



Features

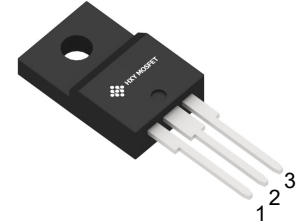
- High Speed Switching with Low Capacitances
- High Blocking Voltage with Low $R_{DS(on)}$
- Easy to drive and parallel
- Effectively lower down T_j and R_{th} , High anti-EMI ability
- RoHS Compliant

Benefits

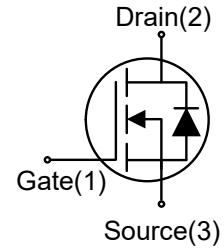
- Increased Power Density
- Faster Operating Frequency
- Reduction of Heat Sink Requirements
- Higher Efficiency
- Reduced EMI

Applications

- Power Factor Correction Modules
- Switch Mode Power Supplies
- Power Inverters
- High Voltage DC/DC Converters



TO-220F



Ordering Part Number	Package	Brand
APC65R210FMF	TO-220F	HXY MOSFET

Maximum Ratings ($T_c = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions
V_{DSmax}	Drain - Source Voltage	650	V	
V_{GSmax}	Gate - Source Voltage (dynamic)	-5/+26	V	
V_{GSop}	Gate - Source Voltage (static)	0/+15	V	
I_D	Continuous Drain Current	20	A	$T_C = 25^\circ\text{C}$
		16.5		$T_C = 100^\circ\text{C}$
$I_{D(pulse)}$	Pulsed Drain Current	30	A	Pulse width t_p limited by T_{jmax}
P_D	Power Dissipation	52	W	$T_C = 25^\circ\text{C}$
		25		$T_C = 100^\circ\text{C}$
T_J, T_{stg}	Operating Junction and Storage Temperature	-55 to +175	$^\circ\text{C}$	



Electrical Characteristics ($T_C = 25^\circ\text{C}$ unless other wise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	650		850	V	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	
I_{DSS}	Zero Gate Voltage Drain Current		2	100	μA	$V_{GS} = 0\text{ V}$, $V_{DS} = 750\text{ V}$	
I_{GSS+}	Gate-Source Leakage Current			200	nA	$V_{DS} = 0\text{ V}$, $V_{GS} = +22\text{ V}$	
I_{GSS-}	Gate-Source Leakage Current			200	nA	$V_{DS} = 0\text{ V}$, $V_{GS} = -10\text{ V}$	
$V_{GS(th)}$	Gate Threshold Voltage	2.2	3.5	4.2	V	$V_{GS} = V_{DS}$, $I_{DS} = 1\text{ mA}$, $T_J = 25^\circ\text{C}$	Fig. 14
			2.6			$V_{GS} = V_{DS}$, $I_{DS} = 1\text{ mA}$, $T_J = 175^\circ\text{C}$	
$R_{DS(on)}$	Static Drain-Source On-Resistance		160	180	m Ω	$V_{GS} = 15\text{ V}$, $I_D = 6\text{ A}$, $T_J = 25^\circ\text{C}$	Fig. 15
			195			$V_{GS} = 15\text{ V}$, $I_D = 6\text{ A}$, $T_J = 175^\circ\text{C}$	
C_{iss}	Input Capacitance		208		pF	$V_{DS} = 400\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	Fig. 8
C_{oss}	Output Capacitance		18				
C_{rss}	Reverse Transfer Capacitance		1.8				
Q_g	Total Gate Charge		10.6		nC	$V_{DD} = 400\text{ V}$, $V_{GS} = -5/18\text{ V}$, $I_D = 5\text{ A}$	Fig. 7
Q_{gs}	Gate-Source Charge		5.1				
Q_{gd}	Gate-Drain Charge		2.2				
$R_{G(int)}$	Gate Input Resistance		1.2		Ω	$f = 1\text{ MHz}$, $I_D = 0\text{ A}$	
E_{on}	Turn-On Switching Energy		25		μJ	$V_{DD} = 400\text{ V}$, $I_D = 5\text{ A}$, $R_G = 10\text{ }\Omega$, $V_{GS} = -5/18\text{ V}$	Fig. 12
E_{off}	Turn-Off Switching Energy		10				
$t_{d(on)}$	Turn-On Delay Time		5		ns	$V_{DD} = 400\text{ V}$, $I_D = 5\text{ A}$, $R_G = 10\text{ }\Omega$, $V_{GS} = -5/18\text{ V}$	
t_r	Rise Time		17				
$t_{d(off)}$	Turn-Off Delay Time		8				
t_f	Fall Time		10				



Reverse SiC Diode Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	4.0		V	$V_{GS} = -4V, I_{SD} = 5A, T_J = 25^{\circ}C$	Fig. 16
		3.6			$V_{GS} = -4V, I_{SD} = 5A, T_J = 175^{\circ}C$	Fig. 17
$*I_{SD}$	Continuous Diode Forward Current		18	A	$T_C = 25^{\circ}C$	
			10		$T_C = 175^{\circ}C$	
t_{rr}	Reverse Recovery Time	50		ns	$I_{SD} = 5A, di/dt = 1000A/\mu s,$ $V_{DD} = 400V, V_{GS} = -5V$	
Q_{rr}	Reverse Recovery Charge	38		nC		
I_{RRM}	Peak Reverse Recovery Current	2.4		A		

* Depends on bonding wire

Thermal Characteristics

Symbol	Parameter	Typ.	Unit	Test Conditions	Note
R_{thJC}	Thermal Resistance from Junction to Case	2.88	$^{\circ}C/W$		Fig. 2
R_{thJA}	Thermal Resistance From Junction to Ambient	40			



Typical Performance

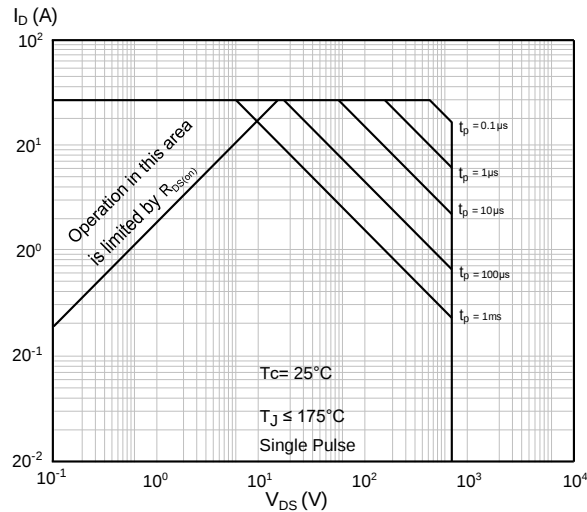


Figure 1. Safe Operating Area

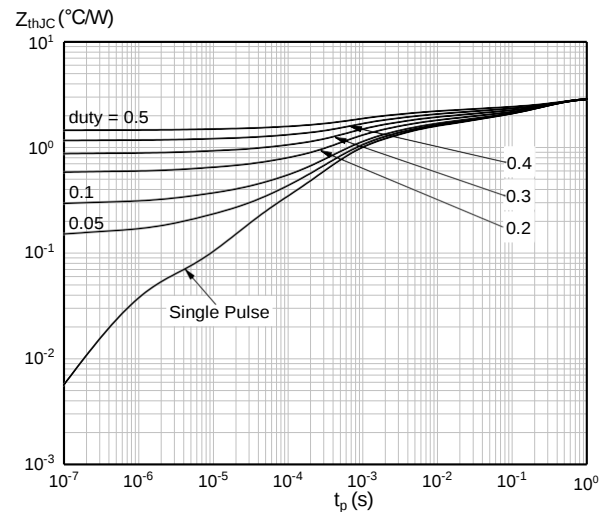


Figure 2. Maximum Transient Thermal Impedance



Figure 3. Typical Output Characteristics, $T_J = 25^\circ\text{C}$

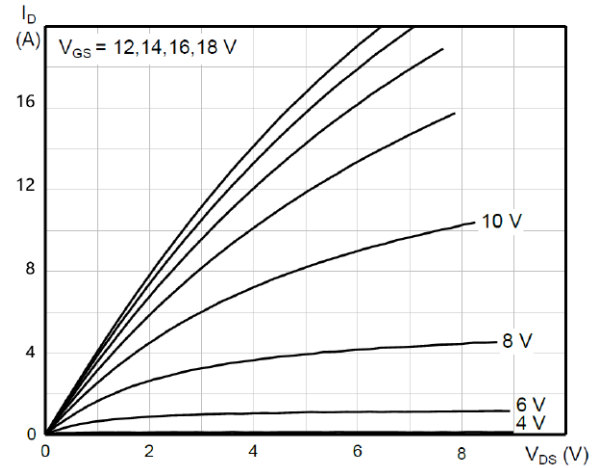


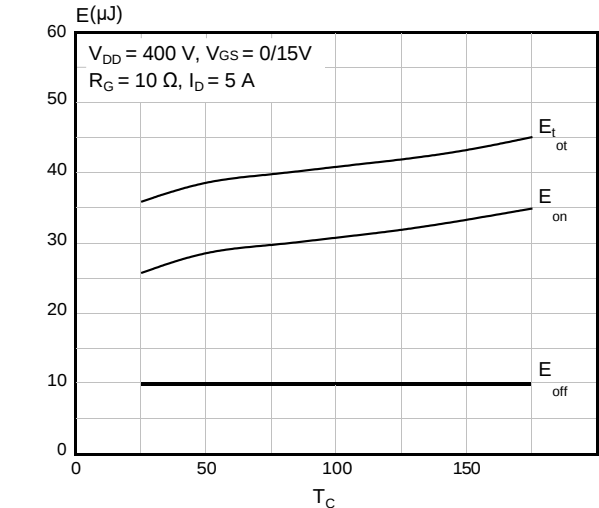
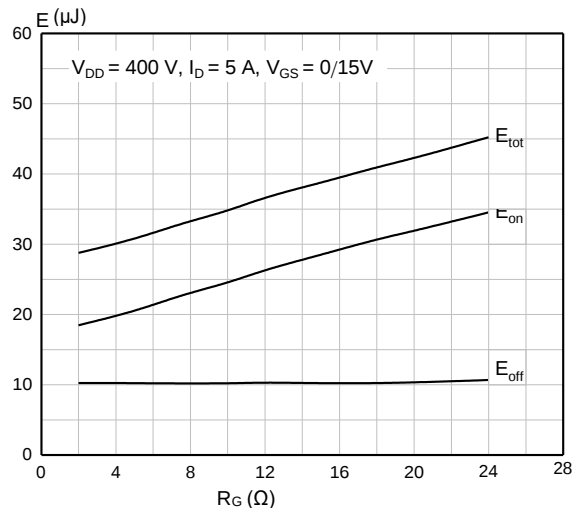
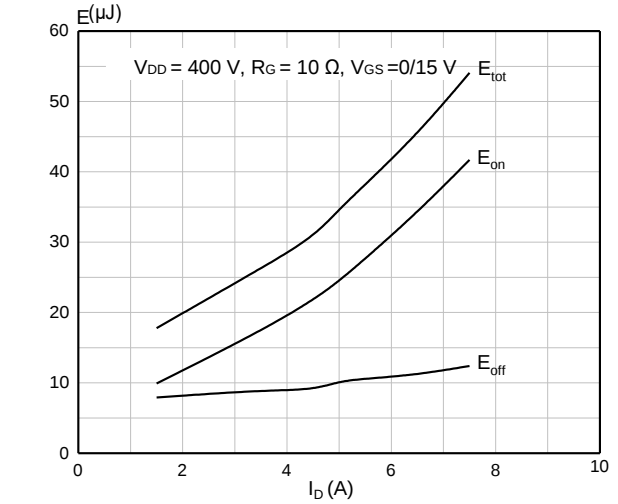
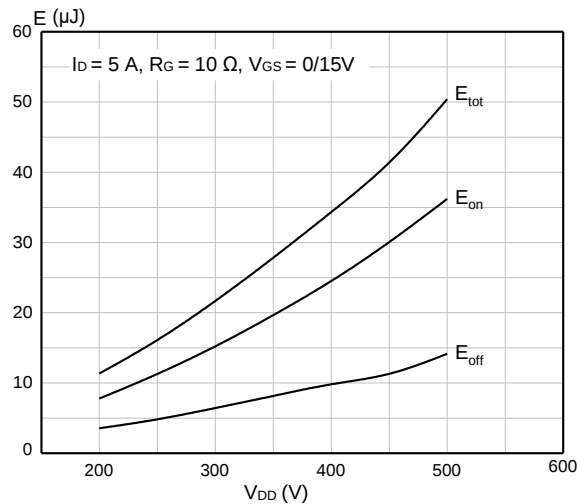
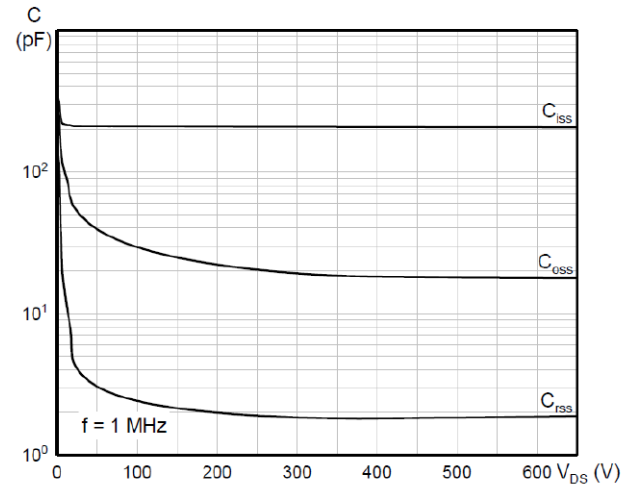
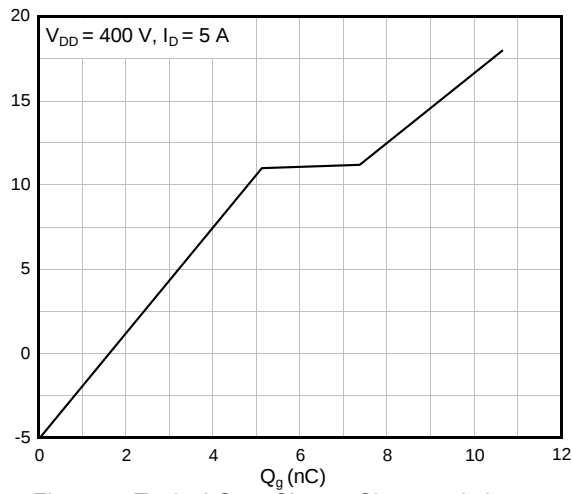
Figure 4. Typical Output Characteristics, $T_J = 175^\circ\text{C}$



Figure 5. Typical Transfer Characteristics



Figure 6. Total Power Dissipation



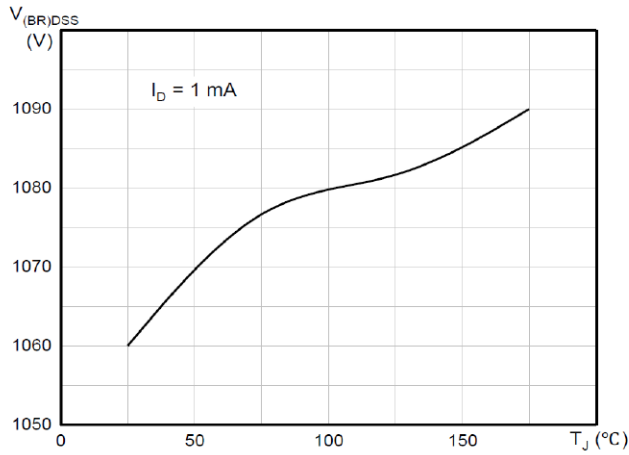


Figure 13. Breakdown Voltage vs. Temperature



Figure 14. Gate Threshold vs. Temperature

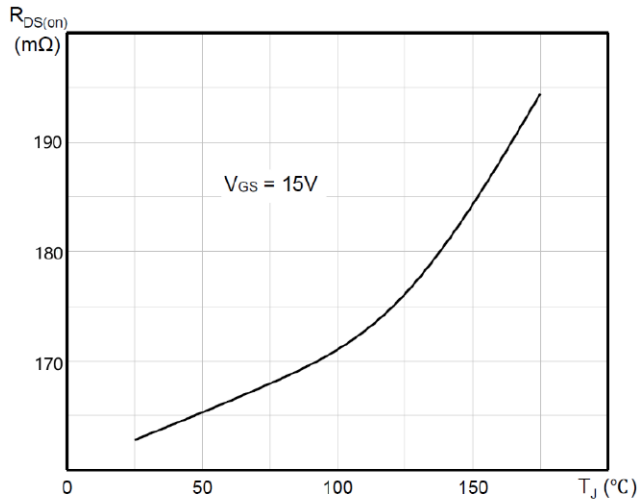


Figure 15. On-Resistance vs. Temperature

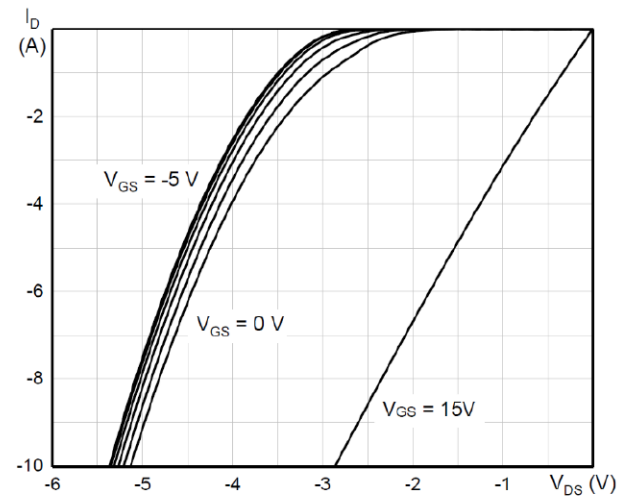
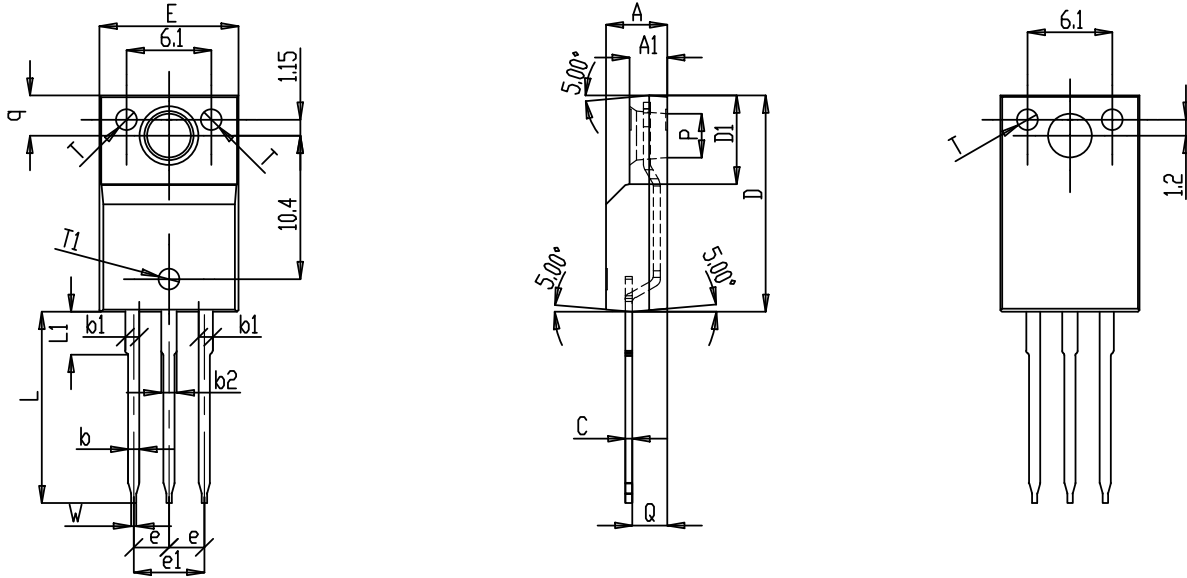


Figure 16. Body Diode Characteristics, T_J=25°C



Package Dimensions

Package TO-220F



SYMBOL	MILLIMETERS			NOTES	SYMBOL	MILLIMETERS			NOTES
	Normal	MIN.	MAX.			Normal	MIN.	MAX.	
A	4.4	4.2	4.6		e1	5.08	5	5.12	
A1	2.7	2.5	2.9		L	13.90	13.5	14.4	
b	0.8	0.7	0.9		L1	3.12	2.8	3.3	
b1	1.07	0.9	1.3		P	3.14	3.00	3.20	
b2	1.17	1	1.4		Q	2.44	2.3	2.6	
C	0.5	0.4	0.6		q	2.87	2.6	3	
D	15.63	15.4	15.8		W	0.37	0.3	0.5	
D1	6.22	6	6.4		T	1.52	1.3	1.7	
E	10.06	9.7	10.3		T1	1.20	1.1	1.3	
e	2.54	2.5	2.58						



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