

## N-Channel 190-V (D-S) MOSFET with 190-V Diode

PRODUCT SUMMARY			
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A) <sup>a</sup>	Q <sub>g</sub> (Typ.)
190	3.8 at V <sub>GS</sub> = 4.5 V	0.95	1.4 nC
	4.2 at V <sub>GS</sub> = 2.5 V	0.9	
	17 at V <sub>GS</sub> = 1.8 V	0.3	

DIODE PRODUCT SUMMARY		
V <sub>KA</sub> (V)	V <sub>f</sub> (V) Diode Forward Voltage	I <sub>F</sub> (A) <sup>a</sup>
190	1.2 at 0.5 A	0.95

## FEATURES

- Halogen-free According to IEC 61249-2-21
- LITTLE FOOT<sup>®</sup> Plus Schottky Power MOSFET
- New Thermally Enhanced PowerPAK<sup>®</sup> SC-70 Package
  - Small Footprint Area
  - Low On-Resistance
  - Thin 0.75 mm profile

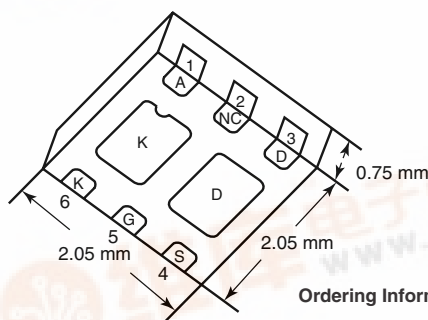


**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

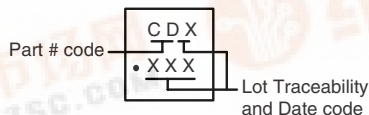
## APPLICATIONS

- DC/DC Converter for Portable Devices
- Load Switch for Portable Devices

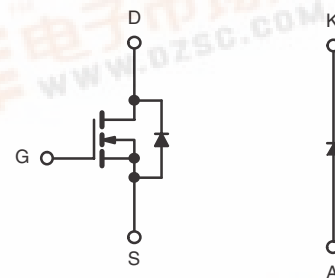
PowerPAK SC-70-6 Dual



Marking Code



Ordering Information: SiA850DJ-T1-GE3 (Lead (Pb)-free and Halogen-free)



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS T<sub>A</sub> = 25 °C, unless otherwise noted

Parameter	Symbol	Limit	Unit
Drain-Source Voltage (MOSFET)	V <sub>DS</sub>	190	V
Reverse Voltage (Diode)	V <sub>KA</sub>	190	
Gate-Source Voltage (MOSFET)	V <sub>GS</sub>	± 16	
Continuous Drain Current (T <sub>J</sub> = 150 °C) (MOSFET)	I <sub>D</sub>	T <sub>C</sub> = 25 °C	0.95
		T <sub>C</sub> = 70 °C	0.76
		T <sub>A</sub> = 25 °C	0.47 <sup>b, c</sup>
		T <sub>A</sub> = 70 °C	0.38 <sup>b, c</sup>
Pulsed Drain Current (MOSFET)	I <sub>DM</sub>	1	A
Continuous Source-Drain Diode Current (MOSFET Diode Conduction)	I <sub>S</sub>	T <sub>C</sub> = 25 °C	
		T <sub>A</sub> = 25 °C	0.47 <sup>b, c</sup>
Average Forward Current (Diode)	I <sub>F</sub>	0.95	A
Pulsed Forward Current (Diode)	I <sub>FM</sub>	2	
Maximum Power Dissipation (MOSFET)	P <sub>D</sub>	T <sub>C</sub> = 25 °C	
		T <sub>C</sub> = 70 °C	5
		T <sub>A</sub> = 25 °C	1.9 <sup>b, c</sup>
		T <sub>A</sub> = 70 °C	1.2 <sup>b, c</sup>
Maximum Power Dissipation (Diode)	P <sub>D</sub>	T <sub>C</sub> = 25 °C	7.8
		T <sub>C</sub> = 70 °C	5
		T <sub>A</sub> = 25 °C	1.9 <sup>b, c</sup>
		T <sub>A</sub> = 70 °C	1.2 <sup>b, c</sup>
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150	°C
Soldering Recommendations (Peak Temperature) <sup>d, e</sup>		260	

THERMAL RESISTANCE RATINGS					
Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient (MOSFET) <sup>b, f</sup>	$t \leq 5$ s	$R_{thJA}$	52	65	°C/W
Maximum Junction-to-Case (Drain) (MOSFET)	Steady State	$R_{thJC}$	12.5	16	
Maximum Junction-to-Ambient (Diode) <sup>b, f</sup>	$t \leq 5$ s	$R_{thJA}$	52	65	
Maximum Junction-to-Case (Drain) (Diode)	Steady State	$R_{thJC}$	12.5	16	

Notes:

a.  $T_C = 25$  °C.

b. Surface Mounted on 1" x 1" FR4 board.

c.  $t = 5$  s.d. See Solder Profile ([www.vishay.com/ppg?73257](http://www.vishay.com/ppg?73257)). The PowerPAK SC-70 is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.

e. Rework Conditions: manual soldering with a soldering iron is not recommended for leadless components.

f. Maximum under Steady State conditions is 110 °C/W.

SPECIFICATIONS $T_J = 25$ °C, unless otherwise noted							
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit	
<b>Static</b>							
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0$ V, $I_D = 250$ $\mu$ A	190			V	
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250$ $\mu$ A		200		mV/°C	
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			-3.0			
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = 250$ $\mu$ A	0.6		1.4	V	
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0$ V, $V_{GS} = \pm 16$ V			$\pm 100$	nA	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 190$ V, $V_{GS} = 0$ V			1	$\mu$ A	
		$V_{DS} = 190$ V, $V_{GS} = 0$ V, $T_J = 85$ °C			10		
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 5$ V, $V_{GS} = 4.5$ V	1			A	
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 4.5$ V, $I_D = 0.36$ A		3.0	3.8	$\Omega$	
		$V_{GS} = 2.5$ V, $I_D = 0.35$ A		3.2	4.2		
		$V_{GS} = 1.8$ V, $I_D = 0.15$ A		3.5	17.0		
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 15$ V, $I_D = 0.36$ A		2		S	
<b>Dynamic<sup>b</sup></b>							
Input Capacitance	$C_{iss}$	$V_{DS} = 100$ V, $V_{GS} = 0$ V, $f = 1$ MHz		90		pF	
Output Capacitance	$C_{oss}$			5			
Reverse Transfer Capacitance	$C_{rss}$			3			
Total Gate Charge	$Q_g$	$V_{DS} = 95$ V, $V_{GS} = 10$ V, $I_D = 0.47$ A		3	4.5	nC	
Gate-Source Charge	$Q_{gs}$	$V_{DS} = 95$ V, $V_{GS} = 4.5$ V, $I_D = 0.47$ A		1.4	2.1		
Gate-Drain Charge	$Q_{gd}$			0.25			
Gate Resistance	$R_g$			0.40			
Turn-On Delay Time	$t_{d(on)}$	$f = 1$ MHz		2.3		$\Omega$	
Rise Time	$t_r$		$V_{DD} = 95$ V, $R_L = 250$ $\Omega$ $I_D \cong 0.38$ A, $V_{GEN} = 4.5$ V, $R_g = 1$ $\Omega$		10	15	ns
Turn-Off DelayTime	$t_{d(off)}$				15	25	
Fall Time	$t_f$				25	40	
Turn-On Delay Time	$t_{d(on)}$			15	25		
Rise Time	$t_r$	$V_{DD} = 95$ V, $R_L = 250$ $\Omega$ $I_D \cong 0.38$ A, $V_{GEN} = 10$ V, $R_g = 1$ $\Omega$			3	10	
Turn-Off DelayTime	$t_{d(off)}$				12	20	
Fall Time	$t_f$			10	15		
				10	15		



<b>SPECIFICATIONS</b> $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$			0.95	A
Pulse Diode Forward Current	$I_{SM}$				1	
Body Diode Voltage	$V_{SD}$	$I_S = 0.5\text{ A}, V_{GS} = 0\text{ V}$		0.8	1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = 0.5\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		45	70	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			45	70	nC
Reverse Recovery Fall Time	$t_a$			21		ns
Reverse Recovery Rise Time	$t_b$			24		

## Notes:

- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
 b. Guaranteed by design, not subject to production testing.

<b>DIODE SPECIFICATIONS</b> $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Forward Voltage Drop	$V_F$	$I_F = 0.5\text{ A}$		0.82	1.2	V
		$I_F = 0.5\text{ A}, T_J = 125\text{ }^\circ\text{C}$		0.7	1.0	
Maximum Reverse Leakage Current	$I_{rm}$	$V_R = 190\text{ V}$			1	$\mu\text{A}$
		$V_R = 190\text{ V}, T_J = 85\text{ }^\circ\text{C}$			10	
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = 0.5\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		45	70	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			45	70	nC
Reverse Recovery Fall Time	$t_a$			21		ns
Reverse Recovery Rise Time	$t_b$			24		

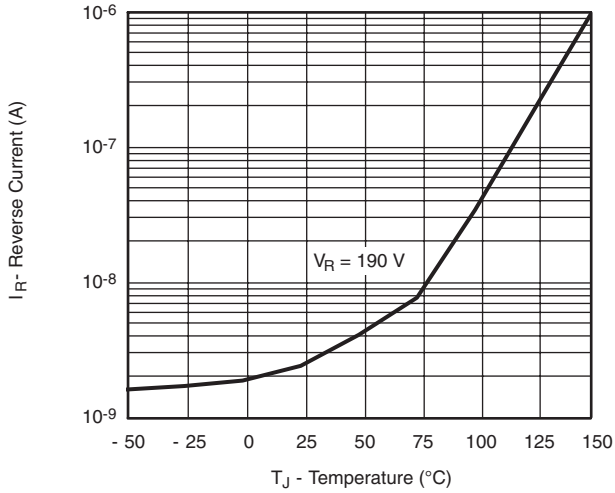
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

# SiA850DJ

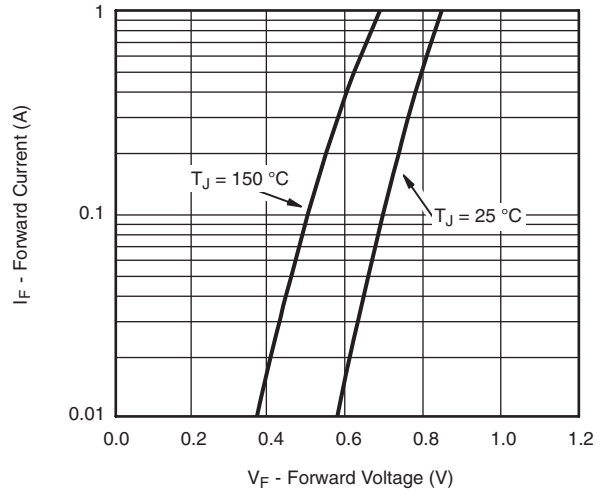


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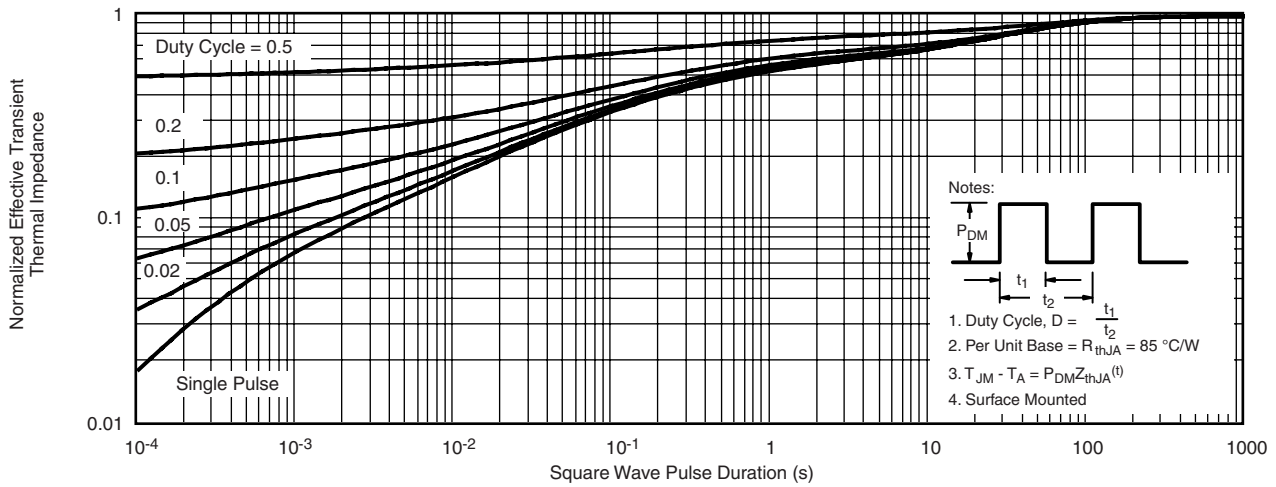
## DIODE TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



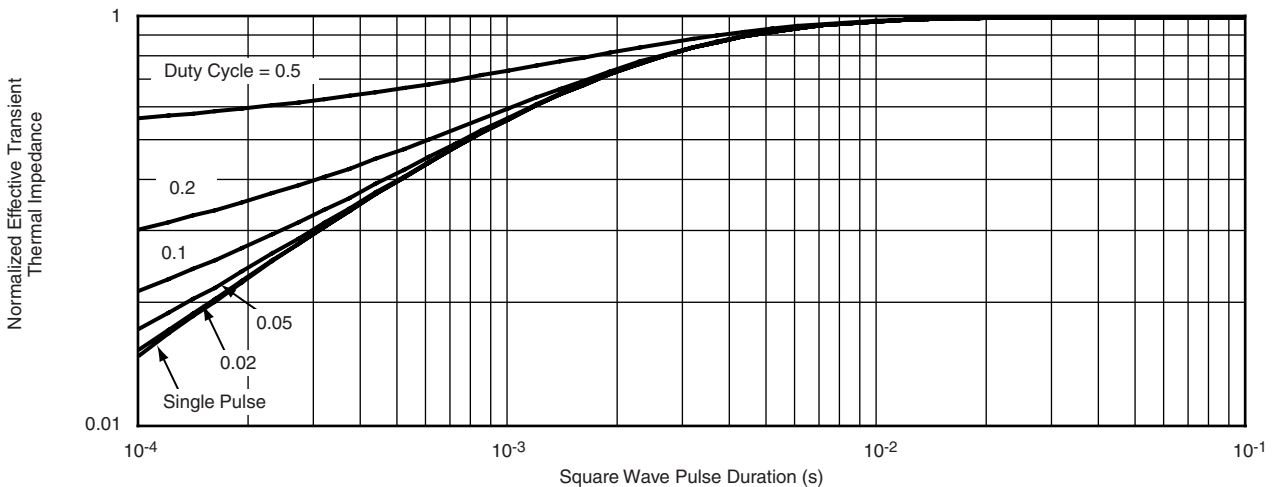
Reverse Current vs. Junction Temperature



Forward Diode Voltage

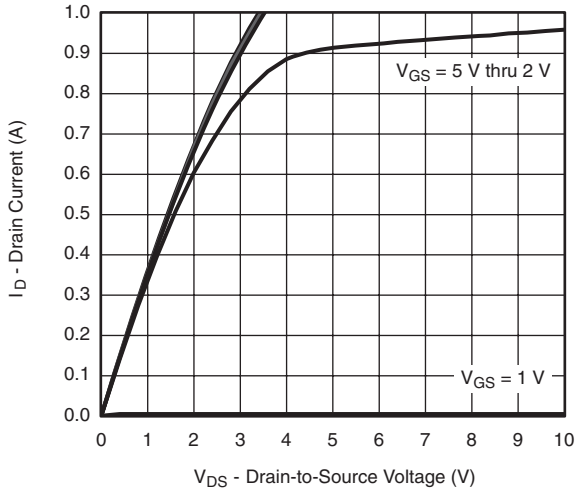


Normalized Thermal Transient Impedance, Junction-to-Ambient

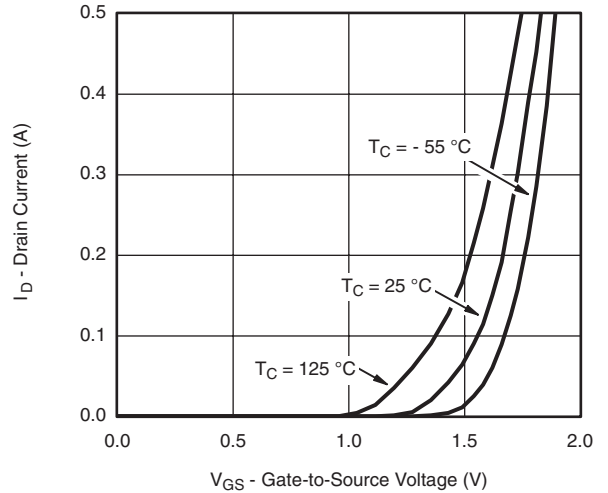


Normalized Thermal Transient Impedance, Junction-to-Case

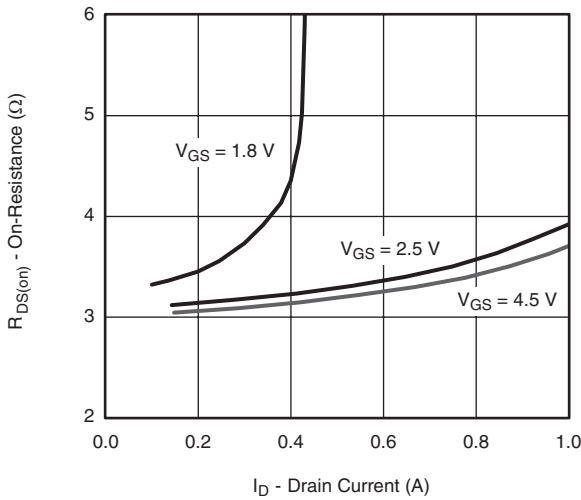
**MOSFET TYPICAL CHARACTERISTICS**  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



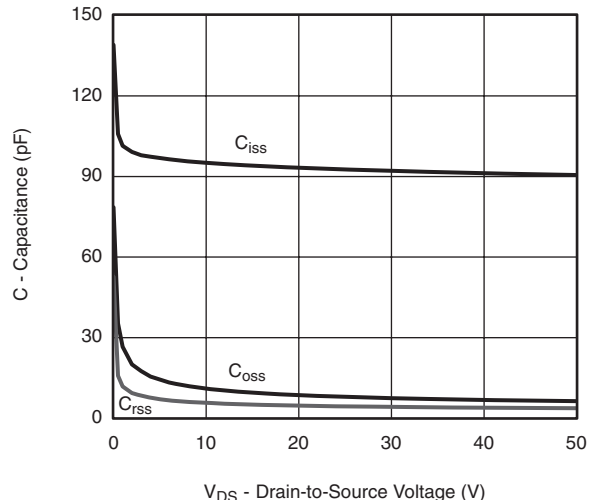
**Output Characteristics**



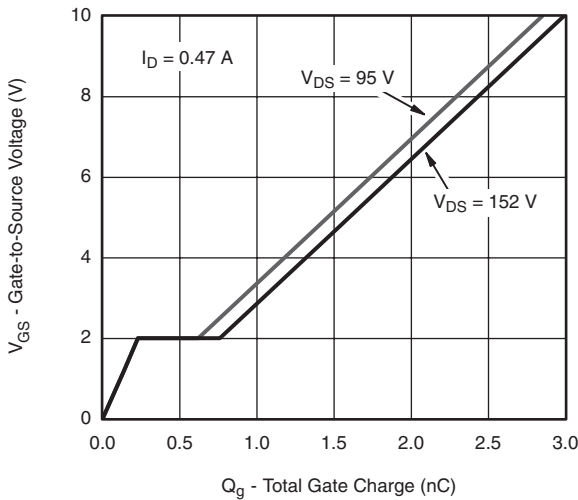
**Transfer Characteristics**



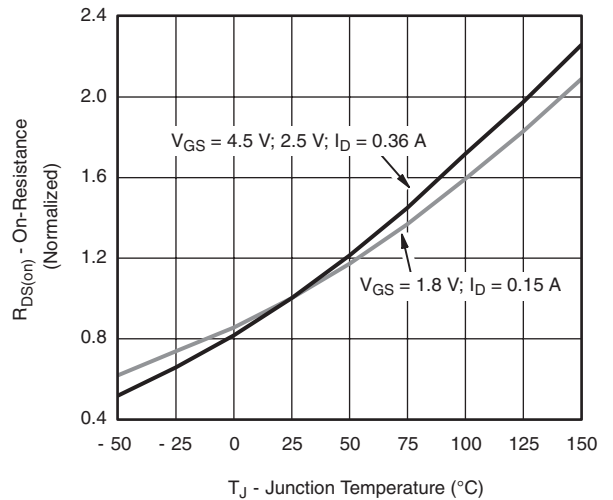
**On-Resistance vs. Drain Current**



**Capacitance**



**Gate Charge**



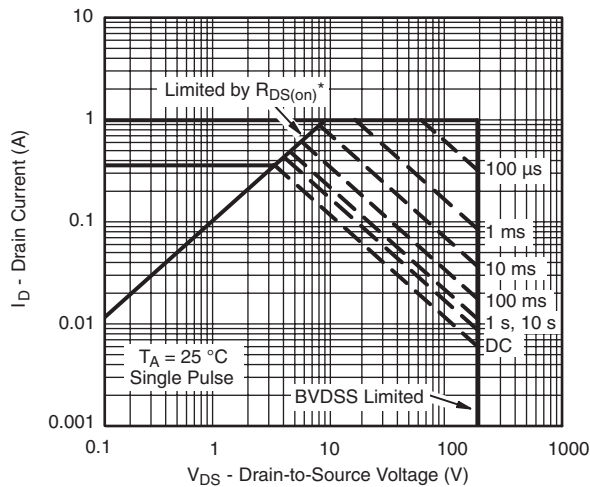
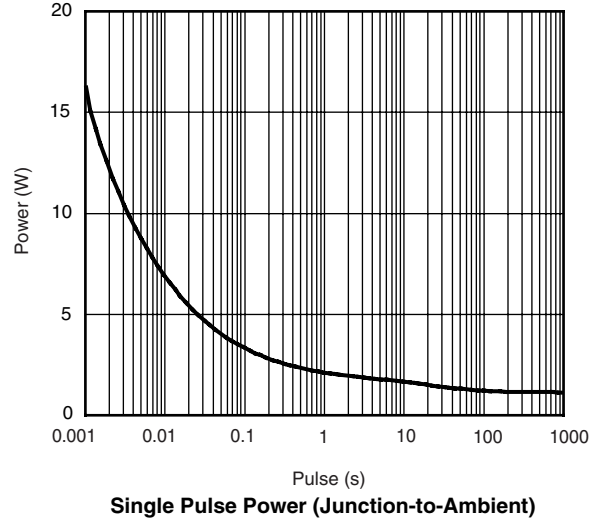
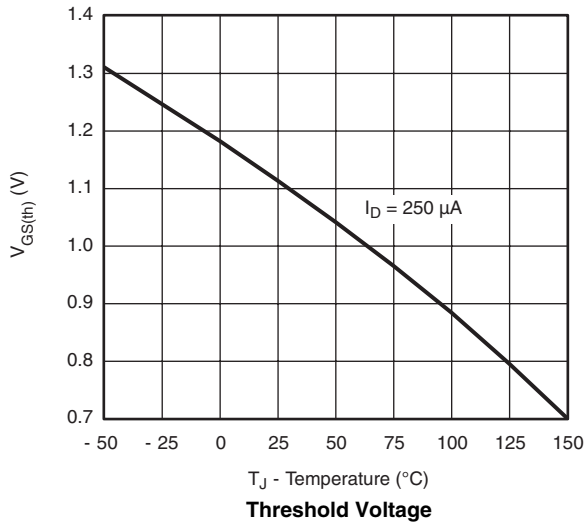
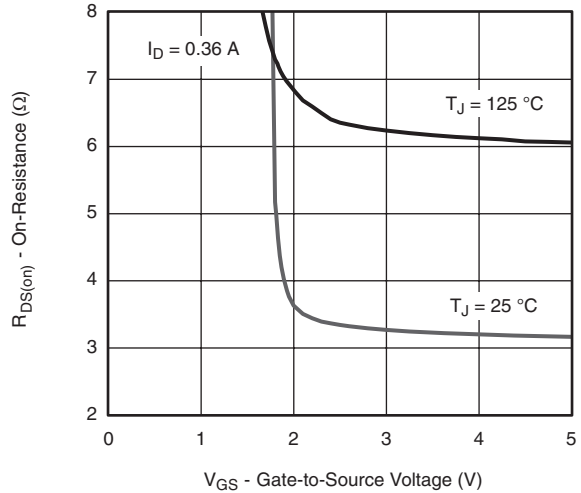
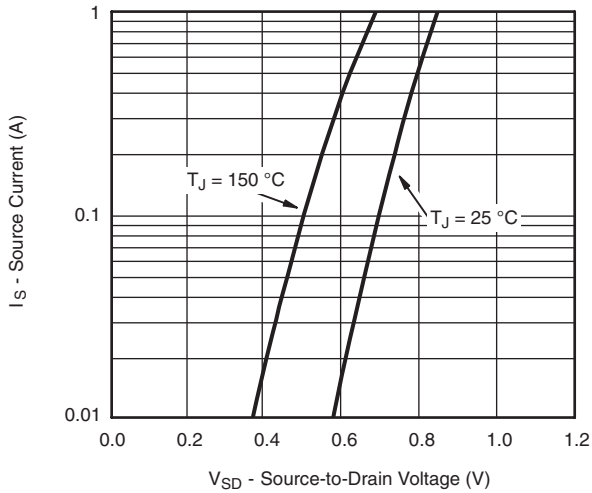
**On-Resistance vs. Junction Temperature**

# SiA850DJ



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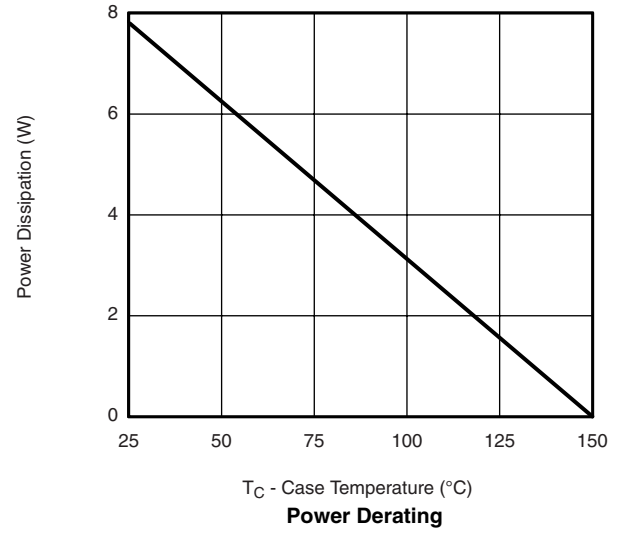
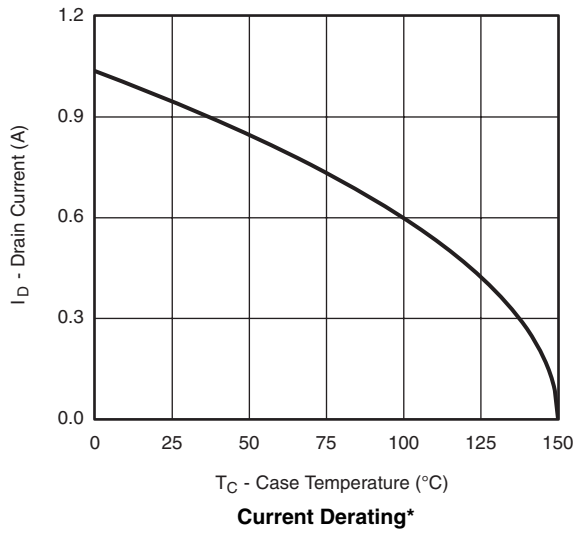
## MOSFET TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified



**MOSFET TYPICAL CHARACTERISTICS**  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



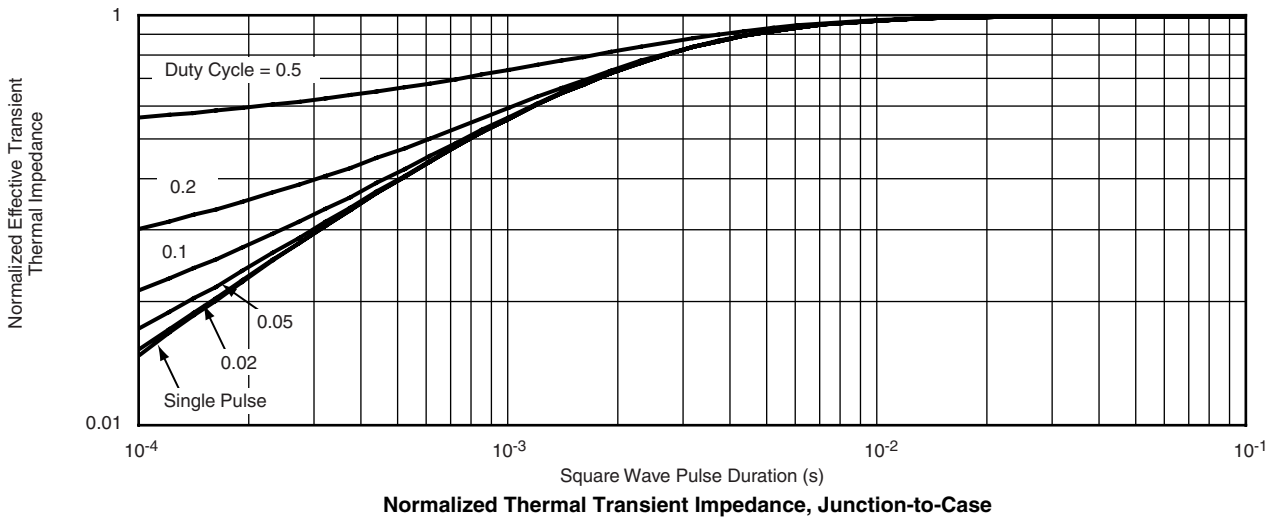
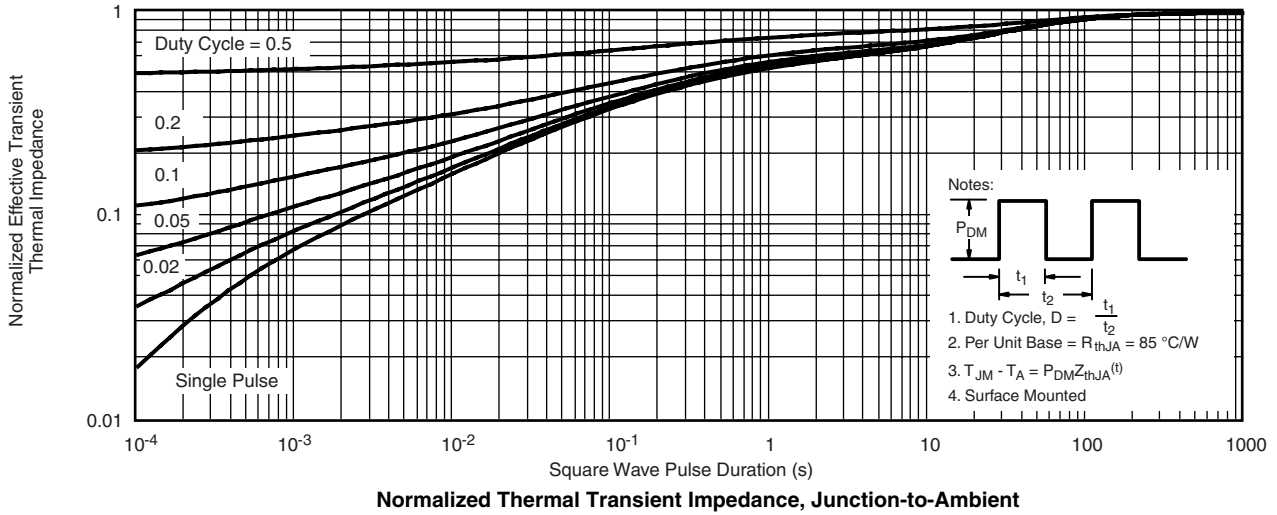
\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150\text{ }^\circ\text{C}$ , using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

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## MOSFET TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



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