1A
Figure 7: Gate-Charge Characteristics
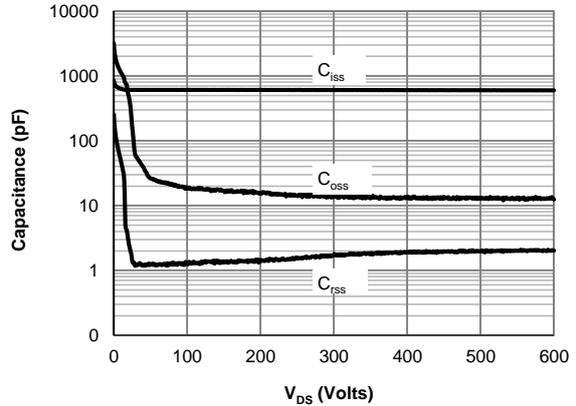
C_{iss}
C_{oss}
C_{rss}
Figure 8: Capacitance Characteristics
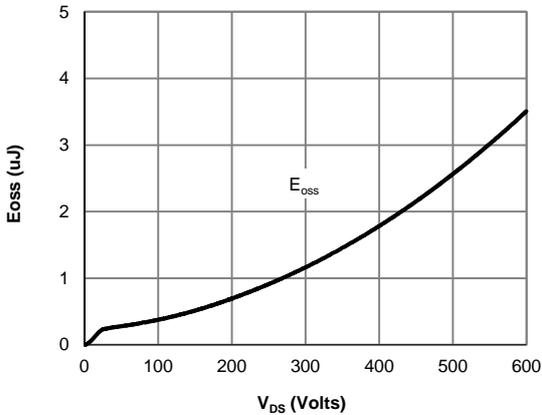
E_{oss}
Figure 9: Coss stored Energy
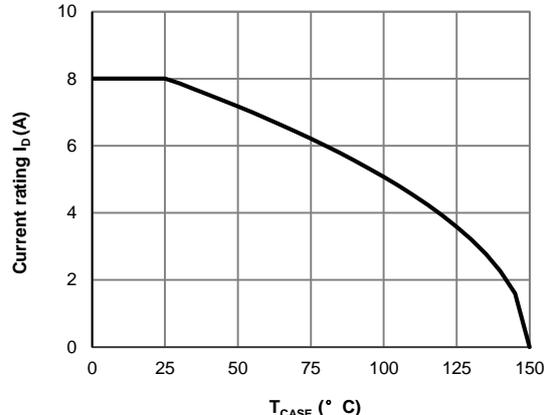
Figure 10: Current De-rating (Note F)
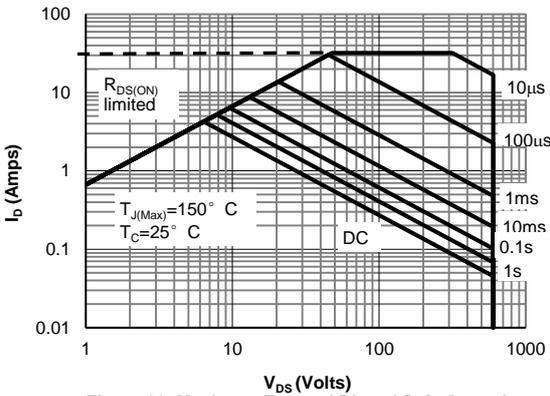
$R_{DS(ON)}$ limited
$T_{J(Max)}$=150°C
T_C=25°C
10μs
100μs
1ms
10ms
0.1s
1s
DC
Figure 11: Maximum Forward Biased Safe Operating Area for AOTF600A60L (Note F)
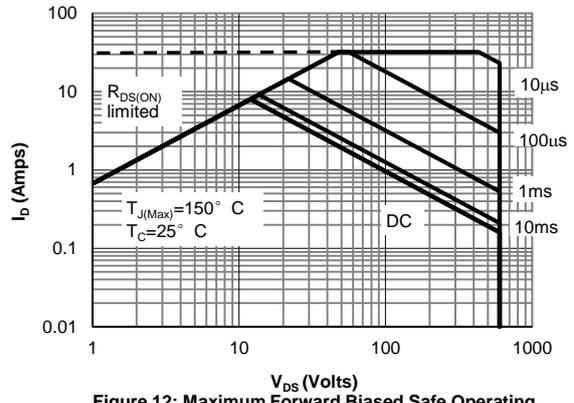
$R_{DS(ON)}$ limited
$T_{J(Max)}$=150°C
T_C=25°C
10μs
100μs
1ms
10ms
DC
Figure 12: Maximum Forward Biased Safe Operating Area for AOT(B)600A60L (Note F)

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## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
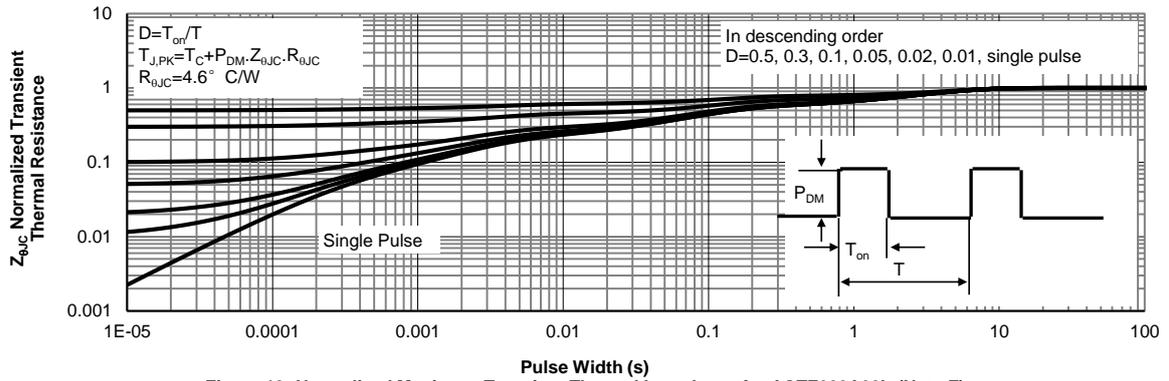
Figure 13: Normalized Maximum Transient Thermal Impedance for AOTF600A60L (Note F)
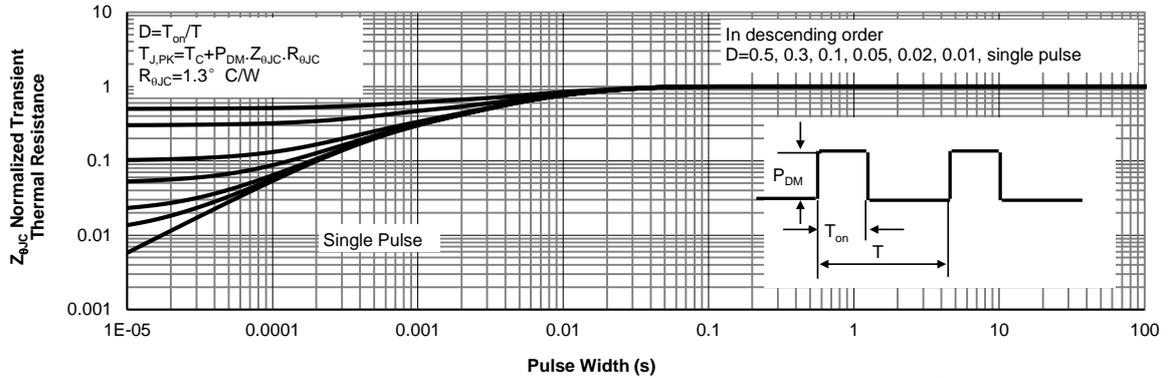
Figure 14: Normalized Maximum Transient Thermal Impedance for AOT(B)600A60L (Note F)

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Gate Charge Test Circuit & Waveform
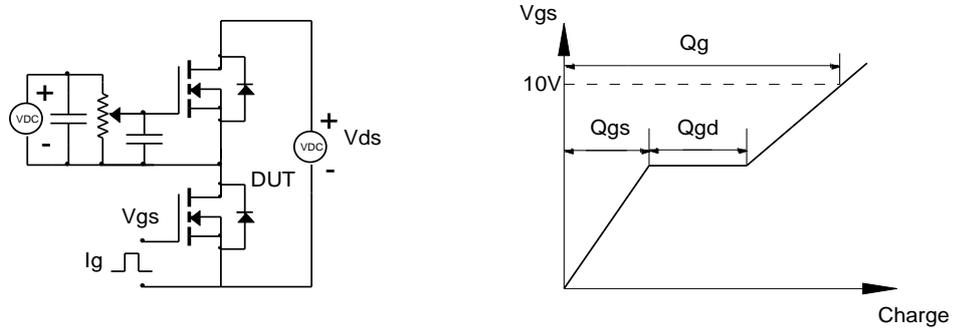
Resistive Switching Test Circuit & Waveforms
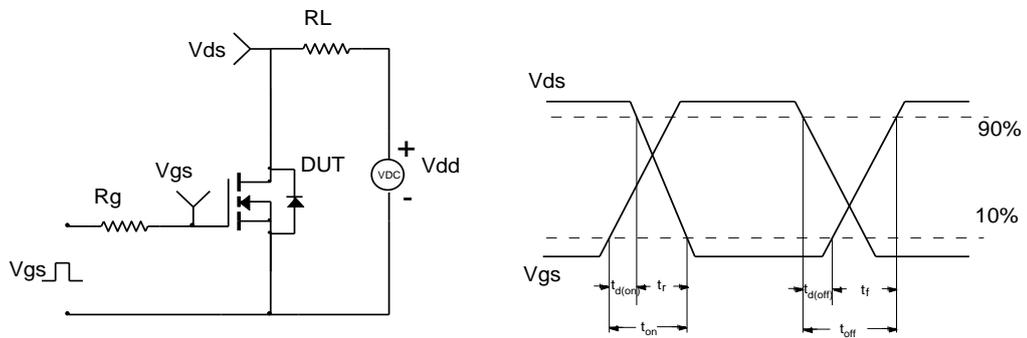
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

$$E_{AR} = 1/2 \, LI_{AR}^2$$
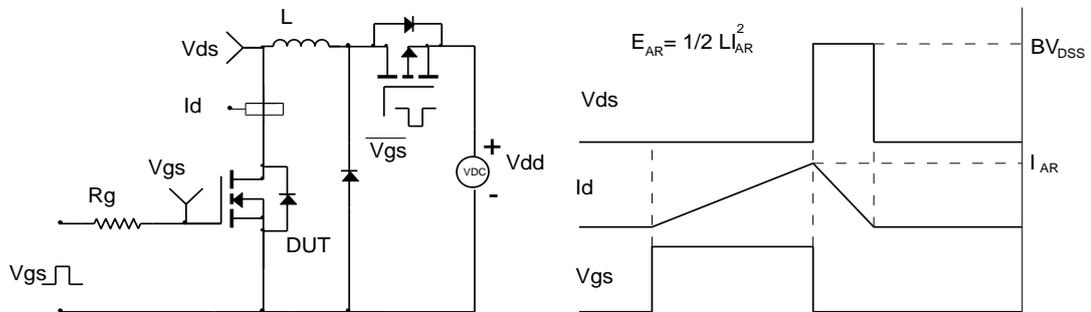
Diode Recovery Test Circuit & Waveforms

$$Q_{rr} = -\int I dt$$