

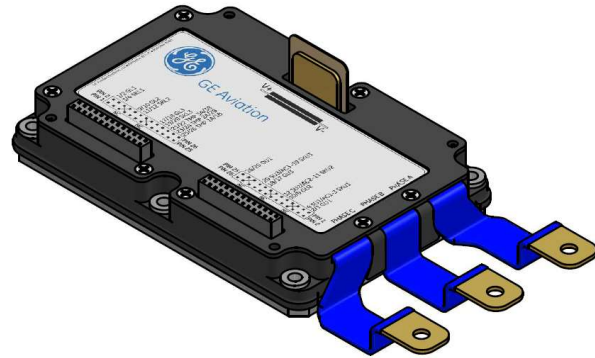


# 1700V 6-pack (3 Phase ) Silicon Carbide Power Module

## GE17045EEA3

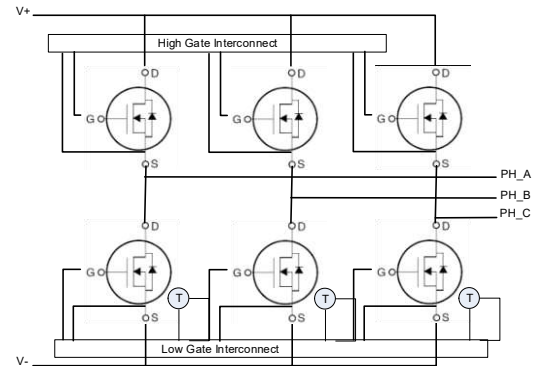
$V_{DS}$ : 1700 V  $I_{DS}$ : 425 A

Superior performance for high power, high frequency applications needing best-in-class power density



## Features

- Highly reliable GE SiC MOSFET devices
- Low  $R_{DS(ON)}$  (3.75 m $\Omega$ ) (device only)
- Low stray inductance
- Ultra-low switching losses over entire operating range
- Body diode with minimal reverse recovery
- Integrated temperature sensing
- Dedicated DESAT Pin and Source-Kelvin Pin
- AlSiC Baseplate and Si<sub>3</sub>N<sub>4</sub> AMB Substrate



### MOSFET DC Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

Symbols	Parameters	Min.	Typ.	Max.	Unit	Test Conditions	Notes
$I_{DS}$	Continuous Drain Current			425		$V_{GS} = 20\text{ V}, T_c = 25^\circ\text{C}$	Per Switch
				300	A	$V_{GS} = 20\text{ V}, T_c = 100^\circ\text{C}$	
				245		$V_{GS} = 20\text{ V}, T_c = 125^\circ\text{C}$	
$I_{DS,pulse}$	Pulsed Drain Current			850	A	$T_c = 25^\circ\text{C}, t_p = 1\text{ ms}$	
$V_{DSmax}$	Drain - Source Breakdown Voltage	1700			V	$V_{GS} = 0\text{ V}, I_{DS} = 100\ \mu\text{A}$	
$V_{GSmax}$	Maximum Gate - Source Voltage			-15/+23	V	$V_{DS} = 0\text{ V}$	
$V_{GSop}$	Recommended Gate - Source Voltage		-5/+20		V		
$T_{Jmax}$	Junction Temperature			175	$^\circ\text{C}$		
$T_c$	Case Temperature Range	-55		150	$^\circ\text{C}$		
$T_{STG}$	Storage Temperature Range	-55		150	$^\circ\text{C}$		
$P_D$	Power Dissipation			1250	W	$T_c = 25^\circ\text{C}$	



(Continued) **MOSFET DC Characteristics @  $T_J = 25^\circ\text{C}$**  (unless otherwise specified)

Symbols	Parameters	Min.	Typ.	Max.	Unit	Test Conditions	Notes
$I_{DS}$	Continuous Drain Current			425	A	$V_{GS} = 20\text{ V}, T_c = 25^\circ\text{C}$	Per Switch
$V_{GS(th)}$	Gate Threshold Voltage	2.5	2.9	4.5	V	$V_{GS} = V_{DS}, I_{DS} = 160\text{ mA}$	
$I_{DSS}$	Drain Leakage Current			0.10 1.6	mA	$V_{DS} = 1700\text{ V}, V_{GS} = 0\text{ V}, T_J = 25^\circ\text{C}$ $T_J = 175^\circ\text{C}$	
$I_{GSS}$	Gate-Source Leakage Current			160	nA	$V_{GS} = -15/+23\text{ V}$	
$R_{DS(on)}$	On State Resistance (Device Only)		3.75 6.70	4.45 8.25	m $\Omega$	$V_{GS} = 20\text{ V}, I_{DS} = 425\text{ A}, T_J = 25^\circ\text{C}$ $T_J = 175^\circ\text{C}$	Per Switch
$R_{G(int)}$	Gate-Source Series Resistance		1.4		$\Omega$	$V_{GS} = 0\text{ V}, f = 100\text{ kHz}, T_c = 25^\circ\text{C}$	

**MOSFET Dynamic Characteristics per switch @  $T_J = 25^\circ\text{C}$**  (unless otherwise specified)

Symbols	Parameters	Min.	Typ.	Max.	Unit	Test Conditions	Notes
$C_{iss}$	Input Capacitance		29.10		nF		
$C_{oss}$	Output Capacitance		1.08		nF	$V_{GS} = 0\text{ V}$ $V_{DS} = 900\text{ V}$	
$C_{rss}$	Reverse Transfer Capacitance		0.08		nF	$f = 100\text{ kHz}$	
$E_{on}$	Turn-On Switching Energy		9.1		mJ		
$E_{off}$	Turn-Off Switching Energy		8.6		mJ	$V_{GS} = -8\text{ V to } +20\text{ V}$ $V_{DS} = 900\text{ V}$	
$t_r$	Rise Time		28		ns	$I_{DS} = 425\text{ A}$	
$t_f$	Fall Time		36		ns	$R_{Gon} = R_{Goff} = 1.0\ \Omega$	
$Q_G$	Total Gate Charge		1207		nC	$V_{GS} = 0\text{ to } 18\text{ V}$	
$Q_{GD}$	Gate-Drain Charge		525		nC	$V_{DS} = 900\text{ V}$	
$Q_{GS}$	Gate-Source Charge		186		nC	$I_{DS} = 240\text{ A}$	

**Body Diode Characteristics per switch @  $T_J = 25^\circ\text{C}$**  (unless otherwise specified)

Symbols	Parameters	Min.	Typ.	Max.	Unit	Test Conditions	Notes
$I_{SD}$	Pulsed body diode current			720	A	$V_{GS} = 0\text{ V}$	1.
$V_{SD}$	Diode Forward Voltage		4.65		V	$V_{GS} = 0\text{ V}, I_{SD} = 425\text{ A}, T_J = 25^\circ\text{C}$	

1. Use of body diode is recommended in pulse mode only

**Thermal Characteristics**

Symbols	Parameters	Min.	Typ.	Max.	Unit	Test Conditions	Notes
$R_{th}$	Thermal Resistance Junction-to-Case		0.10	0.12	$^\circ\text{C/W}$	JESD51-14	Per Switch



## Temperature Sensor Characteristics

Symbols	Parameters	Min.	Typ.	Max.	Unit	Test Conditions	Notes
$R_{RTD}$	Rated Resistance of RTD		1k		ohm		2.
	Tolerance of Resistance		0.12		%		
	Accuracy		0.3		°C		
	Measuring Current	100		300	μA		
TCR	Temperature Coefficient		3850		ppm/K		
	Operating Temperature	-70		+500	°C		
	Insulation Resistance		100		MOhm	20°C	

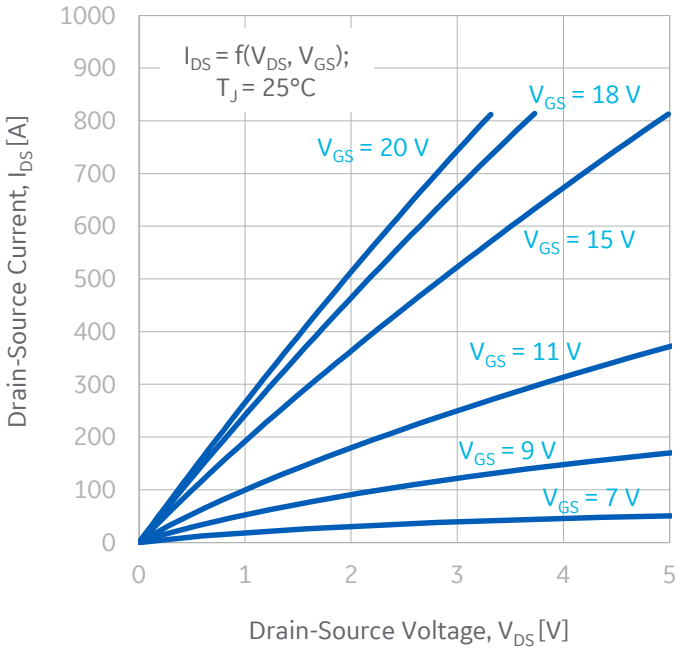
2. RTD is mounted directly over center-most die allowing direct reading of  $T_j$

## Module packaging data

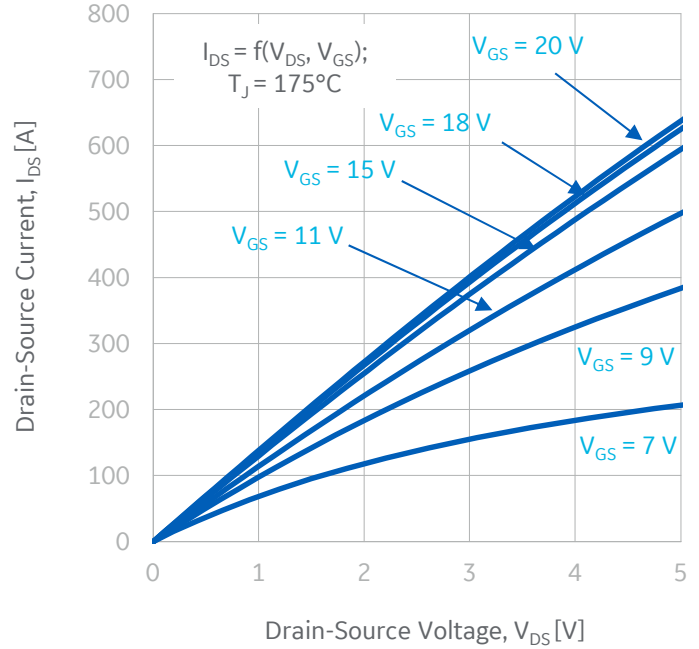
Symbols	Parameters	Min.	Typ.	Max.	Unit	Test Conditions	Notes	
$V_{Iso}$	Case Isolation Voltage	4			kV	AC 50 Hz, 1 min, 25°C		
CTI	Comparative Tracking Index		600					
$M_s$	Mounting Torque			5.0	N-m	Power Terminals		
				4.0		Baseplate		
$L_{V+/V-}$	Loop Inductance		4.0		nH			
	Module Mass		0.54		Kg			
	Clearance Distance		19		mm	Phase A to Phase B		
			19		mm	Phase B to Phase C		
				7		mm	V+ to V-	
				111		mm	V- to Phase A	
				36		mm	Phase B to Baseplate	
				25		mm	V+ to Baseplate	
	Creepage Distance		107		mm	Phase A to Phase B		
				113		mm	Phase B to Phase C	
				7		mm	V+ to V-	
				116		mm	V- to Phase A	
				70		mm	Phase B to Baseplate	
				31		mm	V+ to Baseplate	
$M_{BP}$	Base Plate Material		AlSiC					



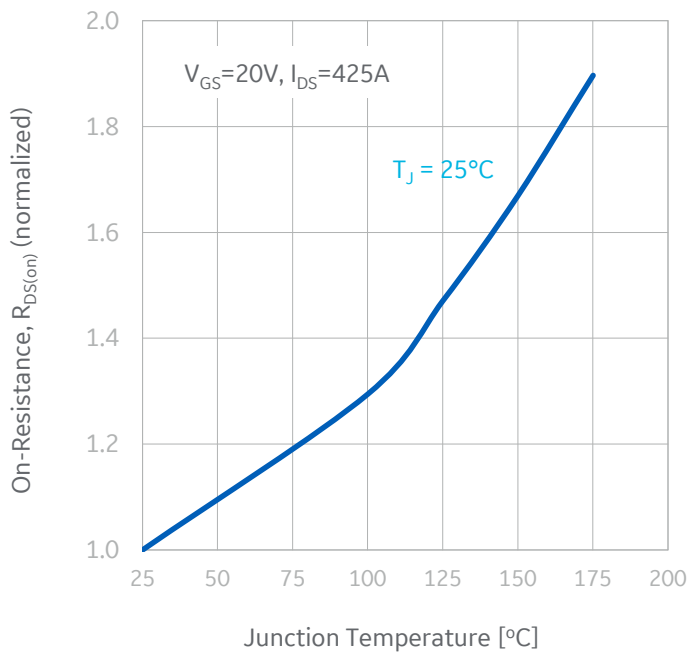
Typical performance: **GE17045EEA3**



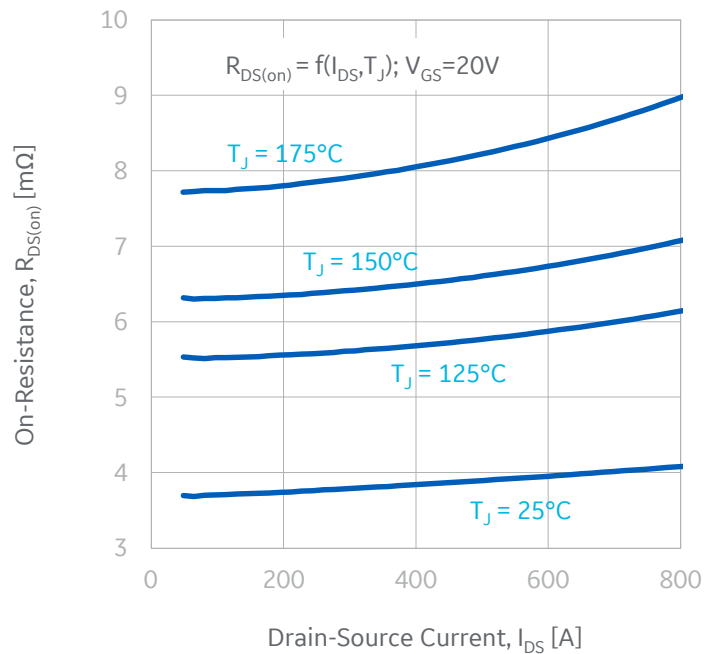
**Figure 1:** Output Characteristics (25°C)



**Figure 2:** Output Characteristics (175°C)



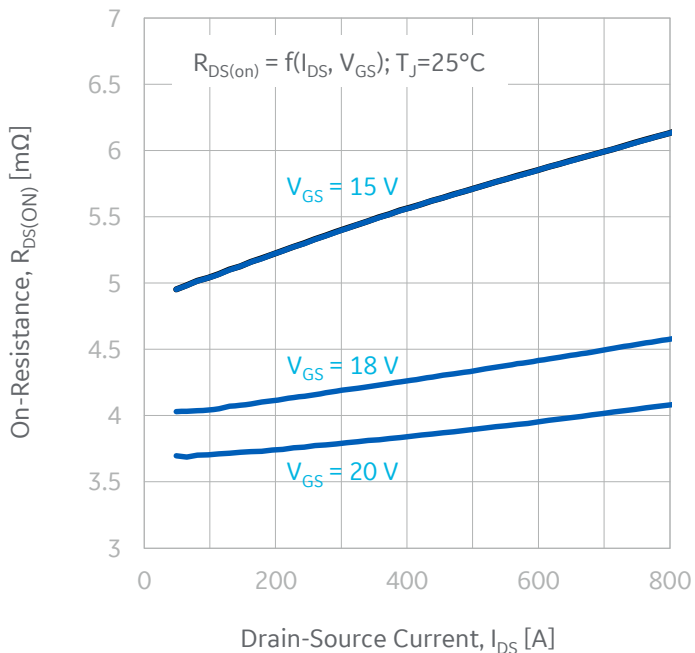
**Figure 3:** Normalized On-state Resistance vs. Temperature



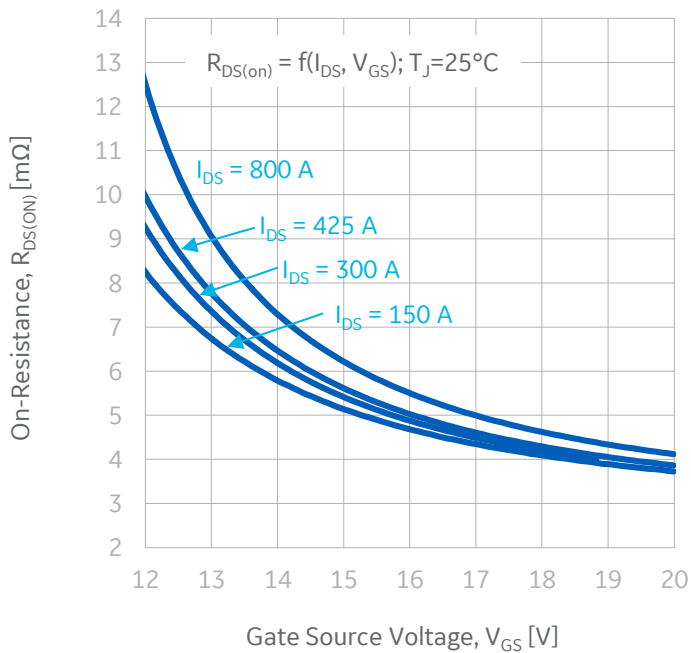
**Figure 4:** Module Drain-Source On-state Resistance



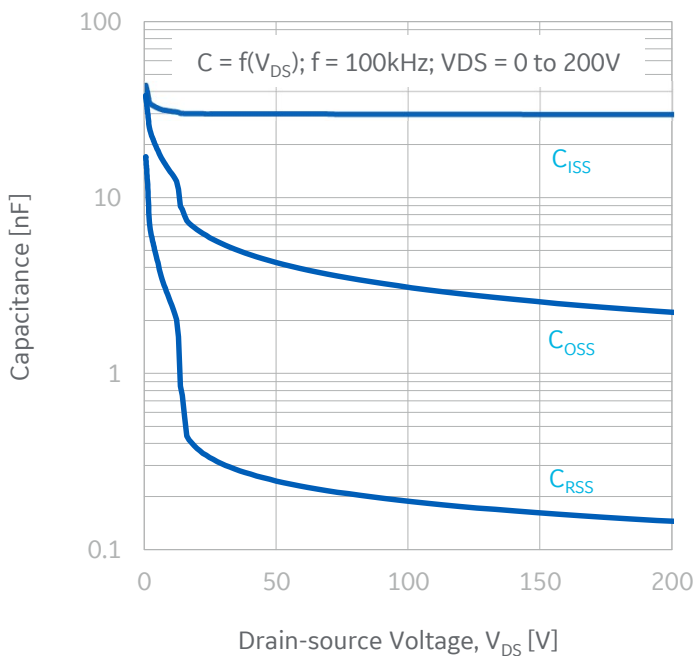
Typical performance: **GE17045EEA3**



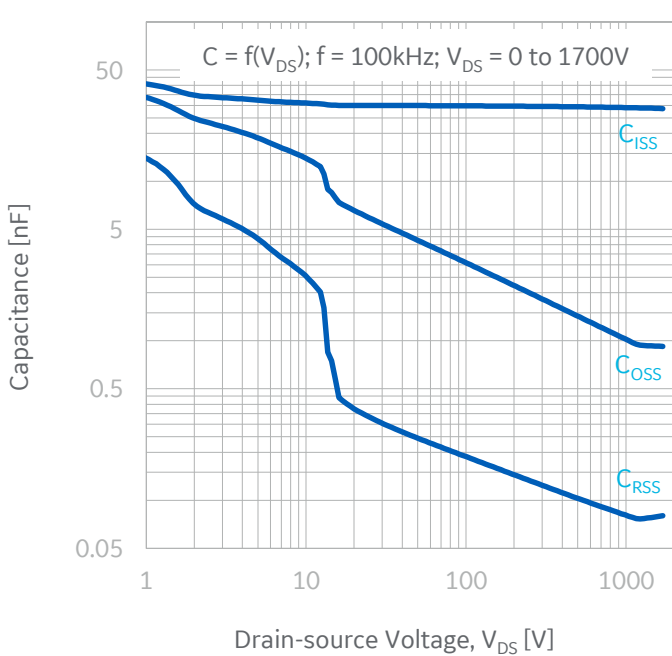
**Figure 5:** Module Drain-Source On-state Resistance



**Figure 6:** Drain-Source On-state Resistance vs. Gate Voltage



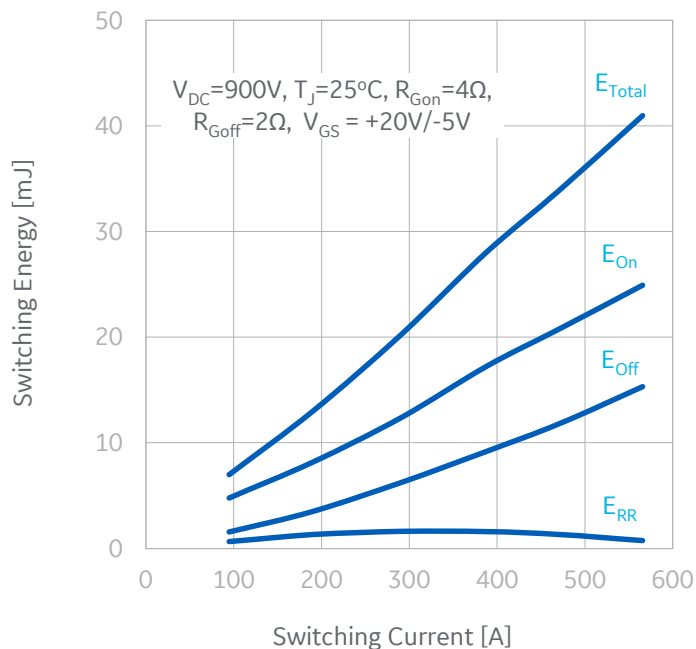
**Figure 7:** Junction Capacitances to 200 V



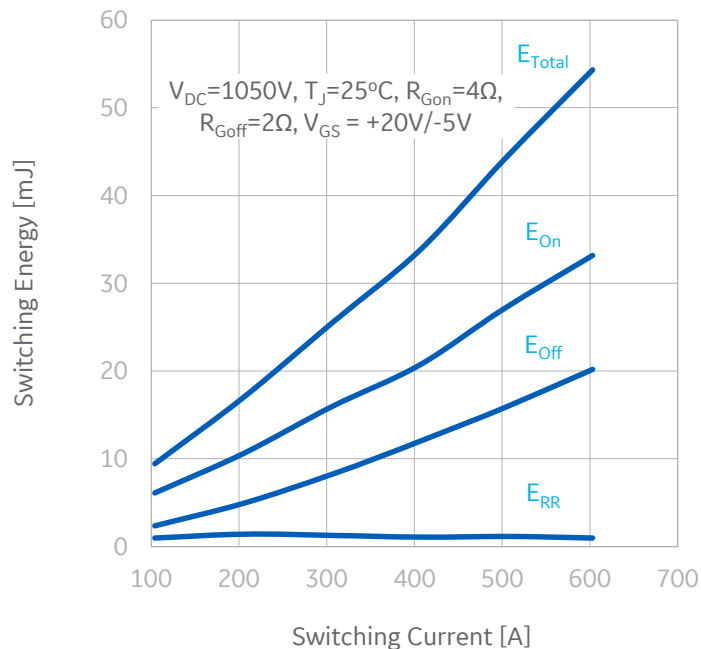
**Figure 8:** Junction Capacitances to 1700 V



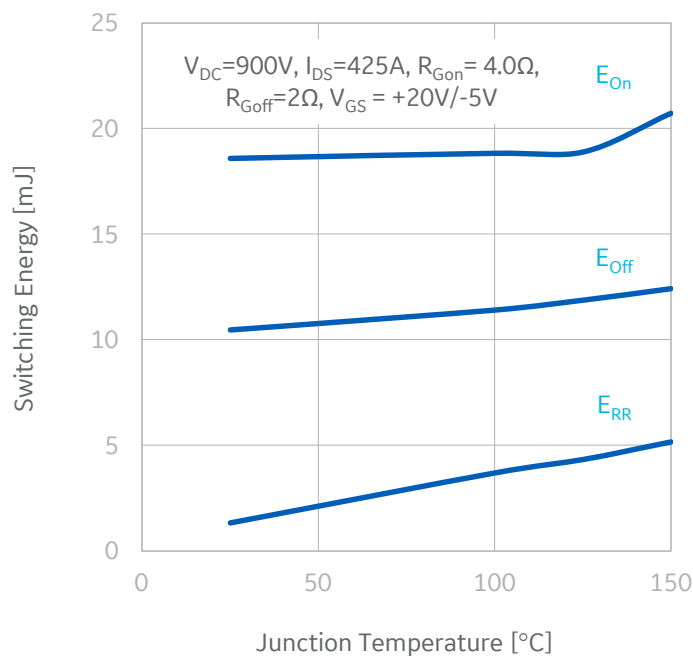
Typical performance: **GE17045EEA3**



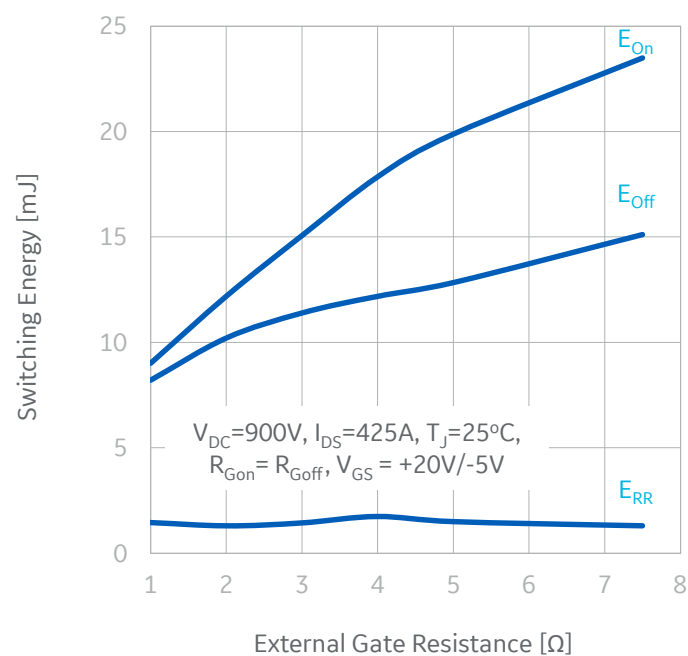
**Figure 9:** Switching Energy vs. Drain Current (900 V)



**Figure 10:** Switching Energy vs. Drain Current (1050 V)



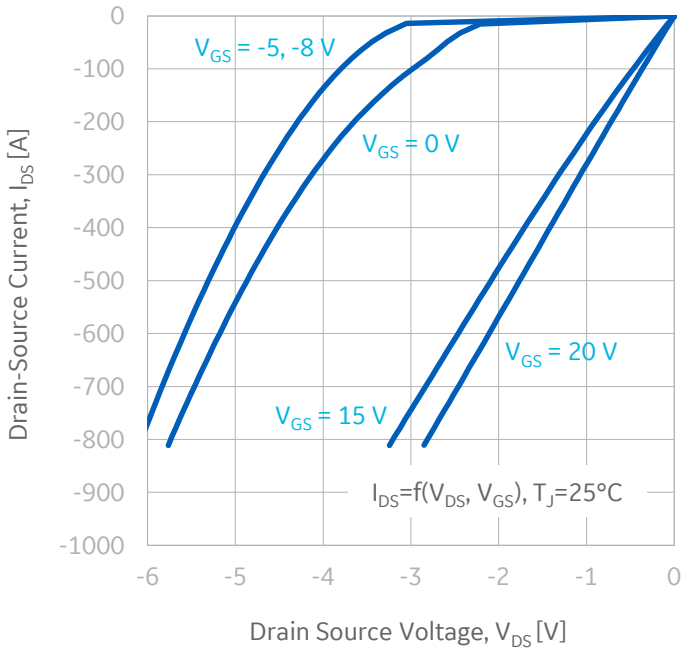
**Figure 11:** Switching Energy vs. Junction Temperature



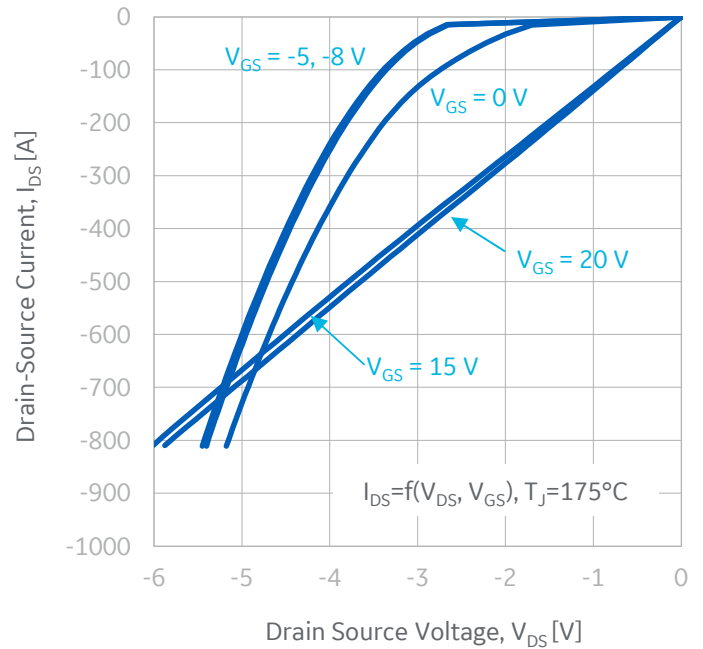
**Figure 12:** Switching Energy vs. Gate Resistance



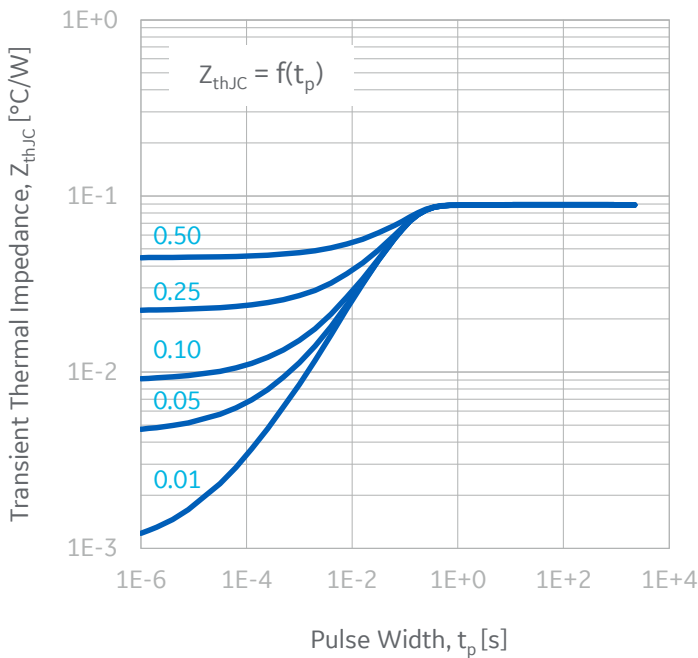
Typical performance: **GE17045EEA3**



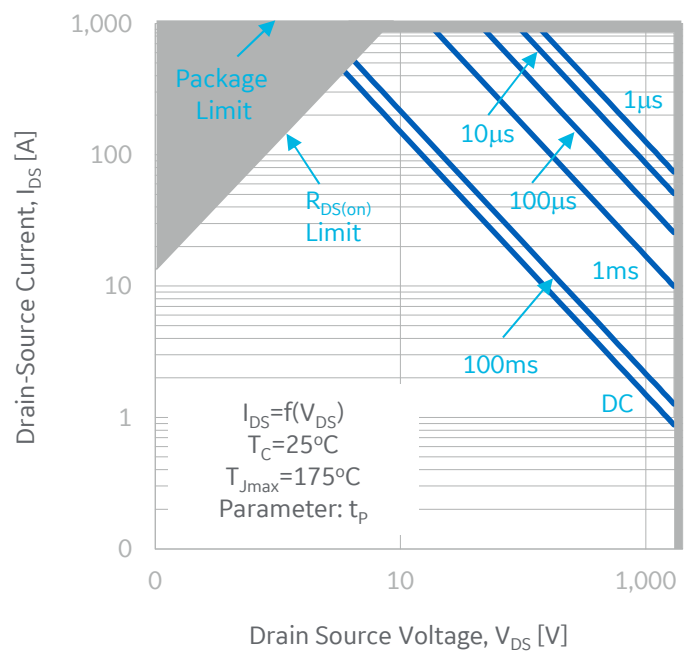
**Figure 13:** 3<sup>rd</sup> Quadrant Characteristics (25°C)



**Figure 14:** 3<sup>rd</sup> Quadrant Characteristics (175°C)



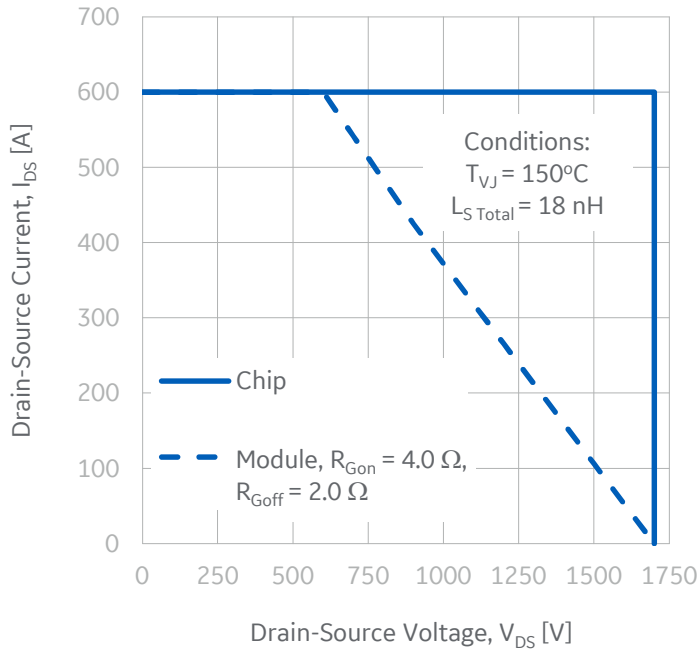
**Figure 15:** Transient Thermal Impedance



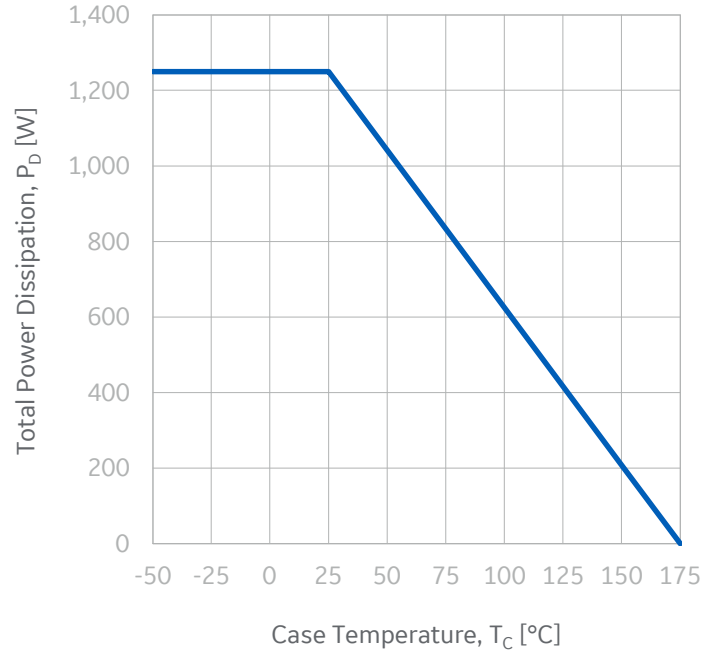
**Figure 16:** Forward-Bias Safe Operating Area



Typical performance: **GE17045EEA3**



**Figure 17:** Reverse-Bias Safe Operating Area



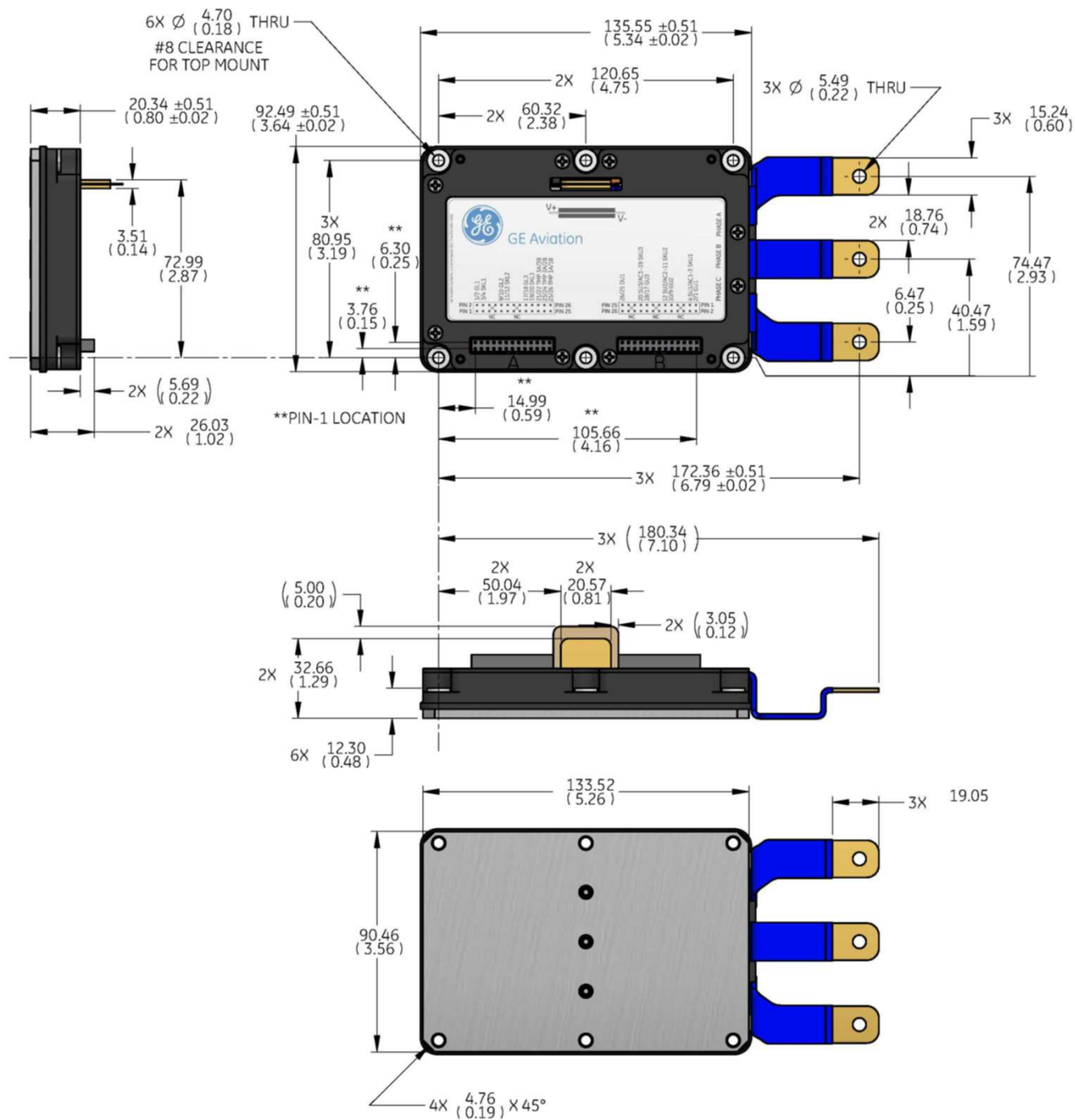
**Figure 18:** Maximum Power Dissipation vs. Case Temperature



# PRELIMINARY



## Module dimensions (millimeters)





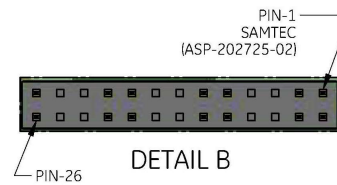
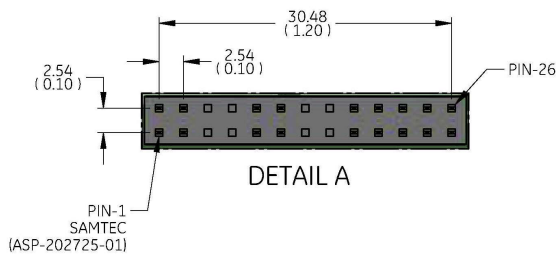
Electrical interface outline drawing

Lower Switch Interconnect	
1	GL1
2	GL1
3	SKL1
4	SKL1
5	**
6	**
7	**
8	**
9	GL2
10	GL2
11	SKL2
12	SKL2
13	**
14	**
15	**
16	**
17	GL3
18	GL3
19	SKL3
20	SKL3
21	TMP3A
22	TMP3B
23	TMP2A
24	TMP2B
25	TMP1A
26	TMP1B

\*\* = No Connection

Upper Switch Interconnect	
1	GL1
2	GL1
3	SKL1
4	SU1/AC1
5	**
6	**
7	**
8	**
9	GL2
10	GL2
11	SKL2
12	SU2/AC2
13	**
14	**
15	**
16	**
17	GL3
18	GL3
19	SKL3
20	SU3/AC3
21	**
22	**
23	**
24	**
25	DU1
26	DU1

\*\* = No Connection



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**Document revisions**

Rev. 0 - Public Release - July 2022