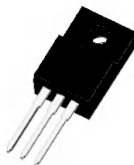


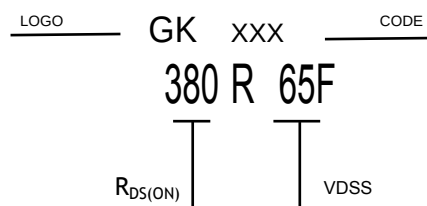
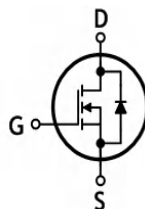
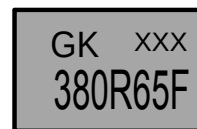
FEATURES

- Drain-Source voltage: $V_{DS}=650V$ (@ $T_J=150^{\circ}C$)
- Low drain-source On resistance: $R_{DS(on)}=0.38\Omega$ (Max.)
- Ultra low gate charge: $Q_g=20nC$ (Typ.)
- RoHS compliant device
- 100% avalanche tested

V_{DSS} 650 V
 I_D 11 A
 $R_{DS(ON)}$ 0.38 Ω



TO-220F



MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

Absolute maximum ratings ($T_C=25^{\circ}C$ unless otherwise noted)

Characteristic	Symbol		Rating	Unit
Drain-source voltage	V _{DSS}		650	V
Gate-source voltage	V _{GSS}		±30	V
Drain current (DC) ^(Note 1)	I _D	T _c =25°C	11	A
		T _c =100°C	7	A
Drain current (Pulsed) ^(Note 1)	I _{DM}		44	A
Single pulsed avalanche energy ^(Note 2)	E _{AS}		135	mJ
Repetitive avalanche current ^(Note 1)	I _{AR}		5	A
Repetitive avalanche energy ^(Note 1)	E _{AR}		63.2	mJ
Power dissipation	P _D		32	W
Diode dv/dt ruggedness ^(Note 3)	dv/dt		15	V/ns
MOSFET dv/dt ruggedness ^(Note 4)	dv/dt		50	V/ns
Junction temperature	T _J		150	°C
Storage temperature range	T _{stg}		-55~150	°C

Thermal Characteristics

Characteristic	Symbol	Rating	Unit
Thermal resistance, junction to case	$R_{th(j-c)}$	Max. 3.9	$^{\circ}C/W$
Thermal resistance, junction to ambient	$R_{th(j-a)}$	Max. 62.5	

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

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	BV _{DSS}	I _D =250uA, V _{GS} =0	650	-	-	V
Gate threshold voltage	V _{GS(th)}	I _D =250uA, V _{DS} =V _{GS}	2	3	4	V
Drain-source cut-off current	I _{DSS}	V _{DS} =650V, V _{GS} =0V	-	-	1	uA
		V _{DS} =650V, T _J =125°C	-	-	100	uA
Gate leakage current	I _{GSS}	V _{DS} =0V, V _{GS} =±30V	-	-	±100	nA
Drain-source on-resistance	R _{DS(ON)}	V _{GS} =10V, I _D =5.5A	-	0.31	0.38	Ω
Internal gate resistance	R _g	f=1MHz, Open drain	-	21	28	Ω
Input capacitance	C _{iss}	V _{DS} =25V, V _{GS} =0V, f=1MHz	629	787	945	pF
Output capacitance	C _{oss}		344	431	518	
Reverse transfer capacitance	C _{rss}		19	24	29	
Turn-on delay time (Note 3)	t _{d(on)}	V _{DS} =350V, I _D =11A, R _G =25Ω	-	17	25	ns
Rise time (Note 3)	t _r		-	14	24	
Turn-off delay time (Note 3)	t _{d(off)}		-	40	55	
Fall time (Note 3)	t _f		-	5	8	
Total gate charge (Note 4)	Q _g	V _{DS} =400V, V _{GS} =10V, I _D =7A	-	20	25	nC
Gate-source charge (Note 4)	Q _{gs}		-	6.5	10	
Gate-drain charge (Note 4)	Q _{gd}		-	5	10	

Source-Drain Diode Ratings and Characteristics (T_C=25°C unless otherwise noted)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Source current (DC)	I _S	Integral reverse diode in the MOSFET	-	-	11	A
Source current (Pulsed)	I _{SM}		-	-	44	A
Forward voltage	V _{SD}	V _{GS} =0V, I _S =11A	-	-	1.2	V
Reverse recovery time (Note 3,4)	t _{rr}	I _S =11A, V _{GS} =0V, dI _S /dt=100A/us	-	326	450	ns
Reverse recovery charge (Note 3,4)	Q _{rr}		-	2.8	4.5	uC

Note:

1. Calculated continuous current based on maximum allowable junction temperature
2. L=10mH, I_{AS}=5A, V_{DD}=50V, Starting T_J=25°C
3. Guaranteed by design, not subject to production testing
4. Pulse test: Pulse width≤300us, Duty cycle≤2%

RATING AND CHARACTERISTIC CURVES

Fig. 1 Typical Output Characteristics

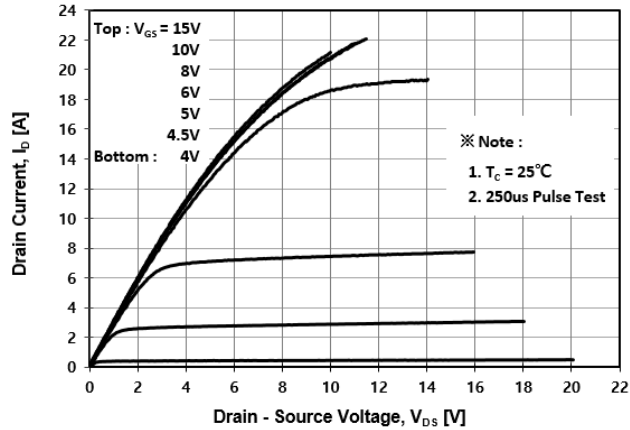


Fig. 2 Typical Transfer Characteristics

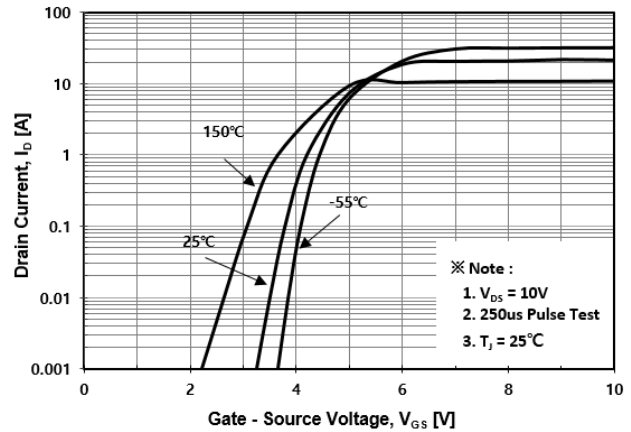


Fig. 3 On-Resistance Variation with Drain Current and Gate Voltage

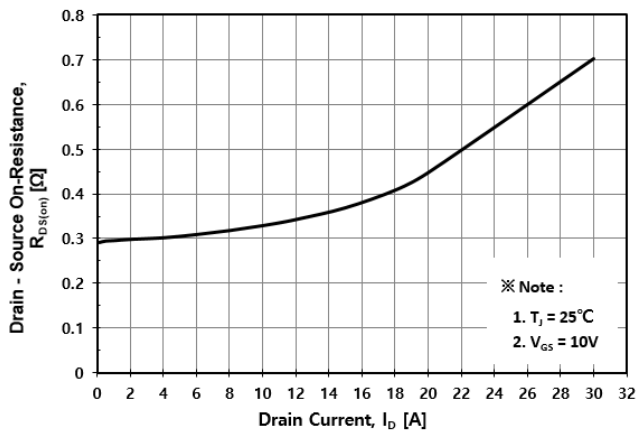


Fig. 4 Body Diode Forward Voltage Variation with Source Current

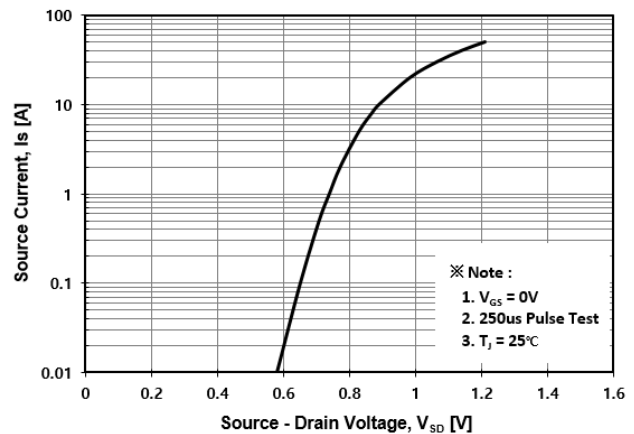


Fig. 5 Typical Capacitance Characteristics

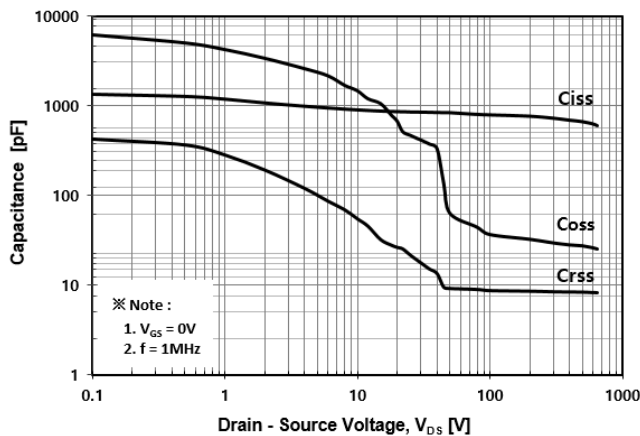
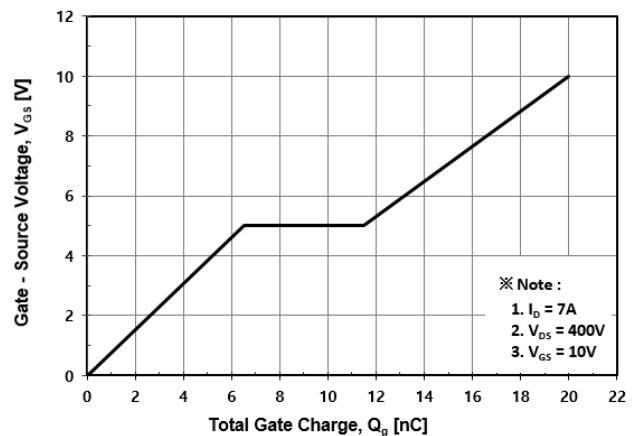


Fig. 6 Typical Total Gate Charge Characteristics



RATING AND CHARACTERISTIC CURVES

Fig. 7 Breakdown Voltage Variation vs. Temperature

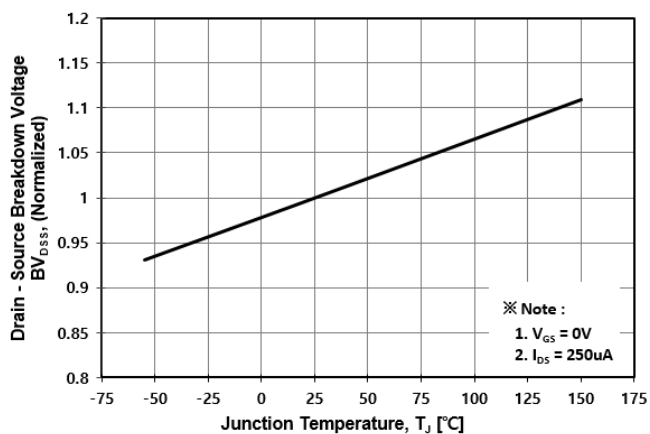


Fig. 8 On-Resistance Variation vs. Temperature

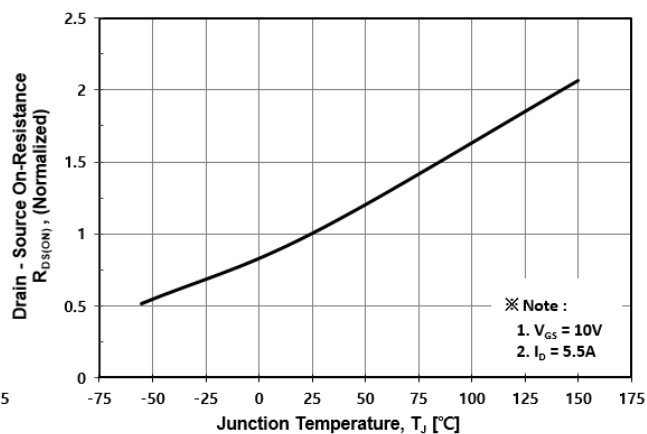


Fig. 9 Maximum Drain Current vs. Case Temperature

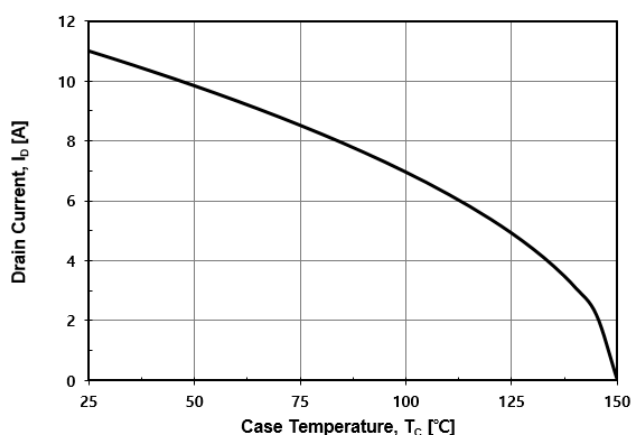


Fig. 10 Maximum Safe Operating Area

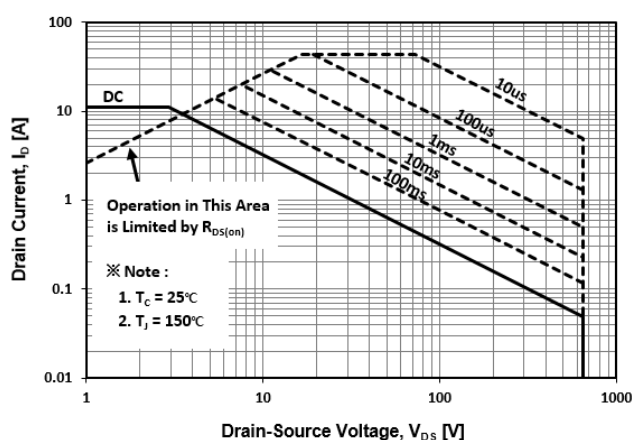
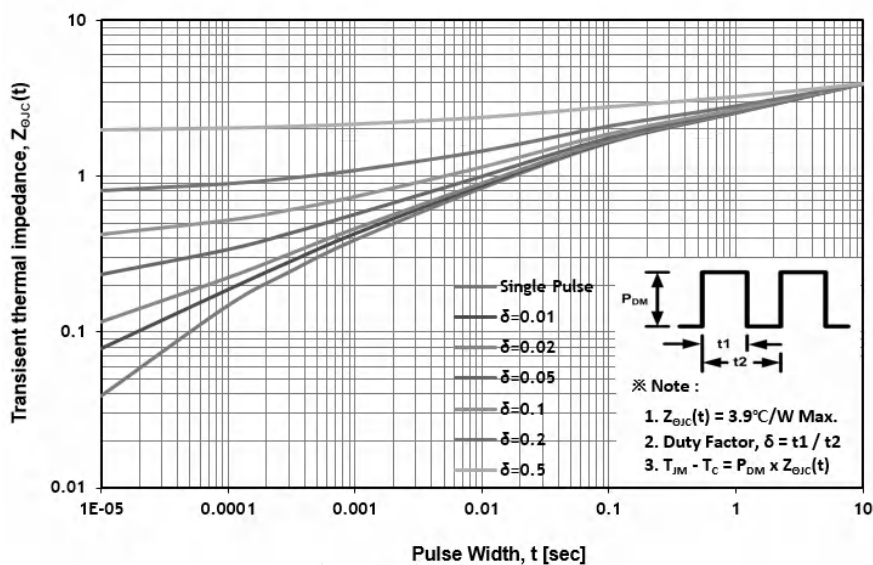
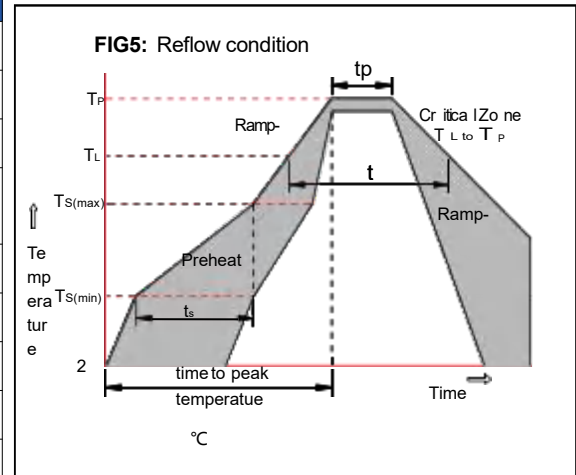


Fig. 11 Transient Thermal Impedance



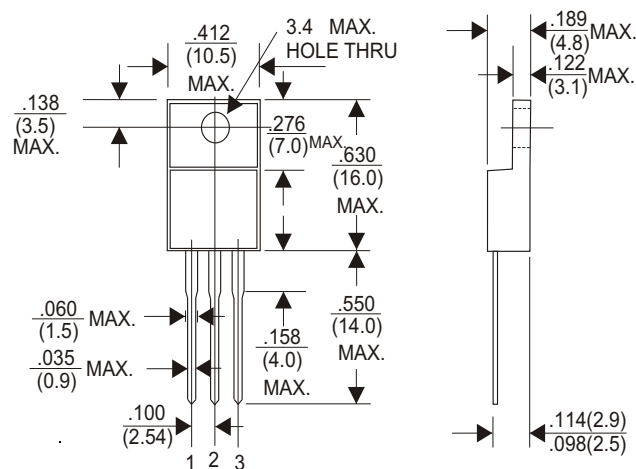
Soldering parameters

Reflow Condition		Pb-Free assembly (see as below)
Pre Heat	-Temperature Min ($T_{s(min)}$)	+150°C
	-Temperature Max($T_{s(max)}$)	+200°C
	-Time (Min to Max) (ts)	60-180 secs.
Average ramp up rate (Liquid us Temp (T_L) to peak)		3°C/sec. Max
$T_{s(max)}$ to T_L - Ramp-up Rate		3°C/sec. Max
Reflow	-Temperature(T_L)(Liquid us)	+217°C
	-Temperature(t_L)	60-150 secs.
Peak Temp (T_P)		+260(+0/-5)°C
Time within 5°C of actual Peak Temp (t_P)		30 secs. Max
Ramp-down Rate		6°C/sec. Max
Time 25°C to Peak Temp (T_P)		8 min. Max
Do not exceed		+260°C



Package Dimensions & Suggested Pad Layout

TO-220F (FULLY INSULATED)



Dimensions in inches and (millimeters)