

# FM400TU-3A

HIGH POWER SWITCHING USE  
INSULATED PACKAGE

## FM400TU-3A



- ID(rms) .....200A
- VDSS.....150V
- Insulated Type
- 6-elements in a pack
- Thermistor inside
- UL Recognized

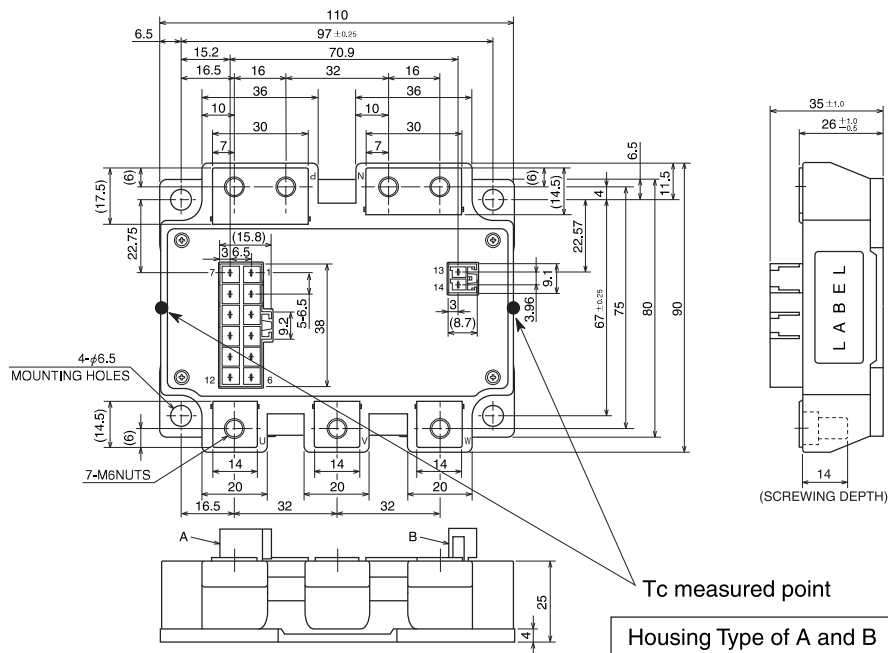
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## APPLICATION

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

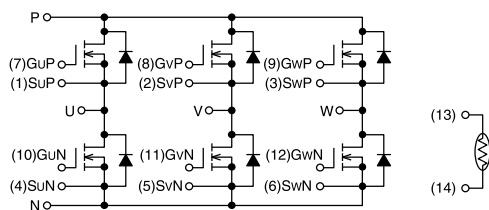
## OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



Tc measured point  
Housing Type of A and B  
(Tyco Electronics P/N:)  
A: 917353-1  
B: 179838-1

### 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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INSULATED PACKAGEABSOLUTE MAXIMUM RATINGS (T<sub>j</sub> = 25°C unless otherwise specified.)

Symbol	Item	Conditions	Rating	Unit
V <sub>DSS</sub>	Drain-source voltage	G-S Short	150	V
V <sub>GSS</sub>	Gate-source voltage	D-S Short	±20	V
I <sub>D</sub>	Drain current	T <sub>c</sub> ' = 112°C* <sup>3</sup>	200	A
I <sub>DM</sub>		Pulse* <sup>2</sup>	400	A
I <sub>DA</sub>	Avalanche current	L = 10μH Pulse* <sup>2</sup>	200	A
I <sub>S</sub> * <sup>1</sup>	Source current		200	A
I <sub>SM</sub> * <sup>1</sup>		Pulse* <sup>2</sup>	400	A
P <sub>D</sub> * <sup>4</sup>	Maximum power dissipation	T <sub>c</sub> = 25°C	650	W
P <sub>D</sub> * <sup>4</sup>		T <sub>c</sub> ' = 25°C* <sup>3</sup>	880	W
T <sub>ch</sub>	Channel temperature		-40 ~ +150	°C
T <sub>stg</sub>	Storage temperature		-40 ~ +125	°C
V <sub>isol</sub>	Isolation voltage	Main terminal to base plate, AC 1 min, f=60Hz, RMS	2500	V
—	Mounting torque	Main Terminal M6	3.5 ~ 4.5	N • m
		Mounting to heat sink M6	3.5 ~ 4.5	N • m
—	Weight	Typical value	600	g

ELECTRICAL CHARACTERISTICS (T<sub>j</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> = 20mA, 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>	Static drain-source (chip) On-state resistance	I <sub>D</sub> = 200A V <sub>GS</sub> = 15V	T <sub>j</sub> = 25°C	—	2.6	3.55	mΩ
			T <sub>j</sub> = 125°C	—	4.8	—	
V <sub>DS(on)</sub>	Static drain-source (chip) On-state voltage	I <sub>D</sub> = 200A V <sub>GS</sub> = 15V	T <sub>j</sub> = 25°C	—	0.52	0.71	V
			T <sub>j</sub> = 125°C	—	0.96	—	
R <sub>DD-SS'</sub>	Internal lead resistance	I <sub>D</sub> = 200A terminal-chip	T <sub>j</sub> = 25°C	—	0.8	—	mΩ
			T <sub>j</sub> = 125°C	—	1.12	—	
C <sub>iss</sub>	Input capacitance	V <sub>DS</sub> = 10V V <sub>GS</sub> = 0V	—	—	75	nF	
C <sub>oss</sub>	Output capacitance		—	—	10		
C <sub>rss</sub>	Reverse transfer capacitance		—	—	6		
Q <sub>G</sub>	Total gate charge	V <sub>DD</sub> = 80V, I <sub>D</sub> = 200A, V <sub>GS</sub> = 15V	—	1300	—	nC	
t <sub>d(on)</sub>	Turn-on delay time	V <sub>DD</sub> = 80V, I <sub>D</sub> = 200A, V <sub>GS1</sub> = V <sub>GS2</sub> = 15V R <sub>G</sub> = 6.3Ω, Inductive load switching operation I <sub>S</sub> = 200A	—	—	400	ns	
t <sub>r</sub>	Rise time		—	—	300		
t <sub>d(off)</sub>	Turn-off delay time		—	—	450		
t <sub>f</sub>	Fall time		—	—	200		
t <sub>rr</sub> * <sup>1</sup>	Reverse recovery time		—	—	200		
Q <sub>rr</sub> * <sup>1</sup>	Reverse recovery charge		—	7.0	—		μC
V <sub>SD</sub> * <sup>1</sup>	Source-drain voltage		I <sub>S</sub> = 200A, V <sub>GS</sub> = 0V	—	—		1.3
R <sub>th(j-c)</sub>	Thermal resistance	MOSFET part (1/6 module)* <sup>7</sup>	—	—	0.19	K/W	
R <sub>th(j-c')</sub>		MOSFET part (1/6 module)* <sup>3</sup>	—	—	0.142		
R <sub>th(c-s)</sub>	Contact thermal resistance	Case to fin, Thermal grease Applied* <sup>8</sup> (1/6 module)	—	0.1	—		
R <sub>th(c-s')</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>25</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 to drain free-wheel diode (FWDi).

\*2: Pulse width and repetition rate should be such that the device junction temperature (T<sub>j</sub>) does not exceed T<sub>j</sub> max rating.\*3: T<sub>c</sub>' measured point is just under the chips. If use this value, R<sub>th(s-a)</sub> should be measured just under the chips.

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

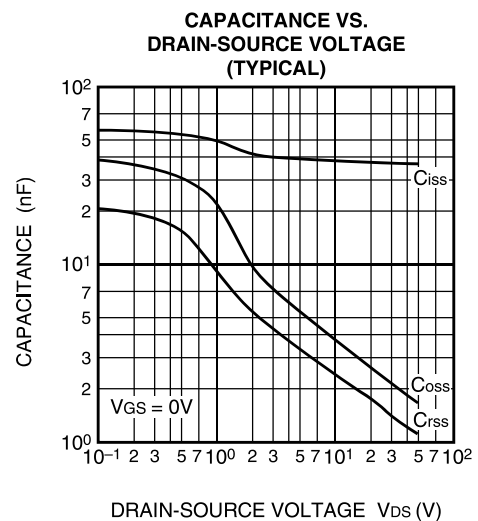
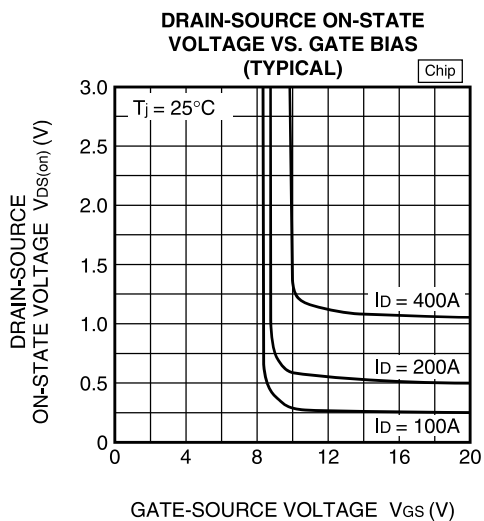
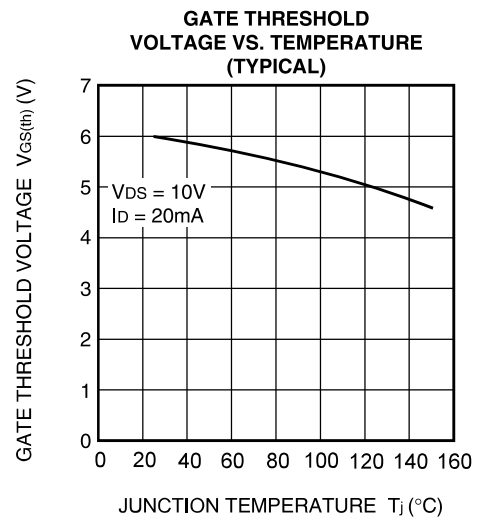
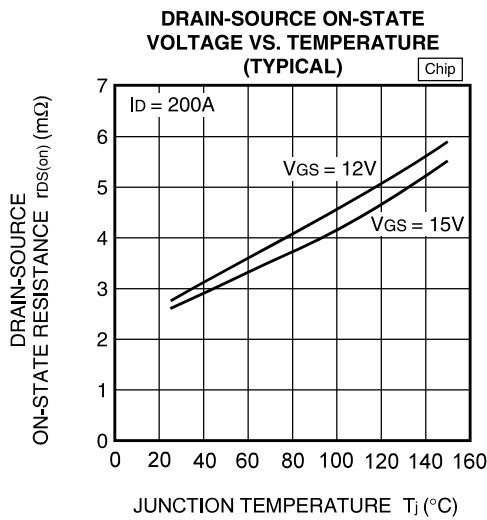
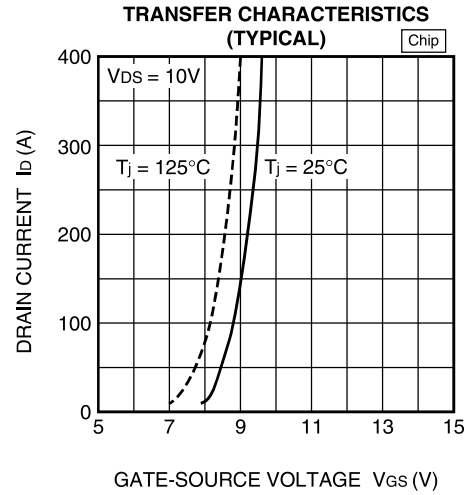
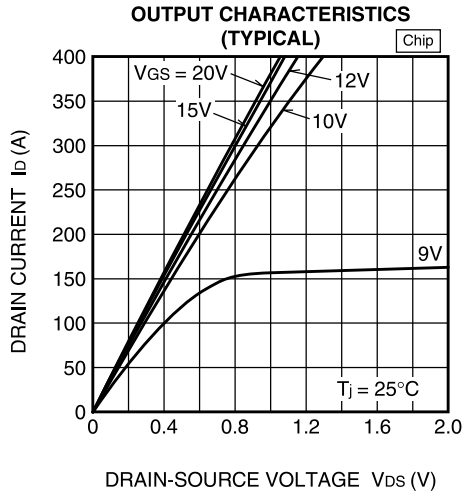
\*5: T<sub>TH</sub> is thermistor temperature.\*6: B = (lnR<sub>1</sub> - lnR<sub>2</sub>) / (1/T<sub>1</sub> - 1/T<sub>2</sub>) R<sub>1</sub>: Resistance at T<sub>1</sub>(K), R<sub>2</sub>: Resistance at T<sub>2</sub>(K)\*7: T<sub>c</sub> measured point is shown in page OUTLINE DRAWING.

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

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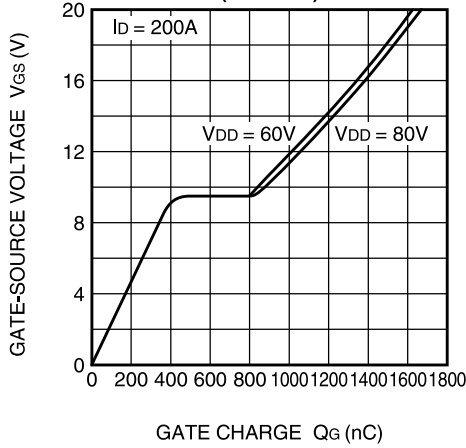
## PERFORMANCE CURVES



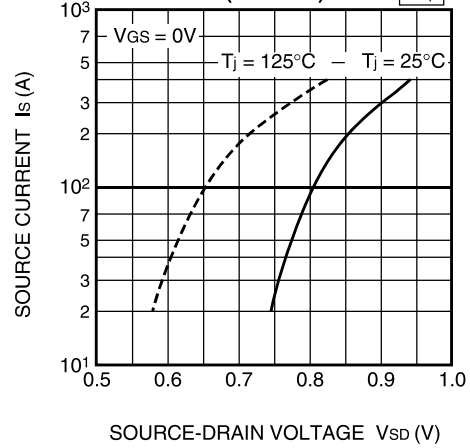
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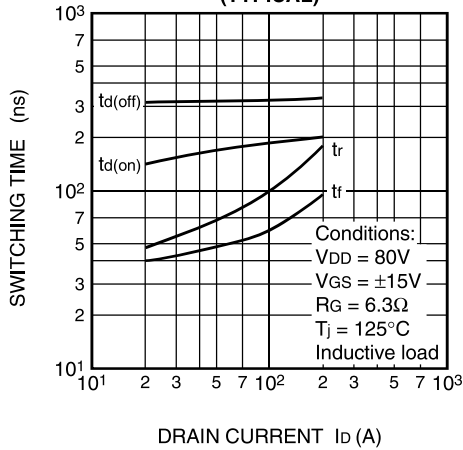
**GATE CHARGE CHARACTERISTICS (TYPICAL)**



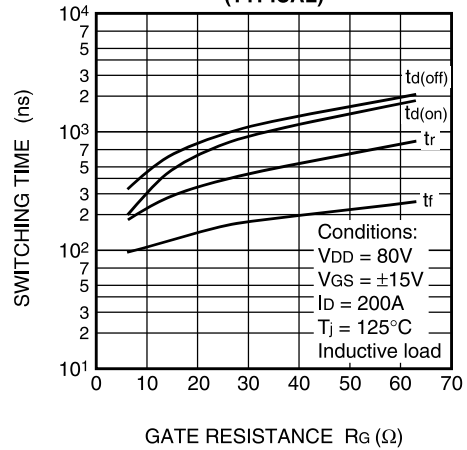
**FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)**



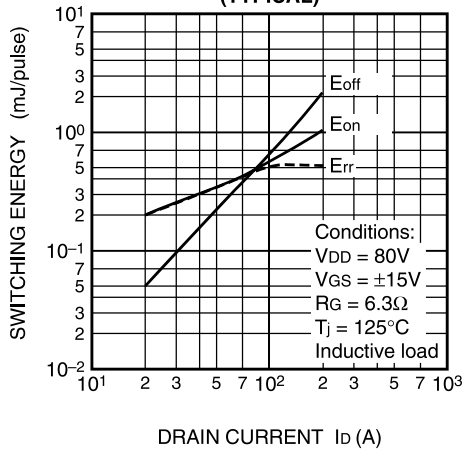
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**



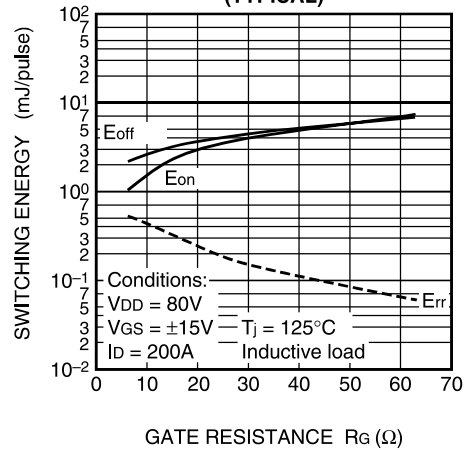
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**



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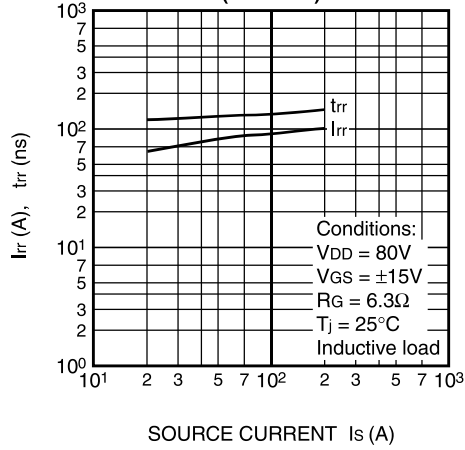
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**



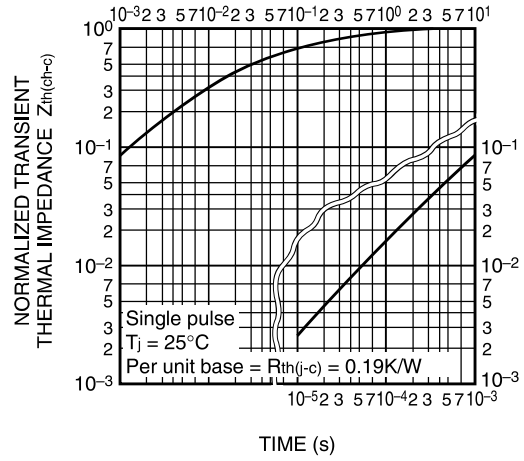
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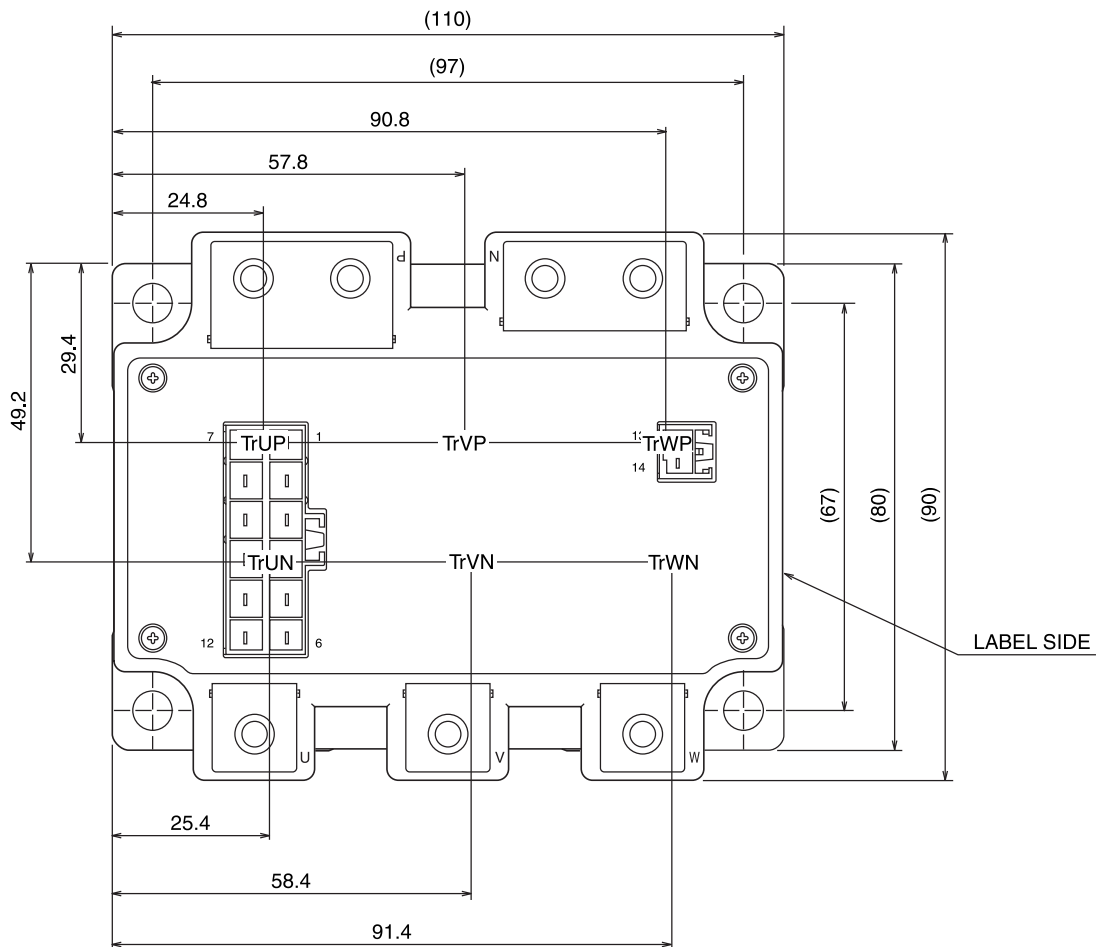
REVERSE RECOVERY CHARACTERISTICS  
OF FREE-WHEEL DIODE  
(TYPICAL)



TRANSIENT THERMAL  
IMPEDANCE CHARACTERISTICS



## CHIP LAYOUT



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