

VCRR N-Channel Enhancement Mode Power MOSFET

Description

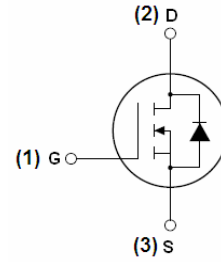
The VCRR0224F uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. It can be used in a wide variety of applications.

General Features

- $V_{DS} = 200V, I_D = 24A$
 $R_{DS(ON)} < 80m\Omega @ V_{GS} = 10V$ (Typ: 64m Ω)
- High density cell design for ultra low R_{dson}
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high E_{AS}
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

Application

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply



Schematic diagram



Marking and pin assignment



TO-220F top view

Package Marking and Ordering Information

Device Marking	Device	Device Package
VCRR0224F		TO-220F

Absolute Maximum Ratings ($T_A = 25^\circ C$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	200	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current-Continuous	I_D	24	A
Drain Current-Continuous ($T_C = 100^\circ C$)	$I_D (100^\circ C)$	16.5	A
Pulsed Drain Current	I_{DM}	72	A
Maximum Power Dissipation	P_D	45	W
Single pulse avalanche energy ^(Note 5)	E_{AS}	250	mJ
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 175	$^\circ C$

Thermal Characteristic

Thermal Resistance, Junction-to-Ambient ^(Note 2)	$R_{\theta JA}$	3.33	$^\circ C/W$
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Electrical Characteristics (T_A=25°C unless otherwise noted)

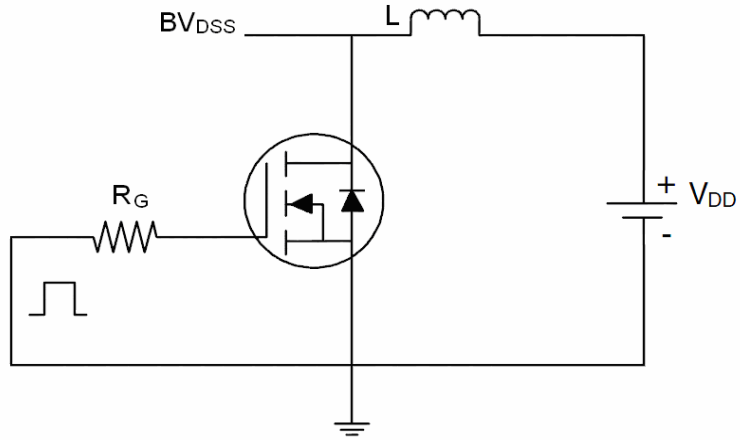
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V, I _D =250μA	200	220	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =200V, V _{GS} =0V	-	-	1	μA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =250μA	2.5	3.2	4	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =20A	-	64	80	mΩ
Forward Transconductance	g _{FS}	V _{DS} =5V, I _D =20A	30	-	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =100V, V _{GS} =0V, F=1.0MHz		4565.8		PF
Output Capacitance	C _{oss}			87.2		PF
Reverse Transfer Capacitance	C _{rss}			70		PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =100V, I _D =20A V _{GS} =10V, R _{GEN} =2.5Ω	-	15	-	nS
Turn-on Rise Time	t _r		-	20	-	nS
Turn-Off Delay Time	t _{d(off)}		-	30	-	nS
Turn-Off Fall Time	t _f		-	9	-	nS
Total Gate Charge	Q _g	V _{DS} =100V, I _D =20A, V _{GS} =10V		91.9		nC
Gate-Source Charge	Q _{gs}			21.8		nC
Gate-Drain Charge	Q _{gd}			29.9		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V, I _S =20A	-	-	1.2	V
Diode Forward Current (Note 2)	I _S	-	-	-	24	A
Reverse Recovery Time	t _{rr}	T _J = 25°C, I _F = 20A	-	51	-	nS
Reverse Recovery Charge	Q _{rr}	di/dt = 100A/μs (Note3)	-	75	-	nC
Forward Turn-On Time	t _{on}	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

Notes:

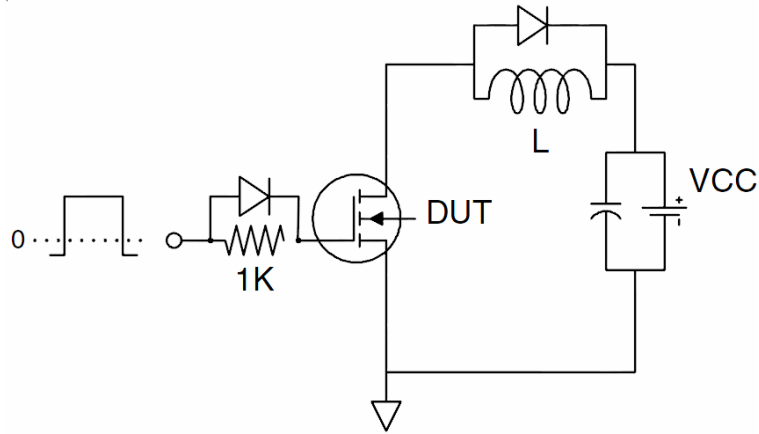
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. EAS condition: T_J=25°C, V_{DD}=100V, V_G=10V, L=0.5mH, R_G=25Ω

Test Circuit

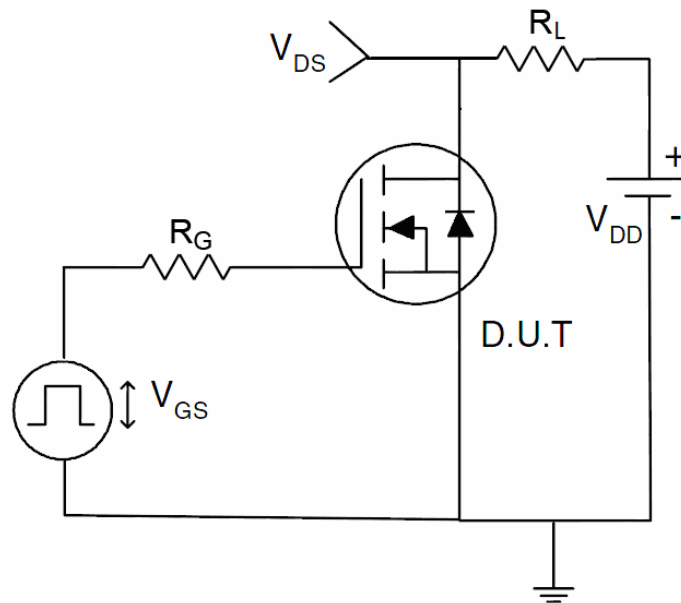
1) E_{AS} Test Circuits



2) Gate Charge Test Circuit



3) Switch Time Test Circuit



Electrical Characteristics (T_C=25°C unless otherwise noted)

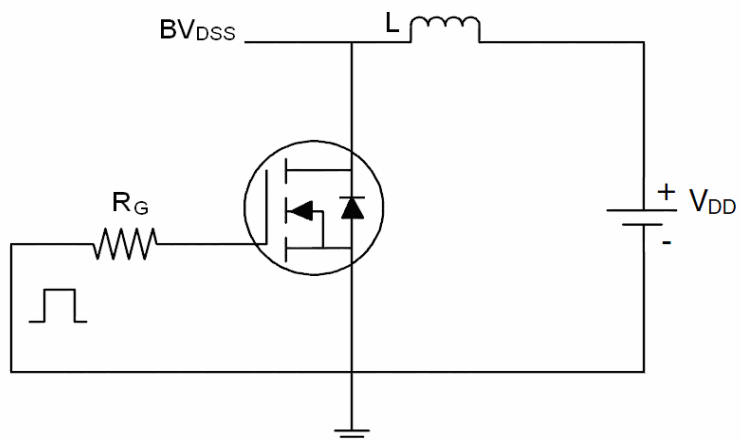
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Notes:

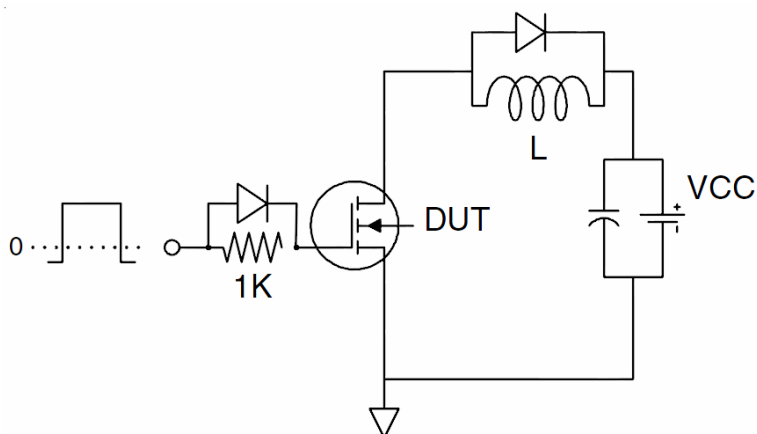
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2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. EAS condition: T_J=25°C, V_{DD}=100V, V_G=10V, L=0.5mH, R_g=25Ω
6. The spike duty cycle 5% max, limited by junction temperature T_J(MAX)=125° C

Test Circuit

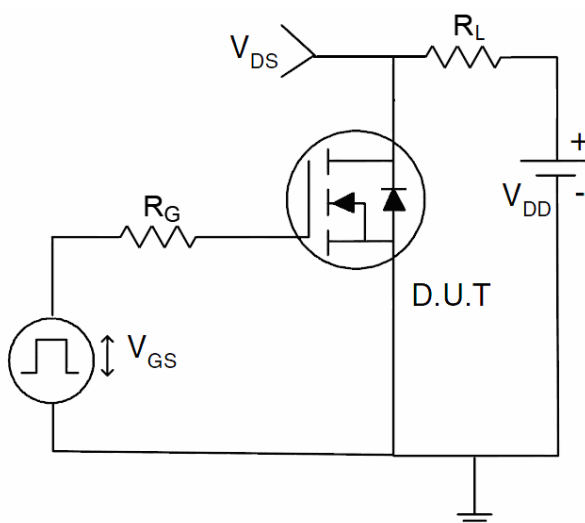
1) E_{AS} test Circuits



2) Gate charge test Circuit



3) Switch Time Test Circuit



Typical Electrical and Thermal Characteristics (Curves)

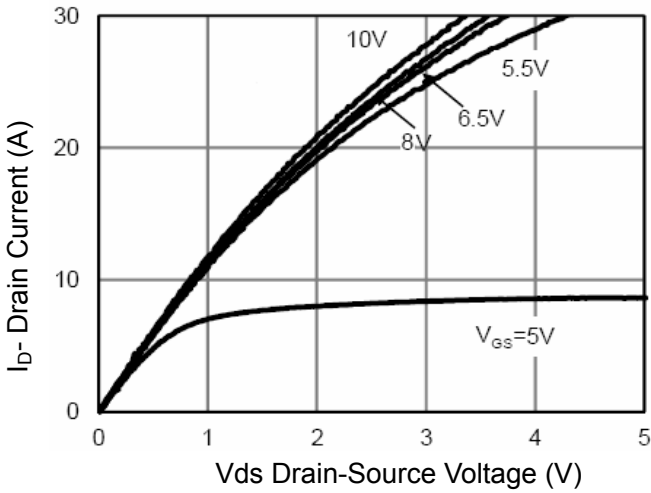


Figure 1 Output Characteristics

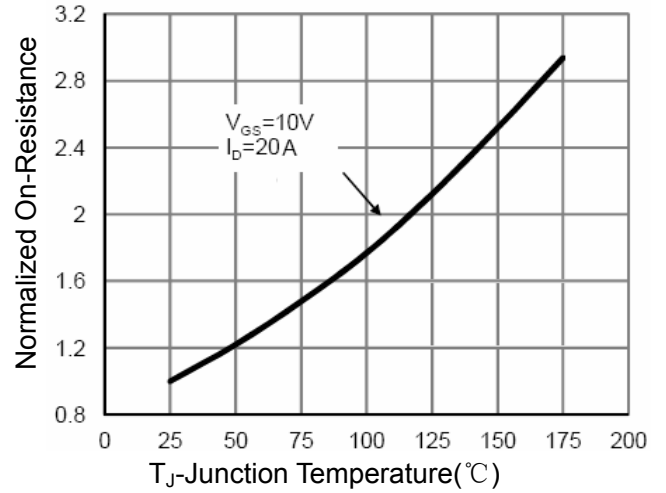


Figure 4 Rdson-Junction Temperature

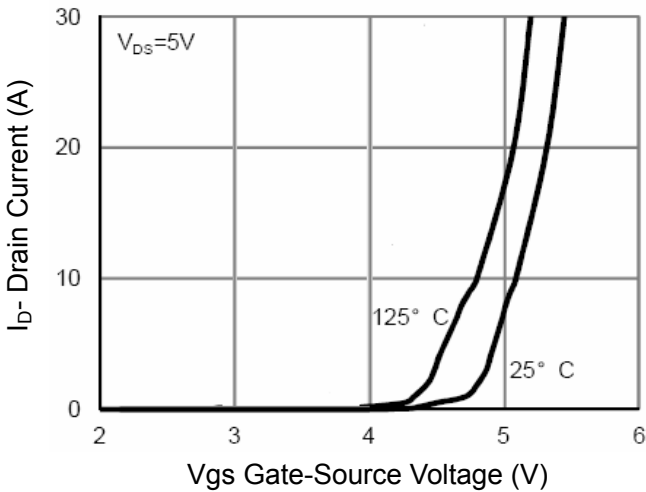


Figure 2 Transfer Characteristics

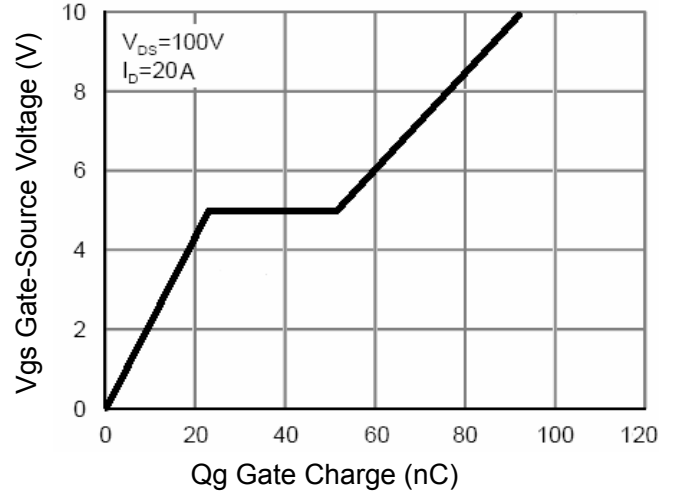


Figure 5 Gate Charge

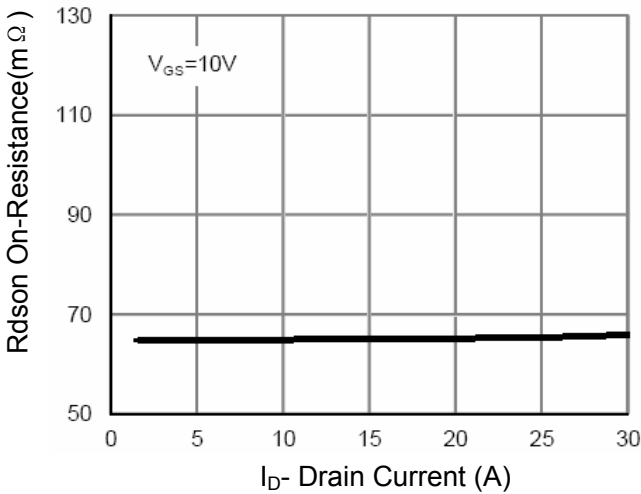


Figure 3 Rdson- Drain Current

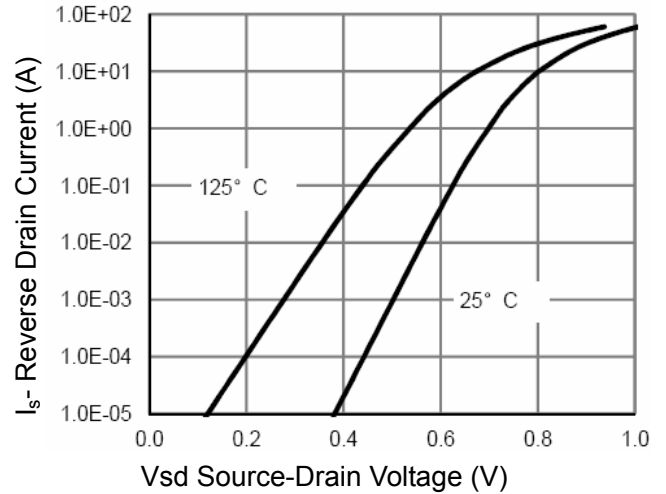


Figure 6 Source- Drain Diode Forward

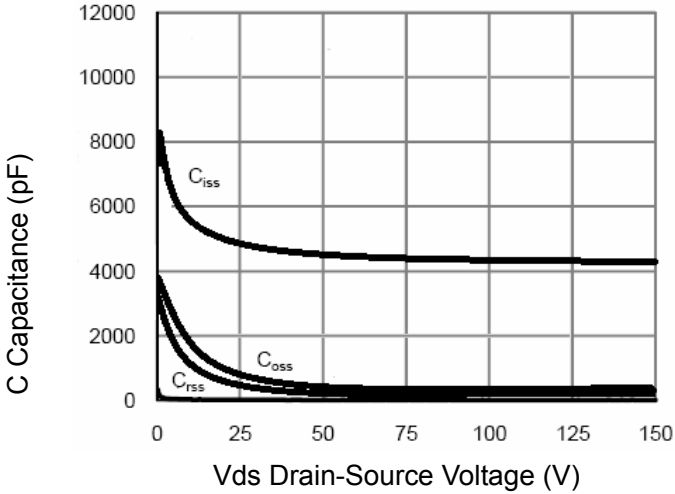


Figure 7 Capacitance vs Vds

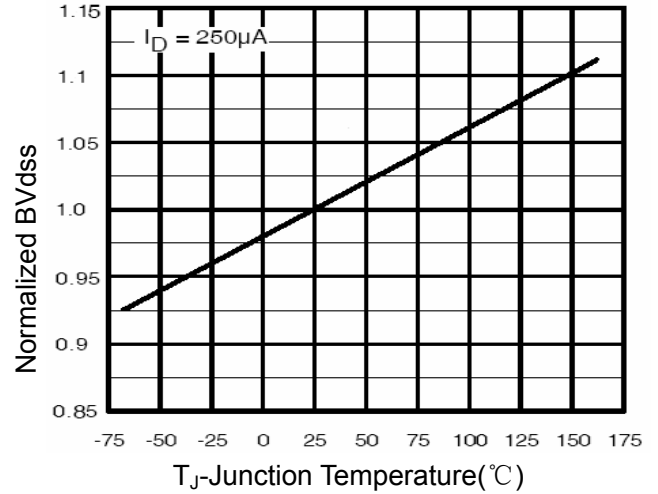


Figure 9 BV_{DSS} vs Junction Temperature

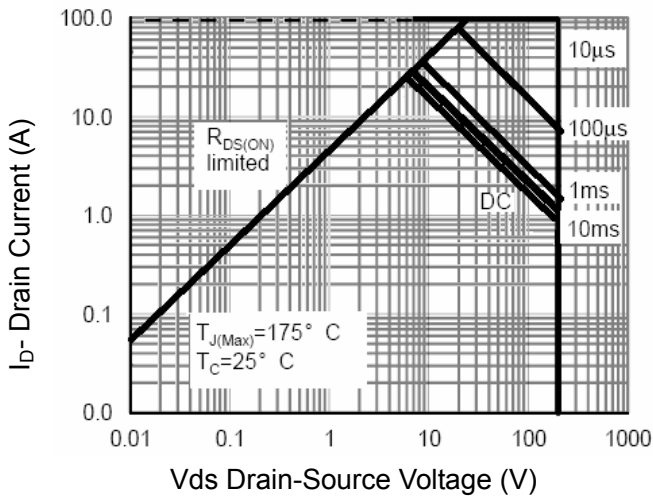


Figure 8 Safe Operation Area

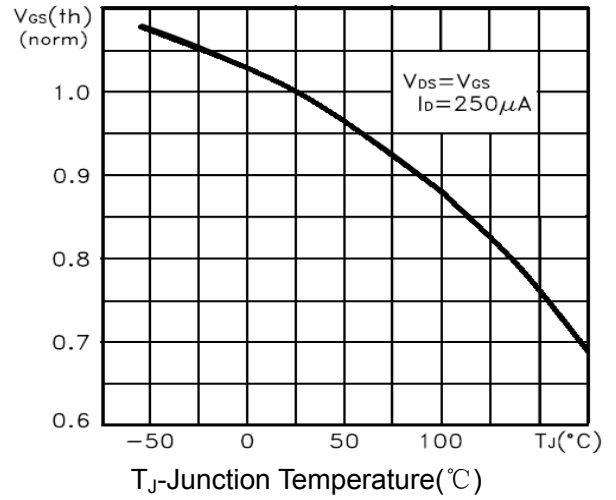


Figure 10 V_{GS(th)} vs Junction Temperature

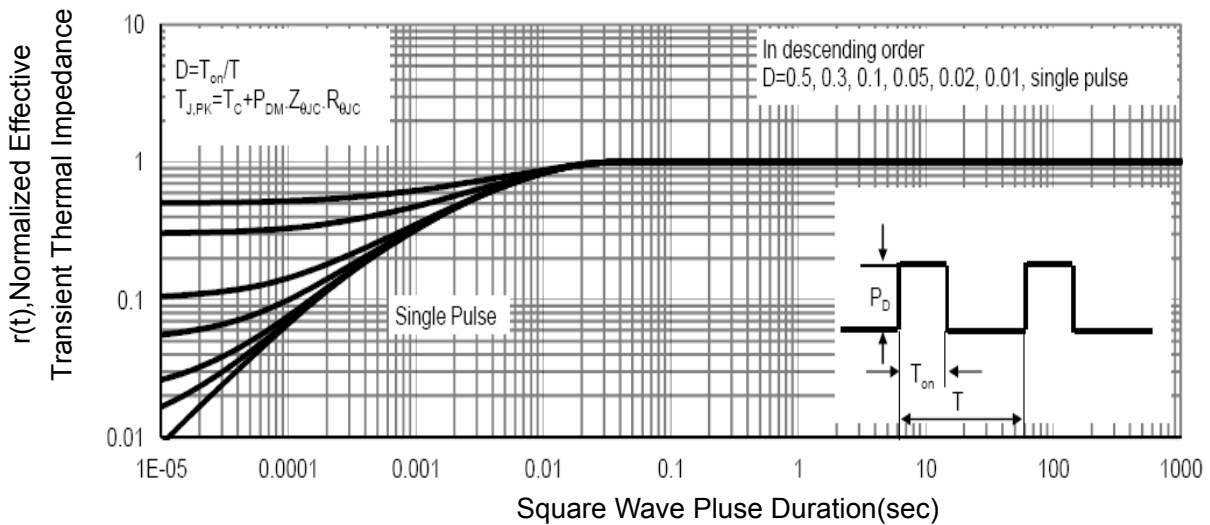
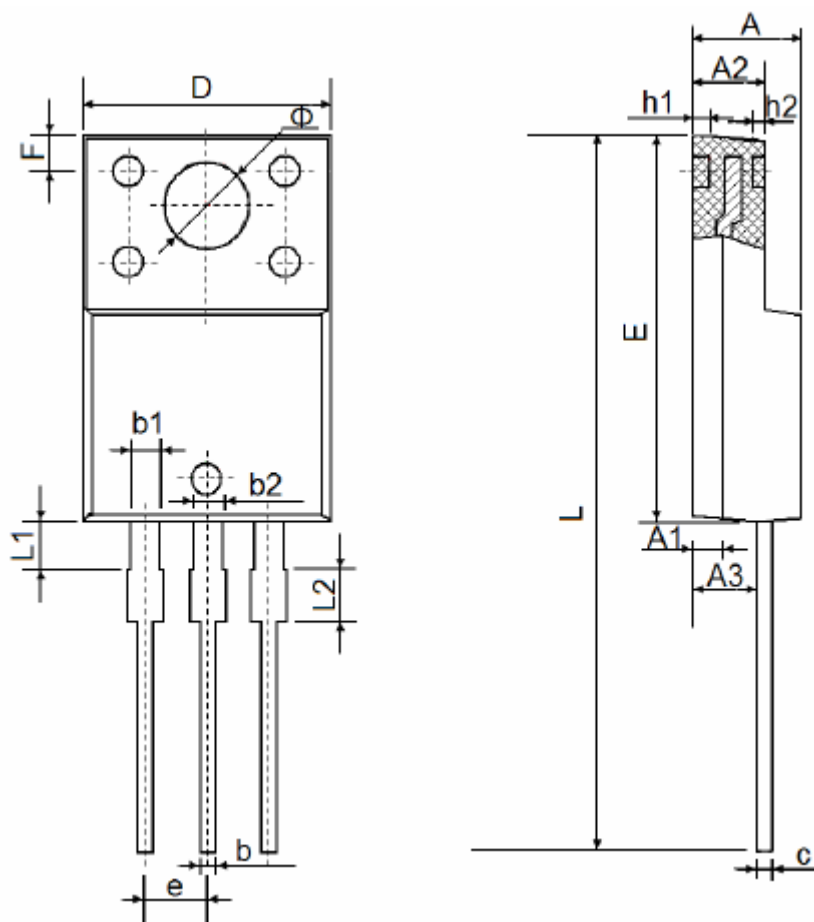


Figure 11 Normalized Maximum Transient Thermal Impedance

TO-220F Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.300	4.700	0.169	0.185
A1	1.300REF		0.051REF	
A2	2.800	3.200	0.110	0.126
A3	2.500	2.900	0.098	0.114
b	0.500	0.750	0.020	0.030
b1	1.100	1.350	0.043	0.053
b2	1.500	1.750	0.059	0.069
c	0.500	0.750	0.020	0.030
D	9.960	10.360	0.392	0.408
E	14.800	15.200	0.583	0.598
e	2.540TYP.		0.100TYP	
F	2.700REF		0.106REF	
Φ	3.500REF		0.138REF	
h1	0.800REF		0.031REF	
h2	0.500REF		0.020REF	
L	28.000	28.400	1.102	1.118
L1	1.700	1.900	0.067	0.075
L2	1.900	2.100	0.075	0.083

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