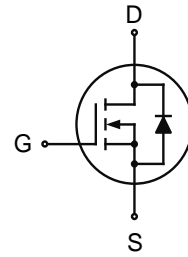


## Features

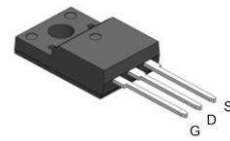
- 650V,11A  
 $R_{DS(on)} < 380m\Omega @ V_{GS}=10V$  TYP:350m $\Omega$
- advanced super junction technology
- extremely low on resistance



Schematic Diagram

## Applications

- Power factor correction (PFC)
- Switched mode power supplies (SMPS)
- Uninterruptible power supply (UPS)
- LED lighting power



TO-220F

## Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity (PCS)
A65R380FM	APA65R380FM	TO-220F	-	-	1000

## ABSOLUTE MAXIMUM RATINGS ( $T_a=25^{\circ}C$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$V_{DS}$	650	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	V
Continuous Drain Current ( $T_c = 25^{\circ}C$ )	$I_D$	11	A
Continuous Drain Current ( $T_c = 100^{\circ}C$ )	$I_D$	8	A
Pulsed Drain Current <sup>(1)</sup>	$I_{DM}$	44	A
Single Pulsed Avalanche Energy <sup>(2)</sup>	$E_{AS}$	251	mJ
Drain Power Dissipation	$P_D$	38	W
Thermal Resistance from Junction to Case	$R_{\theta JC}$	2.9	$^{\circ}C/W$
Thermal Resistance- Junction to Ambient	$R_{\theta JA}$	62.5	$^{\circ}C/W$
Junction Temperature	$T_J$	150	$^{\circ}C$
Storage Temperature	$T_{STG}$	-55~ +150	$^{\circ}C$
Maximum Lead temperature for soldering Purpose	$T_L$	300	$^{\circ}C$

**MOSFET ELECTRICAL CHARACTERISTICS(T<sub>a</sub>=25°C unless otherwise noted)**

Parameter	Symbol	Test Condition	Min	Type	Max	Unit
<b>Static Characteristics</b>						
Drain-source breakdown voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> =250μA	650	-	-	V
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> =650V, V <sub>GS</sub> = 0V	-	-	100	nA
Gate-body leakage current	I <sub>GSS</sub>	V <sub>GS</sub> = ±30V, V <sub>DS</sub> = 0V	-	-	±100	nA
Gate threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	2.0	3.2	4.0	V
Forward Transconductance <sup>(3)</sup>	g <sub>FS</sub>	V <sub>DS</sub> =25V, I <sub>D</sub> =11A	-	7.4	-	S
Drain-source on-resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =5.5A	-	350	380	mΩ
<b>Dynamic characteristics</b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =100V, V <sub>GS</sub> =0V, f =1.0MHz	-	622	-	pF
Output Capacitance	C <sub>oss</sub>		-	40.5	-	
Reverse Transfer Capacitance	C <sub>rss</sub>		-	2.3	-	
<b>Switching characteristics <sup>(3,4)</sup></b>						
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> =300V, I <sub>D</sub> =11A, R <sub>G</sub> =24Ω, V <sub>G</sub> =10V	-	11.5	-	ns
Turn-on rise time	t <sub>r</sub>		-	36.5	-	
Turn-off delay time	t <sub>d(off)</sub>		-	65.1	-	
Turn-off fall time	t <sub>f</sub>		-	30.0	-	
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =520V, I <sub>D</sub> =11A, V <sub>GS</sub> =10V	-	18.2	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	2.0	-	
Gate-Drain Charge	Q <sub>gd</sub>		-	11.4	-	
<b>Source-Drain Diode characteristics</b>						
Diode Forward voltage	V <sub>SD</sub>	T <sub>c</sub> =25°C, V <sub>GS</sub> =0V, I <sub>S</sub> =11A	-	0.85	1.4	V
Diode Forward current	I <sub>S</sub>	T <sub>c</sub> =25°C	-	-	11	A
Body Diode Reverse Recovery Time <sup>(3)</sup>	t <sub>rr</sub>	T <sub>c</sub> =25°C, I <sub>F</sub> =11A, di/dt=100A/us		386		ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>	T <sub>c</sub> =25°C, I <sub>F</sub> =11A, di/dt=100A/us		4.5		uc

**Notes:**

1. Pulse width limited by maximum junction temperature
2. L=79mH, I<sub>AS</sub>=2.4A, V<sub>DD</sub>=100V, V<sub>G</sub>=10V, R<sub>G</sub>=25Ω, starting T<sub>J</sub>=25°C
3. Pulse Test: Pulse width ≤300μs, Duty cycle≤2%
4. Essentially independent of operating temperature

**Typical Performance Characteristics**

Figure 1. On-Region Characteristics

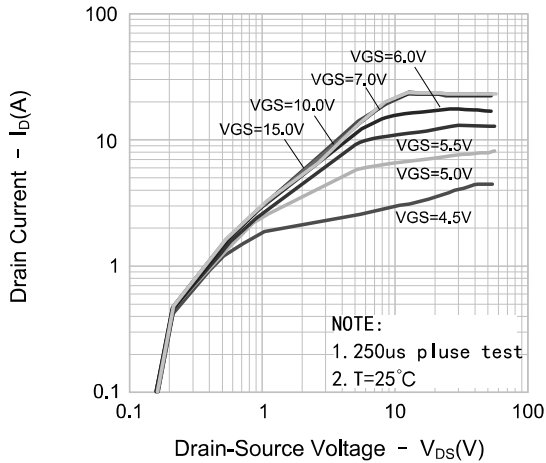


Figure 2. Transfer Characteristics

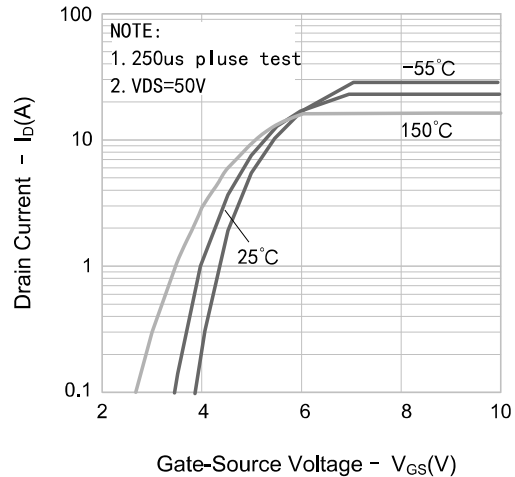


Figure 3. On-Resistance Variation vs. Drain Current

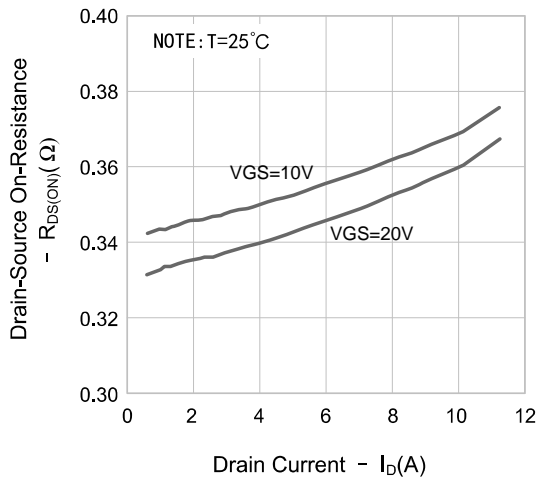


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

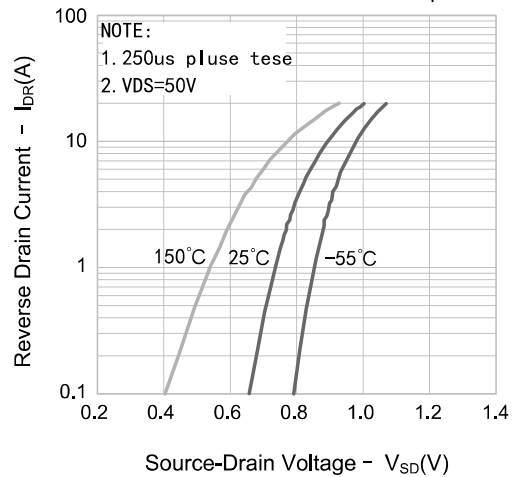


Figure 5. Capacitance Characteristics

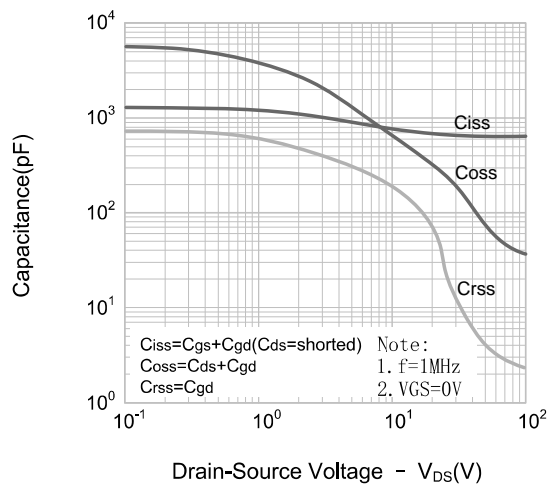
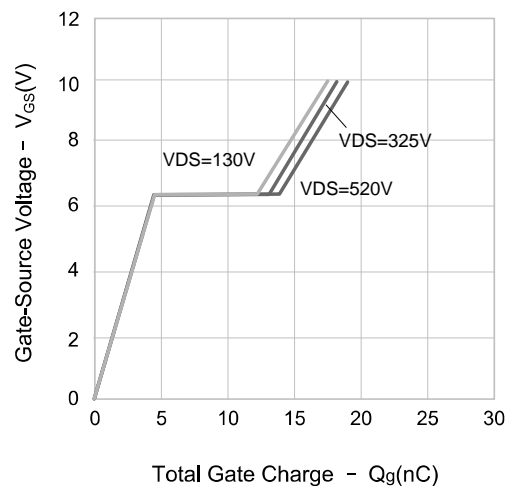


Figure 6. Gate Charge Characteristics



**Typical Performance Characteristics**

Figure 7. Breakdown Voltage Variation vs. Temperature

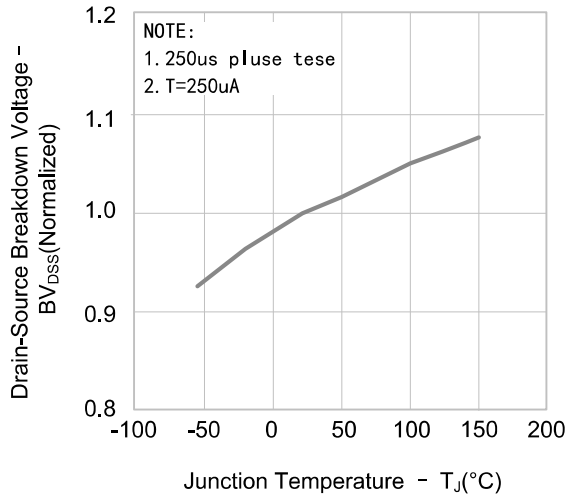


Figure 8. On-resistance Variation vs. Temperature

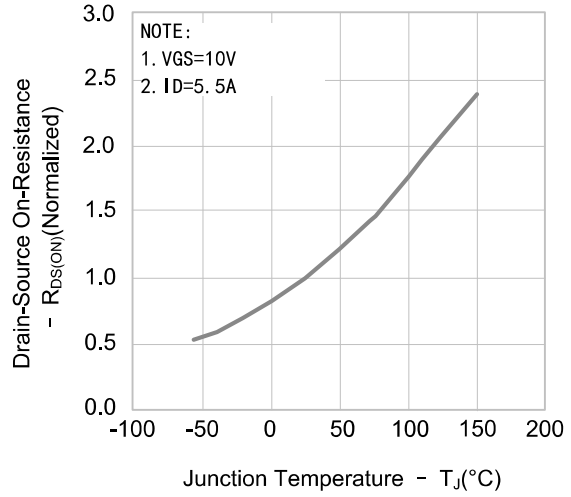
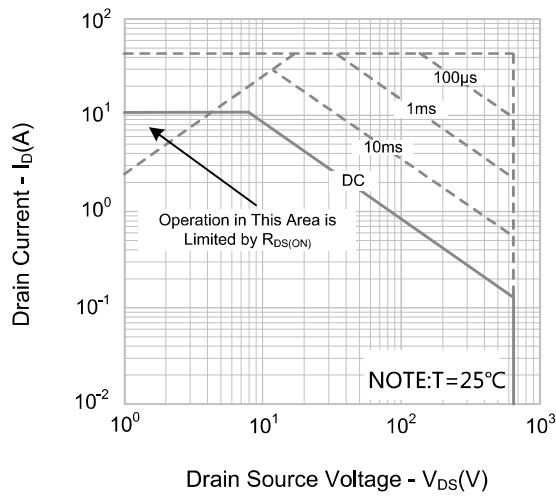
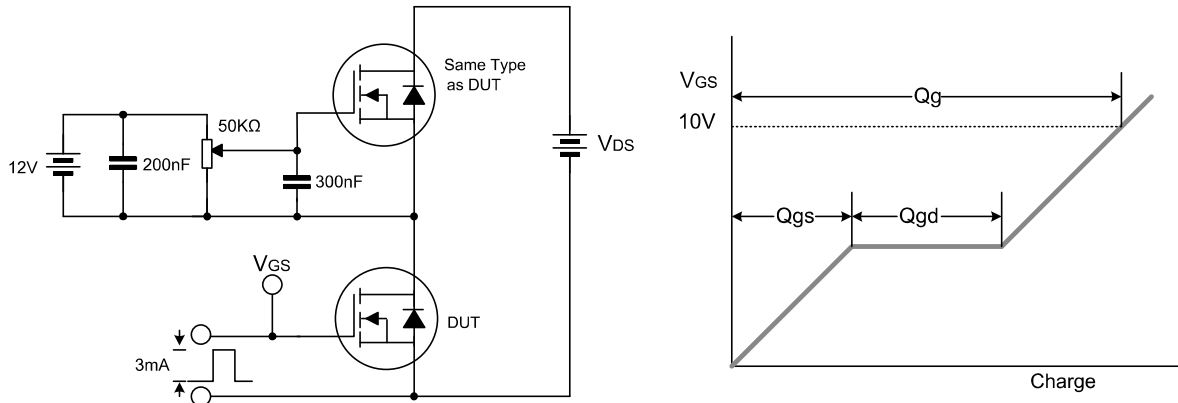


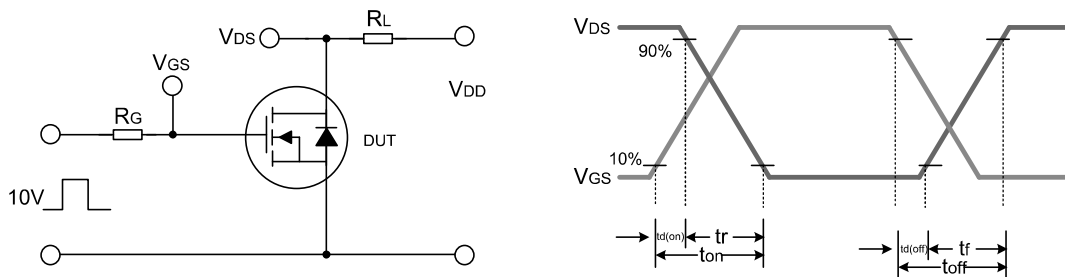
Figure 9. Max. Safe Operating Area



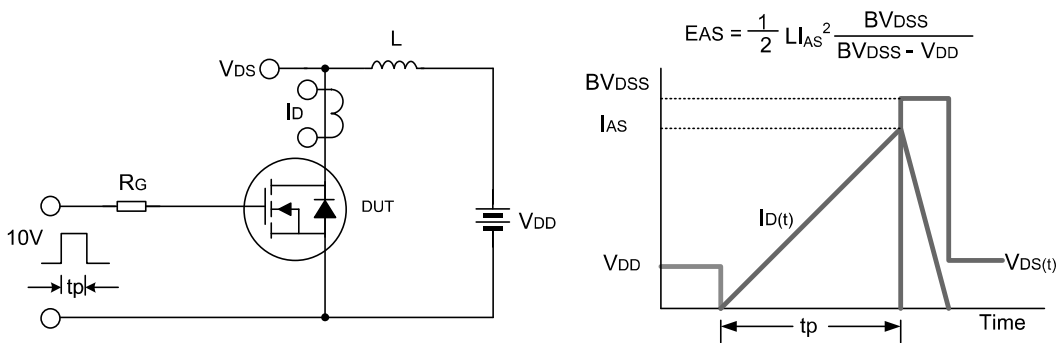
**Test Circuit**



**Gate Charge Test Circuit & Waveform**



**Resistive Switching Test Circuit & Waveform**



**EAS Test Circuit & Waveform**

**Package Dimensions of TO-220F**

**Unit:mm**

