

# FM600TU-2A

HIGH POWER SWITCHING USE  
INSULATED PACKAGE

## FM600TU-2A



- ID(rms) .....300A
- VDSS..... 100V
- Insulated Type
- 6-elements in a pack
- NTC Thermistor inside
- UL Recognized

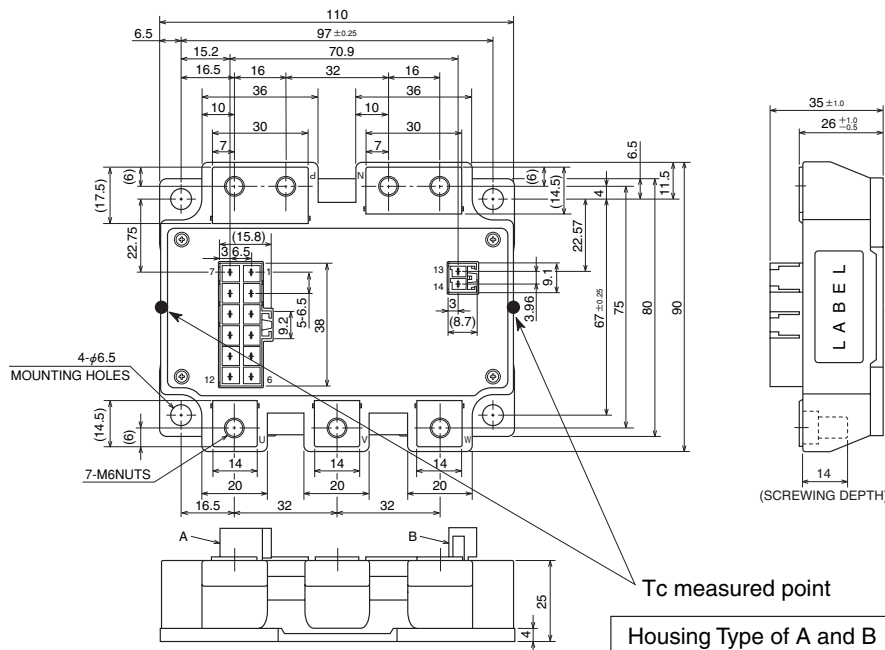
Yellow Card No.E80276  
File No.E80271

## APPLICATION

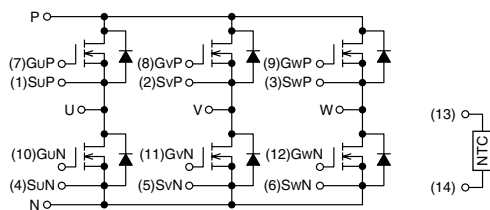
AC motor control of forklift (battery power source), UPS

## OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



### CIRCUIT DIAGRAM



(1)SuP	(2)SvP	(3)SwP	(4)SuN	(5)SvN	(6)SwN	A
(7)GuP	(8)GvP	(9)GwP	(10)GuN	(11)GvN	(12)GwN	A
(13)TH1	(14)TH2					B

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## ABSOLUTE MAXIMUM RATINGS (T<sub>ch</sub> = 25°C unless otherwise specified.)

Symbol	Item	Conditions	Ratings	Unit
V <sub>DSS</sub>	Drain-source voltage	G-S Short	100	V
V <sub>GSS</sub>	Gate-source voltage	D-S Short	±20	V
I <sub>D(rms)</sub>	Drain current	T <sub>C</sub> ' = 133°C* <sup>3</sup>	300	A <sub>rms</sub>
I <sub>DM</sub>		Pulse* <sup>2</sup>	600	A
I <sub>DA</sub>	Avalanche current	L = 10μH Pulse* <sup>2</sup>	300	A
I <sub>S(rms)</sub> * <sup>1</sup>	Source current		300	A <sub>rms</sub>
I <sub>SM</sub> * <sup>1</sup>		Pulse* <sup>2</sup>	600	A
P <sub>D</sub> * <sup>4</sup>	Maximum power dissipation	T <sub>C</sub> = 25°C	960	W
P <sub>D</sub> * <sup>4</sup>		T <sub>C</sub> ' = 25°C* <sup>3</sup>	1300	W
T <sub>ch</sub>	Channel temperature		-40 ~ +150	°C
T <sub>stg</sub>	Storage temperature		-40 ~ +125	°C
V <sub>iso</sub>	Isolation voltage	Terminals to base plate, f = 60Hz, AC 1 minute	2500	V <sub>rms</sub>
—	Mounting torque	Main terminals M6 screw	3.5 ~ 4.5	N • m
		Mounting M6 screw	3.5 ~ 4.5	N • m
—	Weight	Typical value	600	g

## ELECTRICAL CHARACTERISTICS (T<sub>ch</sub> = 25°C unless otherwise specified.)

Symbol	Item	Conditions	Limits			Unit
			Min.	Typ.	Max.	
I <sub>DSS</sub>	Drain cutoff current	V <sub>DS</sub> = V <sub>DSS</sub> , V <sub>GS</sub> = 0V	—	—	1	mA
V <sub>GS(th)</sub>	Gate-source threshold voltage	I <sub>D</sub> = 30mA, V <sub>DS</sub> = 10V	4.7	6	7.3	V
I <sub>GSS</sub>	Gate leakage current	V <sub>GS</sub> = V <sub>GSS</sub> , V <sub>DS</sub> = 0V	—	—	1.5	μA
r <sub>DS(on)</sub> (chip)	Static drain-source On-state resistance	I <sub>D</sub> = 300A V <sub>GS</sub> = 15V	T <sub>ch</sub> = 25°C	0.8	1.1	mΩ
			T <sub>ch</sub> = 125°C	1.37	—	
V <sub>DS(on)</sub> (chip)	Static drain-source On-state voltage	I <sub>D</sub> = 300A V <sub>GS</sub> = 15V	T <sub>ch</sub> = 25°C	0.24	0.33	V
			T <sub>ch</sub> = 125°C	0.41	—	
R <sub>(lead)</sub>	Lead resistance	I <sub>D</sub> = 300A terminal-chip	T <sub>ch</sub> = 25°C	0.7	—	mΩ
			T <sub>ch</sub> = 125°C	1.0	—	
C <sub>iss</sub>	Input capacitance	V <sub>DS</sub> = 10V V <sub>GS</sub> = 0V	—	—	110	nF
C <sub>oss</sub>	Output capacitance		—	—	15	
C <sub>rss</sub>	Reverse transfer capacitance		—	—	10	
Q <sub>G</sub>	Total gate charge	V <sub>DD</sub> = 48V, I <sub>D</sub> = 300A, V <sub>GS</sub> = 15V	—	1800	—	nC
t <sub>d(on)</sub>	Turn-on delay time	V <sub>DD</sub> = 48V, I <sub>D</sub> = 300A, V <sub>GS</sub> ± 15V R <sub>G</sub> = 4.2Ω, Inductive load I <sub>S</sub> = 300A	—	—	400	ns
t <sub>r</sub>	Turn-on rise time		—	—	600	
t <sub>d(off)</sub>	Turn-off delay time		—	—	600	
t <sub>f</sub>	Turn-off fall time		—	—	400	
t <sub>rr</sub> * <sup>1</sup>	Reverse recovery time		—	—	250	
Q <sub>rr</sub> * <sup>1</sup>	Reverse recovery charge		—	6.2	—	
V <sub>SD</sub> * <sup>1</sup>	Source-drain voltage	I <sub>S</sub> = 300A, V <sub>GS</sub> = 0V	—	—	1.3	V
R <sub>th(ch-c)</sub>	Thermal resistance	MOSFET part (1/6 module)* <sup>7</sup>	—	—	0.13	K/W
R <sub>th(ch-c')</sub>		MOSFET part (1/6 module)* <sup>3</sup>	—	—	0.096	
R <sub>th(c-f)</sub>	Contact thermal resistance	Case to fin, Thermal grease Applied* <sup>8</sup> (1/6 module)	—	0.1	—	
R <sub>th(c-f')</sub>		Case to fin, Thermal grease Applied* <sup>3, 8</sup> (1/6 module)	—	0.09	—	

## NTC THERMISTOR PART

Symbol	Parameter	Conditions	Limits			Unit
			Min.	Typ.	Max.	
R <sub>Th</sub> * <sup>6</sup>	Resistance	T <sub>Th</sub> = 25°C* <sup>5</sup>	—	100	—	kΩ
B* <sup>6</sup>	B Constant	Resistance at T <sub>Th</sub> = 25°C, 50°C* <sup>5</sup>	—	4000	—	K

\*1: It is characteristics of the anti-parallel, source-drain free-wheel diode (FWDI).

\*2: Pulse width and repetition rate should be such that the device channel temperature (T<sub>ch</sub>) does not exceed T<sub>ch</sub> max rating.

\*3: Case Temperature (T<sub>C</sub>) measured point is just under the chips. If use this value, R<sub>th(f-a)</sub> should be measured just under the chips.

\*4: Pulse width and repetition rate should be such as to cause negligible temperature rise.

\*5: T<sub>Th</sub> is thermistor temperature.

\*6:  $B = \ln\left(\frac{R_{25}}{R_{50}}\right) / \left(\frac{1}{T_{25}} - \frac{1}{T_{50}}\right)$

R<sub>25</sub>: resistance at absolute temperature T<sub>25</sub> [K]: T<sub>25</sub> = 25 [°C]+273.15 = 298.15 [K]

R<sub>50</sub>: resistance at absolute temperature T<sub>50</sub> [K]: T<sub>50</sub> = 50 [°C]+273.15 = 323.15 [K]

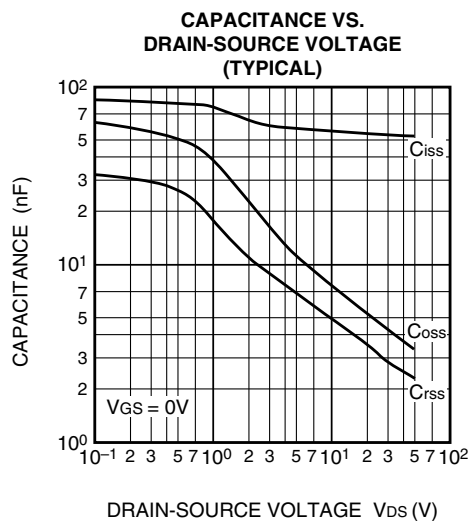
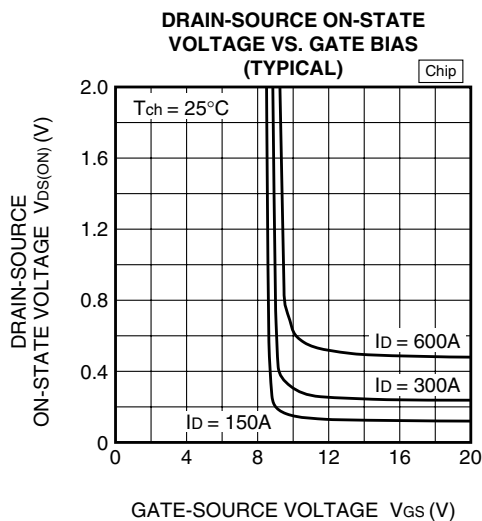
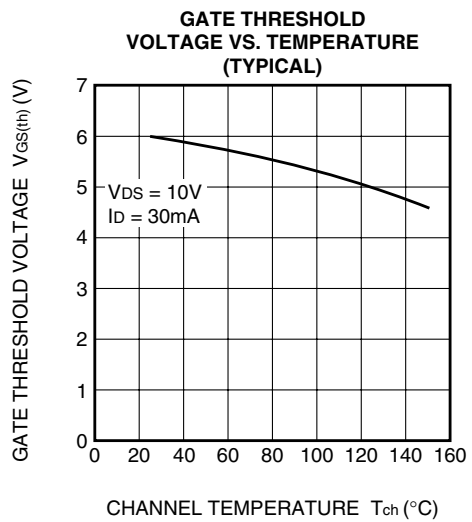
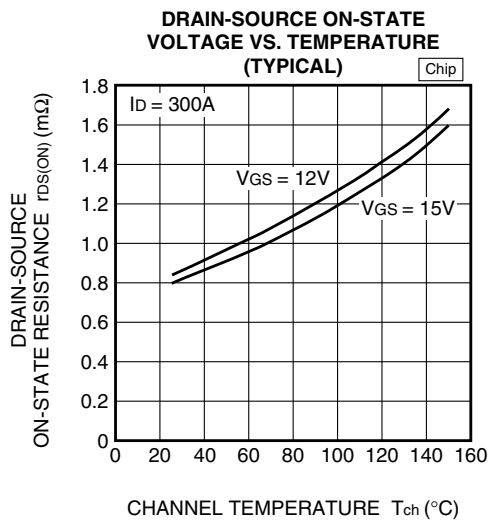
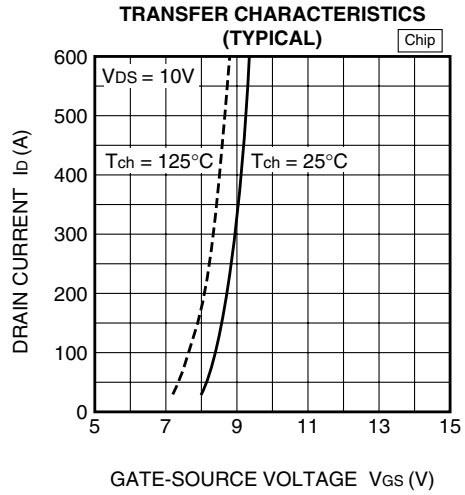
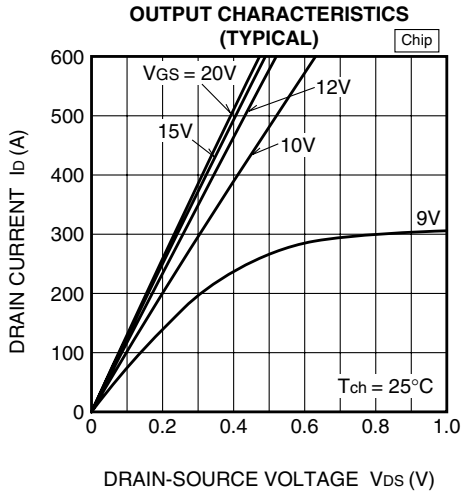
\*7: Case Temperature (T<sub>C</sub>) measured point is shown in page OUTLINE DRAWING.

\*8: Typical value is measured by using thermally conductive grease of λ = 0.9[W/(m • K)].

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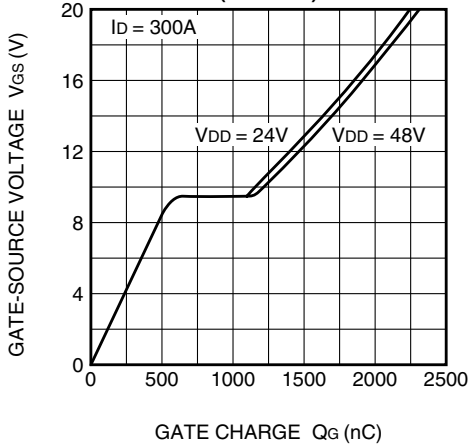
## PERFORMANCE CURVES



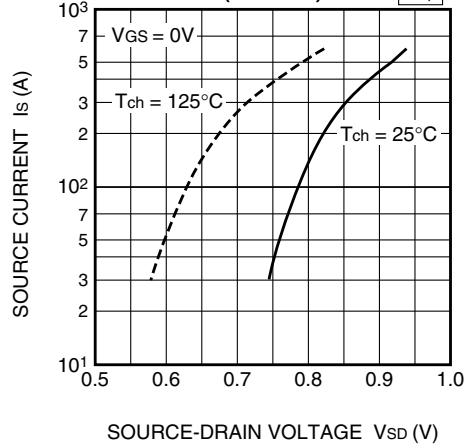
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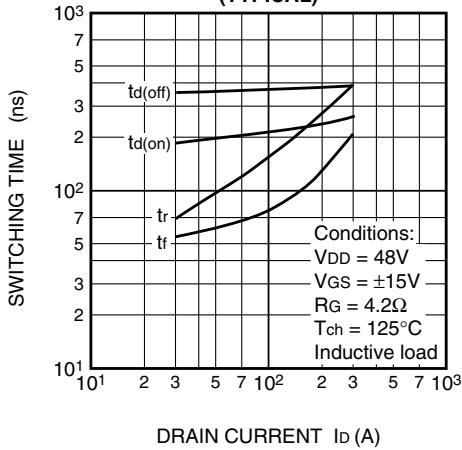
**GATE CHARGE CHARACTERISTICS (TYPICAL)**



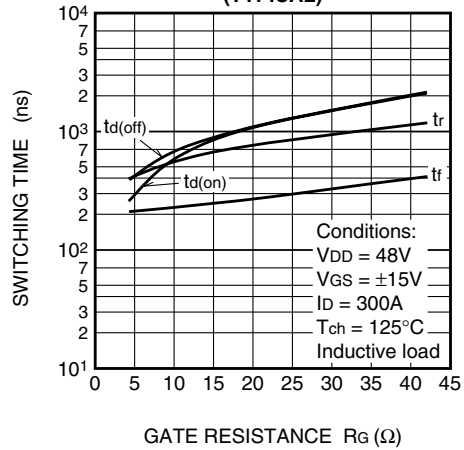
**FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)**



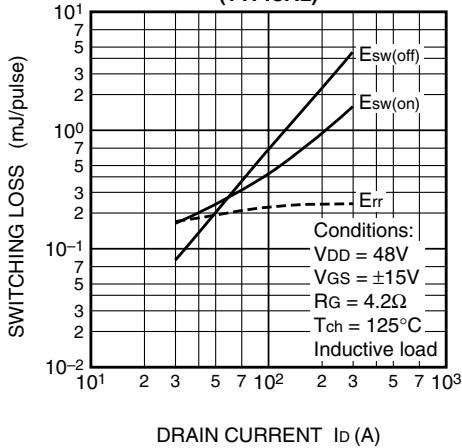
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**



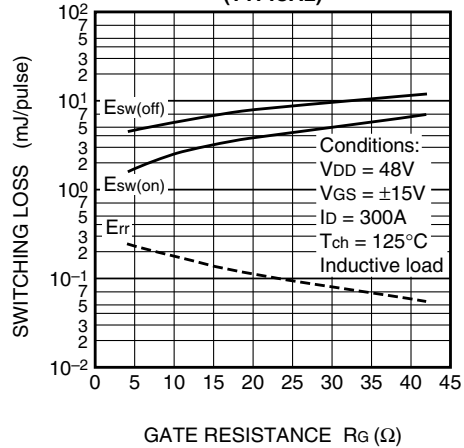
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**



**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**



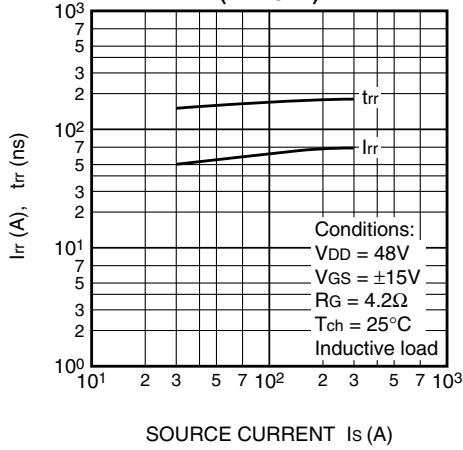
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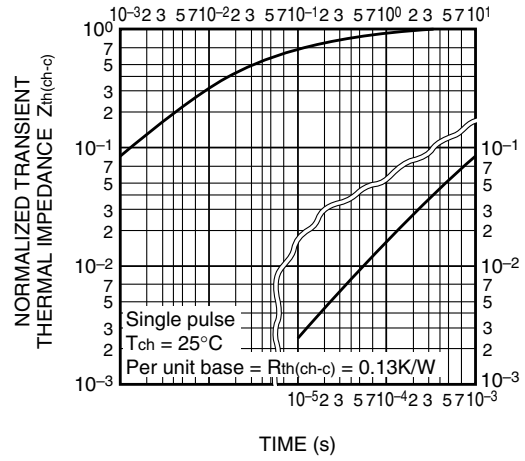
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**REVERSE RECOVERY CHARACTERISTICS OF FREE-WHEEL DIODE (TYPICAL)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS**



**CHIP LAYOUT**

