PRELIMINARY

APE HT-0102

High Temperature Normally-ON Trench Silicon Carbide Power JFET

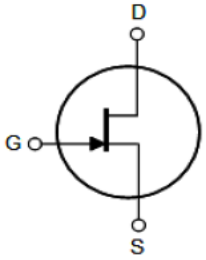
FEATURES

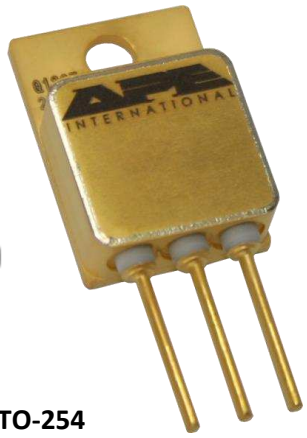
1200 V / 50 A / 45 mΩ

- **High temperature: $T_{c(max)}$ = 225 °C**
  $T_{j(max)}$ = 225 °C
- **AS9100:Rev. C-certified manufacturing, traceable throughout value chain**
- **< 20 ns switching, high system efficiency**
- **Hermetic seal; flux free, void free packaging**
- **Backside isolation**
- **High reliability**

APPLICATIONS

- **Downhole tools**
- **High efficiency converters**
- **Motor drives**
- **Aerospace: Military & Commercial**
- **Smart grid/grid-tie distributed generation**





TO-254 Package **G D S**

Absolute Maximum Ratings[1]

Symbol	Parameter	Condition(s)	Value	Units
V_{DSS}	Drain-source voltage		TBD[3]	V
V_{GSS}	Gate-source voltage	AC, $R_{G(ext)}$ = 1 Ω, $t_p \leq$ 200 ns	-15 to 15	V
I_D	Continuous drain current[2]	T_c = 25 °C	50	A
		T_c = 150 °C	TBD[3]	
		T_c = 225 °C	TBD[3]	
I_{DM}	Peak pulsed drain current[2]	Pulse width limited by $T_{j(max)}$, T_j = 25 °C	140	A
t_{SC}	Short circuit withstand time[2]	V_{DD} < 800 V, T_c < 125 °C	50	µs
E_{AS}	Single-pulse avalanche energy		-	J
E_{AR}	Repetitive avalanche energy		-	J
I_{AR}	Repetitive avalanche current		-	A
P_{tot}	Power dissipation	T_c = 25 °C	TBD[3]	W
		T_c = 100 °C	TBD[3]	
		T_c = 225 °C	TBD[3]	
T_j	Operating junction temperature		-50 to 205[3]	°C
T_{stg}	Storage temperature		-50 to 225[3]	°C
V_{isol}	Insulation test voltage	AC, 1 min.	TBD	V
		AC, 1 s.	TBD	V

[1] Obtained from SemiSouth Laboratories, Inc. SJDC120R045 Rev. 3.0 datasheet
[2] As tested for TO-247 package; P/N SJDP120R045
[3] Data verified through APEI experimentation and/or calculation

SiC JFET Electrical Characteristics[1]

Symbols	Parameter	Condition(s)	Values			Units
			Min.	Typical	Max.	
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = -15 V, I_D = 1200 µA	1200	-	-	V
$V_{GS(th)}$	Gate-source threshold voltage	V_{DS} = 1 V, I_D = 70 mA	-	-5	-	V
I_{DSS}	Zero gate voltage drain current	V_{DS} = 1200 V, V_{GS} = -15 V, T_j = 25 °C	-	20	-	µA
		V_{DS} = 1200 V, V_{GS} = -15 V, T_c = 150 °C	-	200	-	
I_{GSS}	Gate-source leakage current	V_{GS} = -15 V, V_{DS} = 0 V	-	-0.2	-0.6	mA
		V_{GS} = -15 V, V_{DS} = 1200 V	-	-0.2	-	
$R_{DS(on)}$	Drain-source turn-on resistance	V_{GS} = 2 V, I_D = 30 A, T_j = 25 °C	-	35	45	mΩ
		V_{GS} = 2 V, I_D = 30 A, T_j = 100 °C	-	60	-	
I_{GFWD}	Gate forward current	V_{GS} = 2 V	-	41	-	µA
R_G	Internal gate resistance	f = 1 MHz, drain-source shorted	-	4	-	Ω
$R_{G(on)}$		V_{GS} > 2.7 V	-	0.25	-	
C_{iss}	Input capacitance	V_{DD} = 100 V, V_{GS} = -15 V, f = 100 kHz	-	510	-	pF
C_{oss}	Output capacitance		-	160	-	
C_{rss}	Reverse transfer capacitance		-	160	-	
$C_{o(er)}$	Effective output capacitance, Energy related	V_{DS} = 0 V to 600 V, V_{GS} = 0 V	-	100	-	
$t_{d(on)}$	Turn-on delay time	V_{DS} = 600 V, I_D = 30 A, Inductive load, T_j = 25 °C V_{GS} = 15 to -15 V, $R_{G(ext)}$ = 2.5 Ω	-	12	-	ns
t_{rv}	Rise time		-	24	-	
$t_{d(off)}$	Turn-off delay time		-	20	-	
t_{fv}	Fall time		-	22	-	
E_{on}	Turn-On energy		-	180	-	µJ
E_{off}	Turn-Off energy		-	200	-	
E_{ts}	Total switching energy		-	380	-	
$t_{d(on)}$	Turn-on delay time	V_{DS} = 600 V, I_D = 30 A, Inductive load, T_j = 150 °C V_{GS} = 15 to -15 V, $R_{G(ext)}$ = 2.5 Ω	-	12	-	ns
t_{rv}	Rise time		-	26	-	
$t_{d(off)}$	Turn-off delay time		-	20	-	
t_{fv}	Fall time		-	24	-	
E_{on}	Turn-On energy		-	185	-	µJ
E_{off}	Turn-Off energy		-	215	-	
E_{ts}	Total switching energy		-	400	-	

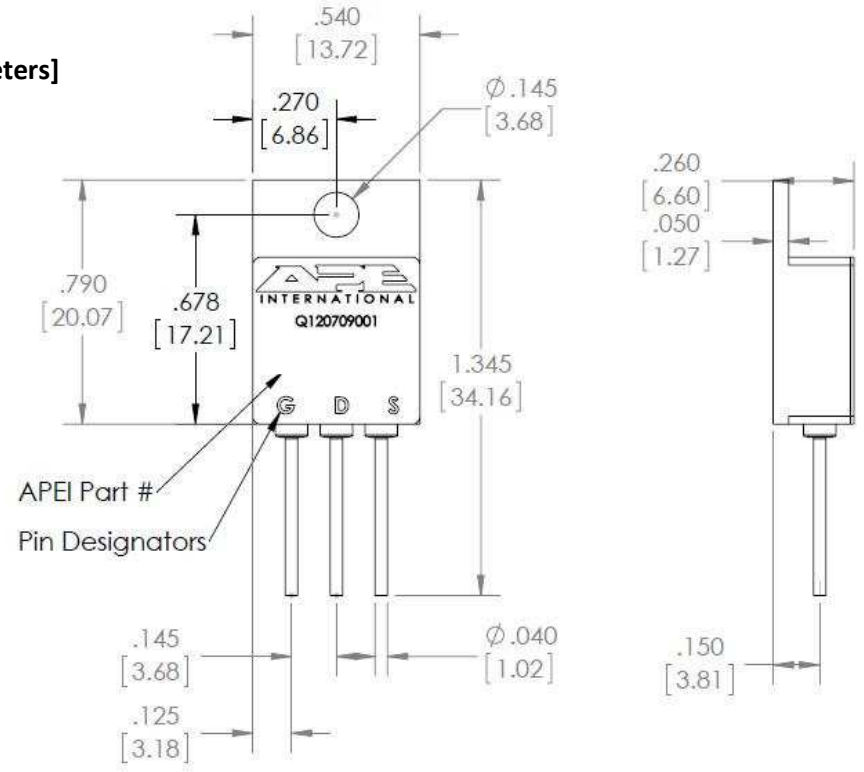
SiC JFET Gate Charge Electrical Characteristics[1]						
Symbols	**Parameter**	**Condition(s)**	**Values**			**Units**
			Min.	**Typical**	**Max.**	
Q_{gs}	Gate to source charge	V_{DS} = 600 V, V_{GS} = 2.5 V I_D = 15 A	-	4	-	nC
Q_{gd}	Gate to drain charge		-	54	-	
Q_g	Gate charge total		-	65	-	

Thermal Characteristics						
Symbols	**Parameter**	**Condition(s)**	**Values**			**Units**
			Min.	**Typical**	**Max.**	
$R_{\theta(j-c)}$	Thermal resistance junction-case	Calculated at 200 °C		TBD	1.0	°C/W

Mechanical Characteristics						
Symbols	**Parameter**	**Condition(s)**	**Values**			**Units**
			Min.	**Typical**	**Max.**	
w	Weight			9.0		g
M_s	Mounting torque	6-32 steel screw, Al heat sink		0.78	1.04	N-m

PACKAGE DIMENSIONS

All dimensions shown are in inches [millimeters]



PART NUMBER	PACKAGE	MARKING
APE HT-xxxx	TO-254	Q120709001

COMPANION PARTS

Silicon Carbide Schottky Diode, APE-HT-xxxx
Low-Temperature Single-Channel Gate Driver, APE-B110321001
Low-Temperature Dual-Channel Gate Driver, APE-B110629001
High-Temperature Dual-Channel Gate Driver, APE-xxxx

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